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# Installation Guide

**DigiBoard PC/X and MC/X**
**Non-Intelligent Asynchronous**
**Serial Communications Boards**

90029700A

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# Certification Information

**Radio Frequency Interference (RFI)** **(FCC 15.105)**

This equipment has been tested and found to comply with the limits for Class B digital devices pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential environment. This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try and correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

**Labeling Requirements** **(FCC 15.19)**

This device complies with Part 15 of FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

**Modifications** **(FCC 15.21)**

Changes or modifications to this equipment not expressly approved by DigiBoard may void the user's authority to operate this equipment.

**Cables** **(FCC 15.27)**

Shielded cables *must* be used to remain within the Class B limitations.

**Canadian DOC Notice**

This digital apparatus does not exceed the Class B limits for radio noise for digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.



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# The DigiBoard Bulletin Board System

DigiBoard provides an electronic bulletin board service (BBS) for our customers. This bulletin board provides general and technical information about DigiBoard's products.

The DigiBoard BBS allows users to download software drivers as soon as they become available. There is also a feature to allow users with problems or questions about DigiBoard products to leave messages to DigiBoard Technical Support.

Using the DigiBoard BBS is easy. Simply dial **(612) 943-0812** or **(612) 943-0549**. The bulletin board accepts calls at 1200, 2400, 9600 and 14.4K baud. V.32, HST 14.4, V.42 and V.42*bis* standards are supported, with full MNP class 1-5 error correction and data compression.

The recommended modem communications parameters are 8 bits, no parity and one stop bit (**8 N 1**). Other settings may also work.

Download protocols include Zmodem, Xmodem, Ymodem, Kermit and others.

# Internet FTP Server

DigiBoard has also set up an Anonymous FTP server for those with access to the Internet network. The address is **`ftp.digibd.com`** (**`192.83.159.193`**). Log in as **`anonymous`**, and enter your E-mail address when asked for a password. Drivers and installation tips are located in the **`/drivers`** directory. A text file, **`download.doc`**, gives information on uncompressing the files after downloading. Tip: Be sure to enter "**`bin`**" before downloading, to ensure binary transfer of files.

# FaxBack Server

Manuals and technical information can also be obtained by FAX. To use the FaxBack server, simply call (612) 943-0573 on a touch tone phone.



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# Technical Support

At DigiBoard, we are proud of our products, and support them. Our dealers and distributors are fully trained on our product line, so that they can help you on a technical level should assistance be needed.

Your first level of support is your DigiBoard dealer, the place where you purchased your PC/X or MC/X board. Your dealer has the training to help you with any installation questions or difficulties you might have.

If you still experience difficulties (after contacting your first level of support), DigiBoard has a staff of Technical Support Specialists that can assist you. They can be reached at **(612) 943-0578**. In Europe, call +**49 221 920520**. FAX numbers are: (612) 943-0579 (USA) and +49 221 9205210 (Europe).

When you call DigiBoard Technical Support, please call from a position where you can operate your system. Also, please fill out the form on the opposite page before calling, so your Technical Support representative can have a clear picture of your system and any potential conflicts between devices.

DigiBoard Technical Support can also be reached via Internet E-mail. Please send correspondences to **support@digibd.com**, and include your voice and FAX phone numbers.




Before calling Tech Support, be sure to run the user diagnostics, **UD-STD.EXE**, in the **\DIAGS** directory of the Windows, OS/2 and FOSSIL driver diskette (provided with the board). Refer to **USER-STD.TXT** and the help screens in the **UD-STD.EXE** for instructions.

# Customer Service

DigiBoard also has a staff of Customer Service representatives to help you with software and documentation update requests, as well as Returned Merchandise Authorizations (RMAs) in case you need to return your board to DigiBoard for repair (see page *xii*). They can be reached at **(612) 943-0577**.

DigiBoard Customer Service can also be reached via Internet E-mail. Please send correspondences to **cust_serv@digibd.com**, and include your voice and FAX phone numbers.



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**Technical Support Information**

Please assist your Technical Support representative by filling in the following information.

Serial number of your PC/X or MC/X board: _____ PAL #s (PC/16) U46: _____ U58: _____

Make, model and clock speed of your computer: _____

How much RAM does your computer have? _____ MB

Hard disk controller: Type: _____ Memory addressed at: _____ I/O port used: ____ IRQ: _____

LAN card: Type: _____ Memory addressed at: _____ I/O port used: ____ IRQ: _____

Other: Type: _____ Memory addressed at: _____ I/O port used: ____ IRQ: _____

Operating system: _____ Version: _____

DigiBoard device driver version: _____

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# Device Driver Support

This product is shipped with device drivers for some of the most commonly used operating systems. Other device drivers may be available, however, and may be obtained, free of charge, from DigiBoard. For information on availability, and to order additional drivers, please contact DigiBoard Customer Service or dial in to the DigiBoard BBS.



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# Return Procedures

All DigiBoard products have a five-year parts and labor warranty, and we are ultimately responsible for any defective parts, according to the limits specified in the warranty. However, many of the reported problems are due to factors other than defects in the product itself. To save you time and possibly additional cost, DigiBoard asks that you *first* try to resolve any difficulties by contacting our Technical Support representatives at **(612) 943-0578.**

**Important!** ***Be sure to have the serial number of your board at hand before calling Technical Support.***

Returns should be directed to the dealer or distributor from whom you purchased the product. If you need to return your PC/X or MC/X board to DigiBoard for repair, it is first necessary to obtain an RMA (Returned Merchandise Authorization) number from DigiBoard, by speaking to a DigiBoard Customer Service representative. Authorized returns should be shipped to DigiBoard, 10000 West 76th Street, Eden Prairie, MN 55344. The RMA number should appear on the shipping carton, on or near the address label.

**Note:** *Products received without an RMA number clearly marked on the outside of the package will be returned, unopened, to the sender*



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# Introduction

This Installation Guide covers the installation and configuration of the DigiBoard PC/X and MC/X asynchronous serial communications boards for ISA and Micro Channel personal computers ("ISA" stands for Industry Standard Architecture, and includes IBM AT and compatible computers, and 80386/80486/Pentium based computers that employ the ISA bus.; Micro Channel computers include most PS/2 computers).

In addition to the board itself (hardware), you may also need to install device driver software for your operating system, so that programs can communicate with the board. Device driver installation instructions are in separate manuals, included with the software diskette(s).

## Components

The carton in which your PC/X or MC/X board was shipped should contain the following items:

- PC/X or MC/X board
- *Installation Guide* (this book)
- One or more software packets containing device driver diskettes and manuals



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# Installation

**Important!** PC/X and MC/X boards contain static-sensitive components. Always touch a grounded surface to discharge static electricity before handling the circuit board.

The procedures for installing the boards in the PC/X and MC/X families begin on the pages listed below:

PC/4 and PC/8 .....3
PC/16 .....15
MC/4, MC/8 and MC/16 .....22



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# PC/4 and PC/8 Boards

This section provides instructions for installing and configuring PC/4 and PC/8 boards in ISA computers. These include IBM AT and compatible computers, and 80386/80486/Pentium based computers that employ the ISA (Industry Standard Architecture) bus.

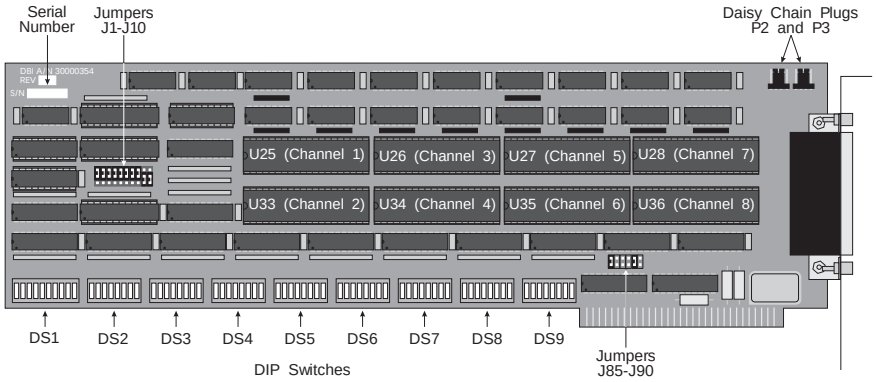
Instructions for installing PC/16 boards begin on page 15.

Instructions for installing MC/4 and MC/8 boards (in Micro Channel computers) begin on page 22.

## Before you plug in the board. . .

**Write down the serial number of the board in the form on page *x*. You will need it if you have to contact DigiBoard regarding the product.**

**Figure 1** **PC/8 Board Layout**




There are a number of DIP switches and jumpers which must be set prior to installing the board in your computer. The DIP switches are used to set the I/O port addresses of the individual asynchronous serial channels and the Interrupt Status Register address. The jumpers are used to select the IRQ (Interrupt Request) line(s) and the board ID number. Consult your software manual for the recommended settings for these parameters.



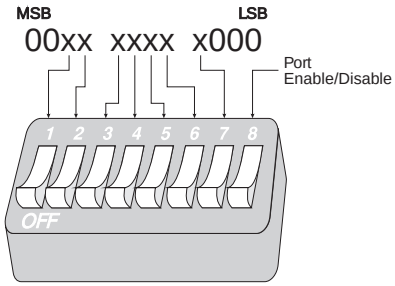
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***Setting the I/O Port Addresses***

Each port on the PC/X board has its own unique I/O port address, which points to the first of eight I/O registers which are used by that port. DIP switches DS2-DS9 determine the I/O address of ports 1 through 8, respectively (on PC/4 boards, DS6-DS9 are absent).

Each port can be set to any hexadecimal address from 000h to 3F8h (PC/X I/O addresses must always end with 0 or 8). The breakdown of the DIP switches is shown in Figure 2, below.

**Figure 2 Breakdown of DIP Switches DS2-DS9**




The switches form a binary representation of the I/O address; note that the two most significant bits (MSB) and the three least significant bits (LSB) are always 0. Thus, switches 1 and 2 set the first hex digit of the address to 0-3, switches 3 through 6 set the second digit to 0-F, and switch 7 sets the third digit to 0 or 8.

Switch 8 enables (ON) or disables (OFF) the port.

Table 1, on the following pages, gives the DIP switch settings for all possible addresses from 000h to 3F8h.



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**Table 1 DIP Switch Settings for I/O Port Addresses**

| I/O | SW-1 | SW-2 | SW-3 | SW-4 | SW-5 | SW-6 | SW-7 | SW-8 |
|---|---|---|---|---|---|---|---|---|
| **000h** | ON | ON | ON | ON | ON | ON | ON | ON |
| **008h** | ON | ON | ON | ON | ON | ON | OFF | ON |
| **010h** | ON | ON | ON | ON | ON | OFF | ON | ON |
| **018h** | ON | ON | ON | ON | ON | OFF | OFF | ON |
| **020h** | ON | ON | ON | ON | OFF | ON | ON | ON |
| **028h** | ON | ON | ON | ON | OFF | ON | OFF | ON |
| **030h** | ON | ON | ON | ON | OFF | OFF | ON | ON |
| **038h** | ON | ON | ON | ON | OFF | OFF | OFF | ON |
| **040h** | ON | ON | ON | OFF | ON | ON | ON | ON |
| **048h** | ON | ON | ON | OFF | ON | ON | OFF | ON |
| **050h** | ON | ON | ON | OFF | ON | OFF | ON | ON |
| **058h** | ON | ON | ON | OFF | ON | OFF | OFF | ON |
| **060h** | ON | ON | ON | OFF | OFF | ON | ON | ON |
| **068h** | ON | ON | ON | OFF | OFF | ON | OFF | ON |
| **070h** | ON | ON | ON | OFF | OFF | OFF | ON | ON |
| **078h** | ON | ON | ON | OFF | OFF | OFF | OFF | ON |
| **080h** | ON | ON | OFF | ON | ON | ON | ON | ON |
| **088h** | ON | ON | OFF | ON | ON | ON | OFF | ON |
| **090h** | ON | ON | OFF | ON | ON | OFF | ON | ON |
| **098h** | ON | ON | OFF | ON | ON | OFF | OFF | ON |
| **0A0h** | ON | ON | OFF | ON | OFF | ON | ON | ON |
| **0A8h** | ON | ON | OFF | ON | OFF | ON | OFF | ON |
| **0B0h** | ON | ON | OFF | ON | OFF | OFF | ON | ON |
| **0B8h** | ON | ON | OFF | ON | OFF | OFF | OFF | ON |
| **0C0h** | ON | ON | OFF | OFF | ON | ON | ON | ON |
| **0C8h** | ON | ON | OFF | OFF | ON | ON | OFF | ON |
| **0D0h** | ON | ON | OFF | OFF | ON | OFF | ON | ON |
| **0D8h** | ON | ON | OFF | OFF | ON | OFF | OFF | ON |
| **0E0h** | ON | ON | OFF | OFF | OFF | ON | ON | ON |
| **0E8h** | ON | ON | OFF | OFF | OFF | ON | OFF | ON |
| **0F0h** | ON | ON | OFF | OFF | OFF | OFF | ON | ON |
| **0F8h** | ON | ON | OFF | OFF | OFF | OFF | OFF | ON |

Note: Addresses below 100h are not recommended—these addresses may be reserved by your system. See following pages for more addresses.



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| I/O | SW-1 | SW-2 | SW-3 | SW-4 | SW-5 | SW-6 | SW-7 | SW-8 |
|---|---|---|---|---|---|---|---|---|
| **100h** | ON | OFF | ON | ON | ON | ON | ON | ON |
| **108h** | ON | OFF | ON | ON | ON | ON | OFF | ON |
| **110h** | ON | OFF | ON | ON | ON | OFF | ON | ON |
| **118h** | ON | OFF | ON | ON | ON | OFF | OFF | ON |
| **120h** | ON | OFF | ON | ON | OFF | ON | ON | ON |
| **128h** | ON | OFF | ON | ON | OFF | ON | OFF | ON |
| **130h** | ON | OFF | ON | ON | OFF | OFF | ON | ON |
| **138h** | ON | OFF | ON | ON | OFF | OFF | OFF | ON |
| **140h** | ON | OFF | ON | OFF | ON | ON | ON | ON |
| **148h** | ON | OFF | ON | OFF | ON | ON | OFF | ON |
| **150h** | ON | OFF | ON | OFF | ON | OFF | ON | ON |
| **158h** | ON | OFF | ON | OFF | ON | OFF | OFF | ON |
| **160h** | ON | OFF | ON | OFF | OFF | ON | ON | ON |
| **168h** | ON | OFF | ON | OFF | OFF | ON | OFF | ON |
| **170h** | ON | OFF | ON | OFF | OFF | OFF | ON | ON |
| **178h** | ON | OFF | ON | OFF | OFF | OFF | OFF | ON |
| **180h** | ON | OFF | OFF | ON | ON | ON | ON | ON |
| **188h** | ON | OFF | OFF | ON | ON | ON | OFF | ON |
| **190h** | ON | OFF | OFF | ON | ON | OFF | ON | ON |
| **198h** | ON | OFF | OFF | ON | ON | OFF | OFF | ON |
| **1A0h** | ON | OFF | OFF | ON | OFF | ON | ON | ON |
| **1A8h** | ON | OFF | OFF | ON | OFF | ON | OFF | ON |
| **1B0h** | ON | OFF | OFF | ON | OFF | OFF | ON | ON |
| **1B8h** | ON | OFF | OFF | ON | OFF | OFF | OFF | ON |
| **1C0h** | ON | OFF | OFF | OFF | ON | ON | ON | ON |
| **1C8h** | ON | OFF | OFF | OFF | ON | ON | OFF | ON |
| **1D0h** | ON | OFF | OFF | OFF | ON | OFF | ON | ON |
| **1D8h** | ON | OFF | OFF | OFF | ON | OFF | OFF | ON |
| **1E0h** | ON | OFF | OFF | OFF | OFF | ON | ON | ON |
| **1E8h** | ON | OFF | OFF | OFF | OFF | ON | OFF | ON |
| **1F0h** | ON | OFF | OFF | OFF | OFF | OFF | ON | ON |
| **1F8h** | ON | OFF | OFF | OFF | OFF | OFF | OFF | ON |



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| I/O | SW-1 | SW-2 | SW-3 | SW-4 | SW-5 | SW-6 | SW-7 | SW-8 |
|---|---|---|---|---|---|---|---|---|
| **200h** | OFF | ON | ON | ON | ON | ON | ON | ON |
| **208h** | OFF | ON | ON | ON | ON | ON | OFF | ON |
| **210h** | OFF | ON | ON | ON | ON | OFF | ON | ON |
| **218h** | OFF | ON | ON | ON | ON | OFF | OFF | ON |
| **220h** | OFF | ON | ON | ON | OFF | ON | ON | ON |
| **228h** | OFF | ON | ON | ON | OFF | ON | OFF | ON |
| **230h** | OFF | ON | ON | ON | OFF | OFF | ON | ON |
| **238h** | OFF | ON | ON | ON | OFF | OFF | OFF | ON |
| **240h** | OFF | ON | ON | OFF | ON | ON | ON | ON |
| **248h** | OFF | ON | ON | OFF | ON | ON | OFF | ON |
| **250h** | OFF | ON | ON | OFF | ON | OFF | ON | ON |
| **258h** | OFF | ON | ON | OFF | ON | OFF | OFF | ON |
| **260h** | OFF | ON | ON | OFF | OFF | ON | ON | ON |
| **268h** | OFF | ON | ON | OFF | OFF | ON | OFF | ON |
| **270h** | OFF | ON | ON | OFF | OFF | OFF | ON | ON |
| **278h** | OFF | ON | ON | OFF | OFF | OFF | OFF | ON |
| **280h** | OFF | ON | OFF | ON | ON | ON | ON | ON |
| **288h** | OFF | ON | OFF | ON | ON | ON | OFF | ON |
| **290h** | OFF | ON | OFF | ON | ON | OFF | ON | ON |
| **298h** | OFF | ON | OFF | ON | ON | OFF | OFF | ON |
| **2A0h** | OFF | ON | OFF | ON | OFF | ON | ON | ON |
| **2A8h** | OFF | ON | OFF | ON | OFF | ON | OFF | ON |
| **2B0h** | OFF | ON | OFF | ON | OFF | OFF | ON | ON |
| **2B8h** | OFF | ON | OFF | ON | OFF | OFF | OFF | ON |
| **2C0h** | OFF | ON | OFF | OFF | ON | ON | ON | ON |
| **2C8h** | OFF | ON | OFF | OFF | ON | ON | OFF | ON |
| **2D0h** | OFF | ON | OFF | OFF | ON | OFF | ON | ON |
| **2D8h** | OFF | ON | OFF | OFF | ON | OFF | OFF | ON |
| **2E0h** | OFF | ON | OFF | OFF | OFF | ON | ON | ON |
| **2E8h** | OFF | ON | OFF | OFF | OFF | ON | OFF | ON |
| **2F0h** | OFF | ON | OFF | OFF | OFF | OFF | ON | ON |
| **2F8h** | OFF | ON | OFF | OFF | OFF | OFF | OFF | ON |

*continued on next page*



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| I/O | SW-1 | SW-2 | SW-3 | SW-4 | SW-5 | SW-6 | SW-7 | SW-8 |
|---|---|---|---|---|---|---|---|---|
| **300h** | OFF | OFF | ON | ON | ON | ON | ON | ON |
| **308h** | OFF | OFF | ON | ON | ON | ON | OFF | ON |
| **310h** | OFF | OFF | ON | ON | ON | OFF | ON | ON |
| **318h** | OFF | OFF | ON | ON | ON | OFF | OFF | ON |
| **320h** | OFF | OFF | ON | ON | OFF | ON | ON | ON |
| **328h** | OFF | OFF | ON | ON | OFF | ON | OFF | ON |
| **330h** | OFF | OFF | ON | ON | OFF | OFF | ON | ON |
| **338h** | OFF | OFF | ON | ON | OFF | OFF | OFF | ON |
| **340h** | OFF | OFF | ON | OFF | ON | ON | ON | ON |
| **348h** | OFF | OFF | ON | OFF | ON | ON | OFF | ON |
| **350h** | OFF | OFF | ON | OFF | ON | OFF | ON | ON |
| **358h** | OFF | OFF | ON | OFF | ON | OFF | OFF | ON |
| **360h** | OFF | OFF | ON | OFF | OFF | ON | ON | ON |
| **368h** | OFF | OFF | ON | OFF | OFF | ON | OFF | ON |
| **370h** | OFF | OFF | ON | OFF | OFF | OFF | ON | ON |
| **378h** | OFF | OFF | ON | OFF | OFF | OFF | OFF | ON |
| **380h** | OFF | OFF | OFF | ON | ON | ON | ON | ON |
| **388h** | OFF | OFF | OFF | ON | ON | ON | OFF | ON |
| **390h** | OFF | OFF | OFF | ON | ON | OFF | ON | ON |
| **398h** | OFF | OFF | OFF | ON | ON | OFF | OFF | ON |
| **3A0h** | OFF | OFF | OFF | ON | OFF | ON | ON | ON |
| **3A8h** | OFF | OFF | OFF | ON | OFF | ON | OFF | ON |
| **3B0h** | OFF | OFF | OFF | ON | OFF | OFF | ON | ON |
| **3B8h** | OFF | OFF | OFF | ON | OFF | OFF | OFF | ON |
| **3C0h** | OFF | OFF | OFF | OFF | ON | ON | ON | ON |
| **3C8h** | OFF | OFF | OFF | OFF | ON | ON | OFF | ON |
| **3D0h** | OFF | OFF | OFF | OFF | ON | OFF | ON | ON |
| **3D8h** | OFF | OFF | OFF | OFF | ON | OFF | OFF | ON |
| **3E0h** | OFF | OFF | OFF | OFF | OFF | ON | ON | ON |
| **3E8h** | OFF | OFF | OFF | OFF | OFF | ON | OFF | ON |
| **3F0h** | OFF | OFF | OFF | OFF | OFF | OFF | ON | ON |
| **3F8h** | OFF | OFF | OFF | OFF | OFF | OFF | OFF | ON |



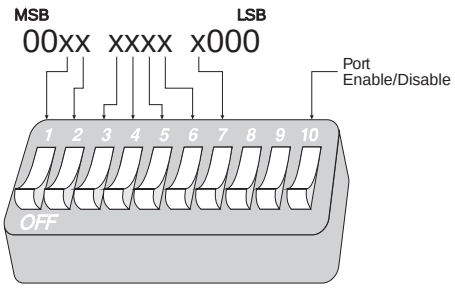
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### *Setting the Interrupt Status Register Address*

PC/X boards have a special Interrupt Status register, which permits all ports on a board (or up to four boards, if they are daisy chained together; see Daisy Chaining PC/X Boards, on page 43) to operate efficiently with a single IRQ line. When any port requires servicing, the board generates an interrupt, and the Interrupt Status register identifies which port requires attention. In this way, software does not have to poll all of the ports to locate the one that generated the interrupt request.

The Interrupt Status register occupies two bytes on the computer's I/O bus, and its address is defined by DIP switch DS1 on the PC/X board. DS1 is a ten position switch, the breakdown of which is shown in Figure 3.

**Figure 3 Breakdown of DIP Switch DS1**




The I/O port address for the Interrupt Status register is set by switches 1-7, in the same way as the I/O port addresses for the individual channels on the board (see Setting the I/O Port Address, on page 4). Note that switches 8 and 9 should always be in the ON position.

Switch 10 enables (ON) or disables (OFF) the Interrupt Status register.



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***Setting the IRQ***

PC/4 and PC/8 boards support one or two IRQ (Interrupt Request) lines per board. If two interrupts are used, one must be ODD (IRQ 3, 5 or 7) and the other must be EVEN (IRQ 2, 4 or 6).

Select the interrupt(s) to be used by placing a jumper on J85, J86 or J87 for IRQ 3, 5 or 7, respectively, and/or J88, J89 or J90 for IRQ 6, 4 or 2, respectively.

Now assign each channel to either the ODD or EVEN interrupt by placing jumpers on J1-J8: for the ODD interrupt, jumper pins 1 and 2 (the top two pins); for the EVEN interrupt, jumper pins 2 and 3 (the bottom two pins). J1-J8 correspond to ports 1-8, respectively.

Finally, make sure that jumpers J9 and J10 are installed on pins 2 and 3 (the bottom two pins). This sets the board number to 0. All boards must be set to number 0 unless they are daisy chained to other PC/X boards .

**Important!** Individual PC/X boards must each be assigned a unique IRQ, which must not be used by any other device in your system, including other PC/X boards, *unless the PC/X boards are daisy chained together* (see Daisy Chaining PC/X boards, on page 43).

**Note:** Dual interrupt capability is provided to facilitate emulation of standard ports COM1-COM4, which use IRQs 3 and 4 (see the section on MS-DOS applications, beginning on page 49).

If you are not emulating standard COM ports, use one IRQ line; performance is not affected, and you'll have more IRQs available for other devices.

Some common sources of contention for IRQs are:

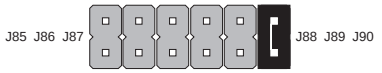
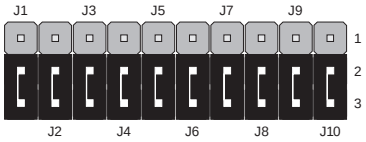
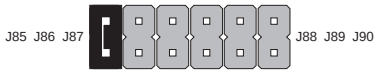
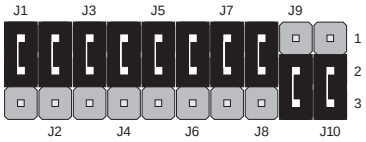
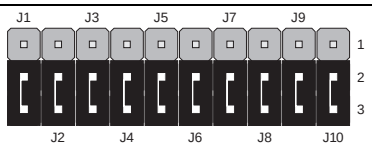
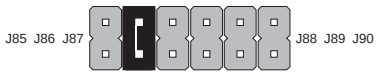
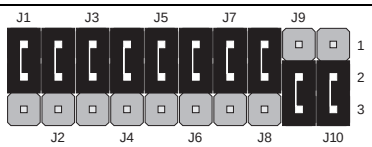
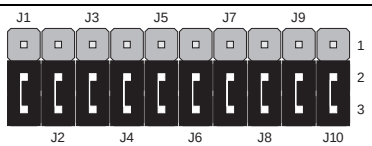
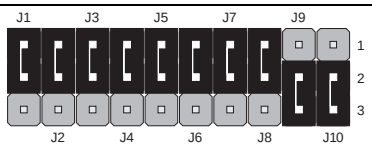
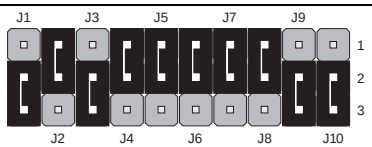
IRQ2: EGA adapters (if present)
IRQ3: Standard COM2 & COM4 ports (if present)
IRQ4: Standard COM1 & COM3 ports (if present)
IRQ5: LPT2 (Second parallel printer port) (if present)
IRQ6: Floppy disk controller
IRQ7: LPT1 (First parallel printer port) (if present)



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Table 2 below shows the required jumper placement for setting all ports for operation with each of the six supported interrupts. The last entry of the table shows how to set the first port for IRQ4, and the remaining ports for IRQ3 (see the note on the previous page).

**Table 2 IRQ Selection for PC/4 and PC/8 Boards**

| IRQ | J85-J90 | J1-J10 |
|---|---|---|
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |
| 5 |  |  |
| 6 |  |  |
| 7 |  |  |
| 3&4 |  |  |

**Note:** PC/4 boards do not have jumpers J5-J8.



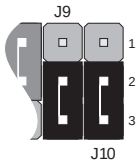
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### *Board Identification*

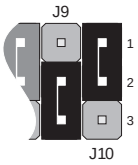
Jumpers J9 and J10 (see Figure 1) are used to set the PC/8 and PC/4 boards' ID number (0-3) when multiple boards are daisy chained together (see Daisy Chaining PC/X Boards, on page 43). The default Board ID is 0; this should be changed *only for the second, third and fourth boards in a daisy chained configuration.*

**Figure 4 Board ID Jumper Settings for PC/4 and PC/8 Boards**

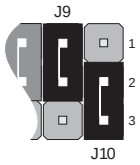
**Board 0:**



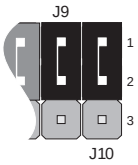

**Board 1:**




**Board 2:**




**Board 3:**



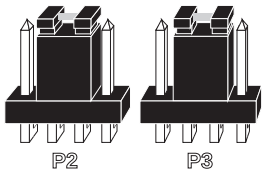



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### *Daisy Chain Connectors P2 and P3*

In the upper right-hand corner of the PC/4 or PC/8 board are two connectors, P2 and P3 (see Figure 1). When multiple boards are daisy chained together (see Daisy Chaining PC/X Boards, on page 43), a daisy chain cable links the boards so that they can share a single IRQ line. For single board installations, a jumper must be placed across pins 2 and 3 (the middle two pins) of P2 when an ODD interrupt is selected, P3 when an EVEN interrupt is selected, and both P2 and P3 if ODD and EVEN interrupts are selected. PC/X boards are shipped with both jumpers installed, and the usual practice is to leave them both in place, even if you are only using one interrupt. See Figure 5, below.

**Figure 5 Connectors P2 and P3 (Single Board Configuration)**






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## Plugging in the Board

Now you are ready to install the PC/X board in your computer. Follow these steps:

1. Turn off your computer's power and remove the cover (refer to your computer's manual for instructions on cover removal and option board installation and cautions).
2. Locate an available slot (8 or 16 bit) in your computer and remove the slot plate.
3. Plug the PC/X board into the slot and screw the endplate to the computer chassis (use the screw you removed from the slot plate). The endplate must to be screwed in to the computer chassis to remain in compliance with Part 15 of the FCC rules for class B operation.
4. Install the interface cable assembly or connector box (see *Connector Options*, on page 35) on the PC/X board by mating the female 78-pin connector on the assembly to the male 78-pin connector on the end of the PC/X board. *Be sure that the plug is completely installed—it may be a snug fit.*

   *HINT: If you have difficulty plugging in the DB-78 connector, try loosening the screw in the endplate—the connector may not be exactly centered in the slot in the back of the computer. Be sure to re-tighten the endplate screw once the DB-78 connector is securely attached.*

   **IMPORTANT! Use only the DigiBoard-supplied shielded cable assemblies or connector boxes to remain in compliance with FCC limits for Class B operation.**
5. Replace your computer's cover.



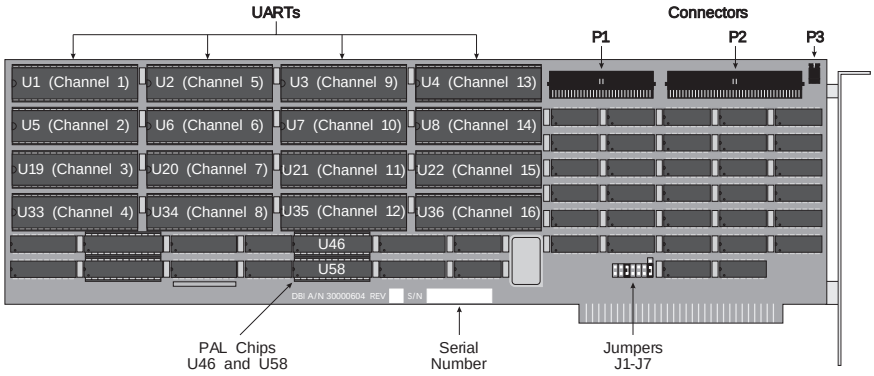
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# PC/16 Boards

## Before you plug in the board. . .

**Write down the serial number of the board in the form on page *x*. You will need it if you have to contact DigiBoard regarding the board.** ***Also write down the part numbers of the PAL chips in sockets U46 and U58 (see Figure 6); it is essential to know these part numbers so you can determine what I/O port addresses correspond to each of the ports on the board.***

**Figure 6** **PC/16 Board Layout**




### *I/O Port Addresses*

The PC/16 board's I/O port addresses are not set by DIP switches. Instead, the addresses are "hard coded" in two PAL (Programmable Array Logic) chips on the board. The PALs are plugged into sockets at locations U46 and U58 (see Figure 6). The part numbers of the PALs can be used to identify the I/O addresses that are used by a particular PC/16 board.

**Important!**

Since the PC/16 board's I/O addresses are hard coded, they cannot be changed in the event of conflict with another device in your system. These conflicts are very rare, but if one should occur, you will need to change the I/O port used by the other device to an address that is not being used by the PC/16 board(s). Tables 3 and 4 on the following pages show the addresses coded in the PC/16 boards' PALs.



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There are two main sets of PALs available for PC/16 boards: Standard (for MS-DOS, OS/2, Windows, etc.) and Pick (for the Pick operating system). These main sets contain two pairs of PALs—one for Board 0 and one for Board 1.

**Important!** If two PC/16 boards are to be installed in the same computer, they must have different PAL sets, or I/O address conflicts will occur. See Tables 3 and 4 for the appropriate part numbers for Board 0 and Board 1 PALs.

### Table 3 Standard (DOS) PALs and their Associated I/O Addresses

| **Board 0** | | **Board 1** | |
|---|---|---|---|
| PAL #40000246 (U58)<br>PAL #40000247 (U46) | | PAL #40000248 (U58)<br>PAL #40000249 (U46) | |
| **Port** | **I/O Address** | **Port** | **I/O Address** |
| 1 | 100h | 1 | 188h |
| 2 | 108h | 2 | 190h |
| 3 | 110h | 3 | 198h |
| 4 | 118h | 4 | 208h |
| 5 | 120h | 5 | 210h |
| 6 | 128h | 6 | 218h |
| 7 | 130h | 7 | 220h |
| 8 | 138h | 8 | 228h |
| 9 | 148h | 9 | 230h |
| 10 | 150h | 10 | 238h |
| 11 | 158h | 11 | 240h |
| 12 | 160h | 12 | 248h |
| 13 | 168h | 13 | 250h |
| 14 | 170h | 14 | 258h |
| 15 | 178h | 15 | 260h |
| 16 | 180h | 16 | 268h |
| Status Register | 140h | Status Register | 140h |



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**Table 4 Pick PALs and their Associated I/O Addresses**

| Board 0 | | Board 1 | |
|---|---|---|---|
| PAL #40000238 (U58)<br>PAL #40000239 (U46) | | PAL #40000240 (U58)<br>PAL #40000241 (U46) | |
| **Port** | **I/O Address** | **Port** | **I/O Address** |
| 1 | 130h | 1 | 230h |
| 2 | 138h | 2 | 238h |
| 3 | 140h | 3 | 240h |
| 4 | 148h | 4 | 248h |
| 5 | 150h | 5 | 250h |
| 6 | 158h | 6 | 258h |
| 7 | 160h | 7 | 260h |
| 8 | 168h | 8 | 268h |
| 9 | 1B0h | 9 | 2B0h |
| 10 | 1B8h | 10 | 2B8h |
| 11 | 1C0h | 11 | 2C0h |
| 12 | 1C8h | 12 | 2C8h |
| 13 | 1D0h | 13 | 2D0h |
| 14 | 1D8h | 14 | 2D8h |
| 15 | 1E0h | 15 | 2E0h |
| 16 | 1E8h | 16 | 2E8h |
| Status Register | 188h | Status Register | 289h |

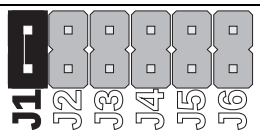
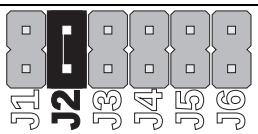
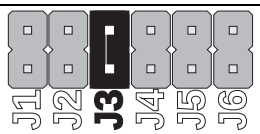
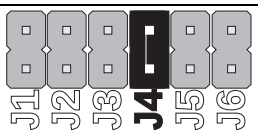
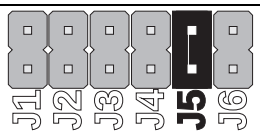
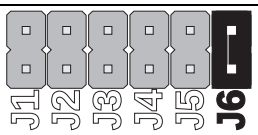


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### *IRQ Selection*

The PC/16 board can be configured to use one of six IRQ (Interrupt Request) lines: IRQ2, IRQ3, IRQ4, IRQ5, IRQ6 or IRQ7. Jumpers J1-J6 (see Figure 6) determine which IRQ the board will use. To set the IRQ for the PC/16 board, place a jumper across the appropriate pair of pins, as shown in Table 5, below.

**Table 5 PC/16 IRQ Jumper Settings**

| | |
|---|---|
|  IRQ2 - J1 Jumpered |  IRQ3 - J2 Jumpered |
|  IRQ4 - J3 Jumpered |  IRQ5 - J4 Jumpered |
|  IRQ6 - J5 Jumpered |  IRQ7 - J6 Jumpered |

The IRQ selected for the PC/16 board must be unique, and may not be shared with any other device in the system, with one exception: two PC/16 boards may share the same IRQ, if the boards are “daisy chained” together (see Daisy Chaining PC/X Boards, on page 43).



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Some common sources of contention for IRQs are:

IRQ2: EGA adapters (if present)
IRQ3: Standard COM2 & COM4 ports (if present)
IRQ4: Standard COM1 & COM3 ports (if present)
IRQ5: LPT2 (Second parallel printer port) (if present)
IRQ6: Floppy disk controller
IRQ7: LPT1 (First parallel printer port) (if present)

### *Board Identification*

Jumper J7 (see Figure 6) is used to set the PC/16 board's ID number (0 or 1) when two boards are daisy chained together (see Daisy Chaining PC/X Boards, on page 43). The default Board ID is 0; this should be changed to 1 *only for the second board in a daisy chained pair of boards.*

**Figure 7 PC/16 Board ID Jumper Settings**




Board 0: Pins 1 and 2 Connected




Board 1: Pins 2 and 3 Connected



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### *Daisy Chain Connector P3*

In the upper right-hand corner of the PC/16 board is a connector, P3 (see Figure 6). When two boards are daisy chained together (see Daisy Chaining PC/X Boards, on page 43), the daisy chain cable is connected between connector P3 of Board 0 and connector P3 of Board 1. *In all other cases, the two pins of P3 must be jumpered together as shown in Figure 8, below:*

**Figure 8 PC/16 Daisy Chain Connector P3, with Jumper**





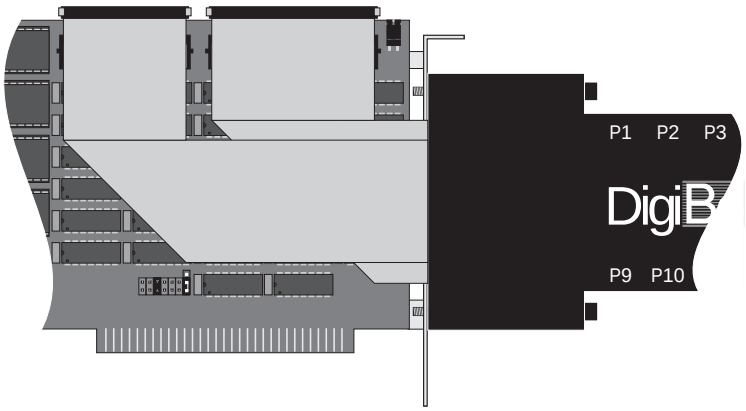
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## Plugging in the Board

Once you have set all of the jumpers and noted the PAL part numbers (and the board's serial number!) you are ready to install the PC/16 board in your computer.

1. Locate a vacant full length eight or sixteen bit (XT or AT) slot in your computer and remove the end plate (save the screw).
2. Fold the cables from the RJ-45 connector box so that they line up with connectors P1 and P2 on the top edge of the board as shown in Figure 9.

**Figure 9 Folding the Interface Cables**




3. Feed the cables through the open slot in the back of the computer.
4. Plug the board into the selected I/O slot in the computer. Use the screw you removed in Step 1 to secure the board to the computer chassis. The endplate must to be screwed in to the computer chassis to remain in compliance with Part 15 of the FCC rules for class B operation.
5. Screw the connector box to the end plate of the PC/16 board.
6. Plug the connector box ribbon cables into connectors P1 and P2 on the top of the board.



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# MC/X Boards

This section provides instructions for installing and configuring MC/4, MC/8 and MC/16 boards in Micro Channel computers. These boards are for use with IBM PS/2 and compatible computers which use Micro Channel bus architecture.

Instructions for installing PC/X boards (in ISA computers) begin on page 3.

# Before you plug in the board. . .

**Write down the serial number of the board in the form on page *x*. You will need it if you have to contact DigiBoard regarding the board.**

Make sure you have the following items at hand:

- *Working* copy of your IBM Reference Diskette (don't use the original—it should be write-protected and stored in a safe place)
- ADF (Adapter Description Files) diskette (supplied with the board)

If you are installing a MC/16 board, remove the cover from the connector "tail" (replace the cover after the board has been installed in the computer).



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**Figure 10** **MC/4 and MC/8 Board Layout**

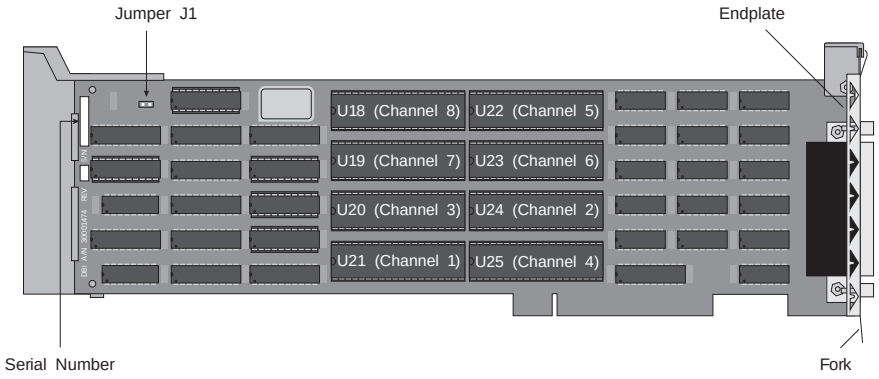
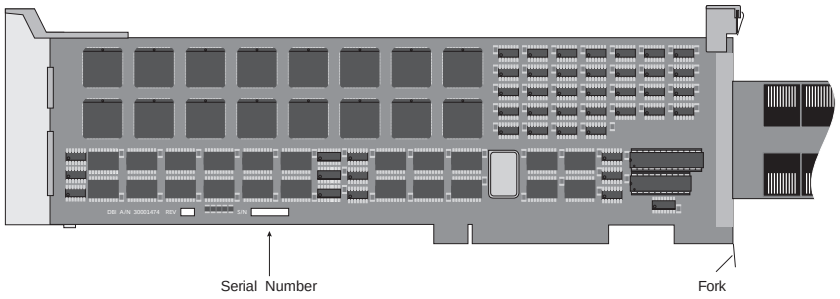



**Figure 11** **MC/16 Board Layout**




**Important!** MC/X boards contain static-sensitive components. Always touch a grounded surface to discharge static electricity before handling the circuit board.



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# Plugging in the Board

Now you are ready to install the MC/X board in your computer. Follow these steps:

1. Turn off your computer's power and remove the cover (refer to your computer's manual for instructions on cover removal and option board installation and cautions).
2. Locate an available Micro Channel slot in your computer and remove the external slot plate (you will need to loosen the thumbscrew to do this). If you are installing an MC/16 board, also make sure that there is at least six inches of clearance behind the computer for the RJ-45 connector tail.
3. Plug the MC/X board into the Micro Channel slot, making sure that the "fork" is in position under the endplate thumbscrew. Tighten the thumbscrew.
4. (MC/16 only) Be sure to replace the cover on the connector tail. This is required in order to remain in compliance with Part 15 of the FCC rules for Class B operation.
5. Replace your computer's cover.



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# Configuring the Board

After the MC/X board has been physically installed in your machine, you need to configure the board for operation in your system. This is done by running the configuration program on the IBM Reference Diskette. Follow these steps:

1. Insert your working copy of the IBM Reference Diskette into your boot drive (Drive A) and turn on the computer's power. Expect an error message—the MC/X board won't be found in the configuration file at this point.

2. Select "Copy an Option Diskette" from the main menu. Follow the instructions given on your computer screen for copying ADF files onto your Reference Diskette. The name of the ADF file for MC/4 and MC/8 boards is **`@6FE5.ADF`**. The ADF file for MC/16 boards is **`@6FE4.ADF`**.

3. Select "Set Configuration" from the main menu. Then select "Change Configuration" from the Set Configuration menu. The screen will now display the configuration of the system. Use the <Page UP> and <Page Down> keys to scroll through the configuration until you see the entry for the slot into which you have plugged the MC/X board. There are three parameters which can be set: I/O Port Address, Com2 Status and Interrupt Select.

   To change a parameter, use the arrow keys to highlight the item you wish to change, then press the <F5> and <F6> function keys to cycle through the available settings for that parameter.

   When you have set all three parameters to the desired values, press <F10> to save the changes, then press <F3> to exit.



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The following options are available:

**MC/4, MC/8 I/O Port Address:**

**0xDB80 → 0xDBC0**
DB80h DB88h DB90h DB98h
DBA0h DBA8h DBB0h DBB8h
Status Register: DBC0h

**0xDC00 → 0xDC40**
DC00h DC08h DC10h DC18h
DC20h DC28h DC30h DC38h
Status Register: DC40h

**0xBB80 → 0xBBC0**
BB80h BB88h BB90h BB98h
BBA0h BBA8h BBB0h BBB8h
Status Register: BBC0h

**0xBC00 → 0xBC40**
BC00h BC08h BC10h BC18h
BC20h BC28h BC30h BC38h
Status Register: BC40h

**0xAB80 → 0xABC0**
AB80h AB88h AB90h AB98h
ABA0h ABA8h ABB0h ABB8h
Status Register: ABC0h

**0xAC00 → 0xAC40**
AC00h AC08h AC10h AC18h
AC20h AC28h AC30h AC38h
Status Register: AC40h

**0xCB80 → 0xCBC0**
CB80h CB88h CB90h CB98h
CBA0h CBA8h CBB0h CBB8h
Status Register: CBC0h

If you are installing an MC/4 board, only the first four addresses in each list are pertinent.



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**MC/16 I/O Port Address:**

**0x3000 → 0x307F**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 3000h | 3008h | 3010h | 3018h | 3020h | 3028h | 3030h | 3038h |
| 3040h | 3048h | 3050h | 3058h | 3060h | 3068h | 3070h | 3078h. |

**0x4000 → 0x407F**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4000h | 4008h | 4010h | 4018h | 4020h | 4028h | 4030h | 4038h |
| 4040h | 4048h | 4050h | 4058h | 4060h | 4068h | 4070h | 4078h |

**0x4100 → 0x417F**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4100h | 4108h | 4110h | 4118h | 4120h | 4128h | 4130h | 4138h |
| 4140h | 4148h | 4150h | 4158h | 4160h | 4168h | 4170h | 4178h |

**0x4200 → 0x427F**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4200h | 4208h | 4210h | 4218h | 4220h | 4228h | 4230h | 4238h |
| 4240h | 4248h | 4250h | 4258h | 4260h | 4268h | 4270h | 4278h |

**0x4300 → 0x437F**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4300h | 4308h | 4310h | 4318h | 4320h | 4328h | 4330h | 4338h |
| 4340h | 4348h | 4350h | 4358h | 4360h | 4368h | 4370h | 4378h |

**0x5000 → 0x507F**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 5000h | 5008h | 5010h | 5018h | 5020h | 5028h | 5030h | 5038h |
| 5040h | 5048h | 5050h | 5058h | 5060h | 5068h | 5070h | 5078h |

**0x6000 → 0x607F**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 6000h | 6008h | 6010h | 6018h | 6020h | 6028h | 6030h | 6038h |
| 6040h | 6048h | 6050h | 6058h | 6060h | 6068h | 6070h | 6078h |

**0x7000 → 0x707F**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 7000h | 7008h | 7010h | 7018h | 7020h | 7028h | 7030h | 7038h |
| 7040h | 7048h | 7050h | 7058h | 7060h | 7068h | 7070h | 7078h |

**MC/16 Status Register Address:**

**0x3080 → 0x3081**
**0x4080 → 0x4081**
**0x4180 → 0x4181**
**0x4280 → 0x4281**
**0x4380 → 0x4381**
**0x5080 → 0x5081**
**0x6080 → 0x6081**



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**Com2 Status:**

When Com2 Status is enabled, the first port on the MC/X board is given an I/O port address of 2F8h and assigned to interrupt IRQ3, regardless of the settings of the other parameters. This makes the first port look like a standard COM2 port. *If your machine already has a COM2 serial port, there will be address and interrupt conflicts between the two devices.*

**Interrupt Vectors:**

IRQ 3, 5, 7, 10, 11, 12, 15 or None (IRQ disabled).

Make a note of the UART Address Range and the Interrupt Select. You will need this information when setting up device drivers. Also verify that "Com2 Status" is set to "Disabled". If it is not, you can change it by selecting the "Set Configuration" menu.

**4.** Remove the Reference Diskette from the drive and reboot your machine. This time you should get no error message.



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# Connecting Peripherals

This section provides information on the most common peripheral connection schemes for terminals, printers and modems. See *RS-232 Serial Interface*, beginning on page 34, for a more comprehensive discussion of serial interface options.

**Important!** When connecting peripheral devices to the PC/X or MC/X board, be sure to turn off the power to both the host computer and the peripheral device.

## Terminals and Printers

***Software Handshaking (XON/XOFF)***

In most cases, serial terminals and printers need only a "three-wire" connection. All DigiBoard PC/X and MC/X device driver software supports XON/XOFF (software) handshaking, so the only signal lines necessary are Transmitted Data (TxD), Received Data (RxD) and Signal Ground (SG). It may be necessary to disable DCD (Data Carrier Detect) sensing through a software command—see your DigiBoard device driver software manual for instructions. Cables must be shielded to remain in compliance with FCC certification requirements, and the shield should be connected to Chassis Ground (GND) at both ends of the cable run.

A simple cable for connecting a terminal or a printer to a PC/X or MC/X board is shown in Figure 12 (DB-25 versions) and Figure 13 (RJ-45 versions).



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**Figure 12 Simple Terminal/Printer Cable (DB-25)**

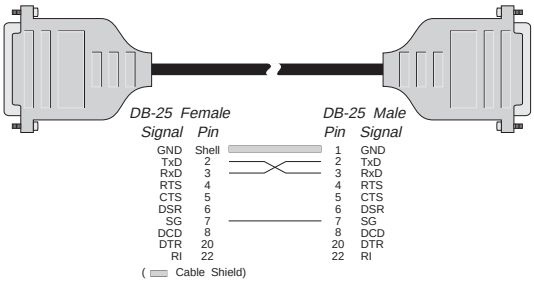
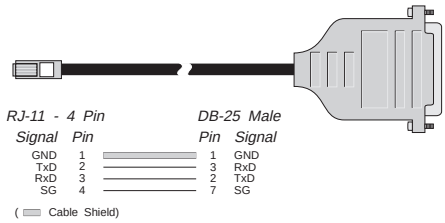



**Figure 13 Simple Terminal/Printer Cable (RJ-45)**




The cables shown in Figures 12 and 13 are three-wire null modem cables—that is, Transmitted Data on one end of the cable is connected to Received Data at the other end, and vice versa.

*DB-25 Equipped Boards:*

The male DB-25 end can be plugged directly into most serial terminals and printers without any adapters. The female DB-25 end plugs directly into one of the DB-25 connectors on the fan out cable or connector box assembly.

*RJ-45 Equipped Boards:*

The male DB-25 end can be plugged directly into most serial terminals and printers without any adapters. The RJ-11 plug fits in the center of the PC/X or MC/X board's RJ-45 jack.



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### *Hardware Handshaking (Ready/Busy)*

Most terminals and printers use Data Terminal Ready (DTR) for Ready/Busy hardware handshaking. The cables below support this method (see note on the following page).

**Figure 14 Terminal/Printer Cable with DTR Handshaking (DB-25)**

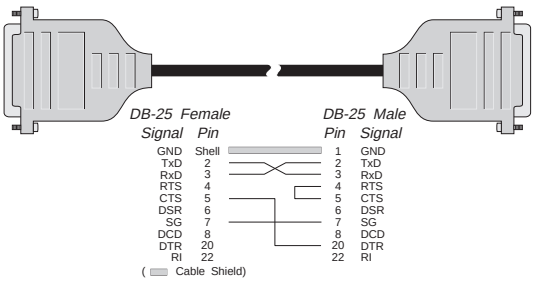
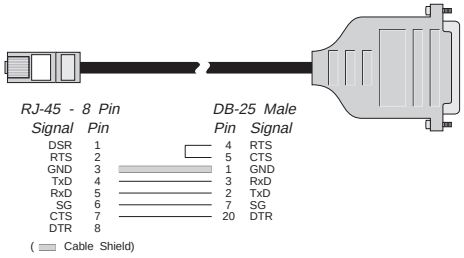



**Figure 15 Terminal/Printer Cable with DTR Handshaking (RJ-45)**




**Note:**

Some Okidata printers use a control signal on pin 11, called Supervisory Send Data (SSD) instead of DTR. In this case, simply connect CTS on the RJ-45 side to pin 11 of the DB-25, instead of pin 20.

Other printer manufacturers may use different methods of flow control. Consult your printer's documentation for specific wiring requirements.



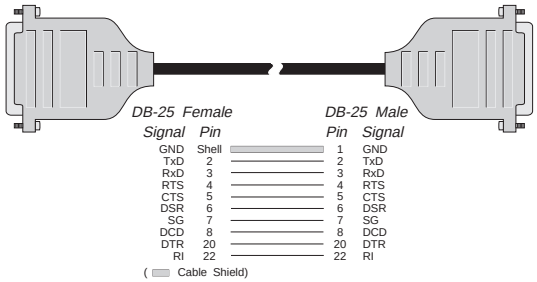
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# Modems

*DB-25 Versions*

Use a standard “straight-through” cable (see Figure 16) to connect a modem to one of the DB-25 connectors on the fan out cable or connector box.

**Figure 16 Modem Cable (DB-25)**

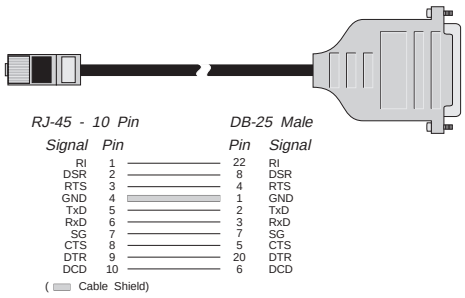



*RJ-45 Versions*

The simplest way to connect a modem to a board with RJ-45 connectors is to use RJ-45 to DB-25 “Cable Legs”, available from DigiBoard (see page 41 for a description and part numbers). These adapters use 10-pin RJ-45 plugs, and therefore provide full modem support (Ring Indicator and Data Carrier Detect are only available on 10-pin RJ-45 connectors).

If you wish to build your own modem cables, follow the diagram in Figure 17.

**Figure 17 Full 10-Wire Modem Cable (RJ-45)**





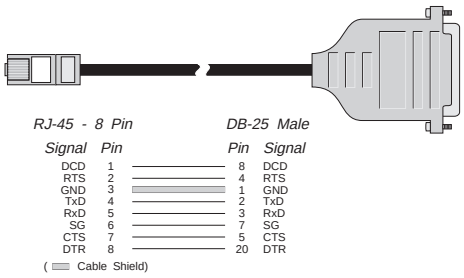

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### *ALTPIN Modem Wiring (RJ-45 Versions)*

10-pin RJ-45 plugs may be difficult to obtain in the retail market; therefore, DigiBoard device driver software incorporates an optional feature called ALTPIN, which swaps the logical functions of DSR (Data Set Ready) with DCD (Data Carrier Detect). When ALTPIN is enabled (see your device driver software reference manual for instructions), DCD becomes available on pin 1 of an 8-pin RJ-45 connector (equivalent to pin 2 of a 10-pin connector).

If you wish to build an 8-wire modem cable for the PC/X or MC/X board, use an 8-pin RJ-45 plug wired as follows:

**Figure 18 8-Wire Modem Cable for use with ALTPIN Configuration**






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# RS-232 Cables and Connector Options

## Cables

RS-232 serial interface cables should be shielded, low-capacitance cables, ideally designed specifically for serial data transmission.

### Grounding

The shield should be grounded at both ends of the cable. Chassis Ground—available on the shell of DigiBoard's DB-25 and DB-9 connectors, and pin 4 of our 10-pin RJ-45 connector, is ideal for this purpose.

### Environment

While good shielding provides reasonable protection against "noise" (Electro-Magnetic Interference, or EMI), cables should still be routed away from noise sources wherever possible. Avoid laying cables in close proximity to transformers, generators, motors, fluorescent lights, etc.

### Capacitance vs. Length of Run

The total capacitance of a cable affects the integrity of transmitted data. As a rule of thumb, the *total* capacitance of a cable (including the connectors) should not exceed 2500 pF. Serial interface cable is usually rated in pico Farads per foot. Therefore, if a cable has a capacitance of 50 pF/ft, and the connectors are 100 pF each, the maximum recommended cable length is 46 feet. If the cable is rated at 12.5 pF/ft, the maximum recommended cable length is 184 feet, and 5 pF/ft cable can be run up to 460 feet.

In situations where low-capacitance cable is unavailable, or very long cable runs are required, "short-haul" modems, available from suppliers such as Black Box, can be used to increase the effective range of the RS-232 interface. Short-haul modems are similar to standard modems, except that they are connected directly to each other via a cable instead of going through a telephone circuit. *NOTE—Use only externally-powered short-haul modems with DigiBoard products.*



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# Connector Options

A variety of connector types are available. Four and eight port PC/X and MC/X boards can be set up with DB-25 connectors (male or female, DTE or DCE wiring), DB-9 connectors (male or female, DTE wiring) or 10-pin RJ-45 jacks. ***NOTE: PC/16 and MC/16 boards are available* only *with RJ-45 connectors.*** The following pages give the part numbers and wiring information for the various connector types.

# DB-25 Connectors

DigiBoard PC/X and MC/X boards can be configured with DB-25 connectors in any of four configurations: DTE male, DTE female, DCE male or DCE female. The pin assignments for the DB-25 connectors follow the usual conventions for RS-232 wiring.

**Table 6 DB-25 Connector Pin Assignments**

| Signal | Description | DTE Use | DCE Use | Pin # |
|---|---|---|---|---|
| GND | Chassis Ground | N/A | N/A | Shell |
| TxD | Transmitted Data | Output | Input | 2 |
| RxD | Received Data | Input | Output | 3 |
| RTS | Request to Send | Output | Input | 4 |
| CTS | Clear to Send | Input | Output | 5 |
| DSR | Data Set Ready | Input | Output | 6 |
| SG | Signal Ground | *reference* | *reference* | 7 |
| DCD | Data Carrier Detect | Input | Output | 8 |
| DTR | Data Terminal Ready | Output | Input | 20 |
| RI | Ring Indicator | Input | Output | 22 |

It should be noted that the DCE configuration is equivalent to a DTE connector plus a fully-wired null modem adapter. Thus, DCD (Data Carrier Detect) and DSR (Data Set Ready) are wired together internally and carry the DTE equivalent of DTR (Data Terminal Ready). *For this reason, DCE cables* cannot *be used with modems*.



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## DB-25 Connector Options

DB-25 connectors are available in two styles: a quad or octa cable assembly, or a connector box assembly. Either style may be ordered with male or female DB-25 connectors, configured as DTE or DCE devices.

***Quad and Octa Cable Option (DTE or DCE)***

Figure 19 shows the eight-port cable assembly, and Table 7 gives the part numbers of the available configurations.

**Figure 19 Octa-Cable Assembly**

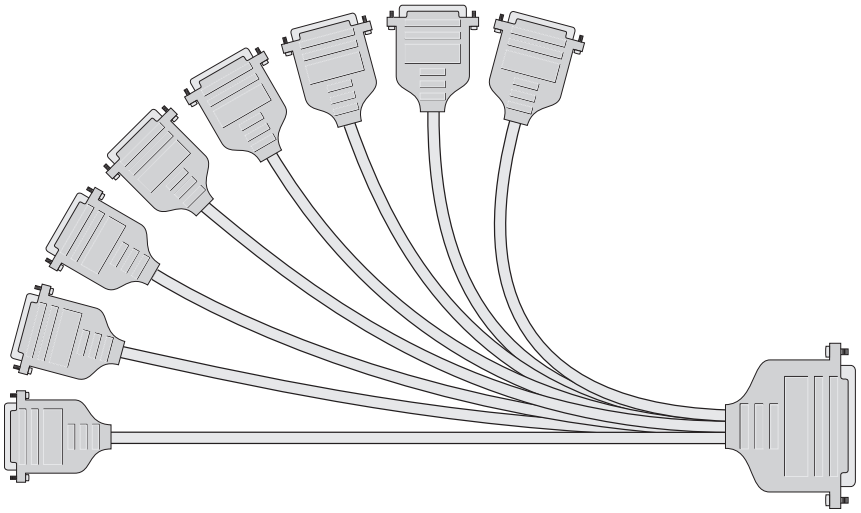


**Table 7 DB-25 Cable Options and Part Numbers**

| | DTE Quad | DCE Quad | DTE Octa | DCE Octa |
|---|---|---|---|---|
| **DB-25 Male** | 76000008 | 76000007 | 76000021 | 76000020 |
| **DB-25 Female** | 76000006 | 76000005 | 76000019 | 76000018 |



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*Quad and Octa Connector Boxes (DTE or DCE)*

**Figure 20 Eight-Port DB-25 Connector Box**

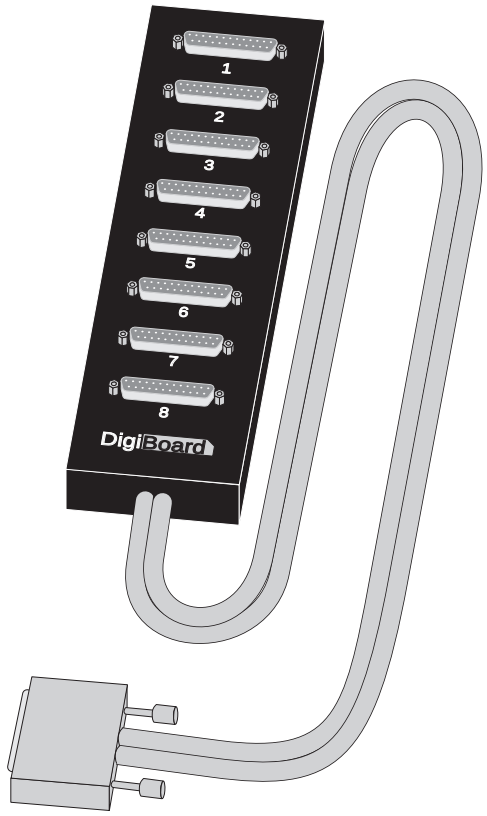



**Table 8 Connector Box Options and Part Numbers**

| | DTE Quad | DCE Quad | DTE Octa | DCE Octa |
|---|---|---|---|---|
| **DB-25 Male** | 76000030 | 76000028 | 76000031 | 76000029 |
| **DB-25 Female** | 76000026 | 76000024 | 76000027 | 76000025 |



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# DB-9 Connectors

PC/X and MC/X boards can be configured with male or female DB-9 connectors (DTE wiring only).

**Table 9 DB-9 Connector Pin Assignments**

| Signal | Description | Direction | Pin # |
|---|---|---|---|
| GND | Chassis Ground | N/A | Shell |
| DCD | Data Carrier Detect | Input | 1 |
| TxD | Transmitted Data | Output | 3 |
| RxD | Received Data | Input | 2 |
| DTR | Data Terminal Ready | Output | 4 |
| SG | Signal Ground | *reference* | 5 |
| DSR | Data Set Ready | Input | 6 |
| RTS | Request to Send | Output | 7 |
| CTS | Clear to Send | Input | 8 |
| RI | Ring Indicator | Input | 9 |

DB-9 connectors are available only in the quad or octa cable “fan-out” configuration (see Figure 19, on page 36).

**Table 10 DB-9 Quad and Octa Cable Options and Part Numbers**

| | Quad DTE | Octa DTE |
|---|---|---|
| **DB-9 Male** | 76000003 | 76000015 |
| **DB-9 Female** | 76000001 | 76000013 |



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# RJ-45 Connectors

PC/X and MC/X boards can be configured with 10-pin RJ-45 modular jacks. These accept plastic snap-in plugs like the ones used for connecting telephones. They are less bulky and more convenient to use than the DB-25, but have not undergone the standardization rigors that have been applied to the larger DB-25 connectors. Figure 21 shows the eight-port RJ-45 connector block, and Table 11 gives the applicable part numbers.

**Figure 21 Eight-Port RJ-45 Connector Box**

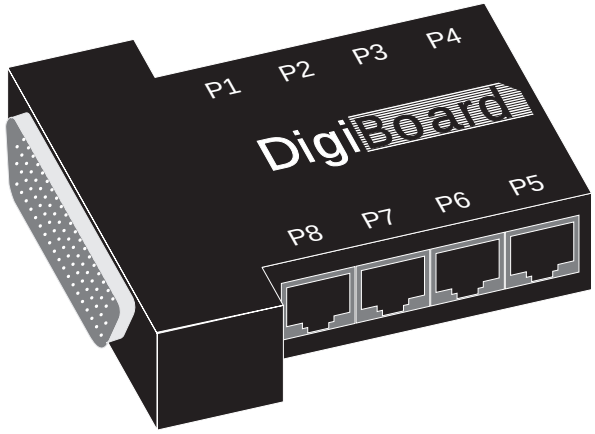



**Table 11 RJ-45 Connector Box Options**

| | Quad | Octa |
|---|---|---|
| **RJ-45** | 76000038 | 76000033 |



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## Modular Plugs

There are four types of modular plugs that can be used with DigiBoard's RJ-45 10-pin jack. These are the 4 or 6-pin RJ-11 plugs, and the 8 or 10-pin RJ-45 plugs.

The 8 and 10-pin RJ-45 plugs are the same physical size, but the 10-pin version has one additional wire at each end of the row of contacts. Thus pins 1-8 of an 8-pin RJ-45 directly correspond to pins 2-9 of a 10-pin RJ-45 connector.

Similarly, the two RJ-11 plugs have the same physical dimensions, but the 6-pin version has an extra pin at each end. The RJ-11 plugs are physically smaller than RJ-45 plugs, but are designed so that they fit into the *center* of an RJ-45 jack. In this way, the four pins closest to the center of any size connector will always carry the same signals as the middle four pins of any other connector. The contacts of a 6-pin RJ-11 connector correspond directly to the middle six pins of an 8 or 10-pin RJ-45 connector, and so on.

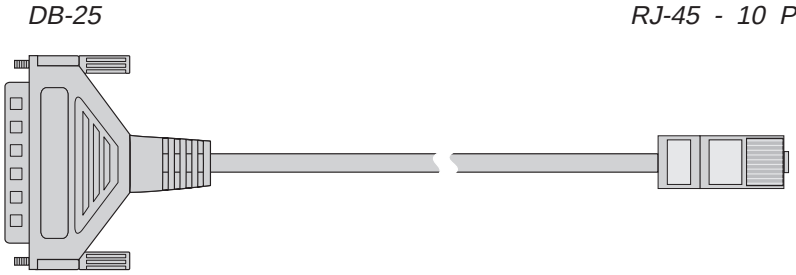


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## RJ-45 to DB-25 Conversion

Since most RS-232 devices are equipped with DB-25 connectors, it is necessary to buy or build an adapter to transfer the signals to a DB-25 plug. The most simple and direct approach is to purchase ready-made "Cable Legs" from a DigiBoard dealer or distributor. These are made with a full 10-pin RJ-45 plug (which can be difficult to obtain in the retail market), connected via a two or four foot cable to a DTE-configured DB-25 plug.

**Figure 22** **RJ-45 to DB-25 "Cable Leg"**




| *Pin* | *Signal* |
|---|---|
| Shell | Chassis Ground |
| 2 | TxD |
| 3 | RxD |
| 4 | RTS |
| 5 | CTS |
| 6 | DSR |
| 7 | Signal Ground |
| 8 | DCD |
| 20 | DTR |
| 22 | RI |

| *Pin* | *Signal* |
|---|---|
| 1 | RI |
| 2 | DSR |
| 3 | RTS |
| 4 | Chassis Ground |
| 5 | TxD |
| 6 | RxD |
| 7 | Signal Ground |
| 8 | CTS |
| 9 | DTR |
| 10 | DCD |

**Table 12** **Cable Leg Options and Part Numbers**

| | DB-25 Male | DB-25 Female | DB-9 Male |
|---|---|---|---|
| **24 Inch Cables** | 61020024 | 61030024 | 61070024 |
| **48 Inch Cables** | 61020048 | 61030048 | N/A |



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The pin configuration of the DB-25 connector on the Cable Leg is identical to that of the DB-25 connectors on the standard DigiBoard DTE octa cable, and provides full modem control.

Since the cable leg's DB-25 connector is configured for DTE, you need a null modem cable or adapter for terminals and printers. See Figure 12 on page 30, and Figure 14 on page 31 for null modem configurations that can be used with cable legs.

If you don't need full modem control, you can use one of the many commercially available RJ-45 to DB-25 adapters. These have both an 8-pin RJ-45 jack and a DB-25 plug in a housing no larger than that found on a standard DB-25 plug. The plug and jack are connected within the housing by jumpers which may be installed by the end-user in any desired configuration.



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# Daisy Chaining PC/X Boards

## PC/4 and PC/8 Boards

In some operating systems, such as MS-DOS and Pick, it is possible, or even necessary, to "daisy chain" multiple PC/X boards together on one or two interrupts. This, in effect, makes the entire group of boards appear to the system as one board. This may be done with up to four PC/4 and/or PC/8 boards, and with two PC/16 boards.

The PC/X board has an interrupt sequencer which cycles through each of the ports on the board, looking for an active interrupt request. When it finds one, it stops cycling, activates the interrupt request line for that port and waits for the interrupt to be serviced by the host computer. Once the interrupt has been handled, the sequencer starts up again and continues in this manner until the last port is polled. At this point the sequencer's counter is reset and a token output is sent to pin 2 of either P-2 (for odd-numbered interrupts) or P-3 (for even-numbered interrupts). In a single-board system, this token passes through a jumper shunt and back into pin 3 of the same connector, and restarts the interrupt sequencer's polling cycle. In a multi-board system, the signal passes through the daisy-chain cable to pin 3 of the same connector of the next board in sequence. Pin 2 of the last board is connected to pin 3 of the first board, closing the loop. In this manner, all ports of all boards are polled in each cycle.

When multiple boards will be sharing interrupt request lines, the interrupt status registers of each board MUST be set to the same address (set by the 10-position switch bank DS-1). When reading the status port to find the particular channel generating an interrupt, the ODD interrupt is checked at the address selected on DS-1, and the EVEN interrupt is checked at that address plus 1. Thus, if the status register is addressed at 140h (the default setting), the ODD interrupt status is found at address 140h and the EVEN interrupt status is found at 141h.

The status port reflects the board number in bits 3 and 4 as a binary number between 0 and 3. Bits 0, 1 and 2 contain a binary number between 0 and 7 indicating the number of the channel that needs servicing. Thus, if the status port contains 16h, or 00010110 binary, the third board (board #2) has an interrupt pending on channel 6 (or the 7th physical port—remember that the first board or port is number 0). If no interrupt is pending, the status port will contain FFh (all bits set to 1).



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If more than one interrupt is pending, the status port will reflect the first one. Once that interrupt has been serviced, the next one in numerical sequence will appear in the status port. Therefore, by reading the status port until it comes up FFh, all pending interrupts will have been serviced.

The following figures show the necessary wiring for one to four boards (a single board system is shown for completeness). Note that if only one interrupt is used (which is recommended, since no performance improvement will be seen by using two), only one set of cables is needed: install cables on connector P2 for ODD interrupts, or P3 for even interrupts.

**Figure 23 Single Board System (PC/4, PC/8)**

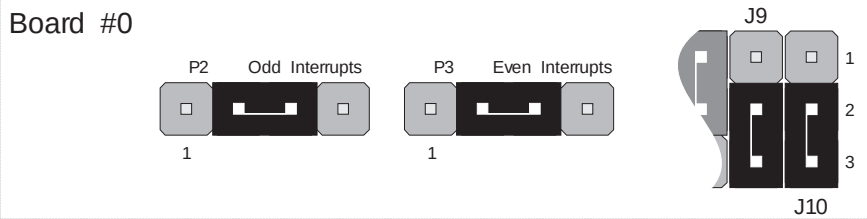
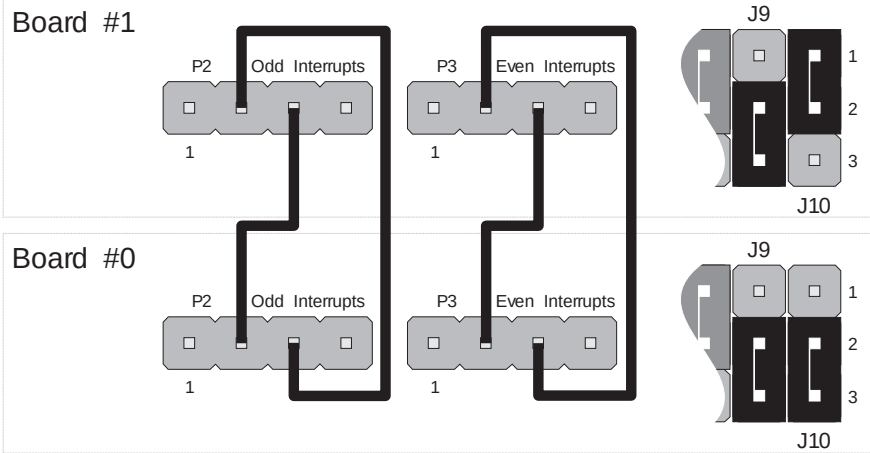


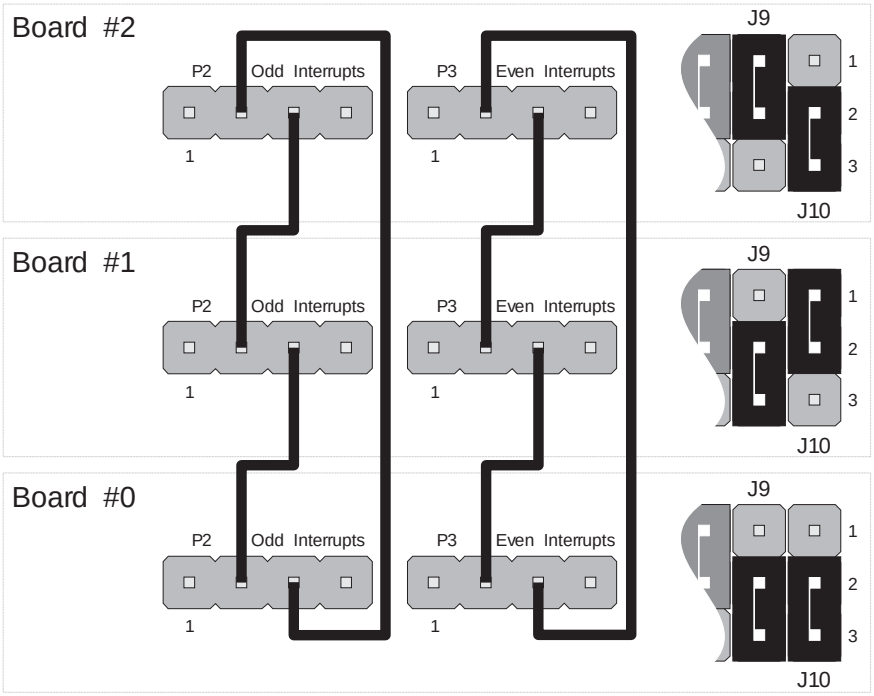

**Figure 24 Two Board System (PC/4, PC/8)**






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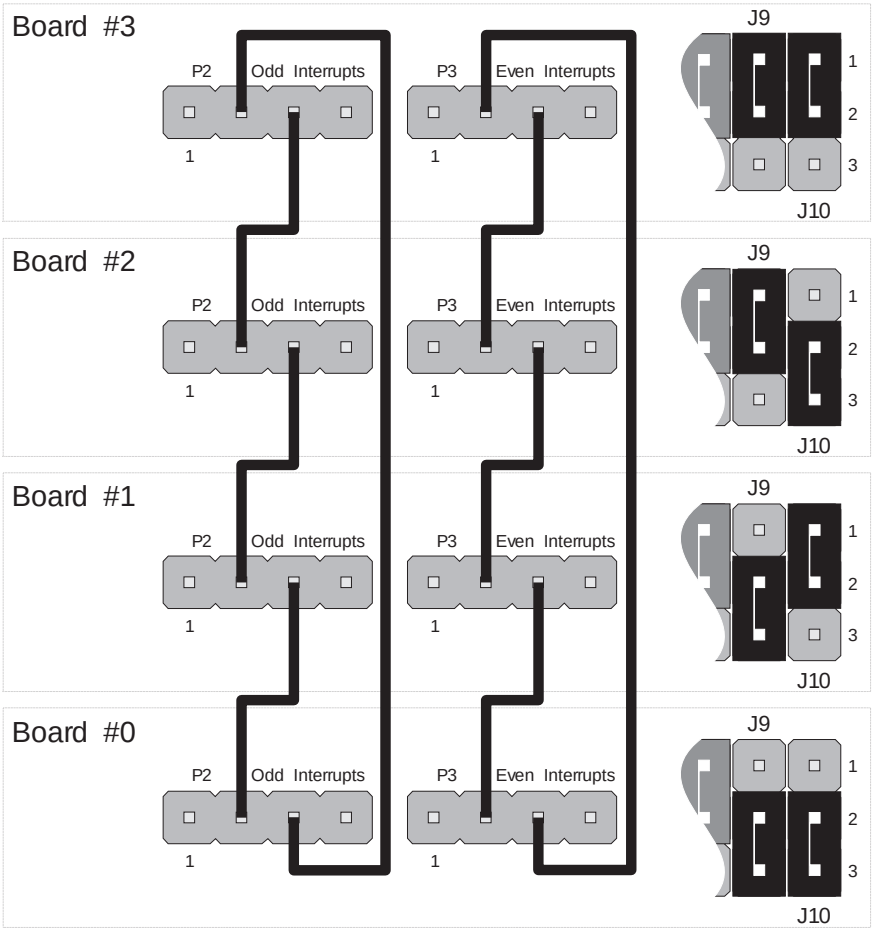
**Figure 25** **Three Board System (PC/4, PC/8)**






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**Figure 26** **Four Board System (PC/4, PC/8)**






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# PC/16 Boards

PC/16 boards function similarly to PC/4 and PC/8 boards, with some minor differences: only two boards may be daisy chained together; since only one interrupt is supported, there is only one daisy chain connector (P3); and both boards must have the correct PALs (e.g. DOS Board 0 and DOS Board 1, or Pick Board 0 and Pick Board 1; see page 16).

**Figure 27** **One Board System (PC/16)**

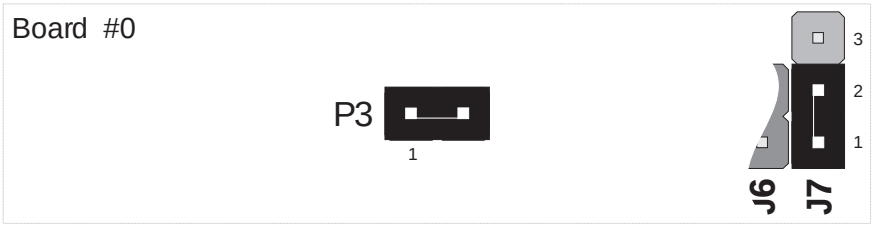
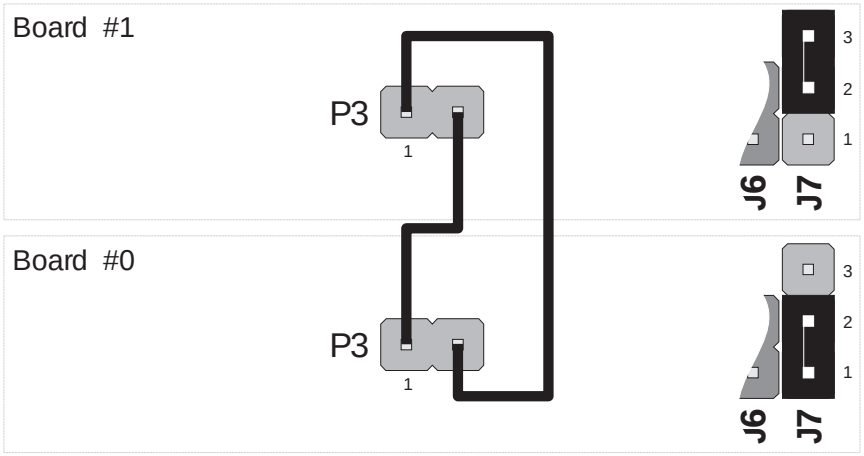



**Figure 28** **Two Board System (PC/16)**






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# Daisy Chain Cables

You can make your own cables as shown in the diagrams, or ready-made cables may be purchased through your DigiBoard dealer or distributor. The part numbers for the cables are:

**PC/4, PC/8:**

| | |
|---|---|
| For Two Boards: | 60000186 |
| For Three Boards: | 60000196 |
| For Four Boards: | 60000197 |

**PC/16:**

| | |
|---|---|
| For Two Boards: | 60000268 |



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# Using PC/X and MC/X Boards with MS-DOS Applications

## PC/X Boards

MS-DOS application programs generally communicate with COM ports by directly accessing the UARTs via their I/O ports. Since these programs control the I/O hardware directly, no device driver is required. Some programs allow the user to specify the I/O port address and IRQ (Interrupt Request) line for each port, while others are able to use only the standard PC COM ports COM1 and COM2 (some applications can also use COM3 and COM4).

To use a DigiBoard PC/4 or PC/8 board with applications that allow the user to specify the I/O port address and IRQ line for each port, set the DIP switches and jumpers for addresses and IRQs that are not used by any other device in the system, then configure the application for the same addresses and IRQs (use the application's setup program or configuration screens).

To use a DigiBoard PC/4 or PC/8 board with MS-DOS applications that can reference only standard PC COM ports, the board must be set up to emulate these ports. To do this, set the DIP switches and jumpers on the board so that the first two (or four) ports on the board have the same I/O addresses and interrupts as the standard PC COM ports, as shown below.

| COM Port | I/O Address | IRQ |
|---|---|---|
| COM1 | 3F8h | 4 |
| COM2 | 2F8h | 3 |
| COM3 | 3E8h | 4 |
| COM4 | 2E8h | 3 |




When using a PC/X board to emulate standard PC COM ports, existing COM ports must be removed or completely disabled.



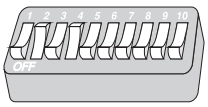

PC/16 boards cannot be configured to emulate standard PC COM ports.



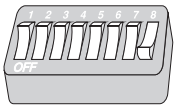
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To use a PC/8 or PC/4 board to emulate COM1 and COM2, set the switches and jumpers as shown below (PC/4 boards have only five banks of switches, DS1-DS5).

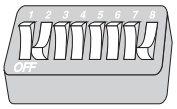
DS1: Status port set to 140h:



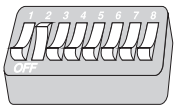
DS2: Port 1 set to 3F8h



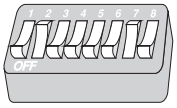
DS3: Port 2 set to 2F8h:



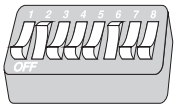
DS4: Port 3 set to 100h:



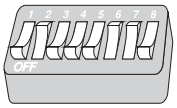
DS5: Port 4 set to 108h:



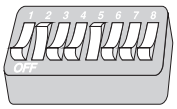
DS6: Port 5 set to 110h:



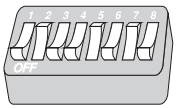
DS7 Port 6 set to 118h:



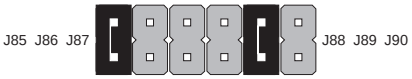
DS8: Port 7 set to 120h:



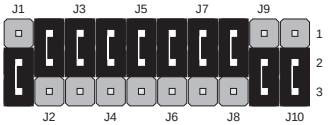
DS9: Port 8 set to 128h:



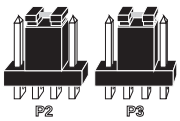
Select *both* IRQ3 and IRQ4 by installing jumpers on J85 and J89:




Set even interrupts for the first port, odd interrupts for the remaining ports:




Install jumpers on both P2 and P3:



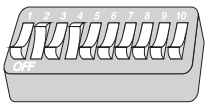

In this configuration, the first two ports emulate COM1 (3F8h, IRQ4) and COM2 (2F8h, IRQ3). The remaining ports are set to I/O addresses 100h-128h, and use IRQ3; these ports are available to software that allows COM ports to be specified by I/O address and IRQ.



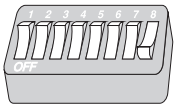
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To use a PC/8 or PC/4 board to emulate COM1 through COM4, set the switches and jumpers as shown below (PC/4 boards have only five banks of switches, DS1-DS5).

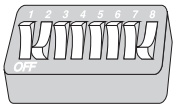
DS1: Status port set to 140h:



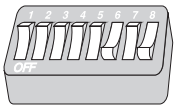
DS2: Port 1 set to 3F8h



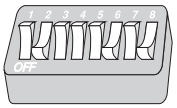
DS3: Port 2 set to 2F8h:



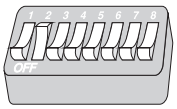
DS4: Port 3 set to 3E8h:



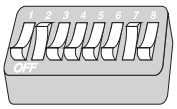
DS5: Port 4 set to 2E8h:



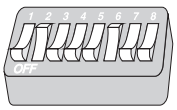
DS6: Port 5 set to 100h:



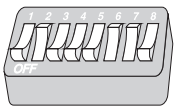
DS7: Port 6 set to 108h:



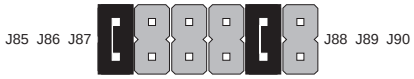
DS8: Port 7 set to 110h:



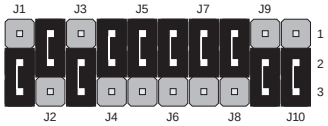
DS9: Port 8 set for 118h:



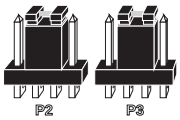
Select *both* IRQ3 and IRQ4 by installing jumpers on J85 and J89:




Set even interrupts for the first and third ports, odd interrupts for the remaining ports:




Install jumpers on both P2 and P3:




In this configuration, the first two ports emulate COM1 (3F8h, IRQ4), COM2 (2F8h, IRQ3), COM3 (3E8h, IRQ4) and COM4 (2E8h, IRQ3). The remaining ports are set to I/O addresses 100h-118h, and use IRQ3; these ports are available to software that allows COM ports to be specified by I/O address and IRQ.



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# MC/X Boards

MC/X boards have a feature that allows the first port to act like COM2. This is set during configuration with the IBM setup disk (see page 28). When Com2 Status is enabled, the first port on the board is assigned I/O address 2F8h and IRQ 3. The remainder of the ports are unaffected.

**Important!**

If your machine has a built-in or installed COM2 port, it must be disabled or removed if Com2 Status is enabled on the MC/X board. Failure to do this will result in I/O and interrupt conflicts between the two devices.

Similarly, only one MC/X board may have Com2 Status enabled.



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# Programming Information

Programming for PC/X and MC/X boards is very similar to programming for a standard COM port. The boards use 16C450 or 16C550 (optional) UARTs, which are directly accessible on your computer's I/O bus.

## Enabling Interrupts

When initializing the UARTs to enable interrupts, one extra step is necessary in addition to setting the appropriate bits in the UART's Interrupt Enable Register: the OUT2 bit in the Modem Control Register must also be set (to logic 1). The INTRPT output line is gated to the interrupt sequencer by the OUT2 line. If OUT2 is not set, the UART will generate an interrupt, but the board will not recognize it and it won't be passed to your computer.



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# Using the Interrupt Status Register

PC/X and MC/X boards have an Interrupt Status Register (ISR) to streamline interrupt handling. When the board requests an interrupt, the software can look at the ISR to see which port caused the interrupt, instead of having to poll each UART. This can save a lot of processor time when a large number of ports is involved. The ISR also supports daisy chaining of PC/X boards so that up to 32 asynchronous serial ports can use the same interrupt (see Daisy Chaining PC/X Boards, on page 43).

## PC/4 and PC/8

The interrupt hardware on PC compatibles is edge triggered. This means that normally only one device may use a given IRQ line (if a second device raised an interrupt on the same line before the first one was serviced, no rising edge would be sensed, and the interrupt would not be detected). PC/X boards provide a method of placing up to four boards on a single IRQ line by daisy chaining the interrupts from board to board (see Daisy Chaining PC/X Boards on page 43). In this way all the boards appear as one device to the host computer.

The PC/X board has an interrupt sequencer which cycles through each of the ports on the board, looking for an active interrupt request. When it finds one, it stops cycling, activates the interrupt request line for that port and waits for the interrupt to be serviced by the host computer. Once the interrupt has been handled, the sequencer starts up again and continues in this manner until the last port is polled. At this point the sequencer's counter is reset and a token output is sent to pin 2 of either P-2 (for odd numbered interrupts) or P-3 (for even numbered interrupts). In a single-board system, this token passes through a jumper shunt and back into pin 3 of the appropriate connector, and restarts the interrupt sequencer's polling cycle. In a multi-board system, the signal passes through the daisy chain cable to pin 3 of the corresponding connector of the next board in sequence. Pin 2 of the last board is connected to pin 3 of the first board, closing the loop. In this manner, all ports of all boards are polled in each cycle.

When multiple boards will be sharing interrupt request lines, the interrupt status registers of each board MUST be at the same address (set by the 10-position switch bank DS-1). When reading the status port to find the particular channel generating an interrupt, the ODD interrupt is checked at the address selected on DS-1, and the EVEN interrupt is checked at that address plus 1. Thus, if the status register is addressed at 140h, the ODD interrupt status is found at address 140h and the EVEN interrupt status is found at 141h.



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The status port reflects the board number in bits 3 and 4 as a binary number between 0 and 3. Bits 0, 1 and 2 contain a binary number between 0 and 7 indicating the number of the channel that needs servicing. Thus, if the status port contains 16h, or 00010110 binary, the third board (board #2) has an interrupt pending on channel 6 (or the 7th physical port—remember that the 1st board or port is number 0). If no interrupt is pending, the status port will contain FFh, or all 1s.

If more than one interrupt is pending, the status port will reflect the first one. Once that interrupt has been serviced, the next one in numerical sequence will appear in the status port. Therefore, by reading the status port until it comes up FFh, all pending interrupts will be serviced. If the interrupt service routine is exited before all interrupts have been cleared, a new interrupt will be generated as soon as interrupts have been reenabled.

## PC/16

PC/16 boards look like two PC/8 boards daisy chained together. Therefore the first eight ports appear to be on Board 0, and the other eight appear to be on Board 1. If two PC/16 boards are daisy chained together, the second board appears as boards 2 and 3.



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## MC/X

Unlike ISA interrupt hardware (which is edge triggered), Micro Channel interrupt hardware is *level* sensitive. This allows multiple boards to share an interrupt line, which eliminates the necessity of daisy chaining boards. The MC/X Interrupt Status Register (ISR) is a 16 bit register that simultaneously reflects ALL pending interrupts for that board. The ISR is bit-mapped so that each bit represents one port on the board. Bit #0 = Port #1, etc. If no interrupts are pending, the ISR contains all zeroes. If multiple boards are using one interrupt, the software must check the ISR for each board in turn to be certain that all interrupts are serviced. When no more interrupts are pending, the ISRs will all be 00 and the IRQ line will drop.



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# Specifications

**PC/4**

**Power requirements**

| | |
|---|---|
| +5 VDC ±5%: | 1.0 Amps max. |
| +12 VDC ±5%: | 55 mA max. |
| -12 VDC ±5%: | 80 mA max. |

**Board dimensions**

| | |
|---|---|
| Length: | 13.1 inches |
| Width: | 0.5 inches |
| Height: | 4.2 inches |
| Weight: | 1.0 pounds |

**Operating environment**

| | |
|---|---|
| Ambient temperature: | 10° C to 55° C |
| Relative humidity: | 5% to 90% |
| Air movement: | 30 CFM forced |
| Altitude: | 0 to 12,000 feet |



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**PC/8**

**Power requirements**

| | |
|---|---|
| +5 VDC ±5%: | 1.2 Amps max. |
| +12 VDC ±5%: | 110 mA max. |
| -12 VDC ±5%: | 160 mA max. |

**Board dimensions**

| | |
|---|---|
| Length: | 13.1 inches |
| Width: | 0.5 inches |
| Height: | 4.2 inches |
| Weight: | 1.0 pounds |

**Operating environment**

| | |
|---|---|
| Ambient temperature: | 10° C to 55° C |
| Relative humidity: | 5% to 90% |
| Air movement: | 30 CFM forced |
| Altitude: | 0 to 12,000 feet |



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**PC/16**

**Power requirements**

| | |
|---|---|
| +5 VDC ±5%: | 1.8 Amps max. |
| +12 VDC ±5%: | 130 mA max. |
| -12 VDC ±5%: | 130 mA max. |

**Board dimensions**

| | |
|---|---|
| Length: | 13.1 inches |
| Width: | 0.5 inches |
| Height: | 4.2 inches |
| Weight: | 0.75 pounds |

**Operating environment**

| | |
|---|---|
| Ambient temperature: | 10° C to 55° C |
| Relative humidity: | 5% to 90% |
| Air movement: | 30 CFM forced |
| Altitude: | 0 to 12,000 feet |



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**MC/4**

**Power requirements**

| | |
|---|---|
| +5 VDC ±5%: | 1.5 Amps max. |
| +12 VDC ±5%: | 50 mA max. |
| -12 VDC ±5%: | 20 mA max. |

**Board dimensions**

| | |
|---|---|
| Length: | 11.5 inches |
| Width: | 0.6 inches |
| Height: | 3.5 inches |
| Weight: | 0.75 pounds |

**Operating environment**

| | |
|---|---|
| Ambient temperature: | 10° C to 55° C |
| Relative humidity: | 5% to 90% |
| Air movement: | 30 CFM forced |
| Altitude: | 0 to 12,000 feet |



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**MC/8**

**Power requirements**

| | |
|---|---|
| +5 VDC ±5%: | 1.5 Amps max. |
| +12 VDC ±5%: | 50 mA max. |
| -12 VDC ±5%: | 20 mA max. |

**Board dimensions**

| | |
|---|---|
| Length: | 11.5 inches |
| Width: | 0.6 inches |
| Height: | 3.5 inches |
| Weight: | 0.75 pounds |

**Operating environment**

| | |
|---|---|
| Ambient temperature: | 10° C to 55° C |
| Relative humidity: | 5% to 90% |
| Air movement: | 30 CFM forced |
| Altitude: | 0 to 12,000 feet |



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**MC/16**

**Power requirements**

| | |
|---|---|
| +5 VDC ±5%: | 1.5 Amps max. |
| +12 VDC ±5%: | 50 mA max. |
| -12 VDC ±5%: | 20 mA max. |

**Board dimensions**

| | |
|---|---|
| Length: | 11.5 inches (16.8 inches with RJ-45 connector) |
| Width: | 0.6 inches |
| Height: | 3.5 inches |
| Weight: | 0.75 pounds |

**Operating environment**

| | |
|---|---|
| Ambient temperature: | 10° C to 55° C |
| Relative humidity: | 5% to 90% |
| Air movement: | 30 CFM forced |
| Altitude: | 0 to 12,000 feet |



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