

Component Replacement: Display Hardware

This chapter describes the following replacement and maintenance procedures for display hardware:

- ◆ Replacing the display monitor
- ◆ Replacing the Neotec Electronics Chassis
- ◆ Aligning and calibrating the image on the display monitor
- ◆ Replacing the touchscreen and touchscreen controller
- ◆ Calibrating the touchscreen

Overview

This chapter contains service and replacement procedures for display components.

Warning: To avoid electric shock, discharge the electrons from the display monitor before you touch components behind the monitor. See "Discharging Electrons from the Display Monitor" on page 2-21.

Important: To ensure proper operation of the display monitor, degauss the monitor before performing calibration and alignment procedures and after moving the slot machine to a different location. See "Degaussing the Display Monitor" on page 2-22.

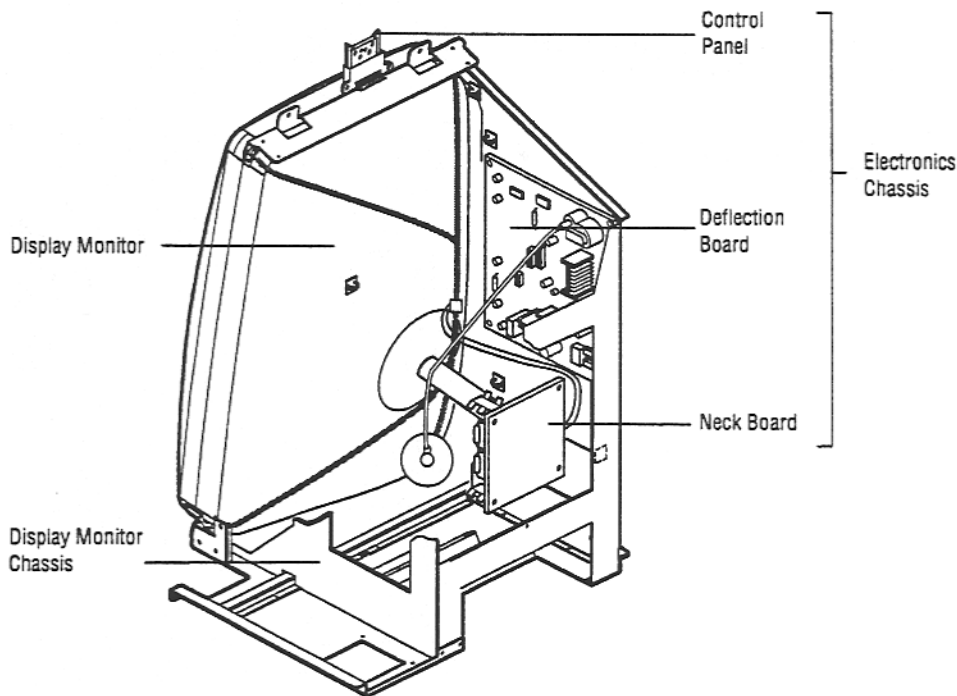
The following table lists the procedures in this chapter.

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Replacing the Display Monitor

To replace the display monitor, you must be familiar with the locations of the display monitor chassis and the electronics chassis. The display monitor is mounted in the display monitor chassis, which contains the electronics chassis. See Figure 9-1.

Figure 9-1 Display Monitor in Display Monitor Chassis



The electronics chassis always includes a neck board, a deflection board, and a control panel, and it may contain other components, depending on the manufacturer. Some of the figures in this procedure show a generic electronics chassis containing a deflection board, a neck board, and a control panel.

To replace the display monitor, you need the following supplies:

- ◆ Roll-away table the same height as the bottom of the display cavity
- ◆ Dolly for moving the slot machine
- ◆ Isopropyl alcohol
- ◆ Soft cotton cloth
- ◆ Workbench or table with a clean, padded (for example, carpeted) surface.
- ◆ Roll of 20-gauge bus-bar wire
- ◆ Soldering iron

After installing the new display monitor, you must align and calibrate the image, degauss the monitor, and calibrate the touchscreen.

The following table is a summary of the sections in this procedure. If you are familiar with the procedure, you may prefer to read the text in the indicated sections only when necessary.


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Removing the Display Monitor	
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"Discharging the Electrons from the Old Display Monitor." on page 9-4	
"Disconnecting the Electronics Chassis" on page 9-4	
"Removing the Display Monitor from the Display Monitor Chassis" on page 9-7	
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Removing the Display Monitor

Before beginning the procedure, be sure to turn the power off.

To turn the power off, perform the following steps:

1. Open the currency column door. Refer to "Opening the Currency Column Door" on page 2-8.
2. Flip the power switch to the Off position.

 **Warning:** Failure to turn off the machine can result in personal injury or damage to equipment.

Before removing the display monitor, you must remove the display monitor chassis from the display cavity, discharge the electrons from the old monitor, and disconnect the electronics chassis.

Removing the Display Monitor Chassis

Refer to "Removing the Display Monitor Chassis" on page 2-16.

Discharging the Electrons from the Old Display Monitor.

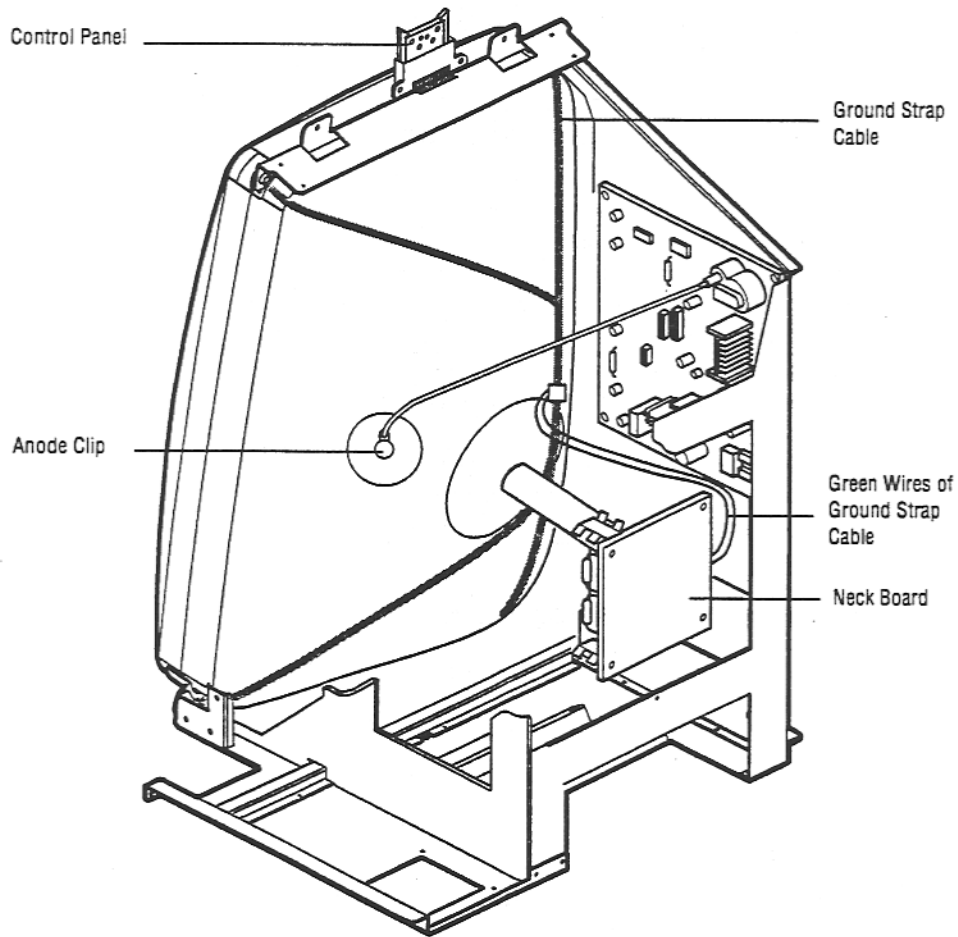
To discharge the electrons from the old display monitor, refer to "Discharging Electrons from the Display Monitor" on page 2-21.

Disconnecting the Electronics Chassis

To disconnect the electronics chassis from the display monitor chassis, perform the following steps:

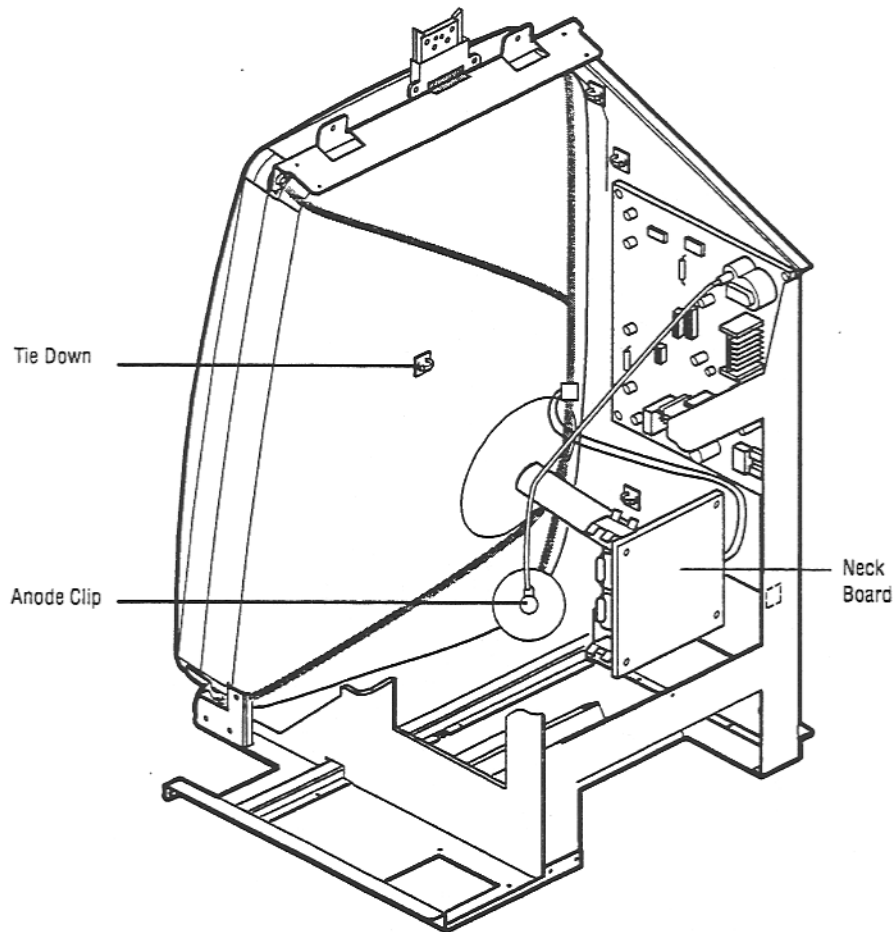
1. Refer to Figure 9-2 and disconnect the anode clip from the back of the monitor as follows:

Figure 9-2 Anode Clip on Back of Display Monitor




2. Refer to Figure 9-3 and cut the tie wrap in the tie down for the cable coming from the anode clip.
 - a. Using your fingers, pull back the rubber around the clip and insert the screwdriver into the hole for the clip.
 - b. Push the screwdriver against one of the prongs of the clip to squeeze the two prongs together.
 - c. Using your hands, pull the clip from the hole.

Figure 9-3 Tie Down for Cable Coming From Anode Clip



3. Refer to Figure 9-3 and remove the neck board from the neck of the display monitor by gently pulling the board until it unplugs from the monitor.

 **Caution:** The neck of the monitor is fragile and can be easily broken.

4. Locate the horizontal and vertical cable on the deflection yoke on the back of the display monitor. Figure 9-4 shows the cable and Figure 9-5 shows the location of the deflection yoke.

Figure 9-4 Horizontal and Vertical Cable

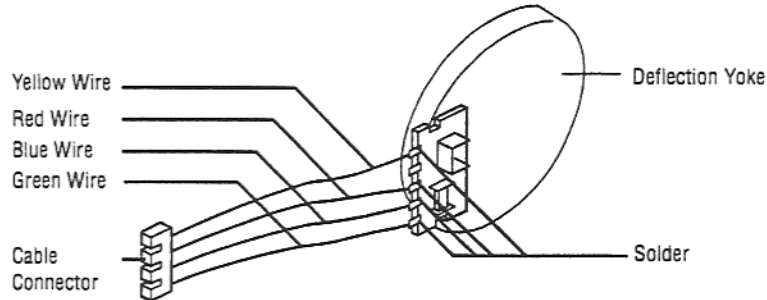
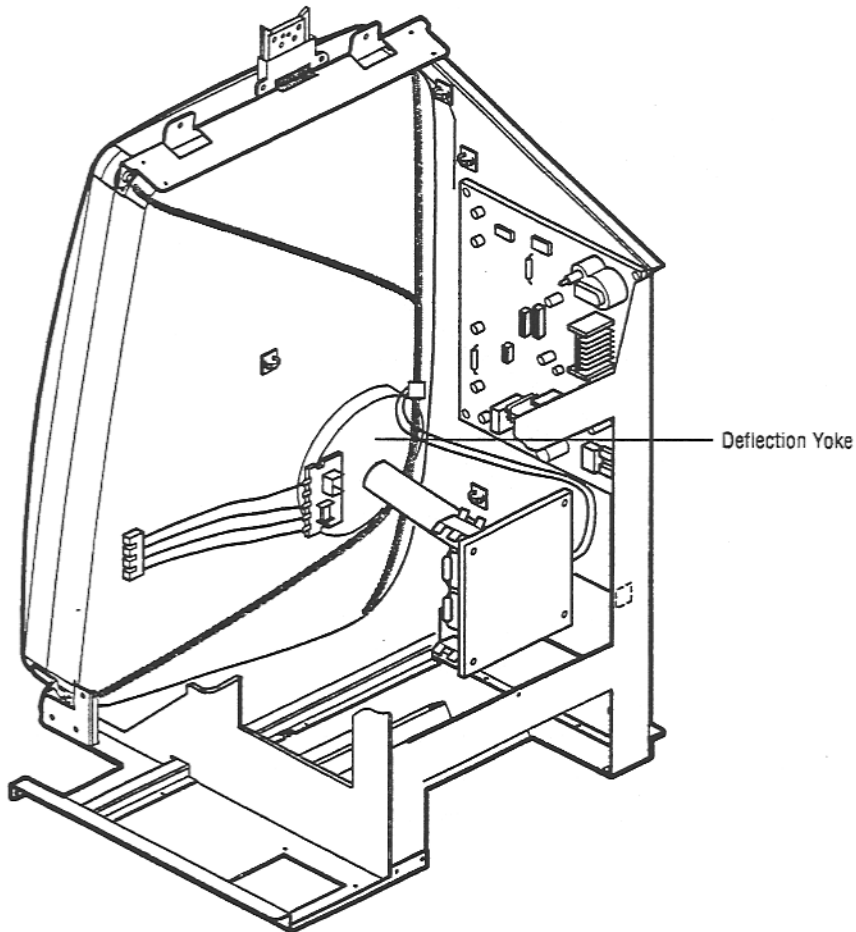
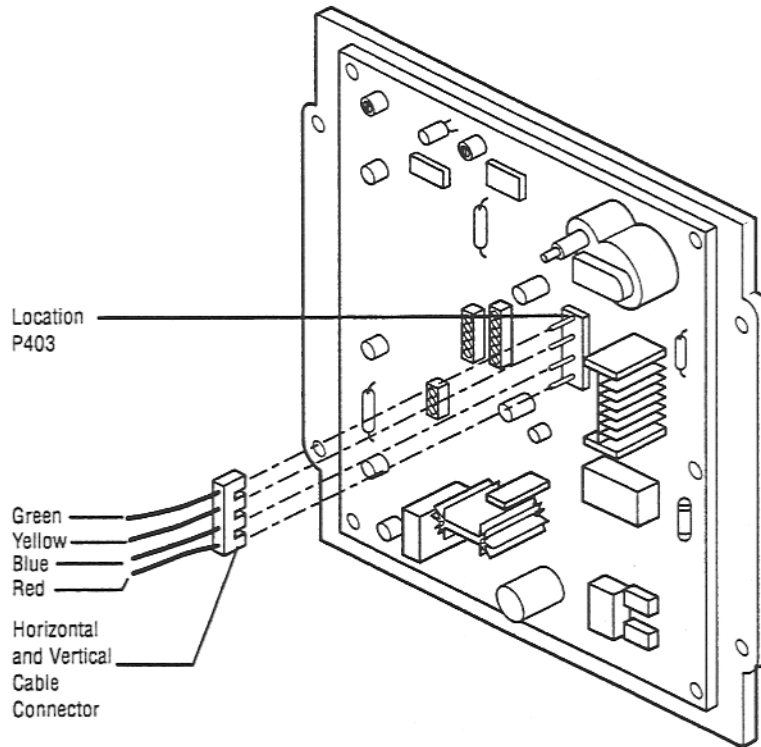


Figure 9-5 Location of Deflection Yoke



5. To remove the horizontal and vertical cable from the deflection board, refer to Figure 9-6 and disconnect the cable from location P403 on the deflection board.



Figure 9-6 Neotec Deflection Board



6. Refer to Figure 9-4 on page 9-6 and Figure 9-5 on page 9-6 and remove the horizontal and vertical cable from the deflection yoke by unsoldering the red, blue, yellow, and brown wires of the cable from the yoke.
7. Save the horizontal and vertical cable for later use.
8. Refer to Figure 9-1 on page 9-2 and remove the control panel from above the display monitor by pulling on the panel until the Velcro strip on the back of the panel separates from the Velcro strip on the monitor.

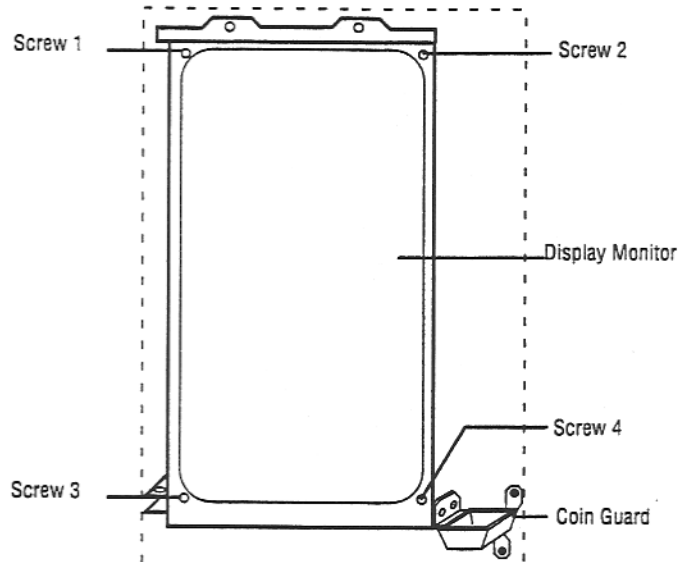
Removing the Display Monitor from the Display Monitor Chassis

To remove the display monitor from the display monitor chassis, perform the following steps:

1. Clean the touchscreen with a soft cotton cloth and isopropyl alcohol.
 -  **Caution:** Do not use Windex or any ammonia-based cleaner on the touchscreen.
 -  **Important:** Cleaning the touchscreen keeps it from scratching when you lay it flat in step 3.
2. Move the display monitor and chassis to a table with a clean, flat, padded surface.

3. Remove the monitor from the chassis as follows:
 - a. Carefully tilt the monitor forward until the touchscreen is flat against the table.
 - b. Refer to Figure 9-7 and remove the four screws from the corners of the display monitor screen.
 - c. Lift up on the display monitor chassis and free it from the display monitor.
 - d. Place the chassis on a table.

Figure 9-7 Screws Securing Display Monitor to Display Monitor Chassis

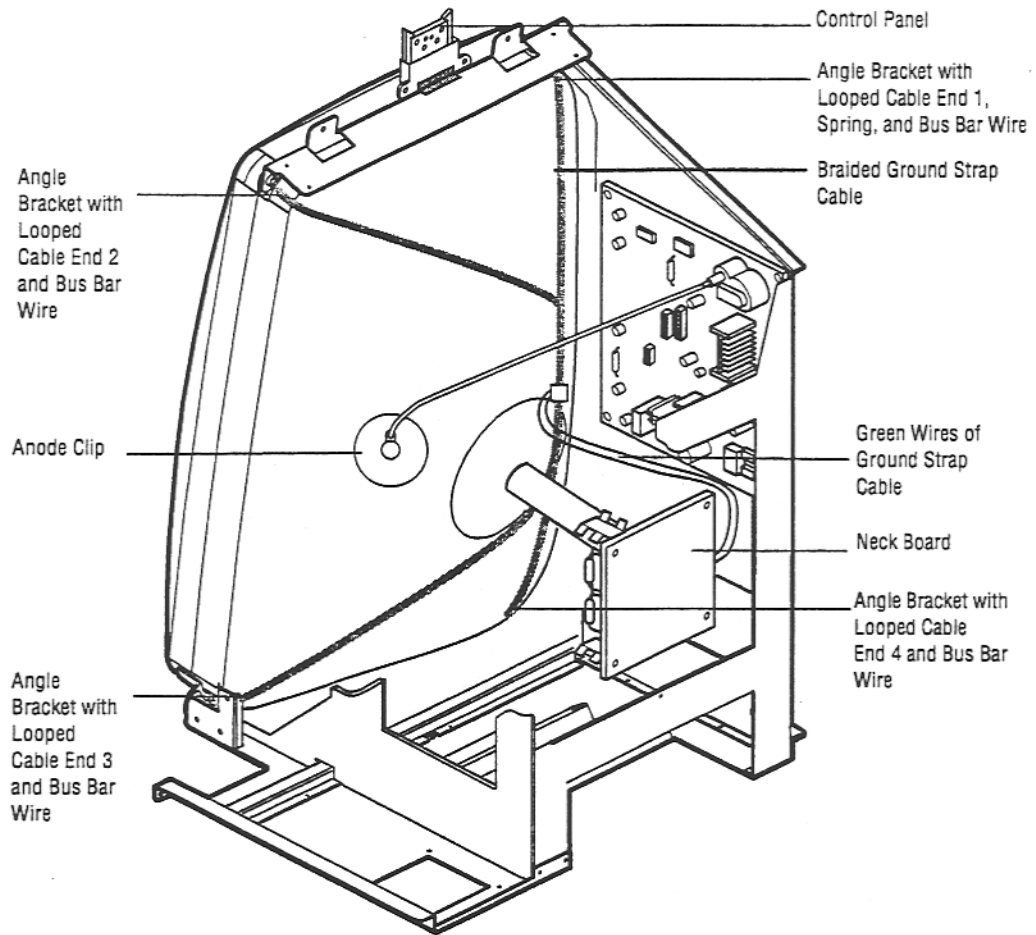


Removing the Ground Strap Cable

To remove the ground strap cable from the display monitor, perform the following steps:

1. Refer to Figure 9-8 and Figure 9-11 on page 9-12 and unplug the two green wires on the ground strap cable from location P905 on the neck board.

Figure 9-8 Ground Strap Cable on Back of Display Monitor



2. On the back of the monitor, cut through the 20-gauge bus bar wires that are threaded through the four ends of the silver braided ground strap cable. Refer to Figure 9-9 and Figure 9-10 to locate the bus bar wire and Figure 9-8 on page 9-9 to locate the four cable ends.

Important: Do not cut the ground strap cable.

Figure 9-9 Wire Threaded Through Loop of Braided Ground Strap Cable

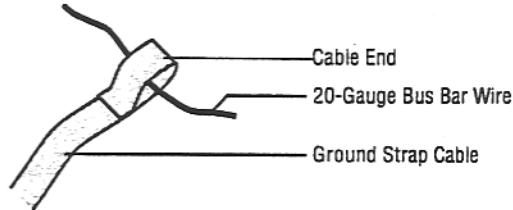
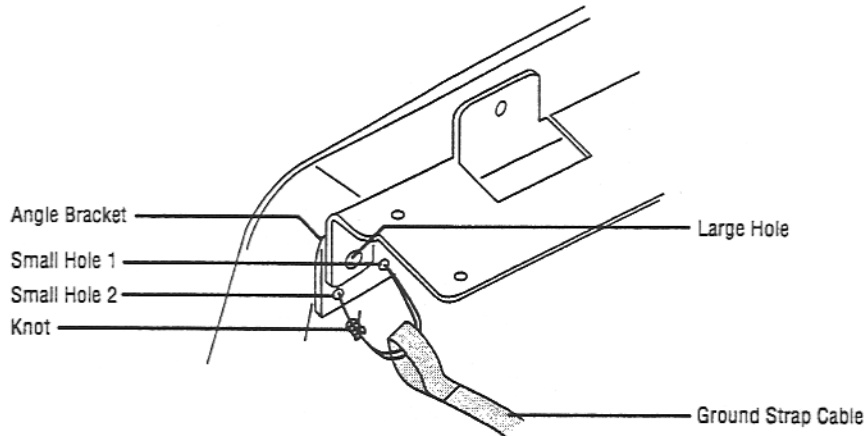


Figure 9-10 Ground Strap Cable Attached to Display Monitor



3. Remove the ground strap cable from the back of the monitor and set it aside for later use.

Installing the Display Monitor

Before installing the new display monitor, you must discharge the electrons.



Discharging the Electrons from the New Display Monitor

Refer to "Discharging Electrons from the Display Monitor" on page 2-21.

If you are replacing both the display monitor and the electronics chassis, skip the remainder of this procedure and proceed to "Replacing the Neotec Electronics Chassis" on page 9-13.


Installing the Display Monitor in the Display Monitor Chassis

To install the new monitor in the display monitor chassis, perform the following steps:

1. Tilt the monitor forward so the screen is flat against the padded surface of a table.
 -  **Caution:** Be sure the surface of the table is well padded with a fabric such as carpet.
2. Hold the display monitor chassis over the display monitor so that the top and bottom of the chassis align with the top and bottom of the monitor and carefully lower the chassis onto the monitor.
 -  **Caution:** The neck of the display monitor is fragile. Be careful not to jar it.
3. Slide the display monitor chassis onto the display monitor, aligning the screw holes in each corner of the chassis with those in the monitor. Figure 9-7 on page 9-8 shows the screw locations.
4. Secure the monitor to the chassis, using four screws.

Attaching the Ground Strap Cable to the Monitor

To attach the ground strap cable to the monitor, perform the following steps:

1. Refer to Figure 9-8 on page 9-9 to locate the four ends of the ground strap cable.
2. Lay out the cable on a table in a way similar to the layout of the cable shown in Figure 9-8 on page 9-9. The end of the cable that has a spring should be in the upper-right corner.
3. Perform the following steps for each of the four ends of the cable:
 - a. Cut a 5" length of 20-gauge bus bar wire.
 - b. Refer to Figure 9-9 on page 9-10 and string the wire through the loop on the end of the braided cable.
 - c. Refer to Figure 9-10 and insert the ends of the bus bar wire into the small holes on either side of the large hole in the angle bracket.
 - d. Refer to Figure 9-10 on page 9-10 and fasten the two ends of the wire together, so the end of the ground strap cable is securely fastened to the angle bracket.
 -  **Note:** Figure 9-10 is an enlargement of the upper-left corner of the display monitor shown in Figure 9-8 on page 9-9. Each cable end goes to a different angle bracket, as shown in Figure 9-8 on page 9-9.


Attaching the Electronics Chassis

To attach the electronics chassis to the display monitor, perform the following steps:

1. Face the front of the monitor and attach the control panel to the top of the monitor by pressing the Velcro strip, on the back of the control panel, against the Velcro strip above the display monitor. Figure 9-8 on page 9-9 shows the location of the control panel.

2. Use a soldering iron to solder the red, blue, green, and yellow wires of the horizontal and vertical cable to the deflection yoke attached to the back of the monitor.

Figure 9-5 on page 9-6 shows the location of the deflection yoke and Figure 9-4 on page 9-6 shows the location of the solder.

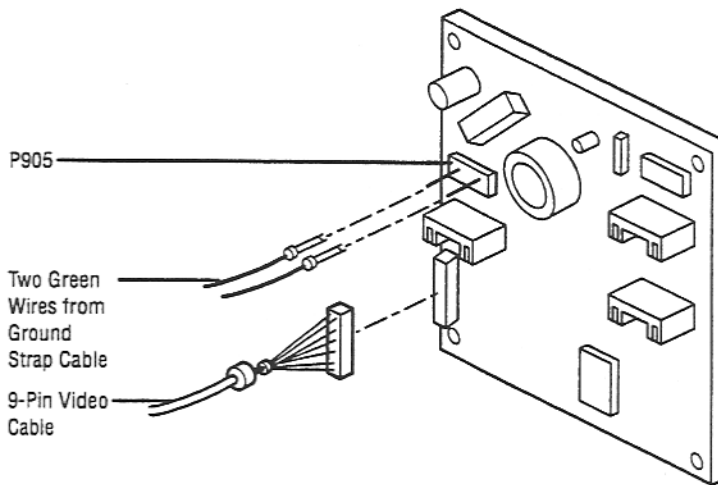
 **Note:** Reuse the cable you removed from the old display monitor.

3. Plug the connector on the horizontal and vertical cable into location P403 of the deflection board, shown in Figure 9-6 on page 9-7.
4. Refer to Figure 9-8 on page 9-9 and plug the neck board into the back of the display monitor.
5. Refer to Figure 9-8 on page 9-9 and attach the anode clip to the back of the display monitor as follows:
 - a. Use your fingers to pull back the rubber cup surrounding the clip.
 - b. Insert the two prongs of the clip into the hole on the left side of the monitor.
 - c. Secure the cable (coming from the anode clip) to the back of the display monitor with a tie wrap through the tie down above the clip.

Attaching the Ground Strap Cable to the Monitor Chassis

To attach the two green wires of the ground strap cable to the display monitor chassis, face the back of the display monitor and plug the wires into location P905 on the neck board, shown in Figure 9-11.

Figure 9-11 Neotec Neck Board



Finishing Up

To finish installation, you must adjust the monitor image and install the display monitor chassis.

Aligning and Calibrating the Display Monitor Image

Refer to "Aligning and Calibrating the Display Monitor Image" on page 9-24.

Installing the Display Monitor Chassis

Refer to "Installing the Display Monitor Chassis" on page 2-20.

Verifying Display Monitor Operation


Refer to "Verifying Display Monitor Operation" on page 2-21.

Replacing the Neotec Electronics Chassis

The Neotec electronics chassis contains the following components:

- ◆ Deflection board with heat sink
- ◆ Neck board
- ◆ Control panel
- ◆ Cables

You must always replace the electronics chassis as one unit. You can replace a defective Neotec electronics chassis with another Neotec electronics chassis.

 **Important:** Do not use a Wells-Gardner electronics chassis to replace a Neotec electronics chassis. The chassis from Wells-Gardner is being phased out.

To access the electronics chassis, you must remove the display monitor chassis from the cabinet, so you may want to move the slot machine from the casino floor. To move the machine, you need a dolly and help from another person.

You also need a roll-away table to remove the monitor chassis and monitor from the slot machine. The table should be the same height as the bottom of the display cavity, so you can easily slide the monitor and monitor chassis from the cavity to the table.

This procedure requires the following:

- ◆ Grounded screwdriver
- ◆ Degausser
- ◆ AC power extension (for calibration and alignment of monitor image)
- ◆ Roll-away table for display monitor
- ◆ Set of nonconductive alignment tools
- ◆ Five tie wraps

The following table is a summary of the sections in this procedure. If you are familiar with the procedure, you may prefer to read the text in the indicated sections only when necessary.


Replacing the Neotec Electronics Chassis	
Removing the Neotec Electronics Chassis	
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"Removing the Tie Downs" on page 9-16	
"Removing the Neck Board" on page 9-16	
"Removing the Deflection Board, Video Cable, and Control Panel" on page 9-17	
Installing the Neotec Electronics Chassis	
"Attaching the Deflection Board" on page 9-18	
"Attaching the Control Panel" on page 9-19	
"Attaching the Cables, Neck Board, and Deflection Board" on page 9-19	
"Discharging Electrons from the Display Monitor" on page 2-21	
"Attaching the Anode Clip" on page 9-23	
"Aligning and Calibrating the Display Monitor Image" on page 9-24	
"Installing the Display Monitor Chassis" on page 2-20	
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"Playing a Game" on page 9-24	
"Degaussing the Display Monitor" on page 2-22	

Removing the Neotec Electronics Chassis

Before beginning the procedure, be sure to turn the power off.

To turn the power off, perform the following steps:

1. Open the currency column door. Refer to "Opening the Currency Column Door" on page 2-8.
2. Flip the power switch to the Off position.

 **Warning:** Failure to turn off the machine can result in personal injury or damage to equipment.

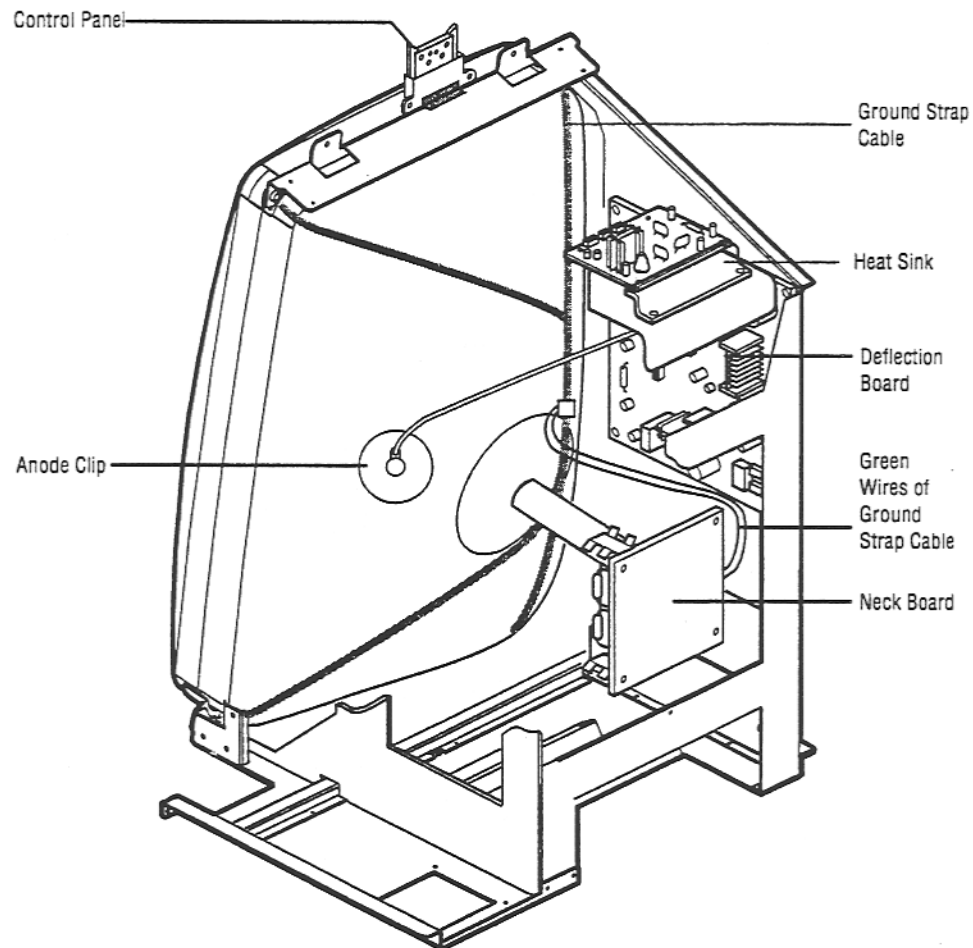
To remove the electronics chassis, you must access the deflection board and the neck board. To locate these boards, you must remove the display monitor chassis.

When you face the back of the monitor, the deflection board is standing upright, secured to the right side of the chassis. The heat sink is above and perpendicular to the deflection board. The neck board is attached to the neck of the display monitor.

The control panel is mounted on top of the display monitor. You must open the display cavity bezel to find it.

Figure 9-12 shows the locations of the control panel, the deflection board, the heat sink, and the neck board.

Figure 9-12 Locations of Control Panel, Deflection Board, and Neck Board



Removing the Display Monitor Chassis

Refer to "Removing the Display Monitor Chassis" on page 2-16.

Discharging the Electrons from the Display Monitor

Refer to "Discharging Electrons from the Display Monitor" on page 2-21.

Disconnecting the Anode Clip

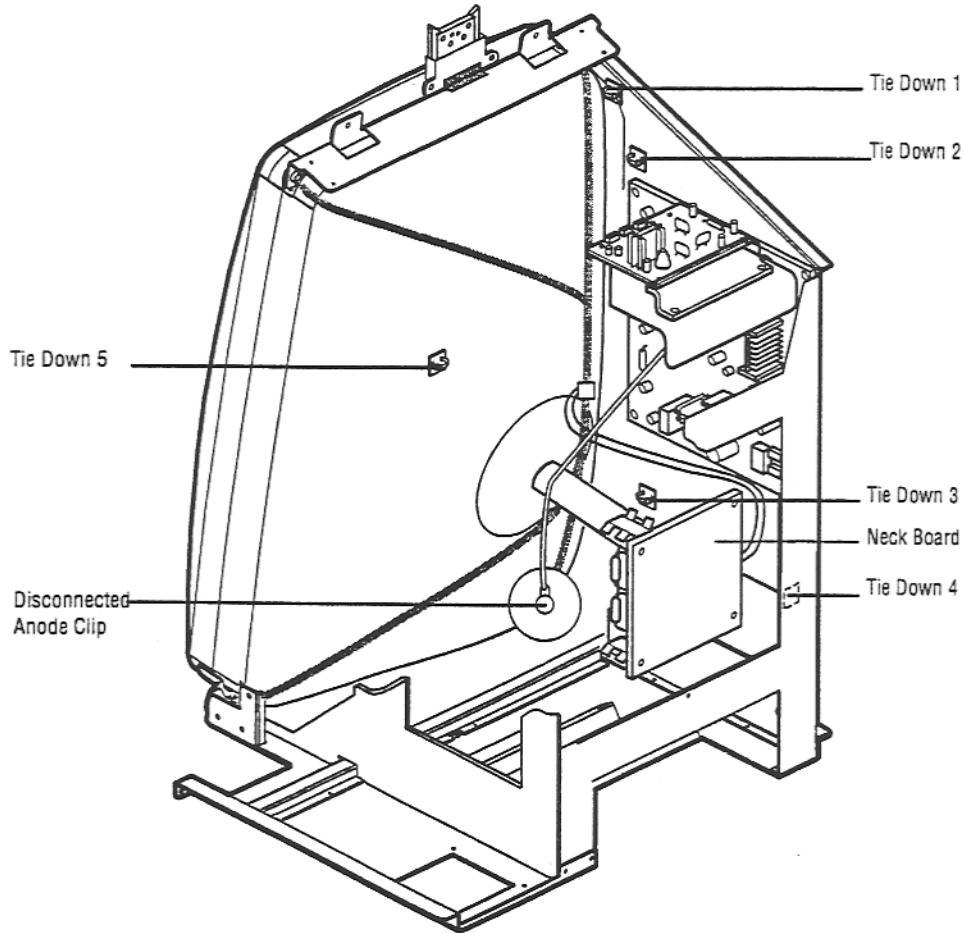
To disconnect the anode clip from the display monitor, perform the following steps:

1. Using your fingers, pull back the rubber around the clip and insert the screwdriver into the hole for the clip.
2. Push the screwdriver against one of the prongs of the clip to squeeze the two prongs together.
3. Using your hands, pull the clip from the hole.

Removing the Tie Downs

Cut the tie wraps in the four tie downs on the display monitor chassis and on the tie down on the back of the display monitor. Figure 9-13 shows the locations of the five tie downs.


Figure 9-13 Tie Downs Securing Cables to Chassis and Display Monitor



Removing the Neck Board

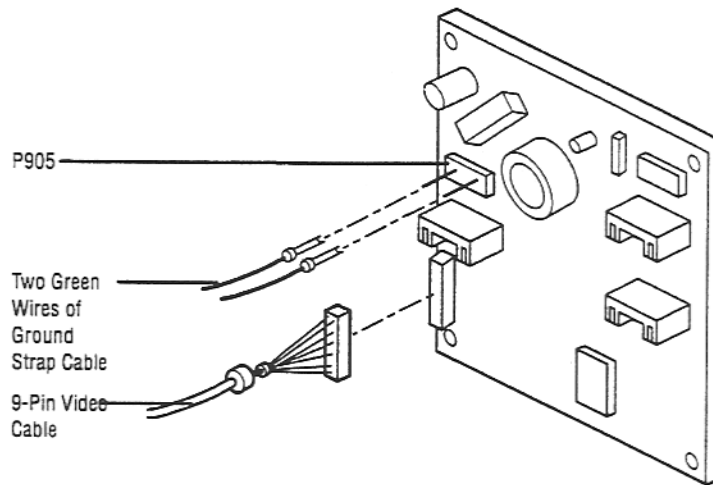
To remove the neck board, perform the following steps:

1. Gently pull the neck board until it unplugs from the monitor. Refer to Figure 9-13 for the location of the neck board.

 **Caution:** The neck of the monitor is fragile and can be easily broken.

2. Face the back of the display monitor and unplug the two green wires of the ground strap cable from location P905 on the neck board, shown in Figure 9-14 on page 9-17.

Figure 9-14 Neck Board



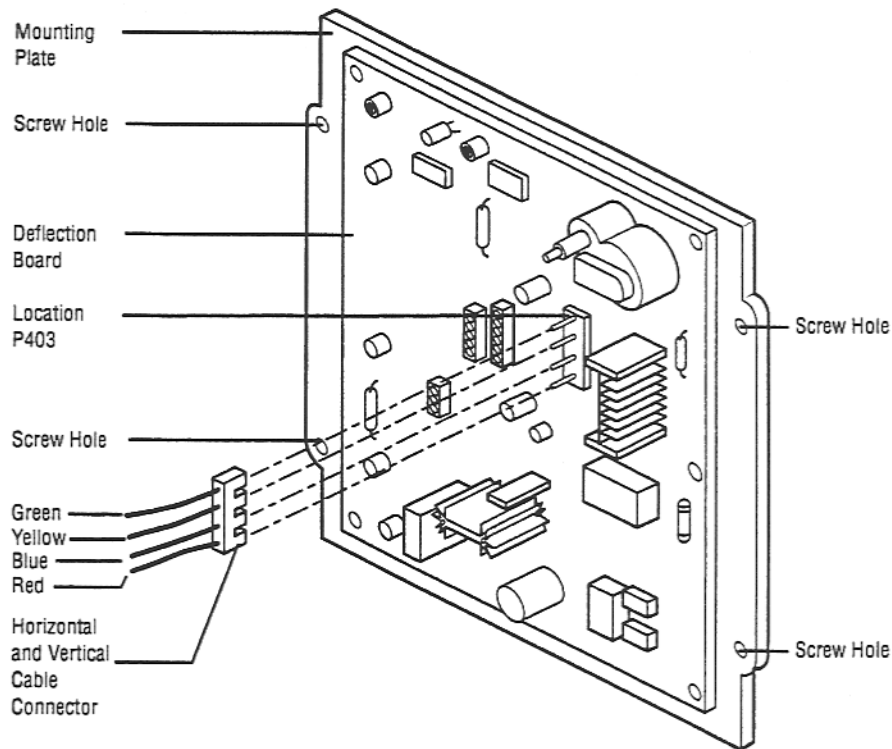
Removing the Deflection Board, Video Cable, and Control Panel

To remove the deflection board, video cable, and control panel, perform the following steps:

1. Unplug the horizontal and vertical cable from location P403 of the deflection board, shown in Figure 9-15.

Note: The connection may be so tight that you need a screwdriver to loosen it.


Figure 9-15 Neotec Deflection Board



2. From inside the display monitor chassis, detach the deflection board from the chassis by removing the four screws securing the mounting plate to the chassis. Figure 9-15 on page 9-17 shows the mounting plate and the four screw holes.
3. Refer to Figure 9-14 on page 9-17 and unplug the video cable from the neck board.
4. Refer to Figure 9-12 on page 9-15 and remove the control panel from above the display monitor by pulling on the panel until the Velcro strip on the back of the panel separates from the Velcro strip on the monitor.
5. Slide the deflection board up the inside of the display monitor chassis and remove it, with the heat sink, from the chassis.

Installing the Neotec Electronics Chassis

Perform this procedure only if you are replacing a Neotec electronics chassis with another Neotec electronics chassis.

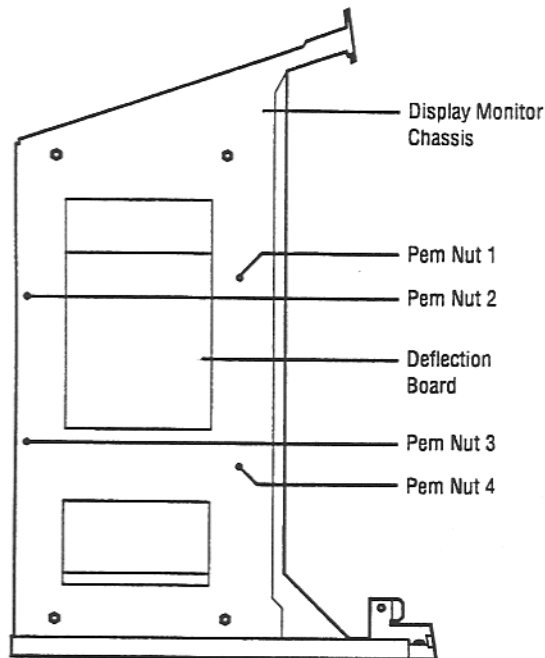
 **Important:** Do not use a Wells-Gardner electronics chassis to replace a Neotec electronics chassis. The chassis from Wells-Gardner is being phased out.

Attaching the Deflection Board

To attach the deflection board to the display monitor chassis, perform the following steps:

1. The four screw holes for attaching the deflection board to the display monitor chassis are on the mounting plate. See Figure 9-15 on page 9-17.
2. Face the back of the display monitor, stand the board upright, and align the four screw holes in the plate to the four pem nuts in the right wall of the chassis. Figure 9-16 on page 9-19 shows the locations of the pem nuts.
3. From the inside of the chassis, insert four screws through the board and into the pem nuts, and secure the board to the chassis.

Figure 9-16 Outside Wall of Display Monitor Chassis



Attaching the Control Panel

Face the front of the monitor and attach the control panel to the top of the display monitor by pressing the Velcro strip, on the back of the control panel, against the Velcro strip above the display monitor. Figure 9-12 on page 9-15 shows the location of the control panel.

Attaching the Cables, Neck Board, and Deflection Board

To attach the cables, neck board and deflection board, perform the following steps:

1. Refer to Figure 9-14 on page 9-17 and plug the video cable into the neck board.
2. If the electronics chassis you removed is from a manufacturer other than Neotec, solder the red, blue, green, and yellow wires of the Neotec horizontal and vertical cable to the deflection yoke on the back of the display monitor. Figure 9-17 on page 9-20 shows the location of the deflection yoke, and Figure 9-18 on page 9-20 shows the location of the solder.

Figure 9-17 Location of Deflection Yoke

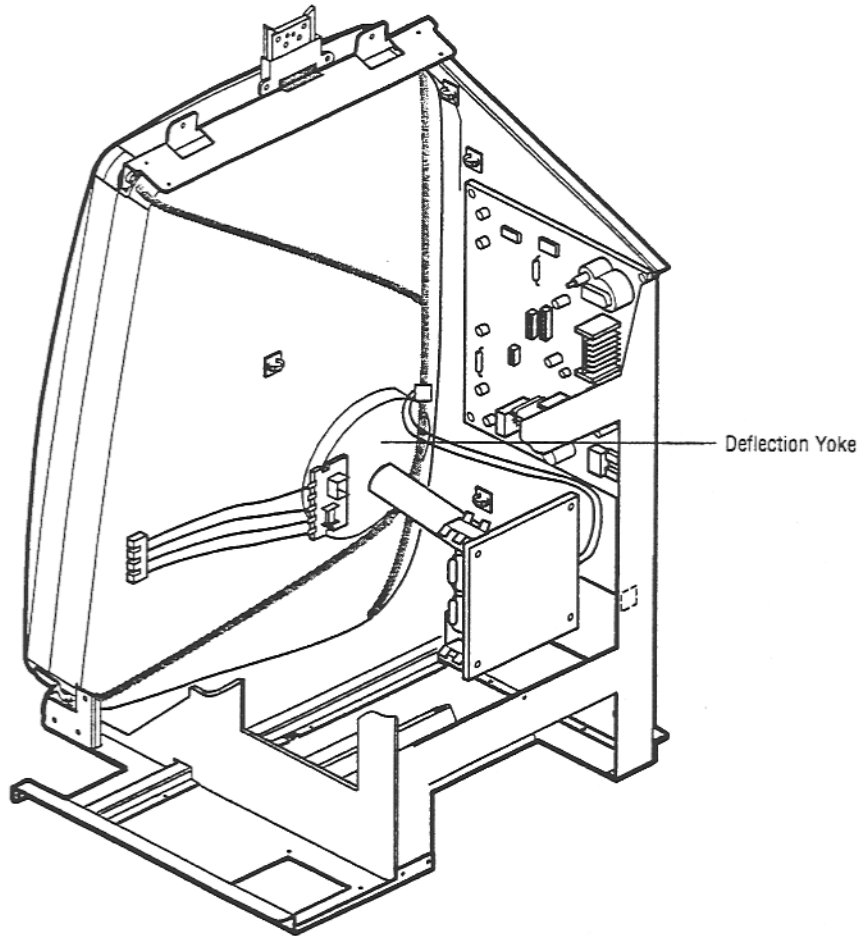
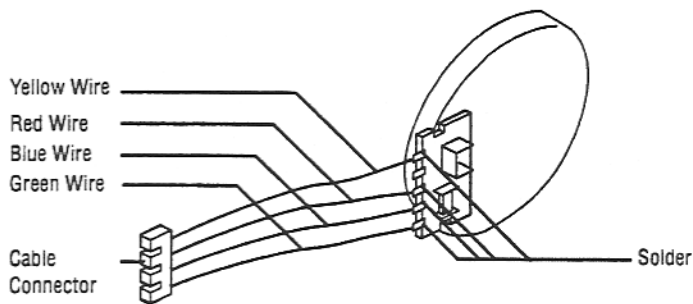


Figure 9-18 Neotec Horizontal and Vertical Cable



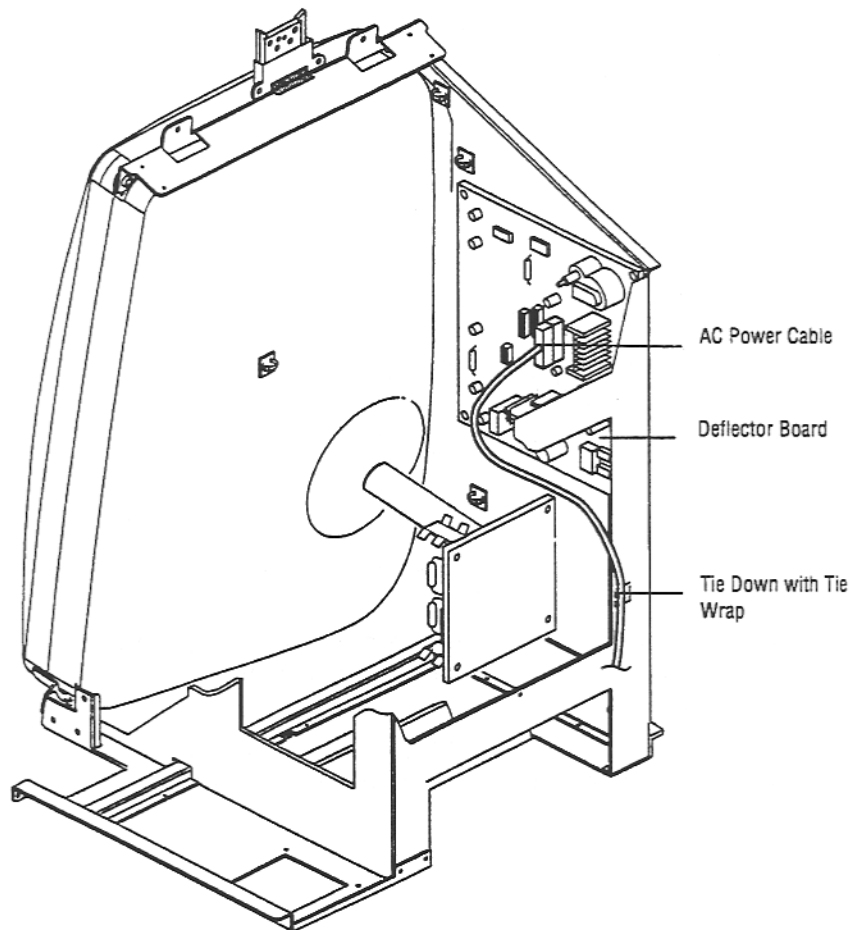
Note: If you have replaced the display monitor with a new one, you may have already soldered the old horizontal and vertical cable to the back of the monitor.

3. Refer to Figure 9-15 on page 9-17 and plug the connector of the horizontal and vertical cable into location P403 on the deflection board.

Important: Reuse the cable from the old board only if the new and old boards are both from Neotec.

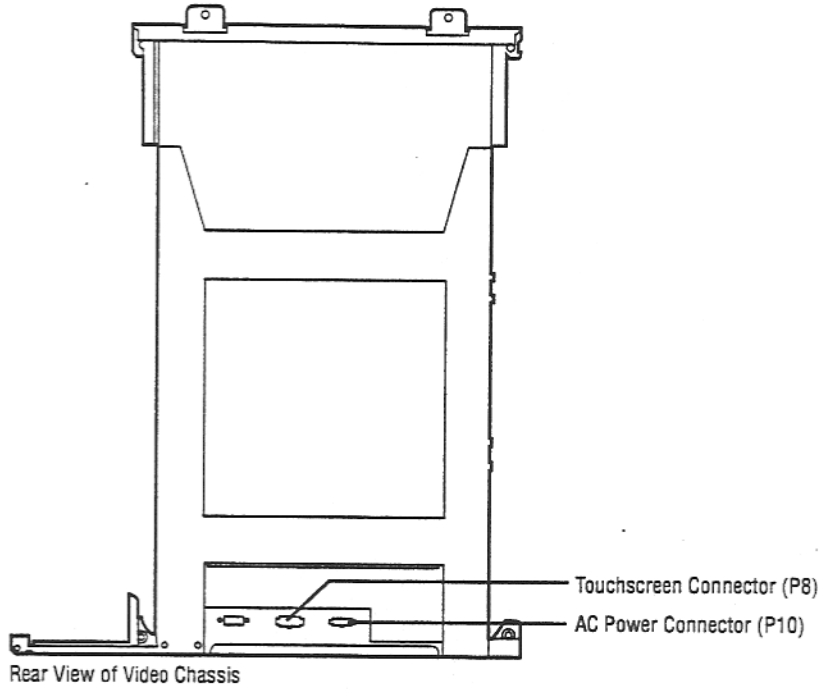
4. Plug the connector on the green wires of the ground strap cable, shown in Figure 9-12 on page 9-15, into location P905 on the neck board, shown in Figure 9-14 on page 9-17.
5. Refer to Figure 9-12 on page 9-15 and plug the neck board into the neck of the display monitor.
6. Connect the cables coming from the deflection board as follows:
 - a. String the green, white, and black AC power cable to the tie down, shown in Figure 9-19, and secure it to the tie down with a tie wrap.

Figure 9-19 AC Power Cable Strung Through Tie Wrap on Chassis



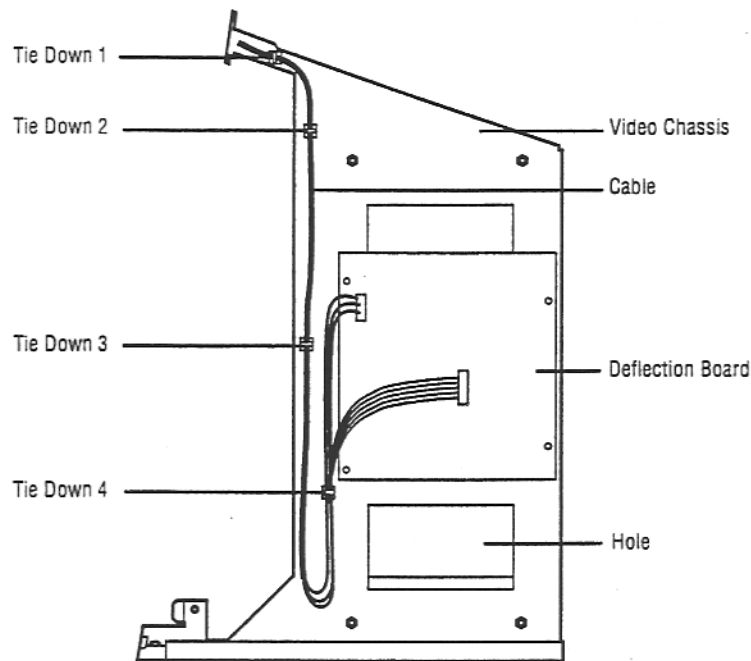
- b. Face the back of the display monitor. Refer to Figure 9-20 and plug the AC power cable (P10) into the connector farthest to the right on the display monitor chassis. Plug the touchscreen cable (P8) into the middle connector.

Figure 9-20 Cables Plugged into Display Monitor Chassis



- c. Allow the remaining long cable coming from the deflection board to hang down as far as the bottom-left corner of the large hole in the display monitor chassis. See Figure 9-21 on page 9-23.
- d. Form a loop with the cable and string it upwards, securing it to the display monitor chassis with new tie wraps in the four tie downs. See Figure 9-21 on page 9-23.
- e. Plug the four connectors, at the end of the cable, into the 5-pin, 4-pin, 10-pin, and 3-pin connectors on the control panel at the top of the monitor.

Figure 9-21 Deflection Board, Cables, and Tie Downs



Discharging the Electrons from the Display Monitor

Refer to "Discharging Electrons from the Display Monitor" on page 2-21.

Attaching the Anode Clip

To attach the anode clip to the display monitor, refer to Figure 9-12 on page 9-15 and perform the following steps:

1. Use your fingers to pull back the rubber cup surrounding the clip.
2. Insert the two prongs of the clip into the hole on the left side of the monitor.
3. Secure the cable (coming from the anode clip) to the back of the display monitor with a tie down. Tie down 5 in Figure 9-13 on page 9-16 shows the location.

Aligning and Calibrating the Image

Refer to "Aligning and Calibrating the Display Monitor Image" on page 9-24.

Installing the Display Monitor Chassis

Refer to "Installing the Display Monitor Chassis" on page 2-20.

Verifying Neotec Electronics Chassis Operation

Finish up by playing a game and degaussing the display monitor.

Playing a Game

Check the operation of the electronics chassis by playing a game and viewing the image on the screen.

Degaussing the Display Monitor


If you have moved the slot machine from the casino floor, return it to its location and degauss the display monitor. Refer to "Degaussing the Display Monitor" on page 2-22.

Aligning and Calibrating the Display Monitor Image


This procedure is for a slot machine with a Neotec electronics chassis. To perform the procedure, the machine must be operating and a fairly clear display must be on the screen. The monitor must have been removed from the machine, connected with extension cables and be resting on a table/chair/floor, allowing access to the adjustments on the deflection, geometry, neck boards, and high voltage section.

To align and calibrate the monitor image, you need the following supplies:

- ◆ MMS key
- ◆ Stubby Phillips screwdriver
- ◆ 6" Phillips screwdriver
- ◆ Nonconductive alignment tools (short 4" - 6" and long 14" - 18")
- ◆ Flashlight
- ◆ Monitor extension cable (Silicon Gaming Part Number 073-9170-0, CBL, Extension)
- ◆ Demagnetizer (degaussing) tool
- ◆ Stool/bench to hold monitor

 **Warning:** High Voltage is present on the back of the monitor assembly where adjustments are made. Use caution when making adjustments. Do not wear jewelry (watches, rings, earrings, and necklaces) when performing these alignments.

When the monitor is removed from the chassis, it is recommended a ground be attached from the monitor chassis to the slot machine box.

 **Important:** Since some monitor adjustments may affect others, the sequence of adjustments may need to be repeated before the desired display is attained.

Vertical and Horizontal adjustments are opposite of what they appear to be. This is because the monitor is manufactured for a landscape orientation, but has been installed in a portrait position in the slot machine.

The following table is a summary of the sections in this procedure. If you are familiar with the procedure, you may prefer to read the text in the indicated sections only when necessary.

Aligning and Calibrating the Display Monitor Image

"Making Image Adjustments" on page 9-25

"Making Horizontal Adjustments" on page 9-26

"Making Vertical Adjustments" on page 9-26

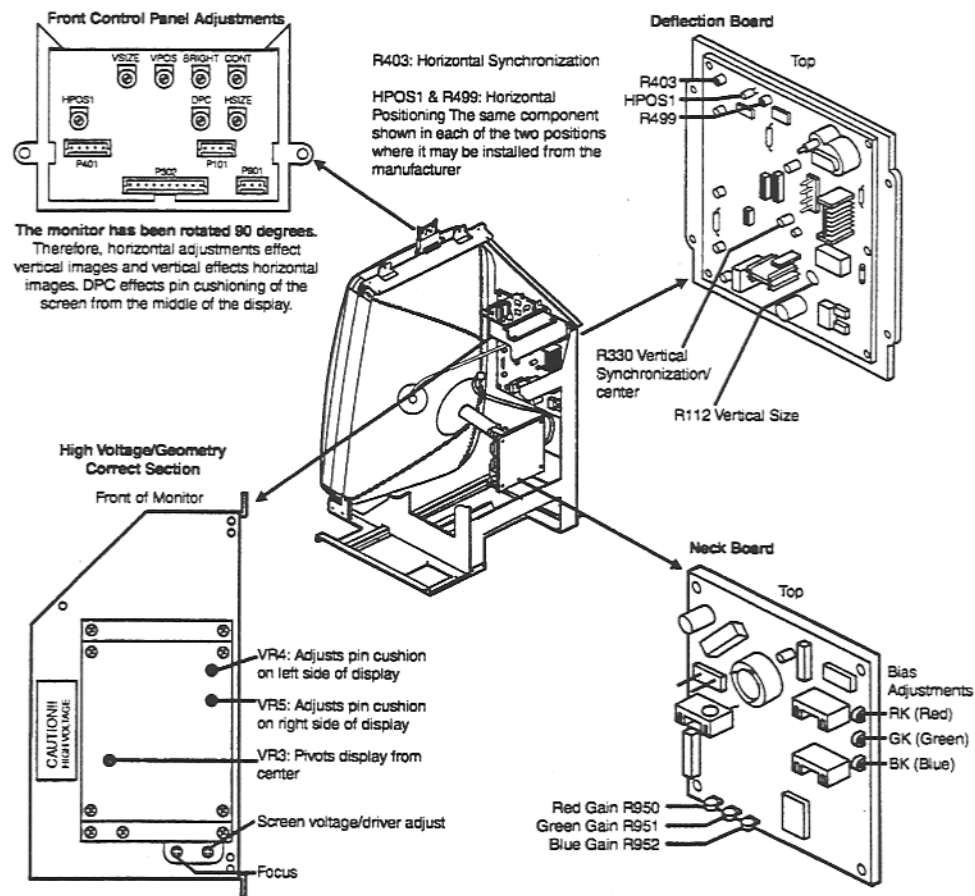
"Making Pin Cushion Adjustments" on page 9-27

"Making Color Adjustments" on page 9-27

"Finishing Up" on page 9-28

Figure 9-22 shows the locations of adjustments referenced in this procedure.

Figure 9-22 Neotec Chassis



Making Image Adjustments

To prepare for making image adjustments, perform the following steps:

1. Remove the monitor assembly and place it on a flat surface.
2. Connect the extension cable between the slot machine cable harness and the monitor assembly. Ensure the hopper remains installed.

3. Turn the power on.
4. Once the machine has completed the boot process, degauss the screen.

To make image adjustments using the control panel shown in Figure 9-22, adjust the following knobs:


1. *HPOSI*: fully counterclockwise (CCW) and then clockwise (CW) 1/8 turn
2. *HSIZE*: until centered
3. *VSIZE*: until centered
4. *VPOS*: until centered
5. *BRIGHT*: to position where display is usable for alignments
6. *CONT*: to position where display is usable for alignments

Making Horizontal Adjustments

The following adjustments affect vertical display size and shape.

To make horizontal adjustments, perform the following steps:


1. The *R403* control on the deflection board affects synchronization (sync) of the display and should be adjusted to center the display image. This can be done one of two ways:
 - ♦ Adjust CCW until sync is lost. This is evident by the display showing nothing but vertical lines. Note the position of the adjustment tool or resistor. Adjust CW and the picture will re-sync and then go out of sync again. Note the position of the adjustment tool or resistor. Adjust CCW to the halfway point.
 - ♦ Adjust CCW and watch the screen for a reference point/object just prior to losing sync. Mark the spot on the display with one finger. Adjust CW until the picture resynchronizes. While watching the same reference point, mark the spot where the display loses sync with another finger. Adjust CCW gaining sync and stop where the reference point/object is centered between the two fingers.
2. On the deflection board, locate the *R499* (*HPOS*) control and the *R112* (Vertical size) control. Adjust *R499* to center the display and *R112* to make the size of the display reach from the top to the bottom of the screen.

 **Note:** After the monitor is installed in the cabinet the *HPOSI* and *HSIZE* controls on the front control panel may need to be readjusted.


Making Vertical Adjustments

The following adjustments affect horizontal display size and shape:

On the front control panel, adjust the *VSIZE* and *VPOS* controls to shape/center the display. If the display won't center or extend from side to side, locate the *R330* (*VSYNC*) control on the deflection board and adjust as necessary. *R330* will affect the size of images, side to side, on the monitor. To ensure *R330* is adjusted properly, similar images on the screen should be of equal size from left to right. That is, cards should be of equal size or reels should be the same size on the left side of the monitor as they appear on the right side of the monitor.

-  **Note:** After the monitor is installed in the cabinet the *VSIZE* and *VPOS* controls may need to be readjusted.


Making Pin Cushion Adjustments

-  **Important:** Use a display image with a straight line near the top, for example the *Door Open* banner, an MMS screen, or the *Test Display* page accessed from the MMS *Diagnostics* page.

To make pin cushion adjustments, perform the following steps:

1. Adjust the *DPC* control on the front control panel for a straight line across the middle.
2. If there is a "bow/low spot" on the left side of the screen, adjust the *VR5* control on the geometry correct board.
3. If there is a "bow/low spot" on the right side of the screen, adjust the *VR4* control on the geometry correct board.
4. If the reference line is straight but appears to be angled from one end to the other, adjust the *VR3* control on the geometry correct board. This adjustment causes the reference line to pivot in the middle of the display.

Making Color Adjustments

-  **Note:** The front control panel *BRIGHT* and *CONT* adjustments, the flyback capacitor *FOCUS* and *SCREEN* adjustments, and the Neck Board *RK*, *GK*, and *BK* adjustments all affect each other. The procedures listed below may need to be accomplished in a sequence different than listed. A "normal" display is the technician's judgement, especially for color adjustments.

To make color adjustments, perform the following steps:

1. Adjust the *BRIGHT* and *CONT* controls on front control panel fully CCW and then CW 1/8 of a turn.
2. Adjust the *SCREEN* control on the high voltage section until the display is illuminated as brightly as possible without retrace lines.
3. Adjust the *BRIGHT* control on front control panel until display is normal.
4. Adjust the *CONT* control on front control panel fully CW.
5. Check to see there are no re-trace lines when changing from the Navigator Icons to a game or into the MMS.
6. Adjust the *FOCUS* control on the high voltage section until the text in the upper right hand corner is as clear as possible. (The *BRIGHT* and *CONT* controls can affect focus too.)
7. On the Neck Board turn
 - a. *RGAIN* (R950) fully CW then CCW 1/16 turn
 - b. *GGAIN* (R951) fully CW then CCW 1/16 turn
 - c. *BGAIN* (R952) fully CW then CCW 1/16 turn

- d. the *RK*, *GK*, and *BK* controls. These color adjustments are left to the discretion of each field engineer. The following descriptions describe the colors to look for in general:

If the machine has more than one game available, the ring around the *ICON* should be violet. This is done with a Blue adjustment

Reds look best when wood grains appear like cherry wood and the grain is visible. Reds are usually bright, but never glowing. They also fade in all games with a red object.

Greens are usually bright but never glowing. The greens also fade in almost all objects and usually appear as lime green to grass green.

- *Note:* The following is an example of good colors using *Phantom Belle* for reference:

- ◆ Red is in the cherry wood, wood appearance, and the rust colored tapestries.
 - ◆ Green on the poker table is bright, fading into the shadows of the table.
 - ◆ Blue is in the windows as they appear slate gray, changing from bright in the upper-left corner to darker on the right.
 - ◆ The front of the table wood is visible in the lower-right corner.
 - ◆ The cards are white with yellow spots/antiquing
8. Return to the *Navigator* *ICON* screen and verify the circle/ring around the game icons is still violet. If not, continue to adjust one or all three controls until the display is acceptable. Also, check for retrace lines while the display is blacked out and look for any one color over-driving the black screen.
 9. Once all adjustments are completed to the satisfaction of the field engineer, the monitor is ready for reinstallation.

Finishing Up

To complete the procedure, perform the following steps:

1. Remove the extension cable and reinstall the monitor in the display cavity. Leave the display cavity door open. Connect the three-pin power connector to the monitor, but do not connect the touchscreen connector. (This is the 8-pin connector on the bottom of the chassis.)
2. Turn on the slot machine.
3. Once the machine has completed the boot process, degauss the monitor.
4. As necessary, make adjustments on the front control panel to fine-tune the picture.
5. Turn the slot machine off and connect the 8-pin touchscreen connector.
6. Close the display cavity and secure with the two screws.
7. Turn the slot machine on and verify the monitor display is normal.
8. Degauss the monitor.
9. Calibrate the touchscreen to ensure that it is operational and calibrated. Refer to "Calibrating the Touchscreen" on page 9-40.

Replacing the Touchscreen and Touchscreen Controller

The touchscreen covers the display monitor and is connected to the touchscreen controller, located on the display monitor chassis. This procedure describes how to replace the touchscreen and, optionally, the touchscreen controller.

To remove the touchscreen or the controller, you must remove the display monitor chassis from the display monitor cavity, so you may want to move the slot machine from the casino floor. To move the machine, you need a dolly and help from another person.

For this procedure, you need the following supplies:

- ◆ Clean cotton cloth
- ◆ Isopropyl alcohol
- ◆ Wire cutter (for cutting the loose ends of the tie wraps)
- ◆ Wire crimper (for modifying the touchscreen controller cable)
- ◆ Pin remover (for modifying the touchscreen controller cable)
- ◆ 1" of shrink tubing (for modifying the touchscreen controller cable)
- ◆ Heat gun (for modifying the touchscreen controller cable)
- ◆ Exacto knife

The following table is a summary of the sections in this procedure. If you are familiar with the procedure, you may prefer to read the text in the indicated sections only when necessary.


Replacing the Touchscreen and Touchscreen Controller	
Removing the Touchscreen and Touchscreen Controller	
"Removing the Display Monitor Chassis" on page 2-16	
"Removing the Control Panel" on page 9-30	
"Removing the Touchscreen Controller" on page 9-31	
"Removing the Touchscreen" on page 9-32	
Installing the Touchscreen and Touchscreen Controller	
"Installing the Touchscreen" on page 9-32	
"Installing the Flat Touchscreen Cable" on page 9-33	
"Modifying the Touchscreen Control Cable" on page 9-34	
Important: Perform this procedure only if you are replacing the touchscreen controller.	
"Modifying the Flat Touchscreen Cable" on page 9-35	
Important: Perform this procedure only if you are <i>not</i> replacing the touchscreen controller.	
"Preparing the Ground Wire" on page 9-36	
"Installing the Touchscreen Controller" on page 9-36	
"Securing the Touchscreen" on page 9-37	
"Installing the Control Panel" on page 9-38	
"Installing the Display Monitor Chassis" on page 2-20	
"Verifying Touchscreen Operation" on page 9-39	
Finishing Up	
"Calibrating the Touchscreen and Degaussing the Monitor" on page 9-39	
"Degaussing the Display Monitor" on page 2-22	

Removing the Touchscreen and Touchscreen Controller

Before beginning the procedure, be sure to turn the power off.

To turn the power off, perform the following steps:

1. Open the currency column door. Refer to "Opening the Currency Column Door" on page 2-8.
2. Flip the power switch to the Off position.

 **Warning:** Failure to turn off the machine can result in personal injury or damage to equipment.

You must detach the touchscreen controller from the display monitor chassis, whether or not you replace the touchscreen controller. To access the controller, you must first remove the display monitor chassis and the control panel from the display cavity.

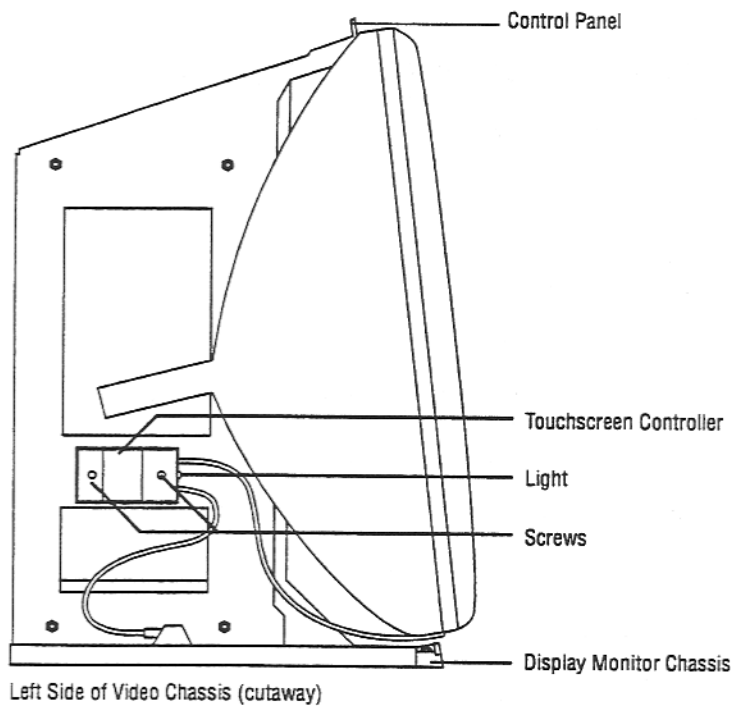
Removing the Display Monitor Chassis

Refer to "Removing the Display Monitor Chassis" on page 2-16.

Removing the Control Panel

Refer to Figure 9-23 and remove the control panel from above the display monitor by pulling on the panel until the Velcro strip on the back of the panel separates from the Velcro strip on the monitor.

Figure 9-23 Control Panel and Touchscreen Controller Locations



Left Side of Video Chassis (cutaway)

Removing the Touchscreen Controller

To remove the touchscreen controller from the display monitor chassis, perform the following steps:



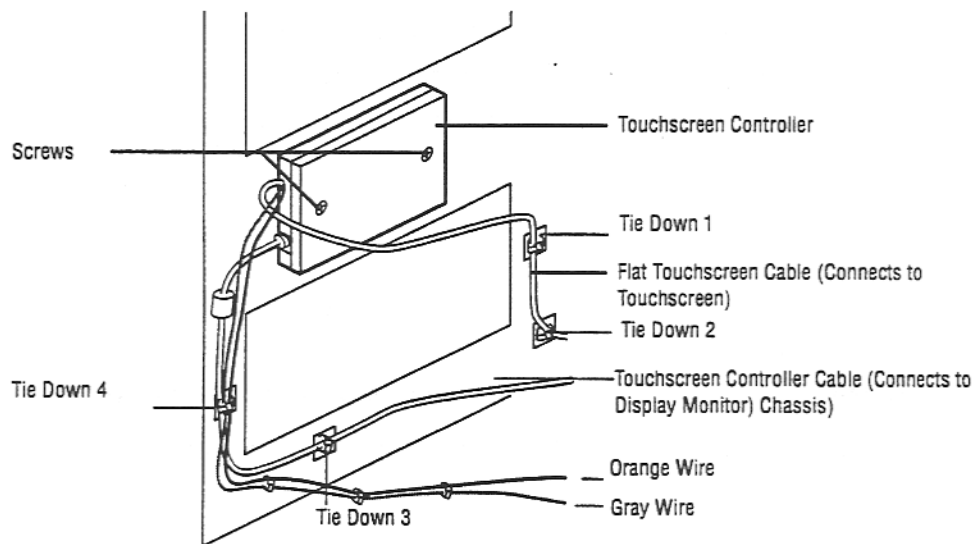
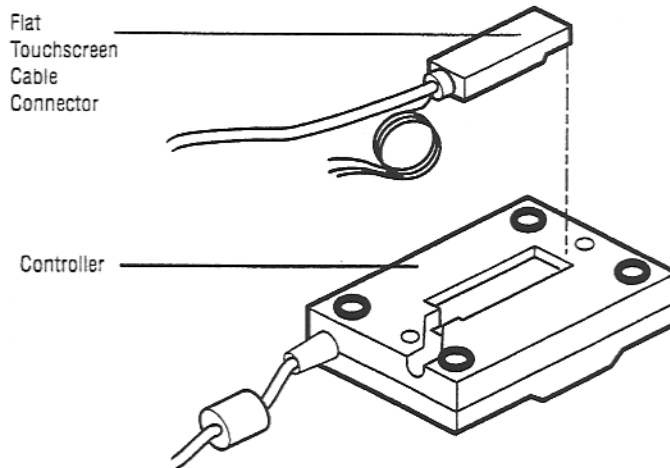
1. Refer to Figure 9-23 on page 9-30 and Figure 9-24 and detach the controller from the display monitor chassis as follows:
 - a.  **Note:** You must remove the touchscreen controller from the display monitor chassis whether or not you are replacing the controller.
 - a. Cut the four tie wraps in the four tie downs.
 - b.  **Note:** The tie wraps in tie downs 1 through 4 secure the flat touchscreen cable and the touchscreen controller cable to the display monitor chassis.
 - b. Remove the two screws shown in Figure 9-24, and remove the controller from the chassis.
 - c. Cut the tie wraps securing the orange and gray wires to the flat touchscreen cable.

Figure 9-24 Touchscreen Controller and Cables



2. Refer to Figure 9-25 on page 9-32 and disconnect the flat touchscreen cable from the controller as follows:
 - a. Unplug the flat touchscreen cable from the touchscreen controller.
 - b. Remove the cable from the groove in the controller.
 - c. Cut the orange and gray wires coming from the flat touchscreen cable.
 - d. Face the front of the display monitor and locate the space below the lower-right corner of the touchscreen, between the touchscreen and the display monitor chassis. Push the flat touchscreen cable through the space and out of the chassis.
 - e. Remove the touchscreen controller from the chassis.

Figure 9-25 Flat Touchscreen Cable Connection to Touchscreen Controller



Removing the Touchscreen

To remove the touchscreen from the display monitor, perform the following steps:


1. Remove the tape from the edges of the touchscreen with your fingers.
2. Loosen the edges of the touchscreen from the display monitor by inserting and gently wiggling an Exacto knife between the edges of the touchscreen and the monitor.
3. Remove the touchscreen from the monitor and place it on a clean, flat, padded surface.
4. Remove the pieces of tape from the monitor screen with your fingers.

Installing the Touchscreen and Touchscreen Controller

The following describes how to assemble the cables and install the touchscreen and touchscreen controller.

Installing the Touchscreen

To install the touchscreen on the front of the display monitor, perform the following steps:

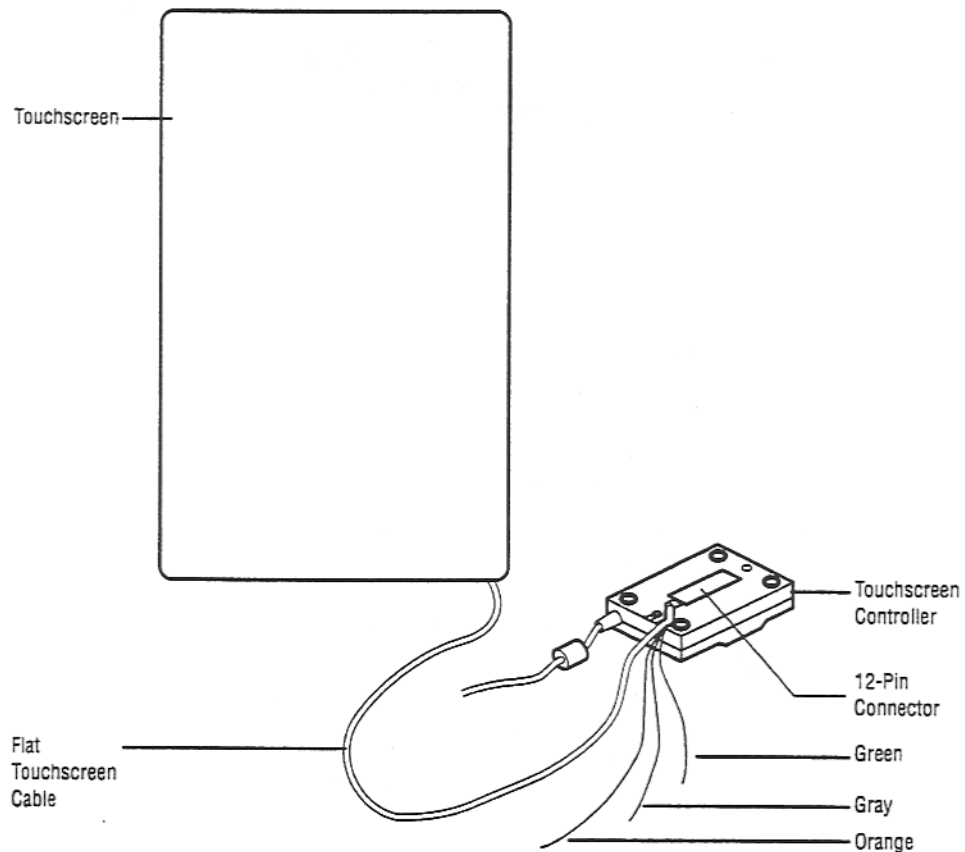
1. Clean the touchscreen with a clean cotton cloth and isopropyl alcohol.
 -  **Caution:** Do not use Windex or any ammonia-based cleaner on the touchscreen.
2. Remove the paper backing from the seven adhesive strips on the inside edges of the touchscreen.
3. Hold the touchscreen up to the display monitor screen so that the seven adhesive strips on the touchscreen face the display monitor screen.
4. Align the four corners with the four corners of the display monitor screen and push on the corners of the touchscreen until it securely adheres to the display monitor screen.

Installing the Flat Touchscreen Cable

To assemble and install the flat touchscreen cable, perform the following steps:

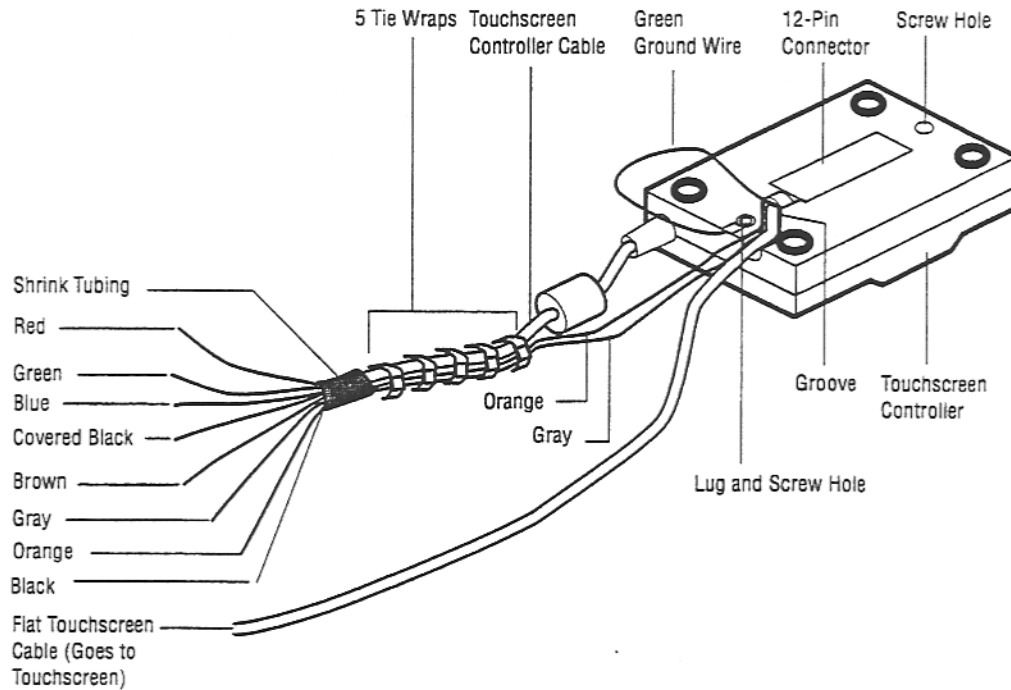
1. The touchscreen comes with a connected flat touchscreen cable, which has a 12-pin connector and three long wires: green, gray, and orange. Unwrap the green wire from around the gray and orange wires so that the wires are loose. See Figure 9-26.

Figure 9-26 Touchscreen and Flat Touchscreen Cable



2. Locate the space below the lower right corner of the touchscreen, between the touchscreen and the display monitor chassis, and push the flat touchscreen cable and the green, gray, and orange wires through the space and to the inside of the display monitor chassis.
3. Refer to Figure 9-25 on page 9-32 and connect the flat touchscreen cable to the touchscreen controller as follows:
 - a. Plug the 12-pin connector at the end of the cable into the 12-pin connector on the touchscreen controller.
 - b. Push the cable into the groove in the controller until the wires are secure in the groove. Figure 9-27 on page 9-34 shows the groove for the cable and wires.

Figure 9-27 Cables in Touchscreen Controller



Modifying the Touchscreen Control Cable

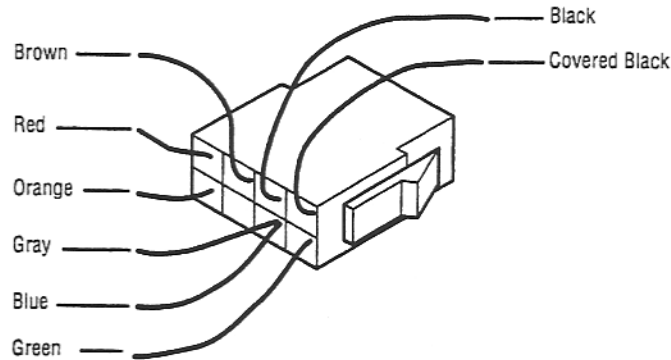
Important: Perform this procedure only if you are replacing the touchscreen controller with a new one.

To modify the touchscreen controller cable, refer to Figure 9-27 and perform the following steps:

1. Lay the orange and gray wires (coming from the flat touchscreen cable) along the touchscreen controller cable.
2. Cut the orange and gray wires to the same length as the touchscreen controller cable.
3. Secure the orange and gray wires to the touchscreen controller cable with five tie wraps, equally spaced along the touchscreen controller cable.
4. Slip a 1" piece of shrink tubing over the end of the controller cable and the orange and gray wires and slide the tubing 2" up the cable and wires.
5. Strip the cable 2" below the sleeve so that the eight wires in the cable are exposed.
6. Shrink the tubing, using a heat gun.
7. Crimp a male Molex pin onto each of the ends of the eight wires protruding through the shrink tubing.
8. Crimp the blue wire to the gray wire coming from the flat touchscreen cable and crimp on a male Molex pin.

9. Insert the eight wires into the holes of a Molex connector and secure them. Figure 9-28 shows the correct holes for each of the wires.

Figure 9-28 Touchscreen Controller Cable Connector



Modifying the Flat Touchscreen Cable

Important: Perform this procedure only if you are *not* replacing the touchscreen controller with a new one.

To modify the cable, refer to Figure 9-27 on page 9-34 and Figure 9-28 and perform the following steps:

1. Slit and remove the 1" shrink tubing from the touchscreen controller cable.
2. Using a pin remover, remove all the wires from the connector on the touchscreen controller cable.
3. Pull the old orange and gray wires out of the cable.
4. Lay the new orange and gray wires (coming from the new flat touchscreen cable) along the touchscreen controller cable. Figure 9-27 on page 9-34 shows the wires and the cable.
5. Cut the orange and gray wires to the same length as the touchscreen controller cable.
6. Secure the orange and gray wires to the touchscreen controller cable with five tie wraps equally spaced along the touchscreen controller cable. Figure 9-27 on page 9-34 shows the tie wraps.
7. Cut and slip a 1" piece of shrink tubing over the end of the controller cable and the orange and gray wires and slide the tubing 2" up the cable and wires. Figure 9-27 on page 9-34 shows the shrink tubing.
8. Strip the cable 2" below the sleeve so that the eight wires in the cable are exposed.
9. Using a heat gun, shrink the tubing.
10. Crimp a male Molex pin onto each of the ends of the red, green, covered black, black, and brown wires protruding through the shrink tubing.
11. Crimp the blue wire to the gray wire coming from the flat touchscreen cable and crimp on a male Molex connector.
12. Insert the red, brown, black, covered black, orange, gray, blue, and green wires into the holes of a Molex connector and secure them. Figure 9-28 shows the correct holes for each of the wires.

Preparing the Ground Wire

To prepare the ground wire coming from the flat touchscreen cable, perform the following steps:

1. Cut the wire to 3".
2. Crimp a ring lug onto the end of the green wire.

Installing the Touchscreen Controller

To install the touchscreen controller on the display monitor chassis, perform the following steps:

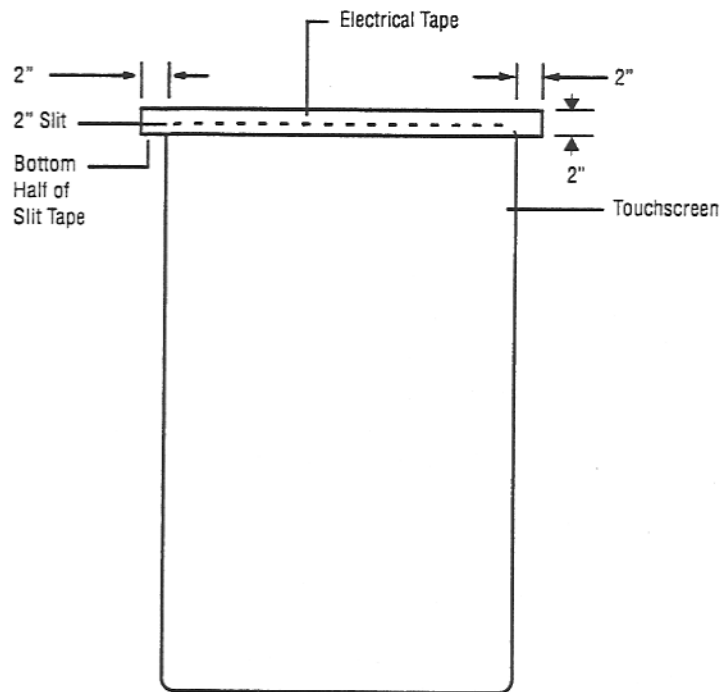
1. On the backside of the touchscreen controller, place the lug of the green ground wire over the screw hole located between the touchscreen controller cable and the flat touchscreen cable. Figure 9-27 on page 9-34 shows the location of the screw hole.
2. From the front side of the controller, insert a screw through the screw hole, the controller, and the lug.
3. Facing the back of the display monitor, place the touchscreen controller in the inside-left side of the monitor chassis, aligning the two screw holes in the controller with the two screw holes in the chassis. Refer to Figure 9-23 on page 9-30 and Figure 9-24 on page 9-31.
4. Push the screw in the controller through the screw hole in the chassis.
5. Insert a screw into the other screw hole in the controller and through the screw hole in the chassis.
6. Secure each of the screws with a nut.
7. Attach the flat touchscreen cable to the display monitor chassis as follows:
 - a. Insert tie wraps into tie downs 1 and 2, shown in Figure 9-24 on page 9-31.
 - b. String the flat touchscreen cable through the two tie wraps and secure the tie wraps around the cable.
8. If you are replacing the touchscreen controller with a new one, secure the touchscreen controller cable to the display monitor chassis as follows:
 - a. Insert tie wraps into tie downs 3 and 4, shown in Figure 9-24 on page 9-31.
 - b. String the touchscreen controller cable through the two tie wraps and secure the tie wraps around the cable.

Securing the Touchscreen

To secure the touchscreen to the display monitor, perform the following steps:

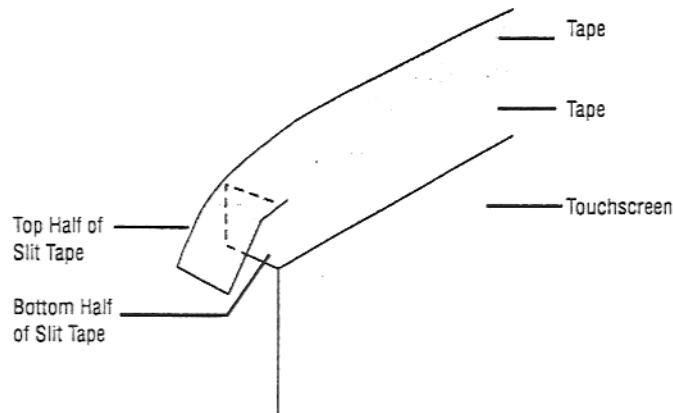
1. Refer to Figure 9-29 and cut a strip of 2" Polyken cloth tape 4" longer than the width of the touchscreen.

Figure 9-29 Electrical Tape and Touchscreen



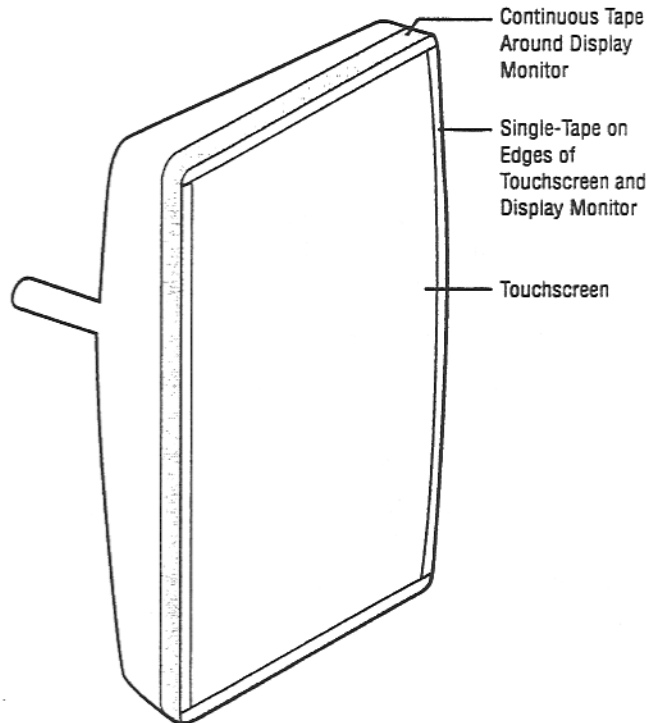
2. Hold the tape horizontally above the top edge of the touchscreen so that the tape extends 2" beyond each top corner of the touchscreen.
3. Apply and press the bottom half of the tape along the top edge of the touchscreen.
4. Cut a 2" slit horizontally in each end of the tape.
5. Wrap the top half of the tape over the top edge of the touchscreen and apply and press it to the top edge of the display monitor.
6. Form a square corner with the left slit end of the tape as follows:
 - a. On the left end of the tape, press the bottom half of the slit tape back until it adheres to the side of the display monitor.
 - b. On the left end of the tape, press the top half of the tape down the side of the display monitor. The result is a square corner. See Figure 9-30 on page 9-38.

Figure 9-30 Taped Corner of Touchscreen



7. Repeat the taping process in steps 1 through 6 on the other three edges of the touchscreen so that all four edges of the screen are secured to the display monitor and all four corners are taped. See Figure 9-30.
8. Cover the tape on all four edges of the display monitor with one continuous piece of electrical tape, starting with the bottom-left corner and ending at the bottom-left corner. Figure 9-31 shows the top and left sides.

Figure 9-31 Taped Touchscreen



Installing the Control Panel

Face the front of the monitor and attach the control panel to the top of the monitor by pressing the Velcro strip, on the back of the control panel, against the Velcro strip


above the display monitor. Figure 9-23 on page 9-30 shows the location of the control panel.

Installing the Display Monitor Chassis

Refer to "Installing the Display Monitor Chassis" on page 2-20.

Verifying Touchscreen Operation

To verify touchscreen operation, perform the following steps:

1. Stand in front of the touchscreen and locate the small green light on the touchscreen controller, between the right side of the display monitor and the inside right wall of the monitor chassis.
 *Note:* To see the light, you may have to push the right side of the chassis to the right.
2. Watch the light while you touch the touchscreen in various places. If the light flickers, the touchscreen controller is working.

Finishing Up

Finish up by closing the doors, calibrating the touchscreen, and degaussing the display monitor.

Calibrating the Touchscreen and Degaussing the Monitor

To calibrate the touchscreen and degauss the monitor, perform the following steps:

1. Close the display cavity bezel. Refer to "Closing the Display Cavity Bezel" on page 2-9.
2. Close the currency column door. Refer to "Closing and Locking the Currency Column Door" on page 2-9.
3. Calibrate the touchscreen. Refer to "Calibrating the Touchscreen," below. If the touchscreen responds as described, the touchscreen installation is correct.
4. Close and lock the belly door. Refer to "Closing and Locking the Belly Door" on page 2-9.
5. If you have moved the slot machine from the casino floor, return it to its location and degauss the display monitor. Refer to "Degaussing the Display Monitor" on page 2-22.

Calibrating the Touchscreen

Perform this procedure when the following conditions occur:

- ◆ Whenever you replace the display monitor
- ◆ Whenever you replace the touchscreen or touchscreen controller
- ◆ After you align the image on the display monitor
- ◆ Whenever the touchscreen does not respond correctly to touch selections

To calibrate the touchscreen, perform the following steps:

1. Invoke the MMS and access the **MMS Diagnostics** page. Refer to "Invoking the MMS" on page 2-23.
2. On the **Diagnostics** page, press the *Touchscreen* button. A path shaped like a backward S is displayed.
3. Place a finger on the displayed path. Move your finger within the double lines and verify that a visible trail accurately follows your movement.
4. Touch the *RETURN TO DIAGNOSTICS* button. The **Diagnostics** page is displayed.
5. Touch the *Calibrate* button.
6. Follow the directions on the monitor by touching the two arrows and the three X's. As you do this, the touchscreen calibration is done automatically; no additional adjustments are necessary.
7. Once the *CALIBRATION COMPLETE* message is displayed, touch the *RETURN TO DIAGNOSTICS* button to return to the **Diagnostics** page.
8. Exit the MMS. Refer to "Exiting the MMS" on page 2-25.
9. If you have received the *CALIBRATION COMPLETE* message, play one of the games to verify that the touchscreen is functioning correctly.