

digital audio measuring equipment

Digital Audio Analysis System

# DAAS<sup>®</sup>4Pro

for Windows<sup>®</sup>

*2 channel FFT-analyzer for Windows<sup>®</sup> - operating systems  
with 24bit/96(192)KHz PCI-converterboard*

## *Digital Audio Analysis System<sup>®</sup>* *DAAS<sup>®</sup>4Pro for Windows*

DAAS4Pro is a PC-based measurement system for laboratory and development in the field of electro-acoustics and audio technical measurements. The business of this equipment covers the measurement of frequency responses as well as impedance responses, Thiele - Small parameters or special distortion measurements. With DAAS4Pro we are in position to present a professional *and* cost-effective solution. It is a two-channel analyzer with 24bit converters and a max. sample rate of 192KHz. DAAS4Pro includes a special designed front-end which is a mighty tool that includes all necessary measurement amplifiers and a software controlled relay switch-bank. The easy use of our system family retained: despite the numerous analysis possible from one sampled signal it is the 'measurement object' and not the sheer signal analysis which takes priority as far as the user is concerned. That is to say that the loudspeaker or amplifier developer/tester need to have no deeper knowledge of digital signal evaluation techniques as he will be closely guided through each measurement to the final result. All important parameters are optimally set for each measurement. For the user who wishes to delve deeper into the system the possibility exists to change the system parameters and use the system in other fields.

DAAS4Pro includes many useful and important functions:

- Runs with Windows<sup>®</sup> - XP
- High resolution by using 24 Bit D/A-A/D converters on a **PCI-bus** board
- Sampling rates up to 96 KHz (192kHz version also available)
- Measurement of frequency and impedance curves with variable frequency resolution up to 0,1Hz
- Calculation of phase from frequency- and impedance-curves with automatic delay correction for acoustical measurements
- Minimal phase and excess phase and propagation time.
- Step response, impulse response and ETC
- Waterfall spectrum (cumulative spectral decay), forward & backward
- Free field correction of acoustic frequency response curves
- Measurement on phono pre-amplifiers by inverse RIAA-curve
- Distortion measurement by virtually any frequency
- Evaluation of distortion curves versus frequency or level
- Intermodulation and difference tone distortion with variable frequencies
- Interface to speaker CAD programs like Audiocad, AkAbak<sup>®</sup>, LspCad, Leap

- Thiele-Small parameters measured with a special symmetric sine-sweep
  - Digital storage oscilloscope function, time selective frequency analysis and waterfall diagram
  - Spectrum analyzer function with linear or exponential averaging
  - 3D-Impulse response measurement with cosine-burst signal
  - Level meter in acc. to IEC 651 and  $L_{TM3/5}$  measurement, weighting filter A, B&C
  - Wow & Flutter measurement on turntables and tape recorders
  - Support of max. 99 different microphones including correction files
- 
- **Optional: QC-software available for quality control applications**
  - Optional: input for 200V- condenser microphones, with LEMO input jack

Working with the Digital Audio Analysis System DAAS<sup>®</sup> will give you a whole series of useful and simple to use features, for example the 'screen zoom' and the possibility to show frequency and impedance curves on top of each other. The operation in combination with the front-end is included - no more annoying connect or disconnect of hook-up wires !



The picture above shows the DAAS front-end with the optional 7pin LEMO microphone input connector for condenser microphone capsules that require 200Volts polarisation voltage.

## Basic functions of the DAAS4Pro for Windows:

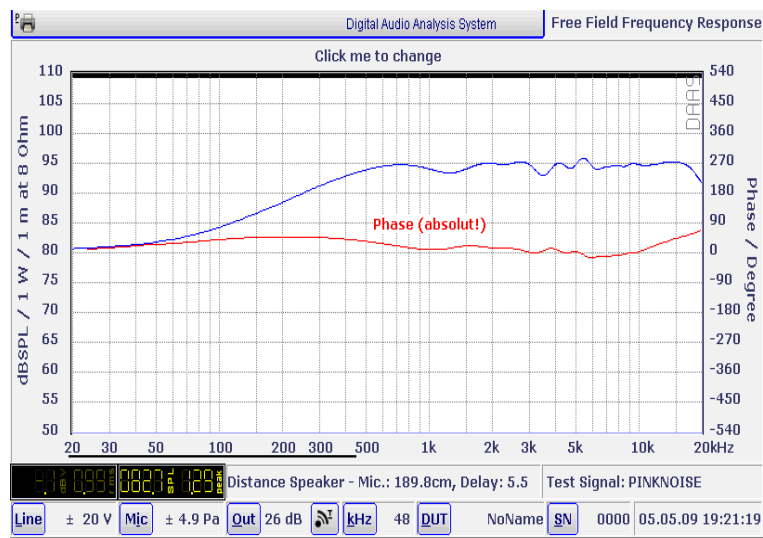
### Frequency response measurement

DAAS4Pro allows frequency response measurements in three frequency ranges, using various noise signals (or a sine-sweep) by comparison to a calibration measuring, acoustical or electrical likewise. FFT - resolutions from 4096... 65535 points. The user gets the following combinations:

Reference measure:	Measure :	Example:
1.electrical	acoustical	speaker meas.
2.electrical	electrical	amplifier meas.
3.acoustical	electrical	e.g. telephone handset meas.
4.acoustical	acoustical	room meas., microphones

Selectable FFT- length from 4096 up to 65K. Sample rates from 8KHz up to 96(192)KHz.

Values in brackets are valid for the 192KHz sample rate version.



Frequency response ( $H_f$ ), free field corrected

### Sub functions of frequency response measurements:

1. **Phase response**, electrical & acoustical; zoom function 3deg. ...270Deg./Div.

incl. minimum phase and excess phase response, available also with free-field correction.

2. **Free Field correction**, time window adjustable between 0,06ms ...48ms/Div. A max. time of 527ms is denotable. Additional display of ETC (Energy Time Curve) and envelope curve.

3. **Step response**, zoom function from 0,06ms... 48ms/Div. a max. time of 527ms is denotable.

4. **Waterfall** (cumulative spectral decay), from 0,3ms to 1024 ms,  $f_{min.} = 200\text{Hz}$ ; numbers of spectra: 48, 60 or 72. Also available with free field correction.

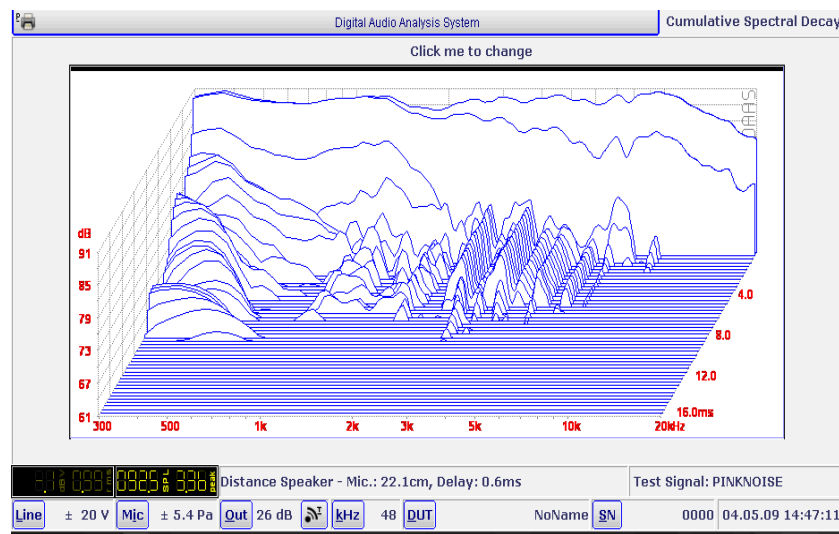
**5. Group delay time**, display range  $\pm 0,25\text{ms}$  ...  $\pm 8\text{ms}$ . Maximum resolution is  $0,04\text{ms}/\text{Div}$ . Also available with free field simulation.

**6. Smoothing frequency response**, avail.: Oct./0.8, Oct./1.5, Oct./3, Oct./6, Oct./12, and Oct./24...48...96, depending on chosen FFT-length. Bar diagram: 3rd/Oct.

**7. Power cepstrum**, zoom function  $0,03\text{ms}$  ...  $4\text{ms}/\text{Div}$ . Maximum display range 44ms.

#### Additional information on frequency response measurements:

- **vertical display range** 5dB to 120 dB, max. response.  $0,5\text{dB}/\text{Div}$ . *free vertical panning*
- **Units** dBV, dBm [electrical] and dBPa/V, dB SPL/V, dB SPL/xWatt/xMeter [acoustical]
- **Frequency range** from 5Hz up to 40(80) KHz, user selectable, max. zoom is 1 Octave FS
- **correction of signal propagation time** [acoustical], automatic or manual
- **export** in ASCII; formatted for AkAbak®, LspCad, Leap, Audiocad, Calsod etc.  
Store / restore and „overlay“ traces, averaging, add and subtract of frequency responses
- **measured signals** can be stored in time domain
- **polar diagram** for frequency response measurement,
- **measurement of slope steepness** of crossover networks
- **shift curve to 0dB @ 1KHz** for standardized display of frequency curves
- **various tolerance mask functions** (draw, import from curve, store/load, delete)



Waterfall (CSD)

### Impedance response measurement

Impedance measurements can be done with a **special sine-sweep**, using the FFT by comparison to a calibration measuring. Display range  $1,6 \Omega$  to  $10\text{K}\Omega$ , max. resolution  $0,2\Omega/\text{Div}$ .

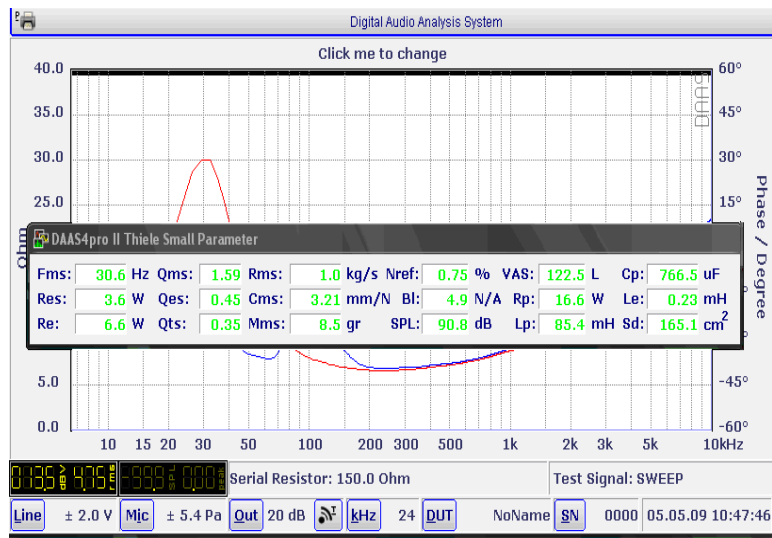
Denotable frequency range from 5Hz ...40(80)KHz. Additional display of phase response. At hand are FFT - resolutions from 4096... 65535 points. An impedance response can be displayed in a frequency response. Signal export is the same as with frequency response.

- **Min.-Max. values** of the curve are denotable
- **various tolerance mask functions** (draw, store/load, delete)

## Thiele - Small parameters

The full range of Thiele - Small parameters (TSP), determined on a speakers impedance measurement using a **special sine-sweep signal**. Calculation of speaker equivalent volume ( $V_{AS}$ ) by putting a small weight around e.g. Speakers dust cap.

**Alternative: measurement in an enclosed volume in accordance to the Carrion-Isbert method.**

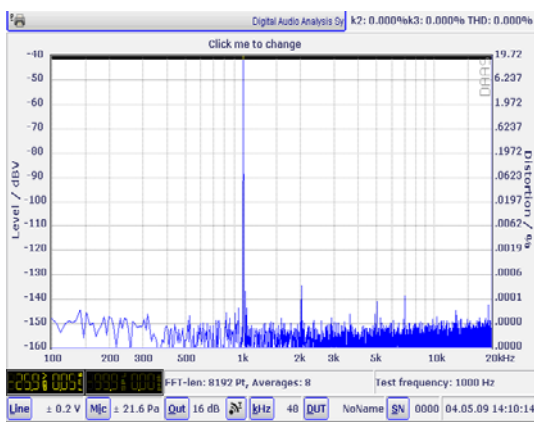


## Distortion measurements

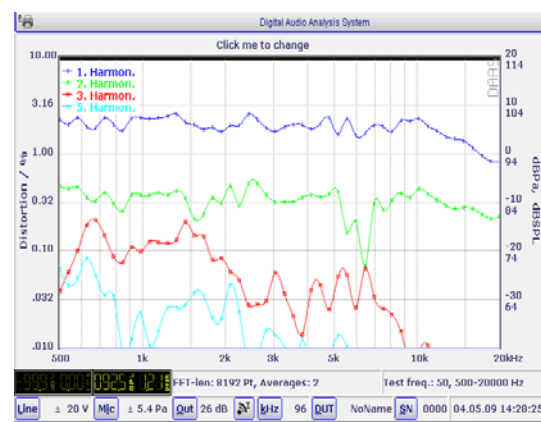
Distortion measurements, electrical and acoustical likewise. One can choose between FFT - resolutions from 4096 to 16384 points and max. 64 time-averagings. DAAS delivers a real bunch of various distortion measurements.

**1. Distortion**, displayed: k2... k9 and THD incl. distortion spectrum. Internal signal frequencies available from 20Hz... 15(40) KHz

**2. Distortion curve**, distortion components : k2... k7 and THD, range : 20Hz to 15(40) KHz with a maximum of 252 frequency steps.



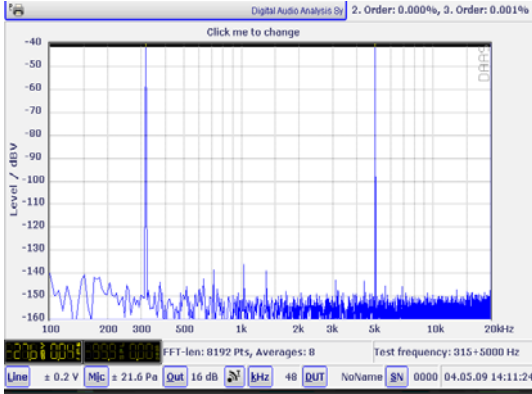
Distortion measurement



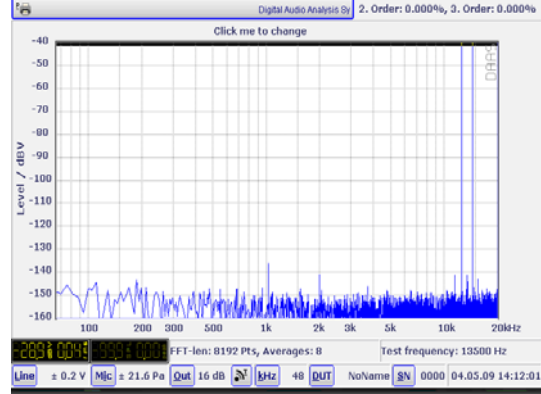
Distortion curves

**3. Intermodulation measurement**, f1 selectable from 100Hz to 2KHz , f2 selectable from 800Hz to 8KHz. Amplitude ratio f1 / f2 = 1:4, 1:2, or 1:1 Displayed: m2 (quadratic ) and m3 ( cubical)

**4. Difference frequency distortion**, Two signals with a distance of 70Hz... 1KHz, signal frequencies between 5KHz to 15,9KHz are available. Display of d2 and d3.

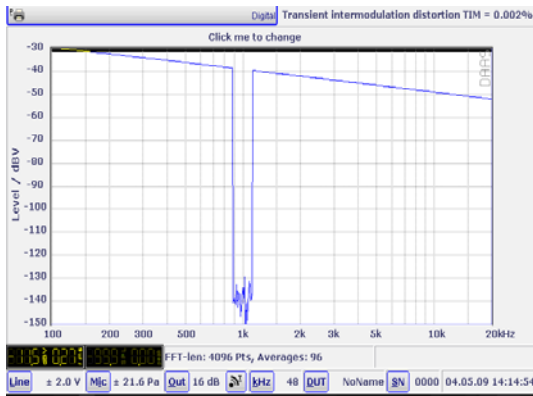


Intermodulation distortion (IMD)

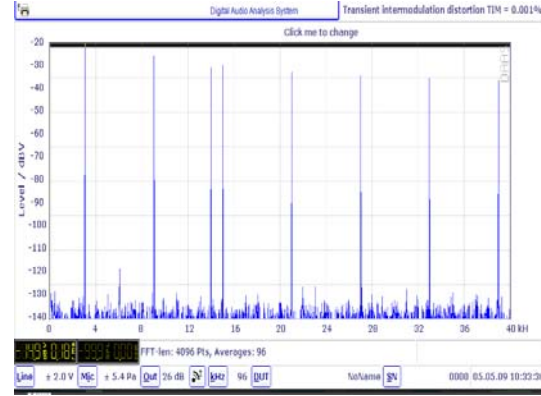


Difference tone distortion

**5. Transient intermodulation distortions ( TIM ),** the stimulus is a noise signal with a 1/3rd octave gap at 1KHz Additional: former sinewave/squarewave method.



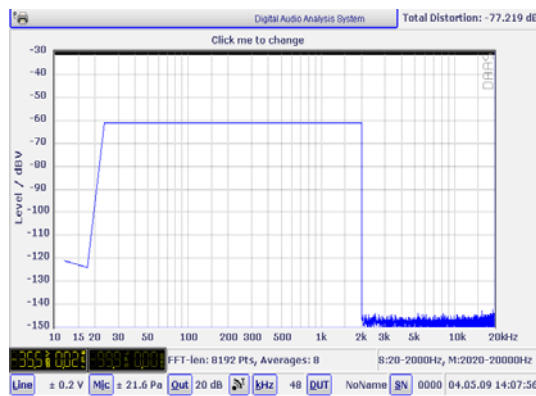
TIM measurement with noise stimulus



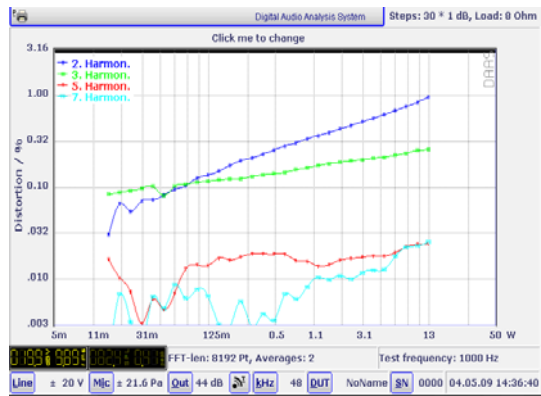
former TIM method (sine /squarewave)

**6. Distortion vs. signal voltage**, distortion vs. voltage [V] or power [W]. The referred load-resistance is variable from 2...32 Ohms. Displayed are k2...k7 and THD.

**7. Total Distortion measurement** (noise-distortion) with a special band-limited noise signal (user variable). All distortions are added in the out-of-band range of the stimulus.



Distortion vs. Volt/Watt

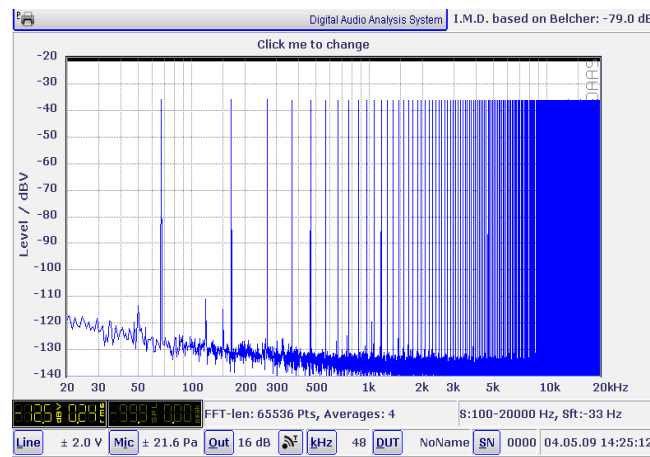


Total distortion (noise-distortion)

## Special functions

### Intermodulation measurement according to Belcher ( known as Belcher test )

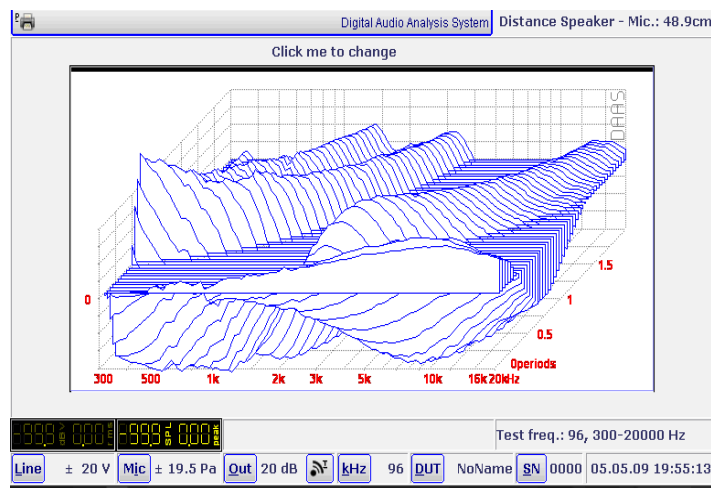
A multi tone intermodulation distortion measurement with pseudo random binary sequence as test signal which give components at equal frequency intervals. This test signal is more “life like” ( in terms of nearer to a “real-world” music signal ) then the standardized two-tone signals. Procedure of measurement: as the IMD components produced by the signal would appear at the same frequencies as components of the test signal, the whole signal is first shifted by a constant frequency shift before it is introduced to device under test (DUT). After passing through the DUT the whole signal is shifted back. Then a comb filter blends out the stimulus frequencies and only the distortion is displayed. The implementation in DAAS4Pro uses the digital signal processing to produce the test signal and process the analysis.



Belcher intermodulation test

**Nearfield measurements.** A frequency response measurement at the low sample rate can be combined seamless with a measurement at the systems high sample rate - by this a complete speakers frequency response from 20Hz... 40(80)KHz is visible.

**Waterfall (cumulative spectral decay) with sine-burst and cosine burst.** A special method using sine signals as stimulus instead of noise. This version delivers much more details, but is more meaningful in nearfield. The utilization is e.g. speaker chassis construction or cabinet construction ( to track down standing waves in reflex cabinets etc. ).



Waterfall with cosine burst ( half wave of a single sine signal )

**Reverberation time (RT) measurement RT60**

Stimulus is a narrow-bandwidth noise from 63Hz...8KHz at octave interval. After switching-off the stimulus the room echoes are evaluated and the RT is displayed. ASCII-export for measured values.

**Spectral analysis**, electr. & acoustic, display range 5dB to 110dB, max. resol. 0,5dB / Div. FFT from 1024 up to 65535 Points. FFT - windows: Uniform, Hanning, Blackman, Kaiser, Flat Top. Add. functions: smoothing, averaging with exponential and linear weighting, continuous running, single shot, cursor-readout. Three frequency ranges are available (145Hz... 40KHz, 98Hz...20KHz and for max. resolution at low frequencies: 12Hz... 2,5KHz). Vertical Units: dBV [electrical] und dB SPL, dB SPL(A) and Sone [acoustical]. All internal signals possible with tracking generator function.

**Storage oscilloscope**, electrical & acoustical, range from 11ms to 1048s. Max. display resolution: (0,5)1ms/Div. **Additional functions:** Cursor - readout, true RMS value, min.& max. - value, crest factor. Further: spectral analysis with the following windows: Uniform, Hanning, Blackman, Kaiser, Flat Top.

**Level meter** (AC only). A true RMS millivolt meter with units dBV, dBm, dBPa dB SPL. Data display in free run modus or controlled by a defined meas. time. Averaging types: „slow“, „fast“, „impulse“ in acc. to IEC651. Resolution is 0,1dB. Add. Functions: peak hold and special functions for acoustical noise level measurements ( $L_m$ ,  $L_{TM3}$ ,  $L_{TM5}$ ). Weighting filters A, B and C.

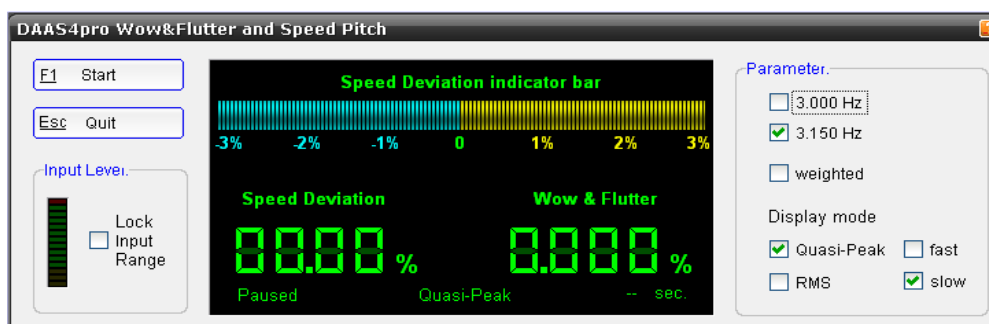
**Microphone linearisation file**

Linearisation data is stored as ASCII-file and is user configurable. Up to 99 various microphones are supported.

**Signal storage for ext. signals.** External signals can be stored or restored. The stored signals are available as measuring signals. Format: 32bit monaural.

**De-emphasis function** for frequency response measurements on phono-preamplifiers (inverse RIAA-curve).

**Wow & Flutter measurement** on turntables and tape-recorders with standardized external signals (customary in trade sources on LP record, cassette or tape) of 3KHz and 3,15KHz including speed deviation measurement.



**Measuring signals, printers, system requirements**

**internal measuring signals.** DAAS4Pro makes a lot of user selectable sinus and noise signals available. For transfer function and impedance measurement the following signals are available: periodic noise 2048Pt., 4096Pt., 8192Pt., 16384Pt. Up to 65535Pt). Signal for Thiele-Small parameter measurements: a special optimized symmetric sine-sweep. Additional: sine-bursts and various special sine wave signals.

**Printers:** all printers with working Windows<sup>®</sup> XP drivers. Additional: screen-export to a BMP file or GIF file.

**System requirements.** Software: Windows<sup>®</sup> XP SP2. Computer: AT-compatible PC, obtaining min. one free PCI-slot, a COM port and free USB slots for software protection key. Minimum CPU speed: 1,6GHz. Main memory minimum is 512Mb, recommend is 1GB RAM.

**DAAS4Pro hardware:****Converter board:**

A PCI-bus card with quartz controlled 24bit-converters and input- output amplifiers. Connectors: 6,35mm connectors (or Sub-D) 15pin. Sample rates: (192)96KHz, 48KHz, 24KHz, 8KHz.

**The front-end of DAAS4Pro:****Electrical input:**

BNC – connectors (Line-asymmetrical):	$\pm 0.20Vs, \pm 2.0Vs, \pm 20Vs, \pm 200Vs$ software switchable
Input impedance	100 KOhm.
Output impedance ( low level output)	<1 KOhm (typ. 600 Ohms)

**Microphone preamplifier:**

XLR – 3 input connector, symmetr. or asymmetr.	
Input impedance symm.	5,4KOhm (XLR Pin2 to Pin3)
Input impedance asymm. Pin1+3)	51KOhm (XLR Pin2 to
Output impedance	<2,5KOhm
Frequency range ( -3dB )	5Hz ... 120KHz
Amplification factor (adjustable)	max. 20dB

2 input ranges switchable via software,  
selectable transmission factor for microphones, unit: [mV/Pa]  
Adjustable socket-base (full scale level for mic. input) [mV]

**All inputs can be calibrated.**

**Power amplifier:**

Output rating	max. 40Watts peak @ 4 Ohm
Distortion ( at Pmax. -10% )	typ. 0.02 %
Distortion ( at 10Watts)	typ. 0.005 %
Input impedance	6,8KOhm
Frequency response ( -3dB )	typ. 9Hz ... 120KHz
Amplification factor of power amp.	30,2dB ± 3% at 1KHz

Technical changes are subject without notice

Windows<sup>®</sup> is a registered trademark of the Microsoft Corporation, Redmond, USA

System delivery without microphones, please order microphones separately.

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*Some questions left ? Need a customized software ?*

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