



# OptoACTIVE™

## The System You've Dreamed Of.

Ultra Slim ANC Headphones for 95%  
MR EPI Noise Reduction in Real-Time



The Only Active Noise Control  
Communications System for MRI

# OptoACTIVE™

Total Noise Control and Two-Way Communications System for MRI

## The Answer to Your Dreams.

OptoACTIVE™ provides the highest level of noise reduction available in MRI-safe headphones, and is the only communications system to use real-time algorithmic, active harmonic noise cancelling, as well as Optoacoustics' proprietary passive noise reduction techniques, to reduce 95 percent of MR EPI main gradient resonance for the patient.

### OptoACTIVE Benefits:

- ▶ Safely cancels EPI main gradient noise
- ▶ Unsurpassed sound clarity
- ▶ Quiet two-way communication during a scan
- ▶ Records sound as patient hears it
- ▶ Self-calibrating with SPL monitoring in real time
- ▶ Enables use of high fidelity audio stimuli
- ▶ Instant control over performance with digital touch display
- ▶ Concurrent multiple audio inputs, including TTL
- ▶ Certified EMI/RFI immunity

# Passive + Active Noise Control



An  
Achievement  
in Quiet

**Safely and effectively  
reduces EPI noise by 60 dB  
(over 95%) without latency.**

OptoACTIVE uses two complementary techniques to eliminate EPI main gradient noise for the patient:

- ▶ Optimal passive noise reduction with a revolutionary slim design, resulting in unsurpassed sound clarity, wearer comfort and safety
- ▶ Real-time algorithmic, out-of-phase harmonic active noise cancelling using our proprietary DSP

The System reduces gradient noise so effectively that we've even added Waves® MaxxAudio digital sound enhancement. Voice and high-fidelity audio has never sounded better in MRI.

# Engineering that Rivals Magic

**Ultra-slim OptoACTIVE headphones are designed for advanced 20- or 32-channel coils used in 3T and 7T fMRI.**

OptoACTIVE provides the slimmest and most sensitive headphones available today for use in MRI, with a frequency response range of 50-20,000 Hz.

Built-in optical microphones enable automatic self-calibration, SPL monitoring and real-time in-ear stereo sound recording.

With its proprietary DSP and predictive behavior algorithms, OptoACTIVE sets the standard for robust, dependable active noise control in a wide variety of applications and settings, regardless of the MRI platform.



**Slim**  
**+**  
**Robust Engineering**



## **Ideal for the study of:**

Sleeping disorders, autism, children suffering from claustrophobia, auditory fMRI and many other new research areas that were previously impractical or unattainable.

OptoACTIVE is used in the world's leading MR research facilities, and comes bundled with our industry-leading FOMRI-III™ noise cancelling microphone.

# Self-Calibrates in Less Than 20 Seconds

# Smart + Simple Operation

OptoACTIVE matches innovation with operating simplicity, enabling you to focus entirely on the research at hand.

The system is completely self-calibrating, session-by-session, Patient-by-Patient. A short sequence of screen taps tells OptoACTIVE to calibrate its advanced noise cancelling algorithms for a scan – an operation that takes 16 seconds and requires no specialized knowledge or operator intervention.

Embedded DSP algorithms are optimized for the challenging acoustic characteristics of MRI, including resonance frequencies, dynamic range and varying duty-cycle time events.

Our bundled OptiMRI software enables concurrent recording of built-in left and right channel microphone outputs, filtered speech processed by the DSP, and up to three synchronized TTL events. A complete set of output post-processing capabilities is also provided.



**LCD touch-screen control console displays noise exposure, stimuli levels and spectrum analysis in real time.**

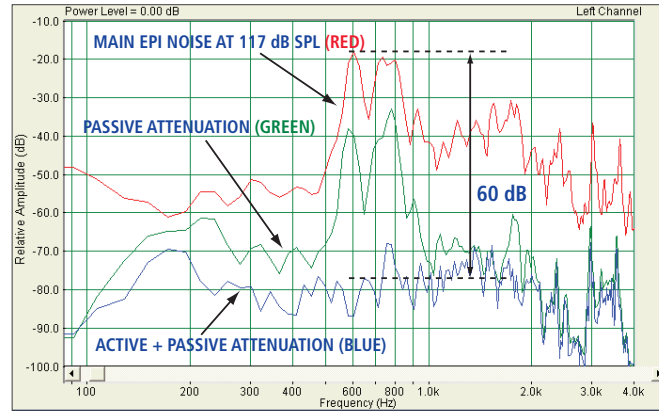
At every moment, the technician can access all basic noise cancelling, advanced attenuation and channel selection. OptoACTIVE uses a hybrid LCD digital touch and pushbutton console that intuitively controls:

- ▶ Initial and ongoing calibrations
- ▶ Real time noise cancelling
- ▶ Channel level volume and recording
- ▶ Music mixing with left/right gain control
- ▶ Full duplex in-line PTT communications
- ▶ FOMRI-III noise-cancelling microphone

# The Challenge of EPI Sequence Noise in MRI

EPI sequences used in fMRI are the loudest in MR imaging, sometimes exceeding 120 dB in a 3T scanner. That equates to the noise intensity of a jet engine at takeoff. Even more challenging for engineers than the intensity of MRI noise are the noise transients and harmonics that are generated at up to several KHz during various fMRI duty cycles, and which exhibit endless patterns of variation.

To solve this, Optoacoustics has developed and implemented a tailor-made, selective digital algorithm which actively attenuates EPI gradient noise in all its forms. Our proprietary real-time method drives the same noise created by the MR machine out of phase, then feeds it back into the patient's headphones. When both real and out-of-phase sounds are superimposed, true noise cancellation is achieved.



**Frequency domain graph showing full 60 dB attenuation (95%) of the main EPI resonance, resulting from combined passive and active noise cancellation.**

## System Accessories

OptoACTIVE accessories enable the highest possible system performance and operating throughput.

### Quiet 2-Way Communication with FOMRI-III™ Microphone

The gold-standard for high quality MRI speech recording and operating simplicity comes bundled with OptoACTIVE headphones.

The FOMRI-III noise cancelling microphone can be mounted securely on any sized head coil, using our instant strap-on gooseneck boom.

Completely safe, this ultra-flexible mount enables extremely close voice proximity and filtered recording with low latency.



**Hear precisely what is said inside the bore, and synchronize speech to TTL signals in real time.**

- ▶ Crisp, clear speech in real time
- ▶ Selectable, automatic noise reduction
- ▶ Synchronize speech with up to 3 TTL signals
- ▶ Monitor, record and broadcast filtered speech
- ▶ Plug-and-play operation
- ▶ Strap-on microphone mounting on your RF coil

### OptoVAC Vacuum Enhancer

Easily attaches to headphones to improve active noise cancelling performance by an additional 10 dB.



The OptoACTIVE system is a product of more than a decade of acoustics research, MRI applied engineering, and close partnering with leading MRI research facilities.

OptoACTIVE components are installed in both the MR Suite and the Control Room.

## OptoACTIVE™ SYSTEM SPECIFICATIONS

### OptoACTIVE Slim Optical ANC Headphones

Frequency Response	50-15,000 Hz
Maximum Sound Pressure Level	104 dB SPL
Total Harmonic Distortion	< 1 % at 1 Pa
Passive Noise Attenuation	25 dB
Active Noise Cancellation	> 20 dB SPL (> 90 %)
EPI Main Resonance Attenuation	> 50 dB (> 99%)
Total Noise Attenuation	> 40 dB SPL (> 99 %)
DSP Latency	0 msec, Real-time
Headphones Base Material	Polyurethane
Maximum Headphone Thickness	10 mm
Optical Fiber Cable (MIL STD)	
Cable Coating Material	Polyester Elastomer
Cable Dimensions 15 m [L], 5 mm [D]	
Cable Connector	4 x ST

### OptoACTIVE Electro-Optical Unit (EOU)

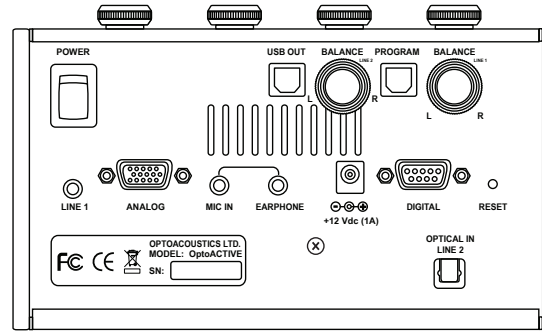
Box Dimensions	44 / 46 / 21.1 cm [H/D/W]
Weight	6 kg (13.3 lb)
Power	110 V / 220 V DC 2A
Operating Temperature	0 to +40 °C (32 to +104 °F)

OptoACTIVE™ is a component of Optoacoustics' MRI Multi-Channel Optical Communication (MOC) System which has been granted approval as a US FDA 510(k) device.

A portion of the ANC algorithm used in OptoACTIVE is licensed from the MRC Institute of Hearing Research (IHR) at Nottingham, UK.



### OptoACTIVE Control Console



- Features: (1) PTT Speak to Patient (Using Built-in Microphone)  
 (2) Self-Hearing Volume Control  
 (4) External Audio Volume Control

Dimensions	105/165/220 mm [H/D/W]
Weight	1.2 Kg
Power	12-15 V DC
Input Connectors	
Optical	8 x ST (Main, Reference) SPDIF (for external audio)
Power	3.5 mm
TTL	3 x BNC
DSP (for algorithm updates)	1 x USB
Output Connectors (for Built-in Mic)	
Analog (Main, Ref, DSP)	3 x RCA (100 mV/Pa)
Digital (Main/Ref, DSP/TTL)	2 x USB, SPDIF
Noise Reduction (for Built-in Mic)	Low/Med/High (15-40 dB)
Loudspeaker (Built-in)	
Frequency Response	100-10,000 Hz
Gain Knob RangeUp to +45 dB	

### FOMRI-III™ Optical Microphone

Our FOMRI-III microphone brings unprecedented clear speech to MRI and enables high quality two-way communications.

Configuration Type	Dual channel, perpendicular
Frequency Response	50-20,000 Hz
Max. Sound Pressure Level (SPL)	130 dB SPL
Total Harmonic Distortion	< 1% at 94 dB SPL
Operating Temperature	0 to +60 °C (32 to +140 °F)

### FOMRI-III Subcomponents

Microphone Housing	Polycarbonate
Head Dimensions	60/20/25 mm [L/W/H]
Head Weight	160 g
Mounting Attachment Box	Polycarbonate
Box Dimensions	60/60/25 mm [L/W/H]
Mounting Mechanism	Velcro® Strips
3D Adjustable Boom	Polypropylene
Boom Dimensions	300/16 mm [L/D]
Optical Fiber Cable (MIL STD)	
Coating Material	Polyester Elastomer
Cable Dimensions	15 m [L], 5 mm [D]
Connector	4 x ST
Pop Screen (Disposable)	Polycarbonate, Polyester

### FOMRI-III OptiMRI Software

Sampling Frequency	
OptiMRI 3.1 (DSP)	8,000/16,000 Hz, 16 Bit
Latency	
OptiMRI 3.1 (DSP)	12 msec

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SOUND SOLUTIONS FROM LIGHT TECHNOLOGY

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Optoacoustics is a leading manufacturer of high performance, optical fiber-based sound and vibration sensors. Each of our products combines the natural intelligence of optics and acoustics to meet technical performance demands which cannot be addressed by conventional sensing solutions. Optoacoustics' pioneering technology is protected by over 20 international patents.