

ATTACHMENT A

RADWORKS™
Digital Radiography Software
Version 1.0

Guide to Operation

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TABLE OF CONTENTS

Installing RADWORKS

- What This Guide Explains**
- What Your RADWORKS Package Includes**
- Hardware and Software in the RADWORKS System**
 - Hardware requirements
 - Software requirements
- Installing RADWORKS Software**
- Modification of Windows Configuration**
- Installing X-ray Sensor Hardware**

RADWORKS Basic Skills

- What You Should Know**
- Starting and Exiting RADWORKS**
- Aborting or Escape Procedure**
- Getting Help**

RADWORKS Tutorial

- Getting Started**
- How to perform a digital radiographic examination**
 - Entering patient and examination information
 - X-ray sensor and sensor placement
 - Making a radiographic exposure
 - Image orientation and positioning
 - Saving an examination
- How to retrieve digital radiographic examination**
 - Finding the patient record
 - Finding the examination
 - Automatic display mode
 - Manual display mode

RADWORKS Menus

- Exam**
 - New
 - Find
 - Edit
 - Delete
 - Exit

Processing

- Contrast
- Sharpen
- Blur
- Math
- Filters
- Revert Image

Analysis

- AOI Histogram
- Point Histogram
- Line Profile
- Distance
- Angle
- Area
- Calibration

Options

- Preferences
- Palette

Windows

- Tools
- Results
- Clear

Help

- About
- Help??

RADWORKS Tools

Appendices

Index

RADWORKS

Installation Guide

Installing RADWORKS

RADWORKS is a Microsoft® Windows-based application allowing you to acquire, save, process and analyze digital radiographic images. Since RADWORKS runs in the Microsoft Windows graphical user interface environment, you must install one of the following versions of Windows:

The full retail version of Windows 3.0.

Installing the full retail version of Windows provides you with all Windows functions, including the *Program Manager* and *File Manager* applications. For a complete description of Windows function, see the *Microsoft Windows User's Guide*.

The version of Windows 3.0 supplied by some computer manufacturers, tailored to the requirements of that computer. Like the full retail version of Windows, this version provides you with all Windows functions.

What This Guide Explains

- Required hardware and software.
- How to install your RADWORKS software.
- How to install your x-ray sensor hardware.

You should also read the file called README.TXT, included on your RADWORKS program disk. This file contains useful information about the latest RADWORKS developments. You can open and read this file using the *Windows Notepad* application. Print a copy of the README.TXT file to keep with you *RADWORKS User's Manual*.

What your RADWORKS package includes

Read this section to make sure your software package is complete and you have all the equipment you need. Carefully read the License Agreement. If you accept the terms of the License Agreement, open the disk pack and fill out the registration card. Return this card to RADWORKS Corporation to receive technical support and software upgrade notices.

The *RADWORKS User's Manual*.

The Software License Agreement printed on a sealed envelope.

A set of the following disks (inside the envelope):

- (1) 5.25 inch, 1.2 MB floppy disk, and
- (1) 3.5 inch, 1.44 MB floppy disk

A registration card inside the envelope.

Hardware and Software in the RADWORKS System

Hardware requirements:

Computer system.

RADWORKS will run on any Windows 3.0-compatible IBM® PC AT or compatible computer. RADWORKS recommends an Intel 80386 or 80486 based system with a minimum of four megabytes of RAM. The computer must have at least one empty, full-length expansion slot into which you will install your x-ray detector interface or a frame grabber board to acquire images. A math coprocessor will accelerate image processing functions but it is not required.

Computer monitor.

An 8-bit SuperVGA color display controller with non-interlaced 1024 x 768 pixels is needed to drive a multisync monitor. RADWORKS recommends a Sigma Designs Legend display controller and a NEC 4DS monitor.

Disk space.

You need 2.0 megabytes of available disk space to install RADWORKS. Approximately 4.0 megabytes of disk space is needed to save each full mouth survey of 24 images. RADWORKS recommends that you have a minimum of 650 megabytes of available disk space for patient images. The disk space may be either fixed hard disk or removable optical disk.

X-ray detector system.

RADWORKS currently supports the Sens-A-Ray™ system from REGAM Medical Systems AB. Contact RADWORKS Corporation for the latest information on x-ray system support.

Mouse.

You need a mouse or other pointing device compatible with MS Windows 3.0.

Hardware key.

A hardware key is provided with each copy of the RADWORKS program. This hardware key must be installed on the parallel printer port at all times for the RADWORKS program to function. The hardware key will in no way affect the performance of the computer or parallel port.

Software requirements:

To run RADWORKS, you need PC- or MS-DOS version 3.1 or later, Microsoft Windows version 3.0 or later, and the RADWORKS program.

Installing RADWORKS Software

Before installing your software, make backup copies of your disk in case the originals are accidentally destroyed. Then use the backup copies to install the software on your hard disk.

RADWORKS runs under Microsoft Windows version 3.0. If you already have Windows installed on your system, you need only install the RADWORKS files using the automatic installation program. If Windows 3.0 (or higher) has not been installed, install it now.

In order to install RADWORKS, you must know which hard drive the RADWORKS software is going to be installed on.

To install RADWORKS on your hard disk:

1. With the power turned OFF on your computer, install the RADWORKS hardware key to the computer's parallel communications port at the back of your computer. This hardware key will in no way affect the performance of your computer or parallel port.
2. Turn the power ON and start your computer.
 1. Start Microsoft Windows 3.0 by typing "win" at the C: prompt.
 2. Insert the RADWORKS Program Disk into a drive.
 3. Select *Run* from the *File* menu.
 4. Type "A:\install.exe" or "B:\install.exe" dependent upon the drive you are using. Next select the OK button.
 4. Follow the instruction on your screen. The RADWORKS installation program will prompt you for necessary information it needs to install RADWORKS.
 5. Finally, Reboot the computer.
 6. Refer to RADWORKS Basic Skills section for instruction on using RADWORKS software.

Installing X-ray Sensor Hardware

The following is copyrighted material taken from the Sens-A-Ray™ *Owner's Manual and Reference Guide* REGAM Medical Systems AB.

The following components should be included in the Sens-A-Ray™ system:

- X-RAY sensor of CCD-type.
- A clockgenerator and A/D board = A/D Box.
- AC/DC power supply.
- Frame grabber.
- All cables and connectors.

Optional components:

- CD-Worm (Write Once Read Many) optical disk storage device.
- Videoprinter for hard copies of images.
- Remote control for the system.

Please follow these instructions to install the framegrabber and SuperVGA card in you computer. You are also given instructions how to install the monitor, A/D Box, and the AC/DC power unit.

1. Turn off your computer and the power to any peripheral devices attached to your computer (such as printers, monitors, videoprinters, CD-WORM drive unit, etc.)
2. Turn the system unit so that the back of the unit faces you. Disconnect the power cord and any other cables from the back of the computer.
3. Remove the system unit cover. (If necessary, refer to your computer user's guide.)
4. Locate the expansion slots at the rear of the system unit, and choose two expansion slots. (If necessary, refer to your computer user's guide to determine how the expansion slots in you system unit are numbered.)
5. Remove the screw that secures the expansion slot covers to the system unit, as shown in the following figure. Then carefully remove the slot covers.
Picture
6. First grasp the upper edges of the framegrabber card. Press the board firmly into the socket.

7. Make sure the slot on the top of the metal retaining bracket lines up with the hole on the top of the expansion slot.
8. Then grasp the upper edges of the SuperVGA card. Press the board firmly into the second empty slot.
9. Make sure the slot on the top of the metal retaining bracket lines up with the hole on the top of the expansion slot.
10. Replace the system unit cover. Reconnect any cables you removed in step 2.
11. Take the cable that is supplied with the multi-sync monitor and connect one end to the female connector at the back of the screen. The other end is connected to the female connector on the SuperVGA card that you have just installed.
12. Connect the power cord from the screen either to the mains or the computer, depending upon which type of power cord is supplied with the monitor.
13. Take the short cable that is supplied with the AC/DC power supply and slide the small male connector into the framegrabber card's female connector at the back of the computer. Take the other end of the cable and the large male connector and slide it into the large female connector on the AC/DC power supply.
14. At one end of the AC/DC power supply is a cable stationary fixed to it. The other end of this cable is connected permanently to the A/D Box.
15. Place the A/D Box on the X-ray tube with the velcro closing that is supplied with your installation kit.
16. Install the cable between the AC/DC power supply and the A/D Box. Use the velcro closing or the clips supplied with your installation kit.
17. The Sens-A-Ray™ sensor is already connected to the A/D Box and after installing the A/D Box the sensor is placed on the special hook that is supplied with the A/D Box.
18. You have now completed the installation of the hardware that is used in connection with the Sens-A-Ray™ sensor. You are now ready to power up the system and test the device.
19. Turn on the green switch on top of the AC/DC power supply.

20. Set the power switch on the monitor to the ON position.
21. Turn the power switch on the computer to the ON position.
22. Refer to the User's Manual further instructions.

Congratulations, you have completed the installation procedure!!!

RADWORKS

Basic Skills

RADWORKS Basic Skills

This chapter introduces you to the basic operation of RADWORKS. Before you begin working in RADWORKS, read and follow the examples and procedures to become familiar with using the program.

RADWORKS is an integrated program for the acquisition, processing, analysis, storage and retrieval of digital radiographic examinations. The program is designed to interface with the image sensor and acquisition hardware provided by the manufacturer.

While RADWORKS is a sophisticated software application, it can be used effectively by novice and expert computer users alike. Explore the flexibility and ease of use designed into the application.

What You Should Know

This chapter assumes you are familiar with the operation of *Microsoft Windows* graphical user interfaces. To operate such software you must master the following skills:

Basic mouse actions: drag, click, double-click, click-and-drag

Selecting commands from pull-down menus

Stretching and moving windows

Selecting items from list boxes

Selecting commands from pop-up lists

Moving through directories and files

If you do not have these skills, consult your Windows documentation. If you are even slightly familiar with the concepts, go ahead and start. You will master them in the process of using RADWORKS.

Starting and Exiting RADWORKS

Starting from the Windows Program Manager

The most common way to start RADWORKS is to start Windows, then launch RADWORKS from the Program Manager.

- 1) From the DOS prompt, enter the following to display the Windows Program Manager: "win".
- 2) From the *File* menu, select *Run*. The *Execute* dialog box appears.
- 3) Type "C:\RADWORKS\RADWORKS.EXE", then press the Enter key. The program window appears. As RADWORKS starts, you will see initialization messages appear in the status dialogue box.

Starting RADWORKS from an Icon

If you have placed the RADWORKS.EXE program in the Program Manager Window, the RADWORKS Icon will appear in the window. Then simply double-click on the RADWORKS Icon to start the program.

Exiting RADWORKS

To exit the program:

- 1) Using the mouse, move the cursor to the upper left corner of the RADWORKS program window.
- 2) Double-click on the Window Command Menu icon.

Aborting or Escape Procedure

In order to abort or escape any procedure:

- 1) Using the mouse, select the *Clear* from the *Window* menu.
- 2) This will abort any procedure and return you to the beginning of any procedure.

Getting Help

RADWORKS offers extensive on-line help for all levels of expertise. The Help menu, located at the far right side of the menu bar, provides access to all the help tools.

RADWORKS

Tutorial

RADWORKS Tutorial

Getting Started

Before attempting this part of the manual, make sure you have installed and configured RADWORKS and the X-ray sensor hardware according to instruction in the Installation Guide.

If you have not read the entire RADWORKS manual, at least read, "RADWORKS Basic Skills", to get the general idea of manipulating the menus and the mouse.

How to perform a digital radiographic examination

The following is a step-by-step guide to performing a digital radiographic examination using RADWORKS. The first step is to input the patient information and then the information relating to the examination. Next you must position the detector in the patients mouth and make an exposure. The image is first checked for quality and then correctly oriented for future viewing. Finally the image is placed in the image holder and subsequent images are taken until the examination is complete. The examination is then stored for later retrieval. Each step in this procedure will be explained in this chapter.

To perform an examination of a new patient:

Entering patient and examination information

- Select *New* from the *Exam* menu.
- The *Enter Patient Info* dialog box will be displayed. (picture)
- Type either a portion of the patient's last name or the patient's chart number. Do Not Type Both.
- Choose the *Look-up* button at the bottom of the dialog box.
- The *Select A Patient* dialog box will now appear, displaying the names of all patients which meet the criteria entered. Since this is a new patient the list should be not contain the patient's name. (picture)
- Choose the *New* button at the bottom of the dialog box to make a new patient record.
- The *Add New Patient* dialog box will be displayed. (picture)

- Type the patient's first name, then press the "tab" key.
- Type the patient's middle name or initial, then press the "tab" key.
- Type the patient's last name, then press the "tab" key. Repeat this procedure until all the fields are completed.
- Choose the *Add* button at the bottom of the dialog box.
- The *Examination Information* window will be displayed. (picture)
The patient information and time/date will automatically be entered into the examination form.
- Type the referring doctor's name, then press the "tab" key.
- Type the referring service, then press the "tab" key.
- Using the mouse select the *Modality* from the popup menu.
- Using the mouse select the *Exam Type* from the popup menu.
- Review the information. Choose the *Acquire* button at the bottom of the dialog box.
- The *Acquisition Control* dialog box will be appear on the left side of the *Image* window showing the number of exposures selected and the number of exposures taken. And the *Image Holder* icon will appear in the upper right next to the *Examination Information* window. These will both be discussed in detail later. You are now ready to take radiographic images.

(Picture of the acquisition screen with all components labeled.)

X-ray sensor and sensor placement

- Place the detector in the plastic sheath to prevent contamination of the detector.
- Using the appropriate aiming device and detector holder, place the detector in the patient's mouth. The position of the detector is identical to that used with conventional film based systems.
- Position the x-ray tube head in alignment with the image detector.
You are now ready to make an exposure

Making a radiographic exposure

- The recommended exposure parameters are described in the appendix. Different x-ray generators may vary in the appropriate exposures and some initial testing of exposure parameters may be necessary. Set the exposure parameters on the x-ray generator.
- Using the mouse select the *Expose* button in the *Acquisition Control* dialogue box. (picture) A green **GO** light will be displayed indicating the system is ready for an exposure. If you do not make an exposure within 15 seconds an *Exposure Error* dialog box will be displayed. This is to protect the sensor from damage. You will need to select the *Expose* button again.
- Next press the exposure control to trigger the x-ray machine. Shortly after the exposure, the x-ray image will be displayed in the *Image* window located in the center of the computer screen. The *Acquisition Tools* palette will be appear on the right side of the *Image* window.

Image orientation and positioning

- Inspect the image to insure that the exposure is correct and that all relevant anatomic structures have been included in the image.
- Using the *Acquisition Tools* palette "rotate" or "flip" the image so that is is oriented correctly. This is done by determining the appropriate orientation of the image to be placed in the image holder and selecting the necessary orientation buttons from the palette. Rotation both clockwise and counterclockwise by 90° and by 180° are supported. Also the image can be "flipped" about the horizontal or vertical axis. "Flipping" the image about the horizontal axis is used to correctly orient the image of the upper or lower dental arches, while "flipping" about the vertical axis is used to correctly orient the image of the left or right sides of the patient.
- Once the image is in the correct orientation, place the image in the appropriate position in the *Image Holder* icon by clicking the mouse in the desired open space.
- The space will immediately become grayed, indicating that the image has been accepted in the *Image Holder* icon. The number of exposures to be taken will decrease by one and the number of images taken will be increased by one.
- You are now ready to make the next exposure. Repeat these steps until all images have been taken for the examination. Once all images have been taken, the *Complete* button will become active.

Saving an Examination

- Select the *Complete* button at the bottom of the *Acquisition Control* dialog box. The examination will automatically be saved to the image storage device.

To perform a new examination of an existing patient:

- Select *New* from the *Exam* menu.
- The *Enter Patient Info* dialog box will be displayed. (picture)
- Type either a portion of the patient's last name or the patient's chart number. Do Not Type Both.
- Choose the *Look-up* button at the bottom of the dialog box.
- The *Select A Patient* dialog box will now appear, displaying the names of all patients which meet the criteria entered. (picture)
- Select the patient's name from the list. (If the patient's name does not appear, no record exists, Check your information or choose the *New* button at the bottom of the dialog box to make a new patient record as described above.)
- The *Examination Information* window will now be displayed. (picture). The patient's name, chart number and date of birth along the the current time and date information will automatically be entered.
- Type the referring doctor's name, then press the "tab" key.
- Type the referring service, then press the "tab" key.
- Using the mouse select the *Modality* from the popup menu.
- Using the mouse select the *Exam Type* from the popup menu.
- Review the information. Choose the *Acquire* button at the bottom of the dialog box.
- You are now ready to take radiographic images. Follow the same instructions as given above for a new patient.

How to retrieve a digital radiographic examination

The following is a step-by-step guide to retrieving and reviewing a digital radiographic examination using RADWORKS. The first step is to "ask" or query the RADWORKS system and to select the examination that is needed. Many different examinations may be present for the same patient. After the examination has been retrieved, you will need to select the radiographs to be viewed. Next you may wish to perform certain image processing or image analysis functions on the radiographic images. Finally you will need to clear the examination from the computer screen.

To retrieve an examination of a patient:

Finding the patient record

- Select *Find* from the *Exam* menu.
- The *Enter Patient Info* dialog box will be displayed. (picture)
- Type either a portion of the patient's last name or the patient's chart number. Do Not Type Both.
- Choose the *Look-up* button at the bottom of the dialog box.
- The *Select A Patient* dialog box will now appear, displaying the names of all patients which meet the criteria entered. (picture)
- Select the patient's name from the list. (If the patient's name does not appear no record exists, check your information.)

Finding the examination

- If more than one examination exists for the patient, the *Select An Exam* dialog box will now appear, displaying a list of all radiographic examinations which have been performed on that patient. (picture)
- Select the examination from the list which you wish to view.
- The examination information will be displayed along with an icon representing the appropriate film holder.

Automatic display mode

This is the default display mode. A single image is displayed in the center of screen. Only one image can be displayed at a time. This mode is designed to

allow the clinician to view one image at a time in a predefined order or randomly. The predefined order can be set from the preference menu.

- To view the images in a predefined order, simply place the cursor in the *Image Window* and click the mouse. The next image will be displayed and the *Image Holder Icon* will indicate the image being displayed by appearing transparent. Alternatively the "Space" bar can be used to advance to the next image to be displayed.
- To view the images in a random order, simply point to the image you wish to be displayed in the *Image Holder Icon* and click the mouse. The image will then be displayed in the *Image Window*.

Manual display mode

This is the optional display mode. Any number of images can be displayed simultaneously. This mode is designed to allow the clinician to view as many images as desired at the same time. This can be useful when comparing images which display the same anatomical area.

- Select the *Manual* button at the lower right of the *Examination Information Window*.
- Select the image to be displayed by clicking on the *Image Holder Icon* and dragging the image into the viewing area. The image will be displayed in a *Image Window* which can be resized and repositioned to any location on the screen.
- To put the image away, simply click the iconize arrow in the upper right corner of the *Image Window*.
- The images which are being displayed will be indicated by the transparent icons in the *Image Holder Icon*.
- To revert back to automatic display mode, simply click on the *Automatic* button at the lower right of the *Examination Information Window*.

RADWORKS

Menus

RADWORKS Menus

This chapter introduces you to the RADWORKS menus. Before you begin working in RADWORKS, read and follow the examples and procedures to become familiar with using the program. All of the basic functions necessary to acquire, process, analyze, store and retrieve digital radiographic examinations are explained in this chapter.

The Exam Menu

This group of menu items provides for entering new patient/examination information and acquiring radiographic images into the RADWORKS system. Also provided is the ability to retrieve, edit or delete a specific radiographic examination.

New

This command allows you to take a new radiographic examination.

To perform an examination of a new patient:

- Select *New* from the *Exam* menu.
- The *Enter Patient Info* dialog box will be displayed. (picture)
- Type either a portion of the patient's last name or the patient's chart number. Do Not Type Both.
- Choose the *Look-up* button at the bottom of the dialog box.
- The *Select A Patient* dialog box will now appear, displaying the names of all patients which meet the criteria entered. Since this is a new patient the list should be not contain the patient's name. (picture)
- Choose the *New* button at the bottom of the dialog box.
- The *Add New Patient* dialog box will be displayed. (picture)
- Type the patient's first name, then press the "tab" key.
- Type the patient's middle name or initial, then press the "tab" key.

- Type the patient's last name, then press the "tab" key. Repeat this procedure until all the fields are completed.
- Review the information. Choose the *Add* button at the bottom of the dialog box.
- The *Examination Information* window will be displayed. (picture)
The patient information and time/date will automatically be entered into the examination form.
- Type the referring doctors name, then press the "tab" key.
- Type the referring service, then press the "tab" key.
- Using the mouse select the *Modality* from the popup menu.
- Using the mouse select the *Exam Type* from the popup menu.
- Review the information. Choose the *Acquire* button at the bottom of the dialog box.
- You are now ready to take radiographic images.

To perform a new examination of an existing patient:

- Select *New* from the *Exam* menu.
- The *Enter Patient Info* dialog box will be displayed. (picture)
- Type either a portion of the patient's last name or the patient's chart number. Do Not Type Both.
- Choose the *Look-up* button at the bottom of the dialog box.
- The *Select A Patient* dialog box will now appear, displaying the names of all patients which meet the criteria entered. (picture)
- Select the patient's name from the list. (If the patient's name does not appear, no record exists. Check your information or choose the *New* button at the bottom of the dialog box to make a new patient record as described above.)
- The *Examination Information* window will now be displayed. The patient, time and date information will automatically be entered into the examination form. (picture)

- Type the referring doctors name, then press the "tab" key.
- Type the referring service, then press the "tab" key.
- Using the mouse select the *Modality* from the popup menu.
- Using the mouse select the *Exam Type* from the popup menu.
- Review the information. Choose the *Acquire* button at the bottom of the dialog box.
- You are now ready to take radiographic images.

Find

This command allows you to retrieve and display of an existing radiographic examination.

To retrieve an examination of a patient:

- Select *Find* from the *Exam* menu.
- The *Enter Patient Info* dialog box will be displayed. (picture)
- Type either a portion of the patient's last name or the patient's chart number. Do Not Type Both.
- Choose the *Look-up* button at the bottom of the dialog box.
- The *Select A Patient* dialog box will now appear, displaying the names of all patients which meet the criteria entered. (picture)
- Select the patient's name from the list. (If the patient's name does not appear no record exists, check your query information or choose the *New* button at the bottom of the dialog box to make a new patient record.)
- If more than one examination exists for the patient, the *Select An Exam* dialog box will now appear, displaying a list of all radiographic examinations which have been performed on that patient. (picture)
- Select the examination from the list which you wish to view.
- The examination information will be displayed along with an icon of the appropriate film holder.

Edit

This command allows the user to modify or edit the contents of an examination. This feature should be used with extreme caution as you are changing a medical-legal record. This command is password protected to prevent unauthorized modification of patient's records.

Delete

This command allows the user to delete an examination. This feature should be used with extreme caution as you are changing a medical-legal record. This command is password protected to prevent unauthorized deletion of patient's records.

Exit

This command exits the RadWorks program and returns to the *Program Manager* application.

The Process Menu

This group of menu items provides for a wide range of image processing functions designed to enhance the visualization of information within the image. The selection of the appropriate function is task dependent and requires some practice. The original image data will not be changed by these functions. You may experiment with different processing functions to enhance the image. The command can be applied to the entire image or a selected portion.

Contrast

This command allows you to interactively manipulate the contrast and brightness of the image using slider control bars. It also provides for several modified contrast scales such as linear, inverse, variable gamma. This process is applied to the entire image.

Sharpen

Sharpens images with high frequency components; accentuates edges. This process is equivalent to a Hi-Pass filter. This process is applied to the entire image.

Blur

Blurs the image and reduces overall image noise. This process is equivalent to a Lo-Pass filter. This process is applied to the entire image.

Math

This command allows you to perform mathematical operations using two images or one image and a constant value. These operations include addition, subtraction, multiplication and division.

Filters

This command allows you to apply convolution filters to the image. Generally these filters are designed to enhance features or remove noise. A filter may be applied to an area of interest (AOI) or the entire image. For more information on convolution filters see Appendix A.

Revert Image

This command allows you undo the previous processing operation.

The Analyze Menu

This group of menu items provides for a wide range of tools to quantitatively analyze information within the digital image.

AOI Histogram

This command tells **RADWORKS** to calculate and display a histogram of the distribution of gray values in the AOI. The mean gray value and its standard deviation are also calculated. A histogram is displayed as a two-dimensional graph. Each value along the horizontal X-axis represent a gray scale value. The values along the vertical Y-axis represent the number of pixels in the image that are of that gray value. In general, the histogram gives us a clue as to what contrast enhancements will improve the image.

To perform an AOI histogram:

- Select *AOI Histogram* from the *Analyze* menu.
- Define an AOI with the *Selection Tool* or select the entire image by clicking in the image window.
- The *Analysis Results* window will appear, displaying the histogram along with the mean gray value and its standard deviation.
- Click on the *Analysis Results* window close box to end the procedure.

Point Histogram

This command returns the gray value and X-Y coordinates of the pixel directly beneath the cursor.

To perform an point histogram:

- Select *Point Histogram* from the *Analyze* menu.
- The cursor will change to a cross-hair. Position the cursor on the pixel of interest.
- The *Analysis Results* window will appear, displaying the X-Y coordinates and gray value of the pixel beneath the cursor. The value will change as the cursor is moved in the *Image* window .
- Click on the *Analysis Results* window close box to end the procedure.

Line Profile

This command displays a two-dimensional graph that represents each pixel on the chosen line along the X-axis and the grey value for the pixel along the Y-axis.

Distance

This command allows you to determine the distance of a straight line within the digital image.

To measure the distance of a straight line:

- Select *Distance* from the *Analyze* menu.

- The cursor will change to a pencil. Define a line by click-and-dragging the mouse to the location desired for measurement.
- The *Analysis Results* window will appear, displaying the distance between the two points in pixels. If a calibration procedure has been performed the distance will be displayed in the correct units defined in the calibration.
- Click on the *Analysis Results* window close box to end the procedure.

Angle

This command allows you to determine the angle defined by three points within the digital image.

To measure an angle:

- Select *Angle* from the *Analyze* menu.
- The cursor will change to a pencil. Define the angle by clicking the mouse at the vertex of the angle, next define one side by clicking the mouse and then define the other side.
- The *Analysis Results* window will appear, displaying the angle being measured.
- Click on the *Analysis Results* window close box to end the procedure.

Area

This command allows you to determine the perimeter and area of a traced closed figure.

Calibrate

This command allows you to define an unit of measurement for all dimensional analyses.

To define the name and size of a measurement unit

- Select *Calibrate* from the *Analyze* menu.
- The cursor will change to a pencil. Define a line by click-and-dragging the mouse which represents an object or distance of known dimensions.
- The *Calibrate Units* dialog box will be displayed.

- Enter the desired units of measurement (ie. millimeters, centimeters, etc.), and the known dimensions of the calibration line in the desired units.
- Choose the *OK* button, once you have confirmed the input. All dimensional analyses will be based on this calibration. To change the calibration simply perform another calibration procedure.

The Options Menu

This group of menu items provides for setting user preference and default display information.

Preferences

This command will allow you to select the small images to be displayed in the *Image Holder* icon.

Palette

This command allows you to alter the palette (PAL) of the image being displayed. Any type of linear or non-linear PAL can be applied to the image. In addition, pseudo-color can be applied to any gray scale image. By selecting a linear PAL the default image can be displayed. Selecting an inverse PAL causes an inverse or negative image to be displayed. By experimenting with the available palettes more detail may be visualized.

The Windows Menu

This group of menu items controls the display of certain components within RADWORKS.

Tools

This command allows you to display or hide the *Tools Palette*. A check will appear next to the selection. You can toggle between displaying or hiding the palette.

Results

This command allows you to display or hide the *Analysis Results* window. A check will appear next to the selection. You can toggle between displaying or hiding the palette.

Clear

This command allows you to clear all windows that are displayed on the screen. This command can also be used to abort or escape any procedure within RADWORKS.

The Help Menu

About RADWORKS

This command allows you to display the *About* box. The *About* box displays the copyright notice and the current version number of the program.

Help??

This command allows you to access the extensive on-line help program. Refer to you *Microsoft Windows Manual* for instruction on using the Help program.

RADWORKS Tools