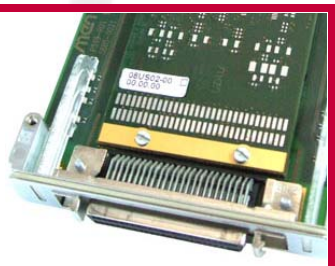
User Manual

P512 – Reflective Memory PMC



P512 - Reflective Memory PMC

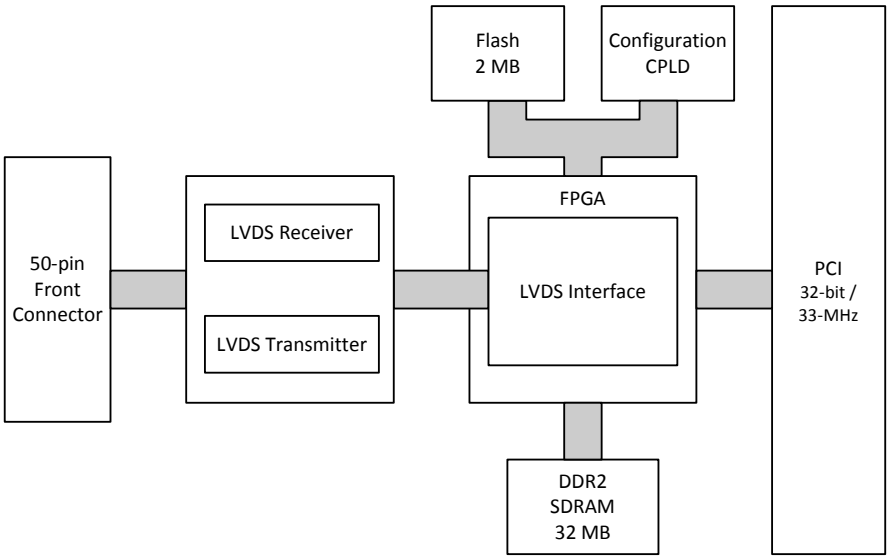
The P512 offers Reflective Memory functionality, for example for redundant computer structures in safety-critical applications. Reflective memory is a memory bus technology from Encore Computer that allows simultaneous reads and writes to multiple memories. It can be used to share memory among multiple CPUs. The advantage of reflective memory is the possibility to set up deterministic real-time communication networks across computer systems and operating systems.

Each P512 module offers one LVDS channel. The modules can be interconnected in a fully connected mesh and support multi-mode up to two meters. Each computer in a system needs one PMC for each connection to another computer (2 computers: 1 PMC each, 3 computers: 2 PMCs each etc).

The module is equipped with 32 MB DDR2 DRAM.

The P512 is a PMC mezzanine card suitable for any PMC compliant host carrier board in any type of bus system, i.e. CPCI, VME or on any type of stand-alone SBC in telecommunication, industrial, medical, transportation or aerospace applications. It supports 32 bits/33 MHz. Appropriate PMC carrier cards in 3U, 6U and other formats are available from MEN or other manufacturers.

Diagram


Flash
2 MB
Configuration
CPLD
FPGA
LVDS Receiver
LVDS Transmitter
LVDS Interface
50-pin
Front
Connector
PCI
32-bit /
33-MHz
DDR2
SDRAM
32 MB

Technical Data

Reflective memory

- 1 LVDS channel
- Usable in fully connected mesh
- Multi-mode up to 2 meters
- Connection speed 230 MHz
  - PCI to LVDS TX write performance (burst): 28.52 MB/s
  - PCI to LVDS TX write performance (longword single): 15.89 MB/s
  - DMA from PCI to LVDS TX performance (burst): 20.81 MB/s

Memory

- 32MB SDRAM memory
  - Soldered
  - DDR2
  - 132MHz memory bus frequency
  - FPGA-controlled
- 2MB non-volatile Flash
  - For FPGA data
  - FPGA-controlled
- Access to LVDS RX/TX memory
  - PCI to RX/TX memory write performance (burst): 107.43 MB/s
  - PCI to RX/TX memory read performance (burst): 99.16 MB/s
  - PCI to RX/TX memory write performance (longword): 15.89 MB/s
  - PCI to RX/TX memory read performance (longword): 5.37 MB/s

PMC Characteristics (PCI)

- Compliant with PCI Specification 2.2
- 32-bit/33-MHz, 3.3V V(I/O)
- Target

Peripheral Connections

- Via front panel on a shielded 50-pin HP D-Sub SCSI 2 receptacle connector

Electrical Specifications

- Supply voltage/power consumption:
  - +5V (-3%/+5%), 109mA
  - +3.3V (-5%/+5%), 143mA

Mechanical Specifications

- Dimensions: conforming to IEEE 1386.1
- Weight: 78g

Environmental Specifications

- Temperature range (operation):
  - -40..+85°C (qualified components)
  - Airflow: min. 1.0m/s
- Temperature range (storage): -40..+85°C
- Relative humidity (operation): max. 95% non-condensing
- Relative humidity (storage): max. 95% non-condensing
- Altitude: -300m to + 3,000m
- Shock: 15g/11ms
- Bump: 10g/16ms
- Vibration (sinusoidal): 1g/10..150Hz
- Conformal coating on request

MTBF

- 1 434 674 h @ 40°C according to IEC/TR 62380 (RDF 2000)

Safety

- PCB manufactured with a flammability rating of 94V-0 by UL recognized manufacturers

EMC

- Conforming to EN 55022 (radio disturbance), IEC1000-4-2 (ESD) and IEC1000-4-4 (burst)

Software Support

- MDIS™ driver

Product Safety

Electrostatic Discharge (ESD)

Computer boards and components contain electrostatic sensitive devices. Electrostatic discharge (ESD) can damage components. To protect the board and other components against damage from static electricity, you should follow some precautions whenever you work on your computer.

- Power down and unplug your computer system when working on the inside.
- Hold components by the edges and try not to touch the IC chips, leads, or circuitry.
- Use a grounded wrist strap before handling computer components.
- Place components on a grounded antistatic pad or on the bag that came with the component whenever the components are separated from the system.
- Store the board only in its original ESD-protected packaging. Retain the original packaging in case you need to return the board to MEN for repair.

About this Document

This user manual is intended only for system developers and integrators, it is not intended for end users.

It describes the hardware functions of the board, connection of peripheral devices and integration into a system. It also provides additional information for special applications and configurations of the board.

The manual does not include detailed information on individual components (data sheets etc.). A list of literature is given in the appendix.

History

Issue	Comments	Date of Issue
E1	First issue	2009-07-01
E2	Added memory speeds in the Technical Data, corrected Table 3, Adapter cable wiring, on page 15	2013-11-11

Conventions

This sign marks important notes or warnings concerning proper functionality of the product described in this document. You should read them in any case.

italics — Folder, file and function names are printed in *italics*.

bold — **Bold** type is used for emphasis.

`monospace` — A `monospaced` font type is used for hexadecimal numbers, listings, C function descriptions or wherever appropriate. Hexadecimal numbers are preceded by "0x".

comment — Comments embedded into coding examples are shown in green color.

hyperlink — Hyperlinks are printed in blue color.

The globe will show you where hyperlinks lead directly to the Internet, so you can look for the latest information online.

IRQ# /IRQ — Signal names followed by "#" or preceded by a slash ("/") indicate that this signal is either active low or that it becomes active at a falling edge.

in/out — Signal directions in signal mnemonics tables generally refer to the corresponding board or component, "in" meaning "to the board or component", "out" meaning "coming from it".

Vertical lines on the outer margin signal technical changes to the previous issue of the document.

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Since January 2005 the SMD and manual soldering processes at MEN have already been completely lead-free. Between June 2004 and June 30, 2006 MEN's selected component suppliers have changed delivery to RoHS-compliant parts. During this period any change and status was traceable through the MEN ERP system and the boards gradually became RoHS-compliant.

WEEE Application

The WEEE directive does not apply to fixed industrial plants and tools. The compliance is the responsibility of the company which puts the product on the market, as defined in the directive; components and sub-assemblies are not subject to product compliance.

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Nevertheless, MEN is registered as a manufacturer in Germany. The registration number can be provided on request.

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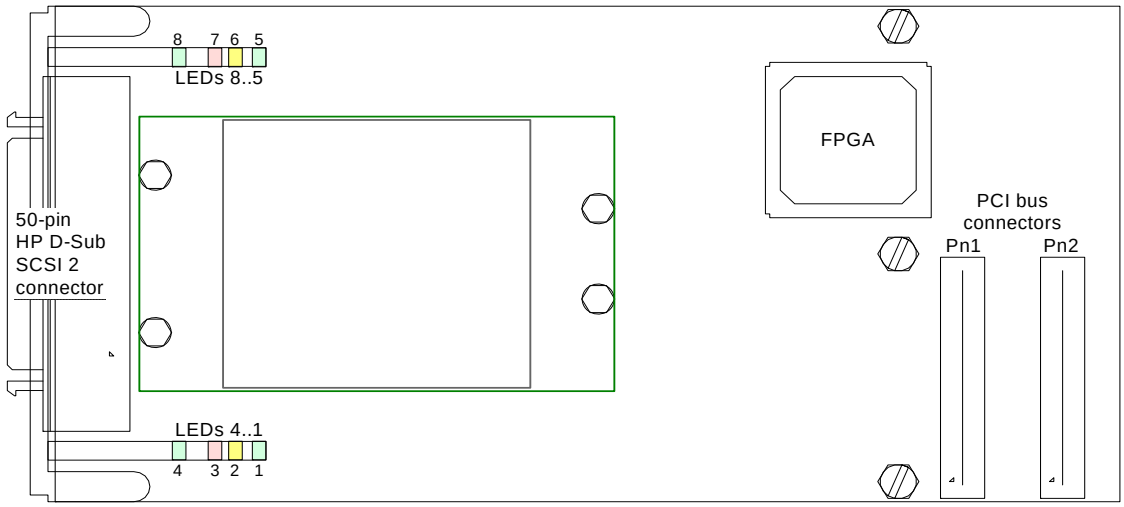
1 Getting Started

This chapter gives an overview of the board and some hints for first installation in a system.

1.1 Map of the Board

Figure 1. *Map of the board – top view*



1.2 Integrating the Board into a System

You can use the following "check list" to install the PMC on a carrier board for the first time and to test proper functioning of the board.

- ☑ Power-down the system and remove the PMC carrier board.
- ☑ Install the PMC in a suitable front-panel slot of the carrier board as described in the carrier board's user manual.
- ☑ Insert the carrier board into the system again.
- ☑ Power-up the system.
- ☑ If there is a system crash or other abnormal behavior at start-up, check if the PMC is plugged properly.
- ☑ You can now install driver software for the P512.

1.3 Installing Driver Software

For a detailed description on how to install driver software please refer to the respective documentation.

You can find any driver software available for download on MEN's website.

2 Connecting the PMC Module

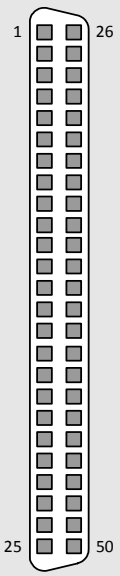
2.1 Peripheral Interfaces

Peripherals can only be connected via the 50-pin half-pitch D-Sub connector.

Connector types:

- 50-pin half-pitch D-Sub receptacle with latch block, 1.27 mm pitch
- Mating connector:
  50-pin half-pitch D-Sub plug with latch, 1.27 mm pitch

Table 1. *Pin assignment of 50-pin HP D-Sub front connector*



1	TX0[0]+	26	TX0[0]-
2	TX0[1]+	27	TX0[1]-
3	TX0[2]+	28	TX0[2]-
4	TX0_CLK+	29	TX0_CLK-
5	GND	30	GND
6	GND	31	GND
7	RX0[0]+	32	RX0[0]-
8	RX0[1]+	33	RX0[1]-
9	RX0[2]+	34	RX0[2]-
10	RX0_CLK+	35	RX0_CLK-
11	GND	36	GND
12	GND	37	GND
13	-	38	-
14	-	39	-
15	-	40	-
16	-	41	-
17	-	42	-
18	-	43	-
19	-	44	-
20	-	45	-
21	-	46	-
22	-	47	-
23	-	48	-
24	-	49	-
25	-	50	-

Table 2. *Signal mnemonics of 50-pin front connector*

Signal	Direction	Function
GND	-	Ground
RX0[0..2]+/-	in	LVDS receive lines, channel 0
TX0[0..2]+/-	out	LVDS transmit lines, channel 0

2.2 Connecting two P512 PMCs

MEN offers a crossed TX-to-RX and RX-to-TX cable for connecting two P512 modules.

For ordering information see MEN's website.

The cable is wired in the following way:

Figure 2. *Cable for connecting two P512 modules*

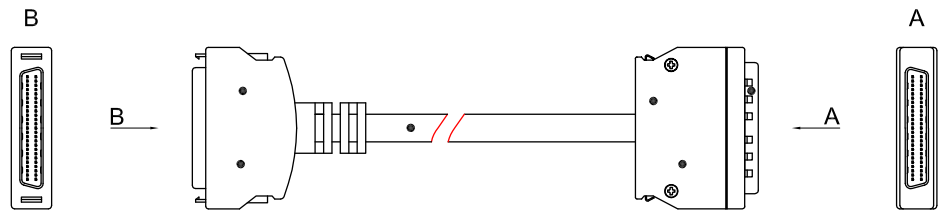


Table 3. *Adapter cable wiring*

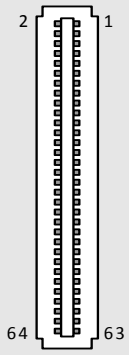
Side B	Side A
Pin 1	Pin 7
Pin 2	Pin 8
Pin 3	Pin 9
Pin 4	Pin 10
Pin 5	Pin 5
Pin 6	not connected
Pin 7	Pin 1
Pin 8	Pin 2
Pin 9	Pin 3
Pin 10	Pin 4
Pin 11 - Pin 25	not connected
Pin 26	Pin 32
Pin 27	Pin 33
Pin 28	Pin 34
Pin 29	Pin 35
Pin 30	Pin 30

Side B	Side A
Pin 31	not connected
Pin 32	Pin 26
Pin 33	Pin 27
Pin 34	Pin 28
Pin 35	Pin 29
Pin 36 - 50	not connected

2.3 Host PCI Interface

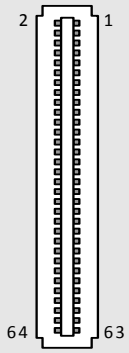
The P512 PMC supports the following signals of the 64-pin carrier board interface connectors:

Table 4. *Pin assignment of 64-pin board-to-board connector Pn1*



1	-	2	-
3	GND	4	INTA#
5	-	6	-
7	-	8	+5V
9	INTD_R#	10	-
11	GND	12	-
13	CLK[0]	14	GND
15	GND	16	GNT[0]#
17	REQ[0]#	18	+5V
19	-	20	AD[31]
21	AD[28]	22	AD[27]
23	AD[25]	24	GND
25	GND	26	C/BE[3]#
27	AD[22]	28	AD[21]
29	AD[19]	30	+5V
31	V_IO	32	AD[17]
33	FRAME#	34	GND
35	GND	36	IRDY#
37	DEVSEL#	38	+5V
39	GND	40	-
41	-	42	-
43	PAR	44	GND
45	-	46	AD[15]
47	AD[12]	48	AD[11]
49	AD[9]	50	+5V
51	GND	52	C/BE[0]#
53	AD[6]	54	AD[5]
55	AD[4]	56	GND
57	-	58	AD[3]
59	AD[2]	60	AD[1]
61	AD[0]	62	+5V
63	GND	64	-

Table 5. *Pin assignment of 64-pin board-to-board connector Pn2*



	1	-	2	-
	3	-	4	-
	5	-	6	GND
	7	GND	8	-
	9	-	10	-
	11	-	12	+3.3V
	13	RST#	14	-
	15	+3.3V	16	-
	17	PME_R#	18	GND
	19	AD[30]	20	AD[29]
	21	GND	22	AD[26]
	23	AD[24]	24	+3.3V
	25	IDSEL[0]	26	AD[23]
	27	+3.3V	28	AD[20]
	29	AD[18]	30	GND
	31	AD[16]	32	C/BE[2]#
	33	GND	34	-
	35	TRDY#	36	+3.3V
	37	GND	38	STOP#
	39	PERR#	40	GND
	41	+3.3V	42	SERR#
	43	C/BE[1]#	44	GND
	45	AD[14]	46	AD[13]
	47	-	48	AD[10]
	49	AD[8]	50	+3.3V
	51	AD[7]	52	-
	53	+3.3V	54	-
	55	-	56	GND
	57	-	58	-
	59	GND	60	-
	61	-	62	+3.3V
	63	GND	64	-

Connector types of Pn1 and Pn2:

- 64-pin SMT plug connector according to IEEE P1386
- Mating connector:
  64-pin SMT receptacle connector according to IEEE P1386

3 Functional Description

3.1 Power Supply

Power supply to the logic part is done via the carrier board (connectors Pn1/Pn2). The necessary voltages are +5V and +3.3V.

3.2 LVDS

The P512 uses a high speed LVDS connection for exchanging memory content between several computer units. One LVDS channel, i.e. one LVDS transmit path and one LVDS receive path is accessible at the front connector.

The transmitted and received data are stored in a 32 MB soldered DDR2 SDRAM memory, which is controlled by an FPGA. The memory bus frequency is 132 MHz.

The DDR2 SDRAM memory is divided into two 16 MB memory sections. The sections are writable and readable via PCI write/read access and are named Transmit Memory Section and Receive Memory Section.

LVDS Data Transmission

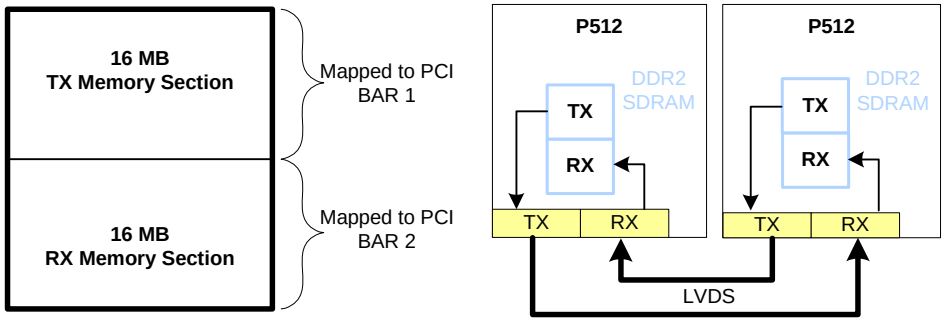
Data written to the Transmit Memory Section is stored in the local DDR2 SDRAM and at the same time the written data is also transmitted via LVDS if the LVDS transmitter is enabled.

LVDS Data Reception

There are two different types of LVDS packets which contain user-defined data. These packets are write data packets and control packets. Write data packets contain information which is stored in the DDR2 SDRAM. This means, if the receiver is enabled and a LVDS write data packet is received, the data is stored in the local DDR2 SDRAM Receive Memory Section.

Example: If the 16-bit data packet 0xABCD is written to offset address 0x104 of the Transmit Memory Section of the transmitting P512, a write data packet is transmitted which contains the data (0xABCD) and the address (0x104). The receiving P512 will evaluate this write data packet and write the received data (0xABCD) to its Receive Memory Section at offset address 0x104.

Figure 3. *P512 memory sections*



3.2.1 LEDs

There are eight status LEDs at the front panel of the P512.

LED 1 lights up as soon as the FPGA was configured. LED 5, 6, 7 and 8 show the status of the LVDS connection.

LEDs 2, 3 and 4 are controlled through a GPIO controller inside the FPGA and are software-configurable. Please contact MEN's sales team for further information.

For a detailed description of the function of each LED see Figure 4, Position of status LEDs at front of P512 on page 20 and Table 6, Status LEDs on page 20.

Figure 4. *Position of status LEDs at front of P512*

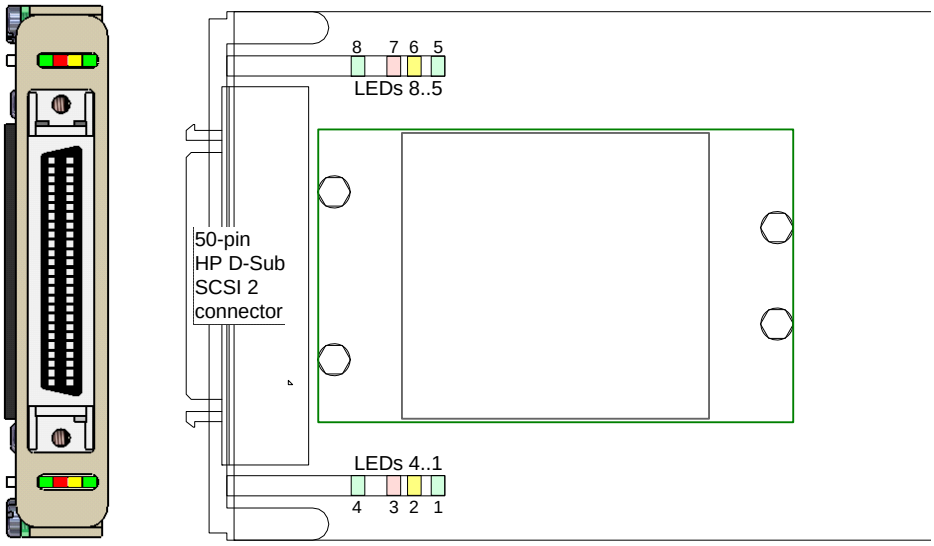


Table 6. *Status LEDs*

LED	Color	Function
1	Green	FPGA is configured
2	Yellow	Software-configurable LEDs
3	Red	
4	Green	
5	Green	LVDS receiver active
6	Yellow	LVDS connection
7	Red	LVDS data lost
8	Green	LVDS transmitter active

4 Appendix

4.1 PCI Configuration

The P512 has the following IDs on the PCI bus:

- PCI Device ID: 0x4D45
- PCI Vendor ID: 0x1A88
- Subsystem Device ID: 0x5A14
- Subsystem Vendor ID: 0x0087

4.2 Literature and Web Resources

- P512 data sheet with up-to-date information and documentation: www.men.de/products/15P512-.html

4.3 Finding out the Board's Article Number, Revision and Serial Number

MEN user documentation may describe several different models and/or hardware revisions of the P512. You can find information on the article number, the board revision and the serial number on two labels attached to the board.

- **Article number:** Gives the board's family and model. This is also MEN's ordering number. To be complete it must have 9 characters.
- **Revision number:** Gives the hardware revision of the board.
- **Serial number:** Unique identification assigned during production.

If you need support, you should communicate these numbers to MEN.

Figure 5. *Label giving the board's article number, revision and serial number*