MKM Multi-Kilowatt Module

User Manual

P/N: URB0001
P/N: URB0001-SMB
P/N: URB0003
P/N: URB0003-SMB

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1 ABOUT THIS MANUAL

Please be sure to read all points in this section in their entirety before proceeding further.

1.1 Symbols Used

The symbols shown in this section appear throughout this manual. The NOTE symbol identifies important information that requires special attention. The other symbols represent important safety advice, and appear in the form of WARNINGS and CAUTIONS against possible hazards to people or equipment, respectively. These safety WARNINGS and CAUTIONS must be followed at all times. They are flagged by use of a triangular alert icon shown just to the left of the cautionary advice given, as shown below:

NOTE: *Note statements contain important information that may affect how you use this product.*

WARNING: *Warning statements mean danger. They identify practices, procedures or conditions such as high voltage that could result in injury or loss of life and which, therefore, require extreme care before proceeding.*

CAUTION: *Caution statements denote a hazard. They identify practices, procedures or conditions that could result in damage to or destruction of this product or other equipment or property.*

CLASS 9 HAZARDOUS

1.2 Caution

- Do inspect all cables and connections for damage prior to use
- Do install only with like MKM products
- Do not mix MKM part numbers
- Do follow all charging recommendations
- Do recharge batteries every 6 months minimum
- Follow all safety instructions
- Do not stack over 4 units high
- Do use 2 man lift

1.3 Warnings

- Do not expose to water
- Do use only approved chargers or consult factory

1.4 High Voltage

- Series configurations lead to high voltage and can be lethal; these systems should only installed by properly trained personnel.
- Consult factory when using in series arrangements
- External diode protection may be required in high voltage systems

1.5 Class 9 Hazardous

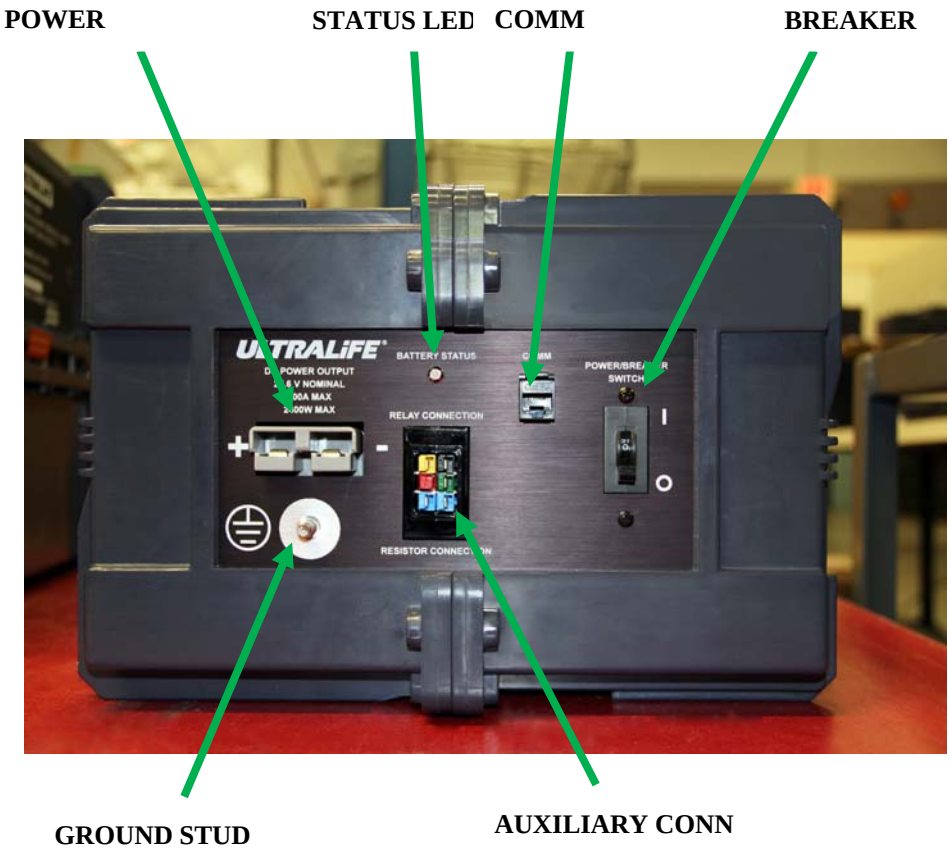
- These batteries contain over 100 Watt Hours of energy and are considered Class 9 goods during transportation. Consult with the factory for additional information.

2 PRODUCT DESCRIPTION

The Multi Kilowatt Modules are large format battery products based on various Lithium Ion chemistries. The chemistry of this group of MKM batteries is based on Lithium Iron Phosphate, offering a very high cycle life and safety characteristics. Nominal voltage for the listed models is 24VDC, with an overall range of 23V to 28.8VDC.

The MKM products have Ultralife SmartCircuit® Protection electronics and fuel gauging. Ultralife SmartCircuit® electronics have been evolved over time to include the most advanced technologies available, attributed to Ultralife's 18+ years of Lithium ion protection circuit design and control. These advanced designs protect the module against several abuse conditions including: Over Discharge, Over Charge, Short Circuit, and Over Temperature. Additionally, there are several layers of passive protection components designed into the MKM including fusing and over current breakers.

2.1 Features Set



1. Power Connection

The main connector is an Anderson Power Products SB120 style power plug. The mating plug has + / - labeled as to the correct orientation.

2. Ground Stud

There is a ground stud on the front panel to protect the panel from being inadvertently energized, connect this stud to a known good ground.

3. Comm Port

The communication connector is a standard RJ45 connector. There are several protocols being used in various versions of MKM. Initial versions have I2C protocol as standard. Future models will have SMBus and CAN Bus, among others. The Communication port is used for State of Charge and other internal battery statuses.

Verify the version MKM you are using and the communication protocol before proceeding. Please consult the factory for additional communications protocol information.

The communication port requires an external +5/3VDC and Ground connection to properly function. The port is fully isolated from the battery by an ADUM1250. The pin out is as follows:
Pin 4 – I2C Data
Pin 5 – I2C Clock
Pin 7 - +5/3VDC
Pin 8 – Return (-)

Available registers are listed at the end of the Manual.

4. Status LED

The status LED provides information about the operational and error modes of the MKM. The list of codes and meaning are present in the status table below:

COLOR	FREQUENCY	STATE
GREEN	BLINKING	OPERATING NORMALLY
RED	BLINKING	FAULT/FULLY DISCHARGED CONDITION PRESENT
AMBER	STEADY ON	BATTERY IS FULLY CHARGED IN “FLOAT” MODE
NONE	NONE	BATTERY IS TURNED OFF

The status LED may turn red briefly before turning off when the circuit breaker is cycled. This is normal.

5. Auxiliary Connector

This connector is an Andersen Power Products Power Pak 6 Position connector.

The auxiliary connector has internal form-C relay connections and the connection for an external balancing resistor; one position is empty (red).

The form C normally closed contact is connected to the black and green positions on the auxiliary connector. The normally open contact is connected between the yellow and black positions on the auxiliary connector. Both contacts actuate to the normal position on power up if the MKM is functioning properly. The relay is rated at 1A continuous and 12V maximum.

The external balancing resistor is recommended to be a 300W 25Ohm resistor for rapid balancing. This resistor is required to rapidly balance MKMs when in series connect mode. The resistor connections are the Blue colored contacts in the auxiliary connector.

6. Breaker

The breaker is a secondary level of protection against output faults. It also controls the power output of the MKM and allows the MKM to go into sleep mode when in the off position, saving power during storage or transport.

7. Case Interlocks

The MKM Case has interlocking features for stacking and securing MKM batteries both horizontally and vertically. It is recommended stacking be limited to 4 MKM batteries high in all applications. The MKMs can be used in any attitude, orientation does not matter.

Do not stack more than four (4) high

2.2 Discharging

The MKM products can be discharged repeatedly to 100% depth of discharge during use. The MKM products have an extremely low internal resistance which allows high utilization of internal battery energy with little loss due to heat. In system design, care should be taken to limit capacitance to less than 2mF on the target device, as this can lead to high inrush currents and nuisance tripping of the protection electronics over current protection. If a highly capacitive load is attached; a pre-charge circuit should be implemented.

If there are extended times between fully discharging and recharging, care should be taken to leave some reserve energy in the MKM during discharge. It is highly recommended to never discharge the battery to "cutoff," when the battery turns off the output voltage. The system should be designed in such a way to prevent discharge to cutoff.

2.3 Charging

The MKM products have been designed to be utilized with advanced Sealed Lead Acid chargers, Power supplies, and Lithium Ion chargers. Please consult factory to verify the applicability of a proposed charging solution. The MKM products can be charged rapidly utilizing a 1-2 hour charge rate depending on model. It is suggested the MKM modules be charged at constant current followed by constant voltage, a standard Lithium Ion type charge. If long charge times (>10 hour) are used in system design, a constant current charge to a cutoff voltage can be used.

The MKM products can be float charged, but it is suggested to conserve energy and maximize life that charge be terminated when full, and then reinitiated when a noticeable voltage drop occurs (approximately 1V).

Due to the low internal resistance of the MKM products, it is suggested that recharge be preformed within 24 hours of a complete discharge. If there are extended times between fully discharging and recharging, care should be taken to leave some reserve energy in the MKM during discharge.

2.4 Parallel Connections

Factory suggests limiting number of MKMs in parallel to less than 10. This will result in a very low resistance battery, so the user is cautioned as high capacitive loads will create large current spikes which will/can lead to nuisance tripping of protection electronics. It is suggested that all batteries be connected to a high current bus with as short wires as possible.

2.5 Series Connections

Series connections can lead to high voltages and should be carefully configured by experienced and qualified personnel only. Please refer to proper codes and guidelines for safe installation. Refer to the latest edition of the National Electric Code for additional details. For series installations, it is recommended a cutoff voltage be set to 23.25V per series module.

Ultralife suggests contacting the factory for assistance when connecting MKMs in series, as external diodes may be required, as well as proper fusing and protection for safety.

2.6 Environmental Controls

Although the Lithium batteries in the MKM series are extremely robust, it is suggested they be used in a controlled temperature atmosphere of between 5C and 45C for optimum performance. Environmental exposure outside of these limits will result in decreased overall performance and possible decrease in cycle life.

3 Appendix A

3.1 Communication Port

The communication port is a direct I2C Connection to the internal fuel gauge. The fuel gauge is programmed at the factory for the specifics of the MKM chemistry. There are a few correction factors needed to use the data stored in the fuel gauge.

Voltage must be multiplied by 8.

Current must be multiplied by 72 for a URB0001, 44 for a URB0003.

Capacity in Ahr must be multiplied by 72 for a URB0001, 44 for a URB0003.

All registers in the fuel gauge are available on the datasheet for the MAXIM 17047 Model M3 Fuel Gauge.

3.2 Contact Information

For Sales, Service, Technical and Safety Assistance:

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