



User's Guide



Series: SPS3/SPS5

Off-grid Solar Power System

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Note: Continued product improvements make specifications subject to change without notice.
Check www.imagineinstruments.com for the latest product information and updates.

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Section1 - Before You Begin

1.1 Symbols & Safety Information

Listed below are the International Symbols used on the product, or in this manual.



Danger: Electric Shock



Warning: Refer To Documentation and/or Manual

General Safety Guidelines

- Follow all safety guidelines outlined in this manual and marked on the unit.
- Never install or operate this product outside the specifications listed in this manual.
- Never install and operate in flammable or explosive environments.
- Install your unit in a location that is out of the reach of unauthorized personnel.
- Always install additional disconnect and safety devices to provided added protection.

Electrical Safety Guidelines

- Never attempt maintenance or service while power is connected.
- Installation and all wiring should be done by a licensed electrician.
- Never Install and operate without proper earth grounding.

Note: Personnel entrusted with installation, setup and operation of this product must be suitably qualified and trained. The required knowledge and experience can be gained via training courses and appropriate on-the-job instruction. Personnel must have this document available to them at all times when working with this product.

1.2 Condition of Use

Imagine Instruments LLC products are not designed, intended or authorized for use in medical applications, applications intended to sustain or support life, in any nuclear facilities or any other application where the failure of the product could create a situation where catastrophic property damage, personal injury or death may occur. In the event that the Customer purchases or uses any Imagine Instruments LLC products for any such unintended or unauthorized application, the Customer shall indemnify and hold harmless Imagine Instruments LLC and its officers, directors, employees, agents, affiliates, successors and assigns against all claims, costs, damages and expenses (including reasonable attorneys' and expert witness' fees) arising out of or in connection with, directly or indirectly, any claim for property damage, personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that Imagine Instruments LLC was negligent regarding the design or manufacture of the subject product.

1.3 Unpacking

Unpack your product carefully and inspect for any shipping damage. Notify the carrier immediately if you find damage.

The following items are included with your system:

- Solar Panel
- Charge Controller
- Solar Panel Mounting Bracket
- Earth Grounding Kit
- Solar Power Cables
- SLA Deep-cycle Battery
- System Enclosure
- Enclosure Mounting Bracket
- User's Guide

Section 2 Introduction

2.1 Product Description

SPS3 Series are pre-wired, ready-to-install, weatherproof, off-grid solar power supply kits that provide power to operate remote equipment such as SCADA, telemetry, transmitters and process instrumentation. These units provide the proper charging, power conditioning and regulation to provide a regulated voltage output. Each System kit Includes a Solar Panel, Charge Controller, Weatherproof UL Rated Enclosure, Earth Grounding Kit, Lightning/Surge Protection, Panel and Enclosure Mounting Brackets.

A deep-cycle battery is used to power remote equipment with solar energy keeping the battery charged. Solar modules, a charge controller, power conditioning module, weatherproof enclosure and a deep-cycle battery are the five primary components of the Solar Power System. Various combinations of these five components allow you to choose a system that suits your application requirements such as load and availability of daily sunlight.

2.2 Solar Power System Main Components

1. Solar Module (Panel)

Solar modules provide the energy source to keep battery(s) charged. The number of modules needed depends on site specifics, such as geographic location in the country, site specific needs such as load demand, and available/access to the sun.

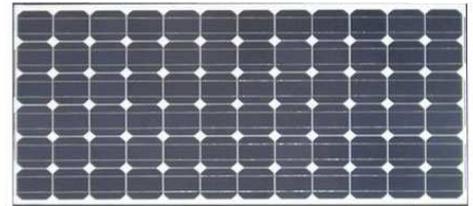


Figure 1: Typical Solar Panel

Solar modules convert the sun's energy into direct current (DC) electricity. The system contains multiple monocrystalline or multicrystalline modules that form one panel. The Solar panel is securely attached to a metal pole with adjustable brackets to enable tilt alignment to match the latitude at which the module is installed and horizontal adjustment for maximum tracking of the sun.

2. Solar Charge Controller

A solar charge controller is needed in all solar power systems that utilize batteries. The job of the solar charge controller is to regulate the power going from the solar panels to the battery. Overcharging the battery will at the least significantly reduce battery life and at worst damage the battery to the point that they are unusable.



Figure 2: Typical Charge Controller

The controller monitors the battery voltage and opens the circuit, stopping the charging, when the battery voltage rises to a certain level.

3. Deep-cycle Battery

A deep-cycle battery is a lead-acid battery designed to be regularly deeply discharged using most of its capacity. A deep-cycle battery is designed to discharge between 50% and 80% depending on the manufacturer and construction of the battery. Although these batteries can be cycled down to 20% charge, the best lifespan versus cost method is to keep the average cycle at about 50% discharge, as there is a direct correlation between depth of Controller discharge on the battery and the number of charge and discharge cycles it can perform.



Figure 3: Typical SLA Battery

4. NEMA 4X Weatherproof Enclosure

The enclosure houses the battery, solar controller, wiring, termination blocks and fusing for the system. This picture shows a typical fiberglass enclosure in the configured system housing the battery, wiring, and the solar controller. Depending on the model ordered you may receive a metal enclosure.



Figure 4: Typical NEMA Enclosure

5. Power Conditioning Module

Power Conditioning Modules are designed for off-grid solar power systems and provide regulated power to low voltage, low power sensors, instrumentation and telemetry equipment. These units' step-up or step-down the 12V battery power into the required voltage.



Figure 5: Power Conditioning Module

Section 3 Specifications

3.1 Specifications

See Data Sheet attachment for your model.

3.2 Environmental Operating Conditions

This product has been designed to provide performance and durability over its life time. To keep this product working correctly it should be handled with care and only operated within the following recommended environmental operating conditions.

- An ambient operating temperature range of -40 to 140 °F (-40 to 60 °C)

3.3 Regulatory Approvals & Export Compliance

Statement of CE Conformity

Imagine Instruments LLC is committed to compliance with the laws and regulations in each country into which we ship our products. Our products are designed and tested to meet the appropriate standards for Product Safety, Electromagnetic Compatibility and other regulatory compulsory requirements. We will affix proper compliance marking upon completion of certification and provide a Declaration of Conformity (DOC).

Export Compliance Policy

Customer shall not, directly or indirectly, export, re-export, transfer, furnish or ship Products in violation of any applicable export control laws or regulations of any country having jurisdiction over the Products, including any and all US law or US Government export controls. Customer agrees, at Customer's own expense, to comply with all applicable export laws and will, in accordance with the indemnification provisions of these Terms and Conditions, indemnify, defend and hold Company harmless from any claim against Company due to Customer's violation or alleged violation of any export laws.

Currently we restrict the sale and shipment of our products to only USA & Canada. Re-sale or re-shipment of Imagine Instruments LLC products outside the USA or Canada must not be done without written approval by us and the United States Government.

Section 4 Installation

4.1 General Guidance

Before You Begin

Your Solar Power System must be installed and maintained as described in this guide to ensure reliable operation of the system. Confirm system load is consistent with design specifications and your established Amp-hrs/day load will not exceed the battery capacity in the targeted days of autonomy required.

Identifying a Site

Careful selection of the exact installation location of the system is very important to continuous and reliable operation. Exposure to shadowing or direct blockage during sunlight hours will reduce power capacity.

Selecting a Site

Shading critically affects a solar panels performance. Just a small amount of shade on a panel can reduce performance significantly. It is essential to have a clear understanding of the sun's path across the horizon from the east to the west. It is recommended that your system be installed by Solar installation professionals. These professionals have the proper tools and experience to provide quick insight to the solar window at a specific location. In principle, these tools evaluate a site by creating a sun chart. The sun chart will determine if the solar modules will be shaded from direct sun radiation during critical times of the day or year. Unwanted shading can occur from many types of objects like trees, buildings or other structures. Shading is often a greater problem during winter months when the sun's altitude is low and shadows are longer.

When a site is being evaluated for equipment installation, be sure that the following parameters are considered:

1. Make sure the panel is not shaded from 9 a.m. to 3 p.m. on any day (this is the optimum solar collection time).
2. Make sure the panel will not be shaded during any month of the year during the optimum solar collection time.
3. Identify any objects that might shade the array over a period of time, such as tree or brush growth.
4. You must eliminate all shading, or move the system to avoid the shading.

Site Guidelines

- Never install your system in areas that are prone to vibration, shock, grease, oil or dirt.
- Never install your system in areas where explosive or flammable gas or material is present.
- Never install your system with power applied. Make connect only after installation.

Recommended Installation for Pole Mounted System

Mounting Pole

For best results, your mounting pole should be standard 2" Diameter EMT conduit. This is not supplied by Imagine Instruments and is available at Home Depot, Lowes and all local electrical supply houses.

Mounting Pole Length

Mounting overall pole length is determined by how high you want your equipment off the ground, plus the recommended depth the bottom of the pole should be buried into the ground. An overall pole length of 15-20 feet is recommended for best results.

Mounting Pole Depth in Ground

The bottom of the pole must be buried under ground with a concrete base applied. A minimum concrete pedestal of 3' diameter by 2' in depth is recommended. This can be larger for better results.

***** Note *****

Imagine Instruments LLC does not provide detailed instructions on how to install the 2" EMT conduit needed to mount your system. Please contact a professional installer that is knowledgeable in local code requirements for your area.

***** Warning *****

Never dig the hole in the ground to mount your EMT conduit without first contacting local utilities to make sure you are clear of buried electrical or gas lines. Failure to do this could lead to electrical shock or an explosion resulting in damage, personal injury or death.

4.2 Mounting

After proper installation and earth grounding of the 2" EMT conduit you are ready to install the solar panel and battery enclosure.

Solar Panel Mounting

Please refer to the specific user guide included with your solar panel mounting bracket. Mounting brackets differ by size and installation procedure depending upon the size of the panel included with your system. You should have received a separate guide with your system titled "Solar Panel Mounting Bracket Assembly & Installation". Please contact us if you are missing this guide.

******* Note *******

Due to the complexity and many different factors that affect installation Imagine Instruments LLC does not provide detailed site selection instructions. It is strongly recommended that you work with a local professional solar installer and licensed electrician to make sure your system is safe and provides the specified performance.

******* Warning *******

Never connect the solar panel power cables to your system during, or directly after mounting the panel. Connecting solar panel power is the last step performed before placing your system into service. Failure to do this could lead to electrical shock resulting in damage, personal injury or death.

Determining the Solar Panel Tilt Angle

Sunlight

Solar panels collect the most sunlight when they directly face the sun. On a clear day, the most sunlight will fall on the panel around noontime. When the sun is highest in the sky, there is less atmosphere between the ground and the sun, allowing more sunlight to fall on the panel. The season and the location's distance above or below the equator determine how high in the sky the sun will be. Mountings with manually adjustable tilt angles are set to optimize the amount of sunlight falling on the panel during the midday peak.

Location

The latitude of the solar panel's location is the key factor in setting its angle. The latitude is a measure of the angular distance in degrees above or below the equator. The latitude for a location can be found using a Global Positioning System (GPS) device or a map marked with the latitudes and longitudes.

Tilt Angle

The latitude of the solar panel's location is the key factor in setting its angle. The latitude is a measure of the angular distance in degrees above or below the equator. The latitude for a location can be found using a Global Positioning System (GPS) device or a map marked with the latitudes and longitudes.

Additional information on "Tilt Angle" can be found at our website: www.ImagineInstruments.com

System/Battery Box Mounting

Please refer to the specific manual included with your solar power supply/battery box. Mounting brackets differ by size and installation procedure depending upon the size and style of enclosure included with your system. You should have received a separate guide with your system titled "Solar Power System Enclosure Mounting". Please contact us if you are missing this guide.

***** **Caution** *****

Do not attempt to mount your system enclosure with the battery installed. The battery is installed after the box is securely mounted. Attempting to install your system enclosure with the battery already installed could damage your enclosure and/or cause personal injury

Section 5 Setup & Wiring

5.1 Earth Grounding Your System

For proper operation and safety your system must be earth grounded.



CAUTION: Electrical Shock Hazard

Improper grounding can result in creating an electrical shock hazard. Personnel injury or damage to your system can result. All electrical wiring should be done by a licensed professional. All work must be done according to local code requirements.

Earth Grounding Rod (not included)

If your system is being installed in a remote location where there is not a good earth ground connection available to you, a grounding rod needs to be installed in order to properly ground your system. Imagine Instruments does not provide grounding rods. This item is available locally at your home improvement store or from your local electrical supply house.



Figure 6. Grounding Rod

Rod Installation & Grounding

Grounding rods can differ depending upon the manufacture. You should follow the manufacture recommended installation procedure for installing the rod. A grounding rod wire clamp was included with your system accessories. This should be used to secure the copper grounding wire to the grounding rod.

Earth Grounding Your Solar Panel

A grounding clamp that bolts to your solar panel was provided with your system accessories. This clamp should be used to attach the copper grounding wire that was also included with your system. Bolt this lug to an unused hole on your solar panels support frame, and then slide one end of the copper grounding wire into the clamp opening and tighten the set screw down onto the wire securely.



Figure 7. Ground Clamp

Earth Grounding Your Solar Power/Batter Box

A green wire nut is provided with your system accessories. This wire nut is used to make your system ground connection to the main earth ground connection. You should run the copper wire that was also provided with your system into the solar power/battery box. In your box you will find one green wire coming from the component mounting plate and one green wire coming from the lightning/surge protection device (If installed). You need to combine the two wires already in your Wire Nut box with the main ground wire you run into the box during installation. Secure all three wire ends together using the green wire nut.



Figure 8. Grounding Nut

5.2 Installing & Wiring the System Battery

Note: Battery(s) are shipped separately and not installed in the enclosure before shipment.

Please observe the following guidelines and cautions when working with batteries:



CAUTION: Electrical Burn Hazard. A short-circuited battery can produce thousands of amperes that will melt hand tools and cause severe burns. Take great care when handling the batteries and connecting wires.

CAUTION: Wear eye protection and gloves. Remove all metal that can come in contact with battery terminals.

CAUTION: Use extreme care in placing the battery(s) into the enclosure, being careful not to short battery terminals to any metal objects.

NOTE:

Refer to the wiring diagram for your system to determine the configuration of the battery supplied. If you have a custom system this will be a separate document titled "System Wiring Diagram" and is included with your document pack. If you did not receive this document please contact us.

To Install and Wire the Battery:

1. Mark and label the battery to indicate the month and year of installation. Your battery may have a label card attached so that you can punch out the month and date.
2. Carefully set the battery into the enclosure. The battery should rest on the bottom shelf of the enclosure.
3. After the battery is positioned correctly in the enclosure connect the RED marked wire to the POSITIVE (+) terminal of the battery using the bolts, washers, and nuts provided. The positive wire might also have an inline fuse built into the lead on some models. Tighten battery connections to 100 in-lbs. Take care not to short circuit the battery terminals with the wrench to the negative terminal or to the enclosure casing.
4. After you have connected the POSITIVE terminal, then connect the BLACK wire lead to the NEGATIVE (-) terminal of the battery in the same way, observing the same precautions.
5. Make sure that the battery terminals are completely covered with an insulating material such as tape.

5.3 Output Power Wiring to your equipment

See attachment for output power connection location.

***** **NOTE** *****

Imagine Instruments LLC does not provide detailed instructions on how to install or wire the external equipment you are powering with the solar power system. Please contact a professional installer that is knowledgeable in the external equipment being installed.

******* Warning *******

All electrical connections should only be done by suitably trained professionals. It is your responsibility to insure Installation meets all local and national regulations. All wiring must be in compliance with the National Electric Code and should be inspected by a licensed electrician prior to being placed into service.

Note: Personnel entrusted with installation, setup and operation of this product must be suitably qualified and trained. The required knowledge and experience can be gained via training courses and appropriate on-the-job instruction. Personnel must have this document available to them at all times when working with this product.

Section 6 Maintenance

6.1 Maintenance

Other than battery or fuse replacement, this product has been designed to be maintenance free during its life time. Periodic inspection should take place to insure that the following has not occurred during use:

- Insure the unit is still mounted securely and has not become loose due to vibration or wind.
- With power removed Insure all wiring connection are still tight and well insulated.
- Insure the unit is free of moisture, grease, dirt or any other foreign material.

If the outside of this product has become soiled, it may be wiped clean with a damp cloth and mild detergent.

******* Warning *******

Do not attempt maintenance on this product without first having a licensed electrician disconnect solar panel power to the unit. Failure to remove power before performing maintenance will create a shock hazard that can result in injury or death.

Section 7 Warranty & Liability

7.1 Warranty/Product Returns

All Product orders are subject to written acceptance by Company by a duly authorized agent of Company. All Products are covered by a Limited Warranty for a period of 3 years from the date of purchase which applies to defective Products only. COMPANY EXPRESSLY DISCLAIMS ALL OTHER WARRANTIES OF ANY KIND, WHETHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Company will only accept the return of defective Products. Such returns must be pre-approved by Company in writing and an RMA (Return Material Authorization) number must be issued by Company before Company will accept such return. Return shipments not pre-approved by Company will be refused. Company will inspect pre-approved returns to determine whether they are defective, which determination by Company is final. Products must be returned in the same or equivalent container and packaging materials in which they were originally shipped. Customer retains title to any Products returned. Return freight cost is the responsibility of Customer. If Company determines a Product is defective, it may repair or replace the defective Product.

7.2 Limitation of liability

COMPANY'S LIABILITY ON ANY CLAIM OF ANY KIND, INCLUDING NEGLIGENCE, FOR ANY LOSS OR DAMAGE ARISING OUT OF, CONNECTED WITH, OR RESULTING FROM THE MANUFACTURE, SALE, DELIVERY, RESALE, REPAIR OR USE OF ANY PRODUCTS COVERED BY OR FURNISHED HEREUNDER, SHALL IN NO CASE EXCEED THE LESSER OF THE COST OF REPAIRING OR REPLACING PRODUCTS FAILING TO CONFORM TO THE WARRANTIES CONTAINED HEREIN, IF ANY, OR THE PRICE OF THE PRODUCTS OR PART THEREOF WHICH GIVES RISE TO THE CLAIM. IN NO EVENT WILL COMPANY BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL OR CONTINGENT DAMAGES, INCLUDING, BUT NOT LIMITED TO, DAMAGES FOR LOSS OF PROFITS, GOODWILL, USE OR OTHER INTANGIBLE LOSS (EVEN IF COMPANY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES), RESULTING FROM: (I) THE USE OR THE INABILITY TO USE PRODUCTS PURCHASED FROM COMPANY; (II) THE COST OF PROCUREMENT OF SUBSTITUTE PRODUCTS RESULTING FROM ANY PRODUCTS PURCHASED OR OBTAINED FROM COMPANY; OR (III) ANY OTHER MATTER RELATING TO PRODUCTS PURCHASED FROM COMPANY.

Additional "Terms & Conditions" apply. Please visit www.imagineinstruments.com to read the complete Imagine Instruments LLC "Terms & Conditions" statement.

Section 8 Service

8.1 Service

A RMA (Return Merchandise Authorization) number must be obtained before the product is returned to us. Please call (203)929-1027 to obtain an RMA number. Any product received without a RMA will be returned to the customer. The cost and method of shipping the product back to us is the sole responsibility of the customer. We recommend a track-able form of shipping to guarantee your package arrives to us. If a package is sent without proof of delivery, Imagine Instruments LLC is not responsible for proving receipt of the package.

All products come with a minimum one year warranty unless otherwise noted on the products data sheet. Warranty replacements must have an RMA issued and be returned to imagine Instruments LLC prior to us sending the replacement. The return cost of insurance and shipping is the sole responsibility of the customer. Imagine Instruments LLC will pay for the return shipping of the replacement and chooses the method of delivery.

After receiving your RMA number, please ship your unit to the following address. Make sure you write the RMA number on the mailing label.

Attn: Service Department

Imagine Instruments LLC
7365 Main Street, #176
Stratford, CT 06614