Kontron HARTMANN-WIENER VPX360DMA

3U / 5HP / 600W VPX Power Supply

Manual

General Remarks

The only purpose of this manual is a description of the product. It must not be interpreted as a declaration of conformity for this product including the product and software.

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1 General Description

The Kontron HARTMANN-WIENER VPX360DMA is a COTS, single stage, wide range 28V to 48V DC input voltage based, conduction cooled VPX power supply with 600W output power according to the ANSI/VITA 62.0 specification. The power supply can be used to power a VPX chassis and will fit into the standard envelope defined by VITA 46.0 specifications.

High efficiency and wide input voltage range is achieved by using state of the art switching power technology. No wet electrolytic capacitors are used. An embedded microprocessor allows monitoring and control via I^{2}C bus.

The 600W VPX power supply mechanical dimensions are 3U x 5HP (1.0” slot). It is outfiĒed with connectors, keying and alignment mechanism as per VITA 62.

The VPX360DMA is designed in compliance with relevant MIL STD 461, 704 and 1275.

1.1 Overview

1.2 FuncĒonal descripĒon

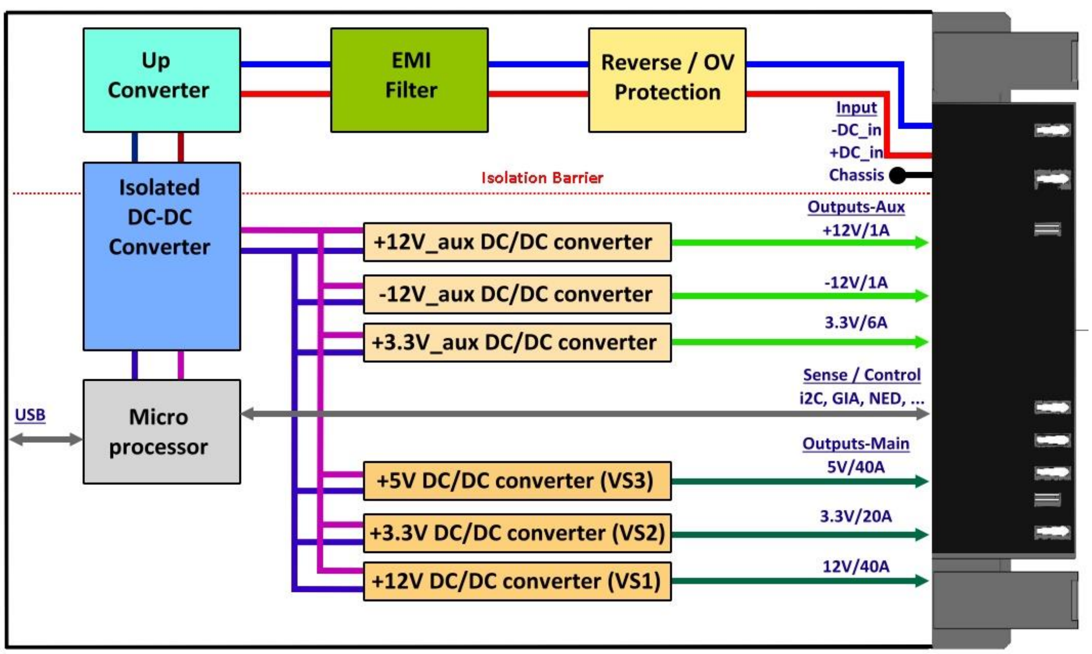


Figure 1: VPX-360DMA Block-Diagram

WARNING: VPX360DMA is a conduction cooled power supply intended to be used with a wedge-lock heat sink and VITA 62 backplane. Failure to properly regulate wedge-lock temperature within the specified limits may result in damage to the power supply.

NOTICE: VITA 62 (4.6.3.12) systems support Remote Sense & Sense Return Pins that are used to accommodate for power distribution losses (i.e. voltage drops across the connector and PCB traces). VPX360DMA contains three sense lines (PO1_SENSE, PO2_SENSE, PO3_SENSE) and one sense return line (SENSE_RETURN) that require connection to the backplane in order provide point of load voltage regulation. The connection is typically provided through a jumper (e.g. 0Ω resistor) located on the backplane. Refer to backplane documentation to ensure the necessary sense and sense return jumpers are installed.

NOTICE: VITA 62 (4.6.3.10) systems support a Signal Return Pin (SIGNAL_RETURN) that is used as the return path for digital signals distributed across the backplane. VPX360DMA requires SIGNAL_RETURN to be connected to the backplane's ground plane. This connection is typically provided through a jumper (e.g. 0Ω resistor) located on the backplane. Refer to backplane documentation to ensure SIGNAL_RETURN jumper is installed.

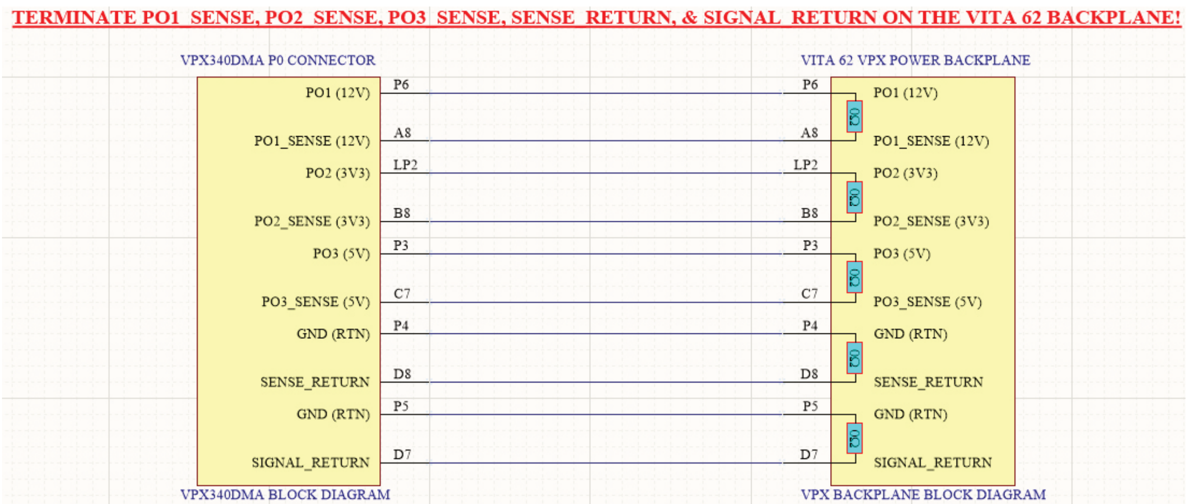


Figure 1.1: Block Diagram of VPX360DMA and VITA 62 Power Backplane. VPX360DMA requires PO1_SENSE, PO2_SENSE, PO3_SENSE, SENSE_RETURN, & SIGNAL RETURN to be terminated on the VITA 62 Power Backplane. Verify that these connections are made on your VPX Power Backplane.

RECOMMENDATION: VPX360DMA has been successfully tested and deployed with VITA46/62 VPX Power Backplanes and conduction cooled chassis manufactured by Hartmann Electronics.
Hartmann Electronics has over 35 years of experience designing high-speed backplanes, please see:

https://www.hartmann-electronic.com/

Support for power supply specific signals: ENABLE*, INHIBIT*, FAIL* and UD (user defined) signals. These input/output signals are low current open collector circuits with electrical characteristics defined per VITA 46 section 4.8.12.1.

NOTICE: NED (C3), NED_RETURN (D3), UD2-4 (B1, C1, D1), SM2-3 (A6, B6), VBAT (A2), & PO1-3_SHARE (A7, B7, C7) are open circuit/no connection on VPX360DMA.

Control Inputs		Power Outputs	
ENABLE*	INHIBIT*	3.3V_AUX	PO1, PO2, PO3, +12V_AUX, and -12V_AUX
High	High	Off	Off
High	Low	Off	Off
Low	High	On	On
Low	Low	On	Off

* means inverted input/output

Communication interface: I^2C communication interface via SM0 (C5) and SM1 (D5). Additional I^2C connection at UD0 (A1) and UD1 (B1) is set by internal jumper (can be removed by factory).

Communication Features (see paragraph 4):

- Remote On / Off
- DC-IN status and measured voltage and current
- Global status, Temperatures
- Voltage, current and status of individual output power modules

2 Specifications

2.1 Standard Input Voltage SpecificaĒon

+28 V or 48V DC nominal, 12 V … 68 V DC input range

UV lockout at 8 V

OutfiĒed with Reverse Polarity Protection

2.2 Output Voltage, Current & Power Specification

VPX standard outputs as per VITA 62, different power configurations are possible:

VPX360DMA

VPX360DMA	Voltage	Current	Power
VS1	+12.00 V	40 A	480 W
VS2	+3.30 V	20 A	66 W
VS3	+5.00 V	40 A	200 W
VAUX1 (+12)	+12 V	1 A	12 W
VAUX2 (–12)	-12 V	1 A	12 W
VAUX3 (3.3)	+3.3 V	6 A	20 W
Total max			**600W**

Maximum output power: limited to 600 W

Noise and ripple (PARD) as per VITA 62 specification:

+5 V / +3.3 V: 50 mV, see [VITA 46.0] Rule 3-6 / 3-9]

+12 V / -12 V: <120 mV peak-to-peak, measured over a range of 0 to 20 MHz.

Input to Output Insulation: 1000 V

Overall Efficiency: ~85% …92% (dependent on output power distribution),
~88% at full load of 600W with power distributed across all outputs.

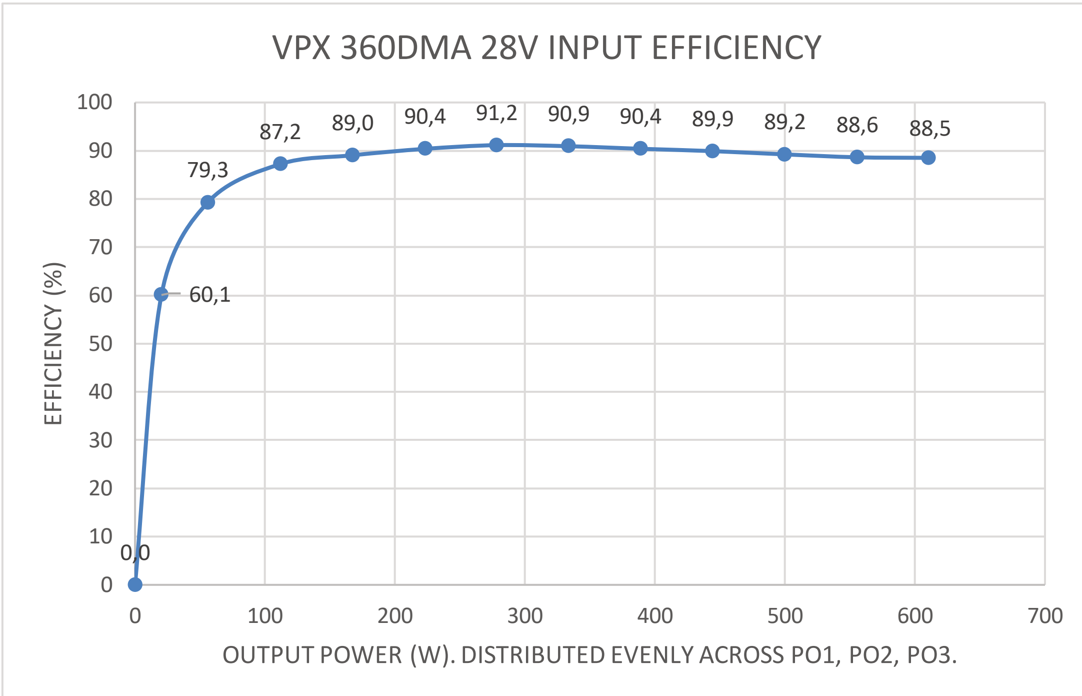


Figure 2: VPX-336DMA Efficiency versus Output Power for VITA 62 nominal input voltage 28V.
VPX360DMA is designed to operate with input voltage 28V DC or 48V DC.
Efficiency curve was generated from empirical data with power distributed across PO1, PO2, & PO3 outputs. (preliminary)

2.3 Technical Specification Table

Form Factor	*3U VPX CC*
Pitch	*5HP / 1.0 inch*
Weight	*0.82 kg / 1.8 Lbs*
Storage Temperature	*-55 °C to 105 °C*
OperaĜng Temperature	*-40 °C to 85 °C (Operating Temperature is referenced at wedge-lock. Failure to regulate wedge-lock temperature may result in damage)* relaØve humidity 95 %
Input to Output InsulaĜon	*500 V*
Input to Case Ground Isolation	*500 V*
Output to Case Ground Isolation	*500 V*
Maximum Output Power	*600 W*
Maximum Input Power	*~680 W*
Maximum Dissipated Power @ max. Power	*~80 W*
Minimum Turn ON Voltage	*12 V*
Minimum Turn OFF Voltage	*8 V*

Maximum Continuous/Peak Input Voltage	*68 V / ± 250 V (<1 ms spike)*
Input Overvoltage Protection:	*Outputs disable if input voltage exceeds 68 VDC for > 600 ms (10 second auto-restart)*
Temperature ProtecĜon Sensing Point (internal)	*125 °C (Outputs disable when internal PCB temperature exceeds threshold)*
Maximum Internal Working Temperatures	*125 °C*
Case Ground to Safety Ground Resistance	*< 10 mΩ (preliminary)*
Maximum Input Line Inductance	*10µH (preliminary)*

Main Power

Maximum Currents 12V / 3V3 / 5V	*40 A / 20 A / 40 A*
Fixed Switching Frequencies 12V / 3V3 / 5V	*520 kHz / 520 kHz / 520 kHz*
Peak Efficiencies 12V / 3V3 / 5V	*92% / 82% / 87%*
Max. Output Ripple and Noise: 12V / 3V3 / 5V	*<120 mVpp / <50 mVpp / <50 mVpp*
(0-20 MHz Bandwidth)	*Typical < 30 mVpp / <25 mVpp / <25 mVpp*
Line Regulation: 12V / 3V3 / 5V.	*<10 mV / <10 mV / <10 mV*
Vin=Vin,min to Vin,max, Io and Tc fixed	*< 0.1%*
Load RegulaĜon: 12V / 3V3 / 5V	*<10 mV / <10 mV / <50 mV*
Maximum output voltage (sense lines open)	*12.3V / 3.45 V / 5.15 V*
Load Transient Recovery Time (50 % load change condition)	*~1 ms*

Auxiliary +12V / -12V / 3.3V Power

Maximum Current	*1.0 A / 1.0 A / 6.0 A*
Load Dependent Switching Frequency	*300 Hz ... 700 kHz*
Peak Efficiencies	*60% to 70%*
Max. Output Ripple and Noise (0-20 MHz Bandwidth)	*<120 mVpp / <50 mVpp / <50 mVpp*

2.4 MIL STD 810 (Shock / Vibe / Ambient Temperature / Environment)

Ruggedized construction to meet shock and vibration requirements, levels to be specified and tested on request.

Storage Temperature: -55 °C to 105 °C

Operating Temperature: -40 °C to 85 °C

Standard acrylic conformal coating (e.g. HumiSeal Type 1B31 or similar) to withstand sand, dust and salt atmosphere. Alternate conformal coating options as for instance Parylene are available upon request.

2.5 MIL-STD-461F (EMI) Compliance

Designed to be in compliance with sections CE102, CS101, CS114, CS115, CS116. **Compliance tests to be performed**.

EMC STANDARD:	**TEST CONDITIONS: LINE, LOAD, EXTERNAL FILTER**	**RESULT:**
MIL-STD-461F CE102	Input Voltage = 28V, Output Power = 600W, No external filter needed	
MIL-STD-461F CS101	Input Voltage = 28V, Output Power = 40W, No external filter needed	
MIL-STD-461F CS114	Input Voltage = 28V, Output Power = 600W, No external filter needed	
MIL-STD-461F CS115	Input Voltage = 28V, Output Power = 600W, No external filter needed	
MIL-STD-461F CS116	Input Voltage = 28V, Output Power = 600W, No external filter needed	

2.6 MIL-STD-704 Compliance

Designed to be in compliance for normal and abnormal transients and distortion spectrum. External hold-up circuit optional. **Compliance tests to be performed**.

EMC STANDARD:	**TEST CONDITIONS: LINE, LOAD, EXTERNAL FILTER**	**RESULT:**
MIL-STD-704F LDC105 Normal Voltage Transients	Input Voltage = 28V, Output Power = 192W, No external filter needed	
MIL-STD-704F LDC302 Abnormal Voltage Transients	Input Voltage = 28V, Output Power = 192W, No external filter needed	
MIL-STD-704F LDC103 Voltage Distortion Spectrum	Input Voltage = 28V, Output Power = 192W, No external filter needed	

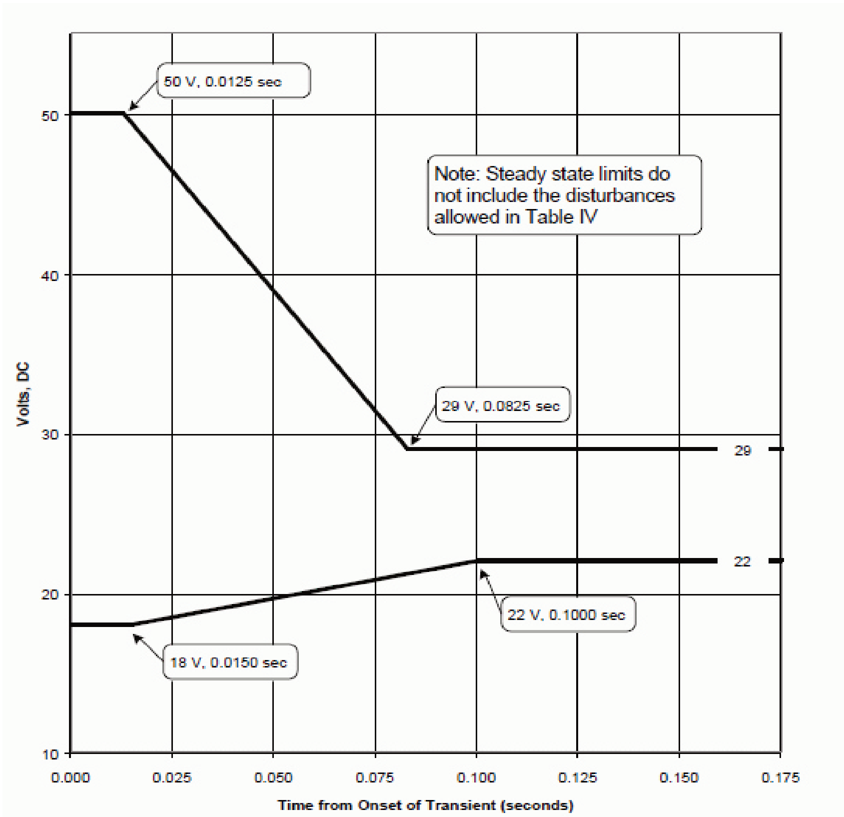


Figure 4: *MIL-STD-704F Envelope for normal voltage transients for 28 VDC Systems*

2.7 MIL-STD-1275D Compliance

Designed to be in compliance for ripple, surge, & spikes. **<u>Compliance tests to be performed</u>**.

EMC STANDARD:	**TEST CONDITIONS: LINE, LOAD, EXTERNAL FILTER**	**RESULT:**
MIL-STD-1275D 5.3.2.2 Exported Voltage Spikes	Input Voltage = 28V, Output Power = 600W, No external filter needed	
MIL-STD-1275D 5.3.2.3 Imported Voltage Spikes	Input Voltage = 28V, Output Power = 600W, No external filter needed, Normal Mode & Generator Mode	
MIL-STD-1275D 5.3.2.4 Imported Voltage Surges	Input Voltage = 28V, Output Power = 600W, No external filter needed, Normal Mode & Generator Mode	
MIL-STD-1275D 5.3.2.5 Imported Ripple Voltage	Input Voltage = 28V, Output Power = 40W, No external filter needed	

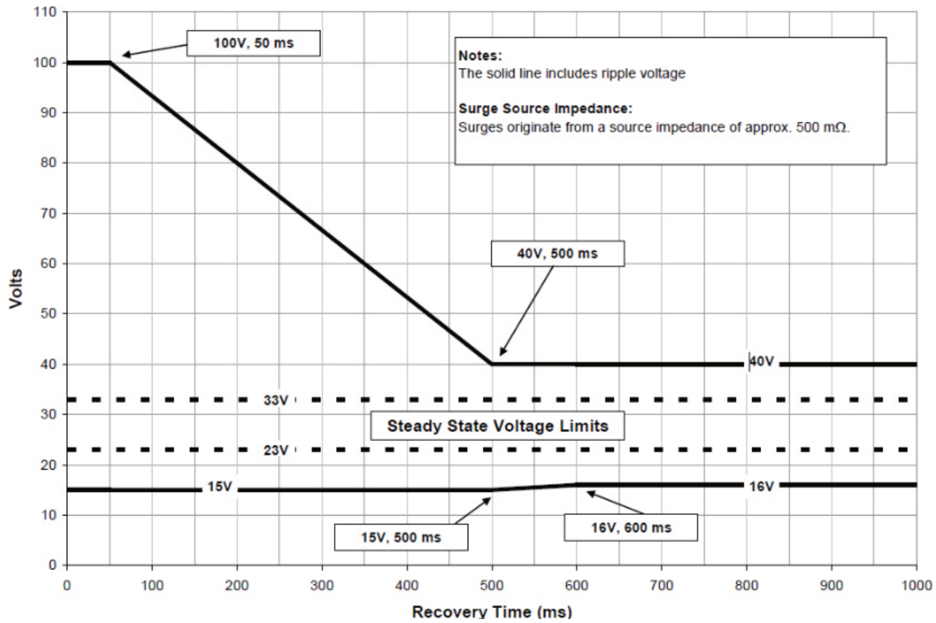


Figure 5: *MIL-STD-1275D Envelope of surges in Generator-only Mode for 28 VDC Systems.*

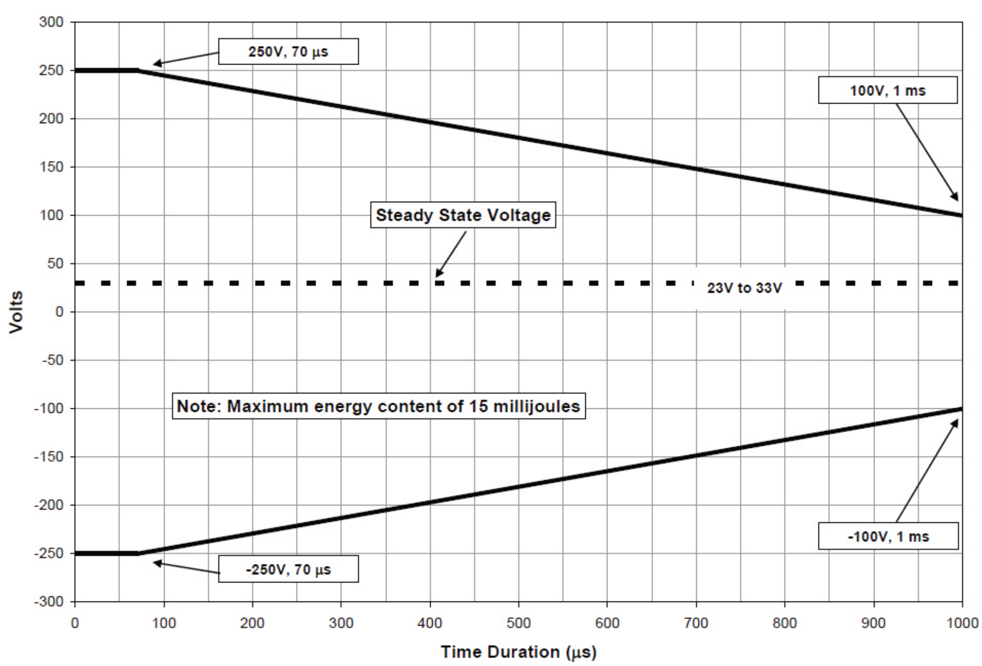
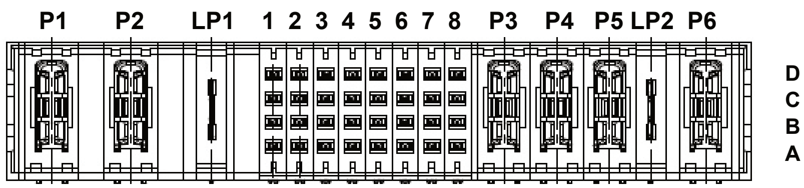


Figure 6: *MIL-STD-1275D Envelope of spikes in Generator-only Mode for 28 VDC Systems.*

2.8 P0 Connector Pin-Layout (as per VITA62)

P0 (3U)	TE Connectivity	Foxconn
Power Supply	6450849-7	HM811C3-B84F
Backplane	1-6450869-4	HM826B3-B64F



Pin Number	Rated Current (A)	Pin Name
P1	40A	- DC_IN
P2	40A	+ DC_IN
LP1	20A	CHASSIS
A1	<1A	UD1
B1	<1A	UD2
C1	<1A	UD3
D1	<1A	UD4
A2	<1A	VBAT
B2	<1A	FAIL*
C2	<1A	INHIBIT*
D2	<1A	ENABLE*
A3	<1A	UD0
B3	<1.5A	+12V_AUX
C3	<1A	NED
D3	<1A	NED_RETURN
A4	<1.5A	3,3V_AUX
B4	<1.5A	3,3V_AUX
C4	<1.5A	3,3V_AUX
D4	<1.5A	3,3V_AUX
A5	<1A	GA0*
B5	<1A	GA1*
C5	<1A	SM0
D5	<1A	SM1
A6	<1A	SM2
B6	<1A	SM3
C6	<1.5A	-12V_AUX
D6	<1A	SYSRESET*
A7	<1A	PO1_SHARE (VS1)
B7	<1A	PO2_SHARE (VS2)
C7	<1A	PO3_SHARE (VS3)
D7	<1A	SIGNAL_RETURN
A8	<1A	PO1_SENSE (VS1)
B8	<1A	PO2_SENSE (VS2)
C8	<1A	PO3_SENSE (VS3)
D8	<1A	SENSE_RETURN
P3	40A	PO3 (VS3)
P4	40A	POWER_RETURN
P5	40A	POWER_RETURN
LP2	20A	PO2 (VS2)
P6	40A	PO1 (VS1)

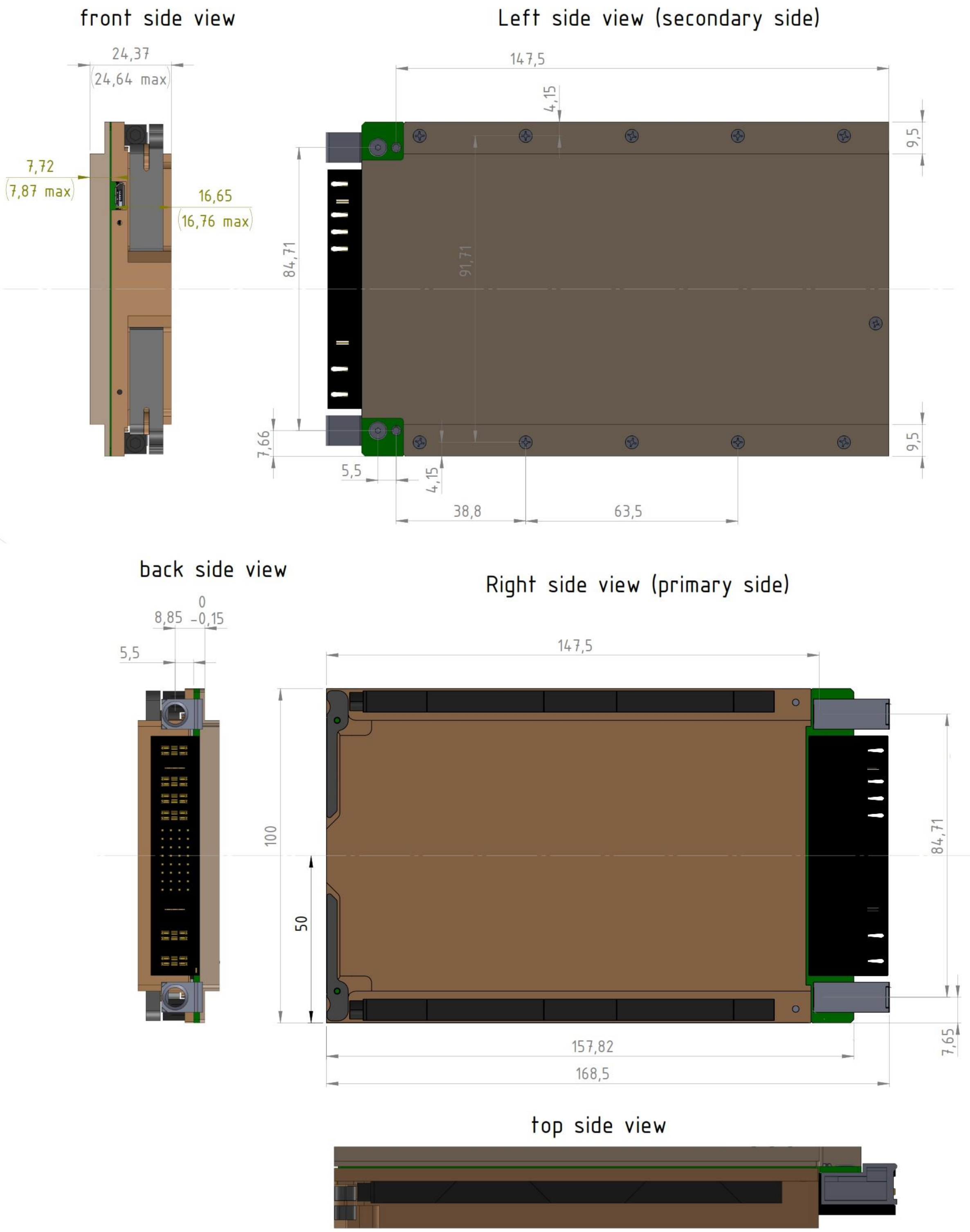
* means inverted input/output

2.9 USB Connector & LED Status Indicator

VPX360DMA is outfiĒed with a USB-C connector. This interface enables communication with a Windows PC running User Software. See section 4.5 of this manual for details on User Software.

VPX360DMA is equipped with a multi-color LED Status Indicator: Flashing GREEN LED indicates that the firmware is running. Solid BLUE LED indicates that the VITA 62 ENABLE* Switch is active (i.e. all outputs are energized). Normal operation is a flashing GREEN LED & Solid BLUE LED on (when ENABLE* active). Contact Kontron HARTMANN-WIENER for support if LED Status indicates otherwise.

3. Mechanical Layout



NOTICE: VPX360DMA is a VITA 62 “1.0 PITCH 3U CONDUCTION COOLED PLUG-IN MODULE”. See VITA 62 FIGURE A-2 “3U Conduction Cooled Module Layout” for additional mechanical details.

4. I2C Documentation Version 1.5

4.1. Device Setup

- 7-Bit Addressing
- Slave Mode
- Address Auto Increment

4.2. I2C Device Address Byte

Accessing the device requires an 8-bit Device Address word following a Start condition to enable the device for a Read or Write operation. Since multiple slave devices can reside on the serial bus, each slave device must have its own unique address so the Master can access each device independently. The most significant four bits of the Device Address word is referred to as the device type identifier. The device type identifier ‘11001’ is required in bits seven through three of the Device Address byte. Following the 2-bit Hardware Slave Address Bits GA1* (Pin B5) and GA0* (Pin A5). GA1* and GA0 both have an internal pull-up resistor of 10k to VCC.
A HIGH level on these pins gives a “0” on the GA pin.
A LOW level on these pins gives a “1” on the GA pin.

Device Type Identifier					Hardware Slave Address Bits		Read / Write
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	1	0	0	1	GA1	GA0	R/

2.10 4.3. Device Access

Reading the device requires a write to the desired memory address of the Slave Device followed by a Read. Since ADC Data has 16-bit values, ADC values are split in high and low bytes. The address pointer will automatically increase after one read cycle.

4.3.1 A Typical Slave I2C™ Message: Multiprocessor Command/Status

Note: This example uses 10-Bit Address instead of 7-Bit Address

4.3.2 Data Mapping

- All Status bits are high active.
- Data size per address is 1 Byte
- All Registers are read only
- Module description :
    - Module0: PO1:12VP (12V Main Power)
    - Module1: PO3:5V (5V Main Power)
    - Module2: PO2:3V3 (3.3V Main Power)
    - Module3: VIN (Input Voltage)
    - Module4: 12VN AUX (-12V Auxiliary Voltage)
    - Module5: 3V3 Aux (3.3V Auxiliary Voltage)
    - Module6: 12VP Aux (+12V Auxiliary Voltage)

  AĒ ention: Module assignment and name can be different for different VPX types.
- All data is stored in LiĒ le Endian order

High Order Byte | Low Order Byte

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

- 16 Bit DataValue = [[High Byte][Low Byte]]

4.3.3 Register

All registers are read-only.

Command Data Byte	Register Name	Type	Description

0x00	PS Global Status Low Byte (Bit field)	uint8_t (Bit field)	Global Power Supply status bits. Refer to "Register Type Definitions" for more information.
0x01	PS Global Status High Byte (Bit field)		
0x02	Reserved		
0x03	Reserved		
0x04	Module 0 Status Low Byte (Bit field)	uint8_t (Bit field)	Module 0 status bits. Refer to "Register Type Definitions" for more information.
0x05	Module 0 Status High Byte (Bit field)		
0x06	Module 0 Output Voltage Low Byte	int16_t	Raw Voltage Value. Calculation details in Section 4.1
0x07	Module 0 Output Voltage High Byte		
0x08	Module 0 Output Current Low Byte	int16_t	Raw Current Value. Calculation details in Section 4.2
0x09	Module 0 Output Current High Byte		
0x0A	Module 0 Temperature Low Byte	int16_t	T0 is 16bit singed integer in degree
0x0B	Module 0 Temperature High Byte		
0x0C	Module 1 Status Low Byte (Bit field)	uint8_t (Bit field)	Module 1 status bits. Refer to "Register Type Definitions" for more information.
0x0D	Module 1 Status High Byte (Bit field)		
0x0E	Module 1 Output Voltage Low Byte	int16_t	Raw Voltage Value. Calculation details in Section 4.1
0x0F	Module 1 Output Voltage High Byte		
0x10	Module 1 Output Current Low Byte	int16_t	Raw Current Value. Calculation details in Section 4.2
0x11	Module 1 Output Current High Byte		
0x12	Module 1 Temperature Low Byte	int16_t	T1 is 16bit singed integer in degree
0x13	Module 1 Temperature High Byte		
0x14	Module 2 Status Low Byte (Bit field)	uint8_t (Bit field)	Module 2 status bits. Refer to "Register Type Definitions" for more information.
0x15	Module 2 Status High Byte (Bit field)		
0x16	Module 2 Output Voltage Low Byte	int16_t	Raw Voltage Value. Calculation details in Section 4.1
0x17	Module 2 Output Voltage High Byte		
0x18	Module 2 Output Current Low Byte	int16_t	Raw Current Value. Calculation details in Section 4.2
0x19	Module 2 Output Current High Byte		
0x1A	Module 2 Temperature Low Byte	int16_t	Reserved
0x1B	Module 2 Temperature High Byte		
0x1C	Module 3 Status Low Byte (Bit field)	uint8_t (Bit field)	Module 3 status bits. Refer to "Register Type Definitions" for more information.
0x1D	Module 3 Status High Byte (Bit field)		
0x1E	Module 3 Output Voltage Low Byte	int16_t	Raw Voltage Value. Calculation details in Section 4.1
0x1F	Module 3 Output Voltage High Byte		
0x20	Module 3 Output Current Low Byte	int16_t	Raw Current Value. Calculation details in Section 4.2
0x21	Module 3 Output Current High Byte		
0x22	Module 3 Temperature Low Byte	int16_t	Reserved
0x23	Module 3 Temperature High Byte		
0x24	Module 4 Status Low Byte (Bit field)	uint8_t	Module 4 status bits.

0x25	Module 4 Status High Byte (Bit field)	(Bit field)	Refer to "Register Type Definitions" for more information.
0x26	Module 4 Output Voltage Low Byte	int16_t	Raw Voltage Value. Calculation details in Section 4.1
0x27	Module 4 Output Voltage High Byte		
0x28	Module 4 Output Current Low Byte	int16_t	Raw Current Value. Calculation details in Section 4.2
0x29	Module 4 Output Current High Byte		
0x2A	Module 4 Temperature Low Byte	int16_t	Reserved
0x2B	Module 4 Temperature High Byte		
0x2C	Module 5 Status Low Byte (Bit field)	uint8_t (Bit field)	Module 5 status bits. Refer to "Register Type Definitions" for more information.
0x2D	Module 5 Status High Byte (Bit field)		
0x2E	Module 5 Output Voltage Low Byte	int16_t	Raw Voltage Value. Calculation details in Section 4.1
0x2F	Module 5 Output Voltage High Byte		
0x30	Module 5 Output Current Low Byte	int16_t	Raw Current Value. Calculation details in Section 4.2
0x31	Module 5 Output Current High Byte		
0x32	Module 5 Temperature Low Byte	int16_t	Reserved
0x33	Module 5 Temperature High Byte		
0x34	Module 6 Status Low Byte (Bit field)	uint8_t (Bit field)	Module 6 status bits. Refer to "Register Type Definitions" for more information.
0x35	Module 6 Status High Byte (Bit field)		
0x36	Module 6 Output Voltage Low Byte	int16_t	Raw Voltage Value. Calculation details in Section 4.1
0x37	Module 6 Output Voltage High Byte		
0x38	Module 6 Output Current Low Byte	int16_t	Raw Current Value. Calculation details in Section 4.2
0x39	Module 6 Output Current High Byte		
0x3A	Module 6 Temperature Low Byte	int16_t	Reserved
0x3B	Module 6 Temperature High Byte		

4.3.3.1 Register Type Definitions

PS Global Status Low Byte (Bit field)

Bit number	Description	Values
0	Main Power output state: All main power channels (PO1-PO3) inactive/active.	0 = off 1 = on
1	AUX Power output state: All auxiliar power channels inactive/active.	0 = off 1 = on
2	Global Failure bit: Reflects the status of all modules. If there is a failure on one of the VPX outputs (overvoltage, undervoltage, overcurrent, overtemperature or max. power limit)	0 = no module errors 1 = one or more modules with output failure

	this bit will change state.	
3	Reserved	-
4	Reserved	-
5	Reserved	-
6	Reserved	-
7	Reserved	-

PS Global Status High Byte (Bit field)

Bit number	Description	Values
0	Self-Test Failure bit: System config data CRC is bad. Power Supply should not be used because internal memory might be damaged.	0 = no failure 1 = failure in config
1	Internal Config Error bit: Power supply internal configuration error. Power supply should not be used because internal memory might be damaged.	0 = no failure 1 = failure in config
2	Reserved (internal)	-
3	Reserved (internal)	-
4	Reserved	-
5	Reserved	-
6	Reserved	-
7	Reserved	-

Module Status Low Byte (Bit field)

Bit number	Description	Values
0	Module power state	0 = off 1 = on
1	Overvoltage (*) Output voltage is over the maximum system limit.	0 = off 1 = on
2	Undervoltage (*)	0 = no undervoltage 1 = undervoltage event

	Output voltage is under the minimum system limit.	
3	Overcurrent (*) Output current is over the maximum system limit.	0 = no overcurrent 1 = overcurrent event
4	Overtemperature (*) Module temperature is over the maximum system limit.	0 = no overtemperature 1 = overtemperature event
5	delayed start active bit. If the channel has a programmed start delay, this bit will change state if the module is waiting to start.	0 = no delayed start active 1 = delayed start active
6	Max Power (*) Output power is over the maximum system limit.	0 = max power not reached 1 = max power reached
7	Reserved	-

(*) If the system shuts down due to this event, the error remains visible until channel is turned on again.

Module Status High Byte (Bit field)

Bit number	Description	Values
0	reserved	-
1	reserved	-
2	reserved	-
3	reserved	-
4	reserved	-
5	reserved	-
6	reserved	-
7	Reserved	-

4.3.4 Special Register Sets

Special Register Sets are multiple bytes on one Address. The internal address will auto increment on every read cycle. One write with multiple read cycles is needed to read all data from one address. Special Registers are available with Firmware release “3.0.6035.0”.

Command Data Byte	Register Name	Type	W/R	Size	Description
0x70	Module Exponents	MODULE_EXPONENTS	Read only	14 Bytes	Module Exponent values needed for calculation
0x71	Firmware String	Char[24]	Read only	24 Bytes	ASCII Firmware String
0x72	Serial Number	Uint32_t	Read only	4 Bytes	Serial Number
0x73	reserved	Uint32_t	Write only	4 Bytes	Reserved
0x74	Power Switch	Uint8_t[2]	Write only	2 Bytes	Switch Module Power

4.3.4.1 Special Register Definitions

4.3.4.1.1 Module Exponents

Type: MODULE_EXPONENTS

Each Module has a signed (negative) voltage and current exponent value stored in the Special Register set at address 0x70 making a total of 14 Bytes (7 modules with one voltage and one current exponent each). Exponents are used for calculating the real measurement value from the raw measurement data.

These values do not change and can be read only once.

Byte	Register Name	Type	Description
0x00	voltageExponent_m0	uint8_t	Voltage Exponent Module 0
0x01	currentExponent_m0	uint8_t	Current Exponent Module 0
0x02	voltageExponent_m1	uint8_t	Voltage Exponent Module 1
0x03	currentExponent_m1	uint8_t	Current Exponent Module 1
0x04	voltageExponent_m2	uint8_t	Voltage Exponent Module 2
0x05	currentExponent_m2	uint8_t	Current Exponent Module 2
0x06	voltageExponent_m3	uint8_t	Voltage Exponent Module 3
0x07	currentExponent_m3	uint8_t	Current Exponent Module 3
0x08	voltageExponent_m4	uint8_t	Voltage Exponent Module 4
0x09	currentExponent_m4	uint8_t	Current Exponent Module 4
0x0A	voltageExponent_m5	uint8_t	Voltage Exponent Module 5
0x0B	currentExponent_m5	uint8_t	Current Exponent Module 5
0x0C	voltageExponent_m6	uint8_t	Voltage Exponent Module 6
0x0D	currentExponent_m6	uint8_t	Current Exponent Module 6

4.3.4.1.2 Power Switch

Byte[1] (Channel) Byte[0] (Switch command)

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Byte	**Name**	**Description**
Byte[0]	Switch command	0x00: Turn off converters selected in Byte[1] (Channel) 0x01: Turn on converters selected in Byte[1] (Channel)
Byte[1]	Channel	The Module Channel specifies the converter module to switch based on the "Switch Command" in Byte[0]. Refer to the "Data Mapping" section for module numbers and descriptions. • 0x00: Module 0 • 0x01: Module 1 • 0x02: Module 2 • ... • Byte[1] represents a bit mask where each bit corresponds to a module (bit 0 for Module 0, bit 1 for Module 1, and so on). • SeĒ ing a bit to 0: Ignores the converter channel (maintains the current state). • SeĒ ing a bit to 1: Turns the converter channel on or off, depending on the value in Byte[0]. <u>Example</u> Sending the command *0b01010101 00000010*: • Turns on Module 0, Module 2, Module 4, and Module 6. • Maintains the current state of Module 1, Module 3, Module 5, and Module 7.

<u>ADenĎon:</u> Changes to the \ENABLE and \INHIBIT lines will overwrite these seR ngs and revert them to their default values, depending on the \ENABLE and \INHIBIT pin signals.
The I2C Power Switch command is disabled by default in the system configuration. This feature is only activated upon customer request.
This feature is available from firmware version 4.0.7144.0.

4. Calculation for Measurement Values

The raw integer values need to be converted into a floating point datatype.
In order to calculate the real floating point value for a module voltage or current, use the following formula:

4.1 Voltage [V]:

4.2 Current [A]:

5. Timing

5.1 I2C™ BUS START/STOP BITS TIMING CHARACTERISTICS (SLAVE MODE)

5.2 I2C™ BUS DATA TIMING CHARACTERISTICS (SLAVE MODE)

5.3 I2C™ BUS DATA TIMING REQUIREMENTS (SLAVE MODE)

These parameters are characterized, but not tested in manufacturing.

AC CHARACTERISTICS		Standard Operating Conditions: 3.0V to 3.6V (unless otherwise stated) Operating temperature: -40°C ≤ TA ≤ +85°C for Industrial -40°C ≤ TA ≤ +125°C for Extended					
Param No.	Symbol	Characteristic		Min	Max	Units	Conditions
IS10	TLO:SCL	Clock Low Time	100 kHz mode	4.7	-	µs	
			400 kHz mode	1.3	-	µs	
IS11	THI:SCL	Clock High Time	100 kHz mode	4.0	-	µs	
			400 kHz mode	0.6	-	µs	
IS20	TF:SCL		100 kHz mode	-	300	ns	

		SDA and SCL Fall Time	400 kHz mode	20 + 0.1 CB	300	ns	CB is specified to be from 10 to 400pF
IS21	TR:SCL	SDA and SCL Rise Time	100 kHz mode	-	1000	ns	CB is specified to be from 10 to 400pF
			400 kHz mode	20 + 0.1 CB	300	ns	
IS25	TSU:DAT	Data Input Setup Time	100 kHz mode	250	-	ns	
			400 kHz mode	100	-	ns	
IS26	THD:DAT	Data Input Hold Time	100 kHz mode	0	-	ns	
			400 kHz mode	0	0.9	µs	
IS30	TSU:STA	Start Condition Setup Time	100 kHz mode	4.7	-	µs	Only relevant for Repeated Start condition
			400 kHz mode	0.6	-	µs	
IS31	THD:STA	Start Condition Hold Time	100 kHz mode	4.0	-	µs	After this period, the first clock pulse is generated
			400 kHz mode	0.6	-	µs	
IS33	TSU:STO	Stop Condition Setup Time	100 kHz mode	4.7	-	µs	
			400 kHz mode	0.6	-	µs	
IS34	THD:STO	Stop Condition Hold Time	100 kHz mode	4	-	µs	
			400 kHz mode	0.6	-	µs	
IS40	TAA:SCL	Output Valid From Clock	100 kHz mode	0	3500	ns	
			400 kHz mode	0	1000	ns	
IS45	TBF:SDA	Bus Free Time	100 kHz mode	4.7	-	µs	Time the bus must be free before a new transmission can start
			400 kHz mode	1.3	-	µs	
IS50	CB	Bus Capacitive Loading		-	400	pF	
IS51	TPGD	Pulse Gobbler Delay		65	390	ns	The typical value for this parameter is 130 ns.

2.11 User Software

MS Windows program with GUI to monitor and control VPX360DMA power supply via USB or I2C Note: USB device driver or I2C interface (e.g. Microchip ADM00559) are required.

Features include:

- Global status
- Remote On / Off
- DC-IN status and measured voltage and current
- 2 internal Temperatures
- Voltage, current and status of individual output power modules (all channels)
- Calibration / setup and diagnostics

Download VPX Tool 2.0.xxxx from hĒ p://file.wiener-d.com/software/VPX/