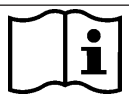
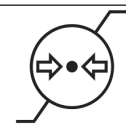
Radiance Ultra 32" 4K ZeroWire Duo

МОНИТОРЫ ХИРУРГИЧЕСКИЕ БЕСПРОВОДНЫЕ

РУКОВОДСТВО ПО ЭКСПЛУАТАЦИИ

Symbols

	Follow instructions for use
	Consult instructions for use
	
	General warning
	Warning; Electricity
EC REP	Authorized Representative in the European Community
MD	Medical Device
Rx ONLY	Authorized for Sale or use by Physician only
	Caution
	Manufacturer
	Date of manufacture (YYYY-MM-DD)
REF	Catalogue number
SN	Serial number

LOT	Batch code
	Atmospheric pressure limitation
	Humidity limitation
	Temperature limit
	Waste management
	Fragile
	Keep dry
	This way up
	Complies to IEC 60601-1 including US and Canadian deviations in their respective valid version
	The Canadian Standards Association (CSA) certification mark represents safety approval by Canadian Standards Association for Canada and the United States.
EAC	EurAsian Conformity (EAC) mark represents safety approval by Custom Union countries: Belarus, Russia, Kazakhstan, Armenia, Kyrgyzstan.

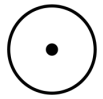
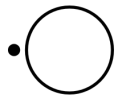
	China Compulsory Certificate (CCC) mark for Information Technology Equipment (ITE) products.
	United States Federal Communications Commission (FCC) symbol indicates EMC compliance per FCC standards.
	UK Authorized Representative
	No hazardous substances contained in the device
	Contains restricted substances. The symbol number refers in years to the Environmental Protection Use Period (EPUP), during which the product can be safely used, and following which should be immediately recycled.
	Equipotentiality
	Closed (On) Switch.
	Open (Off) Switch.
	Protective earth; protective ground
	Alternating current
	Non-ionizing electromagnetic radiation

Table of Contents

1 Important User Notes

Read the instructions for use carefully and become familiar with the operation and function of the device and the accessories before use during surgical procedures. Non-observance of the instructions listed in this manual can lead

- to life-threatening injuries of the patient,
- to severe injuries of the surgical team, nursing or service personnel,
- or damages or malfunction of device and/or accessories.

The manufacturer reserves the right to modify the appearance, graphics, and technical data of the product through continued development of its products.

Please note: Paragraphs marked with the words WARNING, CAUTION, and NOTE carry special meanings. Sections marked with these words must be given special attention.

WARNING!

The safety and/or health of the patient, user, or a third party are at risk. Comply with this warning to avoid injury to the patient, user, or third party.

CAUTION!

These paragraphs include information provided to the operator concerning the intended and proper use of the device or accessories.

NOTE!

These paragraphs contain information to clarify the instructions or provide additional useful information.

2 Safety Information

CAUTION!

Federal law restricts this device to sale by or on the order of a physician.

The manufacturer is not liable for indirect, incidental and consequential damages, including, but not limited to, loss of profit. Any liability and applicable warranty becomes null and void if:

- the device and/or the accessories/ peripherals are improperly used, transported, stored, prepared, or maintained;
- the instructions and rules in the instructions for use are not adhered to;
- unauthorized persons perform repairs, adjustments, or alterations on the device or accessories/peripherals;
- unauthorized persons open the device;
- the prescribed inspection and maintenance schedules are not adhered to.

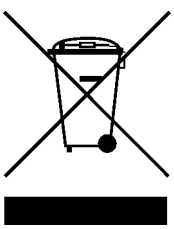
The handing over of technical documents does not constitute authorization to make repairs, adjustments or alterations to the device or accessories/ peripherals.

WARNING!

Modification of the device is not permitted.

Only an authorized service technician may perform repairs, adjustments, or alterations on the device or accessories/ peripherals and use the service menu. Any violation will void any applicable warranty. Authorized service technicians are only trained and certified by the manufacturer.

Waste management



This symbol indicates that the waste of electrical and electronic equipment must not be disposed as unsorted municipal waste and must be collected separately. For disposal of the device and its accessories, please consult the manufacturer or an authorized disposal company, in compliance with legal or national regulations.

3 Warnings and Cautions

This product is T.U.V. approved with respect to electric shock, fire and mechanical hazards only in accordance with CAN/CSA C22.2 No. 60601-1 and ANSI/AAMI ES60601-1.

This product meets the requirements of EN60601-1 so as to conform to the 2017/745 Medical Device Regulation of European Union.

WARNING!

Leaving a fixed (constant) image on the monitor for a long period of time can result in image retention. Avoid leaving a fixed image on the monitor, or turn the monitor off when it is not in use.

WARNING!

Risk of electrical shock

Uninsulated voltage within the unit may have sufficient magnitude to cause electrical shock. Do not touch any part inside the unit. To reduce the risk of electric shock, DO NOT remove the cover or back.

WARNING!

For mission critical applications, we strongly recommend that a replacement ZeroWire 4k Display Pair and a DVI cable be immediately available. Additionally, we recommend that a display that is hard wired to the video source be immediately available whenever a surgical procedure is in progress.

WARNING!

No part of this product may come in contact with a patient. Never touch the product and a patient at the same time. At any time, a minimum separation of 20 cm must be maintained from the operating device and the user or patient.

WARNING!

Fire and shock hazard

Do not expose this product to rain or moisture.

WARNING!

Do not use this unit's polarized plug with an extension cord receptacle or other outlets unless the prongs can be fully inserted.

CAUTION!

In case of serious incident

Please report any serious incident that has occurred in relation to the device to the manufacturer and the competent authority of the State in which the user and/or patient is established.

CAUTION!

This product is a Class I medical device according to the MDR in Europe. No modifications are allowed.

CAUTION!

This product is a Class II medical device in the United States and Canada. No modifications are allowed.

CAUTION!

Do not use this product in the presence of flammable anesthetics mixture with air, oxygen or nitrous oxide.

NOTE!

This equipment/system is intended for use by healthcare professionals only.

NOTE!

There are no user serviceable parts inside. Refer servicing to qualified service personnel.

NOTE!

This product is designed to meet medical safety requirements for a patient vicinity device.

Do not use in MR Environments

Hereby, NDS Surgical Imaging, LLC, declares that this ZeroWire 4K System is in compliance with the essential requirements and other relevant provisions of Directive 2014/53/EU. The full text of the EU Declaration of Conformity is available upon request.

Federal (USA) law restricts this device to sale by or on the order of a physician.

Radio Approval:

This device meets the requirements of EN302 567 and conforms to Radio and Equipment Directive (RED) 2014/53/EU.

FCC Identification: UK2-SII-SK63102, UK2-SII-SK63101 or 2ASUJ-SII-SK63102, 2ASUJ-SII-SK63101

Industry Canada: 6705A-SIISK63102, 6705A-SIISK63101 or 25001-SIISK63102, 25001-SIISK63101

This product complies to the above standards only when used with an NDS supplied medical grade power supply.

4 General Information

4.1 Device Requirements

4.1.1 System Safety Requirements

External equipment connected to the signal input/output or other connectors of this product for use in a patient environment must comply with the requirements of ISO and ANSI/AAMI ES/EN/IEC 60601-1 safety standards. A person who connects such equipment to this product has by definition formed a system, and is responsible for compliance of that system to the same ISO and ANSI/AAMI ES/EN/IEC 60601-1 safety standards.

NDS recommends that VIMA installation be conducted by qualified personnel.

4.1.2 Power Supply

This product complies to the listed safety standards only when used with the supplied medical grade power supply:

Model	**Radiance® Ultra 32" 4K ZeroWire Duo**
Power Supply	BridgePower BPM150S24F06
AC Input	100 - 240 V, 50 to 60 Hz
DC Output	24 Vdc, 6.25 A, 150 W

4.1.3 Power Cord

Use the supplied hospital grade power cord with the correct plug for your power source.

- The power cord is the only recognized disconnect device for this product. To power off the product, disconnect the power cord from the AC mains.
- The product and other medical equipment should be positioned so that the power cord and connection to AC mains is readily accessible.
- If an extension cord or power strip is needed for connection of this product to AC mains, confirm that the power cord plug can be securely connected to the cord or power strip. The low voltage side of the power supply can only be extended to up to 50 ft.
- This product should be powered from a center tapped circuit when used in the US at voltages over 120 V.

4.1.4 Grounding

This product is energized from an external electrical power source for 2017/745 Medical Device Regulation of European Union Class I equipment. It is the responsibility of the installer to test the product's earth ground to verify that it complies with the hospital, local and national impedance requirements.

A ground post is located on the back of the product to use for grounding the chassis of the unit. Any such grounding must be installed in accordance with applicable electrical codes.

5 Display User Interface

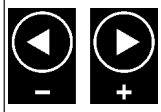
5.1 Display Keypad

The Display Keypad is centered on the lower front surface of the display enclosure, providing controls for adjustment of display parameters using the On Screen Display (OSD) Menu system.

5.2 OSD Menu Overview

The OSD Menu provides controls divided into 4 categories: the Picture Menu, the Color Menu, the Setup Menu, and the Input Menu.

5.3 Keypad Menu Navigation

	**INPUT** Button	To directly open the Input Menu, tap the **INPUT** button. Input signal options are displayed in the right column. See Input Menu [▷ 19].
	**MENU** Button	To open the OSD Menu, tap the **MENU** button. The Picture Menu is initially displayed, with details of the current input listed above the menu tabs.
	**SCROLL** Button: Vertical Selection Control	To enter a menu, tap the **SCROLL** button. The top parameter row is selected with first tap of the SCROLL button, and the selection moves downward to the next row with each successive tap. To exit a menu, use the **SCROLL** button to move the selection to the bottom menu row, and then tap the SCROLL button just once to highlight the menu tab, where you can use the ◀ or ▶ buttons to select another menu tab.
	**LEFT / RIGHT** Buttons: Horizontal Selection Controls	To adjust a parameter, select the parameter row using the **SCROLL** button, then tap the ◀ or ▶ buttons to select or to change a setting.
	**COLOR** Button	To directly open the Color Menu, tap the **COLOR** button. The Color Menu contains Color, Brightness, Contrast, and other parameters described in Color Menu [▷ 16].

5.4 OSD Menu

Access the OSD Menu by tapping the **MENU** button. The OSD Menu opens displaying the Picture Menu, with details of the input listed across the top of the menu above the menu tabs. Operating Hours and Firmware version number are listed at the bottom of the menu.

The keypad goes on standby after 5 seconds of inactivity. When the keypad is on standby press the **MENU** button to activate the keypad. Press the **MENU** button again to enter the menu.

To select other menu tabs, tap the ◀ or ▶ button to highlight a menu tab, then tap the **SCROLL** button to enter the menu.

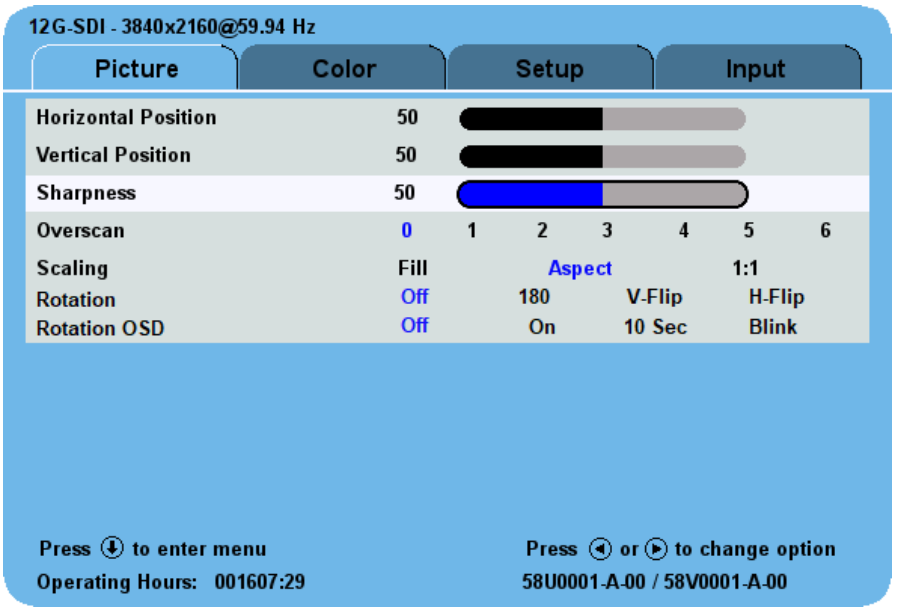
To adjust a parameter, tap the **SCROLL** button to move the row selection down to it, and then tap the ◀ or ▶ button to adjust the parameter or select a setting. Parameter adjustments are applied in real time while changing values or settings.

The OSD Menu closes automatically 30 seconds after the last action or can be closed by tapping the **MENU** button.

NOTE!

Grayed out descriptions indicate parameters not available for the current signal or input configuration.

5.5 Picture Menu



Horizontal Position

To horizontally center the image, tap the ◀ or ▶ button.

Vertical Position

To vertically center the image, tap the ◀ or ▶ button.

Sharpness

To adjust sharpness (edge enhancement) of the displayed image, tap the ◀ or ▶ button.

= 50: default value displays the image as received.

> 50: increasing values sharpen the image.

< 50: decreasing values soften the image.

Overscan (Video)

Parameter enabled when the input is 16:9, 480P, 576P, or interlaced. Press the ◀ or ▶ button to select.

0: The image is displayed at a size that fills the screen without losing any video information. Image could be displayed as letterboxed, with black bars top and bottom or left and right.

1, 2, 3, 4, 5 or 6: Incrementally enlarges and crops the centered image. As the image becomes larger, video information is lost on all sides.

NOTE!

The Link Menu may not be accessible when using Overscan. Displays should be linked berfore using this function.

Scaling

To select a scaling option, tap the ◀ or ▶ button.

Fill: Expands the video image to fill the entire screen. The aspect ratio may not be accurately displayed.

Aspect: Expands the video image until its largest dimension fills the screen while retaining the aspect ratio. The image may be displayed as letterboxed, with black bars top and bottom or left and right.

1:1: Displays the video data in its native size and aspect ratio. Images with resolution less than the 4K/UHD native 3840 x 2160 resolution are displayed with a black background surrounding the image.

NOTE!

Scaling options are limited to Aspect when overscan settings are > 0.

Rotation

The rotation option rotates the orientation of the screen per the option selected.

- To select the screen orientation, tap the ◀ or ▶ button.
- **Off:** No screen orientation change.
- **180:** Rotates the screen 180°.
- **V-Flip:** Rotates the screen vertically 180°.
- **H-Flip:** Rotates the screen horizontally 180°.

NOTE!

Image Rotation is not supported for interlaced signals.

NOTE!

The Link Menu may not be accessible when using rotated images. Displays should be linked berfore using this function.

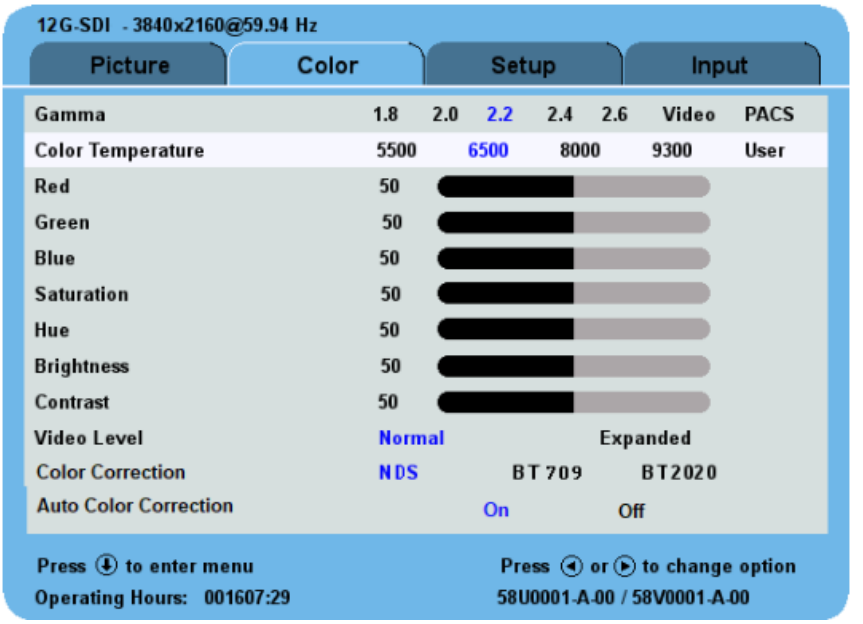
Rotation OSD

The rotation ODS option displays the screen orientation indicator on the screen at the selected interval.

Select the screen rotation indication option: **Off, On, 10 seconds, Blink**.

5.6 Color Menu

Open the Color Menu directly by tapping the **COLOR** tab.



Gamma

To select a gamma setting, tap the ◀ or ▶ button.

1.8, 2.0, 2.2, 2.4 or 2.6: Preset gamma values

Video: Linear gamma Look Up Table (LUT)

PACS: DICOM gamma LUT

This product is capable of displaying Radiology (PACS) images for reference purposes only.

Color Temperature

To select a preset color temperature, tap the ◀ or ▶ button.

5500, 6500, 8000, 9300: Preset color temperatures.

User: With a preset color temperature selected, if any other color parameter is subsequently adjusted from the default setting, the resulting values are copied to the color temperature User presets and User is selected.

Red / Green / Blue

To adjust balance of the selected color in the image, tap the ◀ or ▶ button.

Saturation (available only for YUV inputs)

To adjust saturation (color intensity) of the image, tap the ◀ or ▶ button.

Hue (available only for YUV inputs)

To adjust hue (color) of the image, tap the ◀ or ▶ button.

Brightness

To darken or lighten the image, tap the ◀ or ▶ button.

Contrast

To adjust contrast of the image, tap tap the ◀ or ▶ button.

Video Level

To select a video level setting, tap the ◀ or ▶ button.

Normal: The incoming signal is displayed without modification.

Expanded: Expands a Limited Range 16–235 signal (220 shades from black to white) to a Full Range 0–255 signal (256 shades from black to white).

NOTE!

Expand Setting

Application of the Expanded setting to a Full Range signal will clip the image, with loss of detail in dark and light areas.

Color Correction

To select a color correction setting, tap the ◀ or ▶ button.

NDS: Bypasses the color correction feature.

BT.709: Factory calibrated to meet the BT.709 standard.

BT.2020: Factory calibrated to emulate the BT.2020 standard.

Auto Color Correction

When Auto Color Correction is **ON**, color correction will be selected based on the input signal:

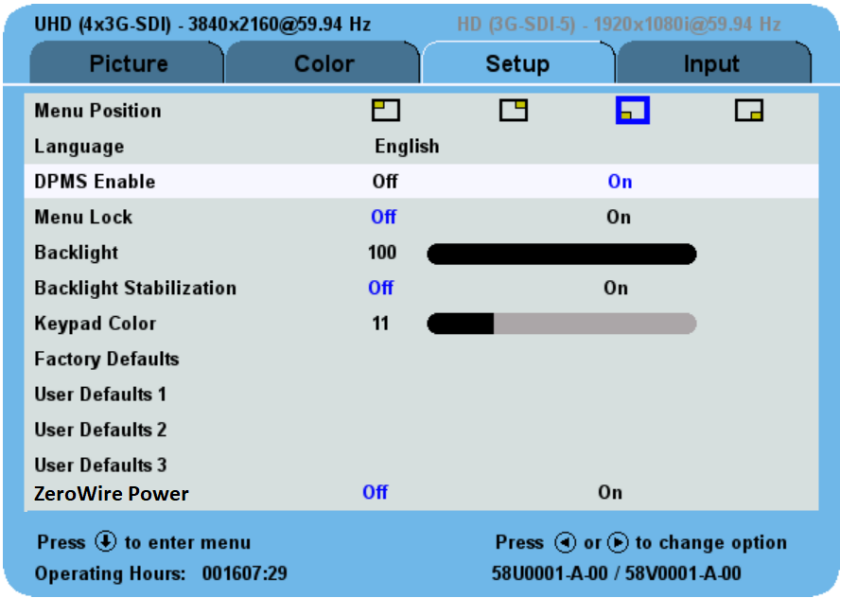
Auto Color Correction Settings by Input and resolution type:

	HDMI-1	HDMI-2	Display Port 1	Display Port 2	DVI	12G-SDI	ZW Receiver
Graphic	NDS	NDS	NDS	NDS	NDS	NDS	NDS
Standard Definition	BT.709	BT.709	BT.709	BT.709	NDS	NDS	BT.709
High Definition	BT.709	BT.709	BT.709	BT.709	NDS	NDS	BT.709
Ultra High Definition	BT.2020	BT.2020	BT.2020	BT.2020	NDS	NDS	BT.2020

NOTE!

Refer to chapter Supported Resolutions for resolution types associated with each input signal.

5.7 Setup Menu



Menu Position

To select from 4 preset screen locations for display of the OSD menu, tap the ◀ or ▶ button.

Language

To select one of eight languages: **English, Deutsch, Français, Italiano, Svenska, Español, Nederlands**, or **Русский**, tap the ◀ or ▶ button.

DPMS Enable

To enable or disable Display Power Management System (DPMS), tap the ◀ or ▶ button.

Off: Default setting.

On: If there is no input signal, a **DPMS** message displays for 10 - 15 seconds before the display goes into Power Saving mode. The display turns on when the input signal is restored.

Menu Lock

To enable Menu Lock. Tap the ▶ button.

Off: Default setting.

On: Disables access to all OSD menus except the Input Menu. The OSD Menu closes, and a **MENU LOCKED** message displays briefly. To unlock OSD access, simultaneously press the **MENU** and **SCROLL** buttons until the **MENU UNLOCKED** message displays**.**

Backlight

To adjust the backlight level of the display, tap the ◀ or ▶ button.

Backlight Stabilization

To enable or disable backlight stabilization, tap the ◀ or ▶ button.

Off: Default setting.

On: Controls LED output to maintain a consistent backlight luminance to compensate for LED output degradation over the display lifetime.

Keypad Color

To modify the Keypad color setting, tap the ◀ or ▶ button.

Factory Defaults

The parameters can be adjusted on a per-use basis; however, the adjustments cannot be saved. Each time **Factory Defaults** is selected, the pre-defined factory default settings will be loaded.

User Default 1-3

The User Defaults for the **Radiance® Ultra 32" 4K ZeroWire Duo** are not available for the standard setting.

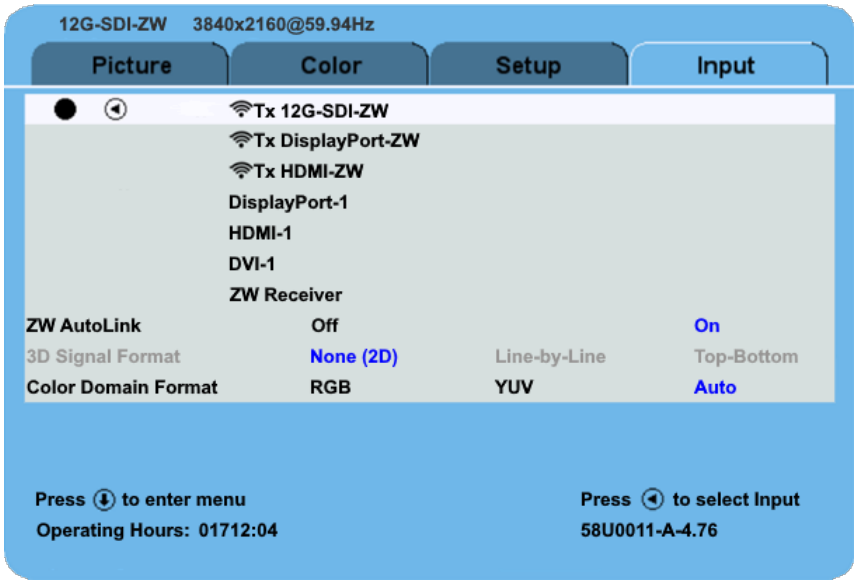
Zero Wire Power

To activate the **Zero Wire Power** tap the ▶ button. **On** is displayed in blue font. **Off** is displayed in grey font**.**

To deactivate the **Zero Wire Power** tap the ▶ button. **Off** is displayed in blue font. **On** is displayed in grey font**.**

Select **On** for both the transmitting (primary) display and the receiving (secondary) display to initiate the linking and transmission of video.

5.8 Input Menu



Open the Input Menu directly by tapping the **INPUT** button.

Input Menu Overview

The Primary image is designated by selection of an input. Only ZeroWire capable inputs can be transmitted to a secondary display when a wireless link is established. To show the video transmitted by the Primary Display select the "ZeroWire Receiver" input on the Secondary Display.

NOTE!

Interlaced signals are not supported on SDI Inputs.

ZeroWire AutoLink

The **ZW AutoLink** feature enables a display to automatically link with another display if

1. The second display was linked previously,
2. A ZeroWire capable input is selected and
3. ZeroWire Power is enabled at both displays and
4. A valid video signal is connected to the selected input of the primary display.

To activate the **ZW AutoLink,** tap the ▶ button. **On** is displayed in blue font. **Off** is displayed in grey font**.**

To deactivate the **ZW AutoLink,** tap the ◀ button. **Off** is displayed in blue font. **On** is displayed in grey font**.**

Color Domain Format

The following settings are available on all inputs:

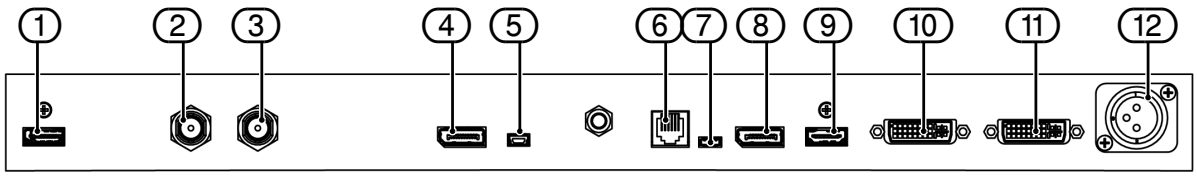
Auto: Select this option to automatically detect the signal color space. This option is unavailable when using the SDI and DVI Inputs

RGB: Select this option if the incoming signal has a RGB color space.

YUV: Select this option if the incoming signal has a YUV color space.

6 Connector Panel

6.1 Connector Panel



Connector panel

Input/Output

①	Tx HDMI ZW	Input accepts a HDMI 2.0 signal to display and capable of transmitting video over ZeroWire
②	Tx 12G-SDI-IN ZW	Input accepts a 12G-SDI signal to display and capable of transmitting video over ZeroWire
③	12G-SDI-OUT	Output is active only with monitor powered on and signal applied to Tx12G-SDI-IN ZW
④	Tx DISPLAYPORT ZW	Input accepts a DisplayPort 1.2a signal to display and capable of transmitting video over ZeroWire
⑤	SERVICE 2	Connector designated for installing firmware upgrades
⑥	RS-232	6-pin modular connector used for Unified Serial Command (USC) input
⑦	SERVICE 1	Connector designated for installing firmware upgrades
⑧	DISPLAY PORT	Input accepts a DisplayPort 1.2a signal to display
⑨	HDMI	Input accepts a HDMI 1.4b signal to display
⑩	DVI-IN	Input accepts a DVI 1.0 signal to display
⑪	DVI-OUT	Output is active only with monitor powered on and signal applied to DVI-IN
⑫	DC INPUT	Power Input

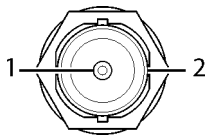
Connector Types

Inputs	Connector Types
12G-SDI	BNC
DVI-IN	DVI-D
DISPLAYPORT & Tx DISPLAYPORT-ZW	DisplayPort Type A
HDMI & Tx HDMI ZW	HDMI Type A
SERVICE 1	USB Micro AB
SERVICE 2	USB Mini B
DC INPUT	XLR, Neutrik type

Outputs	Connector Types
12G-SDI	BNC
DVI–OUT	DVI-D

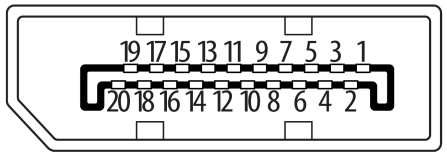
6.2 Data Connectors and Pinouts

SDI



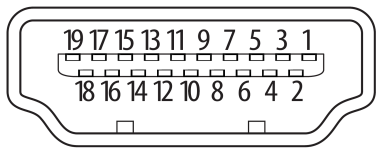
Pin	Name	Description
1	TXD	Transmit
2	GND	Ground

DisplayPort



Pin	Name	Description	Pin	Name	Description
1	ML_Lane 0 (p)	Lane 0 (positive)	11	GND	Ground
2	GND	Ground	12	ML_Lane 3 (n)	Lane 3 (negative)
3	ML_Lane 0 (n)	Lane 0 (negative)	13	CONFIG1	Ground
4	ML_Lane 1 (p)	Lane 1 (positive)	14	CONFIG2	Ground
5	GND	Ground	15	AUX CH (p)	Auxiliary Channel (positive)
6	ML_Lane 1 (n)	Lane 1 (negative)	16	GND	Ground
7	ML_Lane 2 (p)	Lane 2 (positive)	17	AUX CH (n)	Auxiliary Channel (negative)
8	GND	Ground	18	Hot Plug	Hot Plug Detect
9	ML_Lane 2 (n)	Lane 2 (negative)	19	Return	Return for Power
10	ML_Lane 3 (p)	Lane 3 (positive)	20	DP_PWR	Power for Connector (3.3 V 500 mA)

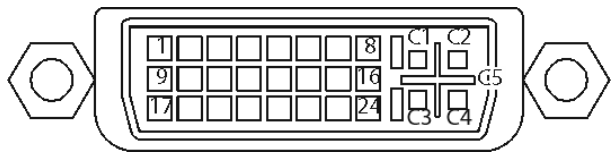
HDMI



Pin	Signal	Pin	Signal
1	TMDS Data2+	11	TMDS Clock Shield
2	TMDS Data2 Shield	12	TMDS Clock–
3	TMDS Data2–	13	CEC
4	TMDS Data2+	14	Reserved (HDMI 1.0–1.3c)
5	TMDS Data1 Shield	15	SCL (I^2C Serial Clock for DDC)
6	TMDS Data0-	16	SDA (I^2C Serial Data Line for DDC)
7	TMDS Data0+	17	DDC/CEC/ARC/HEC Ground
8	TMDS Data0 Shield	18	+5 V (min. 0.055 A)[3]
9	TMDS Data0–	19	Hot Plug detect (all versions)
10	TMDS Clock+		

DVI-D Digital

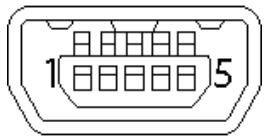
DVI-D IN Supports digital signals.



Pin	Signal	Pin	Signal	Pin	Signal
1	T.M.D.S. DATA 2-	11	T.M.D.S. DATA 1/3 SHIELD	21	Not used
2	T.M.D.S. DATA 2+	12	Not used	22	T.M.D.S. CLOCK SHIELD
3	T.M.D.S. DATA 2/4 SHIELD	13	Not used	23	T.M.D.S. CLOCK+
4	Not used	14	+5V POWER	24	T.M.D.S. CLOCK-
5	Not used	15	GND	**DVI-I IN Only**	
6	DDC CLOCK	16	HOT PLUG DETECT	C1	Not used
7	DDC DATA	17	T.M.D.S. DATA 0-	C2	Not used
8	Not used	18	T.M.D.S. DATA 0+	C3	Not used
9	T.M.D.S. DATA 1-	19	T.M.D.S. DATA 0/5 SHIELD	C4	Not used
10	T.M.D.S. DATA 1+	20	Not used	C5	Not used

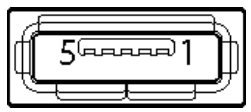
6.3 Control Connectors and Pinouts

USB Mini B



Pin	Name	Description
1	VCC	+5 Vdc
2	D-	Data Transmit Return
3	D+	Data Transmit
4	Not used	No Connection
5	GND	Signal Ground

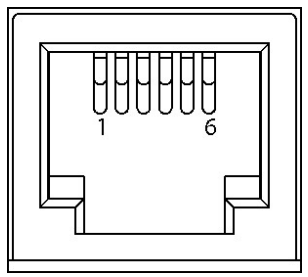
USB Micro AB



Pin	Name	Description
1	VCC	+5 Vdc
2	D-	Data Transmit Return
3	D+	Data Transmit
4	Not used	No Connection
5	GND	Signal Ground

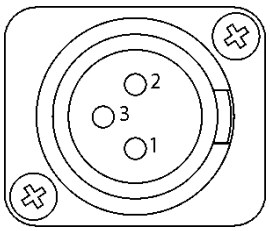
6-pin Modular RS-232 Serial Control

6-pin Modular Serial Command Adapter Cable.



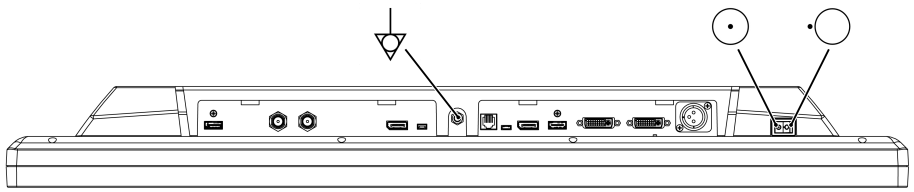
Pin	Name	Description
1	N/C	No Connection
2	N/C	No Connection
3	N/C	No Connection
4	RXD	Receive
5	GND	Ground
6	TXD	Transmit

24 Vdc Connector

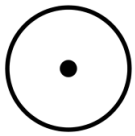
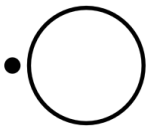


Pin	Name	Description
1	GND	Ground
2	GND	Ground
3	+24 Vdc	Power Input

6.4 Electrical Symbols



Electrical Symbols

	**Equipotentiality** This symbol appears next to the display Potential Equalization Conductor (ground post).
	**Closed (On) Switch** This symbol appears on the closed, or on, side of the display On/Off switch.
	**Open (Off) Switch** This symbol appears on the open, or off, side of the display On/Off switch.

CAUTION!

Degradation of the video signal

We recommend that the bend radius of metallic cables be no less than 2.5 inches (63 mm) or 7 times the diameter of the cable whichever is greater. Sharper bends may damage the cable and/or degrade the video signal.

7 Set up and Installation

7.1 Positioning and Orientation

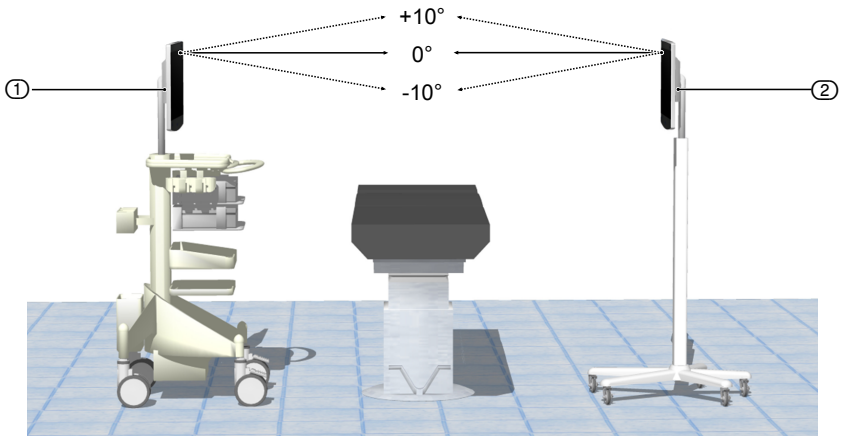
Due to the shape of the antenna's signal field, both the primary and secondary displays should be installed so they are aligned vertically and horizontally within ± 10°.

Vertical Alignment

Vertical alignment should be within ± 10°.

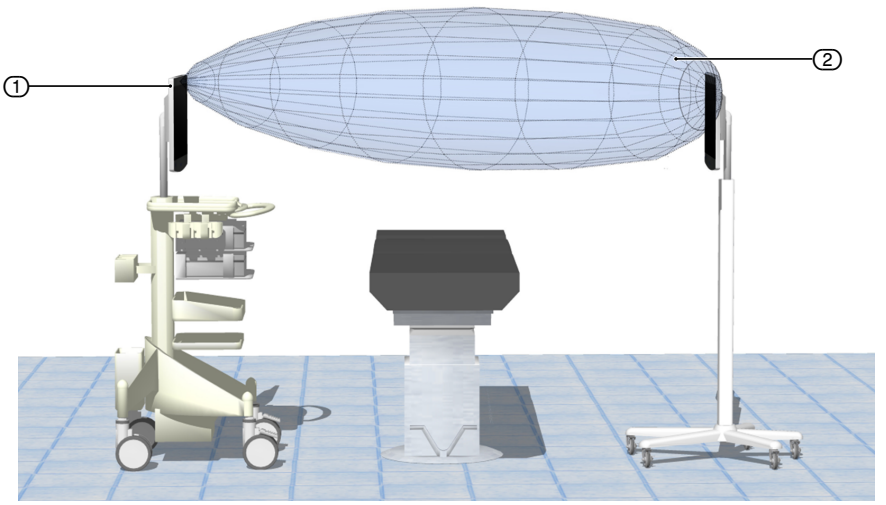
Horizontal Alignment

Horizontal alignment should be within ± 10°.



Display alignment

1. Primary display
2. Secondary display



Viewing cone

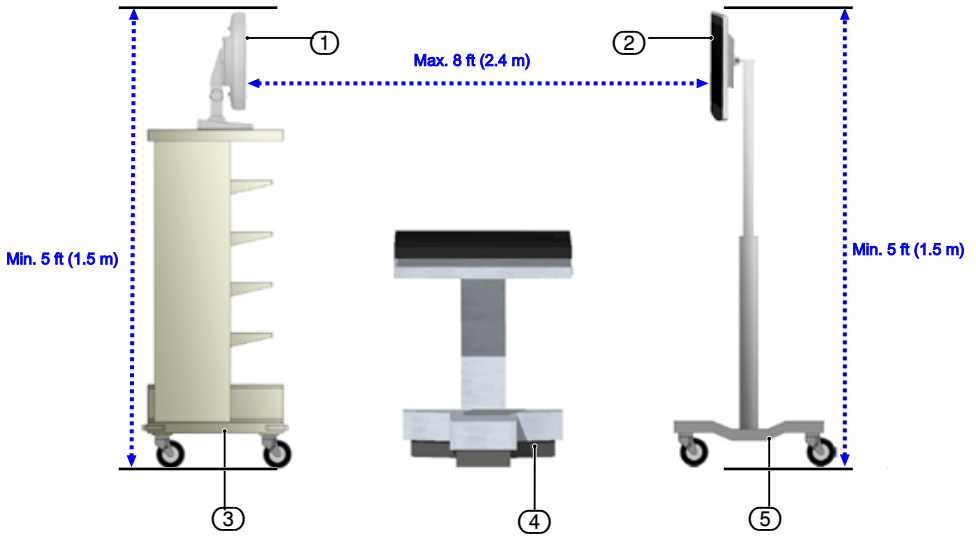
1. Primary display
2. Field Shape

Elevation

The primary and secondary display should be positioned at least 5 feet (1.5 m) above the floor, be at the same height, and, preferably, with the primary and secondary display fronts parallel and facing each other.

Horizontal distance between displays

Radiance® Ultra 32" 4K ZeroWire Duo operates correctly with a horizontal distance between the displays of up to 30 feet (9.1 m). However, in the case of most OR environments, best results are achieved with a horizontal distance of up to 8 feet (2.4 m). To avoid loss of image or flickering, minimize line of sight obstruction between primary and secondary display.



Positioning of displays

1. **Radiance® Ultra 32" 4K ZeroWire Duo**, primary display
2. **Radiance® Ultra 32" 4K ZeroWire Duo**, secondary display
3. Endoscopy cart
4. Surgical table
5. Roll-stand

7.2 Non Line of Sight Operation

The **Radiance® Ultra 32" 4K ZeroWire Duo** System can maintain a wireless link with partial obstructions. However, best performance is realized with a clear line-of-sight between units.

NOTE!

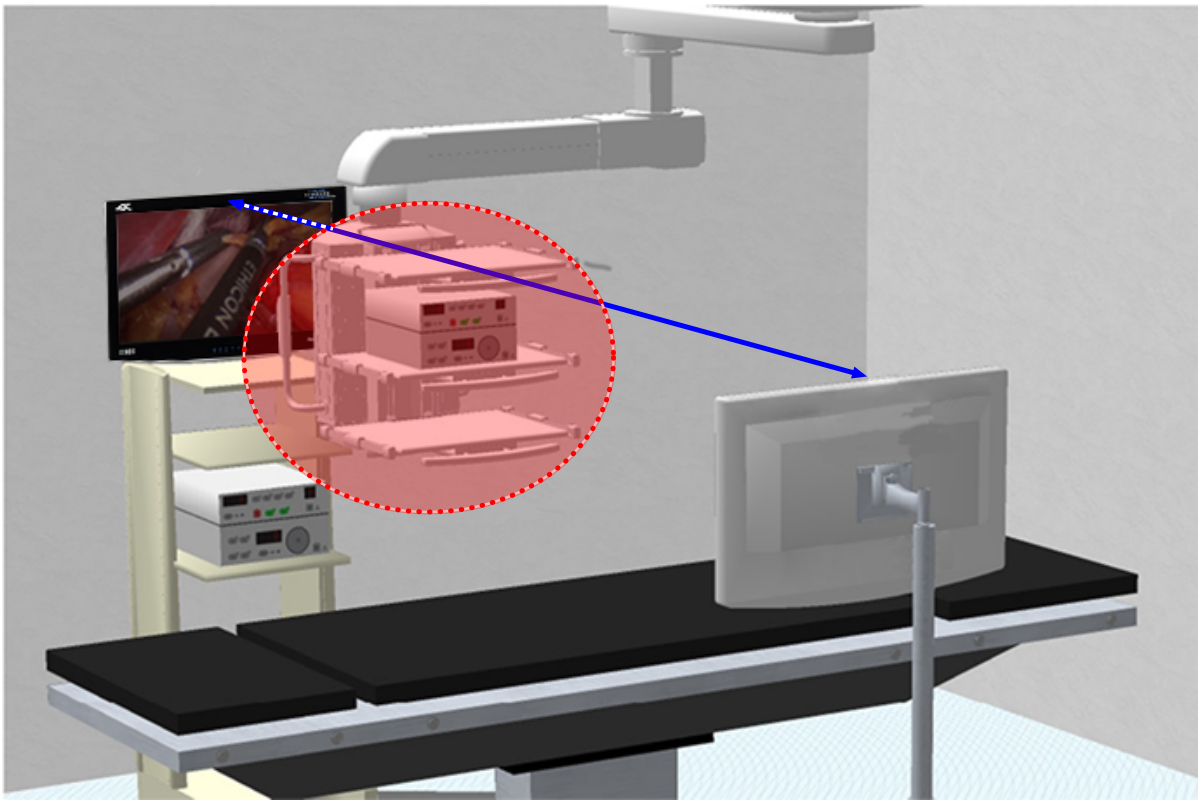
Loss of image or flickering image

Line of sight obstructions between displays should be minimized to avoid the loss of image or a flickering image.

In an OR environment, the ceiling mounted boom system and its spring arm junctions, along with surgical light heads, are large metal structures that can potentially block the wireless signals if they obstruct the line-of-sight between the primary and secondary display (see illustration below).

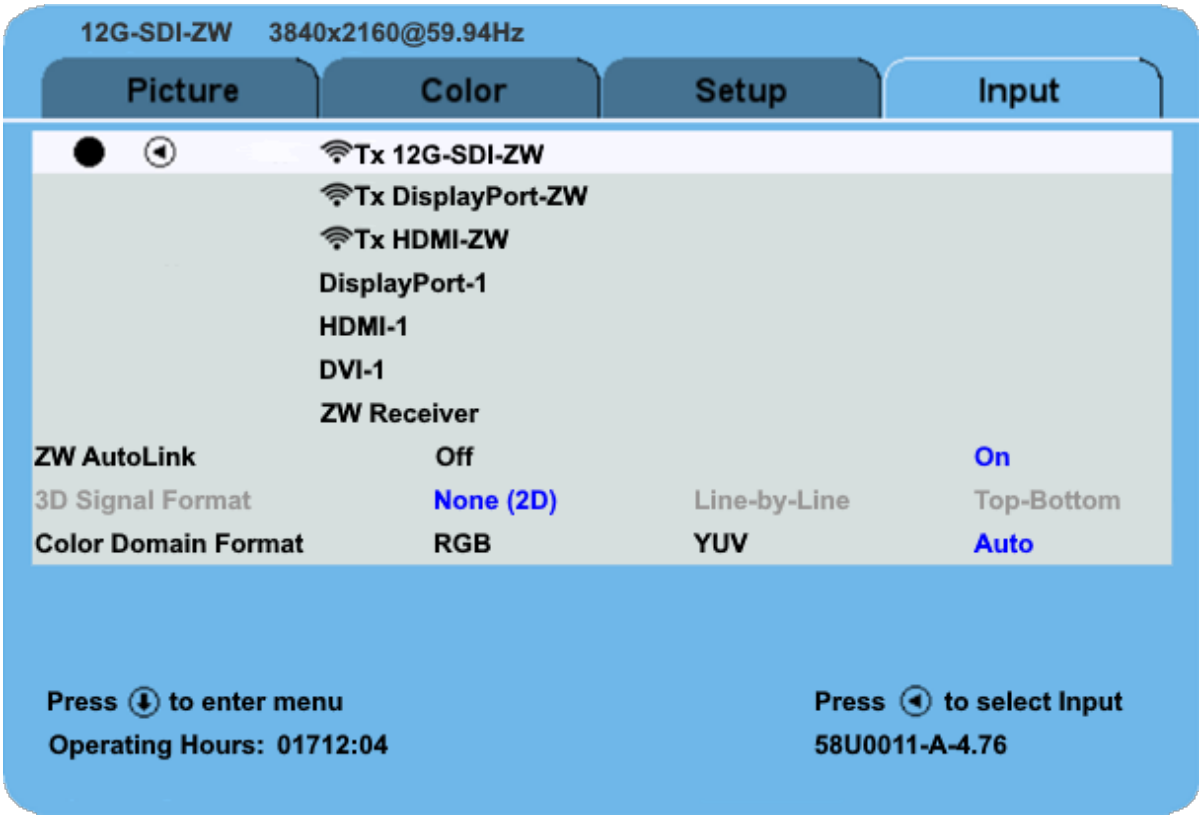
Preferably, surgical lights should be positioned out of the way or raised above the line-of-sight. If an object must obstruct the line-of-sight, the best option is to position it half way between the primary and secondary display.

OR rooms whose walls and/or ceiling are constructed with metal sheets may reduce **Radiance® Ultra 32" 4K ZeroWire Duo** performance. This condition possibly can be mitigated by moving the primary and secondary display closer to each other, setting their line-of-sight to 0° (see Positioning and Orientation), and ensuring that there are no obstructions between the the primary and secondary display.



Non-line-of-sight

7.3 Setting up and linking the displays



Setting up the transmitting (primary) display

The primary display will show and transmit the video from a video source to a linked secondary display.

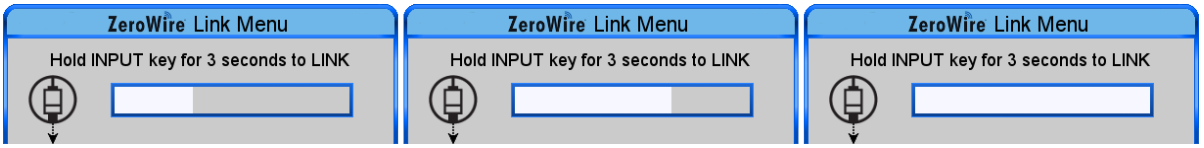
1. Connect a video source to one of the three ZeroWire capable inputs: Tx 12G-SDI-IN ZW, Tx DISPLAYPORT ZW or Tx HDMI ZW (see Connector Panel [▷ 21]).
2. Open the **INPUT** tab (see Input Menu [▷ 19]) on the primary display.
3. Select either Tx 12G-SDI ZW, Tx DisplayPort ZW or Tx HDMI ZW by selecting one of the three Tx ZW options.
4. Open the **SETUP** tab (see Setup Menu [▷ 18]).
5. Ensure ZeroWire Power is set to **On**. If not, set ZeroWire Power to **On**.

Setting up the secondary (receiving) display

The secondary display will receive the video transmitted from the primary display wirelessly.

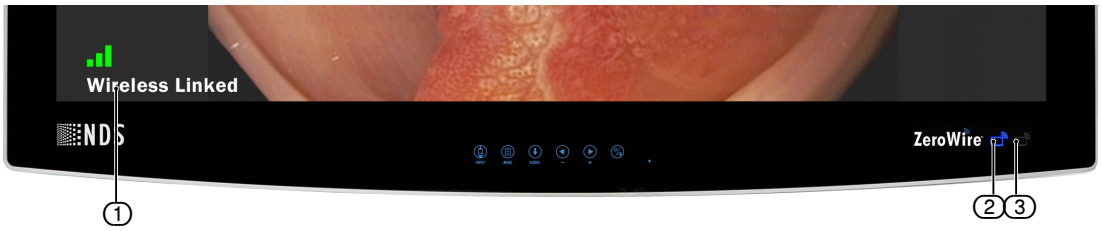
1. Open the **INPUT** tab (see Input Menu [▷ 19]) on the secondary display.
2. Select **ZW Receiver**.
3. Open the **SETUP** tab (see Setup Menu [▷ 18]).
4. Ensure ZeroWire Power is set to **On**. If not, set ZeroWire Power to **On**.

Linking the primary and secondary display



1. Tap the **INPUT** button on the primary display. ZeroWire Link Menu will appear on the screen.
2. Push and hold the **INPUT** button for three seconds to search for a secondary (receiving) display and activate the link. The white bar indicates the linking progress.
3. Wait until the white bar is full then follow the same steps on the secondary display.

Wireless Linking Status Messages



① Status message indicating the stages of the linking process.
② Tx Indicator
③ Rx Indicator

In the lower left corner of the display, a series of status messages will indicate stages of the linking process. In the lower right corner of the display, there are two blue LED indicators. The left corresponds to the TX indicator and the right corresponds to the RX indicator. These indicators light up when the display is set to a ZW input.

Stage 1:

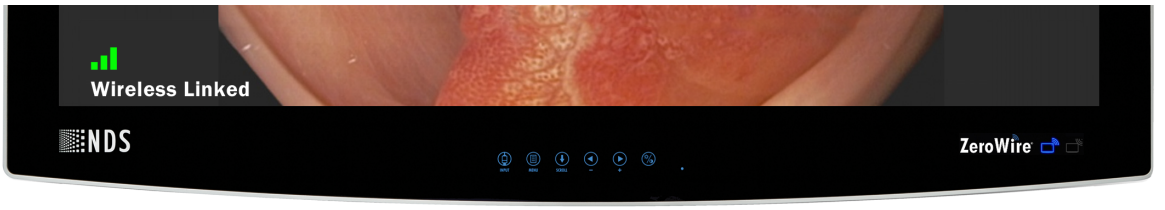
When initiating a link, the typical sequence of status messages presented on the display begins with **Searching for Transmitter** (secondary display) or **Searching for Receiver** (primary display). The corresponding Tx and Rx indicator will blink slowly indicating each display is set to a ZW input and searching for a pair.

Stage 2: Establishing Link

The blinking speed of the respective indicator will increase when establishing a link.

Stage 3: Wireless Linked

The respective indicator will stop blinking and light up in blue when a link has been established.



If after 10 seconds no message is displayed, the link is successful and has sufficient connection quality. If the link has less than 65 % connection quality, an icon will appear indicating the quality of the wireless link.

If a link cannot be established or verified within 60 seconds, the **No Receiver Found** or **No Transmitter Found** status message will be presented on the primary and secondary display respectively.

If the linked displays lose connection **Signal Lost** will be presented on both displays.

NOTE!

If the linking process failed repeat the linking process.

NOTE!

Link Quality Indication

Link Quality Indication may not be fully synchronized between displays for intermittent and brief perturbations of the wireless connection.

8 Display Specifications

NOTE!

Specifications are subject to change

Specifications are subject to change without notice. Contact your regional NDS headquarters for current specifications using contact information on the back cover.

Viewing Area (Diagonal)		32.00" (812.8 mm)
Viewing Angle (Horizontal and Vertical)		178°
Native Resolution		3840 x 2160
Contrast Ratio (Nominal)		1350:1
Typical Luminance (cd/m2)		700
Color Gamut		149 % of BT.709
Pixel Pitch		0.1845 mm
DC Input		24 V/6.25 A
DC Power Consumption (Typical)[a]		130 W
Monitor Weight		32.0 lb. (14.5 kg)
Monitor Dimensions (W x H x D)		30.7 x 20 x 3.4" (780 x 509 x 87 mm)
Temperature Ranges[b]:		
	Operating	32° – 104 °F (0° – 40 °C)
	Storage/Transport	-4° – 122 °F (-20° – 50 °C)
Humidity Ranges (Non-condensing)[b]:		
	Operating	20 % – 90 %
	Storage/Transport	10 % – 90 %
Altitude (Maximum)[b]:		
	Operating	6,600 ft (2,000 m)
	Storage/Transport	16,000 ft (4,877 m)
Air pressure		549 hPa – 1013 hPa

a. Applies to the BridgePower BPM150S24F06 power supply.

b. Per ASTM D6653/D6653M – 13

9 ZeroWire Specifications

The **Radiance® Ultra 32" 4K ZeroWire Duo** Display provides wireless delivery of video signals from the HDMI, DP and 12G-SDI output of OR video sources to the DVI input of a video display. It operates as a 60 Ghz-based wireless HD system in compliance with FCC (Part 15) rules governing the unlicensed 57-64 GHz band which is located in the millimeter-wave (mmW) portion of the electromagnetic spectrum. It receives input video signals directly from an endoscopic camera processor or from any other compatible video source.

Wireless Signal Type	60 GHz Wireless HD band (WiHD)
Frequency Band	57 - 64 GHz
Video Inputs (Tx)	HDMI, DP and 12G-SDI
HIPAA Support	256 bit AES Encryption
System Latency	< 1 Frame
Maximum Pairs per OR	2 Pairs
RF Power Out	< 28 dBm/MHz EIRP
Maximum Range	< 30 ft (9.14m)
Data Rate	50 Mbps - 3.8 Gb/s
Power Consumption	< 8 Watts

Maximum EIPR Output Power of Test Frequency

Channels	Frequency Range Average	EIRP Output Power
LRP (Sink)	60.16 – 62.96 GHz	22.7 dBm
LRP (Source)	60.16 – 62.96 GHz	21.9 dBm
MRP / HRP (Source)	60.48 – 62.64 GHz	28.7 dBm

Noninterference Distance

The listed devices on the following table have been tested to demonstrate the minimum safe distances for the **Radiance® Ultra 32" 4K ZeroWire Duo** to be operating without any interference with each other. At any time, if the **Radiance® Ultra 32" 4K ZeroWire Duo** is believed to be causing or getting the interference from those devices, simply move the devices away from each other, and then maintain at least the separations as specified in the table.

Tested Equipment	Distance to Transmitter	Distance to Receiver
Electrocautery	> 2 feet	> 1 foot
RFID	> 1 cm	> 1 cm
2.4 Ghz Wireless Access Point	> 6 in	> 6 in
5.8 Ghz Wireless Access Point	> 6 in	> 6 in
Cell Phone	> 1 cm	> 1 cm
Bluetooth Device	> 1 cm	> 1 cm

Avoiding Co-Channel Interference

If the **Radiance® Ultra 32" 4K ZeroWire Duo** deployment is a typical one-system per room, there are essentially no restrictions. The primary display's Channel Selection feature picks the channel that is least susceptible to interference from the two available channels based on the result of its scan at power on. Some of the factors affecting isolation of the **Radiance® Ultra 32" 4K ZeroWire Duo** channels are listed below:

1. The thickness and material of the room walls.
2. The opening and closing of room doors.
3. The room's ceiling structure and the materials used in its construction.

Radiance® Ultra 32" 4K ZeroWire Duo primary and secondary displays must be installed in the same room. Cross room operation is not supported. When two **Radiance® Ultra 32" 4K ZeroWire Duo** systems are installed in a given room, each pair must be linked separately, one pair at a time, linking the second pair after successfully linking the first. There is no need to turn off the first linked pair before powering or linking the second pair.

Channel Usage

The recommendations listed below should be used to determine the appropriate setting:

1. **Radiance® Ultra 32" 4K ZeroWire Duo** displays cannot be used with earlier ZeroWire Transmitter and/or Receiver units.
2. A maximum of two **Radiance® Ultra 32" 4K ZeroWire Duo** systems may be operated in the same room. The linked display pairs should be separated by at least 3 ft (1 m) within the room.
3. Groups of two **Radiance® Ultra 32" 4K ZeroWire Duo** systems may be set in multiple rooms, providing the rooms are spaced at least 25 ft (7.6 m) apart.
4. **Radiance® Ultra 32" 4K ZeroWire Duo** displays should not be installed in metal cabinets or surrounded by metallic objects, as this will prevent communication between the displays.

Multi System Installation

When two paired **Radiance® Ultra 32" 4K ZeroWire Duo** systems are to be installed in a given OR, use the following procedure:

1. If the displays have not been linked, power up the primary display and secondary display pair, and follow the linking procedure described in Setting up and linking the displays [▸ 29].
2. Power up the primary display and secondary display pair, and repeat the linking procedure. Displays pairs must be linked one pair at a time. We recommend that linked pairs be labelled to facilitate installation and troubleshooting.

Performance

1. **Radiance® Ultra 32" 4K ZeroWire Duo** System is intended and optimized for use in surgical or procedure rooms. Usage outside of a clinical environment is not recommended.
2. The following steps will help you to achieve optimal performance of the **Radiance® Ultra 32" 4K ZeroWire Duo** system:
3. Mount both components at least 5 ft (1.5 m) from the floor.
4. Ideally, both the primary and secondary display should be at the same height.
5. For a reliable video link, please follow the setup guidelines described in Setting up and linking the displays [▸ 29].
6. The displays should be facing each other and be visible to each other in free air space.
7. For non-line-of-sight applications, we recommend that the displays be located ≤ 6 ft (1.8 m) or less from the walls.

10 Supported Resolutions

Resolution Category	Resolutions Hactive x Vactive	Refresh Rates		Pixel Clock (MHz)	HD-SDI	3G-SDI	DP	HDMI
		H (kHz)	V (Hz)					
High definition	1280 x 720		25.000	74.250	✓		✓	✓
High definition	1280 x 720		29.970	74.250	✓		✓	✓
High definition	1280 x 720	22.500	30.000	74.250	✓		✓	✓
High definition	1280 x 720	37.500	50.000	74.250	✓		✓	✓
High definition	1280 x 720	44.955	59.940	74.176	✓		✓	✓
High definition	1280 x 720	45.000	60.000	74.250	✓		✓	✓
High definition	1920 x 1080	33.716	50.000	74.176	✓		✓	✓
High definition	1920 x 1080	33.716	59.940	74.176	✓		✓	✓
High definition	1920 x 1080	33.750	60.000	74.250	✓		✓	✓
High definition	1920 x 1080		25.000	74.176	✓		✓	✓
High definition	1920 x 1080	33.716	29.970	74.176	✓		✓	✓
High definition	1920 x 1080	33.750	30.000	74.250	✓		✓	✓
High definition	1920 x 1080	56.250	50.000	148.500		✓	✓	✓
High definition	1920 x 1080	67.433	59.940	148.352		✓	✓	✓
High definition	1920 x 1080	67.500	60.000	148.500		✓	✓	✓
Graphic	640 x 480	31.500	60.000	25.200			✓	✓
Graphic	640 x 480	37.861	72.809	31.500			✓	✓
Graphic	640 x 480	37.500	75.000	31.500			✓	✓
Graphic	1024 x 768	48.363	60.004	65.000			✓	✓
Graphic	1024 x 768	56.476	70.069	75.000			✓	✓
Graphic	1024 x 768	60.023	75.029	78.750			✓	✓
Graphic	1152 x 864	67.500	75.000	108.000			✓	✓
Graphic	1280 x 800	49.306	59.910	71.001			✓	✓
Graphic	1280 x 1024	63.981	60.020	108.000			✓	✓
Graphic	1280 x 1024	79.976	75.025	135.000			✓	✓
Graphic	1280 x 1024	91.146	85.024	157.500			✓	✓
Graphic	1024 x 768	41.250	50.000	56.183			✓	✓
Graphic	1280 x 1024	60.000	50.000	108.000			✓	✓

4K and UHD Resolutions

Resolution Category	Resolution Name	HActive x VActive	Frame Rate (Hz)	Color Space	Color Depth	Sub-Sampling	Video Interface
Ultra-high definition	4K DCI	4096x2160	59.94fps	RGB	8bit	4:4:4	HDMI
Ultra-high definition	4K DCI	4096x2160	50fps	RGB	8bit	4:4:4	HDMI / DP
Ultra-high definition	4K DCI	4096x2160 4096x2160	30fps	RGB	8bit	4:4:4	HDMI / DP
Ultra-high definition	4K DCI	4096x2160	50fps	YCbCr	10bit	4:2:2	HDMI / DP
Ultra-high definition	UHD	3840x2160	60fps	RGB	8bit	4:4:4	HDMI / DP
Ultra-high definition	UHD	3840x2160	59.94fps	RGB	8bit	4:4:4	HDMI / DP
Ultra-high definition	UHD	3840x2160	50fps	RGB	8bit	4:4:4	HDMI / DP
Ultra-high definition	UHD	3840x2160	30fps	RGB	8bit	4:4:4	HDMI / DP
Ultra-high definition	UHD	3840x2160	60fps	YCbCr	10bit	4:2:2	HDMI / DP / 12G
Ultra-high definition	UHD	3840x2160	59.94fps	YCbCr	10bit	4:2:2	HDMI / DP / 12G
Ultra-high definition	UHD	3840x2160	50fps	YCbCr	10bit	4:2:2	HDMI / DP / 12G

11 Installation and Maintenance

11.1 VESA Mounting

This monitor is compliant with the VESA Mounting Interface Standard, with 100 x 100 mm and 200 x 100 mm MIS hole mount patterns, suitable for stand or boom mounting.

WARNING!

Mounting bracket screws must be securely tightened. Failure to properly secure the mounting bracket to the display could be hazardous.

11.2 Cable Cover Installation

1. Connect power, control, and video cables before installing the cable cover.
2. Align the cable cover to the cable well recess on the back of the display.
3. Position cables under the cut-out, and slide the cover forward into the recess until tabs on the bottom edge click into place.

11.3 Cleaning Instructions

Prior to cleaning, the monitor must be turned OFF and disconnected from the power source.

Clean the front glass and enclosure with a lint-free cloth lightly dampened with distilled water, or an ammoniabased glass cleaner, or any of the following disinfectants:

Ethanol (80%)	Isopropyl Alcohol	White Vinegar (distilled, 5% acidity)

WARNING!

Do not allow liquids to enter the interior of the monitor, as severe damage to the unit can result. Do not use solvents, abrasive detergents, or chemical cleaning cloths.

12 Troubleshooting

Problem	Possible causes	Remedial action
Ghosting in characters or blurry image	**Wrong sharpness setting**	Check the sharpness setting in the Picture Menu. Set the sharpness to the default value of 50.
Black screen	**Display lost video signal and DPMS is active**	If the display lost the input of the video signal, the display activates sleep mode when the DPMS is enabled. Disable DPMS in the Setup Menu.
	No valid video signal on selected video input	Check if you have selected a video input with a valid video signal.
No transmitter found	**The primary display is OFF, or the cable from the video source is not connected, or the video source is OFF.**	Verify the primary display is ON or source signal is connected.
No image on display after changing input resolution	**The primary or secondary display cannot lock to the video signal.**	Cycle the **Radiance® Ultra 32" 4K ZeroWire Duo** display power.
Fails to establish link after attempting to pair	**The primary and secondary display cannot negotiate the RF Channel to connect on.**	Cycle both **Radiance® Ultra 32" 4K ZeroWire Duo** display's power.
Poor or intermittent video	**The primary and secondary display are spaced more than 30 feet (9.1 m) apart.**	Reduce the spacing between the displays to 30 feet (9.1 m) or less. See Maximum Range in section Specifications.
	The primary and secondary display are not aligned properly	Follow the Transmitter-Receiver alignment recommendations under Positioning and Orientation.
	DVI or SDI connections	Confirm that the cables are properly connected.
	Unsupported video mode	Verify that the applied video mode is supported. See Supported Video Modes.
	DVI or SDI cables	Replace the cables one at a time and check the video display. If the video signal displays properly after a cable is replaced, discard the cable you just replaced.
	Crosstalk	See Avoiding Co-Channel Interference.
	Low signal strength	See Signal Strength and OSD Diagnostic Messages.
	The primary and secondary display are switched	Verify that the video source is connected to the primary display, not to the secondary display.

13 Electromagnetic Compatibility Tables

All medical electronic devices must conform to the requirements of IEC 60601-1-2. Precautions, adherences to the Electromagnetic Compatibility (EMC) guideline information provided in this manual and verification of all medical devices in simultaneous operation are required to ensure the electromagnetic compatibility and co-existence of all other medical devices prior to a surgical procedure.

The emissions characteristics of this equipment make it suitable for use in industrial areas and hospitals (CISPR 11 class A). If it is used in a residential environment (for which CISPR 11 class B is normally required) this equipment might not offer adequate protection to radio-frequency communication services. The user might need to take mitigation measures, such as relocating or re-orienting the equipment.

The following EMC tables are provided for your reference:

13.1 Guidance and Manufacturer's Declaration - Electromagnetic Emissions

The product is intended for use in an environment as described below. The user/operator of the product should make sure the device is operated within such an environment.

Emissions test	**Compliance**	**Electromagnetic environment - guidance**
RF emissions CISPR 11	Group 1	The product uses RF energy solely for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11	Class B	The product is suitable for use in all establishments, other than public establishments and those directly connected to the public mains network that supplies buildings used for public purposes.
Harmonic emissions IEC 61000-3-2	Class A	
Voltage fluctuations/ flicker emissions IEC 61000-3-3	Complies	

13.2 Guidance and Manufacturer's Declaration - Electromagnetic Interference Immunity

This product is intended for use in the electromagnetic environment specified below. The customer or the user of the product should assure that it is used in such an environment.

Immunity Test	Immunity Test
Electrostatic discharge (ESD) IEC 61000-4-2	± 2, ± 4, ± 6, ± 8 kV contract discharge ± 2, ± 4, ± 6, ± 8, ± 15 kV air discharge
Radiated RF field IEC 61000-4-3	3 V/m 80 MHz - 2.7 GHz 80 % AM 1 kHz
Proximity fields from wireless transmitters IEC 61000-4-3	80 MHz to 2.7 GHz. 3 V/m Spot Tests: 385 MHz. at 27 V/m; (710, 745, 780, 5240, 5500, 5785) MHz at 9 V/m; (450, 810, 870,930, 1720, 1845, 1970, 2450) MHz at 28 V/m
Electrical fast transient / burst IEC 61000-4-4	± 2 kV, AC mains ± 1 kV, I/O ports 100 kHz PRR
Surge IEC 61000-4-5 AC mains, Line to Ground AC mains, Line to Line	± 0.5, ± 1, ± 2 kV ± 0.5, ± 1 kV
Conducted RF IEC 61000-4-6	3 V (0.15 MHz – 80 M Hz) 6 V ISM Bands 80 % AM 1 kHz
Power frequency (50/60 Hz) magnetic field IEC 61000-4-8	30 A/m - 50 or 60 Hz
Voltage dips, short interruptions and voltage variations on power supply input lines IEC 61000-4-11	100 % dip, 0.5 periods, 0°, 45°, 90°, 135°, 180°, 225°, 270°, 315° 100 % dip, 1 period 30 % dip, 25/30 periods (50/60 Hz) Interrupt 100 % drop, 5 s

NOTE!

Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the product is used exceeds the applicable RF compliance level above, the product should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the product.

NOTE!

Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.

13.3 Guidance and Manufacturer's Declaration - Recommended Separation Distances

Recommended separation distances between portable and mobile RF communications equipment and the product

The product is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the product can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the product as recommended below, according to the maximum output power of the communications equipment.

WARNING!

Effects of the RF telecommunications devices (transmitters) on the performance characteristics

Portable HF communication devices can have an effect on the performance characteristics of the device. Therefore such devices must be kept a minimum distance of 30 cm (independent of any calculation) from the insufflator, its accessories and cables.

Rated maximum output power (W) of transmitter	Separation distance, in meters according to frequency of transmitter		
	150kHz to 80 MHz	80 MHz to 800 MHz	800 MHz to 2.7 GHz
0.01	0.12	0.12	0.23
0.10	0.38	0.38	0.73
1.00	1.20	1.20	2.30
10.00	3.80	3.80	7.30
100.00	12.00	12.00	23.00

For transmitters rated at a maximum output power not listed above, the recommended separation distance *d* in meters (m) can be estimated using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.

NOTE!

At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.

NOTE!

These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

По вопросам продаж и поддержки обращайтесь:

Алматы (7273)495-231
Ангарск (3955)60-70-56
Архангельск (8182)63-90-72
Астрахань (8512)99-46-04
Барнаул (3852)73-04-60
Белгород (4722)40-23-64
Благовещенск (4162)22-76-07
Брянск (4832)59-03-52
Владивосток (423)249-28-31
Владикавказ (8672)28-90-48
Владимир (4922)49-43-18
Волгоград (844)278-03-48
Вологда (8172)26-4159
Воронеж (473)204-51-73
Екатеринбург (343)384-55-89
Иваново (4932)77-34-06
Ижевск (3412)26-03-58
Иркутск (395)279-98-46
Казань (843)206-01-48
Калининград (4012)72-03-81
Калуга (4842)92-23-67
Кемерово (3842)65-04-62
Киров (8332)68-02-04
Коломна (4966)23-41-49
Кострома (4942)77-07-48
Краснодар (861)203-40-90
Красноярск (391)204-63-61
Курск (4712)77-13-04
Курган (3522)50-90-47
Липецк (4742)52-20-81
Магнитогорск (3519)55-03-13
Москва (495)268-04-70
Мурманск (8152)59-64-93
Набережные Челны (8552)20-53-41
Нижний Новгород (831)429-08-12
Новокузнецк (3843)20-46-81
Ноябрьск (3496)41-32-12
Новосибирск (383)227-86-73
Омск (3812)21-46-40
Орел (4862)44-53-42
Оренбург (3532)37-68-04
Пенза (8412)22-31-16
Петрозаводск (8142)55-98-37
Псков (8112)59-10-37
Пермь (342)205-81-47
Ростов-на-Дону (863)308-18-15
Рязань (4912)46-61-64
Самара (846)206-03-16
Саранск (8342)22-96-24
Санкт-Петербург (812)309-46-40
Саратов (845)249-38-78
Севастополь (8692)22-31-93
Симферополь (3652)67-13-56
Смоленск (4812)29-41-54
Сочи (862)225-72-31
Ставрополь (8652)20-65-13
Сургут (3462)77-98-35
Сыктывкар (8212)25-95-17
Тамбов (4752)50-40-97
Тверь (4822)63-31-35
Тольятти (8482)63-91-07
Томск (3822)98-41-53
Тула (4872)33-79-87
Тюмень (3452)66-21-18
Ульяновск (8422)24-23-59
Улан-Удэ (3012)59-97-51
Уфа (347)229-48-12
Хабаровск (4212)92-98-04
Чебоксары (8352)28-53-07
Челябинск (351)202-03-61
Череповец (8202)49-02-64
Чита (3022)38-34-83
Якутск (4112)23-90-97
Ярославль (4852)69-52-93

Россия +7(495)268-04-70 Казахстан +7(7172)727-132 Киргизия +996(312)96-26-47

Адрес: https://nds.nt-rt.ru/ || эл.почта: nsi@nt-rt.ru