HEAD acoustics

DATA SHEET

Code 1502

HMS V

Digital Artificial Head Measurement System with High Dynamic Range (Dual ADC)

OVERVIEW

HMS V

Code 1502

Binaural artificial head of the latest HMS generation, usable in stand-alone mode, frontend mode, or as a module in a HEAD acoustics measurement system.

The HMS V artificial head measurement system is a compelling combination of cutting-edge technology, high flexibility, and easy operation.

Thanks to Dual-ADC technology, HMS V offers an extremely high dynamic range. Manual selection of the range is no longer necessary.

The high-capacity battery ensures an autonomous operating time of several hours. Measurements can be recorded directly to the internal memory or to an external USB storage medium.

In stand-alone mode, HMS V operates without any additional frontend. The artificial head is controlled via the web interface for Stand-Alone Recording (SAR) using a smartphone, tablet, or PC or—without additional software—directly via the RC X.1 remote control.

In frontend mode, HMS V is connected to a computer via USB or LAN and controlled using the Recorder of ArtemiS SUITE.

In addition, HMS V can be seamlessly integrated into HEAD*lab* systems, combined with other artificial heads or devices to form larger measurement setups, or connected directly to the mobile frontend SQuadriga III.

KEY FEATURES

Digital artificial head measurement system for aurally-accurate recording and correctly equalized playback

High-end audio quality with an extremely high dynamic range

No range switching required thanks to Dual-ADC technology

Independent measurement capability through internal storage and battery

Broad applicability enabled by multiple interfaces, extensions, and operating modes

APPLICATIONS

Sound and vibration analyses

Binaural measurements in product development and quality control

Troubleshooting

Sound Engineering

Investigation and optimization of the sound quality of technical products

Soundscape and environmental acoustics

Mobile binaural measurements in vehicles while driving or in wind tunnels (with appropriate accessories)

DETAILS

The HMS V binaural artificial head measurement system enables sound events to be recorded and played back through connected headphones from HEAD acoustics in a manner corresponding to how they would have been perceived by a person located at the position of the artificial head during the recording.

The headphone connector of HMS V provides a default equalization for the HEAD acoustics HD CL I.1 headphones, enabling aurally-accurate monitoring of recordings directly on the device. HMS V also includes a line-out connector for outputting the recording-equalized signal.

The USB ports support versatile extensions such as storage media, or, in conjunction with the USB WLAN Adapter (Code 0275), enable convenient operation of HMS V via Wi-Fi using a smartphone or tablet.

Flexibility

HMS V can be operated as a frontend on a computer, as a module within a HEAD*lab* system, or in stand-alone mode using a smartphone, tablet, or the RC X.1 remote control. HMS V also provides a connector for a pulse sensor. The HEAD*link*+ interface enables the connection of SQuadriga III, a HEAD*lab* module, or the cascading of an additional HMS V.

Versatile Integration

HMS V is compatible with many modules and accessories of the HEAD acoustics HEAD*lab* family. Data can be output in AES format via the HEAD*link*+ interface, enabling HMS V to be integrated into measurement systems from other manufacturers as well.

Dual-ADC Technology

Dual-ADC technology enables high-end audio quality. The extremely high dynamic range enhances operational convenience by eliminating measurement range switching and massively reduces the risk of incorrect measurements due to overload or underload.

Autonomous Operation

HMS V is equipped with an integrated battery, enabling fully autonomous stand-alone operation for five hours. The operating time can be extended using the *lab*PWR I.2 supply module.

In addition, HMS V can be powered via a power adapter, a vehicle on-board power supply, or through HEAD*link*.

The Real-Time Clock (RTC) buffered for several weeks provides the required time information during stand-alone operation.

Equalization

In all modes, HMS V performs equalization during recording. As a result, no equalization is required in post-processing.

The following equalization options are available:

- Independent of Direction (ID)
- Free Field (FF)
- Diffuse Field (DF)
- Linear (LIN – no equalization)

OPERATION AND CONTROL

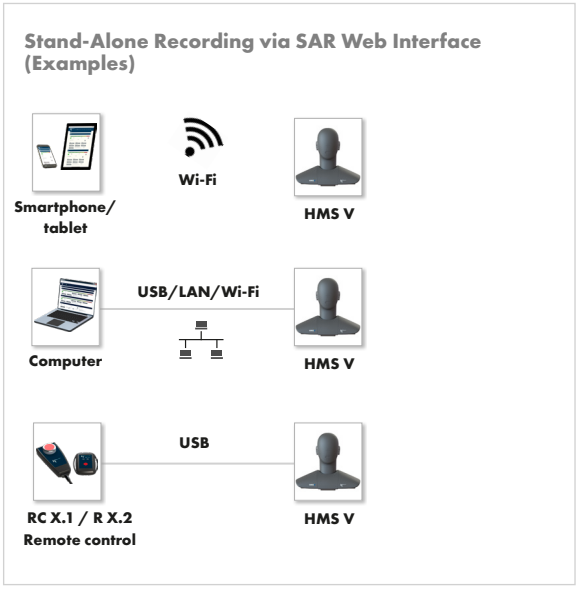
The operation and control of HMS V are determined by the mode in which HMS V is operated.

Stand-Alone Recording (SAR)

Operation as an autonomous measurement system using the Stand-Alone Recording (SAR) web interface

Using the SAR web interface, HMS V can be easily connected via USB/LAN or, when using the optional USB WLAN Adapter, to a notebook, tablet, or smartphone and operated through a web browser. The network interface enables automatic addressing through Zero Configuration Networking (Zeroconf), including in networks that lack a DHCP server, thereby eliminating the need for manual configuration in many cases.

Via HEAD*link+*, a second HMS V or a *lab*HSU can be connected and controlled during SAR operation.

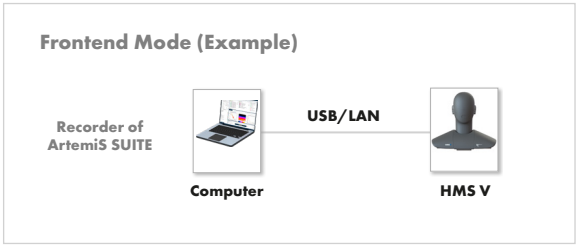


Frontend Mode

Operation as a frontend

In frontend mode, HMS V is connected to a computer via USB or LAN and controlled via the Recorder of ArtemiS SUITE.

To further enhance the functionality of the measurement system, a HEAD*lab* module can be connected directly to HMS V and powered by it. In this configuration, the artificial head functions as a controller, communicates with the Recorder of ArtemiS SUITE, and transmits its data, along with the data of the connected module, to the computer.



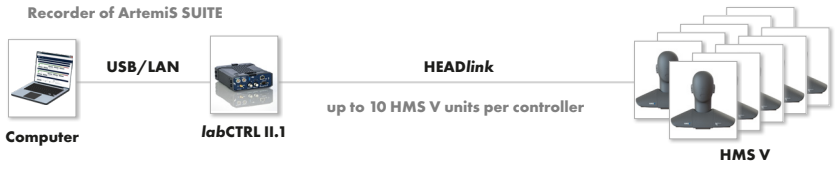
Module Mode

Operation within a HEADlab System

HMS V can be connected as a module to a HEAD*lab* controller, a compact module (labCOMPACT12 II or *lab*COMPACT24 II), or a high-end 2-channel frontend (labHSU). Even larger HEAD*lab* systems comprising numerous artificial heads and modules can be assembled quickly with just a few steps.

Each controller supports the connection of up to ten artificial heads or HEAD*lab* modules. Interconnecting multiple controllers enables systems with up to 600 channels. The systems are controlled via the Recorder of ArtemiS SUITE. The measurement data is transmitted via HEAD*link* to the controller and then forwarded to the computer via LAN or USB.

System Comprising Multiple HMS V Units (Example)



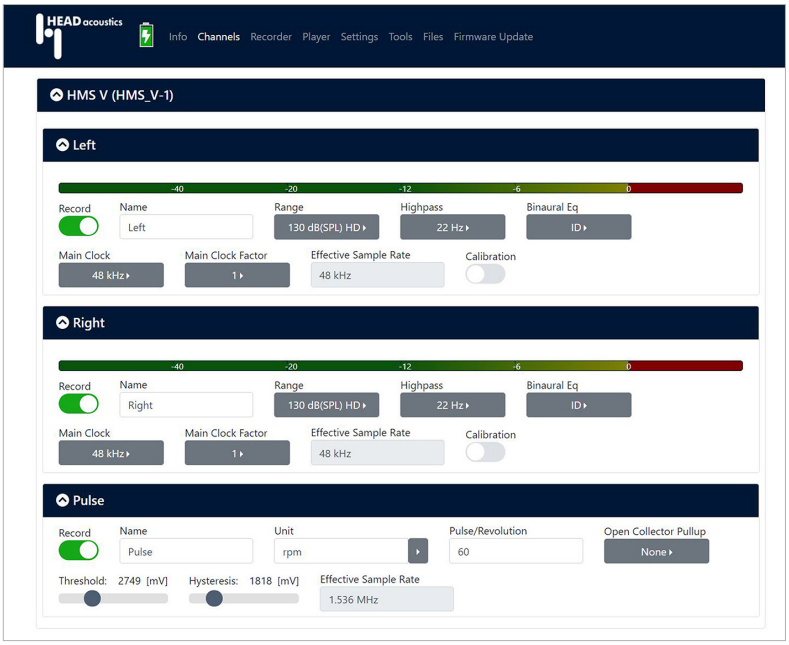
Connection to SQuadriga III

HMS V can be connected directly to the SQuadriga III mobile recording and playback system and operated from there. Since SQuadriga III is also equipped with a battery and internal memory, this combination likewise forms an autonomous measurement system.

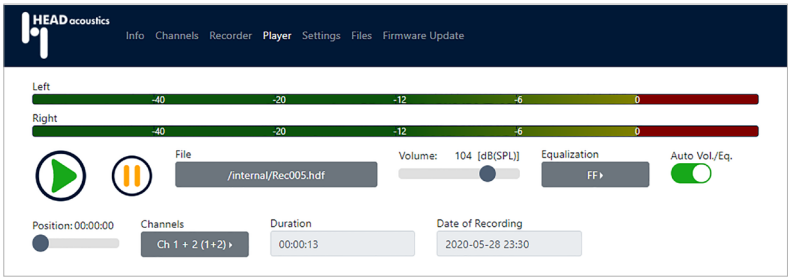
HMS V and SQuadriga III (Example)

Web Interface for Stand-Alone Recording (SAR)

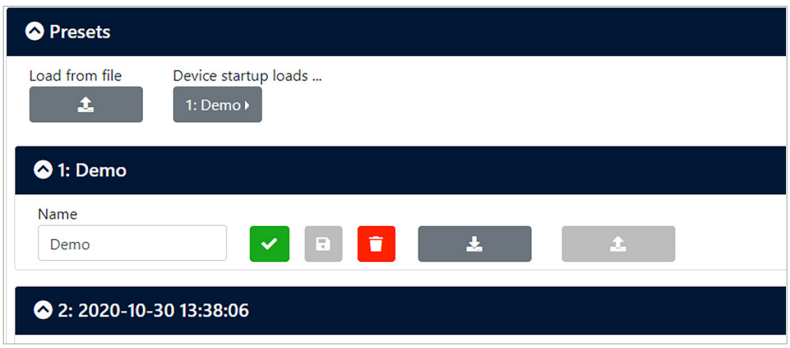
- The SAR web interface enables straightforward access to the configuration options of the input channels using easy-to-use-selection fields.
- The SAR web interface automatically adapts to the screen format and provides clear and straightforward access to the functions of HMS V. You can configure the input channels, work with presets, use filters for binaural recording systems from HEAD acoustics, and perform, monitor, and manage recordings.
- Configuration of external channels
  - You can also conveniently configure the channels of an HMS V or HMS IV artificial head measurement system, or of a *lab*HSU, connected to HMS V, directly within the operating interface. All options are presented in the same clear and well-structured manner as the native channels of HMS V.



- Monitoring and aurally-accurate playback
  - Via the headphone output of HMS V, the operating interface together with HEAD acoustics headphones enables you to monitor an ongoing recording and to perform aurally-accurate playback of stored recordings using the integrated Player. A limiter prevents hearing damage caused by excessively high sound levels.



- Working with presets
  - The preset function enables you to handle varying measurement tasks with a high degree of efficiency. Using presets, you can store individual configurations and recall and apply them with a single click. In addition, you can define which configuration is loaded at system startup.



INTERFACES

Right Shoulder (Device View)

HEAD*link*

- *lab*CTRL II.1 controller
- *lab*COMPACT12 II/ labCOMPACT24 II compact systems
- SQuadriga III
- *lab*HSU
- HMS V

Jack 3.5 mm

- Headphones

LAN

- Computer
- Network

HEAD*link+*

- *lab*HSU
- HEAD*lab* module
- HMS V artificial head

Power In (LEMO)

- *lab*PWR I.2
- PS 24-60-L4

USB Type-C

- Computer

2 x USB Type-A

- External storage media
- USB WLAN Adapter
- RC X.1 remote control

Base Plate

2 x M6

- Camera
- TLP II laser pointer

BNC – Pulse In

- Pulse sensor

Analog output 6.3 mm

- Line Out

Camlock and UNC 3/8“

- HMT II tripod
- HTB VI torso box
- HSM V
- MDM I.7

SCOPE OF DELIVERY AND OPTIONS

Scope of Delivery

Code	Name	Description
1502	HMS V	Digital artificial head measurement system with high dynamic range (Dual ADC)
0617B-XX	PS 24-60-L4	Power adapter 24 V, 60 W, LEMO 4-pin
1525	HSC V	Carrying Case for HEAD Measurement System HMS
1315	SBH I	Stand for HMS
5476-3	CUSB IV.3	USB-A to USB-C cable with side screw locking for SQuadriga III, *lab*HSU, HMS V, *lab*CTRL II.1, 3 m

Optional Accessories

Connection and Adapter Cables

Code	Name	Description
3797-1	CLX X.1	AES/EBU adapter cable LEMO 8-pin XLR 3-pin, male / XLR 3-pin female, 1 m
9862-03	CJB III.3	Analog-out cable 6.3 mm jack plug BNC socket, 30 cm

Headphones

Code	Name	Description
2511.1	HD OP I.1	Open-back dynamic headphones with standard equalization
2512.1	HD OP II.1	Open-back dynamic headphones with standard and individual equalization
2521.1	HD CL I.1	Closed-back dynamic headphones with standard equalization
2522.1	HD CL II.1	Closed-back dynamic headphones with standard and individual equalization

External Power Adapters

Code	Name	Description
3712	*lab*PWR I.2	HEAD*lab* supply module (max. 100 W)
0621 B	PS 24-150-L2	Power adapter 24 V, 150 W, LEMO 2-pin, for *lab*PWR I.1; *lab*PWR I.2; *lab*PWR I.3

Miscellaneous

Code	Name	Description
0275	USB WLAN Adapter	Wi-Fi adapter for *lab*HSU and HMS V
1960	HWS	Windscreen for outdoor recordings
1969	TLP II	Triaxial laser pointer for positioning HMS/HSU
3334	HSUB III.64	USB storage device, 64 GB
9850	RC X.1	Remote control
9851	RC X.2	Radio module for controlling RC X.1

HARDWARE COMPATIBILITY

HEAD*lab* Controller

Code	Name	Description	Availability
3702	*lab*CTRL I.2	*HEADlab LAN controller*	*Discontinued*
3704	*lab*CTRL II.1	*HEADlab controller (second generation)*	Available
31020	*lab*COMPACT12 II	*HEADlab 12-channel compact system (second generation)*	Available
31021	*lab*COMPACT24 II	*HEADlab 24-channel compact module (second generation)*	Available

HEAD*lab* Modules

Code	Name	Description	Availability
3724	*lab*M6	*HEADlab 6-channel microphone/IEPE/ICP input module*	*Discontinued*
3725	*lab*CF6	*HEADlab 6-channel charge/IEPE/ICP input module*	Available
3726	*lab*T6	*HEADlab 6-channel thermocouple input module*	Available
3727	*lab*SG6	*HEADlab 6-channel input module for strain gauges*	Available
3728	*lab*V6HD	*HEADlab 6-channel Line/IEPE/ICP input module with wide-range input*	Available
3731	*lab*O2	*HEADlab 2-channel output module*	Discontinued
3743	*lab*HRT6	*HEADlab high-resolution tachometer input module*	Available
3752	*lab*VF6 II	*HEADlab 6-channel voltage/IEPE/ICP input module*	Available
3753	*lab*V12 II	*HEADlab 12-channel voltage/IEPE/ICP input module*	Available
3754	*lab*M6 II	*HEADlab 6-channel microphone/IEPE/ICP input module*	Available
3755	*lab*V24 II	*HEADlab 24-channel voltage/IEPE/ICP input module*	Available
3756	*lab*V8x3-Iso II	*HEADlab 24-channel IEPE/ICP input module for 8 triaxial accelerometers*	Available
3757	*lab*VF6-Iso II	*HEADlab 6-channel voltage/IEPE/ICP input module with electrically isolated inputs*	Available
3759	*lab*V12-O4 II	*HEADlab 12-channel voltage/IEPE/ICP input module with 4 analog outputs (shaker)*	Available

Binaural Recording Systems

Code	Name	Description	Availability
1500	HMS IV	*Digital artificial head measurement system with CompactFlash*	*Discontinued*

Mobile Data Acquisition

Code	Name	Description	Availability
3324	SQuadriga III	*Mobile 8-channel frontend*	Available

Mount Devices

Code	Name	Description	Availability
1520	HSM V	*HEAD Seat Mount adapter for HMS/HSU*	Available
1574	HTB VI	*HEAD Torso Box for HMS/HSU*	Available
1962	HMT II	*Height-adjustable tripod for HMS/HSU*	Available
3764-7	MDM I.7	*Seat mount adapter for HMS/HSU with ISOFIX*	Available

TECHNICAL DATA

General Information

Communication interfaces	1 x HEAD*link*, 1 x HEAD*link*+, 1 x USB device, 2 x USB host, 1 x LAN
Supply connection	LEMO 4-pin, HEAD*link* (input), HEAD*link*+ (output)
Supply voltage	10 V_{DC} to 28 V_{DC}
Reverse polarity protection	No
Max. power consumption during operation – devices only	55 W
Max. power consumption when switched off	0.01 W
System sampling rate	32.768 (2^n) kHz, 44.1 kHz, 48 kHz, 51.2 kHz
Min. to max. sampling rate @32.768 (2^n) kHz	32.768 kHz to 131.072 kHz
Min. to max. sampling rate @44.1 kHz	44.1 kHz to 176.4 kHz
Min. to max. sampling rate @48 kHz	48 kHz to 192 kHz
Min. to max. sampling rate @51.2 kHz	51.2 kHz to 204.8 kHz
Synchronization	Internal, external HEAD*link*
Max. sampling rate	204.8 kHz
Cooling	Convection (without fan)
Operating temperature	-10 °C to +50 °C (+14 °F to +140 °F)
Storage temperature	-20 °C bis +70 °C (-4 °F to +158 °F)
Dimensions (W x H x D)	450 mm x 400 mm x 180 mm
Weight	5500 g
Tripod thread	⅜“
Processor	ARM Cortex A9, Dual Core 800 MHz
Storage capacity	64 GB internal memory, approx. 60 GB of which for recordings and configurations

Power Battery

Max. power consumption incl. charging	55 W
Max. power consumption charging only	55 W
Efficiency, operation with external power supply	> 80%
Efficiency, operation with internal battery	> 90%
Electrical isolation input/output	Yes
Seamless switching between external power supply/battery	Yes
Automatic shutdown at minimum load	Yes
Battery type	Li-Ion
Battery capacity	4 Ah
Battery voltage	14.6 V
Battery energy	59.2 Wh
Battery operating time	5 hours
Battery discharge time (self-discharge)	200 days
Battery charging time with external power supply (device-switched off)	2.75 hours
Battery charging time with external power supply (device in standby)	4 hours
Battery charge cycles	500
Battery charge level indicator on the device	LEDs, indication in 20% increments
Battery charge level monitoring via software	Yes, in 1% steps

Communication interfaces

Digital USB Host

Plug connector	2 x USB Type-A
Number of interfaces	2
USB specification	USB 2.0
Data rate (gross)	480 Mbit/s
Output voltage	5 V_{DC}
Total output current	0.65 A
Output current per interface	0.5 A
Max. output power	3.2 W
Electrical isolation	No

USB Device

Plug connector	1 x USB Type-C with side screw locking
Number of interfaces	1
USB specification	USB 2.0
Data rate (gross)	480 Mbit/s
Electrical isolation	No

LAN

Plug connector	1 x RJ45
Number of interfaces	1
Standard	IEEE 802.3ab
Data rate (gross)	1000 Mbit/s
Electrical isolation	No
Power over Ethernet	No

HEAD*link*

Plug connector	1 x LEMO 8-pin
Number of interfaces	1
Supply voltage	10 V_{DC} to 28 V_{DC}
HEAD*link* version	HEAD*link* 1.0, HEAD*link* 2.0
Electrical isolation	No
Synchronization	32.768 (2^n) kHz, 44.1 kHz, 48 kHz, 51.2 kHz
Maximum cable length	60 m

HEAD*link*+

Plug connector	1 x LEMO 8-pin
Number of interfaces	1
Output voltage	10 V_{DC} to 28 V_{DC}
Max. output power	10 W
Standard	HEAD*link* 1.0, HEAD*link* 2.0 AES (via CLX X cable)
Electrical isolation	No
Synchronization	32.768 (2^n) kHz, 44.1 kHz, 48 kHz, 51.2 kHz
Maximum cable length	60 m

Analog Outputs

Voltage (Line Out)

Plug connector	1 x jack 6.3 mm
Number of channels	2
Voltage range	2.8 V_P
Output impedance	10 Ω
DC capable	No
Electrical isolation input/output	Yes
Electrical isolation, per channel	No
Resolution	32 bits
Equalization	Yes, recording-equalized signal, no playback equalization
Maximum voltage	2.8 V_P
Nominal voltage	1 V_{eff}
Maximum output power per channel	0.45 W

Headphones

Plug connector	1 x jack 3.5 mm
Number of channels	2
Output impedance	10 Ω
DC capable	No
Frequency response 20 Hz to 20 kHz referenced to 1 kHz	+0.05 dB, -0.25 dB
S/N	113 dB(A)
THD+N	-105 dB
Crosstalk at 1 kHz	-95 dB
Electrical isolation input/output	Yes
Electrical isolation, per channel	No
Resolution	24 bits
Equalization	Standard equalization for HD CL I.1 headphones
Maximum voltage	9.6 V_P
Maximum level	16.6 dB(V)
Maximum output power per channel	0.45 W

Digital Inputs/Outputs

Pulse

Plug connector	1x BNC
Number of channels	1
Switchable power source (substitute for pull-up)	5 mA (±1 mA)/5 V
Maximum pulse frequency	1000 kHz
Threshold value digitally adjustable	Yes
Hysteresis digitally adjustable	Yes
Resolution of threshold value/hysteresis	40 mV
Input impedance	36 kΩ
Input voltage range	0 V to 10 V
Electric strength	±50 V
Electrical isolation	Yes

Acoustic Inputs

Microphone

Measurement range	84 dB_{SPL}, 94 dB_{SPL}, 104 dB_{SPL}, 114 dB_{SPL}, 124 dB_{SPL}, 134 dB_{SPL}, 144 dB_{SPL}
Measurement range HD mode	130 dB_{SPL}
Inherent noise	15 dB_{SPL}
Frequency range	3.5 Hz to 20,000 Hz
Maximum sound pressure level	146 dB_{SPL}
Analog high-pass filter	1.75 Hz, 2nd order, ±10%; 22 Hz, 2nd order, switchable, ±5%
TEDS (IEEE 1451.4)	TEDS class 1, shared return wire (versions 0.9 and 1.0)

Specifications of the Microphone Measurement Ranges

Measurement Range	**84 dB_{SPL}**	**94 dB_{SPL}**	**104 dB_{SPL}**	**114 dB_{SPL}**	**124 dB_{SPL}**	**134 dB_{SPL}**	**144 dB_{SPL}**	**130 dB_{SPL} (HD)**
Inherent noise (acoustic)	15 $dB(A)_{SPL}$	15 $dB(A)_{SPL}$	15 $dB(A)_{SPL}$	15 $dB(A)_{SPL}$	16 $dB(A)_{SPL}$	32 $dB(A)_{SPL}$	34 $dB(A)_{SPL}$	15 $dB(A)_{SPL}$
S/N (acoustic)	75 $dB(A)_{SPL}$	85 $dB(A)_{SPL}$	95 $dB(A)_{SPL}$	105 $dB(A)_{SPL}$	114 $dB(A)_{SPL}$	108 $dB(A)_{SPL}$	116 $dB(A)_{SPL}$	121 $dB(A)_{SPL}$
THD+N (electrical)	-82 dB	-92 dB	-100 dB	-106 dB	-102 dB	-96 dB	-87 dB	-100 dB
Crosstalk (electrical) at 1 kHz	-97 dB	-106 dB	-114 dB	-121 dB	-120 dB	-120 dB	-118 dB	-121 dB
Dynamic range 5 Hz analysis bandwidth	111 $dB(A)_{SPL}$	121 $dB(A)_{SPL}$	131 $dB(A)_{SPL}$	141 $dB(A)_{SPL}$	150 $dB(A)_{SPL}$	144 $dB(A)_{SPL}$	152 $dB(A)_{SPL}$	157 $dB(A)_{SPL}$
Linearity (electrical): 0 dB to 80 dB at full scale	0.03 dB	0.07 dB	0.04 dB	0.03 dB	0.03 dB	0.036 dB	0.03 dB	0.02 dB
Linearity (electrical): 0 dB to 100 dB at full scale	0.3 dB	0.3 dB	0.16 dB	0.13 dB	0.08 dB	0.23 dB	0.3 dB	0.08 dB

Dynamic Range

There is no standardized calculation method for the term “dynamic range”.

Therefore, the signal-to-noise ratio (SNR or S/R) is specified for HMS V. This value is calculated from the level of a sinusoidal tone at maximum modulation in relation to the broadband idle noise of HMS V, measured across the entire relevant frequency range.

In some literature, the term “dynamic range” is used by analogy with the S/N value, however, this is often based on a narrow-band calculation of the inherent noise. Depending on the analysis bandwidth, HMS V can then yield a significantly higher “dynamic range” value.

ITU-T P.58

The dimensions of the head comply with ITU Recommendation P.58, Table 1. They are comparable with the values stated in ANSI 3.36, Table B.1. Please note: Without HEAD Torso Box, some of the dimensions specified in P.58, Table 1 are not applicable.

The monaural head-related transmission characteristics correspond to the monaural head-related transmission characteristics specified in ITU-T P.58, Table 4.

HEAD acoustics

Contact

Ebertstrasse 30a
52134 Herzogenrath, Germany
Phone: +49 2407 577-0
E-Mail: sales@head-acoustics.com
Website: www.head-acoustics.com