Claims

1. A transport refrigeration unit comprising:

a source of AC power, the source of AC power configured to supply power to an AC load of the transport refrigeration unit;

a battery charging module operably connected to the source of AC power, the battery charging module having a fist DC power source and a second DC power source and configured to convert the AC power to a first DC power associated with the first DC power source and a second DC power associated with the second DC power source;

a battery operably connected to the first DC power source, the first DC power source configured as a DC power source for the battery;

at least one of a controller of the transport refrigeration unit and a controller of the battery charging module operably connected to the second DC power source, the second DC power source supplying the second DC power for at least one of the controller of the transport refrigeration unit and a controller of the battery charging module;

a voltage monitor operably connected to the battery and to at least one of the controller of the transport refrigeration unit and the controller of the battery charging module, the voltage monitor configured to measure a voltage of the battery; and

the controller of the battery charging module is configured to interrupt the first DC power source from supplying power to the battery based on at least the voltage of the battery.

2. The transport refrigeration unit of claim 1, wherein the battery charging module disconnects the first DC power supplied from the first DC power source based on at least the voltage of the battery.

3. The transport refrigeration unit of claim 1 or 2, wherein the controller of the battery charging module is configured to interrupt the first DC power source

from supplying power to the battery based on at least the voltage of the battery independent of the second DC power source.

4. The transport refrigeration unit of any one of claims 1 to 3, wherein the battery charging module is an AC/DC converter configured to convert the AC power to DC power and at least one of the first DC power and the second DC power are regulated.

5. The transport refrigeration unit of any one of claims 1 to 4, further comprising that the second DC power source is isolated from the first DC power source under selected conditions.

6. The transport refrigeration unit of claim 5, wherein the isolation is a diode isolation.

7. The transport refrigeration unit of claim 5 or 6, wherein the isolation configured to ensure that the second DC voltage generated the second DC power source is isolated from the first DC power source and the battery, and first DC voltage from the first DC power source is transmitted as the second DC voltage if the second DC power source is inoperative.

8. The transport refrigeration unit of any one of claims 1 to 7, further comprising a current sensor operably connected to the battery and to at least one of the controller of the transport refrigeration unit and the controller of the battery charging module, the current sensor configured to measure a current supplied to or from the battery, wherein the controller of the battery charging module is further configured to interrupt of the first DC power source independent of the second DC power source based on at least the current supplied to or from the battery.

9. The transport refrigeration unit of any one of claims 1 to 8, further comprising at least one of an evaporator fan and a compressor, wherein the AC power source supplies AC power to the at least one of an evaporator fan and a compressor.

10. The transport refrigeration unit of any one of claims 1 to 9, further including, the battery supplying power to at least one of the controller of the transport

refrigeration unit and the controller of the battery charging module when the first DC power source is interrupted.

11. A method of charge management for a battery in a transport refrigeration unit, the method comprising:

configuring the transport refrigeration unit with a plurality of DC power sources operable from a primary power source;

connecting a first DC power source as a battery charger operably connected to the battery and configured to provide charging power to the battery;

connecting a second DC power source as a power source for at least one of a controller for the transport refrigeration system and a controller for the battery charger;

monitoring a voltage of the battery;

interrupting the charging of the battery based on the monitoring of a voltage of the battery.

12. The method of charge management for a battery of claim 11, wherein interrupting the charging of the battery includes disconnecting the first DC power supplied from the first DC power source.

13. The method of charge management for a battery of claim 11 or 12, wherein interrupting the charging of the battery is independent of the second DC power source.

14. The method of charge management for a battery of any one of claims 11 to 13, wherein the configuring includes converting the AC power to DC power and at least one of the first DC power and the second DC power are regulated.

15. The method of charge management for a battery of any one of claims 11 to 14, further comprising isolating the second DC power source from the first DC power source under selected conditions.

16. The method of charge management for a battery of claim 15, wherein the isolation is a diode isolation.

17. The method of charge management for a battery of claim 15 or 16, wherein the isolating is configured to ensure that the second DC voltage generated the second DC power source is isolated from the first DC power source and the battery, and first DC voltage from the first DC power source is transmitted as the second DC voltage if the second DC power source is inoperative.

18. The method of charge management for a battery of any one of claims 11 to 17, further comprising measuring the current supplied to or from the battery with a current sensor operably connected to the battery and to at least one of the controller of the transport refrigeration unit and the controller of the battery charging module, wherein the interrupting of the first DC power source independent of the second DC power source is further based on at least the current supplied to or from the battery.

19. The method of charge management for a battery of any one of claims 11 to 18, further comprising configuring the transport refrigeration unit to include at least one of an evaporator fan and a compressor, wherein the AC power source supplies AC power to the at least one of an evaporator fan and a compressor.

20. The method of charge management for a battery of any one of claims 11 to 19, further including supplying power to at least one of the controller of the transport refrigeration unit and the controller of the battery charging module from the battery when the first DC power source is interrupted.