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Installation Guide

DigiBoard PC/Xi, PC/16e, MC/Xi and COM/Xi
Intelligent Asynchronous
Serial Communications Boards

90029100B

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Electronic Emission Statements

Federal Communications Commission (FCC) Statements

MC/4i, MC/8i, COM/4i, COM/8i

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.

PC/8i, PC/16i, PC/16e, MC/16i

Radio Frequency Interference (RFI)

This Asynchronous Communication Interface Printed Circuit Board generates and uses radio frequency energy, and if not installed and used in strict accordance with manufacturer's instructions, may cause interference to radio and television reception. This board has been type-tested to verify that it complies with the limits for a Class A computing device in accordance with specifications in Subpart J of Part 15 of FCC Rules (Appendix B of OST Bulletin No. 62), which are designed to provide reasonable protection against such interference in a residential installation. However, this does not assure that such interference will not occur in a particular installation. If this printed circuit board does cause interference to radio or television reception, which can be determined by turning your computer OFF and ON, the user is encouraged to attempt correction of the interference by one or more of the following measures:

1. Reorient the receiving antenna.
2. Relocate your computer with respect to the receiver.
3. Move your computer away from the receiver.
4. Plug your computer into a different outlet so the computer and receiver are not on the same circuit.

If these measures fail to eliminate the interference, the user should contact either the distributor or an experienced radio/television technician for further suggestions. The user may also find the following booklet (prepared by the FCC) helpful:

"How to Identify and Resolve Radio/TV Interference Problems"

This booklet is available from the U.S. Government Printing Office, Washington, DC. Request should be made for Stock No. 004000003454.



Shielded cables must be used to remain in compliance with emissions limits.

Industry Canada Compliance Statements

MC/4i, MC/8i, COM/4i, COM/8i

This digital apparatus does not exceed the Class B limits for radio noise for digital apparatus set out in the interference-causing equipment standard entitled: “Digital Apparatus”, ICES-003 of Industry Canada.

Cet appareil numérique respecte les limites de bruits radioélectriques applicables aux appareils numériques de Classe B prescrites dans la norme sur le matériel brouilleur: “Appareils numériques”, NMB-003 édictée par Industrie Canada.

PC/8i, PC/16i, PC/16e, MC/16i

This digital apparatus does not exceed the Class A limits for radio noise for digital apparatus set out in the interference-causing equipment standard entitled: “Digital Apparatus”, ICES-003 of Industry Canada.

Cet appareil numérique respecte les limites de bruits radioélectriques applicables aux appareils numériques de Classe A prescrites dans la norme sur le matériel brouilleur: “Appareils numériques”, NMB-003 édictée par Industrie Canada.

Introduction

This *Installation Guide* covers the installation and configuration of the PC/Xi, PC/16e, MC/Xi and COM/Xi serial communications boards for ISA and Micro Channel computers.

PC/Xi Boards

PC/Xi boards are available with eight or sixteen ports, and 128K, 256K or 512K of dual-ported memory (128K is standard). The PC/Xi board is controlled by a 12.5 MHz 80C186 microprocessor (a 16 MHz version is available as an option).

The PC/Xi board is actually two boards, the *PC/Xi Processor*, and an *I/O Mate* that plug together to form a unit which occupies a single 16-bit slot (see Figure 1 on page 8). The Processor board (or "motherboard") is common to all versions of the PC/Xi, and contains the 80C186 microprocessor and 128K of dual-ported RAM (as an option, this can be expanded to 256K or 512K). The I/O mate (or "daughter card") contains the actual interfacing hardware (communications chips, line drivers and receivers, connectors, etc) which is unique to the various PC/Xi configurations.

PC/Xi boards are available with I/O Mates to support eight or sixteen RS-232 asynchronous serial ports. The PC/16i is also available with an RS-422 interface. The PC/Xi+ board features an optional synchronous port in addition to the asynchronous ports (see page 62 for information about the synchronous port).

PC/16e Boards

The PC/16e is the economy version of the PC/16i. It has 64K of dual ported memory, and a 10MHz 80C186 microprocessor. It is fully compatible with the PC/Xi line, but is available only with an RS-232 interface, and there is no synchronous port option.

MC/Xi Boards

The MC/Xi board is actually two boards, the *MC/Xi Processor*, and an *I/O Mate* that plug together to form a unit which occupies a single Micro Channel slot. The Processor board (or "motherboard") is common to all versions of the MC/Xi, and contains the 80C186 microprocessor and 256K of dual-ported RAM. The I/O mate (or "daughter card") contains the actual interfacing hardware (communications chips, line drivers and receivers, connectors, etc) and Read Only Memory (ROM) which are unique to the various MC/Xi configurations.

MC/Xi boards are available with I/O Mates to support four, eight or sixteen ports with RS-232 or RS-422 interfaces. The MC/Xi+ (four or eight ports) has a synchronous port in addition to the asynchronous ports (see page 58 for information about the synchronous port).

IMPORTANT! This manual is for MC/Xi boards with part number 30001224. This number can be found next to the serial number of the Processor board. The diagram on page 20 points out the location of the part number.

COM/Xi Boards

The COM/Xi board is actually two boards, the *COM/Xi Processor*, and an *I/O Mate* that plug together to form a unit which occupies a single XT or AT slot (see Figure 1). The Processor board (or "motherboard") is common to all versions of the COM/Xi, and contains a 10 MHz 80C188 microprocessor and 256K of dual-ported RAM. The I/O mate (or "daughter card") contains the actual interfacing hardware (communications chips, line drivers and receivers, connectors, etc) which is unique to the various COM/Xi configurations.

COM/Xi boards are available with I/O Mates to support four or eight RS-232 or RS-422 asynchronous serial ports. A special version is also available with half RS-422 and half RS-485 ports.

Installation Tips

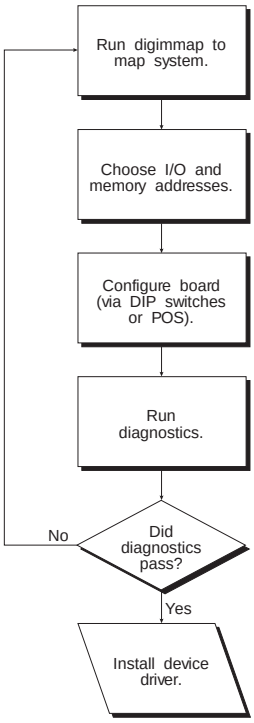
Installing your DigiBoard intelligent serial communications board is easy; however, since the boards require unique I/O and memory addresses, you may experience conflicts with other devices in your system. To minimize installation difficulties, two utilities have been provided: **DIGIMMAP.EXE**, a program which will help you find a block of available memory address space in your computer (needed for the board's dual ported memory), and **UD-CISC.EXE**, a diagnostic program which will verify that the board is functioning correctly, and help you to identify any hardware problems with the board. Both of these utilities are in the **\DIAGS** directory of the DOS, AIO, OS/2 and Windows diskette which is included with your board.

The flow chart below shows a good sequence to follow when installing your board. Following this procedure will minimize installation difficulties and minimize the need for calls to Technical Support.



Please run the memory map utility and diagnostics before calling Technical Support for assistance.

Figure 1 **Installation Flow Chart**



Memory Map Utility

The memory map utility, **DIGIMMAP.EXE**, is an MS-DOS based executable program that is designed to aid in the installation of DigiBoard hardware by detailing locations in memory that are available for the DigiBoard product.

To run **DIGIMMAP.EXE**, follow this procedure:

1. Boot your system normally. This should cause any adapters in your system to be initialized.
2. Place a bootable DOS formatted diskette in drive A (or your boot drive, if different from drive A). This diskette must have no TSRs or memory managers present, or **DIGIMMAP** may give erroneous results (hint: rename **CONFIG.SYS** and **AUTOEXEC.BAT**, if present, so they are not executed during bootup).
3. Press the <Ctrl>, <Alt> and <Delete> keys simultaneously to reboot your machine. DO NOT press the RESET button or cycle power to reboot; resetting the machine may turn off any adapters that were activated in Step 1.
4. Now place the DOS, AIO, OS/2 and Windows diskette in the diskette drive and enter: **A:\DIAGS\DIGIMMAP** (assuming that you put the diskette in drive A).
5. After reading the initial screen, press <**E**> to execute the utility.
6. You will see three lists of starting addresses which appear to be available. The first list shows 8K starting addresses, for use with PC/Xe (8K version) and MC/Xe boards (not covered in this manual). The second list shows 32K starting addresses, for use with COM/Xi and MC/Xi boards. The third list shows 64K addresses, for use with PC/Xi and PC/16e boards. Write down several of the addresses from the applicable column (some devices can fool the memory mapper by turning their memory off, making the area appear to be available). A good order for trying addresses is:
    1. Addresses beginning with "**D**" (D0000h-DE000h)
    2. Addresses beginning with "**C**" (C0000h-CE000h)
    3. Addresses beginning with "**E**" (E0000h-EE000h)

User Diagnostics

The **\DIAGS** directory on the DOS, AIO, OS/2 and Windows diskette contains a user diagnostic program called **UD-CISC.EXE**.

1. Place the DOS, AIO, OS/2 and Windows diskette in the diskette drive and enter **A:\DIAGS\UD-CISC** (assuming that the diskette is in drive A).

2. When asked for a board family, press the letter that corresponds to your board type (if you are installing a Micro Channel board, you will be asked for the number of the slot that the board is plugged into—the board type will be determined automatically).

3. Now you need to enter at least two parameters: the board's I/O address (as set on the DIP switches or jumpers; see the *Installation Guide* for your board) and the Host Base Address (the starting address of the board's dual ported memory—use the memory map utility **DIGIMMAP.EXE** to find a good address to use).

   Note—for Micro Channel boards, you will only be asked for a slot number; the I/O and memory addresses will be read from the POS registers.

   Depending on the version of the diagnostic program, the other parameters may already be filled in with default values; if they are not, enter the following values:

Window Size:	**32K**	(COM/Xi, MC/Xi boards)
	64K	(PC/Xi and PC/16e boards)
IRQ:	**Disabled**	
Machine Environment:	**ISA**	
Port:	**1**	
RS232/422:	**232**	
Loopback:	**No**	
Continuous Test:	**Yes**	
Stop on first:	**Yes**	

4. Now press <**E**> to start the tests. The tests will be run consecutively, and pass/fail status will be indicated on the right hand side of your screen.

5. If all the tests pass, the board is functioning correctly and you are ready to install the device driver software. Make a note of the Host Base Address and I/O address before exiting the diagnostic program (you will need to specify these when you install the device driver software).

6. If failures occur, the most likely cause is a memory conflict. Try a different Host Base Address and execute the diagnostics again. If you get a Hardware Reset Error, try a different I/O address (be sure to set the DIP switches or jumpers for the new address).

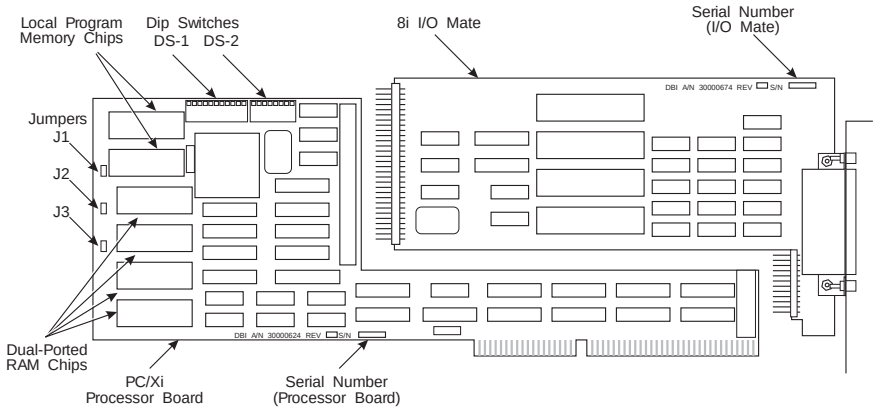
Installing PC/Xi Boards

Before you plug in the board...

Write down the serial number of the processor board in the space provided. You will need it if you have to contact DigiBoard regarding the board.

There are three jumpers and two banks of DIP switches which need to be set prior to installing the board in your computer.

Figure 2 PC/Xi Processor Board and 8-Port I/O Mate



Processor Board Serial Number: _____

Jumper Settings

J1—Local Program Memory Size

PC/Xi boards have a local RAM which is used for the on-board software. The default size of this memory is 16K, but it can be upgraded to 64K. Jumper J1 must be set to correspond to the size of the memory installed. J1 consists of three pins numbered 1, 2 and 3, and a jumper shunt which can connect either pins 1 and 2 or pins 2 and 3. See Figure 2 for the location of J1. The pins are numbered from top to bottom. For 16K, the jumper must be installed across pins 2 and 3 (the bottom two pins). For 64K, place the jumper across pins 1 and 2 (the top two pins).

J2 and J3—Dual-Ported Memory Size

PC/Xi boards have 128K, 256K or 512K of dual-ported RAM which is used for communication with the host computer. This RAM is installed in four chip sockets on the left-hand end of the board (see Figure 2). 128K boards have four chips which are shorter than the sockets (the chips are oriented toward the center of the board so that four empty pin sockets are to the left of the chips). 256K boards have two chips that completely fill the top two sockets, and 512K boards have four full-size chips.

128K boards can also be set for 64K operation to make them easier to install below 1 megabyte (necessary for DOS and systems with 16 megabytes or more of memory). 256K and 512K boards cannot be set for 64K operation.

Jumpers J2 and J3 must be set according to the size of the dual-ported RAM installed on the board. J2 and J3 consist of three pins each, numbered 1, 2 and 3, from top to bottom, and a jumper shunt which connects either pins 1 and 2 or pins 2 and 3. Set the jumpers according to the following table:

Table 1 PC/Xi Dual-Ported Memory Size Jumper Settings

Memory Size	J2 Pins	J3 Pins
*64K	2 & 3	2 & 3
128K	2 & 3	1 & 2
256K	1 & 2	2 & 3
512K	1 & 2	1 & 2

* 128K boards only

DIP Switch Settings

PC/Xi boards have two banks of DIP switches labeled **DS1** and **DS2** (see Figure 2 for the location of the DIP switches). DS1 has eleven switches which are used to set the board's I/O port address and the starting address of the board's dual-ported memory. DS2 is an eight-position switch that specifies which Interrupt Request (IRQ) line to use.

Consult your software installation instructions for recommended address and IRQ selections.

Memory Start Address—DS1, Switches 1-8

PC/Xi boards communicate with the host computer through dual-ported (or "shared") memory. This memory resides on the PC/Xi board, but is directly accessible to the host computer as if it was the host's own memory. The PC/Xi board's dual-ported memory must be mapped into an empty block of host address space. Since the board's entire dual-ported memory is accessible to the host, the size of this empty block must correspond to the size of the board's memory (64K, 128K, 256K or 512K). 64K and 128K boards may be mapped into the area below 1 megabyte, above the system RAM, and all boards may be mapped into high memory (between the 14th and 16th megabyte).

PC/Xi memory can be switched on or off by setting or resetting a bit in the board's I/O port. This permits multiple PC/Xi boards to occupy the same block of memory addresses. This is an especially valuable feature when installing boards below 1 megabyte where memory address space is limited. Most DigiBoard device drivers support this "memory stacking" concept (an exception is the PC-MOS driver).

Switches 1-8 of DIP switch bank DS1 can be set to indicate the start of any 64K block of memory in the first 16 megabytes (from 000000h to FF0000h). In practice, very few of the possible addresses are actually used. DigiBoard device drivers utilize only 15 memory start addresses (not all drivers support all 15 addresses—consult your device driver installation guide for specifics). The 15 commonly used addresses are given on the following pages, along with a pictorial representation of the corresponding DIP switch settings.

Please note that even though there are seven supported addresses below 1 megabyte, 0C0000h and 0D0000h are the only ones commonly available, and that a 128K board will take up the *entire* area from 0C0000h to 0DFFFFh. This can conflict with other peripherals such as ESDI and SCSI controllers, and EGA or VGA video adapters. 128K boards can be reduced to 64K by changing the positions of jumpers on the board. See the Appendix, starting on page 68, for information on resolving memory conflicts.

For technical reference, switches 1-8 of DS1 are decoded as follows:

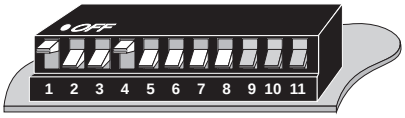
Address Bit	**A1 6**	**A1 7**	**A1 8**	**A1 9**	**A2 0**	**A2 1**	**A2 2**	**A2 3**
Switch (DS1)	SW 1	SW 2	SW 3	SW 4	SW 5	SW 6	SW 7	SW 8

An address bit is decoded as a binary 1 if the corresponding switch is turned OFF (or OPEN), and as a binary 0 if the switch is ON (or CLOSED). Address bits A00-A15 are always decoded as 0, since DS1 only resolves 64K blocks of memory.

Figure 3 DS1, SW1-8—PC/Xi Memory Start Addresses (Below 1 MB)



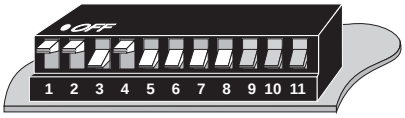
080000h



090000h



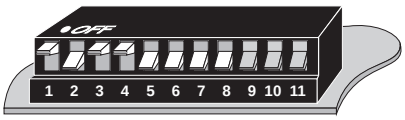
0A0000h



0B0000h



0C0000h



0D0000h



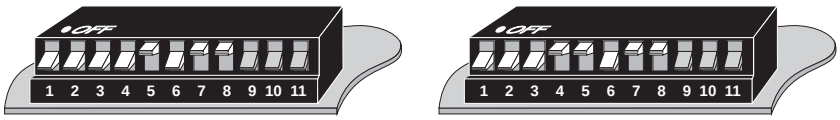
0E0000h

Notes—

- **090000h, 0A0000h, 0B0000h, 0D0000h and 0E0000h can only be used by PC/Xi boards configured for 64K of dual-ported memory.**
- **080000h and 090000h can only be used in systems with 512K (or less) of base memory (memory below 1 megabyte).**
- **PC/Xi boards with 256K or 512K of dual-ported RAM must not be addressed below 1 megabyte.**

See the Appendix, starting on page 68, for more information about memory conflicts.

Figure 4 DS1, SW1-8—PC/Xi Memory Start Addresses (Above 1 MB)



D00000h

D80000h



E00000h



E80000h



F00000h



F80000h



FA0000h



FC0000h

Notes—

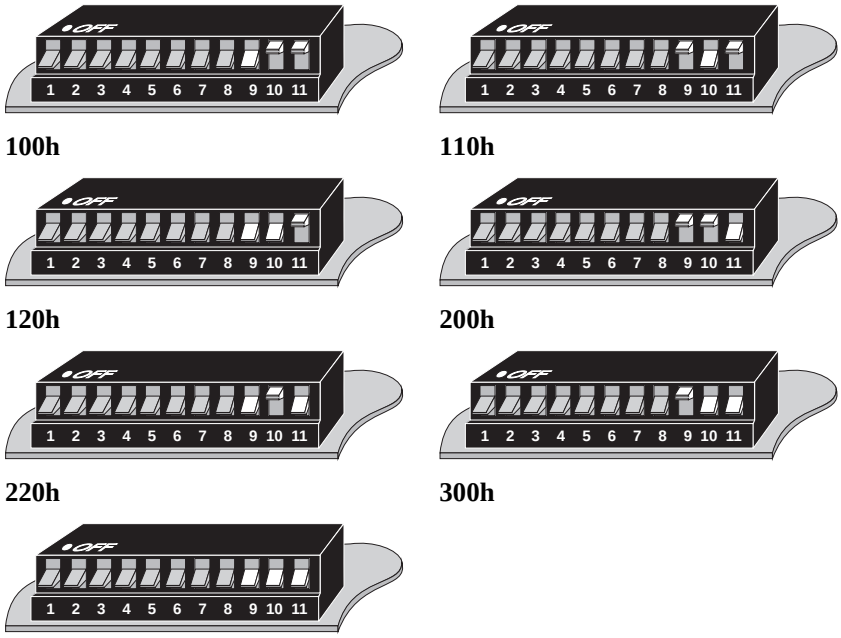
- **These addresses cannot be used in systems with 16 megabytes (or more) of RAM.**
- **These addresses may not work in some systems incorporating a memory cache.**

See the Appendix, starting on page 68, for more information about memory conflicts.

I/O Port Address—DS1, Switches 9-11

Each PC/Xi board must have a unique I/O port address. This address must not be used by any other device in the system, including other PC/Xi boards. The I/O port address is determined by setting switches 9, 10 and 11 of DIP switch DS1 as shown below.

Figure 5 DS1, SW9-11—PC/Xi I/O Port Selection



100h **110h**

120h **200h**

220h **300h**

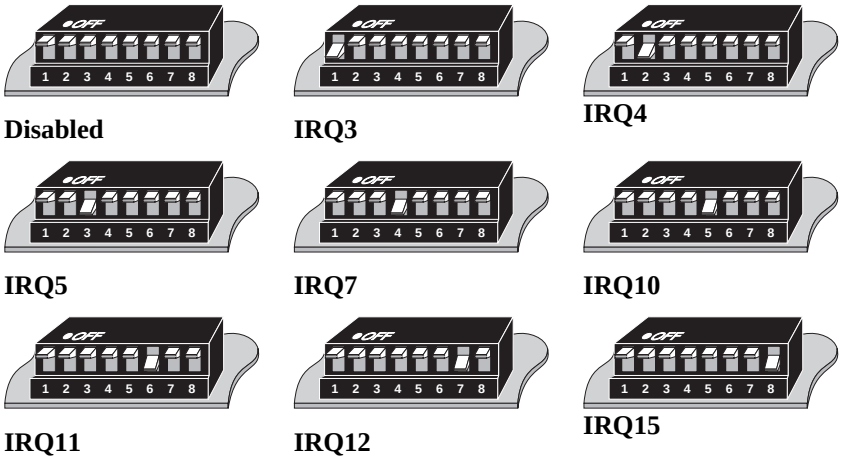
320h

Interrupt Request (IRQ) Line—DS2

DS2 is used to specify which IRQ line will be used by the board to interrupt the host. Each board must have its own unique IRQ selection, and that IRQ line must not be used by any other device in the system. Select the IRQ by setting the appropriate switch in DS2 as shown below.

*Most DigiBoard device drivers do not use interrupts, so the normal setting for DS2 is "**Disabled**" (all switches turned OFF).*

Figure 6 DS2—PC/Xi IRQ Selection



Board Installation—PC/8i

1. Plug the board into a full-length AT (16-bit) slot and screw the endplate to the computer chassis.
2. Install the interface cable assembly or connector box (see *Connector Options* on page 45) on the PC/Xi board by mating the female 78-pin connector on the assembly to the male 78-pin plug on the end of the PC/Xi 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.

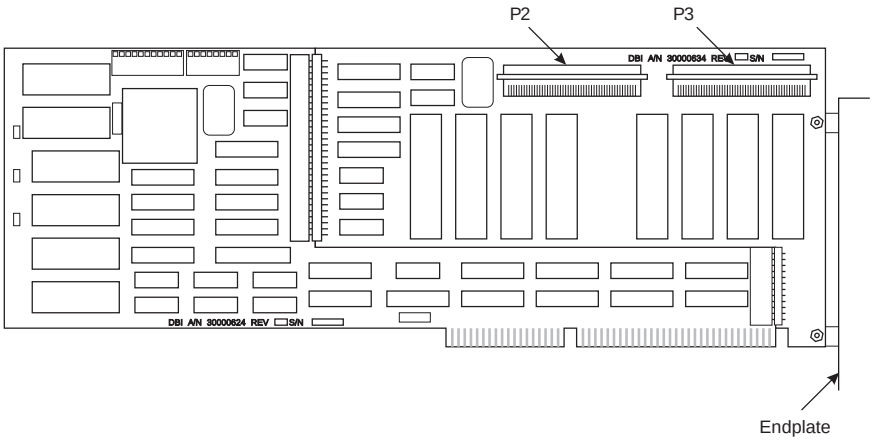
   IMPORTANT! Use only the DigiBoard-supplied shielded cable assemblies or connector boxes to remain in compliance with FCC limits for Class A operation.
3. Screw the connector into the board's endplate. *Do not over-tighten the screws*. If the screws don't go in several turns, or if they don't reach the nuts in the endplate, the 78-pin connectors are probably not completely mated.
4. Replace your computer's cover.

You are now ready to install the device driver software. Instructions for device driver installation are in a separate booklet, shipped with the software.

Board Installation—PC/16i

1. Place the connector box assembly near the open slot at the rear of the machine. Thread the two gray ribbon cables through the slot so that the two plugs are pointing toward the bus connector into which you intend to plug the board.
2. Carefully thread both cables through the opening in the board's endplate so that the shorter of the two cables (marked "P3") is closest to the board and the connectors are pointing toward the board.
3. Plug the cable end marked "P3" (the shorter cable) into the board connector "P3". Plug the cable end marked "P2" (the longer cable) into the board connector "P2" (see Figure 8, below, for the location of P2 and P3).

Figure 7 **PC/16i Board**



4. Carefully move the board and cables into position in the computer. Plug the board into the AT slot and screw the endplate to the computer chassis.
5. Replace your computer's cover.

You are now ready to install the device driver software. Instructions for device driver installation are in a separate booklet, shipped with the software.

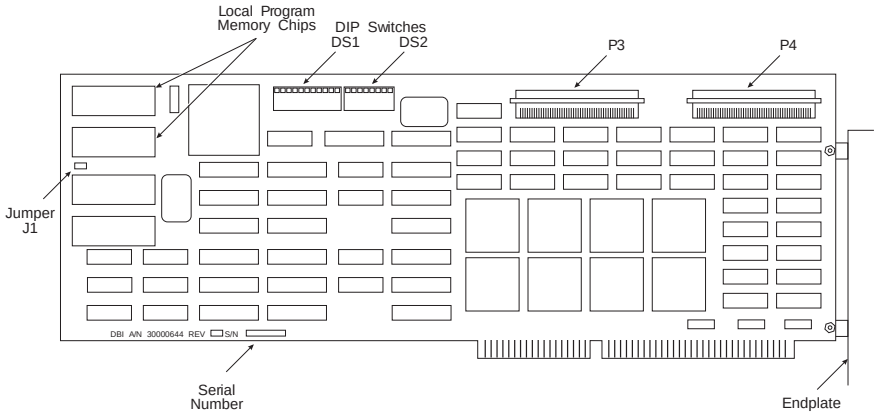
Installing PC/16e Boards

Before you plug in the board...

Write down the serial number of the board in the space provided. You will need it if you have to contact DigiBoard regarding the board.

There are two banks of DIP switches and one jumper which need to be set prior to installing the board in your computer.

Figure 8 **PC/16e Board**



Serial Number: _____

Jumper Settings

J1—Local Program Memory Size

PC/16e boards have a local RAM which is used for the on-board software. The default size of this memory is 16K, but it can be upgraded to 64K. Jumper J1 must be set to correspond to the size of the memory installed. J1 consists of three pins numbered 1, 2 and 3, and a jumper shunt which can connect either pins 1 and 2 or pins 2 and 3. See Figure 8 for the location of J1. The pins are numbered from left to right. For 16K, the jumper must be installed across pins 2 and 3 (the right two pins). For 64K, place the jumper across pins 1 and 2 (the left two pins).

DIP Switch Settings

The DIP switches on the PC/16e are identical to the switches on PC/Xi boards. Refer to page 10 for switch setting information.

Board Installation—PC/16e

1. Place the connector box assembly near the open slot at the rear of the machine. Thread the two gray ribbon cables through the slot so that the two plugs are pointing toward the bus connector into which you intend to plug the board.
2. Carefully thread both cables through the opening in the board's endplate so that the shorter of the two cables is closest to the board and the connectors are pointing toward the board.
3. Plug the shorter of the two cables into the board connector "P4". Plug the longer cable into the board connector "P3" (see Figure 8 for the location of P3 and P4).
4. Carefully move the board and cables into position in the computer. Plug the board into the AT slot and screw the endplate to the computer chassis.
5. Replace your computer's cover.

You are now ready to install the device driver software. Instructions for device driver installation are in a separate booklet, shipped with the software.

Installing MC/Xi Boards

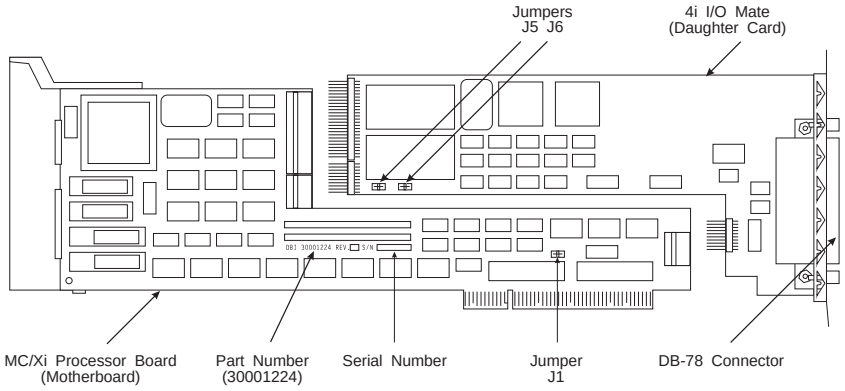
Before you plug in the board...

Write down the serial number of the processor board in the space provided. You will need it if you have to contact DigiBoard regarding the board.

Also, be sure to have on hand the DigiBoard ADF (Adapter Description Files) diskette, and a *working* copy of your IBM Reference Diskette (don't use the original—it should be write protected and stored in a safe place).

MC/Xi boards have one jumper which needs to be set by the user, and two factory preset jumpers which should not be changed.

Figure 9 MC/Xi Processor Board and 4-Port I/O Mate



Processor Board
Serial Number: _____

IMPORTANT! This manual is for MC/Xi boards with part number 30001224. This number can be found next to the serial number of the Processor board. The diagram above points out the location of the part number.

Jumper Settings

J1—Dual Ported Memory Window Size

There is only one jumper on the MC/Xi board that needs to be set by the user. This is J1, located above the edge connector on the processor board (see Figure 9 on page 20). Jumper J1 determines whether the MC/Xi board's dual-ported memory window size will be 32K or 128K.

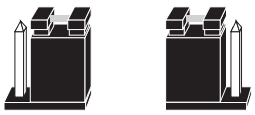
In most cases, if the board is to be installed in a machine that runs DOS (MS-DOS or IBM DOS), systems with 16 megabytes or more of RAM, or systems with a memory cache, the 32K window is recommended (this is the factory default setting for the jumper). This permits the board to be installed with its memory window mapped into a 32K byte range between 0C0000h and 0DFFFFh (below the 1 megabyte boundary). See the Appendix, starting on page 68, for information about the memory window.

Installing the MC/Xi board below 1 megabyte protects it from interference from the cache controllers on some Micro Channel machines, and enables the board to be installed in systems with 16 megabytes of memory.

If your system has 12 megabytes or less of RAM, and the cache controller (if present) can be disabled in the 13th through 16th megabyte, you can use the 128K setting, thus freeing 32K of the 0C0000h-0DFFFFh address space for other expansion boards which may not be addressable above 1 megabyte.

J1 consists of three pins and a jumper block which can connect either the first and second pins, or the second and third pins. With the board oriented so that the component side is up and the edge connector is toward you, connecting the leftmost and center pins sets the board for a 128K memory window. Connecting the rightmost and center pins makes it a 32K window. See Figure 10, below.

Figure 10 MC/Xi Dual-Ported Memory Window Size—Jumper J1



Other Jumpers

The MC/Xi I/O Mates have two jumpers, located near the EPROMs, which identify the size of the EPROMs on the board. These jumpers are set at the factory, and should only be changed if you are installing custom EPROMs. On RS-232 versions of the MC/Xi, the jumpers are labeled J5 and J6. On RS-422 and RS-422/RS-485 versions, they are J3 and J4.

Table 2 MC/Xi EPROM Size Jumpers (RS-232)

EPROM Size	J5 Pins	J6 Pins
*16K	1 & 2	1 & 2
32K	1 & 2	1 & 2
64K	1 & 2	2 & 3
128K	2 & 3	2 & 3

Table 3 MC/Xi EPROM Size Jumpers (RS-422, RS-422/RS-485)

EPROM Size	J5 Pins	J6 Pins
*16K	1 & 2	1 & 2
32K	1 & 2	1 & 2
64K	1 & 2	2 & 3
128K	2 & 3	2 & 3

* The default EPROM size is 16K.

Board Installation - MC/4i and MC/8i

1. Plug the MC/4i or MC/8i board into the Micro Channel slot, making sure that the "fork" is in position under the endplate thumbscrew. Tighten the thumbscrew.

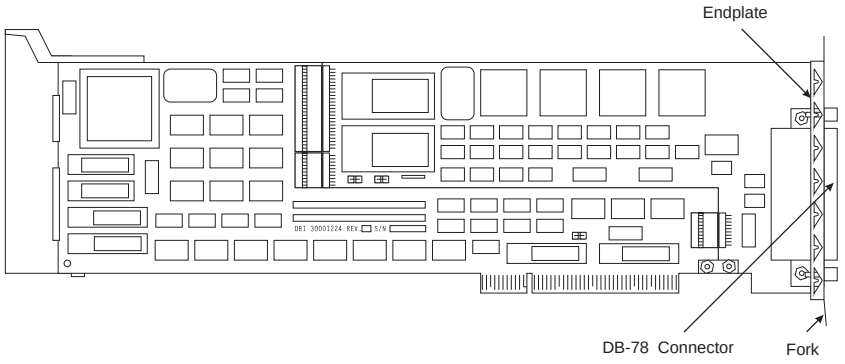
2. Install the interface cable assembly or connector box (see *Connector Options* on page 45) on the MC/Xi board by mating the female 78-pin connector on the assembly to the male 78-pin plug on the end of the MC/Xi board. *Be sure that the plug is completely installed—it may be a snug fit.*

3. Screw the connector into the board's endplate. *Do not over-tighten the screws*. If the screws don't go in several turns, or if they don't reach the nuts in the endplate, the 78-pin connectors are probably not completely mated.

   IMPORTANT! Use only the DigiBoard-supplied shielded cable assemblies or connector boxes to remain in compliance with Part 15 of the FCC rules for Class B operation.

4. Replace your computer's cover, and proceed to *Configuring the MC/Xi Board*, beginning on page 25.

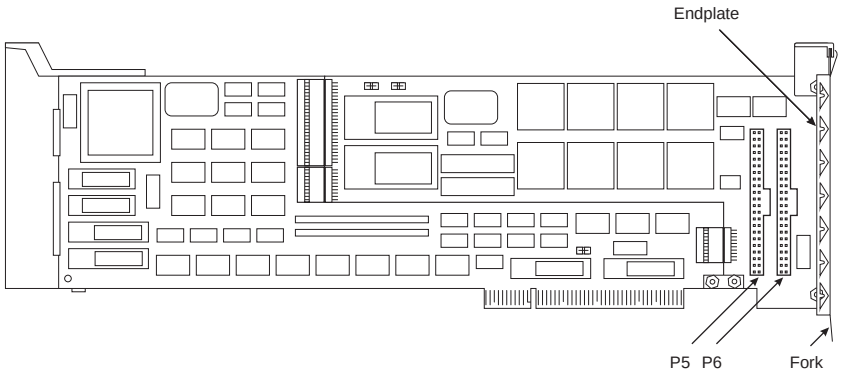
Figure 11 MC/8i Board



Board Installation - MC/16i

1. Place the connector box assembly near the open slot at the rear of the machine. Thread the two gray ribbon cables through the slot so that the two plugs are pointing toward the bus connector into which you intend to plug the board.
2. Carefully thread both cables through the opening in the MC/16i board's endplate so that the shorter of the two cables (marked "P3") is closest to the board and the connectors are pointing toward the board.
3. Plug the cable end marked "P3" (the shorter cable) into the board connector "P6". Plug the cable end marked "P2" (the longer cable) into the board connector "P5" (see Figure 12, below, for the location of P5 and P6).

Figure 12 **MC/16i Board**



4. Carefully move the MC/16i board and cables into position in the computer. Plug the board into the Micro Channel slot, making sure that the "fork" is in position under the endplate thumbscrew. Tighten the thumbscrew.
5. Replace your computer's cover, and proceed to *Configuring the MC/Xi Board*, beginning on the following page.

Configuring the MC/Xi Board

After the MC/Xi 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.

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/Xi 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.
3. Select "Set Configuration" from the main menu. Then select "Run Automatic Configuration" from the Set Configuration menu. Auto-Config will find non-conflicting address and interrupt parameters for the board for you. If you choose to set the parameters manually, you will be given the following choices:

   Memory Start Address (32K Setting):
   0C0000h, 0C8000h, 0D0000h or 0D8000h

   Memory Start Address (128K Setting):
   FC0000h, FA0000h, F80000h or 0C0000h

   I/O Port Address:
   F1F0h, F2F0h, F4F0h or F8F0h

   Interrupt Select:
   IRQ 3, 4, 5, 6, 7, 9, 10 or 11

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

ADF Files

Different Adapter Description Files are necessary for the MC/Xi, depending upon the individual configuration of the board (number of ports, memory size and interface type). These files are supplied on a diskette shipped with the MC/Xi board.

The ADF diskette contains the following files:

@6FE9.ADF 4 & 8 port boards, RS-232 interface, 128K memory.

@7F99.ADF 4 & 8 port boards, RS-232 interface, 32K memory.

@6FEB.ADF 16 port boards, RS-232 interface, 128K memory.

@7F9B.ADF 16 port boards, RS-232 interface, 32K memory.

@6FEA.ADF 4 & 8 port boards, RS-422 interface, 128K memory.

@7F9A.ADF 4 & 8 port boards, RS-422 interface, 32K memory.

Note—The above list is provided as a point of interest only. The "Copy an Option Diskette" function will copy all of the above files, and the configuration program will automatically choose the correct file for your board configuration.

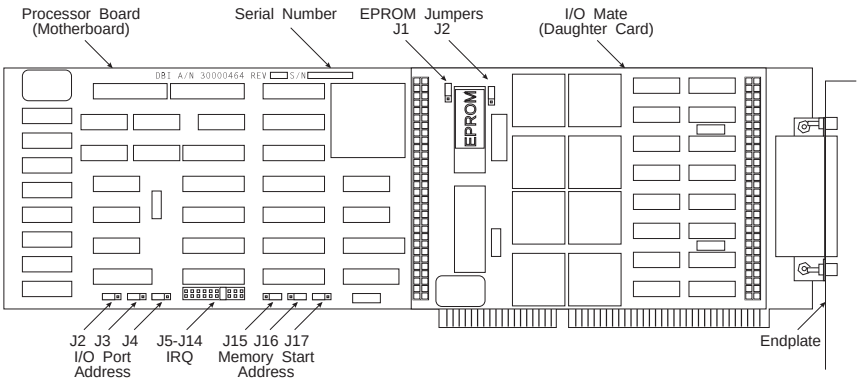
Installing COM/Xi Boards

Before you plug in the board...

Write down the serial number of the processor board in the space provided. You will need it if you have to contact DigiBoard regarding the board.

Several jumpers need to be set to configure the board's I/O address, dual ported memory start address and IRQ line.

Figure 13 **COM/8i Board**



Processor Board
Serial Number: _____

Jumper Settings

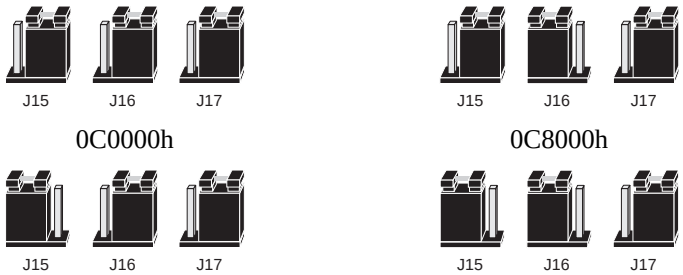
The COM/Xi Processor board has three sets of jumpers which determine the I/O port address, the interrupt request (IRQ) line and the starting address of the board's dual-ported memory window. See your software installation instructions for recommended address and IRQ selections.

Memory Start Address—Jumpers J15, J16 and J17

The COM/Xi board has 256K of on-board RAM which is accessible to the host computer through a 32K "window" in the host's memory map. The 32K window is mapped into an unused block of memory address space in the area reserved for expansion boards (0C0000h-0DFFFFh). There are four address ranges available for the COM/Xi: 0C0000h-0C7FFFh, 0C8000h-0CFFFFh, 0D0000h-0D7FFFh and 0D8000h-0DFFFFh. Each COM/Xi board requires its own 32K block of addresses, and no other device may share these addresses. While up to four COM/Xi boards can be installed in a system, this assumes that the entire 128K from 0C0000h-0DFFFFh is available. In practice, this is often not the case. EGA and VGA cards use memory addresses in this region, as do ESDI and SCSI controllers. Also, the presence of 16-bit memory devices (such as 16-bit VGA cards) in this region can cause COM/Xi boards to fail. See the Appendix, starting on page 68, for a more detailed discussion of potential memory conflicts and ways to resolve them.

Figure 14 shows the jumper settings for the four memory start addresses available on the COM/Xi board.

Figure 14 J15-J17—COM/Xi Memory Start Addresses

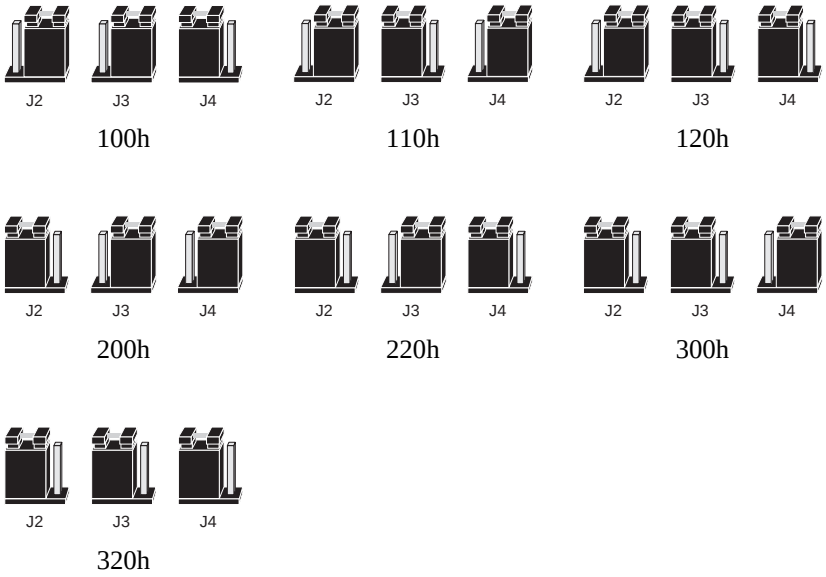


See the Appendix for information about memory conflicts.

I/O Port Address—Jumpers J2, J3 and J4

Each COM/Xi board must have a unique I/O port address. This address must not be used by any other device in the system, including other COM/Xi boards. The I/O port address is determined by setting jumpers J2, J3 and J4 as shown below.

Figure 15 J2-J4—COM/Xi I/O Port Addresses



Interrupt Request (IRQ) Line—J5-J14

Jumpers J5-J14 are used to specify which IRQ line will be used by the board to interrupt the host. Each board must have its own unique IRQ selection, and that IRQ line must not be used by any other device in the system. Select the IRQ by placing a jumper across the pins of *one* of the jumpers J5-J14 as shown in Figure 16.

Many DigiBoard device drivers do not use interrupts. If you are using one of these drivers (see the installation instructions for the device driver), the interrupts should be disabled (no jumper installed).

Figure 16 J5-J14—COM/Xi IRQ Selection



NOTES— The silk-screen numbers below J5-J14 do not line up exactly with the jumpers. To ensure correct jumper placement, count from either end of the row of jumpers.

IRQs 10-15 can only be used if the board is plugged into an AT (16 bit) slot.

EPROM Size Jumpers—J1 and J2

The I/O Mate (daughter card) has two jumpers, J1 and J2, which indicate the size of the EPROM (see Figure 13 on page 27 for the location of J1 and J2). These jumpers are set at the factory, and should only be changed by the user when a customized EPROM is installed. The default positions for J1 and J2 are pins 1 and 2 (the top two pins) connected. The following table gives the possible settings for J1 and J2.

Table 4 COM/Xi EPROM Size Jumpers

EPROM Size	J1 Pins	J2 Pins
*8K	1 & 2	1 & 2
16K	1 & 2	1 & 2
32K	1 & 2	2 & 3
64K	2 & 3	2 & 3

* The default EPROM size is 8K.

Board Installation—COM/Xi

The COM/Xi board is an 8-bit board, but is equipped with an AT-style dual edge connector to facilitate the use of IRQs 10, 11, 12 and 15. When using IRQs 2-7, or no IRQ, the board may be installed in an XT (8-bit) slot, provided that there is clearance at the end of the slot for the extra edge connector.

1. Plug the board into a full-length XT (8-bit) or AT (16-bit) slot and screw the endplate to the computer chassis.
2. Install the interface cable assembly or connector box (see *Connector Options* on page 45) on the COM/Xi board by mating the female 78-pin connector on the assembly to the male 78-pin plug on the end of the 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 Part 15 of the FCC rules for Class B operation.
3. Screw the connector into the board's endplate. *Do not over-tighten the screws*. If the screws don't go in several turns, or if they don't reach the nuts in the endplate, the 78-pin connectors are probably not completely mated.
4. Replace your computer's cover.

You are now ready to install the device driver software. Instructions for device driver installation are in a separate booklet, shipped with the software.

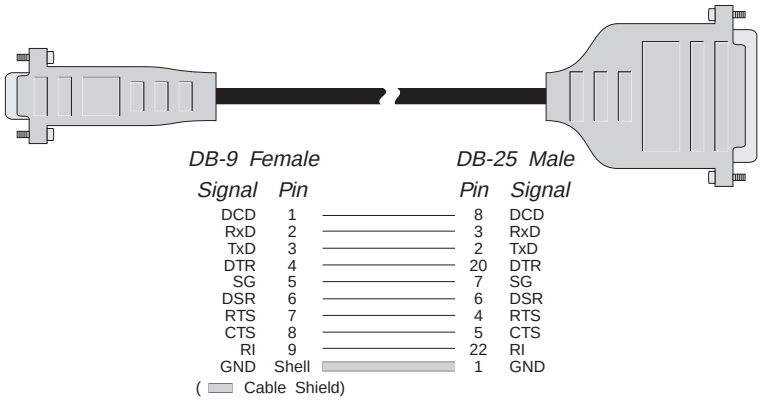
Connecting Peripherals

Connecting to a Modem

DB-9 Equipped Boards

To connect a DB-9 equipped board to a modem, use standard PC modem cables, available from most electronics stores and computer dealers. The wiring diagram for a 9-pin to 25-pin modem cable is shown in Figure 17.

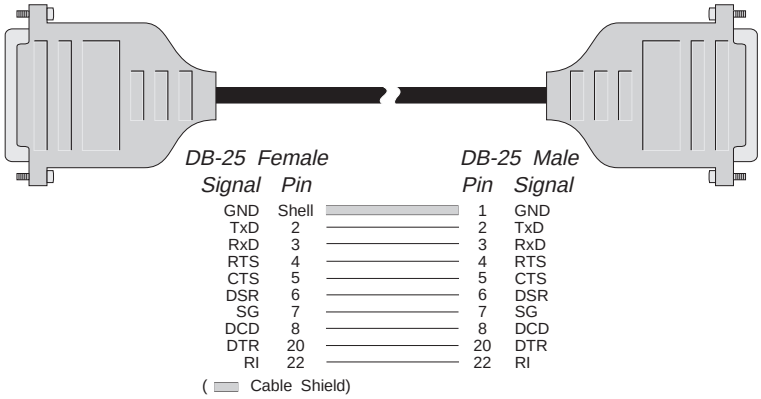
Figure 17 DB-9 to DB-25 Modem Cable



Important! Shielded cable must be used to remain in compliance with Part 15 of FCC rules.

DB-25 Equipped Boards

Figure 18 DB-25 to DB-25 Modem Cable

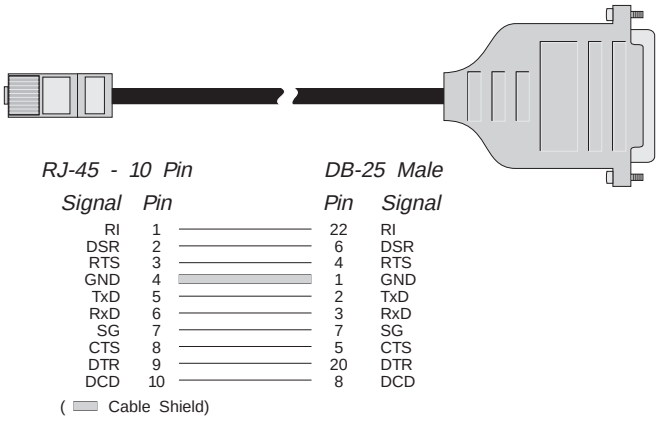


To connect a DB-25 equipped board to a modem, use a standard “straight-through” cable (see Figure 18) to connect the modem to one of the DB-25 connectors on the fan out cable or connector box.

RJ-45 Equipped Boards

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 53 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).

Figure 19 RJ-45 to DB-25 Modem Cable (10 Wire)

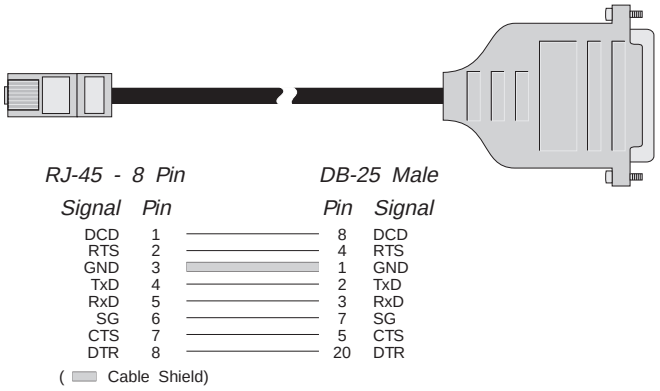


If you wish to build your own modem cable, follow the diagram in Figure 19.

ALTPIN Modem Wiring (RJ-45 Versions)

10-pin RJ-45 plugs may be difficult to obtain in the retail market; therefore, most 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).

Figure 20 8-Wire Modem Cable for use with ALTPIN Configuration



If you wish to build an 8-wire modem cable for an RJ-45 equipped board, use an 8-pin RJ-45 plug wired as shown in Figure 20.

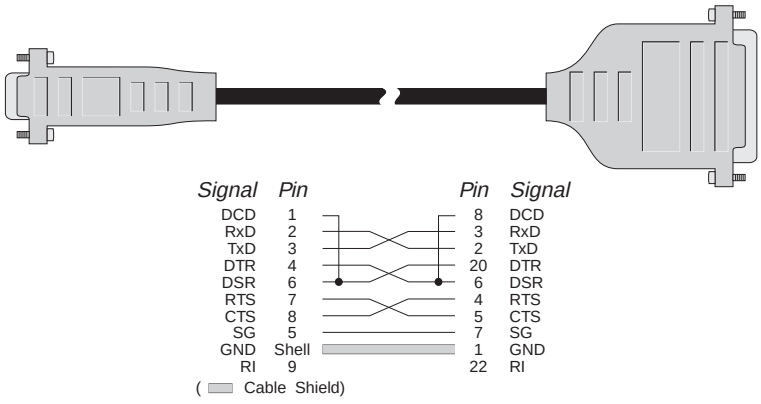
Connecting to a DTE Device

A DTE device is a terminal, serial printer, another computer's serial port, etc. To connect the PC/Xi, MC/Xi or COM/Xi board (which are also DTE devices) to another DTE device, you need a *null modem* cable or adapter.

DB-9 Equipped Boards

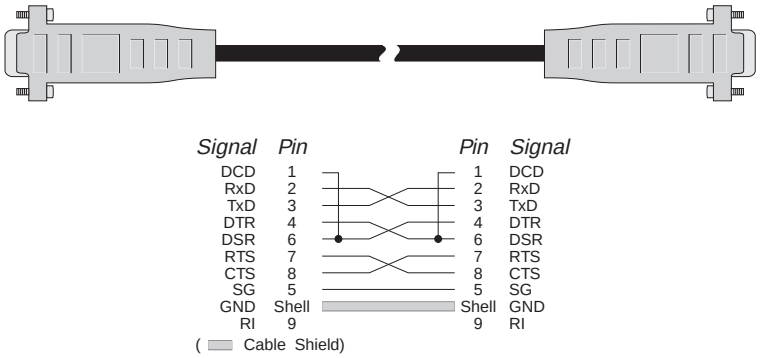
Use a standard PC printer cable, or build a cable as shown in Figures 21 or 22.

Figure 21 9-Pin to 25-Pin Null Modem Cable



Important! Shielded cable must be used to remain in compliance with Part 15 of FCC rules.

Figure 22 **9-Pin Null Modem Cable**



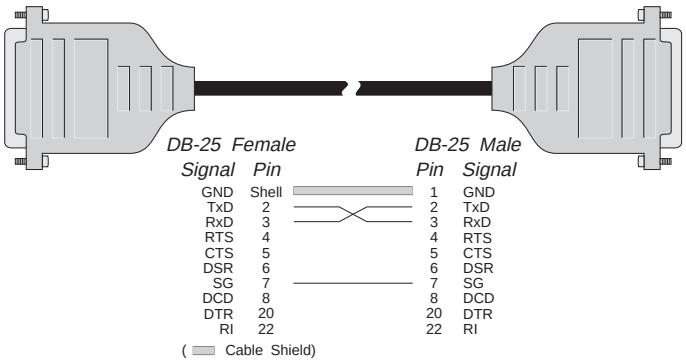
DB-25 Equipped Boards

Software Handshaking (XON/XOFF)

In most cases, serial terminals and printers need only a "three-wire" connection to the board. All DigiBoard 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 DB-25 equipped board is shown in Figure 23.

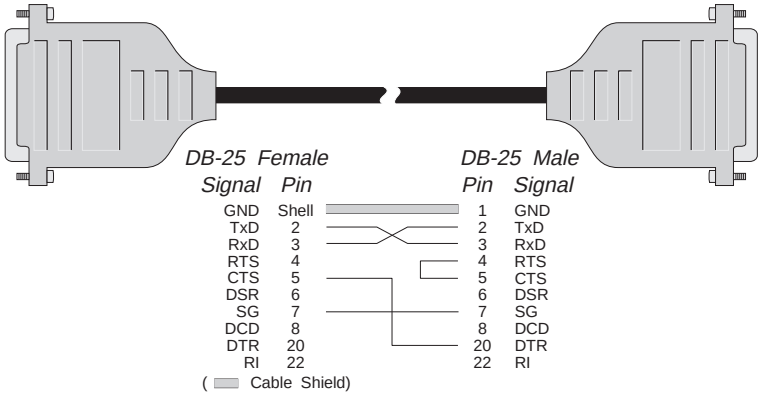
Figure 23 Simple Terminal/Printer Cable (DB-25)



The cable shown in Figure 23 is a three-wire null modem cable—that is, Transmitted Data on one end of the cable is connected to Received Data at the other end, and vice versa.

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.

Figure 24 Terminal/Printer Cable with DTR Handshaking (DB-25)



Most terminals and printers use Data Terminal Ready (DTR) for Ready/Busy hardware handshaking. The cable shown in Figure 24 supports this method.

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 female DB-25 side to pin 11 of the male 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.

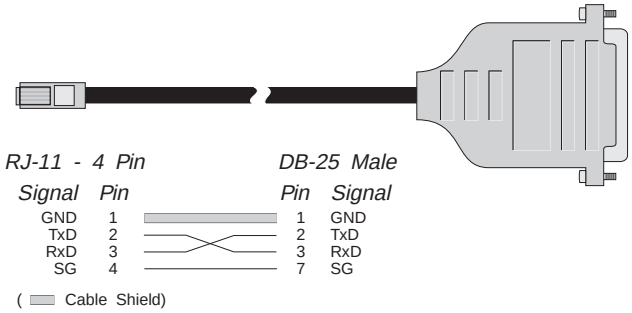
RJ-45 Equipped Boards

Software Handshaking (XON/XOFF)

In most cases, serial terminals and printers need only a "three-wire" connection to the board. All DigiBoard 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 an RJ-45 equipped board is shown in Figure 25.

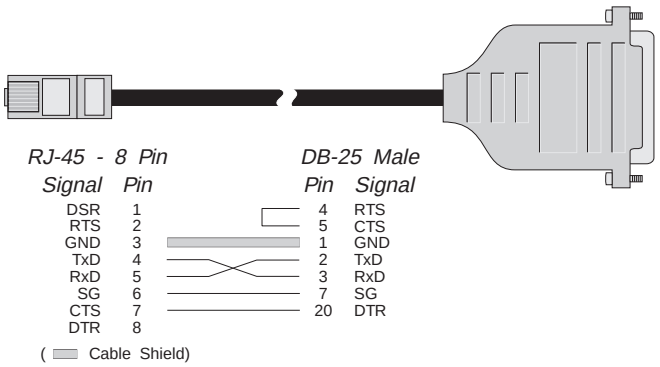
Figure 25 Simple Terminal/Printer Cable (RJ-45)



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

The male DB-25 end can be plugged directly into most serial terminals and printers without any adapters. The RJ-11 plug fits into the center of the RJ-45 jack.

Figure 26 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.

Most terminals and printers use Data Terminal Ready (DTR) for Ready/Busy hardware handshaking. The cable shown in Figure 26 supports this method.

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.

Connector Options

A variety of connector types is available. Four and eight-port 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. Sixteen-port boards are available only with DB-25 connectors (male, DTE wiring).

The following pages give the part numbers and wiring information for the various connector types.

DB-25 Connectors

Table 5 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

DigiBoard four and eight-port boards can be configured with DB-25 connectors in any of four configurations: DTE male, DTE female, DCE male or DCE female. Sixteen-port boards are available only with the DTE male configuration. The pin assignments for the DB-25 connectors follow the usual conventions for RS-232 wiring.

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*.

DB-25 Connector Options (Four and Eight-Port Boards)

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 27 Octa-Cable Assembly

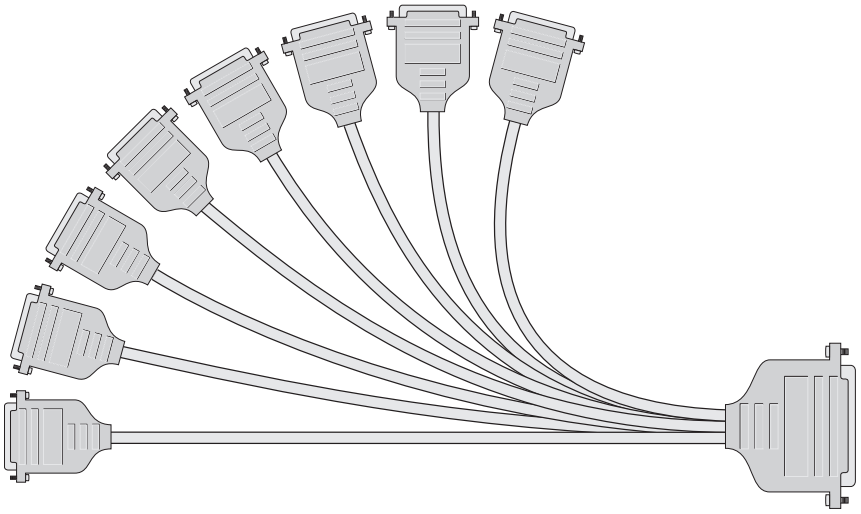


Table 6 DB-25 Cable Options and Part Numbers

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

Figure 27 shows the eight-port cable assembly, and Table 6 gives the part numbers of the available configurations.

Figure 28 Eight-Port DB-25 Connector Box

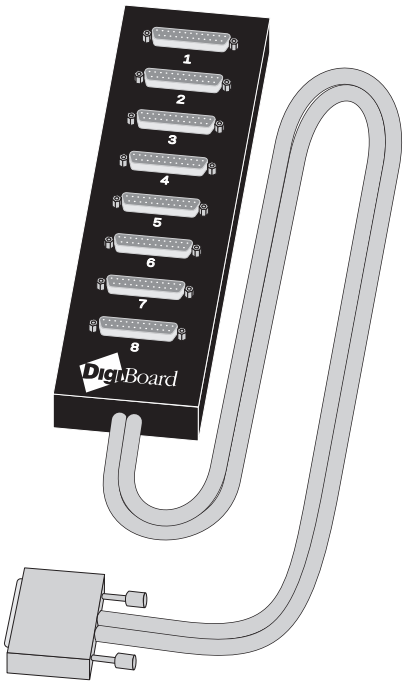


Figure 28 shows the eight-port DB-25 connector box option. A four-port box is also available.

Table 7 Connector Box Options and Part Numbers

	DB-25 Male	DB-25 Female
DTE Quad	7600030	7600026
DCE Quad	7600028	7600024
DTE Octa	7600031	7600027
DCE Octa	7600029	7600025

DB-25 Connector Options (PC/16i and MC/16i Boards)

PC/16i and MC/16i boards are available with male DB-25 connectors, configured for DTE operation. The connector box (shown below) is attached to the board via two ribbon cables which mate to connectors P2 and P3 on the PC/16i board, or P5 and P6 on the MC/16i board.

Figure 29 DB-25 Connector Box for PC/16i and MC/16i Boards



DB-9 Connectors

Four and eight-port boards can be configured with male or female DB-9 connectors (DTE wiring only).

DB-9 connectors are available only in the “fan-out” cable configuration (see Figure 27, on page 46).

Table 8 DB-9 Quad and Octa Cable Options and Part Numbers

	DB-9 Male	DB-9 Female
DTE Quad	7600003	7600001
DTE Octa	7600015	7600013

Table 9 DB-9 Connector Pin Assignments

Signal	Description	Direction	Pin #
GND	Chassis Ground	N/A	Shell
DCD	Data Carrier Detect	Input	1
RxD	Received Data	Input	2
TxD	Transmitted Data	Output	3
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

RJ-45 Connectors

Figure 30 **Eight-Port RJ-45 Connector Box**

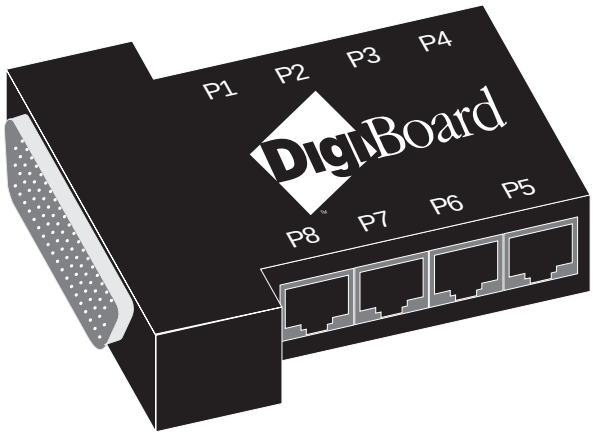
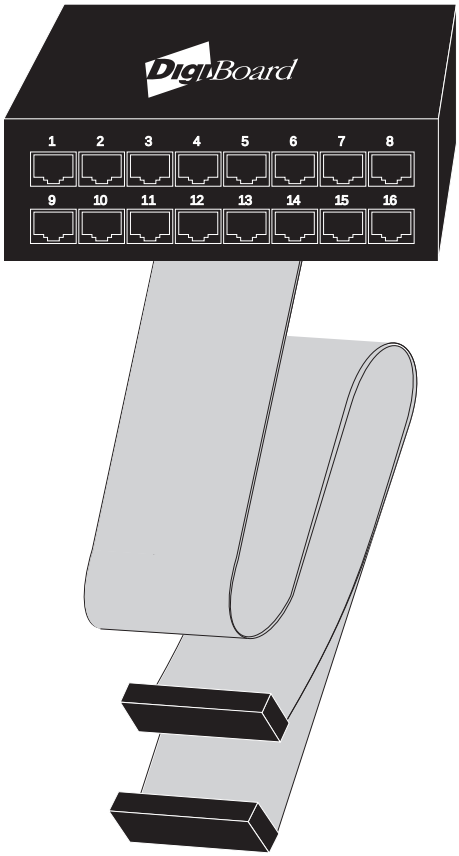


Table 10 **RJ-45 Connector Box Options and Part Numbers**

	Quad	Octa
RJ-45	76000038	76000033

Four and eight-port 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 30 shows the eight-port RJ-45 connector block, and Table 10 gives the associated part numbers.

Figure 31 RJ-45 Connector Box for PC/16e Boards



Modular Plugs

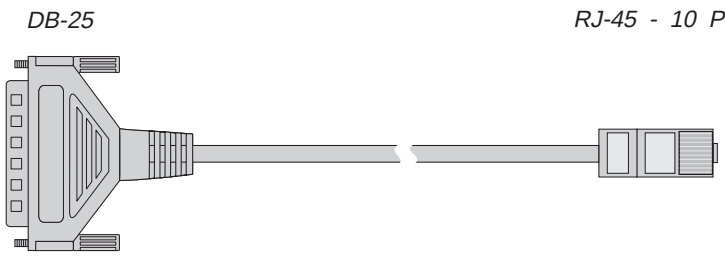
There are four types of modular plugs that can be used with DigiBoard's RJ-45 10-pin jack. These are the 4 or 6-pin RJ-11 plugs, and the 8 or 10-pin RJ-45 plugs.

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.

RJ-45 to DB-25 Conversion

Figure 32 **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 11 **Cable Leg Options and Part Numbers**

	DB-25 Male	**DB-25 Female**	**DB-9 Male**
24 Inch Cables	6102024	6103024	6107024
48 Inch Cables	6102048	6103048	N/A

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.

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.

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 user in any desired configuration.

RS-422 Asynchronous Serial Interface

MC/Xi, COM/Xi and PC/16i boards are available in an optional RS-422 configuration which provides asynchronous serial data communication over differential lines. This permits cable lengths much longer than those supported by an RS-232 interface (up to 4000 feet), and has better noise immunity at high baud rates. The RS-422 interface supports two input pairs (RxD and CTS), and two output pairs (TxD and RTS). The four and eight-port boards (MC/4i, MC/8i, COM/4i and COM/8i) are furnished with a "fan-out" cable assembly terminated in male or female DB-9 connectors; The PC/16i and MC/16i boards are equipped with a connector box assembly that houses sixteen male DB-25 connectors.

Cables

RS-422 interface cables should be shielded twisted-pair cables. Each signal requires two leads (one twisted pair of wires) to complete a balanced voltage digital circuit. The shield should be connected to the Chassis Ground of the devices at *both* ends of the interface cable. Chassis Ground is available on the metal shell of the DigiBoard DB-9 and DB-25 connectors (the DB-25 connector also has Chassis Ground on pin 1).

Grounding

To insure the integrity of data transfers and control signals, a ground path must be provided between the devices to be connected via the RS-422 interface. This should be connected to the Chassis Ground of each device. DigiBoard recommends using the cable shield for this purpose.

Connectors

The following table shows the pin configurations for the RS-422 versions of the DB-9 and DB-25 connectors.

Table 12 DB-9 and DB-25 Connector Wiring for RS-422 Boards

Signal	Description	DB-9 Pin (4i & 8i Boards)	DB-25 Pin (16i Boards)
TxD+	Transmitted Data (+)	8	2
TxD-	Transmitted Data (-)	9	14
RxD+	Received Data (+)	6	3
RxD-	Received Data (-)	7	16
RTS+	Request To Send (+)	2	4
RTS-	Request To Send (-)	3	19
CTS+	Clear To Send (+)	4	5
CTS-	Clear To Send (-)	5	13
GND	Chassis Ground	Shell	1, 7, Shell

Interconnecting Devices

The RS-422 interface provides four signals: Transmitted Data (TxD), Received Data (RxD), Request To Send (RTS) and Clear To Send (CTS). The functions of these signals is identical to their RS-232 counterparts.

Note that two wires are required for each signal, a positive lead ("+"), and a negative lead ("-"). *The "+" leads at one end of the cable must be connected to the "+" leads at the other end, and the "-" leads at one end must be connected to the "-" leads at the other end. Incorrect wiring could result in damage to the connected devices.*

Figure 33 shows a null modem connection for hardware handshaking. Figures 34 and 35 on the following page show a null modem connection for software handshaking, and a DTE to DCE connection. See Table 12 for the pin numbers which correspond to the DigiBoard DB-9 and DB-25 connectors, and refer to your peripheral's documentation for that device's pin numbers.

Figure 33 RS-422 Null Modem for Hardware Handshaking

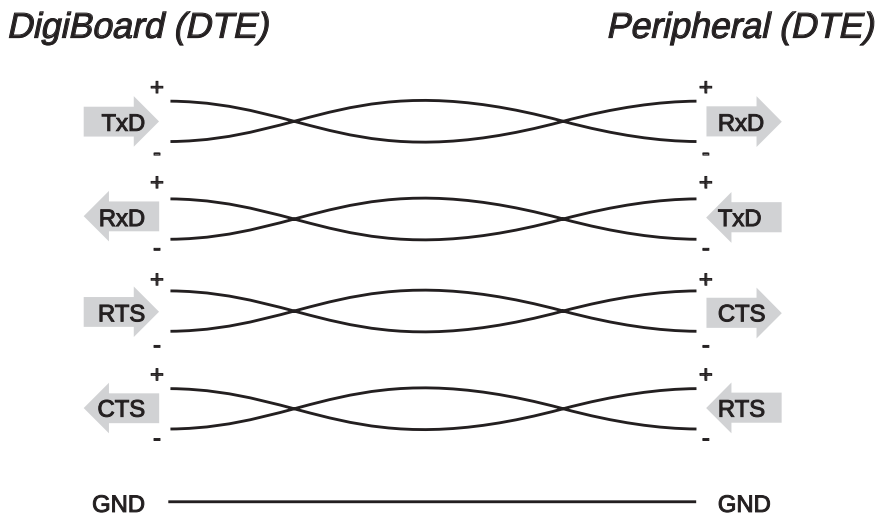


Figure 34 RS-422 Null Modem for Software Handshaking

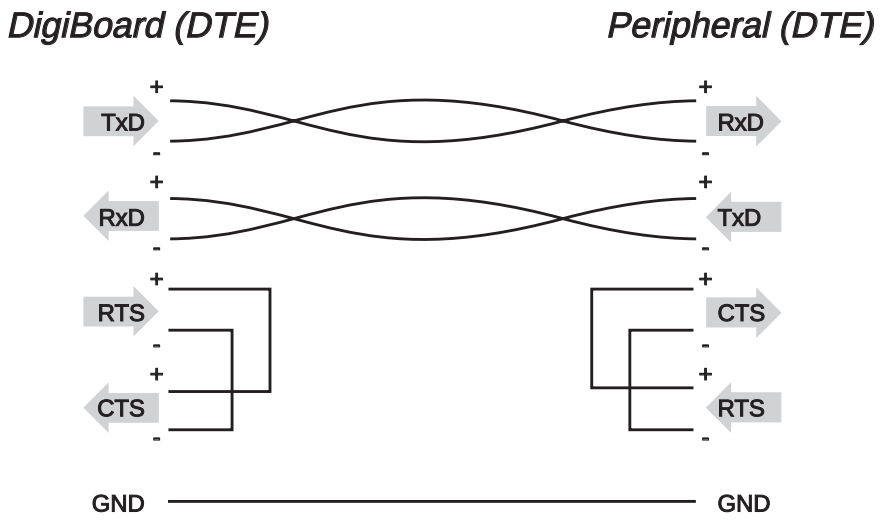
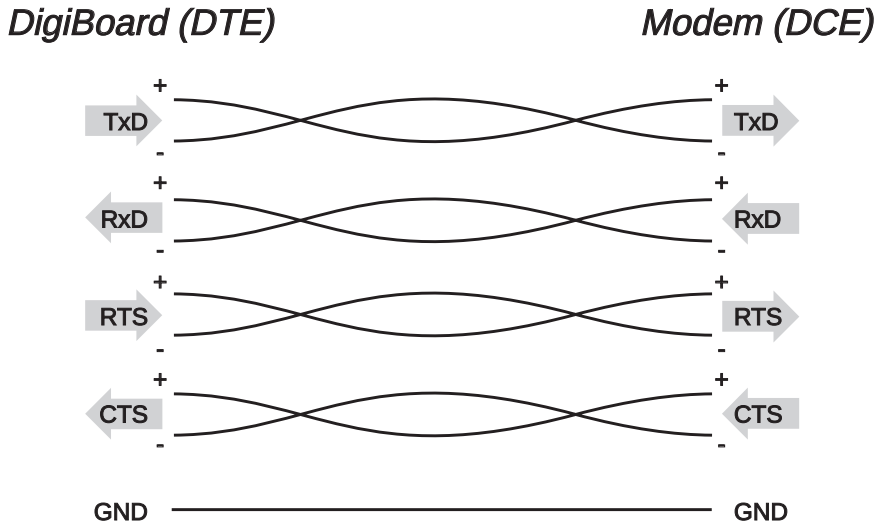


Figure 35 RS-422 DTE to DCE Connection



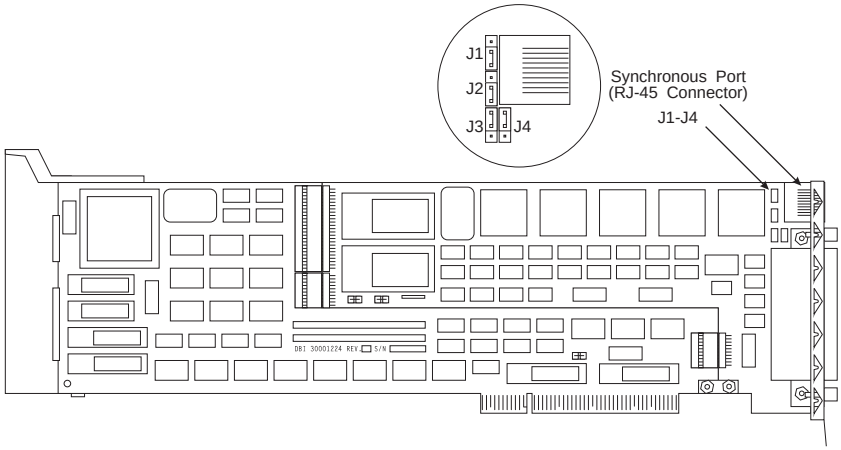
Synchronous Serial Interface—MC/Xi

A special version of the MC/Xi board, called the MC/Xi+ is available in four and eight-port configurations. The MC/Xi+ board has a synchronous port in addition to the standard asynchronous ports.

RS-232

The MC/Xi+ synchronous port uses a 10-pin RJ-45 jack located above the DB-78 connector on the endplate. Three of the ten pins are dual function pins, the functions of which are determined by the setting of jumpers J1-J4 (see Figure 36 for the position of the jumpers and the RJ-45 jack).

Figure 36 MC/8i+ (RS-232) Synchronous Port and Jumpers



The table below shows the pin assignments for the RJ-45 jack. Dual function pins also show the jumper settings required for each function. Signals ending with "A" connect to the "A" port of the 8530 communications controller, and signals ending with "B" connect to the "B" port of the 8530.

Table 13 MC/Xi+ (RS-232) Synchronous Port Pin Assignments

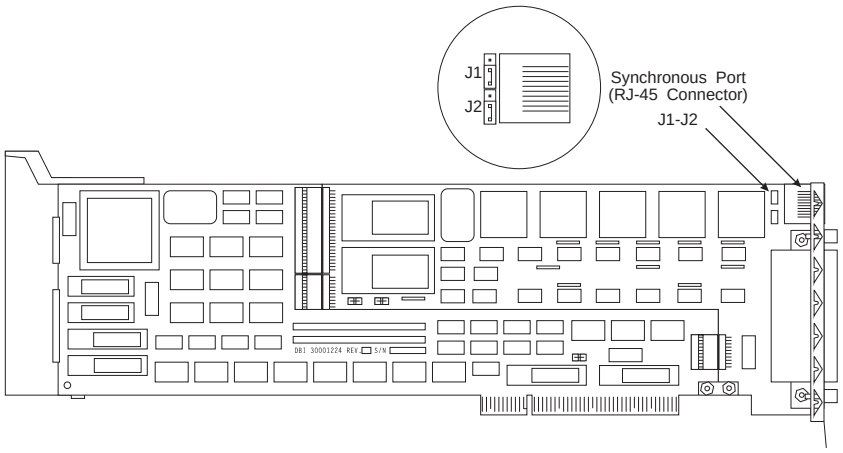
RJ-45 Pin	Signal	Name	Jumpers
1	TRxCA	Transmit/Receive Clock	J2 Pins 1 & 2
	SYNB	Synchronization B (RI)	J2 Pins 2 & 3
2	DSRA	Data Set Ready A (Input)	J3 Pins 1 & 2; J4 Pins 1 & 2
	SYNA	Synchronization A (Output)	J3 Pins 2 & 3; J4 Pins 2 & 3
3	RTSA	Request To Send A	
4	GND	Chassis Ground	
5	TxDA	Transmitted Data A	
6	RxDA	Received Data A	
7	SG	Signal Ground	
8	CTSA	Clear To Send A	
9	DTRB	Data Terminal Ready B	
10	RTxCA	Receive/Transmit Clocks A	J1 Pins 1 & 2
	DCDA	Data Carrier Detect A	J1 Pins 2 & 3

NOTE—Contact your DigiBoard sales representative for information regarding software support for the MC/Xi+ synchronous port.

RS-422, RS-422/RS-485

The MC/Xi+ board is also available in RS-422 and RS-422/RS-485 configurations. As with the RS-232 versions, there is an extra port wired for synchronous communication. The RS-422 version, the synchronous port is set up for RS-422 operation. The RS-422/RS-485 version has four or eight RS-422 asynchronous ports plus one RS-485 synchronous port.

Figure 37 MC/8i+ (RS-422) Synchronous Port and Jumpers



The MC/Xi+ synchronous port uses a 10-pin RJ-45 jack located above the DB-78 connector on the endplate. Two of the ten pins are dual function pins, the functions of which are determined by the setting of jumpers J1 & J2 (see Figure 37 for the position of the jumpers and the RJ-45 jack).

The signals and pin numbers are the same for the RS-422 and RS-485 versions, but the RS-485 output lines can be tri-stated under software control.

The table below shows the pin assignments for the RJ-45 jack. Dual function pins also show the jumper settings required for each function.

Table 14 MC/Xi+ (RS-422) Synchronous Port Pin Assignments

RJ-45 Pin	Signal	Name	Jumpers
1	CTS+	Clear To Send (+)	J1 Pins 1 & 2
	RTC+	Receive/Transmit Clocks (+)	J1 Pins 2 & 3
2	CTS-	Clear To Send (-)	J1 Pins 1 & 2
	RTC-	Receive/Transmit Clocks (-)	J1 Pins 2 & 3
3	GND	Chassis Ground	
4	TxD+	Transmitted Data (+)	
5	TxD-	Transmitted Data (-)	
6	RxD+	Received Data (+)	
7	RxD-	Received Data (-)	
8	SG	Signal Ground	
9	RTS+	Request To Send (+)	J2 Pins 1 & 2
	TRC+	Transmit/Receive Clocks (+)	J2 Pins 2 & 3
10	RTS-	Request To Send (-)	J2 Pins 1 & 2
	TRC-	Transmit/Receive Clocks (-)	J2 Pins 2 & 3

NOTE—Contact your DigiBoard sales representative for information regarding software support for the MC/Xi+ synchronous port.

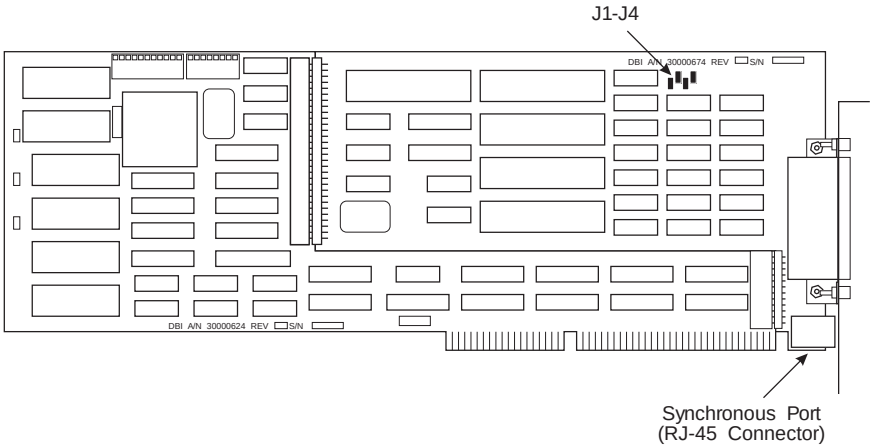
Synchronous Serial Interface—PC/Xi

A special version of the PC/Xi board, called the PC/Xi+ is available in eight and sixteen-port configurations. The PC/Xi+ board has an RS-232 synchronous port in addition to the standard asynchronous ports.

PC/8i+

The PC/8i+ synchronous port uses a 10-pin RJ-45 jack located above the DB-78 connector on the endplate. Three of the ten pins are dual function pins, the functions of which are determined by the setting of jumpers J1-J4 (see Figure 38 for the position of the jumpers and the RJ-45 jack).

Figure 38 PC/8i+ Board Synchronous Port and Jumpers



The table below shows the pin assignments for the PC/8i+ RJ-45 jack. Dual function pins also show the jumper settings required for each function. Signals ending with "A" connect to the "A" port of the 8530 communications controller, and signals ending with "B" connect to the "B" port of the 8530.

Table 15 PC/8i+ Synchronous Port Pin Assignments (RJ-45)

RJ-45 Pin	Signal	Name	Jumpers
1	TRxCA	Transmit/Receive Clock	J4 Pins 1 & 2
	SYNB	Synchronization B (RI)	J4 Pins 2 & 3
2	DSRA	Data Set Ready A (Input)	J1 Pins 2 & 3; J2 Pins 2 & 3
	SYNA	Synchronization A (Output)	J1 Pins 1 & 2; J2 Pins 1 & 2
3	RTSA	Request To Send A	
4	GND	Chassis Ground	
5	TxDA	Transmitted Data A	
6	RxDA	Received Data A	
7	SG	Signal Ground	
8	CTSA	Clear To Send A	
9	DTRB	Data Terminal Ready B	
10	RTxCA	Receive/Transmit Clocks A	J3 Pins 2 & 3
	DCDA	Data Carrier Detect A	J3 Pins 1 & 2

NOTE—Contact your DigiBoard sales representative for information regarding software support for the PC/Xi+ synchronous port.

PC/16i+

The PC/16i+ has an additional DB-25 connector on the back of the connector box assembly. The following table shows the pin assignments for this connector.

Table 16 PC/16i+ Synchronous Port Pin Assignments (DB-25)

DB-25 Pin #	Signal	Description
Shell	GND	Chassis Ground
2	TxD	Transmitted Data
3	RxD	Received Data
4	RTS	Request To Send
5	CTS	Clear To Send
6	DSR	Data Set Ready
7	SG	Signal Ground
8	DCD	Data Carrier Detect
15	TRxCA	Transmit/Receive Clock
17	RTxCA	Receive/Transmit Clock
20	DTR	Data Terminal Ready
22	RI	Ring Indicator

Pin 15, TRxCA, can be configured as either an input or an output by setting jumpers J1 and J2, located inside the connector box, near the synchronous port. To use TRxCA as an input, place jumpers on pins 1 and 2 of both J1 and J2. To use TRxCA as an output, place the jumpers on pins 2 and 3 of J1 and J2.

NOTE—Contact your DigiBoard sales representative for information regarding software support for the PC/Xi+ synchronous port.

Specifications

Power Requirements

PC/16i (RS-232)

+5 VDC	1.7 Amps max.
+12 VDC	200 mA max.
-12 VDC	200 mA max.

PC/16i (RS-422)

+5 VDC	1.85 Amps, plus 60 mA per channel under load.

PC/16e

+5 VDC	2.0 Amps max.
+12 VDC	130 mA max.
-12 VDC	110 mA max.

PC/8i

+5 VDC	1.4 Amps max.
+12 VDC	130 mA max.
-12 VDC	110 mA max.

COM/8i (RS-232)

+5 VDC	1.1 Amps max.
+12 VDC	180 mA max.
-12 VDC	180 mA max.

COM/4i (RS-232)

+5 VDC	1.0 Amps max.
+12 VDC	90 mA max.
-12 VDC	90 mA max.

COM/8i (RS-422/RS-485)
+5 VDC 1.2 Amps, plus 60 mA per channel under load.

COM/8i (RS-422/RS-485)
+5 VDC 1.1 Amps, plus 60 mA per channel under load.

MC/16i (RS-232)

+5 VDC 1.6 Amps max.
+12 VDC 300 mA max.
-12 VDC 300 mA max.

MC/8i (RS-232)

+5 VDC 1.8 Amps max. (2.0 Amps max. with sync port).
+12 VDC 80 mA max.
-12 VDC 80 mA max.

MC/4i (RS-232)

+5 VDC 1.4 Amps max. (1.6 Amps max. with sync port).
+12 VDC 40 mA max.
-12 VDC 40 mA max.

MC/16i (RS-422/485)
+5 VDC 1.75 Amps, plus 60 mA per channel under load.

MC/8i (RS-422/485)
+5 VDC 1.4 Amps max. (1.5 Amps max. with sync port), plus 60 mA per channel under load.

MC/4i (RS-422/485)
+5 VDC 1.2 Amps max. (1.3 Amps max. with sync port), plus 60 mA per channel under load.

Board Dimensions

PC/Xi, PC/16e

Length	13.1 inches
Width	0.6 inches
Height	4.8 inches
Weight	1.0 pound

MC/Xi

Length	11.5 inches
Width	0.6 inches
Height	3.5 inches
Weight	0.75 pounds

COM/Xi

Length	11.5 inches
Width	0.6 inches
Height	4.2 inches
Weight	1.25 pounds

Environmental

All Boards

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

Appendix—Memory Conflicts

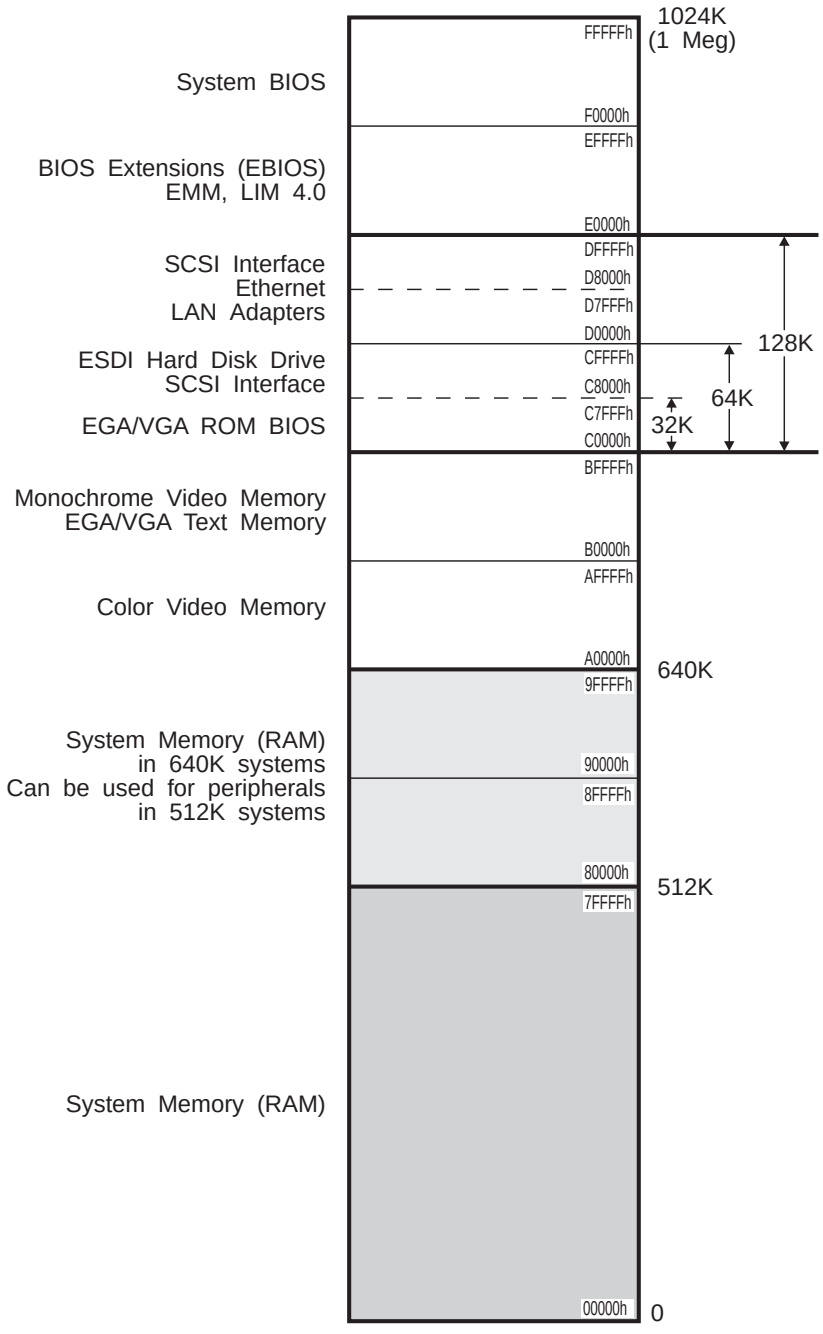
Contention for Memory Addresses

Many intelligent peripheral devices require a block of vacant memory addresses on the host computer's bus for their own use. These memory addresses may be used to access a dual-ported RAM on the peripheral device to facilitate the transfer of large volumes of data between the host and the peripheral (memory-to-memory transfers are much faster than I/O bus transfers), or they may point to a ROM BIOS (a firmware program used by the host computer to control the peripheral device). In either case, the host computer sees this memory as its own, and can use the same high-speed memory-referencing commands that it uses with its internal memory.

Figure 39 on the following page shows a map of the first megabyte of a host system's memory bus. The shaded areas represent the computer's internal RAM (nearly always 640K, but can often be reduced to 512K—there is also usually more RAM above the 1 Meg boundary). The area between the RAM and the 1 Meg boundary is used for the host system's BIOS, option ROMs and peripheral memory. The memory map shows the locations typically used by some of the most common peripheral devices.

The memory map on the following page shows typical *memory usage. To be certain of what areas are available in your system, you will need to consult the documentation for your computer and peripheral devices.*

Figure 39 **Typical PC Memory Usage - 1st Megabyte**



PC/Xi and PC/16e Issues

PC/Xi boards can be ordered with 128K, 256K or 512K of RAM. PC/Xi boards with 128K of RAM can be configured for 64K operation by changing a jumper setting on the board see page. PC/16e boards are only available with 64K of RAM. ***Only the 64K and 128K configurations can be addressed in the region below 1 megabyte.***

The 128K PC/Xi board's dual-ported memory can be addressed at 80000h or C0000h (below 1 megabyte), or at one of several addresses between the 1 megabyte and 16 megabyte boundaries. *256K and 512K PC/Xi boards can only be addressed above 1 megabyte*. Most operating systems allow boards with dual-ported memory to use addresses above the 1 megabyte boundary. These addresses cannot, however, be used when installing the board in a computer with 16 megabytes or more of memory. Also, some cache controllers interfere with the correct operation of peripherals with dual-ported memory addressed above 1 megabyte (they don't affect peripherals addressed below 1 megabyte). If your computer has memory caching, you may have to either disable the cache or address the PC/Xi below 1 megabyte.

As mentioned above, 128K PC/Xi boards can only be installed in two address ranges below the 1 megabyte boundary: 80000h- 9FFFFh or C0000h-DFFFFh. There is always some sort of video memory between A0000h and BFFFFh, and the system BIOS at F0000h makes the E0000h-FFFFFh range unusable for 128K boards. Further, it will probably be necessary to sacrifice something in order to install a 128K board at 80000h or C0000h. To install a board at 80000h, you must have no more than 512K of system memory in the first megabyte. If you have a 640K motherboard you must be able to disable the last 128K and make it into a 512K motherboard. This usually isn't as serious as it sounds in multi-user systems with lots of extended memory, but may cause DOS application programs to fail due to insufficient memory. To install a 128K board at C0000h, you need to clear the C0000h-DFFFFh range of other devices which have memory in that range. This includes (but is not limited to) plug-in EGA and VGA video adapters, ESDI hard disk controllers, SCSI interfaces, many LAN adapters, etc.

MS-DOS does not permit addressing above 1 megabyte. Therefore, PC/Xi boards *must* be installed below 1 megabyte. This eliminates the 256K and 512K versions, because they would overlap the entire video memory, the system BIOS, or both. *It is recommended that only 64K PC/Xi boards be used in DOS systems.*

64K PC/Xi boards (and PC/16e boards) offer more flexibility of addressing than 128K boards. Conflicts with VGA, ESDI and SCSI interfaces can usually be avoided by installing the boards at D0000h (up to four boards may be installed with the same memory address range), and A0000h-AFFFFh may be available in monochrome systems.

Conflicts Between 8-Bit and 16-Bit Memory Devices

The ISA (Industry-Standard Architecture) bus, used in many 80286 (AT compatible), 80386, 80486 and Pentium based computers, supports 16-bit memory and peripherals with 16-bit dual-ported memory or ROM. By default, however, memory devices are considered to be 8-bit devices. 16-bit devices must declare themselves by raising a flag, so that the host knows whether it is referencing a *byte* (8 bits) or a *word* (16 bits) of memory.

Memory addressing on the ISA bus consists of 2 phases: First the *unlatched* address bits (bits A17 to A23) are placed on the bus. Then the *latched* bits (A00 to A16) are placed on the bus. A 16-bit device must declare itself *after* the unlatched bits go on the bus, but *before* the latched bits go out. Since the unlatched bits can only resolve 128K blocks of memory, the presence of *any* 16-bit device in a 128K segment causes the *entire* segment to be treated as 16-bit memory. Thus if an 8-bit device resides in the same 128K block as a 16-bit device, only even-numbered bytes will be accessible, and the device will fail.

PC/Xi and PC/16e boards are 16-bit devices however, their dual-ported memory can be turned on or off by writing a 1 or 0 (respectively) to a bit in the I/O port. This is so multiple boards can use the same memory address space without conflicting with each other. No more than one board is turned on at any given time. If all boards are turned off, they become invisible to the computer, and memory accesses to the 128K block in which they reside will not result in the 16-bit memory flag being raised. In this way, an 8-bit VGA card can reside at C0000h, a COM/Xi board can be at C8000h and a PC/Xi board can be at D0000h with no ensuing conflict. (This is generally only an issue when the board is to be installed below 1 megabyte, where there tends to be crowding of peripherals due to the limited space available.)

As a rule, DigiBoard's device drivers for PC/Xi and PC/16e boards always leave the boards' memory turned off after any operation. This minimizes the likelihood of a conflict with an 8-bit device. *It does not, however, guarantee that no conflict will ensue.* The only sure way to eliminate conflicts of this type is to avoid mixing 8-bit and 16-bit devices in the same 128K region.

MC/Xi Issues

MC/Xi boards can be configured for either 128K or 32K of dual-ported memory by the placement of a jumper, J1, located on the MC/Xi Processor board, just above the edge connector (see Figure 9 on page 20).

The 128K MC/Xi board's dual-ported memory can be addressed at C0000h (below 1 megabyte), or at one of several addresses in the 16th megabyte. Most operating systems allow boards with dual-ported memory to use addresses above the 1 megabyte boundary. These addresses cannot, however, be used when installing the MC/Xi in a computer with 16 megabytes or more of memory. Also, some cache controllers interfere with the correct operation of peripherals with dual-ported memory addressed above 1 megabyte (they don't affect peripherals addressed below 1 megabyte). If your computer has memory caching, you may have to either disable the cache or address the MC/Xi below 1 megabyte.

Under DOS, the 128K MC/Xi can only be installed at C0000h, which makes it impractical in most installations. Micro Channel (PS/2) machines usually have an ESDI hard disk controller which uses memory addresses between C8000h and CFFFFh. A 128K MC/Xi can only be installed at the expense of the ESDI controller.

An MC/Xi configured for 32K, on the other hand, can be installed on any of the 32K boundaries in the C0000h-DFFFFh range (C0000h, C8000h, D0000h or D8000h). The presence of an ESDI controller still eliminates the C8000h-CFFFFh range, but the other three are often available. It is generally only necessary to remove the ESDI controller if you wish to install four 32K MC/Xi boards. Micro Channel machines have built-in VGA capability (on the motherboard), so the VGA BIOS is included as part of the system BIOS, leaving the C0000h-C8FFFh area free (if you have installed a third-party VGA or SVGA, this area will be used for the VGA BIOS, as on ISA machines).

Each MC/Xi board requires its own unique block of memory addresses.

COM/Xi Issues

The COM/Xi board has 256K of on-board RAM which can be accessed by the host computer through a 32K window on the host's memory bus. The COM/Xi's 32K window can be mapped into one of four address ranges on the host memory bus: C0000h-C7FFFh, C8000h-CFFFFh, D0000h-D7FFFh or D8000h-DFFFFh. Contingent upon the availability of these address ranges, up to four COM/Xi boards can be installed in a host computer (each COM/Xi board requires its own 32K block of addresses).

Typical sources of contention and possible solutions are:

- Plug-in VGA and EGA cards, which have a ROM BIOS beginning at C0000h *Solution: Remove the VGA or EGA card from the system and use a Monochrome Display Adapter instead.*
- ESDI hard disk controllers, which typically have a ROM BIOS beginning at C8000h or CC000h *Solution: Replace the ESDI drive and controller with an MFM drive and controller.*
- SCSI interfaces, which have a ROM BIOS that may be located anywhere in the C0000h-DFFFFh range *Solution: Remove or relocate the SCSI interface.*

In most cases, resolution of a memory contention problem involves a sacrifice. The more COM/Xi boards you try to put in a host computer, the more likely it is that contention will result. Another alternative, if it is necessary to have a large number of ports, is to switch to the DigiBoard PC/X* (PC/Xe and PC/Xi) line of boards. While the PC/X* boards need a minimum memory address space of 64K, up to four boards can be stacked in the same address range, and the boards are available with up to 16 ports each, giving you a total of 64 ports.

Conflicts Between 8-Bit and 16-Bit Memory Devices

The ISA (Industry-Standard Architecture) bus, used in many 80286 (AT compatible), 80386, 80486 and Pentium based computers, supports 16-bit memory and peripherals with 16-bit dual-ported memory or ROM. By default, however, memory devices are considered to be 8-bit devices. 16-bit devices must declare themselves by raising a flag, so that the host knows whether it is referencing a *byte* (8 bits) or a *word* (16 bits) of memory.

Memory addressing on the ISA bus consists of 2 phases: First the *unlatched* address bits (bits A17 to A23) are placed on the bus. Then the *latched* bits (A00 to A16) are placed on the bus. A 16-bit device must declare itself *after* the unlatched bits go on the bus, but *before* the latched bits go out. Since the unlatched bits can only resolve 128K blocks of memory, the presence of *any* 16-bit device in a 128K segment causes the *entire* segment to be treated as 16-bit memory. Thus if an 8-bit device resides in the same 128K block as a 16-bit device, only even-numbered bytes will be accessible, and the device will fail.

The COM/Xi board is an 8-bit device (it looks like a 16-bit board because it has an AT-style edge connector, but this is only to permit the board to use IRQs 10, 11, 12 and 15 if these interrupts are not used, the board may be installed in an 8-bit XT slot, provided that there is clearance at the end of the slot for the extra edge connector). Since the COM/Xi board's 32K dual-ported memory window must start at C0000h, C8000h, D0000h or D8000h, it is always in the 128K block C0000h-DFFFFh, and is subject to interference by any 16-bit device in that region.

The most common conflict is with 16-bit VGA cards, which have a ROM BIOS at C0000h. Many of these cards can be switched between 8-bit and 16-bit operation by changing a DIP switch or jumper on the card.

If a 16-bit device which interferes with a COM/Xi board cannot be switched to 8-bit operation, here are three actions you can take to resolve the conflict:

1. Move the 16-bit device out of the C0000h-DFFFFh block.

2. Replace the 16-bit device with an equivalent 8-bit device.

3. Replace the COM/Xi board with a PC/Xe or PC/Xi board

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