VersaDoc™ Imaging System

User's Manual

for Catalog Numbers
1708010, 1708011, 1708030
1708031, 1708140, 1708141, 1708050, 1708051

Manual Part Number 4000183 Rev. E

Welcome

Dear Customer,

On behalf of Bio-Rad Laboratories, we would like to thank you for investing in the VersaDoc™ Imaging System and we are sure that it will provide you with many years of high quality imaging.

One of the best ways to familiarize yourself with the capabilities of your new VersaDoc system is to read this manual. In it, you will learn how to set up the system and operate all hardware components. It is also recommended that you read the accompanying software manual to familiarize yourself with general acquisition functions and data analysis. After reading this manual, please keep it close to your system so that it can be conveniently referred to.

Your VersaDoc system is protected by a comprehensive instrument warranty agreement. Please read this manual thoroughly, so that you fully understand the coverage provided and are aware of your rights and responsibilities. One of the responsibilities of system ownership is regular maintenance. Following the maintenance instructions provided with this manual will help to keep your system and peripherals functioning optimally and will protect your investment. Please also keep in mind that Bio-Rad offers a range of comprehensive service agreements that can be tailored to meet your specific needs.

Bio-Rad Laboratories is dedicated to your total satisfaction and would be pleased to answer any questions that you may have.

How to Contact Bio-Rad Laboratories

In the United States you can reach Bio-Rad Laboratories at the following numbers:

For general information
Toll free: 1-800- 4BIORAD
1-800-424-6723
Fax: 1-510-741-5802
email: lsg.techserv.us@bio-rad.com

For service or technical assistance
Toll free: 1-800-424-6723
Fax: 1-510-741-5802

For information concerning Bio-Rad Laboratories and its products, visit our Worldwide Web site at **http://www.bio-rad.com**

Table of Contents

Section 1
General Information

1.1 About this Manual

This manual provides instructions for installing, operating and maintaining the VersaDoc™ Imaging System. This manual uses certain conventions to facilitate understanding of the text material and to assist operators in using the VersaDoc™ system.

Conventions

Left and right sides of the instrument are as viewed from the front (operator's position) unless otherwise stated.

Commands that are typed in from the keyboard are referred to as <xxxx>, and when you are expected to use the mouse pointer to activate a button it will be referred to as CLICK xxxx. When you are expected to click and drag the mouse to a certain item it will be referred to as SELECT xxxx.

Notes, Cautions and Warnings

Notes, cautions and warnings are used to highlight certain operating procedures and recommendations.

A note indicates a special procedure, an exception to normal operation or something else of specific interest to the reader. Notes are preceded by the word "*Note*" in italics.

A caution precedes an operational step that could damage the instrument or destroy data unless the operator takes certain precautions. Cautions are located in the main text, are preceded by a **Caution:** statement and are accompanied by a "Caution Symbol" in the left margin.

A warning precedes an operating procedure that could cause injury to the operator if not followed correctly. Warnings are located in the main text, are preceded by a **Warning:** statement and are accompanied by a "Warning Symbol" in the left margin.

1.2 Safety Information

This instrument is meant for Laboratory use only and should not be used in any other way or manner that is not specified in this Manual.

Your safety and the safety of others are very important to us. To help you make informed decisions about safety, we have provided comprehensive operating procedures and safety information in this manual and on labels affixed to instrumentation. This information will alert you to any potential hazards. It is the user's responsibility to take time and read and understand the Safety Information and put it to the best use for a Safe operation of the system.

1.2.1 General Cautions

Caution: Ensure that all of the systems ventilation openings are free of interference. Excessive heat build up in the instrument may effect performance or cause operational failure.

Caution: With the exception of cleaning or replacing light bulbs, refer all servicing to qualified Bio-Rad personnel or their agents. If you experience technical difficulties with the instrument contact Bio-Rad to schedule a service appointment. The instrument should not be modified or altered in any way. Alteration of this instrument voids the manufacturer's warranty and may create a potential safety hazard for the user.

Caution: Bio-Rad is not responsible for any injury or damage caused by the use of this instrument for purposes other than that for which it is intended or by the modification of this instrument when not performed by qualified Bio-Rad personnel or an authorized agent.

1.2.2 General Warnings

Warning: This instrument must be connected to an appropriate AC voltage outlet that is properly grounded.

Warning: There are hazardous voltages inside the rear panel of the* VersaDoc™*. Do not remove the cover to the Electronics back panel when the instrument is connected to AC power.

Warning: Do not defeat any instrument interlocks; they are designed to prevent user injury.

Warning: The* VersaDoc™ *weighs 44 kg (96 lbs.) depending on which camera you have purchased. Exercise caution when lifting the instrument. It is recommended that at least two persons lift the instrument. Lift the instrument by the bottom plate. Never lift the instrument by opening at the top which is the plastic camera mounting plate because this will cause light leaks and damage the camera mounting plate.

1.2.3 Power Safety Information

The VersaDoc contains high voltage circuits. The user must disconnect the power cord prior to opening the rear access panel, or removing the lamp modules for bulb replacement.

WARNING: It is mandatory for the users to power down the system and disconnect the AC mains from the unit before performing any disassembly or repair to the instrument.

The VersaDoc system is designed and certified to meet EN61010 Safety and EN61326 +A1 Electromagnetic Compliance requirements, which are internationally accepted safety standards. Certified products are safe to use when operated in accordance with the instruction manual. This safety certification does not extend to uncertified equipment or accessories, even when connected to the VersaDoc system.

Figure 1.1 shows the serial number certification label, which is found on the rear panel of the VersaDoc system. This label provides manufacturing data and safety compliance information about the instrument.

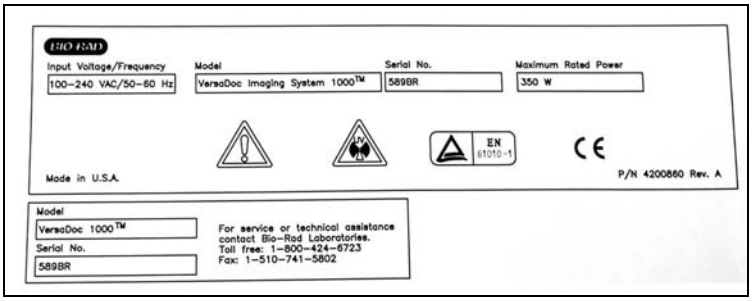


Figure 1.1

For easy customer access the instrument serial number information located at two places in your system.

1. On the rear of the instrument
2. Inside the main door

1.2.4 UV Safety Information

This instrument uses a powerful source of UV radiation and may cause damage to unprotected eyes and skin. The VersaDoc provides safety interlocks on both the main door and the sliding UV transilluminator module to protect the user from accidental UV exposure. A plastic UV shield is provided for convenience, however, it may not be adequate to protect you from accidental UV exposure. You must use additional personal UV protection like UV protective eyeglasses, gowns, gloves etc.

Warning: Do not remove the rear access panel when power is supplied to the instrument or defeat the UV safety interlock. Attempting to operate the unit with the cover removed may damage the instrument and expose the operator to UV radiation.

Warning: Use of controls or adjustments, or performance of procedures other than those specified herein may result in exposure to hazardous UV radiation.

How to Contact Bio-Rad Laboratories

In the United States you can reach Bio-Rad Laboratories at the following numbers:

For general information
Toll free: 1-800- 4BIORAD
1-800-424-6723
Fax: 1-510-741-5802
email: lsg.techserv.us@bio-rad.com

For service or technical support
Toll free: 1-800-424-6723
Fax: 1-510-741-5802

For information concerning Bio-Rad Laboratories and its products, visit our Worldwide Web site at **http://www.bio-rad.com**

Section 2
Introduction

2.1 VersaDoc™ System Capabilities

The VersaDoc Imaging System is a quantitative imaging system for capturing high resolution digital images from single and multi-color fluorescence, chemiluminescence, chemifluorescence and colorimetric samples. Using cooled CCD technology in combination with a unique ultraviolet illumination mechanism and a highly efficient optical design, the VersaDoc offers researchers the sensitivity, uniformity, flexibility and dynamic range they require for the analysis of electrophoretic and microplate samples, among others. With direct imaging and automated acquisition, this system can increase laboratory throughput and eliminate the need for chemiluminescent detection using x-ray film.

Flexible Design:
The VersaDoc Imaging system has a very flexible design. The light tight enclosure can accommodate any of the offered camera modules. The user has the option to upgrade to any of the four standard models. The standard VersaDoc comes with every feature included. The VersaDoc 1000L, 3000L, 4000L and 5000L come with light tight enclosure, camera and filter wheel. The user has the option to choose a variety of illumination modules to fit their needs. This allows customization of the system by selecting the type of camera and the type of illumination you need. Additionally, all systems can be upgraded.

2.2 System Description

Figure. 2.1 The VersaDoc™ Imaging System.

The VersaDoc combines several key components into a unique, powerful and fully integrated image analysis system:

(1) Cooled CCD Technology
The VersaDoc system uses cooled CCD technology for image capture and improves image quality by reducing background noise and enhancing the signal to noise ratio. This is particularly important for low light chemiluminescence and fluorescence applications.

(2) Unique Trans and Epi-illumination Source
The VersaDoc system incorporates unique trans and epi-illumination modules for both UV and white light excitation. This provides high-sensitivity imaging of a variety of fluorescent, chemifluorescent and colorimetric samples. The broad bandwidth UV excitation (290-365 nm) supports the detection of a broad range of fluorescent dyes in contrast to the limited number of dyes, which may be excited using a single wavelength visible laser.

(3) Interchangeable Lens
The VersaDoc is supplied with two standard lenses. One zoom and one 50 mm mono-focal.

Depending upon which VersaDoc system has been purchased, either a 20-40 mm or the 28-80 mm zoom lens will be included. This zoom lens is ideal for most fluorescence and colorimetric applications.

The 50 mm, f1.4 fixed lens has a high light collection efficiency and is the lens recommended for all chemiluminescence applications.

You may purchase an optional 105 mm lens that can be used for imaging small samples at high resolution. The VersaDoc will accommodate most Nikon f-mount lenses with a minimum operating distance (MOD) of 0.65 m.

It is highly recommended that lenses be purchased through Bio-Rad, as some Nikon lenses require modification before they can be inserted into the filter wheel housing. Use of an unmodified lens may result in damage to either the instrument or lens mount.

(4) Emission Filters
An eight-position emission filter wheel has been incorporated into the optical design of the VersaDoc to permit multi-color image discrimination and the detection of many different fluorescent dyes. The VersaDoc is supplied with four standard filters. Filter #1 (520LP-Long Pass) is optimized for single color detection of ethidium bromide, DNAStar, SYBR® Green, SYBR® Gold, Radiant® Red, SYPRO® Orange, SYPRO® Red, SYPRO® Ruby, Texas Red®, Cy2, Cy3 and most fluorescein and rhodamine derivatives. Filters #2 (530BP60) and #3 (610LP) are for the independent detection of green (fluorescein) and red (Texas Red) fluorescence in multiple colored samples. These filters effectively support multiplexing analysis for increased sample throughput and more accurate molecular weight determination. Filter #4 is a clear filter that can be used for white light applications. Filter positions (Filter #6 #7 & #8) are available to users for the installation of application specific custom filters. Filter position #5 should be left vacant for the optimized collection of chemiluminescent samples.

(5) Quantity One® 1-D Analysis Software
The Quantity One software permits user-friendly control of the VersaDoc Imaging System and accurate analysis of the captured image or data. Quantity One is designed for operation in a Windows or Macintosh environment and supports fully automated application-based image acquisition.

NOTE: Windows NT does not support USB therefore all WINDOWS NT based systems must use a Serial Communications port.

The Quantity One package allows substantial flexibility in the presentation of captured images and provides many tools for data analysis. These include molecular weight determination, automated lane and band finding, accurate concentration analysis, VNTR and differential display studies and colony counting. Please refer to the Quantity One instruction manual for a full description of this software package.

2.3 Mechanical Description

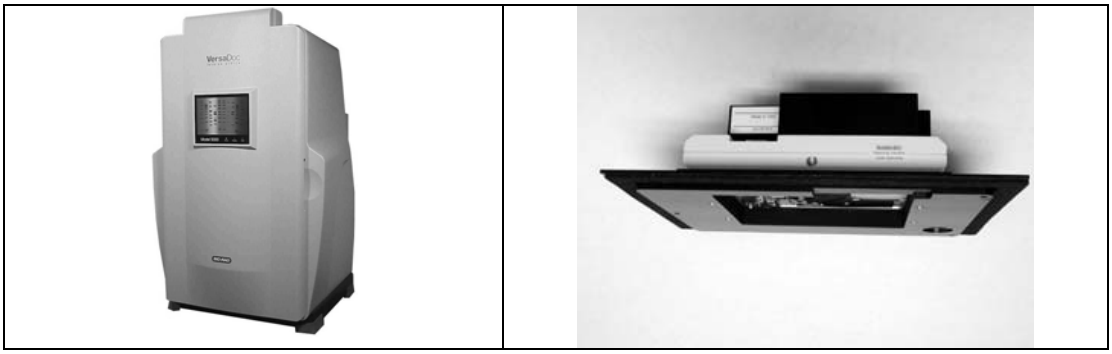
The VersaDoc Imaging System is a modular system and it consists of the following main hardware components. See figure 2.2.

1. The light tight enclosure, which integrates the sliding UV transillumination module, two epi-illumination modules, chemiluminescence tray, access to the filter wheel, lenses and all the electronics needed for controlling the lights and filterwheel.

2. The camera module, which integrates the cooled CCD camera.

3. Depending on which model of VersaDoc you have (1000, 3000, 4000 or 5000), you will have the corresponding camera module but the light tight enclosure will be the same.

4. VersaDoc is also available in a "LITE" versions (1000L, 3000L, 4000L or 5000L) where no illumination sources are included. The unit is offered with a light tight enclosure and a camera with a filter wheel. All illumination modules, lenses, and filters are customized for your specific needs.



Light Tight Enclosure **Camera Module**

Figure. 2.2. Components of the VersaDoc™ system.

2.4 Overview of the Imaging Process

The acquisition and analysis of image data using VersaDoc technology is a simple five-part process.

Step 1: Samples to be imaged are placed on the transilluminator module.

Step 2: The appropriate imaging method is selected in the VersaDoc acquisition window of Quantity One.

Step 3: The sample is aligned using the positioning template in the Quantity One acquisition window.

Step 4: If required, the imaging lens is zoomed and focused onto the sample to obtain the highest quality image.

Step 5: The desired collection time for an aperture setting of the lens is selected and the image is captured. In cases where Flat Fielding is selected, a reference image is also acquired (see below). Once the sample image is collected and saved, this Image can then be reviewed and analyzed using the appropriate tools bundled in the Bio-Rad software package. Please refer to the software manual for further details.

2.5 Illumination Flat Fielding:

A uniform images are essential for quantitative analysis. The VersaDoc Imaging System features a proprietary algorithm that allows elimination of image non-uniformities caused by lens, illumination source. Optimization of the image uniformity is made possible via the Illumination Flat Fielding function in the image acquisition portion of the software.

NOTE: This feature is only for imaging applications that utilize a UV or white light transillumination source.

Illumination Flat Fielding when using the UV transilluminator:

The software takes an initial image and then prompts the user to remove the sample and to place the VersaDoc Fluorescent Reference Plate provided with your system on the UV Transilluminator.

Illumination Flat Fielding when using the white light conversion screen:

The software will prompt the user at the beginning of the image acquisition to place the *VersaDoc white light conversion screen* on the UV transilluminator. The sample is placed on the conversion screen; an initial image is taken. The software then prompts the user to remove the sample from the VersaDoc white light conversion screen and then finishes image acquisition.

Section 3

System Installation

3.1 Operating Requirements

3.1.1 System Location

The VersaDoc system should be located in an area that is free of excessive dust or moisture, strong magnetic fields or ionizing radiation. It is also highly recommended that the ambient temperature be stable and within the range of 10°C to 28°C (21°C is optimal) and that the relative humidity not exceed 70%, non-condensing.

Warning: Care should be taken when lifting and moving the VersaDoc system to avoid personal injury. It is recommended that two people, one on each side of the instrument lift the VersaDoc enclosure from the bottom.

The VersaDoc should be placed on a level bench top with a minimum depth of 70 cm and a height clearance of 180 cm, where there is adequate ventilation for the system's cooling fans to operate. The system's feet allow enough clearance for easy removal of your hands from underneath the instrument once the system has been placed on the bench.

In placing the VersaDoc, users should also allow for easy access to the main power switch, which is located on the lower right hand side of the system's rear panel. The instrument should be placed where there is adequate room to insert the samples into the front of the enclosure and where it can be easily connected to the host computer. The maximum distance between the host computer and the instrument should be two meters. (instrument is supplied with cables long enough for such distances).

Note: The host computer should be located at a workstation that minimizes operator fatigue.

3.1.2 Power Requirements

The VersaDoc system and its host computer should be connected to a stable grounded power outlet on a circuit free of electrical noise. In addition, a high quality electrical surge suppressor/line filter with a 10 Amp or higher rating should be used to avoid damage from AC fluctuations. Only a grounded 3-pin power cord should be used to connect power.

The VersaDoc is designed for operation at an input voltage of 110-240 VAC, at 50-60 Hz.

Deviation from these operating voltages can lead to slower cooling and heating process with your deeply cooled CCD camera.

3.1.3 Host Computer Recommendations

The VersaDoc system is capable of producing large image files of high resolution to easily handle such large files. A powerful computer is required.

Please refer to your software manual for detailed host computer system and software requirements. If the computer is not purchased from Bio-Rad, systems compatibility is the responsibility of the user. Please check with your local Bio-Rad office regarding compatibility for your specific brand of computer.

3.2 System Setup

There are 3 main phases in the installation of the VersaDoc system:

1. The components are delivered to your laboratory.

2. The system is installed by a trained Bio-Rad representative.

3. Users are trained on the operation of the VersaDoc and accompanying peripherals and software by a Bio-Rad representative.

The following steps for setup of the VersaDoc requires approximately two hours.

Prepare the VersaDoc hardware:

1. Unpack components
2. Perform shipping check
3. Install the camera module
4. Install the transilluminator module and epi-illumination modules
5. Connect system cables
6. Install emission filters
7. Install lens
8. Connect electrical and host computer communication cables
9. Power up the instrument

Each of these steps is detailed in the following sections.

3.2.1 Unpacking the VersaDoc System Components

With the exception of operating software, VersaDoc components are shipped in pallet-supported boxes. Unpack the components by following the steps listed below:

1. Cut the two steel straps supporting the main instrument package.

2. Remove the top cardboard lid. Remove other packaging materials and secondary boxes from the top.

3. Slide the outer sleeve off the box vertically. The VersaDoc enclosure can be found within the box.

4. With the assistance of a helper, remove the VersaDoc from the box. Grip the bottom of the enclosure on both sides (do not lift the instrument by the front door or electronics area) and place it on the floor for the next step in the setup procedure. When placing the enclosure allow clear access to the rear panel for connection of the appropriate cables.

Warning: Get a helper; a single person should not attempt to lift the VersaDoc.

Warning: To avoid back injury, always bend your knees and keep a straight back when lifting heavy objects.

Caution: Do not supply power to the instrument until the VersaDoc system has been set up using the following installation procedures.

5. Open all the other boxes and carefully remove all the items.

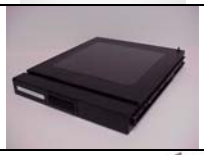
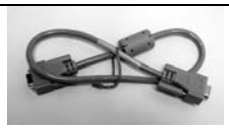
6. Perform a shipping check to confirm that the system has been supplied complete.

3.2.2 Shipping Check

During the unpacking process inspect all shipping containers to ensure that you have received all ordered items and that no boxes are damaged. If items are either missing or damaged, this should be noted at the time of installation so that it can be immediately reported to both the shipping company and Bio-Rad manufacturing.

The Quantity One acquisition and analysis software is supplied in a separate box.

The VersaDoc hardware should arrive complete with the following items:

Quantity	Item	Photo
1	VersaDoc light tight enclosure	
1	VersaDoc camera module (Shown Model 1000 camera module, model 3000, 4000 and 5000 are shown later in this section)	
1	VersaDoc transilluminator module (already installed inside the light tight enclosure)	
1	Pair of UV epiilluminator modules	
1	Pair of White epi illuminator Modules	
1	Sample/chemi tray	
1	Camera power cable (VersaDoc 1000 and 4000 only) Or Fan assembly power cable (VersaDoc 5000 only)	
1	Camera AIA interface cable	
1	Serial/USB communication cable	

Quantity	Item
1	Sample Holder Kit
1	VersaDoc Fluorescent Reference Plate
1	PCI Digitizing Card
1	White Light Conversion Screen (Optional)
5	Filters (530DF70, 520LP, 610LP, Clear, 660Cutoff)
2	Lenses (20-40mm Zoom, 50mm Fixed)*
2	Lenses (28-80mm Zoom, 50mm Fixed)* *
1	Lens and Filter Cleaning Kit
1	Focusing Target
1	Power Cord
1	Instruction Manual
1	Camera Specification File (CD)
1	58mm-52mm Step Down Ring**
1	Warranty Card

**** These are provided with VersaDoc 1000 model only***
***** These are provided with VersaDoc 3000, 4000 and 5000 models***

NOTE: Please retain all packaging materials for future transport of the VersaDoc system. Additional charges will be assessed if packaging is not available for instrument warranty shipping.

3.2.3 Coupling the Camera Module to the enclosure*:*

This applies to all camera modules (VersaDoc 1000, 3000, 4000 and 5000). Follow the procedure outlined below to mount the camera module to the enclosure.

1. Leave the enclosure on the floor for easy access to the camera mount.

2. Correctly position the camera module on the camera mount located at the top of the enclosure such that the three holes in the camera module adapter plate will match the three standoffs located in the filter wheel assembly in the camera mounting plate.

NOTE: The camera module should sit completely flat and square on the surface of the Enclosure to avoid light leaks.

3. Using the 3 cap-head screws and the 9/64” hex key (included), secure the camera adapter plate to the standoffs. Carefully tighten the screws evenly to form proper light seal. See figure 3.1 for details.

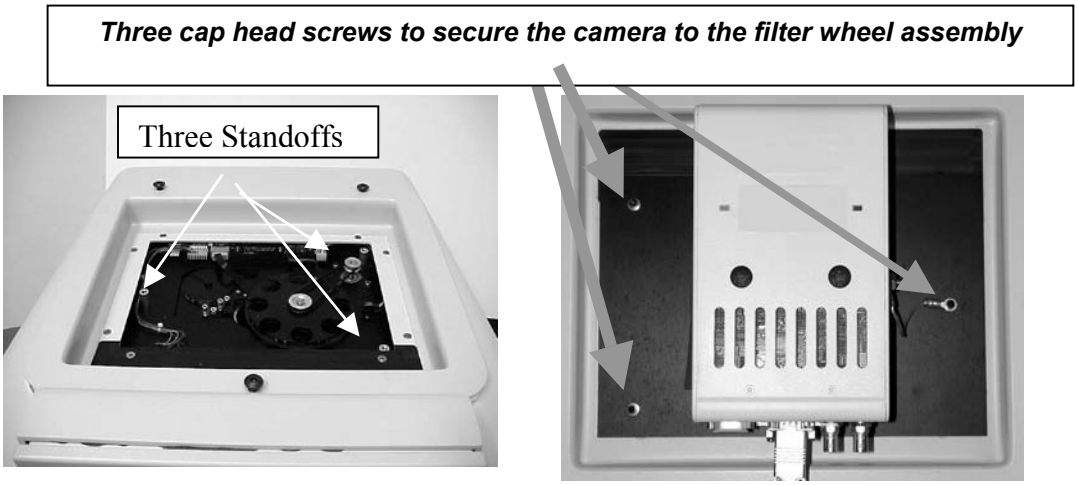


Figure 3.1.

3.2.4 Installing VersaDoc 1000, 3000 ,4000.

Connecting the Cables to the Camera Module:

This procedure applies to the Versa Doc 1000 and 3000 and 4000 systems.

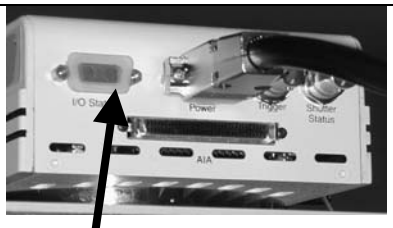
Connecting the camera power cable:

Camera power cord has a DIN connector on each end. The cable with a 9- pin DIN connector is for the VersaDoc 1000 and 4000 cameras and the cable with a 15-pin DIN for the VersaDoc 3000. See Figure 3.2

NOTE: VersaDoc 3000 systems with Enclosures that are serial number XXXBR 300 or greater come with a separate power supply for the camera . This power supply already includes a power cable for the VersaDoc 3000 camera. VersaDoc 3000 systems

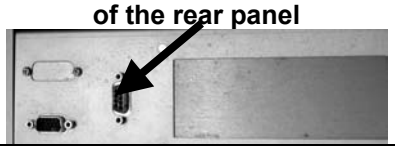
Connect this cable between the camera power socket on the camera module and the enclosure. Picture shown below is for enclosures with serial numbers **below XXXBR0300:**

VersaDoc 1000 and 4000 Camera Power Connector

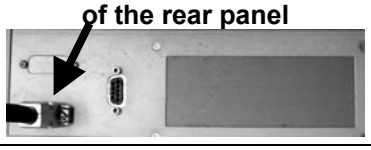


VersaDoc 3000 Camera Power connector

9 pin camera power connector on top side of the rear panel



15 pin camera power connector on top side of the rear panel



If your enclosure has a serial number **above XXXBR300** then connection should be made per pictures shown below:

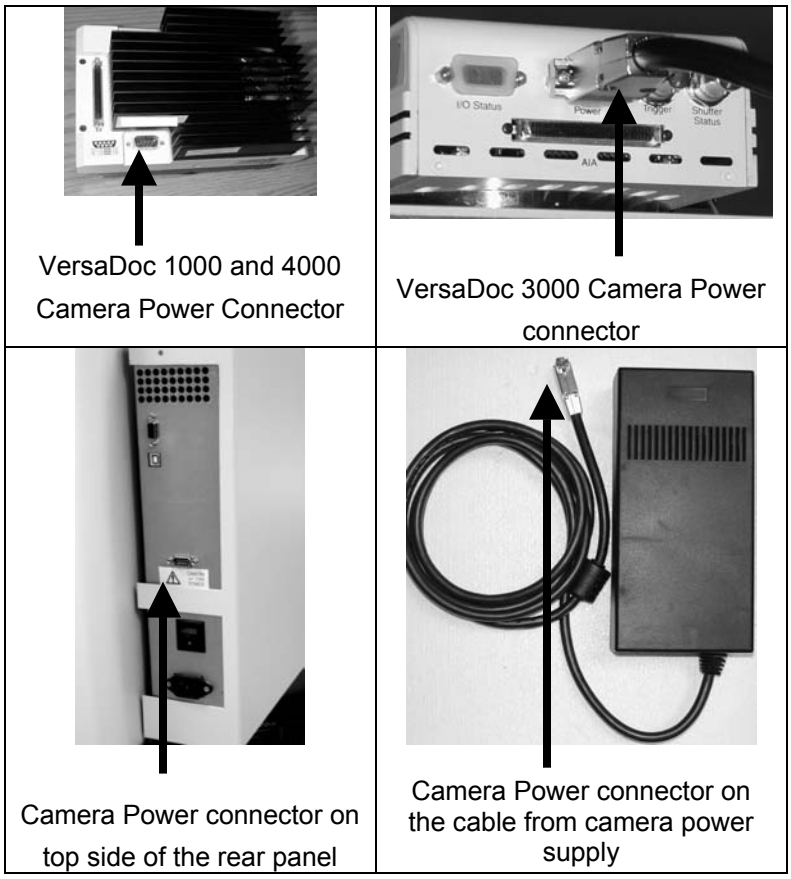


Figure 3.2

NOTE: The VersaDoc 4000 camera must be connected to the same power port as the VersaDoc 1000.

Connecting the AIA CABLE:

For VersaDoc 1000 and 3000 and 4000 only:

1. Connect the AIA cable (Part #800-0247) to the AIA port on the camera (See Figure 3.4). Push the cable to the connector such that it clicks and snaps in place properly.

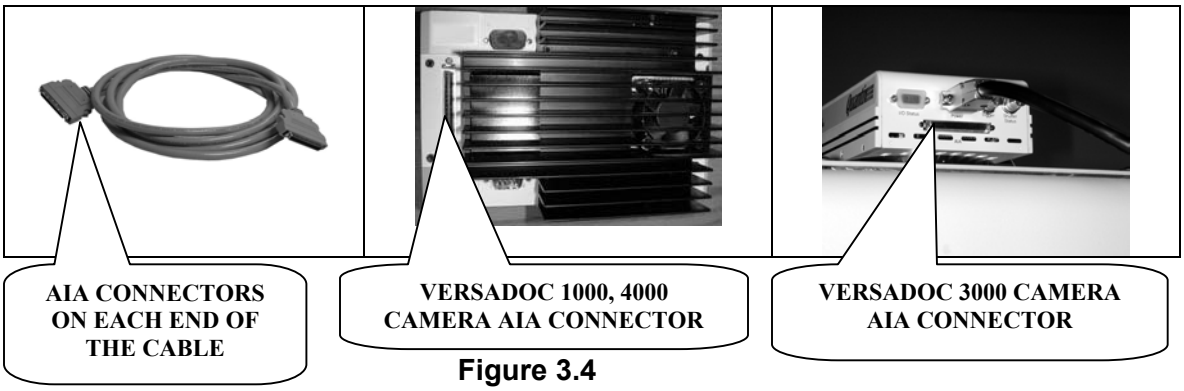


Figure 3.4

2. The other end of the AIA cable will be connected to the PCI digitizing card that will be installed in the PC after software installation as shown later in this procedure.

NOTE: The steps describing the installation procedure for the PCI digitizing card follows later in this procedure.

3.2.5 Installing VersaDoc 5000

Connecting the cables to the camera module:

1. The VersaDoc 5000 camera module comes with a camera controller unit (CEU) and a controller cable. See figure 3.6 below :

Figure 3.6

2. Couple the VersaDoc 5000 camera module to the enclosure as shown in the section 3.2.3 above. ***See Figure 3.1 for details***.

3. Next connect the CEU to the camera.

Caution: The default voltage setting on the camera power supply module is 120 VAC. You must follow the instructions below to make sure proper voltage selection is made and fuse is used for you AC voltage environment.

Caution: The VersaDoc 5000 camera module has a "BLUE" plug installed on the connector on the camera. This plug must not be removed until the module is installed to the enclosure and the camera controller unit is ready to be connected to the Camera.

Setting the VersaDoc 5000 System Power Supply Voltage (If required):

1. Familiarize yourself with the camera controller unit [CEU]. See Figures 3.7a, b and c below:

Figure 3.7a

Figure 3.7b

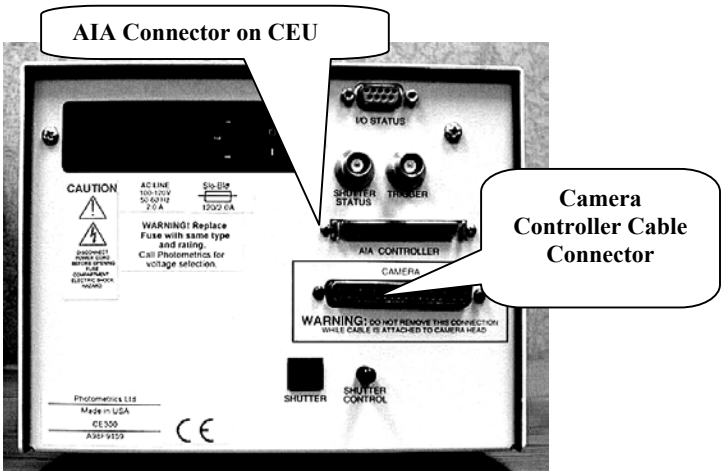


Figure 3.7c

2. A small white tab on the AC inlet located on the rear panel indicates the voltage setting on your camera controller unit. See Figure 3.8

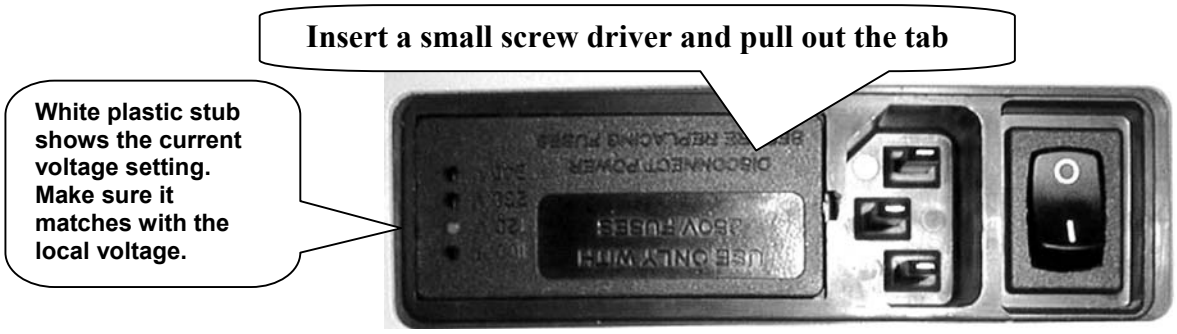


Figure 3.8

3. Pull out the small tab near the AC inlet using a small screwdriver. See Figure 3.8

4. The TAB holds a fuse completely remove it. This will expose a tiny PCB located in a tiny slot as shown in Figure 3.9

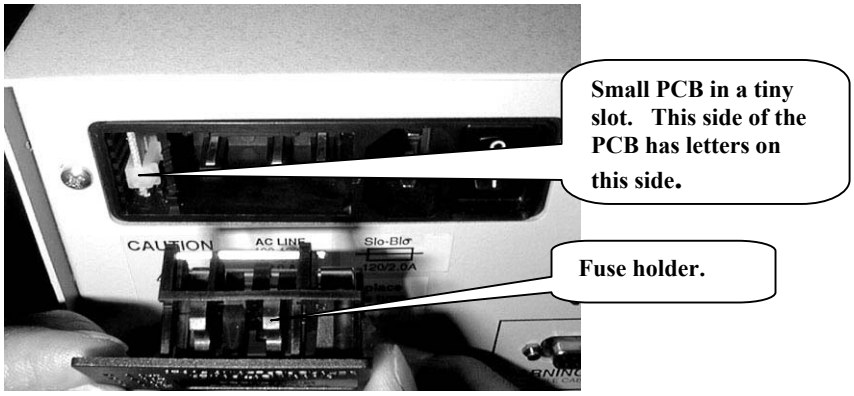
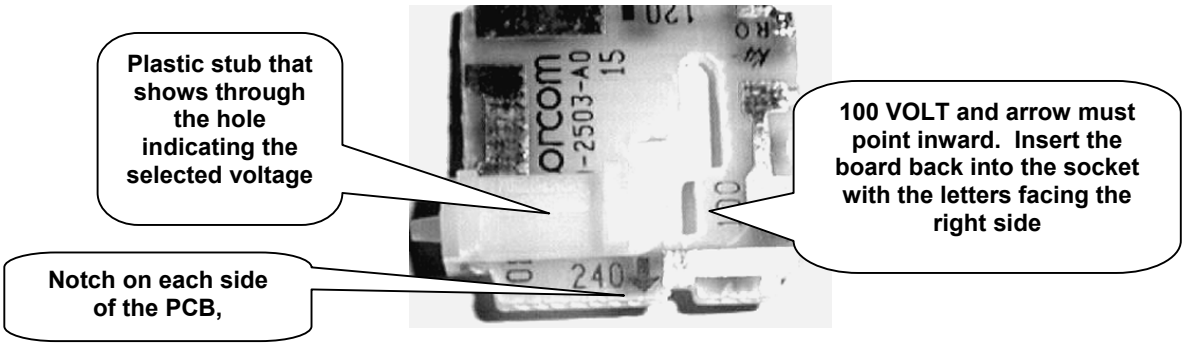


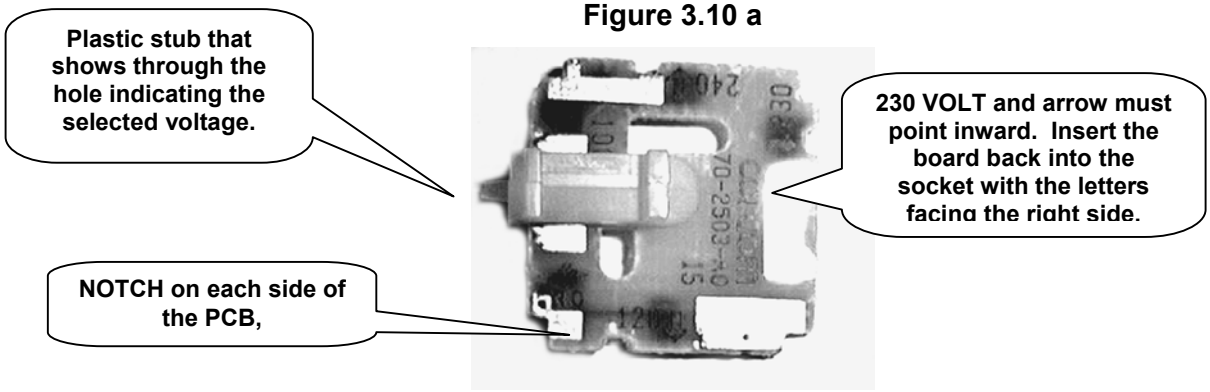
Figure 3.9

5. Using the plastic stub on the PCB select the orientation of the board so that the desired voltage numbers and arrow point towards the socket for the board. The tab on the inside surface of the stub must match with the notch on the tiny PCB See Figure 3.10a and 3.10b:



Setting for 100 volt operation

Figure 3.10 a



230 Volt setting

Figure 3.10b

6. Now reinstall the tiny PCB back into it's socket such that the numbers on it face towards the right side (towards the Fuse holder inlet)

7. Next remove the Phillips screw that holds the fuse holder and turn the holder around so that the two 1 amp fuses face towards the socket. See Figure 3.11

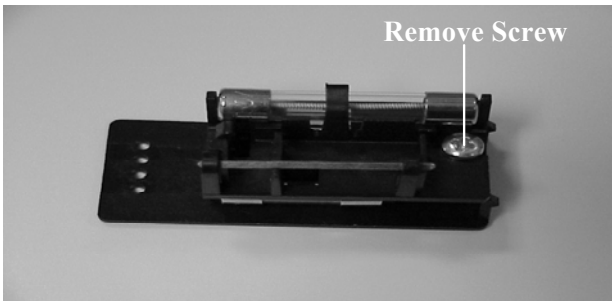


Figure 3.11

8. Push the tab until it locks in its socket.

9. Check again to make sure that the plastic stub indicates the desired voltage selection

Connecting the VersaDoc 5000 Camera and CEU Cables:

1. Connect the AIA cable to the connector labeled AIA on the CEU connector panel. The other end of this cable will be connected to the PCI digitizing card in your PC.
2. Remove the “BLUE” shorting plug from the camera and connect the camera control cable between the camera and the CEU. See figure 3.12

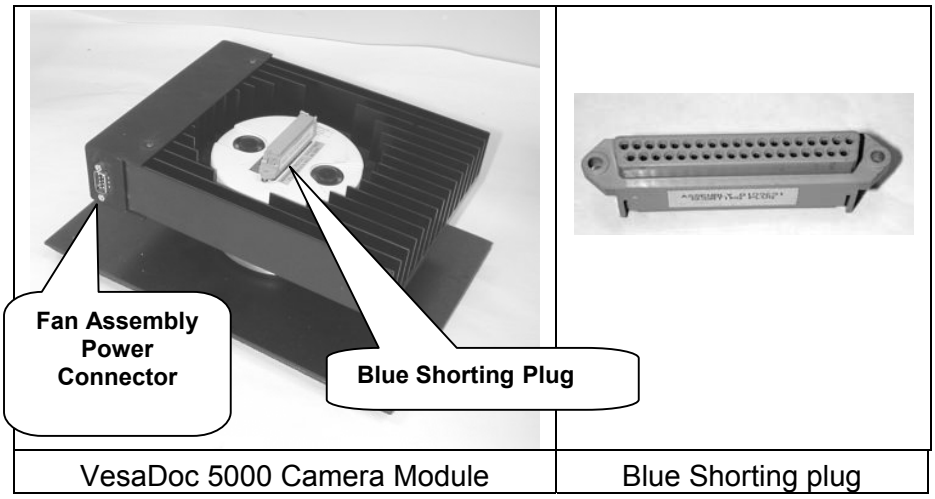


Figure 3.12

3. Connect the AC power cord to the AC inlet on the CEU but do not power up the CEU yet.
4. **For units serial number below XXXBR300:** Connect the fan power cable from the fan assembly (5000 models only) to the DB9 power connector located at the top surface of the electronics module. See picture 3.13A
5. **For units with serial number xxxBR300 or higher:** Connect the fan power cable from the fan assembly (5000 models only) to the DB9 power connector located on the side of the electronics module. Once connected, the system cable

connections will look similar to the ones shown in Figure 3.13 A or B depending on th eserial number of the enclosure you may have.

Figure 3.13

3.2.6 Installing the Epi modules:

1. Remove the access panel mounted on the ballast panel by unthreading the two thumbscrews.

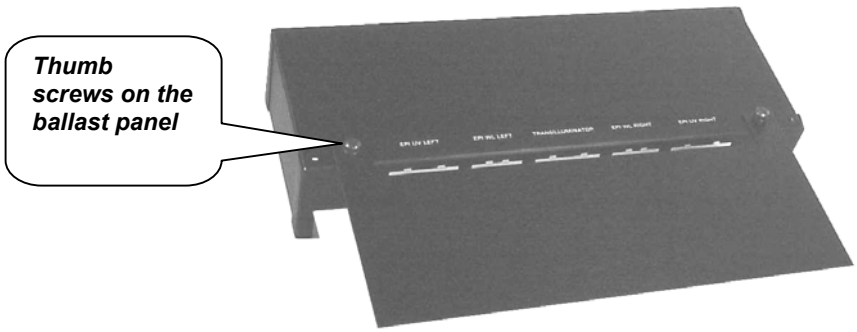


Figure 3.14a

2. If not connected already, connect the transilluminator cable to the connector labeled “UV TRANSILLUMINATOR” located on the ballast panel on interior rear wall of the enclosure.

3. To install the epi UV and white modules first install the epi UV module by inserting the two prongs on its end plate to the slots located at the back wall.

4. Secure the module using the captive screw by lining up the front side of the module with the hole located in the wall of the instrument. (See Figure 3.14b).

5. Now connect the cable from the epi UV module to the appropriate connector on the ballast assembly.

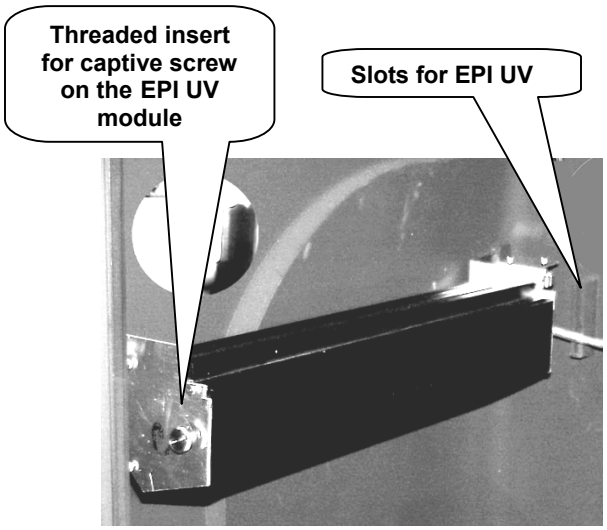


Figure 3.14b

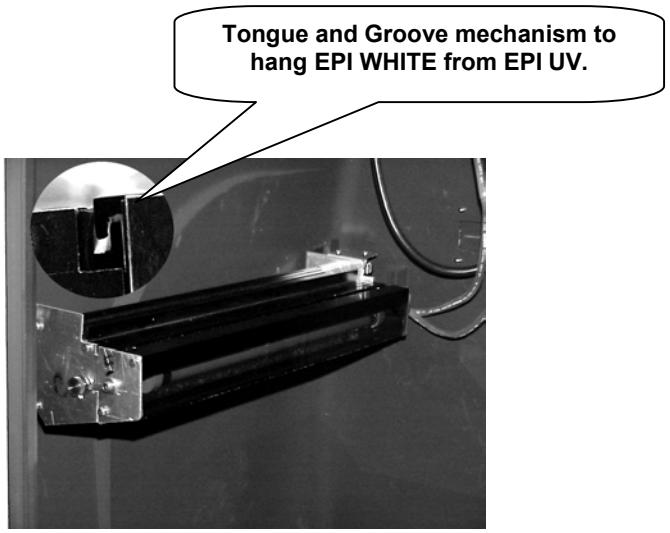


Figure 3.14c

6. Next attach the epi white module to the epi UV module by locking in the tongue and groove located at the outer top edges of each module. (See figure 3.14c)
7. Now secure the epi white module to the epi UV module using the latch and screw mechanism located at the front plate of the modules. See Figure 3.15

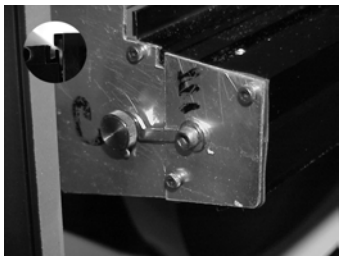


Figure 3.15

8. Next connect the cable from the epi white module to the appropriate connector on the ballast assembly.

9. Re-install the access panel to the ballast panel.

NOTE: The plugs for each illumination module are keyed and cannot be interchanged. Each plug will snap together only to the appropriate socket.

3.2.7 Electrical and Communication Connections

Power

The power entry module of the VersaDoc system is configured for operation at 100/120 VAC, 60 Hz or 220-260 VAC, 50 Hz. After checking that the system's power switch is turned off, insert an approved power cord into the power entry module located on the bottom right of rear panel of the unit. See Figure 3.16

Warning: This instrument must be connected to an appropriate AC voltage mains outlet that is properly grounded.

Warning: There are hazardous voltages inside the rear panel of the VersaDoc. Do not remove the cover to the electronics back panel when the instrument is connected to AC power.

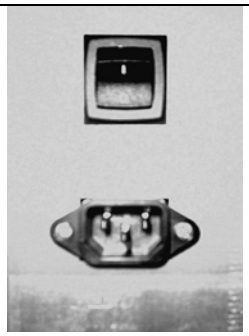
	
Power entry module at the bottom right of the rear panel	**Power entry module**

Figure 3.16

VersaDoc Connections:

The VersaDoc is connected to the host computer via a Serial or USB interface and an AIA interface.

One each of the Serial and USB port is located on the rear right side of the unit. Use the supplied USB or Serial Cable to connect the PC to the VersaDoc.

Caution: To prevent damage to the hardware, all instruments must be turned off before attempting to connect (or disconnect) the unit to the host computer.

Upon insertion of the Serial or USB cable into the VersaDoc, the Serial or USB port the PC will automatically select operation and sense the presence of VersaDoc.

NOTE: Do not turn ON the power to the VersaDoc (and CEU in case of VersaDoc 5000) yet!

Connecting the AIA Cable to the Computer:

To do this, two things must happen:

i. The software must be installation on the PC which will control this system

ii. The PCI Digitizing card must be installed into the PC where the AIA cable is to be connected.

Software Installation:

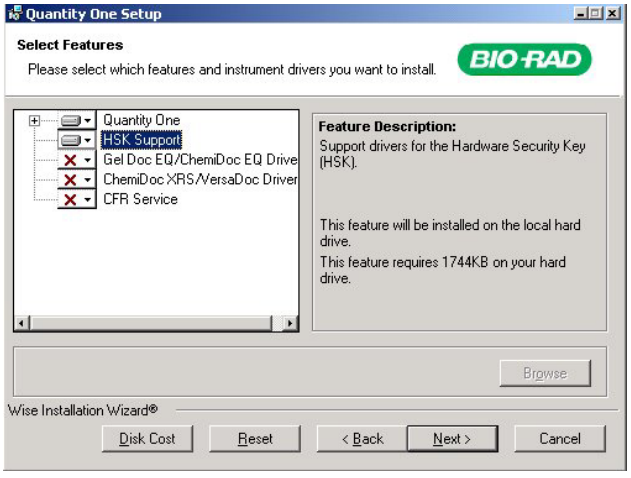
Please follow the instructions below to install the PC or Mac software for VersaDoc system:

NOTE: Do not install the PCI card into the PC yet. First install the drivers as shown below and then install the PCI Card.

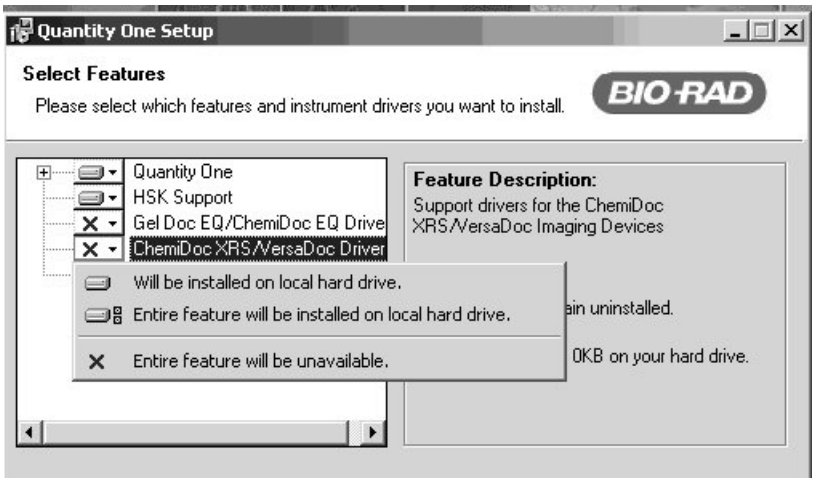
PC: based VersaDoc systems:

a. Insert **"The Discovery Series"** software CD into the CD ROM drive of the PC. It will go into AUTO RUN mode and the following window will open:

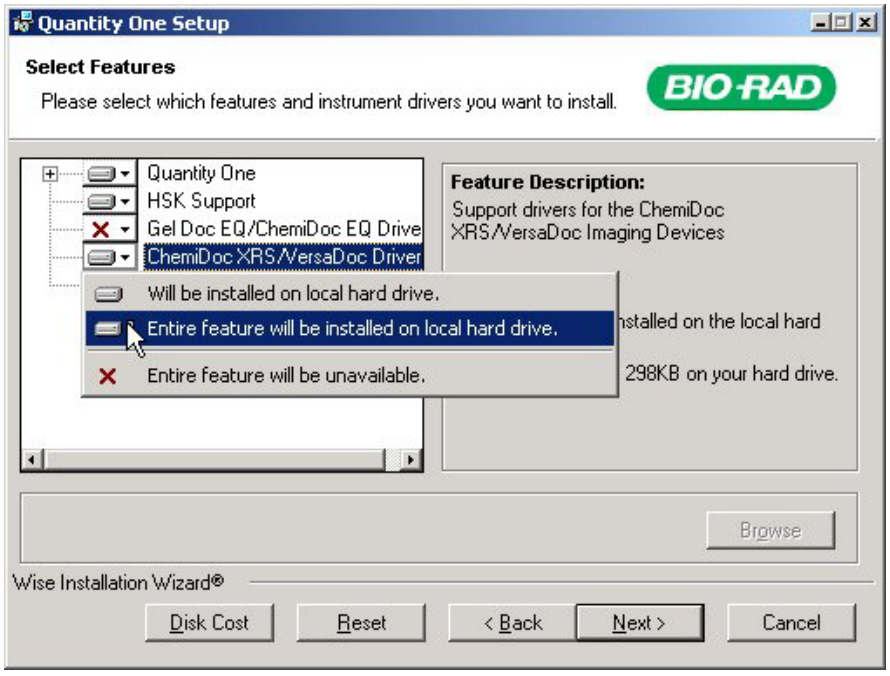
b. Click on **"NEXT"** the following window will open:



c. Click on the arrow next to ChemiDoc XRS/VersaDoc drivers to get installer options. See picture below:



d. If you are installing the drivers on local drive select appropriate option by scrolling down as shown in the picture below. Click on **"NEXT":**



e. Drivers will be copied to the appropriate location on your hard drive and at the completion the following window will appear.

f. Click on “FINISH” and the system will shut down. At this time, install the PCI card into the system and REBOOT the system.

g. As the system re-boots and Windows 2000/XP starts it will find the PCI card and go through a “FOUND NEW HARDWARE” installation routine and find the drivers that were just installed.

NOTE: In case the PCI card was installed before the software then go to section 6 for software troubleshooting. In case of the MAC systems it does not matter if the PCI Card is installed before or after installing the software and drivers.

Mac based VersaDoc systems

NOTE: This procedure applies to both Mac OS 9.xx and OS 10.xx based systems.

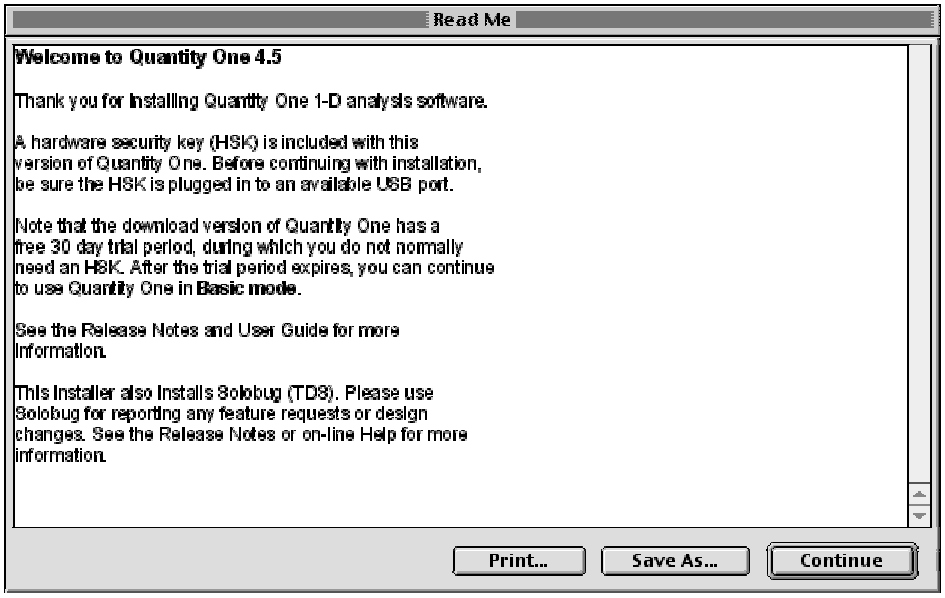
h. Insert **“The Discovery Series”** software CD into the CD ROM drive of the MAC. Installer will open and offer choices.

i. Choose custom install from the pulldown menu in this window and click on "INSTALL" The following window will open.

j. Depending upon the Imaging device you are installing, click on the desired Imager you want to install and then click on "Install". The drivers will get loaded and at the completion of the installation the following window will open

k. Click on “RESTART” so that the system will start and will now restart.

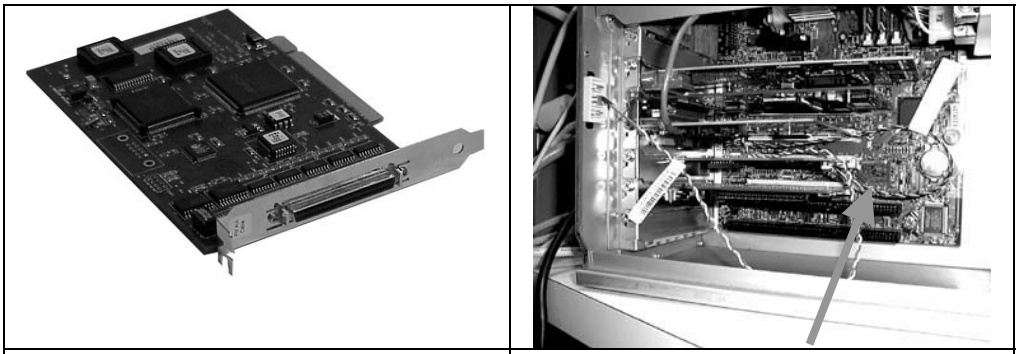
l. Please read the “README” file before using the system



Installing the PCI digitizing card to the PC:

Caution: Ensure that the VersaDoc system is turned off before Installing the digitizing card and AIA cable.

1. Now install the digitizing card into a PCI slot in your computer and secure it with appropriate screw. See Figure 3.17



PCI digitizing card	***PCI slot inside the PC***

Figure 3.17

2. Connect the camera to the digitizing card with the AIA cable. Do not power up the PC/MAC yet. See section 3.2.9 for powering up the PC.

3. With both Serial or USB and AIA cables connected, your system will appear as shown in one of the figures 3.18 a~e below:

:

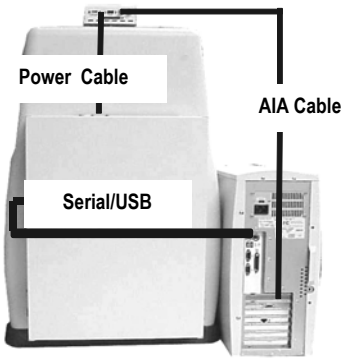


Figure 3.18a

VersaDoc 1000, 3000 and 4000 Systems under Serial # xxxBR300

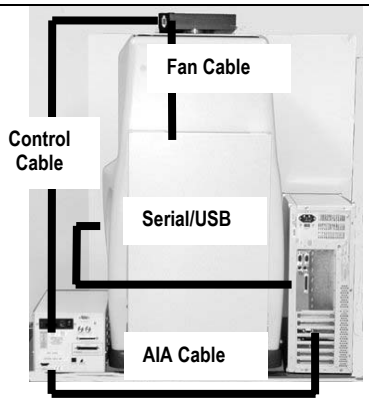


Figure 3.18b

VersaDoc 5000 System under Serial # xxxBR300

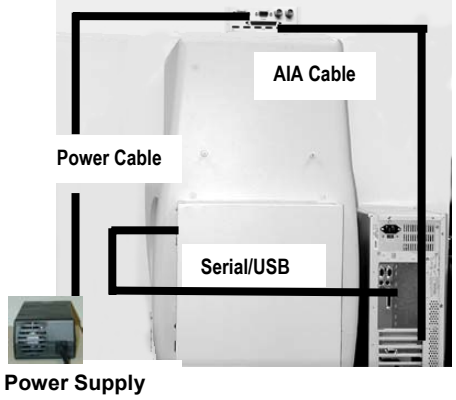


Figure 3.18c

VersaDoc 3000 Systems starting Serial # xxxBR300

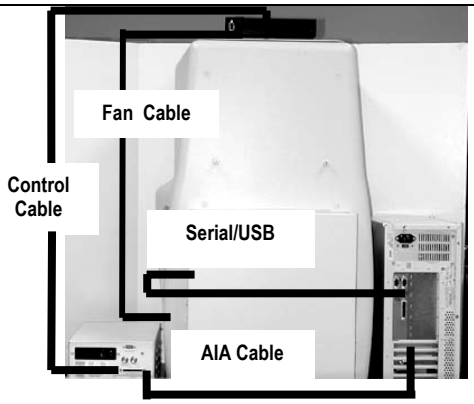


Figure 3.18d

VersaDoc 5000 System starting Serial # xxxBR300

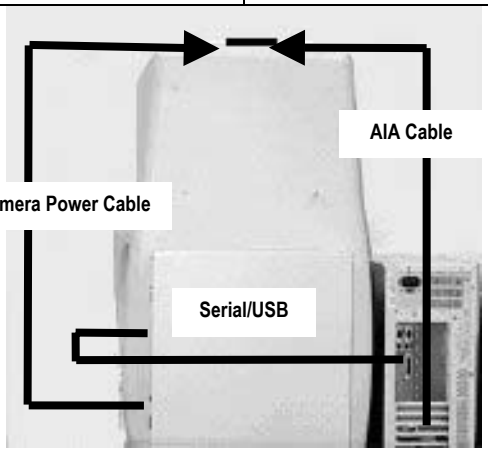


Figure 3.18e

VersaDoc 1000 and 4000 Systems starting Serial # xxxBR300

Power On Sequence

Normally, the VersaDoc system should be switched on for 30 seconds before The host computer is powered up. This protocol is required for the computer to recognize the VersaDoc as a peripheral device.

1. Power up the VersaDoc system first.
2. Also power up the power supply block in case of the VersaDoc 3000 or CEU in case of the VersaDoc 5000 system.
3. Power up the PC/Mac second.
4. In case of a PC, the VersaDoc system is detected via USB connection. A new window will indicate that a new USB device has been found.
5. Proceed to the next step to complete the installation

3.2.8 Installing Filters

The VersaDoc is supplied with three emission filters and one clear filter. These must be installed in the 8-position filter wheel before use. These filters are:

#1 520LP (Long Pass)	Used for most single color fluorescent stains and labels.
#2 530BP (Band Pass)	Used for detection of green signal (FITC etc.) in multi-color fluorescence experiments
#3 610LP (Long Pass)	Used for detection of red signals (Texas Red etc.) in multi- color fluorescence experiments
#4 Clear	Used for system focus and some colorimetric applications.

To install the filters follow the procedure below (Figure 3.19):

1. Ensure that all power and communication cables are connected and that the VersaDoc system is turned on.

NOTE: Do not power up the PC or MAC yet.

2. Open the main door. This will expose the camera, filter assembly, filter advance button and the lens mount assembly.

3. Loosen the left side screw of the filter wheel cover and remove the right side thumbscrew completely by fully unscrewing it. The cover can now be rotated downward to expose the filter wheel.

4. Push the filter advance button until filter position #1 is in the center front position. The #1 label should be clearly visible on both sides of the filter slot.

5. Remove filter #1 from its packaging and check that it is clean, free of dust, fingerprints and scratches. If the filter is dirty it should be cleaned with the materials provided in the lens and filter cleaning kit.

6. Holding the filter by the numbered tab with the number in the correct orientation, carefully slide the filter into the open filter wheel position.

7. Repeat steps 4-5 for the remaining filters (#2, #3, #4)

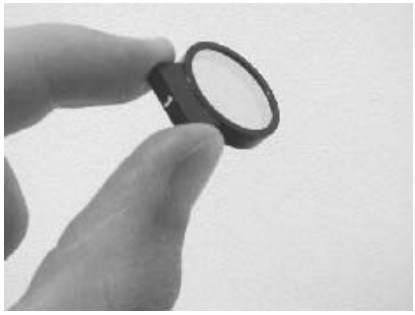
8. Replace the filter wheel cover and hand-tighten both captive thumbscrews.

9. Close the main door firmly. The filter wheel will automatically reset to the home position and is now ready for operation.

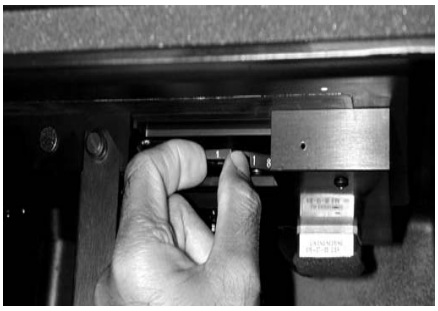
NOTE: The above procedure can also be used for the installation of custom filters.

Open filter wheel access panel and rotate it downward as shown

Advance to position 1



Unpack and carefully install filter 1



Make sure that filter 1 is all the way in its slot and positioned straight.

Figure 3.19

3.2.9 Installing the Lens

The VersaDoc system is supplied with two standard lenses, a flexible zoom lens and a high NA 50-mm lens with improved collection efficiency

Zoom Lens for fluorescence and colorimetric imaging

The Tamron zoom lens is recommended for use with all fluorescence and colorimetric applications and for high intensity chemiluminescence experiments. The zoom capabilities of this lens supports the imaging of small and large samples. The zoom lens is not a high numerical aperture (NA) lens and should not be used for low intensity chemiluminescence experiments.

High Numerical Aperture Lens for Chemiluminescence Imaging

The Nikon 50 mm high NA (f/1.4) lens is designed for optimized light collection efficiency and should be used for all low intensity chemiluminescence experiments. The lens can also be used for collecting typical fluorescence and colorimetric images. The chemiluminescence sample tray may be used to move the sample closer to the camera.

Infrared Cutoff Filter

When performing any fluorescence experiments it is required that the 660 nm infrared cut-off filter that is supplied with the VersaDoc is installed on the front of collecting lens. This filter will block any infrared signal that will be generated by the UV bulbs, substantially reducing image background and improving sensitivity. This filter is not required for chemiluminescence experiments and should not be used when collecting low intensity chemiluminescence signals, as it will reduce the amount of signal collected.

Lens Use Recommendation

For optimal image acquisition, it is recommended that the zoom lens with 660 nm cut-off filter installed is used for all fluorescence and colorimetric applications. In chemiluminescence experiments, the 50 mm fixed lens with no cut-off filter is recommended.

Zoom Lens Installation

To correctly install the zoom lens. Follow the procedure outlined below (Figure 3.20):

1. Remove the lens from its packaging and retain the packaging for future storage.

2. Remove the front lens cap and install the 58mm-52mm step down ring, then the 660 short pass (SP) filter onto the lens.

3. Remove the protective cover from the lens mount (rear of lens) and check that the lens is clean. If the lens is dirty it should be cleaned with the materials provided in the lens and filter cleaning kit.

4. Open the door to the main door and position the lens so that the white line on its mount matches the white mark on the base (right hand side) of the camera assembly.

5. Insert the mount of the lens into the base of the camera assembly and turn the lens counter clockwise (to the left) until you hear it click. The white mark and setting indicators on the lens should now be directly in front of you.

6. The lens in now locked into position and the lens cap and protective platen cover can be removed.

Figure 3.20. Steps in zoom lens installation.

High Sensitivity 50 mm Lens Installation

To correctly install the 50 mm high NA lens, follow the procedure outlined below

(Figure 3.21):

1. Remove the lens from its packaging and retain the packaging for future storage.

2. Remove the protective cover from the lens mount (rear of lens) and check that the lens is clean, free of dust, fingerprints and scratches. If the lens is dirty it should be cleaned with the materials provided in the lens and filter cleaning kit.

3. Open the door to the main door and position the lens so that the white line and dot on its mount matches the white mark on the base of the camera assembly.

4. Insert the mount of the lens into the base of the camera assembly and turn the lens clockwise (to the left) until you hear it click. The main white line and lens settings are directly in front of you.

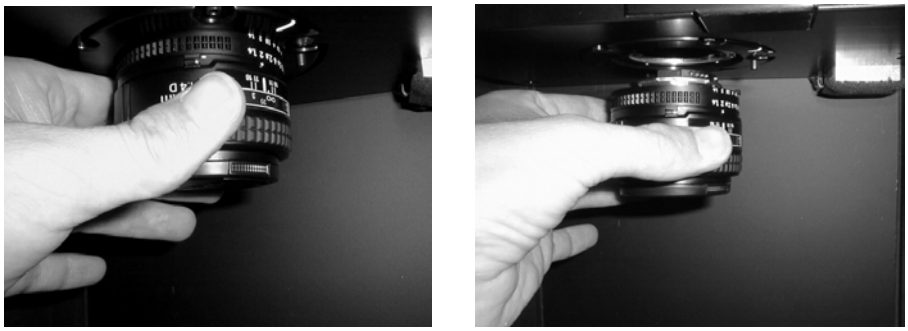


Figure 3.21. Steps in 50 mm lens installation.

5. The lens in now locked into position and the lens cap and protective platen cover can be removed.

Lens Removal

To remove the lens from the camera housing follow the procedure outlined below (Figure 3.22):

1. Place the lens cap on lens

2. Hold the lens firmly with your left hand throughout the remainder or the removal process so that it cannot be dropped accidentally.

Caution: Accidentally dropping the lens could break the UV transilluminator platen or white light conversion screen. Replacement of such a broken platen or white light conversion screen is not covered by warranty or service contract.

3. Depress the red release button on the base of the camera housing. This is located to the rear, right-hand side of the lens.

4. Rotate the lens in a clockwise direction (to the right) to release it from the housing.

5. Pull the lens down and remove it from the filter wheel assembly.

6. Replace the mount cover. If the lens is not being used for some time it is recommended that it be stored in its original packaging.

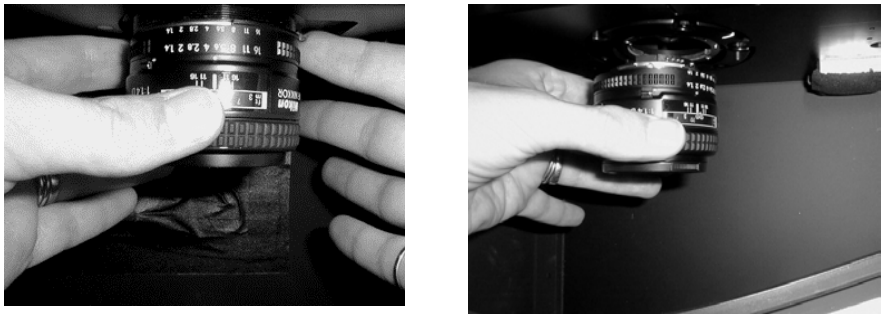


Figure 3.22. Steps in lens removal.

Proceed to section 4.

Section 4
Operating the VersaDoc

4.1 Starting the VersaDoc System

Both the VersaDoc and the camera module must be connected to the computer prior to using the VersaDoc system.

To turn on the VersaDoc press the power switch located on the right-hand side of the rear panel of the instrument. The green LED on the front will illuminate indicating that the system is ready and to confirm that power is being supplied and all the internal light modules are functioning properly. The start up initialization process takes approximately 30 seconds. After this time has elapsed the host computer can be turned on. At this time you can also power up the power supply or CEU if you have a VersaDoc 3000 or 5000 system.

Note: If the LED indicator fails to illuminate and the instrument is inoperative, check that all power cables are firmly attached and that power is being supplied to the unit. If the unit still remains inoperative or the VersaDoc acquisition window cannot be opened on the host computer, please contact the Bio-Rad Technical Service Department for assistance.

The VersaDoc should be switched on at least 30 seconds before the host computer, to allow for complete initialization. If the VersaDoc is not fully operational before the computer is turned on, the system will not be recognized as an attached Serial/USB device and the camera may not be recognized by the digitizing card thus you will not be able to communicate with the VersaDoc from the Quantity One acquisition window.

For best imaging results it is recommended that the VersaDoc be allowed to warm-up for 10 minutes before use.

4.2 Overview of Operational Steps

The user will typically complete the following series of steps when acquiring an image using the VersaDoc:

1. Start the program and open the acquisition window
2. Select the desired application
3. Place the sample on transilluminator platen, converter screen or chemi tray as the case may be and optimize its position
4. Focus
5. Adjust the lens aperture and zoom
6. Readjust focus if required
7. Select the exposure (acquisition) time
8. Acquire the image

4.3 Detailed Operating Procedures

4.3.1 Opening the Acquisition Window

After starting your computer, open the Quantity One acquisition and analysis program by double clicking on the Quantity One icon.

From the FILE menu select VERSADOC to open the instruments acquisition window. The following window will open on the screen.

Note: If the computer cannot establish communications with the VersaDoc a message will indicate this and give the user the option of entering a simulation mode.

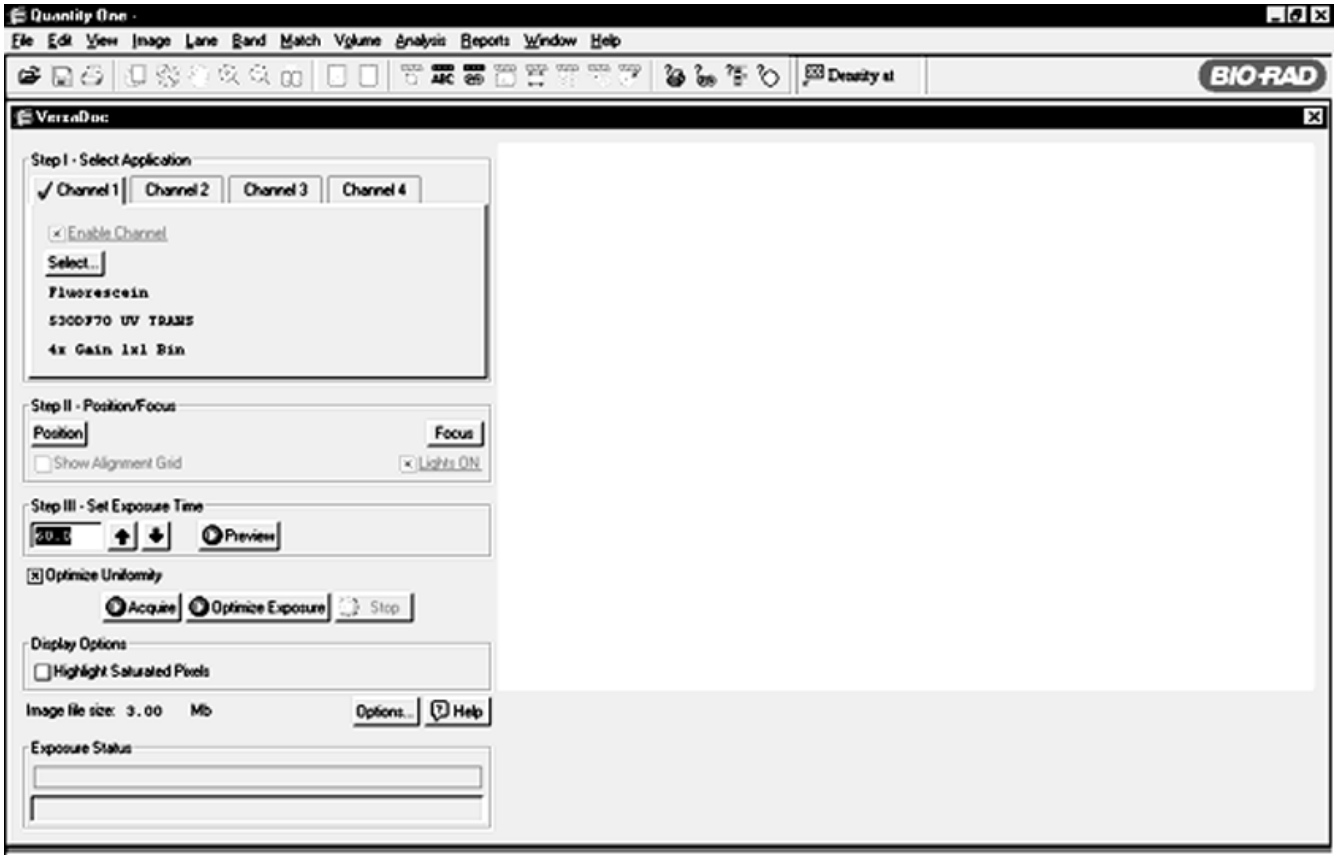


Figure. 4.1. VersaDoc acquisition screen in Quantity One.

4.3.2 Selecting the Application

The Quantity One program uses an application-oriented format to simplify user selection of collection parameters. To correctly set the parameters for collection, simply click the SELECT button in Step I (Figure 4.1) and identify the application name matching your sample type. For detailed acquisition instructions please refer to the Quantity One software instruction manual.

4.3.3 Placing Samples in the Imaging Chamber

The VersaDoc can accommodate a variety of sample types and sizes. The sample stage is 25 X 25 cm. This configuration supports the acquisition of smaller areas of interest within very large samples. The imaging area is liquid sealed so wet samples may be placed directly into the imaging chamber on the UV transilluminator platen. With wet samples you will find it convenient to use the sample holders provided with your VersaDoc system. These sample holders have suction cups that hold the sample in place and keep it from sliding around on the polished glass surface.

Caution: The sample stage area is resistant to most research chemicals but may be damaged by extended contact with strong acid solutions and organic solvents. When imaging samples exposed to these chemicals, users should wash the sample stage with water and wipe dry immediately after imaging.

Samples should be placed in the VersaDoc instrument following the steps outlined below:

1. Open the main door.

2. Visually check that the sample platen is clean. If not, clean using an optical cleaning solution and a soft lint-free towel or lens cleaning tissue.

3. From the VersaDoc acquisition window select the POSITION function in Step II (Figure 4.1). The image display window will now present a real time image of the sample in the chamber that refreshes rapidly.

4. Position your sample on the imaging platen, using the software generated alignment grid, to ensure that it is correctly placed and in the center of the viewing area.

Note: When imaging fluorescent gel samples it is recommended that the sample be removed from the glass or plastic plates of the gel sandwich for good image quality. The glass and plastic will fluoresce when exposed to UV light and will contribute to background signal.

Sample/Chemi Tray

It is recommended that the Sample/Chemi tray (Figure 4.2) be used for all small chemiluminescence samples (8 x 8 cm or less). This tray slides onto the guides on the each epi-illumination assembly and allows the sample to be placed closer to the camera. Large chemi samples should be imaged on the platen. To insert and remove the chemi tray, the door to the enclosure must be fully opened.

Note: When using the VersaDoc for non-chemiluminescence applications the sample tray should be removed from the enclosure, as it will block sample signal from reaching the CCD camera.

When using white light epi illumination the sample tray should be placed on the dark reflective platen of the transilluminator to avoid unwanted reflections on your image.

Fig. 4.2. VersaDoc chemi sample tray.

4.3.4 Lens Selection and Setup

The VersaDoc system is supplied with two standard lenses, a flexible zoom lens and a high numerical aperture 50 mm lens with improved collection efficiency.

For optimal image acquisition, it is recommended that the zoom lens with 660 nm cut-off filter installed be used for all fluorescence and colorimetric applications. This lens can also be used for high intensity chemiluminescence experiments, however it is not ideal for this type of application.

For the best chemiluminescence results, it is recommended that the 50 mm fixed lens with no cut-off filter be used. The 50 mm high NA (f 1.4) lens is designed for optimized light collection efficiency and will produce superior images for all low intensity chemiluminescence experiments. The lens can also be used for collecting typical fluorescence and colorimetric images, however the imaging area is fixed. This lens is designed to work in combination with the chemiluminescence sample tray, placing the sample closer to the camera for improved light collection efficiency

Infrared Cutoff Filter
When performing any fluorescence experiments it is recommended that the 660 nm infrared cut-off filter that is supplied with the VersaDoc be installed on the front of collecting lens (see figure 4.3). This filter will block any infrared signal that may be generated by the UV bulbs, substantially reducing image background and improving sensitivity. This filter is not required for chemiluminescence experiments and should not be present when collecting low intensity chemiluminescence signals, as it will reduce the amount of signal collected.

Figure 4.3

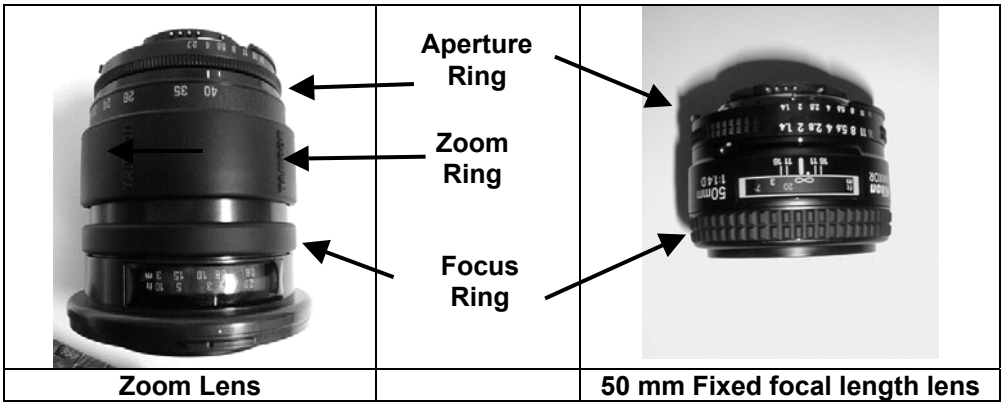


FIGURE 4.4

4.3.5 Aperture Adjustment

The aperture or f-stop ring is located at the top of the lens (Figure 4.4) and controls the amount of light that passes through the lens to be captured by the CCD camera. When the aperture is fully open, the f-stop number will be smallest, the depth of field will be the lowest and the most light will pass through the lens. When the aperture is fully closed, the f-stop number will be largest, the depth of field will be highest and the least light will pass through the lens. For low signal applications such as chemiluminescence, it is recommended that the aperture be fully opened to the smallest f-stop value.

Note: When the aperture on the zoom lens is fully closed (largest f-stop setting of 22), the aperture ring locks. To unlock the aperture ring push the black release button to the right of the f-stop indicator while turning the ring to the right (counter-clockwise).

Note: The aperture ring on the 50 mm lens will not lock in the fully closed (f-stop 16) position, unless the user activates the lock mechanism on the lower right hand side of the f-stop indicators. To lock in this position move the button (white dot) up so that it aligns with the orange indicator. It is not recommended that the lens be locked in this position for chemiluminescence experiments as this setting allows the least light through the lens.

4.3.6 Zoom Adjustment

When using the zoom lens the view area of the image can be adjusted by rotating the zoom ring (Figure 4.4). The zoom ring is located directly below the aperture ring. At maximum zoom the indicator on the lens will be set to its highest specified focal length 40 or 80 mm depending on which lens is being used, also the image resolution will be at its best.

The zoom setting can be adjusted and viewed in real time by selecting the POSITION function in the VersaDoc acquisition window. The image display window will now show a real-time image of the sample, as it will be captured. This image refreshes every second to help you optimize your zoom settings.

Note: The 50 mm lens offers no zoom adjustment.

4.3.7 Focus Adjustment

To focus the lens on the sample for sharp images you must choose the FOCUS button in the Quantity One acquisition window. This button allows focusing on a small part of the image. When using this mode the white epi lights turn on automatically and the shutter is opened and closed repeatedly and the acquisition window is continuously updated to allow you to focus your lens on the sample. The exposure time during the focus mode is adjusted automatically to allow proper unsaturated images. If during focus mode the images still show up saturated, then you must adjust the aperture to a lower setting to view the images in the focus mode. If the images still show up as saturated (all white), then you may turn off the epi lights by clicking on the button labeled "Lights On" (see figure 4.1). This will turn off the white lights and now you may open the main door and adjust the focusing ring (See Figure 4.5) on the lens to achieve a sharp focus on your sample.

4.3.8 Exposure Time

The exposure time refers to the period of time that the shutter will remain open and light will pass from the sample to the CCD. As such, the longer the exposure time, the brighter the captured image will be. For high intensity applications including colorimetric and high intensity fluorescence experiments, an exposure time of only a few seconds is typically required. For low intensity applications such as chemiluminescence, an exposure time of several minutes may be required. The exposure period required to produce an optimal image varies considerably and may need to be optimized for your particular sample. Typical exposure conditions for different sample types have been included in Table 4.1 as a guide to selecting a suitable exposure time. This table also indicates the preferred lens for the sample and if any accessories are recommended.

Table 4.1. Recommended exposure times and setup

Sample	Recommended Exposure	Lens & Filter	Accessories Used
Fluorescent Stain Gel	3-30 sec.	Zoom/IR	None
Fluorescence End-Label Gel	30 sec. – 5 min.	Zoom/IR	None
Fluorescent Blot	0.5-5 sec.	Zoom/IR	Sample/Chemi Tray
Chemifluorescent Blot	0.5-5 sec.	Zoom/IR	None
Colorimetric Gel	0.1-1 sec.	Zoom/IR	VersaDoc white light conversion screen
Colorimetric Blot	0.1 to 1 sec.	Zoom/IR	Sample/Chemi Tray
X-ray film	0.1-1 sec.	Zoom/IR	VersaDoc white light conversion screen
Weak Chemiluminescence	5-10 min.	50 mm	Sample/Chemi Tray (if sample is small)
Strong Chemiluminescence	10 sec. – 2 min.	50 mm	Sample/Chemi Tray (if sample is small)

4.3.9 Acquiring the Image

To collect the sample image, simply press the ACQUIRE button. The yellow LED on the front panel of the VersaDoc will flash during acquisition to indicate that ***the image is being captured.*** The software will automatically set all instrument collection parameters and prompt you to take additional steps for best results.

NOTE: You will notice that after the initial image capture, the software also acquires a dark image. This image is taken for the same amount of time as the exposure, however, this dark image is acquired with the camera shutter closed. This provides a very accurate way to measure and remove the dark current noise from the image.

Once the image is captured, it will be displayed in its own window. You may save the captured image for storage and/or future analysis.

NOTE: When an application is selected that utilizes UV transilluminator, the software will first acquire an initial image and then prompt you to remove the sample. You must make sure that the sample platen is free of any solution from the sample. You will then be prompted to place the VersaDoc Fluorescent Reference plate.

When your application requires white light transillumination, the software will also prompt you to place the VersaDoc white light conversion screen on the UV transilluminator platen. This white light conversion screen absorbs the UV from the UV transilluminator and converts this broadband UV into white light. See figure 4.5.

Figure 4.5 White Light Conversion Screen

In this application, the software will first take an initial image and then prompt you to remove the sample.

NOTE: Please make sure that the surface of the VersaDoc white light conversion screen is clean after the sample has been removed.

After the image has been acquired, its appearance can be optimized. The image may also be analyzed in various ways using the Quantity One program. Analysis options include object volume analysis, lane profile analysis including regression analysis and molecular weight determination, colony counting, fingerprinting, VNTR and differential display studies. The image and various data reports may also be printed or exported to other software programs. Please refer to the Quantity One software manual for detailed instructions.

Note: Please refer to the Quantity One software manual for information concerning additional features available in the acquisition window for VersaDoc.

Section 5
Care and Maintenance

5.1 General Maintenance

With regular use the VersaDoc system should provide years of trouble-free operation without any need for regular operator maintenance other than cleaning. If you suspect that the VersaDoc requires servicing, please contact your local Bio-Rad office.

The outside surface of the VersaDoc should be periodically cleaned with water, mild liquid soap and a sponge or soft cloth towel.

Caution: Never use abrasive cleaners, solvent based cleaners, alcohol or scouring pads to clean the external surface of the instrument.

Caution: Always disconnect the VersaDoc from electrical power prior to cleaning the external surface of the instrument.

5.1.1 Cleaning the Sample Stage Area

The sample platen and sample stage of the VersaDoc should be cleaned between imaging sessions to optimize image quality. Use powder-free gloves when cleaning the instrument to avoid fingerprints that may appear during imaging. Never wear powdered gloves when cleaning the VersaDoc. Clean the sample platen with optical cleaning solution and a lint free optical tissue. Cleaning kits are available from Bio-Rad and one is supplied with the instrument.

Caution: It is recommended that water, mild liquid soap and a soft sponge are used to clean the sample stage. Never use abrasive cleaners, solvent-based detergents or scouring pads to clean the platen surface.

5.1.2 Cleaning the Transilluminator Platen:

The platen on the transilluminator module should also be periodically cleaned to remove dust and optimize image quality. To clean the platen, follow the steps outlined below:

1. Turn off the VersaDoc.

2. Open the main door and slide out the transilluminator assembly.

3. Clean the top platen using optical cleaning solution and optical tissue.

4. Once the platen is clean, push the transilluminator back into the enclosure.

5.1.3 Cleaning the Lens

To optimize image quality it is recommended that any lens used with the VersaDoc be cleaned before it is installed in the system. Both sides of the lens should be cleaned using an optical cleaning solution and optical tissue. Avoid touching the glass surfaces of the lens when installing it into the instrument, as fingerprints will effect image quality.

5.1.4 Cleaning the Emission Filters

To optimize image quality it is recommended that the emission filters installed in the VersaDoc system are periodically cleaned. Both sides of each emission filter should be cleaned using an optical cleaning solution and optical tissue. Avoid touching the glass surfaces of the filter when installing it into the instrument, as fingerprint will effect image quality.

5.2 Replacing Lamps in Illumination Sources

The life of the broad wavelength UV lamp is approximately 500 to 1000 hours, depending upon use. As the lamp ages, the required integration time will increase because the intensity of the UV emission will diminish. If the integration time for image acquisition has increased more than three-fold, it is recommended that the lamps be replaced. The life of the white light lamp is approximately 1000 hours.

NOTE: THE LAMPS SHOULD BE REPLACED IN PAIRS FROM ALL ILLUMINATION MODULES.

5.2.1 Replacing the Lamps in the Transilluminator Module

To access the lamps in the transilluminator follow the procedure outlined below.

Caution: Do not touch the glass parts of the lamp or lamp housing. Fingerprints on the lamp may result in non-uniform illumination. The use of power-free latex gloves is highly recommended.

Tools required: You will need a #2 Phillips screwdriver and 5/16 size socket wrench to change the lamps in the transilluminator.

To change the lamp, follow the procedure outlined below (Figure 5.1):

1. Turn off the power to the system.

2. Open the main door to access the UV transilluminator cable.

3. Disconnect the UV transilluminator cable from the ballast assembly.

4. Slide the UV transilluminator module on the slides out completely.

5. There are two release levers on each rail that are made out of black plastic. Pull the transilluminator module out while pressing down on the lever on the right side and lifting up the lever on the left. This will allow you to completely disengage the slide rails from

the guides rails located in the enclosure and the entire transilluminator module will become free from the enclosure.

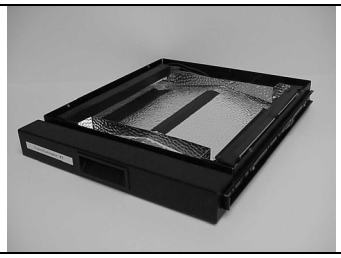
		
Release lever for slides	Transilluminator	Transilluminator without the cover

Figure 5.1

6. Using the Phillips screwdriver, remove the cover assembly from the transilluminator by removing four screws. There are two screws on each side of the cover.

7. Using the 5/16" socket wrench, remove the four hex standoffs that hold the baffles on the lamps of the transilluminator and then gently lift off the baffles exposing the transilluminator lamps.

Note: Be careful and do not bend the baffles because bending the baffles could lead to deterioration of uniformity of your UV transilluminator.

8. Remove lamps by holding the metal part of the lamps with the tip of your fingers and turning them in a rotating movement and by pulling them out of the socket. (See Fig 5.2)

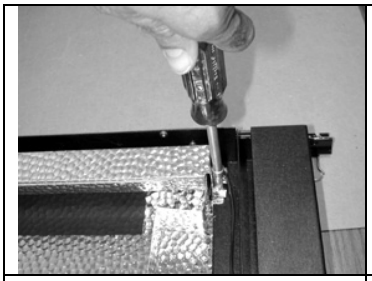
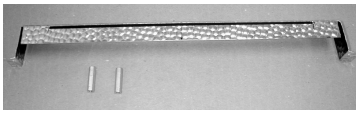
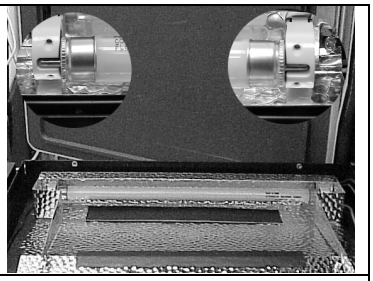
		
Remove hex standoffs (X4)	**Remove the baffle exposing the lamp**	**Hold at the metal ends of the lamps and turn to remove**

Figure 5.2

9. Install the replacement lamp by inserting its ends in the sockets and rotating until it clicks into place.

10. Now reinstall the baffles on the lamps by making sure that they are seated correctly.

11. Reinstall the cover on the transilluminator module. Replace the screws.

12. Carefully reinstall the transilluminator assembly back onto the slides by carefully lining up the slides into the guides and then gently push in all the way.

NOTE: There is no need to push down or up on the levers, they are only used to remove the transilluminator assembly.

13. Next carefully connect the UV transilluminator cable back to the ballast assembly. Turn the power ON to the system.

14. Make sure that the door is closed.

15. Try an application that requires use of UV transilluminator to make sure that the new lamps are fully operational.

5.2.2 Replacing lamps in the Epi-illumination module

Tools required: You will need a size 3/32" hex allenkey to change the lamps in the epi illumination module

The VersaDoc has two epi-illumination modules each contain single white illumination source and broad bandwidth UV sources. It is recommended that lamps in both the right and left epi-assemblies must be replaced at the same time.

To change an epi-lamp, follow the procedure outlined below (Figure 5.3):

NOTE: The procedure to remove and replace the lamp in the UV or white light epi modules is the same. The procedure outlined below applies to both.

1. Turn off the VersaDoc and disconnect all power, removing the power cable.

2. Open the door to the sample compartment.

3. Find the threaded mounting screw that secures the epi modules to the wall of the enclosure and loosen it to free up the epi module from the wall.

4. Disconnect the epi module cables from the ballast assembly and remove the epi module completely from the unit and set it on a clean bench.

5. Using a hex 3/32" key remove the three screws that secure the front end plate on the epi modules and slide out the end piece and filter glass and set aside for future use. See Figure 5.3.

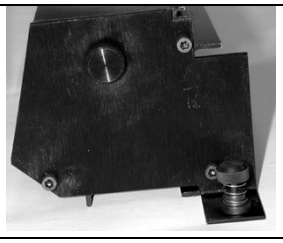
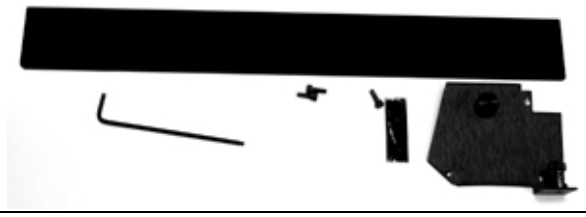
		
Remove the end plate using 3/32” Allenkey	View of the epi end plate	Filter glass, end plate, allen key, 3 cap head screws and the end piece

Figure 5.3

6. This exposes the lamps in the epi module for you to replace. To replace the white light lamp or UV lamp simply grab the two metal ends of the old lamp and carefully rotate to release it from the sockets. See Figure 5.4

Remove lamp by grabbing the two metal ends and turning the lamp to release from its socket

Figure 5.4

16. Install the replacement white light lamp by placing its ends in the sockets and rotating until it clicks into place. Be careful not to touch any glass surfaces of the lamp or the filter glass. Use of latex gloves is highly recommended.

17. Carefully rotate the lamp to make sure it is seated properly.

18. Now reinstall the filter glass, end piece and the end plate. Secure the end plate properly using the 3 cap head screws and the 3/32" hex Allenkey.

19. Reinstall the epi module in its place and reconnect epi cables to the ballast assembly to appropriate connectors.

20. Now power up the system and try running the application that use the epi source in which the lamps were installed to make sure that the lamps are operating normally.

NOTE: THE UV INTERLOCK ON THE MAIN DOOR WILL NOT ALLOW UV EPI TO TURN ON. ACQUIRE AN IMAGE OF A WHITE PIECE OF PAPER TO ENSURE THAT THE EPI UV LAMPS THAT YOU JUST INSTALLED ARE WORKING PROPERLY. IF NO IMAGE COMES UP YOU MAY HAVE A POORLY SEATED LAMP IN THE SOCKET.

To order replacement lamps contact your Bio-Rad Laboratories representative for parts.

5.3 Lens and Filter Storage

Always store unused lenses and filters in their original box and in a low humidity environment with a stable ambient temperature that does not exceed 30 °C.
Lenses should be wrapped in optical tissue before being placed in their storage box. If your laboratory is a high humidity environment it is recommended that all emission filters are stored in a sealed container with desiccant.

Section 6
Troubleshooting & Technical Information

6.1 Problem Solving Guide

Problem	Possible Cause	Solution
VersaDoc is not responding to host computer	Power is not supplied or the system is not switched on	Ensure power is supplied to the system and that the switch is turned on
	VersaDoc Door is open	Close Door
	Serial/USB or AIA cable is not connected properly	Reconnect Serial/USB/AIA cables and ensure it is seated properly
	Camera power cable is not connected properly	Makes sure that the cables are connected and seated properly
	Conflict in the PC	Change PCI slot to which the digitizing card is connected
	AIA cable is defective	Replace AIA cable
	Startup sequence is incorrect	Turn off all components and restart in opposite sequence
	Computer has a conflicting program or initiation (init.) file	Contact Bio-Rad for assistance
Image is not visible on the monitor or only low signal counts are detected	The 'Transform" function in the software is set too high	Set to a lower maximum value
	Lens cap is covering lens	Remove lens cap
	Insufficient integration time	Integrate sample for a longer time
	Chemi tray not removed when imaging nonchemi sample	Remove chemi tray from sample chamber
	Wrong application selected	Verify / reselect correct application
	Wrong imaging area selected	Verify / reselect correct area
	Bad lamp	Replace lamp
	Dirty optics	Ensure that platen, filter and lens are clean
Image intensity varies across the image	Bad lamp	Replace lamp
UV or Epiillumination not working	Main door is open	Ensure doors are closed properly
Fluorescent image has spots	Dust or small particles on the sample platen or optics	Clean the platen, lens and filters
White light Image has vertical lines	Chemi/Sample tray was not used	Use the Chemi/Sample tray on the UV Filter platen and reacquire the image

Problem	Possible Cause	Solution
Fluorescent image has high background	Image was taken without being removed from glass plate	Remove plate from sample. Thin polyacrylamide samples can be transferred to exposed x-ray film and imaged using UV-epi mode
	660 NM filter is not in place	Install 660 NM filter onto lens
	Wrong application selected	Verify / reselect correct application
	Light leak	Check for light leaks, ensure Camera Module tightly connected to
	High fluorescence agarose used	Use low fluorescence agarose
	Auto-fluorescence from sample	Remove sample and acquire a control image
	Destain (if appropriate) was insufficient	Increase destain
Filter wheel does not turn	Obstruction in filter wheel housing	Check for and remove obstruction
	Custom lens is causing obstruction	Contact Bio-Rad for assistance
	Bad filter wheel cable or connection	Reconnect / replace cable
	Poorly seated lamps	Turn the lamps in the sockets to make sure lamps are seated properly in their sockets
Epi lamps are not turning on	Bad lamps	Replace lamps
	Door interlock not working	Contact Bio-Rad
	Lamp intensity has decreased with age	Replace lamps
Integration time to acquire image has increased	Incorrect f-stop setting	Open aperture and reacquire the image
	Incorrect application selected	Verify application is correct for sample
Poor chemiluminescence sensitivity	Sample may have degraded	Some Chemi samples have a short lifetime, make sure the sample is hot and fresh
	Incorrect lens/filter used	Use the 50 mm high NA lens for best chemi results and use no filter Position 5 or higher
	Sample on platen with chemi tray installed	Place sample on chemi tray or remove tray from sample chamber
	Incorrect f-stop setting	Adjust f-stop to a lower value, f/1.4 recommended.
	The 660IR cutoff filter was not removed from the lens	Remove 660 cutoff filter
	Insufficient integration time	Integrate sample for a longer time

Software Troubleshooting:

In case you installed the card in the system before loading the drivers, click on CANCEL when WINDOWS prompts you to point at the drivers for new HARDWARE it has found.

Follow the steps for installing the software and loading the drivers as shown above and reboot the system to properly install the card and drivers to your MAC or PC as the case maybe.

Should you forget to click on CANCEL when windows prompts you that it has found new HARDWARE. It will search for the drivers and then render the card as “DISABLED”
To recover from this take the following steps:

1. Install the drivers as shown in the procedure above.
2. Go to ADD/REMOVE HARDWARE utility in the CONTROL PANELS.
3. Click and highlight the PCI card in question (Roper or Scion) and click on “REMOVE”. Follow the prompts and reboot the system.
4. Windows will now find the card and install the drivers as described above.

6.2 Technical Service

For technical assistance with the VersaDoc system including all hardware and software, contact your local Bio-Rad office, or in the US call 1 800 424 6723. All spare parts not listed in this document can be ordered by contacting your local Bio-Rad office.

For inquiries and requests regarding system repair or service, contact your local Bio-Rad office or distributor (in the U.S., call Technical Service at 1 800 424 6723). Please have the following details available:

1. Instrument model and catalog number.
2. Serial number (located on the back of the main door).
3. Hardware, firmware and software version information (in operating software, “About” box).

6.3 VersaDoc System Specifications

System Technical Specifications	Specification
Light source	
Transillumination	UV (290 - 365 NM) and white light (400 – 750 NM)
Epi illumination	UV (290 - 365 NM) and white light (400 – 750 NM)
Emission filters	8 position filter wheel: 520LP, 530DF70, 610LP and clear filters supplied
Transillumination area	25 x 25 cm
Operating Conditions:	
Supply voltage	100 - 120 or 220 - 240 VAC ± 10%
Frequency	50-60 Hz
Operating Temperature	10 - 28°C (21°C recommended)
Operating Humidity (Relative)	< 70%, non-condensing
Dimensions	23” (W) x 26” (D) x 39” (H)
Total Weight	96 lbs.

VersaDoc 1000

Cooled CCD	Specification
Imaging array	1317 X 1035
Pixel size	6.8 x 6.8 micron
Pixel depth	12bit
Detector type	Scientific grade, high sensitivity front illuminated CCD with antireflective coating
Cooling system	Forced air peltier thermoelectric system
Cooling range	10°C (± 2 °C)
Dynamic Range	3.4 orders
Illumination Flat Fielding	Yes

VersaDoc 3000

Cooled CCD	Specification
Imaging array	1536 X 1024
Pixel size	9 x 9 micron
Pixel depth	12bit
Detector type	Scientific grade, high sensitivity front illuminated CCD with antireflective coating
Cooling system	Forced air peltier thermoelectric system
Cooling range	-25°C (± 2 °C)
Dynamic Range	3.4 orders
Illumination Flat Fielding	Yes

VersaDoc 4000

Cooled CCD	Specification
Imaging array	2184 X 1472
Pixel size	6.8 x 6.8 micron
Pixel depth	12bit
Detector type	Scientific grade, high sensitivity front illuminated CCD with antireflective coating and micro lenses
Cooling system	Forced air peltier thermoelectric system
Cooling range	10°C (± 2 °C)
Dynamic Range	3.4 orders
Illumination Flat Fielding	Yes

VersaDoc 5000

Cooled CCD	Specification
Imaging array	512 x 512
Pixel size	24 x 24 micron
Pixel depth	16bit
Detector type	Scientific grade, high sensitivity back illuminated CCD with antireflective coating
Cooling system	Forced air peltier thermoelectric system
Cooling range	-25 to -35°C (± 2 °C)
Dynamic Range	4.8 orders
Illumination Flat Fielding	Yes

6.4 VersaDoc™ Warranty Information

This warranty statement may vary outside of the continental United States. Please contact you local Bio-Rad office for the exact terms of your warranty.

Bio-Rad laboratories warrants to the customer that the VersaDoc system (catalog number 1708013 or 1708033, 1708143 or 1708053 will be free from defects in material and workmanship and will meet all of the performance specifications for a period of one year from the date of shipment. This warranty covers all parts and labor.

If any defects should occur during this period, Bio-Rad Laboratories will either replace or repair the defective parts free of charge. For the exact terms of warranty, please see the Instrument Warranty Card.

In the event that the VersaDoc must be returned to the factory for repair under warranty, the instrument must be packed and returned in its original shipping container.

Bio-Rad shall not be liable for any incidental, special or consequential loss, damage or expense, directly or indirectly arising from use of the VersaDoc system. Bio-Rad makes no warranty whatsoever in regard to products or parts furnished by third parties, such being subject to the warranty of their respective manufacturers. Service under this warranty shall be requested by contacting your nearest Bio-Rad office.

This warranty does not extend to any instruments or parts thereof that have been subject to misuse, neglect, or accident, or that have been modified or serviced by anyone other than Bio-Rad or its representative, or that have been used in violation of Bio-Rad instructions. It also does not extend to instruments or parts thereof that have been used with fittings or other spare parts not authorized by Bio-Rad Laboratories, that are interfaced to inappropriate external devices, that have been exposed to inappropriate solvents, cleaning agents or samples. The warranty also does not cover instrument damage resulting from facility problems such as power surges.

The foregoing obligations are in lieu of all other obligations and liabilities including negligence and all warranties of merchantability, fitness for a particular purpose otherwise expressed or implied in fact or by law, and state Bio-Rad's entire and exclusive liability and the buyers exclusive remedy for any claims or damages in connection with the furnishing of goods or parts, their design, suitability for use installation and operation. Bio-Rad Laboratories will in no event be held liable for any special, incidental or consequential damages whatsoever, and Bio-Rad's liability under no circumstances will exceed the contract price for the goods for which liability is claimed.

6.5 Glossary of Imaging Terms

CCD:	Charge Coupled Device.
CCD Element:	Each CCD element or pixel is a single photodetector capable of detecting light and converting and storing the information in an electronic form.
CCD Array:	A CCD array can be visualized as a periodic grid array of individual CCD elements, (analogous to buckets of water). When the shutter is open, photons of light (analogous to drops of rain) fall into the photo detectors (buckets of water).
Integration:	When the camera shutter is open and the CCD is exposed to light.
Thermoelectric Cooler:	A thermoelectric cooler (TEC) that pulls heat away from the CCD. The heat is then transferred to the camera body, which is cooled by forced air.
Dark Current:	Dark current arises from the creation of electrons generated through the process of thermal emission within the silicon layers comprising the CCD. Dark current noise is the square root of the number of dark current electrons. The presence of dark current is an additional concern in low light level applications. It is important to ensure that dark current noise does not exceed read noise from the signal even when long integration times are used
Signal to Noise:	Signal to noise ratio (SNR) is the measure of the signal quality at a given pixel. It is the ratio of the measured signal to the overall measured noise at that pixel.
Dynamic Range:	Dynamic range of a CCD is simply defined as the ratio of CCD saturation to the read noise. It is the ability to quantitatively detect very dim and very bright pixels within a single image.
Quantum Efficiency:	Quantum efficiency is the measure of the effectiveness of an imaging device to produce electronic charge from incident photons. This is an especially important property when performing very low light level imaging.
Dead Pixels:	There are a variety of different grades of CCD chips. Each grade has some percentage of dead or bad pixels. These are typically displayed as white or dark lines on the image. Most CCD systems correct for dead pixels.
Image Resolution:	Image resolution refers to the spacing of pixels in the image and is measured in pixels per inch (ppi). If an image has a resolution of 72 ppi this means that it contains 5182 pixels (72 x 72) in a square inch.
Monitor Resolution:	Monitor resolution defines the number of dots or pixels per unit length of output. It is commonly measured in dots per inch (dpi). The monitor resolution determines the size of the displayed image and should not be confused with image resolution, which reflects the spacing of pixels in the image.

6.6 Spare Parts List:

Part Number	Description
8000247	Cable, Camera AIA
9210780	Cable, Camera DC Power, VersaDoc 1000
9310070	Cable, Serial PC,DB9M
9310071	Cable, USB, Type A to B
9310072	Cable, Serial, MAC, DIN8 TO DB9M
9000213*	Lamp, EPI White Light
9000217*	Lamp, UV EPI/Transilluminator
9204929	UV Filter glass for EPI UV
9210491	Diffuser plastic for Epi white module
8000229	EPI UV Module, Left
8000230	EPI UV Module, Right
8000231	EPI WHITE Module, Left
8000232	EPI WHITE Module, Right
8000242	Transilluminator top cover with UV filter glass
8005363	Kit, Focusing Target
4100167	Filter Order Form
9210640	Plate, Reference Fluorescent
1002363	Shipping Container, Complete System
1002364	Shipping Container, Enclosure Only

** You will need these in pairs*

Other Useful Part Numbers

Part Number	Description
1707813	Sample Holder Kit
1708001	White Light Conversion screen
1708007	Sample/Chemi Tray
1708008	Plate, Reference Fluorescent
1708012	Camera Module VersaDoc 1000
1708032	Camera Module VersaDoc 3000`
1708142	Camera Module VersaDoc 4000
1708052	Camera Module VersaDoc 5000`
1708000	UV Transilluminator Module
1707709	Tamron Zoom Lens, 20-40 mm
1707706	Optional 105 mm lens
1707725	Nikon Lens, 50 mm, f1.4
1707726	Tamron Zoom Lens, 28-80 mm
1707727	52-58 mm Filter Adapter Ring
1707729	660 NM Short Pass Filter
1707731	Cleaning Kit
1708009	Converter, USB- SERIAL MAC
1708601	TDS Quantity One, PC
1708609	TDS Quantity One, MAC
1708017	Shield, UV, Plastic
1708020	PCI Digitizing Card

BIO-RAD

Bio-Rad Laboratories

Life Science Group

Web site *www.bio-rad.com* ***Bio-Rad Laboratories Main Office*** *2000 Alfred Nobel Drive, Hercules, CA 94547, Ph. (510) 741-1000, Fx. (510) 741-5800*
Also in: ***Australia*** *Ph. 02 9914 2800, Fx. 02 9914 2889* ***Austria*** *Ph. (01) 877 89 01, Fx. (01) 876 56 29* ***Belgium*** *Ph. 09-385 55 11, Fx. 09-385 65 54*
Brazil *Ph. 55 21 507 6191* ***Canada*** *Ph. (905) 712-2771, Fx. (905) 712-2990* ***China*** *Ph. 86-10-8201-1366/68, Fx. 86-10-8201-1367*
Denmark *Ph. 45 44 52-1000, Fx. 45 4452 1001* ***Finland*** *Ph. 358 (0)9 804 2200, Fx. 358 (0)9 804 1100* ***France*** *Ph. 01 47 95 69 65, Fx. 01 47 41 9133*
Germany *Ph. 089 318 84-177, Fx. 089 318 84-123* ***Hong Kong*** *Ph. 852-2789-3300, Fx. 852-2789-1257* ***India*** *Ph. (91-124)-6398112/113/114, Fx. (91-124)-6398115*
Israel *Ph. 03 951 4124, Fx. 03 951 4129* ***Italy*** *Ph. 34 91 590 5200 , Fx. 34 91 590 5211* ***Japan*** *Ph. 03-5811-6270, Fx. 03-5811-6272*
Korea *Ph. 82-2-3473-4460, Fx. 82-2-3472-7003* ***Latin America*** *Ph. 305-894-5950, Fx. 305-894-5960* ***Mexico*** *Ph. 52 5 534 2552 to 54, Fx. 52 5 524 5971*
The Netherlands *Ph. 0318-540666, Fx. 0318-542216* ***New Zealand*** *Ph. 64-9-4152280, Fx. 64-9-443 3097* ***Norway*** *Ph. 47-23-38-41-30, Fx. 47-23-38-41-39*
Russia *Ph. 7 095 979 98 00, Fx. 7 095 979 98 56* ***Singapore*** *Ph. 65-2729877, Fx. 65-2734835* ***Spain*** *Ph. 34-91-590-5200, Fx. 34-91-590-5211*
Sweden *Ph. 46 (0)8-55 51 27 00, Fx. 46 (0)8-55 51 27 80* ***Switzerland*** *Ph. 061-717-9555, Fx. 061-717-9550* ***United Kingdom*** *Ph. 0800-181134, Fx. 01442-259118*

4000183 REV E