SunSmart E-Shelter Operations Manual & PV System Overview

For Facilities Managers & School Personnel

System Commissioning Date:_____ FSEC Approval Number:_____

WARNING

DANGER - HIGH VOLTAGE

DO NOT SERVICE WHEN WET

HAZARDOUS MATERIAL - ACID

ACKNOWLEDGMENT

This material is based upon work supported by the U.S. Department of Energy and the Florida Energy and Climate Commission under Award Number DE-EE0000241.

IMPORTANT: PLEASE READ

Please carefully read all safety instructions and operations & maintenance procedures contained within this manual to ensure safe and proper operation of the PV system.

Keep flammable liquids away from the shed and solar array at all times. Use extreme caution whenever working around electricity, electrical components, and batteries. There is always a potential for shocks, burns, injury, and even death if you come in contact with electricity.

TROUBLESHOOTING

If you experience problems with the photovoltaic (PV) system, please contact VB Engineering BEFORE performing any service repairs due to malfunctions or damage .

For any problems or questions after the 5-year warranty period expires (effective through August 31, 2016), please contact the SunSmart Program at the Florida Solar Energy Center and VB Engineering.

VB Engineering
Office: 561-750-8677
Email: sunsmart@vbengineering.com

SunSmart E-Shelters c/o the Florida Solar Energy Center
Office: 321-252-9479
Email: sunsmart@fsec.ucf.edu

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SAFETY INFORMATION

WARNING

Hazardous Voltage

Risk of Electric Shock: The connection of several solar panels in series results in the adding up of voltage and imposes danger.

Arcing Warning: Solar panels generate direct current (DC) when exposed to light. When breaking a closed circuit, a dangerous arc may be generated. Do not cut any live wires.

Suitable Ambient Conditions: Solar panels must not be exposed to focused light. The module must neither be immersed in water nor be exposed to continuous wetting (e.g. by fountains). Exposure to salt or sulfur implies a risk of corrosion.

WARNING

Hazardous Material: Corrosive Chemicals

Do not open batteries. Avoid contact with internal components. Internal components include lead and liquid electrolyte.

Electrolyte - Electrolyte is corrosive and contact may cause skin irritation and chemical burns. Electrolyte causes severe irritation and burns of eyes, nose and throat. Ingestion can cause severe burns and vomiting.

Lead - Direct skin or eye contact may cause local irritation. Inhalation or ingestion of lead dust or fumes may result in headache, nausea, vomiting, abdominal spasms, fatigue, sleep disturbances, weight loss, anemia and leg, arm and joint pain.

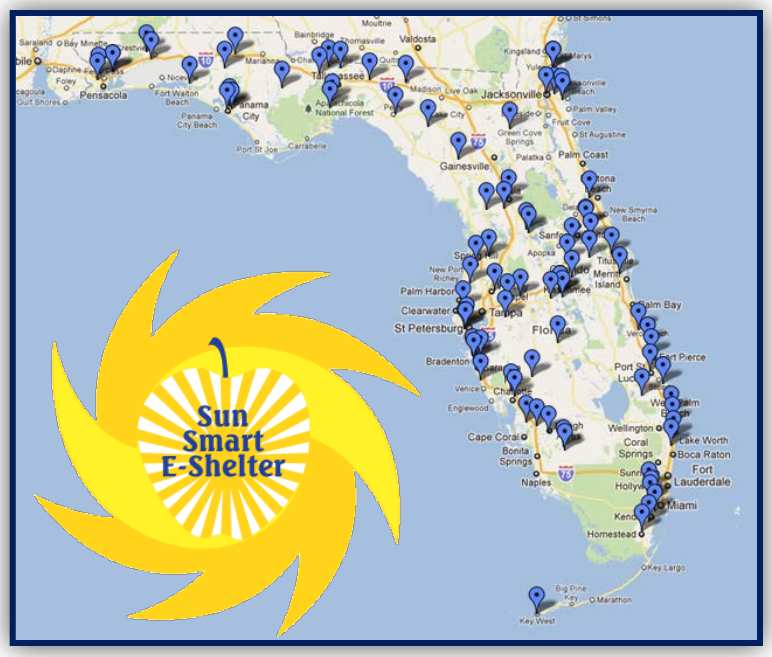
Occupation Safety and Health Administration (OHSA) Requirements

1926.441(a)(5) - Face shields, aprons, and rubber gloves shall be provided for workers handling acids or batteries.

1926.441(a)(6) - Facilities for quick drenching of the eyes and body shall be provided within 25 feet (7.62 m) of battery handling areas.

SUNSMART E-SHELTERS PROJECT OVERVIEW

The SunSmart E-Shelters Project is part of $10M grant awarded to the Florida Solar Energy Center (a research institute of the University of Central Florida) through the American Recovery and Reinvestment Act of 2009 (ARRA) to increase deployment of solar energy systems to schools, colleges, and other public buildings.



FSEC®

UCF

Stands For Opportunity

The SunSmart E-Shelters Project provides solar energy systems of approximately 10kW to 90 public schools/colleges that have been designated by the state as enhanced hurricane protection area (EHPA) shelters. These systems feature a battery back-up that provides emergency power to the shelter in the event of an electrical power outage.

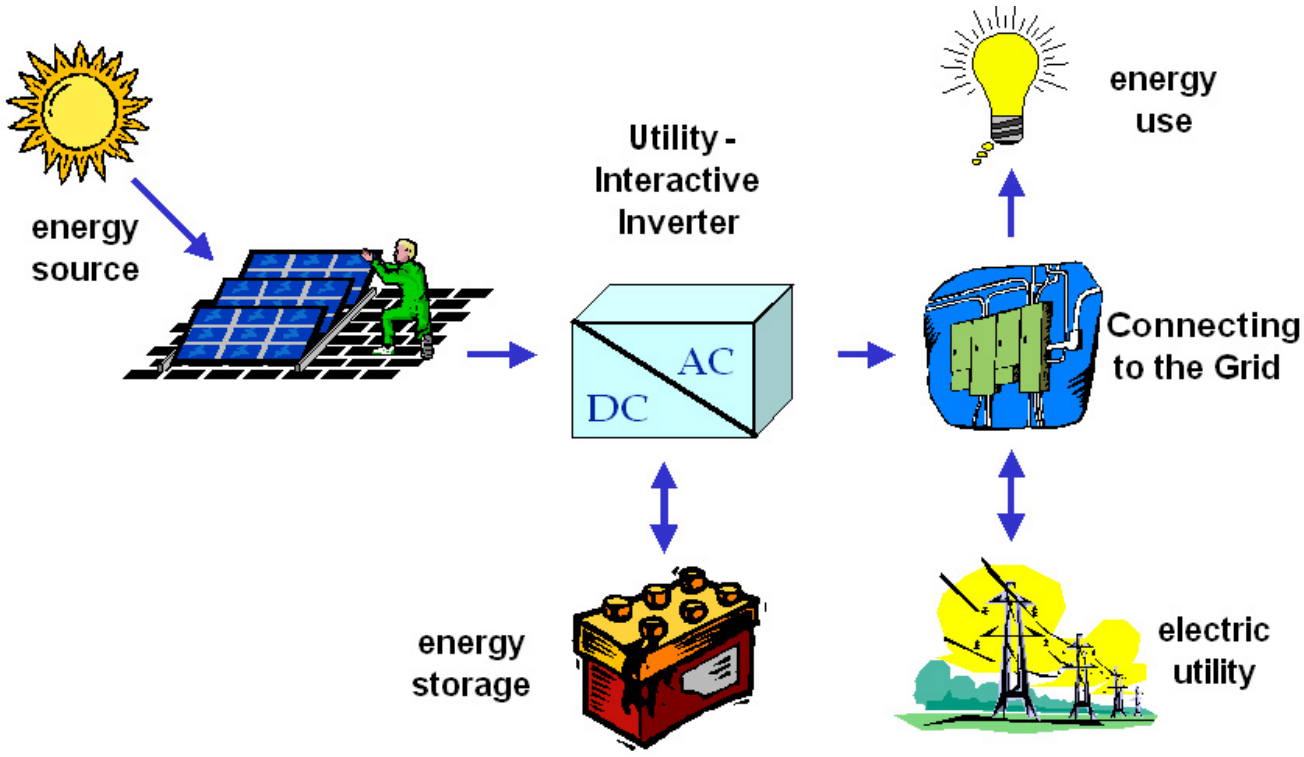
Each school designated as a SunSmart E-Shelter will also receive a solar energy curriculum for students along with specialized training for teachers and school personnel.

PV SYSTEM OVERVIEW

This system is a grid-tied PV system with battery backup, with PV generation consisting of 42 SolarWorld SW-240 modules with a combined STC rated DC output power of 10,080 watts. The modules are connected into two groups of five 3-module source circuits and one group of four 3-module source circuits that feed three OutBack FM80 charge controllers. The charge controllers feed the system batteries and the inverters which are connected to supply 120/208 volt AC (uninterruptible) to the standby loads and also the utility grid. The system is provided with all disconnects and labels required by the National Electrical Code. The system batteries are sized for 610 amp hours at 48V providing approximately 27.0kWh to standby (uninterruptible) loads.

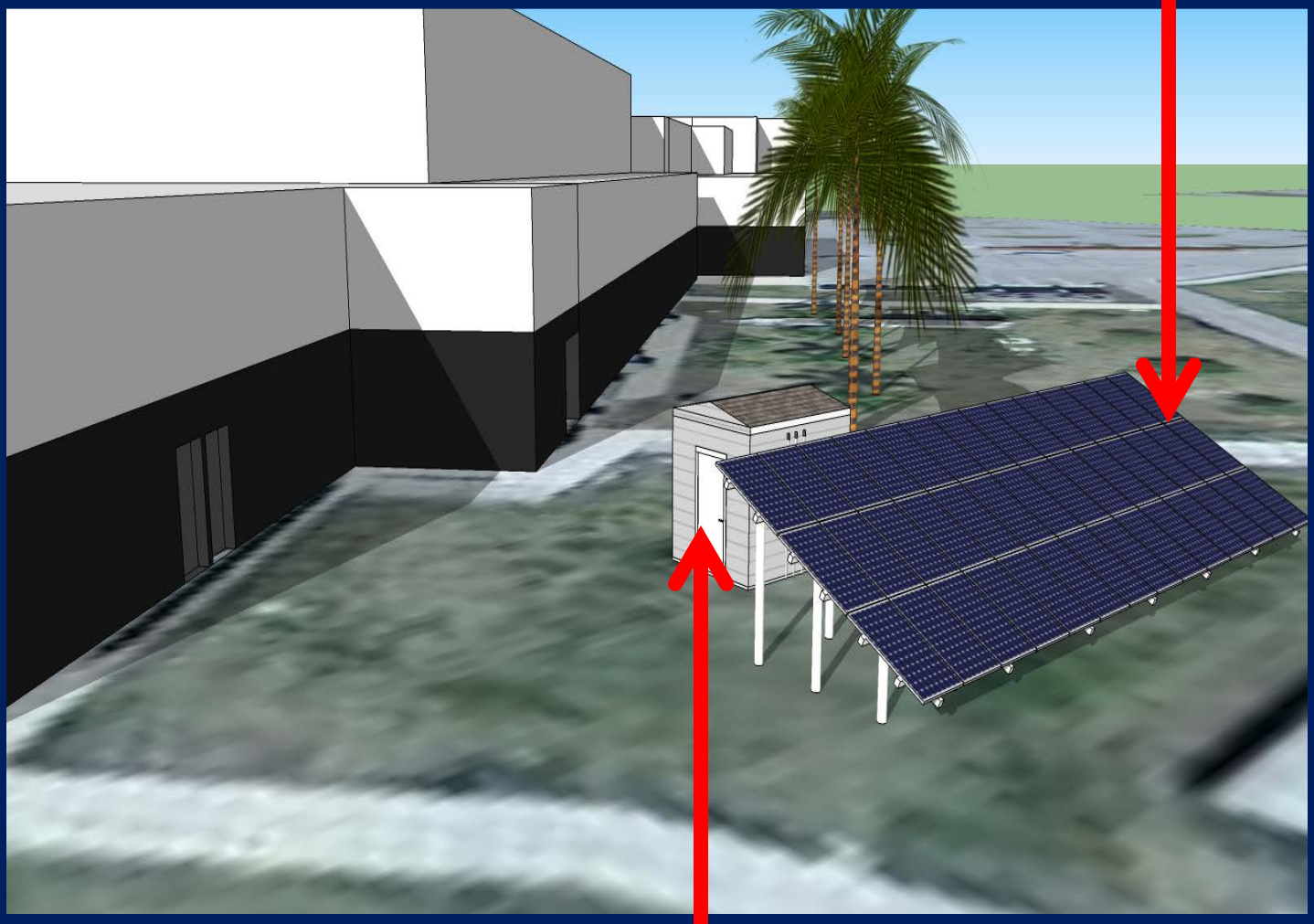
When the sun is shining, power from the PV array is used to keep the batteries fully charged. After charging the batteries, the PV power is made available to the standby loads. If the PV power meets the requirements of the standby loads, any remaining PV power is then directed to the interruptible loads of the occupancy. If any PV power remains after the interruptible loads have been powered, it is delivered to the utility. When utility power is available, but PV power is not available, standby loads are supplied by the utility. If neither utility or PV power is available, standby loads are supplied by the batteries. Thus, the batteries are only cycled if utility power is lost. The batteries used are specially designed, deep cycle, maintenance free batteries that are capable of undergoing approximately 3,000-4,000 charge-discharge cycles. Designing the system to minimize battery cycling extends the life of the batteries.

On an average day of Florida sunshine, the system will produce approximately 36.5kWh of clean energy.



SOLAR ARRAY & SHED OVERVIEW

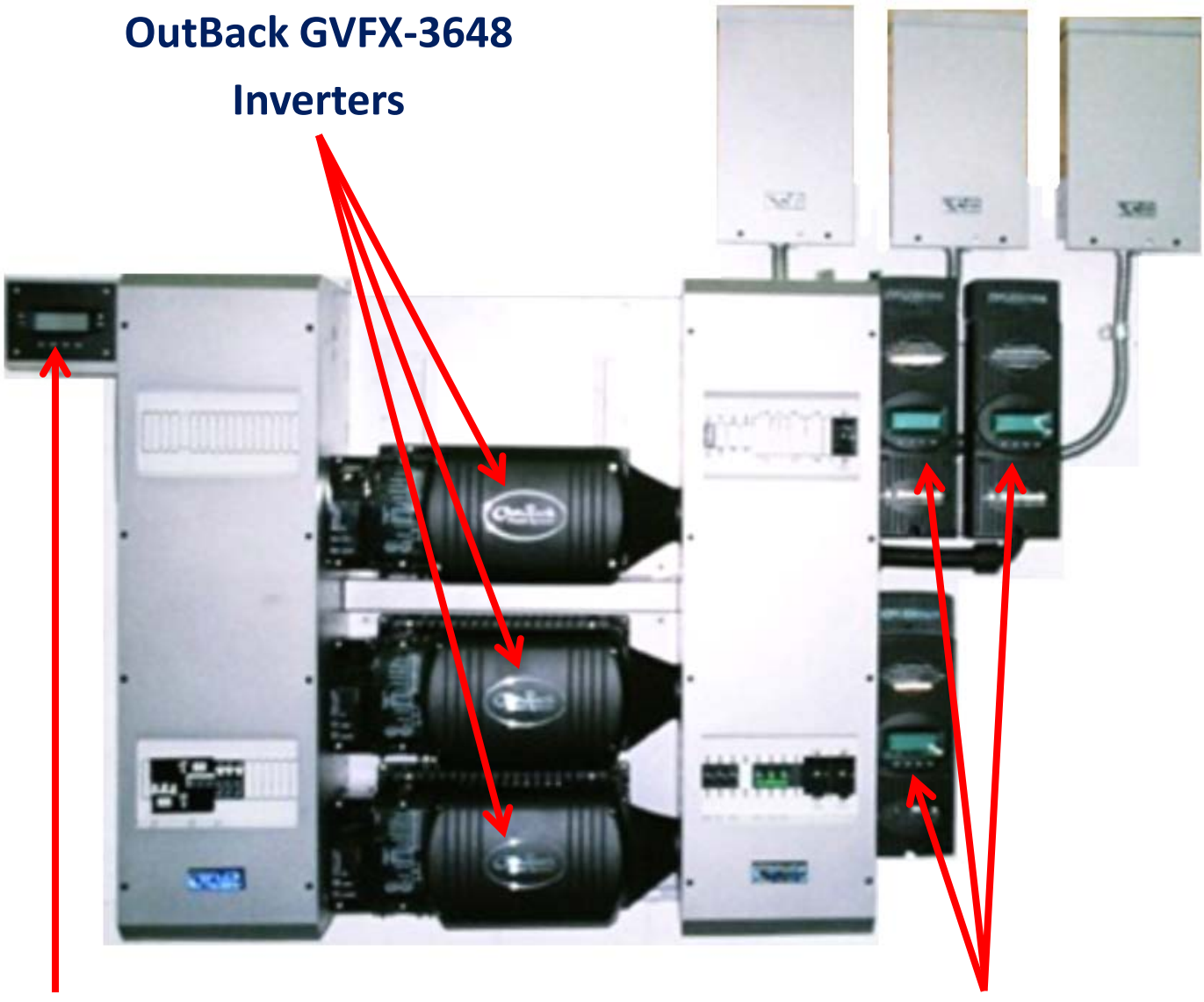
The SOLAR ARRAY is comprised of 42 SolarWorld 240 watt polycrystalline solar modules.



The SOLAR EQUIPMENT ENCLOSURE houses the inverters, batteries, and charge controllers.

INVERTER/CHARGE CONRTOLLER OVERVIEW

The FLEXware 1000 system architecture is capable of supporting three OutBack GVFX-3648 Inverters, three OutBack FM-80 Charge Controllers, and all the required AC and DC components and wiring.



DATA ACQUISITION SYSTEM OVERVIEW

greenMonitor (closed)

greenMonitor (open)

The PV system performance and operation is measured and monitored by an automated data acquisition system (DAS). The DAS is externally interfaced with the PV system to collect the following data:

•*Site meteorological data:*
a. Plane-of-array irradiance
b. Ambient temperature
c. Module temperature
d. Wind speed

•*Site measured data:*
a. Battery voltage
b. Battery current
c. PV array voltage
d. PV array current
e. Energy production from the PV system
f. Energy consumption of critical load panel
g. Power production from the PV system
h. Power consumption of critical load panel

Stevenson Screen
(Instrument Shelter)

Please DO NOT attempt to service and/or program the data acquisition system. For all inquiries, please contact the system installer (Vergona-Bowersox Electric) at 561-750-8677.

ENERGY PRODUCTION & COST SAVINGS

PV Watts is a performance calculator for grid-connected PV systems. The monthly and yearly energy production are modeled using the selected PV system parameters and weather data that are typical or representative of long-term averages. Because weather patterns vary from year-to-year, the values in the tables are better indicators of long-term performance than performance for a particular month or year. PV performance is largely proportional to the amount of solar radiation received, which may vary from the long-term average by 30% for monthly values and 10% for yearly values.

Station Identification	
City:	Tampa
State:	Florida
Latitude:	27.97° N
Longitude:	82.53° W
Elevation:	3 m
PV System Specifications	
DC Rating:	10.0 kW
DC to AC Derate Factor:	0.770
AC Rating:	7.7 kW
Array Type:	Fixed Tilt
Array Tilt:	25.0°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	12.0 ¢/kWh

Results			
Month	Solar Radiation ($kWh/m^2/day$)	AC Energy (kWh)	Energy Value ($)
1	4.46	1004	120.48
2	5.14	1035	124.20
3	5.70	1254	150.48
4	6.57	1366	163.92
5	6.02	1281	153.72
6	5.67	1151	138.12
7	5.55	1158	138.96
8	5.76	1215	145.80
9	5.33	1087	130.44
10	5.35	1147	137.64
11	4.74	1006	120.72
12	4.14	924	110.88
Year	5.37	13628	1635.36

PVWatts

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

ANNUAL INSPECTION CHECKLIST

Please make sure to read the safety information (page 1) before performing an inspection of the PV system,

✓ Solar Panels

1. **All fixtures are securely tightened (torque setting of 11.8 ft.-lbs.) and corrosion-free.**
2. **Wiring is securely connected, properly arranged and free of corrosion.**
3. **Cables are free of damage.**
4. **Please also observe applicable standards.**
5. **Cleaning: On principle, the modules do not need any cleaning since the tilt angle is sufficient (> 15 ; self-cleaning by rain). In case of heavy contamination or during long periods without rainfall, we recommend cleaning the modules with plenty of water (hose) WITHOUT the addition of cleaning agents but application of a soft cleaning device (sponge). NEVER scrape or rub off dirt; this may result in micro-scratches. DO NOT use a pressure cleaner to clean the modules.**

✓ Inverters & Charge Controllers

(see page 6 for location of disconnects)

1. **Turn off all circuit breakers before doing any cleaning or adjustments.**
2. **Please be extremely careful when cleaning the outside/surface of the inverters and charge controllers to ensure that any buttons are not accidentally pushed which could lead to the improper programming of the PV system. Please also use caution to make sure display panels are not damaged in the cleaning and inspection processes.**
3. **Clean the outside of the inverter and the filter using a damp sponge to wipe away dirt from the inverter's surface.**
4. **Follow manufacturer's instructions on removing the cover of the inverter when cleaning the filter.**
5. **Check vents on all charge controllers to make sure they are free from dust and debris.**

✓ Racking, Wiring, & Shed

1. **Make sure that all nuts and bolts in the array mounting structure are tight and secure.**
2. **Make sure metal surfaces are free of corrosion.**
3. **Check electrical cable connections to make sure they are tight and secure.**

ANNUAL INSPECTION CHECKLIST

Please make sure to read the safety information (page 1) before performing an inspection of the PV system,

4. **Check all exposed wiring for scrapes and make sure that cables are not damaged.**
5. **Make sure there is no moisture on the floor of the shed.**
6. **Finally, check that there is continuity between module frames and earth ground.**

✓ Batteries **(please see battery safety information on page 11 BEFORE performing an inspection of the batteries**

1. **Always wear protective clothing - batteries contain acid and any spillage will damage your clothes and burn your skin.**
2. **Clean the batteries around the terminals and ensure that the area is grease-free.**
3. **Clean any deposits that from around the terminals with warm water and coat the terminals with a petroleum jelly or product specifically for the purpose.**
4. **Never totally discharge a battery as it is unlikely you will be able to recharge it back to it's original state. In practice it is best not to let the battery discharge to less than 85% of it's capacity. Using a direct current voltmeter check the state of charge. 12.6 volts or above indicates a fully charged 12v battery, 12.3 volts means it is approximately half charged and anything less than 11 volts means the battery is very flat and may not ever recover. The predicted life of a battery very much depends on it's use and state of charge. Since batteries are only used when the utility is lost, and solar is not available, the batteries are expected to last well beyond the manufacturer's warranty period.**

BATTERY SAFETY INFORMATION

FIRST AID MEASURES

Emergency and First Aid Procedures	Contact with internal components if battery is opened/broken.
1. Inhalation	Remove to fresh air and provide medical oxygen/CPR if needed. Obtain medical attention.
2. Eyes	Immediately flush with water for at least 15 minutes, hold eyelids open. Obtain medical attention.
3. Skin	Flush contacted area with large amounts of water for at least 15 minutes. Remove contaminated clothing and obtain medical attention if necessary.
4. Ingestion	Do not induce vomiting. If conscious drink large amounts of water/milk. Obtain medical attention. Never give anything by mouth to an unconscious person.

DISPOSAL CONSIDERATIONS

Lead-acid batteries are completely recyclable. Return whole scrap batteries to distributor, manufacturer or lead smelter for recycling. For information on returning batteries to Concorde Battery for recycling call 626-813-1234. For neutralized spills, place residue in acid-resistant containers with sorbent material, sand or earth and dispose of in accordance with local, state and federal regulations for acid and lead compounds. Contact local and/or state environmental officials regarding disposal information.

TRANSPORT INFORMATION

All Concorde AGM, GPL, PVX, RG series and D8565 series are valve regulated lead acid (VRLA) batteries. Concorde's VRLA batteries have passed vibration, pressure differential and free flowing acid tests under CFR 49 173.159(d), meet IATA Special Provisions A48 & A67, and IMDG Special Provisions 238.1 & 238.2. The batteries are securely packaged, protected from short circuits and labeled "Non-Spillable." Concorde's VRLA batteries are exempt from DOT Hazardous Material Regulations, IATA Dangerous Goods Regulations, and IMDG Code.

US DOT
Excepted from the requirements because batteries have passed the vibration and pressure differential performance tests, and ruptured case test for Nonspillable designation.

IMO
Excepted from the requirements because batteries have passed the vibration and pressure differential performance tests, and ruptured case test for nonspillable designation. And, when packaged for transport, the terminals are protected from short circuit.

IATA
Excepted from the requirements because batteries have passed the vibration and pressure differential performance tests, and ruptured case test for nonspillable designation. And when packaged for transport, the terminals are protected from short circuit.

FIREFIGHTING MEASURES

Flash Point – Not Applicable	Flammable Limits in Air % by Volume: Not Applicable	Extinguishing Media – Class ABC, CO_2, Halon	Auto-Ignition Temperature 675°F (polypropylene)
Special Fire Fighting Procedures	Lead/acid batteries do not burn, or burn with difficulty. Do not use water on fires where molten metal is present. Extinguish fire with agent suitable for surrounding combustible materials. Cool exterior of battery if exposed to fire to prevent rupture. The acid mist and vapors generated by heat or fire are corrosive. Use NIOSH approved self-contained breathing apparatus (SCBA) and full protective equipment operated in positive-pressure mode.		
Unusual Fire and Explosion Hazards	Sulfuric acid vapors are generated upon overcharge and polypropylene case failure. Use adequate ventilation. Avoid open flames/sparks/other sources of ignition near battery.		

ACCIDENTAL RELEASE MEASURES

Procedures for Cleanup. Avoid contact with any spilled material. Contain spill, isolate hazard area, and deny entry. Limit site access to emergency responders. Neutralize with sodium bicarbonate, soda ash, lime or other neutralizing agent. Place battery in suitable container for disposal. Dispose of contaminated material in accordance with applicable local, state and federal regulations. Sodium bicarbonate, soda ash, sand, lime or other neutralizing agent should be kept on-site for spill remediation.

Personal Precautions: Acid resistant aprons, boots and protective clothing. ANSI approved safety glasses with side shields/face shield recommended.

Environmental Precautions: Lead and its compounds and sulfuric acid can pose a severe threat to the environment. Contamination of water, soil and air should be prevented.

HANDLING AND STORAGE

Precautions to be Taken in Handling and Storage	Store away from reactive materials, open flames and sources of ignition as defined in Section 10 – Stability and Reactivity Data. Store batteries in cool, dry, well-ventilated areas. Batteries should be stored under roof for protection against adverse weather conditions. Avoid damage to containers.
Other Precautions	GOOD PERSONAL HYGIENE AND WORK PRACTICES ARE MANDATORY. Refrain from eating, drinking or smoking in work areas. Thoroughly wash hands, face, neck and arms, before eating, drinking and smoking. Work clothes and equipment should remain in designated lead contaminated areas, and never taken home or laundered with personal clothing. Wash soiled clothing, work clothes and equipment before reuse.

EXPOSURE CONTROLS AND PERSONAL PROTECTION

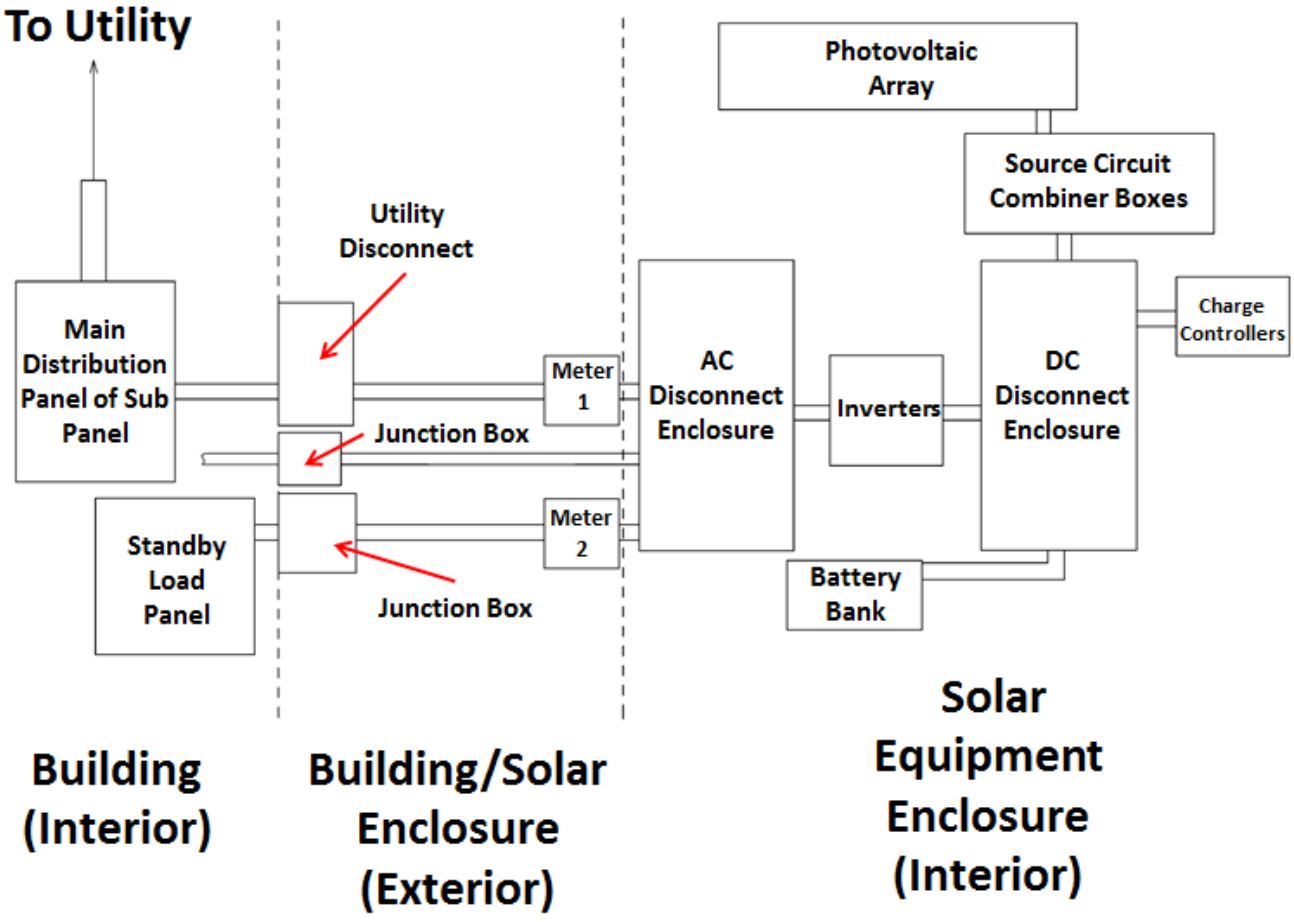
Respiratory Protection (Specify Type)	None required under normal conditions. Acid/gas NIOSH approved respirator is required when the PEL is exceeded or employee experiences respiratory irritation.				
Ventilation	Store and handle in dry ventilated area.	Local Exhaust	When PEL is exceeded.	Mechanical (General)	Not Applicable
Protective Gloves	Wear rubber or plastic acid resistant gloves.	Eye Protection	ANSI approved safety glasses with side shields/face shield recommended		
Other Protective Clothing or Equipment	Safety shower and eyewash.				

START UP PROCEDURES

Note: Failure to follow correct sequencing in startup and shutdown may result in permanent damage to inverters or charge controllers. Please carefully review all start-up & shut-down procedures.

TO START UP THE SYSTEM, perform the shut-down sequence in opposite order. Note that in the start-up sequence, the charge controller OUTPUT circuit breakers are turned on before the charge controller INPUT breakers are turned on. After turning on the charge controller output breakers, observe the charge controller displays to see if they are directing the operator to make any decisions, such as setting the nominal battery voltage. OutBack charge controllers actually direct the user to turn on the PV array when all preliminary charge controller settings have been made. With FM-80 charge controllers, it is up to the operator to make the decisions.

Equipment Locations Diagram



SHUTDOWN PROCEDURES

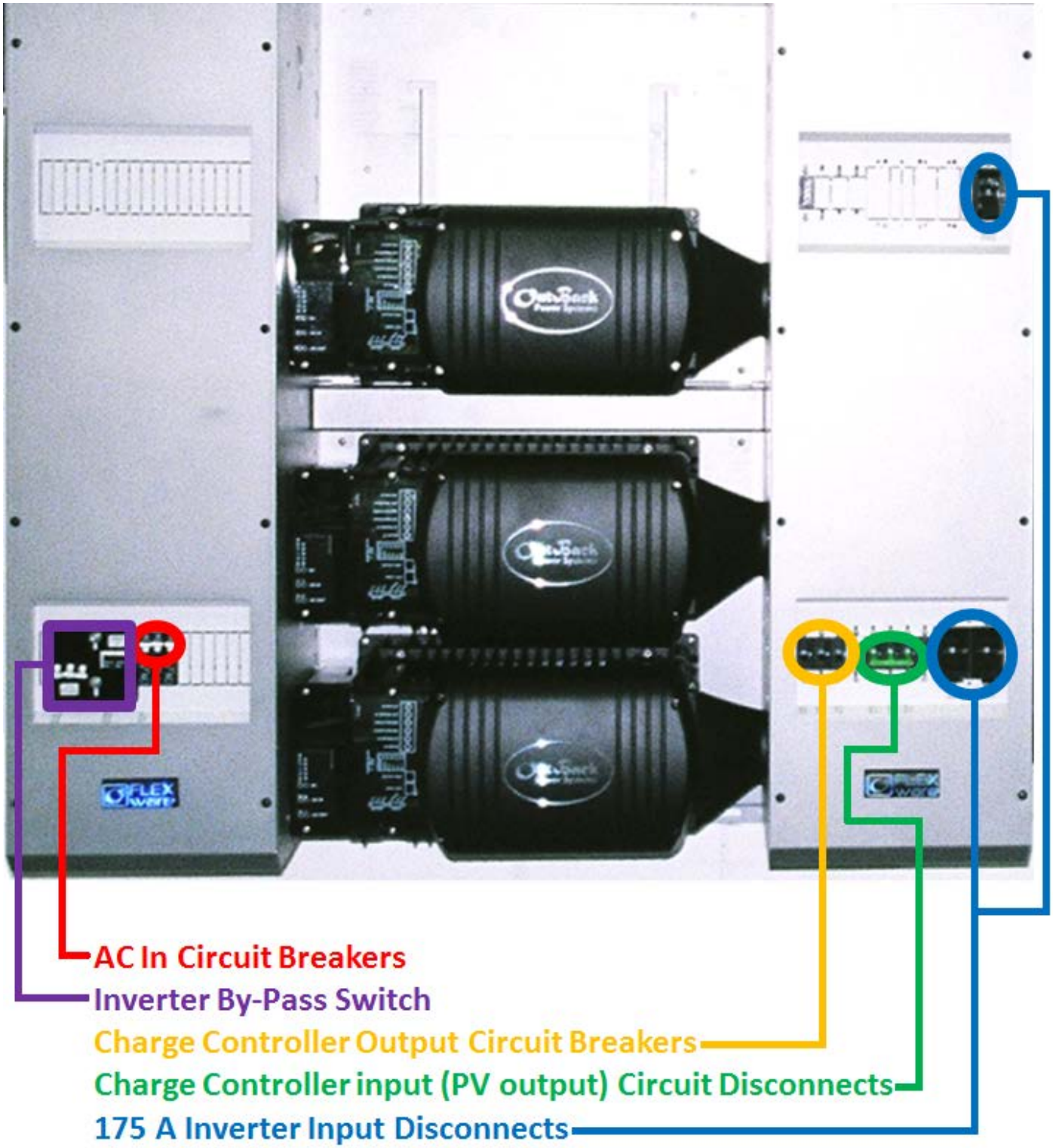
Note: Failure to follow correct sequencing in startup and shutdown may result in permanent damage to inverters or charge controllers. Please carefully review all start-up & shut-down procedures.

TO TURN THE ENTIRE SYSTEM OFF, including the emergency load supply (Inverter AC Out), use the following switching sequence (see page 13 of this Operations Manual for locations of disconnects):

1. **Turn off the point of utility connection circuit breaker in the main distribution panel.**
2. **Turn off the lockable utility disconnect.**
3. **Turn off the AC IN circuit breaker.**
4. **Turn off the 175 A inverter input disconnects.**
5. **Turn off the circuit breakers between the PV output from the source circuit combiner box and the charge controller input terminals (labeled PV Output or Charge Controller Input). IMPORTANT: If the charge controller output circuit breakers are turned off before the charge controller input breakers are turned off, the charge controller can be permanently damaged! The reason is because the charge controller electronics are powered by the connection to the batteries through the charge controller output breakers.**
6. **Turn off the charge controller output circuit breakers.**

TO TURN OFF THE PV SYSTEM BUT MAINTAIN UTILITY VOLTAGE TO THE EMERGENCY LOADS:
See Page 2

LOCATION OF DISCONNECTS



SHUTDOWN PROCEDURES

Note: Failure to follow correct sequencing in startup and shutdown may result in permanent damage to inverters or charge controllers. Please carefully review all start-up & shut-down procedures.

TO TURN OFF THE PV SYSTEM BUT MAINTAIN UTILITY VOLTAGE TO THE EMERGENCY LOADS, use the following switching sequence (see page 13 of this Operations Manual for locations of disconnects):

1. Turn the inverter by-pass switch to by-pass position.
2. Turn off the inverter AC IN disconnect in the FW1000- AC enclosure.
3. Turn off the 175 A inverter input disconnects in the FW1000-DC enclosure.
4. Leave the utility disconnect and point of utility connection switches on to be sure utility power is supplied to the inverter bypass switch.

These 4 steps remove all AC and DC power from the inverter. Additional shut-down may include (be sure to perform in the indicated order):

5. Turn off the Charge Controller input (PV output) circuit disconnects in the DC enclosure. This removes all power from the PV arrays to the charge controllers.
6. Turn off the Charge Controller output circuit breakers in the FW1000-DC Enclosure. This removes all power from the batteries to the Charge Controller.
7. Turn off the circuit breakers in the FWPV-8 Source Circuit Combiner Box. This operation isolates the source circuits from each other.

WARRANTY INFORMATION

5-Year Complete System-Level Warranty

VB Engineering, Inc. fully guarantees all items hereunder against defect in materials and/or workmanship for the manufacturer's normal period of time from the date of acceptance by the SunSmart Program at the Florida Solar Energy Center. This includes a five (5) year complete system-level warranty and service contract for the no-cost replacement of any defective component required for safe and as-specified system operation.

Contact Information

VB Engineering
3601 N. Dixie Hwy #16
Boca Raton, FL 33431

T: 561-750-8677
F: 561-750-0518
E: sunsmart@vbengineering.com
URL: www.vbengineering.com

Manufacturers' Warranty Information

Solar Panels 10-Year Limited Product Warranty 25-Year Limited Service Warranty	For details and contact info, please see page 16
Inverters 5-Year Limited Product Warranty	For details and contact info, please see pages 17
Batteries 5-Year Limited Warranty	For details and contact info, please see page 18

Limited Warranty (valid from 01.01.2011)

By purchasing the Solar modules from SolarWorld Americas LLC ("SolarWorld") (hereinafter referred to as: products), you have chosen a level of quality, which meets the highest requirements. SolarWorld assumes that use in accordance with this Limited Warranty will reliably maintain the function of the products to produce electricity (hereinafter referred to as: functional capability) as well as reliably maintaining the performance of the products. As a sign of our confidence in this quality, SolarWorld is happy to grant you as the end-user of the products (i.e. the person who put the products into operation correctly for the first time or the person who has legitimately purchased the products from such an end-customer without any modifications) a Ten Year Limited Product Warranty and Twenty-Five Year Limited Service Warranty as presented below:

A Ten Year Limited Product Warranty:

1. SolarWorld guarantees the functional capability of the products for ten years beyond the purchase of the product and that the product:
   - will not suffer from any mechanical adverse effects, which limit the stability of the solar module. A condition for this is correct installation and use in accordance with regulations, as described in the installation instructions enclosed with the product.
   - will not be subject to any clouding or discoloration of the glass.
   - with its cable and connector plug will remain safe and operational, if they are installed professionally and are not permanently positioned in water (puddle). However, damage to the cable, which is caused by abrasion on a rough lower surface owing to insufficient fixing or owing to unprotected running of the cable over sharp edges, is excluded. Any damage caused by animals (e.g. rodent bites, birds, insects) is also exempted.
   - with its aluminum frames will not freeze up when it is frosty if it is installed correctly.

   The appearance of the product as well as any scratches, stains, mechanical wear, rust, mould, optical deterioration, discoloration and other changes, which occurred after delivery by SolarWorld, do not represent defects, insofar as the change in appearance does not lead to a deterioration in the functional capability of the product. A claim in the event of glass breakage arises only to the extent that there was no external influence.
2. If the products exhibit one of the above-mentioned defects during this period and this has an effect on the functional capability of the product, Solar-World will repair the defective products, supply replacement products or provide the customer with an appropriate residual value of the products as compensation at its discretion.

B Twenty-Five Year Limited Service Warranty:

1. The products which you have purchased have a performance specification within a certain tolerance range of 3% with regard to the power output (the so-called effective output). The relevant effective output can be found on the nameplate on the reverse of the product. SolarWorld assumes that the actual output of the products will decline only slightly over a period of 25 years as of the purchase of the product.
2. SolarWorld guarantees that the actual output of the product will amount to at least 97% of effective output during the first year of operation of the product and as of the second year of the operation of the product, the effective output will decline annually by no more than 0.7% for a period of 24 years, so that by the end of the 25th year of operation an actual output of at least 80.2% of effective output will be achieved. In the event of a negative deviation of actual product performance from the so-called threshold values, SolarWorld will either supply you with replacement products, which make it possible to maintain actual performance, carry out repair measures, which make it possible to achieve actual performance or grant you financial compensation for the reduced performance of the product. During the initial 15 years of the warranty running time, SolarWorld will exclusively either offer to supply replacement products, which will make it possible to maintain actual performance, or to carry out repair measures which make it possible to achieve such actual performance. After the expiry of 15 years of the warranty SolarWorld may freely decide to grant financial compensation for the reduced performance.
3. When replacement products are supplied, there is no entitlement for the use of new products or those which are as good as new. On the contrary, SolarWorld is authorized to also supply used and/or repaired products as replacements.

C Further conditions of entitlement:

1. The period of the Limited Service Warranty under B) is restricted to a period of 25 years as of the purchase of the product and will not be extended even in the event of a repair or exchange of a product.
2. The effective output and the actual output of the products are to be determined for the verification of any guarantee case using standard test conditions, as described under IEC 60904. The decisive measurement of performance is carried out by a recognized measuring institute or through SolarWorld's own measurements (the assessment of measurement tolerances is undertaken in accordance with EN 50380). The guarantee does not cover transport costs to return the products or for a new delivery of repaired or replacement products. It also does not cover the costs of the installation or re-installation of products, as well as other expenditure by the end-customer or seller.
3. Ownership of all products which have been replaced pass to SolarWorld.
4. The term of the rights granted to you in this Certificate in paragraphs A) and B) starts with the original purchase of the products, insofar as they were purchased by the original end-customer after 01.01.2011. SolarWorld retains the right to adjust voluntary special services in accordance with this document at any time. However, any product purchases which have already been concluded, remain unaffected by this – including the voluntary special services in accordance with this document. You can find out about the current status of this document at any time under www.solarworld-usa.com.

D Assertion of claims:

The assertion of the services specified under A) and B) requires you (i) to inform the authorized seller/dealer of the product of the alleged defect in writing, or (ii) to send this written notification directly to the address mentioned in G), if the seller/dealer who should be informed no longer exists (e.g. owing to business closure or insolvency). Any notification of defects is to be added to the original sales receipt as evidence of the purchase and the time of the purchase of the SolarWorld products. The assertion should take place within six weeks of the occurrence of the defect. In the case of claims arising from the product warranty (under A), the starting point for the recognition of an occurrence of a defect is the knowledge of material and/or workmanship errors. In the case of claims arising from the service warranty (under B), the starting point is the knowledge of reduced performance of the products. The return of products is permitted only after the written consent of SolarWorld has been obtained.

E Use in accordance with this Limited Warranty:

1. The services described above can additionally be ensured only if the product is properly used, operated and installed. Services provided by SolarWorld must therefore be withdrawn if the defects to the product are not exclusively based on the products themselves; e.g. in the following cases:
   a. Delays on your part or on the part of the fitter in observing the assembly, operational and maintenance instructions or information, if this leads to defects and/or loss of performance of the products.
   b. Exchange, repair or modification of the products if these are not done in a proper and professional way.
   c. Incorrect use of the products.
   d. Vandalism, destruction through external influences and/or persons/animals.
   e. Incorrect storage or inappropriate transport before installation if these lead to defects and/or a reduction of performance of the products.
   f. Damage to the customer system or incompatibility of the customer's system equipment with the products if these lead to defects and/or a reduction in performance of the products.
   g. Use of products on mobile units such as vehicles or ships.
   h. Influences such as dirt or contamination on the face-plate; contamination or damage by e.g. smoke, extraordinary salt contamination, or other chemicals.
   i. Force majeure such as flooding, fire, explosions, rock-falls, direct or indirect lightning strikes, or other extreme weather conditions such as hail, hurricanes, whirlwinds, sandstorms or other circumstances outside the control of SolarWorld.
2. The entitlements referred to under A) and B) will not be granted if and as soon as the manufacturer's labels or serial numbers on the PV modules have been changed, deleted, peeled off or made unrecognizable.

F Exclusion of liability:

The remedies set forth in this Limited Warranty are the exclusive remedies available to you as a product purchaser. SolarWorld shall not be liable for damage, injury or loss arising out of or related to a product except as set forth in this Limited Warranty. In particular, under no circumstances shall SolarWorld be liable for incidental, consequential, special or other indirect damages in any way connected with a product. SolarWorld's aggregate liability, if any, shall be limited to a product's purchase price or any service furnished in connection with a product, as the case may be.

G Your contacts:

To receive service under this Limited Warranty, please contact the authorized seller/dealer of your product or SolarWorld at the following address: Customer Service, SolarWorld Americas LLC., 4650 Adohr Lane, Camarillo, CA 93012, USA, e-mail: customerservice@solarworld-usa.com , Phone: +1 805 388 6590; Fax: +1 805 388 6395

H Choice of law:

This Limited Warranty, including without limitation the rights and responsibilities granted hereunder, shall be governed and construed in accordance with the laws of the State of Oregon, without regard to the conflicts of law provisions thereof.

I Validity:

The following table contains all the current products to which this Limited Warranty is to be applied. Products, which do not appear in this list, are not subject to this Limited Warranty.

Sunmodule/Sunmodule Plus/laminate/black

SW 135 mono	SW 200 mono	SW 200 poly	SW 130 Compact mono
SW 140 mono	SW 205 mono	SW 205 poly	SW 135 Compact mono
SW 145 mono	SW 210 mono	SW 210 poly	SW 140 Compact mono
SW 150 mono	SW 214 mono	SW 214 poly	SW 145 Compact mono
SW 155 mono	SW 215 mono	SW 215 poly	SW 150 Compact mono
SW 160 mono	SW 220 mono	SW 220 poly	SW 155 Compact mono
SW 165 mono	SW 225 mono	SW 225 poly	SW 160 Compact mono
SW 170 mono	SW 230 mono	SW 230 poly	SW 165 Compact mono
SW 175 mono	SW 235 mono	SW 235 poly	SW 170 Compact mono
SW 180 mono	SW 240 mono	SW 240 poly	
SW 185 mono	SW 245 mono	SW 245 poly	
SW 190 mono	SW 250 mono	SW 250 poly	
SW 195 mono	SW 255 mono	SW 255 poly	
	SW 260 mono	SW 260 poly	

J State Law:

This Limited Warranty is expressly intended to exclude all other express or implied warranties, including without limitation the warranties of merchantability and fitness for a particular purpose, to the periods set forth herein. This Limited Warranty gives you specific legal rights, and you may also have other rights which vary from state to state. Some states do not allow limitations on implied warranties or the exclusion or limitation of damages, so some of the above limitations may not apply to you.

K Severability:

If any provision of this Limited Warranty is held unenforceable or illegal by a court or other body of competent jurisdiction, such provisions shall be modified to the minimum extent required such that the rest of this Limited Warranty will continue in full force and effect.

Camarillo, 23.05.2011

Kevin Kilkelly
President
SolarWorld Americas LLC

Raju Yenamandra
Vice President, Sales and Marketing
SolarWorld Americas LLC

SOLARWORLD

We turn sunlight into power.

www.solarworld-usa.com

5-Year Limited Warranty on OutBack Power Products

OutBack Power Technologies, Inc. ("OutBack") provides a five (5) year limited warranty ("Warranty") against defects in materials and workmanship for its inverter/chargers, charge controllers, battery monitor and communication products ("Product"), with the exception of the OBX OutBack Extreme Series products, which have a one (1) year limited warranty.

The term of this Warranty begins on the Product(s) initial purchase date, or the date of receipt of the Product(s) by the end user, whichever is later. This must be indicated on the invoice, bill of sale, and/or warranty registration card submitted to OutBack. This Warranty applies to the original OutBack Product purchaser, and is transferable only if the Product remains installed in the original use location.

The warranty does not apply to any Product or Product part that has been modified or damaged by the following:

- Installation or Removal;
- Alteration or Disassembly;
- Normal Wear and Tear;
- Accident or Abuse;
- Corrosion;
- Lightning;
- Repair or service provided by an unauthorized repair facility;
- Operation or installation contrary to manufacturer product instructions;
- Fire, Floods or Acts of God;
- Shipping or Transportation;
- Incidental or consequential damage caused by other components of the power system; or
- Any product whose serial number has been altered, defaced or removed.

OutBack's liability for any defective Product, or any Product part, shall be limited to the repair or replacement of the Product, at OutBack's discretion. OutBack does not warrant or guarantee workmanship performed by any person or firm installing its Products. This Warranty does not cover the costs of installation, removal, shipping (except as described below), or reinstallation of Products or parts of Products.

THIS LIMITED WARRANTY IS THE EXCLUSIVE WARRANTY APPLICABLE TO OUTBACK PRODUCTS. OUTBACK EXPRESSLY DISCLAIMS ANY OTHER EXPRESS OR IMPLIED WARRANTIES OF ITS PRODUCTS, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. OUTBACK ALSO EXPRESSLY LIMITS ITS LIABILITY IN THE EVENT OF A PRODUCT DEFECT TO REPAIR OR REPLACEMENT IN ACCORDANCE WITH THE TERMS OF THIS LIMITED WARRANTY AND EXCLUDES ALL LIABILITY FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING WITHOUT LIMITATION ANY LIABILITY FOR PRODUCTS NOT BEING AVAILABLE FOR USE OR LOST REVENUES OR PROFITS, EVEN IF IT IS MADE AWARE OF SUCH POTENTIAL DAMAGES. IF YOU ARE A CONSUMER THAT PURCHASED THIS PRODUCT IN A MEMBER STATE OF THE EUROPEAN UNION, YOU MAY HAVE ADDITIONAL STATUTORY RIGHTS UNDER DIRECTIVE 1999/44/EC. THESE RIGHTS MAY VARY FROM EU MEMBER STATE TO EU MEMBER STATE. SOME STATES (OR JURISDICTIONS) MAY NOT ALLOW THE EXCLUSION OR LIMITATION OF WARRANTIES OR DAMAGES, SO THE ABOVE EXCLUSIONS OR LIMITATIONS MAY NOT APPLY TO YOU.

Corporate Headquarters
5917 195th St. NE, #7
Arlington, WA 98223 USA
Phone: 360.435.6030
Fax: 360.435.6019
www.outbackpower.com

European Sales Office
Barcelona, ESPANA
Phone: +34.600.843.845

DC BATTERY SPECIALISTS WARRANTY

FOR

SUN-XTENDER "PVX" SERIES BATTERIES

YOUR CONCORDE ABSORBED GLASS MAT (AGM) SUN-XTENDER "PVX" SERIES, VALVE-REGULATED SEALED LEAD-ACID BATTERY (VRSLAB) HAS BEEN HAND CRAFTED TO THE SAME QUALITY STANDARDS AS OUR MILITARY-APPROVED BATTERIES. THE CONCORD BATTERY PROVIDES LONGER LIFE, BETTER CYCLING CAPABILITIES AND SUPERIOR PERFORMANCE WHEN COMPARED TO OTHER SEALED LEAD-ACID BATTERIES.

YOUR SATISFACTION IS GUARANTEED WITH OUR NO-NONSENSE WARRANTY

CONCORDE WARRANTS THE "PVX" SERIES BATTERY FOR 5 YEARS FROM THE DATE OF SHIPMENT, AGAINST DEFECTS IN MATERIAL, WORKMANSHIP, INCLUDING FAILURE, EXCEPT WHEN SUCH FAILURE IS CAUSED BY UNAUTHORIZED MODIFICATIONS OR ALTERATIONS, OR INSTALLATION OF A SMALLER SIZE OR CAPACITY BATTERY THAN IS REQUIRED. THIS WARRANTY DOES NOT COVER BATTERY DAMAGE FROM SHIPPING, LOOSE WIRING, REVERSE POLARITY INSTALLATIONS, NOR BREAKAGE OF CONTAINERS, COVERS OR TERMINAL POSTS, ABUSE, NEGLECT, OVERCHARGING OR UNDERCHARGING, BREAKAGE OR FREEZING, ALLOWING TO BATTERY TO BE DEEPLY DISCHARGED VIA A PARASITIC LOAD, BATTERIES WITH (OCV) OPEN CIRCUIT VOLTAGE EQUAL TO OR LESS THEN 1.7 VOLTS PER CELL WILL BE DEEMED AS OVERDISCHARGED.

SUNXTENDER WILL PROVIDE A FIVE YEAR WARRANTY ON DEEP CYCLE BATTERIES PURCHASED AFTER MAY 1ST 2010 USED IN SOLAR PV AND OTHER RENEWABLE ENERGY APPLICATIONS. THE FIRST YEAR OF THIS WARRANTY IS A FREE REPLACEMENT PERIOD. THE REMAINING 4 YEARS ARE PRO RATA. COPY OF PURCHASE INVOICE MUST BE PROVIDED.

SUNXTENDER WILL NOT BE RESPONSIBLE FOR ELECTRICAL SYSTEM TESTS, LOSS OF TIME, LOSS OF EQUIPMENT USE OR ANY OTHER EXPENSES WHICH CAN BE CONSIDERED INCIDENTAL OR CONSEQUENTIAL DAMAGES

THIS WARRANTY APPLIES TO THE ORIGINAL PURCHASER OF THE BATTERY, IS NON-TRANSFERABLE.

SUNXTENDER 5 YEAR SOLAR WARRANTY STARTS FROM THE DATE SOLD AND APPLIES ONLY TO BATTERIES SOLD IN SOLAR AND RENEWABLE ENERGY APPLICATIONS.

DC BATTERY SPECIALISTS

160 NW 73rd ST

MIAMI FL, 33150

305-758-5041

Sunmodule™

SW 240 poly

Version 2.0 and 2.5 Frame

WORLD CLASS QUALITY

Fully-automated production lines and seamless monitoring of the process and material ensure the quality that the company sets as its benchmark for its sites worldwide.

SOLARWORLD PLUS SORTING

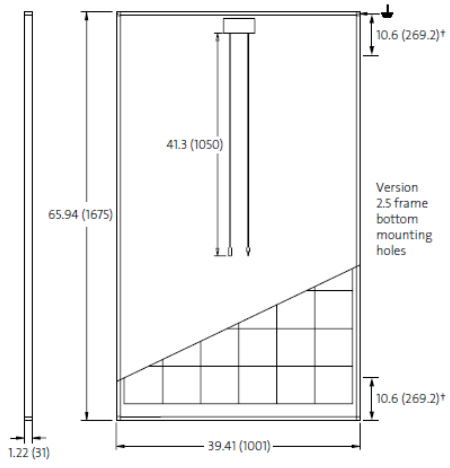
Plus-sorting guarantees the highest system efficiency. Only modules that achieve the designated nominal performance or greater in performance tests are dispatched.

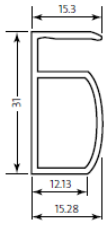
25 YEARS LINEAR PERFORMANCE GUARANTEE*

SolarWorld guarantees a maximum degeneration in performance of 0.7% p.a. for more than 25 years – a clear additional benefit compared with the conventional two-stage industry guarantees. In addition there is a product workmanship warranty that covers 5 years.

PHYSICAL CHARACTERISTICS

Cells per module	60	**Frame**	Anodized aluminum
Cell type	Poly crystalline	**Weight**	46.7 lbs (21.2 kg)
Cell dimensions	6.14 in x 6.14 in (156 mm x 156 mm)	**UL Maximum Test Load****	50 psf (2.4kN/m²)
Front	Tempered glass (EN 12150)	**IEC Maximum Snow Test Load*****	113 psf (5.4kN/m²)





VERSION 2.0 FRAME

- Compatible with "Top-Down" mounting methods
- Grounding Locations: 4 corners of the frame

* In accordance with the applicable SolarWorld Limited Warranty at purchase. www.solarworld-global.com/service-certificate.

** Please apply the appropriate factors of safety according to the test standard and local building code requirements when designing a PV system.

www.solarworld.com

SOLARWORLD

We turn sunlight into power.

Sunmodule™ SW 240 poly

Version 2.0 and 2.5 Frame

PERFORMANCE UNDER STANDARD TEST CONDITIONS (STC)*

		SW 240
Maximum power	P_{max}	240 Wp
Open circuit voltage	U_{OC}	37.2 V
Maximum power point voltage	U_{MPP}	30.2 V
Short circuit current	I_{SC}	8.44 A
Maximum power point current	I_{MPP}	7.96 A

*STC: 1000W/m², 25°C, AM 1.5

PERFORMANCE AT 800 W/m², NOCT, AT 1.5

		SW 240
Maximum power	P_{max}	174.2 Wp
Open circuit voltage	U_{OC}	33.7 V
Maximum power point voltage	U_{MPP}	27.4 V
Short circuit current	I_{SC}	6.80 A
Maximum power point current	I_{MPP}	6.37 A

Minor reduction in efficiency under partial load conditions at 25° C: at 200 W/m², 95% (+/-3%) of the STC efficiency (1000 W/m²) is achieved.

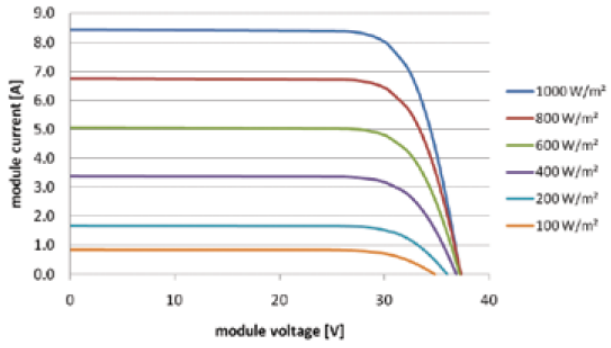
THERMAL CHARACTERISTICS

NOCT	46° C
TC I_{sc}	0.034 %K
TC U_{oc}	-0.34 %
TC P_{mpp}	-0.48%
Operating range	-40°C to 90°C

SYSTEM INTEGRATION PARAMETERS

Maximum system voltage SC II	1000 V
Maximum system voltage USA NEC	600 V
Maximum series fuse rating	16 A
Number of bypass diodes	3

I-V CURVE AT 25°C CELL TEMPERATURE



ADDITIONAL DATA

Measuring tolerance	+/- 3%
SolarWorld Plus-Sorting[1]	$P_{Flash} \geq P_{max}$
Junction box	IP65
Connector	MC4
Module efficiency	14.61%

GROUNDING

We recommend using the following components:

FRAME 2.0/2.5 (CORNERS)

Item	Manufacturer/Description	Tightening torque
Grounding lug	ILsco GBL-4DBT	35 lbf-in, 4-6 AWG str 25 lbf-in, 8 AWG str 20 lbf-in, 10-14 AWG sol/str
Socket head cap screw	#10-24, 5/8", SS 18-8	62 lbf-in (7.0 Nm)

FRAME 2.5 (FLANGE)

Item	Manufacturer/Description
Grounding lug	ILsco GBL-4DBT
Bolt	#10-32, SS
Serrated Washer	#10, SS
Washer	ID 13/64", OD 7/16"
Nut	#10-32, SS

Any PV grounding method and components listed to meet NEC grounding requirements are also acceptable.

c UL US LISTED 10SE
Photovoltaic Module / Panel

c ETL US 2)
Intertek

FOKUS TEST 06/10 Ammoniakbeständigkeit

VDE

ISO 9001
ISO 14001
Certified

CE

www.tuv.com TÜVRheinland
· Qualified, IEC 61215
· Safety tested, IEC 61730
· Periodic Inspection

Made in USA

1) The output identified by SolarWorld (P_{flash}) is always higher than the nominal output (P_{max}) of the module.

2) Depending on the market.

SolarWorld AG reserves the right to make specification changes without notice. This data sheet complies with the requirements of EN 50380.

GTFX & GVFX Series

Grid-Interactive True Sinewave Inverter/Charger

Sealed GTFX

- Provides Power When the Grid is Out
- Sell Renewable Energy Back to the Grid
- Sinewave Output
- Intelligent Battery Charging
- Up to 6.0 kVA
- Sealed Chassis For Harsh Environments
- Corrosion Resistant Internal Components
- Field Serviceable
- Standard 5 year Warranty

Vented GVFX

- Provides Power When the Grid is Out
- Sell Renewable Energy Back to the Grid
- Sinewave Output
- Intelligent Battery Charging
- Up to 7.2 kVA
- "Bug Proof" Chassis
- Field Serviceable
- Standard 5 year Warranty

The OutBack true sinewave grid-interactive inverter/charger is a complete power solution. It incorporates a DC to AC sinewave inverter, battery charger and AC transfer switch housed within a die-cast aluminum chassis. The GTFX and GVFX Series Inverter/Chargers give you the ability to sell solar, wind or hydro power back to the utility grid while providing instantaneous back-up power in the event of a utility outage. Our built in transfer switch automatically disconnects your loads from the utility grid and powers them from the inverter in the event of an outage, allowing you to continue using your solar and battery back-up power, unlike traditional grid-tie systems. Intelligent multi-stage battery charging prolongs the life of your batteries and built-in networked communications enables you to stack up to two units while simultaneously communicating with other OutBack Power components. The exclusive modular system architecture means that increased power output is just an additional inverter/charger away. Our GTFX series uses a sealed chassis that can operate in the harshest environmental conditions such as high humidity and corrosive salt air while the GVFX series uses a vented chassis with "bug proof" screened openings that allow high output AC power various operating conditions.

OutBack Power inverter/chargers are the only choice when you need a true sinewave, powerful, modular and reliable power solution for your home, business or extreme application.

OutBack POWER
member of The Alpha Group

www.outbackpower.com

Grid Interactive Specifications

		GVFX3648
Nominal DC Input Voltage		48 VDC
Continuous Power Rating at 25° C		3600 VA
AC Voltage/Frequency		120 VAC 60 Hz
Continuous AC RMS Output at 25° C		30.0 amps AC
Idle Power	Full	20 Watts
	Search	~6 Watts
Typical Efficiency		93%
Total Harmonic Distortion	Typical	2%
	Maximum	5%
Output Voltage Regulation		±2%
Maximum Output Current	Peak	70 amps AC
	RMS	50 amps AC
AC Overload Capability	Surge	6000 VA
	5 Second	5000 VA
	30 Minutes	4000 VA
AC Input Current Maximum		60 amps AC
Sell Back Voltage Range*		108 to 132 VAC
AC Input Frequency Range		59.3 to 60.5 Hz
DC Input Voltage Range		42 to 68 VDC
Continuous Battery Charge Output		45 amps DC
Operating Temperature Range		-40° C to 60° C (power derated above 25° C)
Warranty		Standard 5 year Warranty
Weight	Unit	61 lbs (27.6 kg)
	Shipping	64 lbs (29 kg)
Dimensions (H x W x L)	Unit	12 x 8.25 x 16.25" (30 x 21 x 41 cm)
	Shipping	21.75 x 13 x 22" (55 x 33 x 56 cm)
Certifications		ETL Listed to UL1741, CSA C22.2 No. 107.1 (stand-alone DC eligible equipment list)
		ETL Listed to UL1741, CSA C22.2 No. 107.1

*This product was designed to meet UL1741 specifications within the U.S. and Canada. Please check your local nominal power voltage ratings in areas where grid specifications might fluctuate.
*Specifications subject to change without notice

Available From:

OutBack POWER
member of The Alpha Group

Main Office:
5917 195th St. NE, #7
Arlington, WA 98223 USA
Phone: (360) 435.6030
Fax: (360) 435.6019

European Office:
BARCELONA, España
Phone: +34.93.654.9568

www.outbackpower.com

980-0012-01-00 REV D

FLEXmax™

FLEXmax 80

FLEXmax 60

The FLEXmax family of charge controllers is the latest innovation in Maximum Power Point Tracking (MPPT) charge controllers from OutBack Power Technologies. The innovative FLEXmax MPPT software algorithm is both continuous and active, increasing your photovoltaic array power yield up to 30% compared to non-MPPT controllers. Thanks to active cooling and intelligent thermal management cooling, both FLEXmax charge controllers can operate at their full maximum current rating, 60 amps or 80 amps respectively, in ambient temperatures as high as 104°F (40°C).

Included in all of the FLEXmax Charge Controllers are the revolutionary features first developed by OutBack Power, including support for a wide range of nominal battery voltages and the ability to step-down a higher voltage solar array to recharge a lower voltage battery bank. A built-in, backlit 80-character display shows the current status and logged system performance data for the last 128 days at the touch of a button. The integrated OutBack network communications allows FLEXmax Series Charge Controllers to be remotely programmed and monitored via a MATE system display and provides unrivaled complete system integration.

FLEXmax MPPT Charge Controllers are the only choice when you demand a high-performance, efficient and versatile charge controller for your advanced power system.

FLEXmax™ Specifications

Nominal Battery Voltages			12, 24, 36, 48, or 60 VDC (Single model - selectable via field programming at start-up)		
Maximum Output Current			60 amps @ 104° F (40°C) with adjustable current limit / 80 amps @ 104° F (40°C) with adjustable current limit		
Maximum Solar Array STC Nameplate		FLEXmax 60	12 VDC systems 900 Watts / 24 VDC systems 1800 Watts / 48 VDC systems 3600 Watts / 60 VDC systems 4500 Watts		
		FLEXmax 80	12 VDC systems 1250 Watts / 24 VDC systems 2500 Watts / 48 VDC systems 5000 Watts / 60 VDC systems 6250 Watts		
NEC Recommended Solar Array STC Nameplate		FLEXmax 60	12 VDC systems 750 Watts / 24 VDC systems 1500 Watts / 48 VDC systems 3000 Watts / 60 VDC systems 3750 Watts		
		FLEXmax 80	12 VDC systems 1000 Watts / 24 VDC systems 2000 Watts / 48 VDC systems 4000 Watts / 60 VDC systems 5000 Watts		
PV Open Circuit Voltage (VOC)			150 VDC absolute maximum coldest conditions / 145 VDC start-up and operating maximum		
Standby Power Consumption			Less than 1 Watt typical		
Power Conversion Efficiency - Typical		FLEXmax 60	98.1% @ 60 amps in a 48 VDC System		
		FLEXmax 80	97.5% @ 80 amps in a 48 VDC System		
Charging Regulation			Four Stages: Bulk, Absorption, Float, and Equalization		
Voltage Regulation Set points			10 to 80 VDC user adjustable with password protection		
Equalization Charging			Programmable Voltage Setpoint and Duration - Automatic Termination when completed		
Battery Temperature Compensation			Automatic with optional RTS installed / 5.0 mV per °C per 2V battery cell		
Voltage Step-Down Capability			Can charge a lower voltage battery from a higher voltage PV array - Max 150 VDC input		
Programmable Auxiliary Control Output			12 VDC output signal which can be programmed for different control applications (Maximum of 0.2 amps DC)		
Status Display			3.1" (8 cm) backlit LCD screen - 4 lines with 80 alphanumeric characters total		
Remote Display and Controller			Optional Mate or Mate2 with RS232 Serial Communications Port		
Network Cabling			Proprietary network system using RJ 45 Modular Connectors with CAT 5e Cable (8 wires)		
Data Logging			Last 128 days of Operation - Amp Hours, Watt Hours, Time in Float , Peak Watts, Amps, Solar Array Voltage, Max Battery Voltage Min Battery Voltage and Absorb for each day along with total Accumulated Amp Hours, and kW Hours of production		
Positive Ground Applications			Requires two Pole Breakers for switching both positive and Negative Conductors on both Solar Array and Battery Connections (HUB-4 and HUB-10 can not be used in positive ground applications)		
Operating Temperature Range			Minimum -40° to maximum 60° C (Power capacity of the controller is automatically derated when operated above 40° C)		
Environmental Rating			Indoor Type 1 (IP 30)		
Conduit Knockouts			One 1" (35mm)on the back; One1" (35mm) on the left side; Two 1" (35mm) on the bottom		
Warranty			Standard 5 year		
Weight	Unit	FLEXmax 80	12.20 lbs (5.56 kg)	FLEXmax 60	11.65 lbs (5.3 kg)
	Shipping		15.5 lbs (7.03 kg)		14.9 lbs (6.7 kg)
Dimensions	Unit (H x W x D)	FLEXmax 80	16.25" x 5.75" x 4.5" (41.3 x 14 x 10 cm)	FLEXmax 60	13.75 x 5.75 x 4.5" (40 x 14 x 10 cm)
	Shipping		21" x 10.5" x 10.5" (53 x 27 x 27 cm)		18 x 11 x 8" (46 x 30 x 20 cm)
Options			Remote Temperature Sensor (RTS), HUB 4, HUB 10, MATE, MATE 2		
Menu Languages			English & Spanish		

System Display and Controller

MATE & MATE2

The MATE system display and controllers are complete management tools for your OutBack Power system. Through the use of a single MATE you can remotely manage and monitor multiple inverter/chargers, charge controllers and monitoring devices.

MATE

The MATE and MATE2 are packed full of features to make system management simple. The easy-to-read 3.1" (8 cm) LCD is backlit for dark operating conditions. Four soft keys allow easy context-based navigation of menus and functions. Two hot keys give immediate access to AC and inverter functions.

MATE2

A built-in clock and calendar function enables timer-based programming of inverter and charger operation. This permits you to set the system to work with time-of-day power rates or to limit a generator's run time to a specific time period of the day or week. All of your settings are stored in permanent memory to eliminate the need to reprogram in the event of a system shutdown or battery replacement. The MATE and MATE2 include a RS232 port with DB9 jack for connection to the serial port of a PC computer. The MATE system display and controller is surface-mounted while the MATE2 is flush-mountable in a wall cut-out.

MATE Specifications

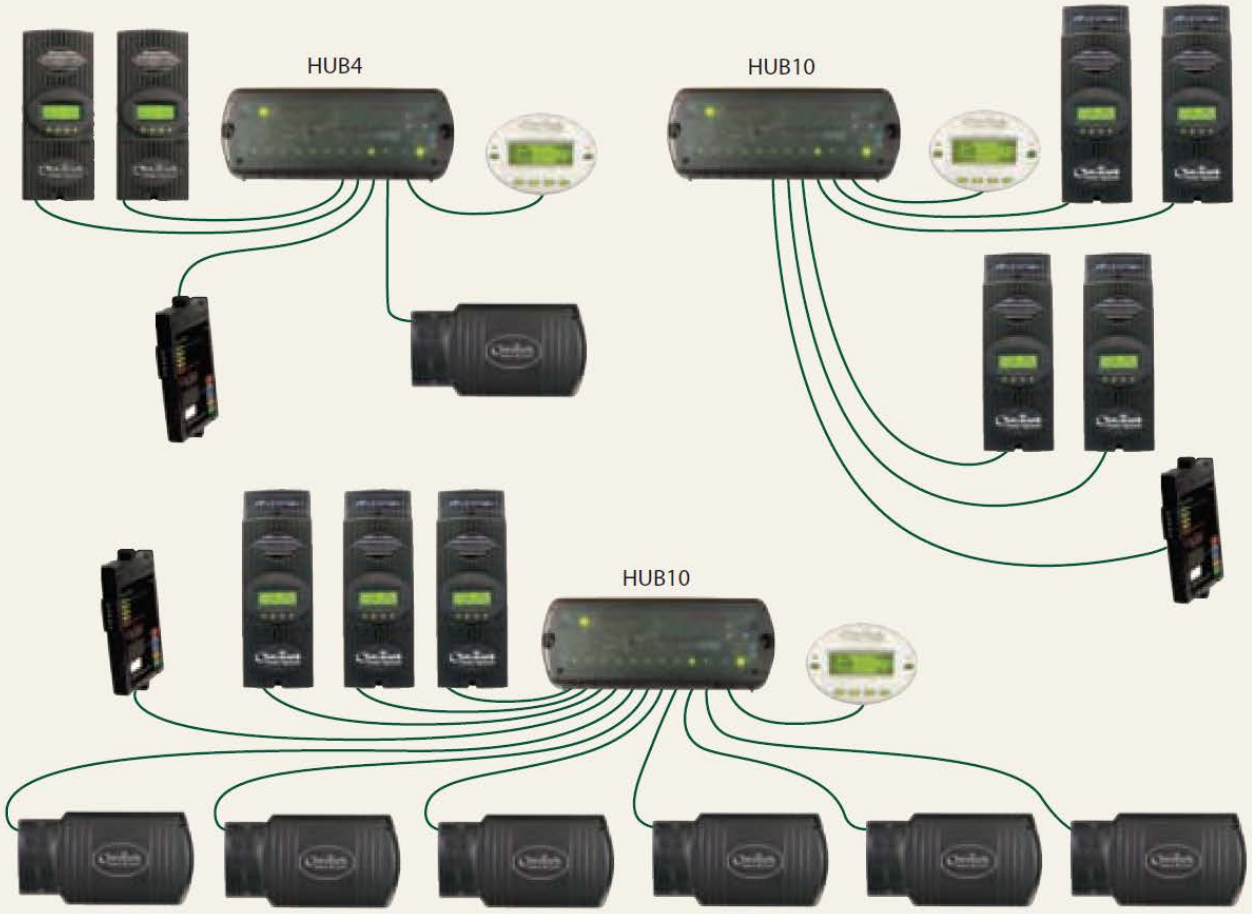
MATE	Grey	Surface-mount
MATE_B	Black	Surface-mount
MATE2	Black	Flush mount
Interface Display		3.1" (8 cm) backlit LCD - four line, 80 alpha numeric characters
Control Keypad		6 backlit silicone keys - dedicated inverter and AC input keys
Status Indicators		Two LED Status Indicators - AC input (yellow), inverting (green)
Communication Protocol		Proprietary OutBack Multi-drop using an OutBack HUB4 or HUB10
Interconnection Cabling		Standard CAT 5 network cable with RJ45 modular jack - 10' (5 m) included
PC Computer Interface		RS232 opto-isolated DB9 jack 9600 baud serial communication
Microprocessor		16 MHz low power consumption version
Set point and Data Memory		32K non-volatile flash RAM
Clock / Calendar		On-board real time clock with battery backup
Environmental Rating		Indoor Type 1 (IP 30)
Maximum Cable Length		1000' (300 m)
Warranty		Standard 2 year / Optional 5 year
Weight	Shipping	1 lb (.5 kg)
Dimensions (H x W x L)	Shipping	5.75 x 4.25 x 2" (15 x 11 x 5 cm)

Communications Manager

HUB

The HUB system communications managers are the backbone of your networked OutBack power conversion system. The OutBack HUB communicates stacking, load share and power save off/on signals. Interconnection cabling is standard Ethernet CAT5 with RJ45 modular jacks. Through the use of a HUB, your system is completely coordinated and managed by the MATE.

HUB Specifications		HUB4	HUB10
Number of Ports		4 Plus MATE	10 Plus MATE
Weight	Unit	1 lb (.5 kg)	1 lb (.5 kg)
	Shipping	3 lbs (1.4 kg)	3 lbs (1.4 kg)
Dimensions (H x W x L)	Unit	10.5 x 6.25 x 1.27" (27 x 16 x 3 cm)	10.5 x 6.25 x 1.27" (27 x 16 x 3 cm)
	Shipping	12 x 6 x 5" (31 x 15 x 13 cm)	12 x 6 x 5" (31 x 15 x 13 cm)



FLEXware™ PV

Advanced Photovoltaic Combiner

- Combine Multiple Strings from a Single Array
- Outdoor Rain-Resistant Aluminum Enclosure
- Optimized Wire Routing For Easy Installation
- Tinted Flame-Retardant Polycarbonate Deadfront Panel
- Generous Wiring Conduit Knockouts
- Wall, Roof or Pole Mountable
- Accommodates dual 2/0 AWG output wiring
- Accommodates 150VDC DC Breakers or 600 VDC Fuses

FLEXware PV 12

FLEXware PV 8

The OutBack Power Systems FLEXware PV Series Combiner Box sets the new standard for PV balance-of-system hardware. Ideal for both small or large systems, the FLEXware PV8 and FLEXware PV12 accommodates the overcurrent protection requirements of your application. From 150VDC breakers for low voltage PV systems, to 600VDC fuse holders for high voltage PV systems, the FLEXware PV Combiner series handles it all.

Designed to survive in outdoor environments, the rainproof, UL type 3R powder coated aluminum chassis can be mounted on a wall, sloped roof or pole. The unique angled negative terminal bus bar design makes wiring fast and easy without the common problem of larger output conductors blocking access to the smaller input terminals. Dual output lug terminals are included for up to 2/0 AWG conductors. The tinted flame-retardant polycarbonate deadfront panel creates a clean appearance while preventing accidental contact with the live terminals and is easily removable during installation.

The FLEXware PV Series Combiner Box makes it easy to take your installation to the next level.

OutBack POWER™

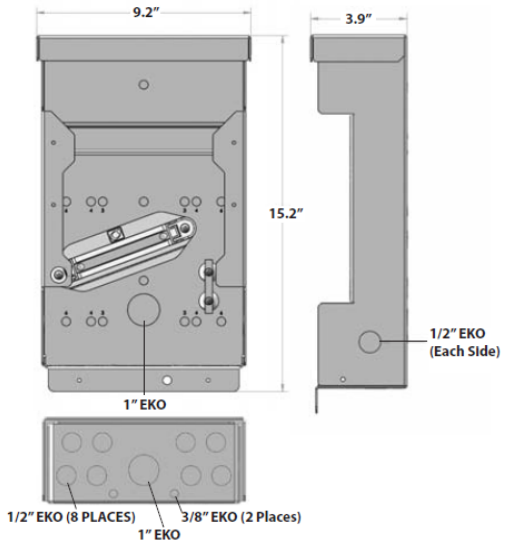
www.outbackpower.com

FLEXware™ PV Specifications

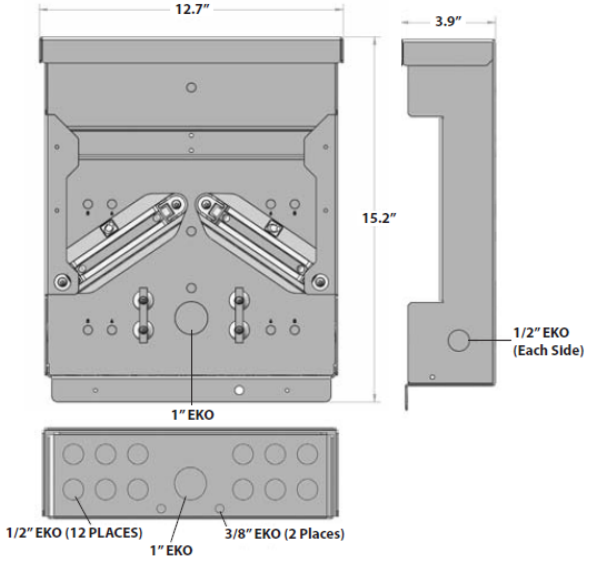
		FWPV-8	FWPV-12
Enclosure Material		Powder coated aluminum with stainless steel hardware	Powder coated aluminum with stainless steel hardware
Mounting Options		Vertical wall mount, pole mount or sloped roof mount to 14 degrees incline (3 in 12 roof pitch)	Vertical wall mount, pole mount or sloped roof mount to 14 degrees incline (3 in 12 roof pitch)
Enclosure Rating		Outdoor Rainproof, UL Type 3R	Outdoor Rainproof, UL Type 3R
Enclosure Security		Padlock hole in chassis and cover for up to 3/8 inch pad lock	Padlock hole in chassis and cover for up to 3/8 inch pad lock
Output Terminals		#14 - 2/0 AWG (2.08 - 67.43 mm^2) Two box lug terminals included	#14 - 2/0 AWG (2.08 - 67.43 mm^2) Four box lug terminals included
Number of separate circuits		One Circuit	One or Two Circuits
Number of 150VDC breakers		up to 8	up to 12 (two groups of six)
Number of 600VDC fuse holders		up to 6	up to 8 (two groups of four)
Input Terminal		150VDC Breakers / #14 - 6 AWG (2.08 - 13.3 mm^2) 600VDC Fuse / #14 - 10 AWG (2.08 - 5.26 mm^2)	150VDC Breakers / #14 - 6 AWG (2.08 - 13.3 mm^2) 600VDC Fuse / #14 - 10 AWG (2.08 - 5.26 mm^2)
Dimensions	Unit (H x W x D)	15.2 x 9.2 x 3.9" (38.7 x 23.3 x 9.9 cm)	15.2 x 12.7 x 3.9" (38.7 x 32.2 x 9.9 cm)
	Shipping (H x W x L)	4.3 x 9.5 x 19" (10.9 x 24.1 x 48.3 cm)	4.3 x 13 x 19" (10.9 x 33 x 48.3 cm)
Weight	Unit	4.4 lbs (2.0 kg)	5.9 lbs (2.7 kg)
	Shipping	5.5 lbs (2.5 kg)	7.4 lbs (3.3 kg)
Certifications		ETL Listed to UL1741, UL67, CSA22.2 #29	ETL Listed to UL1741, UL67, CSA22.2 #29

*Specifications subject to change without notice

FLEXware™ PV8



FLEXware™ PV12



Available From:

Main Office:
19009 62nd Avenue NE
Arlington, WA 98223 USA
Phone: (360) 435.6030
Fax: (360) 435.6019

European Office:
BARCELONA, España
Phone: +34.93.654.9568

www.outbackpower.com

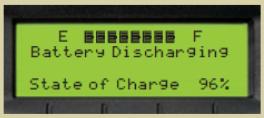
FLEXnet™ DC

Advanced DC System Monitor

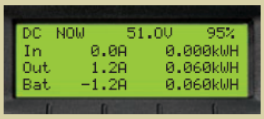
- **Easily Watch What Your DC System Is Doing**
- **Extends Your System's Battery Life**
- **Reduces Generator Run-Time/Fuel-Consumption**
- **Provides Battery State-of-Charge Level**
- **Monitors Energy Production and Consumption**
- **Improves System Performance and Efficiency**
- **Simple Installation and Setup**
- **Provides 128 Days of System Data Logging**

FLEXnet™ DC
(MATE required, not included)

The OutBack Power Systems FLEXnet™ DC is the ultimate in DC System monitoring devices. Our integrated networked communications make valuable, usable data available from your system, viewable on an OutBack MATE communications device (screens seen below), providing you with the answers you need concerning your system's health, performance and efficiency.



Battery Status Screen - Easily see your system's current condition with this at-a-glance display. This screen shows an easy to interpret "fuel gauge" style status bar, current state-of-charge and whether you are currently charging or discharging your batteries. This is useful for those system owners who want a way to quickly understand the current state of their battery bank.



Now Summary Screen - Monitor the amount of power your system is currently producing and consuming as well as the amount of power going IN and OUT of your battery bank. This screen also displays your battery bank's voltage and current state-of-charge, providing you with real-time production monitoring of DC sources, such as a solar array or small wind turbine, as well as consumption by loads.

Today Summary Screen - Monitor the cumulative energy your system has produced and consumed as well as the total amount of energy that has gone to charging your batteries today. This screen also displays today's lowest state-of-charge and allows you to see how your overall system production compares to system consumption.

History Summary Screen - Review historical energy production/consumption data for the most recent 128 days, including the minimum battery state-of-charge reached for each day. This screen can be used to watch power system production and consumption trends.

OutBack POWER
www.outbackpower.com

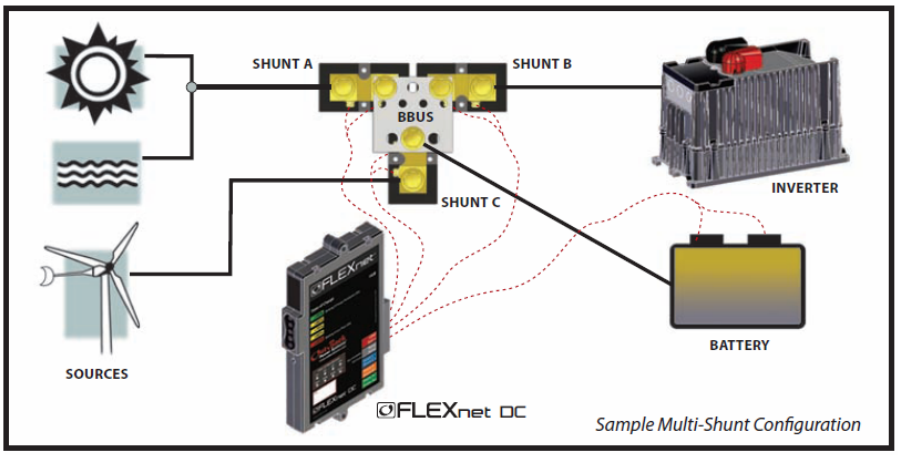
FN-DC Specifications

Battery Voltage Input Range			8.0 to 80.0 Volts DC
Battery Voltage Resolution			0.1 Volts DC
Number of Current Channels			One to Three (each can be a Source or Load)
Current Range (Each Channel)			-1000.0 Amps to +1000.0 Amps DC
Current Resolution			0.1 Amps DC
State of Charge Display			0 to 100% (1% increments)
Aux Relay Configuration			SPST, Magnetic Latching Relay
Aux Relay Max Rating			5 Amps @ 30 Volts DC
Current Shunt Type (order separately)			500 Amp / 50mv
Display		Primary	MATE or MATE2 4 x 20 LCD
		Secondary	Five LED Indicators on front of FLEXnet DC
Battery AH Capacity Range			100 to 10,000 Amp Hours
Data Logging Memory			Most recent 128 Days
Programmable AUX Relay Settings		Battery Volts	Adjustable from 8.0 to 80.0 VDC
		State of Charge	Adjustable from 0 to 100%
		Time Delay	Adjustable from 0 to 240 Minutes
Accuracy		0.5% of Reading +/- 2 LSDs per channel	
Operating Temperature Range		0 - 50°C (32 - 122°F)	
Mounting		3/4" Panel Mount Breaker Slot or Surface Mount using Built-in Mounting Bars	
Warranty		Standard 2 year	
Weight	Unit	5 oz. (.14kg)	
	Shipping	2 lbs. (.91 kg)	
Dimensions (H x W x L)	Unit	0.7 x 3.7 x 6.6" (1.9 x 16.8 cm)	
	Shipping	2.1 x 9.0 x 11.5" (5.4 x 22.9 x 29.2 cm)	

*Specifications subject to change without notice

Additional Available Data

- Total Battery Amps
- Averaged Battery Amps
- Averaged Battery Volts
- DC Amp-Hours IN Per Shunt
- DC Amp-Hours OUT Per Shunt
- DC kWh IN Per Shunt
- DC kWh OUT Per Shunt
- Last Cycle Amp Hours
- Last Cycle Watt Hours
- Last Cycle Amp Hour Charge Factor
- Last Cycle Watt Hour Charge Efficiency
- Total Number of Days Full
- Cumulative Battery Amp Hours Removed



Sample Multi-Shunt Configuration

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Phone: (360) 435.6030
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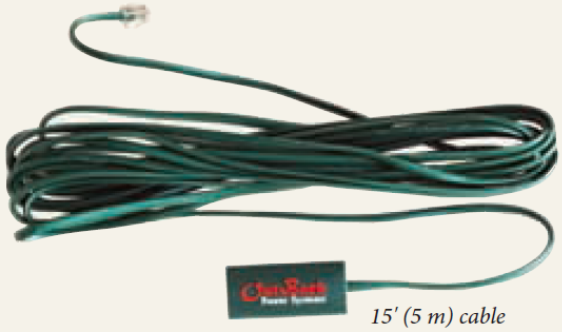
Available From:

Remote Temperature Sensor

RTS

The OutBack Remote Temperature Sensor (RTS) is a necessary tool for proper battery charging. All OutBack products with integrated battery charging have a temperature compensation system built in which benefits from the installation of the RTS (included with inverter/chargers). The RTS ensures that your OutBack system knows the precise battery temperature so that it can recharge your batteries safely and efficiently. Systems with multiple OutBack products connected to one HUB4 or HUB10 require only a single RTS to be installed.



15' (5 m) cable

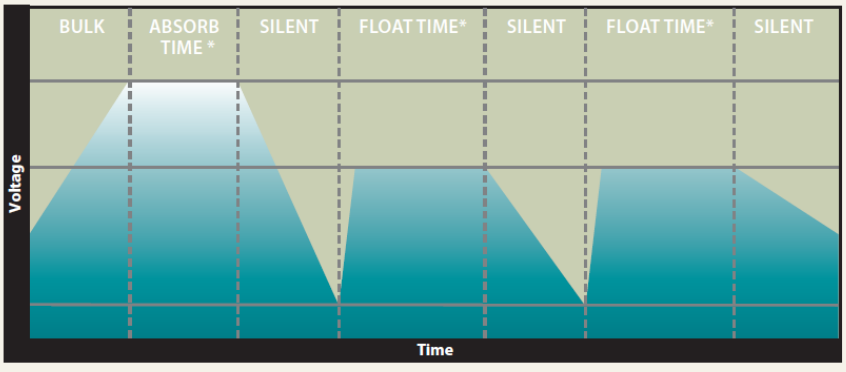
Multi-Stage Battery Charging

Batteries are a key component in backup and off-grid systems, often serving as the only energy storage device. To guarantee that they function properly it is important that your batteries are maintained. A chief part of this maintenance is proper charging. Your batteries should always be maintained above a 50% level of charge and receive a regular recharges once a month to ensure operation at peak performance. Prolonged use of the battery below a 50% state of charge will adversely affect the long-term health of the battery and can result in premature failure.

The multistage charging process (5 stages) uses several regulation stages to allow fast recharging of the battery energy storage system while ensuring a long battery life, high performance and efficient operation of the overall system. The charging process begins with the **BULK** stage, where maximum current is sent to the batteries until the target "absorb" voltage is reached and the absorb stage of the charge begins. During **ABSORB**, the charger provides the batteries with the just enough current to hold at the set voltage for a preset amount of time. Following this cycle, the charging system changes between available OutBack charging products. Using a FLEXmax Series Charge Controller, the batteries enter the **FLOAT** stage where they are given a maintenance charge until there is no excess renewable energy. The FX or VFX inverter/charger will go into **SILENT** mode where the charger turns off until the battery voltage drops to the "re-float" setting. At this point the inverter/charger initiates the maintenance float charge. This method reduces fuel and utility consumption.

It should be noted that the temperature of your batteries has an impact on the charging process. The OutBack RTS should be used to monitor this. In higher ambient temperatures, the battery charging regulation settings will be automatically reduced to prevent overcharging of the batteries. Conversely, in lower ambient temperature conditions, the regulation settings will be increased to ensure complete recharging of the batteries.

Batteries are composed of a group of individual cells. Through normal use, the charge of each individual cell will not be equal to the other cells. To address this, your batteries should be **EQUALIZED** either once each month or once every few months depending on usage. During the equalization charge the electrolyte in the battery is stirred up by gas bubbles, which help to create an equal mixture of water and acid. Simultaneously the full cells are overcharged which allows the low cells to "catch up" and all of the active material in the battery to be reconverted to its charged state. Depending on usage, the hardened battery plate material that is no longer active in the battery-sulfation can also be reduced by an equalization charge.



** MATE Adjustable*

SUN-XTENDER BATTERY OVERVIEW

Sun-Xtender PVX-3050T

Non-spillable construction prohibits any electrolyte leaking or spewing, allowing the battery to be used upright or on its end or side. The maintenance free AGM design means no water replenishment - ever.

Utilizing pure lead calcium grids, the Sun Xtender battery plates are thicker than the industry standard for longer cycle life, increased reliability and power. The low impedance AGM design allows for excellent charge acceptance and there is no current limit required with controlled voltage charging.

The Sun Xtender Battery product line features proprietary PolyGuard™ Microporous Polyethylene Separators, shielding the positive plates against shorting, shock or vibration. No other manufacturers offer this dual layer insulation protection feature.

Sun Xtender Battery covers and containers are uniquely molded with high impact, reinforced copolymer polypropylene and are designed with thick end walls to prevent bulging. The copper alloy T Terminals are corrosion resistant and are supplied with silicon bronze bolts and washers.

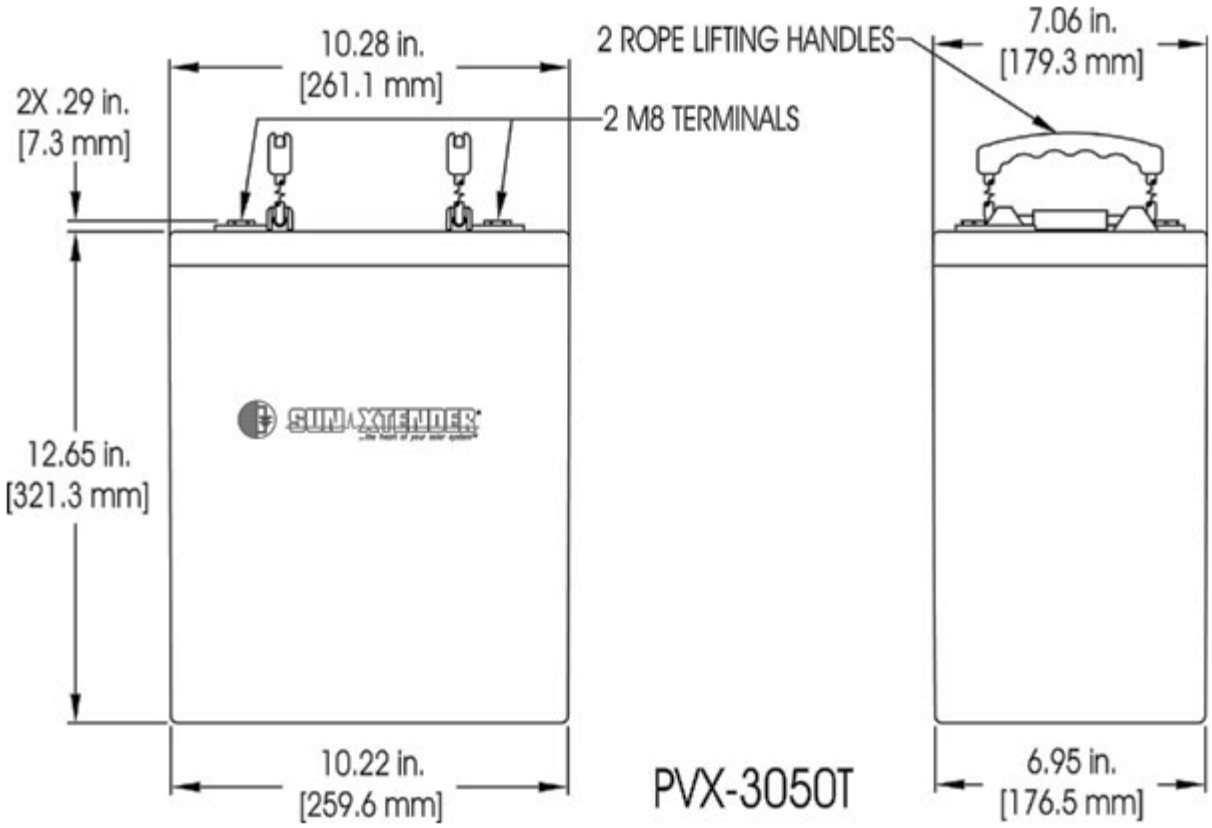
SUN-XTENDER BATTERY SPECIFICATIONS

PVX-3050T

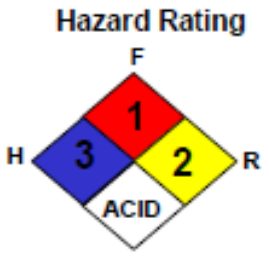
Voltage	6v
Battery Series	6 Volt Sun Xtender Series
Nominal Capacity Ampere Hours @ 25° C (77° F) to 1.75 Volts per cell - 24 Hour Rate	305 Ah
Weight	91 lb / 41.3 kg

Sun Xtender® Solar Battery Part Number	Length		Width		Height	
	in	mm	in	mm	in	mm
PVX-3050T	10.28	261	7.06	179	12.94	328.6

Nominal Capacity Ampere Hours @ 25° C (77° F) to 1.75 volts per cell							
1 Hr Rate	2 Hr Rate	4 Hr Rate	8 Hr Rate	24 Hr Rate	48 Hr Rate	72 Hr Rate	120 Hr Rate
190 Ah	245 Ah	270 Ah	280 Ah	305 Ah	335 Ah	348 Ah	358 Ah



CONCORDE BATTERY
VALVE REGULATED
LEAD ACID BATTERY
MATERIAL SAFETY DATA SHEET



SECTION 1 – CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

MANUFACTURER'S NAME:	CONCORDE BATTERY CORPORATION	EMERGENCY TELEPHONE NO.:	CHEMTEL 800-255-3924
ADDRESS:	2009 San Bernardino Rd., West Covina, CA 91790	OTHER INFORMATION CALLS:	626-813-1234
PERSON RESPONSIBLE FOR PREPARATION:	Gonzalo Ramos, Safety, Health & Environmental Affairs Manager	Revised Date:	OCTOBER 6, 2008

SECTION 2 - COMPOSITION/INFORMATION ON INGREDIENTS

C.A.S.	PRINCIPAL HAZARDOUS COMPONENT(S) (chemical & common name(s))	Hazard Category	% Weight	ACGIH TLV	OSHA PEL/TWA
7439-92-1	Lead/Lead Oxide (Litharge)/Lead Sulfate	Acute-Chronic	60-70	0.05 mg/m^3	0.05 mg/m^3
7440-70-2	Calcium	Reactive	<0.15	Not Established	Not Established
7440-31-5	Tin	Chronic	<1	2	2
7440-38-2	Arsenic (Inorganic)	Acute-Chronic	<1	0.01	0.01
7664-93-9	Sulfuric Acid (Battery Electrolyte)	Reactive-Oxidizer Acute -Chronic	10-15	1.0	1.0

Note: PEL's for individual states may differ from OSHA's PEL's. Check with local authorities for the applicable state PEL's.
OSHA – Occupational Safety and Health Administration; ACGIH – American Conference of Governmental Industrial Hygienists; NIOSH – National Institute for Occupational Safety and Health.

COMMON NAME: (Used on label) Valve Regulated Lead-acid battery
(Trade Name & Synonyms) VRB, VRLA, SLAB, Recombinant Lead Acid: RG, GPL, AGM, PVX or FD Series, D8565 Series
Chemical Family: Toxic and Corrosive Material Mixture
Chemical Name: Battery, Storage, Lead Acid, Valve Regulated Formula: Lead /Acid

SECTION 3 -- HAZARD IDENTIFICATION

Signs and Symptoms of Exposure	1. Acute Hazards	Do not open battery. Avoid contact with internal components. Internal components include lead and liquid electrolyte. Electrolyte - Electrolyte is corrosive and contact may cause skin irritation and chemical burns. Electrolyte causes severe irritation and burns of eyes, nose and throat. Ingestion can cause severe burns and vomiting. Lead - Direct skin or eye contact may cause local irritation. Inhalation or ingestion of lead dust or fumes may result in headache, nausea, vomiting, abdominal spasms, fatigue, sleep disturbances, weight loss, anemia and leg, arm and joint pain.
	2. Subchronic and Chronic Health Effects	Electrolyte - Repeated contact with sulfuric acid and battery electrolyte fluid may cause drying of the skin that may result in irritations, dermatitis, and skin burns. Repeated exposure to sulfuric acid mist may cause erosion of teeth, chronic eye irritation and / or chronic inflammation of the nose, throat, and lungs. Lead - Prolonged exposure may cause central nervous system damage, gastrointestinal disturbances, anemia, irritability, metallic taste, insomnia, wrist-drop, kidney dysfunction and reproductive system disturbances. Pregnant women should be protected from excessive exposure to prevent lead from crossing the placental barrier and causing infant neurological disorders. California Proposition 65 Warning: Battery posts, terminals, and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm, and during charging, strong
Medical Conditions Generally Aggravated by Exposure	Contact with internal components if battery is broken or opened, then persons with the following medical conditions must take precautions: pulmonary edema, bronchitis, emphysema, dental erosion and tracheobronchitis.	
Routes of Entry	Inhalation - YES Ingestion – YES	Eye Contact- YES

Chemical(s) Listed as Carcinogen or potential Carcinogen	Proposition 65 - YES	National Toxicology Program - YES	I.A.R.C. Monographs - YES	OSHA - NO

SECTION 4 - FIRST AID MEASURES

Emergency and First Aid Procedures	Contact with internal components if battery is opened/broken.
1. Inhalation	Remove to fresh air and provide medical oxygen/CPR if needed. Obtain medical attention.
2. Eyes	Immediately flush with water for at least 15 minutes, hold eyelids open. Obtain medical attention.
3. Skin	Flush contacted area with large amounts of water for at least 15 minutes. Remove contaminated clothing and obtain medical attention if necessary.
4. Ingestion	Do not induce vomiting. If conscious drink large amounts of water/milk. Obtain medical attention. Never give anything by mouth to an unconscious person.

SECTION 5 - FIREFIGHTING MEASURES

Flash Point – Not Applicable	Flammable Limits in Air % by Volume: Not Applicable	Extinguishing Media – Class ABC, CO_2, Halon	Auto-Ignition Temperature 675°F (polypropylene)
Special Fire Fighting Procedures	Lead/acid batteries do not burn, or burn with difficulty. Do not use water on fires where molten metal is present. Extinguish fire with agent suitable for surrounding combustible materials. Cool exterior of battery if exposed to fire to prevent rupture. The acid mist and vapors generated by heat or fire are corrosive. Use NIOSH approved self-contained breathing apparatus (SCBA) and full protective equipment operated in positive-pressure mode.		
Unusual Fire and Explosion Hazards	Sulfuric acid vapors are generated upon overcharge and polypropylene case failure. Use adequate ventilation. Avoid open flames/sparks/other sources of ignition near battery.		

SECTION 6 - ACCIDENTAL RELEASE MEASURES

Procedures for Cleanup. Avoid contact with any spilled material. Contain spill, isolate hazard area, and deny entry. Limit site access to emergency responders. Neutralize with sodium bicarbonate, soda ash, lime or other neutralizing agent. Place battery in suitable container for disposal. Dispose of contaminated material in accordance with applicable local, state and federal regulations. Sodium bicarbonate, soda ash, sand, lime or other neutralizing agent should be kept on-site for spill remediation.

Personal Precautions: Acid resistant aprons, boots and protective clothing. ANSI approved safety glasses with side shields/face shield recommended.

Environmental Precautions: Lead and its compounds and sulfuric acid can pose a severe threat to the environment. Contamination of water, soil and air should be prevented.

SECTION 7 - HANDLING AND STORAGE

Precautions to be Taken in Handling and Storage	Store away from reactive materials, open flames and sources of ignition as defined in Section 10 – Stability and Reactivity Data. Store batteries in cool, dry, well-ventilated areas. Batteries should be stored under roof for protection against adverse weather conditions. Avoid damage to containers.
Other Precautions	GOOD PERSONAL HYGIENE AND WORK PRACTICES ARE MANDATORY. Refrain from eating, drinking or smoking in work areas. Thoroughly wash hands, face, neck and arms, before eating, drinking and smoking. Work clothes and equipment should remain in designated lead contaminated areas, and never taken home or laundered with personal clothing. Wash soiled clothing, work clothes and equipment before reuse.

SECTION 8 - EXPOSURE CONTROLS AND PERSONAL PROTECTION

Respiratory Protection (Specify Type)	None required under normal conditions. Acid/gas NIOSH approved respirator is required when the PEL is exceeded or employee experiences respiratory irritation.				
Ventilation	Store and handle in dry ventilated area.	Local Exhaust	When PEL is exceeded.	Mechanical (General)	Not Applicable
Protective Gloves	Wear rubber or plastic acid resistant gloves.	Eye Protection	ANSI approved safety glasses with side shields/face shield recommended		
Other Protective Clothing or Equipment	Safety shower and eyewash.				

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

Boiling Point: Not Applicable	Vapor Pressure Not Applicable	Specific Gravity 1.250-1.320 pH <2	Melting Point: >320°F (polypropylene)
Percent Volatile By Volume Not Applicable	Vapor Density Hydrogen: 0.069 (Air =1) Electrolyte: 3.4 @ STP (Air = 1)		Evaporation Rate Not applicable
Solubility In water 100% soluble (electrolyte)		Reactivity in Water Electrolyte – Water Reactive (1)	
Appearance and Odor:	Battery: Co-polymer polypropylene, solid; may be contained within an outer casing of aluminum or steel. Case has metal terminals. Lead: Gray, metallic, solid; brown/grey oxide Electrolyte: Odorless, liquid absorbed in glass mat material. No apparent odor.		

SECTION 10 - STABILITY AND REACTIVITY

Stability: Stable	Conditions to Avoid: Avoid overcharging and smoking, or sparks near battery surface. High temperatures-cases decompose at >320°F.
Incompatibility (Materials to Avoid)	Sparks, open flames, keep battery away from strong oxidizers.
Hazardous Decomposition Products	Combustion can produce carbon dioxide and carbon monoxide.
Hazardous Polymerization	Hazardous Polymerization has not been reported.

SECTION 11 - TOXICOLOGICAL INFORMATION

GENERAL: The primary routes of exposure to lead are ingestion or inhalation of dust and fumes.

ACUTE:
INHALATION/INGESTION: Exposure to lead and its compounds may cause headache, nausea, vomiting, abdominal spasms, fatigue, sleep disturbances, weight loss, anemia, and pain in the legs, arms and joints. Kidney damage, as well as anemia, can occur from acute exposure.

CHRONIC:
INHALATION/INGESTION: Prolonged exposure to lead and its compounds may produce many of the symptoms of short-term exposure and may also cause central nervous system damage, gastrointestinal disturbances, anemia, and wrist drop. Symptoms of central nervous system damage include fatigue, headaches, tremors, hypertension, hallucination, convulsions and delirium. Kidney dysfunction and possible injury has also been associated with chronic lead poisoning. Chronic over-exposure to lead has been implicated as a causative agent for the impairment of male and female reproductive capacity, but there is at present, no substantiation of the implication. Pregnant women should be protected from excessive exposure. Lead can cross the placental barrier and unborn children may suffer neurological damage or developmental problems due to excessive lead exposure in pregnant women.

SECTION 12 - ECOLOGICAL INFORMATION

In most surface water and groundwater, lead forms compounds with anions such as hydroxides, carbonates, sulfates, and phosphates, and precipitates out of the water column. Lead may occur as sorbed ions or surface coatings on sediment mineral particles or may be carried in colloidal particles in surface water. Most lead is strongly retained in soil, resulting in little mobility. Lead may be immobilized by ion exchange with hydrous oxides or clays or by chelation with humic or fulvic acids in the soil. Lead (dissolved phase) is bioaccumulated by plants and animals, both aquatic and terrestrial.

SECTION 13 - DISPOSAL CONSIDERATIONS

Lead-acid batteries are completely recyclable. Return whole scrap batteries to distributor, manufacturer or lead smelter for recycling. For information on returning batteries to Concorde Battery for recycling call 626-813-1234. For neutralized spills, place residue in acid-resistant containers with sorbent material, sand or earth and dispose of in accordance with local, state and federal regulations for acid and lead compounds. Contact local and/or state environmental officials regarding disposal information.

SECTION 14 - TRANSPORT INFORMATION

All Concorde AGM, GPL, PVX, RG series and D8565 series are valve regulated lead acid (VRLA) batteries. Concorde's VRLA batteries have passed vibration, pressure differential and free flowing acid tests under CFR 49 173.159(d), meet IATA Special Provisions A48 & A67, and IMDG Special Provisions 238.1 & 238.2. The batteries are securely packaged, protected from short circuits and labeled "Non-Spillable." Concorde's VRLA batteries are exempt from DOT Hazardous Material Regulations, IATA Dangerous Goods Regulations, and IMDG Code.

US DOT
Excepted from the requirements because batteries have passed the vibration and pressure differential performance tests, and ruptured case test for Nonspillable designation.

IMO
Excepted from the requirements because batteries have passed the vibration and pressure differential performance tests, and ruptured case test for nonspillable designation. And, when packaged for transport, the terminals are protected from short circuit.

IATA
Excepted from the requirements because batteries have passed the vibration and pressure differential performance tests, and ruptured case test for nonspillable designation. And when packaged for transport, the terminals are protected from short circuit.

SECTION 15 - REGULATORY INFORMATION

U.S. HAZARDOUS UNDER HAZARD COMMUNICATION STANDARD:		LEAD - YES ARSENIC – YES SULFURIC ACID – YES
INGREDIENTS LISTED ON TSCA INVENTORY:	YES	
CERCLA SECTION 304 HAZARDOUS SUBSTANCES:	LEAD – YES ARSENIC – YES SULFURIC ACID – YES	RQ: N/A* RQ: 1 POUND RQ: 1000 POUNDS

* RQ: REPORTING NOT REQUIRED WHEN DIAMETER OF THE PIECES OF SOLID METAL RELEASED IS EQUAL TO OR EXCEEDS 100 µm (micrometers).

EPCRA SECTION 302 EXTREMELY HAZARDOUS SUBSTANCE:	SULFURIC ACID – YES
EPCRA SECTION 313 TOXIC RELEASE INVENTORY:	LEAD – CAS NO: 7439-92-1 ARSENIC – CAS NO: 7440-38-2 SULFURIC ACID – CAS NO: 7664-93-9

SECTION 16 - OTHER INFORMATION

THE INFORMATION ABOVE IS BELIEVED TO BE ACCURATE AND REPRESENTS THE BEST INFORMATION CURRENTLY AVAILABLE TO US. HOWEVER, CONCORDE BATTERY MAKES NO WARRANTY OF MERCHANTABILITY OR ANY OTHER WARRANTY, EXPRESSED OR IMPLIED, WITH RESPECT TO SUCH INFORMATION, AND WE ASSUME NO LIABILITY RESULTING FROM ITS USE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION FOR THEIR PARTICULAR PURPOSES. ALTHOUGH REASONABLE PRECAUTIONS HAVE BEEN TAKEN IN THE PREPARATION OF THE DATA CONTAINED HEREIN, IT IS OFFERED SOLELY FOR YOUR INFORMATION, CONSIDERATION AND INVESTIGATION. THIS MATERIAL SAFETY DATA SHEET PROVIDES GUIDELINES FOR THE SAFE HANDLING AND USE OF THIS PRODUCT; IT DOES NOT AND CANNOT ADVISE ON ALL POSSIBLE SITUATIONS, THEREFORE, YOUR SPECIFIC USE OF THIS PRODUCT SHOULD BE EVALUATED TO DETERMINE IF ADDITIONAL PRECAUTIONS ARE REQUIRED.

The data/information contained herein has been reviewed and approved for general release on the basis that this document contains no export-controlled information.

FORM MSDS REV. 10/06/2008

ADDITIONAL NOTES

ADDITIONAL NOTES

ADDITIONAL NOTES

SunSmart E-Shelter Operations Manual & PV System Overview

For Facilities Managers & School Personnel

WARNING

DANGER - HIGH VOLTAGE

DO NOT SERVICE WHEN WET

HAZARDOUS MATERIAL - ACID