FRONT

PICTURE 1

March 21, 1990

This pamphlet provides the required legal, safety, and general information
for servicers and should be used with the IBM(*) Personal System/2(*)
Hardware Maintenance Service manual (part number 15F2200) when servicing
equipment.

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1.0 IBM Personal System/2 Hardware Maintenance Library

The IBM (*) Personal System/2 (*) Hardware Maintenance Library (HML)
consists of two manuals and also the Reference Diskettes and Advanced
Diagnostics Diskettes that contain the advanced diagnostics tests. The
HML provides the information needed to diagnose and isolate problems to a
field replaceable unit (FRU).

The *Hardware Maintenance Reference* manual has model-specific pamphlets
that provide reference information. The information includes general
information, product descriptions, removal and replacement procedures,
repair information, and introductory information about the advanced
diagnostic tests. A supplemental section is included for options,
adapters, and other information.

The *Hardware Maintenance Service* manual provides the necessary information
for a trained service person to diagnose a failure to the FRU. This
manual contains a general information pamphlet, model-specific service
pamphlets, and an external devices parts catalog. This manual also
includes the Reference Diskettes and Advanced Diagnostic Diskettes that
contain the advanced diagnostic tests.

 (*) IBM and Personal System/2 are trademarks of the
     International Business Machines Corporation.

2.0 General Safety

Use these rules to ensure general safety:
   Observe good housekeeping in the area of the machines during
   maintenance and after completing it.
   When lifting any heavy object:
   1. Ensure you can stand safely without slipping.
   2. Distribute the weight of the object equally between your feet.
   3. Use a slow lifting force. Never move suddenly or twist when you
       attempt to lift.
   4. Lift by standing or by pushing up with your leg muscles; this
       action removes the strain from the muscles in your back. *Do not
       attempt to lift any objects that that weigh more than 16 kg (35
       lb) or objects that you think are too heavy for you.*
   Do not perform any action that causes hazards to the customer or that
   makes the equipment unsafe.
   Before you start the machine, ensure that other service
   representatives and the customer's personnel are not in a hazardous
   position.
   Put removed covers and other parts in a safe place, away from all
   personnel, while you are servicing the machine.
   Keep your tool case away from walk areas so that other people will not
   trip over it; for example, put it under a desk or table.
   Do not wear loose clothing that can be trapped in the moving parts of
   a machine. Ensure that your sleeves are fastened or rolled up above
   your elbows. If your hair is long, fasten it.
   Insert the ends of your necktie or scarf inside other clothing or
   fasten the necktie with a clip, preferably nonconductive,
   approximately 8 centimeters (3 inches) from the end.
   Do not wear jewelry, chains, metal-frame eyeglasses, or metal
   fasteners for your clothing.

   Remember: A metal object lets more current flow if you touch a live
   conductor.
   Wear safety glasses when you are:
   -   Using a hammer to drive pins or similar parts
   -   Drilling with a power hand-drill
   -   Using spring hooks or attaching springs
   -   Soldering parts
   -   Cutting wire or removing steel bands
   -   Cleaning parts with solvents, chemicals, or cleaning fluids
   -   Working in any other conditions that might be hazardous to your
       eyes.
   After maintenance, reinstall all safety devices such as shields,
   guards, labels, and ground wires. Exchange any safety device that is
   worn or defective for a new one.

   Remember: Safety devices protect personnel from hazards. You destroy
   the purpose of the devices if you do not reinstall them before
   completing your service call.
   Reinstall all covers correctly before returning the machine to the
   customer.

3.0 Electrical Safety

Observe these additional rules when working on equipment powered by
electricity:
   Find the room emergency power-off (EPO) switch or disconnecting
   switch. If an electrical accident occurs, you can then operate the
   switch quickly.
   Do not work alone under hazardous conditions or near equipment that
   has hazardous voltages.
   Disconnect all power:
   -    Before removing or installing main units
   -    Before working near power supplies
   -    Before doing a mechanical inspection of power supplies
   -    Before installing changes in machine circuits.
   Before you start to work on the machine, unplug the machines power
   cable. If you cannot unplug the cable easily, ask the customer to
   switch off the wall box that supplies power to the machine and to lock
   the wall box in the off position.
   If you need to work on a machine that has *exposed* electrical circuits,
   observe the following precautions:
   -    Ensure that another person, who is familiar with the power-off
        controls, is near you.

        Remember: Another person must be there to switch off the power,
        if necessary.

        CAUTION:
        Some hand tools have handles covered with a soft material that
        does not insulate you when working with live electrical currents.
        Use only tools and testers that are suitable for the job you are
        doing.

   -    Use only one hand when working with powered-on electrical
        equipment; keep the other hand in your pocket or behind your back.

        Remember: There must be a complete circuit to cause electrical
        shock. By observing the above rule, you may prevent a current
        from passing through your body.
   -    When using testers, set the controls correctly and use the
        approved probe leads and accessories for that tester.

        CAUTION:
        Many customers have, near their equipment, rubber floor mats that
        contain small conductive fibers to decrease electrostatic
        discharges. Do not use this type of mat to protect yourself from
        electrical shock.

   -    Stand on suitable rubber mats (obtained locally, if necessary) to
        insulate you from grounds such as metal floor strips and machine
        frames.
   Observe the special safety precautions when you work with very high
   voltages; these instructions are in the safety sections of maintenance
   information. Use extreme care when measuring high voltages.
   Regularly inspect and maintain your electrical hand tools for safe
   operational condition.
   Do not use worn or broken tools and testers.
   Never assume that power has been disconnected from a circuit. First,
   check that it has been switched off.
   Always look carefully for possible hazards in your work area.
   Examples of these hazards are moist floors, nongrounded power
   extension cables, power surges, and missing safety grounds.
   Do not touch live electrical circuits with the reflective surface of a
   plastic dental mirror. The surface is conductive; such touching can
   cause personal injury and machine damage.
   Unless the maintenance information specifically lets you, do not
   service the following parts *with power on them* when they are removed
   from their normal operating places in a machine:
   -    Power supply units
   -    Pumps
   -    Blowers and fans
   -    Motor generators

   and similar units. (This practice ensures correct grounding of the
   units.)
   If an electrical accident occurs:
   -    **Use caution; do not become a victim yourself.**
   -    **Switch off power.**
   -    **Send another person to get medical aid.**

4.0 Safety Inspection Guide

The intent of this inspection guide is to assist you in identifying
potentially unsafe conditions on these products. Each machine, as it was
designed and built, had required safety items installed to protect users
and service personnel from injury. This guide addresses only those items.
However, good judgment should be used to identify potential safety hazards
due to attachment of non-IBM features or options not covered by this
inspection guide.

If any unsafe conditions are present, a determination must be made on how
serious the apparent hazard could be and whether you can continue without
first correcting the problem.

Consider these conditions and the safety hazards they present:
    Electrical hazards, especially primary power: primary voltage on the
    frame can cause serious or fatal electrical shock.
    Explosive hazards, such as a damaged CRT face or bulging capacitor,
    can cause serious injury.
    Mechanical hazards, such as loose or missing hardware, can cause
    serious injury.

The guide consists of a series of steps presented in a checklist. Begin
the checks with the power off and the power cord removed from the power
receptacle.

Checklist:
1. Check exterior covers for damage (loose, broken, or sharp edges).
2. Power off the system. Disconnect the power cord from the electrical
    outlet.
3. Check the power cord for:
    a. A third-wire ground connector in good condition. Use a meter to
        measure third-wire ground continuity for 0.1 ohm or less between
        the external ground pin and frame ground.
    b. The cord set should be the appropriate molded type as specified in
        the parts section of the *Hardware Maintenance Service* pamphlet for
        the model you are servicing.
    c. Insulation must not be frayed or worn.
4. Remove the cover.
5. Check for any obvious non-IBM alterations. Use good judgment as to
    the safety of any non-IBM alterations.
6. Check inside the unit for any obvious unsafe conditions, such as metal
    filings, contamination, water or other liquids, or signs of fire or
    smoke damage.
7. Check for worn, frayed, or pinched cables.
8. Check that the power-supply cover fasteners (screws or rivets) have
    not been removed or tampered with.

5.0 Switches and Jumpers (PS/2 Non-Micro Channel Systems)

The following information applies to the various options and adapters
supported by PS/2 non- Micro Channel (*) systems.

5.1 Option Compatibility (Non-Micro Channel Systems)

Certain option adapters conflict when used in the same system. The
following adapters should not be installed together in your system unit:
     Synchronous Data Link Control (SDLC) adapter
     Alternate Binary Synchronous Communications (Alt. BSC) adapter.

5.1 - 1

5.2 BIOS ROM Identification

To determine the date of the BIOS ROM module, run the following BASIC
program. Type the program exactly as shown. Press Enter after each line.

```
10 DEF SEG=&HF000
20 FOR X=&HFFF5 TO &HFFFD
30 PRINT CHR$(PEEK(X));
40 NEXT
RUN
```

The date that is displayed is the date of your BIOS ROM module.

 (*) Micro Channel is a trademark of the International Business
     Machines Corporation.

5.3 Setting Switches

The following figure applies to the switch settings shown in this section.

PICTURE 2

Note: For some options, the customer must supply information for correct
        setting of jumpers or switches.

To set a slide switch 1, slide the lug of the switch to the desired
position; to set a rocker switch 2, press the rocker down to the desired
position.

                              PICTURE 3

5.4 PC Network Adapter

Jumper Position (See figure)	Function
W1	Automatic Remote Program Load (RPL)
W2	Not Used
W3	Sets the adapter to use Interrupt Level 2
W4	Sets the adapter to use Interrupt Level 3
W5 & W7	Sets the adapter as alternate adapter
W6	Sets the adapter as primary adapter
W8	Enables ROM on the adapter (see Note)

Note: Do not enable ROM on more than one adapter.

PICTURE 4

5.5 Binary Synchronous Communications (BSC) Adapter

1   Jumper Position - Primary Mode

2   Jumper Position - Alternate Mode

3   Jumpers must be set as shown.

PICTURE 5

5.5 - 1

5.5 Binary Synchronous Communications (BSC) Adapter

1   Jumper Position - Primary Mode

2   Jumper Position - Alternate Mode

3   Jumpers must be set as shown.

PICTURE 5

5.6 Data Acquisition and Control (DAC) Adapter

PICTURE 6

5.6 - 1

5.7 Analog Output Range

PICTURE 7

Note: Only the switch settings shown may be used.

5.8 Analog Input Range

PICTURE 8

Note: Only the switch settings shown may be used.

5.9 Adapter Number

PICTURE 9

Note: Only the switch settings shown may be used.

5.10 Interrupt Request (IRQ) Level

PICTURE 10

Note: Only the switch settings shown may be used.

5.10 Interrupt Request (IRQ) Level

PICTURE 10

Note: Only the switch settings shown may be used.

5.11 General Purpose Interface Bus (GPIB) Adapter

PICTURE 11

1   Adapter Number Jumpers

2   Interrupt Acknowledge (INT ACK) Level Jumpers

3   Interrupt Request (IRQ) Level Jumpers

4   DMA Channel Jumpers

Note: See the following figures for GPIB adapter jumper settings.

5.12 Adapter Number

Each GPIB adapter installed in the same system must have its own adapter
number.

PICTURE 12

5.12 - 1

5.12 Adapter Number

Each GPIB adapter installed in the same system must have its own adapter
number.

PICTURE 12

5.13 Interrupt Request (IRQ) Level

The GPIB adapter can share its IRQ level with other adapters that use
shared interrupts.

PICTURE 13

5.13 - 1

5.13 Interrupt Request (IRQ) Level

The GPIB adapter can share its IRQ level with other adapters that use
shared interrupts.

PICTURE 13

5.14 Interrupt Acknowledge (INT ACK) Level

 The interrupt acknowledge (INT ACK) and interrupt request (IRQ) levels
must be the same.

PICTURE 14

5.14 - 1

5.15 Direct-Memory Access (DMA) Channel

PICTURE 15

5.15 - 1

5.15 Direct-Memory Access (DMA) Channel

PICTURE 15

5.16 Serial/Parallel Adapter

PICTURE 16

1   Alternate Serial Port Setting

2   Primary Serial Port Setting

3   Alternate Parallel Port Setting

4   Primary Parallel Port Setting

Note: The alternate settings must be used for the Serial/Parallel
        Adapter. If either port is set to the primary setting, the adapter
        will override the corresponding port on the system board and cause
        an error during diagnostic tests.

Notes:
Notes:

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