BOLDscreen 32 UHD User Guide

B32UHD01 & BTUHD01

Version 4

CAMBRIDGE RESEARCH SYSTEMS

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Contents

1 Introduction

1.1 Document owner

Job Title
Product manager

1.2 Referenced documents

Reference	Title	Document Number
1.	BOLDscreen 32 UHD Installation Guide	CR-000428-MS
2.	BOLDscreen 32 UHD Trolley System Installation Guide	CR-001029-MS

1.3 Scope

This document covers use of the BOLDscreen 32 UHD system, including control room AVI hub. It does not cover installation of a new system, which is documented separately [1,2]. Some of the material relevant to both installers and users is duplicated in both documents.

1.4 Purpose

This document is intended for everyday users of the BOLDscreen 32 UHD system, post-installation.

2 Safety

Figure 1. Safety labels.

Refer to relevant installation guide [1,2] for instructions and safety information regarding installation of the BOLDscreen 32 UHD system. Further warnings are given in Section 21. During use, do not disconnect any cables, or otherwise uninstall any parts of the system in the magnet room without taking proper safety precautions and following local procedures.

Safety labelling of the items is shown in Table 1.

Table 1. MR safety labels.

	MR-SAFE. These items can go into the magnet room. No displacement with any field strength of any MRI scanner. **No items supplied with this product are MR-SAFE.**
	MR-CONDITIONAL: These items must only go into the magnet room **if specified installation and usage instructions are followed.**
	MR-UNSAFE: Never take these items into the magnet room. **A SERIOUS DANGER FROM THE MAGNETIC FIELD EXISTS WITH THESE ITEMS.**

3 Parts

The parts of the system that the user may interact with are listed here. For a complete list of all parts included and that are part of an installation, refer to the relevant installation manual [1,2].

3.1.1 Monitor (999-00001)

Safe for field strengths up to 7T, when located outside magnet bore. Consult Cambridge Research Systems (support@crsltd.com) before using with higher field strengths.

Figure 2. BOLDscreen 32 UHD monitor.

Located within the magnet room, the monitor must be installed with the plane of the display vertical and in landscape orientation for correct cooling. There are no restrictions on location with regard to field strength, except that no part of it should be within the magnet bore and the subject being scanned must not be able to touch the monitor or the connecting cables.

3.1.2 Standard Trolley (999-00002) (option A)

Safe for field strengths up to 7T, when located outside magnet bore. Consult Cambridge Research Systems (support@crsltd.com) before using with higher field strengths. Assemble outside magnet room.

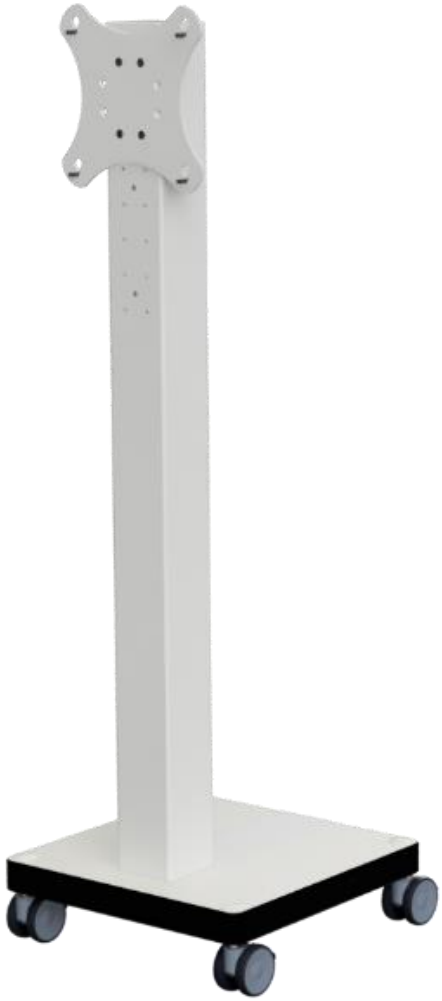

Figure 3. Assembled trolley, without monitor.

3.1.3 Wide Trolley (999-00003) (option B)

Safe for field strengths up to 7T, when located outside magnet bore. Consult Cambridge Research Systems (support@crsltd.com) before using with higher field strengths. Assemble outside magnet room.

Figure 4. Assembled Wide Trolley, without monitor.

3.1.4 Hybrid cable

Connect to trolley and Cable IO unit

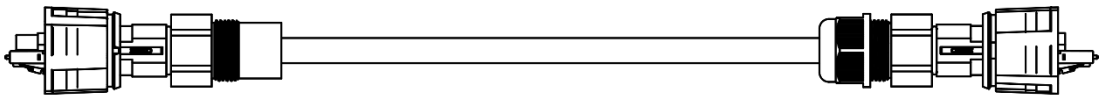

Figure 5. Hybrid cable (not to scale).

This carries both the DC supply and fibre video connection to the monitor in a single rugged cable. This will run across the floor from the fixed Cable IO unit (Section 3.1.5) to the movable trolley.

3.1.5 Cable IO unit (099-0211-00)

Securely attach to wall.

Figure 6. Cable IO unit

When the trolley is used, this will be fixed to the wall, inside the magnet room, close to where the monitor will be positioned. The hybrid cable (Section 3.1.4) will run from the trolley to this unit.

3.1.6 AVI hub (099-0217-00)

Do not take into magnet room.

Figure 7. AVI hub.

This should be located on a desk in the control room. The AVI hub selects the video source and sends it to the monitor. It connects to the fibre optic cable which goes via the penetration panel to the monitor. It has its own mains power supply via USB-C, and a USB-C power supply with captive USB-C cable are supplied. A mains outlet needs to be provided within 1 metre of the AVI hub.

Optionally, an ethernet network connection can be provided for increased functionality.

3.1.7 HDMI-Fibre transmitter (EXT-OF-HDMI20-2LC-AVX-T)

Do not take into magnet room.

Figure 8. VuWall HDMI extender transmitter.

An alternative to the AVI hub is a VuWall HDMI extender transmitter. This simply receives an HDMI input from the video source, and sends it via the fibre optic cable to the BOLDscreen 32 UHD. It is supplied with its own wall-mounted power supply with interchangeable region-specific pins.

4 Buttons and connectors

4.1 BOLDscreen 32 UHD monitor

The rear panel of the BOLDscreen 32 UHD monitor features several connectors as shown in Figure 9. Connections to the "DC In" and "Fibre video" connectors from a trolley or wall-mounted faceplate will have been made during installation of the system. The power button and status LED will be referred to later in this document (Sections 8.1 and 17).

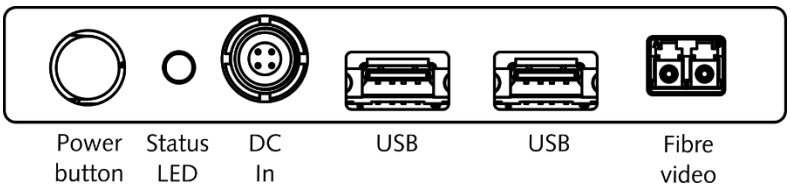

Figure 9. BOLDscreen 32 UDD monitor rear connection plate.

4.2 AVI hub

Ideally the AVI hub will be placed on the desk or shelf in the scanner control room in a place that allows the front panel to be accessible. Video input

connectors and several buttons are on the front panel, as shown in Figure 10 and Section 19.5.1.1. The rear panel features more connectors that are less likely to be accessed on a day-to-day basis, shown in Figure 11. The connection to the BOLDscreen 32 UHD monitor via the port labelled "BS32 UHD" will have been made installation. Power to the AVI hub is supplied via the USB-C port labelled "Power In" and the suppled USB-C power supply and cable.

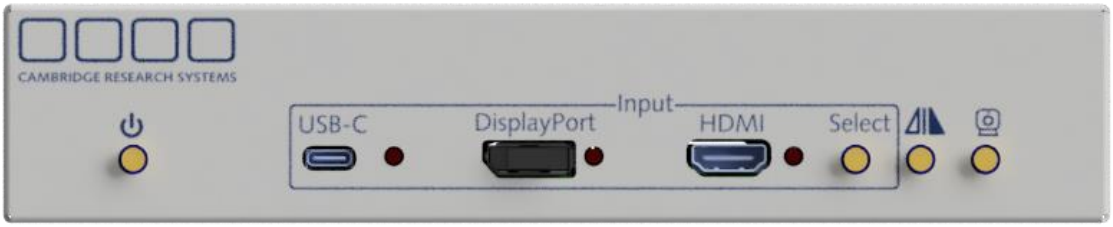

Figure 10. AVI hub front panel.

Figure 11. AVI hub rear panel.

5 Moving the monitor on the trolley (when supplied)

When pushing the trolley with the monitor attached, do this slowly and carefully. Use two hands, one at the top of the upright and one further down. Note that eddy currents near the magnet may cause resistance to motion in some directions. When positioning the monitor, ensure that all four castors are on the floor.

The monitor and trolley can be pushed up against the magnet housing if necessary, and doing this will limit movement of the monitor in the event of a magnet quench.

Under no circumstances should the hybrid or DC cable be inside the magnet bore, be touching, or be within reach of the patient/participant being scanned.

If the trolley is to be moved far from its normal operating position, or out of the magnet room, first disconnect the AC power supply in the control room (see Section 6), then disconnect the hybrid cable from the Cable IO unit.

Under no circumstances should the hybrid cable be routed out of the magnet room while the scanner is active.

6 Hybrid cable

The hybrid cable (used with trolley installations only) carries both the DC power supply and the video signal via both electrical and fibre cabling. It emerges from the trolley and connects to the Cable IO unit attached to the wall. The BOLDscreen 32 UHD monitor on the trolley can be pushed around the room with the hybrid cable attached as long is care is taken not to trip on the cable or snag other objects, and the cable is not stressed (overly bent) at either end.

If the trolley is to be moved far from its normal operating position (e.g. for storage when not in use), or out of the magnet room, the hybrid cable can be disconnected from the Cable IO unit. The monitor, trolley and attached cable can then be moved as a whole. The hybrid cable can then be reattached when the BOLDscreen 32 UHD is to be used again.

Before disconnecting the hybrid cable, the monitor PSU (located in the control room and connected to a filter unit in the penetration panel) should be disconnected from AC mains power. Doing this is far more preferable than disconnecting the hybrid cable (or any of the in-room DC cabling) while the PSU is supplying power.

Under no circumstances should the hybrid cable be routed out of the magnet room while the scanner is active.

6.1 Hybrid cable (dis)connection

The hybrid cable is supplied with a dust cap. Connecting it to a bulkhead connector (inside the trolley or on the Cable IO unit) requires cap releasing a

retaining ring and releasing a locking mechanism to remove the dust cap (see Figure 12).

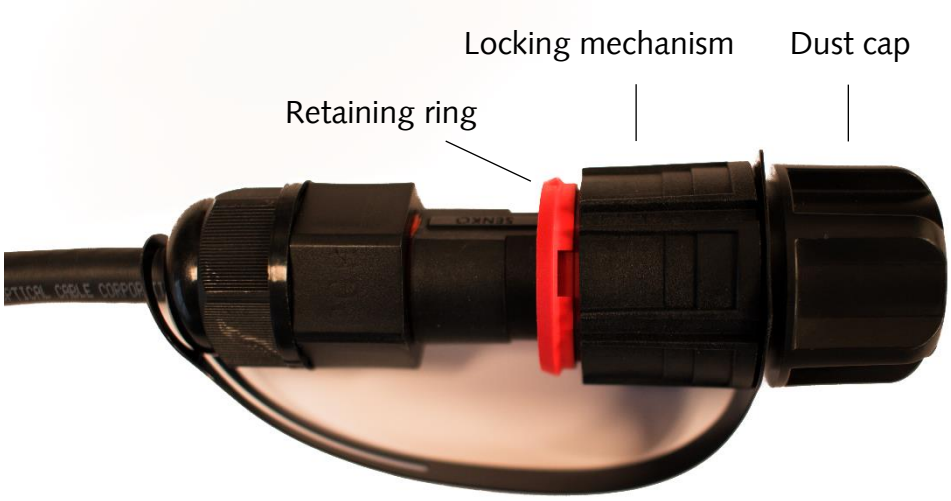

Figure 12. Parts of the hybrid cable connector.

Pull the red retaining ring back towards the cable (Figure 13).

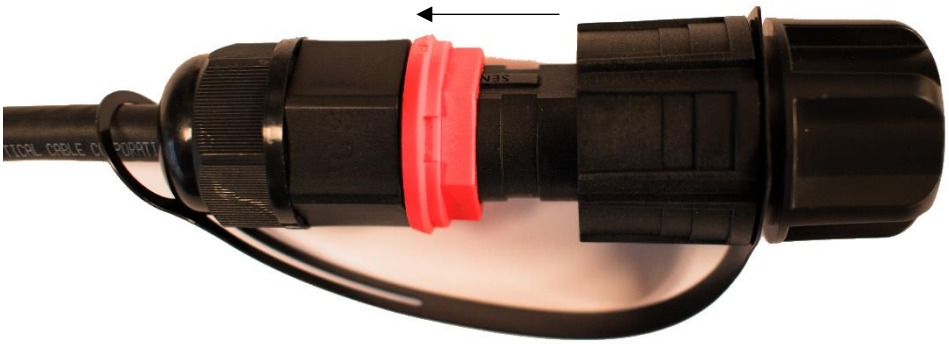

Figure 13. Release the retaining ring.

Turn the locking mechanism anticlockwise (when viewed from the cable) to release it, then slide towards the cable (Figure 14).

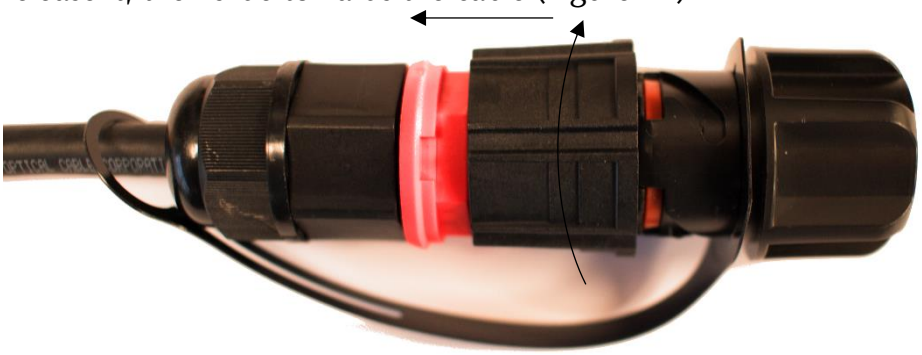

Figure 14. Release the locking mechanism.

Pull the dust cap off to reveal the fibre and DC connectors (Figure 15).

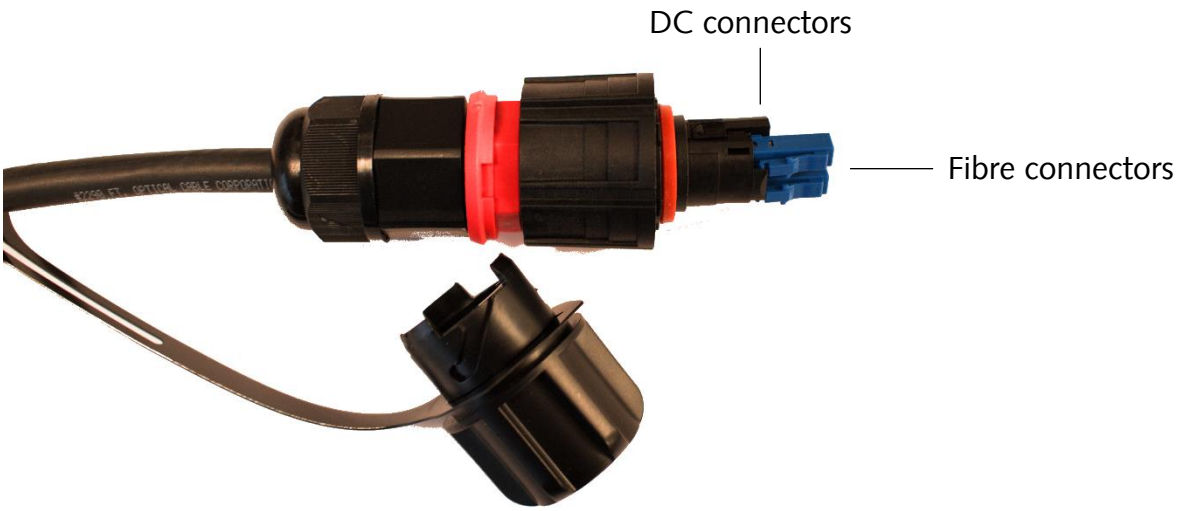

Figure 15. Remove the dust cap.

If a dust cap is present on the bulkhead connector (e.g. on the Cable IO unit), twist it gently anticlockwise to release it.

Push the fibre and DC connectors on the cable into the socket. It will only fit in one orientation, but white marks are present on the plug and socket to help alignment. Take care not to damage the fibre connectors.

Push the locking mechanism towards the socket and twist clockwise, then push the red retaining ring towards the socket to lock the connector in place. Leave the dust caps attached to the cable or bulkhead connector on the retaining strap to that it can be replaced if the cable is disconnected.

To disconnect the cable, reverse the above procedure.

7 Positioning of monitor (for non-fixed installations)

When in use, the optimal position of the monitor relative to the magnet will depend on the visual angle required from the display and/or the area of the display required to be visible.

The active region of the monitor, i.e. the area filled by the video, is 698.4 x 392.9 mm (see Figure 16). The diagonal is 801mm.

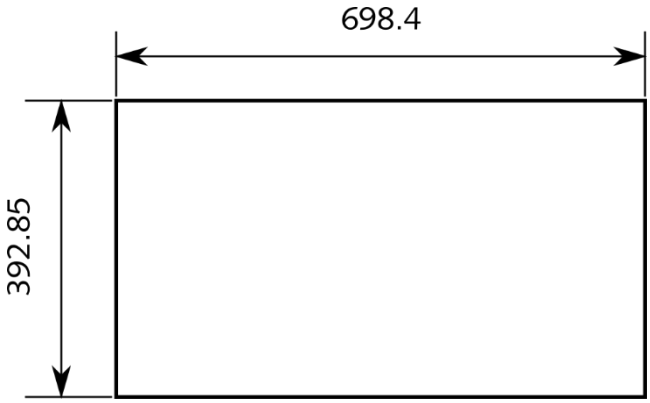

Figure 16. Dimensions of the active area of the monitor, in mm.

To determine the optimal position of the monitor, consider the geometry shown in Figure 17. In the figure, B is the diameter of the bore, d_1 is the distance between the viewing position and the end of the bore (including extra optical path length resulting from viewing through a headcoil mirror), d_2 is the offset of the monitor from the end of the bore, and W is the width of the active area. This will allow the whole width to be visible with the corners covered by the bore (use the diagonal length if you want the whole area to be visible, with space around the top, bottom and sides).

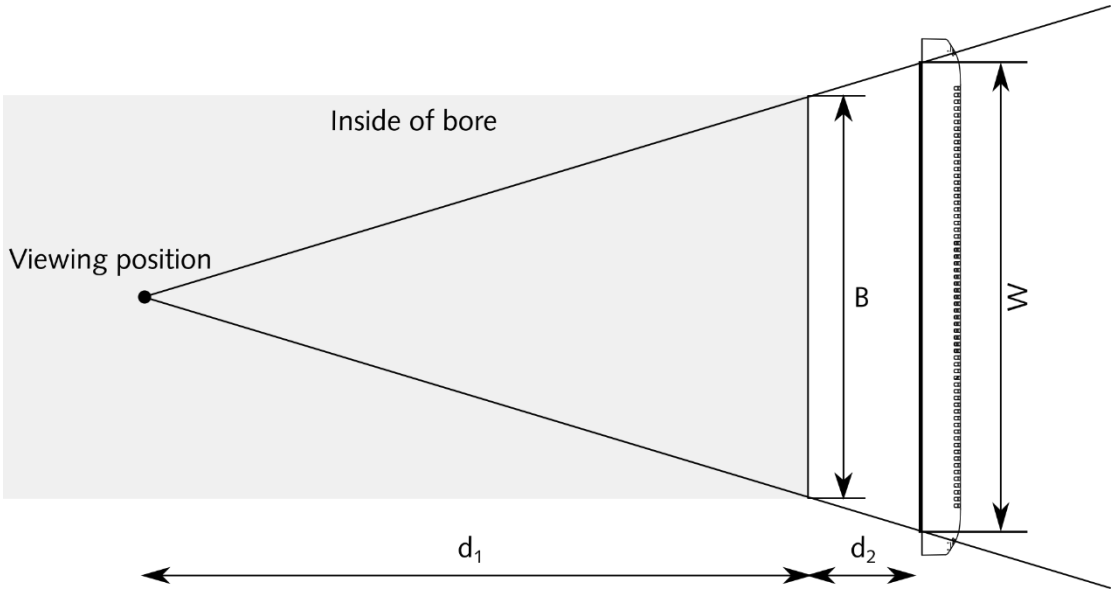

Figure 17. Geometry of the position of the monitor relative to the bore.

To find the distance d_2:

$$d_2 = d_1\left(\frac{W}{B} - 1\right)$$

For a distance between the viewing position and the rear end of the bore of 1.0m, we can calculate the example values in Table 2.

Table 2. Example distances

Bore diameter	Screen area visible	Approximate offset from end of bore	Horizontal visual angle
70cm	Full width	0	33.4°
70cm	Full area	14cm	29.3°
60cm	Full width	16cm	38.6°
60cm	Full area	34cm	33.9°

Where the offset is zero, the monitor can be pushed up against the end of the bore, as much as possible.

If greater offsets than those calculated are used, the visual angle will be smaller.

Examples of the visible proportion of the active area are shown in Figure 18.

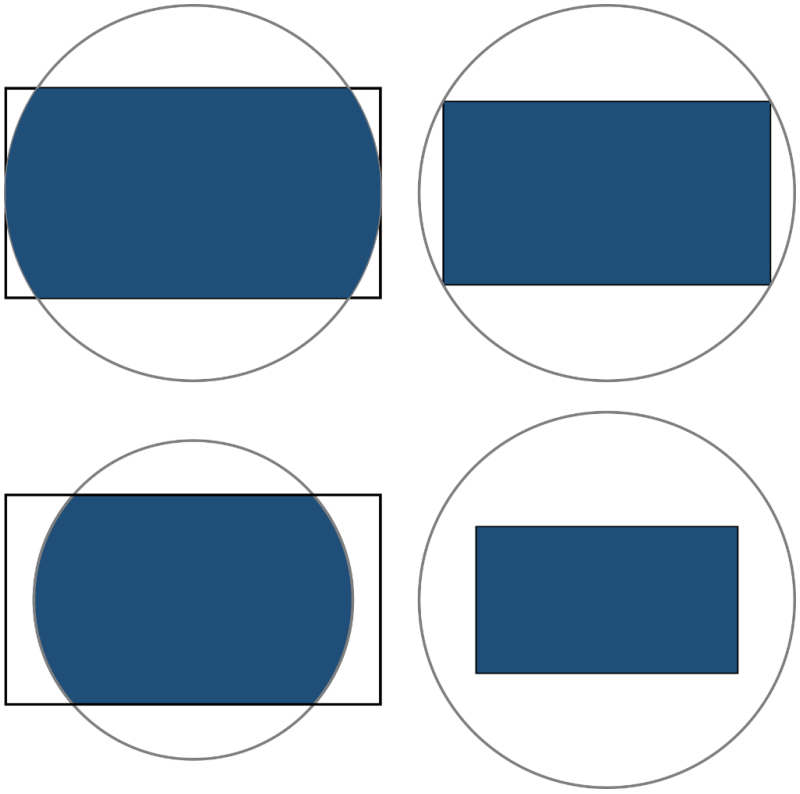

Figure 18. Examples of how the position of the monitor (black rectangle) relative to the exit of the magnet bore (grey circle) affects the visible region (blue) when viewed from inside the bore. Top left: monitor positioned so that full width is visible (at end of 70cm bore). Top right: monitor positioned so that full area is visible. Bottom left: monitor at end of 60cm bore. Bottom right: monitor positioned further than distance calculated.

8 Turning on/off

The BOLDscreen 32 UHD has three power states. These are described in Table 3.

Table 3. Monitor power states

State	Description
Standby	The monitor is in low power mode. The LCD panel and backlight are not powered, but some of the internal electronics are still active. The status LED will blink green. This is the default state when power is connected.
On	All components of the monitor are powered on. The status LED will be solid green. If the monitor receives a valid video signal, an image will be displayed and the status LED will turn solid blue.
Off	All but the minimum electronics required to power on the monitor are off.

8.1 Monitor power button

Pressing this button will cycle the monitor through the three power states described in Table 3. Note that the default state when power is first connected is "Standby", so a single press will be required to switch to "on" before an image can be seen. However, it is expected that users will control the power state from the AVI hub (see 8.2) and will not need to routinely use the monitor power button.

8.2 AVI hub power button

Pressing this button will toggle the AVI hub between a low power state in which video is not sent to the monitor, and the "on" state, in which all the features are available.

Pressing this button also remotely commands the monitor itself to be in the corresponding standby or "on" state. So, the entire system can be toggled between "standby" and "on" from the AVI hub power button alone.

8.3 When not in use

The system can be left in "standby" between uses (i.e. overnight). We do not recommend leaving the system in the "on" state when not in use, as this will shorten the life of the LCD panel.

If any of the DC supply cables (including the hybrid DC/fibre cable in trolley installations) are to be disconnected, first disconnect the monitor PSU (in the control room) from mains AC power.

9 Connecting a video source (HDMI-Fibre transmitter)

If the system was supplied with the VuWall HDMI-Fibre transmitter (Section 3.1.7), then an HDMI 2.0 video source can be connected to it and used with video resolutions of up to 4K UHD (3840 x 2160) at frame rate of 60Hz. Lower resolutions and frame rates can be used, and the system will up-scale these to send to the monitor's LCD display.

Modern video connections also include the capability to carry audio so that, for example, media players can be connected to televisions with a single cable. However, the BOLDscreen 32 UHD has no capability to output audio when connected via the HDMI-Fibre transmitter (this is only possible using the AVI hub). Be aware that the HDMI connection will appear as an audio output device in the computer's operating settings. When the cable is connected the computer may automatically select that, and therefore the transmitter, as the audio output for the computer. If you require audio to be sent to a different output (e.g. the computer's built-in speakers or soundcard audio output) you may have to manually select the output destination. This should be done using the operating system's system preference settings for sound.

10 Connecting a video source (AVI hub only)

The AVI hub has three available video input connections on the front panel (see Figure 10 and Section 19.5.1.1). These are:

- DisplayPort (1.2). This is for use with a DisplayPort output on a computer (including Mini DisplayPort or Thunderbolt if a suitable adapter is used).
- HDMI (2.0). This is for use with an HDMI output (including Mini/Micro HDMI with a suitable adapter) on a computer, media player, or other device.
- USB-C. This will accept video signals in "DisplayPort Alt Mode" and is for use with e.g. a laptop computer or phone with a USB-C or Thunderbolt 3/4 connector that supports video output. Note that not all devices with USB-C connectors are able to output video via this connector, and not all USB-C to USB-C cables support video transmission. This connection can also be used to receive the output from the BOLDscreen 32 UHD's built-in cameras (see Section 12.2), or to configure and control the system (see Section 16.1). This can be done even if another input is being used for video input.

The HDMI and DisplayPort inputs can be used with video resolutions of up to 4K UHD (3840 x 2160) at frame rate of 60Hz. Lower resolutions can be used, and the system will up-scale these to send to the monitor's LCD display. For ideal scaling, please choose 16:9 aspect ratio resolutions such as 1920x1080. The USB-C input is limited to resolutions of 1920x1080 or less, at 60Hz.

All three inputs can be used with DRM protected (HDCP) video content from e.g. Blu-ray Disc players, media streaming devices, or streaming video services.

If the video signal also contains audio this will be routed to audio outputs on the rear of the AVI hub (see Section 13).

Since the appropriate cables are dependent on the video source being used, they are not supplied with the BOLDscreen 32 UHD system, however, the required cables will be easily obtainable from local and online electronics or AV suppliers.

We recommend using as few adapters as possible. Do not attempt to use analogue video (i.e. VGA) signals or adapters. The use of splitters to send a video signal to both the BOLDscreen 32 UHD and another display is discouraged. The AVI hub is capable of duplicating the video shown on the BOLDscreen 32 UHD on a separately connected monitor (see Section 12).

11 Selecting a video source (AVI hub only)

Multiple video sources can be connected simultaneously. To choose which of the sources is displayed on the BOLDscreen 32UHD monitor, press the "Select" button in the "Input" region of the front panel of the AVI hub. Each press of the button changes the selected input, in a repeating cycle through the three available. The LED adjacent to the selected input illuminates and the video from the corresponding connected source is displayed on the BOLDscreen 32 UHD monitor (and clone output, if selected, see Section 12).

When the AVI hub is powered on, the initially selected input will be the one that was selected before the unit was powered off.

12 Viewing camera image or clone (AVI hub only)

The AVI hub features an HDMI connector on the rear panel. An external monitor (not supplied) can be connected to this and can display either of:

1. The image from the BOLDscreen 32 UHD's built in cameras, to view the patient/participant while they are in the magnet bore.
2. A clone (duplicate) of the video being displayed on the BOLDscreen 32 UHD monitor in the magnet room, to monitor what the patient/participant can see on the monitor.

Press the "camera" button on the front panel of the AVI hub to switch between these two modes.

12.1 Suitable clone displays

To reproduce the image shown on the BOLDscreen 32 UHD, the monitor connected to the AVI hub HDMI output must be able to display resolutions of 4K UHD (3840 x 2160) at frame rate of 60Hz. A monitor capable of 1920x1080

at 60Hz will also work, but the picture will be downsampled in order to be displayed.

Note that all displays are different, and luminance/chromatic differences between the BOLDscreen 32 UHD and the external display are likely unless steps are taken to calibrate them.

12.2 Viewing camera image via USB

The image from the BOLDscreen 32 UHD's built in cameras can also be viewed like a webcam on a computer connected via the USB-C port on the front panel of the AVI hub. This is possible even if the selected video input is HDMI or DisplayPort. This feature may be useful if the monitor connected to the AVI hub's HDMI output is being used to clone the BOLDscreen 32 UHD, but the operator still wishes to view the camera images.

When the USB connection is made, the computer will detect (among other devices), a USB Video Device Class (UVC) device. This is a standard device similar to a webcam and modern computer operating systems have built-in drivers, so installation will not be necessary. The camera image can be viewed in any software that can display or record this type of video. Examples include the "Camera" app in Microsoft Windows 10, "Photo Booth" on Apple macOS, or the cross-platform VLC (https://www.videolan.org). Consult the documentation for the software you wish to use to learn how to select from available video capture sources.

To switch between the two cameras, a USB CDC command will be required (see Section 16.1).

13 Audio (AVI hub only)

Modern video connections also include the capability to carry audio so that, for example, media players can be connected to televisions with a single cable. If speakers were included in the BOLDscreen 32 UHD, the sound would not be audible to the patient/participant over the noise from the scanner and through the ear protection they will likely be wearing. For these reasons, and to simplify connecting a video source to the AVI hub, the hub includes audio outputs on the rear panel for connection to separately-installed MRI compatible audio equipment (e.g. BOLDfonic from Cambridge Research Systems) or that provided by the scanner manufacturer.

The AVI hub rear panel features both a TOSLINK S/PDIF digital audio connector, and a 3.5mm stereo analogue audio connector. Both of these will require the signal to be amplified and are not capable of driving high-impedance headphones alone.

Connect either or both outputs to the input of your audio system, using appropriate cables (not supplied). Consult the manufacturer's documentation to learn how to use that system.

Note that the video connection (e.g. HDMI) will appear as an audio output device in the computer's operating settings. When the cable is connected the computer may automatically select that, and therefore the AVI hub, as the audio output for the computer. If you require audio to be sent to a different output (e.g. the computer's built-in speakers or soundcard audio output) you may have to manually select the output destination.

14 Viewing the BOLDscreen 32 UHD via a headcoil mirror.

This feature is not yet functional and will be implemented in a future update.

When the monitor is positioned at the rear of the scanner and viewed by the patient via a mirror on the headcoil, the image they see will be "mirrored" (flipped left to right). To compensate for this, the BOLDscreen 32 UHD can mirror the image it receives so that it appears correctly to the patient. This mirror mode can be toggled on/off by pressing the second-from-right button on the front of the AVI hub. The button will illuminate when the BOLDscreen 32 UHD is mirroring the image.

15 Connecting ancillary equipment

15.1 Connecting devices to the monitor

Use only devices that are designed for use in MRI environments. Follow manufacturers' instructions.

USB devices such as a mouse, keyboard, or participant response device can be connected to the rear panel of the monitor via the two USB ports (see Figure 9). Such devices will behave as if they are connected, via a USB hub, to a computer connected to the USB-C port on the front panel of the AVI hub.

15.2 Connecting devices to the AVI hub

One of the video inputs on the front panel of the AVI hub is a USB-C connector (see Figure 10). When this is connected to a computer, the following other USB devices will be detected by that computer:

- A UVC video device for viewing the images from the built-in cameras in the BOLDscreen 32 UHD monitor.
- A COM port/serial port device (CDC virtual serial port). This will allow sending commands to the AVI hub and monitor and receiving responses. See section 16.1.

- A keyboard, which will simulate keypresses when the TTL trigger input receives a trigger (see below).
- A USB hub, to which all the above devices (and those connected directly to the monitor, see Section 15.1) are connected.

The above are all standard USB device classes for which modern computer operating systems have drivers, so manual installation should not be necessary.

In addition to the power input, fibre connection to the BOLDscreen 32 UHD monitor, and the HDMI and audio outputs, the rear panel of the AVI hub features:

15.2.1 USB-A female connector

Any USB devices connected to this will behave as if they are connected, via a USB hub, to a computer connected to the USB-C port on the front panel of the AVI hub. This is useful if you wish to connect USB devices to a computer or device with only one USB-C port, and this is taken by the connection to the AVI hub.

15.2.2 BNC connector labelled "Scanner"

This can be connected to a TTL trigger output from the scanner. The scanner will often produce trigger pulses at the start of every slice or epoch, for example (contact the scanner manufacturer for more information). When this port receives a trigger pulse, the computer will receive a "T" keypress.

15.2.3 1Gb Ethernet port

This port allows the AVI hub to be connected to the local network. This feature will be enabled in future update.

16 Advanced features

16.1 USB CDC commands

If the AVI hub is used, it and the monitor can be configured and commanded using USB CDC (virtual serial port) commands. A list of these commands will be published in a future update to this document.

17 Status LED

Lists the possible states of the LED on the rear of the BOLDscreen 32 UHD monitor and what each state indicates.

Table 4. Rear status LED indications

LED state	Status
Off	Unit is in very low power state (press power button to power up) or not connected to power.
Flashing Green	Unit is in standby.
Solid Green	Unit is on, but not receiving video.
Solid blue	Monitor is receiving and displaying video.
Solid Red	Overheating. See 18.1.
Flashing Red	Hardware fault detected.
Solid Yellow	Powering on.
Flashing yellow	Firmware update in progress.
Purple	Non-volatile settings corrupted, using defaults. See 18.2.

18 Troubleshooting

18.1 Monitor feels very warm and/or the status LED is solid red

The unit is overheating. Power off and leave the unit to cool. If the problem persists contact Cambridge Research Systems (see Section 20).

18.2 Monitor is not behaving as set and status LED is solid purple

The non-volatile memory area in the monitor is corrupted, and defaults have been applied. This can be ignored, but will persist when the monitor is rebooted. Re-apply the required setting and use the $SaveSettings command (see Section 16.1), or simply use the $SaveSettings command if the defaults are appropriate, to clear the purple LED.

19 Specifications

19.1 LCD Panel

Dual-edge (left and right) WLED backlit VA LCD panel.

Active area: 698.4 x 392.9 mm.

Pixel dimensions: 3840 x 2160 (4K UHD). Other input signals will be rescaled.

Pixel Pitch: 0.181 (H) x 0.181 (V) mm.

Native frame frate: 60Hz. Lower input framerates will be resampled.

Default peak luminance: 300 cdm^{-2}.

Colour resolution: 10 bit RGB.

Colour gamut: 95% of NTSC.

Colour chromaticities (CIE 1931 x,y):

Red: (0.685, 0.310)

Green: (0.260, 0.685)

Blue: (0.152, 0.055)

White: (0.313, 0.329)

Contrast ratio 3000:1.

Grey-to-grey (GTG) response time: 9.5 ms.

Luminance regulation system: sensor measures backlight once per second and adjusts to maintain output within 2% of set value.

19.2 Cameras

2x 1920x1080, 30Hz CMOS cameras with fixed focus lens (1m) and large depth-of-field (distance will have little effect on focus). Locations are shown in Figure 19. Only one camera can be used at any one time.

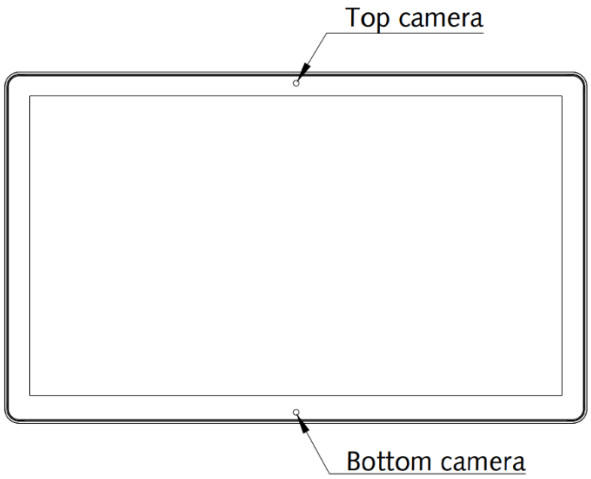

Figure 19. Camera locations.

19.3 Electrical

19.3.1 Monitor

Power requirements: 48V, 150W. Connect to supplied filter unit only, via supplied Cable IO unit (for trolley installations) and cabling as described in the appropriate installation guide [1,2].

Operating temperature: 0-35°C.

19.3.2 Filter Unit

Power input/output: 48V 150W. Connect to supplied power supply unit only.

19.3.3 Cable IO unit

Power input/output: 48V 150W. Connect to supplied power supply via filter unit only.

19.3.4 Trolley

Power input/output: 48V 150W. Connect to Cable IO unit only.

19.3.5 Power supply unit

Specifications vary slightly depending on the exact model supplied. The following minimum values apply to all models:

Power requirements: 90 – 264V AC, 50/60Hz.

Power output: 48V, 150W.

Conforms to EN 60601-1. Other regional specifications may apply and will depend on the unit supplied.

19.3.6 AVI Hub

Power requirements: 100 – 240V AC, 50/60Hz.

19.3.7 AVI Hub Power supply unit

Power requirements: 100 – 240V AC, 50/60Hz.

Power output: 20V, 65W.

19.4 Mechanical

19.4.1 Monitor

Mass: 10kg

Dimensions of the monitor are shown in Figure 20.

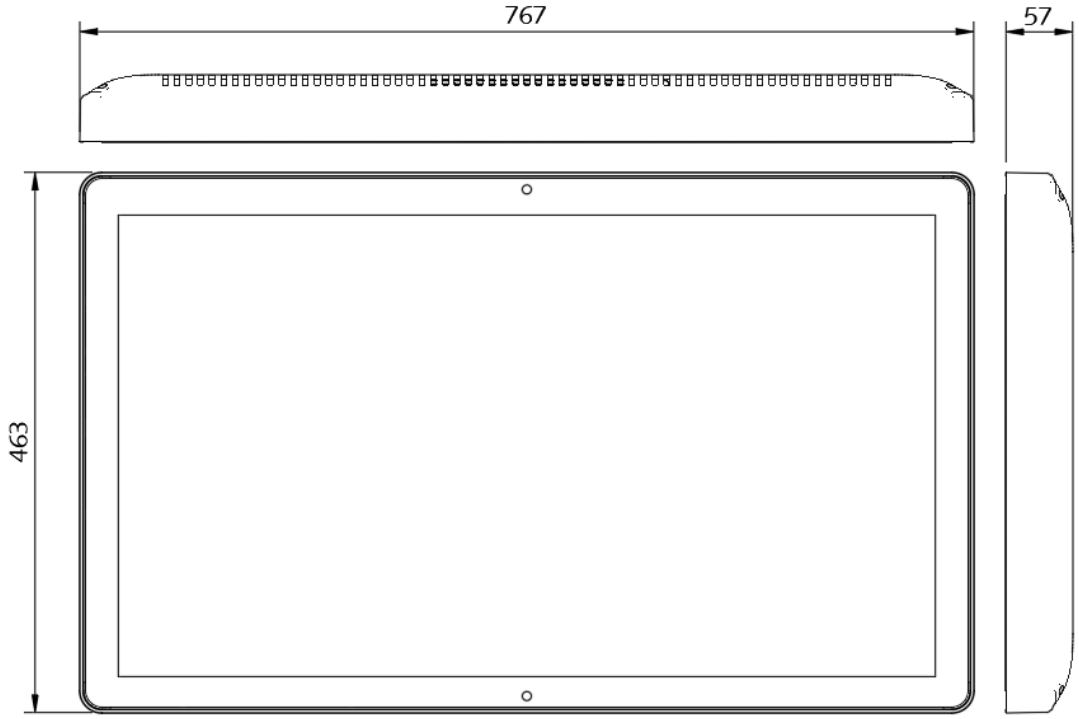

Figure 20. Physical dimensions of monitor in mm.

19.4.2 Standard Trolley

Dimensions of the trolley are shown in Figure 21. Note that the total height is variable since the monitor can be mounted at several positions on the upright.

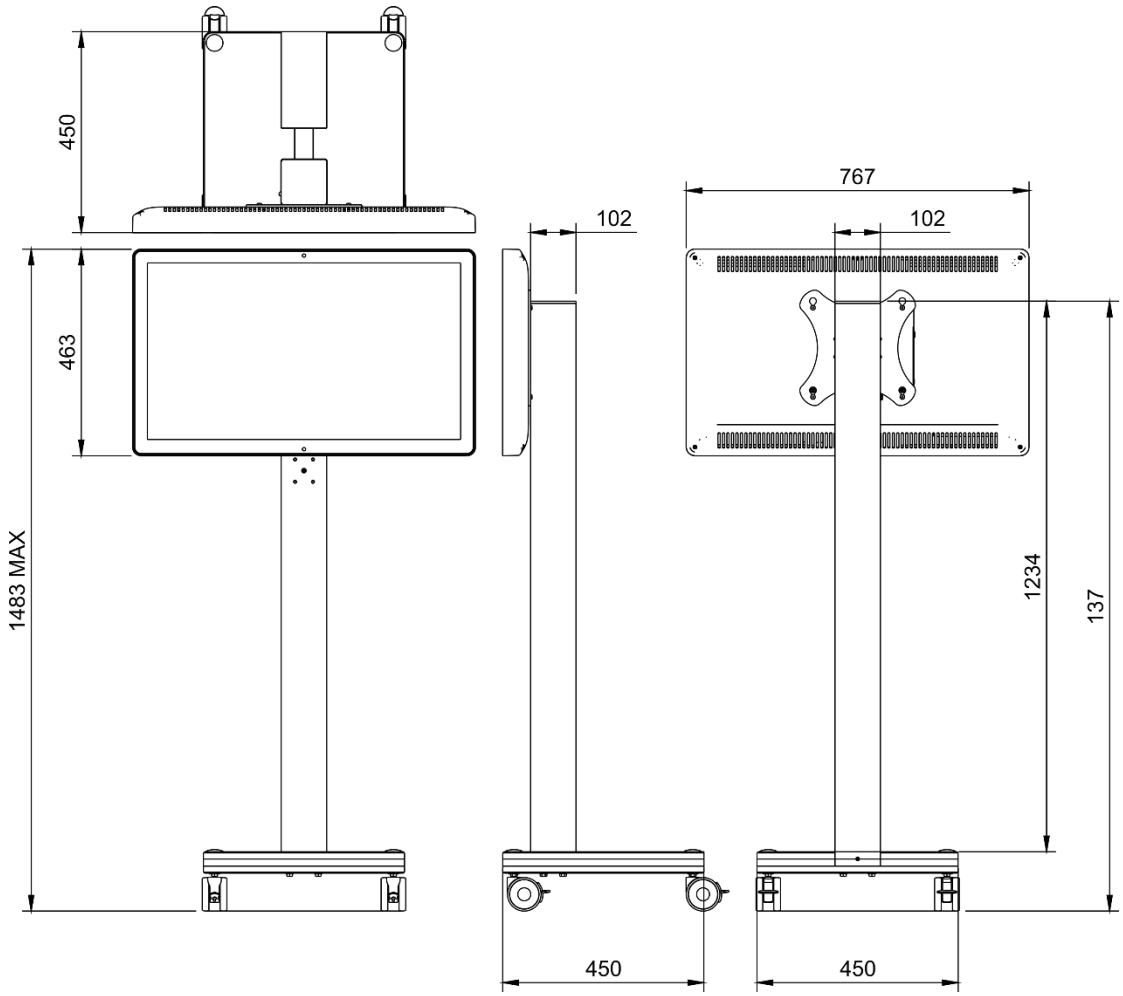

Figure 21. Dimensions (mm) of monitor on trolley at highest mounting point.

Mass of trolley: 21kg

Total mass of trolley and monitor: 30kg.

19.5 Wide Trolley

Dimensions are shown in Figure 22. Note that the total height is variable since the monitor can be mounted at several positions on the upright.

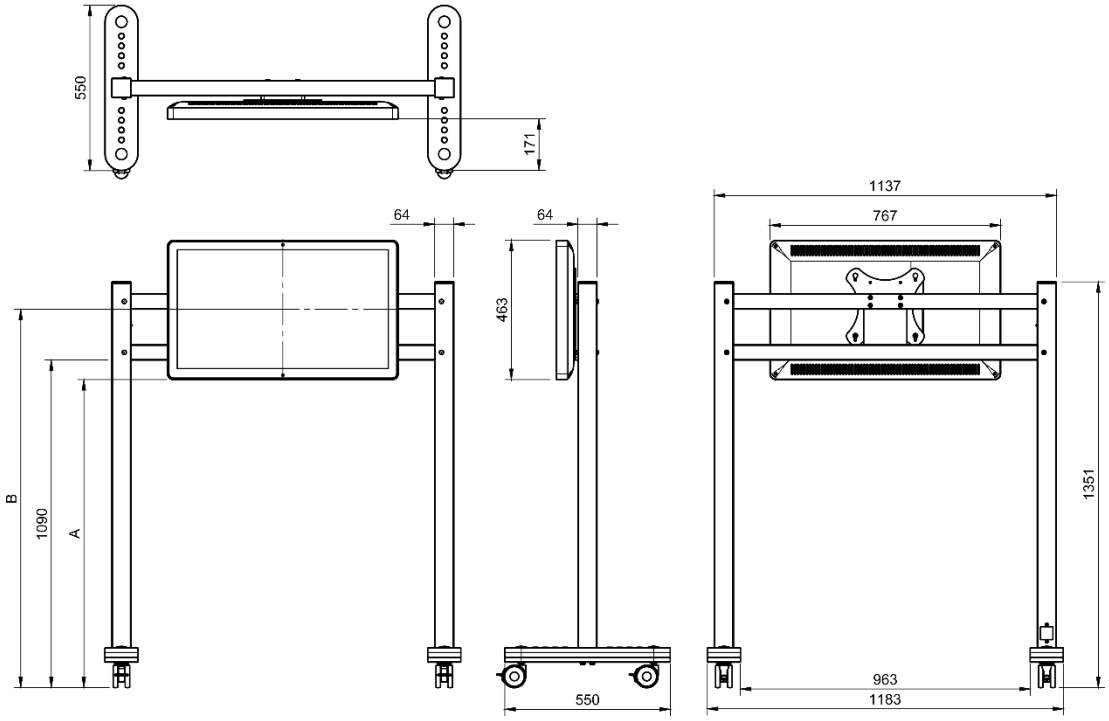

Figure 22. Dimensions (mm) of monitor on Wide Trolley.

Mass of trolley: 21kg.

Total mass of trolley and monitor 31kg.

19.5.1 AVI hub

Dimensions of the AVI hub are shown in Figure 23.

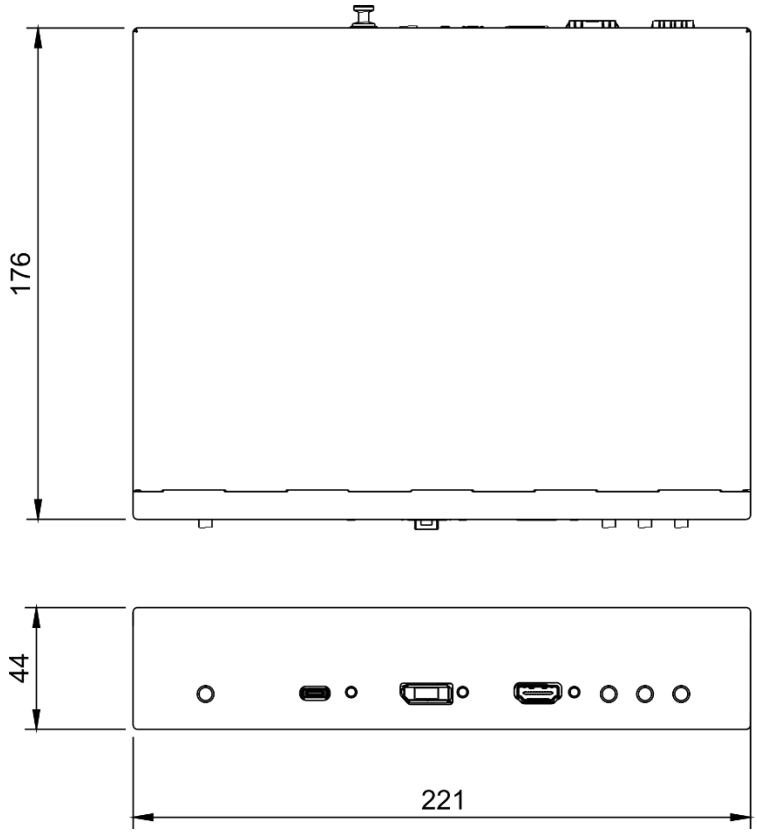

Figure 23. Physical dimensions of AVI hub in mm.

19.5.1.1 Connections and buttons

Input connections, output connections and buttons are shown in Figure 24 and Figure 25.

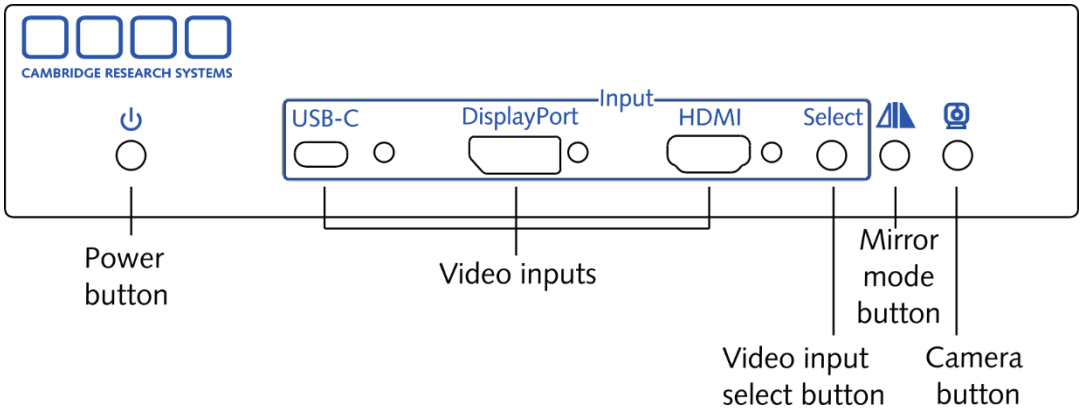

Figure 24. AVI hub front panel connections and buttons.

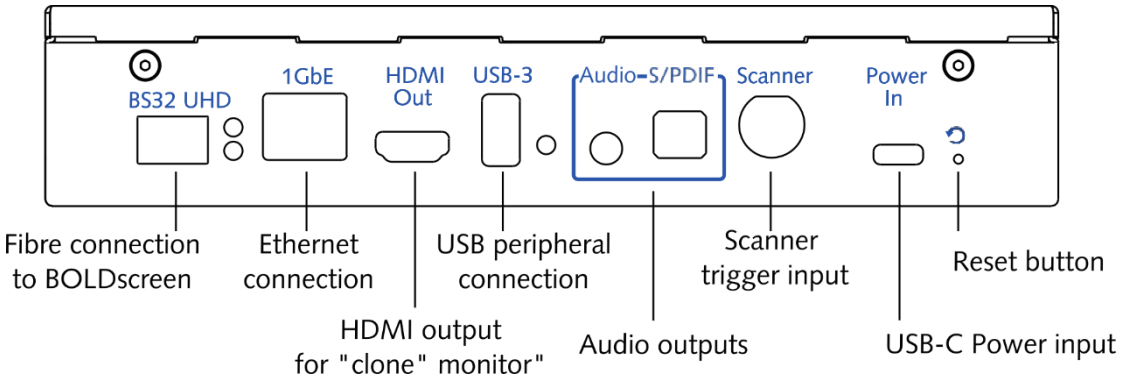

Figure 25. AVI hub rear panel connections and buttons.

20 Getting help

If your questions are not answered by reading this document, please contact Cambridge Research Systems Limited technical support by visiting: https://www.crsltd.com/how-to-contact-us/technical-support/ or email support@crsltd.com, including the serial number of the product in your message.

21 Safety warnings

The MRI scanner should only be used by suitable qualified personnel aware of the risks involved. National regulations and guidelines should be followed. Follow all safety instructions from the MRI scanner manufacturer.

21.1 Life support applications

BOLDscreen 32 UHD should NOT be used in situations where failure of the device would constitute a hazard. It is designed for patient entertainment and visual stimulus presentation in research applications only, and like any other regular electronic device the display could fail at any time, without warning.

21.2 Photo sensitive epilepsy

Any system capable of creating flashing images can potentially induce photo sensitive epilepsy in susceptible individuals. The confines of the MRI environment exacerbate the risk should a seizure occur. Experiment design should take this risk into account.

21.3 Optical hazard

The high-powered LED backlight could present an eye hazard if viewed directly. Therefore, do not attempt to operate BOLDscreen 32 UHD if the LCD screen has been damaged or removed.

The infra-red laser diodes in the SFP+ transceiver modules in the monitor, AVI hub and HDMI-Fibre transmitter are class 1. Do not view the output of the transceivers, or end of the fibre cable, with optical instruments.

21.4 Servicing

DO NOT ATTEMPT TO DISMANTLE any part of the BOLDscreen 32 UHD system. The BOLDscreen 32 UHD monitor, trolley upright, penetration panel filter unit, Cable IO unit, AVI hub (or HDMI-fibre transmitter) and mains PSU contain no user serviceable components, refer all servicing to Cambridge Research Systems.

21.5 Cleaning

Clean external components of BOLDscreen 32 UHD with a damp cloth only. Do NOT allow fluids to enter the monitor, voltage converter or PSU. Do not sterilise in an autoclave.

21.6 Monitor

The monitor does not pose a missile hazard in an MRI environment with a field strength up to 7T. Consult Cambridge Research Systems before using in higher magnetic fields. THE TROLLEY, MONITOR AND CABLING MUST BE OUT OF REACH OF THE SUBJECT WHEN SCANS ARE PERFORMED TO PREVENT R.F. BURNS.

Any adjustments made to the mounting should be carried out ONLY using non-magnetic tools, appropriate safety procedures, and following local regulations.

DO NOT UNDER ANY CIRCUMSTANCES TAKE STANDARD STEEL ALLEN KEYS INTO THE MAGNET ROOM. DO NOT SUBSTITUTE STEEL MOUNTING SCREWS FOR THE NON-MAGNETIC STAINLESS SCREWS SUPPLIED.

It is recommended that a helper is used when mounting BOLDscreen 32 UHD in the magnet room due to the weight of the unit. Walk slowly into the magnet room with BOLDscreen 32 UHD. Due to the internal conductive screened case, considerable resistance to movement will be encountered in high field areas due to eddy currents. This is normal. Do not try to force it to move quickly.

Always mount BOLDscreen 32 UHD (and DC connecting cables) out of reach of the subject. The case of BOLDscreen 32 UHD and DC connecting cable could cause RF burns if touched whilst a scan is in progress.

During a magnet quench BOLDscreen 32 UHD is likely to be displaced (it will be forced against the magnet as it will follow the collapsing field). Satisfy yourself that this will not cause any additional hazard with your setup. If BOLDscreen 32 UHD is placed hard against the magnet, this should prevent it from falling over should a quench occur.

21.7 Trolley

The supplied BOLDscreen 32 UHD trolley does not pose a missile hazard in an MRI environment with a field strength up to 7T. Consult Cambridge Research Systems before using in higher magnetic fields. THE TROLLEY, MONITOR AND CABLING MUST BE OUT OF REACH OF THE SUBJECT WHEN SCANS ARE PERFORMED TO PREVENT R.F. BURNS.

BOLDscreen 32 UHD should be attached to the trolley and adjusted ONLY using the purple titanium Allen key and stainless-steel screws.

Make sure that all castor wheels of the trolley are resting on the floor once BOLDscreen 32 UHD is attached. You may find it easier to attach BOLDscreen 32 UHD to the trolley outside the magnet room, then push the complete assembly to the final position.

If possible, locate BOLDscreen 32 UHD in contact with the magnet to prevent further movement in the event of a magnet quench.

21.8 RF filter unit

This must be bolted into the penetration panel, outside the magnet room. Do not take the RF filter unit into the magnet room. Use extreme caution when installing the unit in the penetration panel: ensure that suitable non-magnetic tools, fixings, and local procedures and safety precautions are used.

21.9 Cable IO unit (trolley installations only)

This must be securely attached to the wall inside the magnet room with the included non-magnetic screws and Allen key. Use extreme caution when installing the unit: ensure that suitable non-magnetic tools, fixings, and local procedures and safety precautions are used.

21.10 Fibre bulkhead connector (round)

This must be screwed into the penetration panel. Use extreme caution when installing the unit in the penetration panel: ensure that suitable non-magnetic tools, fixings, and local procedures and safety precautions are used.

21.11 Faceplate, pattress box and corresponding connectors

The faceplate must be screwed to the pattress box, which must be properly installed in the wall or ceiling, using the supplied screws. The fibre bulkhead connector and DC cable Lemo connector must be securely fastened in the faceplate. Use extreme caution when installing the unit: ensure that suitable non-magnetic tools, fixings, and local procedures and safety precautions are used.

21.12 Fibre optic, DC supply and hybrid cables

The supplied BOLDscreen 32 UHD fibre optic, DC supply and hybrid (combined DC and fibre) cables do not pose a missile risk in any foreseeable condition in an MRI magnet room.

Route all cables around the edge of the room and NOT across the doorway to prevent trip hazard and to avoid damage to them.

Under no circumstances must the DC supply or hybrid cable route over the subject in the scanner as a serious RF burn hazard exists.

Disconnect mains power before attaching or removing the DC cable.

21.13 Mains PSUs

The mains PSUs have SIGNIFICANT FERRO-MAGNETIC CONTENT. **DO NOT TAKE THE MAINS PSUS INTO THE MAGNET ROOM.**

The power supply contains dangerous mains voltage and also has no user serviceable parts. Do not attempt to dismantle.

21.14 AVI hub or HDMI-Fibre transmitter

Do not take the AVI hub or HDMI-Fibre transmitter into the magnet room. These units contain no user-serviceable parts. Do not attempt to dismantle.

The PSUs supplied with these units have SIGNIFICANT FERRO-MAGNETIC CONTENT. **DO NOT TAKE THE MAINS PSUs INTO THE MAGNET ROOM**

22 Revision History

Document version	Date	Document change
1	2021-12-17	First version
2	2022-01-10	Added Specification section
3	2022-06-07	Added mechanical details of AVI hub.
4	2022-12-22	Part number updates