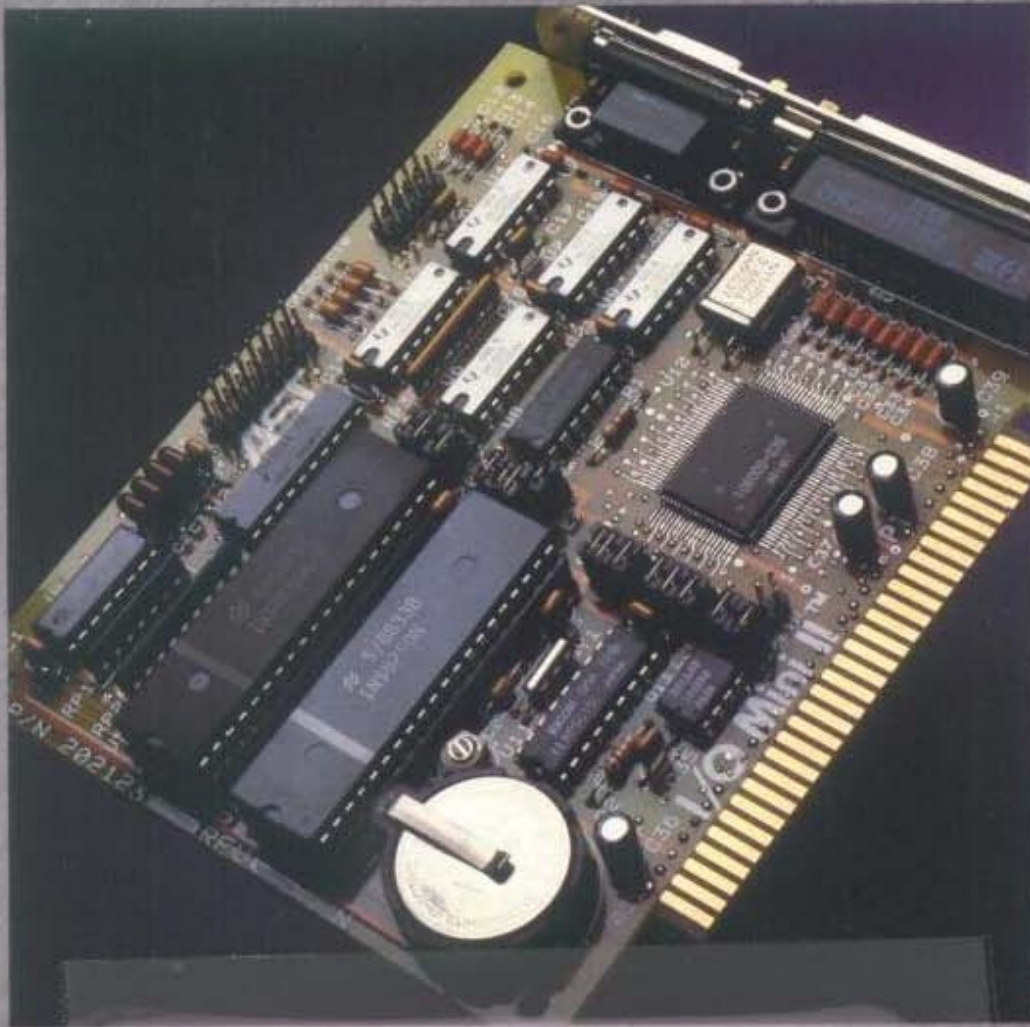


Multifunction Products

I/O Mini II™

AST
RESEARCH INC.

*Single Slot Half-Card
Offering Powerful I/O
Expansion*



I/O MINI II

SERIAL NO. 24066 ASSY. REV. B
(C) Copyright 1986 AST Research Inc.

FCC WARNING

This equipment has been certified to comply with the limits for a Class B computing device, pursuant to Subpart J of Part 15 of FCC Rules. Only peripherals (computer input/output devices, terminals, printers, etc.) certified to comply with the Class B limits may be attached to a computer that complies with Class B limits. Operation with non-certified peripherals is likely to result in interference to radio and TV reception. When connecting to a peripheral device, a shielded I/O cable is required to ensure compliance with FCC Rules.

Instructions to User

This equipment generates and uses radio frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception. It has been type tested and found to comply with the limits for a Class B computing device in accordance with the specifications in Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient the receiving antenna.
- Relocate the computer with respect to the receiver.
- Move the computer away from the receiver.
- Plug the computer into a different outlet so that computer and receiver are on different branch circuits.
- Ensure that board slot covers are in place when no board is installed.
- Ensure that all brackets are fastened securely to the PC chassis.

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions. The user may find the following booklet prepared by the Federal Communications Commission (FCC) helpful: "How to Identify and Resolve Radio-TV Interference Problems". This booklet is available from the U.S. Government Printing Office, Washington, DC 20402. Stock No. 004-000-00345-4.

**I/O Mini II™
I/O Card
for the
IBM Personal Computer,
PC-XT, and
Other IBM-Compatible Machines**

User's Manual
000380-001 A
July 1986

AST RESEARCH, INC.
Irvine, California
(714) 863-1333

First Edition (July 1986)

I/O Mini II, SuperPak, SuperDrive, SuperSpool, MonoGraphPlus, and *Preview!* are trademarks of AST Research, Incorporated.

IBM, PC, PC-XT, and IBM Monochrome Display/Printer Adapter are registered trademarks of International Business Machines Corporation.

Changes are periodically made to the information contained in this manual; these changes will be incorporated into new editions.

In view of demonstrated product reliability and comprehensive warranty policies, AST Research, Inc. does not normally provide schematics or material lists. AST recognizes that some customers with a large installed base of AST products want supportive documentation for their own service organizations. In such cases, customers should contact AST Research corporate offices to consider an appropriate nondisclosure agreement to obtain this documentation.

A Product Comment Form is provided at the back of this publication. If this form has been removed, please address your comments to: AST Research, Inc., Attn: Product Marketing, 2121 Alton Ave., Irvine, CA 92714. AST Research may use or distribute any of the information you supply in any it deems appropriate without incurring any obligations whatsoever.

Copyright © 1984 AST Research, Inc. All rights are reserved, including those to reproduce this book or parts thereof in any form without permission in writing from AST Research, Inc.

WARNING

This manual and software are both protected by United States Copyright law (Title 17 United States Code). Unauthorized reproduction and/or sales may result in imprisonment of up to one year and fines of up to \$10,000 (17 USC 506). Copyright infringers may be subject to civil liability.

CONTENTS

SECTION 1. INTRODUCTION	1-1
1.1 Checklist	1-2
1.2 System Requirements	1-2
1.3 How to Use This Manual	1-3
1.3.1 Format Notation	1-3
1.3.2 Related Reading	1-4
1.3.3 Manual Outline	1-4
SECTION 2. CONFIGURATION AND INSTALLATION ...	2-1
2.1 Standard Configuration	2-2
2.2 Installing I/O Mini II into Your PC	2-5
2.3 Testing the New Installation	2-10
SECTION 3. CLOCK-CALENDAR	3-1
3.1 Configuring the Clock-Calendar	3-2
3.1.1 Disabling the Clock-Calendar	3-2
3.2 Preparing Your PC Boot Disk	3-3
3.3 Setting the TIME and DATE	3-4
3.4 Clock-Calendar Battery	3-8
3.5 Technical Information	3-10
SECTION 4. SERIAL PORT	4-1
4.1 Configuring the Serial Port(s)	4-2
4.1.1 Installing Multiple Serial Ports in a PC	4-3
4.1.2 Configuring the RS-232C Interface Lines	4-4
4.1.3 Disabling the Serial Port	4-6
4.2 Adding the Second Serial Port	4-6
4.3 Programing the Serial Port	4-9
4.4 I/O Address Assignments and Pinouts	4-11
4.5 Diagnostic Testing	4-14

CONTENTS

(Continued)

SECTION 5. PARALLEL PORT	5-1
5.1 Configuring the Parallel Port	5-1
5.1.1 Installing Multiple Parallel Ports in a PC	5-3
5.1.2 Display Adapters with Built-in Parallel Ports ..	5-3
5.1.3 Disabling the Parallel Port	5-3
5.2 Programming the Parallel Port	5-3
5.3 I/O Addresses and Pinouts	5-4
5.4 Diagnostic Testing	5-5
5.5 Interrupt Driven Parallel Printer Software	5-7
SECTION 6. GAME PORT	6-1
6.1 Configuring the Game Port	6-1
6.2 Adding the Game Port to Your I/O Mini II	6-2
6.3 Software Compatibility	6-5
6.4 Technical Information	6-5
6.4.1 I/O Addresses and Assignment	6-5
6.4.2 Pinouts	6-5
6.5 Diagnostic Testing	6-7
APPENDIX A. SERIAL INTERFACES	A-1
A.1 RS-232C Interface Standard	A-2
A.2 Interfacing DTE to DCE	A-3
A.3 Interfacing DTE to DTE ("Null Modem")	A-6
A.4 Design Aids	A-10
APPENDIX B. SWITCHING BETWEEN PARALLEL PRINTER PORTS	B-1
B.1 Switching Between LPT1 and LPT2	B-2
B.2 Restoring LPT1 to LPT1 and LPT2 to LPT2	B-2
B.3 Switching Between LPT1 and LPT3	B-3
B.4 Restoring LPT1 to LPT1 and LPT3 to LPT3	B-3

CONTENTS

(Continued)

Figures

Figure 2-1. I/O Mini II Installation Overview	2-1
Figure 2-2. I/O Mini II Standard Configuration	2-3
Figure 2-3. Removing the PC Cover	2-6
Figure 2-4. Connecting I/O Mini II Cables	2-7
Figure 2-5. Installing Your I/O Mini II Board	2-9
Figure 3-1. Clock-Calendar Factory Configuration	3-2
Figure 3-2. Removing the Clock-Calendar Battery	3-9
Figure 4-1. Serial Port Configuration	4-3
Figure 4-2. Creating a "Forced True" State	4-5
Figure 4-3. Installing the Second Serial Port Chips	4-8
Figure 4-4. I/O Mini II Serial Port Pinouts	4-12
Figure 4-5. DE9-to-DB25 Adapter Cable Pinout	4-13
Figure 4-6. Typical DE9-to-DB25 Cable Application	4-13
Figure 4-7. Loopback Plug Configuration	4-14
Figure 5-1. Parallel Port Configuration	5-2
Figure 5-2. Loopback Plug Configuration	5-6
Figure 5-3. IRQ7 Enabled	5-7
Figure 6-1. Game Port Enable/Disable	6-2
Figure 6-2. Installing the Game Port Chips	6-4
Figure A-1. DTE-to-DCE Interface	A-5
Figure A-2. Example #1: Null Modem (DTE-to-DTE) Interface	A-7
Figure A-3. Example #2: Null Modem Interface	A-8
Figure A-4. Example #3: Null Modem Interface	A-9
Figure A-5. Serial Interface Form	A-11

Tables

Table 2-1. Standard I/O Mini II Configuration 2-5

Table 4-1. Clock-Calendar Chip I/O Addressing 4-11

Table 5-1. Parallel Port I/O Addresses 5-4

Table 5-2. Parallel Port Pinouts 5-5

Table 6-1. I/O Mini II Game Port Pinouts 6-6

SECTION 1

INTRODUCTION

The AST Research I/O Mini II™ is a compact and versatile input/output (I/O) enhancement product for the IBM Personal Computer (PC), PC-XT, and compatibles. I/O Mini II includes these features:

- Real-time clock-calendar with battery backup.
- Up to two RS-232C asynchronous serial communications ports (the first serial port comes standard, and the second is available as an option). You can use the serial port to interface to a modem, serial printer, remote display terminal, or other serial device.
- Parallel port. You can use the parallel port to connect a parallel printer to the PC.
- Optional game port.

Your I/O Mini II comes with a SuperPak™ diskette that includes these valuable utility programs:

- *ASTCLOCK*, the real-time clock-calendar program that frees you from having to re-enter the time and date every time you turn on your PC.
- *SuperDrive™*, a disk emulation program that allows you to use part of your random access memory (RAM) as a superfast "electronic diskdrive".
- *SuperSpool™*, an intelligent print spooler that allows you to output files to a printer while freeing your PC for other tasks.
- *RAMCLEAR*, a memory initialization program that clears your PC's RAM of any false parity errors.

Introduction

The *ASTCLOCK* program is useful for your I/O Mini II clock-calendar, and the remaining SuperPak programs can be used with your other AST Research multifunction products.

Your SuperPak diskette may also include other software (which may pertain to other AST products). The README file on your SuperPak diskette describes the programs included in your SuperPak software.

See your *SuperPak User's Manual* for more information on the SuperPak utility programs.

1.1 Checklist

Before you get started, check that your I/O Mini II package includes the following:

- I/O Mini II circuit board.
- I/O Mini II serial interface cable and bracket.
- SuperPak diskette, version 5.1 or later.
- *SuperPak User's Manual*.

1.2 System Requirements

The minimum hardware requirements for operation with I/O Mini II are an IBM PC or PC-XT (or compatible) with one floppy diskette drive and an unused expansion slot.

All references to operating system commands in this manual assume operation under DOS (versions 2.1 and above). The I/O Mini II hardware is completely IBM-compatible and will function properly under other IBM-approved operating system software. However, configuring the I/O ports under another operating system requires the use of commands specific to that operating system. See your operating system manual for the appropriate command syntax.

1.3 How to Use This Manual

This section provides an outline of the format notation used throughout the manual, a list of related documentation, and an outline of the manual.

1.3.1 Format Notation

The following format notation is used throughout this manual:

- *Uppercase characters* indicate items (such as commands) that you enter exactly as shown. However, you can enter those items in any combination of upper- or lowercase letters.
- *Boldface* indicates information that you enter, as contrasted to system prompts or messages (which are shown in regular typeface). A boldface entry can be a parameter such as a file name or a key to press.
- *Square brackets ([])* indicate an optional term which is included or omitted at your discretion. The brackets are not entered.
- *Lowercase letters* represent parameters that are defined by the user. While the user defines the parameters, they must satisfy the conditions of the command description.
- *Angle brackets* tell you to press a key. For example, **<Esc>** instructs you to press the "Esc" key. You do not have to press the "Enter" key unless you are specifically told to do so. A notation such as **<Ctrl>-<Alt>** means to press the **<Ctrl>** and **<Alt>** keys simultaneously.
- System prompts and messages are shown in color.
- *Hexadecimal numbers* are indicated with a leading zero (0) and a trailing lowercase "h" (for example, 02C0h).

1.3.2 Related Documentation

Your I/O Mini II comes with a SuperPak diskette. You can find detailed information on the SuperPak utilities in the *SuperPak User's Manual*.

This manual assumes some familiarity with the PC-DOS operating system (versions 2.1 and above) and the IBM PC or PC-XT hardware. You can find this information in these manuals for your PC:

- *Guide to Operations*
- *Technical Reference*
- *Disk Operating System*

1.3.3 Manual Outline

The following outline describes this manual.

SECTION 1: INTRODUCTION

Describes the features of the I/O Mini II, and provides information on format notation, and related documentation.

SECTION 2: CONFIGURATION AND INSTALLATION

Tells you how to install your I/O Mini II into your PC.

SECTION 3: CLOCK-CALENDAR

Tells you how to use the I/O Mini II clock-calendar.

SECTION 4: SERIAL PORT

Describes the I/O Mini II serial port(s) in detail.

SECTION 5: PARALLEL PORT

Describes the I/O Mini II parallel port in detail.

SECTION 6: GAME PORT

Describes the I/O Mini II game port in detail.

APPENDIX A: SERIAL INTERFACES

Gives recommended wiring to interface specific serial devices to the I/O Mini II serial port.

APPENDIX B: SWITCHING BETWEEN PARALLEL PRINTER PORTS

Provides a program that routes printer output from one parallel printer port to another.

SECTION 2

CONFIGURATION AND INSTALLATION

This section tells you how to configure your I/O Mini II and install it in your PC. Figure 2-1 summarizes the I/O Mini II installation procedure.

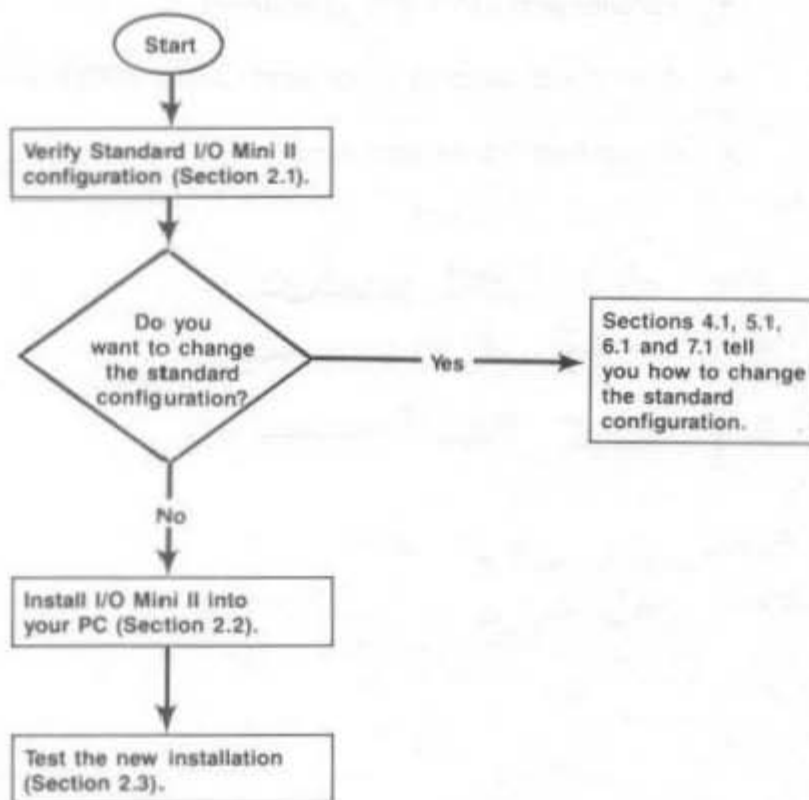


Figure 2-1. I/O Mini II Installation Overview.

2.1 Standard Configuration

The I/O Mini II is shipped from the factory in the following configuration:

- Clock-calendar enabled.
- Serial port COM1 (and interrupt request line IRQ4) enabled.
- Parallel port LPT1 (IRQ7) enabled.
- If installed: second serial port COM2 (IRQ3) enabled.
- If installed: game port enabled.

E10 OPEN LPT1 DISABLED

E11 CLOSE LPT2 ENABLED.

E17 CLOSE FOR PARALLEL NT.

HERE HAS LPT1

AST HAS LPT2

The standard I/O Mini II factory configuration is shown in Figure 2-2.

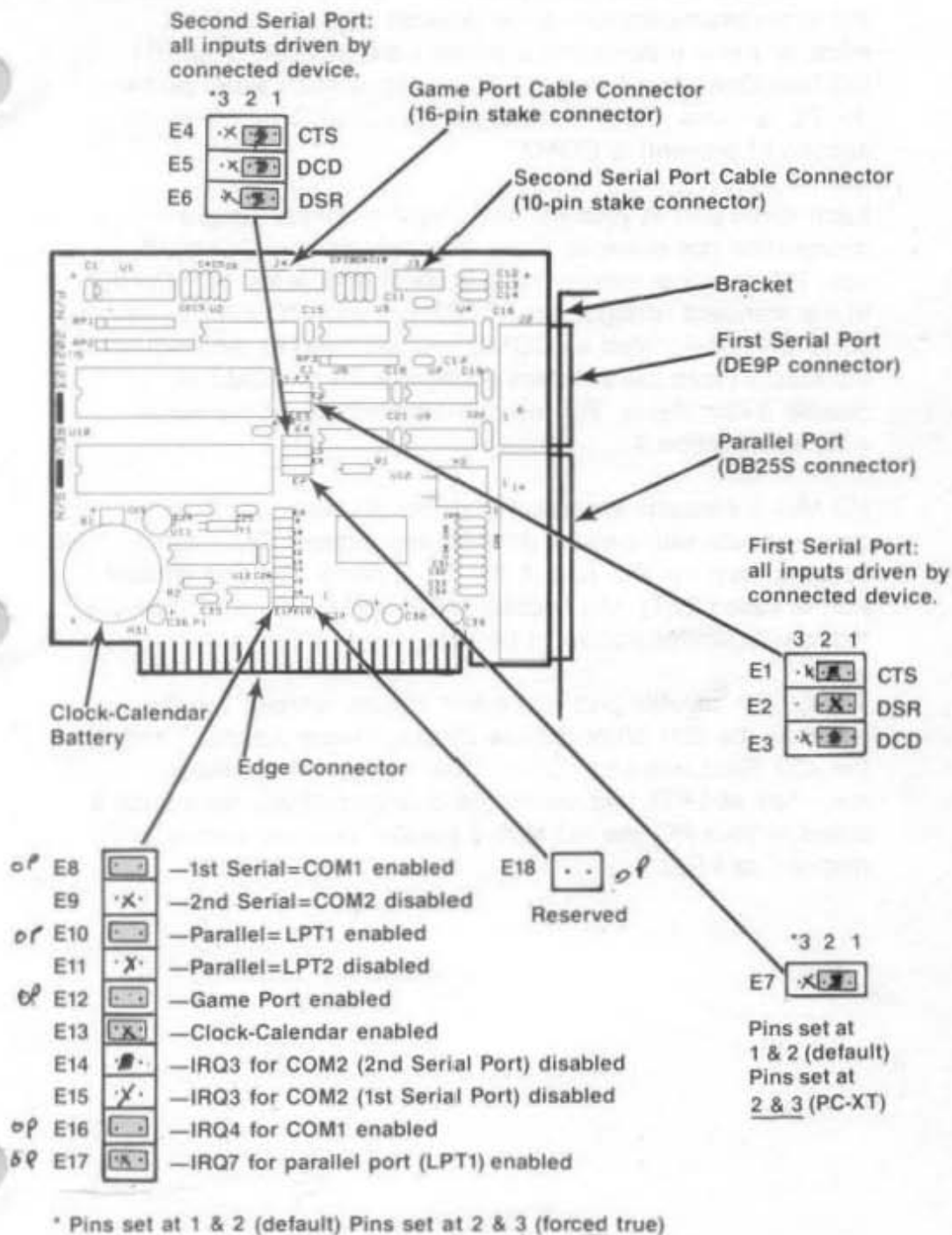


Figure 2-2 I/O Mini II Standard Configuration.

The I/O Mini II board contains a serial port that allows your PC to communicate with serial devices such as modems, mice, or serial printers (most printers are parallel). The IBM PC Disk Operating System (DOS) assigns each serial port in the PC a name: the first serial port is called COM1, and the second (if present) is COM2.

Each serial port in your PC must have a unique jumper designation (for example, there may only be one COM1). If your PC does not already have a serial port, leave I/O Mini II in the standard configuration (COM1). If your PC already has a serial port designated as COM1, you will need to reconfigure I/O Mini II (from the standard configuration) to COM2 or disable it completely. For more information about the serial port, see Section 4.

I/O Mini II contains a parallel port that allows your PC to communicate with parallel printers and plotters. DOS also assigns each parallel port in the PC a name: the first parallel port is called LPT1, the second LPT2, and the third LPT3. Note that each parallel port must be assigned a different name.

The built-in parallel port on certain display adapter boards (such as the IBM Monochrome Display/Printer Adapter™ and the AST Research MonoGraphPlus™ or *Preview!*™) always responds as LPT1 and cannot be changed. If you have such a board in your PC, the I/O Mini II parallel port will automatically respond as LPT2.

Table 2-1 summarizes the standard I/O Mini II configuration.

Table 2-1. Standard I/O Mini II Configuration.

Parameter	Standard Configuration	Comments
Serial port	First serial port is COM1 using IRQ4. (Shorting plugs at E8 and E16.) If installed, second serial port is COM2, using IRQ3. (Shorting plugs at E9 and E14.)	Removing shorting plugs disables port designations (for example, COM2 and IRQ4 respectively). First serial port can also be installed as COM2. Do not enable second serial port unless installed on I/O Mini II. Section 4 tells you how to change the default setting.
Parallel port	Configured as LPT1 using IRQ7. (Shorting at E10 and E17.)	Can also be configured as LPT2 or disabled. Section 6 tells you how to change the setting.
Game port (if installed)	Enabled if installed. (Shorting plug at E12.)	Must be disabled if game port is not installed. Refer to Section 6.
Clock-calendar	Enabled. (Shorting plug at E13.)	Refer to Section 3.
Serial port inputs	CTS, DSR, DCD driven by the connected device. (Shorting plugs at at E1, E2, and E3 for first serial port; E4, E5, and E6 for second serial port.)	You should not need to change this setting. However, you can force certain serial input signals true if required by your serial device (the manual for the serial device should tell you if you need to force serial inputs true). Section 4 provides more information.

2.2 Installing the I/O Mini II into Your PC

You can install the I/O Mini II card in any of the expansion slot receptacles on the PC or PC-XT (or compatible) system board, including the PC-XT eighth slot.

NOTE

To use the short (eighth) slot PC-XT users *must* reconfigure jumper E7 by placing a shorting plug at pins 2 and 3. The default setting is pins 1 and 2.

CAUTION

Be sure that the power switch is off and that the power cord is removed from the wall outlet. Turn off any of the equipment connected to the computer. Installing any component while the power is on can permanently damage your computer and its components.

You will need a flathead screwdriver or nut driver to perform the following procedure.

STEP 1

Remove the PC cover: Use a flathead screwdriver or nut driver to remove the cover mounting screws from your PC (see your PC's manual for the location of the cover mounting screws). Once you have removed the cover mounting screws, pull the PC cover off as shown in Figure 2-3.

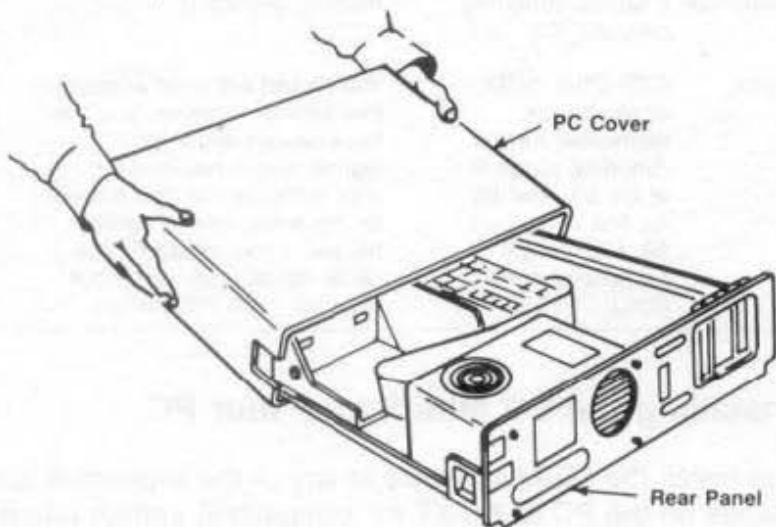


Figure 2-3. Removing the PC Cover.

STEP 2

Install the ribbon cable(s): This step is required only if you plan to use the second serial port and/or game port mounted on the supplied brackets. If not, go directly to STEP 3.

Each cable comes with a bracket. Use the hardware supplied on the D-shell connectors to mount each connector on its bracket. Plug each connector onto I/O Mini II (as shown in Figure 2-4), taking care to align pin 1 on the cable connector (the pin closest to the cable stripe) with pin 1 on the stake connector.

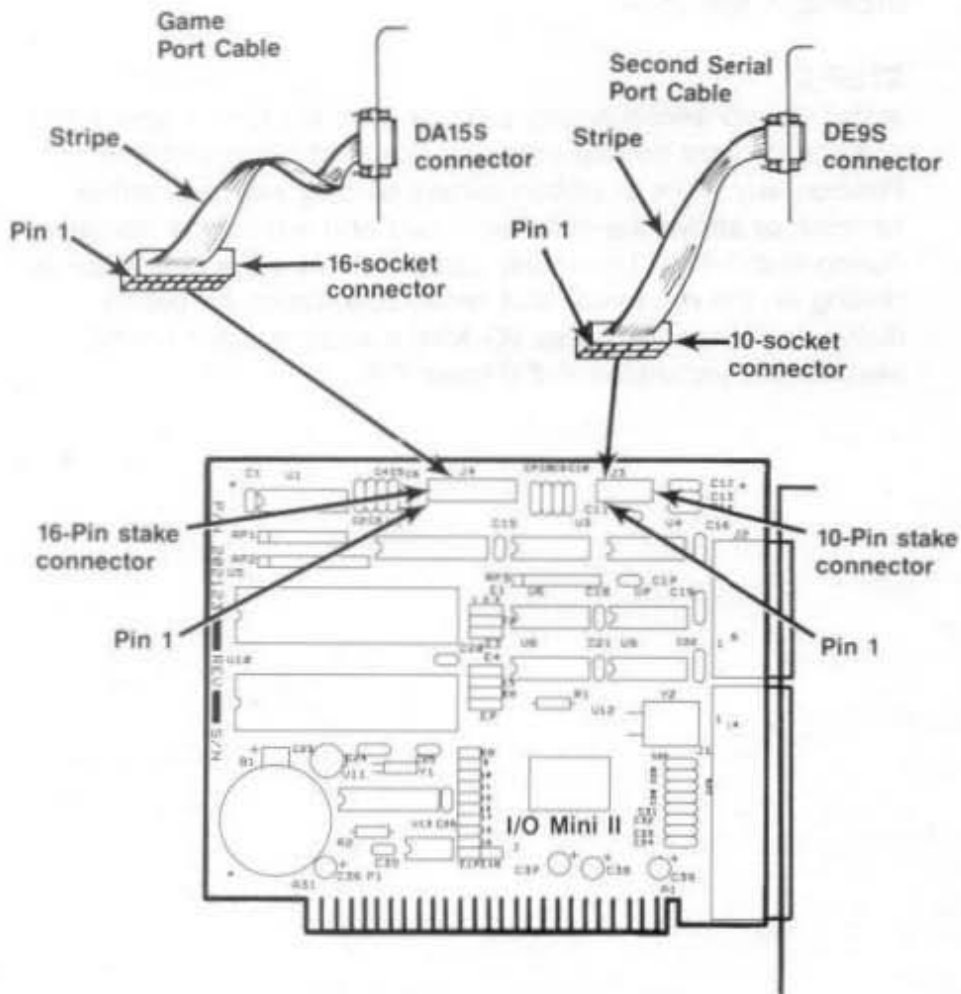


Figure 2-4. Connecting I/O Mini II Cables.

STEP 3

Select an open expansion slot: The I/O Mini II board requires one slot, full-length or short. You will need an additional slot if you are installing the second serial port bracket and/or game port bracket.

STEP 4

Remove expansion slot cover: Locate the metal cover for the cutout in the back panel of the PC chassis for the slot that you have selected. Remove and save the bracket retaining screw using a small flathead screwdriver. Remove the expansion slot cover.

STEP 5

Install the I/O Mini II board: Line up your I/O Mini II board and position its front bottom corner in the card guide channel. Position any wires or ribbon cables so they will pass either beneath or above the installed board and will not be damaged during installation. Lower the board until its edge connector is resting on the expansion slot receptacle. Using an evenly distributed pressure, press I/O Mini II straight down until it seats in the expansion slot (Figure 2-5).

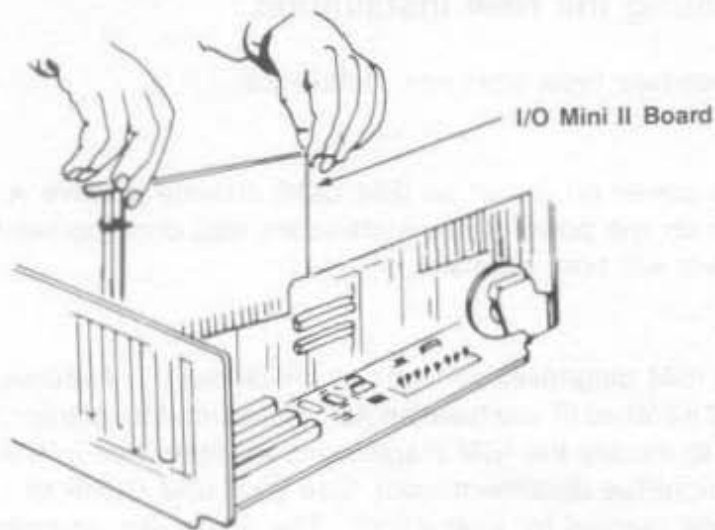


Figure 2-5. Installing Your I/O Mini II Board.

STEP 6

Secure the board to the rear of the PC chassis: Use the screw you removed from the expansion slot cover in STEP 4.

STEP 7

Replace PC cover: Carefully slide the cover from the front until it stops securely against the rear panel. Reinstall the cover mounting screws you removed earlier.

STEP 8

Install cables: Replace the power cord to the system unit and be sure that the keyboard and the monitor connectors are plugged in.

2.3 Testing the New Installation

This procedure tests your new installation:

STEP 1

With the power off, insert an IBM DOS diskette in drive A, and turn on the power. If the installation was done correctly, the system will boot normally.

STEP 2

Run the IBM diagnostic routines to check out the features you have just installed (if you have an AST Research MonoGraphPlus, be sure to modify the IBM diagnostics as described in the MonoGraphPlus documentation). See your *IBM Guide to Operations* manual for instructions. The diagnostic routines do not test the clock-calendar feature.

STEP 3

Use the clock-calendar software (included on your SuperPak diskette) to set the correct time and date on your I/O Mini II. Section 4 tells you how to set your I/O Mini II clock-calendar.

SECTION 3

CLOCK-CALENDAR

The AST Research clock-calendar can answer the TIME and DATE prompts that the Disk Operating System (DOS) issues each time you boot the system. The PC is not aware of the existence of any expansion card clock unless you use the clock software supplied on your SuperPak diskette.

CAUTION

To set the I/O Mini II clock chip, you must use the ASTCLOCK program contained on SuperPak version 5.1 or later (except for versions 6.0 and 6.01). With the exception of ASTCLOCK program, you can use earlier SuperPak versions of SuperDrive, SuperSpool, and RAMCLEAR programs with I/O Mini II.

The I/O Mini II clock-calendar features:

- 24-hour clock, maintained in an advanced clock chip on the I/O Mini II board.
- Battery backup power supply (with a battery life of approximately one year).
- Replaceable lithium battery.
- Full DOS compatibility.
- Automatic accounting for leap year.

Optional CP/M-86 and CCP/M-86 clock utility software from AST is available from your dealer.

3.1 Configuring the Clock-Calendar

The I/O Mini II is shipped from the factory with the clock-calendar enabled. To confirm the default configuration, check that a shorting plug is installed at jumper block position E13, as shown in Figure 3-1.

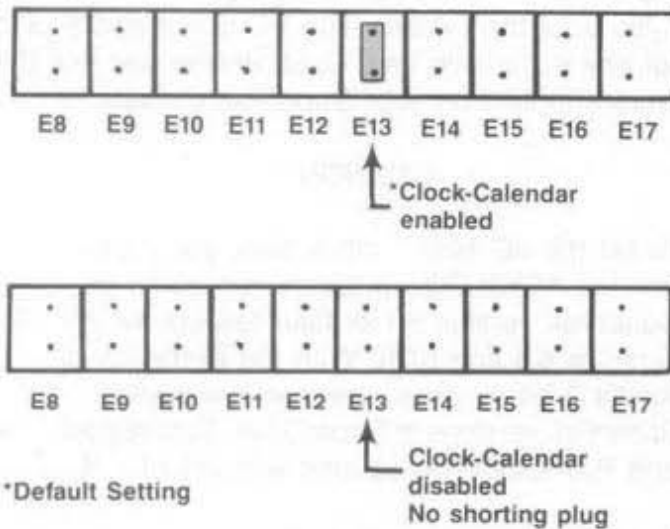


Figure 3-1. Clock-Calendar Factory Configuration.

3.1.1 Disabling the Clock-Calendar

You can disable the clock-calendar by removing the shorting plug shown in Figure 3-1. You might want to disable the clock-calendar to avoid a conflict between the I/O addresses (02C0-02C1h) used by the I/O Mini II clock and other devices installed in your PC.

Section 3.5 provides further technical information on the I/O Mini II clock-calendar.

3.2 Preparing Your PC Boot Disk

Once you have installed your I/O Mini II card, you can prepare your working PC boot disk to automatically initialize the time and date each time that you boot the system. This section tells you how to prepare your DOS boot disk to automatically invoke the clock-calendar.

STEP 1

If you have not already done so, copy the ASTCLOCK.COM program from the SuperPak diskette.

If you are unsure how to COPY a file, consult your *DOS Manual*.

STEP 2

If your DOS boot disk already has an AUTOEXEC.BAT file (a batch file that is automatically executed when your PC boots up), you must alter that file to include the ASTCLOCK/R command. The /R parameter allows you to update the PC's date and time whenever you choose (refer to Section 3.3). To see the current contents of your AUTOEXEC file, insert the working DOS diskette in drive A: and from the DOS prompt, enter this command:

```
TYPE AUTOEXEC.BAT <Enter>
```

Your screen will display the contents of your AUTOEXEC file. Now you must create a new or modify your existing AUTOEXEC.BAT file so that the command ASTCLOCK/R precedes these other command(s). Enter this command sequence:

```
COPY CON: AUTOEXEC.BAT <Enter>  
ASTCLOCK/R <Enter>
```

```
·  
· (other commands)
```

```
<Function key F6> <Enter> or <Ctrl-Z> <Enter>
```

If your boot disk has no AUTOEXEC file, use the sequence above or the DOS EDLIN command to create one. The only command in the file will be ASTCLOCK/R.

If you are unsure how to use the EDLIN command, consult your *DOS Manual*.

NOTE

If you want ASTCLOCK/R to display the date in European format (dd/mm/yy) when you boot the system, substitute the command ASTCLOCK/R/E for ASTCLOCK/R in your AUTOEXEC file. Specifying the /E parameter in the AUTOEXEC file only changes how ASTCLOCK/R shows the date when you boot the system; it does not affect how DOS or other software displays the date.

STEP 3

Reboot your PC by pressing the <Ctrl>-<Alt>- key sequence.

The ASTCLOCK/R command will display the time and date on the screen. The ASTCLOCK command without the /R parameter simply initializes your PC's date and time. ASTCLOCK may substitute for ASTCLOCK/R, but it will not allow you to update your PC by entering new number sequences after the DOS TIME and DATE prompts. Section 3.3 explains the /R parameter fully.

3.3 Setting the TIME and DATE

This section tells you how to set the time and date in the I/O Mini II clock chip — allowing you to maintain the correct time and date even when the PC is turned off. Be sure to use the version of SuperPak that came with the I/O Mini II.

Once you have copied ASTCLOCK to your PC boot disk, you can update the clock-calendar on the I/O Mini II internal clock chip. DOS TIME and DATE commands only update the system's time and date parameters in memory; they don't update the values stored in the I/O Mini II clock chip until you execute this procedure:

STEP 1

Boot the system with a disk that contains the ASTCLOCK.COM program.

STEP 2

Enter this command:

ASTCLOCK/R <Enter >

NOTE

Selecting the ASTCLOCK "/R" parameter selects the *resident* option, which allows you to update the date and time in both PC memory and the I/O Mini II clock chip (you cannot update the clock chip unless a certain portion of the ASTCLOCK.COM program is resident).

If you use the ASTCLOCK command without the /R parameter, it simply initializes the PC's date and time by reading that information from the I/O Mini II clock chip, and then "goes away". No portion of ASTCLOCK remains resident, so you cannot update the date and time information in the clock chip. You may substitute ASTCLOCK for ASTCLOCK/R, allowing approximately 2 kilobytes (KB) less memory to be taken up in your PC.

Clock-Calendar

Your PC will display a message similar to this (the actual date and time will be different):

```
ASTclock      Version x.xx  
(c) Copyright AST Research, Inc.,  
1982, 1984, 1985, 1986
```

```
resident clock/calendar  
DATE & TIME processors loaded.
```

```
Current date is 05/21/86  
Current time is 08:07:56.65
```

NOTE

If you want **ASTCLOCK** to display the date in European format (dd/mm/yy) when you enter this command, type **ASTCLOCK/R/E** instead of **ASTCLOCK/R**. Specifying the **/E** parameter only changes how **ASTCLOCK** shows the date when you enter this command; it does not affect how **DOS** or other software displays the date.

STEP 3

Enter this command:

```
DATE <Enter>
```

Your PC will display the current date (the actual date displayed may be different):

```
Current date is Tue 5-21-1986  
Enter new date:
```

Enter the new month, day, and year as follows:

mm-dd-yy <Enter>

where:

mm is the one- or two-digit month designation.

dd is the day.

yy is the year.

If you do not want to change the date, press **<Enter>** only.

STEP 4

Enter this command:

TIME <Enter>

Your PC will then display the current time in the following format (the actual time displayed may be different):

Current time is 8:14:15.82

Enter new time:

Enter the new hour, minute, and second as follows:

hh:mm:ss <Enter>

where:

hh is the hour

mm is the minute.

ss is the second.

Be sure to use 24-hour format for the hour (that is, 1:00 PM = 13, 2:00 PM = 14, and so forth).

Do not enter hundredths of a second. If you do not want to change the time, press **<Enter>** only.

Hint: For maximum accuracy, type in a time that is 10 to 15 seconds ahead of the actual time, then observe a digital watch, and press <Enter> when the seconds reading on the watch catches up to the value that you typed.

STEP 5

Reboot your computer by pressing the <Ctrl>-<Alt>- key sequence.

3.4 Clock-Calendar Battery

The lithium clock-calendar battery should last for about a year, and is easily replaceable. You can purchase replacement batteries from your AST product dealer. Table 3-1 also lists compatible lithium batteries that are available in camera or department stores.

Table 3-1. Compatible Clock-Calendar Batteries.

Manufacturer	Part Number
Duracell	DL2032
General Electric	BR2325
Panasonic	BR2325
Ray-O-Vac	BR2325
Sanyo	CR2032
Varta	CR2032
Radio Shack	CR2320H*

* Compared to the other batteries listed in this table, the Radio Shack battery is 0.5 millimeters thinner and rated at 50 milliampere-hours less. Its life expectancy is approximately 9 months (compared to a year for the other batteries).

Because the battery is used only when your PC is not operating, the actual life of your battery will be determined by how much the PC is used. The clock chip on your I/O Mini II is powered by the PC system when your PC is on. The battery is used as backup power only while your PC is off.

To replace the battery, slightly lift the retaining clip with your finger (or a small screwdriver) and use another small screwdriver to pry up the silver battery from its holder, then slide it out sideways (Figure 3-2). Do not remove the battery socket from the board.

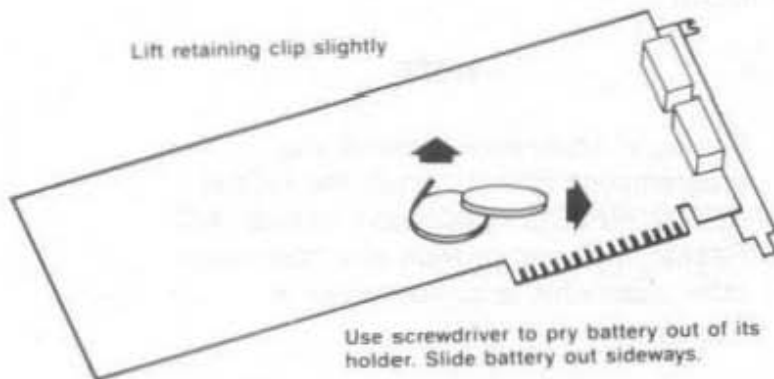


Figure 3-2. Removing the Clock-Calendar Battery.

Take care not to damage or bend the retaining clip by lifting it too far. The clip completes an electrical circuit and must make solid contact with the positive (+) side of the battery. Whenever the battery is removed, it is a good idea to check the clip in the bottom of the battery holder. Be sure that it is sticking up high enough to make good contact with the bottom surface of the battery. When installing a new battery, make sure it is clean and dry.

NOTE

If you replace the battery, be sure to use the procedure described in Section 3.3 to restore the proper time and date.

3.5 Technical Information

This information is for reference only, and is not necessary to use the clock-calendar feature. The I/O Mini II clock-calendar chip is the RICOH RP5C15, and uses I/O locations 02C0h through 02C1h.

NOTE

For more information, consult the programming information in the *RICOH RP5C01/RP5C15 Application Manual*. AST Research cannot provide any information other than what is presented here.

SECTION 4

SERIAL PORT

I/O Mini II comes standard with one serial port for asynchronous communications, and is available with a second optional serial port. A serial port can connect your PC to a serial printer, modem, or other device that uses an RS-232C interface. The I/O Mini II interface is configured as a data terminal equipment (DTE) device with a male DE9P connector (a nine-pin connector).

This section includes the following information:

- Section 4.1 tells you how to reconfigure the serial ports: changing COM1 to COM2, forcing RS-232C inputs true, disabling the serial ports.
- Section 4.2 tells you how to add the optional second serial port to I/O Mini II.

The following sections are provided as technical reference:

- Section 4.3 discusses serial port programming.
- Section 4.4 gives serial port I/O address assignments and pinouts.
- Section 4.5 discusses serial port diagnostic testing.

4.1 Configuring the Serial Ports

You can install up to two serial ports (called COM1 and COM2) into your PC. The standard I/O Mini II serial port configuration is:

- *First serial port:* Responds as COM1 (which uses IRQ4). (Shorting plugs installed at E8 and E16.)

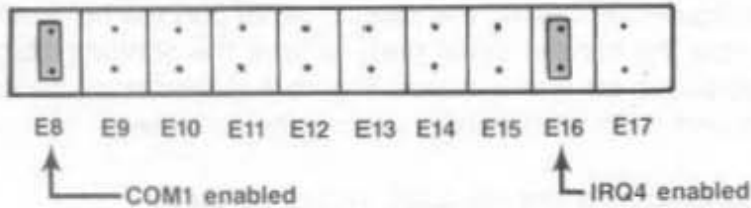
You can also disable the serial port (remove both shorting plugs) or change it to respond as COM2 (install shorting plugs at E8 and E15).

- *Second serial port (if installed):* Responds as COM2 (which uses IRQ3). Shorting plugs installed at positions E9 (COM2 enable) and E14 (IRQ3 enable).

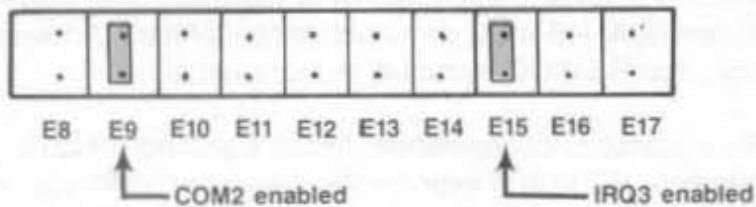
Do not enable the second serial port if that option is not installed. If both the first and second serial ports are configured as COM2, the first serial port will respond as COM2 and the second serial port will be disabled.

Figure 4-1 illustrates the I/O Mini II serial port configuration.

*First Serial Port enabled as COM1, using IRQ4:

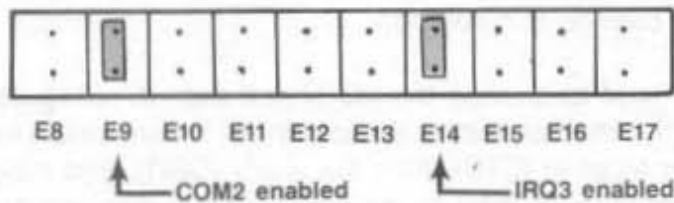


*First Serial Port enabled as COM2, using IRQ3



*Second Serial Port enabled as COM2, using IRQ3

COM1 must be enabled.



*Default Configuration

Figure 4-1. Serial Port Configuration.

4.1.1 Installing Multiple Serial Ports in a PC

If your PC already has another card with a serial port on it configured to respond as COM1 (such as the PC-XT with its standard serial board), you must remove or reconfigure one of the devices to avoid a conflict.

Figure 4-1 shows how to change the first serial port on the I/O Mini II to respond as COM2 using IRQ3 as shown in Figure 4-1 (move shorting plugs from jumper positions E8 to E9, and from E16 to E14).

You can only configure the second I/O Mini II serial port (if installed) as COM2. If both the first and second serial ports are configured as COM2, the second serial port will be disabled. To disable the second serial port, remove the shorting plug from positions E9 and E14 (see Figure 4-1). You must disable the second serial port if that option is not installed.

4.1.2 Configuring the RS-232C Interface Lines

The I/O Mini II serial ports conform to the Electronic Industries Association (EIA) RS-232C communication standard. Appendix A describes the RS-232C standard in more detail.

I/O Mini II standard configuration: In the standard (default) configuration, I/O Mini II expects the connected device(s) to drive all input signals to its serial ports.

Unless specifically required by your serial device, you should not have to change this setting.

You do not need to change the I/O Mini II default configuration as long as the the connected device drives these serial port inputs: clear to send (CTS), data set ready (DSR), and data carrier detect (DCD). Refer to the actual user's manuals for each connected device.

To force certain inputs true: If your serial device does not drive all I/O Mini II serial port inputs, you can "force true" these three inputs to each serial port: clear to send (CTS), data set ready (DSR), and data carrier detect (DCD).

First serial port

CTS input (J2 pin 8)
DSR input (J2 pin 6)
DCD input (J2 pin 1)

Second serial port

CTS input (J3 pin 6)
DSR input (J3 pin 2)
DCD input (J3 pin 1)

J2 refers to the
first serial port
(DE9P connector)

J3 refers to the
second serial port
cable connector
(10-pin stake connector)

Figure 4-2 shows how to force one or more of the above signals to always be in the true state. Whether certain inputs should be forced true depends on the particular device you connect to the serial port.

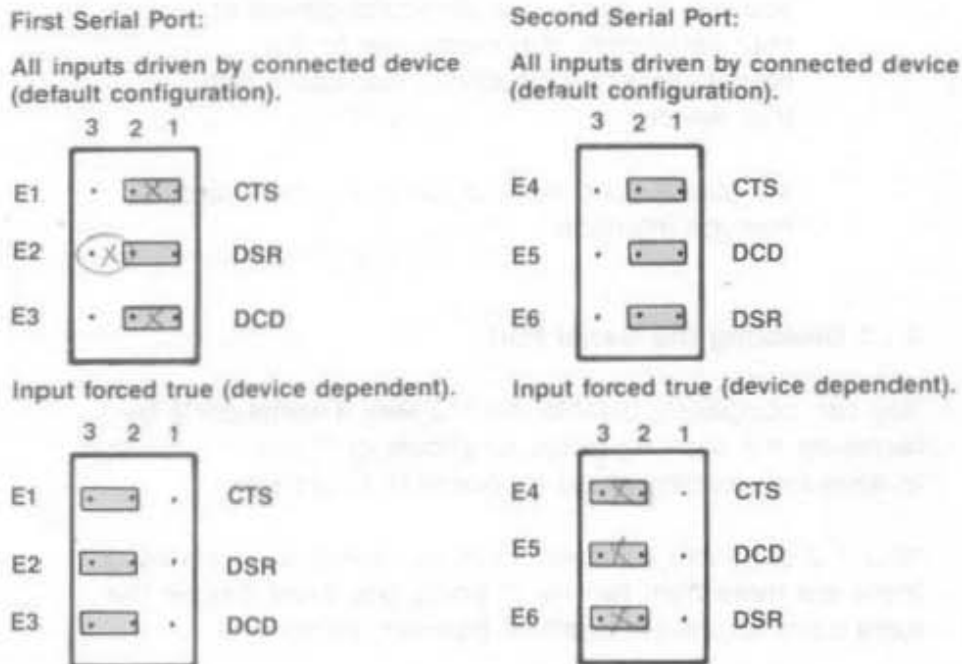


Figure 4-2. Creating a "Forced True" State.

You might want to leave the shorting plugs in their "normal" configuration and instead build a special cable for the serial device. This would be especially convenient if you will be using different serial devices on the port at different times. In most cases, you can connect your remote device to the I/O Mini II serial port with a cable provided with the device itself. Simply refer to the instructions provided with the device or with the software for driving it.

In some cases, your instructions will specify how your remote device uses RS-232C line signals and which pin numbers supply which signals. With this information, plus the general information in Appendix A, you can construct an interface cable yourself.

NOTE

Serial devices use RS-232C signals in different ways. AST Research cannot tell you how to connect a particular device to your serial port. You must refer to the manufacturer's instructions that came with that device.

I/O Mini II does not support the current loop teletype interface.

4.1.3 Disabling the Serial Port

You can completely disable the I/O Mini II serial ports by removing the shorting plugs as shown in Figure 4-1. Be sure to save the shorting plugs for possible future use.

Your PC can have a maximum of two serial ports installed. If there are more than two serial ports, you must disable the extra ports to prevent conflicts between ports.

4.2 Adding the Second Serial Port

AST Research offers an upgrade kit for field installation of the second I/O Mini II serial port. To order the serial port upgrade kit: order model number I/O Mini-000S through your AST dealer.

The upgrade kit consists of three chips (1488, 1489, and 8250B). Use the following procedure to install the second serial port.

CAUTION

Be sure the power switch is off and the power cord is removed from the wall outlet. Turn off any other equipment connected to the computer. Installing any component while the power is on can permanently damage your computer and its components.

STEP 1

Remove the PC's system unit cover: Follow the instructions in Section 3.

STEP 2

Remove any devices connected to the board: Remove any serial and/or parallel devices connected to the I/O Mini II board. Also remove the game port ribbon cable (if installed) from the board.

STEP 3

Remove the I/O Mini II board: Remove the bracket retaining screw from the bracket securing the I/O Mini II board to the PC chassis. With a steady, evenly distributed upward tension, remove the I/O Mini II board from its slot.

STEP 4

Install the second serial port chips: Upgrade kit comes with three chips (1488, 1489, and 8250B). Each chip is labeled with a notch or a small dot to identify the bottom left. Insert the chips as shown in Figure 4-3. It is very important that you do not bend any pins when you insert your chips.

Serial Port

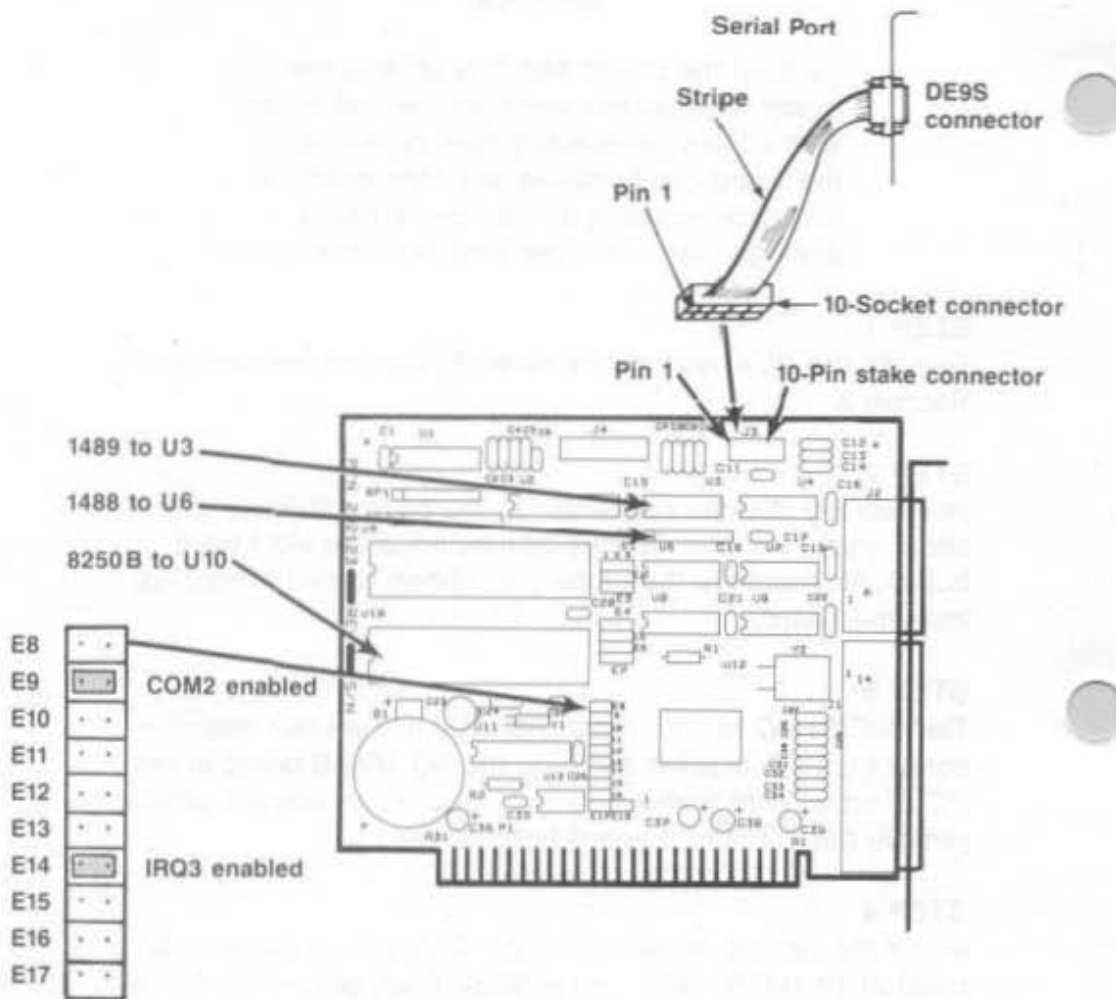


Figure 4-3. Installing the Second Serial Port Chips.

NOTE

If the chip seems too wide to allow the pins to properly line up with their socket receptacles, place the chip on its side on a flat surface and *gently* angle it under both thumbs to *slightly* bend the pins inward. You may find this same technique useful when actually inserting the chip into the socket on the board. Angle the chip, and slightly insert one row of pins, then bring the other row down into position and slightly start its pins in the socket. Once you have both sides started, you can evenly depress the entire chip until it is firmly seated.

STEP 5

Enable the second port: Make sure the shorting plugs are installed as shown in Figure 4-3.

STEP 6

Replace the I/O Mini II board: Section 2 tells you how to install I/O Mini II into the PC. The second serial port cable plugs onto the 10-pin stake connector (see Figure 4-3).

4.3 Programming the Serial Port

The I/O Mini II serial ports are completely under software control, and must be initialized for correct Baud rate, parity, number of databits, and number of stopbits before it can be used. You or your software must initialize the serial ports each time you turn on the computer.

NOTE

Using SuperSpool with your serial printer eliminates the need to use the DOS MODE command.

Serial Port

Typically, the DOS MODE command initializes the serial ports (refer to your *DOS Manual* for a detailed explanation of this command). A typical MODE command might look like this:

```
MODE COM1:1200,N,8,1,P <Enter>
```

The above command initializes serial port COM1 for 1200 Baud, no parity, 8 databits, and 1 stopbit. The "P" is optional and tells DOS that you will be using the port with a serial printer. You can also use a similar command to establish communication parameters for serial port COM2.

Many application programs (such as word processors) automatically handle port initialization, making it unnecessary to use the MODE command. Refer to your software manual; if it does not mention the MODE command, it is probably safe to assume that you can omit that step. If you are unsure, it will not harm anything to go ahead and use the MODE command anyway.

If you are using the serial port to operate a serial printer, you may also need to redirect printer output from LPT1 to COM1 or COM2. This is because DOS always assumes that printer output goes to parallel port LPT1 unless told otherwise. You can use the MODE command to redirect printer output from a parallel port to a serial port. For example:

```
MODE LPT1: = COM1: <Enter> For printer output to COM1
```

```
MODE LPT1: = COM2: <Enter> For printer output to COM2
```

A redirection command should follow the first MODE command that sets up the Baud rate, parity, and so forth. Again, it is possible that your application program is handling this redirection automatically. If so, you can eliminate this step as well.

4.4 I/O Address Assignments and Pinouts

The I/O Mini II serial ports use the system I/O addresses and IRQ interrupt request lines shown in Table 4-1.

Table 4-1. Serial Port I/O Addresses and IRQs.

Port Configuration	I/O Addresses	IRQ Line
COM1	03F8-03FFh	IRQ4
COM2	02F8-02FFh	IRQ3

NOTE

The first (standard) I/O Mini II serial port can be configured as COM1 or COM2. The second serial port can be configured as COM2 only. If both the first and second I/O Mini II serial ports are configured as COM2, the second serial port will be disabled.

Serial Port

Figure 4-4 shows the serial port pinouts.

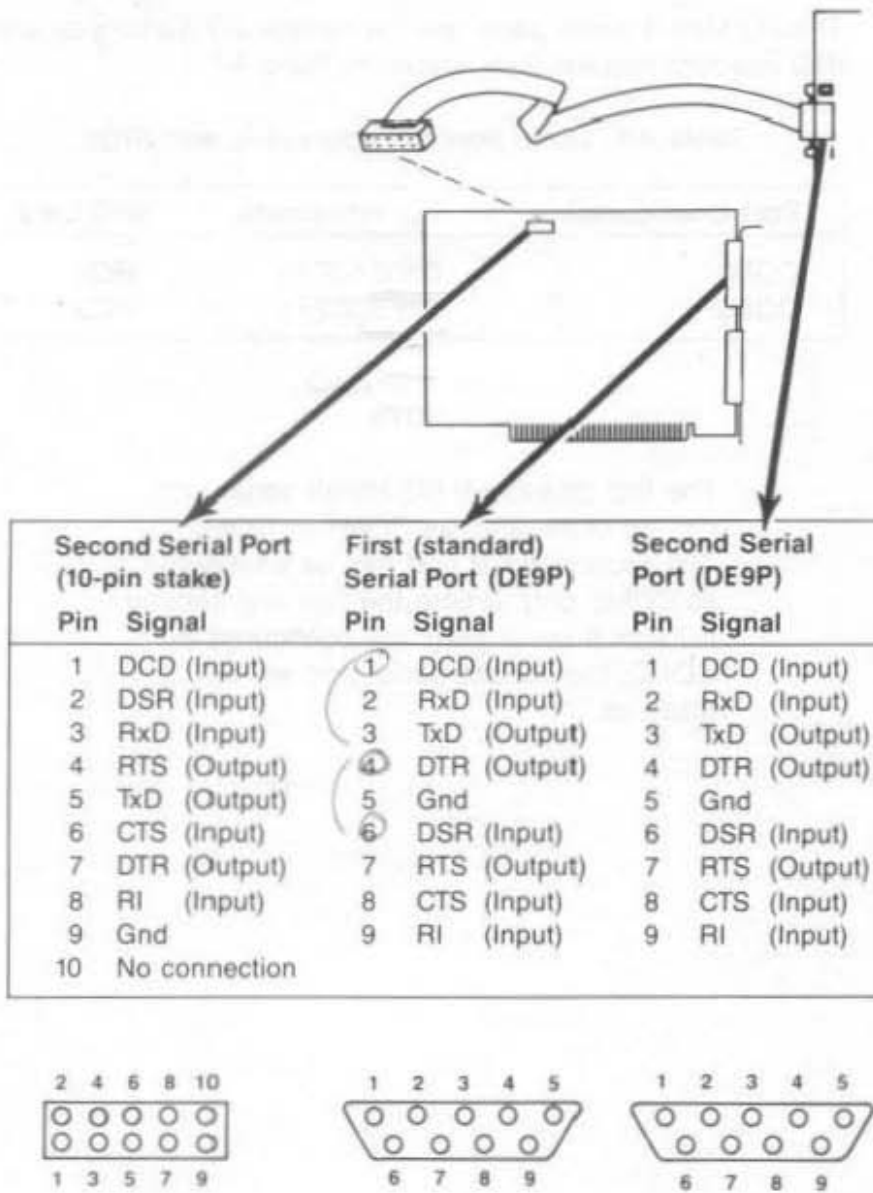


Figure 4-4. I/O Mini II Serial Port Pinouts.

You must use a DE9-to-DB25 adapter cable if your serial device uses a DB25 connector. AST offers a DE9-to-DB25 cable (model number ADV-AC) that remaps DE9 serial pinouts (such as from the I/O Mini II serial ports) to the DB25 configuration, as shown in Figure 4-5.

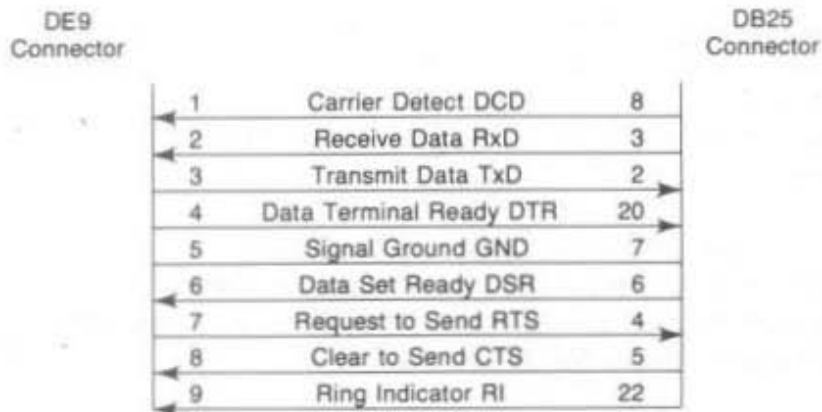


Figure 4-5. DE9-to-DB25 Adapter Cable Pinouts.

Figure 4-6 shows a typical application using the DE9-to-DB25 adapter cable.

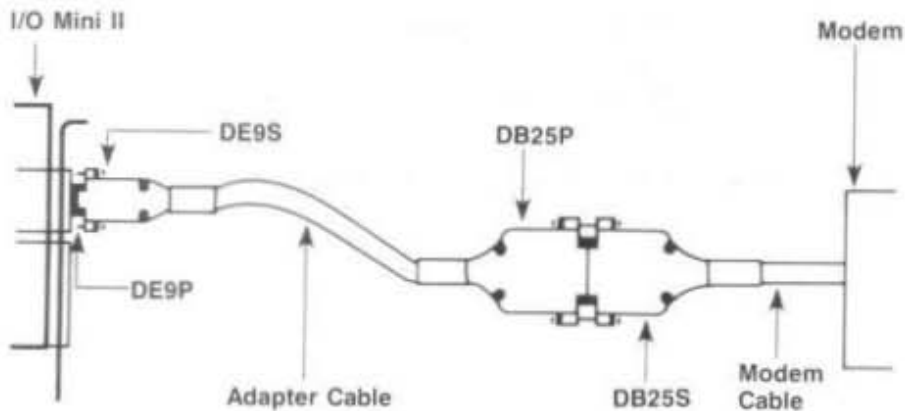


Figure 4-6. Typical DE9-to-DB25 Cable Application.

4.5 Diagnostic Testing

Whenever there is any question about the operation of the I/O Mini II serial port, we recommend that you run the IBM diagnostics, preferably the advanced diagnostics supplied with the IBM *Hardware Maintenance Manual*.

For proper diagnostics operation, disconnect any device connected to the I/O Mini II serial port (such as a modem or serial printer). Also, make sure that the CTS, DSR, and DCD jumpers (Figure 4-2) are in the normal (not "forced true") setting.

You can use a "loopback plug" on the serial port connectors to perform a very thorough test of the serial port with the advanced diagnostics. Figure 4-7 shows the loopback plug configuration for I/O Mini II serial ports.

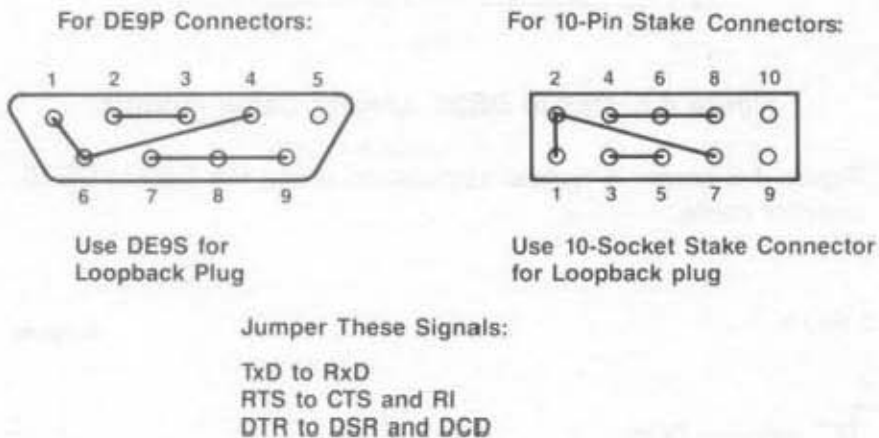


Figure 4-7. Loopback Plug Configuration.

Answer the Advanced Diagnostics loopback plug question with **Y** when this plug is installed on the serial port connector.

NOTE

Certain versions of the IBM diagnostics may fail on the first pass. Ignore the results of the first pass if an error occurs.

SECTION 5

PARALLEL PORT

I/O Mini II comes standard with a parallel port for interfacing the PC to a parallel printer. This port is completely compatible with the IBM PC and uses the same female DB25S connector as an IBM port.

- Section 5.1 tells you how to configure the parallel port.

The following sections are provided as technical reference:

- Section 5.2 discusses parallel port programming.
- Section 5.3 gives parallel port I/O address assignments and pinouts.
- Section 5.4 discusses parallel port diagnostic testing.
- Section 5.5 tells you how to configure your I/O Mini II to allow interrupt-driven parallel printer software to operate correctly.

Section 2.2 of this manual tells you how to install the parallel port ribbon cable onto your I/O Mini II board, and how to install the board and the parallel port into your PC.

5.1 Configuring the Parallel Port

You can install a maximum of three parallel ports in the IBM PC (called LPT1, LPT2, and LPT3). When looking for parallel ports, the PC polls these I/O addresses in order:

1. 03BC-03BEh (display adapters with built-in parallel ports).
2. 0378-037Fh (I/O Mini II LPT1).
3. 0278-027Fh (I/O Mini II LPT2).

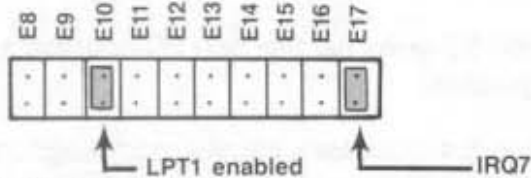
Parallel Port

If there is a parallel port at I/O addresses 03BC-03BEh (the address space occupied by display adapters with built-in parallel ports), that port responds as LPT1. A port at 0378-037Fh responds as LPT2, and a port at 0278-027Fh responds as LPT3.

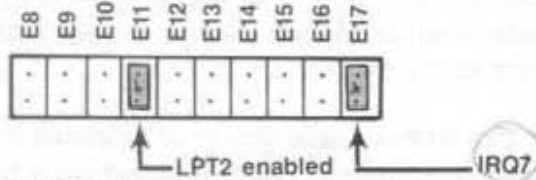
If there is no parallel port at the first I/O address range, the parallel port at the second address responds as LPT1 and the parallel port at the third address responds as LPT2.

The parallel port on the I/O Mini II has been configured at the factory to respond as LPT1 — or LPT2 when a display card with built-in parallel port is present (see Section 5.1.2). You can confirm LPT1 configuration by checking that a shorting plug is installed as shown in Figure 5-1.

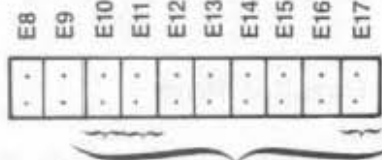
*LPT1 (I/O 0378-037Fh) enabled:



LPT2 (I/O 0278-027Fh) enabled:



Parallel port disabled:



*Default Configuration

No shorting plug

Figure 5-1. Parallel Port Configuration.

5.1.1 Installing Multiple Parallel Ports in a PC

If your PC already has another card with a parallel port that occupies the same I/O address range as the I/O Mini II parallel port, you must change one of the devices to avoid conflicts between the two ports. Figure 5-1 shows how to configure I/O Mini II as LPT1 (I/O addresses 0378-037Fh) or LPT2 (I/O addresses 0278-027Fh).

5.1.2 Display Adapters with Built-in Parallel Ports

The built-in parallel port on certain display adapter boards (such as the IBM Monochrome Display/Printer Adapter and the AST Research MonoGraphPlus™ or *Preview!*™) always responds as LPT1 and cannot be changed. If you have such a board in your PC, the I/O Mini II parallel port will automatically respond as LPT2 in its factory default configuration. You do not need to reconfigure the I/O Mini II to respond as LPT2.

5.1.3 Disabling the Parallel Port

You can disable the I/O Mini II parallel port by removing the shorting plug shown in Figure 5-1. You can disable the parallel port to avoid conflicts when you have several parallel adapters installed in your PC. Save the shorting plug for possible future use.

5.2 Programming the Parallel Port

The IBM PC always sends printer output to parallel port LPT1 unless specifically told otherwise. Appendix B tells you how you can cause the PC to redirect printer output from LPT1 to LPT2 or LPT3.

Although it is not required, you can use the DOS MODE command to set the line width and the number of lines per page. Refer to your IBM *DOS Manual* for more information.

5.3 I/O Addresses and Pinouts

The I/O Mini II parallel port uses the PC I/O addresses listed in Table 5-1.

Table 5-1. Parallel Port I/O Addresses.

Port Configuration	I/O Addresses
LPT1*	0378-037Fh
LPT2*	0278-027Fh

* When you use a display adapter with a built-in parallel port, DOS sees a I/O Mini II parallel port configured for LPT1 as LPT2, and a I/O Mini II parallel port configured for LPT2 as LPT3.

You can use the standard IBM Parallel Printer Cable to connect the I/O Mini II to an IBM or IBM-compatible printer. You can also use the information in Table 5-2 to help build a cable for your parallel printer.

Table 5-2. Parallel Port Pinouts.

Line Name	Output DB25S	AST Adapter Cable IBM Matrix Printer Centronics Interface
—STROBE	1	1
D0	2	2
D1	3	3
D2	4	4
D3	5	5
D4	6	6
D5	7	7
D6	8	8
D7	9	9
—ACK	10	10
BUSY	11	11
PE	12	12
SLCT	13	13
—AUTOFD	14	14
—ERROR	15	32
—INIT	16	31
—SLCT IN	17	36
GROUND	(18–25)	(16,19–30,33)

NOTE

A dash in front of the line name denotes lines which are functionally active when low.

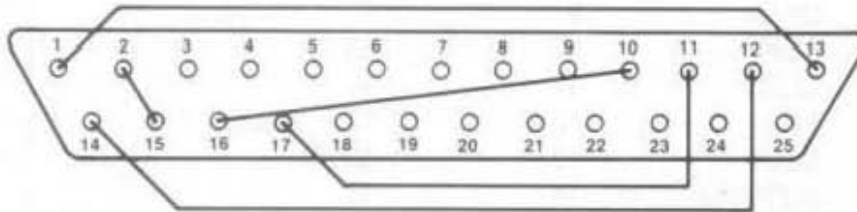
5.4 Diagnostic Testing

The parallel port on your I/O Mini II is completely compatible with IBM's diagnostics. However, you must configure the parallel port as LPT1 so that the port can be recognized by the diagnostics.

NOTE

If there is a display card installed in your PC that always responds as LPT1 (I/O addresses 03BC-03BEh), the IBM diagnostics cannot recognize the I/O Mini II parallel port.

For proper diagnostics operation, disconnect any device connected to the I/O Mini II parallel port. You can use a loopback plug to perform a very thorough test of the parallel port with the IBM diagnostics. Figure 5-2 shows the loopback plug configuration for the I/O Mini II parallel port.



Use DB25P for loopback plug
Jumper these pins: 1 to 13
2 to 15
10 to 16
11 to 17
12 to 14

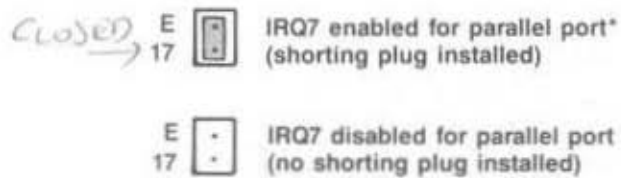
Figure 5-2. Loopback Plug Configuration.

NOTE

If you run the matrix printer test, your printer must be 100% compatible with an Epson FX-80 or errors can be generated.

5.5 Interrupt Driven Parallel Printer Software

Interrupt-driven parallel printer software uses IRQ7. To ensure that your interrupt-driven parallel printer software operates correctly, you must enable IRQ7 on the I/O Mini II board as shown in Figure 5-3. It will not harm anything to enable IRQ7 even if you do not run interrupt-driven software for your parallel printer.



*Default setting

Figure 5-3. IRQ7 Enabled.

NOTE

If IRQ7 is already in use, disable the I/O Mini II IRQ7 as shown in Figure 5-3.

SECTION 6

GAME PORT

The optional game port provides an interface for connecting one or two joysticks to your PC. With appropriate software, the joystick can be used for cursor control, as well as graphics development and interactive games.

This section includes the following:

- Section 6.1 tells you how to enable or disable the game port.
- Section 6.2 tells you how to add the game port to the I/O Mini II.

The following sections are provided as technical reference:

- Section 6.3 discusses software compatibility.
- Section 6.4 gives the I/O address assignment and pinouts for the game port.
- Section 6.5 discusses game port diagnostic testing.

6.1 Configuring the Game Port

To enable the game hardware: The game port ribbon cable must be installed on your I/O Mini II board and the shorting plug must be installed as shown in Figure 6-1.

The game port hardware must be installed on the board. (Section 6.2 provides information on adding the port to your I/O Mini II.)

Game Port

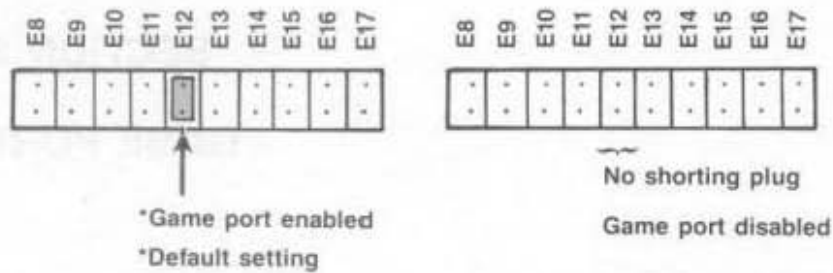


Figure 6-1. Game Port Enable/Disable.

To completely disable the game port: Remove the jumper shown in Figure 6-1.

6.2 Adding the Game Port to Your I/O Mini II

AST Research offers an upgrade kit for field installation of the I/O Mini II game port. To order the game port upgrade kit: order model number I/O Mini-000G through your AST dealer.

The upgrade kit consists of a 16- and a 20-pin chip. To install the game port, follow the procedure described below.

CAUTION

Be sure the power switch is off and the power cord is removed from the wall outlet. Turn off any other equipment connected to the computer. Installing any component while the power is on can permanently damage your computer and its components.

STEP 1

Remove the PC's system unit cover: Follow the instructions in Section 2.2.

STEP 2

Remove any devices connected to the board: Remove any serial and/or parallel devices connected to the I/O Mini II board. Also remove the second serial port ribbon cable (if installed) from the board.

STEP 3

Remove the I/O Mini II board: Remove the bracket retaining screw from the bracket securing the I/O Mini II board to the PC chassis. With a steady, evenly distributed upward tension, remove the I/O Mini II board from its slot.

STEP 4

Install the game port chips: Your game port upgrade kit comes with two chips: a 16- and a 20-pin chip (558 and LS244 respectively). Each chip is labelled with a notch or a small dot to identify the bottom left. Insert the chips as shown in Figure 6-2. *It is very important that you do not bend any pins when you insert your chips.*

Game Port

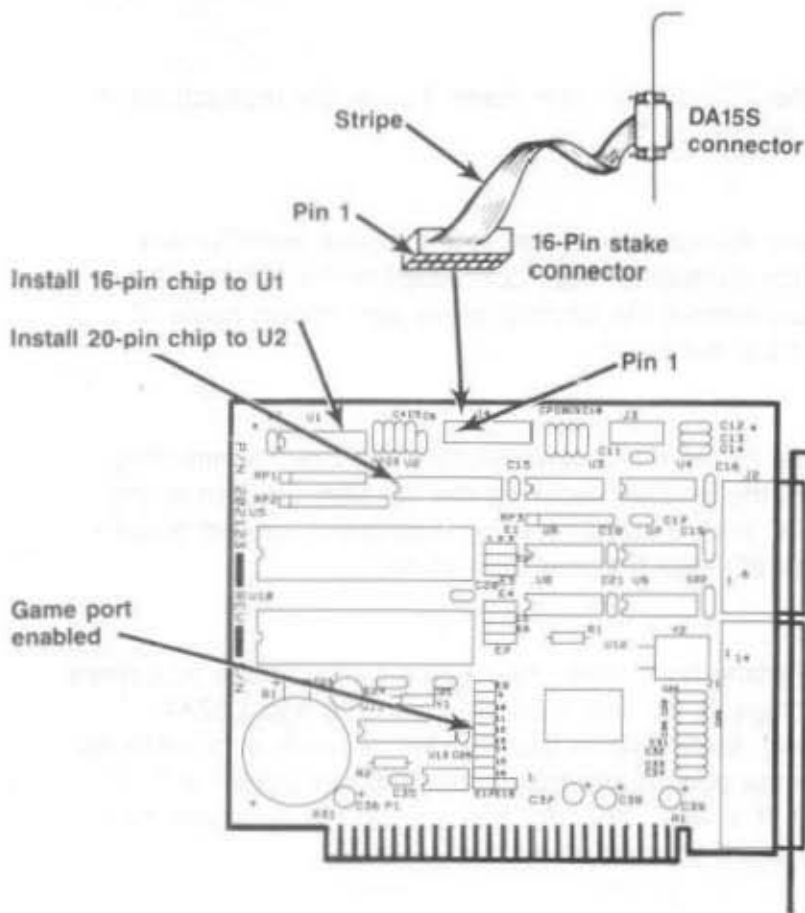


Figure 6-2. Installing the Game Port Chips.

NOTE

If the chip seems too wide to allow the pins to properly line up with their socket receptacles, place the chip on its side on a flat surface and *gently* angle it under both thumbs to *slightly* bend the pins inward. You may find this same technique useful when actually inserting the chip into the socket on the board. Angle the chip, and slightly insert one row of pins, then bring the other row down into position and slightly start its pins in the socket. Once you have both sides started, you can evenly depress the entire chip until it is firmly seated.

STEP 5

Enable the game port: Make sure the shorting plug is installed as shown in Figure 6-2.

STEP 6 *Replace the I/O Mini II Board:* Section 2.2 tells you how to install I/O Mini II into the PC. The game port cable plugs onto the 16-pin stake connector (see Figure 6-2).

6.3 Software Compatibility

The game port is totally software-compatible with the IBM game adapter. Because joysticks are analog devices, the function of some software can vary with the joystick used, even though the game port is functioning properly. To compensate for differences between joysticks, use software that includes a joystick-centering function.

You can use the program listing in Section 6.5 to test the correct operation of the I/O Mini II game port.

6.4 Technical Information

This section provides the I/O address assignment and pinouts for the I/O Mini II game port.

6.4.1 I/O Addresses and Assignment

The game port uses I/O address 0200h or 0201h. This information is for technical reference only; you do not need to know the I/O address to use the game port.

6.4.2 Pinouts

The I/O Mini II game port cable uses a DA15S (socket or female) connector to enable the connection of up to two joysticks. Table 6-1 summarizes the game port cable connector pinouts.

Table 6-1. I/O Mini II Game Port Pinouts.

	I/O Mini II J4 Pin No.	DA15S Pin Number	Signal Name
Joystick A	1	1	+5VDC
	3	2	A-Button 1
	5	3	X Axis
	7	4	Ground
	9	5	Ground
	11	6	Y Axis
	13	7	A-Button 2
	15	8	+5VDC
Joystick B	2	9	+5VDC
	4	10	Button 3
	6	11	X Axis
	8	12	Ground
	10	13	Y Axis
	12	14	Button 4
	14	15	+5VDC

You can connect one joystick directly to the DA15S connector. To connect two joysticks, you will need a Y-connector adapter cable. The adapter cable should have one DA15S connector (to the I/O Mini II game port) and two DA15P connectors (to the joysticks). Pins 1 through 8 on the DA15S should connect to one DA15P connector, and pins 9 through 15 to the other, as shown in Figure 6-1. Consult your dealer for further information.

6.5 Diagnostic Testing

You can use the IBM diagnostics to test the I/O Mini II game port. Because of a problem in the diagnostic program, however, the port may not always show up on the listing of installed devices. You might prefer to use the program below to test out the port. This program requires the use of BASICA (not BASIC).

```
10 DEFINT A-Z:KEY OFF:CLS:STRIG ON:SCREEN 2
20 PRINT " X1", " Y1", " X2", " Y2", " S1";" S2";" S3"
30 X1 =STICK(0):Y1 =STICK(1):X2 = STICK(2):Y2 = STICK(3)
40 A = STRIG(1):C = STRIG(5):C = STRIG(3):D = STIG(7)
50 LOCATE 3:PRINT X1,Y1,X2,Y2,A;B;C;D
60 GOTO 30
```

When you run the above program, moving the joystick in the X-plane (left-right) causes a change in the "X1" readout, while moving the joystick in the Y-plane (up-down) causes a change in the "Y1" readout. The values for "X" and "Y" differ according to the type of computer (PC, PC-XT, or compatible) and joystick you are using. Pressing the switch (either one or two, depending on your joystick) causes a change in the "S1" or "S3" readouts from 0 to -1. Note that, depending on the quality of your joystick, you may not be able to get a zero reading in the X- and Y- planes when running the program. This is normal and no cause for alarm.

APPENDIX A

SERIAL INTERFACES

This appendix provides general information on wiring the I/O Mini II serial port to other serial devices (such as printers, plotters, or modems), including:

- The RS-232C serial interface standard (Section A.1).
- Interfacing DTE to DCE (Section A.2).
- Interfacing DTE to DTE — “null modem” (Section A.3).
- Designing your own serial interface (Section A.4).

The I/O Mini II serial port is completely IBM-compatible. In most cases, you can connect your remote device to the I/O Mini II serial port with a cable provided with the device itself. Simply refer to the instructions provided with the device or with the software for driving it.

In some cases, your instructions will specify how your remote device uses RS-232C line signals and which pin numbers supply which signals. With this information, plus the information in this appendix, you can construct an interface cable yourself.

NOTE

Serial devices use RS-232C signals in different ways. AST Research cannot tell you how to connect a particular device to your serial port. You must refer to the manufacturer's instructions that came with that device.

The I/O Mini II serial port does not support the current loop teletype interface.

A.1 RS-232C Interface Standard

I/O Mini II connects to other serial devices according to the Electronic Industry Association (EIA) RS-232C interface standard.

The RS-232C standard describes the sequence of signals that travel between two serial devices. The signals control the exchange of data between serial devices. RS-232C defines 21 signals (although few applications use all 21), and each signal travels separately on a predefined wire.

The RS-232C standard classifies communications devices as:

- *Data terminal equipment (DTE)*: Equipment associated with the user, such as a PC or a mainframe computer. The I/O Mini II serial port is a DTE device.
- *Data communications equipment (DCE)*: Equipment associated with transmission facilities, such as a modem.

The RS-232C standard describes the ideal case, where a DTE device connects to a DCE device. Before sending data, the I/O Mini II serial port must send and receive RS-232C signals in this order:

1. Some DCE devices use the Ring Indicator (RI) signal to alert I/O Mini II that incoming data is due.
2. I/O Mini II sends Data Terminal Ready (DTR) to signal a request for a communications link.
3. I/O Mini II receives Data Carrier Detect (DCD) and Data Set Ready (DSR) — these signals indicate that the DCE is ready.
4. I/O Mini II sends Ready to Send (RTS) — this signal tells the DCE that I/O Mini II is ready to send data.

5. I/O Mini II receives Clear to Send (CTS) — a signal from the DCE to go ahead and transmit data.
6. I/O Mini II then starts transmitting data via the Transfer Data (TxD) signal. I/O Mini II receives data via the Receive Data (RxD) signal.

To prevent damage to either device, the ground signals must always be connected. You can think of certain pins on one side of the interface as "functional pairs":

<i>DTE</i>		<i>DCE</i>
DTR	————	DSR and DCD
RTS	————	CTS
TxD	————	RxD

A.2 Interfacing DTE to DCE

An example of a DTE-to-DCE interface that conforms to the RS-232C standard would be to connect the I/O Mini II serial port (DTE) to a telephone modem (DCE). A correctly configured DCE-to-DTE interface is wired straight across: DTE pin 4 wired to DCE pin 4, pin 2 to pin 2, and so forth.

Two serial devices interact in a certain sequence — called "handshaking" — to function properly:

1. Some modems (DCE) has an automatic answer mode that uses the signal RI to alert the DTE that incoming data is due. I/O Mini II (the DTE) would then use DTR to respond to RI.
2. When the I/O Mini II serial port (DTE) wants to send or receive data it raises the voltage on the pin that carries the DTR (Data Terminal Ready) signal. This voltage travels to the DCE where the modem interprets it to mean that a communications link is being requested by the DTE device.

Serial Interfaces

3. If an open phone line exists, the DCE brings up two lines on its side of the interface: DSR and DCD.
4. When the DTE sees high voltage at its DSR and DCD inputs, it can then bring up RTS. RTS tells the DCE that the DTE has data to transmit to it.
5. The DCE checks that it is ready to receive data; if so, it brings up CTS.
6. Once the DTE sees voltage at CTS, it can transmit data on the wire connected to TxD — or it can receive data via RxD (Receive Data).

CAUTION

To help protect your equipment from damage, be sure to connect the ground wires between the I/O Mini II serial ports and your external serial devices.

Figure A-1 shows an ideal DTE-to-DCE interface, including signals, signal directions, and sequence (top to bottom). The interface must handle these signals before the DTE can transmit or receive data:

- DCD, DSR, CTS, and RxD are input signals to the I/O Mini II.
- DTR and RTS are output signals from the I/O Mini II.

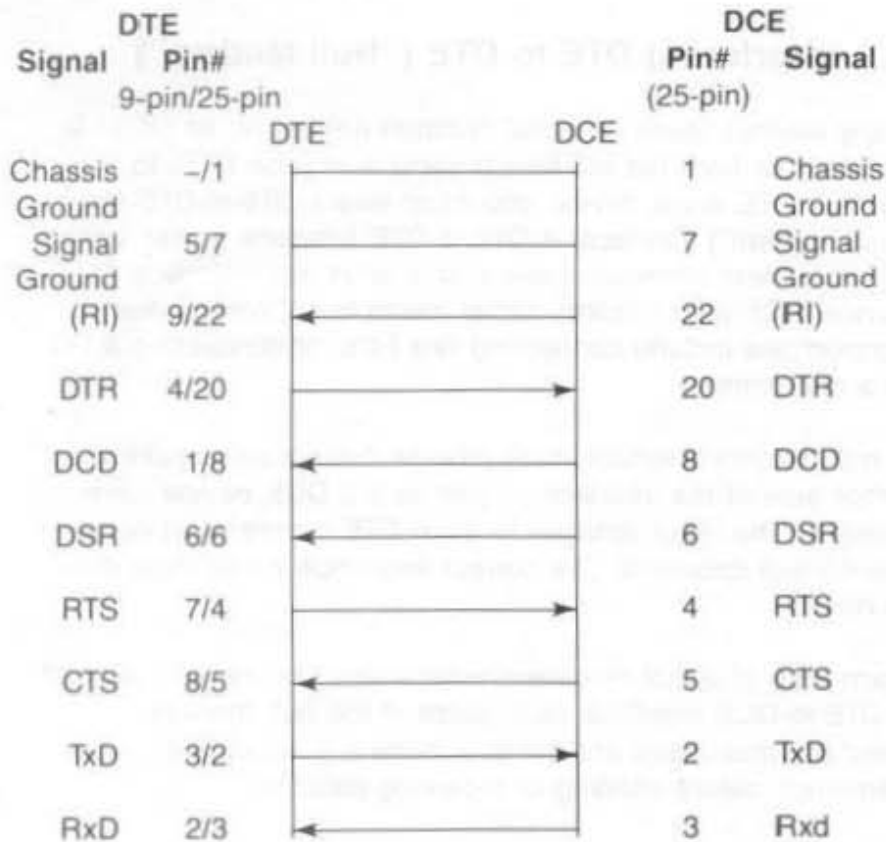


Figure A-1. DTE-to-DCE Interface.

Figure A-1 shows the interface signals in order of occurrence (top to bottom). From the DTE's standpoint, it must send DTR, see DCD, see DSR, send RTS, and see CTS before transmitting or receiving data.

The DTE inputs must have voltage applied to them for the interface to become operational (the DTE outputs are necessary only because they are inputs to the DCE side of the interface). The DTE hardware does not release data to the communications link until it has received the proper set and sequence of signals.

A.3 Interfacing DTE to DTE ("Null Modem")

Many devices (such as serial printers) are set up as DTE. To output data from the I/O Mini II serial port (also DTE) to another DTE serial device, you must wire a DTE-to-DTE (or "null modem") interface. A DTE-to-DTE interface is also called a *null modem* connection because it does not include a DCE device such as a modem. Other examples of null modem connections include connecting two PCs, or connecting a PC to a mainframe.

A null modem interface must provide "response" inputs to either side of the interface — just as if a DCE device were present. The input voltages to each DTE device must occur in the correct sequence (the correct sequence varies from device to device).

Each side of a null modem interface acts like the DTE side of a DTE-to-DCE interface. Both sides of the null modem interface must send and receive these signals in this sequence before sending or receiving data:

- Send DTR
- Receive DCD and DSR
- Send RTS
- Receive CTS

Figure A-2 shows a standard null modem configuration, including signal directions and sequence.

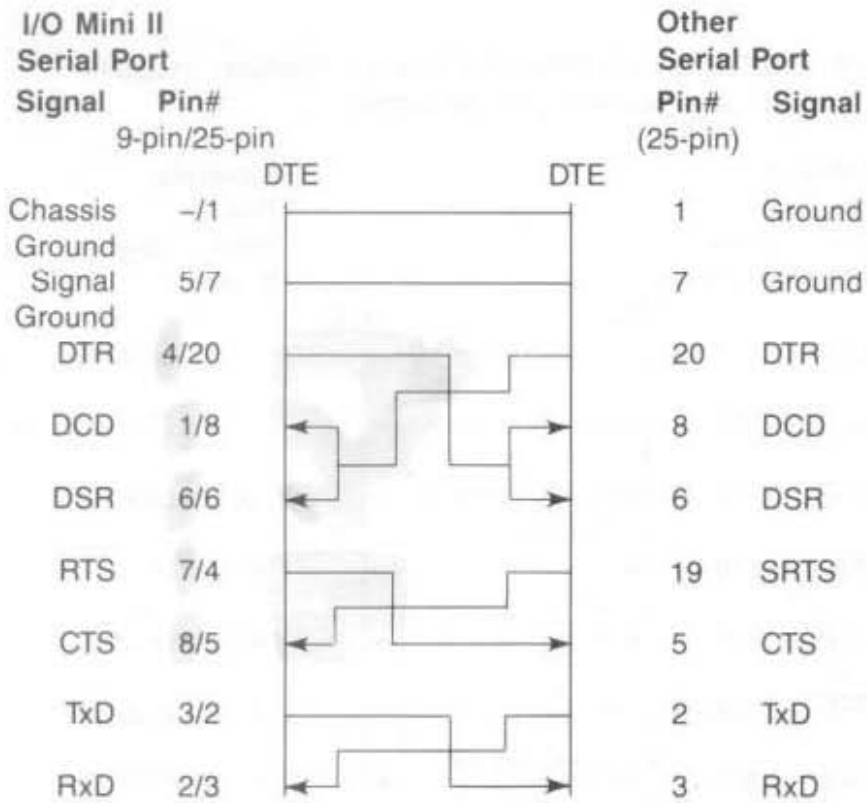


Figure A-2. Example #1: Null Modem (DTE-to-DTE) Interface.

Figure A-3 illustrates another null modem interface, including the direction and sequence of the signals.

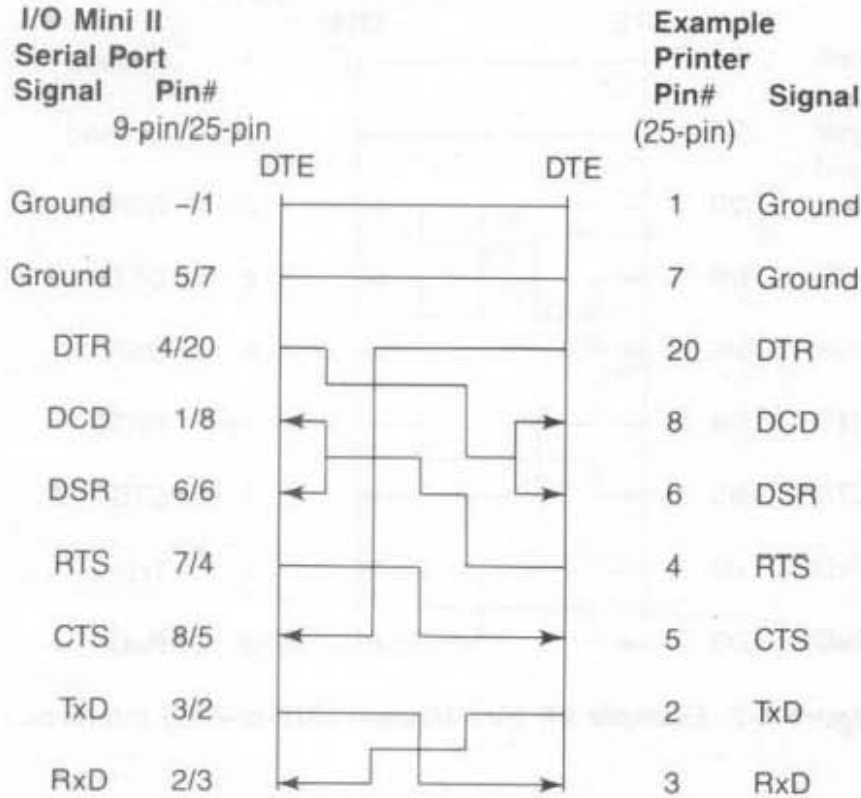


Figure A-3. Example #2: Null Modem Interface.

Notice that the necessary input signals are supplied to both sides. DCD, DSR, and CTS have voltage applied to them on either side.

The example shown in Figure A-3 changes the ideal sequence by having the printer DTR signal drive PC signal CTS. The chip that controls the I/O Mini II serial port (an 8250 UART chip) is fairly flexible in reading the sequence of inputs.

The input sequence in Figure A-3 is changed because the printer in the example drops its DTR signal when its receive buffer is about to fill up. To avoid losing data when the printer's receive buffer overflows, the interface halts PC data output immediately by dropping the CTS input to the PC side immediately. The remainder of the interface then "idles" until the printer raises DTR again. Remember that this is a specific case for this particular printer.

Figure A-4 shows another example of how to interface a serial printer to a I/O Mini II serial port.

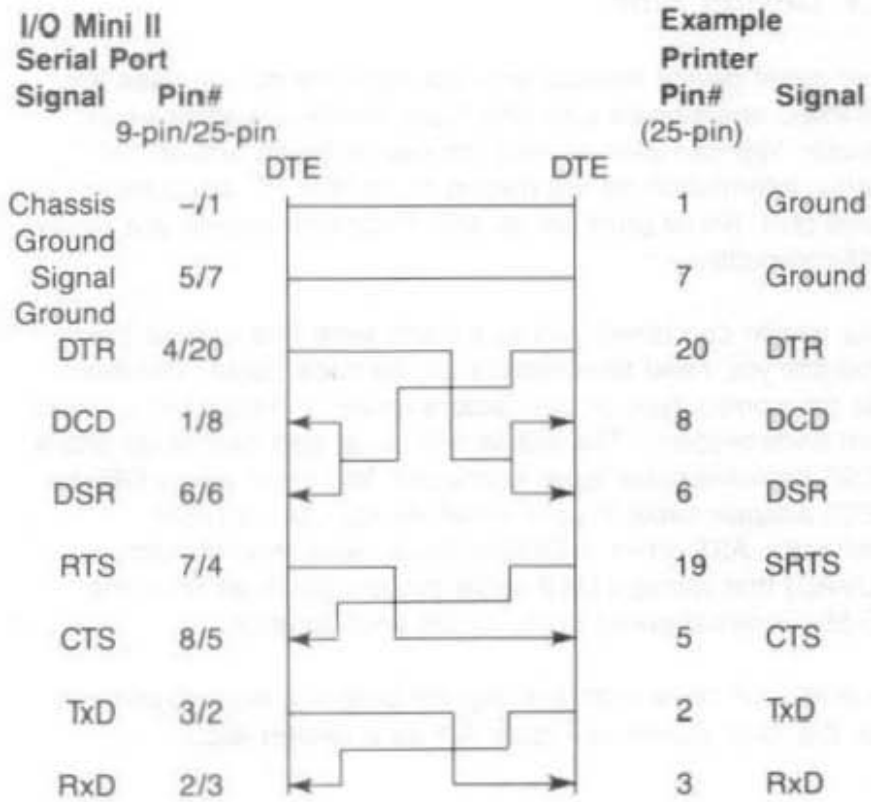


Figure A-4. Example #3: Null Modem Interface.

Serial Interfaces

In this case, the printer uses SRTS (Secondary Request to Send, pin 19) instead of pin 4 (RTS); apart from that exception, Figure A-3 follows the ideal DTE input and sequence rules.

The advantage of the interface shown in Figure A-4 is that every pin is driven by its functional counterpart on the other side of the interface; the functionally related signal pairs include DTR/DSR, RTS/CTS, and TxD/RxD. This should also hold true for the interface you design.

A.4 Design Aids

Your serial device manual tells you how the device uses the RS-232C line signals and which pin numbers supply which signals. You can also contact the device manufacturer for further information on interfacing to an IBM PC asynchronous serial port. Serial ports on all AST Research boards are IBM-compatible.

Your dealer can direct you to a parts store that carries the products you need to construct an interface cable. You must use the correct type of connectors (male or female) to connect both ends properly. The I/O Mini II serial port end plugs into a DE9S (female/socket type) connector. You must use a DE9-to-DB25 adapter cable if your serial device uses a DB25 connector. AST offers a DE9-to-DB25 cable (model number ADV-AC) that remaps DE9 serial pinouts (such as from the I/O Mini II serial ports) to the DB25 configuration.

To wire your serial interface signals properly, we suggest you use the form shown in Figure A-5 as a design aid.

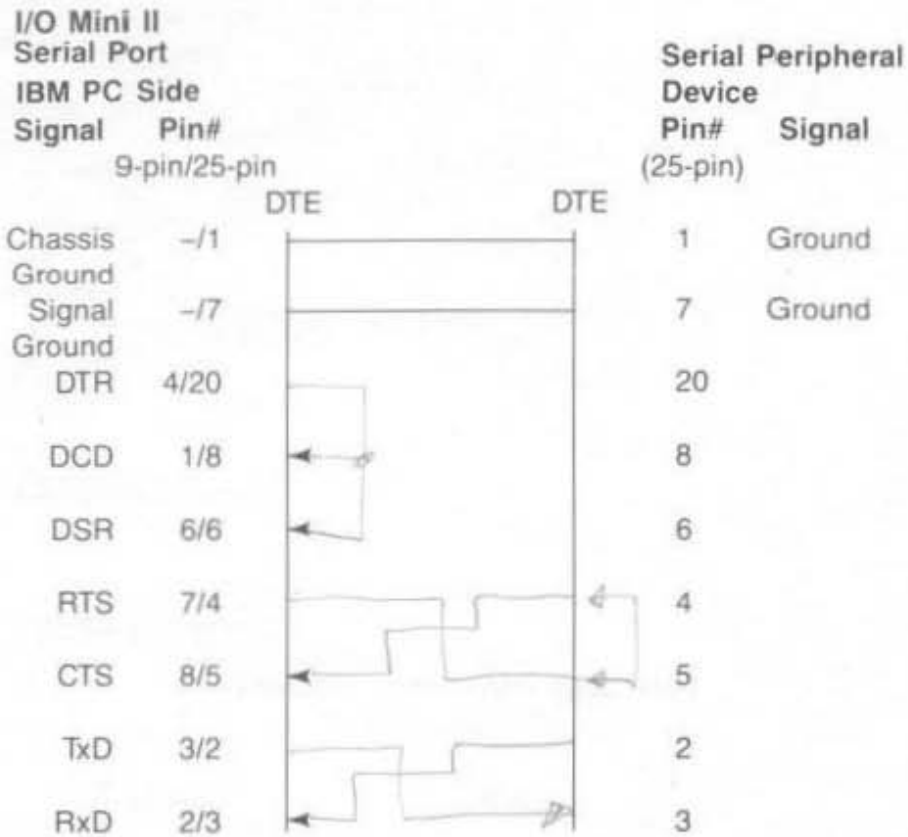


Figure A-5. Serial Interface Form.

If you plan to use several different serial devices on your serial port, you can make a separate interface assembly for each device. That way you can use the same long cable to connect your PC to any of these devices.

APPENDIX B

SWITCHING BETWEEN PARALLEL PRINTER PORTS

This appendix gives you programs you can use in a batch file to direct printer output normally designated for the device attached to port LPT1, to instead be routed to the device attached to port LPT2 or LPT3. (The program also directs output, normally designated for the device attached to port LPT2 or LPT3, to instead be routed to the device attached to port LPT1.) For more information on creating a batch file, see your *IBM DOS Manual*.

The programs in this appendix are particularly useful if your application program (such as a word processing program) is capable of sending print output to only one parallel port. You might also use this program when your LPT1 printer (call it printer #1) is down for service, or when you want to take advantage of the type style or speed of the printer attached to LPT2 or LPT3 (call it printer #2 or #3). This program allows you to quickly switch between outputs without having to alter your hardware interface or change each line in programs where LPT1, LPT2, or LPT3 appear as your output port designation.

If your printers are not configured to the same parameters, as defined in the DOS MODE command, you must add two MODE statements when switching devices.

Notice that the "swap" program in Section B.1 is written in BASIC. Because the printer port swap is best handled in DOS, BASIC is invoked within the .BAT file. No RUN command is required when the BASIC call and the program file name occur on the same line (**BASIC LPTSWAP**). Consult your *IBM BASIC Manual* if you have any questions about entering and saving the LPTSWAP.BAS program.

B.1 Switching Between LPT1 and LPT2

The following DOS batch file and BASIC program will redirect printer output from LPT1 to LPT2 or vice versa, depending on which port is being used at the time.

LPTSWAP.BAT (or a name of your choosing) with the following:

```
MODE LPT1:[parameters for printer #2]
MODE LPT2:[parameters for printer #1]
BASIC LPTSWAP
```

LPTSWAP is a BASIC program, as shown below. The comments are included for clarification and need not be included in the actual program.

```
10 DEF SEG = &H40           ' finds port address table
20 A = PEEK (8): B = PEEK (9) ' save LPT1 address
30 POKE 8,PEEK (10): POKE 9,PEEK (11) ' LPT2 address to LPT1
40 POKE 10,A: POKE 11,B     ' LPT1 address to LPT2
50 SYSTEM                   ' return to DOS
```

Omit statement 50 if you will be LPRINTing from BASIC.

B.2 Restoring LPT1 to LPT1 and LPT2 to LPT2

Use the same program, LPTSWAP, to restore your parallel printer ports to their original arrangement. Be sure to restore the proper parameters using a new batch file and MODE statements.

LPTRSTR.BAT is as follows:

```
MODE LPT1:[parameters for printer #1]
MODE LPT2:[parameters for printer #2]
BASIC LPTSWAP
```

B.3 Switching Between LPT1 and LPT3

The following DOS batch file and BASIC program will redirect printer output from LPT1 to LPT3 or vice versa, depending on which port is being used at the time.

LPTSWAP.BAT (or a name of your choosing) with the following:

```
MODE LPT1:[parameters for printer #3]
MODE LPT3:[parameters for printer #1]
BASIC LPTSWAP
```

LPTSWAP is a BASIC program, as shown below. The comments are included for clarification and need not be included in the actual program:

```
10 DEF SEG = &H40           ' finds port address table
20 A = PEEK (8): B = PEEK (9) ' save LPT1 address
30 POKE 8,PEEK (12): POKE 9,PEEK (13) ' LPT3 address to LPT1
40 POKE 12,A: POKE 13,B    ' LPT1 address to LPT3
50 SYSTEM                  ' return to DOS
```

Omit statement 50 if you will be LPRINTing from BASIC.

B.4 Restoring LPT1 to LPT1 and LPT3 to LPT3

Use the same program, LPTSWAP, to restore your parallel printer ports to their original arrangement. Be sure to restore the proper parameters using a new batch file and MODE statements.

LPTRSTR.BAT is as follows:

```
MODE LPT1:[parameters for printer #1]
MODE LPT3:[parameters for printer #3]
BASIC LPTSWAP
```

LIMITED WARRANTY

AST Research, Inc. warrants to the original purchaser of this AST Research, Inc. product that it is to be in good working order for a period of two years from the date of purchase from AST Research, Inc. or an authorized AST Research, Inc. dealer. Should this product, in AST Research, Inc.'s opinion, malfunction during the warranty period, AST will, at its option, repair or replace it at no charge, provided that the product has not been subjected to misuse, abuse, or non-AST authorized alterations, modifications, and/or repairs.

Products requiring Limited Warranty service during the warranty period should be delivered to AST with proof of purchase. If the delivery is by mail, you agree to insure the product or assume the risk of loss or damage in transit. You also agree to prepay shipping charges to AST.

ALL EXPRESS AND IMPLIED WARRANTIES FOR THIS PRODUCT INCLUDING, BUT NOT LIMITED TO, THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED IN DURATION TO THE ABOVE TWO-YEAR PERIOD. Some states do not allow limitations on how long an implied warranty lasts, so the above limitations may not apply to you.

UNDER NO CIRCUMSTANCES WILL AST RESEARCH, INC. BE LIABLE IN ANY WAY TO THE USER FOR DAMAGES, INCLUDING ANY LOST PROFITS, LOST SAVINGS, OR OTHER INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OF, OR INABILITY TO USE, SUCH PRODUCT. Some states do not allow the exclusion or limitation of incidental or consequential damages for consumer products, so the above limitations or exclusion may not apply to you.

THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH MAY VARY FROM STATE TO STATE.

The limited warranty applies to hardware products only.

AST RESEARCH, INC.

Product Comment Form

**I/O Mini II
000380-001A**

We appreciate your comments regarding any problems or suggestions related to AST Research products. Please use this form to communicate any observations that you have concerning the improvement of either the product itself or the product documentation provided in this manual.

Submitter Information

Submitter's name:

Address:

Product/Manual Comments and Suggestions

Please mail this form to:

**AST Research, Inc.
Attn: Product Marketing
2121 Alton Ave.
Irvine, CA 92714**

000380-001 A

PRINTED IN HONG KONG