ORBIT POWER GROUP
Behlman Electronics

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VPX YOUR WAY

The latest power supply technology finally catches up to the past, as VPX goes 'back to the future.'

Back in the "good old days," the power supply mantra for all power supplies was *Standard, Modified Standard, or Custom Designed.* Often that translated into *lowest cost, slightly more expensive,* and *too expensive for my system.* In the 1970s, the US Government Department of Defense (DoD) started moving toward the purchase and use of commercial-off-the-shelf products (COTS), whenever they could find proven technology in the commercial marketplace that met their requirements, or could easily be reconfigured to do so.

In 1994, Secretary of Defense, William J. Perry, released a document asking the military to increase its purchase of commercial items. Shortly thereafter, COTS was further addressed in the Federal Acquisition Streamlining Act (FASA); the Clinger-Cohen Act; the Federal Acquisition Regulation; the Defense Federal Acquisition Regulation; and the basic DoD Acquisition Policy (5000 series).

As a result, the term *COTS* increasingly replaced the term *Standard,* and *Modified COTS* was often the descriptor for a standard product that was modified to meet a specific requirement.

VPX emerged in the early 2000s as a viable way to scale backplane technology. VPX, formerly known as VITA 46, is an ANSI standard. It was defined by VITA (VME International Trade Association), a working group that includes many major companies in the electronics

marketplace. *[Disclosure: Jerry Hovdestad, the Director of COTS Engineering at Behlman and the author of this paper, sits on a number of VITA committees involved in Open VPX.]*

The value of VPX technology cannot be overstated, as it not only provides for standardization that enables interconnectivity between VPX products from many manufacturers, but also promotes new generations of embedded computing systems with high-speed serial switched fabric interconnects.

However, for all its advantages, the very standards that made VPX possible in the first place provide limitations which, in some circumstances, make it difficult to achieve the desired end result. This is especially evident in certain 3U and 6U VPX power supplies.

Power supplies have always been the problem child in electronic system design. Very often, high-end systems are configured for specialized applications and, as a result, power requirements tend to be quite different from one configuration to another. VITA attempted to standardize some aspects of VME system design, which also put some constraints on power. Mechanical standards were agreed upon for circuit cards, and there was an effort to organize voltages and their characteristics, such as regulation, noise, ripple, and rise time. There was really no successful attempt to control the size and shape of VME power supplies.

After the introduction of VPX standard VITA 46, the standardization process continued to advance and define many more features of system cards. Chassis, backplane, and card profiles are defined in VITA 65, although this appears to be a monster with unlimited growth potential. In addition, specification VITA 62 was written in an effort to further standardize VPX power supplies. This specification defines mechanical configurations, connectors, voltages, and general interfaces, so that system integrators can design platforms with standard backplanes and be able to plug in power supply cards from a variety of suppliers. The expectation was that cards from these different manufacturers would function properly and identically. This may actually work with some less complex systems, but there are still many variables, such as user-defined pins, which allow designers to make use of sophisticated, “undefined” features. These are specification enhancements offered by only some power supply manufacturers, even if they are VITA 62 compliant. A further complication is the

programmability often offered with these power supplies, which is very loosely defined in the VITA 46.11 system management specification.

VITA 62 does define a starting point that system designers can use for basic power requirements. They must add actual power levels, as well as decide how to incorporate other undefined system power needs. EMI filtering, hold-up requirements, and transient and lightning protection are just some of the possible considerations. If multiple cards are used, shared circuit performance, compatibility, sensing, and synchronization are issues that must be resolved. The Vita 62 specification, as currently released, allows for considerable flexibility in requirements. Output currents for each allowable voltage are the parameters that are most variable. Seldom does a power supply company see two requirements with the same output power levels. Therefore, it is very important that the products being offered are able to be tailored to meet these needs.

System integrators should not be afraid to ask for what they really need, and the power supply manufacturer must be able to discuss these needs and offer solutions which are acceptable to that individual program. For some programs, it might be important to stick with a fully compliant power supply, while other programs may allow some configuration changes in the interest of saving cost or size.

Behlman has a history of innovative VPX breakthroughs.

2012: Behlman broke through the VPX power ceiling. That raised the bar for the amount of power available in a single VPX power supply higher than ever before.

2015: Behlman broke through the VPX power intelligence ceiling. That enabled lower-cost creation of smarter systems having communication, measurement, and control capability provided by the power supply.

2016: Behlman broke through the VPX power supply reconfiguration ceiling, enabling designers to specify – and receive – unique configurations that exactly meet their needs.

One example is a system with a 5 V 120 A requirement, and a lower power requirement on the 12 V and 3.3 V outputs. This type of situation is fairly common, because there are some processor assemblies widely used in VPX systems that require a significant amount of 5 V. Standard 3U VPX cards are available with outputs up to 5 V @ 40 A because the pins designated for the 5 V output are rated at 40 A. One system designer may opt to use three cards to meet the requirement and stay fully compliant with the VITA 62 specification, while another may opt for some tailoring of the card in order to reduce size and cost. This system designer may opt for one standard card and a second card with two 5 V outputs by replacing the 12 V on that card with a second 5 V. This would save a card slot,

and the cost of the power supply would be roughly 33% less as a result of the reduced number of cards. Each program designer must decide what degree of specification compliance or deviation is acceptable. The designer should not be reluctant to discuss the requirement with his supplier, because this interaction is usually the best way to optimize the design. In fact, it is important to consult with the power supply manufacturer very early in the design stage, since the reconfiguration of the power supply could affect other parts of the system design which, if not considered early, could add cost for reworking and time to the process.

Besides hardware requirements, VPX power supply software capability is also important for system customization and optimization. Modern power supplies can offer significant design flexibility. While IPMI based VITA 46.11 can be used to optimize system performance, there should be a more detailed definition of programmable functions. Some manufacturers continue to use a PMBus based I^2C structure, because the functions available are well defined. When we talk about tailoring a system, this structure allows many desirable features. Some of the features that could be tailored include over-voltage, over-current, temperature warnings, and limits. It is quite common to see wide variations in these requirements from system to system, and it would be quite difficult and expensive to have each variation fixed in hardware. The ability to program these settings enables the use of standard hardware. Temperature warnings and limits are other factors that are often system dependent, and the ability to set these parameters can greatly enhance system performance. The ability to read output and input currents is also something that can be used by a system programmer to monitor operational performance and diagnose system problems.

VITA 62 is an important step forward in the effort to have an Open VPX Standard power supply, but there is still significant work to be done to meet existing and emerging system needs. Several hardware areas are not adequately covered by established standards, and software definitions need to be addressed. In the area of hardware, there is no real definition of an energy storage card that would allow system designers and manufacturers to have a standard configuration. While VITA 62 does mention these devices, there is no connector pin assignment. As a minimum, we need to define input and output pins for such a card. It would also be desirable to have some basic logic and control functions defined, such as “card ready” or “fault.” Another area that needs work is a specification for three-phase inputs for 3U

cards. The current 3U connector does not have sufficient input pins for this function. The original VITA 62 committee did not foresee a need for this, but many systems now have such a requirement. There is, however, a present effort to have some of these loose ends solidified. In addition to VITA, industry attention has been growing in the VPX arena. The DoD “Host” for hardware and “Fast” for software are just two of the industry thrusts to reinforce the Open VPX Standard.

Behlman actively participates in appropriate VITA committees and offers a wide variety of both standard and existing nonstandard VPX power cards, while also offering system designers the opportunity to explore whatever reconfiguration is required for maximum performance and economy. For example, working within its new VP*Xtra*™ Reconfiguration Program, Behlman has modified the VP*Xtra*™ 500M to create the new VP*Xtra*™500M1 with 80 Amps of 5 VDC output. This unit, in conjunction with the standard VP*Xtra*™ 500M, can supply 120 Amps of 5 VDC, along with the customer-required 12 VDC and 3.3 VDC.

The Behlman VP*Xtra*™ Reconfiguration Program

At the time of this writing, four standard Behlman VP*Xtra*™ COTS Power Supplies (three 6U and one 3U) meet the specifications needed by the majority of systems designers. However, under the auspices of its **VP*Xtra*™ Reconfiguration Program**, Behlman has proven that they can efficiently and economically provide a wide range of modified COTS configurations to meet specific system design challenges.

As a result, Behlman has already created over a dozen modified COTS VP*Xtra*™ Power Supplies, having special features needed by unique systems, and more are being explored every day.

Behlman now invites all system designers to request additional system-specific VP*Xtra*™ reconfigurations, without the cost of full-custom development.

Behlman conducts conferences with concerned system designers, in which they specify and

discuss their typical and non-typical VPX power supply requirements, which can vary significantly from system to system. Variables can range from different power levels of the standard voltages, to mechanical configurations, such as connectors, user-defined pins, and general interfaces. EMI filtering and hold-up requirements, as well as transient and lightning protection, are other possible considerations. All-in-all, it turns out that industry standards set for VPX power supplies do not always satisfy the needs of systems requiring VPX power supplies.

The Behlman **VP*Xtra*™ Reconfiguration Program** is designed to address all of these needs, and more. This program has already resulted in an impressive list of new, non-typical, COTS VPX power supply models (3U 3-phase AC to DC; High Voltage Hold-up card, Low Voltage Hold-up card; PS with extra 5 VDC, 6U 3-phase and single-phase AC to DC, PS with extra 12 VDC, and PS with extra 5 VDC). But that is only the beginning, as illustrated in the Behlman advertisement below.

WE BROKE THROUGH THE VPX POWER CEILING IN 2012.
WE BROKE THROUGH THE VPX INTELLIGENCE CEILING IN 2015
WE BROKE THROUGH THE RECONFIGURATION CEILING IN 2016.

NEXT? TELL US WHAT YOU NEED.

VPXtra™ **HU300LV** (3U) 550 W, 28 VDC hold-up IAW MIL-STD-704.

VPXtra™ **HU700HV** (3U) 700 W, 270 VDC hold-up IAW MIL-STD-704.

VPXtra™ **800A** (3U) 800W. 3-phase AC to 28 VDC & 3.3 Aux.

VPXtra™ **500M1** (3U). 460 W, 28 VDC to 6 outputs, with high-current 5 VDC.

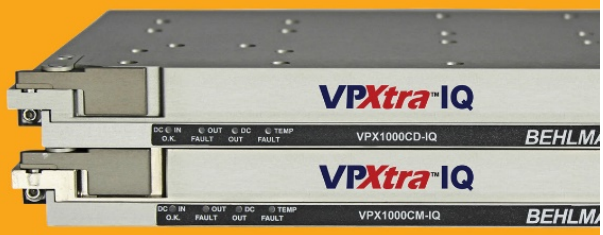
VPXtra™ **500M** (3U). 560 W, 28 VDC to 6 outputs.

VPXtra™ IQ **1000CM4-IQ** (6U). 790 W, 28 VDC to 5 outputs with extra 5 VDC, plus intelligent communication and control.

VPXtra™ **1000CM4** (6U). 790 W, 28 VDC to 5 outputs with extra 5 VDC.

VPXtra™ **1000CM3** (6U). 950 W, 28 VDC to 5 outputs with extra 5 VDC.

VPXtra™ **1000CM2** (6U). 1000 W, 28 VDC to 12 VDC & 3.3 Aux with extra 12 VDC.

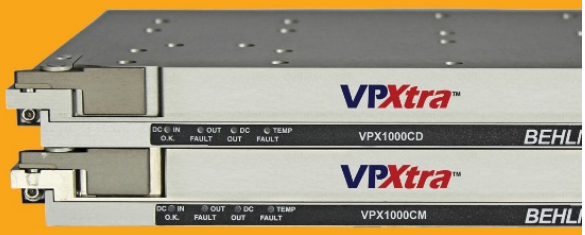


VPXtra™ IQ **1000CM-IQ** 6U). 700 W, 28 VDC to 12 VDC, 5 VDC & 3.3 Aux, +12 & -12 Aux, plus intelligent communication and control.

VPXtra™ **1000CM** (6U). 700 W, 28 VDC to 12 VDC, 5 VDC & 3.3 Aux, +12 & -12 Aux.

VPXtra™ IQ **1000CD-IQ** (6U). 1000 W, 28 VDC to 12 VDC & 3.3 Aux, plus intelligent communication and control.

VPXtra™ **1000CD** (6U). 1000 W, 28 VDC to 12 VDC & 3.3 Aux.



VPXtra™ **1500CS** (6U). 1500 W or 1000 W, 3-phase PFC AC to 33 VDC.

VPX POWER RECONFIGURED WITHOUT FULL-CUSTOM COST.

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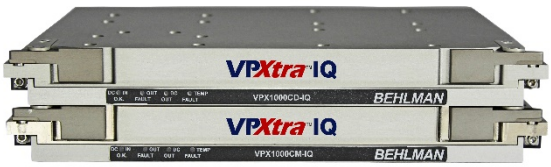
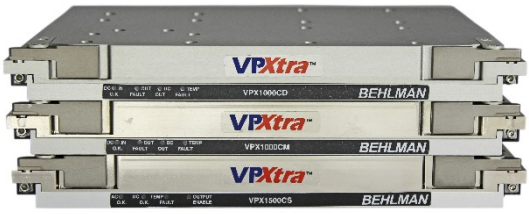
Although standardization may have been expected to meet current and future VPX needs, it soon became apparent that emerging systems required modifications that were not easy for some manufacturers to provide, while also maintaining VITA compatibility. With the **Behlman VP*Xtra*™ Reconfiguration Program**, VP*Xtra*™3U and 6U Power Supplies are able to maintain VITA and Open VPX compatibility, as they step “back to the future” to join the hundreds of other standard COTS AC and DC power supplies, inverters, and UPS units in the Behlman line that have been readily reconfigurable for decades -- without full-custom cost -- to give system designers greater flexibility, improved system performance, and lower total cost.

A growing list with specs for available 3U and 6U standard and non-standard reconfigured VP*Xtra*™ Power Supplies is available upon request, by sending an email to sales@behlman.com. Some of these are so new that data and spec sheets are not yet published, but data and spec sheets for many can already be downloaded at http://www.behlman.com/products_detail/vpx-power-supply.

For more information, contact Behlman Electronics Inc., 80 Cabot Court, Hauppauge, New York 11788 USA; TEL: +1 631 435-0410; FAX: +1 631 951-4341; sales @behlman.com; www.behlman.com.



Behlman 6U VP*Xtra*™ IQ Power Supplies add communication, measurement and control capability to systems.



In 2012, Behlman VP*Xtra*™ Power Supplies raised the bar for the amount of power available in a single 6U VPX power supply.