

Install Endoscope on Camera Head

Before you can install the endoscope on the camera head, you must install the camera head sterile adapter, as described in [6.5 Camera Head Draping Procedure](#) on page [6-15](#).

Endoscope Orientation on the Camera Head and Calibration

The endoscope has pins in its base that help you to align it easily with the corresponding channels on the camera head sterile adapter.

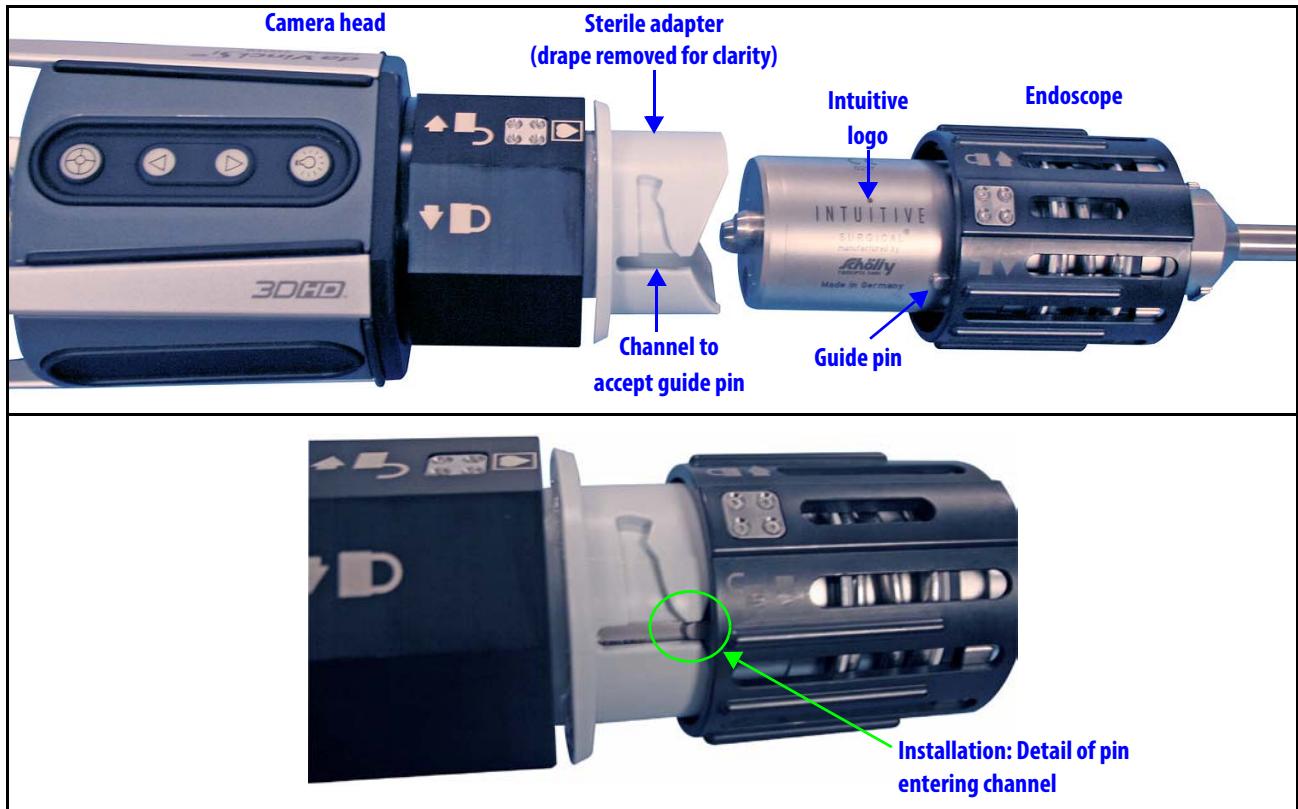


Figure 7.5 Installing endoscope in camera head

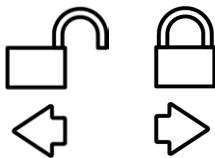
The pins support installing the endoscope on the camera head in two orientations 180 degrees opposite. The calibration process is sensitive to the orientation of the endoscope with respect to the camera head. You must successfully calibrate the endoscope in each orientation in which you will use it. For an angled endoscope, you must calibrate the scope in both orientations to make sure it is ready for use as a 30 degrees up scope and as a 30 degrees down scope.

- For angled endoscopes, the orientation with which you install it determines whether the scope is 30 degrees up or down. (The system automatically detects and displays it, whichever way it is installed.) For 30 degrees up, orient the scope so that the angled tip is on the same side as the camera head buttons; do the opposite for 30 degrees down. The scope base also indicates which side is which with marking that says **30°↑** on one side and **30°↓** on the other.
- For flat endoscopes (0 degrees), we recommend you install the endoscope on the camera head consistently in the same orientation: with the “Intuitive Surgical” logo on the base of endoscope on the same side as the camera head buttons, as shown above in [Figure 7.5](#).

30°↑
30°↓

Follow these steps to install the scope:

1. Hold the endoscope and camera head with attached sterile adapter firmly in each hand – avoid dropping either part.
2. Place the endoscope base over the sterile adapter, turning the scope as necessary until the scope slides down over the camera head sterile adapter.
3. Push down the scope until it bottoms and turn until it locks into place. You will hear a click when the endoscope is locked into the sterile adapter. Icons on the endoscope base (shown at left) indicate the direction you must turn to lock or unlock the scope over the sterile adapter.



Camera / Scope Setup from the Camera Head

The *da Vinci Si* System supports camera / scope setup, including white balance and automatic 3D calibration, completely via the camera head buttons. Using only the camera head buttons as explained below, a single sterile person can select options presented on the touchscreen. There is no need to touch the touchscreen, although it is still possible to perform manual calibration at the touchscreen, as described under [Manual 3D Calibration](#), page 7-13.

Three buttons are provided on the camera head for quick vision system setup.

Control	Adjustment	Description
	Vision Setup	Use the Vision Setup button to open and make selections within the Camera/Scope Setup menu.
	Focus In & Out / Navigate menu	Press the Focus In or Out buttons to adjust the focus of the surgical image, and to navigate the Camera/Scope Setup menu.
	Lamp On/Off	Press and hold Lamp On/Off for 1 second to turn the lamp on or off.

Figure 7.6 shows the camera head buttons.



Figure 7.6 Camera head buttons, shown draped on right

Invoke Camera / Scope Setup and Navigate

As long as no instruments are in following mode, you can open the **Camera / Scope Setup** menu on the touchscreen by pressing and holding for 1 second the **Vision Setup** button on the camera head. When you do, the following menu appears.

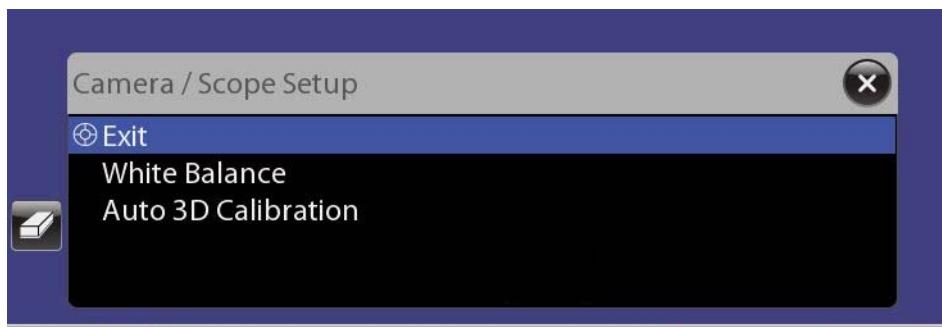


Figure 7.7 Camera / Scope Setup on touchscreen via camera head



This menu is navigable only by means of the **Focus In** and **Out** arrow buttons on the camera head. You cannot select these options by touching them directly on the touchscreen (except for the **X** button to close the menu). For orientation, the up arrow is the one nearer the **Lamp On/Off** button. Press up or down to move up or down the list. Press the **Vision Setup** button to “click” your selection like a mouse button.

The message “**Auto-calibration in progress...**” appears continually in the stereo viewer until you exit the menu.



Figure 7.8 Auto-calibration in progress (appears in stereo viewer only)

To exit the **Camera / Scope Setup** menu completely, select **Exit** in the menu (see [Figure 7.7](#) above) or touch the **X** button on the touchscreen. The surgeon cannot enter following mode until calibration is complete and you exit this menu.

Setting the White Balance

You must white balance the camera at the start of each procedure and any time a camera head, endoscope, lamp module, or Illuminator is changed. White balance sets a white color benchmark for the vision system.

To set the white balance, follow these steps:



1. Turn on the lamp by pressing the **Lamp On/Off** button on the camera head or Illuminator front panel. (The Illuminator must be powered on. When Illuminator power is on but lamp is off, the display reads “**OFF**” and the LED on the front panel is lit amber.)

The display flashes “**OFF**” while the lamp ignites. When the lamp is on, the LED on the front panel turns blue, and the display indicates intensity as a percentage of maximum. Use the **–** and **+** buttons to adjust intensity in 10% increments. Make sure the intensity is set to **100%** before proceeding.

2. Point the endoscope at a white object so the object covers the entire field of view. The white object should be 4 in. (10 cm) from the endoscope tip.



Figure 7.9 Using paper to set the white balance

Note: Do not use gauze. Gauze does not provide an appropriate background for white balancing.

3. If the **Camera / Scope Setup** menu is not already open, press and hold for 1 second the **Vision Setup**  button on the camera head to open it.



Figure 7.10 Camera / Scope Setup on touchscreen via camera head

4. Select **White Balance**. (Navigate with the **Focus In** and **Out** buttons, and press the **Vision Setup** button to make a selection.) It runs to completion automatically.
 - Alternatively, you can start white balance by touching the **White Balance** button on the **Camera / Scope Setup** screen on the touchscreen or touchpad. To access the **White Balance** button from the touchscreen, select **Camera / Scope Setup** from the **Video Settings** tab; from the touchpad, select **Camera / Scope Setup** from the **Video** tab.

A message appears briefly on the screen indicating when white balance is complete, and then you return to the menu and a check mark appears next to **White Balance**.

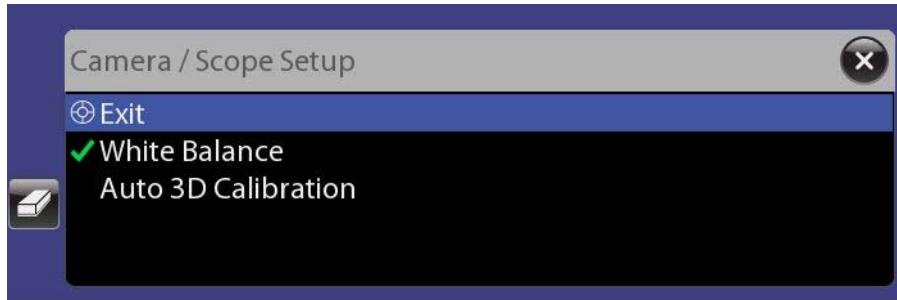
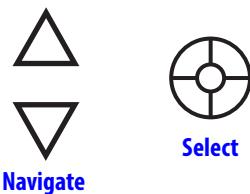


Figure 7.11 White Balance marked complete

3D Calibration of the Endoscope Assembly

3D Calibration adjusts the 3D image for mechanical variances in the assembly comprised of the endoscope, sterile adapter and camera head.

- The *da Vinci Si* System automatically detects the scope angle, which is necessary to perform calibration. If the system does not detect the scope angle, the touchscreen enables you to manually select the scope angle.
- We recommend you perform calibration at the start of each procedure for all endoscopes and angles you expect to use with the current camera head and its sterile adapter. The system saves the last calibration for every combination of endoscope, angle and camera



White Balance

head, so if you follow this recommendation, it enables you to change angles (and scopes when using both a 0 degree and 30 degree up/down scope) during a procedure without having to recalibrate.

- If during surgery you change to use a camera head, sterile adapter or endoscope you did not use for calibration before surgery, recalibrate all the endoscope angles you plan to use with the new equipment.

Auto 3D Calibration

Auto 3D Calibration is driven exclusively by the camera head buttons. Follow these steps to perform Auto 3D Calibration:

1. Insert the endoscope tip fully inside the endoscope alignment target, using the proper hole and orientation, which depends on the tip angle, so that the target crosshairs are visible on the center of the touchscreen.

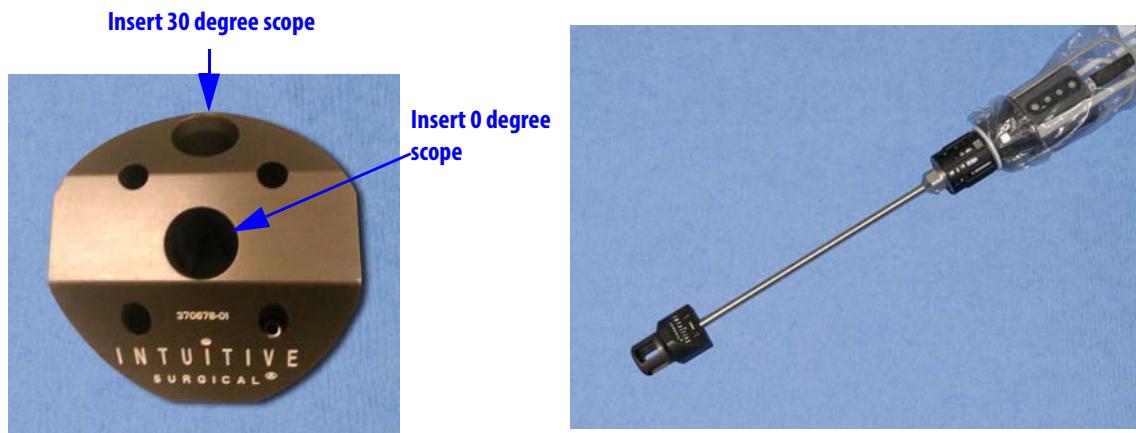


Figure 7.12 Using the alignment target

i Note: For 3D calibration to be successful, the crosshairs must be well centered on screen and the target must be kept as still as possible on the endoscope.

2. If the Camera / Scope Setup menu is not already open, press and hold for 1 second the **Vision Setup**  button on the camera head to open it.

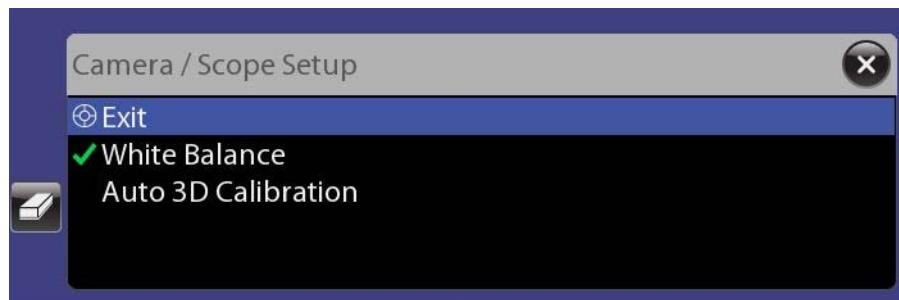


Figure 7.13 Camera / Scope Setup on touchscreen via camera head

3. Select **Auto 3D Calibration**. (Navigate with the **Focus In** and **Out** buttons, and press the **Vision Setup** button to make a selection.) The process starts, the touchscreen shows calibration in progress, and the process runs to completion in a few seconds. (You cannot stop or cancel it once started.)



Navigate



Select

When complete, the system asks you, “**Does this calibration look correct?**”

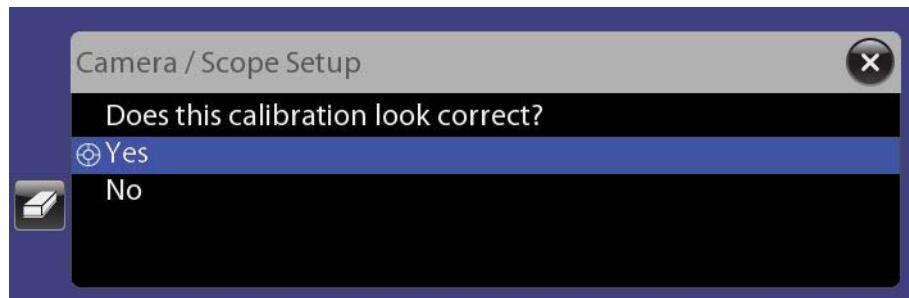


Figure 7.14 Verify calibration (appears on touchscreen only)

If you select **Yes**, you return to the previous menu and a check mark appears next to **Auto 3D Calibration**.

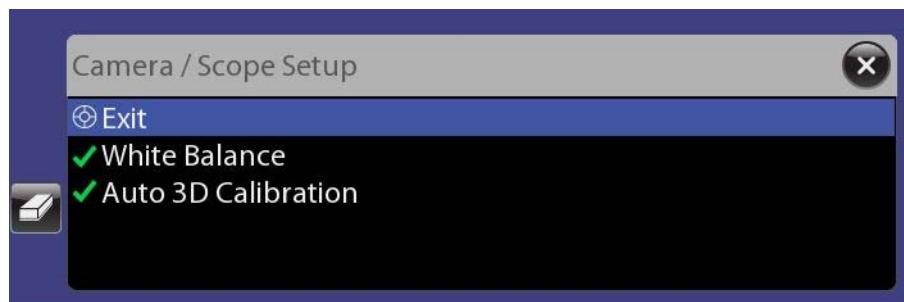


Figure 7.15 Check mark indicates action complete (appears on touchscreen only)

No check mark will appear if you select **No**, but the calibration setting will be kept, since it is the system's best estimate of calibration. If you are not satisfied, you have the option to run Auto 3D Calibration again, or to run it manually via the touchscreen or touchpad menus. You always can access **Camera / Scope Setup**, including manual **3D Calibration**, via the touchscreen **Video Settings** tab or touchpad **Video** tab.

To exit the **Camera / Scope Setup** menu completely, select **Exit** in the menu (see [Figure 7.15](#) above) or touch the **X** button on the touchscreen. The surgeon cannot enter following mode until calibration is complete and you exit this menu.

i Note: **To avoid having to calibrate endoscopes during a procedure, repeat calibration for all endoscopes and angles you expect to use with the current camera head and its sterile adapter.**

Manual 3D Calibration

Follow these steps to perform manual 3D calibration:

3D Calibration

1. Touch **3D Calibration** on the touchscreen or touchpad. (If you are not there already, go to **Camera / Scope Setup** on the **Video** or **Video Settings** tab.) The system shifts into calibration mode: both the touchscreen and the Surgeon Console viewer present the left and right eye images in distinct colors, using green and magenta.

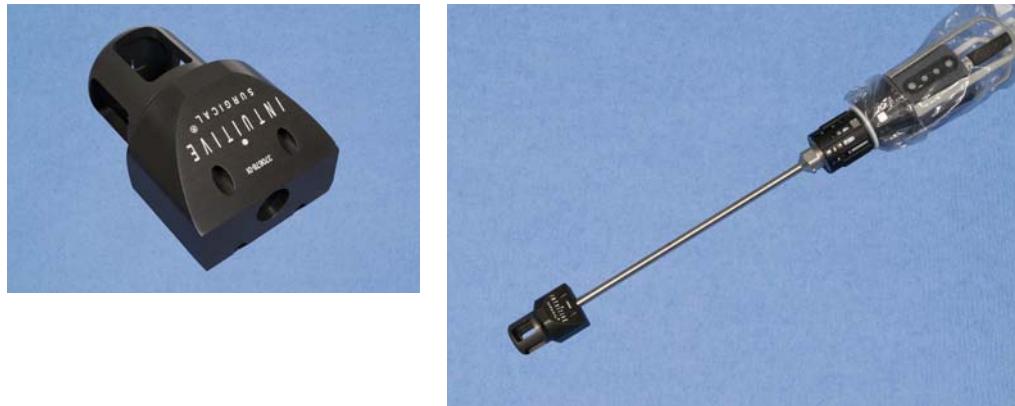


Figure 7.16 Alignment target and scope tip inserted, target centered on screen

2. Insert the endoscope tip fully inside the endoscope alignment target, using the proper hole and orientation, which depends on the tip angle, so that the target crosshairs are visible on the center of the touchscreen.

i Note: For 3D calibration to be successful, the crosshairs must be well centered on screen and the target must be kept as still as possible on the endoscope.



3. Use the **Focus In** and **Out** buttons on the camera head to focus the image.
4. Touch the arrows on the touchscreen or touchpad to move the green crosshairs until aligned with the magenta crosshairs.

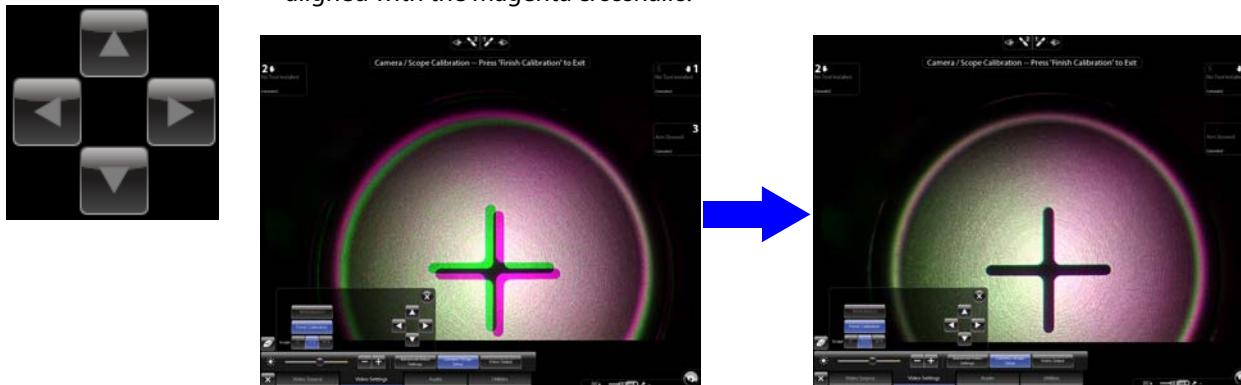


Figure 7.17 Aligning crosshairs

Finish Calibration

Touch **Finish Calibration** on the touchscreen or touchpad to save the calibration setting and exit calibration mode.

i Note: To avoid having to calibrate endoscopes during a procedure, repeat calibration for all endoscopes and angles you expect to use with the current camera head and its sterile adapter.

Preoperative and Intraoperative Endoscope Care

Before use, ensure the endoscope tip is adequately heated to minimize fogging when entering the surgical site. To heat the endoscope tip, dip it in a canister of heated sterile water. Place a piece of sterile gauze at the bottom of the canister to prevent damage to the delicate endoscope tip.

Intraoperative Endoscope Cleaning

As necessary due to fogging or smudging of the tip, remove the endoscope and wipe the tip with moistened sterile gauze.

Confirm Live Image in Stereo Viewer

Each time you install an endoscope, and after changing view modes or settings during a procedure, look in the stereo viewer to confirm a live image is present and has the desired orientation. Adjust endoscope orientation as necessary. If no image is present, confirm the lamp is on and at 100% intensity, as shown below. See section [C.3 Basic Troubleshooting](#), page [C-5](#), for further troubleshooting if no image is present.

7.3 Working with the Illuminator Controls



Figure 7.18 Illuminator controls and intensity display

Table 7-1 Illuminator Controls and Adjustments

Control	Adjustment	Description
	Lamp On/Off	Press Lamp On/Off to turn the lamp on and off. Use Lamp On/Off when the Illuminator is temporarily not in use. Press and hold Lamp On/Off when the lamp is on to turn off the lamp at the Illuminator.
	Intensity Control Decrease (-) Increase (+)	Press Intensity Control decrease (-) and increase (+) buttons to adjust Illuminator output in 10% increments. Press and hold both (-) and (+) at the same time to display the current lamp hour usage.

Note: To minimize fogging, maintain heating of the endoscope tip by setting the Illuminator brightness to 100% and use the brightness controls through the touchscreen or touchpad to adjust the brightness of the surgical image.

WARNING: The temperature of the distal tip of the endoscope may exceed 41°C during use. Avoid contact with skin, tissue and clothing when the Illuminators are turned on and the endoscope is outside the camera cannula, as damage may occur to skin, clothing and equipment. Do not attempt to clean the tip of the endoscope by dipping it in tissue. The tissue can be damaged because of the heat, and the tip of the endoscope may develop baked-on deposits which can decrease light throughput.

7.4 Working with the Touchscreen Vision Controls

The touchscreen monitor provides the ability to adjust vision system functions as described in this section. The following figure illustrates arrangement of overlaid elements in the touchscreen display. Note that many overlaid elements appear only when needed, and others are usually or always present. For a complete list of icons and text messages, please refer to Appendix G: Symbols, Icons and Text Messages Reference.

Touchscreen Display

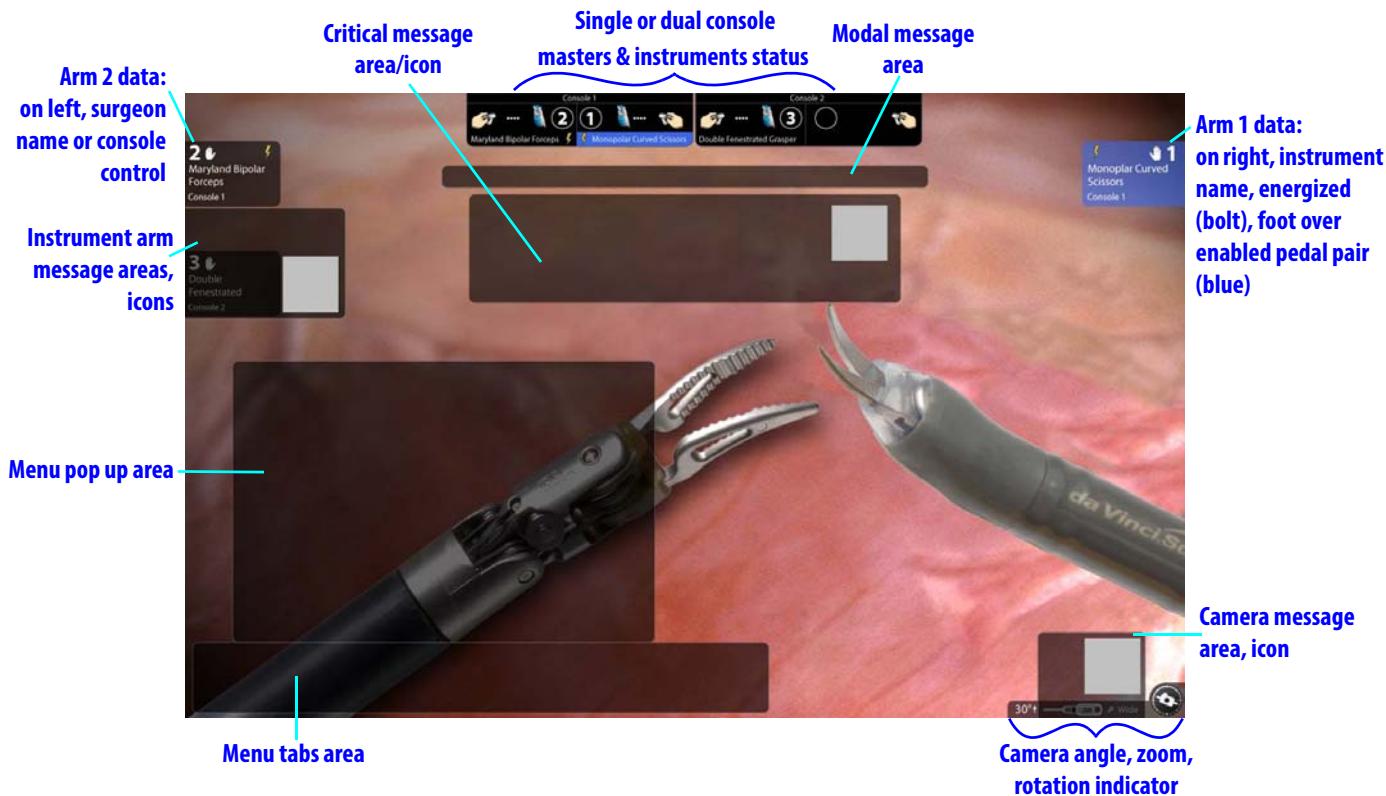


Figure 7.19 Touchscreen display

Single or Dual Console Masters & Instruments Status Area

When one Surgeon Console is in use, the touchscreen shows masters and instruments status at top center with a single status area like the one shown in Figure 7.20 below. When in dual console mode, two small status areas (as below in Figure 7.20) appear side by side at top center of the touchscreen.

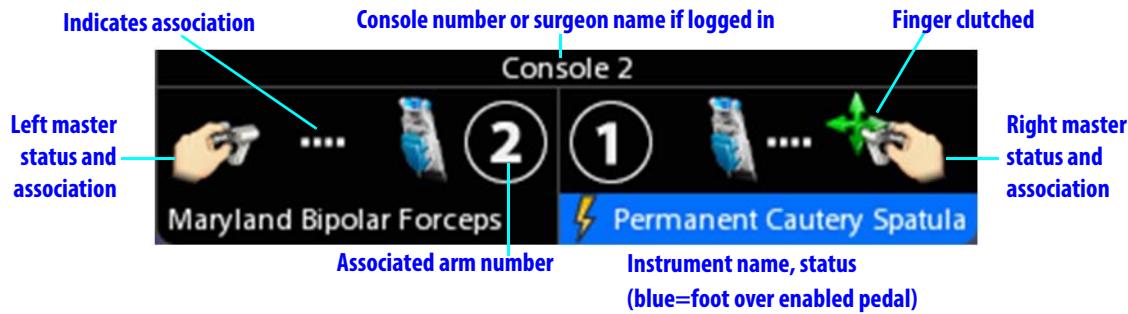


Figure 7.20 Masters and instruments status area for consoles in use

This area provides masters and instruments status for consoles in use, showing:

- The console number at the top, or the user name of the surgeon if logged in
- For left and right masters, the associated instrument name, arm number and energy status, including turning orange when firing
- The same status icons as appear elsewhere, and the additional icon showing that the master is clutched (finger clutched) as seen on the right above. For a complete list of icons and text messages, please refer to [Appendix G: Symbols, Icons and Text Messages Reference](#).

i Note: On the stereo viewer when in dual console mode, only one of these status areas appears, at upper left, showing the instrument status of the other Surgeon Console. If you select the Surgeon View from the [Video Source Tab](#) (see page 7-17), you will have the further choice of which console's view and icons to see on the touchscreen.

Touchscreen Menu Access



Touch the **Open** button in the bottom left corner to access the following menu tabs to make adjustments:



Figure 7.21 Touchscreen menu tabs: Video Source, Video Settings, Audio, Utilities

i Note: Items highlighted blue are currently selected. Grayed-out items are not available in the current context.



The **Open** button toggles to **Close** when the menu is open; touch it to close the menu. Below we address the adjustments available in each menu tab. Before that, we explain telestration, since it is always available.

Telestration

Telestration is available by default. You can telestrate on the touchscreen monitor no matter what video source is displayed. To telestrate, drag your finger on the monitor, pressing slightly, to draw a colored line on the video image. The telestration drawn also appears in the Surgeon Console viewer, overlaid on whichever video channel (left or right) is being used at the touchscreen. The surgeon cannot block the appearance of telestration, but can remove it by pressing the camera pedal.



- **Erase Button:** The **Erase** button is always present when telestration is available. Touch it to erase all telestration marks from the touchscreen and Surgeon Console. The following actions also erase telestration marks:
 - Pressing the camera footpedal
 - Clutching the camera arm or camera arm setup joint
 - Change in endoscope
 - Change in video source selection



WARNING: Telestration is an educational tool and should be used to assist in communication during surgery. Telestration should not be used as a tool for performing surgery (for example, making telestration marks to indicate where to cut).

Video Source Tab

When you touch the **Video Source** tab, you can select which video source to display on the touchscreen. You can also select which eye's video image to display, right or left, and use telestration. Select from the following options:

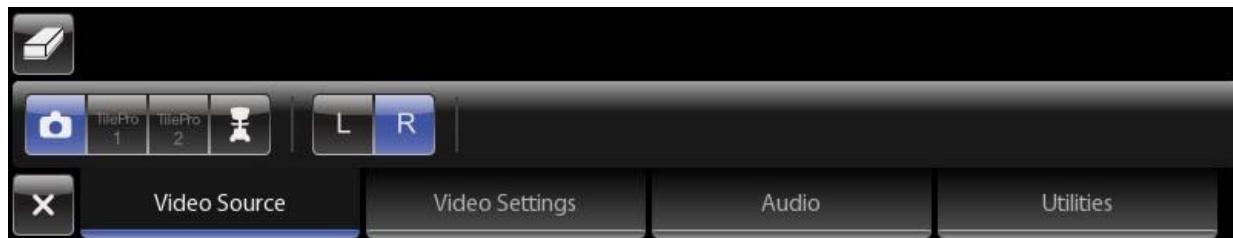
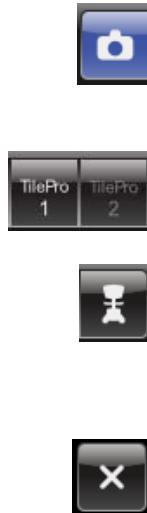


Figure 7.22 Video Source tab



- **Endoscope:** Touch this camera icon to display the endoscope video image. The touchscreen displays either the left or right eye video, and you can select which eye using the **L** (left) or **R** (right) button. This **L / R** option is useful when something impairs video from one or the other eye.
- **TilePro 1 or TilePro 2:** Touch either to display the video input from the TilePro 1 or TilePro 2 connection on the back of the Core or Surgeon Console.
- **Surgeon View:** Touch to display the surgeon's view, including overlays. (Among these are those that show energy status of instruments.) When selected, you have the further option to select the surgeon's left or right eye video image using the **L** (left) or **R** (right) button. This **L / R** option is useful when something impairs video from one or the other eye. When two Surgeon Consoles are in use, another option becomes available to select which console view to display. Select either to display that console's view and icons. To exit the surgeon view and access the menu tabs, you must touch the **X** button.

Video Settings Tab

The **Video Settings** tab enables you to adjust the brightness of the surgical image, and gives access to Advanced Video Adjustments, Camera / Scope Setup and Video Output.



Figure 7.23 Video Settings tab

Advanced Video Adjustments

Enables adjustment of **Brightness**, **Contrast**, **Red**, **Yellow**, **Edge Enhancement**, and **Illuminator**. You can also revert to factory default settings by touching **Restore Factory Settings**.

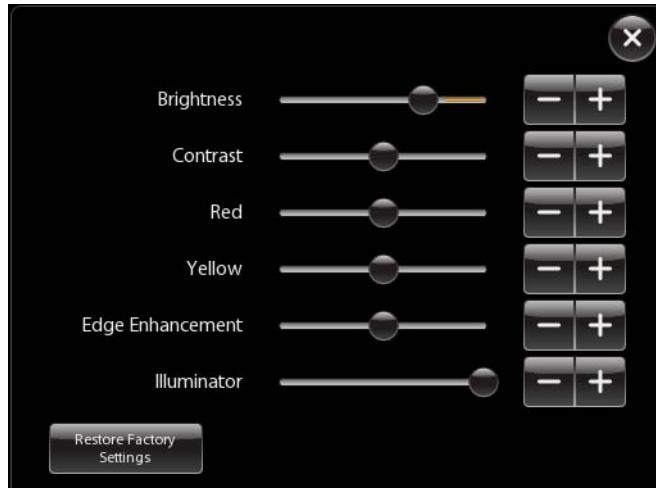


Figure 7.24 Advanced Video Adjustments

i Note: The specific adjustment of these settings is a matter of surgeon preference. Like any adjustable video image, you may observe that some settings affect others, with the result that a specific combination of settings may represent a tradeoff, for example, between glare in one part of the image and enhanced visibility in another part. Keep in mind that you can readjust these settings at any time.

- **Brightness:** Drag the slider to adjust the brightness of the surgical image. This is video brightness, as opposed to actual illumination.
- **Contrast:** Drag the slider to adjust the contrast of the surgical image.
- **Red:** Drag the slider to adjust the red of the surgical image.
- **Yellow:** Drag the slider to adjust the yellow of the surgical image.
- **Edge Enhancement:** Drag the slider to adjust the edge enhancement of the surgical image. Increasing edge enhancement (slider to the right) may also increase noise.
- **Illuminator:** Drag the slider to adjust the actual light output transmitted to the surgical field in 10% increments.
- **Restore Factory Settings:** Touch to restore all advanced video adjustments to default values, which should be appropriate for most clinical scenarios.

Restore Factory Settings

i Note: Both the Brightness slider (video brightness) and the Illuminator slider (lamp intensity) will affect the brightness of the image seen in the stereo viewer. To minimize fogging, maintain heating of the endoscope tip by setting the Illuminator slider to maximum and then adjust image brightness using the Brightness slider. If working close to tissue, decrease the Illuminator intensity using the Illuminator slider, and increase image brightness as necessary using the Brightness slider. If the image is too dark, check both the Illuminator and Brightness sliders, making sure each is far enough to the right, given the working distance of the endoscope tip from tissue.



Camera / Scope Setup

Provides the ability to perform white balance, scope calibration, and to manually set the scope angle when the system does not detect it automatically. See the interface and instructions for this tool under [Vision System Overview](#) on page 7-1.



Video Output

Enables you to specify the video output format and graphics source for up to three video outputs. (Video Out Aux available by default; Video Out 1 and 2 available as part of optional upgrades.) See the example below.

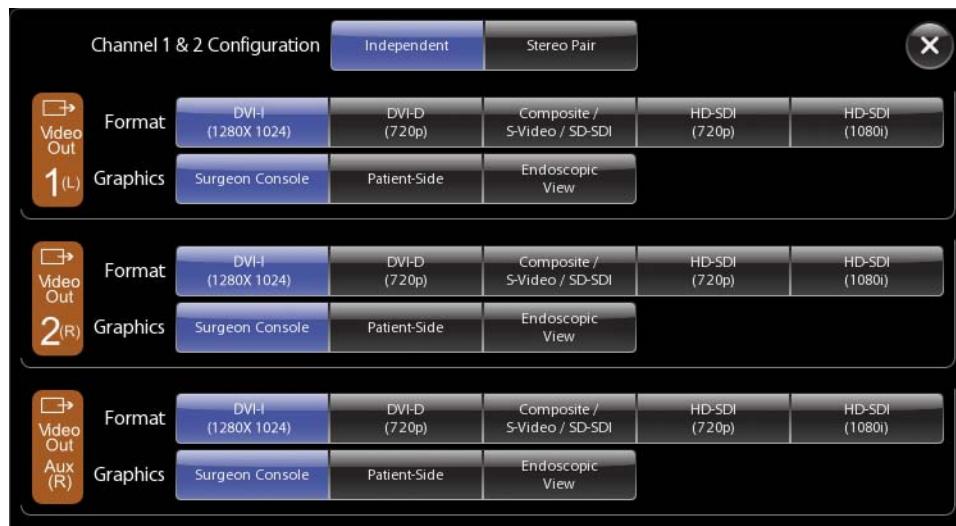


Figure 7.25 Example of video output option selections

i Note: One video output is standard. Optional upgrades can provide up to two additional video outputs.

The software buttons on this screen correspond to the applicable Video Out connector bay as explained in [Table H-1 Video Output Connections – Core](#), page H-2.

Audio Tab

The **Audio** tab enables you to adjust touchscreen speaker volume and mute the touchscreen microphone.

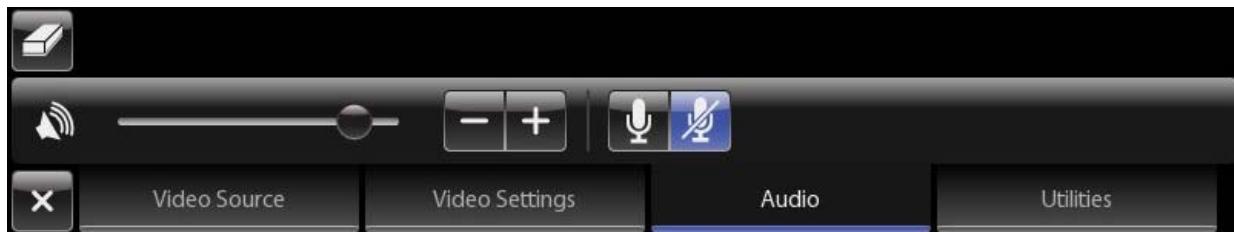


Figure 7.26 Audio tab



- Microphone On and Off:** On by default, select to mute the touchscreen microphone.



- Volume Adjustment:** Use the slider—volume increases to the right—or the **Volume Decrease (-)** or **Increase (+)** buttons.

Utilities Tab

The **Utilities** tab provides access to Inventory Management, Event Logs and Troubleshooting.

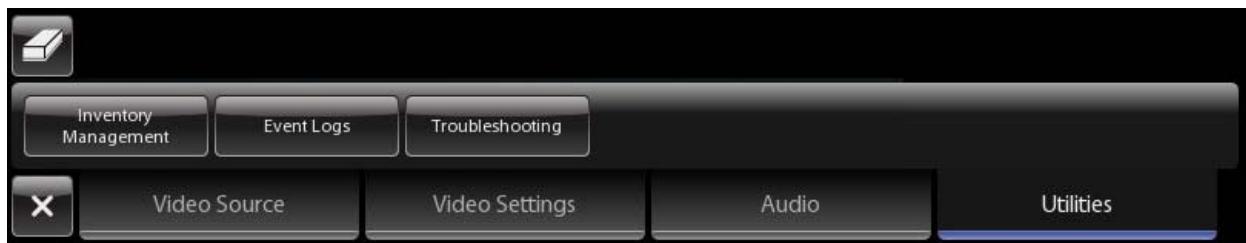


Figure 7.27 Utilities tab

- **Inventory Management:** Provides an overview of the accessories used during the procedure.
- **Viewing Lamp Hours:** To view usage hours of the lamp module, select **Inventory Management** (on the touchscreen or touchpad). You can also view the lamp hours on the Illuminator by pressing the decrease (-) and increase (+) buttons simultaneously, as described in [Appendix C: Illuminator Information](#).
- **Event Logs:** Provides access to the system event logs, including error logs.
- **Troubleshooting:** Displays the system name and system software version, and provides **L** (left) and **R** (right) buttons to display the color bar test pattern in the left or right video channel independently.



7.5 Adjusting the Touchscreen Monitor

The hardware controls to adjust the touchscreen monitor image are locked. We recommend you make video settings adjustments through the Video Settings tab on the touchscreen (see page [7-17](#)). If you wish to change the video settings of the monitor, contact *Intuitive Surgical* Technical Support.



Figure 7.28 Touchscreen monitor hardware controls

7.6 Troubleshooting Image Quality

Missing Image (One or Both Eyes)

1. Re-do white balance.
2. Ensure camera cable connections are tightly connected.
3. Replace the camera head and camera cable.

Image Poor

Two scenarios may be encountered intra-operatively where adjustments may be required: 1. a condition where the image appears too bright, or 2. a condition where the image appears too dark or the color is poor. We provide specific recommendations to optimize each scenario.

Overly Bright Image

1. From the Video Settings tab of the touchscreen or touchpad, decrease the brightness to the desired level.

⚠ CAUTION: If the endoscope is working close to tissue, reduce the light source output by adjusting the Illuminator to a lower light output setting. This will prevent tissue damage due to excessive heat. Note that decreasing the light output will result in a more grainy image.

ⓘ Note: Do not use the Illuminator to control image brightness as this may result in increased fogging.

Dark Image or Poor Color

1. Restore factory settings from the touchscreen or touchpad: **Video Settings> Advanced Video Adjustments> Restore Factory Settings.**
2. Increase video brightness from the touchscreen or touchpad: **Video Settings> Advanced Video Adjustments.**

ⓘ Note: Increasing the brightness may cause the image to look noisier and reduce image quality.

3. Perform white balance.
4. Check the light guide connection to the Illuminator to ensure it is secure.
5. If the problem persists, replace the endoscope.
6. If the problem persists, replace camera head and camera cable.
7. Perform white balance.
8. If possible, clean the tip of the endoscope with a piece of moistened sterile gauze. Blood or other protein may have accumulated on the tip, diminishing light throughput.

Flickering Image

If the image is flickering in one or both eyes:

1. Power off the system.
2. Check and reseat the vision cable connections, including the camera cable at the CCU.
3. Power on the system.
 - a. If the image in the Surgeon Console is clear, continue with normal use.
 - b. If flickering continues and is constant: contact customer service for assistance: U.S. 800-876-1310, International +800 0821 2010 or +41 21 821 2020.
 - c. If flickering happens only when applying cautery, proceed to Step 4:
4. Remove the ESU from the Vision Cart.
 - a. If the image quality in the Surgeon Console is clear, continue with normal use.
 - b. If the problem persists, contact customer service for assistance: U.S. 800-876-1310, International +800 0821 2010 or +41 21 821 2020.

"Soft" Image

1. Try adjusting the focus by pressing the camera pedal and rotating the masters on the Surgeon Console or using the **Focus In** and **Out** buttons on the camera head.

2. If possible, clean the tip of the endoscope with a piece of moistened sterile gauze. Blood or other protein may have accumulated on the tip, diminishing light throughput.
3. Adjust the edge enhancement setting to increase the sharpness of the image. Edge Enhancement is found under [Advanced Video Adjustments](#) (see page 7-18 or page 10-13).

Blurry Image

1. Remove endoscope and detach from camera head. Clean both the endoscope tip and the end where it connects to the camera head. If possible, wipe the camera head lenses.
 - a. Check the image quality in the Surgeon Console. If the image is clear, continue with normal use.
2. Focus the image.
3. If one eye is in focus and one eye is not in focus, change the endoscope.
 - a. Check the image quality in the Surgeon Console. If the image is clear, continue with normal use.
 - b. If the problem persists, proceed to Step 3:
4. Power off the system and replace the camera.
5. Power on the system.
 - a. Perform white balance and 3D calibration.
 - b. Check the image quality in the Surgeon Console. If the image is clear, continue with normal use.
 - c. If the problem persists, contact customer service for assistance: U.S. 800-876-1310, International +800 0821 2010 or +41 21 821 2020.

Unable to Focus

1. Clean the tip of the endoscope with a piece of moistened sterile gauze.
 - a. Check the image quality in the Surgeon Console. If the image is in focus, continue with normal use.
 - b. If the image in the Surgeon Console is not in focus:
2. Focus the image. (From the camera head, use the **Focus In** and **Out** buttons. From the Surgeon Console, press the camera pedal and rotate one master controller.)
 - a. If the image is in focus in one eye only, change the endoscope and then check the image quality in the Surgeon Console. If the image is in focus, continue with normal use.
 - b. If the image is not in focus:
3. Power off the system.
4. Change the camera head and camera cable.
5. Power on the system.
 - a. Focus the image. (From the camera head, use the **Focus In** and **Out** buttons. From the Surgeon Console, press the camera pedal and rotate one master controller.)
 - b. Perform white balance and 3D calibration.

6. Check the image quality in the Surgeon Console.
 - a. If the image is in focus, continue with normal use.
 - b. If the problem persists, contact customer service for assistance: U.S. 800-876-1310, International +800 0821 2010 or +41 21 821 2020.

Replacing the Lamp Module

If the lamp does not turn on or the illumination seems faint even when illumination is set at 100%, the lamp module may require replacement. For further instructions, see [Illuminator Lamp Module Replacement](#) on page 12-2.

End of section

8 Patient Preparation, Port Placement, and Docking

This chapter provides instructions for the following:

- [8.1 Patient Preparation Guidelines, page 8-1](#)
- [8.2 Port Placement and Cannula Insertion, page 8-1](#)
- [8.3 Docking, page 8-4](#)

8.1 Patient Preparation Guidelines

Patient positioning is procedure-specific and is at the discretion of the surgeon. System positioning guidelines, specific to the *da Vinci Si* Surgical System, are as follows:

- Arrange Patient Cart arms to avoid contact with the patient.

i Note: The patient should be positioned before docking. Table movements are most easily performed before driving the Patient Cart into position.

8.2 Port Placement and Cannula Insertion

Port Placement Guidelines

Port placement is key to a successful *da Vinci Si* procedure. The goals of port placement are to avoid Patient Cart arm collisions and to maximize instrument and endoscope range of motion. Port placement varies by procedure and patient and should be thoroughly discussed with an experienced surgeon, since improper port placement may cause difficulty performing *da Vinci* Surgery. For procedure-specific port placements, see published *Intuitive Surgical* Procedure Guides. Contact your local ISI representative for available Procedure Guides. An example of the basic port placement philosophy is provided in [Figure 8.1](#).

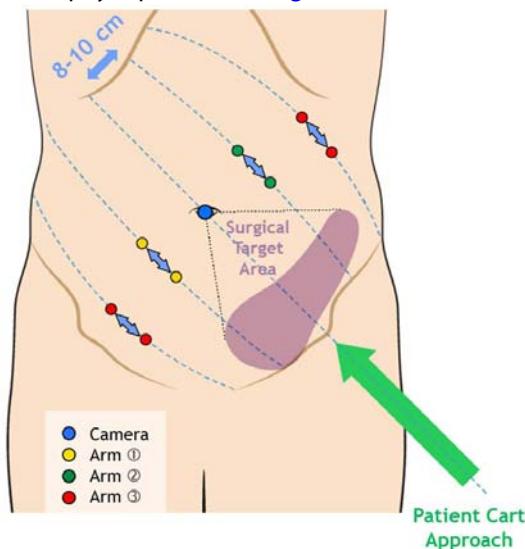


Figure 8.1 Port placement philosophy example

The following are generic guidelines for choosing port placement. Anatomical restrictions may necessitate an alternate setup.

Determine port placement based on a parallel line pattern:

- Insufflate before measuring.
- Use the camera location as the center point (maintain 10-20 cm from target anatomy).
- Based on line from target anatomy to camera port, draw parallel lines with 8-10 cm line spacing.
- Place *da Vinci* ports along lines, maintaining 10-20 cm from target anatomy, and 8-10 cm from other *da Vinci* ports.
- Triangulate *da Vinci* ports toward or away from the target anatomy as necessary for the procedure.
- Do not place ports within surgical target area (maintain 10-20 cm from target anatomy).
- For accessory ports, maintain at least 5 cm from the other ports, with a clear trajectory to the target anatomy.
- If working in more than two quadrants, re-dock the Patient Cart.

Placing Ports and Inserting Cannulae

i Note: Follow the instructions in the Instrument and Accessories User Manual to inspect cannulae before use, including use of a gage pin for 8 mm cannulae.

Initial port location should be selected giving consideration to the procedure, specific anatomy, and the type of components being used (such as endoscope and camera combination, cannula length, etc.). For procedure specific port placements, see published *Intuitive Surgical* Procedure Guides. Contact your local ISI representative for available Procedure Guides.

The patient should be prepped, draped and positioned in standard fashion. Following insufflation, mark the desired location of all instrument and accessory ports. Place all ports using a standard surgical technique. The camera head and endoscope assembly can be used manually (not connected to the Patient Cart) during port placement.

i Note: Hold the body of the camera head during manipulation to avoid potential damage to the wiring harness.

da Vinci instrument cannulae may be placed with either blunt or bladeless obturators.

i Note: It is recommended that obturator tips remain in view at all times during cannula insertion (under endoscopic video visualization).

Specific applications may warrant placement of the cannula while connected to the instrument arm (for example, Cardiac and Thoracic procedures). In this application, the Patient Cart will need to be positioned before cannula insertion. As with all port placement, this should be done only under endoscopic video vision.

i Note: When inserting cannulae into the patient while the cannulae are attached to the instrument arms, ensure that Patient Cart is positioned with instruments arms and setup joints near the center of their range of motion.

⚠ WARNING: Once the *da Vinci Si* System is connected to the patient, the surgical table MUST NOT BE MOVED in any way. Serious injury could result.

If intraoperative OR table movement is necessary, remove all instruments and the endoscope, undock the *da Vinci Si* System, move the OR table and re-dock the system.

Remote Center

The instrument arms and the camera arm on *da Vinci* Surgical Systems use remote center technology. Remote center technology enables the System to maneuver instruments and endoscopes in the surgical site while exerting minimal force on the patient's body wall. The remote center is the fulcrum point around which the *da Vinci* System moves the instrument and camera arms. When the cannula's remote center is placed correctly in the patient's body wall, moving the Patient Cart arms around the remote center exerts minimal pull and tug at the port site, which lends itself to reduced pain and faster healing of the incision.

Instrument Cannula Remote Center Setup

The instrument arm remote center is indicated by the thick, center black band on the instrument cannula.

- To correctly place the remote center, the thick black line on the *da Vinci* cannula (which indicates the remote center) should be inserted within the boundaries of the patient's body wall. Correct placement allows instruments to pivot through the incision with less friction and greater precision, which reduces tissue trauma ([Figure 8.2 a](#)).

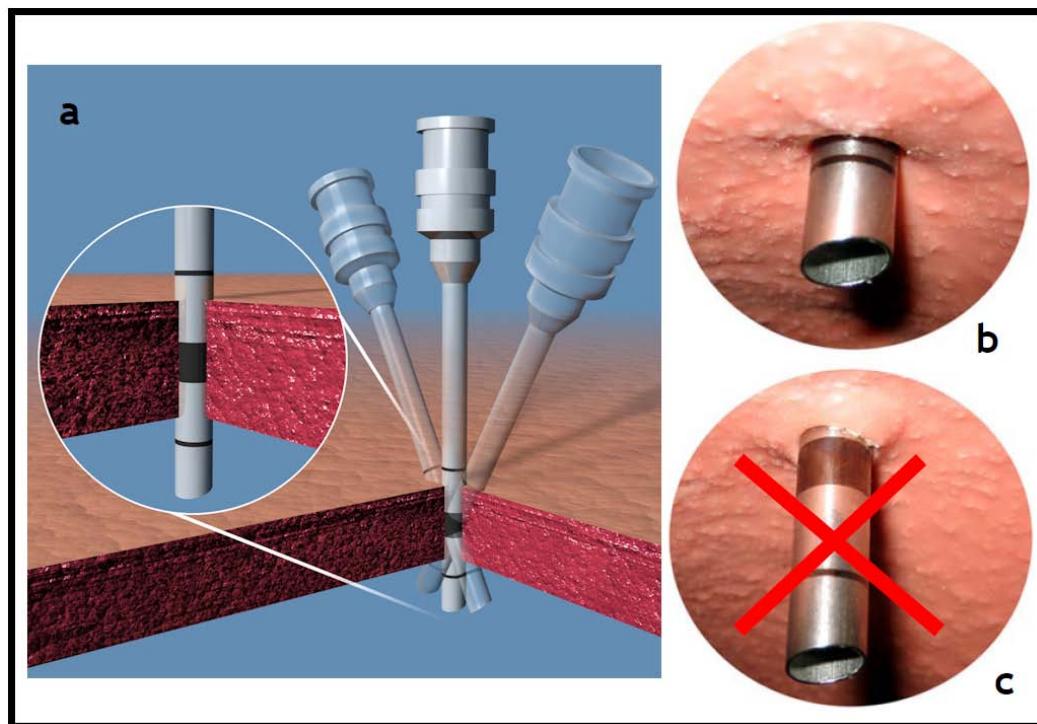


Figure 8.2 Proper placement of instrument cannula remote center

- Correct placement of the cannula should be verified by looking at the cannula tip with the endoscopic camera (cannulae should always be placed under endoscopic visualization). Only the first thin line at the distal cannula tip should be visible. This indicates that the remote center is placed correctly within the boundaries of the patient's body wall ([Figure 8.2 b](#)).
- If the thick black line on the cannula is seen in the endoscopic view, this means that the remote center is inserted too deeply. Moving the arms with the remote center incorrectly placed increases friction, reduces precision and increases tissue trauma at the port site ([Figure 8.2 c](#)).

The Surgeon Console operator cannot move the instrument arm remote center. However, the Patient Cart operator can reposition the remote center by pressing the port clutch button and repositioning the instrument arm.

Endoscope Cannula Remote Center Setup

Endoscope cannulae used with the *da Vinci* System do not have a ring or other mark to indicate the remote center. Therefore, it is vital to attach the endoscope cannula correctly in the endoscope cannula mount.

- To ensure the remote center of the cannula is properly positioned, the cannula should be attached at a point immediately below the cannula housing (see [Figure 8.3](#) below).

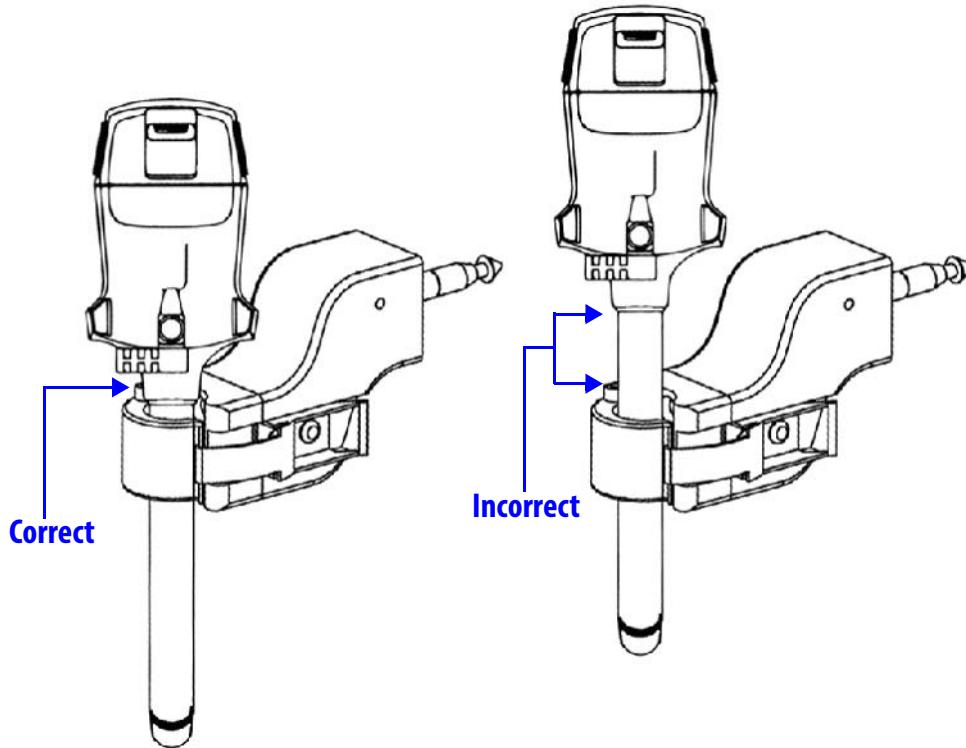


Figure 8.3 Proper attachment of the endoscope cannula

8.3 Docking

Docking is the process of moving the Patient Cart up to the OR table and connecting the Patient Cart arms to the patient.

Patient Cart Positioning

Once cannulae are inserted in the patient, a non-sterile person operates the Patient Cart motor drive to move the Patient Cart into the sterile field. Communication is critical when docking the Patient Cart. Only one person should give directions to the non-sterile person to advise of potential collisions and to direct him/her when approaching the patient. Use anatomical or room references (such as "toward the head," or "away from the Vision Cart") to direct the non-sterile person as they move the cart. Avoid using relative terms such as left or right.

1. Make sure the camera arm remote center is sufficiently away from the Patient Cart tower to facilitate adequate range of motion for the Patient Cart arms. This is known as setting the “sweet spot.” To set the “sweet spot,” move the camera arm so that the blue arrow lines up between the limits of the blue bar located in the middle of the camera arm setup joint (left or right side).

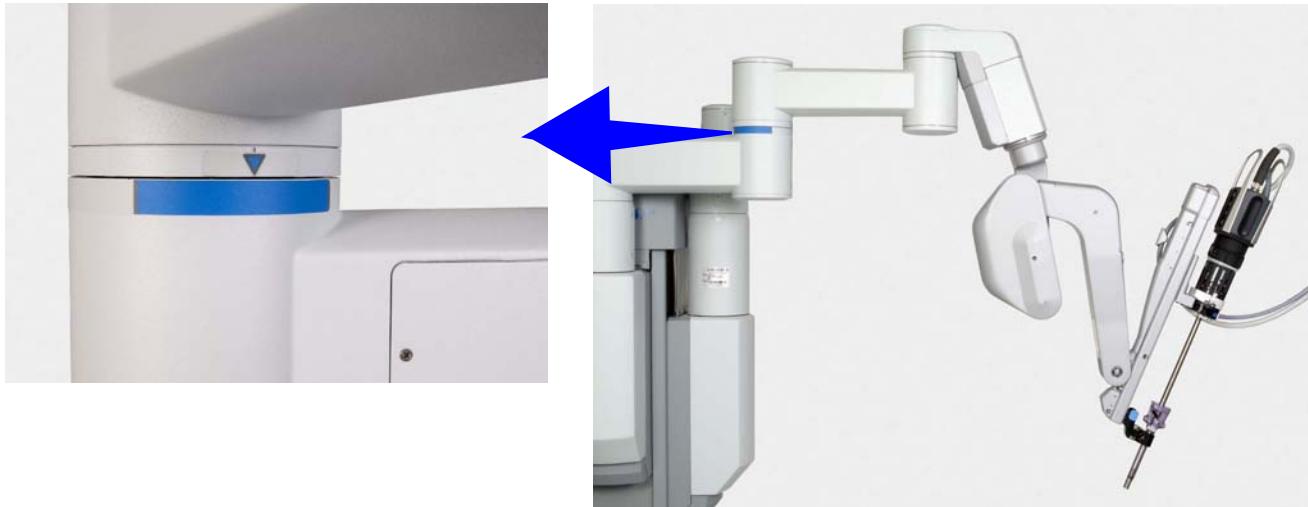
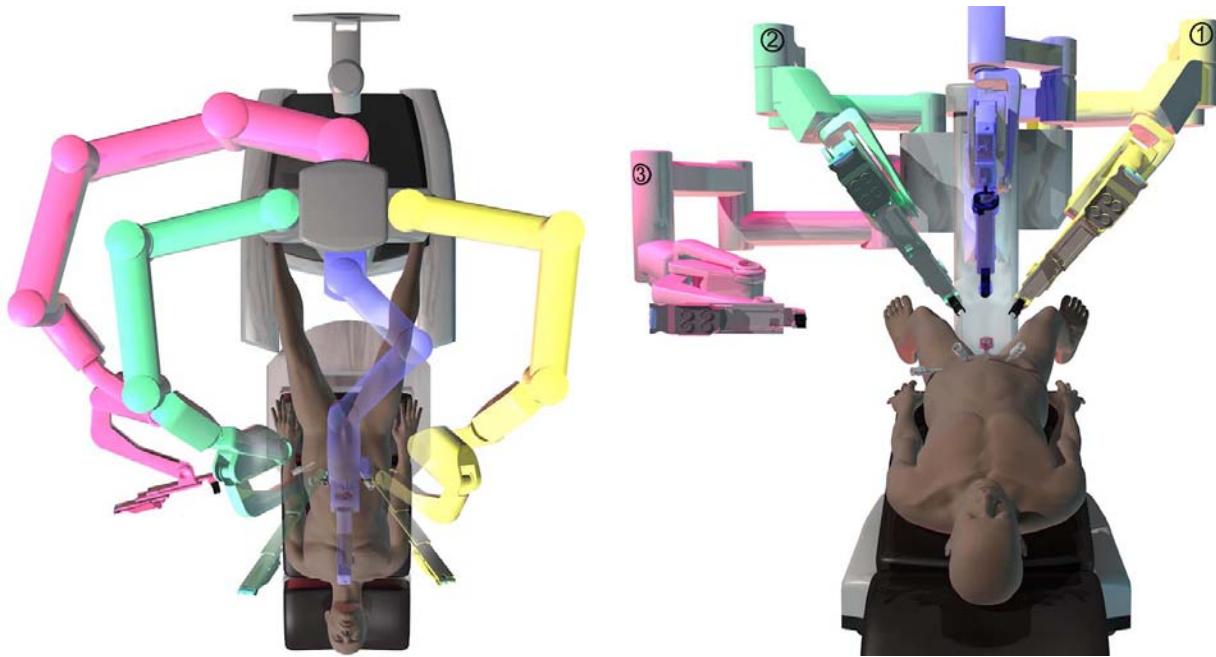


Figure 8.4 “Sweet spot” label

2. Move the Patient Cart towards the patient using the motor drive. See [Motor Drive Operation](#) on page 3-3 for details. The Patient Cart should approach the patient with the tower of the Patient Cart lined up in a straight line with the camera cannula and the target anatomy.



Align Patient Cart tower, camera cannula and camera port

Figure 8.5 Patient Cart positioned over patient model

3. Position the Patient Cart so the camera arm cannula mount is just above the camera cannula.

Camera Arm Docking

- Once the camera cannula mount is above the camera cannula, use the camera arm port clutch button to bring the cannula mount toward the cannula.

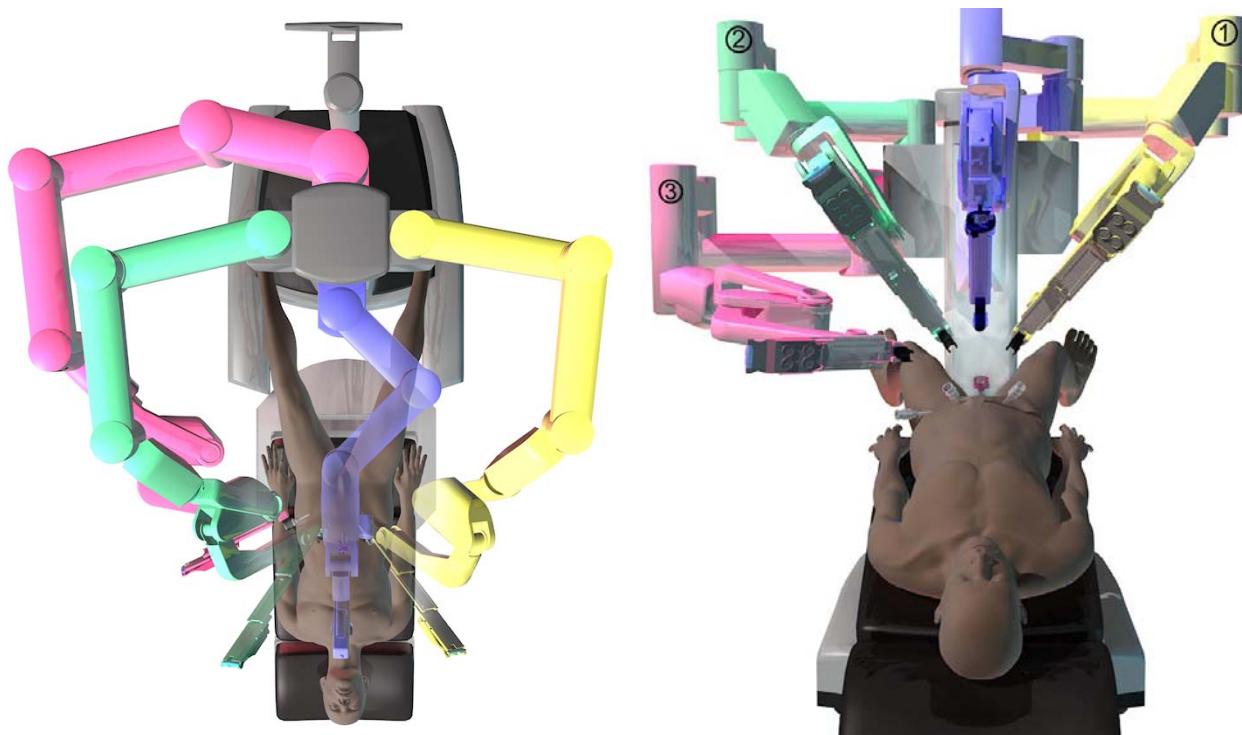


Figure 8.6 Clutch arms to move into docking position

i Note: Refer to section **9.2 Moving the Patient Cart Arms** on page **9-3** for detailed instructions on instrument arm, camera arm and port clutching.

- Align the cannula mount to the cannula by using the camera arm clutch button. Be sure to un-clutch the camera arm afterwards.
- Ensure the drape boot is properly aligned with the cannula mount. Connect the cannula mount to the cannula by using the latches located on the cannula mount. Make sure that both latches are closed.

i Note: To prevent the cart from moving during a procedure, the Patient Cart will automatically engage the motor drive brakes when any cannula is docked.

Instrument Arm Docking

1. Use the instrument arm port clutch button to bring the cannula mount to the cannula.
2. Align the cannula mount to the instrument cannula by using the instrument arm clutch button. Be sure to un-clutch the instrument arm afterwards to lock the arm in place.
3. Ensure the drape boot is properly aligned with the cannula mount. Connect the cannula mount to the cannula by using the latches located on the cannula mount. Make sure that both latches are closed.
4. Ensure the back end of the instrument arm is rotated away from the camera arm. If there are two instrument arms on one side, ensure the instrument arm closest to the camera arm has adequate range of motion while minimizing collisions.

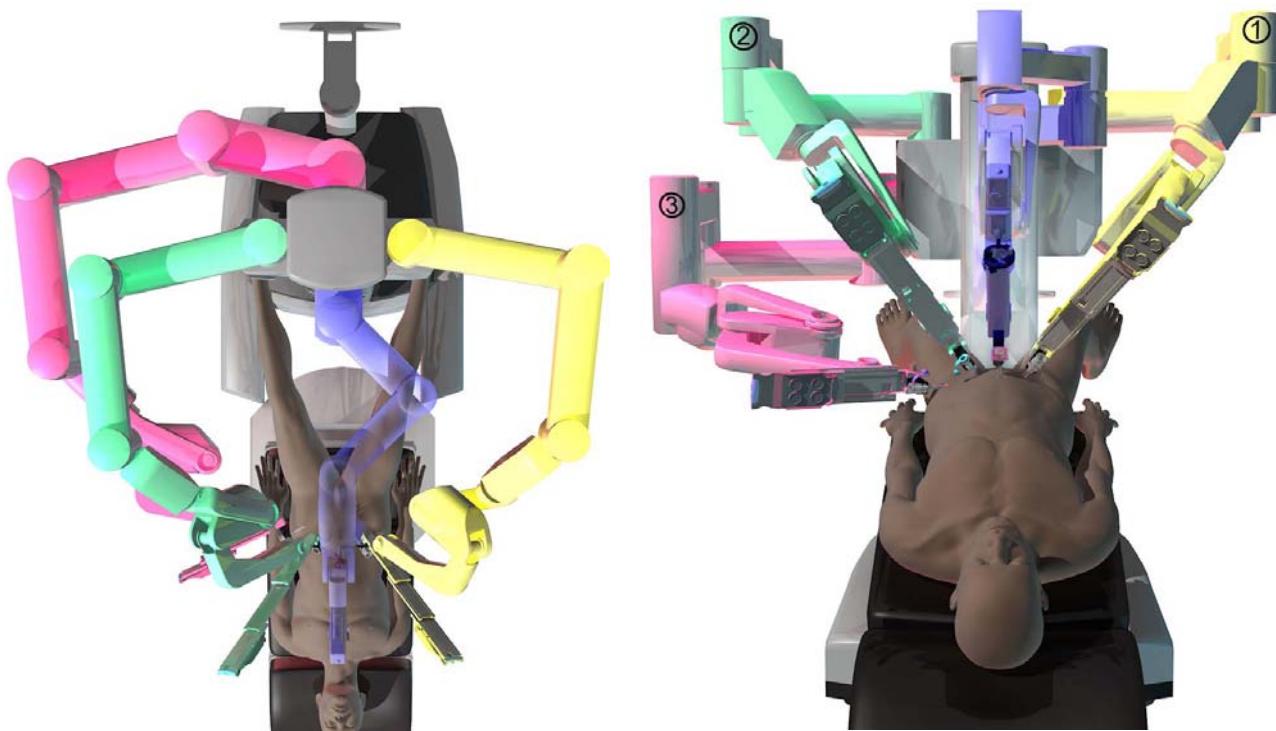


Figure 8.7 Docking complete

i Note: Once the Patient Cart arms are docked, the port clutch button should only be used to reposition the remote center. If the port clutch button is used, use care to prevent sliding the cannula out of the port site.

⚠ WARNING: Once the *da Vinci Si* System is positioned, cannulae are placed in the patient and Patient Cart arms are attached to the cannulae, the surgical table MUST NOT BE MOVED in any way. Serious injury could result.

If intraoperative OR table movement is necessary, undock the *da Vinci Si* System, move the OR table and re-dock the system.

⚠ CAUTION: Unexpected motion can occur when instruments collide. Ensure there is adequate room for instruments to move inside the patient.

⚠ CAUTION: Make sure there is adequate room for the arms to move without contacting the patient during the procedure. Ensure that the patient-side assistant can see all arms during the procedure and can alert the surgeon when the arms are close to contacting the patient.

- i Note:** If, while operating, you move the masters and no instrument motion occurs, there may be a collision between instruments or instrument arms, or between an arm and the patient. Resolve the collision before proceeding with the surgery.
- i Note:** If collisions between the arms occur, it may be possible to slightly adjust the position of setup joints using the port clutch button to create more space between arms. Remove the instruments before pressing the port clutch button and use care to prevent sliding of the cannula out of the port site while you adjust the set up joint positions.
- i Note:** If collisions between the arms occur, ensure that the instruments are still fully engaged on the instrument arm.

End of section

9 Patient Cart Use

This chapter explains the use of the Patient Cart during surgery. The following subjects are covered:

- [9.1 Patient Cart Overview, page 9-1](#)
- [9.2 Moving the Patient Cart Arms, page 9-3](#)
- [9.3 Working with EndoWrist Instruments, page 9-5](#)
- [9.4 Instrument Installation, Insertion, Removal and Intraoperative Care, page 9-7](#)
- [9.5 Working with the Endoscope at the Patient Side, page 9-14](#)
- [9.6 Endoscope Installation, Insertion, Removal and Intraoperative Care, page 9-16](#)



Figure 9.1 Instruments installed on the insertion axes

9.1 Patient Cart Overview

The Patient Cart has five main components with which users interact:

- Setup Joints
- Instrument Arms
- Camera Arm
- *EndoWrist* Instruments
- Endoscope Assembly

i Note: Some Patient Cart functions are not used during surgery. Functions used outside of surgery (such as system setup and teardown) are explained in their respective sections.

⚠ CAUTION: Do not touch any wire harnesses or mechanical cables located on the camera or instrument arms while simultaneously touching the patient or when positioning the arms.

LED Status Indicators

Indications of the status of the instrument and camera arms are provided by LEDs on the top of the insertion axis of each instrument and camera arm. The meanings of the colors are as follows:

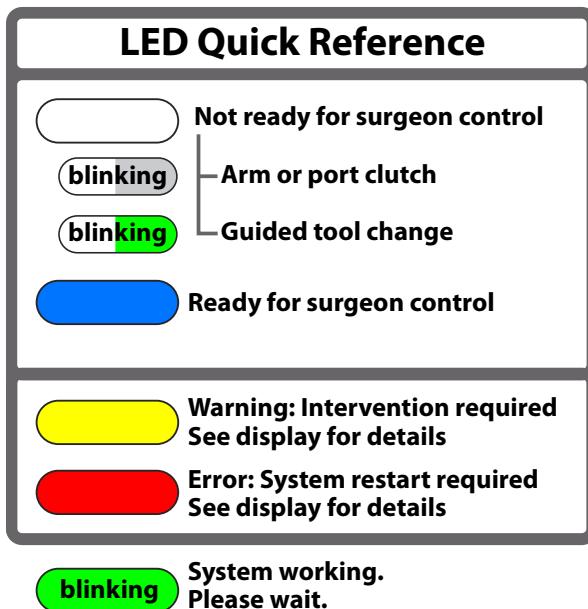


Figure 9.2 LED Quick Reference

Corresponding LED icons—graphics that reproduce the LED status—appear simultaneously on the touchscreen and stereo viewer.

9.2 Moving the Patient Cart Arms

Arm Clutch and Port Clutch Buttons

Use the arm clutch and port clutch buttons (Figure 9.3) to position the instrument and camera arms.



Figure 9.3 Arm clutch and port clutch buttons

⚠ CAUTION: When using setup joint or clutch buttons, keep your fingers clear of the joints located on the camera and instrument arms to avoid injury.

Arm Clutch to Move Arms Manually

You can manually position instruments and endoscopes in the surgical field using their arm clutch buttons (Figure 9.3). While you clutch an arm, you can move the arm around the remote center, but the remote center does not move. When clutched, the arm LED blinks white, alternating side to side.

You can clutch the arm in two ways:

- **Press and hold:** Press and hold the arm clutch button to free the arm and move it. When you release the button, the arm exits clutch mode and the brakes are reapplied.
- **Quick click:** Quick click the arm clutch button to free the arm and move it. Quick click the arm clutch button again to exit clutch mode.

ℹ Note: For instrument arms, the telescoping insertion axis extends fully when you remove an instrument, and remains fully extended until an instrument is re-installed.

⚠ CAUTION: To prevent movement of the insertion axis while clutching, hold the instrument or camera arm steady by grasping the top of the insertion axis whenever you press the arm clutch button.

Port Clutch to Move Setup Joints Manually

i Note: The term “port clutch” is used interchangeably with “set-up arm clutch”; both refer to the button and to the action that results from pressing it, which is to free the setup joint so you can reposition the setup arm manually.

You can move Patient Cart setup joints manually using the port clutch button. Both instrument and camera arms have two port clutch buttons on the lower part of the arm, one behind the cannula mount and one on the middle of the arm. (See [Figure 9.3](#) above.) When you move the setup joint, it changes the position of the remote center (port position). While you clutch the setup joint, the associated arm LED blinks white, alternating side to side.

To move a setup joint, first hold the arm and then apply the port clutch in this way:



- Press and hold.** Press and hold the port clutch button to free the setup joint and move it. When you release the button, the setup joint exits port clutch mode and the brakes are reapplied.

The label at left appears near the upper port clutch buttons. It includes the following text in English, and translations of the same in German and French:

"BRAKE RELEASE"

HOLD ARM BEFORE RELEASING"

i Note: It may be necessary for the reader to be as close as 6 in (15 cm) from the label to read this information.

i Notes on Clutching

Note: You can apply the arm clutch and port clutch simultaneously. On an instrument arm, if you clutch arm and port simultaneously, it locks the instrument arm insertion axis; this does not apply to the camera arm.

Note: Clutching an instrument arm prevents control of that arm at the Surgeon Console. Clutching the camera arm prevents control of all arms at the Surgeon Console.

Unexpected Setup Joint Motion

Unexpected setup joint motion occurs when the setup joint brakes are overpowered. Multiple factors can cause this, including excessive force on the patient and collisions of Patient Cart components (arms, setup joints, nearby objects). If the system detects unexpected setup joint motion, the arm LED for the associated setup joint turns yellow and a message appears on screen.

- To clear the error, press the port clutch button for that arm. This also relieves any potential excessive force on the patient.

i Note: If collisions between the arms occur, it may be possible to slightly adjust the position of setup joints using the port clutch button to create more space between arms. Remove the instruments before pressing the port clutch button and use care to prevent sliding of the cannula out of the port site while you adjust the setup joint positions.

i Note: If collisions between the arms occur, ensure that the instruments are still fully engaged on the instrument arm.

EPO (Emergency Power Off)

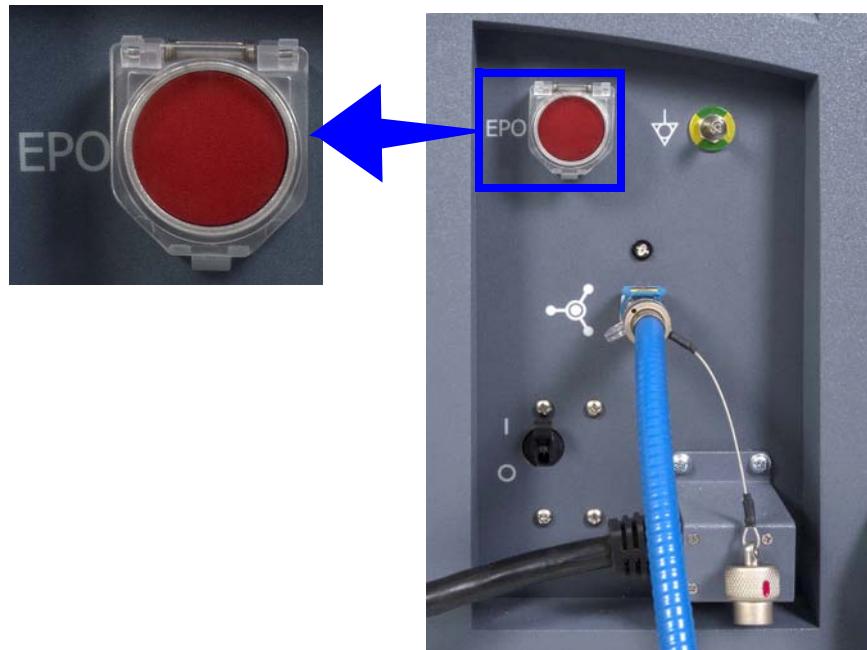


Figure 9.4 EPO button on rear of Patient Cart

The **Emergency Power Off (EPO)** button is on the back of the Patient Cart. Press this button to completely remove power to the Patient Cart. The system classifies this a non-recoverable fault. The system must be restarted.

9.3 Working with EndoWrist Instruments

⚠ CAUTION: Only use instruments and accessories approved by *Intuitive Surgical* for use with the *da Vinci Si™* Surgical System. *Intuitive Surgical* performs extensive testing to ensure compatibility of approved instruments and accessories. Compatibility of the system with non-approved instrumentation cannot be guaranteed. Any damage to the *da Vinci Si* Surgical System as a result of using non-approved instruments and accessories is not covered under warranty.

EndoWrist instruments consist of five main components (illustrated in [Figure 9.5](#)):

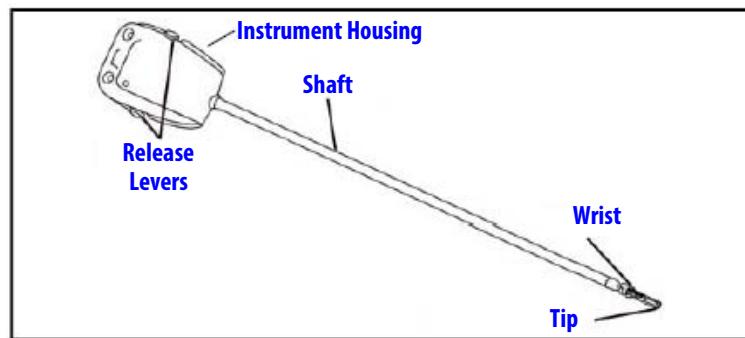


Figure 9.5 EndoWrist instrument components

1. **Tip:** The end effector of the instrument (such as graspers, cautery hooks, scalpels, etc.)
2. **Wrist:** The articulating wrist designed to mimic the wrist of the human hand

3. **Shaft:** The rotating “arm” of the instrument
4. **Release Levers:** The mechanism for removal of the instrument
5. **Instrument Housing:** The portion of the instrument that engages with the sterile adapter of the instrument arm

On the bottom of the instrument housing, you'll see a series of discs, which connect to the instrument wrist via cables that run through the instrument shaft. The movement of the master controllers on the Surgeon Console is translated through the pulleys to the *EndoWrist* instrument wrist. You also can rotate these disks by hand (when not attached to the sterile adapter) to verify the cable functionality, or to align the wrist for tool insertion.



Figure 9.6 Discs located in the instrument housing

The instrument interface of the instrument arm consists of three parts (Figure 9.7):

1. Insertion Axis
2. Instrument Sterile Adapter
3. Cannula

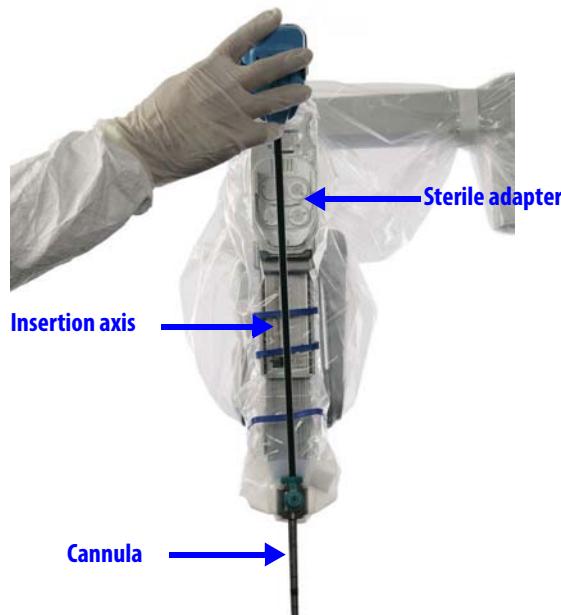


Figure 9.7 Insertion axis, sterile adapter and cannula with instrument being loaded

Insertion Axis

The telescoping insertion axis delivers the instrument to the surgical site. When no instrument is present, the insertion axis is fully retracted.

Instrument Sterile Adapter

The instrument sterile adapter is part of the instrument arm drape and provides the point of connection between the instrument and the instrument Arm.

Cannula

The cannula provides the port through the body wall of the patient.

- i Note:** Follow the instructions in the Instrument and Accessories User Manual to inspect cannulae before use, including use of a gage pin for 8 mm cannulae.

9.4 Instrument Installation, Insertion, Removal and Intraoperative Care

Installation

1. Inspect the instruments for broken, cracked, chipped, or worn parts and discontinue the use of instruments if any damage is noticed.
2. Straighten the instrument wrist—by rotating the discs on the back of the instrument housing, **not** by manipulating the wrist directly—to ensure easy insertion into the cannula and to prevent damage to the instrument.
3. Insert the instrument tip into the cannula and slide the instrument housing into the sterile adapter. You will hear three beeps when the instrument is engaged.



Figure 9.8 Inserting the instrument into the cannula and sterile adapter

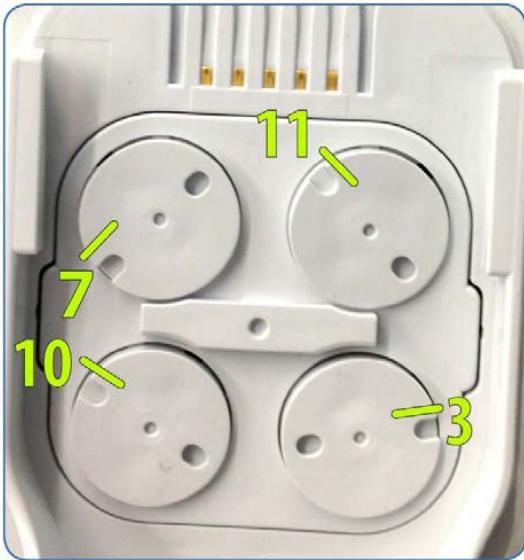
⚠ CAUTION: When inserting the instrument tip into the cannula, be careful not to puncture the instrument arm drape with the tip of the instrument.

⚠ CAUTION: Ensure all installed instruments are visible in the Surgeon Console view before proceeding to prevent inadvertent harm to the patient.

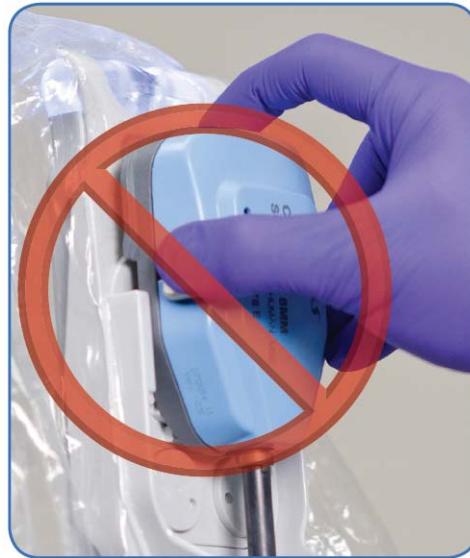
- i Note:** One instrument life is used whenever the instrument is used via the Surgeon Console (following mode). The number of uses left on the instrument may be queried without using a “life” by removing the instrument before entering following mode. When an instrument has no remaining uses, it will not engage on the system and a message on the touchscreen says the instrument has expired.

Instrument Installation Best Practices

1. Verify the sterile adapter discs are aligned using the process above before installing an instrument.



2. Do not squeeze the release levers while installing the instrument onto the Sterile Adapter.



3. Do not apply excessive force when installing the instrument.



4. Verify pins on the back of the arm are flush on the arm and not protruding.



Troubleshooting

Sequence:

1. If the instrument does not engage properly, reseat the instrument.
2. If the problem is not resolved, reseat the sterile adapter using the [Sterile Adapter Engagement Verification](#) process on page [6-11](#).
3. If the problem is not resolved, re-drape the arm.

For assistance, contact Technical Support: U.S. 800-876-1310, International +800 0821 2010 or +41 21 821 2020.

Plug and Play

Newly released instruments may need to download their new parameters to the *da Vinci Si* System. This process is only required once for each new type of instrument, and will take up to 15 seconds. During this download period, the arm LED will rapidly flash green and a message is displayed. Progress is shown as a percentage of completion. If an error occurs during plug and play, re-install the instrument.

Insertion

⚠ CAUTION: Make sure the Surgeon Console operator is ready to resume control of the instrument before inserting an instrument into the sterile field.

Once the system recognizes an instrument installed on an arm, you can insert it into the patient's body either manually or by using Guided Tool Change.

Manually

For the first instrument you install on an arm for this procedure, you must manually insert the instrument by pressing an arm clutch button (see [Figure 9.9](#)). The LEDs will blink alternating white during arm clutch. The Surgeon Console operator cannot control the instrument until it is moved out of the cannula and is no longer being clutched. Note that if you press and release the arm clutch button, instead of holding it down continuously as you insert the instrument, you must press and release the arm clutch button again after insertion through the cannula, to give control of the instrument to the surgeon.



Figure 9.9 Using arm clutch to insert an instrument manually

⚠ WARNING: The instrument may not be immediately visible when being moved from the cannula into the patient. Move the endoscope to visualize the instrument and use appropriate caution when inserting instruments into the patient.

Guided Tool Change

To provide an efficient and safe method for instrument insertion, the system can assist the patient-side assistant by guiding an instrument into the patient. Guided Tool Change only works when you replace an instrument. When you install the next instrument, the insertion axis unlocks and guides the instrument tip to a location just short of the last position of the previously installed instrument tip ([Figure 9.10](#)).

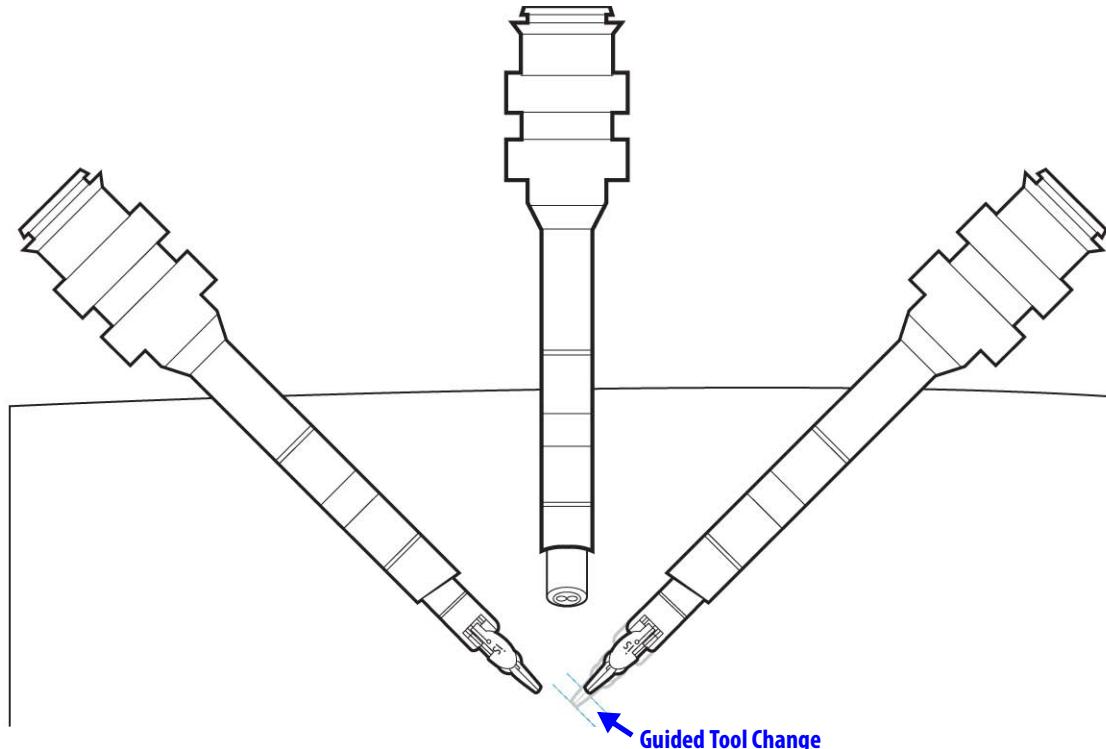


Figure 9.10 Illustration of Guided Tool Change

- If Guided Tool Change is enabled, the instrument arm LED blinks side-to-side, alternating white and green.

⚠ WARNING: During an instrument exchange, including using Guided Tool Change, the surgeon must not remove his/her hands from the masters until he/she has removed his/her head from the stereo viewer.

ℹ Note: For Guided Tool Change, the surgeon should remove their head from the stereo viewer to take all instruments out of following before removing and installing an instrument.

⚠ WARNING: Use appropriate caution when inserting instruments into the patient by visualizing the instrument on the touchscreen as it is being inserted.

- If Guided Tool Change is not enabled, the instrument arm LED is white and does not blink. Also, the system will display an icon and message instructing you to insert the instrument past the cannula tip.

The following occurrences disable Guided Tool Change:

- Pressing an instrument arm or port clutch button
- Any errors
- Instrument tip too close to cannula

After successful instrument insertion (using either Guided Tool Change or manual clutching), the arm LED turns blue, which means that now the surgeon can control the arm.

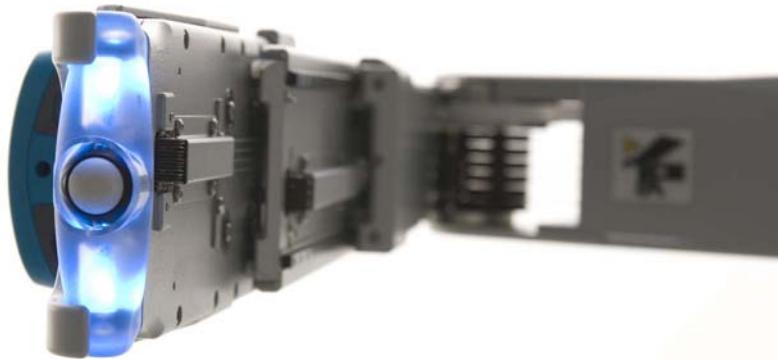


Figure 9.11 Blue arm LED indicates successful instrument insertion

- i Note:** When certain instruments are installed, the instrument arm provides extra holding force to ensure the instrument does not move during operation. If an outside force is acting on the arm for more than 300 milliseconds, the system will prevent following on that arm and will give error beeps until the force is removed.
- i Note:** If Guided Tool Change is disabled or does not initiate, use the arm clutch button to insert the instrument **Manually**, as described on page 9-9.

Troubleshooting: Guided Tool Change Does not Initiate

1. Remove and reseat the instrument and the instrument arm sterile adapter.
2. Use the arm clutch button to insert the instrument manually, under visualization, as described on page 9-9.
3. On the next instrument exchange, pull the instrument straight out and reinsert a new instrument without touching the clutch buttons.

If the problem persists, contact customer service for assistance: U.S. 800-876-1310, International +800 0821 2010 or +41 21 821 2020.

Fluid Leakage Precautions

The *EndoWrist* instruments are designed so that they may be positioned horizontally or inclined upwards during surgery according to the requirements of the procedure. As with any laparoscopic instrument, these positions can allow blood or other fluids to migrate through the instrument shaft towards its proximal end in such instrument positions. The *EndoWrist* instruments are designed to resist fluid migration of this nature and minimize fluid leakage from the proximal end.

However, in the event that blood or other fluid is noticed leaking out of the instrument and onto the instrument arm drapes or sterile adapter during the surgery, please take following actions:

1. Remove the instrument from the instrument arm and hold it vertically (tip down) to drain any fluids.
2. Thoroughly wipe any fluid off of the sterile adapter and drape before inserting any other instrument.

3. After surgery, thoroughly clean the instrument following the cleaning instructions from the IFU before reuse.

In addition, if any blood or other fluid is observed on the inside of the drapes (on the instrument arm), contact *Intuitive Surgical* Technical Support as soon as possible and before any future use. *Intuitive* personnel will provide guidance in adequately cleaning the instrument arm.

Instrument Removal

Before attempting to remove an instrument, make sure the surgeon is ready for it.

⚠ CAUTION: Removal of instruments during a procedure should be done very carefully and only with the knowledge of and full view of the Surgeon Console operator. Do not remove the instrument if it is not in view.

1. Before instrument removal, the Surgeon Console operator should do the following:
 - a. Ensure that the instrument tip is in view and is free of any patient anatomy.
 - b. Straighten the instrument wrist.
 - c. Clearly communicate to the patient-side assistant which instrument to remove. Identify the name of the instrument or the number of the instrument arm (for example, instrument arm 1, 2, 3).
2. Once the instrument is positioned for removal, the patient-side assistant should squeeze the release levers on the sides of the instrument and pull the instrument out.

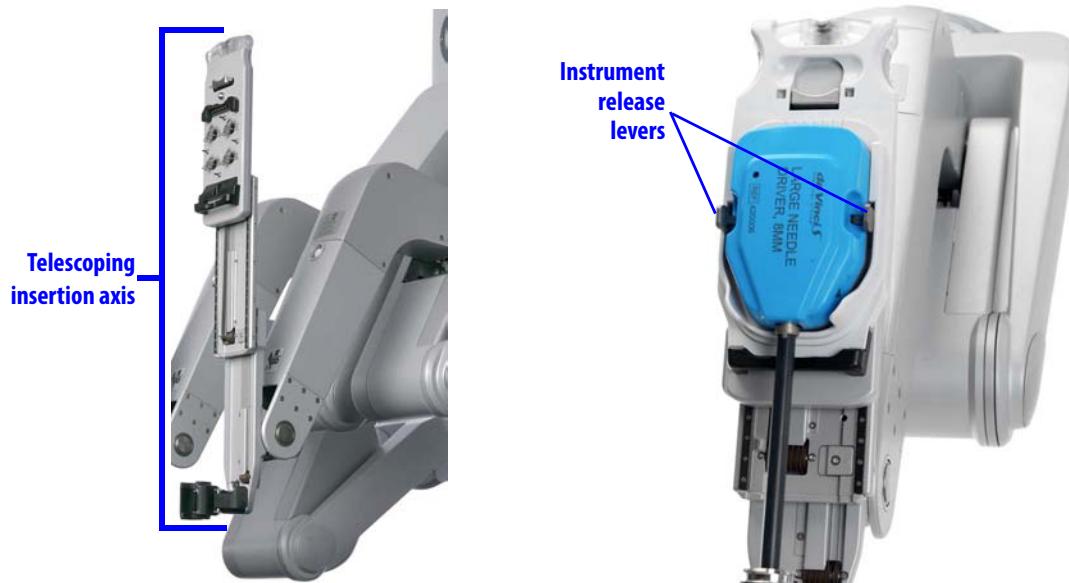


Figure 9.12 Telescoping axis and instrument release levers

ℹ Note: The instrument arm insertion axis will automatically retract when the instrument is removed. If the instrument is not removed in time, the instrument sterile adapter may re-engage the instrument during the insertion axis retraction. If this happens, simply remove the instrument from the instrument arm.

⚠ CAUTION: Any lateral pressure on the instrument during removal may damage the instrument.

Grip Release

⚠ WARNING: Do not perform grip release on a non-faulted system without first pressing the Emergency Stop button. Failure to observe this warning may result in unintended instrument motion or damage to the grip release mechanism.

For additional information regarding the Emergency Stop button, see [Right-Side Pod – Power and Emergency Stop](#), on page 10-4 (Chapter 10, Surgeon Console Use).

⚠ WARNING: Rotating the grip release tool too far and/or in the incorrect direction can cause unintended instrument motion or damage to the grip release mechanism.

i Note: Whenever possible, use Surgeon Console control to release the instrument grips.

i Note: The *EndoWrist* instrument release kit (PN 381199) includes a grip release tool attached to illustrated instructions for quick-reference. Be sure to keep a sterile instrument release kit in an accessible location.

The grip release mechanism facilitates removal of an instrument in the event of a system fault or power failure. For example, if the instrument tips are gripping tissue, the grip release tool allows the patient-side operator to manually open the grips.

To release the instrument grips manually, perform these steps while visualizing the surgical site:

1. Press Emergency Stop on the right-side of the Surgeon Console.
2. Insert the grip release tool into the grip release socket on the instrument housing ([Figure 9.13](#)). Ensure that the tool engages with the socket. Once engaged, you will feel slight resistance when you gently rotate the tool.
3. For 8 mm Clip Appliers and *Harmonic* instruments, carefully turn the grip release tool **clockwise** (approximately 1/4th turn) to open the instrument grips. For other instruments, carefully turn the grip release tool **counter-clockwise** (approximately 1/4th turn).
4. Under visualization, clear tissue from the grips. If needed, adjust the instrument arm to position the instrument away from tissue: support the instrument arm before clutching, to prevent unintended instrument motion.
5. Once tissue is cleared from the grips, remove the grip release tool from the instrument.
6. Squeeze the release levers on the sides of the instrument housing and pull the instrument out. Do not reuse the instrument.



Figure 9.13 Grip release socket

⚠ WARNING: Do not reuse an instrument that has had its grip released with the instrument release kit. Reusing an instrument after use of the instrument release kit could result in critical failure of the instrument and injury to the patient.

After use of the instrument release kit, return the affected instrument to *Intuitive Surgical* by contacting Technical Support. In the US, call 1-800-876-1310. International, call +800.0821.2010 or +41 21.821.2020.

Intraoperative Instrument Care

Please follow these recommendations to ensure the *EndoWrist* instruments are kept at their highest level of functionality:

- Clean the tips of instruments between instrument exchanges
- Do not use instruments to clean other instruments while inside the body

Instrument Usage

EndoWrist instruments are valid for a predetermined number of uses. We designed this feature to help ensure reliable and consistent performance throughout the *EndoWrist* instrument life. The system decrements one use from an instrument the first time it is installed and taken into following mode during a procedure. While we design most instruments to be used for a predetermined number of procedures, a few (such as the Large and Small Clip Appliers) we design to be used for a predetermined number of activations.

i Note: When an instrument's life is based on activations, it usually has a relatively large number of activations compared to instruments whose life is based on the number of procedures it is used in. For these instruments, the system decrements one use from the instrument each time it is installed on the system and goes into following mode.

View Remaining Uses

You can view the number of uses left for all instruments used during the current procedure by accessing Inventory Management on the **Utilities** tab of the touchscreen (see page [7-20](#)) or the touchpad (see page [10-18](#)).

- If an installed instrument is taken into following mode, the system decrements one use for that instrument. If an installed instrument does not enter following mode, it may be removed without reducing the number of uses remaining.

When you start to use an instrument that is on its last use, the system displays the message, “**Instrument will expire after procedure.**” In this case, and when the Inventory Management screen reports “**0**” remaining uses for an installed instrument, you still can use that instrument during the current procedure, but not for a new procedure.

Expiration and Disposal

When instruments expire, they are automatically inactivated and can no longer be used. Expired instruments must be properly disposed of following all applicable national and local laws and guidelines.

9.5 Working with the Endoscope at the Patient Side

The Endoscope Assembly

The patient-side assistant is responsible for endoscope installation, insertion, removal and intraoperative camera head maintenance. The operator must ensure that the endoscope is handled with great care, as the instrument is very delicate and can be easily broken if dropped or struck. For instructions to assemble and prepare the endoscope for use, see [Setting Up the Vision System](#) on page [7-5](#).

The endoscope assembly consists of two main components:

- **Endoscope:** The interchangeable sterile endoscope

- **Camera Head:** The draped video capture device



Figure 9.14 Endoscope assembly

The endoscope interface of the camera arm consists of four parts:

- **Insertion Axis:** Delivers the endoscope to the surgical site.
- **Camera Arm Sterile Adapter:** Provides the point of connection for the endoscope to the camera arm.
- **Cannula Mount:** Designed to hold the cannula securely in place
- **Cannula:** Provides the port through the body wall of the patient, through which the endoscope is inserted.

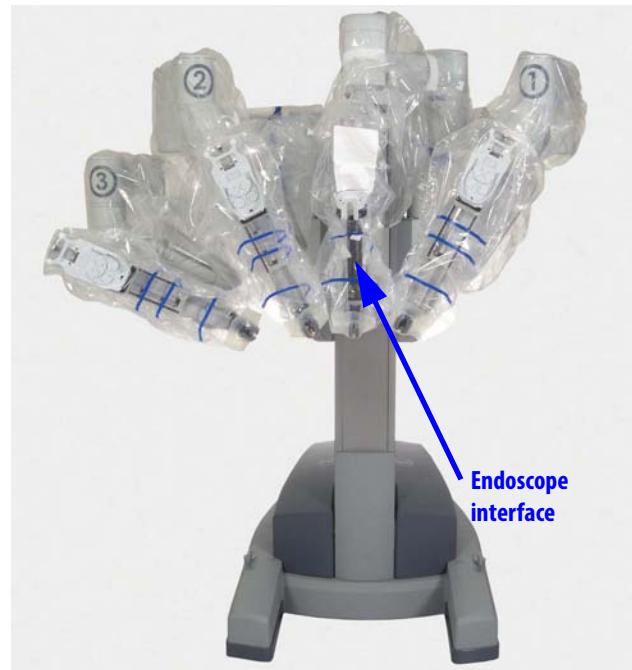


Figure 9.15 Patient Cart showing endoscope interface location

9.6 Endoscope Installation, Insertion, Removal and Intraoperative Care

Preoperative Endoscope Care

Before use, ensure the endoscope tip is adequately heated to minimize fogging when entering the surgical site. To heat the endoscope tip, dip it in a canister of heated sterile water. Place a piece of sterile gauze at the bottom of the canister to prevent damage to the delicate endoscope tip.

Installation

When the endoscope is ready to install on the camera arm, follow these steps:

1. Make sure the camera control buttons on the camera head are facing the tower of the Patient Cart. Carefully insert the endoscope tip through the camera cannula.



Figure 9.16 Installing the endoscope on the camera arm

2. Align the scope with the insertion axis as you pass it through the camera cannula and press the endoscope body into the camera arm sterile adapter. You will hear a click when the endoscope body is pressed into the sterile adapter. Make sure the endoscope body is fully engaged by gently pulling up on the endoscope. If properly engaged, the endoscope will not disengage from the sterile adapter. Re-seat as necessary.

⚠ CAUTION: If not fully engaged, the endoscope may fall out.

⚠ CAUTION: To avoid possible thermal damage to the cannula, do not leave the endoscope tip inside a plastic endoscope cannula for a prolonged period of time while the lamp is on.

Confirm Live Image in Stereo Viewer

Each time you install an endoscope, and after changing view modes or settings during a procedure, look in the stereo viewer to confirm a live image is present and has the desired orientation. Adjust endoscope orientation as necessary. If no image is present, confirm the lamp is on and at 100% intensity, as shown below. See section [C.3 Basic Troubleshooting](#), page [C-5](#), for further troubleshooting if no image is present.

3. Connect the yellow portion of the camera cable to the strain relief support on the camera arm.

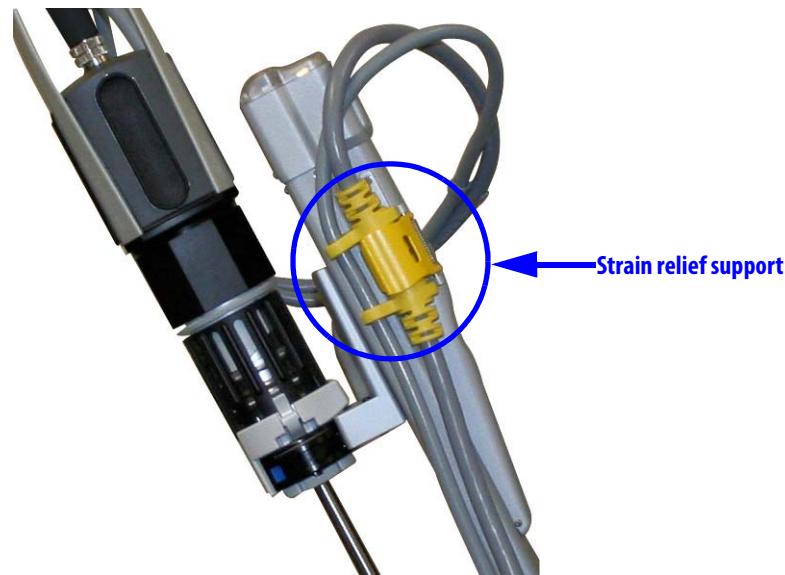


Figure 9.17 Camera cable in strain relief support shown without sterile drapes

- i Note:** Leave the cable attached to the strain relief support when working with the camera head or endoscope assembly.

⚠ WARNING: The temperature of the distal tip of the endoscope may exceed 41°C during use. Avoid contact with skin, tissue and clothing when the Illuminator is turned on and the endoscope is outside the camera cannula, as damage may occur to skin, clothing and equipment. Do not contact tissue with the endoscope nor attempt to clean the tip of the endoscope by dipping it in tissue. The tissue can be damaged because of the heat, and the tip of the endoscope may develop baked-on deposits which can decrease light throughput.

Insertion

Once the endoscope is installed, use the camera arm clutch to manually guide it into the patient's body.

Intraoperative Endoscope Cleaning

As necessary due to fogging or smudging of the tip, remove the endoscope and wipe the tip with a piece of moistened sterile gauze.

Removal

1. Release the camera head cables from the strain relief support.
2. Squeeze the release levers on either side of the camera arm sterile adapter and gently pull the endoscope straight up and out of the cannula.

i Note: *Intuitive recommends you wipe clean the tip of the endoscope immediately after removing it, to prevent hardening of deposits that may be present.*

Changing the Endoscope

⚠ WARNING: **The connection point between the camera head and the endoscope can become hot. Exercise caution when handling the endoscope.**

The endoscope may be changed during a procedure. To change the endoscope, perform the following steps:

1. Remove the endoscope from the camera arm as instructed above.
2. Remove the endoscope from the camera head.
3. Assembly is the opposite of disassembly. If using an angled endoscope, ensure the tip is oriented correctly.

End of section

10 Surgeon Console Use

This chapter explains use of the *da Vinci Si* Surgeon Console during surgery. The following subjects are covered:

- [10.1 Surgeon Console Overview](#), page 10-1
- [10.2 Setting up the Surgeon Console](#), page 10-5
- [10.3 Touchpad Controls](#), page 10-11
- [10.4 Surgical Controls](#), page 10-22
- [10.5 Dual Console Surgery](#), page 10-39



Figure 10.1 Surgeon Console

10.1 Surgeon Console Overview

The Surgeon Console has six main components:

- [Master Controllers](#) (left and right), page 10-2
- [Stereo Viewer](#), page 10-2
- [Touchpad](#), page 10-3
- [Left-Side Pod – Ergonomic Controls](#), page 10-4
- [Right-Side Pod – Power and Emergency Stop](#), page 10-4
- [Footswitch Panel](#), page 10-5

Master Controllers

The master controllers (masters) enable the Surgeon Console operator to control the Patient Cart instruments and endoscope. The masters have two main parts, an orientation platform and a positioning arm.

- The orientation platform ([Figure 10.2](#)) rotates the instrument tips and opens and closes the grips of the instruments.
- The positioning arm ([Figure 10.2](#)) moves the instrument in the surgical environment. Positioning movements can be scaled to a 3:1 (Fine), 2:1 (Normal), or 1.5:1 (Quick) ratio.

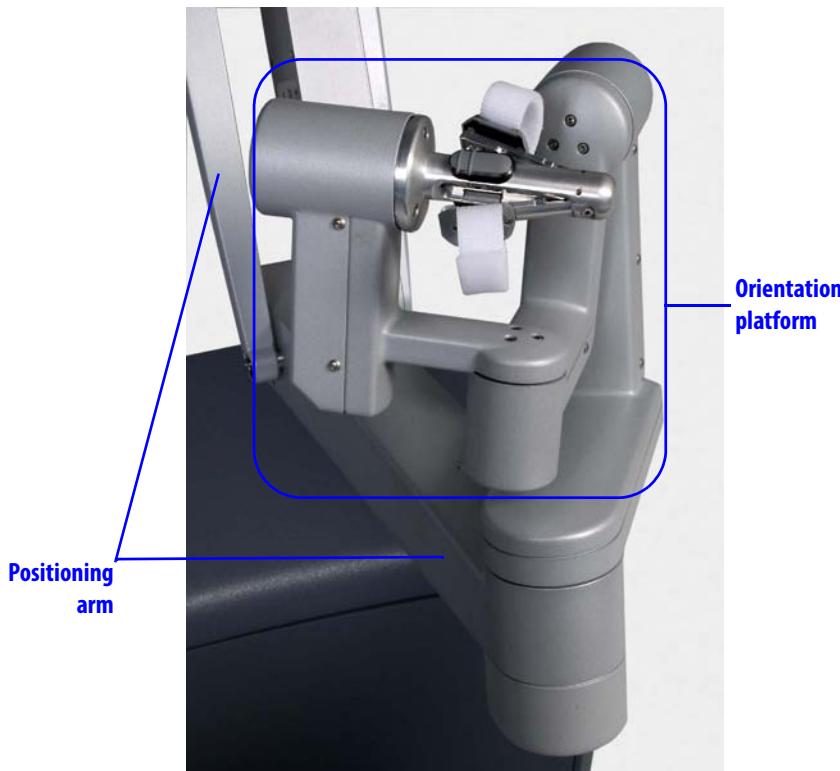


Figure 10.2 Master controller

i Note: If instruments cannot be manipulated in a precise and controlled manner contact *Intuitive Surgical* Technical Support.

i Note: If instrument motion appears to be non-intuitive, contact *Intuitive Surgical* Technical Support immediately. In the US, call 1-800-876-1310, where phones are staffed 24 hours a day, seven days a week. In Europe, call +41.21.821.2020.

For more information on use of the masters, see [Matching Grips](#) (page 10-22), [Finger Clutch](#) (page 10-23), and the [Surgical Controls](#) section starting on page 10-22.

Stereo Viewer

The stereo viewer provides the video image to the Surgeon Console operator, the surgeon. With his or her head in the viewer, the surgeon can view the 3D image in full-screen mode or can choose to swap to *TilePro*™ mode, which displays the 3D image along with up to two auxiliary images. Icons and text messages are overlaid on the video to provide extended information to the surgeon. The system provides 2-way audio communications with the

Patient Cart operator by a microphone located under the viewport and a pair of speakers located in the head rest. See [Video](#) (page 10-12) and [Audio](#) (page 10-17) for more information on use and adjustment of the stereo viewer.



Figure 10.3 Stereo viewer

Touchpad

The touchpad is the main control interface of the Surgeon Console. Functional descriptions of the specific controls are provided in the following section.



Figure 10.4 Touchpad (home screen)

For more information on use of the touchpad, see [10.3 Touchpad Controls](#) on page 10-11.

Left-Side Pod – Ergonomic Controls

The left-side pod provides the ergonomic adjustment controls for the Surgeon Console, as indicated below.

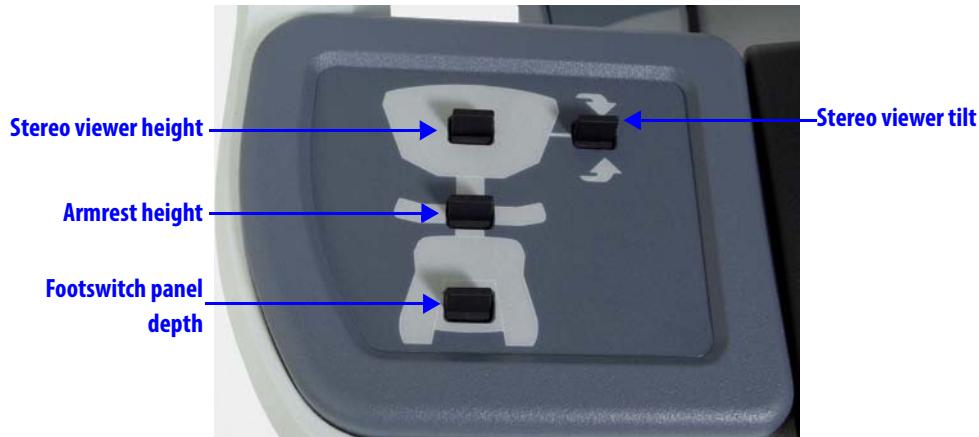


Figure 10.5 Left-side pod – ergonomic controls

For more detail on ergonomic adjustments, see [Ergonomic Setup](#) on page 10-10.

Right-Side Pod – Power and Emergency Stop

The right-side pod on the Surgeon Console provides **Power** and **Emergency Stop** buttons (Figure 10.6).

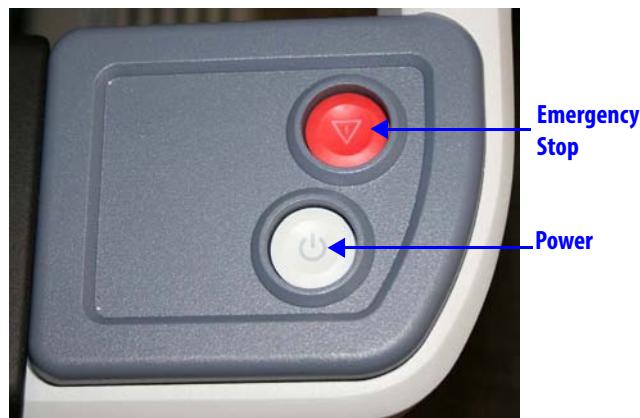


Figure 10.6 Right-side pod

Press the red **Emergency Stop** button should it be necessary to stop system operation at any time. The Emergency Stop button will cease robotic control of the instruments and endoscope. The instruments and endoscope will stay in their last commanded position.

If the instrument grips are closed when the Emergency Stop button is pressed, the grips will remain closed. However, the gripping force of the instrument may decrease.

Pressing Emergency Stop generates a recoverable fault, which can be cleared by pressing **Recover** on the touchscreen or touchpad. The Emergency Stop button illuminates until the fault is recovered.

Footswitch Panel

The footswitch panel allows the surgeon to control the camera, instruments, and ESU without removing his or her head from the stereo viewer

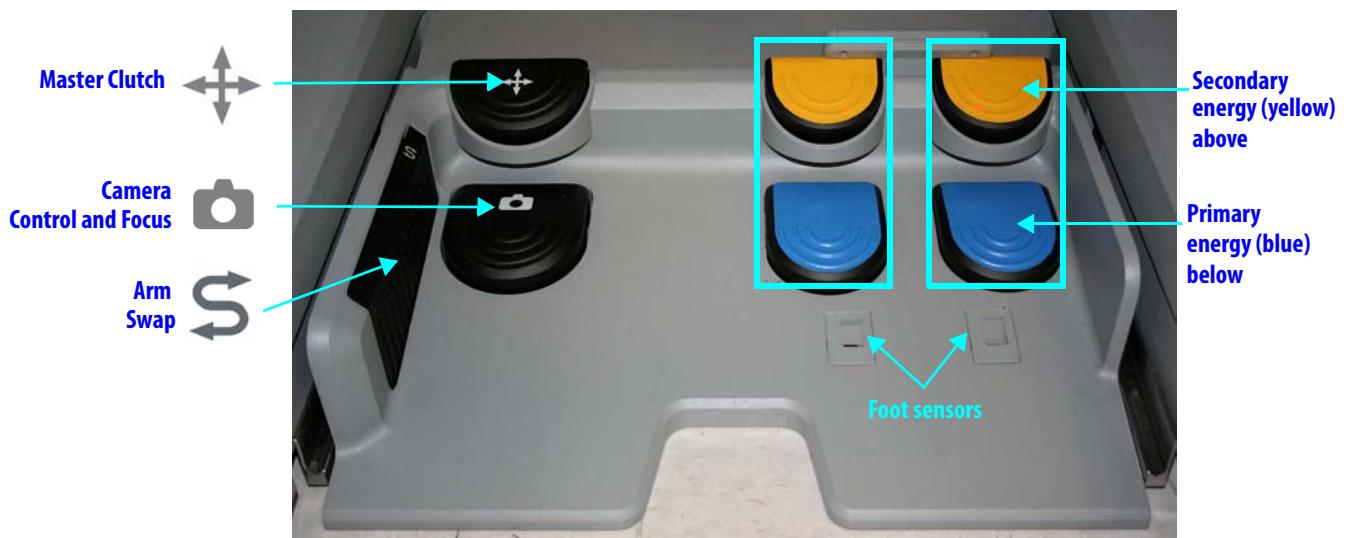


Figure 10.7 Footswitch panel

For instructions to use the footswitch panel, see [Footswitch Panel Use](#) on page 10-24.

10.2 Setting up the Surgeon Console

This section explains how to set up the Surgeon Console for use.

Login and Settings

The *da Vinci Si* System provides enhanced ease of use by automatically saving your last set of user-adjustable settings, such as your ergonomic settings, with your user name, and then applying your preferences automatically when you log in. To enjoy this benefit, we recommend you log in with your user name each time you use the Surgeon Console. (It is possible to bypass login, in which case your preferences cannot be saved.)

For each of the settings in [Table 10-1](#) below, the system saves the last selection made to the current user profile, when a user is logged in. [Table 10-2](#) lists settings not saved to a user profile, but applied until changed again. For all settings, the second column reports whether changes made on one Surgeon Console affect the other console when changes are made while in dual console mode.

Table 10-1 Settings Saved to the User Profile

Setting (options, default bold)	Change affects other console when made in dual console mode ^a	For details, see this section, on page
Ergonomic Settings	No, local effect only	Ergonomic Setup , page 10-10
Video Brightness (0-100)	Yes, affects other console ^a	Video , page 10-12
Video Contrast (0-100)	Yes, affects other console ^a	Advanced Video Adjustments , page 10-13
Video Saturation, Red & Yellow (0-100)	Yes, affects other console ^a	Advanced Video Adjustments , page 10-13

Table 10-1 Settings Saved to the User Profile

Setting (options, default bold)	Change affects other console when made in dual console mode^a	For details, see this section, on page
Video Edge Enhancement (0-100)	Yes, affects other console ^a	Advanced Video Adjustments , page 10-13
Digital Zoom (Wide/ Full /2x/4x)	No, local effect only	Display Preferences , page 10-15
<i>TilePro</i> (Off /2D/3D, and <i>TilePro</i> window sizing slider)	No, local effect only	Display Preferences , page 10-15
Telestration Eye (L/R)	Yes, affects other console ^a	Display Preferences , page 10-16
Image Depth (Normal /Far)	No, local effect only	Display Preferences , page 10-16
Image Enhancement (On /Off)	Yes, affects other console ^a	Display Preferences , page 10-16
Finger Clutch (On /Off)	No, local effect only	Control Preferences , page 10-20
<i>TilePro</i> QuickClick (On / Off)	No, local effect only	Control Preferences , page 10-20
Haptic Zoom (On / Off)	No, local effect only	Control Preferences , page 10-20
Motion Scaling (from masters to instruments, Quick/ Normal /Fine)	No, local effect only	Control Preferences , page 10-20
Disable <i>SmartPedal</i> Notification screen (present on login and unlock)	No, local effect only	On <i>SmartPedal</i> Notification screen, before surgeon login

a. Changes that affect video image display also affect video output to the touchscreen and to the Video Out Aux bay of video output ports on the Core.

Table 10-2 Settings Not Saved to a User Profile

Setting (options, default bold)	Change affects other console when made in dual console mode	For details, see this section, on page
Illuminator Light Output (0-100)	Yes, affects other console	Advanced Video Adjustments , page 10-13
Scope Angle (0 degrees/30 \uparrow /30 \downarrow)	Yes, affects other console	Camera / Scope Setup , page 10-14
Stereo Viewer Mode (2D/ 3D)	No, local effect only	Display Preferences , page 10-16
Master Associations (Configure)	Yes, affects other console	Control Preferences , page 10-21

Follow these steps to log in:

Repeat User

If you already have a user name, touch it to log in. Scroll using the arrow keys if necessary.

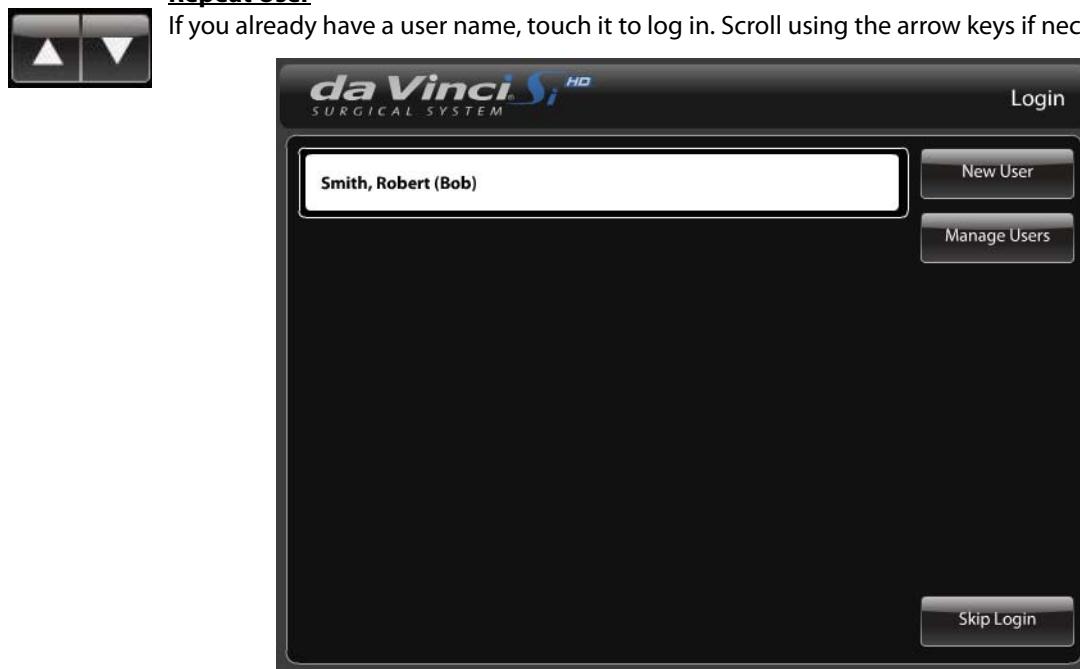


Figure 10.8 Login screen

When you select the user name, the touchpad notifies you by the following screen that the ergonomic adjustment axes of the Surgeon Console will move:



Figure 10.9 Restore ergonomic settings

Make sure persons and objects are clear of the Surgeon Console and, as the button says, **Press and Hold to Restore Settings**. A blue bar indicates progress as the Surgeon Console applies the last ergonomic settings for this user. If you press and hold the **Reverse** button, the Surgeon Console reverses its movement, and the progress bar backs up. If you release either button, movement stops, as does the progress bar. Press and hold the desired button again to resume movement in that direction. When you finish restoring settings, the Restore Settings screen closes automatically and the touchpad home screen appears (see [Figure 10.13](#), page [10-11](#)). (Touch **Cancel** at any time to login with the current ergonomic settings.)

New User

New User

If you have not logged in to the system before, setup a user account like this:

1. Touch the **New User** button located on the login screen of the touchpad. The New User (Step 1 of 6) screen appears.



Figure 10.10 New User (Step 1 of 6) screen

2. Enter your name using the touchpad keyboard and touch **OK**.

Now the system walks you through ergonomic setup. This is required only one time, when creating a new account. The following New User screens appear in order.



Step 2: Adjust chair height



Step 3: Adjust armrest height



Step 4: Adjust viewer height



Step 5: Adjust viewer tilt



Step 6: Adjust foot switch panel depth

Figure 10.11 New User ergonomic setup screens

You are now logged in. Once logged in, the system saves to your profile any changes you make to the system configuration, like ergonomic settings, and then applies your profile automatically each time you log in again. To logout, touch the **Logout** button in the lower left corner of the home screen.

Manage Users

Manage Users

Touch **Manage Users** to access the Manage Users screen, where you can delete users.

Ergonomic Setup

⚠ CAUTION: Before adjusting ergonomic controls on the Surgeon Console, make sure there is adequate room for the components to move.

Once logged in, the system saves to your profile any changes you make to the system configuration, like ergonomic settings, and then applies your profile automatically each time you log in again. To adjust the Surgeon Console ergonomics to your preference, perform the following steps:

1. Adjust the chair height so your thighs are at a slightly downward angle relative to the floor. This ensures easy movement of the legs to activate the footswitches.
2. Adjust the armrest height so your forearms rest comfortably on the armrest with your shoulders relaxed ([Figure 10.12](#)).
3. Adjust the stereo viewer height to your preference ([Figure 10.12](#)).
4. Adjust the stereo viewer tilt according to your preference ([Figure 10.12](#)). Tilting up allows for a more comfortable neck angle. Tilting down allows for more alignment of your hands and the instruments in the stereo viewer.
5. Adjust the footswitch panel depth to your preference ([Figure 10.12](#)).

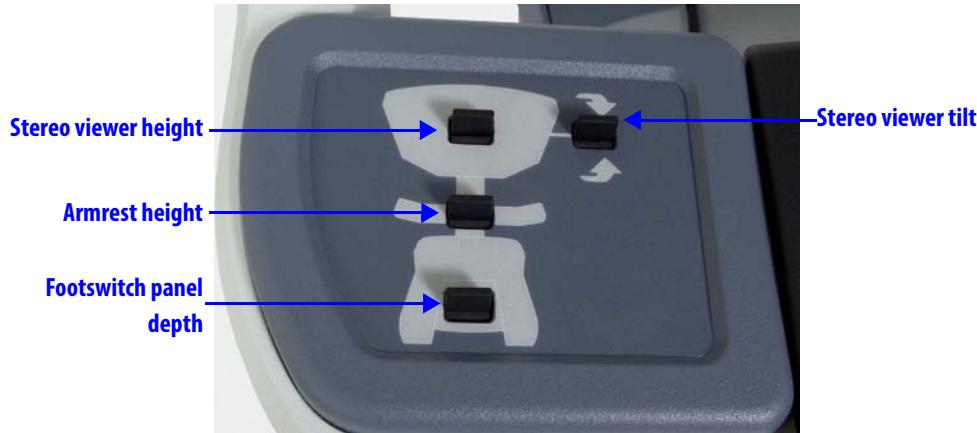


Figure 10.12 Left-side pod adjustments

10.3 Touchpad Controls

Overview

The touchpad home screen provides system status, including instrument arms, camera arm, and energy controls. In dual console mode, it also enables you to give or take control of instrument arms (see [Dual Console Surgery](#) on page 10-39).

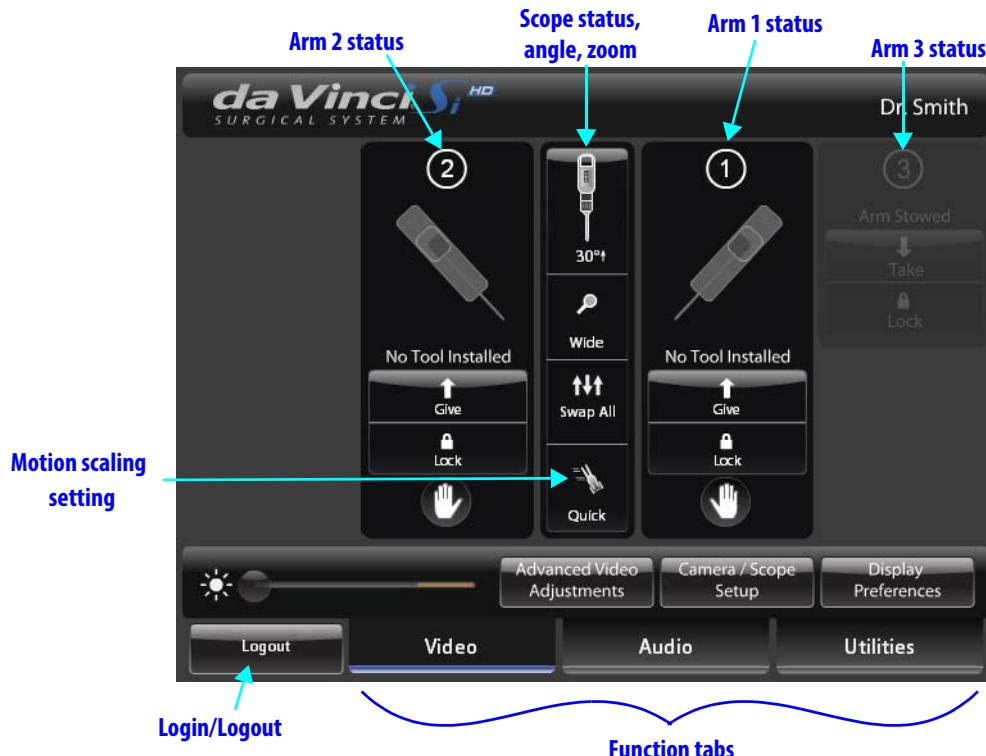
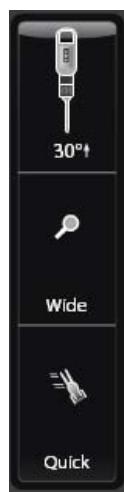


Figure 10.13 Touchpad home screen

- In general, as for the touchscreen menus:
- Grayed-out items are not active or unavailable in the current context. Observe that Arm 3 is stowed and not available for use in [Figure 10.13](#).
- Items highlighted blue are selected.
- **Quick Settings Buttons:** Three quick settings buttons run down the center of the screen. From top to bottom, the buttons indicate current settings for scope angle, zoom level (in the stereo viewer) and motion scaling. Touching these opens the associated settings screen, where you can adjust:
 - [Camera / Scope Setup](#), see page 10-14
 - Zoom level, as in [Display Preferences](#), see page 10-15
 - [Control Preferences](#), see page 10-20
- **Lock:** Touch **Lock** to lock an arm's position and prevent accidental switching to an instrument arm that is performing a static function (for example, retracting or stabilizing tissue). When an instrument arm is locked, it maintains its position. The lock button is highlighted blue when selected, indicating it is locked. You must touch **Lock** again to enable control of the arm.



Unlock Touchpad

When the surgeon takes instruments into following mode, the touchpad automatically locks, to prevent inadvertent actions.



Figure 10.14 Touchpad locked

Touch **Unlock** to access the touchpad again.

Video

The **Video** tab provides quick access to the brightness adjustment as well as Advanced Video Adjustments, Camera/Scope Setup and Display Preferences.



Figure 10.15 Video tab



- **Brightness:** Drag the **Brightness** slider (sun icon at lower left) to adjust video brightness (not actual illumination) in the stereo viewer. Brightness increases to the right.

Advanced Video Adjustments

**Advanced Video
Adjustments**

Touch **Advanced Video Adjustments** to adjust the Advanced Video settings of the surgical image.



Figure 10.16 Advanced Video Adjustments

i Note: The specific adjustment of these settings is a matter of surgeon preference. Like any adjustable video image, you may observe that some settings affect others, with the result that a specific combination of settings may represent a tradeoff, for example, between glare in one part of the image and enhanced visibility in another part. Keep in mind that you can readjust these settings at any time.

- **Brightness:** Drag the slider to adjust the brightness of the surgical image. This is video brightness, as opposed to actual illumination.
- **Contrast:** Drag the slider to adjust the contrast of the surgical image.
- **Red:** Drag the slider to adjust the red of the surgical image.
- **Yellow:** Drag the slider to adjust the yellow of the surgical image.
- **Edge Enhancement:** Drag the slider to adjust the edge enhancement of the surgical image. Increasing edge enhancement (slider to the right) may also increase noise.
- **Illuminator:** Drag the slider to adjust the actual light output transmitted to the surgical field in 10% increments.

i Note: To minimize fogging, maintain heating of the endoscope tip by setting the Illuminator intensity to 100% and adjust the brightness of the surgical image using the Illumination slider on the touchpad or touchscreen under Advanced Video Adjustments.

Camera / Scope Setup

Touch **Camera / Scope Setup** to setup the camera head and endoscope from the Surgeon Console. This is equivalent to setup using the touchscreen and/or camera head (see [Camera / Scope Setup from the Camera Head](#) on page 7-7)



Figure 10.17 Camera / Scope Setup

- **Scope Angle:** You can specify the scope angle by touching the corresponding button: **0** (degrees, for straight endoscopes), **30 \uparrow** (degrees up) or **30 \downarrow** (degrees down) for angled endoscopes.

i Note: When a new scope angle is selected, the system realigns the master controllers to match the instrument tip orientation and position.

⚠ WARNING: If the wrong scope angle is manually selected, instrument motion may appear non-intuitive.

- **White Balance:** Touch to perform white balance.
- **3D Calibration:** Touch to calibrate the camera/scope assembly from the Surgeon Console. For further instructions, see [3D Calibration of the Endoscope Assembly](#) on page 7-10.

Display Preferences

Touch **Display Preferences** to configure the stereo viewer display.

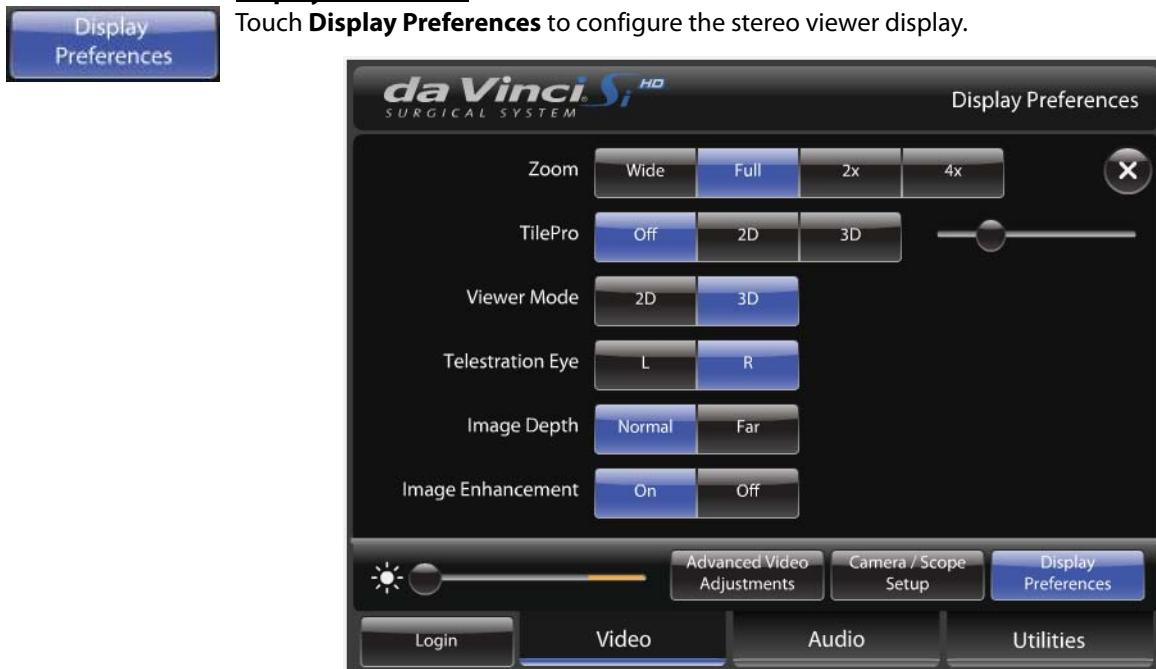


Figure 10.18 Display Preferences

- **Zoom:** Also known as digital zoom, this allows you to zoom in on the image without changing the position of the endoscope tip. Zoom has four settings (**Wide**, **Full**, **2x**, **4x**). The current setting appears below the scope status icon on the touchpad.
When you change the Zoom setting, a navigation window appears in the bottom right corner of the Surgeon Console image. The navigation window represents the widescreen (16:9) image. The blue rectangular outline indicates the zoom level.
- **TilePro:** Selecting **2D** or **3D** switches the stereo viewer display from full endoscope view to *TilePro* (multi-image) mode. *TilePro* allows display of up to two auxiliary video inputs (PACS, ultrasound, room camera, etc.) along with the operative image. When *TilePro* is active, the system detects auxiliary video inputs and arranges the *TilePro* display accordingly. While in *TilePro* mode, you can use the slider to scale the endoscopic image relative to the auxiliary images. As the operative image size changes, the auxiliary images will scale to fill in the remaining display area.
 - **3D TilePro:** To display a 3D *TilePro* video source in the stereo viewer, connect a compatible (stereo) video source to both the **TilePro** (L) and (R) connectors at once and select **3D** on the touchpad.

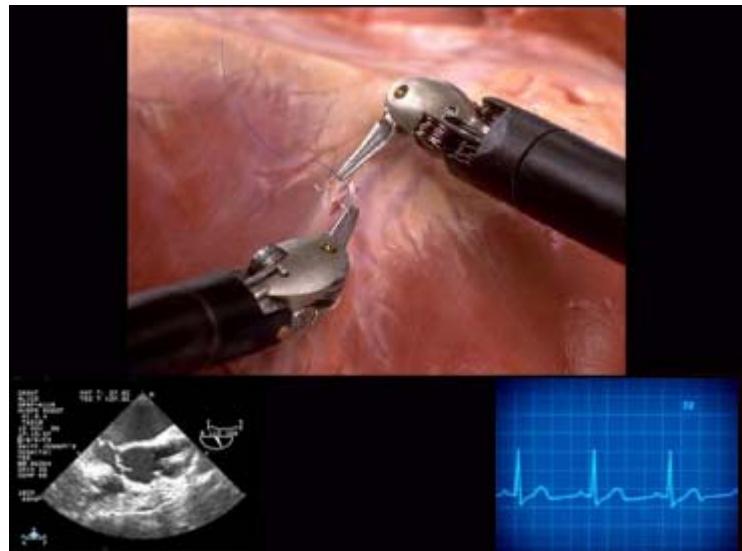


Figure 10.19 Sample TilePro layout in stereo viewer

- i Note:** *TilePro is disabled unless the system senses auxiliary video input(s).*
- **Viewer Mode:** Toggles the stereo viewer between **2D** and **3D** mode.
 - **Telestration Eye:** Toggles display of telestration overlay between the left-eye (**L**) and right-eye (**R**) image.
 - **Image Depth:** Optimizes the surgeon's ability to see a fused 3D image at **Normal** or **Far** distances. The system defaults to **Normal**.
 - **Image Enhancement:** Default is **On**. When on, it optimizes sharpness of the video image display in most situations. Turning it off may reduce noise in the image.
- i Note:** *For details regarding icons and text messages overlaid on the stereo viewer display see [Appendix G: Symbols, Icons and Text Messages Reference](#).*

Audio

The **Audio** tab enables volume adjustments and microphone mute.

i Note: If you experience difficulty in communicating with the patient side assistant, check the audio settings.



Figure 10.20 Audio tab



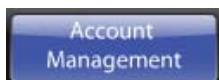
Addressing Audio Feedback

To address audio feedback, attempt the following mitigations:

- **Volume:** Drag the slider to adjust volume in the Surgeon Console speakers; volume increases left to right.
 - **Mute:** Touch to mute the Surgeon Console microphone.
- Reduce speaker volume in the Surgeon Console and/or at the touchscreen.
 - Orient the Surgeon Console(s) and touchscreen so that microphones and speakers do not point toward each other.
 - Increase the distance between the Surgeon Console(s) and touchscreen.
 - Mute either the Surgeon Console or touchscreen microphone to allow amplified audio in one direction only.
 - Use an external speaker connected to the Surgeon Console Audio Line Out to amplify the audio output from that Surgeon Console only.

Utilities

The **Utilities** tab provides access to Account Management, Inventory Management, Event Logs and Control Preferences.

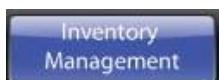


Account Management

Provides access to user account information. Users may change information regarding their profile or delete their account.



Figure 10.21 Account Management



Inventory Management

Reports usage status for instruments used during the procedure. When the surgeon selects **Inventory Management**, the inventory list appears in the stereo viewer, not the touchpad.

The list also displays the usage hours of the lamp module. Press **Page Up** or **Page Down** to scroll the inventory list.



Figure 10.22 Inventory Management

Event Logs**Event Logs**

Provides access to system event logs, including error logs. When the surgeon selects **Event Logs**, the event logs appear in the stereo viewer, not the touchpad. The touchpad notifies you that the information is displayed in the stereo viewer.



Figure 10.23 Event Logs

Troubleshooting**Troubleshooting**

Displays the system name and system software version, and provides **L** (left) and **R** (right) buttons to display the color bar test pattern in the left or right video channel independently. The functionality is the same as found on the touchscreen **Troubleshooting** screen.

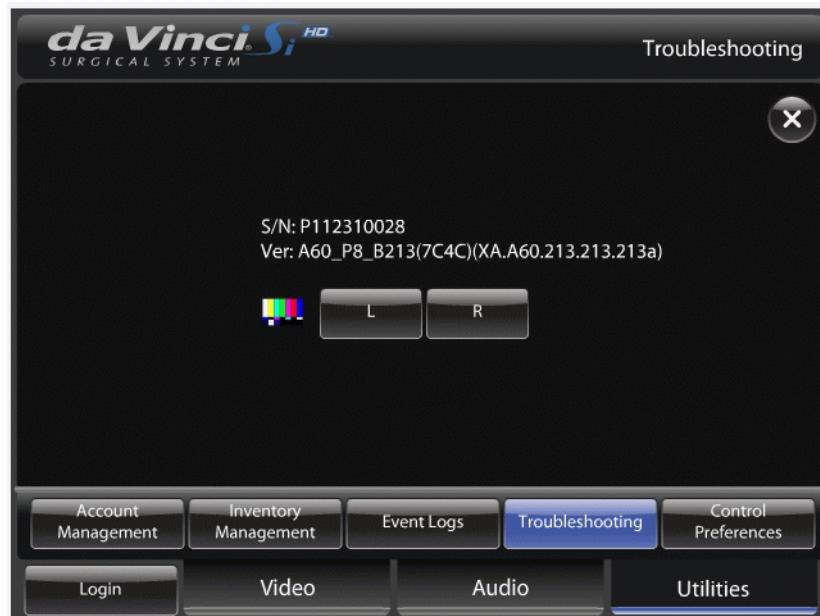


Figure 10.24 Troubleshooting on touchpad

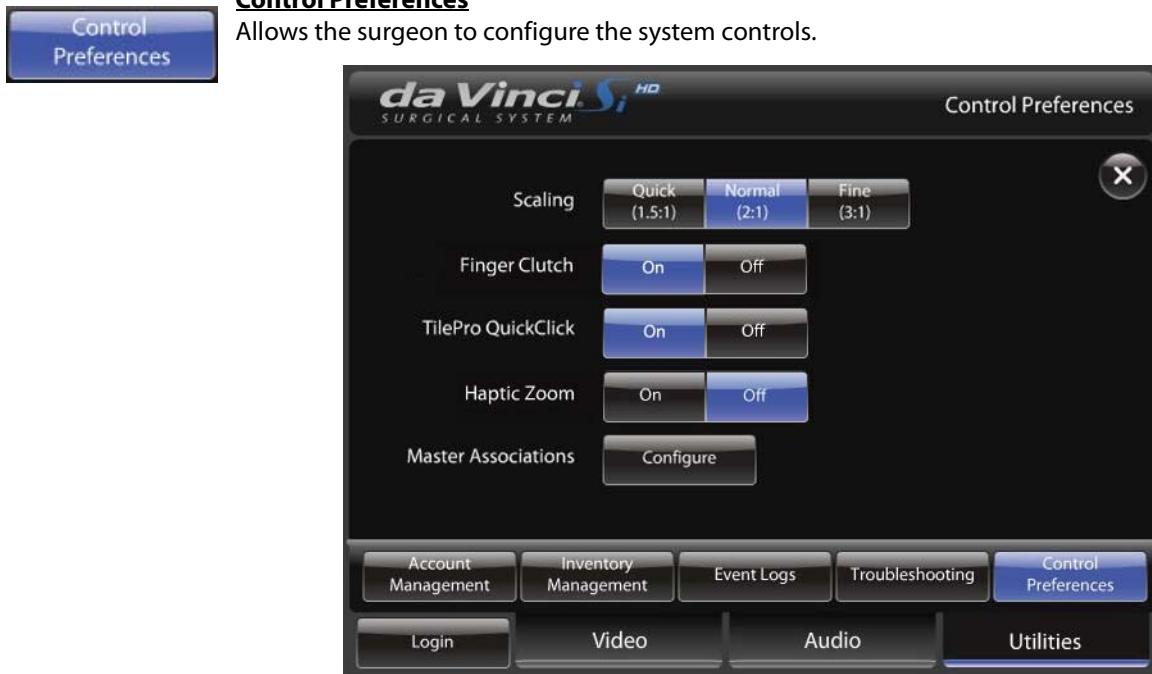


Figure 10.25 Control Preferences

- **Scaling:** Scales master controller positioning movements to **Quick** (1.5:1), **Normal** (2:1) and **Fine** (3:1) ratios. The system defaults to **Fine**.
- **Finger Clutch:** Turn finger clutching on or off. The finger clutch buttons on the masters are on by default, when no one is logged in to the Surgeon Console. However, note that finger clutch on or off is saved to a user's profile. So if you change the setting while logged in to the Surgeon Console, that setting will be saved to your profile and apply automatically whenever you log in.
- **TilePro QuickClick:** Turn *TilePro* QuickClick on or off. When on, the surgeon can switch into *TilePro* mode by quickly clicking the camera pedal.
- **Haptic Zoom:** Turn haptic zoom on or off. Off by default, haptic zoom is a method to apply digital zoom using the masters, while in camera control mode. Recall that digital zoom does not move the endoscope tip. To use haptic zoom, press the camera pedal to enter camera control mode and:
 - Push the masters closer together to zoom in (digitally).
 - Pull the masters apart from each other to zoom out (digitally).

i Note: You may feel a slight detent (pushback) on the masters as the levels are adjusted.

- **Master Associations:** Touch **Configure** to open the Master Association screen, which enables you to manually associate either master with any instrument arm.



Figure 10.26 Master Associations

- You can press **Auto** to apply master associations automatically, or use the arrow buttons to manually switch masters association by instrument arm. When instruments are reassigned, the system takes the instruments out of following, notifies and prompts you with the icon and associated message below:



Your instruments have been reassigned.
Tap 'Arm Swap' pedal to acknowledge
and continue.

Figure 10.27 Icon and message when instruments reassigned

i Note: In dual console mode, either surgeon can use the Master Associations screen to reassign instruments to different masters – even while the other surgeon has control of the instruments. The new instrument assignment applies on both consoles and persists when instruments are swapped. The system notifies the surgeons as usual when reassignment occurs.

- The system does not allow you to associate all 3 arms with one master, and notifies you if you attempt it: “**Maximum of two arms per side.**”



Figure 10.28 Maximum of two arms per side

10.4 Surgical Controls

This section describes the interface for controlling the instruments, camera and stereo viewer display via the masters and footswitch panel.

To begin using the surgical controls, the surgeon must first put his or her head in the stereo viewer. The stereo viewer uses a pair of infrared head sensors to determine whether the system is in use or not. If the surgeon’s head is out of the viewer, he or she cannot take control of the instruments or camera.

⚠ CAUTION: The infrared head sensors performs a safety function by preventing movement of the Patient Cart arms when the surgeon’s head is not in the viewer. Do not defeat this safety feature by intentionally blocking the sensors.

Matching Grips

Before taking control of instruments, the surgeon must first “match grips.” Matching grips is a safety feature designed to prevent inadvertent activation of instruments. It also ensures that items being held by inactive instruments are not accidentally dropped when activated.

To enable surgeon control, matching grips requires two steps:

- Satisfy Intended Motion:** Satisfy intended motion by using the master to partially close or open the grips, or slightly rotate the grips.
- Match Grip Angle:** After satisfying intended motion, you must match the master grip angle to the instrument grip angle.

Once you match grips, you can control the instruments. You cannot match grips until the instrument tip moves past the cannula tip. When the instrument is ready to match grips, an icon and text message prompt you to match grips.

i Note: Clip applicators must match grips and be open more than 90% before they will be allowed to close.

⚠ WARNING: For patient safety, the surgeon *must not* match grips nor move instruments whose tips are not visible in the stereo viewer. Failure to observe this warning can cause serious harm to the patient.

i Note: To ensure patient safety, the Patient Cart operator's actions take precedence over Surgeon Console control. Any movement of the arms by the Patient Cart operator takes all instruments out of following.

⚠ WARNING: Once in following, the Surgeon Console operator must not remove his or her hands from the masters until removing his or her head from the Surgeon Console viewer—thereby taking the system out of following mode. Failure to do so may result in uncontrolled movement of the masters, resulting in serious harm to the patient.

⚠ CAUTION: To avoid an electrical hazard, the Surgeon Console operator must not touch the patient while using the master controllers.

Maintain a light grip on the masters when taking or retaking control of the masters (for example, when a new instrument is installed, when the Patient Cart operator moves the Instrument or camera arms, after instrument arm swapping, etc.). This allows the system to align the master grips relative to the tips of the instruments in the stereo viewer.

Finger Clutch

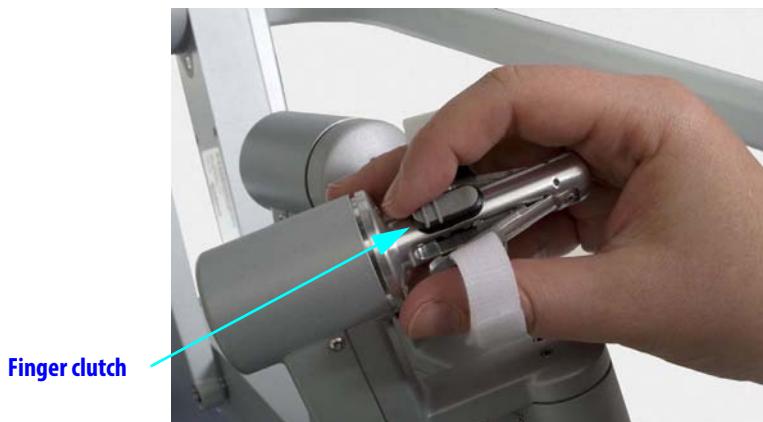


Figure 10.29 Finger clutch

Slide the finger clutch to decouple the master from control of its instrument. While you hold the finger clutch, you can move the master and the instrument will not move. Unlike the master clutch pedal, the finger clutch applies only to its own master controller. So when you apply one finger clutch, the other master's instrument remains in following. Applying the finger clutch enables you to reposition the master for comfort, and to reclaim space to maneuver when the master reaches its limits. To resume control, release the finger clutch and match grips as usual (see [Matching Grips](#) on page 10-22).

- You can turn off finger clutching using the [Control Preferences](#) screen on the touchpad (see page 10-20).

Footswitch Panel Use

The footswitch panel features two groups of footswitches. The three switches on the left control system functions (camera control, master clutch, and arm swap). The four pedals on the right side of the footswitch panel control energy activation for devices connected to the **Energy** connectors on the Core (for example, electrosurgical units or ESUs). The energy control pedals are arranged as a left pair of pedals and a right pair of pedals.

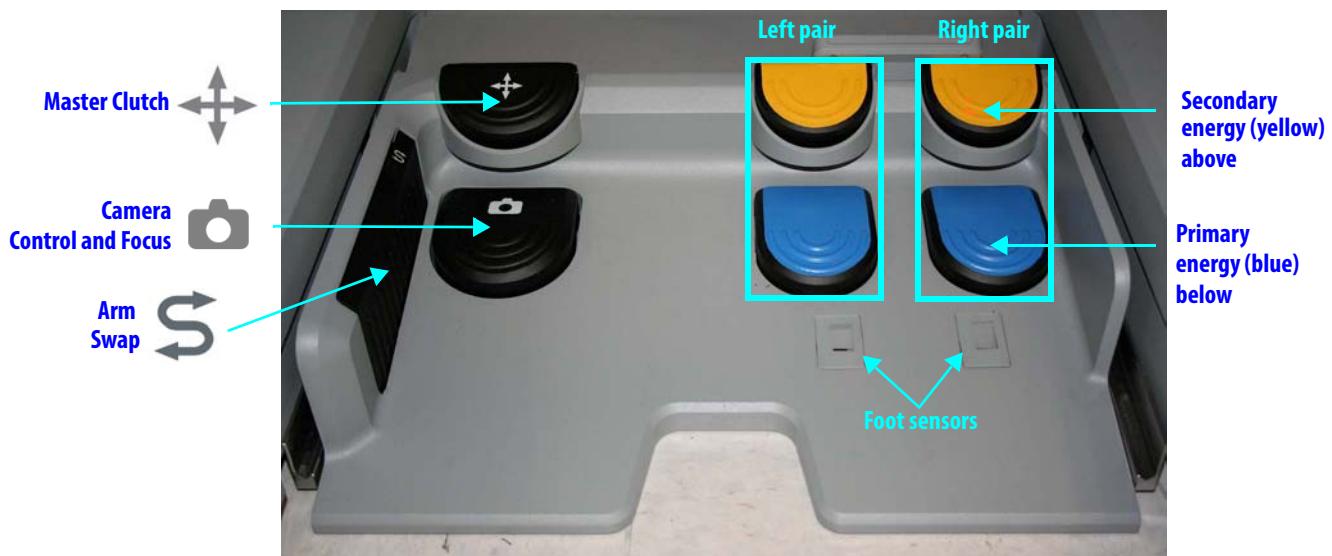


Figure 10.30 Footswitch panel controls



- **Camera Control and Focus:** Press the camera pedal to switch the masters from instrument control to camera (endoscope) control. In camera mode, the surgeon's movement of both masters together – such as moving in or out, side to side, or rotating – translates into endoscope movements. To move the scope in, pull the image toward you: pull both masters toward your eyes. To rotate the image clockwise, rotate the two masters together clockwise, like a steering wheel. To adjust focus, rotate your wrists in either direction while holding the masters.

- i Note:** Pressing the camera pedal takes all instruments out of following and also stops firing of energy instruments on the other console when operating in dual console mode (see section [10.5 Dual Console Surgery](#)). When you release the camera pedal, the masters resume control of the instruments.

⚠ CAUTION: Instrument tips should be kept in the view of the surgeon at all times.



- **Master Clutch:** Pressing the master clutch pedal decouples both masters from control of their instruments and enables you to move the masters easily while all instruments remain immobile. (You cannot use the footpedal to clutch masters independently.) Pressing the master clutch pedal allows the surgeon to reposition the masters for ergonomic comfort, and to reclaim space to maneuver the masters when they run out of working space. All instruments remain immobile until the surgeon resumes control by releasing the pedal and then matching grips as usual (see [Matching Grips](#) on page [10-22](#)).
- **Arm Swap (left kick-plate):** Swaps control between two instrument arms associated with the same master.



Primary (Blue) and Secondary (Yellow) Pedals

Each pair has a blue pedal below for primary activation, and a yellow pedal above for secondary activation.



- **Primary Pedal (blue):** Activates the primary function of a pedal-linked instrument (for example, **Coag** for monopolar instruments).
- **Secondary Pedal (yellow):** Activates the secondary function of a pedal-linked instrument (for example, **Cut** for monopolar instruments).



For information about the user interface associated with pedal activation, see [Footswitch Panel Use](#) on page 10-24.

Identify System Configuration: SmartPedal™ Technology or Not

The *da Vinci Si* System may be equipped with *SmartPedal* technology or not. This manual provides instructions for both configurations, in consecutive sections. It is important to distinguish which configuration is present to use the energy pedals correctly.

The following things indicate the presence of *SmartPedal* technology on the system:

- “L” and “R” pedal labels on the blue and yellow pedals
- Orange *SmartPedal* Quick Reference Guide hanging on Surgeon Console
- User interface differences, particularly in the footswitch map at bottom center of stereo viewer display. These differences are shown in the following sections on each configuration.

SmartPedal notification screen ([Figure 10.31](#)) appears on touchpad, upon startup, and at the login and unlock screens. Note that this message can be permanently disabled for each user when logging in by pressing “Don’t show this message again.” Once disabled, the message will not be displayed at the login and unlock screens.



Figure 10.31 SmartPedal Indicators

The following things indicate that *SmartPedal* technology is **not** present on the system:

- No “L” and “R” pedal labels on the blue and yellow pedals
- User interface differences, particularly in the footswitch map at bottom center of the stereo viewer display.

If your system is configured with *SmartPedal* technology, follow the instructions immediately below. If your system is configured without *SmartPedal* technology, follow the instructions starting on page 10-32 with the section [Non-SmartPedal: Energy Control Pedals](#).

SmartPedal Technology: Stereo Viewer Display

The high resolution stereo viewer displays the surgical site and provides extended system information via icons and text messages. The following figure illustrates arrangement of overlaid elements displayed in the stereo viewer monitor. Note that many overlaid elements appear only when needed, and others are usually or always present. For a complete list of icons and text messages, please refer to [Appendix G: Symbols, Icons and Text Messages Reference](#).

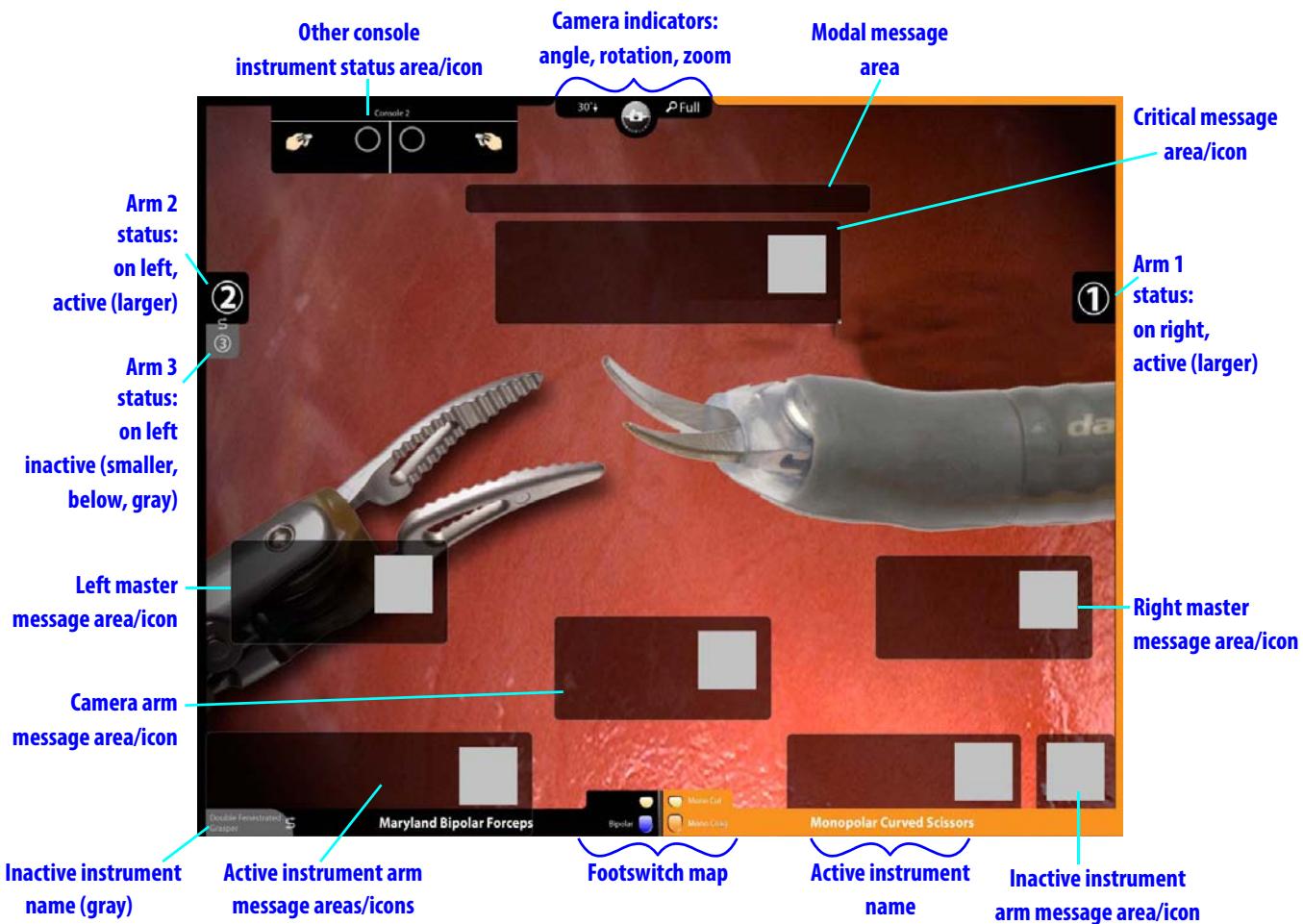


Figure 10.32 Stereo viewer display

- Instrument Arm Indicator:** Provides the instrument arm number on the same side as the master that controls the instrument arm. When two arms are associated with the same master, the top number represents the active arm.
- Background colors on instrument names, arm numbers:** The background colors on instrument names and arm numbers, which extend around the screen border on that side, have the following meanings:
 - Blue:** Foot detected over an enabled pedal pair
 - Orange:** Instrument activated
- Camera Indicators:** At top center of stereo viewer display, they include:
 - Camera Angle:** Displays **0°**, **30°↑** or **30°↓**.
 - Camera Rotation:** Provides information regarding the rotation of the endoscope relative to ground. This feature is useful for understanding the frame of reference of the video relative to the anatomy.
 - Zoom:** Shows current zoom level (**Wide**, **Full**, **2x**, **4x**) of the viewer.
- Footswitch Map:** Provides a reference for understanding the available function and status of the instrument activation pedals.
- Message Areas:** Provide extended information regarding the state of the system.



SmartPedal Technology: Other Console Instrument Status Area

When in dual console mode, a small status area as in Figure 10.33 appears at upper left of the stereo viewer.



Figure 10.33 Dual console status area

This area provides the instrument status for the **other** console, showing:

- The console number at the top, or the user name of the surgeon if logged in
- For left and right masters, the associated instrument name, arm number and activation status, including turning orange when activated
- The same status icons as appear elsewhere, and the additional icon showing that the master is clutched (finger clutched) as seen on the right above. For a complete list of icons and text messages, please refer to [Appendix G: Symbols, Icons and Text Messages Reference](#).

i Note: On the touchscreen, two of these status areas appear side by side at top center when in dual console mode.

SmartPedal Technology: Left Controls Left, Right Controls Right

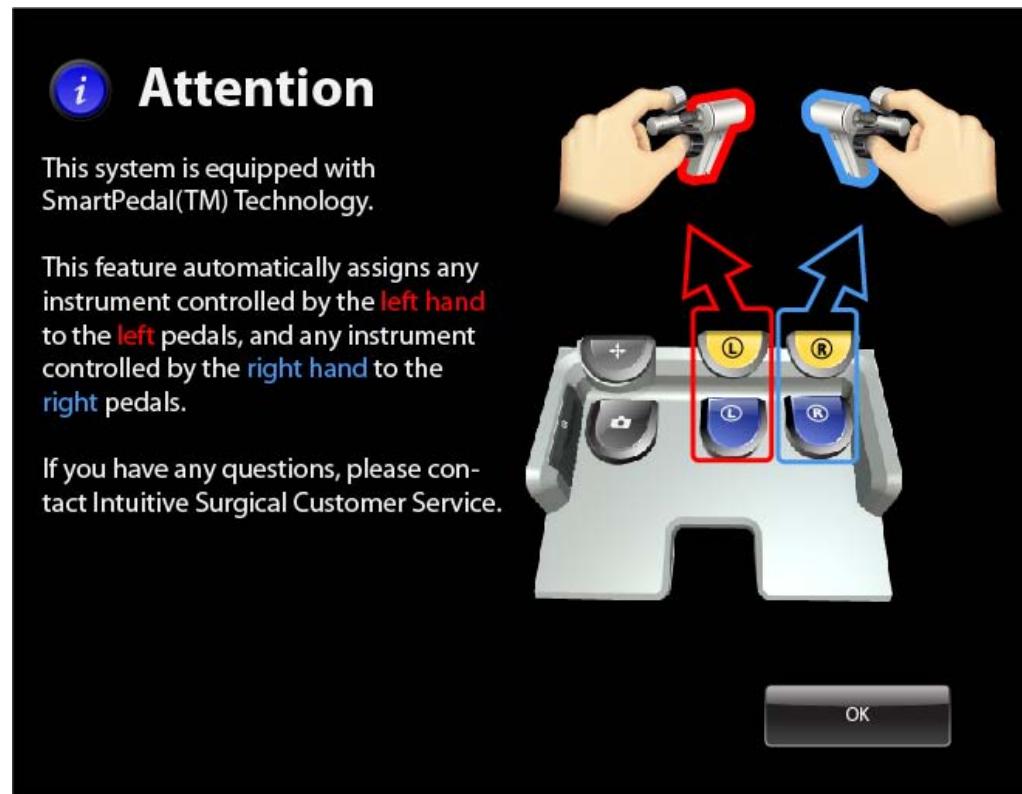


Figure 10.34 SmartPedal Technology touchpad message: Pedal to instrument associations

SmartPedal Technology expresses a simple association of pedals with instruments: The left pair of pedals activate the instrument associated with the left master; likewise, the right pair of pedals activate the instrument associated with the right master. These automatic associations for pedals cannot be changed.

Note: This message can be permanently disabled for each user when logging in by pressing “Don’t show this message again”. Once disabled, the message will not be displayed upon login or in the unlock screen.

SmartPedal Technology: Footswitch Map (Stereo Viewer)

The footswitch map in the bottom center of the stereo viewer displays the available function and status for each pedal, when a pedal-linked instrument is installed and an ESU supporting that function is connected to the system Core.

Pedal color meaning:

- gray = disabled pedal
- blue or yellow= enabled pedal
- orange = activated pedal
- orange pedal outline = disabled pedal being pressed



Figure 10.35 Footswitch map example

- When no pedal function is available, the pedal is disabled and its icon is gray and lacks accompanying text that would list an available function. When a disabled pedal is pressed, its outline is highlighted orange, though it is not activated.
- When a pedal function is available, the pedal is enabled and its icon is blue or yellow, and has accompanying text showing the available function.

SmartPedal Technology: Stereo Viewer Border Colors

The activation status colors in the stereo viewer extend around the screen border for the instrument on that side. A blue border means that a foot is over (close to or touching) an enabled pedal on that side. An orange border means a pedal function is activated on that side.

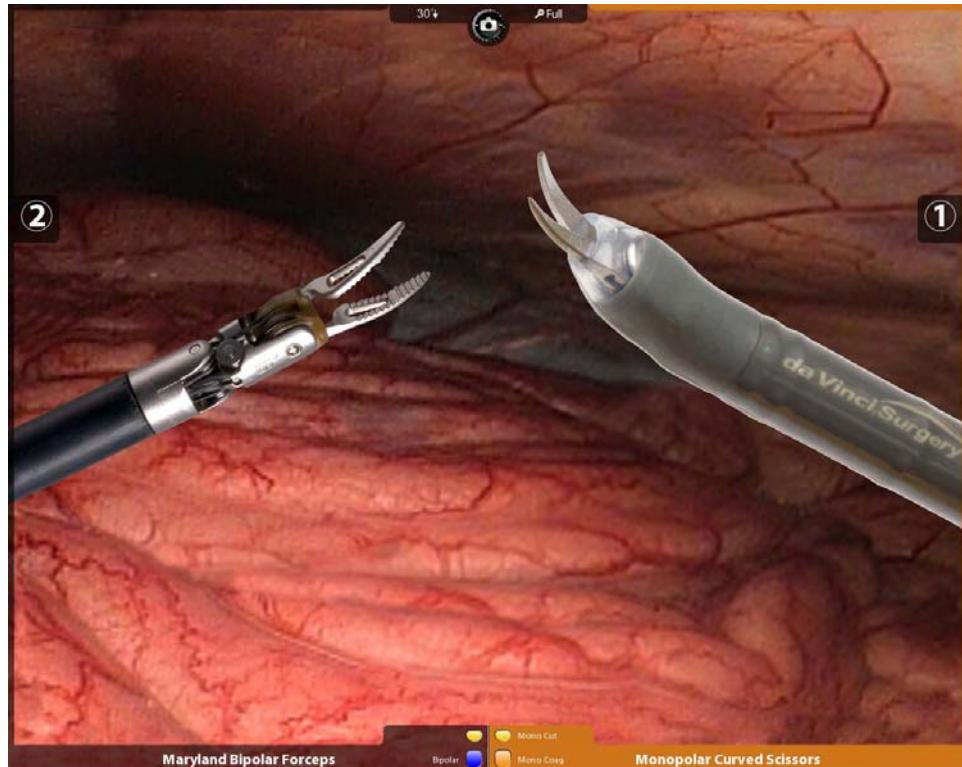


Figure 10.36 Example of orange border on right

SmartPedal Technology: Activation Status Indicators in Surgeon's View

Instrument Function Not Available



- Black border
- Gray pedals with no function listed
- Pedals turn light gray when the surgeon's foot is held over a pedal

Instrument Function Available



- Color pedals with associated function

Foot Held Over an Enabled Pedal



- Blue border
- Color pedals with associated function

Activating Instrument Function



- Orange border
- Activated pedal turns orange

SmartPedal Technology: Pedal Activation Behavior

- The system can activate only one energy instrument at a time: pressing a second pedal on a single console makes the first stop firing, and neither can fire until both pedals are released. The lone exception to this behavior regards the Suction/Irrigator, which can be activated at the same time as other energy instruments.
- In dual console mode, if each surgeon controls an energy instrument, the first press of an energy pedal activates the associated instrument, and other presses are locked out until the first is ended. When the first press ends, a blocked press must be released and re-applied before it is effective.

- In single and dual console mode, pressing the camera control pedal stops all energy firing (and instrument motion).
- The system beeps if you press a pedal while the instrument cannot be activated.

SmartPedal Technology – Troubleshooting: Activation Not Available

Activation is disabled in any of the following situations:

- The associated generator is not connected to the *da Vinci* System, or not powered on.
- Two generators with the same energy type are connected to the system, for example, two monopolar ESUs.
- Two energy instruments of the same type are installed on the system, for example, two bipolar instruments as shown below. Observe that:
 - Red text near the top of the screen reports, **Bipolar energy disabled; only one Bipolar device is allowed**.
 - The pedals of the footswitch map are grayed out, meaning the pedals are disabled.

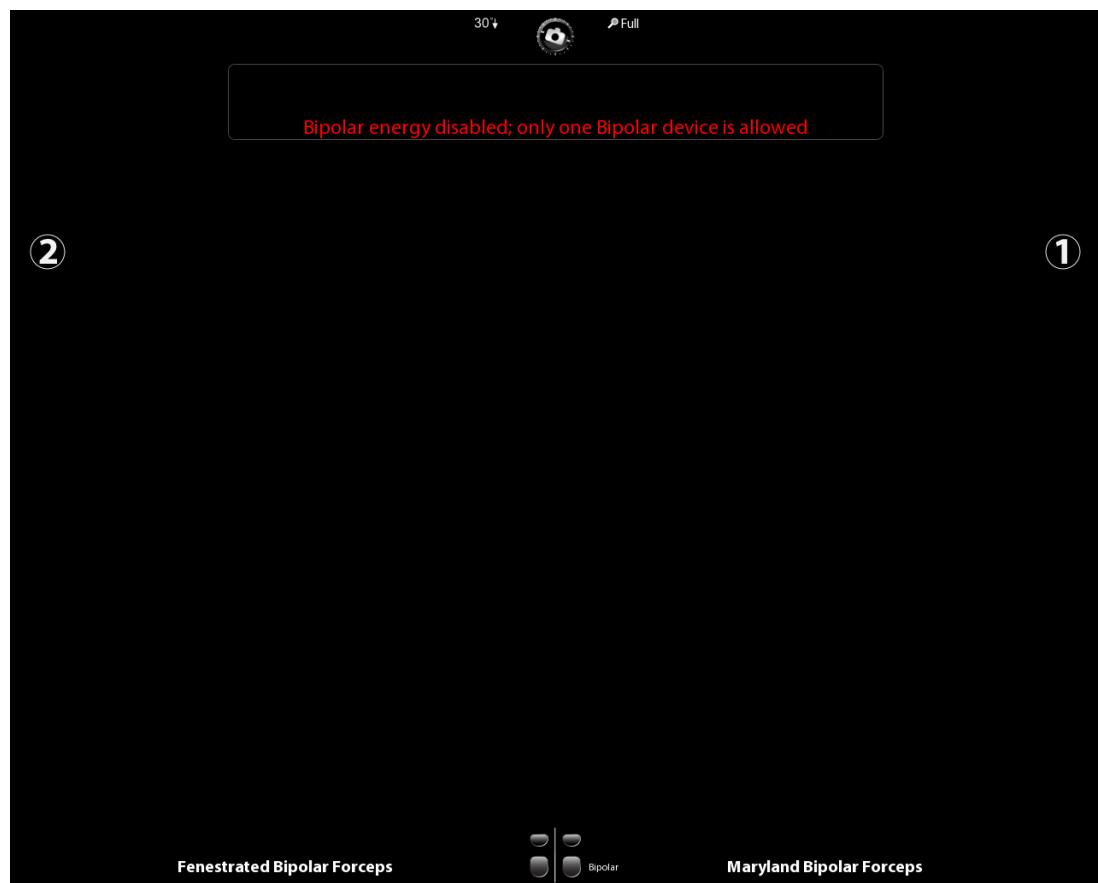
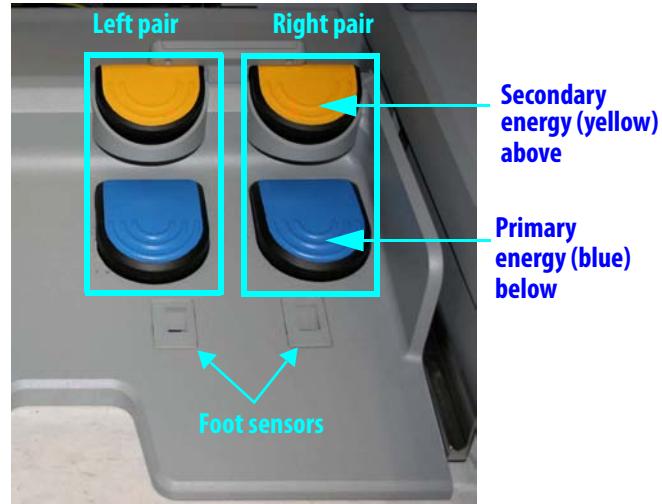


Figure 10.37 Example of energy device conflict

Non-SmartPedal: Energy Control Pedals



Right Pair Controls Monopolar, Harmonic, Vessel Sealer and Stapler Instruments

The right pair of pedals controls energy activation for monopolar, harmonic, Vessel Sealer and Stapler energy instruments.

Left Pair Controls Bipolar Instruments (Standard or PK) and Suction/Irrigator

The left pair of pedals controls energy activation for bipolar energy instruments, either standard or PK, and the Suction/Irrigator instrument.

Primary (Blue) and Secondary (Yellow) Pedals

Each pair has a blue pedal below for primary energy control, and a yellow pedal above for secondary energy control.



- **Primary Energy (blue):** Activates the primary energy mode of an energized instrument (for example, **Coag** for monopolar instruments).
- **Secondary Energy (yellow):** Activates the secondary energy mode of an energized instrument (for example, **Cut** for monopolar instruments).

For information about the user interface associated with energy control, see [Footswitch Panel Use](#) on page 10-24.

Non-SmartPedal: Stereo Viewer Display

The high resolution stereo viewer displays the surgical site and provides extended system information via icons and text messages. The following figure illustrates arrangement of overlaid elements displayed in the stereo viewer monitor. Note that many overlaid elements appear only when needed, and others are usually or always present. For a complete list of icons and text messages, please refer to [Appendix G: Symbols, Icons and Text Messages Reference](#).

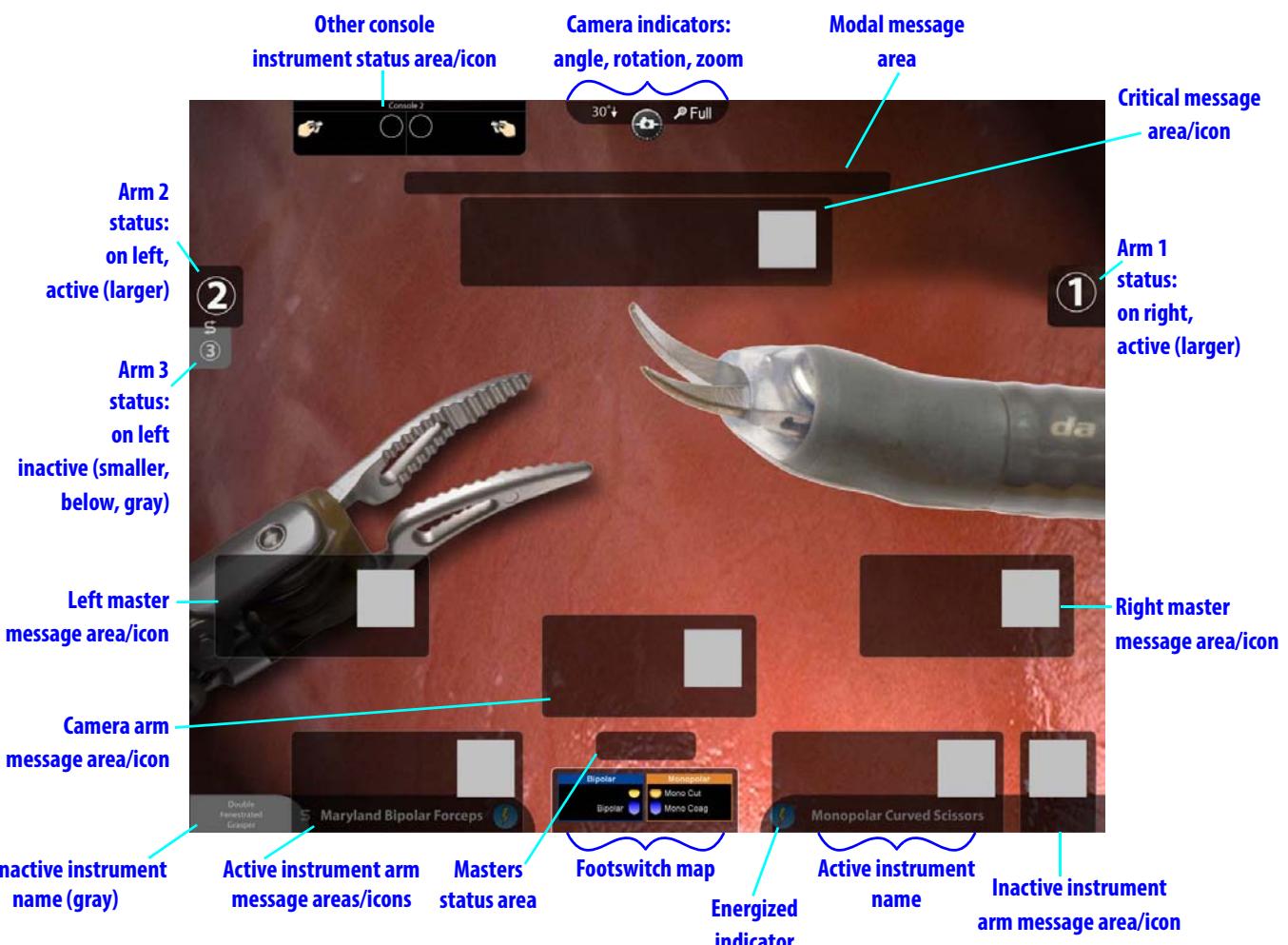


Figure 10.38 Stereo viewer display

- Energized indicator:** This lightning bolt icon, filled with yellow, appears next to the name of instruments that are energized and ready to fire. When an energy instrument is not ready to fire for some reason, the lightning bolt icon is crossed out and empty .
- Instrument Arm Indicator:** Provides the instrument arm number on the same side as the master that controls the instrument arm. When two arms are associated with the same master, the top number represents the active arm.

- Background colors on instrument names, arm numbers:** The background colors on instrument names and arm numbers have the following meanings:

- **Black**, partially transparent (default): Foot sensors detect nothing
- **Gray**: Foot detected over a disabled pedal pair
- **Blue**: Foot detected over an enabled pedal pair
- **Orange**: Energy firing



- Camera Indicators:** At top center of stereo viewer display, they include:
 - **Camera Angle:** Displays **0°**, **30°↑** or **30°↓**.
 - **Camera Rotation:** Provides information regarding the rotation of the endoscope relative to ground. This feature is useful for understanding the frame of reference of the video relative to the anatomy.
 - **Zoom:** Shows current zoom level (**Wide**, **Full**, **2x**, **4x**) of the viewer.
- Footswitch Map:** Provides a reference for understanding the locations and status of the footswitch panel pedals. See [Footswitch Panel Use](#) on page 10-24.
- Message Areas:** Provide extended information regarding the state of the system.



Other Console Instrument Status Area

When in dual console mode, a small status area as in [Figure 10.39](#) appears at upper left of the stereo viewer.



Figure 10.39 Dual console status area

This area provides the instrument status for the **other** console, showing:

- The console number at the top, or the user name of the surgeon if logged in
- For left and right masters, the associated instrument name, arm number and energy status, including turning orange when firing
- The same status icons as appear elsewhere, and the additional icon showing that the master is clutched (finger clutched) as seen on the right above. For a complete list of icons and text messages, please refer to [Appendix G: Symbols, Icons and Text Messages Reference](#).

i Note: On the touchscreen, two of these status areas appear side by side at top center when in dual console mode.

Non-SmartPedal: Footswitch Map (Stereo Viewer)

The footswitch map in the bottom center of the stereo viewer displays the type of energy instrument and the available primary and secondary energy modes, when an energy instrument is installed and an ESU supporting that energy type is connected to the system Core.

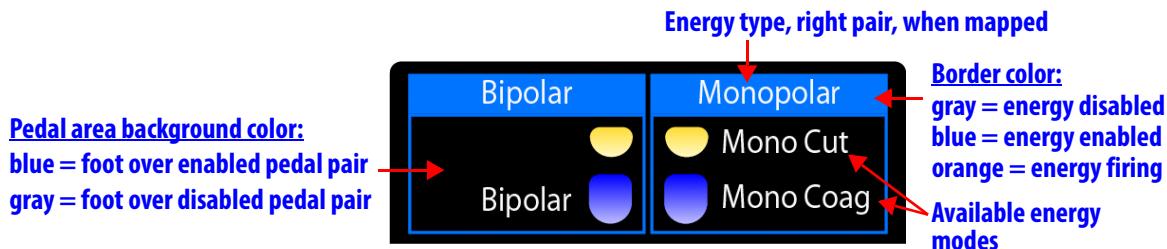


Figure 10.40 Footswitch map example

Note: If combinations of installed energy instruments or connected ESUs make mapping of energy pedals ambiguous, the system will not map nor enable the pedals for that energy type. The system will prompt the user to resolve the ambiguity by either disconnecting or powering down one of the ESUs, or by removing one of the conflicting instruments.

- For example, if two monopolar instruments are installed at the same time, the system cannot determine which should be mapped to the right pair of pedals, so both monopolar instruments will be unable to fire until one is removed. For ESUs, if two powered ESUs that support monopolar energy instruments, for example, are connected to the Core at the same time, both ESUs will be disabled until one is powered down or disconnected. For more explanation, see [Non-SmartPedal – Simultaneous Energy Control: Disallowed Combinations](#) on page 10-37.
- If the system can map an instrument to either the left or right pair of pedals, the mapped energy type appears above the pedals on that side, and the associated energy mode appears next to each pedal icon. The table below shows energy types and associated pedal modes that can appear in the footswitch map.

Table 10-3 Left Pedal Pair: Energy Types and Associated Pedal Modes

Instrument	Primary Energy (blue)	Secondary Energy (yellow)
Bipolar	Bipolar	Not available
PK	PK	Not available
Suction/Irrigator	Suction	Irrigation

Table 10-4 Right Pedal Pair: Energy Types and Associated Pedal Modes

Instrument	Primary Energy (blue)	Secondary Energy (yellow)
Monopolar	Mono Coag	Mono Cut
Harmonic	Max	Min
Vessel Sealer	Seal	Cut
Stapler	Clamp	Fire

Border Color

The color of the border on each side can be blue, gray or orange: gray signifies that energy is disabled, or not ready to fire; blue signifies that energy is enabled, or ready to fire; and orange signifies that energy is firing.

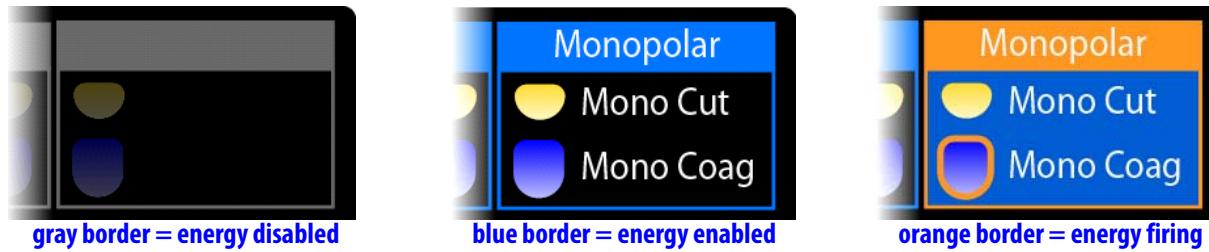


Figure 10.41

Pedal Area Background Colors

Besides the default black, the pedal area background color turns blue when a foot is over (close to or touching) a pedal pair ready to fire, or gray when over a pedal pair not ready to fire. When a pedal is pressed, its outline is highlighted orange, whether energy is actually firing or not.



Figure 10.42 Pedal area background colors

- **Black**, partially transparent (default): Foot sensors detect nothing
- **Gray**: Foot detected over a disabled pedal pair
- **Blue**: Foot detected over an enabled pedal pair
- **Orange**: Energy firing

Non-SmartPedal: Energy Activation Behavior

The *da Vinci Si* System displays the following energy activation behavior:

- The system does not support combinations of ESUs or energy instruments that make pedal controls ambiguous; you cannot be in simultaneous energy control of two energized instruments of the same type (for example, bipolar and bipolar). The system

indicates a disallowed configuration in different ways, depending on the source of ambiguity. In all cases, the system grays out the energized indicator and does not map a pedal whose function would be ambiguous.

- The system can activate only one energy instrument at a time: pressing a second pedal makes the first stop firing, and neither can fire until both pedals are released.
- In dual console mode, if each surgeon controls an energy instrument, the first press of an energy pedal activates the associated instrument, and other presses are locked out until the first is ended. When the first press ends, a blocked press must be released and re-applied before it is effective.
- In dual console mode, pressing the camera control pedal stops firing of energy instruments on the other console, but not on your own. (It also takes all instruments out of following mode on both consoles, which means they do not move.)
- The system beeps if you press an energy pedal while energy cannot be activated.

Non-SmartPedal – Simultaneous Energy Control: Disallowed Combinations

If combinations of the installed energy instruments or connected ESUs make mapping of energy pedals ambiguous, the system will not map nor activate the pedals for that energy type. For instance, you can not be in simultaneous energy control of two energized instruments of the same type (for example, bipolar and bipolar): if a surgeon has bipolar energy instruments active on both the left and right masters, then he or she will not be able to activate energy on either instrument.

Disallowed Combinations for Simultaneous Energy Control

On the *da Vinci Si* system, simultaneous energy control is not allowed for the following combinations of energy instrument types and ESUs:

- Two of the same type of energy instruments, for example:
 - Bipolar and Bipolar
 - Monopolar and Monopolar
- Two energy instruments activated by the same pedals, for example:
 - Bipolar and PK (both use left pedals)
 - Monopolar and Harmonic (both use right pedals)
- Two of the same type of ESU generators

Example: Controlling Two of Same Type of Energy Instrument

When a surgeon has simultaneous control of two of the same type of energy instrument, neither instrument is mapped to pedals, the energy indicator (lightning bolt icon) is grayed out, and so are the borders of the footswitch map, as shown:

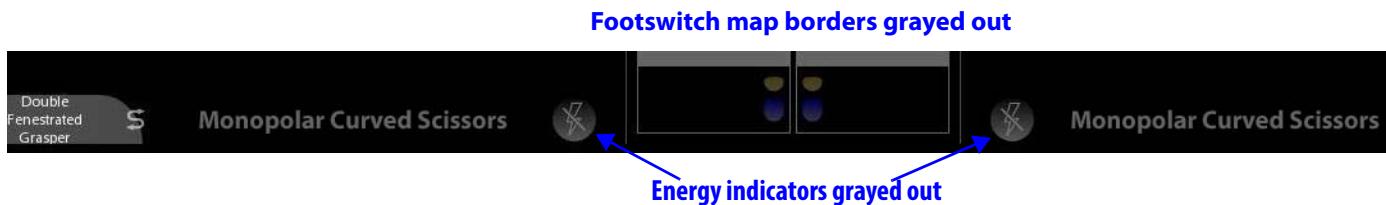


Figure 10.43 Example: Controlling two of same type of energy instrument

Example of Pedal Conflict

When a surgeon has simultaneous control of energy instruments that use the same pedals, the system reports a pedal conflict, as in the example shown below.



Figure 10.44 Example of pedal conflict

In Figure 10.44, the PK Dissecting Forceps is installed and active on instrument arm 1, and the Maryland Bipolar Forceps is installed and active on instrument arm 2. Since the system would map both instruments to the left pair of energy pedals, the system does not allow either instrument to fire, because which instrument should fire on a left energy pedal press is ambiguous. The system disables energy and displays the message shown in Figure 10.44: “**Pedal Conflict. Remove conflicting instrument to enable.**”

Two of Same Type of ESU Generators Connected

The system displays an analogous message in red text near the top center of the screen if pedal mapping is ambiguous due to two of the same type of ESU generators being connected to the system. The message instructs you to disconnect or power down an ESU.

Non-SmartPedal – Swapping Energy Control: Allowed Combinations

It is possible to swap between the following combinations of energy instruments, but **only if both instruments are associated with the same master controller:**

- between monopolar and Harmonic
- between a bipolar and PK instrument

i Note: It is never possible to swap between two monopolar or two bipolar instruments because they require the same ESU cord.

These combinations permit swapping energy control because the two instruments can never be in simultaneous control, when they are associated with the same master. An example is shown in Figure 10.45.

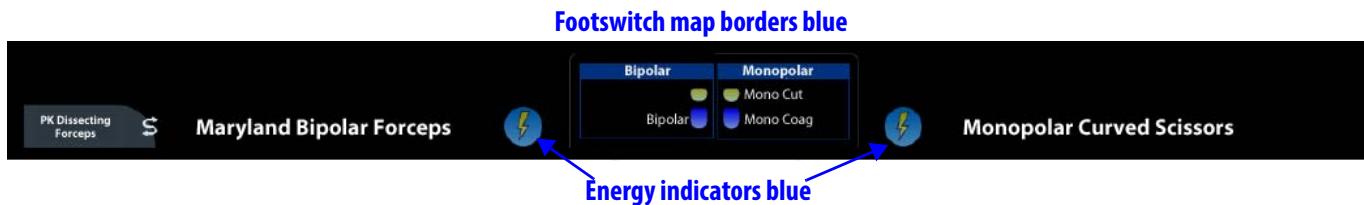


Figure 10.45 Example of an allowed configuration

Here a Maryland Bipolar Forceps is installed on instrument arm 2, a PK Dissecting Forceps is installed on instrument arm 3, and both arms are associated with the left master. Since both are on the left master, the surgeon can never simultaneously control both energy instruments. Therefore energy control ambiguity is impossible. The surgeon can swap control between these two energy instruments and avoid simultaneous control of a disallowed combination.

The system indicates an allowable combination by highlighting blue the energy indicators and the borders of the footswitch map.

10.5 Dual Console Surgery

This section describes the interface for working with two Surgeon Consoles.



Dual Console Connection and Startup

To operate in dual console mode (using a second Surgeon Console), simply plug the second console's system cable in one of the available Fiber ports on the back of the Core. No other connection is necessary, except of course to plug in the Surgeon Console to a dedicated AC power outlet. The second Surgeon Console behaves just as the first with respect to power operations, as described in Chapter [5 Startup](#).

Comparison Between Consoles

This section describes the relationships between the touchpads, stereo viewers and instrument controls when two Surgeon Consoles are in use.

Touchpads

Except for the availability of the **Give/Take** and **Swap All** buttons, the arm status area functions the same as usual, reporting arm status to both consoles. Each surgeon controls independently the touchpad settings that affect only their console and viewer. For example, one surgeon can apply digital zoom and TilePro in their viewer without affecting the other surgeon's viewer.

Stereo Viewers

The stereo viewers act independently except that they share the endoscopic video source and its associated video settings for view of the surgical field, and the overlays associated with shared elements like the endoscope (for example, the camera rotation indicator). Each stereo viewer presents the overlays for instruments that the surgeon controls in the usual places, and shows information about the instruments the other surgeon controls near the top center of the stereo viewer. Each surgeon can adjust their view independently, both content and settings. For example, one surgeon can apply digital zoom and use *TilePro* in their viewer without affecting the other surgeon's viewer. See [Comparison Between Consoles](#) on page [10-39](#) for additional details on what surgeons can see about the instrument status of the other console.

Instrument Control

The instrument control settings, in particular motion scaling, operate independently for each Surgeon Console. When instrument control is transferred, the instrument goes out of following until the surgeon assuming control matches grips in the usual way (see [Matching Grips](#) on page 10-22). When she takes control, she does so using the control settings selected at her console.

Master Associations

The system gives both surgeons the ability to reassign instruments to different masters, and this feature continues to operate in dual console mode. The new instrument assignment applies on both consoles and persists when instruments are swapped. For details, see [Master Associations](#) on page 10-21.

Instrument Control

When the system detects two Surgeon Consoles in use, the **Give/Take** and **Swap All** buttons on the touchpad home screen appear.



Figure 10.46 Dual console home screen



- Give/Take button:** This button says “Give” when you have control and “Take” when you do not have control at your console. Either surgeon can **Give** or **Take** control of a specific instrument arm by touching its **Give** or **Take** button. When control is transferred by touching **Give** or **Take**, the instrument goes out of following until the surgeon assuming control matches grips in the usual way (see [Matching Grips](#) on page 10-22).

i Note: During dual console surgery, you can give or take a locked instrument arm using the Give/Take button on the touchpad home screen. Instrument arms remain locked when transferred until unlocked at the touchpad in the usual way.



- **Swap All:** Either surgeon can change control of all (instrument) arms by touching **Swap All**. Energy control follows the instrument arm. All instruments go out of following after **Swap All** is touched until the surgeon assuming control matches grips as usual (see [Matching Grips on page 10-22](#)).

Swap All affects all 3 instrument arms (not the endoscope). However, if Surgeon A controls no arms before the swap, Surgeon A can control only up to two arms when he matches grips after the swap. He or she must first match grip on the two instruments that were in following with the other surgeon before the swap; the third arm will remain out of following as it was. To take control of the third instrument, he or she must press the arm swap pedal (left kick-plate) as usual.

- **Lock:** The surgeon with control can use the **Lock** button to lock the instrument in place as usual, and unlock a locked arm to enable control of it. The current lock status shows on both Surgeon Consoles.

Note: In dual console mode, either surgeon can use the Master Associations screen (see [page 10-21](#)) to reassign instruments to different masters – even while the other surgeon has control of the instruments. The new instrument assignment applies on both consoles and persists when instruments are swapped. The system notifies the surgeons as usual when reassignment occurs.

- When instruments are reassigned via the Master Associations screen, the system takes the instruments out of following, notifies and prompts you with the icon and associated message below:



Your instruments have been reassigned.
Tap 'Arm Swap' pedal to acknowledge
and continue.

Figure 10.47 Icon and message when instruments reassigned

Camera Control

Either surgeon can take control of the camera arm by pressing the camera pedal as usual; the first one to do so has camera control and, as usual, all instrument arms go out of following while the camera arm is under control, and energy instruments on the other Surgeon Console will stop firing.

Video Control

While in dual console mode, video settings are shared between the two Surgeon Consoles as well as the touchscreen monitor on the Vision Cart. Video settings are not saved while in dual console mode.



Virtual Pointer (Dual Console Teaching Aid)

The virtual pointer is a software tool designed as an instructional aid, typically for use during dual console surgery. The pointer is a three-dimensional (3D) graphical object, light blue and conical in shape, which appears overlaid on the live video image when activated. It enables a surgeon to point and refer to specific anatomical features on the live video image intraoperatively. The surgeon can activate and control one pointer with each master that is not associated with an instrument arm. Normally, an unassociated master is available only during dual console surgery. It is possible to activate two pointers simultaneously, as described in the usage scenarios below.

Virtual Pointer Usage Scenarios

Since a pointer can be activated only by a master not associated with an instrument arm, you can arrange the usage scenarios below by setting master associations and giving or taking instrument arm control on a given Surgeon Console. Set master associations by going to **Utilities > Control Preferences** and touching **Configure** next to **Master Associations**. Give or take instrument arm control using the **Give/Take** button on the dual console home screen.

Typical Usage Scenario

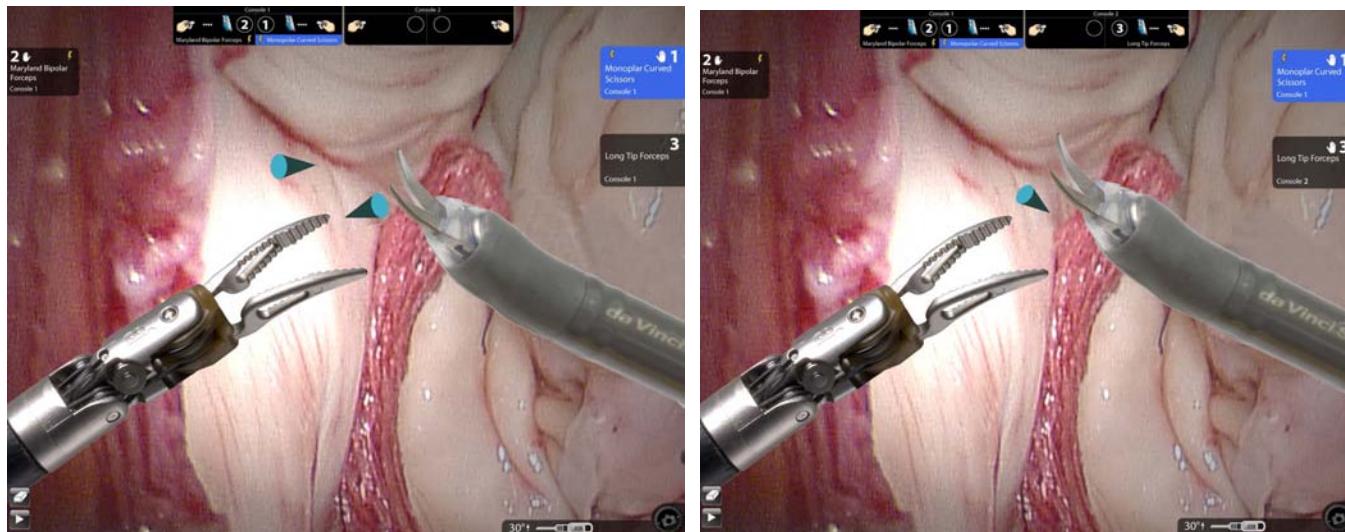


Figure 10.48 Typical dual console usage for proctoring

In the typical usage scenario, a proctor surgeon at Surgeon Console 2, which controls either one or no instrument arms, is providing guidance to a surgeon being proctored at Surgeon Console 1, which controls 2 or 3 instrument arms. The proctor surgeon would use one or two unassociated masters to activate one or two pointers, and then use each pointer to refer to anatomical features while speaking with the surgeon being proctored.

One Pointer Controlled at Each Console

In a less typical scenario, both Surgeon Console 1 and Surgeon Console 2 can have one unassociated master and therefore each surgeon can activate one pointer as desired. In this scenario, one surgeon would have control of two instrument arms associated with the same master, and the other surgeon would have control of the other instrument arm, so that one master on each console is not associated with an instrument arm.

i Note: It is possible to activate the pointer when using a single Surgeon Console if the third arm is stowed. For example, if arm 3 is stowed and you associate arms 1 and 2 with the left master, the right master can be used to activate the pointer.

Use Characteristics

The virtual pointer has the following use characteristics:

- By closing the grips of an unassociated master, the surgeon activates a virtual pointer. Its initial position is vertically centered and slightly offset right or left in correspondence with the master used. At a console having neither master associated with an instrument arm, the surgeon can activate two pointers simultaneously by closing the grips of both masters.
- While a pointer is activated, the master controlling it is free to move. The surgeon manipulates the position and orientation of the pointer using the master while holding the grips closed. The pointer's tip corresponds to the fingertips closing the grips.
- As part of the 3D effect, the pointer is shaded as if the light comes from where you are looking, and it gets smaller as you move it away from you, and larger as you move it back towards you. It has vanishing points left and right, near and far, past which you can bring it back on screen if you do not release the grips. If you do release the grips while past a vanishing point, the pointer reappears in its default position when you close the grips again.
- If telestration marks are on screen, they are erased when the pointer is activated, and telestration is not available while the pointer is activated.
- You can clutch the master while the pointer is active to reposition the master without moving the pointer.
- The pointer disappears when the surgeon releases the grips and while a surgeon presses the camera pedal (during camera control mode). The master that controlled the pointer is not free to move when the pointer is not present, except by clutching the master as usual.
- On subsequent activations, the pointer appears in its last position, unless that position is such that it would be off screen. In that case, it reappears in its initial position.

End of section

11 System Shutdown and Storage

This chapter explains the following:

- [11.1 Preparing the System for Shutdown, page 11-1](#)
- [11.2 Inventory Management, page 11-2](#)
- [11.3 Shutting Down the da Vinci Si System, page 11-3](#)
- [11.4 Storing the System, page 11-4](#)



Figure 11.1 Patient Cart in stow position, ready for storage

11.1 Preparing the System for Shutdown

1. Remove the instruments and endoscope from the Patient Cart.
2. Disconnect the cannulae from the instrument and camera arms.
3. Use the port clutch buttons to move the instrument and camera arms away from the patient.
4. Move the Patient Cart away from the OR table.

5. Remove all sterile system accessories for cleaning.



Figure 11.2 System accessories

For instructions on cleaning system components, see [12.2 System Cleaning](#) on page [12-1](#).

6. Remove and properly dispose of all drapes.

i Note: Users will find it easier to separate the camera head from the sterile adapter by first cutting off the camera head drape, as indicated by the label on the drape itself, shown here.

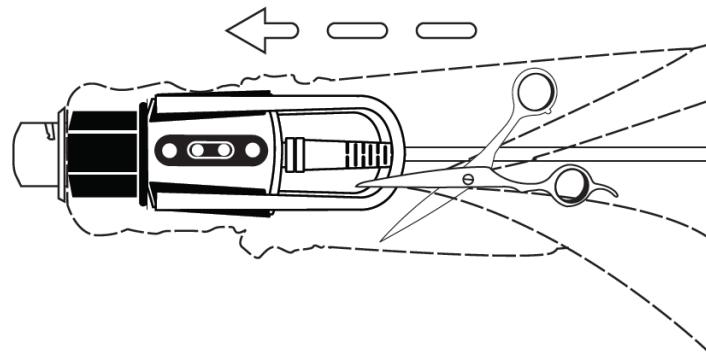


Figure 11.3 Cut off camera head drape to remove sterile adapter

11.2 Inventory Management

You can view the number of uses left for all instruments used during the current procedure by accessing Inventory Management on the **Utilities** tab of the touchscreen (see page 7-20) or the touchpad (see page 10-18).

Serial Number	Description	Uses Left
1/		X
0712282 699	Black Diamond Micro Forceps	9+/ 9+
S10110228 489	Large Needle Driver	9+/ 9+
S10110128 688	Prograsp Forceps	9+/ 9+
S10091222 006	Large Needle Driver	1/ 9+

Figure 11.4 Usage Summary

For instruments that expire after a certain number of procedures, the system displays the number of uses or activations left out of uses allowed in the right column. See [Instrument Usage](#) on page 9-14 for details on how the system tracks usage.

11.3 Shutting Down the *da Vinci Si* System

1. Prepare the Patient Cart for storage by folding the setup joints against the cart as shown in [Figure 11.5](#). Instrument arm 3 should be placed in the stow position. (See [Stow Position](#) on page 5-7 for details on preparing the Patient Cart for stow position.)



Figure 11.5 Patient Cart in the stow position

2. Press any system **Power** button. The system will begin the ten second shutdown process and displays the following message:

Preparing to shutdown.

Press Power to reverse within 10 seconds.

i Note: If the system is not restarted within ten minutes after power down, the system will view any restart as a new procedure and instrument uses will be decremented accordingly.

i Note: Cooling fans on the Patient Cart and the Core (Vision Cart) run continually when either is plugged into AC. This is part of normal operation. Do not use the Patient Cart Emergency Power Off (EPO) button to turn off the cooling fans. This will prevent the Patient Cart battery from charging.

3. It is now safe to disconnect all system cables, although we recommend that you leave them connected to minimize exposure of the connectors to contaminants.

i Note: If possible, the system cables should be left connected to minimize exposure to contaminants.

Should you need to detach system cables, follow these steps:

1. Remove non-system connections as necessary (such as auxiliary video and audio cables, ESUs, insufflators, etc.)
2. Disconnect system cables from the Surgeon Console and Patient Cart by twisting counter-clockwise and pulling back on the metal collar.

i Note: Immediately attach the protective cap to protect the connectors from contamination and physical damage.

3. Store the system cables on the side of the Vision Cart.

11.4 Storing the System

Follow these steps to store the *da Vinci Si* System:

1. Ensure the storage room meets the following specifications:
 - a. Room temperature between -10 to 55 °C (14 to 131 °F).
 - b. Relative humidity between 10 to 85% non-condensing
2. Place the Patient Cart near a wall outlet and plug it into AC power.

i Note: To maintain battery backup charge, it is important to keep the Patient Cart plugged into AC power while stored. Failure to do so will drain the batteries. The Surgeon Console and Vision Cart do not need to be plugged into AC power.

i Note: A cooling fan continues to run on the Patient Cart when plugged into AC power. Do not use the Patient Cart Emergency Power Off (EPO) button to turn off the cooling fan. This will prevent the Patient Cart battery from charging.

End of section

12 Cleaning and Maintenance

This chapter covers the following subjects:

- [12.1 System Maintenance, page 12-1](#)
- [12.2 System Cleaning, page 12-1](#)
- [12.3 Illuminator Lamp Module Replacement, page 12-2](#)
- [12.4 CCU Fuse Replacement, page 12-6](#)

12.1 System Maintenance

Preventive maintenance is required and must be performed by an authorized *Intuitive Surgical* Service Representative. There are no user-serviceable parts on the main system components, with the exception of the Illuminator.

 **WARNING: Do not service or perform maintenance on the *da Vinci Si* System while in use with a patient unless noted otherwise.**

For Technical Support

If the system requires maintenance or service, please call our Technical Support line. In the US, call 1-800-876-1310, where phones are staffed 24 hours a day, seven days a week. In Europe, call +41.21.821.2020.

12.2 System Cleaning

Surgeon Console, Patient Cart, Vision Cart, System Cables

Use a soft, lint-free cloth and a surface disinfectant product (or a pre-moistened disinfectant wipe product) to wipe the exterior surfaces of the system components and cabling at the frequency required by individual hospital policy. Examples of these products include Envirocide®, CaviCide®, deconex® S-WIPES, neodisher® neoform MED rapid and 70% isopropyl alcohol or the corresponding pre-moistened disinfectant wipe product. Allow components to dry before use. If any liquids – including bodily fluids – get inside the system, contact ISI Technical Support.

 **CAUTION: Equipment on the Vision Cart, Patient Cart and Surgeon Console is not designed for exposure to liquids. Care should be taken to ensure liquids do not come into contact with electronic equipment on the system components.**

-  Note: In particular, do not submerge the camera and camera cables. They are not designed to be submerged and could be damaged if fluid gets inside them.**
-  Note: Pay particular attention to areas where the Surgeon Console operator comes into contact with the system (such as the master controller grips, the stereo viewer, and the armrest).**
-  Note: The system cables and their receptacles contain fiber-optics. Only when requested by *Intuitive Surgical* personnel, clean both cable and receptacles by blowing the fiber ends with a generic dry and oil-free canned air duster.**

Cleaning the Touchscreen Display

Follow your hospital protocol for the handling of blood and body fluids. Clean the display with a diluted mixture of mild detergent and water. Use a soft towel or swab. Use of certain cleaning agents may cause degradation to the labels and plastic components of the product. Consult cleanser manufacturer to see if agent is compatible with it. Do not allow liquid to enter the display.

Instrument Release Kit

Clean and sterilize the instrument release kit in the same way as the grip release tool. For grip release tool cleaning and sterilization instructions, refer to the Reprocessing Instructions (PN 550875).

12.3 Illuminator Lamp Module Replacement

 **WARNING:** During operation, the lamp gets very hot, even if lit only for a short time. After turning off the lamp, allow the internal fans to cool the lamp for 5 minutes before removing power to the Illuminator.

 **WARNING:** Use ONLY approved lamp modules. Use of a non-approved lamp may result in premature failure or severe damage.

 **CAUTION:** The Illuminator lamp module should be replaced every 1000 hours.

The Cermax VQ Xenon Lamp module typically provides more than 1000 hours of service. It should be replaced every 1000 hours to avoid periods of diminished light output or lamp failure during a procedure. The symptoms indicating the need for replacement are:

- Repeated ignition attempts without lamp going into operation.
- Evident low light output at maximum light level setting.

When the lamp requires changing, you must replace the complete lamp module. The lamp and heat sinks are installed as a complete unit as shown below.

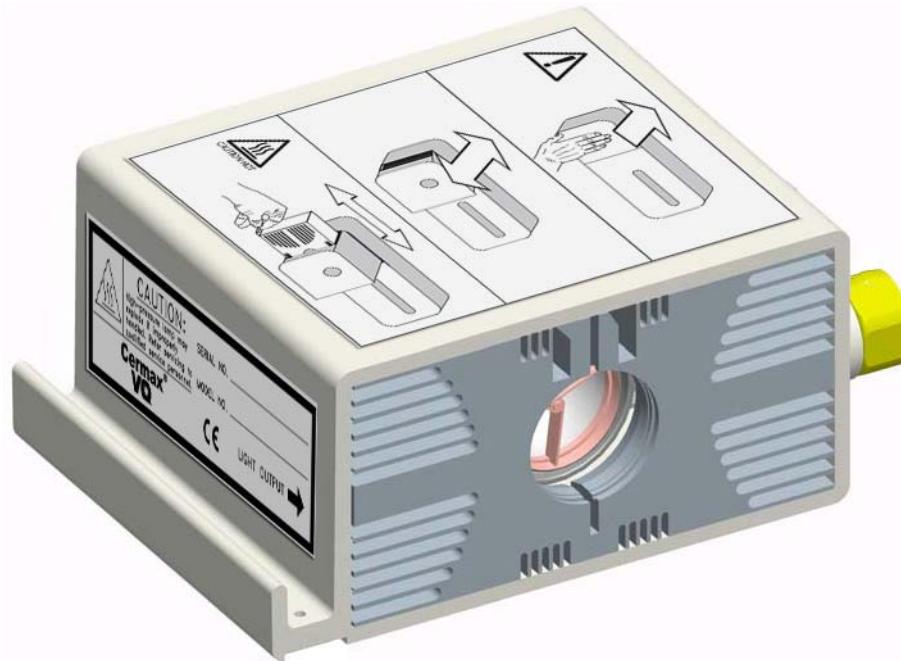


Figure 12.1 Cermax VQ Xenon Lamp Module

The module is designed for simple and quick changing, but should be performed by qualified personnel.

The following image shows the label affixed to the lamp module itself, and explains pictorially the steps to replace the lamp module.

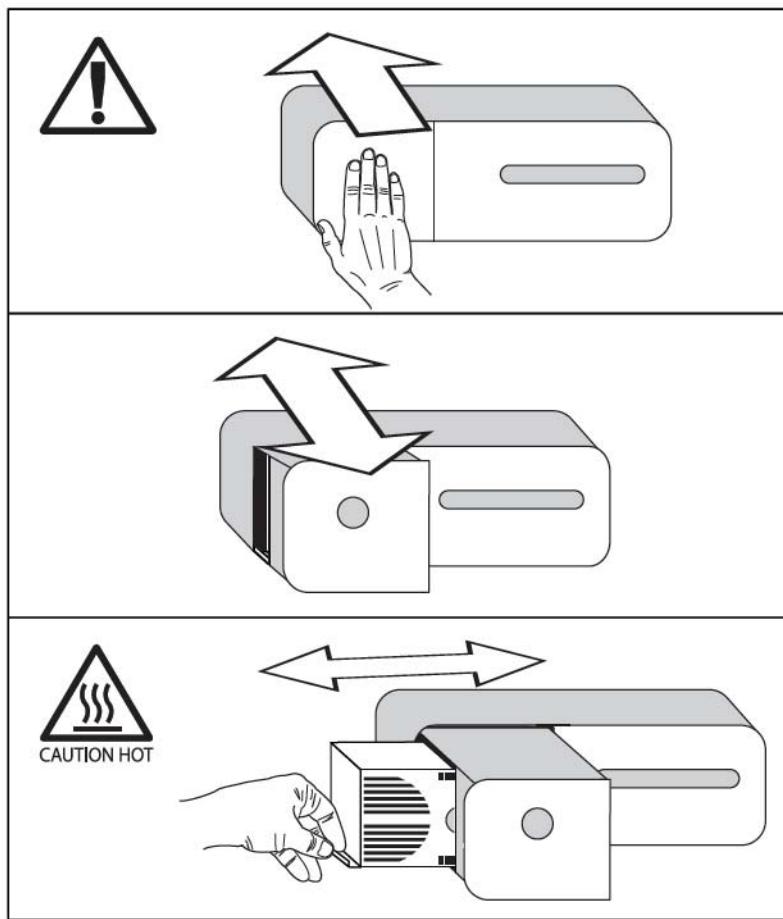


Figure 12.2 Lamp module replacement label—on lamp module

To remove the old lamp module:

1. Turn the Illuminator off by pressing the **Lamp On/Off** button.



CAUTION: Hot. Wait 10 minutes while system is cooling with internal fan operation.

2. Push inward to open the access drawer on the left side (front) of the Illuminator.



Figure 12.3 Open the access drawer

3. Grasp the handle and pull the entire lamp module out as shown.

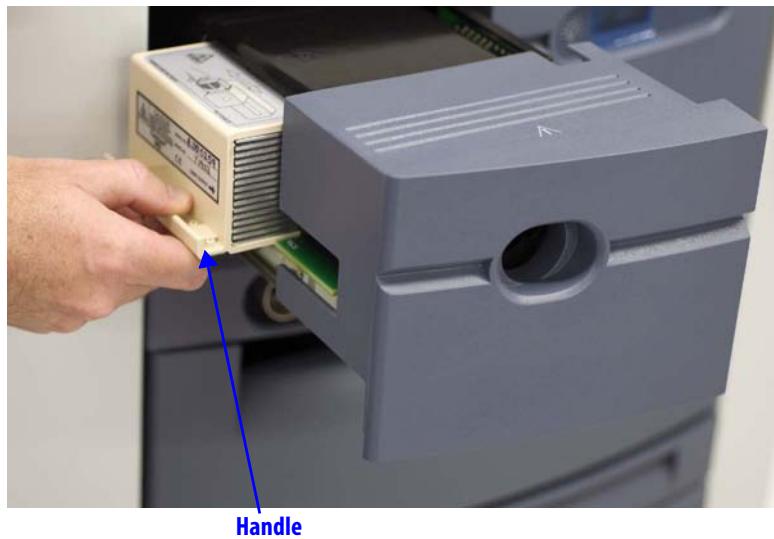


Figure 12.4 Grasp handle and remove module

To insert new lamp module:

1. Orient the new lamp module so the lamp window faces the front of the Illuminator, handle on the bottom.
2. Carefully align the sides of the module and place in the receiver channel (see [Figure 12.5](#)). To ensure proper connection, firmly push the module as far as it will insert. The edge of the module will be flush with the sides of the drawer once connected.

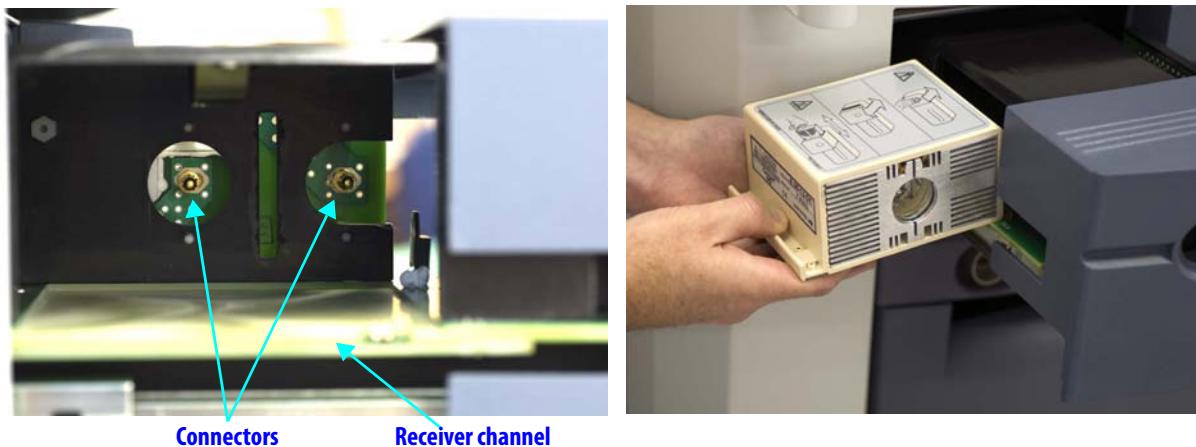


Figure 12.5 Installing new lamp module

3. Close the drawer firmly so it is fully engaged.

For assistance replacing the lamp, call our Technical Support line. In the US, call 1-800-876-1310, where phones are staffed 24 hours a day, seven days a week. In Europe, call +41.21.821.2020.

12.4 CCU Fuse Replacement

This section contains instructions to replace the fuse in the Camera Control Unit (CCU).

(i) Note: Intuitive designed the CCU fuse not to blow during normal operation over the life of the system. A blown CCU fuse is a likely indicator of a technical issue that requires maintenance by Intuitive Surgical personnel. Therefore, if you have a problem powering on the CCU, we strongly recommend you do not attempt fuse replacement without first calling Intuitive Surgical Technical Support. The following instructions are provided as reference material.

Troubleshooting a CCU Power Problem

If the CCU appears not to be powered on while the rest of the system is powered on, first check that the CCU power switch, next to the power cord inlet on the back of the CCU, is switched on. Then check that the mains circuit breaker of the Vision Cart is in the on position (indicated by "I" near the switch). Finally, check that the Vision Cart is connected to a dedicated, working AC power outlet, and that the system is powered on. CCU fuse replacement may be warranted only when the rest of the system and other Vision Cart components power on normally, while only the CCU does not. Again, if this is the case, we recommend you contact *Intuitive Surgical* Technical Support for assistance. The following instructions are provided as reference material.

CCU Fuse Replacement Instructions

To replace the fuse on the Camera Control Unit, follow these steps:

1. For safety, remove power from the *da Vinci Si* Surgical System as follows:
 - a. With the system already in standby (sleep) mode, switch off the mains circuit breaker of the Vision Cart.
 - b. Unplug the Vision Cart and other main system components from their AC wall outlets.
 - c. Switch off the CCU power switch next to the power cord inlet.
2. Remove the CCU power cord from the power inlet next to the CCU power switch and fuse housing. The fuse housing latches on the power cord when it is in place, preventing removal of the fuse housing unless the power cord is removed first.
3. The fuse housing is located between the power cord inlet and the CCU power switch on the back of the CCU. To remove the fuse housing with the fuses inside, use one or two very small, flat-bladed screwdrivers. If you use one screwdriver, you must pry inward on each of the thin latching tabs on the top and bottom of the fuse housing in succession. If you use two screwdrivers, one in each hand, you can pry the tabs at each end inward at the same time to clear the latches.
4. When you clear the latches on top and bottom, the fuse housing will be loose and you can remove it carefully with your fingers. Both fuses will be retained in the housing you remove.
5. Inspect both fuses and replace any blown fuse. A blown fuse has a broken wire filament. For continued protection against fire hazard, replace the CCU fuse only with the same type, specified here:
 - **Manufacturer:** Schurater AG
 - **Fuse Type:** FST, Time Lag
 - **Ratings:** 2 A, 250 V
6. Replace the fuses in the fuse housing and re-install it in the same orientation. The housing is keyed and will prevent you from installing it in the wrong orientation. Push the housing in all the way until it clicks in place audibly, and is flush with the surrounding surface.
7. Switch on the power switch on the back of the CCU; switch on the mains circuit breaker of the Vision Cart and plug the Vision Cart and all other system components into their dedicated AC power outlets.

For Technical Support

If the system requires maintenance or service, please call our Technical Support line. In the US, call 1-800-876-1310, where phones are staffed 24 hours a day, seven days a week. In Europe, call +41.21.821.2020.

End of section

A Appendix A: Error Handling

Intuitive Surgical is committed to safety. Every effort has been made to ensure the system will not only be reliable, but in the event an error occurs, the system will handle the error in the safest and most efficient manner possible. This appendix explains the following:

- [Obtaining Technical Support](#), page A-1
- [Error Handling](#), page A-1
- [Conversion to Open Surgery](#), page A-5

A.1 Obtaining Technical Support

If the system requires maintenance or service, please call our Technical Support line. In the US, call 1-800-876-1310, where phones are staffed 24 hours a day, seven days a week. In Europe, call +41.21.821.2020.

Accessing the Event Logs

To assist your ISI support representative in diagnosing the system, it may be necessary to access the event logs.

From Surgeon Console Touchpad

To access the event logs from the Surgeon Console touchpad, perform the following steps:

1. Touch the **Utilities** tab on the Surgeon Console touchpad.
2. Touch the **Event Logs** button. The system log appears in the stereo viewer.
3. Touch **Page Up** or **Page Down** to scroll up or down the error log.
4. Touch **Previous Log** or **Next Log** to go to the previous log or next log.

From Vision Cart Touchscreen

To access the event logs from the Vision Cart touchscreen, perform the following steps:

1. Touch the **Utilities** tab on the Vision Cart touchscreen.
2. Touch the **Event Logs** button. The system log appears on the touchscreen.
3. Touch **Page Up** or **Page Down** to scroll up or down the error log.
4. Touch **Previous Log** or **Next Log** to go to the previous log or next log.

A.2 Error Handling

System Faults

When a fault occurs, the system determines whether the fault is recoverable or non-recoverable. The system takes the following actions when a fault occurs:

- Locks all the Patient Cart arms. In this state the Patient Cart arms and setup joints can be clutched but are slightly harder to move and will not be able to be left in clutch mode.
- Sounds a series of error beeps. You can silence the beeps by touching **Silence** on the touchpad or touchscreen.

- Displays a text message on the monitors to describe the error.



Figure A.1 Fault message on touchpad

- If the fault is arm-specific, the system displays an error icon and lights the arm LED yellow or red. If the fault is not arm-specific, all arm LEDs light yellow or red.



Figure A.2 Arm LEDs in fault states

Recoverable Faults

If the fault is recoverable, you can override it by touching **Recover** on the touchpad or touchscreen, which enables the system to continue. Touching **Recover** also silences the alarm if no one has yet touched **Silence**.

i Note: After a recoverable fault, the system does not recover until two seconds elapse after you touch Recover.

i Note: Using Recover does not diminish the system's fault detection capability in any way. Thus, if the fault condition remains, the system immediately faults again. If the fault condition is removed, then the system is fully functional.

! CAUTION: The Recover button should be used only with a thorough understanding of the fault's cause. Overriding a fault without understanding its cause may result in uncontrolled movement of the Patient Cart arms up to 2 cm, or uncontrolled motion of the master controllers up to 5 cm.

Disabling Instrument Arms and Master Controllers

The *da Vinci Si* System allows users to disable an instrument arm or master controller in the event of arm-specific error. *Intuitive Surgical* designed this feature to allow a user to complete a procedure with the remaining arms.

In the event of an arm-specific error, the system presents the option to disable the arm on the touchscreen and touchpad. Once the arm has been disabled, it can not be re-enabled until the next power cycle.

If you question whether or not you should disable an arm, please contact ISI Technical Support.

After Disabling a Master Controller

You cannot control the camera arm from a Surgeon Console with a disabled master controller.