



QUEST SPECTRUM® 3

Instructions for Use (US version)



Intraoperative Fluorescence Imaging
Open and Minimally Invasive Surgery



Document Change History

Summary of Change					
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4	4230	9 - 10	10-DEC-2024	AGU	Added charging instructions and correcting the power dissipation

5	4278	11 - 12	09-JAN-2025	AGU	<i>Removal of redundant software classification</i>
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Open and Minimally Invasive Surgery



**Corporate Headquarters**

Quest Medical Imaging B.V.
Westrak 3
1771 SR Wieringerwerf
The Netherlands

Website: www.quest-mi.com

Customer Service and Technical Support

Email: qpd-support@olympus.com
Phone: +31-227-60-40-46

Location USA

Quest Medical Imaging Inc.
10000 Cedar Avenue
Suite 3-164
Cleveland, OH 44106 U.S.A.

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1 Health and Safety Compliance

1.1 Important Information



WARNING: Read Before Use



This instruction manual contains essential information on using the QUEST SPECTRUM® 3 safely and effectively. Before use, thoroughly review this manual and use the system as instructed.

Keep this manual in a safe, accessible location. Questions or comments about any information in this manual should be sent to Quest Medical Imaging B.V.

The following signal words serve to distinguish between warning notes according to the type of danger:



WARNING: indicates risks to the safety of the patient or user. Failure to follow warnings may result in injury to the patient or user.



CAUTION: indicates risks to the equipment. Failure to follow cautions may result in product damage.



Note: provides special information to clarify instructions or present additional useful information.

1.2 Indication for Use

The Quest Spectrum® is a fluorescent imaging system used in capturing and viewing fluorescent images for the visual assessment of blood flow for the evaluation of tissue perfusion, and related tissue-transfer circulation in tissue and free flaps used during plastic, reconstructive and reconstructive surgeries.

The system uses direct visualization for open procedures, or via a laparoscope for minimally invasive procedures.



WARNING: The QUEST SPECTRUM® should be used according to its approved Indication for Use.

1.3 User Qualifications

This manual is addressed exclusively to qualified and trained personnel (licensed physician, medical assistants supervised by a licensed physician). The QUEST SPECTRUM® 3 is to be used exclusively by qualified personnel to carry out clinical applications.



WARNING: This manual does not explain or discuss clinical procedures. The qualified personnel is responsible for correct execution of clinical procedures.

1.4 Repair and Modification



WARNING: The QUEST SPECTRUM® 3 does not contain any user-serviceable parts. Annual preventive inspection or maintenance is required. Do not disassemble, modify, or attempt to repair it. Patient or user injury and/or instrument damage can result.

Minor problems that appear can be solved by Troubleshooting, refer to 10 Appendix A: Trouble Shooting. If a problem cannot be resolved, contact Quest Medical Imaging. Before sending it back:

- ❖ Clean, disinfect and sterilize the light guide cable and laparoscope thoroughly prior to returning for repair.
- ❖ Clean and disinfect the QUEST SPECTRUM® 3 and its camera and ring light.
- ❖ Return the part in its original packaging. If this is not possible, package the part to secure it for transport.
- ❖ Quest Medical Imaging is not liable for damage resulting from improper shipping.



Note:

The QUEST SPECTRUM® 3 and its separate components are backed by a warranty period according to the national regulations on parts and labor, starting from the moment that the product is dispatched from Quest Medical Imaging B.V. The warranty covers defects in parts as described in the Terms and Conditions.

1.5 Serious incident reporting

If a serious incident occurs with the Quest Spectrum® 3, report it to Quest Medical Imaging B.V., and the relevant national authority.

2 System Overview

2.1 Components

The QUEST SPECTRUM® 3 is a Fluorescent Imaging System designed and developed to assist in open and minimally invasive fluorescence image-guided surgery and consists of the following components shown in Figure 1.

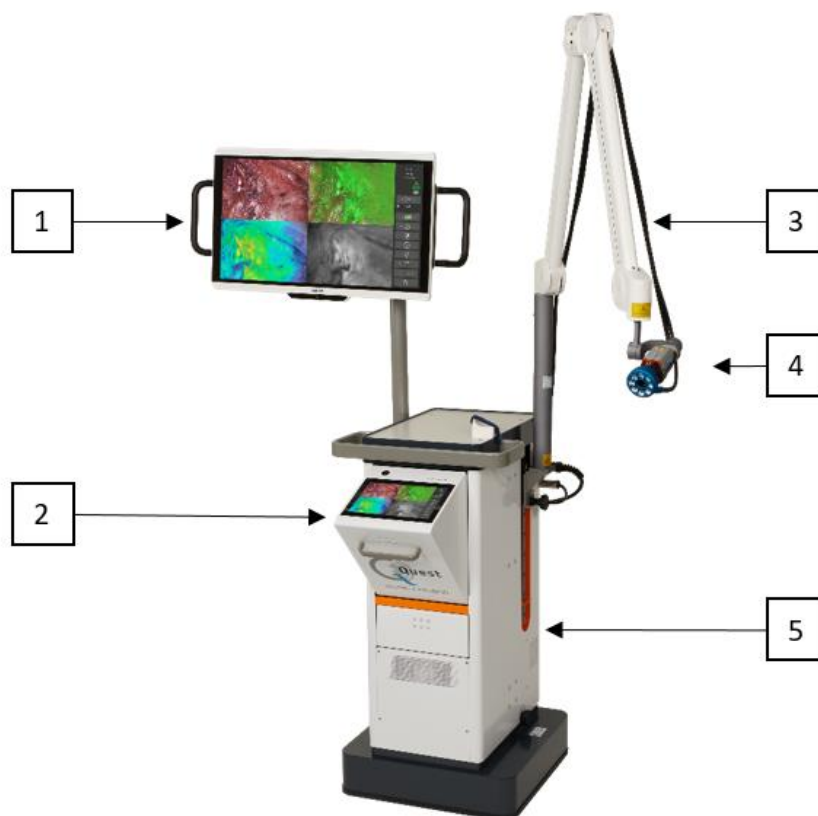


Figure 1: Overview of the QUEST SPECTRUM® 3. 1) 4K UHD surgical display, 2) IPC, 3) Mechanical Camera Arm, 4) Camera, 5) Trolley



WARNING: Do not use the QUEST SPECTRUM® 3 with components that have not been clearly identified for use with the system



WARNING: Do not exchange components of the QUEST SPECTRUM® 3 between devices.



Note:

The QUEST SPECTRUM® 3 can be used for minimal invasive surgeries by connecting the QUEST SPECTRUM® Laparoscope to the QUEST SPECTRUM® Camera.

2.2 Imaging Agent

- ❖ The Indocyanine Green (ICG) imaging agent is a sterile, water-soluble lyophilized green powder. ICG contains not more than 5.0% sodium iodide.
- ❖ ICG for Injection USP is dissolved using Sterile Water for Injection and is to be administered intravenously.
- ❖ Instructions for preparation, handling, and administration of ICG imaging agent are provided in Chapter 4 ICG Safety.








2.3 Article List

Table 1: Overview of all articles sold with the QUEST SPECTRUM® 3. ¹Laparoscopes have a separate manual, ²Drapes have a separate manual, ³USA only.






Article Number	Item Name
System	
ART-SYS-0029	QUEST SPECTRUM® 3 for VIS/ICG/MB 115V
ART-SYS-0030	QUEST SPECTRUM® 3 for VIS/ICG/MB 230V
Included components	
ART-HH-0016	QUEST SPECTRUM® Camera
ART-LE-0016	QUEST SPECTRUM® Light Engine
ART-MC-0004	QUEST SPECTRUM® IPC
ART-MC-A01-0012	Barco Branded 4K UHD surgical display
ART-CS-0107	QUEST SPECTRUM® Capture Suite
ART-TR-C01-0006	QUEST SPECTRUM® Mechanical Camera Arm
ART-TR-B01-0010	QUEST SPECTRUM® Power Battery Module
ART-TR-B01-0011	QUEST SPECTRUM® Battery Pack
Optional components	
ART-RL-0012	QUEST SPECTRUM® Ring Light & Lens
ART-LAP-0008	QUEST SPECTRUM® Laparoscope 30° ¹
ART-LAP-0008S	QUEST SPECTRUM® Laparoscope 30° Short ¹
ART-LAP-0009	QUEST SPECTRUM® Laparoscope 0° ¹
ART-LAP-0009S	QUEST SPECTRUM® Laparoscope 0° Short ¹
ART-OP-0007	QUEST SPECTRUM® Light Cable ¹
Drapes	
ART-DRP-2-001	SPECTRUM® drape for Open Surgery ²
ART-DRP-1-001	QUEST SPECTRUM® two-piece drape Laparoscopic Surgery ²
Kits	
ART-ICG-0001	QUEST SPECTRUM® Kit for open surgery ³
ART-ICG-0002	QUEST SPECTRUM® Kit for laparoscopic surgery ³

3 General System Safety

3.1 Electrical Safety – General

-  **WARNING:** To avoid risk of electric shock, this equipment must only be connected to a supply main with protective earth.
-  **WARNING:** Do not use the system adjacent to or stacked with other equipment. If adjacent or stacked use is necessary, observe to verify normal operation in the configuration in which it will be used.
-  **WARNING:** Do not connect multi-socket extension cords to QUEST SPECTRUM® 3. Connecting additional devices may overload the power supply of the QUEST SPECTRUM® 3.
-  **WARNING:** Do not connect devices to QUEST SPECTRUM® 3 that are not compliant with IEC 60601-1. Non-compliant devices may cause the QUEST SPECTRUM® 3 to stop functioning or show abnormal behavior.
-  **CAUTION:** Do not use or store liquids around the QUEST SPECTRUM® 3. If liquid enters components of the QUEST SPECTRUM® 3, immediately turn system off and unplug it from the power outlet.
-  **CAUTION:** Do not insert objects into the ventilation holes of QUEST SPECTRUM® 3 enclosure.
-  **CAUTION:** Do not connect or disconnect the camera cable while QUEST SPECTRUM® 3 is powered on.

3.2 Electrical Safety – Power

-  **WARNING:** Do not connect any devices to the power connectors inside the QUEST SPECTRUM® 3. Connecting additional devices may overload the power supply of the QUEST SPECTRUM® 3.
-  **WARNING:** Do not use the QUEST SPECTRUM® 3 if the power cord or plug is damaged or modified in any way.
-  **WARNING:** Do not remove or override the ground connection on the power cords.
-  **WARNING:** It is required that the user plugs the QUEST SPECTRUM® 3 into the mains power socket for a duration of eight hours once in six months to ensure a sufficiently charged battery.
-  **CAUTION:** Unplug power cords by grasping the plug. Do not unplug power cords by pulling on the cable.

3.3 Damaged or Malfunctioning Equipment

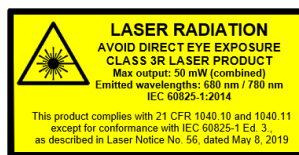


WARNING: Do not use QUEST SPECTRUM® if any part of the system is damaged or does not function properly. Failure to follow this warning may lead to injury.

3.4 Light Safety



WARNING: Do not detach the optical fiber from the ring light or laparoscope when the excitation light source is enabled. Without qualified optical components ring light or laparoscope, the excitation light source must be considered class 3R and corresponding precautions must be taken.



WARNING:



WARNING: Do not directly view in the beam.



WARNING: Do not target the beam directly into others' eyes.



WARNING: Do not look in the QUEST SPECTRUM Light Engine's exit port (see 7.2.2 for the exact location of the exit port).



WARNING: Do not stare into the output of the light engine. The brightness of this light source is higher than most commercial lighting fixtures and is intended to couple directly into a lighting cable.



CAUTION: Do not open the unit. There are no serviceable parts inside and opening the Light Engine enclosure will void the manufacturer's warranty.



CAUTION: Do not shine Light Engine beam in the direction of other people or at reflective surfaces.

3.5 Cleaning and Disinfecting



WARNING: Follow the instructions in Chapter 9 to clean, disinfect and/or sterilize the QUEST SPECTRUM® 3 components and accessories.



WARNING: Do not sterilize the Ring Light with Lens.

3.6 Heat



WARNING: The light source can generate significant amount of heat (exceeding 41°C/106°F) at the scope tip, the scope light post, the light cable tip, and/or near the light cable adapter. Higher levels of brightness from the light source result in higher levels of heat. Always adjust the brightness level of the camera and the monitor before adjusting the brightness level of the light source. If the brightness level of the light source can be adjusted, set it to the minimum brightness necessary to adequately illuminate the surgical site.

In addition, adjust the internal shutter of the camera higher in order to run the light source at a lower intensity. Avoid touching the scope tip or the light cable tip to the patient, and never place them on top of the patient, as doing so may result in burns to the patient or user. In addition, never place the scope tip, the scope light post, the light cable adapter, or the light cable tip on the surgical drapes or other flammable material, as doing so may result in fire.

Always place the light source in standby mode whenever the scope is removed from the light cable, or the device is unattended. The scope tip, scope light post, light cable adapter, and light cable tip will take several minutes to cool off after being placed in standby mode, and therefore may still result in fire mode, and therefore may still result in fire or burns to the patient, user, or inanimate objects.



WARNING: Never use the QUEST SPECTRUM® 3 in the presence of flammable or explosive gases

4 ICG Safety

4.1 Clinical Pharmacology

Following intravenous injection, Indocyanine Green (ICG) is rapidly bound to plasma protein, of which albumin is the principle carrier (95%). ICG undergoes no significant extrahepatic or enterohepatic circulation; simultaneous arterial and venous blood estimations have shown negligible renal, peripheral, lung or cerebral-spinal uptake of the dye. ICG is taken up from the plasma almost exclusively by the hepatic parenchymal cells and is secreted entirely into the bile. After biliary obstruction, the dye appears in the hepatic lymph, independently of the bile, suggesting that the biliary mucosa is sufficiently intact to prevent diffusion of the dye, though allowing diffusion of bilirubin. These characteristics make ICG a helpful index of hepatic function.

The plasma fractional disappearance rate at the recommended 0.5 mg/kg dose has been reported to be significantly greater in women than in men, although there was no significant difference in the calculated value for clearance.

4.2 Contraindications

ICG for Injection USP contains sodium iodide and should be used with caution in patients who have a history of allergy to iodides.

4.2.1 General

ICG Powder and Solution: ICG is unstable in aqueous solution and must be used within 6 hours. However, the dye is stable in plasma and whole blood so that samples obtained in discontinuous sampling techniques may be read hours later. Sterile techniques should be used in handling the dye solution as well as in the performance of the dilution curves.

ICG powder may cling to the vial or lump together because it is freeze-dried in the vials. This is not due to the presence of water - the moisture content is carefully controlled. The ICG is suitable for use.

4.2.2 Drug Interactions

Heparin preparations containing sodium bisulfite reduce the absorption peak of ICG in blood and, therefore, should not be used as an anticoagulant for the collection of samples for analysis.

4.2.3 Drug/Laboratory Test Interactions

Radioactive iodine uptake studies should not be performed for at least a week following the use of ICG.

4.2.4 Carcinogenesis, Mutagenesis, Impairment of Fertility

No studies have been performed to evaluate the carcinogenicity, mutagenicity, or impairment of fertility.

Pregnancy Category C: Animal Reproduction studies have not been conducted with ICG. It is not known whether ICG can cause fatal harm when administered to a pregnant woman or can affect reproduction capacity. ICG should be given to a pregnant woman only if clearly indicated.

Nursing Mothers: It is not known whether this drug is excreted in human milk. Because many drugs are excreted in human milk, caution should be exercised when ICG is administered to a nursing woman.

4.2.5 Pediatric Use

Safety and effectiveness in pediatric patients have not been established.

4.2.6 Geriatric Use

No overall differences in safety or effectiveness have been observed between elderly and younger patients.

4.3 Adverse reactions

Anaphylactic or urticarial reactions have been reported in patients with or without history of allergy to iodides. If such reactions occur, treatment with the appropriate agents (e.g., epinephrine, antihistamines, and corticosteroids) should be administered.

4.4 Over dosage

There are no data available describing the signs, symptoms, or laboratory findings accompanying over dosage. The LD 50 after I.V. administration ranges between 60 and 80 mg/kg in mice, 50 and 70 mg/kg in rats and 50 and 80 mg/kg in rabbits.

Under sterile conditions, the ICG for Injection USP powder should be dissolved with Sterile Water for Injection, *USP*. Exactly 5 mL of Sterile Water for Injection, *USP*, should be added to the 25-mg vial, giving 5 mg of dye per mL of solution.

5 Symbols and indicator Lights

Table 2: General Symbols and Signs














	Catalogue number
	Unique Device Identifier
	Serial number
	Type BF applied part
	Manufacturer
	Date of manufacture
	Consult instructions for use
	Mass
	WEEE directive symbol
	Temperature limit
	Humidity limit
	Fluorescence range
	Federal (USA) law restricts this device to sale by or on the order of a physician

Table 3: Symbols and Signs IPC







	On/ off button with blue light indicator
---	--

Table 4: Symbols and Signs Trolley

	<p>Aperture Warning: Do not view the beam with magnifying optical instruments (e.g., a loupe).</p>
	<p>Laser warning indications</p>
	<p>Do not step</p>
	<p>Mind your fingers</p>
<p>For open surgery only</p>  <p>Do not use this camera arm with a laparoscope</p>	<p>Do not use the mechanical camera arm with the laparoscope</p>

6 Disposal

The QUEST SPECTRUM® components and consumables should be disposed of in compliance with local, regional, and national regulations.

- ❖ Single use or consumable components and accessories such as the QUEST SPECTRUM® Drapes should be disposed in compliance with the regulatory regulations.
- ❖ Other QUEST SPECTRUM® 3 components should be returned to Quest Medical Imaging B.V. for disposal.

7 Unpacking and Setting Up

7.1 Unpacking the System




WARNING: Check according to Table 5 below if all components are complete and undamaged before proceeding installing the QUEST SPECTRUM® 3. Contact Quest Medical Imaging B.V. or representative if components are missing or damaged.

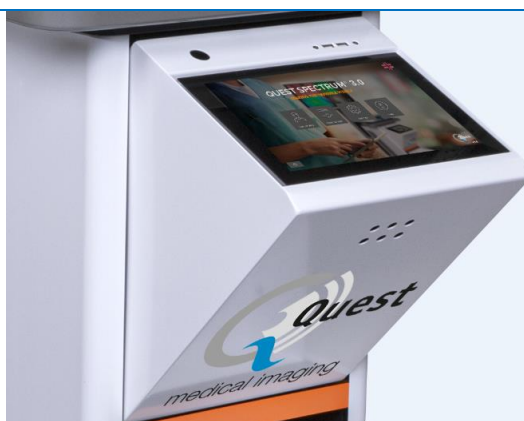


Note: The QUEST SPECTRUM® Drapes are purchased separately.

Table 5: Component summary

Description	Component
QUEST SPECTRUM® Camera + QUEST SPECTRUM® Ring Light (Optional)	
QUEST SPECTRUM® Camera + QUEST SPECTRUM® Laparoscope (Optional)	
QUEST SPECTRUM® Mechanical Camera Arm	

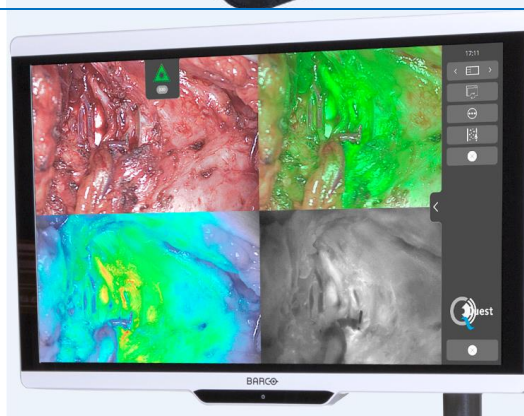
QUEST SPECTRUM® IPC



Trolley



Barco Branded 4K UHD surgical display



Instructions for Use



7.2 Setting Up QUEST SPECTRUM® 3

7.2.1 Installation of components

Quest Medical Imaging or a qualified representative will install the components.



CAUTION: Installation by personnel that is not qualified by Quest Medical Imaging can result in damage or failure of the device. Quest Medical Imaging is not liable for damage caused by installation by unqualified personnel.

7.2.2 Main power supply

In Figure 2 the main power supply of the QUEST SPECTRUM® 3 is shown. Make sure both cables are connected to ensure power supply and protective earth.



Figure 2: Main power supply



WARNING: Charge the QUEST SPECTRUM® 3 once in six months for eight hours by plugging in the power cable into a power socket.



Note: The yellow-green cable is omitted in the USA version. The protective earth is incorporated in the black cable.



Note: Make sure to use the metal frame above the power supply in order to prevent accidental disconnection of the cables which can result in undesired power loss.



Note: The plug can be disconnected from the system to isolate its circuits from supply mains

7.2.3 Camera and Light Connector

In Figure 3, the Camera and Light connection are shown. The camera adapter has a magnetic lock mechanism that eases the connection. The Ring light or the Laparoscope adapter can be connected to the Quest Spectrum®. Make sure the adapter is in the locked position: **push & click**

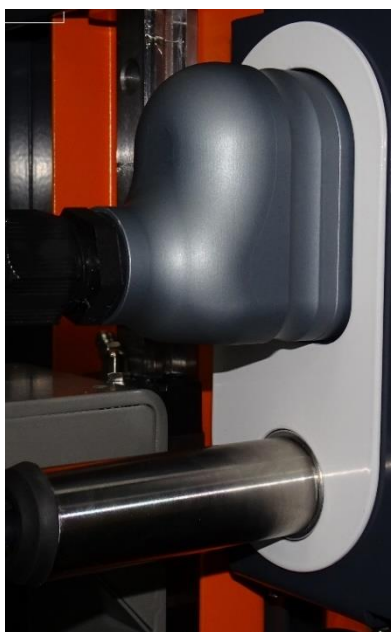


Figure 3: Camera and Light Connection

7.2.4 Connecting Ring Light or Laparoscope to the Camera

Depending on the procedure a laparoscope or ring light needs to be attached to the camera. The fully assembled camera consists of two parts: the camera & the ring light/laparoscope. When assembling, make sure that the three pins on the ring light/laparoscope fit into the camera.



Figure 4: Connecting the ring light/Laparoscope to the camera

Assembly:

- 1) Unlock the camera by turning the lens adapter clockwise (from the user's perspective)
- 2) Insert the ring light/ laparoscope into the camera
- 3) Make sure the lens adapter is back in the locked position:
 - a. Check if you hear a click
 - b. Check if rotation of the laparoscope/ring light is possible

8 Operation

8.1 Preparing the QUEST SPECTRUM® 3

Take the following into consideration before moving the QUEST SPECTRUM® 3.

1. If the Trolley is equipped with an arm onto which the camera or a monitor is mounted, the arm should be folded away before the Trolley is moved.
2. Ensure that objects being transported on the Trolley are properly attached.
3. Cables must be securely rolled away.
4. Before moving the Trolley, release the brakes
5. Use the side handles to push the Trolley.
6. Adjust your speed to the immediate circumstances.
7. Drive cautiously over inclines and obstacles such as cables and thresholds (elevator). If this is necessary, do it slowly by at least two persons.
8. Be aware that the Trolley always has a certain brake path.
9. If you plan to move backwards, watch out that you do not become trapped between the Trolley and obstacles.
10. When the Trolley is equipped with an arm to which the camera is attached, make sure that when moving (swivelling or lifting) the arm, trolley, or camera, neither hit any objects or persons. Do not pull or push the arm to move the Trolley!
11. Make sure to fold the IPC back in its closed position before moving the trolley.
12. Before use, select a stable location with sufficient space.
13. Use the Trolley only with the wheels in their fixed position (brakes applied).
14. The Trolley is usually placed on the other side from where the surgeon is positioned but can be placed in a different position if preferred.
15. The equipment on the Trolley needs a power supply to function. The Trolley is equipped with a medical isolation transformer located below in the Trolley, that is connected to the 5 m (16.4 ft) mains cable to the mains power supply. Always plug into an electrical socket with Protective Earth. Do not lay the mains cable over pathways and prevent persons from tripping over the cable.
16. All devices are to be connected via a potential compensation cable with the potential compensation bar. First connect the potential compensation (potential equalization) with the corresponding plug pin and then connect the mains plug. During electric safety measurements and tests (leakage currents, etc.) the potential equalization cable must be disconnected temporarily.
17. When all components of the QUEST SPECTRUM® 3 are connected and the Trolley is plugged into the mains power supply, the preparation is completed.



Note:

Prevent any kinks in the cabling during usage of the device.



WARNING:

The QUEST SPECTRUM® Laparoscopes needs to be sterilized prior usage. The sterilization procedures are explained in its own manual.

8.2 Brake instructions

The QUEST SPECTRUM® 3 can be put on the brakes by using the buttons on the side of the trolley.

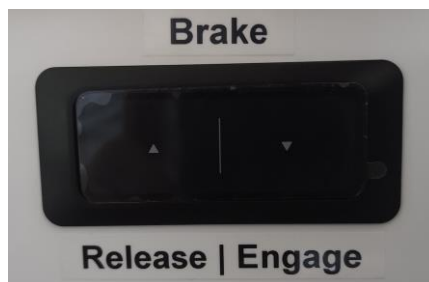


Figure 5: Brake control centre



CAUTION: Before lowering the brakes, make sure no cables or other objects are underneath.



Note: After putting the Quest SPECTRUM® idle for more than 6 months, the battery equipped braking functionality need to be recharged.

8.3 Powering on and Shutting the QUEST SPECTRUM® 3 down

The QUEST SPECTRUM® 3 can be powered on with the On / Off button which can be found on the IPC. The on/off button only needs to be pressed once. After having pressed once the blue light indicator should light up as an indicator that the system is starting up. This light will stay on until the system has been shut down.

The shutting down process also includes pressing the On / Off button once. As a result, the blue light indicator will start blinking as an indicator that the system is shutting down. The system has been shut down when the button stopped blinking.

8.4 Starting surgery

The QUEST SPECTRUM® 3 will load into the start surgery screen immediately after powering on (see figure 8). For the surgery to commence, the right surgeon and surgery type need to be selected (see figure 8 & 9). Also, an option is given to insert the patient's data (see figure 7). However, this step is not mandatory, it can be skipped. After all this, the surgery and imaging can start. The next pages give a more detailed explanation about the imaging.

The arrow in the upper left corner can be selected in both figure 7 and 8 when not wanting to start surgery. The user will then return to the home screen (see figure 6: Home screen). For more information about the home screen see chapter 8.8 "pin code" up till and including chapter 8.11 "help".

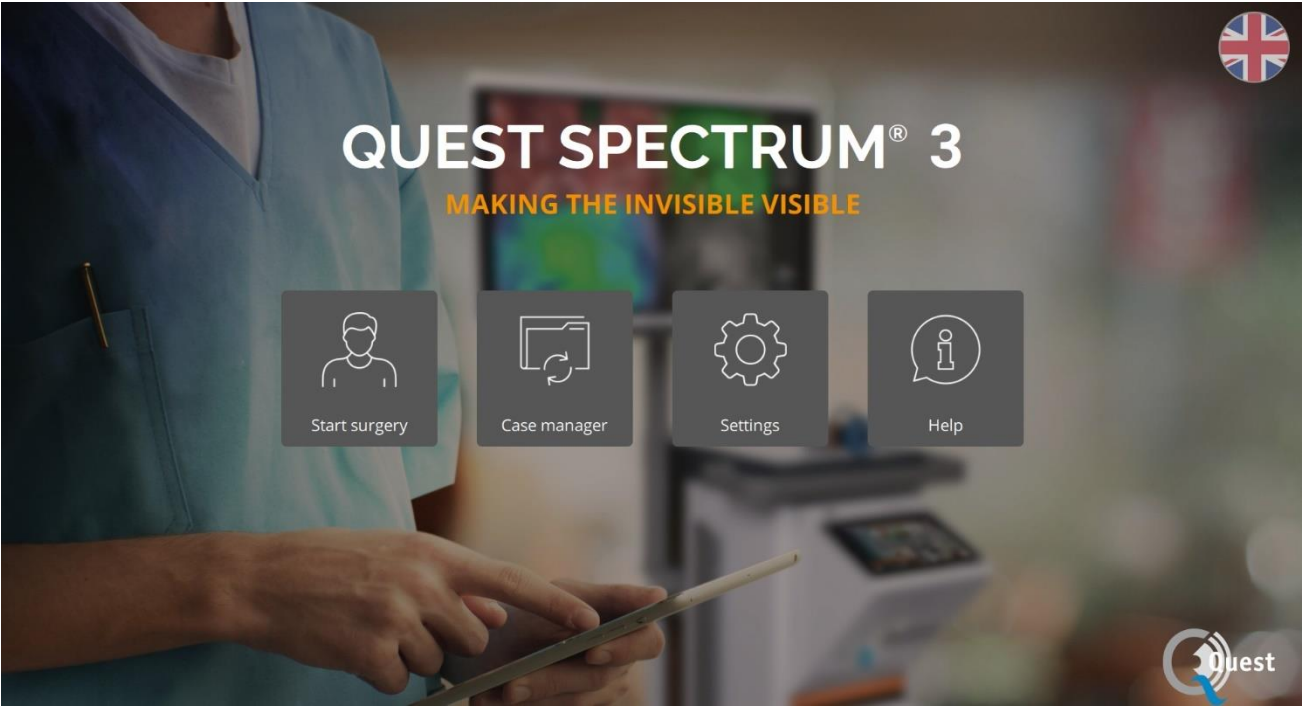


Figure 6: home screen

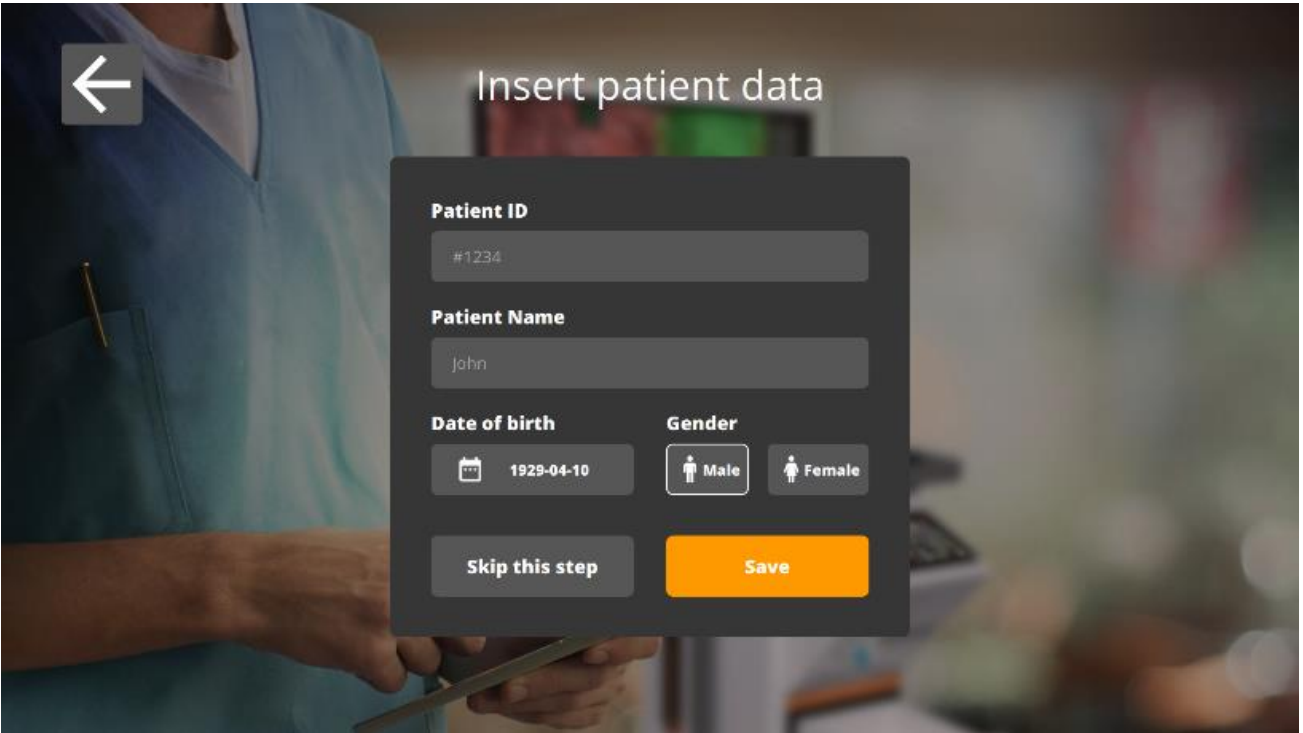


Figure 7: insert patient data

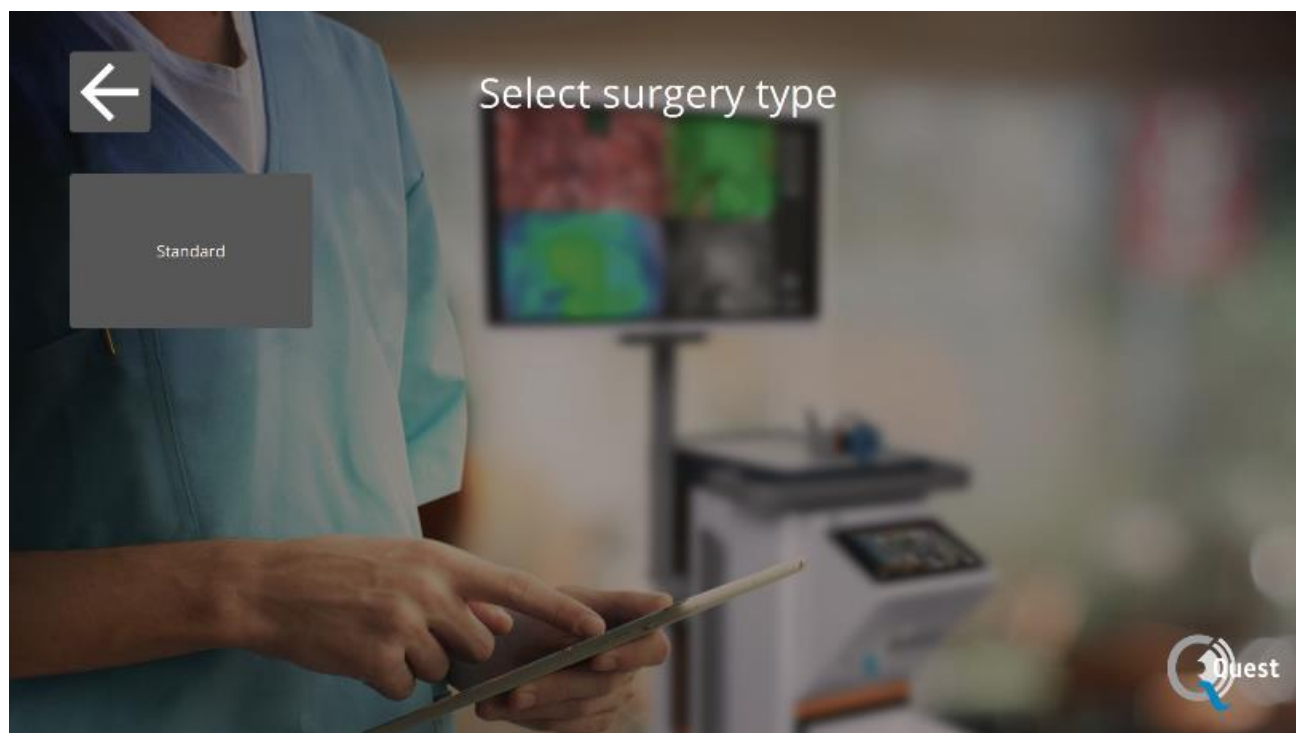


Figure 8: Start Surgery

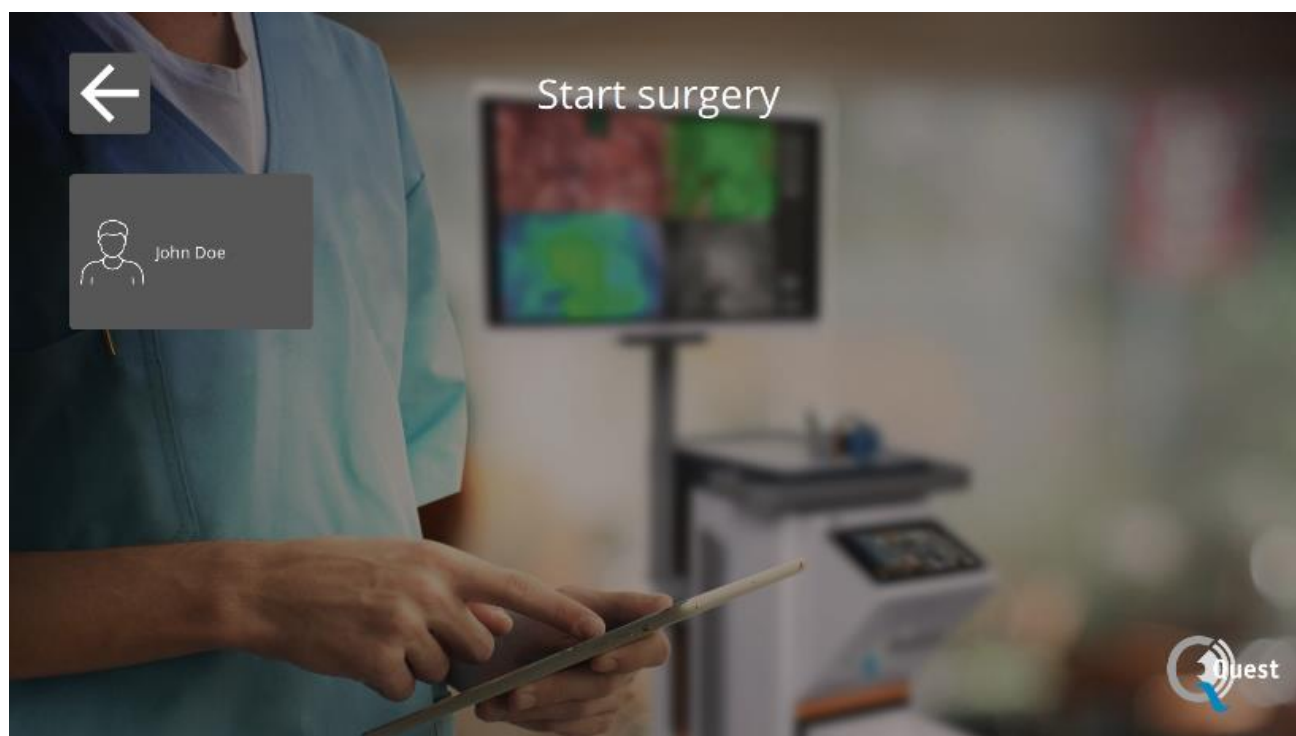


Figure 9: Select surgery



Focus

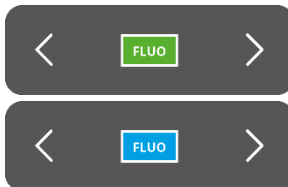
The camera can be focused manually by using the following options:

- By using the camera (see chapter 8.6 “using the camera”)
- By using the touchpad of the IPC

When focusing, the icon will be set to MF (Manual Focus), when done this will be set to the other icon.

Using the touchpad to focus

Select the icon on the touchpad of the IPC (see the first image on the left). When selected, the icon will transform into an icon as shown on the left. Focusing can be done by selecting the arrows on the side. When done focusing, select the icon again and it will transform back into his previous form.



Mode

When starting surgery, the correct mode needs to be selected otherwise no fluorescent overlay can be seen. There are two modes:

- Green icon: the 800 nm channel (supports the use of ICG)
- Blue icon: the 700 nm channel

It is important to know what kind of fluorescence is used before starting surgery in order for the correct mode to be selected.

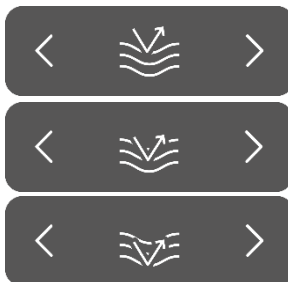


Note:

Only the ICG mode is activated for USA purposes.

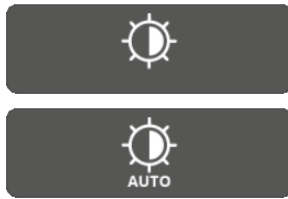
Sensitivity

The sensitivity can be increased by use of this function. When unable to clearly visualise the fluorescence during the procedure, this setting can be adjusted to improve the device's sensitivity. The sensitivity has three different modes, the arrow represents the sensitivity of the device within tissue, by increasing the sensitivity the arrow “penetrates” deeper through the tissue to symbolise the increase of the sensitivity



Note:

Consequently, when increasing the sensitivity, the real-time behavior decreases and the image noise increases. This may possibly result in a lower quality image.

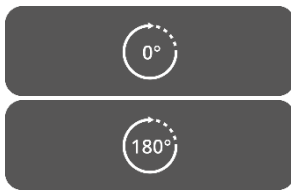


Brightness

The brightness is by default set to automatic so the image is optimizing the brightness with respect to the signal it obtains. This setting can be switched to locked, after which the brightness will stay fixed. The locked state could be used for comparison applications, in case all other image parameters are fixed.



Note: When the Brightness is locked the Mode, Sensitivity and Light settings are locked as well.



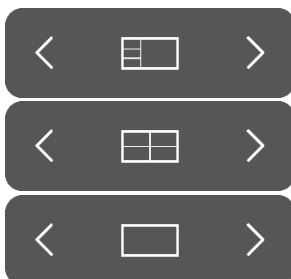
180° turn

When wanting to rotate the image a complete 180° this function can be used. The whole image will rotate 180° by simply selecting the icon on the side. The icon will also automatically transform into an 180° icon. By selecting the 180° icon the image will rotate back.



Total light output

By using this function, the total light output can be switched on and off with only one click. Both the laser and visible light output can be turned off or on by selecting the icon.



Viewing Modes





By using the arrows on the side of the icon, the monitor can be adjusted to the user's preferred settings. The different viewing possibilities of the monitor are shown on the left:

- 3x1 screen
- 2x2 screen
- 1x full screen

Rotating screens

There are 4 different screens (see table below). By using the arrows on the side of the icons the user can rotate through these various screens.

Table 6: overview different screens

Icon	Definition	Explanation
	<i>Red/Green/Blue</i>	Natural image that can be seen by the eye in colour.
	<i>Near infra-red</i>	Fluorescent response in grayscale
	<i>Overlay</i>	Overlay of fluorescent image in green with the Color image
	<i>Gradient</i>	Overlay of the fluorescent response in Color (Blue to Red) on the Color image in grayscale



Second menu

When selecting this icon, another menu will appear. With these extra settings the imaging can be perfected to create the best possible image. Further explanation about these options and possibilities can be found below.



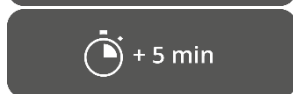
Exit

When wanting to end surgery this icon needs to be selected. A question will come up to ask for confirmation. After having verified to end the surgery, a new interface will show up: the Case view. See chapter 8.5 “Case view” for a more detailed explanation about this interface.



Snapshot

By pressing this icon, a snapshot will be made. The snapshot can be retrieved during surgery by selecting the “Timeline” icon. When wanting to access the snapshot after surgery, go to the case manager (see chapter 8.9)



Recording

By pressing the left camera icon, a live recording will be made. By pressing the square icon, the recording will be stopped. The recording can be retrieved during surgery by selecting the “timeline” icon. After surgery, the recording can be accessed by going to the case manager (see chapter 8.9)

When recording, a red-coloured circle will turn up next to the laser safety tag as an indicator that the recording has started, also a timer will show the user how much time of recording is left. Recording time starts off with 5 min. However, when wanting to record for a longer time press the “+ 5 min” icon and an additional 5 minutes will be added to the recording time.



Timeline

During surgery, snapshots can be retrieved by selecting this icon. They will be stored in chronological order with time stamps. For more information about retrieving recordings and snapshots after surgery see 8.9 Case manager.



Visible light

The amount of visible light can be adjusted by use of these icons. Increasing the amount of visible light has no influence on the fluorescence. Furthermore, increasing or decreasing the light is advised depending on the situation and personal preferences of the user. However, keep in mind: no visible light means there is no laser light as well.

As shown on the left there are 5 different settings. By using the arrows on the side, the user can scroll through these settings. Each next setting increases or decreases the visible light output by 25%. When wanting to turn the light output off completely without scrolling through all the settings, see *Total light output*.



Laser

The amount of laser light can be adjusted by use of these icons. Increasing the amount of laser light results in a greater fluorescent response. By default, the laser setting is at its highest level.

As shown on the left, there are 4 different settings. Scrolling through the settings is possible by using the arrows on the side. Each next setting increases or decreases the laser output by 33,3%. When wanting to turn the light output off completely without scrolling through all the settings, see *Total light output*.



Save settings

Personal preferred settings can be saved by using this function. The next surgery will then start with the same setting, so no time needs to be spent on finding the best settings again.



Back

By selecting this arrow, the user will return to the previous menu.

After adjusting the different settings for imaging during surgery, it is expected to observe the fluorescence on the area of interest, according to the screens and viewing mode selected (Figure 10).



Figure 10: Surgery mode view (ICG). Main image corresponds to Overlay (OV) mode. On the left, from top to bottom: RGB, NIR, GR modes.

8.5 Case View

After having ended the surgery the Case view screen will turn up (see figure 11). In this screen an overview is given of all taken snapshots and recordings. They are all organised in chronological order with timestamps beneath them. It is also possible to re-watch the snapshots and recording just by selecting them. By selecting the top right icon, the patient data can be accessed. When done, select the top left arrow and you will return to the home screen.

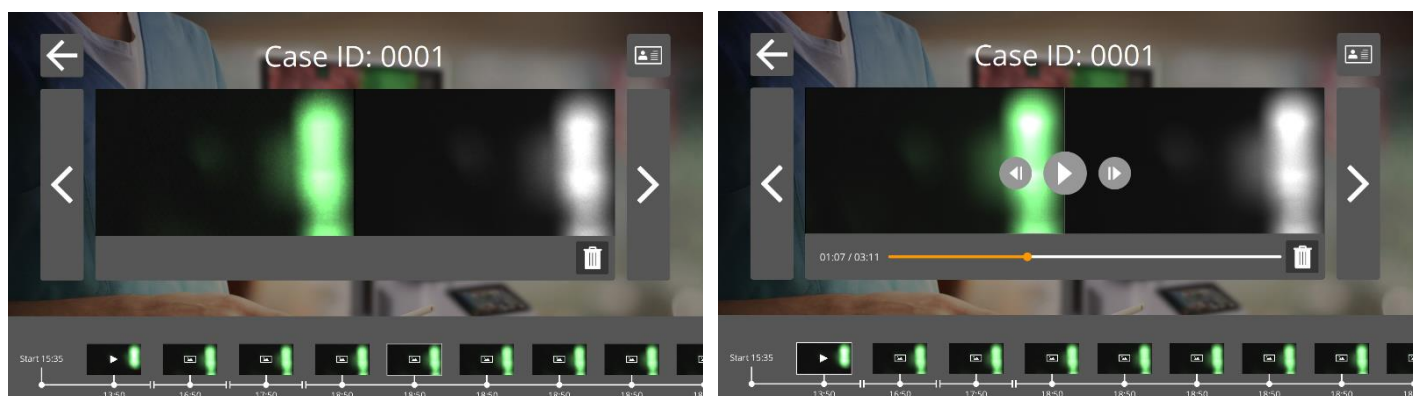


Figure 11: Case view





8.6 Using the Camera







Figure 12: camera

The tables below give an overview of all the options and functions of the camera. There are two different tables, the first one showcases all the options and functions when the menu is closed, and the second table shows the various camera options when the menu is open. Each table has also been divided into two parts: “No focus” and “MF” (manual focus). “No focus” symbolises all the functions and options when the manual focus has not been selected and MF represents the opposite situation.

Table 7: overview camera functions

		Menu Closed	
		No focus	MF
	Long press	start video/end video	start video/end video
	Short press	snapshot	snapshot
		Turn Manual Focus on	Turn manual focus off
		<u>Not applicable</u>	<u>Not applicable</u>
	Long press	open menu	open menu
	Short press	<u>Not applicable</u>	<u>Not applicable</u>

		Menu Open	
		[o]	MF
	Long press	start video/end video	start video/end video
	Short press	snapshot	snapshot
		Turn Manual Focus on	Turn manual focus off
		Scrolling through menu	Manual focusing
	Long press	Closes menu	Closes menu
	Short press	Selecting an icon	Selecting an icon

For an open surgery, the camera can be handheld or held by the mechanical camera arm included. For minimally invasive surgery, the camera must be equipped with the laparoscope.

8.7 Using the Camera Arm

The mechanical camera arm can be used for holding the camera during an open surgery (Figure 13). It is not meant for its use in minimally invasive surgery procedures. The mechanical arm can be adjusted to move the camera to the region of interest. Before usage, this component is sterilized by putting sterile drapes over the camera, gripper, and joints of the mechanical arm.

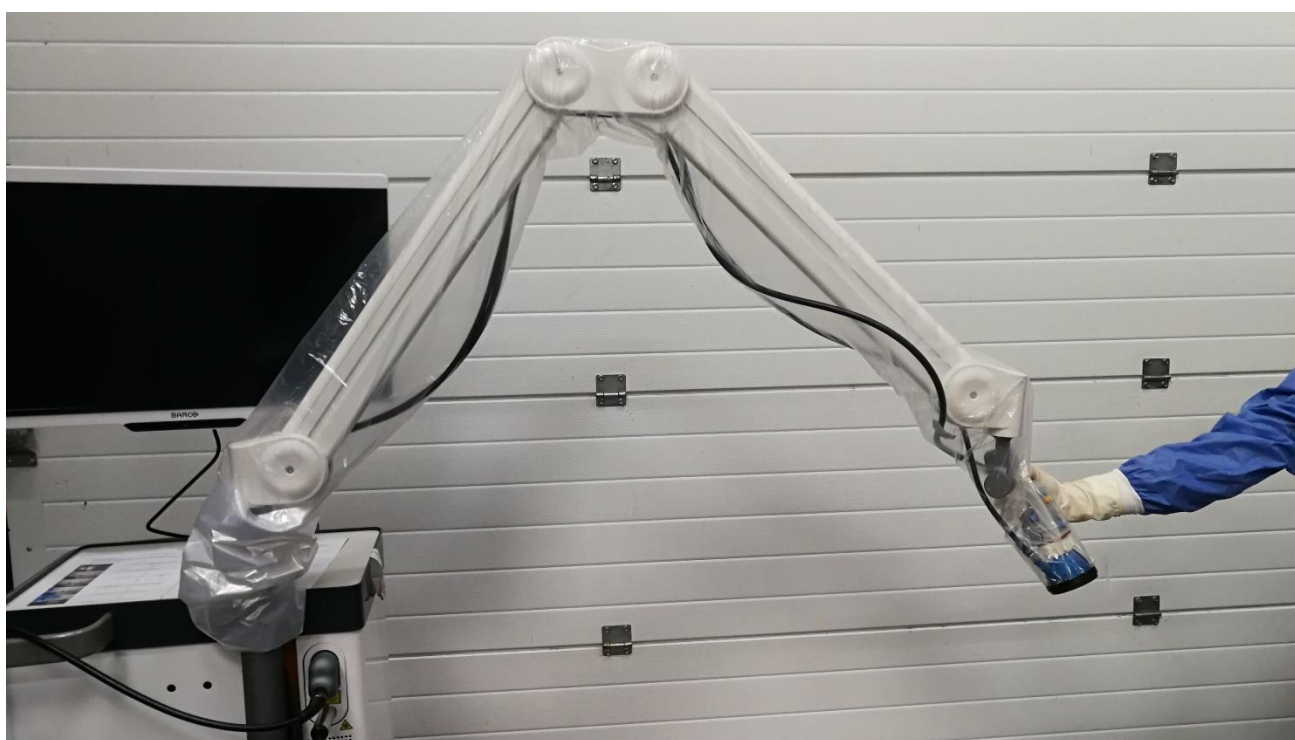


Figure 13: Mechanical Camera Arm

For setting the camera in the mechanical arm, it needs to be slide across the gripper. The cable must be also across the gripper. Rotate the cable of the ring light for the camera to slide accordingly, then as shown in Figure 14. The cable of the camera and ring light should be fastened to the clips located along the joints of the arm (Figure 15). Cables should not be tight between joints, to avoid any damage due to pulling.



Figure 14: Camera positioned in arm gripper



Figure 15: Cables secured in camera arm



WARNING:

Do not use the QUEST SPECTRUM® Mechanical Camera Arm with the QUEST SPECTRUM® Laparoscope.



WARNING:

Detach Camera from QUEST SPECTRUM® Mechanical Camera Arm before using as handheld.

8.8 Pin code

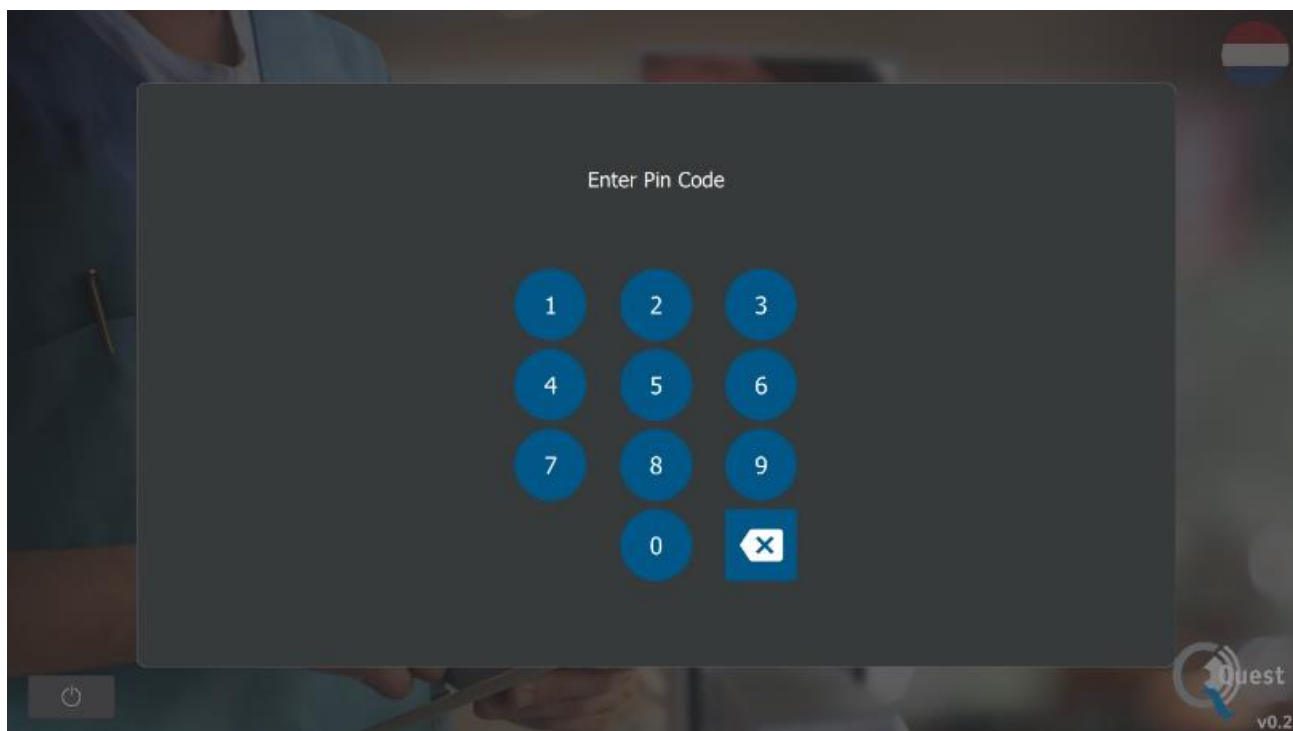


Figure 16: Pin code

Each surgeon is given a personal four-digit pin code. This pin code is requested when wanting to access the “case manager” and the “settings”. First, the correct surgeon needs to be selected. Thereafter, the surgeon’s correct pin code needs to be entered (see figure 16).



Note:

Please note that a surgeon can never be logged in. Every time a user wants to access the “case manager” or “settings”, the pin code is requested. Sharing the pin code with third parties is not advised.

8.9 Case manager

All the taken recordings are stored in the “case manager”. The Case manager can be found on the home page (see figure 6). After selecting the “case manager” icon, a surgeon must be selected. Accessing the recordings can only be done by entering the surgeon’s personal pin code. After having entered the code, an interface as shown in figure 17 will appear. Now, all the recordings and snapshots taken by the surgeon can be accessed. All the snapshots and recordings can be filtered on date by selecting the calendar icon. The search bar can be used as well to search a specific patient for example.

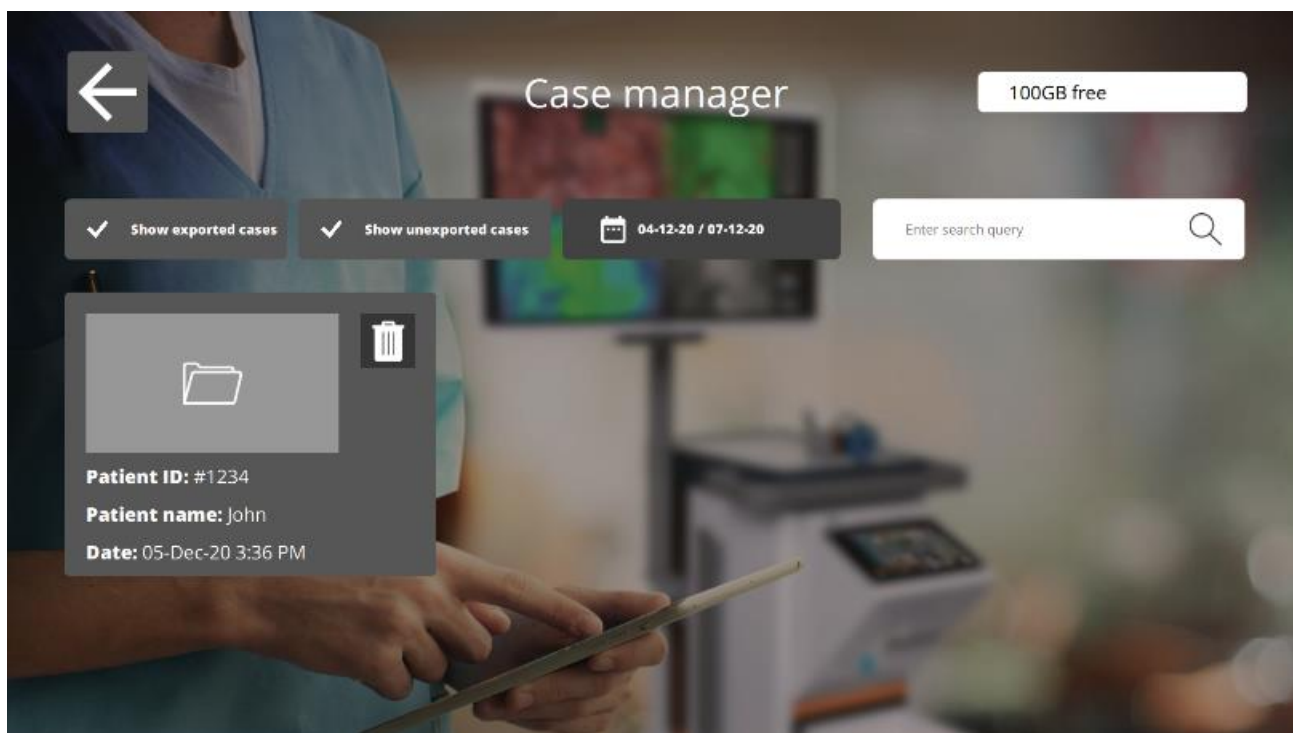


Figure 17: Case manager



Delete

By selecting this icon, recordings and snapshots can be deleted.



Export

When wanting to export a recording or snapshot, this icon should be selected. After having selected this icon, the correct device needs to be selected and all content can be exported to this device. Devices can be connected by using the USB ports on the IPC.

8.10 Settings

After selecting the settings icon on the home page (see figure 6) an interface similar to figure 18 will appear. The user has two access options:

- Access the surgeon's settings (by selecting the surgeon and entering the correct pin code see 8.8)
- Access the technical staff's settings (see figure 19 and figure 20 and further explanation below)

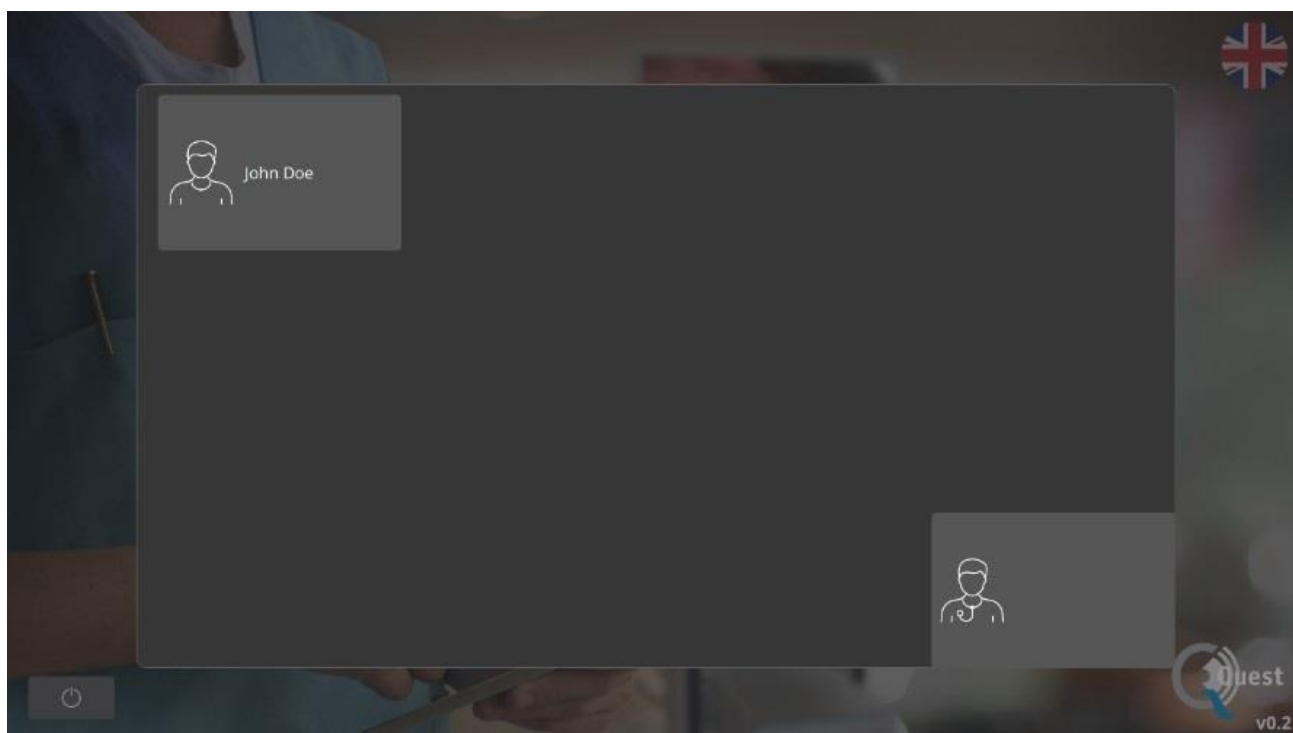


Figure 18: Settings

Technical service settings

When having entered the correct pin-code after selecting the option Technical service, an interface as shown in figure 19 will appear. See an explanation about the setting options below.

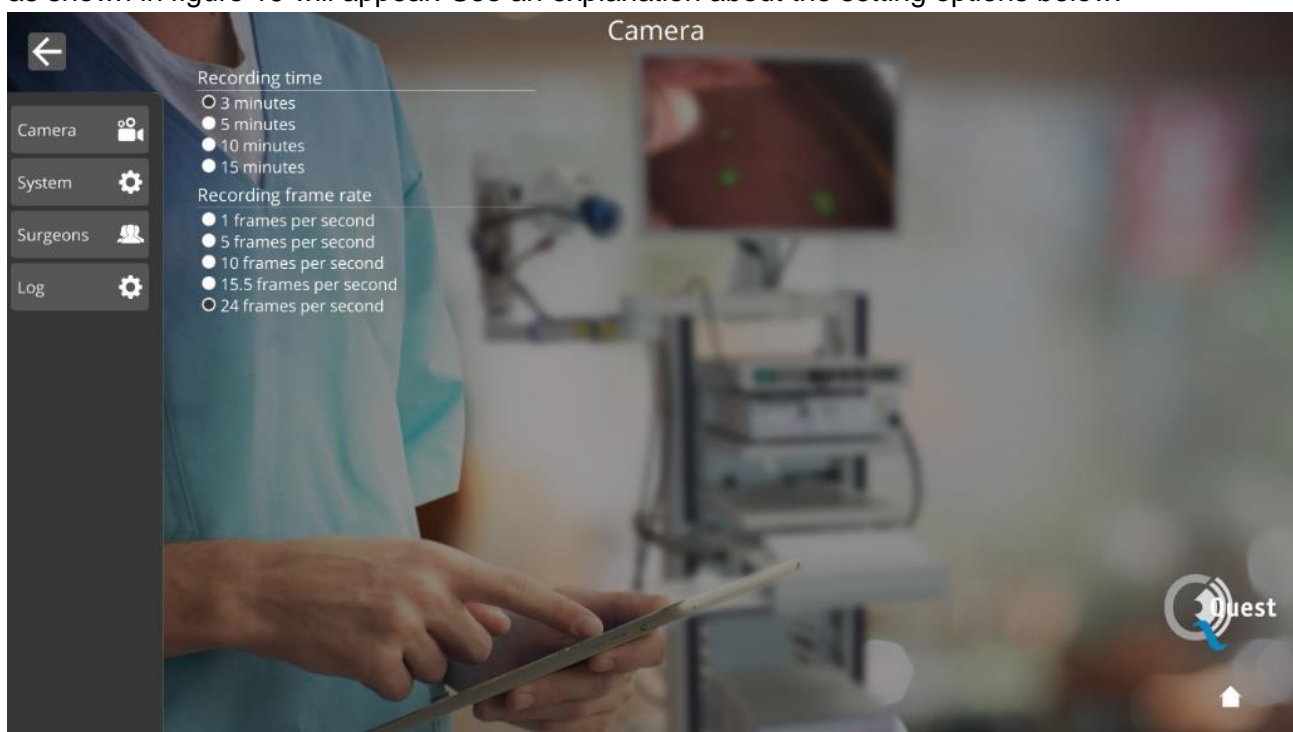




Figure 19: Technical service settings


- Camera




By selecting this icon, the recording time and the frame rate during recording can be changed to the user's preferences.
- System



The language and pin code settings can be changed by selecting this icon.
- Surgeons



When wanting an overview of all registered surgeons this icon should be selected.
- Log



After pressing this icon, a log of all activities is given. The log includes time stamps of the activities and names of the active users.

Surgeon's settings

After having selected the surgeon and correct pin code, an interface as shown in figure 20 will appear.

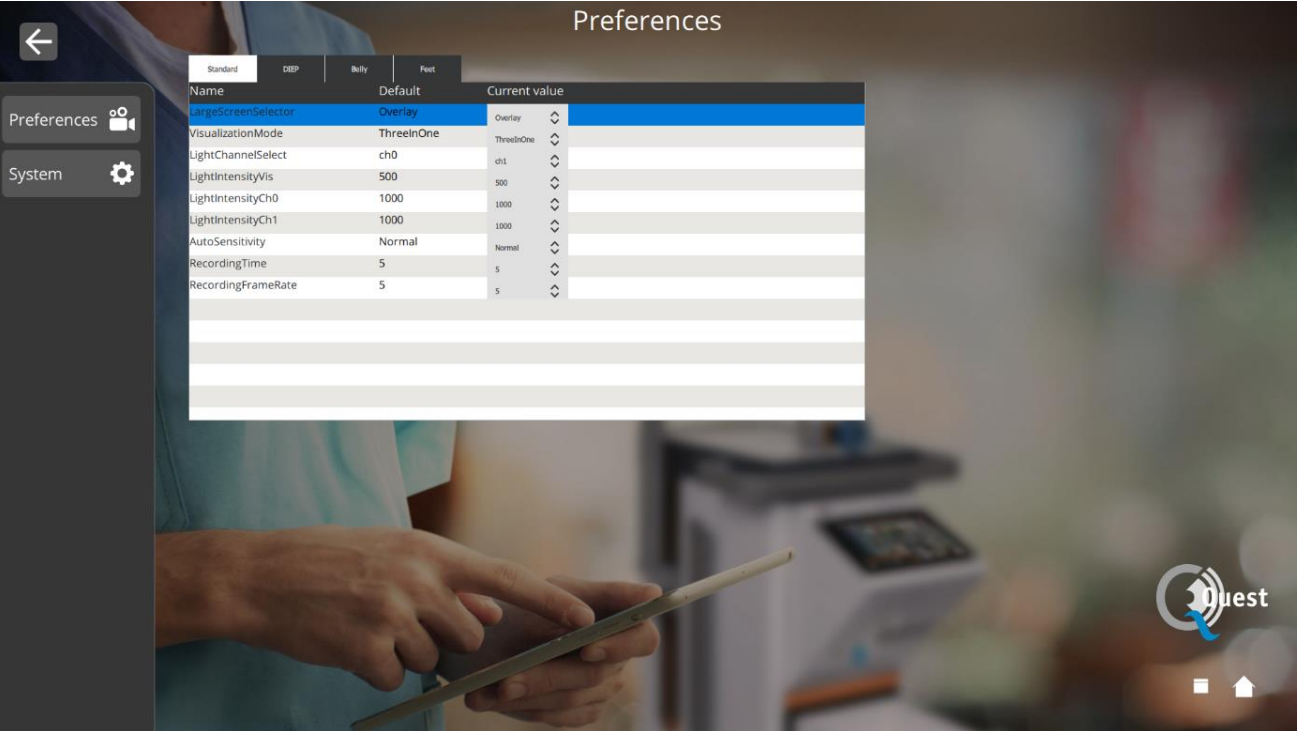



Figure 20: surgeon's settings

- Preferences



By selecting this icon, settings can be set to the surgeon's preferences. Advised is not to change much, by default the best settings have been set.



The language and pin code settings can be changed by selecting this icon.

8.11 Help

The “help” icon on the home page can be selected when experiencing trouble with the system (see figure 21). Advised is first to try and solve the problem by using the appendix trouble shooting (see *appendix A: trouble Shooting*). When still experiencing trouble, the “help” icon should be selected. After selecting this icon an interface like figure 9 will appear containing all contact details for help. Depending on what country the user is in, different contact details are needed. This information can be retrieved by selecting the correct country on the left-hand side of the screen.

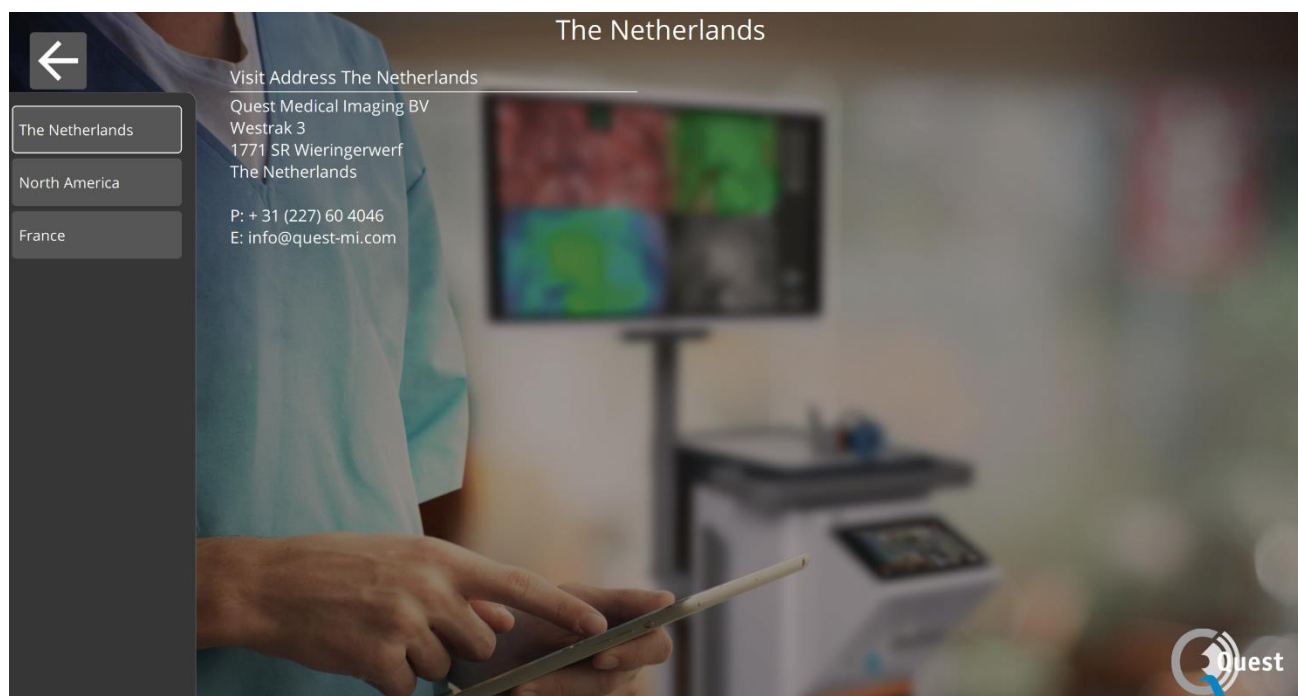


Figure 21: Help

8.12 System Security and Protection

To ensure this system remains safe and secure from viruses and spyware/malware, the following security best practices are recommended:

- Physical access to the system should be in accordance with facility policies.
- It is the user's responsibility to ensure that the media used for data communication, such as USB drives, are free from viruses.
- Media used for data communication, such as USB drives, used to create copies of patient records should be handled and stored in a secure manner.
- Media used for data communication, such as USB drives, should be regularly scanned for malicious software to prevent infection.
- Separate accounts should be created for each user.
- Users should not share accounts nor passwords.
- User passwords should be changed after a user is created and at intervals as identified by IT policies.
- Change the password of the technical account of the hospital.
- Remove user accounts when a user no longer requires access (change in personnel, move, etc.)
- Turn the system off when not in use.
- Users should log out of the case overview when finished.

9 Cleaning, Disinfection and Sterilization

9.1 Cleaning Instructions

Cleaning:

- ❖ Make sure to unplug the main power supply before cleaning
- ❖ Use a slightly moistened lint free soft cloth material. Do not soak in cleaning fluids as liquid ingress into unit may result in damage of the electronics. A mild detergent is permissible.
- ❖ Wipe down the system with a dry, lint free cloth.
- ❖ Wipe off water drops immediately

Disinfection:

- ❖ Wipe the QUEST SPECTRUM® 3
- ❖ with a soft and lint free cloth moisturized with 70% IPA solution.

External housing materials of the device are powder coated or anodized aluminum.

9.2 Sterilization

Laparoscopes and their Lighting Cables are compatible with conventional sterilization methods. The operating facility is responsible for the sterility of the Laparoscopes and Optical Fiber Cables.

For cleaning and sterilization of your Laparoscope and Optical Fiber Cables, see their Instructions for Use.



CAUTION: Do not sterilize the Lens with Ring Light.

9.3 Maintenance

Refer all repairs, maintenance, or service work to the Quest Medical Imaging.

The QUEST SPECTRUM® 3 does not contain any user-serviceable parts. Annual preventive inspection or maintenance is required.

10 Appendix A: Trouble Shooting

10.1 Trouble shooting

Table 8: Trouble shoot overview

Situation	Recommended action
System does not start after pressing the on / off button	Check whether the on/off button lights blue (if not press the on/off button till it turns blue) Restart the system after 1 minute Try another socket Replace fuses (see 10.2)
Monitor is black while other components are working	Check if all cables are connected. Check if monitor is turned on.
Images in Surgical App are black	Check if all cables are connected Turn off device as described in section 8.3. Restart System after 1 minute.
Image flickers 'on and off' within one second	Turn all surgical lights off, with exception of the light generated by the QUEST SPECTRUM® 3.
No fluorescence appears	Check that the laser is turned on. Check that the system illuminates light. Check that the injected product is fluorescent Check that the injected dose is appropriate Check that the right fluorescent tracer is selected.
Unexpected bright areas	Check that all surgical lights are turned off. Check if the fluorescent tracer can accumulate or leak to those areas Check if the tissue could fluoresce by itself Check if the light is not reflected by other medical equipment.
The contrast of the fluorescent image is too low	Check that all surgical lights are turned off. Move the camera closer to the tissue. Increase the light intensity of the laser.
The image appears too bright	Decrease the intensity of the light source.
No laser- or visible light	Check if the main power supply is connected Check if all cables regarding the light engine are connected
Frozen screen	Check if all cables are connected Turn off device as described in section 8.3 Restart the system after approximately 1 minute
Light engine overheated	Check that all ventilator holes not blocked

10.2 Fuse Replace Procedure



Note:

If a fuse needed to be replaced make sure that both fuses are replaced at the same time.

To replace the fuses, unscrew the fuse holder as shown in Figure 22. The fuses can be found just above the main power supply.



Figure 22: Replacement of the fuses

Pull out the fuse from the fuse holder (see Figure 23) and replace it with a new fuse.

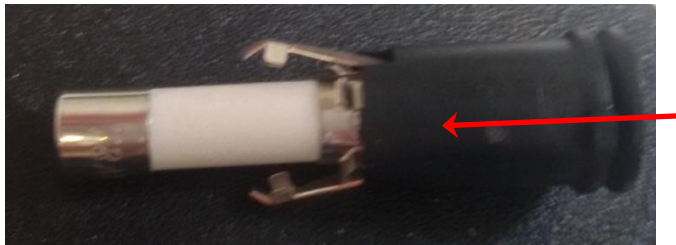


Figure 23: Pull out the fuse

Screw the fuse holder back in place.

11 Appendix B: Technical Specifications

Table 9: Technical specifications

Item	Value		Remark
	EU	US	
Input voltage	230V AC	115V AC	
Input frequency	50Hz	60Hz	
Power dissipation	450 W	450 W	
Current consumption	1.9A	3.8A	
Fuse rating	2 x 5A (In series) p/n ART-ETC-0011	2 x 8A (In series) p/n ART-ETC-0008	Ceramic or sand filled
Medical Device Classification	Ila	2	
Device classification (IEC 60601)	Class 1 BF type		
Maximum installation height	1000 m		
Temperature range	10 - 30 °C		Operating
	-20 - 50 °C		Storage
Humidity range	30 - 85% R.H.		Operating
	10-85% R.H		Storage
IP class	20		
Laser class	Class 3R		See chapter 3.4 for details
Dimensions	53 x 53 x 194.5 cm		
Weight	199 kg		

Table 10: Cable specifications

Item	Max. length	Remark
Power cord	5 m	
Camera cable	3 m	

12 Appendix C: EMC and Environmental Safety

The QUEST SPECTRUM® 3 has been tested and found to comply with electromagnetic compatibility (EMC) limits for medical devices to IEC/EN 60601-1-2. These limits are designed to provide reasonable protection against harmful interference in a typical medical installation. The QUEST SPECTRUM® 3 does not have Essential Performances as referred to in IEC 60601-1 and ISO14971 standards.

12.1 Electromagnetic interference

Medical electrical equipment requires special precautions regarding EMC and must be installed and operated according to these instructions. It is possible that high levels of radiated or conducted radio-frequency electromagnetic interference (EMI) from portable and mobile RF communications equipment or other strong or nearby radio-frequency sources could result in performance disruption of the imaging system. Evidence of disruption may include image degradation or distortion, erratic readings, equipment ceasing to operate, or other incorrect functioning. If this occurs, survey the site to determine the source of disruption, and take the following actions to eliminate the source(s).

- ❖ Turn equipment in the vicinity off and on to isolate disruptive equipment.
- ❖ Relocate or re-orient interfering equipment.
- ❖ Increase distance between interfering equipment and your imaging system.
- ❖ Manage use of frequencies close to ultrasound system frequencies.
- ❖ Remove devices that are highly susceptible to EMI.
- ❖ Lower power from internal sources within facility control (such as paging systems).
- ❖ Label devices susceptible to EMI.
- ❖ Educate clinical staff to recognize potential EMI-related problems.
- ❖ Eliminate or reduce EMI with technical solutions (such as shielding).
- ❖ Restrict use of personal communicators (cell phones, computers) in areas with devices susceptible to EMI.
- ❖ Share relevant EMI information with others, particularly when evaluating new equipment purchases which may generate EMI.
- ❖ Purchase medical devices that comply with IEC 60601-1-2 EMC Standards (3V/meter EMI immunity, limit interference level to 0.0014 V/meter).
- ❖ Always use and plug in the Potential Equalizer Conductor for safe use according to 60601-1 standard.

12.2 Electrostatic discharge

Electrostatic discharge (ESD), or static shock, is a naturally occurring phenomenon. ESD is common in conditions of low humidity, which can be caused by heating or air conditioning. Static shock is a discharge of the electrical energy from a charged body to a lesser or non-charged body. The degree of discharge can be significant enough to cause damage to a transducer or an imaging system. The following precautions can help reduce ESD: anti-static spray on carpets, anti-static spray on linoleum, and anti-static mats.

12.3 General notes and benefits of potential equalization

The voltage of a conductor or body to earth is called the "potential" of this conductor or body. The earth is electrically neutral and thus has the potential "zero". The unit of measurement for the potential is volt. A conductor or body has the potential "zero" (earth potential) if it is conductively connected with the earth. As a consequence of damage to the insulation, voltages may be transmitted to metal parts which do not belong to the service circuit. This causes the development of potentials between the metal parts which might be dangerous for man. If a man touches two different metal parts at a time - for instance an electrical device and a water pipe - he bridges the existing potential and current flows through his body. The flow of electric current through the body of a human being could be mortal. A remedy for this is a potential equalization to zero potential. Potential equalization therefore can be seen as an additional earthing (in addition to normal earthing included in power cords) and improves the safety standard of medical devices and medical systems. Potential equalization has the additional benefit of equal voltage potential on all involved metal housings of medical devices of a medical system. Different voltage potentials on housings could lead to false measurements during medical diagnosis, since the difference of voltage potential of the medical devices within a system would interfere with voltage measurements (ECG, EMG, etc.) of the human body. Thus, potential equalization is also important for correct and valid measurements.

13 Appendix D: Manufacturer's declaration

The system is intended for use in the electromagnetic environment specified in the tables below. For maximum performance, ensure that the system is used in the environments described in these tables.

Table 11: Guidance and Manufacturer's declaration-electromagnetic emissions

Guidance and Manufacturer's declaration-electromagnetic emissions		
The QUEST SPECTRUM® 3 is intended for use in the electromagnetic environment specified below. The customer or the user of QUEST SPECTRUM® 3 should assure that it is used in the following environment:		
Emissions Test	Compliance	Electromagnetic Environment - guidance
RF emissions CISPR11	Group 1	The QUEST SPECTRUM® 3 uses RF energy only for its internal function Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR11	Class A	The QUEST SPECTRUM® 3 is suitable for use in all establishments other than domestic and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions IEC 61000-3-2	Class A	
Voltage Fluctuations/ Flicker emissions IEC 61000-3-3	Complies	

Table 12: Guidance and Manufacturer's declaration-electromagnetic immunity

Guidance and Manufacturer's declaration-electromagnetic immunity			
The QUEST SPECTRUM® 3 is intended for use in the electromagnetic environment specified below. The customer or the user of the QUEST SPECTRUM® 3 should assure that it is used in the following environment:			
Immunity Test	IEC 60601-1-2 Test Level	Compliance Level	Electromagnetic Environment - guidance
Electrostatic discharge (ESD) IEC 61000-4-2	±8 kV contact ±15 kV air	±8 kV contact ±15 kV air	Floors should be made of wood, concrete, or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Electrical fast transient/burst IEC 61000-4-4	±2 kV for power supply lines	±2 kV for power supply lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	±1 kV line(s) to line(s) ±2 kV line(s) to earth	±1 kV line(s) to line(s) ±2 kV line(s) to earth	Mains power quality should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions, and voltage variations on power supply input lines IEC 61000-4-11	<5% Un (>95% drop in Un) for 0,5 cycle 40% Un (60% drop in Un) for 5 cycles 70% Un (30% drop in Un) for 25 cycles <5% Un (>95% drop in Un) for 5 seconds	<5% Un (>95% drop in Un) for 0.5 cycle 40% Un (60% drop in Un) for 5 cycles 70% Un (30% drop in Un) for 25 cycles <5% Un (>95% drop in Un) for 5 seconds	Mains power quality should be that of a typical commercial or hospital environment. If the user of the QUEST SPECTRUM® 3 requires continued operation during power mains interruptions, it is recommended that the QUEST SPECTRUM® 3 be powered from an uninterruptible power supply or a battery.
Power frequency (50/60 Hz) magnetic field IEC 61000-4-8	30 A/M	30 A/M	
NOTE: Un is the AC main voltage prior to application of the test level			

Table 13: Guidance and Manufacturer's declaration-electromagnetic immunity

Guidance and Manufacturer's declaration-electromagnetic immunity			
The QUEST SPECTRUM® 3 is intended for use in the electromagnetic environment specified below. The customer or the user of the QUEST SPECTRUM® 3 should assure that it is used in the following environment:			
Immunity Test	IEC 60601-1-2 Test Level	Compliance Level	Electromagnetic Environment - guidance


<p>RF Common mode/ Conducted Susceptibil ity IEC 61000-4-6</p> <p>Radiated RF Electroma gnetic Field IEC 61000-4-3</p>	<p>3 Vrms 150 kHz to 80 MHz 6 Vrms Inside IMS bands</p> <p>3 V/m 80 MHz to 2.7 GHz</p>	<p>3 Vrms 150 kHz to 80 MHz 6 Vrms Inside IMS bands</p> <p>3 V/m 80 MHz to 2.7 GHz</p>	<p>Portable and mobile RF communications equipment should be used no closer to any part of the QUEST SPECTRUM® 3, including cables than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter.</p> <p>Recommended separation distance</p> <p>$d = 1,2 \sqrt{P}$</p> <p>$d = 1,2 \sqrt{P}$ 80 MHz to 800 MHz</p> <p>$d = 2,4 \sqrt{P}$ 800 MHz to 2,5 GHz</p> <p>Where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in meters (m).</p> <p>Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey,^a should be less than the compliance level in each frequency range.</p> <p>Interference may occur in the vicinity of equipment marked with the following symbol:</p> <div style="text-align: center;">  </div>
Proximity fields form RF wireless communications equipment	<p>385 MHz 380 – 390 MHz</p> <p>430 – 470 MHz 28 V/m</p> <p>704 – 787 MHz 9 V/m</p> <p>800 – 960 MHz 28 V/m</p> <p>1700 – 1990 MHz 28 V/m</p> <p>2400 – 2570 MHz 28 V/m</p> <p>5100 – 5800 MHz 9 V/m</p>	<p>385 MHz 380 – 390 MHz</p> <p>430 – 470 MHz 28 V/m</p> <p>704 – 787 MHz 9 V/m</p> <p>800 – 960 MHz 28 V/m</p> <p>1700 – 1990 MHz 28 V/m</p> <p>2400 – 2570 MHz 28 V/m</p> <p>5100 – 5800 MHz 9 V/m</p>	
<p>NOTE These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people.</p>			
<p>^a Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the QUEST SPECTRUM® 3 is used exceeds the applicable RF compliance level above, the QUEST SPECTRUM® 3 should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the QUEST SPECTRUM® 3.</p>			

Table 14: Guidance and Manufacturer's declaration-electromagnetic immunity

Recommended separation distance between portable and mobile RF communications equipment and the QUEST SPECTRUM® 3			
The QUEST SPECTRUM® 3 is intended for use in the electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the QUEST SPECTRUM® 3 can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the QUEST SPECTRUM® 3 as recommended below, according to the maximum output power of the communications equipment.			
Rated maximum output power of transmitter W	Separation distance according to frequency of transmitter m		
	150 kHz to 80 MHz $d = 1,2 \sqrt{P}$	80 MHz to 800 MHz $d = 1,2 \sqrt{P}$	800 MHz to 2,5 GHz $d = 2,4 \sqrt{P}$
0,01	0,12	0,12	0,24
0,1	0,38	0,38	0,76
1	1,2	1,2	2,4
10	3,8	3,8	7,6
100	12	12	24
For transmitters rated at a maximum output power not listed above, the recommended separation distance d in meters (m) can be estimated using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watt (W) according to the transmitter manufacturer.			
NOTE 1 At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.			
NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.			