HESC104 Manual

High Efficiency & Smart Charging
Vehicle Power Supply
DC to DC Convertor

Manufactured by
TRI-M ENGINEERING
Engineered Solutions for Embedded Applications

Technical Manual

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PREFACE

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

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CHAPTER 1 - INTRODUCTION

1.1 GENERAL DESCRIPTION

The HESC104 is a high efficiency, high performance DC to DC 60 watt converter that supplies +5V, -5V, +12V & -12V outputs. The HESC104 also includes a flash based microcontroller that supplies advanced power management, smart battery charger and PC/104 bus. The HESC104 is designed for low noise embedded computer systems, has a wide input range of 6-40V(>6:1) and is ideal for battery or unregulated input applications. The HESC104 is specifically designed for vehicular applications and has heavy-duty transient suppressors (5000W) that clamp the input voltage to safe levels, while maintaining normal power supply operation.

The HESC104 is a state-of-the-art mosfet based design that provides outstanding line and load regulation with efficiencies up to 95 percent. Organic Semiconductor Capacitors provide filtering that reduces ripple noises below 20mV. The low noise design makes the HESC104 ideal for use aboard aircraft or military applications or wherever EMI or RFI must be minimized. The +5VDC and +12VDC outputs are controlled by a constant off-time current-mode architecture regulator that provides excellent line and load transient response.

The HESC104 provides up to four stages of battery charging and can charge Lead-Acid, NiCd, and NiMH batteries and is also SMBus level 3 compatible. Charge currents are up to 4A, and battery charging voltages from 9.5 to 19.5V.

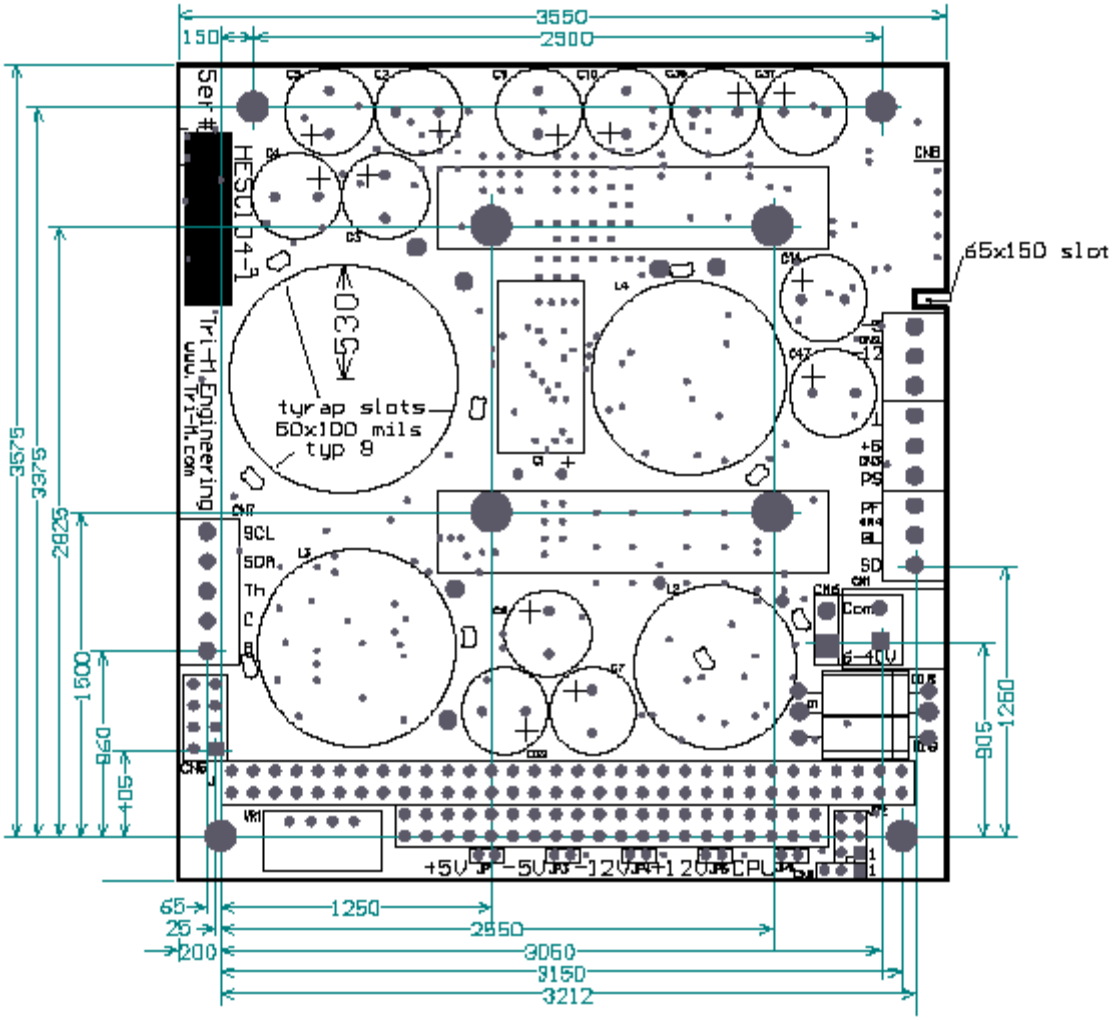
The HESC104 has advanced power management functions that allows timed on/off control of the HESC104, notification of changes to main power and changes in the battery status. For example, the HESC104 can be programmed to power off it's outputs in 60 seconds, then turn on again 12 hours later.

The HESC104 is PC/104 compliant with a 16 bit PC/104 bus. All generated voltages are provided to a Phoenix header. A removable plug allows the HESC104 to be easily installed.

The HESC104 can be configured to meet almost any power supply and battery charging need for embedded applications, whether that be a simple +5V application, or providing power for back lighted LCD panels, or a full UPS (un-interruptible power supply configuration).

1.2 FEATURES

- DC to DC converter for embedded applications.
- “Load Dump” transient suppression on input power supply.
- Operates from 6VDC to 40VDC input.
- PC/104 size and mounting holes.
- 60 watt power supply outputs.
- 5V, 12V, -12V, -5V, and battery charger outputs.
- Temperature range -40 to 85C.
- Monitors up to 16 external temperatures using I2C digital temperature sensors.
- Optocoupled inputs for ignition, and system "shut-down" pushbutton.



1.3 SPECIFICATIONS

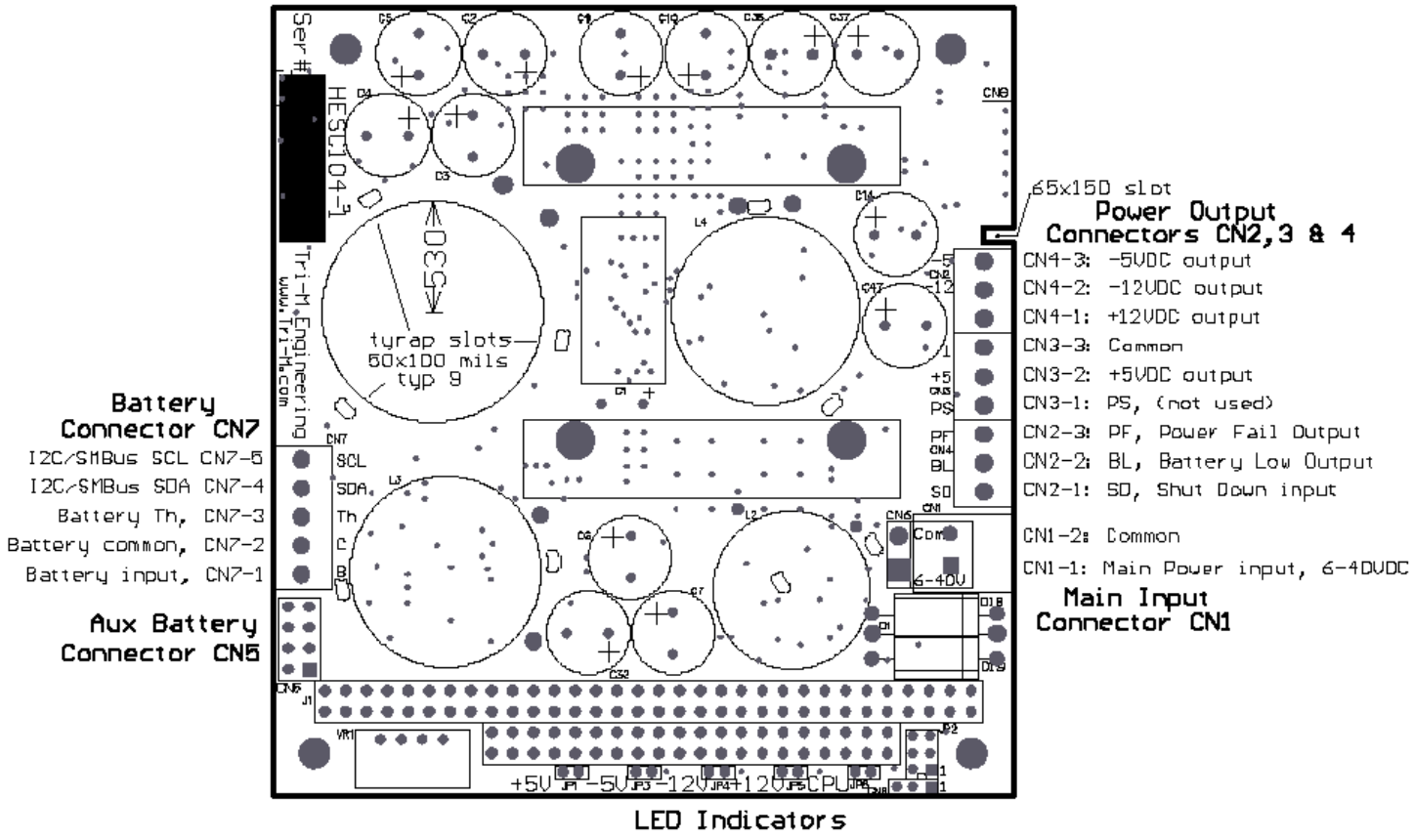
Power Supply Specifications	
Model	**HESC104**
5V output*	12 A
12V output	2.5 A
-5V output	400mA
-12V output	500mA
Input Voltage Range	6 to 40V
Load Regulation **	<60mV
Line Regulation **	±40mV
Output temp. drift **	<40mV
Switching Freq.	75kHz
Max. Input Transient	125V for 100msec
Output Ripple**	<20mV
Conducted Susceptibility **	>57db
Efficiency**	up to 95%
Temp Range	-40 to 85C
Quiescent current***	2mA
Size, PC/104 form factor compliant****	3.55"W. x 3.75"L x 0.6"Height

*Current rating includes current supplied to 12V, -12V, & -5V regulators.
**Measured on the 5V output.
***LEDs disabled,

CHAPTER 2 - CONFIGURATION AND INSTALLATION

2.1 Introduction

This chapter describes the configuration and installation of the HESC104 power supply. In addition, section 2.2 provides a formula to calculate the available +5VDC. Figure 2-1 shows the HESC104 connectors, jumpers and other options.



2.2 Power Considerations.

The +5V switching regulator is rated at 12A maximum output, however the +5V output supplies power to the +12, -5, and -12VDC regulators. To obtain the usable range of +5V output, “derate” according to the use of +12, -5, and -12VDC. Use the following formulae to calculate the maximum usable output.

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

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).

2.3.1 Main Input Power Connector

Input power is connected to the HESC104 by a “Molex” plug and pin connector CN6. The power supply accepts DC input voltages in the range of 6VDC to 40VDC.

Unregulated vehicle power is connected as follows:

- Terminal 1:“hot” polarity
- Terminal 2: Common (0VDC)

2.3.2 Output Power Connector

Output power is available for use via Phoenix MiniCombicon connector. Connectors CN2, CN3 & CN4 are immediately side by side, with a nine position mating plug-in mating header supplied

- CN4-1: Position 1, SD (Ignition input, ie maintained contact closure) *TTL logic level
- CN4-2: Position 2, BL (Battery Low signal output) TTL logic level; active low
- CN4-3: Position 3, PF (Power Fail signal output) TTL logic level; active low
- CN3-1: Position 4, PS (not used)
- CN3-2: Position 5, +5VDC output
- CN3-3: Position 6, common
- CN2-1: Position 7, +12VDC output
- CN2-2: Position 8, -12VDC output
- CN2-3: Position 9, -5VDC output

* The logic level to activate SD is programmable

2.3.3 Battery Connector

Batteries are connected via the Phoenix MiniCombicon connector, CN7. The HESC104 accepts DC battery voltages in the range 6.5V to 35VDC through the Battery Power Connector.

- CN7-1: Battery Positive
- CN7-2: Common
- CN7-3: TH, thermistor/safety input
- CN7-4: SDA, I2C/SMBus data input/output signal
- CN7-5: SCL, I2C/SMBus clock input/output signal

2.3.4 Aux Battery Connector

Tri-M Engineering battery packs such as the BAT104-NiCd, BAT104-NiMh, BAT104-SLA25 and BAT104-SLA45 can be directly plugged into the HESC104 through connector CN5. Connector CN5 is a two row by four pin header, with the BAT104 battery packs having a mating female connector.

- CN5-1: Battery Positive
- CN5-2: Common
- CN5-3: Battery Positive
- CN5-4: Common
- CN5-5: SDA, I2C/SMBus data input/output signal
- CN5-6: SCL, I2C/SMBus clock input/output signal
- CN5-7: +5VC, +5V for digital temperature sensor and battery enable
- CN5-8: BE, Battery Enable output

2.3.5 PC/104 Parallel Port Interface

The HESC104 provides a memory mapped "parallel" PC/104 port for remote control, monitoring and datalogging. In addition, a 2mm jumper block allows selection of the memory-mapped address. A three-pin header allows selection of the HESC104 service request flag to either IRQ5 or IRQ7 interrupt line. Please refer to section 2.6 for jumper selections.

2.6 Jumper Selection

This section describes the function of each jumper, the location of it, the default setting, and how to change it.

2.6.1 LED Jumper Enable/Disable

These jumpers allow the LEDs to be disabled. This is most likely to be used when absolute minimum power consumption must be maintained, such as when operating off a limited battery source.

The location of each LED jumper shown in the diagram below.

Each LED is enabled by factory default. To disable any LED, remove the LED jumper (or cut the small PCB trace if no jumper is installed) associated with the LED. To re-enable any LED, re-install the associated jumper (or solder a short jumper wire between each of the jumper pads).

2.6.2 Interrupt Service Request Jumpers

Jumper CN9 sets the interrupt service request to either IRQ5 or IRQ7.

- Pin 1 to 2, IRQ5
- Pin 2 to 3, IRQ7

2.6.3 PC/104 Memory Mapped Address Jumper

Jumper J2 sets the PC/104 Memory Mapped Address Jumper.

- Pin 1 to 3, Address 0x300 (300 hex)
- Pin 2 to 4, Address 0x310 (310 hex)
- Pin 5 to 3, Address ox320 (320 hex)
- Pin 6 to 4, Address ox360 (360 hex)

3.1 Using HESC104 Power Management Features.

Note: In order to activate power management features, HESC104 must be upgraded with UPS Firmware.

By monitoring and activating the following inputs and outputs, the HESC104 power supply is capable of responding to changes in input supply and battery voltage to alert the host CPU of such conditions. To help accomplishing this task with ease, TRI-M provides a Windows based Smart Charger Utility (SCU). This utility is also required when changing the charge profile for different batteries or future firmware update.

- CN4-1: Position 1, SD (Ignition input, ie maintained contact closure)
- CN4-2: Position 2, BL (Battery Low signal output)
- CN4-3: Position 3, PF (Power Fail signal output)

SD responses to TTL level signal input. It can be triggered on either low or high level of input. The input polarity is set by changing one of the Charger flag. Figure 3-1 is a snap-shot of the SCU utility page which shows the charger flags. When the flag is checked, SD reacts to logic high input and vice-versa with flag unchecked.

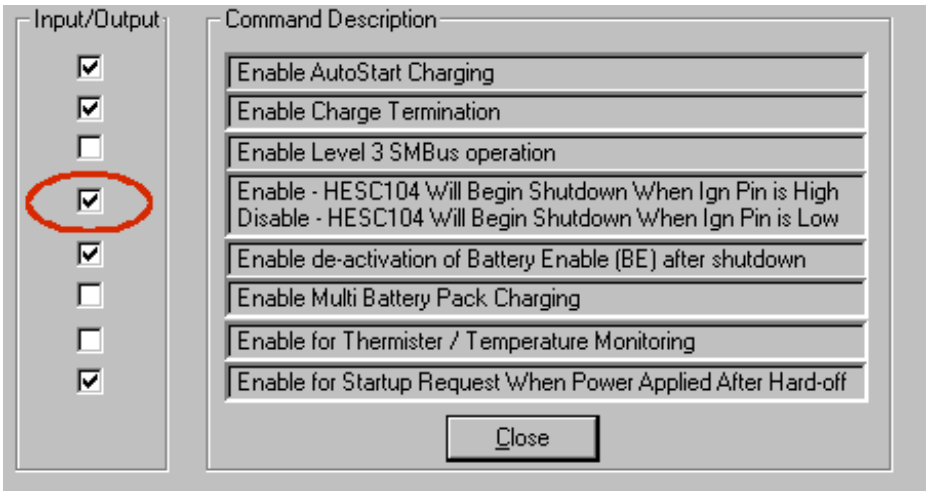


Figure 3-1

BL is driven low when the battery voltage is below the setpoint value of Minimum Battery Operating Voltage EEPROM variable. Figure 3-2 shows this variable under the OTHER EEPROM SETPOINTS page. Please note the unit of 9400 is in millivolt.

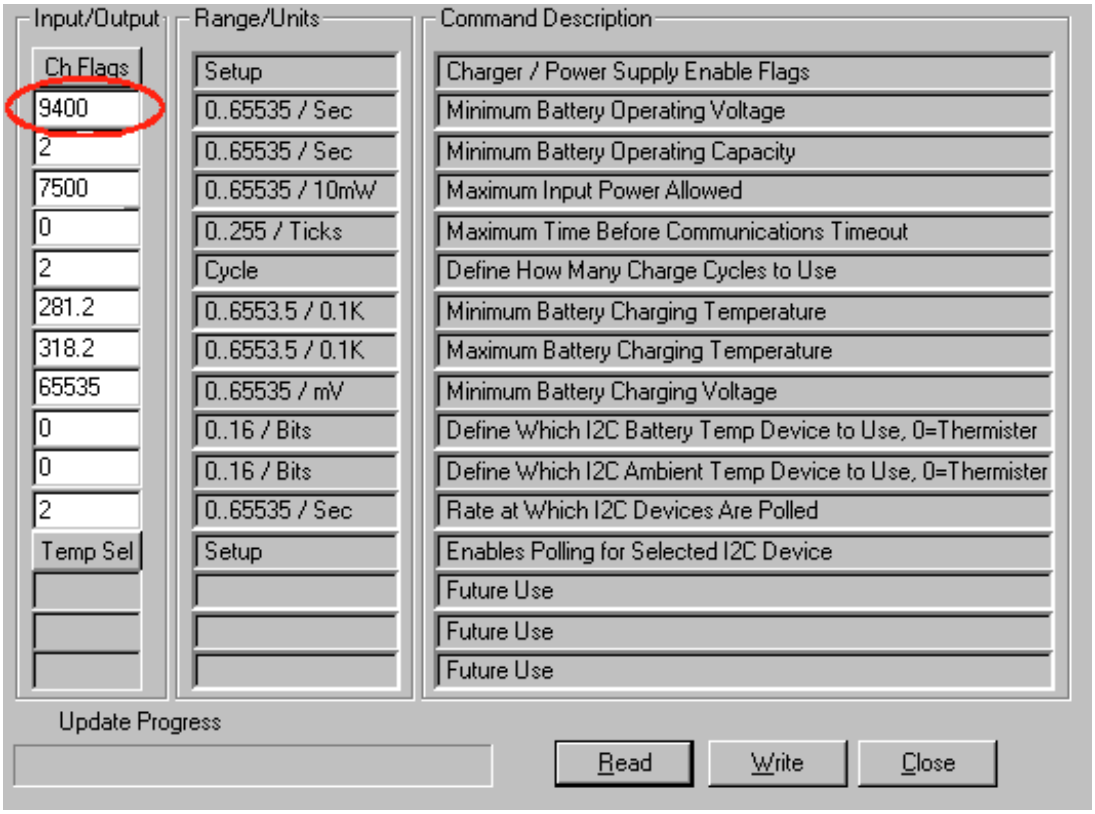


Figure 3-2

PF is driven active high when the HESC104 Main Input shutdown counter starts counting down after main input is removed.

SD, BL and PF can be used to signal the host CPU to prepare for shutdown. It is critical that operating system such as Linux and Window to be shutdown gracefully otherwise catastrofic consequence may result.

The following diagram summarizes the various input conditions which generate shutdown command to the HESC104. After 1 of the 3 signals (BL, PF, SD) becomes active, the corresponding counter will start counting down to zero. When the counter reaches zero, a shutdown command is issued to switch off the HESC104 outputs immediately.

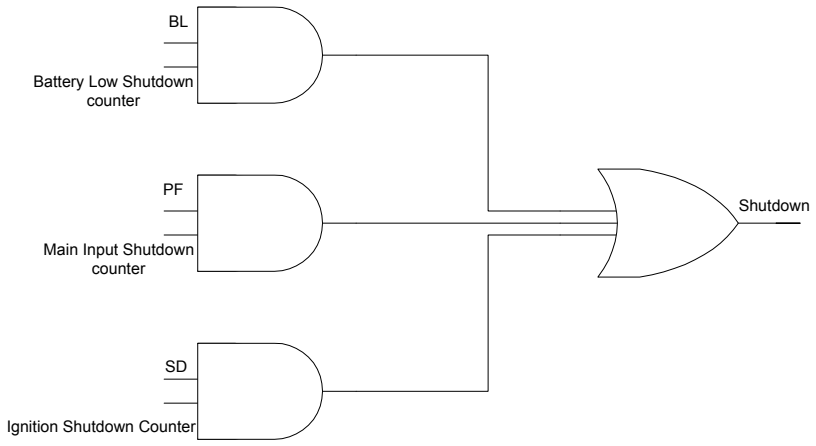


Figure 3-3

Figure 3-4 shows the various counters that are associated with BL, PF and SD signal to generate shutdown command. These counters are found under the EEPROM UPS SETTINGS page of the SCU utility.

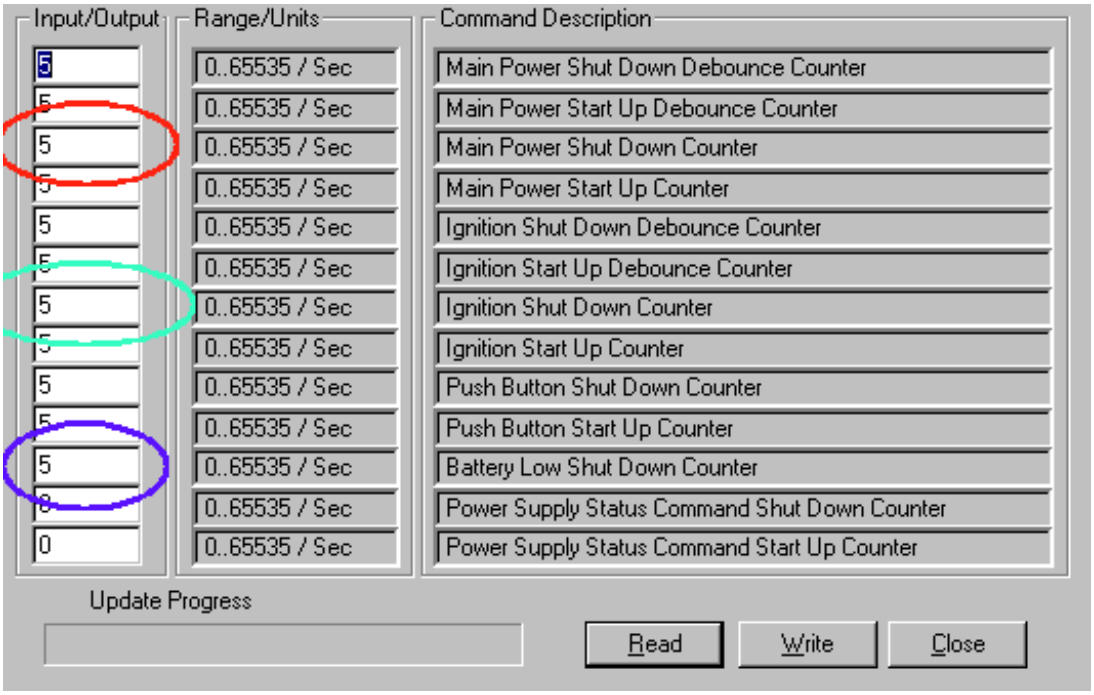


Figure 3-4