

INSTALLATION MANUAL

(IEC VERSION)

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1. DISCLAIMER OF LIABILITY

This manual provides instructions about the installation of Honeywell Solar crystalline modules in a PV array, system or in power plant applications. Honeywell solar modules consist of a series of electrically interconnected crystalline silicon solar cells, which are permanently encapsulated between a low iron toughened glass superstrate and substrate. 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. However, the installation, handling and use of Honeywell solar crystalline photovoltaic (PV) modules are beyond company control. Honeywell solar does not assume any responsibility for the loss, damage, injury or expense resulting from the improper installation, handling, use or the maintenance. Honeywell solar assumes no responsibility for any infringement of patents or other rights of third parties that may result from use of the module. No license is granted by implication or under any patent or patent rights. Specifications are subject to change without prior notice. Note: Please note that the term “modules” and “products” are interchangeably used in this document.

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2. SAFETY PRECAUTIONS

DO's:

- PV modules upon exposure to light could generate potential lethal DC voltages, so avoid contacting with the electrically active parts.
- Do ensure to isolate all live circuits before attempting to make or break any connections.
- Do ensure only authorized and trained personnel perform the necessary work with the modules or solar system.
- Do ensure the installation personnel are free from jewel ornaments, wristwatches, etc., when working on electrical connections.
- Do ensure the use of properly insulated tools, their insulation conditions and appropriate personal protective equipment to reduce the risk of electric shock.
- Do protect the electrical plug contacts against corrosion and soiling. Make sure that all connectors are corrosion free and clean before making the connection.
- Do ensure sure that all connections are securely made with no gap between the contacts. Any gap can result in electrical arcing that can cause a fire hazard and/or an electric shock.
- Do ensure the polarity connections of each module or a string are connected as per the system design.
- Modules are certified for operating at voltages below 1000Vdc. This maximum voltage should not be exceeded at any time. Please take into consideration while designing the PV system, the effect of operating temperatures less than 25°C to the module or array or system voltage. Under normal operating conditions, a solar photovoltaic module is likely to produce more current and/or voltage than the reported values in the datasheet under standard test conditions. Accordingly, the value of Isc marked on this module should be multiplied by the factor of 1.25 when determining the conductor current ratings, fuse sizes and size of controls connected to the SPV output.

DONT's:

- Do not stand or step on, damage or scratch the front or backside surfaces of the module.
- Do not attempt to repair the module when connected. Broken modules cannot be repaired and contact with any module surface or frame can lead to electrical shock.
- Do not use a module with broken glass or torn substrate.
- Do not disassemble the modules or remove any part of the module.
- Do not install or handle modules when they are wet or during periods of high wind.
- Do not artificially concentrate sunlight on these solar modules.
- Do not use water to extinguish fires of an electrical origin.

3. UNPACKING AND STORAGE

Upon receipt of the shipment delivery, the users / customers are required

- To verify that the products delivered are actual products ordered and carry the correct label/invoice information such as the product code, sub codes if any, and serial numbers. Every product carry a bar-code label with unique serial number laminated behind the glass and a label attached to the back-sheet of the module on the product sticker. Please note all serial numbers for your future records;
- To leave the products in their original packing box until they are ready for installation;
- To store packing boxes in a clean, dry area with relative humidity below 85% and ambient temperatures between - 20°C and 40°C;
- Not to stack more than the allowed stacking as per the recommendations;
- To ensure the electrical contacts of the products are not exposed outside weathering conditions and kept clean and dry. If connector cables are left in damp conditions then the contacts may corrode. Any module with corroded contacts should not be used;
- To protect the products with a suitable protective clothing / covering if pallets are stored temporarily outside;
- To ensure the products are handled by two personnel, using both hands for unpacking and moving the products;
- To use wire cutting pliers or any other suitable cutting tools but refrain from using knives to cut the zip-ties;
- Not to place the products directly on top of each other.

4. ENVIRONMENTAL CONSIDERATIONS:

Honeywell solar crystalline series modules may be installed in the following conditions for more than 25 years under the following environment considerations.

- Ambient temperature: -40°C to +50°C.
- Operating temperature: -40°C to +85°C.
- Storage temperature: -20°C to +50°C.
- Relative Humidity: < 85RH%
- Mechanical Load Pressure*: 5400Pa (550 Kg/m²) Max from the front side (snow) 2400Pa (wind) from the rear

*The modules have been evaluated by TUV according to IEC61215 for a maximum design loading of below 112.78lb / ft² (5400Pa). The mechanical load bearing is dependent upon the mounting methods used and failure to follow the instructions of this manual may result in different capabilities to withstand snow and wind loads. The system installer must ensure that the installation methods used meet these requirements and any local codes and regulations.

5. SITE SELECTION

- Honeywell Solar modules can be mounted in landscape and portrait orientation; however it is beneficial to mount the module in portrait orientation to minimize the impact of dust / dirt shading the solar cells.
- For optimum energy production, solar modules should normally be mounted facing the equator at an angle to the horizontal plane equivalent to the latitude of the installation. In the event that you mount the solar modules at a different angle or orientation then the annual energy production may potentially be adversely impacted.
- It is required to leave a safe work area always between the roof edge and the extreme module edge of the array when installing solar modules on a roof.
- It is required to place and position the modules to minimize the every chance of shading at any time of the day. Ensuring that the distance between the obstruction and solar array is greater than three times the obstruction's height can normally minimize shading.
- Do not install the modules in locations where there is a likely chance of product immersion in water or continuous exposure to water such from locations near to a water sprinkler or fountain, etc.
- Avoid using a mounting method that will block the drainage holes in the module frame.
- When all similar power rated solar modules are mounted in the same plane and orientation then all can be expected to have similar performance throughout the day and can be connected together to the same inverter channel.
- If solar modules on the same installation are mounted at different angles or orientations then energy production can normally be optimized by connecting the different orientations to different inverters (or different MPPT if the inverter has more than one MPPT). Refer to inverter manufacturers for further guidelines.

6. MOUNTING INSTUCTIONS

PV modules can be mounted to the substructure using either corrosion-proof M8 bolts placed through the mounting holes on the rear of the module or specially designed module clamps. Regardless of the fixing method the final installation of the modules must ensure that:

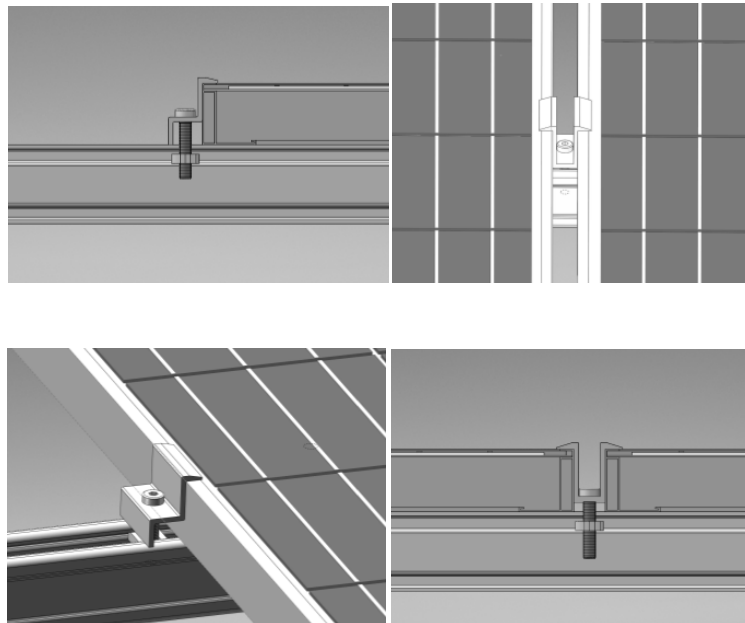
- A clearance of at least 300mm is provided between modules frame and the surface of the wall or roof.
- The minimum distance between two modules is 20 mm.
- The mounting method does not block the module drainage holes.
- Panels are not subjected to wind or snow loads exceeding the maximum permissible loads, and are not subject to excessive forces due to the thermal expansion of the support structures.

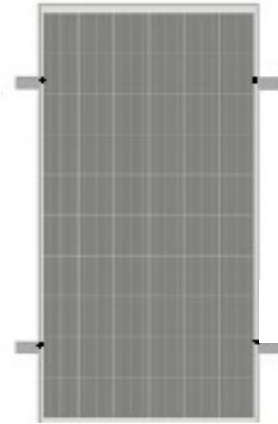
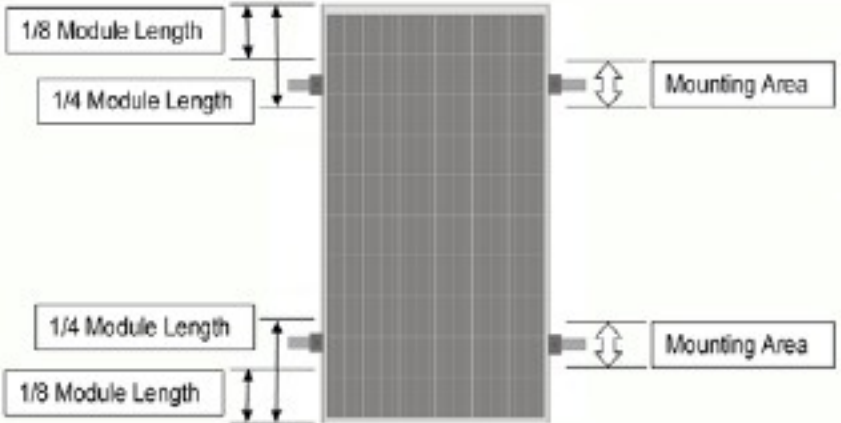
MOUNTING WITH BOLTS

- The frame of each module has 4 x $\phi 9$ mm mounting holes, ideally placed to optimize the load handling capability, to secure the modules to supporting structure.
- To maximize mounting longevity, it is recommended the use of corrosion proof (stainless steel) fixings
- Secure the module in each fixing location with an M8mm bolt and a flat washer, spring washer and nut as shown in Figure 1 and tighten to a torque of 16 Nm.

MOUNTING WITH CLAMPS

- It is recommended to use minimum 4 clamps that have an EPDM or similar insulating washer with fixing bolt of at least M6 to fix modules on the mounting rails. When using 4 clamps, two clamps should be attached on each long sides of the module (for portrait orientation) and each short sides of the module (for landscape orientation). Depending on local wind and snow loads, additional clamps may be required to ensure that modules can bear the load.
- The clamps must cover the module frame by at least 7mm but no more than 10 mm.
- Modules clamps should not come into contact with the front glass and must not deform the frame.
- Be sure to avoid shadowing effects from the module clamps.
- The module frame is not to be modified under any circumstances.
- Applied torque should refer to mechanical design standard according to the bolt customer is using, ex: M6 ---- 8N*M, M8 ---- 16N*M.



	Mechanical load: 5400Pa
Mounting system	
Mounting Area	

OTHER MOUNTING CONFIGURATIONS

Other mounting configurations can be used, however, failure to comply with the above recommendations will result in a lowering of the load handling (snow/wind load) capabilities below the product specification 5400/2400Pa and product failure as a result of an overload situation will not be covered by the guarantee.

7. GROUNDING

- All module frames and mounting racks must be properly grounded in accordance with appropriate respective National Electrical Code (NEC) norms.
- Proper grounding is achieved by connecting the module frame(s) and all metallic structural members together continuously using a suitable grounding conductor. The grounding conductor or strap may be copper, copper alloy or any other material acceptable for use as an electrical conductor per respective National Electrical Codes.
- The grounding conductor must then make a connection to earth using a suitable earth ground electrode.
- Modules can be installed with the use of third party listed grounding devices for grounding the metallic frames of PV modules. The devices have to be installed in accordance with the grounding device manufacturer's specified instructions.

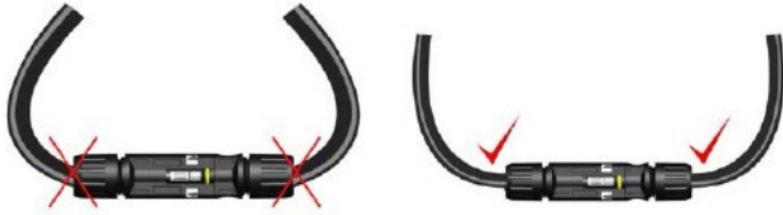
8. MODULE WIRING

All wiring should be performed by qualified installers, in accordance with the local codes and regulations.

- Modules can be connected in series to increase the operating voltage by plugging the positive connector of a module to the negative socket of the next. Before connecting modules always ensure that the contacts are corrosion free, clean and dry.
- Product can be irreparably damaged if an array string is connected in reverse polarity to another. Always verify the voltage and polarity of each individual string before making a parallel connection. If you measure a reversed polarity or a difference of more than 10V between strings then check the string configuration before making the connection.
- Honeywell Solar modules are provided with stranded copper cables with a cross sectional area of 4mm² which are rated for 1000Vdc, 90°C and are UV resistant. All other cables used to connect the DC system should have a similar (or better) specification. Honeywell Solar recommends that all cables are run in appropriate conduits and sited away from areas prone to water collection.
- The maximum voltage of the system must be less than the maximum certified voltage (1000V typically) and the maximum input voltage of the inverter and of the other electrical devices installed in the system. To ensure that this, the open circuit voltage of the array string needs to be calculated at the lowest expected ambient temperature for the location using the following formula $\text{System voltage} = N * V_{oc} * [1 + TC_{Voc} * (25 - T_{min})]$
Where

N	–	Number of modules connected in series
V _{oc}	–	Open circuit voltage (V)
TC _{Voc}	–	Temperature coefficient of V _{oc}
T _{min}	–	Minimum ambient temperature at installation location

- The minimum and maximum outer diameters of the cable are 5 to 7mm
- For field connections, use at least 4 mm² copper wires insulated for a minimum of 90°C and sunlight resistance with insulation designated as PV Wire
- The minimum bending radius cables should be 43mm.



9. ELECTRICAL CONFIGURATION & FUSING

- Honeywell solar modules are certified for operating at voltages below 1000Vdc. This maximum voltage should not be exceeded in designing a PV system or array configuration. Under normal operating conditions, a solar photovoltaic module is likely to produce more current and /or voltage than the reported values in the datasheet under standard test conditions. In the event of connections are not securely made with gap between the contacts there is a likely chance electrical arcing that can cause a fire hazard and/or an electric shock. So, it is recommended to always use a suitably rated isolator (DC switch) to interrupt the current flow before disconnecting the connectors.
- When fuses are fitted, they should be rated for the maximum DC voltage and connected in each, non-grounded pole of the array (i.e. if the system is not grounded then fuses should be connected in both the positive and negative poles).
- The maximum rating of a fuse connected in series with an array string is typically 15A but the actual module specific rating can be found on the product label and in the product datasheet.
- This fuse rating value also corresponds to the maximum reverse current that a module can withstand (when one string is shaded then the other parallel strings of modules will be loaded by the shaded string and current will flow) and therefore impacts the number of strings in parallel.

Model#	Dimension (L*W*H),mm	Weight, Kg	Pmax, W	Vmpp, V	Impp, A	Voc, V	Isc, A	Max.System Voltage,VDC	Max. Series Fuse Rating,A	Recommended Max.Model#	
										In Series	In Parallel
HONP72W /***W	1956*992*40	25.5	265	34.70	7.64	42.95	8.13	1000	15	18	3
			270	34.75	7.77	43.15	8.28			18	3
			275	34.80	7.90	43.26	8.42			18	3
			280	34.85	8.04	43.45	8.56			18	3
			285	35.01	8.14	43.65	8.68			18	3
			290	35.30	8.22	44.05	8.77			18	3
			295	35.45	8.32	44.70	8.84			18	3
			300	35.91	8.36	45.22	8.87			18	3

			305	36.14	8.44	45.42	8.95			18	3
			310	36.34	8.53	45.60	9.06			18	3
			315	36.48	8.63	45.72	9.18			18	3
			320	36.58	8.75	45.79	9.31			18	3
			325	36.63	8.87	46.05	9.45			18	3
			330	36.85	8.95	46.30	9.57			18	3
			335	36.85	9.09	46.39	9.73			18	3
			340	37.14	9.16	46.70	9.80			18	3
			345	37.06	9.31	46.75	9.98			18	3
			220	27.68	7.95	35.03	8.53			21	3
			225	28.09	8.01	35.48	8.60			21	3
			230	28.45	8.09	35.90	8.68			21	3
			235	28.85	8.15	36.39	8.74			21	3
			240	29.22	8.22	36.85	8.80			21	3
			245	29.47	8.31	37.27	8.87			21	3
			250	29.83	8.39	37.59	8.93			21	3
			255	30.16	8.46	37.87	8.99			21	3
			260	30.41	8.54	38.11	9.06			21	3
			265	30.76	8.61	38.39	9.13			21	3
			270	31.05	8.69	38.61	9.21			21	3
			275	31.68	8.69	39.43	9.25			21	3
			280	32.00	8.75	39.80	9.32			21	3
			285	32.25	8.84	40.10	9.42			21	3
HONP60W /***W	1636*992*35	18						1000	15		

10. INVERTER COMPATIBILITY

When installed in systems governed by IEC regulations, Honeywell solar modules normally do not need to be electrically connected to earth and therefore can be operated together with either galvanically isolated (with transformer) and transformer-less inverters.

Potential Induced Degradation (PID) is sometimes observed in PV modules due to a combination of high humidity, high temperature and high voltage. PID is most likely to cause degradation under the following conditions: Installations in warm and humid climates; Installation close to a source of continual moisture, such as bodies of water.

To reduce the risk of PID, we strongly suggest using Honeywell solar modules resistant to PID. Alternatively, the use of a transformer based inverter proper grounding of the negative DC leg of the PV array is strongly recommended to mitigate the PID effect completely. Choose inverters with isolation transformers in hot and wet areas (such as shores, wetlands), to ensure proper module function under positive voltage.

11. MAINTENANCE

A well-designed solar system requires minimal maintenance; however, system performance and reliability can be improved by ensuring the following recommendations

- Maintenance should be carried out at least once a year by trained personnel.
- Trim any vegetation, which may shade the solar array thus impacting performance.
- Check that mounting hardware is properly tightened.
- Inspect all cables to verify that connections are tight; the cables are protected from direct sunlight and sited away from areas of water collection.
- Check that all string fuses in each non/earthed pole are operating.
- In the event that the solar modules need to be cleaned then clean the module use a soft cloth together with a mild detergent and clean water.
- On large systems, the benefit of cleaning dirt and debris from the array is a trade-off between the cost of the cleaning, increased energy production as a result of this cleaning, and the time for the re-soiling of the modules after cleaning.
- If you are unsure whether the array or section thereof needs to be cleaned then first select an array string that is particularly soiled then measure & record the inverter feed in current from that string, clean all modules in the string, measure the inverter feed in current again and calculate the % improvement from cleaning. If the improvement is less than 5% then it is normally not worth spending the expense on cleaning. The above verification should only be carried out when the insolation is effectively constant (clear sky, strong sunshine, no clouds)
- The back surface of the module normally does not need to be cleaned but, in the event this is deemed necessary, avoid the use of any sharp projects that might damage the penetrating the substrate material.

12. WARNINGS

These solar modules do not contain any user serviceable parts. If you suspect that your installation is not working properly, then contact your installer immediately. For any electrical

maintenance, the PV system must first be shut down. Improper maintenance can cause lethal electric shock and/or burns.