HE104 Version V11

High Efficiency Vehicle Power Supply

DC to DC Convertor

Technical Manual

Manufactured by

Tri-M Technology

Rugged Power Solutions for Hostile Environments

http://www.Tri-M.com

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Index

PREFACE

This manual is for integrators of applications of embedded systems. It contains information on hardware requirements and interconnection to other embedded electronics.

DISCLAIMER

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Section 1: INTRODUCTION

The HE104 is a high efficiency, high performance DC to DC 60 watt converter that supplies 5V, 12V, -12V (optional), -5V (optional) outputs. The HE104 is specifically designed for vehicular applications requiring low noise, has an ultrawide input range of 6-40V and is ideal for battery and unregulated input applications.

The input protection circuit includes an input filter, three heavy duty transient suppressors (5000W), Mosfet reverse polarity protection and an active circuit surge stopper with Mosfet.

The HE104 5V output is a synchronouse buck regulator design that provides outstanding line and load regulation and ripple noise below 20mV. The low noise design makes the HE104 ideal for use on aircraft and military applications or wherever EMI or RFI must be minimized.

The HE104 12V output is a synchronouse boost regulator that converts the 5V rail up to 12V. This allows the main input to range from a low of 6V up to 40V while maintaining both 5V and 12V output within their specified levels.

The HE104 has a opto-isolated on/off input (SD), allowing for remote signal between 6 and 40V to control the On/Off operation of the outputs. When jumper shunt JP2 is intalled (default) the outputs will automatically turn on when main power is applied to CN1.

The HE104 is PC/104 compliant with a 16-bit PC/104 bus. All generated voltages are provided to the auxilliary power connector block CN2. A removable main input power plug allows the HE104 to be easily installed.

Section 2: FEATURES

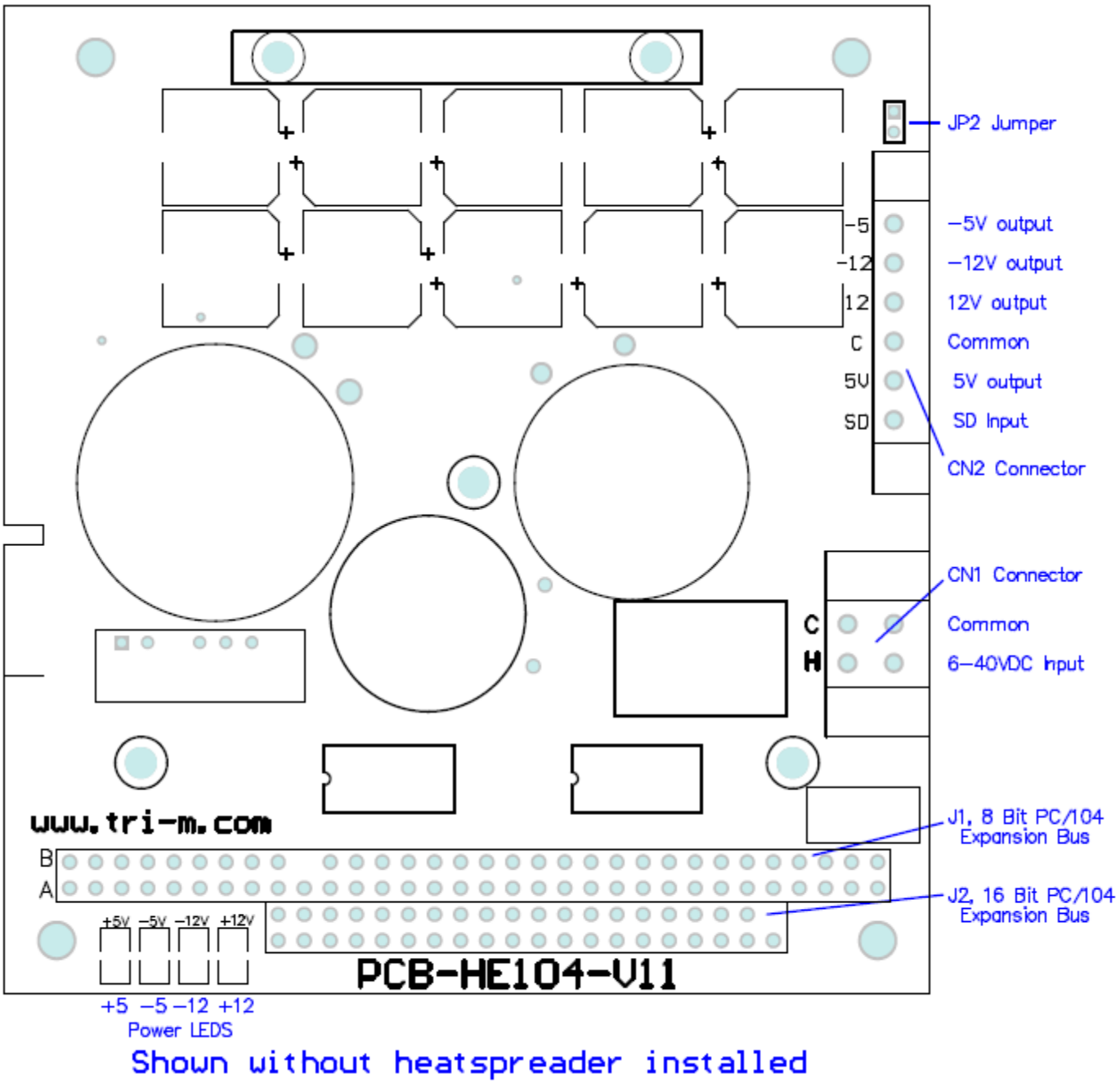
- DC to DC converter for embedded applications.
- Three stage with active transient surge stopper transient suppression on input power supply.
- Operates from 6VDC to 40VDC input.
- PC/104 size and mounting holes.
- 60 maximum watt power supply output.
- 5V, 12V, -12V (optional) and -5V (optional).
- Temperature range -40 to 85C (on heat spreader).
- Opto-coupled 6 to 40V input for remote On/Off control.

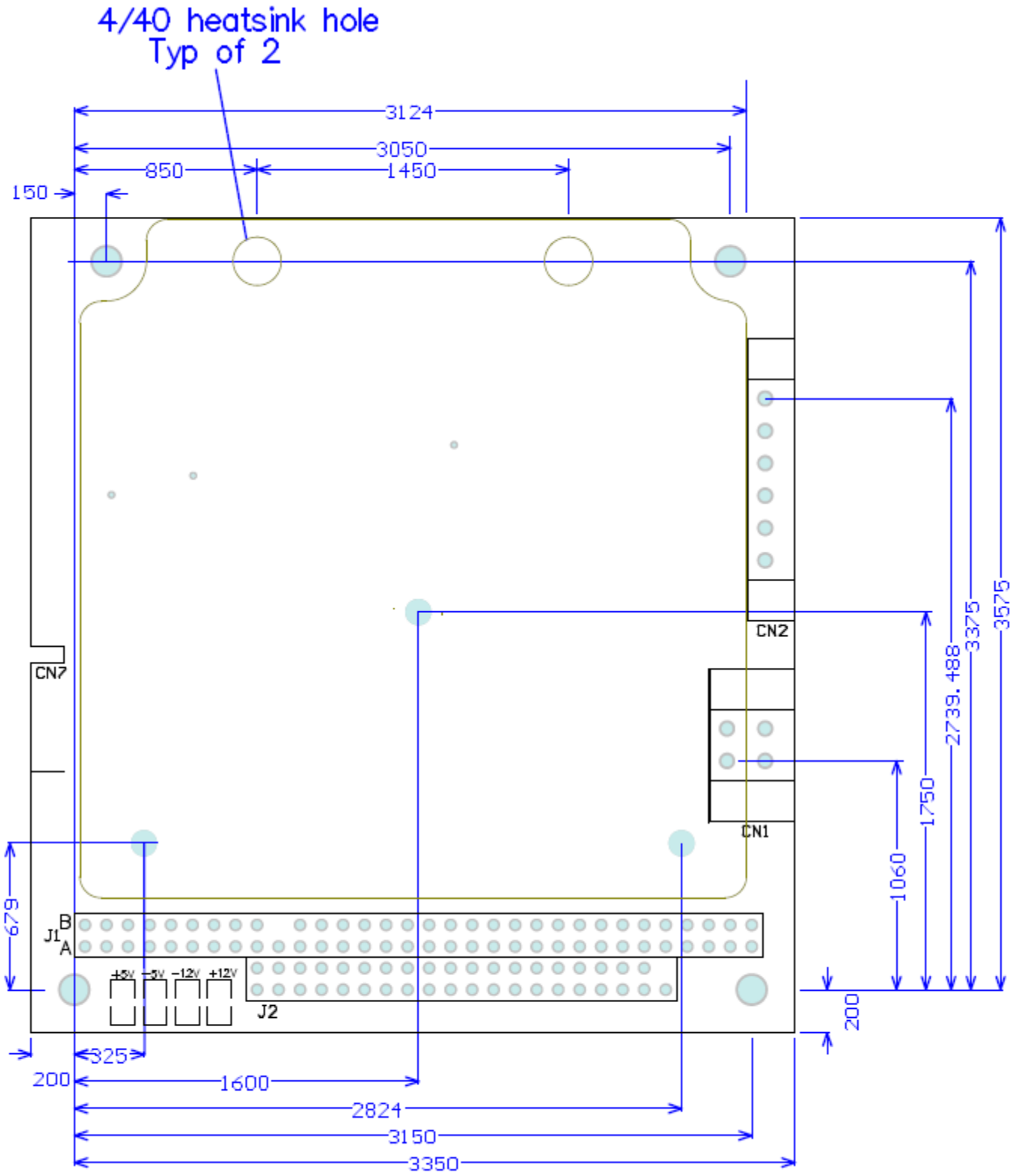
Section 3: SPECIFICATIONS

Power Supply Specifications	
Model	**HE104 Version V11**
5V output (includes current supplied to 12V, -12V and –5V outputs)	12 A
12V output	2.5 A
-5V output	400 mA
-12V output	500 mA
Input Voltage Range	6 to 40V
Load Regulation (5V output)	< 60mV
Line Regulation (5V output)	40mV
Output temp. drift (5V output)	< 40mV
Switching frequency (nominal)	75kHz
Output Ripple (5V output)	< 20mV
Conducted Susceptibility (5V output)	> 57db
Efficiency (5V output)	Up to 95%
Temperature Range (on heat spreader)	-40 to 85C
Size, PC/104 form factor compliant	3.55”W x 3.75”L x 0.6”H

Section 4: Wiring, Connectors and Loads

The figure below shows the HE104 connectors CN1 & CN2, jumper JP2 and the LED indicators. Section 4.1 provides a formula to calculate the available 5V power (as the 5V power also supplies the 12V, -12V and -5V outputs).





Mechanical Layout for HE104 Version V11

4.1 Power Considerations

The 5V switching regulator is rated at 12A maximum output, however this includes the 12V, -5V, and -12V power usage. To obtain the usable range of 5V output, “derate” according to the use of 12, -5, and -12V loads. Use the following formulae to calculate the maximum available 5V amperage.

$$Usable\,5\,Voutput = 12\,A - \frac{(I[-5] + I[-12] * 2.4 + I[12] * 2.4)}{0.9}$$

Where: I[-5] = -5VDC current load

I[-12] = -12VDC current load

I[12] = 12VDC current load

Assuming 90 percent converter efficiency (actual efficiency may vary).

4.2 Main Input Power Connector CN1

The plug for CN1 is Phoenix part# 1827703 and is supplied with each unit.

Input power is connected to the HE104 by a removable connector block CN1. The power supply accepts DC input voltages in the range of 6 to 40V.

Unregulated vehicle power is connected as follows:

- Terminal 1:6 to 40V, “hot” polarity
- Terminal 2: Common (0V)

4.3 Output Power Connector CN2 *(screw terminals standard)*

Output power and the SD input is available on the auxilliary connector block CN2.

- CN2-1: -5VDC output (optional)
- CN2-2: -12VDC output (optional)
- CN2-3: 12VDC output
- CN2-4: Common (0V)
- CN2-5: 5VDC output
- CN2-6: 6 – 40 VDC input (SD, when JP2 not installed)

The HE104 has an opto-isolated input (SD) allowing for remote signal between 6 and 40V to control the On/Off operation of the outputs. When jumper shunt JP2 is installed (default) the outputs will automatically turn on when main power is applied to CN1.

4.4 PC/104 Bus Power Connections

The HE104 provides a PC/104 bus that passes the PC/104 signals including the voltages 5V, 12V, -5V and 12V through to PC/104 cards that may be installed above or below.

The table below lists the pins where the voltages 5V, 12V, -5V and 12V are connected on the PC/104 bus.

Pin #	Signal	Pin #	Signal	Pin #	Signal	Pin #	Signal
A1	N/C	B1	GND	C0	GND	D0	GND
A2	N/C	B2	N/C	C1	N/C	D1	N/C
A3	N/C	B3	5V	C2	N/C	D2	N/C
A4	N/C	B4	N/C	C3	N/C	D3	N/C
A5	N/C	B5	-5V	C4	N/C	D4	N/C
A6	N/C	B6	N/C	C5	N/C	D5	N/C
A7	N/C	B7	-12V	C6	N/C	D6	N/C
A8	N/C	B8	N/C	C7	N/C	D7	N/C
A9	N/C	B9	12V	C8	N/C	D8	N/C
A10	N/C	B10	N/C	C9	N/C	D9	N/C
A11	N/C	B11	N/C	C10	N/C	D10	N/C
A12	N/C	B12	N/C	C11	N/C	D11	N/C
A13	N/C	B13	N/C	C12	N/C	D12	N/C
A14	N/C	B14	N/C	C13	N/C	D13	N/C
A15	N/C	B15	N/C	C14	N/C	D14	N/C
A16	N/C	B16	N/C	C15	N/C	D15	N/C
A17	N/C	B17	N/C	C16	N/C	D16	5V
A18	N/C	B18	N/C	C17	N/C	D17	N/C
A19	N/C	B19	N/C	C18	N/C	D18	GND
A20	N/C	B20	N/C	C19	N/C	D19	GND
A21	N/C	B21	N/C				
A22	N/C	B22	N/C				
A23	N/C	B23	N/C				
A24	N/C	B24	N/C				
A25	N/C	B25	N/C				
A26	N/C	B26	N/C				
A27	N/C	B27	N/C				
A28	N/C	B28	N/C				
A29	N/C	B29	5V				
A30	N/C	B30	N/C				
A31	N/C	B31	GND				
A32	GND	B32	GND				

4.5 Bus Termination (Optional)

One of the requirements of embedded electronics is low power consumption. One method of reducing power is to reduce the drive current available to power the PC/104 expansion bus. With over eighty signal lines a reduction in the drive current reduces overall power requirements. The PC/104 drive currents can be as low as 4mA which is 84 percent less than the equivalent ISA104 signals 24mA drive level. The disadvantage to reducing drive current is the increasing possibility for noise to infiltrate the bus. The symptoms of noise-induced problems can be erratic and unreliable operation.

AC bus termination can improve the reliability of the PC/104 bus reducing crosstalk and reducing unwanted high frequency noise. Additionally, AC termination reduces the EMI generated from the PC/104 bus.

AC bus termination is provided by five “RC” SOIC packages (RC1 to RC5) and discrete capacitors (C32 and C33). Each RC package contains 16 resistor/capacitor combinations of 47R and 47PF with a common bus connected to the signal ground.

	RC1	**RC2**	**RC3**	**RC4**	**RC5**
1	GND	GND	GND	GND	GND
2	*SMEMW	IRQ10	*BACK6	SA11	SA3
3	AEN	LA22	SD9	*Refresh	BALE
4	IOCHRDY	IRQ11	DRQ6	SA12	SA4
5	SD0	LA21	*DACK7	DRQ1	IRQ3
6	SD1	LA20	SD11	SA13	SA5
7	SRDY	IRQ15	DRQ7	*DACK1	*DACK2
8	SD2	LA19	SD12	SA14	SA6
9	SD3	LA18	-----	SA15	SA7
10	GND	GND	GND	GND	GND
11	GND	GND	GND	GND	GND
12	SD7	*MEMR	SD15	*IOW	IRQ6
13	SD6	LA17	SD14	SA17	SA9
14	SD5	LA18	SD13	*IOR	IRQ5
15	SD4	IRQ12	SD10	SA16	SA8
16	DRQ2	LA23	SD8	*DACK3	IRQ4
17	SA19	*IOCS16	DRQ5	DRQ3	DA2
18	*SMEMR	*SBHE	*MEMW	IRQ7	SA1
19	SA18	*MEMCS16	*DACK5	SA10	SA0
20	GND	GND	GND	GND	GND

The following signals are terminated with discrete components.

- TC; C32 (330pF)
- Reset; C33 (330pF)

4.6 Installation Onto PC/104 Modules

There is a large number of pins and sockets in the PC/104 bus (104 total) and caution must be used in separating the PC/104 modules to prevent bending of the pins or punchering a finger of the person separating the modules. The PC/104 removal tool (model# EXTRACT104) safely separates PC/104 modules is available from Tri-M Technologies.