Nordic Neuro Lab

VisualSystem HD

High-end Visual Stimulation for fMRI

Trusted by SIEMENS Healthineers GE Healthcare

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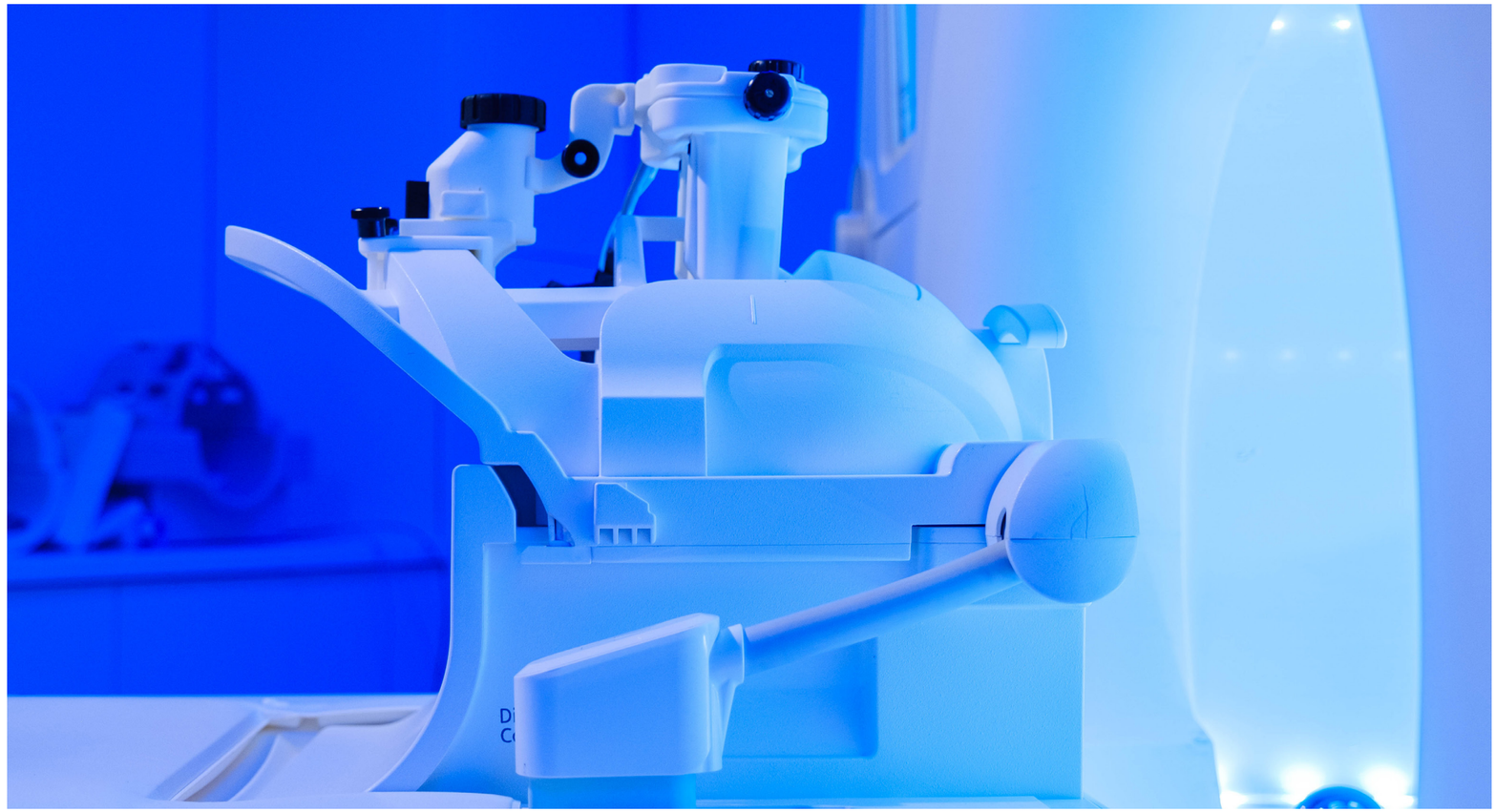
VisualSystem HD



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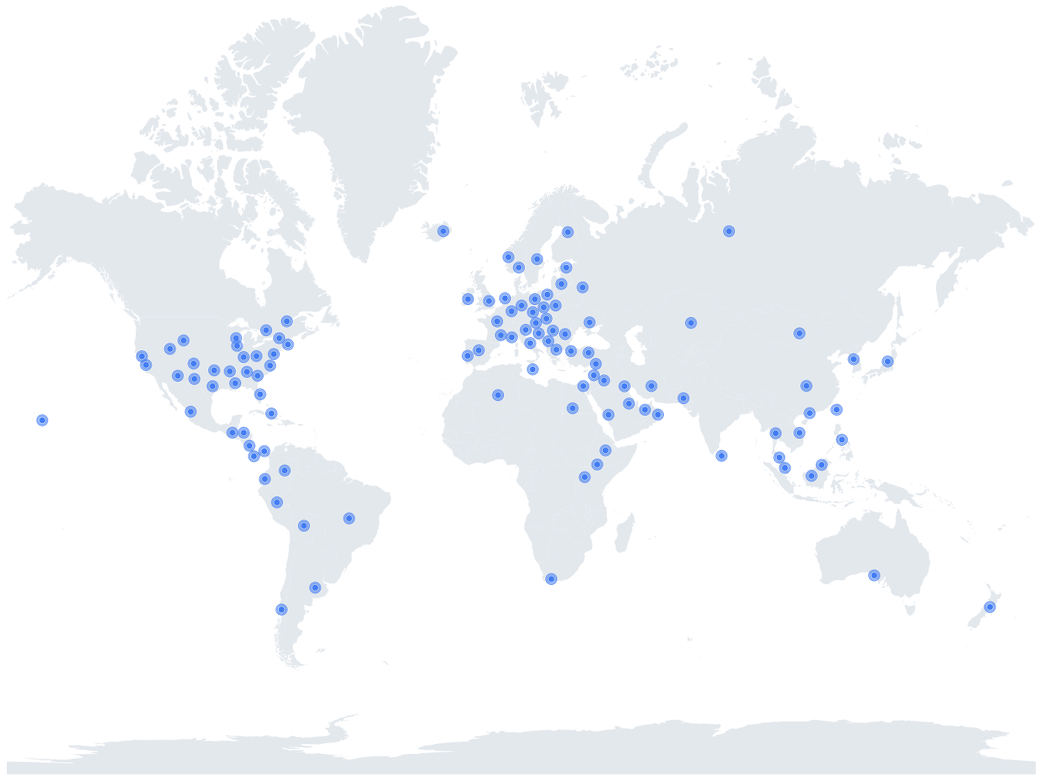
Installations

We are committed to providing the highest quality products and services worldwide

With more than 2000 installations in over 70 countries and solid partnerships with the biggest MR scanner manufacturers, we continue to develop fMRI as a clinical tool for precision medicine as well as expanding into related segments such as patient entertainment and in-room viewing for interventional purposes.



Testimonials

Jakub Wojciechowski

Institute of Physiology and Pathology of Hearing, Kajetany, Poland

"The VisualSystem HD has given us the ability to monitor participants' eyes in real time, allowing us not only to track and record gaze and pupils, but also to assess their wakefulness and overall task engagement. This, combined with high resolution and immersive displays, makes the VSHD an excellent tool for fMRI research."

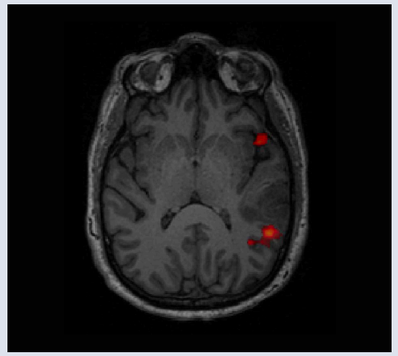
Immersive Technology for functional neuroimaging

fMRI is minimally invasive and gives us insight into the inner workings of our brain

The Challenge

Are you a neuroscientist interested in studying how memories are created and how we use memory to navigate in space? Or a neurologist who would like to develop noninvasive methods for early detection of neurological disorders such as Parkinson's disease, Alzheimer's disease and other forms of dementia?

Perhaps you are a neuropsychologist who would like to understand the neurophysiological manifestations of phobias and PTSS and design better treatment strategies? Or maybe a neuromarketing researcher who would like to study how our mind responds to certain stimuli on the neurophysiological and neurofunctional level to apply this knowledge to marketing applications?



Broca and Wernicke brain regions are activated (red) when a subject performs a language task during an MRI exam.

Looking inside the brain

These and similar questions are being studied with a range of experimental techniques, most notably neuroimaging using fMRI, CT, PET, EEG, MEG, and NIRS. Many of these techniques, such as fMRI, are minimally invasive and give us insight into the inner workings of our brain.

For example, fMRI can help localize not only parts of the brain that are engaged during language processing and speech production, but also brain areas that are employed when we perceive danger, or when we try to orient ourselves in space. Although all imaging techniques have their limitations, they nevertheless aid neuroscientists in understanding the brain and physicians in diagnosing functional abnormalities, often long before the occurrence of visible symptoms or structural changes.

Eye tracking provides important data about a subject's gaze patterns when presented with a scene, for example.

The eyes are the window to the soul

Another powerful tool to study the brain is eye tracking. Using eye-tracking cameras, combined with powerful software, one can determine the subject's involvement in a given task, as well as monitoring eye movements and gaze in relation to a visual stimulus.

For example, when studying responses of the war veteran to a war scenario, or the creation of spatial memory maps, one can determine which environmental elements captured the subject's attention and for how long.

In neuromarketing, eye-tracking is an indispensable tool that enables the researcher to understand the subject's marketing decisions, and in neuropsychology, distinctive eye movements and gaze behavior can help diagnose psychological disorders such as Schizophrenia, ADHD/ADD and autism (Bittencourt et al. 2013; O'Driscoll et al. 2008; Ytter et al. 2013).

The combination of fMRI and eye-tracking is a very powerful tool in neuroscience

fMRI & Eye-Tracking

The combination of fMRI and eye-tracking is a very powerful tool in neuroscience and has led to many advances in neuropsychology, neuropsychiatry, neurophysiology and basic science (Bonhage et al. 2015; Tylen et al. 2012; Hausler et al. 2016; Kalpouzos et al. 2010; Kim et al. 2020). However, one disadvantage of MRI is that due to the inherent nature of the technology the subjects are forced to lie still inside a very confined and extremely loud environment.

Can you imagine trying to study how a person with PTSS responds to a dangerous and stressful war scenario when the main stress factor during fMRI is confinement in a narrow magnet bore? Or to study how a person with early manifestations of dementia is able to navigate in a 3D maze when they are required to lie as still as possible (Vlcek et al. 2014)?

Immersive Technology for functional neuroimaging

Creating virtual environments

One solution is virtual reality (VR). This is now becoming feasible for researchers due to advances in audio-visual technology (Bohil et al. 2011). VR lenses or goggles are becoming affordable consumer goods that can help immerse the subject into an ecologically valid situation.

The major obstacle in combining modern VR and eye-tracking technology with MR imaging is the interference such devices cause when placed inside a strong magnetic field. The electronics inside the VR goggles and eye-tracking cameras can significantly degrade MR image quality, or worse, make such equipment unsafe for use.

Many past studies that have explored VR scenarios in combination with fMRI (Voermans et al. 2004; Kim & Maguire 2019; Speirs & Maguire 2006) have made use of projectors and 2D screens to present the visual stimuli.

The use of VR for creating 3D immersive environments is proven in itself to be an advantage over 2D representations, in a number of applications (Gaebler et al. 2014; Wiederhold et al. 2008).

NordicNeuroLab Visual Systems for MR environment The NordicNeuroLab VisualSystem HD (VSHD) solves these problems. Shielded electronics and MR-safe materials make the VSHD MR-conditional for use at field strengths up to 3T.

The use of VR for creating 3D immersive environments is proven in itself to be an advantage over 2D representations

All these features enable the subject to be completely immersed in the experience.

The VSHD goggles mount on top of the most commonly used fMRI head coils via a coil-specific adapter and are height adjustable such that the rubber eye-caps completely enclose the subject's eyes. This prevents spurious light sources from entering the subject's visual field.

Built-in diopter correction (-8 to +5) and fine-tuning of pupil distance are easy to regulate and customize to each patient, both children as well as adults.

All these features enable the subject to be completely immersed in the experience.

The NordicNeuroLab VSHD goggles come with a wide field-of-view (51.2 degrees horizontal) allowing for presentation of stimuli within a larger area of the subject's visual field.

In addition to aiding the feeling of immersion, the large field-of-view could provide a useful tool for functional imaging studies which map the visual field and examine visual field deficits (Urbanski et al. 2014). Furthermore, HD (1920x1200 @ 60Hz) display resolution results in crystal clear images.

Imagine, there are as many pixels on these tiny displays as there are on a HD TV screen or the state-of-the-art smart phone!

Immersive Technology for functional neuroimaging

Using dual-display OLED technology, the NordicNeuroLab VSHD can display a stereoscopic (3D) view with high visual fidelity (without compromising the picture refresh rate), making the subject's experience more compelling and immersive. Each display is driven separately via a standard HDMI port, providing a simple and intuitive setup for integration with third party paradigm presentation software.

This unique technology allows you to experiment with paradigm designs that are dynamic and interactive, creating a more engaging experience for the subjects, with a high degree of ecological validity (Parsons et al., 2017).

Additionally, the VSHD immersion experience offers a solution that can complement VR technology when used in the context of cognitive behavioral therapy (CBT) for psychiatric or emotional disorders. Simulating realistic environmental situations while in the MR scanner enables the researcher to investigate the brain's response to stimuli that can be designed to be either therapeutic, or to simply measure an emotional response.

The NordicNeuroLab VSHD are the only MR compatible goggles with integrated binocular eye-tracking. The video-based PCCR eye-tracking technology uses two active glint points and an adjustable camera focus for precise and reliable tracking of each eye.

The integration of the eye-tracking cameras into the goggles themselves reduces the amount of cables and equipment in the MR bore, simplifying the setup and reducing possible compatibility issues. With HDMI video outputs for each eye camera it is easy to interface the eye-tracking video signal with third party eye-tracking post-processing software.

By combining the VSHD with the NordicNeuroLab ResponseGrips one can additionally create interactive scenarios inside the MR scanner that allow applications spanning from clinical research to patient entertainment to neuromarketing, and many more.

All products are designed and developed in our NordicNeuroLab HQ in Bergen, Norway.

Solution Components

MR conditional up to 3 Tesla

Head coil fixation: Adjustable fixation mechanism supporting Siemens 64 channel and GE 48 channel and a wide range of other head coils

VisualSystem HD – VHD

HD displays

By rendering sharp images and brilliant colors through its 1920x1200 (Full HD) resolution, high quality graphics and text can be presented to the subject. Using the two independent displays, the user can create 3D stereoscopic environments to increase the sense of immersion of the participant.

Dual Integrated Eye Tracking Cameras

The VSHD includes 2 frame grabbers that convert the camera signal from HDMI to USB. This allows your PC to capture the signal as 2 separate USB cameras. On most PC's, these can be viewed in the built-in camera application that can appear on the desktop for the technician or researcher to view.

Adjustable to every patient

The VSHD is designed to fit a variety of commonly used head coils and is easy to mount with coil specific adapters. The adjustable arm allows for fast and precise positioning at a comfortable viewing angle. The built-in diopter correction (-8 to +5) and fine-tuning of pupil distance are easy to regulate and customize to each patient, both adults and children.

VisualSystem Power Supply – VPS

The VisualSystem HD (VHD) and the VisualSystem Power Supply (VPS) are connected via a single cable. The VPS is located in the MR room, however the VPS contains ferromagnetic material and must be kept at a safe distance from the MR scanner (outside the 20 mT (200 Gauss) line.

Control Room Interface – CRI

The Control Room Interface has 2 HDMI outputs to send images to the 2 independent displays of the goggles. It also has 2 separate HDMI inputs to receive the signals from the eye tracking cameras.

When connected to a PC, the VSHD shows up as two separate monitors, so the desktop can either be extended or duplicated upon, which allows the user to utilize standard software solutions for paradigm generation or more sophisticated gaming environments for stereoscopic display.

For eye tracking, the cameras operate independently of one another with their own dedicated HDMI input and USB frame grabber which offers flexibility in connecting to multiple eye tracking software solutions. To support additional hardware, converters to composite video can be provided by NordicNeuroLab.

Benefits

New possibilities in fMRI

With larger built-in OLED displays and fully redesigned custom optics, the VSHD has significant improvement in image quality and color balance, as well as an increased field of view (FOV) for the subject. The integrated eye tracking cameras allow for quicker calibration and sharper eye-tracking image quality.

With the head coil specific adapters and the increase in diopter range and focus adjustment, the VSHD enables easier attachment and quicker set up times at the preferred viewing angle. NordicNeuroLab has also upgraded the RF noise shielding and mechanical stability of the VSHD, resulting in better signal-to-noise ratio and an improvement in overall safety of the device.

- Large field of view to create a more immersive experience
- Diopter correction indicators for faster patient setup
- Adjustable height and inter-pupil distance
- HD resolution
- Independent video sources for each OLED allowing 3D stereoscopic display
- Integrated eye trackers for faster setup

Having the eye tracking integrated with the VisualSystem HD allows you to have a faster setup.

Corporate information

About Us

With over 20 years of experience, NordicNeuroLab provides products and solutions that define the field of functional MR imaging. Having grown from a spin-off from the fMRI research environment in Bergen, Norway, we understand the growing need for reliable and innovative tools in this emerging field. This is why we make it a priority to collaborate with research and clinical teams from both academic and clinical centers, MRI system manufacturers and third party providers.

From fMRI hardware for audio and visual stimulation, eye tracking and patient response collection, to patient entertainment, NordicNeuroLab products are used around the world by researchers and clinicians alike. We are dedicated to bringing the most advanced neuroimaging tools to market while making functional MRI programs easy to implement

Our Mission Statement

NordicNeuroLab will apply world leading competence and experience to provide professional solutions for functional imaging, enabling improved patient care and clinical efficiency.

Our Corporate Values

- We push for innovation
- We listen to our customers
- We focus on ease of use
- We deliver high quality
- We value safety

Regulatory Compliances and Certificates

NordicNeuroLab has always emphasized quality and safety in the development and production of our devices. NordicNeuroLab fMRI hardware system is designed, developed and manufactured under certified ISO 13485 Quality Management system. As our product portfolio grows, we continue to ensure that all our products intended for clinical use meet regulatory and safety requirements, have respective market clearances, and are tested for international UL and IEC consensus standards for Device Safety and Electromagnetic Compatibility (EMC) for medical equipment.

Service and Support

NordicNeuroLab takes pride in providing excellent service and support to our customers. Whether you are working with our team directly or through local partners and distributors, we are ready to support you in any way we can. We offer warranty, software maintenance solutions and professional installation and training packages based on your individual needs. We also offer online and on-site workshops in order to further improve product understanding and customer satisfaction.

Other products

NordicNeuroLab is a leading global provider of products and integrated solutions for functional MRI, used for evaluation of diseases and injuries related to brain function.

Our goal is to bring the most advanced neuroimaging tools to market, and at the same time make them easy to implement and use. We have therefore created complete fMRI solutions that include everything required to conduct an fMRI scan. In addition to complete packages, we also offer modular solutions both for clinical and research purposes.

InroomViewingDevice

The 40" 4K UHD InroomViewingDevice is an MR compatible monitor that satisfies the needs of both clinical and advanced scientific applications.

With its slim design, high definition display and superior image quality, the InroomViewingDevice is an optimal choice for an easy to use alternative to conventional projectors or goggle based image delivery systems.

Integrated Camera

The innovative, front-facing camera provides an uninterrupted patient surveillance during examination. Thanks to the built-in USB hub, connecting patient communication and interface devices is now extremely easy.

Flexible Positioning

The lightweight and height adjustable mobile foot stand allows easy positioning of the monitor anywhere in the MRI room.

Instant Feedback

The monitor facilitates the examination process by allowing the operating personnel to remain inside the examination room during procedures, thus allowing uninterrupted patient care and quick response time, which significantly improves clinical workflow.

ResponseGrips

The MR compatible ResponseGrips allow subjects to provide feedback by pressing one of four buttons. They have been developed for clinical and research users alike. Ergonomically designed for both hands to help minimize patient movement inside the scanner, they are suitable for a wide range of experimental paradigms.

The ResponseGrips are compatible with all leading stimulus presentation software packages, and interface with a number of third-party hardware devices.

The ResponseGrips are 100% fibre optic, and connect to the ResponseGrips Interface Unit in the operator room through an available waveguide. The Interface Unit provides real-time feedback of subject responses via LED indicators and optional sound signaling.

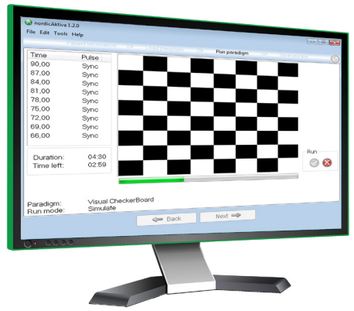
SyncBox

One of the challenges in fMRI is synchronizing stimulus presentation with MR image acquisition. The accuracy and verification of timing information is critical to the validity of results. With a flexible and user-friendly menu system, the SyncBox allows the user to select how the trigger pulse from the scanner is transferred to the software presenting the stimuli. Furthermore, when used alongside nordicAktiva, serial communication allows the syncbox settings to be controlled automatically by the stimulus presentation PC.

The SyncBox can simulate the trigger signals produced by the scanner during an MRI sequence. This enables the user to develop and test the entire experimental paradigm in the office, minimizing the need for testing in a costly scanning environment.

The SyncBox is MRI scanner independent and interfaces with a variety of external devices, allowing synchronization of signals from different hardware sources and providing accurate logging of time stamps.

Other products



nordicAktiva

NordicAktiva is an easy-to-use stimulus presentation software, designed with the MRI technician in mind.

By using nordicAktiva, a single technician can handle stimulus presentation and image acquisition at the same time. Through an intuitive interface, the user is guided step-by-step through the process of presenting stimuli during image acquisition.

Our ready-to-use paradigms follow recommendations from the ASFNR (American Society for Functional Neuroradiology). On selecting a paradigm, clear instructions allow the operator to successfully plan their protocol and prepare the patient. These instructions, as well as the paradigm content, are available in many different languages.

NordicAktiva runs seamlessly with the NNL fMRI hardware, displaying the paradigm to the patient during the MR imaging exam. An integrated hardware test assures that the fMRI hardware is connected and working properly prior to the exam.

Technical information

VisualSystem HD

VSHD- Display (VHD)	
Display type	Dual Full HD OLED, one for each eye
Resolutions (native) (Aspect ratio)	1920x1200@60Hz, 71Hz (16:10 WUXGA) 1920x1080@60Hz, 80Hz (16:9 FHD) 1600x1200@60Hz, 85Hz (4:3 UXGA)
Field of view	60° diagonal (52.1 ° horizontal, 34° vertical)
3D imaging	Independent video sources can be sent to each OLED for 3D imaging. Optional feature.
Video Input	2x HDMI
Contrast ration	> 1000:1
White luminance	> 150cd/m2
Inter Pupil Distance (IPD) adjustment range	44 to 75mm
Diopter correction	-8 to +5
Power Consumption	<15W
Dimensions, Weight	90x150x155 (HxWxD) [mm], 0.6Kg
EyeTracking	
Type	Video-based pupil Centre Corneal Reflection (PCCR). One independent output video stream for each eye (binocular)
Image resolution	640x480 (progressive)
IR Illumination	Wavelength of Peak Sensitivity 875nm. Max irradiance at ocular plane < 70 W/m2
Frame rate	60 fps
Field of view	25mm ocular plane horizontal
Environmental data	
Optical radiation Classification (2006/25/EC)	Exempt group
Storage ambient temperature	-20°C to +60°C
Operation ambient temperature	+18°C to +35°C
Relative Humidity	20% to 90%
Maximum operation altitude	4000 m. above sea level
Atmospheric pressure limits	61.7 kPA to 107.0 kPA
Display Lifetime	10,000 Hours at 150 cd/m2 (25°C ambient)

Technical information

VPS	
Voltage range	100-240 VAC
Frequency	50-60Hz
Fuse	T 2A H 250V
Power consumption	40W
Optical connections	2x MPO connector
Dimensions, Weight	164,3x132,6x315,5 (HxWxD) [mm], 2.4Kg
Environmental data	
Storage ambient temperature	-20°C to +60°C
Operation ambient temperature	+18°C to +35°C
Relative Humidity	20%to 90%
Maximum operation altitude	4000 m. above sea level
Atmospheric pressure limits	61.7 kPA to 107.0 kPA

Control Room Interface (CRI)	
Video interface	HDMI in, HDMI out for EyeTracking (can be externally converted to composite video)
Control interface	2xUSB
Power Adaptor	XP Power ACM18US12 Input: 100-240V ~ 0,SA, 50/60Hz Output: 12V, 1.5 A. 18VA
Dimensions, Weight	95x310x220 (HxWxD) [mm], 2.0 Kg
Environmental Data	
Storage ambient temperature	-2o·c to +60°c
Operation ambient temperature	0 to +so·c
Relative Humidity	20%to90%
Maximum operation altitude	4000 m. above sea level
Atmospheric pressure limits	57.1 kPA to 107.0 kPA
Approvals and regulations	
Safety	IEC 60601-1 Edition 3.1
IR and LED safety	IEC-62471:2006
EMC	IEC 60601-1-2:2014

Nordic Neuro Lab

CE

VisualSystem HD

Exklusiver Service- und Vertriebspartner in Deutschland:

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NL-100-0088-02