

**4. Accessories**

The units will be provided with a 3" long, 4 wire unit-unit balancing cable.

**5. Operation**

Unit should be operated within specified voltage and temperature ratings. Determine whether current limiting is necessary on input/output based on current ratings of ancillary devices.

**6. Safety****CAUTION****DANGER - HIGH CURRENT HAZARD!**

Never touch the power terminals as the module can be charged and cause fatal electrical shocks. Always check that the module is fully discharged before manipulating the module.

The maximum operating voltage for this family of modules has been set to 50V, per UL810a recommendation. Therefore the maximum number of modules that can be connected in series is 3.

A higher operating voltage - up to 350V or max 23 modules in series - can be achieved by implementing additional isolation around the module housing. The recommended integration procedure is described in Figure 6.

- Do not operate unit above recommended voltage.
- Do not operate unit above recommended 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.
- Provide sufficient electrical isolation when working above 50VDC.
- Do not operate on conductive surfaces unless proper insulation is in place for exposed conductors.

**CAUTION**

A fully discharged module may "bounce back" if it is stored without a shorting wire connected to the + and - terminals. Measure terminal voltage and discharge prior to handling.

**7. Maintenance**

Periodically check the main power terminal connections. Re-tighten the terminal screws as necessary. Prior to any handling, ensure energy storage unit is completely discharged. **The stored energy and the voltage levels may be lethal if mishandling occurs.**

**8. Storage**

The module can be stored in the original package discharged in a dry place. Discharge used module prior to stock or shipment. A wire across the terminals may be used to maintain short circuit after having discharged the unit.

**9. Disposal**

Do not dispose of unit in trash. Dispose of according to local regulations.

**10. Specifications**

For specifications see datasheets on our website: [www.tecategroup.com](http://www.tecategroup.com).

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## User Manual for 16.2V Ultracapacitor modules:

- **PBL-25/16.2**
- **PBD-58/16.2K**
- **PBD-58/16.2M**

1. Introduction

The Tecate Group 16.2V energy storage units are available in three models, PBL-25/16.2 (Figure 1), PBD-58/16.2K (Figure 2), and PBD-58/16.2M (Figure 3) with active balancing. All modules are provided with the ultracapacitor cells mounted to a PCB along with the balancing electronics. The actively balanced units employ a linear voltage-balancing scheme, whereby the cell-to-cell leakage is dependent on the imbalance of the individual cells. When the cells are in balance the quiescent current is low and the leakage current of the ultracapacitor cells defines the pack leakage. The PBD-58/16.2K and the PBL-25/16.2 assemblies are covered with plastic heat shrink adding to the mechanical integrity of the unit. The PBD-58/16.2M is contained within a rugged, aluminum enclosure. This provides further mechanical integrity with additional splash resistant protection.

All three models may be connected in series as required for higher voltage applications- refer to isolation instructions in section 3.2.

The active balance circuit uses a four wire unit-to-unit balancing cable to keep the individual cell voltage balanced throughout the series string. The unit-to-unit balancing cable is not used when units are placed in parallel. At no time should the balancing cable be connected across the jumpers of single pack. See section 3.2.



Figure 1 PBL-25/16.2



Figure 2 PBD-58/16.2K



Figure 3 PBD-58/16.2M

2. Unpacking

Inspect the shipping carton for signs of damage prior to unpacking the unit. If the shipping carton or the unit has signs of damage report it to the carrier immediately. Remove the unit from the shipping carton and retain the shipping materials until the unit has been inspected and is determined to be operational.

**NOTE:** The original shipping materials are approved for both air and ground shipment.

The shipping container should contain one energy storage unit, one user manual and one balance cable.

If the unit is found to be defective or any parts are missing, contact your supplier. A Return Material Authorization (RMA) number must be issued prior to returning the unit for repair or replacement.

3. Installation

3.1. Mechanical

Units are mountable and operated in any orientation. The PBD-58/16.2K and PBL-25/16.2 should be shock mounted within a protective enclosure. Care should be taken to prevent motion between the pack and the enclosure. This motion can wear through the shrink-wrap covering over time and expose electrically conductive surfaces.

**CAUTION**

When mounting the PBD-58/16.2K or PBL-25/16.2 with the circuit board against a conductive surface an additional insulating barrier is recommended.

The PBD-58/16.2M is provided with four clearance holes for mounting with either 8-32 or M4 screws. See data sheet for location of mounting holes. When several packs or modules are stacked in series for operating at higher voltage, care must be taken to ensure proper creepage distance in compliance with national standards for electrical shock and hazards.

3.2. Electrical

**CAUTION**

To avoid arcing and sparking the energy storage units should be in a discharged state and the system power disconnected during installation. The unit should be shipped discharged. It is recommended to first check the unit voltage to ensure minimum voltage is on the system.

DO NOT plug the unit-to-unit balance cable across the two outputs of a single unit. The resulting short circuit may damage the pack and/or the balance cable. See the Figure 4.

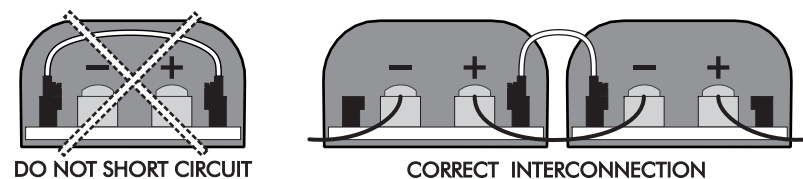


Figure 4 Short circuit caution.

3.2. Electrical (Continued)

Electrical attachment to the units should be made with copper ring lugs rated for the expected current of the application. The energy storage units have a low ESR and care should be taken to select the appropriate copper wire connecting the energy storage unit to the application. Improper wire selection can enable the wire ESR to exceed the ESR of the unit.

To provide the lowest possible ESR the energy storage units are not fused. Care should be taken within the application to prevent excessive current flow for adjoining electronics within the application.

**CAUTION**

To provide the lowest possible ESR the energy storage modules are not fused. Care should be taken within the application to prevent excessive current flow as required. Excessive current and/or duty cycle will result in overheating the module which will cause irreparable damage. Please consult the data sheet for current and duty cycle capabilities.

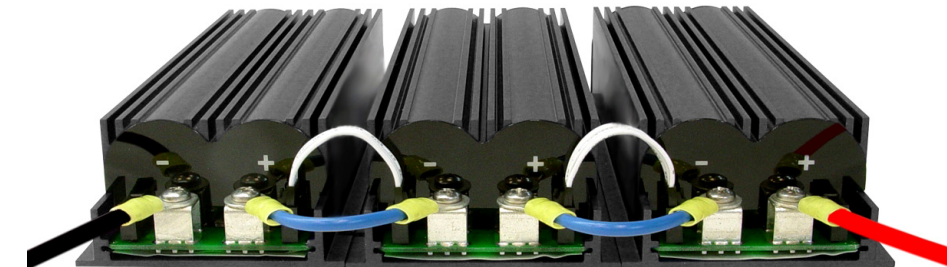


Figure 5 Units in series for higher voltage applications.

UL810a compliance is satisfied for up to 3x58F, 16.2V modules/packs in series (maximum operating voltage of 50V)

Electric isolation of the module is tested to 1250 VAC (1700 VDC). However, for string operating voltages over 50V, we recommend that an additional isolation has to be implemented similar to the isolation instructions below:

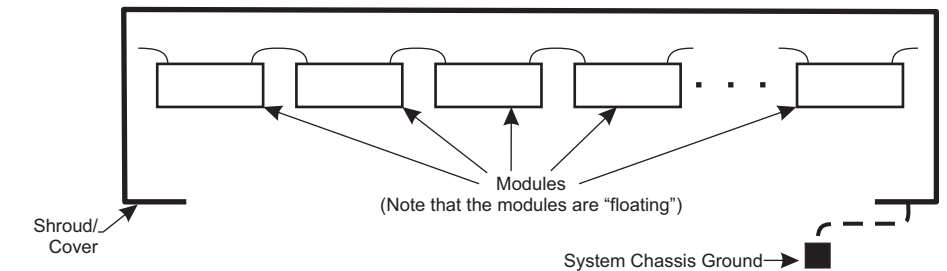


Figure 6 Concept of module connection for higher voltage operation.

The module string will have to be isolated from the system chassis ground - effectively "float" the modules. Care must be taken to ensure safety in the system. A possible approach is that the module string can be enclosed in a protective cover that is connected to system chassis ground. Proper creepage and clearance distances must be maintained between the modules and the cover.

Units may be connected in parallel for higher energy storage applications. Using the same gauge wire appropriate for the outputs, connect the positive output terminals of the units together and the negative output terminals of the units together. The 4-wire cable is **not** used to connect parallel-arranged units.



Figure 7 Units in parallel for higher energy storage applications.