

Stationary Power Battery Charger Specification for 24/48/120/125/130 Vdc Applications

1. GENERAL

- 1.1.** This specification describes a battery charger for 24/48/120/125/130 volts DC (nominal) stationary/reserve/standby power applications.
- 1.2.** The charger is a constant DC output voltage float type.
- 1.3.** The charger is designed to maximize uptime, availability, reliability, and durability in industrial environments.
- 1.4.** The charger utilizes a modular architecture with a chassis, system controller that serves as the user interface, and one (1) or more power (rectifier) modules.
- 1.5.** Multiple power modules in a chassis provide redundancy. If a power module stops operating, the other power modules in the system continue to operate and will automatically increase their DC output current to source the load (up to the maximum DC output power or current capabilities of the remaining power modules). Power modules will also continue to operate, using the last configuration communicated to them, if the system controller stops operating.
- 1.6.** To maximize uptime and availability, the power modules are hot swappable to facilitate adding or removing modules from the chassis without taking the charger offline.
- 1.7.** The charger is natural convection cooled with no fans or other moving parts.

2. STANDARDS

- 2.1.** The charger is compliant with IEEE 2405-2022.
- 2.2.** The charger is compliant with NERC TPL-001-5.
- 2.3.** The charger is listed to UL 1012.
- 2.4.** The charger is certified to CAN/CSA-C22.2 NO. 107.2-01.
- 2.5.** The charger is compliant with FCC Part 15, Class A.
- 2.6.** The charger is compliant with ICES-003.
- 2.7.** The charger is certified to the California Energy Commission (CEC) Appliance Efficiency Regulations, Title 20.

2.8. The charger is compliant with 23 CFR § 635.410 (Buy America Requirements).

2.9. The charger is compliant with 2011/65/EU (ROHS Directive).

3. ENVIRONMENTAL

3.1. The charger has an operating temperature range of -40 to 70 °C (-40 to 158 °F) with over-temperature protection. The charger retains full DC output power across this entire operating temperature range with no de-rating or cutbacks due to temperature.

3.1.1. Some optional accessories may have more restrictive operating temperature ranges than the charger.

3.2. The charger has a storage temperature range of -55 to 85 °C (-67 to 185 °F).

3.2.1. Some optional accessories may have more restrictive storage temperature ranges than the charger.

3.3. The charger circuit boards are conformal coated for protection from moisture and other contamination.

3.4. The charger has an operating humidity range of 0 to 95 percent, non-condensing.

3.5. The charger has a storage humidity range of 0 to 95 percent, non-condensing.

4. MECHANICAL

4.1. The charger case and modules are constructed out of heavy-gauge, powder-coated steel.

4.2. The charger has a terminal block for the AC input and DC output wiring.

4.3. The AC input and DC output terminals are covered. A tool is required to gain access to the terminals. A Standard lockable door can be used to further secure access to the terminals and Ethernet port.

4.4. The 4/8/16-slot chargers include standard, adjustable hardware to be mounted to a wall, floor, or EIA 19-inch rack. Optional, adjustable hardware is available for EIA 23-inch rack mounting.

5. AC INPUT

5.1. The charger has an AC input rating and operating range of:

5.1.1. 4/8-slot chargers:

5.1.1.1. The charger has a wide AC input rating range of 100-240 volts, 50-200 hertz, single-phase. The charger has an AC input operating range of 90-264 volts, 45-205 hertz, single-phase. Below 100 volts, the charger may reduce output power.

5.1.2. 16-slot chargers:

5.1.2.1. The charger has a wide AC input rating range of 208-240 volts, 50-200 hertz, single-phase. The charger has an AC input operating range of 187-264 volts, 45-205 hertz, single-phase.

- 5.2. The charger automatically adjusts to an AC input voltage within its operating range. No manual adjustments or tapping are required.
- 5.3. The charger efficiency is at least 91 percent at 120 volts AC input and full load (if applicable) and 93 percent at 240 volts AC input and full load.
- 5.4. The charger power factor is at least 0.98 at 120 volts AC input and full load (if applicable) and 0.96 at 240 volts AC input and full load.
- 5.5. The AC input of the charger includes current limit, surge, transient, under voltage, and over voltage protections.
- 5.6. The following table shows the chassis AC circuit breaker ratings of the charger based on the number of chassis slots.

Chassis Slots	Standard AIC Breaker Ratings	Optional High AIC Breaker Ratings
4	30A, 2 POLE, 120/240 Vac, 10 kAIC (@ 120/240 Vac)	30A, 2 POLE, 120/240 Vac, 22 kAIC (@ 120/240 Vac)
8	60A, 2 POLE, 120/240 Vac, 10 kAIC (@ 120/240 Vac)	60A, 2 POLE, 120/240 Vac, 22 kAIC (@ 120/240 Vac)
16	60A, 2 POLE, 120/240 Vac, 10 kAIC (@ 120/240 Vac)	60A, 2 POLE, 120/240 Vac, 22 kAIC (@ 120/240 Vac)

6. DC OUTPUT

6.1. The charger power modules have a maximum power and current rating per module of:

- 6.1.1. 24 volts: 400 watts and 10 amps
6.1.2. 48 volts: 480 watts and 10 amps
6.1.3. 120/125/130 volts: 480 watts and 4 amps

6.2. The charger has an adjustable float voltage range (including temperature compensation) of:

- 6.2.1. 24 volts: 10.00 to 40.00 volts
6.2.2. 48 volts: 30.00 to 61.00 volts
6.2.3. 120/125/130 volts: 75.00 to 150.00 volts

6.3. The charger has an adjustable equalize voltage range (including temperature compensation) of:

- 6.3.1. 24 volts: 10.00 to 40.00 volts
- 6.3.2. 48 volts: 30.00 to 61.00 volts
- 6.3.3. 120/125/130 volts: 75.00 to 150.00 volts

- 6.4. The charger chassis can support up to four (4), eight (8), or sixteen (16) power module slots, depending on the DC output power, DC output current, and redundancy requirements of the application.
- 6.5. The charger DC output includes current limit, short circuit, reverse polarity, high voltage, surge, and transient protections.
- 6.6. Each bank of power modules in a chassis includes an independent circuit breaker. The following table shows the chassis DC circuit breaker ratings of the charger based on the nominal DC voltage of the charger and the number of chassis slots.

DC Voltage	Chassis Slots	Number of Breakers	Breaker Ratings
24	4	1	50A, 1 POLE, 65 Vdc, 10 kAIC (@ 65 Vdc)
24	8	2	50A, 1 POLE, 65 Vdc, 10 kAIC (@ 65 Vdc)
48	4	1	50A, 1 POLE, 65 Vdc, 10 kAIC (@ 65 Vdc)
48	8	2	50A, 1 POLE, 65 Vdc, 10 kAIC (@ 65 Vdc)
120/125/130	4	1	25A, 2 POLE, 160 Vdc, 5 kAIC (@ 160 Vdc)
120/125/130	8	2	25A, 2 POLE, 160 Vdc, 5 kAIC (@ 160 Vdc)
120/125/130	16	4	25A, 2 POLE, 160 Vdc, 5 kAIC (@ 160 Vdc)

7. SYSTEM CONTROLLER

- 7.1. The charger system controller is both AC and DC powered for continued operation without AC power.
- 7.2. The charger system controller includes a real-time clock with battery backup to retain the date and time if both AC and DC power are lost.
- 7.3. The charger includes continuity test functionality, which can be configured to execute automatically per a configurable interval or manually. This functionality tests the continuity of the battery system.
- 7.4. The charger includes manual battery load test functionality. This functionality performs a load test on the battery pack using the system load.
- 7.5. The charger supports configurable battery equalization capabilities, including the following methods of triggering an equalize cycle:

- 7.5.1. Automatically per a configurable interval
- 7.5.2. Automatically on AC power up when the battery pack voltage is below a configurable level
- 7.5.3. Manually

8. COMMUNICATION

- 8.1.** The charger includes 10/100BASE-TX Ethernet and an RJ45 connector.
- 8.2.** The charger includes an internal web server and supports both networked communication and communication with a directly connected computer. For security purposes, only one user is allowed to be logged in at a time.
- 8.3.** The web server uses a responsive framework to automatically adapt the display of the web pages for different devices, including laptops, PCs, smart phones, and tablets.
- 8.4.** The charger supports SNMP v2 (Simple Network Management Protocol) Traps for alarm events. Traps are issued both when alarms are triggered and cleared.
- 8.5.** The charger supports SNMP v2 Gets for the current status of the alarms, as well as other system status values, including:
 - 8.5.1. batteryVoltage
 - 8.5.2. dcCurrentOutput
 - 8.5.3. serialNumber
 - 8.5.4. acInputVoltage
 - 8.5.5. batteryTemperature
 - 8.5.6. internalChargerTemperature
 - 8.5.7. uimFirmwareVersion
 - 8.5.8. floatVoltageControlledBy
 - 8.5.9. dcVoltageSensing
 - 8.5.10. localPresenceTime
 - 8.5.11. iPM_1_SerialNumber
 - 8.5.12. iPM_1_SoftwareVersion
 - 8.5.13. iPM_1_Current
 - 8.5.14. OIDs are available for all power modules...
- 8.6.** The charger supports NTP (Network Time Protocol) to synchronize the system date and time with a network time server.
- 8.7.** Modbus TCP and Modbus RTU (RS-232 and RS-485) communication are available as options.
- 8.8.** IEC 61850 communication is available as an option.

9. DISPLAY

- 9.1.** The following display items are available via the charger web server: Battery Voltage, DC Output Current, DC Output Power, AC Input Voltage, Battery Temperature, Internal Charger Temperature, Site Name, System Controller Serial Number, System Controller Firmware Version, Power Module Serial Number(s), Power Module Firmware Version(s), DC Voltage Sensing Local/Remote, Confirmed Local Presence Time Remaining.
- 9.2.** The charger includes a display that simultaneously displays the DC voltage at the charger output to 1 decimal place with 1 percent accuracy and the DC output current to 2 decimal places with 1 percent accuracy.
- 9.3.** The system controller includes the following LEDs: System Controller Status, AC Present, Alarm Active, Confirm Local Presence.
- 9.4.** Each power module includes a tri-color LED that provides the DC output status and fault/limit notification.

10. BATTERY COMPATIBILITY AND TEMPERATURE COMPENSATION

- 10.1.** The charger is compatible with flooded lead-acid (FLA), valve-regulated lead-acid (VRLA), nickel-cadmium (Ni-Cd), and lithium-ion (Li-ion) type batteries. The charger can only be used with lithium-ion batteries when the batteries include a Battery Management System (BMS) to monitor and protect the batteries.
- 10.2.** The charger supports battery temperature compensation with controlled limits. Battery temperature compensation can be enabled/disabled, the compensation value/slope can be adjusted, the minimum compensation limit can be adjusted, and the maximum compensation limit can be adjusted via the charger web server.
- 10.3.** The remote probe for sensing temperature at the battery pack is available as an option.

11. REMOTE DC VOLTAGE SENSING

- 11.1.** The charger supports remote DC voltage sensing with the DC voltage sensing wire assembly connected directly to the battery pack to both measure the voltage of the battery pack without any DC cable drop and continue monitoring the voltage of the battery pack if the DC circuit breaker(s) is (are) open. Remote DC voltage sensing can be enabled/disabled via the charger web server.
- 11.2.** The remote DC voltage sensing wire assembly is available as an option.

12. GROUND FAULT DETECTION (GFD)

- 12.1.** For systems of 48 or 120/125/130 DC volts (nominal), the charger supports ground fault detection between DC positive (+) or DC negative (-) and ground with an adjustable trigger current level of 1.5 to 4.0 milliamps. Ground fault detection can be enabled/disabled and the trigger current level can be adjusted via the charger web server.
- 12.2.** The charger includes a switch for disabling/enabling the ground fault detection hardware to support manual ground fault detection activities.

13. ADJUSTMENTS, CONFIGURATION CHANGES, AND FIRMWARE

- 13.1.** The charger includes rotary switches to manually adjust the number of battery cells and the float voltage per cell. These settings can also be configured via the charger web server.
- 13.2.** All settings can be configured via the charger web server.
- 13.3.** All firmware can be upgraded via the charger web server.
- 13.4.** The charger supports the uploading of configuration files via the web server.
- 13.5.** The charger web server includes configurable user access levels.
- 13.6.** To provide the highest-possible level of security, the charger includes a physical Confirm Local Presence (CLP) button and LED. Pressing this button is required to save any changes to the web server and ensures that the changes are being made and/or confirmed locally.

14. ALARMS AND LOGGING/HISTORY

- 14.1.** The charger supports the following alarms, which can be individually enabled/disabled, assigned a delay, assigned a priority, and assigned to the summary alarm relay via the charger web server: AC Input Power Lost, AC Input Voltage High, Battery Voltage Low, Battery Voltage High, Battery Temperature Low, Battery Temperature High, Minimum DC Output Current, Power Module Fault, Power Module Communication Lost, Incorrect Power Module DC Voltage, System Controller Fault, Battery Temperature Sensor Fault, Remote DC Voltage Sensing Fault, Ground Fault Detection, and Continuity Test Fault.
- 14.2.** The following alarms have configurable trigger levels via the charger web server: AC Input Voltage High, Battery Voltage Low, Battery Voltage High, Battery Temperature Low, Battery Temperature High, Minimum DC Output Current, Ground Fault Detection.
- 14.3.** The charger includes a Form C, dry-contact summary alarm relay with contacts rated for 2 amps at 30 volts DC, 0.6 amps at 125 volts DC, 0.6 amps at 125 volts AC, and 0.2 amps at 250 volts AC.

- 14.4.** The charger supports Ethernet-based alarming via SNMP v2 (see the COMMUNICATION section).
- 14.5.** The charger optionally supports alarming via Modbus TCP and Modbus RTU (RS-232 and RS-485) communication (see the COMMUNICATION section).
- 14.6.** The charger optionally supports alarming via IEC 61850 communication (see the COMMUNICATION section).
- 14.7.** The charger includes High DC Voltage Shutdown functionality.
- 14.8.** The charger logs all alarm events as history records, both when alarms are triggered and cleared. Alarm records include the date/time and triggering value.
- 14.9.** History records can be downloaded via the charger web server as a CSV (comma-separated values) file.
- 14.10.** The charger includes non-volatile storage for up to 10,000 history records. If the storage reaches capacity, the oldest records are overwritten.
- 14.11.** The charger optionally supports an external module with individual Form C, dry-contact alarm relays with contacts rated for 2 amps at 30 volts DC, 0.6 amps at 125 volts DC, 0.6 amps at 125 volts AC, and 0.2 amps at 250 volts AC. The optional module includes individual alarm relays for the following alarms:
 - 14.11.1. Power Module Fault / Power Module Communication Lost
 - 14.11.2. AC Input Power Lost / AC Input Voltage High
 - 14.11.3. Minimum DC Output Current
 - 14.11.4. Battery Voltage Low / Battery Voltage High / High DC Voltage Shutdown
 - 14.11.5. Continuity Test Fault
 - 14.11.6. Ground Fault Detection Negative (-)
 - 14.11.7. Ground Fault Detection Positive (+)

END OF SPECIFICATION