



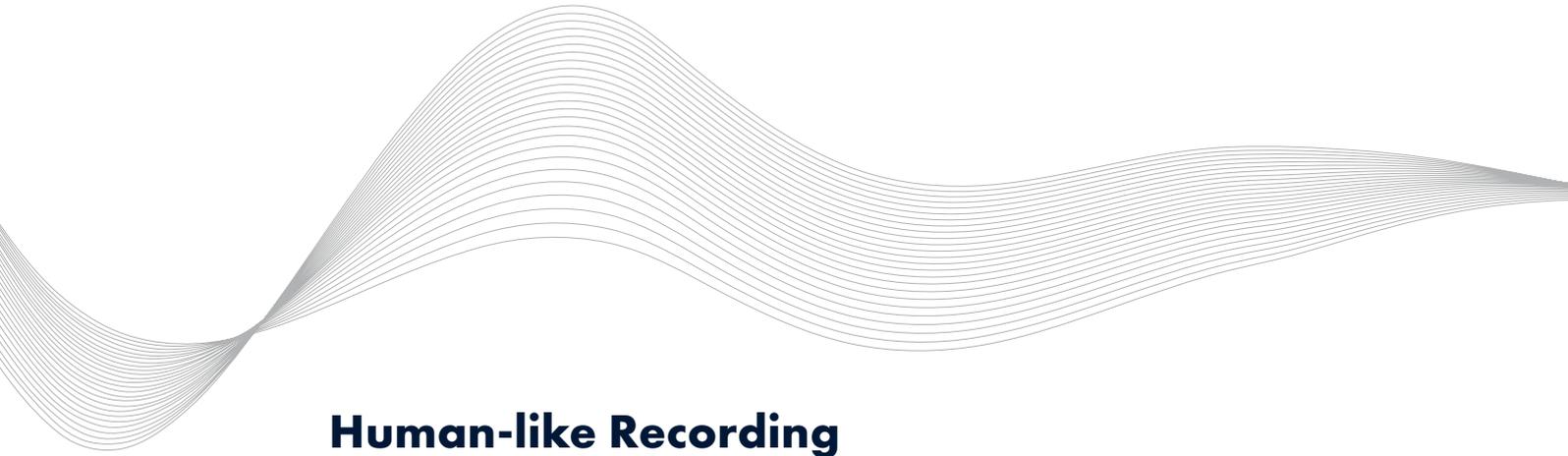
optimize
**VOICE & AUDIO
QUALITY**

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Human-like Recording and Voice Generation

Artificial Heads

HEAD acoustics' Artificial Heads combine cutting-edge technology, high flexibility, and ease of use that help advance your development and improve your products. They are ideal for measuring voice and audio quality in virtually any conceivable application scenario, in sending and receiving directions, for close-to-ear audio and telecommunication devices, as well as for far-to-ear communication devices.



Realistic headset testing with human-like pinnae



With our Artificial Heads, we meet the highest demands for quality and faithfulness to reality in the lab – we make your testing real-life-proof.



Artificial Head with Handset positioner for fully automated voice quality testing of telephones (HHP IV)

POWERFUL

- » A broad range of Artificial Heads ideally suited for all applications
- » Fullband-capable for increased naturalness
- » Realistic diffraction and reflection of head and torso
- » Meeting or exceeding relevant standards and specifications

Human-like Recording and Voice Generation

Modular & Unique



Replaceable anatomically shaped pinnae

Replaceable impedance simulators with human-like impedances

VERSATILE

- » Close-to-ear: mobile phones, handsets, ANC headphones/headsets, and smart speakers in the nearfield
- » Far-to-ear: hands-free systems or smart speakers
- » Sending and receiving directions

Its modularity makes the HEAD acoustics range of Artificial Heads uniquely versatile.



Available with or without a nose for recordings with, e.g., VR glasses

The unique modular concept of our HMS Artificial Heads gives you unprecedented possibilities. You can equip the Artificial Head with various realistically shaped ear simulators and, depending on the model, an artificial mouth. You can even upgrade an existing HMS II.3 LN HEC with our ViBRIDGE technology to simulate and measure Bone Conduction. This modularity makes the HEAD acoustics range of Artificial Heads uniquely versatile.

The Head Shoulder Unit is now available as a head-rotating variant (move°S technology, p. 22)

MODULAR

- » Adapt your HMS quickly and efficiently to alternating tasks with state-of-the-art accessories
- » Comprehensive choice of ear simulators and an artificial mouth
- » Exclusive bone conduction variant ViBRIDGE for in-ear headsets using a structure-borne sound sensor
- » Handset positioners HHP III.1 and fully automated HHP IV place handheld devices in standard or user-defined positions

Communication and Audio Analysis

ACQUA

Advanced Communication Quality Analysis

ACQUA is a highly sophisticated measurement and analysis software for optimizing voice and audio quality. The software, combined with the hardware platform *labCORE*, forms a precise, automated, and flexible system for R&D, conformance tests, and quality control of devices and systems.

ACQUA is the reliable basis for the complete measurement chain – from the generation of complex excitation signals to the automated conduct of measurements and the analysis of measurement signals to secure storage and documentation.



KEY FEATURES

- » Analyses in the time domain: level, level vs. time, delay, etc.
- » Analyses in the frequency domain: frequency response, loudness ratings, echo loss, distortion, background noise, out-of-band signals, etc.
- » Database-controlled configuration & control of test procedures, front ends, and hardware platforms
- » Predefined test cases for automated & guided measurements according to various – partly mandatory – international standards
- » Digital real-time equalization of any ITU-T-compliant artificial mouth
- » Individual default settings definable
- » Modifiable measurement descriptors
- » Automated measurement sequences





ACOPTs – ACQUA options for extended software functionality

Our ACQUA options, so-called ACOPTs, make it easy to tailor the software individually to your requirements. The ACOPTs cover a broad range of tools and methods for any conceivable application and need, for example

- » tools for signal generation and analysis
- » unique calculation methods for psychoacoustics
- » exclusive perception-based methods for instrumental speech quality evaluation using Mean Opinion Score (MOS) values
- » convenient options for clear and concise result presentation, e.g., one-view visualizations according to ITU-T

Communication and Audio Analysis

ACOPTs

A Small Selection from Our Various Options for ACQUA

EQUEST

Perceptual Tests of Echo Perception
for Better Echo Quality in Telecommunications

EQUEST is an approach to echo control testing based on a hearing model analysis that extends standard echo analysis methods, offering high potential for echo analyses. The EQUEST rating and the subscriber's viewpoint highly correlate thanks to incorporating sidetone into the model, its value assessment, and using a psychoacoustic parameter. EQUEST is extremely useful for the in-depth evaluation of echo disturbances of modern telephone terminal equipment, especially regarding the challenges of wide-band and super-wideband telephony and its specific requirements regarding echo performance.

3QUEST

3QUEST is an algorithm to evaluate speech in noise instrumentally, based on human perception and MOS (Mean Opinion Scores) on speech distortion, noise intrusion, and global quality. It simulates the typical ratings of human listeners. Comprehensive listening tests with human listeners enabled us to create this sophisticated method to bring human perception to the lab and make your testing real-life-proof. 3QUEST fully conforms to ETSI EG 202 396-3, TS 103 106, and TS 103 281.





MDAQS

A Milestone in Instrumental Audio Quality Evaluation

The ACQUA option MDAQS uses binaural recordings to mimic human hearing and the acoustics involved. It merges three key MOS values for audio playback quality – timbre, distortion, and immersiveness – into one overall MOS value for a quick assessment and good comparability, making it the world’s first binaural, perception-based measurement tool that assesses device audio quality in a scientific and quantifiable way. MDAQS, ACQUA, and the labCORE hardware easily replace your current measurement gear for unrivaled versatility and performance, delivering fast, consistent, and comparable results that no other audio quality measurement system offers today.

- » Uses advanced metrics and AI to recreate the human perception
- » Substitutes naïve listener evaluation in the audio device development process
- » Achieves more reliable and meaningful audio quality testing results
- » Speeds up the development process

Find out everything about all ACQUA Options:



ABLE

Objective Assessment of Listening Effort in Telecommunications

ACQUA Option ABLE is a prediction algorithm that enables an instrumental method for determining listening effort, complying with ETSI TS 103 558. In several studies, the perceived listening effort proved to be a more suitable measure than speech intelligibility when it comes to analyzing near-end voice communication quality in the presence of background noise, benchmarking, and comparing system and device performance in crowded rooms, noisy cars, etc.

ABLE uses noisy speech signals as perceived by users as input and Mean Opinion Scores (MOS) for quick evaluation and comparison of results. The highly accurate 3PASS background noise simulation complements the setup. Measurements with ABLE are a simple but universal, efficient, and conclusive method for comprehensively analyzing near-end voice communication quality in telecommunication, thus ensuring consistent, fully repeatable testing.



Communication and Audio Analysis

HEAD Standards

ACQUA Standards

Automated Test Suites for ACQUA

ACQUA standards provide complete implementations of all relevant international standards, for example, from 3GPP, ITU-T, ISO, IEC, ETSI, TIA, GCF, CTIA, GSMA, and Microsoft (Teams) for voice and audio quality. HEAD acoustics implements the ACQUA standards in databases for automated testing according to typical requirements. The more than sixty test suites provide advanced testing methods and focus on audio, voice, and communication quality.



HEAD acoustics Quality Standards (HQS)

Optimize Product Quality Beyond International Specifications

The international standardization bodies define specifications that cover a wide range of measurements and analyses for evaluating and optimizing communication systems. HEAD acoustics Quality Standards (HQS) go one step further: The test suites developed by HEAD acoustics enable manufacturers to measure and analyze their products beyond international specifications and optimize product quality.



*HQS smart home
measurement configuration
with double talker setup*



Speech Recognition

VoCAS (Voice Control Analysis System)

Test Speech Recognition Performance
– Bring Reality into the Lab

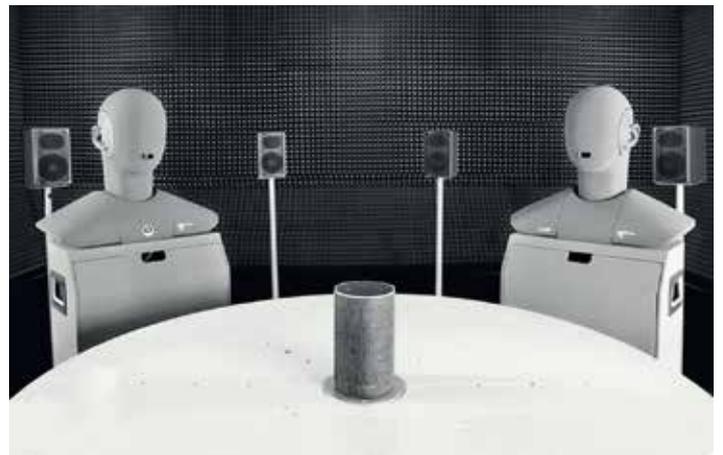


The VoCAS software objectively tests and evaluates speech recognition performance in a smart home, vehicle, or smartphone – to name a few – in a realistic environment. VoCAS is part of HEAD acoustics' sophisticated measuring and playback framework that mimics real-life situations as closely as possible, incorporating critical factors in measuring speech recognition quality with a so far unknown scope: VoCAS considers the acoustic environment, background noise, different talkers, different languages, and even accents.

VoCAS Core is the basic framework of VoCAS.

It features

- » test sequence templates for creating test cases to test and train ASR systems
- » remote control of background noise and reverberation simulation software
- » remote control of turntable HRT I





VoCOPTS

Build VoCAS Applications According to Your Requirements

VoCAS Options (VoCOPTS) extend the VoCAS Core with additional features and can be freely combined. The VoCOPTS fit any customer requirements.

Make any voice-activated device understand and perform better with VoCAS and VoCOPTS

VoCAS Options allow you to

- » record and edit customized audio files
- » create customized audio source databases for application in VoCAS
- » distract and test ASR systems with concurrent talkers
- » automate and accelerate test sequences with Python scripting
- » control VoCAS remotely
- » generate audio file batches with different parameters to train or test ASR systems



Data Acquisition

labCORE

Modular Multi-Channel Hardware Platform
for Voice and Audio Quality Testing



Up to 32 channels at 48 kHz or up to 8 channels at 192 kHz sampling rate, high-end inputs and outputs, and programmable interfaces



labCORE is a high-precision voice and audio quality testing hardware platform tailored to the ACQUA measurement and analysis software.

Up to 32 channels at 48 kHz or up to 8 channels at 192 kHz sampling rate, high-end inputs and outputs, and programmable interfaces: the state-of-the-art all-in-one solution offers and combines numerous features, so you can adapt *labCORE* precisely to your individual test scenarios and expand the hardware platform flexibly whenever needed. This modularity makes *labCORE* future-proof: New technologies can be added quickly and easily via optional hardware or software extensions.

Use *labCORE* for

- » testing voice and audio quality of communication devices
- » measuring loudspeakers and high-quality audio devices
- » testing transmission systems such as networks and routers
- » research and development (R&D)
- » conformance testing
- » quality control



KEY FEATURES

- » High-precision measurement technology
- » High-performance digital & analog inputs and outputs
- » Modular: up to 10 optional hardware extension boards and numerous software extensions
- » Up to 32 channels at 48 kHz or up to 8 channels at 192 kHz
- » Versatile, individual tailoring to specific measurement tasks
- » Future-proof – conveniently implement new technologies and interfaces
- » Fast, easy configuration and control via ACQUA
- » Silent operation, no fan

Data Acquisition

Integrated *labCORE* Extensions

Adapt *labCORE* to Your Needs

These are some of the essential *labCORE* extensions.

- » **coreOUT-Amp2** is a power amplifier board that adds two separate power amplifiers to the system, each providing 20W RMS, allowing the simultaneous operation of two artificial heads' mouths or two loudspeaker drivers, for example, for in-car communication measurements (ICC).
- » **coreIN-ICP4** provides four high-precision low-noise analog input channels for pre-polarized ICP[®] sensors, e.g., ICP[®] microphones. Each of the four inputs supports TEDS for data exchange with the connected sensor.
- » **coreOUT-A2**, and **coreIN-A2**: Analog input and Analog output boards. These *labCORE* extensions provide two analog input or output channels with XLR and BNC sockets. Both in/outputs offer the highest signal precision, achieving the lowest distortion and inherent noise.
- » **coreBEQ** enables *labCORE* to equalize the binaural ear simulators of HEAD acoustics artificial heads. The extension consists of a set of equalization filters for one user-selected artificial head.
- » **coreIP**: With *coreIP*, *labCORE* becomes a reference gateway for voice quality measurements of IP-based communication devices such as VoNR, VoIP or VoLTE phones.
- » **Bluetooth[®] connections**, including the Bluetooth[®] Low Energy Audio: Realistically and reproducibly testing voice and audio quality via a Bluetooth connection (as transmitter and receiver) poses a real challenge for manufacturers since Bluetooth connections can significantly impact both the communication and audio quality.

You can find the complete overview on our website:





Other special extensions:

- » The **coreA2B** interface offers four user-selectable modes, allowing *labCORE* to operate as a master or slave node, listen passively, or actively receive and insert user-specified signals in the Automotive Audio Bus.
- » **coreIP-IMP** simulates network conditions like jitter, delay, and packet loss.
- » **coreIP-OPUS** provides the audio codec Opus.
- » **coreIP-Alexa** enables the hardware platform to act as an Amazon Alexa reference client.

With the **coreA2B** board, *labCORE* connects to Analog Devices' **A2B**[®] bus in four user-selectable modes. Together with the extensions **coreIN-Mic4** (LEMO) or **coreIN-ICP4**, it forms an ideal solution for automotive applications.



The analog input and output extension cards **coreIN-A2** and **coreOUT-A2** are highly precise, low-noise interfaces for analyzing broadband audio signals such as speech, music, or noise. They feature two in- or outputs respectively.



Sound Field Simulation

3PASS *lab, flex, reverb*

Background noise and reverberation can impair voice recognition system quality, speech quality, and speech intelligibility during phone conversations. To evaluate communication devices as well as systems with complex microphone setups, they must be tested with realistic and reproducible background noise and reverberation simulation. Our 3PASS simulation integrates into the powerful *labCORE* and *ACQUA* tool framework, offering unprecedented possibilities and ease of use.

3PASS *lab*

Fully Automated Background Noise Simulation for Communication Device Testing

3PASS *flex*

Fully Automated Background Noise Simulation for distributed and complex Microphone Setups

3PASS *reverb*

Room Reverberation Simulation – controlled via 3PASS *lab* or 3PASS *flex*



Automated background noise and reverb simulation with 3PASS

Find out everything about products related to Playback and Noise Simulation:





*MSA I
Asymmetrical 8-Channel
Microphone
Surround Array for
recording three dimensional
sound scenarios for mobile
phone applications*



*MSA II
Symmetrical 8-Channel
Microphone
Surround Array for
recording three dimensional
sound scenarios for binaural
applications*

MSA I & MSA II

Microphone Arrays for Three-Dimensional Noise Recordings

The microphone arrays MSA I (asymmetrical microphone setup) and MSA II (symmetrical microphone setup) enable recording, equalizing the associated loudspeaker setup and realistically reproducing background noise and reverberation across laboratories.

HAE-car & HAE-BGN

Background Noise Playback and Semi-Automated Equalization in a Lab and Vehicle

The HAE-car and HAE-BGN software allow semi-automated equalization and enable automated playback of background noise in a vehicle cabin (HAE-car) and a lab (HAE-BGN). The equalization makes it possible to reproduce previously recorded noises in level and spectrum at an arbitrary location in the vehicle.

labBGN

Hardware Platform for Background Noise Simulation

labBGN is an audio distribution interface for up to ten channels. You can use this ACQUA/lab Generation platform with all our background noise simulation systems for fully repeatable testing of telecommunication and other devices in the presence of background noise.

Dynamic and Time-Variant Testing

Accessories

move°S

High-precision Ultra-silent Motorized Head Shoulder Unit

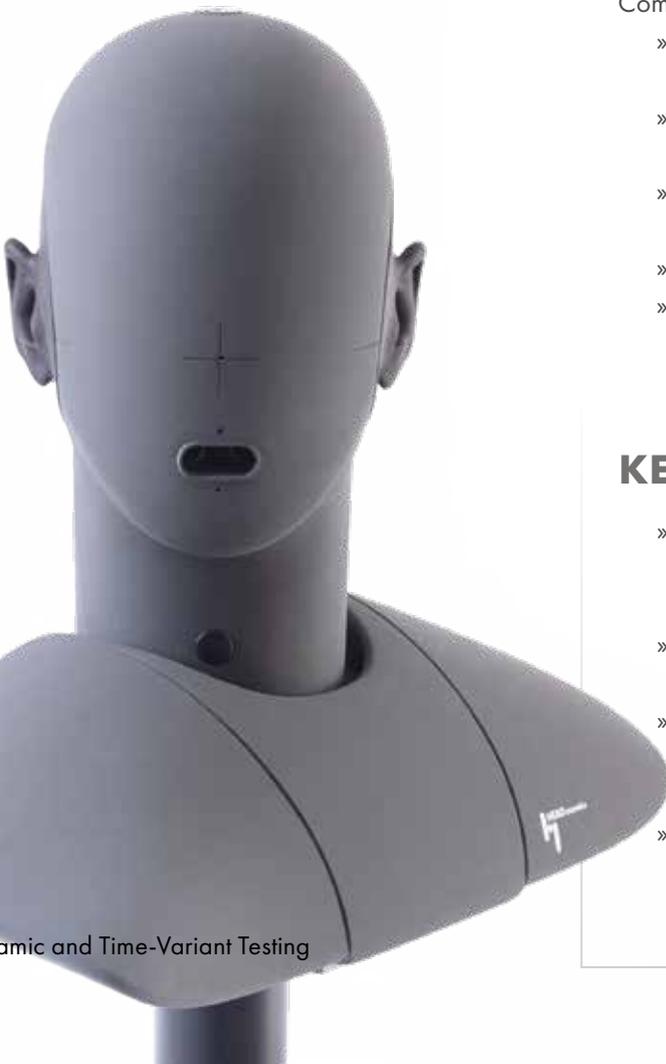
move°S rotates the 2021-generation HMS II.x and all Head Shoulder Units (HSU) III of the 2021 generation 1 with high precision and full repeatability. move°S can realistically simulate the head movements of a real person. The mechanism operates virtually noiseless and, therefore, can also turn the artificial head during measurements at all reasonable speeds.

Comprehensive testing of, e.g.:

- » virtual- / augmented Reality (VR/AR) headsets
- » in-vehicle communication systems & devices (ICC, eCall, hands-free communication, etc.)
- » effects of acoustic reflections on shoulders and nearby surfaces, e.g., in vehicles
- » arbitrary applications using head tracking
- » systems with direction-dependent behavior, e.g., multi-user conferencing systems

KEY FEATURES

- » Upgrades qualified HMS II and HSU III with a motorized turning of the artificial head
- » Realistically simulates the head movements of a natural person
- » Virtually noiseless operation – move°S can be used between and during measurements
- » Software-controlled movement via USB or pulses, e.g., for full automation in HEAD acoustics test suites





HRT I

High-precision Ultra-silent Turntable for Orientation-dependent Acoustic Tests

The HRT I high-precision turntable rotates test objects, e.g., telephony devices, (video) conferencing systems, loudspeakers, microphones, or measurement equipment like the HMS to specific angles in the measurement field while emitting no noise at the target positions. HRT I can perform fully automated tests offering a 360° rotation range in 0.1°-steps and a reproduction accuracy of 0.02 °.



HRR I

Rotating Sound Reflector

During acoustic tests, the HRR I noiseless motorized rotating reflector influences the acoustic coupling between the loudspeaker and microphones, allowing you to quickly change and reset the acoustic echo path, e.g., in hands-free communication. You can use HRR I in any hands-free situation and location as an automated and noise-free acoustic reflector, giving you complete control and precise repeatability.



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