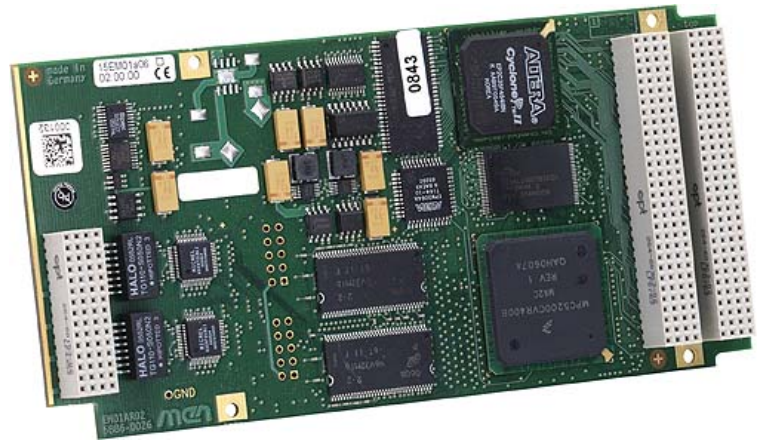# EM1A – Embedded System Module COM with MPC5200B

- **MPC5200B / 384 MHz**
- **FPGA 18,752 LEs (225,000 gates)**
- **Up to 256 MB on-board DDR SDRAM**
- **Up to 8 MB boot Flash, NAND Flash**
- **2 MB SRAM, 16 MB additional SDRAM**
- **Dual Ethernet, COM, USB 1.1 (J3)**
- **Dual CAN controller**
- **MENMON™ BIOS for PowerPC® cards**
- **User defined I/O functions optional via FPGA**
- **-40 to +85°C with qualified components**

The EM1A Computer-On-Module is a complete embedded SBC for use on any carrier board in different industrial environments. The final application consists either of a stand-alone EM1A, the EM1A with an application-specific carrier card and/or with additionally plugged PCI-104 modules.

The EM1A is controlled by the MPC5200B PowerPC® processor which was especially developed for automotive applications and which operates at up to 400 MHz and 700 MIPS. The complete ESM™ module is exclusively available in -40 to +85°C operation temperature, as is the processor itself which consumes less than 1 W at 384 MHz. The EM1A is equipped with up to 256 MB soldered SDRAM and up to 1 GB NAND Flash as well as with 16 MB additional SDRAM, up to 8 MB boot Flash and 2 MB battery-backed SRAM.

The EM1A provides one 10MBit and one Fast Ethernet interface, one serial line and USB 1.1 via its I/O connector J3. Two CAN controllers with V2.0A/B CAN protocol are included in the MPC5200B. The physical CAN interfaces are accessible via SA-Adapters™. Further UARTs and other additional I/O functions can be realized in the onboard FPGA and accessed via a carrier board. The functionality of the FPGA is dynamically loaded by the application software.
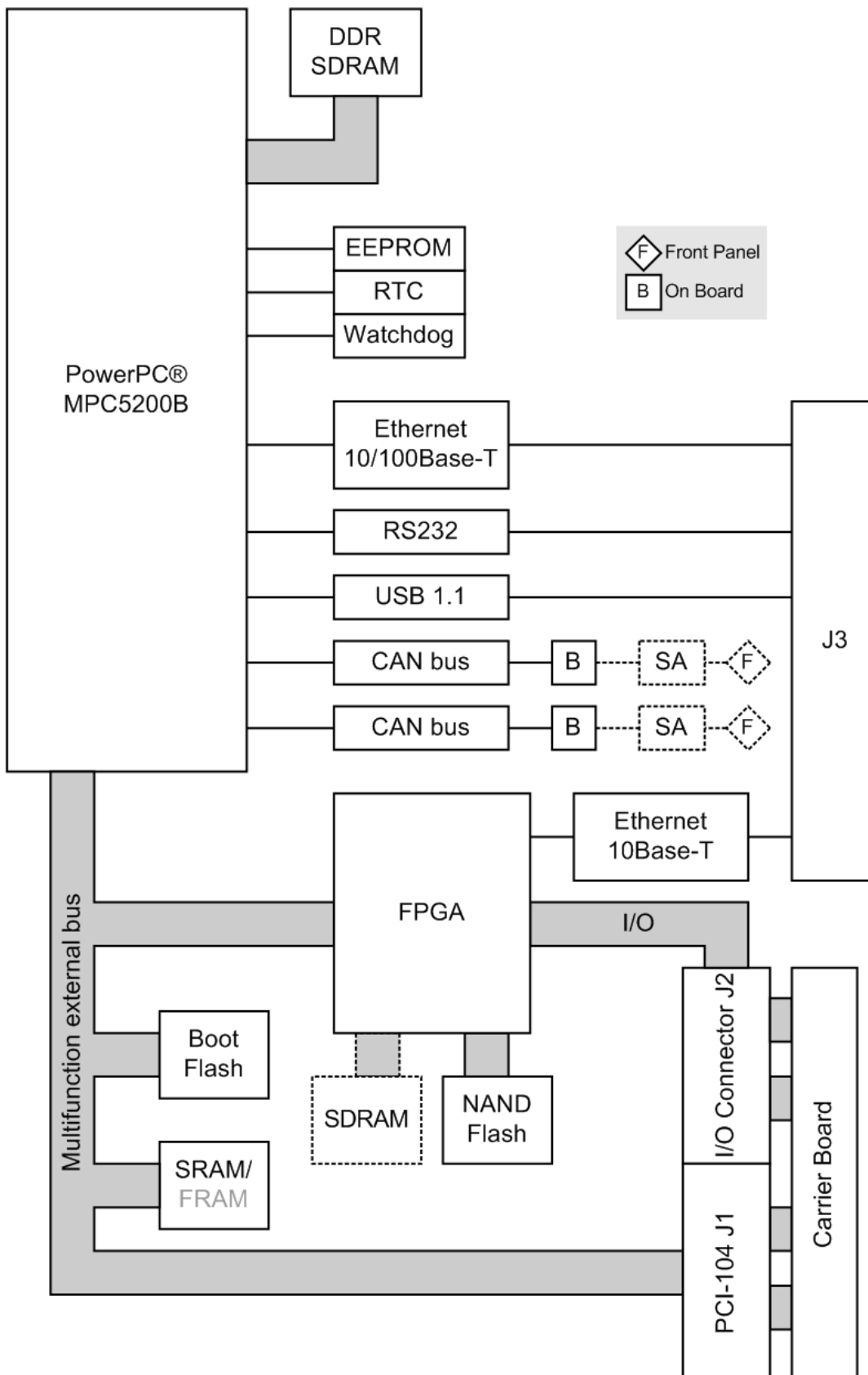
The EM1A comes with MENMON™ support. This firmware/BIOS can be used for bootstrapping operating systems (from disk, Flash or network), for hardware testing, or for debugging applications without running any operating system.

The EM1A is designed to operate under harsh environmental conditions including -40 to +85°C operation temperature, shock, vibration, humidity. It focuses on applications in transportation (railways), automotive and avionics.

For a first evaluation of the functions of the EM1A it is strongly recommended to use the EK6N ESM™ starter kit. The kit consists of the function-compatible EM1N module (with front I/O), 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 which 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 for user-defined I/O. 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.

Diagram

Technical Data

CPU	■ PowerPC®
	    □ MPC5200B
	    □ Up to 400MHz

Memory	■ 2x16KB L1 data and instruction cache integrated in MPC5200
	 ■ Up to 256MB SDRAM system memory
	    □ Soldered
	    □ DDR
	    □ 64MHz memory bus frequency
	 ■ Up to 1GB soldered NAND Flash (and more), FPGA-controlled
	 ■ Up to 16MB additional SDRAM, FPGA-controlled, e.g. for video data and NAND Flash firmware
	 ■ Up to 8MB boot Flash
	 ■ Up to 2MB battery-backed SRAM, or: up to 128KB non-volatile FRAM
	 ■ Serial EEPROM 8kbits for factory settings

Mass Storage	■ Parallel IDE (PATA)
	    □ One port for hard-disk drives
	    □ Available via I/O connector
	    □ FPGA-controlled
	 ■ Up to 1GB soldered ATA NAND Flash (and more), FPGA-controlled

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

I/O	■ USB
	    □ One USB 1.1 port
	    □ On board-to-board connector J3
	    □ OHCI implementation
	    □ Data rates up to 12Mbit/s
	 ■ Ethernet
	    □ One 10/100Base-T Ethernet channel
	    □ One 10Base-T Ethernet channel
	    □ On board-to-board connector J3
	 ■ One RS232 UART (COM1)
	    □ On board-to-board connector J3
	    □ Data rates up to 115.2kbit/s
	    □ 512-byte transmit/receive buffer
	    □ Handshake lines: CTS, RTS
	 ■ CAN bus
	    □ Two CAN bus channels
	    □ 2.0 A/B CAN protocol
	    □ Data rates up to 1 Mbit/s
	    □ Connection via onboard connectors
	    □ External transceivers using SA-Adapters™
	 ■ Further I/O depending on FPGA configuration

FPGA	■ Standard factory FPGA configuration:
	    □ Main bus interface
	    □ 16Z070_IDEDISK - IDE controller for NAND Flash
	    □ 16Z043_SDRAM - Additional SDRAM controller (16MB)
	    □ 16Z023_IDENHS - IDE controller (PIO mode 0; non-hot-swap)
	    □ 16Z077_ETH - Ethernet controller (10Base-T)
	    □ 16Z025_UART - UART controller (controls COM10)
	    □ 16Z034_GPIO - GPIO controller (40 lines, 5 IP cores)
	 ■ 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 ■ Compliant with PCI Specification 2.2 ■ Support of 4 external masters

Technical Data

Miscellaneous	■ Real-time clock ■ Power supervision and watchdog

Electrical Specifications	■ Supply voltage/power consumption:
	  □ +5V (-2%/+5%), 10mA max., only for USB
	  □ +3.3V (-2%/+5%), 1A typ.
	■ MTBF:
	  □ 15EM01A00: 320,787h @ 40°C according to IEC/TR 62380 (RDF 2000)
	  □ 15EM01A01 (5V only): 326,635h @ 40°C according to IEC/TR 62380 (RDF 2000)

Mechanical Specifications	■ Dimensions: conforming to ESM™ specification (PCB: 149mm x 71mm), Type II-N ■ Weight: 85g (w/o heat sink)

Environmental Specifications	■ Temperature range (operation):
	  □ -40..+85°C
	  □ Airspeed: min. 2 m/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): 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™
Software Support	■ VxWorks® ■ Linux (ELinOS) ■ QNX® ■ PikeOS (partitionable RTOS) certified platform ■ MSCAN/Layer2 support: MEN Driver Interface System (MDIS™ for all supported operating systems) ■ For more information on supported operating system versions and drivers see Downloads.

FPGA

This product offers the possibility to add customized I/O functionality in FPGA.

Flexible Configuration	■ Customized I/O functions can be added to the 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® II EP2C20
	  □ 18,752 logic elements
	  □ 239,616 total RAM bits
	■ Connection
	  □ Available pin count: 77 pins
	  □ Functions available via I/O connector J2
	■ MEN offers a starter kit for a computer-on-module of the same product family (version with front I/O). The kit includes a suitable carrier board with different I/O connectors for FPGA signals. An FPGA development package for this hardware kit is also available for download.

Configuration & Options

Standard Configurations

Article No.	CPU Type	FPGA	System RAM	NAND Flash	Boot Flash	Additional SDRAM	SRAM	Misc.
15EM01-00	MPC5200, 384MHz	12,000 LE	128 MB	128 MB	2 MB	16 MB	2 MB	Front I/O
15EM01N00	MPC5200B, 384MHz	18,752 LE	256 MB	1 GB	2 MB	16 MB	2 MB	Front I/O
15EM01A00	MPC5200B, 384MHz	18,752 LE	256 MB	128 MB	2 MB	16 MB	2 MB	Rear I/O
15EM01A01	MPC5200B, 384MHz	18,752 LE	256 MB	128 MB	2 MB	16 MB	2 MB	Rear I/O, 5V only

Options

CPU	■ MPC5200B, 384 MHz

Memory	■ System RAM
	  □ 128 MB or 256 MB
	■ NAND Flash
	  □ 0 MB up to maximum available
	■ Boot Flash
	  □ 2 MB, 4 MB or 8 MB
	■ Additional SDRAM
	  □ 0 MB or 16 MB
	■ SRAM
	  □ 0 MB or 2 MB
	■ 128KB non-volatile FRAM instead of SRAM

I/O	■ Two 10/100Base-T Ethernet channels instead of one 10Base-T and one 10/100Base-T □ Through easy FPGA modification

Power Supply	■ 5V supply only
	  □ With onboard +3.3V voltage regulator
	  □ Regulator could be loaded with additonal 500mA for plug-on boards

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

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

Ordering Information

Standard EM1A Models	**15EM01A00**	MPC5200B/384MHz, FPGA 18,752 logic elements, 256MB SDRAM, 128MB NAND Flash, 2MB SRAM, 16MB graphics memory, 2MB boot Flash, -40..+85°C with qualified components
Related Hardware	**15EM01N00**	MPC5200B/384MHz, FPGA 18,752 logic elements, 256 MB SDRAM, 1 GB NAND Flash, 2 MB SRAM, 16 MB graphics memory, 2 MB boot Flash, front: 2 Fast Ethernet (RJ45), 1 UART (RJ45), 1 USB, -40..+85°C with qualified components (also for ESM™ evaluation kit EK6N)
Software: Linux		This product is designed to work under Linux. See below for potentially available separate software packages from MEN.
	10EM01-90	Linux BSP (MEN) for EM1, EM1A, EM1N, EK6, EK6N, F12, F12N and PP1 under ELinOS 5.0 (rpm for direct installation in ELinOS)
		This product is designed to work under ELinOS Embedded Linux by SYSGO. For more information and product support please contact www.sysgo.com.
	13Z015-06	MDIS5™ low-level driver sources (MEN) for 16Z029_CAN (MSCAN/Layer2)
	13Z017-06	MDIS5™ low-level driver sources (MEN) for 16Z034_GPIO, 16Z037_GPIO and 16Z127_GPIO
	13Z025-90	Linux native driver (MEN) for 16Z025_UART, 16Z057_UART and 16Z125_UART
	13Z077-90	Linux native driver (MEN) for 16Z077_ETH and 16Z087_ETH
Software: VxWorks®		This product is designed to work under VxWorks®. For details regarding supported/unsupported board functions please refer to the corresponding software data sheets.
	10EM01-60	VxWorks® BSP (MEN) for EM1, EM1A, EM1N, EK6, EK6N, F12N and F12
	10EM01-61	VxWorks® 6.8 BSP for EM1A and EM1N
	13Z015-06	MDIS5™ low-level driver sources (MEN) for 16Z029_CAN (MSCAN/Layer2)
	13Z017-06	MDIS5™ low-level driver sources (MEN) for 16Z034_GPIO, 16Z037_GPIO and 16Z127_GPIO
	13Z025-60	VxWorks® native driver (MEN) for 16Z025_UART, 16Z057_UART and 16Z125_UART
Software: QNX®		This product is designed to work under QNX®. For details regarding supported/unsupported board functions please refer to the corresponding software data sheets.
	10EM01-40	QNX® 6.3 SP3 BSP (MEN) for EM1, EM1A, EM1N, EK6, EK6N, F12 and F12N
	10EM01-41	QNX® 6.4.1 BSP (MEN) for EM1, EM1A, EM1N, EK6, EK6N, F12 and F12N
	10EM01-42	QNX® 6.5.0 BSP (MEN) for EM1, EM1A, EM1N, EK6, EK6N, F12 and F12N
	13Z015-06	MDIS5™ low-level driver sources (MEN) for 16Z029_CAN (MSCAN/Layer2)
	13Z017-06	MDIS5™ low-level driver sources (MEN) for 16Z034_GPIO, 16Z037_GPIO and 16Z127_GPIO
	13Z025-40	QNX® 6.3 native driver (MEN) for 16Z025_UART and 16Z125_UART
	13Z025-41	QNX® 6.4 native driver (MEN) for 16Z025_UART and 16Z125_UART
	13Z025-42	QNX® 6.5 native driver (MEN) for 16Z025_UART and 16Z125_UART
	13Z087-40	QNX® native driver (MEN) for 16Z087_ETH

Ordering Information

Software: PikeOS	This product is designed to work under PikeOS by SYSGO. PikeOS is a real-time operating system for use in safety and mission-critical systems which can be certified according to DO-178B DAL-B and EN 50128 SIL 4. For more information and product support please contact www.sysgo.com.
Software: Firmware/BIOS	MENMON™ is MEN's firmware/BIOS for PowerPC® platforms.
	14EM01-00 MENMON™ (Firmware) for EM1, EM1A, EM1N, F12 and F12N (object code)

For operating systems not mentioned here contact MEN sales.

Documentation	Compare Chart ESM™ Embedded System Modules » Download	
	20EM00-00	ESM™ Specification
	20EM01NER	EM1N/EM1A Errata
	20EM01N00	EM1N/EM1A User Manual
	21MENM-00	MENMON™ User Manual
	21Z025-90	16Z025_UART and 16Z125_UART under Linux User Manual
	22Z025-ER	16Z025_UART Errata

Contact Information

Germany	France	USA
MEN Mikro Elektronik GmbH	MEN Mikro Elektronik SA	MEN Micro Inc.
Neuwieder Straße 3-7	18, rue René Cassin	860 Penllyn Blue Bell Pike
90411 Nuremberg	ZA de la Châtelaine	Blue Bell, PA 19422
Phone +49-911-99 33 5-0	74240 Gaillard	Phone (215) 542-9575
Fax +49-911-99 33 5-901	Phone +33 (0) 450-955-312	Fax (215) 542-9577
	Fax +33 (0) 450-955-211	
info@men.de	info@men-france.fr	sales@menmicro.com
www.men.de	www.men-france.fr	www.menmicro.com