

VERY LOW COST EMBEDDED CONTROLLERS FOR USE IN INDUSTRIAL, COMMERCIAL AND SCIENTIFIC APPLICATIONS



FM-200 *Embedded* CONTROLLER

1MB Memory
3 Serial
10 Digital



The picture shows the FM-200P Controller

FEATURES

- 68000 Compatible Micro controller
- 14.7456 MHz operating speed
- 512 K-bytes of Flash EEPROM
- 512 K-bytes of Battery Backed Static RAM
- Three Serial Ports
- 2 RS-232, 1 RS-232 or RS-485
- Real Time Calendar Clock
- Software Watch dog
- Compact size, only 100 x 90mm
- 5 Volt only operation
- Many low power modes
- Typical current, < 150mA
- Module Bus expansion
- M-Bus (I²C bus)
- 10 TTL/CMOS digital I/O channels
- 2 16-bit timer/counters
- Minos Real Time Multitasking Operating System
- Program in Modula-2, 'C' or Assembler

DESCRIPTION

The FlashModule FM-200 is the lowest cost controller in our FlashModule range, typically £95 in quantity. In common with all controllers in the range it has a powerful 16-bit 68000 based controller, three serial ports, 512 K-bytes of Flash EEPROM, 512 K-bytes of static RAM and a Real Time Calendar Clock. Code that is written for this controller can also be used with no modification on any other controllers in this range, allowing the user to choose the controller most suitable for a particular application without having to rewrite the code each time.

The three serial ports can be configured to operate over a wide range of formats. By default the terminal serial port (S1) is configured to operate at 38400 baud with a data format of 8 bits, 1 stop bit and no parity. The other two serial ports default to 9600 baud with the same data format. One of the serial ports can be configured for networking operation (drivers and libraries provided as standard) and can operate with up to 253 slaves over a two wire half-duplex RS-485 interface in addition to the standard full duplex RS-232 interface provided by the other two serial ports. CTS/RTS handshaking is used as standard on all RS-232 serial ports. Baud rates can be configured from an application program in the range 300 to 38400 baud.

The Real Time Calendar Clock is fully year 2000 compliant and will keep track of the current time, day and date. It also has an alarm facility which can interrupt the processor at a given time and date. A battery retains the data in the real time clock when the board is not powered. The device used is interfaced to the main processor using the M-Bus. Its own on board oscillator drives the clock for accurate time keeping.

The on board static RAM is battery backed to prevent data loss during power down. The control signals are disabled to prevent erroneous data being written into the RAM during the power down cycle. The 512 K-bytes of on board RAM can be expanded up to 8.5 M-bytes using static RAM on an expansion card. When the FlashModule is used with our RAM expansion cards the operating system detects how much RAM is available and configures the memory manager accordingly at power up.

The 512 K-bytes of Flash EEPROM on the FlashModule can be user programmed using the utility programs provided with the Development or Starter Packs. The Flash memory can be pro-

grammed using the single 5 Volt supply removing any requirements for high voltage supplies. The Flash memory is divided up into eight blocks each of 64 K-bytes. Before data can be programmed into one of these blocks the whole block must be erased. When using the Minos operating system the first three blocks of the Flash memory are protected for system use and can not easily be erased or written to. The remaining five blocks are designated user sectors and can be read or written as required. The utilities provided allow data to span block boundaries and a sector will only be erased if an area to be programmed contains data. Turnkey programs can be loaded into the Flash memory and run from power on. To allow these programs to be modified a switch is provided which gives access to the development environment. The on board Flash memory can be expanded up to 1 M-byte using an expansion card. As with the

static RAM expansion, when the CMS expansion cards are used the operating system will detect how much Flash or EPROM memory is available and configures the memory manager accordingly. The whole on-board Flash memory can be erased and reprogrammed using the Flash-Formatter card which contains a compatible Flash memory and a default boot EPROM to enable new programs or data to be uploaded. The FlashFormatter card is supplied in the multi license Development Packs, it can also be used in data logging applications to upload data or download programs or parameters.

The Module Bus expansion connector is a 68000 bus that allows extra memory and peripherals to be added to the FlashModule controller. The FlashFormatter and the static RAM expansion cards use this expansion bus to interface to the processor. The bus supports A0:23, D0:15 and all the address and data strobes, control lines and four interrupt lines. Also supported on the Module Bus expansion is M-Bus or I²C bus. This is a high speed serial bus used for interconnecting a range of peripheral devices. Other products in the FlashModule range use M-Bus devices for the digital I/O and some of the analogue I/O as well as the real time clock that is present on all products in the range. The expansion bus allows the FlashModule products to be used with the many peripherals from our Module Bus range. These include Serial I/O, Video output, Analogue I/O, Digital I/O, Timer/Counters etc.

The FM-200 has 10 digital I/O channels that are fully compatible with CMOS or TTL inputs or outputs. Two of the digital I/O channels are treated as 'specials'. The other eight digital I/O lines can be used either as a single 8-bit port or as individual channels. When used as channels each channel can be configured as an input or an output. If they are configured as outputs, when read, they will re-

FM-200 Embedded CONTROLLER

turn the last value that was written to them.

SOFTWARE DEVELOPMENT

All development tools for the FlashModule product range make use of Cambridge Microprocessor Systems Ltd own real time multi tasking operating system. The operating system has been developed specifically for use in embedded control environments and makes I/O devices very easy to use. It removes all the device specific code from the user and provides a uniform interface, this

allows the user to use a range of devices including serial ports, liquid crystal displays, keypads etc. without having to understand the device or write any code.

The task scheduler is based on a round robin method giving a time slice to each running proc-

ess in turn. Also provided is the ability to signal between processes. The operating system can be licensed on a single board basis or royalty free unlimited copy multi license basis. If the multi license package is purchased the operating system can be used FREE of charge on all FlashModules. The single license option allows the operating system to be used on the FlashModule for which it is purchased.

The software support provided in all packages is compatible with all FlashModule products. You simply purchase your chosen development pack and then choose which controller is required for the particular application. For new applications you can simply purchase the relevant controller. Any future updates to libraries for extra features and new controllers can be obtained free of charge.

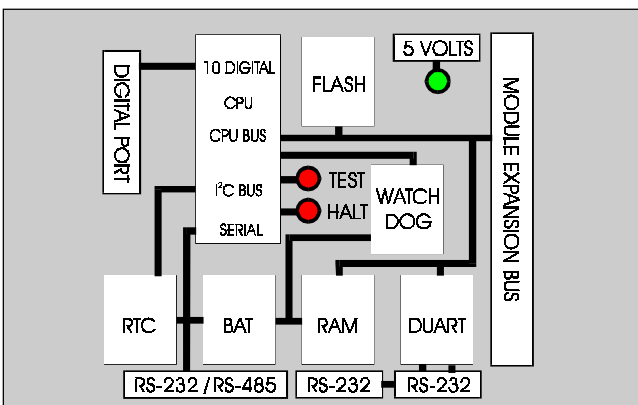
The FlashModule can be programmed in Modula-2, 'C' or

assembler. Modula-2 is a very easy language to learn. It is similar in structure to Pascal. The CMS implementation of Modula-2 includes a number of additions to the language to allow the language to be used in an embedded environment.

The Modula-2 Starter Pack is the lowest cost package for developing with the FlashModule range. It includes full documentation, power supply, interface cable for the PC, your chosen FlashModule with a single version of Minos, Modula-2 interpreter, utility programs and extensive example programs.

The 'C' Starter Pack includes C

Cross Compiler, 68000 Assembler, Linker, Make utility, Editor, Library manager, full documentation, power supply, interface cable, your chosen FlashModule with a single version of Minos, utility programs and extensive example programs. The Development Packs are supplied with the same items as the Starter Packs but they have a unlimited multi copy Minos License and a FlashFormatter card. The FlashFormatter makes it very easy to copy your application and program the Flash memory on future purchases of FlashModule controllers.



This is a block diagram of the FM-200 Controller.

ORDER CODES

Order Number	Product Name	1 off	100 off
FM-200	FlashModule FM-200 10 TTL/CMOS Digital I/O	£145	£95
FM-400	FlashModule FM-400 26 TTL/CMOS Digital I/O, LCD, Keypad, 8 Analogue inputs, 2 Analogue outputs	£195	£145
FM-600	FlashModule FM-600 42 TTL/CMOS Digital I/O, LCD, Keypad, 16 Analogue inputs, 2 Analogue outputs	£295	£195
M-100FMS	Modula-2 Starter Pack Single license Minos Modula-2 programming package (including FM-200)	£195	
C-100FMS	C Starter Pack Single license Minos 'C' programming package (including FM-200)	£295	
M-200FM	Modula-2 Development Pack Multi License Minos Modula-2 programming package (including FM-200)	£495	
C-200FM	C Development Pack Multi License Minos 'C' programming package (including FM-200)	£595	

FM200-03 980616



CAMBRIDGE
MICROPROCESSOR
SYSTEMS LIMITED

SPECIFICATION

CPU. Motorola 68307 controller, 14.7456 MHz Main clock speed.

Memory. 512 K-bytes of on board programmable Flash EEPROM, 512 K-bytes of Battery Backed Static RAM, No wait states.

Serial. 2 RS-232 Serial Ports, 1 RS-232/RS-485 Serial Port, User selectable baud rates - 300 to 38400, User selectable data size - 5 to 8 bits, User selectable stop characters - 1, 1.5, 2, User selectable parity - odd, even or none, Hardware handshaking on RS-232 ports, Tx and Rx tristates on RS-485.

Real Time Calendar Clock. Stores Day, Date and Time, Alarm day, data and time, Accurate to less than 3 seconds per month.

Digital. 10 Digital I/O lines (1 8-bit port), TTL/CMOS compatible I/O, User configurable.

Module Bus Expansion. A0:23, D0:15, 4 Interrupt inputs, 1 non-maskable interrupt input, M-Bus or I²C bus interface.

Environmental. Operating Temperature Range 0 - 70 degC, Relative Humidity 0 to 90% (non condensing).

Power Supply. Single 5 Volt operation, Many low power modes, < 150mA typical current consumption.



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