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- P1700483
- P1500394; PCT/HU2016/050039; EP 16840280.8.; US 15/756.370
- Po700409; US 2008/0306964
- Po800181; PCT/HU2009/000027; EP 09721248.4.
- Po6oo435; PCT/HU2oo7/000047; EP 2024772; US 12/301.781
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### **CAUTION**

This product has not been approved or cleared as a medical device by the U.S. Food and Drug Administration.

Do not use this device in close proximity to sources of strong electromagnetic radiation (e.g., unshielded intentional RF sources), as these may interfere with the proper operation.

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### **Company Address**

3 Öv Street, 1141 Budapest – HUNGARY

# **Declaration of Conformity**

3DHISTECH Ltd. declares that the product Pannoramic® MIDI II slide scanner is designed and produced with consideration of specified requirements according to the IEC 61326-2-6:2005 standard, and conforms to the directives and other standards listed below:

IEC 61010-1:2001, "Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 1: General Requirements"

IEC 61010-2-101:2002, "Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 2-101: Particular requirements for in vitro diagnostic (IVD) medical equipment"

UL 61010-1:2004 R10.08, "Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 1: General Requirements"

Conformity with Directive IEC 61010-2-101 is marked by IVD on the product labeling.

There is no further operator (user) action required in case of residual risks.

Further information may be obtained from the manufacturer:

3DHISTECH Ltd.
3 Öv Street
1141 Budapest – HUNGARY

### **About this User's Guide**

The purpose of this manual is to assist the user in the safe and reliable operation of the product described. Before operating the device, you must carefully read this instruction manual, and adhere to all **WARNING** and **CAUTION** notices (refer to chapter **Notes Regarding Operational Safety** for more information), and a copy should be kept in the close to the scanner for reference whenever required.

This User's Guide is a part of the Pannoramic® MIDI II system identified by the following article numbers:

- MI2BGHM00010070001
- MI2BGHM00010090001
- MI2BGHM00020070001
- MI2BGHM00020090001
- MI2FPC40001007LUM1
- MI2FPC40001009LUM1
- MI2FPC4000A007LUM1
- MI2FPC4000A009LUM1
- MI2FGHM0001007SOL1
- MI2FGHM0001009SOL1
- MI2FGHM0002007SOL1
- MI2FGHM0002009SOL1
- MI2FGHM0001007LUM1
- MI2FGHM0001009LUM1
- MI2FGHM0002007LUM1
- MI2FGHM0002009LUM1

# **Character Formats and Symbols**

### Example (text in bold)

Words or characters that appear on the screen. These include field names, screen and window titles, push-button and menu names, paths, or options. Keys on the keyboard. For example, function keys (such as **F11**) or the **Ctrl+S** hotkey.

### Example (text in bold and italics)

Cross-references within this document or to other documents.



#### Warning

Can cause irreversible damage or harm to the user of the product or the product itself if this instruction is not followed.



#### Caution!

Can cause the product to not work properly if this instruction is not followed and alerts to a potentially critical situation.



#### Notice:

Calls attention to some important information or feature.

Special attention should be paid to all information provided and the procedures described in chapter <u>Safety Information</u>.

# **Notes Regarding Operational Safety**

The below section of this User's Guide contains information and warnings of a kind that must be followed by owner/operator personnel.

Warning and advisory symbols which are used on the base unit of the Pannoramic® MIDI II and in the chapter <u>Warning and information labels</u> have the following meanings:



#### Caution!

Disconnect mains plug before any kind of intervention into the device!



#### Caution

Crush hazard!

The Pannoramic® MIDI II, including any of its original accessory components, should not be operated in any other way than described in chapter *Intended use*.

Any of the following notes should be strictly observed:



### Warning!

If operating the device other than specified by the manufacturer, the level of safety will decrease.



#### Caution!

In the event of any non-conforming type of use, including non-conforming use of assemblies or single parts, no liability will be assumed by the Manufacturer. This shall also apply to service or repair work of any kind, which is performed by other than authorized service personnel. All claims for warranty and warranty services will be null and void in any such case.



The safety level of the equipment after servicing will be identical with level of the original equipment.



### Warning!

Insert the power cord plugs only into a grounding outlet. The protective action must not be rendered ineffective by extension cables without protective conductor. The Pannoramic® MIDI II has a built-in protection which must not be rendered ineffective by extension cables without protective (earth-ground) conductor.



### Warning!

The operation of the instrument in explosion-risk environments is not allowed.



### Warning!

If protective devices are found to be ineffective, the Pannoramic® MIDI II must be shut down and precautions must be taken to prevent unintended usage. For necessary repair work or work to restore proper operating condition, you should contact the 3DHISTECH Customer Service.



#### Notice:

Electric power to the Pannoramic® MIDI II is supplied via an internal mains power supply unit. It allows for operation at line voltages in the range of 100 V to 240 V  $\pm$ 10%, 50-60 Hz, without any extra facilities required for voltage transformation.



### Warning!

Check that your local line voltage is compatible with Pannoramic® MIDI II specifications before you turn power on.



### Disconnect plug!

Remember to unplug the power cord before you open the Pannoramic® MIDI II main unit for maintenance.



### Warning!

Only connect external devices to the instrument which are approved to avoid the risk of electrical shock.



### Warning!

The Pannoramic® MIDI II does not include any special facilities to protect from samples with an etching, potentially infectious, toxic, radioactive, or other health-damaging effect. You are under obligation to comply with all currently binding legislation, notably, national accident prevention rules when handling samples of this kind.



### Warning!

Use of this instrument in a dry environment, especially if synthetic material is present (synthetic clothing, carpets, etc.) may cause damaging electrostatic discharges that may cause erroneous results.



### Caution!

Dirt or dust may adversely impact the operating capability of the Pannoramic® MIDI II. For this reason, measures must be taken to eliminate such influences on a maximum possible degree. During periods of non-use, the Pannoramic® MIDI II must be protected with a dust cover. Check that power is turned off before you put the cover on.



### Caution!

Do not position the equipment so that it is difficult to operate and to disconnect the device if necessary.



#### Crush hazard!

There is crush hazard in the movement area of the slide insert during operation. Please note that the digitizing process has to be interrupted and the insert moved via software to the output position before removing the insert.



### Warning!

If a Lumencor SOLA SM II fluorescent illumination unit is used, the corresponding warnings included in the manufacturer's operating manual have to be observed.



### Warning!

A defective Pannoramic® MIDI II is not classified as domestic waste. It must be properly disposed in accordance with currently valid legal requirements.



The Pannoramic® MIDI II may not be operated by other than properly instructed persons. Operating personnel must be fully aware of the potential dangers which a particular field of application involves. The Pannoramic® MIDI II is a precision instrument which may suffer a significant reduction in operational functions or even physical destruction following intervention performed in any nonconforming manner.

## **Notes on Warranty**

3DHISTECH Ltd. – as the Product Manufacturer – warrants the Pannoramic® MIDI II to be free from faults in material and workmanship at the moment of installation. Defects must be notified immediately on identification and maximum efforts must be undertaken to minimize damage. On receiving notice of a fault, the Product Manufacturer will be under obligation to remove the fault, at his own option, either by providing adequate repair services or by delivering a faultless product for replacement. No warranty will be accepted in cases of natural wear (notably, wear and tear) or improper product handling.

The Product Manufacturer will refuse any liability in the event of damage resulting from faulty operation, negligence, or unauthorized intervention into the product, notably, from the replacement of product parts or the usage of accessory parts from other manufacturers. Any such case will void the user's claim for warranty.

Except for actions which are explicitly described in this User's Guide, you are prohibited from performing any kind of maintenance or repair work at the Pannoramic® MIDI II. Only authorized 3DHISTECH Service personnel or specifically authorized representatives are allowed to handle repair work. In case of malfunction contact 3DHISTECH Service Support first.

# **Terms and Abbreviations**

Term/Abbreviation	Description
CSV	Comma Separated Value
FOV	Field of View
NA	Numerical Aperture
Virtual Slide / Slide	A digital image of a thin glass plate on which specimens are mounted for microscopic study:
	a dynamic, interactive image that you can manage, save, magnify, zoom, name, evaluate, annotate, mark, comment, send to a colleague electronically for co-operation or advice, and so on.

Table 1: Terms and abbreviations

## 1 Product Description

### 1.1 Product overview

### 1.1.1 Intended use

The Pannoramic® MIDI II is designed to use transmitted light and reflected light fluorescence to digitize biological samples and specimens (histological sections, typically). The target users of the product can work for example, in education, research, industry or medical sectors.



### Warning!

After each scanning make sure to inspect the digital slide for over-exposed areas. If the slide has been scanned based on improperly set parameters, it can highly affect the diagnostic result because of information loss.



### Warning!

Any modification to a hardware or software component of the PC will highly affect the functionality of the scanner program.

### 1.1.2 Features and benefits

The Pannoramic® MIDI II equipped with pco.edge 4.2 / pco.edge 4.2 bi camera offers world-class brightfield and fluorescent whole slide scanning on up to 9 channels. An outstanding 0.16  $\mu$ m/pixel (in Brightfield) and 0.16  $\mu$ m/pixel (in Fluorescent) resolution is achieved with the 40×/0.95 NA (equivalent to 80× magnification) Plan-Apochromat objective.

**NOTE:** The above specified pixel resolution may vary depending on the selected camera.

Key features of the Pannoramic® MIDI II scanner:

- A single monochrome camera is used both for Brightfield and Fluorescent scanning.
- LED-based RGB illumination unit
- Up to 9 freely selectable physical color filters for fluorescence
- High-end fluorescent illumination devices Lumencor SPECTRA 6 or SOLA SM II Light Engine
- Multiband filter support

- FL scanning with a low-noise, 16-bit scientific CMOS pco.edge 4.2 camera / Back illuminated 16 bit sCMOS pco.edge 4.2 bi camera
- Note that all pco.edge 4.2 camera information in this manual is applicable to pco.edge 4.2 bi camera, too, except technical data.
- New software-aimed flat-field correction compensation method to create homogeneous slide image
- 12-slide automatic loading and scanning
- Improved permanent autofocus
- Compact and robust device
- Good quality and stable manufacturing
- 3MP camera for barcode reading and preview image
- Image sharpening (for both Fluorescence and Brightfield) feature to improve the visual appearance of digital slides
- Focus algorithm finds the focus which is most appealing to the human eye.

### 1.1.3 Warning and information labels

The following figure contains the labels used on the Pannoramic® MIDI II main unit, the external mains power supply unit, and the Lumencor SOLA SM II illumination unit.

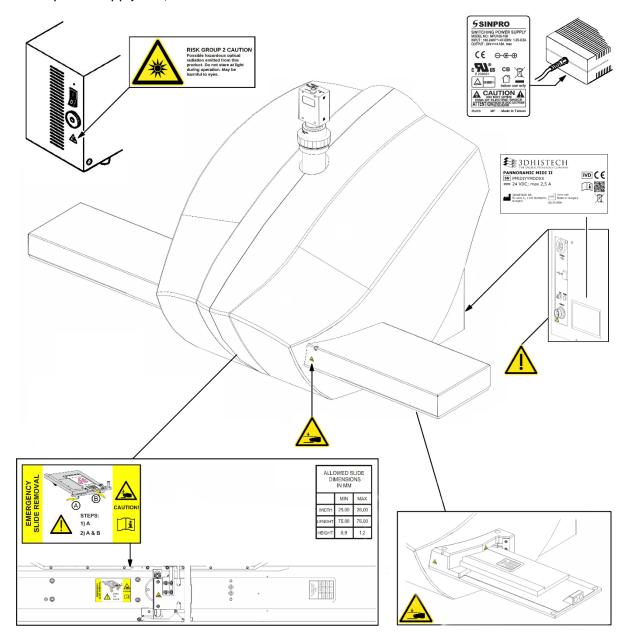


Figure 1: Warning and information labels

### 1.1.4 Base unit

The following figure shows the main parts of the base unit.

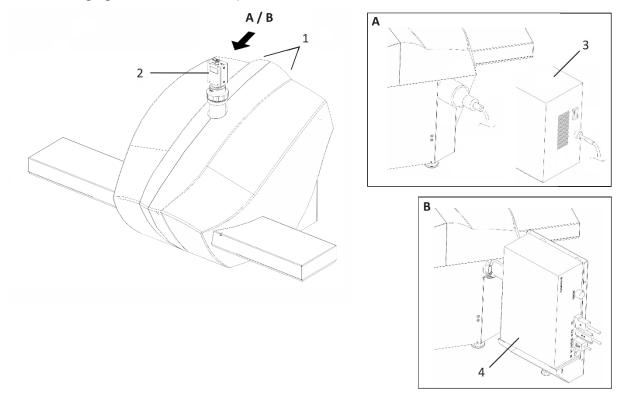


Figure 2: Main parts of the base unit

- 1) Protective covers
- 2) Point Grey Grasshopper 3 or pco.edge 4.2 camera

### Fluorescent option A

3) Lumencor SOLA SM II fiber-coupled illumination unit (can be used with Point Grey Grasshopper 3 camera only) with Lumencor illumination adapter and cable

### Fluorescent option B

4) Lumencor SPECTRA 6 Light Engine fiber-coupled illumination unit

## 1.2 System overview

The standard scope of delivery of the product includes the following hardware and software items.

### 1.2.1 Pannoramic® MIDI II system

The following figure shows the main components of the Pannoramic® MIDI II system.

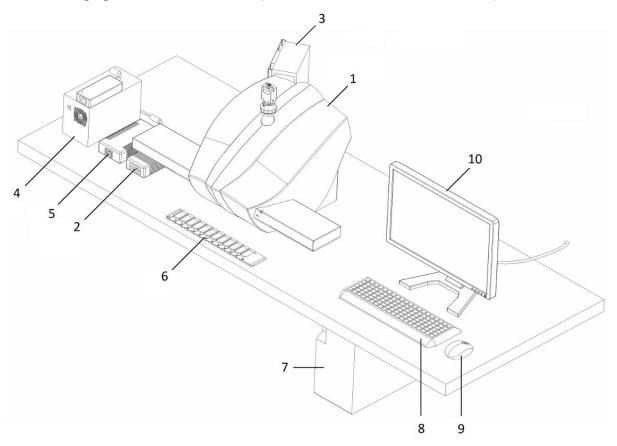


Figure 3: Pannoramic® MIDI II system overview

- 1) Pannoramic® MIDI II base unit
- 2) 24 V external power supply unit for Pannoramic® MIDI II
- 3) Lumencor SPECTRA 6 Light Engine illumination unit (option)
- 4) SOLA SM II fiber-coupled illumination unit (option)
- 5) External power supply unit for SOLA SM II
- 6) Slide tray
- 7) Control computer
- 8) Keyboard
- 9) Mouse
- 10) Monitor

### 1.2.2 Hardware options



The configuration of the control computer and monitor can vary depending on the product order.

### Camera types

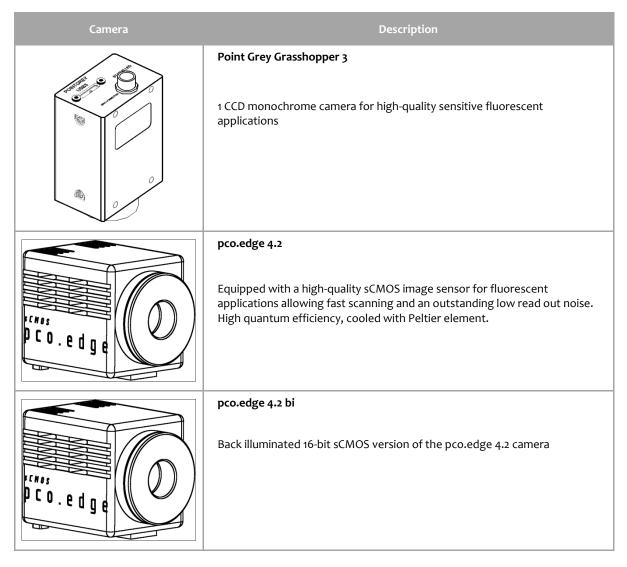


Table 2: Camera types

### **Camera adapters**

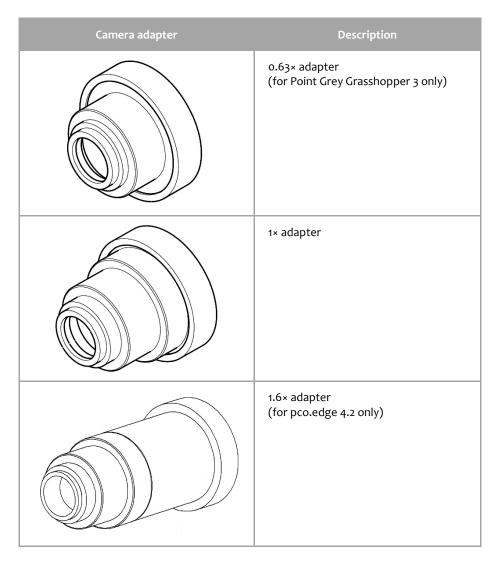


Table 3: Camera adapter types



The installation of the cameras in Pannoramic® MIDI II must be carried out by trained professionals!

In any other case the warranty will be automatically voided. The supplier or distributor is not liable for any damages caused by an installation carried out by an unauthorized person.

### **Base Unit options**

- Pannoramic® MIDI II Basic Scan Option / Fast Option base unit equipped with Point Grey Grasshopper 3 camera for Brightfield scanning (no fluorescent accessories included)
- Pannoramic® MIDI II Basic Brightfield and Fluorescence Option base unit completely equipped with Point Grey Grasshopper 3 camera and Lumencor SOLA SM II (non-triggered) or Lumencor SPECTRA 6 fluorescent illumination unit, with filters for fluorescence scanning
- Pannoramic® MIDI II Advanced Brightfield and Fluorescence Option base unit completely equipped with pco.edge 4.2 camera and Lumencor SPECTRA 6 fluorescence illumination unit, trigger cable and filters for fluorescence scanning



If Lumencor SPECTRA 6 unit is ordered, the custom light source and filter modules can be variable. For more information, contact 3DHISTECH customer service.

### **Objectives**

- Plan-Apochromat 10×/NA 0.45 (optional, can be used only for FL scanning)
- Plan-Apochromat 20×/NA 0.8
- Plan-Apochromat 40× Corr/NA 0.95



### Warning!

Do not change correction collar settings on the 40×/NA objective, if you need it to be set, contact customer service.

### Fluorescent Options for Pannoramic® MIDI II

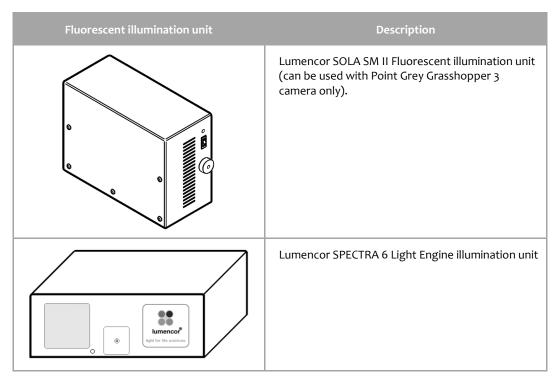


Table 4: Fluorescent illumination units

### 1.2.3 Control software

### Pannoramic® Scanner 3.0.5 control software

### Optional:

- Fluorescence
- Extended focus
- Z-stack
- Barcode reader (licensed feature)
- Converter software (2.3.2 RTM), only available in Full scanner install mode

### Pannoramic® Viewer software (fully functional)

### Optional:

- CaseCenter<sup>™</sup>
- TMA module
- 3D Reconstruction module
- QuantCenter<sup>™</sup>, HistoQuant<sup>™</sup>, NuclearQuant<sup>™</sup>, MembraneQuant<sup>™</sup>, CISHQuant<sup>™</sup>,
   FISHQuant<sup>™</sup>, and DensitoQuant<sup>™</sup> modules
- TumorBoard™ module
- E-School™ Encoder

### 2 Installation



### Warning!

The installation of Pannoramic® MIDI II must be carried out by a trained professional! In any other case the warranty will be automatically voided. The supplier or distributor is not liable for any damages caused by an installation carried out by an unauthorized person.

Only qualified service assistants are allowed to install the hardware and software. The product is ready for use after installation.



#### Caution!

Make sure that the device is placed so that there is enough space for ventilation and for safe and efficient operator maintenance.



### Caution!

If the temperature of the location where the scanner is operated is much lower than the temperature of the equipment (for example, the device is brought in from an outer storage, or has been transported to the site), please leave enough time to normalize the temperature differences before operating the device within the safe range.

## 2.1 Operation system of the control computer

The scanner is shipped with Windows 10, but it is also fully compatible with previously sold systems running Windows 7 if the PC meets the minimum hardware requirements (see table **Control computer, minimum system requirements** in chapter <u>Technical Data</u>).

Third-party antivirus programs can affect the operation of the Pannoramic® Scanner 3.0.5 control software, but we are not responsible for any resulting problems. We recommend that you place the following (default) folders in the "real-time scanning" exceptions of the antivirus program:

- C:\Program Files\3DHISTECH
- C:\ProgramData\3DHISTECH
- C:\Program Files (x86)\3DHISTECH
- (E:\ScannerSwap\ as the SWAP folder by default)

We recommend that you use the "SWAP" partition for storing temporary files generated during scanning, as the lack of space required will result in interruption of scanning.

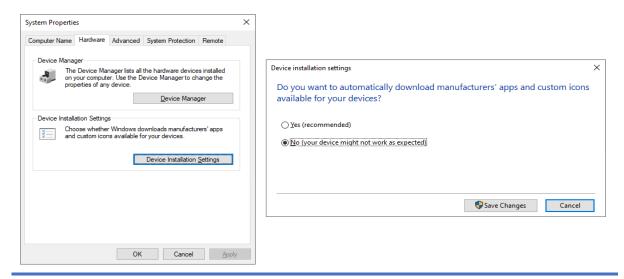
### **Microsoft Hardware Driver Updates**

We are not taking responsibility for errors caused by automatic hardware driver updates issued by Microsoft, so we recommend that you turn the automatic updates option off.

### **Third-Party Driver Updates**



Automatic updates of devices drivers are disabled, but if you happen to modify system settings in **Control Panel / System and Security / System** panel, do **NOT** modify **Device Installation Settings** – leave this option turned **OFF**.



### 2.2 Control computer ports

The following figure shows the location of the connectors to enable easier transportation of the product for a short distance, by disconnecting cables and detaching hardware components from each other.

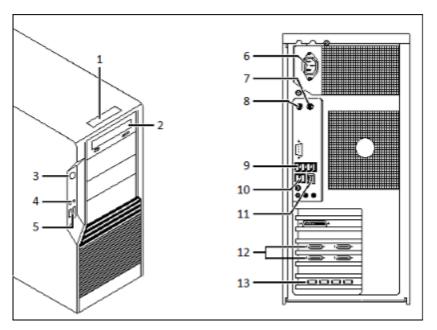


Figure 4: Ports on control computer

- 1) Status display
- 2) DVD drive (RW)
- 3) Power on/off button
- 4) Earphone and microphone 3.5mm Jack ports
- 5) 2x USB port
- 6) Power supply connector
- 7) PS/2 mouse port
- 8) PS/2 keyboard port
- 9) 4x USB port
- 10) 2x USB port
- 11) Network port
- 12) Matrox Radient eCL CameraLink ports (for pco.edge 4.2 camera)
- 13) 4x USB 3.0 ports for Point Grey Grasshopper 3 camera

## 2.3 Connectors and cables

- Control USB (between scanner and control computer)
- Preview camera USB cable (between scanner and control computer)
- Point Grey Grasshopper 3 USB 3.0 cable (between Point Grey Grasshopper 3 camera and control computer)
- pco.edge 4.2 a pair of CameraLink cables (between pco.edge 4.2 camera and control computer)
- Video cable (between monitor and control computer)
- Power supply cable (between 230V/110V and monitor)
- Power supply cable (between 230V/110V and Lumencor SPECTRA 6 unit)
- Power supply cable (between 230V/110V and control computer)
- Power supply cable (between 230V/110V and 24V external power supply unit)
- Power supply cable (between 230V/110V and Lumencor SOLA SM II fluorescent illumination unit)
- Power supply cable (between 230V/110V and pco.edge 4.2 camera)
- Optical cable (between Lumencor SOLA SM II fluorescent illumination unit and scanner)
- Trigger cable (between pco.edge 4.2 or Point Grey Grasshopper 3 camera and Lumencor SPECTRA 6 fluorescent illumination unit)
- USB-to-RS232 serial communication cable (between Lumencor SPECTRA 6 fluorescent illumination unit and control computer)



Only connect external devices that are safety extra low voltage rated to the instrument to avoid the risk of electrical shock.

### 2.4 Coupling the Lumencor SOLA SM II unit with the scanner

To operate the Lumencor SOLA SM II fluorescent illumination unit, it has to be connected to the Pannoramic® MIDI II base unit.

- 1) Turn the control computer and the Pannoramic® MIDI II unit off.
- 2) Connect both ends of the fiber optic cable to the coupling ports of the scanner and the illumination unit (see *Figure 2 option A* in chapter *Base unit*).
- 3) Connect the power supply cables of both the scanner and the illumination unit.

### 2.5 Coupling the Lumencor Spectra 6 unit with the scanner

To operate the Lumencor Spectra 6 Light Engine fluorescent illumination unit, it has to be attached to the Pannoramic® MIDI II base unit, and connected to the camera, and the control computer with cables.

- 1) Turn the control computer and the pco.edge 4.2 camera off.
- 2) Attach Lumencor SPECTRA 6 fluorescent illumination unit to the coupling adapter of the Pannoramic® MIDI II scanner (see *Figure 2 option B in* chapter *Base unit*).
- 3) Connect power supply cables of both the scanner and the illumination unit.
- 4) Connect TTL trigger cable between pco.edge 4.2 camera (out 4) or Point Grey Grasshopper 3 camera and the Lumencor SPECTRA 6 unit (TTL port), and USB-to-RS232 communication cable between the Lumencor SPECTRA 6 unit and the computer.

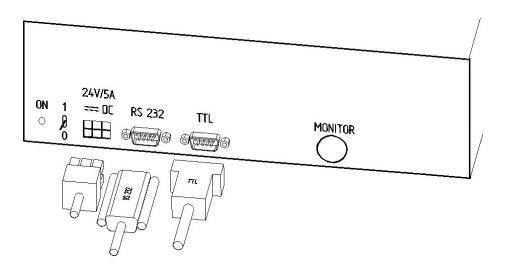


Figure 5: Lumencor SPECTRA 6 Light Engine connecting ports

### 2.6 External power supply unit

For the proper operation of the scanner, the SINPRO – MPU101-108 24V external power supply unit must be connected between the mains power and the device.

### Front panel:

- 1) main power switch
- 2) power supply connector

### Back panel:

3) detachable power cord to connect the external power supply unit with the main unit

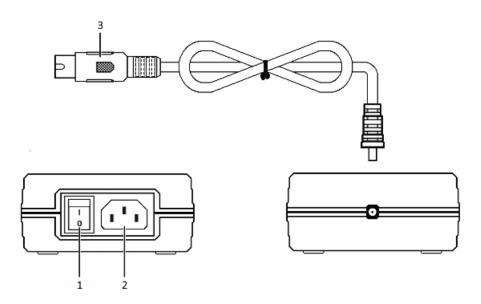


Figure 6: 24V external power supply unit

## 2.7 Power the scanner on/off

To turn the scanner on, press down the I side of the rocker switch at the front panel of the 24V external power supply unit (*Figure 6* - 1), and press **O** to power the scanner off.

# 3 Preparing Slides and Trays

This section demonstrates how to prepare slides and trays. You may use slides and coverslips that meet the following specifications:

	Slides	Coverslips
Length	75.0 to 76.0 mm	max. 50 mm
Width	25.0 to 26.0 mm	max. 24 mm (recommended: 22 mm)
Thickness	0.90 to 1.2 mm	No. 1 and No. 1.5 (0.13 to 0.16 mm and 0.16 to 0.19 mm)
Corners 45° beveled corners		
Edges Polished or cut		

Table 5: Specifications of slides and coverslips



Always wear personal protective equipment (safety goggles, gloves, and coat) when working with biohazardous material or slides.



Do not use a slide when it is broken, or its edges are not properly cut or grounded. Using such slides can lead to injury.



### Warning!

If the scanner is equipped with a 40× objective, the outer rim of the sample should be at least 3mm distance from the slide edge on the left side, since the working distance of the 40× objective is 0.25mm, therefore, the objective edge may collide with the stage edge during digitization.



### Warning!

Ensure that no part of the mounted coverslip protrudes from the edges of the slide. Use slides with completely dried embedding medium only. Otherwise, the coverslip can be shifted that makes slide insertion less reliable. Not completely dried embedding might also influence the operation of objectives and other device parts.



### Caution!

Do **NOT** scratch any circular marker onto the glass surface of a slide, use a soft tip pen instead for marking area of interest.



#### Notice:

The distance between slide edges and the edges of the mounted coverslip should be 1-2 mm, and they should be parallel with each other.



#### Notice:

Fluorescent signals become more easily detectable for the scanner, therefore resulting in a brighter and better image, by treating the slide with a formula that prevents rapid photobleaching of fluorescent reagents (e.g., VECTASHIELD® Fluorescent Mounting Medium by **Vector Laboratories** and ProLong® Gold and *SlowFade*® Gold antifade reagents by **Invitrogen**) during the FISH protocol.

For further information, see the homepages of the manufacturers: <a href="http://www.vectorlabs.com/">http://www.vectorlabs.com/</a> and <a href="http://www.invitrogen.com">http://www.invitrogen.com</a>.

## 3.1 Affixing barcode stickers to slides

This section describes how to affix barcode stickers to large slides. Barcodes enable virtual slide identification.

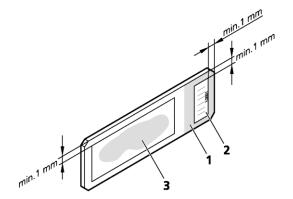


Figure 7: slide with a barcode sticker

The label area (1) is recorded by the preview camera and can be displayed by the Pannoramic® Scanner 3.0.5 control and the viewer software.

To affix barcode stickers to slides, do the following:

- 1) Peel off the barcode sticker (2) from the roll.
- 2) Stick it on the colored label area (1) of the slide, on the specimen side.



#### Caution!

Ensure that a marginal space of 1-2 mm remains on all sides between the sticker and the label area outer limits. It is vital for barcode identification. Do not let barcode sticker protrude from slide edges or stick on the coverslip surface (3).

The thickness of the barcode sticker on the slide must not exceed 0.4 mm!

Do not stick more than four barcode stickers over each other and the overall thickness must be kept below 1.65 mm (including the barcodes and the slide).

## 3.2 Inserting and removing slides

### To insert slides into a tray

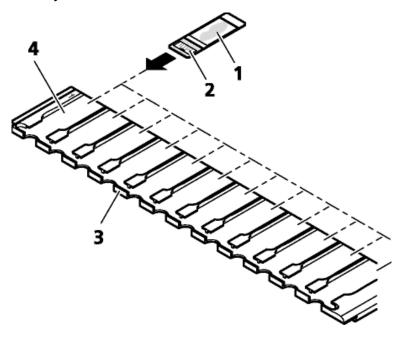
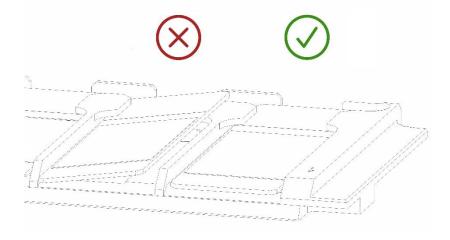


Figure 8: Inserting slides into a tray

A tray can contain a maximum of 12 slides.

- Push a slide (1) into the desired slot (4) of the tray (3) with its barcode end (2) first.
- Make sure that the slides are inserted correctly in the tray.



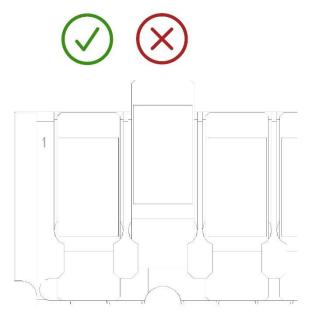


Figure 9: Incorrectly inserted slides



## Caution!

Incorrect slide insertion may break the glass. Always make sure that slides are correctly inserted in the tray. The edge of the broken area of the slide is sharp and its removal can lead to injury and contagion! Broken slide can be removed only by a well-trained person!

Only original 3DHISTECH trays are allowed for use with Pannoramic® MIDI II!



The coverslip and the label area should be on the top.

# 3.3 Inserting and removing the tray

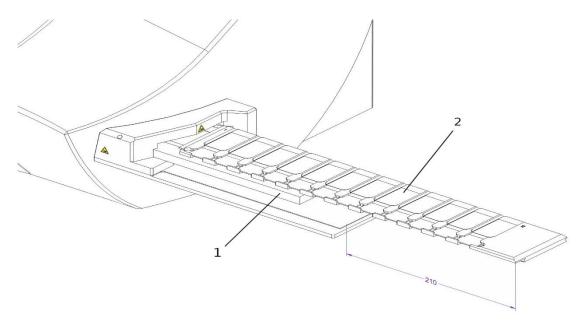


Figure 10: Inserting the tray

- 1) Remove FL cover from the insert sled by slightly moving it upwards and to the right (refer to **Figure 11**).
- 2) Insert the tray (2) that contains at least one slide into the opening (1) on the right side of the device. Push it until it cannot be pushed further and the LED switches from green to red.



#### Caution!

To insert or remove a filled tray from the device, first check tray for incorrectly inserted slides (refer to *Figure 9*) and always ensure also when moving the tray, slightly tilt it to its closed side to prevent the slides from accidentally falling out. Inserts should always be kept clean from dust, broken glass, and other mounting media residues. Slides will only operate safely and properly if trays are clean.

3) Attach the FL tray covers on the insert sled by moving it downwards and to the left (refer to *Figure 11*).

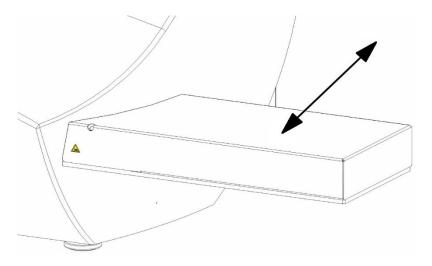


Figure 11: Removing / attaching the FL tray cover



After the tray is inserted into the device, the FL tray covers must be attached thus securing the tray movement area from external impacts and the effectiveness of Fluorescent scanning while slides are digitized.



Do not place objects near the device, or in the movement area of the slide tray.

4) After digitizing slides, the tray is moved to the output position where it can be removed.

# **4 Software Description**

# 4.1 Starting / exiting Pannoramic® Scanner 3.0.5 control software

# 4.1.1 Starting the software

To start the program, double-click on the program icon on the desktop or start it from **Start** \ **Program Files** \ 3**DHISTECH** \ **Pannoramic Scanner.** Before software initialization the user interface is opened, and the mode selection icons are displayed.

These three buttons represent **Microscope** and **Planner** scanner modes, and the **Service** mode.



Figure 12: Mode selection window

## Microscope mode

- for digitization of individual slides
- set scanning profile of the slide
- run Live teleconsultation
- use Live microscope

#### Planner mode

- plan the entire scanning procedure
- assign one or more profiles to each slide
- define Brightfield and Fluorescence or mixed scanning mode within a run
- define scanning profile to slides included in racks or trays
- automated scanning mode

#### Service mode

- Service password
- Camera settings
- Image compensation
- Barcode settings
- Microscope control

# 4.1.2 Exiting the software

To exit the Pannoramic® Scanner 3.0.5 control software, Click **X** at the main window header to close the program. Note, that when exiting the software, the loaded slide will be automatically unloaded.

# 4.2 Main window functions

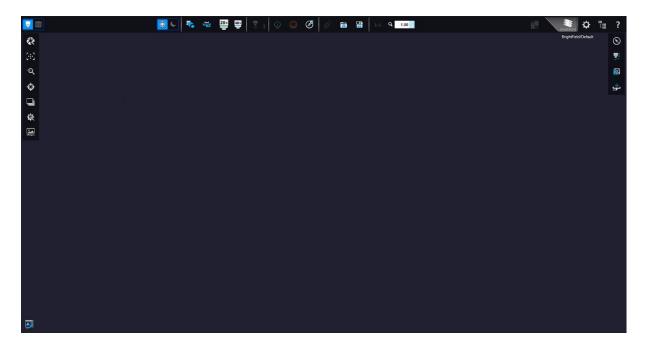
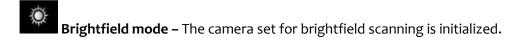


Figure 13: Pannoramic® Scanner 3.0.5 main window

The following functions are available for you to select from at the main menu bar:



Microscope initialization – All motors and the preview camera during start-up



Fluorescence mode – The camera set for fluorescence scanning is initialized.

Remote server hosting – Start and host a live Teleconsultation session (see chapter Hosting).

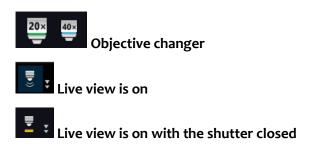


Upon clicking the slide icon or entering slide position number at the right side, the slide can be loaded. Unload the slide by clicking **Unload** next to slide image and unload the tray by clicking **Unload** next to the rack image.



Figure 14: Slide/tray control

If there is a lens marking at the bottom of the position preview on the tray image, the preview image of that slide has already been created, and if a question mark is displayed the slide was not yet loaded. A hatch and lens marking represent a slide that is loaded at the moment.





Click to display the toolbar for Live view. These functions are only available for the displayed live image (i.e., Live view is ON), but not available for camera images during digitization.

When in **Normal live mode**, the images are taken with the user-specified exposure time.

- One pixel on the monitor corresponds to one pixel on the camera.
- The live image completely fills the display area.
- Displays or hides the vertical and horizontal scale bars
- Displays the magnifier window
- Activates red marking on overexposed pixels
- Saves the current image as BMP or JPEG file

The following functions are available for you to select from the toolbar:



Live images are displayed with a frequency of at least 10 images per second. If an exposure time is set to more than 100 ms, the pixel values are multiplied accordingly (for example, if an exposure time of 200 ms is set, the pixel values are multiplied by 2, and the exposure time is reset to 100 ms). Therefore, the resulting images will have a higher noise level.

This function is useful for fluorescent live view where despite the higher noise level, the resulting image will be refreshed as in normal mode.

– Image intensity



Figure 15: Image intensity

- Screenshot
- Displays the magnifier window
- Displays or hides the vertical and horizontal scale bars
- Calculate white balance (accessible in Brightfield mode only)
- Image Processor Plugins
  - Convolute gray-scale image by custom kernel
  - Multi-channel histogram with normalization
  - Invert image (for testing purposes)
  - Mark overexposed pixels

# Scan Properties

Unique settings can be defined even for each separate scanning. These settings are included but not editable on the profile cards in Planner mode.

• Scan to Local

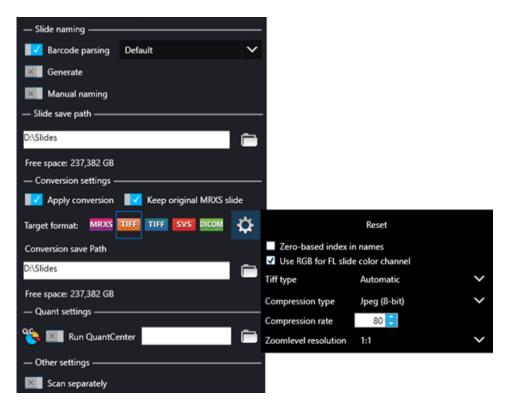


Figure 16: Scan to Local

#### Slide naming

Slide name can be defined manually or automatically. If you want to name the slide manually, turn on the **Manual naming** function, and if you want to generate slide name based on the corresponding settings set in **Preferences**, activate **Generate** function.

**Barcode parsing:** Select the type of barcode profile from the drop-down list for slide naming through parsing the barcode string. By using **Default** barcode profile, the barcode of the slide is being matched with all the barcode types selected in the Barcode settings window.



Figure 17: Select type of barcode profile

Click at the left of a list item to open the **Barcode editor** window in which the settings of the selected profile can be edited.

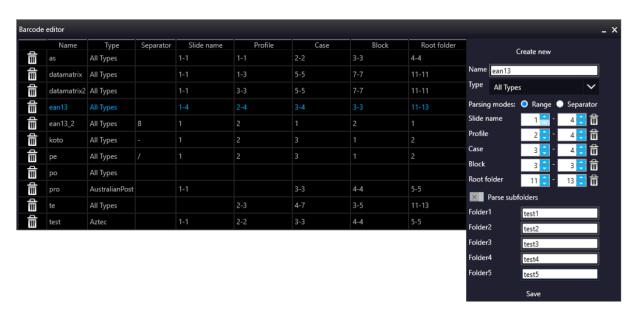


Figure 18: Barcode editor window

Name
Type

Parsing modes: ○ Range ○ Separator
Slide name
Profile
Case
Block
Root folder

Parse subfolders

Folder2

Folder4
Folder5

If you click **Add new item ...** on the list, blank input fields will be displayed.

Figure 19: Create new barcode

- Define/modify profile name in the Name input field, select barcode type from the Type drop-down list.
- Define/modify ranges within the barcode string when Range is selected at Parsing modes to extract necessary information (Slide name, Profile, Case, Block, Root folder).
- If **the** option **Separator** is selected at **Parsing modes**, the character used as a separator in the selected barcode type can be defined in the **Separator** input field.

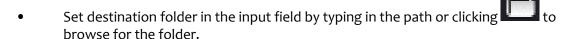


Figure 20: Parsing settings

Click to delete range values set for the corresponding field.

- Enable **Parse subfolders** to make it available to create subfolders when parsing data from the barcode. Type name of the subfolder in the **Folder1**, **Folder2**, etc. fields depending on the depth you want to define.
- Click **Save** to apply settings and click **Create new** at the top of the panel to create a new profile item.

#### Slide save path



• Free space: Free space capacity of selected local drive

## **Conversion settings**

- Apply conversion: Turn on to convert the slide to other formats once the scanning has finished.
- **Keep original MRXS Slide:** The original MRXS format of the slide is stored in the local folder.



If the **Keep original MRXS Slide** function is inactive, the original MRXS slide will be deleted after the conversion is complete.

- Target format: The slide is converted to the selected final format. Click one of the buttons to define the final slide format (MRXS, Tiled-TIFF, Roche-TIFF, SVS, DICOM).
- Click to open MRXS, Tiled-TIFF and DICOM conversion settings panel:
  - MRXS settings



Figure 21: MRXS settings

- Click Reset to set everything to default.
- Select Change JPG compression rate to enable the modification of the value in the Compression rate value box.



MRXS to MRXS conversion will result in an overlap-free final image (tile fitting is performed without overlapping).

## Tiled-TIFF settings



Figure 22: Tiled-TIFF settings

- Click Reset to set everything to default.
- Zero based index in names: Z-Stack layers of the generated TIFF files will be indexed starting with o, and the focus distance of the actual layer will not be included (inactive by default).
- Display FL channels RGB-colorized: a 24-/48-bit color TIFF image is generated based on the FL channels. File size is bigger, but most of the image viewers are capable to open it. An 8-/16-bit grayscale TIFF image will be generated if not selected. File size is smaller, but some of the viewers cannot handle it.

### TIFF type

- Automatic: the converter automatically selects the most appropriate method based on the size of the source slide.
- Force simple tiff: TIFF files use 32-bit offset addressing; therefore, file size is limited to a maximum of 4Gb.
- Force big tiff: Big TIFF files use 64-bit offset addressing allowing the creation of bigger TIFF files.

#### Compression type

- Jpeg (8-bit): compression rate can be set (1-100, default: 80).
- Lossless compression 8-bit
- Lossless compression native: color depth of the source slide is inherited (16-bit is supported).
- Uncompressed 8-bit

- **Uncompressed native:** color depth of the source slide is inherited (16-bit is supported).
- Compression rate: default is 80, on a scale of 1-100.
- Zoom scale: set the level of zoom at which the TIFF image is created to get the smallest file size possible.

## DICOM settings

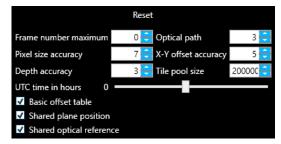


Figure 23: DICOM settings

- Click Reset to set everything to default.
- Frame **number maximum** (default: 0)
- Optical path / frame (default: 3)
- Pixel size accuracy (default: 7)
- X-Y offset accuracy (default: 5)
- Depth accuracy (default: 3)
- Tile pool size (default: 1000)
- UTC time in minutes (default: 0)
- Basic offset table (active by default)
- Shared plane position (active by default)
- Shared optical reference (active by default)

#### Conversion save path

The folder set in this box is designed to store the final slides after conversion. Conversion progress is displayed in the Converter queue window of the converter.



Figure 24: Conversion window

#### **Quant settings**

• Run QuantCenter™: Turn this function on for automatic evaluation of the completed digital slide by using the integrated QuantCenter™, right after the scanning has finished.



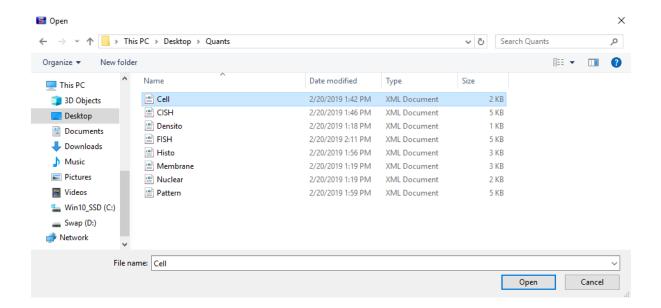
## Warning!

Make sure that the proper Quant probe (XML file) is selected for the quantification of the slide, as the resulting measurement data will be incorrect.

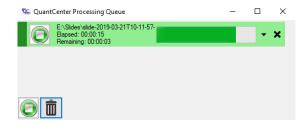


The Pannoramic® Scanner 3.0.5 control software is compatible with licensed QuantCenter™ application only, otherwise it may close due to an error.

Click to assign the appropriate Quant probe to the digital slide.



If the scanning of slide has finished, the progress of Quant evaluation is displayed in the QuantCenter™ Processing Queue window.



For further information on QuantCenter™, please read **QuantCenter™ User's Guide**.

## Other settings

- Scan separately: The FOV areas of the preview image will be scanned and saved separately as discrete digital slides.
- Scan to Server

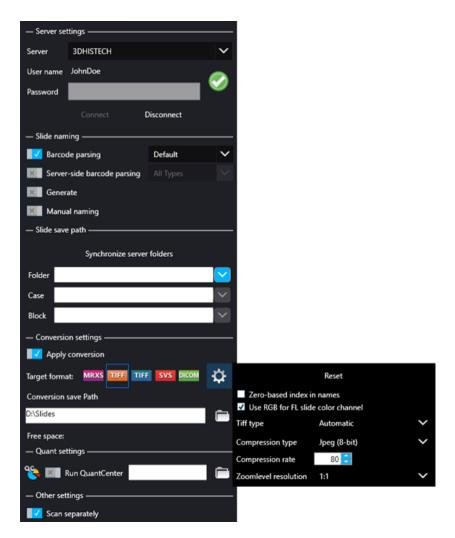


Figure 25: Scan to Server settings

#### Server settings

Select the dedicated server to which you want to scan from the **Server** drop-down list. Click the arrow to show the list of saved server profiles, or click **Add new item ...** at the bottom of the list to create another server connection.

When creating another server connection, define the following details of the server in the **Server Editor** window:

- Display Name
- Host Name
- Protocol



Figure 26: Window of server editor

**Server Editor** stores each of the created server in a list. List entries can be removed, or a new entry can be added if required. With the **Filters** function you can narrow down the results by searching for a specific server data. By double-clicking a list item, server data will be loaded in the **Scan to Server** panel.

After loading server data, username and password is required to be added for authentication and accessing the server. If connection is successful, a green checkmark is displayed in the window.

## Slide naming

• **Barcode parsing:** Similarly to the settings of the **Scan to local** panel, barcode settings for parsing can be modified in the Barcode Editor window.



Figure 27: Barcode Editor

If using MIL for barcode reading, you can select the following barcode types:

## 1D barcode types

- \*Code 39
- Code 128
- Code 16K
- \*Interleaved 2 of 5
- Standard 2 of 5
- IATA 2 of 5
- Matrix 2 of 5
- Telepen
- Code 93
- Code 11
- MSI
- Codabar
- Patch Code
- Pharmacode
- EAN-13
- EAN-8

- UPC-A
- UPC-E

#### 2D barcode types

- Aztec
- Data Matrix
- PDF417/Compact
- Micro PDF417
- QR
- Micro QR
- MaxiCode

**NOTE**: If embedded barcode library (provided by Vintasoft barcode reader software) is used, refer to *Figure Barcode settings* in chapter *Service* for the list of supported barcode types.

- Server-side barcode parsing option can be selected if CaseCenter™ is connected to the supported HIS/LIS. This way the barcode read by the software is being identified, and the predefined location of that specific case in CaseCenter™ is automatically selected as scanning destination based on the CaseID (containing slide and patient data stored on HIS/LIS). Therefore, Folder, Case, Block, and Slide name field data cannot be modified, only a profile can be selected.
- Activate Generate to create slide name automatically based on the criteria defined in the corresponding settings of the Preferences window.
- Activate the option Manual naming to name slides manually.

## Slide save path

Synchronize server folders: select Folder / Case / Block to synchronize folders.

#### **Conversion settings**

• Refer to **Scan to local** panel (see above), parameterization and settings are the same.

## **Quant settings**

• Run QuantCenter™: Turn this function on for automatic evaluation of the completed digital slide by using the integrated QuantCenter™, right after the scanning has finished.

#### Other settings

• **Scan separately:** The FOV areas of the preview image will be scanned and saved separately as discrete digital slides.



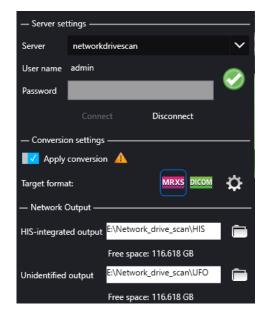


Figure 28 Scan to Network Drive settings

## Server settings

Select the dedicated server to which you want to scan from the **Server** drop-down list. Click the arrow to show the list of saved server profiles, or click **Add new item ...** at the bottom of the list to create another server connection.

When creating another server connection, define the following details of the server in the **Server Editor** window:

- Display Name
- Host Name
- Protocol
- User name
- Is DX server

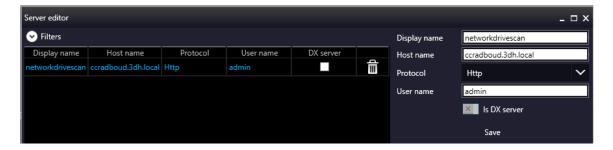


Figure 29 Window of server editor

**Server Editor** stores each of the created servers in a list. List entries can be removed, or a new entry can be added if required. With the **Filters** function you can narrow down the results by searching for a specific server data. By double-clicking a list item, server data will be loaded in the **Scan to Network Drive** panel.

After loading server data, **User name** and **Password** are required to be added for authentication and accessing the server. If connection is successful, a green checkmark is displayed in the window.

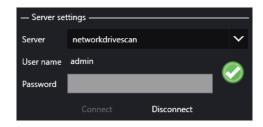


Figure 30 Connecting to server is successful

## **Conversion settings**



Figure 31 Conversion settings

For parameterization and settings, refer to **Conversion settings** at **Scan to Local** panel (see above).



At scanning to network drive, slide conversion is only available in MRXS and DICOM formats.



At scanning to network drive, the **Keep Original MRXS Slide** function is not available.

### **Network Output**

The folders set in the **HIS Integrated output** and **Unidentified output (UFO)** boxes are designed to store the final slides after conversion.



#### Caution!

Before storing slides permanently to the network output folders, they are stored temporarily to a local folder. Make sure to set this local folder, **Temporary scan location**, in **Basic settings** of the **Settings** menu. See chapter **Settings** for more information.

- **HIS Integrated output:** This folder contains converted slides where barcode reading was successful, and they can be connected to a HIS case.
- Unidentified output: This folder contains converted slides where no barcode is available, or barcode reading was not successful. These slides are scanned with a default profile.

Conversion progress is displayed in the **Converter queue** window of the converter.



Figure 32 Successful HIS conversion



Figure 33 Successful UFO conversion

- **Start Scan**: Scanning of the actual slide or performing the whole previously planned scanning procedure can be initiated.









Figure 34: Take all previews selector

Each preview of slides in the tray is taken automatically. Preview types are the following (from top to bottom):

- Brightfield
- Pre-Scan
- Pre-Scan High-Resolution
- Pre-Scan + High-Resolution

Activate **Retake Preview** for all the slides in the magazine if necessary. This operation can be initiated from the slide preview window as well.



Auto attach: Actual profile is assigned to the loaded slide automatically.



# - Open profile

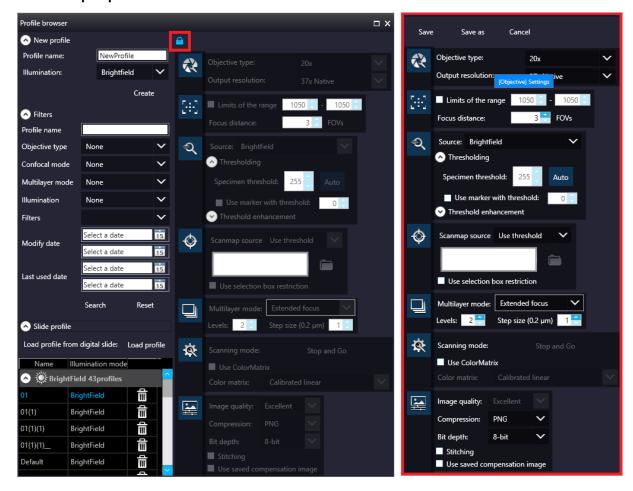


Figure 35: Profile browser window

The Profile Browser window containing a list of previously saved profiles is opened. Based on the Illumination type, profiles are grouped into two clusters: Brightfield and Fluorescence. Additional profiles can be created here as well, and you can also search for a specific profile by filtering based on the following data:

- Profile name
- Objective type (None / 10x / 20x / 40x)
- Multilayer mode (Extended focus / Z-stack)
- Illumination (None / Brightfield / Fluorescent)
- Filters
- Modify date
- Last use date

Click **Search** to run search based on the set criteria. Click to make parameters of the selected profile available for editing. Click **Reset** to restore default parameters. After modification click **Save** to overwrite existing profile or **Save as** to create another one.



The selected profile can be saved in this window after typing the profile name into the text field and clicking **Save as.** 



Figure 36: Save profile



This function is active only in Live view at 1:1 magnification.



Service.

Service function descriptions are detailed in chapter Settings and



In the **About** window the version of the Pannoramic® Scanner 3.0.5 control software and licensing details are included.

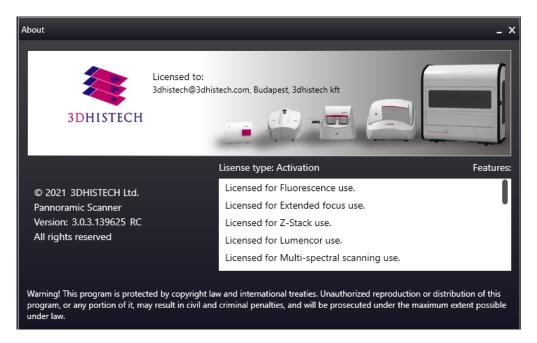


Figure 37: About window

# 5 Scanning Modes and Settings

After microscope initialization, if FL HW option is provided, you can select from the following two modes:

- Brightfield scanning mode (See chapter <u>Brightfield scanning mode</u> for more information.)
- Fluorescence scanning mode (See chapter Fluorescence microscope mode for more information.)
- Option modes
  - Microscope mode
  - Services (See chapter <u>Settings and Service</u> for more information.)
  - Settings (See chapter <u>Settings and Service</u> for more information.)

In accordance with the selected mode, the **Profile Settings Panel** and the **Microscope Control Panel** views are modified.

# 5.1 Brightfield scanning mode

Microscope View consist of three different sections:

- **Main functions:** Located at below the window header, these functions are identical in both modes.
- **Profile Settings panel:** Profile settings containing parameters used for scanning
- Microscope Control Panel: Live microscope movement functions

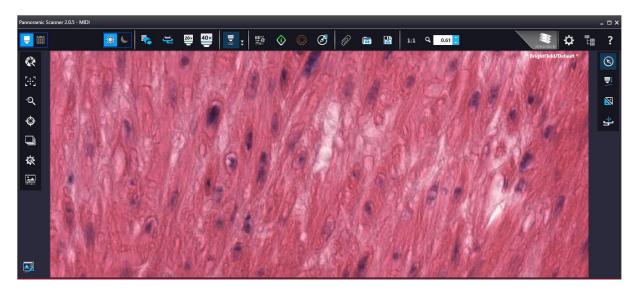


Figure 38: Main window of Brightfield Microscope mode

# 5.1.1 Profile settings panel



This field displays the objective used for scanning. Objective type: 20x; 40x.



Figure 39: Objective settings





Figure 40: Focus settings for scan profile

• **Limits of the range**: You can define focus limits by selecting **Limits of the range** for focusing. You can set the upper and lower limits by selecting the desired value

- in the selection boxes. This is useful if focusing was not targeted on the specimen, but on a spot on the coverslip.
- Focus distance: the distance of focal points can be set to create a focus map, based on which the software calculates interpolated focus values (one step in distance means one FOV).
- Auto focus: Focus value is set automatically to match sample characteristics.
- Manual focus: The manually set focus point coordinates are listed. Set and Go to
  options are available on this panel too, and each point can be deleted by clicking
  Remove. Click Clear points to remove all the manual focus points.

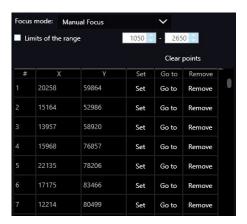


Figure 41: Focus mode



## Sample detection

This panel offers options for threshold setting and selection of the area to be scanned.

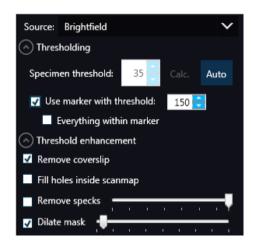


Figure 42: Sample detection window

• **Source:** Brightfield preview – a normal type of illumination in the microscope for scanning the slide. This option is recommended when scanning in Brightfield mode.

## Thresholding

The manually specified value is used for thresholding during scanning. Preview image of the loaded slide is displayed in the Preview window, and when modifying any of the parameter values, it will have effect on the preview image. If the threshold value presented on the Microscope Controller preview window is modified, this value is automatically applied by the profile in the Profile Settings panel.

#### Specimen threshold

This value is definable manually: This sets the sensitivity of the specimen detection. To set the desired threshold value manually, change the setting in the **Specimen threshold level** selection box in the range of 0-255. The default value is 220. Smaller values result in a more sensitive scanning, meaning that more areas will be digitized, however, this may also include specks or other imperfections of the slide. Greater values result in a less sensitive scanning, but it is possible that some of the smaller specimen areas will not be digitized.

#### Auto Threshold

By clicking the specimen will automatically be detected in the preview image.



Make sure that the detection result is acceptable for you. Otherwise, set the threshold value manually or append missing areas with the help of appropriate functions in the **Preview** window.

#### Use marker with threshold

If the specimen cannot be identified as required for digitization, (for example, weak contrast), it can help to encircle completely the specimen with a black marker pen. You have to draw a full circle with the pen to enable the detection. Marker pen detection will make specimen detection easier by limiting the scanned area. If this option is selected, only the area encircled with a marker pen will be scanned. You can define the threshold level by changing the threshold value in the **Use marker with threshold** selection box in the range of 0-255. This sets the sensitivity of the specimen detection inside the marker area. To set the desired threshold value manually, change the setting in the **Specimen threshold** selection box in the range of 0-255. The default value is 105.

• Everything within marker – To scan everything within the marked area, check the Everything within marker selection box.

Alternatively, click in the preview window to activate this function.

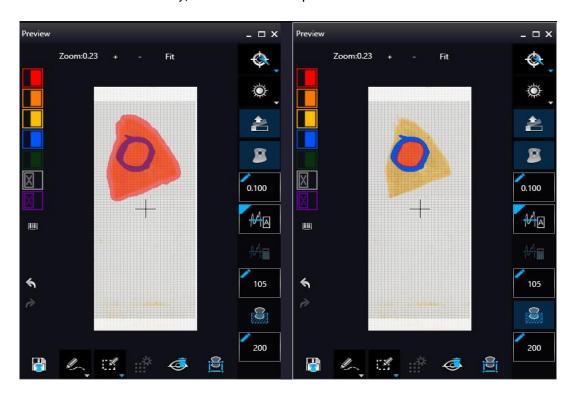


Figure 43: Scan everything within the marked area (selected / not selected)

#### • Threshold enhancement

 Remove coverslip – If selected, the edges of the coverslip are not detected as specimen to be scanned. Depending on the threshold level, it is possible that the edges of the coverslip are detected as areas to be digitized.

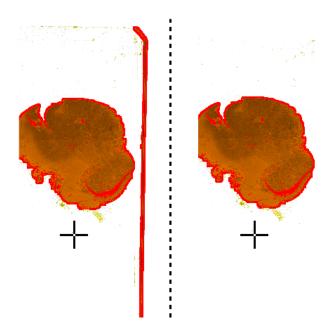


Figure 44: Preview image with and without coverslip edge



It requires lots of time (since it cannot find focus neither on the edges, nor on specks) to digitize coverslip edges. Select **Remove coverslip** function to eliminate those areas.



Do **NOT** use **Remove coverslip** function on TMA slides! The layout of TMA slides may mislead the detecting algorithm.

- o **Fill holes inside the scanmap** If selected, the holes inside the specimen will also be scanned. Often these holes contain small sample objects that otherwise would not be scanned.
- Remove specks If selected, the scanner does not digitize objects smaller than the predetermined size. This helps filtering specks and other

- uninteresting objects out. Set the maximum size of specks not to be digitized by adjusting the slider.
- O **Dilate mask** Adjust the slider to enlarge or decrease the scanned area. The edge is extended discretely by 100 μm each time.



#### Scanmap

A previously saved scanmap can be loaded and applied.

- **Use Threshold:** Preview settings defined in the Microscope Controller Panel / Preview window are applied as the basis of scanmap.
- **Load scanmap:** This function is useful if the slides contain areas of interest that cannot be detected by the preview camera. This function along with saving profiles helps to scan all slides with the most adequate settings.
  - To load a mask, click **Load**. It will display a drop-down menu. Select whether to load preview mask or TMA grid.
- Custom scanmap: The scanmap draws manually on the preview image is used for scanning.

#### Use selection box restriction

If selected, only the area inside the box is scanned. It is useful if you only want to scan the area that is equivalent with the size of the coverslip, so external specks will not be scanned.



# Multilayer mode

- Select **Single layer** option if you want to scan a single layer of the slide.
- By choosing the **Extended focus** option, the software selects the sharpest image from each focus level for each image field and combines them into one single image. Therefore, those parts that were blurry in auto/manual focus will also be sharp. This method guarantees the maximum depth of sharpness; however, it reduces digitization speed.

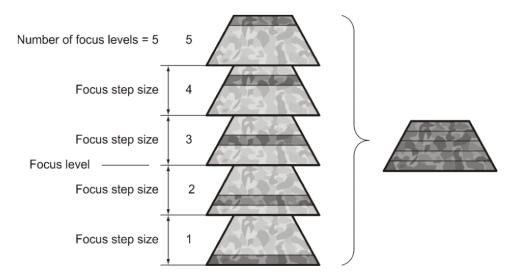


Figure 45: Focus level and step size

• **Z-Stack:** For **Extended focus** and **Z-Stack** scanning methods, you can determine the desired number of focus levels with the **Levels** selection box. The current focus value is the initial level. If you set 5 for example, then the initial level, plus four (two focus levels above and below the FOVs) are captured. Therefore, it is advised to choose an odd number for the focus levels. Separate layers are created and stored this way and can be opened with Viewer applications. The Z-Stack slide contains the extended focus layers.



Figure 46: Focus level settings

**Step size** determines the spacing between focus levels. One step is around 0.2 μm. Default settings are: **Levels**: 7; **Step size**: 5.

The number of iterations the Deconvolution algorithm is run can be determined in the **Iteration number for deconvolution**: value box.

**NOTE:** The purpose of deconvolution is to produce a sharper image, but the use of a deconvolution algorithm can significantly increase the time that takes to create a digital slide.

The capacity of deconvolution is minimum 96GB RAM.



# **Scanning Settings**

These settings cannot be modified when using Pannoramic® MIDI II as scanner. Here you can activate the **Stop and go** scanning mode by which the slide tray stands still during recording the FOV, then it moves on so that the scanner can record the next FOV.

**Use Color matrix:** Select an applicable preset color profile to be used for Brightfield scanning from the drop-down menu. Settings according to the profile has effect on the color set, color

temperature, and gamma value of the scanned image. Separate color matrix can be defined and used for each profile and scanning.

#### **Preset profiles** are the following:

- **Calibrated Linear:** Color scheme is defined by calibration (Gamma value is not included).
- **sRGB standard:** Color scheme is defined by calibration (standard Gamma value 2.2- is applied).
- **sRGB standard Microscope Like:** Color scheme is defined by calibration (standard Gamma value / White Point: D50).
- Legacy: A Color scheme calibrated for the previous software version is applied.
- Custom: Color profile set in Service is applicable if needed.



## Image settings

You can choose the following predefined image formats (and a subsequent custom option) from the **Image Quality** drop-down list in the **Image Encoding** section of the window:

- Excellent (JPEG: 90)
- Good (JPEG: 80)
- Medium (JPEG: 60)
- Low (JPEG: 30)
- Custom...

If choosing this option, the image compression setting is displayed on which you can select from different image formats. Accordingly, further adjustments can be made, except if PNG or BMP image format is selected.



Figure 47: Image encoding window

- JPEG The quality can be adjusted with the JPEG quality factor slider. Greater values result in better quality, but larger files. The default setting is 80%.
- PNG Lossless compressed image format.
- BMP Lossless uncompressed image format, but larger files due to less effective compression. It is a raw data file.
- **Stitching:** Use this function to enable the seamless stitching of digital tiles.
- **Use saved compensation image:** This function enables the use of previously recorded reference images for all slides. Use this function when the slide is

completely covered by the specimen (for example, blood smear) thereby making compensation image capture impossible. For such slides, use an empty slide with coverslip to grab a compensation image. If you select this, the software will not create new compensation images for each slide. Compensation images are reference images used for white balancing and shading.

- Save focus quality: The measurement of focus quality (correctness of average focus on layers) is saved. This option is inactive when Extended focus option is activated.
- Save image in original Bayer size function is only available if pco.edge 4.2 camera is installed on the scanner. It is not accessible for configurations installed with Point Grey Grasshopper 3 camera. Image fields will be saved with native pixel resolution. If this function is disabled, you will work with reduced pixel resolution. These resolution differences are not really visible with the human eye, what is important in this feature is the resulting smaller file size.

# 5.1.2 Microscope control panel

The Microscope Control panel includes the main control features of the microscope.

## 5.1.2.1 Preview window

The Preview panel offers options for threshold setting and selection of the area to be scanned.

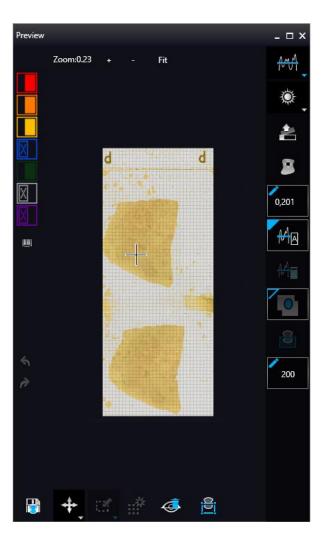


Figure 48: Preview panel

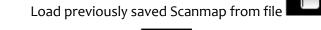
## Threshold options

This section is located at right side of the preview window. **Scanmap Source** is designed to set which type of scanmap is used on the preview image. This scanmap is displayed automatically in the **Profile Scanmap Source** setting. Selectable scanmap types are the following:

Use threshold

Custom Scanmap

Load previously saved Scanmap from file



**Preview Type** setting determines the type of illumination. In Brightfield mode when using MIDI II, the following preview types are available:

- Brightfield preview - a normal type of illumination in the microscope for scanning the slide. This option is recommended when scanning in Brightfield mode.
- Remove Coverslip - If selected, the edges of the coverslip are not detected as specimen to be scanned. Depending on the threshold level, it is possible that the edges of the coverslip are detected as areas to be digitized.

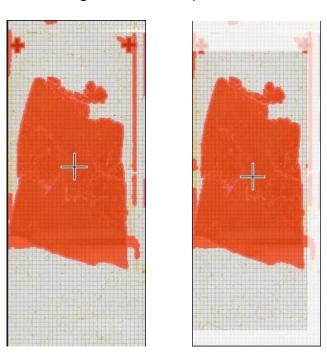


Figure 49: Preview image with and without coverslip edge

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## Caution!

It requires lots of time (since it cannot find focus neither on the edges, nor on specks) to digitize coverslip edges. Select **Remove coverslip** function to eliminate those areas.



## Warning!

Do **NOT** use **Remove coverslip** function on TMA slides! The layout of TMA slides may mislead the detecting algorithm.



If a hematology slide is detected including blood smear, the **Remove Coverslip** function cannot be activated and focusing on the coverslip area is not available. If you want to use the **Remove Coverslip** function, first switch to **Custom Scanmap**.

- **Fill holes inside scanmap** If selected, the holes inside the specimen will also be scanned. Often these holes contain small sample objects that otherwise would not be scanned.
- **Remove specks** If selected, the scanner does not digitize objects smaller than the predetermined size. This helps filtering specks and other uninteresting objects out.

Set the maximum volume of specks manually in the setting window



### Threshold settings have two different statuses:

• Auto threshold : It automatically detects the specimen in the preview image.



#### Caution!

Make sure that the detection result is acceptable for you. Otherwise set the threshold value manually.

- Manual threshold: Set threshold value manually or calculate value on the actual preview with Calculate Threshold function which is active only if setting the value manually. This sets the sensitivity of the specimen detection. To set the desired threshold value manually, change the setting in the Specimen threshold selection box in the range of 0-255. The default value is 212. Smaller values result in a more sensitive scanning, meaning that more areas will be digitized, however, this may also include specks or other imperfections of the slide. Greater values result in a less sensitive scanning, but it is possible that some of the smaller specimen areas will not be digitized.
- Use marker with threshold : If the specimen cannot be identified as required for digitization, (for example, weak contrast), it can help to encircle completely the specimen with a black marker pen. You have to draw a full circle with the pen to enable the detection. Marker pen detection will make specimen detection easier by limiting the scanned area.
- **Manual setting of Use marker with threshold** If this option is selected, only the area encircled with a marker pen will be scanned. You can define the threshold level by changing the threshold value in the **Marker threshold** selection box in the range of 0-255. This sets the sensitivity of the specimen detection inside the marker area. To set the desired threshold value manually, change the setting in the **Threshold** selection box in the range of 0-255. The default value is 212.
- Everything within marker This function is available only to select if the Use marker with threshold function is activated. To scan everything within the marked area, check the Everything within marker selection box.

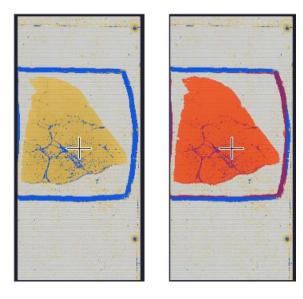


Figure 50: Scan everything within the marker selected / not selected

• **Dilate mask**: Adjust the slider to enlarge or decrease the scanned area. The edge is extended discretely by entering a new value each time. To switch to manual mode, click the top left corner of the button and the required value can be

entered in the box

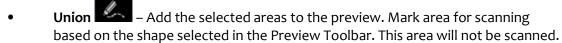
#### **Preview Toolbar**



This section is located at the bottom of the preview image.

- Save scanmap Click this icon to save the currently selected areas to scanmap.
- **Position** To position the specimen holder that holds the current slide, click **Position sample**, and then click on the area of interest on the preview image.

This will define the Live image that you can access from the Live view



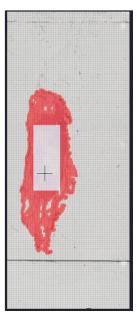


Figure 51: Not scanned selection

 Erase — Delete selected areas from the preview image. Deselection is made based on the selected shape from the Preview Toolbar. This area will not be scanned.

• Edit — The size of selected area (positive or negative) can be modified at the borderlines or corners.

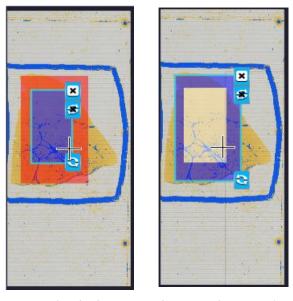


Figure 52: Edited negative and positive selection masks

- **Crop** Crop the area of the selected area.
- **Place Circle** You can select the area to be scanned with the different tools on the **Preview toolbar.**
- Place focus point

You can add manual focus points on the preview image – the coordinates of the manual focus points you add are listed on the **Focus settings** panel.

**NOTE:** The maximum number of focus points that you can manually add is 100.

- Rectangle tool Draw rectangle shaped area.
- Ellipse tool Draw ellipse selection.
- **Polygon tool** Area selection by defining a polygon shape. Finish area selection by double-clicking with the mouse at or near the starting point.
- TMA tool TMA tool is used for selecting TMA spots on TMA slides. You can set the selection settings on the following four tabs:

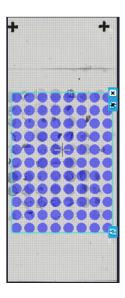


Figure 53: TMA grid preview

• TMA Grid Setting — This function is enabled only if a TMA grid has already been placed on the preview image. Set grid parameters (row and column numbers) and spot shape (round or rectangle).



Figure 54: TMA tool: Grid selector

Delete TMA grid by clicking the **X** at the top right corner and rotate grid by clicking the icon at the bottom right corner. Enter the number of rows and columns in the **Rows** and **Columns** fields or select the appropriate values with the arrows. Enter the distance between two spots on the X and the Y axis in µm in the **Core distance** fields or select the appropriate values with the arrows. Enter the average diameter of the spots in the **Core size** field or select the appropriate value with the arrows.

- Clear scanmap The entire scanmap area will be cleared and reset to default.
- Use selection box restriction The preview image shows the area that will be digitized with a red and/or an orange mask. If the Use selection box is enabled, and the crop function is selected, a black frame displayed in the image, and only the area inside the box is scanned. It is useful if you only want to scan the area that is equivalent with the size of the coverslip, so external specks will not be scanned.

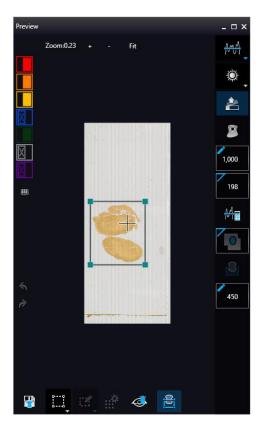


Figure 55: Use selection box

The following colors are used in the preview image to demonstrate digitization and selection settings:



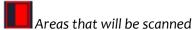
Figure 56: Colors in preview image and Label area switching button



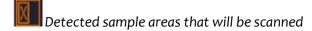




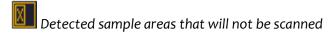




These areas are digitized based on user settings (for example, **Fill holes in scan area**) and not detected by the selected threshold value.



These areas are digitized. They are detected based on the selected threshold value.



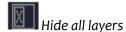
These areas are not digitized based on their position (for example, they are outside the selection box). They are detected by the selected threshold value.



If **Scan area inside the marker** is selected in the Preview panel, the preview camera detects the marker pen. The inside areas appear in red color and will be digitized.

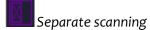


This color is only displayed during scanning.



All the layers will be hidden / existing but not visible. The original preview image is shown but layer information is still valid. Note, that while this function is active, none of the other preview functions can be selected.

**NOTE:** If all layers are hidden, the scanning selection is not visible.



Discrete sample areas will be scanned separately as individual slides. If there are two samples on a slide, two separate virtual slides will be created. **NOTE:** Discrete areas are numbered in the preview window. You can select up to 650 discrete areas. All discrete areas are scanned, please make sure to activate the **Remove specks** function.

Click the button to display barcode label area. To rotate the label area by 180°, click



Figure 57: Barcode label area window

– Undo / Redo modification made during specifying the **Scanmap**. These buttons are inactive when **Use threshold** function is applied.

#### 5.1.2.2 Focus indicator

Click to activate the Focus indicator function. Search for the sharpest focus on the current

field of view automatically by clicking Auto focus button.

To define focus limits, select **Limit the range**. Set the upper and lower limits by selecting the desired value in the selection boxes. By using **Set +-Range**, the **Lower limit** value is set to -32 of the current focus value and the **Upper limit** value is set to +32 of the current focus value. This is useful if **Auto Focus** does not find the focus on the specimen, but on the coverslip. Also, this makes the focusing sequence faster.

For manual focusing define the manual focus step size by adjusting the **Step size** slider and use the two arrow buttons to focus manually. This is useful when you are interested in an area that remained blurry with **Auto Focus** (for example, the specimen is thicker in that area). This does not influence the way slides are digitized in Auto focus mode.



Figure 58: Focus indicator panel

### 5.1.2.3 Exposure indicator

Activate Exposure indicator function by clicking . Click to calculate exposure time for the actual Live image. In Brightfield mode there is no option for manually setting the values. Exposure time can be displayed in microsecond, millisecond, and in second.



Figure 59: Window of Exposure Indicator in Brightfield scan mode

## **Image Intensity**

Click to open Image intensity settings window. An **image** is defined as a two-dimensional function f (x, y) the amplitude of at any pair of coordinates (x, y) is called the **intensity** or gray level of the **image** at that point. The pixel intensity at the coordinate pointing at with the cursor is displayed in the Image Intensity window.



Figure 60: Window of Image Intensity

## 5.1.2.4 Stage positioning

Click to activate **Stage Positioning Tool** to navigate on the slide, so to perform microscope movements on the Live image with this control function. The number at the center of the controller defines the step size by which the stage is moved. Value can be entered by hand or with the slider.

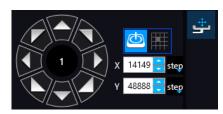


Figure 61: Stage positioning tool

This tool offers easy and punctual slide navigation in distinctive steps. Set step size (FoV) – 1,  $\frac{1}{2}$ , or  $\frac{1}{2}$  to determine the size of movement in proportion of one FOV. Click an arrow to move to the required direction with the set step size.

## 5.1.3 Quick preview functions

Use **Ctrl+mouse wheel** to zoom in or out to the preview area or the Live image.

A quick preview function tool pops up by right-clicking to the preview area. It allows a quick access to main preview-related functions:

- Drag
- Draw
- Erase
- Retake preview
- Settings
  - o Toggle deletion always on top
  - Reset zoom
  - Window auto-size
  - o Clean scanmap



Figure 62: Quick toolbar

## 5.1.4 Quick microscope functions

A quick microscope functions tool can be displayed upon right-clicking on the background of the main window (outside the preview window). It includes quick-access-buttons to main functions for MIDI II:



Figure 63: Quick toolset for microscope

## Autofocus



Figure 64: Autofocus

## • Live tools



Figure 65: Live tools

- o Fast mode
- o Screenshot
- o Magnifier
- o Ruler
- Image processor plugins
- o Add scanmap

## Auto exposure



Figure 66: Auto exposure

## 5.2 Fluorescence microscope mode

Fluorescence Microscope View consist of three different sections:

- Profile Settings panel: Profile settings containing parameters used for scanning
- Microscope Control Panel: Live microscope movement functions
- Main functions: Located at below the window header, these functions are identical in both modes.

## 5.2.1 Profile settings panel



Every parameter is set automatically during scanning.



Compact table view of microscope filters used for Fluorescence scanning.

Legend of the table:

- **A:** Actually used filter
- Use: Filters used for viewing Live image and for scanning
- Auto Exp: When activated, the exposure time of the selected filter is calculated automatically during scanning.
- **Exp. Time:** If **Auto Exp** is inactive, exposure time of each filter can be defined manually. Values such as **Calc Exposure time** in Microscope Control panel and those that are specified manually are loaded in these fields. Value units can be the following: microsec, millisec, sec.
- **Exc** %: The given value specifies the excitation intensity in percentage of the illumination unit.
- **DG** (Digital Gain): This is camera-dependent, with Point Grey Grasshopper 3 the index value ranges from 0 to 4, and with pco.edge 4.2 from 0 to 6. Give **Index** value by entering it in the box or by selecting the value with the arrow buttons. If you raise the **Index** value, the exposure time is halved by every step, and the image becomes noisier. To move between the filters, click **Previous Filter** or **Next Filter**.
- TW %: You can set the Exposure time weight (%) here (displayed under TW in the Filter Selection frame).
- **F**: Focus channel under the scanning
- **S:** The selected channel will be the stitching channel under the scanning.

- **E** / **Z**: Multilayer option: Select **Extended focus** or **Z-stack** for scanning the required channels in accordance with the scanning mode set in the profile.
- **D**: Deconvolution can be activated per channel in this column.

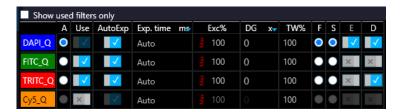


Figure 67: Filter table



This field displays the objective used for scanning. Objective type: 20x; 40x.



Focus settings for the scanning. Focus modes can be the following:

• Coarse focus: By selecting the Use manual focus box, you can preset the coarse focus value. By activating the Coarse focus function, the lower limit value is set to -64, and the upper limit value is set to +64 of the current focus value.



Before entering coarse focus value, turn live image on and set a suitable focus position.

You can accept the current Z-value by clicking **Assign Current**.

• Interpolated focus: If you select the Interpolated focus option, the coarse focus level is calculated from three different focus points of the specimen. Carry out a manual focusing sequence in the preview image on those three points. Set the correct focus value of the desired preview position by clicking **Set** in the table of interpolated focus. If you want to go back to any of the previously set focus points, click the appropriate **Goto** button.

To delete the stored values, click the other proper focus point or turn off the function. The software calculates a coarse focus level from the three values determined this way as a basis for the fine focusing routine. You can only define the start parameter here. This will, however, speed up the focusing process. If you

deselect the **Use fine focus** checkbox, the software immediately starts scanning based on the interpolated values, without pre-fine-focusing.

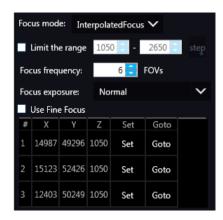


Figure 68: Focus settings

- Auto focus: Focus value is set automatically to match sample characteristics.
- **Limit the range:** You can define focus limits by selecting **Limit the range** for focusing. You can set the upper and lower limits by selecting the desired value in the selection boxes. This is useful if focusing was not targeted on the specimen, but on a spot on the coverslip.
- **Focus frequency:** This value determines how many fields of views will pass before the sample is refocused. This value should be selected depending on the unevenness and size of the specimen.
- **Focus Exposure:** The exposure time during focusing, it can have three states:
  - o Short
  - o Normal
  - Long



#### Sample detection

The Sample detection panel offers options for setting threshold and the selection of scannable areas.

#### Source

- Brightfield preview a normal type of illumination in the microscope for scanning the slide. This option is recommended when scanning in Brightfield mode.
- Pre-scan creates a fast FL preview image that is displayed in the Profile Wizard window. Scanning process takes a couple of minutes only, and it cannot be interrupted.
- Pre-scan high-resolution creates a High-Resolution fast FL preview image of every FOV within the selected area (in single layer DAPI, with an illumination

- time of 20ms) that is displayed in the Profile Wizard window. Scanning process takes a couple of minutes only and cannot be interrupted.
- Pre-scan + high-resolution creates a High-Resolution fast FL preview image
  of every FOV within the selected area (in single layer DAPI, with an
  illumination time of 20ms) that is displayed in the Profile Wizard window.
   Scanning process is initiated with a simple PreScan, the located sample with
  auto threshold is selected, and finally, an HR PreScan is launched.

### Thresholding

The manually set threshold value is applied during scanning. The preview of the loaded slide is displayed in the Preview window. The set value has effect on the preview image. If threshold value is modified in the Microscope Controller preview window, that value is automatically applied in the profile in the Profile Settings panel.

#### Specimen threshold

- Manually set value: This sets the sensitivity of the specimen detection. To set the desired threshold value manually, change the setting in the Specimen threshold level selection box in the range of 0-255. The default value is 212. Smaller values result in a more sensitive scanning, meaning that more areas will be digitized, however, this may also include specks or other imperfections of the slide. Greater values result in a less sensitive scanning, but it is possible that some of the smaller specimen areas will not be digitized.
- Auto Threshold: By clicking detected in the preview image.



### Caution!

Make sure that the detection result is acceptable for you. Otherwise, set the threshold value manually or append missing areas with the help of appropriate functions in the **Preview** window.

#### Use marker with threshold

If the specimen cannot be identified as required for digitization, (for example, weak contrast), it can help to encircle completely the specimen with a black marker pen. You have to draw a full circle with the pen to enable the detection. Marker pen detection will make specimen detection easier by limiting the scanned area. If this option is selected, only the area encircled with a marker pen will be scanned. You can define the threshold level by changing the threshold value in the **Use marker with threshold** selection box in the range of 0-255. This sets the sensitivity of the specimen detection inside

the marker area. To set the desired threshold value manually, change the setting in the **Specimen threshold** selection box in the range of 0-255. The default value is 105.

## Everything within marker

To scan everything within the marked area, check the **Everything within** marker selection box.

Alternatively, click in the preview window to activate this function.

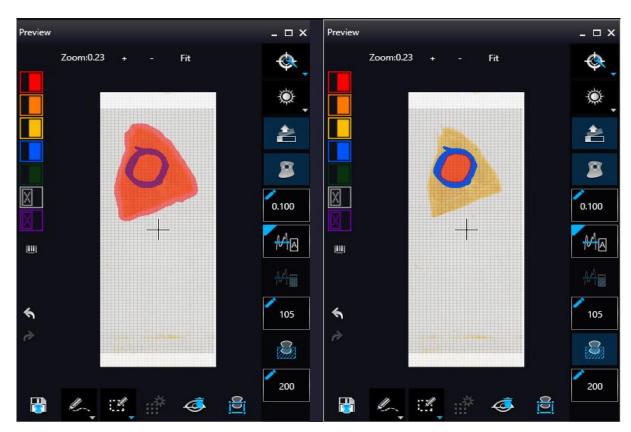


Figure 69: Scan everything within the marked area (selected / not selected)

#### • Threshold enhancement

 Remove coverslip – If selected, the edges of the coverslip are not detected as specimen to be scanned. Depending on the threshold level, it is possible that the edges of the coverslip are detected as areas to be digitized.

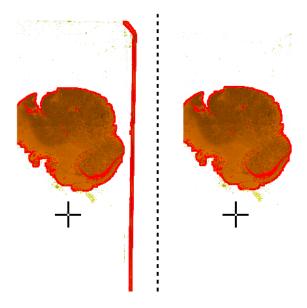


Figure 70: Preview image with and without coverslip edge



It requires lots of time (since it cannot find focus neither on the edges, nor on specks) to digitize coverslip edges. Select **Remove coverslip** function to eliminate those areas.



Do **not** use **Remove coverslip** function on TMA slides! The layout of TMA slides may mislead the detecting algorithm.

- Fill holes inside the scanmap If selected, the holes inside the specimen will also be scanned. Often these holes contain small sample objects that otherwise would not be scanned.
- Remove specks If selected, the scanner does not digitize objects smaller than the predetermined size. This helps filtering specks and other uninteresting objects out. Set the maximum size of specks not to be digitized by adjusting the Speck size slider.
- O **Dilate mask** Adjust the slider to enlarge or decrease the scanned area. The edge is extended discretely by 100 μm each time.

# Scanmap option

The previously saved scanmap can be loaded for use. Select one of the following as **Scanmap source**:



Figure 71: Scanmap settings

- **Use Threshold:** Preview settings set in Microscope Controller Panel / Preview window are applied to create a scanmap.
- **Loaded scanmap:** This function is useful if the slides contain areas of interest that cannot be detected by the preview camera. This function along with saving profiles helps to scan all slides with the most adequate settings.
- To load a mask, click first, then browse for the scanmap to be loaded.
- **Custom scanmap:** The scanmap drawn on the preview image is used for scanning.
- If the **Use selection box restriction** function is activated, only the area inside the box is scanned. It is useful if you only want to scan the area that is equivalent with the size of the coverslip, so external specks will not be scanned.



- **Single layer mode:** If none of the filters are selected in the Filters table for multilayer scanning, this mode is active and can be selected, and Multilayer mode turns inactive.
- Extended focus: By choosing the Extended focus option, the software selects the sharpest image from each focus level for each image field and combines them into one single image. Therefore, those parts that were blurry in auto/manual focus will also be sharp. This method guarantees the maximum depth of sharpness; however, it reduces digitization speed.
- **Z-Stack:** For **Extended focus** and **Z-Stack** scanning methods, you can determine the desired number of focus levels with the **Levels** selection box. The current focus value is the initial level. If you set 5 for example, then the initial level, plus four (two focus levels above and below the FOVs) are captured. Therefore, it is advised to choose an odd number for the focus levels. Separate layers are created and stored this way and can be opened with Viewer applications. The Z-Stack slide contains the extended focus layers.

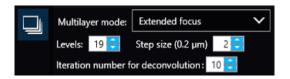


Figure 72: Multilayer mode settings

**Step size** determines the spacing between focus levels. One step is around 0.2 μm. Default settings are: **Levels**: 7; **Step size**: 5.

The number of iterations the Deconvolution algorithm is run can be determined in the **Iteration number for deconvolution:** value box.

**NOTE:** The purpose of deconvolution is to produce a sharper image, but the use of a deconvolution algorithm can significantly increase the time that takes to create a digital slide.

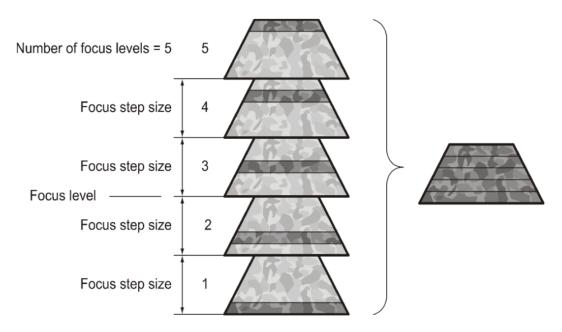


Figure 73: Focus level and step size





Figure 74: Scan settings

## • Change filters after whole slide scanning

To optimize speed, filter change should take place after the digitization of the slide with one channel.

### Change filters at each field-of-view

Filters should be changed for each field of view if very precise colocalization is required but consider that this option is more time consuming.



Make sure to select the **Change filters at each field of view** option if using multi band filter for multi-channel digitization.



#### Caution!

If the specimen area is barely visible, it is possible that the software will analyze that area as an empty one.

Maximum exposure time – A limit value can be set to determine that the
exposure time cannot be longer than the time of focusing and calculation of
exposure. This is necessary because the exposure time would be too long when
taking image of an empty field of view. Default value is 2000 ms.

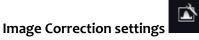




Figure 75: Image correction settings

- Use Flatfield correction If this function is active the scanned slide compensates itself with a special method (light intensity statistical data, not to modify the average intensity of the slide. Quantitative measurements can be made on the slide. The following three options can be selected from the drop-down list:
  - o Intensity statistics legacy compensation algorithm
  - Reduce intensity pixel-level analyzation of the acquired image during which
    the background of the image is reduced based on the comparison of the
    image recorded by the camera and the compensation image.

- o **Intensity equalization** pixel-level analyzation of the acquired image, a one-by-one type image compensation method is applied.
- Extended focus Select the type of the extended focus algorithm used during scanning:
  - Legacy uses original extended focus algorithm, it is recommended for widefield fluorescence scanning. Note, that this algorithm is optimized for scanning large areas, so if the size of the area to be scanned is insufficient, the correction might not be perfect.
  - o **Maxima** the final image is made up from all of the layers created, areas (pixel groups) with the highest intensity are combined together.
  - o **AVG** an average of the layers is used for the final image.
  - Max-AVG the final image is made up from all of the layers created, areas
     (pixel groups) with higher intensity than the average are combined together.



## Image settings

Choose one of the following predefined image formats (and a subsequent custom option) from the **Image Quality** drop-down list:

- Excellent (JPEG: 90)
- Good (JPEG: 80)
- Medium (JPEG: 60)
- Low (JPEG: 30)
- Custom... If choosing this option, the Image compression setting is displayed on which you can select from different image formats. Accordingly, further adjustments can be made, except if PNG or BMP image format is selected.



Figure 76: Image encoding window

### Compression

- BMP Lossless uncompressed image format, but larger files due to less effective compression. It is a raw data file.
- PNG Lossless compressed image format.
- JPG The quality can be set in the value box. Greater values result in better quality, but larger files. The default setting is 80%.
- **Bit depth:** 8-bit
- **Stitching:** Use Stitching function enables the seamless stitching of digital tiles.

- Sharpening: Select this option to improve the visual appearance of digital slides.
- Save focus quality: Saves the focus quality.

## 5.2.2 Microscope control panel

## 5.2.2.1 Preview window

Click to open the Preview panel that offers options for threshold setting and selection of the area to be scanned.

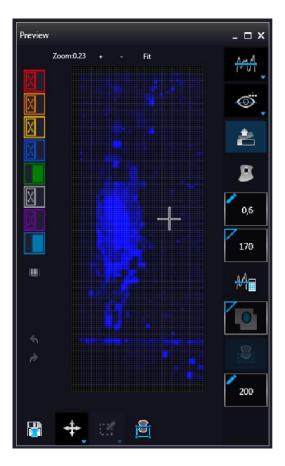


Figure 77: Pre-scan preview image

## Threshold options

This section is located at right side of the preview window. **Scanmap Source** is designed to set which type of scanmap is used on the preview image. This scanmap is displayed automatically in the **Profile Scanmap Source** setting. Selectable scanmap types are the following:

- Use threshold
- Load previously saved scanmap from file



## **Preview Types**

In FL Microscope mode the following additional preview modes are available:

- **Brightfield preview** a normal type of illumination for scanning. This option is recommended when scanning in Brightfield mode.
- **Pre-scan** creates a fast FL preview image that is displayed in the Profile Wizard window. Scanning process takes a couple of minutes only, and it cannot be interrupted.
- **Pre-scan high-resolution** creates a High-Resolution fast FL preview image of every FOV within the selected area (in single layer DAPI, with an illumination time of 20ms) that is displayed in the Profile Wizard window. Scanning process takes a couple of minutes only and cannot be interrupted.
- **Pre-scan + high-resolution** creates a High-Resolution fast FL preview image of every FOV within the selected area (in single layer DAPI, with an illumination time of 20ms) that is displayed in the Profile Wizard window. Scanning process is initiated with a simple PreScan, the located sample with auto threshold is selected, and finally, an HR PreScan is launched.

## Remove coverslip

If selected, the edges of the coverslip are not detected as specimen to be scanned. Depending on the threshold level, it is possible that the edges of the coverslip are detected as areas to be digitized.

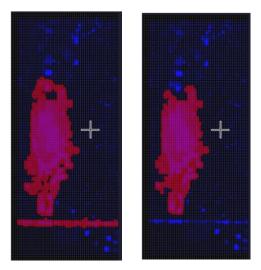


Figure 78: Preview image with and without coverslip edge



It requires lots of time (since it cannot find focus neither on the edges, nor on specks) to digitize coverslip edges. Select **Remove coverslip** function to eliminate those areas.



Do **not** use **Remove coverslip** function on TMA slides! The layout of TMA slides may mislead the detecting algorithm.

## Fill holes in scanmap

If selected, the holes inside the specimen will also be scanned. Often these holes contain small sample objects that otherwise would not be scanned.

# Remove specks

If selected, the scanner does not digitize objects smaller than the predetermined size. This helps filtering specks and other uninteresting objects out.

Set the maximum volume of specks manually in the setting window



#### **Threshold**

• Auto threshold

Select this option to automatically detect the specimen in the preview image.



#### Caution!

Make sure that the detection result is acceptable for you. Otherwise set the threshold value manually.

## Manual threshold



Set value manually or calculate value by using the **Calculate Threshold** function (can be activated only when manual thresholding is selected). This sets the sensitivity of the specimen detection. To set the desired threshold value manually, change the setting in the **Specimen threshold level** selection box in the range of 0-255. The default value is 212. Smaller values result in a more sensitive scanning, meaning that more areas will be digitized, however, this may also include specks or other imperfections of the slide. Greater values result in a less sensitive scanning, but it is possible that some of the smaller specimen areas will not be digitized.

## Use marker with threshold



If the specimen cannot be identified as required for digitization, (for example, weak contrast), it can help to encircle completely the specimen with a black marker pen. You have to draw a full circle with the pen to enable the detection. Marker pen detection will make specimen detection easier by limiting the scanned area.

## Manual setting of Use marker with threshold



If this option is selected, only the area encircled with a marker pen will be scanned. You can define the threshold level by changing the threshold value in the **Marker threshold level** selection box in the range of 0-255. This sets the sensitivity of the specimen detection inside the marker area. To set the desired threshold value manually, change the setting in the **Threshold** selection box in the range of 0-255. The default value is 212.

## Everything within marker

Available only if **Use marker with threshold** function is activated. To scan everything within the marked area, check the **Scan everything within marker** selection box.

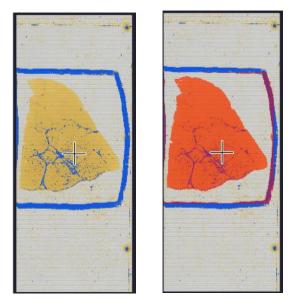


Figure 79: Scan everything within the marker selected / not selected



Adjust the slider to enlarge or decrease the scanned area. To switch to manual mode, click the top left corner of the button and the required value can be entered in the box

#### **Preview Toolbar**

This section is located at the bottom of the preview image.



Save scanmap

Click this icon to save the currently selected areas to scanmap.

• Position

To **position** the specimen holder that holds the current slide, click **Position sample**, and then click on the area of interest on the preview image.

This will define the Live image that you can access from the Live view





Add the selected areas to the preview. Mark area for scanning based on the shape selected in the Preview Toolbar. This area will not be scanned.



Delete selected areas from the preview image. Deselection is made based on the selected shape from the Preview Toolbar. This area will not be scanned.

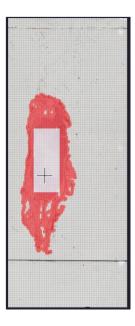


Figure 80: Not scanned selection



The size of selected area (positive or negative) can be modified at the borderlines or corners.

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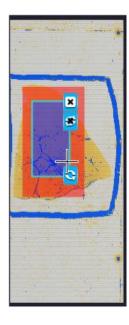




Figure 81: Edited negative and positive selection masks

# • Crop

Crop the area of the selected area.

## Place Circle



You can select the area to be scanned with the different tools on the **Preview toolbar.** 

## Place focus point



You can add manual focus points on the preview image – the coordinates of the manual focus points you add are listed on the **Focus settings** panel.

NOTE: The maximum number of focus points that you can manually add is 100.

## Rectangle tool



Draw rectangle shaped area.

## • Ellipse tool



Draw ellipse selection.

## Polygon tool



Area selection by defining a polygon shape. Finish area selection by double-clicking with the mouse at or near the starting point.

## • TMA tool

TMA tool is used for selecting TMA spots on TMA slides. You can set the selection settings on the following four tabs:

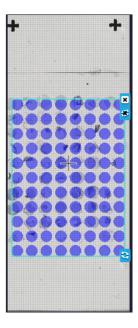


Figure 82: TMA tool

# • TMA Grid Setting

This function is enabled only if a TMA grid has already been placed on the preview image. Set grid parameters (row and column numbers) and spot shape (round or rectangle).



Figure 83: TMA tool: Grid selector

Delete TMA grid by clicking the **X** at the top right corner and rotate grid by clicking the icon at the bottom right corner. Enter the number of rows and columns in the **Rows** and **Columns** fields or select the appropriate values with the arrows. Enter the distance between two spots on the X and the Y axis in µm in the **Core distance** fields or select the appropriate values with the arrows. Enter the average diameter of the spots in the **Core size** field or select the appropriate value with the arrows.

## Clear scanmap

The entire scanmap area will be cleared and reset to default.

## • Use selection box restriction



The preview image shows the area that will be digitized with a red and/or an orange mask. If the **Use selection box** is enabled, and the crop function is selected, a black frame displayed in the image, and only the area inside the box is scanned. It is useful if you only want to scan the area that is equivalent with the size of the coverslip, so external specks will not be scanned.

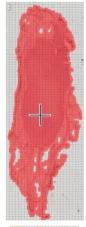


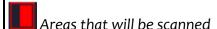
Figure 84: Use selection box

The following colors are used in the preview image to demonstrate digitization and selection settings:

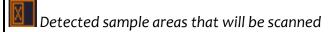


Figure 85: Colors in preview image and Label area switching button

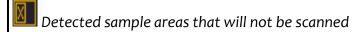




These areas are digitized based on user settings (for example, **Fill holes in scan area**) and not detected by the selected threshold value.



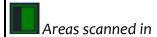
These areas are digitized. They are detected based on the selected threshold value.



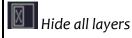
These areas are not digitized based on their position (for example, they are outside the selection box). They are detected by the selected threshold value.



If **Scan area inside the marker** is selected in the Preview panel, the preview camera detects the marker pen. The inside areas appear in red color and will be digitized.



This color is only displayed during scanning.

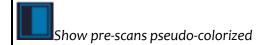


All the layers will be hidden / existing but not visible. The original preview image is shown but layer information is still valid. Note, that while this function is active, none of the other preview functions can be selected.

**NOTE:** If all layers are hidden, the scanning selection is not visible.



Discrete sample areas will be scanned separately as individual slides. If there are two samples on a slide, two separate virtual slides will be created. **NOTE:** Discrete areas are numbered in the preview window. You can select up to 650 discrete areas. All discrete areas are scanned, please make sure to activate the **Remove specks** function.

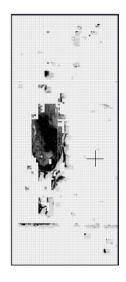








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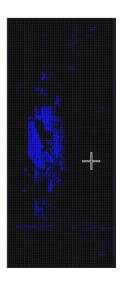


Figure 86: Pseudo-colorized pre-scan image

Click the button to display barcode label area. To rotate the label area by 180°, click



Figure 87: Barcode label area window

– Undo / Redo modification made during specifying the **Scanmap**. These buttons are inactive when **Use threshold** function is applied.

#### 5.2.2.2 Focus indicator

Click to activate the **Focus indicator** function. Search for the sharpest focus on the current field of view automatically by clicking - **Auto focus** button.

If you select the **Use fine focus** option, the coarse focus level is calculated from three different focus points of the specimen. Carry out a manual focusing sequence in the preview image on those three points. Set the correct focus value of the desired preview position by clicking **Set11**, **Set12**, or **Set13**. If you want to go back to any of the previously set focus points, click the appropriate button. To delete the stored values, click **Clear Values**.

The software calculates a coarse focus level from the three values determined this way as a basis for the fine focusing routine. You can only define the start parameter here. This will, however,

speed up the focusing process. If you deselect the **Use fine focus** checkbox, the software immediately starts scanning based on the interpolated values, without pre-fine-focusing.

To define focus limits, select **Limits of the range**. Set the upper and lower limits by selecting the desired value in the selection boxes. By using **Set +-Range**, the **Lower limit** value is set to -32 of the current focus value and the **Upper limit** value is set to +32 of the current focus value. This is useful if **Auto Focus** does not find the focus on the specimen, but on the coverslip. Also, this makes the focusing sequence faster.

For manual focusing define the manual focus step size by adjusting the **Step size** slider and use the two arrow buttons to focus manually. This is useful when you are interested in an area that remained blurry with **Auto Focus** (for example, the specimen is thicker in that area). This does not influence the way slides are digitized in Auto focus mode.



Figure 88: Focus indicator panel

## 5.2.2.3 Exposure indicator

Exposure time for the live image can be calculated by using the Calculated Exposure time

function . It is available to switch between microsec, millisec, and sec units for the reading of exposure time.

Select the types of filters you want to use during scanning. You can select the filter types and the number of channels to be used. The values in the **EXC** column define the excitation of the Lumencor illumination, in **TW** define exposure time weight, and in the **DG** the amount of digital gain is displayed. It is also available for you to enable Extended Focus (**EF**) and/or Z-stack (**ZS**) functions in this field.

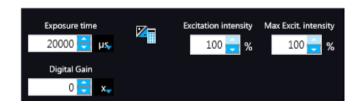


Figure 89: Window of Exposure Indicator in Fluorescence scan mode

## **Exposure Settings**

You can set the **Exposure time weight (%)** here (displayed under **TW** in the **Channel Settings** frame). Set Lumencor excitation intensity at the **Excitation intensity (%)** field. The defined value will be used as maximum when applying Auto Exposition time if you activate the **Max. excit. Intensity** option.



To prevent over-exposure, the **Excitation intensity (%)** value can be modified by the software when calculating **Auto Exposure** time.

#### **Image Intensity**

Click to open Image intensity panel. An **image** is defined as a two-dimensional function f(x, y) the amplitude of at any pair of coordinates (x, y) is called the **intensity** or gray level of the **image** at that point. The pixel intensity at the coordinate pointing at with the cursor is displayed in the Image Intensity window.



Figure 90: Window of Image Intensity

#### 5.2.2.4 Stage positioning

After clicking you can perform microscope movements on the Live image with this control function. The number at the center of the controller defines the step size by which the stage is moved. Value can be entered by hand or with the slider.

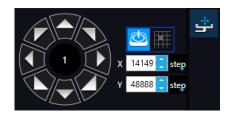


Figure 91: Stage positioning panel

# 5.2.3 Quick preview functions

Use Ctrl + mouse wheel to zoom in or out to the preview area or the Live image.

#### 5.2.3.1 Quick toolbar of preview window



Figure 92: Settings of preview quick toolbar

A **Quick Toolbar** pops up by right clicking any of the control menu items. It allows a quick access to main functions, and for FL these are the following:

- Drag
- Draw
- Erase
- Retake preview
- Settings
  - o Toggle delation always on top
  - Reset Zoom
  - Window auto-size
  - o Clear Scanmap

#### 5.2.3.2 Quick microscope functions

A quick microscope functions tool can be displayed upon right-clicking on the background of the main window (outside the preview window). It includes quick-access-buttons to main functions for MIDI II:



Figure 93: Quick toolset for microscope

#### Autofocus



Figure 94: Autofocus

# • Objective type



Figure 95: Objective type

- O 20X
- o 40x
- Filters



Figure 96: Filters

# • Microscope mode

o Brightfield

#### o Fluorescence



Figure 97: Microscope mode

#### Live tools

- o Fast mode
- Screenshot
- o Magnifier
- o Ruler
- o Image processor plugins
- o Use pseudo-color
- o Add scanmap



Figure 98: Live tools

#### Auto-exposure



Figure 99: Auto-exposure

#### 5.2.4 Bottom menu bar of the main window

#### **Profile History**

This function can be activated by clicking in **Preferences**. During setting scanning profile all the previously used parameters will be saved automatically.

Each modification in the profile creates a so-called Milestone unit. These stage units are linked in a row displayed at the bottom left corner of the main window.



Figure 100: Progress of the profile modification history

Once you are moving the mouse cursor over a unit all the parameters will become visible in a popup window.



Figure 101: Details of parameter modification

For the easier perspicuity, modifications can be observed in a pop-up window by clicking the button in which both the original and the modified values are presented.

Click to save parameters of the milestone unit into a new profile.

Click to restore a modification stage (load parameters of a milestone unit) if needed.



Figure 102: Profile history tree

# 5.3 Planner mode

The whole scanning procedure can be planned in this mode. Assign profiles to slides, modify scanmaps without performing physical loading of slides. In Planner mode not only the scanning of the actually loaded tray can be planned, but also profile assignment to slides of prepared virtual trays is available to be performed. It is also possible to scan to different locations with each profile, and virtual slides can be created and stored in different folder or server.

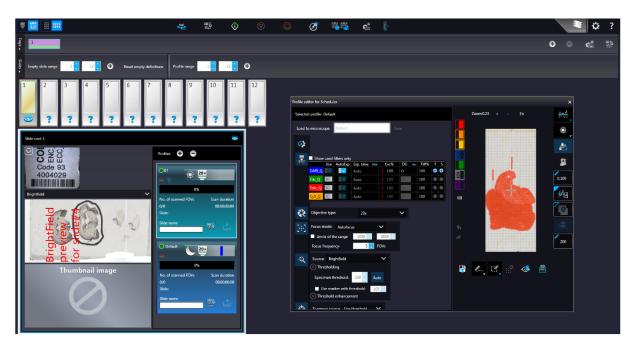
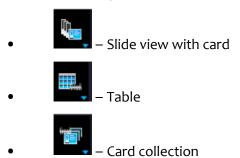


Figure 103: Planner mode

Planner module includes three appearance types for planning scans, located under the **Preferences / Planner Layout Selector** menu:



#### 5.3.1 General functions at the main menu





Stage Control – Available after initialization, upon clicking the slide icon or entering slide position number at the right side, the slide can be loaded.

Scan to – Available after loading procedure, unique settings can be defined even for each separate scanning.

Start scan – Scanning of the actually loaded slide, or if the planner has been defined, the whole scanning process can be initiated.





**Take all previews** – Preview images of all the slides on the tray are taken automatically. Select the required preview type from the following (from top to bottom): Brightfield, Pre-scan, Pre-scan high-resolution, Pre-scan + high-resolution.



Figure 104: Take all preview selector

Load / Save Plan menu – Opens a drop-down menu including the following:

• **Load plan –** The previously saved scanning plan can be loaded.

- Save plan A scanning plan containing all parameters and profile assignment will be saved.
- Load CSV Rack number, slide position, slide name, barcode (optional), profile name, illumination type data from a CSV file can be loaded.

Note, that by the Barcode parameter in the CSV file the barcode of the slide can be specified, but this parameter is optional and does not need to be specified.



To prevent case mix-up, **ALWAYS** pay special attention when entering barcodes manually, as the slide will be identified based on the barcode specified in the CSV file.

Before loading the CSV file, the required settings in the Planner mode must be performed.

• Save CSV – Rack number, slide position, slide name, profile name, illumination type data can be saved to a CSV file.

**Profile management for all the magazines** – The following profile-related tasks applicable for the planner can be performed:

- Add current profile to all racks
- Open profile for all racks
- Detach current profile from all racks
- Detach profiles from racks
- Clear planner
- Clear all slide results from every rack

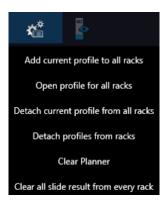
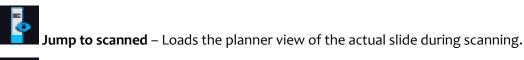


Figure 105: Profile management for all the magazines menu







# 5.3.2 General functions at the tray menu

#### Rack view mode selector

Switch view by clicking this button. Click to add a virtual tray to the planner, and remove a virtual tray from the planner.



Figure 106: Rack view mode selector

**Profile management for selected magazine** menu includes the following global settings applicable to all trays:

- Add current profile for all slides
- Open profile to all slides
- Detach current profile from all slides
- Detach profiles from slides
- Clear all slide results

#### 5.3.3 General functions at the slide menu

- Mark empty slide positions Define range in the Range to skip boxes to set
  multiple slide positions as empty. For single slides, enter / set slide position with
  the arrows in the Range to skip box or right-click on a slide and select Skip.
- Click **Reset** at the Slides settings bar to cancel slide selections as empty, or rightclick the thumbnail of a slide selected as skipped and click **Reset**.



Figure 107: General functions at the slide menu

- You can apply a selected profile to a defined range of slides at the **Profile range** section. Set the slide positions within the range (first and last slide) then click.
- You can also set **Scan properties range** to a slide with a profile attached. When more profiles are attached to a slide, always the last scan record will be set with the selected scan property.



Figure 108: Scan properties range

Click '+' to Open **ScanContext selector** and click **Apply** to validate the scan properties settings to all selected slides and related profiles.

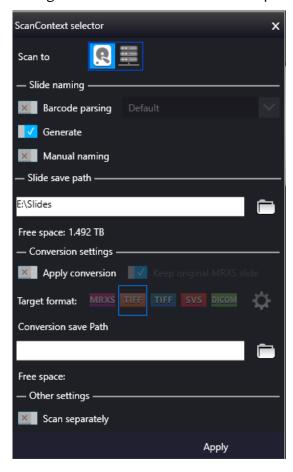


Figure 109: ScanContext selector

# 5.3.4 Slide view with card

Select from **Preferences / Appearance settings / Planner layout selector** to activate this view.

Depending on the actual view preference selected at horizontal or vertical layout. Slide preview and the list of the assigned profiles are displayed.

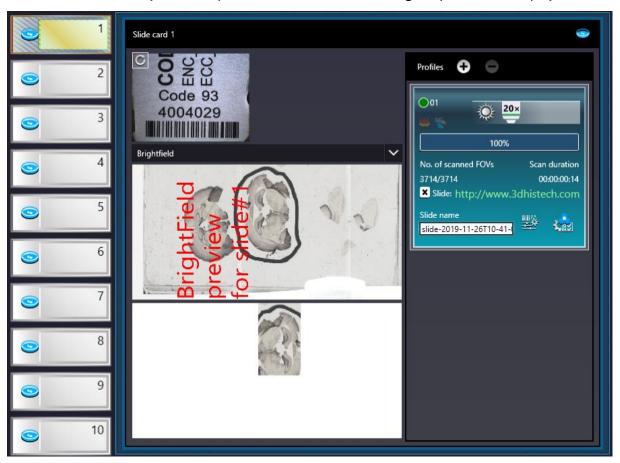


Figure 110: Horizontal Slide view with card



Figure 111: Vertical Slide view with card

By clicking or profiles can be added or removed for/from the slide, respectively. The parameters of the assigned profile are displayed in a card. The colors of a Brightfield and a Fluorescence profile cards are different.



Figure 112: Brightfield and fluorescence profile cards

The following information are included in a profile card:

- Profile name in the top left corner.
- Profile status is marked with spots of different color:
  - ■ Stored
  - o Edited
- Scanning mode icon representing Brightfield or Fluorescence mode
- Objective type
- Filter channel color bars (for FL mode only)
- Scan progress
- No. of scanned FOVs
- Scan duration
- Slide: actual status of the slide is presented here. If the slide is under scanning, the "Scanning", if scanning has been interrupted by some error, the "Failed" text is visible.

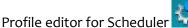
**NOTE:** If slide status is marked as "Failed", delete status before scanning by clicking .

If the virtual slide is created (the scanning is finished), the location path of the destination folder is displayed. To re-scan and thus recreate the slide, click at the front of the displayed path to start the scanning process over.

Priority scan



Scan properties



NOTE: Once scanning has finished, the thumbnail of the digital slide is added to the card at the bottom. Double click the thumbnail image of the digital slide to open it in Viewer. If scanning is performed to a local destination, the digital slide can be opened in CaseViewer™ only, but when scanned to CaseCenter™, it can be opened in InstantViewer™ as well (depending on the settings made in Settings / Preferences / Server scan result viewer).

#### 5.3.5 Table view mode

By clicking each slide will be displayed in a separate row. Click to assign profile to a slide, and to detach a profile from a slide. A slide can have more than one profile assigned to it, and these profiles can either be BF or FL if the scanner is capable to operate in these two scanning modes.

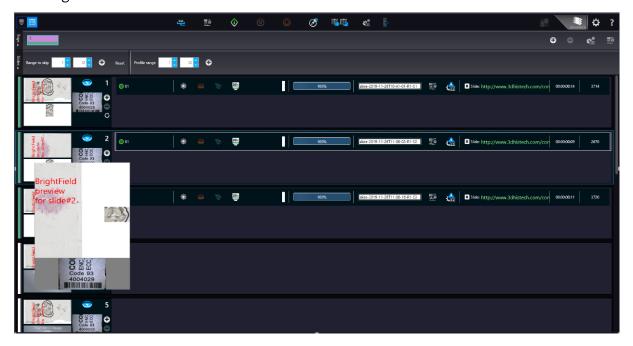


Figure 113: table view mode

In Table view, the following information are displayed in the profile strip based on the loaded profile:

- Profile name
- Illumination
- Priority
- Quant probe
- Objective type
- Filters (N/A)
- Progress
- Scan properties: The location of the virtual slide with the selected profile can be defined
  - Scan result
  - Scan duration
  - Scanned FOVs
  - Total no. of FOVs

• Profile editor for Scheduler

# 5.3.6 Card collection view mode

If you click the button, each of the slide previews are displayed in the window. Add profiles by clicking and detach profiles by clicking . Functions are the same as with the other modes.



Figure 114: Card collection view mode

# 5.4 Profile and preview overview on the planner

Each of the assigned profiles are checkable and modifiable. The panel at the right side includes all the profile settings, in coherence with the view type of the Profile Setting panel. Slide preview is displayed in the Preview window in which the scanmap can be modified until beginning the scanning process. Every aforementioned profile setting can be modified depending on the scan profile type, being either Brightfield or Fluorescence.



to load the planner view of the actual slide during scanning.

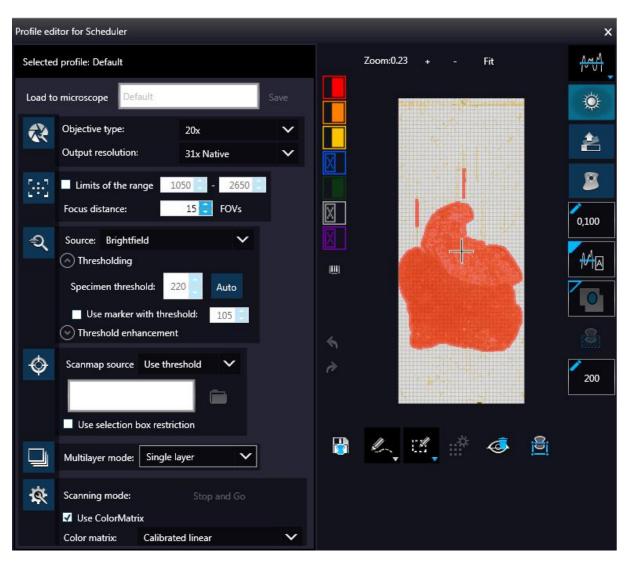


Figure 115: Profile editor for Scheduler window in Planner mode

# 5.5 Progress features

The progress is visible both in Microscope and Planner modes whenever there is a running hardware operation or scanning procedure. Progress content can be therefore different depending on the type of the running procedure.

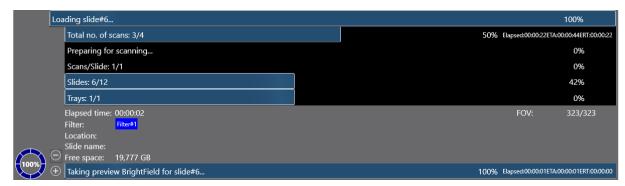


Figure 116: Progress data

The following information is included in the progress log list during scanning:

- Filter
- Elapsed time
- Location
- Slide name
- Free space
- FOV number

# **6 Settings and Service**

Activate **Settings** by clicking and **Services** by clicking at the right side of the main menu bar.

# 6.1 Settings

Activate **Settings** by clicking at the right side of the main menu bar.



This panel contains user settings that have global effect on the GUI and some of its functions.

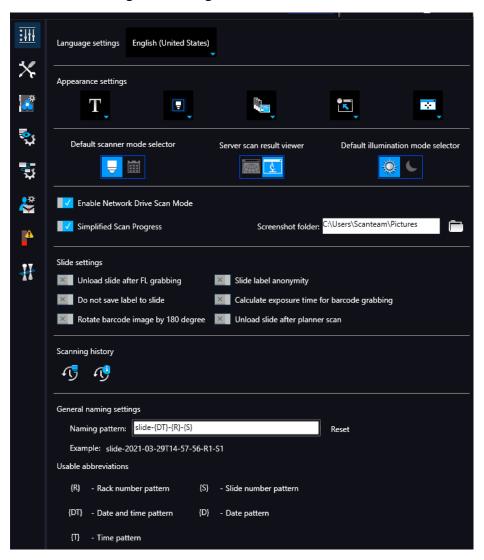


Figure 117: Settings

#### Language settings

The default language of the Pannoramic® Scanner 3.0.5 control software is English (United States). If the folder c:\ProgramData\3DHISTECH\SlideScanner\Globalization contains another language file, that language can be set in this drop-down menu, too.

#### **Appearance settings**

- View Mode Selector
  - Text mode T
  - o Icon mode
  - Float Text mode T를
  - o Float Icon mode
- Style selector
  - o Black Jelly
  - o Flat style
  - o Black Jelly light
  - o Flat style light
- Planner style editor
  - Slides with card
  - o Table
  - Card Collection
- Preview window, start position
  - o Initial position
  - Last position
  - Center screen
- Live mode
  - Rendered live image is displayed in an embedded window.



#### Default scanner mode selector



**Enable Network Drive Scan Mode** – Turn on this function to enable Network Drive Scan Mode.

#### Server scan result viewer

Opens digital slide with InstantViewer<sup>™</sup> (in web browser) or
 CaseViewer<sup>™</sup> when scanning to server.

#### Default illumination mode selector

Brightfield or Fluorescence mode

Simplified Scan Progress (for Brightfield scanning only)

**Screenshot folder** – Set the folder for storing screenshots by clicking **Browse**. Otherwise, the C:\Users\<Username>\Pictures folder is used by default.

#### Slide settings

- Unload slide after FL grabbing (N/A)
- Slide label anonymity Slide label area is displayed as a clear white image during scanning, patient data will not be visible in CaseViewer™.
- Do not save label to slide The original label area is not saved to the slide and will
  not be visible in CaseViewer™.
- Calculate exposure time for barcode grabbing Three images are recorded for barcode image creation. Exposure times will be recalculated each time, thus creating prefect light conditions for barcode reading, so to make sure that barcode identification is successful.
- Rotate barcode image by 180° degrees
- Unload slide after planner scan

# **Scanning History**



#### • Hardware log

Scanner hardware operations are contained in this log. To enable this function, first the database from the following folder must be loaded: C:\ProgramData\3DHISTECH\SlideScanner\HWLogDataBase.

The following motor movements are recorded in the log list:

- o Camera Changer
- Filter Wheel
- o General
- Halogen Light
- Microscope Part
- o MIDI Loader
- o ND
- Objective Changer
- Preview Light
- o RGB Light
- o Relay
- o Scan Loader
- o Service
- o Shutter
- o Slide Scanner
- Stage



All the circumstances and states of the slide scanning procedure are saved. LogID is the sequence number of scanning performed on the scanner in use (Profile Name, Illumination mode, Scan type, Scan Start, Scan Finished, URL, Error).

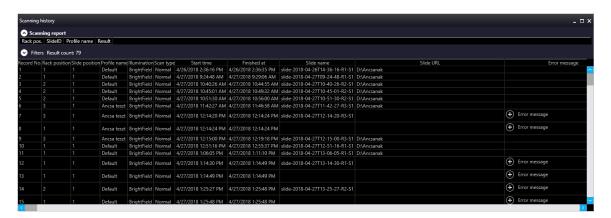


Figure 118: Scanning log

Filtering for the following parameters is available:

- Scanning date
- Profile name
- o Illumination mode
- URL
- o Slide name
- o Slide index
- Rack index

#### **General naming settings**

Naming pattern – The set string defines the slide naming pattern (shown by the example below the text box). Click **Reset** to set pattern to default. The abbreviations and their meaning are listed at the bottom of the section under **Usable abbreviations**.

# - Basic settings

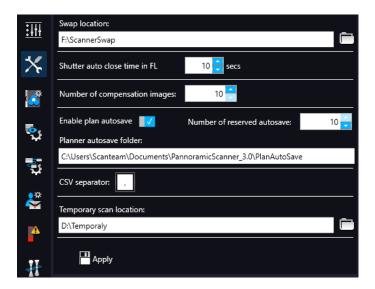


Figure 119: Basic settings

- On this panel, you can define the Swap file location, set Shutter auto close time in FL, and set the Number of compensation images for preview camera if needed.
- If you Enable plan autosave, for more comfortable and safer use, by defining a location in the Planner autosave folder field, a scan plan will be automatically saved. The save frequency can be set in the Number of reserved autosave box.
- Set the character as value separator used in the Planner export file at the CSV separator field.
- For scanning to a network drive, a Temporary scan location must be set. For more information, see Scan to Network Drive in chapter <u>Main window</u> <u>functions</u>.

Click **Apply** to accept modifications.



#### Profile behavior settings

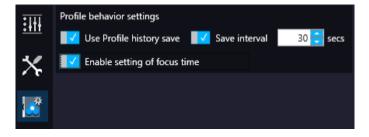


Figure 120: Profile behavior settings

- **Use profile history save** With this function each profile modification is saved in Profile History from which the different stages can be reloaded.
- Save interval Profile content is automatically saved at the specified timeframes.
- Enable setting of focus time Parameters (Short / Normal / Long) related to focus time will be enabled on the profile settings panel. Normal is set as default.



# - Pre-scan settings



Figure 121: Pre-scan settings

Unlike scan settings in Microscope or Planner mode, Pre-scan toolbar includes the same settings for pre-scanning, but these depend on the hardware / filter settings.



# – External application call

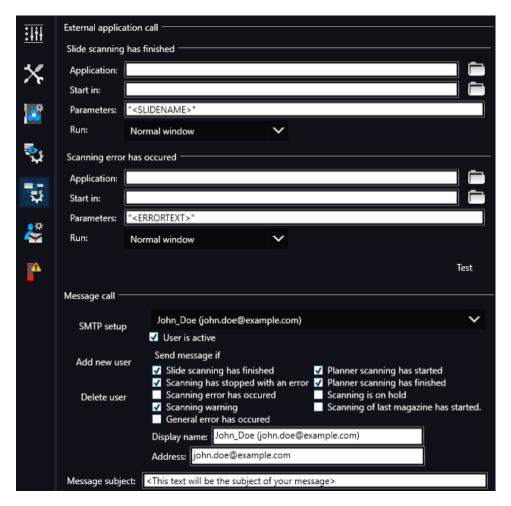


Figure 122: External application call window

Two of the three settings are responsible for opening external applications (.exe or .bat) as defined (for example, CaseViewer™ software can be opened after scanning is finished). These calls can run only the following scripts:

- cmd
- bat
- exe

The application cannot handle script languages that are not supported by the Windows Operation System.

You can define external application call settings for the following cases:

- Slide scanning has finished
- Scanning error has occurred

For Slide scanning has finished and Scanning error has occurred you can define the external software by entering the file path in the **Application** box, or by



browsing for it by clicking

If you define parameters in the Parameters field, it will pass them to the software that it starts. If no parameter is defined, then the parameter will not be passed.

The default parameters are the following:

- For **Slide scanning has finished:** "<SLIDENAME>" transfers the slide name
- For **Scanning error has occurred:** "<ERRORTEXT>" transfers the error message

**NOTE**: Pannoramic® Scanner 3.0.5 control software can provide not only the "<SLIDENAME>" but the path of the digital slide as well.

**Run** defines the window mode that the external application will start in. The following window modes can be set:

- Normal window
- Minimized
- Maximized

You can test whether the **Scanning Error Occurred** settings work by clicking lest .





#### Caution!

If C:\ProgramData\3DHISTECH\SlideScanner\MessengerUserPreferences.xml is missing or damaged, the External application call feature will not be able to read the address book, therefore it will not operate. To solve this issue, the address book must be repaired or created again.

> In the Message Call section of the window complex messaging functions can be defined. Here you can setup parameters of the mail server, add or remove users, and set the message body in the Message subject field by entering a text for example, to inform recipients on the location of the scanner, or the slide set you are working with.

Click to test settings (by sending an e-mail to the address defined in the Email To field) after you have finished to check their relevancy before applying them.

First click **SMTP setup** to display the E-mail settings window, in which you can dedicate an e-mail server through which the software sends e-mails to the selected recipients.

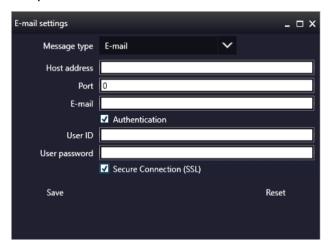


Figure 123: Messenger Setup window

In the Messenger Setup window, the following parameters can be set:

- Message Type E-mail
- Host Address
- Port
- E-mail
- Authentication User ID and User password are required.
- **Secure Connection (SSL)** If activated, the messages will be sent through secured connection.
- If you have properly set messenger settings, click **Save**.
- Click Add new user in the Message Call section of the External application call settings window then enter Display name and Address of the recipient. Select message functions under the Send Message if: field for the selected recipients (from the drop-down list at the top of the section).
- Click **Delete user** if you want to remove a user from the list after selection.



# - Report sender settings



Figure 124: Report sender settings

Add new recipients to the list by clicking + or remove selected from the list by clicking -. To send an example mail to the selected recipient, click. Open E-mail settings window to modify recipient data by clicking.



# Emergency slide functions

This panel contains control and maintenance functions.

#### Emerg. position

The slide holder will be moved to a position where the slide can be removed manually after opening the cover (see chapter *Opening the protective covers*).

#### Slide removed

Click this button to notify the software that you have removed the slide manually.



# - PSF settings

This panel serves to specify **Point Spread Function** values. PSF values are required to use the new deconvolution function. Click **Add filter** to add another filter to the list.



Figure 125: PSF settings

# 6.2 Service

Activate **Service** menu by clicking at the right side of the main menu bar.



Enter password first to enable service settings for modification.



Figure 126: Enter service password



#### - Camera settings

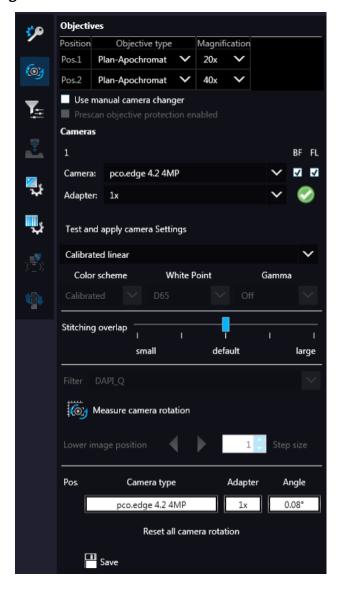


Figure 127: Camera settings

- Set **Position**, **Objective type**, and **Magnification** settings of the objective.
- Use manual camera changer Changing the cameras is performed manually.
- Pre-scan objective protection enabled If activated, slide area near the edges will
  not be scanned to record fast preview image. If inactive, Fast Preview processing
  becomes slower.
- Cameras Activate BF and/or FL mode for the camera. The software automatically loads the camera settings upon clicking the Test and apply camera settings button.
- Preset profiles are the following:

- Calibrated Linear: Color scheme is defined by calibration (Gamma value is not included).
- sRGB standard: Color scheme is defined by calibration (standard Gamma value -2.2- is applied).
- **sRGB standard Microscope Like:** Color scheme is defined by calibration (standard Gamma value / White Point: D50).
- **Legacy:** a Color scheme calibrated for the previous software version is applied.
- **Custom:** parameters are freely customizable as follows:

#### **Color Scheme**

- **Calibrated**: Scheme is defined by the color calibration slide.
- **Legacy:** A Color scheme calibrated for the previous software version is applied.
- **Raw:** the color information of the recorded raw image is applied.

#### **White Point**

- **D65:** color temperature according to a standard illuminant D65 white point value is applied (6500K / daylight).
- **D50**: color temperature according to a standard illuminant D50 white point value is applied (5000K / horizontal daylight).

#### Gamma

- Standard: a value of 2.2 is used.
- Medium: a value of 1.8 is used.
- Off: a value of 1.0 is used.



If Lumencor SPECTRA 6 is configured as illumination unit, the corresponding **Enable Lumencor hardware trigger** option is displayed on the **Filter settings** form.

- **Stitching overlap** Set the amount how much the FOVs should extend over.
- Measure camera rotation Camera rotation angle is measured.
- **Alpha blending** The two images are blended.
- **Lower image position** Moves the upper image sideways in distinctive steps.
- Reset all camera rotation Click this button to set camera rotation values to default.

Save settings by clicking





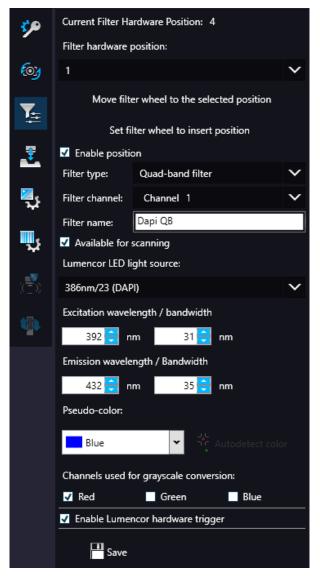


Figure 128: Filter settings

On this panel, you can define which filters occupy which turret positions.

- The actually set filter position is marked at the **Current filter hardware position** field.
- Select filter hardware positions from the **Filter hardware position:** drop-down list.



The maximum number of virtual filters is 50 if you insert Penta filters (and this type is selected from the **Filter type** list) in the available 10 filter positions in the turret.

- Move filter wheel to insert position
- Enable position



Whenever a selected physical filter is disabled, the filter itself must be removed from the turret.

- Select **Filter type**, **Filter channel**, and **Filter name**.
- Check **Available for scanning.**
- Set Lumencor LED light source, set Excitation and Emission wavelength / bandwidth values for the selected filter.
- Set Pseudo-color.
- Select channels used for grayscale conversion.
- Select Enable Lumencor hardware trigger.

Click Save to save settings.



#### Z-difference

This function is available only for fluorescence settings; it enables you to set the basic focus differences between the filters. This facilitates more precise focusing during scanning.



Figure 129: Filter settings



# - Image compensation

You can use a saved compensation image whenever compensation-related issues occur (deriving from the slide, illumination, staining or embedding medium irregularities).

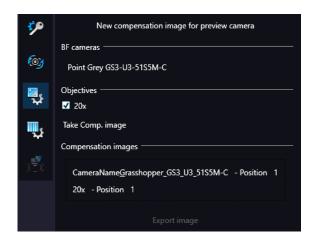


Figure 130: Image compensation window

- **BF cameras** field displays the active camera. Currently, there is only one active camera for Brightfield mode.
- **Objectives** field displays the objective used for scanning.

There might be specks or minor etches on the surface of the compensation slide that require modifying the threshold settings. Therefore, the scanner will not use those areas for the creation of the compensation images. To modify the threshold settings, set the desired threshold value in the box.

To create the compensation image(s), click **Take Comp. image**. Click the **Stop** button to interrupt the process. The progress bar at the bottom of the window displays the progress of the compensation image creation.

• **Export image** – Save compensation image.



#### Barcode settings

By predefining barcode type, foreground color (black or white – the color of the barcode), and other settings, you enable the **Read Barcode** option when using the Pannoramic® Scanner 3.0.5 control software.

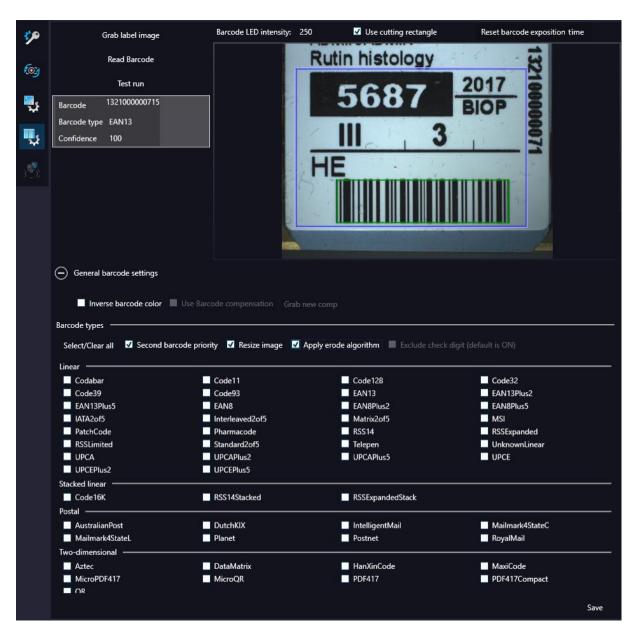


Figure 131: Barcode settings

To display an image of the barcode area, click . You can redefine the barcode reading area by dragging the edges of the blue square. To check whether the barcode reading settings are correct, display the barcode digits in the **Barcode** field by clicking

Bead Beroods. If the label area is not correctly illuminated, adjust Barcode LED intensity

value. Click to check that barcode settings are correctly set. Click **Reset barcode** exposition time to load default exposition time used for barcode reading.



If you did not set the figure correctly, or there is no barcode in the barcode area, the software will display the following error message: "Barcode detection unsuccessful! There might be no barcode present."

- Barcode reader library
  - o Select MIL barcode library or Embedded barcode library.
- General Barcode settings
  - Inverse barcode color

Activate to invert foreground and background colors of the barcode.

Use barcode compensation

A compensation image is used during barcode reading.

Grab new comp

Click this button to create a new compensation image for barcode.

**NOTE:** New compensation image for barcode can be recorded only if MIL is used for barcode identification.

- Barcode types
  - Linear
  - Stacked linear
  - Postal
  - o Two-dimensional
- **Second barcode priority** The software is capable to read two barcodes at the same time. If activated, the second barcode will be the barcode used for slide identification.



When having two barcodes on the slide, barcode layout must be consequential.

- Resize image Label image is downsized to 1:4 before barcode reading.
- Apply erode algorithm The *Erode* algorithm is run before barcode reading. It is a useful function for reading 2D barcode types since the algorithm completes the scuffed and faded areas of the barcode by applying the morphological erode filter to an image. This filter widens and enhances bright areas of the image.
- **Exclude check digit** Checksum value is ignored when reading *Interleaved2of5* and Code39 barcode types.



### – Microscope control

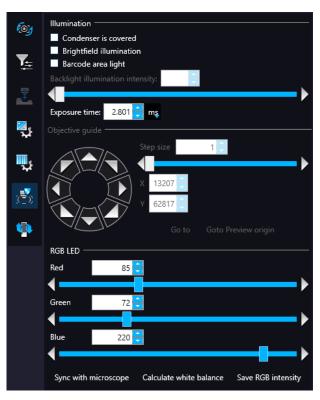


Figure 132: Microscope control settings

#### Illumination

- Condenser covered
- Brightfield illumination
- Barcode area light
- Backlight illumination intensity

### Objective guide

- o Step size
- o X/Y values or navigation arrows
- o Goto
- o Goto Preview Origin
- RGB LED
  - Set illumination intensity per channel
- Sync with microscope
- Calculate white balance
- Save RGB intensity



- Slide load tester



Figure 133: Slide load tester

Slide loading operation can be checked for each of the slides on the tray. Click **Insert tray** if the prepared tray is placed onto the feeder plate and pushed in.

Click **Start slide insert test** button to launch the process. Slides are loaded in, but preview image will not be recorded.

Slides will be tested in cycles based on the value set in the Loading cycle per tray field.

Click Remove tray when finished.

# 7 Hosting

Hosting a live teleconsultation session gives specialists the opportunity to examine the same Live microscopic image during a real-time counseling even if being in laboratories far away from each other. This means multiple users can connect to the device at the same time. The user of the scanner will be the host with direct access to the scanner.



Both the client's and the host's Pannoramic® Scanner 3.0.5 control software version must be identical.

Once client users have connected, they will be able to reach the following functions of scanner:

- Live image
- Preview window
- Profile content
- Stage control.

Each participant can see the same live image within the same preview window. The active user can navigate on the slide and set up a scanning profile. The **Start scan** function is also available for the active user. Each participant can make comments in a chat window while examining the slide image.



### Warning!

The user who starts hosting should not touch the hardware after the control has been passed on to avoid personal injury from possible hardware movements (for example, inserting new cassettes or slides, installing fluorescent filters, etc.).

#### Hosting a teleconsultation session

- 1. Select **Hosting** from the microscope mode menu.
- 2. Type in your nickname used during the session.
- 3. Click to start hosting the session.
- 4. The software displays the hosting address and the port number.



Figure 134: Teleconsultation host data

#### Join teleconsultation as a client

- 1) Start the Lite version of the Pannoramic® Scanner 3.0.5 control software.
- 2) Type in your nickname used during the session.
- 3) Enter Host address and Port number.
- 4) Click Connect.

On the client side the following functions are unavailable/inactive:

- Selection box
- Scan properties
- Separate scanning



During a fluorescence Live consultation, the shutter of light path will be closed automatically during the host time to save the sample from the burnout effect.

# **8 Using Profiles**



Saved profile settings cannot be applied if using a different type of Pannoramic® scanner.

If you want to scan a group of slides, it is advised to save your settings previously in a profile and continue scanning in Automatic mode. You can save the following settings in a profile:

#### Scan Mode

- Brightfield
- Fluorescent

#### **Scan Options**

- Focus frequency (in Fluorescent mode)
- Focus frequency (in Brightfield mode)
- Compression procedure
- Use of a fixed compensation image (in Brightfield mode ON/OFF)
- Use of Save focus quality (ON/OFF)
- Use of Stitching (ON/OFF)

#### Determination of the area to be scanned

- Use of automatic threshold specimen
- Use of specimen threshold value
- Use of marker pen threshold and specimen threshold values
- Remove coverslip function (ON/OFF)
- Use of scan everything within marked area (ON/OFF)
- Filling of holes (ON/OFF)
- Use of removing specks according to the set value (ON/OFF)
- Use saved scan area
- Use selection box (ON/OFF)

#### Fluorescent settings

- Filter position(s)
- Selected focus channel

- Selected stitching channel
- Flat field correction (ON/OFF)
  - Intensity statistics
  - Intensity reducing
  - o Intensity equalization
- Sharpening (ON/OFF)

### Other settings

- Limitation of focus range (ON/OFF)
- Focus quality (ON/OFF)
- Enable/disable Multilayer options
- Use of extended focus or Z-stack step size and focus level
- Output resolution

JANUARY 19, 2022

# 9 Troubleshooting and Maintenance

# 9.1 Recovery functions

PSW automated backups allow you to continue scanning after unexpected events within as little time as possible. After the program is restarted and the microscope is initialized, you can confirm the automatic restore of pre-event state by clicking **Yes**.

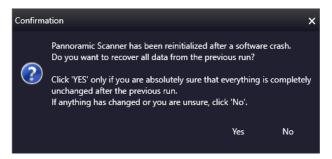


Figure 135: Recovery confirmation window



Click **Yes** only if you are sure that everything is completely unchanged after the previous run. If anything has changed or you are unsure, click **No**.

For more comfortable and safer use, the **Planner autosave** function allows the taking of automatic backups while creating a scan plan. The backups are placed in the default document folder of the actual windows user and can be loaded by clicking the **Load plan** button.

# 9.2 Safety information

Check cables, plugs and connections before operation, and if defective or cannot be replaced, contact 3DHISTECH Service for support.

Check whether the device is compatible with your local line voltage. It can operate at line voltages 100V to 240V and 50/60 Hz.

Only plug the device in a socket with protective grounding (earth) contact.

Do not operate the device in explosive environment.

Disconnect the device from the power outlet before opening it or replacing a part.

The product is not equipped with protection against hazardous materials (infectious, toxic, radioactive, corrosive substances or other effects damaging to health). Decontaminate infectious materials after use.

Slides that are not used any longer do not classify as domestic waste and must be treated as hazardous materials and disposed in compliance with the currently valid legal requirements.

Dust, specks, and humidity may decrease or harm the operating capability of the device. Protect it with dust cover when not in use. Switch the power off before covering it.

There is crush hazard during operation in the area of input or output. Trays should be moved through software. Never open the device unless prompted accordingly by the software.

Defective devices do not classify as domestic waste. Dispose of the device in compliance with the currently valid legal requirements.

#### **Lumencor SPECTRA 6 illumination unit**

- **NEVER** switch on the Lumencor SPECTRA 6 Light Engine illumination units when they are not connected to the microscope.
- Ensure that the light source is properly connected.
- Do not cover the unit, as it would cause abnormal temperature rising.

#### Lumencor SOLA SM II illumination unit

- Keep inflammable and combustible materials outside the range of SOLA SM II illumination unit.
- Do not expose yourself to the UV radiation of the **SOLA SM II** illumination unit.
- When the **SOLA SM II** illumination unit is switched on:
  - **NEVER** look directly into the fiber-optic cable.
  - **NEVER** remove the fiber-optic cable from the device.
  - **NEVER** connect the fiber-optic cable to the device.
  - o **NEVER** remove the housing from the device.

### 9.2.1 Cleaning the device

- Before cleaning, switch off the device and pull the plug out.
- Do not let liquid penetrate into the system.
- To clean liquid from the device, use a lint-free cotton cloth. You can moisten the cloth with water.
- To clean greasy surfaces, it is recommended to apply **soapy water** on a piece of lint-free cotton cloth and gently rub the surface.

### 9.2.2 Cleaning the trays

**NEVER** clean the trays with **Xylene** because it might harm the plastic. We recommend applying **Isopropanol** on a piece of lint-free cotton cloth and gently rub the surface instead. In case the tray is damaged, use either order a new one, as inserting a deteriorated tray could lead into unsafe loading of slides.

### 9.2.3 Preventive maintenance

### To prevent fungus growth

- Do not leave the equipment in an unconditioned environment with a storage temperature above 60°C (140°F) or below 0°C (32°F), which may damage the equipment.
- Maximum operating temperature is 35°C (95°F) with a relative humidity of less than 75%.
- Install it in a room with proper air ventilation.
- Do not let dust or fingerprints remain on optical surfaces.

# 9.3 Troubleshooting

This section describes the most common troubleshooting solutions for the Pannoramic® MIDI II product. If any problem arises that does not have solution in this manual, contact the service personnel.

#### The product does not start.

- Power supply is interrupted.
  - 1. Make sure that the 24V external power supply is on.
  - 2. Check cable connections.

#### Control software has stopped.

#### Slide jammed

- 1. Exit Pannoramic® Scanner 3.0.5 control software.
- 2. Switch off control computer and 24V power supply, disconnect power cable.
- 3. Remove protective covers. Follow the steps in chapter <u>Opening the protective</u> covers.
- 4. Remove slide manually (see chapter **Removing a slide**).
- 5. Reattach protective covers.
- 6. Reconnect 24V power supply and control computer to line power supply.
- 7. Switch on the 24 V power supply.
- 8. Switch on the control computer.
- 9. Launch control software.

#### Tray jammed

- 1. Exit Pannoramic® Scanner 3.0.5 control software.
- 2. Switch off control computer and 24V power supply, disconnect power cable.
- 3. Remove protective covers (see chapter **Opening the protective covers**).
- 4. Remove tray manually. If a jammed tray cannot be removed, contact service personnel.
- 5. Reattach protective covers.
- 6. Reconnect 24V power supply and control computer to line power supply.
- 7. Switch on the 24 V power supply.
- 8. Switch on the control computer.
- 9. Launch control software.

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Virtual slide is improperly focused almost across its entire surface.

- Focus range enabled
  - Disable Limiting focus range function.

#### Poor image quality

- Imaging error (for example, chromatic aberrations)
  - Contact 3DHISTECH Service for support.



Do not modify the camera driver settings, as the default factory settings give the most accurate images.

Virtual slides show poor stitching in Pannoramic® Viewer.

- Scan camera is not properly adjusted (for example, due to loose fixture)
  - o Contact 3DHISTECH Service for support.

#### Slide is often positioned incorrectly.

- Guiding fault in transport system
  - o Contact 3DHISTECH Service for support.

### Digitization process is extremely slow.

- Extended focusing option is activated.
  - o Deactivate the **Extended focusing** option if not required.
- Z-stack option is activated.
  - o Deactivate the **Z-stack** option if not required.

#### Image is out of focus. (in Manual mode)

- Focus range limit is activated.
  - o Deactivate the **Limiting focus range** option.
- Focus range setting is incorrect
  - o Change focus range setting.

#### All individual images show a shading effect.

- Algorithm failed to find empty image fields
  - o Capture a reference image with a blank slide.

### 9.3.1 Fluorescent applications (optional)

The switching of the Lumencor SPECTRA 6 cannot be triggered, despite triggering connection through the camera.

Contact 3DHISTECH Service for support.

No suitable exposure time can be found. Signal is too weak.

- Lumencor SOLA SM II is switched off.
  - o Switch light source on.

## 9.4 Maintenance

This section describes the most common maintenance solutions that can be performed by the user of the product. For maintenance solutions not described in this manual, contact the service personnel.

### 9.4.1 Opening the protective covers

To perform any maintenance work and to interrupt a running digitization procedure because of slide or tray jamming, the protective covers of the Pannoramic® MIDI II need to be opened to eliminate the problem.

Before removing the cover, exit Pannoramic® Scanner 3.0.5 control software, switch off the 24 V power supply and disconnect the power cables (exception: filter change).



To improve access to special points you can remove the covers completely.

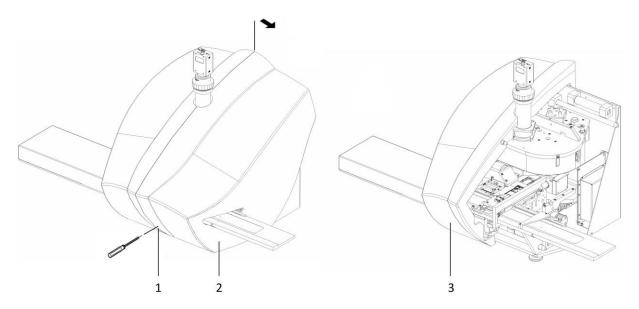


Figure 136: Removal of covers

The protective cover is composed of two halves locked to each other. Locate the hole (1) at the front of the right half of the cover (2):

- 1. Push with a blunt or long object (for example, with a 3 mm Allan key) against the opener lever behind the hole to open the lock. You will hear a "clack".
- 2. The right half of the cover can be pulled apart only after the FL tray cover is removed. To pull apart the other half, the left side FL tray cover must be removed first. For more information on how to remove the tray cover, see section 3.3 Inserting and Removing the Tray.



If necessary, one or both halves can be removed completely. For this purpose, push them to the right or to the left until they can be detached.

3. On completion of the maintenance or repair work, the cover halves must be pushed together again and locked. A "clack" sound can be clearly heard.



#### Caution!

Make sure that no cables are squeezed as you replace the cover(s). This refers in particular to the cable(s) of the scan camera.

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### 9.4.2 Removing a slide

If a slide got jammed or has suffered breakage during the process of digitization, stop the process and, if possible, move the slide holder to a position where the slide can be easily removed by clicking the **Emerg. position** button.



#### Warning!

Crush hazard! Before you remove a jammed slide, cancel the running digitization process, terminate the software session and turn the power off.

Any manipulation performed on a mechanical component must be followed by a complete device initialization routine (software restart).

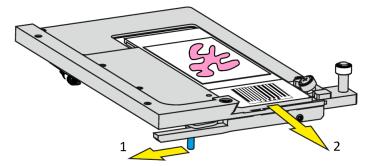


Figure 137: Removing a slide

- 1. Push protective covers apart (see chapter **Opening the protective covers**).
- 2. Move clamp (1) to the left, so the slide could be easily removed.
- 3. While holding the clamp pushed to the left, remove the slide (2) carefully.



#### Caution!

If the slide is broken, make sure to remove all pieces completely from the device. The edge of the broken area of the slide is sharp and it can lead to injury and contagion! Broken slide can be removed only by a well-trained person!

- 4. Push protective covers together again (see chapter **Opening the protective covers**).
- 5. Launch Pannoramic® Scanner 3.0.5 control software.

# 9.4.3 Installing and removing the filter module (fluorescent option)

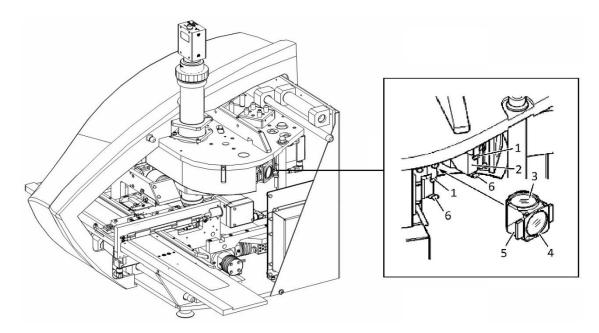


Figure 138: Installing and removing the filter module

1. Turn off the fluorescent illumination unit.



### Warning!

Crush hazard! Stop the running digitization process and turn off the scanner (refer to chapter <u>Power the scanner on/off</u>) before you proceed with filter module installation or removal.

- Select the desired filter in the corresponding software window (see chapter <u>Settings</u>). The
  filter will be positioned in such a way that the user can access it without having to turn the
  filter wheel manually.
- 3. Power off the scanner. See chapter **Power the scanner on/off** on how to power off the device.
- 4. Pull the pair of the protective cover halves apart or remove the right part completely (see chapter *Opening the protective covers*).
- 5. Hold the filter module by its handling pads (5) (one on the right, one on the left side of the module) and insert its upper part in forward tilted position under the upper spring-loaded clamps (1).

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### Warning!

Avoid touching the surface of the filters and store the modules in their own boxes when not used.

- 6. Press the filter module by its handling pads, until it safely connects to the bottom spring-loaded clamps (6) of the filter wheel. Mounting position of the filters: Excitation filter (4); Emission filter (3).
- 7. To remove the filter module, first slightly tilt it out of its bottom spring-loaded fixtures (6), then pull it out of the upper spring-loaded components (1) and take it off.
- 8. Push the protective covers back again (see chapter **Opening the protective covers**).
- Power on the scanner. See chapter <u>Power the scanner on/off</u> on how to power on the device.
- 10. Enter the respective parameters in the input fields of the software (see chapter <u>Settings</u>).
- 11. Turn the illumination unit on again.

### 9.4.4 Transporting Pannoramic® MIDI II

The following procedure shows how to transport Pannoramic® MIDI II in-house.



#### Notice:

The base unit does not have carrying handles for transporting. Two people can carry the base unit by holding it by its base plate. You can find the weight data of the base unit in chapter <u>Technical Data</u>.



#### Caution!

Be sure that the scan camera is not moved during transportation.

To transport Pannoramic® MIDI II do the following:

- 1. Turn power supply off and detach all cables.
- 2. Remove the slide tray if necessary.
- 3. Transport Pannoramic® MIDI II with the help of another person.
- 4. After finishing transportation, reestablish cable connections.



#### Caution

Do not lift or transport Pannoramic® MIDI II by holding its protective covers!



### Caution!

Readjust camera angle if necessary, after transporting and reinstalling the Pannoramic® MIDI II!

# 10 Technical Data

## Dimensions (width x depth x height)

Base unit	approx. 900 mm (W) x 500 mm (D) x 500 mm (H)	
Base unit with fluorescence option approx. 900 mm (W) x 500 mm (D) x 500 mm (H)		
24V 100W power supply	approx. 189 mm x 90 mm x 44 mm	

### Weight

Base unit	approx. 23 kg
Base unit with fluorescence option	approx. 26 kg
24V 100W power supply	approx. 550 g

### **Environmental conditions**

### Transportation / Shipment (packed)

Permissible ambient temperature	-40°C to +70°C
Storage	
Permissible ambient temperature	o°C to +6o°C
Permissible relative air humidity (non-condensing)	25-75%

### Operation

Permissible ambient temperature	+10°C to +35°C
Permissible relative air humidity	25-75%
Altitude at installation site	max. 2000 m
Atmospheric pressure	70 to 110 kPa
Degree of pollution	2

# Operating data

Intended site	closed room facilities	
Electrical protection class	I	
Internal protection degree	IP 20	
Electrical safety	in compliance with DIN EN 61010-1:2001, DIN EN 61010-2- 101:2002 (IEC 61010-1:2001, IEC 61010-2-101:2002)	
Over-voltage category	II	
Radio interference suppression	in accordance with EN 55011 class B	
Noise immunity	in accordance with EN 61326-2-6:2012	
Base unit input voltage	24V DC ± 1V	
Power consumption of the complete device	60 VA	

## SINPRO MPU101-108 – 24V external mains power supply unit

Intended site	closed room facilities	
Electrical protection class	I	
Internal protection degree	IP 20	
Electrical safety	in compliance with UL 2601-1, TÜV EN 60601, CE EN60601-1- 2:2001	
Over-voltage category	II	
Radio interference suppression	in accordance with CISPR-11 EN 55011 class B	
Line input voltage	100 V AC to 240 V AC	
Line input frequency	50 / 60 Hz	
Power consumption	max. 100 VA	
Secondary voltage	24V DC	
Secondary current	max. 4.8 A	

# Light sources

Transmitted light source – RGB LED	Multichannel LED-based with wide red, green, blue emission	
Average service life of transmitted light source	~ 30000 hrs	
Fluorescent light source 1 (optional)	SOLA SM II 365 (5 solid-state sources producing white light)	
Wavelength range	350–680 nm	
Average service life	20 000 hours	
Fluorescent light source 2 (optional)	SPECTRA (6 individually addressable solid-state light sources)	
Average service life	20 000 hours	

### Preview camera

Preview camera	VRmagic VRmC-8+ PRO
Sensor	CMOS, rolling shutter
Sensor size	<i>ሃ</i> ."
Resolution	2056×1544
Pixel size	3.2 um x 3.2 um
Max. frame rate	13 Hz
Bit depth	8/10 bit

# Objectives

Plan-Apochromat	20×/NA 0.8 or 40× Corr/NA 0.95

### Scan cameras

# Point Grey Grasshopper 3 (GS3-U3-51S5M-C) Global Shutter Type CMOS (Sony IMX250)

Pixel size	3.45μm × 3.45μm
Camera resolution	2448 (H) × 2048 (W) pixel
Frames rates	75 fps
Bit-depth	10-bit / 12-bit
Pixel resolution with 20x objective and 0.63x C-mount adapter	0.27μm
Pixel resolution with 20x objective and 1x C-mount adapter	0.17μm
Pixel resolution with 40x objective and 0.63x C-mount adapter	0.14µm
Pixel resolution with 40x objective and 1x C-mount adapter	0.09µm
Connection type	USB 3.0

## pco.edge 4.2 13.3 mm × 13.3 mm sCMOS (CIS2020A)

Physical state	6.5
Pixel size	6.5 μm x 6.5 μm
Camera resolution	2048 x2048 active pixel
Camera max. speed	100 fps at full resolution (2048 × 2048 pixel)
Bit-depth	16 bits
Pixel resolution with 20x objective and 1x C-mount adapter	o.33µm
Pixel resolution with 20x objective and 1.6x C-mount adapter	0.20μm
Pixel resolution with 40x objective and 1x C-mount adapter	o.16µm
Pixel resolution with 40x objective and 1.6x C-mount adapter	o.10µm
Cooling	Peltier with forced air (fan)
Connection type	Dual Camera Link Full (10 taps, 85MHz)

### pco.edge 4.2 bi

13.3 mm × 13.3 mm backside illuminated sCMOS

Pixel size	6.5 µm x 6.5 µm
Camera resolution	2048 x2048 active pixel
Diagonal	18.8 mm
Shutter mode	rolling shutter (RS)
мтғ	76.9 lp/mm (theoretical)
Fullwell capacity	48 000 e-
Dynamic range (typ.)	26667: 1 up to 88.5 dB
Quantum efficiency	up to 95 %
Dark current (typ.)	o.2 e-/pixel/s @ -25 °C sensor temperature
DSNU	0.9 rms e-
PRNU	1.20%
Cooling	Peltier with forced air (fan)
Frame rate	40 fps @ full resolution
Exposure / shutter time	10 μs 20 s
Pixel scan rate	46.0 MHz
Pixel data rate	184.0 Mpixel/s
Region of interest (ROI)	horizontal: steps of 32 pixels
	vertical: steps of 8 pixels
Trigger input signals	frame trigger, acquire (SMA connectors)
Trigger output signals	exposure, busy (SMA connectors)
Data interface	USB 3.1 Gen 1
Time stamp	in image (1 µs resolution)

# Control computer, minimum system requirements

Operating System	Microsoft Windows 10 Professional 64-bit EN
СРИ	Intel Xeon W-2245
RAM	64 GB DDR4
Hard disk	256 GB SSD + 2×1 TB HDD
Optical drive	DVD-RW
Display	96 dpi
Graphics	SXGA (1280×1024, True color)
Input devices	Keyboard, mouse
Ports	2xDouble CameraLink port; 1 FireWire (1394 A); 4 × USB 2.0
Network connection	1 Gb/s Ethernet cable class CAT6A with Rj45 connector