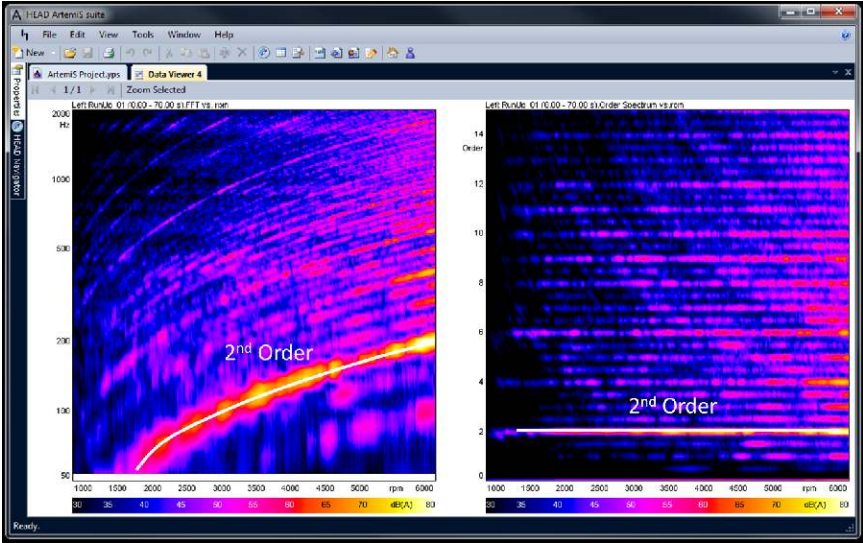


**DATA SHEET**

**ArtemiS SUITE Signature Analysis Module (Code 5013)**

Expansion module for the calculation of order spectra



**Overview**

The Signature Analysis Module allows e.g. the calculation of order spectra (average value / peak value) of the input signal.

For the computation of the order analysis, different calculation methods are available:

Variable DFT length: The window length of the analysis varies with the engine speed.

RPM-synchronous resampling:

With this method, sampling is performed in equidistant rotation angle steps (resampling of the signal).

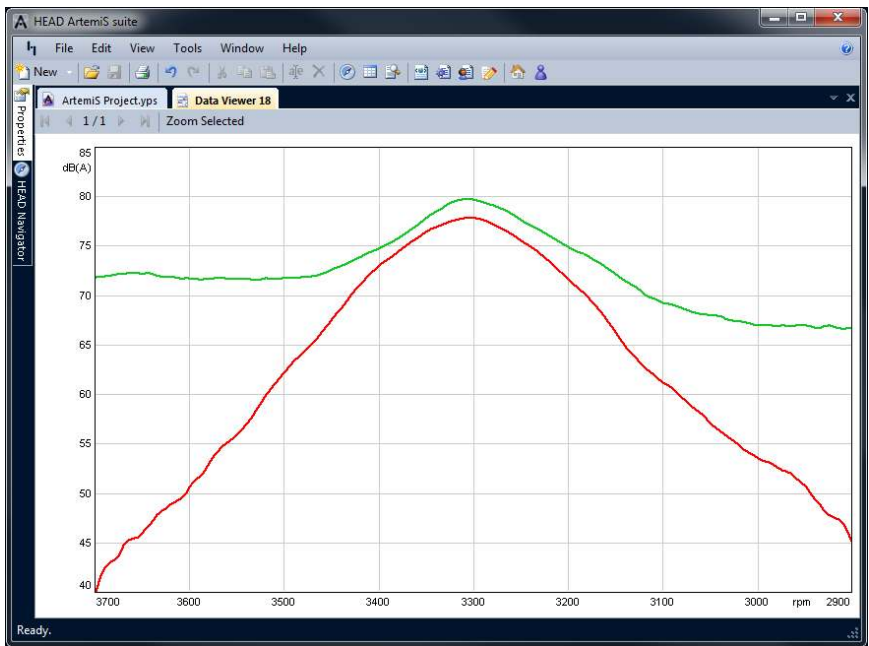
Time domain average: Signal sections are averaged vs. rotation angle with identical phasing in time domain (based on RPM-synchronous resampling)

**Features**

- Expansion module of the ArtemiS SUITE for the calculation of order spectra
- Order Spectrum for the calculation of the average value from every order
- Order Spectrum (peak hold) for generating the peak value from all calculated short-time spectra (one for each signal segment)
- Calculation methods:
  - Variable DFT length
  - RPM-synchronous resampling
  - Time domain average
- Determination of a channel as reference value for calculating orders (mark properties)
- 3rd Octave Spectrum / Oktave Spectrum vs. RPM (FFT Synthesis)
- In addition to the analyses included in the Signature Analysis Module of the ArtemiS SUITE, ArtemiS 12 provides the analyses of the Signature Analysis Module ATP 03

**Requirements**

- ArtemiS SUITE Basic Framework (Code 5000)
- ArtemiS SUITE Basic Analysis-Module (Code 5001)



Total level and level of the 6th order of a sound signal passing through a resonance at 3300 rpm

## Analysis Pool

### Order Spectrum (averaged) / Order Spectrum (peak hold)

Window Function:	Rectangle / Hanning / Hamming / Blackman / Bartlet / Kaiser-Bessel 8 - 16 / Flat-top / Gauss 8, 16, 32
Spectral Weighting:	None / A / B / C / D / G / $W_d$ / $W_k$ / $W_h$ etc. Weighting
Amplitude Scaling:	RMS / Peak
Spectral Range (Ord):	Min. Order / Max. Order
Spectral Resolution (Ord):	0.01 - 1
Width:	Off / Order / Hz / Factor / Bark
Order Algorithm:	Variable DFT size / RPM Synchronous Resampling / Time Domain Averaging
Phase:	Off / Ref Channel (1 - n) / Ref Order / Ref to Pulse
Frequency Offset (Hz):	Selectable
Average vs.:	RPM / Time
Step Size:	0.001 - 1000 rpm / 1 - 9999.9 ms

### 1/nth Octave vs. RPM (FFT Synthesis)

Method:	FFT Synthesis
Band Resolution:	Octave / 3rd Octave - 96th Octave
Row:	A / B
Band Border Frequency:	Nominal / Octave / Decade
Spectral Weighting:	None / A / B / C / D / G / $W_d$ / $W_k$ / $W_h$ etc. Weighting / Equal Loudness
Window Function:	Rectangle / Hanning / Hamming / Blackman / Bartlet / Kaiser-Bessel 8 - 16 / Flat-top / Gauss 8, 16, 32
Spectrum Size:	16 - $2^{23}$ Samples
Step Size:	Selectable
Slope:	Auto Detect / Rising / Falling / Angle / Rotation
Cuts:	Extracting of 2D curves from the three dimensional spectrum (Cut Mode: First Abscissa / Second Abscissa / Free selectable cuts)

The Signature Analysis Module of the ArtemiS SUITE (ASM 13) extends the functionality of other modules. The following analysis types are only available with the combination of the Signature Analysis Module and the Psychoacoustics Module:

#### Loudness vs. RPM

#### Spec. Loudness vs. RPM

#### 1/nth Octave Spectrum vs. RPM

The following analysis is only available with the combination of the Signature Analysis Module and the Octave Analysis Module (ASM 14):

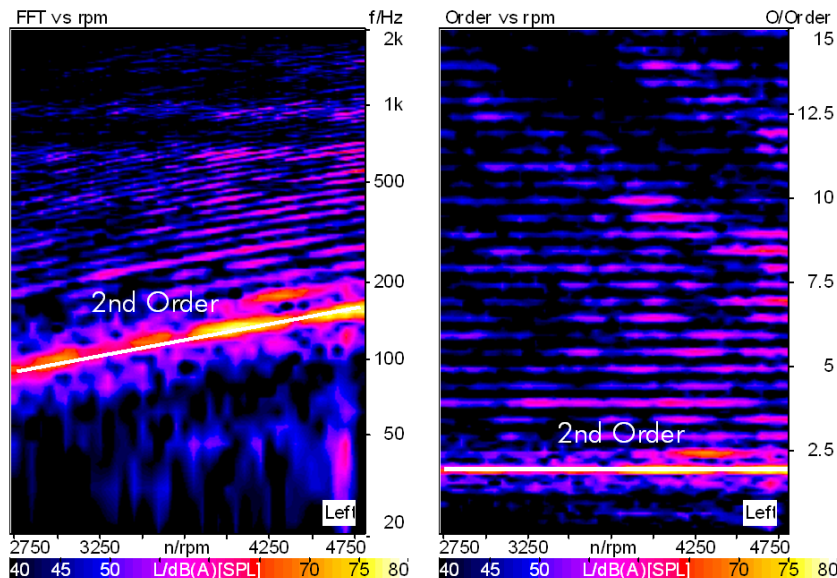
#### 1/nth Octave Spectrum (Filter) vs. RPM

**ATP 03 (Code 5013)**

**ArtemiS Signature Analysis Module**

for the analysis of signals as functions of a reference quantity (RPM, speed, pressure, ...).

ASM 13 (Code 5013) of the ArtemiS SUITE includes ATP 03.



Comparison of the analysis types FFT vs. RPM and Order vs. RPM

**Overview**

Engine speed as well as other factors like temperature, pressure etc. are with the signal analysis of great importance.

With ATP 03 users can accomplish most analyses available in Artemis (see back side) not only as a function of the time, but also on other reference quantities (RPM, temperature, pressure, crank angle etc.).

**Specifics**

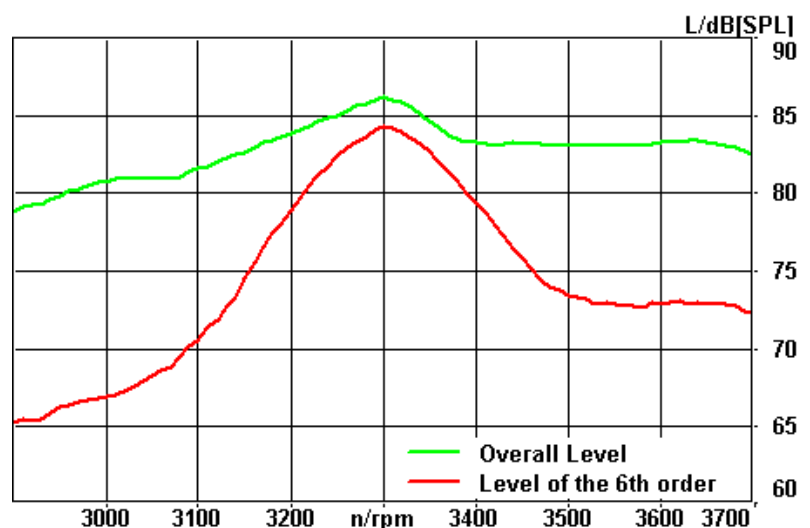
- For the computation of the order analysis two calculation methods are available:
  1. Variable DFT length: The window length of the analysis varies with the engine speed.
  2. RPM-synchronous resampling: According to this method, sampling is performed in equidistant rotation angle steps (resampling of the signal).
  3. Time domain average: Signal sections are averaged vs. rotation angle with identical phasing in time domain (based on RPM-synchronous resampling)

**Features**

- Analysis vs. RPM or other reference quantities (pressure, temperature, crank angle, voltage etc.). The reference quantities can be stored in the 16th bit of an analog signal or in a separate channel.
- 1/3-octave spectrum vs. RPM (FFT synthesis)
- Order spectrum (averaged) / Order spectrum (peak hold)
- Reference quantity vs. time
- Time signal vs. rotation
- Gated Time Cuts / Gated Time Cuts (Average)
- Harmonic Distortion vs. PPM
- Tracking filter with variable frequency offset (in Hz)
- High resolution calculation of RPM vs. time in the Filter Pool for the analysis of rotational vibrations

**Applications**

- Examination of the sound and vibration behaviour of vehicles and machines
- Analysis vs. RPM, speed, pressure, temperature, crank angle and other reference quantities
- Analysis of rotational vibrations



Total level and level of the 6th order of a sound signal passing through a resonance at 3300 rpm

## Technical data

### Filter Pool

#### RPM vs. time

Pulse factor:  
Channel 1 - 255: 1 - 99999 ipr

### Analysis Pool

#### 1/nth Octave vs. RPM (FFT synthesis)

Band resolution: octave / 3rd octave  
Spectral Weighting: none / A / B / C / D / G /  $W_d$  /  $W_k$  /  $W_h$  etc. Weighting  
Window Function: Rectangle / Hanning / Hamming / Blackman / Bartlet / Kaiser-Bessel 8 - 16 / Flat-top / Gauss 8 - 32  
Spectrum Size: 16 - 2<sup>20</sup>  
Row: A / B  
Step: 0,001 - 1000  
Slope: RPM (falling) / RPM (detect) / RPM (rising) / CA / rotation

#### Reference quantity vs. time

Displays the content of the pulse channel (e.g. RPM) against time

#### Order spectrum (averaged) / Order spectrum (peak hold)

Window Function: Rectangle / Hanning / Hamming / Blackman / Bartlet / Kaiser-Bessel 8 - 16 / Flat-top / Gauss 8 - 32  
Spectral Weighting: none / A / B / C / D / G /  $W_d$  /  $W_k$  /  $W_h$  etc. Weighting  
Amplitude scaling: rms / peak  
Average vs.: RPM / time  
Step: 0,001 - 1000 RPM / 1 - 9999,9 ms  
Spectral Resolution (Order): 0,01 - 1  
Spectral Range (Order): 0 - 1000  
Frequency offset (Hz): selectable  
Width: Off / Order / Hz / Frequency / Bark  
Algorithm: Variable DFT size / RPM-sync. resampling / Time domain averaging  
Phase: Off / Ref channel (1 - n) / Ref order / Ref to pulse

#### Time signal vs. rotation

Samples per rotation: 1 - 100000  
Envelope: Display of the envelope function  
RMS signal: Adjustment of the rotation(s) to integrate  
Rotation axis / time axis: selectable

#### Gated Time Cuts / Gated Time Cuts (Average)

Trigger: First window at trigger 1 - n  
Window at every 1 - n rotation  
Window definition: Time (ms) (delay / width) / Degree (CA) (delay / width)

#### Harmonic Distortion vs. PPM

Overlap: 0 - 99,9 %  
DFT Size: 256 - 2<sup>20</sup> Samples  
Frequency Range: 0 - 500 000 Hz  
Reference: Signal Power / 1st harmonic / All harmonics  
Results: THD / THD+N / SN / Sum / Single  
Slope: RPM (falling) / RPM (detect) / RPM (rising)

The ArtemiS Signature Analysis Module extends the functionality of other ArtemiS modules. The following analysis types are only available with the combinations of ATP 03 with ATP 02, ATP 04, ATP 05, ATP 06, or ATP 07, respectively.

#### ATP 03 and ATP 02 (ArtemiS Psychoacoustics Module)

Articulation Index vs. RPM  
Loudness vs. RPM  
Order Loudness vs. RPM  
Order Loudness vs. RPM  
Order Roughness vs. RPM  
Order Loudness vs. RPM  
Roughness vs. RPM  
Sharpness vs. RPM  
Fluctuation Strength vs. RPM  
Spec. Fluctuation Strength vs. RPM  
Spec. Loudness vs. RPM  
Spec. Order Loudness vs. RPM  
Spec. Order Loudness vs. RPM  
Spec. Order Roughness vs. RPM  
Spec. Order Roughness vs. RPM  
Spec. Prominence Ratio vs. RPM  
Spec. Roughness vs. RPM  
Speech Intelligibility Index vs. RPM  
Tonality vs. rpm

#### ATP 03 and ATP 04 (ArtemiS Octave Analysis Module)

1/nth Octave vs. RPM (filter)

#### ATP 03 and ATP 05 (ArtemiS System Analysis Module)

Auto Correlation vs. RPM DFT  
Autospectrum vs. RPM  
Impulse response vs. RPM  
Coherence vs. RPM  
Cross correlation vs. RPM DFT  
Cross spectrum vs. RPM  
Transfer function vs. RPM

#### ATP 03 and ATP 06 (ArtemiS Advanced Psychoacoustics Module)

Hearing Model Impulsiveness vs. RPM  
Hearing Model Roughness vs. RPM  
Hearing Model Spec. Impulsiveness vs. RPM  
Hearing Model Spec. Roughness vs. RPM

#### ATP 03 and ATP 07 (ArtemiS Advanced Analysis Module)

Cepstrum vs. RPM DFT  
Degree of Modulation vs. RPM  
Curtosis vs. RPM  
Modulation Freq. vs. RPM Octave  
Modulation Spec. vs. RPM Octave  
Tonality DIN 45681 vs. RPM  
Tone-to-Noise Ratio vs. RPM  
VFR vs. RPM