

FRONT

PICTURE 1

Part Number 10G6623

Form Number S84F-7768-01

EDITION Edition Notice

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- General Safety*
- Electrical Safety.*

**Second Edition (March 1992)**

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IBM  
Personal System/2

CONTENTS Table of Contents

EDITION Edition Notice

FRONT\_1 Notices

CONTENTS Table of Contents

1.0 Product Description

1.1 Security

1.1.1 Cover Lock

1.1.2 Power-On Password

1.2 System-Board Features

1.2.1 Microprocessor

1.2.2 CMOS RAM

1.2.3 ROM BIOS

1.2.4 16-bit VGA Graphics Controller

1.2.5 Serial Port

1.2.6 Parallel Port

1.2.7 Diskette-Drive Controller

1.2.8 Fixed Disk Drive Connector

1.2.9 Keyboard Connector and Pointing-Device Connector

2.0 Option Compatibility

2.1 Incompatible Adapters

2.2 Fixed Disk Drives

2.2.1 Fixed Disk Drive Switches/Jumpers

2.3 Drive and Diskette Compatibility

3.0 Operating Requirements

3.1 Power Supply

3.2 Power-On Self-Test (POST)

3.3 System Memory

4.0 Specifications

5.0 Special Tools

6.0 Removals and Replacements

6.1 1005 Cover

6.2 1010 Adapters

6.3 1015 Rear Cover

6.4 1020 Bus Adapter and Support Bracket

6.5 1025 Front Retainer Plate and Bezels

6.6 1030 Fixed Disk Drive

6.7 1035 Diskette Drive

6.8 1040 Power Supply

6.9 1045 Math Coprocessor

6.10 1050 Air Baffle

6.11 1060 Memory Module Kits

6.12 1065 System Board

6.13 1070 Control Panel Assembly

6.14 1080 Front Adapter Support Guide

6.15 1085 Cover Lock Assembly

6.16 1090 Real-Time Clock Module

7.0 Locations

7.1 Front View

7.2 Rear View

7.3 Interior View

7.4 System Board

8.0 Grounds

## 1.0 Product Description

The IBM(\*) Personal System/2(\*) Model 40 computers have the following features:

- Security: cover lock, power-on password, and keyboard password.
- System board:
  - 20-MHz microprocessor (See "Microprocessor" in topic 1.2.1)
  - 128KB (KB equals 1024 bytes) of read-only memory (ROM)
  - Connector for a 80387SX or equivalent math coprocessor
  - A minimum of 2MB (MB equals 1,048,576 bytes) random access memory (RAM) expandable to 16MB on the system board
  - 64 bytes of complementary metal-oxide semiconductor random access memory (CMOS RAM)
  - Read-only memory basic input/output system (ROM BIOS)
  - 16-bit VGA graphics controller
  - Bus adapter with five 16-bit expansion slots
  - Serial port
  - Parallel port
  - Diskette-drive controller
  - Keyboard connector
  - Pointing-device connector
  - Display connector
  - Fixed disk drive (hard disk drive) connector.
- 197 watt power supply, manually switchable for 100-125 V ac or 200-240 V ac, 50 or 60 Hz
- Speaker
- Keyboard
- Four bays for internal devices:
  - One for a 3.5- or 5.25-inch slim-high device
  - Two for 3.5- or 5.25-inch half-high or slim-high devices
  - One for a 3.5-inch half-high or slim-high device.

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### Subtopics

1.1 Security

1.2 System-Board Features

1.1 Security

Subtopics

1.1.1 Cover Lock

1.1.2 Power-On Password

1.1.1 Cover Lock

The cover lock is located on the bottom front-left of the system unit and can be unlocked with the user's key.

If the keys for the cover lock are lost, a new cover lock assembly can be ordered (see the parts section in the Model 40 *Hardware Maintenance Service* pamphlet). The new cover lock assembly contains two keys.

### 1.1.2 Power-On Password

A power-on password denies access to the system when the system is powered-on. To service a system with an active and *unknown* power-on password, power-off the system and do the following:

- See page 7.4 for the password-override connector location (J14) on the system board.
- Note the position of the jumper. If the jumper covers the first and second pins, move it so that it covers the second and third pins. If the jumper covers the second and third pins, move it so that it covers the first and second pins. To move the jumper, lift it straight up.

**Note:** After you have moved the jumper to the new position, leave it in that position until the next time you need to reset the password.

To reactivate the power-on password, the user must start the system with the Starter Diskette inserted, select the **Set features** option from the main menu, and follow the instructions.

## 1.2 System-Board Features

The major features of the system board are:

- 20-MHz microprocessor
- CMOS RAM
- 16-bit VGA graphics controller
- Serial port
- Parallel port
- Keyboard connector
- Diskette-drive controller
- Pointing-device (mouse) connector
- Math coprocessor connector.

### Subtopics

- 1.2.1 Microprocessor
- 1.2.2 CMOS RAM
- 1.2.3 ROM BIOS
- 1.2.4 16-bit VGA Graphics Controller
- 1.2.5 Serial Port
- 1.2.6 Parallel Port
- 1.2.7 Diskette-Drive Controller
- 1.2.8 Fixed Disk Drive Connector
- 1.2.9 Keyboard Connector and Pointing-Device Connector

1.2.1 *Microprocessor*

The Model 40 SX uses an 80386SX microprocessor; the Model 40 SLC uses an IBM386 SLC, a high-performance 80386SX-compatible microprocessor with 8KB of internal cache memory. Both microprocessors have a 32-bit internal bus with a 16-bit external data bus and a 24-bit external address bus. Both operate in two modes: real-address and virtual-address (protected) mode. The processor speed is 20 MHz.

1.2.2 CMOS RAM

The CMOS RAM provides 64 bytes of storage. The real-time clock uses the first 14 bytes to track the date, time, and battery level. The remaining 50 bytes are used to store system-configuration and security information.

The data stored in CMOS RAM is kept active by the battery when the system is powered-off. If the stored data is lost due to a depleted battery, the data can be restored by starting the Starter Diskette to allow the automatic configuration program to run. The data also can be restored by using the restore configuration program on the user's backup copy of the Starter Diskette.

1.2.3 ROM BIOS

ROM BIOS contains the instructions and routines that control the keyboard, diskette drives, fixed disk drive, displays, and other major input/output devices in the system. Some adapters have their own ROM modules containing extended BIOS routines that work with the system board ROM BIOS. The routines for performing the power-on self-test (POST) are also contained in the ROM BIOS.

1.2.4 16-bit VGA Graphics Controller

A 16-bit VGA graphics controller is on the system board. The controller supports color and monochrome analog direct-drive displays in a variety of modes, including alphanumeric text mode and all-points-addressable (APA) graphics mode.

The controller supports a maximum of 720 x 400 picture elements (PELs) in the text mode and a maximum of 640 x 480 PELs in graphics mode. Up to 256 colors or 64 shades of gray can be used at one time. The 3278-compatibility modes 2, 3, 4, and 5 are supported; composite video is not supported.

#### 1.2.5 Serial Port

The serial port is fully programmable and supports asynchronous communications. The 25-pin, D-shell connector provides the signals to drive a device with a standard 25-contact, RS-232 connector. The connected device is identified (addressed) by the system configuration as either Serial 1 (primary) or Serial 2 (alternate).

If an adapter with a serial port is installed in the system, it should be set to Serial 2.

**Note:** Conflicts occur when using multiple communication ports if two or more ports are addressed the same. Select the **Set configuration** option on the Starter Diskette. Select **View configuration** to verify that no ports are addressed the same.

#### 1.2.6 Parallel Port

The parallel port allows the attachment of devices that accept eight bits of parallel data at standard transistor-transistor-logic (TTL) levels. The port has a 25-pin, D-shell connector and is designed primarily for printers. However, the port can be used as a general input/output port for any device or application that matches its input/output capabilities. The connected device is identified (addressed) by the system configuration as Parallel 1, Parallel 2, or Parallel 3.

When an adapter with an additional parallel port is installed, it should be set as Parallel 2. The system can support two different devices, each addressed separately.

1.2.7 *Diskette-Drive Controller*

The controller connects to the diskette drives through a single 40-pin connector on the system board. On 3.5-inch diskette drive, the signals and voltages are supplied through the diskette-drive cable that plugs into the drive connector. On 5.25-inch diskette drives, signals are supplied through the diskette-drive cable and voltages are supplied through a cable from the power supply. Up to three diskette drives can be supported.

*1.2.8 Fixed Disk Drive Connector*

The fixed disk drives are connected to the system board through a single 40-pin connector. Signals are supplied through the cable that plugs into the drive connector. (Voltages are supplied directly from the power supply.) Up to two AT-integrated-controller fixed disk drives are supported.

*1.2.9 Keyboard Connector and Pointing-Device Connector*

The two 6-pin connectors at the rear of the system board are for connecting a keyboard and a pointing device (mouse). The keyboard connector is marked with a small keyboard figure; the mouse connector is marked with a small mouse figure. The interface logic does not allow the keyboard and the pointing device to be interchanged.

2.0 *Option Compatibility*

Subtopics

2.1 Incompatible Adapters

2.2 Fixed Disk Drives

2.3 Drive and Diskette Compatibility

### 2.1 Incompatible Adapters

Certain adapters are not compatible when used in the same system. If one of the following adapters is installed, the other adapters listed may not be installed in the same system unit:

- Synchronous Data Link Control (SDLC) Communications Adapter
- 3278/3279 Emulation Adapter.

Problems can occur in the system when adapters share the same interrupt level. Check the adapter interrupt levels to ensure that they do not conflict. If the adapters have selectable interrupt levels, verify that the jumpers on the adapters are not set for the same level.

Some option adapters are not supported by the Model 40 computers. Supported option adapters are listed in the parts section of the *Hardware Maintenance Service* pamphlet.

## 2.2 Fixed Disk Drives

Several fixed disk drives are available. The Model 40 system board has an AT-integrated-controller fixed disk drive connector. See the parts section in the Model 40 *Hardware Maintenance Service* pamphlet for a listing of the supported drives.

### Subtopics

#### 2.2.1 Fixed Disk Drive Switches/Jumpers

2.2.1 Fixed Disk Drive Switches/Jumpers

The fixed disk drives have a switch or jumper that determines if the drive is the primary (master) or secondary (slave) drive. If one fixed disk drive is installed, it must be set as the primary. If two fixed disk drives are installed, one must be set as primary and one as secondary. See the *Model 40 Hardware Maintenance Service* pamphlet for switch and jumper information.

2.3 Drive and Diskette Compatibility

The following provides information concerning the identification of 3.5-inch diskette drives.

Diskette Drive	Identifying Mark
3.5-Inch - 1.44MB	1.44 on the Eject Button
3.5-Inch - 2.88MB	2.88 on the Eject Button

The following addresses the compatibility of 3.5-inch diskettes to 3.5-inch diskette drives.

Diskette Capacity	1.44MB Drive
1.0MB	Read/Write
2.0MB	Read/Write
4.0MB	Read/Write

The following provides information concerning the identification of 5.25-inch diskettes drives.

Diskette Drive	Identifying Mark
5.25-Inch - 360KB (External)	Asterisk on Bezel
5.25-Inch - 1.2MB (Internal)	1.2 on the Eject Button

The following addresses the compatibility of 5.25-inch diskettes to 5.25-inch diskette drives.

Diskette Capacity	360KB Drive	1.2MB Drive
360KB	Read/Write	Read/Write
1.2MB	Not Compatible	Read/Write

**Note:** A 360KB diskette written to or formatted on a 1.2MB drive can be read reliably only on a 1.2MB drive.

For additional information, see "Diskette Drives and Diskettes" in the *IBM Personal System/2 Hardware Maintenance Reference General Information* pamphlet.

3.0 *Operating Requirements*

This section describes the operations that occur from the time the system is powered-on until the minimum operating requirements have been met.

Subtopics

3.1 Power Supply

3.2 Power-On Self-Test (POST)

3.3 System Memory

### 3.1 Power Supply

The manually-switchable power supply must be switched to either the 100-125 V ac or the 200-240 V ac range *before* the power cord is plugged into an outlet. The ac input is converted to dc outputs that supply the system with the proper operating voltages.

When the system is powered-off and then powered-on, the power supply generates a 'power good' signal that resets system logic. The presence of the 'power good' signal indicates that the power supply is operating properly.

The 'power good' signal turns on the green power-good light on the front of the system unit, indicating that all system-board power requirements have been met.

**Note:** There may be a 3 to 5 second delay before output voltages are generated after power-on, due to system sequencing requirements.

### 3.2 Power-On Self-Test (POST)

The POST, which is initiated automatically each time the system power is powered on, is a series of system checks and initializations that verify the correct operation of the system unit.

The POST tests only those areas that allow the system to be operational enough to run advanced diagnostics. It detects two types of errors: critical and noncritical.

*Critical errors* prevent the system from operating or can cause incorrect results that are apparent to the user. Examples of critical errors include microprocessor or interrupt-controller errors. If the POST detects a critical error, the microprocessor attempts to display the error and all testing stops.

*Noncritical errors* cause incorrect results that might not be apparent to the user. An example of a noncritical error would be a serial communications failure. If the POST detects a noncritical error, the microprocessor attempts to display the error. Pressing the F1 key allows the diskette to be loaded or the operating system to be initialized.

After a successful POST, one short beep occurs. Control is then given to a BIOS routine called the system bootstrap loader. The bootstrap loader attempts to load an operating system or a program from either a diskette or the fixed disk drive. If neither is present in the system, the Insert Diskette icon is displayed (see the *IBM Personal System/2 Non Micro Channel Diagnostics* pamphlet). This icon indicates that a self-starting (bootable) diskette should be inserted into one of the drives in the startup sequence. After the diskette is inserted, press the F1 key to resume operation. If the F1 key is pressed with no diskette in the diskette drive, the IBM BASIC screen appears (unless BASIC has been removed from the startup sequence).

### 3.3 System Memory

The system has at least 2MB of memory installed at the time of shipment. Additional memory-module kits can be installed in the second and third memory-module connectors on the system board. The maximum system-board memory capacity is 16MB in any combination of 1, 2, 4, or 8MB memory module kits.

When memory is added or removed from the system, run the set configuration program on the Starter Diskette.

If a memory errors occur, the system reallocates system-board memory in 1MB blocks for 1MB and 2MB memory modules and in 4MB blocks for 4MB and 8MB memory modules. If only 1MB of memory is installed and the POST detects a memory error, the entire 1MB of memory is deactivated and an error code is displayed.

#### 4.0 Specifications

##### Size

- Width: 440 mm (17.3 in.)
- Depth: 394 mm (15.5 in.)
- Height: 169 mm (6.65 in.).

##### Weight

- Maximum configuration: 15.9 kg (35 lb).

##### Environment

- Temperature:
  - Power-on: 10° to 35°C (50° to 95°F)
  - Power-off: 10° to 43°C (50° to 110°F).
- Humidity:
  - Power-on: 8% to 80%
  - Power-off: 8% to 80%.
- Maximum altitude: 2134 m (7000 ft).

##### Heat Output (Approximate)

- Minimum (as shipped by IBM): 90 British thermal units (BTUs) per hour (26 watts)
- Maximum: 1030 BTUs per hour (300 watts)

##### Electrical

- Input Voltage - Sinewave input (50 or 60 Hz)
  - Low Range:
    - Minimum: 90 V ac
    - Maximum: 137 V ac.
  - High Range:
    - Minimum: 180 V ac
    - Maximum: 265 V ac.
- Input kilovolt-amperes (kVA) (Approximate)
  - Configuration as shipped from IBM: 0.05 kVA
  - Maximum Configuration: 0.5 kVA.

5.0 Special Tools

The following special tools are required to service the system.

**Volt-Ohm Meter**

A meter similar to the Triplet Model 310. (1)

**Wrap Plug**

The Tri-Connector wrap plug (IBM part 72X8546) is used during advanced diagnostic tests of serial and parallel ports.

**Note:** Remove the rear cover before installing the wrap plug on the system board serial port.

PICTURE 2

(1) Manufactured by Triplet Corporation, Bluffton, Ohio 45817,  
U.S.A.

## 6.0 Removals and Replacements

This section contains information on removals and replacements, component locations, and system grounding.

The arrows in the removals and replacements figures show the direction of movement to remove a field replaceable unit (FRU), to turn a screw, or to press a tab to release a FRU. The arrows are marked in numeric order to show the correct sequence of removal.

When other FRUs must be removed prior to removing the failing FRU, they are listed at the top of the page. Go to the removal procedure for each FRU listed, remove the FRU, then continue with the removal of the failing FRU.

To replace a FRU, reverse the removal procedure and follow any notes that pertain to replacement. See "Locations" for internal cable connection and arrangement information.

### CAUTION:

Before removing any FRU, power-off the system, unplug all power cords from electrical outlets, and disconnect any interconnecting cables.

**Warning:** The system board, adapters, memory modules, math coprocessor, and circuit boards on the drives are sensitive to, and can be damaged by, electrostatic discharge. Establish personal grounding by touching a ground point with one hand before touching these units.

**Note:** An electrostatic discharge (ESD) strap may be used to establish personal grounding.

### Subtopics

- 6.1 1005 Cover
- 6.2 1010 Adapters
- 6.3 1015 Rear Cover
- 6.4 1020 Bus Adapter and Support Bracket
- 6.5 1025 Front Retainer Plate and Bezels
- 6.6 1030 Fixed Disk Drive
- 6.7 1035 Diskette Drive
- 6.8 1040 Power Supply
- 6.9 1045 Math Coprocessor
- 6.10 1050 Air Baffle
- 6.11 1060 Memory Module Kits
- 6.12 1065 System Board
- 6.13 1070 Control Panel Assembly
- 6.14 1080 Front Adapter Support Guide
- 6.15 1085 Cover Lock Assembly
- 6.16 1090 Real-Time Clock Module

6.1 1005 Cover

**CAUTION:**

Before removing any FRU, power-off the system, unplug all power cords from electrical outlets, and disconnect any interconnecting cables.

**Note:** Unlock the cover first.

PICTURE 3

6.2 1010 Adapters

Cover (1005)

**Note:** Before replacing an adapter, note the locations of the adapter and cables. When replacing an adapter, install the replacement adapter in the same slot as the adapter that was removed.

PICTURE 4

6.3 1015 Rear Cover

□ Cover (1005)

PICTURE 5

6.4 1020 Bus Adapter and Support Bracket

- Cover (1005)
- Adapters (1010)
- Rear Cover (1015).

PICTURE 6

6.5 1025 Front Retainer Plate and Bezels

Cover (1005)

**Note:** Remove left bezels from the bottom to top; replace them from top to bottom.

PICTURE 7

6.6 1030 Fixed Disk Drive

Warning: Improper shipping or handling can result in permanent loss of all data and formatting on the fixed disk drive. Have the user back up all information on the fixed disk drive.

- Cover (1005)
- Front Retainer Plate (1025).

PICTURE 8

6.7 1035 Diskette Drive

- Cover (1005)
- Front Retainer Plate (1025).

**Note:** Only 5.25-inch diskette drives require this 4-pin cable from the power supply 1 .

PICTURE 9

6.8 1040 Power Supply

- Cover (1005)
- Rear Cover (1015).

PICTURE 10

6.9 1045 Math Coprocessor

□ Cover (1005)

Warning: Establish personal grounding by touching a ground point with one hand before touching the math coprocessor. The math coprocessor can be damaged by electrostatic discharge. Remove the math coprocessor carefully.

**Note:** The system uses a 20-MHz 80387SX or equivalent math coprocessor. When replacing the math coprocessor, make sure the dot or dimple on the coprocessor is aligned with the beveled corner of the connector. (From the front of the system, the bevel is on the left rear corner.)

PICTURE 11

6.10 1050 Air Baffle

- Cover (1005)
- Adapters (1010).

PICTURE 12

6.11 1060 Memory Module Kits

- Cover (1005)
- Adapters (1010)
- Air Baffle (1050).

PICTURE 13

6.12 1065 System Board

- Cover (1005)
- Adapters (1010)
- Rear Cover (1015)
- Bus adapter and support bracket (1020)
- Math coprocessor, if installed (1045)
- Air Baffle (1050)
- Memory module kits (1060).

**Notes:**

1. Disconnect all cables from the system board.
2. When a new system board is installed, use the backup copy of the Starter Diskette to set the time and date, and to restore the configuration data.

PICTURE 14

6.13 1070 Control Panel Assembly

- Cover (1005)
- Front Retainer Plate (1025).

PICTURE 15

6.14 1080 Front Adapter Support Guide

- Cover (1005)
- Adapters (1010)
- Air Baffle (1050).

PICTURE 16

6.15 1085 Cover Lock Assembly

Cover (1005)

(Cover is upside down and viewed from the rear.)

PICTURE 17

6.16 1090 Real-Time Clock Module

Warning: Establish personal grounding by touching a ground point with one hand before touching the clock module. The clock module can be damaged by electrostatic discharge. Remove the clock module carefully. Do not bend the pins when installing the clock module.

- Cover (1005)
- Adapters (1010).

PICTURE 18

7.0 Locations

Subtopics

- 7.1 Front View
- 7.2 Rear View
- 7.3 Interior View
- 7.4 System Board

7.1 Front View

- 1 Cover lock
- 2 Diskette drive
- 3 Diskette in-use light
- 4 Diskette eject button
- 5 Fixed disk drive (if installed)
- 6 Fixed disk in-use light
- 7 Power-good light
- 8 Power switch
- 9 Optional drive bay
- 10 Optional drive bay
- 11 Serial number.

PICTURE 19

7.2 Rear View

- 1 Bolt-down holes
- 2 Power connector
- 3 Voltage selector switch
- 4 Display connector
- 5 Serial port connector
- 6 Parallel port connector
- 7 Expansion slots
- 8 Keyboard connector
- 9 Pointing-device connector.

**Note:** The display, serial port, parallel port, keyboard, and pointing device connectors are marked with icons.

PICTURE 20

7.3 Interior View

- 1 Fixed disk drive
- 2 Diskette drive
- 3 Retainer plate
- 4 Front adapter support guide
- 5 Air Baffle
- 6 Bus adapter and support bracket
- 7 Memory module connectors
- 8 System board
- 9 Expansion slots
- 10 Power supply.

PICTURE 21

7.4 System Board

- 1 Real-time clock-module connector
- 2 Pointing-device connector
- 3 Keyboard connector
- 4 Parallel port
- 5 Serial port
- 6 Display connector
- 7 Control panel connector
- 8 Power-supply connector (P2)
- 9 Power-supply connector (P1)
- 10 Diskette-drive connector
- 11 Fixed-disk drive connector
- 12 Password override connector (J14)
- 13 Math coprocessor connector
- 14 Bus-adapter connector
- 15 Memory-module connector 1
- 16 Memory-module connector 2
- 17 Memory-module connector 3.

PICTURE 22

8.0 Grounds

- 1 Chassis ground
- 2 Safety ground
- 3 Power cord connector.

PICTURE 23

**Notes:**