

 Discover®

# ADVANCED ENERGY

Lithium Ion Battery

## APPLICATION NOTE:

### OPEN LOOP INTEGRATION WITH VICTRON ENERGY

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## 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 Victron Energy systems, including MultiPlus inverter chargers, Quattro inverter chargers and MPPT Charge Controllers, BMV 700 Series Battery Monitor, Venus GX / Color Control GX, VE Configure software and VictronConnect Bluetooth application.

Victron Energy reference documents:

- Quattro Inverter Charge Manual
- Multi Inverter Charge Manual
- SmartSolar Charge Controller Manual
- BMV 700 Series Battery Monitor Manual
- Venus GX (VGX) / Color Control GX (CCGX) 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 LiFePO<sub>4</sub> Battery 44-24-2800 42-48-6650 Manual

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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 Victron Energy manuals for guidance on product features, functions, parameters and how to use the product safely.**

## 1. Battery Operating Limits

### 1.1 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
Peak Current (3 seconds)	300 Adc	300 Adc
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 your system.

#### ▲ NOTE!

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

### 1.2 Minimum Battery Capacity

Using very large solar arrays with battery banks that are too small can exceed the operating limits of the battery to charge and possibly lead to the BMS triggering over-current protection. Battery capacity must be sized to accept the maximum charge current of the system, or the the charging devices must be curtailed to charge below the operating limit of the installed batteries. This value is derived by adding together the charge capacities of all inverter/chargers and solar charge controllers in the system. Additionally, battery peak capacity must be sized to support the surge requirements demanded by the load attached to the inverter. Match the sum of all inverter peak power values with the sum of all battery peak battery current values.

Model	Inverter Peak at 48V	Charger	Single Phase Minimum 42-48-6650	Three Phase Minimum 42-48-6650
Multiplus 48/3000/35	125 Adc	35 Adc	1	2
Multiplus / Quattro 48/5000/70	208 Adc	70 Adc	1	2
Quattro 48/8000/110	333 Adc	110 Adc	1	4
Quattro 48/10000/140	416 Adc	140 Adc	2	4
Quattro 48/15000/200	520 Adc	200 Adc	2	6

Model	Inverter Peak at 24V	Charger	Single Phase Minimum 44-24-2800
Multiplus / Quattro 24/3000/70	250 Adc	70 Adc	1
Multiplus / Quattro 24/5000/120	416 Adc	120 Adc	2
Multiplus / Quattro 24/8000/200	666 Adc	200 Adc	3

### 1.3 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
Continuous Charge Current	< 78 A	< 92 A
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)	

## 2.0 AES Open Loop Integration with Victron Energy Equipment

### 2.1 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 LYNK Gateway Communication User Manual and the appropriate AES Edge Card User Manual for your Power Conversion device available from the [Discoverbattery.com](http://Discoverbattery.com) website, or contact your Discover Battery provider for assistance.

The settings in this document are for an off-grid application with Open Loop configuration using Victron Energy equipment.

## 2.2 VE.Configure Device Settings

The charge and discharge settings for AES batteries in a Open Loop configuration are set up manually using Victron's VE.Configure software for Quattro and Multiplus inverter chargers using the following recommended parameters. You will need the latest firmware on all connected devices. This section presumes familiarity with VE.Configure software. These settings are for an off-grid application. After setting the parameters, 'send' all parameters to the inverter and CCGX. Restart the CCGX after completion. Refer to Victron product manuals for the safe and correct operation of Victron products.

General Tab	44-24-2800	42-48-6650
Overruled by remote <sup>(1)</sup>	Enable	Enable
Enable battery monitor <sup>(2)</sup>	Enable	Enable
SoC when Bulk finished	95%	95%
Total battery capacity (per battery installed)	installed x 110 Ah	installed x 130 Ah
Charge efficiency	95%	95%

Inverter Tab	44-24-2800	42-48-6650
DC input low shut-down <sup>(3)</sup>	24.0 V	48.0 V
DC Input low restart <sup>(4)</sup>	26.0 V	52.0 V
DC input low pre-alarm <sup>(5)</sup>	25.5 V	51.0 V
Enable AES <sup>(6)</sup>	Disable	Disable

Charger Tab	44-24-2800	42-48-6650
Enable charger	Enable	Enable
Battery Type	Blank	Blank
Lithium batteries	Enable	Enable
Charge curve	Select: Fixed	Select: Fixed
Absorption voltage	27.2 V	54.4 V
Float voltage	26.8 V	53.6 V
Charge current per battery installed (Recommended < Maximum)	installed x (78 A < 110 A)	installed x (92 A < 130 A)
Repeated absorption time <sup>(7)</sup>	1.0 < 3.0 Hr	1.0 < 3.0 Hr
Repeated absorption interval <sup>(8)</sup>	7.0 Days	7.0 Days
Absorption time <sup>(7)</sup>	1.0 < 3.0 Hr	1.0 < 3.0 Hr

(1) Enabled is recommended.

(2) Used to enable and define the general display of voltage based SoC. However voltage based SoC accuracy is low with AES battery and generator start stop control is not recommended using this feature as the SoC trigger. A Victron BMV Battery Meter is recommended for triggering generator start stop control with AES Battery based on measured SoC.

(3) The lowest operating voltage allowed, increase voltage as required.

(4) Restart voltage after DC input low shut-down, recommended to be set to the minimum value (minimum varies according to the DC Input low shut-down value).

(5) 51.0 V value (approximately 15% SoC) will trigger low battery warning, increase or decrease as preferred.

(6) 'Enable AES' has no relation to the AES Battery, refer to Victron manuals for information on setting and function.

(7) The recommended minimum is 1.0 hour. A longer period of time may be required to compensate for multiple batteries to achieve a smooth completion of charge.

(8) Duration of maximum Float period or Interval between a repeated absorption cycle.

### ▲ NOTE

- Confirm the Float Voltage after completing the installation of any Victron 'Assistants', and if necessary reset the Float Voltage back to 26.8 V / 53.6 V.

## 2.3 VE.Direct Device Settings

The settings for AES batteries in an Open Loop configuration with Victron VE.Direct MPPT are as follows below. This section presumes familiarity with VictronConnect (Bluetooth App) used to configure, monitor and diagnose Victron MPPT products which feature Bluetooth, or are equipped with a VE.Direct Port.

Refer to Victron product manuals for the safe and correct operation of Victron products.

MPPT Charge Controller Settings	44-24-2800	42-48-6650
Battery voltage	24 V	48 V
Max current per battery installed (Recommended < Maximum) <sup>(9)</sup>	installed x (78 A < 110 A)	installed x (92 A < 130 A)
Charger enabled	Enabled	Enabled
Battery preset	User Defined	User Defined
Absorption voltage	27.2 V	54.8 V
Maximum absorption time <sup>(10)</sup>	1.0 < 3.0 Hr	1.0 < 3.0 Hr
Float voltage	26.8 V	54.0 V
Equalization voltage	26.8 V	54.0 V
Auto equalization	Disabled	Disabled
Temperature compensation	Disabled	Disabled
Low temperature cut off	5° C	5° C

(9) May be set to lower value if necessitated by charger controller size.

(10) Duration of absorption period after the bulk charge interval. The recommended minimum is 1.0 hour. A longer period of time may be required to compensate for multiple batteries to achieve a smooth completion of charge.

## 2.4 Victron BMV 700 Battery Monitor Settings

The settings for AES batteries in an Open Loop configuration with a Victron BMV 700 Series Battery monitor are as follows below. Set up is established using the +/- and Select buttons on the face of the BMV 700 Series Battery Monitor.

Refer to Victron product manuals for the safe and correct operation of Victron products.

BMV 700 Battery Monitor Settings	44-24-2800	42-48-6650
Battery capacity (per battery installed)	installed x 110 Ah	installed x 130 Ah
Charged voltage	26.8 V	53.6 V
Tail current	4%	4%
Charge detection time	1 min	1 min
Peukert exponent	1.05	1.05
Charge efficiency factor	95%	95%
Current threshold	0.1 A	0.1 A
Time to go averaging period	3 min	3 min

## 2.5 Victron CCGX Set Up

To optimize performance of a Victron system the following items need to be manually set using the CCGX.

Navigate from the Device List screen > Settings > System Setup.

From the System Setup menu scroll down to select each item and then set as indicated.

- Battery Monitor: Automatic (defaults to the installed Multi or Quattro)
- DVCC - Distributed Voltage and Current Control: ON
- SVS - Shared voltage sense: ON <sup>(7)</sup>
- STS - Shared temperature sense: OFF
- Limit charge current: ON
- Max charge current: installed x (92A < 130A) <sup>(8)</sup>

(7) SVS automatically selects the best available voltage measurement. It will use the battery voltage reported by the VE.Bus system. The voltage displayed on the CCGX reflects the same voltage measurement.

(8) Limit charge current works across the whole system. MPPTs are automatically prioritized over the mains.