Smart Power for Smart Systems

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With the current need for smart systems with more computing power, lighter weight and smaller size, the need for smart power to compliment these systems becomes even more important. In the past, a system designer would decide what components he needed to accomplish a required function or mission. Once all the components were known, the system power requirement was determined. Often the attempt was made to squeeze a power supply into whatever corner of the system remained vacant. Accommodating that supply with its requisite needs for cooling was usually an afterthought. Performance monitoring and power supply optimization were barely considered if at all. Simple fault monitoring was sometimes possible but detailed analysis was beyond the scope of most system designs.

Today, system specifications are being written with an emphasis on intelligent platform management/ intelligent system management as called out in the recently ANSI approved VITA 46.11. This specification makes a strong case for carefully monitoring and controlling all aspects of the system to significantly improve system performance and to drastically reduce downtime and maintenance costs. An intelligent power supply is a vital part of this effort. Behlman has recently released IQ versions of our VPX VITA 62 power supplies in order to provide reliable, flexible and very intelligent power for the new VPX systems.

Behlman VPX supplies have been used in many systems for several years. Some of these systems require thousands of watts of power. The systems are continuing to perform very reliably however they use only very basic fault and temperature monitoring. The new VPXtra-IQ series takes the concept of system intelligence to a whole new level. The system manager can now monitor, input voltage and current, as well as output voltages and currents. In addition temperatures are measured at several locations throughout the power supply. While this information is very useful in determining if there is a power supply problem, it is also invaluable to the system manager for total system performance monitoring. A great deal of system information can be derived through the judicious interpretation of the data available from the power supply. For example, an increase in input power could mean many different things ranging from a normal response to increased workload, changes in local or ambient temperature, power supply problems, or other system anomalies. Input power changes without output changes might indicate a problem with the power supply itself if other monitored parameters such as temperature remain unchanged. An intelligent system manager can take all the available information being fed to it, make well informed decisions about system performance and alter system operation as necessary. For example, airflow might be increased or processing workloads modified depending on the interpretation of monitored parameters.

Overheating might be indicated based on monitored temperatures, or perhaps problems with a specific FRU or other load. The ability to rapidly communicate with all the system components, power supplies, chassis, FRU's etc.as described in VITA 46.11 yields a very robust, flexible system.
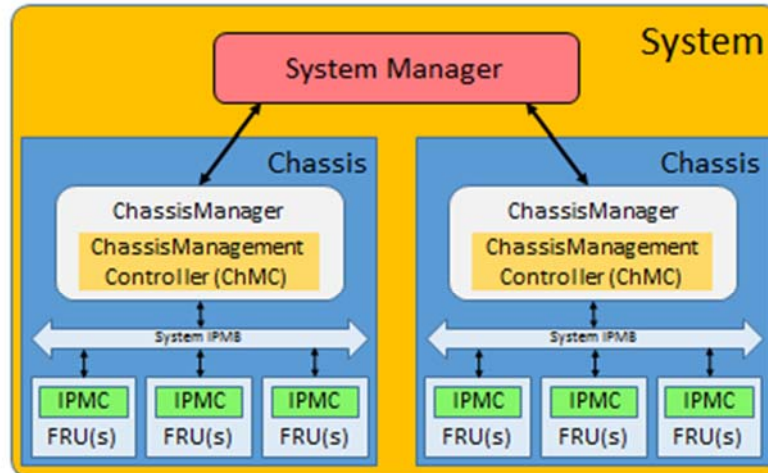
Co-resident System Manager with Dual Redundant VITA 46.11 Chassis Managers
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Besides providing detailed power supply and system performance information, Behlman VPXtra IQ series supplies give the system manager great flexibility in adjusting internal power supply limits and warnings. These parameters are normally fixed in older "dumb" supplies. However in the spirit of VITA46.11 flexibility, Behlman's smart interface allows the user to adjust warning and limit thresholds for many functions, such as over and under voltage, over current and over temperature.
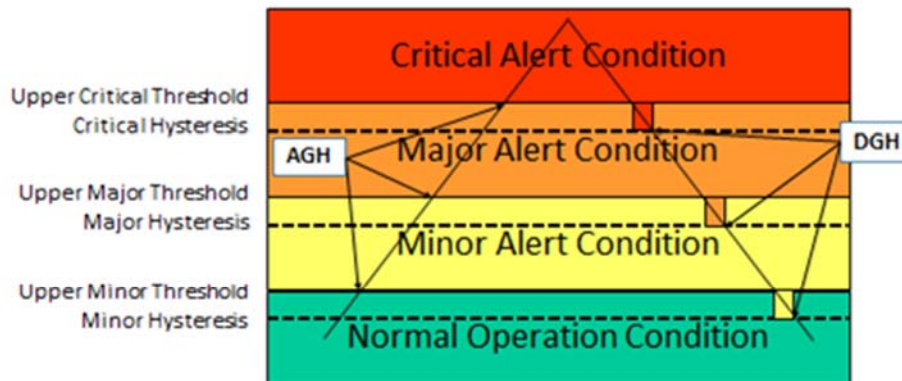
AGH – Assertion Going High
DGH – De-assertion Going High

IPMI Event Thresholds with Hysteresis
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One shortcoming of the existing VPX specifications is a clear definition of programmable power supply functions. As discussed in the system management specification, VITA 46.11 Behlman has incorporated the well defined functions in the PMbus specification as a starting point for power supply management. It has been suggested that a new specification dedicated to power supply management be written possibly as a subset of VITA 46.11 or VITA62. The PMbus commands could be used and then modified or added to as the new system configurations evolve. The table below lists the functions currently available in Behlman's IQ power supplies. It includes all of the inventory information discussed in VITA46.11 as well as a significant amount of performance data and adjustable thresholds as discussed above. This starting point will allow system designers the ability to envision a path forward to configure a truly intelligent self-monitoring and self-diagnostic system of the future.

Table 1: Supported Manufacturer Specific Commands

Command Code	Command Name	Description	Type	Paged
D0h	MFR_SPECIFIC_00_RESET	Initiates software reset of device	Write Byte	N
D1h	MFR_SPECIFIC_01_VOLT_MCC	Allows host to read or write voltage measurement correction coefficients.	R/W Word	N
D3h	MFR_SPECIFIC_03_CUR_MCC	Allows host to read or write current measurement correction coefficients.	R/W Word	N
D5h	MFR_SPECIFIC_05_INT_ADDR	Allows host to set the internal address of the EEPROM where the first byte will be read from.	R/W Word	N
D7h	MFR_SPECIFIC_07_WR_PROT	Allows host to limit write commands to EEPROM memory and/or device memory.	R/W Byte	N

Table 2: Supported PMBus Commands

Command Code	Command Name	Description	Type	Paged
00h	PAGE	Allows user to read or select the page for any commands that support paging.	R/W Byte	N
03h	CLEAR_FAULTS	Clears fault flags set in status registers.	Send Byte	Y
11h	STORE_DEFAULT_ALL	Stores measurement correction coefficients into device default memory.	Send Byte	N
12h	RESTORE_DEFAULT_ALL	Instructs device to load measurement correction coefficients from device default memory into operating memory.	Send Byte	N
15h	STORE_USER_ALL	Stores measurement correction coefficients into device user memory.	Send Byte	N
16h	RESTORE_USER_ALL	Instructs device to load measurement correction coefficients from device user memory into operating memory.	Send Byte	N
19h	CAPABILITY	Provides the host with capabilities of the device.	Read Byte	N
1Ah	QUERY	Allows host to query support of specific command.	Block R/W	N
1Bh	SMBALERT_MASK	Allows host to mask out future warnings or faults from triggering ALERT* signal.	Block R/W	Y
40h	VOUT_OV_FAULT_LIMIT	Allows host to set output over voltage fault limit for each output.	R/W Word	Y
42h	VOUT_OV_WARN_LIMIT	Allows host to set output over voltage warning limit for each output.	R/W Word	Y
43h	VOUT_UV_WARN_LIMIT	Allows host to set output under voltage warning limit for each output.	R/W Word	Y
44h	VOUT_UV_FAULT_LIMIT	Allows host to set output under voltage fault limit for each output.	R/W Word	Y
46h	IOUT_OC_FAULT_LIMIT	Allows host to set output over current fault limit for each output.	R/W Word	Y
4Ah	IOUT_OC_WARN_LIMIT	Allows host to set output over current warning limit for each output.	R/W Word	Y
4Fh	OT_FAULT_LIMIT	Allows host to set output over temperature fault limit.	R/W Word	Y
51h	OT_WARN_LIMIT	Allows host to set output over temperature warning limit.	R/W Word	Y

52h	UT_WARN_LIMIT	Allows host to set under temperature warning limit for each sensor.	R/W Word	Y
53h	UT_FAULT_LIMIT	Allows host to set under temperature fault limit for each sensor.	R/W Word	Y
55h	VIN_OV_FAULT_LIMIT	Allows the host to set input over voltage fault limit.	R/W Word	N
57h	VIN_OV_WARN_LIMIT	Allows the host to set input over voltage warning limit.	R/W Word	N
58h	VIN_UV_WARN_LIMIT	Allows the host to set input under voltage warning limit.	R/W Word	N
59h	VIN_UV_FAULT_LIMIT	Allows the host to set input under voltage warning limit.	R/W Word	N
5Bh	IIN_OC_FAULT_LIMIT	Allows the host to set input over current fault limit.	R/W Word	N
5Dh	IIN_OC_WARN_LIMIT	Allows the host to set input over current warning limit.	R/W Word	N
78h	STATUS_BYTE	Provides host with one byte general status register.	Read Byte	N
79h	STATUS_WORD	Provides host with two byte general status register.	Read Word	N
7Ah	STATUS_VOUT	Provides host with one byte status on currently paged output voltage.	R/W Byte	Y
7Bh	STATUS_IOUT	Provides host with one byte status on currently paged output current.	R/W Byte	Y

Command Code	Command Name	Description	Type	Paged
7Ch	STATUS_INPUT	Provides host with one byte status on device input.	R/W Byte	N
7Dh	STATUS_TEMPERATURE	Provides host with one byte status on device temperature.	R/W Byte	N
7Eh	STATUS_CML	Provides host with one byte status on communication.	R/W Byte	N
80h	STATUS_MFR	Provides host with one byte of device specific faults and warnings.	R/W Byte	N
88h	READ_VIN	Returns input voltage measurement.	Read Word	N
89h	READ_IIN	Returns input current measurement.	Read Word	N

8Bh	READ_VOUT	Returns output voltage measurement for currently selected page.	Read Word	Y
8Ch	READ_IOUT	Returns output current measurement for currently selected page.	Read Word	Y
8Dh	READ_TEMPERATURE_1	Returns temperature reading from sensor 1.	Read Word	N
8Eh	READ_TEMPERATURE_2	Returns temperature reading from sensor 2	Read Word	N
8Fh	READ_TEMPERATURE_3	Returns temperature reading from sensor 3	Read Word	N
98h	PMBUS_REVISION	Provides host with PMBUS revision device complies with.	Read Byte	N
99h	MFR_ID	Provides host with manufactures ID.	Read Block	N
9Ah	MFR_MODEL	Provides host with model number of device.	Read Block	N
9Bh	MFR_REVISION	Provides host with firmware revision level of device	Read Block	N
9Eh	MFR_SERIAL	Provides host with device serial number	Read Block	N
ADh	IC_DEVICE_ID	Provides host with devices' system on a chip ID code.	Read Block	N
AEh	IC_DEVICE_REV	Provides host with devices' system on a chip revision level	Read Block	N
B0h	USER_DATA_00	Provides the host with the ability to store user data inside device EEPROM	Block R/W	N
B1h	USER_DATA_01	Provides the host with the ability to store user data inside device EEPROM	Block R/W	N
B2h	USER_DATA_02	Provides the host with the ability to store user data inside device EEPROM	Block R/W	N
B3h	USER_DATA_03	Provides the host with the ability to store user data inside device EEPROM	Block R/W	N
B4h	USER_DATA_04	Provides the host with the ability to store user data inside device EEPROM	Block R/W	N
B5h	USER_DATA_05	Provides the host with the ability to store user data inside device EEPROM	Block R/W	N

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