TAB
Li-Ion batteries

TAB e.module L5.1

Li-ion Energy Storage System

Operation Manual
Bedienungsanleitung
Manual de instrucciones
Istruzioni Operative
Manual de Operações
Navodila za uporabo

www.tab.si

Contents

This manual introduces e.module L5.1 from TAB. Please read this manual before using and follow the instruction carefully during the installation process. Any confusion, please contact TAB for advice and clarification.

1. Symbols on labels, in the manual and on the products

	Caution! Warning! Reminding. Safety related information. Risk of battery system failure or life cycle reduces.
	Do not reverse the positive and negative connection.
	Do not place near open flame.
	Do not place at the children touchable area.
	Warning electric shock.
	Warning Fire. Do not place near flammable material.
	Read the operation manual before operating the battery system.
	Grounding.
	Recycle label.
	The certificate label for CE.

	Label for Waste Electrical and Electronic Equipment (WEEE) Directive (2012/19/EU).
	The certificate label for Safety by SIQ

2. Safety precautions

Reminding

1. It is important and necessary to read the operation manual carefully before installing or using battery. Failure to do so or to follow any of the instructions or warnings in this document can result in electrical shock, serious injury, or death, or can damage battery, potentially rendering it inoperable.
2. If the battery is stored for a long time, it is required to perform one full cycle (charging and discharging) every 6 months.
3. Battery needs to be recharged within 12 hours after fully discharged.
4. Do not install the product in outdoor environment, or an environment out of the operation temperature or humidity range listed in manual.
5. Do not expose cable outside.
6. Do not connect power terminal reversely.
7. All the battery terminals must be disconnected for maintenance.
8. Please contact the supplier within 24 hours if there is something abnormal.
9. Do not use cleaning solvents to clean battery.
10. Do not expose battery to flammable or harsh chemicals or vapors.
11. Do not paint any part of battery, including any internal or external components.
12. Do not connect battery with PV solar wiring directly.
13. Do not insert any foreign objects into any part of the battery.
14. The warranty claims are excluded for direct or indirect damage due to written above.

Warning

2.1 Before connecting

1. After unpacking, please check product and packing list first. If product is damaged or lack of parts, please contact with the retailer.
2. Before installation, be sure to cut off the grid power and make sure the battery is in the turned-off mode.
3. Wiring must be correct, do not mistake the positive and negative cables and ensure no short circuit with the external device.
4. It is prohibited to connect the battery and AC power directly.
5. The embedded BMS in the battery is designed for 51.2 V DC. Please DO NOT connect battery in series.
6. Battery must be connected to the ground and the resistance must be less than 0.1Ω.
7. Please ensured the electrical parameters of battery system are compatible to related equipment.
8. Keep the battery away from water and fire.

2.2 In using

1. If the battery system needs to be moved or repaired, the power must be cut off and the battery must be completely shutdown.
2. It is prohibited to connect the battery with different type of battery.
3. It is prohibited to connect batteries with faulty or incompatible inverter.
4. It is prohibited to disassemble the battery (QC tab removed or damaged).
5. In case of fire, dry powder fire extinguisher or vast amount of water can be used.
6. Please do not open, repair or disassemble the battery except staffs from TAB or authorized by TAB. We assume no liability or responsibility for any damage caused by violation of the safety, design, production and equipment safety conditions.

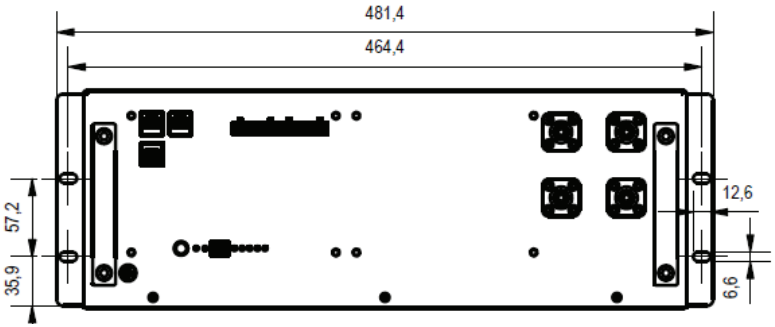
3. Introduction

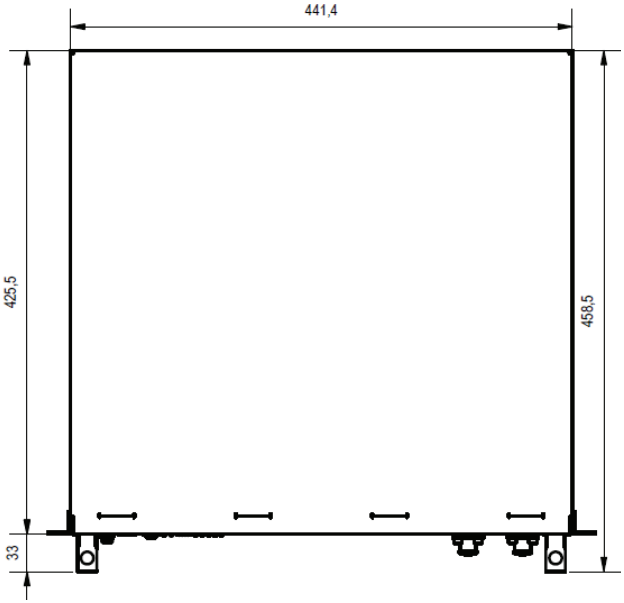
e.module L5.1 lithium iron phosphate battery is the new energy storage product developed and produced under TAB's quality requirements. It can be used to support reliable high power supply for various types of equipment and systems.

3.1 Features

1. Built-in soft-start function is able to reduce current strike when inverter needs to start from battery.
2. Active protection on BMS level.
3. Automatic address setting when connect in parallel.
4. Enable 97% depth of discharge. Available for the inverter which completely follow TAB latest protocol to operate.
5. The module is non-toxic, non-pollution and environmentally friendly.
6. Cathode material is made from LiFePO4 with safety performance and long cycle life.
7. Battery management system (BMS) has protection functions including overdischarge, overcharge, overcurrent and high/low temperature.
8. The system can automatically manage charge and discharge state and balance voltage of each cell.
9. Flexible configuration. Multiple battery modules can be in parallel for expanding capacity and power.
10. Adopted self-cooling mode rapidly reduced system entire noise.
11. The module has less self-discharge, up to 6 months without charging it on shelf, no memory effect, excellent performance of shallow charge and discharge.
12. Small size and light weight, standard of 19-inch embedded designed module is comfortable for installation and maintenance.

3.2 Specification





TAB e.module L5.1 (TAB Nr.: 1026194)

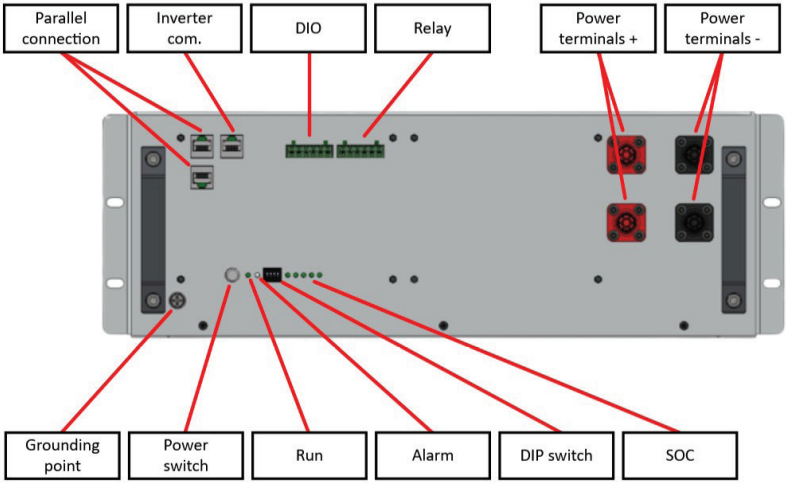
Basic Parameters	**L5.1**
Nominal Voltage (Vdc)	51.2
Nominal Capacity (Wh)	5120
Depth of Discharge (%)	97
Discharge Voltage (Vdc)	44.8
Charge Voltage (Vdc)	56.8
Charge/Discharge Current (A)	75 (recommended continuous)
	100 (maximum continuous) *
	200 (peak@15s)
Communication Port	CAN, RS485
Dimension (WxDxH, mm)	442x459x160
Weight (kg)	47.5
Working Temperature (°C)	0 ~ 45
Storage Temperature (°C)	-30 ~ 45 (up to 1 month)
	-20 ~ 35 (up to 6 months) **
Humidity (%)	20 ~ 95 (no condensation)
Altitude (m)	<3000
IP Rating of Enclosure	IP20
Certification	CE / IEC 62619 / IEC 61000 / IEC 63056 / UN 38.3

*The maximum continuous current for the battery is considered at a temperature of 10 ~ 35°C. Outside this temperature range, the current will be lower.

**It is required to perform one full cycle (charging and discharging) every 6 months.

3.3 Front panel

L5.1 Front Panel



Start (POWER)

Turn on: press the button for 1 s to start the battery.

Turn off: press the button for 1 s to turn off the battery.

Run (RUN)

Green LED lighting shows the battery running status.

Alarm (ALM)

Red LED flashing shows the battery has alarm; lighting shows the battery is under protection.

Warning: In case of a warning ALM LED starts blinking yellow.

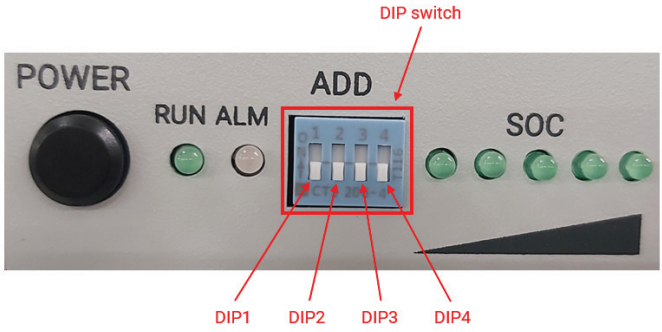
Alarm: In case of an alarm ALM LED starts blinking red. The module disconnects itself from the system, other modules in a string continue working.

Critical Alarm: In case of a critical error all LEDs start blinking. Color LED starts blinking red. The whole system stops operating for safety reasons.

State of Charge (SOC)

LEDs to show the battery's current capacity.

DIP Switch (ADD)



DIP1: /

DIP2: /

DIP3: Standalone mode. Battery is working without connected inverter.

DIP4: CAN terminal resistance on BMS side. 1: None. 0: Connected. After change no restart required.

The first and last module in the string have DIP4 set to 1, the other modules have DIP4 set to 0. If there is only 1 module, DIP4 is set to 1.

Contacts

DIO	Pin 1	Ground for DI/DO	GND ISO
	Pin 2	VDD for DI/DO	VDD ISO
	Pin 3	Not defined	DO1
	Pin 4	Not defined	DO2
	Pin 5	Not defined	DI1
	Pin 6	Not defined	DI2
Relay	Pin 1	Low SOC Signal – Relay switches on when SOC drops below 15%.	Relay 1 COM
	Pin 2		Relay 1 NO
	Pin 3		Relay 1 NC
	Pin 4	Charge Enabled – Relay switches on when charging is enabled.	Relay 2 COM
	Pin 5		Relay 2 NO
	Pin 6		Relay 2 NC

CAN

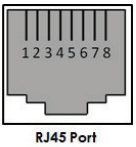
500 Kbps. Recommended 120 Ω. Connection to an inverter or another battery.

Link Port A, B

For communication between multiple parallel batteries.

Definition of RJ45 Port Pin

COM Port	Usage
Pin 1	Not used
Pin 2	Not used
Pin 3	GND
Pin 4	Not used
Pin 5	Not used
Pin 6	Not used
Pin 7	CAN-High
Pin 8	CAN-Low



RJ45 Port

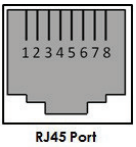
RJ45 Plug

Link Port COM

For communication between battery system and inverter.

Definition of RJ45 Port Pin

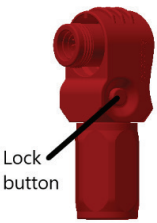
COM Port	Usage
Pin 1	Not used
Pin 2	GND
Pin 3	Not used
Pin 4	CAN-High
Pin 5	CAN-Low
Pin 6	Not used
Pin 7	RS485_A
Pin 8	RS485_B



RJ45 Port

RJ45 Plug

Power Terminals



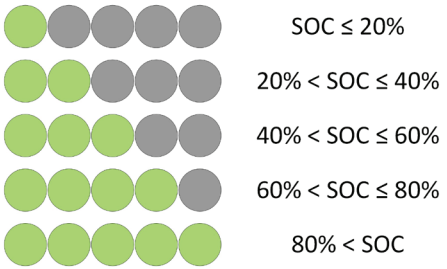
Power cable terminals: there are two pair of terminals with same function, one connects to equipment, the other one paralleling to other battery module for capacity expanding.

For power cables uses self-locked connectors. Must keep pressing this Lock Button while pulling out the power plug.

- Cable connector RED: Amphenol SLPPA25BSR (TAB No.: 3014686)
- Cable connector BLACK: Amphenol SLPPA25BSB (TAB No.: 3014687)

LED Status Indicators

Condition	RUN	ALR	1	2	3	4	5
Power off	-	-	-	-	-	-	-
Power on	-	-	Show Power on Animation				
Idle/Normal	-	-	Show SOC				
Charge	●	-	Show SOC; LED is blinking				
Discharge	●	-	Show SOC				
Warning	●	●	Show SOC				
Alarm	-	●	Turned OFF				
Critical Alarm	-	Blink with RED	Blink with LEDs, 400ms period				
Shutdown	-	-	Show Shutdown Animation				

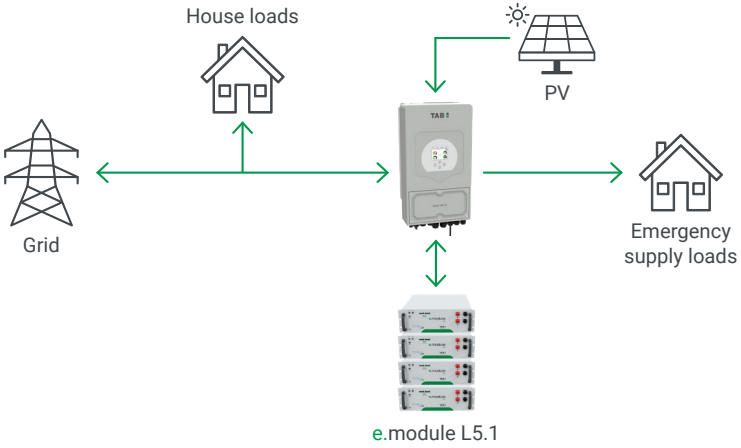


BMS Basic Function

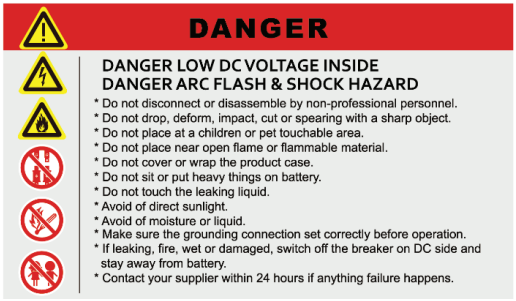
Protection and alarm	Management and monitor
Charge/Discharge End	Cells Balance
Charge Over Voltage	Intelligent Charge Model
Discharge Under Voltage	Charge/Discharge Current Limit
Charge/Discharge Over Current	Capacity Retention Calculate
High/Low Temperature (cell/BMS)	Administrator Monitor
Short Circuit	Operation Record
	Power Cable Reverse
	Soft Start Of Inverter

4. Safe handling of lithium batteries

4.1 Schematic diagram of solution



4.2 Danger label



4.3 Tools

The following tools are required to install battery system.

insulated cross-head screwdriver

insulated fork wrench No. 13

insulated fork wrench No. 10

NOTE

Use properly insulated tools to prevent accidental electric shock or short circuits.

If insulated tools are not available, cover the entire exposed metal surfaces of the available tools, except their tips, with electrical tape.

4.4 Safety Gear

It is recommended to wear the following safety gear when dealing with installing e.storage.

Insulated gloves

Safety goggles

Safety shoes

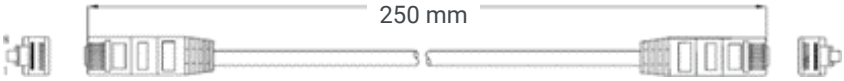
Installation can only be performed by a trained electrician!

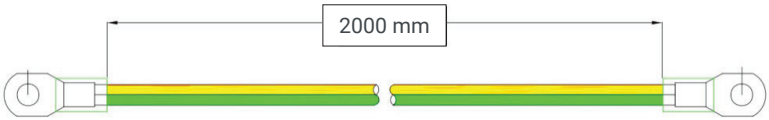
5. Installation and operation

5.1 Cables

CABLE KIT LONG E.MODULE L5.1 (TAB Nr.: 3014870)

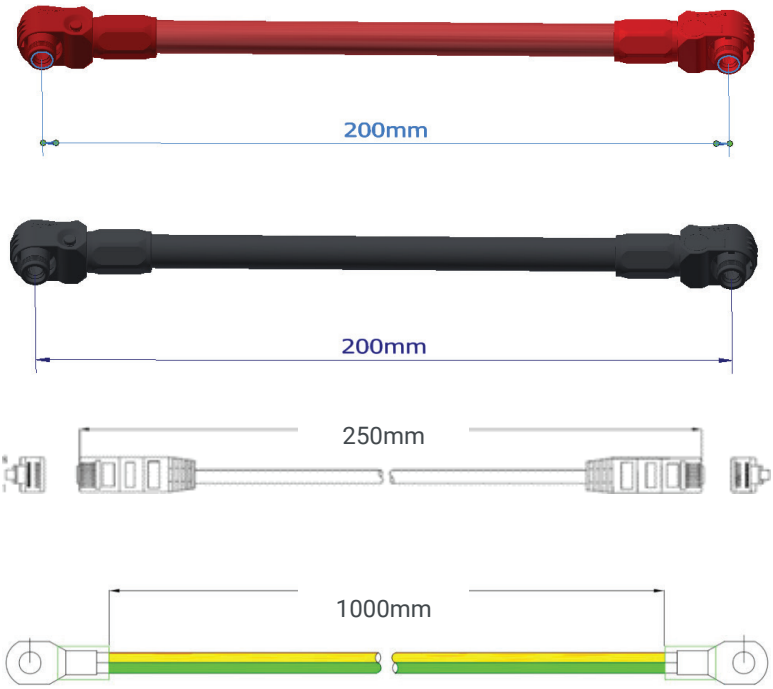
- 2 * power cable (25 mm², 2000 mm, M8)
- 1 * communication cable (RJ45, 250 mm)
- 1 * grounding cable (6 mm², 2000 mm, M6)





CABLE KIT SHORT E.MODULE L5.1 (TAB Nr.: 3014867)

- 2 * power cable (25mm², 200mm)
- 1 * communication cable (RJ45, 250 mm)
- 1 * grounding cable (6 mm², 1000 mm, M6)



5.2 Installation location

Make sure that the installation location meets the following conditions:

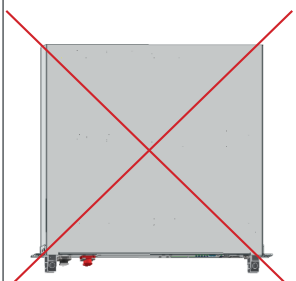
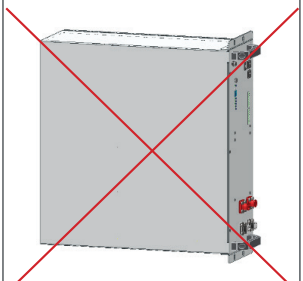
1. The area is completely dry.
2. The floor is flat and level.
3. There are no flammable or explosive materials.
4. The ambient temperature is within the range from 0°C to 45°C.
5. The temperature and humidity are maintained at a constant level.
6. There is minimal dust and dirt in the area.
7. The distance from heat source is more than 2 meters.
8. The distance from air outlet of inverter is more than 0.5 meters.
9. The installation areas shall avoid of direct sunlight.
10. There is no mandatory ventilation requirements for battery module, but please avoid of installation in confined area. The aeration shall avoid of high salinity, humidity or temperature.

Caution

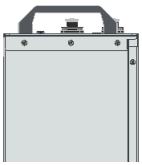
If the ambient temperature is out of the operating range, the battery stops operating to protect itself. The optimal temperature range for the battery pack to operate is 10°C to 35°C. Frequent exposure to harsh temperatures may reduce the performance and life of the battery.

5.3 Installation direction

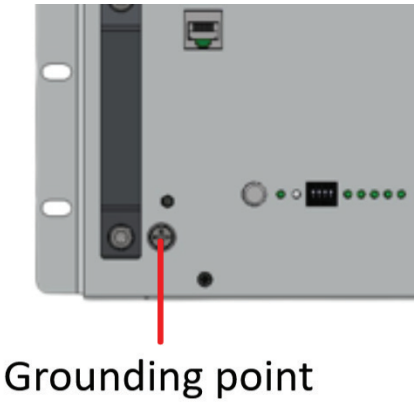
NOT allowed:

Upside down	Sidelong	Sidelong
		

Recommended:

A			Caution: Do not stack modules together directly.
B			Caution: Make sure there is a holder for more than 50 kg of weight at the bottom of each module.
			Installed only on two handles is NOT allowed.

5.4 Grounding



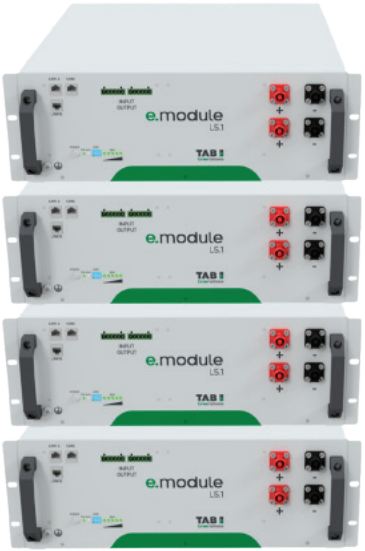
Grounding cables shall be 6mm² or higher yellow-green cables. After connection, the resistance from battery grounding point to ground connection point of room or installed place shall be smaller than 0.1Ω.

1. Based on metal directly touch between the module's surface and rack's surface. If using painted rack, the corresponding place shall remove the painting.

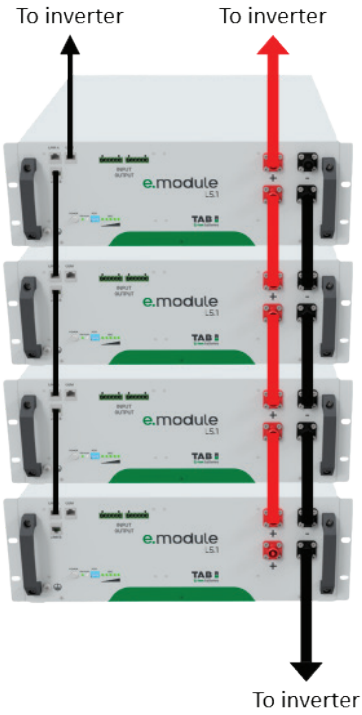
2. Install a grounding cable to the grounding point of the modules.

5.5 Putting modules into cabinet or rack

Put battery modules into cabinet and connect the cables:



1. Put the batteries into the cabinet.
2. Tighten the 4 pcs screws.
3. Connect the power cables between battery modules.
4. Connect the power cables to inverter. In the case of a parallel connection, the power cable + should go from the first battery, while the power cable - should go from the last battery. This ensures that all batteries are equally loaded.
5. Insert the communication cables. Cables run from the Link B connector to the Link A connector.
6. Communication with the inverter is connected to the COM port.



Caution

1. Follow local electric safety and installation policy, a suitable disconnection device between battery system and inverter could be required.
2. All the installation and operation must follow local electric standard.

5.6 Suitable disconnection device

It is required to have a disconnection device for protection between battery system and inverter:

1. The rated voltage shall be ≥ 60V DC. Do NOT use AC fuse.
2. The rated current shall match with system design:

shall consider:

- the maximum DC current on inverter side,
- the number of power cables: for instance, if only one pair of 25mm² cable, the rated current of fuse shall be 125A or smaller.

3. If using breaker, the type shall be type C (recommended) or type D. The Icu required:
   The maximum short circuit current for calculation of each module is 6500A. For instance:

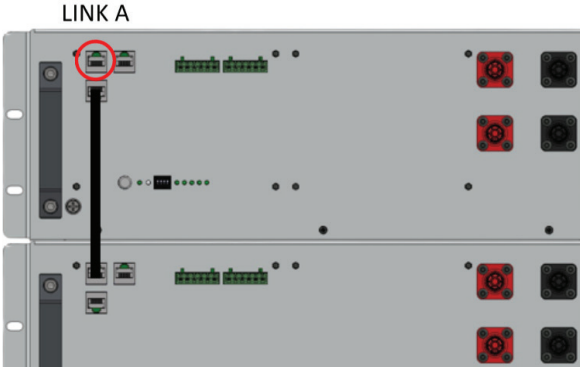
Nr. of modules	Icu of breaker
1~2 modules	Must ≥ 15kA
3~8 modules	Must ≥ 20kA

5.7 Power on

Double check all the power cables and communication cables between batteries and between battery and inverter. Switch ON the disconnection device between battery and inverter if available.

For e.module L5.1:

1. The module with **empty LINK A** is the **Master Battery Module**, others are slaves. (1 master modul configure with maximum 31 slave modules):



2. Press the black **SW button of master battery** to turn on the system. The master module will turn on first, then the rest of the batteries will turn on automatically, one by one. **Do not press the SW button on the slave modules.**

Note:

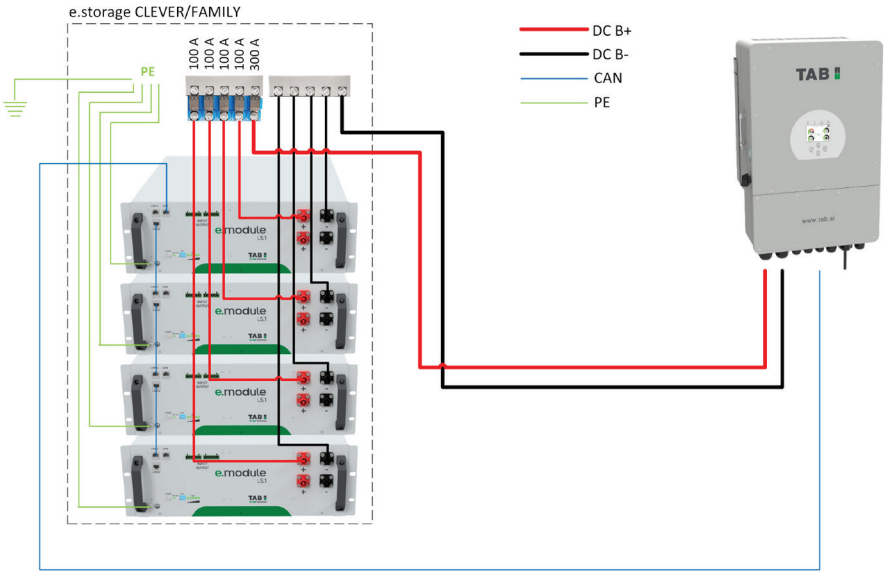
1. After the battery module is powered on, the soft-start function takes few seconds to active. After soft-start, the RUN LED is on and the battery is ready to output high power.
2. During capacity expansion or replacement, when parallel different SOC/ voltage of modules together, it is recommended to maintain the system in idle for ≥15mins or till the SOC LEDs becomes similar (≤1 green LED difference) before normal operation.

When the batteries are connected to the inverter for the first time and the system is powered on, it is required to charge the batteries for at least 48 hours to allow the cells to balance properly.

5.8 Shutdown

1. Turn external power source off.
2. Press black SW button of the master battery. Then all other batteries will power off automatically.
3. Switch off the disconnection device between battery system and inverter, if available and disconnect power cables.

5.9 Connection of the e.storage CLEVER/FAMILY



Disconnection devices for protection between the battery system and the inverter are already included and are mounted in the cabinet. Fuses for battery modules have a rated current of 100 A. The rated current of the fuses for the inverter depends on the power of the inverter. A 300 A fuse is installed by default. Always check the **required fuse size** for the inverter being used.

1. Ground all modules. There are pre-prepared screws in the cabinets for grounding. They are located on the side of the cabinet. The size of the screws is M6. Recommended torque: 8 Nm (M6 nut)
   1.1 Ground the cabinet door.
2. Connect e.storage CLEVER/FAMILY cabinet to external grounding.
3. Connect the battery modules.
   - connect DC B+ cables to the provided fuses (100 A)
   - connect DC B- cables to the negative busbar
   - connect the communication cables

All cables must be the same length.

Use an insulated torque wrench to avoid shorting the battery.
The size of the screw on the connectors: M8
Recommended torque: 12 Nm (M8 nut)

4. Connect the battery system to the inverter.

Recommended cross section.

6 kW	8 kW	10 kW	12 kW
50 mm²	50 mm²	70 mm²	70 mm²

The length of external cables must be less than 2 meters and must be of the same length.

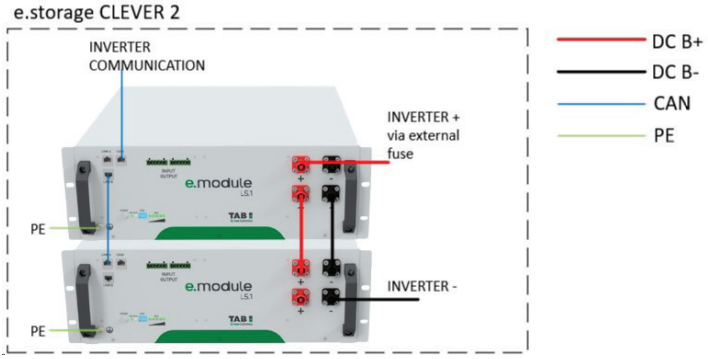
Connect the cable DC B+ to the provided fuse (300 A or required fuse size), while connect the DC B- cable to the common busbar.

Use an insulated torque wrench to avoid shorting the battery.
The size of the screw on the connectors: M8
Recommended torque: 12 Nm (M8 nut)

Please refer to the inverter Operating Manual for the appropriate cable lugs for the inverter connection screws.

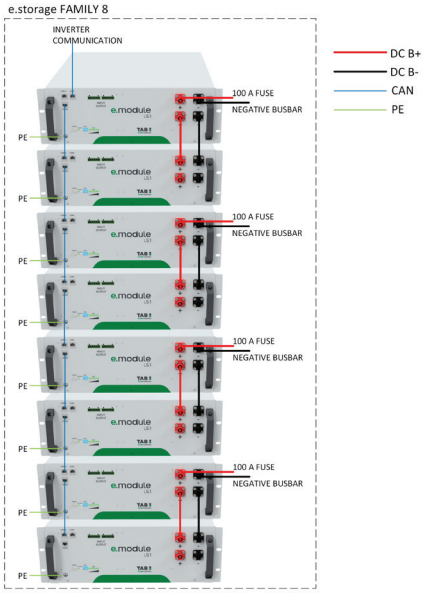
5. Connect the communication cables between the battery system and the inverter.

5.9.1 Connection of e.storage CLEVER 2



The cabinet does not have built-in busbars, so we connect the battery directly to the inverter. An external fuse must be used on the positive connection.

5.9.2 Connection of e.storage FAMILY 8



2 modules are connected in parallel and then connect to the busbars.

6. Video instructions

Video instructions are available showing the installation of e.storage and the connection to the inverter.

You can find the instructions on the websites below or scan the QR code.

6.1 Installation of e.storage

https://www.youtube.com/watch?v=hkGIBZD0bqY

6.2 Connection to the inverter

https://www.youtube.com/watch?v=RNkBmKfE2Sk

7. Emergency situations

1. **Leaking Batteries**
   If the battery pack leaks electrolyte, avoid contact with the leaking liquid or gas. If one is exposed to the leaked substance, immediately perform the actions described below.
   a.) Inhalation: Evacuate the contaminated area and seek medical attention.
   b.) Contact with eyes: Rinse eyes with flowing water for 15 minutes and seek medical attention.
   c.) Contact with skin: Wash the affected area thoroughly with soap and water and seek medical attention.
   d.) Ingestion: Induce vomiting and seek medical attention.

2. **Fire**
   If detect the battery cell is catching fire, firstly cut off the external power source. Then use vast of water for suppression. After fire suppressed, soaking battery within water and contact TAB or an authorized dealer. If detect the cabling or other components (not battery cell) is catching fire. Firstly, cut off the external power source. Then use dry powder fire or carbon dioxide extinguisher for suppression.

3. **Wet Batteries**
   If the battery pack is wet or submerged in water, do not let people access it, and then contact TAB or an authorized dealer for technical support. Cut off all power switch on inverter side.

4. **Damaged Batteries**
   Damaged batteries are dangerous and must be handled with the utmost care. They are not fit for use and may pose a danger to people or property. If the battery pack seems to be damaged, pack it in its original container, and then return it to TAB or an authorized dealer.

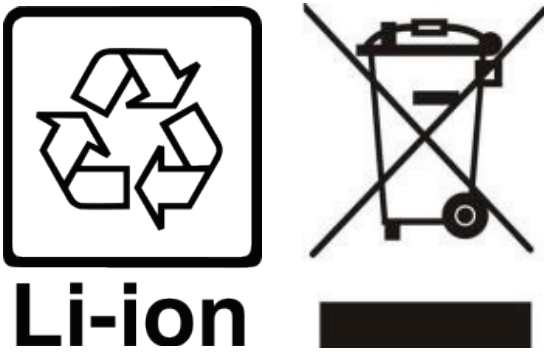
Caution

Damaged batteries may leak electrolyte or produce flammable gas.

8. Remarks

8.1 Recycle and disposal

In case a battery (normal condition or damaged) needs disposal or needs recycling, it shall follow the local recycling regulation (i.e. Regulation (EC) Nº 1013/2006 among European Union) to process and using the best available techniques to achieve a relevant recycling efficiency.



8.2 Storage, maintenance and expansion

1. It is required to perform one full cycle (charging and discharging) every 6 months. For this charge maintenance make sure the SOC is charged to higher than 90%.
2. It is required to charge the batteries to SOC 100% at least once a month to recalibrate the SOC.
3. Every year after installation, the connection of power connector, grounding point, power cable and screws are suggested to be checked. Make sure there is no loose, no broken, no corrosion at connection point. Check the installation environment such as dust, water, insect etc. Make sure it is suitable for IP20 battery system.
4. A new battery module can be add onto an existing system at any time. Please make sure the new battery is acting as the master. The new module, due to a higher SOH may have a difference on SOC with existing system, but it will not affect the parallel connection system performance. It is recommended that the new battery at the time of connection has the same SOC as the existing batteries.