MEMC

SunEdison

Installation Manual

for MEMC Silvantis™ 72 cell Photovoltaic Modules

Product List: MEMC-P270AMA, MEMC-P275AMA, MEMC-P280AMA, MEMC-P285AMA, MEMC-P290AMA
MEMC-P270ACA, MEMC-P275ACA, MEMC-P280ACA, MEMC-P285ACA, MEMC-P290ACA
MEMC-P280AMC, MEMC-P285AMC, MEMC-P290AMC, MEMC-P295AMC, MEMC-P300AMC, MEMC-P305AMC
MEMC-P280ACC, MEMC-P285ACC, MEMC-P290ACC, MEMC-P295ACC, MEMC-P300ACC, MEMC-P305ACC

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1.0 INTRODUCTION

The purpose of this guide is to provide general information regarding the proper installation and handling of MEMC photovoltaic modules that serve residential, commercial, and industrial segments. System design, construction, and commissioning should be performed by qualified personnel only.

To ensure system integrity, designers, installers and operators must meet all mechanical and electrical requirements for the system and its components. It is the responsibility of the system designer and installer to ensure that all codes and requirements are followed as well.

Please review all the sections that pertain to proper installation of modules listed in this Guide. The instructions detailed in this guide must be followed throughout the module's lifetime deployment. If you need additional information about the safe, proper use and handling of MEMC photovoltaic module products, please contact MEMC.

2.0 PHOTOVOLTAIC MODULES PRODUCT CODE

This guide is to be used for MEMC Silvantis™ 72 cell photovoltaic (PV) module installation. Please refer to the following module numbers before using the guide: P270AMA, P275AMA, P280AMA, P285AMA, P290AMA, P270ACA, P275ACA, P280ACA, P285ACA, P290ACA

Modules with anti-reflective coating (AR coating or ARC): P280ACC, P285ACC, P290ACC, P295ACC, P300ACC, P305ACC, P280AMC, P285AMC, P290AMC, P295AMC, P300AMC, P305AMC

3.0 MODULE OVERVIEW

MEMC Silvantis Photovoltaic modules consist of a series of electrically interconnected crystalline silicon solar cells that are sealed within a laminated sheet of tempered glass superstrate* and EVA/back-sheet substrate. These laminates are secured inside an aluminum frame to provide rigidity and a means for attachment to mounting sub-structures. The frames should not be modified or removed. ** Tempered glass may have AR coating.*

- Photovoltaic modules are designed and constructed for outdoor use. Do not submerge modules in water at any time.
- The front and back of each module is labeled with a product bar code. Do not cover, remove or deface these labels. This may be required for product identification.
- Damage to the glass surface or the anti-reflective coating can impact the power output and overall efficiency of the system. Scratches, handling marks, or any damage to the glass surface must be avoided.
- For best performance and to avoid potential issues, keep the front side of the module clean and free of obstructions including covers, tape, adhesives, paint and debris.

3.1 STORAGE, UNPACKING, AND HANDLING

- Packaged modules must be stored in a dry and ventilated area.
- Packaged modules must not be exposed to rain, snow, hail or other environmental conditions that may compromise the packaging material and the modules.
- Packaged modules must be on appropriate provided pallets and must not be stacked more than two pallet high for storage.
- Once the modules are opened, store modules in a dry and ventilated room.
- Modules should never be stored in a wet environment.
- Upon unpacking, do not carry a module by its wires or junction box. Only carry a module by its frame with two or more people.
- Precaution should be taken to avoid damage to the glass surface with or without anti-reflective coating due to improper handling during storage or unpacking.

- Keep all electrical contacts clean and dry.
- All modules are manufactured with a sealed junction box and pre-attached cables and locking connectors. These components should not be modified or tampered with in any way.
- Do not allow unauthorized persons near the installation site or storage area of modules.
- Do not place modules on top of one another.
- Do not place any load on the module or twist the module frame.
- Do not stand, step, walk, or jump on the module.
- Do not drop or place objects on the modules such as tools.
- Do not handle modules with bare hands and avoid scratches, handling marks, or any damage especially to the front glass of the module, backsheet, or electrical components.
- Do not mark the modules with sharp instruments.
- Do not leave a module unsupported or unsecured.
- Do not modify module frames in any way.

3.2 SAFETY

The following safety guidelines and best practices should be followed:

- All installations must be performed in compliance with all applicable regional and local electrical codes or other national or international electrical standards.
- Use insulated tools during installation, troubleshooting and maintenance of photovoltaic modules.
- Wear suitable protection to prevent direct contact with module's electrical output and mechanical sharp edges.
- Cover the front of the modules with an opaque material to stop production of electricity when installing or working with a module or wiring.
- Modules connected in a series should not be disconnected under illumination. Disconnecting modules under illumination may cause electrical arcing which may result in burns, fires or other problems.
- Follow industry best practices when commissioning, trouble shooting, disconnecting, or connecting a PV system.
- Trouble shooting should include planning, checking, disconnecting, cause seeking, replacement, and record keeping.
- Do not install or handle the modules or their components when they are wet or during periods of high wind.
- Do not attempt to disassemble, repair, or open any part of the module including junction box or sub-components.
- Do not artificially concentrate sunlight on a module.
- Do not install or handle any broken modules. If a module is broken, or the back sheet is torn, contact with the surface or frame can cause an electrical shock.
- Do not wear rings, jewelry, watches, or other metallic items while working with photovoltaic modules.

3.3 MAINTENANCE

Check modules, glass, and frames for damage. Regularly inspect all MEMC Solar Modules for safe electrical connections, sound mechanical connections, and freedom from shading and corrosion. If dirt or debris buildup becomes excessive, periodically clean the glass only with a soft cloth using mild, non-abrasive detergent and water. When using mild cleaning liquids, a neutral pH in the range of 6.0 to 8.0 is recommended. Chemicals with pH less than 6.0 or greater than 8.0 should be avoided as it may damage the glass surface and or the AR coating. Please consult with system designer to decide the cleaning and inspection frequency according to local environmental conditions.

Do not power wash or use harsh cleaning materials or objects such as scouring powder, steel wool, scrapers, blades, or other sharp instruments to clean the glass surface of the module. Use of such materials will invalidate the product warranty.

WARNING: Use caution when cleaning the back surface of the module to avoid penetrating the substrate materials.

4.0 MECHANICAL INSTALLATION

4.1 PLANNING AND DESIGN

- Before installation, check to ensure all sub-structure will accommodate expected system loads. This includes and is not limited to roof, foundations, mechanical structure, and mechanical connections.
- For roof installations, utilize a fire-resistant roof covering rated for the application.
- Mechanical structures should not contact the module backsheet under any expected load conditions
- Consider the following factors during system design, which will influence performance:

  a) MEMC solar modules produce the most power when they are pointed directly at the sun, and should be tilted for optimum system performance.

  b) Proximity to obstructions such as: walls, buildings, trees, groundcover, snow cover, or dust and debris that have the potential to shade or damage the modules.

  c) Elevated temperatures will decrease energy yield, so designs should ensure adequate airflow across the back of the module.

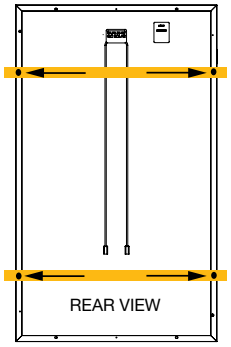
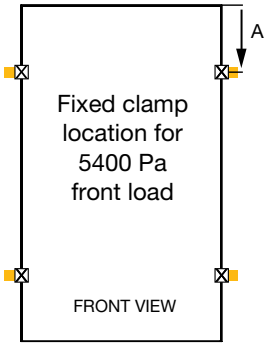
  d) Allow a minimum spacing of 10 mm between modules for thermal expansion.

4.2 MODULE INSTALLATION OPTIONS FOR MOUNTING LOCATIONS

For mounting locations for clamps or bolt for specified load, please refer to Table on page 5.

- Each module should be mounted using four bolts through the mounting holes on the rear side of the module, or with four clamps over the front side.
- Depending on the desired load capability of the array, modules may be mounted either perpendicular or parallel to the structure rails. Clamps can be mounted anywhere inside of the safe mounting range for each case illustrated below (referring to chart showing clamp and bolt mounting locations).
- If using bolts, eight mounting holes are provided on the rear side the module frame as shown in Appendix 8.1. Use a stainless steel bolt stack no smaller than ¼"-20 or M6, with two flat washers and a locking washer as shown in Appendix 8.2.
- To ensure an adequate clamping area, all clamps used should comply with the following general conditions:
  1. Clamp height must correspond to 50 mm frame height
  2. Clamp must have a minimum width of 38 mm
  3. Clamp depth must be between 6 mm to 10 mm
- All fasteners used to fix the modules with clamps should be stainless steel, and no smaller than ¼”-20 or M6.
- To provide adequate fixing or clamping force, torque the minimum recommended fasteners to 6.2 - 8.9 Nm (4.6 - 6.6 ft-lb).
- All other structural dimensions, such as clamp and rail thickness, should be sized appropriately for the intended site load.

4.2A MOUNTING CONFIGURATIONS USING BOLT MOUNT OR CLAMP MOUNT OPTIONS

<table>
<tr><th>MOUNTING CONFIGURATIONS</th><th colspan="2">LOAD PARAMETERS</th><th>BOLT MOUNT LOCATIONS</th><th>CLAMP MOUNT LOCATIONS</th></tr>
<tr><td rowspan="2">PERPENDICULAR MOUNTING (CASES 1 & 2)
Structural rails running perpendicular to the length of the module should be fixed via bolts or clamps at the mounting holes between each long side frame, OR at the holes on each short end frame.
NOTE: All modules are rated for a maximum rear load of 2400 Pa and a maximum front load of 5400 Pa when fixed to the side frames mounting holes for CASE 1 or a front load of 2400 Pa when fixed to the end frames mounting holes for CASE 2.</td><td>CASE 1</td><td>Maximum Rear Load:
2400 Pa or 50 psf
Maximum Front Load:
5400 Pa or 113 psf</td><td> 
</td><td> 
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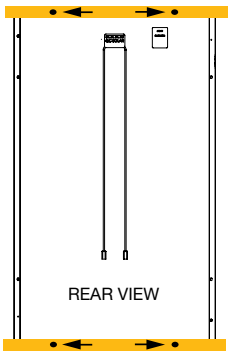
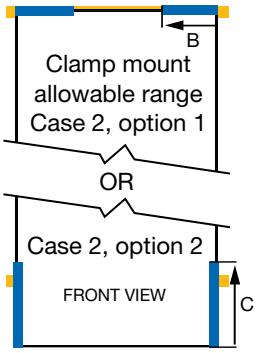
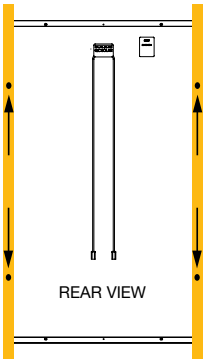
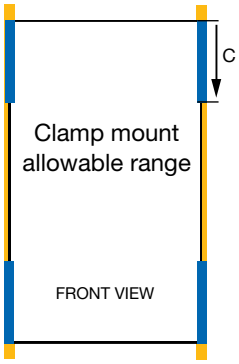
Maximum Front Load:
2400 Pa or 50 psf</td><td> 
</td><td> 
</td></tr>
<tr><td>PARALLEL MOUNTING (CASE 3)
Structural rails running parallel to the length of the module should be fixed via bolts or clamps ONLY at the mounting holes on each long side frame.
NOTE: All modules are rated for a maximum rear load of 2400 Pa and a maximum front load of 5400 Pa when fixed to the mounting holes on the long side frames only.
Structural rails running parallel to the length of the module should NEVER be fixed to the end frames.</td><td>CASE 3</td><td>Maximum Rear Load:
2400 Pa or 50 psf
Maximum Front Load:
5400 Pa or 113 psf</td><td> 
</td><td> 
</td></tr>
</table>

Mounting Color Code: ● Mounting Hole Location ■ Module Rail ☒ Fixed Clamp Mount ■ Clamp Mount Range

Fixed Clamp Mount location: A – 394 mm
Clamp mount allowable range: B – 248 mm
C – 444 mm

4.3 MODULE INSTALLATION USING CENTER MOUNTING BRACKETS

- Modules may also be mounted using center clamps as shown in Appendix 8.2, for use with trackers.
- Module clamps for center mounting must be based on MEMC approved extrusion and hardware.
- For module loads higher than 2400 Pa, module clamps and hardware must be pre-approved by MEMC.

4.4 MECHANICAL INSTALLATION WARNINGS

- Installation and maintenance should be performed by qualified personnel only.
- Use insulated tools during installation, troubleshooting and maintenance of photovoltaic modules.
- Installers should adhere to all applicable local, regional, and national codes and regulations when designing and constructing the photovoltaic system.
- Do not stand or walk on any surface of the modules. Do not place any objects or load on the surface of the modules.
- Precaution should be taken to avoid damage to the glass surface with or without anti-reflective coating due to improper handling during installation.
- Mechanical structures should not contact the module backsheet under any expected load conditions.
- Additional mounting holes may not be drilled in the frame, glass or backsheet.
- Ensure that frame weep holes (see Appendix 8.1) are not obstructed by the mechanical installation.

5.0 ELECTRICAL INSTALLATION

5.1 PLANNING AND DESIGN

- All modules are manufactured with a sealed junction box and pre-attached cables and locking connectors. These components should not be modified or tampered with in any way.

NOTE: Installers should ensure that the polarized locking connectors are from the same supplier when connected on the same string. We do not recommend mixing polarized interlocking connectors from different manufacturers—including connections at the inverter, combiner boxes, and modules.

- Ensure connectors are clean and dry before establishing connection.
- Ensure that all wire, fusing and disconnects are appropriately sized for the system design according to national, regional, and local codes.
- Electrical characteristics are within plus or minus 5% of rated values for Isc, Voc, Impp and Vmp. Pmax ranges between -0/+5W at standard test conditions (STC). However, modules will operate under conditions which may be significantly different than STC. MEMC suggests multiplying specified ratings by a minimum of 1.25* or more when specifying the system and balance of system components. *1.25* Refer to local codes before planning and design of the system.*
- Determine the maximum number of modules connected in series using the following formula: $N_s = Vmax_s / Voc_m$

  Where:
  N_s equals the maximum modules in series
  $Vmax_s$ equals the maximum system voltage
  Please refer to module data sheet for actual Vmax rating, as some models are rated for 600 V UL while others are 1000 V UL.
  Voc_m equals the module open circuit voltage at coldest conditions for the site (refer to local codes)

WARNING: Installers should adhere to all applicable local, regional, and national codes and regulations when designing and constructing the photovoltaic system.

NOTE: In colder climates, it may be necessary to further reduce the maximum number of modules in series by using Voc_m at the minimum expected operating temperature.

5.2 MODULE WIRING

- The module includes wires and polarized locking connectors from the junction box on the back of the module. The wires have sufficient length to connect to adjacent modules in either a portrait or landscape configuration. Field replacement of connectors or cables must be avoided and it will invalidate the product warranty. Polarized locking connectors of the same type and make are needed for all series string wiring. The maximum operating temperature of wires and connectors should not exceed 85ºC.

WARNING: It is not recommended to mix connectors from different suppliers within the same string. This includes connections at the inverter, combiner boxes, and modules.

- Always wire modules so that proper polarity is maintained. Avoid placing excessive tension on the cables.
- There is no limit to the maximum number of series strings that can be combined in parallel. However, when doing so, each string must include overcurrent protection with a maximum rating of 15A. MEMC recommends the use of DC rated fuses or overcurrent protection devices with the appropriate maximum voltage rating.
- Do not connect modules directly to a parallel bus.
- The cross-sectional area of cable and the connector type must be selected to align with the overall system design and should include the maximum short circuit current of the system, maximum operating temperatures, and cable run lengths.
- For field connections, use at a minimum #12 AWG/4 mm^2 wires insulated for a minimum of 85°C. Use copper wire only.

5.3 GROUNDING

- The module frame includes several labeled grounding holes. These holes may not be used for any other purpose.
- MEMC recommends a Burndy BGBL-4 AL lay-in lug for grounding.
- Only Negative grounding circuits (negative polarity to ground) shall be used within the array design.
- Attach the grounding lug to the frame as follows:

  Step 1: Use stainless steel hardware.

  Step 2: Place the grounding lug over the grounding hole on the exterior of the module frame.

  Step 3: Place a star washer directly between the bottom of the grounding lug and the exterior surface of the frame.

  Step 4: Place an M4 or #8-32 bolt through the lug, star washer and frame grounding hole.

  Step 5: Secure the lug to the frame using a flat washer, split washer and M4 or #8-32 nut.

  Step 6: Torque the bolt stack to approximately 1.5 Newton·meters (or 1.1 foot pounds) to ensure the star washer scratches the anodized frame.

5.4 ELECTRICAL INSTALLATION WARNINGS

- Installation and maintenance should be performed by qualified personnel only.
- Use insulated tools during installation, troubleshooting and maintenance of photovoltaic modules.
- Installers should adhere to all applicable local, regional, and national codes and regulations when designing and constructing the photovoltaic system.
- Photovoltaic modules produce DC electrical energy from light. When illuminated, each module can have a DC potential of greater than 45V and should be handled with care.
- Disconnecting modules under illumination may cause electrical arcing which may result in burns, fires, or other problems. Modules connected in series should not be disconnected under illumination.

  WARNING: The PV system can generate hazardous voltage even after the system has been disconnected. Follow standard safety regulations when disconnecting energized modules.
- Always use a wire management system that keeps wires and cables out of direct contact with edge surfaces which could cut or damage the insulation. Do not allow wires to rest on the ground or roof surface.
- The module junction box should not be opened or modified in any way in the field.
- Additional grounding holes may be added only with the express written consent of MEMC. New grounding holes must be drilled using an approved drill jig, avoiding damage to the module glass, backsheet, or other module components.
- Do not use mirrors, lenses, or other techniques to magnify or concentrate additional light on the module.

6.0 DISCLAIMER OF LIABILITY

The information in this manual is based on MEMC's knowledge and experience and is believed to be accurate. However, all information in this manual (without exception) including recommendations and specifications does not constitute a warranty, expressed or implied. MEMC reserves the right to change the manual, the module, or specifications without prior notice.

The product warranty shall be VOID if handling and installation of the product does not conform to MEMC's written installation instructions, or if the product has been reworked, repaired or otherwise modified in a manner not previously authorized by MEMC in writing, or if the product is installed in an environment for which it was not designed. MEMC shall not be liable for special, indirect, consequential, contingent or incidental damages related to or arising from the installation or use of the product by purchaser under any circumstances.

MEMC assumes no responsibility for any product application or use which is beyond MEMC's direct control. MEMC does not accept responsibility and expressly disclaims liability for loss, damage, or expense arising out of or in any way connected to such installation, operation or maintenance of the product.

International Product Certifications:
IEC 61215, IEC61730, CE, UL 1730, UL1703 listed by CSA and Safety Class II certifications ensure that MEMC solar products operate safely and comply with global electrical, performance, reliability, and fire safety codes.

Certification	• IEC61215 certified by T V S D to ensure long-term operation in a variety of climates • IEC61730 certified by T V S D to ensure electrical safety • Stringent outgoing quality acceptance criteria benchmarked to industry standards • UL1703 listed by CSA for Canada and US
Environmental	AB8 (-50°C to +40°C)
Fire Resistance Rating	Class C

MEMC Silvantis Modules are certified by:

7.0 MECHANICAL AND ELECTRICAL PARAMETERS AND SPECIFICATIONS

Modules with tempered glass: MEMC-P270/P275/P280/P285/P290AMA, MEMC-P270/P275/P280/P285/P290ACA
Modules with ARC glass: MEMC-P280/P285/P290/P295/P300/P305AMC, MEMC-P280/P285/P290/P295/P300/P305ACC

PHYSICAL PARAMETERS

Module Dimensions (mm)	1,976 x 990 x 50
Module Weight (kg)	23
Cell-Type	Multi-crystalline
Number of Cells	72
Frame Material	Anodized Aluminum
Glass (mm)	3.2 Tempered Glass 3.2 Tempered ARC Glass

TEMPERATURE COEFFICIENTS AND PARAMETERS*

		Modules with ARC glass
Nominal Operating Cell Temperature (NOCT) (°C)	47 ± 2	47 ± 2
Temperature Coefficient of P_{max} (%/°C)	-0.45	-0.45
Temperature Coefficient of V_{oc} (%/°C)	-0.33	-0.33
Temperature Coefficient of I_{sc} (%/°C)	0.06	+0.066
Operating Temperature (°C)	-40 to +85	-40 to +85
Maximum System Voltage (V)†	600 &1000 UL & 1000 IEC	600 &1000 UL & 1000 IEC
Limiting Reverse Current (A)	8.40	8.40
Maximum Series Fuse Rating (A)	15	15
Power Range (W)	-0/+5	-0/+5

Temperature coefficients may vary by ±10%
†Please refer to module data sheet for actual Vmax rating.

ELECTRICAL CHARACTERISTICS*

Model #	MEMC-P270AMA	MEMC-P275AMA	MEMC-P280AMA	MEMC-P285AMA	MEMC-P290AMA	MEMC-P270ACA	MEMC-P275ACA	MEMC-P280ACA	MEMC-P285ACA	MEMC-P290ACA
Rated Maximum Power Pmax (W)	270	275	280	285	290	270	275	280	285	290
Open-Circuit Voltage V_{oc} (V)	43.8	44.0	44.3	44.5	44.7	43.8	44.0	44.3	44.5	44.7
Short Circuit Current I_{sc} (A)	8.50	8.55	8.62	8.71	8.78	8.50	8.55	8.62	8.71	8.78
Module Efficiency (%)	13.9	14.2	14.3	14.6	14.8	13.9	14.2	14.3	14.6	14.8
Maximum Power Point Voltage V_{mpp} (V)	34.1	34.6	34.8	35.1	35.4	34.1	34.6	34.8	35.1	35.4
Maximum Power Point Current I_{mpp} (A)	8.00	8.05	8.12	8.18	8.20	8.00	8.05	8.12	8.18	8.20

All electrical data at STC: 1000W/m², AM1.5, 25ºC
Electrical characteristics measurement tolerance is ±5% and power is -0/+5W

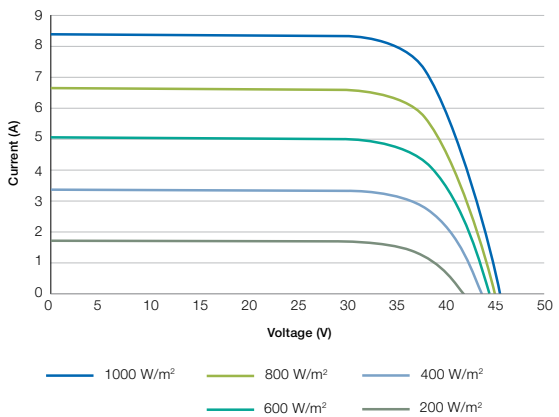
ELECTRICAL CHARACTERISTICS* - Modules with ARC glass

Model #	MEMC-P280AMC	MEMC-P285AMC	MEMC-P290AMC	MEMC-P295AMC	MEMC-P300AMC	MEMC-P305AMC	MEMC-P280ACC	MEMC-P285ACC	MEMC-P290ACC	MEMC-P295ACC	MEMC-P300ACC	MEMC-P305ACC
Rated Maximum Power Pmax (W)	280	285	290	295	300	305	280	285	290	295	300	305
Open-Circuit Voltage V_{oc} (V)	44.0	44.4	44.7	45.1	45.3	45.4	44.0	44.4	44.7	45.1	45.3	45.4
Short Circuit Current I_{sc} (A)	8.60	8.65	8.71	8.95	9.00	9.05	8.60	8.65	8.71	8.95	9.00	9.05
Module Efficiency (%)	14.3	14.6	14.8	15.1	15.4	15.6	14.3	14.6	14.8	15.1	15.4	15.6
Maximum Power Point Voltage V_{mpp} (V)	34.7	34.9	35.4	35.7	36.0	36.3	34.7	34.9	35.4	35.7	36.0	36.3
Maximum Power Point Current I_{mpp} (A)	8.08	8.16	8.20	8.26	8.34	8.41	8.08	8.16	8.20	8.26	8.34	8.41

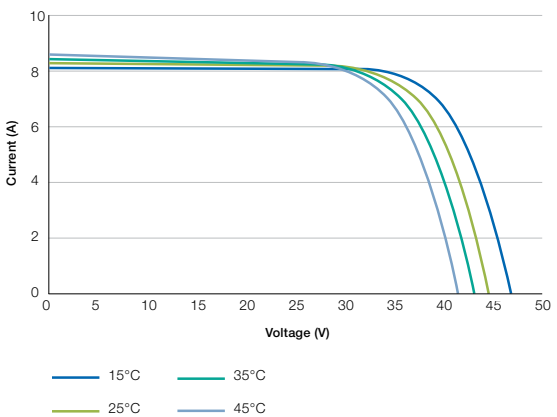
All electrical data at STC: 1000W/m², AM1.5, 25ºC
Electrical characteristics measurement tolerance is ±5% and power is -0/+5W

** Listed specifications are subject to change without prior notice.*

IV CURVES AT MULTIPLE IRRADIANCES* [25°C]

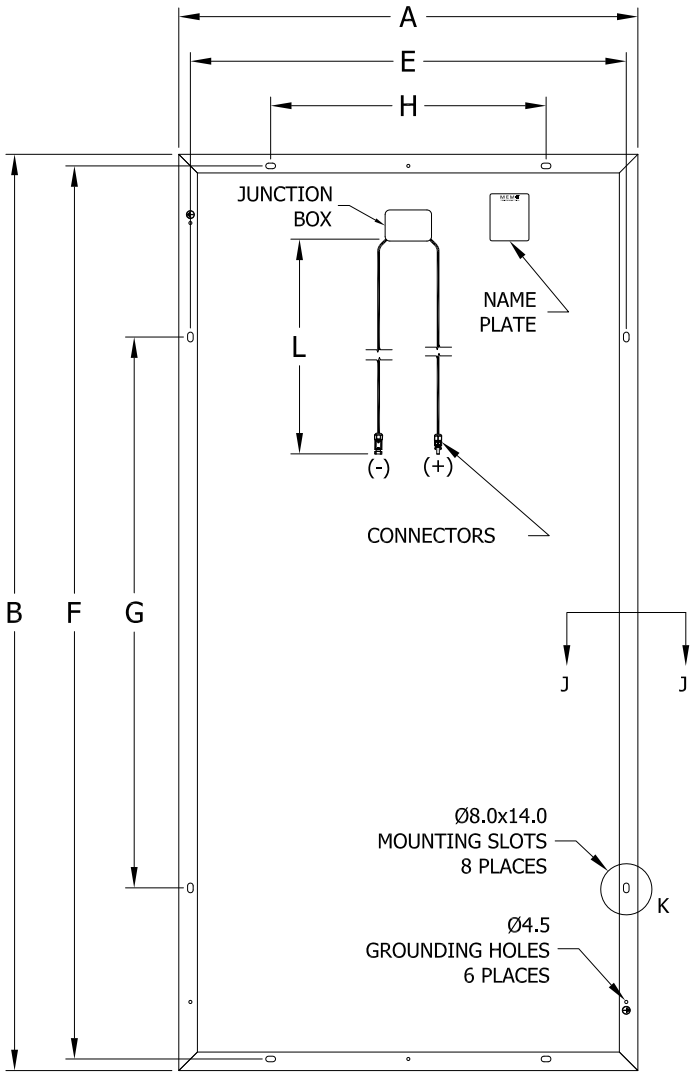


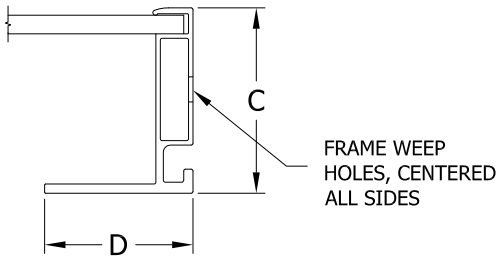
IV CURVES AT MULTIPLE TEMPERATURES* [1000 W/m²]



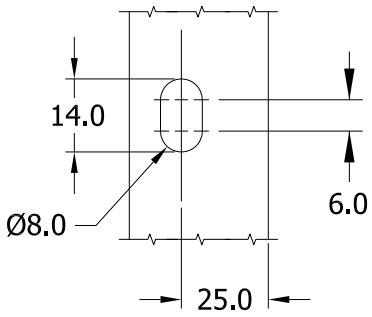
8.0 APPENDIX

8.1 MODULE DETAILS





SECTION J-J
FRAME PROFILE



DETAIL - K
MOUNTING HOLE

Dimension	MM	INCH
Module Dimensions		
A	990	39.0
B	1,976	77.8
C	50	2.0
D	40	1.6

Dimension tolerance range for:
A ±3 mm, B ±3 mm and C ±0.3 mm

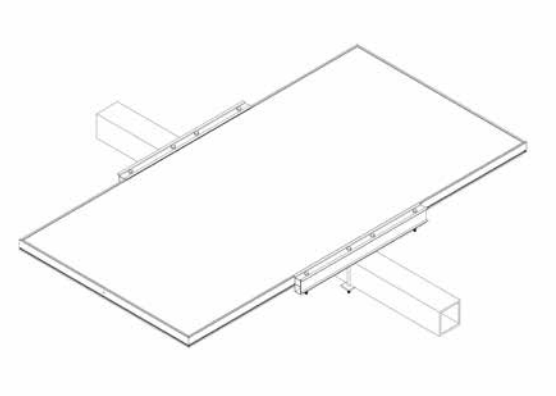
Dimension	MM	INCH
Mounting Hole Spacing		
E	940	37.0
F	1,926	75.8
G	1,188	46.8
H	594	23.4

Dimension	MM	INCH
Cable Length for AMA and AMC		
L	1,000	39.4
Cable Length for ACA and ACC		
L	1,300	51.2

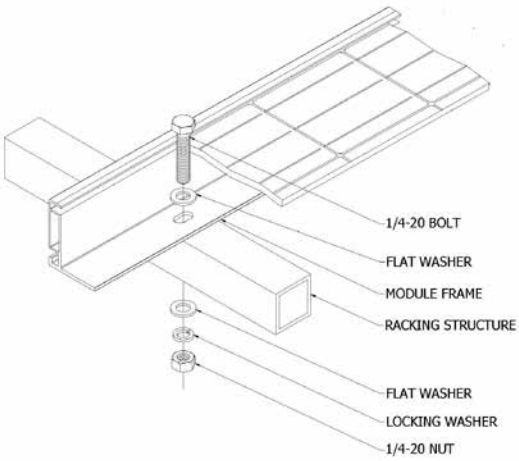
Cable length Tolerance - 2.5 mm to + 52.5 mm

8.0 APPENDIX

8.2 MODULE ILLUSTRATIONS



Center Mount Option



Bolt Stack Details

8.0 APPENDIX

8.3 PRE-MOUNTED CABLES AND CONNECTORS

Mounting Configuration	Pre-mounted cables	Pre-mounted connectors
Type	TUV – PV1-F & UL – PV wire	locking polarized connectors
Cross section	4.0 mm^2	4 mm dia.
Max. current	16 A	25 A
Max. system voltage	(600 V &1000 V)UL & 1000 V IEC	(600 V &1000 V)UL & 1000 V IEC
Temperature rating	-40°C to +90°C	-40°C to +85°C
Qualification	TUV 2PFG & UL PV wire	EN 50521 & UL for PV sys