

Nanometrics Solar Power System

Installation Guide

**Nanometrics Inc.
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Canada**

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Nanometrics Solar Power System

Nanometrics solar arrays provide continuous uninterrupted power to Nanometrics equipment in locations where mains power is unavailable.

Installing the Nanometrics Solar Power System comprises three tasks:

- Preinstallation
- Assembling the solar panel support structure
- Installing the battery kit and solar charger box (charge regulator and load controller integrated unit)

Once it is installed, the solar power system will require some remote monitoring and periodic on-site maintenance.



Warning Installing a power system incorrectly may cause injury or may cause damage to equipment. Before installing the solar array or connecting any of the electrical components, check all applicable local and national codes, and thoroughly review all relevant manuals.

1 Preinstallation

Preinstallation tasks:

- Unpack and check the shipped items
- Ensure you have the required installation tools and system components
- Ensure the installation site is prepared

1.1 Check the shipment

Open the shipment and check the contents for completeness against the packing slip. Visually inspect the equipment for any damage that may have occurred in transit. If there are any problems with the shipment, please contact Nanometrics Support.

email: support@nanometrics.ca

FAX: To: Support
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1.2 Required tools and system components

1.2.1 Installation tools

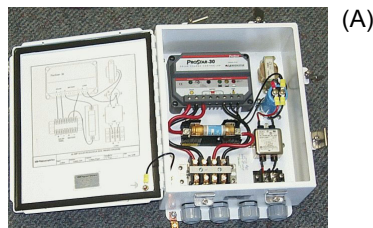
Refer to the manufacturer's installation instructions for recommended installation tools.

1.2.2 System components

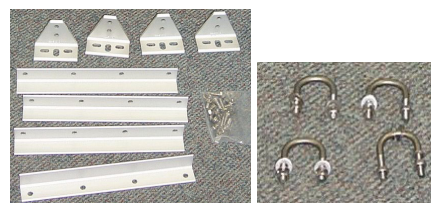
The basic Nanometrics Solar Power System consists of the following components. The quantity and some ratings of the components will depend on the size of the solar array. Be sure you have all components available before beginning assembly.

- Pre-assembled solar panels with termination boxes, and red and black cables (8m, 4AWG) to connect the panel array to the solar charger box
- Red and black cables (3m, 8AWG), to connect batteries to the Solar Charger Box
- Batteries and battery interconnect cables, as per your order

- Solar charger box (30A example) (A)
- Solar panel mounting hardware: brackets, support legs, and U-bolts (B)



(A)



(B)

- Basic support frame components for one bay (quantities and sizes will depend on the size of the solar panel array):
 - 4 ea.: 40" pipes (C)
 - 4 ea.: 56" pipes (C)
 - 2 ea.: 78" pipes (C)
 - 4 ea.: frame corners (D)
 - 4 ea.: frame pivot joints (D)
 - 4 ea.: frame feet (D)



(C)



(D)

1.3 Site preparation

Ensure the installation site is prepared, including a concrete platform with mounting bolts for the solar panel array, cable conduits, and appropriate storage (vault or hut) to house the battery kit and solar controller. General site preparation guidelines are provided in “Guidelines for Site Preparation” on page 11; site preparation details will depend on your system configuration.

2 Assemble the solar panel support structure



Warning The solar panels will generate voltage immediately upon exposure to the sun (typically around 20V DC), and may present a shock hazard if shorted. To avoid charge buildup, cover the panels with an opaque sheet until they are wired to the solar charger box.

The solar panel support structure consists of the basic support frame, and the solar panel mounting hardware—support legs, brackets, and U-bolts. For reference, the final assembly of a single bay is shown in Figure 1. Typically, at least two people are required to install a solar power system.

Figure 1 Completed assembly of a single bay support frame



2.1 Assemble the support frame

1. Assemble the basic frame (Figure 2):
 - a) Place the four frame feet onto the solar array platform mounting bolts and firmly tighten the nuts.
 - b) Insert a 40" pipe into each of the four feet and firmly tighten the bolt in each foot.
 - c) Drop one of the pivot joints onto each pipe. Do not tighten the pivot joints yet.
 - d) Lay out the four frame corners on the ground.

- e) Insert the 56" pipes to make a square. Loosely tighten the bolts on the horizontal poles.
- f) Lift the square frame onto the four vertical posts. Loosely tighten the bolts on the vertical poles.

Figure 2 Basic frame



- 2. Insert the two frame struts (78" poles) diagonally between opposite corners of the frame (Figure 3):
 - a) Insert an end of one of the frame struts into the socket of one of the pivot joints.
 - b) Position the pivot joint at the bottom of the frame struts, and loosely tighten the nut.
 - c) Position the diagonally opposite pivot joint at a height that allows the free end of the frame strut to be inserted into the socket.
 - d) Insert the free end of the frame strut completely into the socket of the second pivot joint and tighten the nut.
 - e) Repeat the process for the other frame strut, but position the lower pivot joint to allow some clearance between the two struts.

Figure 3 Insert the frame struts



✧ Allow some clearance between the diagonal frame struts

✧ Position the first pivot joint at the bottom of the support pole

3. Firmly tighten all of the bolts in the feet, corners, and pivot joints.

2.2 Attach the solar panel assembly

1. Loosely attach the solar panel mounting brackets to the 56" poles, using the U-bolts. Attach two brackets to the front pole and two to the rear pole, in each case with the vertical plate facing out toward the end of the pole (Figure 4).

Figure 4 Attach the solar panel mounting brackets



✧ Attach each bracket with the vertical plate facing the end of the pole

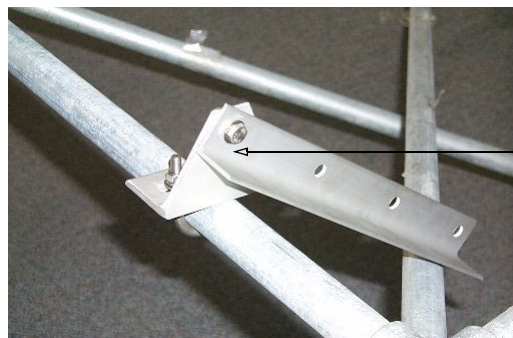
Front bracket positions

Rear bracket positions



2. Attach the primary support legs to the rear brackets, as per the instruction sheet included with the solar panel. The leg should go on the outside of the bracket, as shown in Figure 5.

Figure 5 Attach the primary support legs



✧ Attach the primary support legs to the outside of the brackets

3. Attach the secondary support legs to the primary legs (Figure 6), per the required angle elevation for your solar panel. Refer to the included instruction sheets for the proper support leg length.

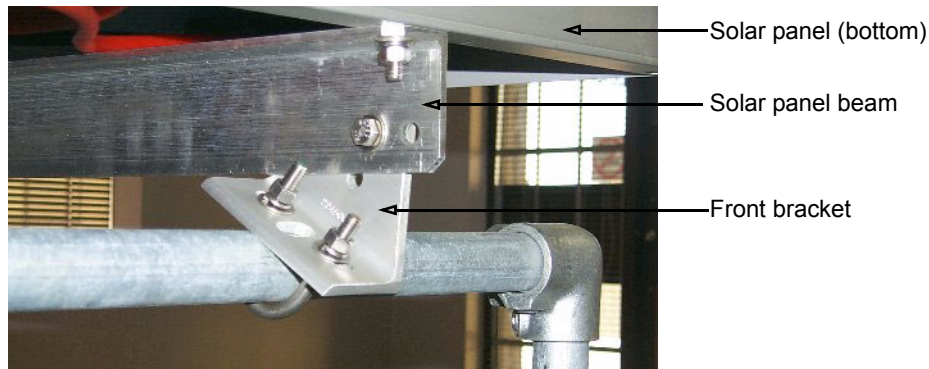
Figure 6 Attach the secondary support legs



4. Attach the solar panel to the brackets and support legs (Figure 7):
 - a) Let the support legs hang loosely inside the frame.
 - b) Lift the solar panel carefully onto the top of the frame. Orient the solar panel so that the bottom of the panel is facing the front brackets (the brackets without support legs).
 - c) Adjust the distance between the front mounting brackets to match the distance between the solar panel beams. Position the beams inside the brackets.

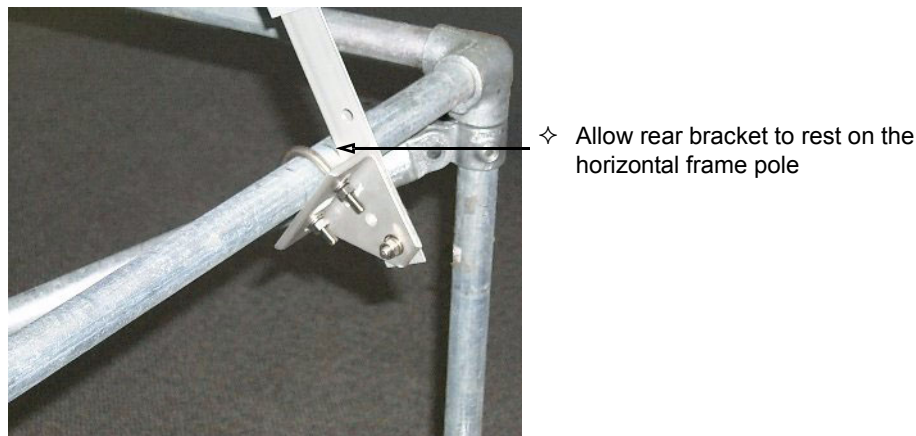
- d) Fasten the brackets to the solar panel beams, using the top hole of the bracket and the inner hole of the beam, as shown in Figure 7.

Figure 7 Attach the solar panel beams to the front brackets



- e) Adjust the distance between the rear mounting brackets to match the distance between the solar panel beams.
- f) Lift the top of the solar panel and raise the support legs. When raising a support leg, allow the bracket to tilt backward so that the support leg rests on the frame, as shown in Figure 8.

Figure 8 Position of support leg and bracket



- g) Fasten the support legs to the solar panel beams.
5. Check that all nuts and bolts are firmly tightened.

3 Install the battery kit and solar charger box

Ensure the site is prepared, with a proper vault or hut available to install the battery kit and solar charger box, an effective site grounding system, and cables have been pulled through conduits installed between the vault or hut and the solar array platform.

3.1 Safety precautions

Observe normal precautions for working with batteries, including for example:



- Shock hazard:
 - Remove conductive materials (for example, metal wristwatches) before working with batteries
 - Use insulated tools



- Explosion hazard:
 - Ensure the vault or hut is ventilated, even for sealed batteries
 - Ensure terminals are well tightened to avoid generating sparks



- Physical hazard:
 - Wear rubber gloves and protective eyewear when installing or maintaining batteries
 - Use proper lifting techniques, both to prevent physical strain and to limit the chance of dropping and damaging the battery

3.2 Installation



Note The general procedure described below assumes that the regulator is attached to the batteries, panels, and load in the sequence appropriate for the model of solar controller provided. Refer to the solar controller documentation to confirm the connection sequence.

1. Mount the solar charger box vertically on the wall of the vault or hut, allowing space (at least 15 cm) above and below for air circulation.
2. Place the batteries on the floor of the vault or hut, or on a support rack off of the floor. Place the batteries as close as possible to the solar charger box to minimize the length of interconnect cable required, and connect the batteries in parallel using the cables provided in the battery kit.
3. Optionally, cut any excess length from the interconnect cables before connecting the battery kit to the solar charger box, to minimize resistive loss and EMI from the cables during charge cycles.
4. Connect the solar charger box to the battery kit.



Caution Incorrectly connecting the battery kit to the solar charger box may damage the solar controller. Before proceeding, confirm that the battery kit + and – are connected correctly.

5. Confirm that the regulator displays appropriate status (refer to the solar controller documentation.)
6. Connect the panels to the regulator, remove any covering from the panels, and verify that the batteries are charging.
7. Ensure that the negative conductor of the solar power system is properly grounded.
8. Once the batteries are charged, connect the load.
9. Confirm that the batteries support the load without excessive voltage drop.

10. When remote site commissioning tests are passed, secure all power system connections and weatherproof equipment as necessary.

4 Maintenance

The solar array should have routine maintenance once a year, if possible. As a minimum for more inaccessible sites where yearly maintenance visits are not practical, visit prior to the calculated end of battery life to check and replace components as needed.



Warning Improper handling of batteries during maintenance may cause injury or may cause damage to equipment. Observe normal safety practices for working with batteries, including for example those listed in section 3.1.

Maintenance consists of physical maintenance at the site and monitoring battery voltage remotely:

- Physical maintenance at the site:
 - Check batteries per the manufacturer's recommendations.
Battery health is critical to reliable operation of remote sites, and battery discharge due to undersized battery banks, poor battery maintenance, and use beyond the recommended service life are the most common cause of data loss at a remote site.
 - Check wires and cables for damaged insulation.
 - Check all connections for corrosion.
 - Clean the solar panel surfaces and check for damage.
 - Tighten all connections.
- Monitoring battery voltage remotely:
 - Battery voltage from remote site instruments can be monitored in near real-time through the Nanometrics UI
 - Longer-term battery cycling can be monitored by extracting and plotting the data from Naqs SOH ringbuffers.

Guidelines for Site Preparation

This section provides an overview of how to prepare a site for a Nanometrics solar power system, and lists Nanometrics solar power system specifications. These general guidelines should be supplemented with detailed information from a site-specific plan before installing the solar power system.

A.1 Overview of a solar power system installation

Installing a solar power system involves the following general steps. Solar power system site preparation involves the first two steps: planning the site layout, and preparing civil works.

1. Plan the site layout:
 - a) Select an appropriate site for the solar array.
 - b) Prepare a site plan for component locations and mounting, cable routing, and grounding connections.
2. Prepare civil works (for example, equipment vault or hut, cable conduits, solar array platform) in accordance with the site plan.
3. Install the grounding systems.
4. Assemble the solar panel support structure and panels, and run the cables through the conduit to the equipment vault or hut.
5. Install the solar controller and batteries in the equipment vault or hut.
6. Connect the components and check the system.
7. Secure all power system connections and weatherproof equipment as necessary, once the remote site commissioning tests have been passed.

A.2 Solar power system site preparation

A.2.1 Select an appropriate site

The site should have an unobstructed view of the sun's arc for all seasons. Avoid sites where objects may fall onto the solar panels (for example, branches, rocks) or sites where deposits may accumulate substantially on the surface of the panels and reduce insolation (for example, leaves, dust, salt spray).

A.2.2 Prepare a site plan

The site plan describes in detail the physical layout of components based on the size of solar panel array, and how the components will be housed and interconnected. The size of the array will already have been calculated. Array size for a given area is based on the average number of low peak full sun hours and minimum period of sun in a year, and the load created by the equipment.

Things to consider when preparing your site plan:

- If the site is to be surrounded by a fence, ensure that the fence is placed at sufficient distance that it does not cast shade on the solar panels during periods required for battery charging.
- For storage of the batteries and solar controller, the vault or hut must provide a passively ventilated, relatively temperature-controlled environment. In areas with temperature extremes, a reinforced concrete vault helps to stabilize battery temperature. For regions with more precipitation, an above-ground hut is appropriate to avoid flooding.
- Cable conduits should be 10cm PVC pipe. Elbows should have a bend radius that will accommodate pulling of 4AWG cable.
- The cable conduit to the solar array should be installed prior to pouring the array platform if the conduit is to penetrate the array platform. The conduit should be placed close to the planned location of the connection to the solar panel, to minimise the amount of cable run above the surface.
- The solar panel array platform should be oriented so the panels will be installed facing true south.
- The platform should be slightly elevated for drainage.
- The size of the solar panel array will determine the required area and strength of the array platform:
 - Platform area:
 - The panel support structure dimensions will vary according to the number of panels in a system. For example, a 240 W system will have three 80 W panels thereby increasing the width of the structure.
 - Platform strength:
 - All concrete should conform to building code standards and have minimum compressive strength of 3000 PSI at 28 days.
 - Concrete should be poured against undisturbed soil.
 - Allow at least a 24 hour set time before installation of the array.

- The concrete platform should be reinforced with steel mesh with at least 25 mm x 25 mm squared pattern through the entire area of the platform.
- The thickness of the platform will depend partly on expected maximum wind strength at the site and the number of panels, but should never be less than 150 mm.
- The mounting bolts for the solar panel support structure must be positioned very precisely on the platform, to avoid bending the frame on installation. Holes for the support structure mounting feet can be drilled when the concrete is completely set. Use M5 bolts.
- The system components should be properly grounded to meet applicable local standards. The batteries will typically use a floating ground. All other system components should use a single point ground (for example, a borehole if used, or a rod to earth in the equipment vault).

A.2.3 Prepare the civil works

Please refer to your site-specific plan for information.

