



## INSTALLATION MANUAL

FOR THE

**KD50SE-1P~KD135SX-1PU**

OF

SOLAR PHOTOVOLTAIC POWER MODULES

Please read this manual carefully before installing the modules.

KYOCERA

6C-207511

### 1. INTRODUCTION

As the world leader in development and application of high technology ceramic/silica materials, Kyocera offers a wide range of highly efficient and reliable crystalline silicon solar photovoltaic (PV) power modules. Kyocera began to extensively research PV technology in 1975 and commenced manufacturing operations in 1978. Since then, Kyocera has supplied millions of cells and modules throughout the world. With years of experience and state-of-the-art technology, Kyocera provides the highest quality PV power modules in a range of sizes designed to meet the requirements of the most demanding energy and power users worldwide.

### 2. POWER MODULES

Kyocera power modules consist of a series of electrically interconnected crystalline silicon solar cells, which are permanently laminated within a pottant and encapsulated between a tempered glass cover plate and a back sheet. The entire laminate is secured within an anodized aluminum frame for structural strength, ease of installation, and to protect the cells from the most severe environmental conditions.

### 3. APPLICATIONS

Kyocera modules are a reliable, virtually maintenance-free direct current (DC) power source, designed to operate at the highest level of efficiency. Kyocera modules are ideal to remote homes, recreational vehicles, water pumps, telecommunication systems and many other applications either with or without using storage batteries.

### 4. WARNINGS AND SAFETY PRECAUTION

PV modules generate electricity when exposed to light. Arrays of many modules can cause lethal shock and burn hazards. Only authorized and trained personnel should have access to these modules. To reduce the risk of electrical shock or burns, modules may be covered with an opaque material during installation. Do not touch live terminals with bare hands. Use insulated tools for electrical connections. Do not use these modules for solar concentration.

### PERMIT

- Before installing your PV system, contact local authorities to determine the necessary permitting, installation and inspection requirements.

### INSTALLATION AND OPERATION

- Systems should be installed by qualified personnel only. The system involves electricity, and can be dangerous if the personnel are not familiar with the appropriate safety procedures.
- **Do not step on a PV module.**
- Although Kyocera modules are quite durable, the glass can be broken (and the module will no longer work properly) if it is dropped or hit by tools or other objects.
- Sunlight shall not be concentrated on the module.
- The module frame is made of anodized aluminum, and therefore corrosion can occur if the module is subject to a salt-water environment and is in contact with another type of metal (electrolytic corrosion). If required, PVC or stainless steel washers can be placed between PV module frame and support structure to prevent this type of corrosion.
- KD series module frames must be attached to a support structure using M6 (M8, when an installation hole is 9mm) stainless steel screw in a minimum of four (4) places symmetrical on PV module. The stainless steel screw used for fixing the module frame should secure with an adequate torque. (usually, 8 N-m (in case of M6) or 19N-m (in case of M8.))

- Module support structures to be used to support PV modules should be wind rated and approved by the appropriate local and civil codes prior to installation.
- Do not expose the back of the module to direct sunlight.

### FIRE RATING

- In case of roof installation, PV module assembly shall be mounted on a fire resistant roof covering rated for the application. KD series modules are comprised of a glass front surface, polyethylene terephthalate (PET) back sheet with a Class C fire rating.

### GROUNDING

- Refer to "Grounding" section.

### BATTERY

- When PV modules are used to charge batteries, the battery must be installed in a manner which will ensure the performance of the system and the safety of its users. **Follow the battery manufacturer's safety guidelines concerning installation, operation and maintenance recommendations.** In general, the battery (or battery bank) should be kept away from people and animals. Select a battery site that is protected from sunlight, rain, snow, debris, and is well ventilated. Most batteries generate hydrogen gas when charging, which can be explosive. Do not light matches or create sparks near the battery bank. When a battery is installed outdoors, it should be placed in an insulated and ventilated battery case specifically designed for this purpose.

### 5. SITE SELECTION

In most applications, Kyocera modules should be installed in a location where they will receive maximum sunlight throughout the year. In the Northern Hemisphere, the modules should typically face south, and in the Southern Hemisphere, the modules should typically face north. Modules facing 30 degrees away from true South (or North) will lose approximately 10 to 15 percent of their power output. If the module faces 60 degrees away from true South (or North), the power loss will be 20 to 30 percent. When choosing a site, avoid trees, buildings or obstructions which could cast shadows on PV modules especially during winter season when the arc of the sun is lowest over the horizon.

### 6. MODULE TILT ANGLE

Kyocera modules produce bigger power when they are pointed directly at the sun. For stand alone installations PV modules should be tilted for optimum winter performance. As a general rule, if the system power production is adequate in the winter, it will be satisfactory during the rest of the year. PV module tilt angle is measured between PV modules and the ground. Refer to the recommended module tilt angle table for your site.

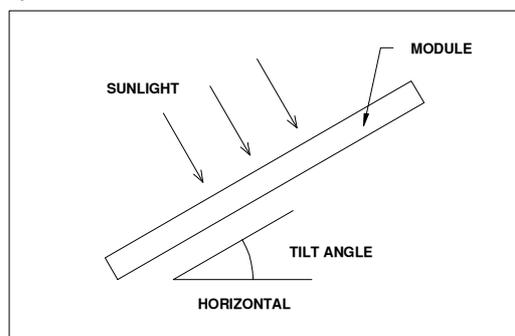


Figure 1. Module Tilt Angle

Table 1. Recommended Tilt Angles for Stand Alone Fixed Systems - Based on Winter Performance

SITE LATITUDE IN DEGREES	FIXED TILT ANGLE
0° TO 15	15°
15° TO 25°	SAME AS LATITUDE
25° TO 30°	LATITUDE + 5°
30° TO 35°	LATITUDE + 10°
35° TO 40°	LATITUDE + 15°
40° +	LATITUDE + 20°

For grid tie installations where the solar modules are attached to a permanent structure, PV modules should be tilted at an angle equal to the site's latitude. This will typically result in the highest annual energy output.

## 7. INSTALLING KD SERIES MODULES

The minimum spacing of 15 mm is required between PV module and the mounting surface around the perimeter of PV module. The frame of each module has 7mm (or 9mm) diameter mounting holes (Refer to Module Mounting Specifications). These are used fixing PV modules to the supporting structure. An example of a ground mounted structure is shown in Figure 2. The four holes close to the corners of the module are most often used for installation. Refer to the Mounting Specifications for the position of these holes. Clearance between PV module frame and the mounting surface may be required to prevent the junction box from touching the surface, and to circulate cooling air around the back of the module. Spacing between PV modules must be a minimum of 3.2mm to allow for thermal expansion. If the modules are to be installed on the roof or wall of a building, the standoff method or the rack method is recommended.

**STAND-OFF METHOD:** PV modules are supported parallel to the surface of the building wall or roof. Clearance between the module frames and surface of the wall or roof is required to prevent module and / or wiring from damage.

The recommended stand-off height is about 115 mm. If other mounting means are employed, this may affect the Listing For Fire Class Ratings.

**RACK:** The supporting frame is used to mount PV modules at correct tilt angles. PV modules specified in this installation manual are not designed for Building Integrated Photovoltaic(B.I.P.V) as part of a roof or wall application. The mounting design may have an impact on the fire resistance.

**OTHER:** Other method(s) certified by a registered professional engineer, and in compliance with local codes.

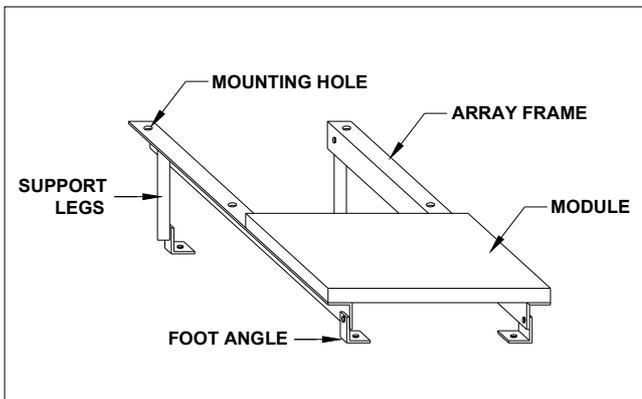


Figure 2. Basic Rack or Standoff Mounting Structure

## 8. MODULE WIRING

As shown in Figure 3 Standard Wiring Examples, Kyocera PV modules utilize the Type "IM" junction box (see J-box details). This junction box, located on the back side of the module, is weatherproof and is designed to be used with standard wiring or conduit connections. A cable clamp with a minimum rating of IP65 must be used to maintain the weatherproof integrity of the junction box. Bypass diodes are preinstalled at factory.

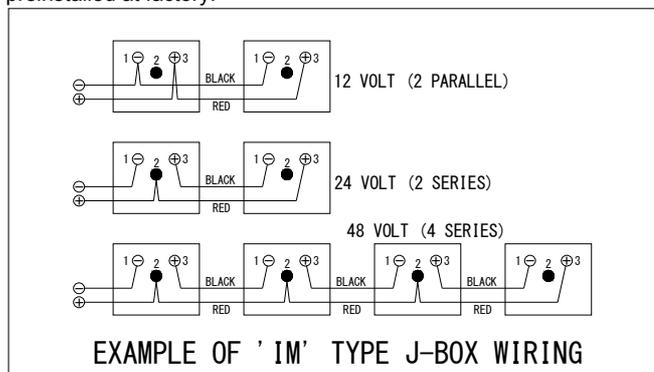


Figure 3. Standard Wiring Examples

To wire Kyocera PV modules:

- A. Determine the nominal system array voltage of your system. Each panel is equivalent to a 12 VDC nominal block. Standard array voltages 12, 24 and 48 volt are shown as examples in Figure 3.

- B. Open the "IM" box cover by loosening the screws in the cover.
- C. The wire used to interconnect PV modules may be single or two conductors, from 2.08 mm<sup>2</sup> up to 5.26 mm<sup>2</sup> gauge stranded copper wire, in a "SUNLIGHT RESISTANT" and insulated for 90°C minimum jacket cable. This cable is suitable for applications where wiring is exposed to the direct rays of the sun. The maximum and minimum outer diameters of the cable that may be used with the cable connector are 8 mm and 6 mm respectively (Figure 4).
- D. Using a flat blade screwdriver, remove only the appropriate "KNOCK-OUTS" from the sides of the "IM" box.
- E. Route wires through the knock-outs and clamps refer to installation example (see Figure 5).
- F. Gently hand tighten the terminal screws with cross slot (Phillips -head) screwdriver. Do not over tighten, as the terminal can be damaged.  
(Recommendation Torque : 1.5 N-m)
- G. The output wiring from the final module is generally run to a separate array junction box. In commercial system, this wiring from the array box to the next component (i.e. fuse box or charge regulator, etc.) is generally run in conduit. The maximum electrical rating of an acceptable series fuse is 6~15 amperes.
- H. After checking that module wiring is correct, close all the junction boxes. Use a Phillips head screw driver to secure all screws on the junction box cover to ensure a waterproof seal.

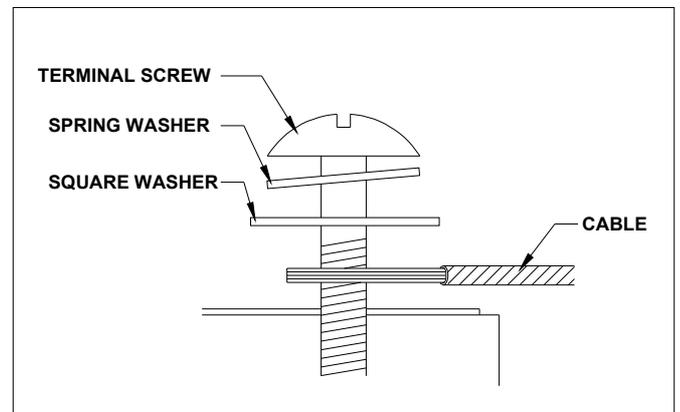


Figure 4. Ring or Spade Terminal Connectors

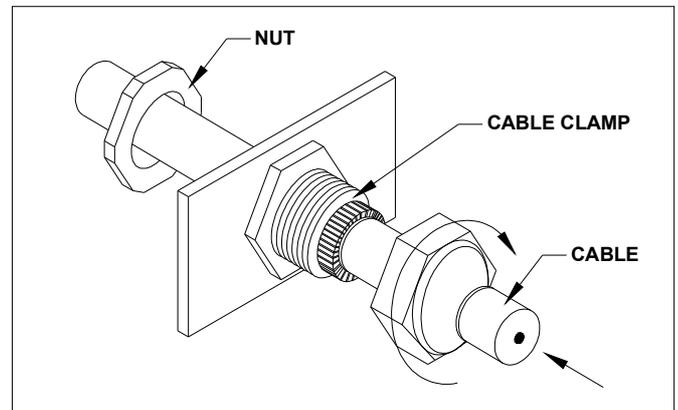


Figure 5. Installation Example of Cable Clamp

### NOTE: MAXIMUM SYSTEM VOLTAGE 750VDC.

KD series modules and most PV system components have a maximum system voltage rating of 750 volts DC. Some grid-tie systems operate at or near this voltage rating. Like other polycrystalline solar modules, the open circuit voltage of the KD series module increases as the ambient temperature decreases. Maximum System voltage is computed as the sum of the open-circuit voltage of the series-connected PV modules for the lowest expected ambient temperature. Temperature coefficients, specific to the module of use, can be used to provide the most accurate prediction of module voltage under temperature extremes.

**NOTE:** Install the maximum number of series connection for the KD series modules so that the system voltage is less than 750V.

**NOTE:** In normal conditions, PV modules may produce bigger current and/or voltage than reported in the standard test conditions. Therefore, when voltage evaluations for components, capacity of conductors, size of fuses, and size of control systems connected to the module output

are determined, multiply the values of short-circuit current (Isc) and open-circuit voltage (Voc) that are marked in KD series modules by the factor of 1.25.

## 9. GROUNDING

Before installing your solar system, contact local authorities to determine the necessary grounding requirements. Attach all PV module frames to the earth ground. Proper grounding is achieved by connecting PV module frame(s) and all metallic structural members continuously one to another using a suitable "grounding conductor". The grounding conductor, or strap, may be copper, copper alloy, or good conduct. Ensure positive electrical contact through the anodizing on PV module's frame by utilizing one of the following grounding methods. Attach the grounding conductor:

- (1) to one of the 7 mm (or 9 mm) diameter holes marked 'ground' with a bolt and nut assembly that incorporates a bonding or external tooth washer, or a serrated screwhead.  
(When holes size is the diameter of 7mm, the bolt which is the M6 is recommended.)  
(When holes size is the diameter of 9mm, the bolt which is the M8 is recommended.)
- (2) to electrically conductive metal, such as that of a support structure, which has been bonded to the module frame through the use of 4 bonding or external tooth washers, a welded, soldered for brazed joint or other suitable means. A minimum torque of 8 N-m(in case of M6) or 19 N-m(in case of M8) must be applied to ensure a proper electrical connection through module frame anodizing.
- (3) with two or more screws, or two full threads of a single screw engaging PV module frame metal.

## 10. BLOCKING DIODES

In systems utilizing a battery, blocking diodes are typically placed between the battery and PV module output to prevent battery from discharging at night. Kyocera PV modules are made of polycrystalline cells with high electrical "back flow" resistance to nighttime battery discharging. As a result, Kyocera PV modules do not contain a blocking diode when shipped from the factory. Most PV charge regulators and inverter incorporate nighttime disconnect feature, however.

## 11. BYPASS DIODES

Partial shading of an individual module in a source circuit string (i.e. two or more PV modules connected in series) can cause a reverse voltage across the shaded cells within PV module. PV Module output current is then forced through the shaded area by the remaining illuminated cells and other PV modules in series with the partially shaded PV module(s). The current forced through the shaded cells within PV module (or modules) causes additional PV module heating and serve loss of power.

The purpose of bypass diodes is to provide a low-resistance current path around the shaded cells, thereby minimizing PV module heating and array current losses.

PV modules employ bypass diodes that have:

- Rated Average Forward Current [ $I_{F(AV)}$ ] **Above** maximum system current at highest PV module operating temperature.
- Rated Repetitive Peak Reverse Voltage [ $V_{RRM}$ ] **Above** maximum system voltage at lowest PV module operating temperature.

## 12. MAINTENANCE

Kyocera PV modules are designed for long life and require very little maintenance. Under most weather conditions, normal rainfall is sufficient to keep PV module glass surface clean. If dirt build-up becomes excessive, clean the glass surface only with a soft cloth using mild detergent and water. USE CAUTION WHEN CLEANING THE BACK SURFACE OF PV MODULE TO AVOID PENETRATING THE BACK SHEET. PV modules that are mounted flat ( $0^\circ$  tilt angle) should be cleaned more often, as they will not "self clean" as effectively as PV modules mounted at a  $15^\circ$  tilt or greater. Once a year, check the tightness of terminal screws and the general condition of the wiring. Also, check to be sure that mounting hardware is tight. Loose connections may result in a damaged PV module or array.

## KYOCERA Solar Group Sales Office

- KYOCERA Corporation  
Corporate Solar Energy Group  
6 Takeda Tobadono-cho Fushimi-ku, Kyoto 612-8501, Japan  
Phone : 81-75-604-3476  
Fax : 81-75-604-3475  
<http://www.kyocera.com/>
- KYOCERA Solar, Inc.  
7812 East Acoma Drive, Scottsdale, AZ 85260, U.S.A.  
Phone : 1-480-948-8003 or 1-800-223-9580  
Fax : 1-480-483-6431  
<http://www.kyocerasolar.com/>
- KYOCERA Solar Pty Ltd.  
Level 3, 6-10 Talavera Road,  
North Ryde NSW 2113, Australia  
Phone : 61-2-9870-3946  
Fax : 61-2-9888-9673  
<http://www.kyocerasolar.com.au/>
- KYOCERA Solar do Brasil Ltda.  
Av. Guignard 661, Loja A  
Recreio dos Bandeirantes-Rio de Janeiro, 22790-200, Brazil  
Phone : 55-21-3261-7111  
Fax : 55-21-3261-7103  
<http://www.kyocerasolar.com.br/>
- KYOCERA Fineceramics GmbH  
Fritz-Müller-Strasse 27, 73730 Esslingen, Germany  
Phone : 49-711-93934-999  
Fax : 49-711-93934-950  
<http://www.kyocerasolar.de/>
- KYOCERA Asia Pacific Pte. Ltd.  
298 Tiong Bahru Road, #13-03/05 Central Plaza,  
168730, Singapore  
Phone : 65-6271-0500  
Fax : 65-6271-0600  
<http://www.kyocera.com.sg/>
- KYOCERA Asia Pacific Ltd.  
Room 801-802, Tower 1 , South Seas Centre,  
75 Mody Road, Tsimshatsui East, Kowloon, Hong Kong  
Phone : 852-2723-7183  
Fax : 852-2724-4501
- KYOCERA Asia Pacific Pte. Ltd. Taipei Branch  
10 Fl., No.66, Nanking West Road, Taipei, Taiwan  
Phone : 886-2-2555-3609  
Fax : 886-2-2559-4131
- KYOCERA (Tianjin) Sales & Trading Corporation  
Room 2107, Ruoy Chai Building, No.8  
Yong An Dong Li, Jian Guo Men Wai Road,  
Chao Yang District, Beijing, 100022, China  
Phone : 86-10-8528-8838  
Fax : 86-10-8528-8839  
<http://www.kyocera.com.cn/>
- KYOCERA Korea Co., Ltd.  
Diplomatic Center Room # 406, 1376-1,  
Seocho-2Dong, Seocho-Ku, Seoul, 137-072, Korea  
Phone : 82-2-3463-3538  
Fax : 82-2-3463-3539  
<http://www.kyocera.co.kr/>

# 13. SPECIFICATIONS

- Under certain conditions, a photovoltaic module may produce more voltage and current than reported at Standard Test Conditions (STC).

**Table.2 Kyocera KD Series Module Specification**

Electrical Characteristics : @ STC						
Model Type	KD50SE-1P	KD70SX-1P	KD75SE-1P	KD95SX-1P	KD130SX-1PU	KD135SX-1PU
Rated Power, Watts (Pmax) (W)	50 <sup>+10%</sup> / <sub>-5%</sub>	70 <sup>+10%</sup> / <sub>-5%</sub>	75 <sup>+10%</sup> / <sub>-5%</sub>	95 <sup>+10%</sup> / <sub>-5%</sub>	130 ±5%	135 ±5%
Open Circuit Voltage (Voc) (V)	22.1	22.1	22.1	22.1	22.1	22.1
Short Circuit Current (Isc) (A)	3.07	4.30	4.56	5.81	8.06	8.37
Voltage at Load (Vpm) (V)	17.9	17.9	17.9	17.9	17.7	17.7
Current at Load (Ipm) (A)	2.80	3.92	4.19	5.31	7.35	7.63
Maximum System Voc (V)	750					
Recommended maximum number of PV modules connected in series	27					
Factory installed Bypass Diode (Qty)	8					
Series Fuse Rating (A)	6	8	10	15		
Thermal Characteristics :						
Temp. Coefficient of Voc (V / °C)	-0.80x10 <sup>-1</sup>					
Temp. Coefficient of Isc (A / °C)	1.84x10 <sup>-3</sup>	2.58x10 <sup>-3</sup>	2.76x10 <sup>-3</sup>	3.50x10 <sup>-3</sup>	4.84x10 <sup>-3</sup>	5.02x10 <sup>-3</sup>
Temp. Coefficient of Vpm (V / °C)	-9.26x10 <sup>-2</sup>	-9.18x10 <sup>-2</sup>	-9.26x10 <sup>-2</sup>	-9.20x10 <sup>-2</sup>	-9.10x10 <sup>-2</sup>	-9.16x10 <sup>-2</sup>
Physical Characteristics :						
Length (mm)	706	778	940	1043	1500	1500
Width (mm)	744	660	744	660	668	668
Depth (mm)	45	45	45	45	46	46
Weight (kg)	6.5	6.5	8.5	8.5	12.5	12.5
Mounting Hole Diameter (mm)	7, Qty-8pcs				9, Qty-4pcs	
Grounding Hole Diameter (mm)	7, Qty-2pcs				9, Qty-4pcs	
Application Class	Class A					

## NOTES

- Standard Test Conditions of irradiance of 1000 W/m<sup>2</sup>, spectrum of air mass 1.5, and cell temperature of 25 deg C.
- See module drawing for mounting and grounding holes locations.

### MODULE DRAWING

MODULE TYPE	MODULE DIMENSIONS								
	DIM. A	DIM. B	DIM. C	DIM. D	DIM. E	DIM. F	DIM. G	DIM. H	DIM. I
KD50SE-1P	706mm	744mm	705mm	19.5mm	29mm	648mm	7mm	—	—
KD70SX-1P	778mm	660mm	621mm	19.5mm	29mm	720mm	7mm	—	—
KD75SE-1P	940mm	744mm	705mm	19.5mm	29mm	882mm	7mm	—	—
KD95SX-1P	1043mm	660mm	621mm	19.5mm	29mm	985mm	7mm	—	—
KD130SX-1PU, KD135SX-1PU	1500mm	668mm	643mm	12.5mm	278.5mm	943mm	9mm	1360mm	70mm

**DIODE POSTS DO NOT USE**

**DIODE (8PL)**

**TYPE 'IM' J-BOX**

**TERMINAL DESIGNATIONS**  
 1: NEGATIVE POST  
 2: ISOLATED POST  
 3: POSITIVE POST

**DIODE DETAIL**