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. DOD refers to a battery's state of discharge.
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. LVD is a device in charge controllers that disconnects the load from the battery to protect from over discharge.
PF:	Abbreviation for power factor. PF is used to describe the quality of AC current in percent.
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. SOV is 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® POWER ONLINE UPS SYSTEMS

The SunWize® Power Online UPS Systems provide continuous DC power with battery backup from an AC and/or a DC source for applications such as microwave and cell repeaters, WiFi and WiMax networks, RTU and SCADA. These fully-integrated, weatherproof units, convert AC and/or DC primary power to charge a 12, 24 or 48 VDC sealed battery bank while powering the DC loads. Upon loss of AC and DC primary power, the battery powers the DC load(s) with "zero transfer time" since the loads are connected to the battery bank 100% of the time. Various system sizes are available to provide increased backup capability.

Power Online UPS Series systems include the following features:

- Multi-stage, temperature compensated battery charging
- Maintenance-free deep-cycle batteries, suitable for continuous float duty or banked switch load applications
- AC and DC circuit protection
- Weatherproof, aluminum control/battery enclosure suitable for pad mounting.
- One year system limited warranty

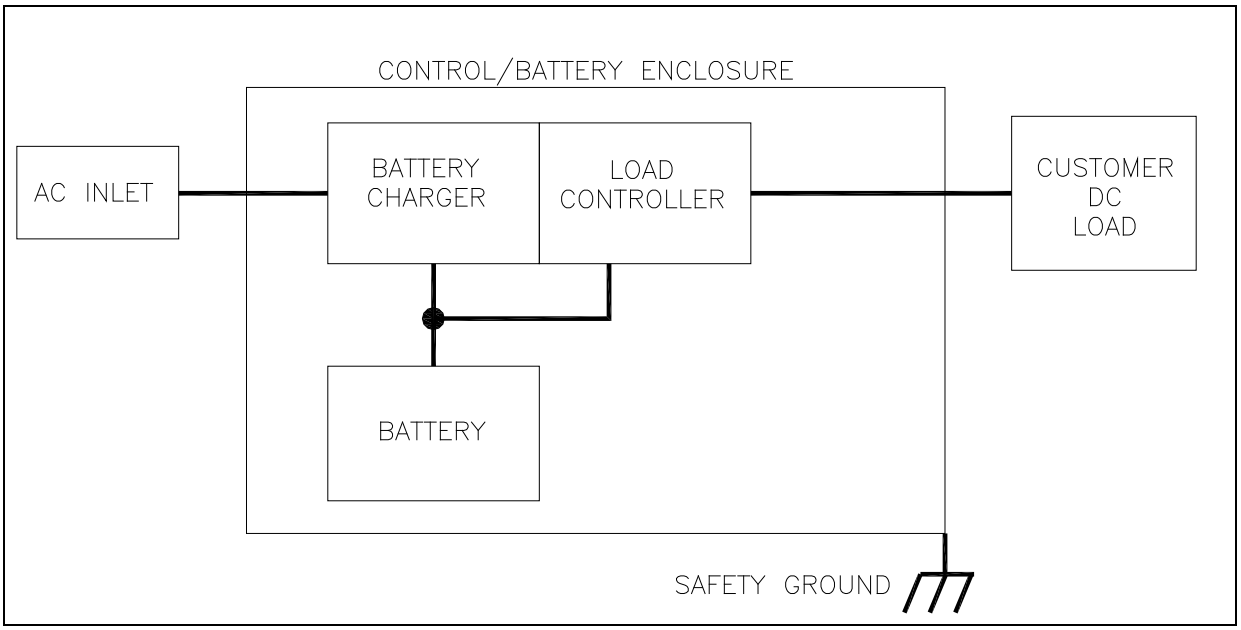

FIGURE 1: SYSTEM ONE LINE DIAGRAM (TYPICAL)

The AC utility power and/or DC power input charges the sealed batteries mounted in the enclosure via the battery charger and/or charge controllers, which regulate battery charging by limiting the upper voltage level of the battery. The low voltage load disconnect limits the lower voltage level of the battery by disconnecting the load, thus protecting the battery from severe over discharge. The equipment is protected by either circuit breakers or fuses.

1.1 COMPONENT IDENTIFICATION

1.1.1 (OPTIONAL) AC CHARGER PANEL

The AC charger panel contains the AC powered battery charger and ground bus.

1.1.2 (OPTIONAL) LOAD CONTROL PANEL

The load control panel contains the DC low voltage load disconnect.

1.1.3 (OPTIONAL) DUAL DC INPUT PANEL

The dual DC input panel contains two DC charge controllers and associated disconnects.

1.1.4 (OPTIONAL) DC LOAD COMBINER PANEL

The DC load combiner panel contains one load combiner diode block and associated terminal blocks.

1.1.5 (OPTIONAL) REMOTE AC INPUT SPLITTER

The remote AC input splitter contains terminal blocks and disconnects providing the ability to connect two AC power sources (primary and backup) to two UPS systems.

1.1.6 (OPTIONAL) REMOTE OUTPUT COMBINER

The remote output combiner contains all needed components to combine the DC output of two UPS systems into one series of load disconnects.

1.1.3 BATTERY BANK

The system battery bank consists of sealed VRLA batteries of either gel electrolyte (GEL) or absorbed glass mat (AGM) construction. Batteries are left separate for shipping and must be installed in enclosures and wired with provided battery interconnect cables.

Standard configuration in a UPS enclosure consists of a single charger control panel and load controller panel mounted with batteries.

Optional configuration consists of any combination of optional components, prewired in most cases.

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")
- 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
5	Battery enclosure/stand anchor bolts	1/2" dia. (4 per enclosure) (chest style only)

2.2 SUNWIZE® SUPPLIED PARTS LIST

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

Item	Description
1	Pre-assembled, pre-wired UPS system
2	Pre-assembled, pre-wired optional components (if applicable)
3	Batteries
4	Battery cables
5	Optional nylon wire ties
6	Enclosure keys
7	SunWize Installation & Operation Manual
8	Controller OEM Manual

3.0 MECHANICAL INSTALLATION INSTRUCTIONS

☠ DANGER ☠

Battery chargers are powered by AC utility, which present lethal voltage levels. Use caution in wiring and maintenance of systems to avoid electrical shock.

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 2.1.1 and the PARTS LIST in Section 2.1.2 and 2.2.

3.1 SYSTEM SITE LOCATION

- For optimum performance, the system should be installed out of direct sun exposure whenever possible. Systems should be protected from water ingress. Vents should be free of obstruction to allow maximum air flow. This will help minimize high temperature excursions of the batteries and electronics, extending the system life.

3.2 ENCLOSURE INSTALLATION – UPS ENCLOSURE

☠ DANGER ☠

The enclosure may weigh up to 150 lbs. and individual batteries may weigh up to 130 lbs. each. Use caution to avoid injury when lifting and securing the enclosure.

- Install the UPS enclosure or optional mounting base at the desired location using appropriate 1/2" concrete fastening hardware. If using the option base, once the base is fastened down, install the UPS enclosure on the base using supplied fasteners.
- Check alignment of all assembled parts and tighten all bolted connections.
- Install the battery(s) per the wiring diagram. Do not wire them at this point.

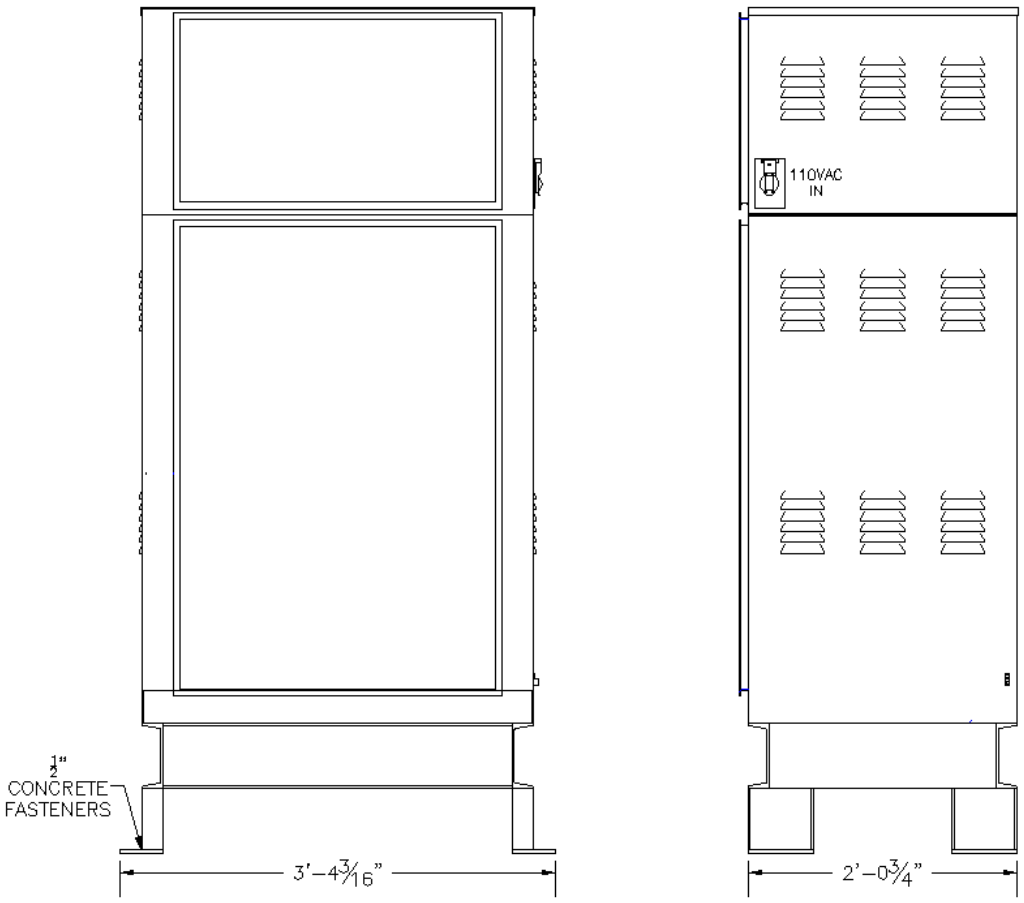

FIGURE 2: UPS ENCLOSURE ISTALLATION DETAILS (200018 – PO-UPS-375-3)

FIGURE 2A: UPS ENCLOSURE INSTALLATION DETAILS (200019 – PO-UPS-505-3)

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.

! NOTE !

Refer to the wiring diagram on the inside door of the control enclosure of your system for actual wiring configuration of the system.

4.1 GROUND WIRING

- Verify all components are installed per the wiring diagrams located on the sticker inside the enclosure.
- Verify all circuit breakers are set to the **OFF (OPEN)** position.
- Install the equipment grounding conductor (not provided) to the UPS enclosure ground lugs located outside the enclosures. 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 AC UTILITY WIRING

- Verify all components are installed per the wiring diagrams located on the sticker inside the enclosure.
- Verify all circuit breakers in the enclosure control section are set to the **OFF (OPEN)** position. Verify all fuses (if applicable) in the enclosure control section are removed.
- Install the system grounding conductor to the desired point of termination to comply with NEC A.690. The system **BATTERY NEGATIVE(-)** terminal is typically used, but is dependent on the application. Refer to NEC A.690 for specific details.
- Route the output wiring/conduit (not provided) from the AC utility source to the control enclosure. Secure the wire/conduit to the mounting surface using wire ties or other restraining hardware (not provided) to prevent damage during severe weather conditions.
- Inside the enclosure control section, or optional AC input splitter, mate the Utility **LINE** to the designated AC Mains breaker, Utility **NEUTRAL** to the designated white terminal block, Utility **GROUND** to the designated green terminal block**.**

4.3 BATTERY WIRING

- Inside the control enclosure, connect the controller **RED BAT(+)** wire terminal to the battery bank **POSITIVE (+)** terminal. Connect the controller **BLK BAT(-)** wire terminal to the battery bank **NEGATIVE (-)** terminal.

For 24V systems:

- Each pair of 12V batteries are in series and form one string. Ensure the jumper connects the **BLK** jumper from **BAT 1 NEGATIVE(-)** terminal to the **BAT 2 POSITIVE(+)** terminal. This pattern repeats for each additional series string.

- Each series string must be connected in parallel to complete the bank wiring. Ensure the parallel jumpers connect the **RED** jumper from **BAT 1 POSITIVE(+)** terminal to the **BAT 3 POSITIVE(+)** terminal and the **BLK** jumper from **BAT 2 NEGATIVE(-)** terminal to the **BAT 4 NEGATIVE(-)** terminal. Repeat this pattern for each additional parallel pair. A system can accommodate from one to four battery strings. (See Figure 3)

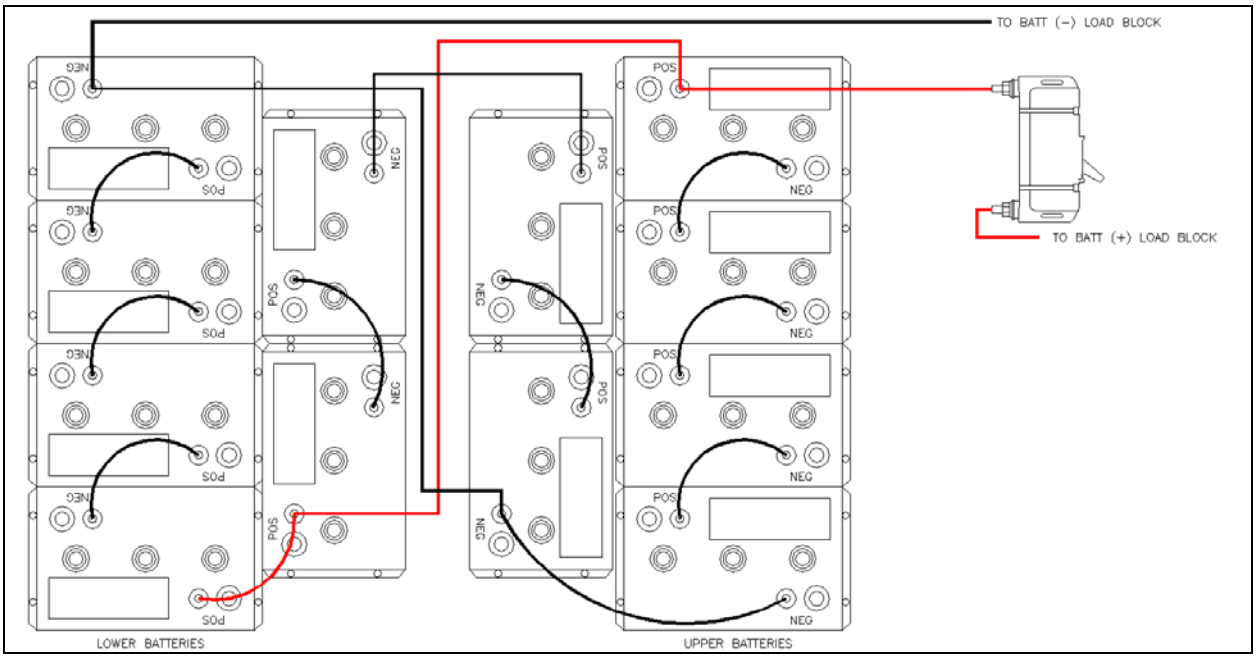

FIGURE 3: 24V BATTERY WIRING DETAILS

4.4 LOAD WIRING

- Inside the enclosure control section, find the labeled DC load breakers (CB1 through CB17) and AC load blocks if applicable.
- Connect the **DC LOAD(+)** wires to the labeled **LOAD POSITIVE(+)** breakers. Connect the **DC LOAD(-)** wire to the labeled **LOAD NEGATIVE(-)** blocks #1 and #2.

5.0 SYSTEM COMMISSIONING

- Verify the mechanical installation is complete per the Commissioning Checklist (Appendix A)
- Verify grounding continuity between all mechanical assemblies to the earth grounding bond. All resistive measurements should be below 0.5 ohms.
- Verify the electrical operation per the Commissioning Checklist (Appendix A) as follows:
- Verify the battery bank voltage by measuring from the **BAT(+)** terminal block to the **BAT(-)** terminal block.

  24V-26V for a 24V system
- Verify that polarity is positive for all measurements. If negative, reverse battery wiring to the system and repeat measurement.
- On the charge control panel, set the **AC LINE** input breaker(s) to the **ON (CLOSED)** position.
- On the charge control panel, set the **BAT(+)** input breaker(s) to the **ON (CLOSED)** position.
- Verify the charger and load controller LEDs illumination status per SECTION 8.
- On the charge control panel, set the **LOAD(+)** output breaker(s) to the **ON (CLOSED)** position, or insert the fuses into the fuse holder.
- 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.
- User load is active at this point.

5.1 SYSTEM OPERATION SUMMARY

- The SunWize® Power Online Systems control panel optimally charges the battery to maximize performance. Note, new batteries are received from the manufacturer approximately 90% formed and therefore require approximately 75% to 100% charging cycles before maximum capacity is reached.
- Integral temperature compensation optimizes the battery charging over temperature extremes. An optional external sensor is available on some models.
- A Low Voltage Disconnect (LVD) protects the battery from over discharge. The control panel automatically disconnects the load from the battery at 80% depth of discharge (DOD), and automatically re-connects at 50% DOD.

- The systems can be configured for two modes of charging, 2-stage or 3-stage charging. These methods of charge are shown as follows:

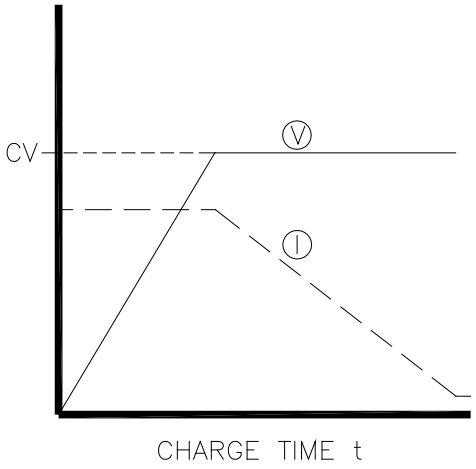

FIGURE 4: 2-STAGE CHARGING

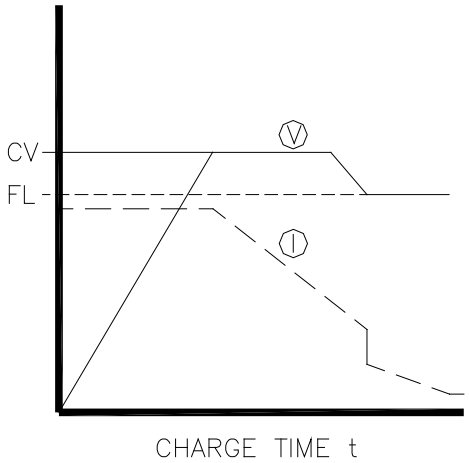

FIGURE 4A: 3-STAGE CHARGING

- The 2 stage charger will reach a CV set-point intended for long term standby use (approximately 2.25 Volts per cell). The output current falls off as the battery voltage is maintained, and the output voltage is raised or lowered to compensate for temperature differences.

- The 3 stage charger will reach a CV set-point that is intended to overcharge the battery when the battery is cycled deeply and often (approximately 2.35 Volts per cell). The output current falls off as the battery voltage is maintained. After a period of time, the system then lowers the voltage to the FV set-point for long term operation (approximately 2.25 Volts per cell).

- The 45W to 150W models come pre-configured for 3-stage charging and do not require any user adjustment for any load situation.

- The 150W to 1350W models come pre-configured for 2-stage charging, but can be adjusted for either the 2-stage or 3-stage configuration. If the load is expected to exceed 25% of the charger output capacity, 2-stage charging is recommended. 3-stage charging is recommended for bank switch operation where batteries are cycled daily.

- The control panel is factory configured for the system operating voltage, and is adjustable on some models. Refer to SECTION 8 for details.

- The battery charger charges the battery and supplies the load with direct power while utility power is available.

- Refer to SECTION 8 for control panel component specifications.

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
- An annual inspection checklist is provided in Appendix B.

6.2 TROUBLESHOOTING GUIDE

- Refer to SECTION 8.7 for LED definitions of controller status and possible error codes.

Problem	Probable Cause	Solution
No Charging Power	Overload at the 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.
	Charger is damaged	Confirm that the charger is working per the manufacturer guidelines.
Load Disconnected	LVD trip on the load controller	Confirm battery voltage is above the LVD cut-off voltage. If not, allow battery to fully charge.
	Load overload or short circuit	Check the wire terminations for proper Configuration.
	Repeated LVD trip	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.

TABLE 1: TROUBLESHOOTING GUIDE

6.3 TROUBLESHOOTING PROCEDURE

- Use the procedures below in conjunction with the troubleshooting guide table 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.

6.3.1 CHARGER TROUBLESHOOTING

- The voltages can be measured at the designated terminal blocks.

    - If the battery voltage is present at the load blocks, then the load fuse and the load low voltage disconnect (LVD) are assumed to be fully functional.

    - If the battery voltage is above 25.6VDC, with charger powered on and charging, the load is attached and active, and the charger is actively charging.

    - No further troubleshooting of the charger is required.

6.3.2 BATTERY TROUBLESHOOTING

- Batteries can be measured for both open circuit voltage (OCV), and voltage under charge (VUC). The VUC is a simple method to measure voltage without disabling the system from charging or the load. The OCV is used when the battery end of life is in question, and a more accurate means of measurement is required.

- Batteries should be tested for end of service life whenever a particular system begins to fall in a state of charge (SOC) repeatedly below 80% or the system begins to LVD on a recurring basis. This may vary depending on load use, depth of discharge and extreme temperatures, however can vary between 3 – 10 years.

- To measure for battery end of life, disconnect the battery from the system and charge with an appropriate 3-stage battery charger. After completion, allow battery to settle for 3 hours with no charge or load attached.

- Below is a table of OCV and VUC vs. SOC at 25^{o}C:

SOC	OCV	VUC
100	12.8	14.2
80	12.6	12.91
60	12.3	12.60
40	12.0	12.25
20	11.8	11.81
0	<11.6	<11.81

TABLE 2: OCV and VUC vs. SOC at 25^{o}C

- If an individual battery does not hold a voltage of at least 12.6VDC open circuit after a full charge and a 3 hour wait period under no load, you may have a damaged cell and require a battery replacement.

- If battery voltage climbs very rapidly under charge, then falls rapidly after removing charge, you may have a damaged cell and require a battery replacement.

7.0 LIMITED WARRANTY

SunWize® Power & Battery warrants the SunWize® Power Online UPS System against defects in materials and workmanship, described below, under normal installation, application, and 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 accidents, negligence, or misuse, 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, as well as component manufacturers' manuals that may be supplied with the product. 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® Power & Battery including:
    - Address for return of product.
    - Preferred shipping method.
      (customer is responsible for the shipping charges).
    - A return materials authorization (RMA) 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 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.

8.0 EQUIPMENT SPECIFICATION

CAUTION

The SunWize® controllers are configured for use with a sealed-type battery in accordance with the manufacturer's recommendations. If a flooded lead-acid battery is substituted, the controller must be set to the flooded setting to provide for battery equalization during charging.

! NOTE !

The SunWize® controllers optimally charge the battery to maximize performance. Note, that new batteries are received from the manufacturer approximately 90% formed and therefore require approximately 75% to 100% charging cycles before maximum capacity is reached.

8.1 CHARGER OPERATION – 300W to 1350W Chargers

- See included BCA1000 AC Source Battery Charger Installation & Operation Manual

8.2 CONTROLLER OPERATION – ProStar Controller (15A to 30A)

- See included ProStar Operator's Manual

8.3 CONTROLLER OPERATION – TriStar Controller (45A to 60A)

- See included TriStar Installation & Operation Manual

APPENDIX A: COMMISSIONING CHECKLIST

Date: _____
Model No.: _____
Serial No.: _____
Inspected By: _____ **Approved by:** _____

I. Mechanical Inspection					
A. Enclsoure					
1	Mounting fasteners tight				YES / NA
2	Ground lug fastened tightly, free of corrosion,				YES / NA
B. Charge Cont.					
1	Wiring secure to terminals				YES / NA
2	Backpanel to ground continuity (< 0.5 ohm)				YES / NA
3	Breakers in the CLOSED (ON) position				YES / NA
II. Electrical Inspection					
	System DC Voltage (circle)	12	24	48	
A. Charge Cont.					
1	System battery voltage under CV charge:	VDC:	_____	14.4VDC	YES / NA
	System charging current under CV charge:	ADC:	_____		YES / NA
2	System battery voltage under FL charge:	VDC:	_____	13.5VDC	YES / NA
	System charging current under FL charge:	ADC:	_____		YES / NA
3	DC load voltage	VDC:	_____	>12.6VDC	YES / NA

For 24V systems, multiply values x2
For 48V systems, multiply values x4

APPENDIX B: ANNUAL INSPECTION CHECKLIST

Date: _____
Model No.: _____
Serial No.: _____
Inspected By: _____ **Approved by:** _____

I. Mechanical Inspection

A. Enclsoure

1	Mounting fasteners tight	YES / NA
2	Ground lug fastened tightly, free of corrosion,	YES / NA

B. Charge Cont.

1	Wiring secure to terminals	YES / NA
2	Backpanel to ground continuity (< 0.5 ohm)	YES / NA
3	Breakers in the CLOSED (ON) position	YES / NA

II. Electrical Inspection

A. Battery

1	System DC Voltage (circle)	12	24	48	
2	PV breakers in the OPEN (OFF) position				YES / NA

Battery open circuit:

BATTERY 1 _____	VDC	BATTERY 7 _____	VDC
BATTERY 2 _____	VDC	BATTERY 8 _____	VDC
BATTERY 3 _____	VDC	BATTERY 9 _____	VDC
BATTERY 4 _____	VDC	BATTERY 10 _____	VDC
BATTERY 5 _____	VDC	BATTERY 11 _____	VDC
BATTERY 6 _____	VDC	BATTERY 12 _____	VDC

Maximum Delta:

Highest Battery Voltage _____	VDC	
Lowest Battery Voltage _____	VDC	
Highest - Lowest Battery Voltage _____	VDC	(<.05VDC)

B. Charge Cont.

1	All Breakers in the CLOSED (ON) position			YES / NA
	System operateing:			
3	System battery voltage(V):	VDC: _____	> 2.1Vpc	YES / NA
4	Load voltage under charge meas:	VDC: _____	> 2.1Vpc	YES / NA