



The OES₂[™] Manual

Optimized Energy Storage for Residential and Commercial Applications
Utilizing Lithium Ferro Phosphate Chemistry



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The OES₂[™] Technical Overview

OES₂[™] Storage Module Safety Protocol:

Important Note: Circuit Breakers, Disconnects and Fuses should be employed throughout several points of an installation to effectively isolate and protect all components of the power system to safeguard against faults, short circuits, polarity reversals or a failure of any component in the circuit. Fuse, breaker and wiring ratings and values can be determined by established standards and evaluated by electrical professionals, certified installers, and regional code authorities.

OES₂[™] Modules pose some risk of shock or sparking during the installation and initial wiring and connection process. This is consistent with all other battery based storage formats. Use of insulated gloves, clothing and footwear is recommended. Cover, Restrain or Remove jewelry or conductive objects (bracelets, rings, belt buckles, metal snaps, zippers, etc.) when working with any electrical or mechanical device. Cover or Restrain long hair and loose clothing when working with any electrical or mechanical device. Complete all initial connections in a ventilated area free of flammable fumes or gases.

OES₂[™] Modules do not vent any harmful gasses, and do not require special ventilation.

OES₂[™] Modules are not capable of thermal runaway under any circumstance. However, if the cells are severely damaged due to physical abuse, which causes electrolyte leakage, and as with any flammable battery, the electrolyte can be ignited by an open flame.

There are no hazardous or toxic materials in the electrolyte of the material components of OES₂[™] Modules. See MSDS for chemical analyses.

OES₂[™] Module Construction:

OES₂[™] Modules are made with Lithium Iron Phosphate cells, which are manufactured under exclusive patented, licensed technologies and are assembled utilizing proprietary methods in the USA by an American owned and managed company. This assures the highest grade and quality, longest cycle life and freedom from material impurities.

Each OES₂[™] Module contains multiple cell packs assembled in series in a proprietary arrangement to produce voltages in 3.2-volt increments of 12.8, 25.6 and 51.2 volts depending on the application. Higher voltage systems are under design and can be specified by OES. Please contact us with any questions.

Each OES₂[™] Module contains circuitry that protects the lithium ferro phosphate cells from overcharge, over-discharge and excessive load amperage. If the values specified are exceeded, the protective circuitry will shut down the flow of electricity to/from the OES₂[™] Modules. In some cases this will result in the need to re-initialize an inverter charger. Often, inverter system settings will be saved within the inverter memory storage and will not need to be reset. This is not an absolute standard but is common among most inverter chargers.

OES₂TM Module Performance and Sizing Calculations:

OES₂TM Modules perform at full rated capacity in most operating environments.

No increase in sizing, no special compensations, no burying procedures or insulation needs to be considered when determining the size of the energy storage and management system under the following circumstances and conditions:

- C/2 to C/200 or less of continuous current input or output
- -20 (-4°F) to 60 (140°F) degrees Celsius ambient temperatures
- Up to 90% depth of discharge (DOD)

See appendix of charts for operating performance under more extreme conditions

Core Storage Component: The OES₂TM Modules

	12V OES2	24V OES2	48V OES2
Amp Hours (C/2):	180	90	51.2
Nominal Voltage:	12.8	25.6	51.2
Max Charge Voltage:	16	32	64
Low Discharge Voltage:	10	20	40
Max Charge Amperage:	90A - Continuous	45A - Continuous	26A - Continuous
Max Discharge Amperage:	90A - Continuous	45A - Continuous	26A - Continuous
Capacity	2.3KWH	2.3KWH	2.6KWH

Recommended Continuous Operating Range:

Temperature Range: -20 (-4°F) to 60 (140°F) Celsius (-20 TO 70C Max)

Charge Rate: C/2*

Discharge Rate: C/2

Depth of Discharge: 90% **

Peak (1 Min) Discharge: 4C

*Note: There is less than 1% loss of energy during charging.

**OES₂TM Modules do not need to be de-rated unless running continuously at more than 90% capacity, at temperatures below 0 degrees Celsius, or above 50 degrees Celsius. Further details are available on request from OES.

Installation Procedure and Diagrams

System Sizing for Your Installation:

OES₂[™] Systems should be specified in terms of total storage capacity before the initial install. All OES₂[™] Systems are balanced during final production and testing stages. Following proper wiring guidelines ensures that a system will not require any manual balancing processes. All modules should be installed at one point in time. Adding capacity or modules to a system after the initial installation is specifically not recommended. Should such a need arise; please contact OES or your installer. Where modular expansion is planned or desired, OES or your installer can advise strategies that can optimize system life, uniformity of performance and overall system reliability.

*****DO NOT COMBINE OES₂[™] MODULES WITH OTHER BRANDS OR CHEMISTRIES*****
*****DO NOT MIX MODULES FROM DIFFERENT INSTALLATIONS, CLIENTS, OR JOB SITES*****

System Configuration - Basic Concepts:

Safe and reliable installation requires trained and certified technicians. The following discussion of module arrangement is a basic primer. Due to the variety of systems and components in the field, all scenarios are not covered. This is not the purpose of this section of the manual. Refer to professional installers regarding your system and its components and specifications. We encourage you or your installer to contact us with any specific questions. We are committed to working with you and your installation team to achieve a safe, reliable storage system that will provide years of maintenance free service.



Figure 1.0 - One OES₂[™] 48 Volt, 2500 watt-hour (2.5KW) Module

System Wiring Basics:

Refer to published wiring specifications and ratings. All wire should be an appropriate gauge and construction to handle the loads that will be placed upon it. Heavy gauge, high strand copper wire is the industry standard due to its stability, efficiency and overall quality. A qualified installer will understand this implicitly and will adhere to the industry standard and published guidelines.

In all instances:

- Maintain identical wire lengths from each OES₂[™] Module terminal to the common bus.
- Use identical wire construction from each OES₂[™] Module terminal to the common bus.

All OES₂[™] Modules are designed to serve at a fixed voltage range (12V, 24V or 48V) in parallel arrangements for maximum available amperage and storage capacity. **OES₂[™] Modules are not designed to be arranged in series for increased voltage.** Series arrangements can result in damage to the Modules protective circuitry and will result in a voided warranty. High voltage systems are under design and can be specified from OES. Please contact us with any questions.

Simple Parallel Arrangements:

Storage Capacity and total available **Amperage** is increased by **Parallel** arrangements. The following illustration shows two OES₂[™] Modules in **Parallel**. Let's assume that these are 24V modules. Note: the overall Voltage range is not changed. The arrangement remains at 24 Volts, the available AH capacity, or ability to provide 24 Volt power over time, has been doubled. The available amperage from the system has been doubled. The same configuration should be applied to parallel arrangements, be it 12V, 24V or 48V. See Figure 1.2 on the following page.

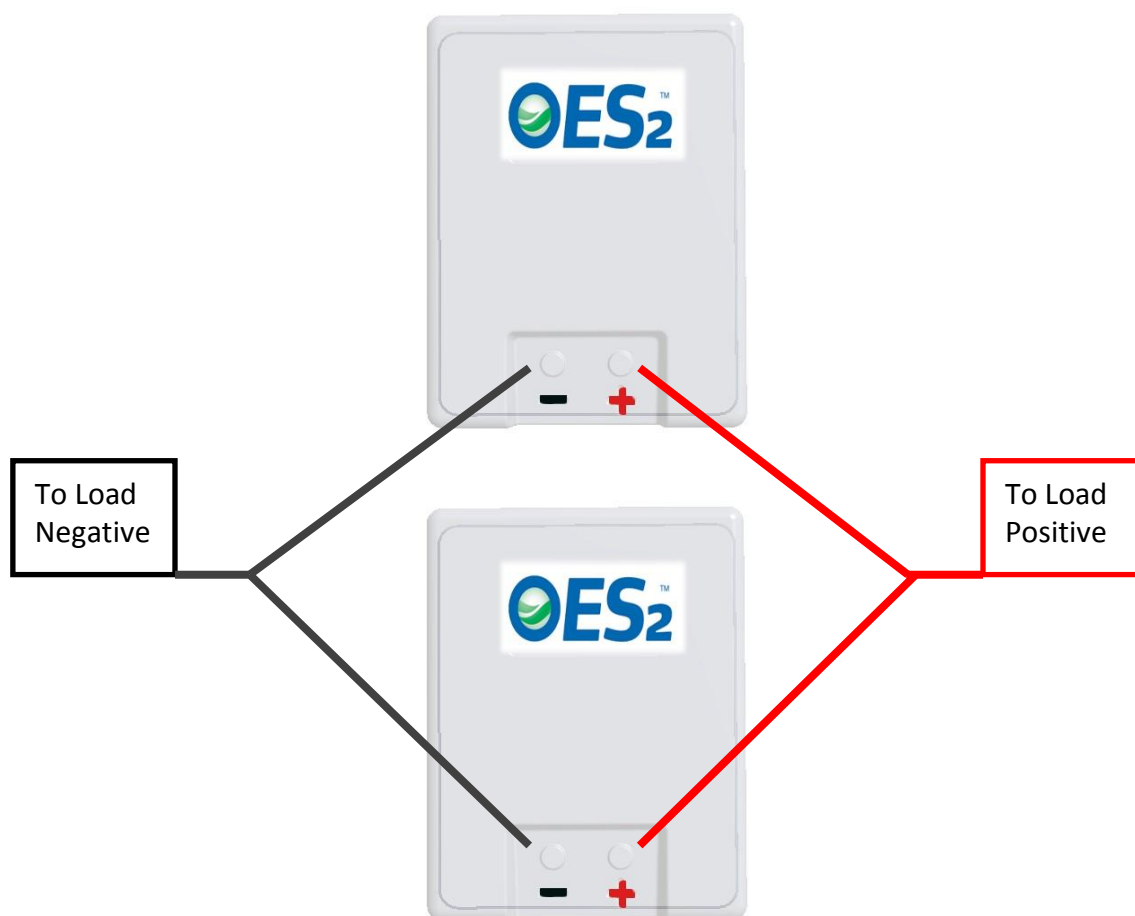


Figure 1.2

Figure 1.2 represents two OES₂™ Modules in Parallel for 24 Volts, 180AH. Wire lengths from Modules should be **close to identical** to balance the load across both Modules. "Close to Identical" wiring length is a key theme that will be repeated throughout all parallel wiring instructions.

Increasing Capacity with Parallel Module Configurations.

Special attention should be paid for parallel installations. Correct wiring is essential to insure optimum performance and system longevity. All wire "runs" should utilize identical wiring and **close to identical wire lengths** between OES₂™ Modules and the common negative or positive "Bus" or Load. For more information, please contact your installer.

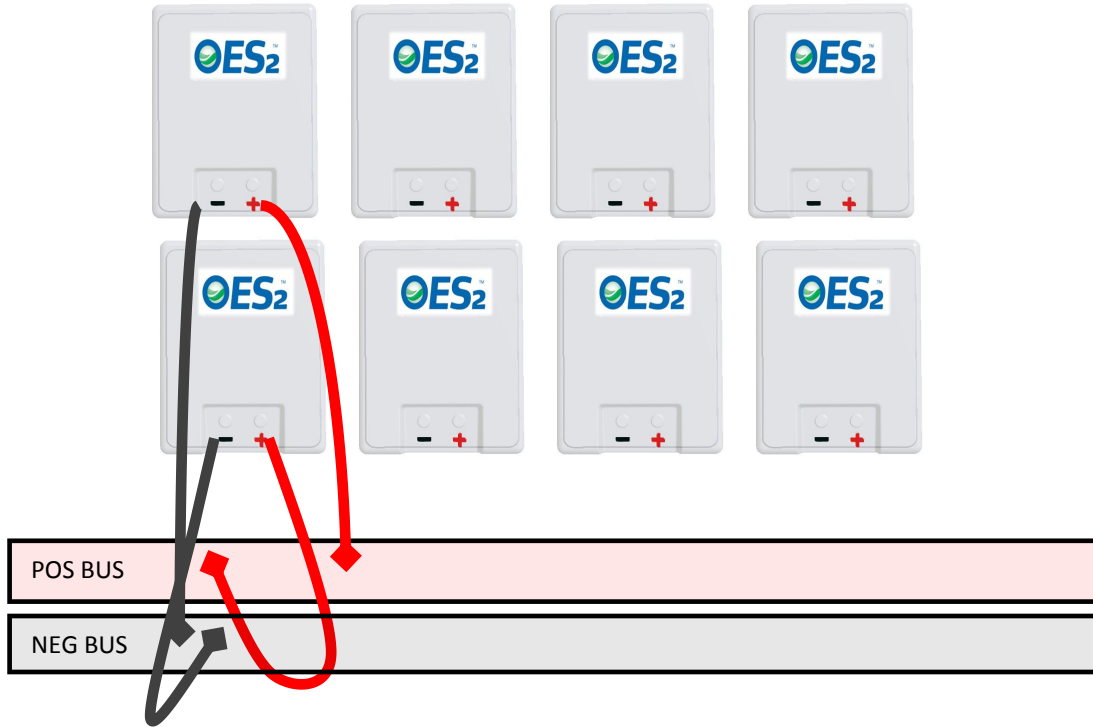


Figure 1.3

Figure 1.3 Two of eight OES₂[™] Modules have been wired in Parallel. The wiring arrangement will be repeated to connect all eight modules in parallel. The completion of this configuration will require **16 identical lengths of appropriately heavy gauge copper wire.**

Alternate wiring schemes are also effective. The "Cross Diagonal" method is perhaps less common but has been evaluated in outside facilities and found to be very effective. The Cross diagonal method can minimize copper wire runs to a degree and can also serve as a tool in complex wiring schemes where space is at a minimum or system layouts are complex or irregular. For more information on cross diagonal wiring methods, and the benefit of correct wiring configurations, please see:

http://www.smartgauge.co.uk/batt_con.html

Included Mounting Hardware

OES₂[™] Modules are equipped with metal mounting brackets that are designed be mounted upon 1 - 5/8" Strut Channel. The Strut Channel and related hardware is not provided with the OES₂[™] Modules. Please contact your installer for further information.

OES₂[™] 48V Module Weight

OES₂[™] Modules weigh approximately 64 pounds. The Strut Channel should be mounted into load bearing beams, studs or solid posts. Check with your installer to select an appropriate wall space or surface.

OES₂™ Module Dimensions

Width: 14"

Length: 15"

Depth: 12.5"

Mounting Bar Spacing: 10" from Bar Center to Bar Center (See image below for disambiguation)

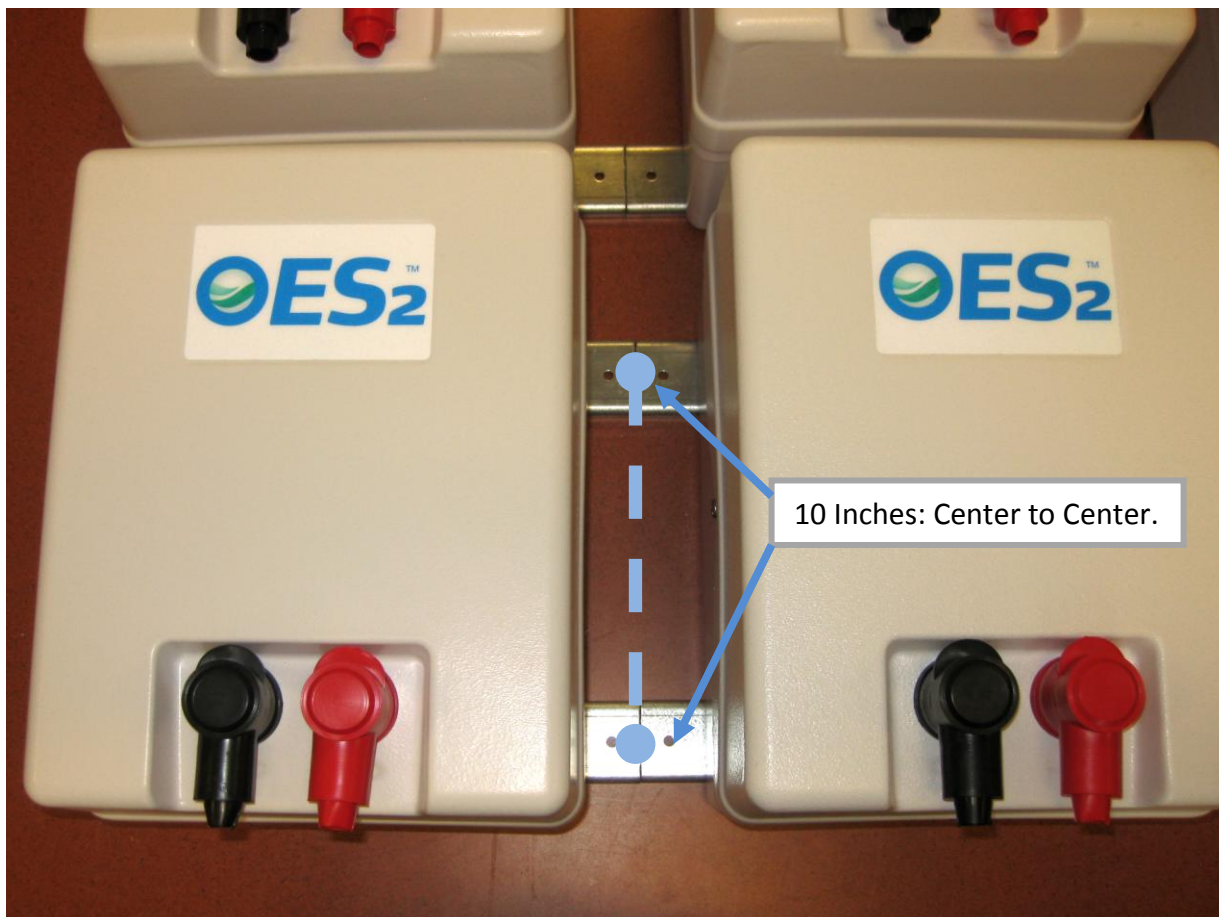


Figure 1.4



Figure 1.5 Four OES₂[™] 48V Modules Mounted on Strut Rails.

KEY POINTS!

- 1.** Each OES₂[™] Module houses circuitry that protects the Lithium Ferro Phosphate cells from overcharge, over-discharge and excessive charge and load amperage. If the values specified are exceeded, the Modules will enter a protective shut down state. In some cases this will result in the need to re-initialize an inverter charger or other pieces of equipment in the installation. Often, inverter system settings will be saved within the inverter memory storage and will not need to be reset. This is not an absolute standard but is common among most inverter chargers.
- 2.** If OES₂[™] Modules enter a self protect mode, negligible voltage readings will be present until the units reset. In some instances, after a prolonged shut down, a charge might need to be manually applied to the energy storage bank. Should this occur, please contact us at your earliest convenience. The systems are designed to remain robust and safe under even the worst circumstances. It is likely that the systems are in excellent shape.
- 3.** Grid Tied Systems: Once the OES₂[™] Modules have been installed, turn on the entire system to test, but once testing has been completed please disconnect the cables to the OES₂[™] Modules until your local Utility Inspector is ready to turn on the entire system. The charge controllers and inverter monitoring systems can drain the OES₂[™] Modules over an extended period of time when the entire system is not fully operational.
- 4.** Off Grid Systems: Do not leave the OES₂[™] Modules connected until the entire system is ready to turn on and fully operational.
- 5.** See Charge Controller Settings in the Appendix of this manual. OES₂[™] Modules are compatible with an almost all Inverter Chargers and Charge Controllers. Please contact us for recommended settings for any device not expressly covered in this manual.

Connecting OES₂[™] Modules: Terminal Specs and Hardware



● **CAUTION: DO NOT ATTEMPT TO LOOSEN THE LARGE BRASS NUT AT THE BASE OF THE TERMINALS.**

OES₂[™] Module Connection Terminals:

The OES₂[™] Modules are equipped with two 3/8" threaded studs with a lock washer and nut. The right hand stud resides in a red colored high temperature molded insert and is marked by a recessed Plus/+ sign. This connection is for the positive lead. The left hand stud resides in a black colored high temperature insert and is marked with a recessed Negative/- sign. This connection is for the negative lead.

Water Resistant Cable Boots are also included and will be in place when your units arrive. The boots are to be placed over the cable terminations and will stretch to form a water resistant seal around the base of the molded inserts. See following image.



Connecting Cable Leads to the OES₂[™] Modules:

Notice – Spark may be present when connecting wiring to OES₂[™] Terminals

A brief small spark is often present when connecting the second of two leads to an OES₂[™] Module. Example: If the Positive has been connected, a small spark will likely be present when connecting the Negative lead. This is a normal occurrence. Complete all connections in a clean, ventilated, well lit area.

Power Cabling for the OES₂[™] Modules is not included. Your qualified installer or application specifications will determine the wire gauge for your system.

Considerations for power cable terminations:

- OES₂[™] Module Mounting Stud Size: 3/8”.
- Power Cable Wire Gauge: Generally anywhere from 6 AWG to 2/0 AWG or larger.

High amperage rated ring terminals can be found for these and other common dimensions. Your installer can source these or we can provide them based on the specs you supply.

Protection from the Environment:

Anticorrosive compounds or epoxies are occasionally used in harsh or marine climate installations. Please contact your Electrician or Qualified Installer to determine if this is advisable, and if so, what solution best suits your application.

Final Connection of the Installation:

Final Installation and operation guidelines will be dictated by your Electrician and Installer based on the properties and procedures of the equipment in your installation and any code requirements that apply to your region. Ojai Energy Systems, Inc. technical and sales staff members are available to provide any additional information on the OES₂[™] Modules as needed. Please contact us at your convenience, if necessary. Ojai Energy Systems, Inc. is committed to providing safe, reliable energy storage. This commitment extends to our customers, valued installers and partners, and to our community at large. Please be aware of the potential hazards before interacting with any and all electrical or mechanical devices. Please take all necessary precautions in your projects and installations.

OES₂[™] Module Units

*Safety Attributes and Certifications/
Green Characteristics*

Safety Attributes and Certifications

Intrinsically Safe Operation and Installation:

The OES Lithium Ferro Phosphate (LiFePO₄) battery cell component is made with an intrinsically safe cathode material (iron phosphate). This creates a strong molecular bond, which withstands extreme conditions, prolongs cycle life, and maintains integrity with little or no maintenance over extended periods of time. There is virtually no danger of Thermal Runaway, as there may be with Lead Acid, NiCd, and Lithium Cobalt type batteries. No venting is required. No precautions or special structural considerations are necessary when installing OES₂[™] Modules.

There are No Safety Hazards due to Off-Gassing, Exposure to Acids or Thermal Runaway as there are with Lead Acid AGM type batteries:

OES₂[™] Modules do not vent dangerous gasses, such as hydrogen and oxygen, because there are no chemicals used in the creation of the electrical energy in contrast to Lead Acid batteries. There are no dangers of exposure to sulfuric acid because OES₂[™] Modules do not have caustic electrolytes. Thermal runaway is not an issue with OES products due to the basic nature of the cell makeup in OES₂[™] Modules.

OES₂[™] Modules Control and Protective Circuitry:

Ojai Energy Systems, Inc. utilizes balancing, voltage regulation, heat and current controls, as well as other protective measures, in its OES₂[™] Module Management System. This protective circuitry is embedded in the architecture of each OES₂[™] Module.

UN DOT certified cells:

The LiFePO₄ cells are independently certified to withstand the UN DOT T1-T8 testing guidelines with no special circuitry added. These tests include short circuit, over-voltage, overcharging, extreme temperature, high altitudes, shock and extreme vibration testing.

UL Compliance:

The Lithium Ferro Phosphate cells within the OES₂[™] Modules fully comply with the safety testing parameters of UL 1642.

RoHS compliant:

Any RoHS compliant component is tested for the presence of Lead (Pb), Cadmium (Cd), Mercury (Hg), Hexavalent chromium (Hex-Cr), Polybrominated biphenyls (PBB), and Polybrominated diphenyl ethers (PBDE). For Cadmium and Hexavalent chromium, there must be less than 0.01% of the substance by weight at raw homogeneous materials levels. For Lead, PBB, and PBDE, there must be no more than 0.1% of the material, when calculated by weight at raw homogeneous materials. Any RoHS compliant component must have 100 ppm or less of mercury and the mercury must not have been intentionally added to the component. In the EU, some military and medical equipment are exempt from RoHS compliance.

Green Characteristics, Environmental and Ecological considerations

Materials:

The primary materials (lithium, iron, phosphates, aluminum) that make up OES₂[™] Modules are environmentally benign and pose very few polluting or environmentally degrading by-products in the harvesting and refinement processes, especially when compared to those of lead acid, NiCad, and NiMH batteries.

By Products

There are no toxic by-products associated with the assembly or use of OES₂[™] Modules, such as off gassing hydrogen, sulfuric acid spillage, lead contamination, or explosions

Operation:

There is no maintenance, such as adding water or chemicals, nor is there corrosion of terminals or containment facilities, or dispersion of fumes as with other battery types. Once installed, OES₂[™] Modules are maintenance free from labor and materials costs for years.

Life Cycles:

OES₂[™] Modules are designed for a 2000 – 4000 cycle life before any capacity is lost. If you discharge/recharge an OES₂[™] to 90% depth of discharge once a day it will last up to 10.9 years. This is a conservative estimate. Lead Acid based batteries must be replaced and disposed of up to 5 times during the same 10 year period. This equates to 5 times the manufacturing, installation and disposal costs. The manufacturing and disposal of aging lead acid technology based batteries increases the energy usage, pollution, and materials depletion. Use of OES products eliminates up to 80% of this waste and the potentially negative environmental impact.

Disposal:

OES products are non-hazardous, may be disposed of without damage to the eco system, and return to the earth, easily recombining with the elements without harmful by-products. The outer casing and brackets contain steel, aluminum, copper, cardboard, and recyclable plastic. Lithium Ferro Phosphate materials can also be recycled through established battery centers if desired.

Lithium Ferro Phosphate Batteries and the Environment:

Increasingly, lithium ferro phosphate batteries are being considered for such large format uses as electric vehicle and energy storage applications. As the use of this battery chemistry in larger batteries becomes more common, questions of sustainability and environmental impact inevitably arise. Of the lithium ferro phosphate chemistries being considered for large format batteries, OES believes that batteries based on our proprietary lithium ferro phosphate chemistry and circuitry offer a clear advantage, not only over alternate Li-ion chemistries, but all battery chemistries that are currently commercially available. This belief is based on both the minimal environmental impact associated with the synthesis of OES₂[™] Modules and the significantly smaller end-of-life footprint that results from the use of OES₂[™] Modules.

Lithium ferro phosphate is almost unique among common battery chemistries in that no heavy metals are used in its manufacture. OES₂[™] Modules are also unique in that the material is environmentally benign enough to be considered non-toxic and is approved for landfill disposal. Consequently, any

facility engaged in the manufacture of OES₂[™] Modules or assembly of OES technology does not present any extraordinary environmental or health concerns. The same cannot be said for lead-acid, Ni-Cad, or nickel metal hydride facilities where care must be taken to prevent worker exposure to heavy metals or the release of these materials into the environment.

The major environmental impact of the use of OES₂[™] Modules, however, is in the very much-reduced end-of-life footprint, i.e., the volume of spent batteries that must be either recycled or otherwise disposed of. The table below compares the specific energy and cycle life of the various battery chemistries currently being used or being considered for large-format applications. Note that the table does not include lithium cobalt oxide (LCO), the dominant lithium ion chemistry in portable electronic applications as, due to safety considerations; LCO is not generally considered a viable large format chemistry.

	Lead-Acid	NiCd	NiMH	LMO	NMC*	OES UNITS
Battery Specific Energy (Wh/kg)	40	65	90	115	160	130
Cycle Life	250	1500	400	500	500	2000

*Nickel-manganese-cobalt oxide (tn-oxide) cathode material.

1 For the purpose of this paper, "large format" will refer to any battery larger than those typically used for portable electronic applications, i.e., 75 Wh and larger.

These values can be used to estimate the amount of spent battery waste generated by a given battery chemistry in a given application. For example, given an application that requires a relatively modest 200Wh battery, the weight of spent batteries generated after 10,000 application discharge cycles is given in the table below.

	Lead-Acid	NiCd	NiMH	LMO	NMC*	OES UNITS
200 Wh Battery weight (kg)	5.0	3.1	2.2	1.7	1.3	1.5
Battery replacements over 10K cycles	40	6.7	25	20	20	5
Spent batteries after 10K cycles (kg)	200	21	55	34	26	7.5

Because of the intrinsic electrochemical stability of OES₂[™] Modules and its consequential long life, end-of-life disposal or recycling issues for OES₂[™] Modules are very dramatically reduced as compared to competing chemistries.

Summary:

The Lithium Ferro Phosphate batteries in the OES product lines are classified as non-hazardous by the federal government. They are non-toxic, and the least polluting of any other commercially available battery. Unlike NiMH, NiCad or Lead Acid types of batteries (including AGM), the OES₂[™] Modules contain the least amount of toxic metals, and is the most eco friendly of all common battery types. Lithium easily combines into harmless compounds when disposed. OES₂[™] Modules are the least polluting rechargeable batteries – no fumes, leaking, or gas discharge and no chemicals or acids to worry about.

Designed and Assembled in the USA using exclusive American Patented technologies.

Appendix

Material Safety Data Sheet

MSDS Information Online Resource: www.batteryspace.com/prod-specs/MSDS_LiFePO4.pdf

Product Name: OES₂[™] Modules.

Product Use: Electrical Storage

Section 2 - Composition and Ingredient Information

Under normal use, this battery is not expected to expose the user to hazardous ingredients.

USA: This battery is an article pursuant to 29 CFR 1910.1200 and, as such, is not subject to the OSHA Hazard Communication Standard Requirement. The information contained in this Material Safety Data Sheet contains valuable information critical to the safe handling and proper use of the product. This MSDS should be retained and available for employees and other users of this product.

Canada: This is not a controlled product under WHMIS. This product meets the definition of a "Manufactured article" and is not subject to the regulations of the Hazardous Products Act.

Section 3 - Hazards Identification

Preparation Hazards and Classification: Not dangerous with normal use. The battery should not be disassembled or incinerated. Exposure to the ingredients contained within or their combustion products could be harmful.

Appearance, Color, and Odor: Solid object, no odor.

Primary Route(s) of Exposure: Risk of exposure will only occur if the battery or cell is mechanically, thermally or electrically abused and the enclosure is compromised. If this occurs, exposure to electrolyte solutions contained within the battery or cell may occur by inhalation, eye contact, skin contact and ingestion.

Potential Health Effects:

Inhalation: Inhalation of material from a sealed battery is not an expected route of exposure. Vapors or mists from a ruptured battery may cause respiratory irritation.

Ingestion: Swallowing of material from a sealed battery is not an expected route of exposure. Swallowing mists from a ruptured battery may cause respiratory irritation, chemical burns of the mouth and gastrointestinal tract irritation.

Skin: Contact between the battery and skin will not cause any harm. Skin contact with positive and negative terminals of high voltages may cause burns to the skin. Skin contact with a ruptured battery can cause skin irritation.

Eye: Contact between the battery and eye will not cause any harm. Eye contact with the contents of a ruptured battery can cause severe irritation to the eye.

Medical Conditions Aggravated by Exposure: Not Available

Section 4 – First Aid Measures

Skin Contact: Wash affected area with lukewarm water for at least 30 minutes. If irritation or pain persists, seek medical attention.

Eye Contact: Wash affected eye with lukewarm water for at least 30 minutes. Rinse with saline solution if possible. Seek medical attention.

Inhalation: Move victim to fresh air and remove source of contamination from area. Seek medical

attention.

Caution: In all cases if irritation persists, seek medical assistance at once.

Section 5 - Fire Fighting Measures

Extinguishing Media: Water, carbon dioxide, dry chemical powder and foam are most effective means to extinguish a battery fire

Fire Fighting Procedure: Put on fully protective gear, including self-contained breathing apparatus, goggles, fireproof jacket and gloves.

Unusual Fire and Explosion Hazards: Exposing battery pack or cell to excessive heat, fire or over voltage condition may cause a leak, fire, hazardous vapors and hazardous decomposition products. Damaged or opened cells can result in rapid heating and the release of flammable vapors.

Section 6 - Accidental Release Measures

The material contained within the batteries or cells is only expelled under abusive conditions. Use a shovel and cover battery with sand or vermiculite, place in an approved container and dispose in accordance with section 13.

Section 7 – Handling and Storage

Handling: Do not expose battery or cell to extreme temperatures or fire. Do not disassemble, crush or puncture battery.

Storage: Insulate positive and negative terminals to avoid short circuit. Store in a cool and well - ventilated area and avoid direct sunlight. Elevated temperatures can result in reduced battery life.

Section 8 – Exposure Controls and Personal Protection

Respiratory Protection: Not necessary under normal use. In case of battery or cell rupture, use a self-contained full-face respiratory mask.

Eye Protection: Not necessary under normal use. Wear safety goggles if handling a ruptured or leaking cell or battery pack.

Hand Protection: Not necessary under normal use. Wear Viton rubber gloves when if handling a ruptured or leaking cell or battery pack.

Skin Protection: Not necessary under normal use. Wear rubber apron and Viton rubber gloves if handling a ruptured or leaking cell or battery pack.

Section 9 – Physical and Chemical Properties

Physical State	Solid
Odor Type	Odorless
Appearance	Battery
Odor Threshold	Not Applicable
pH	Not Applicable
Evaporative Rate	(n-Butyl Acetate = 1) Not Applicable
Relative Density	Not Applicable
Auto Ignition Temperature(C°)	Not Applicable
Boiling Point	Not Applicable
Flammability Limits (%)	Not Applicable
Melting Point	Not Applicable
Vapor Pressure	(mm Hg @ 20 C°) Not Applicable
Viscosity	Not Applicable
Vapor Density	(Air = 1) Not Applicable
Oxidizing Properties	Not Applicable
Solubility in Water	Insoluble
Flash Point and Method (C°)	Not Applicable
Water/ Oil distribution coefficient	Not Applicable

Section 10 – Stability and Reactivity

Stability: Stable

Conditions to Avoid: Avoid exposing battery to high temperatures. Do not incinerate, deform, mutilate, crush, pierce, short circuit or disassemble.

Materials to Avoid: Not Applicable

Hazardous Decomposition Products: Combustible vapors may be released if exposed to fire.

Possibility of Hazardous Reactions: Not available.

Section 11 - Toxicological Information

Irritation: Risk of irritation only occurs if cells or batteries are mechanically, thermally or electrically abused and the enclosure is compromised.

Neurological Effects: Not applicable.

Sensitization: Not applicable.

Teratogenicity: Not applicable.

Reproductive Toxicity: Not applicable.

Mutagenicity (Genetic Effects): Not applicable.

Toxicologically Synergistic Materials: Not available

Section 12 – Ecological Information

Bioaccumulative potential: Not available.

Persistence and degradability: Not available.

Mobility: Not available.

Ecotoxicity: Not available.

Other adverse effects: Not available.

Section 13 – Disposal Considerations

Waste Disposal Method: Recycling is encouraged. Dispose of in accordance with local, state and federal laws and regulations.

USA: Dispose of in accordance with local, state and federal laws and regulations.

Canada: Dispose of in accordance with local, state and federal laws and regulations.

EC: Dispose of in accordance with relevant EC Directives.

Section 14 – Transport Information

Hazardous Classifications: Based on lithium content:

Some single lithium ferro phosphate cells and multi cell battery packs are exempted from Class 9. No class 9 marking, specification packaging, or Class 9 labels are required.

Use lithium ferro phosphate battery labels for transport of lithium ion batteries, which are not assigned Class 9.

Use Class 9 Miscellaneous Dangerous Goods and UN Identification labels for transportation of lithium-ion batteries, which are assigned Class 9. Refer to relevant transportation documents.

Lithium and lithium ferro phosphate cells and batteries are regulated in the U.S. in accordance with Part 49 of the Code of Federal Regulations, (49 CFR Sections 105-180) of the U.S. Hazardous Materials Regulations.

California Prop 65:

This product does not contain chemicals known to the State of California to cause cancer or reproductive toxicity.

Canada

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contain all the information required by the Controlled Products Regulations.

WHMIS Classification: Not Controlled

New Substance Notification Regulations: All ingredients in the product are listed, as required, on Canada's Domestic Substance List.

NPRI Substances (National Pollutant Release Inventory): This product does not contain any NPRI chemicals.

EC Classification for the Substance/ Preparation:

Symbol: This product is not classified as dangerous according to Directive 1999/45/EC and its amendments.

Risk Phrases: None

Safety Phrases: S2: Keep out of the reach of children.

Section 16 – Other Information

Preparation Date: March 24, 2009

Revision Date: March 24, 2009

Revision Summary: March 24, 2009: Release

Charge Controller Integrations

12-Volt System

Product:	OES₂TM - 01v12
Description:	2300 Watts, 12v/180ah
System Type:	Residential
Solar System Voltage:	12 volts
Wind System Voltage:	12volts
Charge Controllers:	SMA. Xantrex. Outback.

SMA

Equalized Support:	Off
Capacity Limit:	180A
Equalized Voltage:	Off
Recharge Volts:	11.8V
Bulk Voltage:	14.5V
Absorb Voltage:	14.5V
Float Voltage:	If used on a daily, weekly, or monthly use case then Off . Self-Discharge is <1% per month.

Xantrex

Equalized Support:	Off
Capacity Limit:	180A
Equalized Voltage:	Off
Recharge Volts:	11.8V
Bulk Voltage:	14.5V
Absorb Voltage:	14.5V
Float Voltage:	If used on a daily, weekly, or monthly use case then Off . Self-Discharge is <1% per month

Outback

Equalized Support:	Off
Capacity Limit:	180A
Equalized Voltage:	Off
Recharge Volts:	11.8V
Bulk Voltage:	14.5V
Absorb Voltage:	14.5V
Float Voltage:	If used on a daily, weekly, or monthly use case then Off . Self-Discharge is <1% per month

Charge Controller Integrations

24-Volt System

Product: **OES₂TM - 01v24**

Description: 2300 Watts, 24v/90ah
(Available in a 12v/180ah)

System Type: Residential

Solar System Voltage: 24 volts

Wind System Voltage: 24 volts

Charge Controllers: SMA. Xantrex. Outback.

SMA

Equalized Support: Off

Capacity Limit: 45 to 90A

Equalized Voltage: Off

Recharge Volts: 21V

Bulk Voltage: 25.5V

Absorb Voltage: 25.5V

Float Voltage: If used on a daily, weekly, or monthly use case then **Off**.
Self-Discharge is <1% per month.

Xantrex

Equalized Support: Off

Capacity Limit: 45 to 90A

Equalized Voltage: Off

Recharge Volts: 23.6V

Bulk Voltage: 29V

Absorb Voltage: 29V

Float Voltage: If used on a daily, weekly, or monthly use case then **Off**.
Self-Discharge is <1% per month

Outback

Equalized Support: Off

Capacity Limit: 45 to 90A

Equalized Voltage: Off

Recharge Volts: 23.6V

Bulk Voltage: 29V

Absorb Voltage: 29V

Float Voltage: If used on a daily, weekly, or monthly use case then **Off**.
Self-Discharge is <1% per month

48-Volt System

Product: **OES₂TM - 01v48**

Description: 2600Watts, 48v/50ah

System Type: Residential
Solar System Voltage: 48 volts
Wind System Voltage: 48 volts
Charge Controllers: SMA. Outback. Xantrex.

SMA

Equalized Support: Off
Capacity Limit: 45 to 90A
Equalized Voltage: Off
Recharge Volts: 47V
Bulk Voltage: 58V
Absorb Voltage: 58V
Float Voltage: If used on a daily, weekly, or monthly use case then **Off**.
Self-Discharge is <1% per month.

Xantrex

Equalized Support: Off
Capacity Limit: 45 to 90A
Equalized Voltage: Off
Recharge Volts: 47.2V
Bulk Voltage: 58V
Absorb Voltage: 58V
Float Voltage: If used on a daily, weekly, or monthly use case then **Off**.
Self-Discharge is <1% per month

Outback

Equalized Support: Off
Capacity Limit: 45 to 90A
Equalized Voltage: Off
Recharge Volts: 47.2V
Bulk Voltage: 58V
Absorb Voltage: 58V
Float Voltage: If used on a daily, weekly, or monthly use case then **Off**.
Self-Discharge is <1% per month