EMERALD-MM-OPTO PC/104 Module with
Opto-Isolated RS-232/422/485 Ports and GPIO

DIAMOND SYSTEMS

PC104

FEATURES

2 or 4 RS-232/422/485 optically isolated serial ports

Isolation of 1000V AC or DC, port to port or port to system

150Ω termination resistors for RS-422/485

460.8kbps max data rate

128-byte transmit / receive FIFOs

Auto-flow RS-485 control

24 digital I/O using 82C55

-40ºC to +85ºC extended temperature operation

PC/104 form factor

◆ Description

Emerald-MM-Opto provides an integrated, rugged, and reliable solution for PC/104-expandable embedded systems requiring serial communications in demanding applications. It offers 2 or 4 optically isolated serial ports with RS-232, RS-422, and RS-485 protocols, as well as 24 digital I/O lines, all on a single board.

Optical isolation of 1000V DC or AC protects your embedded system from ground differentials or noise spikes that would damage non-isolated boards. Each port is isolated from the other ports as well as the system. Extended temperature capability (-40 to +85ºC) enables the board to operate in vehicles such as trains and buses without concern for temperature swings. These features enable Emerald-MM-Opto to provide reliable serial communications in harsh environments such as trains and buses.
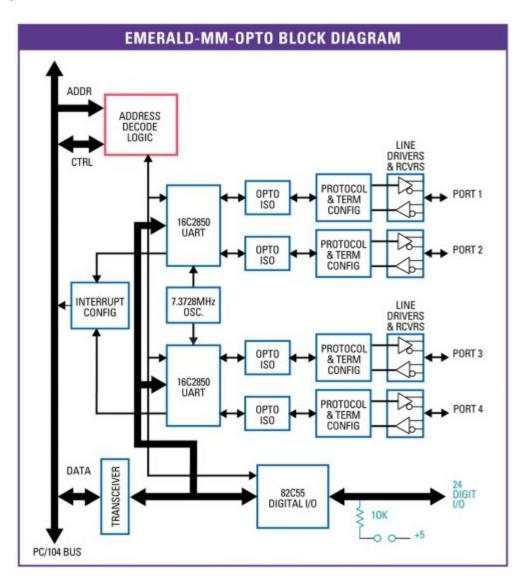
In addition to ruggedness, Emerald-MM-Opto offers flexibility and advanced features. Each serial port is independently configurable for protocol and IRQ settings. Eight different I/O address combinations are built in. The 16C2850 UART chips with 128-byte FIFOs support high-speed data rates at up to 460kbps without overloading the system processor. Auto-flow control enables easy RS-485 operation by automatically enabling and disabling the transmitter during data transmission, to prevent bus conflicts or excessive software overhead.

Emerald-MM-Opto also offers multiple termination methods on the serial ports to support varying interface requirements. In RS-422 or RS-485 networks, termination resistors are normally installed at the endpoints of the cables to minimize reflections on the lines. The board provides jumper-selectable termination and pull-up/pull-down resistors for this purpose. The sensible jumper positioning and layout help simplify board configuration and minimize confusion.

The 24 digital I/O lines are based on an 82C55 chip and feature programmable direction in 4- and 8-bit groups. All I/O lines contain user-configurable 10K Ohm pull-up resistors for convenience. This 2-in-1 combination of serial ports and digital I/O can help lower the size and cost of your embedded system by eliminating one additional board from your PC/104 stack.

Diamond Systems offers appropriate mating cables for your convenience. Cable no. C-DB9M-1 provides a DB-9 male connector with standard PC serial port pinout. Each serial port requires one cable. Cable no. C-26-18 is a 26-conductor ribbon cable for the digital I/O lines.

◆ **System Block Diagram**

EMERALD-MM-OPTO BLOCK DIAGRAM

◆ **Configuration**

The following I/O addresses are selected with jumpers or 0-ohm resistors. All addresses are in hex.

A	B	C	Port 1	Port 2	Port 3	Port 4	Interrupt status
In	In	In	3F8-3FF	2F8-2FF	3E8-3EF	2E8-2EF	220
Out	In	In	3E8-3EF	2E8-2EF	3A8-3AF	2A8-2AF	220
In	Out	In	380-387	388-38F	288-28F	230-23F	224
Out	Out	In	240-247	248-24F	260-267	268-26F	224
In	In	Out	100-107	108-10F	110-117	118-11F	240
Out	In	Out	120-127	128-12F	130-137	138-13F	244
In	Out	Out	140-147	148-14F	150-157	158-15F	248

Out	Out	Out	160-167	168-16F	170-177	178-17F	24C

The interrupt status register indicates the pending interrupt status of all 4 serial ports. It is a read-only register. Only bits 3-0 are used. Bits 7-4 read back as 0 always.

Bit	7	6	5	4	3	2	1	0
Function	0	0	0	0	IRQD	IRQC	IRQB	IRQA

IRQD-A = interrupt status for ports 4-1, respectively. 1 = interrupt pending, 0 = no interrupt pending.

◆ I/O Headers

Each serial port has its own 10-pin (2x5) pin header with the following pinouts. These pinouts are consistent with the pinout of the SP334 transceiver for each mode.

(NC = no connection)

	RS-232 Configuration	RS-422 Configuration	RS-485 Configuration
1	NC	RXD+	TXD+/RXD+
2	NC	CTS-	NC
3	RXD	RXD-	TXD-/RXD-
4	RTS	RTS+	NC
5	TXD	TXD+	TXD+/RXD+
6	CTS	CTS+	NC
7	NC	TXD-	TXD-RXD-
8	NC	RTS-	NC
9	ISO GND	ISO GND	ISO GND
10	NC	NC	NC

In RS-485 mode, only one pair of signal wires is used, plus ground reference. Either pins 1 and 3 or pins 5 and 7 may be used. These signal pairs are duplicated on the connector due to the jumpering of the RX and TX lines on the configuration jumper block.

◆ Digital I/O

The digital I/O is provided on a 26-pin (2x13) pin header with the following pinout.

C7	1	2	C6
C5	3	4	C4
C3	5	6	C2
C1	7	8	C0
B7	9	10	B6
B5	11	12	B4
B3	13	14	B2
B1	15	16	B0
A7	17	18	A6
A5	19	20	A4
A3	21	22	A2
A1	23	24	A0
+5V	25	26	GND

◆ Specifications

Serial Ports	2 or 4, RS-232/422/485
Data Rates	RS-232, 230.4kbps max RS-422/485: 460.8kbps max
Signals	RS-232: RXD, TXD, RTS, CTS RS-422/485: RXD, TXD
Addresses	8 preconfigured standard I/O address options; custom addresses available
Interrupts	IRQ levels 2, 3, 4, 5, 6, 7, 10, 12, 15; Interrupt sharing supported
Isolation	1000V AC or DC, port to port or port to system
Termination	150Ω with 1KΩ pull-up/pull-down
UART	16C2850 with 128-byte FIFO and auto-flow control
Digital I/O	24 programmable direction using 82C55
DIO termination	10KΩ pull-up
Connectors	Individual 10-pin connector for each serial port; 26-pin connector for digital I/O
Bus	PC/104 16-bit bus (8-bit data)
Power	+5VDC @ 300mA typical, all outputs open
Operating Temperature	-40ºC to +85ºC
Dimensions	3.550"W x 3.775"H
RoHS	Compliant

◆ Ordering Information

◆ Models and Accessories

Emerald-MM-Opto
available models:

EMM-OPT4-XT   4 Opto-Isolated RS-232/422/485 + 24 Digital I/O   Available

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