APPLICATION NOTE

Industrial Battery Chargers

Dual Integritas Battery Chargers in Parallel

Two Integritas Battery Chargers and Load

Introduction

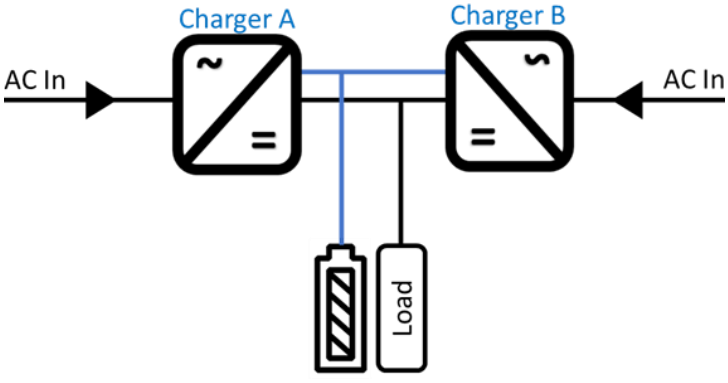
Battery charging in a high reliability environment requires consistent power and ultra-reliable equipment. To make the availability of charging equipment as reliable as possible many users require dual-redundant battery chargers so that failure of one charger does not compromise charging of the battery or powering of critical loads. To operate battery chargers in a dual-redundant mode they must typically be operated in parallel, with each charger sized to be able to support the entire load on its own. This adds cost to the system but is the price to be paid for fully redundant reliability.

While switch mode chargers, such as the Integritas line of industrial chargers from OmniOn Power typically contain multiple, redundant charge (rectifier) modules, many applications require complete charger redundancy. For complete charger redundancy it is essential that two or more independent chargers be able to operate in parallel to charge a single battery bank.

Dual Redundant Battery Chargers

Dual redundant battery chargers are completely independent battery chargers that are used to charge a common battery, allowing for continuous operation even in the event of one charger failing. Typical arrangement is shown on the right.

Each of the chargers in the diagram are multi-rectifier Integritas wall mounted chargers, utilizing three 125V, 20A rectifier modules. Extensive testing was performed on this configuration with a common load and battery connected. The detailed results of this testing are chronicled in OmniOn Power SIT Report: 19ESSR031 - 10/16/2019



Dual Redundant Battery Chargers

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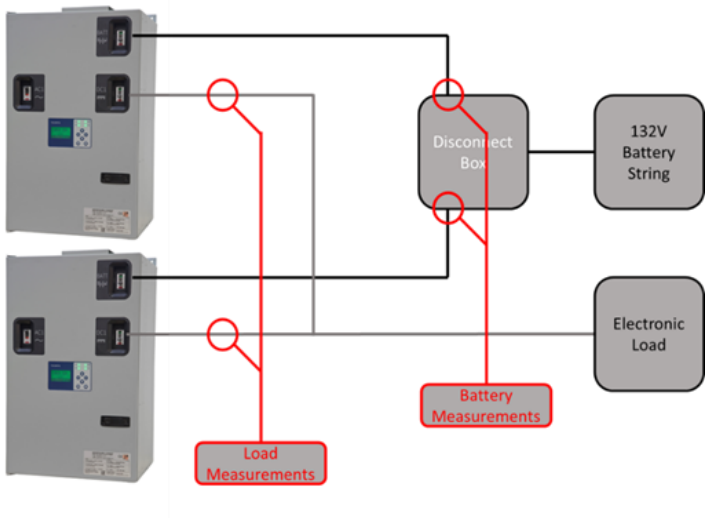
Test Configuration Connections

Charger outputs are connected directly to the battery and load, no diode protection is used between chargers. Each charger has its own controller and the settings for the controller should be identical, with particular attention to the float voltage setting – this ensures accurate load sharing between chargers in normal operation.



Dual Redundant Battery Chargers

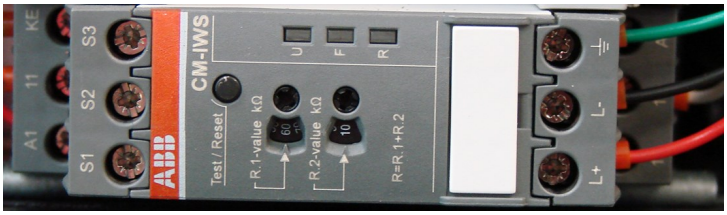
It can be expected that load sharing between chargers will be degraded if the cables used for each charger are different gages or lengths. Matching the cables optimizes load sharing.

A prerequisite for using dual redundant chargers is that the capacity of each charger should be adequate to support the load and charging needs independently. The units tested were provisioned with 3 rectifiers each, giving a load and charge capacity of 60A at 125V for each charger.

Ground Fault Protection

When two chargers are connected together in this manner, a measurement (ground fault) conflict occurs, resulting in a “phantom” ground fault alarm. For this reason it is recommended that one of the two chargers is purchased without the ground fault option.

If it is necessary to use chargers where both are equipped with ground fault detectors, the ground fault protection circuit must be disabled in one charger. To do this the L+ and L– connections of one of the units are disconnected from the GFI and properly insulated and secured. This prevents spurious alarms. The ground fault protection in the second charger will detect ground faults to either system when they are connected in parallel.



Ground Fault Indicator

Results of Detailed Testing

Charger load sharing – same voltage setpoints, various loads

The dual charger setup was tested with both chargers configured with the same number of rectifier modules and set to the same voltage. Load sharing between the chargers was found to be within 3% of each other, at various levels of load, up to 50% of the combined maximum capacity of the two chargers. Load sharing between modules within each charger was also as expected.

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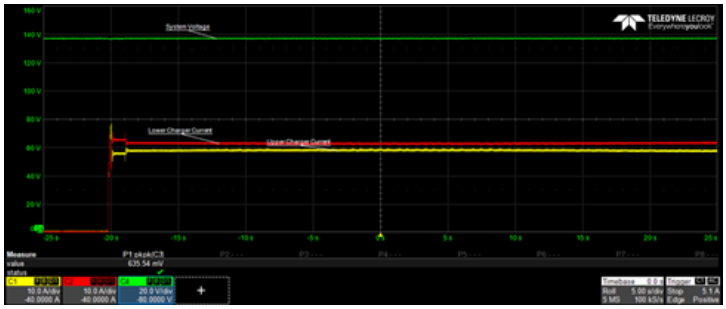
Charger load sharing – different voltage setpoints

When the chargers have different voltage setpoints the load is not shared equally by the two chargers. The charger with the higher voltage setpoint will assume a higher portion of the load. For proper load sharing, both chargers must be set to the same voltage.

Charger response to step load changes

Step changes in load current are accommodated by the charger combination without intervention. Load sharing adjusts to correctly share to changes in load. Voltage regulation is maintained during transitions.



60A Load transition

Chargers with different rectifier provisioning

Removal or failure of one rectifier within a charger results in an alarm from that charger and a larger imbalance between the loading of the two chargers. This is resolved by replacement of the failed or missing rectifier.

Single Charger failure—AC Failure to one charger

This was tested by removing the ac input to one charger and observing that the other charger fully assumes all of the load. This happens without interruption. The Charger that is switched off or disconnected from power will issue multiple alarms providing it remains connected to the battery as the battery back biases the controller in the powered down charger.

Recharge Current Limit on both chargers

Recharge current limit is a feature of Integritas Battery Chargers intended to prevent over charging of batteries. Each charger has its own current limit setpoint and battery current measuring shunt. Chargers control the output voltage to limit the battery current to its own setpoint. This means that the recharge current limit for both chargers should be set to 50% of the charge current that is desired for the battery. Both chargers add the same current, so the total battery current is the sum of that from each charger. Load current is not affected beyond the variations in voltage required for battery current limiting.

Ripple measurement with two chargers

Ripple measurements were made for both chargers with various load conditions, with and without batteries. The ripple measurements were within specifications under all conditions.

Summary

Dual redundant battery chargers provide the ultimate in reliability for applications where down time is not an option. Integritas switch mode battery chargers provide reliable battery charging with built in rectifier redundancy. The use of two Integritas chargers in parallel provides two levels of redundancy. Thorough testing has shown that two Integritas chargers can be operated in parallel, while maintaining the performance specifications of the individual chargers for load sharing, step load performance, ripple, and battery recharge current limiting. No issues were found, and the chargers performed flawlessly even when one unit is taken offline, transitioning the load seamlessly.

OmniOn Power Inc.
601 Shiloh Rd.
Plano, TX USA

omnionpower.com

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