USER MANUAL

PBLH-54R0/166SD02X9

TYPE 54V Module

166F | 54 VDC | ULTRACAPACITOR

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1. OVERVIEW:

The PBLH-54R0/2X9 Ultracapacitor Module is comprised of 18 series-connected 3V, 3000F ultracapacitor cells in a 2×9 configuration for an optimized footprint. Power terminals are conveniently located at the same end of the module to enable easy module-to-module series and parallel connections.

This 54V, 166F module combines a weight-optimized form factor with a durable plastic housing for protection and easy handling. Metal-lined mounting holes at each corner of the base ensure secure, reliable system mounting.

The module features an actively balancing circuitry design with over-voltage alarm and temperature monitoring. Low internal resistance and ample energy density allow the module to meet the energy storage and power delivery requirements of many applications.

For electrical, thermal, and mechanical specifications, refer to the Tecate Group website for full datasheet specifications.

2. UNPACKING:

Prior to unpacking the module, inspect the shipping carton for signs of damage. Damage to the shipping carton or module should be reported to the carrier immediately.

Remove the module from the shipping carton and retain the shipping materials until the unit has been inspected and is determined to be operational.

If a shorting strap is fitted across the positive and negative power terminals for transport safety, leave it in place until the module is ready to be connected to a system.

NOTE: The original shipping materials are approved for both air and ground shipment. The module should be removed from the shipping carton by lifting the body of the module.

3. SAFETY:

- **Do not operate above specified voltage.**
- **Do not operate above specified temperature rating.**
- **Do not touch terminals with conductors while charged. Serious burns, shock, or material fusing may occur.**
- **Protect surrounding electrical components from incidental contact.**
- **Do not attempt to open the module housing.**

4. INSTALLATION:

Mechanical Mounting

The modules can be optionally mounted via the corner mounting holes at the base of each module. Refer to **Figure 1** for mounting hole positions and dimensions. Ensure the modules are mounted in locations well protected from external conditions, including water and dust.

Note: Mounting hardware is not included.

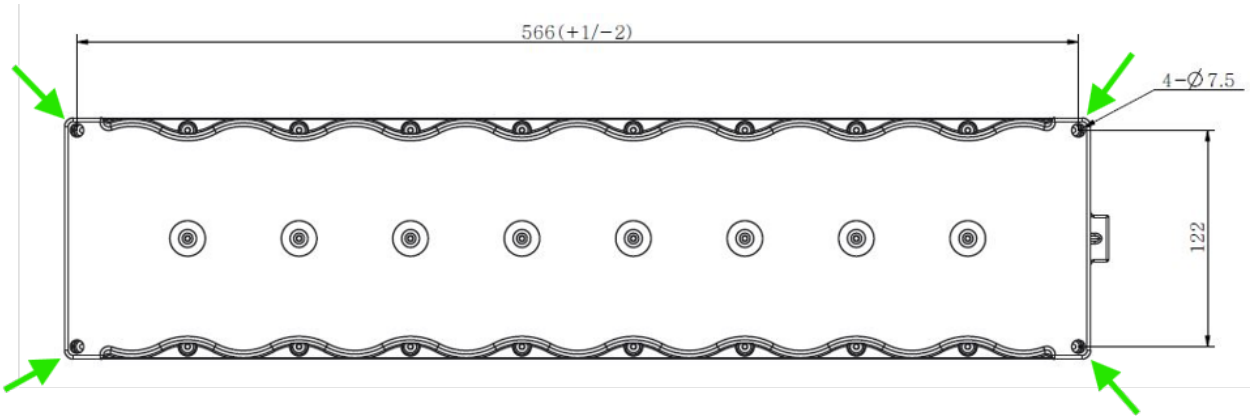

Figure 1. Mounting hole positions and dimensions (mm).

5. MODULE TO MODULE CONNECTIONS:

Ensure every module is discharged to 0V before attempting the electrical connections. Ultracapacitor modules can be configured in series (up to the rated max. series voltage) to achieve higher application operating voltages (see **Figure 2**) and /or in parallel (see **Figure 3**) to support higher system power requirements.

Series Connection:

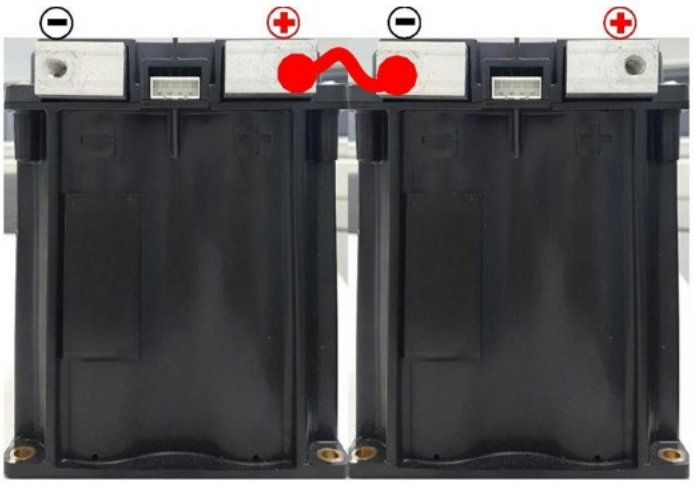

Figure 2: Series connection of PBLH-54R0/2X9 modules

Parallel Connection:

Figure 3: Parallel connection of PBLH-54R0/2X9 modules

6. TERMINAL CONNECTIONS

The PBLH-54R0/166SDO2X9 Ultracapacitor modules are designed to connect directly to an electrical cable ring connector or a bus bar. The positive and negative terminals both have a threaded hole for bolt connections. The module comes equipped with terminal hardware that includes bolts, washers, and a shorting strap. Wave washers are required to ensure long-term, reliable connections.

Terminal hole thread sizes are different: the positive terminal is M8 and the negative terminal is M10. Ultracapacitor modules have very low ESR, which may be adversely impacted by poor mechanical connections with the electrical cable ring connector or bus bar. It is recommended that all module terminal connections be adequately protected to avoid shock hazards and corrosion.

Tightening Instructions:

TORQUE SPECIFICATIONS are NOT the same for the positive and negative terminals and should be applied according to the specifications below.

6.1 Positive Terminal M8 bolt – Torque of 20 N·m.

6.2 Negative Terminal M10 bolt – Torque of 30 N·m.

7. MONITORING OUTPUT CONNECTOR & DIAGRAMS:

Each module is equipped with a 4-pin output connector located between the positive and negative terminals, enabling temperature and over-voltage alarm monitoring signals to the user system.

7.1 Module Front View:

The 4-pin connector is located between the positive and negative terminals, as shown in **Figure 4** below.

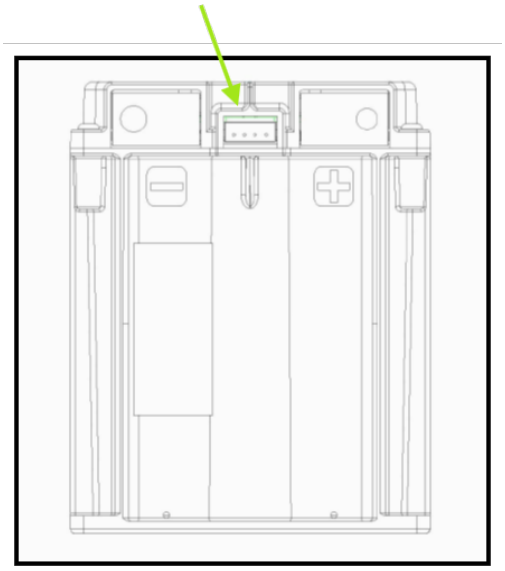

Figure 4. Module front view – output connector location.

7.2 Connector Pin Out:

The monitoring output signals (**See Table 1 for connector pinout**) are isolated from the ultracapacitor voltage and chassis ground. **Figure 5** diagrams the output connector to a typical user receiver circuit. The module is equipped with a PTC (positive temperature coefficient) temperature sensor and an OVA (Over Voltage Alarm) signal. Refer to ***Appendix I** for the PTC resistance to temperature chart and **Section 7.4** for proper OVA operation and recommended connection.

Pin #	Pin Out	Signal
1	Temperature Pin #1	470Ω ± 50% @25℃
2	Temperature. Pin #2	470Ω ± 50% @25℃
3	Over Voltage Alarm	ACTIVE HIGH = No Alarm LOW = Alarm Event
4	Ground	

Table 1. Monitoring Pinout.

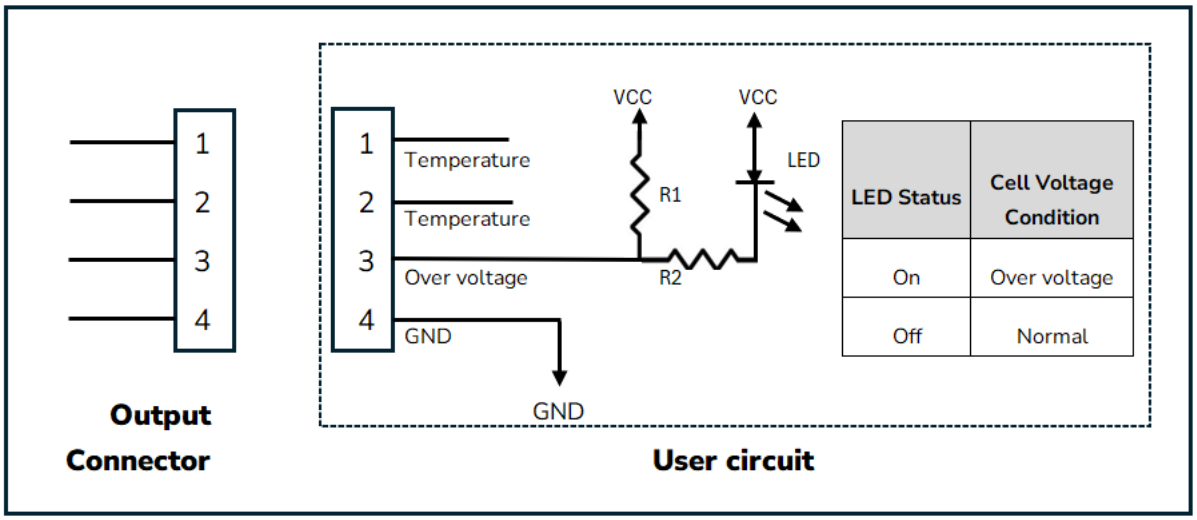

Figure 5. Typical output signal receiver circuit.

7.3 Temperature Pins:

Pins 1 and 2 are connected to a PTC thermistor inside the module for temperature monitoring. The thermistor's resistance reading changes with temperature; a reading of approximately 470 Ω corresponds to an internal module temperature of 25 °C. Please refer to **Appendix I** for the temperatures associated with different resistance levels.

7.4 Over Voltage Alarm (OVA):

This module is designed with dedicated active balanced circuitry. If any single cell in the module exceeds 2.8V, the voltage balancing circuit is activated to discharge the cell.

Alarm Operation: If a cell's voltage continues to rise and crosses the 3.1V threshold, the Over Voltage Alarm is activated, triggering the output of Pin 3 to go LOW. Users should interpret this as an over voltage alarm event and signal the system to stop charging.

Pull-up Resistor: To properly use the Over Voltage Alarm feature, attach a recommended 1kΩ pull-up resistor to Pin 3 and a 5V supply.

7.5 Connector Vendor References:

Item	Lock Wafer Connector (Module Side)	Crimp Terminal Housing (User System Side)	Crimp Terminal (User System Side)
Manufacturer	Hanlim	Hanlim	Hanlim
Part Number	LAB 1143-04	CHB 1143-04	CTB 1140
Alt. Manufacturer	N/A	Molex	Molex
Alt. Part Number	N/A	35156-040	50217

8. MAINTENANCE:

8.1 Power Rating: If the applied voltage exceeds the rated voltage, charging should be stopped immediately. **Discharging the module to 0V has no negative consequences.**

8.2 Temperature: The module's optimal operating temperature range is –40 °C to +65 °C. If the temperature exceeds 70 °C, charging and discharging should be paused until the temperature drops below +65 °C.

8.3 Do Not Expose to Direct Sunlight: Ensure the modules are not exposed to direct sunlight, which will cause the temperature to rise inside the module.

8.4 Projected Life: The module has a projected life of over 10 years at rated voltage and +25 °C. Actual life of the module may be decreased in high-temperature conditions or over-voltage charging.

8.5 Detection of Abnormal Conditions: If abnormal conditions are detected, the system should be shut down to enable a safe evaluation of electrical and mechanical connections. Abnormal conditions to watch for:

1. High temperature exceeding normal operating conditions.
2. Increase in the internal resistance or an increase in the initial voltage drop.
3. Deformation of the module case.

9. APPENDIX I

Temperature [°C]	Resistance [Ω]
0	522
5	500
10	487
15	476
20	469
25	470
30	475
35	480
40	498
45	528
50	574
55	647
60	766
65	987
70	1532
75	3880
80	8934
85	19347
90	36595
95	68392
100	116316
105	189903
110	315151
115	524433
120	813038
125	1288220