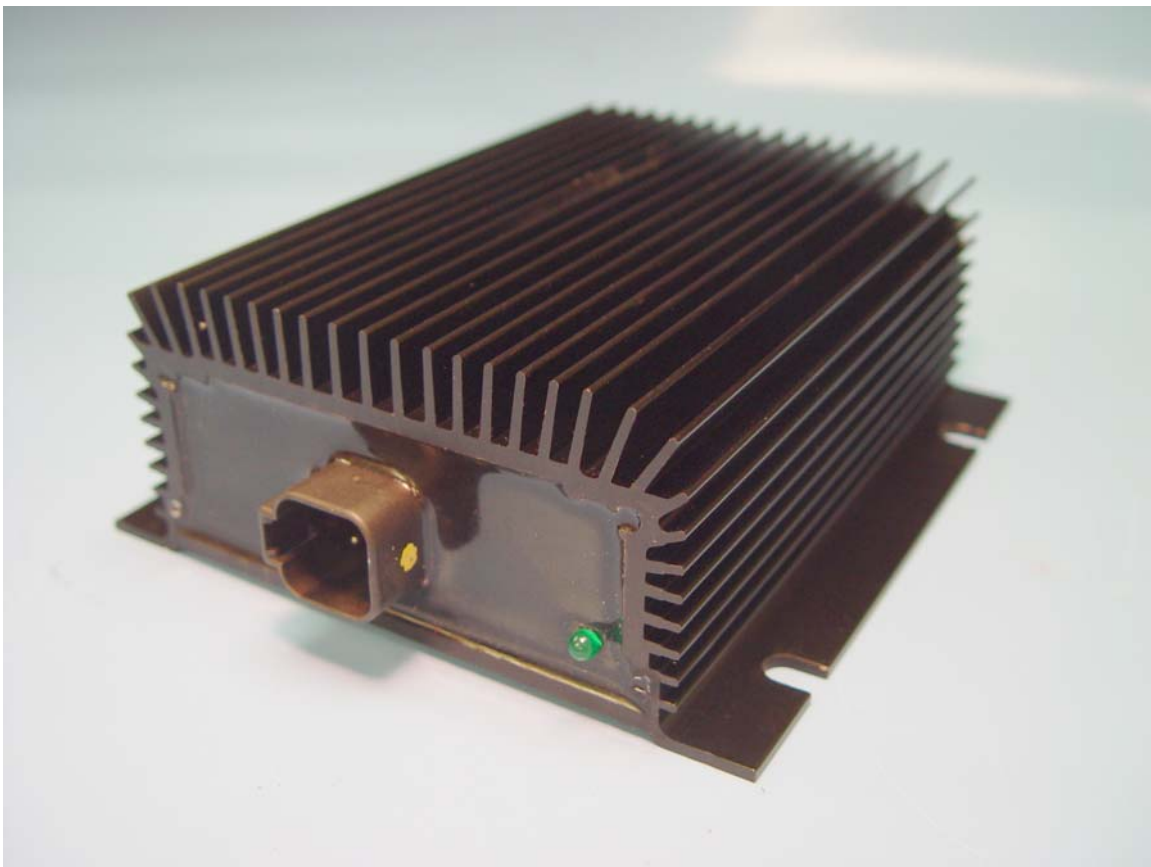



REVISIONS				
REV	ECO	DESCRIPTION	DATE	BY
001	4178	PRODUCTION RELEASE	8/5/04	BF
002	4583	ADD PIN DETAIL TO PAGE 8	7/15/05	BF

Product Specification

12010E00 EQUALIZER AND 12010C00 CONVERTER, 12V TO 24V FAMILY



<small>UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES [MM]</small> <small>TOLERANCES ARE: .XX ± .10 [X ± 2.5] .XXX ± .030 [XX ± .76]</small> <small>INTERPRET GEOMETRIC DIMENSIONS AND TOLERANCING PER ASME Y14.5-1994 DRAWINGS IN THIS DOCUMENT ARE NOT TO SCALE</small>		 <small>TUALATIN, OREGON USA 97062</small>	
<small>APPROVALS</small> <small>DRAWN</small> DSR		<small>DATE</small> 21JUNE04	
<small>PRJCT ENGR</small> <small>ENGR MNGR</small>		<small>TITLE</small> MODEL NO: 12010X00 EQUALIZER/CONVERTER, 12 TO 24V FAMILY SPECIFICATION OUTLINE	
<small>SALES/MRKTG</small>		<small>SIZE</small> A	<small>CAGE CODE NO.</small> 55156
		<small>DWG NO.</small> 12010X00	<small>REV</small> 002
		<small>SCALE:</small> NONE	<small>FILE:</small> 12010X00-002
		<small>SHEET</small> 1 OF 9	

PROPRIETARY

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General Description

This Sure Power product is designed to provide 12V to 24V power conversion for heavy-duty applications.

The equalizers provide equalization for dual battery systems where the charging system is 12V.

Features

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

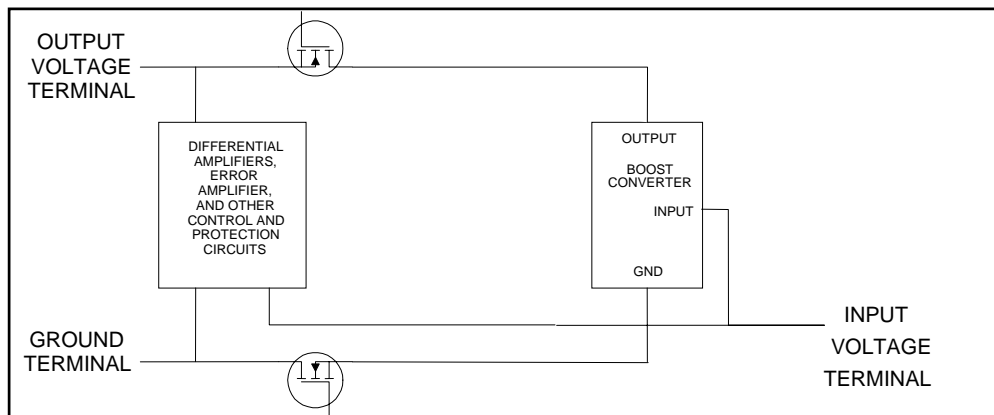
Theory of Operation

The 12010X00 Sure Power equalizers and converters are designed to step up the input voltage in order to achieve the appropriate output voltage.

The equalizer monitors the input voltage at the terminals and provides an output that is twice the input.

The converters provide a fixed output to power 24V loads directly from a 12V source.

Block Diagram



TITLE MODEL NO: 12010X00
EQUALIZER/CONVERTER,
12 TO 24V FAMILY
SPECIFICATION OUTLINE

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Description of Features

Included are a number of protection and added features.

PROTECTION FEATURES:

Reversal of the input polarity is protected with MOSFETs in series with the ground.

Reversal of the output polarity is protected with MOSFETs in series with the output 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 input current. Detection of a short circuit or overload turns the output off. The unit then cycles the output on every 1.5 seconds to determine if the short circuit has been removed. Upon removal of this condition the output voltage will return to its normal state.


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

Loss of ground protection ensures no damage occurs to the unit.

Unit is protected against all miswiring conditions with the exception of the condition where: Unit ground is connected to system Load, unit +12V is connected to system +12V, Unit +24V is connected to system Ground and unit ignition is connected to system +12V.

STATUS INDICATOR:

An LED status indicator is provided to denote when the unit is producing current. As the batteries become equalized and the charger current approaches 0 amps, the LED indicator will diminish in intensity and eventually go dark.

				
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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	10A	Note 5
Heat Sink Temperature	100°C	Note 4
Operating Temperature Range	-40°C to +85°C	Note 3
Storage Temperature Range	-55°C to 105°C	

Notes:

1. This is maximum voltage applied between INPUT 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. Unit tested at full current at 85°C within a Tenney T10RC thermal chamber.
4. 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.
5. Due to boost topology for a converter, the output current is dependent on input voltage. Below 12.0V input voltage, the output current cannot be sustained. Please refer to graph. Equalizers are able to sustain 10 amps throughout the entire operating range.


			
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ELECTRICAL CHARACTERISTICS

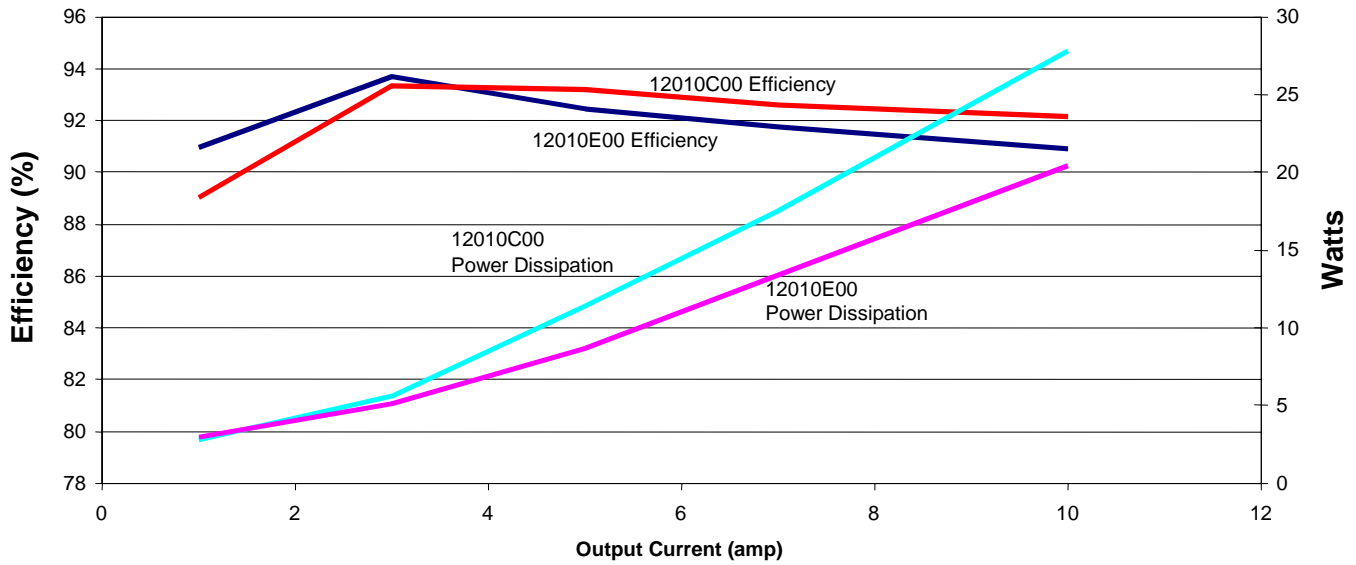
Unless otherwise stated, conditions apply to full temperature range and full input voltage range.

Characteristic	MIN	TYP	MAX	Unit	Notes:
Input Under Voltage Turn ON	8	9.5	10	V	
Input Under Voltage Hysteresis		0.5		V	
Input Over Voltage Turn OFF (Equalizers)	16	16.5	17	V	Voltage on INPUT that causes the equalizer to turn off.
Input Over Voltage Turn OFF (Converters)	15	15.5	16	V	Voltage on INPUT that causes the equalizer to turn off.
Input Over Voltage Hysteresis		0.4		V	
Quiescent Current IGN off			1	mA	Current draw from the INPUT with IGN off. $V_{IN} = 12V$
Quiescent Current IGN on		20		mA	Current draw from the INPUT with no load attached to OUTPUT. $V_{IN} = 14V$
Output Voltage (Equalizers)	$V_{IN} * 2 - 1\%$	$V_{IN} * 2$	$V_{IN} * 2 + 1\%$	V	
Output Voltage (Converters)	23.5	24.0	24.5	V	At 12.6V input voltage. Output current derates with lower input voltage – refer to graph.
Current Limit	10	11		A	At 12.6V input voltage
Over-Temp Limit		105		°C	The trip point for over-temp shutdown
Over-Temp Hysteresis		15		°C	
Load Dump		100V			Ref. SAE J1455, Table 4b. As tested with EM Test LD200
Inductive Load Switching		±300V			Ref. SAE J1455, Table 4b.
Mutual Coupling		±600V			
ESD – Handling		±8kV, Direct ±15kV, Air			Ref. SAE J1455, Section 4.11.2.2.5.1
ESD – In Vehicle		±8kV, Direct ±15kV, Air			Ref. SAE J1113-13, Class C
EMI Emmissions Radiated (30MHz to 1GHz)		Per Spec			Certified to UN Regulation ECE R 10.02 (Also Reference ISO 13766 and EN 13309)

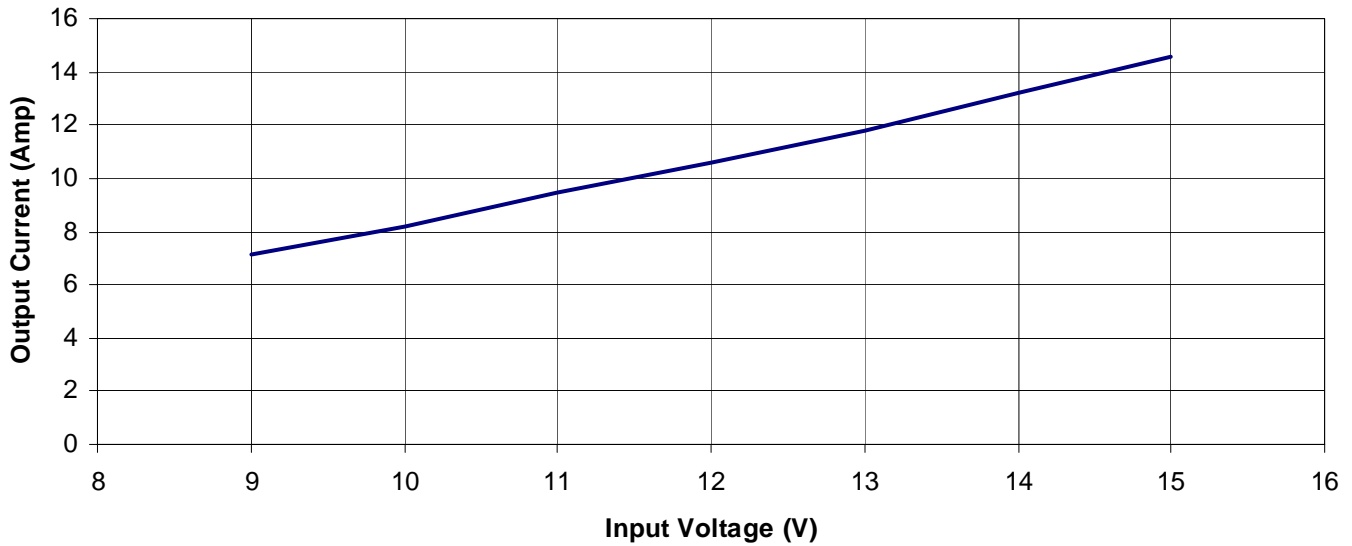
				
TITLE MODEL NO: 12010X00 EQUALIZER/CONVERTER, 12 TO 24V FAMILY SPECIFICATION OUTLINE				
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ELECTRICAL CHARACTERISTICS (cont.)
12010X00 Typical Efficiency and Power
Dissipation vs. Output Current with Vin at 14V



12010C00 Current Limit vs. Input Voltage



— Current Limit vs. Input Voltage


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ENVIRONMENTAL SPECIFICATIONS

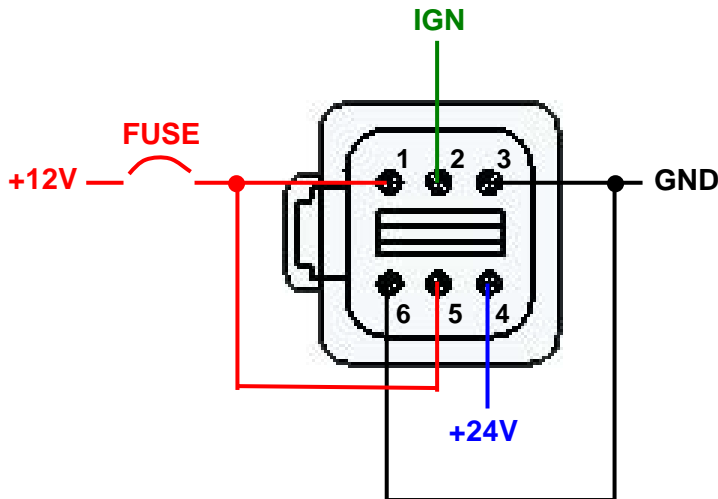
Parameter	Level	Conditions / Notes
Thermal Shock		per SAE J1455 Section 4.1
Thermal Cycle		
Humidity	0 – 100 %RH	per SAE J1455, Section 4.2.3
Splash		per SAE J1455 Section 4.4, Splash only See Note 1
Pressure Wash		per SAE J1455 Section 4.5, See Note 1
Dust Bombardment	0.88 g/m ³	per SAE J1455 Section 4.7, See Note 1
Salt Spray	96 Hrs	per SAE J1455 Section 4.3, See Note 1
Altitude	12000 ft	per SAE J1455 Section 4.8. See Note 1
Mechanical Vibration		per SAE J1455 Section 4.9 and Appendix A, Category 2, See Note 1
Handling Shock	Will Show Damage	per SAE J1455 Section 4.10,

Note 1: Specifications not validated at this revision, SAE J1455 represents design intent.

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CONNECTION DIAGRAM:



The unit has five power connections and one signal connection. All terminations are made via a Deutsch 6-pin sealed connector. The aluminum chassis is isolated and can be grounded or ungrounded.

UNIT CONNECTIONS:

+24V: Pin 4

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

In converter applications, the +24V OUTPUT is connected directly to 24V loads.

GND: Pin 3 and 6


These terminals are for grounding the unit. All internal operating currents are returned to this terminal. Both should be wired for proper operation.

+12V: Pin 1 and 5

These terminals are connected to the +12V terminal of the battery stack. Both should be wired and appropriately fused for proper operation.

IGN: Pin 2

This connection enables and disables the unit. When voltage is applied to the ignition terminal, the unit turns on.

			
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MECHANICAL SPECIFICATIONS

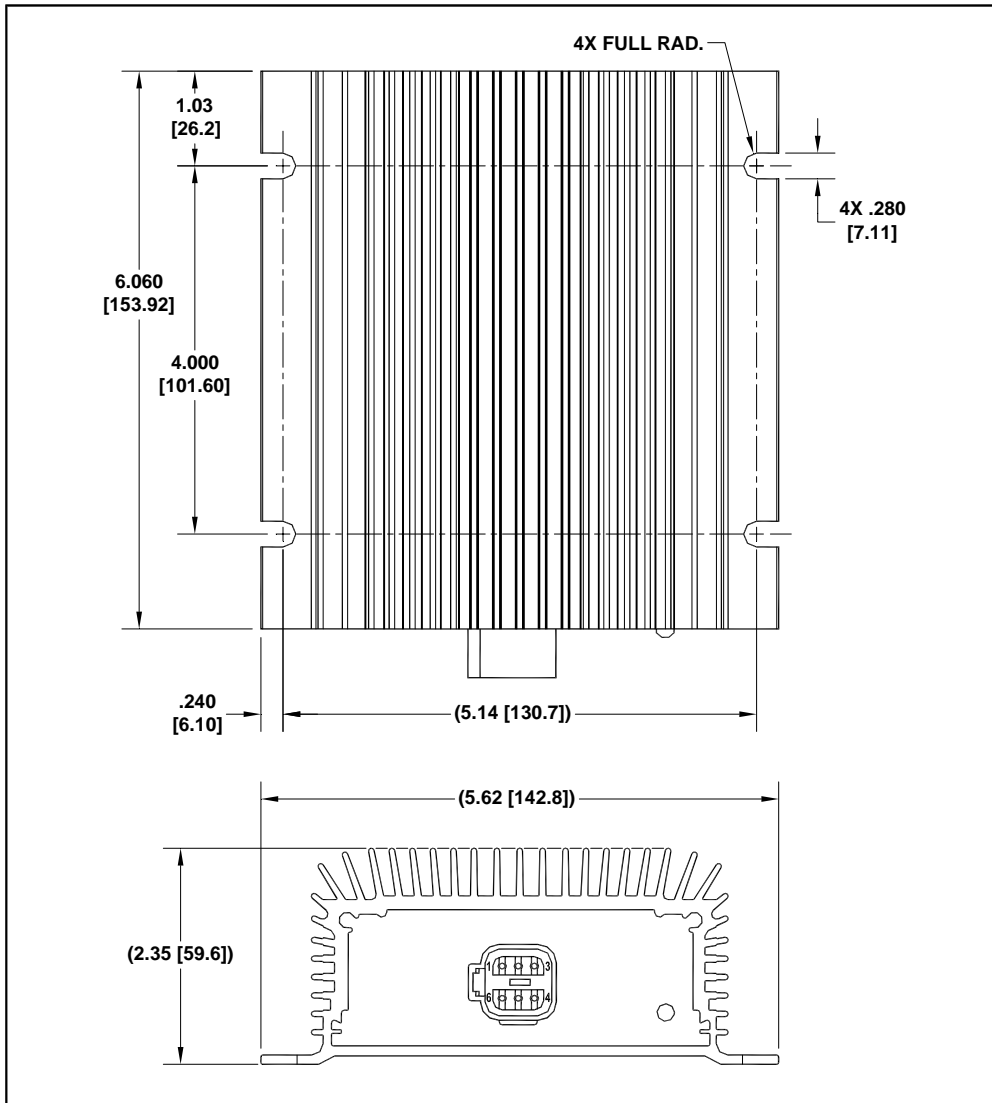
The unit utilizes a 6 pin sealed Deutsch connector (DT Series).

Finish: Black Anodized Aluminum (0.5mils min)

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

Weight: 3.51 Lb

Unit Dimensions



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