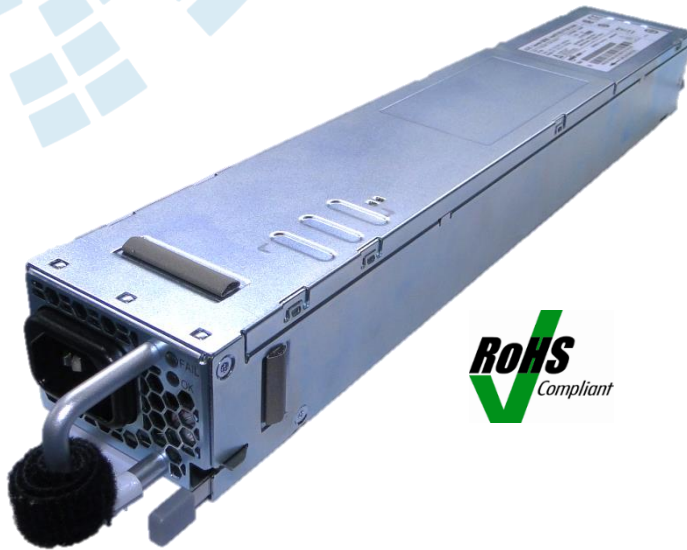


## PET1300-12-054xA Series



The **PET1300-12-054xA** is a 1300 Watt AC to DC power-factor-corrected (PFC) power supply that converts standard AC mains power into a main output of 12 VDC for powering intermediate bus architectures (IBA) in high performance and reliability servers, routers, and network switches. The PET1300-12-054xA meets international safety standards and displays the CE-Mark for the European Low Voltage Directive (LVD).

### Features

- High efficiency up to 94.0%
- Wide input voltage range: 90-264 VAC
- Active power factor correction
- Always-On 10 W standby output (3.3 V)
- Hot-plug capability
- Parallel operation with active current sharing
- Full digital control for circuit loop and power management
- High density design: 30.25 W/in<sup>3</sup>
- Compact form factor: 54.5 x 40.0 x 321.5 mm
- PMBus™ for control, programming and monitoring
- Fully protected (OTP, OCP, OVP, SCP)
- 4K Bytes of EEPROM for user information
- 2 Status LEDs: FAIL and OK with fault signaling
- Approved to the latest edition of following Safety Standards: UL/CSA60950-1, IEC / EN 60950-1
- Designed to meet Class A emissions per CISPR 22 and EN55022

### Applications

- High performance servers
- Routers
- Switches

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# PET1300-12-054xA Series

## 1 Ordering Information

| PET                              | 1300                  | -    | 12                | -    | 054            | X                                   | A              |
|----------------------------------|-----------------------|------|-------------------|------|----------------|-------------------------------------|----------------|
| Product Family<br>PET Front-Ends | Power Level<br>1300 W | Dash | V1 Output<br>12 V | Dash | Width<br>54 mm | Airflow<br>N: Normal<br>R: Reversed | Input<br>A: AC |

## 2 Overview

The PET1300-12-054xA AC/DC power supply is a fully DSP controlled, highly efficient front-end power supply. It incorporates resonance-soft-switching technology and interleaved power trains to reduce component stresses, providing increased system reliability and very high efficiency. With a wide input operational voltage range and minimal linear derating of output power with input voltage and temperature, the PET1300-12-054xA maximizes power availability in demanding server, network, and other high availability applications. The supply is fan cooled and ideally suited for integration with a matching airflow paths.

The PFC stage is an analogue solution; MCU is used to communicate with DSP chip on secondary side.

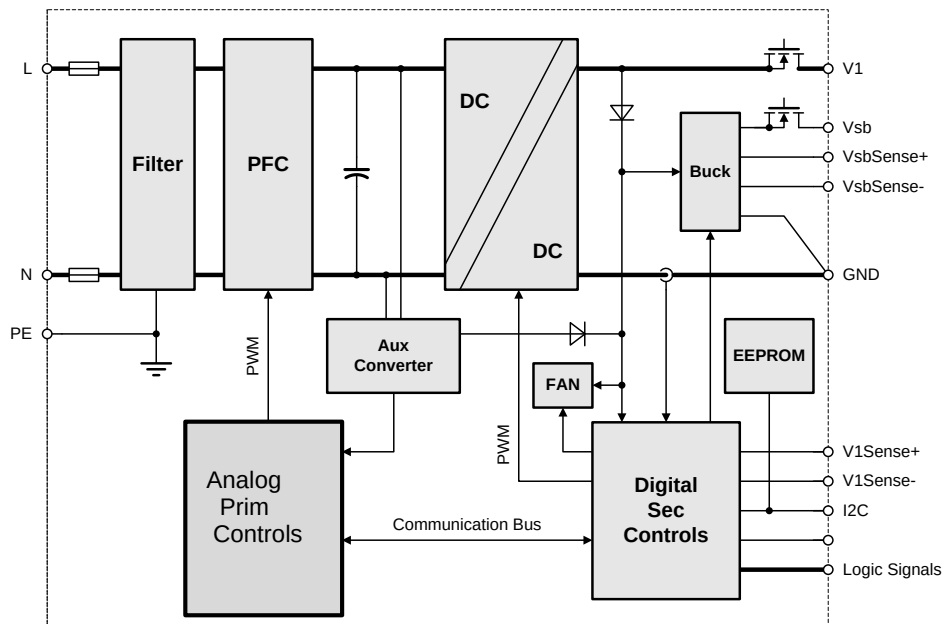
The DC/DC stage uses soft switching resonant techniques in conjunction with synchronous rectification. An active OR-ing device on the output ensures no reverse load current and hence it is ideally suited for operation in redundant power systems.

The always-on standby output with voltage level (3.3 Volts), provides power to external power distribution and management controllers. It is protected with an active OR-ing device for maximum reliability.

Status information is provided with front-panel LEDs. In addition, the power supply can be controlled and the fan speed set via the I<sup>2</sup>C bus. The I<sup>2</sup>C bus allows full monitoring of the supply, including input and output voltage, current, power, and inside temperatures.

Cooling is managed by a fan controlled by the DSP controller. The fan speed is adjusted automatically depending on the actual power demand and supply temperature and can be overridden through the I<sup>2</sup>C bus.

Figure 1 - PET1300-12-054xA Block Diagram



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# PET1300-12-054xA Series

## 3 Input

General Condition:  $T_A = 0 \dots +60^\circ\text{C}$  unless otherwise noted.

| PARAMETER          | DESCRIPTION / CONDITION                | MIN                                                                                                                                     | NOM   | MAX  | UNIT             |
|--------------------|----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|-------|------|------------------|
| $V_{i\text{ nom}}$ | Nominal Input Voltage                  | 100                                                                                                                                     |       | 240  | VAC              |
| $V_i$              | Input Voltage Ranges                   | Normal operating ( $V_{i\text{ min}}$ to $V_{i\text{ max}}$ )                                                                           |       | 264  | VAC              |
| $I_{i\text{ max}}$ | Max Input Current                      | $V_{i\text{ in}}=110\text{ VAC}/60\text{ Hz}$ , Full load                                                                               |       | 13.6 | $A_{\text{rms}}$ |
| $I_{i\text{ p}}$   | Inrush Current Limitation              | $V_{i\text{ min}}$ to $V_{i\text{ max}}$ , $T_{\text{NTC}} = 25^\circ\text{C}$                                                          |       | 50   | $A_p$            |
| $F_i$              | Input Frequency                        | 47                                                                                                                                      | 50/60 | 63   | Hz               |
| PF                 | Power Factor                           | $V_{i\text{ nom}}$ , 50 Hz, $> 0.2 I_{i\text{ nom}}$                                                                                    |       | 0.95 | W/VA             |
| $V_{i\text{ on}}$  | Turn-on Input Voltage <sup>1)</sup>    | Ramping up                                                                                                                              |       | 90   | VAC              |
| $V_{i\text{ off}}$ | Turn-off Input Voltage <sup>1)</sup>   | Ramping down                                                                                                                            |       | 83   | VAC              |
| Power              | Rated Power (Figure 2&3) <sup>2)</sup> |                                                                                                                                         |       | 1100 | W                |
|                    |                                        |                                                                                                                                         |       | 1300 | W                |
| $\eta$             | Efficiency without Fan                 | $V_{i\text{ in}} = 230\text{ V}$ , 12 V / 21.6 A, 3.3 V / 0.6 A $T_A = 25^\circ\text{C}$                                                |       | 93.0 |                  |
|                    |                                        | $V_{i\text{ in}} = 230\text{ V}$ , 12 V / 54 A, 3.3 V / 1.5 A $T_A = 25^\circ\text{C}$                                                  |       | 94.0 | %                |
|                    |                                        | $V_{i\text{ in}} = 230\text{ V}$ , 12 V / 108 A, 3.3 V / 3 A $T_A = 25^\circ\text{C}$                                                   |       | 92.0 |                  |
| $T_{\text{hold}}$  | Hold-up Time                           | After last AC zero point, $V_i > 11.6\text{ V}$ , $V_{\text{SB}}$ within regulation, $V_i = 230\text{ VAC}$ , 12 V / 108 A, 3.3 V / 3 A |       | 10   | mS               |

<sup>1)</sup> The Front-End is provided with a minimum hysteresis of 3 V during turn-on and turn-off within the ranges.

<sup>2)</sup> The output power is should be derating as below curve if operation temperature increases from  $45^\circ\text{C}$  to  $60^\circ\text{C}$ .

Figure 2 - Derating on  $I_{\text{out}}$  vs  $V_{i\text{ in}}$  and  $T_A$  for PET1300-12-054NA

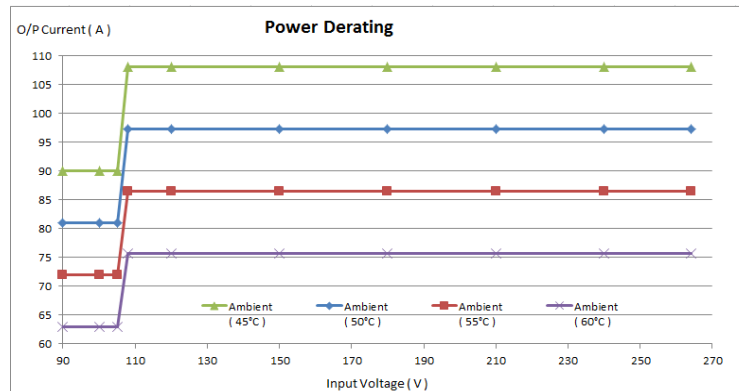
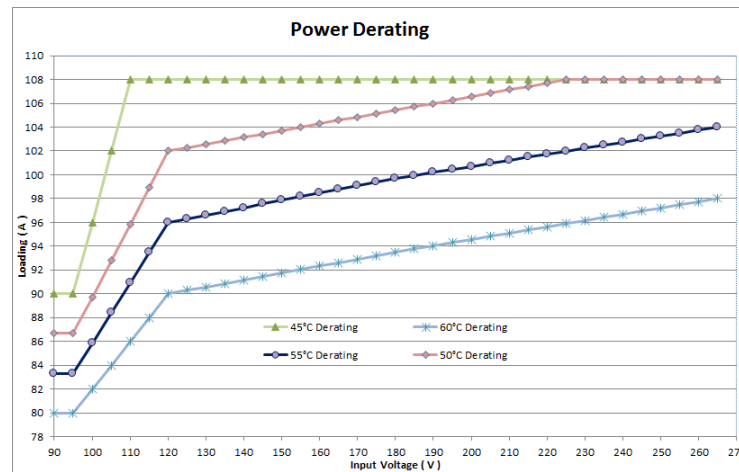


Figure 3 - Derating on  $I_{\text{out}}$  vs  $V_{i\text{ in}}$  and  $T_A$  for PET1300-12-054RA



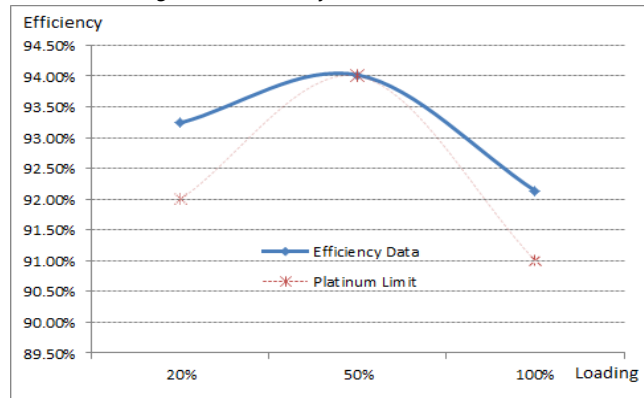
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# PET1300-12-054xA Series

Figure 4 - Efficiency Measurement Curve



## 4 Output

General Condition:  $T_a = 0 \dots +60^\circ\text{C}$  unless otherwise noted.

| PARAMETER                                        | DESCRIPTION / CONDITION                                                  | MIN  | NOM  | MAX   | UNIT                  |
|--------------------------------------------------|--------------------------------------------------------------------------|------|------|-------|-----------------------|
| <b>Main Output <math>V_1</math></b>              |                                                                          |      |      |       |                       |
| $V_{1\text{ nom}}$                               | Nominal Output Voltage                                                   |      | 12.0 |       | VDC                   |
| $V_{1\text{ set}}$                               | Output Setpoint Accuracy                                                 | -0.5 |      | +0.5  | % $V_{1\text{ nom}}$  |
| $dV_{1\text{ tot}}$                              | Total Regulation                                                         | -3   |      | +3    | % $V_{1\text{ nom}}$  |
| $P_{1\text{ nom}}$                               | Nominal Output Power                                                     |      | 1296 |       | W                     |
| $I_{1\text{ nom}}$                               | Nominal Output Current                                                   |      | 108  |       | A <sub>DC</sub>       |
| $V_{1\text{ pp}}$                                | Output Ripple Voltage                                                    |      |      | 180   | mVpp                  |
| $dV_{1\text{ Load}}$                             | Load Regulation                                                          |      | 60   |       | mV                    |
| $dV_{1\text{ Line}}$                             | Line Regulation                                                          |      | 20   |       | mV                    |
| $dI_{\text{share}}$                              | Current Sharing( <i>abs (I1-I2), between any two units in parallel</i> ) |      |      | 4.5   | A                     |
|                                                  | when Bus load $\geq 27\text{ A}$                                         |      |      | 5.6   | A                     |
|                                                  | when Bus load $< 27\text{ A}$                                            |      |      |       |                       |
| $dV_{\text{dyn}}$                                | Dynamic Load Regulation                                                  | -0.6 |      | 0.6   | V                     |
| $T_{\text{rec}}$                                 | Recovery Time                                                            |      | 0.5  | 1     | mS                    |
| $t_{\text{AC } V_1}$                             | Start-up Time from AC                                                    |      |      | 2     | sec                   |
| $t_{V_1\text{ rise}}$                            | Rise Time                                                                |      | 3    |       | mS                    |
| $C_{\text{Load}}$                                | Capacitive Loading                                                       |      |      | 11000 | $\mu\text{F}$         |
| <b>Standby Output <math>V_{\text{SB}}</math></b> |                                                                          |      |      |       |                       |
| $V_{\text{SB nom}}$                              | Nominal Output Voltage                                                   |      | 3.3  |       | VDC                   |
| $V_{\text{SB set}}$                              | Output Setpoint Accuracy                                                 | -1   |      | +1    | % $V_{1\text{ nom}}$  |
| $dV_{\text{SB tot}}$                             | Total Regulation                                                         | -1.5 |      | +1.5  | % $V_{\text{SB nom}}$ |
| $P_{\text{SB nom}}$                              | Nominal Output Power                                                     |      | 10   |       | W                     |
| $I_{\text{SB nom}}$                              | Nominal Output Current                                                   |      | 3    |       | A <sub>DC</sub>       |
| $V_{\text{SB pp}}$                               | Output Ripple Voltage                                                    |      |      | 45    | mVpp                  |
| $dV_{\text{SB}}$                                 | Droop                                                                    |      | 67   |       | mV                    |
| $dV_{\text{SB dyn}}$                             | Dynamic Load Regulation                                                  | -3   |      | 3     | % $V_{\text{SB nom}}$ |
| $T_{\text{rec}}$                                 | Recovery Time                                                            |      |      | 250   | $\mu\text{s}$         |
| $t_{\text{AC } V_{\text{SB}}}$                   | Start-up Time from AC                                                    |      |      | 3     | sec                   |
| $t_{V_{\text{SB}}\text{ rise}}$                  | Rise Time                                                                |      | 4    | 20    | mS                    |
| $C_{\text{Load}}$                                | Capacitive Loading                                                       |      |      | 1000  | $\mu\text{F}$         |

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# PET1300-12-054xA Series

## 5 Protection

General Condition:  $T_a = 0 \dots +60^\circ\text{C}$  unless otherwise noted.

| PARAMETER                      | DESCRIPTION / CONDITION                                 | MIN                                                                            | NOM | MAX  | UNIT             |
|--------------------------------|---------------------------------------------------------|--------------------------------------------------------------------------------|-----|------|------------------|
| F                              | Input Fuses (L+N)                                       | Not user accessible, quick-acting (F)                                          |     | 16   | A                |
| $V_{1\text{ OV}}$              | OV Threshold $V_1$                                      | 13.5                                                                           |     | 14.5 | VDC              |
| $t_{\text{OV } V_1}$           | OV Latch Off Time $V_1$                                 |                                                                                |     | 1    | mS               |
| $V_{\text{SB OV}}$             | OV Threshold $V_{\text{SB}}$                            | 3.6                                                                            |     | 4.3  | VDC              |
| $t_{\text{OV } V_{\text{SB}}}$ | OV Latch Off Time $V_{\text{SB}}$                       |                                                                                |     | 1    | mS               |
| $I_{V_1 \text{ lim}}$          | Current Limit $V_1$ (Figure 5&6)                        | 112                                                                            | 115 | 117  | A <sub>DC</sub>  |
| $I_{\text{sb lim}}$            | Current Limit $V_1$ $T_{\text{amb}} = 25^\circ\text{C}$ | Standby output can recovery.                                                   |     | 4.5  | A                |
| $I_{V_1 \text{ SC}}$           | Max Short Circuit Current $V_1$                         |                                                                                | 150 |      | A                |
| $t_{V_1 \text{ SC}}$           | Short Circuit Regulation Time                           | $V_1 < 3\text{ V}$ , time until $I_{V_1}$ is limited to $< I_{V_1 \text{ SC}}$ |     | 2    | mS               |
| $t_{V_1 \text{ SC off}}$       | Short Circuit Latch Off Time                            | Time to latch off when in short circuit                                        |     | 500  | mS               |
| $T_{\text{SD}}$                | Over Temperature On Heat Sinks                          | Automatic shut-down                                                            |     | 115  | $^\circ\text{C}$ |

**Note:** The OCP should be derating as below curve if operation temperature increases from  $45^\circ\text{C}$  to  $60^\circ\text{C}$ , And OCP warning is before 2 A than OCP set point.

Figure 5 -  $V_{\text{in}}$  vs Output Current for PET1300-12-054NA

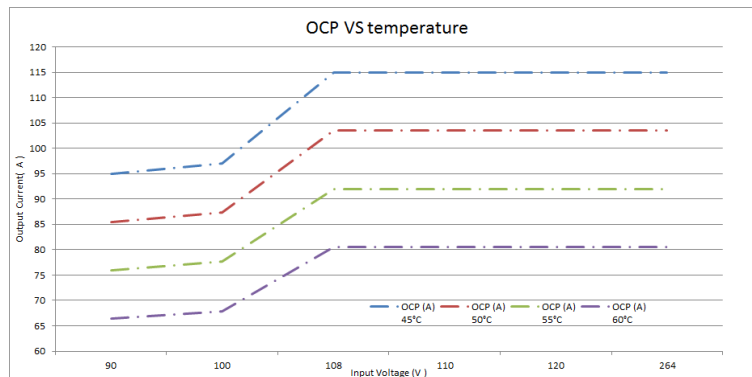
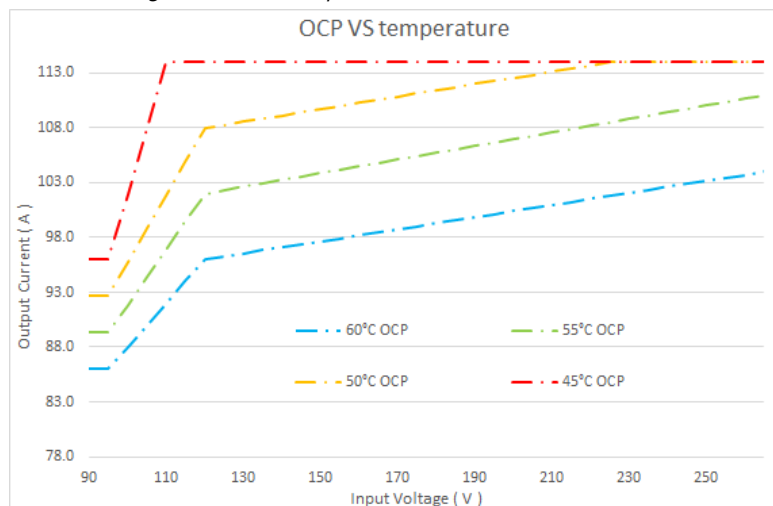


Figure 6 -  $V_{\text{in}}$  vs Output Current for PET1300-12-054RA



# PET1300-12-054xA Series

## 6 Signaling and Control

### 6.1 Front LEDs

The front-end has 2 front LEDs showing the status of the supply. LED number one is green which indicates presence of AC power, LED number two is bi-colored: green and yellow, which indicates DC power presence or fault. For the position and states of the LEDs see *Table 1*.

Table 1 - LED Status

| POWER SUPPLY CONDITION                                                                                              | GREEN (OK) LED STATUS | AMBER (FAIL) LED STATUS |
|---------------------------------------------------------------------------------------------------------------------|-----------------------|-------------------------|
| No AC power to all power supplies                                                                                   | OFF                   | OFF                     |
| Power Supply Failure (includes over voltage, over current, over temperature and fan failure)                        | OFF                   | ON                      |
| Power Supply Warning events where the power supply continues to operate (high temperature, high power and slow fan) | OFF                   | 1 Hz Blinking           |
| AC Present / 3.3 VSB on (PSU OFF)                                                                                   | 1 Hz Blinking         | OFF                     |
| Power Supply ON and OK                                                                                              | ON                    | OFF                     |

\*When unit see fan failure, unit will shut down and can only be restarted by using PSON\_L signal or AC input power recycling or PMBus commands. Refer to software spec. for detail.

### 6.2 Electrical Characteristics

General Condition:  $T_a = 0 \dots +60^\circ\text{C}$  unless otherwise noted.

| PARAMETER                        | DESCRIPTION/CONDITION                    | MIN                           | NOM  | MAX | UNIT          |
|----------------------------------|------------------------------------------|-------------------------------|------|-----|---------------|
| <b>PSKILL_H/PSON_L/PRESENT_L</b> |                                          |                               |      |     |               |
| $V_{IL}$                         | Input Low Level Voltage                  | 0                             |      | 0.8 | V             |
| $V_{IH}$                         | Input High Level Voltage                 | 2.0                           |      | 3.6 | V             |
| $I_{IL, H}$                      | Maximum Input Sink or Source Current     | 0                             |      | 1   | mA            |
| $R_{puSKILL\_H}$                 | Internal Pull Up Resistor on PSKILL_H    |                               | 10   |     | k $\Omega$    |
| $R_{puPSON\_L}$                  | Internal Pull Up Resistor on PSON_L      |                               | 10   |     | k $\Omega$    |
| $R_{puPRESENT\_L}$               | Internal Pull Up Resistor on PRESENT_L   |                               | None |     | k $\Omega$    |
| $R_{LOW}$                        | Resistance Pin to SGND for Low Level     | 0                             |      | 1   | k $\Omega$    |
| $R_{HIGH}$                       | Resistance Pin to SGND for High Level    | 50                            |      |     | k $\Omega$    |
| <b>PWOK_H Output</b>             |                                          |                               |      |     |               |
| $V_{ext}$                        | Maximum External Pull Up Voltage         |                               |      | 3.6 | V             |
| $V_{OL}$                         | Output Low Level Voltage                 | $I_{sink} < 2 \text{ mA}$     | 0    | 0.4 | V             |
| $V_{OH}$                         | Output High Level Voltage                | $I_{source} < 0.5 \text{ mA}$ | 2.4  | 3.6 | V             |
| $R_{puPWOK\_H}$                  | Internal Pull Up Resistor on PWOK_H      |                               | None |     | k $\Omega$    |
| <b>ACOK_H Output</b>             |                                          |                               |      |     |               |
| $V_{ext}$                        | Maximum External Pull Up Voltage         |                               |      | 3.6 | V             |
| $V_{OL}$                         | Output Low Level Voltage                 | $I_{sink} < 2 \text{ mA}$     | 0    | 0.4 | V             |
| $V_{OH}$                         | Output High Level Voltage                | $I_{source} < 0.5 \text{ mA}$ | 2.4  | 3.6 | V             |
| $R_{puACOK\_H}$                  | Internal Pull Up Resistor on ACOK_H      |                               | None |     | k $\Omega$    |
| <b>SMB_ALERT_L Output</b>        |                                          |                               |      |     |               |
| $V_{ext}$                        | Maximum External Pull Up Voltage         |                               |      | 12  | V             |
| $V_{OL}$                         | Output Low Level Voltage                 | $I_{sink} < 2 \text{ mA}$     | 0    | 0.4 | V             |
| $I_{OH}$                         | Maximum High Level Leakage Current       |                               |      | 10  | $\mu\text{A}$ |
| $R_{puSMB\_ALERT\_L}$            | Internal Pull Up Resistor on SMB_ALERT_L |                               | None |     | k $\Omega$    |

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# PET1300-12-054xA Series

## 6.3 Graphical User Interface

Bel Power Solutions provide with its “Bel Power Solutions I<sup>2</sup>C Utility” a Windows® XP/Vista/Win7 compatible graphical user interface allowing the programming and monitoring of the PET1300-12-054xA Front-End. The utility can be downloaded on [www.belpowersolutions.com](http://www.belpowersolutions.com) and supports both the PSMI and PMBus™ protocols.

The GUI allows automatic discovery of the units connected to the communication bus and will show them in the navigation tree. In the monitoring view the power supply can be controlled and monitored.

Figure 7 - I<sup>2</sup>C Bus to DSP and EEPROM

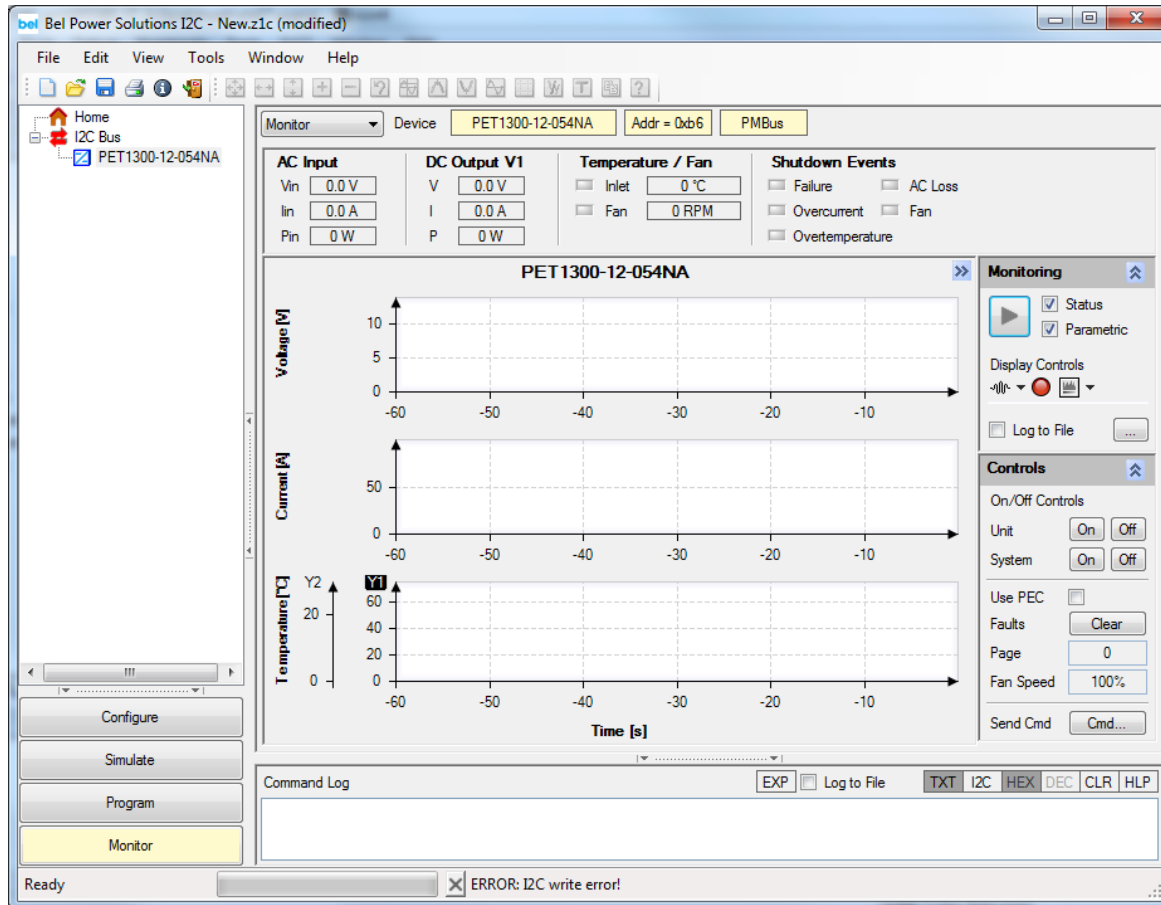


Table 2 - Accuracy for PMBus

| COMMOND   | 10% ~ 20% FULL LOAD | 20% ~ 100% FULL LOAD | REMARK                                        |
|-----------|---------------------|----------------------|-----------------------------------------------|
| Read_lin  | < 0.5 A             | +/- 3%               | It is for corresponding to max input current  |
| Read_lout | +/- 2%              | +/- 2%               | It is for corresponding to max output current |
| Read_Vin  | +/- 3%              | +/- 2.5 V            |                                               |
| Read_Vout | +/- 2%              | +/- 2%               |                                               |
| Read_Pin  | ---                 | +/- 15%              | It is for corresponding to max input power    |
| Read_Pout | +/- 3%              | +/- 3%               | It is for corresponding to max output power   |

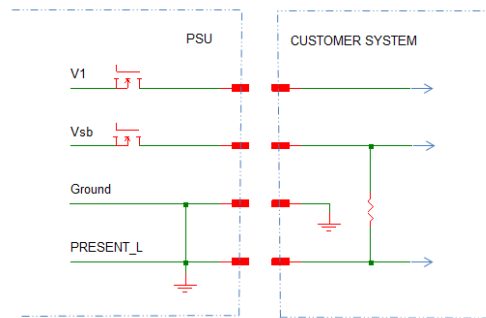
## 6.4 PRESENT\_L

The PRESENT\_L is an output signal and it is used to sense the number of power supplies in the system (operational or not). This signal is connected to the power supply's output ground. Electrical characteristics see 6.2.



# PET1300-12-054xA Series

*Interconnect Diagram of PRESENT\_L Signal*

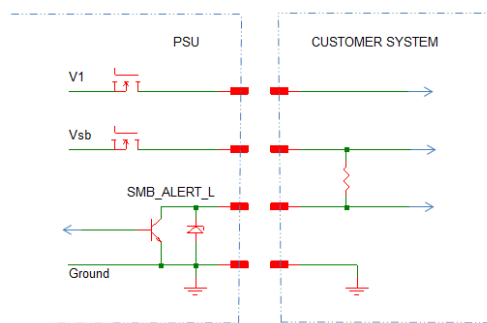


## 6.5 SMB\_ALERT\_L

The SMB\_ALERT\_L is an output signal and shall be an open collector with the pull-up resistor located at the receiving end and shall be capable of sinking up to 4 mA.

This signal indicates that the power supply is experiencing a problem that the user should investigate. This may be asserted due to Critical events or Warning events. See PMBUS specification for further details.

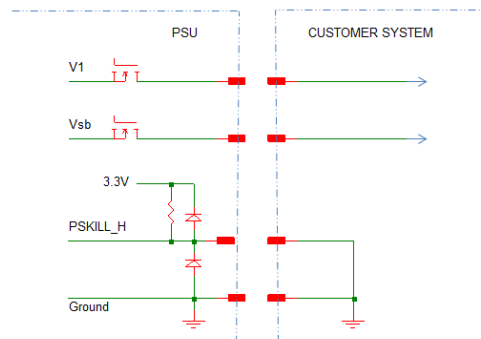
*Interconnect Diagram of SMB\_ALERT\_L Signal*



## 6.6 PSKILL\_H

This is an input signal and is used to force the 12 V main output off if the supply is removed from the system. At the system level this pin will be connected to the output return directly. When this input is low the power supply will operate. If the input is floating the 12 V main output will turn off while the 3.3 VSB will remain on. This signal overrides all other on-and-off signals. On the power supply connector, this pin is shorter than the others so it is a last-make and first-break contact. See below Table 3 for Logic Table.

*Interconnect Diagram of PSKILL\_H Signal*





# PET1300-12-054xA Series

Table 3 - PS\_KILL Signal Characteristics

| SIGNAL CHARACTERISTICS              |                                                 |      |
|-------------------------------------|-------------------------------------------------|------|
| Signal Type:                        | Accepts a ground input from the system.         |      |
| Input Signal to the power supply    | Pull-up to 3.3 VSB located in the power supply. |      |
| PS_KILL = Low, PS_ON = Low          | ON                                              |      |
| PS_KILL = Open, PS_ON = Low or Open | OFF                                             |      |
| PS_KILL = Low, PS_ON = Open         | OFF                                             |      |
|                                     | MIN                                             | MAX  |
| Source current, Vps_kill =Low       |                                                 | 4 mA |

## 6.7 PS\_ON\_L

The PS\_ON\_L signal is an input signal used to remotely turn on/off the power supply. PS\_ON\_L is an active LOW signal that turns on the 12 V main output. In the low state this input will not source more than 4 mA of current. The 12 V output will be disabled when this input is driven HIGH, or open circuited. See Table 4 for Logic Table.

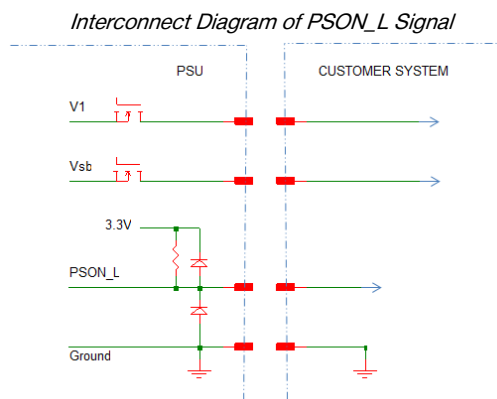


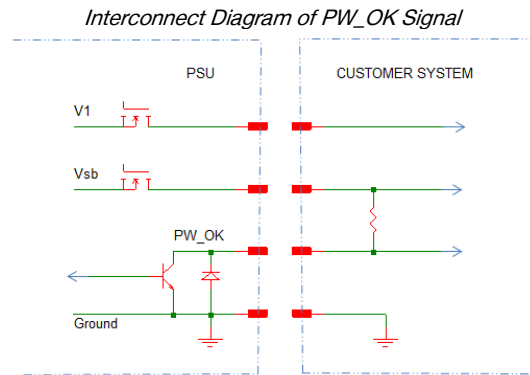
Table 4 - PS\_ON\_L Signal Characteristics

| SIGNAL CHARACTERISTICS                |                                                                                                    |      |
|---------------------------------------|----------------------------------------------------------------------------------------------------|------|
| Signal Type:                          | Accepts an open collector/drain input from the system. Pull-up to 3.3 VSB located in power supply. |      |
| Input signal to the power supply      |                                                                                                    |      |
| PS_ON_L = Low, PS_KILL = Low          | ON                                                                                                 |      |
| PS_ON_L = Open, PS_KILL = Low or Open | OFF                                                                                                |      |
| PS_ON_L = Low, PS_KILL = Open         | OFF                                                                                                |      |
|                                       | MIN                                                                                                | MAX  |
| Output Source Current, VPS_ON_L= Low  |                                                                                                    | 4 mA |

## 6.8 PW\_OK

PW\_OK is an output signal and will be pulled HIGH by the power supply to indicate that all the outputs are within the regulation limits of the power supply. When 12 V main output is < 10.9 V or > 13.2 V, or if any of the outputs fail due to over current protection, over voltage protection, over temperature, or fan failure then this output will be driven LOW. In the event when AC mains power is lost, this signal will be driven LOW at least 20 mS before the +3.3 VSB output is lost. The output will be an open collector/drain. The start of the PW\_OK delay time shall be inhibited as long as any power supply's 12 V output is in current limit. See Table 5.

# PET1300-12-054xA Series

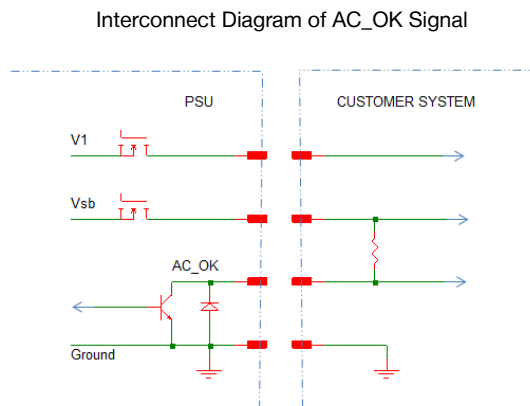


*Table 5 - PW\_OK Signal Characteristics*

| SIGNAL CHARACTERISTICS              |                                                                                                                             |      |
|-------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|------|
| Signal Type:                        | Open collector/drain (system side to provide pull-up, another pull-up to 3.3 VSB could also be located in the power supply) |      |
| Output signal from the power supply |                                                                                                                             |      |
| PW_OK = High                        | Power OK                                                                                                                    |      |
| PW_OK = Low                         | Power Not OK                                                                                                                |      |
|                                     | MIN                                                                                                                         | MAX  |
| Input Sink current, PW_OK = Low     |                                                                                                                             | 4 mA |
| Output Source current, PW_OK = High |                                                                                                                             | 2 mA |

## 6.9 AC\_OK

This signal is an output signal and will be asserted, driven HIGH, by the power supply to indicate that the input voltage meets the minimum requirements of Section 3.1.3. After falling outside the input voltage requirements for more than 20 mS, the signal must be driven LOW. The output will be an open collector/drain. See below Table 6.



*Table 6 - AC\_OK Signal Characteristics*

| SIGNAL CHARACTERISTICS              |                                                                                                                             |      |
|-------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|------|
| Signal Type:                        | Open collector/drain (system side to provide pull-up, another pull-up to 3.3 VSB could also be located in the power supply) |      |
| Output signal from the power supply |                                                                                                                             |      |
| AC_OK = High                        | AC OK                                                                                                                       |      |
| AC_OK = Low                         | AC Low (Not OK)                                                                                                             |      |
|                                     | MIN                                                                                                                         | MAX  |
| Input Sink current, AC_OK = Low     |                                                                                                                             | 4 mA |
| Output Source current, AC_OK = High |                                                                                                                             | 2 mA |

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## 6.10 Current Sharing

All outputs shall be capable of operating in a redundant current share mode. A maximum of 6 power supplies may be operated in parallel. All outputs shall incorporate an isolation device (Or-ing MOSFET or diode) for fault isolation. Filter capacitors that are located after the isolation device shall be of high reliability and shall be de-rated sufficiently to minimize failures.

The 3.3 V output current sharing shall be of a droop type. The +12 V current sharing shall be a single wire type, active current sharing. Connecting the Ishare (current share) pins of each power supply together shall enable the current share feature. Shorting or opening of a current share pin shall not cause the output voltage to go out of steady state regulation.

For 12 V output the Ishare (load sharing) voltage shall be a linear function  $I_{share} [V] = 8 \times I_{out}/108$  (with 8 V at 108 A) for a single power supply (~74 mV/A).

At light load, the load share becomes difficult because of low feedback signal. Refer to Table 2 for current sharing accuracy.

The current balance accuracy is calculated as:  $2 \times |I_1 - I_2| / (I_1 + I_2)$ , where the  $I_1$  is the PSU1 load current and  $I_2$  is the PSU2 load current.

## 6.11 Remote Sense

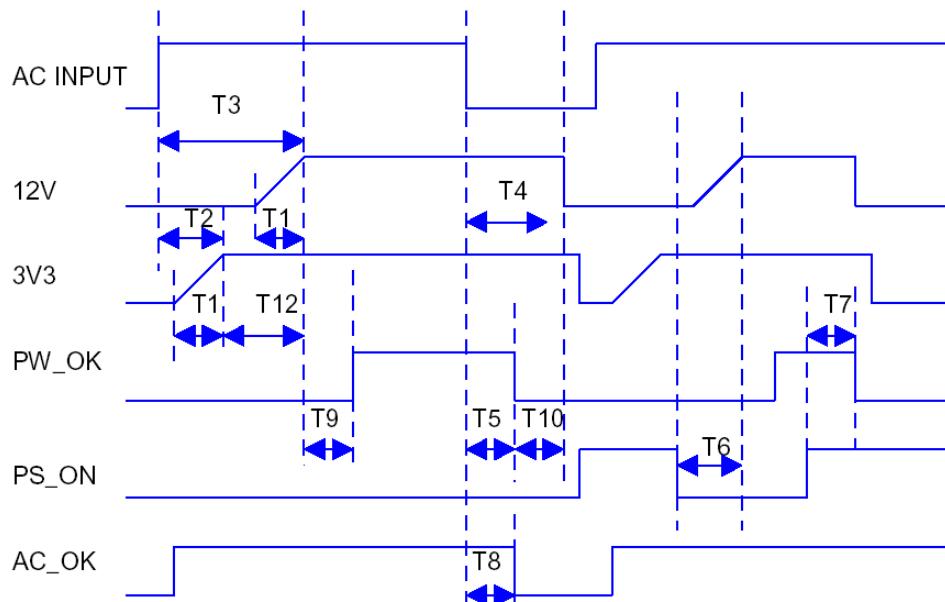
The outputs specified shall incorporate remote sense and will compensate for specified load cable drop. In the event of loss of remote sense, all outputs shall revert to internal sense so as to limit the outputs to less than 105% of nominal.

## 7 Timing Diagram and Table

Unless defined otherwise, all control signals shall be TTL compatible with respect to the output return and shall be isolated from the primary circuit and be SELV rated. All input signals shall be driven from an open collector with the pull-up resistor located in the power supply and shall be capable of sourcing up to 4 mA. General LVTTL signal levels are specified in below table except where explicitly specified otherwise.

Table 7 - Low-Voltage TTL (LVTTL) Voltage Levels

| PARAMETER           | SYMBOL | MIN | MAX | UNITS |
|---------------------|--------|-----|-----|-------|
| Output High Voltage | Voh    | 2.4 | 3.6 | V     |
| Output Low Voltage  | Vol    | 0   | 0.4 | V     |
| Input High Voltage  | Vih    | 2.0 | 3.6 | V     |
| Input Low Voltage   | Vil    | 0   | 0.8 | V     |



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| PARAMETER            | MIN. | TYP. | MAX. | UNITS | CONDITION/COMMENTS                                                               |
|----------------------|------|------|------|-------|----------------------------------------------------------------------------------|
| T1 (Tout_rise)       | 0.5  |      | 100  | mS    | Output voltage rise time from each main output                                   |
| T2 (Tsb_on_delay)    |      |      | 2500 | mS    | Delay from AC being applied to 3V3 being within regulation                       |
| T3 (Tac_on_delay)    |      |      | 3000 | mS    | Delay from AC being applied to all output voltages being within regulation       |
| T4 (Tvout_holdup)    | 10   |      |      | mS    | Time all output voltages, including 3V3, stay within regulation after loss of AC |
| T5 (Tpw_ok_holdup)   | 5    |      |      | mS    | Delay from loss of AC to de-assertion of PW_OK                                   |
| T6 (Tps_on_delay)    | 5    |      | 400  | mS    | Delay from PS_ON_L active to output voltages within regulation limits            |
| T7 (Tps_on_pw_ok)    |      |      | 50   | mS    | Delay from PS_ON_L de-active to PW_OK being de-asserted                          |
| T8 (Tac_ok_off)      |      |      | 20   | mS    | Delay from loss of AC input to de-assertion of AC_OK                             |
| T9 (Tpw_ok_on)       | 100  |      | 1000 | mS    | Delay from output voltages within regulation limits to PW_OK asserted at turn on |
| T10 (Tpw_ok_off_12V) | 1    |      | 700  | mS    | Delay from PW_OK de-asserted to 12 VDC dropping out of regulation limits         |
| T11 (Tpw_ok_off_3V3) | 20   |      |      | mS    | Delay from PW_OK de-asserted to 3V3 dropping out of regulation limits            |
| T12 (Tsb_vout)       | 50   |      | 1000 | mS    | Delay from 3V3 being in regulation to 12 VDC being in regulation at AC turn on.  |
| T13 (Tac_ok_on)      |      |      | 1500 | mS    | Delay from AC being applied to assertion of AC_OK                                |

## 8 Immunity

**NOTE:** Most of the immunity requirements are derived from EN 55024: 1998/A2:2003.

| PARAMETER                      | DESCRIPTION / CONDITION                                                                                                                                                                                       | CRITERION                                                                            |
|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| ESD Contact Discharge          | IEC / EN 61000-4-2, ±8 kV, 25+25 discharges per test point (metallic case, LEDs, connector body)                                                                                                              | A                                                                                    |
| ESD Air Discharge              | IEC / EN 61000-4-2, ±15 kV, 25+25 discharges per test point (non-metallic user accessible surfaces)                                                                                                           | A                                                                                    |
| Radiated Electromagnetic Field | IEC / EN 61000-4-3, 10 V/m, 1 kHz/80% Amplitude Modulation, 1 µs Pulse Modulation, 10 kHz...2 GHz                                                                                                             | A                                                                                    |
| Burst                          | IEC / EN 61000-4-4, level 3<br>AC port ±2 kV, 1 minute<br>DC port ±1 kV, 1 minute                                                                                                                             | A                                                                                    |
| Surge                          | IEC / EN 61000-4-5<br>4 kV CM<br>2 kV DM                                                                                                                                                                      | A                                                                                    |
| RF Conducted Immunity          | IEC/EN 61000-4-6, Level 3, 10 Vrms, CW, 0.1 ... 80 MHz                                                                                                                                                        | A                                                                                    |
| Voltage Dips and Interruptions | IEC/EN 61000-4-11<br>1: Vi 230 V, 100% Load, Phase 0°, Dip 100%, Duration 10 mS<br>2: Vi 230 V, 100% Load, Phase 0°, Dip 100%, Duration 20 mS<br>3: Vi 230 V, 100% Load, Phase 0°, Dip 100%, Duration > 20 mS | A<br>V <sub>SB</sub> : A, V <sub>I</sub> : B<br>V <sub>SB</sub> , V <sub>I</sub> : B |

### 8.1 Emission

| PARAMETER          | DESCRIPTION / CONDITION                                                 | CRITERION |
|--------------------|-------------------------------------------------------------------------|-----------|
| Conducted Emission | EN55022 / CISPR 22: 0.15 ... 30 MHz, QP and AVG, single unit            | Class A   |
|                    | EN55022 / CISPR 22: 0.15 ... 30 MHz, QP and AVG, 2 units in rack system | Class A   |
| Radiated Emission  | EN55022 / CISPR 22: 30 MHz ... 1 GHz, QP, single unit                   | Class A   |
|                    | EN55022 / CISPR 22: 30 MHz ... 1 GHz, QP, 2 units in rack system        | Class A   |
| Harmonic Emissions | IEC61000-3-2, Vin = 115 VAC / 60 Hz, & Vin = 230 VAC / 50 Hz, 100% Load | Class A   |
| Acoustical Noise   | 46 dBA at 1 meter, 25 °C, 50% Load                                      | -         |
| AC Flicker         | IEC61000-3-3, Vin = 230 VAC / 60 Hz, 100% Load                          | Pass      |

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## 9 Safety / Approvals

Maximum electric strength testing is performed according to UL / CSA 60950-1, IEC/EN 60950-1. Input-to-output electric strength tests should not be repeated in the field. Bel Power Solutions will not honor any warranty claims resulting from electric strength field tests.

| PARAMETER                | DESCRIPTION / CONDITION                                                                            | MIN                                               | NOM | MAX | UNIT |
|--------------------------|----------------------------------------------------------------------------------------------------|---------------------------------------------------|-----|-----|------|
| Agency Approvals         | Approved to the latest edition of the following standards:<br>UL / CSA 60950-1<br>IEC / EN 60950-1 | Approved by independent body (see CE Declaration) |     |     |      |
| Isolation Strength       | Input (L/N) to case (PE)                                                                           | Basic                                             |     |     |      |
|                          | Input (L/N) to output                                                                              | Reinforced                                        |     |     |      |
|                          | Output to case (PE)                                                                                | Functional                                        |     |     |      |
| Electrical Strength Test | Input to case                                                                                      | 2121                                              |     |     | VDC  |
|                          | Input to output                                                                                    | 4242                                              |     |     |      |

## 10 Environmental

| PARAMETER      |                     | DESCRIPTION / CONDITION                                                             | MIN | NOM | MAX    | UNIT |
|----------------|---------------------|-------------------------------------------------------------------------------------|-----|-----|--------|------|
| T <sub>A</sub> | Ambient Temperature | V <sub>i min</sub> to V <sub>i max</sub> , I <sub>1 nom</sub> , I <sub>SB nom</sub> | 0   |     | +60    | °C   |
| T <sub>S</sub> | Storage Temperature | Non-operational                                                                     | -40 |     | +85    | °C   |
|                | Altitude            | Operational, above Sea Level                                                        | -   |     | 10,000 | Feet |
| N <sub>a</sub> | Audible Noise       | V <sub>i</sub> = 230 VAC, 50% I <sub>o nom</sub> , T <sub>A</sub> = 25°C            |     | 46  |        | dBA  |

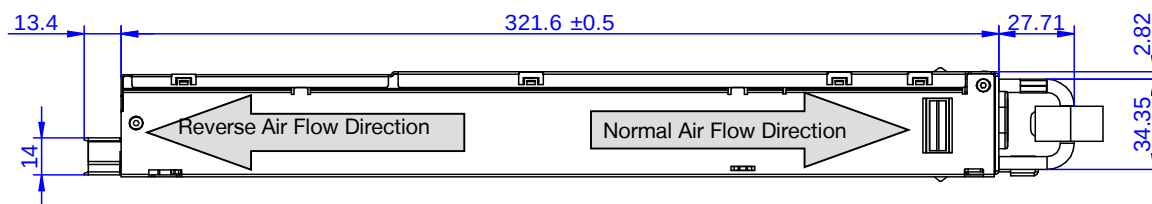
Note: Refer to Figure 2&3 for Derating.

## 11 Mechanical

| PARAMETER  | DESCRIPTION / CONDITION | MIN   | NOM   | MAX   | UNIT |
|------------|-------------------------|-------|-------|-------|------|
| Dimensions | Width                   | 54.1  | 54.5  | 54.9  | mm   |
|            | Height                  | 39.6  | 40.0  | 40.4  |      |
|            | Depth                   | 321.1 | 321.6 | 322.1 |      |
| M          | Weight                  |       | 1.09  |       | kg   |

Otherwise stated, Tolerance: 0.5mm – 120mm: ±0.3mm; 120mm – 400mm: ±0.5mm.

Figure 8 - Side View 1



**NOTE:** A 3D step file of the power supply casing is available on request.

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Figure 9 - Top View

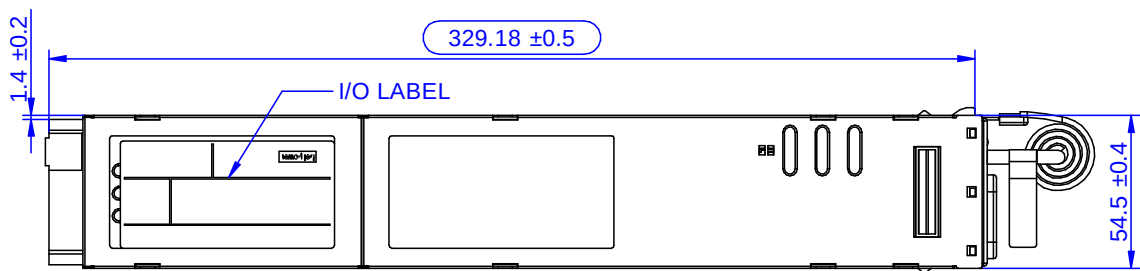


Figure 10 - Side View 2

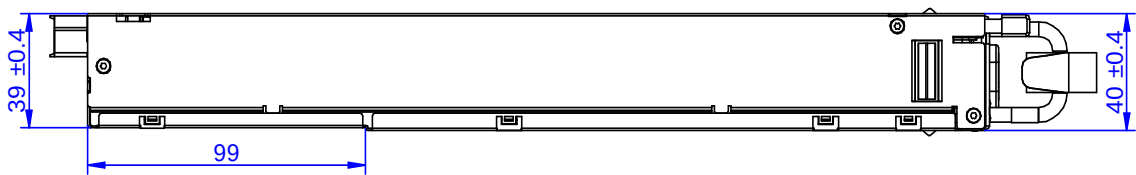
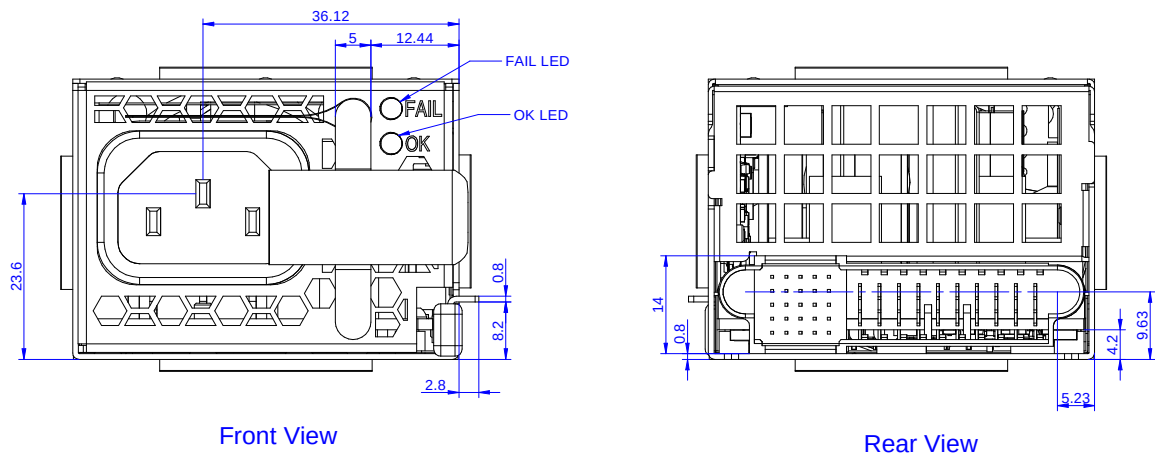
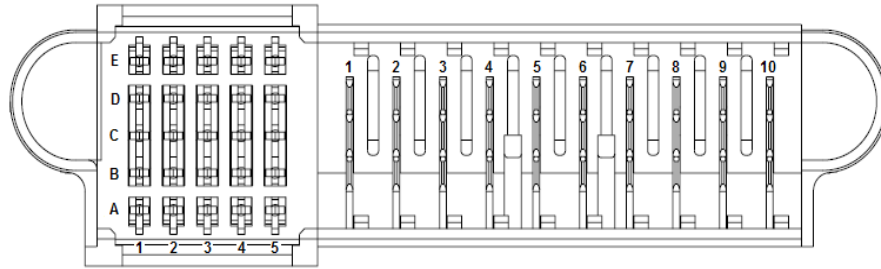


Figure 11 - Front and Rear View



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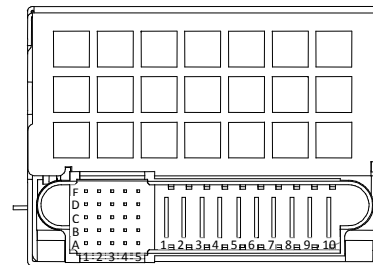
## 12 Connections



Unit: Tyco Electronics P/N 1926736-2 or FCI 10122460-002LF

Counter part: Tyco Electronics P/N 2-1926739-5 or FCI 10108888-R10253SLF (Bel Power Solutions P/N: ZES.00672)

| PIN                 | NAME       | DESCRIPTION                                              |
|---------------------|------------|----------------------------------------------------------|
| <b>Output</b>       |            |                                                          |
| 6, 7, 8, 9, 10      | V1         | +12 VDC main output                                      |
| 1, 2, 3, 4, 5       | PGND       | Power ground (return)                                    |
| <b>Control Pins</b> |            |                                                          |
| A1, B1, C1, D1, E1  | VSB        | Standby positive output (+3.3 V)                         |
| A2, B2              | SGND       | Signal ground (return)                                   |
| C2                  | NC         | Reserved                                                 |
| D2                  | NC         | Reserved                                                 |
| E2                  | NC         | Reserved                                                 |
| A3                  | PS_KILL    | Power supply kill (lagging pin)                          |
| B3                  | NC         | Reserved                                                 |
| C3                  | SDA        | I <sup>2</sup> C data signal line                        |
| D3                  | V1_SENSE_R | Main output negative sense                               |
| E3                  | V1_SENSE   | Main output positive sense                               |
| A4                  | SCL        | I <sup>2</sup> C clock signal line                       |
| B4                  | PS_ON_L    | Power supply on input (connect to A2/B2 to turn unit on) |
| C4                  | ALERT_L    | SMB Alert signal output                                  |
| D4                  | ISHARE     | 12 V current share signal (LS)                           |
| E4                  | AC_OK      | AC input OK signal                                       |
| A5                  | A0         | Address 0                                                |
| B5                  | NC         | Reserved                                                 |
| C5                  | PW_OK      | Power OK signal output (lagging pin)                     |
| D5                  | A1         | Address 1                                                |
| E5                  | PRESENT_L  | Power supply present (lagging pin)                       |





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## 13 Accessories

| ITEM                                                                              | DESCRIPTION                                                                                                                                                                                    | ORDERING PART NUMBER | SOURCE                                                                   |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|--------------------------------------------------------------------------|
|  | <b>Bel Power Solutions I²C Utility</b><br>Windows XP/Vista/7 compatible GUI to program, control and monitor PET Front-Ends (and other I²C units)                                               | N/A                  | <a href="http://www.belpowersolutions.com">www.belpowersolutions.com</a> |
| Evaluation board                                                                  | <b>Dual Connector Board</b><br>Connector board to operate 2 PET units in parallel. Includes an on-board USB to I²C converter (use <i>Bel Power Solutions I²C Utility</i> as desktop software). | VRA.00333.0          | Bel Power Solutions                                                      |

## 14 PMBus Communication

### 14.1 Address Select

Table 8 - Address Select

| A2 | A1 | A0 | UNIT ADDRESS | EEPROM ADDRESS |
|----|----|----|--------------|----------------|
| 0  | 0  | 0  | 0xB0         | 0xA0           |
| 0  | 0  | 1  | 0xB2         | 0xA2           |
| 0  | 1  | 0  | 0xB4         | 0xA4           |
| 0  | 1  | 1  | 0xB6         | 0xA6           |

**Note:** A2 = 1 is not implemented.

### 14.2 PMBus Commands

#### NOTE:

Reference: PMBus Power System Management Protocol Specification Part II – Command Language Revision 1.1.

Commands not included in the table below are Not Implemented.

Feature that are To Be Defined (TBD), or Not Implemented are shaded.

R = Read-Only; RW = Read/Write; W = Write-Only.

Table 9 - PMBus Commands

| COMMAND NAME          | BIT NAME | CODE | BIT | VALUE  | ACCESS | DATA BYTES | REMARKS                                                                                                                                                  |
|-----------------------|----------|------|-----|--------|--------|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| PAGE                  |          | 00h  |     | -      | RW     | 1          | Page 0 applies to + 12 V output<br>Page 1 applies to + 3.3 V output<br>Other Page values are considered invalid and will generate an INVALID_DATA error. |
| OPERATION             |          | 01h  |     |        |        | 1          |                                                                                                                                                          |
|                       |          |      | 7-6 | -      | RW     |            | 0b00 = OFF<br>0b10 = ON (Default)                                                                                                                        |
|                       |          |      | 5-0 | 0d     | R      |            | Not Implemented                                                                                                                                          |
| CLEAR_FAULTS          |          | 03h  |     | -      | W      | 0          | Clear all bits in all status registers.                                                                                                                  |
| CAPABILITY            |          | 19h  |     |        | R      | 1          |                                                                                                                                                          |
| PACKET_ERROR_CHECKING |          |      | 7   | 0b1    |        |            | Supported                                                                                                                                                |
| MAXIMUM_BUS_SPEED     |          |      | 6-5 | 0b01   |        |            | 400 kHz                                                                                                                                                  |
| SMBALERT#             |          |      | 4   | 0b1    |        |            | Supported                                                                                                                                                |
| RESERVED              |          |      | 3-0 | 0b0000 |        |            | Reserved                                                                                                                                                 |
| VOUT_MODE             |          | 20h  |     | -      | R      | 1          |                                                                                                                                                          |

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|                   |     |     |         |    |   |                                                                                                                                                                                                                                                |
|-------------------|-----|-----|---------|----|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| MODE              |     | 7-5 | 0b000   |    |   | Linear                                                                                                                                                                                                                                         |
| PARAMETER         |     | 4-0 | 0b10111 |    |   | N = -9                                                                                                                                                                                                                                         |
| FAN_CONFIG_1_2    | 3Ah |     |         | R  | 1 |                                                                                                                                                                                                                                                |
|                   |     | 7   | 0b1     |    |   | Fan1 Installed                                                                                                                                                                                                                                 |
|                   |     | 6   | 0b0     |    |   | Fan1 Commanded in Duty Cycle                                                                                                                                                                                                                   |
|                   |     | 5-4 | 0b01    |    |   | Fan1 (2) Tachometer Pulses per Revolution                                                                                                                                                                                                      |
|                   |     | 3   | 0b0     |    |   | Fan2 Not Installed                                                                                                                                                                                                                             |
|                   |     | 2   | 0b0     |    |   | Don't Care                                                                                                                                                                                                                                     |
|                   |     | 1-0 | 0b00    |    |   | Don't Care                                                                                                                                                                                                                                     |
| FAN_COMMAND_1     | 3Bh |     | -       | RW | 2 | MIN = 0 → 0%<br>MAX = 100 → 100%<br>Values outside limits will generate INVALID_DATA error.<br>Write request is executed only if the desired Fan speed is greater than what is required by the PSU.<br>Fan Speed =<br>FAN_COMMAND*21000RPM/100 |
| STATUS_BYTE       | 78h |     |         | R  | 1 | STATUS bits remain set, even if the fault or warning is removed. They are reset by: CLEAR_FAULTS Command<br>AC Recycle<br>PSON Recycle                                                                                                         |
| BUSY              |     | 7   | 0b0     |    |   | Not Implemented                                                                                                                                                                                                                                |
| OFF               |     | 6   | -       |    |   |                                                                                                                                                                                                                                                |
| VOUT_OV           |     | 5   | -       |    |   |                                                                                                                                                                                                                                                |
| IOUT_OC           |     | 4   | -       |    |   |                                                                                                                                                                                                                                                |
| VIN_UV            |     | 3   | -       |    |   |                                                                                                                                                                                                                                                |
| TEMPERATURE       |     | 2   | -       |    |   |                                                                                                                                                                                                                                                |
| CML               |     | 1   | -       |    |   |                                                                                                                                                                                                                                                |
| NONE_OF_THE_ABOVE |     | 0   | 0b0     |    |   | Not Implemented                                                                                                                                                                                                                                |
| STATUS_WORD       | 79h |     |         | R  | 2 |                                                                                                                                                                                                                                                |
| VOUT              |     | F   | -       |    |   |                                                                                                                                                                                                                                                |
| IOUT/POUT         |     | E   | -       |    |   |                                                                                                                                                                                                                                                |
| INPUT             |     | D   | -       |    |   |                                                                                                                                                                                                                                                |
| MFR               |     | C   | -       |    |   |                                                                                                                                                                                                                                                |
| POWER_GOOD#       |     | B   | -       |    |   |                                                                                                                                                                                                                                                |
| FANS              |     | A   | -       |    |   |                                                                                                                                                                                                                                                |
| OTHER             |     | 9   | -       |    |   |                                                                                                                                                                                                                                                |
| UNKNOWN           |     | 8   | 0b0     |    |   | Not Implemented                                                                                                                                                                                                                                |
| STATUS_BYTE       |     | 7-0 | -       |    |   | See STATUS_BYTE                                                                                                                                                                                                                                |
| STATUS_VOUT       | 7Ah |     |         | R  | 1 |                                                                                                                                                                                                                                                |
| VOUT_OV_FAULT     |     | 7   | -       |    |   | Asserts when an OV fault condition is detected on V1 output.<br>SMB Alert Mask = 1 (Default)                                                                                                                                                   |
| VOUT_OV_WARNING   |     | 6   | 0b0     |    |   | Not Implemented                                                                                                                                                                                                                                |
| VOUT_UV_WARNING   |     | 5   | 0b0     |    |   | Not Implemented                                                                                                                                                                                                                                |
| VOUT_UV_FAULT     |     | 4   | -       |    |   | Asserts when an UV fault condition is detected on V1 output.<br>SMB Alert Mask = 1 (Default)                                                                                                                                                   |

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|                       |     |     |        |   |   |                                                                                                                                                                                                     |
|-----------------------|-----|-----|--------|---|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| VOUT_MAX_WARNING      |     | 3   | 0b0    |   |   | Not Implemented                                                                                                                                                                                     |
| TON_MAX_FAULT         |     | 2   | -      |   |   | Asserts when V1 output is not in regulation 3s after PSON and AC is applied.<br>SMB Alert Mask = 1 (Default)                                                                                        |
| TOFF_MAX_WARNING      |     | 1   | 0b0    |   |   | Not Implemented                                                                                                                                                                                     |
| PWR_ON_TRACKING_ERROR |     | 0   | 0b0    |   |   | Not Implemented                                                                                                                                                                                     |
| STATUS_IOUT           | 7Bh |     |        | R | 1 |                                                                                                                                                                                                     |
| IOUT_OC_FAULT         |     | 7   | -      |   |   | Asserts when an OC fault condition is detected on V1 output.<br>SMB Alert Mask = 1 (Default)                                                                                                        |
| IOUT_OC_FAULT_LV      |     | 6   | 0b0    |   |   | Not Implemented                                                                                                                                                                                     |
| IOUT_OC_WARNING       |     | 5   | 0b0    |   |   | Asserts when an OC warning condition is detected on V1 output.<br>SMB Alert Mask = 0 (Default)                                                                                                      |
| IOUT_UC_FAULT         |     | 4   | 0b0    |   |   | Not Implemented                                                                                                                                                                                     |
| ISHARE_FAULT          |     | 3   | 0b0    |   |   | Not Implemented                                                                                                                                                                                     |
| PIN_LIMITING_MODE     |     | 2   | 0b0    |   |   | Not Implemented                                                                                                                                                                                     |
| POUT_OP_FAULT         |     | 1   | 0b0    |   |   | Not Implemented                                                                                                                                                                                     |
| POUT_OP_WARNING       |     | 0   | 0b0    |   |   | Not Implemented                                                                                                                                                                                     |
| STATUS_INPUT          | 7Ch |     |        | R | 1 |                                                                                                                                                                                                     |
| VIN_OV_FAULT          |     | 7   | 0b0    |   |   | Not Implemented                                                                                                                                                                                     |
| VIN_OV_WARNING        |     | 6   | 0b0    |   |   | Not Implemented                                                                                                                                                                                     |
| VIN_UV_WARNING        |     | 5   | 0b0    |   |   | Not Implemented                                                                                                                                                                                     |
| VIN_UV_FAULT          |     | 4   | 0b0    |   |   | Not Implemented                                                                                                                                                                                     |
| UNIT_OFF_VIN_LOW      |     | 3   | -      |   |   | Asserts when the PSU is disabled because of low input voltage.<br>SMB Alert Mask = 1 (Default)                                                                                                      |
| IIN_OC_FAULT          |     | 2   | 0b0    |   |   | Not Implemented                                                                                                                                                                                     |
| IIN_OC_WARNING        |     | 1   | 0b0    |   |   | Not Implemented                                                                                                                                                                                     |
| PIN_OP_WARNING        |     | 0   | 0b0    |   |   | Not Implemented                                                                                                                                                                                     |
| STATUS_TEMPERATURE    | 7Dh |     |        | R | 1 |                                                                                                                                                                                                     |
| OT_FAULT              |     | 7   | -      |   |   | Asserts when an OT fault condition is detected.<br>SMB Alert Mask = 1 (Default)                                                                                                                     |
| OT_WARNING            |     | 6   | -      |   |   | Asserts when an OT warning condition is detected.<br>SMB Alert Mask = 1 (Default)                                                                                                                   |
| UT_WARNING            |     | 5   | 0b0    |   |   | Not Implemented                                                                                                                                                                                     |
| UT_FAULT              |     | 4   | 0b0    |   |   | Not Implemented                                                                                                                                                                                     |
| RESERVED              |     | 3-0 | 0b0000 |   |   | Reserved                                                                                                                                                                                            |
| STATUS_CML            | 7Eh |     |        | R | 1 |                                                                                                                                                                                                     |
| INVALID_COMMAND       |     | 7   | -      |   |   | Asserts when the System tries to access unsupported commands, write to supported commands with read-only access, or read supported commands with write-only access.<br>SMB Alert Mask = 0 (Default) |
| INVALID_DATA          |     | 6   | -      |   |   | Asserts when the System tries to write invalid data (including when PEC byte is incorrect) to supported commands with write access.<br>SMB Alert Mask = 0 (Default)                                 |

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|                     |     |   |     |   |   |                                                                                                                      |
|---------------------|-----|---|-----|---|---|----------------------------------------------------------------------------------------------------------------------|
| PEC_FAIL            |     | 5 | -   |   |   | Asserts when the received PEC byte is incorrect.<br>SMB Alert Mask = 0 (Default)                                     |
| MEMORY_FAULT        |     | 4 | 0b0 |   |   | Not Implemented                                                                                                      |
| PROCESSOR_FAULT     |     | 3 | 0b0 |   |   | Not Implemented                                                                                                      |
| RESERVED            |     | 2 | 0b0 |   |   | Reserved                                                                                                             |
| OTHER_COMM_FAULT    |     | 1 | 0b0 |   |   | Asserts when the communication between monitoring components inside the PSU is lost.<br>SMB Alert Mask = 0 (Default) |
| OTHER_MEMORY_FAULT  |     | 0 | 0b0 |   |   | Not Implemented                                                                                                      |
| STATUS_OTHER        | 7Fh |   |     | R | 1 |                                                                                                                      |
| RESERVED            |     | 7 | 0b0 |   |   | Reserved                                                                                                             |
| RESERVED            |     | 6 | 0b0 |   |   | Reserved                                                                                                             |
| INPUT A FUSE        |     | 5 | 0b0 |   |   | Not Implemented                                                                                                      |
| INPUT B FUSE        |     | 4 | 0b0 |   |   | Not Implemented                                                                                                      |
| INPUT A ORING       |     | 3 | 0b0 |   |   | Not Implemented                                                                                                      |
| INPUT B ORING       |     | 2 | 0b0 |   |   | Not Implemented                                                                                                      |
| OUTPUT ORING        |     | 1 | -   |   |   | Asserts when a fault is detected on the V1 ORing device.<br>SMB Alert Mask = 0 (Default)                             |
| RESERVED            |     | 0 | 0b0 |   |   | Reserved                                                                                                             |
| STATUS_MFR_SPECIFIC | 80h |   |     | R | 1 |                                                                                                                      |
| RESERVED            |     | 7 | 0b0 |   |   | Reserved                                                                                                             |
| RESERVED            |     | 6 | 0b0 |   |   | Reserved                                                                                                             |
| RESERVED            |     | 5 | 0b0 |   |   | Reserved                                                                                                             |
| RESERVED            |     | 4 | 0b0 |   |   | Reserved                                                                                                             |
| VSB_UV_FAULT        |     | 3 | -   |   |   | Asserts when an UV fault condition is detected on Vsb output.<br>SMB_Alert Mask = 0 (Default)                        |
| VSB_OV_FAULT        |     | 2 | -   |   |   | Asserts when an OV fault condition is detected on Vsb output.<br>SMB_Alert Mask = 0 (Default)                        |
| PHASE_SHARE_FAULT   |     | 1 | -   |   |   | Asserts when there is a current imbalance between DCDC Phases.<br>SMB_Alert Mask = 0 (Default)                       |
| HOLDUP_FAULT        |     | 0 | -   |   |   | Asserts when V1 goes out of regulation if Bulk voltage level is reduced.<br>SMB_Alert Mask = 0 (Default)             |
| STATUS_FANS_1_2     | 81h |   |     | R | 1 |                                                                                                                      |
| FAN1_FAULT          |     | 7 | -   |   |   | Asserts when a Fan fault condition is detected.<br>SMB Alert Mask = 1 (Default)                                      |
| FAN2_FAULT          |     | 6 | 0b0 |   |   | Not Implemented                                                                                                      |
| FAN1_WARNING        |     | 5 | 0b0 |   |   | Not Implemented                                                                                                      |
| FAN2_WARNING        |     | 4 | 0b0 |   |   | Not Implemented                                                                                                      |
| FAN1_SPEED_OVERRIDE |     | 3 | -   |   |   | Asserts when the Fan is running according to the speed defined by the System.<br>SMB Alert Mask = 0 (Default)        |
| FAN2_SPEED_OVERRIDE |     | 2 | 0b0 |   |   | Not Implemented                                                                                                      |
| AIR_FLOW_FAULT      |     | 1 | 0b0 |   |   | Not Implemented                                                                                                      |

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| AIR_FLOW_WARNING          |     | 0   | 0b0 |    |        | Not Implemented                                                                       |
|---------------------------|-----|-----|-----|----|--------|---------------------------------------------------------------------------------------|
| READ_VIN                  | 88h |     | -   | R  | 2      | Linear Format, N = -1                                                                 |
| READ_IIN                  | 89h |     | -   | R  | 2      | Linear Format, N = -6                                                                 |
| READ_VOUT                 | 8Bh |     | -   | R  | 2      | Linear Format, N = -9<br>Refer to Section 8.3.1 of PMBus Spec<br>Part II Revision 1.1 |
| READ_IOUT                 | 8Ch |     | -   | R  | 2      | Linear Format, N = -3                                                                 |
| READ_TEMPERATURE_1        | 8Dh |     | -   | R  | 2      | Linear Format, N = -2<br>Inlet Temperature                                            |
| READ_TEMPERATURE_2        | 8Eh |     | -   | R  | 2      | Linear Format, N = -2<br>Outlet Temperature                                           |
| READ_TEMPERATURE_3        | 8Fh |     | -   | R  | 2      | Linear Format, N = -2<br>ORing FET Temperature                                        |
| READ_FAN_SPEED_1          | 90h |     | -   | R  | 2      | Linear Format, N = 5                                                                  |
| READ_POUT                 | 96h |     | -   | R  | 2      | Linear Format, N = 1                                                                  |
| READ_PIN                  | 97h |     | -   | R  | 2      | Linear Format, N = 1                                                                  |
| MFR_ID                    | 99h |     | -   | R  | CNT+9  | ID = Bel Power<br>Format: ASCII                                                       |
| MFR_MODEL                 | 9Ah |     | -   | R  | CNT+16 | MODEL = PET1300-12-054xA<br>Format: ASCII                                             |
| MFR_REVISION              | 9Bh |     | -   | R  | CNT+3  | REVISION = vv<br>Format: ASCII                                                        |
| MFR_LOCATION              | 9Ch |     | -   | R  | 2      | LOCATION = xx<br>Format: ASCII                                                        |
| MFR_DATE                  | 9Dh |     | -   | R  | CNT+4  | DATE = yyww<br>Format: ASCII                                                          |
| MFR_SERIAL                | 9Eh |     | -   | R  | CNT+18 | SERIAL = xxxxxxxxxxxxxxxxxxxx<br>Format: ASCII                                        |
| CALIBRATION_POINTER       | C0h |     | -   | RW | 2      | <b>For Bel Power Solutions Use Only</b>                                               |
| CALIBRATION_DATA          | C1h |     | -   | RW | 2      | <b>For Bel Power Solutions Use Only</b>                                               |
| CALIBRATION_COMMAND       | C2h |     | -   |    | 2      | <b>For Bel Power Solutions Use Only</b>                                               |
| RESERVED                  |     | F-1 | 0d  | R  |        | Reserved                                                                              |
| COMMIT_TO_FLASH           |     | 0   | -   | RW |        | 0 = No Action<br>1 = Commit RAM to Flash                                              |
| READ_VSTBY                | C3h |     | -   | R  | 2      | <b>For Bel Power Solutions Use Only</b><br>Same format as READ_VOUT                   |
| READ_ISTBY                | C4h |     | -   | R  | 2      | <b>For Bel Power Solutions Use Only</b><br>Same format as READ_IOUT                   |
| READ_VOUT_INT             | C5h |     | -   | R  | 2      | <b>For Bel Power Solutions Use Only</b><br>Same format as READ_VOUT                   |
| BOOTLOADER_STATUS_REQUEST | C7h |     |     | RW | 2      | <b>For Bel Power Solutions Use Only</b>                                               |
| BOOTLOADER_PAGE_DATA      | C8h |     | -   | W  | -      | <b>For Bel Power Solutions Use Only</b>                                               |
| PRODUCT_ID_NUMBER         | C9h |     |     | R  | 2      | <b>For Bel Power Solutions Use Only</b><br>Refer to Table 3                           |
| FW_REV                    | CAh |     |     | R  | 2      | <b>For Bel Power Solutions Use Only</b>                                               |
| SEC_DSP_MAJOR             |     | F-C | -   |    |        | M = 0 to 9                                                                            |
| SEC_DSP_MINOR             |     | B-8 | -   |    |        | m = 0 to 9<br>i.e: Mm = 25 → Revision 2.5                                             |
| PRI_DSP_MAJOR             |     | 7-4 | -   |    |        | M = 0 to 9                                                                            |
| PRI_DSP_MINOR             |     | 3-0 | -   |    |        | m = 0 to 9<br>i.e: Mm = 13 → Revision 1.3                                             |
| SEC_CTRL1                 | CCh |     |     | R  |        | <b>For Bel Power Solutions Use Only</b>                                               |
| SEC_CTRL2                 | CDh |     |     | R  |        | <b>For Bel Power Solutions Use Only</b>                                               |
| SEC_STAT                  | CEh |     |     | R  |        | <b>For Bel Power Solutions Use Only</b>                                               |
| PRI_STAT                  | CFh |     |     | R  |        | <b>For Bel Power Solutions Use Only</b>                                               |

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|                                        |     |     |    |    |   |                                                                                                                                                                                                                                                                                                                                       |
|----------------------------------------|-----|-----|----|----|---|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| MFR_SPECIFIC_00<br>(PSU_CONTROL)       | D0h |     |    |    | 2 |                                                                                                                                                                                                                                                                                                                                       |
| RESERVED                               |     | F-1 | 0d | R  |   | Reserved                                                                                                                                                                                                                                                                                                                              |
| EEPROM_WP                              |     | 0   | -  | RW |   | EEP Write-Protect (WP) Control<br>0 = Enable WP (Default)<br>1 = Disable WP                                                                                                                                                                                                                                                           |
| MFR_SPECIFIC_05 (FW_VERSION)           | D5h |     | -  | R  | 8 | Format: xx.xx.xx (e.g. 01.02.01). The length is fixed at 8 Ascii characters. Each field will be an Ascii value stored in one byte.<br>* For example: aa.bb.cc, where aa is development stage (P0, P1 ... A0); bb is primary mcu firmware revision (00 ~ 99); cc is secondary mcu firmware revision (00 ~ 99).<br><b>NO BYTE COUNT</b> |
| MFR_SPECIFIC_09<br>(SMB_ALERT_MASKING) | D9h |     | -  | RW | 7 | Refer to Table 4<br><b>NO BYTE COUNT</b>                                                                                                                                                                                                                                                                                              |

Table 10 - Product ID Number

| BIT(S) | DESCRIPTION            | REMARKS                                                               |
|--------|------------------------|-----------------------------------------------------------------------|
| F-A    | Product Family         | TBD                                                                   |
| 9-8    | Communication Protocol | 0b00 = Reserved<br>0b01 = Reserved<br>0b10 = PMBus<br>0b11 = Reserved |
| 7-0    | Product Part Number    | TBD                                                                   |

Table 11 - SMB\_ALERT Masking

| BYTE | BYTE DESCRIPTION | BIT | BIT DESCRIPTION                         | DEFAULT |
|------|------------------|-----|-----------------------------------------|---------|
| 0    | GLOBAL_MASK      | 7   | Not Implemented                         | -       |
|      |                  | 6   | Not Implemented                         | -       |
|      |                  | 5   | Not Implemented                         | -       |
|      |                  | 4   | Not Implemented                         | -       |
|      |                  | 3   | Not Implemented                         | -       |
|      |                  | 2   | Not Implemented                         | -       |
|      |                  | 1   | Not Implemented                         | -       |
|      |                  | 0   | Global Mask. Clear to disable SMB_ALERT | 1       |
| 1    | STATUS_VOUT      | 7   | VOUT_OV_FAULT Mask                      | 1       |
|      |                  | 6   | Not Implemented                         | -       |
|      |                  | 5   | Not Implemented                         | -       |
|      |                  | 4   | VOUT_UV_FAULT Mask                      | 1       |
|      |                  | 3   | Not Implemented                         | -       |
|      |                  | 2   | TON_MAX_FAULT Mask                      | 1       |
|      |                  | 1   | Not Implemented                         | -       |
|      |                  | 0   | Not Implemented                         | -       |
| 2    | STATUS_IOUT      | 7   | IOUT_OC_FAULT Mask                      | 1       |
|      |                  | 6   | Not Implemented                         | -       |
|      |                  | 5   | Not Implemented                         | -       |
|      |                  | 4   | Not Implemented                         | -       |

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|   |                    |   |                          |   |
|---|--------------------|---|--------------------------|---|
|   |                    | 3 | Not Implemented          | - |
|   |                    | 2 | Not Implemented          | - |
|   |                    | 1 | Not Implemented          | - |
|   |                    | 0 | Not Implemented          | - |
| 3 | STATUS_TEMPERATURE | 7 | OT_FAULT Mask            | 1 |
|   |                    | 6 | OT_WARNING Mask          | 1 |
|   |                    | 5 | Not Implemented          | - |
|   |                    | 4 | Not Implemented          | - |
|   |                    | 3 | Not Implemented          | - |
|   |                    | 2 | Not Implemented          | - |
|   |                    | 1 | Not Implemented          | - |
|   |                    | 0 | Not Implemented          | - |
| 4 | STATUS_INPUT       | 7 | Not Implemented          | - |
|   |                    | 6 | Not Implemented          | - |
|   |                    | 5 | Not Implemented          | - |
|   |                    | 4 | Not Implemented          | - |
|   |                    | 3 | UNIT_OFF_VIN_LOW Mask    | 1 |
|   |                    | 2 | Not Implemented          | - |
|   |                    | 1 | Not Implemented          | - |
|   |                    | 0 | Not Implemented          | - |
| 5 | STATUS_FANS_1_2    | 7 | FAN1_FAULT Mask          | 1 |
|   |                    | 6 | Not Implemented          | - |
|   |                    | 5 | Not Implemented          | - |
|   |                    | 4 | Not Implemented          | - |
|   |                    | 3 | FAN1_SPEED_OVERRIDE Mask | 0 |
|   |                    | 2 | Not Implemented          | - |
|   |                    | 1 | Not Implemented          | - |
|   |                    | 0 | Not Implemented          | - |
| 6 | STATUS_CML         | 7 | INVALID_COMMAND Mask     | 0 |
|   |                    | 6 | INVALID_DATA Mask        | 0 |
|   |                    | 5 | PEC_FAIL Mask            | 0 |
|   |                    | 4 | Not Implemented          | - |
|   |                    | 3 | Not Implemented          | - |
|   |                    | 2 | Not Implemented          | - |
|   |                    | 1 | Not Implemented          | - |
|   |                    | 0 | Not Implemented          | - |

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