Manual

PROAUTARCH

BATTERY SYSTEM

24-1800-25	24-2100-25	24-2100-60
	48-2200-15	

24V / 48V Lithium-Ionen Energy storage module with BMS

Generation 4

Content

1. Product description

All modules of type PBS VV-KKKK-AA are stackable lithium energy storage modules. Depending on the setup, different system voltages of 24, 48, or 96 VDC can be realized. Every module is built inside a 19'' rack housing with 2 height units (2U) so that it can be easily mounted inside a 19'' rack. The nominal voltage of a module of type PBS 24-KKKK-AA is 21.6 V and type PBS-48-KKKK-AA is 46.8 V. Depending on setup the ProAutarch Battery System is able to provide different voltages, currents, wattages and discharge times. The modules are equipped with a battery management system (BMS) for monitoring of the system parameters. It is capable of deactivating the module to guarantee lifetime and maximizing safety.

2. Warranty Note

The module shall not be stored more than 2 months without power supply. In case of longer storing times, the module may become deep-discharged so that it is not usable anymore.

In that case, the warranty is getting invalid!

3. Technical data of a single module

PBS Modell	**24-1800-25 Gen4**	**24-2100-25 Gen4**	**24-2100-60 Gen4**	**48-2200-15 Gen4**
Technology	Lithium Ion	Lithium Ion	Lithium Ion	Lithium Ion
System voltage	24 VDC	24 VDC	24 VDC	48 VDC
Nominal voltage	21,6 V	21,6 V	21,6 V	47,5 V
Nominal capacity	2,2 kWh	2,4 kWh	2,4 kWh	2,9 kWh
Effective capacity at 25 °C	1,8 kWh	2,1 kWh	2,1 kWh	2,2 kWh
Discharge voltage range	25,2 - 21,0 V (min. 20,5 V)	25,2 - 21,0 V (min. 20,5 V)	25,2 - 21,0 V (min. 20,5 V)	54,6 - 45,0 V (44,5 V)
Charging voltage	25,2 V	25,2 V	25,2 V	54,6 V
Float voltage	25,0 V	25,0 V	25,0 V	54,2 V
Compensation voltage	25,1 V	25,1 V	25,1 V	54,4 V
Max continuous charging current	25 A	25 A	60 A	15 A
Max peak charging current for 30 seconds	30 A	30 A	90 A	20 A
Recommended cont. charging current for max cycle life	20 A	22 A	22 A	11 A
Max continuous discharging current	25 A	25 A	60 A	15 A
Max peak discharging current for 30 seconds	30 A	30 A	90 A	20 A
Max power at low voltage	500 Watt	500 Watt	1200 Watt	675 Watt
Max power for 30 seconds	600 Watt	600 Watt	1800 Watt	900 Watt
Recommended cont. power for max cycle life	410 Watt	450 Watt	450 Watt	500 Watt
Weight	18,4 kg	18,4 kg	18,4 kg	19,2 kg

<u>Identical parameters for all modules</u>

Temperature range for charging and discharging	5-50 °C	Enclosure	19" casing, 2U, steel, alloy
Battery management system (BMS)	Yes	Stackable without rack	up to 5 modules
Active balancing	Yes	Dimensions width x depth x height in cm	44 x 36 x 8,8
Protective functions (voltage/current/short circuit)	Yes	Dimensions incl. front cover, feet, terminals and handles in cm	49 x 39,5 x 9,2
Temperature sensor integrated	3 pcs	Life expectancy as solar energy storage at 25C until 50% cap	10 years
Interfaces	no	Life expect. as emergency power storage at 25C until 50% cap	10 years

4. Technical details of a setup with several modules

Total effective capacity (kWh)	No. of modules	PBS Model	Setup	System-voltage	Max. continuous discharging current	Min. power of discharging inverter	Charging voltage	Charging current	Min. wiring specification for max. length of 2 m
1.8	1	24-1800-25	single	24 VDC	25 A	550 W	25.2 V	20 A	8 AWG / 10 mm²
3.6	2	24-1800-25	parallel (2P)	24 VDC	50 A	1100 W	25.2 V	40 A	4 AWG / 25 mm²
3.6	2	24-1800-25	series (2S)	48 VDC	25 A	1100 W	50.4 V	20 A	8 AWG / 10 mm²
5.4	3	24-1800-25	parallel (3P)	24 VDC	75 A	1650 W	25.2 V	60 A	4 AWG / 25 mm²
7.2	4	24-1800-25	parallel (4P)	24 VDC	100 A	2200 W	25.2 V	80 A	2 AWG / 35 mm²
7.2	4	24-1800-25	2P2S	48 VDC	50 A	2200 W	50.4 V	40 A	4 AWG / 25 mm²
9.0	5	24-1800-25	parallel (5P)	24 VDC	125 A	2750 W	25.2 V	100 A	1 AWG / 42 mm²
10.8	6	24-1800-25	3P2S	48 VDC	75 A	3300 W	50.4 V	60 A	4 AWG / 25 mm²
14.4	8	24-1800-25	4P2S	48 VDC	100 A	4400 W	50.4 V	80 A	2 AWG / 35 mm²
18.0	10	24-1800-25	5P2S	48 VDC	125 A	5500 W	50.4 V	100 A	1 AWG / 42 mm²
2.1	1	24-2100-25	single	24 VDC	25 A	550 W	25.2 V	22 A	8 AWG / 10 mm²
4.2	2	24-2100-25	parallel (2P)	24 VDC	50 A	1100 W	25.2 V	44 A	4 AWG / 25 mm²
4.2	2	24-2100-25	series (2S)	48 VDC	25 A	1100 W	50.4 V	22 A	8 AWG / 10 mm²
6.3	3	24-2100-25	parallel (3P)	24 VDC	75 A	1650 W	25.2 V	66 A	2 AWG / 35 mm²
8.4	4	24-2100-25	parallel (4P)	24 VDC	100 A	2200 W	25.2 V	88 A	2 AWG / 35 mm²
8.4	4	24-2100-25	2P2S	48 VDC	50 A	2200 W	50.4 V	44 A	4 AWG / 25 mm²
10.5	5	24-2100-25	parallel (5P)	24 VDC	125 A	2750 W	25.2 V	110 A	1 AWG / 42 mm²
12.6	6	24-2100-25	3P2S	48 VDC	75 A	3300 W	50.4 V	66 A	2 AWG / 35 mm²
16.8	8	24-2100-25	4P2S	48 VDC	100 A	4400 W	50.4 V	88 A	2 AWG / 35 mm²
21.0	10	24-2100-25	5P2S	48 VDC	125 A	5500 W	50.4 V	110 A	1 AWG / 42 mm²
2.1	1	24-2100-60	single	24 VDC	60 A	1800 W	25.2 V	22 A	8 AWG / 10 mm²
4.2	2	24-2100-60	parallel (2P)	24 VDC	120 A	3600 W	25.2 V	44 A	4 AWG / 25 mm²
4.2	2	24-2100-60	series (2S)	48 VDC	60 A	3600 W	50.4 V	22 A	8 AWG / 10 mm²
6.3	3	24-2100-60	parallel (3P)	24 VDC	180 A	5400 W	25.2 V	66 A	2 AWG / 35 mm²
8.4	4	24-2100-60	parallel (4P)	24 VDC	240 A	7200 W	25.2 V	88 A	2 AWG / 35 mm²
8.4	4	24-2100-60	2P2S	48 VDC	120 A	7200 W	50.4 V	44 A	4 AWG / 25 mm²
10.5	5	24-2100-60	parallel (5P)	24 VDC	300 A	9000 W	25.2 V	110 A	1 AWG / 42 mm²
12.6	6	24-2100-60	3P2S	48 VDC	180 A	10800 W	50.4 V	66 A	2 AWG / 35 mm²
16.8	8	24-2100-60	4P2S	48 VDC	240 A	14400 W	50.4 V	88 A	2 AWG / 35 mm²
21.0	10	24-2100-60	5P2S	48 VDC	300 A	18000 W	50.4 V	110 A	1 AWG / 42 mm²
2.2	1	48-2200-15	single	48 VDC	20 A	1100 W	54.6 V	11 A	8 AWG / 10 mm²
4.4	2	48-2200-15	parallel (2P)	48 VDC	40 A	2200 W	54.6 V	22 A	8 AWG / 10 mm²
4.4	2	48-2200-15	series (2S)	96 VDC	20 A	2200 W	109.2 V	11 A	8 AWG / 10 mm²
6.6	3	48-2200-15	parallel (3P)	48 VDC	60 A	3300 W	54.6 V	33 A	6 AWG / 16 mm²
8.8	4	48-2200-15	parallel (4P)	48 VDC	80 A	4400 W	54.6 V	44 A	4 AWG / 25 mm²
8.8	4	48-2200-15	2P2S	96 VDC	40 A	4400 W	109.2 V	22 A	8 AWG / 10 mm²
11.0	5	48-2200-15	parallel (5P)	48 VDC	100 A	5500 W	54.6 V	55 A	4 AWG / 25 mm²
13.2	6	48-2200-15	3P2S	96 VDC	60 A	6600 W	109.2 V	33 A	6 AWG / 16 mm²
16.0	8	48-2200-15	4P2S	96 VDC	80 A	8800 W	109.2 V	44 A	4 AWG / 25 mm²
22.0	10	48-2200-15	5P2S	96 VDC	100 A	11000 W	109.2 V	55 A	4 AWG / 25 mm²

5. Before commissioning

After transporting the module, leave it to stand in a warm, dry place for at least 12 hours to allow any condensate that may have formed inside to evaporate. Pay attention to the LCD display. The batteries are legally required to be shipped with a low charge. The right display for the battery voltage should therefore be between 20.5 V and 21 V resp. 45.0 V and 47.0 V on delivery. The left meter for current should read 0 A. If the display shows other values, please contact the customer service of EnStoreTech GmbH and do NOT put the module into operation. Do not press the top button. This is only used to set up the display at the factory and shall not be changed.

If the left display is reading some small current of ±0.1 A without module connection, the display may be recalibrated by pressing the lower button of the display for 3 seconds while having the main switch of the module turned off. The reading of the display will be nulled.

6. Turning on and off the LCD display light

In order to be able to read the battery data well in the dark, the module is equipped with background lighting. Switch them on by briefly (below one second) pressing the lower button on the display. Press the button two times shortly to switch off the display again.

7. Setting up the modules

If the module is to be set up individually or stacked, please glue the rubber feet supplied to the underside of the module.

Place the module on a horizontal, flat, stable surface. The module must not wobble.

If you use several modules, you can stack them on top of each other. To do this, glue the rubber feet supplied under each module. You can stack up to four modules on top of each other. Never stack more than 4 modules on top of each other without a rack. Do not wire them directly, always use a fuse.

Do not use the modules without installing suitable DC fuses.

8. Rack mounting of the modules

The modules are prepared for installation in standard 19-inch rack cabinets with minimum depth of 45 cm. Due to the weight, rails are required for assembly. These are available as accessory for rack cabinets and sold separately. Please install the rails securely before mounting the modules.

When mounting the modules inside a rack cabinet, the rubber feet are not needed.

Suitable racks cabinets can also be purchased at www.proautarch.de.

The front plate is not eligible to carry the weight of the module. Weight rails must be used when rack mounted.

9. Commissioning a single module

Before you start wiring, make sure that the modules are switched off at the main switch. Only use suitable connecting cables. You may find guidance on cables in section 4. Suitable cables can also be purchased at www.proautarch.de.

Please, do not connect the modules directly to the inverter or charger. A DC-Fuse needs to be installed in between the module and the inverter/charger to limit the maximum current according to section 4.

DANGER!

Use a DC-Fuse in between the module and the inverter/charger

Please hire a professional electrical installation company, if assistance is needed-.

10. Commissioning of up to 5 modules in parallel

Up to 5 modules of the same capacity and voltage can be connected in parallel setups in order to achieve the desired system capacity charging and discharging currents. In section 4, possible setups and the corresponding wiring specifications are summarized. Suitable cables can also be purchased at www.proautarch.de.

DANGER!

Do not use too small wiring. You risk inflaming & fire.

Before you connect modules in parallel, make sure that they have the same voltage in advance, e.g. by discharging or charging all of them independently to the same voltage. If the voltage differs by more than 0.3V, the modules must not be connected in parallel without prior equalization.

DANGER!

Do not connect modules that differ more than 0.3 Volt

Before you start wiring, make sure that the modules are switched off at the main switch.

11. Commissioning up to 10 modules in series and parallel

Two modules of the same model can be connected in series to realize 48 V or 96 V setups. Then, the setups may be connected in parallel In order to achieve the desired system capacity charging and discharging currents. In section 4, possible setups and the corresponding wiring specifications are summarized. Suitable cables can also be purchased at www.proautarch.de.

DANGER!

Do not use too small wiring. You risk inflaming & fire.

Before you connect modules in series, make sure that they have the same voltage in advance, e.g. by discharging or charging all of them independently to the same voltage. If the voltage differs by more than 0.3V, the modules must not be connected in parallel without prior equalization.

DANGER!

Do not connect modules that differ more than 0.3 Volt

Before you start wiring, make sure that the modules are switched off at the main switch.

12. Conditions for reaching the maximum cycle life

Each module is made up of high-quality, individually tested, selected and refurbished lithium-ion batteries connected in a 40P6S setup for 24 VDC respectively 20P13S setup for 48 VDC. Life cycle will depend on number of cycles, depth of discharge, maximum discharging currents and temperatures while charging. For a maximum life time, the modules should not be charged by more than the recommended charging current specified in the section 3 and 4. In addition, it should not be discharged lower than 20.5 V respectively 44.5 V.

This way, 10 years of use as a solar energy storage system or as an emergency power storage, with 200 cycles per year can be achieved until the capacity may fall below 50% of the original capacity,

13. Active Battery Management System (active BMS)

An active BMS is installed with automatic cell voltage difference compensation to avoid cell drift during continuous operation. The BMS has the following safety functions:

PBS Modell	24-1800-25 Gen4	24-2100-25 Gen4	24-2100-60 Gen4	48-2200-15 Gen4
Automatic discharging interruption at	20,3 V	20,3 V	20,3 V	44,2 V
Recommended external discharging voltage	21,0 V	21,0 V	21,0 V	45,5 V
Automatic charging interruption at	25,2 V	25,2 V	25,2 V	54,6V
Active balancing at charging voltage above	24,0 V	24,0 V	24,0 V	52,0 V
Compensation voltage	25,1 V	25,1 V	25,1 V	54,4 V
Recommended duration at compensation voltage (per month)	4 hours	4,5 hours	4,5 hours	6 hours
Recommended current limit during balancing	1,5 A	1,5 A	4,5 A	0,8 A
Short-circuit protection	yes	yes	yes	yes
Automatic over-temperature protection at	60 °C	60 °C	60 °C	60 °C
Automatic under-temperature protection at	5 °C	6 °C	7 °C	10 °C
Wait time after automatic interruption	30 Sec.	30 Sec.	30 Sec.	30 Sec.

During interruption wait time the module will be disconnected from the load even when the main switch is „on”.

14. Casing

The casing consists of sheet metal with an aluminum front plate. The main switch is used to disconnect the load for commissioning and decommissioning. A LCD display permanently shows all relevant battery values for each module. The M8 terminals may carry up to three cable lugs. Weight and dimensions are summarized in section 3.

15. Return of used modules

Used or unused battery modules must not be disposed in the trash. You can return your modules free of charge to the EnStoreTech GmbH. To do this, please contact customer service.
The shipment of batteries is restricted by regulations. Therefore, please keep the original packaging for a possible return to comply with these regulations.

16. Manufacturer data and contact information

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