KEY TO SAFETY WARNING STATEMENTS

☠ DANGER ☠

Failure to follow this warning may result in serious injury or death to humans.

✋ CAUTION ✋

Failure to follow this warning may result in damage to the system equipment.

! NOTE !

Failure to follow these instructions or information may prevent operation of the system.

KEY TO COMMONLY USED ELECTRICAL TERMS

AC:	Abbreviation for alternating current, typically used in grid applications.
Amp:	Common unit of measurement for electrical current.
Ammeter:	Instrument used to measure current.
Array:	Refers to the PV modules and all the associated wiring and mounting hardware.
AH:	Abbreviation for Amp-hour. Refers to battery capacity.
Converter:	Instrument used to convert power from AC:DC or DC:DC in a regulated manner.
DC:	Abbreviation for direct current, typically used in battery applications.
DOD:	Abbreviation for Depth of Discharge. Refers to a battery's state of dis-charge.
Earth:	Common term referring to the reference point for electrical equipment where it comes into contact with the soil, also referred to as Earth Ground.
Ground:	Common term referring to the electrical zero volt reference point.
Hz:	Abbreviation for hertz, unit of measurement for AC frequency. 60Hz equals 60 cycles per second.
Inverter:	Instrument used to convert power from DC:AC in a regulated manner.
Joule:	Common unit of measurement for electrical energy. Joules equals watts per second.
Ohm:	Common unit of measurement for electrical resistance.
LVD:	Abbreviation for Low Voltage Disconnect. A device in charge controllers that disconnects the load from the battery to protect from over discharge.
PF:	Abbreviation for power factor. Used to describe the quality of AC current in percentage.
PV:	Abbreviation for Photovoltaic. Refers to the solar module that generates power from sunlight in a SunWize® Power Ready System
Volts:	Common unit of measurement for electrical potential.
Voltmeter:	Instrument used to measure voltage.
Sine Wave:	Refers to the wave-form of AC power, measured in hertz (Hz).
SOV:	Abbreviation for Silicon Oxide Varistor. Used to protect electrical equipment from surges.
VA:	Common unit of measurement for AC Power. VA equals Volts x Amps x Power Factor.
Vpc:	Abbreviation for volts per cell, used to describe the individual battery cell voltage. A 12V battery has 6, 2V cells
Watt:	Common unit of measurement for DC Power. Watts equals Volts x Amps.
Wattmeter:	Instrument used to measure power.

IT IS THE OWNER'S RESPONSIBILITY TO ABIDE BY APPLICABLE NATIONAL AND LOCAL CODES WHEN INSTALLING THIS SYSTEM.

1.0 INTRODUCTION TO SUNWIZE® PHOTOVOLTAIC KITS

Congratulations on your purchase of the SunWize® Photovoltaic Kit. This fully value added assembly combines innovative technologies to provide you with a reliable stand-alone electrical power source. It is pre-assembled and ready to use. Because the system is powered by clean, quiet solar energy, you'll also enjoy independence from the utility electrical grid, as well as the reliability and satisfaction that comes with owning and operating an environmentally friendly renewable power source.

The system may consists of:

- A photovoltaic (PV) module
- Array wire(s) in a jacketed cable or encased in conduit
- A pre-mounted or kitted module structure that can be configured for the following options:
  - side-of-pole (SOP) mount
  - top-of-pole (TOP),
  - roof-ground mount (RGM)
- An integral Solar charge controller

The PV array converts the sunlight into electrical current that charges the sealed batteries (not provided) The optional charge controller, regulates battery charging by limiting the upper voltage level of the battery. The equipment is protected by fuses.

1.1 COMPONENT IDENTIFICATION

1.1.1 SOLAR ARRAY

The solar array or module is comprised of the photovoltaic (PV) module(s). The modules are pre-wired and factory tested for correct output voltage configuration.

1.1.2 SOLAR ARRAY MOUNT

The solar modules are mounted to the supporting structure for field installation. All bolts are factory tightened to specification where applicable.

1.1.2 CHARGE CONTROLLER

The charge controller provides the system DC charge control necessary to enable seamless operation between the solar electric array and the DC battery bank (provided by others). The main disconnect fuse is housed in PV junction box.

2.0 INSTALLATION EQUIPMENT

2.1.1 CUSTOMER SUPPLIED TOOL LIST

- Wide, medium, and narrow flat head and Phillips screwdrivers
- Socket driver set and open end wrenches (3/8" – 3/4")
- Magnetic compass
- Tape measure
- Grease pencil, chalk, scribe or other marker
- Digital multi-meter
- Digital clamp on Ammeter (optional)

2.1.2 CUSTOMER SUPPLIED PARTS LIST

Item	Description	Comments
1	Load wire	18 – 6 AWG (0.8 – 13.0mm)
2	Load Conduit	½" KO provided
3	Equipment grounding	14-2 AWG Lug provided, ground per local electrical code
4	Array mount anchor bolts	1/2" dia. (4 per mount) (ground mounted only)
5	Galvanized steel pole	2"-8" SCH 40

2.2 SUPPLIED PARTS LIST

Refer to the wiring diagram enclosed for the specifics of your system.

Item	Description
1	Pre-assembled, pre-wired PV modules and mounts
2	Optional spare controller load fuse
3	Pole mounting hardware (band clamps standard, U-bolt optional)
4	SunWize Installation & Operation Manual
5	Controller OEM manual
6	Thread locking adhesive

3.0 MECHANICAL INSTALLATION INSTRUCTIONS

☠ DANGER ☠

Photovoltaic (PV) modules generate electricity when exposed to light. Modules pose a shock hazard and risk of serious injury or death if instructions and safety precautions are not followed carefully. Cover the glass faces of the modules with opaque material while working on the system to stop the production of electricity. Avoid touching the module terminals and isolate wire ends until all connections are made. Always observe proper polarities when making electrical connections to the modules, batteries, and controller.

✋ CAUTION ✋

The back-side of modules is susceptible to damage. Avoid dropping tools or other items on them.

! NOTE !

Each rack is optimized for specific pole diameter ranges, for standard round SCH40 steel poles. Ensure that the pole used matches the optimal range and geometry for the racking equipment provided. Failure to do so may cause mounts to detach from the pole.

Prior to commencing assembly and installation:

- Thoroughly read and follow all safety precautions and instructions to insure proper operation of the system.
- Gather the items identified in the TOOL LIST in Section 2.1 and the PARTS LIST in Section 2.2.

3.1 PV ARRAY SITE LOCATION

- For optimum performance in the Northern Hemisphere, the PV array should face true south (true north in the Southern Hemisphere). Determine true south by using a magnetic compass corrected for local magnetic declination. (SEE APPENDIX A for details).
- The PV array should be located so that there are no shadows or shading falling upon the face of the array from 8AM – 5PM. Even partial shading could reduce the array output to 0%.
- Determine the desired tilt angle of the array by using an atlas to determine the latitude of the installation location (SEE APPENDIX A for details).
- The module tilt angle is measured from horizontal, thus a panel that is lying parallel to the earth's surface is said to be at 0^{o} tilt, a panel that is perpendicular to the earth surface is said to be at 90^{o} tilt.

3.2 MOUNT ASSEMBLY AND INSTALLATION

- Refer to the installation instructions provided with the assembly for details.

4.0 ELECTRICAL INSTALLATION INSTRUCTIONS

☠ DANGER ☠

Batteries can explode or severely burn if the terminals are shorted to the opposite polarity. Exercise extreme care when handling batteries. Use insulated tools when practical.

✋ CAUTION ✋

Per NEC A.690, a single point system ground is required. It is recommended that the battery negative (-) terminal be tied to the equipment chassis at the time of installation.

4.1 GROUND WIRING

- Verify all circuit breakers or fuses are set to the **OFF (OPEN)** position.
- Install the equipment grounding conductor (not provided) to the array frame and module frame. Use wire rated for outdoor use per local codes and sized per NEC A.690.
- Verify system neutral bonding is per local code.

4.2 PV ARRAY WIRING

- Verify all charge control components are installed per the wiring diagrams provided with the system.
- Verify fuses in the J-box are removed.

For systems with separate charge controls (controls not provided)

- Inside the control/battery enclosure (not provided), mate the PV array **RED PV(+)** wire to the controller **PV(+)** terminal block. Mate the PV array **BLK PV(-)** wire to the controller **PV(-) or NEG** terminal block. Mate the PV array **GRN GND** wire (if a 3-wire system) to the controller **GND** terminal block.

For systems with integral charge controls (controls provided)

- Inside the control/battery enclosure (not provided), mate the array **RED PV(+)** wire to the battery **BAT(+)** terminal. Mate the PV array **BLK PV(-)** wire to the controller **BAT(-)** terminal.

5.0 SYSTEM OPERATION

5.1 SYSTEM COMMISSIONING

- Verify the mechanical installation is complete per the Commissioning Checklist (Appendix C)
- Verify grounding continuity between all mechanical assemblies to the earth grounding bond. All resistive measurements should be below 0.5 ohms.
- For systems without an integral charge controller:, under optimum overhead sunlight conditions, verify the PV array open circuit voltage (Voc) by measuring the voltage from the **PV(+)** to the **PV(-)** terminals inside the control enclosure. This should measure appx:

  21VDC for a 12V system
  42VDC for a 24V system
  84VDC for a 48V system

- Check the name plate rating on the module or the wiring diagram included with the system for actual figures.
- Verify the battery bank voltage by measuring from either the **BAT(+)** terminal block to the **BAT(-)** terminal block or the **BANK POSITIVE(+)** to the **BANK NEGATIVE(-).** This should measure appx:

  12-13V for a 12V system
  24-26V for a 24V system
  48–52V for a 48V system.

- Verify that polarity is positive for all measurements. If negative, reverse battery wiring to the system and repeat measurement.
- On the customer supplied charge control panel or in the J-box, set the **PV(+)** input breaker(s) to the **ON (CLOSED)** position, or install the fuse.
- On the charge control panel, verify the load voltage by measuring from the **LOAD(+)** terminals to the **LOAD(-)** terminal**.** This should measure the same as the battery bank voltage.
- Under optimum overhead sunlight conditions, verify the battery charging is occurring by measuring the voltage from the BAT**(+)** to the BAT**(-)** terminals. You should see a steady slow increase in voltage.
- Connect the user load at this point.

5.2 SYSTEM OPERATION SUMMARY

- Upon completion of the system, you can expect the following typical performance:
- When sunlight is available, the system will begin to charge. The amount of charging current available is dependent on the time of year and the position of the sun in the sky. This equates to low charging power in the morning, gradually increasing and reaching full potential during the mid-day, then gradually

decreasing until the end of the day. It is typical to see both an increase in charging current and battery voltage throughout the day.

- The regulation of the charge is performed by the charge controller. It will prevent the battery voltage from climbing too high for too long.

- In the evening, the load is run strictly from battery. Throughout the evening the battery will discharge but remain at a safe operating level.

- The system voltage will fluctuate throughout the year depending on outside air temperature. In cold weather the system voltage can rise to 16VDC (12V battery) and in summer it will typically be 13.5VDC (12V battery). The range varies with specific controller type and battery configuration, but is what can be typically expected. The load output will track the battery voltage.

6.0 SYSTEM MAINTENANCE

6.1 ANNUAL MAINTENANCE

- An annual inspection of the system is recommended and should consist of the following:
    - Visual inspection
    - Electrical inspection and test
    - Routine maintenance, troubleshooting and repair

6.2 TROUBLESHOOTING GUIDE

- Refer to controller use manual for controller status and possible error codes

Problem	Probable Cause	Solution
No Charging Power	Overload Solar/Load	Verify the load is not exceeding the system capability
	High temperature disconnect	Allow the controller to cool down then verify operation continues
	Reverse Polarity	Re-configure the wiring terminations to restore operation
	Battery Select fault	Verify that the jumper settings are correct for the system configuration
	Solar module is shaded	Confirm that the solar module angle and direction are correct. Verify no shading
Load Disconnected	LVD trip on the load controller	Confirm battery voltage is above the LVD cutoff voltage. If not, allow battery to fully charge
	Load overload or short circuit	Check the wire terminations for proper configuration
	LVD trip repeatedly	Verify the load is not exceeding the system capability. Confirm that battery DOD cycles have not exceed normal end of life
Breaker Trip or Fuse Blown	Improper wiring	Confirm wiring is correct and terminals are not corroded. Confirm wire and terminal continuity using an ohm meter
	Short circuit	Confirm that the load end of the circuit breaker does not have a short circuit.
	Breaker damaged	Verify breaker continuity out of circuit with an ohm meter. Replace breaker if necessary

6.3 TROUBLESHOOTING PROCEDURE

- Use the procedures below in conjunction with the Troubleshooting guide to determine if there is a problem with the system.

- In the event that you experience any difficulties with installation or operation of your system, please contact SunWize Customer Service at 1-800-81-SOLAR.

6.3.3 ARRAY TROUBLESHOOTING

- If the array is un-obstructed, un-shaded, at the correct tilt angle and in full light, (between 10am and 3pm), you can verify the module performance per the nameplate ratings for voltage open circuit (VOC) and short circuit current (ISC).

- Set the **PV(+)** breaker to **OPEN (OFF)** position, or remove the fuse..

- Using a volt meter, measure the VOC voltage between the **PV(+)** and **PV(-)** terminal blocks. It should measure within 5% of the nameplate rating in LOW to HIGH sunlight.

- Set the **PV(+)** breaker to **CLOSED (ON)** position, or install the fuse.

- Using an ammeter rated for a maximum system ISC value, measure the charging current through the **PV(+)** conductor. It should measure appx 30% or less of nameplate rating in LOW sunlight, 60% or less of nameplate rating in MED sunlight, 60% or greater in HIGH sunlight.

- The degree of sunlight is based on cloud cover and height on the horizon for that time of day in winter. As a reference:

LOW	a clear sunny day at 7AM-9AM	(10-30% sun capacity)
MED	a clear sunny day at 9AM-11AM	(30-60% sun capacity)
HIGH	a clear sunny day at 11AM-1PM	(60-100% sun capacity)
MED	a clear sunny day at 1PM-3PM	(30-60% sun capacity)
LOW	a clear sunny day at 3PM-5PM	(10-30% sun capacity).

- In summer sky:

LOW	a clear sunny day at 7AM-9AM	(10-30% sun capacity)
MED	a clear sunny day at 9AM-11AM	(30-60% sun capacity)
HIGH	a clear sunny day at 11AM-2PM	(60-100% sun capacity)
MED	a clear sunny day at 2PM-5PM	(30-60% sun capacity)
LOW	a clear sunny day at 5PM-8PM	(10-30% sun capacity).

7.0 LIMITED WARRANTY

SunWize Technologies warrants the SunWize Photovoltaic Kits against defects in materials and workmanship described below under normal installation, application, use and service conditions, for a period of one year from date of original purchase. This warranty extends to the original retail purchaser ("Customer") only. SunWize will, at its sole discretion, either repair or replace the product if it becomes inoperable due to a defect in material or workmanship performed directly by SunWize during the one year period of this warranty. This warranty does not cover cosmetic damage, damage from accident, negligence, misuse, or acts of God, and is voided by failure of the Customer to install, operate or use the product in accordance with instructions and warnings contained in the Installation & Operation Manual and in component manufacturers' manuals supplied with the product, if any. SunWize makes no warranty against defects in materials and workmanship by component parts manufacturers, except to the extent provided below.

SunWize will pass through to the Customer any and all additional warranties provided by the manufacturer(s) of component parts as applicable, such as batteries, PV modules, controllers, inverters, pumps, or lights, subject to the terms and enforceability of such manufacturers' warranties.

In order to obtain warranty service, the Customer must contact SunWize and be prepared to supply the following information:

- Where and when your SunWize product was purchased.
- Your product serial number, if applicable.
- Description of the problem. If we cannot correct the situation through phone consultation, we will provide you with the following information regarding shipping the SunWize product to SunWize Technologies including:
    - Address for return of product
    - Preferred shipping method
      (the user is responsible for the shipping charges)
    - An RMA (return materials authorization) number to be prominently displayed on the return packaging.

Provided that the necessary repairs are covered under warranty, SunWize will pay the return shipping charges to any destination within the United States.

SUNWIZE MAKES NO OTHER WARRANTIES TO CUSTOMER, EXPRESS OR IMPLIED, AND HEREBY EXPRESSLY DISCLAIMS ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Except as herein stated, SunWize shall not be liable for any damages of any kind. SunWize shall have no responsibility for damage to persons or property or other loss or injury resulting from a defect in the product or from improper installation or use. Under no circumstances will SunWize be liable for any incidental or consequential damage.