



SELECTRONIC SELF-MANAGED (OPEN LOOP) CONFIGURATION WITH DISCOVER LITHIUM BATTERIES

READ AND SAVE THESE INSTRUCTIONS

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INTRODUCTION

This document describes how to set up Selectronic inverter-chargers to create a self-managed (open-loop) charge configuration with AES LiFePO₄ batteries and AES RACKMOUNT battery modules.

1. AUDIENCE, WARNINGS, MESSAGES, GENERAL SAFETY, PERSONAL PROTECTIVE EQUIPMENT

1.1 Audience

Configuration, installations, service, and operating tasks should only be performed by qualified personnel in consultation with local authorities having jurisdiction and authorized dealers. Qualified personnel should have training, knowledge, and experience in the:

- Installation of electrical equipment
- Application of electrical codes, safety, and installation standards
- Analysis and reduction of hazards involved in performing electrical work
- Installation and configuration of batteries
- Installation and configuration of systems activated by relays

1.2 Warning, Caution, Notice, and Note Messages

Messages in this manual are formatted according to this structure.



Additional information concerning important procedures and features of the product. Read all the instructions before installation, operation, and maintenance.



Important information regarding hazardous conditions.

Important information regarding hazardous conditions that may result in personal injury or death.

Important information regarding hazardous conditions that may result in personal injury.

NOTICE

Important information regarding conditions that may damage the equipment but not result in personal injury.

NOTE

Ad hoc information concerning important procedures and features unrelated to personal injury or equipment damage.

1.3 General Warnings

ELECTRIC SHOCK AND FIRE HAZARD

- This equipment must only be installed as specified.
- Do not disassemble or modify the battery.
- If the battery case has been damaged, do not touch exposed contents.
- There are no user-serviceable parts inside.

Failure to follow these instructions may result in death or serious injury.

ELECTRIC SHOCK AND FIRE HAZARD

Do not lay tools or other metal parts on the battery or across the terminals.

Failure to follow these instructions may result in death or serious injury.

ELECTRIC SHOCK

- Do not touch the energized surfaces of any electrical component in the battery system.
- Before servicing the battery, follow all procedures to fully de-energize the battery system.
- Follow the "Safe Handling Procedures" below when working with the battery.

Failure to follow these instructions may result in injury.

1.4 Safe Handling Procedures

Before using the battery and any power electronics, read all instructions and cautionary markings on all components and appropriate sections of their manuals.

- Use personal protective equipment when working with batteries.
- Do not dispose of the battery in a fire.
- Promptly dispose of or recycle used batteries following local regulations.
- Do not disassemble, open, crush, bend, deform, puncture, or shred.
- Do not modify, re-manufacture, or attempt to insert foreign objects into the battery, immerse or expose the battery to water or other liquids, fire, explosion, or other hazards. If the user suspects damage to the battery module due to water, heat, or other reason, take it to a service center for inspection.
- Only use the battery for the system for which it is specified.
- Do not lift or carry the battery while in operation.
- When lifting a heavy battery, follow the appropriate standards.
- Only lift, move, or mount following local regulations.
- Take care when handling battery terminals and cabling.
- Only use the battery with a charging system that meets specifications. Using a battery or charger that does not meet specifications may present a risk of fire, explosion, leakage, or other hazards.

- Do not short-circuit a battery or allow metallic conductive objects to contact battery terminals.
- Replace the battery only with another battery that has been qualified for the system. Using an unqualified battery may present a risk of fire, explosion, leakage, or other hazards.
- Do not drop the device or battery. If the device or battery is dropped, especially on a hard surface, and the user suspects damage, take it to a service center for inspection.

1.5 Personal Protective Equipment

When handling or working near a battery:

- Use Personal Protective Equipment, including clothing, glasses, insulated gloves, and boots.
- Do not wear rings, watches, bracelets, or necklaces.

2. DOCUMENTATION

This Application Note provides information about the integration of Discover Lithium Batteries with Selectronic inverter-chargers in a self-managed (open-loop) configuration.

Before installation and configuration, consult the relevant product documentation, including Manuals, Application Notes, Installation and Configuration Guides.

Selectronic Documentation

- SP PRO 2i Instruction Manual (Document No: Ol0003 Part 004122 Rev 42 Feb 2023)
- SP PRO Series 2i datasheet (Document No: BR0007_20 Aug 2022)
- Instruction Manual for SP LINK Configuration and monitoring for SP PRO Series 2i (Document No: Ol0005 Rev30 2022)

Visit <u>https://www.selectronic.com.au/</u> for the most recent version of published documents.

Discover Energy Systems Documentation

- AES 42-48-6650 LiFePO4 Installation and Operation Manual (805-0065)
- AES LiFePO4 datasheet (808-0004)
- AES RACKMOUNT Installation and Operation Manual (805-0043)
- <u>AES RACKMOUNT datasheet</u> (808-0039)

Visit <u>https://www.discoverlithium.com</u> for the most recent version of published documents.

3. OVERVIEW

This manual provides general settings and is not a comprehensive guide to the programming and configuration of a specific installation. An installation may have unique conditions or use cases that require modification or adaptations. Installers must be capable of reviewing and adapting to the specifics of an installation and its specific use case and optimizing settings where needed.

3.1 System Overview

The key steps required to install and configure the Discover Lithium batteries and power conversion equipment are as follows:

- Review and confirm equipment compatibility and correct sizing.
- Terminate all networks correctly.
- Set up the self-managed (open-loop) configuration parameters such as charge and discharge settings on the power conversion equipment.
- Set up user preferences and enable the use case using the power conversion control system.



Figure 1. System Overview

Discover Lithium Batteries

- AES LiFePO,: 42-48-6650
- AES RACKMOUNT: 48-48-5120, 48-48-5120-H

Selectronic Inverters

- SPMC480-AU
- SPMC481-AU
- SPMC482-AU

NOTE

LYNK II Communication Gateway

- The LYNK II communication gateway is not required in a self-managed (open-loop) configuration. However, it is a useful tool to diagnose the battery. For example, by connecting the LYNK II to the battery, you can access the battery logs, which can be used to confirm if the inverter charge settings are fully charging the battery.
- As another example, use the relays on the LYNK to turn equipment or warning lights ON/OFF based on various conditions on the battery.

Selectronic SP PRO 2i Instruction Manual

 Follow installation instructions outlined in the SP PRO 2i Instruction Manual, especially content about pre-charge wiring and requirements on DC coupling.

3.2 Minimum Battery System Capacity

Battery charge and discharge rates are managed automatically by the Discover Lithium Battery and Selectronic device. Using 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 accept the maximum charge current of the system, or charging must be curtailed below the operating limit of the installed batteries. Derive this value by adding together the charge capacities of all inverter-chargers and solar charge controllers in the system. Additionally, battery peak capacity must support the surge requirements demanded by the load attached to the inverter-charger. Match all inverter-charger peak power values with the sum of all battery peak battery current values.

Inverter Peak = (Inverter Surge Value) / (Inverter Efficiency) / (48V: Low Battery Cut-Off)

Single-Phase Models	Inverter Peak (20 seconds)	Max Continuous Charge	Max Continuous Discharge	AES LiFePO4 42-48-6650 Minimum per inverter ⁽²⁾	AES RACKMOUNT 48-48-5120/ 48-48-5120-H Minimum per inverter ⁽³⁾
SPMC480-AU	184 A ⁽¹⁾	73 ADC	83 ADC	1	1
SPMC481-AU	262 A ⁽¹⁾	104 ADC	119 ADC	1	2
SPMC482-AU	391 A ⁽¹⁾	156 ADC	179 ADC	2	2

⁽¹⁾ Calculated based on the surge power and efficiency CEC as published in Selectronic SP PRO Series 2i Instruction Manual (Doc Ol0003 Part 004122 Rev 42 - Feb 2023).

⁽²⁾ Discover AES LiFePO₄ 42-48-6650 Battery, Peak Discharge Current: 300 A (3 seconds), 130 A DC Continuous Charge/ Discharge, as published in Discover LiFePO4 42-48-6650 Installation and Operation Manual (805-0065 Rev A).

⁽³⁾ Discover AES RACKMOUNT 48-48-5120/48-48-5120-H Battery, Peak Power: 218 A RMS (3 seconds), 95 A DC Continuous Charge/Discharge, as published in Discover AES RACKMOUNT Installation and Operation Manual (805-0043 Rev E).

4. SELECTRONIC SETTINGS – SP LINK

Battery charge and discharge rates are managed by the Selectronic device based on settings configured in the SP Link application.

Program the Selectronic inverter-charger with the correct voltage-based parameters so the system can operate in a self-managed (open-loop) configuration.

4.1 Self-Managed (Open-Loop) Configuration

Refer to the latest Discover Battery documentation for battery values and the latest Selectronic documentation for details on menu navigation and the setup procedure.

- 1. Install and then start the latest version of the SP LINK application.
- 2. Either use the Easy Start Guide > Site Configuration Wizard or create a new site and fill in the site connection details.
- 3. In the Site Configuration tab, define the site and inverter equipment information.
- 4. In the Configuration Settings tab, set the battery parameters as shown in the tables below.
- 5. Once the configuration is complete, from Configuration Settings, click Configure SP PRO to send it to all assigned SP PROs.

4.1.1 Configuration Settings

Configuration can be done in either the Configuration Wizard or the SP LINK application interface.

Start Guide	Selectronic SP LINK Elle Connection Performance Da Ste Information Configuration Settings (and a failure		Decennected 00.0	0.00	
Site Configuration Wizard	Configuration File 1	orner men i rese men i e	ence serings				Get SP PRO's Conligue Contraure SP PRO
Select Battery Configuration	Guick Start Thirt Appleciation*	Powerchain Plan	Ballery Type		AC Source Power (0.1 - 15.0 kH)	SoC Control	Idlery Capacity" 20-60000 Anj
Battery Configuration	Solar Hybrid (Dr. Grid)	~ Doubled	 Litium LifePC 	4 v (15 cels)	60.0 kW	v Enabled v	300@ 15.3kWh
Standard Battery Configurations and myGrid kits Model No Select from list	Investor* Bittm* Duage* AC Source Limits AC Case AC Case AC Case Max Charge Websage* AC Case AC Case AC Case (#10 - 10) 55.2 (a) AC Case AC Case	and Tra an	System" Inputs / Oxfput IS Oxeger Adjustment out Voltage Adjust 02-2011 2016	* Sturts Expansion Card III Eatiny Periodic Equalse Dashied ~ Equalse Period*	Md Fort Monitoring Daabled ~	Sec Seting Parket's Exponent" (1.00-1.50) 1.02(8)	Over Teng. Protectio Limit Charge abov [28 - 50 °C]
Custom Battery Configuration	His Battery Alent" (d.068.4 tr) 57.4 (c) His Battery Alent Cheer"		100.000 100.000 100.0000 100.000	Periodic Recharge*	2-10 S] S(2) Equalse Request		1.000 Rate" (0-20%)
Is the battery a sealed or flooded type? If unsure, select Sealed.	[54.0-62.4 1/] Over T	Langet Oxange # Tinp"		Dabled v Recharge Period*	Enabled ~		
Sealed Lead Acid Battery Capacity	30.0-21	2.0(4)		(2 - 100 e) 14 (ф.)			
O Rooded Lead Acid 300 💠 Ah 15.3 kWh	Tap D 19.2 - 20			Soft Battery			
Lithium LiFePO4 Max Charge Current		2.0(0)		Daabied ~			
19.9 💠 🏃 59.7 A							
With Midpoint Monitoring (All three precharge / battery sense wires must be installed)							
State Of Charge							
SoC Support Limit (Generator Start SoC for Off Grid)							
50 🗘 1.7 kWh Support Battery Capacity							
Inverter Shutdown SoC							
25 🗘 🌾 3.8 kWh Extra Backup Battery Capacity							

Figure 2. Site Configuration Wizard and SP LINK Application

All values and parameters assume an operating temperature of 25 °C.

SP-LINK - Inverter

ile <u>Connection</u> Perfor te Information Configuration S	_		w Service Settings	L	Disconnected 00	00:00	[
Configuration File 🗐								D's Configuratio ure SP PRO
Nuick Start Unit Application* Solar Hybrid (On Grid)	v	Powerchain F Disabled	Man Battery Typ		AC Source Power (0.1 - 15.0 kW) 6.0 Q	SoC Control	Battery Capa [20 - 60000 AF 300 \$	
teeffer Stellery' Diaget Econo Priver Sere Mode Econo Mode Dialebiot (s. 50 M) 10 (g) Econo Transition Level (s. 50 M) 10 (g) Econo Patel Period (0.2 · 1 s) 0.5 (g)	Inverter Out Nominal / [210 - 240 1	put VC Voltage	C Studient PCB / Utage" Bottery 02: Load" [396 - 52.8 V] Battery 102: Load" [396 - 52.8 V] Estery 102: Load" [36 - 52.8 V] Estery 102: Load" [45 - 55.2 V] 51.2 [↓	ta' Srutta Epaneton Card Wee Soc Stadown Disabled ↓ Shutdown SoC (0:100 %) 40(\$)	g usgam			

Figure 3. Inverter Settings

Setting	AES LiFePO ₄ 42-48-6650	AES RACKMOUNT 48-48-5120 / 48-48-5120H			
Quick Start					
BatteryType	Lithium LiFePO4	Lithium LiFePO4			
Battery Capacity	130 Ah x the number of batteries	100 Ah x the number of batteries			
Inverter					
DC Shutdown • Battery 0% Load	 When setting the DC Shutdown consider what is set for the Ger These settings should not be th 10% SoC apart. For example, if is 50.2 V (20% SoC), set the Ger or more. 48.0 V (0% SOC) 49.5 V (10% SOC) 50.2 V (20% SOC) 	nerator Start SoC. ne same and should be at least DC Shutdown Battery 0% Load			
Battery 100% Load	46.0 V				
Recovery Voltage	51.2 V				
Shutdown SoC	Recommended value varies, depending on the type of installation.				
	For example, when off grid with Shutdown SOC such as 20%. If configured, 10%.	h no generator, set a higher an automatic start generator is			

e <u>C</u> onnection Performanc Information Configuration Setting onfiguration File Junk Start Unit Application"		 Service Settings 		Disconnected 00:00	00	
onfiguration File 🗐	gs Quick View Data View	v Service Settings				
luick Start						
luick Start						Get SP PRO's Configuration
						Configure SP PRO
	Powerchain Pl	lan Battery Type	•	AC Source Power	SoC Control	Battery Capacity*
Solar Hybrid (On Grid)	V Disabled	 Lithium LiFePO 	4 ~ (16 cells)	6.0 ÷ kW	Enabled V	300 💠 15.3 kWh
(0000000)						
verter* Battery* Charger* AC S Limits AC	Source" Solar Hybrid Cont Coupled Trip	BMS Charger Adjustment	Battery	Mid Point	SoC Setting	Over Temp. Protection
	Coupled Trip*	Float Voltage Adjust	Periodic Equalise	Monitoring	Peukert's Exponent*	
	3.0 - 72.0 V]	[-20.0 - 0.0 %]	Disabled ~	Disabled V	[1.00 - 1.50]	[35 - 70 °C]
55.2 🜩	60.0 🖨	0.0 🖨	Equalise Period*		1.02	÷ 55 ÷
	ver Target Charge	Current Target Scale	[2 - 100 d]	Mid Point Range		Limit Rate*
	oltage Trip*	[90.0 - 100.0 %]	100 🗘	5.\$		[0 - 20 %]
57.4 🖨	2.0	100.0 🜩	Periodic Recharge*	Equalise Request		20 🔤
Battery Alert Clear*			Enabled ~	Equalise request		
54.0 - 68.4 V] Ov 56.4 Cu	rer Target Charge ment Trip*			Eugoso v		
J0.4 💌 [0.0	0 - 25.0 %]		Recharge Period* [2 - 100 d]			
	2.0 🜩		14			
Tri	ip Delay*		L Lotor			
[0.2	2 - 20.0 s)		Soft Battery			
	2.0 😌		Disabled ~			

Figure 4. Battery Settings

All values and parameters assume an operating temperature of 25 °C.

Setting	AES LiFePO ₄ 42-48-6650	AES RACKMOUNT 48-48-5120 / 48-48-5120H
Battery		
Max Charge Voltage	55.2 V	55.2 V
Hi Battery Alert Voltage	57.6 V	57.6 V
Hi Battery Alert Clear Voltage	56.8 V	56.8 V
Periodic Recharge	7 to 14 days	7 to 14 days
Peukert's Exponent	1.02	1.02
Limit Charge Above °C	45 °C	50 °C
Limit Rate %	20%	20%

SP LINK - Charger

Nuick Start Unit Application*	Po	werchain Plan	Battery Type*				Configure SP PRO
Jnit Application*	Po	werchain Plan	Pattern Torne				
olar Hybrid (On Grid)			battery type	1	AC Source Power [0.1 - 15.0 kW]		lattery Capacity* 20 - 60000 Ab]
	✓ Dis	sabled \checkmark	Lithium LiFePO4	4 ~ (16 cels)	6.0 🔹 kW 🕓	Enabled	300 🜲 15.3 kWh
erter" Battery" Charger" AC S	Source" Sol	ar Hybrid Control System*	Inputs / Outputs*	Shunts Expansion Card Wir	ring Diagram		
arge Settings Inti	al Stage	Bulk Stage		Absorption Stage	Absorb-Roat Transition	Float Stage	Equalse Stage
	itage*	Voltage*		Voltage*	Net Change	Voltage*	Voltage*
s % of Battery Capacity) [48 .0 - 200.0 %]	0 - 62.4 V]	[48.0 - 62.4 55.2 -	4 V] 55.2 🚔	[48.0 - 62.4 V] 55.2 📤	(as % of Battery Capacity) [0.1 - 5.0 %]	[48.0 - 62.4 V] 55.2 4	[48.0 - 64.8 V] 55.2 4
95 0 1 295 0 4	ment	55.2 Current*	55.2	Current*	1.0 -		Current*
itial Return Voltage* (as	**************************************		ax Chrg Current)	(as % of Max Chrg Current) [1 - 100 %]	Change Time* [1 - 240 min]	Current (as % of Max Chrg Current) [1 - 100 %]	(as % of Max Chrg Curren [1 - 100 %]
52.9 🜲	100 0 285	5.0 A 100 🜩	285.0 A	10 🜩 28.5 A	60 🕀	20 🜩 57.0 A	1 🗘 2.9 A
[1-99%]	240 min]	Time* [1 - 240 mir			Max Time" [1 - 240 min]	Long Term Voltage* [48.0 - 62.4 V]	Time* [0.1 - 24.0 hours]
95 🚖		45 🚭	30 🜩		60 🜩	55.2 🜩	0.1
			n] 30 🌩				[0.1 - 24.0 hours]

Figure 5. Charger Settings

All values and parameters assume an operating temperature of 25 °C.

Setting	AES LiFePO ₄ 42-48-6650	AES RACKMOUNT 48-48-5120 / 48-48-5120H					
Charger							
Charger Settings							
Max Charge Current	130 A x the number of batteries	95 A x the number of batteries					
Initial Return Voltage	52.9 V	52.9 V					
Initial Return SoC	95%	95%					
Initial Stage	·						
Voltage	55.2 V	55.2 V					
Current	100%	100%					
• Time	45 minutes	45 minutes					
Bulk Stage							
Voltage	55.2 V	55.2 V					
Current	100%	100%					
• Time	30 minutes	30 minutes					
Absorption Stage	·						
Voltage	55.2 V	55.2 V					
Current	10%	10%					
Absorb - FloatTransition	ו						
Net Change	1%	1%					
ChangeTime	60 minutes	60 minutes					
• MaxTime	60 minutes	60 minutes					

Setting	AES LiFePO4 42-48-6650	AES RACKMOUNT 48-48-5120 / 48-48-5120H					
Float Stage							
Voltage	55.2 V	55.2 V					
Current	Keep default value	Keep default value					
 Long Term Float Voltage 	55.2 V	55.2 V					
Equalise Stage							
Voltage	55.2 V	55.2 V					
Current	1%	1%					
• Time	0.1 hours	0.1 hours					
Battery Temperature Compensation	Not applicable	Not applicable					

NOTE

- If a DC Solar Charge Controller is used with a SP PRO, there can be some conflicts when charging due to cable impedances. In some instances the displayed SoC on the SP PRO may not reach 100%. If the DC Solar Charge Controller is the main charging source, you may need to set the DC Solar Charge Controller 0.3 V greater than the SP PRO.
- The SP PRO inverter may default the SOC to 85% if the DC power supply is suddenly interrupted (e.g. BMS protection). Either reset the SOC via the Service setting or charge the batteries all the way to float mode prior to discharge.
- Set at least a 10% difference between the DC Shutdown 0% Load and Generator Start SoC.

Example:

- DC Shutdown 0% Load = 50.2V (20% SoC)
- SoC Start = 30% SoC