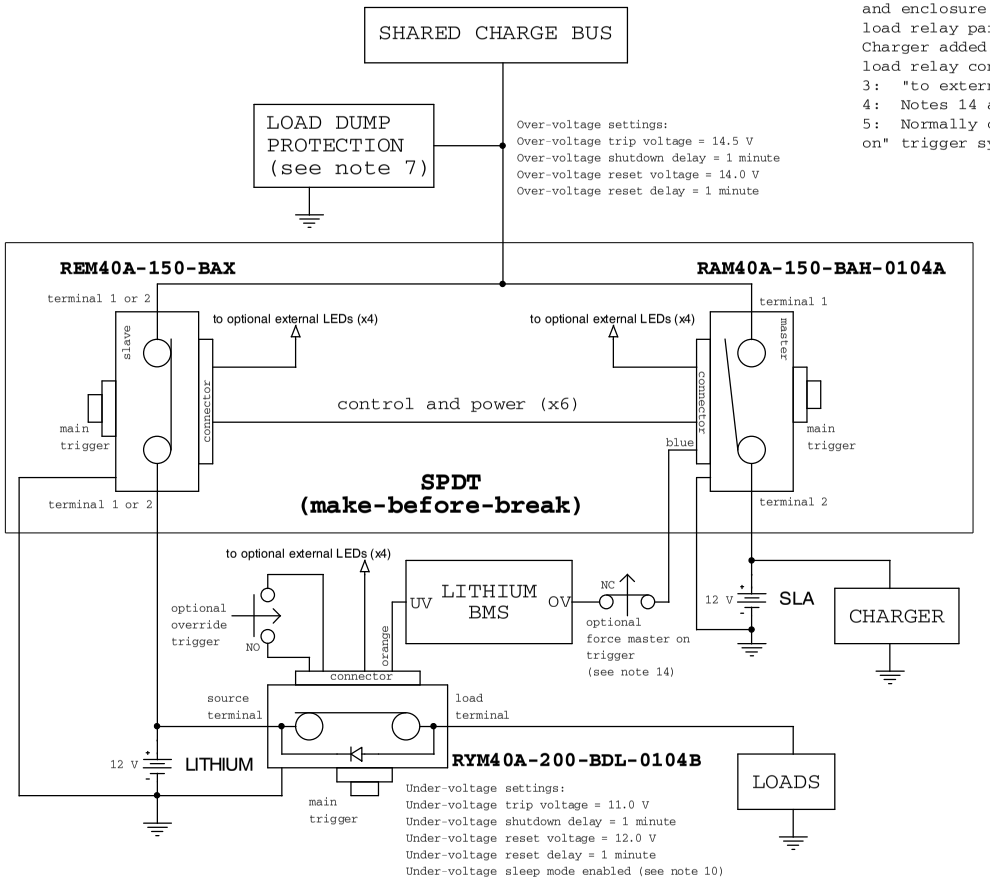

REVISION HISTORY

1: Original

2: Relay between lithium battery and loads changed to uni-directional type (MOSFET integral body diode added for clarity); SPDT configuration changed to make-before-break; 0104A specification code added to master relay part number and enclosure size changed to medium; Slave relay enclosure size changed to medium; 0104B specification code added to load relay part number and enclosure size changed to medium; Active-low override trigger enabled on load relay; Charger added directly to SLA battery; Load dump protection added to charge bus; Optional override trigger added to load relay connector

3: "to external LEDs (x4)" changed to "to optional external LEDs (x4)"; notes 9, 10, 11, 12, and 13 added

4: Notes 14 and 15 added

5: Normally open switch recommendation in note 14 changed to normally closed; Optional "override" and "force master on" trigger symbols changed (NO=normally open, NC=normally closed

NOTES:

1. Lithium BMS UV and OV outputs are driven to ground when a corresponding fault condition is present, and are 12 V otherwise.
2. Should the BMS detect an over-voltage condition, the OV output will trigger the slave relay to open and the master relay to close.
3. Should the BMS detect an under-voltage condition, the UV output will trigger the relay between the lithium battery and its loads to open.
4. The relay main triggers enable normal operation (i.e. allows the relays to respond to the BMS signals). Should a relay open due to an over-current or short-circuit event, toggling the relay's main trigger will reset the device. In the case of the load relay, toggling of the UV output wil also reset the relay. The main triggers also allow for safe installation and removal by providing a way to force the relay open.
5. Relay ground wires should be connected as close as possible to battery negative terminals.
6. External LED connections are not required for proper relay operation, but are included to allow for maximum monitoring flexibility.
7. Load dump protection is necessary in case slave relay is off and the master relay opens due to an over-current, short-circuit, or over-temperature event. Disconnection of the battery from the charge bus can cause the alternator to generate a large voltage spike (i.e. a load dump) as it attempts to dissipate the energy from magnetic field (the higher the current generated by the alternator at the moment of battery disconnection, the higher the voltage spike). 12 V relays can tolerate a spike up to 40 V: many alternators today have integrated load dump protection in the form of avalanche diodes, but it is up to the customer to ensure that a load dump condition will not exceed 40 V.
8. Should an over-voltage event on the charge bus occur, the slave relay will open and the master relay will close.
9. All battery and load grounds should be tied together with low impedance cables.
10. Uni-directional relay RYM40A-200-BDL-0104B will go into its low-power sleep mode immediately upon opening due to an under-voltage event. The purpose of this is to minimize the current draw on the lithium battery, and, therefore, the possibility of deep discharge (which can pose a safety threat). If the override trigger is activated, the relay will wake up from its low-power sleep mode and close only if the the main trigger is active and the BMS UV line is high; if this occurs and the override trigger is then de-activated, the relay will go back into its low-power sleep mode if an under-voltage reset event has not occurred.
11. The slave relay is powered from the higher of the SLA battery and the sharged charge bus voltages. The purpose of this is to reduce the current draw on the lithium battery, particularly when its has reached a low-voltage condition (defined by either the BMS or the uni-directional relay's internal settings).
12. Current draw on the lithium battery when its voltage is 11 V and the uni-directional relay is in its low-power sleep mode is a maximum of 2.0 mA.
13. Connections to labeled relay terminals must be adhered to.
14. When the optional force master on trigger is used, a switch closed position will allow the BMS to control the state of the SPDT switches, while a switch open position will force the master relay closed (and open the slave relay if it is on). A normally closed switch is recommended.
15. Should the control and power harness between the two SPDT relays becoming disconnected, both relays will be forced open, the power OK LEDs will go dark, and the red fault LEDs will illuminate.

DRAWING IS FOR APPLICATION DISCUSSION ONLY.
USER IS RESPONSIBLE FOR ENSURING ALL POWER-GATE ELECTRICAL LIMITS ARE ADHERED TO.

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Title: SAMPLE - POWER-GATE Implementation for L ithium Battery System

Size	Document Number	Rev
B	AD-09262017-1	5

Date: Thursday, October 26, 2017 Sheet 1 of 1