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HMS III.0 (Code 1307)

HEAD Measurement System
Basic version of the digital Artificial Head Measurement System HMS III

Overview

The digital artificial head HMS III is the result of further targeted development of artificial head technology by HEAD acoustics.

With state-of-the-art 24 bit technology, the artificial head HMS III.0 is able to achieve a dynamic range comparable to that of human hearing.

The artificial head accurately simulates all acoustically relevant components of the human outer ear, and is thus able to achieve aurally-accurate, binaural recording of sound events, in which all features of human sound perception are supported.

The measurement electronics, along with an independent-of-mains power supply, are integrated in the head-and-shoulder unit, making the artificial head an easy-to-handle, use-anywhere measurement tool. Investigation of the sound quality of technical products and the possibility of product-specific sound design are some of the most important fields of application for the artificial head.

Special features

High dynamic range
thanks to 24 bit signal processing.

Digital equalization
Linear equalization (LIN - no equalization), independent-of-direction equalization (ID), free-field equalization (FF), diffuse field equalization (DF), user-specific equalization (USER) for special, individual requirements.

External synchronization
via the AES/EBU input socket included.

Extendable to a four-channel system
by connecting a second artificial head to the AES/EBU input socket.

Automatic system check
checks for error-free functioning of all devices in the signal path.

Pulse input
allowing RPM pulses to be fed into the digital signal.

USB interface
for user-friendly applications.

Analog output
enabling interface to analog measurement and audio devices.

Remote control
via hand held remote control or PC.

Compatibility to 16 bit systems
including pulse and HMS data.
Mobility
ensured by low weight of device and independent-of-mains power supply.

Artificial head technology
Human beings are able to localize sound sources. This is not only because of delay and differences in SPL at the two ears. Localization is also supported by directionally dependent filtering of sound signals by the outer ear, causing attenuation, deflection, reflection and resonance of the sound waves. Crucial in this process is the geometry of the head and shoulders and the impact of the pinna.

Aurally-accurate, undistorted spatial recordings are thus only possible if the filtering properties of the head and ears are taken into account. Playback of an artificial head recording creates an auditory impression for the listener which is the same as would have been experienced if he had been present at the original sound event.

The patented and award-winning design of the geometry of the artificial head is a mathematically describable simulation of the human head and shoulders. Integrated within are all the electronics required for sound measurement, signal processing and power supply. The inclusion of an independent-of-mains, interruption-free power supply makes the artificial head a mobile, measuring tool that can be used anywhere.

Dynamic range
24 bit technology enables the artificial head to achieve a high dynamic range, comparable to that encountered in the human auditory apparatus. Optimum range for digital signal processing and equalization is ensured by preselection (seven separate levels) for nominal sound pressure level.

All relevant artificial head settings are saved within the audio data as HMS data. The HMS data can be automatically read out by the analysis system ArtemiS, the HEAD Audio Recorder and the programmable, digital Equalizer PEQ V, or the high voltage power amplifier PVA IV.3, and included in subsequent data processing.
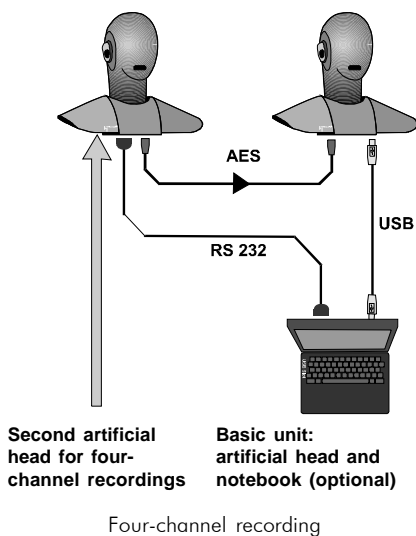The playback systems PEQ V and PVA IV.3 can be connected to the AES output socket of the artificial head.

Equalization

Digital signal processing enables exact equalization of acoustic signals, which can be adapted to various sound field properties. Five different modes of equalization are available: linear = no equalization (LIN), directionally independent equalization (ID), free-field equalization (FF), diffuse field equalization (DF) and also a user-specific equalization (USER), which can be tailored to individual requirements. The equalizers take account of the way the artificial head impacts the sound field and ensure that artificial head measurements remain compatible to conventional measurement technology. These settings are also saved in the HMS data.

External synchronization

The artificial head can be synchronized to an external set sampling rate via the AES/EBU input. This feature is essential in simultaneous use of a number of digital artificial head Measurement Systems, or when a digital measurement system, such as HEAD acoustics mobile multichannel frontends SQlab II and III, is connected.

Second artificial head for four-channel recordings

Basic unit: artificial head and notebook (optional)

Four-channel recording

Four-channel recordings

Four-channel recordings, each of data width up to 24 bits and sampling rate up to 48 kHz, can be performed by connecting a second artificial head to the AES/EBU input socket of the first head (see figure above).

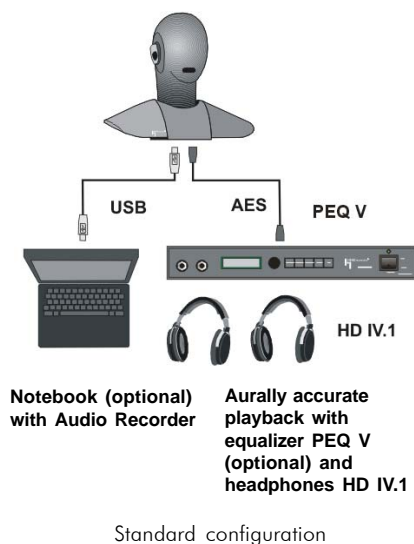The first artificial head is then synchronized by the second head.

Automatic system check

The new artificial head performs a full system check testing all devices in the signal path. Possible malfunctions in the measurement chain can thus be identified. Deviations from applicable tolerances are automatically corrected.

This comfortable system check supports the long-term accuracy of the artificial head Measurement System, based on the absolute calibration completed at our factory. Since intervals between external calibrations can be longer, the availibility of equipment is increased.

Pulse inputs

The electronics of HMS III enable feed-in of RPM pulses to the digital signal via two pulse inputs. RPM can be displayed on the Remote Control RC V of the artificial head.

Notebook (optional) with Audio Recorder

Aurally accurate playback with equalizer PEQ V (optional) and headphones HD IV.1

Standard configuration

Remote control

All settings required for artificial head recording can be made using the remote control software HUS I.1 included in the scope of supply (HEAD Tools CD). These settings include equalization, sampling rate, volume and data format. The remote control window and the SPL and modulation display provide real-time information about the current status of the artificial head. The remote control software supports the artificial head system check and simplifies calibration. Software remote control of the artificial head can be either via the USB or RS 232 interfaces, according to mode of operation.

A further option is to control the artificial head via the RS 232 interface via the Remote Control RC V. The RC V has features similar to the controlling software.

USB interface

The USB interface of the artificial head enables a whole range of applications. For example, connecting a notebook connected to the artificial head via the USB interface enables the notebook (no additional sound card necessary) to be used with the HEAD Audio Recorder (HEAD Tools CD) for storing sound events to hard disk. These sound events can be subsequently analysed using the analysis program ArtemiS.

The USB interface also allows remote control of the artificial head via PC. Thus you need only one USB connection between HMS III and notebook for all: recording, playback and remote control.

Analog output

The artificial head can also be used together with analog measurement systems by connecting these analog systems to the analog output. Since analog output signals are obtained from digital signals, the advantage of digital signal equalization remain.

Compatibility to 16 bit systems

The artificial head is downwardly compatible to existing 16 bit systems. When audio data are converted to 16 bit format, HMS data (or pulse data, see below) are also converted.

Conversion of data from 24 bit to 16 bit is either via a rounding algorithm or a dither & noise shaping algorithm, which, instead of simply truncating the data stream after the 16th bit, shifts the quantization noise to uncritical frequency ranges. This achieves a subjectively perceptible reduction in quantization distortion in the acoustic signal. This data conversion from 24 bit audio data results in high quality 16 bit signals.

Mobility

Independent-of-mains power supply and low weight make the artificial head very suitable for mobile applications. The artificial head can be easily transported, making it extremely flexible for a wide range of applications.

APPLICATIONS

Investigation and Optimization of sound quality for technical products:

- Motor vehicles
- Vehicle components
- Household devices
- Office equipment
- Power tools

Binaural measurements:

- Product development
- Quality control
- Measurements in vehicles
- Measurements on test stands
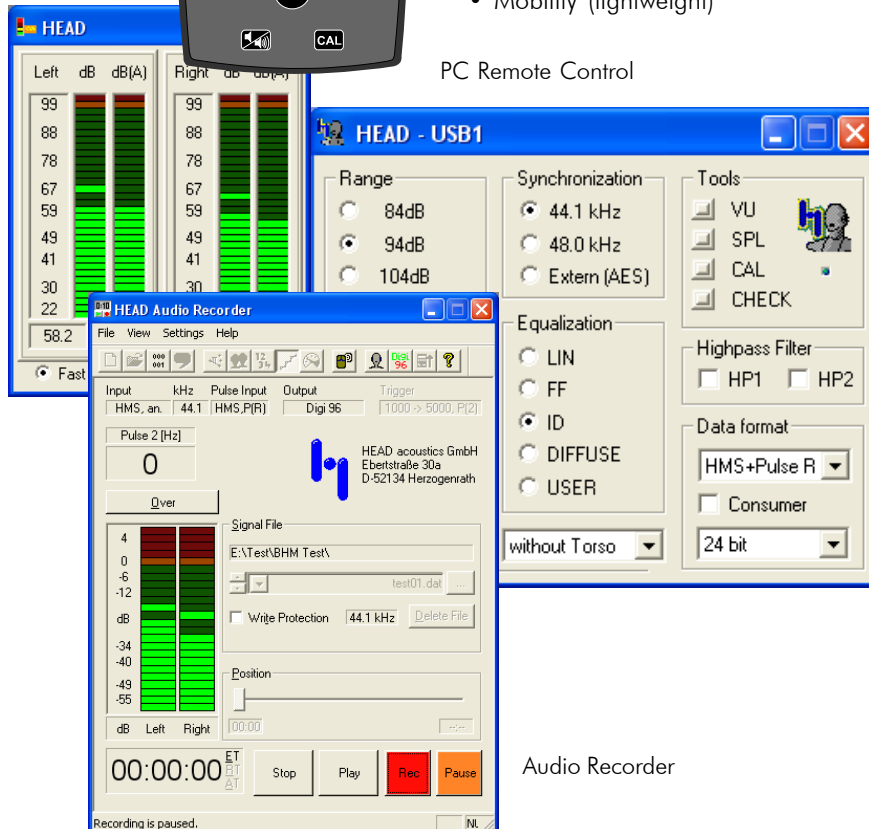- Production monitoring
- Environmental and work protection

Sound Design:

- Noise diagnosis
- Product optimization

RC V
Remote Control

PC Remote Control

Audio Recorder

FEATURES

- High dynamic range thanks to 24 bit technology
- High modulation range
- Extremely low noise
- Equalization modes: linear (LIN - no equalization), independent-of-direction (ID), free-field (FF), diffuse field (DF), user-specific (USER) via download
- Equalization options for a range of configurations, e.g. for measurements with or without torso, with or without windshield
- Compatible to human hearing and conventional measurement engineering technology
- Compatible to HMS II Artificial Head recordings and 16 bit format, incl. HMS/pulse data
- USB interface
- Pulse input
- Analog output
- 4-channel recordings via two Artificial Heads
- Data format: AES/EBU and IEC/SP-DIF
- Synchronization via external AES/EBU signal
- Automatic system check
- User-friendly remote control and SPL meter via the remote control software or the Remote Control RC V (optional)
- Independent-of-mains power supply
- Mobility (lightweight)

STANDARD DELIVERY ITEMS

HMS III.0 (Code 1307)
comprises the following components:

HDM I.0 (Code 1300)
Digital Artificial Head microphone unit, incl. measurement electronics, signal processing and power supply, built into the head-and-shoulders unit

HUS I.1 (Code 1313)
HMS III remote control software

HUS II.1 (Code 1319)
HEAD Audio Recorder, HMS III recorder software

SBH I (Code 1315)
Stand base for HDM I.0

PSH I.1 (Code 1364)
External power supply
100 V - 250 V AC -> 12 V DC

PCC I.9x (Code 997x)
Mains cable (local specification)

CXX II.3 (Code 5177-3)
2.95 m cable AES/EBU,
XLR –> XLR 3-pin

CAB I.3 (Code 5475-3)
2.95 m cable D-SUB 9-pin

CUSB II.1.5 (Code 5478-1.5)
Cable USB 2.0, 1.5 m (4.9 ft)

HEAD Tools CD
User's Manual HMS III.0

ACCESSORIES (software)

ArtemiS (Code 4600)
Multichannel analysis system

HEADRecorder (Code 4630)
Remote control software for HMS III

NoiseBook (Code 4800)
Mobile sound analysis system

ACCESSORIES (hardware)

HTB V (Code 1374)
HEAD Torso box for HMS III

OctoBox+ (Code 3311)
8-Channel Frontend with USB Port

RC V (Code 1312)
Remote Control for HMS III

PEQ V (Code 2492)
Programmable, digital Equalizer

HD IV.1 (Code 2380)
Dynamical headphone for PEQ V

PVA IV.3 (Code 2486)
High voltage power amplifier for 2 headphones HA III

HA III (Code 2480)
Electrostatic headphone for PVA IV.3

PSB II (Code 1329)
Pulse Splitter Box

HWS II (Code 1960)
Windshield for outside recording

HMT II (Code 1962)
Height-adjustable tripod for HMS

HSC IV (Code 1524)
Flight case for Artificial Head HMS III

CMD III.1 (Code 9810)
Cable, *Pulse In and Power Supply for PSB II*

CDB III.1 (Code 9811)
Cable, *Analog Out*

CDM III.1 (Code 9812)
Cable, *Pulse In and Analog Out*

Technical Data – HMS III.0

Measuring components

Nom. SPL (selectable):	84 dB_{SPL}, 94 dB_{SPL}, 104 dB_{SPL}, 114 dB_{SPL}, 124 dB_{SPL}, 134 dB_{SPL}, 144 dB_{SPL}
Headroom (electrical):	6 dB (except for range 144 dB)
Equalization modes:	Linear (LIN), Independent-of-Direction (ID), Free-Field (FF), Diffuse Field (DF), User-specific (USER)
Directional pattern:	Corresponds to the structurally-averaged directional pattern of the human outer ear to IEC 959
Microphones:	½" electrostatic microphones, 200 V polarization voltage
Filters:	Highpass 1st order, switchable 22 / 180 Hz ($\pm$10 %), passive Highpass 2^{nd} order, 22 Hz ($\pm$10 %), active. All filters can be deactivated
Transmission range:	20 Hz - 20 kHz: $\pm$0.1 dB; 3 Hz - 20 kHz: -3 dB/+0.1dB
Linearity:	103 dB at 1 kHz
Max. SPL:	145 dB_{SPL} ($<$ 3% distortion factor)
Inherent noise 94 dB_{SPL}:	15 dB(A), typical (LIN)
Inherent noise 124 dB_{SPL}:	21 dB, 18 dB(A) (LIN); 24 dB, 20 dB(A) (ID) typical
A-weighted S/N ratio:	112 dB at 124 dB (LIN)
Unweighted S/N ratio:	109 dB at 124 dB (LIN)
Crosstalk, LIN:	116 dB (250 Hz), 120 dB (1000 Hz), 116 dB (5000 Hz)
Crosstalk, ID:	100 dB (250 Hz), 95 dB (1000 Hz), 80 dB (5000 Hz)
Intermodulation:	-92 dB at 1000 Hz with simultaneous excitation of the system by 10 kHz and 11 kHz sine
Resolution:	24 bit, 128-fold oversampling
Sampling rate:	Internal: 44.1 kHz, 48 kHz; external: 32 kHz, 44.1 kHz, 48 kHz: synchronizable via AES/EBU

Analog output

Nom. output level:	1 V_{rms} + 6 dB Headroom
Inherent noise:	90 dB below nom. level

Digital output:	AES/EBU, IEC II Subcode selectable; 24 bit or 16 bit format. Noise Shaping activatable
USB interface:	To Specification Rev 1.1. Enables 2-Head recordings up to 48 kHz, 24 bit
Operation:	Remote control software HUS I.1 (via RS 232 or USB) and Remote Control RC V (RS 232)
System check:	Automatic hardware check for digital and analog component and A/D converter after power on
Pulse inputs:	Limit frequency: 5 kHz, TTL-compatible
Power supply:	Interruption-free switching between external and internal power supply Smart charge electronics
Altern. external DC supply:	12 V DC from 9 - 34 V vehicle on-board power supply or power pack
Internal DC supply:	Charging: fast charge (max. 2.5 h), trickle charge. Operating time with battery: 2.5 h typical (w/o Remote Control RC V)
Current, output:	Charging and operation: 2 A / 24 W
Environmental conditions:	Operating temperature range: 0° C - 50° C (32° F - 122° F) Storage temperature range: -20° C - 70° C (-4° F - 158° F)
Overall dimensions (WxHxD):	450 mm x 400 mm x 180 mm (17.72" x 15.75" x 7.09")
Weight:	5.6 kg
Tripod socket:	UNC 3/8"

Radiated emission according to: EN 61326-1: 1997 + A1: 1998 + A2: 2001 + A3: 2003 (equipment class A)

Radiated immunity according to: EN 61326-1: 1997 + A1: 1998 + A2: 2001 + A3: 2003

Safety according to: EN 61010-1: 2001

Physical dimensions of the head designed according to ITU P 58, section 4.2 and comparable to ANSI 3.36, table 1 and IEC 959, table 1.

Please note: Without torso box, some dimensions in P.58, table1 are not applicable.

The monaural frequency responses comply with ITU P 58, table 4 and to those that can be derived from ANSI 3.36, table 3 and IEC 959, table 3.

External Power Supply PSH I.1

Input voltage:	100 V - 240 V, 47 Hz - 63 Hz
Max. input current:	1.6 A at 100 V AC
Output voltage/current:	15 V DC / 4 A to XLR (4-pin)