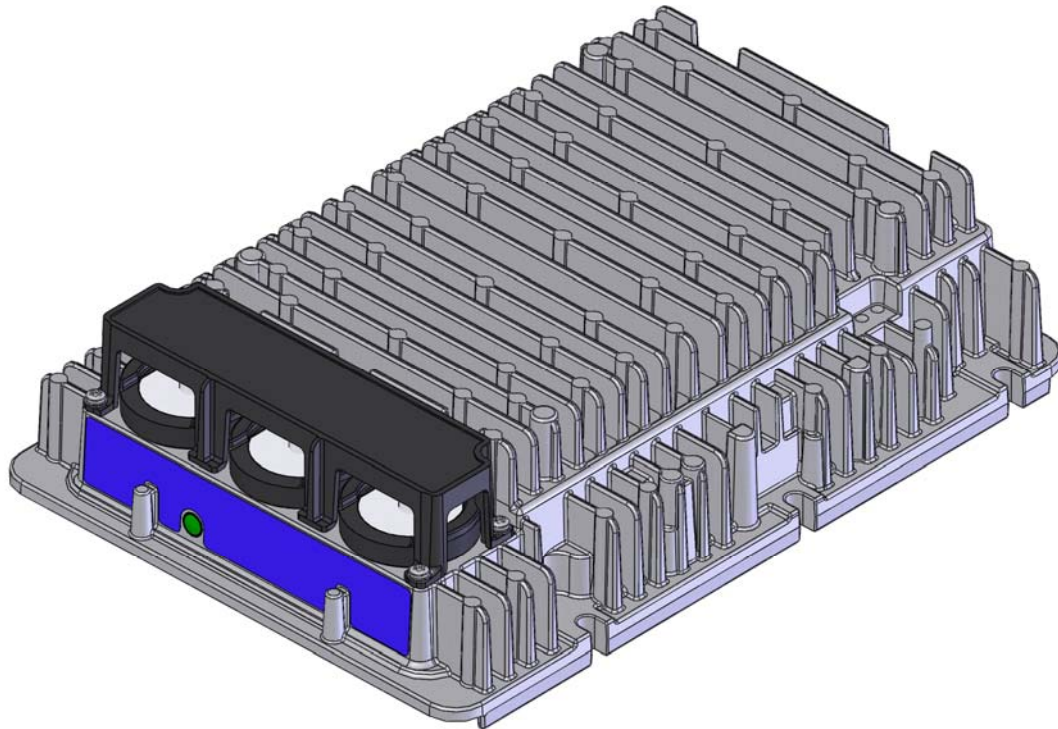



REVISIONS				
REV	ECO	DESCRIPTION	DATE	BY
001	5332	PRODUCTION RELEASE	11/26/08	JT
002	5489	ADD 21100C00 MODEL NUMBER – CLARIFY EQUALIZER'S OUTPUT VOLTAGE DURING NO-LOAD – CHG 'SALES/MRKTG APPROVAL' BLOCK TO 'PROD MANAGER APPROVAL' BLOCK	10/15/09	JT

Product Specification

21XXE00 EQUALIZER AND 21XXC00 CONVERTER FAMILY



UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES [MM] TOLERANCES ARE: .XX ± .10 [X.X ± 2.5] .XXX ± .030 [X.XX ± 0.76] INTERPRET GEOMETRIC DIMENSIONS AND TOLERANCING PER ASME Y14.5-1994 DRAWINGS IN THIS DOCUMENT ARE NOT TO SCALE		 A Part Of COOPER Bussmann	
APPROVALS		DATE	
DRAWN BY MGEORGE		08/28/08	
PROJECT ENG APPROVAL			
ENG MANAGER APPROVAL			
PROD MANAGER APPROVAL			
		TITLE MODEL NO: 21XXC00/E00 CONVERTER AND EQUALIZER FAMILY SPECIFICATION OUTLINE	
		SIZE A	CAGE CODE NO. 55156
		DRAWING NO. 21XXC00-E00	REV 002
		SCALE: NONE	FILE: 211XXC00-E00-002
		SHEET 1 OF 13	

PROPRIETARY

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Overview

In dual battery (24V systems) it is often desirable to have 12V power available. Often this 12V power is available by tapping the battery stack at the junction of the lower and upper battery. Tapping the battery stack will result in unequal current draw from the lower and upper battery. Unequal current draw from the batteries will result in a state of charge unbalance. The lower battery will be discharged more than the upper battery. Eventually this will lead to damage and reduced life from the batteries.

The battery equalizer provides an effective method for ensuring that the two batteries maintain voltage balance by providing all of the 12V current. The battery is only called upon to supply transient currents that exceed the output capability of the equalizer. The equalizer thus maximizes the life of the batteries in dual battery systems.

Converters provide fixed outputs to power 12V loads directly where a 12V battery is not available.


Features

- Under and Over Voltage Protection
- Reverse Voltage Protection
- Voltage Transient Protection
- Over load and Short Circuit Protection
- Thermal Overload Shutdown
- Equalization Status Indicator
- Protected from the Elements

Part Number / Ordering Information

Table 1

Sure Power Part Number	Output Current	Equalizer / Converter
21100E00	100 Amps	Equalizer
21080E00	80 Amps	Equalizer
21060E00	60 Amps	Equalizer
21100C00	100 Amps	Converter
21080C00	80 Amps	Converter
21060C00	60 Amps	Converter

			
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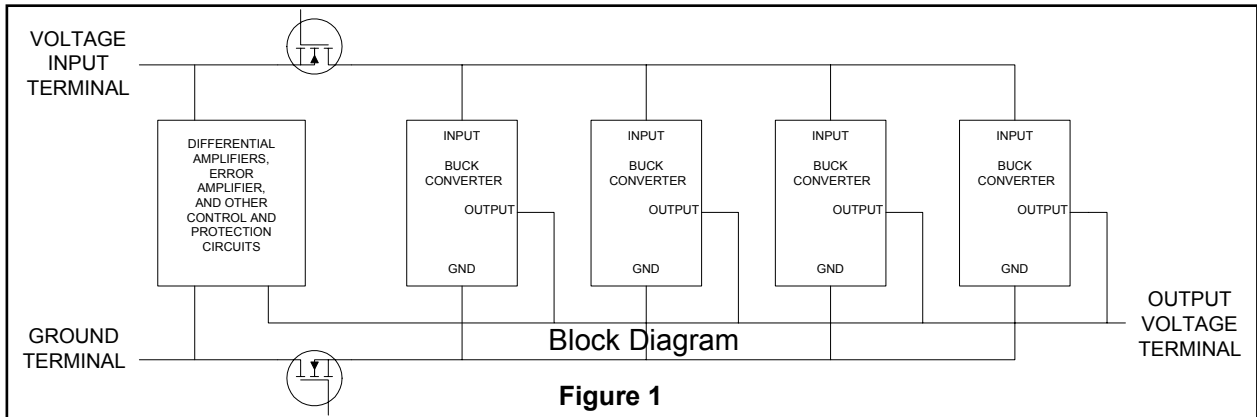
Theory of Operation


The family of equalizers and converters utilize paralleled buck converters to step down the input voltage in order to achieve the appropriate output voltage.

The equalizers monitor the input voltage at the terminals and provide an output that is one-half of the input. Converters provide a fixed output independent of the input voltage at the terminals.

Isolation is provided between chassis and input / output / ground terminals.

Internal construction consists of both SMT and thru-hole components.



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Description of Features

Included are a number of protection and other features.

PROTECTION FEATURES:

Reversal of the input polarity is protected with MOSFETs in series with the input. Reversal of the output polarity is protected with MOSFETs in series with the ground connection. The protection feature will automatically reset when the correct polarity is applied.

A Metal Oxide Varistor circuit is used to protect the input from load dump and inductive transients.

Input under-voltage and over-voltage conditions cause the unit to safely turn off. When the correct voltage is applied to the input the unit will automatically turn back on.


Short circuit and current limiting protection is supplied by monitoring the output current. Detection of a short circuit or overload limits the output current to 1.2 to 1.4 times the maximum steady state output rating. Upon removal of this condition the output voltage will return to its normal state.

Monitoring the internal temperature provides thermal protection. Detection of excess temperature shuts the unit off. As the heat sink cools, the unit will automatically reset.

Loss of ground protection ensures no damage occurs to the unit if ground is inadvertently lost.

STATUS INDICATOR:

An LED status indicator is provided to denote when the unit is producing current. In equalizers, as the batteries become equalized the LED indicator will diminish in intensity and eventually go dark. In converters, when the output current approaches zero, the LED will go dark.

			
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ELECTRICAL SPECIFICATIONS

Table 2 ABSOLUTE MAXIMUM RATINGS:

Maximum ratings establish the maximum electrical rating to which the unit may be subjected without damage.

Parameter	Typical	Notes:
Standoff Voltage	36V	Note 1
Reverse Polarity	-26V	Note 2
Output Current		
Model 21060E00, 21060C00	60A	Note 3
Model 21080E00, 21080C00	80A	Note 3
Model 21100E00, 21100C00	100A	Note 3
Heat Sink Temperature	100°C	Note 4
Over-temperature Shutdown	110°C	Unit will shutdown if internal temperature exceeds this value.
Over-temperature hysteresis	12°C	Amount temperature of unit must drop before it will automatically turn back on.
Ambient Operating Temperature Range	-40°C +85°C	Note 3
Storage Temperature Range	-55°C +105°C	

Note 1: Standoff Voltage

This is maximum voltage applied between +24V and GND that the unit will standoff without causing damage to the unit.

Note 2: Reverse Polarity


This is the maximum reverse voltage that may be applied between the 24V terminal and the GND terminal, or between +12V terminal and the GND terminal.

Note 3: Output Current

Units can be operated up to +85°C at a reduced output current. Refer to "Output Current Derating Guideline."

Note 4: Heat Sink Temperature

The unit generates a significant amount of heat. When determining a mounting location it is important to account for this heat. Adequate ventilation must be provided. Under all conditions the heatsink temperature must be maintained below this required value.

			
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Output Current Derating Guideline

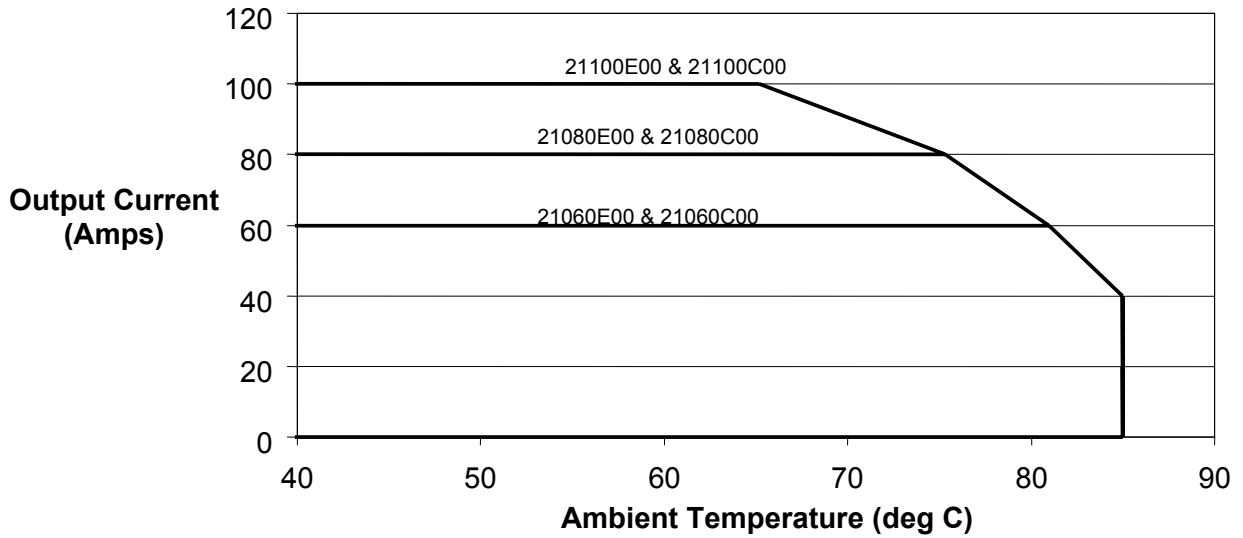


Figure 2


Table 1 INPUT ELECTRICAL CHARACTERISTICS

Unless otherwise stated, conditions apply to full temperature range and full input voltage range.

Characteristic	MIN	TYP	MAX	Unit	Notes:
Input Under Voltage Turn ON	14.9	15.9	16.9	V	
Input Under Voltage Turn OFF	10.1	10.8	11.5	V	
Input Over Voltage Turn OFF	32	33	34	V	Voltage on INPUT that causes the equalizer to turn off.
Input Over Voltage Hysteresis		0.5		V	
Quiescent Current ^{1,2}		18	25	mA	Current draw from the INPUT with no load attached to OUTPUT. Input voltage is 24V, 25°C ambient
Isolation rating		50		V	Input/output/GND to chassis

Note 1: Quiescent Current may slightly increase at elevated temperatures.

Note 2: With no load on the output, the output voltage will drift up slightly due to leakage currents.



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Table 2 OUTPUT ELECTRICAL CHARACTERISTICS

Unless otherwise stated, conditions apply to full temperature range and full input voltage range.

Characteristic	MIN	TYP	MAX	Unit	Notes:
Output Voltage ² (Equalizers)	$V_{24}/2$ -1%	$V_{24}/2$	$V_{24}/2$ +1%	V	21100E00, 21080E00, 21060E00
Output Voltage (Converters)	13	13.5	14	V	For Models 21080C00, 21060C00 When Input Voltage is greater than 22V. (For Input Voltage less than 22V, Output Voltage Equals ½ Input Voltage)
Load Range Model 21060C00, 21060E00	0		60	A	See derating curves for extended ambient operating temperatures.
Current limit ³ Model 21060C00, 21060E00	64	69	74	A	Constant Current
Load Range Model 21080C00, 21080E00	0		80	A	See derating curves for extended ambient operating temperatures.
Current limit ³ Model 21080C00, 21080E00	87	92	97	A	Constant Current
Load Range Model 21100E00, 21100C00	0		100	A	See derating curves for extended ambient operating temperatures.
Current limit ³ Model 21100E00, 21100C00	110	115	120	A	Constant Current
Loop Stability (BW)		2		KHz	Line, Load, temperature

Note 2: Output Voltage

To maintain battery balance, the equalizer monitors the input voltage and provides an output voltage that is one-half of the input voltage. The input voltage is the voltage that exists between the 24V Terminal and the GND Terminal. The input voltage is called V24, for simplicity. Table 1 lists the input operating voltage range. The output voltage is the voltage between the 12V Terminal and the GND Terminal. The output voltage is called V12 for simplicity. For example, if the input voltage (V24) is 24.0 volts, the output voltage (V12) would be 12.0 volts.

Note 3: Current Limit Protection

The equalizer automatically limits the output current. It monitors the output current and limits it to a preset value (Current Limit). As the output load is increased beyond Current Limit the output voltage will drop and the current will only slightly increase. The Table above gives the typical characteristics of the current limit circuit. When the over-load or short circuit is removed the output voltage will automatically return to normal.


			
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Table 3 Electromagnetic Compatibility Specifications

Characteristic	Typical	Notes:
Load Dump	28V + 122	Ref. SAE J1455 Rev Aug94, Table 4b. As tested with EM Test LD200. Applied to +24V terminal.
Inductive Load Switching	±600 V	Ref. SAE J1455 Rev Aug94, Table 4b. As tested with EM Test MPG200.
Mutual Coupling	±300 V	Ref. SAE J1455 Rev Aug94, Table 4b. As tested with EM Test MPG200.
ESD – Handling	±8kV, Direct ±15kV, Air	Per SAE J1113-13 Rev Nov2004
ESD – In Vehicle	±8kV, Direct ±15kV, Air	SAE J 1113-13 Class C, Region 2
Conducted Immunity	0 - 100 mA	Per SAE J1113-4 Rev Aug2004 Bulk Current Injection Appendix A, Class C
Radiated Immunity	40 - 150 V/m	SAE J1113-21 Rev Oct2005 Absorber-Lined Chamber Appendix C, Group 2
Conducted Emissions	Class 2	Per J1113-41 Rev May2000
Radiated Emissions	Class 2	
Immunity and Emissions		Per UN Regulation ECE R 10.02 for E mark.



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Table 4 ENVIRONMENTAL SPECIFICATIONS

Parameter	Level	Conditions / Notes
Thermal Shock	+85°C to -40°C 2hr soak per temp 36 Cycles	per . SAE J1455 Rev Aug94 Sec 4.1.3.
Thermal Cycle	+85°C, -40°C 9 Cycles, 2 hr exposure	
Humidity	0 – 98 %RH	per SAE J1455 Rev Aug94, Section 4.2.3
Splash	DOT4 brake fluid, 20W40 synthetic motor oil, unleaded gas, engine degreaser, and carburetor cleaner.	per SAE J1455 Rev Aug94 Section 4.4, Splash only
Pressure Wash	1400 kPa	per SAE J1455 Rev Aug94 Section 4.5
Dust Bombardment	0.88 g/m ³	per SAE J1455 Rev Aug94 Section 4.7
Salt Spray	96 Hrs	per SAE J1455 Rev Aug94 Section 4.3
Altitude	12000 ft	per SAE J1455 Rev Aug94 Section 4.8
Mechanical Vibration	0.0635G ² /Hz, 5 to 100Hz 3dB per Octave roll-off to 500Hz	Random Vibration, 3 axes, 3 hr/axis.
Operational Shock	30g, 11ms, Sawtooth	3 axes, both directions.
Handling Shock	Will Show Damage	per SAE J1455 Rev Aug94 Section 4.10

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Efficiency and Power Dissipation Curves

21100X00 Typical Efficiency and Power Dissipation vs Output Current
 $V_{24}=24V, V_{12}=12V$

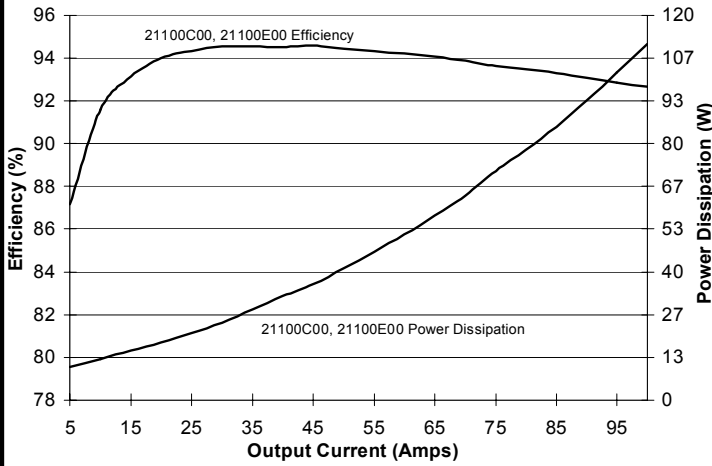


Figure 3

21080X00 Typical Efficiency and Power Dissipation vs Output Current
 $V_{24}=24V, V_{12}=12V$

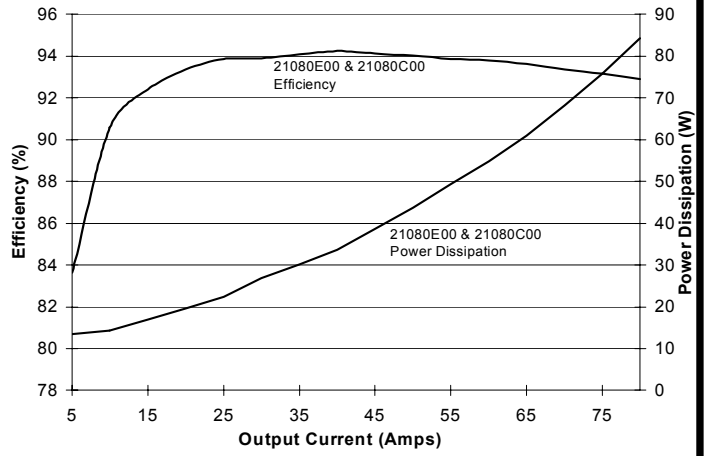


Figure 4

21060X00 Typical Efficiency and Power Dissipation vs Output Current
 $V_{24}=24V, V_{12}=12V$

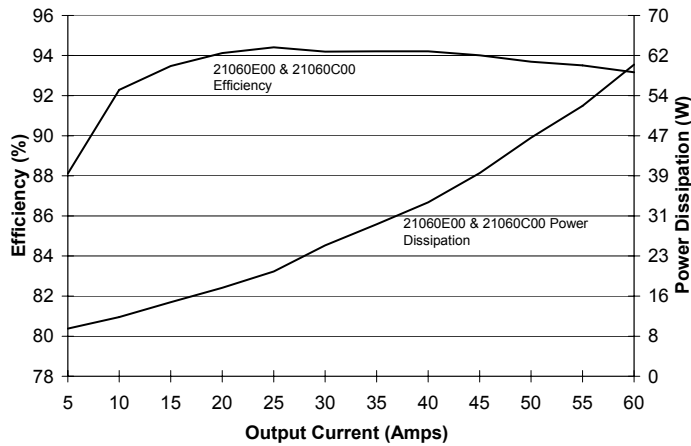



Figure 5

			
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CONNECTION DIAGRAMS:

Recommended Equalizer Connection

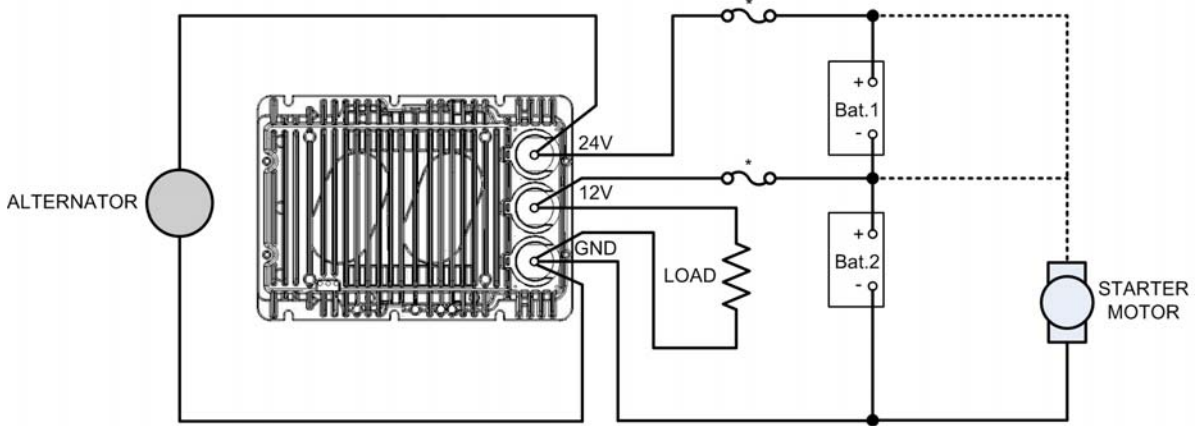


Figure 6

Typical Converter Connection

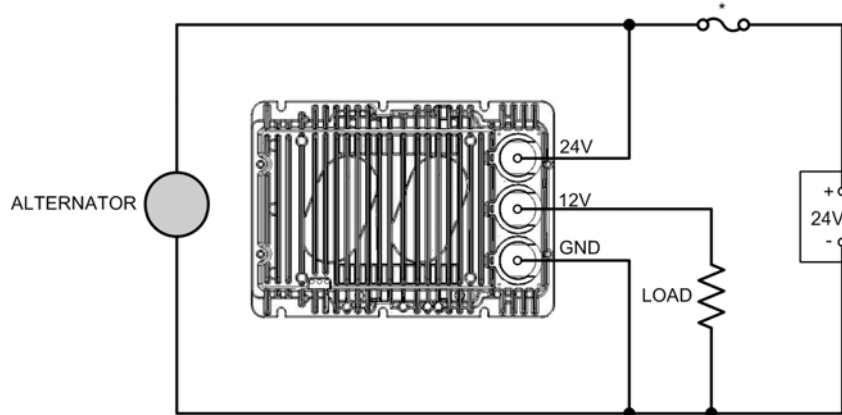


Figure 7

Note *: Fuses
See Sure Power document 180098E for appropriate fuse ratings

Unit Connections

24V:

This terminal is connected to the +24V side of the battery stack


GND:

This is the terminal for grounding the unit. All internal operating currents are returned to this terminal

12V:

This terminal is connected to the +12V terminal of the battery stack for equalizers.

In converter applications the OUTPUT terminal is connected to the loads.

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MECHANICAL SPECIFICATIONS

Unit power connections are made through three M8 threaded studs. A plastic cover is provided to protect these studs from damage.

Finish: Cast Aluminum

Terminals: 0.050 C11000 ETP 1045 steel, Bright Tin Plate per ASTM-B545, Class A over, Nickel Plate per ASTM-B689, Type 1

Hardware Included:


- Nuts – 3X, M8 Hex, Tin Plated Steel
- Lock Washers – 3X, M8, Tin Plated Steel

Maximum Torque: 110 in-lbs

21100E00, 21100C00, 21080E00, 21080C00, 21060E00, and 21060C00

Mounting Slots: 6X, Accepts M6 or ¼" Hardware (not included)

Weight: 4.9 kg ± 5% (10.8 lbs. ± 5%)

			
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**Unit Dimensions – 21100E00, 21100C00, 21080E00, 21060E00,
21080C00, and 21060C00**

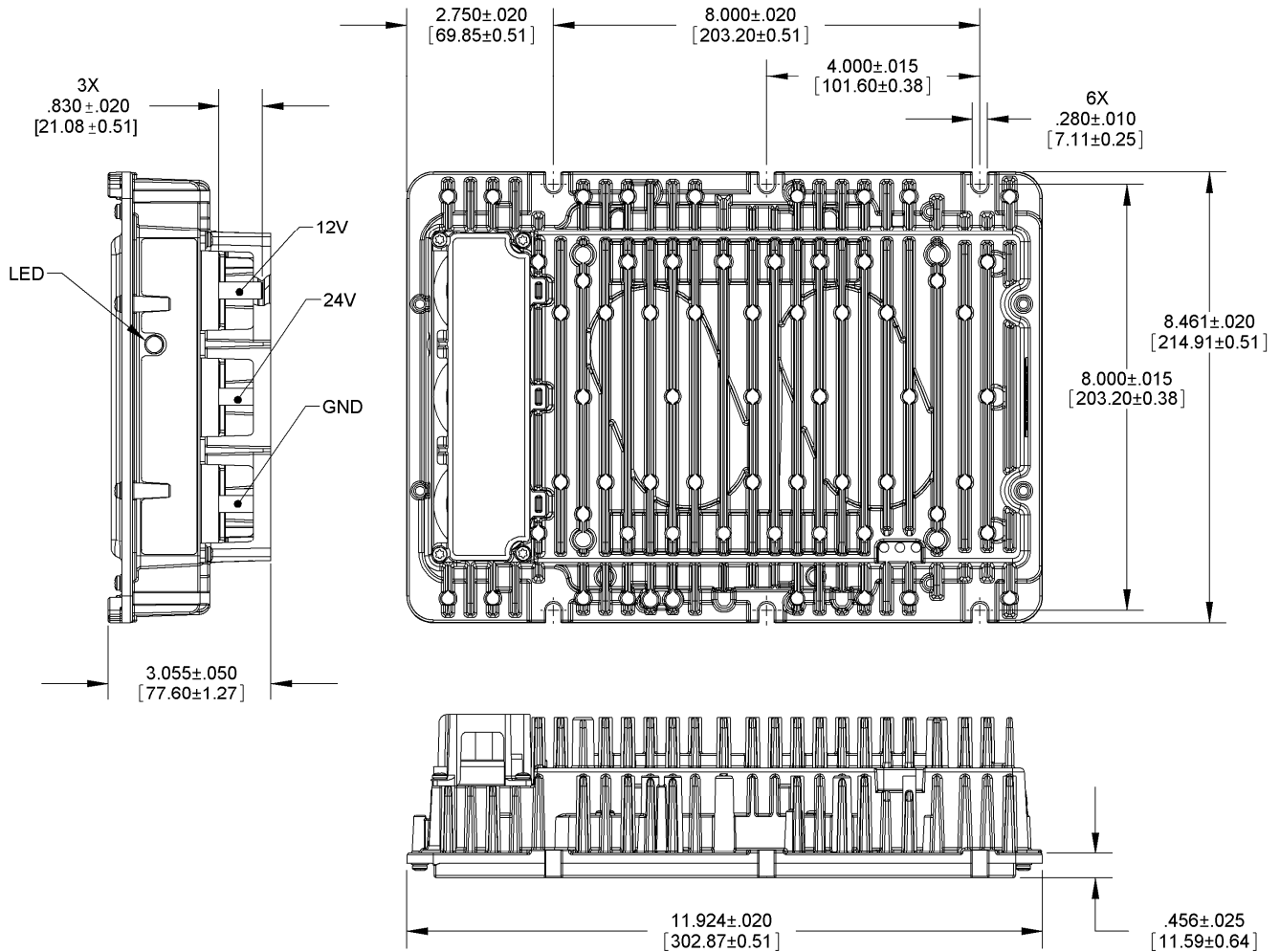


Figure 8

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