Tomorrow’s digital world today

Audio Analyzer UPD

ROHDE & SCHWARZ
Pacemaker for progress

The allrounder

The market for audio products gets more and more sophisticated by the day. And the demands made on measurements—from development to production and monitoring—get tougher and tougher. Analog technology has reached the limits of the physically possible—digital technology opens a totally new dimension. What is needed is a first-class audio analyzer. With digital technology, equipped to meet the full range of current analog and digital measuring tasks—open and programmable for the future. A truly versatile allrounder with state-of-the-art technology that can measure the best that audio technology has to offer with unbeatable accuracy.
A complete solution

The Audio Analyzer UPD is a compact, universal measuring instrument with built-in generators for measuring the full range of audio parameters at analog and digital interfaces. The UPD measures fast and is equipped with all commonly used interfaces. Windowing and user prompting make the UPD easy to use despite the large number of measuring and signal generating possibilities.

Latest digital signal processing, an extensive range of analysis modes and Fast Fourier Transform (FFT) give you peace of mind for the future - for this technology allows the implementation of new measuring functions simply by loading the required software.

Analog testers are almost two a penny

The market for analog audio analyzers is full of suppliers with a very wide range of quality aspirations. But in the digital area there is only one device - the UPD from Rohde & Schwarz. Not an analog device with a digital add-on - but a fully digital measuring instrument that can also handle everything the analog world has to offer. The pearl among the audio analyzers that already masters the requirements of tomorrow's digital world.
Versatile in application

The UPD is the right analyzer for measurements on high-end audio equipment — whether an individual component or an audio mixer in a sound studio. And because it is so compact, the UPD can also be taken along for measurements on site. The UPD demonstrates its strengths in a wide range of applications:

- Entertainment electronics
  - DCC
  - Minidisc
  - CD player
  - Cassette decks
  - Amplifiers
  - Tape decks
  - Car hifi

“Your decision for the UPD is a decision for the future.”
UPD measures where performance is critical

- Professional studio technology
  - Audio mixers
  - Tape machines
  - DAT recorders
  - Sampling rate converter
  - Sound processors etc.
- Modules and components
  - ADC, DAC
  - Equalizers
- Electroacoustics
  - Loudspeakers
  - Headphones
  - Microphones
  - Hearing aids
- Communications
  - Mobile radio
  - Telephone
  - Program feed

The advantages at a glance
- Compact unit with integrated PC
- Two-channel measurement for all functions
- Versatile analysis modes through built-in FFT analyzer
- Quick and easy implementation of new measuring functions with 3½" diskette
- All measurements with any combination of input and output (AA, AD, DA and DD)
- Flexible application through almost unlimited range of filters
- Extremely high dynamic range for measurements on high-end equipment
- High measuring accuracy and speed
- Fast and simple operation
The benefits are measurable in dollars and cents

Measure anything at any interface

Equipped with all common interfaces, the UPD can measure just about anything. In future you won't need three measuring instruments — but just one. The UPD Audio Analyzer. No matter what interface you have — we'll make the connection.

Programmed for the future

Digital filters and signal processing mean superb accuracy and great flexibility. As filters and signal processing are software-implemented, new features can be added with little effort. Formerly, changed testing requirements often called for the purchase of new equipment. Not with the UPD. A software update is all that is needed.

Pacemaker for measurement

Fast signal setting and high measuring speed are features of the UPD that ensure a high throughput in production and help to reduce costs.
Easy to operate

Despite the wide range of functions offered, intelligent user prompting and context-sensitive help keep the UPD remarkably simple to operate.

Routine measurements become truly routine: call up settings, carry out measurement and generate the protocol at the press of a key. And because familiarization is fast, you save both time and costs.

A sound investment

Many reasons speak for the UPD. Alone the name Rohde & Schwarz holds the promise of superb quality - and of a secure future for servicing and spares. Ensuring that you will be more than happy with your UPD way into the future. And that your investment remains sound for years to come.
Technical description

The Audio Analyzer UPD contains analyzers and generators for dual-channel measurements and for generating a wide variety of analog and digital audio signals.

Measurement functions

Thanks to the wide range of built-in analysis functions, practically any audio measurement problem can be solved:

- Level or S/N measurements, rms, peak or quasi-peak measurements can be made.
- Selective level measurements. The centre frequency of bandpass/bandstop can be swept or can be coupled to the generator frequency, to the frequencies of a multi-tone signal (e.g. for fast frequency response measurements) or to the input signal.
- SINAD or THD+N measurements. The sum of all harmonics and noise is measured.
- Harmonic distortion measurements. All the harmonics, single harmonics or any combination of harmonics can be measured (Fig. 1).
- Modulation distortion analysis to DIN IEC 268-3. 2nd and 3rd order intermodulation is measured.
- Intermodulation measurements using the difference tone method. 2nd and 3rd order intermodulation is measured.
- Dynamic intermodulation distortion measurements on the products stipulated in the DIN IEC standard.
- Wow and flutter measurements to DIN IEC, NAB, JIS or the 20 method to DIN IEC where the demodulated-signal spectrum is also displayed.
- DC voltage measurements.
- Frequency and phase measurements.
- Polarity test.
- Display of bit activity on digital interfaces.

Fig. 1: Values obtained from harmonic distortion and intermodulation measurements can also be displayed as a histogram diagram.

Measurements can be triggered in different ways: single-shot, at fixed time intervals or upon frequency or level variation of the input signal (external sweep). With unknown or varying transient response of the device under test, different settling algorithms can be selected to ensure that only test results obtained in the steady state will be recorded.
FFT analysis

As it contains an FFT analyzer, the UPD can also carry out spectrum analysis (Fig. 2). The number of samples for the Fast Fourier Transform can be selected from 256 to 8192 in binary steps.

Fig. 2: FFT spectrum of a two-tone signal produced by UPD generator shown in full-screen mode

A special feature is the zoom FFT (Fig. 3). The signal to be measured is digitally processed and the frequency resolution can be increased by a factor of 2 to 256 over a selectable range. In this way, a maximum resolution of 0.02 Hz can be obtained. It must be emphasized that this is not just a scale expansion, the measurement is really made at this higher resolution.

Fig. 3: Zoom FFT of a sinewave signal with a nonharmonic spaced 10 Hz away

Test signals at a glance

The generators in the UPD produce an extremely wide range of analog and digital test signals:

- Sinewaves, for example for level and harmonic distortion measurements. The signal can be connected to an equalizer with a user-selectable nominal frequency response.
- Two-tone signal for modulation distortion analysis (or for intermodulation measurements using the SMPTE method). Various amplitude ratios can be selected and the frequency is continuously adjustable.
- Difference tone signal for intermodulation measurements with continuous setting of the centre frequency and frequency difference.
- Signal for Dynamic Intermodulation distortion Measurements (DIM). It comprises a rectangular signal and a sine signal with an amplitude ratio of 4:1.
- Multi-tone signal comprising up to 17 sinewaves with any frequency and with the same or different levels.
- Sine burst signal with adjustable interval and on-time as well as programmable LOW level, e.g. for psophometric voltage measurements.
- Sine² burst, also with adjustable interval and on-time, e.g. for testing rms rectifier circuits.
- Squarewave, the ideal signal for measuring the transient response of DUTs.
- Noise with a variety of probability distributions, e.g. for investigating the DUT’s response.
- Special noise signals which are defined by a selectable number of frequencies and their amplitude distributions. The frequency raster can be linked to the analysis raster used for Fast Fourier Transforms making it possible to rapidly and precisely determine the frequency response of a DUT at one go.
- Arbitrary waveforms – any voltage curve with 16000 points or less can be generated.
- Polarity test signal to check for reversed polarity on the signal path.
- FM signal for simulating impaired audio signals.

These test signals can be continuously varied by means of the variety of sweep modes available. The amplitude and frequency can be swept and in the case of bursts, the interval and the on-time. The sweep is either defined by means of a table or parameters such as start values, number of steps, linear/log stepping or time interval. Two variables can also be swept simultaneously.

Audio Analyzer UPD
Interfaces

All UPD interfaces are dual-channel. All interfaces with the exception of the parallel interface are on the front panel:

Analog interfaces
- Balanced inputs and outputs with a particularly high common mode rejection. A variety of impedances which are commonly used in the studio are provided. They are floating so that measurements can be made on lines which are also used to carry supply voltages (phantom feeds).
- Unbalanced inputs and outputs, also floating (e.g. to prevent hum loops).

The generator outputs can be internally connected to the analyzer inputs so that different types of measurements can be made without having to change the cabling.

Digital interfaces
- Parallel inputs and outputs for connecting boards or converters with parallel interfaces.
- Serial inputs and outputs for boards with non-standard serial interfaces or audio chips. This interface is user-programmable, i.e. it can be adapted to practically all serial formats by selecting the appropriate word length, clock polarity, the timing of the sync pulse etc.
- AES/EBU interface for connecting professional studio equipment (option).

Instrument architecture – leaves way open for extensions

The UPD comprises a generator, analyzer and processor section, the latter being built around a 386 SX-PC (Fig. 4) operating under MS-DOS.

Standard interfaces (2 × RS-232, Centronics, VGA) are provided for a keyboard, mouse, monitor, printer and plotter. A hard disk and a 3.5" disk drive are built in.

This processor concept has distinct advantages:
Test data can be processed further at the MS-DOS level with standard software.

Free slots for measurement and data processing expansions (e.g. network board).

Future-proof - application programs and measurement functions that will be developed in the future can be easily and rapidly loaded using the disk drive.

Signal processing in the generator and analyzer is all-digital. Signals fed in via the analog inputs are also converted to digital signals (after complex analog-signal conditioning) inside the instrument.

All-digital signal processing provides the following:

1. All measurements at all interfaces are carried out in the same way. Results from different interfaces are therefore directly comparable.
2. All measurement signals are available at all outputs, i.e. measurements with every input/output combination are possible (A/A, A/D, D/A, D/D).
3. The UPD can easily accommodate modifications in test procedures and functions that will be introduced in the future. The user only needs to load the new software.

Digital signal processing also has other advantages. For example, multi-frequency signals can be generated elegantly.

Even the built-in filters are software-implemented. This means that the user essentially has an infinite number of filters at his disposal. The 13 most common weighting filters are available as standard. Other filters can be programmed in a matter of seconds by entering the type (lowpass, highpass, bandpass, bands, notch, third octave or octave), frequency and attenuation. The instrument's open architecture really pays off when special requirements have to be met. Special filters can be implemented using commercially available filter design programs. The data is transferred to the UPD and the designed filter is looped into the signal path.

Lots of functions but easy to operate

Attempts to create an easy-to-use universal measuring instrument with a wide range of measurement and generator facilities often do not produce the desired result. The UPD, however, has succeeded where others have failed. The following are the salient features:

- Short learning time thanks to an easy-to-understand operating concept and treating analog and digital measurements in the same way.
- Operator is not bombarded with unnecessary information. Only essential parameters and settings are displayed - the others are available in the background. For example, the sweep parameters are only transferred to the generator panel and displayed when the sweep function is selected.
- Operation is safe from incorrect entries. The UPD will only accept entries that make sense in the context of the measurement being performed. The range of the parameter to be entered for any menu item is also displayed. Incorrect entries are ignored.

Self-documentation. A comprehensive help system with information on all current menu items explains the application or function in question in English or German.

The LCD screen has a principle role to play in the operation of the UPD. All setting parameters and results are displayed on it in a clear and logical way. Related functions and settings are displayed together in panels which can be selected with one keystroke. A maximum of three panels can be displayed simultaneously (Fig. 5).

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Fig. 5: Related functions and settings are combined in panels.

The operator can choose to make entries either from the instrument front panel, from an external keyboard or with a mouse.
Results at a glance

The way results can be displayed on the UPD is really unique. The results for both channels can be displayed simultaneously on the screen in numerical and graphical form. The peak values of the input signals and the frequency and/or phase can also be displayed. The graphics modes range from the bargraph (Fig. 6) through the spectrum display to the three-dimensional waterfall display (Fig. 7). Results can be read off from the graphics with vertical and horizontal cursors. Tolerance masks or stored results can also be added to the screen and compared with the graphics. A full-screen display is also possible (Fig. 2). Hardcopy, of course, can be printed out on a printer or plotter. Drivers for over 130 printers are supplied with the UPD.

The status panel - a useful special feature

It is often the case that only a few parameters have to be modified after a measurement sequence has been started. The UPD takes this requirement fully into account. Entry lines can be taken from the entry panels for the generator, the analyzer etc. and transferred to the status panel. This clear summary of the measurement routine has the following advantages:

- Instrument settings can be displayed together with graphical and numerical results (Fig. 3).
- All important information can be printed on a single hardcopy.
- Instrument settings can be modified quickly without changing panels as the UPD can also be operated from the status panel.
Options for more advanced applications

Low distortion generator
The low distortion generator is essential for all applications where extremely pure analog signals or an analog DIM signal are required. Its inherent distortion is well below that of the built-in universal generator which already has excellent specifications.

AES/EBU interface
This interface option (UPD-B2) contains the AES/EBU interface, the S/P DIF interface and the optical interfaces. Thanks to the extra signal processor on the plug-in card, user bits, status bits, parity and CRC error bits etc. can be generated and analyzed as well as audio bits. To adapt to various types of protocols, both input and display masks can be user-defined with the aid of configuration files. Masks are already available for protocols of AES3 or consumer format. The output level is programmable. An additional high-impedance input makes it possible to perform measurements without disconnecting the signal path.

High-speed option
In the design of the UPD, obtaining high measurement speed was one of the priorities. A dual-channel design was therefore adopted for all analog circuits. The processor operations for the two measurement channels are time-multiplexed. Where even higher speeds are required, say in a production environment, the high-speed option UPD-B3 can be used. With this option, even the digital processing for the two channels is performed in parallel.

Audio monitor
Fitted with the Audio Monitor UPD-B5, the UPD features a headphones output and a built-in loudspeaker. With RMS measurements in the frequency range up to 20 kHz, both the input and the filtered signal can be monitored at the interfaces of the analog analyzer and the AES/EBU option.

The UPD-B5 also provides 4 TTL inputs and 8 TTL outputs which may be used for example for driving checkpoint selectors.

IEC/IEEE-bus option
The IEC/IEEE-bus option UPD-B4 makes it possible to remote control the UPD to IEC 625 or IEEE 488. The commands implemented correspond for the most part to SCPI guidelines.

With the exception of the UPD-B3, all options are cards and software packages which the user can slot in and load himself.

Universal sequence controller
This option (UPD-K1) enables test sequences to be generated and executed, thus turning the UPD into an automatic test system. Programming of the test sequences is highly facilitated by the built-in program generator.

In the so-called logging mode, each manual control step is translated into a complete line of the sequence program with correct syntax, i.e. test sequences can be programmed without a single line to be typed by the user. The program thus generated does not only give the sequence of the keys to be pressed but easy-to-read instructions (IEC/IEEE-bus syntax to SCPI). BASIC commands can then be used to modify the program, e.g. for branching or graphic outputs.

Complete application programs that are based on this universal sequence controller are available for measurements on CD players, tuners, etc.

If the IEC/IEEE-bus option (UPD-B4) is fitted, the sequence controller may be used for remote control of other IEC/IEEE-bus devices. After slight modifications, the programs generated on the UPD are portable to an external controller for remote control of the UPD. Generation of remote-control programs is thus highly facilitated.

Automatic measuring system
The option UPD-K33 is used for automatic measurement of all relevant parameters of sound broadcast links in line with the recommendations of CCITT 0.33. Generator and analyzer are usually accommodated at different places and are synchronized with the aid of FSK signals. The user has the choice of using the standard sequences defined by CCITT 0.33 or configure his own test sequences.

For use of the optional automatic measuring system the Universal Sequence Controller UPD-K1 is required and UPD model 04 with built-in 486 microprocessor.

Audio Analyzer UPD

Audio Monitor UPD-B5

Low distortion generator

AES/EBU interface

IEC/IEEE-bus option

Audio monitor

UPD-B5

High-speed option

Universal sequence controller

SCPI

ICP
Specifications

Data without tolerances are typical values.

Analog analyzers

For analog measurements with different bandwidth, specifications and measurement functions are provided.

<table>
<thead>
<tr>
<th>Analyzer</th>
<th>Frequency range</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANLG 22 kHz</td>
<td>2 Hz to 10 Hz to 21 kHz</td>
</tr>
<tr>
<td>ANLG 100 kHz</td>
<td>2 Hz to 100 kHz</td>
</tr>
<tr>
<td>ANLG 300 kHz</td>
<td>50 Hz to 300 kHz</td>
</tr>
</tbody>
</table>

| Voltage measurement ranges | 5-dB steps for V<sub>N</sub> > 200 mV |
| Measurement error | ±0.05 dB at 1 kHz (sine, rms) |

- Frequency response: ±0.03 dB from 20 Hz to 22 kHz, ±0.15 dB from 22 kHz to 50 kHz, ±0.2 dB from 50 kHz to 100 kHz, ±1 dB from 100 kHz to 300 kHz.

Inputs

- **Balanced**: 2 independent channels, each floating, XLR connectors (female)
- **Unbalanced**: 2 independent channels, BNC connectors, floating/grounded switchable

| Voltage range | 0.1 µV to 35 µV (line) |
| Input impedance | 100 kΩ, ±0.5 % each, one value ±20 pF specified by user, parallel 100 MHz |
| Cross-talk attenuation | >120 dB, frequency >22 kHz |
| Common mode rejection (V<sub>N</sub> < 3 V) | >110 dB at 50 Hz, >80 dB at 1 kHz, >50 dB at 16 kHz |
| Common mode voltage (V<sub>N</sub>) | max. 50 V (safety regulation), protected by surge protector |

Generator output

- Each input switchable to any output, input impedance: balanced 200 kΩ, unbalanced 100 kΩ

Measurement functions

- **RMS value, selective**
  - Bandwidth: ±0.1 dB
  - Selectivity
  - Dynamic range: ±0.5 dB
  - Frequency setting
  - Measurement error

- **Noise (600 Ω)**
  - Filter with A-weighting filter
  - Filter with CCIR unweighting filter
  - Spectrum

**Filtering**

- Noise (600 Ω): ±0 dB at 1 kHz, sine
- Measurement error: ±0.05 dB at 1 kHz (sine, rms)
- Frequency response: ±0.03 dB from 20 Hz to 22 kHz, ±0.15 dB from 22 kHz to 50 kHz, ±0.2 dB from 50 kHz to 100 kHz, ±1 dB from 100 kHz to 300 kHz.

DC voltage

- Voltage range: 0 to ±300 V unbalanced, 0 to ±35 V balanced
- Measurement error: ±(1.5 % ± 2 mV)
- Measurement range: 100 mV to ±300 V (balanced 30 V), 10-dB steps

S/N measurement routine

- Available for measurement functions
- +/- peak
- Quasi-peak indication S/N ratio in dB
- No post-FFT

FFT analysis

- See FFT analyzer section

Total harmonic distortion (THD)

- Fundamental from 6 Hz to 110 kHz
- Frequency tuning: automatic to input signal, coupled to generator, fixed through entered value
- Weighted harmonics: any combination of d<sub>1</sub> to d<sub>n</sub>, up to max. 300 kHz
- Measurement error, harmonics: ±0.5 dB at ±100 kHz, ±0.7 dB at ±300 kHz

Inherent distortion

- Analyzer ANLG 22 kHz
  - Fundamental: >100 Hz
  - Measurement error, harmonics: ±0.5 dB at ±100 Hz, ±0.7 dB at ±300 kHz

- Analyzer ANLG 100 kHz
  - Fundamental: >100 Hz
  - Measurement error, harmonics: ±0.5 dB at ±100 Hz, ±0.7 dB at ±300 kHz

- Analyzer ANLG 300 kHz
  - Fundamental: >100 Hz
  - Measurement error, harmonics: ±0.5 dB at ±100 Hz, ±0.7 dB at ±300 kHz

Spectrum

- Bar chart for signal and distortion

Audio Analyzer UPD
THD+N and SNAD

Measurement procedure selective weighing of all nine interference spectra bar chart for signal and distortion

Spectrum bar chart for signal and distortion

Inherent distortion: $\leq -85 \, \text{dB}$, typical, $-90 \, \text{dB}$

Dynamic intermodulation distortion (DIM) with analyzer ANLG 22 kHz only

Measurement error

Spectrum

Post FFT of demodulated signal

WAFERFLEX display

Trigger level

Trig level

Trace length

Interpolation

Frequency range

Frequency error

Input voltage

Phase

Measurement error

Input range

Display range

Polarity test

Input range

Display range

Output range

Interpolation

Trigger level

WAVEFORM display

Trigger level

Trigger level

Trace length

Interpolation

Frequency range

Frequency error

Input voltage

Phase

Measurement error

Input range

Display range
### Signals

**Sine**
- **Frequency range**
  - Generator ANLG 25 kHz
    - 2 Hz to 25 kHz
  - Generator ANLG 110 kHz
    - 2 Hz to 110 kHz
- **Frequency error**
  - ±0.05 dB at 1 kHz
  - ±1 dB at 1 kHz
- **Inherent distortion**
  - THD+N
    - Measurement bandwidth
      - 20 Hz to 2 kHz
      - < -92 dB
      - -96 dB
  - Measurement bandwidth
    - 50 Hz to 100 kHz
    - < -87 dB
- **Sweep parameters**
  - Center frequency, level
  - Dynamic range
    - 80 dB referred to total peak value
  - Level error
    - ±0.5 dB
  - Inherent distortion
    - DFD
      - < -96 dB
      - -100 dB
      - Dynamic range
        - 80 dB referred to total peak value
- **Characteristics**
  - Level and frequency individually selectable for each line
  - 1 to 17 spectral lines
  - Multi-sine
    - 1 to 17 spectral lines
  - Frequency spacing
    - 20 Hz to 20 kHz
    - 2.05 kHz
    - ±0.01 dB
    - ±0.5 dB
  - Modulation distortion
    - 20 Hz to 2 kHz
    - ±0.05 dB
    - ±0.5 dB
  - Dynamic range
    - ±0.5 dB

**Sine (with low-distortion generator option)**
- **Frequency range**
  - 2 Hz to 110 kHz
- **Frequency error**
  - PRECISION
    - ±0.1 dB
  - FAST
    - ±0.5% at 15 to 30°C
    - ±0.7% at 5 to 45°C
- **Level error**
  - ±0.1 dB
- **Inherent distortion**
  - THD+N
    - Measurement bandwidth
      - 20 Hz to 2 kHz
      - < -92 dB
      - -96 dB
    - Measurement bandwidth
      - 50 Hz to 100 kHz
      - < -87 dB
- **Sweep parameters**
  - Frequency, level
  - Dynamic range
    - 80 dB referred to total peak value
  - Level error
    - ±0.5 dB
  - Inherent distortion
    - DFD
      - < -96 dB
      - -100 dB
      - Dynamic range
        - 80 dB referred to total peak value
  - Sweep parameters
    - Center frequency
      - ±0.5 dB
      - ±0.5 dB

**Multi-sine**
- Characteristics
  - Level and frequency individually selectable for each line
  - 1 to 17 spectral lines
  - Frequency spacing
    - 20 Hz to 20 kHz
    - 2.05 kHz
    - ±0.01 dB
    - ±0.5 dB
  - Modulation distortion
    - 20 Hz to 2 kHz
    - ±0.05 dB
    - ±0.5 dB
  - Dynamic range
    - ±0.5 dB

**DIM (with option UPD-B only)**
- **Characteristics**
  - Level and frequency individually selectable for each line
  - 1 to 17 spectral lines
  - Frequency spacing
    - 20 Hz to 20 kHz
    - 2.05 kHz
    - ±0.01 dB
    - ±0.5 dB
  - Modulation distortion
    - 20 Hz to 2 kHz
    - ±0.05 dB
    - ±0.5 dB
  - Dynamic range
    - ±0.5 dB

**MOD DIST**
- **Frequency range**
  - Lower frequency
    - 30 Hz
    - 100 Hz
  - Upper frequency
    - 500 Hz
    - 1 kHz
- **Level ratio (LF:UF)**
  - ±0.5 dB
  - ±0.5 dB
- **Level error**
  - ±0.5 dB
  - ±0.5 dB
- **Inherent distortion**
  - DFD
    - ±0.5 dB
  - ±0.5 dB
  - Dynamic range
    - ±0.5 dB

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**Audio Analyzer UPD**

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16 Audio Analyzer UPD
Digital analyzers

Squarewave
- Frequency range: 2 Hz to 10 kHz
- Max. level: 40 Vpp (20 Vpp unbalanced)
- Rise time: ≤ 2.5 ns
- Sweep parameters: with generator ANLG 25 kHz only

Sine burst, sine^3 burst
- Burst time: 1 sample up to 60 s
- Interval: 1 sample resolution
- Bandwidth: 25/110 kHz with generator ANLG 25 kHz/110 kHz
- Sweep parameters: burst frequency, level and time, interval

Noise
- Noise in time domain
- Noise in frequency domain

Carrier frequency
- Frequency range: 1.86 Hz to 25 kHz
- Frequency spacing: adjustable from 5.86 Hz above
- Distribution: white, pink, 1/3 octave, defined by file

Sine burst
- Burst time: 1 sample up to 60 s
- Interval: 1 sample resolution
- Bandwidth: 25/110 kHz with generator ANLG 25 kHz/110 kHz
- Sweep parameters: burst frequency, level and time, interval

Polarity test signal
- with generator ANLG 25 kHz only

FM signal
- Carrier frequency: 2 Hz to 25 kHz
- Modulation frequency: 2 Hz to 25 kHz
- Modulation: 0 to 100%

DC offset
- if all signals except squarewave and DTM: no DC offset in the case of signal generation with low Dist ON
- with analyzer DIG 768 kHz only

Serial (universal)
- Channels: 1 and/or 2 separate or multiplexed
- Channel 1/2
- Word width: 37-contact DSub connector (male)
- Synchronization: clock selectable, provided by option UPD-B3 (high speed extension)

Parallel
- Channels 1 and/or 2 multiplexed
- Word width: 37-contact DSub connector (male)
- Synchronization: clock selectable

Audio
- Impedance
- Level
- Unbalanced input

Measurement functions
- (all measurements at 24 bits, full scale)
- RMS value, wideband
- Measurement bandwidth
- Measurement error
- AUTO FAST
- AUTO
- FIX
- Integration time
- AUTO FAST
- AUTO VALUE
- Filter
- Spectrum
- Measurement error
- RMS value, selective
- Bandwidth (-0.1 dB)
- Selectivity
- Frequency setting
- Measurement error
- Peak value
- Measurement
- Measurement error
- Peak value
- Filter

Inputs
- with option UPD-B2
- Channels: 1, 2 or both
- Format: 32/64/148 kHz professional and consumer format to IEC-958 as well as user-selectable formats at all inputs
- XR connector (female), transformer coupling
- Unbalanced input
- Impedance Level
- Optical input

Audio Analyzer UPD
Quasi-peak Measurement, measurement error
Filter
S/N measurement routine
FFT analysis
Total harmonic distortion (THD)
Spectral distortion
Modulation distortion (MOD DIST)
Difference frequency distortion (DFD)
Dynamic intermodulation distortion (DIM)
Wow and Flutter
WAVEFORM display
Polarity test
Digital generators

1) Total inherent distortion of analyzer and generator.
2) Fixed frequency independent of sampling rate.
**Audio Analyzer UPD 19**

<table>
<thead>
<tr>
<th>Format</th>
<th>Professional and consumer format to IEC-PS 8 as well as user-definable formats for all outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balanced output</td>
<td>XLR connector (male), transformer coupling</td>
</tr>
<tr>
<td>Impedance</td>
<td>110 Ω, balanced, transformer coupling</td>
</tr>
<tr>
<td>Level</td>
<td>20 mVpp to 1.5 Vpp into 110 Ω, step size 20 mVpp</td>
</tr>
<tr>
<td>Unbalanced output</td>
<td>BNC connector, transformer coupling</td>
</tr>
<tr>
<td>Impedance</td>
<td>75 Ω, short-circuitproof</td>
</tr>
<tr>
<td>Level</td>
<td>10 mVpp to 1.5 Vpp into 75 Ω, step size 10 mVpp</td>
</tr>
<tr>
<td>Error</td>
<td>±1 dB (rms)</td>
</tr>
<tr>
<td>Optical input</td>
<td>TOSLINK</td>
</tr>
</tbody>
</table>

**Serial (universal)**
- Channels: 1-5 contact SUB connector (female)
- Word length: 8 to 16/24/32 bits
- Audio bits: 8 to 24
- Data format: MSB/LSB first
- Synchronization: 
  - Internal: 32 kHz, 44.1 kHz, 48 kHz
  - External: 100 Hz to 768 kHz
- Clock rate (word clock): Internal: 32 kHz, 44.1 kHz, 48 kHz and multiples thereof up to max. 768 kHz
  - External: 100 Hz to 768 kHz

**Parallel**
- Channels: 37-contact SUB connector (female)
- Word length: 28 bits
- Synchronization: word clock with pass./neg. edge
- Clock rate: Internal: 32 kHz, 44.1 kHz, 48 kHz and multiples thereof up to max. 768 kHz
  - External: 100 Hz to 768 kHz

**Signals**
- (all signals with 24 bits, full scale)
  - General characteristics:
    - Level resolution: 2-24
    - Audio bits: 8 to 28 (8 to 24 with AES), LS8 rounded off
    - Other:
      - Distribution: Gaussian, triangular, rectangular
      - Frequency error: ±50 ppm (internal clock), ±1 ppm relative to clock rate
      - Frequency offset*:
        - DC offset: 0 ± 1000 ppm
        - AC offset: 0 ± 1 FS adjustable
  - With SINE, DFD and MOD-DIST signals:
    - Differentiator generator DIG 768 kHz

**Sine**
- Frequency range: 2 Hz to 21 kHz [350 kHz]
- Sweep parameters: 1 cycle

**MOD DIST**
- Frequency range: 30 Hz to 200 kHz
- Lower frequency: 30 Hz
- Upper frequency: 200 kHz
- Level ratio (SL/LF):
  - LF/LF level ratio: 1 to 1
  - LF/LH level ratio: 1 to 1
- Inherent distortion:
  - LF/LF level ratio: 1 to 1
  - LF/LH level ratio: 1 to 1
- Sweep parameters:
  - Fixed frequency, independent of sampling rate.
  - Total inherent distortion of analyzer and generator.

**DFD**
- Frequency range: 80 Hz to 100 Hz to 1 kHz
- Sweep parameters: center frequency, level
- Inherent distortion:
  - 2nd order

**DIM**
- Waveform: Square wave
- Sweep parameters: 
  - Frequency range: 2 Hz to 21 kHz
  - Frequency spacing: 1 dB
  - Dynamic range: 2 Hz to 1 kHz, 20 kHz

**Noise**
- Noise in time domain:
  - Distribution: Gaussian, triangular, rectangular
  - Frequency range: 2.93 Hz to 21 kHz
  - Frequency spacing: adjustable from 2.93 Hz to 21 kHz
  - Level: -90 dB to 0 dB

**Arbitrary waveform**
- Memory size: 20 ms
- Clock rate: 768 kHz

**FM signal**
- Carrier frequency: 2 Hz to 21 kHz
- Frequency modulation: ±100 Hz

---

* | For difference tone measurements
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>80 Hz</td>
<td>100 Hz to 1 kHz</td>
</tr>
<tr>
<td>200 Hz</td>
<td>200 Hz to 20 kHz</td>
</tr>
<tr>
<td>2.93 Hz</td>
<td>2.93 Hz to 21 kHz</td>
</tr>
<tr>
<td>2 Hz</td>
<td>2 Hz to 21 kHz</td>
</tr>
</tbody>
</table>

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**Audio Analyzer UPD 19**
**Digital audio protocol (option UPD-B2)**

**Generator**
- Validity bit: NONE, L, R, L+R
- Error simulation: parity/block error/sequence error/CRC error (correctly or with adjustable error rate)
- Channel status data: predefined masks, predefined masks for professional and consumer formats to IEC 958
- Local time code: automatic generation selectable
- User data: loaded from file (max. 16384 bytes) or set to zero

**Analyzer**
- Display: validity bit L and R, change of status bits, differences between L and R
- Error indication: block errors, sequence errors, clock rate errors, preamble errors, parity, CRC
- Clock-rate measurement: 50 ppm
- Channel status display: user-definable mnemonic display of data fields, predefined setting for professional and consumer format to IEC 958, binary and hexadecimal format
- User bit display: user-definable mnemonic display, block-synchronized

**FFT analyzer**
- Frequency range: digital 2 Hz to 150 kHz, analog 2 Hz to 300 kHz
- Dynamic range:
  - Digital: >135 dB (120 dB/10 dB)
  - Analyzer ANLG 22 kHz (with/out analog notch filter) 115 dB/95 dB (with/out analog notch filter)
  - Analyzer ANLG 100/300 kHz (with/out analog notch filter)
- Noise floor:
  - Digital -160 dB
  - Analyzer ANLG 22 kHz -140 dB/10 dB
  - Analyzers ANLG 100/300 kHz -120 dB/90 dB (with/out analog notch filter)
- FFT size:
  - Digital 256, 512, 1 k, 2 k, 4 k, 8 k points
  - Window functions: rectangular, Hann, Blackman-Harris, Rife-Vincent 1 to 3, Hamming, flat top, Kaiser (0 = 1 to 20)
  - Resolution:
    - from 0.023 Hz without zoom
    - from 0.023 Hz with zoom
  - Zoom: 2 to 256 with ANLG 22 kHz and DIG 48 kHz
  - 2 to 16 with ANLG 100/300 kHz
  - 2 to 8 with DIG 192/768 kHz
  - 1 to 256, exponential and normal

**Filters**
- For all analog and digital analyzers: Up to 4 filters can be combined as required. All filters are digital filters with a coefficient accuracy of 12 bit floating point (exception: analog notch filter)
- **User-definable filters**
  - Design parameters:
    - Butterworth (cubic, quartic, {...})
    - Low-pass and high-pass filter
    - Band-pass and band-stop filter
    - Notch filter
    - Third and octave filters
- **File-defined filters**
  - Any 5th-order filter cascaded from 4 bins, defined in the range by poles/zeroes or coefficients

**Analog notch filter**
- For measurements with high S/N ratio, this filter improves the dynamic range of the analyzer by up to 30 dB to 120 dB with 22 kHz analyzer or 100 kHz and 300 kHz analyzers (typical noise floor of FFT). This filter is also used for measuring THD, THD+N and MOD DIST with dynamic noise precision.

**Audio monitor/parallel I/O interface (option UPD-B5)**
- **Headphone connector:** 6.3 mm jack socket
- **Output voltage:** max. 8 V
- **Source impedance:** max. 50 kΩ
- **Source impedance:** 10 kΩ, short-circuit proof
- **Headphone impedance:** 600 Ω
- **Parallel I/O interface:** for signal routing switches 25-pin DB25 connector (female)

**Sweep**
- **Generator sweep**
  - Parameters: frequency, level, with bursts also interval and duration, one or two-dimensional
  - Linear, logarithmic, cubic, single, continuous, manual
  - Automatic after end of measurement
  - Time delay (fixed or loaded table)
- **Analyzer sweep**
  - Parameters: frequency or level of input signal, single, continuous, delayed (0 to 10 s) after input level or input frequency variation, setting function selectable
  - Time controlled for level, frequency, phase, distortion measurement
  - Setting: function, exponential, linear or averaging

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**Audio Analyzer UPD 20**
**Result display**

**Units**
- Level (analog): V, dBu, dBV, W, dBm, difference ( Δ ), deviation ( %Δ ) and ratio (without dimension, %, dB), to reference value
- Level (digital): FS, % FS, dB FS, Δ FS, deviation ( %Δ ) or ratio (dB), to reference value

**Distortion**
- % at dB, referred to signal amplitude, THD and THD+N on all available level units (absolute or relative to selectable reference value)

**Frequency**
- Hz, difference (Δ), deviation ( %Δ ) and ratio (as quotient f/f REF, 1/3 octave, octave or decade), to reference value (entered or stored, current generator frequency)

**Phase**
- °, rad, difference ( Δ ), to reference value (entered or stored)

**Reference value (level):**
- Fixed value (entered or stored)
- Current value of a channel or generator signal permits direct measurement of gain, linearity, channel difference, crosstalk. In sweep mode curves (other trace or loaded from file) can be used as reference too.

**Graphical data display**
- Screen: 9" LCD, monochrome or colour
- Display modes:
  - Display of curve groups
  - Bar graph display with min. /max. values
  - Spectrum, also as waterfall display
  - Result lists
  - Bar chart for THD and
  - Intermodulation measurements
- Display functions:
  - Autoscale
  - X-axis zoom
  - Full-screen and part-screen mode
  - 2 vertical, 1 horizontal cursor line
  - Search function for max. values
  - Marker for harmonics (spectrum)
  - User-labelling for graphs
  - Change of unit and scale also possible for loaded curves

**Ordering information**
- Audio Analyzer UPD 1030.7500.03 (colour LCD)
- 1030.7500.04 (monochrome LCD)
- Order designation
- Accessories supplied
  - Power cable, operating manual, backup program disk with operating software and measurement software

**Remote control**
- to IEC 623.2 (IEEE 488), commands mostly to SCPI (option UPD-B4)

**Storage functions**
- Instrument settings
- Spectrum
- Sweep results
- Sweep lists
- Tolerance curves
- Equalizer curves

**General data**
- Operating temperature range: 0 to +45°C
- Storage temperature range: -20 to +60°C
- Humidity: 85% for max. 60 days, below 65% on average/year, no condensation
- EMI: EN 50081-1
- Power supply: 110/120/220/230/240 V ±10%, 290 VA, 47 to 63 Hz
- Dimensions (W x H x D): 435 mm x 236 mm x 475 mm
- Weight: 22 kg

**Recommended extras**
- 19" Adapter ZZA-95 0396.4911.00
- Service-manual UPD 22 1031.3208.02
- Service Kit UPD 22 1031.3208.02