REVISIONS				
REV	ECO	DESCRIPTION	DATE	BY
A	3355	Product Release	2/28/01	BF
B	3574	UPDATE UNDERVOLTAGE CHARACTERISTIC	3/29/03	BF
003	3876	MORE UNDERVOLTAGE CHANGES		

Product Specification

522XX EQUALIZER AND 523XX CONVERTER FAMILY

52210 Model Shown

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES [MM]
TOLERANCES ARE:
.XX ± - [.X ± -]
.XXX ± 0.030 [.XX ± 0.762]
∠ ± -
DRAWINGS IN THIS DOCUMENT ARE NOT TO SCALE

APPROVALS	DATE
DRAWN A. VANDERZANDEN	23FEB01
PRJCT ENGR	
ENGR MNGR	
SALES/MRKTG	

SURE POWER INDUSTRIES, INC.
TUALATIN, OREGON USA 97062

TITLE
PRODUCT SPECIFICATION
522XX EQUALIZER AND 523XX CONVERTER FAMILY

SIZE	CAGE CODE NO.	DWG NO.	REV
A	55156	SPEC-52210FAM	003

SCALE: NONE | FILE: 52210FAM Rev 003-SPEC | SHEET 1 OF 11

General Description

The Sure Power family of equalizers and converters are designed to provide 24V to 12V power conversion for heavy duty applications.

The equalizers provide equalization for dual battery systems where high 12V loads are required, enhancing battery life and ensuring maximum performance for vehicle charging 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

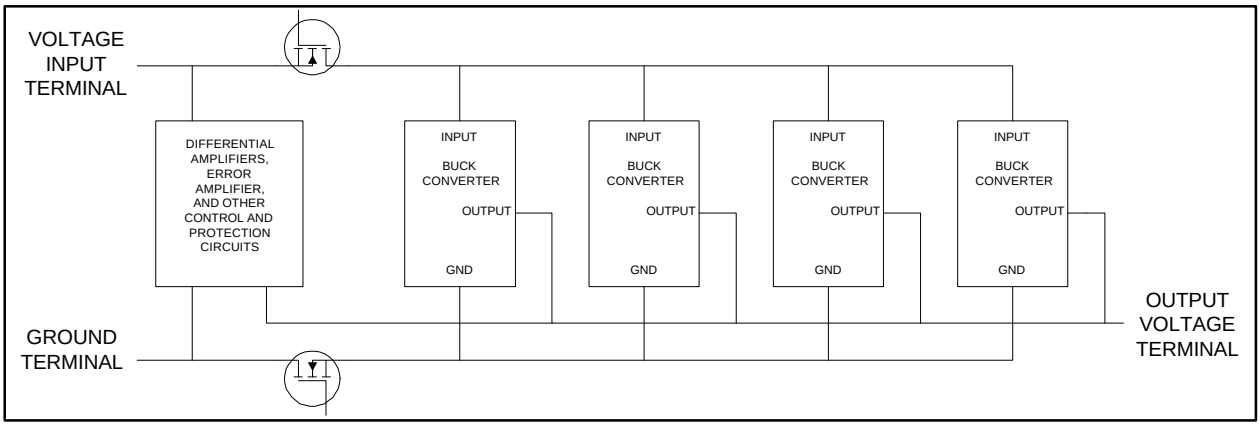
Sure Power Part Number	Output Current	Equalizer / Converter
52210	100 Amps	Equalizer
52208	80 Amps	Equalizer
52206	60 Amps	Equalizer
52204	40 Amps	Equalizer
52308	80 Amps	Converter
52306	60 Amps	Converter
52304	40 Amps	Converter

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.

Block Diagram



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.

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.

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.

Thermal protection is provided by monitoring the heatsink temperature. Detection of extreme temperature shuts the unit off. As the heatsink cools, the unit will automatically turn back on.

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

Description of Features (cont.)

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.

ELECTRICAL SPECIFICATIONS

ABSOLUTE MAXIMUM RATINGS:

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

Parameter	Value	Notes:
Standoff Voltage	36V	Note 1
Reverse Polarity	-26V	Note 2
Output Current		
Model 52204, 52304	40A	Note 3
Model 52206,52306	60A	Note 3
Model 52208,52308	80A	Note 3
Model 52210	100A	Note 3
Heat Sink Temperature	100°C	Note 4
Operating Temperature Range	-40°C - +85°C	Note 3
Storage Temperature Range	-55°C- 105°C	

Notes:

1. This is maximum voltage applied between VBAT and GND that the unit will standoff without causing damage to the unit.
2. This is the maximum reverse voltage that may be applied between INPUT and GND, or between OUTPUT and GND.
3. Units can be operated up to 85°C at a reduced output current. Reference “Output Current vs Ambient Temperature Chart”.
4. The unit generates a significant amount of heat (as shown in the ELECTRICAL CHARACTERISTICS section). When determining a mounting location it is important to account for this heat. Adequate ventilation must be provided.

ELECTRICAL CHARACTERISTICS

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

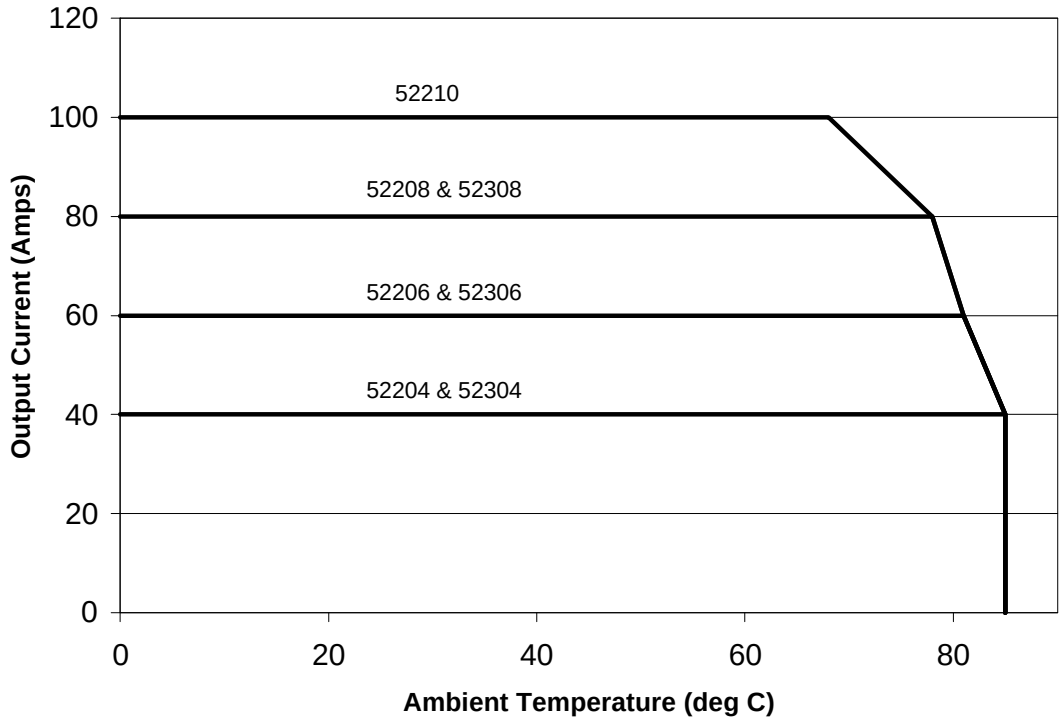
Characteristic	**MIN**	**TYP**	**MAX**	**Unit**	**Notes:**
Input Under Voltage Turn ON	10	11.5	14	V	
Input Under Voltage Hysteresis		0.5		V	
Input Over Voltage Turn OFF	32	33	34	V	Voltage on INPUT that causes the equalizer to turn off.
Input Over Voltage Hysteresis		0.4		V	
Quiescent Current		20	25	mA	Current draw from the INPUTwith no load attached to OUTPUT. V_{IN} = 24V
Output Voltage (Equalizers)	$V_{IN}/2$ –1%	$V_{IN}/2$	$V_{IN}/2$ +1%	V	52210, 52208, 52206, 52204
Output Voltage (Converters)	13	13.5	14	V	For Models 52308, 52306, 52304 When Input Voltage is greater than 22V. (For Input Voltage less than 22V, Output Voltage Equals ½ Input Voltage)
Current Limit					
Model 52204, 52304	40	42		A	
Model 52206, 52306	60	62		A	
Model 52208, 52308	80	84		A	
Model 52210	100	108		A	
Over-Temp Limit		105		°C	The trip point for over-temp shutdown
Over-Temp Hysteresis		15		°C	
Load Dump		150V			Ref. SAE J1455, Table 4b. As tested with EM Test LD200
Inductive Load Switching		±300V			Ref. SAE J1455, Table 4b.
Mutual Coupling		±600V			

ELECTRICAL CHARACTERISTICS (cont.)

ESD – Handling		±15kV			Ref. SAE J1455, Section 4.11.2.2.5.1
ESD – In Vehicle		±8kV, Direct ±15kV, Air			Ref. SAE J1113-13, Class C
EMI Immunity		55	100	V/m	@10kHz – 1GHz (See Note 1) SAE J1113/21 Class B Region II
EMI Emmissions Conducted		TBD			SAE J1113/41 See Note 1:
EMI Emmissions Radiated		TBD			

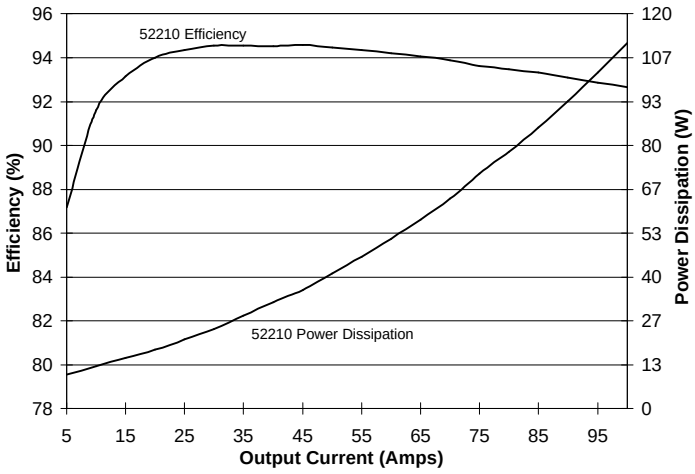
Note 1: EMI Specifications not validated at this revision, SAE J1113/41 represents design intent.

Output Current vs Ambient Temperature Chart

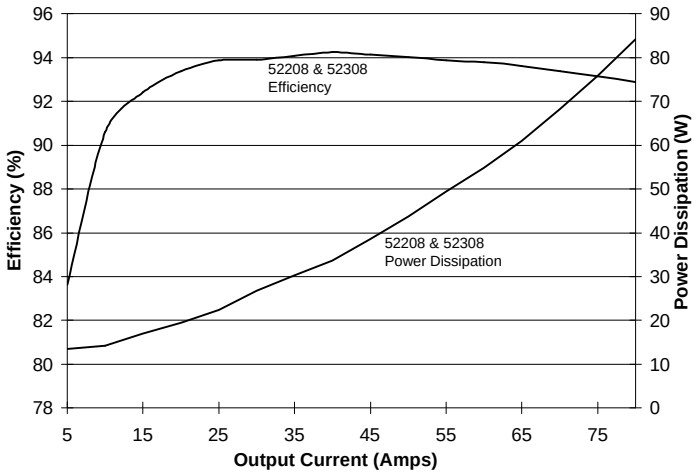


ELECTRICAL CHARACTERISTICS (cont.)

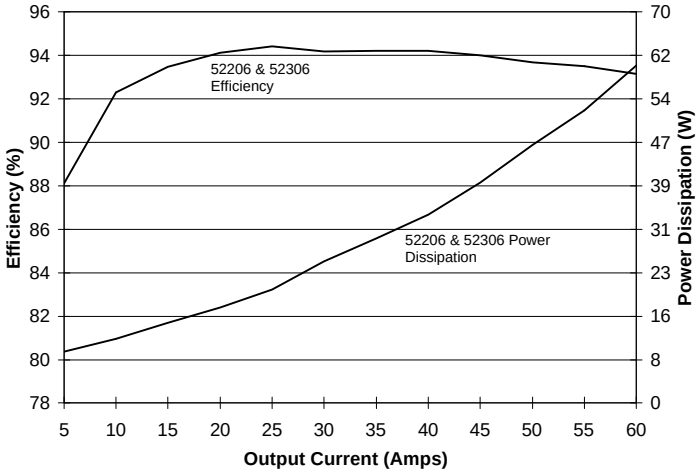
52210 Typical Efficiency and Power Dissipation vs Output Curent



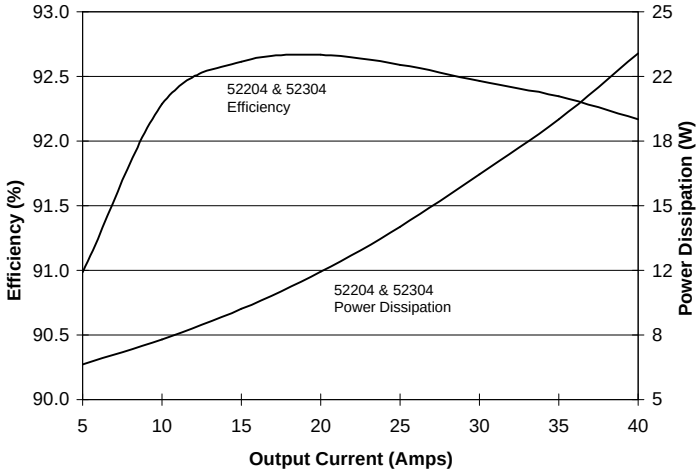
52X08 Typical Efficiency and Power Dissipation vs Output Curent



52X06 Typical Efficiency and Power Dissipation vs Output Curent



52X04 Typical Efficiency and Power Dissipation vs Output Curent

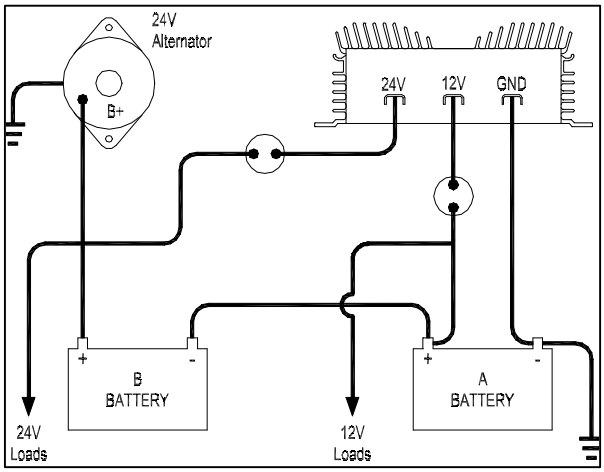


ENVIRONMENTAL SPECIFICATIONS

Parameter	Level	Conditions / Notes
Thermal Shock		per SAE J1455 Section 4.1
Thermal Cycle		
Humidity	0 – 100 %RH	per SAE J1455, Section 4.2.3
Splash		per SAE J1455 Section 4.4, Splash only
Pressure Wash		per SAE J1455 Section 4.5
Dust Bombardment	0.88 g/m^3	per SAE J1455 Section 4.7
Salt Spray	96 Hrs	per SAE J1455 Section 4.3
Altitude	12000 ft	per SAE J1455 Section 4.8
Mechanical Vibration		per SAE J1455 Section 4.9 and Appendix A, Category 2
Handling Shock	Will Show Damage	per SAE J1455 Section 4.10

CONNECTION DIAGRAMS:

Typical Equalizer Connection



The unit has three connections. The aluminum chassis is isolated and can be grounded or ungrounded.

UNIT CONNECTIONS:

+24V:

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

GND:

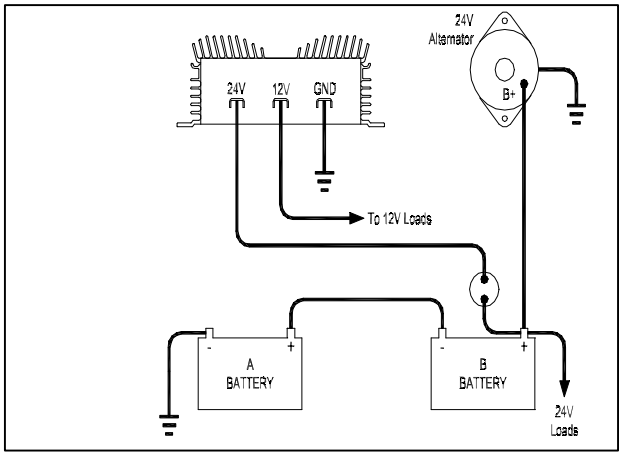
This is the terminal for grounding the unit. All internal operating currents are returned to this terminal.

+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 12V loads.

Typical Converter Connection



Note: If using disconnect switches, reference latest revision of Sure Powers installation instruction p/n 180098.

MECHANICAL SPECIFICATIONS

The unit utilizes three channel shaped bus bars for making connections. Each bus bar is designed to accommodate a M8 hex head bolt. The head of the bolt fits within the channel and the channel prevents rotation of the head when tightening the nut.

Finish: Black Anodized Aluminum (0.5mils min)

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

Hardware Included: Bolts – 3X, M8x20mm Hex Head, Tin Plated Steel
Nuts – 3X, M8 Hex , Tin Plated Steel
Lock Washers – 3X, M8, Tin Plated Steel

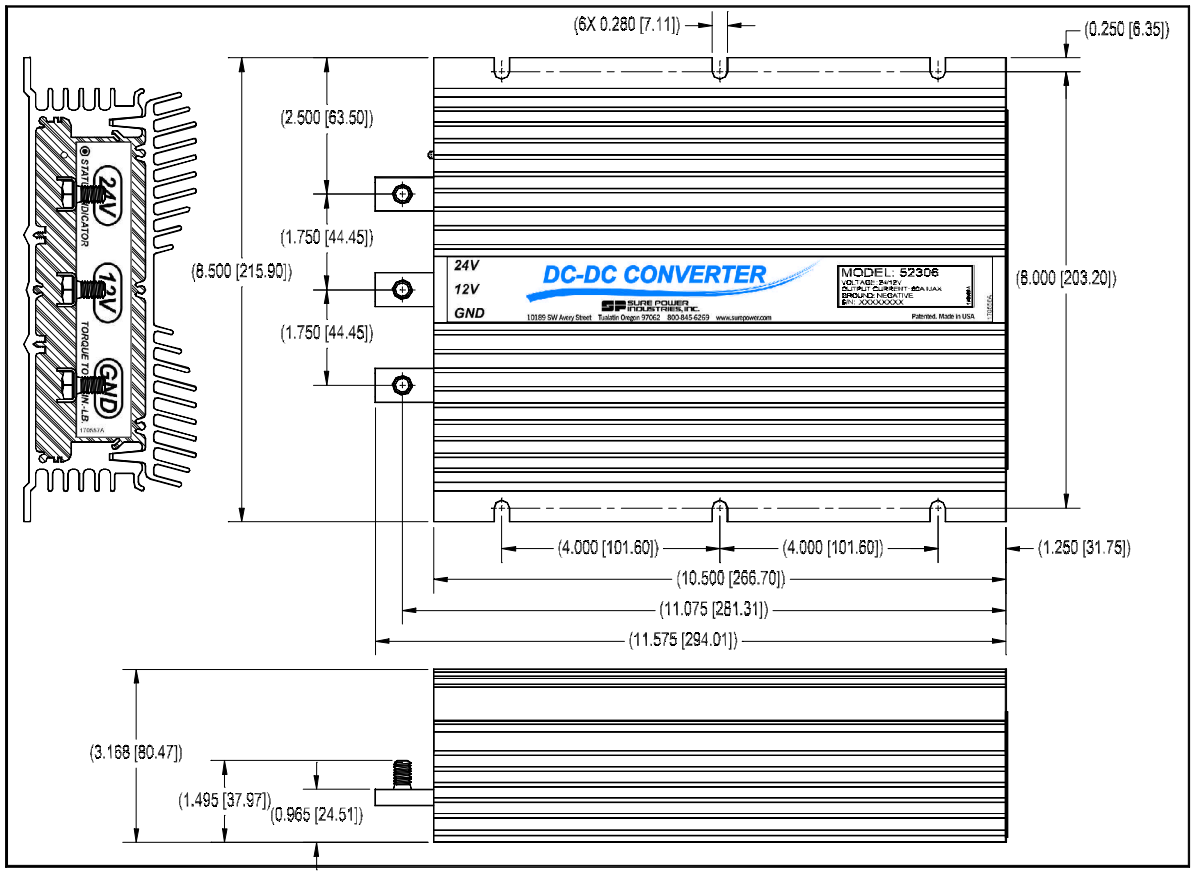
Maximum Torque: 110 in-lbs

52210, 52208, 52308, 52206, and 52306

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

Weight: 13 pounds

Unit Dimentions – 52210,52208,52206,52308, and 52306



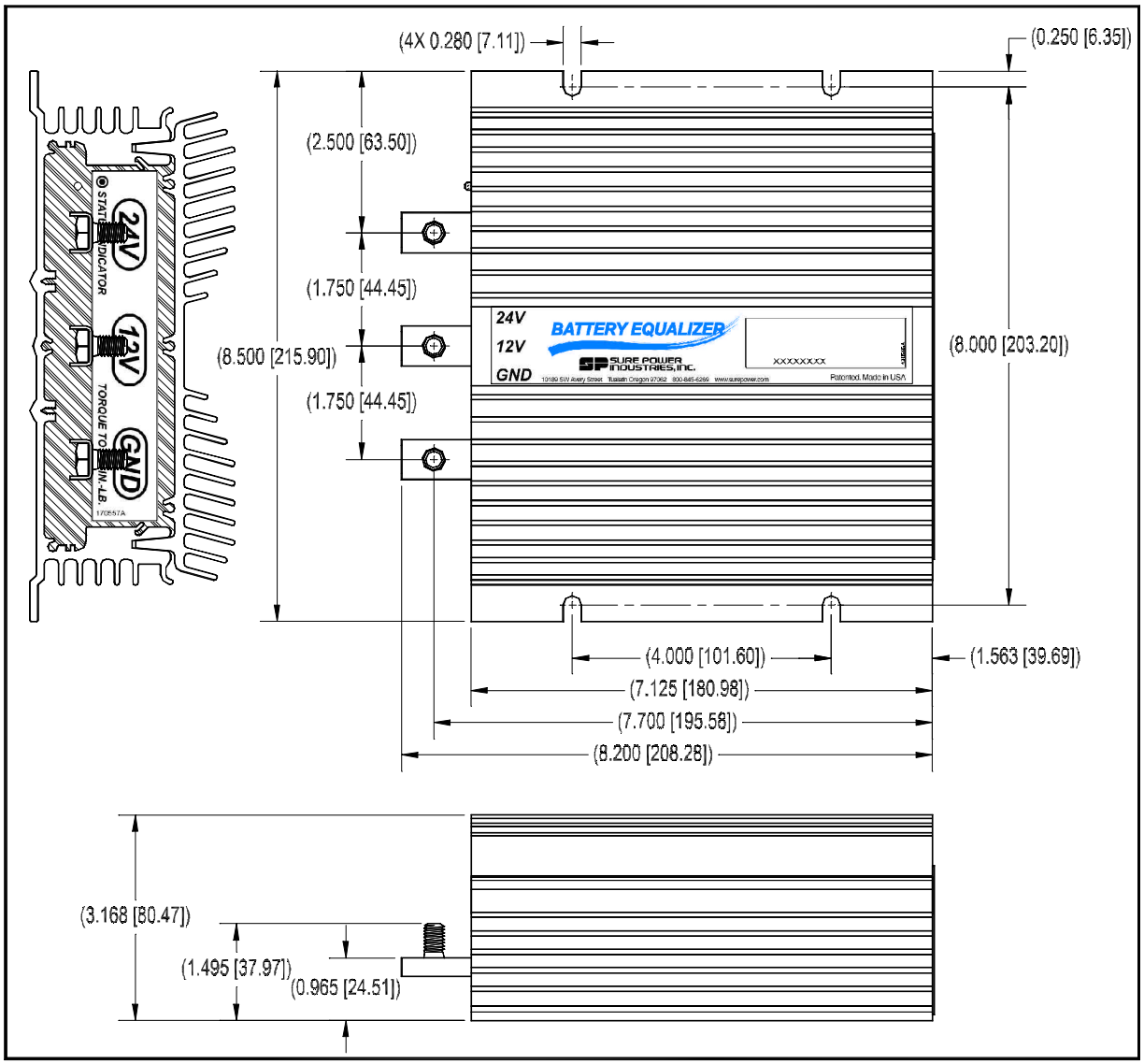
MECHANICAL SPECIFICATIONS (cont.)

52204 and 52304

Mounting Slots: 4X, Accepts M6 or ¼" Hardware (not included)

Weight: 9 pounds

Unit Dimentions – 52204, and 52304



SIZE	CAGE CODE NO.	DWG NO.	REV
A	55156	SPEC-52210FAM	003
SCALE: NONE	FILE: 52210FAM Rev003-SPEC	SHEET 11 OF 11	