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PREFACE About this Manual

This manual contains hardware and maintenance information previously contained in the Hardware Maintenance Reference and Hardware Maintenance Service booklets for IBM (*) Personal System/2 (*) Displays. The materials have been combined and condensed where reference information and service procedures are the same for all displays. This information appears in the first part of this book, "Part I. General Service Information."

Information specific to each display appears in the chapters listed under the second part of this book, "Part II. Display-Specific Service Information." These chapters include all removal and replacement steps and service procedures that apply only to that specific display.

The third part of the book, "Part III. Parts Catalog," lists all parts and parts numbers for serviceable displays, lists all Element Exchange displays with part numbers, and includes a complete list of the tools and test equipment needed for servicing displays of any type.

To use this manual:

1. Determine which display you will be servicing
2. Use the diagnostic guide to pinpoint problems
3. Follow the common removal procedures to gain access to the display components you will be servicing
   - refer to the display-specific removal procedures for components particular to that display
4. Continue to the display-specific service information chapter for the display you are servicing for:
   - function checks
   - pattern checks
5. Consult "Part III. Parts Catalog" for parts numbers of components you must replace
6. Return to the removal and replacement procedures to replace parts on the display
7. Use display-specific adjustment procedures to return the display to normal function.

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This material summarizes safety procedures you should follow in servicing and maintaining PS/2 Displays.

Subtopics
FRONT_2.1 Safety Labels
FRONT_2.2 Safety at Work
FRONT_2.3 Cathode Ray Tube (CRT) Safety

FRONT_2.1 Safety Labels

The following safety labels are used on all PS/2 Displays. Small symbols are also used to identify high voltages on some components.

PICTURE 1

Figure 0-1. Example Safety Labels

FRONT_2.2 Safety at Work

This product meets IBM safety standards.

The following information has been included in this publication for the use and safety of IBM personnel. For more information, see *Electrical Safety for IBM Service Representatives*, S229-8124, and *Safety/Health Guidelines for IBM Service Representatives*, S241-5493.

Use these rules to ensure general safety:

- Observe good housekeeping in the area of the machines during and after completing maintenance.

- Use only field-supply items (such as adhesives, cleaning fluids, lubricants, paints, and solvents) that have been approved by IBM, that is, are supplied under an IBM part number.

- When lifting any heavy object:

  1. Ensure that you can stand safely without slipping.
  2. Balance the weight of the object between your two 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 you think are too heavy for you.*

- Do not perform any action that causes hazards to the customer or that makes the equipment unsafe.

- Put removed covers and other parts in a safe place, away from all personnel, while you are servicing the machine.

- Always keep your tool case away from walk areas so that other persons 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 are rolled up above the elbows. If your hair is long, fasten it.

- Do not wear jewelry, chains, metal-frame eyeglasses, or metal fasteners for your clothing.

  Note: Remember: A metal object lets more current flow if you touch a live conductor.

- 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 ends.

- 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.

- Before you start the machine, ensure that other service representatives and the customer's personnel are not in a hazardous position.

- 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.

  Note: 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.

FRONT_2.3 Cathode Ray Tube (CRT) Safety

See also *General Safety CEM 100 (87)*.

The primary hazard of CRTs is flying glass as a result of an implosion. The following sections describe different phases of CRT safety. All phases are equally important and negligence in any area could result in possible injury to an employee or customer.

Any additional information or variation from this information will be included in CEM/Service Aids.

Subtopics
FRONT_2.3.1 Storage of CRTs
FRONT_2.3.2 Maintenance and Installation of CRTs
FRONT_2.3.3 Disposal of CRTs

FRONT_2.3.1 Storage of CRTs

1. Cathode ray tubes must be enclosed when received, transported, or otherwise moved from area to area.

   If they are shipped in a carton, they must be in the original carton or one of equivalent strength, and securely sealed to prevent accidental opening. Also, original or equivalent packing materials and forms must be placed inside the carton to give the CRT proper support and protection. If CRTs are transported in a unit or piece of equipment, the equipment must be able to contain the glass fragments should an implosion occur.

2. CRTs should be stacked as directed on the manufacturer's carton. When in doubt, stack with faceplate (viewing surface) down. Cartons should not be stacked more than two high.

3. CRT storage areas must be away from the normal flow of material handling equipment and pedestrian traffic. Also, storage areas must be dry to ensure that cartons will not absorb moisture and collapse.

FRONT_2.3.2 Maintenance and Installation of CRTs

1. No one shall be permitted to install, adjust, maintain, replace, or handle high-vacuum CRTs until they have reviewed these instructions.

2. CRTs when received, transported, or otherwise moved from area to area should be completely enclosed in their original shipping cartons and sealed.

3. When handling CRTs, personnel must wear safety equipment at all times. The minimum safety equipment required is:

   a. Safety glasses -- IBM part number 5715010.
   b. Long-sleeved garment.

4. CRTs under vacuum will not be permitted to remain out of their cartons unless they are under test or inspection.

5. Do not scratch or bump any part of the CRT because this may weaken the glass and cause it to implode.

6. Before removing any CRT, discharge all stored potential that may exist on the CRTs anode button or base socket pins and the capacitor in the high-voltage supply. The procedures for discharging CRTs are explained in "High Voltage Discharge Procedure" as part of the steps in removal and replacement.

   Note: Some CRTs contain a conductive coating on both the inside and outside surfaces to form a capacitor. Within some CRTs, a second capacitive charge builds up following the original discharge. It is therefore important to discharge each CRT a second time immediately before removal.

7. Do not handle CRTs by the neck alone. The neck is the weakest part of the CRT and is easily broken. Always handle CRTs with two hands. If the CRT is shipped with a lifting strap, use this strap for removing a CRT from, and placing a CRT into, the shipping container.

8. When CRTs are inserted or removed from equipment, they must be supported by the large end while carefully guiding the neck in or out of position. The lifting strap, if available, can be used in this process.

9. Do not place the CRT on a table or bench when there is any possibility of the CRT rolling. If it is necessary to place a CRT anywhere except in its special carton, a piece of felt or other soft material should be placed under it to prevent scratching the glass. Place larger CRTs vertically on their faces, and not on their sides, to prevent the possibility of rolling.

10. When a CRT is removed from equipment, it should be enclosed in its shipping container as soon as possible to reduce the chances of breaking. Cathode ray tubes should each be placed in their cartons with the large face end up and the neck down. Ensure that the weight of the CRT is not resting on the neck. The container should be sealed securely with strong tape and, to prevent tipping, turned over so the CRT is positioned face down.

FRONT_2.3.3 Disposal of CRTs

Field personnel must not release the vacuum in CRTs. Dispose of CRTs in accordance with existing safe working procedures.

1.0 Part I. General Service Information

The following chapters contain general service information about the PS/2 (*) Displays. This information includes descriptions of display operation, basic diagnostics, and removal and replacement procedures.

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Subtopics

1.1 1. Operation

IBM Personal System/2 Displays are analog displays with three to six externally controlled display modes.

All displays have the following features:

- Tilt or lift tilt swivel stands
- Three to six operating modes (resolution controls)
- Brightness control
- Power-on LED indicator
- Power-on/off pushbutton
- Display self-test with a white screen test pattern
- For color displays, analog video inputs that allow an infinite number of color choices
- Automatic degaussing
- Very low magnetic field (VLMF) characteristics
- Low electrostatic field (ESF) characteristics
- Very low electric field (VLEF) characteristics
- 1.8-m (6-ft) signal cable with 15-pin, D-type connector
- 1.8-m (6-ft) detachable power cord.

Additionally, 95xx display models comply with ISO 9241/3 standards to reduce flicker

Besides the external operator controls, all displays include a cathode ray tube (CRT) and a card assembly. These are enclosed in the two-part housing consisting of the bezel, in which the CRT is mounted, and the back cover, which encases the card tray assembly.

The card tray assembly is made up of an analog card and a video card. These cards are mounted on an assembly tray which also mounts the signal cable and ac inlet connector.

The functions of the displays and all of the components within each are essentially the same, with some differences in the functional characteristics of the unit -- higher resolutions or larger CRT-screen sizes, for example.

Each display has various models available that conform to the voltages and supply requirements found in different countries. Low voltage models are typically available for the Unites States and Canada in the Northern Hemisphere; high voltage models are designed for use in the Southern Hemisphere and Europe, the Middle East, and Africa. Universal voltage models are designed for use in many countries in both the northern and southern hemispheres.

Parts lists for these displays include part numbers for each of the models offered under the display type.

Subtopics

1.1.1 Display Modes

Displays receive separate red, green, and blue analog signals through the signal cable (75 ohms impedance). Separate, non-interlaced, horizontal and vertical synchronization signals are also received through the signal cable.

The polarity of the synchronization signals controls the modes of operation. Modes of operation set vertical frequencies to vary the maximum number of lines that can be displayed. The number of lines displayed creates screen resolution. Each display can be used in three to six operating modes. The modes are dependent on the display and the computer system that the display is connected to. The polarities and operating characteristics of the four primary modes are shown in the following table:

	Mode 1	**Mode 2**	**Mode 3**	**Mode 4**
Horizontal synchronization signal	**+**	**--**	**--**	**+**
Vertical synchronization signal	**--**	**+**	**--**	**+**

Displays with only three operating modes have mode 4 reserved. Displays with more than these four modes use interlaced horizontal and vertical synchronization signals to create additional modes. The 8517 display has two mode 4s available; the program providing the mode automatically selects one of them, depending on the adapter in use.

The IBM Personal System/2 Color Displays Test-Pattern Diskette examines the mode configuration from the monitor and the type of computer being used and displays the modes available for the monitor.

1.1.2 Operator Controls and Power-On Indicator

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PICTURE 2

Figure 1-1. Example Operator Controls

All PS/2 Displays have operator controls and power-on indicators similar to those shown in Figure 1-1. On some older displays, the controls perform the same functions but are not located at the same places.

When the power switch is set to off, the pushbutton is level with the surface of the control panel. Press the pushbutton 1 to switch on the display. Press again to switch off; the pushbutton returns to its original position.

On the older model displays, the power switch is located on the right side of the display. Push the lever-action switch in to switch on the display. To turn off the display, push in the opposite side of the switch.

Subtopics
1.1.2.1 Contrast Control
1.1.2.2 Brightness Control
1.1.2.3 Power-On Indicator

1.1.2.1 Contrast Control

The contrast control is on the face of the display. To increase contrast, move the control 2 from left to right. On some older displays, the contrast control is on the left side. To increase contrast, move the control from back to front.

1.1.2.2 Brightness Control

The brightness control is on the face of the display. To increase brightness, move the control 3 from left to right. On some older models, the brightness control is on the left side. To increase the brightness, move the control from back to front. All brightness controls have a center detent position (midpoint).

1.1.2.3 Power-On Indicator

For all models, the power-on indicator (green LED) 4 lights when the display is switched on and electrical power is present.

1.1.3 Powering Off the System

CAUTION:
Before removing any part of the display:

1. Power off the PS/2 system (including all attached devices).

2. Power off the display, and wait for five seconds.

3. Disconnect all power cords from power outlets and the display.

4. Disconnect all connecting cables.

PICTURE 3

Figure 1-2. Power Off the System

1.2 2. Diagnostic Guide

This chapter describes the procedures for basic diagnoses, function checks, and self-tests that can be used to pinpoint problems on the display. The basic diagnostic procedures include initial visual and power checks; the self-test is a display-powered, on-screen pattern check.

This chapter also introduces general function checks and adjustment procedures. Complete function checks and adjustment procedures for individual display types are included in "Part II. Display-Specific Service Information."

Initial checks for the 8516 Color Touch Display appear in "8516-Specific Information" in topic 2.4. The general initial checks included here for all other displays do not apply to the 8516 Touch Display.

DANGER

Areas of the analog and video card assemblies that you will be removing and replacing carry high voltages. Use extreme caution when carrying out the removal and replacement steps and while adjusting the display when it is on.

CAUTION:
Use extreme caution when making adjustments with the display powered on; these adjustments should not be performed unattended.

The display must never be left unattended with the covers removed and powered on in a customer environment.

To prevent electrical shock, power off the display and disconnect the power cord before you change any part.

High voltages may remain on the anode of the CRT after the display is powered off. Discharge in accordance with CRT safety instructions. See "High Voltage Discharge Procedure" in topic 1.3.4 for instructions on how to discharge the CRT.

CRTs are under vacuum. All persons working near an exposed CRT must wear safety glasses and long-sleeved clothing (or comparable protection).

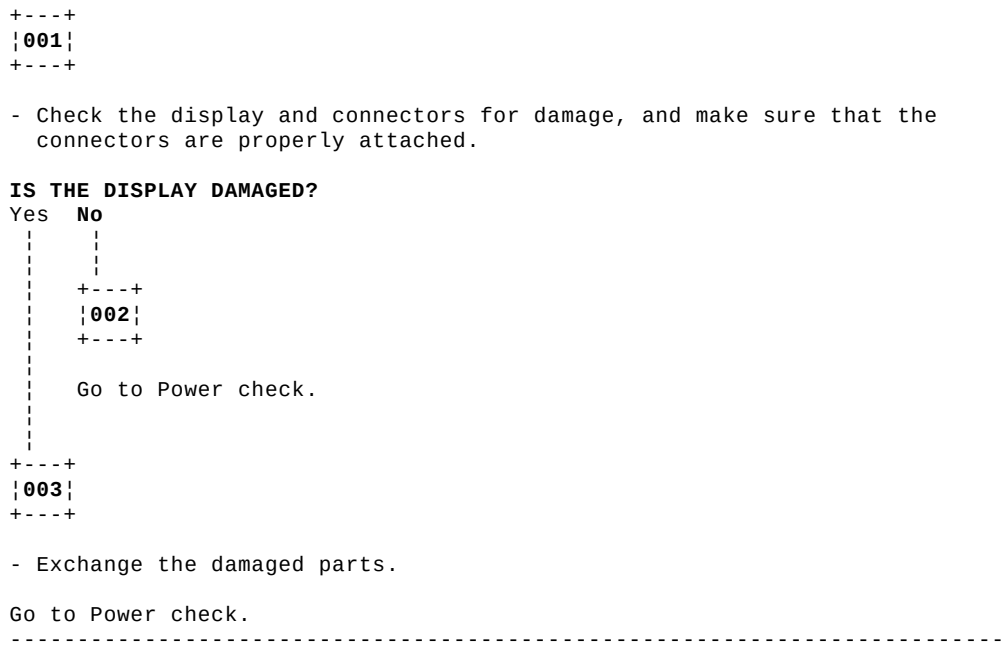
Subtopics

1.2.1 Initial Checks

The initial checks, visual and power, confirm whether or not the display is ready for operation.

Subtopics
1.2.1.1 Visual check 0100
1.2.1.2 Power check 0110

1.2.1.1 Visual check 0100



- Check the display and connectors for damage, and make sure that the connectors are properly attached.

- Exchange the damaged parts.

Go to Power check.

1.2.1.2 Power check 0110

Note: If you change the card tray assembly or the Integrated Tube Component (ITC), you must then check all the adjustments for the display.

001

- Remove the power cord from the power outlet, and then from the display.

- Set the power switch to on and to off several times.

DOES THE POWER SWITCH OPERATE NORMALLY?

Yes **No**

002

Install new card tray assembly. See removal and replacement information under "Part II. Display-Specific Service Information" for the display you are servicing.

On 8517/9517 Displays, a new Pod Assembly must be installed. See "8517/9517-Specific Information" in topic 2.5 for Pod Assembly information.

003

- Set the power switch to off.

- Connect a power cord (that is known to be good) to the display and then to the electrical power outlet.

- Set the power switch to on.

IS THE POWER LED ON?

Yes **No**

004

Install new card tray assembly. See removal and replacement information under "Part II. Display-Specific Service Information" for the display you are servicing.

For 8517/9517 Displays, a Pod Assembly check must be performed (see "Pod Assembly Checks" in topic 2.5.2.3). The Pod Assembly must be replaced if it is defective. Otherwise, install a new analog card. See "8517/9517-Specific Information" in topic 2.5 for card removal and replacement information.

005

Continue with Self-Test.

1.2.2 Self-Test

The self-test checks for a full white display screen. The white screen will have black borders of various thickness on one or all sides depending on which display you are servicing.

1. Power off the display.

2. Disconnect the signal cable.

3. Power on the display.

   Note: The display must be powered on for five minutes before starting the test.

4. Set the contrast and brightness controls to maximum.

5. The self-test pattern on the screen should be a full white raster (a pattern of horizontal scanned lines) with a black border.

6. If the self-test pattern does not appear correctly, go to "Basic Function and Pattern Checks and Adjustments" in topic 1.2.3.

7. If the self-test raster appears correctly, the video problem may be caused by the system unit, the display signal cable, or connection. Connect the display to another system unit to test the video problem, then proceed to the function and pattern checks and adjustments for the specific display you are servicing.

PICTURE 4

Figure 2-1. Typical Self-Test Pattern

Note: There are two fine transverse black lines across the screens of 8517/9517 Displays. These are part of the normal background for these displays.

1.2.3 Basic Function and Pattern Checks and Adjustments

Basic function and pattern checks are diagnostic procedures based on the self-test. A series of questions about the raster image indicates the symptom of the problem. Each symptom has an action to resolve the problem. The actions involve adjusting certain control potentiometers on the analog or video cards and/or replacing a part of the display.

If any components of the display require replacement, then a series of adjustments is required to return the display to normal operation. The IBM Personal System/2 Color Displays Test-Pattern Diskette (part number 41G8502) is used with the display and host PS/2 to help you perform the adjustments. These adjustments reset normal color, contrast, and other display functions.

The diagnostic procedures and actions required to return a display to normal operation vary from display to display. Because the diagnoses and actions are specific to each display, the detailed function and pattern checks and adjustment procedures are included under the display type in "Part II. Display-Specific Service Information."

1.2.4 Degaussing

Throughout the display-specific service procedures, references are made to degaussing the color display. The following material explains degaussing and the procedures to follow for degaussing a display.

The effect of stray magnetic fields on the color purity of an Integrated Tube Component (ITC) depends on the orientation of these fields with respect to the ITC. Color displays have a magnetic shielding system, consisting of a magnetic screen (internal to the ITC), and the shadow mask (together with its mounting frame), to combat stray magnetic fields.

To be effective, the shielding system must be degaussed by applying a strong alternating magnetic field which decays gradually and symmetrically to zero.

This is achieved by using dual, positive temperature coefficient resistors (PTC) in conjunction with a degauss coil on the ITC. When the mains input voltage is applied to the display, the peak inrush current through the coil is limited by one half of the dual PTC, while the other half is heated by the current flow in it. Equilibrium is achieved when the heat in one half of the PTC is sufficient to prevent current flow in the other half, and consequently in the degauss coil.

When degaussing is required, (for example, if a display is relocated) the heating associated with a degauss action means that another degauss action cannot be started until the circuit has cooled down.

Allow at least 30 minutes with the display powered off, before starting another degauss action.

1.3 3. Removal and Replacement

This chapter describes how to remove and replace parts of the PS/2 Display. The first part of the chapter covers removal and replacement procedures for the tilt swivel stands and rear covers of the displays. The chapter continues with instructions on how to discharge high voltages in the displays once the rear cover is removed.

This chapter also covers general removal and replacement procedures for the card tray assemblies, signal cables, and integrated tube components (ITCs). Included here are references to display-specific information, where you will find complete details on removing and replacing these components for each individual display type.

CAUTION:
The display must never be left unattended with the covers removed and powered on in a customer environment.

Each main part of the display has its own removal procedure, for example, "Tilt Swivel Stand." Where a *step* in a specific procedure represents a complete *procedure* that is described separately, a reference to that complete procedure is given. For example:

1. Power off the system (see "Powering Off the System" in topic 1.1.3).

2. Remove the tilt swivel stand (see "Tilt Swivel Stand" in topic 1.3.1).

3. Remove the rear cover (see "Rear Cover" in topic 1.3.3).

The steps show you where you can find the complete instructions for each procedure.

To replace a part, reverse the removal procedure and observe any additional replacement instructions.

Always ensure that parts are located correctly and latched into position (where applicable) before securing.

After removing and replacing any field replacement units (FRUs), the appropriate alignment procedures must be performed on the display. Adjustment procedures are presented in "Part II. Display-Specific Service Information" for each display type.

Subtopics

1.3.1 Tilt Swivel Stand

The tilt swivel stand is the same for most models, but some have a different method of attachment and some lift as well as tilt and swivel.

1. Power off the system and the display, and disconnect all cables. (See "Powering Off the System" in topic 1.1.3.)

2. Place the display on its front cover, protected with a soft cloth or similar material.

3. Remove the thumbscrew 1 , disengage the locating hooks 2 , and move the tilt swivel stand away from the display.

PICTURE 5

Figure 3-1. Removing the Tilt Swivel Stand

Other displays have a tilt swivel stand that is held on with two release clips. For those types of stands, use these instructions after powering off the system and removing all cables.

1. Place the display on a flat surface, ensuring that there is sufficient space to set the display down after removing from the stand.

2. Press the two release clips at the front of the stand assembly.

3. Pull the display forward from the tilt swivel stand.

4. Lift the display from the stand and place it on a flat surface.

Replacement:

Replace the tilt swivel stand by using these instructions in reverse order.

1.3.2 Lift Tilt Swivel Stand

The other type of stand for the PS/2 Displays is the lift tilt swivel stand. Remove it by following these steps.

1. Power off the system and the display, and disconnect all cables (see 1.1.3).

2. Carefully place the display upside down on a clean surface.

3. Remove the lift tilt swivel stand by moving the lever in the direction of the arrow, and disengaging the latches from the base of the display.

PICTURE 6

Figure 3-2. Removing the Lift Tilt Swivel Stand

Replacement:

Replace the lift tilt swivel stand by using these instructions in reverse order.

1.3.3 Rear Cover

Two types of rear covers are used on the displays:

- Type 1 cover removal involves removing one or more securing screws and inserting delatching tools (IBM part number 59X6319) into slots to release the cover.

- Type 2 cover removal involves simply uncapping securing screws and removing all screws normally to release the rear cover.

Instructions and illustrations for both types are shown below.

Subtopics
1.3.3.1 Rear Covers, Type 1
1.3.3.2 Rear Cover, Type 2

1.3.3.1 Rear Covers, Type 1

The removal procedures for this type of rear cover are:

1. Power off the system and the display, and disconnect all cables (see "Powering Off the System" in topic 1.1.3).
2. Remove the tilt swivel stand (see "Tilt Swivel Stand" in topic 1.3.1), or the lift tilt swivel stand (see "Lift Tilt Swivel Stand" in topic 1.3.2).
3. Refer to Figure 3-3.
4. Remove the two securing screws 1 from the rear cover.

Some models have only a single hex head screw on the bottom of the display that must be removed. Additionally, these covers may require that you unclip two plastic closing plates from the interface cable to allow the plug to pass through the cover.

5. Insert the delatching tools 2 into the slots to release the fasteners.
6. Ease the rear cover 3 away from the display, after disengaging the signal cable from the retention slot.

PICTURE 7

Figure 3-3. Removing the Rear Cover, Type 1

Replacement:

Ensure that the securing arms of the card tray assembly are latched into the front cover.

1.3.3.2 Rear Cover, Type 2

The removal procedures for this type of rear cover are:

1. Turn power off at the system unit and the display, and disconnect all cables (see "Powering Off the System" in topic 1.1.3).
2. Remove the tilt swivel stand (see "Tilt Swivel Stand" in topic 1.3.1), or the lift tilt swivel stand (see "Lift Tilt Swivel Stand" in topic 1.3.2).
3. Refer to Figure 3-4.
4. Remove the covers 1 from the two securing screws 2 on the top of the rear cover 3 .
5. Remove the four screws 2 from the rear cover.
6. Ease the rear cover away from the display.

PICTURE 8

Figure 3-4. Removing the Rear Cover, Type 2

Replacement:

Replace the rear cover using these instructions in reverse order.

1.3.4 High Voltage Discharge Procedure

This section describes how to discharge high voltages from the exposed components of the display.

DANGER

- Hazardous voltages are present on the analog and video cards.
- The extra high tension (EHT) voltage on the CRT anode cap exceeds 23 kV. Use extreme caution when working on the display with the power on and the covers removed.
- Some adjustments require you to place tools close to the EHT voltage. For safety and performance reasons, *only plastic or insulated metal* tools should be used.
- *Remove all jewelry* before starting any repair process.
- *Never leave the display unattended* with the covers removed. This applies whether or not the power cord is connected to the power outlet.
- With the power cord connected, voltage may be present at the power supply card even with power switched off.
- A static charge may be present at the line cord connector, at the rear of the display, if the line cord is disconnected before the power is switched off.
  Always turn the power on/off switch off first, then wait approximately five seconds before unplugging the power cord from the back of the display.
- Under fault conditions, a static charge can remain on the CRT anode long after the power cord has been disconnected. For this reason, it is important *to discharge the CRT anode* before disconnecting the anode lead.

To avoid any shock hazard when working in the area of the high voltage anode lead, use the following to discharge the CRT to ground:

- Screwdriver (part 1650855 or equivalent)
- Jumper (part 7838690 or equivalent) with an alligator clip (part 7838688 or equivalent) attached to each end; or Meter Lead Kit (part 6428104).

Please read the complete discharge procedure before starting; then continue in the order given.

1. Power off the system and the display, and disconnect all cables (see 1.1.3).
2. Remove the tilt swivel stand (see "Tilt Swivel Stand" in topic 1.3.1), or the lift tilt swivel stand (see "Lift Tilt Swivel Stand" in topic 1.3.2).
3. Remove the rear cover (see 1.3.3).
4. Refer to Figure 3-5.
5. Connect one end of the jumper 1 to the CRT ground 2 , and the other end to the screwdriver shaft 3 , except for models 8517 and 9517.

PICTURE 9

Figure 3-5. Connecting the Jumper for CRT Discharge

For display models 8517 and 9517, connect the jumper between the shield around the integrated tube component and the uninsulated part of the screwdriver shaft as shown in Figure 3-6. This will discharge the anode of the CRT 1 to the ITC shield (ground).

PICTURE 10

Figure 3-6. CRT Discharge Connection for 8517/9517 Displays

6. **Do not touch any conductive parts when discharging high voltages**. Insert the blade of the screwdriver under the suction cup until the end touches the anode lead connector 4 .

PICTURE 11

Figure 3-7. Discharge High Voltage to CRT Ground

7. Do this several times to ensure a complete discharge.

8. Carefully remove the anode suction cup from the CRT.

Note: Remove the anode suction cup immediately after discharge, to prevent the CRT capacitance from recharging. If you are delayed for more than a minute or two, perform the discharge procedure again.

1.3.5 Card Tray Assemblies

Card tray assemblies include the analog and video cards, the brightness and contrast controls, and the ac inlet connector. However, card tray assemblies are different for most of the displays, and procedures specific to each individual display type are presented in the related sections in "Part II. Display-Specific Service Information."

To remove the card tray assembly:

1. Power off the system and the display, and disconnect all cables (see "Powering Off the System" in topic 1.1.3).
2. Remove the tilt swivel stand (see "Tilt Swivel Stand" in topic 1.3.1), or the lift tilt swivel stand (see "Lift Tilt Swivel Stand" in topic 1.3.2).
3. Remove the rear cover (see "Rear Cover" in topic 1.3.3).
4. Refer to "Part II. Display-Specific Service Information" for detailed instructions and illustrations for the type of display you are servicing.

1.3.6 Signal Cable

The signal cable transmits signals to the display from the computer processor. This cable is clamped to the card tray and must be unclamped to clear the card tray assembly from the cable.

Several of the clamps and card trays are different, however. Procedures for clearing the signal cable from the card tray assemblies of specific display models are presented "Part II. Display-Specific Service Information."

To remove the signal cable clamps:

1. Power off the system and the display, and disconnect all cables (see "Powering Off the System" in topic 1.1.3).
2. Remove the tilt swivel stand (see "Tilt Swivel Stand" in topic 1.3.1), or the lift tilt swivel stand (see "Lift Tilt Swivel Stand" in topic 1.3.2).
3. Remove the rear cover (see "Rear Cover" in topic 1.3.3).
4. Refer to "Part II. Display-Specific Service Information" for detailed instructions and illustrations for removing the cable clamps from the type of display you are servicing.

1.3.7 Integrated Tube Component (ITC)

CAUTION:
Refer to CRT safety notices before handling CRTs.

The following instructions cover general removal procedures for ITCs, including those displays with ITC shields.

Note: The card tray assembly and signal cables should be removed from the display your are servicing before you proceed with removal of the ITC. Check the removal and replacement instructions under "Part II. Display-Specific Service Information" for the display you are servicing before removing the ITC.

Adjustments are required for geometry, video levels and cutoff, after replacing any ITC. Adjustment procedures for each type of display appear in "Part II. Display-Specific Service Information."

1. Power off the system and the display, and disconnect all cables (see "Powering Off the System" in topic 1.1.3).

2. Remove the tilt swivel stand (see "Tilt Swivel Stand" in topic 1.3.1), or the lift tilt swivel stand (see "Lift Tilt Swivel Stand" in topic 1.3.2).

3. Remove the rear cover (see "Rear Cover" in topic 1.3.3).

For Displays without an ITC shield:

1. Refer to Figure 3-8.
2. Remove the Torx (**) screws 1 from each corner of the bezel.
3. Remove the ITC 2 from the bezel.

PICTURE 12

Figure 3-8. Removing the ITC

Replacement:

1. Carefully place the CRT against the locating ribs on the bottom and left-hand side of the bezel (viewed from the rear of the display).

2. Tighten all screws firmly.

For 8513 displays, make sure the DAG contact is not obscured by the labels.

For Displays with an ITC shield:

1. Refer to Figure 3-9.
2. Remove the four screws 1 from each corner of the front cover.
3. Remove the ITC ground lead 4 from the ITC shield.
4. Remove the ITC shield 2 .
5. Remove the ITC 3 from the front cover.

PICTURE 13

Figure 3-9. Removing the Shield and ITC

Replacement:

Ensure that the ITC is aligned correctly before tightening the securing screws.

(**) Trademark of Textron Incorporated. For a list of trademarks see "Notices" in topic FRONT_1.

1.3.8 Safety Check for Chassis Ground

After reassembling any display, do the following safety check before connecting the power cord.

1. Connect a multimeter between the ground pin on the power connector and a rear cover securing screw (chassis).

2. Check that the resistance is no more than 0.1 ohm, after compensating for the resistance of the meter leads.

PICTURE 14

Figure 3-10. Safety Check

2.0 Part II. Display-Specific Service Information

The following chapters contain removal and replacement information, functional checks, adjustment procedures, specifications, and part location illustrations for IBM Personal System/2 Displays.

Subtopics

2.1 4. 6318/8511/8518-Specific Information

This chapter contains display-specific service procedures and reference information for the IBM PS/2 6318, 8511 and 8518 Displays. Included are:

- Removal and replacement procedures for the:
  - Card-tray assembly
  - Signal cable
- Functional checks and adjustments, including:
  - Function checks
  - Pattern checks
  - Adjustment procedures
- Physical and functional specifications
- Part location illustrations.

For information or procedures that are the same for all displays, you are referred to the appropriate sections under "Part I. General Service Information."

Subtopics

2.1.1 Display-Specific Removals and Replacements

Subtopics
2.1.1.1 Tilt Swivel Stand
2.1.1.2 Rear Cover
2.1.1.3 Card Tray Assembly
2.1.1.4 Signal Cables
2.1.1.5 Integrated Tube Component (ITC)

2.1.1.1 Tilt Swivel Stand

Refer to the general procedures for removing and replacing tilt swivel stands in "Tilt Swivel Stand" in topic 1.3.1.

2.1.1.2 Rear Cover

Refer to the general procedures for removing and replacing the rear cover in "Rear Cover" in topic 1.3.3.

2.1.1.3 Card Tray Assembly

1. Refer to Figure 4-1.

2. Remove the anode cap 2 from the CRT, (see 1.3.4).

3. Remove the two DAG braid leads 1 from the card tray assembly.

4. Refer to Figure 4-2.

5. Remove the two video card ground screws 1 .

6. Release the locking lever for the video card to CRT clamp 6 .

   CAUTION:
   Take care not to damage the neck of the CRT.

   Observe all safety notices for handling CRTs.

7. Remove the video card 3 from the CRT base.

8. Remove the connectors 8 (P401 and P100) from the ITC to the analog card.

9. Delatch the two securing arms (**view A**) with a screwdriver then pull the card tray assembly 4 away from the front cover.

PICTURE 15

Figure 4-1. Removing the Card Tray Assembly, 6318/8511/8518 Displays

PICTURE 16

Figure 4-2. Removing the Video Card Ground Screws, 6318/8511/8518 Displays

Replacement:

Refer to Figure 4-1.

1. Check that the CRT pins are straight, the locking lever for the CRT retainer is raised, and the video card is aligned correctly with the CRT base, before replacing the card and locking it in position.

2. Replace the plastic safety shield and the video card ground screws.

3. Ensure that the securing arms for the card tray assembly are latched into the front cover; take care not to damage the on/off switch in this process.

4. Ensure that the two DAG braid leads are properly installed, and reconnect all cables.

Note: Adjustments are required after replacing analog and/or video cards.

2.1.1.4 Signal Cables

1. Refer to Figure 4-1 in topic 2.1.1.3.

2. Remove the connectors 5 from the signal cable to the video card and the associated ground lead.

3. Remove the two screws 9 and move the tab 10 to release the analog card. Lift the card at the rear to clear the locating pin and ease it away from the retaining lugs on the front of the card tray assembly.

4. Remove the clamp screws at each end of the cable 7 , and remove the lead from the braid to ground.

5. Note how each clamp is fitted on the cable before removing the signal cable from the retention tabs.

PICTURE 17

Figure 4-3. Signal Cable Clamps, 6318/8511/8518 Displays

Replacement:

1. Ensure that the front clamp makes contact with the braid and the cable sheath because it acts as a strain relief for the cable.

2. Replace the cable in the retention tabs so that the longer section of braid is aligned with the rear clamp. This clamp is attached to the braid only.

2.1.1.5 Integrated Tube Component (ITC)

Refer to the general procedures for removing and replacing ITCs in "Integrated Tube Component (ITC)" in topic 1.3.7.

2.1.2 Functional Checks and Adjustments

This section contains complete function and pattern checks and adjustment procedures for the 6318, 8511 and 8518 Displays. There are two steps to follow in the function and pattern checks, that is, to read the "Symptom" and follow the "Action" presented in the diagnostic tables.

Subtopics
2.1.2.1 Function Checks
2.1.2.2 Pattern Checks
2.1.2.3 Adjustment Procedures

2.1.2.1 Function Checks

Basic functions can be checked using the self-test raster.

Refer to "Adjustment Procedures" in topic 2.1.2.3 when adjustments are required after replacing components.

Refer to "Display-Specific Removals and Replacements" in topic 2.1.1 for removal and replacement procedures.

Symptom	**Action**
Any problems.	First, check all connections and plugs for continuity.
Green LED lit but test raster missing.	Adjust G2 control clockwise until test raster appears AGAINST background raster. If no raster appears, replace ITC.
Test raster is not white.	Adjust gain controls for missing colors. If colors reappear, reset color point of ITC. Otherwise replace ITC.
Background raster is not white.	Adjust cutoff controls for missing colors. If colors reappear, reset color point of ITC. Otherwise replace ITC.
Test raster scan is collapsed horizontally or vertically.	If partially collapsed, adjust as appropriate. If fully collapsed, replace card tray assembly.

2.1.2.2 Pattern Checks

These symptoms relate to operating the display with a crosshatch pattern displayed.

Before starting any checks, ensure that all plugs and connectors are positioned correctly and securely.

Refer to "Adjustment Procedures" in topic 2.1.2.3 when adjustments are required.

Refer to "Display-Specific Removals and Replacements" in topic 2.1.1 for removal and replacement procedures.

Symptom	**Action**
Displayed image width is too large or too small.	Adjust RV303. If symptom persists, replace card tray assembly.
Displayed image height is too large or too small.	Adjust RV400. If symptom persists, replace card tray assembly.
Color purity of displayed image is poor.	Check degauss circuit. Ensure that P100 is connected. Power off for 30 minutes. Power on again to check degauss action. If symptom persists, replace card tray assembly. ITC defective. Replace ITC.
Contrast or brightness controls are not working.	Check connections between P400 and P802. If good, replace card tray assembly.
Maximum or minimum white is poor.	Video color point is not set. Adjust as appropriate.
East west pincushion correction (EWPCC) is poor (vertical lines are bowed or barrel shaped).	Adjust RV302 for optimum vertical lines. If this is not possible, replace the card tray assembly.
No horizontal or vertical synchronization. One or more colors missing.	If good with test raster (signal cable disconnected), replace signal cable.
Displayed image does not synchronize horizontally.	Ensure that P300 is connected. If symptom persists, replace card tray assembly.
Displayed image does not synchronize vertically.	Ensure that P300 is connected. If symptom persists, replace card tray assembly.
Displayed image is not centered horizontally.	Adjust RV304. If image cannot be centered, centering circuit is faulty. Replace card tray assembly.
Displayed image height varies excessively between modes.	Height selection circuit is faulty. Replace card tray assembly.
Displayed image appears broken up horizontally.	Width regulation is unstable. Ensure that P300 is connected. If symptom persists, replace card tray assembly.

2.1.2.3 Adjustment Procedures

CAUTION:
Use extreme caution when making adjustments with the display powered on; these adjustments should not be performed unattended.

The display must never be left unattended with the covers removed and powered on in a customer environment.

Refer to "Removal and Replacement" for details of how to get access to maintenance controls.

All adjustments must be completed in the sequence given here.

Subtopics

2.1.2.3.1 Test Equipment

Refer to "Tools and Test Equipment" in topic 3.3 for details of tools and test equipment required. Ensure that the connections of all cables are set up as shown in Figure 13-1 in topic 3.3.1.

2.1.2.3.2 Maintenance Controls and Internal Connectors

The following illustrations show the maintenance controls -- analog and video card controls -- and the internal connectors of the 6318, 8511 and 8518 Displays.

PICTURE 18

Figure 4-4. Analog and Video Cards, 6318/8511/8518 Displays

PICTURE 19

Figure 4-5. Video Card, Gain and Cutoff Controls, 6318/8511/8515 Displays

2.1.2.3.3 Preliminary Steps

Proceed as follows.

1. Insert the IBM PS/2 Color Displays Test-Pattern Diskette into drive A of the system unit.

   CAUTION:
   Use caution when making adjustments with the cover removed. There are high voltages on the analog and video cards.

2. Power on the system unit and the display. The system unit runs its internal checks, and then loads the program from the diskette.

3. With the Brightness control set to center detent (midpoint), adjust G2 and Focus until the setup menu is visible. Select pattern C and adjust the G2 control to give minimum background illumination.

4. Allow 20 minutes for the display to warm up before making any further adjustments.

5. Set the Contrast control to midpoint.

Note: On 6318 Displays center the four POTS on the Operator Control Card prior to performing the Geometry Adjustments.

2.1.2.3.4 Geometry Adjustments

Proceed as follows.

1. Select pattern A, the cross-hatch pattern on a black background:

    a. Adjust RV304 (Raster Centering) to center the rectangle.

    b. Adjust RV303 (Width) for a gap of:

        16 mm (for 6318, 8511 Color Displays),

        11 mm (for 8518 Color Displays),

        (measured at the horizontal center line of the screen) between the vertical edges of the green rectangle and the inner edges of the bezel.

    c. Adjust RV302 (East West Pincushion) to set the straightest possible vertical lines.

    d. You may have to repeat steps a, b, and c.

2. Using the same test pattern, adjust sequentially RV400 (Vertical Height) and RV401 (Vertical Centering). Set the picture in the center of the screen with a gap of:

    11 mm (for 6318, 8511 Color Displays),

    7.5 mm (for 8518 Color Displays),

    (measured at the vertical center line of the screen) between the horizontal edges of the green rectangle and the inner edges of the top and bottom of the bezel.

2.1.2.3.5 Video Levels and Cutoff Voltages

Proceed as follows.

1. Select pattern C, the full screen raster and press the spacebar four times for a black field:

    a. Set RV600, RV631, RV651, and RV671 (cutoff potentiometers) fully clockwise, as viewed from the video card shield.

    b. Set RV632 and RV652 (gain potentiometers) fully clockwise, as viewed from the top of the video card.

    c. Set the Brightness control to center detent (midpoint), and the Contrast control to midpoint.

    d. Adjust G2 so that the screen is just not illuminated. Set the Brightness control to maximum.

    e. Adjust the cutoff potentiometers for a correct white color point.

    f. Set the Brightness control to center detent (midpoint). If necessary, adjust G2 to ensure that the screen is just not illuminated.

2. Select Pattern B, 50 mm square box and press the spacebar three times for a white box.

3. Ensure that the Contrast control is at midpoint.

4. Adjust RV652 (green) and RV632 (red) for correct white color points.

5. Set Contrast to maximum.

6. Set RV600 to midpoint.

7. Select pattern D, gray scale blocks.

8. Check, at maximum and minimum contrast, that the gradation of the blocks is even from black through white with no color tinges.

9. Check that there is no color smearing.

If steps 8 and 9 are not satisfactory, repeat this complete procedure.

Note: The use of a color analyzer is recommended for steps 1e, 4, and 6.

2.1.2.3.6 Procedure Using a Color Analyzer

The use of a Minolta TV Color Analyzer (**), or equivalent, is recommended for setting the white color point and maximum brightness.

1. Select pattern C, full-screen raster and depress the spacebar four times for a black field:

    a. Set RV600, RV631, RV651, and RV671 (cutoff potentiometers) fully clockwise, as viewed from the video card shield.

    b. Set RV632 and RV652 (gain potentiometers) fully clockwise, as viewed from the top of the video card.

    c. Set the Brightness control to center detent (midpoint), and the Contrast control to midpoint.

    d. Adjust G2 so that the screen is just not illuminated. Set the Brightness control to maximum.

    e. Adjust the cutoff potentiometers for a correct white color point. Using a Minolta Color Analyzer, or equivalent, in accordance with the manufacturer's instructions, this is:
    x=0.267 ± 0.01, y=0.282 ± 0.01.

    f. Set the Brightness control to center detent (midpoint). If necessary, adjust G2 to ensure that the screen is just not illuminated.

2. Select Pattern B, 50 mm square box and press the spacebar three times for a white box.

3. Ensure that the Contrast control is at midpoint.

4. Adjust RV652 (green) and RV632 (red) for correct white color points. Using a Minolta Color Analyzer, or equivalent, in accordance with the manufacturer's instructions, this is:
x=0.297 ± 0.01, y=0.320 ± 0.01.

5. Set Contrast to maximum.

6. Set RV600 using the color analyzer, to give 200 nits ± 5 nits (cd/m^2) in the white block.

7. Select pattern D, gray scale blocks.

8. Check, at maximum and minimum contrast, that the gradation of the blocks is even from black through white with no color tinges.

9. Check that there is no color smearing.

If steps 8 and 9 are not satisfactory, repeat this complete procedure.

(**) Trademark of the Minolta Corporation. For a list of trademarks see "Notices" in topic FRONT_1.

2.1.2.3.7 Focus

Proceed as follows.

1. Select pattern E, Focus.
2. Adjust the Focus control to give sharp vertical and horizontal lines.
   Take care not to disturb the G2 setting.

This completes the alignment procedures.

2.1.3 Specifications

Subtopics
2.1.3.1 Physical Characteristics
2.1.3.2 Functional Characteristics

2.1.3.1 Physical Characteristics

The following information applies to all models of the 6318, 8511 and 8518 Displays:

Subtopics
2.1.3.1.1 Size
2.1.3.1.2 Weight
2.1.3.1.3 Environment
2.1.3.1.4 Power Output
2.1.3.1.5 Electrical

2.1.3.1.1 Size

- Height 310 mm (12.2 in.), excluding stand
- Width 355 mm (14 in.)
- Depth 390 mm (15.3 in.).

2.1.3.1.2 Weight

12.5 kg (27.5 lb), excluding stand.

2.1.3.1.3 Environment

- Temperature:
  - Operating 10° to 35°C (50 to 95°F)
  - Storage 1° to 60°C (33 to 140°F)
  - Shipping -20° to 60°C (-4 to 140°F).
- Humidity:
  - Operating 8% to 80%
  - Storage 5% to 80%
  - Shipping 5% to 100%

  Note: The higher levels of humidity for shipping allow for condensation, but not direct contact with moisture.

- Maximum Altitude 2000 m (6565 ft).

2.1.3.1.4 Power Output

75 watts maximum

2.1.3.1.5 Electrical

- Model 6318001: 90 to 137 V ac, 47 to 63 Hz
- Model 8511001 and 8518001: 90 to 137 V ac, 47 to 63 Hz
- Model 8511002 and 8518002: 90 to 265 V ac, 47 to 63 Hz
- Model 8511003 and 8518003: 90 to 265 V ac, 47 to 63 Hz
- Model 8511004 and 8518004: 90 to 265 V ac, 47 to 63 Hz
- Model 8518022: 180 to 265 V ac, 47 to 63 Hz

2.1.3.2 Functional Characteristics

Video input: analog, direct-drive, 75 ohm, 0 to 0.7 V.

6318/8511 CRT faceplate: antiglare (etched or silica coated).

8518 CRT faceplate: dark, antiglare (etched or silica coated).

CRT phosphor: short persistence (P22).

MODE	**1**	**2**	**3**
Horizontal deflection rate (kilohertz)	31.5	31.5	31.5
Vertical deflection rate (frames per sec)	70	70	60
Horizontal blanking time (microseconds)	5.72	5.72	5.72
Vertical blanking time (milliseconds)	2.76	1.12	0.92
Vertical addressability (lines)	362	414	496
Interlace ratio	1:1	1:1	1:1

Resolution:

Mode 1, 720 x 350 Pels, 70 Hz, non interlaced.

Mode 2, 720 x 400 Pels, 70 Hz, non interlaced.

Mode 3, 720 x 480 Pels, 60 Hz, non interlaced.

The 6318 display can also support the following modes:

Mode 4, 640 x 480 Pels, 72 Hz, non interlaced.

Mode 5, 800 x 600 Pels, 56 Hz, non interlaced.

Mode 6, 800 x 600 Pels, 60 Hz, non interlaced.

Mode 7, 1024 x 768 Pels, 87 Hz, non interlaced.

2.1.4 Locations 6318/8511/8518 Display

Subtopics
2.1.4.1 Safety Grounds
2.1.4.2 Parts Locations

2.1.4.1 Safety Grounds

PICTURE 20

Figure 4-6. Safety Grounds, 6318/8511/8518 Displays

2.1.4.2 Parts Locations

PICTURE 21

Figure 4-7. Parts Locations, 6318/8511/8518 Displays

2.2 5. 8513-Specific Information

This chapter contains display-specific service procedures and reference information for the 8513 Color Display. Included are:

- Removal and replacement procedures for the card-tray assembly
- Functional checks and adjustments, including:
  - Function checks
  - Pattern checks
  - Adjustment procedures
- Physical and functional specifications
- Part location illustrations.

For information or procedures that are generic for all displays you are referred to the appropriate sections under "Part I. General Service Information."

Note: This service information supports only 8513 Displays with serial numbers beginning with "23" or "55". All other 8513 monitors must be serviced by element exchange. See "Element Exchange Monitors" for a complete list of the 8513 Element Exchange displays.

Subtopics

2.2.1 Display-Specific Removals and Replacements

Subtopics
2.2.1.1 Tilt Swivel Stand
2.2.1.2 Rear Cover
2.2.1.3 Control Bridge Assembly
2.2.1.4 Card Tray Assembly
2.2.1.5 Integrated Tube Component (ITC)

2.2.1.1 Tilt Swivel Stand

Refer to the general procedures for removing and replacing tilt swivel stands in "Tilt Swivel Stand" in topic 1.3.1.

2.2.1.2 Rear Cover

Refer to the general procedures for removing and replacing the rear cover in "Rear Cover" in topic 1.3.3.

2.2.1.3 Control Bridge Assembly

To complete the general removal procedures for the model 8513 display, you will need to follow these instructions to remove the control bridge assembly.

1. Refer to Figure 5-1.

2. Unclip and remove the user controls from the control bridge, as shown in View A.

3. Remove the On/Off switch by pushing down the tab and withdrawing the switch downward, as shown in View B.

4. Disengage the two latches, and pull the Control Bridge assembly away from the front bezel.

PICTURE 22

Figure 5-1. Control Bridge Assembly, 8513 Display

Replacement:

Replace the Control Bridge Assembly using the above instructions in reverse order.

2.2.1.4 Card Tray Assembly

1. Refer to Figure 5-2.

2. Remove the anode cap 1 .

3. Remove the DAG connectors 2 from the video card and the mains socket.

4. *Metal Card Tray Versions only:* Remove the short DAG ground leads from the metal card tray.

5. Unplug the scan connector 3 .

6. Unplug the degauss connector 4 .

7. Place the display front downward on a table and lift the main card assembly away.

PICTURE 23

Figure 5-2. Card Tray Assembly, 8513 Display

Replacement:

Replace the Card Tray Assembly using the above instructions in reverse order.

2.2.1.5 Integrated Tube Component (ITC)

Refer to the general procedures for removing and replacing ITCs in "Integrated Tube Component (ITC)" in topic 1.3.7.

2.2.2 Functional Checks and Adjustments

This section contains complete function and pattern checks and adjustment procedures for the 8513 Display. There are two steps to follow in the function and pattern checks, that is, to read the "Symptom" and follow the "Action" presented in the diagnostic tables.

Subtopics
2.2.2.1 Function Checks
2.2.2.2 Pattern Checks
2.2.2.3 Adjustment Procedures

2.2.2.1 Function Checks

Basic functions can be checked using the self-test raster.

Refer to "Adjustment Procedures" in topic 2.2.2.3 when adjustments are required after replacing components.

Refer to "Display-Specific Removals and Replacements" in topic 2.2.1 for removal and replacement procedures.

Symptom	**Action**
Any problems.	First, check all connections and associated items for continuity.
Raster missing and green LED not lit.	Replace card assembly.
Raster missing, but green LED flashes during attempt to power on.	Replace card assembly.
Raster missing, but green LED lit.	Check if CRT heater is glowing: □ **NO** - Replace card assembly. If fault persists, replace the CRT. □ **YES** - Turn G2 potentiometer clockwise. If a raster appears, readjust the video gain and cut-off potentiometer if possible. Otherwise, replace the card assembly. If no raster appears, replace the CRT.
Raster visible but one or two colors missing.	Turn cutoff or gain controls, for the missing color(s), clockwise. If the color(s) reappear, readjust the video gain and cut-off potentiometer if possible; otherwise, replace the card assembly. If the colors do not appear, replace the CRT.
Raster visible but is too narrow, or does not fill the bezel vertically.	Replace card assembly.

If the raster is the correct size, then additional checks should be carried out. Connect the display to the PS/2 system unit, and load the Alignment Diskette as described in "Adjustment Procedures" in topic 2.2.2.3.

2.2.2.2 Pattern Checks

Select the required pattern to suit the adjustment.

Before starting any checks, ensure that all plugs and connectors are positioned correctly and securely.

Refer to "Adjustment Procedures" in topic 2.2.2.3 when adjustments are required.

Refer to "Display-Specific Removals and Replacements" in topic 2.2.1 for removal and replacement procedures.

Symptom	**Action**
No E-W pincushion correction.	Turn RV201 to check whether readjustment is possible; otherwise, replace card assembly.
Data not centered horizontally.	Turn RV200 H.PHASE to check whether readjustment is possible; otherwise, replace the card assembly. **Note:** On units with a metal card tray, first adjust RV203 to center the background raster, then RV200. If the fault persists, replace the CRT.
Data will not sync horizontally.	Replace the interface cable. If the fault persists, replace the card assembly.
Data has insufficient width.	Turn RV202 WIDTH to check whether readjustment is possible; otherwise replace the card assembly.
Data will not sync vertically.	Replace the interface cable. If the fault persists, replace the card assembly.
Data has insufficient height.	Turn RV300 HEIGHT to check whether readjustment is possible; otherwise replace the card assembly.
Data does not center vertically.	Turn RV301 V.CENT to check whether readjustment is possible; otherwise, replace the card assembly. If the fault persists, replace the CRT.
Vertical linearity poor.	Turn RV302 V.LIN to check whether readjustment is possible; otherwise, replace the card assembly.
Horizontal linearity poor.	Replace the card assembly.
Color(s) missing.	Replace the interface cable. If the fault still persists, replace the card assembly. If the fault still persists, exchange the CRT.
Maximum white point is poor.	Make sure the brightness control is in the center detent position. Readjust RV700 G.GAIN, RV701 R.GAIN, and RV702 B.GAIN to determine whether the correct white color can be obtained; otherwise, replace the card assembly.
Minimum white point is poor.	Make sure the brightness control is in the center detent position. Readjust RV800 G.CUT-OFF, RV801 R.CUT-OFF, and RV802 B.CUT-OFF to determine whether the correct white color can be obtained; otherwise, replace the card assembly.
Convergence poor.	Replace the CRT.
Focus poor.	Turn the focus potentiometer to determine if readjustment is possible;, if not, replace the card assembly. If the fault persists, replace the CRT.
Colors change or flicker	Install a new signal interface cable, then proceed as for 'Color(s) missing' above.

Note: To meet required safety standards, repair of the main PCB assembly and video card assembly is **not** recommended.

2.2.2.3 Adjustment Procedures

CAUTION:
Use extreme caution when making adjustments with the display powered on; these adjustments should not be performed unattended.

The display must never be left unattended with the covers removed and powered on in a customer environment.

Refer to "Display-Specific Removals and Replacements" in topic 2.2.1 for details of how to get access to maintenance controls.

All adjustments must be completed in the sequence given here.

Subtopics

2.2.2.3.1 Test Equipment

Refer to "Tools and Test Equipment" in topic 3.3 for details of tools and test equipment required. Ensure that the connections of all cables are set up as shown in Figure 13-1 in topic 3.3.1.

2.2.2.3.2 Maintenance Controls and Internal Connectors

The following illustrations show the maintenance controls -- the analog and video card controls -- and the internal connectors of the 8513 Display.

PICTURE 24

Figure 5-3. Potentiometers, 8513 Display

PICTURE 25

Figure 5-4. Internal Connectors, 8513 Display

2.2.2.3.3 Preliminary Set-Up

Proceed as follows.

1. Insert the IBM Personal System/2 Color Displays Test-Pattern Diskette in drive A of the system unit.

   CAUTION:
   Use caution when making adjustments with the cover removed. There are high voltages on the Yoke, analog, and video cards.

2. Check to make sure that the G2 potentiometer is turned fully counter clockwise (CCW).

3. Power on the system unit and the 8513 Display. The system unit runs internal checks, and then loads the program from the diskette.

4. With the Brightness control set to the center detent position (midpoint), adjust G2 and focus until the setup menu or an informational prompt is visible on the screen. From the setup menu select pattern C and adjust G2 to give minimum background illumination.

5. Allow 20 minutes for the display to warm up before making any further adjustments.

6. Set the contract control to midpoint.

2.2.2.3.4 Geometry Adjustments

Proceed as follows.

1. Select pattern B, 50 mm Square Box on a black background:

   Note: Before doing this step, if you are servicing a display with a metal card tray, adjust RV203 (Raster Center) first to centralize the raster in the bezel. You may have to turn Brightness control CCW to see raster.

   Adjust RV200 (H.Phase) potentiometer to centralize the rectangle horizontally on the screen.

   a. Adjust RV202 (Width) for a gap of 14 mm (measured at the horizontal center line of the screen) between the vertical green edges of the rectangle and the inner edges of the bezel.

   b. Adjust RV201 (East West Pincushion) to set the straightest possible vertical lines.

   c. Press the F3 function key, then select pattern A (Crosshatch). Adjust the RV302 (V. Lin.) potentiometer to get squares of equal height.

   d. You may have to repeat steps a, b, c, and d.

2. Press the F3 function key, then select pattern B (50 mm Square Box), adjust sequentially RV300 (Vertical Height) and RV301 (Vertical Centering). Set the picture in the center of the screen with a gap of 8 mm (measured at the vertical center line of the screen) between the horizontal edges of the green rectangle and the inner edges of the top and bottom of the bezel.

2.2.2.3.5 Color Point Adjustments

Proceed as follows.

1. Insert the Color Displays Test-Pattern Diskette in drive A of system unit.

   CAUTION:
   Use caution when making adjustments with the cover removed. There are high voltages on the Yoke, analog and video cards.

2. Power on the system unit and the 8513 Display. The system unit runs internal checks, and then loads the program from the diskette.

3. Turn all color pots RV700, RV800, RV701, RV801, RV702, and RV802 on the ITC card (on the back of the tube) full CCW.

4. With the Brightness control set to center detent (midpoint) and Contrast control to midpoint: Adjust G2 (intensity pot), lower pot on HVT, until the MSG. and A: prompt are visible. Adjust FOCUS, upper pot on HVT for clarity. Type "VGA" at the A: prompt and press Enter. Press Enter 720 x 350 screen. Select pattern C (Full Screen Raster), then press Enter four times for a BLACK field. Turn G2 CCW until the screen just goes blank.

5. Allow 20 minutes for the display to warm up before making any further adjustments.

6. Set the Brightness and Contrast control to maximum CCW, looking from the top of the display.

7. Adjust the cutoff potentiometers RV800 (Green Cut-Off), RV801 (Red Cut-Off), RV802 (Blue Cut-Off), for a correct white color point.

   Note: Adjust the predominant color on the screen last if needed.

8. Set the Brightness control to center detent (midpoint). If screen is illuminated, adjust G2 to ensure the screen is just not illuminated.

9. Depress F3, select pattern A (Crosshatch) on the setup diskette. This will display the GREEN crosshatch.

10. Set the Brightness and Contrast controls (minimum) fully CW, as viewed from the top of the display. Then Adjust RV700 (GREEN Gain) CW until the crosshatch illuminates GREEN then CCW until the vertical lines just go blank.

11. Depress the Enter key once to display the BLUE crosshatch. Then adjust RV702 (BLUE Gain) CW until the crosshatch illuminates BLUE, then CCW until the vertical lines just go blank.

12. Depress the Enter key once to display the RED crosshatch. Then adjust RV701 (RED Gain) CW until the crosshatch illuminates RED then CCW until the vertical lines just go blank.

13. Set the Brightness control to center detent (midpoint) and Contrast control to midpoint.

14. Depress F3, select pattern C (Full Screen Raster), press Enter three (3) times to display the WHITE screen raster.

15. Adjust if necessary RV700 (Green Gain), RV701 (Red Gain), RV702 (Blue Gain), for correct white color point.

    Note: Adjust the predominant color on the screen last if needed.

16. Depress F3, select pattern D (Gray Scale).

17. Check, at maximum and minimum Contrast, that the blocks are evenly graduated from black through white with no color tinges.

18. Check that there is no color smearing.

If steps 17 and 18 are not satisfactory, repeat this complete procedure.

2.2.2.3.6 Focus Adjustment

Proceed as follows.

1. Select pattern E, Focus pattern.

2. Adjust the Focus (upper pot on the HVT) for sharp vertical and horizontal lines. Take care not to disturb the G2 setting.

2.2.2.3.7 Adjustment Procedure Using Color Analyzer

The following instructions are included for those cases when adjustment by eye is not successful.

1. Insert the Color Displays Test-Pattern Diskette in drive A of system unit.

   CAUTION:
   Use extreme caution when making adjustments with the cover removed. There are high voltages on the yoke, analog and video cards.

2. Power on the system unit and the 8513 Display. The system unit runs internal checks, and then loads the program from the diskette.

3. Turn RV800 Green cut off, RV801 red cut off, RV802 blue cut off, on the ITC card (on the back of the tube) fully clockwise (CW).

4. Set the Brightness and Contrast control to maximum CCW, as looking from the top of the display.

5. Select Pattern C (Full Screen Raster) and press the spacebar four times for a BLACK field/raster.

6. Turn the G2 potentiometer on the EHT transformer slowly CW until the first color appears. Turn the associated cutoff potentiometer fully CW.

7. Continue turning the G2 potentiometer CW until the second color appears. Turn the associated cutoff potentiometer fully CW also.

8. Continue turning the G2 potentiometer CW until the third color appears.

9. Readjust the first and second cutoff potentiometers and G2 to get the following white luminance and chromaticity:

   (line 1 are CIE COORDINATES)

cd/m 2	x	y
2+1.0/-0	.0245+/-).010	0.263+/-0.010

   a. Green cutoff potentiometer (RV800) CW predominantly increases y.

   b. Red cutoff potentiometer (RV801) CW predominantly increases x.

   c. Blue cutoff potentiometer (RV802) CW predominantly decreases both x and y.

10. Set the Brightness control to center detent (midpoint). Adjust RV700 (GREEN Gain), RV701 (RED Gain), RV702 (BLUE Gain) to the mid position.

11. Select pattern E, Focus pattern. Adjust the Focus (upper pot on the HVT) for sharp vertical and horizontal lines. Take care not to disturb the G2 setting.

12. Select pattern C (Full Screen Raster), press Enter three times to display the WHITE screen raster. Adjust RV700 (GREEN Gain), RV701 (RED Gain), RV702 (BLUE Gain) only to set the center screen luminance and chromaticity to:

    (line 1 are CIE COORDINATES)

cd/m 2	x	y
120 to 150	0.313+/-0.010	0.239+/-0.010

    a. Green gain potentiometer (RV700) CW predominantly increases y.

    b. Red gain potentiometer (RV701) CW predominantly increases x.

    c. Blue gain potentiometer (RV702) CW predominantly decreases both x and y.

    d. CW rotation of all gain potentiometers increases y (brightness).

2.2.3 Specifications

Subtopics
2.2.3.1 Physical Characteristics
2.2.3.2 Functional Characteristics

2.2.3.1 Physical Characteristics

The following information applies to all models of the 8513 Display:

Subtopics
2.2.3.1.1 Weight
2.2.3.1.2 Environment
2.2.3.1.3 Electrical

2.2.3.1.1 Weight

12.0 kg (26.4 lb), excluding stand.

2.2.3.1.2 Environment

- Operating Temperature: - 15° to 33°C

2.2.3.1.3 Electrical

- Model 8513001: 90 to 137 V ac
- Model 8513002: 180 to 264 V ac
- Model 8513003: 180 to 264 V ac
- Model 8513102: 180 to 264 V ac

2.2.3.2 Functional Characteristics

Video input: analog, direct-drive, 75 ohm, 0 to 0.7 V.

CRT faceplate: dark, non-reflective (etched).

CRT phosphor: short persistence (P22).

Horizontal deflection rate (kilohertz)	31.5
Vertical deflection rate (frames per sec)	50 to 70
Horizontal blanking time (microseconds)	5.7
Vertical blanking time (milliseconds)	0.88
Vertical addressability (lines)	350 to 480
Interlace ratio	1:1

Resolution:

Mode 1, 720 x 350 Pels, non-interlaced.

Mode 2, 720 x 400 Pels, non-interlaced.

Mode 3, 720 x 480 Pels, non-interlaced.

2.2.4 Locations

Subtopics
2.2.4.1 Card Locations
2.2.4.2 Cable Connection Locations

2.2.4.1 Card Locations

PICTURE 26

Figure 5-5. Card Locations, 8513 Display

2.2.4.2 Cable Connection Locations

PICTURE 27

Figure 5-6. Cable Connection Locations, 8513 Display

2.3 6. 8515-Specific Information

This chapter contains display-specific service procedures and reference information for the 8515 Color Display. Included are:

- Removal and replacement procedures for the:
  - Card-tray assembly
  - Signal cable
- Functional checks and adjustments, including:
  - Function checks
  - Pattern checks
  - Adjustment procedures
- Physical and functional specifications
- Part location illustrations.

For information or procedures that are the same for all displays, you are referred to the appropriate sections under "Part I. General Service Information."

Note: This service information supports only "02X" models of the 8515 Display. The "00X" models of the 8515 Displays must be serviced by Element Exchange. See "Element Exchange Monitors" in topic 3.2 for a list of element exchange displays.

Subtopics

2.3.1 Display-Specific Removals and Replacements

Subtopics
2.3.1.1 Tilt Swivel Stand
2.3.1.2 Rear Cover
2.3.1.3 Shield Cover
2.3.1.4 Card Tray Assembly
2.3.1.5 Signal Cable
2.3.1.6 Integrated Tube Component (ITC)

2.3.1.1 Tilt Swivel Stand

Refer to the general procedures for removing and replacing tilt swivel stands in "Tilt Swivel Stand" in topic 1.3.1.

2.3.1.2 Rear Cover

Refer to the general procedures for removing and replacing the rear cover in "Rear Cover" in topic 1.3.3.

2.3.1.3 Shield Cover

1. Remove the two DAG braid leads from the shield.
2. Remove the screw from each corner of the shield.
3. Lift the shield cover at the front and take it off after disengaging the hooks at the rear.

CAUTION:
Shield cover may have sharp corners or edges.

2.3.1.4 Card Tray Assembly

The video and analog cards are permanently connected to each other. They are supplied as one card assembly from which the video card is snapped off and located on the base of the CRT, and mounted in a metal card tray.

The video card is held in position by the shield cover. The video card spring is compressed when the shield cover is attached.

1. Refer to Figure 6-1.

2. Remove the anode cap 2 from the CRT.

3. Remove the two DAG braid leads 1 from the video assembly.

4. Unplug the connectors from the CRT to the analog and video cards (P400, P600, and P901).

   CAUTION:
   Take care not to damage the neck of the CRT.

   Observe all safety notices for handling CRTs.

5. Release the video card 3 and remove it from the CRT base.

6. Pull the video assembly 4 away from the CRT after delatching the two securing arms (see view A) with a screwdriver.

7. Unplug the connectors 5 from the signal cable to the video card.

8. Release the signal cable from the clip 6 on the EHT assembly.

9. Unscrew the cable clamp screw 7 and remove the signal cable.

PICTURE 28

Figure 6-1. Removing the Video and Analog Card Assembly, 8515 Display

Replacement:

Replace the Card Tray Assembly using the above instructions in reverse order.

Note: On replacement, ensure that the securing arms for the video assembly are latched into the front cover.

2.3.1.5 Signal Cable

1. Refer to Figure 6-1 in topic 2.3.1.4.
2. Remove the connectors 5 from the signal cable to the video card and the associated ground lead.

Replacement:

Replace the Signal Cable using the above instructions in reverse order.

2.3.1.6 Integrated Tube Component (ITC)

Refer to the general procedures for removing and replacing ITCs in "Integrated Tube Component (ITC)" in topic 1.3.7.

2.3.2 Functional Checks and Adjustments

This section contains complete function and pattern checks and adjustment procedures for the 8515 Display. There are two steps to follow in the function and pattern checks, that is, to read the "Symptom" and follow the "Action" presented in the diagnostic tables.

Subtopics
2.3.2.1 Function Checks
2.3.2.2 Pattern Checks
2.3.2.3 Adjustment Procedures

2.3.2.1 Function Checks

Basic functions may be checked using the self-test raster.

Refer to "Adjustment Procedures" in topic 2.3.2.3 when adjustments are required.

Refer to "Display-Specific Removals and Replacements" in topic 2.3.1 for removal and replacement procedures.

Symptom	**Action**
Any problems.	First, check all connections and associated items for continuity.
Green LED lit but test raster missing.	Check CRT heater. If not glowing, replace card assembly. Otherwise, adjust G2 control clockwise until test raster appears AGAINST background raster. If no raster appears replace ITC.
One or more colors missing from background raster.	Adjust cut-off controls for missing colors. If colors reappear, reset color-point of ITC. Otherwise replace ITC.
One or more colors missing from test raster.	Adjust gain controls for missing colors. If colors reappear, reset color-point of ITC. Otherwise replace ITC.
Test raster scan is collapsed horizontally/ vertically.	If partially collapsed, adjust as appropriate. If fully collapsed, replace card assembly.

2.3.2.2 Pattern Checks

Subtopics
2.3.2.2.1 Modes 1, 2, and 3 checks
2.3.2.2.2 Mode 4 checks

2.3.2.2.1 Modes 1, 2, and 3 checks

These symptoms relate to operating the display in mode 1, 2, or 3 with a crosshatch image displayed.

Refer to "Adjustment Procedures" in topic 2.3.2.3 when adjustments are required.

Refer to "Display-Specific Removals and Replacements" in topic 2.3.1 for removal and replacement procedures.

Symptom	**Action**
Displayed image width is too large or too small.	Adjust RV600. If symptom persists, regulator is faulty. Replace card assembly.
Displayed image height is too large or too small.	Adjust RV400. If symptom persists, vertical preamplifier is faulty. Replace card assembly.
Color purity of displayed image is poor.	Degauss circuit or video blanking circuit is faulty. Replace card assembly. Or, ITC defective, replace ITC.
User foreground control not working.	Video control circuit or user foreground potentiometer is faulty. Replace card assembly.
Maximum or minimum white point is poor.	Video color point is not set. Adjust as appropriate.
East-west pincushion correction is poor.	Adjust RV402 for optimum geometry between modes. If impossible, EWPCC selector is faulty. Replace card assembly.
Displayed image does not sync horizontally.	Horizontal oscillator frequency is out of capture range. If symptom persists, replace card assembly.
Displayed image does not sync vertically.	Vertical preamplifier is faulty. Replace card assembly.
Displayed image is wrapped around raster horizontally.	Adjust RV501 until displayed image is central to background raster. If impossible, PLL is faulty. Replace card assembly.
Displayed image is wrapped around raster vertically.	Vertical power amplifier supply circuit is faulty. Replace card assembly.
Background raster is not centered horizontally.	Adjust RV601. If raster cannot be centered, centering circuit is faulty. Replace card assembly.
Displayed image is not centered horizontally.	Adjust RV501 until displayed image is central to background raster. If impossible, PLL is faulty. Replace card assembly.
Displayed image height varies excessively between modes.	Height selection circuit is faulty. Replace card assembly.
Displayed image appears broken up horizontally.	Width regulation is unstable. Repeat actions for image does not sync horizontally, or is wrapped around raster horizontally.

2.3.2.2.2 Mode 4 checks

These symptoms relate to operating the display in mode 4, when the line scan frequency is increased from 31.47 kHz to 35.52 kHz.

Refer to "Adjustment Procedures" in topic 2.3.2.3 when adjustments are required.

Symptom	**Action**
Displayed image is wrapped around raster horizontally.	Adjust RV502 until displayed image is central to background raster. If this is impossible, PLL mode 4 select is not working. Replace card assembly.
Displayed image width varies excessively between mode 4 and other modes.	Mode 4 selection circuit is not working. Replace card assembly.

2.3.2.3 Adjustment Procedures

CAUTION:
Use extreme caution when making adjustments with the display powered on; these adjustments should not be performed unattended.

The display must never be left unattended with the covers removed and powered on in a customer environment.

Refer to the "Display-Specific Removals and Replacements" in topic 2.3.1 for details of how to get access to maintenance controls.

All adjustments must be completed in the sequence given here.

Subtopics

2.3.2.3.1 Test Equipment

Refer to "Tools and Test Equipment" in topic 3.3 for details of tools and test equipment required. Ensure that the connections of all cables are set up as shown in Figure 13-1 in topic 3.3.1.

2.3.2.3.2 Maintenance Controls and Internal Connectors

The following illustration shows the maintenance controls -- analog and video card controls -- and internal connectors of the 8515 Display.

PICTURE 29

Figure 6-2. Analog and Video Cards, 8515 Display

2.3.2.3.3 Preliminary Set-Up

Proceed as follows.

1. Insert the IBM Personal System/2 Color Displays Test-Pattern Diskette in drive A of the system unit.

   CAUTION:
   Use extreme caution when making adjustments with the cover removed. There are high voltages on the Yoke, analog and video cards.

2. Check to make sure that the G2 potentiometer is turned fully counter clockwise (CCW).

3. Power on the system unit and the display. The system unit runs internal checks, and loads the program from the diskette.

4. With the Brightness control set to the center detent position (midpoint), adjust G2 and focus until the setup menu or an informational prompt is visible on the screen. From the setup menu select pattern C and adjust G2 to give minimum background illumination.

5. Allow 20 minutes for the display to warm up before making any further adjustments.

6. Set the contract control to midpoint.

2.3.2.3.4 Geometry Adjustments

Proceed as follows.

1. Select Display Mode 1, then select Pattern A (Crosshatch)

   Note: It may be necessary to adjust G2 and Focus on the HVT and RV500 (factory preset Horizontal Frequency) to be able to view the Main Menu of the Test-Pattern Diskette.

2. Ajust G2 control (on EHT) until a background raster appears and the left and right borders of the raster are visible.

3. Adjust RV601 (Horizontal Raster Centering) to center the background raster on the screen.

   Note: If Display Mode 4 is available also check for this condition in Display Mode 4.

4. Adjust RV400 (Vertical Height) counter clockwise until there is approximately 30 mm between the top and bottom of the crosshatch pattern and the top and bottom of the bezel.

5. Adjust RV401 (Vertical Linearity) for equal height of the top and bottom squares of the crosshatch pattern.

6. Using the same test pattern, adjust sequentially RV400 (Vertical Height) and RV403 (Vertical Centering). Set the crosshatch in the center of the screen with a gap of 7.5 mm (Measured at the vertical center line of the screen) between the horizontal edges of the green rectangle and the top and bottom of the bezel.

7. Adjust RV402 (East West Pincushion) to set the straightest possible vertical lines

8. Adjust RV501 (Horizontal Phase Mode 1,2, and 3) to center the crosshatch within the right and left bezel.

   Note: If Display Mode 4 is available also check for this condition in Display Mode 4 and adjust RV502 (Horizontal Phase Mode 4) as required.

9. Adjust RV600 (Width) for a gap of 11 mm (measured at the horizontal center line of the screen) between the vertical edges of the green rectangle and the inner edges of the bezel.

2.3.2.3.5 Color Adjustments

Proceed as follows.

1. Select pattern C, and depress the spacebar four times until the black field is selected.

2. Set RV202, RV232, and RV262 (Cutoff Potentiometers) fully CCW, as viewed from the top of the video card.

3. Set RV201, RV231, and RV261 (Gain Potentiometers) fully CW, as viewed from the rear of the video card.

4. Set the background and foreground brightness controls to the midpoint position.

   Note: The midpoint can be found by turning the controls fully CW as viewed from the top of the display. Then turning the control the length of the window two times.

5. Adjust G2 so that the screen is just illuminated. Set both brightness controls to maximum.

6. Adjust the cutoff potentiometers for the correct white color point.

7. Set both brightness controls to the center midpoint. If necessary, adjust G2 to ensure that the screen is just not illuminated.

8. Select Pattern B, 50 mm Square Box and depress the spacebar three times until a white square appears.

9. Ensure that both brightness controls are at the midpoint.

10. Adjust RV201 (blue), RV231 (red), and RV261 (green) gain potentiometers on the rear of the video card for the correct white color point.

11. Some video cards may contain RV280. If this potentiometer is present is should be adjusted fully CCW.

12. Select Pattern D, Gray Scale Blocks and adjust G2 so the top right hand block is visible and the block to the left of it is just visible.

13. Check, at maximum and minimum foreground and background brightness that the blocks are evenly graduated black through white with no color tinges.

14. Check that there is no color smearing.

2.3.2.3.6 Focus

Proceed as follows.

1. Select pattern E, Focus pattern.

2. Adjust the Focus control to give sharp vertical and horizontal lines.
   Take care not to disturb the G2 setting

This completes the adjustment procedures

2.3.3 Specifications

Subtopics
2.3.3.1 Physical Characteristics
2.3.3.2 Functional Characteristics

2.3.3.1 Physical Characteristics

The following information applies to all models of the 8515 Display:

Subtopics
2.3.3.1.1 Size
2.3.3.1.2 Weight
2.3.3.1.3 Environment
2.3.3.1.4 Electrical

2.3.3.1.1 Size

- Height 345 mm (13.6 in.), excluding stand
- Width 355 mm (14.0 in.)
- Depth 389 mm (15.3 in.).

2.3.3.1.2 Weight

14.5 kg (31.9 lb), excluding stand.

2.3.3.1.3 Environment

- Temperature:
  - Operating 10° to 35°C (50 to 95°F)
  - Storage 6° to 60°C (33 to 140°F)
  - Shipping -20° to 60°C (-4 to 140°F).
- Humidity:
  - Operating 8% to 80%
  - Storage 5% to 80%
  - Shipping 5% to 100%

- Maximum Altitude 2187 m (7175 ft).

2.3.3.1.4 Electrical

- Model 8515001: 90 to 137 V ac, 47 to 63 Hz
- Model 8515002: 90 to 265 V ac, 47 to 63 Hz
- Model 8515003: 180 to 265 V ac, 47 to 63 Hz
- Model 8515A01: 90 to 137 V ac, 47 to 63 Hz

2.3.3.2 Functional Characteristics

Video input: analog, direct-drive, 75 ohm, 0 to 0.7 V.

CRT faceplate: dark, antiglare (etched or silica coated).

CRT phosphor: medium persistence

CRT resolution: 0.29 mm (max) dot pitch

MODE	**1**	**2**	**3**	**4**
Horizontal deflection rate (kilohertz)	31.5	31.5	31.5	35.5
Vertical deflection rate (frames per sec)	70	70	60	43.5
Horizontal blanking time (microseconds)	5.72	5.72	5.72	5.13 to 5.35*
Vertical blanking time (milliseconds)	2.76	1.12	0.92	0.69 to 0.70*
Vertical addressability (lines)	362	414	496	768
Interlace ratio	1:1	1:1	1:1	2:1

Note: *Rate varies with pel resolution

2.3.4 Locations

Subtopics
2.3.4.1 Safety Grounds
2.3.4.2 Parts Locations

2.3.4.1 Safety Grounds

PICTURE 30

Figure 6-3. Safety Grounds, 8515

2.3.4.2 Parts Locations

PICTURE 31

Figure 6-4. Parts Locations, 8515

2.4 7. 8516-Specific Information

This chapter contains display-specific service procedures and reference information for the IBM PS/2 8516 Touch Display.

The 8516 Touch Display is a high resolution color display. It has a power switch, power-on indicator, and controls for foreground and background brightness. The front of the display contains a transducer assembly that responds to touch on the surface of the screen. Picture height and line switching are controlled externally. Three models of this display are available:

Model 8516001	**Model 8516002**	**Model 8516004**
Low Voltage (U.S. and Canada)	Universal Voltage (Northern Hemisphere)	High Voltage (Southern Hemisphere)

This material pertains to display-specific service procedures and reference information including:

- General checkout procedures
- Basic and advanced diagnostics
- A symptom to Field-Replaceable-Unit (FRU) index
- Specifications
- A parts list.

Subtopics

2.4.1 General Checkout Procedures

The advanced diagnostic tests are intended to test *only* IBM products. Non-IBM products or modified options can give false errors and invalid system responses.

IMPORTANT:

You have entered this supplement because you were directed here from a system service pamphlet, or you suspect a problem with the 8516 Touch Display.

Subtopics
2.4.1.1 MAP 0120: 8516 Touch Display MAP

2.4.1.1 MAP 0120: 8516 Touch Display MAP

001

Did you receive an '86XX' or '0086XXXX' error during POST, or did the keyboard lock-out?

Yes **No**

002

Go to Step 007.

003

- Power off the display and system unit.

- Remove the display logic cable from the system unit.

- Power on the display and system unit.

Go to Step 004.

004

(From step 003)

Did you receive an '86XX' or '0086XXXX' error during POST, or did the keyboard lock-out?

Yes **No**

005

Replace the 8516 Touch Display.

006

Go to "Symptom-to-FRU Index" in topic 2.4.3 for your system unit.

007

(From step 002)

Did you receive a '54XX' or '0054XXXX' error message?

Yes **No**

008

If there are intermittent or system problems, go to "Symptom-to-FRU Index" in topic 2.4.3.

009

Replace the 8516 Touch Display. (If only the calibration or an accuracy test failed, check that nothing is pressing on the screen, and that the display does not rock when the screen is pressed.)

2.4.2 8516 Touch Display Diagnostics

Two test routines are available for testing the 8516 Touch Display:

- Display Self-test
- Advanced Diagnostic Tests (touch-screen and non-interactive diagnostic tests).

Subtopics
2.4.2.1 Display Self-test
2.4.2.2 Advanced Diagnostic Tests

2.4.2.1 Display Self-test

The self-test pattern comprises a full white raster with a black border.
The display must be switched on for 5 minutes before starting the test.
If the image is not present or not steady, exchange the display.

1. Power off the display.
2. Check that the signal cable is disconnected.
3. Power on the display.
4. Set the background brightness control to maximum (from left to right).
5. The image on the screen should be white with a black border, 2 mm to 20 mm (0.08 in. to 0.79 in.), on all or most sides.

For extended display tests, run the advanced diagnostic tests.

2.4.2.2 Advanced Diagnostic Tests

- If you are using a PS/2 Model 30 286, Model 35SX, or Model 40SX use the 8516 Touch Display Advanced Diagnostics diskette and restart the system.
  Select 'System Checkout', and follow the instructions on the screen to test the display.

- If you are using a PS/2 Model 50 or above, copy the Option diskette onto a backup copy of the Reference diskette.

To run the tests, select the 'Device Test Menu', then the '8516 Touch Display' from the list of installed devices. Follow the instructions on the screen to complete the test.

If you cannot use the touch display to complete the tests, a message and/or error panels will tell you what action to take.

Note:

Because the processor logic cable is connected to the mouse port of the system unit, 8516 Touch Display faults may cause an error message that says there is a problem with a pointing device, or the keyboard, or cause a keyboard lock-up.

If a POST or diagnostic error '86XX' or '0086XXXX' occurs, or the keyboard locks-up, carefully note the error number (or note what happened), then:

1. Power off the system unit.
2. Remove the processor logic cable from the system unit.
3. If you have an IBM PS/2 mouse, connect it to the system unit.
4. Power on the system unit and rerun the tests.

If no errors occur with the display disconnected, have the display serviced.

If errors still occur with the display disconnected, service the indicated unit.

2.4.3 Symptom-to-FRU Index

This Symptom-to-FRU Index lists symptoms and errors and the possible causes. The most likely cause is listed first. Use this index to help you decide which FRUs (field replaceable units) you should have available for servicing.

An 'X' in an error message can be any number.

Symptom/Error	**FRU/Action**
54XX	**8516 Touch Display**
0054XXXX	**8516 Touch Display**
Cannot use the touch screen	**8516 Touch Display**
Cannot use the mouse attached to 8516 Touch Display	**8516 Touch Display** Mouse
86XX	**8516 Touch Display** Mouse System unit system board
0086XXXX	**8516 Touch Display** Mouse System unit system board
Keyboard lock-up	**8516 Touch Display** Mouse System unit system board

2.4.4 Specifications

The following information applies to all models of the 8516 Display:

Subtopics
2.4.4.1 Physical Characteristics

2.4.4.1 Physical Characteristics

Subtopics
2.4.4.1.1 Size
2.4.4.1.2 Weight
2.4.4.1.3 Environment
2.4.4.1.4 Heat Output
2.4.4.1.5 Electrical

2.4.4.1.1 Size

- Height 345 mm (13.6 in)
- Width 355 mm (14.0 in)
- Depth 389 mm (15.3 in).

2.4.4.1.2 Weight

14.5 kg (31.9 lb).

2.4.4.1.3 Environment

- Temperature:
  - Operating Temperature 10 to 35°C (50 to 95°F)
  - Storage Temperature 0.6 to 60°C (33 to 140°F)
  - Shipping Temperature -20 to 60°C (-4 to 140°F).
- Humidity:
  - Operating Humidity 8 to 80%
  - Storage Humidity 5 to 80%
  - Shipping Humidity 5 to 100% (see Note 1).
- Maximum Altitude 3000 m (9842 ft).

2.4.4.1.4 Heat Output

100 watts (341.2 Btu per hour maximum).

2.4.4.1.5 Electrical

- Model 8516001: 90 to 137 Vac, 47 to 63 Hz
- Model 8516002: 90 to 265 Vac, 47 to 63 Hz
- Model 8516004: 180 to 265 Vac, 47 to 63 Hz.

Note:

The higher level of humidity for shipping allows for condensation, but not direct contact with moisture.

2.5 8. 8517/9517-Specific Information

This chapter contains display-specific service procedures and reference information for the IBM PS/2 8517 and 9517 Displays. Included are:

- Removal and replacement procedures for the:
  - Card-tray assembly
  - Signal cable
- Functional checks and adjustments, including:
  - Function checks
  - Pattern checks
  - Adjustment procedures
- Physical and functional specifications
- Part location illustrations.

For information or procedures that are the same for all displays, you are referred to the appropriate sections under "Part I. General Service Information."

Subtopics

2.5.1 Display-Specific Removals and Replacements

Subtopics
2.5.1.1 Tilt Swivel Stand
2.5.1.2 Rear Cover
2.5.1.3 Pod Assembly
2.5.1.4 Electromagnetic Interference Shield
2.5.1.5 Card Tray Assembly
2.5.1.6 Signal Cable
2.5.1.7 Integrated Tube Component (ITC)

2.5.1.1 Tilt Swivel Stand

Refer to the general procedures for removing and replacing tilt swivel stands in "Tilt Swivel Stand" in topic 1.3.1.

2.5.1.2 Rear Cover

Refer to the general procedures for removing and replacing the rear cover in "Rear Cover" in topic 1.3.3.

2.5.1.3 Pod Assembly

The pod contains the control and filter cards.

1. Refer to Figure 8-1
2. Remove the three screws 1 securing the pod.
3. Disconnect the earth lead 2 from the card tray.
4. Release the two latches 3 with a flat-blade screwdriver and ease the pod back.
5. Remove the power connector 4 from the filter card to the analog card.
6. Remove the connector 5 from the control card to the analog card.

PICTURE 32

Figure 8-1. Removing the Pod Assembly, 8517 Display

Replacement:

Replace the Pod Assembly using the above instructions in reverse order.

2.5.1.4 Electromagnetic Interference Shield

1. Refer to Figure 8-2.

2. Remove the three screws 1 from each side of the shield, and the ground wire 2 .

3. Lift the shield at the back and move it away from the retaining slots on the Integrated Tube Component (ITC) shield.

PICTURE 33

Figure 8-2. Removing the Electromagnetic Interference Shield, 8517 Display

Replacement:

Ensure that the spring tabs on the bottom of the interference shield are correctly disposed on either side of the card tray, and the ground wire is reconnected.

2.5.1.5 Card Tray Assembly

1. Refer to Figure 8-3.

2. Remove the video shield ground strap 1 from the chassis.

3. Remove the DAG lead 2 from the video shield.

4. Remove the black lead 3 from the EHT transformer.

5. Remove the red lead to the EHT transformer from the H.STAT 7 potentiometer.

6. Remove the two connectors 4 from the analog card to the video card.

7. Loosen (but do not remove) the screw 5 that secures the video card clamp to the CRT.

8. Ease the video card away from the neck of the CRT. The final movement requires a slight bias outward on the right side.

9. When the video card is clear of the CRT, remove the five connectors 6 from the base of the video card.

PICTURE 34

Figure 8-3. Removing the Video Card, 8517/9517 Displays

Replacement:

1. Replace the connectors on the base of the card.

2. Check that the CRT pins are straight and the video card is aligned correctly with the CRT base, before replacing the card and securing the clamp.

3. Reconnect the remaining connections, including the CRT anode.

Note: Adjustments are required for video levels and cutoffs.

Subtopics
2.5.1.5.1 Card Tray
2.5.1.5.2 Analog Card

2.5.1.5.1 Card Tray

Proceed as follows.

1. Place the display on its front cover, protected by a soft cloth or similar material.

2. Refer to Figure 8-4.

3. Remove the connector 1 from the analog card and release the cable tie on the card tray lug.

4. Remove connector D21 (9517 only).

5. Remove two screws 2 from the card tray lugs and the ground lead 4 (9517 only).

6. Move the card tray away from the ITC shield and remove the connector 3 from the analog card.

   CAUTION:
   Take care not to damage the neck of the CRT.

   Observe all safety notices for handling CRTs.

PICTURE 35

Figure 8-4. Removing the Card Tray, 8517/9517 Displays

Replacement:

Ensure that the connectors to the analog card are replaced and check that all of the other analog card connectors are in place.

2.5.1.5.2 Analog Card

Proceed as follows.

1. Refer to Figure 8-5.

2. Remove two screws 1 .

3. Release the two cable ties 2 on the pod cable and the power cable.

4. Move the analog card away from the retaining mounts 3 and lift it out.

PICTURE 36

Figure 8-5. Removing the Analog Card, 8517/9517 Displays

Replacement:

Ensure the connector to the analog card is put through the slot at the front of the card tray.

Note: Geometry adjustments are required after replacing the analog card.

2.5.1.6 Signal Cable
The signal cable is clamped to the card tray.

1. Refer to Figure 8-6.

2. Remove the P-clip 1 from the card tray.

3. Release the two cable ties 2 .

4. Turn the card tray over.

5. Release the metal clamp 3 from the underside of the card tray.

6. Ease the signal cable out from the card tray.

PICTURE 37

Figure 8-6. Removing the Signal Cable, 8517/9517 Displays

Replacement:

Ensure that both the P-clip and the clamp are in contact with the braid of the signal cable.

2.5.1.7 Integrated Tube Component (ITC)

Refer to the general procedures for removing and replacing ITCs in "Integrated Tube Component (ITC)" in topic 1.3.7.

2.5.2 Functional Checks and Adjustments

This section contains complete function and pattern checks and adjustment procedures for the 8517 Display. There are two steps to follow in the function and pattern checks, that is, to read the "Symptom" and follow the "Action" presented in the diagnostic tables.

Subtopics
2.5.2.1 Function Checks
2.5.2.2 Pattern Checks
2.5.2.3 Pod Assembly Checks
2.5.2.4 Adjustment Procedures

2.5.2.1 Function Checks

Basic functions can be checked using the self-test raster.

Refer to "Adjustment Procedures" in topic 2.5.2.4 when adjustments are required.

Refer to the "Display-Specific Removals and Replacements" in topic 2.5.1 for removal and replacement procedures.

Symptom	**Action**
Any problems.	First, check all connections and plugs for continuity.
Green LED lit but test raster missing.	Adjust RV508 (G2) clockwise until a background raster appears. If no raster appears, replace analog card. If raster still absent, replace ITC. If background raster appears, replace video card.
Test raster is not white.	Adjust video levels and cutoffs for correct colorpoint. If no improvement, replace video card.
Test raster is multicolored.	Ensure that D2 is connected. Turn power off for 30 minutes, and then on again to check degauss action. Check continuity of degauss coil. If defective, replace ITC shield, otherwise replace analog card.
Test raster scan is collapsed horizontally or vertically.	If partially collapsed, adjust as appropriate. If fully collapsed, replace analog card.

2.5.2.2 Pattern Checks

These symptoms relate to operating the display with a crosshatch pattern displayed. Before starting any checks, ensure that all plugs and connectors are positioned correctly and securely.

Subtopics
2.5.2.2.1 Preliminary Steps

2.5.2.2.1 Preliminary Steps

Proceed as follows.

1. Insert the IBM Personal System/2 Color Displays Test-Pattern Diskette in drive A of the system unit.

2. Turn power on at the system unit and the display. The system unit runs its internal checks, and then loads the program from the diskette.

3. Allow 20 minutes for the display to warm up before making any further adjustments.

Refer to "Adjustment Procedures" in topic 2.5.2.4 when adjustments are required.

Refer to the "Display-Specific Removals and Replacements" in topic 2.5.1 for removal and replacement procedures.

DANGER

Use caution when making adjustments with the cover removed. There are high voltages on the analog and video cards.

Symptom	**Action**
Displayed image width is too large or too small.	Adjust RV354, RV355 (8517 only), RV356, and RV357. If symptom persists, replace analog card.
Displayed image height is too large or too small.	Adjust RV211, RV212, RV213, RV214 (8517 only), RV215, and RV216. If symptom persists, replace analog card.
Contrast or brightness controls are not working.	Check connections between H3 (see Figure 8-7 in topic 2.5.2.3) and B6 (see Figure 8-11 in topic 2.5.2.4.2). If good, do pod assembly checks. Replace pod if it is defective. Otherwise replace video card.
Maximum or minimum white is poor.	Video colorpoint is not set. Adjust as appropriate.
Pattern is out of focus, vertical lines have colored edges or are multicolored.	Do focus and convergence adjustments.
Geometry is poor.	Follow alignment procedures to achieve good geometry. If impossible, replace analog card.
One or more colors missing.	If colors good with test raster (signal cable disconnected), check connector B1 (see Figure 8-11 in topic 2.5.2.4.2). Check connector on system unit. If symptom persists replace signal cable. If symptom still persists replace video card.
Displayed image does not synchronize horizontally or vertically.	Check connector on system unit. Ensure that D6, B2, and B11 are connected (see Figure 8-11 in topic 2.5.2.4.2). If symptom persists replace analog card. If symptom still persists replace video card.
Background raster is not centered horizontally.	Adjust RV506 (see Figure 8-8 in topic 2.5.2.4.2 or Figure 8-9 in topic 2.5.2.4.2). If raster cannot be centered, replace analog card.
Displayed image is not centered horizontally.	**For 8517,** adjust RV403, RV404 and RV405 (see Figure 8-8 in topic 2.5.2.4.2). **For 9517,** adjust RV403, RV404 (see Figure 8-9 in topic 2.5.2.4.2). If image cannot be centered, replace analog

	card.
Displayed image is not centered vertically.	Adjust RV204 (see Figure 8-8 in topic 2.5.2.4.2 or Figure 8-9 in topic 2.5.2.4.2). If image cannot be centered, replace analog card.
Displayed image height varies excessively between modes.	Adjust RV211, RV212, RV213, RV214 (8517 only), and RV216. If image cannot be centered, replace analog card.

2.5.2.3 Pod Assembly Checks

The pod assembly resistance checks are done with the power off and the power cord disconnected.

1. Refer to Figure 8-7.

2. Connect the meter across the pins designated A and B on the mains connector.

3. Short across pins 1 and 4 on connector F2.

4. With the power switch ON, the resistance should be less than 5 ohms.

PICTURE 38

Figure 8-7. Pod Assembly Resistance Checks

5. Connect meter between pin 1 (GND) and pin 4 (CONT) on connector H3 (see Figure 8-7).

6. When the contrast control is moved from maximum to minimum, the resistance range should be at least 8 kilohms.

7. Connect meter between pin 1 (GND) and pin 3 (BRIGHT +) on connector H3.

8. When the brightness control is moved from maximum to minimum, the resistance range should be at least 4 kilohms.

9. Replace the pod assembly if any of these checks are not correct.

2.5.2.4 Adjustment Procedures

CAUTION:
Use extreme caution when making adjustments with the power turned on at the display; these adjustments should not be performed unattended.

The display must never be left unattended with the covers removed and power turned on in a customer environment.

Refer to the "Display-Specific Removals and Replacements" in topic 2.5.1 for details of how to get access to maintenance controls.

All adjustments must be completed in the sequence given here.

Subtopics

2.5.2.4.1 Test Equipment

Refer to "Tools and Test Equipment" in topic 3.3 for details of the tools and test equipment required. Ensure that the equipment is set up as shown in Figure 13-1 in topic 3.3.1.

2.5.2.4.2 Maintenance Controls and Internal Connectors

The following illustrations shown the maintenance controls -- the analog and video card controls -- and internal connectors for the 8517 and 9517 Displays.

Where maintenance controls for the 8517 and 9517 Displays are different, a separate illustration is given to show each display.

Note: References to **modes** in this section are to the six operating modes, and **not** to the modes defined for the test procedures.

PICTURE 39

Figure 8-8. 8517 Analog Card Potentiometers

PICTURE 40

Figure 8-9. 9517 Analog Card Potentiometers

PICTURE 41

Figure 8-10. Video Card Potentiometers

PICTURE 42

Figure 8-11. Analog and Video Card Connectors

2.5.2.4.3 Preliminary Steps

Proceed as follows.

1. Insert the Color Displays Test-Pattern Diskette in drive A of the system unit.

   CAUTION:
   Use caution when making adjustments with the cover removed. There are high voltages on the analog and video cards.

2. Turn power on at the system unit and the display. The system unit runs its internal checks, and then loads the program from the diskette.

3. Allow 20 minutes for the display to warm up before making any adjustments.

Mode Selection: The mode for setting up the display is determined by the modes supported by the display adapter cards.

Table 8-1. Mode Selection 8517 Display

Adapter	**Modes**
VGA (system)	1 to 3
8514/A	1 to 4 (interlaced)
XGA	1 to 4 (interlaced)
Image/A	1 to 5

Table 8-2. Mode Selection 9517 Display

Adapter	**Modes**
XGA-2	1 to 4
Image/A	1 to 5

If mode 4 is not available, test patterns must be displayed in the highest resolution mode supported.

2.5.2.4.4 Geometry Adjustments

The test-pattern diskette provides menus for selecting the required test patterns. The test for mode 4 gives patterns with a resolution of 1024 x 768 pixels (interlaced or non-interlaced, depending on the video source).

All adjustments must be made with the brightness control set at center detent and the contrast control set at maximum. All test patterns should be displayed in mode 4, or in the highest resolution mode supported.

CAUTION:
Only use the plastic end of the adjustment tool for these procedures. Adjustments for unsupported modes are not required.

1. Select mode 4 (or mode 3 if mode 4 is not available).

2. Select option 3, pattern C (Full Screen Raster), and press the spacebar to get a black screen.

3. Adjust RV508 (G2) until the background raster is just visible.

4. Adjust RV506 (H.CENT) until background is centered within the bezel.

5. Adjust RV508 until the background raster just disappears.

6. Press **F3** to return to the setup patterns.

7. Select option 1, pattern A (Crosshatch).

8. Adjust the following controls to center the pattern horizontally within the bezel.

Display	**Mode 4**	**Mode 3**
8517	RV405 or RV404	RV403
9517	RV404	RV403

9. Adjust RV204 (V.CENT) until the pattern is centered vertically within the bezel.

10. Adjust the following width controls until the distance between each vertical edge of the pattern and the bezel is:
    7.5 mm ±0.5mm (mode 4) or
    11 mm ±0.5mm (mode 3).

Display	**Mode 4**	**Mode 3**
8517	RV356 or RV355	RV354
9517	RV356	RV354

11. Adjust the following height controls until the distance between each horizontal edge of the pattern and the bezel is:
    7.5 mm ±0.5mm (mode 4) or
    11 mm ±0.5mm (mode 3).

Display	**Mode 4**	**Mode 3**
8517	RV215 or RV214	RV213
9517	RV215	RV213

12. Adjust RV202 (V.LIN) until the distance between the top of the pattern and the center point is the same as the distance between the bottom line of the pattern and the center point.

13. Adjust RV307 (PIN.BAL) until the center vertical line of the pattern is straight.

14. Adjust RV305 (S-CORE) until the vertical edges of the pattern are straight.

15. Adjust the following pincushion controls until the vertical edges of the pattern are straight.

Display	**Mode 4**	**Mode 3**
8517	RV352 or RV351	RV350
9517	RV352	RV350

PICTURE 43

Figure 8-12. Geometry Adjustments

16. Adjust the following trapezoid controls until the edges of the pattern are vertical.

Display	**Mode 4**	**Mode 3**
8517	RV358	RV358
9517	RV359	RV358

17. Adjust RV203 (V.ANGLE) until the edges of the pattern are vertical.

18. You may need to repeat the adjustments for RV307, RV305, RV352, RV358 and RV203.

19. Press **F3** to return to the setup patterns.

20. Press **ESC** to return to the selection menu.

21. Select mode 5. If mode 5 is not available, ignore this step. Select option 1, pattern A (Crosshatch).

    a. Adjust RV353 until the vertical edges of the pattern are straight.

    b. Set width (RV357) until the distance between each vertical edge of the pattern and the bezel is 7.5 mm ±0.5mm.

    c. Set height (RV216) until the distance between each horizontal edge of the pattern and the bezel is 7.5 mm ±0.5mm.

22. Press **F3** to return to the setup patterns.

23. Press **ESC** to return to the selection menu.

24. If you have already set up mode 3, because mode 4 was not available, ignore this step.
    Select mode 3. Select option 1, pattern A (Crosshatch).

    a. Adjust RV350 (AMP VGA) until the vertical edges of the pattern are straight.

    b. Set width (RV354) until the distance between each vertical edge of the pattern and the bezel is 11 mm ±0.5mm.

    c. Set height (RV213) until the distance between each horizontal edge of the pattern and the bezel is 11 mm ±0.5mm.

25. Press **F3** to return to the setup patterns.

26. Press **ESC** to return to the selection menu.

27. Select mode 2. Select option 1, pattern A (Crosshatch).

28. Set height (RV212) until the distance between the outer edge of the pattern and the bezel is 11 mm ±0.5mm.

29. Press **F3** to retunr to the setup patterns.

30. Press **ESC** to return to the selection menu.

31. Select mode 1. Select option 1, pattern A (Crosshatch).

32. Set height (RV211) until the distance between the outer edge of the pattern and the bezel is 11 mm ±0.5mm.

33. Do focus and convergence adjustments after these procedures.

2.5.2.4.5 Video Levels and Cutoff Voltages

All adjustments must be made with the brightness control set at center detent and the contrast control set at maximum. Select mode 4 (or mode 3 if not available) to display the test patterns.

1. Select option 3, pattern C (Full Screen Raster), and press the spacebar to get a black screen.

    a. Set RV014 (R.BKG) and RV034 (B.BKG) fully clockwise.

    b. Adjust RV508 (G2) until a background raster is just visible.

    c. Adjust RV014 (R.BKG) until raster has a red tinge, then readjust until the red tinge just disappears.

    d. Adjust RV034 (B.BKG) until raster has a blue tinge, then readjust until the blue tinge just disappears.

    e. Adjust RV508 until the background raster just disappears. When the background color point is set correctly, the raster is white or gray until it disappears. If it is not, repeat this step.

2. Connect a voltmeter between ground (GND) and ABL1 on connector D8.

PICTURE 44

Figure 8-13. Connector D8

3. Press the spacebar to get a full blue screen.

4. Adjust RV031 (B.DRIVE) to give:
    (8517) -1.38 V dc.
    (9517) -1.60 V dc.

5. Press the spacebar to get a full green screen.

6. Adjust RV021 (G.DRIVE) to give:
    (8517) -2.30 V dc.
    (9517) -2.15 V dc.

7. Press the spacebar to get a full red screen.

8. Adjust RV011 (R.DRIVE) to give:
    (8517) -2.50 V dc.
    (9517) -2.60 V dc.

9. Press **PF3** to return to the setup patterns. Select option 2, pattern B (50 mm square white block).

10. Press the spacebar to get a white block.

11. Adjust RV102 (SUB.CONT) to the highest voltage possible within the range:
    (8517) -0.45 V dc to -0.50 V dc.
    (9517) -0.50 V dc to -0.55 V dc.

12. If the voltage is not within this range, repeat all the previous steps for this procedure.

13. Press **PF3** to return to the setup patterns. Select option 4, pattern D (Gray Scale).

14. Check at maximum and minimum contrast that the blocks are evenly gradated from black through to white with no color tinges. If they are not, repeat this procedure.

15. Do focus and convergence adjustments after this procedure.

2.5.2.4.6 Procedure Using a Color Analyzer

The use of a color analyzer is recommended, if available, for setting color points and brightness.

All adjustments must be made with the brightness control set at center detent. Select mode 4 (or mode 3 if not available) to display the test patterns.

1. Select option 3, pattern C (Full Screen Raster), and press the spacebar to get a black screen.

   a. Set RV014 (R.BKG) and RV034 (B.BKG) fully clockwise.

   b. Adjust RV508 (G2) until a background raster is just visible.

   c. Adjust RV014 (R.BKG) until raster has a red tinge, then readjust until the red tinge just disappears.

   d. Adjust RV034 (B.BKG) until raster has a blue tinge, then readjust until the blue tinge just disappears.

   e. Adjust RV508 until the background raster just disappears. When the background color point is set correctly, the raster is white or gray until it disappears. If it is not, repeat this step.

2. Check that the contrast control is set to maximum and the brightness control is at center detent.

3. Press **PF3** to return to the setup patterns. Select option 2, pattern B (50 mm square block).

4. Press the spacebar to get a white block.

5. Adjust the three drive potentiometers (RV011, RV021, and RV031) for the correct white color point.

   Using a color analyzer, in accordance with the manufacturer's instructions, this is:
   x=0.297 ± 0.01
   y=0.320 ± 0.01.

6. Set RV102 (SUB CONT), using the color analyzer to give:
   (8517) 150 cd/m².
   (9517) 130 cd/m².

7. Set contrast control to minimum (counterclockwise). Readjust RV014 and RV034 for correct color point.

8. Repeat step 2 to step 7, until the color point is maintained at minimum and maximum settings of the contrast control.

9. Press **PF3** to return to the setup patterns. Select option 4, pattern D (Gray Scale). Set contrast control to maximum.

10. Check that all levels of the scale are visible. If a background raster is visible, adjust G2 until the background raster just disappears.

11. After adjusting G2 reset the color point, step 2 to step 10.

12. Do focus and convergence adjustments after this procedure.

2.5.2.4.7 Focus and Convergence

Select mode 4 (or mode 3 if not available) to display the test patterns.

1. Select option 1, pattern A (Crosshatch),

2. Adjust the focus control on the video shield to focus the vertical lines.

3. Adjust the focus control on the EHT transformer to focus the horizontal lines.

4. Press **PF3** to return to the setup patterns. Select option 5, pattern E (Focus Pattern), to check the focus settings.

5. Press **PF3** to return to the setup patterns. Select option 1, pattern A (Crosshatch), and press the spacebar to get a white crosshatch pattern.

6. Adjust the H.STAT control on video shield to set convergence.

This completes the alignment procedures.

2.5.3 Specifications

Subtopics
2.5.3.1 Physical Characteristics
2.5.3.2 Functional Characteristics, 8517 Display
2.5.3.3 Functional Characteristics, 9517 Display

2.5.3.1 Physical Characteristics

The following information is for all models of the displays.

Subtopics
2.5.3.1.1 Size
2.5.3.1.2 Weight
2.5.3.1.3 Environment
2.5.3.1.4 Power Dissipation
2.5.3.1.5 Electrical

2.5.3.1.1 Size

- Height 409 mm (16.1 in.), including tilt swivel stand
- Width 412 mm (16.2 in.)
- Depth 458 mm (18.1 in.).

2.5.3.1.2 Weight

- 22 kg (48.5 lb), excluding stand.

2.5.3.1.3 Environment

- Temperature:
  - Operating 10° to 35°C (50 to 95°F)
  - Storage 1° to 60°C (33 to 140°F)
  - Shipping -20° to 60°C (-4 to 140°F).
- Humidity:
  - Operating 8% to 80%
  - Storage 5% to 80%
  - Shipping 5% to 100%

  Note: The higher levels of humidity for shipping allow for condensation, but not direct contact with moisture.

- Maximum altitude 2000 m (6565 ft).

2.5.3.1.4 Power Dissipation

- 130 watts maximum

2.5.3.1.5 Electrical

- Model 8517001: 90 to 137 V ac, 47 to 63 Hz
- Model 8517002: 90 to 265 V ac, 47 to 63 Hz
- Model 9517001: 90 to 137 V ac, 47 to 63 Hz
- Model 9517002: 90 to 265 V ac, 47 to 63 Hz
- Model 9517003: 90 to 265 V ac, 47 to 63 Hz

2.5.3.2 Functional Characteristics, 8517 Display

Video input: analog, direct-drive, 75 ohm, 0 to 0.7 V.

CRT faceplate: dark, antiglare (silica coated)

The functional characteristics of the display depend on the operating mode:

Table 8-3. Functional Characteristics 8517 Display

MODE	**1**	**2**	**3**
Horizontal deflection rate (kilohertz)	31.5	31.5	31.5
Vertical deflection rate (frames/second)	70	70	60
Horizontal blanking time (microseconds)	5.72	5.72	5.72
Vertical blanking time (milliseconds)	2.76	1.12	0.92
Vertical addressability (lines)	362	414	496
Interlace ratio	1:1	1:1	1:1

Table 8-4. Functional Characteristics 8517 Display

MODE	**4**	**4**	**5**
Horizontal deflection rate (kilohertz)	35.5	57	56.5
Vertical deflection rate (frames/second)	43.5	70	51.5
Horizontal blanking time (microseconds)	5.35	4.41	4.5
Vertical blanking time (milliseconds)	0.69	0.82	0.65
Vertical addressability (lines)	768	768	1024
Interlace ratio	2:1	1:1	2:1

Note: There are two mode 4s available; the program providing the mode automatically selects one of them, depending on the adapter in use. If the display is moved to a display adapter with a higher resolution, it may have to be serviced for adjustments to the higher mode.

2.5.3.3 Functional Characteristics, 9517 Display

Video input: analog, direct-drive, 75 ohm, 0 to 0.7 V.

CRT faceplate: dark, antiglare (silica coated)

The functional characteristics of the display depend on the operating mode:

Table 8-5. Functional Characteristics 9517 Display

MODE	**1**	**2**	**3**
Horizontal deflection rate (kilohertz)	31.5	31.5	31.5
Vertical deflection rate (frames/second)	70	70	60
Horizontal blanking time (microseconds)	5.72	5.72	5.72
Vertical blanking time (milliseconds)	2.76	1.12	0.92
Vertical addressability (lines)	362	414	496
Interlace ratio	1:1	1:1	1:1

Table 8-6. Functional Characteristics 9517 Display

MODE	**4**	**4**	**5**
Horizontal deflection rate (kilohertz)	35.5	57	56.5
Vertical deflection rate (frames/second)	43.5	70	51.5
Horizontal blanking time (microseconds)	5.35	4.41	4.5
Vertical blanking time (milliseconds)	0.69	0.82	0.65
Vertical addressability (lines)	768	768	1024
Interlace ratio	2:1	1:1	2:1

Note: There are two mode 4s available; the program providing the mode automatically selects one of them, depending on the adapter in use. If the display is moved to a display adapter with a higher resolution, it may have to be serviced for adjustments to the higher mode.

2.5.4 Locations

Subtopics
2.5.4.1 Safety Grounds
2.5.4.2 Parts Locations
2.5.4.3 Analog and Video Card Connectors

2.5.4.1 Safety Grounds

PICTURE 45

Figure 8-14. Safety Grounds, 8517/9517 Displays

2.5.4.2 Parts Locations

PICTURE 46

Figure 8-15. Parts Locations, 8517/9517 Displays

2.5.4.3 Analog and Video Card Connectors

Figure 8-16 shows the location of the analog and video card connectors.

PICTURE 47

Figure 8-16. Analog and Video Card Connectors, 8517/9517 Displays

2.6 9. 9515-Specific Information

This chapter contains display-specific service procedures and reference information for the 9515 Color Display. Included are:

- Removal and replacement procedures for the:
  - Card-tray assembly
  - Signal cable
- Functional checks and adjustments, including:
  - Function checks
  - Pattern checks
  - Adjustment procedures
- Physical and functional specifications
- Part location illustrations.

For information or procedures that are the same for displays you are referred to the appropriate sections under "Part I. General Service Information."

Subtopics

2.6.1 Display-Specific Removals and Replacements

Subtopics
2.6.1.1 Tilt Swivel Stand
2.6.1.2 Rear Cover
2.6.1.3 Card Tray Assembly
2.6.1.4 Signal Cables
2.6.1.5 Integrated Tube Component (ITC)

2.6.1.1 Tilt Swivel Stand

Refer to the general procedures for removing and replacing tilt swivel stands in "Tilt Swivel Stand" in topic 1.3.1.

2.6.1.2 Rear Cover

Refer to the general procedures for removing and replacing the rear cover in "Rear Cover" in topic 1.3.3.

2.6.1.3 Card Tray Assembly

The card tray assembly includes the analog, video, control, and ac inlet cards.

1. Refer to Figure 9-1.

2. Remove the anode cap 1 from the CRT, (see "High Voltage Discharge Procedure" in topic 1.3.4).

   CAUTION:
   Take care not to damage the neck of the CRT.
   Observe all safety notices for handling CRTs.

3. Remove the video card 2 from the CRT base.

PICTURE 48

Figure 9-1. Removing the Anode Cap and Video Card, 9515 Display

4. Refer to Figure 9-2.

5. Remove the DAG braid lead 4 from video card connector H4.

6. Remove connectors Q2 5 and Q3 3 from the analog card.

7. Delatch the two securing arms (**view A**) with a screwdriver, then pull the card tray assembly 6 away from the front cover.

PICTURE 49

Figure 9-2. Removing the Card Tray Assembly, 9515 Display

Replacement:

Refer to Figure 9-2.

1. Check that the CRT pins of the video card are straight, and the card is correctly aligned with the CRT base. Now attach the card.

2. Ensure that the securing arms for the card tray assembly are latched into the front cover; take care not to damage the on/off switch in this process.

3. Ensure that the DAG braid lead is properly installed, and reconnect all cables.

2.6.1.4 Signal Cables

The signal cable is clamped to the card tray.

1. Refer to Figure 9-3.

2. Remove the connector 1 from the analog card.

3. Remove the signal connector 2 from the video card.

4. Remove the ground wire 3 from the video card.

PICTURE 50

Figure 9-3. Removing the Connectors, 9515 Display

5. Refer to Figure 9-4.

6. Remove the four screws 4 to release the analog card.

7. Lift the card at the rear, and ease it away from the retaining lugs 5 on the front of the card tray assembly.

8. Remove the clamp screws 6 at each end of the cable.

Note: Note how each clamp is fitted on the cable before removing the signal cable from the retention tabs.

PICTURE 51

Figure 9-4. Removing the Analog Card and Cable Clamp Screws, 9515 Display

PICTURE 52

Figure 9-5. Signal Cable Clamps, 9515 Display

Replacement:

1. Ensure that the front clamp makes contact with the braid and the cable sheath, because it acts as a strain relief for the cable.

2. Replace the cable in the retention tabs so that the longer section of braid is aligned with the rear clamp. This clamp is attached to the braid only.

2.6.1.5 Integrated Tube Component (ITC)

Refer to the general procedures for removing and replacing ITCs in "Integrated Tube Component (ITC)" in topic 1.3.7.

2.6.2 Functional Checks and Adjustments

This section contains complete function and pattern checks and adjustment procedures for the 9515 Display. There are two steps to follow in the basic and pattern checks, that is, to read the "Symptom" and follow the "Action" presented in the diagnostic tables.

Subtopics
2.6.2.1 Function Checks
2.6.2.2 Pattern Checks
2.6.2.3 Adjustment Procedures

2.6.2.1 Function Checks

Basic functions can be checked using the self-test raster.

Refer to "Adjustment Procedures" in topic 2.6.2.3 when adjustments are required.

Refer to the "Display-Specific Removals and Replacements" in topic 2.6.1 for removal and replacement procedures.

Symptom	**Action**
Any problems.	First, check all connections and plugs for continuity.
Green LED lit but test raster missing.	Adjust G2 control clockwise until test raster appears AGAINST background raster. If no raster appears, replace ITC.
Test raster is not white.	Adjust gain controls for missing colors. If colors reappear, reset color point of ITC. Otherwise replace ITC.
Background raster is not white.	Adjust cutoff controls for missing colors. If colors reappear, reset color point of ITC. Otherwise replace ITC.
Test raster scan is collapsed horizontally or vertically.	If partially collapsed, adjust as appropriate. If fully collapsed, replace card tray assembly.

2.6.2.2 Pattern Checks

These symptoms relate to operating the display with a crosshatch pattern displayed. Pattern checks must be done using pattern A on the IBM Personal System/2 Color Displays Test-Pattern Diskette.

Before starting any checks, ensure that all plugs and connectors are positioned correctly and securely.

Refer to "Adjustment Procedures" in topic 2.6.2.3 when adjustments are required.

Refer to the "Display-Specific Removals and Replacements" in topic 2.6.1 for removal and replacement procedures.

Symptom	**Action**
Displayed image width is too large or too small.	Adjust RT7 for modes 1 through 3, RT8 for mode 4. If symptom persists, replace card tray assembly.
Displayed image height is too large or too small.	Adjust RT6. If symptom persists, replace card tray assembly.
Color purity of displayed image is poor.	Check degauss circuit. Ensure that Q2 is connected. Power off for 30 minutes. Power on again to check degauss action. If symptom persists, replace card tray assembly. ITC defective. Replace ITC.
Contrast or brightness controls are not working.	Replace card tray assembly.
Maximum or minimum white is poor.	Adjust video color point as appropriate.
East-west pincushion correction is poor (vertical lines are bowed or barrel shaped).	Adjust RT14, RT11, and RT12 for optimum vertical lines. If this is not possible, replace the card tray assembly.
No horizontal or vertical synchronization. One or more colors missing.	If good with test raster (signal cable disconnected), replace signal cable.
Displayed image does not synchronize horizontally.	Ensure that Q1 and Q4 are connected. If symptom persists, replace card tray assembly.
Displayed image does not synchronize vertically.	Ensure that Q1 and Q4 are connected. If symptom persists, replace card tray assembly.
Background raster is not centered horizontally.	Adjust RT15. If raster cannot be centered, centering circuit is faulty. Replace card tray assembly.
Displayed image is not centered horizontally.	Adjust RT3 for modes 1 through 3, RT2 for mode 4. If image cannot be centered, centering circuit is faulty. Replace card tray assembly.
Displayed image height varies excessively between modes.	Height selection circuit is faulty. Replace card tray assembly.
Displayed image appears broken up horizontally.	Width regulation is unstable. Ensure that Q1 and Q4 are connected. If symptom persists, replace card tray assembly.

2.6.2.3 Adjustment Procedures

CAUTION:
Use extreme caution when making adjustments with the display powered on; these adjustments should not be performed unattended.

The display must never be left unattended with the covers removed and powered on in a customer environment.

Refer to "Display-Specific Removals and Replacements" in topic 2.6.1 for details of how to get access to maintenance controls.

All adjustments must be completed in the sequence given here.

Subtopics

2.6.2.3.1 Test Equipment

Refer to "Tools and Test Equipment" in topic 3.3 for details of tools and test equipment required. Ensure that the connections of all cables are set up as shown in Figure 13-1 in topic 3.3.1.

2.6.2.3.2 Maintenance Controls and Internal Connectors

The following illustrations show the maintenance controls -- the analog and video card controls -- and the internal connectors of the 9515 Display.

PICTURE 53

Figure 9-6. Analog Card and Video Card, 9515 Display

Note: Figure 9-6 shows the potentiometers of the analog card and video card. The video card is shown removed from the ITC. The video card potentiometers can also be adjusted when the video card is attached to the ITC. The back view of the video card and its potentiometers is shown in Figure 9-7.

PICTURE 54

Figure 9-7. Back View of Video Card, 9515 Display

2.6.2.3.3 Preliminary Steps

Proceed as follows.

1. Insert the Color Displays Test-Pattern diskette into drive A of the system unit.

   Note: The Test-Pattern Diskette is used for setting up the 9515 Color Display.

CAUTION:
Use caution when making adjustments with the cover removed. There are high voltages on the analog and video cards.

2. Power on the system unit and the display. The system unit runs its internal checks, and then loads the program from the diskette.

   Note: The following error codes might appear. Do the actions specified to solve the problem.

   - **ASP001E: Cannot Open Adapter**

   The setup program has detected that the display is attached to the PS/2 planar VGA port.
   To continue testing in VGA modes only, type **VGA** at the **A: DOS** prompt and press Enter

   - **ASP002E: Cannot Open Display**

   The setup program has detected that a display adapter is installed in the system, but cannot find a display attached.
   a. Power off the system unit.
   b. Check that the display to be tested is attached to the adapter that is closest to slot 1.
   c. Power on the system unit.
   Alternatively, remove all adapters not needed for the test, reconfigure the PS/2 and retry the setup test.

3. With the Brightness control set to center detent (midpoint), adjust G2 and Focus until the setup menu is visible. Select pattern C and press the keyboard spacebar until the black field is selected. Adjust the G2 control to give minimum background illumination.

4. Allow 20 minutes for the display to warm up before making any further adjustments.

5. Set the Contrast control to midpoint.

2.6.2.3.4 Geometry Adjustments

Proceed as follows.

1. Select pattern A, the crosshatch pattern on a black background:

    a. Adjust RT12 (Trapezoidal) and RT11 (Orthogonal) so that the four corners of the green rectangle are square within the bezel (see Figure 9-8).

    b. Adjust RT14 (East-West Pincushion) to set the most straight vertical lines (see Figure 9-8).

PICTURE 55

Figure 9-8. Geometry Adjustments, 9515 Display

    c. For modes 1, 2, and 3, adjust RT3 (Horizontal Image Centering) to center the rectangle. Repeat for Mode 4, adjusting RT2.

    d. For modes 1, 2, and 3, adjust RT7 (Width) for a gap of 11 mm (measured at the horizontal center line of the screen) between the vertical edges of the green rectangle and the inner edges of the bezel. Repeat for Mode 4, adjusting RT8.

    e. You might have to repeat steps 1a, 1b, 1c, and 1d.

2. Using the same test pattern, adjust sequentially RT6 (Vertical Height) and RT13 (Vertical Centering). Set the picture in the center of the screen with a gap of 7.5 mm (measured at the vertical center line of the screen) between the horizontal edges of the green rectangle and the inner edges of the top and bottom of the bezel.

2.6.2.3.5 Video Levels and Cutoff Voltages

Proceed as follows.

Note: The use of a color analyzer is recommended for steps 1e, 4, and 6.

1. Select pattern C, and press the keyboard spacebar until the black field is selected.

    a. Set RTH110, RTH210, and RTH310 (Cutoff Potentiometers) fully clockwise, as viewed from the video card shield.

    b. Set RTH101 and RTH301 (Gain Potentiometers) fully clockwise, as viewed from the top of the video card.

    c. Set the Brightness control to center detent (midpoint), and the Contrast control to midpoint.

    d. Adjust G2 so that the screen is just not illuminated. Set the Brightness control to maximum.

    e. Adjust the cutoff potentiometers for a correct white color point.

    f. Set the Brightness control to center detent (midpoint). If necessary, adjust G2 to ensure that the screen is just not illuminated.

2. Select Pattern B, and press the keyboard spacebar until the white block is selected.

3. Ensure that the Contrast control is at midpoint.

4. Adjust RTH101 (green) and RTH301 (red) for correct white color points.

5. Set Contrast to midpoint.

6. Set RT17 (Maximum Contrast) to midpoint.

7. From the main menu, select Display Mode 1.

    a. Select pattern D, Gray Scale Blocks.

    b. Adjust RT18 (G2 Fine Adjustment) to midpoint.

    c. Adjust G2 on the EHT so that the top right-hand block is visible, and the block to the left is just visible.

8. Return to the main menu, and select Mode 4. (If Mode 4 is not present, go to step 9.) Select Pattern D, Gray Scale Blocks, and adjust RT16 for the same condition as that described in step 7. The block pattern should now look the same in all modes.

9. Return to Pattern D, Gray Scale Blocks. Check, at maximum and minimum contrast, that the gradation of the blocks is even from black through white with no color tinges.

10. Check that there is no color smearing.

If steps 9 and 10 are not satisfactory, repeat this complete procedure.

2.6.2.3.6 Procedure Using a Color Analyzer

The use of a color analyzer is recommended for setting the white color point and maximum brightness.

1. Select pattern C, and press the keyboard spacebar until the black field is selected.

    a. Set RTH110, RTH210, and RTH310 (Cutoff Potentiometers) fully clockwise, as viewed from the video card shield.

    b. Set RTH101 and RTH301 (Gain Potentiometers) fully clockwise, as viewed from the top of the video card.

    c. Set the Brightness control to center detent (midpoint), and the Contrast control to midpoint.

    d. Adjust G2 so that the screen is just not illuminated. Set the Brightness control to maximum.

    e. Adjust the cutoff potentiometers for a correct white color point. Using a color analyzer, in accordance with the manufacturer's instructions, this is:
    x=0.297 ± 0.01, y=0.320 ± 0.01.

    f. Set the Brightness control to center detent (midpoint). If necessary, adjust G2 to ensure that the screen is just not illuminated.

2. Select pattern B, and press the keyboard spacebar until the white block is selected.

3. Ensure that the Contrast control is at midpoint.

4. Adjust RTH101 (green) and RTH301 (red) for correct white color points. Using a color analyzer, in accordance with the manufacturer's instructions, this is:
    x=0.297 ± 0.01, y=0.320 ± 0.01.

5. Set Contrast to maximum.

6. Set RT17 (Maximum Contrast) using the color analyzer, to give 200 nits ± 5 nits (cd/m²) in the white block.

7. From the main menu, select Display Mode 1.

    a. Select pattern D, Gray Scale Blocks.

    b. Adjust RT18 (G2 Fine Adjustment) to midpoint.

    c. Adjust G2 on the EHT so that the top right-hand block is visible, and the block to the left is just visible.

8. Return to the main menu, and select Mode 4. (If Mode 4 is not present, go to step 9.) Select Pattern D, gray scale blocks, and adjust RT16 (for the same condition as that described in step 7. The block pattern should now look the same in all modes.

9. Return to Pattern D, gray scale blocks. Check, at maximum and minimum contrast, that the gradation of the blocks is even from black through white with no color tinges.

10. Check that there is no color smearing.

If steps 9 and 10 are not satisfactory, repeat this complete procedure.

2.6.2.3.7 Focus

Proceed as follows.

1. Select pattern E, focus pattern.

2. Adjust the Focus control to give sharp vertical and horizontal lines.
   Take care not to disturb the G2 setting.

This completes the alignment procedures.

2.6.3 Specifications

Subtopics
2.6.3.1 Physical Characteristics
2.6.3.2 Functional Characteristics

2.6.3.1 Physical Characteristics

The following information applies to all models of the display:

Subtopics
2.6.3.1.1 Size
2.6.3.1.2 Weight
2.6.3.1.3 Stand Adjustment
2.6.3.1.4 Environment
2.6.3.1.5 Power Dissipation
2.6.3.1.6 Power Requirement

2.6.3.1.1 Size

- Height: 345 mm (13.6 in.) with tilt swivel stand
- Height: 375 mm (14.8 in.) to 495 mm (19.5 in.) with lift tilt swivel stand
- Width: 355 mm (14 in.)
- Depth: 389 mm (15.3 in.)

2.6.3.1.2 Weight

- 13.5 kg (30 lb) approx with tilt swivel stand
- 17 kg (38 lb) approx with lift tilt swivel stand

2.6.3.1.3 Stand Adjustment

- Rotation: ±150 degrees
- Forward tilt: 5 degrees
- Backward tilt: 20 degrees.

2.6.3.1.4 Environment

- Temperature:
  - Operating: 10° to 35°C (50° to 95°F)
  - Storage: 1° to 60°C (33° to 140°F)
  - Shipping: -20° to 60°C (-4° to 140°F).
- Humidity:
  - Operating: 8% to 80%
  - Storage: 5% to 80%
  - Shipping: 5% to 100%

  Note: The higher levels of humidity for shipping allow for condensation, but not direct contact with moisture.

- Maximum Altitude: 2187 m (7175 ft).

2.6.3.1.5 Power Dissipation

- 75 watts maximum

2.6.3.1.6 Power Requirement

- Low voltage model: 90 to 137 V ac, 47 to 63 Hz
- Universal voltage model: 90 to 265 V ac, 47 to 63 Hz

2.6.3.2 Functional Characteristics

Video input: analog, direct-drive, 75 ohm, 0 to 0.7 V.

CRT faceplate: dark, nonreflective (etched or silica coated).

CRT phosphor: medium persistence (P22).

MODE	**1**	**2**	**3**	**4**
Horizontal deflection rate (kilohertz)	39.4	39.4	39.4	61.1
Vertical deflection rate (frames per sec)	87.8	87.8	75.0	75.8
Horizontal blanking time (microseconds)	4.56	4.56	4.56	4.47
Vertical blanking time (milliseconds)	2.206	0.887	0.737	0.622
Screen lines (including border)	362	414	496	768
Screen lines (excluding border)	350	400	480	768
Interlace ratio	1:1	1:1	1:1	1:1

Resolution:

- Mode 1 720 x 350 Pels, 88 Hz, noninterlaced
- Mode 2 720 x 400 Pels, 88 Hz, noninterlaced
- Mode 3 640 x 480 Pels, 75 Hz, noninterlaced
- Mode 4 1024 x 768 Pels, 75 Hz, noninterlaced

2.6.4 Locations

Subtopics
2.6.4.1 Safety Grounds
2.6.4.2 Parts Locations

2.6.4.1 Safety Grounds

PICTURE 56

Figure 9-9. Safety Grounds, 9515 Display

2.6.4.2 Parts Locations

PICTURE 57

Figure 9-10. Parts Locations, 9515 Display

2.7 10. 9518-Specific Information

This chapter contains display-specific service procedures and reference information for the 9518 Color Display. Included are:

- Removal and replacement procedures for the:
  - Card-tray assembly
  - Signal cable
- Functional checks and adjustments, including:
  - Function checks
  - Pattern checks
  - Adjustment procedures
- Physical and functional specifications
- Part location illustrations.

For information or procedures that are the same for all displays, you are referred to the appropriate sections under "Part I. General Service Information."

Subtopics

2.7.1 Display-Specific Removals and Replacements

Subtopics
2.7.1.1 Tilt Swivel Stand
2.7.1.2 Rear Cover
2.7.1.3 Card Tray Assembly
2.7.1.4 Signal Cable
2.7.1.5 Integrated Tube Component (ITC)

2.7.1.1 Tilt Swivel Stand

Refer to the general procedures for removing and replacing tilt swivel stands in "Tilt Swivel Stand" in topic 1.3.1.

2.7.1.2 Rear Cover

Refer to the general procedures for removing and replacing the rear cover in "Rear Cover" in topic 1.3.3.

2.7.1.3 Card Tray Assembly

1. Refer to Figure 10-1.

2. Remove the anode cap 2 from the CRT, (see High Voltage Discharge Procedure).

3. Remove the two DAG braid leads 1 from the card tray assembly.

4. Refer to Figure 10-2. Remove the two video card ground screws 1 .

5. Refer to Figure 10-1 in topic 2.7.1.3.

   CAUTION:
   Take care not to damage the neck of the CRT.
   Observe all safety notices for handling CRTs.

6. Remove the video card 3 from the CRT base.

7. Remove the connectors 8 (P401 and P100) from the analog card.

8. Delatch the two securing arms (**view A**) with a screwdriver then pull the card tray assembly 4 away from the front cover.

PICTURE 58

Figure 10-1. Removing the Card Tray Assembly, 9518 Display

PICTURE 59

Figure 10-2. Removing the Video Card Ground Screws, 9518 Display

Replacement:

Refer to Figure 10-1 in topic 2.7.1.3.

1. Before replacing the card, check that the CRT pins are straight and the video card is aligned correctly with the CRT base. Attach the card, then push it firmly onto the CRT base.

2. Replace the video card ground screws.

3. Taking care not to damage the on/off switch, ensure that the securing arms for the card tray assembly are latched into the front cover.

4. Ensure that the two DAG braid leads are properly installed.

5. Reconnect all cables.

2.7.1.4 Signal Cable

1. Refer to Figure 10-1 in topic 2.7.1.3.

2. Remove the signal cable connector and its associated ground lead 5 , from the video card.

3. Remove the two screws 9 and move the tab 10 to release the analog card. Lift the card at the rear, to clear the locating pin, and ease it away from the retaining lugs on the front of the card tray assembly.

4. Remove the clamp screws at each end of the cable 7 , then remove the lead from the cable braid from the ground point.

5. Note how each clamp is fitted on the cable before removing the signal cable from the retention tabs.

PICTURE 60

Figure 10-3. Signal Cable Clamps, 9518 Display

Replacement:

1. Ensure that the front clamp makes contact with the braid and the cable sheath, because it acts as a strain relief for the cable.

2. Replace the cable in the retention tabs so that the rear section of braid is aligned with the rear clamp. This clamp is attached to the braid only.

2.7.1.5 Integrated Tube Component (ITC)

Refer to the general procedures for removing and replacing ITCs in "Integrated Tube Component (ITC)" in topic 1.3.7.

2.7.2 Functional Checks and Adjustments

This section contains complete function and pattern checks and adjustment procedures for the 9518 Display. There are two steps to follow in the basic and pattern checks, that is, to read the "Symptom" and follow the "Action" presented in the diagnostic tables.

Subtopics
2.7.2.1 Function Checks
2.7.2.2 Pattern Checks
2.7.2.3 Adjustment Procedures

2.7.2.1 Function Checks

Basic functions can be checked using the self-test raster.

Refer to "Adjustment Procedures" in topic 2.7.2.3 when adjustments are required.

Refer to the "Display-Specific Removals and Replacements" in topic 2.7.1 for removal and replacement procedures.

Symptom	**Action**
Any problems.	First, check all connections and plugs for continuity.
Green LED lit but test raster missing.	Adjust G2 control clockwise until test raster appears AGAINST background raster. If no raster appears, replace ITC.
Test raster is not white.	Adjust gain controls for missing colors. If colors reappear, reset color point of ITC. Otherwise replace ITC.
Background raster is not white.	Adjust cutoff controls for missing colors. If colors reappear, reset color point of ITC. Otherwise replace ITC.
Test raster scan is collapsed horizontally or vertically.	If partially collapsed, adjust as appropriate. If fully collapsed, replace card tray assembly.

2.7.2.2 Pattern Checks

The Pattern checks should be performed using pattern A from the IBM Personal System/2 Color Displays Test-Pattern diskette.

Before starting any checks, ensure that all plugs and connectors are positioned correctly and securely.

Refer to "Adjustment Procedures" in topic 2.7.2.3 when adjustments are required.

Refer to the "Display-Specific Removals and Replacements" in topic 2.7.1 for removal and replacement procedures.

Symptom	**Action**
Displayed image width is too large or too small.	Adjust RV303. If symptom persists, replace card tray assembly.
Displayed image height is too large or too small.	Adjust RV400. If symptom persists, replace card tray assembly.
Color purity of displayed image is poor.	Check degauss circuit. Ensure that P100 is connected. Power off for 30 minutes. Power on again to check degauss action ("Degaussing" in topic 1.2.4 explains the action). If symptom persists, replace card tray assembly. ITC defective. Replace ITC.
Contrast or brightness controls are not working.	Replace card tray assembly.
Maximum or minimum white is poor.	Video color point is not set. Adjust as appropriate.
East-west pincushion correction is poor (vertical lines are bowed or barrel shaped).	Adjust RV302 for optimum vertical lines. If this is not possible, replace the card tray assembly.
No horizontal or vertical synchronization.	Ensure the display signal cable is connected to the correct port in the system unit. Power off the system unit, then power on the system unit.
No horizontal or vertical synchronization. One or more colors missing.	If good with test raster (signal cable disconnected), replace signal cable.
Displayed image does not synchronize horizontally.	Replace card tray assembly.
Displayed image does not synchronize vertically.	Replace card tray assembly.
Displayed image is not centered horizontally.	Adjust RV304. If image cannot be centered, centering circuit is faulty. Replace card tray assembly.
Displayed image height varies excessively between modes.	Height selection circuit is faulty. Replace card tray assembly.
Displayed image appears broken up horizontally.	Replace card tray assembly.

2.7.2.3 Adjustment Procedures

CAUTION:
Use extreme caution when making adjustments with the display powered on; these adjustments should not be performed unattended.

The display must never be left unattended with the covers removed and powered on in a customer environment.

Refer to "Display-Specific Removals and Replacements" in topic 2.7.1 for details of how to get access to maintenance controls.

All adjustments must be completed in the sequence given here.

Subtopics

2.7.2.3.1 Test Equipment

Refer to "Tools and Test Equipment" for details of tools and test equipment required. Ensure that the connections of all cables are set up as shown in Figure 13-1 in topic 3.3.1.

2.7.2.3.2 Maintenance Controls and Internal Connectors

The following illustrations show the maintenance controls -- analog and video card controls -- and internal connectors of the 9518 Display.

PICTURE 61

Figure 10-4. Analog and Video Cards, 9518 Display

PICTURE 62

Figure 10-5. Video Card, Gain and Cutoff Controls, 9518 Display

2.7.2.3.3 Preliminary Steps

Proceed as follows.

1. Insert the Color Displays Test-Pattern Diskette into drive A of the system unit.

   CAUTION:
   Use caution when making adjustments with the cover removed. There are high voltages on the analog and video cards.

2. Power on the system unit and the display. The system unit runs its internal checks, and then loads the program from the diskette.

   Note: The following error codes may appear. Take the action specified to clear the problem.

   - **ASP001E: Cannot open adapter**

     The setup program has detected that the display is attached to the Personal System/2 planar VGA port. To continue testing in VGA modes only, type **VGA** at the **A: DOS** prompt and press Enter

   - **ASP002E: Cannot open display**

     The setup program has detected that a display adapter is installed in the system but cannot find a display attached.

     a. Power off the system unit.

     b. Check that the display to be tested is attached to the adapter nearest slot 1.

     c. Power on the system unit.

     Alternatively, remove all adapters not needed for the test, reconfigure your Personal System/2 and retry the setup test.

3. With the Brightness control set to center detent (midpoint), adjust G2 and Focus until the setup menu is visible. Select pattern C, and depress the keyboard spacebar until black field is selected, then adjust the G2 control to give minimum background illumination.

4. Allow 20 minutes for the display to warm up before making any further adjustments.

5. Set the Contrast control to midpoint.

2.7.2.3.4 Geometry Adjustments

Proceed as follows.

1. Select option 3 for Mode 3 timings.

2. Select pattern A, the crosshatch pattern on a black background:

    a. Adjust RV304 (Raster Centering) to center the rectangle.

    b. Adjust RV303 (Width) for a gap of 11 mm (measured at the horizontal center line of the screen) between the vertical edges of the green rectangle and the inner edges of the bezel.

    c. Adjust RV302 (East-West Pincushion) to set the most straight vertical lines.

    d. You may have to repeat steps a, b, and c.

3. Using the same test pattern, adjust sequentially RV400 (Vertical Height) and RV401 (Vertical Centering). Set the picture in the center of the screen with a gap of 7.5 mm (measured at the vertical center line of the screen) between the horizontal edges of the green rectangle and the inner edges of the top and bottom of the bezel.

2.7.2.3.5 Video Levels and Cutoff Voltages

Proceed as follows.

Note: The use of a color analyzer is recommended for steps 2e, 5, and 7; see *Procedure Using a Color Analyzer* on the next page.

1. Select option 3 for Mode 3 timings.

2. Select pattern C, and depress the keyboard spacebar until black field is selected.

    a. Set RV631, RV651, and RV671 (Cutoff Potentiometers) fully counter-clockwise, as viewed from the video card shield.

    b. Set RV600, RV632 and RV652 (Gain Potentiometers) fully counter-clockwise, as viewed from the top of the video card.

    c. Set the Brightness control to center detent (midpoint), and the Contrast control to midpoint.

    d. Adjust G2 so that the background raster is just not illuminated. Set the Brightness control to maximum.

    e. Adjust the cutoff potentiometers for a correct white color point.

    f. Set the Brightness control to center detent (midpoint). If necessary, adjust G2 to ensure that the background raster is just not illuminated.

3. Select pattern B, and depress the keyboard spacebar until white box is selected.

4. Ensure that the Contrast control is at midpoint.

5. Adjust RV652 (green) and RV632 (red) for correct white color points.

6. Set Contrast to maximum.

7. Set RV600 to midpoint.

8. Select pattern D, Gray Scale Blocks.

9. Check, at maximum and minimum contrast, that the gradation of the blocks is even from black through white with no color tinges.

10. Check that there is no color smearing.

If steps 9 and 10 are not satisfactory, repeat this complete procedure.

2.7.2.3.6 Procedure Using a Color Analyzer

The use of a Minolta TV Color Analyzer (**), or equivalent, is recommended for setting the white color point and maximum brightness.

1. Select option 3 for Mode 3 timings.

2. Select pattern C, and depress the keyboard spacebar until black field is selected.

    a. Set RV631, RV651, and RV671 (Cutoff Potentiometers) fully counter-clockwise, as viewed from the video card shield.

    b. Set RV600, RV632 and RV652 (Gain Potentiometers) fully counter-clockwise, as viewed from the top of the video card.

    c. Set the Brightness control to center detent (midpoint), and the Contrast control to midpoint.

    d. Adjust G2 so that the background raster is just not illuminated. Set the Brightness control to maximum.

    e. Adjust the cutoff potentiometers for a correct white color point. Using a Minolta Color Analyzer, or equivalent, in accordance with the manufacturer's instructions, this is:
    x=0.267 ± 0.01, y=0.282 ± 0.01.

    f. Set the Brightness control to center detent (midpoint). If necessary, adjust G2 to ensure that the background raster is just not illuminated.

3. Select pattern B, and depress the keyboard spacebar until white box is selected.

4. Ensure that the Contrast control is at midpoint.

5. Adjust RV652 (green) and RV632 (red) for correct white color points. Using a Minolta Color Analyzer, or equivalent, in accordance with the manufacturer's instructions, this is:
x=0.297 ± 0.01, y=0.320 ± 0.01.

6. Set Contrast to maximum.

7. Set RV600 using the color analyzer, to give 200 nits ± 5 nits (cd/m²) in the white block.

8. Select pattern D, Gray Scale Blocks.

9. Check, at maximum and minimum contrast, that the gradation of the blocks is even from black through white with no color tinges.

10. Check that there is no color smearing.

If steps 9 and 10 are not satisfactory, repeat this complete procedure.

(**) Trademark of the Minolta Corporation. For a list of trademarks see "Notices" in topic FRONT_1.

2.7.2.3.7 Focus

Proceed as follows.

1. Select pattern E, Focus.

2. Adjust the Focus control to give sharp vertical and horizontal lines.
   Take care not to disturb the G2 setting.

This completes the alignment procedures.

2.7.3 Specifications

Subtopics
2.7.3.1 Physical Characteristics
2.7.3.2 Functional Characteristics

2.7.3.1 Physical Characteristics

The following information applies to all models of the display:

Subtopics
2.7.3.1.1 Size
2.7.3.1.2 Weight
2.7.3.1.3 Environment
2.7.3.1.4 Power dissipation
2.7.3.1.5 Power Supply Requirement

2.7.3.1.1 Size

- Height 310 mm (12.2 in.), excluding stand
- Width 355 mm (14 in.)
- Depth 390 mm (15.3 in.).

2.7.3.1.2 Weight

- 13 kg (29 lb) approx, with tilt swivel stand.
- 19 kg (42 lb) approx, with lift tilt swivel stand.

2.7.3.1.3 Environment

- Temperature:
  - Operating 10° to 35°C (50 to 95°F)
  - Storage 1° to 60°C (33 to 140°F)
  - Shipping -20° to 60°C (-4 to 140°F).
- Humidity:
  - Operating 8% to 80%
  - Storage 5% to 80%
  - Shipping 5% to 100%

  Note: The higher levels of humidity for shipping allow for condensation, but not direct contact with moisture.

- Maximum Altitude 2000 m (6565 ft).

2.7.3.1.4 Power dissipation

75 watts maximum

2.7.3.1.5 Power Supply Requirement

- Model 9518001: 90 to 137 V ac, 47 to 63 Hz
- Models 9518002, 9518003, and 9518004:
  90 to 265 V ac, 47 to 63 Hz

2.7.3.2 Functional Characteristics

Video input: analog, direct-drive, 75 ohm, 0 to 0.7 V.

9518 CRT faceplate: dark, antiglare (etched or silica coated).

CRT phosphor: short persistence (P22).

MODE	**1**	**2**	**3**
Horizontal deflection rate (kilohertz)	39.4	39.4	39.4
Vertical deflection rate (frames per sec)	87.8	87.8	75
Horizontal blanking time (microseconds)	4.56	4.56	4.56
Vertical blanking time (milliseconds)	2.21	0.89	0.74
Vertical addressability (lines)	350	400	480
Interlace ratio	1:1	1:1	1:1

Resolution:

Mode 1, 720 x 350 Pels, 88 Hz, non-interlaced.

Mode 2, 720 x 400 Pels, 88 Hz, non-interlaced.

Mode 3, 640 x 480 Pels, 75 Hz, non-interlaced.

2.7.4 Locations

Subtopics
2.7.4.1 Safety Grounds
2.7.4.2 Parts Locations

2.7.4.1 Safety Grounds

PICTURE 63

Figure 10-6. Safety Grounds, 9518 Display

2.7.4.2 Parts Locations

PICTURE 64

Figure 10-7. Parts Locations, 9518 Display

3.0 Part III. Parts Catalog

The following chapters include parts lists for each of the displays included in the display-specific service information. Part number lists for element exchange monitors are also included, along with a part number list for the tools and test equipment required to service IBM PS/2 Displays.

Subtopics

3.1 11. Parts Lists

The following lists contain parts numbers for each of the models available for a display. Display types are broken out by page; model numbers appear within each list.

Subtopics

3.1.1 Power Cords

The following list provides part number for the power cords used with IBM PS/2 Displays.

Display Power Cables
1.8 m (6 ft) for:

U.S., Canada, Taiwan, S.Korea, Mexico, Central and Southern America, Saudi Arabia, Japan (low voltage), Peru (low voltage)	38F3908
Austria, Belgium, Finland, France, Germany, Netherlands, Norway, Portugal, Spain, Sweden	38F3970
Ireland, U.K.	38F3972
Italy, Chile	38F3981
Australia, New Zealand	38F3974
Brazil, Uruguay, Paraguay	6952292
Denmark	13F9996
Israel	14F0086
Pakistan, South Africa	14F0014
Switzerland	38F3983
Japan (high voltage), Peru (high voltage)	1838576

3.1.2 6318 Parts List

Note: Order the appropriate Field Replacement Unit (FRU) for the display you are servicing from this list. The FRU number includes the packaging.

Model 6318001	
Analog Card	39G2727
Bezel assembly	68G2167
Rear cover assembly	68G2168
ITC	68G2164
Tilt Swivel Stand	38F3909
Signal cable	68G2735
Small parts kit	45F1545
FRU packaging with cushion (USA)	92F8592
FRU packaging with cushion (EMEA)	7312115

3.1.3 8511 Parts List

Note: Order the appropriate Field Replacement Unit (FRU) for the display you are servicing from this list. The FRU number includes the packaging.

Model 8511001 Low Voltage (N. Hemisphere - restricted part)	14G3051
Model 8511002 Universal Voltage (N. Hemisphere - restricted part)	14G3052
Model 8511003 Universal Voltage (Equatorial - restricted part)	14G3053
Model 8511004 Universal Voltage (S. Hemisphere - restricted part)	14G3054
ITC assembly for Model 8511001	14G3045
ITC assembly for Model 8511002	14G3046
ITC assembly for Model 8511003	14G3047
ITC assembly for Model 8511004	14G3048
Card Tray assembly LV for Model 8511001	14G3049
Card Tray assembly UV for Models 8511002, 8511003, 8511004	14G3050
Cover set for Model 8511001	14G3056
Cover set for Model 8511002	14G3057
Cover set for Model 8511003	14G3058
Cover set for Model 8511004	14G3059
Signal cable	45F1544
Tilt Swivel Stand	38F3909
Small parts kit	45F1545
FRU packaging with cushion (USA)	92F8592
FRU packaging with cushion (EMEA)	7312115

3.1.4 8513 Parts List

Note: Order the appropriate Field Replacement Unit (FRU) for the display you are servicing from this list. The FRU number includes the packaging.

CRT/Yoke assembly (Northern Hemisphere), degaussing coil/ DAG strap assembly	75X8924
Card assembly (110/120 volt) (Brightness and contrast controls, switch assembly, power supply 110/120 volt)	75X8925
Card assembly (220/240 volt Northern Hemisphere - brightness and contrast controls, switch assembly, power supply 220/240 volt)	75X8926
Cover set complete - exchange basis only	75X8927
Control bridge	75X8928
Signal cable for plastic card tray	75X8929
Signal cable for metal card tray	44F5069
Signal cable cover blank (quantity 1)	75X8930
Feet (quantity 2)	75X8931
Tilt/swivel stand	68X3061
Shipping material (box, front cushion, rear cushion, poly bag, dryer)	72X7871
Display assembly 110/120 volt	68X3088
Display assembly 220/240 volt (Northern Hemisphere)	72X7870
Display assembly 220/240 volt (Southern Hemisphere)	72X7877

3.1.5 8515 Parts List

Note: Order the appropriate Field Replacement Unit (FRU) for the display you are servicing from this list. The FRU number includes the packaging.

Model 8515021 Low Voltage (N. Hemisphere)	07G4759
Model 8515022 Universal Voltage (N. Hemisphere)	07G4761
Model 8515023 Universal Voltage (S. Hemisphere)	07G4762
Model 8515024 Low Voltage (Japan, S. Korea, Taiwan)	07G4763
ITC for Model 8515021/A21	07G4752
ITC for Model 8515022	07G4753
ITC for Model 8515023	07G4754
ITC for Model 8515024	07G4755
Card Tray Assembly 8515021/A21	07G4756
Card Tray Assembly 8515022	07G4757
Card Tray Assembly 8515023	07G4758
Cover Set for Model 8515021	07G4764
Cover Set for Model 8515022	07G4766
Cover Set for Model 8515023	07G4767
Cover Set for Model 8515024	07G4768
Signal Cable	38F3907
Small Parts Kit	45F1545
Tilt/Swivel Stand	38F3909
Shipping Material (Box, Cushions)	38F3910

3.1.6 8516 Touch Display Parts List

Display Assembly 8516001	
90/137 V (US and Canada)	44F9759
Display Assembly 8516002	
90/265 V (Northern Hemisphere)	70F9129
Display Assembly 8516004	
180/265 V (Southern Hemisphere)	70F9132
ITC/Transducer Assembly/Covers	
Model 8516001	44F9753
ITC/Transducer Assembly/Covers	
Model 8516002	37F9993
ITC/Transducer Assembly/Covers	
Model 8516004	70F9133
Special card assembly -	
Model 8516001 (including	
power-supply assembly)	44F5597
Special card assembly -	
Model 8516002 (including	
power-supply assembly)	44F5598
Special card assembly -	
Model 8516004 (including	
power-supply assembly)	70F9134
Video cable	38F3907
Processor logic cable	44F9757
Logic card	44F9756
Front and rear feet assembly	44F5600
Cover clips (2)	44F5601
Shipping material	
Box, front and rear cushion	44F9758

3.1.7 8517 Parts List

Note: Order the appropriate Field Replacement Unit (FRU) for the display you are servicing from this list. The FRU number includes the packaging.

Model 8517001		
(N. Hemisphere - restricted part)	69F9784	
Model 8517002		
(N. Hemisphere - restricted part)	69F9785	
ITC assembly (8517001)	69F9767	
ITC assembly (8517002)	69F9783	
ITC shield	69F9766	
Electromagnetic interference shield		69F9775
Pod assembly	69F9779	
Video card	69F9778	
Analog card	69F9768	
Card tray (no components)	69F9780	
Cover set	69F9769	
Signal cable	69F9774	
Tilt swivel stand	69F9773	
Small parts kit	69F9777	
Caution labels kit	69F9781	
Small cables kit	69F9782	

3.1.8 8518 Parts List

Note: Order the appropriate Field Replacement Unit (FRU) for the display you are servicing from this list. The FRU number includes the packaging.

Model 8518001 Low Voltage (N. Hemisphere - restricted part)	45F1746
Model 8518002 Universal Voltage (N. Hemisphere - restricted part)	34G5714
Model 8518003 Universal Voltage (Equatorial - restricted part)	45F1748
Model 8518004 Universal Voltage (S. Hemisphere - restricted part)	45F1749
Model 8518022 High Voltage (N. Hemisphere - restricted part)	14G3068
ITC assembly for Model 8518001	45F1534
ITC assembly for Models 8518002 and 8518022	45F1535
ITC assembly for Model 8518003	45F1536
ITC assembly for Model 8518004	45F1537
Card Tray assembly LV for Model 8518001	45F1538
Card Tray assembly UV for Models 8518002, 8518003, 8518004	45F1539
Card Tray assembly HV for Model 8518022	34G6591
Cover set for Model 8518001	45F1540
Cover set for Model 8518002	34G5715
Cover set for Model 8518003	45F1542
Cover set for Model 8518004	45F1543
Cover set for Model 8518022	14G3069
Signal cable	45F1544
Tilt Swivel Stand for Models 8518001, 8518022	38F3909
Lift Tilt Swivel Stand for Models 8518002, 8518003, 8518004	6398210
Small parts kit	45F1545
FRU packaging with cushion (USA) for Models 8518001, 8518003 and 8518004	74F8717
FRU packaging with cushion (EMEA)	
- for Model 8518002	7312115
- for Model 8518022	8119215

3.1.9 9515 Parts List

Note: Order the appropriate Field Replacement Unit (FRU) for the display you are servicing from this list. The FRU number includes the packaging.

Model 9515001 Low Voltage, (N. Hemisphere; for information only)	07G9828
Model 9515002 Universal Voltage (N. Hemisphere; for information only)	07G9829
Model 9515003 Universal Voltage (Equatorial; for information only)	07G9830
Model 9515004 Universal Voltage (S. Hemisphere; for information only)	07G9831

ITC assembly, including CRT, yoke, DAG assembly, and degauss:	
For Model 9515001	07G9832
For Model 9515002	07G9832
For Model 9515003	07G9833
For Model 9515004	07G9834

Card Tray assembly, including analog card, video card, power card, power-switch card, card tray, and signal cable:	
For Model 9515001	07G9835
For Models 9515002, 9515003, and 9515004	07G9836

Front cover set, including front cover, mask, logo, nameplate and lens. (Front cover Ni sprayed)	07G9837

Rear cover set, including rear cover, logo plate, warning label, and cushions (Rear cover Ni sprayed)	39G2570

Signal cable	07G9839

Tilt Swivel Stand (Models 9515001, 9515003, and 9515004 only)	07F9670
Lift Tilt Swivel Stand (Model 9515002 only)	6398240

Small parts kit, including cover screws, CRT screws, and SMC springs	07G9838

Packaging kit with cushions:	
For Models 9515001, 9515003, and 9515004	07G9840
For Model 9515002 only	07G9841

3.1.10 9517 Parts List

Note: Order the appropriate Field Replacement Unit (FRU) for the display you are servicing from this list. The FRU number includes the packaging.

Model 9517001		
(N. Hemisphere)	39G2091	
Model 9517002		
(N. Hemisphere)	39G2092	
Model 9517003		
(S. Hemisphere)	39G2093	
ITC assembly (9517001)	39G2094	
ITC assembly (9517002)	39G2094	
ITC assembly (9517003)	39G2095	
ITC shield	69F9766	
Electromagnetic interference shield		69F9775
Pod assembly	69F9779	
Video card	39G2100	
Analog card	39G2096	
Card tray (no components)	69F9780	
Cover set	39G2099	
Signal cable	39G2098	
Tilt swivel stand	69F9773	
Small parts kit	69F9777	
Caution labels kit	39G2101	
Small cables kit	69F9782	

3.1.11 9518 Parts List

Note: Order the appropriate Field Replacement Unit (FRU) for the display you are servicing from this list. The FRU number includes the packaging.

Model 9518001 Low Voltage (N. Hemisphere - for information only)	07G8456
Model 9518002 Universal Voltage (N. Hemisphere - for information only)	07G8457
Model 9518003 Universal Voltage (Equatorial - for information only)	07G8458
Model 9518004 Universal Voltage (S. Hemisphere - for information only)	07G8459

ITC assembly for Model 9518001	07G8460
ITC assembly for Model 9518002	07G8461
ITC assembly for Model 9518003	07G8462
ITC assembly for Model 9518004	07G8463

Card Tray assembly LV for Model 9518001	07G8464
Card Tray assembly UV for Models 9518002, 9518003, and 9518004	07G8465

Front Cover	07G8473
Rear Cover	07G8474

Signal cable	07G8470
Tilt Swivel Stand for Models 9518001, 9518003, and 9518004	38F3909
Lift Tilt Swivel Stand for Model 9518002,	6398240
Small parts kit	07G8471
FRU packaging with cushion (USA)	92F8781
FRU packaging with cushion (EMEA)	7312115

3.1.12 RID Tag

If the cover set or display is exchanged, a repair identification (RID) tag must be applied. Blank RID tags may be obtained from the Part Return Form booklet (F/N Z150-0406) or by ordering FRU 1416996. The RID tag must be placed on the new cover set or display and contain the original Machine Type, Model, and Serial Number.

3.2 12. Element Exchange Monitors

This is a list of the IBM PS/2 Displays that are element exchange parts.

6312 14" VP Color Monitor

98/137 Vac (US/Canada)	39G3321
180/264 Vac (Northern Hemisphere)	39G3322
180/264 Vac (Equatorial)	39G3323
180/264 Vac (Southern Hemisphere)	39G3494
Tilt/Swivel Stand	39G3496

6314 14" VP Color Monitor

98/264 Vac (US/Canada)	39G3352
98/264 Vac (Northern Hemisphere)	39G3353
98/264 Vac (Equatorial)	39G3454
98/264 Vac (Southern Hemisphere)	39G3498
Tilt/Swivel Stand	39G3502
Signal Cable	39G3331

6317 17" VP Color Monitor

90/250 Vac (US/Canada)	39G3359
90/250 Vac (Northern Hemisphere)	39G3360
90/250 Vac (Southern Hemisphere)	39G3361

6319 15" VP Color Monitor

98/264 Vac (US/Canada)	39G3385
98/264 Vac (Northern Hemisphere)	39G3386
98/264 Vac (Equatorial)	39G3387
98/264 Vac (Southern Hemisphere)	39G3500
Tilt/Swivel Stand	39G3503
Signal Cable	39G3331

8503 12" Monochrome Monitor

110/120 Vac (US/Canada)	68X3045
220/240 Vac (Northern Hemisphere	68X3046
220/240 Vac (Southern Hemisphere	72X7878
Tilt/Swivel Stand	68X3061

8504 12" Monochrome Monitor

110/120 Vac (Universal Model)	44F9807
220/240 Vac (Northern Hemisphere)	44F9808
220/240 Vac (Southern Hemisphere)	44F9809
Tilt/Swivel Stand	44F9820

8506 17" Monochrome Monitor

110/220 Vac (US/Canada)	39F8087
220/240 Vac (Northern Hemisphere)	39F8088
220/240 Vac (Southern Hemisphere)	39F8089

8507 19" Monochrome Monitor

110/120 Vac (US/Canada)	6247808
220/240 Vac (Northern Hemisphere)	6247843
220/240 Vac (Southern Hemisphere)	6247842

8508 19" Monochrome Monitor

110/220 Vac (US/Canada)	6247883
220/240 Vac (Northern Hemisphere)	39F8067
220/240 Vac (Southern Hemisphere)	39F8068

8512 14" Color Monitor

110/120 Vac (US/Canada)	61X8924
220/240 Vac (Northern Hemisphere)	61X8928
220/240 Vac (Southern Hemisphere)	61X8927
Tilt/Swivel Stand	61X8925

8513 12" Color Monitor

110/120 Vac (US/Canada)	68X3088
220/240 Vac (Northern Hemisphere)	72X7870
220/240 Vac (Southern Hemisphere)	72X7877
Tilt/Swivel Stand	68X3061

8514 16" Color Monitor

110/120 Vac (US/Canada)	75X5945
220/240 Vac (Northern Hemisphere)	75X5946
220/240 Vac (Southern Hemisphere)	75X5947
Tilt/Swivel Stand	75X5907

8515 14" Color Monitor

110/120 Vac (US/Canada)	07G4759
110/220 Vac (Northern Hemisphere)	07G4761
220/240 Vac (Equatorial)	07G4762

220/240 Vac (Southern Hemisphere)	07G4763
110/120 Vac (Japan,S.Korea,Tiwan)	38F3914
Tilt/Swivel Stand	38F3909
Lift Tilt/Swivel Stand	6398210

8516 Color Touch Screen Monitor

110/120 Vac (US/Canada)	44F9759
220/240 Vac (Northern Hemisphere)	70F9129
220/240 Vac (Southern Hemisphere)	70F9132

3.3 13. Tools and Test Equipment

The following equipment is required to repair an IBM PS/2 Display.

- IBM Personal System/2 system unit
- IBM Personal System/2 Color Displays Test-Pattern Diskette (part 41G8502; form S41G-3317)
- IBM Personal System/2 8516 Color Display Advanced Diagnostic Diskette (part 04G3167) and 8516 Color Display Options Diskette (part 10G2945); both these diskettes are included in form S92F-2674.
- Jumper (part 7838690) with alligator clip (part 7838688) attached to each end or, Meter Lead kit (part 6428104)
- Digital voltmeter (part 8496278; 9900628) for 8517/9517 displays
- Trimming tool (part 6247769); 8517/9517 displays
- Two rear-cover delatching tools (IBM part 59X6319)
- Hex-head 2 mm trimming tool (part 39F8405)
- Screwdriver (flat blade)
- Socket set, 1/4 inch-drive, (part 1650830)
- Hex socket, 8 mm (part 1650834), 9515 display only
- Torx (**) kit (part 39F8407)
- Nonmagnetic metric rule
- Safety glasses.

Optional equipment: TV Color Analyzer.

(**) Trademark of Textron Incorporated. For a list of trademarks see "Notices" in topic FRONT_1.

Subtopics
3.3.1 Test Equipment Setup

3.3.1 Test Equipment Setup

Set up the equipment as shown in Figure 13-1.

PICTURE 65

Figure 13-1. Test Equipment Setup