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REVISIONS

PLANT DIST CODE(S): U

REV	DESCRIPTION	DATE	BY
01	PRODUCTION RELEASE ECN BU-U13237	07/02/2013	BF

Product Specification

12040X1X

12V to 24V / 28V DC to DC CONVERTER / EQUALIZER



**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



TITLE
MODEL NO: 12040X1X
12V to 24V / 28V
CONVERTER
SPECIFICATION OUTLINE

	DATE
DRAWN BY DSR	
PROJECT ENG APPROVAL	
ENG MANAGER APPROVAL	
PRODUCT MANAGER APPROVAL	

SIZE A	PLANT OF ORIGIN U	DRAWING NO. 12040X1X	REV 01
SCALE: NONE	FILE: 12040X1X-01	SHEET 1 OF 11	

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General Description

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

Features

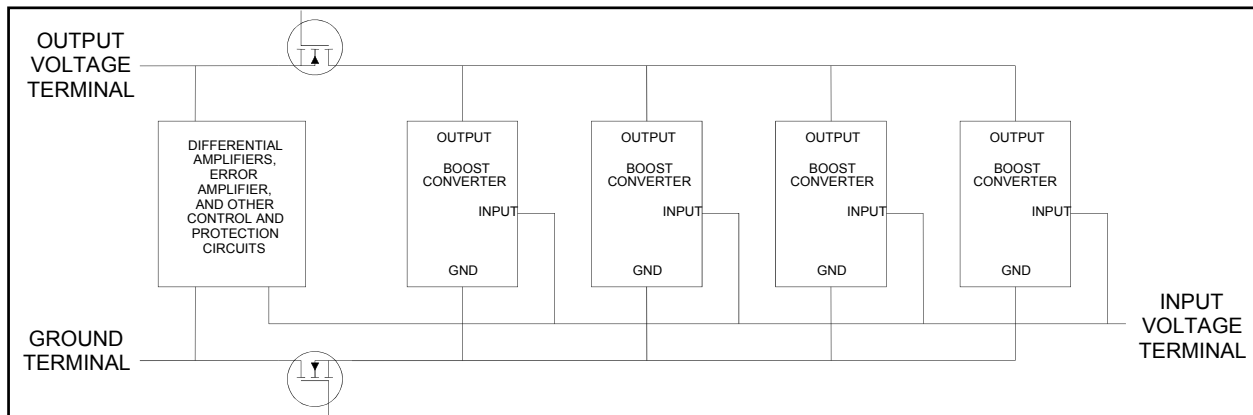
- Under and Over Voltage Protection
- Reverse Voltage Protection
- Voltage Transient Protection
- Over load and Short Circuit Protection
- Thermal Overload Protection
- Sealed from the Elements
- Ignition Turn On

Theory of Operation

The 12040C1X / E10 Sure Power converter / equalizer is designed to step up the input voltage in order to achieve the appropriate output voltage. To reduce quiescent current, the converter is enabled through an ignition terminal.

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

Block Diagram



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Description of Features

Included are a number of protections 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 output current. Detection of a short circuit or overload turns the output off. The unit then cycles the output 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 PCB temperature in different areas. If elevated temperature is detected, the unit reduces its maximum output current. Normal output current is re enabled as temperature decreases.

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

Unit is protected against all miswiring conditions with the exception of the conditions where: Unit GND is connected to system +12V, Unit +12V is connected to system +24V, and Unit IGN is connected to system +24V.

			
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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	40A	When input voltage \geq 11.5V
Heat Sink Temperature	100°C	Note 3
Operating Temperature Range	-40°C - +85°C	Note 4
Storage Temperature Range	-55°C - +105°C	

Notes:

1. This is maximum voltage applied between INPUT and GND that the unit will standoff without causing damage.
2. This is the maximum reverse voltage that may be applied between INPUT and GND, or between OUTPUT and GND.
3. 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.
4. Units can be operated up to 85°C at a reduced output current.



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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	9.5	10	10.5	V	Minimum voltage on INPUT that causes the converter to turn on. Once unit is on, maximum turn off threshold is 8.5V.
Input Under Voltage Hysteresis		1.5		V	
Input Over Voltage Turn OFF	16	16.5	17	V	Maximum voltage on INPUT that causes the converter to turn off.
Input Over Voltage Hysteresis		1.4		V	Input voltage must drop by this amount in order to turn the unit back on following an over-voltage shutdown.
Quiescent Current IGN off		0.7	2	mA	Current draw from the INPUT with IGN off. VIN = 12V and 25°C
Quiescent Current IGN on		80	150	mA	Current draw from the INPUT with no load attached to OUTPUT. VIN = 14V.
Output Voltage (12040C10)	23.5	24	24.5	V	Measured at Output terminal.
Output Voltage (12040C11/12040C12)	27.5	28	28.5	V	Measured at Output terminal.
Output Voltage (12040E10) no load	$V_{in} \times 2 - 1\%$	$V_{in} \times 2$	$V_{in} \times 2 + 1\%$	V	Measured at Output terminal.
Output Voltage (12040E10) full load	$V_{in} \times 2 - 2\%$	$V_{in} \times 2$	$V_{in} \times 2 + 1\%$	V	Measured at Output terminal.
Output Offset Voltage (12040E10)		0.9		V	With Vin = 13.5V.
Current Limit (12040C11/C12)	40	42	47	A	Above this limit the output will lose regulation. (Vin=11.5V).
Current Limit (12040C10/E10)		47	51		Above this limit the output will lose regulation. (Vin=11.0V).
Over-Temp Limit		100		°C	Unit starts derating its output if ambient temperature increases over 50C
Efficiency	90			%	Minimum efficiency at full load



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ELECTROMAGNETIC COMPATIBILITY:


Transient Immunity Tests	Level	Notes:
Load Dump	12V Vehicle	ISO7637-2-2004, pulse 5a. Pulse applied to Vbat and ignition terminal.
Conducted and Coupled Transient Immunity	12V Vehicle	ISO7637-2-2004, pulses 1,2a,2b,3a,4,5a and ISO7637-3 pulses A and B. Pulses applied to all I/O.

Electrostatic Discharge Immunity	Level	Notes:
In Vehicle ESD	±8 kV direct ±15 kV air	Ref. SAE J1113/13 Rev 2/95, Class C utilizing a 330pF / 2000ohm discharge network.
Package and Handling ESD	±8 kV direct ±15 kV air	Ref. SAE J1113/13 Rev 2/95, Class C utilizing a 150pF / 2000ohm discharge network.

Emissions	Level	Notes:
Radiated; 30MHz – 1 GHz	Class 2	CISPR 25
Conducted; 30MHz – 1 GHz	Class 2	CISPR 25

Conducted Immunity	Level	Notes
250 kHz to 400 MHz Direct Injection of Radio Frequency (RF) Power	200mW, Level 3	SAE J1113-26

Immunity to Radiated Electromagnetic Fields	Level	Notes:
Absorber-Lined Chamber	60V/m	Class B, Region 2. SAE J1113-21, Rev Oct 2005
Bulk Current Injection (BCI) Method	60mA	Class B, Region 2. SAE J1113-4, Rev Aug 2004

			
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ENVIRONMENTAL SPECIFICATIONS

Parameter	Value	Notes:
Thermal Shock	30 cycles	SAEJ1455, Rev. JUN2006, sec 4.1.3.2, Fig. 2C – 1hr dwell time
Thermal Stress	30 cycles	SAEJ1455, Rev. JUN2006, sec 4.1.3.3, Fig. 2B – 1hr dwell time
Humidity	0 – 100 %RH	SAEJ1455, JUN2006 sec 4.2, Fig 4C
Pressure Wash	8,000 to 10,000 KPa	per ISO20653 IP6K7
Immersion	1 meter, 30 min	per MIL-STD-810G Method 512.5, Procedure 1
Dust Bombardment	0.88 g/m ³	per SAE J1455 Section 4.7, JUN2006
Chemical Exposure	DOT4 brake fluid, 20W40 synthetic motor oil, unleaded gas, engine degreaser and carburetor cleaner	Per SAE J1455 Rev JUN2006 Section 4.4, Splash only
Salt Spray	500 Hrs	per SAE J1455 Section 4.3, JUN2006
Altitude	12.2Km	per SAE J1455 Section 4.8, JUN2006
Mechanical Vibration	9.26Grms, 5Hz to 2KHz 8hr/axis	Random vibration - MIL-STD-202G, Method 214A, Test Condition 1C
	10Hz to 2000Hz sweep	Resonance search - SAEJ1455, Rev. JUN2006, Appendix A Figure A1 Category 2
Operational Shock	30G, 11ms, ½ sine	MIL-STD-202F, Test 213B, Test Condition J
Handling Shock	Minor damage of the housing is permitted	SAE J1455, Rev. JUN2006, Sec. 4.11.3.1



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CONNECTION

The unit has three connections and a signal connection. The aluminum chassis is isolated and may be grounded or ungrounded.

UNIT CONNECTIONS:

+24V/28V: This terminal is connected to the +24V side of the battery stack for equalizers. In converter applications, the 24V OUTPUT is connected directly to 24V loads.

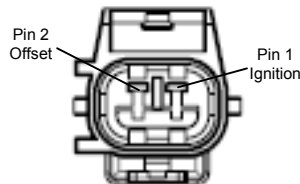
+12V: This terminal is connected to the +12V terminal of the battery stack.

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

IGN: Pin 1 of the auxiliary connector is connected to the Ignition (+12V). This connection enables and disables the unit. When voltage is applied to the ignition terminal, the unit turns on.

OFFSET (for 12040E10 only): Pin 2 of the auxiliary connector is connected to the Offset circuit (+12V). When voltage is applied to this terminal output is increased over the normal setting.

Yakazi PN 7282-7028-40



Parallel operation:

Generally, paralleling units is not recommended.

Converters running in this configuration might cycle on/off several times when they have to deliver a high inrush current upon startup. Once the load is stable, one of the units will provide most of the current until it goes in current limit mode. At this point the other unit will provide the rest of the current to the load.

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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

Ignition / Offset (equalizer only) connector: Yakazi PN 7282-7028-40.

Mating connector: Yakazi PN 7283-7028-40 (connector housing), Yakazi PN 7116-4026 (contact), Yakazi PN 7158-3007-10 (wire seal).

Hardware Included:

Nuts – 3X, M8 Hex, Tin Plated Steel

Lock Washers – 3X, M8, Tin Plated Steel

Maximum Torque: 110 in-lbs

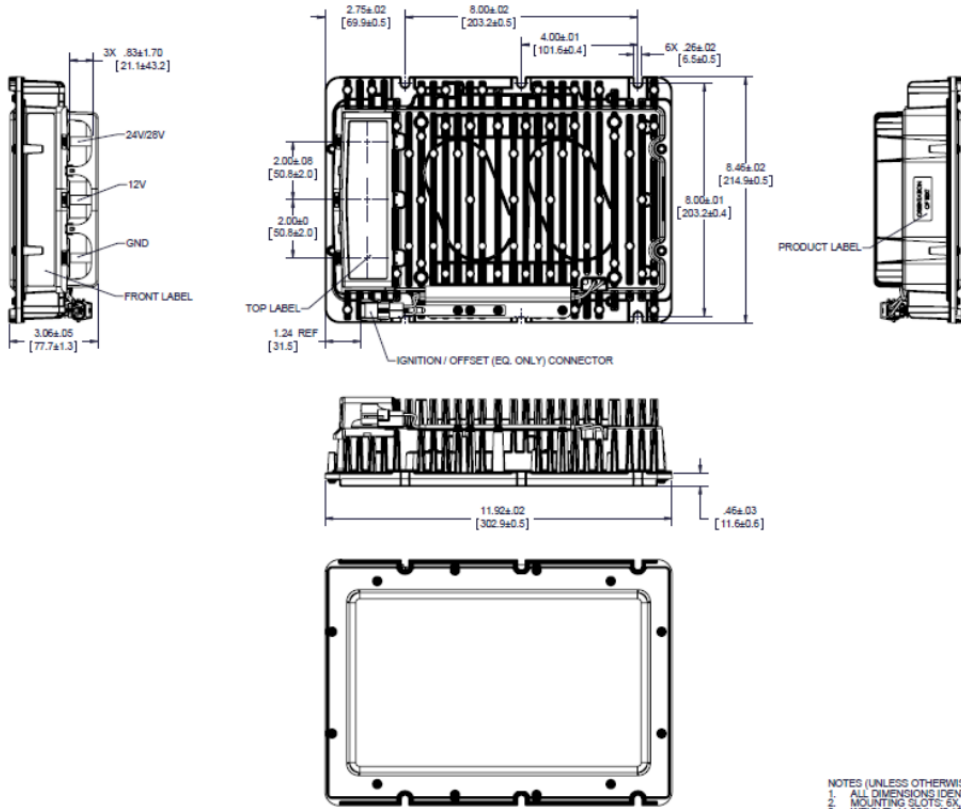
Apply a coating of corrosion inhibitor material (E.g., dielectric grease, insulating paint, etc.), as per manufacturers application instructions, to Battery Equalizer terminals to help eliminate corrosion and protect the metal surfaces.

Mounting Slots: 6X, Accepts M6 or 1/4" Hardware (not included)

Weight: 5.15 kg max (11.35 lbs max)

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NOTES (UNLESS OTHERWISE SPECIFIED):
 1. ALL DIMENSIONS IDENTIFIED FOR REFERENCE
 2. MOUNTING SLOTS: 6X ACCEPTS M6 or 1/4" HARDWARE
 3. WEIGHT: 11.35 lbs (5.15 kg)

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Revision History

Spec. Rev.	Description of Change	Date
Rev A	PRODUCTION RELEASE - ECN# BU-U13237	June 20, 2013



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