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PMC665 Intelligent Dual ETHERNET Interface Card
Hardware Reference
and
Installation Manual

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Preface

Purpose

This manual describes the design and operational features of the PMC665 Intelligent Dual Ethernet card, as well as installation procedures for attaching the card on a host Single Board Computer (SBC).

Audience

This manual is intended to guide installation, configuration and maintenance of the Ethernet Switch product.

The information in this manual has been carefully reviewed and is believed to be entirely accurate. However, **RAMiX** shall not be liable nor responsible for errors contained herein.

RAMiX reserves all rights to make any changes to improve the reliability, function or design, without any notice.

Conventions

This manual uses the following conventions:

Convention	Meaning
Return	Press the key that executes commands or terminates a sequence. This key is labeled Return or Enter depending on your keyboard.
<CTRL> X	While you hold down the Ctrl key, press any other key. RAMiX monitor commands are case sensitive. You must enter commands in the correct case, as printed in the text.
Courier type	Indicates examples of system output or user input.
Italics	In commands and examples, *italics* indicate a value (e.g., the name of a file) that you should supply.
[ ]	Square brackets in command descriptions enclose the optional command qualifiers. Do not type the brackets when entering information enclosed in the brackets.
|	A vertical bar in command descriptions indicates that you have a choice between two or more entries. Select one entry unless the entries are optional.
{ }	Braces indicate that you are required to specify one (and only one) of the enclosed options. Do not type the braces when you enter the command.
( )	Parentheses enclose a set of options that must be specified together.
0xNNNN	Hexadecimal values are indicated with the 0x prefix.

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1 General Information

1.1 Introduction

This manual describes operation, configuration and installation instructions for the **RAMiX,** PMC665 PMC Module. The PMC665 is an Intelligent Dual Ethernet interface card, offering two, fully independent 100 Mbit Ethernet channels using multi mode Fiber media (100BaseFx). Designed to be plugged onto a host processor (e.g., Single Board Computer) board, the PMC665 provides an extremely compact, economical high performance Ethernet solution. Incorporating an on-module I/O co-processor, the PMC665 allows off-loading of the host processor of high over tasks.

1.2 Features

The PMC665 complies with the CMC specification for PCI Mezzanine Cards (commonly known as PMC). As such, it will directly connect to any Single Board Computer (SBC), or Expansion Card that supports PMC modules. All initialization and functional configuration of the PMC665 is done automatically by software. Features implemented on the PMC665 include:

- Two, independent 100Mbit Ethernet controllers drive separate multi mode Fiber connections
- Full duplex operation is supported
- Automatic power up configuration per PCI specification
- On module I/O co-processor with local instruction and data store allows the PMC665 to present application specific functional support such as:
    - High performance Point-to-Point data mover, separate from standard network protocol stack
    - Fault tolerant data monitoring

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2 Hardware Installation

2.1 Introduction

This chapter provides unpacking, hardware preparation, and installation procedures for the PMC665 module.

2.2 Unpacking Instructions

RAMiX boards are protected by an anti-static envelope and/or wrapping. Observe anti-static precautions and work at an approved anti-static workstation when unpacking the board

Note: The PMC665 is shipped in an individual, reusable shipping box. When you receive the shipping container, inspect it for any evidence of physical damage. If the container is damaged, request that the carrier's agent be present during unpacking and inspection of the unit.

Unpack the PMC665 module from shipping carton. Check to verify that all items are present by referring to the packing list.

2.2.1 Included Items

Each PMC665 is shipped with the following items:

- PMC665 PMC Assembly

2.3 Handling

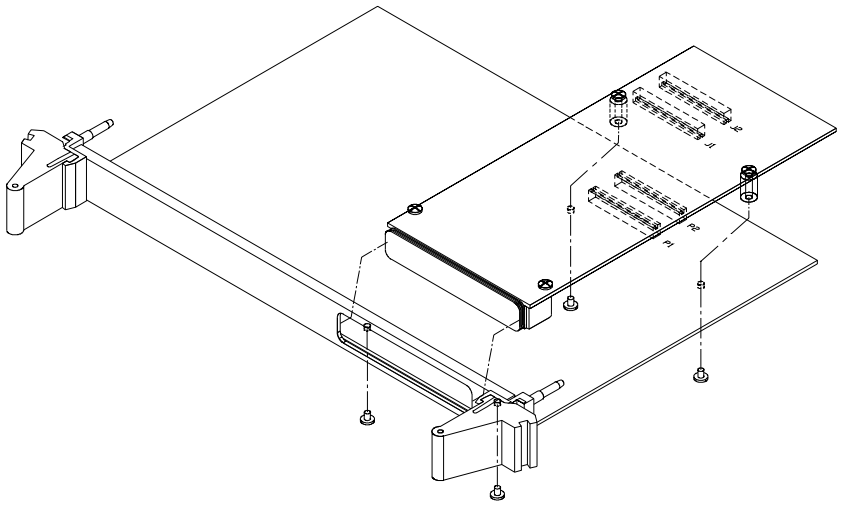
Electronic assemblies use devices that are sensitive to static discharge; this applies to both the PMC665 and the host board on to which it will be mounted. Observe anti-static procedures when handling these boards. The PMC665 should be in an anti-static plastic bag or conductive foam for storage or shipment.

2.4 PMC665 Installation

The PMC665 Module is now ready for installation. Turn all system power off. Remove the host board from the chassis (if currently installed). Locate the PMC connectors on the host board. Carefully plug the PMC665 into the mating connectors on the host's printed circuit board. Be sure

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module is seated properly into CMC connectors on the host. Use screws to fasten module into host PCB.



1. Remove the four screws from bottom of the stand-offs of the PMC665.
2. Line-up the J1 and J2 on the host PCB to PMC665, J1 & J2.
3. Push the PMC665 down (make sure the connectors J1 and J2 are positioned properly).
4. Use the four screws to connect the PMC665 stand offs to the host PCB.

2.5 Connection to the Local Network Media

The PMC665 has two fiber transceiver connections on the front panel, one for each Ethernet channel. Connection is made using industry standard fiber cables.

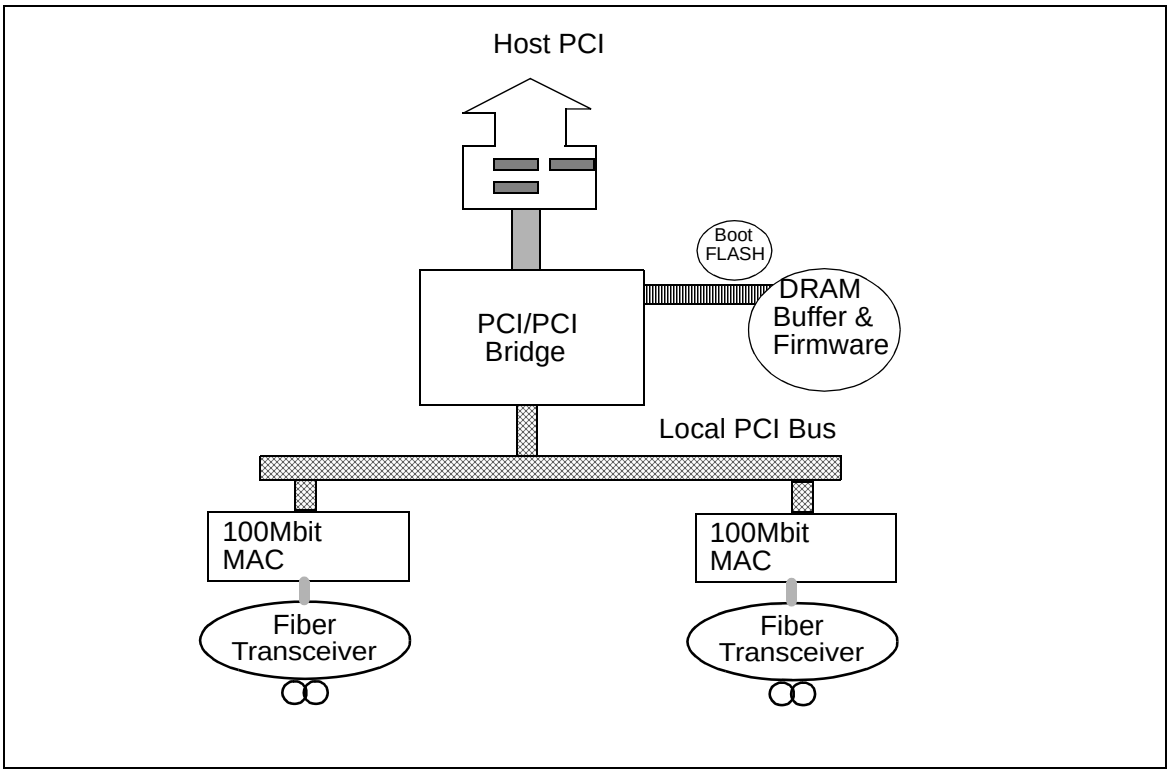
2.6 POINT to POINT Operation

Two PMC665 modules may be connected “back to back” for direct connection using standard Fiber cabling.

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3 PMC665 Architecture

The PMC665 is a complete I/O subsystem, illustrated in the block diagram below:



3.0.1 PMC665 Subsystems

At the functional center of the PMC665 is the integrated bridge/Co-processor unit. Combining the bridge and co-processor creates a high bandwidth, low latency integration between the computational capabilities of the co-processor and the data flow of the bridge.

3.0.2 Transaction Isolation

There are three, independent busses contained on the PMC665: Host PCI bus, Secondary PCI bus and Local co-processor bus. Data can flow between any pair; transactions have no affect on traffic on the third bus. Thus, control and data flow between the Co-processor and local memory system will consume no bandwidth on the Host PCI. It is this isolation that allows the PMC665 to perform arbitrary manipulation, filter, etc., of data from the Ethernet, without compromising the host system performance. The Co-processor/Bridge controller contains DMA engines, with FIFO buffers to each of the busses. This is a critical factor, as the actual (opposed to theoretical) bandwidth of a PCI bus decreases dramatically without burst (and relatively long burst) transfers.

3.0.3 Co-processor

The co-processor is an Intel i960 RISC CPU. The i960 architecture excels at data movement and control, exactly the requirements of an I/O co-processor. Highly integrated, the i960 conforms quite closely to the generic RISC architecture definition: single cycle instruction execution, multiple

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registers, load/store memory access, etc. In addition, the i960 features a “register stack” mechanism that maintains initial interrupt response on chip, which improves performance and determinism.

The co-processor can initiate all transaction types on each of the three buses.

Included in the bridge/co-processor are the DMA engines (described earlier), several counter/ timers to support time based event activity of the firmware and an interrupt multiplexer/handler for responding to the Ethernet controllers. Both register and message based interfaces to the host processor are available, allowing support of a variety of control paradigms. This greatly simplifies integrating the PMC665 into some existing software environments, while preserving the ability to develop higher performance complex message based controls.

Integrating the processor and bridge has the useful side effect of exposing most of the control logic to the host processor (mapped into the PCI Configuration space and optionally the memory space of the host). This creates the option for a continuum of control distribution, between the host and co-processor. The PMC665 can be configured such that the:

- bridge/co-processor functions primarily as a bridge, with control local to the host
- with one Ethernet under control of the host, the other by the co-processor or
- with all low level control resident in the co-processor

How the PMC665 responds to PCI configuration requests from the host can be altered by on-board firmware. Upon power-up (or reset), the on-board processor performs a Built-In-Test (BIT) sequence of the internal (Bridge/co-processor) operation, local memory subsystem and Ethernet controllers. Results are available to the host via configuration registers. During the BIT, the co-processor loads firmware from the FLASH device. It is this firmware that controls how the PMC665 behaves in relationship to the host and the Ethernet interfaces. The on-board FLASH is 512Kbytes; 128Kbyte is reserved for customer-specific configuration parameters. It is possible to update the FLASH contents either from the host, or (with appropriate on-board firmware loaded) over the Ethernet.

The switch is set at the factory for different modes of operations: with processor enabled or disabled. If enabled, the processor will load firmware from on card flash and begin execution. If Disabled, the processor will be held in reset. In this condition the PCI bridge functions remain operational, the PMC665 can be treated as an unintelligent dual network card.

3.0.4 Ethernet Controllers

The Ethernet Controllers on the PMC665 have enjoyed several years of active evolution, featuring improvements at both the PCI bus and Ethernet interface. Each controller is a fully independent unit, with local FIFO buffers to decouple PCI and Ethernet activity. Decoupling the Ethernet and PCI ensures that data transfers will meet the timing requirements of each transaction (which is of particular importance on the Ethernet) regardless of the loading on the other bus interface. These FIFO buffers are sufficiently deep to support good burst transfers and presenting minimum overhead to the PCI bus. When doing data transfer on the PCI bus the Ethernet DMA engine will attempt to maximize the length of burst transactions, which is critical to obtain the potential bandwidth of the PCI protocol. These properties allow sustained full bandwidth transfers on both Ethernet ports.

3.0.5 Fiber Connections

The PMC665 uses two Dual Transceivers with SC style connectors, and PMC665A uses the ST style connectors. The Transceivers are fully compliant with the standards defined by the Feast

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Ethernet Alliance for 100 Base-FX (which is identical to the FDDI PMD standard - ANSI X.3.166). The Transceivers are rated for 2000 meter multi-mode fiber cabling.

3.0.6 Control and Data Flow

From the description of the Bridge/co-processor, it will be apparent that control of the Ethernet interfaces can be either by the host, or the co-processor. This decision can be made on a per-interface basis. When control is resident in the co-processor, the Ethernet interface is not detected (or accessible) to the host processor. Data can be transferred between the Ethernet interface and either the local DRAM buffer or the host PCI bus. Which is appropriate depends upon the functional requirements to be implemented by the firmware. Allowing data to move directly from host PCI (and by inference the host memory system) to the Ethernet can reduce transfer latencies.

Note: (Direct data transfer is not a requirement for sustaining maximum performance. The 100+ Mbytes per second bandwidth of each of the busses on the PMC665*, combined with their independent operation provides substantial margin in store (filter) and forward operations. Thus, implementing sophisticated translation, filtering response or fail-over with the co-processor does not compromise full Ethernet performance).*

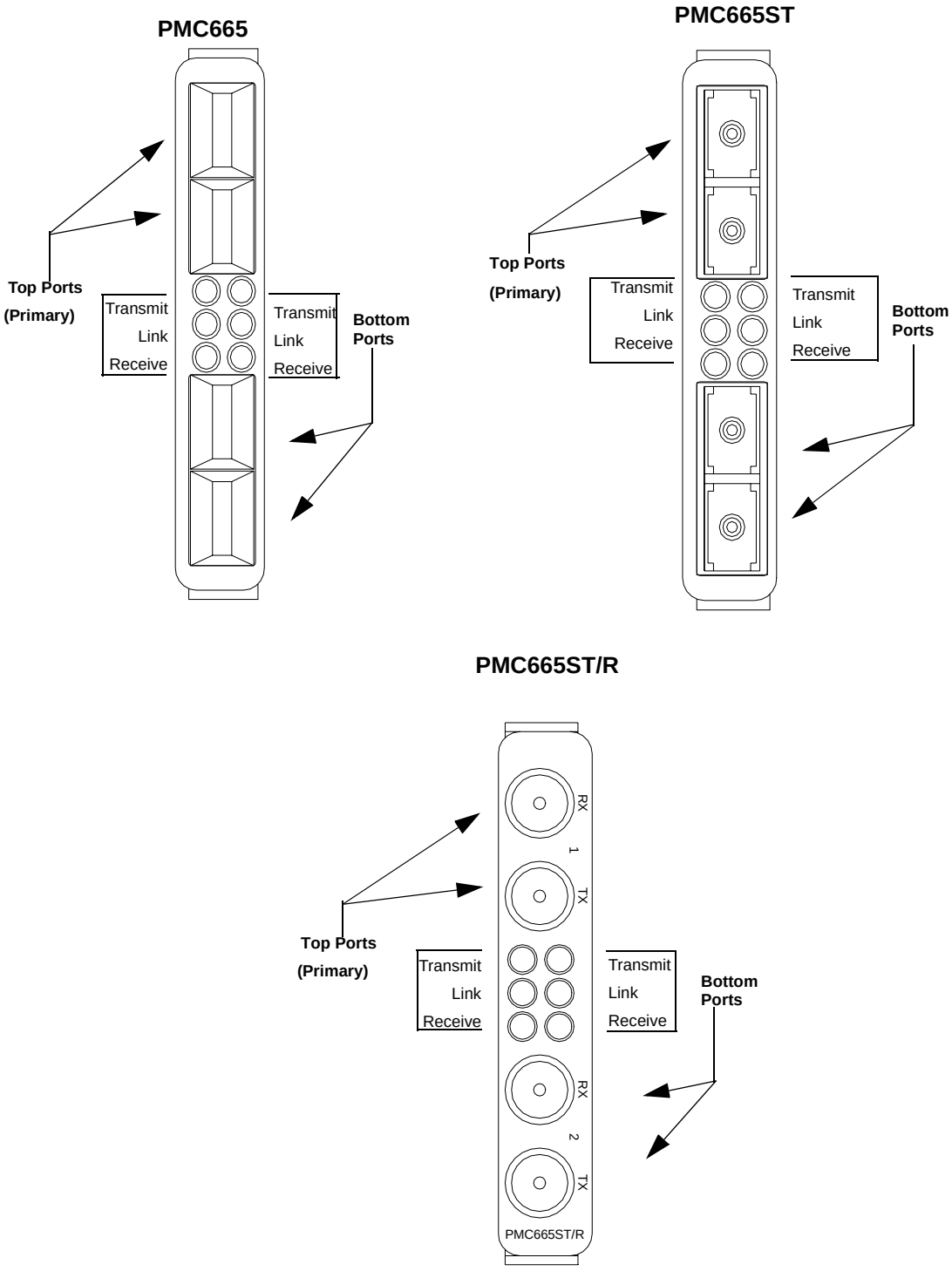
3.1 Switch Control (SW1)

SW1 controls the initialization status of the on-card processor. It should **not** be altered from the factory default which will have been set appropriatly for the ordered configuration. (Processor Enabled if firmware was specified, Disabled if no firmware was specified)

Switch Number	Enable Processor	Disable Processor
1	Open	Open
2	Open	Open
3	Open	CLOSED
4	Open	CLOSED

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4 Front Panel Indicators



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5 Specifications

5.1 General

5.1.1 General specifications for PMC665 are listed below.

CHARACTERISTICS	SPECIFICATIONS
100 Mbit Fiber Ethernet	100BaseFx
Connector Dual SC Package	ANSI X.3166-1990
Compatibility	IEEE1386, IEEE802.3, ANSI 8802-3
Interface	PCI Revision 2.1
Size	IEEE1386, Standard Single PMC
Drivers	VxWorks,pSOS,Lynx, Digital UNIX, Windows NT. (Contact **RAMiX** for additional software support information)
Temperature	
Operating	0°C to 60°C
Storage	-40°C to 85°C
Power Requirements	
Power Max.	1.5A @ 3.3V, typical 1.3A @ 3.3V
Power Max.	300mA @ 5V, typical 210mA @ 5V

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