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 available on the market, providing you with process-secure and fully automated fault detection. This will help you to meet your customers' quality expectations of your products 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. Customize conTEST to your individual needs. Switch quickly and flexibly between different profiles at the push of a button.

KEY FEATURES

Quality testing software for 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

Quality testing of products, devices, and systems with OK/NOK classification (Post-Processing) and real-time Condition Monitoring

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

High flexibility thanks to easy switching between different profiles

Customizing procedures using automation specifications

Detailed logging

Customized configuration of the main screen

APPLICATIONS

EoL quality testing 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, ...

DETAILS

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

1. Interfaces

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

› MQTT adapter

Practical programming examples and detailed interface documentation can be found in the integrated help system.

Documentation for the gRPC adapter from the conTEST help system

2. Post-Processing

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 use 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 used in conTEST, these analyses detect anomalies that otherwise only the human sense of hearing could detect.
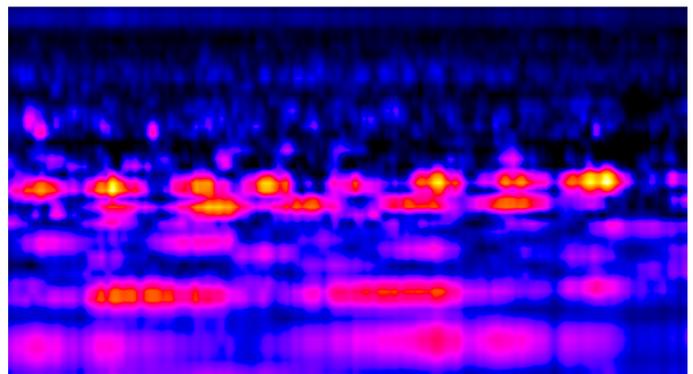
In addition, conTEST provides further tools, such as statistical calculations, filters, signal extraction, etc.

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.

If you wish to program your own applications and use them for data processing, CTS 250 is an add-in that enables you to directly access the conTEST data flow and seamlessly integrate your application.

Artificial Intelligence

conTEST enables neuronal networks to be used for detecting distinctive noise phenomena in your test benches and production lines. We work with you to train and test the optimum AI for you. This enables your individual conTEST solution to recognize product anomalies on the basis of deep learning models (ONNX – Open Neural Network Exchange) and to decide in real time whether or not a product meets the requirements.

Customized User Interface

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

3. 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 downtimes.

There are selected analyses and tools available for real-time monitoring. Like Post-Processing, Condition Monitoring also enables user interfaces, operator controls, analyses, etc. to be individually adapted and positioned.

The AQuire V4 4-channel frontend, which is perfectly coordinated with conTEST, can be used for both tasks.
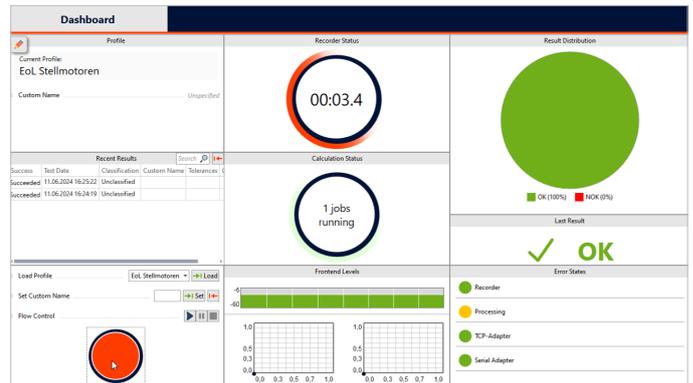
conTEST user interface
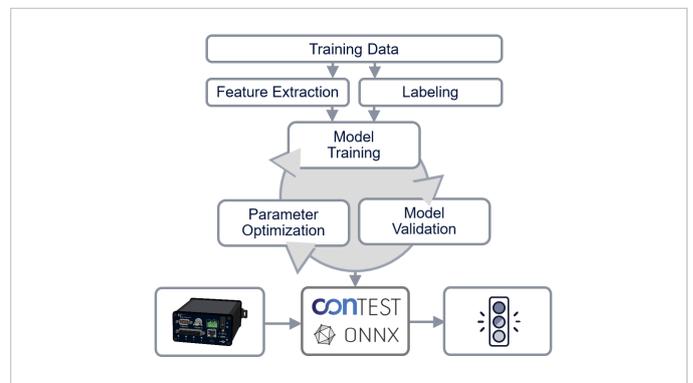
AI-enabled noise detection

Detection of bearing damage using Condition Monitoring

Perfectly Coordinated Software and Hardware

Versatile and Accurate in Continuous Operation

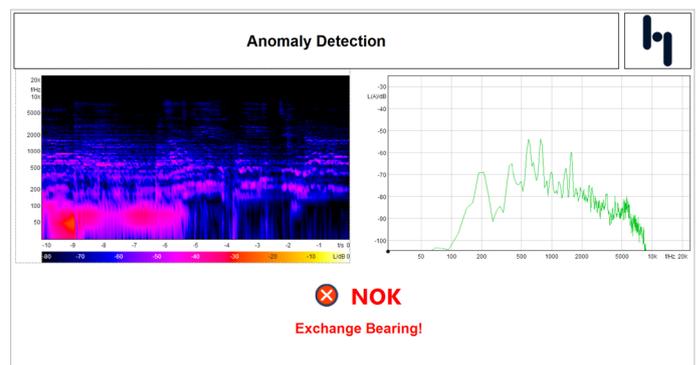AQuire V4 is a cost-effective 4-channel frontend with network and USB connectivity for sound and vibration measurements including non-contact data acquisition techniques such as laser vibrometers.

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.

AQuire V4 4-channel frontend

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 1898-2:2015 and ISO 15765-4

› Pulse inputs with a maximum pulse frequency of 250 kHz (adjustable threshold value and adjustable hysteresis)

› Compatible with ArtemiS SUITE

Overview – conTEST Modules

Take advantage of the modular structure of conTEST and put together your own customized solutions.
Select a package consisting of CTM 000 Framework, the CTM 010 Post-Processing module, and at least one CTS option and/or the CTM 020 Condition Monitoring module. The CTX 100 Remoting module with various interfaces is available for connecting to your test bench.

EOL Quality Testing

Test Benches Production Lines

CTX 100 REMOTING

CTM 010 POST PROCESSING

CTM 020 CONDITION MONITORING

CTS 210 BASIC PROCESSING

CTS 220 ADVANCED PROCESSING

CTS 230 PSYCHOACOUSTIC PROCESSING

CTS 240 DECODER PROCESSING

CTS 250 DATA PROCESSING ADD-IN API

conTEST

CTM 000 FRAMEWORK

AI
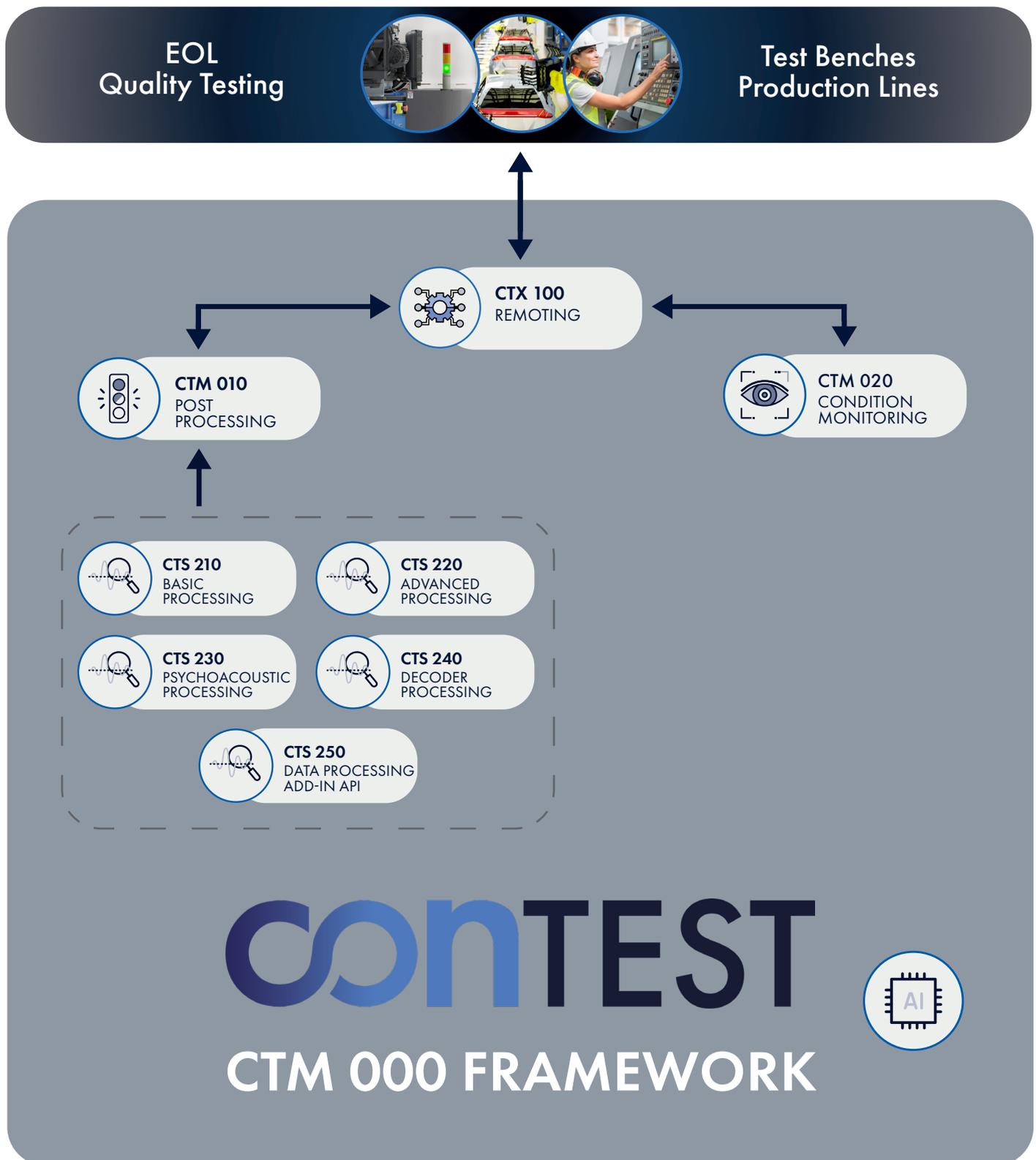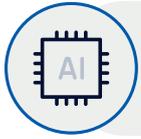
Framework

CTM 000
FRAMEWORK

Framework
CTM 000 (Code 42000)

License for the basic module of conTEST that combines the various conTEST modules into a single unit. The Framework license includes a clearly structured and freely configurable user interface as well as additional tools, such as Flow Control and triggers, enabling you to easily operate the individually assembled components.

Remoting Module

CTX 100
REMOTING

Remoting
CTX 100 (Code 42100)

License to use the implemented standardized interfaces for automated monitoring or long-term monitoring of EoL test benches and production lines using conTEST.

› 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

› MQTT adapter
  Communication using a structured topic tree via network interfaces

The CTX 100 scope of delivery does not provide the option of implementing a non-standardized interface that is not yet included in conTEST. If you need this option, please get in touch with your contact person.

Post-Processing Modules

CTM 010
POST PROCESSING

Post-Processing
CTM 010 (Code 42010)

License to use the tools for OK/NOK classification.

› Automation specifications (HPSX files created from Automation Projects in ArtemiS SUITE can be imported)

› Tolerance checks

CTM 010 is the prerequisite for CTS 210, CTS 220, CTS 230, CTS 240, and CTS 250.

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
› Differentiate
› Integrate
› 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 of a 2D/3D analysis or a recording
› Percentiles of a 2D analysis or a 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 with a high or variable frequency resolution (calculated vs. time and as a function of the reference quantities, such as RPM, force, ...)

› Modulation analyses, 1/n order analyses, and octave analyses (filters), ...

› Individual processing of channels (Channel Calculation)

Spectral analyses

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

Channel calculation

› Creating a script for individual processing of channels or cross-channel operations

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 human 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

› 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
  › DIN 45631/A1
  › ISO 532-1, ISO 532-3
  › ANSI S3.4-2007 (FFT) / (FFT/Octave)

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

› Tonality
  › DIN 45681

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)
› Pulses
› Triggers
› Resolvers
› Direction of rotation

CTS 250 DATA PROCESSING ADD-IN API

Data Processing Add-In API
CTS 250 (Code 42250)

License to directly access the conTEST data flow and seamlessly integrate external applications (analyses, filters, etc.) into the OK/NOK classification process.

› Various programming platforms (MATLAB®, Python, etc.) can be used for programming external applications. Practice-oriented model applications, programming references, and detailed technical information help you to use the Data Processing Add-In API quickly and efficiently.

› The programmed applications can be used in the same way as the post-processing tools available in conTEST. However, the data stream is passed from the Data Processing Add-In API to the external application and is filtered, analyzed, or post-processed by it, for example. The results are then passed back to conTEST. All other conTEST functionalities can be used as usual.

› Appropriate add-ins are available for the various use cases in data exchange between conTEST and the external application.

Analysis Add-In
(Time signal to 2D/3D analysis)

› Calculating a 2D/3D analysis from a time signal

Post-Analysis Add-In
(Analysis from 2D/3D analysis)

› User-specific post-processing of a 2D/3D analysis result – e.g., integrating a user-specific weighting function or an analysis based on an averaged spectrum (FFT averaged)

Filter Add-In
(Time signal to time signal)

› Filtering or processing a multi-channel time signal
› Calculating a time signal from a time signal

Programming platforms

› MATLAB®
› Python for .NET
› All executable files (*.exe) programmed in a language that can import .NET libraries, for example:
  › C#, F#, Visual Basic .NET
  › C++/CLI
  › PowerShell Script

Export Add-In
(Export to any user-specific file format)

› Exporting the input format from any time signals as well as 2D and 3D files
› Processing several HDF files into one export file

Export-Merge Add-In

› Creating any data format from several HDF data sets for further processing of conTEST data in an external program
› Simultaneous transfer of any number of HDF data sets, e.g., to MATLAB®, for conversion into a foreign format

Condition Monitoring Module

CTM 020
CONDITION
MONITORING

Condition Monitoring
CTM 020 (Code 42020)

License to monitor a test bench or production line in real time.

› Various analyses and individually definable tolerance checks

› Connecting the test bench or production line via an interface of the CTX 100 (Remoting) module enables CTM 020 to be used for automatic monitoring of incoming data and to trigger alarms when faults are detected.

Recommended Analyses and Tools

› 2D Diagram
(Representation of two-dimensional data over a frequency, order, or time axis)
  › FFT
  › 1/n Octave
  › Order
  › Time
  › Sound Power
  › Transfer Function
  › Coherence

› 2D Floating Diagram
(Representation of the time curve of one-dimensional short-term analysis results over a time axis)
  › Time
  › Level
  › Sound Power

› 3D Floating Diagram
(Representation of the time curve of a two-dimensional short-term analysis result over a time axis)
  › FFT
  › Order

› 3D Floating Diagram vs. RPM
(Representation of a time curve of a two-dimensional short-term analysis result over an RPM axis; in addition to speed, other references values are possible as well.
  › FFT vs. RPM
  › Order vs. RPM

› Level Meter
(Representation of the current level for each activated channel)

› Single Values

› Tachometer

Notes

› A CTM 000 Framework license is required for each conTEST solution!

› When using CTM 010 (Post Processing), at least one of the following licenses is also required: CTS 210 (Basic Processing), CTS 220 (Advanced Processing), CTS 230 (Psychoacoustic Processing), CTS 240 (Decoder Processing), or CTS 250 (Data Processing Add-In API)!

› For automated monitoring or long-term monitoring of the test bench or the production line using CTM 010 (Post Processing) and CTM 020 (Condition Monitoring), a standardized CTX 100 interface (Remoting) is required; manual monitoring is possible without using a CTX 100 interface.

› CTM 010 (OK/NOK classification, analyses, ...) and CTM 020 (interactive monitoring with real-time analyses, ...) can be used simultaneously/in parallel!

Scope of Delivery, Options, and Accessories

Scope of Delivery

› CTM 000 (Code 42000)
Framework
(Basic model and prerequisite for conTEST)

Software Options (conTEST Modules)

› Interfaces
  › CTX 100 (Code 42100)
  Remoting

› Post-Processing
  › CTM 010 (Code 42010)
  Post Processing
  Prerequisite for the CTS options
  › CTS 210 (Code 42210)
  Basic Processing
  › CTS 220 (Code 42220)
  Advanced Processing
  › CTS 230 (Code 42230)
  Psychoacoustic Processing
  › CTS 240 (Code 42240)
  Decoder Processing
  › CTS 250 (Code 42250)
  Data Processing Add-In API

› Condition Monitoring
  › CTM 020 (Code 42020)
  Condition Monitoring

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*VF6-Iso II (Code 3757)
    › *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

System Requirements

› Windows 11 x64 (Pro, Enterprise, Education; version: 21H2 or newer; languages: US, Western European)

or:

Windows 10 x64 (Pro, Enterprise, Education; version: 1809 or newer; languages: US, Western European)

› Xeon E5-1680, Core i7-7700, Core i5-8250U, Ryzen 5 1500X, Ryzen 5 2500U (recommended: Core i7-9700KF, Core i9-9980HK, Ryzen 5 3600, Ryzen 9 4900HS)

› 8 GB RAM (recommended: 16 GB)

› DirectX 9.0c-capable graphics card 512 MB (recommended: 2 GB)

› Display with WXGA resolution (1366 x 768) (recommended: FHD resolution (1920 x 1080))

› .NET Framework 4.8

› HASP Dongle Driver

› HEAD USB Driver (optional)

› Microsoft 365 x86, Microsoft Office 2024 x86, Microsoft Office 2021 x86, Microsoft Office 2019 x86 (optional)

Installing software and drivers from HEAD acoustics requires administrator rights. Operating the software requires standard user rights.

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HEAD acoustics

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