FS Series 2 PV Module User Guide - Europe

1.0 Introduction

First Solar Series 2 PV modules are manufactured in state-of-the-art manufacturing facilities using a breakthrough process that rapidly deposits thin films of compound semiconductor material on glass. The modules have been designed to have a long operating life and high energy yield if installed, operated, and serviced in accordance with the instructions in this User Guide.

1.1 Key Product Features

- High energy production in real-world conditions.
- Size and weight that enables efficient handing and installation.
- Easy, quick connect wiring for fast interconnection.
- Internationally recognized product certifications.
- Five year limited material/workmanship and twenty-five year limited power output warranties according to "First Solar FS Series Module Warranty Terms & Conditions" (PD-5-102).

1.2 Before You Begin

This document provides guidelines and information on First Solar FS Series 2 PV modules for system designers, installers, and maintenance personnel. We encourage you to read this User Guide thoroughly before beginning any work related to the installation, operation, or maintenance of the First Solar Series 2 PV module. Only qualified personnel should install, operate or maintain a PV module or system.

This guide pertains to modules installed within the European Union only. If a module is being installed outside of Europe, contact First Solar or the product distributor for the User Guide appropriate for other geographic areas.

Guidelines related to workmanship are beyond the scope of this document and are **not** covered in this document.

2.0 Warnings & Cautions



The FS Series 2 PV Modules may produce voltage in excess of 90 Volts DC (V_{dc}) and current in excess of 1.0 Amp when exposed to sunlight.

***A single module could represent a lethal shock hazard during hours of daylight,* including periods of low light levels. The danger increases as modules are connected together in series and/or parallel.**

Do not disconnect the module connectors during daylight hours unless the module is in an open circuit condition or all modules in series and parallel are covered with an opaque material, such as a tarp or blanket. An electrical arc could occur and pass through the fingers and body of the person holding the two ends of the connector.

Never allow the PV array open-circuit voltage to exceed 1000 Volts DC under any condition (e.g. cold winter conditions). Leakage currents could create a shock hazard or fire.

Keep all array wiring out of reach of non-qualified personnel. Defective or damaged wiring could result in an electrical shock hazard.

Do not concentrate light on the module in an attempt to increase power output.

2.1 Recommended Safe Practices

- Wear eye protection when working on modules or systems.
- Do not work on modules or systems when the modules or wiring are wet.
- Replace broken modules as they represent a shock hazard due to leakage currents, especially when wet.
- Comply with all local codes and permit requirements.

Before beginning the PV system design and installation, contact appropriate local authorities to determine local code, permit and inspection requirements.

3.0 Electrical Specifications

See the FS Series 2 data sheet or module label for all electrical ratings of the module. All electrical ratings are at Standard Test Conditions (irradiance of 1000 W/m^2, AM 1.5 spectrum, and a cell temperature of 25°C) and have a tolerance of +/- 10% of the specified value; power tolerance is +/- 5%.

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4.0 Installation: Mounting

Caution: Modules should be handled with care during installation, as heavy impact on the front, back, or edges could result in damage to the module. Do not attempt to install the modules in high wind or wet conditions.

Mounting of the FS Series 2 PV module to a suitable structure can be done by attaching the module directly to the structure using retaining clips (see Figure 5.1).

The retaining clip design must meet the technical requirements specified in First Solar Application Note PD-5-320 and must be approved for use by First Solar prior to installation. The mounting system design must provide adequate support for the glass laminate module to prevent damage from occurring when the module is subjected to wind loads of 130km/h, with a safety factor of 3 for gusty conditions. The location of the clips shall be along the 1200mm length of the module and the center point of the clip shall be located between 250mm and 300mm from the module edge. See figure 5.1 for allowed location. Retaining clips must each provide a minimum contact area of 15mm x 80mm. Rubber gasket material, or equivalent must be used between the module and both the clip and mounting structure to provide adequate protection of the glass laminate module. No direct contact of rigid structures is permitted against the surface or edges of the glass laminate.

All mounting structures must provide a flat plane for the modules to be mounted, and must not cause any twist or stress to be placed on the module.

Modules should not be installed in a way that restricts air circulation to the backside of the module. Modules generate heat and require adequate airflow for cooling.

Modules must not be installed in applications where static load on the module exceeds 2400 Pa at any time.

5.0 Mechanical Specifications & Drawings

4.1 Location, Angle and Tilt

To maximize performance, modules should be located in an area that receives direct sunlight from mid morning to mid afternoon (typically 9:00 a.m. to 3:00 p.m.). Avoid locating the modules where shadows may be caused by buildings, trees, etc.
PV performance modeling software should be used to determine the optimum orientation and tilt angle for each location.

4.2 Electrical Interconnection

First Solar FS Series 2 PV modules are pre-configured with industry standard connectors that are “touch proof” with all live parts protected against accidental contact, self locking, and protect against polarity reversal. The connectors are UV and weather resistant from –40°C to +90°C, and rated for 1000V_{DC} and 20A (before derating for ambient temperature).

Caution: PV module plug connections must not be unplugged while under load.

Components used to interconnect the modules must be compatible with the connectors, and provide proper system operation and fault protection as required by any applicable codes and standards.

FS Series 2 PV modules are designed for interconnection solely with grid-connected PV inverters capable of continuous operation at the maximum power point of the PV array. All inverters must meet the technical requirements specified First Solar Application Note PD-5-310 and must be approved by First Solar prior to installation.

First Solar recommends that modules not be operated in open or short circuit conditions for more than ninety (90) consecutive days to avoid a potential reduction in energy output over the life of the modules.

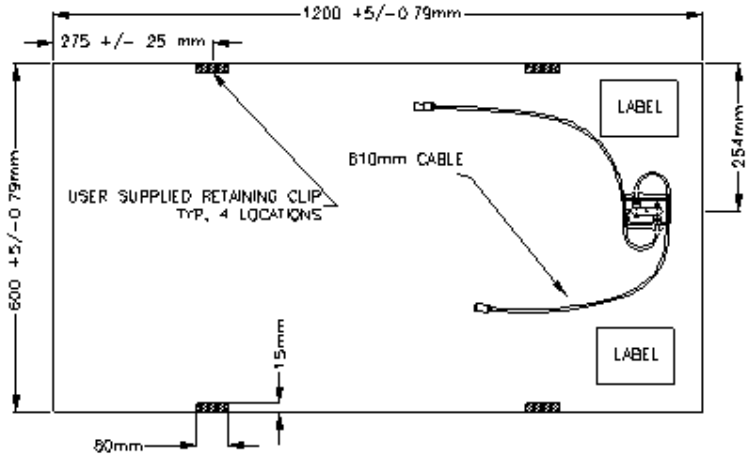
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Table 5.1: Mechanical Specifications

Specifications	FS Series 2 PV Module
Length	1200 mm
Width	600 mm
Thickness	6,8 mm
Area (total aperture)	0,72 m^2
Weight	12 kg
Fire Rating	Class C

Figure 5.1: Mechanical Drawing for FS Series 2 PV Modules



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6.0 Proper Operating Conditions

The proper operating condition requirements listed below must be maintained. Failure to maintain proper operating condition requirements for the modules will void the warranty (refer to First Solar FS Series Module Warranty Terms & Conditions PD-5-102).

Requirements:

- First Solar must be notified in writing if modules are operated in open or short circuit conditions for more than 90 consecutive days during the installation period or any subsequent operating period; for modules operated in open or short circuit conditions for 90 consecutive days or longer, First Solar requires installers to use commercially reasonable efforts to grid-connect the modules as soon as practicable.
- All electronic components that are interconnected to modules must have an operating voltage window that matches the maximum power point of the array, and be capable of operating the array at the maximum power point at all times.
- All electronic components that are interconnected to modules must be rated for the maximum operating voltage of the array.
- Modules must have adequate ventilation and airflow to prevent excessive operating temperatures.
- Modules should not be shaded by obstructions at times of high irradiance (typically between 9:00am and 3:00pm).
- Modules should not be submersed in water or covered by snow or ice for long periods of time.
- Modules should not be used in positive-grounded or bi-polar systems.

7.0 Service

- Periodically inspect modules for any signs of damage or broken glass. Broken modules should be replaced immediately.
- Check that all electrical connections are tight and corrosion free.
- Large amounts of dust and dirt on the surface of the module can reduce the power produced. The recommended cleaning method is to simply spray off the modules with water.
- Abrasive cleaners should never be used to clean the module.

The most common causes of lower than expected PV system power output are:

- Inverter failure.
- Improper or faulty field wiring or connections.
- Blown fuses or tripped circuit breakers.
- Excessive amounts of dirt and dust on the modules
- Shading of modules by trees, poles or buildings.

8.0 Warranty Terms & Conditions

Please refer to, “First Solar FS Series Module Warranty Terms & Conditions” (PD-5-102) for warranty terms, limitations, and product return policies.

Notice

Changes to certain components of the module are common as First Solar continuously strives for product improvements. Changes may be a result of component improvements or changes by a supplier, or by minor design modifications initiated by First Solar. All products within the same model classification remain functionally equivalent and fully compatible with one another, even though there may be slight differences. Modifications that do not impact the functionality of the product will typically be made without customer notification. Internal testing, and review or retesting by a certifying agency, will be completed before component or design changes are introduced into the manufacturing process.

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