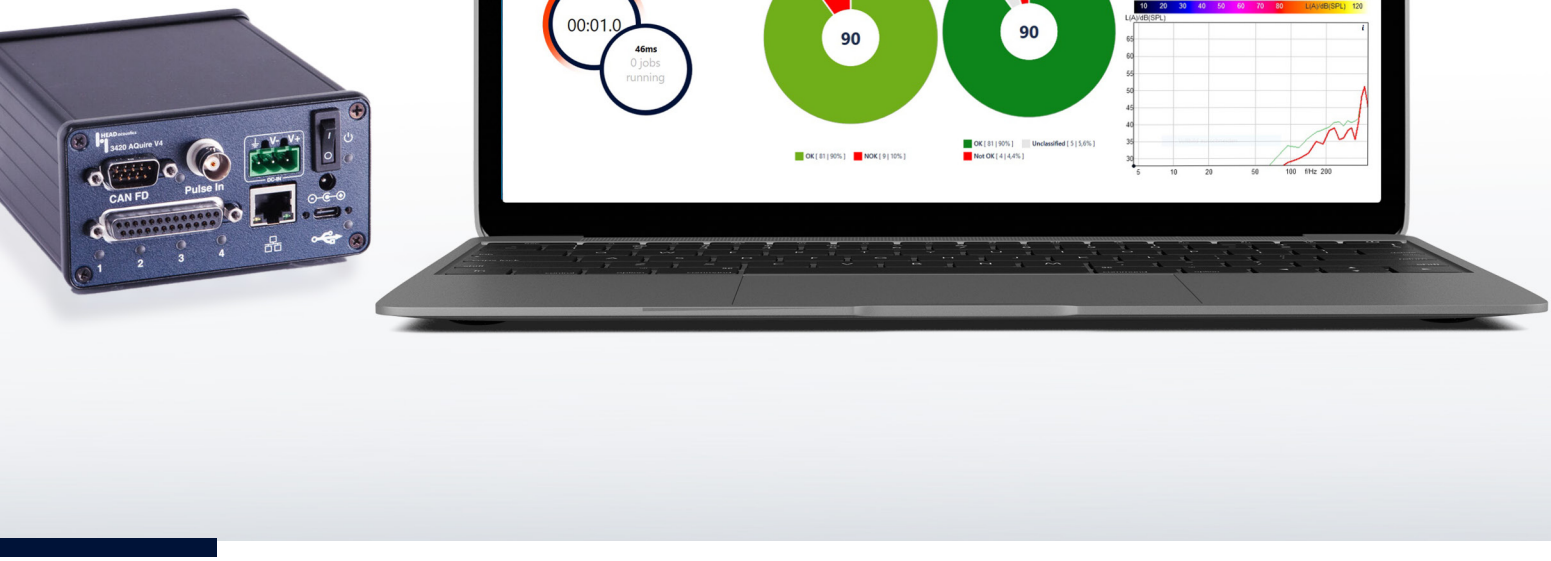
HEAD acoustics

DATA SHEET



Code 42000

conTEST

conTEST is a modular, AI-enabled software specifically designed for end-of-line processes (EoL) and condition monitoring. With conTEST, you are using the most advanced and reliable vibroacoustic quality testing solutions on the market, providing you with process-secure and fully automated fault detection. This will help you meet your customers' expectations and remain competitive.

OVERVIEW

conTEST

Code 42000

Using standardized interfaces, conTEST can be quickly and seamlessly integrated into your test benches or production lines. Not only do you receive real-time data processing for 24/7 continuous operation, but also a comprehensive range of analyses and tools for your EoL quality testing.

The conTEST user interface is clear and easy to use. You are free to customize conTEST to your individual needs. Switch quickly and flexibly between different profiles at the push of a button.

KEY FEATURES

Software for quality assurance of production lines (end-of-line) based on vibration and sound measurements including non-contact data acquisition techniques such as laser vibrometers

Standardized interfaces for smooth integration into production lines

Easy integration of AI models

Real-time data processing (including condition monitoring)

Wide range of analyses and tools (psychoacoustic analyses, sound metrics, FFT analyses, ...)

High flexibility thanks to easy switching between the different profiles

Customizing procedures using automation specifications.

Detailed logging

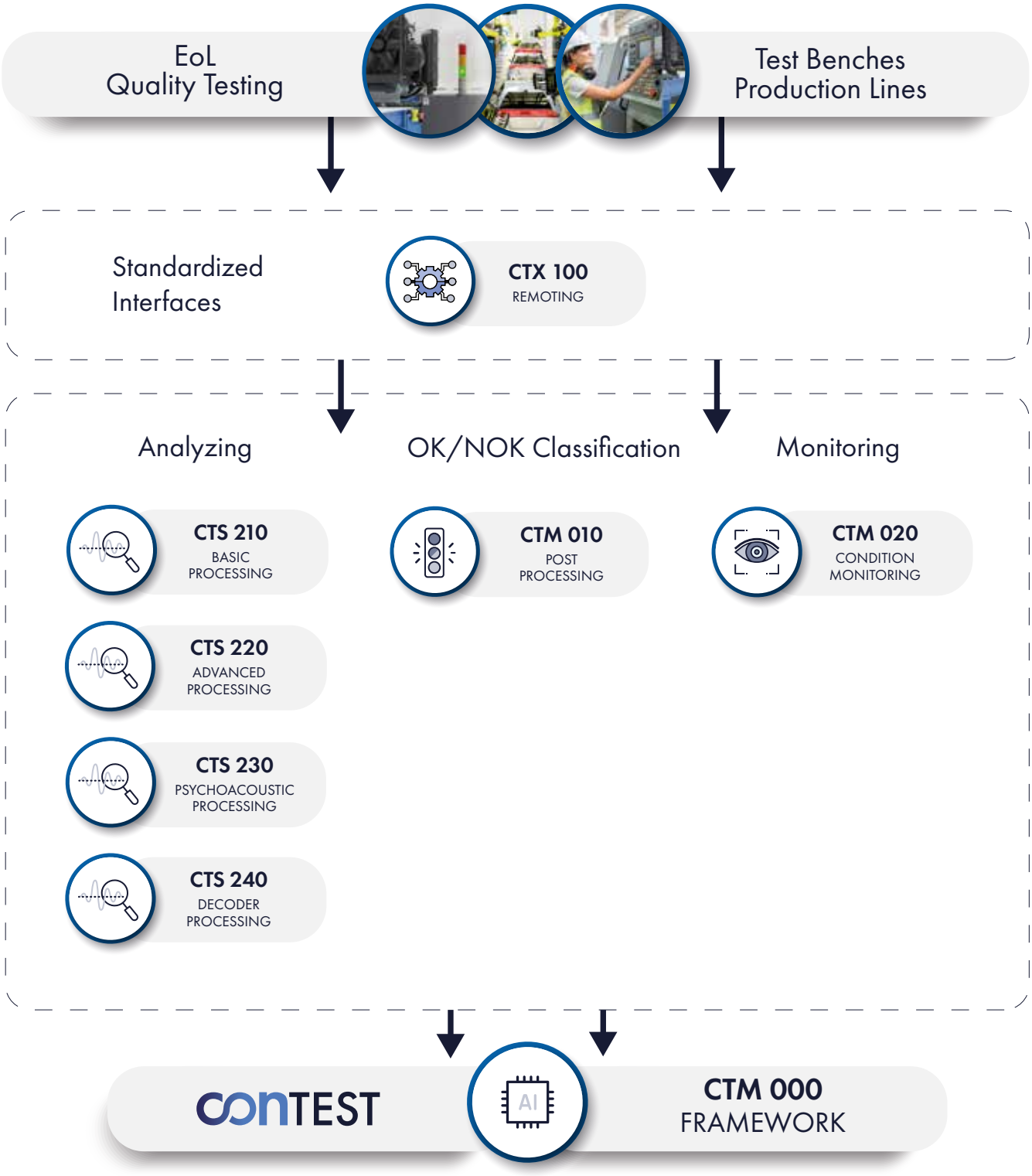
User-friendly operation thanks to customized configuration of the main screen

APPLICATIONS

EoL quality controls for

- Vehicle components in the automotive sector (engines, gear boxes, electronics, brakes, ...)
- Electrical appliances (washing machines, dryers, vacuum cleaners, ...)
- Computers, hard disks, ...
- Air conditioning systems, heat pumps, ...
- Aviation and aerospace, ...

At a Glance


EoL
Quality Testing
Test Benches
Production Lines
Standardized
Interfaces
CTX 100
REMOTING
Analyzing
OK/NOK Classification
Monitoring
CTS 210
BASIC
PROCESSING
CTM 010
POST
PROCESSING
CTM 020
CONDITION
MONITORING
CTS 220
ADVANCED
PROCESSING
CTS 230
PSYCHOACOUSTIC
PROCESSING
CTS 240
DECODER
PROCESSING
CONTEST
AI
CTM 000
FRAMEWORK

DETAILS

The innovative conTEST software supports your EoL quality assurance using advanced signal processing algorithms for fully automated problem detection in your daily production routine. With its modular design, conTEST is easy to use, runs reliably even in continuous operation (24/7), and delivers highly accurate results in real time.

Seamless Integration

For seamless integration into your EoL test benches and production lines, conTEST currently provides the following standardized interfaces:

- gRPC adapter
- TCP/IP adapter
- Serial adapter
- Digital I/O adapter

Programming examples on how to use these interfaces as well as a detailed interface documentation can be found in the integrated help system.

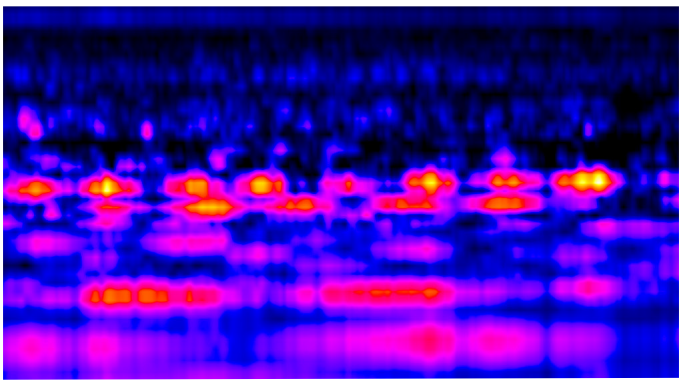
Programming example for the gRPC adapter from the conTEST help system

Highly Accurate Quality Testing – e.g., by Using Psychoacoustic Analyses Based on the Sottek Hearing Model

When it comes to problem detection and identification, conTEST uses sound and vibration analyses to check assemblies and components. conTEST provides a wide range of analysis and test methods that enable you to make precise OK/NOT OK classifications (OK/NOK).

In addition to a large number of basic analyses and methods, you have the option of using psychoacoustic analyses, such as Loudness, Roughness, Impulsiveness, and Tonality, all based on the Sottek Hearing Model. Based on cognitive signal processing and pattern recognition of the human sense of hearing, the Sottek Hearing Model is characterized by a high correlation between objective measurement results and subjective ratings of psychoacoustic jury tests. When being used in conTEST, these analyses detect anomalies that otherwise only the human sense of hearing could detect.

In addition, conTEST provides further tools, such as statistical calculations, filter options, extracting of signals, etc.



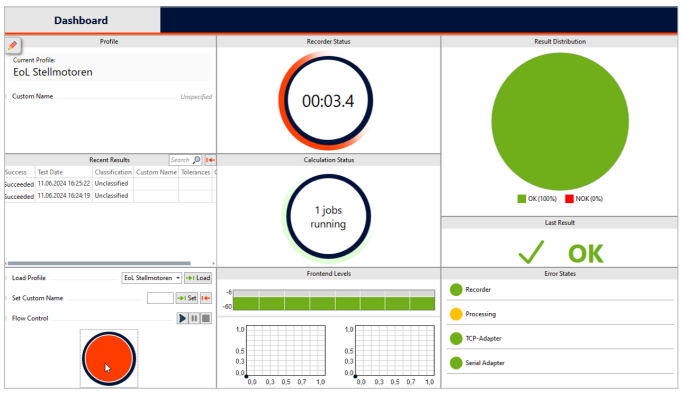
Example of the Specific Tonality (Hearing Model) vs. Time analysis

Reliable OK/NOK Classification

With conTEST, designing the best OK/NOK classification procedures for your purposes is as easy as can be.

Individually configurable automation specifications enable you to define the analysis, evaluation, and monitoring tasks you need as processing steps that are automatically executed one after another and used for classification. In addition to analysis tasks, this also includes the decoding of input signals, filtering, and statistical calculations, for example.

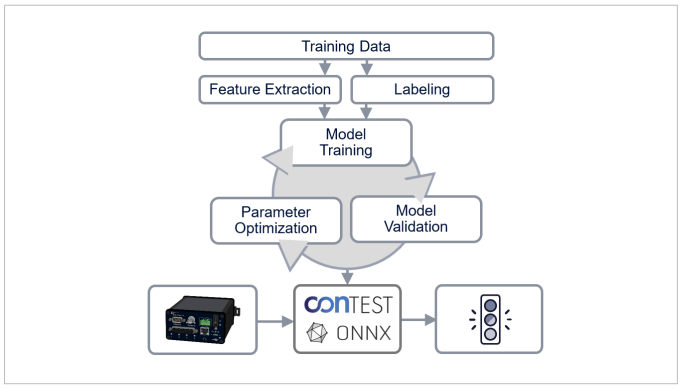
It is particularly important to use tolerances to check measurements for exceeding or falling below limits. With just a few steps, customized threshold curves can be defined and used as a basis for classifications.



conTEST user interface

Artificial Intelligence

conTEST enables neuronal networks to be used for detecting distinctive noise phenomena in your test benches and production lines. Based on deep learning models (ONNX – Open Neural Network Exchange), conTEST can detect product anomalies and decide in real time whether or not a product meets the requirements.



AI-enabled noise detection

Customized User Interface

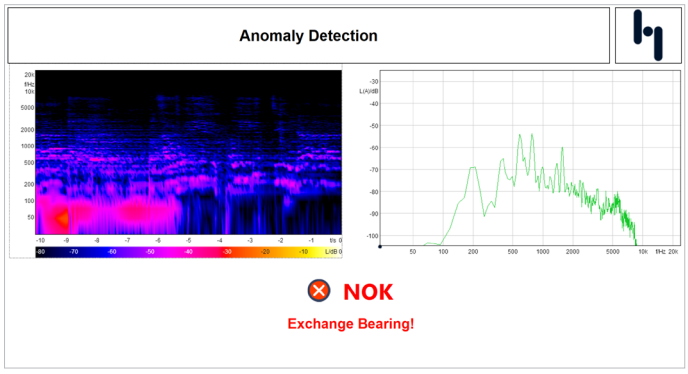
Feel free to position controls as well as analysis and evaluation elements, etc. anywhere on the screen to optimize the user interface to your specific requirements.

Condition Monitoring

The Condition Monitoring module enables real-time monitoring, e.g., to check functionality, quality, and safety quickly and flexibly with the help of endurance tests. Use this tool to detect wear and tear on components or vibrations on rotating machines at an early stage, take preventive measures, and prevent downtime.

Real-time monitoring is carried out using selected analyses and tools that can be freely positioned.

The AQuire V4 4-channel frontend, which is perfectly coordinated with conTEST, can also be used for this purpose.



Detection of bearing damage using Condition Monitoring

conTEST Modules

CTM 000
FRAMEWORK

Framework
CTM 000 (Code 42000)

License for the basic module of conTEST which combines the various conTEST modules into a single unit. The Framework license includes a clearly structured, freely configurable user interface, enabling you to easily operate the individually assembled components.

CTX 100
REMOTING

Remoting
CTX 100 (Code 42100)

License to use the implemented standardized interfaces in order to integrate conTEST in EoL test benches and production lines.

- gRPC adapter
  Communication via Remote Procedure Calls
- TCP/IP adapter
  Communication using the text-based protocol via network adapter
- Serial adapter
  Communication using the text-based protocol via serial interfaces
- Digital I/O adapter
  Reduced communication using digital I/O devices connected via USB
- The CTX 100 scope of delivery does not include the option of implementing a non-standardized interface not yet included in conTEST. If you need this option, please get in touch with your contact person.

CTM 010
POST
PROCESSING

Post Processing
CTM 010 (Code 42010)

License to use the tools for OK/NOK classification

- Automation specifications
  (Import of HPSX files created from Automation Projects in ArtemiS SUITE)
- Tolerance checks
- Flow Control
- Triggers

CTS 210
BASIC
PROCESSING

Basic Processing
CTS 210 (Code 42210)

License to use basic analysis and editing tools

- Analyses
- Offline filters
- Statistical functions

Spectral analyses

- FFT vs. Time
- FFT (averaged)
- FFT (peak hold)
- 1/n Octave Spectrum (FFT)
- 1/n Octave Spectrum (FFT) vs. Time
- 1/n Octave Spectrum (FFT) (peak hold)
- Power Spectral Density vs. Time
- Power Spectral Density (averaged)
- Power Spectral Density (peak hold)

RPM analyses

- FFT vs. RPM
- 1/n Octave Spectrum (FFT) vs. RPM
- Power Spectral Density vs. RPM
- Level vs. RPM
- Level vs. RPM (filtered)
- Gated Time Cuts
- Gated Time Cuts (averaged)
- RPM vs. Time
- Signal vs. RPM

Level analyses

- Level (single value)
- Level vs. Time
- Level vs. Time (filtered)

Offline filters

- Equalization filter
- IIR filter
- FIR filter
- Binaural FIR filter
- Differentiating
- Integrating
- Resample
- Unit Conversion
- Vector Magnitude
- Linear Mapping
- Envelope
- Pitch Shift
- Delay

Statistical functions:

- Channel statistics: 2D, 3D, time data
- File statistics: 2D, 3D, time data
- Folder statistics
- Channel difference: 2D, 3D, time data
- File difference: 2D, 3D, time data

Distribution, percentile analyses, and functions:

- Distribution from 2D Analysis, 3D Analysis, or Recording
- Percentiles from 2D Analysis or Recording

Analyses to characterize the decay behavior of rooms

- Reverberation Time
- Reverberation Time vs. Band

CTS 220
ADVANCED
PROCESSING

Advanced Processing
CTS 220 (Code 42220)

License to use sophisticated analyses, e.g.,:

- Spectral analyses showing a high or variable frequency resolution (calculated vs. time and as a function of reference quantities, such as RPM, force, ...)
- Modulation analyses, 1/n Order analyses, and octave analyses (filters), ...

Spectral analyses

- HSA vs. Time
- HSA (averaged)
- VFR vs. Time
- VFR (averaged)
- Wavelet
- HSA vs. RPM
- VFR vs. RPM

Order analyses

- Order Spectrum
- Order Spectrum vs. Time
- Order Spectrum vs. RPM
- Order Spectrum (peak hold)
- Time Signal vs. Rotation

1/n Octave analyses

- 1/n Octave Spectrum (filter)
- 1/n Octave Spectrum (filter) (peak hold)
- 1/n Octave Spectrum (filter) vs. Time
- 1/n Octave Spectrum (filter) vs. RPM

Modulation analyses

- Modulation Frequency vs. Time or RPM
- Modulation Spectrum
- Degree of Modulation vs. Time or RPM
- Modulation Spectrum vs. Time or RPM
- Modulation Spectrum vs. Band
- Weighted Modulation Analysis

More analyses

- Gated DFT vs. Time
- Gated DFT (averaged)
- Cepstrum
- Cepstrum vs. Time
- Kurtosis vs. Time
- Cepstrum vs. RPM
- Kurtosis vs. RPM

CTS 230
PSYCHOACOUSTIC PROCESSING

Psychoacoustic Processing
CTS 230 (Code 42230)

License to use sophisticated psychoacoustic analyses based on the characteristics of the human sense of hearing

- Basic psychoacoustic analyses, such as Loudness, Sharpness, Tonality, Specific Prominence, and Fluctuation Strength
  (calculated vs. time and as a function of reference quantities, such as RPM, force, ...)
- Sophisticated psychoacoustic analyses, such as Loudness, Roughness, and Tonality, all based on the Sottek Hearing Model
  (calculated vs. time and as a function of reference quantities, such as RPM, force, ...)

- Psychoacoustic analyses
  - Loudness vs. Time
  - Specific Loudness
  - Specific Loudness vs. Time
  - Sharpness vs. Time
  - Tonality DIN 45681
  - Tonality DIN 45681 vs. Time
  - Tone to Noise Ratio
  - Tone to Noise Ratio vs. Time
  - Specific Prominence Ratio
  - Specific Prominence Ratio vs. Time
  - Fluctuation Strength vs. Time
  - Specific Fluctuation Strength
  - Specific Fluctuation Strength vs. Time
  - Loudness vs. RPM
  - Specific Loudness vs. RPM
  - Sharpness vs. RPM
  - Tonality DIN 45681 vs. RPM
  - Tone to Noise Ratio vs. RPM
  - Specific Prominence Ratio vs. RPM
  - Fluctuation Strength vs. RPM
  - Specific Fluctuation Strength vs. RPM

Standards

- Loudness
  - DIN 45631/A1
  - ISO 532-1, ISO 532-3
  - ANSI S3.4-2007 (FFT) / (FFT/3rd Octave)
- Sharpness
  - Aures
  - von Bismarck
  - DIN 45692
  - DIN 45631/A1
  - ISO 532-1, ISO 532-3
  - ANSI S3.4-2007 (FFT) / (FFT/3rd Octave)
- Tonality
  - DIN 45681

- Psychoacoustic analyses (Hearing Model)
  - Loudness (Hearing Model) vs. Time
  - Specific Loudness (Hearing Model)
  - Specific loudness (Hearing Model) vs. Time
  - Tonality (Hearing Model) vs. Time
  - Specific Tonality (Hearing Model)
  - Specific Tonality (Hearing Model) vs. Time
  - Tonality (Hearing Model) Frequency vs. Time
  - Roughness (Hearing Model) vs. Time
  - Specific Roughness (Hearing Model)
  - Specific Roughness (Hearing Model) vs. Time
  - Impulsiveness (Hearing Model) vs. Time
  - Specific Impulsiveness (Hearing Model)
  - Specific Impulsiveness (Hearing Model) vs. Time
  - Spectrum (Hearing Model) vs. Time
  - Relative Approach 2D
  - Relative Approach 3D
  - Loudness (Hearing Model) vs. RPM
  - Specific Loudness (Hearing Model) vs. RPM
  - Tonality (Hearing Model) vs. RPM
  - Specific Tonality (Hearing Model) vs. RPM
  - Tonality (Hearing Model) Frequency vs. RPM
  - Roughness (Hearing Model) vs. RPM
  - Specific Roughness (Hearing Model) vs. RPM
  - Impulsiveness (Hearing Model) vs. RPM
  - Specific Impulsiveness (Hearing Model) vs. RPM

Standards

- Loudness (Hearing Model)
  - ECMA-418-2 (2nd)
- Roughness (Hearing Model)
  - ECMA-418-2 (1st) / (2nd)
- Tonality (Hearing Model)
  - ECMA-74 (15th) / (17th)
  - ECMA-418-2 (1st) / (2nd)

CTS 240
DECODER
PROCESSING

Decoder Processing
CTS 240 (Code 42240)

License to use decoders for the extraction of signals

Extracting signals

- CAN FD, CAN, OBD-2, incl. WWH-OBD
- FlexRay
- GPS (satellite navigation systems)
- Pulse
- Trigger
- Resolver
- Direction of rotation

CTM 020
CONDITION
MONITORING

Condition Monitoring
CTM 020 (Code 42020)

License to monitor test benches or production lines in real time

Available analyses and tools

- 2D Diagram
- 3D Floating Diagram
- 3D Floating Diagram vs. RPM
- 2D Floating Diagram
- Level Meter

Perfectly coordinated Software and Hardware

Versatile and Accurate in Continuous Operation

AQuire V4 is a cost-effective 4-channel frontend with network and USB connectivity for sound and vibration measurements including non-contact data acquisition techniques such as laser vibrometers.

Perfectly coordinated with conTEST, AQuire V4 enables customized OK/NOK classifications and is the ideal solution for accurate results in end-of-line quality testing. AQuire V4 records vibroacoustic and other analog measurement quantities which are then automatically checked and evaluated by conTEST. Products that do not meet the desired specification are quickly and safely separated from flawless units.

AQuire V4 can be used as a desktop device on a desk, e.g., in control rooms of test benches, or permanently mounted for continuous operation using the top hat rail (DIN EN 60715 TH35) that comes with the device.

With its wide range of power supply options (Power over Ethernet, USB 3.0, DC-coaxial power connector, or the three-pole terminal), AQuire V4 is very easy to integrate into an existing infrastructure.

4-channel frontend AQuire V4

More Features of AQuire V4

- 4 analog voltage ICP inputs with switchable power supply (±5 V, ±12 V, ±15 V)
- Switchable analog highpass filters (1.6 Hz, 22 Hz)
- High signal quality due to electrical isolation of the inputs
- CAN FD input with 5 Mbit/s data rate in accordance with ISO 11898-2:2015 and ISO 15765-4
- Pulse inputs with a maximum pulse frequency of 250 kHz (adjustable threshold value and adjustable hysteresis)
- Compatible with ArtemiS SUITE

Scope of Delivery, Options, and Accessories

Scope of Delivery

- CTM 000 (Code 42000)
  Framework (conTEST basic module)

Software Options (conTEST Modules)

- CTM 010 (Code 42010)
  Post Processing
- CTM 020 (Code 42020)
  Condition Monitoring
- CTS 210 (Code 42210)
  Basic Processing
- CTS 220 (Code 42220)
  Advanced Processing
- CTS 230 (Code 42230)
  Psychoacoustic Processing
- CTS 240 (Code 42240)
  Decoder Processing
- CTX 100 (Code 42100)
  Remoting

Hardware Options

- AQuire V4 (Code 3420)
  4-channel frontend with network connection for end-of-line applications
- Modular HEAD*lab* system
  - Controller, compact systems (required)
    - *lab*CTRL II.1 (Code 3704)
    - *lab*COMPACT12 II (Code 31020)
    - *lab*COMPACT24 II (Code 31021)
  - Input modules (recommended) for voltage and IEPE/ICP sensors (TEDS), condenser microphones, charge sensors, thermocouples, measuring bridges, CAN FD, CAN, OBD, FlexRay, RPM sensors
    - *lab*VF6 II (Code 3752)
    - *lab*V12 II (Code 3753)
    - *lab*V24 II (Code 3755)
    - *lab*M6 II (Code 3754)
    - *lab*V6HD (Code 3728)
    - *lab*CF6 (Code 3725)
    - *lab*T6 (Code 3726)
    - *lab*SG6 (Code 3727)
    - *lab*DX (Code 3741)
    - *lab*HRT6 (Code 3743)
    - *lab*V12-O4 II (Code 3759)
    - More input modules are in preparation

HEAD acoustics

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