

*Graphics Products*

# *AST-3G Plus II™*

**AST**  
RESEARCH INC.

*User's Manual*

## **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.

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- 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.

**FCC Warning**

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.

**AST-3G Plus II™**  
**Enhanced Graphics Adapter**  
**for the**  
**AST Premium/286™ Personal Computer,**  
**IBM® Personal Computer,**  
**IBM PC XT, PC XT Model 286,**  
**PC AT®, and**  
**Other IBM-Compatible Machines**

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**NOTES**



## INTRODUCING AST-3G PLUS II

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The AST-3G Plus II™ graphics display adapter (hereafter referred to as AST-3G) provides advanced color and high-resolution graphics capabilities for the AST Premium/286, IBM® Personal Computer (PC), PC XT, PC AT, and most IBM-compatibles. AST-3G, AST's third-generation graphics product, can perform the functions of four different display adapter cards. It is compatible with the AST Premium Display, three IBM PC display monitors (and equivalents), and the NEC™ MultiSync.

You can emulate the Hercules™ Graphics Card (HGC) and the AST Preview™ card. You will also have far greater compatibility with software designed for use with the IBM Color/Graphics Adapter (CGA), and the IBM Monochrome Display/Printer Adapter (MDA).

Basic AST-3G features include:

- Compatibility with the following monitors:
  - IBM 5151 Monochrome Display (MD).
  - IBM 5153 Color Display (CD).
  - IBM 5154 Enhanced Color Display (ECD).
  - NEC MultiSync™.
  - AST Premium Display (monochrome and color).
- Compatibility with the IBM Enhanced Graphics Adapter (EGA). Includes operational characteristics of the IBM CGA and MDA.
- Can coexist with the MDA, HGC, AST Preview, or the CGA. (Refer to Section 2.5.)

- Using EGA capabilities, can provide 640 x 350 pixel resolution, with use of 16 colors simultaneously from a color palette of 64 different colors.
- Using CGA capabilities, provides 640 x 200 and 320 x 200 pixel resolutions, 4-color graphics and 16-color text. Provides 640 x 400 pixel resolutions if MultiSync monitor is attached.
- Using MDA capabilities, provides a 9 x 14 pixel character box for high-quality monochrome text.
- Random access memory (RAM)-based, loadable character generator capable of generating up to 512 displayable characters for use in any application (such as scientific notation and foreign language character sets).
- Supports up to 43 lines of 80-column text.
- Supports 132-column x 25-line text.
- 256 KB of on-board graphics memory supports up to eight graphics pages in 320 x 200 pixel, 16-color mode.
- Designed using advanced very large scale integration (VLSI) technology for speed, reliability, and compatibility.
- Provides a standard IBM-compatible feature connector.
- Includes a standard IBM-EGA-compatible light pen interface.
- Performs the functions of the HGC or the AST Preview adapter. Compatible with HGC/Preview hardware (mode registers). Using HGC capabilities, provides 720 x 348 pixel resolution monochrome graphics and a 9 x 14 pixel character box for high-quality text characters.

- Compatible with software designed for the IBM CGA and MDA. In addition to EGA compatibility, has CGA and MDA hardware compatibility (mode and color registers).
- Automatically adjusts to monitor type.
- Automatically adjusts to CGA/MDA/EGA modes as required by your application software, if the appropriate monitor is connected.

# NOTES

## ABOUT THIS MANUAL

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This manual is divided into three parts to make it easy to find the information you need. Part I, "Getting Started", offers information you need to know before you install AST-3G. Part II, "Basic Installation", shows you how to configure and install AST-3G. Part III, "Appendices", provides information about the feature connector and the light pen interface.

### How to Find What You're Looking For

*For information on compatibility and system requirements:*

Section 1 provides important considerations for installing AST-3G.

*For information on graphics and text capabilities:*

Section 2 defines some basic graphics terms, describes the different monitors you can use with AST-3G and lists the graphics and text capabilities available with AST-3G.

*To configure and install the AST-3G board in your PC:*

Section 3 shows you how to configure and install AST-3G on your PC board.

*For information on the feature connector:*

Appendix A describes feature connector inputs and outputs.

*For information on the light pen interface:*

Appendix B shows light pen pinouts.

## Format Notation

This manual uses the following format notation:

- *Uppercase characters* indicate items that you enter exactly as shown. However, you can enter those items in any combination of upper- or lowercase letters.
- *Boldface* indicates the information that you enter, as contrasted with 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 you can include or omit at your discretion. The brackets are not entered.
- *Lowercase letters* identify variable information (such as filenames) that you must supply.
- *Angle brackets (< >)* tell you to press a key. For example, < Esc > tells you to press the "Esc" key. You do not have to press the < Enter > key unless you are specifically told to do so.
- Numbers on the numeric keypad are abbreviated as < Num Key > . For example, < Num Key 5 > means to press the **5** key on the numeric keypad. Do not press the **5** key on the main keyboard.
- When you see two keys joined by a dash, (< Alt > - < F1 >) press those two keys simultaneously. < Ctrl > - < Alt > - < Del > instructs you to press and hold the **Ctrl** and **Alt** keys while pressing the **Del** key (the reboot sequence). You then release the keys simultaneously.
- System prompts and messages are shown in color.

- Hexadecimal numbers are indicated with a leading zero (0) and a trailing "h" (for example, 0207h).



## Related Documentation

This manual assumes you are familiar with DOS, the AST Premium/286, the IBM PC, PC XT, or the PC AT. If you are not, please read your computer's user manuals before proceeding.

For more information, you may refer to the following publications:

For the AST Premium/286:

- *AST Premium/286 User's Manual*
- *AST Premium/286 MS-DOS Manual*
- *AST Premium Display Supplement*
- *AST Premium/286 Utility Software Manual*

For the IBM PC and PC XT :

- *IBM Disk Operating System (DOS) Manual.*
- *IBM PC Guide to Operations*
- *IBM PC Technical Reference Manual.*

For the IBM PC AT :

- *IBM PC AT Guide to Operations*
- *IBM PC AT Technical Reference Manual.*
- *IBM PC AT Installation and Setup Manual.*

## PART I. GETTING STARTED

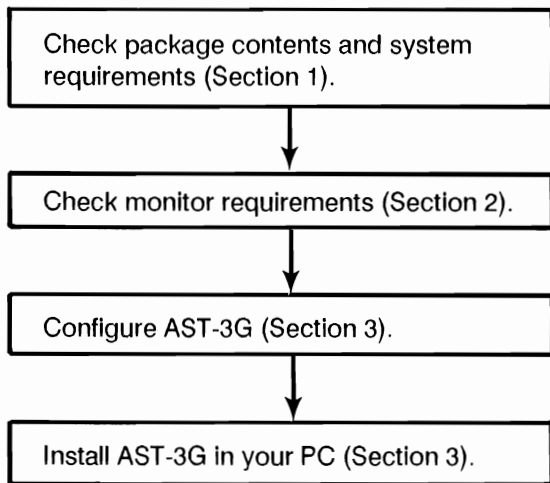
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1. Before You Begin . . .
2. Overview

# NOTES



This section presents information you'll need to know before you install AST-3G. Figure 1-1 shows an overview of the steps to take when you install the AST-3G board.



**Figure 1-1. Installation Overview.**

## 1.1 Checking the Contents

Before getting started, check that your AST-3G package includes the following items:

- AST-3G graphics adapter.
- *AST-3G User's Manual*.
- AST-3G diagnostics diskette. Includes diagnostics, emulation enable/disable software, and Hercules graphics and page enable software.

## 1.2 Compatibility and System Requirements

The minimum hardware requirements for operation with AST-3G are:

- An AST Premium/286, IBM PC, PC XT, PC AT, or IBM-compatible PC with one floppy diskette drive and an unused full-length expansion slot.
- One of the following types of monitor is necessary:

An IBM 5154 ECD or compatible 350-line, 64-color TTL RGB/R'G'B'.

An IBM 5153 CD or compatible 200-line, 16-color TTL RGBI.

An IBM 5151 MD or compatible TTL monochrome monitor.

An NEC MultiSync or equivalent.

An AST Premium Display (monochrome or color).

The AST-3G diagnostics software is compatible with DOS 2.0 or later, or an MS-DOS equivalent.

### **1.2.1 ROM Module Requirement**

If you are installing AST-3G in a PC or PC XT, then you must have a ROM BIOS (Read-Only Memory Basic Input Output System) module in your PC or PC XT that is dated 10/27/82 or later. If you are not sure of the date of your PC's ROM module, you can use the AST-3G diagnostics diskette to check the date. (It is not necessary to check for this with the PC AT.)

Even without the AST-3G installed in your PC, you can run the diagnostics program (with another display adapter installed), as described in Section 5. The first screen that appears is the configuration screen. This screen displays the date of the ROM module in your PC or PC XT. If the date displayed is earlier than 10/27/82, you must have a new ROM module installed. See your PC dealer to obtain a new ROM module.

## 1.3 What You Need to Know Before You Start

This section tells you what information you need before you begin installing AST-3G. A checklist appears at the end of this section to help you organize the information you will need. Fill out the checklist as you answer each question.

*A. In which computer are you installing AST-3G?*

AST-3G is designed to work with the AST Premium/286, and IBM PC, PC XT and PC AT.

*B. What type of monitor are you using?*

AST-3G needs a Premium Display/Monochrome. Premium Display/Enhanced Color, an IBM 5154 ECD, IBM 5153 CD, IBM 5151 MD, or an NEC Multisync.

*C. Do you want to use two display adapters?*

The AST-3G can be used with another display adapter if one adapter is in a color mode and the other is in a monochrome mode.

### 1.3.1 Configuration Checklist

A. In what computer are you installing AST-3G?

Premium/286

PC

PC XT

PC AT

B. What monitor are you using?

Premium Display

IBM 5154

IBM 5153

IBM 5151

NEC MultiSync

C. Do you want to use two display adapters?

Yes

No



# NOTES



This section provides some basic graphics vocabulary, describes the different monitors you can use with AST-3G, and lists the graphics and text capabilities available with AST-3G. Information on using two display adapters is also provided.

## 2.1 Some Terms You Should Know

The following definitions describe terms used throughout this manual.

### **Pages**

Refers to the number of screens of graphics or text information that can be stored in the on-board graphics memory.

### **Pixels**

The smallest unit available for display on a raster screen, representing a single graphics point. Also called picture elements (PELs).

### **Raster display**

The predominant type of cathode ray tube (CRT) display. It operates similarly to an ordinary television set whereby images are created by illuminating individual pixels via a line-by-line scan of the CRT screen by an electron beam.

### **Resolution**

The number of pixels displayed on a monitor per horizontal line, by the number of horizontal lines displayed on the vertical axis (for example, 640 x 350 indicates 640 pixels wide by 350 pixels high).

## 2.2 Versatility of the AST-3G

Many IBM-compatible monitors and adapters are also compatible with the AST-3G. The graphics capabilities available with the AST-3G, including resolution and number of colors, vary depending on what monitor type is used and which display adapter you wish to emulate.

The capabilities of AST-3G may be affected when another graphics display adapter is installed in your system along with AST-3G. The graphics features of specific applications software packages may also be affected by the monitor you are using with your AST-3G.

## 2.3 Monitors Used with AST-3G

The AST-3G can be used with several IBM and other monitors:

- The IBM 5151 Monochrome Display (MD), designed for use with the Monochrome Display/Printer Adapter (MDA) (Section 2.3.1).
- The IBM 5153 Color Display (CD), designed for use with the CGA (Section 2.3.2).
- The IBM 5154 Enhanced Color Display (ECD), designed for use with the Enhanced Graphics Adapter (EGA) (Section 2.3.3).
- The NEC MultiSync, designed for use with the CGA and EGA. (Section 2.3.4)
- The AST Premium Display (monochrome and color). (Section 2.3.5)

Descriptions of the IBM monitors used with AST-3G follow.

### **2.3.1 IBM 5151 Monochrome Display Monitor**

The IBM 5151 Monochrome Display (MD) was designed to be used with the IBM MDA. The MD monitor has a screen refresh rate of 50 hertz (Hz) (non-interlaced), and a maximum bandwidth of 16.257 megahertz (MHz). The MD monitor is TTL-compatible and has a horizontal scan frequency of 18.432 kilohertz (KHz).

### **2.3.2 IBM 5153 Color Display Monitor**

The IBM 5153 Color Display (CD) was designed to work with the IBM CGA. The CD monitor can display up to 16 different colors, by combining digital outputs of red, green, blue and intensity. Monitors of this type are generally called RGB (Red-Green-Blue) monitors. The CD monitor has a high-contrast black screen. There are many IBM-compatible RGB monitors; however, some of them provide only 8 colors instead of 16.

The maximum bandwidth of the CD monitor is 14.318 MHz. The screen refresh rate is 60 Hz (non-interlaced). The CD is TTL-compatible, with a horizontal scan frequency of 15.750 KHz.

### **2.3.3 IBM 5154 Enhanced Color Display Monitor**

The IBM 5154 Enhanced Color Display (ECD) was designed to take advantage of the unique capabilities of the EGA. The ECD monitor is extremely versatile in that it can be used with software written for either the EGA or the CGA.

For the ECD monitor, the screen refresh rate is 60 Hz. The horizontal scan rate can be either 15.75 KHz or 21.850 KHz. The maximum bandwidth is 16.257 MHz.

### **2.3.4 NEC MultiSync Monitor**

The NEC MultiSync was also designed to work with the IBM CGA and EGA. It is TTL- and analog-compatible. It has a maximum bandwidth of 30 MHz and a horizontal scan rate range of 15.5 KHz to 35 KHz. The screen refresh rate range is 56 Hz to 62 Hz (non-interlaced).

### **2.3.5 AST Premium Display**

The AST Premium Display is available in two models: the Premium Display/Monochrome, designed to work with MDA, HGC and EGA, and the Premium Display/Enhanced Color, designed to work with CGA and EGA. Both models have a 20 MHz maximum bandwidth, a horizontal scan rate range of 15.75 KHz to 18.432 KHz and a screen refresh rate of 50 Hz to 60 Hz.

## **2.4 AST-3G Graphics and Text Operating Modes**

Tables 2-1 and 2-2 summarize adapter and monitor combinations your AST-3G can accommodate, along with the resulting graphics and text capabilities. The mode your computer operates in with the AST-3G is actually determined by the software package you are using and by the type of monitor you have. The AST-3G can emulate any type of adapter listed in these tables.

Table 2-1 provides an overview of the combinations of colors, pages of on-board memory, and resolution that are available with your AST-3G when it is in graphics mode. Many of these combinations correspond to standard graphics modes that software packages are designed to use.

Table 2-2 provides an overview of the combinations of colors, memory pages, character size and characters per screen in different text modes that software packages are designed to utilize.

Table 2-1. AST-3G Graphics Modes.

<b>Monitor Required(1)</b>	<b>Adapter AST-3G Emulates(2)</b>	<b>Number of Colors</b>	<b>Resolution (h x v)</b>	<b>Memory Pages</b>
ECD	EGA	16/64(3)	640 x 350	2
ECD	EGA	4/64	640 x 350	1
CD/ECD	EGA	16	320 x 200	8
CD/ECD	EGA	16	640 x 200	4
CD/ECD	CGA	4	320 x 200	1
CD/ECD	CGA	2	320 x 200	1
CD/ECD	CGA	2	640 x 200	1
MD	EGA	2(4)	640 x 350	2
MD	HGC (5)	2	720 x 348	2

**Table 2-2. AST-3G Text Modes.**

<b>Monitor Needed(1)</b>	<b>Adapter AST-3G Emulates(2)</b>	<b>Number of Colors</b>	<b>Character Size (pixels)</b>	<b>Characters per Screen</b>	<b>Memory Pages</b>
ECD	EGA	16/64 (3)	8 × 14	80 × 25	8
ECD	EGA	16/64 (3)	8 × 8	80 × 43	8
ECD	CGA/EGA	16	8 × 14	80 × 25	8
ECD/CD	CGA/EGA	16	8 × 8	80 × 25	8
ECD/CD	CGA/EGA	16	8 × 8	40 × 25	8
ECD/CD	CGA/EGA	2	8 × 8	80 × 25	8
ECD/CD	CGA/EGA	2	8 × 8	40 × 25	8
MD	EGA	2	9 × 14	80 × 25	8
MD	EGA	2	9 × 8	80 × 43	4
MD	MDA/HGC	2	9 × 14	80 × 25	1

**Notes for Tables 2-1 and 2-2**

(1) ECD = IBM 5154 Enhanced Color Display or equivalent;

CD = IBM 5153 Color Display or equivalent;

MD = IBM 5151 Monochrome Display or equivalent.

(2) EGA = Enhanced Graphics Adapter;

CGA = Color/Graphics Adapter;

MDA = Monochrome Display/Printer Adapter;

HGC = Hercules Graphics Card (or AST Preview! adapter).

(3) Sixteen displayable colors with a 64-color palette to choose from.

(4) Also includes blinking and high-intensity attributes.

## 2.5 Using Two Display Adapters

You can install an AST-3G in your computer and use it in one of the operating modes described in Tables 2-1 and 2-2. If appropriate for your software applications, you can also install your AST-3G along with another coexisting display adapter. This situation is typically needed for software applications that require two monitors for operation, where each display adapter supports one monitor.

The AST-3G can only be used with another display adapter if one adapter is operating in a color mode, and the other is in a monochrome mode. For example, if an AST-3G coexists with a CGA, then the AST-3G must be configured in monochrome mode because the CGA is only capable of operating in a color mode. Likewise, if an AST-3G coexists with an MDA, then the AST-3G must be set up as a color adapter since the other adapter is for monochrome only.

Two coexisting adapters cannot be configured as the same type of adapter. For example, an AST-3G adapter cannot emulate an MDA when another MDA is coexisting. The combinations of display adapters which are not possible include the following:

- AST-3G with AST-3G.
- AST-3G with EGA.
- AST-3G (in any color mode) with CGA.
- AST-3G (in monochrome mode) with MDA.

### CAUTION

When AST-3G coexists with a Hercules or Preview I/O adapter, the Hercules or Preview I/O must not use the second page of graphics. Damage to either adapter may result if the second page of graphics is used.



When two display adapter cards do coexist, you must specify one adapter as "primary" and the other as "secondary". This is accomplished through switch settings on the AST-3G, which are described in Section 3. The adapter designated as primary will be the adapter in use when you boot up your system. After boot-up, a DOS command can be used to select either of the two adapters as a primary one.

For example, to designate a monochrome display adapter as a primary card, enter the following command at the DOS prompt:

**A > MODE MONO < Enter >**

Conversely, to designate a color display adapter as a primary display adapter, enter the following command at the DOS prompt:

**A > MODE CO80 < Enter >**

For further information, refer to your DOS manual (Version 2.0 and later).

## PART II. BASIC INSTALLATION

---

### 3. Configuration and Installation

# NOTES

## CONFIGURATION AND INSTALLATION 3

---

This section provides the steps needed to configure your AST-3G and install it in an AST Premium/286, PC, PC XT, or PC AT. Section 3.1 provides a quick installation procedure to install your AST-3G in its default factory configuration. More detailed configuration and installation procedures follow in the rest of Section 3.

### 3.1 Quick Installation Procedure

This procedure is based on using your AST-3G display adapter in the factory default configuration. It assumes the following:

- Your PC has a new Read-Only Memory Basic Input Output System (ROM BIOS) module for PCs manufactured after April 1983.
- You have an Enhanced Color Display (ECD), AST Premium Display/Enhanced Color, NEC MultiSync or compatible.
- You will use your AST-3G as an Enhanced Graphics Adapter (EGA), and AST-3G will be the adapter used when you power up your PC.

If you wish to use AST-3G in a different configuration, or if you need more detailed installation instructions, go to Section 3.2.

#### STEP 1

*Remove the Premium/286, PC, PC XT, or PC AT cover:* For the Premium/286, PC, and PC XT, remove the cover mounting screws and slide off the cover (Figure 3-3).

For the PC AT, unlock the key lock at the front of the PC AT by turning the key counterclockwise. Remove the back panel,

remove cover mounting screws, then slide the cover toward the front until it comes off (Figure 3-4).

### **STEP 2**

*If you have a PC or PC XT, set the system board switch block SW1 positions 5 and 6 to ON (Figure 3-5).*

### **STEP 3**

*Select an open expansion slot: The AST-3G adapter requires one half-size slot. Remove and save the cutout bracket and the bracket retaining screw for the slot you have selected, using a small flathead screwdriver.*

### **STEP 4**

*Install the AST-3G adapter: Line up the AST-3G adapter and position its front bottom corner in the card guide channel. Lower the board until its edge connector is resting on the expansion slot receptacle. Using an evenly distributed pressure, press the AST-3G adapter straight down until it sits in the expansion slot receptacle (Figure 3-7).*

### **STEP 5**

*Secure the card to the back of the PC chassis: Use the screw from the cutout bracket you removed.*

### **STEP 6**

*Replace the Premium/286, PC, PC XT, or PC AT cover: Reinstall the cover mounting screws you removed earlier.*

### **STEP 7**

*Attach the display monitor cable to the AST-3G: The cable from the display monitor should be plugged in to the AST-3G's connector.*

### **STEP 8**

*Power up the computer. If you are using a Premium/286 or PC AT, you must run the SETUP program.*

## **3.2 Complete Configuration and Installation Overview**

Figure 3-1 shows the steps needed to configure and install your AST-3G display adapter.

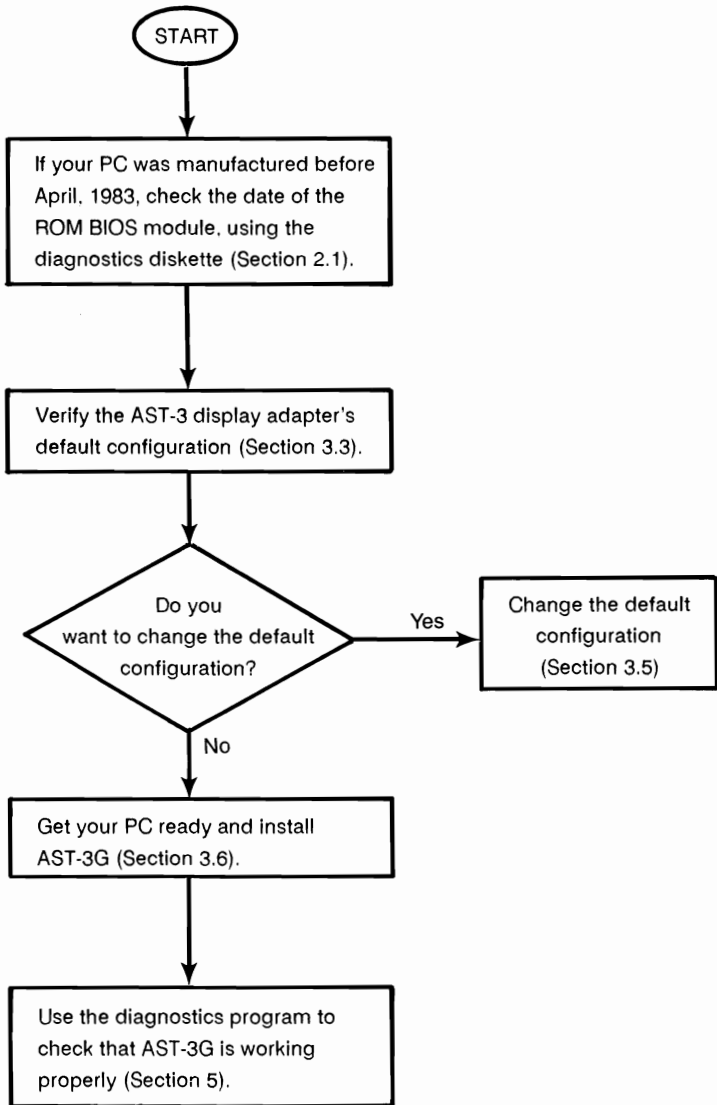


Figure 3-1. Configuration and Installation.

### 3.3 Check ROM Module Date

If you have a PC or PC XT manufactured before April 1983, you

may need to have a new ROM BIOS (Read-Only Memory Basic Input Output System) module installed in your system. (If you have a PC AT, disregard this requirement.) The ROM module must be dated 10/27/82 or later.

If you need to check on the date of your ROM module, initiate the diagnostics program by booting up your PC, then place the diagnostics diskette in drive A: and enter the following command at the DOS prompt:

```
A> DIAG <Enter>
```

After this command is entered, the diagnostics program will present a configuration screen. The configuration screen will list the ROM module date on one line as follows:

```
System Board BIOS date is.....xx/xx/xx
```

This date should be 10/27/82 or later. If it is earlier, you need to have a new ROM BIOS module installed. Contact your dealer to obtain a new ROM module.

#### **NOTE**

To run the diagnostics program, you need a display adapter in your PC system (but not necessarily the AST-3G).

### **3.4 AST-3G Default Configuration**

Figure 3-2 shows the default factory configuration of the AST-3G display adapter.



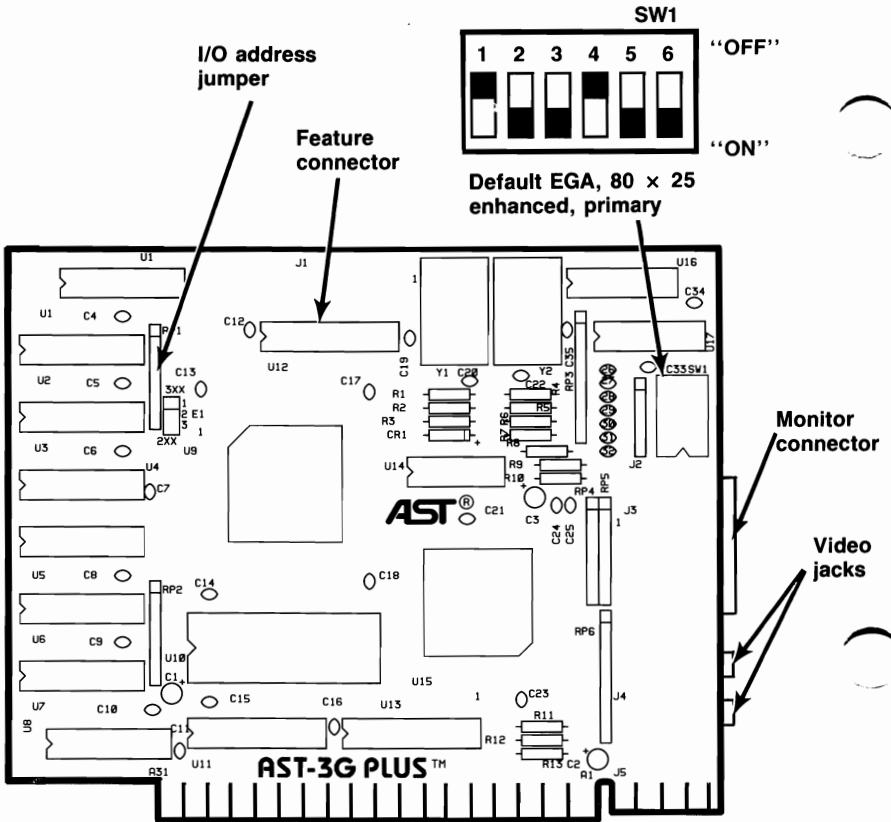


Figure 3-2. AST-3G Display Adapter Layout (Default Configuration).

Table 3-1 summarizes the AST-3G display adapter's default factory configuration.

Parameter	Default	Comments
Card type, mode, Monitor Primary, Auto emulation Auto monitor	EGA, 80 x 25 text, ECD monitor, Primary ON ON SW1-1 OFF SW1-2 ON SW1-3 ON SW1-4 OFF SW1-5 ON SW1-6 ON	The SW1 switch block provides the power-up graphics configuration for the AST-3G. Refer to Table 3-2 for switch settings and configurations. (Section 3.5.2)
Base I/O address	3xx. (Plug at jumper block E3.)	The base I/O address is used for PC-to-AST-3G communication. Changing this will destroy software compatibility.

**Table 3-1. AST-3G Default Configuration.**

### 3.5 Changing the Factory Configuration

You may need to change the factory configuration described above. Check the following subsections for instructions on how to reconfigure particular settings:

- The SW1 Switch (3.5.1).
- SW1-5 Auto Emulation (3.5.2).
- SW1-6 Auto Monitor (3.5.3).
- SW1 Switch Setting Tables (3.5.4).

### 3.5.1 SW1 Switch

A six-position switch block, SW1, is located on the rear of the AST-3G display adapter. The SW1 switch block configuration you select should be based on:

- What type of monitor you have.
- What type of adapter you want the AST-3G to emulate.
- Whether AST-3G is to be the adapter used when you power up your PC or (if two adapters are installed) the secondary adapter.
- Whether you want Auto Emulation on or off.
- Whether you want Auto Monitor Detect on or off.

If you wish to change the SW1 switch configuration, you can reconfigure the SW1 switch without taking it out of your PC. The switch is accessible through the cutout at the back of the PC.

Your system will always power up in a text mode, using the configuration you have selected with the SW1 switch. However, the application software you run on your system can change the AST-3G configuration to a graphics mode, or to another text mode.

### 3.5.2 Auto Emulation

SW1-5, the Auto Emulation switch, is used to enable Hercules Graphics card (HGC) or CGA emulation. For Hercules or CGA emulation to be invoked at power-up, SW1-5 must be ON.

**NOTE**

A few programs may cause problems if SW1-5 is ON, making it necessary to change the switch to OFF.

Once you have powered up, an alternative to SW1-5 is the EMUL utility program. This program, supplied on the diagnostics diskette, allows you to switch emulation ON and OFF through a software command, without having to change SW1-5 or reboot your PC. The EMUL module commands override the SW1-5 switch setting. The EMUL module is described in Section 3.7

**3.5.3 Auto Monitor**

SW1-6, the Auto Monitor switch, automatically detects the type of monitor you are using. It overrides the SW1 1-4 switches.

**NOTE**

Some monitors may not work properly with SW1-6. Also, if SW1 1-4 are set properly, this switch is not needed.

**3.5.4 SW1 Switch Setting Tables**

When choosing a switch setting, determine that it meets the following criteria:

- Your monitor type matches the monitor type for the switch setting you choose (MD, CD, or ECD).
- The switch setting you choose selects the type of adapter you want AST-3G to emulate (EGA, CGA, MDA, or HGC).
- The switch setting selects correctly whether your AST-3G is the adapter you will use when you power up your PC

(primary), or your AST-3G is a second adapter that will not be used when you power up (secondary).

The following abbreviations are used in Tables 3-2 and 3-3:

MD -- Monochrome Display Monitor

CD -- Color Display Monitor

ECD -- Enhanced Color Display Monitor

MDA -- Monochrome Display Adapter.

CGA-1 -- Color/Graphics Adapter Level 1, EGA BIOS-level compatibility (standard EGA operation).

CGA-2 -- Color/Graphics Adapter Level 2, CGA hardware compatibility.

EGA -- Enhanced Graphics Adapter.

HGC -- Hercules Graphics Card or AST Preview! Adapter.

40x25 -- Text display 40 columns horizontally by 25 rows vertically.

80x25 -- Text display 80 columns horizontally by 25 rows vertically.

**Table 3-2. SW1 Settings with AST-3G Used at Powerup Time**

SW1 Settings				Monitor Type	AST-3G Powerup Mode	Secondary Adapter (if present), Mode
1	2	3	4			
OFF	ON	ON	OFF	*ECD	EGA, 80x25	MDA, 80x25
ON	ON	ON	OFF	** CD	CGA-1, 80x25	MDA, 80x25
OFF	OFF	OFF	ON	** CD	CGA-1, 80x25	MDA, 80x25
ON	OFF	OFF	ON	** CD	CGA-1, 40x25	MDA, 80x25
OFF	OFF	ON	OFF	MD	MDA, 80x25	CGA, 80x25
ON	OFF	ON	OFF	MD	MDA, 80x25	CGA, 40x25
<p>* Default setting.</p> <p>** An ECD can also be used, but only CD capabilities will be available.</p>						

**Table 3-3. SW1 Settings with AST-3G as Secondary Adapter**

SW1 Settings				Monitor Type	AST-3G Powerup Mode	Primary Adapter, Mode
1	2	3	4			
OFF	OFF	ON	ON	ECD	EGA, 80×25	MDA, 80×25
ON	OFF	ON	ON	* CD	CGA-1, 80×25	MDA, 80×25
OFF	ON	ON	ON	* CD	CGA-1, 80×25	MDA, 80×25
ON	ON	ON	ON	* CD	CGA-1, 40×25	MDA, 80×25
OFF	ON	OFF	ON	MD	MDA, 80×25	CGA, 80×25
ON	ON	OFF	ON	MD	MDA, 80×25	CGA, 40×25
* An ECD monitor can also be used, but only CD capabilities will be available.						

### 3.6 Installing Your AST-3G

Before installing your AST-3G adapter, you must turn off your PC, disconnect any device attached to it, and remove the PC cover. This section includes procedures for the Premium/286, PC, PC XT, and PC AT.

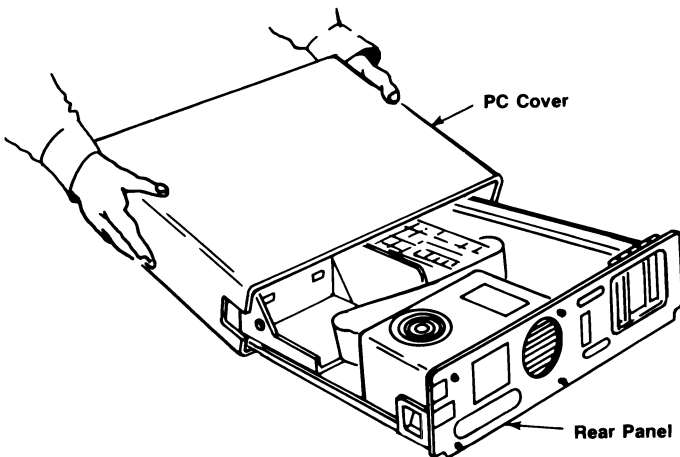
**CAUTION**

Be sure that the power switch is off and the power cord is removed from the system unit. 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.

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

**STEP 1**

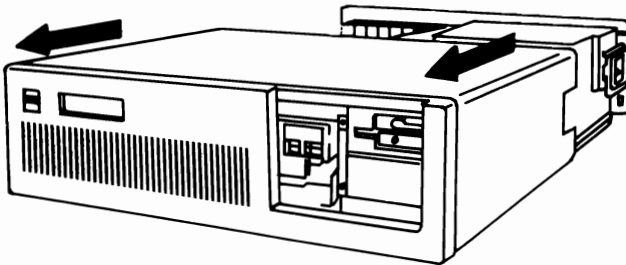
*Remove the PC cover:* Use a flathead screwdriver or nut driver to remove the cover mounting screws from your PC (see your PC's manual for the location of the cover mounting screws). Once you have removed the cover mounting screws, pull the PC cover off as shown in Figure 3-3.



**Figure 3-3. Removing the PC Cover.**



For the PC AT, unlock the key lock at the front of the PC AT by turning the key counterclockwise. Remove the back panel (which is attached to the PC AT with plastic fastener strips) from the rear of the PC AT. Use a flathead screwdriver or nut driver to remove the cover mounting screws. Slide the cover toward the front until it comes off, as shown in Figure 3-4.



**Figure 3-4. Removing the PC AT Cover.**

## **STEP 2**

*Set PC or PC XT system board SW1:* Locate switch block SW1 on the main circuit board of the PC or PC XT (the PC XT has only one system board switch block). Set switches SW1-5 and SW1-6 to ON (on the eight-switch block). Also, check for the correct setting of switch SW1-2. If an 8087 coprocessor is installed, switch SW1-2 must be OFF. Otherwise, it must be ON. Figure 3-5 shows the location of SW1 on the PC and PC XT when you look down into the open PC directly at the system board.

For the Premium/286 and PC AT, there is no SW1. But you will need to run the SETUP program once your system is powered up again after AST-3G has been installed (see STEP 10).

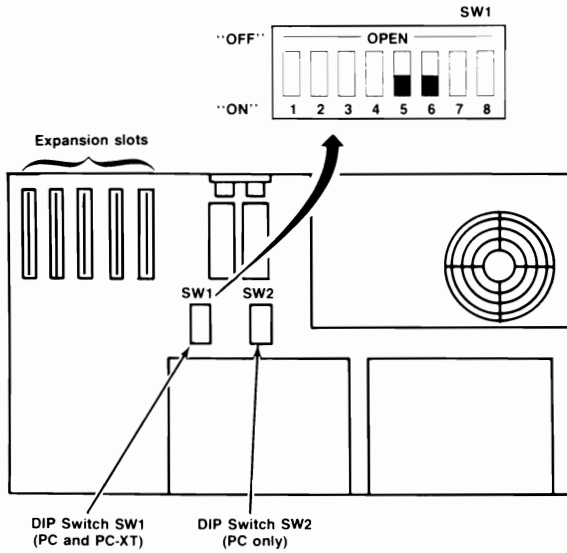


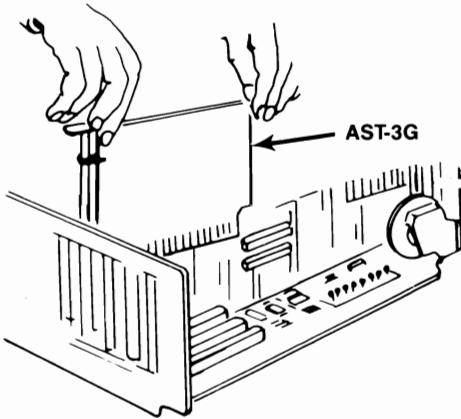
Figure 3-5. System Board SW1 (PC and PC XT only).

**STEP 3**

*Select an open expansion slot:* The AST-3G adapter requires one half-size slot. Remove and save the cutout bracket and the bracket retaining screw for the slot you have selected, using a small flathead screwdriver.

**STEP 4**

*Install the AST-3G adapter:* Line up the AST-3G adapter 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 card and will not be damaged during installation. Lower the board until its edge connector is resting on the expansion slot receptacle. Press the AST-3G adapter straight down, evenly, until it sits in the expansion slot (Figure 3-6).



**Figure 3-6. Installing the AST-3G Adapter.**

**STEP 5**

*Secure the card to the rear of the PC system chassis:* Use the screw you removed from the cutout bracket in STEP 3.

**STEP 6**

*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. For the PC AT, slide the cover from the front until it stops securely against the rear panel, reinstall the cover mounting screws, and press the back panel so that the plastic fastener strips secure it in place.

**STEP 7**

*Install cables:* Replace the power cord to the system unit and be sure that the keyboard and the monitor connectors are plugged in. Re-attach any other cables (including the printer cable to your new printer port), and connectors you removed previously.

**STEP 8**

*Attach the display monitor cable to the AST-3G:* The cable from the display monitor should be plugged in to the AST-3G's connector.

**NOTE**

Be sure that the SW1 switch setting is correct for your monitor or the Auto Monitor Detect switch (SW1-6) is on. If the SW1 switch is incorrect or SW1-6 is not on, your monitor could be damaged. Refer to Section 3.5.2 for switch settings.

**STEP 9**

*Now you are ready to power up.* On the Premium/286 and PC AT, run the SETUP program. Check your computer's manual for full instructions on using SETUP.

**3.7 The EMUL Program**

The EMUL program provided on the diagnostics diskette turns emulation mode ON or OFF without your having to reboot your computer or change the SW1-5 switch.

To start emulation mode (without SW1-5 having been set), place the diagnostics diskette in drive A: of your PC and enter the following command at the DOS prompt:

**EMUL ON < Enter >**

To end emulation mode, place the Diagnostics diskette in drive A: of your PC and enter the following command at the DOS prompt:

**EMUL OFF < Enter >**

To check on your current emulation mode, enter this command at the DOS prompt:

**EMUL < Enter >**

You will receive a response indicating whether emulation is currently enabled or disabled. The response will be one of the following, depending on what adapter your AST-3G is configured to emulate:

Hercules Emulation mode is currently ENABLED

Hercules Emulation mode is currently DISABLED

CGA Emulation mode is currently ENABLED

CGA Emulation mode is currently DISABLED

If you want to put the emulation software onto a disk unit or another diskette other than the diagnostics diskette, copy the file EMUL.COM onto that disk or diskette using a DOS COPY command (refer to your DOS manual for other details about the COPY command).

## **PART III. APPENDICES**

---

A. Feature Connector

B. Light Pen Interface

# NOTES



# FEATURE CONNECTOR

A

AST-3G provides a 32-pin feature connector which is compatible with the IBM EGA feature connector. The feature connector is located along the top of the AST-3G and can be used to support feature adapters that enhance the AST-3G.

Following are descriptions of the signals that are "inputs" from the AST-3G to the feature connector, or "outputs" through the feature connector to the AST-3G.

**Table A-1. Feature Connector Inputs and Outputs.**

Pin #	Signal	Description
4	J1	Pin J1 connects to auxiliary jack 1 on AST-3G's back panel.
5	J2	Pin J2 connects to auxiliary jack 2 on the back panel of AST-3G.
6	G'OUT	Secondary green output.
7	R'OUT	Secondary red output.
8	B'OUT	Secondary blue output.
9	ATRS/L	Attribute shift/load. This signal determines serialization of video information. The shift register parallel loads at the dot clock leading edge when this signal is low.
10	BOUT	Blue output.
11	GOUT	Primary green output.
12	G	Green input.
13	R'	Secondary red input.



**Table A-1. Feature Connector Inputs and Outputs  
(Continued).**

<b>Pin #</b>	<b>Signal</b>	<b>Description</b>
14	B	Blue input.
15	R	Primary red input.
16	R OUT	Red Output.
17	FEAT 1	Output to bit 6 of Input Status register 0 (Feature Code 1).
18	BLANK	Composite horizontal and vertical blanking signal from the CRTIC.
19	FEAT 0	Output to bit 5 of the Input Status register 0 (Feature Code 0).
20	FC1	Input from bit 1 of the Feature Control register.
21	FC0	Input from bit 0 of the Feature Control register.
22	G'I	Secondary green/Intensity input.
23	B'V	Secondary blue input/Monochrome video.
24	HIN	Horizontal retrace input from the CRTIC.
25	VIN	Vertical retrace input.
26	14MHz	14 MHz signal from the system board.
27	Internal	Output to bit 4 of the Miscellaneous Output register (Disable Internal Video Drivers).
28	EXT OSC	External dot clock output.
29	V OUT	Vertical retrace output.
30	HOUT	Horizontal retrace output.

Figure A-1 shows the layout and pin numbering of the feature connector.

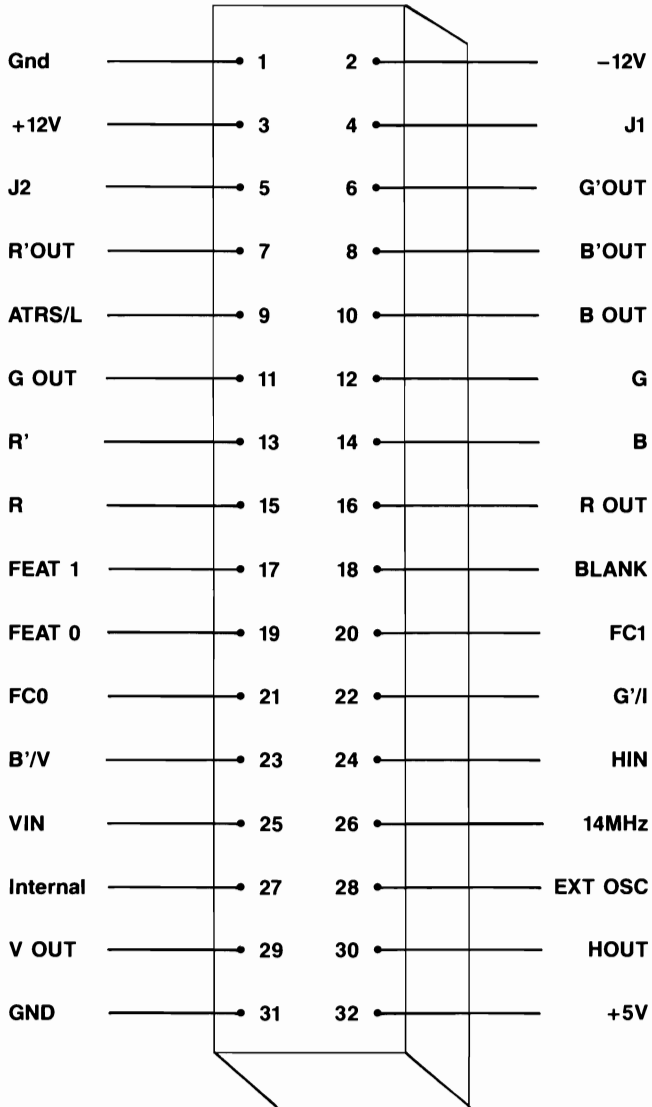


Figure A-1. Feature Connector Layout.

# NOTES



## LIGHT PEN INTERFACE

**B**

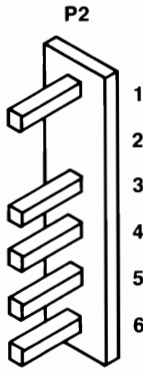
Your AST-3G adapter provides a six-pin connector, labeled P2, for a standard light pen. Only five of the six pins are used. The light pen pinouts are shown in Table B-1.

**Table B-1. Light Pen Interface Pinouts.**

<b>Light Pen Connector Pin Number</b>	<b>Pin Function</b>
1	+Light Pen Input
2	Not used
3	+Light Pen Switch
4	Ground
5	+5 Volts
6	12 Volts

The P2 light pen connector is shown in Figure B-1. Placement of the P2 connector on the AST-3G adapter is shown in Figure 3-2.

Note that the light pen interface on the AST-3G is designed to be compatible with the IBM EGA. The light pen may not be accurate if CGA software is used.



**Figure B-1. Light Pen Interface Connector.**

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**AST-3G™  
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000457-001 A**

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