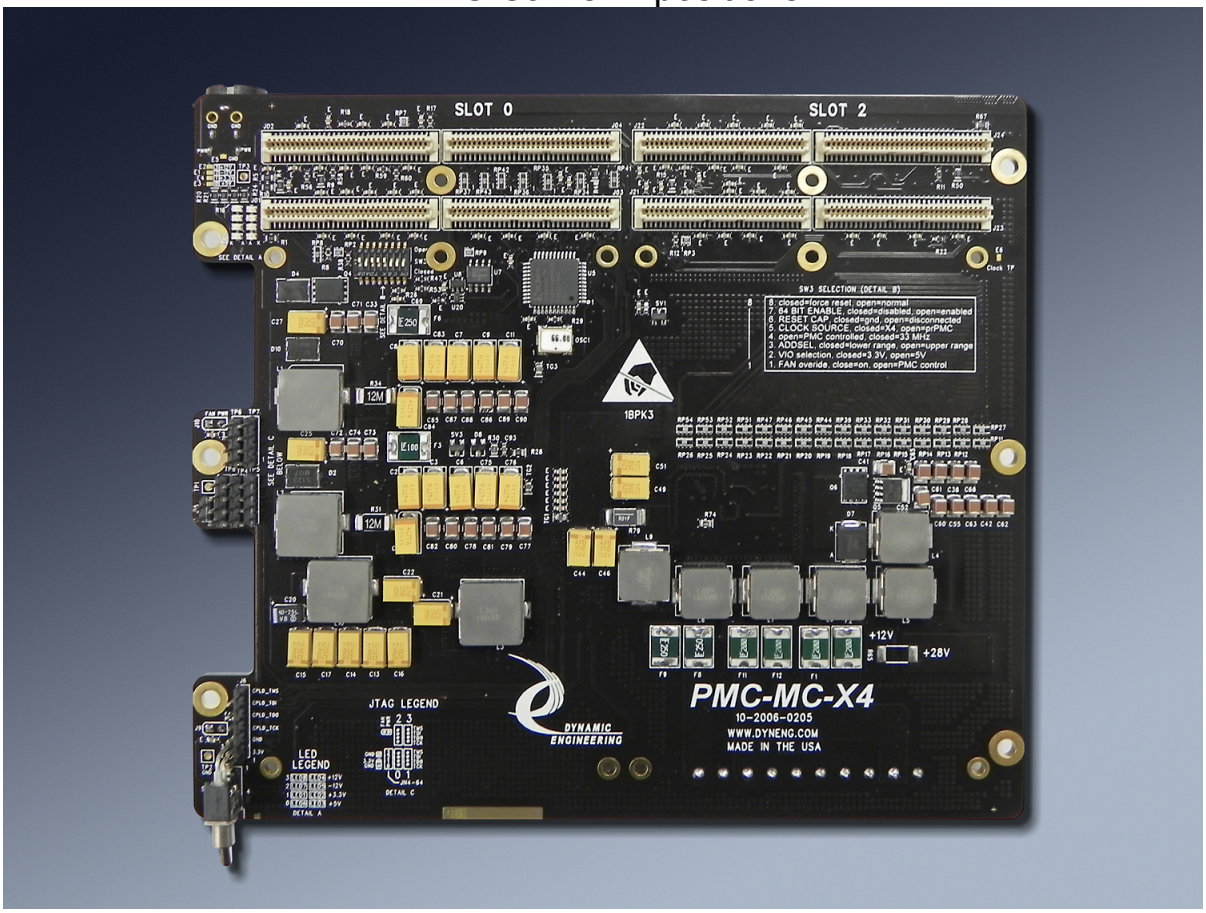
DYNAMIC ENGINEERING

150 DuBois St Suite C, Santa Cruz Ca 95060
831-457-8891 **Fax** 831-457-4793
http://www.dyneng.com
sales@dyneng.com
Est. 1988

User Manual

PMC-MC-X4

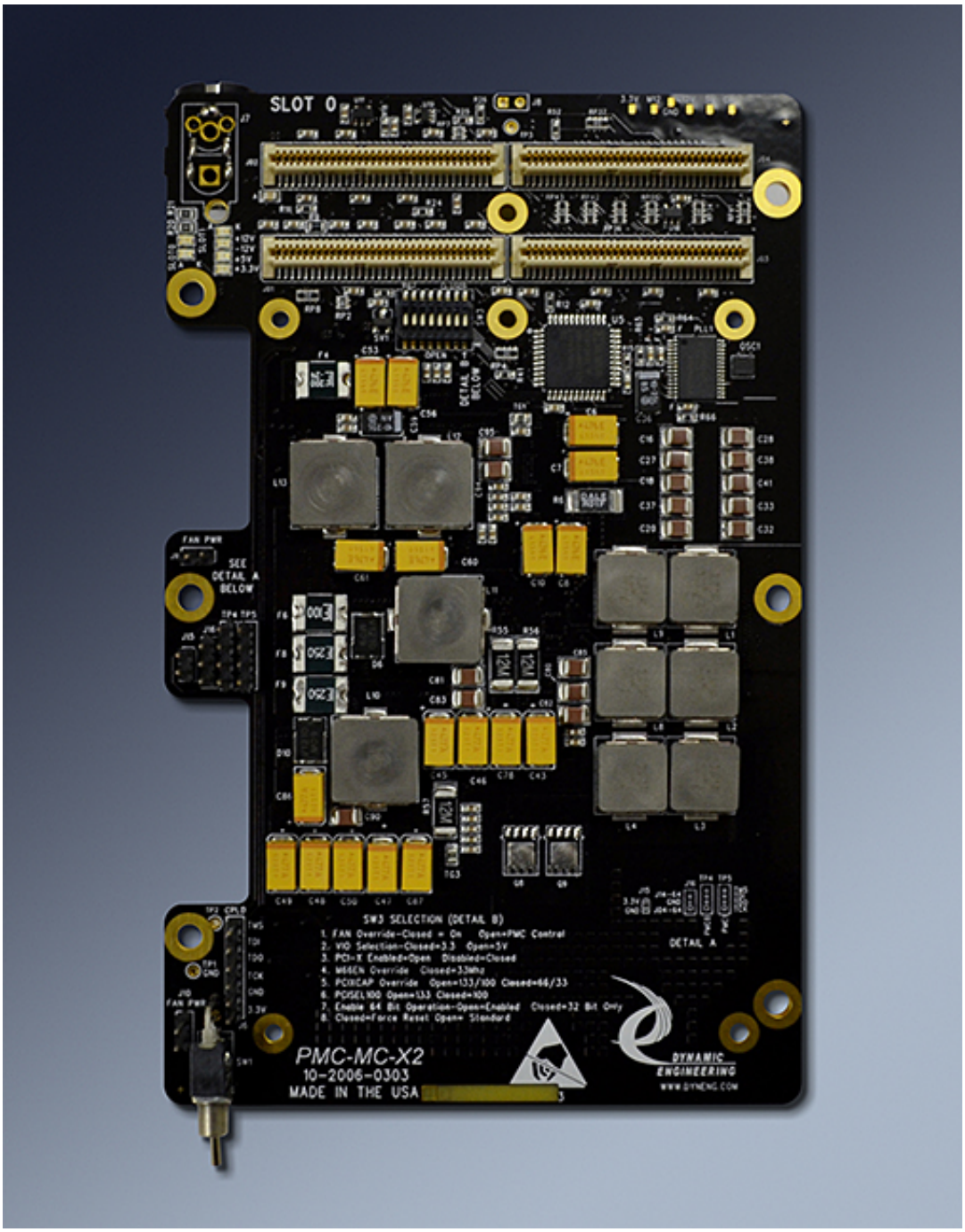
PMC Carrier 4 positions



10-2006-0210 X4 Rev J
Current Firmware: X4: RevB

PMC-MC-X2

PMC Carrier 2 positions



Corresponding Hardware:
10-2006-03 X2 Rev C
Current Firmware: X2 : RevC
Manual Revision J1

PMC-MC-X2
PMC-MC-X4
PMC Mini Carrier 2/4 Slots

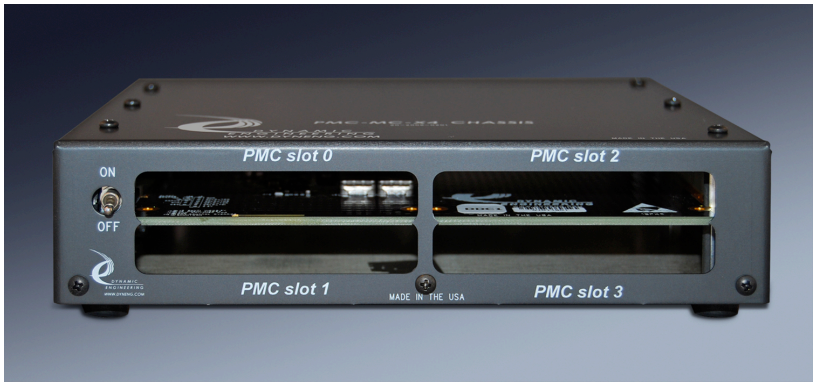
Dynamic Engineering
150 DuBois St. Suite C
Santa Cruz, CA 95060
831-457-8891
831-457-4793 FAX

Table of Contents

Product Description

High density packaging of your PMC's is accomplished with the "X2" and "X4" carrier designs. PMC-MC-X2 provides two PMC sites, and PMC-MC-X4 has 4. PMC-MC-X2 has one PMC card slot mounted top, and one on the bottom to create a compact arrangement with 2 PMC positions. PMC-MC-X4 has two PMC slots on the top, and two on the bottom.

A complete solution based on the Mini Carriers can be provided with the PMC-MC-X2 or PMC-MC-X4 chassis. The Dynamic Data Sheet for the chassis is located at http://www.dyneng.com/pmc_mc_x2x4_chassis.html



PMC-MC-X4 carrier mounted in X4 chassis.

Customer chassis solutions can be supported; the engineering kit contains dimensioned drawings of the X2 or X4.

The PCB and terminations are designed to support 32 and 64 bit operation. The trace lengths are designed to work with the layout concept, and matched to work with 33 or 66 MHz PCI rates. The clock rate is programmable with an on-board DIPSWITCH. For the PMC-MC-X2 the faster PCI-X rates are also available.

An external power supply [wall mount transformer or other] provides the reference voltage for the internal switching power supplies. +5, +3.3, and minus 12 are created with high efficiency industrial temp rated switching power supplies. The +12 is either derived from an external 14-40V "28V" supply with an additional switching power supply or comes from an external 12V supply. The default version is the 28V model. For the 12V option add "–12V" to the part number. Please note that the 40V figure is a hard limit. Derate based on reference supply noise/ripple level.

The power rails are filtered to provide quiet power to the PMC slots. 10A @5V, 10A @3.3V, 4A @-12V and 4A @12V are routed to the PMC positions. The PMC rails are

protected with “self healing” fuses. The reference supply will need sufficient wattage to handle the total load of the converted power taking into account the efficiency of the supplies.

Power entry to the carrier is accomplished with a PowerDin4 connector. The contacts are rated for 7.5A each for a total of 15A at the connector for 28V or 12V.

When operating with a +12V reference, the 3.3, 5V, -12V, and +12V at the PMC will be converted from this supply. With 15A available a total of 180W can be sourced. The +12V rail comes directly from the supply in this case so no efficiency losses at the supply. The other rails will have approximately 90% efficiency – higher at higher loads and lower at lower loads. With 8A @3.3, 9A @5V, 2A @-12 and 1A @+12V the load at the reference supply will be be 29.33W + 50W + 26.67W + 12W = 118W => 9.8A. 9.8 is less than the connector maximum of 15A. Please note that the fans used may be powered from the PMC-MC carrier and the power used will be part of this calculation. Also for exact power calculations the minor amount of power used for the CPLD and terminations would need to be taken into account.

With the 28V option the math is similar but more power is available for a given current due to the higher voltage. Using 24V : 2X the wattage – 360W would be able to be input to the chassis. In reality the 28:12V switcher is designed to source 15A which is sufficient to supply all of the internal power supplies to the maximum rating. The 28V option will reduce the amount of current supplied to the PMC-MC carrier which will reduce the wire size required and potentially allow for other interfacing options.

An Excel spread-sheet with the power calculations designed in is available. Fill in the blanks and see what your required current will be.

Arbitration is accomplished with a CPLD mounted to the card. Each of the slots Request signal is tied to the CPLD where the arbiter determines the current master and sets the Grant for that slot. Please see additional information in the switch setting section of this manual.

The CPLD and clock circuitry work together to provide 33/66 on the X4 and the standard PCI and PCI-X (up to 125)frequencies for the X2.

The PCI VIO is programmable allowing 5V or 3.3V PMC’s to be used. The voltage select pins are not installed on the PMC-MC-X2/X4. The positions are provided to allow for the keys to be installed by special request. Many PMC’s are "universal" and can work with 3.3 or 5V IO backplanes. The DIPSwitch is used to select 5V or 3V operation.

PMC-MC-X4 has an option to mount a secondary power connector. The secondary power connector has the input power plus the local power supply power plus grounds to allow other embedded equipment to use power from the X4 for operation. For example

if the X4 and another device are mounted within a chassis to form a complete end-point and the other equipment needs 5V, 3.3V, +/-12V or the input power to operate it can save a second power supply and allow a smaller chassis. One client is mounting a LASER along with a prPMC and local interface to the LASER within a small enclosure. The input power connection is made with the PowerDin4. The connector is a common option on “brick” power supplies. The X2 and X4 can be ordered with a 24V 7A supply for your convenience.

For an embedded solution, a wide range of buses is available for communication purposes. The buses can be tied directly to the processor [prPMC] or via installed PMC’s. For example Ethernet and serial ports are common on prPMC’s while SpaceWire, 1553 etc. usually require an installed PMC.

LED’s are provided on the 12V, 5V, 3.3V and –12V plus one for each PMC slot illuminated when a PMC is “present” in that slot. The LED’s are located after the fuses to show the PMC power is available. Revision A-E use resistors to limit the current to the LED. Revision F and later have voltage monitor circuits to detect under and over-voltage situations and illuminate the LED when the voltage is within the legal range. The window is set to 5% plus an allowance for parts tolerances.

An option on the X4 is the interconnection of the Pn4 “user IO” connectors. Matched length differential pairs can be selected using a resistor matrix located under slots 2 and 3. The signals are in groups of 4 allowing many combinations of connections for buses between the slots. All can be connected together or 2 of 3.

PMC-MC-X2 and -X4 are designed to allow two fans to be mounted within the cutouts on the side of the board. Power is available and power control from a user selected slot. Pin 55 on Pn4 can be used or the always on selection on the DIPSwitch set. Please select the slot requested or the always on option with the table at the end of the manual. 1.5A @ 5V is available in total for the two headers supplied. The total can be split between the headers or used from one.

With Revision F and later X4 models a separate power supply is provided to handle the 5V for the Fan load. The 5V is also used to provide power to a thermal switch. If the board level temperature exceeds the setpoint of the switch [SW1] the main power supply is shut-down until the temperature falls. The switch is set with hysteresis to prevent toggling when at the limit. The switch can be set to 70, 75, 80, or 85C. The standard value is 75C with 10C hysteresis. The power supply for the fans is separated to make sure the fans stay on when the temperature switch shuts down the main supply. This has the side affect of quieter 5V power to the PMC’s and more current available to the PMC’s since the fans are separately powered.

Proper cooling will be required with larger power loads to handle the power dissipated by the PMC's and the power supplies. The X2 and X4 chassis have built in fans to blow air across the PMC's and X2 or X4 carrier.

A JTAG connector is tied to each of the PMC slots to allow hardware programming while PMC's are installed if the PMC's use the JTAG pins. An additional control pin can be connected to support boards with multiple devices sharing the JTAG connections. Pin 64 on each of the PMC's can be connected to a header on the carrier. Slot 0 is always connected. Slots 1,2,3 are optional. Please select with the table at the end of the manual.

Product Details

The X2 and X4 are designed for a prPMC to be installed into slot 0. Slot 0 is the primary slot with the interrupts routed there for processing. Slot 0 is further supported with the ability to have a local secondary PCI address space decoded plus a local PCI interrupt, reference clock, reset and reset out.

The CPLD combines the PCI requests from all of the slots to generate the local Grant with a round robin style arbiter. The CPLD is reprogrammable with the JTAG connector to allow for customer "improvements".

DIPSwitch Definitions X2:

Switch	Signal
1	FAN override. C = Always on, O = CPU control or off
2	VIO Select C = 3.3, O = 5V
3	PCI-X En O = enabled C = Disabled
4	M66EN Override C = 33 MHz only O = PMC controlled
5	PCIXCAP Override C = 33/66 O = 133/100
6	PCISEL 100 C= 100, O = 133
7	64 Bit Enabled O = Enabled C = Disabled
8	Reset O = run, C = Reset

DIPSwitch Definitions X4:

Switch	Signal
1	FAN override. C = Always on, O = CPU control or off
2	VIO Select C = 3.3, O = 5V
3	Address Select O = UpperRange C = LowerRange
4	M66EN Override C = 33 MHz only O = PMC controlled
5	Clock Source Select O = prPMC Clock C = X4 [std]
6	Reset Cap O = disconnect, C = Connect
7	64 Bit Enabled O = Enabled C = Disabled
8	Reset O = run, C = Reset

C = Closed O = Open settings on DIPSwitch. C and O are shown in silk.

The CPLD accepts RESET-OUT from slot 0, power on reset signals based on the 3.3V and 5V power rails, and a DIPSwitch reset input to create the PCI RST signal. PCI RST is pull-ed up with 4.7K to VCC_IO. With Switch 6 on the X4 model a capacitor can be used to change the shape of the reset signal. Normally not needed, certain prPMC modules are sensitive to the reset line signal shape.

X4: A 66 MHz reference clock is provided to the CPLD along with the M66EN signal. The CPLD divides the 66 MHz to create 33 when M66EN is set to '0' by the DIPSwitch or an installed PMC device. E6 is a testpoint tied to the clock buffer and is located on the edge of the card for scope reference when PMC's are installed. E6 is located near Slot 2 on the side rail. The signal at E6 is not matched length or terminated in any way and may not be as clean as the matched length, terminated clock lines used at the PMC slots.

On the X4, the DIPSwitch selects the source for the clock buffer. The CPLD with automatic or DIPSwitch selection can be used or a clock output from Slot 0. The clock is buffered and re-driven to the other slots. The clock lines are equal length. With revision B and later FLASH installed on revision F and later X4 Fab's, the clock selection also selects the remote or standard mode of operation.

In standard mode the local clock is used and the CPLD performs the arbitration for the PMC's and supplies reset etc.

When remote mode is selected it is expected that an extension cable is in use [PMC Extendio II or similar] along with an external host – the X4 is an expansion chassis in this configuration. The external clock is distributed instead of the local one. The arbitration is modified to use the PMC positions 1,2,3 to arbitrate locally with the request from position 0 used to ask the host for the bus and the grant from the host used to allow the local PMC's access to the bus. In addition the reset and other house keeping functions responsibilities are passed to the remote host.

The remote configuration has been tested with the PCIeBPMCX1 and PCIBPMC. Multiple PMC's running DMA in parallel were used for the main test. The length of the expansion cable will be determined by the characteristics of the cable. It is recommended to use a bridged interface within the host computer to reduce the apparent length before the cable.

With 12" cables up to two PMC's can be installed and operate as targets – that is without DMA. With the 4/6" cable set up to two PMC's can be installed using DMA.

On the X2 the DIPswitch and PMC signals are used with the CPLD to control a PCI clock PLL. The combination allows the standard PCI and PCI-X frequencies to be generated. **Please note**: *100 MHz is the fastest "supported" frequency.* The CPLD is guaranteed at 125 Mhz. 133 is an "over-drive" option and should only be used at room temperatures. E1 is available for checking the frequency selected. The signal at E1 is not matched length or terminated in any way and may not be as clean as the matched length, terminated clock lines used at the PMC slots.

J6[X2,X4] CPLD JTAG

1. 3.3V
2. GND
3. TCK
4. TDO
5. TDI
6. TMS

TP4 Slot 0 JTAG TP5 Slot 1 JTAG TP6 Slot 2 JTAG TP7 Slot 3 JTAG
1 – TCK
2 – TDO
3 – TDI
4 – TMS

J15 is supplied with pin 1 = 3.3V and 2 – GND to reference the JTAG programmer in use. The JTAG connections are routed to the JTAG pins on the individual PMC slots.

VIO is selected with the DIPSwitch. VIO is 3.3 when the switch(2) is closed and 5V with it open.

SW2 is the power switch. With the adapter plugged in [J5] and "turned on" the switch can be used to supply power to the board. All voltages are controlled with the single switch. Up is on and down is off. J5 is a PowerDin4 connector with a 15A rating.

IDSEL, INTA, B, C, D, REQ/GNT 0..3 are routed with the convention of Slot 0,1,2,3 for the order of precedence.

SLOT 0	0B	1	2	3
INTA		INTB	INTC	INTD
INTB		INTC	INTD	INTA
INTC		INTD	INTA	INTB
INTD		INTA	INTB	INTC
REQ0	REQ0B	REQ1	REQ2	REQ3
GNT0	GNT0B	GNT1	GNT2	GNT3
	A16/A20	A17/A21	A18/A22	A19/A23

On the X4 the Address Select DIPSwitch(3) can be used to choose the range 16-19 or 20-23 for the addresses used for IDSEL. The X2 has the same options but implemented with fixed resistors. The upper range is standard on the X2.

INTA on Slot 0 is connected to INTB on slot 1 and INTC on slot 2 and INT D on slot 3 etc. Slot 0B is the secondary PCI accessible port on Slot 0 as defined in the prPMC specification. Slots 2,3 are only present on the X4 model.

Pn4 pin 55 on each slot is tied via a resistor to a transistor pair used to control 5V to external fans (if used). Slot 0 is the default slot to be connected to the power switch. When the control signal is high the fan is on. If your PMC's do not have the ability to control this signal the DIPSWITCH can be used to turn the fans on at all times. 1.5A at 5V is the switch rating. J9 and J10 are the headers used to connect to the fan(s). Pin 2 = GND, and 1 = 5V when enabled.

Pn4 pin 64 on each slot is tied to a header to allow for inter-board communication or for external events to be connected. The header can also be used to control which device is programmed when PMC's have multiple JTAG devices to program. This feature is primarily to support the PMC-XM. Please use the table at the end of the manual to make your selections [if any].

X4	X2
Slot 0 – TP8-1	Slot 0 – J16 - 1
Slot 1 – TP8-2	Slot 1 – J16 - 3
Slot 2 – TP8-3	GND - J16 - 2
Slot 3 – TP8-4	

The X4 supports the interconnection of the Pn4 "user IO" connectors. The option is accomplished by routing with matched length differential pairs from each of the Pn4 connectors for slots 1-3 to a common location where resistor jumpers can be installed.

The resistors are located in close proximity to make a no stub connection for connectors not selected. The signals are routed as differential pairs using the Dynamic Engineering standard for PMC differential pairs. The pairs are matched, paired, spaced, and referenced to allow high-speed connections. Single ended signals can be used without issue. The resistors are 4 to a pack meaning that each connector has 16 options to install or not. The table at the end of this manual can be used to select the connections between the slots that you want.

P1 is an optional connector installed ["**-OBP**"], to allow the internal Power Supplies to be used for external devices – for example: additional equipment mounted in a common enclosure. With Revision J An OnShore connector [OSTOQ0815(0,5,6,8)1(2)] is mounted to the board. With revision J the outline of the connector is smaller allowing it to be relocated outside of the PMC footprint. All 4 PMC positions can be used. OSTTJ0811(0,5,6,8)20 is the mate [cable side] connector. () show options in the PN. () with only one number means the option can be deleted all-together.

Pins 1,3,5,7 are ground
Pin 2 = -12V
Pin 4 = 3.3V
Pin 6 = 5V
Pin 8 = 12V

Additional Notes: The voltages are fused at the power supplies, the load added at P2 is part of the load supplied by the internal power supplies. The total power delivered must stay within the operating range for each supply and in the aggregate.

The standard PowerDin4 connector is pinned out with 1,4 = VREF [28V typical], and 2,3 Ground => standard PowerDin4 connector definitions. The mounting pins and shield are also tied to Ground on the board. Applies to X2 and X4.

The X4 revision F or later boards have an option for a vertical power connector [**-VPI**]. The PowerDin4 connector is not installed and a Molex 15-31-1026 is installed instead for new production boards. Product Change Order boards may have both present. Be sure to specify if you do not want the PowerDin4 connector. Pin1 is +28 and Pin2 is ground. This connector has 12A 600V rated contacts.

Interfacing

Some general interfacing guidelines are presented below. Do not hesitate to contact the factory if you need more assistance.

ESD

Proper ESD handling procedures must be followed when handling the PMC-MC-X2/X4. The card is shipped in an anti-static, shielded bag. The card should remain in the bag until ready for use. When installing the card the installer must be properly grounded and the hardware should be on an anti-static work-station.

Watch the system grounds. All electrically connected equipment should have a fail-safe common ground that is large enough to handle all current loads without affecting noise immunity. Power supplies and power consuming loads should all have their own ground wires back to a common point.

Within the PMC-MC-X2/X4 the power switch, and single source [12V/28V] power accomplish common timing and ground. External connections to the PMC's may damage the PMC's if the installed hardware is not rated for hot insertion. Please consult the PMC manufacturers documentation for the specifics on your system.

Construction and Reliability

PMC Modules were conceived and engineered for rugged industrial environments. The PMC-MC-X2 is .130" and the X4 is constructed out of 0.090" inch thick high temp FR4 material.

Surface-mount components are used. The PMC connectors are rated at 1 Amp per pin, 100 insertion cycles minimum. These connectors make consistent, correct insertion easy and reliable.

The PMC is secured against the carrier with four screws attached to the 2 stand-offs and 2 locations on the front panel. The four screws provide significant protection against shock, vibration, and incomplete insertion. Please note that special standoffs are required to mount the PMC's due to the common hole from front to rear side. The supplied mounting hardware includes the required attachment devices.

Thermal Considerations

The PMC-MC-X2/X4 design consists of CMOS circuits. The power dissipation due to internal circuitry is very low. It is possible to create higher power dissipation requirements with the installed PMC's.

With the PMC-MC-X2/X4 typically mounted within a small enclosure and using a potentially high powered prPMC the use of fans within the chassis is recommended.

Warranty and Repair

Please refer to the warranty page on our website for the current warranty offered and options.
http://www.dyneng.com/warranty.html

Service Policy

Before returning a product for repair, verify as well as possible that the suspected unit is at fault. Then call the Customer Service Department for a RETURN MATERIAL AUTHORIZATION (RMA) number. Carefully package the unit, in the original shipping carton if this is available, and ship prepaid and insured with the RMA number clearly written on the outside of the package. Include a return address and the telephone number of a technical contact. For out-of-warranty repairs, a purchase order for repair charges must accompany the return. Dynamic Engineering will not be responsible for damages due to improper packaging of returned items. For service on Dynamic Engineering Products not purchased directly from Dynamic Engineering contact your reseller. Products returned to Dynamic Engineering for repair by other than the original customer will be treated as out-of-warranty.

Out of Warranty Repairs

Out of warranty repairs will be billed on a material and labor basis. Customer approval will be obtained before repairing any item if the repair charges will exceed one half of the quantity one list price for that unit. Return transportation and insurance will be billed as part of the repair and is in addition to the minimum charge.

For Service Contact:

Customer Service Department
Dynamic Engineering
150 DuBois St. Suite C
Santa Cruz, CA 95060
831-457-8891
831-457-4793 fax
support@dyneng.com

Specifications

Interface:	32/64 -bit PCI bus routed to PMC sites
Clock rates supported:	X4: 33/66 MHz X2: 25/33/50/66/100/(133 see limitations) MHz
Software Interface:	No SW required for X2/X4 operation. prPMC and installed PMC's determine SW interface for system.
PMC Positions:	X4: 1-4 X2: 1-2
Initialization:	Hardware reset based on 3.3 and 5V valid plus ~200 mS delay. Software reset via "Reset OUT" signal on Slot 0
Access Modes:	All PCI modes supported by prPMC installed in Slot 0. Remote mode available on X4 model.
Interrupt:	Interrupts routed to each slot with standard rotating assignment.
IDSEL:	AD20-23 or AD16-19 – DIPSWITCH select X4, Resistor select X2
Dimensions:	X2 – slightly larger than two Single PMC Modules stacked. X4 – slightly larger than two PMC's side by side and stacked Dimensioned drawings available as part of engineering kit.
Construction:	High temp FR4 Multi-Layer Printed Circuit, Surface Mount Components
Power:	12V/28V in. 5V(10A), 3.3V(10A), +12(4A), -12(4A) supplied to PMC slots. Self healing fuses. LED's on rails with UV and OV checking.
User	PCI clock speed select, PCI VIO select, Clock source select, Manual Reset, Fan Power Control over-ride, 64 bit enable.

Order Information

PMC-MC-X2	http://www.dyneng.com/pmc_mc_x2.html Standard version (28V) with two PMC positions.
PMC-MC-X4	http://www.dyneng.com/pmc_mc_x4.html Standard version (28V) with four PMC positions.
PMC-MC-X2-12	Standard version with 12V power supply option
PMC-MC-X4-12	Standard version with 12V power supply option
PMC-MC-X4-Pn4XX	Part number assigned for customer specific Pn4 bus routing. Please see the following table to define your interconnections.
-ROHS	Add ROHS processing. Standard is with leaded solder.
-CC	Add conformal Coating
-LA	Use lower address range [X2 only]
-VPI	Use Vertical Power connector instead of PowerDin4 – X4 model only.
-OBP	Add Power Expansion right angle connector. Brings +/- 12, 5 and 3V to a convenient connector for in chassis power for additional HW.
-FPR	Move fan headers to rear of X2/X4. Standard is mounted to Slot 0 side, -FPR moves to Slot 1 side. For custom chassis.
-NPS	Remove Power Switch for always on operation.

Please note that options can be mixed, -12 and –Pn4 can both be selected.

Detailed dimensions etc. available with NDA

Pn4 Interconnection Selection Table

Please fill out the table by circling the requested connections, scan and send to Dynamic Engineering sales@dyneng.com. A part number will be assigned for your configuration to allow PO order control. Applies to X4 only.

Pin Groups	Slot 0	Slot 1	Slot 2	Slot 3
1,3,2,4	-	A	A	A
5,7,6,8	-	B	B	B
9,11,10,12	-	C	C	C
13,15,14,16	-	D	D	D
17,19,18,20	-	E	E	E
21,23,22,24	-	F	F	F
25,27,26,28	-	G	G	G
29,31,30,32	-	H	H	H
33,35,34,36	-	I	I	I
37,39,38,40	-	J	J	J
41,43,42,44	-	K	K	K
45,47,46,48	-	L	L	L
49,51,50,52	-	M	M	M
53,55,54,56	-	N	N	N
57,59.58,60	-	O	O	O
61,63,62,64	-	P	P	P
55	FC	FC	FC	FC
64	PC	PC	PC	PC

Pins 1,3 and 2,4 etc. are routed differentially. The signals are matched length for each connector to form matched length pairs between any of the connectors. At least two of the same group have to be selected to form a connection between the slots for those pin pairs.

Two pins have a dual functions: Fan and Programming Control. Usually slot 0 will be selected, or the DIPSWITCH used for the Fan Control. The Programming control selection ties pin 64 to a JTAG header on an independent pin to support the PMC MC XM. For non XM slots or for cards without this programming option pin 64 can be used as part of the interconnection bus. Please note that Slot 0 is hardwired for this option.