

NXR-1400i

Operator Manual



Notices

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Introduction

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Introduction

Your Nicolet Imaging Systems NXR-1400i x-ray systems are typically used for microfocus, real-time, nondestructive inspection of electronic components, hybrid circuitry, multi-layer circuit boards, sealed components and electronic assemblies.

Positioning of the sample during inspection is accomplished using a joystick with the NXR-1400i.

High voltage and video controls on the front control panel allow you to adjust the system for viewing the best possible image.

The basic NXR-1400i system consists of a lead-lined cabinet that houses an x-ray source, x-ray camera, control panel, and sample tray and a display monitor.

System Accessories

The following equipment is supplied with the basic NXR system:

- Video hardcopy printer
- Video image processor
- Sample rotation fixture
- UPS Line Conditioner

FIGURE 1-1

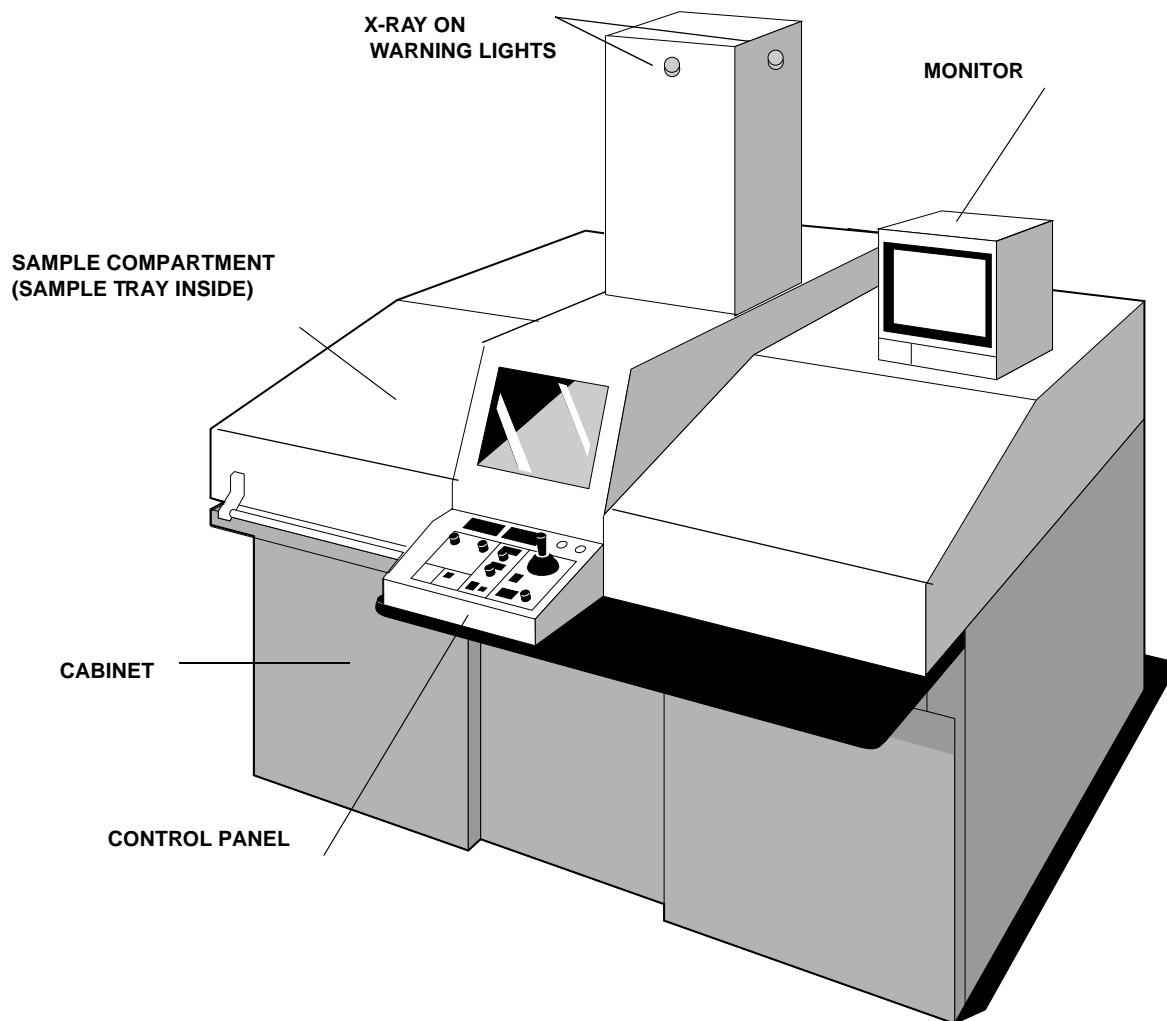


Figure 1-1 • NXR-1400i System

User Responsibility

This Product will perform in conformity with the description thereof contained in this operating manual and accompanying labels and/or inserts when assembled, operated, maintained, and repaired in accordance with the instructions provided.

This Product must be checked periodically. A defective Product should not be used. Parts that are broken, missing, plainly worn, distorted, or contaminated should be replaced immediately. Should such repair or replacement become necessary, Nicolet Imaging Systems recommends that a telephone or written request for service advice be made to the nearest NIS Service Office.

This Product or any of its parts should not be repaired other than in accordance with written instructions provided by Nicolet Imaging Systems and NIS trained personnel.

The Product must not be altered without the prior written approval of Nicolet Imaging Systems. The user of this Product shall have the sole responsibility for any malfunction which results from improper use, faulty maintenance, improper repair, damage, or alteration by anyone other than Nicolet Imaging Systems.

You are required to register the use of this Product with the state in which the product is installed. See [Appendix B - X-ray Equipment Registration](#) at the end of this manual.

Receiving & Inspection

The NXR system is carefully inspected both mechanically and electrically before shipment and should be free from damage. As a normal part of receiving, please do the following:

1. When the system is delivered by commercial carrier, check it for damage with the carrier. Contact the carrier's office and NIS Customer Service if any damage is found.
2. When unloading from the commercial carrier, do **not** use any hooks.
3. If your system is shipped crated, follow the uncrating instructions attached to the shipping crate. If you have any questions regarding the uncrating instructions, contact NIS Customer Service at the number provided on the inside title page.

4. Compare the packing list with your order invoice. If you find any discrepancies, contact your regional NIS office.
5. Save all packing material for the system in case it should ever have to be moved or shipped again.

Potential, Current, and Duty Cycle Ratings

Your Nicolet Imaging Systems NXR-1400i is designed such that:

- The x-ray source potential does not exceed 120 kv.
- The x-ray source beam current does not exceed 500 microamps.
- No combination of the x-ray source voltage and current exceeds 60 watts.

The NXR-1400i has a 100% duty cycle when the x-rays are on.

Safety Precautions

Specific notations are used in this manual to call attention to conditions which could result in injury, damage to the equipment, or require special attention.

WARNING

A Warning notation is used to describe an operating or maintenance procedure, practice, condition, or statement which, if not strictly observed, could result in injury or loss of life.

CAUTION

A Caution notation is used to describe an operating or maintenance procedure, practice, condition, or statement which, if not strictly observed, could result in damage to or destruction of equipment.

NOTE: A Note is used to describe an essential operating or maintenance procedure, condition, or statement which requires special attention.

Definitions

The terms *operation*, *maintenance*, and *service* have specific and important meanings throughout this manual. They are defined as follows:

Operation means the use of the NXR system over the full range of its functions.

Maintenance means the performance of those adjustments or procedures specified in this manual which are to be performed by you.

Service means the performance of those adjustments or procedures which are to be performed only by individuals certified by Nicolet Imaging Systems.

About Your Manuals

The NXR system is shipped with a number of manuals depending on the options and accessories you ordered.

Read this *NXR-1400i Operator Manual* first. It describes the basic installation, setup, and operation of the NXR-1400i system. Please read and refer to all other manuals before operating your NXR system.

NOTE: The installation procedures described in Chapter 3 of this manual are provided for informational purposes only. Your system must be installed by a qualified NIS Service Representative.

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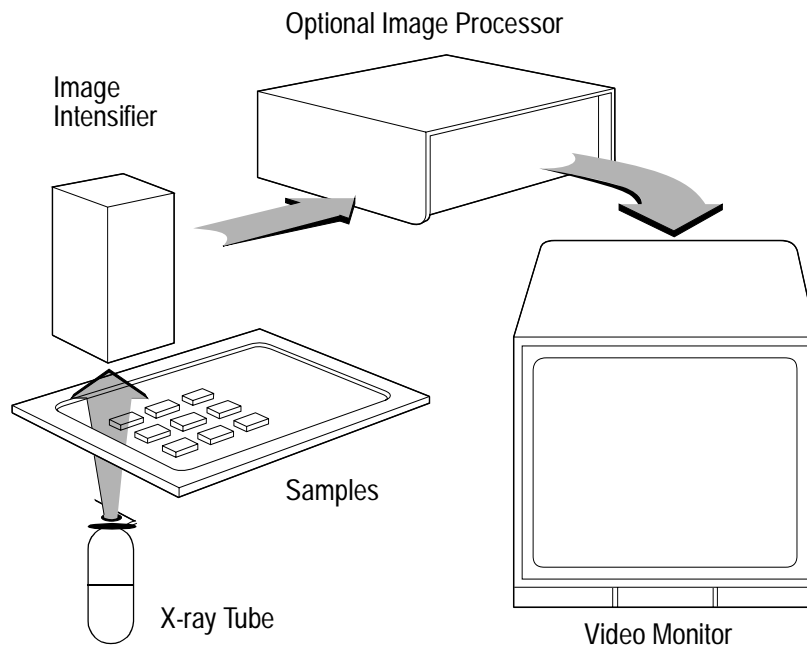
Introduction

Figure 2-1, "Typical NXR Image Stream", shows the image stream of a typical NXR1400i microfocus x-ray system. The samples to be inspected are placed on the sample tray. The x-ray tube generates x-rays, some of which pass through the sample and strike the target area of the image intensifier. This image is then processed and sent to a video monitor that allows you to view the internal features of the sample in real-time.

The following pages provide a brief description of the different elements used to produce the image.

FIGURE 2-1

Typical NXR Image Stream



X-rays

Using the highly penetrating, non-destructive properties of x-rays, the NXR creates an image on the video monitor for viewing the internal construction of an object. You can examine the image on the monitor to determine if there are hidden defects or internal irregularities in the object.

X-rays are a form of electromagnetic radiation. They exhibit properties similar to visible light rays but have shorter wavelengths.

X-rays have wavelengths less than 100 angstroms as compared to wavelengths of 10,000 angstroms in visible light. Because of their shorter wavelengths, x-rays are capable of penetrating solid objects in their path. Light rays are absorbed or reflected by the objects.

The X-ray Tube

CAUTION

Leave the system in the Standby mode with power on when it is not in use to help prolong the life of the x-ray tube. On/Off cycling of power accelerates the stress factors of any x-ray tube.

The Filament

The tube filament emits electrons when a current is passed through the filament. The greater the current passing through the filament, the greater the number of electrons emitted. These electrons are gated and accelerated by high voltage applied to the anode. This electron emission is called the **tube current**. X-ray output is proportional to the tube current. See *Figure 2-2, "Components of an NXR X-ray Tube"*

Focusing Grid

The electron optics of the x-ray tube in the NXR system are designed to focus the emitted electrons down to a very small beam. This beam is then focused onto the tungsten anode.

The Anode

A high voltage applied to the anode of the x-ray tube attracts the electrons emitted by the filament. X-rays are generated when the emitted electrons, which travel at high speed, either collide with the anode or abruptly change direction.

The anode is comprised of a tungsten target because of tungsten's high melting point. Large numbers of electrons strike the anode and transform to heat at the target.

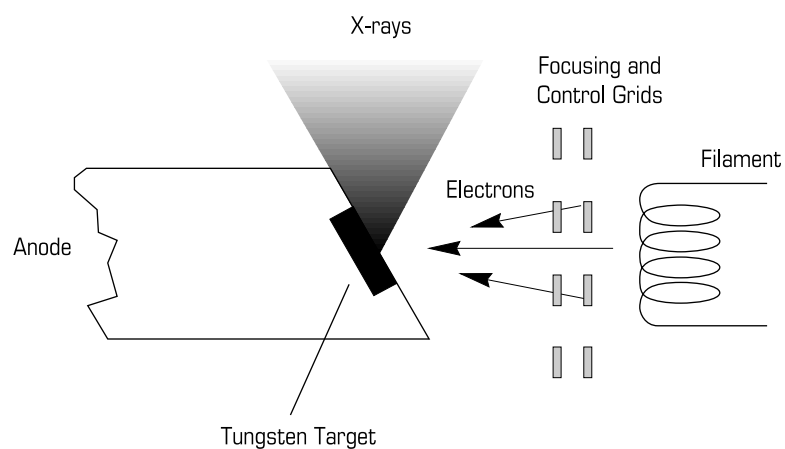
Tungsten is also an efficient material for generating x-rays because it has a high atomic number. The efficiency of a material to generate x-rays depends on its atomic number — the higher the number, the more efficient the material.

Cooling the Tube

When electrons strike the tungsten target, most of the energy is transformed into heat. This heat must be dissipated to prolong the life of the tungsten. NXR 1400i systems circulate air through the inside of the x-ray tube enclosure to reduce the temperature to a suitable operating level.

FIGURE 2-2

Components of an NXR X-ray Tube



Shadow Formation

To understand how an x-ray image is produced, it is important to understand the principles of shadow formation.

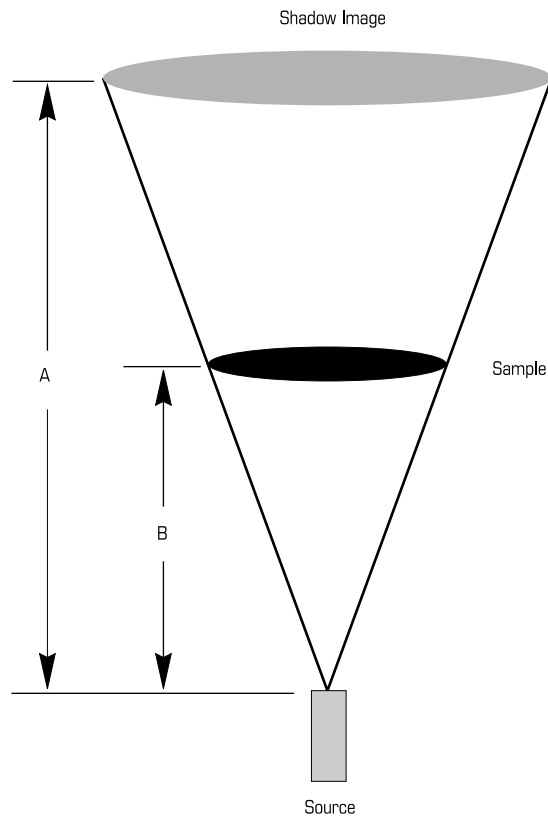
The shadow formation principles (**enlargement**, **sharpness**, and **distortion**) discussed in this chapter are explained using light rays as examples. X-rays and light rays have similar characteristics. However, x-rays have other properties, such as scattered radiation, which also affect the image. See *Image Quality* later in this chapter.

Enlargement

The displayed image can be enlarged by moving the image camera away from the sample and x-ray source as shown in *Figure 2-3, "Sample Magnification"*. The image diameter is calculated using the equation shown.

FIGURE 2-3

Sample Magnification



$$\text{Image Diameter} = \text{Sample Diameter} \times \text{---}$$

Where:

A = Distance from source to the shadow

B = Distance from source to the sample

--- = Magnification

Sharpness

Another characteristic of shadow formation is the sharpness of the image. As illustrated in *Figure 2-4, "Source Size"*, the size of the light source (or effective focal spot on the target) affects image sharpness. If the source is more than a single point, multiple shadows are cast that will be slightly displaced. This creates an image area that appears unfocused, called the **penumbra** as shown in *Figure 2-5, "Images vs. Penumbra"*. The larger the effective focal spot, the greater the penumbra area.

Image sharpness is also affected by the distance between the source and the object. The larger the area of the light source (or effective focal spot), the further the source must be from the object to minimize the penumbra effect as shown in *Figure 2-6, "Source to Sample Distance"*.

Distortion

It is also important in the formation of shadow images that the object and the surface upon which the shadow is projected be as parallel as possible. The center of the light source or x-ray beam should be perpendicular to the object and collector surface. This reduces distortion and ensures that the shadow image is a true representation of the object.

FIGURE 2-4

Source Size

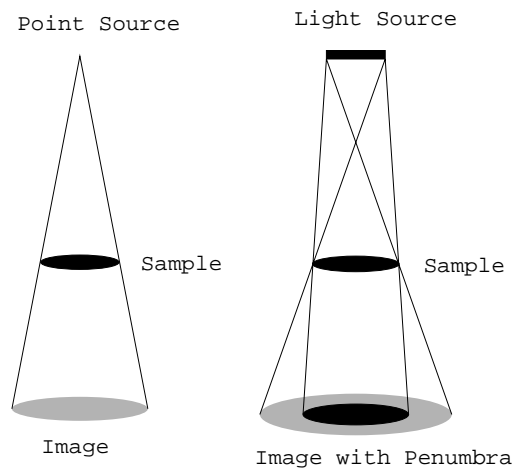


FIGURE 2-5

Images vs. Penumbra

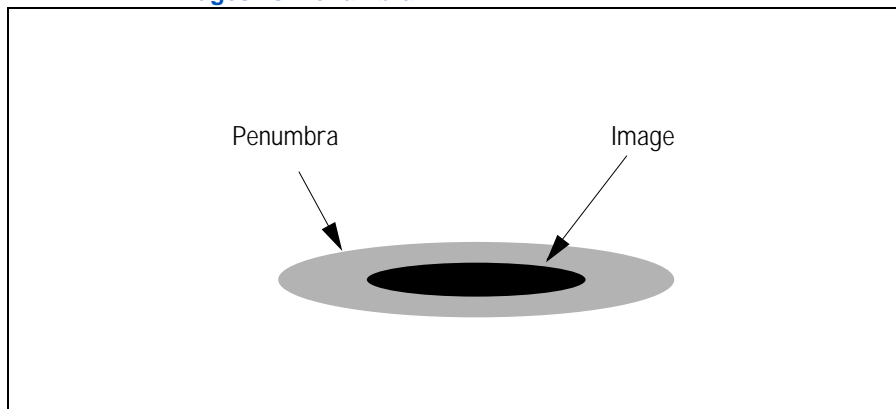


FIGURE 2-6

Source to Sample Distance

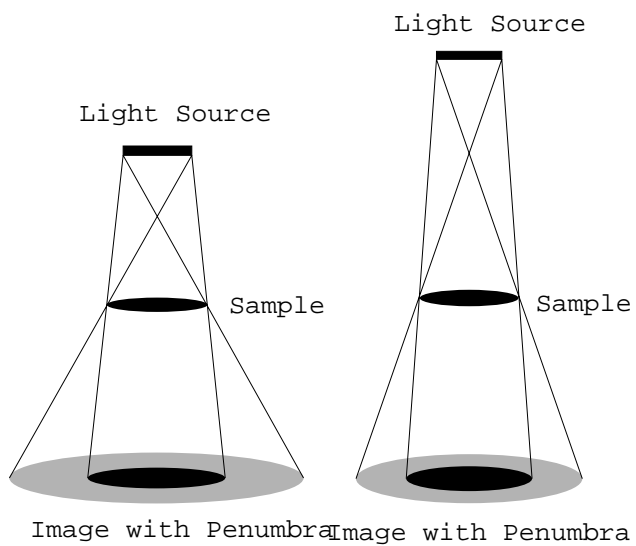


Image Quality

X-rays can penetrate solid objects because they have shorter wavelengths than visible light. Some are absorbed by the object while others pass through the object. X-rays that pass through the object are projected onto an x-ray sensitive detector that in turn produces a shadow image of the object's mass.

The quality of the image is affected by a number of factors. These include:

- x-ray intensity
- x-ray penetration
- size of the effective focal spot
- mass of the object
- properties of the detector surface.

X-ray Intensity

The amount (intensity) of radiation emitted by the x-ray tube's filament is proportional to the current flowing through the x-ray tube. Adjusting the **Power** knob on the control panel clockwise increases the intensity.

X-ray Penetration

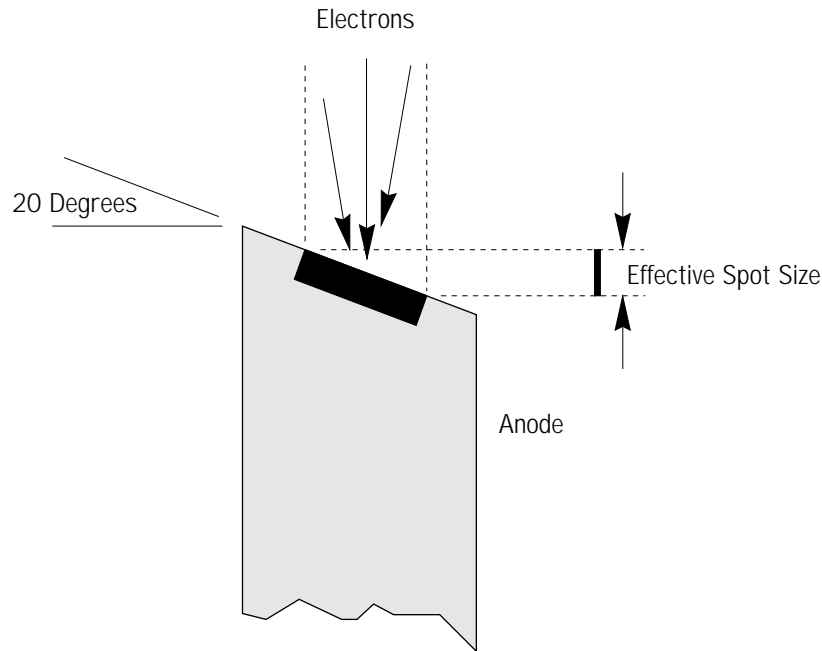
The speed of the electrons as they travel to the tungsten target is proportional to the voltage applied to the x-ray tube anode. Increasing the **Kilovolts** setting on the control panel increases the x-ray beam's penetration capabilities.

Focal Spot

NXR systems use a microfocus source (point source) x-ray tube. Microfocus refers to the size of the area onto which the electron stream is focused and the size of the effective focal spot. The target of the x-ray tube is placed at an angle of 20° to the electron beam as shown in *Figure 2-7, "Effective Focal Spot"*. This creates an effective focal spot much smaller than the actual area on the anode target.

FIGURE 2-7

Effective Focal Spot



Object Mass

The density, thickness, and atomic number of an object determine the rate at which x-rays pass through the object to illuminate the collector surface of the camera. When no or few x-rays pass through an object, the displayed image is black. The image becomes lighter and lighter as more x-rays reach the camera. If an object has mass variations, such as the object in [Figure 2-8, "Contrast at Lower Voltage"](#), the variations are displayed having different grey levels.

To adjust the contrast of the image, you need to lower or raise the voltage. For example, at lower kilovolt settings, fewer x-rays pass through the thicker side of the example in [Figure 2-8](#). In this example, the contrast ratio between the thick and thin areas of the object is 1:4.

Higher kilovolt settings add x-rays of shorter wavelengths that more readily pass through the chip. The higher voltage causes the ratio of x-rays passing through the sample to decrease. This in effect decreases the contrast between the variations on the image.

Sensitivity

When an object has minute density variations, use a lower kilovolt setting to increase the contrast between the different densities. See *Figure 2-8, "Contrast at Lower Voltage"*.

When inspecting extremely dense objects, use a higher kilovolt setting to increase the penetration capabilities of the x-rays. See *Figure 2-9, "Contrast at Higher Voltage"*.

Detector

The x-rays are projected onto a thin layer of fluorescent material that converts invisible x-ray photons into visible light photons to be collected by the camera. The image of the object's mass is then displayed on the monitor.

FIGURE 2-8

Contrast at Lower Voltage

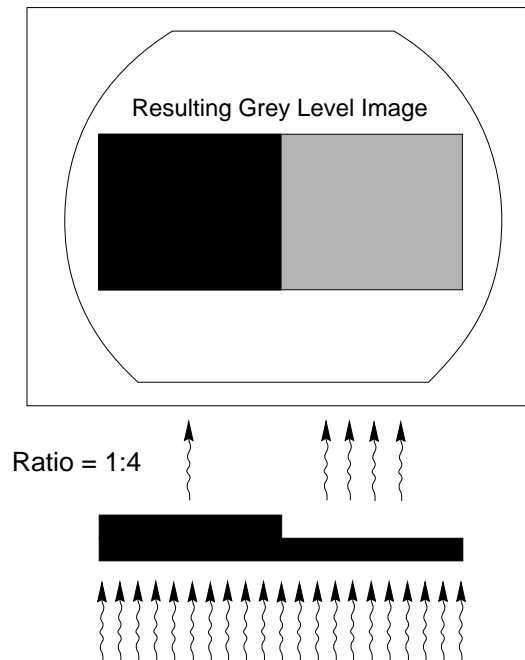
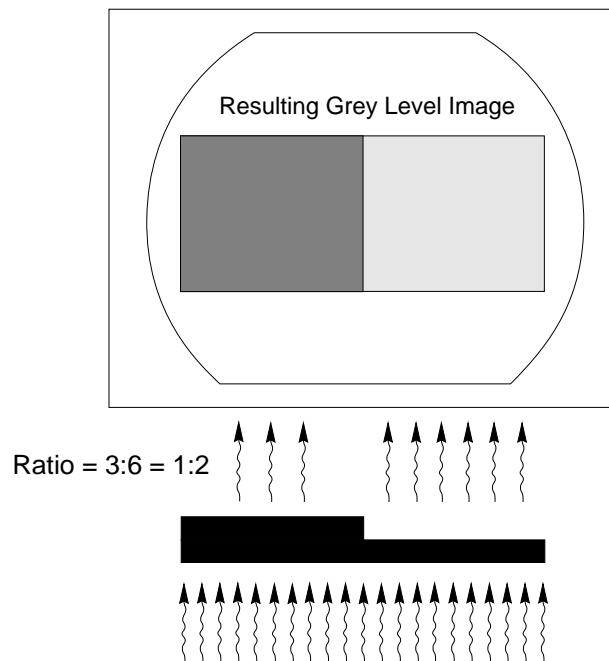


FIGURE 2-9

Contrast at Higher Voltage







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Introduction

The installation procedures described in this chapter are provided for informational purposes. A Nicolet Imaging Systems Service Representative must install your NXR system.

System Requirements

AC Power

Your NXR system is equipped with a three-conductor power cord in accordance with NEMA recommendations. When plugged into the appropriate receptacle, the power cord is designed to ground the equipment cabinet.

NXR systems can be ordered for any of these four AC power sources:

- 110-125 VAC, 10 Amp, 50 Hz
- 110-125 VAC, 10 Amp, 60 Hz
- 210-240 VAC, 5 Amp, 50 Hz
- 210-240 VAC, 5 Amp, 60 Hz

If your power source is subject to severe fluctuations or irregularity, NIS recommends that you purchase an optional UPS line conditioner to ensure proper operation of your NXR-1400i system.

Clearance

- Allow at least 76 cm (30 inches) in front of the cabinet for operating the system.
- Allow at least 15 cm (4 inches) between the rear of the system and wall for air circulation.
- Locate the cabinet where it can be rolled out for access to the rear panels during installation and service.

NOTE: NXR systems are caster-mounted and easy to move.

Environment

The environment for your NXR system should be free from excess dust and dirt, and the floor should not vibrate. The system is designed to tolerate the following temperature and humidity ranges:

Temperature: 0× to +35×C (32× to 95×F).

Humidity: 70% max. to 20% min. at 35×C with no condensation.

Safety

This system is designed to conform to Federal Regulation (CFR) 21, subchapter J, paragraph 1020.40, "Cabinet X-ray Systems." Various localities may have different rules and regulations that must be complied with prior to installation. Make an inquiry as to these rules and regulations with the installation facility's Safety Department and with the local Department of Health. Notify them that the installation is taking place and inquire about any special plant requirements that may apply. Requirements may involve wiring, notices, or special safety procedures unique to that particular company. Take whatever steps necessary to comply with these requirements.

See [Appendix B - X-ray Equipment Registration](#) in this manual for a listing of each state's agency with which your NXR X-ray system must be registered.

Inspection

1. Carefully inspect the NXR for any physical damage. Look for:
 - dislodged components
 - loose cables
 - any other apparent damage

NOTE: Do not discard the packing material. If you find damage, the carrier may want to examine the material. Also, in the event the system needs to be returned to Nicolet, it should be shipped in the original containers.

2. Record the system serial number on the Service Installation form. The serial number appears on the back of the cabinet.
3. Compare the shipped items to those listed on the packing slip.
4. Report any discrepancies to the regional NIS Customer Service Office.

Line Conditioner

An optional line conditioner is available if it is determined that a line conditioner is necessary.

Installing the Control Panel Shelf

Have someone help you install the shelf for the control panel.

1. Locate the eight bolts provided for the shelf.
2. Position the shelf and spacer under the right front of the sample compartment.
3. Start one bolt on each end and only finger-tighten each bolt.
4. Start the remaining six bolts.
5. Securely tighten all eight bolts.

CAUTION

Do not use bolts in excess of 1-1/2 inches. Longer bolts may damage the table top.

Cabling

These instructions tell you how to route and connect all cables for the system and its components. Before you begin, locate all the cables.

Monitor

1. Set the monitor on the shelf to the right of the tower.
2. Route the power plug through the hole in the top rear of the cabinet.
3. Connect the Y cable on the back of the monitor to the VPC-40.
4. Locate the monitor's power plug by removing the right rear door of the cabinet.
5. Plug the monitor's power cord into the utility power strip mounted on the inside right rear of the cabinet.

Electronics Chassis

1. Check that the ribbon cable connector (from the control panel to the electronics chassis) is properly seated.
2. Check all other connectors on the electronics chassis and ensure proper electrical connections.
3. Untie the AC power cord at the rear center of the cabinet.
4. Verify that the power source is correct for the system.
5. Plug the cord into the power source. The power required is specified on a label located near where the power cord enters the machine.
6. Run the ribbon cable and the other cables through the large hole in the control panel shelf.
7. Use cable ties to secure these cables to the cable anchors on the bottom of the shelf.

Control Panel

1. Connect the cables you put through the hole in the shelf to the connectors on the underside of the control panel housing.
2. Ensure that all the cables are fully seated.
3. Align the control panel housing holes with the holes in the shelf.
4. From the underside of the shelf, secure the control panel housing to the shelf with four bolts. Use the longest bolt at the left/front corner for the ground strap connection.
5. Securely tighten all bolts.

Initial Setup

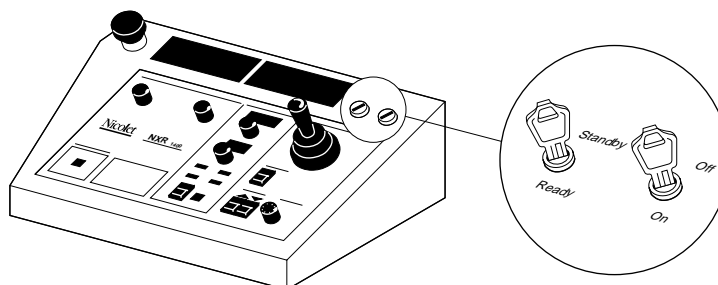
If you have not already done so, familiarize yourself with the control panel. See [Chapter 4 - Before You Begin](#). Then perform the following steps **before** turning on the system.

1. Set the kilovolts to the lowest voltage by turning the **Kilovolts** control knob all the way to the left.
2. Set the power to its lowest setting by turning the **Power** control knob all the way to the left.

3. Turn on the video monitor.
4. Locate and remove the keys taped inside the sample compartment.
5. Insert the keys into the **AC Power** and **X-ray** key switches on the control panel (*Figure 3-1, "Keyswitches"*).

FIGURE 3-1

Keyswitches



Starting the System

1. Start the system by turning the **AC Power** key switch to On as shown in *Figure 3-2, "AC Power and X-ray Switches"*.

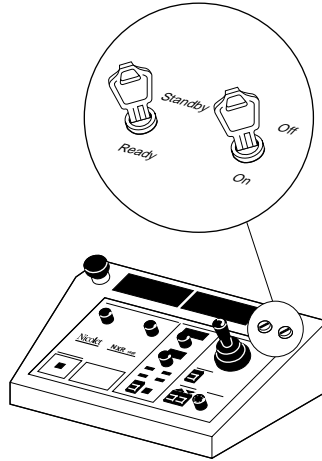
WARNING

The fans are energized when the power is turned on.

2. Turn the **X-ray** key switch to Ready.

It takes approximately ten minutes for the NXR to warm up. The **Ready** light appears when the system is ready to generate x-rays. While you are waiting for the system to warm up, check the indicators and joystick operation as described in the next two sections: *Indicators* and *Joystick Operation*.

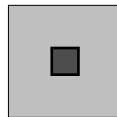
FIGURE 3-2 AC Power and X-ray Switches



Indicators

While you are waiting for the system to warm up, check for the following indicators:

- a. The red **Power** light is on.



- b. Zeroes appear in the **Kilovolts** display.



- c. The number "00" appears in the **Power** display.



- d. The **Interlock 1** light is on. This light blinks when the sample compartment door is open. If the light is blinking, close the door.



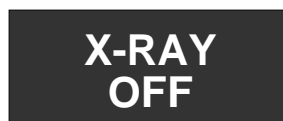
- e. The **Interlock 2** light is on. This LED indicates the Service Access Panel is closed and the x-ray source is properly secured.



- f. The **Stand By** light is on.



- g. The green **X-ray Off** light is on.



- h. No other indicator is on.

Joystick Operation

To test the joystick (*Figure 3-3, "NXR-1400i Joystick"*):

1. Move the joystick in all directions and ensure the sample tray moves in the same direction as the joystick. Vary the speed of the tray by more or less deflection of the joystick.
2. Use the joystick to move the tray to all extreme positions. Ensure the tray reaches its full limit of travel and stops when it contacts limit switches.
3. Stop the sample tray somewhere in the middle of travel and press the **Load** button. The sample tray should move to the extreme left front position and stop.

FIGURE 3-3

NXR-1400i Joystick

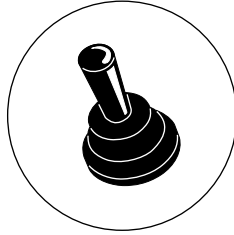


Image Controls

To check movement:

1. Press the **MAG Up/Down** buttons and ensure that the II moves.



2. Press the **FOV** switch to move x-ray tube up and down.



3. Press the **ZOOM** switch to zoom the camera lens in and out.



4. **Video Contrast** changes the contrast level and brightness of the image.



Cold Start Procedures

All System Operators Should Read This Section For Operational Information Affecting X-ray Source Life.

The life of the x-ray tube is affected by how well you adhere to specified operating procedures. All operators of your system must be informed of these procedures and the importance of following the procedures exactly. There are some general concepts regarding high voltage and high vacuum systems that must be considered.

You should not change the high voltage abruptly. An abrupt change results in a high degree of stress on all insulators within the high voltage system. These include the high voltage cables, connector dry well, high voltage power supply and components inside the vacuum tube. Abruptly switching high voltage will contribute to insulator breakdown over time resulting in failure of components.

A high vacuum system that does not have voltage applied internally can essentially lose vacuum over a period of time. Due to outgassing of the internal elements, free atoms become loose within the vacuum creating a current path for high voltage. The more free atoms, the lower the resistance. Consequently, the longer the vacuum exists without voltage applied to the internal elements of the tube, the more free atoms will exist and the greater the probability of a discharge through the now compromised vacuum.

When high voltage is once again applied to the internal elements of the tube and current flows to the anode, the free atoms tend to be attracted to the internal elements and are absorbed. The atoms are no longer free within the vacuum and cannot create a current path for high voltage. This is the rationale for the “cold start” procedure for x-ray systems that have been idle for a period of time. The longer the idle time, the longer the cold-start time required to eliminate free atoms within the tube.

X-ray Source Burn-in

A burn-in period must always be implemented when making a cold start (power up of machine after power has been removed). This burn time is proportional to the time the system has been shut off. The following table has recommended burn-in times vs. idle time:

IDLE or OFF TIME	100 KV	120 KV
1 day or less	10 minutes	15 minutes
1 day to less than 1 week	20 minutes	25 minutes
1 week to less than 1 month	60 minutes	70 minutes
1 month to less than 2 months	90 minutes	100 minutes
2 months to less than 6 months	2 hours	3 hours
6 months and over	3 hours	4 hours

Conditioning the X-ray Tube

When you first install the NXR, or after it has been turned off or left in Standby for a long time with no KV applied to the tube, you must condition the x-ray tube so it can withstand high voltage. To condition the tube you must always follow the burn in procedure exactly.

1. Ensure that the **Ready** light is on.
2. Close the sample compartment door if it is not already closed.
3. Ensure that the voltage is set at its lowest kilovolt level.
4. Turn the **Kilovolt** knob all the way to the left.
5. Ensure that the **Power** control is set to 10.
6. Press the **X-ray** button.

Check for the following indicators:

- The system beeps.
- The high voltage power supply fan starts.
- The **Ready** light is on.
- The **X-ray On** light by the **X-ray On** button is on.
- The **red X-ray On Warning** light is on and the green **X-ray Off** light is off.
- The voltage increases on the **Kilovolts** display. The voltage should stop at 20 KV. If it continues to increase, turn the **Kilovolts** knob all the way to the left to set the voltage to the minimum amount.

CAUTION

Do not increase the kilovolts at this time.

7. Divide the required time determined from the chart by 4. After this amount of time has passed, the KV can be increased to an amount equal to 25% of full KV.

WARNING

DO NOT INCREASE BY MORE THAN THIS AMOUNT UNTIL THE NEXT STEP

Example:

100 KV X-ray source has been inactive for 1 month. The reference chart indicates a burn-in time of 90 minutes is required. 90 minutes divided by 4 equals approximately 23 minutes. This is the time period for each of the burn-in KV increments.

8. After the required time has elapsed, increase the KV by 25% again, bringing it to 50% of full KV. Listen carefully while the KV is increased. If arcing is heard, (an audible ticking or snapping sound), immediately reduce the KV setting to a level where the arcing stops. Let the source operate at that level for one complete time period.
9. Once the time period has elapsed, again increase the KV to an additional 25% of full KV.
10. After the time period at this level has elapsed, slowly increase the KV to 75% of full KV. Once again, listen very carefully for any sign of arcing.
11. Again, after the required time has elapsed, slowly increase the KV by 25%. The system should now be operating at maximum KV. Assuming no arcing, the system should now be operational. You can now adjust the **Power** or **Kilovolts** settings as desired for your application.

Because of the burn-in period required when power has been turned off, NIS recommends that the system always be left with the power applied except for extended periods of time.

For short periods of no use (overnight or weekends), reduce the KV to approximately 50% of maximum and turn on x-rays. Allow the system to idle in this condition.

If it is impractical or installation procedures dictate that the system be locked in Standby when not in use, a burn-in procedure should be implemented before use after one or two days of no use even though power has been applied.

Turning X-rays On

Always turn the KV control fully counterclockwise (minimum setting) before turning on x-rays. Never turn on x-rays with the KV control set at maximum.

After the x-ray on has been started, slowly rotate the KV control to increase high voltage.

Turning X-rays Off

Rotate the KV control fully counter clockwise at a slow rate before turning x-rays off.

Never turn off the x-ray mode with high KV applied to the source. Doing so will result in instantaneous reduction of high voltage.

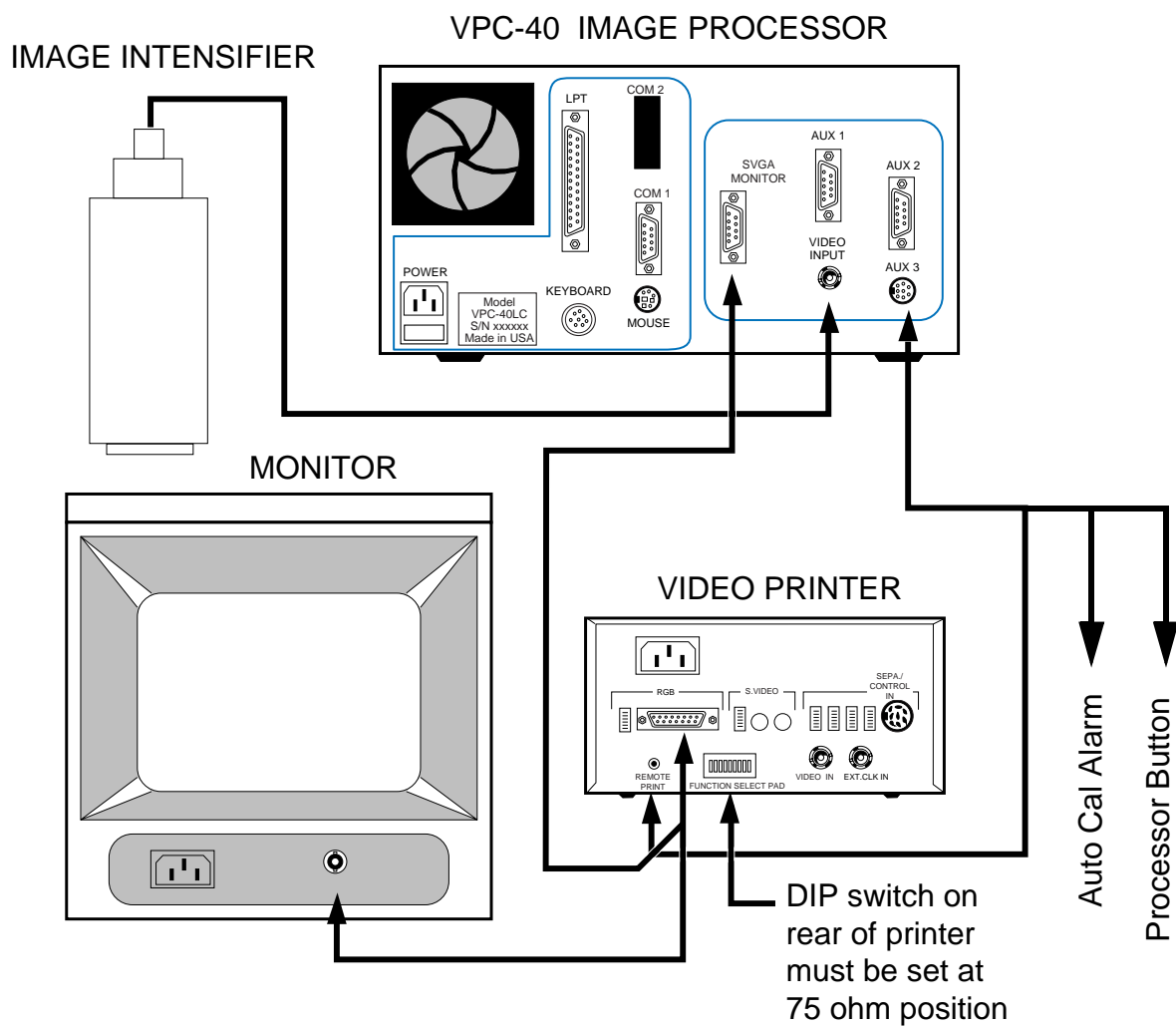
Never open the sample compartment door while the system is in the X-ray On mode. Set the KV control to minimum, then open the sample compartment door.

Installing Accessories

Refer to your NIS Service Manual and the option or accessory's manual before installing them. *Figure 3-4, "Video Configuration with Accessories"* illustrates how to connect the accessories. As a general rule, always terminate the last item in the string using the 75 ohm termination switch. If a termination switch is not present it can be assumed that the input is 75 ohms.

NOTE: Any other configuration may affect the signal impedance and image quality,

FIGURE 3-4 Video Configuration with Accessories



Before You Begin

4





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<i>The Keys</i>	<i>page 4-3</i>
<i>Emergency Off</i>	<i>page 4-4</i>
<i>Front Panel Controls</i>	<i>page 4-6</i>
<i>The Image Intensifier</i>	<i>page 4-9</i>

Before You Begin

Introduction

Take the time to become familiar with the NXR system, its components, and any options and accessories on your system. Be aware of and pay attention to all safety precautions set by your operating site.

WARNING

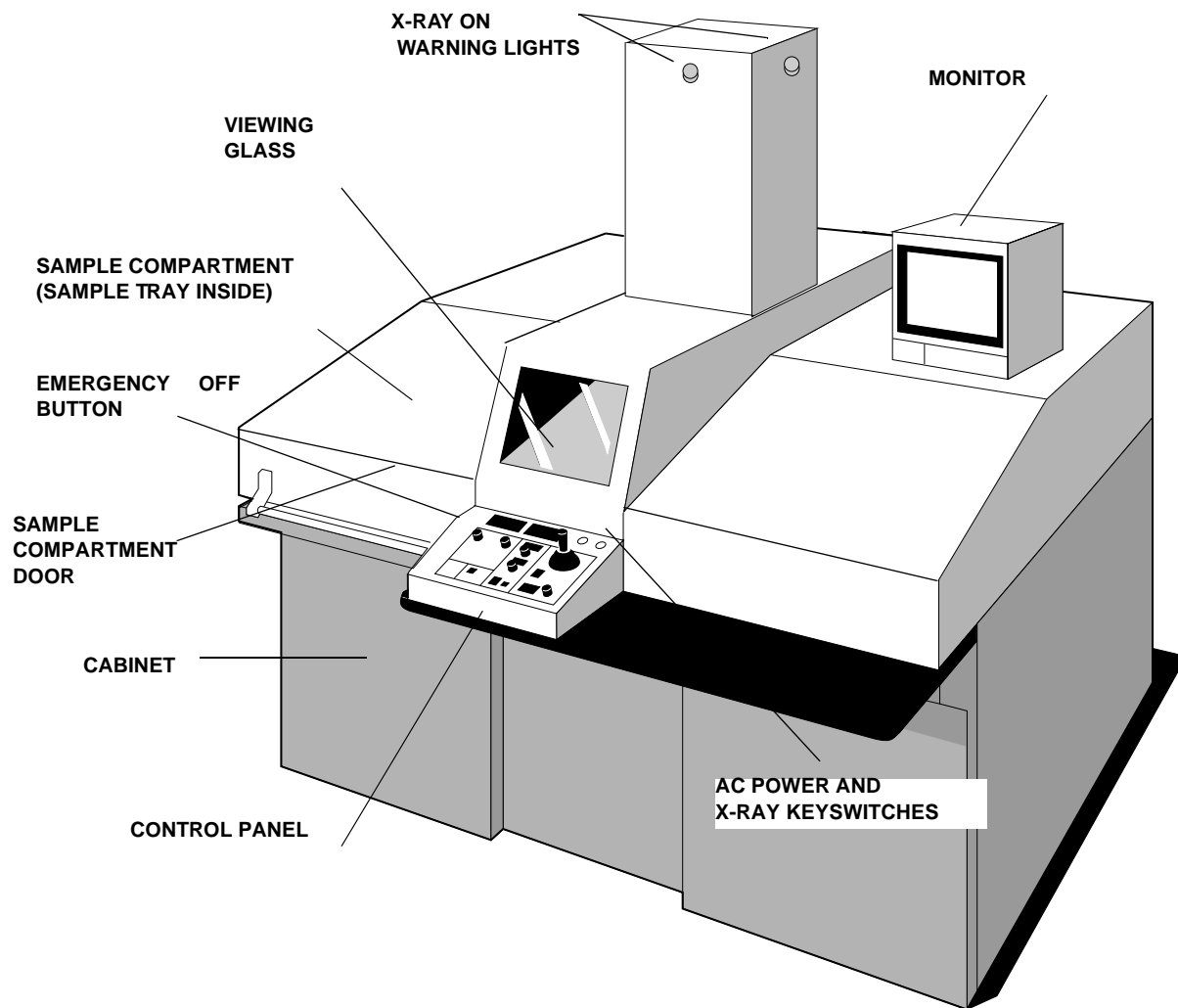
Never operate the system if any of these conditions exist: The viewing glass is cracked or broken; The lead lining is separating from the inside of the sample compartment.

WARNING

This equipment produces X-rays when energized. Follow all safety procedures set by the installation site.

FIGURE 4-1

NXR-1400i Major Components



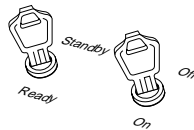
The Keys

Four keys were shipped with the NXR. Even though all the keys are identical, you need two of them to operate the system. Store two keys in a safe place as a master set and use the other two in your day-to-day operation of the system. You can duplicate these keys if necessary.

You cannot remove the key from the X-ray keyswitch while the NXR is in the Ready mode. To remove the key, turn the keyswitch to Standby (Figure 4-2).

FIGURE 4-2

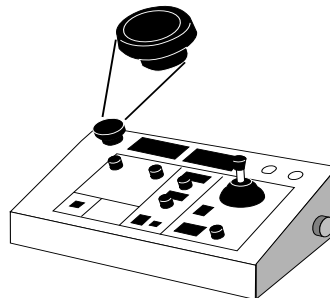
Position Required to Remove Keys



You cannot remove the key from the AC Power keyswitch while the NXR is on. To remove the key, turn the keyswitch to Off (Figure 4-2).

FIGURE 4-3

Emergency Off Button



Emergency Off

The NXR is equipped with an **Emergency Off** button (*Figure 4-3*). Press this large, red button whenever you want to immediately shut down the system. This button turns off the AC power.

Restarting the System After an Emergency Off

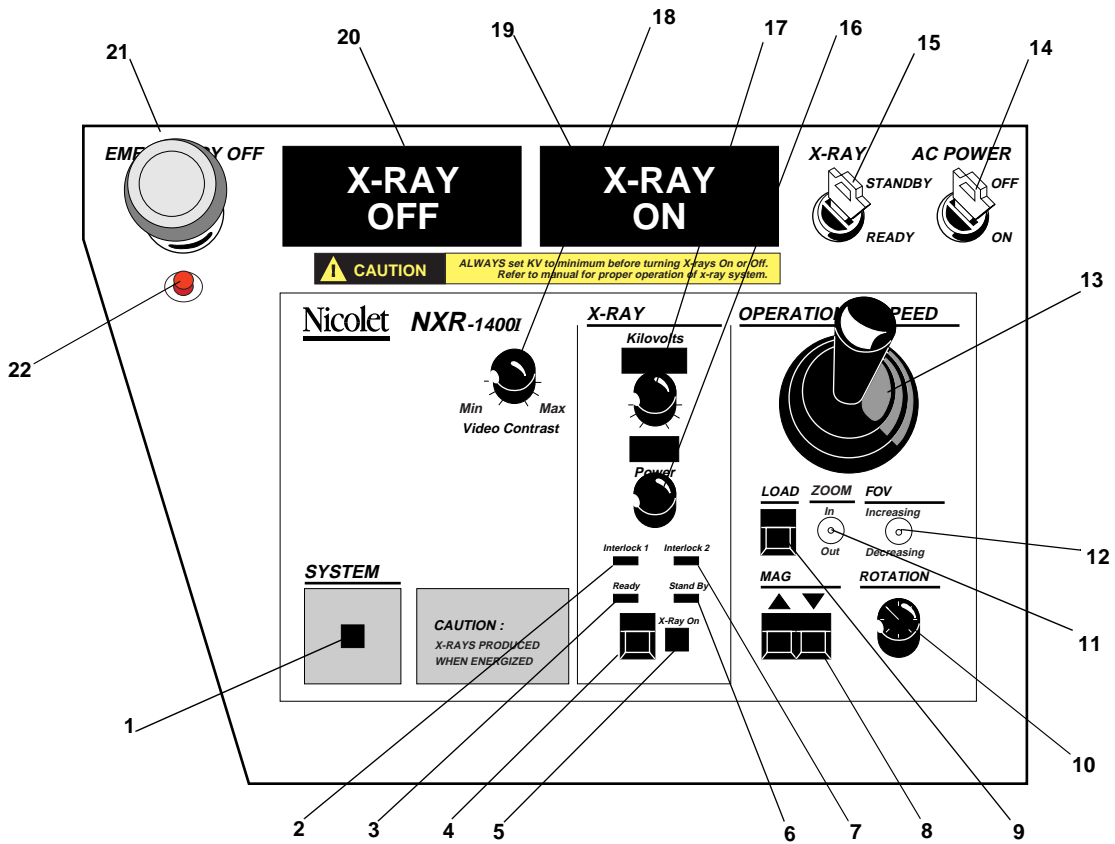
To restart the system after pressing the Emergency Off button:

1. Set the voltage to its lowest amount by turning the Kilovolts control all the way to the left.
2. Turn the AC Power keyswitch to Off.
3. Turn the AC Power keyswitch back to On.

The NXR needs approximately 10 minutes to warm up. After turning on the system, the yellow **Standby** LED comes on and remains on until the NXR is ready to generate x-rays. Be sure the X-ray keyswitch is set to Ready

FIGURE 4-4

NXR-1400i Control Panel



Front Panel Controls

1. Power

A red light appears here when the AC power is on.

2. Interlock 1 LED

This green LED lights when you turn the X-ray keyswitch (14) to ready. You cannot turn on the x-rays when either of the following conditions cause the LED to blink on and off:

- Sample compartment door is open, or
- Service access door is removed.

3. Ready LED

This green LED lights when the NXR is ready to generate x-rays. The AC power must be on and the X-ray keyswitch set to Ready. You cannot turn on the x-rays until this LED lights.

4. X-ray On Button

Turns the x-rays on or off. When you turn on the x-rays, the red X-ray On Warning light (15) at the top of the control panel comes on, a long “beep” sounds, and then the red X-ray On LED (5) turns on. When you turn off the x-rays, a short “beep” sounds, and the X-ray On Warning light and X-ray On LED turn off.

5. X-ray On LED

This red LED comes on when you press the X-ray On button (4) to turn on the x-rays.

6. Standby LED

This yellow LED lights whenever the system needs to warm up or the X-ray keyswitch (14) is set to standby.

7. Interlock 2 LED

This green LED lights when you turn the X-ray keyswitch (14) to ready. You cannot turn on the x-rays when either of these conditions cause the LED to blink on and off:

- x-ray tube is over heated, or
- x-ray tube enclosure is removed.

8. MAG

Press the Up button to raise the II, thus increasing the magnification and reducing the intensity of the displayed image. Press the Down button to lower the II, thus decreasing the magnification and increasing the intensity of the displayed image.

9. LOAD Switch

Moves the sample tray to its load position, which is the front left of the sample compartment.

10. ROTATION

Rotates an object 360° around the x axis. Your NXR must be equipped with the sample rotation accessory described in Chapter 6.

11. ZOOM (Optional Zoom Lens)

Zooms the camera lens in and out.

12. FOV

Adjusts the gain of the camera which affects the contrast of the image displayed on the monitor.

13. Joystick

Move the joystick in the direction you want the sample tray to move. Speed of movement is proportional to the deflection of the joystick.

14. AC POWER Keyswitch

Turns the system on or off. This is the master switch and controls the power for the entire system.

15. X-RAY Keyswitch

Sets the system to Ready or Standby. Set the system to Standby and remove the key to guard against unauthorized use of the system.

16. Power Knob (Option)

Adjust clockwise to increase the power, thus increasing the x-ray intensity. Power levels of 10W, 20W, 30W and 50W (60W for the 120 KV tube) are selectable.

17. Kilovolts Knob

Increases or decreases the voltage applied to the x-ray tube. The voltage in kilovolts appears in the display directly above this control. There is a delay between the time you turn the control to increase the voltage and the displayed voltage to guard against sudden increases.

18. Video Contrast Knob

Adjusts the gain of the camera which affects the contrast of the image displayed on the monitor.

19. X-RAY ON Warning Light

This red warning light comes on when the x-rays are turned on.

20. X-RAY OFF Light

This green light stays on when the x-rays are turned off.

21. EMERGENCY OFF

Press to immediately turn off the system. You then must restart the system by turning the AC Power keyswitch (13) to off and then back to on. Expect a 10-minute delay for system warm-up.

22. VPC Reset

Resets the VPC.

The Image Intensifier

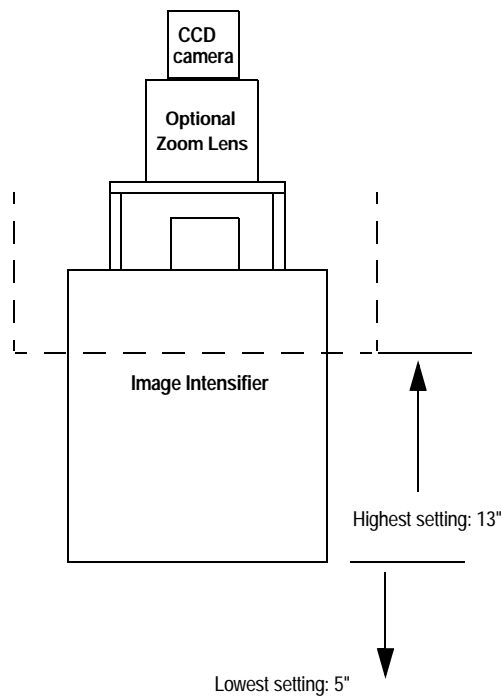
Pressing the **Mag Up** or **Down** button moves the Image Intensifier. See *Figure 4-5, "Image Intensifier Limits"*

The precise magnification factor which these positions represent is impossible to predict because other variables influence the actual factor. These variables include:

- the size of the monitor's screen,
- distance between the object and x-ray source,
- thickness of the sample.

FIGURE 4-5

Image Intensifier Limits







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<i>Enabling the X-rays</i>	<i>page 5-3</i>
<i>Loading the Sample</i>	<i>page 5-4</i>
<i>Inspecting the Sample</i>	<i>page 5-5</i>

Introduction

Before you can operate the NXR system, it must be installed by a qualified NIS representative. The instructions in this chapter assume the system is properly installed and operating normally. You must read this chapter completely before operating the NXR 1400i.

CAUTION

Follow all safety rules set by your installation site. If the system has been turned off for any period, perform the *Starting the System* procedure in Chapter 3. The NXR may move the sample tray to the LOAD position whenever you turn on the power. To avoid damaging the camera, remove the sample rotation's tailstock from the sample compartment before turning on the power.

Turning on the Power

Keep the NXR in the *STANDBY* mode when it is not being used for short lengths of time. Never turn the system completely off except for service or maintenance.

CAUTION

If the system is off for any reason, perform the *Cold Start Procedures* described in Chapter 3 of this manual. Failure to complete each step of the procedure could result in severe damage to the x-ray tube.

The following information tells you how to start the NXR when the AC power is off. If the NXR is in the *STANDBY* mode, skip to "*Enabling the X-rays*" on *page 5-3*.

To Turn On the System

1. Set the voltage to its lowest setting by turning the Kilovolts control all the way to the left or counter clockwise as shown in *Figure 5-1*.

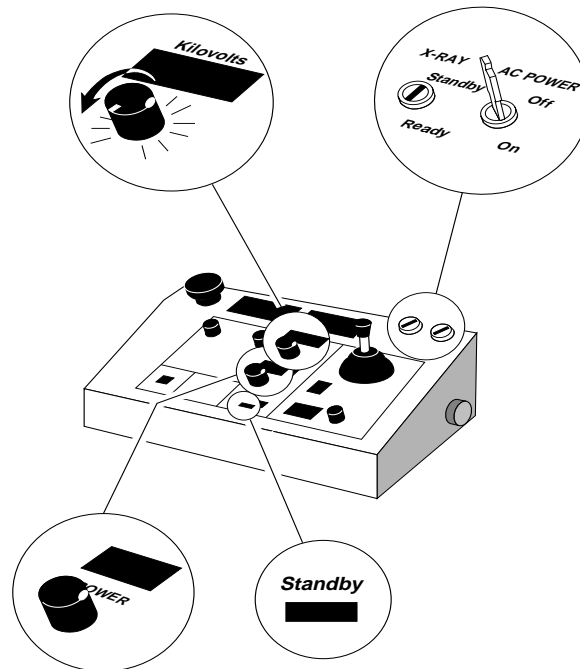
It is important that you always set the Kilovolts to the lowest setting before turning on the system.

2. Set the power to its lowest setting by turning the Power control all the way counter clockwise. It is important to always set the power to its lowest setting before turning on the system.
3. Insert the key in the AC Power keyswitch as shown in *Figure 5-1* and turn it to the ON position. The light in the camera area flickers and then comes on. The sample tray may move to the front left of the sample compartment.

The NXR requires approximately 10 minutes to warm up. After turning on the system, the Standby LED comes on and remains on until the NXR is ready to generate x-rays.

FIGURE 5-1

Control Panel Start Up Settings



Enabling the X-rays

In order to generate x-rays, the NXR must be in the Ready mode. When the NXR is in the Ready mode, the only way to generate x-rays is to press the X-ray On button. The Ready mode does not turn on the x-rays; it only enables them to be turned on.

NOTE: Refer to the *Cold Start Procedures* in Chapter 3 of this manual if the system has been turned off.

To Enable X-rays

Set the voltage to its lowest setting by turning the Kilovolts control all the way to the left (counter clockwise).

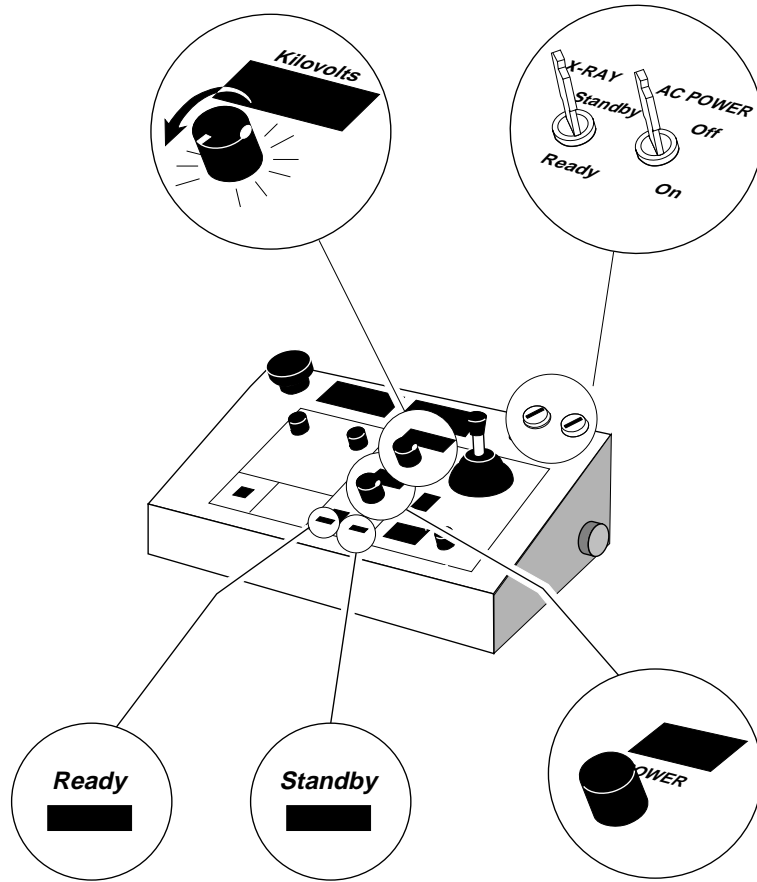
Always set the kilovolts to its lowest setting before enabling x-rays.

1. Insert the key in the x-ray keyswitch and turn it to Ready as shown in *Figure 5-2, "Enabling X-rays"*. The Standby LED goes out and the REady LED comes on.

The NXR 1400i is now ready to generate x-rays.

FIGURE 5-2

Enabling X-rays



Loading the Sample

Load the first sample while you are waiting for the system to warm up.

To Load a Sample

If necessary, press the Load button to automatically move the sample tray to the front left of the sample compartment.

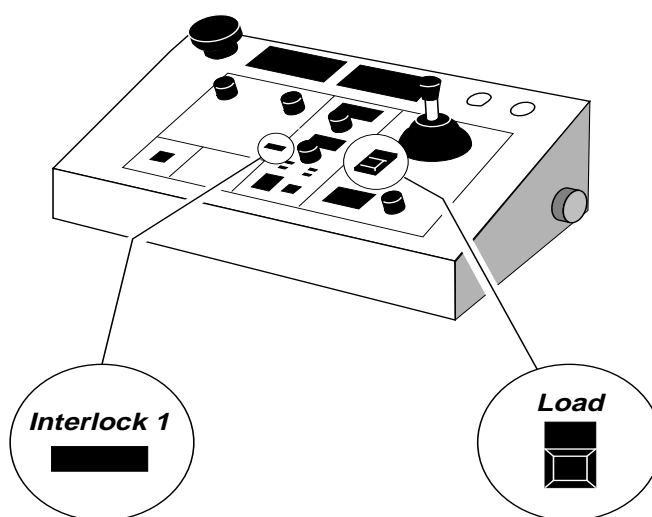
Open the sample compartment door and place the sample on the sample tray. The Interlock 1 LED will blink whenever the sample compartment door is open. See [Figure 5-3, "Loading the Sample"](#).

Close the compartment door. The Interlock 1 LED should be on but not blinking. If it is blinking, the sample compartment door is not securely closed.

NOTE: This necessary safety feature of the NXR is designed to guard against turning on the x-rays when the sample compartment door is open. The x-rays cannot be turned on until the sample compartment door is closed.

FIGURE 5-3

Loading the Sample



Inspecting The Sample

Adjusting Image Quality

The NXR must be in the Ready mode before you can turn on the x-rays. The Ready LED comes on when the system is ready to generate x-rays.

1. Use the joystick to move the sample under the II.
2. Press the X-ray On button as shown in [Figure 5-4, "Image Quality Controls"](#). The system beeps and the X-ray On LED and the Warning light come on.

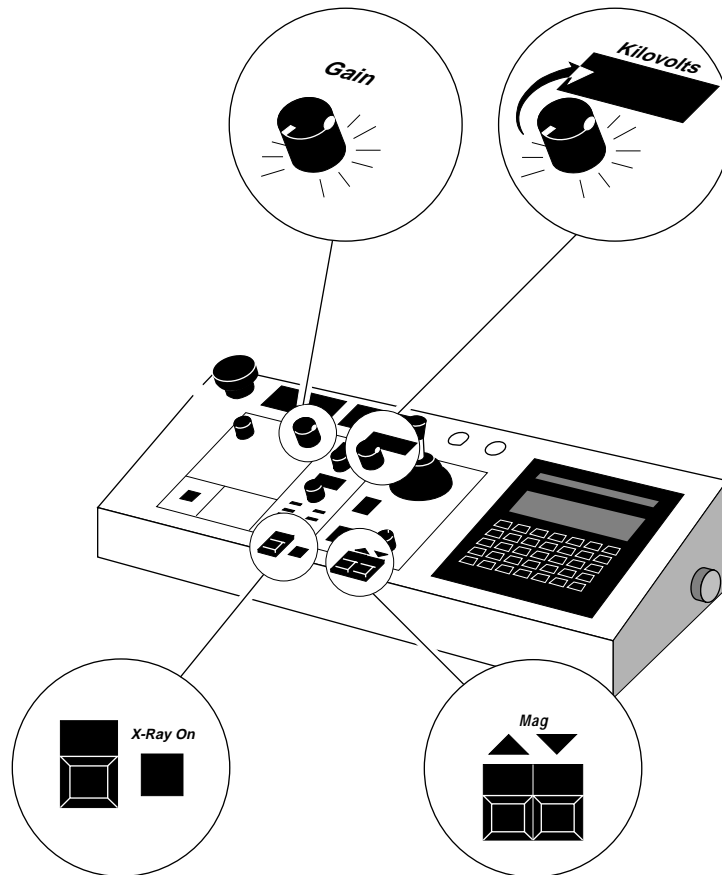
CAUTION

If the NXR has been turned off for approximately four or more days, perform the *Cold Start Procedures* described in Chapter 3 of this manual. Failure to do so can result in damage to the x-ray tube.

3. Increase the voltage slowly turning the Kilovolts control clockwise. This increases the kilovolts readout and brightens the image on the monitor.
4. Turn the Gain and Kilovolts controls until the displayed image is clear and distinguishable.
5. Press the Mag buttons to move the II up and down until you have the desired image on the monitor. As you move the II toward or away from the sample, it will be necessary for you to readjust the contrast and brightness controls to maintain image quality. See *Figure 5-4, "Image Quality Controls"*.

FIGURE 5-4

Image Quality Controls

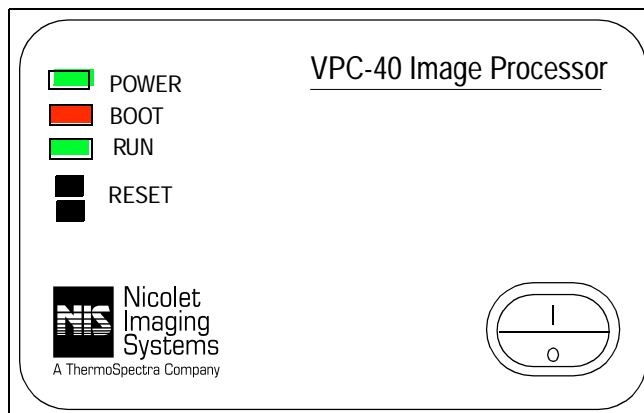


6. If you have a VPC-40 Image Processor as an option on your system, you can use the Frame Average function to further enhance the quality of the screen image. See [Figure 5-5, "VPC-40 Image Controls"](#)

NOTE: The VPC-40 Processor is housed within the lower enclosure of the NXR-1400i. All VPC-40 face controls are inaccessible. The Power is connected to system power. Boot, Boot-up and Run start at Powerup and the Reset Button is mounted on the Control Panel.

FIGURE 5-5

VPC-40 Image Controls



Options and Accessories

6





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<i>Sample Rotation Accessory</i>	<i>page 6-1</i>
<i>Laser Pointer</i>	<i>page 6-7</i>

Options and Accessories

Introduction

This chapter contains general information about accessories that do not have an accompanying manual. For options and accessories that have separate documentation provided, please refer to the appropriate manual before operating the accessory.

Contact your NIS sales representative if you are interested in upgrading or adding accessories to your system.

Sample Rotation Accessory

The Sample Rotation accessory lets you rotate samples a full 360° while they are in the x-ray beam. This helps you:

- Inspect samples such as tube ICs for bond wire height, wire sweep, molding voids, or die attach voids without manually repositioning the samples.
- View samples such as pin grid arrays and plated-through-hole boards at an angle to obtain additional information about their internal characteristics.

Installing the Sample Rotation Accessory

The Sample Rotation accessory (*Figure 6-1*) has a motor assembly that mounts on the front left swivel arm, and a tailstock (assembly) that mounts on the small rail at the back of the sample tray. To mount a sample for inspection, follow these steps:

1. Turn the **X-ray Adjust** and **X-ray Power** controls to their lowest settings.
2. Press the **X-ray Off** button to temporarily turn off the generation of x-rays.
3. Open the sample compartment door and locate the socket at the top left side of the compartment (*Figure 6-2, "Locating the Socket"*).
4. Plug the motor assembly's 6-pin connector into the socket. The ridges on the connector must match the grooves on the socket.

FIGURE 6-1

Sample Rotation Fixture

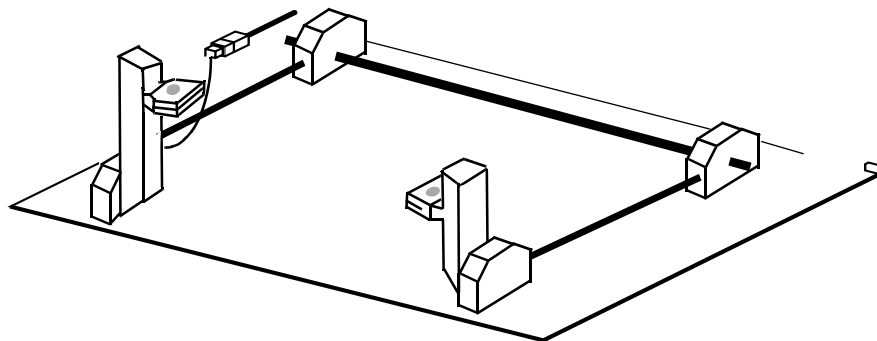


FIGURE 6-2

Locating the Socket

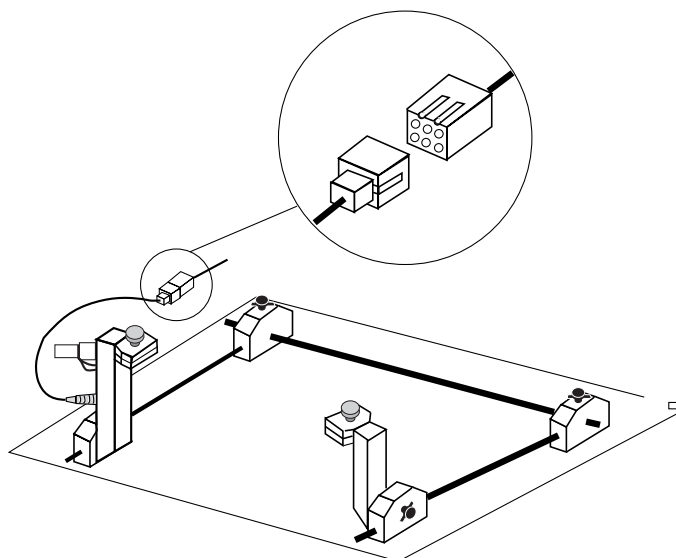
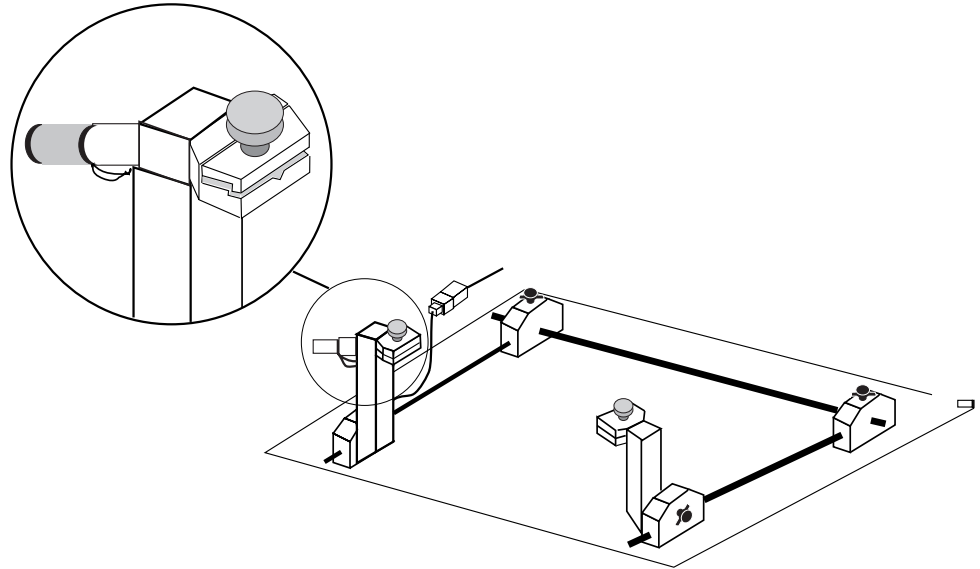


FIGURE 6-3

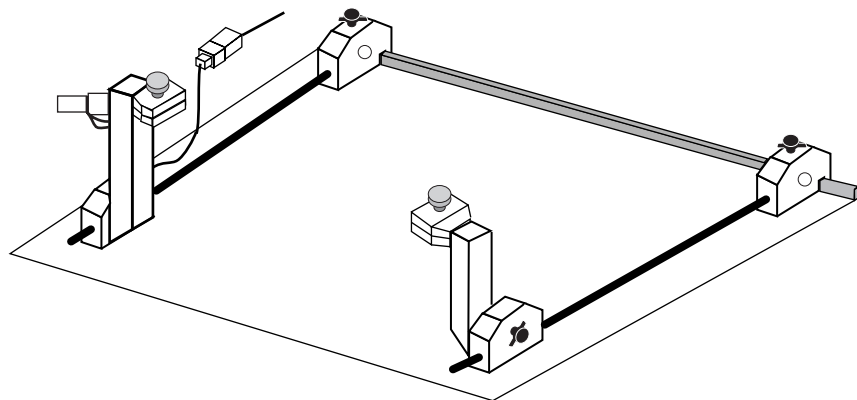
View of the Motor Assembly



5. Mount the tailstock onto the small rail at the back of the sample tray. The rail fits into the groove in the blocks at the bottom of the assembly (*Figure 6-4, "Mounting the Tailstock Assembly"*).

FIGURE 6-4

Mounting the Tailstock Assembly



CAUTION

When the Sample Rotation fixture is in the sample compartment, be extremely careful when you move the sample tray. Avoid striking the Image Intensifier with the motor assembly or tailstock.

Adjusting the Swivel Arms

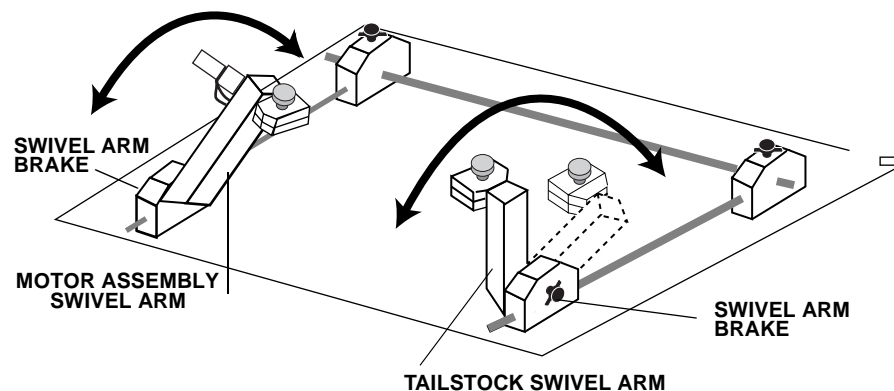
Before using the Sample Rotation feature, raise or lower the swivel arms on the Sample Rotation fixture so the sample just clears the sample tray. When the swivel arms are in their lowest positions, there is approximately 0.5-inch clearance between the rotation shaft and the sample tray. When the arms are in the highest position, there is approximately 5.5 inches of clearance. You can position the arms at any height between these two extremes.

Adjust the swivel arms so the sample is as close as possible to the sample tray, but far enough away so it does not strike the tray when it rotates.

1. Loosen the swivel brake at the bottom of the left swivel arm (*Figure 6-5, "Adjusting the Swivel Arms"*).

FIGURE 6-5

Adjusting the Swivel Arms

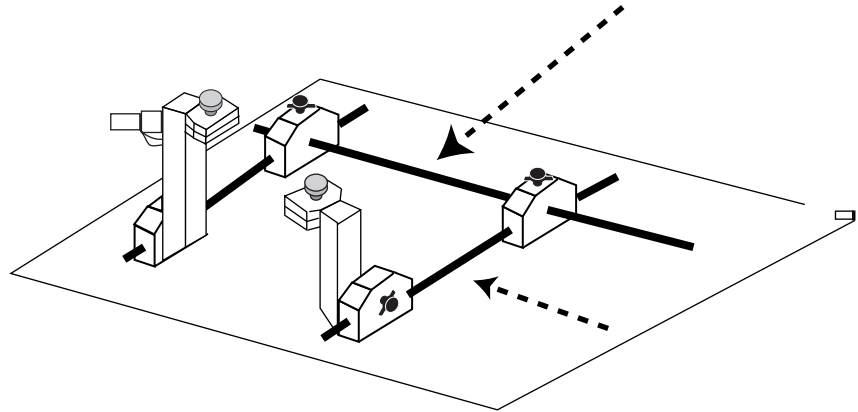


2. Rotate the arm toward the front of the sample compartment until there is sufficient clearance for the sample to rotate freely. Always keep the distance between the sample and the tray to a minimum to take advantage of the denser x-ray field.
3. Tighten the swivel brake to lock the arm in position.

4. If you are using the tailstock, adjust its swivel arm (the front, right arm) to the same height as the swivel arm on the motor assembly.
5. Test to ensure that the sample rotates freely by turning the **Rotation** knob. The rotating sample must not touch the tray or Image Intensifier.

FIGURE 6-6

Adjusting the Tailstock

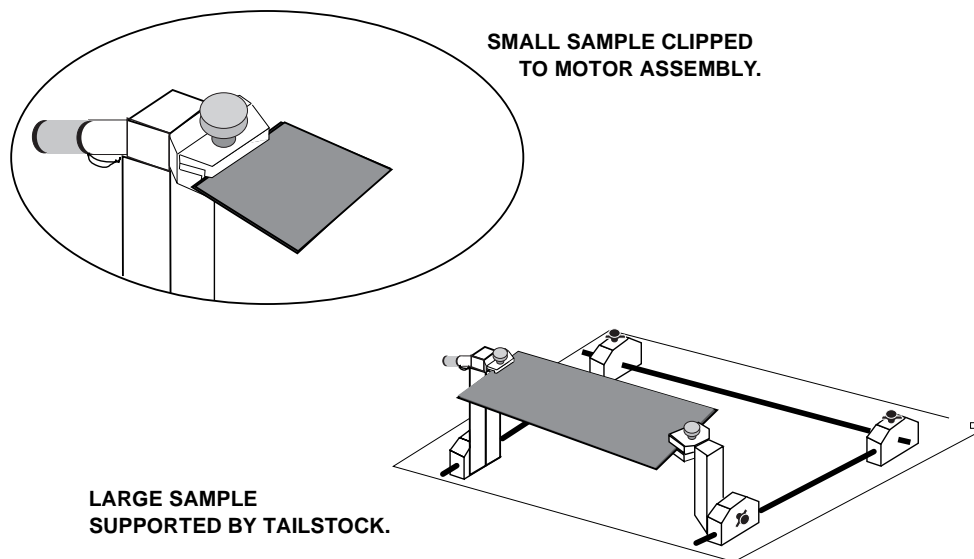


Using the Sample Rotation Accessory

1. When you are inspecting small samples, simply clip them to the motor assembly. Use the tailstock to support large samples (*Figure 6-7, "Mounting Samples"*).

FIGURE 6-7

Mounting Samples



2. Turn the **Rotation** knob on the control panel to rotate the sample. Turning the knob all the way to the right (clockwise) rotates the sample slightly more than 360°.

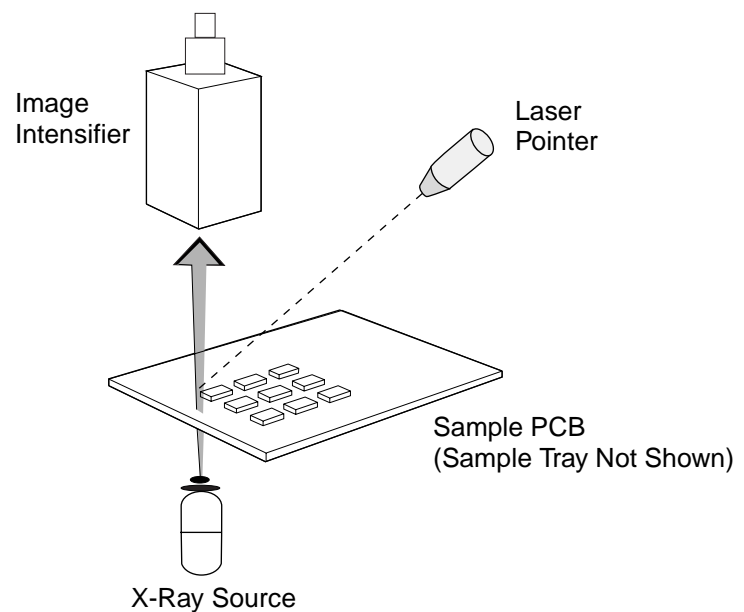


Laser Pointer

The laser pointer is a stationary device (like a small flashlight) that displays a red laser dot (of light) on the sample tray to indicate the center point of the camera's focus. This shows you the focal point of the image stream so that when you move a component into the field of view, you can immediately locate the portion of the component that is directly under the camera.

FIGURE 6-8

Laser Pointer Showing Camera Focal Point



After installation, the laser pointer does not normally require any adjustment, nor is it "operated" in any fashion by the user. It is merely a reference tool to show you the focal point of the camera on the sample, which is the area being displayed on the image monitor.

Normally, the laser pointer is installed in your x-ray system prior to shipment and is activated (the laser dot is visible) whenever power is applied to the system. However, if you are retrofitting this option to a unit already in the field, you should find both the installation and the alignment to be simple procedures.

Receiving and Inspection

The laser pointer is carefully inspected before shipment and should be free from damage.

The pointer is shipped partially disassembled. You should receive the following:

- Mounting base and shaft
- Pointer unit

If the pointer is delivered by commercial carrier, check it for damage with the carrier. Damage to check for includes, but is not limited to, the following:

- Any cracks, dents, or scratches that appear on the tip of the pointer, where the laser light is emitted.
- Bent connector on laser pointer to which wiring connects.
- Any damage to the shaft indicating it may be broken or cracked.

If any damage is found or suspected, contact the carrier's office and your NIS regional office immediately.

FIGURE 6-9

NXR-1410i Laser Pointer



Assembling the Laser Pointer

Since the development of this optional feature, all NXR-1400i, 1410i, and 1410HR systems have been designed to accommodate a laser pointer. This

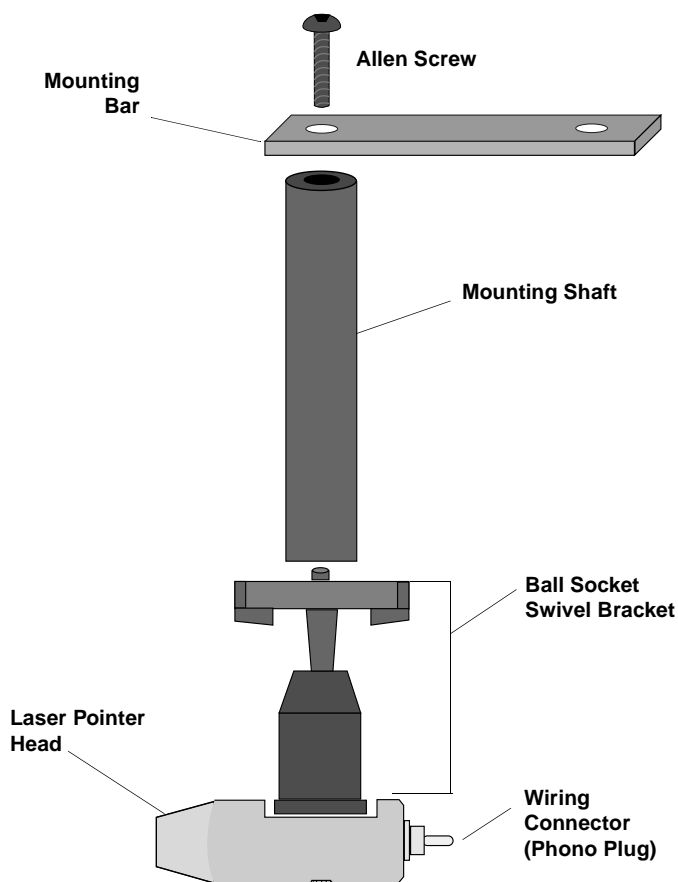
means that installation is a simple matter of attaching the mounting shaft to the inside of the sample viewing compartment, attaching the laser pointer assembly to the shaft, and plugging in the wiring connection. After a simple alignment adjustment, the pointer will be ready for use within a few moments.

The Laser Pointer assembly consists of two main parts: the pointer head that comes already attached to a swivel bracket, and a mounting shaft (*Figure 6-10*). For the NXR-1410HR, the assembly kit also includes a metal mounting bar that attaches to the top plate of the sample compartment, to enable mounting of the assembly. All kits also contain an appropriate screw for attaching the mounting shaft to the sample compartment's interior.

The wiring necessary to activate the pointer is already built into the NXR-1400i; you simply connect (plug in) the pointer to existing wires (see *Figure 6-13*, "*Laser Pointer Plug-In Connection*").

FIGURE 6-10

Laser Pointer Components



Pre-Installation

If your X-ray System is currently powered on, NIS recommends that you keep the system in the Idle mode (power being applied to the system but x-ray production is off) during installation since this is only a minor procedure.

- Ensure that x-rays are turned off. (If x-rays are on, press the X-RAY OFF button.)
- Verify that all warning indicators (tower lights and control panel LEDs) are yellow (not red), indicating that the x-rays are off.

NOTE: If your X-ray System is powered down when you install the Laser Pointer, make sure you follow the *Cold Start Procedures* described in Chapter 3 after you install the assembly but before you do the alignment procedure.

Installing the Laser Pointer Assembly

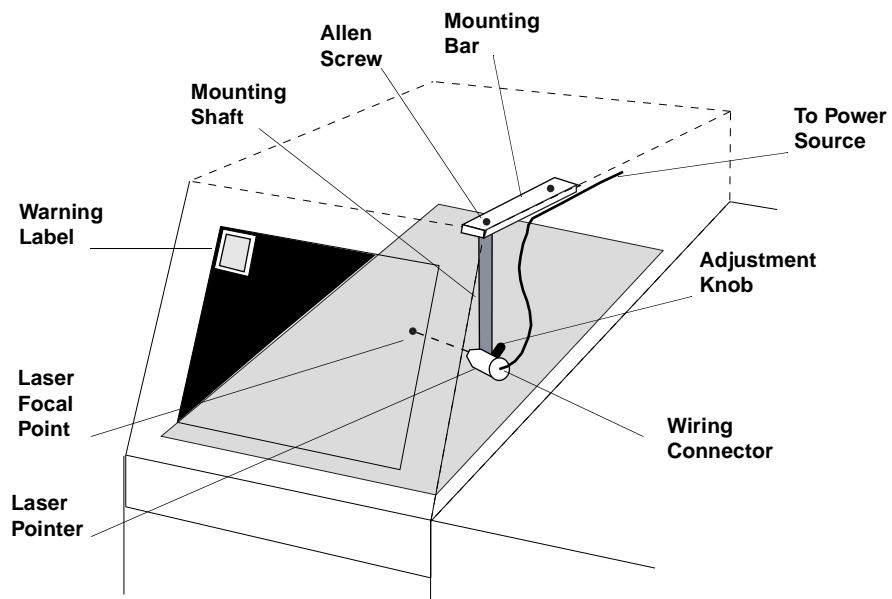
To install the laser pointer assembly, perform the following steps:

1. Screw the mounting shaft into the appropriate laser mounting screwhole in the underside of the sample compartment's top plate.

There are two screwholes, one on either side of the Image Intensifier, so you can mount the pointer on whichever side you prefer. However, NIS suggests that you mount the pointer to the right of the II (away from the loading door) for convenience since inspection samples in the NXR-1400i are loaded and removed from the left side of the sample compartment.

FIGURE 6-11

Laser Pointer Placement

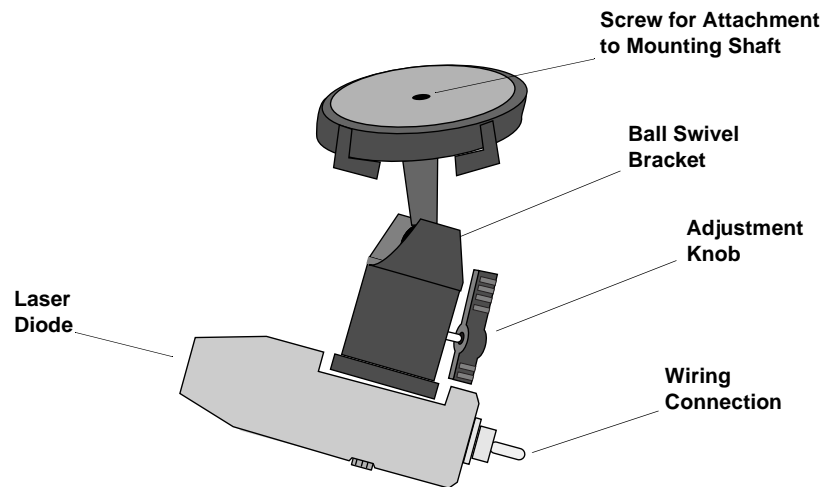


2. Screw the laser pointer swivel bracket into the bottom of the mounting shaft, being careful not to hit the laser pointer against the sides of the sample compartment.
3. Loosen the adjustment knob, and tilt and swivel the pointer head so that it points toward the sample tray. Then tighten the adjustment knob.

The wires should extend from the back of the pointer and come out toward the operator's viewing window.

FIGURE 6-12

Laser Pointer Swivel Bracket



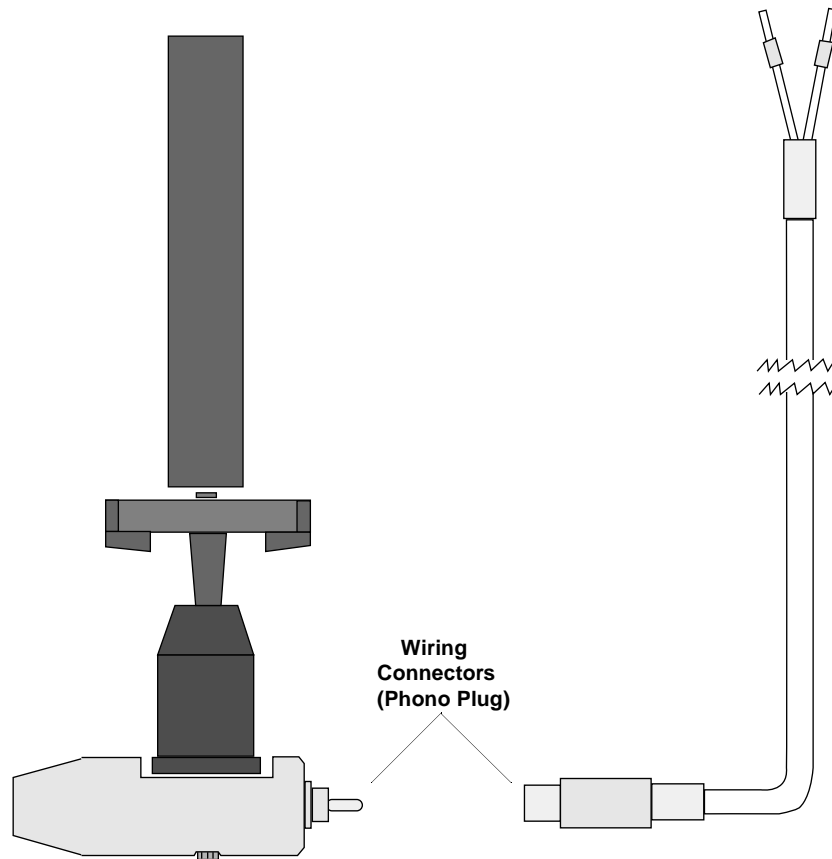
At this point, the Laser Pointer tip should be pointing down toward the center of the sample compartment inspection area. You will make the necessary final adjustments during the alignment procedure (*Aligning the Laser Pointer*), which is explained next.

WARNING

Before doing the next step, make sure that the Laser Pointer head is directed down towards the inspection table. The laser dot will be activated as soon as power is connected to it. Direct exposure of the eye to the laser beam can lead to permanent loss of sight.

4. Connect the pointer's power cable by plugging it into the connector which is already in place at the sample compartment's top plate. Make sure that the cable is threaded behind the wiring protector.

FIGURE 6-13 Laser Pointer Plug-In Connection



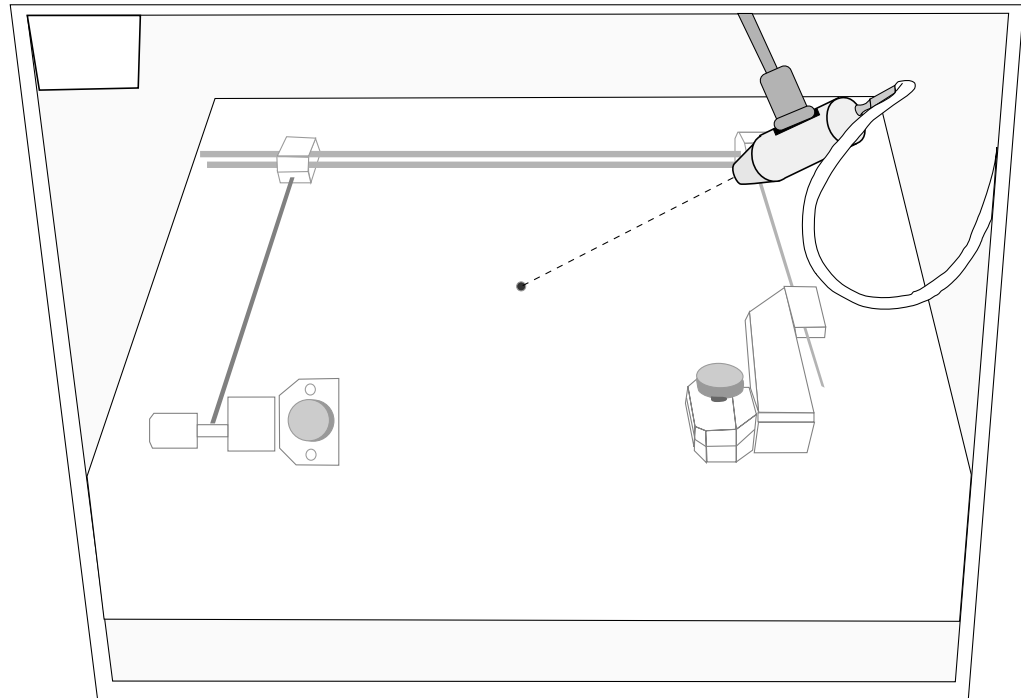
You are done with the installation of the laser pointer. You must now set the alignment of the pointer before it will be of use to you during your inspections.

Aligning the Laser Pointer

Before you can use the laser pointer, you must manually align the laser dot to indicate the point at which the x-rays are focused. You can perform this procedure using any sample or component that has an easily recognizable feature, such as a corner drill hole on a PCB.

FIGURE 6-14

Installed Laser Pointer with Laser Dot Centered



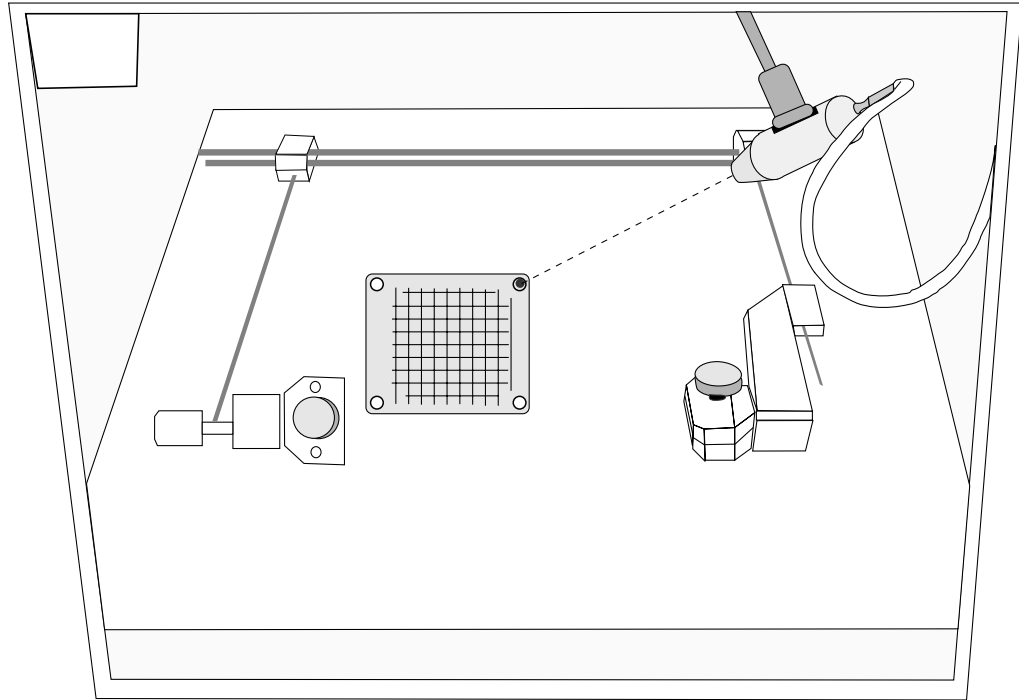
NOTE: View is through operator's viewing window looking down on centered Sample Table. No sample is currently loaded.

To align the laser pointer, perform the following steps:

1. Press LOAD on the NXR-1400i Control Panel to move the sample tray to the load position.
2. Open the Load Door and load your sample. In our illustration (*Figure 6-15*), we show a PCB with a corner drill hole.
3. Close the Load Door and push the X-RAY ON button.
4. Move the sample under the camera and watch the image monitor until a point or component you recognize is centered under the camera.

FIGURE 6-15

Aligning the Laser Pointer



5. Push the X-RAY OFF button.
6. Open the Load Door.
At the next step, you must press and hold the two door Safety Lock buttons to temporarily override the Interlocks to enable laser power while the doors are open.
7. While the Safety Locks are held down, manually adjust the Laser Pointer until the laser beam's red dot is centered on the point you selected (in our case, the corner drill hole.)
8. Release the Safety Locks and close the Load Door.
9. Push the X-RAY ON button.

You can now use the pointer's beam to show you the exact x-ray focus point on the sample that you are inspecting. This is the permanent setting for the laser pointer. Unless the pointer is inadvertently bumped or repositioned during maintenance, you should not need to adjust this setting again.

Maintenance and Troubleshooting

7





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Maintenance and Troubleshooting

Introduction

This chapter contains basic maintenance procedures you should follow to keep your NXR performing at its optimum capabilities. It also includes how to obtain service information and a list of problems and their solutions.

If you have questions, please call NIS Customer Service (CS).

CS: 800-228-1147

FAX: 619-693-0815

LOCAL: 619-635-8696

Maintenance

Cleaning-General

To avoid damage and unnecessary cleaning, protect the equipment from dust, dirt, and any other environmental hazards that damage surfaces or impair operation.

Do not use rough, abrasive cloths to clean equipment, or solvents such as acetone, carbon tetrachloride, or trichloroethylene. These solvents may damage painted surfaces.

- Clean controls and other machine surfaces with a no-rinse liquid cleaner.
- Clean acrylic plastic surfaces with an acrylic plastic cleaner and a soft cloth.
- Clean glass surfaces with a glass cleaner and a soft cloth.

CAUTION

Use only glass cleaner and a soft cloth to clean the viewing glass. The leaded glass is especially designed for protection against x-ray radiation exposure. Abrasives may damage its protective capabilities.

WARNING

Do NOT operate the system if the viewing glass is damaged in any way. Immediately contact NIS Customer Service for repairs

Cleaning - Sample Tray and Sample Table

To keep the sample tray moving smoothly and the displayed images distinct, regularly clean the tray and table. Remove the sample tray by unscrewing the four screws along the right edge. Thoroughly clean the table top and bottom of the tray.

Inspection

As with any equipment or system, periodically inspect the NXR for signs of wear and damage.

- Examine the interior of the sample compartment and make certain that the lead lining is intact.
- Examine the viewing glass for any cracks, chips, or scratches.

Shipping Kit

The shipping kit packaged with your system contains additional lamps and fuses. Keep this kit in a safe place. If you suspect that a lamp or fuse has burned out, please contact Nicolet Imaging Systems' Customer Service:

Depending on the lamp or fuse location, an NIS service representative may need to replace it.

Service

If you have questions, please call NIS Customer Service. If you need service, please call your regional office.

CS: 800-228-1147

FAX: 619-693-0815

LOCAL: 619-635-8696

Troubleshooting

This section describes solutions to common problems you may encounter as you use the NXR system.

Check your system for any indicators that may be listed and see that the same conditions exist before trying the solution.

Before Calling Help

In order to help us better serve you and determine whether a service call is necessary, please complete the following steps before you call:

1. Determine the general problem.
2. Follow the appropriate Troubleshooting procedure described in this section.
3. If the problem cannot be solved with a Troubleshooting procedure, turn off the AC power. Let the system cool down, and then turn on the power again. Determine if the problem still exists.
4. Make a visual inspection of all controls and cables. Note any unusual conditions, or correct improper settings and connections.
5. Determine whether the **Kilovolts** display appears normal.
6. Make a note of any other control panel indicators and all abnormal conditions you observe.

Calling for Help

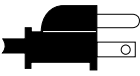
If you cannot solve your problem, please call NIS Customer Service at:

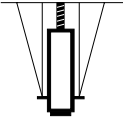
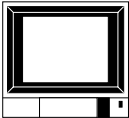
CS: 800-228-1147


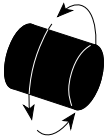
FAX: 619-693-0815

LOCAL: 619-635-8696

Troubleshooting Procedures

<p>POWER</p> 	<p>Problem: The AC Power key switch is set to on but the system is not on.</p> <p>Indicator: AC Power LED is out.</p> <p>Solution: Ensure that the system is plugged into an active AC power source and the fuse has not been blown. Also, someone may have pressed the Emergency Off button and did not restart the system. To restart the system, turn the AC Power key switch to off and then back to on.</p>
<p>X-RAYS</p>	<p>Problem: The power is on but you cannot turn on the x-rays.</p> <p>Indicators: Standby LED is on. Ready LED is out.</p> <p>Solution: The system either needs to warm up, or the X-ray key switch is set to Standby. The NXR needs approximately ten minutes to warm up after you turn on the power. If the X-ray key switch is set to Standby, turn it to Ready. The Ready LED comes on when the system is ready to generate x-rays.</p>
	<p>Problem: The power is on but you cannot turn on the x-rays.</p> <p>Indicator: Interlock 1 LED is blinking.</p> <p>Solution: Ensure that the sample compartment door is securely closed.</p>
	<p>Problem: The power is on, but you cannot turn on the x-rays.</p> <p>Indicator: Interlock 2 LED is blinking.</p> <p>Solution: Immediately contact Nicolet's Technical Information Center.</p>

<p>Image Intensifier</p> 	<p>Problem: The Image Intensifier does not move up when you press the Mag Up button.</p> <p>Indicators: AC Power key switch is on. AC Power LED is on.</p> <p>Solution: The II is already at its maximum height. You can only lower the II by pressing the Mag Down button.</p>
	<p>Problem: The Image Intensifier does not move down when you press the Mag Down button.</p> <p>Indicators: AC Power key switch is on. AC Power LED is on.</p> <p>Solution: The II may be impacting the sample or already at its lowest position. Raise the II by pressing the Mag Up button. If you want to position the II lower than its present lowest position.</p>
<p>MONITOR</p> 	<p>Problem: No image appears in the monitor.</p> <p>Indicators: X-ray On LED and X-ray On Warning light are on. Sample is below camera. Coaxial cable is connected to the back of the monitor. Monitor is on.</p> <p>Solution: Try adjusting the following controls on the control panel: Kilovolts Contrast Power Camera</p>

<p>PRINTER</p>  <p>Refer to the printer's manual for additional troubleshooting and service information</p>	<p>Problem: Printer does not respond when you press the Print button.</p> <p>Solution: Press the power switch on the front of the printer to turn on the printer's power. If that does not work, ensure that the cable is properly connected between the monitor and printer, and that there is paper in the printer. The Alarm lamp on the front of the printer lights when the printer is out of paper.</p>
	<p>Problem: You cannot preview the printer's output on your color monitor.</p> <p>Solution: Press either the Line A or Line B button on the front of the color monitor. You must turn on the line to which the printer's Mon Out cable is connected in order to preview the printer's output.</p>
<p>SAMPLE ROTATION</p> 	<p>Problem: The sample hits the tray when you try to rotate it.</p> <p>Solution: Adjust the swivel arms on the sample rotation. See Chapter 6.</p>
	<p>Problem: The sample hits the camera when you try to rotate it.</p> <p>Solution: Move the camera up by pressing the Camera Up button. You may want to adjust the camera's lower limit if this is a recurring problem. See Chapter 6.</p>
	<p>Problem: The sample does not rotate or slips when you turn the Rotation knob.</p> <p>Solution: The weight of the sample may be causing the clips to slip. Try using the tailstock to help support the sample. If that does not work, please contact your NIS representative for an application-specific solution.</p>

Appendix

Programmable User
Interface





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Programmable User Interface

Introduction

The NXR-1400i can be configured to include a programmable user interface as an option. This section describes the operation of that option.

Programmable User Interface

The NXR-1400i incorporates an imbedded microprocessor-based motion controller that features a programmable X-Y table. This controller gives you to the ability to record and store X-Y table coordinates and dwell times in a program using the “Teach” mode. These location and dwell times can be loaded and run in a sequential motion program when the NXR system is in the *Auto* mode and RUN or STEP is selected. The NXR sample tray automatically moves to the appropriate coordinates, one set at a time, in the order created in the motion program.

Motion Control Panel

Function keys on the MOTION CONTROL PANEL allow you to create new programs, or load existing programs for running or editing. Table coordinate and program information is displayed on an 8-line by 40 character LCD display located on the motion control panel. Commands are selected and data are entered using the 30-key control panel.

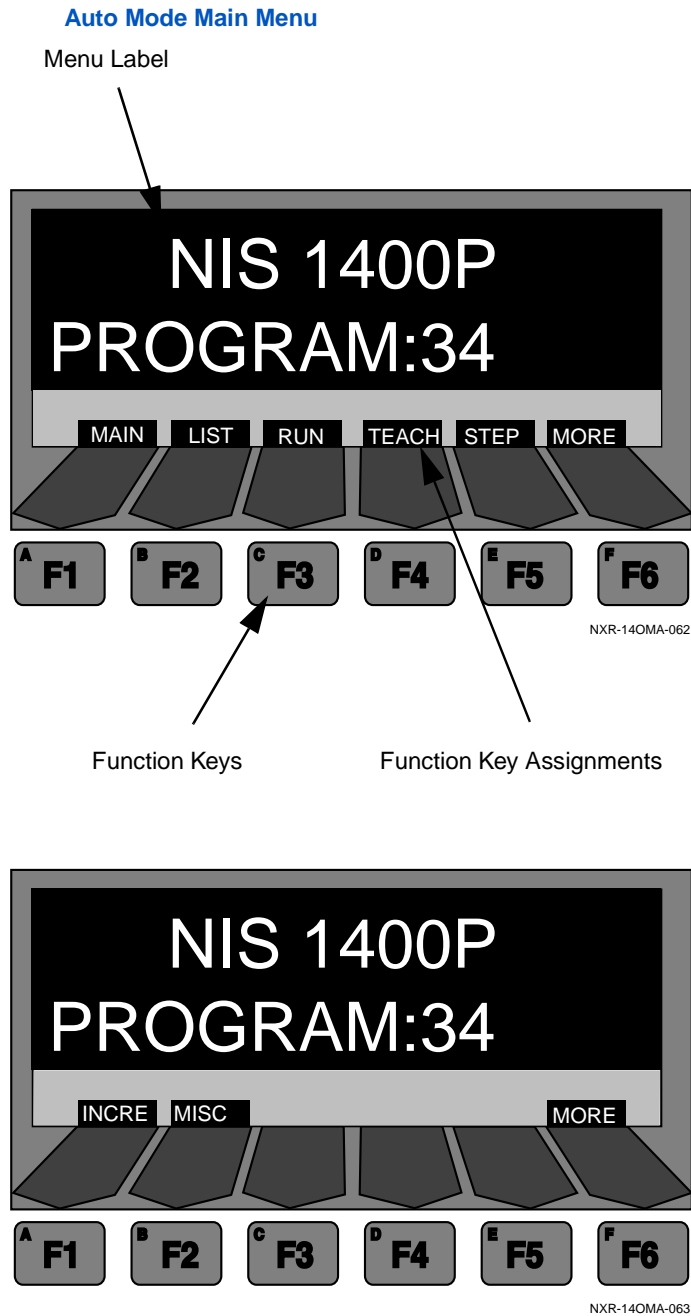
The keys are color-coded with three different colors defining their purpose:

- White = Numeric entry
- Blue = Action - Cursor, enter, insert, delete, help
- Yellow = Function keys

LCD Display

The LCD display shows the various menus associated with the motion control. Small labels at the bottom of the display indicate the function key assignment for each of the menus.

FIGURE B-1



Manual Operation

The NXR-1400i allows you to view a sample in either the MANUAL mode or AUTOMATIC mode. When the NXR-1400i is started up, the MOTION CONTROL interface will show the MAIN menu display. Operation of the JOYSTICK is disabled until you press <F1>.

To access manual operation press the <F1> key. The Motion Controller will present the *Manual* mode display as shown in [Figure A-1, "Auto Mode Main Menu"](#)

This display provides information such as the x, y coordinates in inches when the joystick is moved. These values are referenced to a "Home" position of Ø,Ø.

The LIMIT lines indicate whether or not the sample tray is at the x and y limits.

- X in the first LIMIT line indicates the status of the right limit switch (RT).
Ø = switch is open (stops motion in this direction). 1 = switch is closed (normal run).
- X second LIMIT line indicates the status of the LEFT Limit Switch.
- Y in the first LIMIT line indicates the status of the UP limit switch.
- Y in the second LIMIT line indicates the status of the DOWN switch.

F2 — Moves the sample tray to LOAD position.

F6 — Returns you to the MOTION CONTROL MAIN menu

A 1 in HOME SW ON indicates the sample tray has moved to the X and/or Y HOME positions.

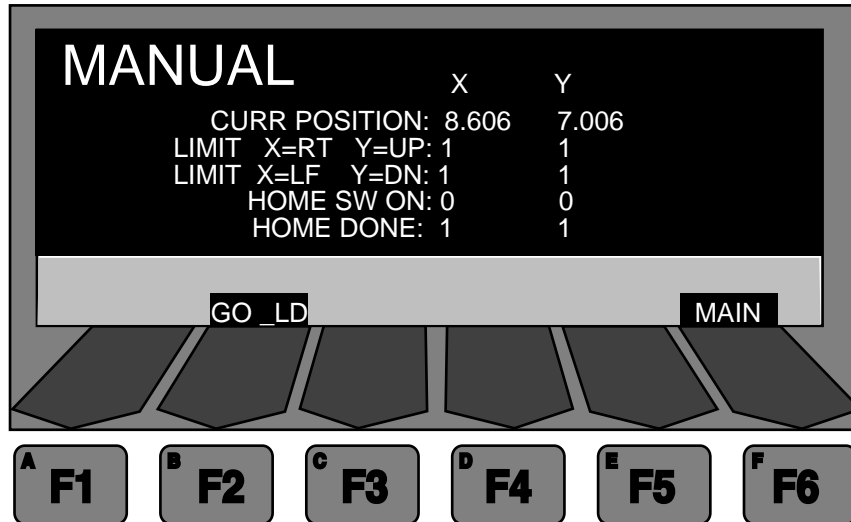
Ø = switch is open (normal run)

1 = switch is closed (used only during the "HOME" routine).

The HOME DONE switches:

- 1 home routine is successfully completed
- Ø = home routine is not completed (the system cannot perform critical functions, i.e. teach, run, step).

FIGURE B-2 Manual Mode Display



NXR-140MA-064

Viewing Program List

To determine if there are any programs loaded into the NXR-1400i motion controller, press <F2> (LIST) from the main menu. The program list menu will appear. If there are programs already loaded into the controller memory, the menu will show what number the current program is and how many programs are in the list.

Each program has an ID number created when the initial program is created. It must also have a label. The program list displays the number of views in each of the programs and the memory usage.

Scroll through the program list by pressing either the <F1> (NEXT) or <F2> (PREV) key. If you know the ID number of the program, press F4 (GOTO). Then enter the number of the program. The menu will display that program in the highlighted or current program box.

RELABEL A PROGRAM

You can name or rename the program that is displayed in the **CURRENT** → line. Press the <F5> (MORE) key to see more options, then press the <F1> (NAME) key. Enter the new name using the <SHIFT> key and the appropriate

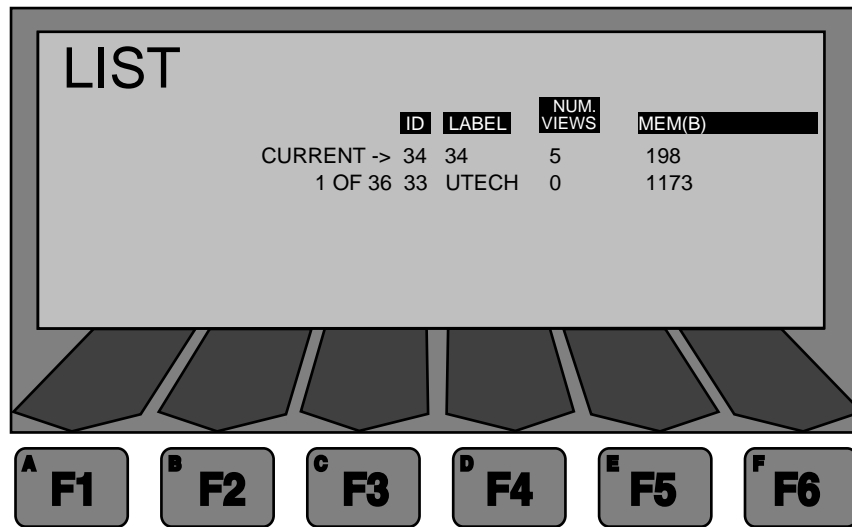
alpha numeric keys. The new name will be displayed under the “LABEL” column.

Deleting a Program

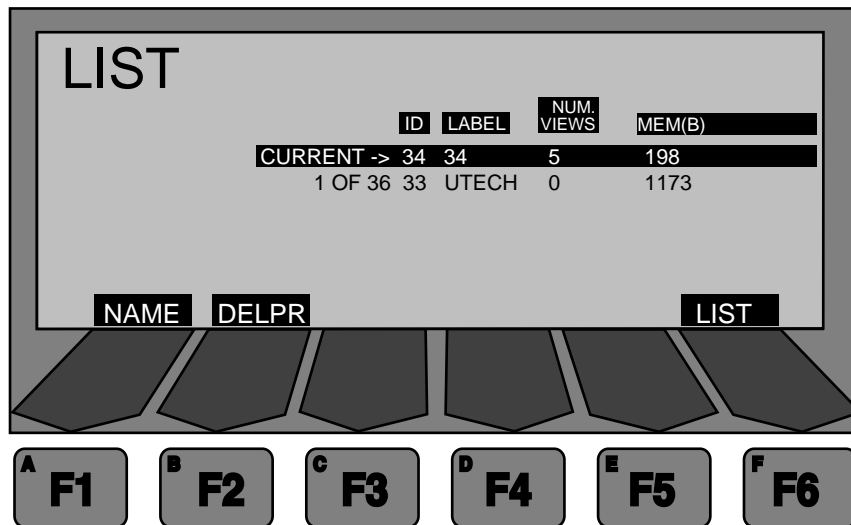
To delete a program from the list, scroll until the appropriate program is listed in the **CURRENT** -> line. Press the <F5> (MORE) key followed by the <F2> (DELPR) key. You will be prompted for a password. Enter the password and the prompt “OK TO DELETE?” will appear. The default password is NIS. The procedure for changing passwords is described at the end of this section. Press **ENTER** and the program will be deleted. The program name will no longer appear in the listing. Press <F6> to abort the DELETE action.

FIGURE B-3

LIST Program Menus



NXR-14OMA-066



NXR-140MA-067

LOADING A PROGRAM

To select a program from the program list, scroll through the list until the desired program appears in the **CURRENT ->** line. Press <F3> (LOAD) and the program will be loaded as the current program. While the program is being loaded, a menu will appear displaying “LOADING PROGRAM” in the middle of the screen and the number of views in the program will scroll up in the upper right corner of the display.

Once loaded, a new menu is displayed as shown in *Figure A-4, "LOAD Program Menu"*. From this menu you can step through each of the views, edit views, or run the program in its entirety. The program name and number of views is displayed.

FIGURE B-4

LOAD Program Menu



Running a Program

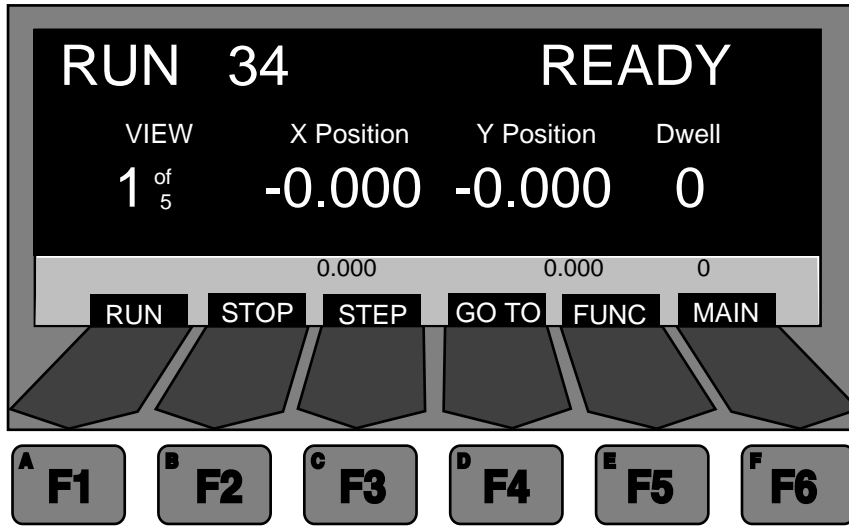
Once programs have been created and stored in memory, you can load a program for running or stepping through the views.

Press <F2> (LIST) from the main menu to display the program list. Select a program from the list and press <F3> (LOAD). The program listed in the **CURRENT** → line will be loaded. Press <F6> (MAIN) to return to the main menu.

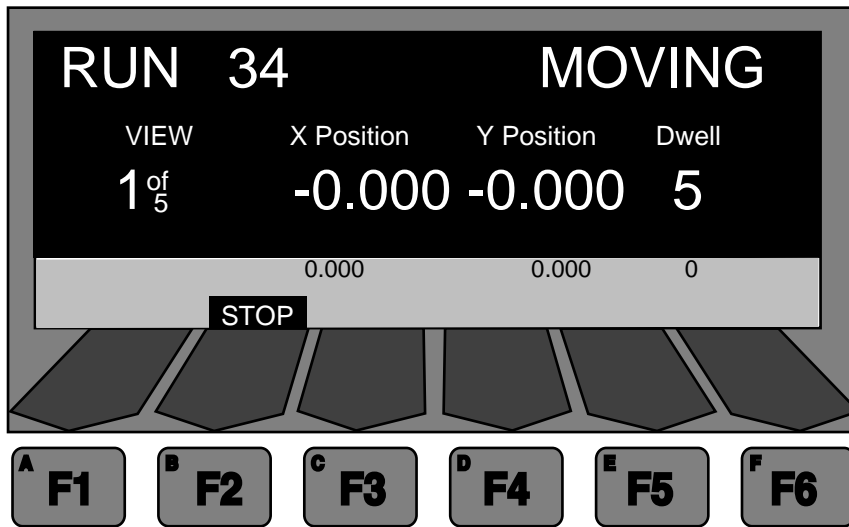
Press <F3> (RUN) in the Main menu to start the program. A Run menu will appear. From this menu, you can start the program running by pressing <F1> (RUN). Press <F5> (MORE) to access additional selections including <F3> (STEP). Press <F3> and a STEP menu will appear.

FIGURE B-5

RUN Program Menus



NXR-14OMA-069



NXR-14OMA-070

Stepping through views

Once a program is loaded, you can step through each of the views in the program. From the Program Run menu, press the <F5> (MORE) key, then <F1> (STEP) key.

From the main menu, press <F5> (STEP). A Step menu will appear.

The Step menu displays which view you are at, the X position, Y position and the dwell time. In addition, the next requested position of current view is displayed below the current view coordinates. The display changes as the table moves to the current view position.

Press <F1> (STEP) to move to the next view in the program sequence.

If you want to go to a specific view in the program and you know what the view number is, press <F4> (GOTO) to go directly to that view. Key in the number of the view and press <ENTER>. The controller will move you to the X,Y position of the selected view.

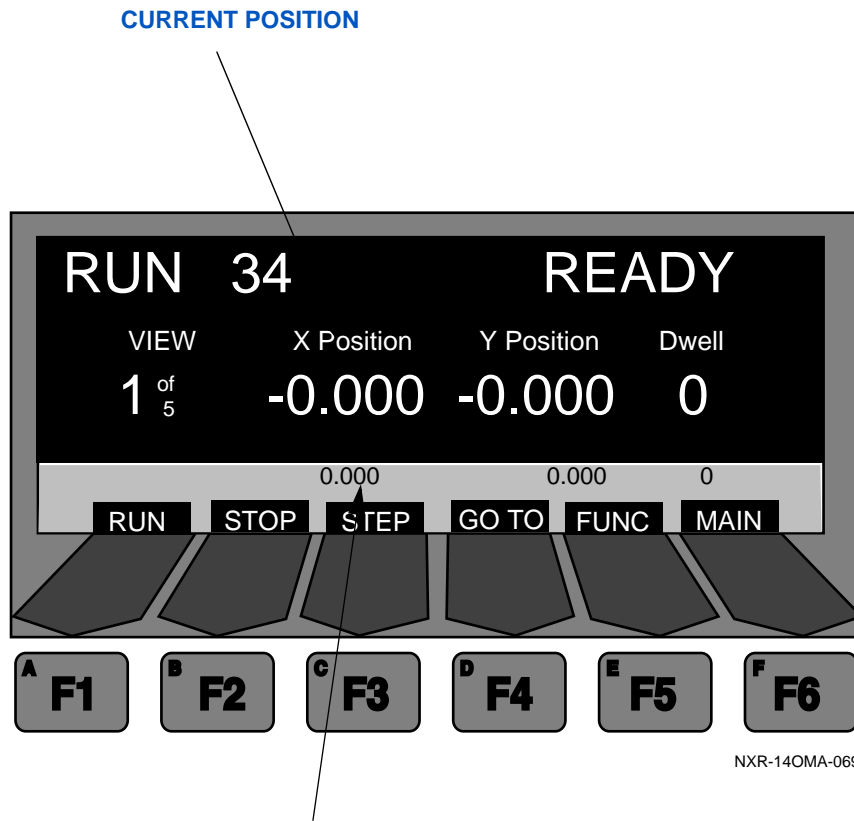
RUN

It is also possible to run the program in its entirety. Press <F5> (RUN) to call up the RUN Menu. Then press <F1> to begin the program. The program will run all views from start to finish.

Multiple views may have X=Ø, Y=Ø, and D=Ø, but the program will return to view 1 after 2 views of Ø,Ø,Ø are executed. This feature is especially useful when there are more views in your program than you need. Instead of cycling through null views, the system starts over at view 1.

FIGURE B-6

STEP Menu



Editing a Program

After a program has been created, it is possible to edit the program. You can add a view anywhere in the program or you can remove a view as well as change coordinates or dwell times. Press <F5> (MORE) in the main menu. An additional part of the main menu will appear. Press <F1> (EDIT) to call up the edit menus.

From here you can scroll through the program views, add or delete views, or change the x-y coordinate data or dwell time as required.

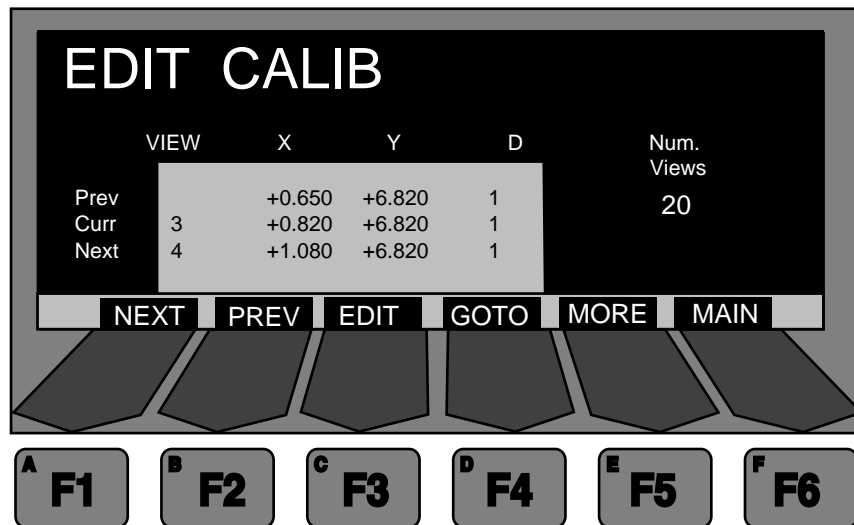
Edit a View

To edit a view, scroll through the program until the desired view is listed in the **CURRENT** → line. Press <F3> (EDIT) and a cursor will appear in the view line. Use the keypad to enter a change to X or Y coordinates or the dwell time. After you change the values, press the **ENTER** key. The entered value must be within limits or the system will not accept it. Press <F5> in the MISC 1 menu. This will take you to the MISC2 menu. From here, press <F8> to view the current set limits.

GOTO will take you to a specific view. Press <F4> and enter the appropriate number of the desired view. Press enter and

FIGURE B-7

VIEW EDITING Menu



NXR-14OMA-072

Insert a View

To insert a view, scroll through the program list until you reach to point where you want to insert a view. Press <F1>(INSV) and the system will create a blank line after the current line.

INSERT CURRENT POSITION

To insert the current position, use the joystick to move the sample tray to the desired location. Scroll through the program list until you are at the location where you want to insert the current position. Press <F5> (INSCP) and the coordinates of the current position will be displayed at the top of the

coordinates list. Press <F1> (INPUT) and the current coordinates are inserted in the **CURRENT** -> line.

Press <F4> (GOTO) to go to a view before or after the current view before inserting the view if you want the new view in a different location.

Delete a View

To delete a view, scroll through the program until the view you wish to delete is displayed in the **CURRENT** -> line. Press <F2> (DELV) and the view will be removed from the program list.

The number of views will also change to reflect the deleted view, and all the view will be shifted up. For example, view 6 will become view 5.

Once you have finished editing a program, press <F6> (MAIN) to return to the main menu. The program will automatically be saved.

Creating a New Program

The NXR-1400i allows you to create up to 50 different programs that can be stored in memory at any one time. It is also possible to have up to 300 views in any one program. It is possible to have a total of 900 views in aggregate with the standard memory configuration. It is possible to have 3400 views in aggregate with the upgraded indexer memory.

To create a new program, you must first call up the “TEACH” mode of the NXR-1400i. Press <F4> (TEACH) from the Main Menu. A TEACH SETUP menu will be displayed first with the message “HELP key is active!”.

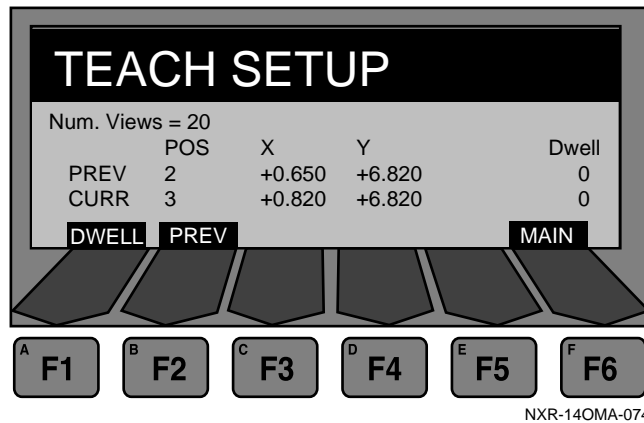
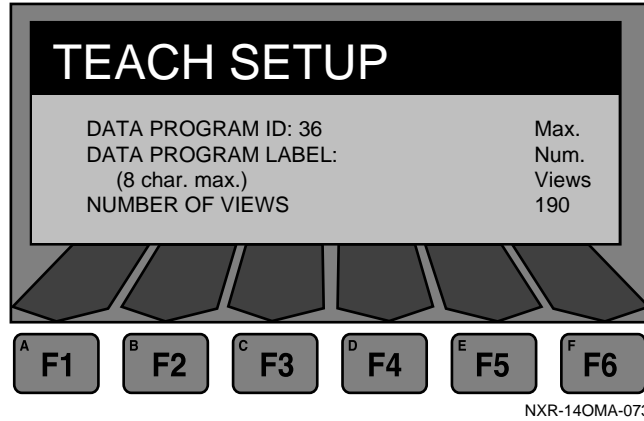
When you are in the first menu of the “Teach” mode, you can call up the help screens by pressing the **HELP** button on the motion controller keypad. Press the <F5> (TEACH) key to call up the Teach SETUP main menu. The JOYSTICK is also active during the “Teach” mode.

A program ID number that is different from any other number in the program list is automatically entered.

A cursor will flash in the DATA PROGRAM LABEL field. Enter a program label up to 8 characters in length, and press <ENTER>. You also enter the number of views in the program. Always select more views than required. For example, if you plan 20 views, then request 25. It is possible to add or delete views during the Editing mode; however, the EDIT mode is typically used for minor changes.

FIGURE B-8

TEACH Mode Menus



Entering Views

To enter a new view in the *Teach* mode, press <F2> (NEXT) so that the current line is displaying a blank view.

Use the joystick to move to the desired position.

Set the <F1> (DWELL) or <F3> (NEXT) view. If you do not enter a new value for dwell it will default to the previous value for the next position.

As you add views, the number on the right side of the display will change according to the actual number of views in the program

NOTE: The X and Y values are restricted to X and Y positions that are within the over travel limits of the NXR system. You cannot program outside these limits.

Press <F1>1 (DWELL) to enter dwell times. Enter Dwell time as the number of seconds you want to stop at each view. The dwell time can be different for different views. The first value entered will continue to be the default value for dwell unless another value is entered.

Once you have entered all of the views, press <F6> (MAIN) on the initial TEACH menu to return to the Main Menu. A display will appear with the message "SAVE IN PROGRESS..." as shown in *Figure A-7, "VIEW EDITING Menu"*.

FIGURE B-9

SAVE INIDICATOR Menu



Increment Mode

In addition to creating a program with a variety of moves, it is possible to operate the system so that the sample tray moves in regular increments.

Press <F6> (MORE) in the main menu. The additional main menu appears. From this menu, press <F2> (INCR). An increment menu will appear. You can enter a positive or negative increment value that is used to incrementally move the sample tray. This increment value is displayed in mils (1000/inch).

Press <F1> (INC) to move the specified distances.

Press <F2> (JOG) to enable the joystick. This allows you to make minor adjustments in the position of the view.

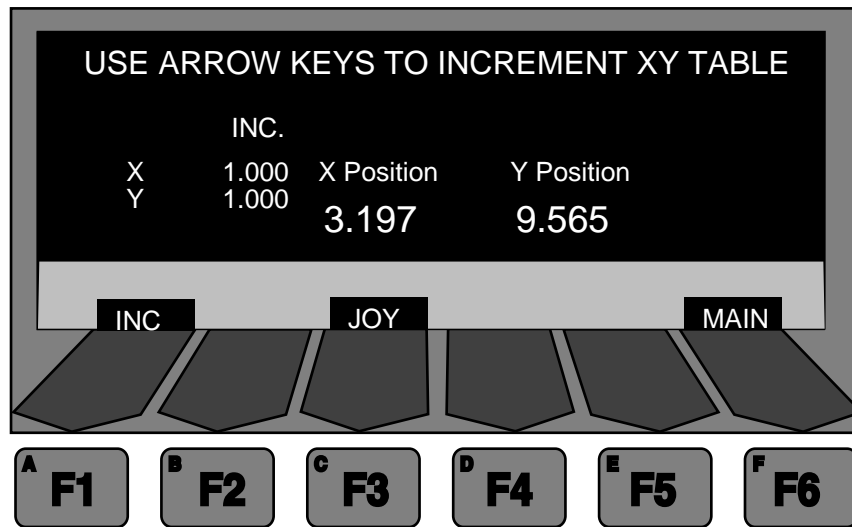
Press <F4> (XVAL) to enter a positive or negative value for movement in the X-axis. After entering the value, press the ENTER key.

Press <F5> (YVAL) to enter a positive or negative value for movement in the Y axis. After entering the value, press the ENTER key.

Press <F6> to return to the main menu.

FIGURE B-10

Increment Menu



NXR-14OMA-076

Miscellaneous Menus

The Motion Controller features menus that allow you to access additional utility functions for program setup or data manipulation. To call up these menus, first press <F6> (MORE) from the main menu. Then press <F5> (MISC) to call up MISC 1 menu.

MISC 1 Menu

The following functions are available from this menu.

Press <F1> (COM) to reset the controller comm port for communication between the motion controller and a remote indexer.

Press <F2> (BEGIN) key to start the control program from the beginning. This feature is useful if you want to execute the control program without repowering.

Press <F3> (FAULT) key to display the status of the Drive (F1) or the Indexer (F2). If the X or Y motion is not working, you can use this function to determine if the Drive or Indexer is working properly.

Press <F4> (REVS) key to display the software and firmware revision level of the installed drives, indexer and operator interface.

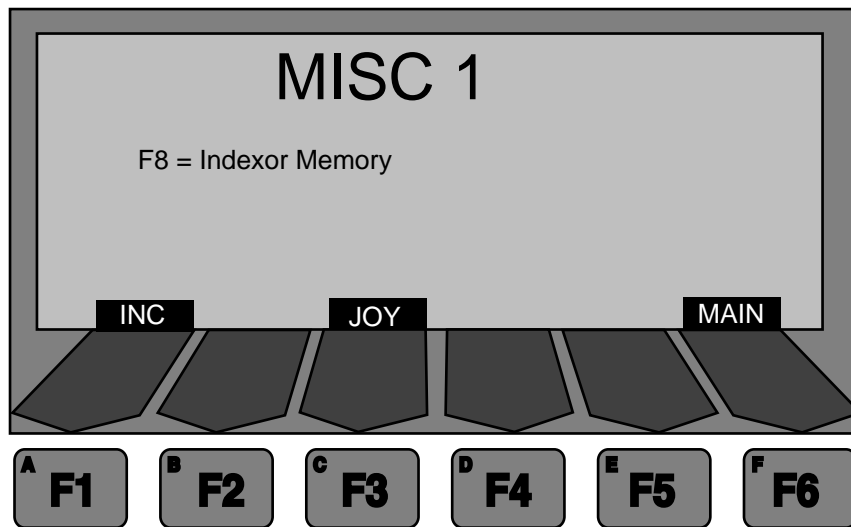
Press <F5> to call up MISC 2 menu.

Press <F6> to return to the Main menu.

Press <F9> to lock the program. When the program is locked, it cannot be edited, viewed, or listed. The control program is locked at the factory and should always be locked.

FIGURE B-11

Miscellaneous Menus



NXR-14OMA-077

Misc 2 Menu

The following functions are available from the MISC 2:

Press <F1> (HMSTP) to turn AUTO HOME ON and OFF.

Press <F2> (HOME) to perform the HOME routine that is run on system boot-up.

Press <F4> (PHONE) to display the phone numbers for NIS Field Service.

1- 800 - 228 - 1147

1- 619 - 695 - 9910

Press <F5> (END) to exit the motion program and go to the basic editor. After the software is locked this key is no longer used.

Press <F6> (MISC) to return to the MISC 1 menu.

Press <F8> to set X and Y limits.

Press <F9> to change the sample tray velocity and acceleration. A screen will appear that allows you to edit joystick and table movement speed.

Press <F1> to change Run speed the default run speed will be displayed. Using the keypad, enter a new speed within the specified range and press **Enter**.

Press <F2> to change the joystick speed.

Press <F3> to change the move to HOME position speed.

Press <F4> to change the move to LOAD position speed.

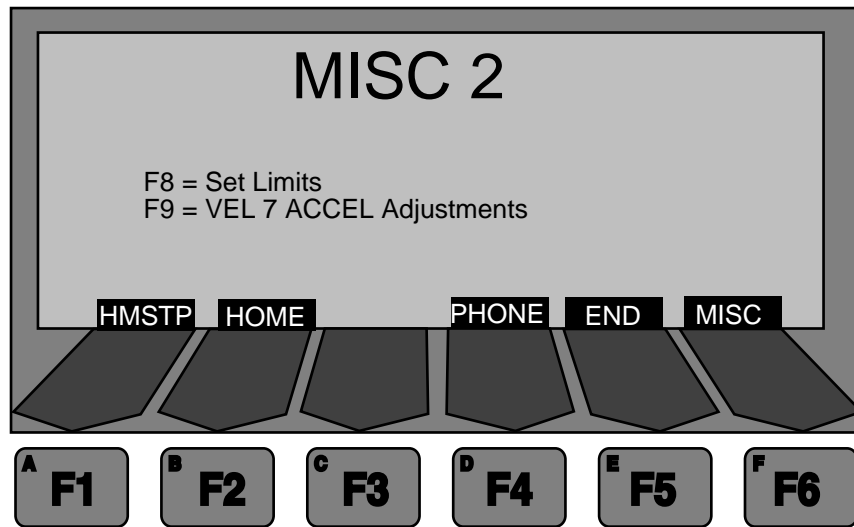
Press <F5> to change the acceleration value.

Press <F6> to return to the MISC 2 menu.

Press <F7> to return to default values.

FIGURE B-12

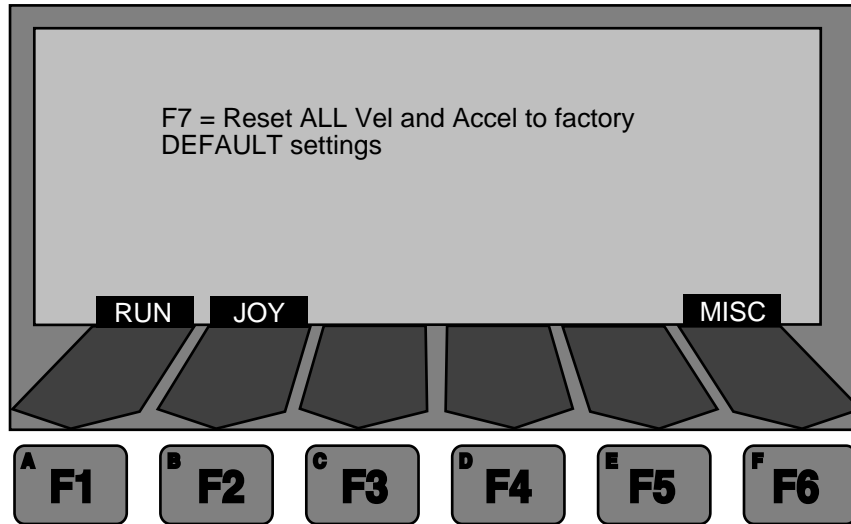
Miscellaneous 2 Menu



NXR-14OMA-079

FIGURE B-13

Acceleration and Velocity Adjustment Menus



NXR-14OMA-081

To change passwords

When you are viewing the program list from the LIST menu, press <F5> (MORE) for additional functions. A second menu will appear. Press <F2> (DELPR) from this menu.

A prompt will appear asking you to enter a password.

Enter the current password (the factory installed password is "NIS").

Press <ENTER>.

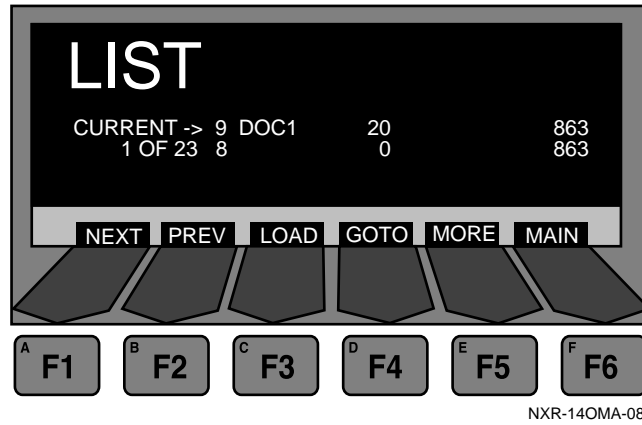
A menu will appear as shown. When this screen is displayed, press <F9> and a screen prompt will appear asking you to enter a new password.

Enter the new password and press <ENTER>.

A prompt will appear asking you to verify the password. Type the password again and press <ENTER>. The new password will now be in effect.

FIGURE B-14

Change Password Menus



Appendix

X-ray Equipment
Registration

B



X-ray Equipment Registration

Introduction

This appendix contains additional information pertaining to your NXR-1400i X-ray System.

Registration of X-ray Equipment

Each state requires you to register your NXR Real-Time X-ray Imaging System. Below is a list, by state, of the agencies with whom you are required to register your x-ray equipment.

Alabama (AL) Director of X-ray Compliance, Division of Radiological Health, State Department of Public Health, State Office Bldg., Montgomery, AL 36130
Tel. (205) 261-5315

Alaska (AK) Radiological Health Program, Department of Health & Social Services, Box H, Juneau, Alaska 99811-0613 Tel. (907) 465-3019

Arizona (AZ) X-ray Compliance, Arizona Radiation Regulatory Agency, 4814 South 40th St., Phoenix, Arizona 85040 Tel. (602) 255-4845

Arkansas (AR) Division of Radiation Control and Emergency Management, Department of Health, 4815 West Markham Street, Little Rock, Arkansas 72205-3867 Tel. (501) 661-2301

California (CA) Radiological Health Branch, State Department of Health Service, 714 P Street, Office Bldg. #18, Sacramento, California 95814 Tel. (916) 322-2040

Colorado (CO) Radiation Control Division, Department of Health, 4210 East 11th Avenue, Denver, Colorado 80220 Tel. (303) 331-8480

Connecticut (CT) Radiation Control Unit, Dept. of Environmental Protection, 165 Capitol Avenue, Hartford, Connecticut 06106 Tel. (203) 566-5668

Delaware (DE) Office of Radiation Control, Division of Public Health, Robbins Bldg., Silver Lake Plaza, Box 637, Dover Delaware 19903 Tel. (302) 736-4731

District of Columbia (D.C.) Department of Consumer and Regulatory Affairs, Service Facility Regulation Administration, 614 H Street, N.W., Room 1014, Washington, D.C. 20001 Tel. (202) 727-7190

Florida (FL) Office of Radiation Control, Department of Health and Rehabilitative Services, 1317 Winewood Boulevard, Tallahassee, Florida 32399-0700 Tel. (904) 487-1004

Georgia (GA) Radiological Health Section, Department of Human Resources, 878 Peachtree Street, Room 600, Atlanta, Georgia 30309 Tel. (404) 894-5795

Hawaii (HI) Noise and Radiation Branch, Environmental Protection and Health Services Division, Dept. of Health, 591 Ala Moana Blvd., Honolulu, Hawaii 96813 Tel. (808) 548-4383

Idaho (ID) Bureau of Hazardous Materials, Division of Environmental Quality, 450 West State Street, Boise, Idaho 83720 Tel. (208) 334-5879

Illinois (IL) Department of Nuclear Safety, 1035 Outer Park Drive, Springfield, Illinois 62704 Tel. (217) 785-9868

Indiana (IN) Radiological Health Section, State Board of Health, 1330 West Michigan Street, Box 1964, Indianapolis, Indiana 46206 Tel. (317) 633-0152

Iowa (IA) Bureau of Environmental Health, Iowa Department of Public Health, Lucas State Office Building, Des Moines, Iowa 50319 Tel. (515) 281-4928

Kansas (KS) Bureau of Air Quality and Radiation Control, Department of Health and Environment, Forbes Field, Bldg. 321, Topeka, Kansas 66620 Tel. (913) 296-1542

Kentucky (KY) Radiation Control Branch, Cabinet for Human Resources, 275 East Main Street, Frankfort, Kentucky 40621 Tel. (502) 564-3700

Louisiana (LA) Department of Environmental Quality, Box 44066, Baton Rouge, Louisiana 70804 Tel. (504) 342-9103

Maine (ME) Division of Health Engineering, 157 Capitol Street, State House, Station 10, Augusta, Maine 04333 Tel. (207) 289-3826

Maryland (MD) Center for Radiological Health, Environmental Science and Health, Maryland Dept. of the Environment, 201 W. Preston St., Baltimore, Maryland 21201 Tel. (301) 333-3130

Massachusetts (MA) Radiation Control Program, Department of Health, 150 Tremont Street, Second Floor, Boston, Massachusetts 02111 Tel. (617) 727-6214

Michigan (MI) Div. of Radiological Health, Bureau of Environmental & Occupational Health, Dept. of Public Health, 3500 N. Logan St., Box 30035, Lansing, MI 48909 Tel. (517) 335-8200

Minnesota (MN) Section of Radiation Control, Minnesota Dept. of Health, 717 Delaware St., S.E., Box 9441, Minneapolis, Minnesota 55440 Tel. (612) 623-5351

Mississippi (MS) Division of Radiological Health, State Department of Health, 3150 Lawson Street, Box 1700, Jackson, Mississippi 39215-1700 Tel. (601) 354-6657

Missouri (MO) Bureau of Radiological Health, 1730 East Elm Street, Box 570, Jefferson City, Missouri 65102 Tel. (314)-751-6083

Montana (MT) Environmental Sciences Division, Department of Health and Environmental Sciences, Cogswell Building, Helena, Montana 59620 Tel. (406) 444-3948

Nebraska (NE) Division of Radiological Health, Department of Health, 301 Centennial Mall, South, Box 95007, Lincoln, Nebraska 68509 Tel. (402) 471-2168

Nevada (NV) Radiological Health Section, Health Division, Department of Human Resources, 505 East King Street, Carson City, Nevada 89710 Tel. (702) 885-5394

New Hampshire (NH) Radiological Health Program, Box 148, Concord, New Hampshire 03302 Tel. (603) 271-4588

New Jersey (NJ) Division of Environmental Quality, Department of Environmental Protection, 380 Scotch Road, CN411, Trenton, New Jersey 08625 Tel. (609) 530-4002

New Mexico (NM) Radiation Protection Bureau, Environmental Improvement Division, Dept. of Health and Environment, Box 968, Santa Fe, New Mexico 87504-0968 Tel. (505) 827-2959

New York (NY) Bureau of Environmental Radiation Protection, New York State Health Department, Two University Place, Albany, New York 12203 Tel. (518) 458-6461

North Carolina (NC) Radiation Protection Section, Division of Facility Services, Department of Human Resources, 701 Barbour Drive, Raleigh, North Carolina 27603 Tel. (919) 733-4283

North Dakota (ND) Division of Environmental Engineering, Department of Health, 1200 Missouri Avenue, Box 5520, Bismark, North Dakota 58502-5520 Tel. (701) 224-2348

Ohio (OH) Radiological Health Program, Department of Health, 122 Kinnear Road, Columbus, Ohio 43212 Tel. (614) 481-5800

Oklahoma (OK) Radiation and Special Hazards Service, State Department of Health, Box 53551, Oklahoma City, Oklahoma 73152 Tel. (405) 271-5221

Oregon (OR) Radiation Control Section, State Health Division, Department of Human Resources, 1400 Southwest Fifth Avenue, Portland, Oregon 97201 Tel. (503) 229-5797

Pennsylvania (PA) Bureau of Radiation Protection, Department of Environmental Resources, Fulton Bldg., 16th Floor, Third and Locust St., Harrisburg, Pennsylvania 17120 Tel. (717) 787-2480

Puerto Rico (PR) Radiological Health Division, G.P.O., Call Box 70184, Rio Piedras, Puerto Rico 00936 Tel. (809) 767-3563

Rhode Island (RI) Division of Occupational Health and Radiation Control, Department of Health, Cannon Bldg., Davis Street, Providence, Rhode Island 02908 Tel. (401) 277-2438

South Carolina (SC) Bureau of Radiological Health, South Carolina Department of Health and Environmental Control, 2600 Bull Street, Columbia, South Carolina 29201 Tel. (803) 734-4700

South Dakota (SD) Licensure and Certification Program, State Dept. of Health, Joe Foss Office Building, 523 East Capital, Pierre, South Dakota 57501 Tel. (605) 773-3364

Tennessee (TN) Division of Radiological Health, TERRA Building, 150 9th Avenue North, Nashville, Tennessee 37219-5404 Tel. (615) 741-7812

Texas (TX) Bureau of Radiation Control, Texas Department of Health, 1100 West 49th Street, Austin, Texas 78756-3189 Tel. (512) 834-6688

Utah (UT) Bureau of Radiation Control, State Department of Health, 288 North 1460 West, Box 16690, Salt Lake City, Utah 84116-0690 Tel. (801) 538-6734

Vermont (VT) Division of Occupational and Radiological Health, Dept. of Health, Administration Bldg., 10 Baldwin St., Montpelier, Vermont 05602 Tel. (802) 828-2886

Virginia (VA) Bureau of Radiological Health, Division of Health Hazards Control, Department of Health, 109 Governor Street, Richmond, Virginia 23219 Tel. (804) 786-5932

