



ATevo Series Float Battery Charger

A battery charger shall be furnished in accordance with the following specification.

1. General

- 1.1. The battery charger shall be sized, using IEEE sizing methods, to continuously carry any standing load, recharge the battery and have sufficient reserve capacity as required for the application.
- 1.2. The battery charger shall provide a continuous regulated DC output derived from an AC source. The battery charger shall also have the ability to automatically or manually provide an equalizing charge for recharging the battery after a discharge.
- 1.3. The battery charger shall be of a design that employs microprocessor technology to control and define all critical operational, calibration, regulation and alarm functions.

2. Applicable Codes

The charger shall meet the requirements of the latest versions of the following industry and agency standards:

- 2.1. NEMA PE5 / IEEE 2405 Stationary type battery chargers
- 2.2. IEEE 946 DC System Design
- 2.3. UL 1564 Standard for industrial battery chargers
- 2.4. UL 1012 Standard for stationary power supplies
- 2.5. CSA 22.2 Standard for battery chargers
- 2.6. IEEE/ANSI C37.90.1 Surge withstand capability definitions and tests
- 2.7. FCC Part 15 Subpart J Class A
- 2.8. Current Seismic requirements: IBC 2012, CBC 2013, IEEE 693-2005



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3. Standard Features

- 3.1. The Standard Single Phase Input Voltages include: 120, 208, 240, 480 and 600Vac 60Hz and 220, 380, 416Vac 50Hz-60Hz. AC input frequency tolerance 47Hz to 63Hz and AC input voltage tolerance +10%/-12%. Other custom AC input voltages are available.
- 3.2. Standard Output Voltages include: 24, 48, 130 and 260Vdc with output current ratings of: 6, 12, 16, 20 and 25Amp (24 –130Vdc); 6 and 12Amp (260Vdc).
- 3.3. Output regulation of +/- 0.25% of DC voltage setting with input line variations of +10%/-12% voltage and/or +/-5% frequency with load variations from no load to full load over the operating DC voltage range. For extended operating DC voltage ranges regulation may not meet regulation of +/-0.25%.
- 3.4. AC input and DC output circuit breakers are standard.
- 3.5. Output control is constant-voltage, current-limited.
- 3.6. The charger is capable of delivering 110% continuous rated output current at the maximum equalize voltage and at the rated AC input voltage, from -10°C to + 50°C. Current limit shall be factory set at 110% of output and adjustable from 50% to 110% of the nominal output.
- 3.7. Operating environment shall be -10°C to +50°C without de-rating, storage at -10°C to +50°C, RH 0% - 95% non-condensing, and elevation to 1,000 meters (3,300 feet).
- 3.8. Minimum DC output filtering, consisting of two inductors and one or more capacitors, limiting the output ripple as specified in NEMA PE5.
- 3.9. Random parallel load share operation of 2 or more chargers with the same DC voltage rating shall be a standard feature of the filtered charger.
- 3.10. DC Voltage transients due to sudden changes in load current over the range of 10% to 90% or 90% to 10% of full load occurring within 2 milliseconds shall not result in an output variation of greater than +/-6% of the nominal voltage setting. Recovery to within +/-0.25% of the nominal will occur within 300 milliseconds.
- 3.11. Startup: Charger start-up will incorporate a safe start feature that stabilizes charger output within 15 seconds when a load of at least 5% of rating is applied to the charger which is connected to a fully charged battery.
- 3.12. Charger will operate into zero battery voltage without activating any protective devices other than electronic current limiting.
- 3.13. Charger will start and operate with a crowbar short circuit on the output without tripping the standard dc circuit breaker.



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- 3.14. A battery charger with a standard DC circuit breaker installed does not require a blocking diode.
- 3.15. Charger will survive a reverse polarity battery connection. A polarity diode is included with all filtered chargers to protect the output capacitors.
- 3.16. Cooling: Natural convection for all charger ratings in NEMA 1 enclosures.
 - 3.16.1. NEMA 4 enclosures may have forced air-cooling. A terminal block is provided for power connection to the cooling fans (fans are not powered by the charger).
- 3.17. Charger shall have a HindlePower patented clear safety cover over all internal components. The safety cover is marked with a patented component layout and connection diagram.
- 3.18. Available remote sense terminals are standard for all chargers. This sensing feature detects and compensates for a voltage difference, as measured between the charger and the battery, caused by a resistance in a dc cable over a given distance.
- 3.19. All non-magnetic wiring shall use Hypalon or XLPE (cross-linked polyethylene) insulation system, 600V, 105 °C. PC board interconnections may use ribbon cables, or other standard PC board interconnections.
- 3.20. Solderless CU-AL compression input and output terminals including chassis ground.
 - 3.20.1. Standard AC input terminations will be at the AC input circuit breaker.
 - 3.20.2. Standard DC charger output termination will be at the DC output circuit breaker.
- 3.21. Test points (TB3 and TB4) are provided for easy field testing of the DC Output Voltage.

4. Operation

- 4.1. Battery charger shall be programmable via the HMI soft touch pad and at a minimum display the following:
 - 4.1.1. DC voltage
 - 4.1.2. DC current
 - 4.1.3. Float/equalize mode
 - 4.1.4. Manual/auto equalize timer mode
 - 4.1.5. Equalize hours remaining
 - 4.1.6. Error and message codes
 - 4.1.7. AC ON
 - 4.1.8. Alarm indications
 - 4.1.9. **ATevo** menu functions (see section 8.1.1)
 - 4.1.10. Hindle Health® System (HHS) to indicate overall health of the charger
- 4.2. The charger DC voltage and DC current are displayed simultaneously with 0.5% accuracy.
- 4.3. Float and equalize charge modes are displayed in the upper line of the display.
- 4.4. Equalize methods as indicated in section 5.1 are displayed in an upper line of the display. In equalize mode the display will alternate between the display mode setting and the hours of equalize charge remaining.



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- 4.5. Alarms are indicated by the associated labeled LEDs and on the bottom line of the display.
- 4.6. The battery charger shall automatically annunciate alarms and respond to any programmed options without operator intervention. Errors and messages, indicated by self-diagnostics and operating conditions shall be indicated on the digital HMI display.
- 4.7. High DC Voltage shutdown may be operator enabled or disabled.
 - 4.7.1. When enabled requires user intervention to reset.
- 4.8. Charger operational security may be enabled and activated by user defined password.

5. Equalize modes and functions

- 5.1. Equalize modes:
 - 5.1.1. Equalize mode disabled
 - 5.1.2. Manual Timed Equalize
 - 5.1.2.1. Activate by pressing “Charge Mode” button.
 - 5.1.2.2. Charger returns to float mode after equalize timer expires.
 - 5.1.3. Auto Timed Equalize
 - 5.1.3.1. Charger will activate equalize mode when AC power is restored after an outage of greater than 12 seconds.
 - 5.1.3.2. Charger returns to float mode after equalize timer expires.
- 5.2. Equalize Timer
 - 5.2.1. Equalize Timer is adjustable from 0 to 999 hours in 1 hour increments.
- 5.3. Equalize time remaining appears on display when equalize charge mode is active.

6. Alarms & Communications

- 6.1. Standard Alarms:
 - 6.1.1. AC failure, low voltage
 - 6.1.2. High DCV battery bus (HVDC)
 - 6.1.3. High level detect alarm (analog HVDC)
 - 6.1.4. Low DCV battery bus (LVDC)
 - 6.1.5. Low level detect alarm (analog LVDC)
 - 6.1.6. DC output failure
 - 6.1.7. Battery open alarm
 - 6.1.8. Alarm relay failure
 - 6.1.9. Open external feedback
 - 6.1.10. Open internal feedback
 - 6.1.11. DC power supply failure
 - 6.1.12. Main microprocessor failure
 - 6.1.13. Charger output ripple too high
 - 6.1.14. Charger output at current limit
 - 6.1.15. Charger over temperature alarm
 - 6.1.16. Rectifier temperature sensor failure
 - 6.1.17. End of discharge alarm



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- 6.1.18. DC Circuit Breaker (DCCB) open
- 6.1.19. Charger cooling fan not operating (applies only to forced air cooled chargers)
- 6.1.20. Ground fault:
 - 6.1.20.1. Positive (+) fault
 - 6.1.20.2. Negative (-) fault

- 6.2.** Form C contacts (relays):
 - 6.2.1. Standard, one (1) common Form C contact for all alarm functions.
 - 6.2.1.1. Common alarm relay can be configured to activate when any alarm(s) occur.
 - 6.2.1.2. Contact rating: 120Vac/Vdc @ 0.50A.
 - 6.2.2. Optional, additional Form C contacts for alarms.
 - 6.2.2.1. Programmable Form C contact for any one alarm (groups of 6 relays)
 - 6.2.2.2. Contact rating 120Vac/Vdc @ 0.50A.
 - 6.2.3. Optional, additional High Current Form C contacts for alarms.
 - 6.2.3.1. Programmable Form C contact for any one alarm (individual relays).
 - 6.2.3.2. Contact rating 120Vac/Vdc @ 5.0A.

- 6.3.** Alarm and Form C Contact Configuration
 - 6.3.1. Common alarm assignment
 - 6.3.1.1. The common alarm Form C contact can be programmed to activate when any one of a group of alarms is present.
 - 6.3.2. Optional Form C contact alarm assignment
 - 6.3.2.1. Each Form C contact can be programmed to indicate the status of any one alarm.
 - 6.3.3. Each Form C contact has a time delay configuration.
 - 6.3.3.1. The Form C contact relay time delay is adjustable from 0 to 300 seconds after alarm occurs.
 - 6.3.4. Each Form C contact may be configured to “latch” when active.
 - 6.3.4.1. “Self-clearing” relays automatically return to the non-alarm state when alarm clears.
 - 6.3.4.2. “Latched” relays will remain in the alarmed state until the user manually clears the alarm.



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6.4. Optional Communications

- 6.4.1. Serial Communications Adapter
 - 6.4.1.1. **ATEvo** battery chargers can support up to three (3) Serial Communication Adapters
 - 6.4.1.2. Serial Modbus and DNP3.0 ports can be supported simultaneously
 - 6.4.1.3. Each Serial Communication Adapter will support:
 - 6.4.1.3.1. Isolated port connection (isolated from charger and all other ports)
 - 6.4.1.3.2. RS-232 or RS-485 (2-wire or 4-wire) networks
 - 6.4.1.3.3. Modbus or DNP3.0 protocols supporting all HMI functions and alarms
 - 6.4.1.3.4. Forced Load Share option
 - 6.4.1.3.5. Future expandability
- 6.4.2. Ethernet Communications Adapter
 - 6.4.2.1. Supports 10/100 Mbps copper media via standard RJ-45 connector
 - 6.4.2.2. Supports both Modbus and DNP3.0 simultaneously
- 6.4.3. Fiber Communications
 - 6.4.3.1. Serial fiber options are available
 - 6.4.3.2. Ethernet over fiber options are available

7. Protective Devices

- 7.1. The charger shall employ a protection circuit breaker as standard for the AC input and DC output.
- 7.2. AC input transient over voltage protection shall be accomplished via MOVs (metal oxide varistor) on the AC input terminals.
- 7.3. DC external transient over voltage protection shall be via a MOV (metal oxide varistor) on the DC bus. This shall be located on the power board of the battery charger.
- 7.4. The charger shall be protected against damage in the event that the battery is connected in reverse.
- 7.5. Output electronic current limit shall be adjustable in amps from 50% to 110% of rated output current.
- 7.6. The battery charger shall electronically protect itself from a short circuit in the output so as to limit the current output. When the short is corrected, the battery charger will automatically return to normal charger operation. An alarm shall be provided to indicate a short circuit of the output. The error code shall be automatically removed when the output voltage rises above 2.0Vdc.



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8. Soft Touch (HMI, Human Machine Interface)

- 8.1. The HMI will be interactive and provide the following information via a single LCD screen display:
 - 8.1.1. Standard menu for programming the charger:
 - 8.1.1.1. Charger operation and alarm settings
 - 8.1.1.2. System settings – date, time, backlight, contrast
 - 8.1.1.3. Alarm view – view active alarms
 - 8.1.1.4. Event log – view event log
 - 8.1.1.5. Event log utilities – clear or download event log
 - 8.1.1.6. Relay configuration – latching/non-latching, delay, relay assignment to alarms
 - 8.1.1.7. Relay utilities – reset latched alarms
 - 8.1.1.8. System information – software version
 - 8.1.2. Network and communication settings
 - 8.1.3. Lamp/display test will test display operation and lamps
 - 8.1.4. Hindle Health® System: (see Section 10)
 - 8.1.5. Alarm conditions, status and adjustments: (see Section 6)
 - 8.1.6. Event logging of alarm conditions (see Section 9)
 - 8.1.7. Security password

9. Data Recording and Event Log

- 9.1. System to record all data events for the life of the charger and provide status as follows:
 - 9.1.1. Each alarm function, date, start time and end time
 - 9.1.2. Each self-diagnostic event, date and time
 - 9.1.3. Hours of operation since last reset
- 9.2. All events are viewable on the digital display and may be downloaded.
- 9.3. Over 1,000 events may be stored on the charger's removable memory SD card.

10. Hindle Health® System

- 10.1. The Hindle Health® System (HHS) provides a 2-stage self-diagnostic and system verification tool designed to assist the operator in verifying proper operation and settings of system parameters. This feature offers a systematic verification procedure to confirm the health of the battery charger. It queries the operator to verify all charger parameters and alarm settings. HHS steps the operator through an electronic functional check of all parameters including relay operations.
 - 10.1.1. HHS Status Lights: Front panel green and red status lights confirm whether your charger is functioning properly or requires attention.
 - 10.1.2. HHS Parameters Verification:
 - 10.1.2.1. LED Lamp Test
 - 10.1.2.2. Verify dc output using hand-held dc voltmeter
 - 10.1.2.3. Float voltage
 - 10.1.2.4. Equalize voltage
 - 10.1.2.5. Equalize timer
 - 10.1.2.6. Auto equalize on/off
 - 10.1.2.7. Current limit



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- 10.1.2.8. High dc alarm
- 10.1.2.9. High dc voltage level detect
- 10.1.2.10. High dc voltage shutdown
- 10.1.2.11. Low dc alarm
- 10.1.2.12. End of discharge alarm
- 10.1.2.13. Low dc voltage level detect
- 10.1.2.14. AC ripple
- 10.1.2.15. Positive ground detect
- 10.1.2.16. Negative ground detect
- 10.1.3. The self-diagnostic system automatically monitors any charger malfunction or alarm condition.
- 10.1.4. Alarm Simulations
 - 10.1.4.1. High dc voltage alarm
 - 10.1.4.2. Low dc voltage alarm
 - 10.1.4.3. AC ripple alarm
 - 10.1.4.4. Negative ground detect
 - 10.1.4.5. Positive ground detect
 - 10.1.4.6. Common alarm relay

11. Construction

- 11.1. I/O power terminals with CU-AL compression lugs, appropriately sized for field wiring.
 - 11.1.1. Standard AC input terminations will be to the circuit breakers.
 - 11.1.2. Standard DC charger output termination will be to the circuit breaker.
- 11.2. Alarm function terminals use standardized compression terminal block for #22-14 gauge.
 - 11.2.1. Optional barrier type terminal block for connections using spade type connectors with wire sizes to #10 gauge.
- 11.3. Enclosure shall be no less than 18 gauge steel for the outer skin, door and chassis. The enclosure will include adequate knock-outs for bottom, right and left side conduit entry.
- 11.4. Finish will be ANSI-61 gray, baked powder epoxy inside and out.
- 11.5. Serviceability: The battery charger shall be serviceable by a technician using standard hand tools. No special tools are required for any routine installation, maintenance or repair. All service made through front of unit, no rear access required. The addition of any and all options including but not limited to filtering, alarm capabilities, battery eliminator, remote temperature compensation, forced load share, and either medium or high rated interrupting capacity circuit breakers and/or fuses, will be capable of being added in the field by the technician without any special training, using standard hand tools.



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12. Options

- 12.1. Multi-input tap transformers: 120/208/240 @ 60Hz, 120/220/240 @ 50/60Hz, 380/416 @ 50/60Hz.
- 12.2. NEMA PE5 battery eliminator filter. Reduces output ripple voltage to 30mVrms up through 48Vdc, 100mVrms for 130Vdc and 200mVrms for 260Vdc chargers.
- 12.3. Super filtering to 30mVrms on 130VDC systems with a battery connected.
- 12.4. Programmable Form C contacts in groups of 6 for available alarms, contact rating 120Vac/Vdc @ 0.50A.
- 12.5. High current rated programmable Form C alarm contacts. Contact rating 120Vac/Vdc @ 5.0A.
- 12.6. Communications:
 - 12.6.1. MODBUS/DNP3.0 communications for all HMI functions and alarms
 - 12.6.2. Ethernet Communications of all HMI functions and alarms
 - 12.6.3. Fiber Link
 - 12.6.4. Expandable ports for future communications protocols
- 12.7. Generic Binary Inputs
 - 12.7.1. Independent optical isolated inputs are available in groups of four
 - 12.7.2. Input can be user configured for 12, 24, 48, or 130Vdc thresholds
 - 12.7.3. Uses include: remote shutdown, electrolyte level, ventilation fan failure
- 12.8. Generic Analog inputs
 - 12.8.1. 0-10VDC inputs referenced to charger DC (-) are available in groups of four
 - 12.8.2. Input can be scaled to report and alarm in primary values
 - 12.8.3. Uses include: AC voltage, AC current, and temperature transducer inputs
- 12.9. Forced load share
 - 12.9.1. Two chargers with the same DC ratings connected to the same DC bus will negotiate and equally share the system load
 - 12.9.2. The chargers negotiate the load via serial communications through a cable connected between to the two chargers
- 12.10. Medium and high rated AIC circuit breakers
- 12.11. Battery DC circuit breaker (separate enclosure)
 - 12.11.1. Auxiliary contacts for battery DC circuit breaker
- 12.12. Aux. contacts for AC circuit breakers
- 12.13. Temperature compensation external temperature probe, mounted on or near the battery. For lead-acid or Nickel-Cadmium batteries and available in 25, 50, 100 and 200 ft. lengths.



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- 12.14. Remote equalize with the addition of an auxiliary I/O board
- 12.15. Battery temperature alarm (requires temperature compensation probe)
- 12.16. Circuit breaker pad-lockable and lock out features
- 12.17. Enclosure safety interlocks to prevent charger operation if the front panel is opened
- 12.18. Special enclosures: NEMA 2(drip shield), NEMA 4 and NEMA 12
- 12.19. Blocking diode
- 12.20. Copper ground bus
- 12.21. Alarm barrier terminals
- 12.22. Custom paint, internal/external
- 12.23. Custom engraved tag plates
- 12.24. Thermostatically controlled space heaters
- 12.25. Internal LED lighting
- 12.26. Conformal coating of all printed circuit boards
- 12.27. Fungus protection
- 12.28. Static protection
- 12.29. ANSI/IEEE lightning protection
- 12.30. Custom drawing packages
- 12.31. Certified Test Data



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13. Filtering

- 13.1. DC output filter, consistent with NEMA PE5 standard, consisting of two inductors and one or more capacitors capable of limiting the output ripple with battery connected. The DC output filter reduces the output ripple voltage to less than 30mVrms on batteries through 48 Vdc, less than 100mVrms for 130Vdc batteries and less than 200mVrms for 260Vdc batteries when measured at the battery terminals.
- 13.2. Battery Eliminator filter, consistent with NEMA PE5 standard, consisting of two inductors and two capable of limiting the output ripple with or without a battery connected. The filter reduces the output ripple voltage to less than 30mVrms on chargers through 48Vdc, less than 100mVrms for 130Vdc chargers, and less than 200mVrms for 260Vdc chargers. The ripple voltage is measured at the charger terminals.
- 13.3. Super filtering to less than 30mVrms on 130VDC systems with battery connected.
- 13.4. As defined by NEMA PE5, a test battery must be fully charged and have an ampere-hour capacity equal to four times the rated output of the charger where the AH rating is at least four times the charger output current rating.

14. Documentation

- 14.1. A manual completely describing the installation, operation, and maintenance of the charger including all accessories and options shall be included. The charger shall have provision for storing the manual in a convenient permanent pocket attached directly to the charger.
- 14.2. Standard drawings consisting of an outline, internal layout, schematic and wiring diagram are provided in the manual.
- 14.3. A customized parts data package, including manufacturer's replacement part number and recommended spares shall be included with charger.
- 14.4. Optional customized drawings are available for user defined charger requirements.