

Document: PRODSPEC-130
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Product: 20-amp “EnerGenius NRG”
Battery Charger

- Complies with FCC and EN emissions standards
- Complies with EN immunity standards
- C-UL listed and CE marked (50/60 Hz units)

1. GENERAL DESCRIPTION

1.1 General Description

Fully regulated, constant voltage, current limited battery charger designed for heavy-duty industrial service. Primary application: quick recharge and long-life maintenance of engine start batteries.

1.2 Features overview

- Rated 120/ 208-240 VAC, 60 Hz input, 10/5 amps. Optional 50/60 Hz input.
- Operates on 120, 208, 220, 230, 240 VAC
- Field configurable for 12 or 24 volts
- Simple voltage programming to specific battery type and cell quantity
- Battery interactive, four-rate charge mode
- Precision current limiting
- ±0.5% voltage regulation
- Temperature compensated output with options of remote sensing or disabling temperature compensation
- Able to charge a dead battery
- -20C to +40C operation at full rated output
- High temperature fold-back permits higher temperature operation. Current limit drops to zero amps at about 90C.
- Reverse battery protection
- Conformally coated PCBA
- Status indicator LEDs
- Alarm Form C contacts
- Battery fault protection system
- Precision digital ammeter and voltmeter
- Rugged aluminum chassis
- Surge protected to IEEE and EN standards

1.4 Safety isolation

Electrical isolation from input AC to output DC is maintained through the use of power transformers meeting relevant safety agency requirements. Transformers are built to UL listed Class H (180 C) insulation systems.

1.5 Model configurations summary

Model Number	Alms	DC Output	AC Hz.	C-UL	CE
NRG22-20-RC	C	12/24	60	√	
NRG22-20-HC	C	12/24	50/60	√	√
NRG12-20-RC	C	12	60	√	
NRG12-20-HC	C	12	50/60	√	√
NRG24-20-RC	C	24	60	√	
NRG24-20-HC	C	24	50/60	√	√

2. TECHNICAL STANDARDS AND CERTIFICATIONS

2.1 International standards

Chargers are designed and built to relevant international safety and electromagnetic compatibility (EMC) standards as follows:

2.1.2 Safety agency standards

Designed and built to UL 1236 (Category BBGQ), CSA 22.2 No. 107.2, EN 60335-2-29 and best commercial practice for heavy-duty battery chargers designed for continuous operation.

2.1.2.1 Agency markings

- 60 Hz units: UL and C-UL listed marks to UL 1236 and CSA 22.2 No. 107.2
- 50/60 Hz units: CE mark; DOC to EN 60335-2-29, EN 50081-2 and EN 50082-2

- 2.1.3 EMC standards: emissions
 - FCC Part 15 Class B
 - EN 50081-2
- 2.1.4 EMC standards: immunity
 - ANSI/IEEE C62.41 Category B
 - EN 50082-2 (heavy industrial), including: EN 61000-6-2, 61000-4-2, 61000-4-3, 61000-4-4, 61000-4-5 and EN 61000-4-6

3. AC MAINS SUPPLY

- 3.1 Field selectable 120/208-240 volts, 60 Hz or 50/60 Hz based on model (see table in Paragraph 1.5.)
- 3.2 Input voltage range is $\pm 10\%$ of rating. Lower voltage does not harm unit, but reduces maximum available current at fast charge voltage. Charger operates to full specification from low line 208 volts (187 volts) to high line 240 volts (264 volts.)
- 3.3 Input frequency range is $\pm 5\%$

4 SECTION NOT USED

5 OUTPUT

- 5.1 Output voltage configurations
 - a) 12 volts, factory selected
 - b) 24 volts, factory selected
 - c) 12/24 volts field selectable

See table under Paragraph 1.5 for model designators for each voltage rating.

- 5.1.1 Battery compatibility
Twelve battery configurations are pre-programmed into the unit (six each for the 12V and 24V ranges).

<u>Setting</u>	<u>12-volt</u>	<u>24-volt</u>
6	14.30	28.60
5	13.62	27.24
4	13.50	27.00
3	13.31	26.62
2	13.08	26.16
1	12.87	25.74

- 5.3 4-rate automatic float/fast charge mode control

The high rate (fast charge) voltage is a fixed level 6.5% $\pm 1\%$ over the selected float voltage level. A jumper is available to defeat fast charge mode operation for use with VRLA batteries.

Automatic fast charge responds to the battery's current demand, providing the fastest possible recharge and lowest possible water consumption plus longest battery life.

Constant current: The charger operates at maximum possible output in the fast charge mode.

High-rate taper charge: The charger stays at the fast charge voltage level while battery current acceptance falls to 90% of the charger's rated output

Finishing charge: The charger operates at the float voltage and completes battery charge.

Maintaining charge: The charger supplies only the very few milliamps required by the battery to stay at peak capability.

- 5.4 Output current limit
Rectangular current limit at 20 amps
Current limit tolerance is 105% plus or minus 5%.

- 5.5 Output regulation
Line and load voltage regulation in float mode is $\pm 0.5\%$ at 25 degrees C.

Voltage regulation in fast charge mode in all battery selector configurations is $\pm 1\%$. In some configurations full current at maximum required fast charge voltage might not be available at low AC line voltage.

- 5.5.1 Output voltage temperature compensation (TC)
The nominal voltage-temperature (V-T) curve changes output voltage when the temperature of the TC probe is between

+10C and +40C at the rate of $-0.22\% \pm 0.009\%$ per degree. The factory voltage setting corresponds with +25C. The standard thermistor sensor is located on the I/O board in a position as exposed to incoming ambient air as possible.

Installation of the temperature sensor element to a terminal block on the I/O card activates TC. Two options for TC are available; local and remote TC.

Remote sensing of temperature is sometimes required. The remote sensor is permitted to be up to 100 feet away from the charger.

5.6 Output stability

The charger will operate in a stable fashion when connected to battery. Charger operation without battery is inhibited by control electronics.

5.8 Voltage sensing point

Voltage sense is at the output terminals of the charger

5.9 Dead battery charge

When the “Jump” configuration is closed the charger will charge a fully discharged battery from zero volts.

6 PROTECTION

6.1 Soft Start (current walk-in)

Soft start interval of between 2 and 5 seconds to full-required output.

6.2 Surge suppression standards

See Section 2.

6.3 Input overcurrent protection device

Single-pole input cartridge-type fuse, mounted on circuit card protects against internal fault.

6.4 Output over-current protective device

Electronic current limit. Single pole output fuse mounted on circuit card protects against internal fault.

6.5 Over Temperature Protection

Maximum current rating is maintained up to +40 C. In higher ambient conditions maximum output current reduces so that charger electronics remain at a safe temperature

6.6 Reverse polarity protection

Charger does not start into a reversed battery. Reversed battery is detected for reverse polarity exceeding 1 volt.

6.7 Corrosion damage protection

PCBA is conformally coated.

7 STATUS INDICATORS & ALARMS

7.1 Front panel LEDs

LED illumination is immediate upon achievement of alarm threshold.

7.1.1 Not used

7.1.2 Front panel LEDs:

- “**AC/ON**”; green for normal operation† (HKPS powered)
- “**Float mode**”; green for normal voltage (float charge)† (HKPS powered)
- “**Boost mode**”; yellow for boost (fast charge mode)† (HKPS powered)
- “**TC active**”; (TC) green. On when TC system working† (HKPS powered)
- “**AC fail**”; red. (AC F) On when AC is not available to power charger.* (battery powered)
- “**DC low**”; red for low battery voltage* (battery powered.)
- “**DC high**”; red for excessive battery voltage* (battery powered)
- “**Battery fault**”; red for open, wrong voltage or reversed battery.*† (HKPS and battery powered)
- “**Charger fail**”; red for internal charger failure* (HKPS powered)

(*) Must operate correctly when only battery power is present.

(†) Must operate correctly when only AC power is present

(*†)Must operate both when battery is present and when battery is removed and charger is powered by AC.

b) HKPS operates and drives the “battery fault” alarm (LED and relay)

7.1.2.1 Alarm voltage levels

- Low battery voltage: 12 volts ± 0.25 volt or 24 volts ± 0.5 volt (according to output voltage setting)
- High battery voltage: set point is 16.9 ± 0.35 volt or 34.0V ± 0.35 volt.

7.2 Form C contacts for remote alarming

Each relay is single-pole, double-throw (SPDT) with contacts rated for 2A max at 30 VDC/VAC, 5mA to 1A recommended for maximum service life. Indications are as follows:

- **AC fail**; activates when AC supply is not available to charger or if fuse is blown. This alarm has no additional time delay. It activates when the AC input is inadequate to operate the internal control circuits.
- **Low battery**: activates after the time delay when battery voltage is lower than the preset level.
- **High battery**: activates after the time delay when battery voltage is above the preset level.
- **Battery fault**: activates after the time delay when the battery fault protection system (BFPS) shuts down the charger. Relay remains in the alarm state until battery fault conditions are removed.
- **Charger fail**: activates immediately upon failure of the charger to deliver demanded current. Does not activate when the battery fault protection system (BFPS) inhibits charger operation.

7.3 Alarm contact time delay

20 to 50 seconds.

7.3.5 Battery Fault Protection System (BFPS)

Purpose and operation:

1. Prevent damage to the charger when battery polarity is reversed.
 - a) SCR firing is inhibited

2. Prevent overvoltage damage to the charger or connected customer electronic loads when battery is disconnected from charger while charger is running (“load dump”)
 - a) SCR firing is inhibited so that no additional cycles fire
 - b) Passive voltage clamp operates to limit voltage on output terminals.
 - c) Battery fault alarm activates

3. Reduce likelihood of over voltage damage to customer electronic loads caused by high ripple voltage (see 7.3.6 for causes of this condition.) Operates upon detection of peak voltage in excess of 120% of the average DC voltage to which the output is being controlled. **Example 1:** Shutdown for 27.24V float setting, with TC inactive is $27.24 \times 1.2 = 32.69$ volts. **Example 2:** Shutdown for 27.55V float setting at fast charge with TC active at +10 deg. C is $((27.55(.0022 \times (25-10)) + 27.55) \times 1.065) \times 1.2 = 36.37$ volts.
 - a) SCR firing is inhibited so that no additional cycles fire
 - b) Passive voltage clamp operates to limit voltage on output terminals.
 - c) Battery fault alarm activates

7.3.6 Causes of excessive output ripple

- Battery is disconnected from charger
- Battery internal resistance is excessive
- Battery to charger cable resistance is excessive – due to insufficient cable size, excessive cable length or damage or corrosion in cable
- Battery to charger cable terminations resistance is excessive
- Installation topology is incorrect. (Example: charger & load connected to a common busbar. High resistance leads connected between busbar and battery while low resistance leads

connected between busbar and load. This prevents the battery's capacitance from effectively filtering the charger's unfiltered output.)

- Humidity: 5% to 95%, non-condensing
- Altitude: 0-2000 meters; no derating

7.4 Output meter

A single 3-digit meter displays output current to an accuracy of $\pm 4\%$, or output voltage to an accuracy of $\pm 2\%$. Automatic meter alternately displays output volts and amps. Jumper selection sets display to show either constant volts or amps.

9.2 Cooling
Convection cooled

9.3 Not used

8 CONTROLS & ADJUSTMENTS

10 MECHANICAL

8.1 Controls

- Meter volt/amp selector jumper has three settings: alternating volt/amp display, constant volts, or constant amps.

10.1 Installation
Wall mounting. Unit must be installed vertically with conduit openings to ensure proper ventilation.

8.2 Installation set-up

- 12/24 volt output selector jumper
- Battery type selector jumper (6 positions). This is the only adjustment of output voltage offered.
- Fast charge activate jumper
- Temperature comp. connection
- 120/240 VAC select switch

10.2 Dimensions and weight
12.50" (318 mm) H
14.00" (356 mm) W
6.73" (171 mm) D

Weight 45 lbs (19.1 KG)

10.2 Power connections (input and output)
Hard wired via conduit knockouts to a terminal block. Terminals will accept 14AWG to 6 AWG copper conductors.

9 ENVIRONMENTAL

10.3 Alarm connections
Hard wired via conduit knockout to a terminal block. Terminals will accept 22 AWG to 14 AWG copper conductors.

9.1 Ambient

- Temperature: -20C to +40C at full rated output, -40C to +60C with automatic output current reduction

END OF SPECIFICATION