



ADVANCED ENERGY

Lithium Ion Battery

APPLICATION NOTE

OPEN LOOP INTEGRATION WITH OUTBACK POWER

1. Battery Sizing	3
1.1 Minimum Battery Sizing with Outback Radian	3
2. Battery Operating Limits	3
2.1 Maximum Battery Operating Limits	3
2.2 Recommended Battery Operating Settings	3
3. AES Open Loop Integration with Outback Equipment	4
3.1 Device Settings	4
4. Configuration Settings	4
4.1 Access to MATE3(s) Main Menu	4
4.2 MATE3(s) Menu Map	4
4.3 Outback Radian Inverter Settings	5
4.4 Charge Controller Settings	5
4.5 FLEXnet Battery Monitor Settings	5
4.6 Optimizing LBCO Function with MATE3 Controller	6
4.7 Settings for MATE3 and MATE3s SoC Warnings	6

OVERVIEW

There are some notable differences when configuring your Discover AES installation versus conventional lead acid batteries.

This Application Note provides information about the integration of Discover AES Lithium batteries with OutBack Power systems and related components.

OutBack Power reference documents:

- MATE3 and MATE3s Programming Guides
- Radian GS8048 Installation Manual
- Radian GS8048 Operator's Manual

Discover reference documents:

- Discover Energy 808-0004 42-48-6650 Data Sheet
- Discover Energy 808-0005 44-24-2800 Data Sheet
- Discover Energy 805-0015 AES Lifepo4 Battery 44-24-2800 42-48-6650 Manual

Visit discoverbattery.com for the most recent version of published documents.

Certain configuration, installations, service, and operating tasks should only be performed by qualified personnel in consultation with local utilities and/or authorized dealers. Qualified personnel should have training, knowledge, and experience in:

- Installing electrical equipment
- Applying applicable installation codes
- Analyzing and reducing hazards involved in performing electrical work
- Installing and configuring batteries

No responsibility is assumed by Discover Battery for any consequences arising out of the use of this material.

Read AES Battery Manual and Safety instructions before installing the battery.

Read Outback manuals for guidance on product features, functions, parameters and how to use the product safely.

1. Battery Sizing

1.1 Minimum Battery Sizing with Outback Radian

To support a surge rating of 17 kVA and to prevent overcharging of the battery bank, Outback recommends that a minimum battery bank size of 350 amp-hours for every Radian GD 8048 inverter charger should be installed. If other charging devices are present, the minimum battery bank size should be determined by adding the inverter(s) charge capacity with that of any other charging devices, such as solar charge controllers, and multiplying the result by five. Example: If the combined charge rate is 160 Adc, the minimum battery bank size should be 800 amp-hours. Please see the Outback GS 8048 Installation Manual for further information.

2. Battery Operating Limits

2.1 Maximum Battery Operating Limits

The battery should not be operated outside these operating limits. The BMS will open its internal relay and disconnect the battery if any of these limits are exceeded.

Maximum Operating Limits	44-24-2800	42-48-6650
Continuous Charge Current*	110 Adc	130 Adc
Continuous Discharge Current*	110 Adc	130 Adc
Charge Voltage	27.2 V	54.4 V
Operating Voltage (Min / Max)	22.4 V / 29.2 V	44.8 V / 58.4 V
Charge Temperature (Min / Max)	0°C / 45°C (32°F / 113°F)	
Discharge Temperature (Min / Max)	-20°C / 50°C (-4°F / 122°F)	
Storage Temperature (Min / Max)	-20°C / 45°C (-4°F / 113°F)	

* Effects of AC Ripple must be taken into consideration when sizing and configuring the system.

▲ NOTE!

Intentional bypassing of BMS to operate battery outside maximum and minimum limits voids warranty.

2.2 Recommended Battery Operating Settings

Although the battery is capable of performing at higher operating limits, the following settings are recommended to maximize battery health and account for unforeseen external conditions.

Recommended Operating Settings	44-24-2800	42-48-6650
Max Continuous Charge Current	< 78 A	< 92 A
Max Continuous Discharge Current	< 78 A	< 92 A
Charge Voltage (Bulk/Absorb)	27.2 V	54.4 V
Charge Voltage (Float)	26.8 V	53.6 V
Low Voltage Disconnect	24 V	48 V
Operating Temperature	20°C (68°F)	

3.0 AES Open Loop Integration with Outback Equipment

3.1 Device Settings

AES batteries must be set up to work with power conversion and monitoring devices in either an Open Loop or Closed Loop configuration. The charge and discharge settings in a Open Loop configuration are set up manually through the controller for the Power Conversion device at the time of installation. In a Closed Loop configuration, charge and discharge settings are dynamically controlled by the BMS of the AES Battery over a connection with the Power Conversion device network.

Note: Closed Loop communication with a Power Conversion device network requires the use of a LYNK Gateway Communication device (p/n 950-0015) available from Discover Battery. For details please refer to the appropriate AES LYNK Edge Card User Manual for your Power Conversion device available from the Discoverbattery.com website, or contact your Discover Battery provider for assistance.

The settings in this document are for an Open Loop configuration with Outback equipment.

4. Configuration Settings

▲ CAUTION!

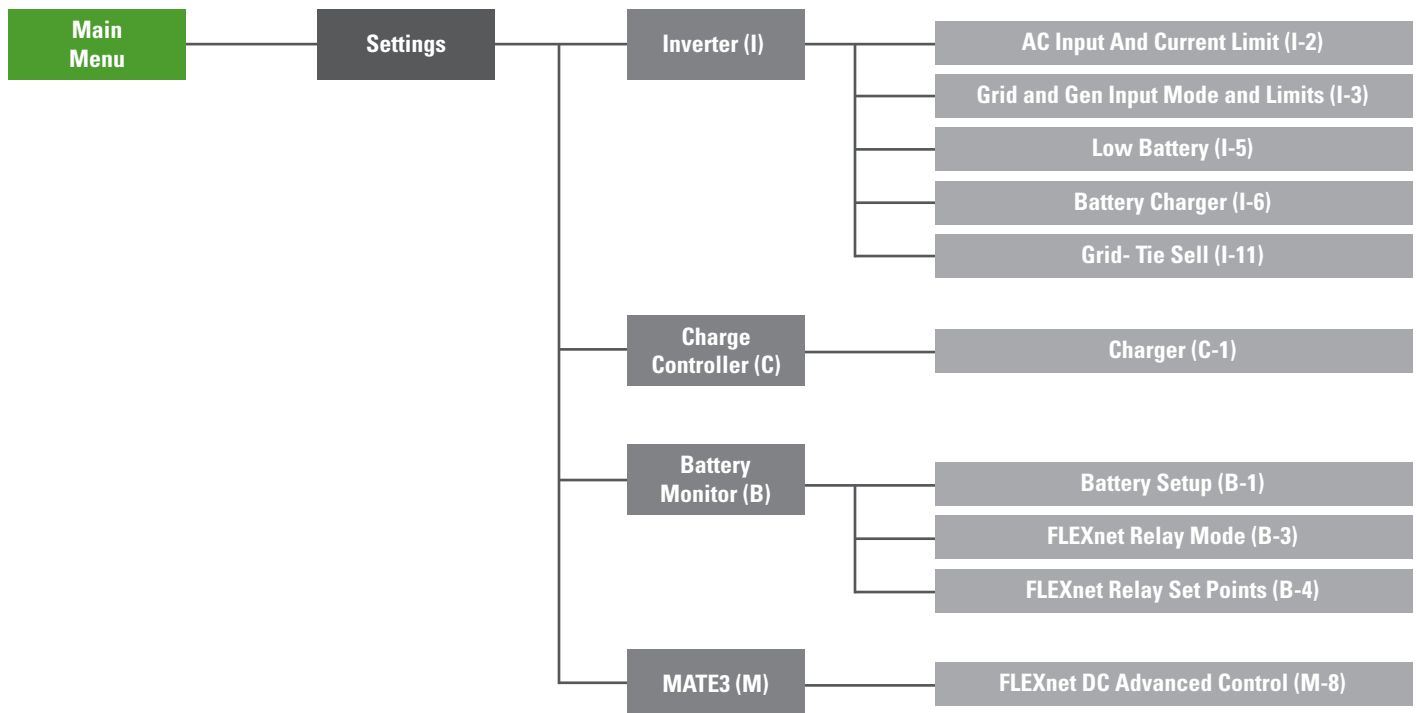
The OutBack Remote Temperature Sensor (RTS) should not be used with Discover AES lithium batteries.

4.1 Access to MATE3(s) Main Menu

The charge and discharge settings for AES batteries in a Open Loop configuration can be set up manually through the Main Menu of the MATE3(s) Display. To gain access to Main Menu a password is required.

1. From the home screen, press the LOCK key to bring up the 'Enter Password' screen.
2. Rotate the Control Wheel until the display shows the number 141.
3. Press the Center Button to accept the password.

4.2 MATE3(s) Menu Map



4.3 Outback Radian Inverter Settings

Inverter Settings (I)	MATE3(s) Menu	44-24-2800	42-48-6650
Absorb Voltage	I-6	27.2 V	54.4 V
Absorb Time ⁽¹⁾	I-6	0.5 < 3.0 hour	0.5 < 3.0 hour
Float Voltage ⁽²⁾	I-6	26.8 V	53.6 V
Float Time	I-6	Disable, Time = 0	Disable, Time = 0
Re-Float Voltage	I-6	Disabled (25V used as default value)	Disabled (50V used as default value)
Re-Bulk Voltage	I-6	25.2 V	50.4 V
AC Input Mode	I-3	Adjust as needed	Adjust as needed
Grid-Tie - Sell Voltage	I-11	26.6 V	53.2 V
Charger AC Limit per installed battery	I-2	12 A @ 240 V / 24 A @ 120 V	29 A @ 240 V / 58 A @ 120 V
Low Battery Cut-Out Voltage	I-5	24.0 V	48.0 V
Low Battery Cut-Out Delay ⁽³⁾	I-5	5 sec	5 sec
Low Battery Cut-In Voltage	I-5	25.6 V	51.2 V
High Battery Cut-Out Voltage	I-5	30.0 V	60.0 V
High Battery - Cut-Out Delay ⁽³⁾	I-5	5 sec	5 sec

(1) Under lightly loaded conditions, power charging devices may not regulate their voltage well and may cause voltage fluctuations that rise above the battery operating limits. The recommended minimum Absorb time is 0.5 hour, up to 3.0 hours for larger battery banks. 1.5 hours is recommended for two 42-48-6650 batteries

(2) Set Float Voltage as a precautionary default prior to Disabling Float Time.

(3) Not available with MATE3 Controller.

4.4 Charge Controller Settings

Charge Controller Settings (C)	MATE3(s) Menu	44-24-2800	42-48-6650
Absorb Voltage ⁽⁵⁾	C-1	27.4 V	54.8 V
Absorb Time ^{(1) (4)}	C-1	0.5 < 3.0 hour	0.5 < 3.0 hour
Float Voltage ⁽⁵⁾	C-1	27.0 V	54.0 V
Re-bulk Voltage	C-1	25.2 V	50.4 V
Current Limit per Installed battery	C-1	110 A	130 A
Absorb End Amps	C-1	0.0 A	0.0 A

(4) Under lightly loaded conditions, power charging devices may not regulate their voltage well and may cause voltage fluctuations that rise above the battery operating limits. The recommended minimum Absorb time is 0.5 hour up to 3.0 hours for larger battery banks. 1.5 hours is recommended for two 42-48-6650 batteries. Note charge controllers will turn off nightly due to the absence of the sun acting as a natural ending for Absorb Time.

(5) To prioritize charging from the charge controller, set the Charge Controller Absorb and Float voltages at 0.2Vdc (24V Nominal Systems) and 0.4Vdc (48V Nominal Systems) higher than the inverter settings.

4.5 FLEXnet Battery Monitor Settings

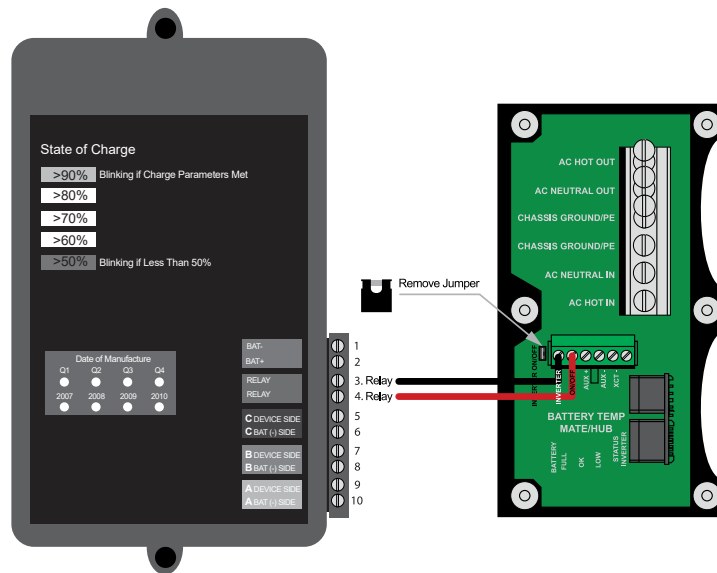
FLEXnet Settings (B)	MATE3(s) Menu	44-24-2800	42-48-6650
Battery Amps-hours per installed battery	B-1	110 Ah	130 Ah
Charged Voltage	B-1	27.2 V, 1.0 min	54.4 V, 1.0 min
Charged Return Amps	B-1	5.5 A	6.5 A
Charge Factor	B-1	98 %	98 %

4.6 Optimizing LBCO Function with MATE3 Controller

Using a MATE3s controller allows for control over the LBCO delay and should be set up using the parameters noted. However, if a MATE3 controller is used, the inverter’s Low Battery Cut-Out timer (5 minute minimum) is not optimized for use with heavy inverter surge loads and a lithium battery. Use the set up outlined below to manage the system when using a MATE3 controller.

FLEXnet Settings (B)	MATE3 Menu	44-24-2800	42-48-6650
Relay Mode - Invert Logic	B-3	No	No
Relay Set Points - Voltage	B-4	High = 26.5 V Low = 24.8 V	High = 53.0 V Low = 49.6 V
Relay Set Points - SOC	B-4	High = 0% Low = 0%	High = 0% Low = 0%
Relay Set Points - Delay	B-4	High = 1 Low = 0	High = 1 Low = 0

This timer may prevent inverter low battery cut-out from occurring before the AES battery BMS self-protects and shuts the battery down. To avoid this situation, the relay contacts on the FLEXnet DC Battery Monitor are used to trigger the low voltage cut-out. Connect the relay contacts to the INVERTER ON/OFF terminals, once triggered the inverter will be set to OFF and prevent the battery from being discharged below the AES Battery BMS protection value. Refer to section 4.5 FLEXnet Settings for the recommended settings. Connect the FLEXnet DC Battery Monitor relay contacts to the Inverter as diagrammed below.



4.7 Settings for MATE3 and MATE3s SoC Warnings

MATE3(s) Settings (M)	MATE3(s) Menu	44-24-2800	42-48-6650
FLEXnet DC Advanced - Low SOC Warning Level	M-8	20%	15%
FLEXnet DC Advanced - Critical SOC Warning Level	M-8	10%	10%