GE Healthcare

ImageQuant™ LAS 4000

User Manual

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1 Introduction

The ImageQuant LAS 4000

The ImageQuant LAS 4000 is a camera system for producing digital images of gel or membrane samples or films. It is used together with the ImageQuant LAS 4000 Control Software to:

- Expose chemiluminescent samples or membranes.
- Expose fluorescent samples using epi (incident) or trans (transmitted) light sources, for example gels stained by ethidium bromide (EtBr).

  The ImageQuant LAS 4000 can be supplied with NIR, Red, Green, Blue and UV epi lights.
- Expose dye-stained gels and membranes or films using epi or trans illumination.
- Expose a sample repeatedly, incrementally or by programming exposure schemes.

Purpose of this manual

The ImageQuant LAS 4000 User Manual provides detailed instructions on using the ImageQuant LAS 4000 and outlines the functions of the ImageQuant LAS 4000 Control Software.

Note: *Be sure to refer also to the manual Getting Started with ImageQuant LAS 4000 for regulatory information, specifications and the troubleshooting guide.*

1.1 Important user information

Read this before using the ImageQuant LAS 4000

All users must read the safety instructions in *Getting started with ImageQuant LAS 4000* before installing, using or maintaining the equipment.

Do not operate the ImageQuant LAS 4000 in any other way than described in the user documentation. Otherwise, you may be exposed to hazards that can lead to personal injury and you may cause damage to the equipment.

Intended use

The ImageQuant LAS 4000 is a camera system that produces digital images of chemiluminescent, dyed or fluorescent gels and membranes. The ImageQuant LAS 4000 is intended for research use only, and shall not be used in any clinical procedures, or for diagnostic purposes.

Safety notices

The user documentation contains WARNINGS, CAUTIONS and NOTICES concerning the safe use of the product. See definitions below.

Warnings

WARNING

WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury. It is important not to proceed until all stated conditions are met and clearly understood.

Cautions

CAUTION

CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury. It is important not to proceed until all stated conditions are met and clearly understood.

Notices

NOTICE

NOTICE indicates instructions that must be followed to avoid damage to the product or other equipment.

Regulations and standards - supplementary information

This equipment conforms to the regulations and standards described below.

EMC	VCCI Class A Conformance
	FCC Part 15B Class A
	ICES-003 Class A
	IEC 61326-1: 2005
	EN 61326-1: 2006

Safety	UL61010-1: second edition
	CAN/CSA-C22.2 No. 61010-1, second edition
	IEC61010-1: 2001, second edition
	IEC61010-2-081, first edition
	EN 61010-1: 2001
	EN 61010-2-081: 2002
Laser	USA 21 CFR, Chapter I, Subchapter J, Part 1040.10 Laser Products
	IEC 60825-1: 2001
	EN 60825-1: 1994+A11: 1996+A2: 2001
CE	LV Directive 2006/95/EC (as amended)
	EMC Directive 2004/108/EC (as amended)
	Machinery Directive 2006/42/EC

Note: *This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.*

This Class A digital apparatus complies with Canadian ICES-003. Cet appareil numérique de la classe A conforme à la norme NMB-003 du Canada.

Note: *This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.*

Information for traceability

Manufacturer:	GE Healthcare
Contact information:	See back cover

Power cable

1 In Japan and North America:

Do not use cables other than the power cable that comes with the equipment.

2 In EU countries:

The cable is given the following CEE Certification Number.

VDE	6522-1570-8035/AIG	DEMKO	116773 ASC
SEMKO	9449029	KEMA	93.6830.04-KCS/LB
NEMKO	P94102620	CEBEC	8652
EI (FIMKO)	179615-02	OVE	0204-515-00

Mercury-containing products label

CAUTION

Ultraviolet ray lamps in this product contain mercury, which must be recycled or disposed of in accordance with local, state, or federal laws.

LED safety

This product is categorized as a class 1 laser (LED) device (IEC60825-1+A2:2001).

LED light sources

Red Epi light	Wavelength 630nm	Class 1
Green Epi light	Wavelength 520nm	Class 1
Blue Epi light	Wavelength 460nm	Class 1
RGB module	Wavelength 630, 520 and 460nm	Class 1
UV Epi light	Wavelength 365nm	Class 1M
NIR Epi light	Wavelength 710nm	Class 1
White Epi light	Wavelength 470-740nm	Class 1

CAUTION

Do not look at the light directly through optical instruments.

CAUTION

If the door is opened and the interlock is cancelled, class 1 laser (LED) will be emitted.

CAUTION

Use of controls or adjustments or performance of procedures other than those specified in the user documentation may result in hazardous radiation exposure.

Notes and tips

Note: *A Note is used to indicate information that is important for trouble-free and optimal use of the product.*

TIP: A tip contains useful information that can improve or optimize your procedures.

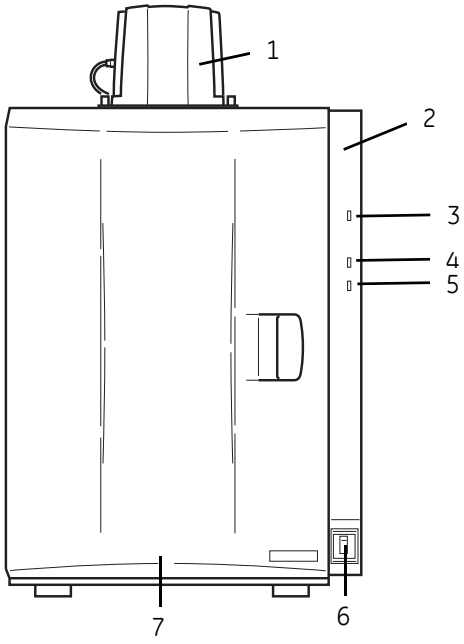
Typographical conventions

Software items are identified in the text by ***bold italic*** text. A colon separates menu levels, thus ***File:Open*** refers to the ***Open*** command in the ***File*** menu. Hardware items are identified in the text by **bold** text (e.g., **Power** switch).

2 The ImageQuant LAS 4000

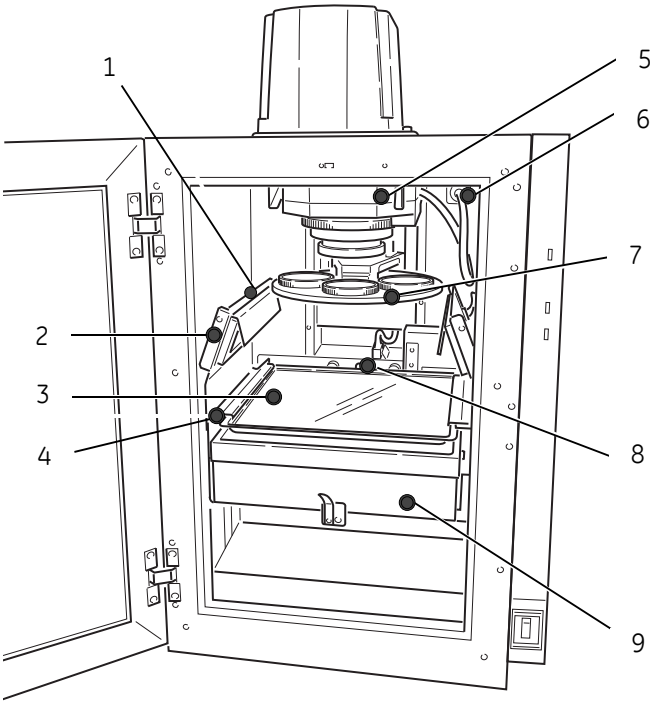
This chapter describes the features and part names of the ImageQuant LAS 4000 hardware, and the connectors that connect the various parts of the equipment.

2.1 The ImageQuant LAS 4000 exterior



Part	Name	Description
1	Camera head	CCD cooling and image data output
2	Indicator panel	Status lights
3	Power LED	Lights when the power is on
4	Busy LED	Lights when an exposure is in progress
5	Error LED	Lights when an error is detected
6	Power switch	I Power ON O Power OFF
7	Intelligent dark box (IDX)	Dark box

2.2 Inside the ImageQuant LAS 4000



Part	Name	Description
1	Epi light connector	Connects the epi light to the IDX
2	Epi light source	NIR Epi light (710 nm) Red Epi light (630 nm) Green Epi light (520 nm) Blue Epi light (460 nm) RGB Module (Epi light with red, green and blue LEDs) UV Epi light (365 nm) White Epi light
3	Sample tray	Supports the sample
4	Lifting table	Moves the sample to the selected tray position
5	Lens	F0.85/43 mm LAS High Sens. lens, or F1.8/24 mm wide view lens
6	Lens connector	Connects lens to IDX

Part	Name	Description
7	Automatic filter changer	Used to hold filters selected in the control software. The following filters are commonly used: IR785 Alexa (filter for NIR LED) R670 Cy5 (filter for red LED) 575DF20 Cy3 (filter for green LED) 605DF40 EtBr (filter for detecting EtBr) 510DF10 (filter for detecting GFP) Y515 (filter for blue LED) L41 UV (filter for UV LED)
8	Trans light source connector	Connects the UV transilluminator or White light table to IDX
9	Trans light source	312 nm UV transilluminator White light table

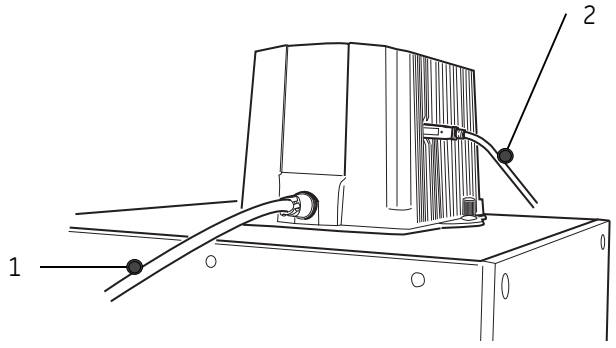
Note: *Do not use connectors other than those supplied for the Epi light sources.*

Note: *Do not connect cables other than those supplied to the lens.*

Note: *Do not connect anything other than the transmitted light sources to the transmitted light source connector.*

2.3 Connections

Camera head



No.	Name
1	Camera cable
2	USB cable

Note: *Do not connect cables other than the camera cable supplied with the equipment.*

Note: *Do not disconnect the camera cable other than when removing the camera head.*

LAS High Sens. lens

High Sens. lens cable

A cable used for connecting the LAS High Sens. lens and the IDX. Make sure that the cable is securely connected.

Note:

- *Never remove the cable except when replacing the lens.*
- *Be sure to turn off the equipment before replacing the lens.*

Epi lights

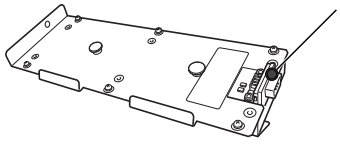


Figure 2.1: Incident (Epi) light source connector (rear)

Connector on Epi light source

The Epi light sources illuminate the object to be imaged from the upper right and upper left.

The connector is connected to the Epi light source connector inside the IDX.

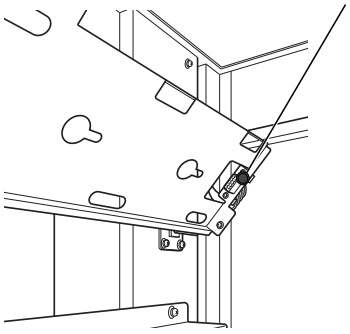


Figure 2.2: Inside the instrument

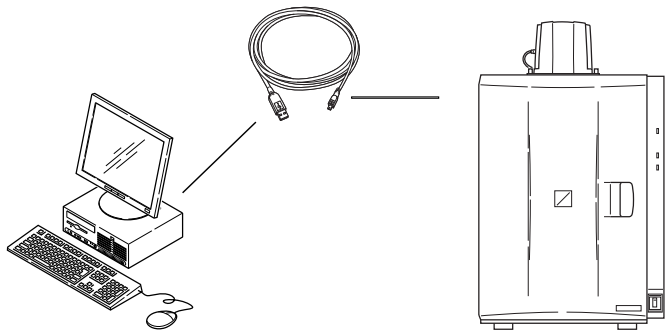
Epi light source connector

A connector used for connecting the Epi light source. Power is supplied to the Epi light source through this connector.

Note:

- *The Epi light sources for the right and left sides are different. Attach the appropriate source on respective sides.*
- *The connector will be connected when the Epi light source is inserted. Make sure that the connector is securely connected. See Section 3.3.2 Changing the Epi lights, on page 29.*
- *Be sure to use Epi light sources of the same type for the right and left sides otherwise an incorrect image will be obtained.*
- *Do not insert any connector other than those for the Epi light sources.*

USB cable



USB cable

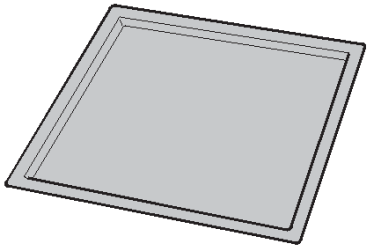
Connects ImageQuant LAS 4000 and the analysis PC. Read data will be sent from ImageQuant LAS 4000 to the analysis PC through the USB cable. USB 2.0 is supported.

Connect one end with the ImageQuant LAS 4000 camera head USB connector, and the other to a USB port of the analysis PC.

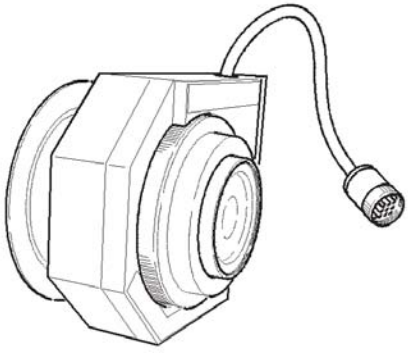
Note:

- *Use the USB cable supplied with the equipment.*
- *Do not connect the instrument and the PC via a USB hub.*
- *Do not connect USB equipment other than ImageQuant LAS 4000 to the PC. Similarly, do not use other USB equipment connected to the PC while ImageQuant LAS 4000 is in use. This may result in the loss of image data.*
- *The PC must be certified according to UL60950-1 (UL listed) and IEC60950-1.*

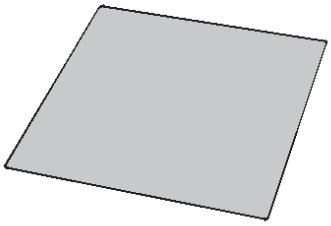
2.4 Parts and accessories



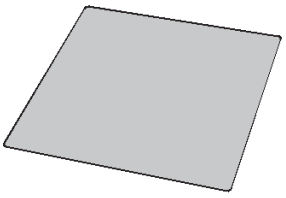
Epi tray



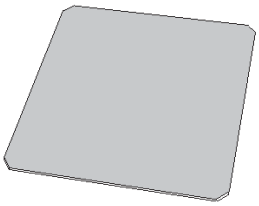
F0.85 43mm LAS high sensitivity lens



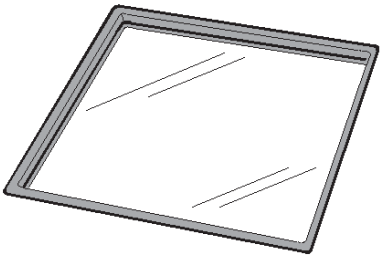
Cal plate FL (Green)



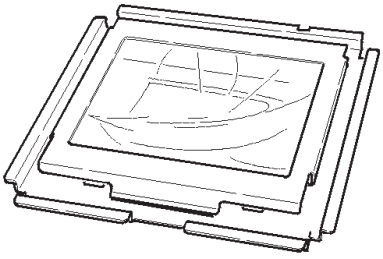
Cal plate GR (Pink)



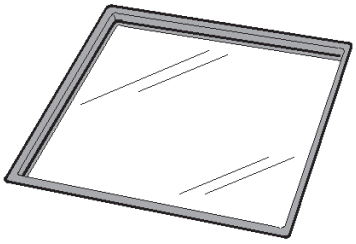
Cal plate DI



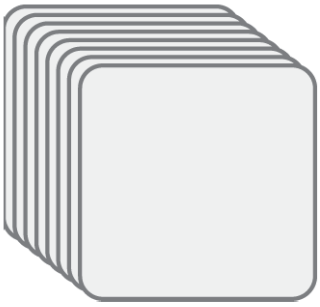
White trans tray



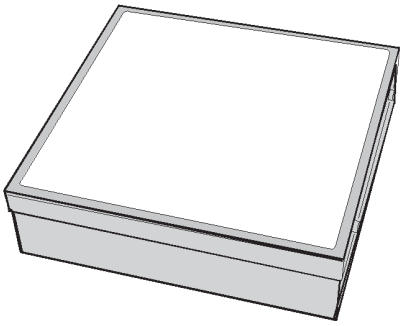
NP tray



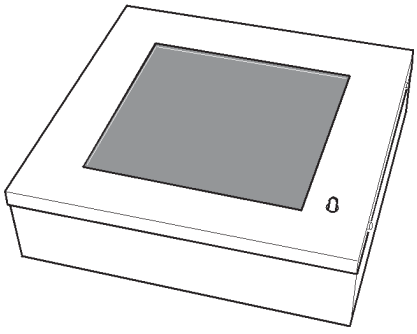
UV trans tray



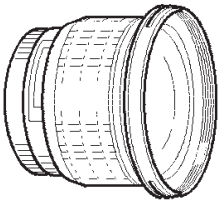
Gel sheet



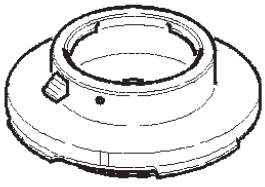
White light table



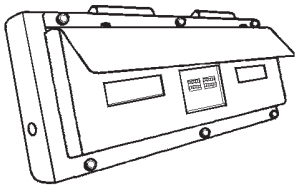
UV transilluminator



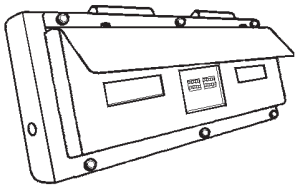
F1.8 24mm wide view lens



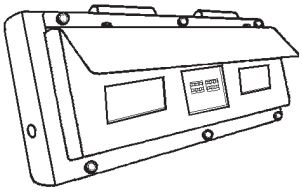
F-mount adapter



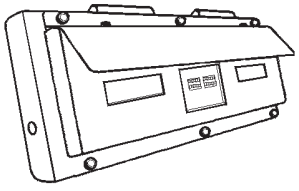
Blue Epi light (460 nm), set of two



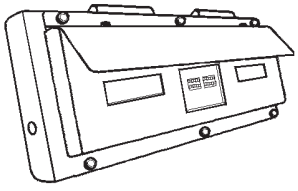
Green Epi light (520 nm), set of two



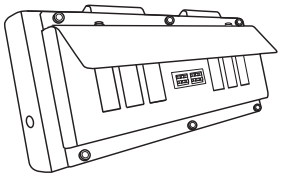
Red Epi light (630nm), set of two



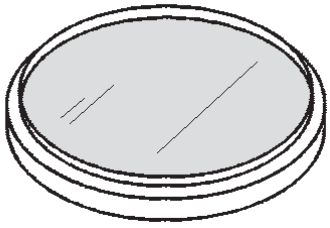
UV Epi light (365 nm), set of two



NIR Epi light (710 nm), set of two



RGB module, Epi lights, set of two



Filters:

- Y515 filter (Y515)
- GFP detection filter (510DF10/GFP)
- EtBr detection filter (605DF40/EtBr)
- Cy3 detection filter (575DF20/Cy3)
- Cy5 detection filter (R670BP/Cy5)
- Alexa Fluor 750 detection filter (IR785/Alexa)
- Ultraviolet protection filter (L41/UV)

Note:

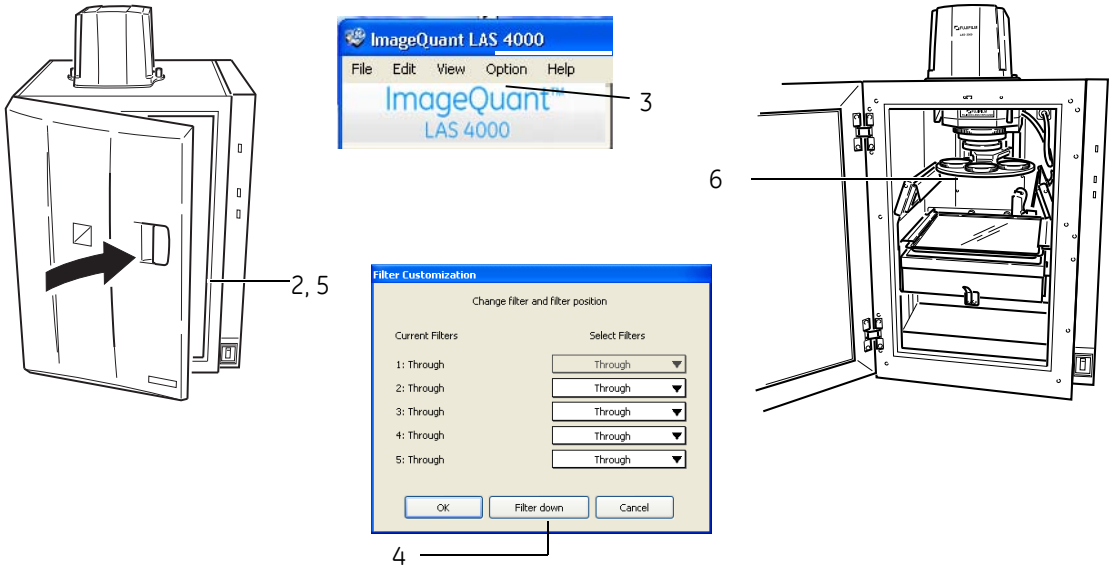
- *The combined accessories and light source vary depending on the system that you purchase.*
- *Make sure to retain the caps and filter cases.*
- *Store the incident (Epi) light sources in a container box.*
- *The UV trans tray will degrade after many UV illuminations. It can be used up to approximately 1000 times if each exposure time is 1 second. New trays can be purchased separately.*

3 Exchanging accessory parts

3.1 Changing or installing a filter

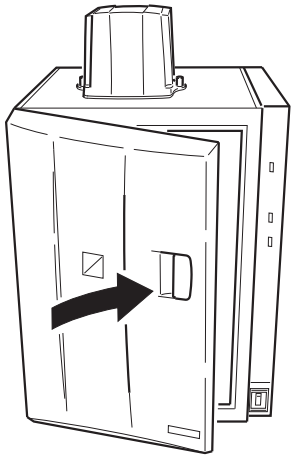
Optical filters are installed in the filter turret localted under the lens inside the IDX. This section describes how to install or change a filter on the filter turret.

Install a filter in the filter turrent and register it in the ImageQuant LAS 4000 Control Software as follows:



1 Ensure that the camera head and PC are connected. Turn on the instrument and the PC, and start the ImageQuant LAS 4000 Control Software.

2 Close the instrument door



3 Select ***Filter Customization*** in the ***Option*** menu in the ImageQuant LAS 4000 Control Software main window.

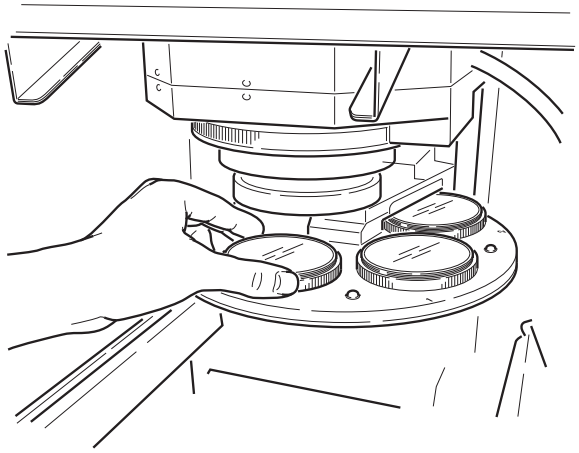
4 Click the ***Filter down*** button.

The filter changer is lowered.

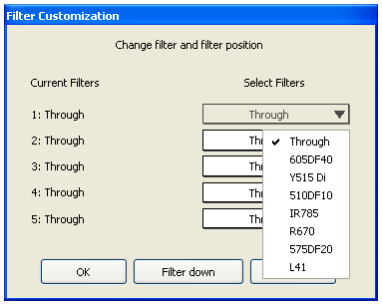
5 Open the instrument door.

6 Turn the filter changer so the desired position is easily accessible. If a filter is already in place at this position, unscrew it carefully and put it back in its cover.

7 Screw the new filter into place.



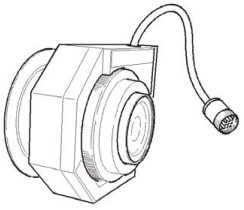
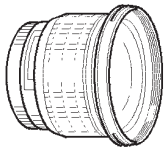
8 Select the appropriate filter from the drop-down list and click the ***OK*** button.



Note: *The filter changer returns to the original position when you click the* ***Start***, ***Focusing*** *or* ***Method/Tray position*** *buttons.*

3.2 Installing or exchanging the lens

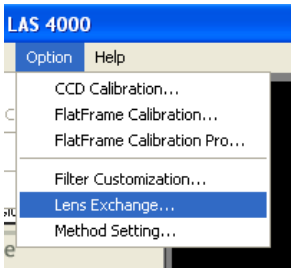
Two lenses can be used with the ImageQuant LAS 4000, an F0.85 43mm LAS High Sens. lens, and an optional F1.8 24mm wide view lens. The wide view lens can image samples up to 250 x 250 mm in size. For all other applications, the LAS High Sens. lens is recommended. This section describes how to install or exchange the lenses.

	
F0.85 43mm LAS High Sens. lens	F1.8 24mm wide view lens

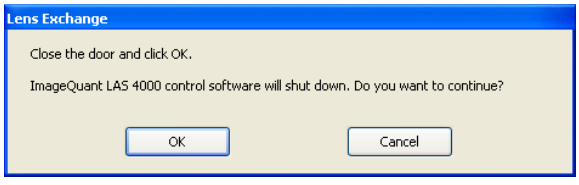
3.2.1 Removing the LAS High Sens. lens

1 Close the instrument door. If the power is turned off and the filter changer is down, proceed to step 4.

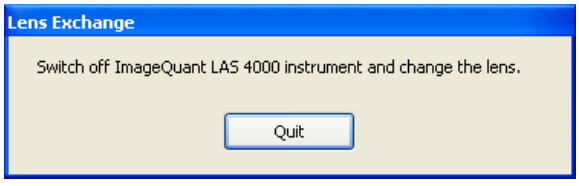
2 Select ***Option:Lens Exchange***.



A message is displayed.

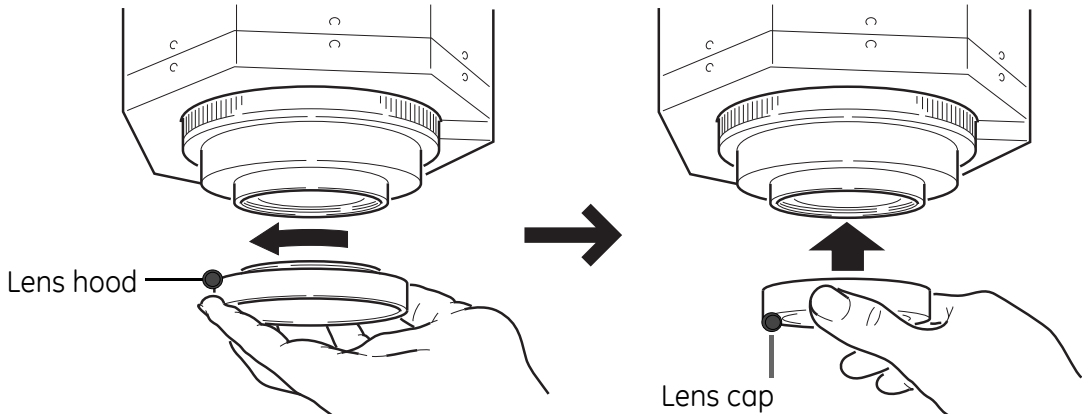


3 Click ***OK***.

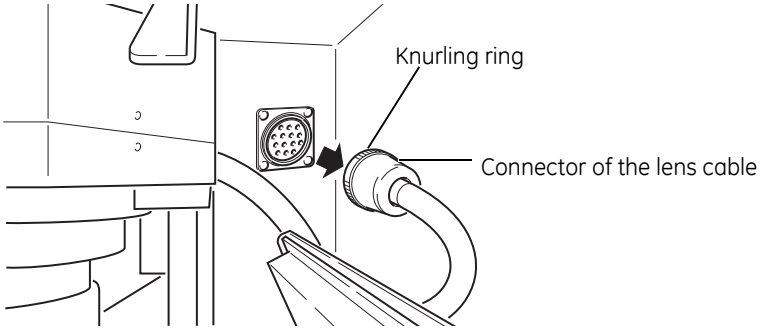
4 

Turn off the instrument using the power switch.

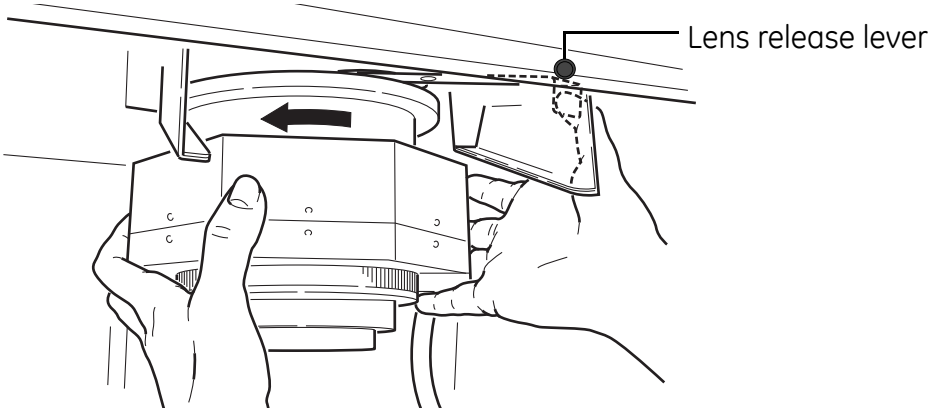
5 Loosen and remove the lens hood, then place the lens cap over the lens.



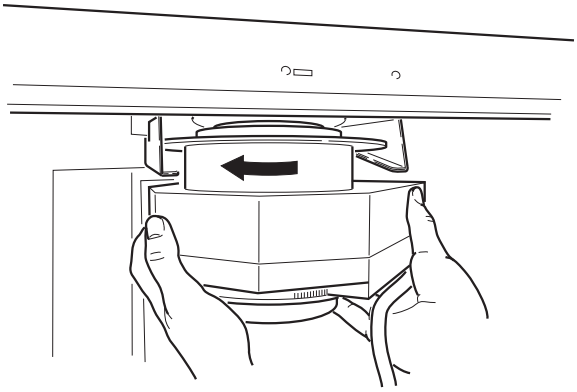
6 Disconnect the lens cable connector by rotating the knurling ring.



7 Turn the lens slightly to the left and loosen it while pushing the lens release lever.

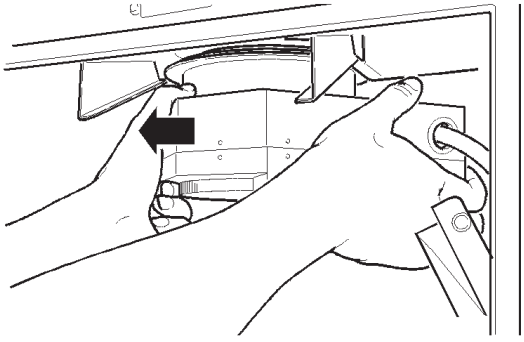


8 Rotate the lens to the left by 45 degrees.
The lens comes off downward.

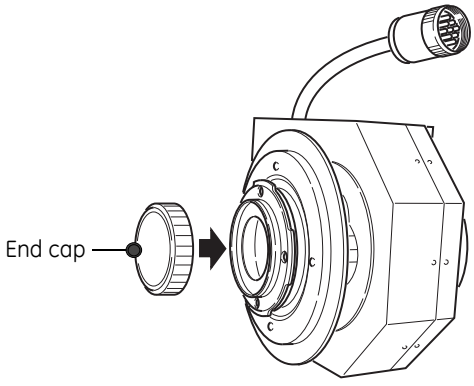


Note: *Hold the lens with both hands so as to prevent the lens guide from being damaged.*

9 Take out the lens slowly along the lens guide toward you.



10 Place the end cap on.



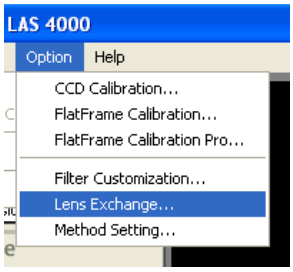
Note:

- *Be sure to put the high-sensitivity lens sideways and lower it gently when placing it on the desk. Placing the lens downward may affect the mechanical precision of the lens barrel.*
- *Make sure that the filter changer has come down far enough to make room for replacing the lens.*
- *Do not let the high-sensitivity lens hang on the lens guide. The lens may fall causing injury or damage.*
- *The high sensitivity lens weighs 4.5 kg. Be careful when handling it.*

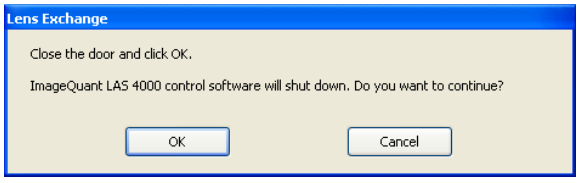
3.2.2 Installing the LAS High Sens. lens

1 Close the instrument door.If the power is turned off and the filter changer is down, proceed to step 4.

2 Select ***Option:Lens Exchange...***.

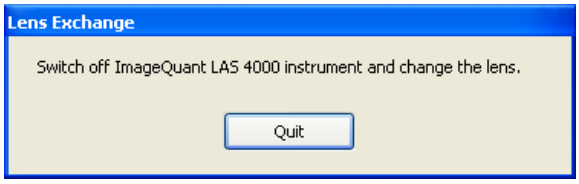


A message is displayed.



Click ***OK***.

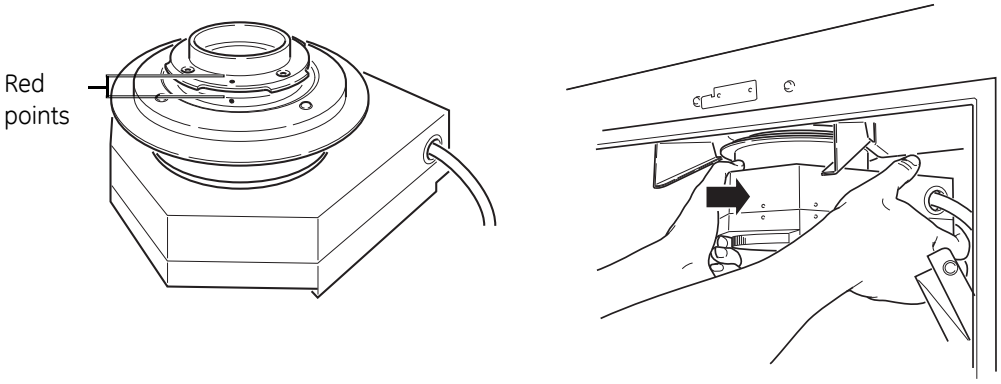
3



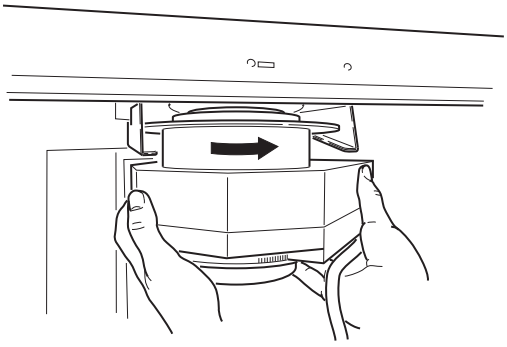
Turn off the instrument using the power switch.

4 Remove the end cap from the lens.

5 Insert the lens along the lens guide with the red points facing towards you.

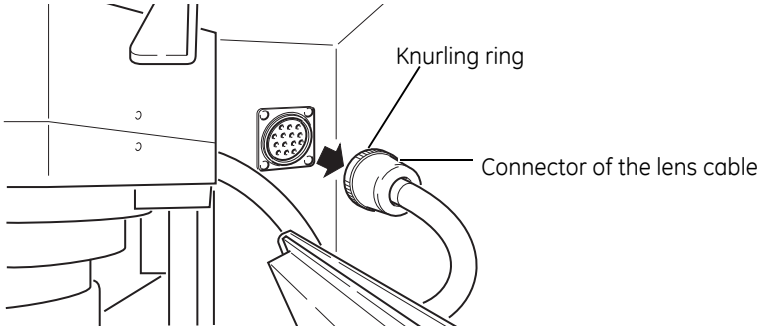


6 Raise the lens into position and rotate it clockwise to lock in position.



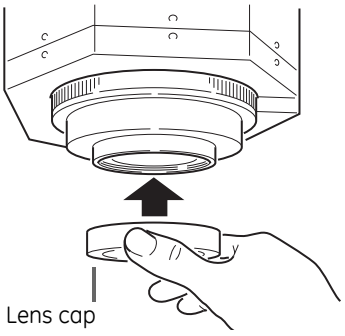
7 Connect the lens cable.

Turn the knurling ring until it is securely fixed.

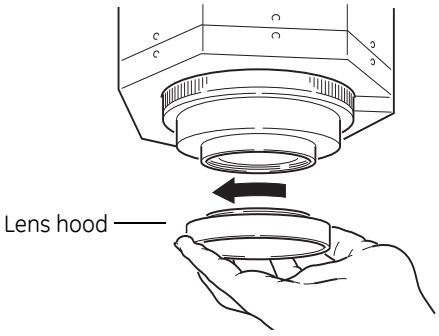


Note: *Be sure to connect the lens cable. Otherwise, the high sensitivity lens cannot be recognized. This may cause malfunction of the equipment.*

8 Remove the lens cap.



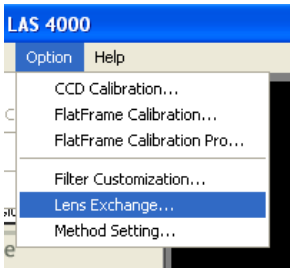
9 Install the lens hood.



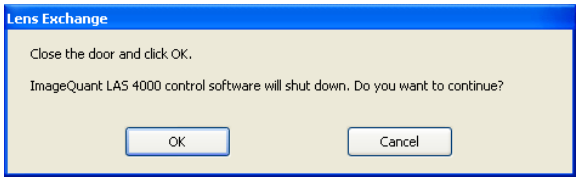
3.2.3 Removing the wide view lens

1 Close the instrument door. If the power is turned off and the filter changer is down, proceed to step 4.

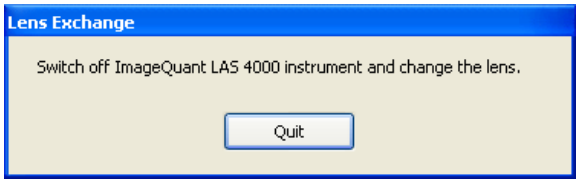
2 Select ***Option:Lens Exchange...***.



A message is displayed.

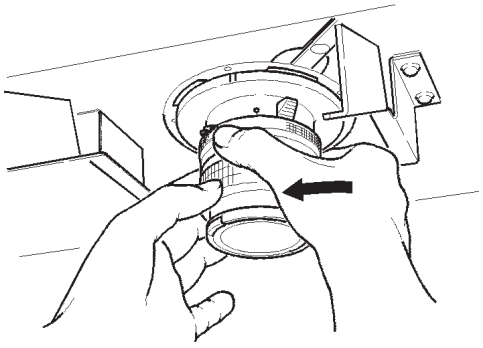


Click ***OK***.

3 

Turn off the instrument using the power switch.

4 Remove the F-mount adapter and lens while pushing the release button provided on the lens.



5 Remove the wide view lens together with the F-mount adapter by rotating it.

6 Remove the lens hood from the lens.

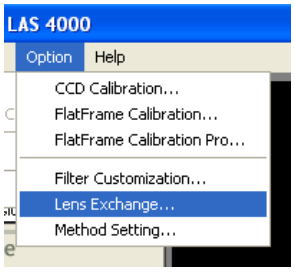
7 Place the lens cap on.

8 Place the end cap on the lens and the cap on the F-mount adapter.

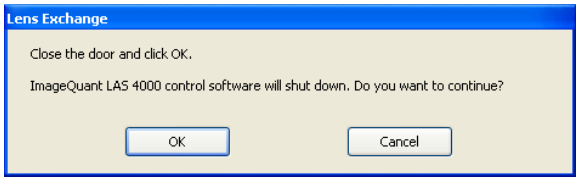
3.2.4 Installing the wide view lens

1 Close the instrument door. If the power is turned off and the filter changer is down, proceed to step 4.

2 Select ***Option:Lens Exchange...***.

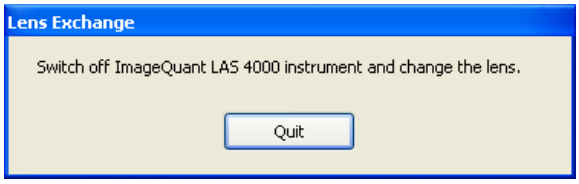


A message is displayed.



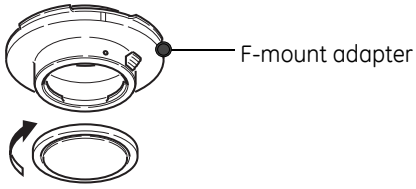
Click ***OK***.

3



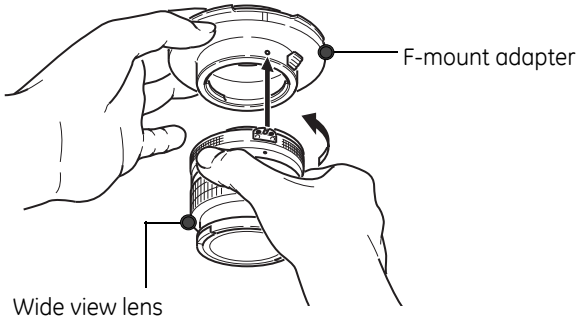
Turn off the instrument using the power switch.

4 Remove the cap attached to the F-mount adapter by turning it to the right.

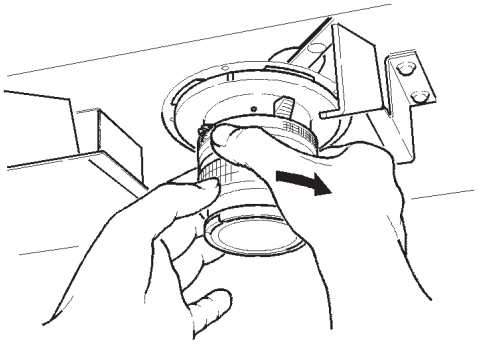


5 Remove the end cap from the wide view lens.

6 Align the White point mark of the F-mount adapter with the lens mark and turn to lock them together. Hold the lens so that the red point is towards you.

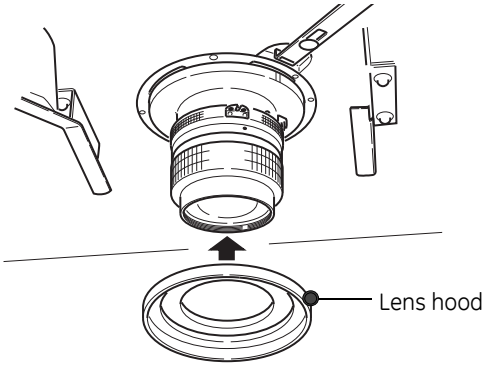


7 Fix the lens in position be turning it to the right.



8 Remove the lens cap.

9 Placel the lens hood on the lens.



3.3 Changing the light sources

Both trans (transmitted) and epi (incident) light sources are available for exposure with the ImageQuant LAS 4000. This section describes how to change both types of light source.

The following table summarizes the properties of the various light sources.

Type	Name	Peak wavelength
Transmitted	UV transilluminator	312 nm
	White light table	-

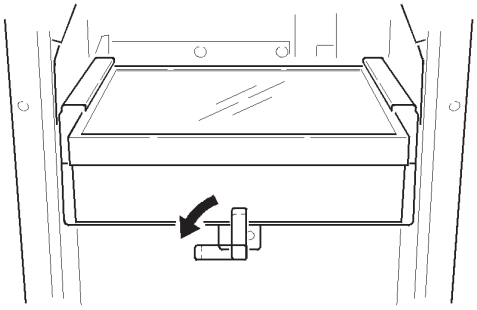
Type	Name	Peak wavelength
Incident	UV Epi light	365 nm
	Blue Epi light	460 nm
	Green Epi light	520 nm
	Red Epi light	630 nm
	RGB module (3-color Epi light)	460nm or 520nm or 630 nm
	NIR Epi light	710 nm
	White Epi light	-

3.3.1 Changing the UV transilluminator or white light table

The UV transilluminator and white light table are exchanged as follows:

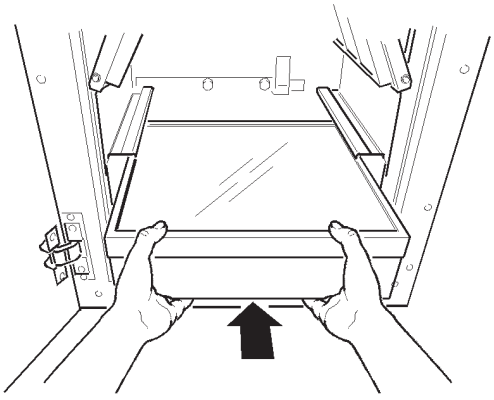
1 If neither the UV transilluminator or white light table are currently in place inside the instrument, proceed to step 4.

2 Turn the lever holding the light source to unlock it.

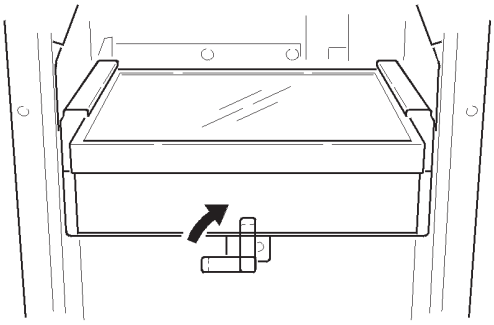


3 Pull out the light source carefully along the guide while holding it with both hands.

4 Push the desired light source in along the guide at the bottom of the IDX.



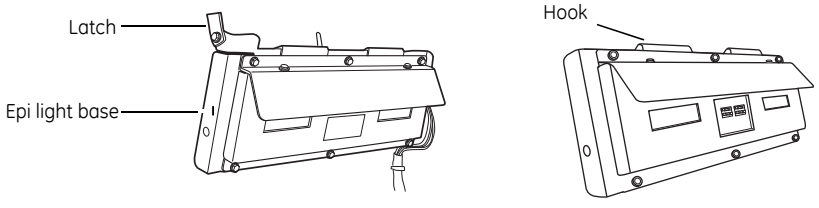
5 Turn the lever at the front to lock the light source into position.



3.3.2 Changing the Epi lights

This section describes how to change a set of Epi lights. The RGB module Epi lights are also installed as described here.

Note: *The tray should be at tray position 4 before installing Epi lights. If the tray is higher, then it should be lowered to tray position 4 using the ImageQuant LAS 4000 Control Software before attaching the lights, as described below.*

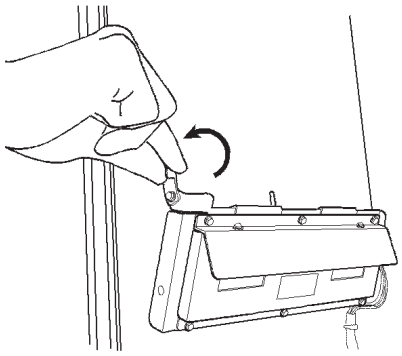


1 If the tray is at ***Tray position*** 4, proceed to step 3. Otherwise, close the IDX door.

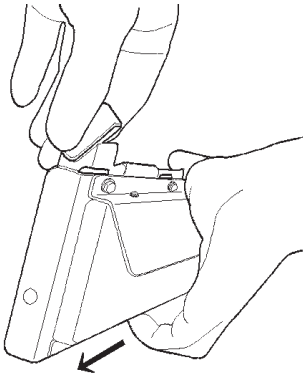
2 Click on ***Method/Tray position***, set ***Tray position*** to 4, and click the ***OK*** button.

3 Open the IDX door. If no Epi light is currently in place inside the instrument, proceed to step 7.

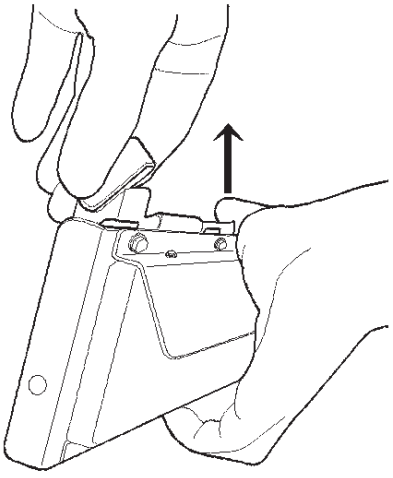
4 Spring up the latch to unlock the Epi light.



5 Holding the latch with one hand, remove the Epi light by pulling it gently outwards.

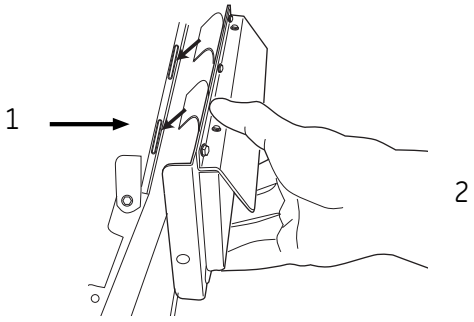


6 Lift up and remove the Epi light.



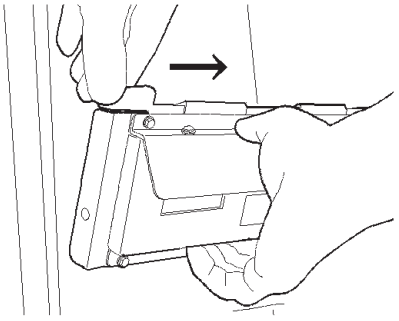
7 Before installing the new Epi light, ensure that the latch is sprung open (upwards).

8 Hook the hanger located on top of the Epi light to the top edge of the Epi light base.

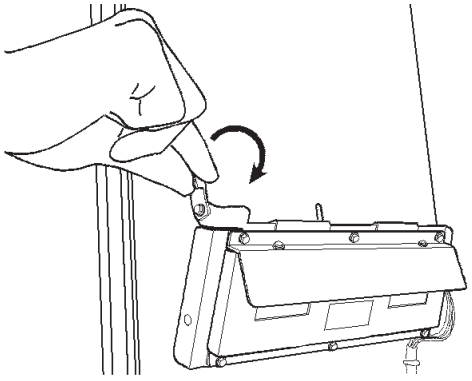


No.	Action
1	Two guide holes are located on the back of the Epi light base.
2	Slide the hook after attaching the guide pins to the guide holes.

9 Push the Epi light while holding the latch open, and slide it inwards until a click sound is heard.



10 Lower the latch to lock the Epi light in place.



11 Repeat this process for the opposite side.

Note:

- *The Epi lights are clearly labelled **L** for the left and **R** for the right sides.*
- *Install the Epi lights in matching pairs only. If Epi lights with different wavelengths are used, the intended image will not be obtained.*

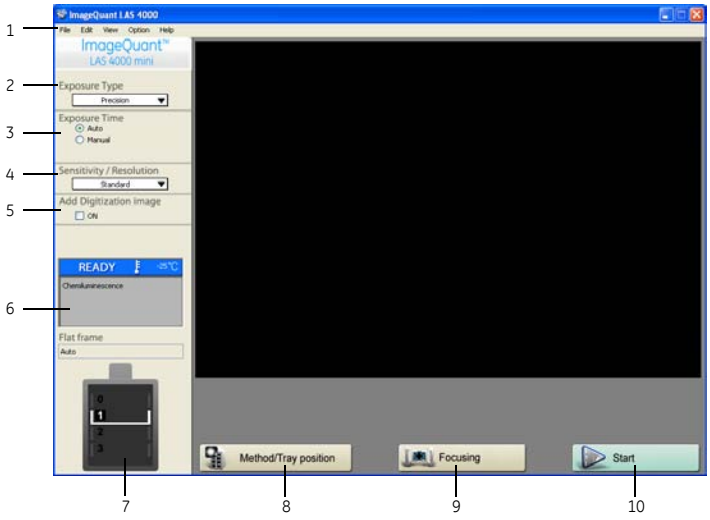
4 Operating the ImageQuant LAS 4000

This chapter describes the ImageQuant LAS 4000 Control Software and how to expose gels, membranes or films to obtain digital images.

4.1 Layout of the ImageQuant LAS 4000 Control Software

The exposure of samples in the ImageQuant LAS 4000, the setting of exposure conditions and the viewing of the digitized images are performed within the ImageQuant LAS 4000 Control Software.

The following illustration shows the features of the main window of the ImageQuant LAS 4000 Control Software.

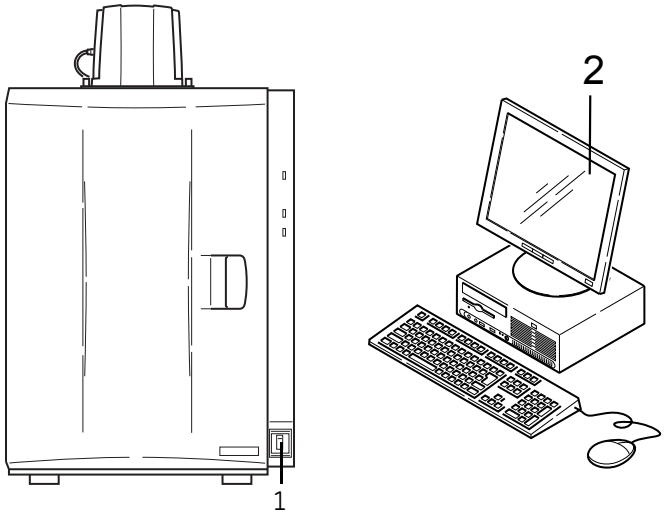


No.	Description	No.	Description
1	Menu bar	6	The setting state such as the temperature condition of CCD is displayed.
2	***Exposure Type*** Sets the exposure method	7	The state of the Intelligent dark box (IDX) is displayed.
3	***Exposure Time*** Sets the exposure time.	8	***Method/Tray position*** Sets the detection method and tray position.

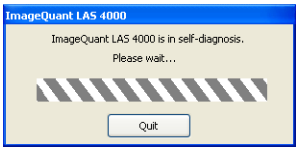
No.	Description	No.	Description
4	***Sensitivity/Resolution*** Sensitivity can be set.	9	***Focusing*** Adjusts the focus and position.
5	***Add Digitization Image*** A digitization image is exposed simultaneously with a chemiluminescence image. (Chemiluminescence method only.)	10	***Start*** Starts the exposure.

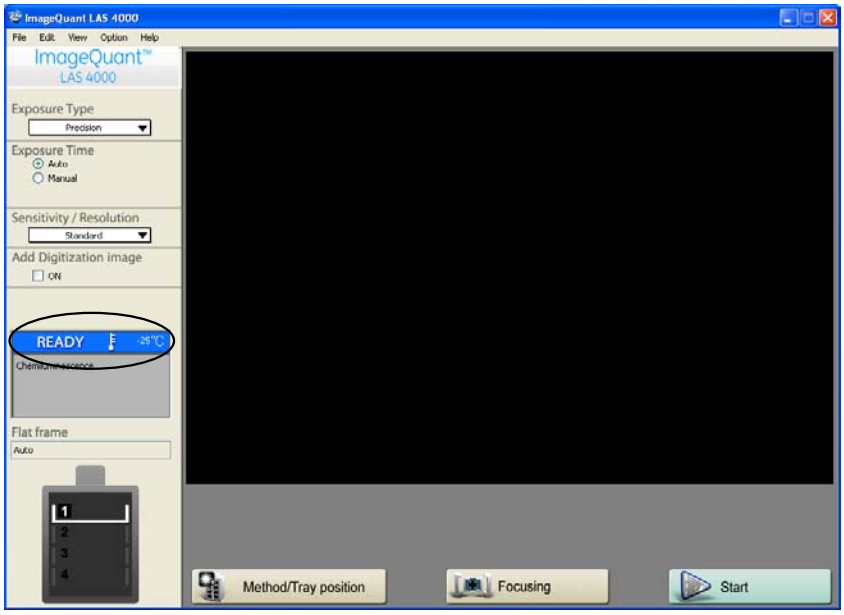
Note: *The software needs to be started once after installing from an account with administrator priveleges. This is to ensure that necessary folders and files are created.*

4.2 Preparation for exposure



Analyzing PC

Step	Operation
1	Turn on the ImageQuant LAS 4000, computer and peripheral equipment.
2	Start up ImageQuant LAS 4000 Control Software. A message is displayed until the ImageQuant LAS 4000 is ready.  ***Note:*** *The power switches of the instrument and PC can be turned on in any order.*

Step	Operation
3	Wait until the CCD has reached the preset cooling temperature and is ready for use. 

TIP:

- The instrument will be ready in a few minutes. The power LED on the instrument is lit blue when the instrument is ready.
- ***Method/Tray position*** and ***Focusing*** can be prepared even if the CCD has not cooled completely.
- The ***Start*** button can be clicked even when the CCD is not completely cooled with the ***EtBr trans*** method.

4.3 Calibration

Ensure that the ImageQuant LAS 4000 is properly calibrated. See *Section 5.12.1 CCD Calibration, on page 104* and *Section 5.12.2 Flat Frame Calibration, on page 105*.

4.4 Placing the sample

This section describes how to choose an appropriate sample tray, and how to place the sample for exposure.

1 Select a sample tray suitable for the type of exposure to be performed.

Detection	Sample type	Tray
Chemiluminescence Bioluminescence	Membrane	Epi tray
	Titer plate	NP tray

Detection	Sample type	Tray
Fluorescence	Gel (UV Trans illumination)	UV trans tray
	Gel (Epi illumination)	Epi tray
	Membrane	Epi tray
Digitization	Membrane	Epi tray
	Gel (Coomassie, silver stain)	White trans tray

2 Place a sample on the sample tray.

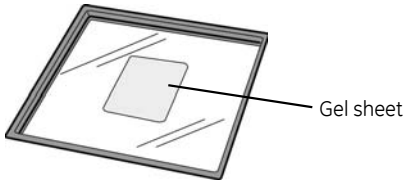
For Epi tray

a Place the sample directly on the tray.

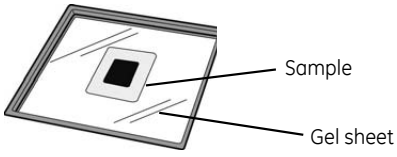
For UV or White Trans trays

a Cut out a gel sheet slightly larger than the sample size.

b Place the gel sheet on the Trans tray.



c Place the sample on the gel sheet.

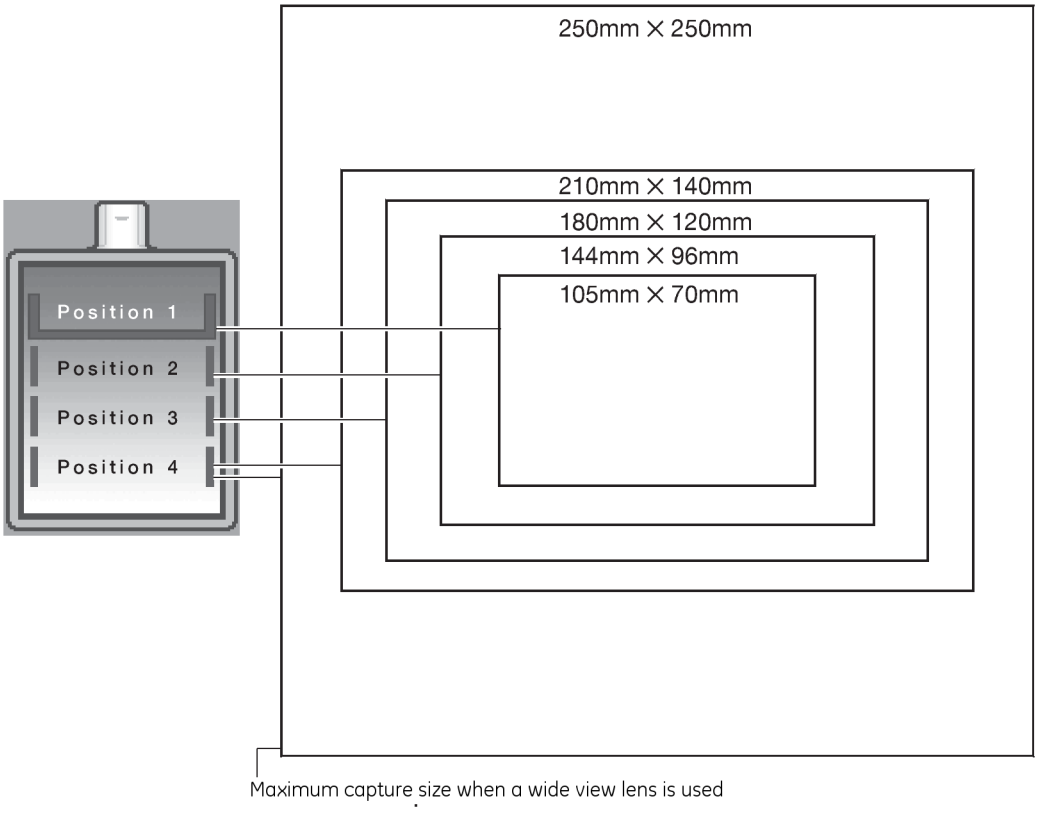


Note: *The gel sheet can be used repeatedly. After use, wash it with mild detergent, rinse with water then dry well. A gel sheet can be reused about 20 times.*

3 Choose the exposure size and tray position

For Epi and Trans trays

- The readable area varies depending on the tray position. Place the sample in position according to its size.



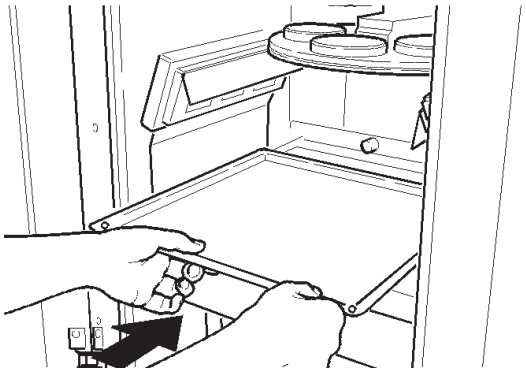
TIP: On the Epi tray, there are round dents marked on the tray for positioning the sample. Line up the sample using the appropriate dents.

For NP tray

- The NP tray is to be used at tray position 3.

Note: *The readable area will be slightly smaller using the F1.8 wide view lens.*

4 Open the IDX door and insert the tray. Place the Epi or Trans trays in position with the side with a hole facing outwards.

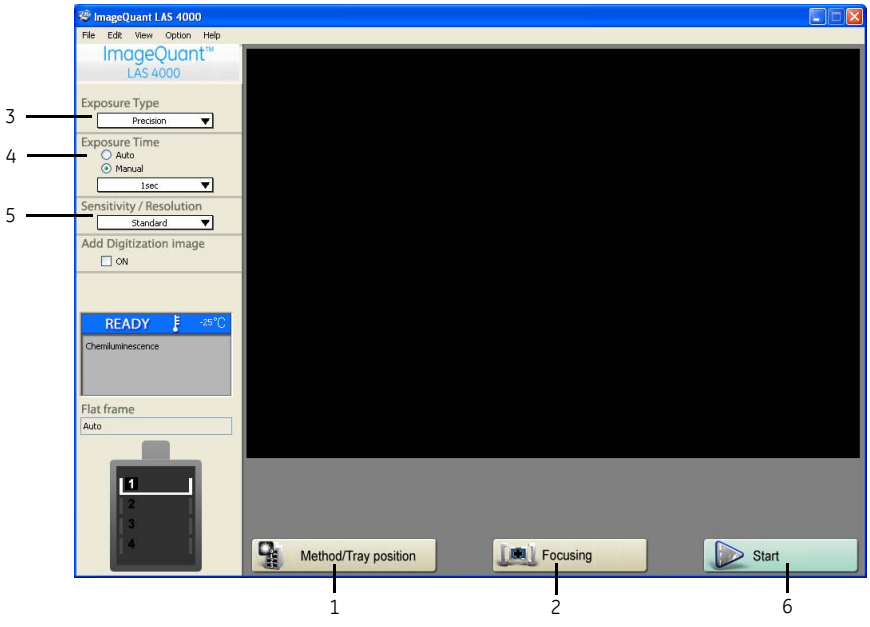


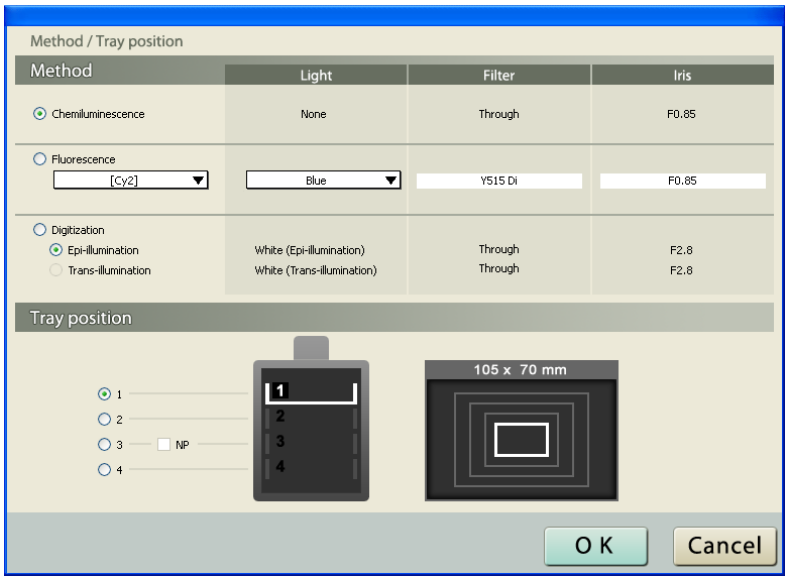
5 Ensure the lens cap is removed and close the IDX door.

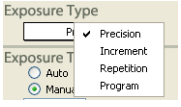
4.5 Exposing chemiluminescent samples

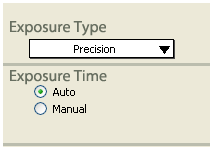
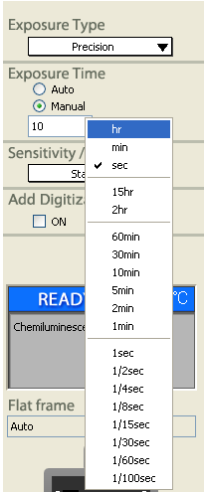
This section describes how to take images of chemiluminescent samples. No illumination is used for this application.

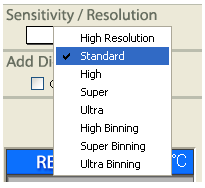
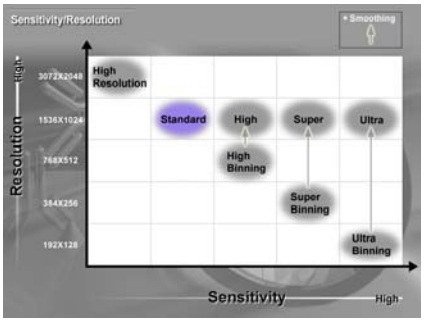
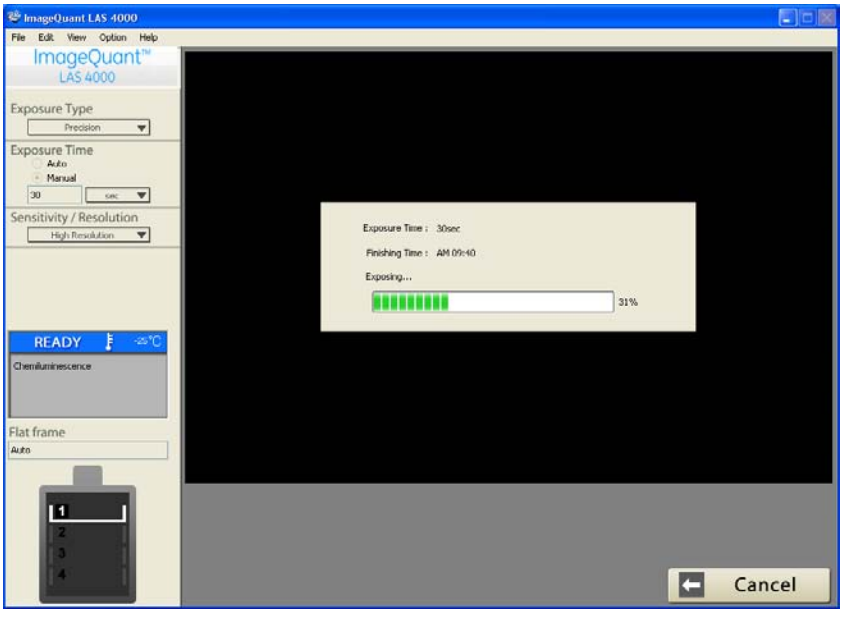
Place a sample on the Epi tray. Put the tray in the ImageQuant LAS 4000 then close the door.

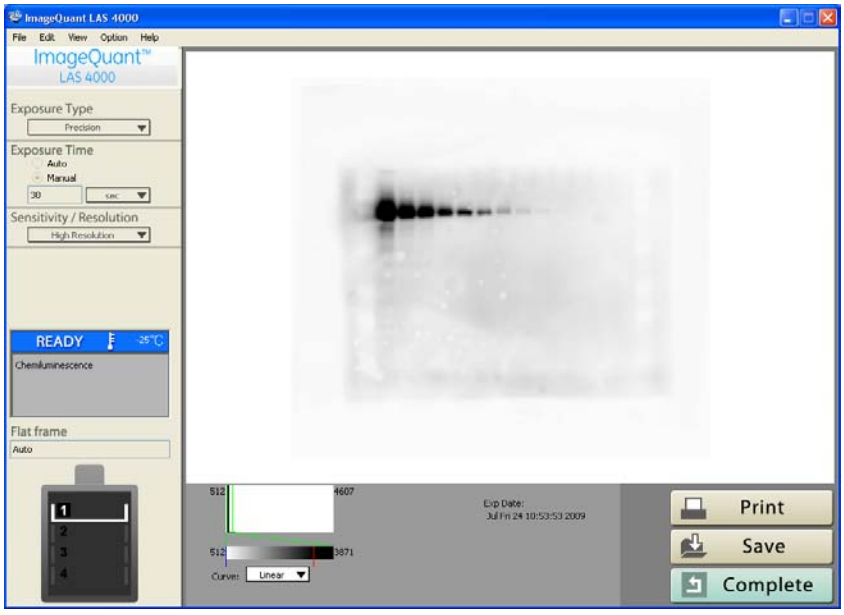


Step	Action
1	Click the ***Method/Tray position*** button. *Result*: The ***Method/Tray position*** dialog opens.  • Select ***Chemiluminescence*** for ***Method***. • Select ***Tray position*** according to the sample. • Click the ***OK*** button.

Step	Action
2	Click the ***Focusing*** button. *Result*: The focusing controls appear.  Check that the sample is correctly postioned and focus the image. Click the ***Return*** button. **TIP:** Click on the image to magnify it. Click on the image again to return to the original size.
3	Select ***Precision*** for ***Exposure Type***. 

Step	Action
4	Select ***Auto*** or ***Manual*** for ***Exposure Time***. **Auto**  ***Note:*** *Automatic exposure time setting may not be possible depending on the sample type and method.* **Manual** Select an exposure time from the drop-down list or enter the exposure time manually. The exposure time can be set from 0.01 seconds up to 30 hours. 

Step	Action
5	Select ***Sensitivity/Resolution***.  ***Note:*** *The check box for* ***Add Digitization Image*** *can be checked to also perform a white-light exposure, for example to image dye-stained molecular weight markers. In this case the white epi light should be in place. Leave unchecked if this is not necessary.* **TIP:** Select ***Help:Sensitivity/Resolution...***. This opens the following diagram that describes the relation between sensitivity and resolution. 
6	Click the ***Start*** button. *Result*: The exposure is started. The orange **Busy** LED lights on the instrument during exposure. 

Step	Action
7	Adjust the gradations of the exposed image, then save and print the image.  Click the ***Complete*** button. *Result*: The display returns to the main screen.

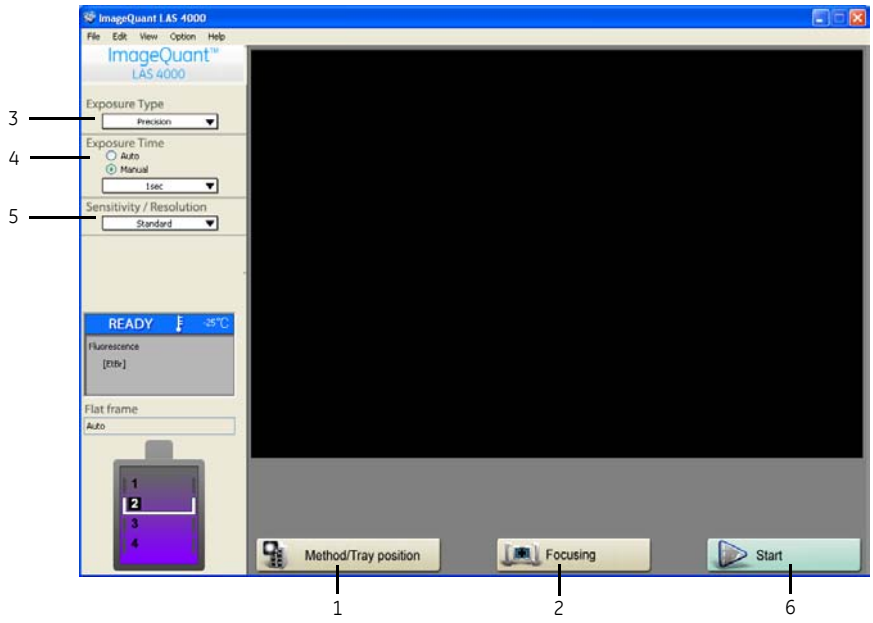
4.6 Exposing fluorescent samples (EtBr)

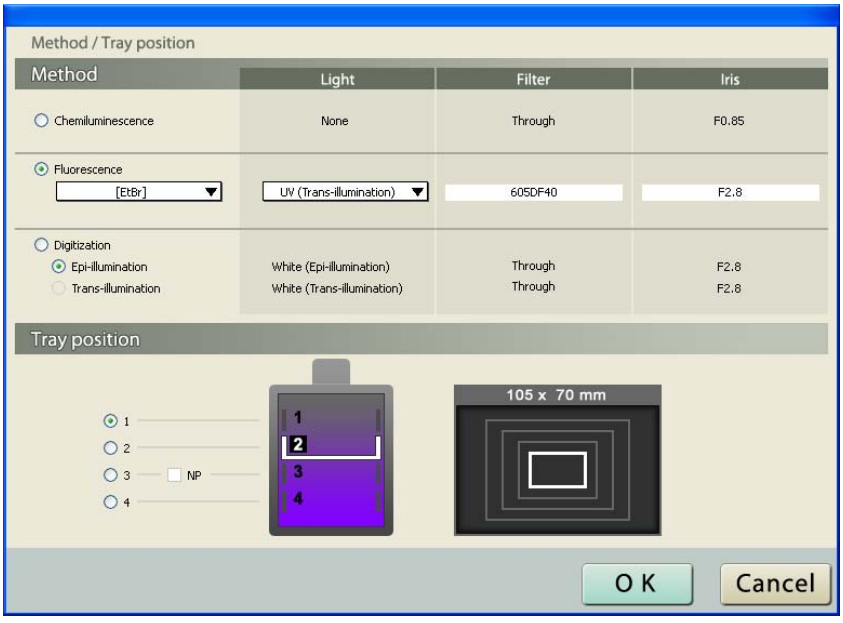
This section describes how to expose ethidium bromide (EtBr) stained samples using the UV transilluminator (312 nm).

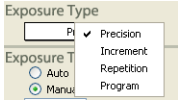
Place a gel sheet, which has been cut out to be slightly larger than the sample, onto the UV trans tray. Place the sample on the gel sheet. Put the tray into the ImageQuant LAS 4000 and close the door.

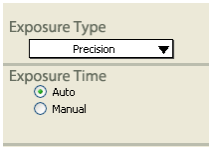
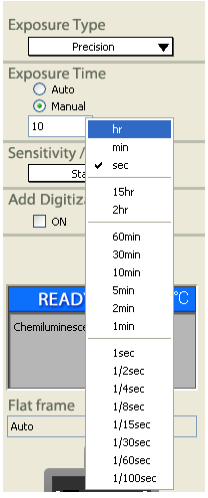
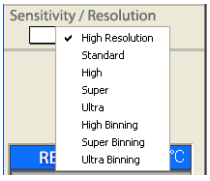
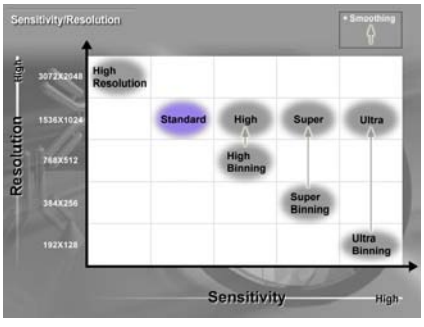
Note: *The 605DF40 filter is normally used. If this filter is currently not in the filter turret, it should be installed. Refer to* *Section 3.1 Changing or installing a filter, on page 17*.

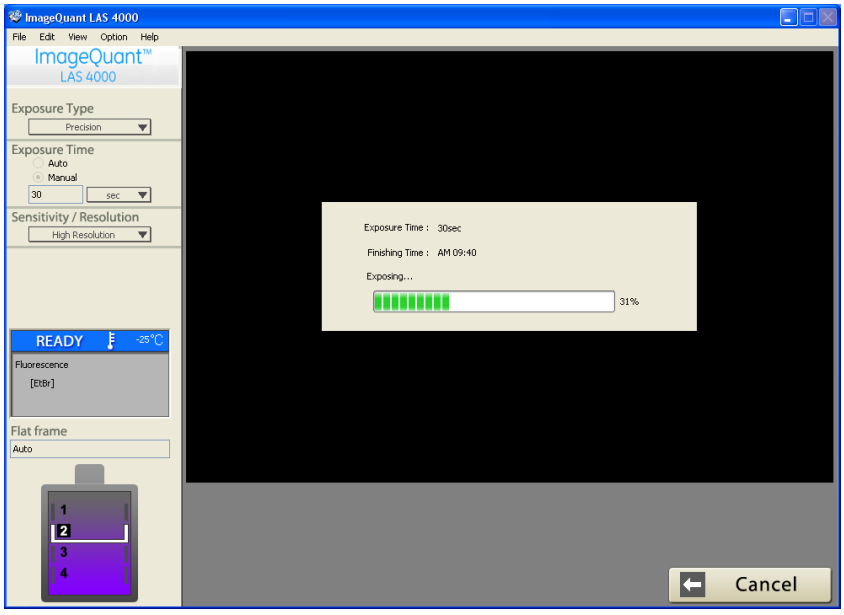
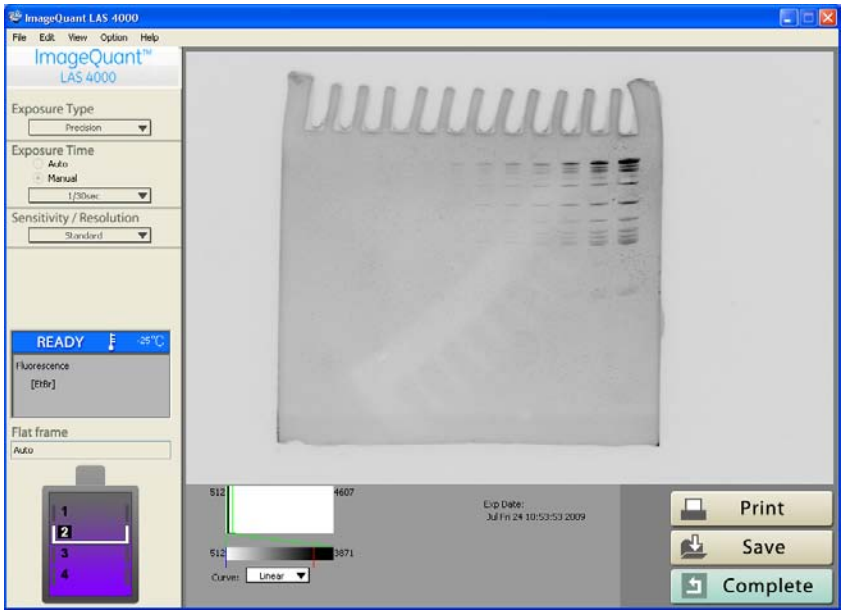
Note: *Ensure that the UV transilluminator is installed. For instructions on changing the trans light source, see* *Section 3.3.1 Changing the UV transilluminator or white light table, on page 28*.



Step	Action
1	Click the ***Method/Tray position*** button. *Result*: The ***Method/Tray position*** dialog opens.  • Select ***Fluorescence*** as the ***Method***, and choose ***EtBr*** from the pull-down menu. The ***605DF40*** filter is automatically selected. • Select the ***Tray position***. • Click the ***OK*** button.

Step	Action
2	Click the ***Focusing*** button. *Result*: The focusing controls appear.  Confirm the sample position and focus. Click the ***Return*** button. **TIP:** Click on the image to magnify it. Click on the image again to return to the original size.
3	Select ***Precision*** for ***Exposure Type***. 

Step	Action
4	Select ***Auto*** or ***Manual*** for ***Exposure Time***. **Auto**  ***Note:*** *Automatic exposure time setting may not be possible depending on the sample type and method.* **Manual** Select an exposure time from the drop-down list or enter the exposure time manually. The exposure time can be set from 0.01 seconds up to 30 hours. 
5	Select ***Sensitivity/Resolution***.  **TIP:** Select ***Help:Sensitivity/Resolution...***. This opens the following diagram that describes the relation between sensitivity and resolution. 

Step	Action
6	Click the ***Start*** button. The orange **Busy** LED lights on the instrument during exposure. 
7	Adjust the gradations of the exposed image, then save and print the image.  Click the ***Complete*** button. The display returns to the main screen.

TIP: If the Method ***EtBr UV (Trans-illumination)*** is used, the ***Start*** button can be clicked and exposure taken even if the temperature setting state of the CCD is ***Not Ready***.

4.7 Exposing fluorescence (Epi illumination)

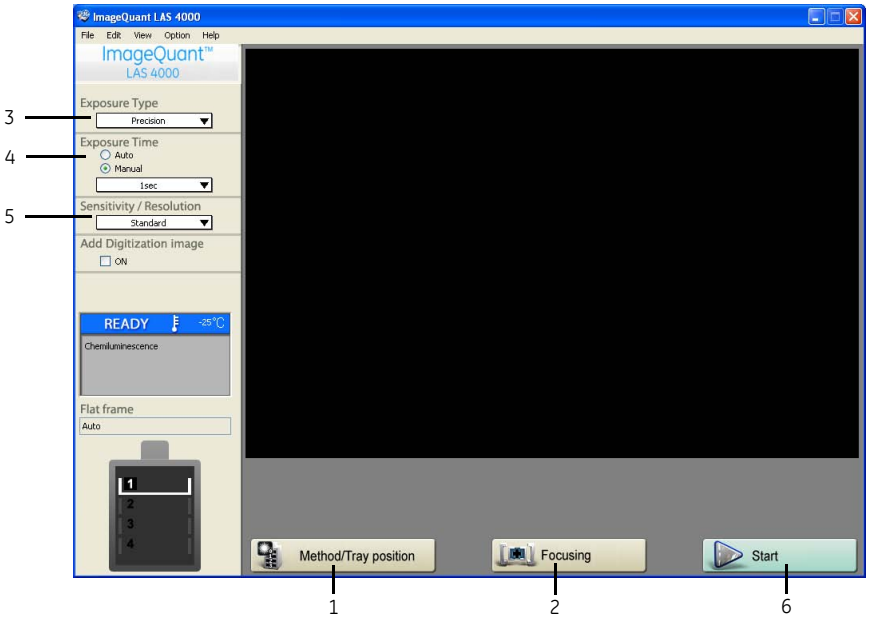
This section describes how to expose fluorescent samples using Epi illumination.

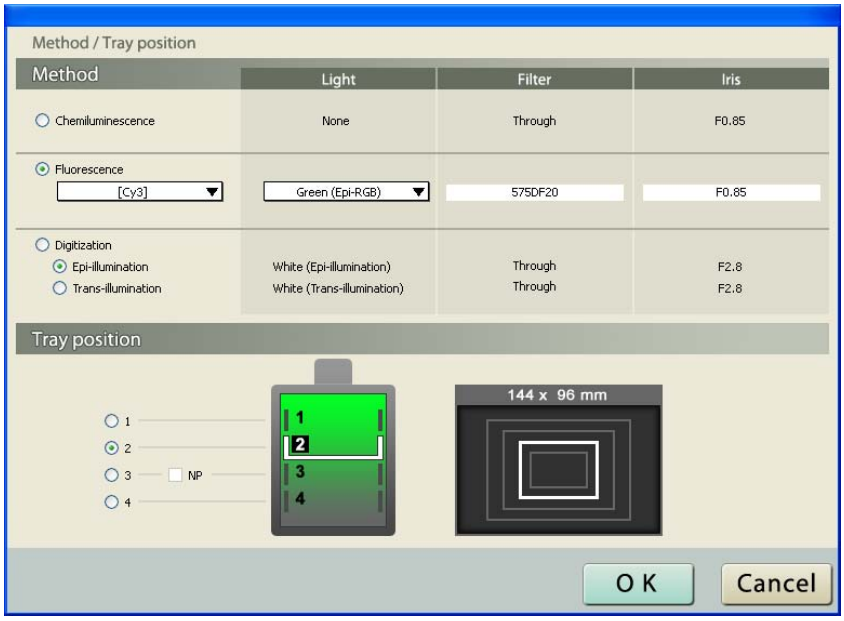
Ensure that the correct Epi lights and filter are installed. See *Chapter 3 Exchanging accessory parts, on page 17*.

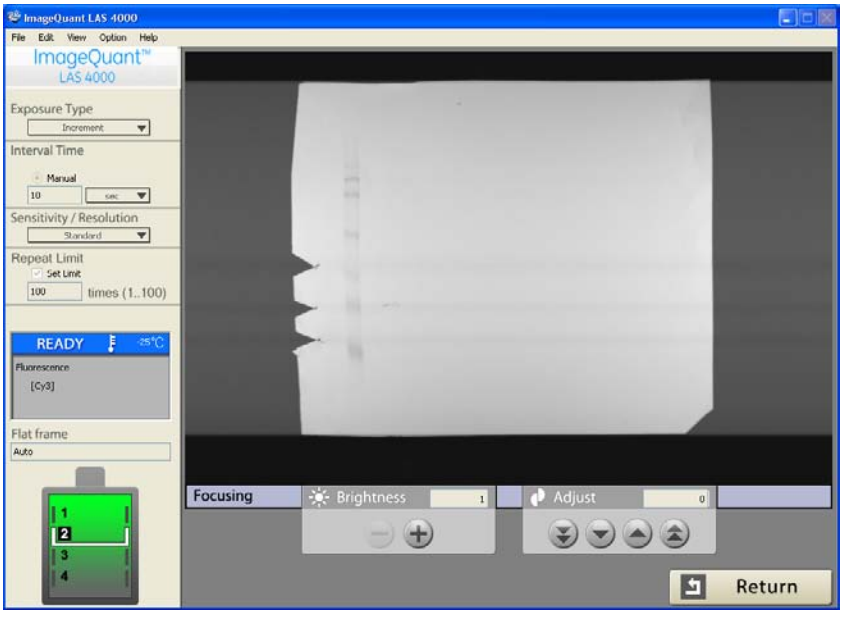
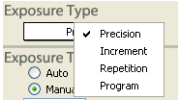
Place a sample on the Epi tray. Put the tray into the ImageQuant LAS 4000 and close the door.

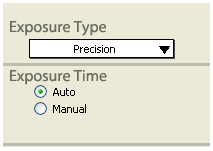
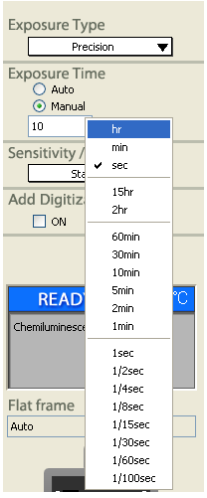
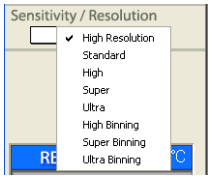
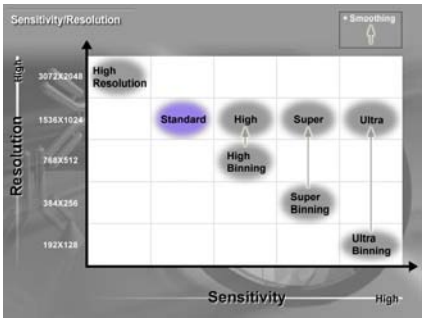
Note:

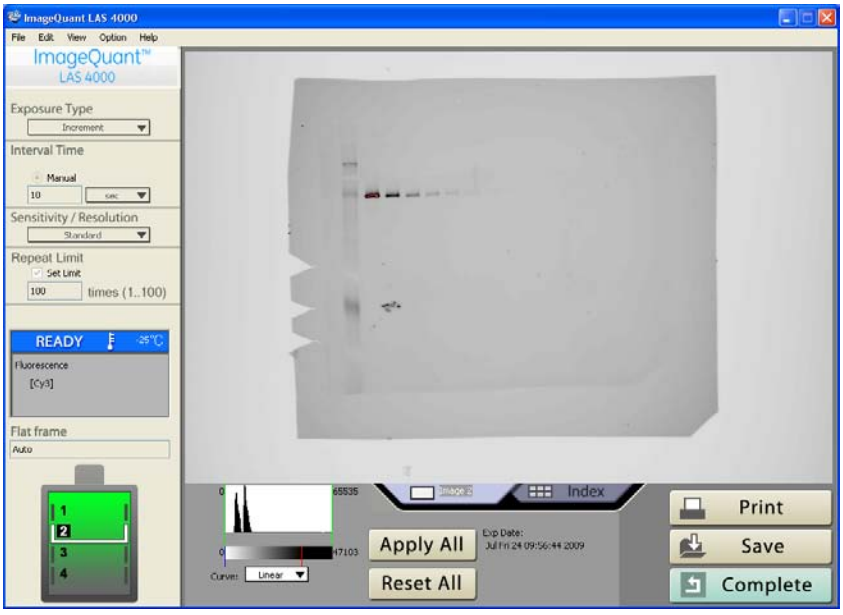
- *Make sure that sample is suitably placed on the tray for the desired tray position.*
- *Ensure that a suitable method exists and that the ImageQuant LAS 4000 is properly calibrated. See Section 4.16 Creating a new method and performing flat frame calibration, on page 78.*



Step	Action
1	Click the ***Method/Tray position*** button. *Result*: The ***Method/Tray position*** dialog opens.  • Select ***Fluorescence*** as the ***Method***, choose the appropriate fluorescent marker and the appropriate light source from the pull-down menus. The appropriate filter is automatically selected. • Select the ***Tray position***. • Click the ***OK*** button.

Step	Action
2	Click the ***Focusing*** button. *Result*: the focusing controls appear.  Confirm the sample position and focus. Click the ***Return*** button. **TIP:** Click on the image to magnify it. Click on the image again to return to the original size.
3	Select ***Precision*** for ***Exposure Type***. 

Step	Action
4	Select ***Auto*** or ***Manual*** for ***Exposure Time***. **Auto**  ***Note:*** *Automatic exposure time setting may not be possible depending on the sample type and method.* **Manual** Select an exposure time from the drop-down list or enter the exposure time manually. The exposure time can be set from 0.01 seconds up to 30 hours. 
5	Select ***Sensitivity/Resolution***.  **TIP:** Select "Sensitivity/Resolution..." in the Help menu. You can display Help that describes the relation between sensitivity and resolution. 
6	Click the ***Start*** button. The orange **Busy** LED lights on the instrument and a progress dialog is displayed during exposure.

Step	Action
7	Adjust the gradations of the exposed image, then save and print the image.  Click the ***Complete*** button. The display returns to the main screen.

4.8 Exposing dye stained samples and films (White Epi light)

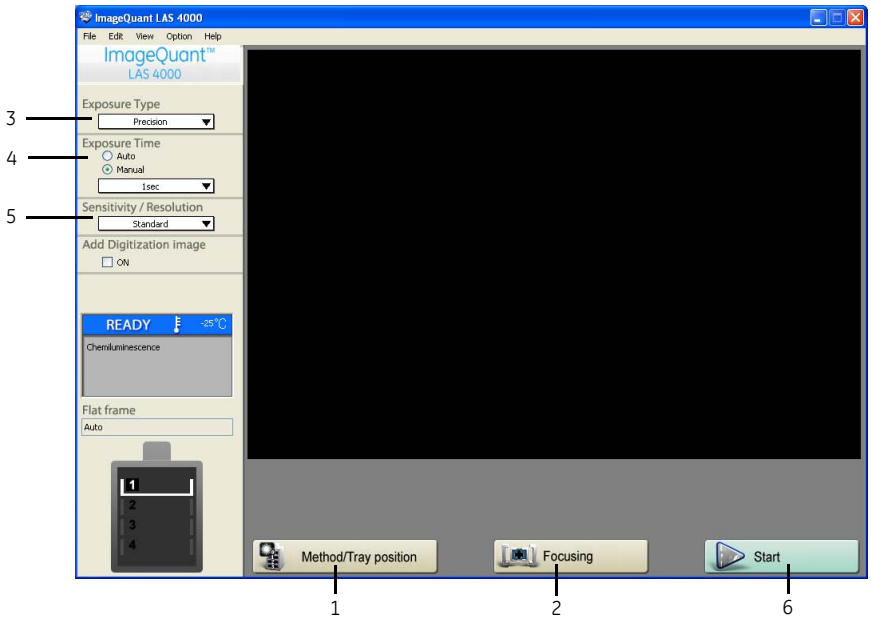
This section describes how to expose dye-stained samples using white Epi illumination.

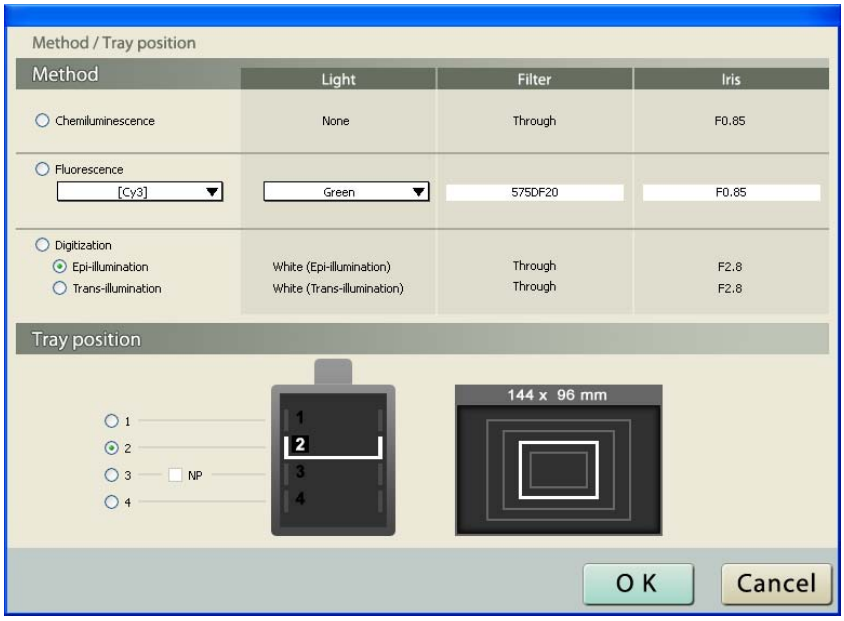
For some applications, such as imaging gels stained with Coomassie Blue dye, results may not be optimal using the white epi light. If the White trans tray is available, see *Section 4.9 Exposing dye stained samples and films (Trans illumination), on page 55* for a more optimal method.

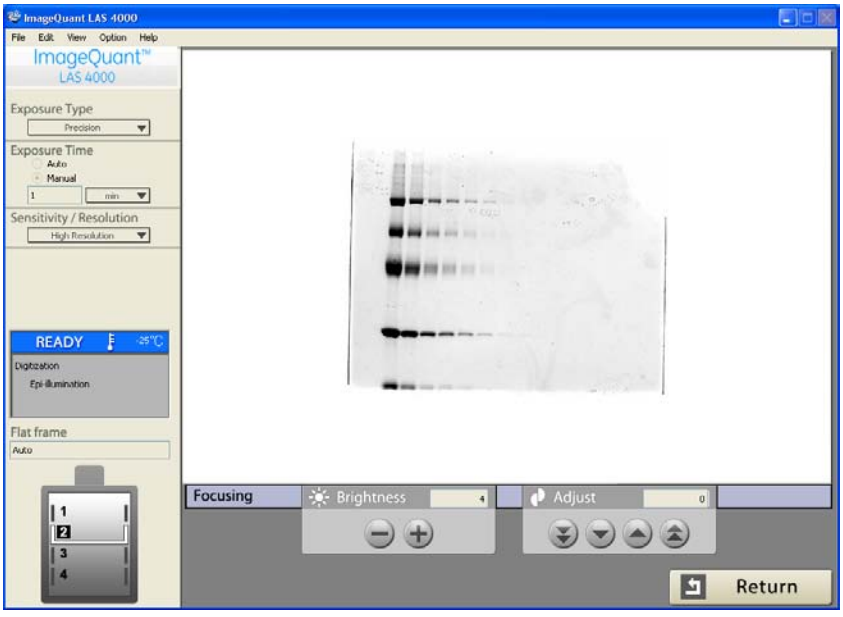
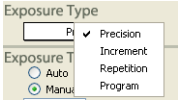
Place a sample on the Epi tray. Put the tray in the ImageQuant LAS 4000 then close the door.

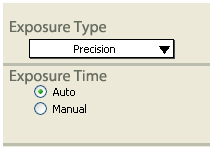
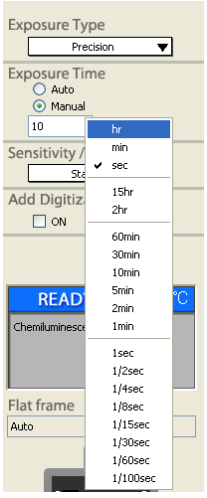
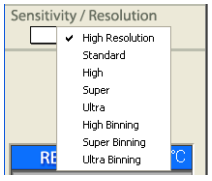
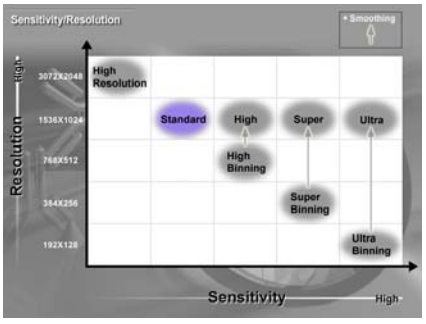
Note:

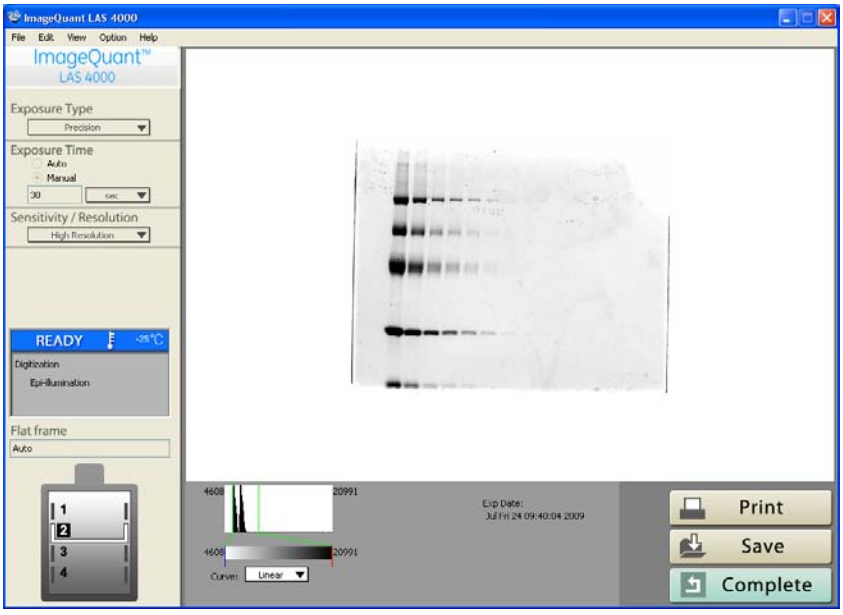
- *Prior to exposure, click on the **Digitization Epi-illumination** tab in **Edit:Preference** and make sure that **YES** is selected for **Invert Pixel-data**. If this is set to **NO**, the data will not be inverted and the quantitative value will be reversed.*



Step	Action
1	Click the ***Method/Tray position*** button. *Result*: The ***Method/Tray position*** dialog opens.  • Select ***Digitization*** and ***Epi-illumination*** for ***Method***. • Select ***Tray position*** according to the sample used. • Click the ***OK*** button.

Step	Action
2	Click the ***Focusing*** button. *Result*: The focusing controls appear.  Confirm the sample position and focus. Click the ***Return*** button. **TIP:** Click on the image to magnify it. Click on the image again to return to the original size.
3	Select ***Precision*** for Exposure Type. 

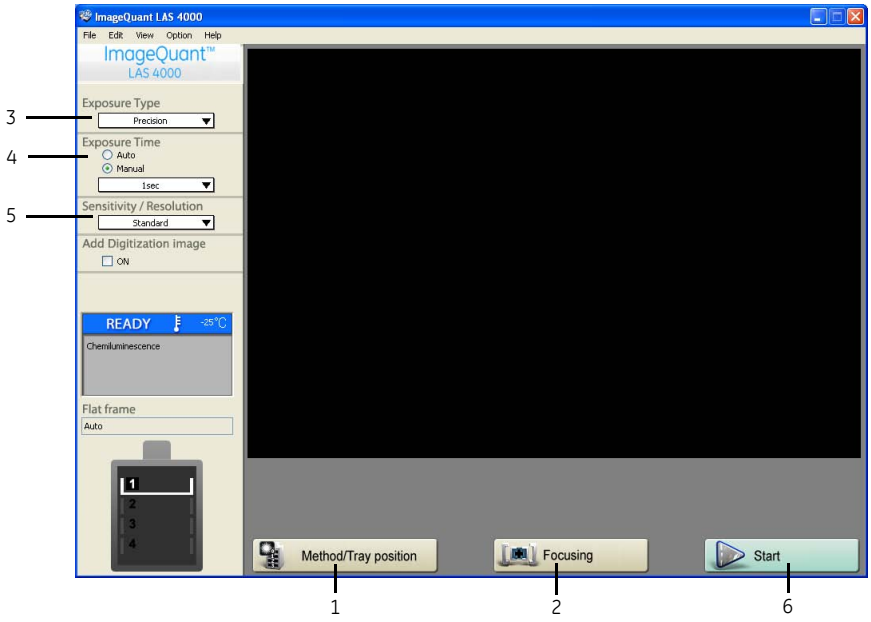
Step	Action
4	Select ***Auto*** or ***Manual*** for ***Exposure Time***. **Auto**  ***Note:*** *Automatic exposure time setting may not be possible depending on the sample type and method.* **Manual** Select an exposure time from the drop-down list or enter the exposure time manually. The exposure time can be set from 0.01 seconds up to 30 hours. 
5	Select ***Sensitivity/Resolution***.  **TIP:** Select "Sensitivity/Resolution..." in the Help menu. You can display Help that describes the relation between sensitivity and resolution. 
6	Click the ***Start*** button. The orange **Busy** LED lights on the instrument and a progress dialog is displayed during exposure.

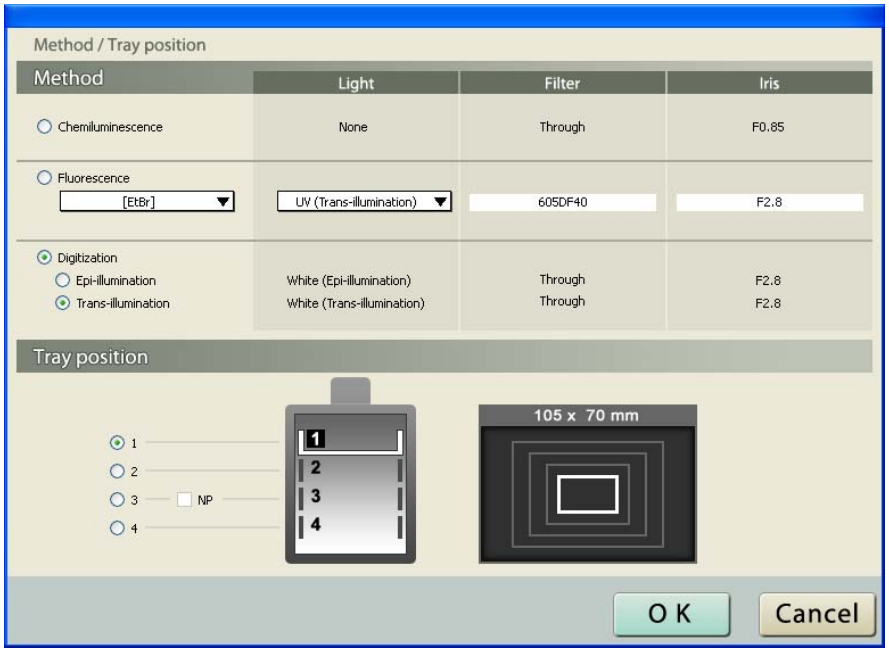
Step	Action
7	Adjust the gradations of the exposed image, then save and print the image.  Click the ***Complete*** button. The display returns to the main screen.

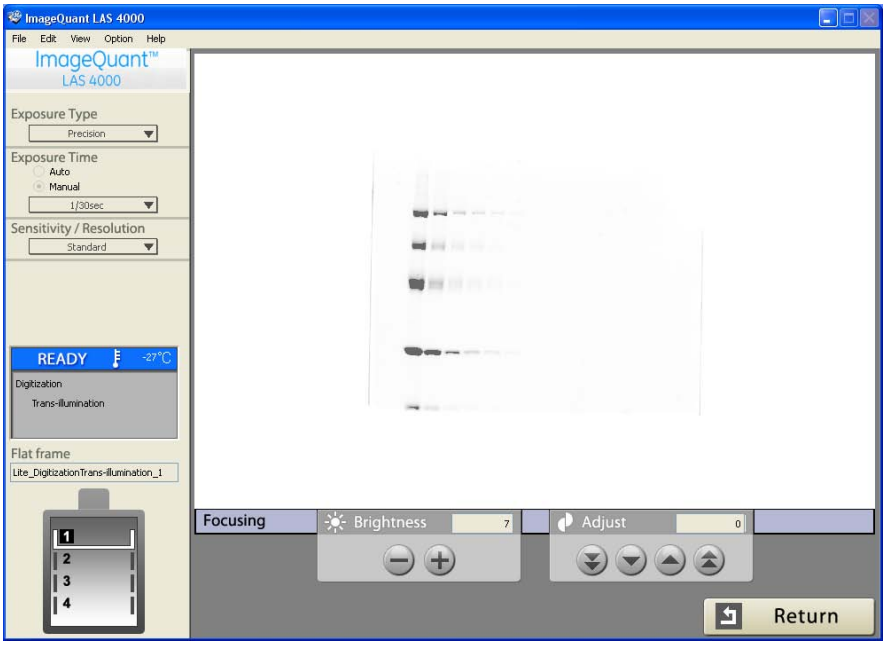
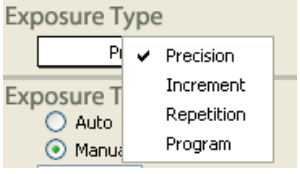
4.9 Exposing dye stained samples and films (Trans illumination)

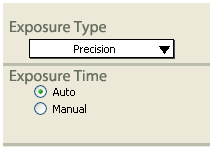
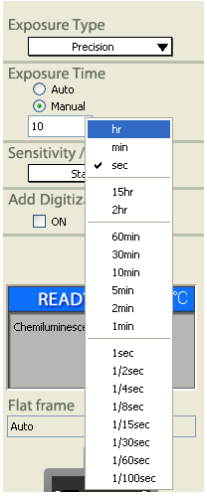
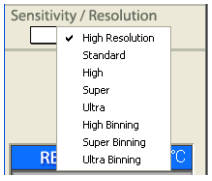
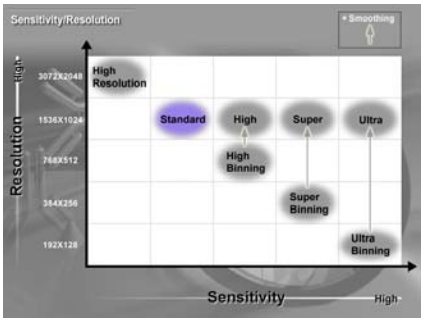
This section describes how to expose dye-stained samples using white trans illumination.

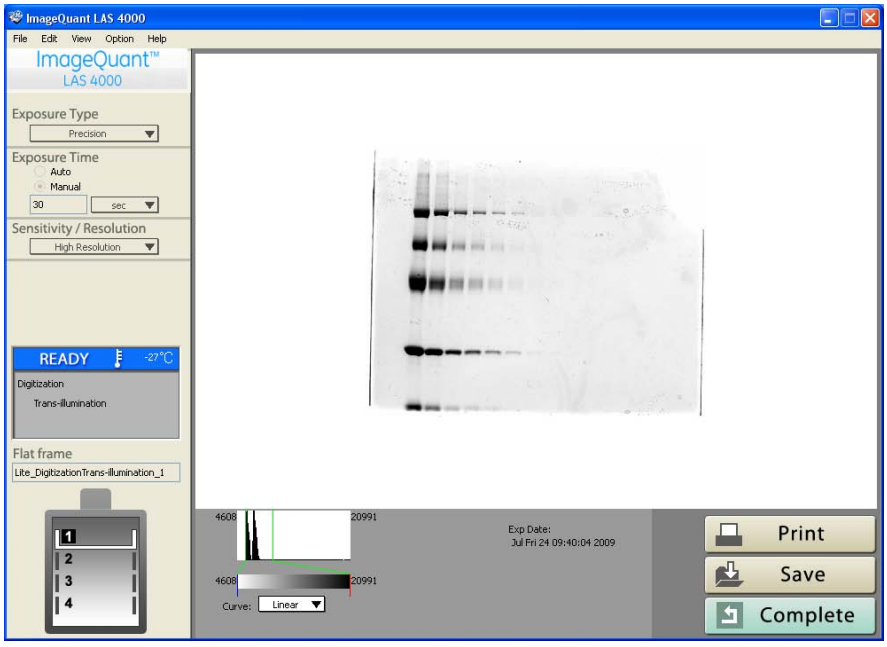
Place a sample on the White trans tray. Put the tray in the IDX and close the door.



Step	Action
1	Click the ***Method/Tray position*** button. *Result*: The ***Method/Tray position*** dialog opens.  1 Select ***Digitization:Trans-illumination*** for ***Method***. 2 Select ***Tray position*** according to the sample used. 3 Click the ***OK*** button.

Step	Action
2	Click the ***Focusing*** button. *Result*: The focusing controls appear.  Confirm the sample position and the focus. Click the ***Return*** button. **TIP:** Click on the image to magnify it. Click on the image again to return to the original size.
3	Select ***Precision*** for ***Exposure Type***. 

Step	Action
4	Select ***Auto*** or ***Manual*** for ***Exposure Time***. **Auto**  ***Note:*** *Automatic exposure time setting may not be possible depending on the sample type and method.* **Manual** Select an exposure time from the drop-down list or enter the exposure time manually. The exposure time can be set from 0.01 seconds up to 30 hours. 
5	Select ***Sensitivity/Resolution***.  **TIP:** Select “Sensitivity/Resolution...” in the Help menu. You can display Help that describes the relation between sensitivity and resolution. 
6	Click the ***Start*** button. The orange **Busy** LED lights on the instrument and a progress dialog is displayed during exposure.

Step	Action
7	Adjust the gradations of the exposed image, then save and print the image.  Click the ***Complete*** button. The display returns to the main screen.

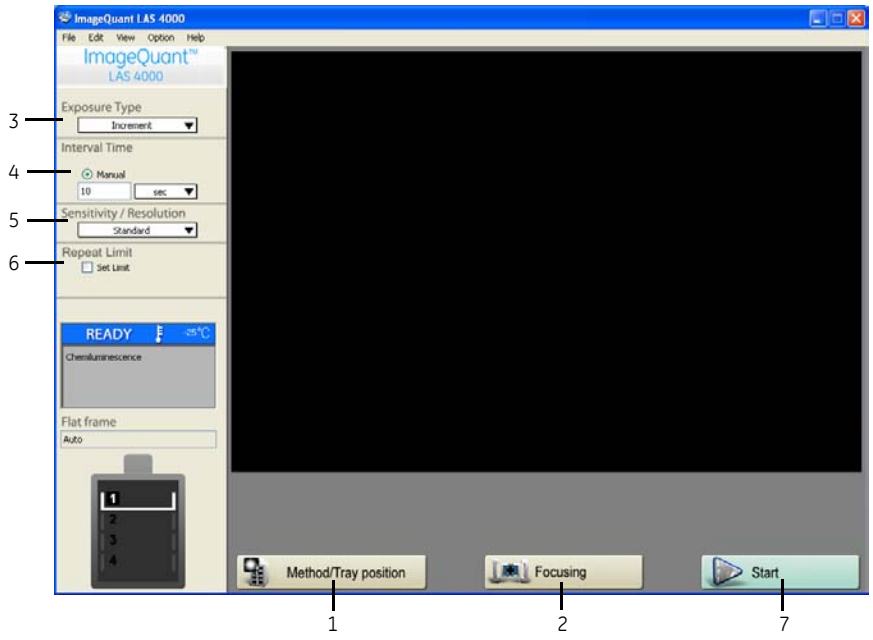
4.10 Exposing consecutively (Increment)

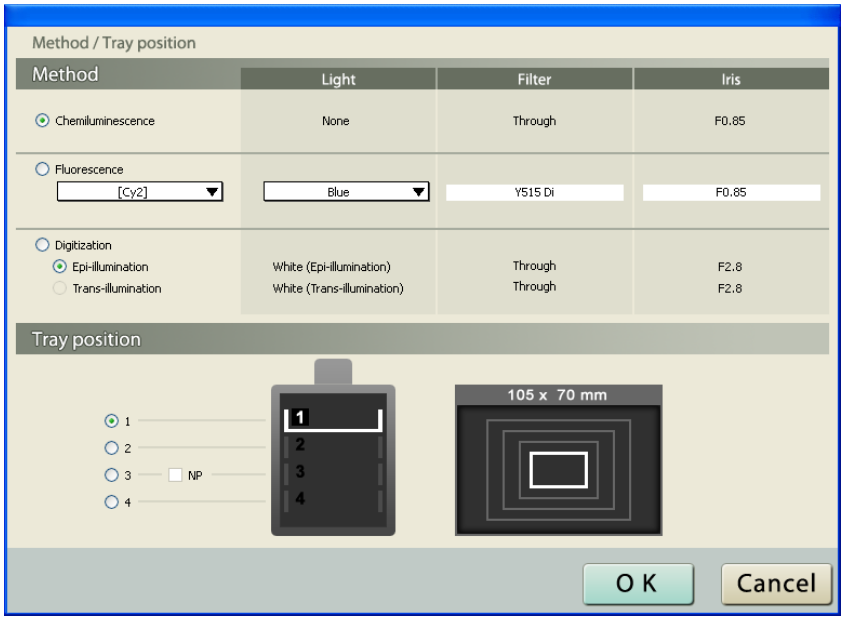
The ***Increment*** exposure type enables a series of images to be exposed consecutively. The data for each image is added to the previous images to provide accumulated exposure data. This section describes how to perform this type of experiment.

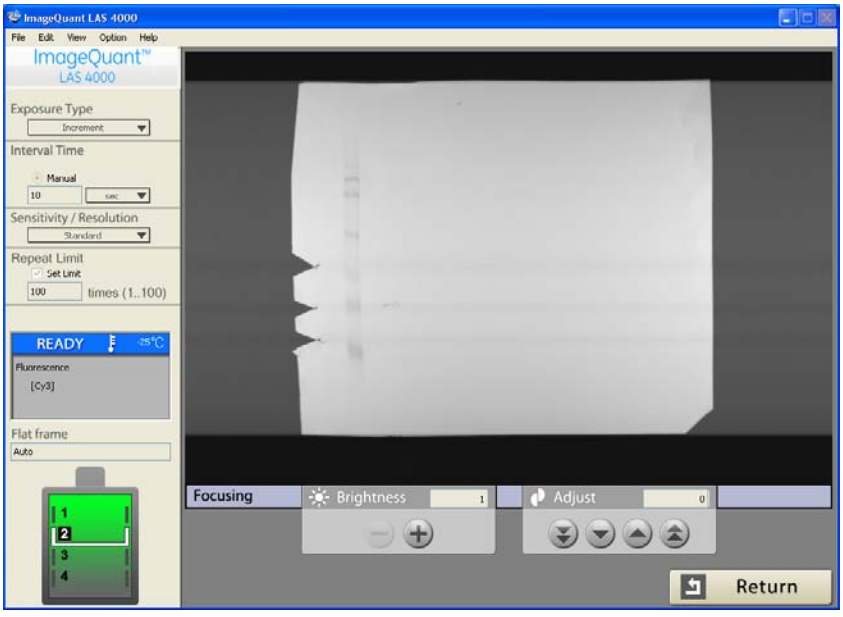
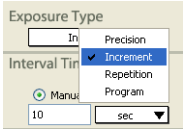
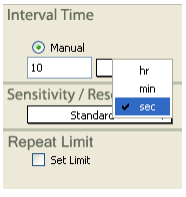
Place a sample on the appropriate tray. Place the tray in the ImageQuant LAS 4000 then close the door.

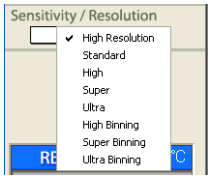
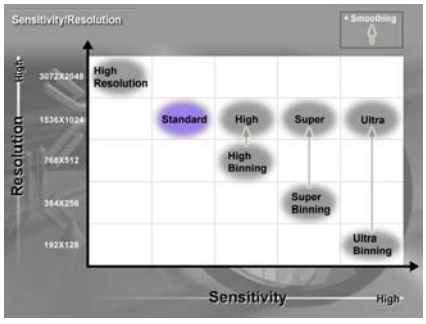
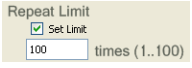
Note:

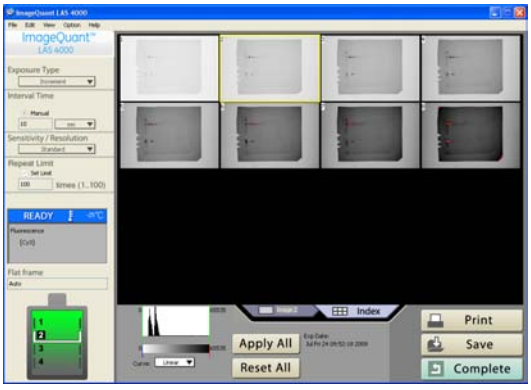
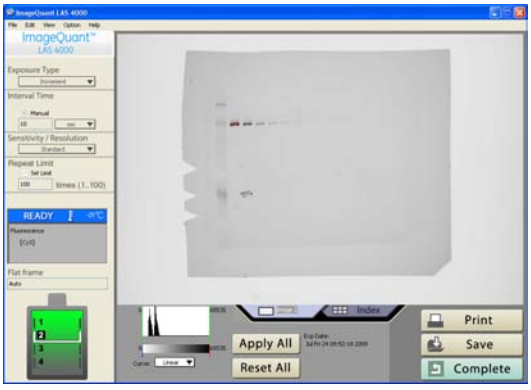
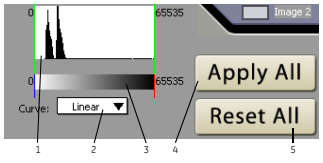
- *Make sure that the tray is placed at the required position.*



Step	Action
1	Click the ***Method/Tray position*** button. *Result*: The ***Method/Tray position*** dialog is opened.  Select the ***Method*** and ***Tray Position***. Click the ***OK*** button.

Step	Action
2	Click the ***Focusing*** button. *Result*: The focusing controls appear.  Confirm the sample position and focus. Click the ***Return*** button. **TIP:** Click on the image to magnify it. Click on the image again to return to the original size.
3	Select ***Increment*** for ***Exposure Type***. 
4	Select ***Interval Time*** unit and enter a numeric value.  ***Note:*** ***Interval Time*** *can be entered in the range of 10 seconds to 2 hours.*

Step	Action
5	Select ***Sensitivity/Resolution***.  **TIP:** Select "Sensitivity/Resolution..." in the Help menu. You can display Help that describes the relation between sensitivity and resolution. 
6	To specify the maximum number of exposures to be taken, check the ***Set Limit*** check box and specify the number of images. 

Step	Action
7	Click the ***Start*** button to begin exposure. The index view and expanded view can be switched by clicking the ***Index*** or ***Image*** tab. ***Note:*** *The displayed expanded image is the latest image.* ***Index*** view  ***Image*** view  Exposure automatically stops after the number of images set in ***Repeat Limit***. ***Note:*** *Clicking the **Stop** button cancels the current exposure.* **TIP:** It is possible to stop exposures automatically when the image is saturated. This function is activated in ***Edit:Preference*** under the ***Increment*** tab. **TIP:** During exposure, the gradation conversion curve can be changed and the gradation adjusted. When the ***Apply All*** button is clicked, the adjusted gradation will be applied to all images. 

No.	Description	No.	Description
1	The range can be changed by dragging the mouse.	4	The changed gradation is applied to all images.
2	The gradation conversion curve can be toggled between Linear or Sigmoid.	5	Return to initial setting.
3	The gradation can be changed by dragging the mouse.		

Step	Action
8	Adjust the gradations of the exposed image(s) as described above, then save and print the image(s). Click the ***Complete*** button. The display returns to the initial screen.

Note: *Only the last 100 images can be kept. Previous images are discarded.*

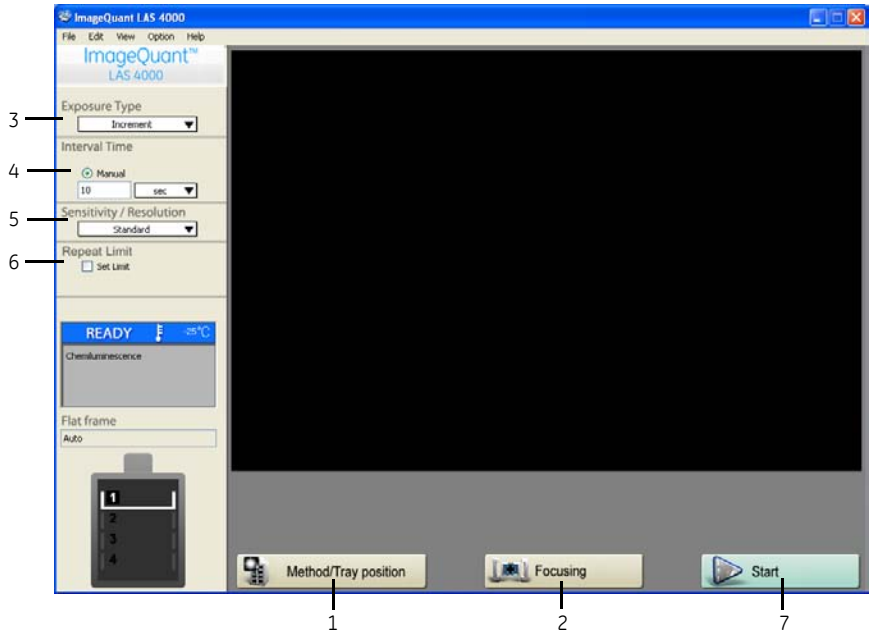
4.11 Exposing repeatedly (Repetition)

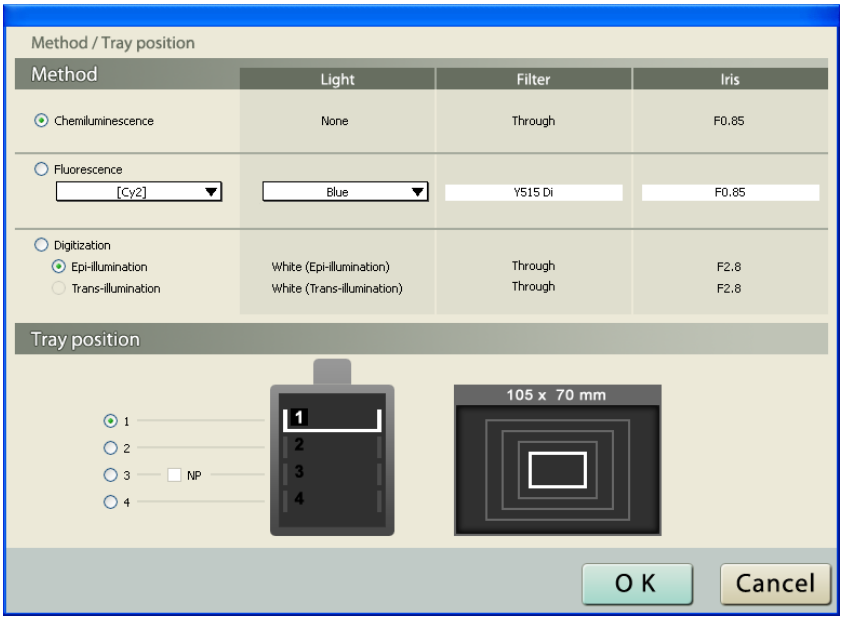
The ***Repetition*** exposure type enables a series of images to be exposed consecutively. Each image is recorded separately and data is not accumulated. This section describes how to perform this type of experiment.

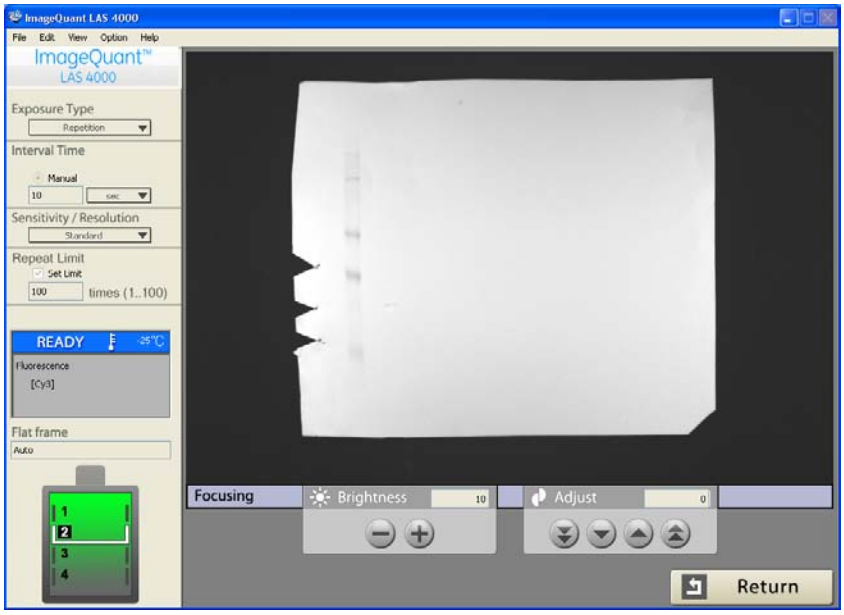
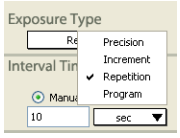
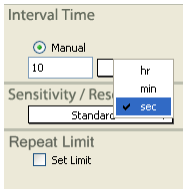
Place a sample on the tray that you selected according to the type of a sample. Put the tray in the ImageQuant LAS 4000 then close the door.

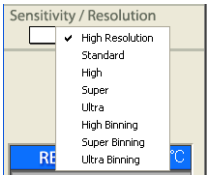
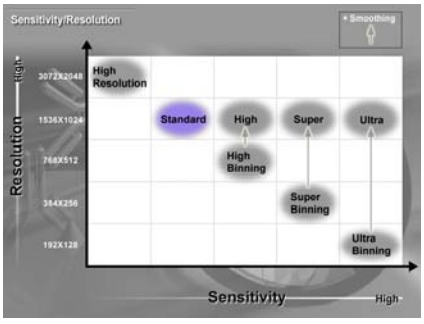
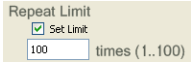
Note:

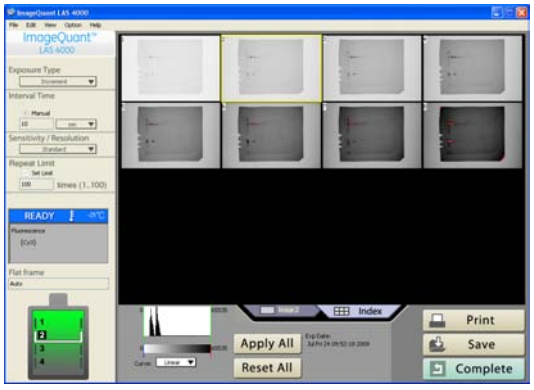
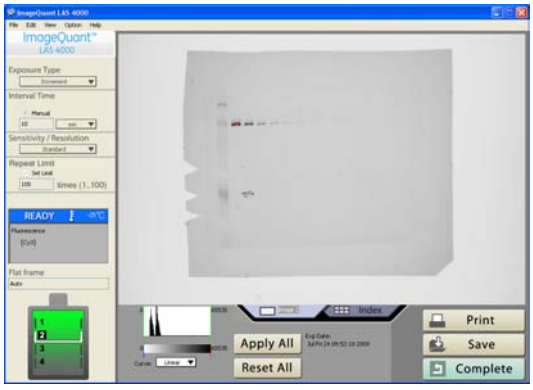
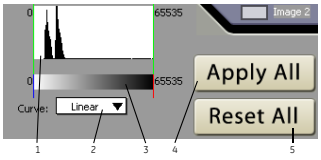
- *Make sure that the tray is placed at the required position.*



Step	Action
1	Click the ***Method/Tray position*** button. *Result*: The ***Method/Tray position*** dialog is opened.  Select the ***Method*** and ***Tray Position***. Click the ***OK*** button.

Step	Action
2	Click the ***Focusing*** button. *Result*: The focusing controls appear.  Confirm the sample position and focus. Click the ***Return*** button. **TIP:** Click on the image to magnify it. Click on the image again to return to the original size.
3	Select ***Repetition*** for ***Exposure Type***. 
4	Select ***Interval Time*** unit and enter a numeric value.  ***Note:*** ***Interval Time*** *can be entered in the range of 10 seconds to 2 hours.*

Step	Action
5	Select ***Sensitivity/Resolution***.  **TIP:** Select "Sensitivity/Resolution..." in the Help menu. You can display Help that describes the relation between sensitivity and resolution. 
6	To specify the maximum number of exposures to be taken, check the ***Set Limit*** check box and specify the number of images. 

Step	Action
7	Click the ***Start*** button to begin exposure. The index view and expanded view can be switched by clicking the ***Index*** or ***Image*** tab. ***Note:*** *The displayed expanded image is the latest image.* ***Index*** view  ***Image*** view  Exposure automatically stops after the number of images set in ***Repeat Limit***. ***Note:*** *Clicking the **Stop** button cancels the current exposure.* **TIP:** During exposure, the gradation conversion curve can be changed and the gradation adjusted. When the ***Apply All*** button is clicked, the adjusted gradation will be applied to all images. 

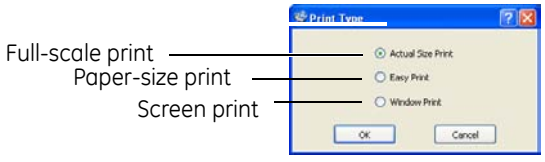
No.	Description	No.	Description
1	The range can be changed by dragging the mouse.	4	The changed gradation is applied to all images.
2	The gradation conversion curve can be toggled between Linear or Sigmoid.	5	Return to initial setting.
3	The gradation can be changed by dragging the mouse.		

Step	Action
8	Adjust the gradations of the exposed image, then save and print the image. Click the ***Complete*** button. The display returns to the initial screen.

Note: *Only the last 100 images can be kept. Previous images are discarded.*

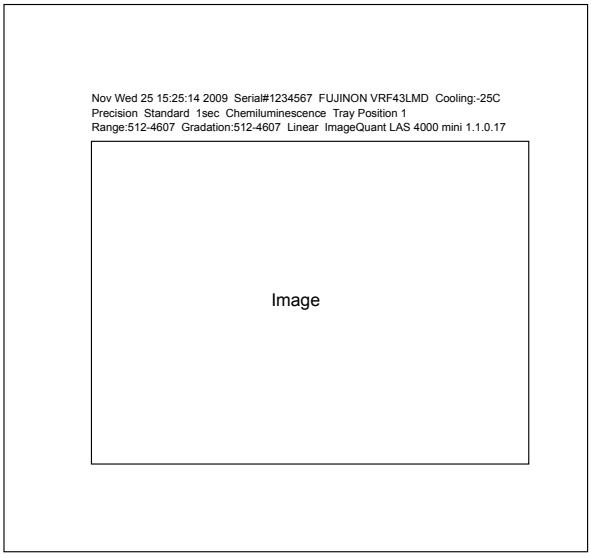
4.12 Printing exposed images

The exposed image can be output as a full-scale print or screen print (the window displayed on the screen). The print can be done using the ***Print*** button displayed in the post-exposure state or the ***File:Print***. This section describes how to print an image.

Step	Action
1	For a screen print, first display the window you wish to output. Click the ***Print*** button or select ***Print*** from the ***File*** menu.
2	Select the output setting for the printer and the type (full-scale print, paper-size print or screen print). Click the ***OK*** button.  The Print dialog is displayed. Choose settings for the printer and click the ***Print*** button. The image is printed.

TIP: Exposure information is printed together with the image (except for the ***Easy Print*** option). This is convenient since it is unnecessary to note the exposure information and the conditions. The following exposure information is included:

Exposure date, camera serial number, lens type, cooling temperature at the time of exposure, exposure type, sensitivity, exposure time (or interval time), name of Method, tray position number, values at both ends of the range scope, values at both ends of the gradation, type of gradation, Control Software version number.

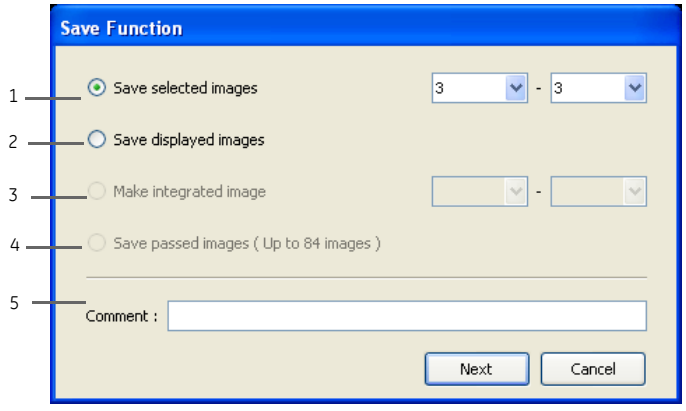


4.13 Saving exposed images

The exposed image can be saved using the ***Save*** button displayed in the post-exposure state or by ***File:Save***. This section describes how to save an image.

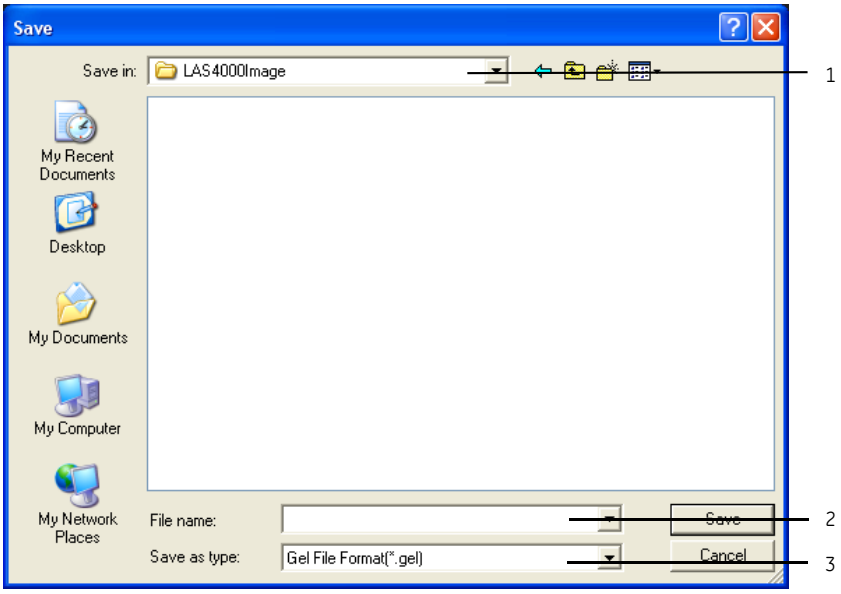
Step	Action
1	Click on the ***Save*** button or select ***File:Save***.

Step	Action
2	When the ***Save Function*** screen is displayed, select one of the following 3 saving methods to save the photographed image. Click ***Next*** button.



No.	Description	No.	Description
1	***Save Selected Image*** (Exposure Type: Increment, Repetition, Program) For multiple files, specify the range of files to be saved.	4	***Save Images in temporary folder (Max84)*** Image files not displayed in the Index view are saved in the 100 latest images (maximum 84 files).
2	***Save Display image (Max16)*** (Exposure Type: Increment, Repetition, Program) All image files displayed in the index view are saved (maximum 16 files).	5	***Comment*** When the file is saved in gel format (*.gel), a comment can be entered in the file. When the file is saved in TIFF format, the comment will not be saved.
3	***Make Increment Image*** (Exposure Type: Program only) Files of multiple exposures are accumulated and saved. The range of image files to be processed in accumulation can be specified.		

Step	Action
3	The ***Save*** dialog is displayed. Type in a ***File name*** and press the ***Save*** button to save the file.



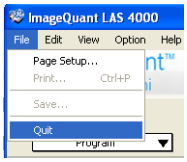
No.	Description
1	Select where to save the file.
2	The file name is set automatically but may be replaced. File names for single and programmed exposures are automatically set in the format <FileName>_n, where n is the next available index. For images taken in exposure type Increment, file names are automatically set in the format <FileName>_n_N_<TotalTime>, where n is the next available index, N the total number of exposures and TotalTime is the total exposure time for the image.
3	Select a file format. The ***.gel*** format is a GE Healthcare format that records details of the exposure. Such details are not saved in ***.tif*** format.

TIP: To automatically launch an external application to view images upon saving, refer to *Launch Applicaton, on page 98*.

Note: *Special characters such as \, *, / or other characters that have a special meaning in Windows should not be used in a file name.*

4.14 Ending the session

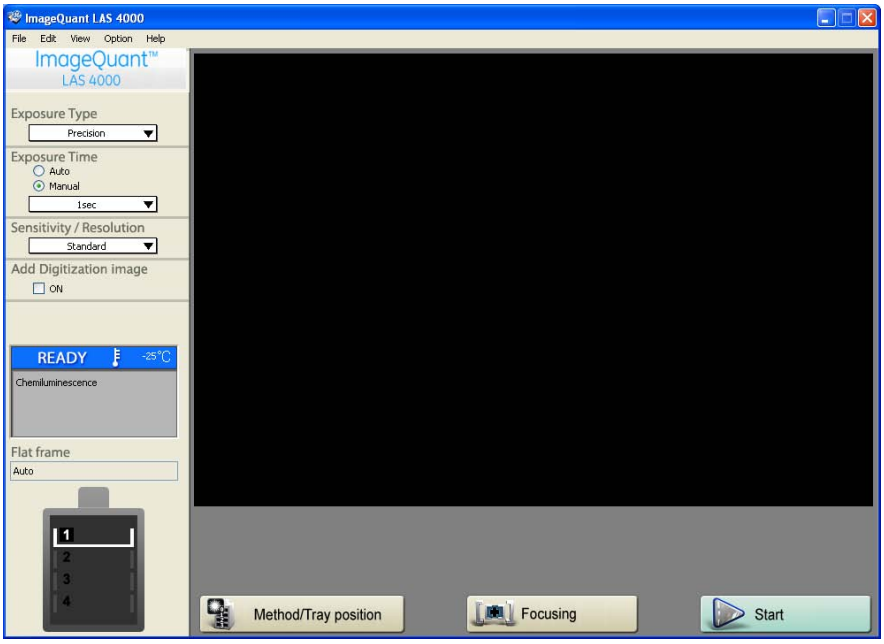
This section describes how to end the current session with the ImageQuant LAS 4000. The instrument should be switched off as described below when it will not be used for some time.

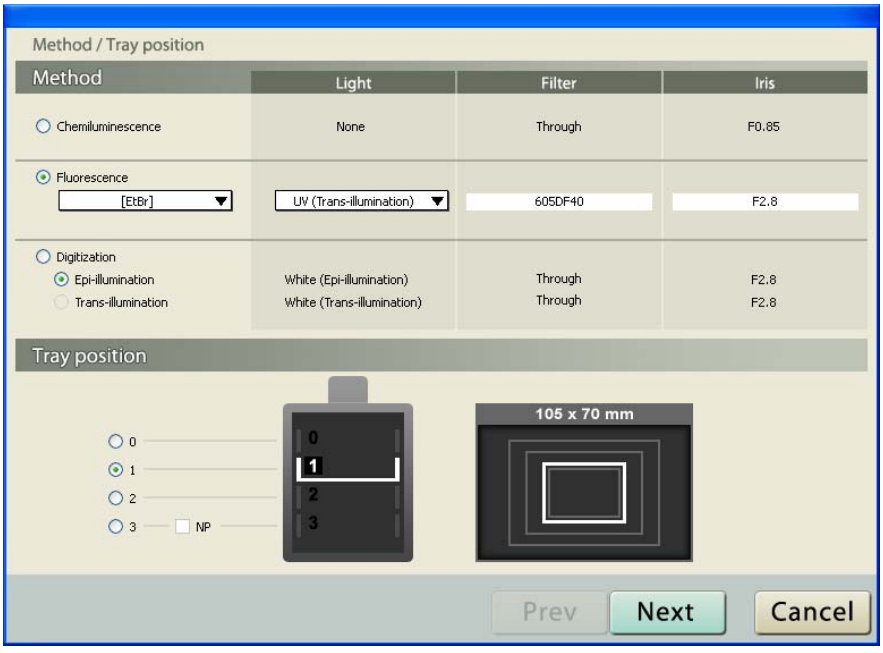
Step	Operation
1	Select ***Quit*** from the ***File*** menu. 
2	Select ***Stop the CCD cooling now*** and click OK.  **TIP:** When ***Keep the CCD cooling after quit*** is selected, the cooling temperature of the CCD will be maintained and the instrument can be used straight away the next time the ImageQuant LAS 4000 Control Software is started. In this case, do not turn off the ImageQuant LAS 4000. However, if the instrument will not be used for a long period, it should be turned off.
3	Shut down the computer.
4	Switch the ImageQuant LAS 4000 off using the power switch.

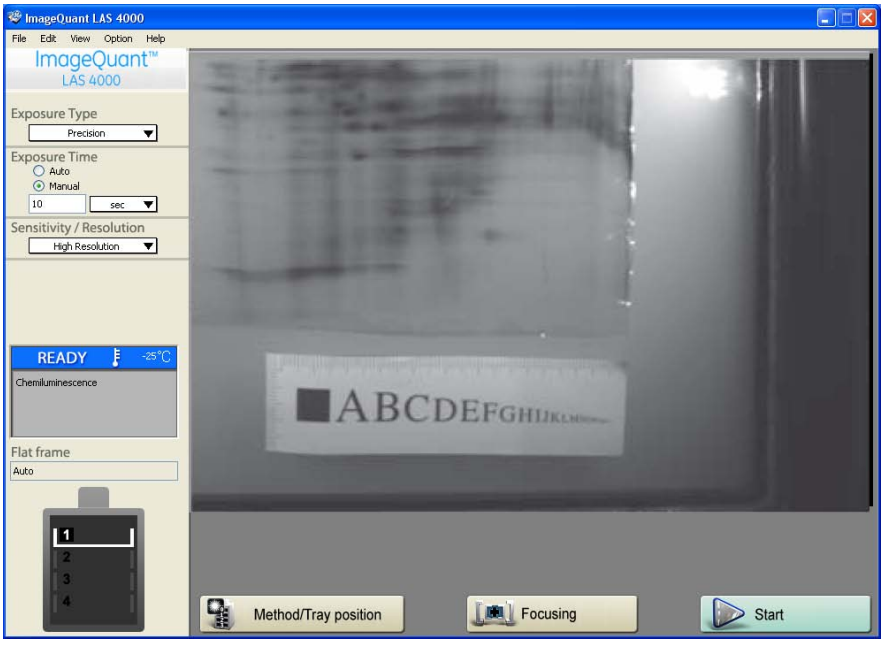
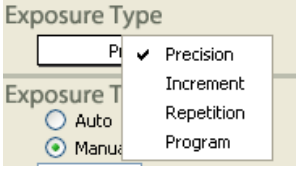
4.15 Exposing large sample using wide view lens

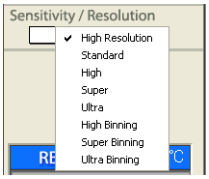
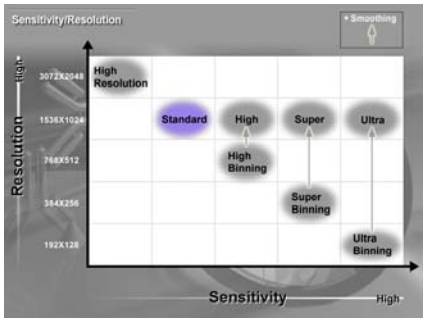
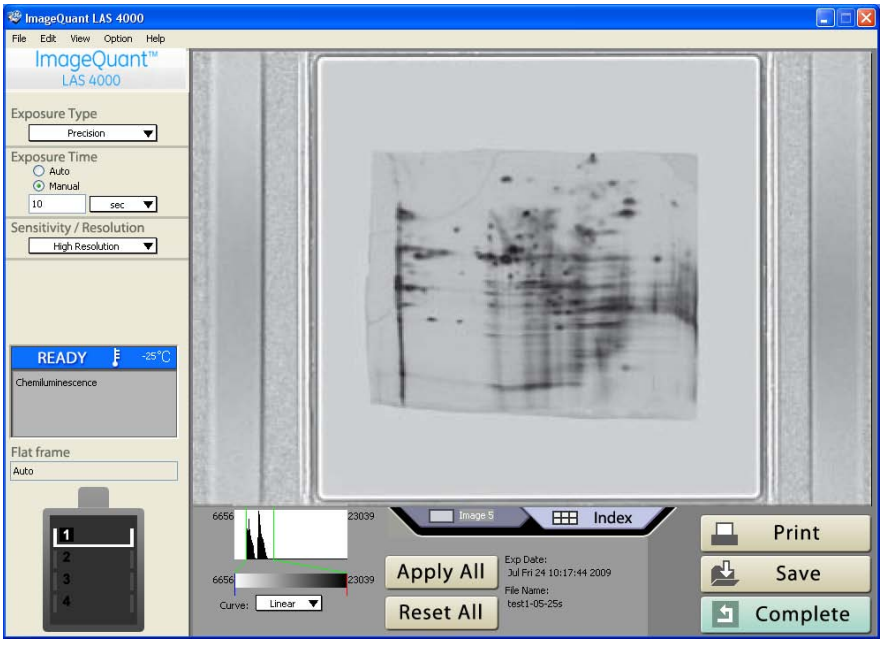
A larger sample (of up to 250 x 250 mm) can be exposed by replacing a high-sensitivity lens with a wide view lens. This section describes how to expose large samples.

Step	Action
1	Install the wide view lens. See *Section 3.2 Installing or exchanging the lens, on page 18*.

Step	Action
2	Place a sample on the tray that you selected according to the light source used. Put the tray in IDX and close the door. 

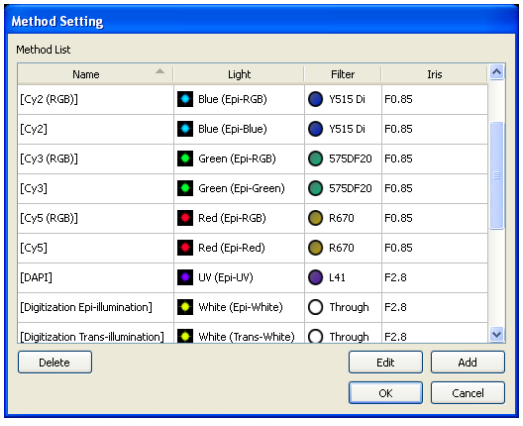
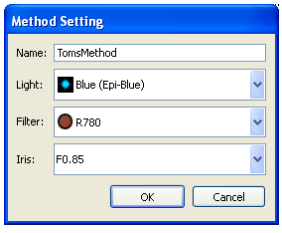
Step	Action
3	Click the ***Method/Tray position*** button.  1 Select the ***Method***, ***Light source***, ***Filter***, ***Iris***, and ***Tray position***. 2 If ***FlatFrame Mode*** is set to manual in ***Edit:Preference***, click the ***Next*** button. 3 Select the appropriate ***Flat Frame*** file. 4 Click the ***OK*** button.

Step	Action
4	Click the ***Focusing*** button. Using for example some printed text on the sample tray, turn the lens while viewing the screen, and adjust the focus manually.  Click the ***Return*** button. **TIP:** Click on the image to magnify it. Click on the image again to return to the original size.
5	Select ***Exposure Type***. 
6	Set the ***Exposure Time*** or ***Interval Time***.

Step	Action
7	Select ***Sensitivity/Resolution***.  **TIP:** Select ***Sensitivity/Resolution...*** in the ***Help*** menu. You can display Help that describes the relation between sensitivity and resolution. 
8	Click the ***Start*** button. Exposure is started.
9	Adjust the gradations of the exposed image, then save and print the image. Click the ***Complete*** button.  The display returns to the main screen.

4.16 Creating a new method and performing flat frame calibration

For most purposes a pre-existing method will be sufficient. For other filter, light source and iris combinations a new method needs to be created. The following describes how to create a new method and perform a Flat Frame calibration.

Step	Operation
1	In ***Preference*** in the ***Edit*** menu, select ***FlatFrame mode***, and set this to ***Manual***. 
2	To create a new method click ***Method Setting*** in the ***Option*** menu. The ***Method Setting*** dialog opens. 
3	Select an existing method to change and click the ***Edit*** button, or to create a new method click ***Add***. The ***Method Setting*** edit dialog opens. 
4	Select the appropriate ***Light***, ***Filter*** and ***Iris***, edit the ***Name*** for the method and click ***OK***. Once the method is added to the list of methods, click ***OK*** to return to the main window.

<table>
<tr><th>Step</th><th>Operation</th></tr>
<tr><td>5</td><td>Insert the calibration plate appropriate for the light source into the ImageQuant LAS 4000.

<table>
<tr><th>Light source</th><th>Calibration plate</th></tr>
<tr><td>Red Epi light</td><td>Cal plate GR (pink)</td></tr>
<tr><td>Green Epi light</td><td>Cal plate GR (pink)</td></tr>
<tr><td>Blue Epi light</td><td>Cal plate FL (green)</td></tr>
<tr><td>RGB module</td><td>Use the Cal plate that corresponds to the chosen wavelength (red, green or blue)</td></tr>
<tr><td>NIR Epi light</td><td>Cal plate GR (pink)</td></tr>
<tr><td>UV Epi light</td><td>Cal plate FL (green)</td></tr>
<tr><td>White Epi light</td><td>Cal plate DI (white)</td></tr>
</table>
Close the door of the instrument.
Note: Ensure the the appropriate lights and filter are in place.</td></tr>
<tr><td>6</td><td>To perform a Flat Frame calibration, select FlatFrame Calibration in the Option menu.
The FlatFrame Calibration dialog opens.

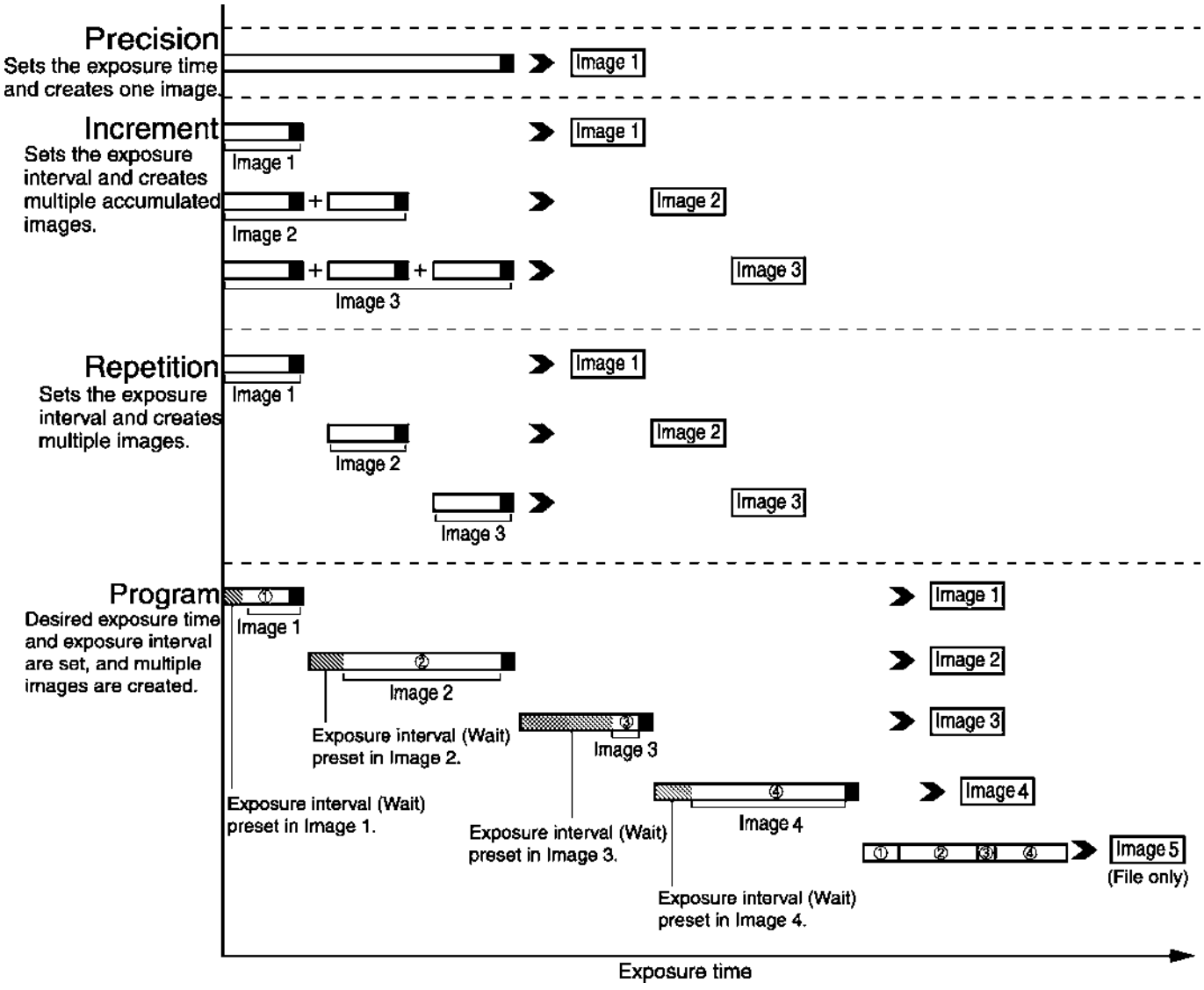
Note: Administrator priveleges are required in order to perform a Flat Frame calibration.</td></tr>
<tr><td>7</td><td>Select the method to calibrate from the drop-down list. Choose which tray positions to calibrate, then click Start to begin the calibration.</td></tr>
<tr><td>8</td><td>Once the calibration is complete, click the Close button to close the dialog. The calibration plate can now be removed.</td></tr>
</table>

5 Software reference guide

5.1 Exposure type

This function is for selecting exposure methods. There are four types of exposure methods.

Exposure Type	Description
Precision	Exposes for the entire time set in ***Exposure Time***.
Increment	Exposes for each time set in ***Interval Time*** and accumulates images.
Repetition	Exposes for each interval time set in ***Interval Time*** and displays images for each section.
Program	Exposure is made for the desired time and exposure intervals. A file is created automatically for each read image, and the file of accumulated images is also saved automatically.



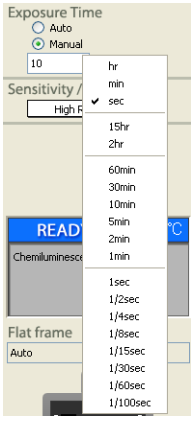
5.2 Exposure time

This function is for setting the exposure time.

When exposure type is precision

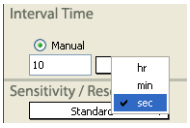
- ***Auto***: The exposure time is automatically calculated by histogram analysis.

- ***Manual***: Select a suitable exposure time from the drop-down list. Alternatively select a time unit and type in an exposure time.



When exposure type is increment or repetition

Choose a time unit from the drop-down list and enter an interval time.



TIP: The interval time can be set from 10 seconds to 2 hours. For a UV transmitting light source, the interval time can be set from 10 seconds to 1 minute.

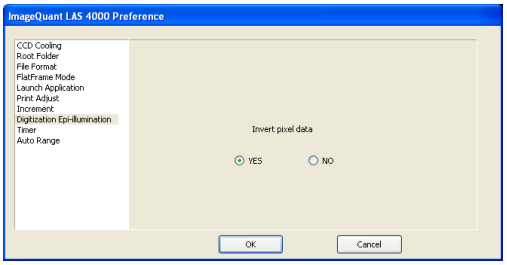
Note: *An image can be exposed for up to 30 hours in* ***Precision*** *mode. However, the image quality and quantitative performance are only guaranteed for a maximum of 2 hours.*

5.3 Add digitization image

A chemiluminescence and a white-light epi-illuminated image are exposed by single-click operation when this function is set to ON. After exposure, both chemiluminescence and white epi-illuminated images can be saved.

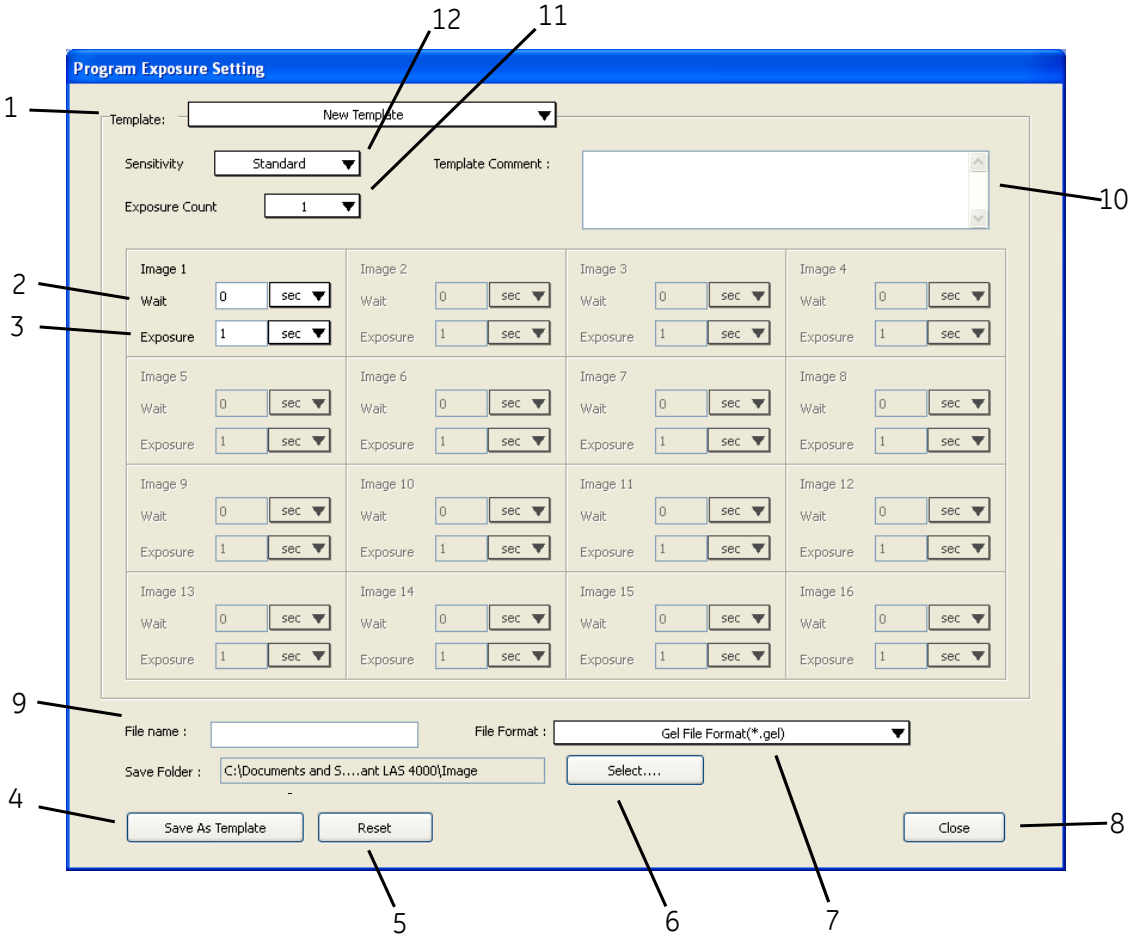
This function can be used only when the method is chemiluminescence.

TIP: Click on ***Digitization Epi-illumination*** in ***Preference*** in the ***Edit*** menu, and select ***YES*** for ***Invert Pixel-data***.



5.4 Program settings

Program Settings are used to set exposure time and exposure intervals when ***Program*** mode is selected as ***Exposure Type***. The input settings are saved as a template file.



No.	Description	No.	Description
1	A template file is selected. If a new template is to be created, select New Template. ***Note:*** *When the selected template is modified,* ***Modified*** *will be displayed.*	7	Select the image file format to be saved. ***Note:*** *Two types of format can be selected, the GE Healthcare gel format (*.gel) and a linear 16-bit grayscale tiff file format (*.tif).*
2	Set exposure intervals. This is the time from the shutter closure until the start of the next exposure. ***Note:*** *The wait time can be set within the range of 0 seconds to 30 hours.*	8	Close the settings window.
3	Set exposure time. ***Note:*** *This can be set within the range of 0.01 seconds to 30 hours.*	9	Enter a file name to be saved.
4	Save the template.	10	Enter a comment.
5	Settings will return to the initial settings.	11	Select the number of frames (between 1 and 16) to be preset.
6	Folder in which the template is saved	12	Select detection sensitivity.

Delete a template

Navigate to the folder chosen in step 6 above and delete the template file.

The default locations are as follows:

- **For Windows XP**

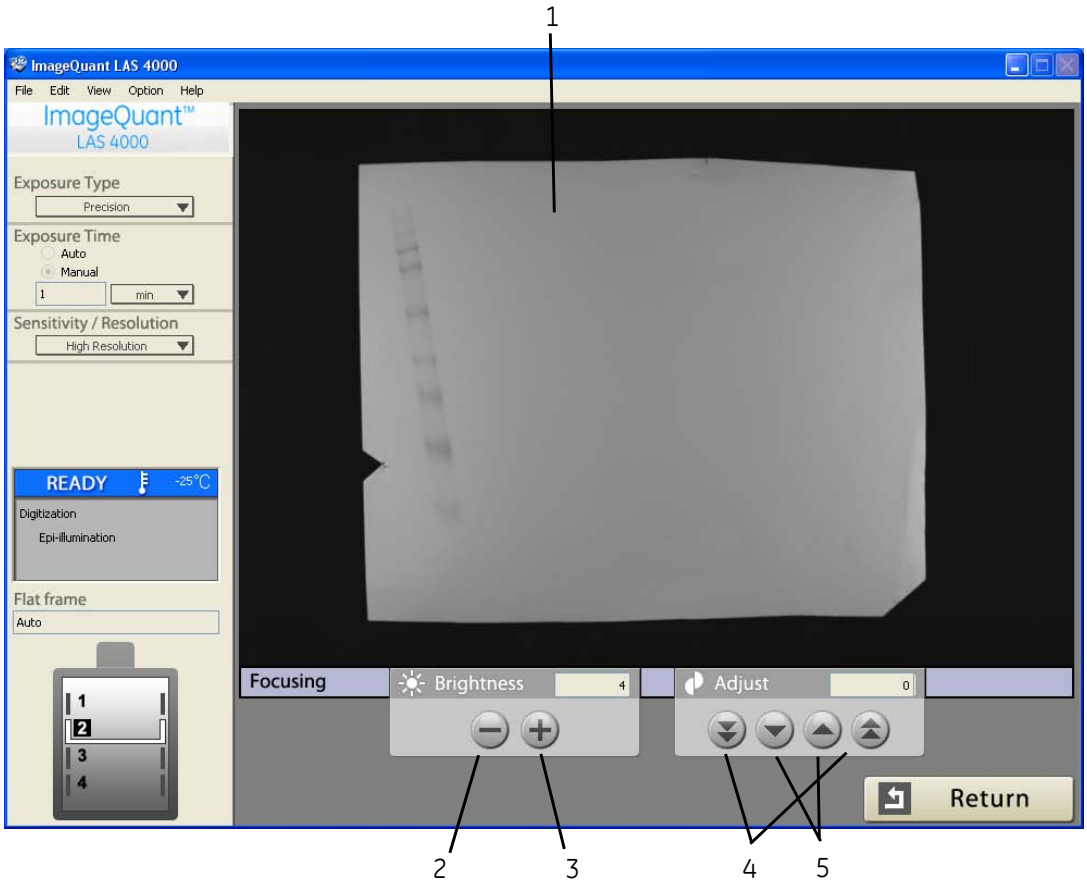
  C:\Document and Settings\All users\Application Data\GE Healthcare\ImageQuant LAS 4000\ProgramTemplate

- **For Windows Vista**

  C:\GE Healthcare\ImageQuant LAS 4000\ProgramTemplate

5.5 Focusing

The Brightness function enables adjustment of the brightness of the Focusing screen, and the Adjust function enables adjustment of the focus when the LAS High Sens. lens is used.



No.	Description	No.	Description
1	Click on the image to expand or reduce the display.	4	Coarse adjustment of focus.
2	The view of the focusing screen becomes darker.	5	Fine adjustment of focus
3	The view of the focusing screen becomes lighter.		

TIP: Select ***Pan Focus Fast*** in the ***View*** menu. The focusing speed then increases.

This is effective for the alignment of a sample (see *Pan Focus Fast, on page 104*).

Note:

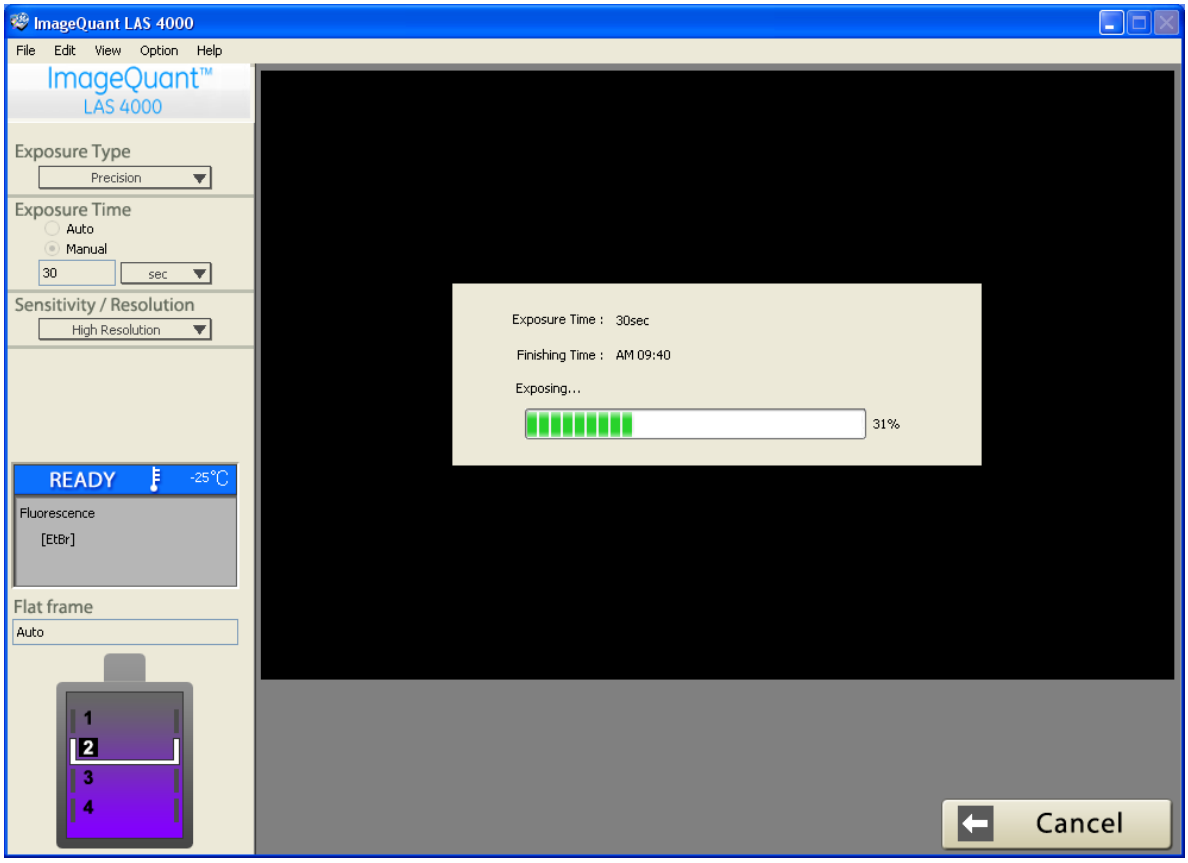
- *When the NP tray is used, adjust so that the bottom of a plate is focused. Adjustment using a printed paper facilitates focusing.*
- *Check the tray positions to be exposed in advance.*

5.6 Start

Exposure starts when you click the ***Start*** button.

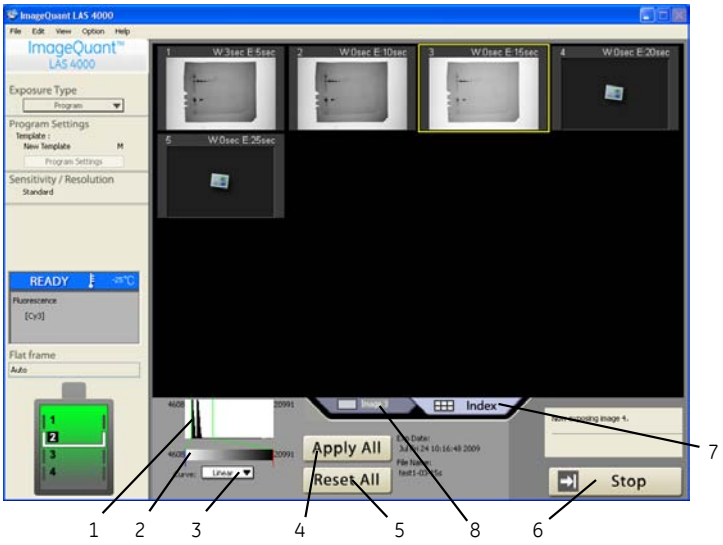
During exposure (type Precision)

During exposure, a progress bar and ending time are displayed to indicate the progress status of exposure.



Click ***Cancel*** to discontinue exposure. The current image is not saved.

During exposure (type Increment or Repetition)



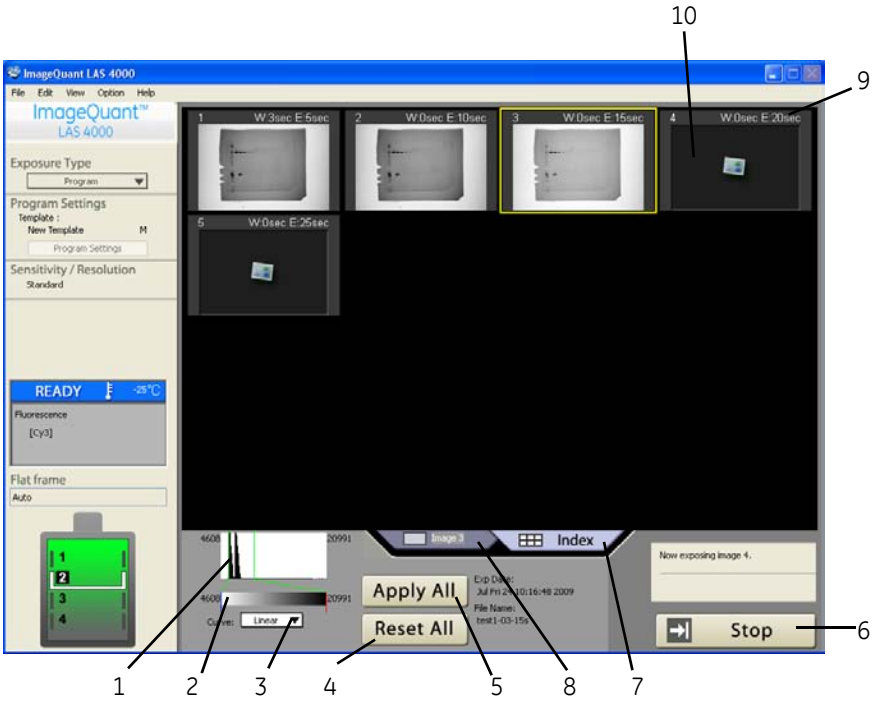
No.	Description	No.	Description
1	Range Scope can be changed by dragging the mouse.	5	The changed gradation is applied to all images.
2	Gradation can be changed by dragging the mouse.	6	Exposure is discontinued. The current image is discarded.
3	Gradation conversion curve can be changed (linear or sigmoidal).	7	Click this tab to enter index view.
4	Returns the gradation to the initial setting.	8	Click this tab to magnify the selected image.

TIP:

- Exposure is interrupted when you click the ***Stop*** button during ***Precision*** exposure. In this case, the image in course of exposure is not saved.
- When you click the ***Apply All*** button during magnified image display, the gradation changed in the expanded image display state is applied to all magnified images.

Note: *Only the 100 latest exposed images can be saved for exposure types* ***Increment*** *and* ***Repetition****.*

During exposure (type Program)



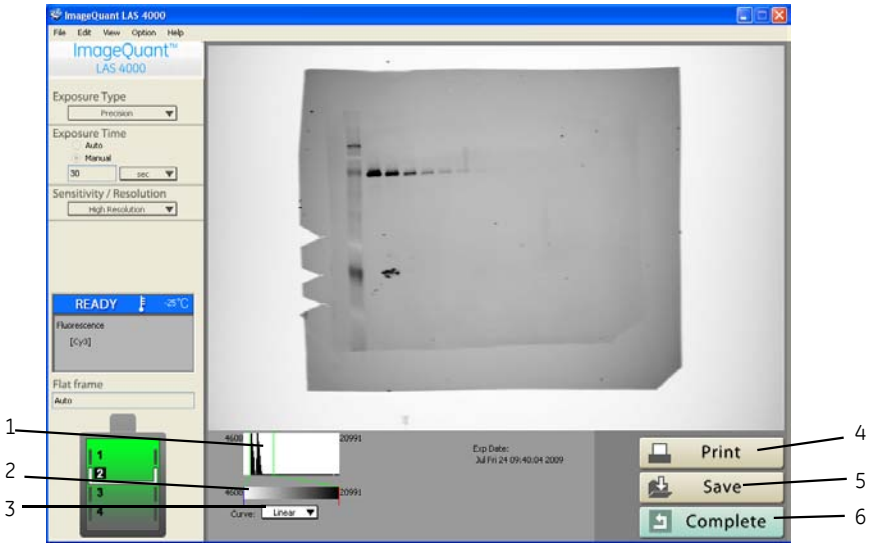
No.	Description	No.	Description
1	The range can be changed by dragging the mouse.	6	Exposure is discontinued. The current image is discarded.
2	Gradation can be changed by dragging the mouse.	7	Click this tab to enter index view.
3	The gradation conversion curve can be changed (linear or sigmoidal).	8	Click this tab to magnify the latest image.
4	Return to initial setting.	9	Preset conditions.
5	The changed gradation is applied to all images.	10	The area where an image will be displayed.

TIP:

- Images for which exposure is completed are automatically saved in a file with name format: <FileName>_<PhotographNo.>_<ExposureTime>
- An image, which is the accumulation of all exposed images is saved in a file with name format: <FileName>_<Sum>_<TotalExposureTime>

Note: *Only the 16 latest exposed images can be saved for exposure type* ***Program****.*

After exposure (type Precision)

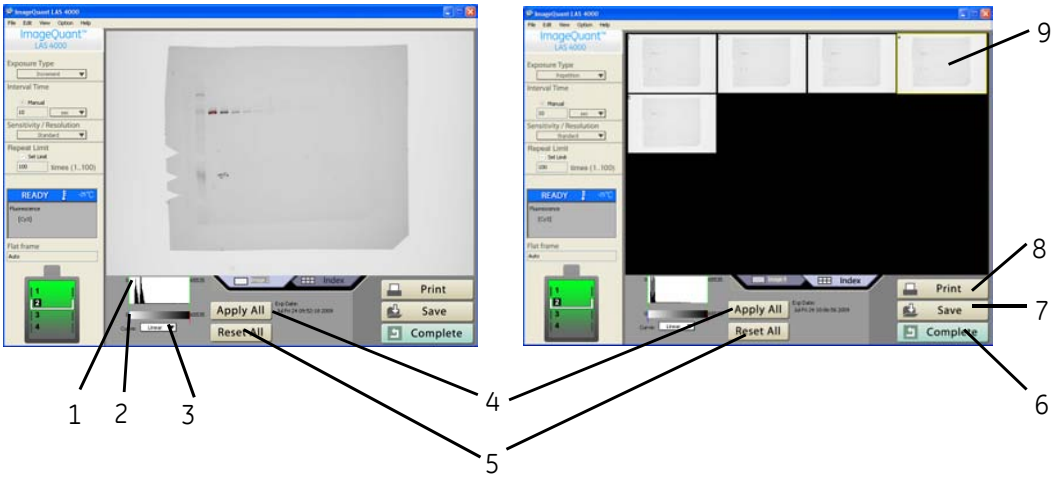


No.	Description	No.	Description
1	The range can be changed by dragging the mouse.	4	Print image or screen.
2	Gradation can be changed by dragging the mouse.	5	Save image.
3	The gradation conversion curve can be changed (linear or sigmoidal).	6	Return to main screen.

After exposure (type Increment, Repetition or Program)

For magnified image view

For index image view

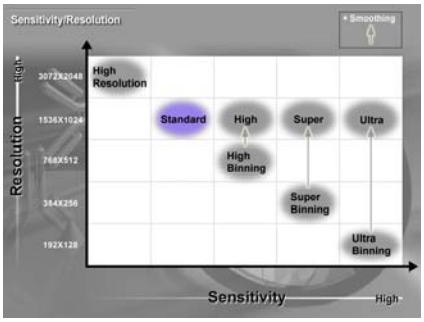


No.	Description	No.	Description
1	The range can be changed by dragging the mouse.	6	Return to main screen.
2	Gradation can be changed by dragging the mouse.	7	Save image.
3	The gradation conversion curve can be changed (linear or sigmoidal).	8	Print image or screen.
4	The changed gradation is applied to all images.	9	The selected image is marked by a yellow frame. Click on an image to select it. Double-click an image or click the Image tab to open the magnified image view.
5	Returns the gradation to the initial setting.		

5.7 Sensitivity/Resolution

This function sets the sensitivity and resolution.

The relation between the sensitivity and resolution is shown below.



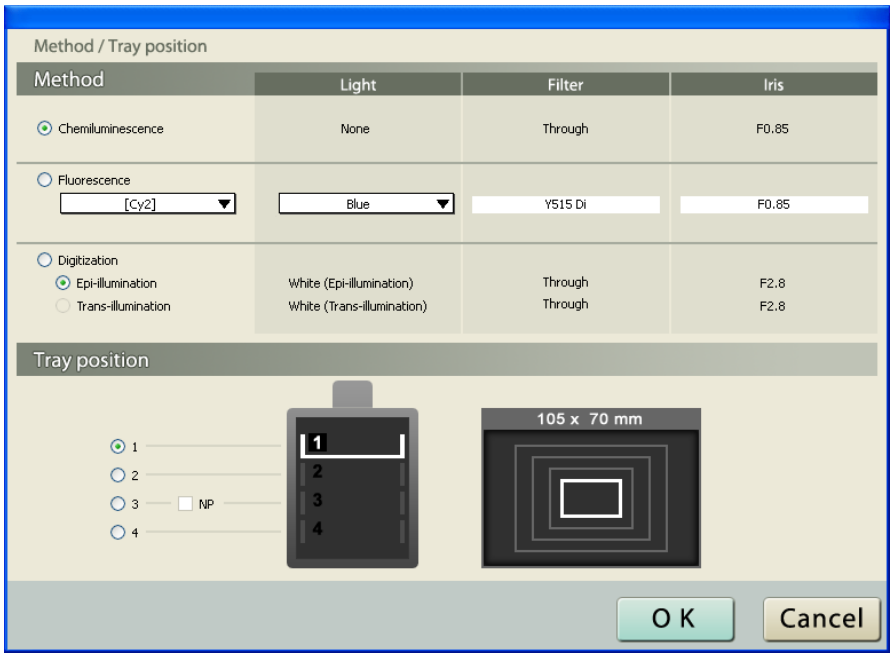
File size for each sensitivity

High Resolution	12.6MB
Standard	3.15MB
High	3.15MB
Super	3.15MB
Ultra	3.15MB
High Binning	786MB
Super Binning	197MB
Ultra Binning	49.2MB

TIP: Select ***Sensitivity/Resolution...*** in the ***Help*** menu. The relation between the sensitivity and resolution is displayed.

5.8 Method/Tray position

The window for setting the method and tray position is displayed when you click the ***Method/Tray position*** button. Select a method and tray position most suitable for the sample and click the ***OK*** button.



Set the method and tray position

Method

The method (the combination of the optimum light source, filter, and iris) is registered for each detection method. When a method is selected, the light source, filter, and iris are set automatically. The contents of each setting are shown in the table below.

Note: *The RGB module may be used instead of the separate red, green and blue Epi lights.*

Method	Option	Light	Filter	Iris
Chemiluminescence		None	Through	F0.85
Fluorescence	SYBR Green	Blue (460nm Epi)	Y515 Di	F0.85
	GFP	Blue (460nm Epi)	510DF10	F0.85
	EtBr	UV (312nm Trans-illumination)	605DF40	F2.8
	Cy2	Blue (460nm Epi)	Y515 Di	F0.85
	Cy3	Green (520nm Epi)	575DF20	F0.85
	Cy5	Red (630nm Epi)	R670	F0.85
	Dy781	NIR (710nm Epi)	IR785	F0.85
	DAPI	UV (365nm Epi)	L41	F2.8

Method	Option	Light	Filter	Iris
Digitization	Epi-illumination	White (Epi-illumination)	Through	F2.8
	Trans-illumina-tion	White (Trans-illumina-tion)	Through	F2.8

Note: *The method that can be used varies depending on the state of the light source set in IDX. Unusable options cannot be selected.*

Note: *Before clicking the OK button, be sure to close the IDX door.*

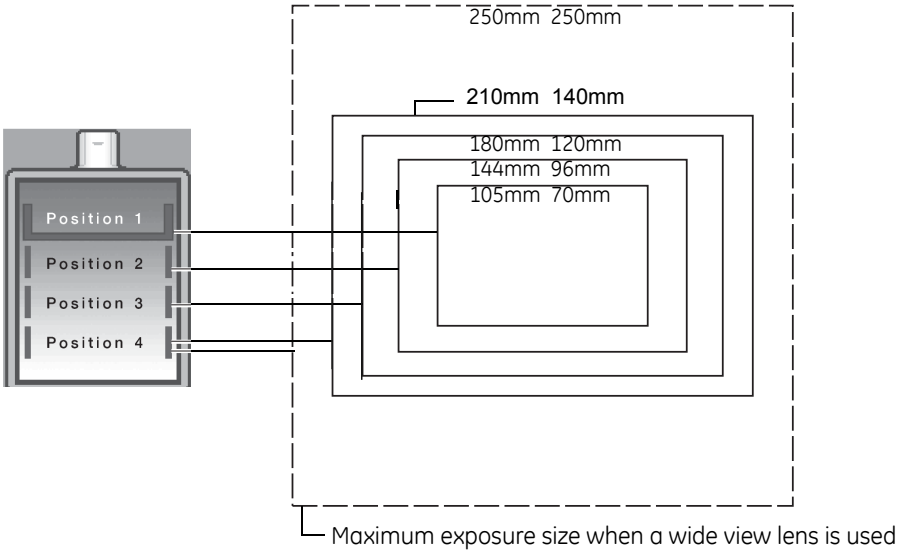
Note: *Filter position 1 is dedicated for chemiluminescence. Do not put a filter in it.*

Tray position

The tray position is changed according to the sample size.

The tray size that can be read varies depending on the tray position.

Position	Width (mm)	Length (mm)
1	105	70
2	144	96
3	180	120
4	210	140
	250 (wide view lens)	250 (wide view lens)

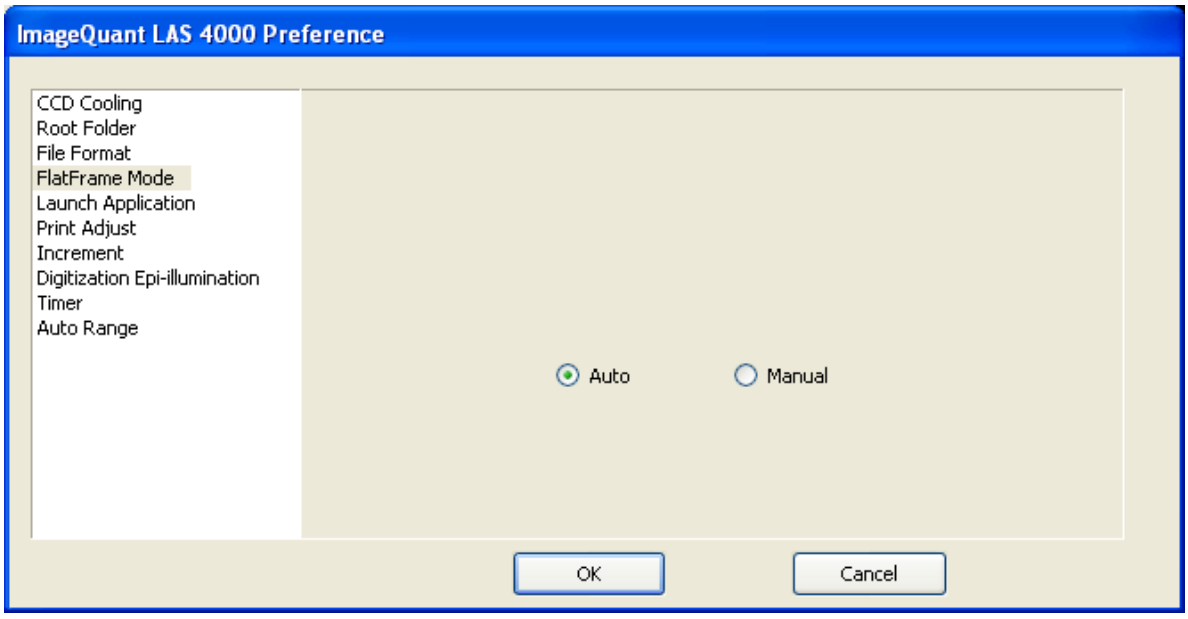


TIP:

- The display on the main window changes to reflect the current choice of method and tray position.
- The NP tray is to be used at tray position 3 using the ***Chemiluminescence*** method and the NP check box should be checked. The tray will not be detected otherwise.

Manual flat frame mode

In order to be able to manually specify a Flat frame file for the method and tray position, set ***FlatFrame Mode*** to ***Manual*** in ***Edit:Preference***. Click Next in the ***Method/Tray position*** dialog to select the appropriate ***Flat Frame Correction***.



TIP: Only Flat Frame files that satisfy the currently selected exposure conditions are displayed in the ***Flat Frame Correction*** list.

To create a Flat Frame file, see the description of the Flat Frame Calibration function, *Section 5.12.2 Flat Frame Calibration, on page 105*.

Note: *Before clicking the **OK** button, be sure to close the instrument door.*

5.9 File menu

Page Setup

Opens the settings for the printer, for example the direction of paper.

Print

Outputs an image to a printer.

The image can be printed as a full-scale print or screen print. For the output method, see *Section 4.12 Printing exposed images, on page 69*.

Save

Saves a file. The default setting for the file format to be saved is that selected in ***Preference*** in the ***Edit*** menu. See *Section 5.10 Edit menu, on page 95*.

Quit

Exits ImageQuant LAS 4000 Control Software.

5.10 Edit menu

Cut

Cuts the selected characters. This function can be used during manual input of exposure time and interval.

Copy

Copies the selected characters. This function can be used during manual input of exposure time and interval.

Paste

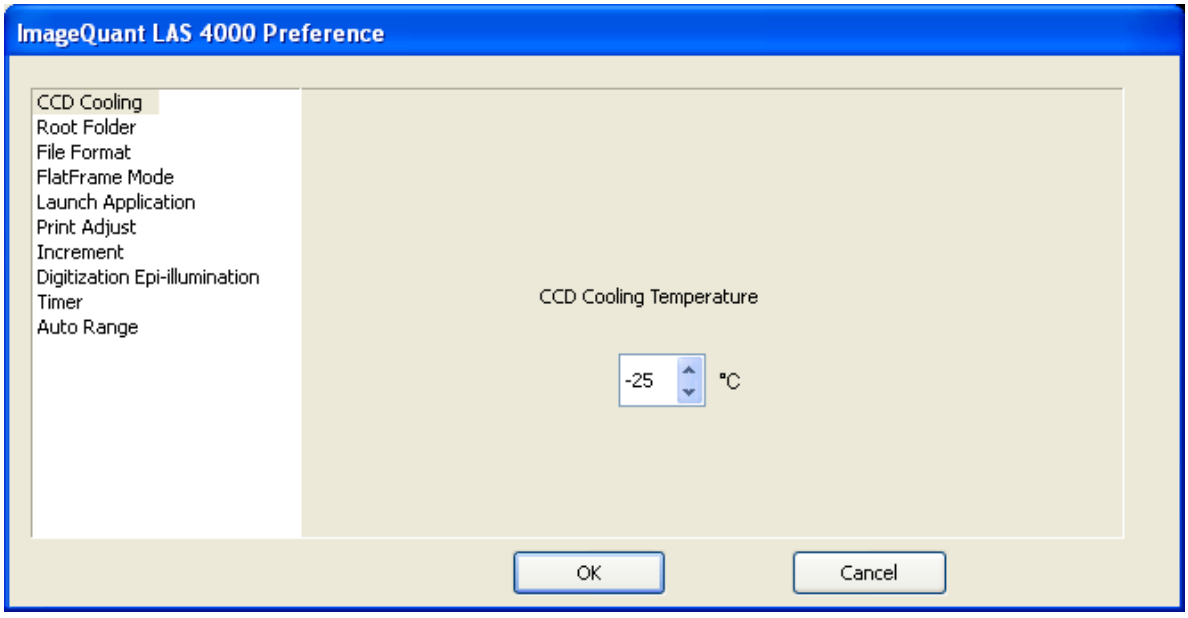
Pastes the copied characters. This function can be used during manual input of exposure time and interval.

Preference

The available settings can be viewed by clicking the respective item.

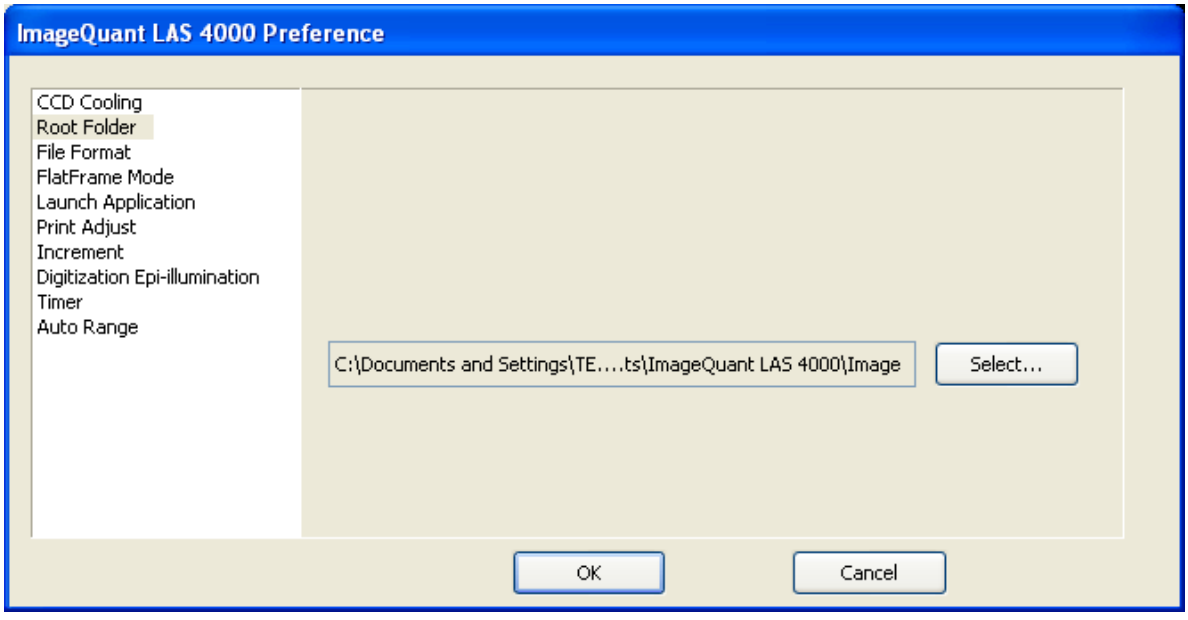
CCD Cooling

Sets the CCD temperature.



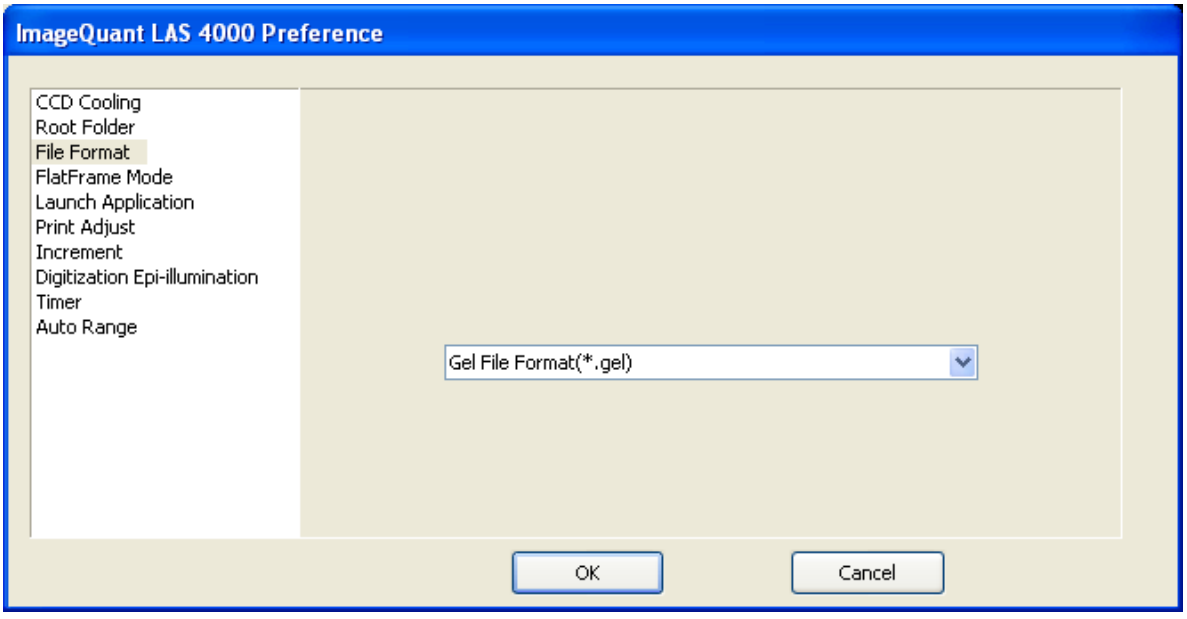
Root Folder

Sets the folder in which files are saved.



File Format

Select the default format for saving images.



- Gel File Format (*.gel)

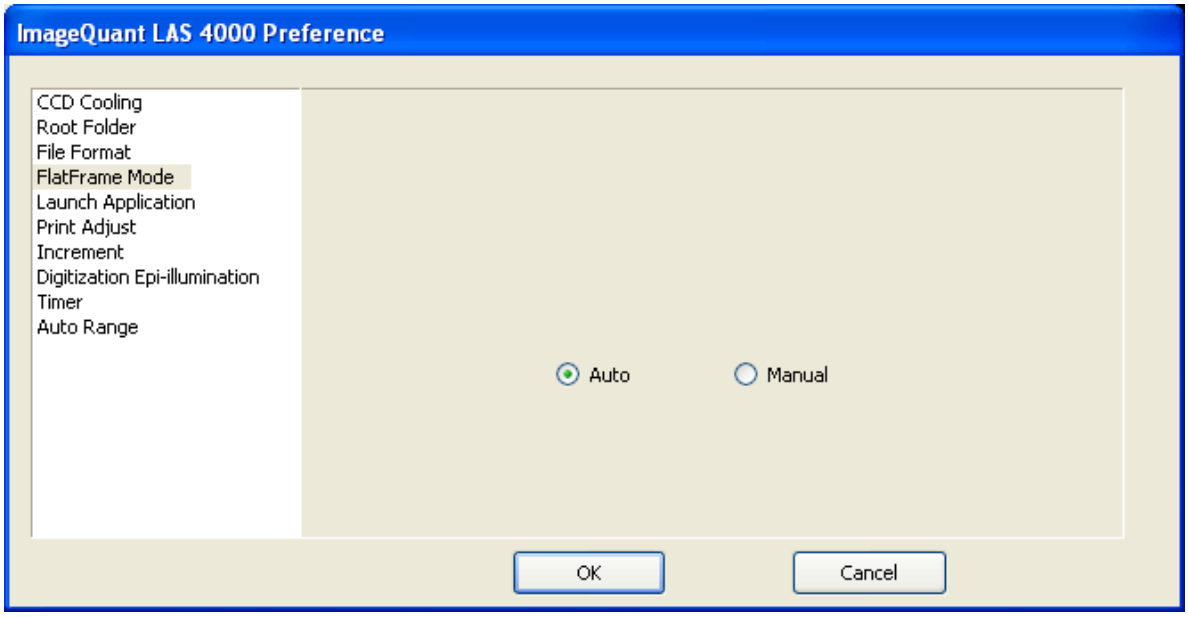
  Linear 16-bit grayscale encoding. Can include additional information compared to .tif format.
- Original Image TIFF File-Linear 16bit Gray (*.tif)

  This is a 16-bit TIFF format.
- Window Image TIFF File-8bit Color (*.tif)

  This is a TIFF format that has an eight-bit color gradation.

  The changed gradation can be saved directly.

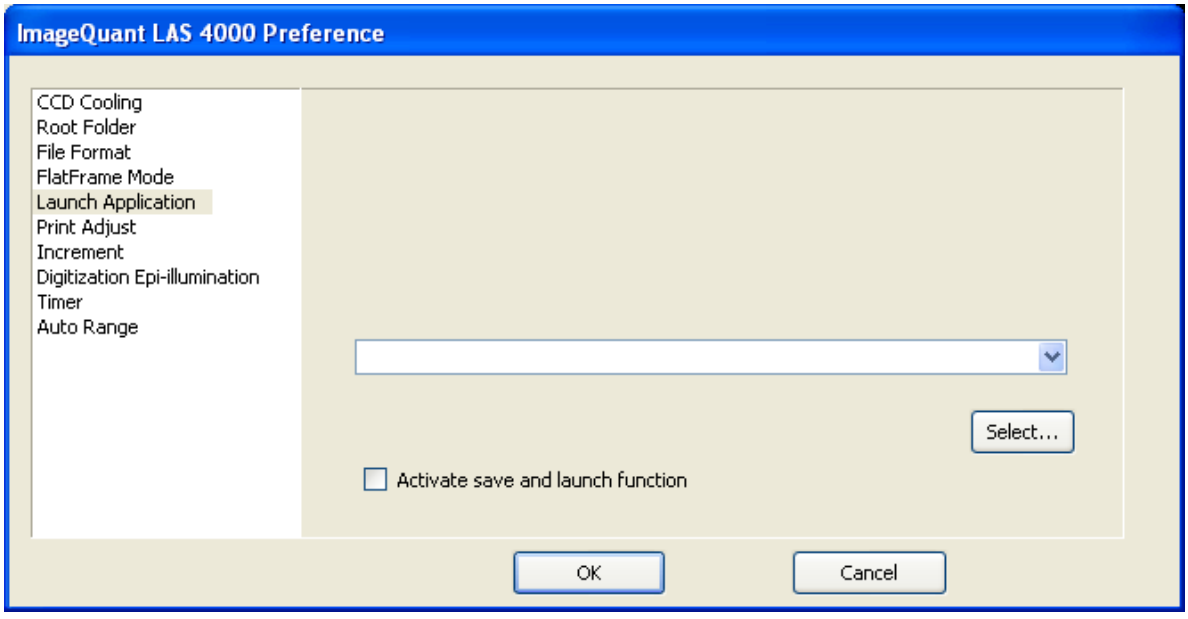
FlatFrame Mode



Option	Description
Auto	Optimal correction data is automatically set.
Manual	Correction data can be selected in the Flat Frame selection screen.

Launch Applicaton

This option can be used to automatically launch an external application when an image is saved.

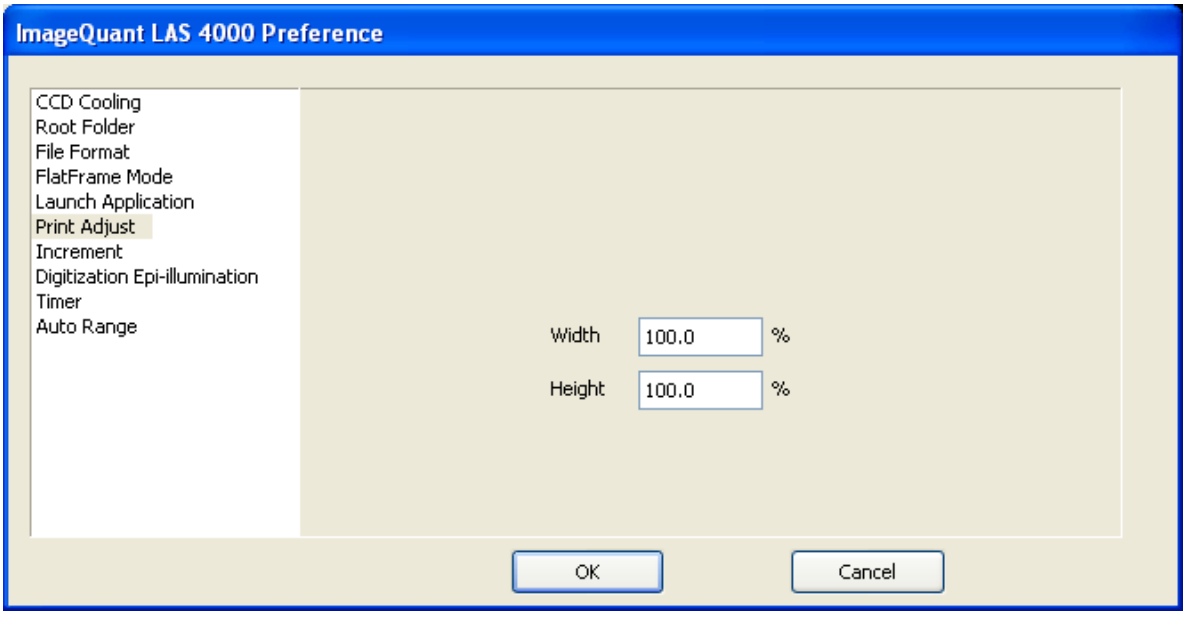


To define an application to launch, do the following:

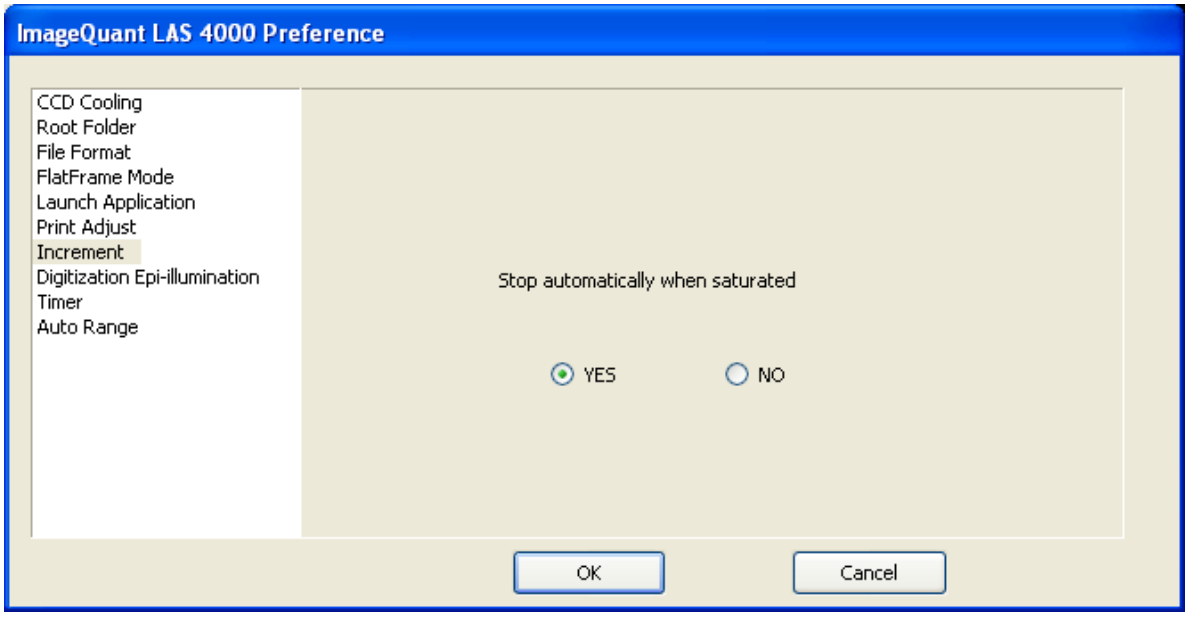
- Select the application to be launched from the drop down list, or locate the application using the ***Select...*** button.
- Check the ***Activate save and launch function*** checkbox.

Print Adjust

Adjusts the print output size.

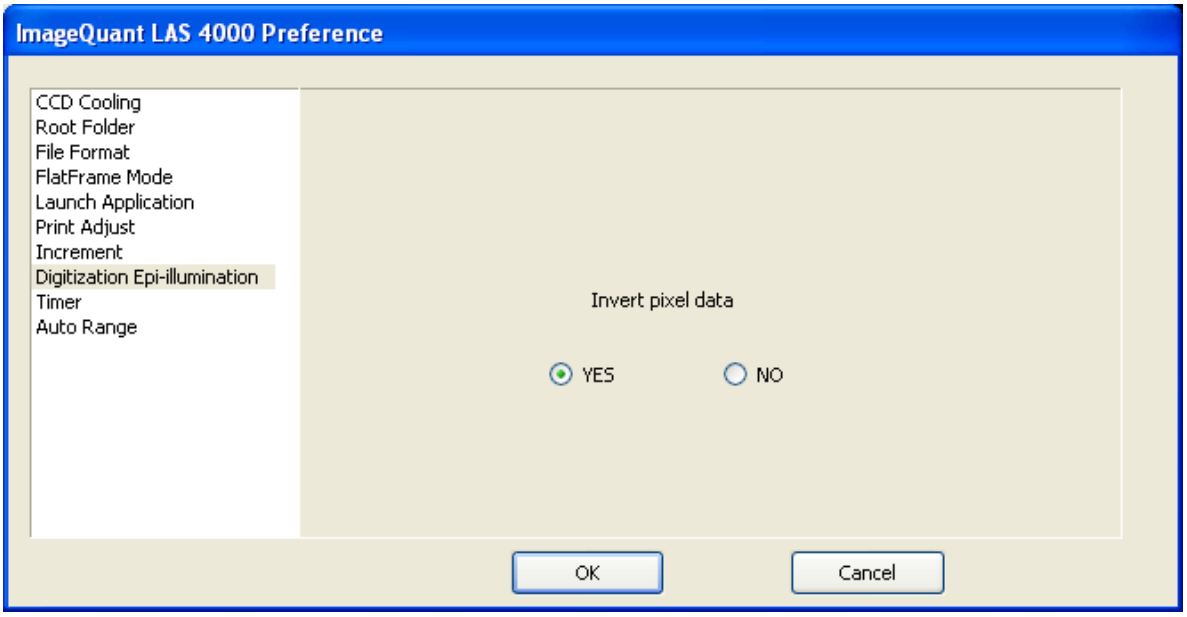


Increment



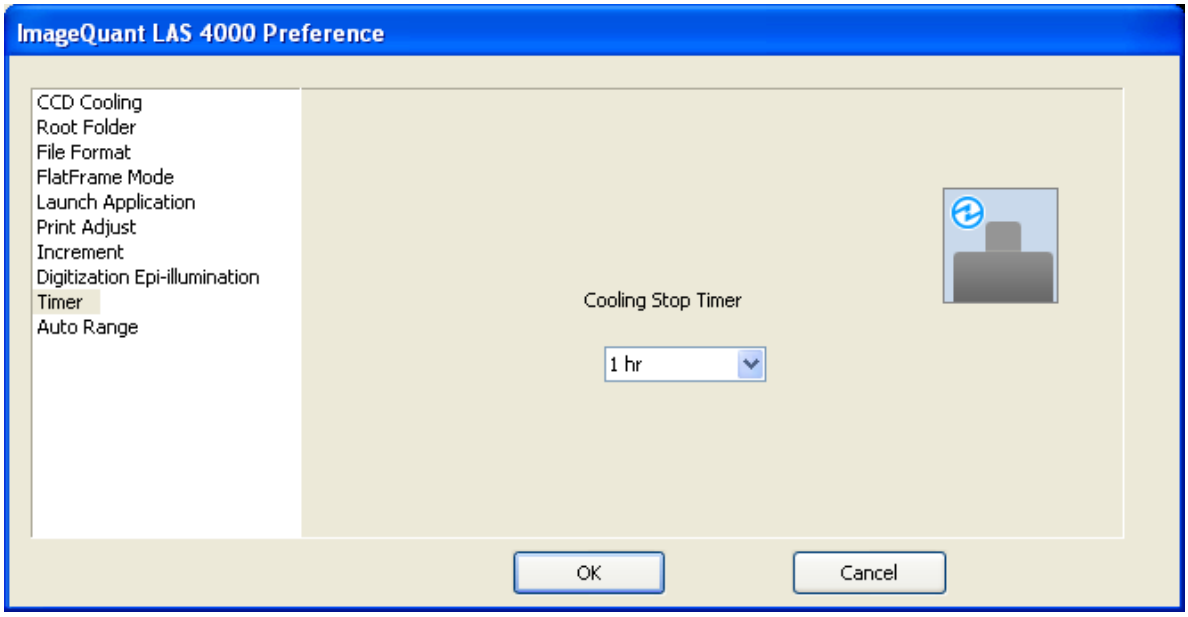
Option	Description
YES	During incremental imaging, exposure is automatically stopped when the amount of saturated data is too large.
NO	During incremental imaging, exposure is continued until the Stop button is pressed.

Digitization EPI



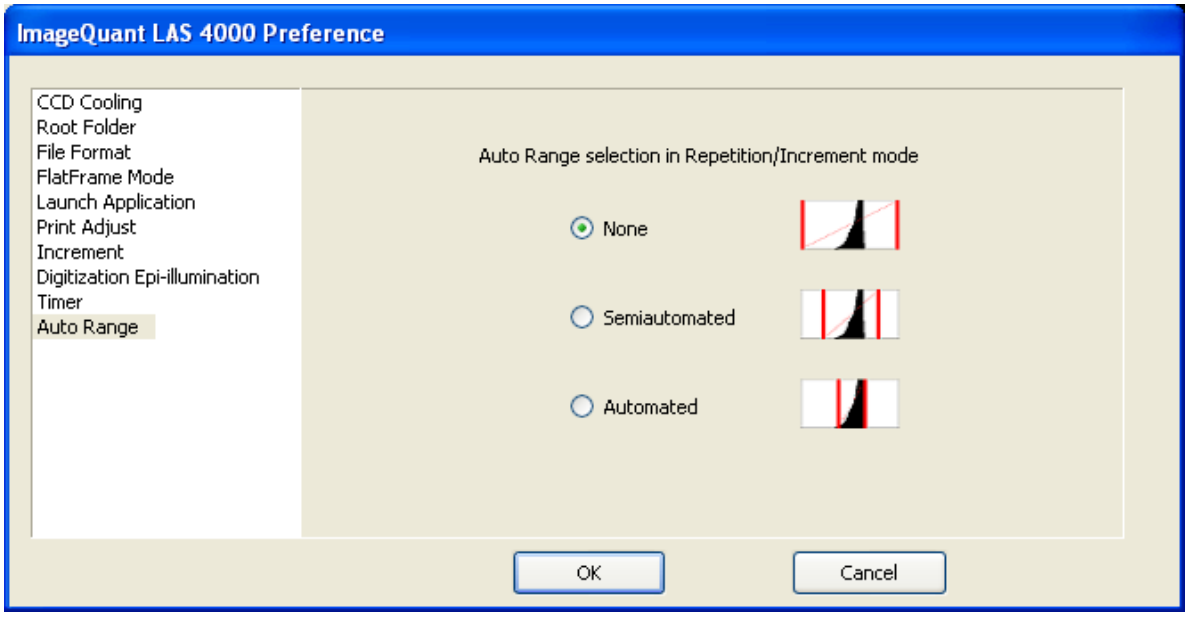
Option	Description
YES	Pixel data inversion is performed.
NO	Pixel data inversion is not performed.

Timer



If the ImageQuant LAS 4000 is not used during the chosen time, the cooling will be automatically shut off and the system will enter power saving mode.

Auto Range



An image whose gradations are adjusted automatically is displayed when exposure type is Increment or Repetition.

- None

An image is displayed without adjusting its gradations.

- Semiautomated

  An image is displayed with its light and shade highlighted.

- Automated

  An image is displayed with its light and shade more highlighted. (The effect is the same as when exposure type is Precision.)

5.11 View menu

Paint saturated data red

This function toggles whether to display saturated data in red.

Negative Gray

This sets the display color of an image such that absorbing bands are darker and the background lighter.

Positive Gray

This sets the display color of an image such that absorbing bands are lighter and the background darker.

Red

This sets the display color of an image such that illuminated regions are displayed in red.

Green

This sets the display color of an image such that illuminated regions are displayed in green.

Blue

This sets the display color of an image such that illuminated regions are displayed in blue.

Pan Focus All

This function toggles the quality of a focus image. The image is displayed in high image quality when this option is selected.

Pan Focus Fast

This function toggles the quality of a focus image. With this option selected the image quality is lower than using ***Pan Focus All***, but it is displayed faster.

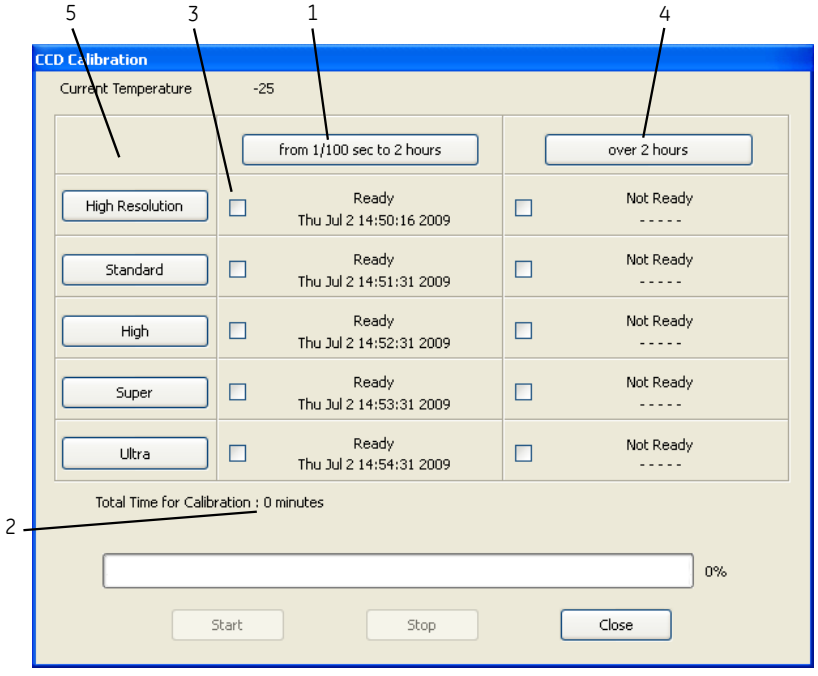
TIP: During sample alignment, a sample can be quickly aligned when Pan Focus Fast is selected.

5.12 Option menu

5.12.1 CCD Calibration

This function creates a correction file that is used for correcting characteristics of the CCD detector. The created correction file varies depending on the sensitivity, exposure time (short or long), and CCD cooling temperature.

1 When ***CCD Calibration*** is selected in the ***Option*** menu, the following window is shown.



No.	Description	No.	Description
1	Click here to check the boxes for all resolutions for up to 2 hours.	4	Click here to check the boxes for all resolutions for more than 2 hours.
2	The time required for creation is displayed.	5	Click on the buttons in this column to check the boxes for both correction files for specific resolutions.

No.	Description	No.	Description
3	Check individual check boxes to generate specific correction files.		

2 Click the ***Start*** button to generate the file.

- The progress of file creation is shown on the progress bar.
- To stop file creation, click the ***Stop*** button. The file will not be saved.

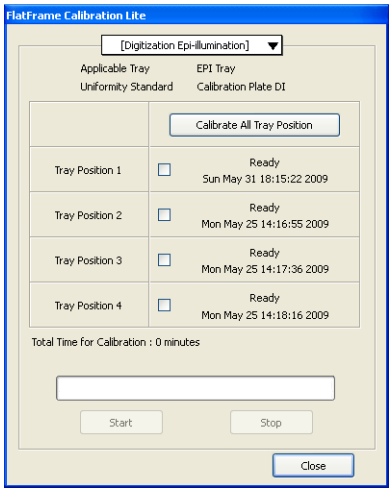
5.12.2 Flat Frame Calibration

This function creates a correction file (Flat Frame) that is required for correcting the optical characteristics. The Flat Frame file varies depending on Light, Filter, Iris, and Tray Position.

Note: *Administrator priveleges are required to perform Flat Frame calibration.*

Flat Frame Calibration

1 Select ***Flat Frame Calibration*** in the ***Option*** menu. The window below is then displayed.



2 Select a method from the drop-down menu at the top.

3 Put the displayed tray and Calibration Plate in the instrument.

4 Select the condition to be created.

5 Click the ***Start*** button.

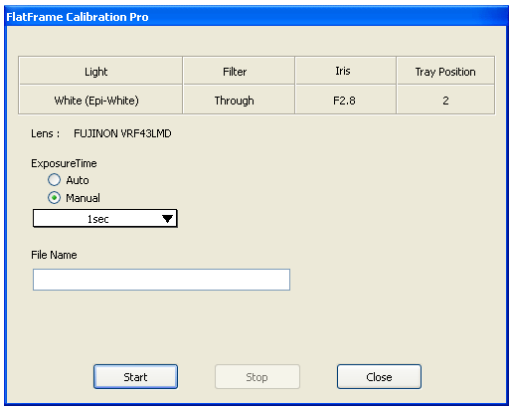
Note: *Make sure that an appropriate filter and tray are in place.*

6 A message window opens when the calibration is completed. Click ***OK***.

7 Click the Close button to close the ***FlatFrame Calibration*** window.

Flat Frame Calibration Pro

1 If ***FlatFrame Calibration Pro*** is selected in the ***Option*** menu, the window of the conditions preset in the Method/Tray position window will be displayed.



2 Put the appropriate tray and calibration plate in the instrument.

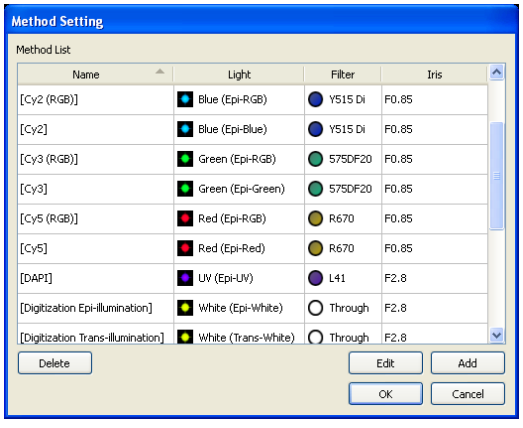
3 Set the exposure time.

4 Enter a file name.

5 Click the Start button.

5.12.3 Method Setting

Method Setting is used to set the content displayed on the ***Method/Tray position*** screen.

- 

  To delete a method, select the method to be deleted and click ***Delete***.

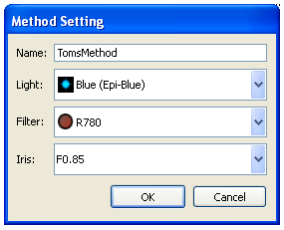
  Note: *Only user-defined methods can be deleted.*

- To edit a method, select the method to be edited and click ***Edit***.

  Note: *Only user-defined methods can be edited.*

- To add a method, click ***Add***.

Result: The following dialog is displayed.



1 Enter a ***Name*** for the method.

2 Select appropriate settings for ***Light***, ***Filter*** and ***Iris***.

3 Click ***OK***.

Note: *Optical characteristics can be corrected using the Flat Frame Calibration function for the added Method. See Section 5.12.2 Flat Frame Calibration, on page 105.*

5.13 Help menu

User Manual

Opens the ImageQuant LAS 4000 User Manual in the default pdf browser.

Getting Started

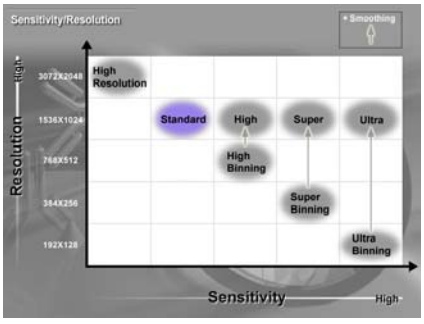
Opens the Getting Started with ImageQuant LAS 4000 manual in the default pdf browser.

End-User License Agreement

Opens the End-User License Agreement in the default pdf browser.

Sensitivity/Resolution

The figure showing the relation between sensitivity and resolution is displayed. Click to close the window.



About ImageQuant LAS 4000 Control Software

The version information of Image Reader is displayed.

Click to close the window.

6 Installing ImageQuant LAS 4000 Control Software

Administrator priveleges required

All tasks related to software installation or uninstallation require a computer account with administrator priveleges.

6.1 Installation sequence

Software installation is performed in the following sequence:

1 Install the USB contol driver

2 Install the USB function driver

3 Install the ImageQuant LAS 4000 Control Software

6.2 Install ImageQuant LAS 4000 Control Software under Windows XP

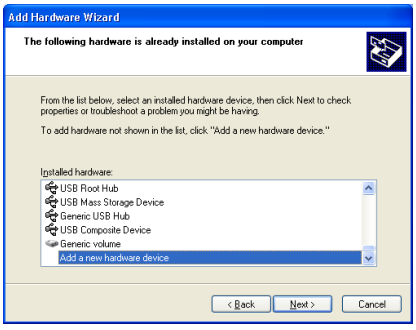
Before you begin

Log in using a Windows account with administrator privileges.

Install the USB Control Driver (Windows XP)

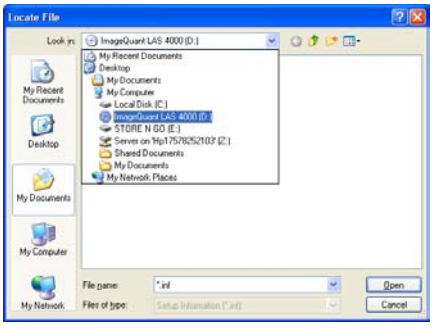
Step	Action
1	Disconnect ImageQuant LAS 4000 from the computer.
2	Open the control panel and select ***Printers and Other Hardware***.
3	Click ***Add Hardware***.
4	Click the ***Next*** button in the ***Add hardware wizard***.
5	Select ***Yes, I have already connected the hardware*** and click the ***Next*** button.

Step	Action
6	Select ***Add a new hardware device*** and click the ***Next*** button.

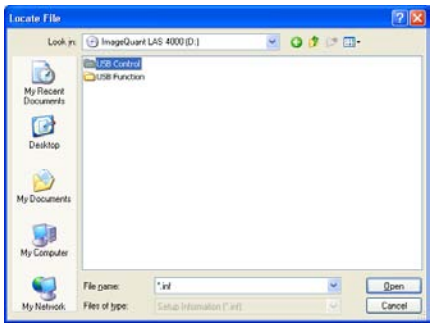


7	Select ***Install the hardware that I manually select from a list [Advanced]*** and click the ***Next*** button.
8	Select ***Show All Devices*** and click the ***Next*** button.

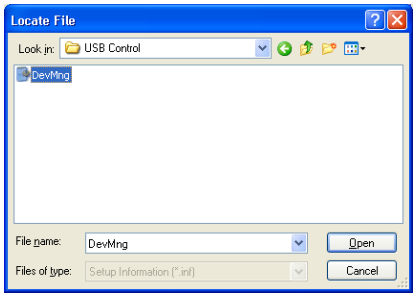
9	Click the ***Have Disk*** button in the ***Add hardware wizard***.
10	Insert the ImageQuant LAS 4000 Control Software CD and click the ***Browse*** button.
11	Select to install the driver from the ImageQuant LAS 4000 Control Software CD.



Step	Action
12	Open the ***USB Control*** folder.



13	Select the ***DevMng.inf*** file and click the ***Open*** button.



14	Click the ***OK*** button in the ***Install from disk*** dialog.
15	Click the ***Next*** button in the ***Add hardware wizard***.
16	Click the ***Next*** button again.
17	Click the ***Continue Anyway*** button in the ***Hardware Installation*** dialog.

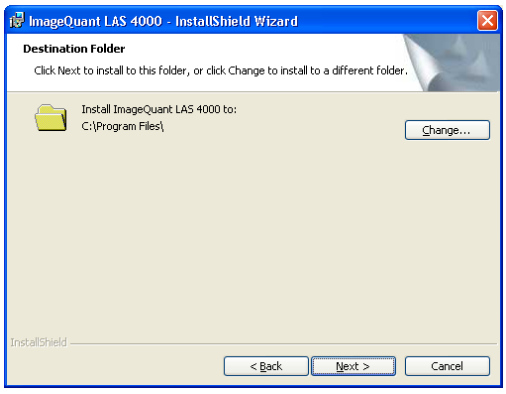
18	Click the ***Finish*** button to complete the driver installation.

Install the USB function driver (Windows XP)

Step	Action
1	Connect the computer and the ImageQuant LAS 4000 with a USB cable and turn **ON** the power switch of ImageQuant LAS 4000. The scanner is automatically detected by the computer.
2	In the ***Found New Hardware Wizard*** dialog, choose ***No, not this time***. 
3	Click the ***Next*** button in the ***Found New Hardware Wizard*** dialog.
4	Insert the installation CD.
5	Select ***Install the software automatically (Recommended)***.
6	Click the ***Next*** button in the ***Found New Hardware Wizard*** dialog.
7	Click the ***Finish*** button to complete the installation.

Install ImageQuant LAS 4000 Control Software (Windows XP)

Step	Action
1	Insert the ImageQuant LAS 4000 Control Software CD.
2	Locate and double-click the file ImageQuant LAS 4000.msi.
3	In the ***ImageQuant LAS 4000 - InstallShield Wizard***, click the ***Next*** button.
4	Read the license text. If the license agreement is not acceptable please contact a GE Healthcare representative, see back cover of this manual for contact information. Select ***I accept the terms in the license agreement*** and click the ***Next*** button.

Step	Action
5	Select destination folder in the dialog:  • Click the ***Next*** button to install the software at the default folder ***C:\Program Files***. • Click the ***Change*** button to install to a different folder.
6	Click the ***Install*** button in the installation dialog.
7	Click the ***Finish*** button.
8	Start the ImageQuant LAS 4000 Control Software. This will ensure that necessary folders and files are created.

6.3 Install ImageQuant LAS 4000 Control Software under Windows Vista

Before you begin

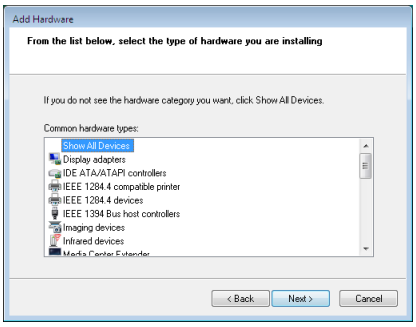
Log in using a Windows account with administrator privileges.

Install the USB Control Driver (Windows Vista)

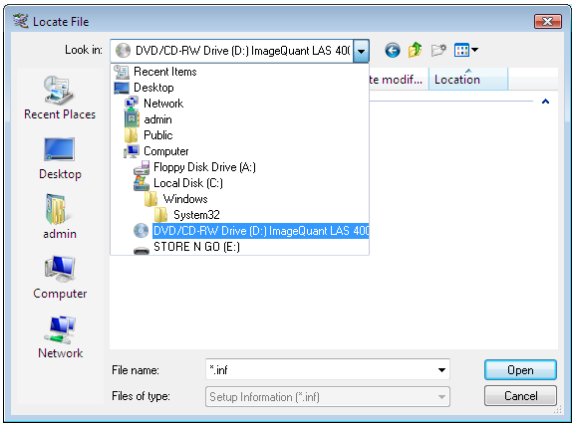
Note: *During software installations, you may be asked to confirm your actions in a dialog with the text* ***Windows needs your permission to continue****. Enter an administrator password, if prompted, then click* ***Continue*** *to proceed with the installation.*

Step	Action
1	Disconnect ImageQuant LAS 4000 Control Software from the computer.
2	Open the control panel and click ***Classic View*** in the upper left corner.
3	Open ***Add Hardware***.

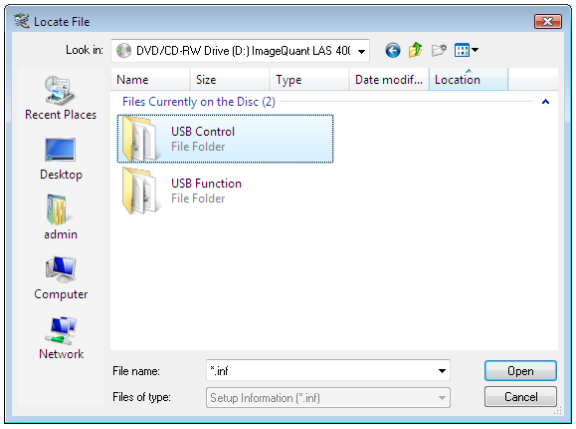
Step	Action
4	In the ***Add Hardware*** dialog, click the ***Next*** button.
5	Select ***Install the hardware that I manually select from a list (Advanced)*** and click the ***Next*** button.
6	Select ***Show All Devices*** and click the ***Next*** button.



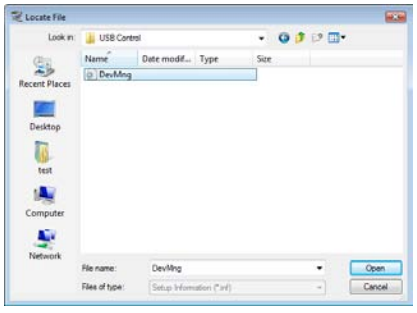
7	Click the ***Have Disk*** button.
8	Insert the ImageQuant LAS 4000 Control Software CD and click the ***Browse*** button.
9	Select to install the driver from the ImageQuant LAS 4000 Control Software CD.



Step	Action
10	Select the ***USB Control*** folder and click ***Open***.



11	Select the file ***DevMng*** and click the ***Open*** button.

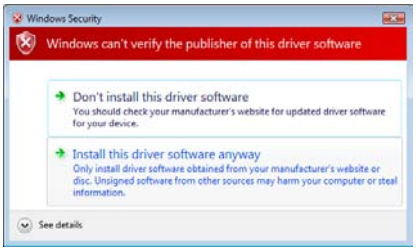


12	Click the ***OK*** button in the dialog ***Install from disk***.
13	Click the ***Next*** button in the wizard ***Add hardware***.
14	Click the ***Next*** button once again.
15	The following warning is displayed. Proceed by cliking ***Install this driver software anyway***.

16	Click the ***Finish*** button in the ***Add Hardware*** wizard to complete the installation.

Install the USB function driver (Windows Vista)

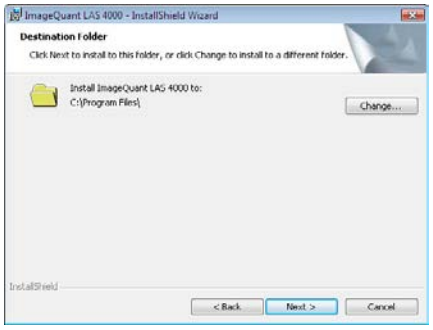
Note: *During software installations, you may be asked to confirm your actions in a dialog with the text* ***Windows needs your permission to continue****. Enter an administrator password, if prompted, then click* ***Continue*** *to proceed with the installation.*

Step	Action
1	Connect the computer and the ImageQuant LAS 4000 with a USB cable and turn **ON** the power switch of ImageQuant LAS 4000. *Result:* The scanner will automatically be detected by the computer and the Plug and Play function in Windows Vista starts.
2	In the ***Found New Hardware*** dialog, select ***Locate and install driver software (recommended)***.
3	Insert the ImageQuant LAS 4000 Control Software CD and click the ***Next*** button in the ***Found New Hardware*** dialog.
4	Select ***Install this driver software anyway***. 
5	A successful installation message appears. Click the ***Close*** button.

Install ImageQuant LAS 4000 Control Software (Windows Vista)

Note: *During software installations, you may be asked to confirm your actions in a dialog with the text* ***Windows needs your permission to continue****. Enter an administrator password, if prompted, then click* ***Continue*** *to proceed with the installation.*

Step	Action
1	Insert the ImageQuant LAS 4000 Control Software CD.
2	Locate and double-click the file ImageQuant LAS 4000.msi.
3	In the ***ImageQuant LAS 4000 - InstallShield Wizard*** dialog, click the ***Next*** button.
4	Read the license text. If the license agreement is not acceptable, please contact a GE Healthcare representative. See the back cover of this manual for contact information. Select ***I accept the terms in the license agreement*** and click the ***Next*** button.

Step	Action
5	Select destination folder in the dialog:  • Click the ***Next*** button to install the software at the default folder ***C:\Program Files***. • Click the ***Change*** button to install to a different folder.
6	Click the ***Install*** button.
7	If User Account Control (UAC) is enabled in Windows Vista, a dialog displays the message ***An unidentified program wants access to your computer***. Click ***Allow***.
8	Click the ***Finish*** button. The installation of ImageQuant LAS 4000 Control Software is now completed.
9	Start the ImageQuant LAS 4000 Control Software. This will ensure that necessary folders and files are created.

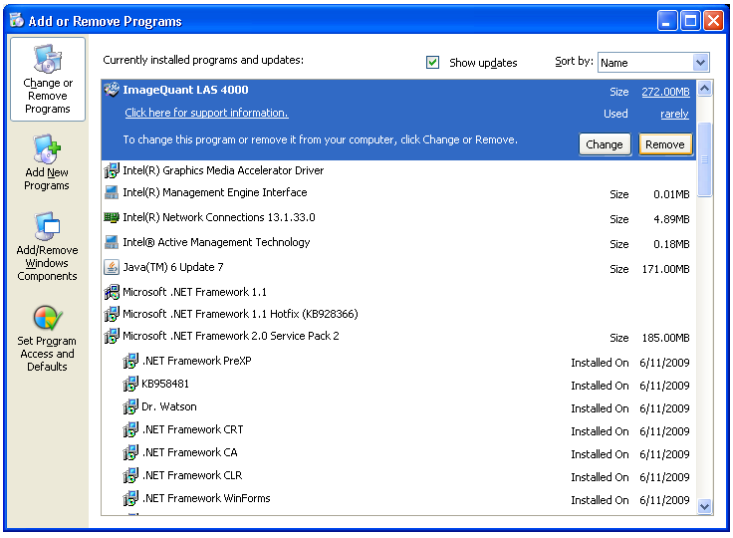
7 Uninstalling and upgrading ImageQuant LAS 4000 Control Software

Before you begin

Log in using a Windows account with administrator privileges.

Uninstalling ImageQuant LAS 4000 Control Software under Windows XP

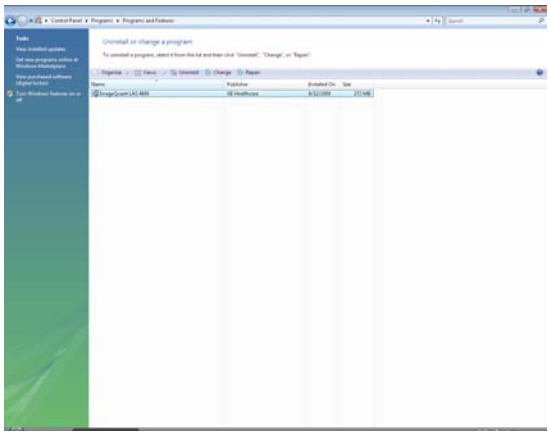
Step	Action
1	Open the control panel and select ***Add or Remove Programs***.
2	Select **ImageQuant LAS 4000** and click the ***Remove*** button.



Note: *Correction files created during calibration are required by the ImageQuant LAS 4000 Control Software. They are not deleted during the uninstallation, and remain in the Data folder of ImageQuant LAS 4000 Control Software folder.*

Uninstalling ImageQuant LAS 4000 Control Software under Windows Vista

Step	Action
1	Open the control panel and Select ***Uninstall a program*** under ***Programs***.

Step	Action
2	Select ***ImageQuant LAS 4000*** and then click ***Uninstall.*** 
3	Confirm the uninstallation by clicking ***Yes*** when prompted.
4	If User Account Control (UAC) is enabled in Windows Vista, a dialog displays the message ***An unidentified program wants access to your computer***. Click ***Allow***.

Upgrading ImageQuant LAS 4000 Control Software

Step	Action
1	Uninstall the current version of ImageQuant LAS 4000 Control Software.
2	Install the new version of ImageQuant LAS 4000 Control Software.

8 After-sales service

8.1 Warranty

1 The warranty period will expire after 1 year from the date the system was delivered.

2 GE Healthcare will make repairs free of charge for failures during the warranty period, provided that normal usage conditions and the instructions given in this manual, etc., are followed.

3 Repairs of the following failures will be charged for even if the warranty period has not yet expired.

- Problems caused by incorrect usage and/or by any products other than those authorized by GE Healthcare and/or problems caused by other equipment.
- Problems and/or damage due to moving, transport and/or falling.

8.2 Repairs

1 Before asking for repairs, refer to the troubleshooting section in Getting Started with ImageQuant LAS 4000.

2 If the problem persists, fill in the service report fax sheet at the end of this manual and contact your GE Healthcare representative.

3 The guaranteed repair service period of this product is 5 years from the termination of sales. Thereafter, repair service may not be provided if repair parts become out of stock.

Appendix A Appendix

A.1 Glossary

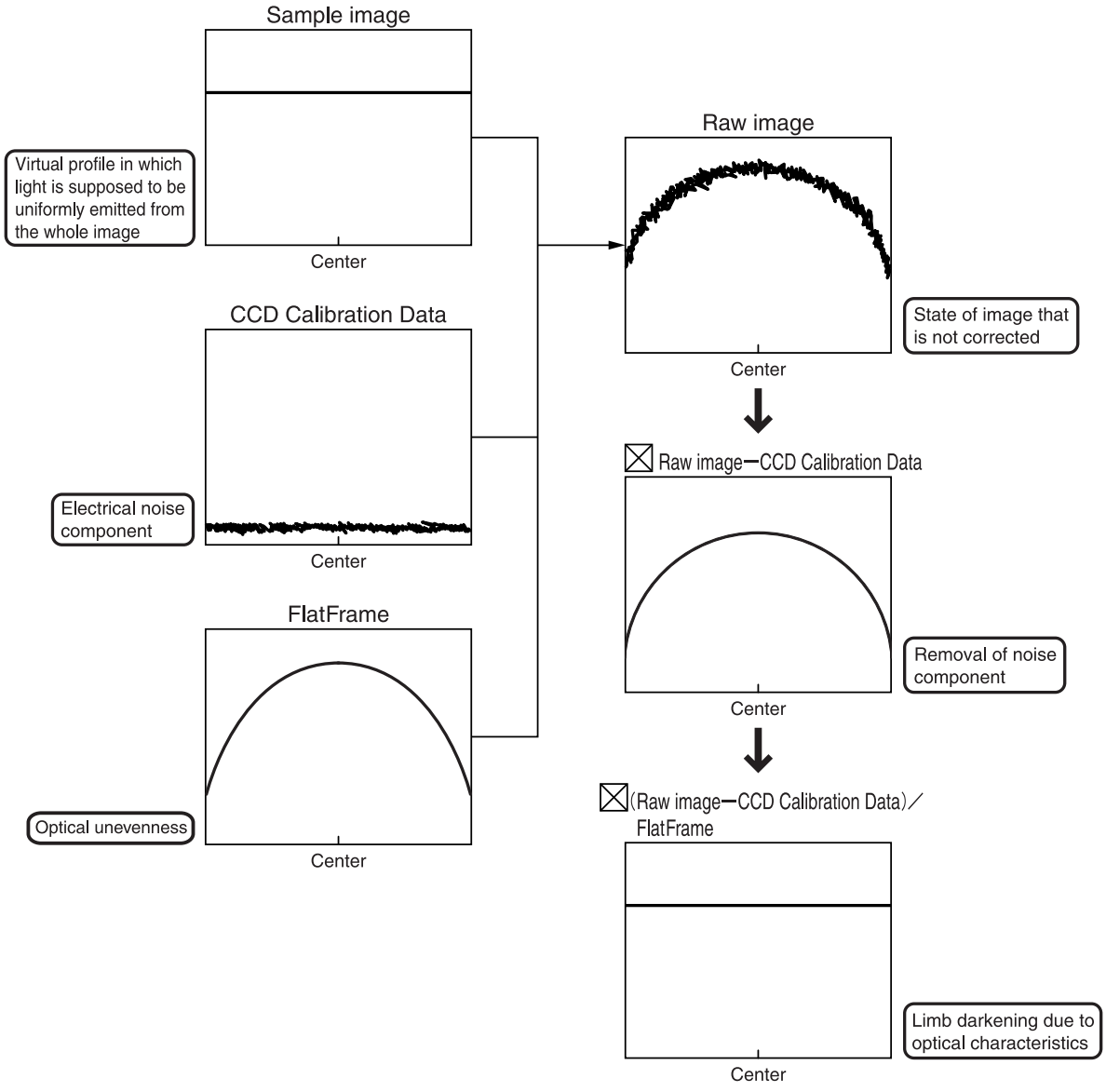
CCD Calibration

Electric charges are accumulated on the CCD even if it is not exposed to light. The accumulated electric charge is called a dark current noise. The process for eliminating the noise component is performed by CCD calibration. The image constituted by the dark current noise is called CCD calibration data. An image that is constituted by only the electric charges accumulated during exposure can be created by subtracting the CCD calibration data from the exposed image.

Flat Frame

In an exposure system using a 2D sensor such as a CCD, unevenness due to the lens or lighting system appears on the image. By correcting the unevenness, an object that radiates light at the same brightness is represented evenly in any section of an exposure area. A correction file for correcting unevenness is called a flat frame. Under the same conditions (tray position, iris, fluorescent filter, light source, and tray) as when exposing an object sample, a flat frame records the image in a uniform fluorescent plate (fluorescent mode) or white plate (digitize mode).

Conceptual diagram of CCD calibration and flat frame



A.2 Quick-reference functions

Function	Function name	Set item
Exposing for a fixed exposure time	***Exposure Type***	Precision
Exposing consecutively	***Exposure Type***	Increment
Exposing repeatedly	***Exposure Type***	Repetition

Function	Function name	Set item
Determining exposure time automatically	***Exposure Time***	Auto
Entering and determining exposure time	***Exposure Time***	Manual
Determining a desired exposure time and expose.	***Exposure Type***	Program
Setting the exposure time and the exposure intervals.	***Exposure Type***	Program settings
Setting sensitivity and resolution	***Sensitivity/Resolution***	High Resolution
		Standard
		High
		Super
		Ultra
		High Binning
		Super Binning
		Ultra Binning
Exposing a chemiluminescence and a digitized (white epi-illuminated) image by single-click operation	***Add Digitization Image***	On
Selecting detection method	***Method***	Chemiluminescence
		Fluorescence:EtBr
		Fluorescence:SYBR Green
		Fluorescence:GFP
		Fluorescence:Cy3
		Fluorescence:Cy5
		Fluorescence:Dy781
		Fluorescence:DAPI
		Digitization:DIA
		Digitization:EPI
Changing tray position	***Method/Tray position***	Select the tray position from 1 to 4.

Function	Function name	Set item
Adjusting focus	***Focusing***	Fine-adjust the light using Brightness and the focus using Adjust.
Starting exposure	***Start***	
Inverting image data	***Edit:Preference*** ***Digitization Epi-illumination*** tab ***Invert pixel data***	Yes
Saving a file in TIFF format	***Edit:Preference*** ***File Format*** tab	Select a 16-bit Linear TIFF format
Saving window image directly	***Edit:Preference*** ***File Format*** tab	Select an 8-bit Color TIFF format
Changing the temperature setting of CCD	***Edit:Preference*** ***CCD Cooling*** tab	Set the temperature
Changing the folder of file saving	***Edit:Preference*** ***Root Folder*** tab	Specify the folder where a file is saved
Fine-adjusting the print size	***Edit:Preference*** ***Print Adjust*** tab	Enter size in percent
Displaying saturated data in red	***View:Paint saturated data Red***	Select and check
Displaying image in Negative Gray	***View:Negative Gray***	Select and check
Displaying image in Positive Gray	***View:Positive Gray***	Select and check
Creating CCD Calibration file	***Option:CCD Calibration***	Select and set conditions for Start
Creating Flat Frame	***Option:Flat Frame Calibration***	Select and set conditions for Start
Checking software version information	***Help:About ImageQuant LAS 4000 Control Software***	Select
Checking the relation between sensitivity and resolution	***Help:Sensitivity/Resolution***	Select

A.3 Detection Reagents and corresponding settings

Note: *The RGB module may be used instead of the separate red, green and blue Epi lights.*

Classification	Reagent name	ImageQuant LAS 4000 setting			
		Method	Light	Filter	Iris
Chemiluminescence	ECL	Chemiluminescence	none	Through	0.85
	ECL Plus	Chemiluminescence	none	Through	0.85
	Lumi-Light Plus	Chemiluminescence	none	Through	0.85
	Renaissance	Chemiluminescence	none	Through	0.85
	Super Signal	Chemiluminescence	none	Through	0.85
	Bright-Star	Chemiluminescence	none	Through	0.85
	CDP-Star	Chemiluminescence	none	Through	0.85
	CSPD	Chemiluminescence	none	Through	0.85

Classification	Reagent name	ImageQuant LAS 4000 setting			
		Method	Light	Filter	Iris
Fluorescence dye	EtBr	Fluorescence:EtBr	UV (312nm Trans)	605DF40	2.8
	Cy2	Fluorescence:SYBR Green	Blue (460nm Epi)	Y515-Di	0.85
	SYBR Green I	Fluorescence:SYBR Green	Blue (460nm Epi)	Y515-Di	0.85
	SYBR Green II	Fluorescence:SYBR Green	Blue (460nm Epi)	Y515-Di	0.85
	SYBR Gold	Fluorescence:SYBR Green	Blue (460nm Epi)	Y515-Di	0.85
	SYPRO Ruby	Fluorescence:SYBR Green	Blue (460nm Epi)	Y515-Di	0.85
	SYPRO Orange	Fluorescence:SYBR Green	Blue (460nm Epi)	Y515-Di	0.85
	SYPRO tanger-ine	Fluorescence:SYBR Green	Blue (460nm Epi)	Y515-Di	0.85
	FITC	Fluorescence:SYBR Green	Blue (460nm Epi)	Y515-Di	0.85
	FAM	Fluorescence:SYBR Green	Blue (460nm Epi)	Y515-Di	0.85
	EGFP	Fluorescence:GFP	Blue (460nm Epi)	510DF10	0.85
	ECFP	Fluorescence:GFP	Blue (460nm Epi)	510DF10	0.85
	RITC	Fluorescence:Cy3	Green (520nm Epi)	575DF20	0.85
	Cy3	Fluorescence:Cy3	Green (520nm Epi)	575DF20	0.85
	Cy5	Fluorescence:Cy5	Red (630nm Epi)	R670	0.85
	Alexa 633	Fluorescence:Cy5	Red (630nm Epi)	R670	0.85
	Alexa 660	Fluorescence:Cy5	Red (630nm Epi)	R670	0.85

Classification	Reagent name	ImageQuant LAS 4000 setting			
		Method	Light	Filter	Iris
	Alexa 680	Fluorescence:Cy5	Red (630nm Epi)	R670	0.85
	Q-dot	Fluorescence:DAPI	UV (365nm Epi)	L41	2.8
	Dy781	Fluorescence:IR	Infrared (710nm Epi)	IR785	0.85
	Alexa 680	Fluorescence:IR	Infrared (710nm Epi)	IR785	0.85
	Alexa 700	Fluorescence:IR	Infrared (710nm Epi)	IR785	0.85
Fluorescence dye (Chemi-fluorescence)	Attophos[1]	Fluorescence:SYBR Green	Blue (460nm Epi)	Y515-Di	0.85
	ECL Plus	Fluorescence:SYBR Green	Blue (460nm Epi)	Y515-Di	0.85
Digitization	Silver stain	Digitization:Trans	White (Trans)	Through	2.8
	CBB stain	Digitization:Trans	White (Trans)	Through	2.8
	X-ray film	Digitization:Trans	White (Trans)	Through	2.8
	NBT/BCIP	Digitization:Epi	White (Epi)	Through	2.8

1 Attophos cannot be used for detecting nucleic acid on a nylon membrane.

Note: *With regard to patents owned by third parties related to, among other things, sample preparation, we recommend that you consult with a lawyer or patent attorney about obtaining a license from the third parties.*

A.4 Main specifications

CCD	3 200 000 pixels (Fujifilm super CCD)
Cooling temperature	-25°C
Number of gradations	Recorded image: 16 bit Focusing: 8 bit
Exposure time	1/100 seconds to 2 hours (Images can be continuously exposed for up to 30 hours using ImageQuant LAS 4000 Control Software.)

Lens	High-sensitivity lens F0.85 43 mm Wide view lens F1.8 24 mm
Shading correction	Software system
Maximum sample size	250 x 250 mm with F1.8 24 mm lens 210 x 140 mm with F0.85 43 mm lens
Dynamic range	4 orders of magnitude
Maximum image size	12.6 MB
Light source	Epi (class 1 light source) Blue Epi light : 460 nm Green Epi light : 520 nm Red Epi light : 630 nm RGB Module (Epi light) : 460 nm, 520 nm or 630 nm NIR Epi light : 710 nm Epi and Trans (class 1M light source) UV Epi light : 365 nm UV transilluminator : 312 nm Size : 322 x 313 x 87 mm UV transmitted filter size : 200 x 200 mm White transmitted light table : White LED Size : 322 x 313 x 87 mm
External dimensions	Camera head : 224 x 161 x 252 mm (W/H/D) IDX : 510 x 730 x 480 mm (W/H/D)
Weight	Camera head : 3.4 kg IDX : 49 kg (not including the light source, lens, and tray) High-sensitivity lens : 4.5 kg

Power requirements	Input voltage : 100-240 V~ Voltage variation : +/-10% Phase : Single phase Power frequency : 50/60 Hz Rated input current : 3.0-1.5 A AC power cable Use the cable supplied with the instrument. Specifications of cables required for the use of ImageQuant LAS 4000 Voltage : 100-120 V Plug/connector : 125 V AC, 13 A Cable : SJT3 x 16AWG 60°C Power supply cord length : Maximum 3 m Voltage : 200-240 V Plug/connector : 250 V AC, 10 A Cable : CENELEC OC 3 x 1.0 mm^2 70°C Power supply cord length : Maximum 3 m

Installation conditions	Placement conditions Free space required around ImageQuant LAS 4000 Secure space for maintenance work as follows: Front : 600 mm Right : 600 mm Left : 600 mm Rear : 200 mm Top : 1000 mm Table strength The allowable load must be 981 N/m^2 (100kg/m^2) or greater. Other conditions 1 Decide on an installation location taking into consideration the work flow and ancillary facilities to be used. 2 Required construction work and electricity/air conditioning work must be completed in advance. 3 It is not desirable to have a heat source on the IDX right side face where there is an air intake fan even if the environmental requirements have been met. 4 Do not install the equipment near a window to avoid direct sunlight. Attach a blind to nearby windows. 5 Do not place objects near the power outlet so that you can disconnect the power cable from the outlet in case of emergency. Floor oscillation conditions (1) Operating time Oscillation : 0.03G (5 to 60 Hz) Impact : 1G (2) Non-operating time Oscillation : 0.4G (5 to 60 Hz) Impact : 2G

	Environmental conditions Operating temperature/humidity conditions Temperature :15°C to 28°C (with temperature fluctuation below 10°C per hour or lower) Humidity :30 % to 70 % RH (no dew condensation) When the above conditions cannot be satisfied, modify the facilities accordingly. Transportation/storage conditions Temperature : -25°C to 70°C Humidity : 5 % to 100 % RH (no dew condensation) Installation location conditions 1 Do not install the equipment in an area where the temperature varies widely. 2 Do not install the equipment near a source of heat. 3 Do not install the equipment in an area where it may get wet or flooded. 4 Do not install the equipment in an area where it may be exposed to corrosive gas. 5 Do not install the equipment in a dusty area. 6 Do not install the equipment in an area constantly or excessively exposed to oscillations or impacts. 7 Do not install the equipment in an area exposed to direct sunlight. Operation site : Indoors Maximum operating altitude : 2000 m or lower Overvoltage category category II : Transient overvoltage Rated pollution applied : Pollution Degree 2
Analysis unit interface	USB 2.0 Do not connect the ImageQuant LAS 4000 USB connector to a computer not certified with UL60950-1 (UL listed) and IEC60950-1.
Others	Noise : 70 dB (A) or lower

A.5 Minimum computer requirements

Operating system	Windows™ XP™ SP3 or Windows Vista™ Business SP1 (32-bit)
Memory	1 GB or more
Processor	Intel Core 2 Duo processor
HD	80 GB or more
USB port version	USB 2.0
Optical drives	DVD-ROM
Monitor resolution	1280 × 1024 pixels or more

A.6 Service report fax sheet

To:

SERVICE REPORT FAX SHEET	
Customer information	
1) Company name	
2) Person in charge	
3) TEL	
4) FAX	
5) E-mail	
ImageQuant LAS 4000 system information	
6) Serial No.	
• Camera head • Others	
7) Analyzing unit type	
• Operating environment • Machine model	Windows
8) Usage frequency	
9) Trouble occurrence frequency	
10) Error code and failure description	

For local office contact information, visit
www.gelifesciences.com/contact

GE Healthcare Bio-Sciences AB
Björkgatan 30
751 84 Uppsala
Sweden

www.gelifesciences.com/quantitative_imaging

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GE Healthcare Europe GmbH
Munzinger Strasse 5, D-79111 Freiburg, Germany

GE Healthcare UK Limited
Amersham Place, Little Chalfont, Buckinghamshire, HP7 9NA, UK

GE Healthcare Bio-Sciences Corp.
800 Centennial Avenue, P.O. Box 1327, Piscataway, NJ 08855-1327, USA

GE Healthcare Japan Corporation
Sanken Bldg.3-25-1, Hyakunincho Shinjuku-ku, Tokyo 169-0073, Japan

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