

Elecnova



Liquid-cooled Battery PACK

ECO-P1P52LS Specifications

Shanghai Elecnova Energy Storage Co., Ltd.

Table of Contents

1	Definition of Terms	3
2	Application Scope	4
3	Normative References	4
4	Test Conditions	4
5	Product Introduction	4
6	Identification, Packaging, Transportation and Storage Requirements	7
7	Application Conditions	7
8	Precautions	8
9	Other Provisions	9

1 Definition of Terms

Elecnova	Shanghai Elecnova Energy Storage Co., Ltd.
Customer	The purchaser of battery energy storage system
Product	The Liquid cooled Battery PACK, ECO-P1P52LS
Cell	The basic unit that realizes the conversion between chemical energy and electrical energy, consisting of positive electrode, negative electrode, separator, electrolyte, shell, and terminals.
PACK	A battery combination which is composed of battery cells connected in series, parallel, or series-parallel, with only one pair of positive and negative output terminals, and should also include shell, management components, and protection components.
New PACK status	The status of PACK within 15 days (for domestic transportation only) after being received by the customer and with less than 5 charging/discharging cycles.
BMS	Battery Management System: A device that detects the voltage, current, temperature and other parameter information of battery, and manages and controls the status of battery.
BMU	Module level unit of BMS: the slave control module of BMS. BMU is responsible for the acquisition of voltage and temperature of battery cells within the PACK, as well as cell balancing management.
BCU	Cluster level unit of BMS: BCU provides real-time monitoring, fault diagnosis, SOC/SOH estimation, insulation detection, display alarm and remote monitoring of battery cluster parameters, and communicates with the BMU to upload real-time battery data.
Nominal voltage	Appropriate voltage approximation for marking or identifying a battery or an electrochemical system.
Charging rate	The ratio of charging power to the energy value of the product measured for multiple times by BMS. For example, if the energy capacity of the product is 896Wh and the charging power is 448W, then the charging rate will be 0.5P; if the energy capacity of the product is degraded to 627.2Wh and the charging power is 313.6W, then the charging rate will be 0.5P.
Discharging rate	The ratio of discharging power to the energy value of the product measured for multiple times by BMS. For example, if the energy capacity of the product is 896Wh and the discharging power is 448W, then the discharging rate will be 0.5P; if the energy capacity of the product is degraded to 627.2Wh and the discharging power is 313.6W, then the discharging rate will be 0.5P.
Standard charging	Charging the product at room temperature (25±2)°C with a constant power of 0.5P till the voltage of any cell in the PACK rises to DC 3.65V, and then keep still for 30 minutes.
Standard discharge	Discharging the product at room temperature (25±2)°C with a constant power of 0.5P till the voltage of any cell in the PACK rises to DC 2.5V, and then keep still for 30 minutes.
Cycle	A cycle means that the battery is fully charged and fully discharged once according to the prescribed standards.
Measurement unit	Voltage unit: "V" (Volt) Current unit: "A" (Ampere) Power unit: "W" (Watt) Capacity unit: "Ah" (Ampere-Hour) Energy unit: "Wh" (Watt-Hour) Internal resistance unit: "mΩ" (milliOhm) Temperature unit: "°C" (degree Celsius) Length unit: "mm" (millimeter) Time unit: "s" (second) Frequency unit: "Hz" (Hertz) Mass unit: "kg" (kilogram) Force unit: "N" (Newton)

2 Application Scope

The Specification sets forth the detailed technical scheme, transportation, packaging and storage requirements, and precautions for PACK ECO-P1P52LS.

The product specifications, performance and parameters in the Specification are for the customer's preliminary reference only. Elecnova has the right to modify these technical specifications. For specific contract, the specifications may change according to mutual agreement.

3 Normative References

The following documents are essential for the application of this Document. For dated references, only the dated version applies to this Document. For undated references, the latest version (including all amendments) applies to this Document.

GB/T 36276 Lithium-ion batteries for electric energy storage

GB/T 34131 Technical specifications for lithium-ion BMS for electrochemical energy storage power stations

GB/T 4208 Degrees of ingress protection provided by enclosures (IP code)

4 Test Conditions

Unless otherwise specified, the parameters of the product are the parameters of the new PACK and the test object is the battery module of the new PACK (except for the self-discharging test). Unless otherwise specified, the experiments and measurements shall be carried out at room temperature (25 ± 2 °C) and standard humidity (55 ± 20 %).

4.1 Measurement Equipment and Accuracy

- 1) Current measurement accuracy: ≥ 0.5 class.
- 2) Voltage measurement accuracy: ≥ 0.5 class.
- 3) Temperature measurement accuracy: ± 0.5 °C.
- 4) Time measurement accuracy: $\pm 0.1\%$ S.
- 5) Dimensional measurement accuracy: $\pm 0.1\%$ mm.
- 6) Weight measurement accuracy: ± 0.1 kg.

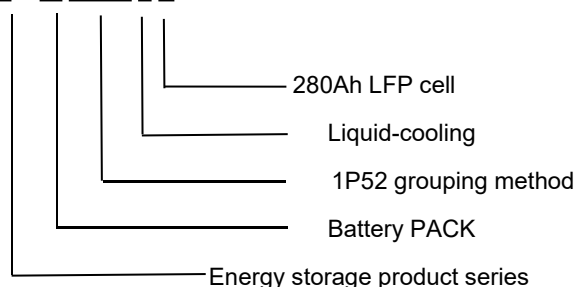
4.2 Charging/Discharging Mode

Unless otherwise specified, it refers to standard charging/discharging mode.

5 Product Introduction

This product is composed of 52 units of LFP cells in 1524S grouping, with high energy density, wide temperature range, long service life, and high safety. The cell is square aluminum-shell lithium-iron phosphate cell, and the entire PACK consists of battery cells, CCS, end plates, steel ties, MSD, shell, liquid cooling plate, acquisition harness and BMU. It adopts a modular design, so as to facilitate handling, installation and maintenance.

Product Model: ECO - P 1P52 L S



5.1 PACK

The PACK adopts 3.2V/280Ah LFP cell 1P52S design. Each PACK is composed of four units of 1P13S modules in series, 166.4V/280Ah for each pack, with total energy of 46.59kWh. In addition, it is internally equipped with

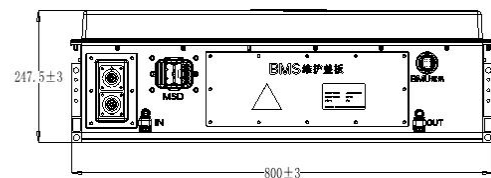
acquisition harness and BMU, which are used to acquire voltage data and temperature data of cells. The cooling method is liquid cooling.

The technical parameters of PACK are based on the measurement results of new battery cells, measured at room temperature (25 ± 2)°C and humidity (55 ± 20)%.

Cell & PACK parameters are shown in the table below:

Item	Parameter	Condition
PACK Model	ECO-P1P52LS	N.A.
Cell type & capacity	LFP, 280Ah	Standard charging and discharging
PACK grouping mode	1P52S	N.A.
PACK nominal voltage	DC 166.4V	Standard charging and discharging
PACK nominal energy	46.59kWh	Standard charging and discharging
PACK dimensions (W*D*H)	800*1135*247.5mm	See drawings
PACK Weight	Approximately 342kg	Including connecting copper bars
Operating voltage range	2.5V-3.65V (cell)	$T > 0^{\circ}\text{C}$
Maximum continuous charging/discharging current	196A (0.7P)	$(25\pm 2)^{\circ}\text{C}$, 50%SOC, for 30 seconds
Rated charging/discharging current	140A (0.5P)	$(25\pm 2)^{\circ}\text{C}$
Operating temperature range	Discharging: -20 to 55°C	Temperature of cell
	Charging: $0\sim 55^{\circ}\text{C}$	
Storage conditions	$-20\sim 45^{\circ}\text{C}$, 95% RH, no condensing	Short-term storage (1 month)
Positive and negative pole leading terminals	Direct plug	N.A.
Communication methods	CAN	N.A.
Shipping SOC	30%-50%	$(25\pm 2)^{\circ}\text{C}$
Warranty operating conditions	$(25\pm 2)^{\circ}\text{C}$	N.A.
Ingress Protection level	IP65	N.A.
Cooling method and coolant	Liquid cooling with 50% glycol	N.A.

5.2 Dimensions

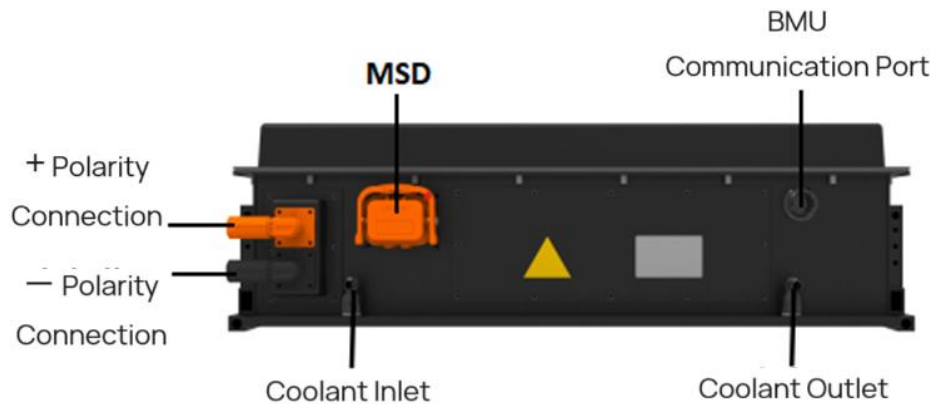


External Dimensions of Product (mm)		
Width	Depth	Height
800	1135	247.5

5.3 Front Panel Layout of PACK

The interfaces on front panel of PACK include the positive/negative pole interfaces, coolant inlet/outlet, MSD and BMU communication interface.

The layout of the interfaces is as follows:



PACK front panel Layout

5.4 Data Acquisition Module

The battery PACK is equipped with an acquisition module (BMU) of slave control. The BMU acquires cell voltage and temperature signals and transmit signals to the battery main control unit of cluster-level (BCU). The BMU also executes the battery equalization control commands issued by the BCU to ensure safety and reliability of PACK.

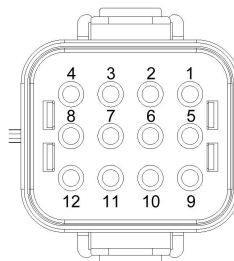
5.4.1 Technical Parameters

No.	Item	Parameters	Notes
1	Supply voltage of BMU (V)	9-32	24V by default
2	Communication mode	CAN	/
3	Sampling range of cell voltage (V)	0-5	/
4	Sampling precision of cell voltage (mV)	±3.0	/
5	Sampling range of cell temperature (°C)	-40 to 125	/
6	Sampling precision of cell temperature (°C)	±1	±1°C@-25°C to 65°C ±2°C@-40°C to -25°C or 65°C-125°C
7	Equalization type	100	Passive equalization

5.4.2 Interface Definition

BMU communication harness plug model: USCM012-P02_A

Plug spring model: USCT000-054



Harness Interface Definitions

Fire Protection Communication			BMU Communication		
No.	Pin	Definition	No.	Pin	Definition
1	12Pin-1	External power supply 4V+	1	12Pin-1	External power supply 2V+
2	12Pin-2	External power supply 4V-	2	12Pin-2	External power supply 2V-

3	12Pin-3	CAN2H	3	12Pin-3	Address encoding line IO1
4	12Pin-4	CAN2L	4	12Pin-4	CANOH
5	12Pin-5	Encoded outgoing	5	12Pin-5	CANOL
6	12Pin-6	/	6	12Pin-6	/
7	12Pin-7	/	7	12Pin-7	External power supply 2V+
8	12Pin-8	/	8	12Pin-8	External power supply 2V-
9	12Pin-9	/	9	12Pin-9	Address encoding line IO2
10	12Pin-10	/	10	12Pin-10	CANOH
11	12Pin-11	Encoded in-coming	11	12Pin-11	CANOL
12	12Pin-12	/	12	12Pin-12	/

6 Identification, Packaging, Transportation and Storage Requirements

- 1) The specifications of package box and packing shall be agreed upon by Customer and Elecnova. If no specification is agreed, the standards of Elecnova shall apply.
- 2) The shipment report shall contain information of dimensions, weight and voltage data of product
- 3) For storage, the PACK shall be placed in a well-ventilated, waterproofing, corrosion-resistant and dustproofing warehouse with $RH \leq 75\%$ and the ambient temperature being within -20 to 45°C (short-term storage for 1 month) and the SOC shall be maintained at 30-50%.
- 4) The package shall be marked, such as "Handle with Care", "Waterproof", "No Upside Down", "Stackable Layers" etc.
- 5) During transportation, the package shall be handled with care and protected against collisions and impacts, and shall not be placed together with corrosive substances such as acids and alkalis.
- 6) Battery PACK is not allowed to stay tilted or collapsed during transportation or storage.

7 Application Conditions

The customer shall ensure that the following application conditions related to the product are complied with:

- 1) The product shall be used according to their batches. PACK of different batches shall not be mixed.
- 2) The customer shall complete the inbound inspection within 15 days after receiving the product, with reference to the inspection conditions agreed upon by both parties.
- 3) Operating temperature range: Charging: $0-50^{\circ}\text{C}$; Discharging: -20 to 55°C .
- 4) Short-term storage temperature range (within 1 month): -20 to 45°C .
- 5) Altitude: $\leq 2000\text{m}$.
- 6) Relative humidity: $\leq 95\%\text{RH}$.
- 7) Pollution level: Level II and below.
- 8) To conduct auxiliary design evaluation on the system, Customer shall provide Elecnova detailed information on the characteristics, framework, data and format of BMS to. The auxiliary design evaluation is a non-mandatory task for Elecnova and the evaluation conclusions and suggestions need to be comprehensively considered by the customer. If the customer fails to adopt Elecnova's evaluation suggestions, Elecnova shall not be held liable for any quality or safety problem arising therefrom; In order to avoid affecting the performance of PACK, the customer shall not modify the design and framework of BMS without authorization; Otherwise, Elecnova shall be exempted from liability for problems or quality accident arising therefrom.
- 9) Customer shall keep and provide complete operation data of cells to verify liabilities for quality claim; Otherwise, Elecnova shall be exempted from liability of quality issues.
- 10) BMS shall meet the following basic detection and control requirements:
 - (1) Cell voltage sampling accuracy error $\leq 5\text{mv}$.
 - (2) SOC estimation error $\leq 5\%$.
 - (3) SOH accuracy error ≤ 8 .

- (4) Current sampling accuracy $\leq \pm 0.5\%$.
- (5) Temperature sampling accuracy $\pm 1^\circ\text{C}$.
- (6) Recommended protection parameter setting for BMS:

Items	Protection Parameters	Protection Measures	Remarks
Single cell charging protection voltage (V)	3.65	Stop charging	
Single cell discharging protection voltage (V)	2.5	Stop discharging	
System charging protection voltage (V)	3.65V*N	Stop charging	N for number of PACKs in a string
System discharging protection voltage (V)	2.5V*N	Stop discharging	N for number of PACKs in a string
High temperature protection for battery charging ($^\circ\text{C}$)	50	Stop charging and enhance heat dissipation	Details as per Cell Specifications
High temperature protection for battery discharging ($^\circ\text{C}$)	55	Stop discharging and enhance heat dissipation	Details as per Cell Specifications
Low temperature protection for battery charging ($^\circ\text{C}$)	0	Stop charging and activate heating function	Details as per Cell Specifications
Low temperature protection for battery discharging ($^\circ\text{C}$)	-20	Stop discharging and activate heating function	Details as per Cell Specifications

Note: PACK operating parameter limits are listed in above table. When a cell voltage or temperature reaches any of above limits, protection measures for the cell shall be taken in accordance with the "Protection Measures" and other relevant provisions of Specifications. In addition, Elecnova declares that Elecnova does not assume any warranty liability of product which operates beyond above limits. Elecnova shall be exempted from compensation for any loss thus incurred.

- 11) BMS shall meet the following basic detection and control requirements:

The product shall be protected against running in over-discharging status. When a cell voltage is lower than 2.0V, the product may be permanently damaged and Elecnova's quality warranty may be therefore invalidated. When the cut-off voltage of a cell is lower than 2.5V, the battery shall be recharged in soonest time to protect the product against over-discharging.

- 12) The battery management system shall meet the following basic detection and control requirements:

The battery module SOC during storage shall be maintained within 30%-50%. If the PACK is to be kept in storage for 1 month up to 3 months, one cycle of charge and discharge shall be performed in the first month till the SOC is adjusted to 30%-50%. If the SOC of the PACK is beyond 30%-50% or if the PACK is stored for more than 3 months without charging/discharging cycle, Elecnova shall not be held liable for any capacity loss or other losses thus incurred to the PACK.

8 Precautions

- 1) It is prohibited to immerse the product in water.
- 2) Improper use and storage of the product pose a risk of fire, explosion, and burns; do not disassemble, crush, incinerate, or heat the product, otherwise, explosion or fire may occur.
- 3) It is prohibited to put the product into fire or expose it to high temperature exceeding the temperature conditions specified in these Technical Specification for a long time; otherwise, fire may occur. Under any normal usage, the temperature of the battery cells inside the module may not exceed 55°C . If the temperature exceeds 55°C , the product shall be shut down.
- 4) Keep the product out of reach of children and do not remove the original packaging before use. Dispose of end-of-life product in a timely manner in accordance with local recycling or waste regulations.
- 5) Do not disassemble, dismantle or repair the product in any way without authorization.
- 6) Do not use this product together with any product of different specifications, brand or batch.
- 7) If the product emits an odor, heats up, deformed, discolored, or showing any other abnormality, do not use it, but transfer it to a safe location.
- 8) Connect the positive and negative poles of the product in strictly accordance with the markings and instructions. Incorrect electrical connection methods may cause short circuit, which may cause fatal current with very high

temperature, leading to immediate personal injury or fire. Sufficient safety measures shall always be taken during assembling and connection of battery system.

9) It is prohibited to overcharge/over-discharge batteries to avoid overheating of battery cells thus to avoid a fire accident. During installation and use of the product, it is necessary to implement multiple charging/discharging protections by means of hardware and software.

10) Improper termination of charging may occur during the charging process. If the allowed charging time is exceeded, the charging may be terminated by the too high charging voltage or the too strong charging current. The above incident is defined as "inappropriate termination of charging". When such incident occurs, it may indicate that there is current leakage in the battery system or some components are malfunctioning. Continuing to charge the product without identifying and thoroughly resolving the problem may lead to overheating of battery cells thus lead to fire.

11) The product shall be fixed on a solid surface with cables securely connected and tied up so as to avoid friction that may cause arcs and sparks.

12) When the electrolyte leaks, prevent contact the electrolyte with skin or eyes. In case of contact, please flush the affected area with plenty of water and seek immediate medical help. No one or animal is allowed to swallow any part of the product.

13) The product shall be protected from mechanical vibrations, collisions, and pressure impacts during use; otherwise, there may be short circuit inside the product, and thus high temperature or fire may occur. The product poses potential hazards of fire therefore protective measures must be taken during operation and maintenance; improper operation during safety performance test may cause the battery cells to catch fire or explode. The safety test shall be conducted by professionals equipped with protective equipment in specialized laboratories only; otherwise, serious personal injury and property damage may occur. Failure to follow the above warnings may lead to various disasters.

14) The customer and its employees should be aware of the following potential hazards during the use and operation of the product: The operator may be injured by chemicals, electric shocks, or electric arcs during operation; Though the human body's response to direct current and alternating current is different, the DC voltage above 36V can cause harm to the human body as serious as AC voltage. Therefore, the customer must adopt a conservative posture during operation, so as to avoid the harm caused by electric current. The customer and its employees must consider the potential risks mentioned above during operation and always wear personal protective equipment (PPE) to prevent accidental short circuits as well as arcs, explosions, or thermal runaway arising therefrom.

15) The service life of battery cells is limited. When the internal resistance of any single battery cell in use exceeds 200% of the initial internal resistance or its capacity is less than or equal to 70% of the nominal capacity, the customer shall stop using this product; otherwise, Elecnova shall not be held liable for any parameter discrepancy, quality problem, battery cell failure or loss arising therefrom.

9 Other Provisions

1) When technical support from Elecnova is required during installation and use of the product, Elecnova can provide services and technical support. For any problem caused by use of the product in violation of the contents of the Specification, Elecnova can provide technical guidance, but does not undertake to provide free replacement services.

2) The customer shall use the product in strict accordance with the contents of the Specification, and the customer shall ensure that the users of the product use the product in accordance with the contents of the Specification; otherwise, Elecnova shall not be held liable for any parameter discrepancy, quality problem, battery cell failure or loss arising therefrom.

3) The customer has a confidentiality obligation regarding the contents of the Specification, and shall not disclose such contents to any third party without authorization. The confidentiality agreement signed by both parties shall apply.

4) Without written consent of Elecnova, the customer, product users and any related parties shall not synthesize, separate, modify the technical scheme of the product under any circumstances, and shall not probe or reverse-engineer the product.

5) Elecnova reserves the right to modify the specifications and performance parameters of the product. Before placing an order for any Elecnova product, the latest specifications and performance parameters shall be mutually confirmed by both parties.

6) If the product samples are in the development stage, they are for testing purposes only. The specific testing items shall be determined by both parties through negotiation. It is prohibited to sell such samples to any third party without authorization.

7) In case of the improper use of the product by the customer, any product user, or any related party causes negative social impact, which results in loss of Elecnova's reputation, the customer, and/or product user, and/or the related party shall compensate Elecnova for the losses thus incurred.

8) Other issues such as commodity inspections, warranty terms, after-sales services and technical services are subject to agreement by both parties.

9) In case of any inconsistency between this Technical Specification and other relevant documents, Elecnova's final decision prevails.

(END)