Simple Alternator Thermal Safety w/ Manual Override Switch

Connecting optional loads to a vehicle electrical system, such as charging auxiliary batteries, places a heavy load on the alternator. At times, the added load may cause overheating, leading to failure. This simple thermal switch provides a means of sensing overheating and temporarily disconnecting optional loads when it occurs. Overheating is likely when alternator demand exceeds capacity relative to driving and environmental conditions:

- Low airflow from low engine or vehicle speed.
- High engine bay temperatures when hauling heavy loads, climbing hills, or at high ambient temperatures.
- High vehicle electrical demand when operating headlights, heating or A/C system, wipers, seat heaters, etc.
- Optional loads exceeding the alternator's continuous reserve capacity.

Epoxying a KSD-9700 thermal switch to the center of the alternator case senses the winding temperature. Connecting the leads in series with the circuit provides 'permission to charge' to the DC/DC converter ignition lead or split charge relay any time the alternator temperature is safe. When the alternator temperature exceeds safe limits (120C), 'permission to charge' is withheld, disconnecting charging.

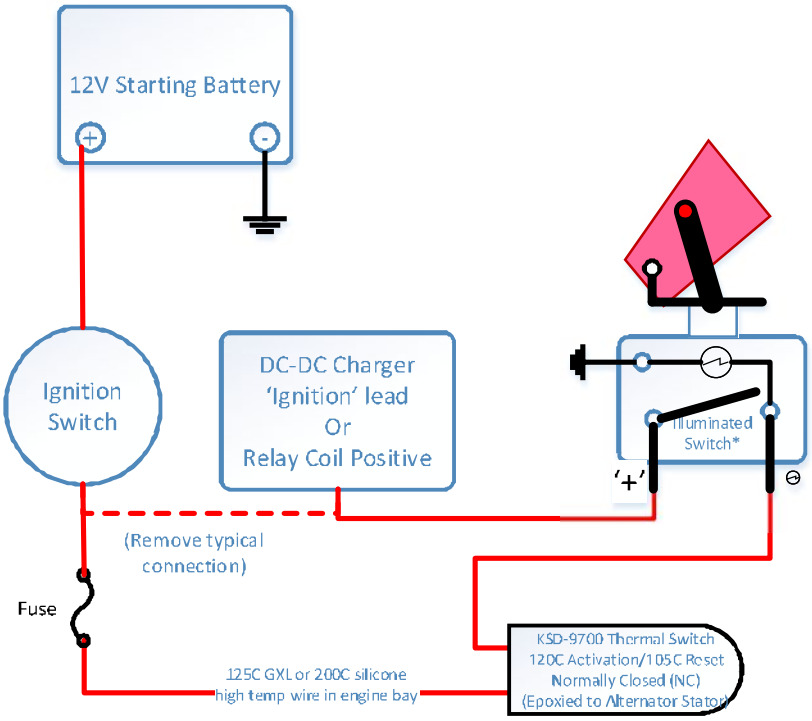
The disconnect temperature is selected when purchasing the switch. The recommended activation temperature is 120C. When the alternator heats to 120C, the switch opens, disconnecting the optional load. When the reduced electrical load allows the alternator to cool by 15C/27F, the switch closes, turning the optional load back on. The optional load can safely cycle on and off to maximize charging while always preventing the alternator from overheating.

To allow manual control over optional charging, an override switch placed in series in the same circuit allows the driver to enable/disable charging. Disabling charging could be desirable when solar charging is sufficient (fuel savings), demanding driving conditions are anticipated, or the ambient temperature is high. Using an illuminated switch will communicate if/when the thermal switch opens.

1) Normal Operation (override switch 'ON'): The normal switch position is recommended to be installed with the cover down being 'ON' (protected). Ignition power flows from the ignition switch, through the thermal switch and manual override switch to signal the optional device to operate. The indicator light visible through the cover and is illuminated any time the alternator is less than 120C/248F indicating auxiliary power is 'available'.
2) Manual Override (override switch 'OFF'): When the manual override switch is up/'OFF', ignition power is cut to the optional device, turning it OFF. If the indicator light is illuminated, power is passing through the thermal switch indicating the alternator is below 120C/248F showing charging is available.
3) Thermal Override (switch not illuminated): If the alternator temperature exceeds 120C/224F. (regardless of override switch position), the thermal switch opens, interrupting the ignition signal which prevents operation of the optional device. When alternator temperature reduces below ~105C, the thermal override will close, the indicator light will illuminate and if the manual override is down/'ON', optional equipment will resume.

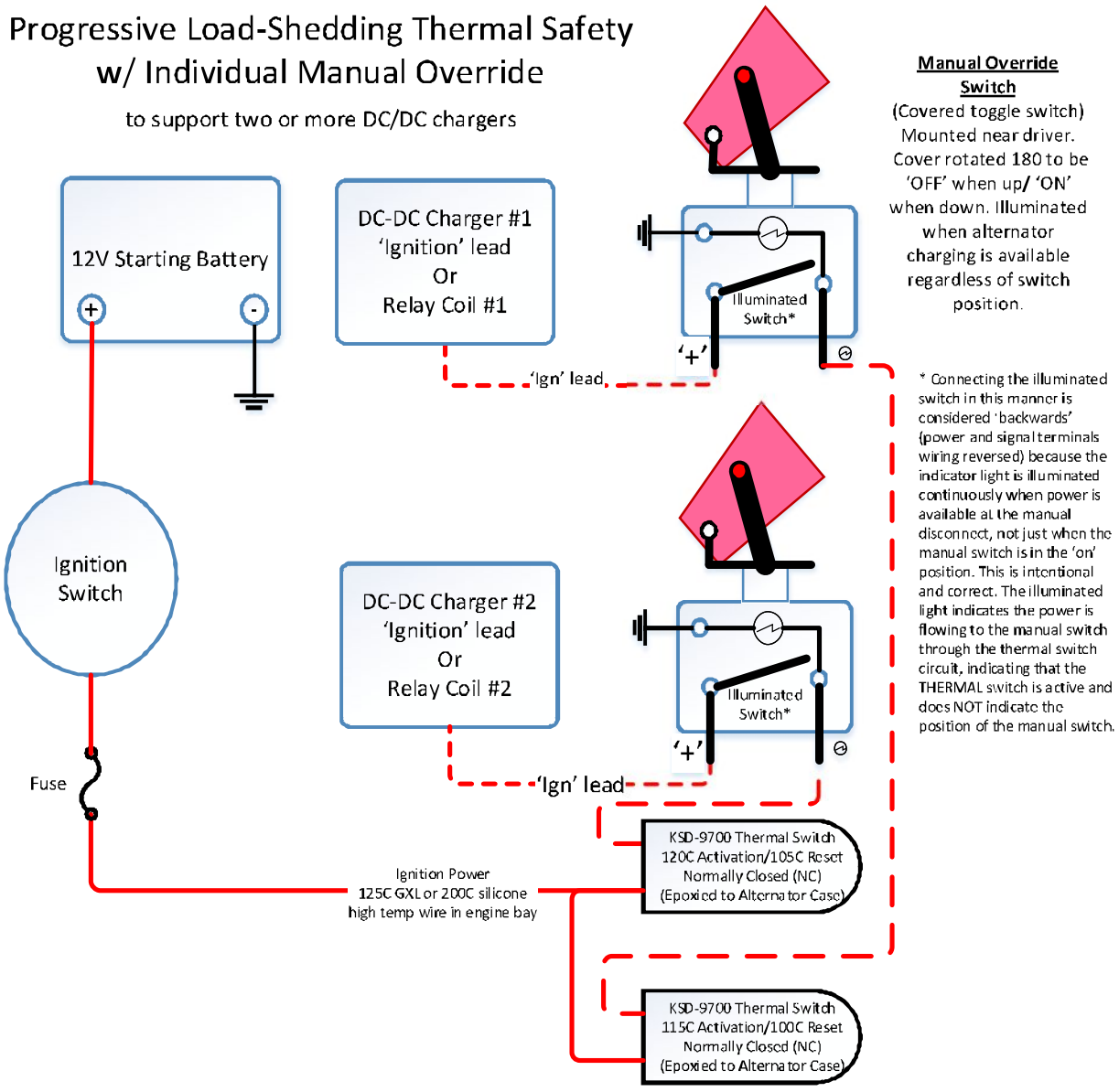
NOTE:

- At no time will alternator power be disrupted to vehicle systems. This ONLY reduces the load on the alternator by shutting of the optional equipment.
- 'Load shedding' of large relay connected loads will cause a voltage spike on disconnection but the starting battery and avalanche diodes in the alternator will damp reasonable disturbances.
- If controlling a split charge relay, ALL operating DC equipment in the camper will experience voltage fluctuation between alternator voltage (~14V) and camper battery voltage. This is already a normal experience when starting and stopping the vehicle.



Manual Override Switch
(Covered toggle switch)
Mounted near driver.
Cover rotated 180 to be 'OFF' when up/ 'ON' when down.
Illuminated when alternator charging is available regardless of switch position.

* Connecting the illuminated switch in this manner is considered 'backwards' (power and signal terminals wiring reversed) because the indicator light is illuminated when power is available at the manual disconnect, not just when the manual switch is in the 'on' position. This is intentional and correct. The illuminated light indicates the power is flowing to the manual switch through the thermal switch circuit, indicating that the THERMAL switch is active and does NOT indicate the position of the manual switch.

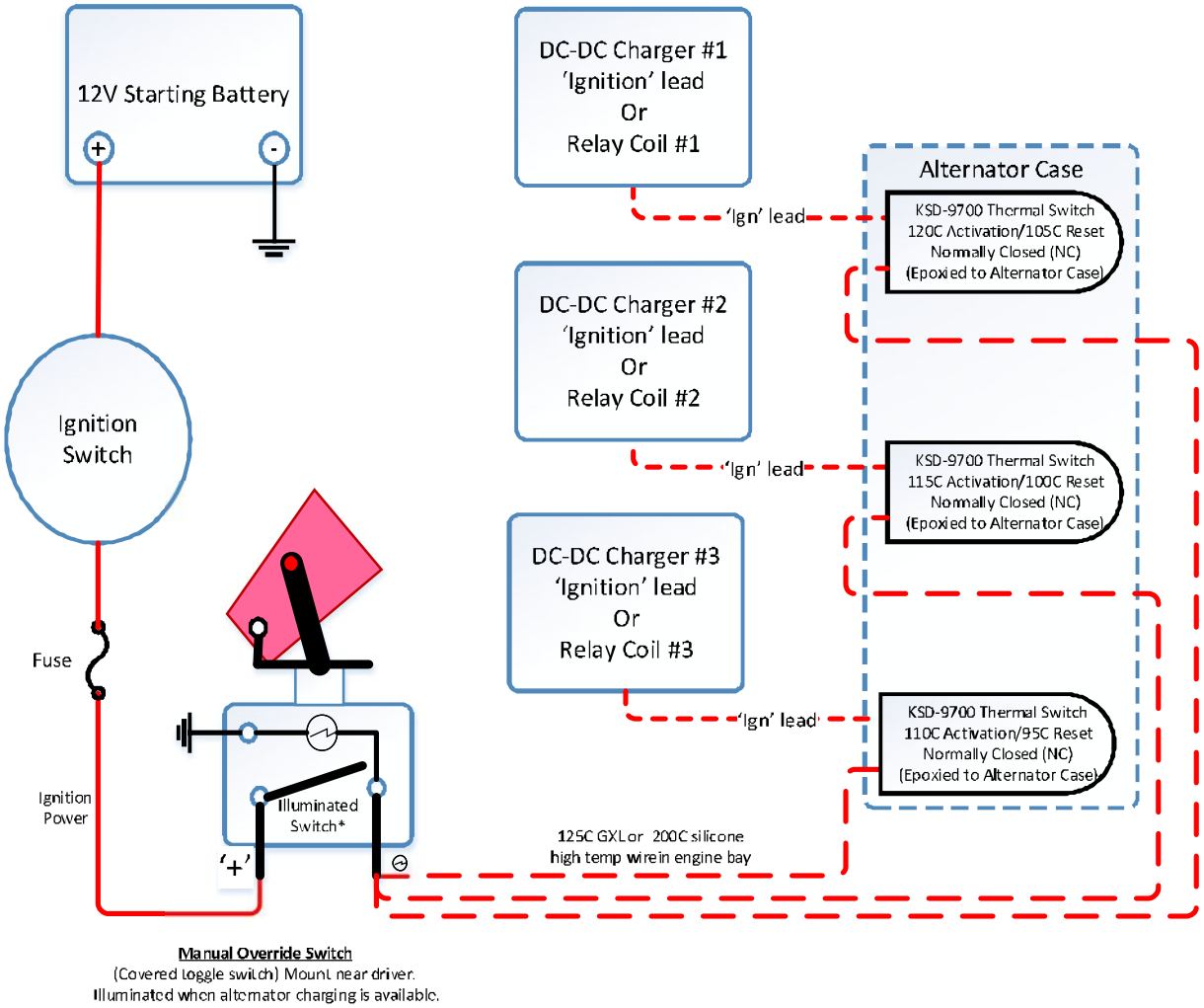


This schematic indicates how to construct a 'cascading' thermal safety circuit for 2 (or more) DC/DC chargers operating from the same alternator. Both KSD-9700 thermal switches are epoxied together on the alternator case. One switch has a lower activation temperature causing one charger to disconnect (at 115C) before the other (at 120C). This provides a progressive load shedding.

If both chargers are 'on' and the alternator reaches 115C, one will disconnect. If the temperature continues to rise, the second will disconnect. If the temperature stops rising but does not drop below 100C, the system will continue to operate with only one charger. If either or both disconnect and doing so allows the alternator to cool off significantly, they will both automatically reconnect at 15C below their activation temperature. Both also have manual disconnect switches with indicator lights. The indicator light shows the state of the thermal switch (illuminated = charging available/switch closed), not the manual switch position.

If more than 2 devices are connected, activation temperature for each added device should be 5C lower than the current lowest device so progressive load shedding will occur. The highest temperature device should be 120C. Separate manual switches for each device is not necessary but the indicator light will not be available to indicate activation of load shedding for each device.

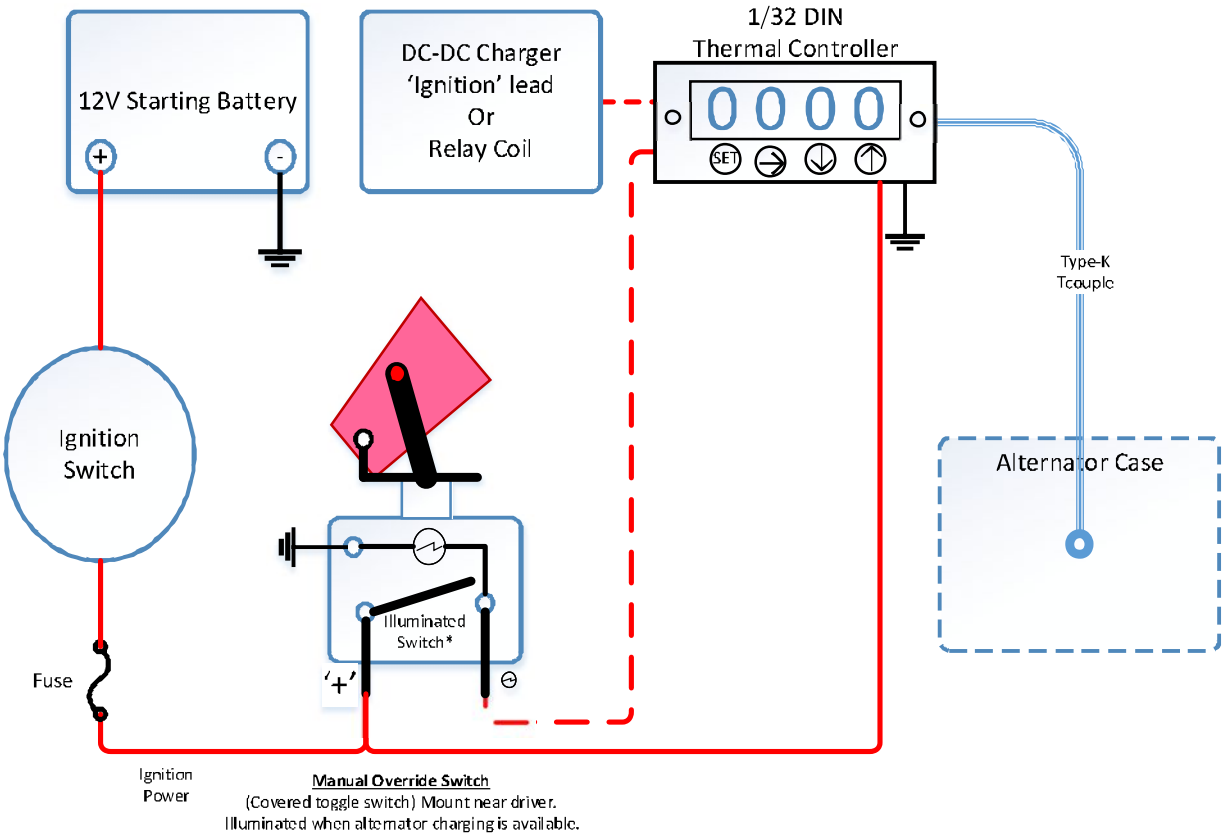
Progressive Load-Shedding Thermal Safety For Multiple Devices w/ System Manual Override



This schematic indicates how to construct a 'cascading' thermal safety circuit for 2 (or more) DC/DC chargers operating from the same alternator. KSD-9700 thermal switches are epoxied together on the alternator case. Each switch has a lower activation temperature causing each charger to disconnect at progressively higher temperatures. This provides a step-wise load shedding.

The manual override switch affects all devices in the system. If 'on' and the lowest thermal activation temperature is reached, the first device will disconnect and the remaining will continue to operate. If the temperature still continues to rise, the second will disconnect, then a third. At any point, if the temperature stops rising but does not drop below the reactivation temperature of the first unit that disconnected, the remaining units will continue to operate. If enough disconnect that the alternator to cools off significantly, they will reconnect in turn. The indicator light shows the state of the override switch, illuminated = charging available. Nothing indicates the state of the thermal switches.

If more devices are connected, activation temperature for each added device should be 5C lower than the current lowest device so progressive load shedding will occur. The highest temperature device should be 120C.



This schematic indicates how to construct a thermal safety circuit for a DC/DC charger operating from an alternator. It is based on a 1/32DIN (12mm x 24mm), 12VDC thermal controller (~$50 for generic) sensing the alternator case temperature with a Type-K thermocouple. Larger sizes can display the current temperature and set point simultaneously. The controller has an internal 2A relay in series between the ignition switch and the ignition terminal of the DC/DC charger. Reaching the activation temperature (120C) opens the internal relay, disabling the DC/DC charger.

The manual override switch provides ignition power through the relay. Turning the override switch 'off' allows the controller to display temperature but disables the DC/DC charger. Both the activation temperature and reset temperature are programmable.

If more than one charger is used, use KSD-9700 at 5C progressively lower temperatures than the thermal controller for cascading load shedding. Only one thermal controller is needed to display alternator temperature. Maximum disconnect should be 120C.