PICTURE 1

September 1990

This pamphlet is intended to be used with the IBM Personal System/2
Hardware Maintenance Reference manual (part number 15F2190).

Part Number 15F2250

Form Number S15F-2250-00

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Safety Information

Refer to the *Hardware Maintenance Reference General Information* pamphlet in this manual for the following safety information:

    General Safety

    Electrical Safety.

First Edition (September 1990)

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80387SX   Intel Corporation

Contents

1.0 Product Description

The IBM(*) Personal System/2(*) Model 55 computers use the IBM Micro
Channel(*) architecture. The features of the various types of Model 55
are:

    Security: cover lock and power-on password
    System board:
    -   16-MHz 80386SX(**) Microprocessor
    -   80387SX (**) Math Coprocessor connector
    -   1MB (MB = 1,048,576 bytes) random access memory (RAM)
    -   64 bytes of complementary metal-oxide semiconductor random access
        memory (CMOS RAM)
    -   2KB Non Volatile (NV) RAM (some models)
    -   Read-only memory basic input/output system (ROM BIOS)
    -   Video graphics array (VGA)
    -   Bus Adapter:
        -   Two 16-bit expansion slots
        -   One 16-bit slot with auxiliary video-connector extension
        -   One 2- by 34-pin edge connector for the fixed disk drive.
    -   Serial port
    -   Parallel port
    -   Diskette-drive controller
    -   Keyboard connector
    -   Pointing-device connector
    -   Display connector
    -   Fixed-disk-drive connector.
    Power supply:
    -   Manually switchable to the 100-125 Vac or the 200-240 Vac range
    -   50 or 60 Hz
    -   90 watts.
    Speaker
    101/102-key keyboard
    Fixed disk drives supported (see "Fixed Disk Drives" in topic 2.2).

 (**) Trademark on the Intel Corporation.

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 on the right side 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 *Hardware Maintenance Service*
pamphlet for the system you are servicing). The new assembly contains two
keys.

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pamphlet for the system you are servicing). The new 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 reverse the speaker connector 1 located
on the bus adapter. The change in the connector position is detected and
the password is deactivated. It is not necessary to reverse the connector
back to its previous position after service.

To reactivate the power-on password, start the system with the Reference
Diskette in drive A, select the **Set features** option, and follow the
instructions.

PICTURE 2

1.2 System-Board Features

The major features of the system board are:

```
80386SX Microprocessor
CMOS RAM
ROM BIOS
VGA
Serial port
Parallel port
Diskette-drive controller
Keyboard connector
Pointing-device connector.
```

Subtopics
1.2.1 Microprocessor
1.2.2 CMOS RAM
1.2.3 CMOS RAM Extension
1.2.4 ROM BIOS
1.2.5 VGA
1.2.6 Serial Port
1.2.7 Parallel Port
1.2.8 Diskette-Drive Controller
1.2.9 Keyboard Connector and Pointing-Device Connector

1.2.1 Microprocessor

The microprocessor interprets and carries out instructions. The 80386SX
Microprocessor is a 32-bit processor with a 16-bit external data bus and
operates in two modes: real-address mode and virtual-address (protected)
mode. The processor speed is 16 MHz.

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operates in two modes: real-address mode and virtual-address (protected)
mode. The processor speed is 16 MHz.

1.2.2 CMOS RAM

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

The real-time clock module is kept active by a built-in battery. If the battery is depleted, replace the real-time clock module.

1.2.3 CMOS RAM Extension

A 2KB (KB = 1024 bytes) CMOS RAM extension (may not be on some system
boards) stores additional configuration and system-status information.
The data stored in the CMOS RAM extension is kept active by a built-in
battery when the system is powered-off. If the stored data is lost, the
data can be restored using one of the following methods:

    If the user has a customized configuration that uses settings other
    than the default, run the restore configuration program on the user's
    backup copy of the Reference Diskette.

    If the configuration uses the default settings, run the automatic
    configuration program on the Reference Diskette.

1.2.4 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.

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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.

1.2.5 VGA

The VGA is a graphics controller on the system board. The VGA 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 VGA supports a maximum of 720-by-400 picture elements (PELs) in the
text mode and 640-by-480 PELs in the graphics mode. The VGA can support
256 colors or 64 shades of gray at one time. Composite video is not
supported.

One expansion slot on the system board bus adapter extends farther to the
rear of the system board than the others. This extended expansion slot
accommodates video adapters that are designed to interface with the
system-board VGA. Some of these adapters have a display connector of
their own. The extended expansion slot also supports all adapters
designed to be installed in the shorter slots.

1.2.6 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 by the system configuration as either SERIAL 1 or SERIAL 2.

If adapters with serial ports are installed in the system, they can be configured from SERIAL 1 to SERIAL 8.

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

1.2.7 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 an input/output port for any
device or application that matches the input/output capabilities of the
port. When adapters with additional parallel ports are installed, the
system can support three different devices, each addressed separately as
PARALLEL 1, PARALLEL 2, or PARALLEL 3.

Note: Conflicts occur when two or more devices have the same address.
Select the **Set configuration** option on the Reference Diskette.
Select **View configuration** to verify that no lines are addressed the
same.

1.2.8 Diskette-Drive Controller

The controller connects to the diskette drive through a single 40-pin connector on the system board. Signals and voltages are supplied through the diskette-drive cable that plugs into the connector.

1.2.9 Keyboard Connector and Pointing-Device Connector

The two 6-pin connectors at the rear of the system board are for a
keyboard and a pointing device (mouse). The keyboard connector is marked
with a small keyboard figure molded into the back panel; the unmarked
connector is for the pointing device. The interface logic is the same for
both.

1.2.9 Keyboard Connector and Pointing-Device Connector

The two 6-pin connectors at the rear of the system board are for a
keyboard and a pointing device (mouse). The keyboard connector is marked
with a small keyboard figure molded into the back panel; the unmarked
connector is for the pointing device. The interface logic is the same for
both.

2.0 Option Compatibility

The Model 55 uses most of the adapters designed for the Model 50 and Model 60 computers. All supported 16-bit non-video adapters operate in any expansion slot. For supported options, see the parts section in the *Hardware Maintenance Service* pamphlet for the system you are servicing.

Subtopics
2.1 Drive and Diskette Compatibility
2.2 Fixed Disk Drives
2.3 Terminators

2.1 Drive and Diskette Compatibility

The following provides information concerning the identification of
diskette drives.

```
+-------------------------------------+
¦ Diskette Drive  ¦ Identifying Mark  ¦
+-----------------+-------------------¦
+-----------------+-------------------¦
¦ 3.5 Inch - 720KB ¦ None             ¦
+-----------------+-------------------¦
¦ 3.5 Inch -      ¦ 1.44 on the Eject ¦
¦ 1.44MB          ¦ Button            ¦
+-----------------+-------------------¦
¦                 ¦                   ¦
+-------------------------------------+
```

The following addresses the compatibility of diskettes to diskette drives.

```
+---------------------------------------------+
¦ Diskette   ¦ 720KB            ¦ 1.44MB       ¦
¦ Capacity   ¦ Drive            ¦ Drive        ¦
+------------+------------------+------------- ¦
¦ 1.0MB      ¦ Read/Write       ¦ Read/Write   ¦
+------------+------------------+------------- ¦
¦ 2.0MB      ¦ Not Compatible   ¦ Read/Write   ¦
+------------+------------------+------------- ¦
¦            ¦                  ¦              ¦
+---------------------------------------------+
```

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

2.2 Fixed Disk Drives

Several fixed disk drives are available for PS/2 (*) systems. The fixed
disk drive and fixed-disk-drive interface must be the same. For example,
an enhanced small device interface (ESDI) adapter must be used with an
ESDI drive. For supported fixed disk drives, see the parts section in the
Hardware Maintenance Service pamphlet for the system you are servicing.

The Model 55 uses fixed disk drives that automatically position the
read/write heads in nondata areas when the system is powered-off. No
special precautions are required regarding parking the heads when moving
the computer.

 (*) Trademark of the International Business Machines
     Corporation.

2.3 Terminators

Diskette Drives: do not use or require terminators.

ESDI and ST506 Fixed Disk Drives: do not use or require terminators.

SCSI Fixed Disk Drives: one or more cables are used to connect the fixed-disk adapters to the fixed disk drives. For each cable used, the last drive on the cable must have a terminator.

The location, quantity, and appearance of the terminator may vary from drive to drive. An identification label or tag (usually "T-RES") is attached to the terminator for easy identification.

Note: For additional information, see "SCSI Devices" in the "Options and Adapters (Micro Channel)" section of this manual.

3.0 Operating Requirements

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

Subtopics
3.1 Power Supply
3.2 Power-On Self-Test (POST)
3.3 System Memory

3.0 Operating Requirements

This section describes the operations that occur from the time the system
is powered-on until the minimum operating requirements are 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 Vac or the 200-240 Vac range *before* the power cord is plugged into
an outlet. The ac input is converted to dc outputs that supply the system
with proper operating voltages.

When the system is powered-off for 10 seconds or more 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 and that the minimum under-voltage sense levels have
been established. This means that all system-board power requirements
have been met.

Output (Vdc)	Minimum Under-Voltage Sense Level (Vdc)
+ 5.0	+ 4.5
– 5.0	– 4.2
+12.0	+10.8
–12.0	–10.2

3.2 Power-On Self-Test (POST)

The POST is initiated automatically each time the system power is turned
on.

The POST 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. The POST can detect two types of errors: critical and
noncritical.

Critical errors prevent the system from operating or 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, all
testing stops and the microprocessor displays an error code. Pressing the
F1 key allows testing to continue.

Subtopics
3.2.1 Systems with Diskette Drives
3.2.2 Medialess Systems

3.2.1 Systems with Diskette Drives

When the Reference Diskette is in drive A, and a noncritical error is
detected, the system displays the POST error message along with a message
generated from the Reference Diskette. The Reference Diskette message
instructs the user to take a specific action to correct the error.

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 Micro Channel
Diagnostics* pamphlet in this manual). This icon indicates that a
diskette should be inserted into drive A. After the diskette is inserted,
press the F1 key to resume operation. If the F1 key is pressed when no
diskette is in the diskette drive, the IBM Cassette BASIC screen appears.

3.2.2 Medialess Systems

To access the Diagnostic program (Reference Diskette image) from the file
server, contact the LAN administrator. After the LAN administrator makes
the Diagnostic program available to the system you are servicing, power-on
the system and the Reference Diskette image will operate the same as the
Diagnostic program on the Reference Diskette.

When the Reference Diskette image is accessed from the file server, and a
noncritical error is detected, the system displays the POST error message
along with a message generated from the Reference Diskette image. The
Reference Diskette image instructs the user to take a specific action to
correct the error.

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 the file server.

3.3 System Memory

Subtopics

3.3.1 System-Board Memory

The Model 55 has at least 1MB of memory installed at the time of shipment.
An additional memory-module kit can be installed in the second
memory-module connector on the system board. The maximum system board
memory capacity is 8MB (4MB memory module kits installed in memory-module
connector 1 and 2). A memory-module kit must be installed in memory
module connector 1. The system can support a total of 16MB of memory.

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3.3.2 Memory-Expansion Adapters

Memory-expansion adapters can be installed in any 16-bit expansion slot.

3.3.2 Memory-Expansion Adapters

Memory-expansion adapters can be installed in any 16-bit expansion slot.

3.3.3 Memory Requirements and Limitations

The system board *does not* have to be fully populated before
memory-expansion adapters can be installed, and a memory-expansion adapter
does not have to be filled to capacity before another memory-expansion
adapter can be installed.

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

3.3.3 Memory Requirements and Limitations

The system board *does not* have to be fully populated before
memory-expansion adapters can be installed, and a memory-expansion adapter
does not have to be filled to capacity before another memory-expansion
adapter can be installed.

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

3.3.4 Memory Errors

The Model 55 reallocates system-board memory in 1MB blocks. If the POST
detects a memory error in the first 1MB of system-board memory, the entire
1MB of memory is deactivated and an error code is displayed.

4.0 Specifications

Size

```
Width:   406 mm (16 in.)
Depth:   397 mm (15.6 in.)
Height:  102 mm (4 in.).
```

Weight

```
8.6 kg (19 lb)
```

Environment

```
Temperature:
-   Power on:  16° to 32°C (60° to 90°F)
-   Power off:  10° to 43°C (50° to 110 °F).
Humidity:
-   Power on:  8% to 80%
-   Power off:  5% to 80%.
Maximum altitude:  2134 m (7000 ft).
```

Heat Output

```
475 British thermal units (BTUs) per hour (140 watts per hour).
```

Electrical

```
Input voltage (Sinewave input is required)
-   Low Range:
    -   Minimum:  90 Vac
    -   Maximum:  137 Vac.
-   High Range:
    -   Minimum:  180 Vac
    -   Maximum:  265 Vac.
Input kilovolt-amperes (kVA)
-   Minimum Configuration (as shipped from IBM):  .08 kVA
-   Maximum Configuration:  Approximately .25 kVA.
```

5.0 Special Tools

The following special tools are required to service the Model 55.

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 the advanced
diagnostic tests of the serial and parallel ports.

The Tri-Connector wrap plug replaces the following:

```
    (IBM part 8529228) Printer Adapter wrap plug
    (IBM part 8286126) Serial Port wrap plug
    (IBM part 8529280) Communications Adapter wrap plug
    (IBM part 62X1083) Communications wrap plug 25-pin
    (IBM part 62X1084) Communications wrap plug  9-pin.
```

                          PICTURE 3

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

6.0 Removals and Replacements

The arrows in the removals and replacements show the direction of movement
to remove a FRU, to turn a screw, or to press a tab to release the 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, and 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 field replaceable unit (FRU), power-off the system,
unplug all power cords from electrical outlets, and disconnect any
interconnecting cables.

Warning: The system board, adapters, memory modules, and the math
coprocessor 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 Bus Adapter and Bus Adapter Support Bracket
6.4 1020 Fixed Disk Drive and Fixed Disk Drive Bezel
6.5 1025 Diskette Drive and Diskette Drive Bezel
6.6 1030 Cover Lock Assembly
6.7 1035 Real-Time Clock Module
6.8 1040 Power Supply and Switch Link
6.9 1045 Math Coprocessor
6.10 1050 Memory Module Kits
6.11 1055 System Board
6.12 1060 Rear Cover
6.13 1065 Speaker and Adapter Guide
6.14 1070 Front Bezel
6.15 1075 Drive Cradle and Grounding Bracket
6.16 1080 Adapter Support Panel

6.1 1005 Cover

CAUTION:
Before removing any field replaceable unit (FRU), power-off the system,
unplug all power cords from electrical outlets, and disconnect any
interconnecting cables.

Note: Unlock the cover and loosen the cover screws 1.

PICTURE 4

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.

Stored configuration information depends on the location of the
adapter. If the replacement adapter is installed in a different
location, run the set configuration program on the user's Reference
Diskette to reset the system-configuration information.

PICTURE 5

6.3 1015 Bus Adapter and Bus Adapter Support Bracket

Cover **(1005)**
Adapters **(1010).**

Note: Disconnect any cables attached to the bus adapter.

PICTURE 6

6.3 1015 Bus Adapter and Bus Adapter Support Bracket

Cover **(1005)**
Adapters **(1010).**

Note: Disconnect any cables attached to the bus adapter.

PICTURE 6

6.4 1020   Fixed Disk Drive and Fixed Disk Drive Bezel

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)**

                            PICTURE 7

6.5 1025 Diskette Drive and Diskette Drive Bezel

Cover **(1005)**

PICTURE 8

PICTURE 9

6.6 1030 Cover Lock Assembly

Cover **(1005)**

PICTURE 10

6.6 1030 Cover Lock Assembly

Cover **(1005)**

PICTURE 10

6.7 1035 Real-Time Clock Module

Warning: Remove the clock module carefully. Do not bend the pins when
removing the clock module. The clock module can be damaged by
electrostatic discharge, prying between the connector, or prying between
the connector and the system board.

    Cover **(1005)**
    Adapters **(1010)**.

           PICTURE 11

6.8 1040 Power Supply and Switch Link

Cover **(1005)**
Bus-adapter support bracket **(1015).**

PICTURE 12

6.8 1040 Power Supply and Switch Link

Cover **(1005)**
Bus-adapter support bracket **(1015).**

PICTURE 12

6.9 1045 Math Coprocessor

> Cover **(1005)**
> Remove any option adapter **(1010)** that may hinder removal and
> replacement of the math coprocessor.

The system will not operate properly if the math coprocessor is not
installed correctly or is the wrong type for the system.

Warning: Remove the math coprocessor carefully. Do not bend the pins
when removing the math coprocessor. The math coprocessor can be damaged
by electrostatic discharge, prying between the module and connector, or
prying between the connector and system board. Establish personal
grounding by touching a ground point with one hand before touching the
math coprocessor.

Note: The Model 55 uses a 16-MHz 80387SX Math Coprocessor. When
       replacing the math coprocessor, make sure the dot on the
       coprocessor is aligned with the dot on the system board.

                         PICTURE 13

6.10 1050 Memory Module Kits

     Cover **(1005)**
     Fixed-disk-drive cable
     Bus-adapter support bracket **(1015).**

Note: When servicing the two side-by-side memory-module kits, remove the
       kit in connector 2 before attempting to remove the kit in connector
       1. A memory-module kit must be installed in connector 1.

                         PICTURE 14

                         6.10 - 1

6.11 1055 System Board

    Cover **(1005)**
    Adapters **(1010)**
    Bus adapter and bus-adapter support bracket **(1015)**
    Math coprocessor, if installed **(1045)**
    Memory module kits **(1050).**

Notes:

1. Disconnect all cables from the system board.

2. When a new system board is installed, use the backup copy of the
    Reference Diskette to set the time and date, and to restore unique
    configuration data.

PICTURE 15

6.12 1060 Rear Cover

Cover **(1005)**

PICTURE 16

6.13 1065 Speaker and Adapter Guide

    Cover **(1005)**
    Adapters **(1010).**

PICTURE 17

6.14 1070 Front Bezel

    Cover **(1005)**
    Fixed disk drive and bezel **(1020)**
    Diskette drive and bezel **(1025)**
    Speaker and adapter guide **(1065)**.

                     PICTURE 18

6.15 1075 Drive Cradle and Grounding Bracket

Cover **(1005)**
Option adapters **(1010)**
Fixed disk drive **(1020)**
Diskette drive **(1025)**
Speaker and adapter guide **(1065)**
Front bezel **(1070).**

PICTURE 19

6.15 - 1

6.16 1080 Adapter Support Panel

    Cover **(1005)**
    Option adapters **(1010)**
    System board **(1055)**
    Rear cover **(1060).**

                        PICTURE 20

7.0 Locations

Subtopics

7.1 Front View

```
     1  Diskette drive
     2  Diskette eject button
     3  Fixed disk drive
     4  Power switch
     5  Serial number
     6  Cover lock.
```

```
                PICTURE 21
```

```
     1  Diskette drive
     2  Diskette eject button
     3  Fixed disk drive
     4  Power switch
     5  Serial number
     6  Cover lock.
```

7.2 Rear View

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

PICTURE 22

7.3 Interior View

```
1  Fixed disk drive
2  Bus adapter
3  Diskette drive
4  Speaker and adapter guide
5  System board
6  Expansion slots
7  Power supply
8  Fixed-disk-drive cable
9  Diskette-drive cable.
```

PICTURE 23

7.4 *System Board*

```
 1  Display connector
 2  Serial port
 3  Parallel port
 4  Pointing-device connector
 5  Keyboard connector
 6  Fuse
 7  Power-supply connector (P7)
 8  Power-supply connector (P14)
 9  Memory-module connector 1
10  Memory-module connector 2
11  Diskette-drive connector
12  80387SX Math Coprocessor connector
13  Real-time clock-module connector
14  2KB CMOS RAM extension module connector (2)
14  2KB NV RAM extension module connector (2)
15  Bus-adapter connector.
```

PICTURE 24

 (2) May not be present on all system boards.

8.0 Safety Grounds

```
     1   Chassis ground
     2   Primary ground
```

PICTURE 25