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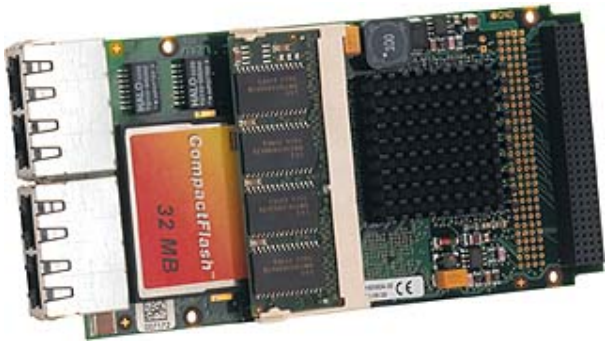
EM4N - Embedded System Module with MPC8245



- **PowerPC® MPC8245 up to 400 MHz**
- **FPGA 12,000 LEs (approx.144,000 gates)**
- **Up to 512 MB SDRAM, CompactFlash®**
- **Dual Fast Ethernet, dual COM (front)**
- **Graphics optional via FPGA (plus 16 MB SDRAM)**
- **User defined I/O functions (COMs, CAN bus, IDE etc.)optional via FPGA on carrier**
- **Stackable with PCI-104**
- **MENMON™ BIOS for PowerPC® cards**

The EM4N is a complete embedded single-board computer for use on any carrier board in different industrial environments. The final application consists either of a stand-alone EM4N, the EM4N with an application-specific carrier card and/or with additionally plugged PCI-104 modules.
The EM4N is controlled by an MPC8245 PowerPC® microprocessor which operates at 266 MHz up to 400 MHz. The MPC8245 includes a Floating Point Unit and a Memory Management Unit. The EM4N has an SO-DIMM socket for data and a CompactFlash® slot for program storage.
At its front panel the EM4N provides two RS232 interfaces and two Fast Ethernet channels. Additionally, nearly unlimited I/O functionality such as graphics controllers, serial interfaces, CAN bus controller etc. can be realized in a very flexible and cost-effective way by means of an on-board FPGA. Physical interfaces for such functions must be implemented on the carrier board. Compared to the EM4, the EM4N is equipped with a larger on-board FPGA, which has a capacity of 12,000 logic elements.
The EM4N comes with MENMON™ support. This firmware/BIOS can be used for bootstrapping operating systems (from disk, Flash or network), for hardware testing, or for debugging applications without running any operating system.
The EM4N is an ideal computer for low-cost deeply embedded solutions in very harsh environments, for machine control, Man-Machine Interfaces, fieldbus bridges or embedded Linux PCs.

For a first evaluation of the functions of the EM4N it is strongly recommended to use the EK2 ESM™ starter kit. The kit consists of the standard CPU module, an FPGA loaded with additional I/O functions, the carrier card with I/O connectors, an external PSU, VGA and RJ45 to D-Sub cables, and an adapter for mounting a PCI-104 module.

ESM™ modules are complete computers on a plug-on module. They consist of the hardware (CPU, chip set, memory, I/O) which is not fixed to any application-specific function, and an FPGA programmed in VHDL code, which provides I/O that is also still independent of a specific application. ESM™ modules are based on PCI. They have two system connectors: J1 has a fixed signal assignment, while J2 is variable depending on the final application-specific configuration of the ESM™ and the carrier board. J2 also feeds the I/O signals of the functions programmed in the FPGA to the carrier card.

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Technical Data

CPU
- PowerPC®
  - MPC8245
  - 266MHz..400MHz

Memory
- L1 Cache integrated in MPC8245
- Up to 512MB SDRAM system memory
  - One 144-pin SO-DIMM slot for SDRAM modules
  - 133MHz memory bus frequency
- 2MB Flash
- Up to 16MB additional SDRAM, connected to FPGA, e.g. for video data
- Serial EEPROM 4kbit for factory settings
- CompactFlash® card interface for Flash ATA
  - Via onboard IDE
  - Type I
  - True IDE

Mass Storage
- Parallel IDE (PATA)
  - One port for hard-disk drives
  - Available via I/O connector
  - FPGA-controlled
- CompactFlash® interface

Graphics
- Available via I/O connector
- FPGA-controlled

I/O
- Ethernet
  - Two Ethernet 10/100Base-T channels
  - Two RJ45 connectors at front panel
  - Two onboard LEDs to signal LAN Link and Activity
- Two RS232 UARTs (COM1/COM2)
  - Two RJ45 connectors at front panel
  - Data rates up to 115.2kbits/s
  - 16-byte transmit/receive buffer
  - Handshake lines: none
- Further I/O possible through FPGA

Front Connections
- Two Ethernet (two RJ45 or one D-Sub)
- COM1/COM2 (two RJ45 or one D-Sub)

FPGA
- Standard factory FPGA configuration:
  - Main bus interface
  - 16Z024_SRAM - SRAM controller (64KB)
  - 16Z023_IDE - IDE controller (PIO mode 0)
  - 16Z033_DISP - Display controller (800 x 600, 16-bit)
  - 16Z031_SPI - SPI touch panel controller
  - 16Z025_UART - UART controller (controls COM10..COM13)
  - 16Z029_CAN - CAN controller
  - 16Z022_GPIO - GPIO controller
- The FPGA offers the possibility to add customized I/O functionality. See FPGA.

PCI Interface
- 32-bit/33-MHz PCI interface at PCI-104 connector J1
- Support of two external masters

Miscellaneous
- Real-time clock
- Power supervision and watchdog

Electrical Specifications
- Supply voltage/power consumption:
  - +5V (-2%/+5%), 500mA
  - +3.3V (-2%/+5%), 1A, w/o SO-DIMM; increases up to 1.6A depending on installed SO-DIMM
- MTBF: 320,000h @ 40°C (derived from MIL-HDBK-217F)

Mechanical Specifications
- Dimensions: conforming to ESM™ specification (PCB: 149mm x 71mm), Type I-S
- Weight: 100g

Environmental Specifications
- Temperature range (operation):
  - 0..+60°C or -40..+85°C
  - Airflow: min. 10m³/h
- 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): 2g/10..150Hz
- Conformal coating on request

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

EMC
- Tested according to EN 55022 (radio disturbance), IEC1000-4-2 (ESD) and IEC1000-4-4 (burst)

BIOS
- MENMON™

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Software Support

- Linux (ELinOS)
- VxWorks®
- QNX® (on request)
- CANopen support: MEN Driver Interface System (MDIS™ for Windows®, Linux, VxWorks®, QNX®, OS-9®)
- MSCAN/Layer2 support: MEN Driver Interface System (MDIS™ for Windows®, Linux, VxWorks®, QNX®, OS-9®)
- For more information on supported operating system versions and drivers see Software.

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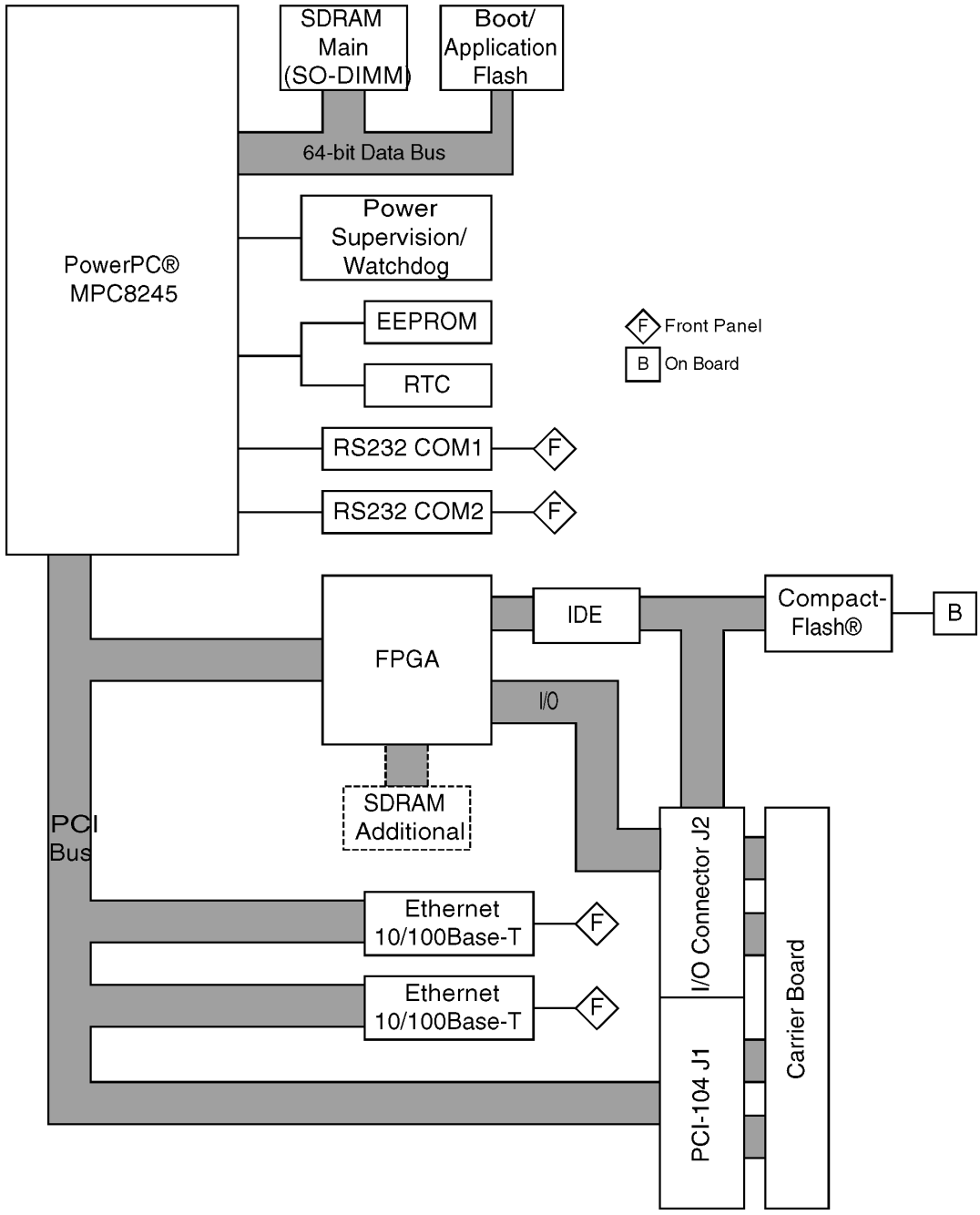
Diagram



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Configuration & Options

Standard Configurations

Article No.	CPU Type	Clock	System RAM	CFlash	Additional SDRAM	Boot Flash	Operation Temperature
15EM04N01	MPC8245	400 MHz	0 MB	0 MB	16 MB	2 MB	0..+60°C

Options

CPU
- MPC8245, 400 MHz

Memory
- System RAM
  - 64 MB, 128 MB, 256 MB or 512 MB
- CompactFlash®
  - 0 MB up to maximum available
- Additional SDRAM
  - 0 MB or 16 MB
- Boot Flash
  - 2 MB

I/O
- Front Connections
  - D-Sub connectors for Ethernet and COM

Mechanical
- PCI and I/O connectors can also be placed for face-to-face assembly (ESM™ Type N)

Operation Temperature
- 0..+60°C
- -40..+85°C

Please note that some of these options may only be available for large volumes. Please ask our sales staff for more information.

FPGA

Flexible Configuration

- This MEN board offers the possibility to add customized I/O functionality in FPGA.
- It depends on the board type, pin counts and number of logic elements which IP cores make sense and/or can be implemented. Please contact MEN for information on feasibility.
- You can find more information on our web page "User I/O in FPGA"

FPGA Capabilities

- FPGA Altera® Cyclone® EP1C12
  - 12,060 logic elements
  - 239,616 total RAM bits
- Connection
  - Available pin count: tbd
  - Functions available via I/O connector J2
- MEN offers a starter kit for this computer-on-module. The kit includes a suitable carrier board with different I/O connectors for FPGA signals.

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Ordering Information

Standard Hardware

15EM04N01	MPC8245/400MHz, 16MB graphics memory, 2MB Flash, front: 2 Fast Ethernet (RJ45), 2 UARTs (RJ45), 0..+60°C (also for ESM evaluation kit EK2)

Related Hardware

08EK02-03	ESM evaluation kit for EM4N: Mini ATX carrier board, EM4N with PowerPC MPC8245/400MHz, 256MB DRAM, 16MB graphics memory, 2MB Flash, 2 Fast Ethernet, 2 COMs, quad UART, graphics, CAN, 0..+60°C; incl. external PSU, RJ45 to D-Sub cable, VGA cable and adapter for mounting of one PCI-104 module - CompactFlash not installed

Memory

0751-0023	CompactFlash card, 2 GB, Type I, -40..+85°C, fixed bit set
0751-0025	CompactFlash card, 512 MB, Type I, -40..+85°C, removable
0751-0026	CompactFlash card, 256 MB, Type I, -40..+85°C, removable
0751-0027	CompactFlash card, 1 GB, Type I, -40..+85°C, fixed bit set
0751-0031	CompactFlash card, 4 GB, Type I, -40..+85°C, fixed bit set
0751-0032	CompactFlash card, 8 GB, Type I, -40..+85°C, fixed bit set
0752-0123	256MB DRAM 0..+60°C for 15EM04N01
0752-0158	512MB DRAM 0..+60°C for 15EM04N01
0752-0183	64MB DRAM 0..+60°C for 15EM04N01

Miscellaneous

05F006-00	RS232 interface cable RJ45 to 9-pin D-Sub (1 COM to 1 COM), 2m

Software: OS independent

13Z015-06	MDIS4/2004 driver (MEN) for 16Z029_CAN (MSCAN/Layer2)
13Z016-06	MDIS4/2004 driver (MEN) for 16Z029_CAN (CANopen master)

Software: Linux

13Z025-90	Linux native driver (MEN) for 16Z025_UART, 16Z057_UART and 16Z125_UART

Software: VxWorks

10EM04-60	VxWorks BSP (MEN) for EM4 and EM4N
13Z025-60	VxWorks native driver (MEN) for 16Z025_UART, 16Z057_UART and 16Z125_UART

Software: Firmware/BIOS

14EM04-00	MENMON (Firmware) for EM4 and EM4N (object code)

Documentation

20EM00-00	ESM Specification
20EM04N00	EM4N User Manual
21APPN004	Application Note: ELinOS demo-em04-001, simple demo project for EM04
21APPN005	Application Note: ELinOS demo-em04-000, X-Window/RTAI demo project for EM4
21APPN006	Application Note: ELinOS demo-em04-002, simple demo project for EM4
21APPN009	Application Note: 16Z025_UART and 16Z125_UART under Linux
21MENM-00	MENMON 2nd Edition User Manual
22Z025-ER	16Z025_UART Errata

For the most up-to-date ordering information and direct links to other data sheets and downloads, see the EM4N online data sheet under » www.men.de.

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