KYOCERA

INSTALLATION MANUAL

FOR THE

KD135GH-2FBS～KD235GH-2FB

OF

SOLAR PHOTOVOLTAIC POWER MODULES

Please read this manual carefully before installing the modules.

KYOCERA

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1. INTRODUCTION

As the world leader in the 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. APPLICATIONS

KD series modules are a reliable, virtually maintenance-free direct current (DC) power source, designed to operate at the highest level of efficiency. KD series modules are ideal for remote home, water pumping, telecommunications, utility-tied and many other power system applications either with or without using storage batteries.

3. WARNINGS＋SAFETY

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 permits, 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 the module.**
- Although KD series 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.
- The module frame is made of anodized aluminium, 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 frame(s) must be attached to a support structure by one of the methods described in Section 6, Installing KD series module(s).
- Module support structures to be used to support KD series module(s) 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

4. SITE SELECTION

In most applications, KD series modules should be installed in a location where they will receive maximum sunlight throughout the year. In the Southern Hemisphere, the modules should typically face North, and in the, Northern Hemisphere the modules should typically face South. Modules facing 30 degrees away from true North (or South) will lose approximately 10 to 15 percent of their power output. If the module faces 60 degrees away from true North (or South), 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 the winter season when the arc of the sun is lowest over the horizon.

5. MODULE TILT ANGLE

KD series modules produce bigger power when they are pointed directly at the sun. 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.

6. INSTALLING KD SERIES MODULES

The minimum spacing of 15mm is required between PV module and the mounting surface around the perimeter of PV module. KD series modules may be

installed in various applications utilizing a variety of support structure options and attachment methods. For optimal performance in all applications, clearance between the module frame and the mounting surface is required to allow cooler ambient air to circulate around the back of the module and to avoid the module and / or wiring damage. A minimum of 3.2mm spacing must also be maintained between module frames to allow for thermal expansion.

KD series modules may be attached to a support structure by the following methods. When installing modules in snowy area, an appropriate countermeasure has to be taken to prevent possible damages to the lower side frame by slipping snow (e.g. attach supporting parts to the lowest modules.). Any damage caused by snow or such countermeasure is not covered under warranty.

The below mounting methods are able to reduce the damage risk to the lower side frame by the slipping snow.

(1) Install modules with 90 degree tilt angle (e.g. install on vertical wall).

(2) Install modules without space between each module.

(3) Attach supporting parts to the lowest modules.

Detailed mounting method is described in 'mounting table' in the appendix:

BOLTING: Utilizing 8mm steel hardware through the existing 9mm diameter mounting holes in the module frame and then through mounting holes on the support structure. The steel hardware used for securing the module frame should be secured with an adequate torque. Refer to the Module Drawings for the position of the solar module mounting holes.

CLAMPING: Fasten modules firmly with the clamps which must not be deformed by wind load or snow load, nor cause the module fall off. Clamps also must not shade the sunlight incidence on glass surface.

7. MODULE WIRING

KD series modules come pre-wired with terminals ready for most building attachments or free standing installations. Each module has two IEC 4mmsq output cables each terminated with Multi-Contact® connectors. The positive (+) terminal has a female connector while the negative (-) terminal has a male connector. The module wiring is solely for series connections only, i.e. female (+) to male (-) interconnections. Series and parallel connections shall be made by use of two IEC 4mmsq output cables with male and female Multi-Contact® connectors.

NOTE: When making connections with Multi-Contact connectors, make sure the array is disabled. **DO NOT MAKE CONNECTIONS WHILE UNDER LOAD**. Module output connections are marked "Do not disconnect under load".

NOTE: MAXIMUM SYSTEM VOLTAGE 1000 VDC. KD series modules and most PV system components have a maximum system voltage rating of 1000 volts DC. Some grid feed in systems operate at or near this voltage rating. Like other polycrystalline solar modules, the open circuit voltage of the KD series modules 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 1000 V. NOTE: Do not connect the modules in parallel without maximum over current protection. NOTE: The minimum diameter that the cable can be bent for the KD series modules is 49mm. NOTE: In normal conditions, PV modules may produce larger 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 coefficient, 1.25.

8. 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 9mm diameter holes marked 'ground' with a bolt and nut assembly that incorporates a bonding or external tooth washer, or a serrated screw head. (A bolt of 8mm in diameter 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 Newton meters (6 " pounds) 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.

9. 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. KD series modules are made of polycrystalline cells with the electrical “back flow” resistance to night time battery discharging. As a result, KD series modules do not contain a blocking diode when shipped from the factory. Most PV charge regulators and inverters incorporate night time disconnect feature.

10. BYPASS DIODES

Partial shading of an individual module in a source circuit string (i.e. two or more modules connected in series) can cause a reverse voltage across the shaded cells within the module. 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 module(s). The current forced through the shaded cells within PV module (or modules) causes additional module heating and severe loss of power. All KD series modules are supplied with factory installed (non user serviceable) bypass diodes. 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.

11. MAINTENANCE

KD series modules are designed for long life and require very little maintenance. Under most weather conditions, normal rainfall is sufficient to keep the 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 BACK SHEET. PV modules that are mounted flat (0°tilt angle) should be cleaned more often, as they will not "self clean" as effectively as modules mounted at a 15° tilt or greater. Once a year, check the general condition of the wiring and check to be sure that mounting hardware is tight. Loose connections may result in a damaged 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:5-21-3261-7111
  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/

12. SPECIFICATIONS

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

Kyocera KD Series Module Specification

	Electrical Characteristics: @ STC						
Module Type	KD135GH-2FBS	KD185GH-2FBS	KD190GH-2FBS	KD210GH-2FBS	KD215GH-2FBS	KD230GH-2FB	KD235GH-2FB
Pmax	135W	185W	190W	210W	215W	230W	235W
Voc	22.1V	29.5V	29.5V	33.2V	33.2V	36.9V	36.9V
Isc	8.37A	8.58A	8.82A	8.58A	8.78A	8.36A	8.55A
Vpm	17.7V	23.6V	23.6V	26.6V	26.6V	29.8V	29.8V
Ipm	7.63A	7.84A	8.06A	7.90A	8.09A	7.72A	7.89A
	Factory installed Bypass Diode						
(QTY)	YES(2pcs)	YES (3pcs)					
Series Fuse Rating (A)	15	15	15	15	15	15	15
	Thermal Characteristics: Temp. Coefficient						
Voc (V/°C)	-0.80×10^{-1}	-1.06×10^{-1}	-1.06×10^{-1}	-1.20×10^{-1}	-1.20×10^{-1}	-1.33×10^{-1}	-1.33×10^{-1}
I sc (A/°C)	5.02×10^{-3}	5.15×10^{-3}	5.29×10^{-3}	5.15×10^{-3}	5.27×10^{-3}	5.02×10^{-3}	5.13×10^{-3}
Vpm (V/℃)	-0.92×10^{-1}	-1.23×10^{-1}	-1.23×10^{-1}	-1.38×10^{-1}	-1.39×10^{-1}	-1.53×10^{-1}	-1.54×10^{-1}
	Physical Characteristics:						
Module Type	KD135GH-2FBS	KD185GH-2FBS	KD190GH-2FBS	KD210GH-2FBS	KD215GH-2FBS	KD230GH-2FB	KD235GH-2FB
Length (mm)	1500	1338	1338	1500	1500	1662	1662
Width (mm)	668	990	990	990	990	990	990
Depth (mm)	46	46	46	46	46	46	46
Weight (kg)	12.9	16.6	16.6	18.6	18.6	21.0	21.0
Mounting Hole	Diameter 9mm Quantity 4pcs						
Grounding Hole	Diameter 9mm Quantity 4pcs						
Application Class	Class A						

NOTES

(1) Standard Test Conditions of irradiance of 1000 W/m^2, spectrum of 1.5 air mass, and cell temperature of 25 deg C.

(2) See module drawing for mounting and grounding holes locations.

	MODULE DIMENSIONS						
MODULE TYPE	DIM. A	DIM. B	DIM. C	DIM. D	DIM. E	DIM. F	DIM. G
KD135GH-2FBS	1500mm	668mm	643mm	12.5mm	278.5mm	943mm	9mm
KD185GH-2FBS, KD190GH-2FBS	1338mm	990mm	965mm	12.5mm	256.5mm	825mm	9mm

	MODULE DIMENSIONS						
MODULE TYPE	DIM. A	DIM. B	DIM. C	DIM. D	DIM. E	DIM. F	DIM. G
KD210GH-2FBS, KD215GH-2FBS	1500mm	990mm	965mm	12.5mm	278.5mm	943mm	9mm
KD230GH-2FB, KD235GH-2FB	1662mm	990mm	965mm	12.5mm	281mm	1100mm	9mm