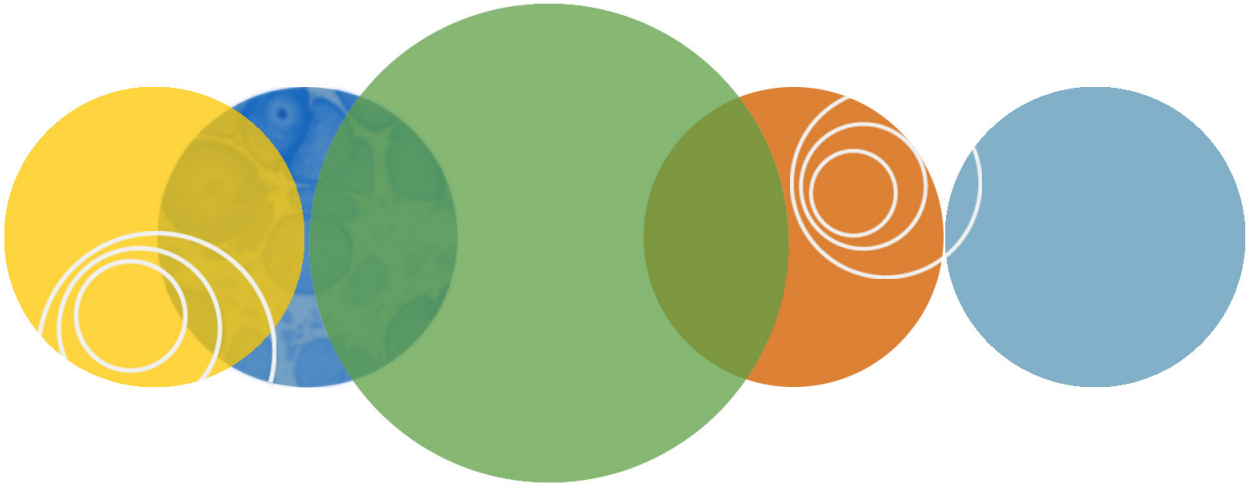

GenePix® 4300A/4400A High-Resolution Microarray Scanner

User Guide

MOLECULAR DEVICES

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Product manufactured by Molecular Devices, LLC.

3860 N First Street, San Jose California, United States of America 95134.

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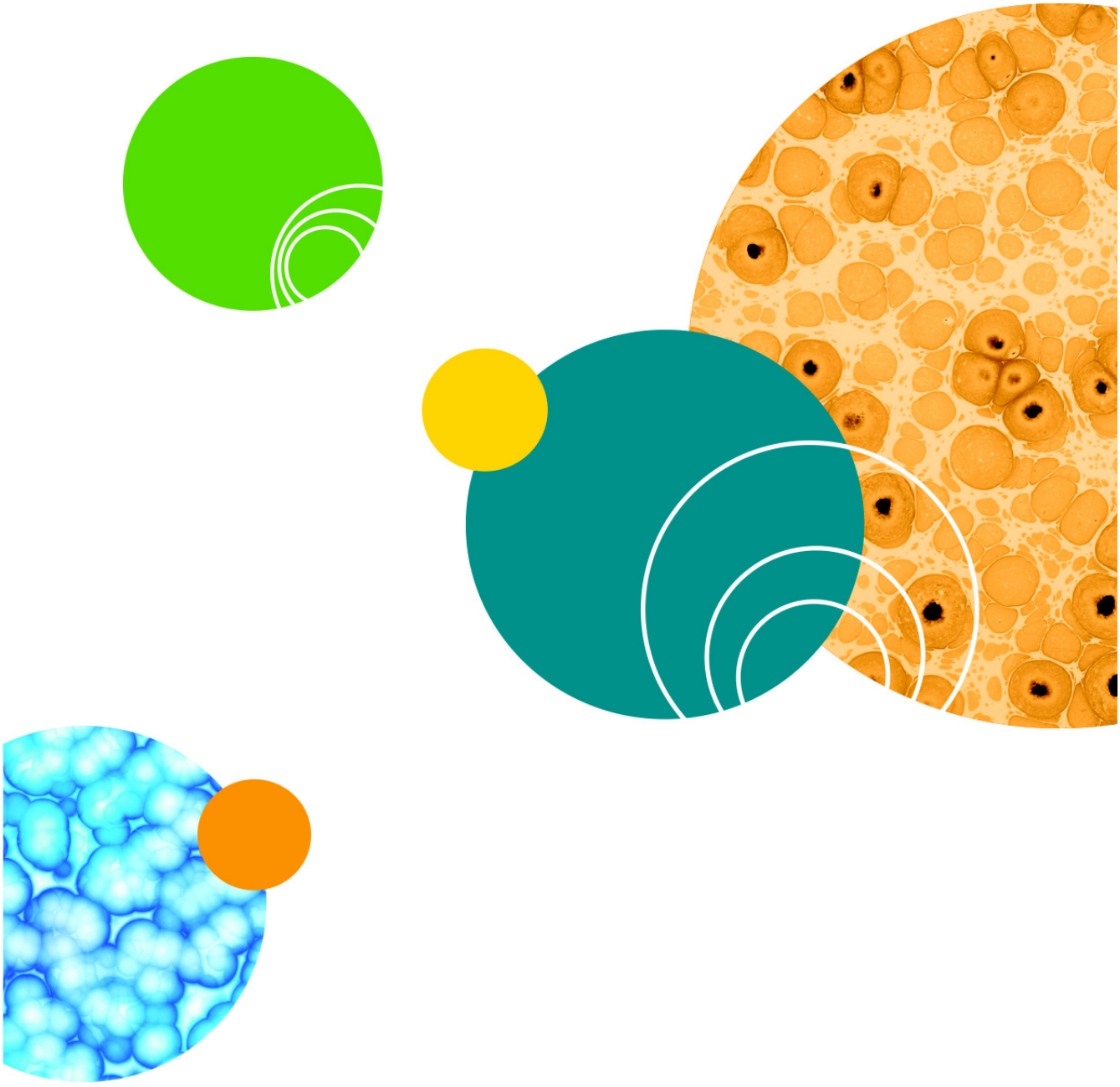


Contents

Foreword

The foreword describes the intended audience for the manual. It defines the typographical conventions used in the manual and lists the related documentation.

Who This Manual Is For

This manual is written for the GenePix® 4300A/4400A High-Resolution Microarray Scanner user. It contains the information required to install the scanner, turn it on, and perform maintenance procedures.

Conventions

Within the scope of this manual, the following typographical conventions are used:

WARNING! A warning indicates an operation that may cause personal injury if precautions are not followed.

CAUTION! Indicates an operation that may cause damage to the instrument, device, or data, if the precautions are not followed.

Tip: Provides useful information that helps apply the techniques and procedures in the text to your specific needs, and provides shortcuts, but is not essential to the completion of a procedure.

Note: Provides essential information for the completion of a procedure.

Related Documentation

The customer documentation for the GenePix 4300A/4400A Microarray Scanner includes the *GenePix Pro Software Reference Guide, Safety Practices* manual, and the GenePix Pro online Help.

Introduction

The GenePix® 4300A/4400A Microarray Scanner uses a laser-excitation based fluorescence scanning and imaging system. The laser-based scanning system uses a patent-pending mechanical design, and operates by slowly moving the slide in the Y–direction, while the slide is rapidly scanned in the X–direction. The design of the scanner allows scanning up to four wavelengths of a 25 mm by 75 mm slide at:

- 5 μm resolution for the 4300A in approximately 30 minutes for all four channels
- 2.5 μm resolution for the 4400A in approximately 60 minutes for all four channels

Scanner Features

- Up to four internally installed laser-excitation sources
- Gradient neutral density wheel permitting 5 to 100 % laser transmission
- Data Scan resolution from 5 to 100 μm for the 4300A, or 2.5 to 100 μm for the 4400A.
- Fast Preview Scan at 40 μm
- 16-bit ultra-low noise digitization
- Dynamic range of 10^4
- Easy-access 16-position emission filter cartridge with standard filters for each pre-installed laser
- Standard 1 inch by 3 inch (25 mm by 75 mm) microscope slides
- Full integration with GenePix Pro Microarray Software and Acuity® Microarray Software

Scanner Components

The main components of the GenePix 4300A/4400A Microarray Scanner are:

- Protective enclosure
- Optics
- Lasers
- Optical Path
- Emission Filters
- PMT (photo-multiplier tube)
- Status lights

Figure 1-1: GenePix 4300A/4400A Microarray Scanner

Protective enclosure

The protective enclosure protects the user from exposure to laser radiation, high voltage, and moving parts.

WARNING! Laser Hazard! Do not remove the protective enclosure. Operating the scanner with the protective enclosure removed exposes the user to laser radiation.

Optics

The GenePix 4300A/4400A Microarray Scanner uses a laser-excitation based fluorescence scanning and imaging system. The optical system can be considered in terms of excitation light, mirrors, lenses, filters, and photo-detection.

Lasers

In the GenePix 4300A/4400A Microarray Scanner standard configuration, laser excitation is provided by individual 532 nm and 635 nm lasers. These wavelengths correspond to the ideal wavelengths used to excite the fluorophores Cy3 and Cy5 (GE Healthcare), or other fluorophores with similar fluorescent characteristics. The individual lasers have been selected because of their superior optical performance and reliability. Since the performance of such lasers is often sensitive to external temperature fluctuations, the scanner uses an active temperature stabilization design to minimize temperature-based laser fluctuations. Furthermore, each laser has integrated output monitoring feedback to compensate for fluctuations in photon output, ensuring consistency in measured fluorescence.

The scanner can be configured with two additional lasers for a total of four installed laser light sources. A blue laser with 488 nm excitation can be used with fluorescein and similar dyes, and a yellow laser with 594 nm excitation can be used with Texas Red and similar dyes.

Optical Path

Excitation laser light is directed onto the slide after passing through a series of filters and mirrors. While laser light is by definition very narrow band, the GenePix 4300A/4400A Microarray Scanner employs additional optical filters to make sure that no spurious excitation light is directed onto the slide. If the laser light impinges on an appropriate fluorophore bound on the slide, emission light of a longer wavelength is emitted. These emission photons are directed back through the optical system where they pass through another bandpass filter before reaching the photodetector.

Emission Filters

The GenePix 4300A/4400A Microarray Scanner is available in standard configuration with either two or four lasers. The scanner can be custom configured with one to four lasers. Each laser (red, yellow, green, and blue) includes a matching emission filter pre-installed in the sixteen-position filter cartridge.

Four positions in the filter cartridge are reserved for the standard emission filters.

- Position 1 – red (661 to 690 nm)
- Position 5 – yellow (619–641 nm)
- Position 9 – green (562–596 nm)
- Position 13 – blue (513–555 nm)

These filters are not accessible, however, the remaining twelve positions are available for custom filter installation.

Each standard emission filter is optimized for the emission spectrum of the respective dye, designed to reject laser light at OD 8 (optical density) for each respective laser excitation, and reject broad-spectrum light at OD 5.

For specific information on custom filters and their applications, refer to the filter manufacturer's website.

- Semrock Inc.: **www.semrock.com**
- Chroma Technology Corp: **www.chroma.com**

PMT

The GenePix 4300A/4400A Microarray Scanner uses a high-sensitivity, low-noise PMT to detect the emitted fluorescent light. A PMT converts incident photons into electrons through the photoelectric effect. When an incident photon impinges on the active surface of the PMT (the photocathode), an electron is generated. The electron flows through a series of electron multipliers (dynodes) to the anode. The amount of current that flows from the anode is directly proportional to the number of photons at the photocathode.

Status Lights

Three lights on the front of the GenePix 4300A/4400A Microarray Scanner indicate status.

- Device standby
- Scanning
- Eject

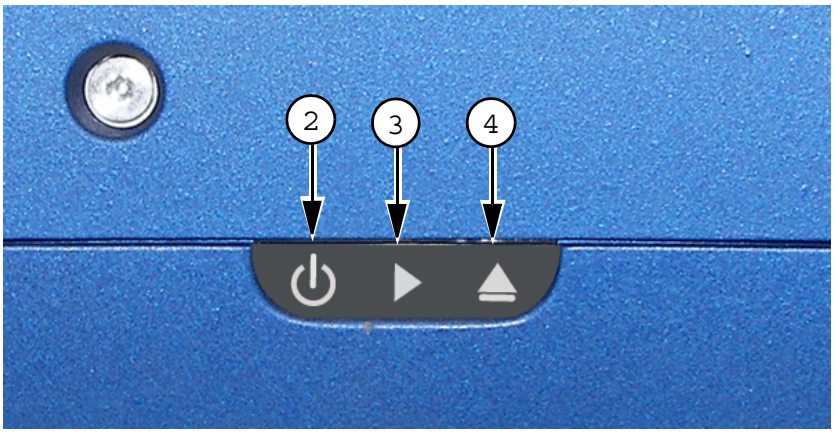


Table 1-1: Status lights

Item	Color	Description
1	Green	Device Standby Mode The scanner is powered on and ready to scan a slide
2	Blue	Scanning A scan is in process
3	Yellow	Eject The slide holder has been ejected from the scanner and the slide can now be removed

Note: The GenePix scanners are equipped with a mechanical safety laser interlock that triggers as soon as the slide holder door is opened. There is no danger of being exposed to laser light when the slide door is opened.

Scanner Specifications

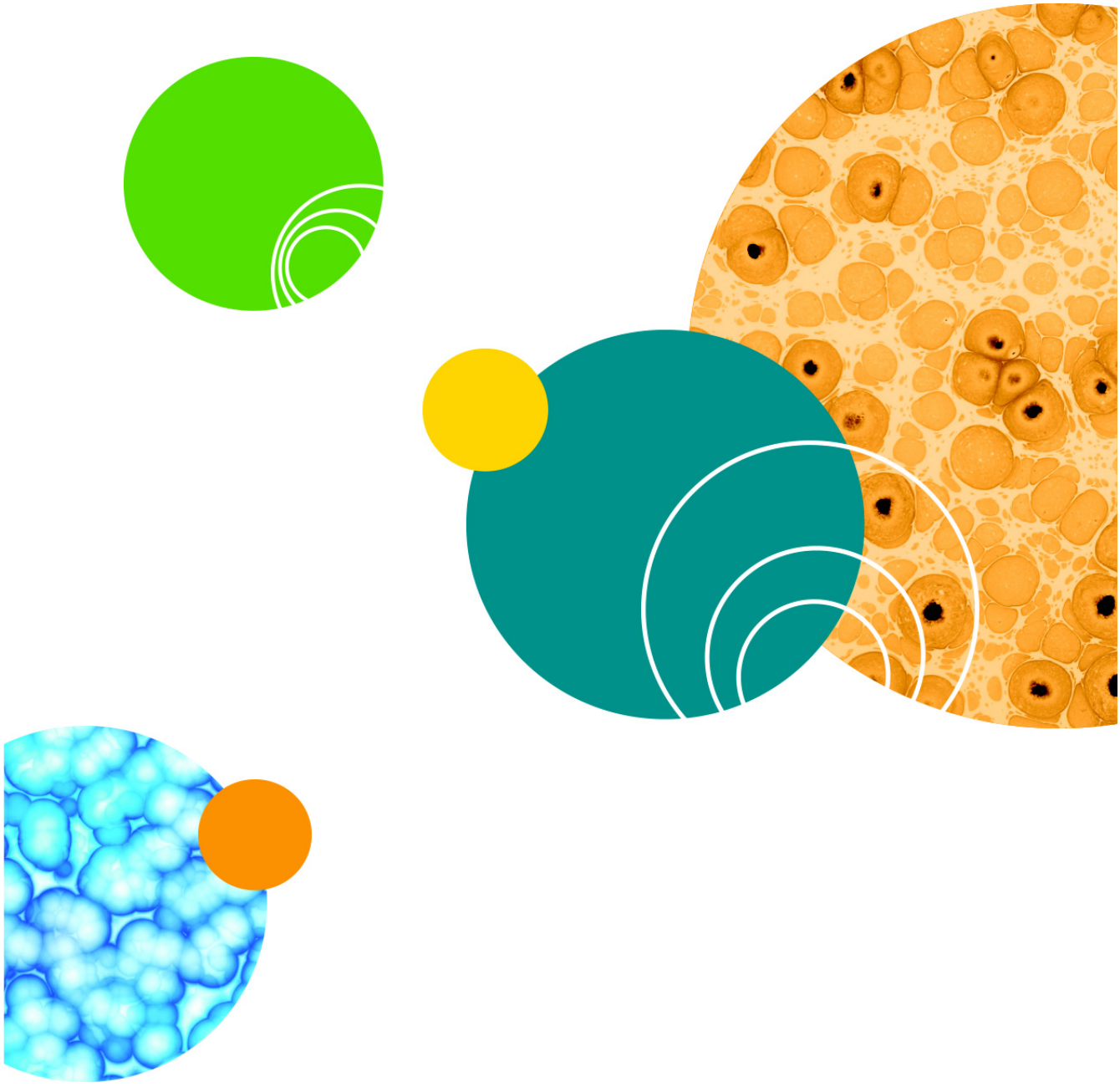
Table 1-2: Specifications

Sample type	Standard microscope slides (1 inch by 3 inches, 25 mm by 75 mm; 0.9 to 1.2 mm thick)
Maximum scan area	22 mm by 72 mm
Maximum resolution	5 μm for the 4300A, 2.5 μm for the 4400A
Scan mode and order	Sequential scan of user-configured wavelengths
Detector	PMT
Signal digital output	16-bit
Image format	Single or multi-image TIFF
Computer interface	USB 2.0
Scan time	Four minutes per channel for full size scan area at 10 μm resolution
Dynamic range	Four orders of magnitude
Rotational uniformity	Less than 4% non-uniformity
Dimensions	16.9 inches wide by 25.6 inches long by 13.4 inches high (43 cm by 65 cm by 34 cm).
Weight	99 lb (45 kg)
Power supply	Line voltage: 85 to 264 VAC (110 to 340 VDC) universal voltage input
Line frequency	50 to 60 Hz
Power	85 W, Fuse: 2.0 A slow. 5 to 20 mm

Site Requirements

Table 1-3: Site Requirements

Temperature	50 to 86º F (15 to 30º C)
Humidity	5 to 95% non-condensing
Power	Universal input 50 to 60 Hz, 100 to 240 VAC, 2A max
Space	25.6 inches deep by 16.9 inches wide by 13.4 inches high (65 cm by 43 cm by 34 cm). An additional 6 inches (15.2 cm) for clearance.
Bench support	Sufficient to support 99 lbs (45 kg) with minimal vibration
Power supply	Line voltage: 85 to 264 VAC (110 to 340 VDC) universal voltage input
Line frequency	50 to 60 Hz
Power	2.0 A



Installation

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The GenePix 4300A/4400A Microarray Scanner should be unpacked and in position on a flat level surface before performing any of the installation procedures. Perform the procedures in the following order.

- Unpack the scanner and position it on the bench
- Install the software
- Turn on the scanner
- Insert a slide

Unpacking the scanner and positioning it on the bench

The GenePix 4300A/4400A Microarray Scanner is packed in a specially designed crate. Retain the crate and the packing materials. In the event the scanner requires repair, you must return it to Molecular Devices in the original packaging. If the crate has been damaged in transit, you must retain it for inspection by the carrier.

WARNING! Shock Hazard. In an emergency, users must be able to safely disconnect the mains power cable without moving the scanner. Locate the scanner so that either the power outlet or the scanner's appliance connector is accessible.

WARNING! The scanner weighs approximately 99 pounds (45 kg). To avoid potential injury, a minimum of two people are needed to lift the scanner.

WARNING! Biohazardous Material. Do not operate the scanner in an environment where potentially damaging liquids or gases are present, or in a room with a temperature below 15° C.

To unpack the scanner and position it on the bench

1. Open the crate and remove any foam blocks used to protect the scanner from excessive shock and vibration during shipping.

CAUTION! Do not touch or loosen any screws or parts other than those specifically described in the instructions. Doing so may cause misalignment and voids the scanner warranty.

Note: Do not tilt or slide the scanner when transferring it from the crate to its final position on a bench or desk.

2. Lift the scanner using the molded lifting handgrips, and then place the scanner on a flat level surface, away from direct sunlight, dust, drafts, vibration, and moisture. Carefully move the scanner to its final position.

Table 2-1: Lifting handgrips

Item	Name	Description
1	Lifting handgrip	Lifting handgrips are molded into each side of the base of the protective enclosure

Tip: For proper ventilation and cooling, leave at least six inches of space between the back of the scanner and the nearest object or surface.

3. Plug the USB cable into the USB type B port on the back of the scanner, and the USB type A port on the control computer.

Table 2-2: Connections on back of the scanner

Item	Name
1	Mains power supply connection
2	USB type B port

4. Plug the mains power cable into the port on the back of the scanner, and the lab's power outlet.

   Molecular Devices recommends you use a surge protector between the mains power cable and the power outlet.

Installing the Software

Before operating the scanner, you must install the GenePix Pro Microarray Software on a Windows based control computer.

To install the software

1. Locate the GenePix Pro Software CD.

Note: You must be fully aware of the information contained in the *GenePix Pro Software Reference Guide* to ensure a successful software installation. The installation instructions are provided in hard copy, and soft copy on the GenePix Pro Software CD.

2. Read the supplied software installation instructions.
3. Insert the GenePix Pro Software CD into the computer. Follow the InstallShield Wizard instructions to install the GenePix Pro Software.

CAUTION! Do not to insert the security key into the control computer until after the GenePix Pro Software has been installed.

4. Install the security key. For more information, refer to the *GenePix Pro Software Reference Guide* included with the GenePix Pro Software.

Turning on the Scanner

Proper startup of the GenePix 4300A/4400A Microarray Scanner includes a functional checkout procedure to confirm that the scanner is performing according to the specifications established by Molecular Devices commissioning before the scanner left the factory.

To turn on the scanner

1. Make sure the slide door is closed.
2. Turn on the scanner power switch.
3. Turn on the control computer.
4. Click **Start > Programs > Molecular Devices > GenePix Pro,** and then click the **Report** tab.
5. Click **Functional Checkout**, and follow the steps in the Wizard.

   The GenePix Pro software automatically logs hardware performance events into the Hardware Diagnostics Report every two hours during operation.

Note: For optimum performance allow the GenePix 4300A/4400A Microarray Scanner to warm up for one hour before scanning slides with the GenePix Pro Software.

Inserting a Slide

The slide holder is a precision component designed to ensure proper focusing and field uniformity. Improper handling may damage the slide holder and affect imaging performance.

CAUTION! Never touch the slide holder while it is moving. Never force the slide holder closed, or apply significant pressure to it.

To insert a slide

1. Raise the slide door.

   The slide holder moves forward into the load position.
2. With the slide held between your thumb and finger, carefully place the slide, feature-side down into the slide holder.

Note: Make sure the barcode on the slide is facing the front of the scanner.

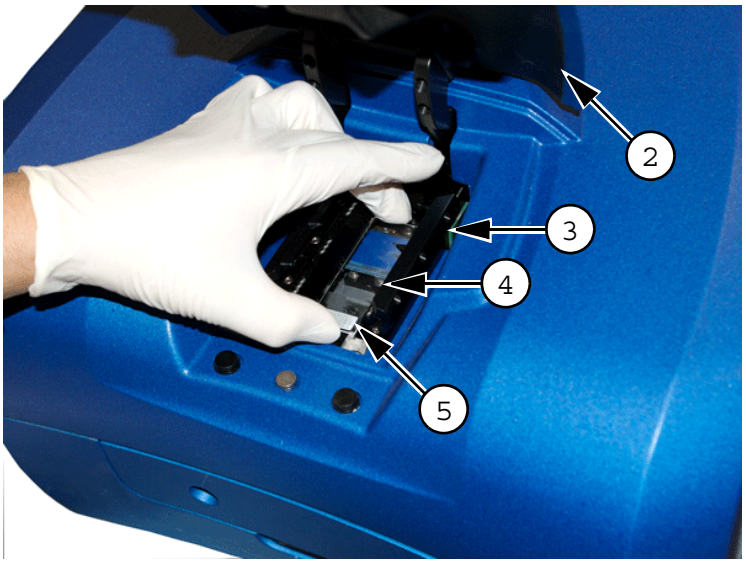


Table 2-3: Slider holder

Item	Name	Description
1	Slide door	In raised position
2	Slide holder	In load position
3	Slide	Place feature-side down
4	Barcode	Barcode is facing the front of the scanner

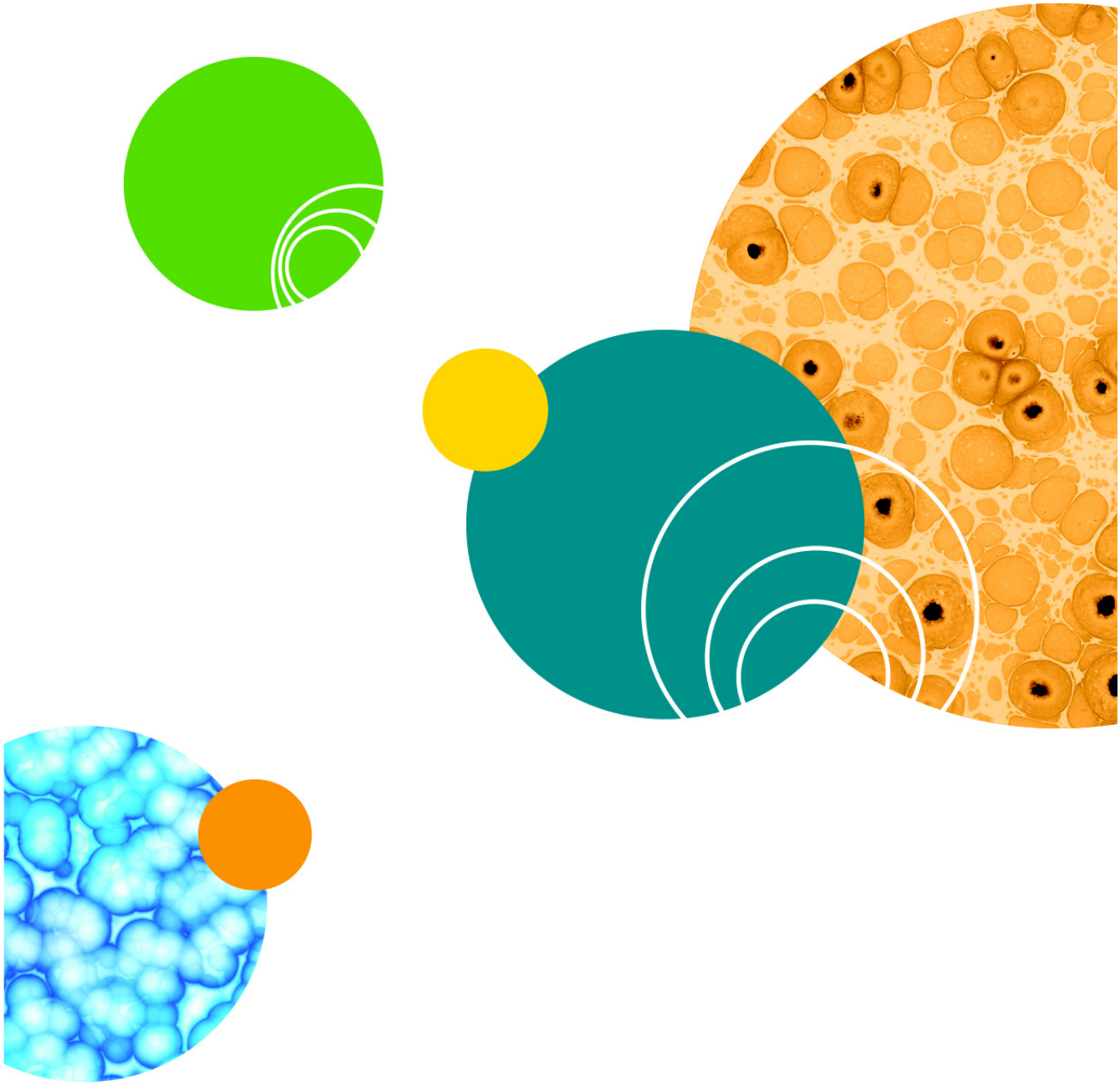
3. Close the slide door.
   The slide holder moves into the scan position.

Shutting Down the Scanner

Proper shutdown of the GenePix 4300A/4400A Microarray Scanner ensures the scanner or software are not damaged.

To shut down the scanner

1. Close the GenePix Pro Software.
2. Turn off the scanner power switch.
3. Turn off the control computer.



Maintenance & Troubleshooting

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The GenePix® 4300A/4400A Microarray Scanner requires very little maintenance. The procedures are limited to moving the scanner, and installing additional filters.

WARNING! Biohazardous Material. It is your responsibility to decontaminate the scanner, as well as any accessories, before requesting service from Molecular Devices representatives, or before returning the scanner or any components to Molecular Devices.

WARNING! Biohazardous Material. Never perform any maintenance procedures on the scanner in an environment where potentially damaging gases or liquids are present.

WARNING! Shock Hazard. Do not remove the protective enclosure or any covers marked with the high-voltage warning symbol.

WARNING! Shock Hazard. Always turn the power switch off and disconnect the mains power cable before performing any maintenance procedures.

WARNING! The scanner weighs approximately 99 pounds (45 kg). To avoid potential injury, a minimum of two people are needed to lift the scanner.

CAUTION! Do not touch or loosen any screws or parts other than those specifically described in the maintenance procedures. Doing so may cause misalignment, and void the scanner warranty.

Moving the Scanner

If the GenePix 4300A/4400A Microarray Scanner must be moved within the lab, or returned to Molecular Devices for service, the scanner must be prepared for transport.

If you do not have the original shipping crate, contact Molecular Devices and a new crate can be provided for an additional charge.

To move the scanner

CAUTION! Always use the Park Scanner utility prior to moving the scanner. Failure to park the scanner can result in misalignment or damage of the optical system.

1. Remove any slide from the slide holder.
2. Close the GenePix Pro Software.
3. Click **Start > Programs > Molecular Devices > GenePix Pro > GenePix Utilities.**

   The GenePix Utilities window appears
4. Click **Park Scanner for Shipping.**

   A message box appears informing you that the scanner has been successfully parked.

   CAUTION! Always turn off power to the scanner using the power switch. Do not turn off the power by unplugging the mains power cable from the power outlet.
5. Turn off the power switch on the scanner.

Tip: Do not turn on the power switch after parking the scanner.

6. Unplug the mains power cable from the back of the scanner and the lab's power outlet.

CAUTION! Never unplug the USB cable unless the scanner has been turned off and the mains power cable disconnected.

7. Unplug the USB cable from the back of the scanner and the control computer.

CAUTION! Do not tilt or stand the scanner on its end when moving it within the lab, or transferring it from the bench to the shipping crate.

8. If the scanner is to be moved within the lab or returned to Molecular Devices for service, pack the scanner in its original shipping crate. Otherwise, have two people lift the scanner or place it on a rolling cart to transport it to the new location.
9. For information on installing the scanner in a new location, see Unpacking the scanner and positioning it on the bench on page 17.

Note: When powering up the scanner, the scanner is automatically removed from park state.

Installing Custom Filters

You can install twelve custom filters in the filter wheel. When choosing filters, it is important to match the optical characteristics of the filter, dye, and laser. The transmission band of the filter should be centered as close as possible to the emission peak of the chosen dye, and must be narrow enough to exclude light from the laser and other dyes, but not so narrow that too many emission photons are excluded. Molecular Devices recommends you use a reject filter of OD 8 to eliminate laser excitation.

Required tools:

- Powder-free latex or nitrile gloves
- 5/32 inch Allen wrench
- Filter ring tool

To install custom filters

1. Turn off the power switch on the scanner.
2. Insert the 5/32 inch Allen wrench into the filter door latch, turn the wrench counterclockwise to release the latch, and then pull the filter door down.

Table 3-1: Filter door

Item	Name
1	Filter door
2	5/32 inch Allen wrench

3. Use the handle to pull the filter cartridge from the scanner.

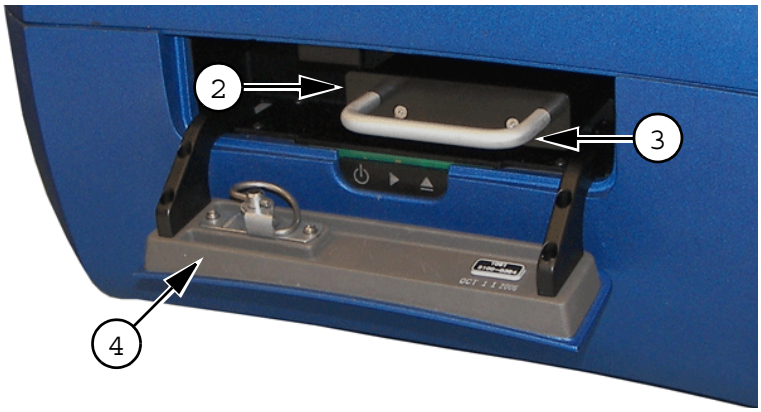


Table 3-2: Filter cartridge

Item	Name	Description
1	Filter cartridge	
2	Filter cartridge handle	
3	Filter door	In open position

4. Rotate the filter wheel until an open access port is visible in the top of the filter cartridge.

The filter position number is displayed in the indicator port nearby.

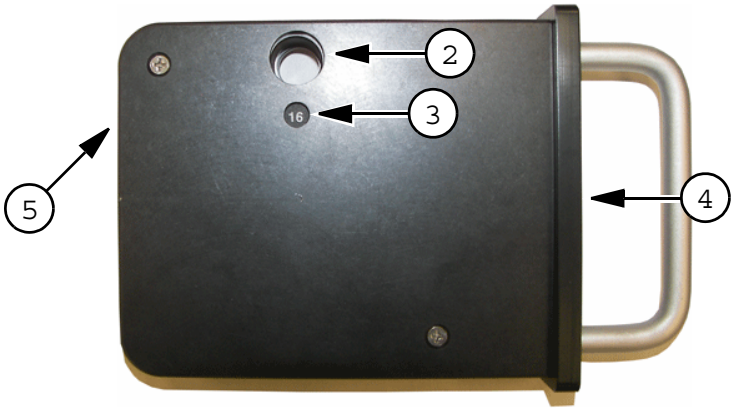


Table 3-3: Filter position

Item	Name	Description
1	Filter access port	No filter installed in photo
2	Indicator port	Displays filter position number
3	Filter cartridge	
4	Filter wheel	Thumb wheel located on the edge of the filter cartridge

5. Record the filter position in the GenePix Pro Software. See To record the filter information on page 33.

Note: If using a filter not supplied by Molecular Devices, consult the manufacturer's documentation in order to determine the correct filter orientation.

Note: Do not touch the optical surface of the filter. Handle the filter by the mounting ring only.

6. Place the filter in the access port with the orientation arrow on the filter pointing down.

   Make sure the filter is seated properly.

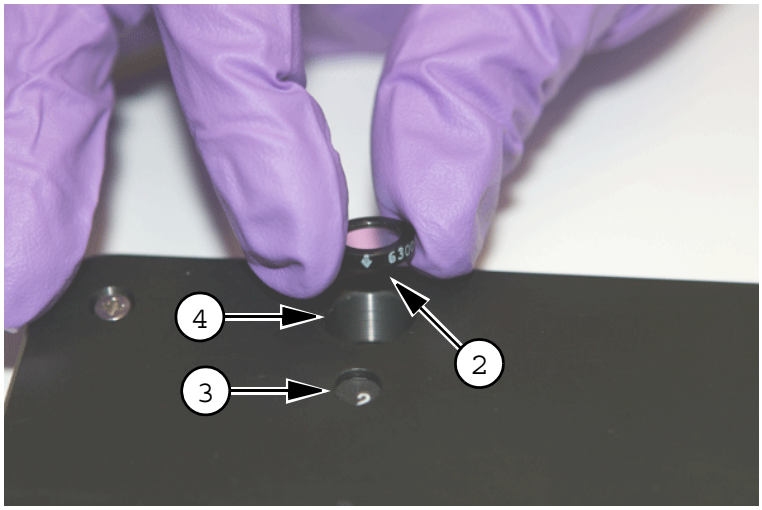


Table 3-4: Filter arrow pointing down into access port

Item	Name	Description
1	Filter	Lower filter into access port with arrow pointing down
2	Indicator port	
3	Filter access port	

7. Place the filter ring in the access port with the grooves facing up.
8. Insert the filter ring tool into the access port, making sure it locks into the grooves on the filter ring, and then rotate the filter ring tool clockwise to tighten the filter ring down onto the filter.

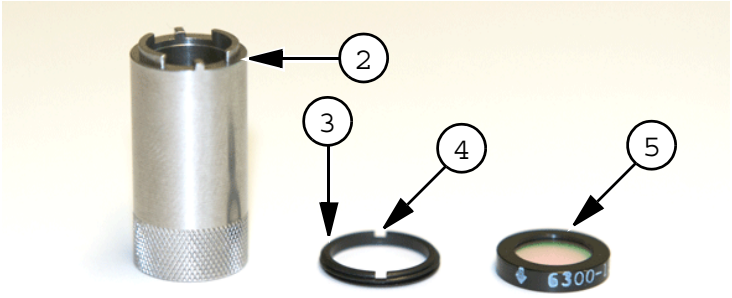


Table 3-5: Filter, filter ring, and filter ring tool

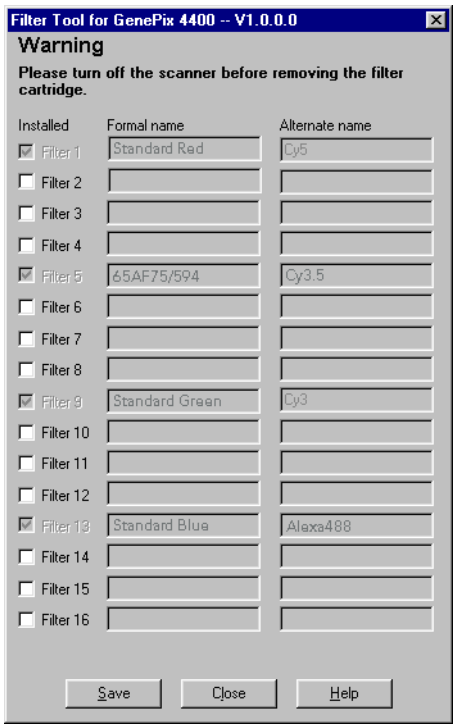
Item	Name	Description
1	Filter ring tool	Locks into the grooves of the filter ring
2	Filter ring	
3	Groove in filter ring	
4	Filter	

9. To install additional filters, repeat steps 4 to 8.
10. Position the filter cartridge inside the scanner, close the filter door, and then insert and turn the 5/32 inch Allen wrench clockwise to secure the latch.

To record the filter information

1. Turn on the scanner power switch.
2. Turn on the control computer.
3. Click **Start > Programs > Molecular Devices > GenePix Pro > Filter Tool**.

   The Filter Tool for GenePix 4300A/4400A window appears



4. Select the **Installed** filter position number, then type a **Formal Name** and an **Alternate Name**.

   Molecular Devices recommends you use the filter supplier's designation as the Formal Name and an easily recognizable description for Alternative Name, such as the dye name, for example, FITC or Texas Red.
5. Click **Save**.
6. Click **Close**.

The filter locations are saved and displayed in the GenePix Pro Hardware Settings window.

Interlock Failure Symptoms

WARNING! Laser Hazard. Never operate the scanner if you suspect an interlock has failed. Doing so exposes the user to laser radiation.

If an interlock fails, do not operate the GenePix 4300A/4400A Microarray Scanner. Shut down the scanner and contact Molecular Devices Technical Support immediately.

The following are typical symptoms of an interlock failure.

- The mirror and lens assembly keep moving below the slide after the door is opened.
- The blue Scanning LED on the front of the scanner does not extinguish when the slide door is open.
- The GenePix Pro Software does not recognize the scanner or the slide.
- You can no longer hear the distinctive metal-on-metal sound that the mechanical interlock makes when it falls into place. This occurs when the slide loading door has opened about one quarter inch.

Fuses

If the GenePix 4300A/4400A Microarray Scanner does not start up, a fuse may no longer be functioning. If you suspect a fuse has stopped functioning, contact Molecular Devices Technical Support.

Warranty and Service

Molecular Devices is committed to ensuring the highest quality of our products and customer service.

If you have any problems with your GenePix® 4300A/4400A Microarray Scanner, contact our Technical Support group. In the U.S., contact us at 1-800-635-5577. For locations outside the U.S., please contact your local sales representative.

Standard Warranty

Molecular Devices warrants its non-consumable hardware products to be free from defects in materials and workmanship for 12 months from date of invoice or date of purchased installation visit, which ever is later. The warranty covers the cost of parts and labor to repair the product.

Please keep the shipping container for future use. If you require an additional container, one can be provided for an additional charge. Products returned to Molecular Devices for repair should be properly packaged with transportation charges prepaid. Molecular Devices will pay for the return shipping of the product to the customer. If the shipment is to a location outside the United States, the customer is responsible for all duties, taxes and freight clearance charges.

The warranty is valid when the product is used for its intended purpose and does not cover products which have been modified without approval from Molecular Devices, or which have been damaged by abuse, accident or connection to incompatible equipment.

This warranty is in lieu of all other warranties, expressed or implied.

Out-of-Warranty Repair Service

Out-of-warranty repair service is available. Contact Molecular Devices Technical Support for more information.

Optional Service Agreement

Purchasing an optional Service Agreement extends the coverage of the Standard Warranty. Contact the supplier for current rates.

Technical Support

In order to receive the best possible technical support, we encourage you to register on our website www.moleculardevices.com, especially if your sales transaction was conducted by a purchasing agent. Your name in our database ensures that we can contact you directly with important information about product upgrades and special promotional opportunities. Once you register your name, you can then register your instrument.

If you require advice on the use of your GenePix 4300A/4400A Microarray Scanner, do not hesitate to contact Molecular Devices Technical Support. Visit the website http://support.moleculardevices.com and complete the Technical Support Request form. You can also phone Molecular Devices Technical Support.at 800-635-5577. Follow the prompts for **GenePix Technical Support**.

At Molecular Devices, staying in touch with all our customers is a valuable part of our ongoing development process, ensuring the excellence of every product we offer.