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

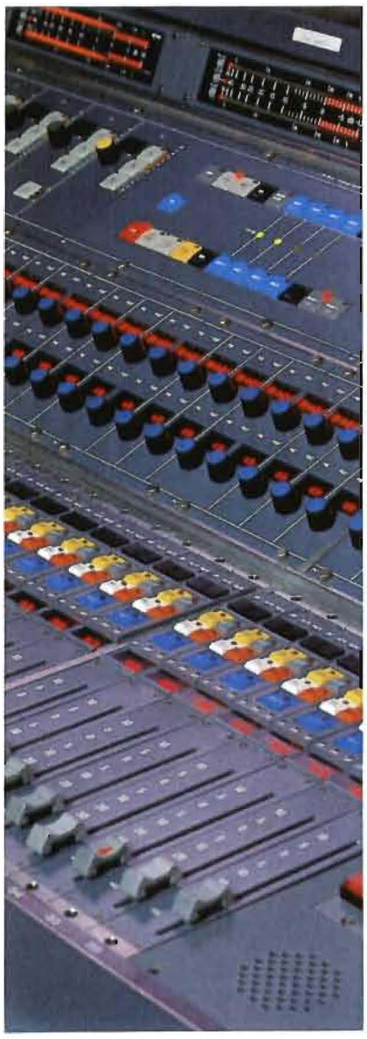
The Audio Analyzer UPD is a compact, universal measuring instrument with built-in generators for measuring the full range of audio parameters at analog and digital interfaces. The UPD measures fast and is equipped with all commonly used interfaces. Windowing and user prompting make the UPD easy to use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

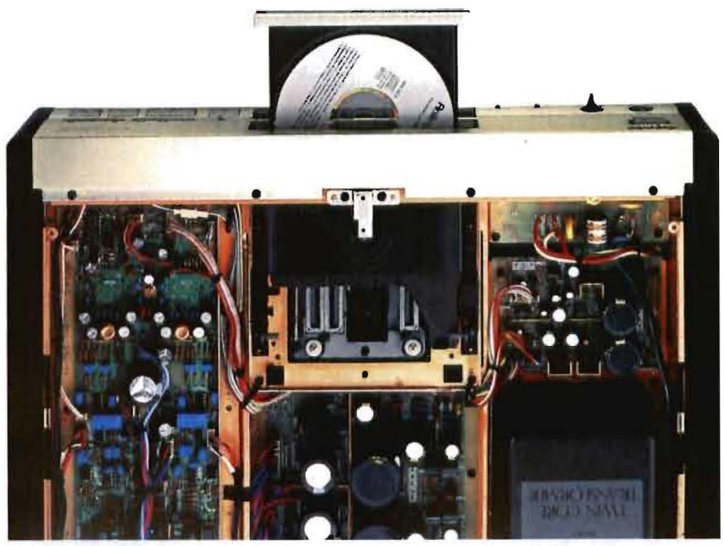
"Your decision for the UPD is a decision for the future."

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 3 ½" 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

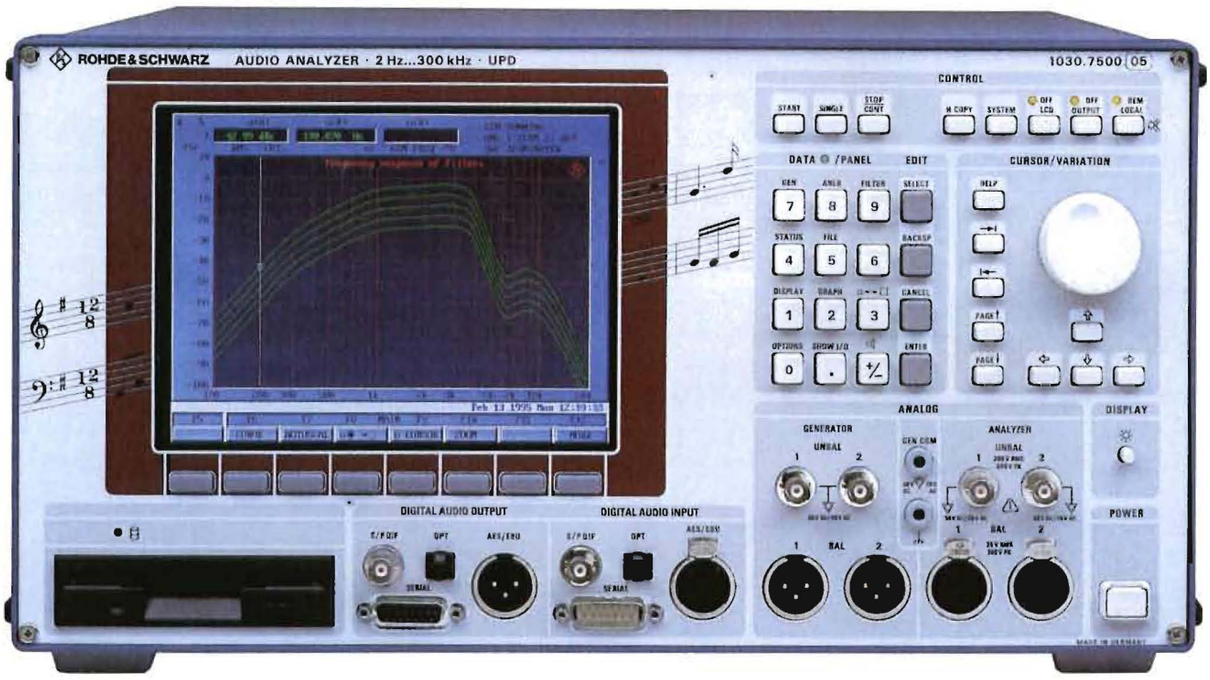
Equipped with all common interfaces, the UPD can measure just about anything. In future you won't need three measuring instruments – but just one. The UPD Audio Analyzer. No matter what interface you have – we'll make the connection.

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 2σ 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.

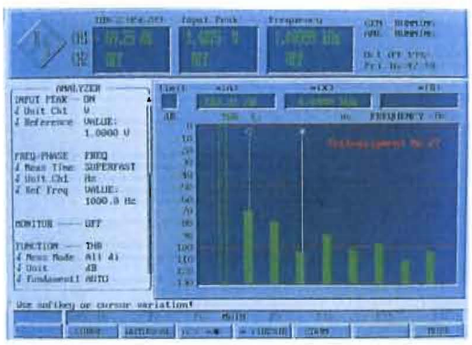


Fig. 1: Values obtained from harmonic distortion and intermodulation measurements can alsa be displayed as a histogram diagram

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.

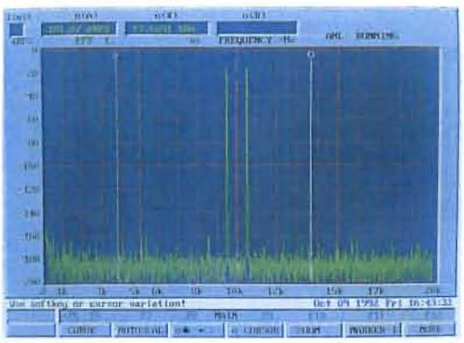


Fig. 2: FFT spectrum of a two-tone signal produced by UPD generator shown in full-screen mode

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.

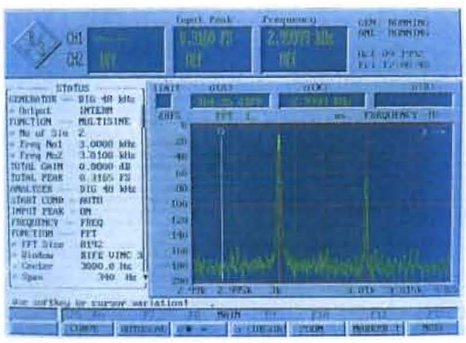


Fig. 3: Zoom FFT of a sinewave signal with a nonharmonic spaced 10 Hz away

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.
- Sine^2 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.

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).

- S/P DIF and optical interface for measurements on consumer electronics (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:

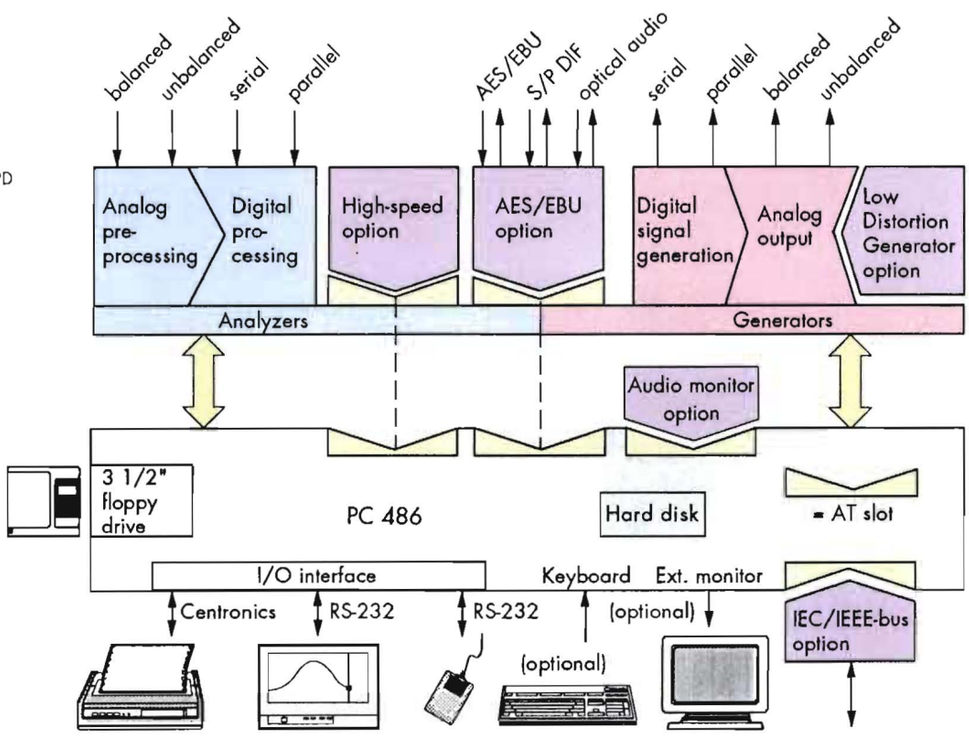


Fig. 4: Block diagram of UPD

- 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, bandstop, 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).

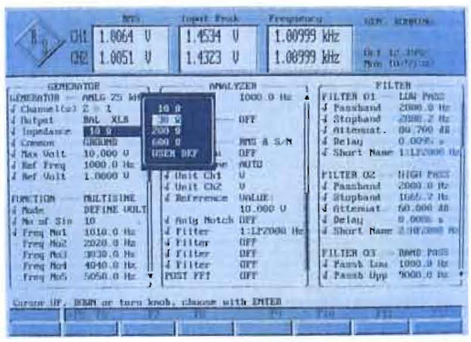


Fig. 5: Related functions and settings are combined in panels

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 can, of course, be printed out on a printer or plotter. Drivers for over 130 printers are supplied with the UPD.

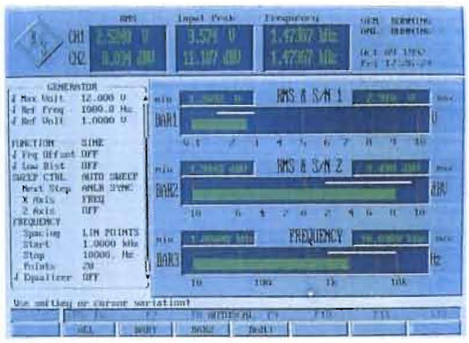


Fig. 6: Bargraph display of rms value for both channels and of frequency with maximum and minimum indicotions superimpased

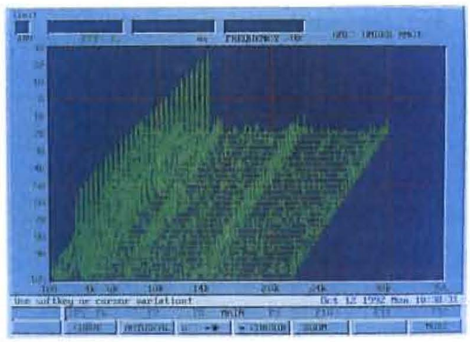


Fig. 7: Three-dimensional spectral display (waterfoll)

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 SCPCI). 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.

Specifications

Data without tolerances are typical values

Analog analyzers

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

Analyzer	Frequency range
ANLG 22 kHz	2 Hz/10 Hz to 21 90 kHz
ANLG 100 kHz	20 Hz ta 100 kHz
ANLG 300 kHz	50 Hz ta 300 kHz
Voltage measurement ranges	5-dB steps for V_{in} >300 mV 10-dB steps for V_{in} <300 mV
Measurement error	±0.05 dB at 1 kHz (sine, rms)

Frequency respanse*)

20 Hz ta 22 kHz	±0 03 dB
10 to 20 Hz	±0.15 dB
22 to 50 kHz	±0.1 dB
50 to 100 kHz	±0.2 dB
100 ta 300 kHz	±1 0 dB

*) Relative to 1 kHz, sine, rms.
For analyzer ANLG 22 kHz with lower measurement limit 2 Hz (min. freq. 2 Hz): ±0.03 dB from 10 Hz to 22 kHz, ±0.5 dB from 2 Hz ta 10 Hz.
Additional error ±0.1 dB for voltages >60 V unbalanced (>10 V balonced) and frequencies >50 kHz.

Inputs

Balanced

Voltage ronge	0.1 µV to 35 V_{rms} (sine)
Input impedance	300 Ω, 600 Ω, 20 kΩ, ±0 5% each, one value <20 kΩ specified by user, parallel 200 pF
Crosstalk attenuation	>120 dB, frequency <22 kHz
Common mode rejection (V_{in} <3 V)	>110 dB at 50 Hz, >86 dB at 1 kHz, >60 dB at 16 kHz
Common mode voltage (V_p)	max. 50 V (safety regulation), protected by surge protector

Unbalanced

	2 independent channels, BNC connectors, floating/grounded switchable
Voltage range	0.1 µV to 300 V_{rms} (sine)
Input impedonce	1 MΩ shunted by 200 pF
Crasstalk attenuation	>120 dB, frequency <22 kHz
Cammon-mode rejection (V_{in} <3 V)	>100 dB at 1 kHz
Cammon-mode voltage (V_p)	max. 50 V (safety regulation), protected by surge protectar

Generator output

each input switchable ta any autput, input impedance: balanced 200 kΩ, unbalanced 100 kΩ

Measurement functions

RMS value, wideband

Measurement error	
Measurement speed	
AUTO	±0.05 dB at 1 kHz, sine
AUTO FAST	±0.1 dB additional error
Integration time	
AUTO FAST	4.2 ms, at least 1 cycle
AUTO	42 ms, at least 1 cycle
VALUE	1 ms to 10 s
Noise (600 Ω)	
with A weighting filter	1 µV
with CCIR unweighting filter	<2 µV (typ. 1.6 µV)
Filter	weighting filter and user-definable filters, up to 4 filters cambinable; additional analog notch filter (dynamic range expanded by up to 30 dB)
Spectrum	post-FFT of filtered signal

RMS value, selective

Bandwidth (–0.1 dB)	1%, 3%, 1/12 octove, 1/3 octave and user-selectable fixed bandwidth; minimum bandwidth 10 Hz
Selectivity	100 dB, bondpass or bandstop filter, 8th-order filter, elliptical
Frequency setting	– automatic to input signal – coupled to generator – fixed through entered value – sweep through user-selectable range
Measurement error	±0.1 dB + ripple af filter

Peak value

Meosurement	with analyzer ANLG 22 kHz only peak max., peak min., peak-ta-peak, peak absalute
Measurement error	±0.2 dB at 1 kHz
Interval	20 ms to 10 s
Filters	weighting filter and user-definable filters, up to 3 filters combinable

Quasi-peak

Measurement, measurement error	with analyzer ANLG 22 kHz only to CCIR 468-4
Noise (600 Ω)	<8 µV with CCIR weighting filter
Filters	weighting filter and user-definable filters, up to 3 filters combinable, analog notch filter in addition

DC voltage

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

S/N measurement routine

available for measurement functions
– rms, wideband
– peak
– quasi-peak
indication of S/N ratia in dB,
no past-FFT

FFT analysis

see FFT analyzer section

Total harmonic distortion (THD)

Fundamental	6 Hz to 110 kHz
Frequency tuning	– automatic ta input signal – coupled to generator – fixed through entered value
Weighted harmanics	any combination af d_2 to d_9, up to max. 300 kHz
Measurement error, harmanics	
<50 kHz	±0.5 dB
<100 kHz	±0.7 dB
<300 kHz	±1.5 dB

Inherent distortion*)

Analyzer ANLG 22 kHz		
Fundamental	>100 Hz	<–110 dB, typ. –115 dB
	20 to 100 Hz	<–100 dB
	10 ta 20 Hz	<–96 dB
Analyzer ANLG 100 kHz		
Fundamental	50 Hz to 20 kHz	<–97 dB, typ –105 dB
	20 ta 50 kHz	<–92 dB
Analyzer ANLG 300 kHz		
Fundamental	130 Hz to 20 kHz	<–97 dB, typ. –105 dB
	20 to 50 kHz	<–92 dB
	50 to 110 kHz	<–86 dB

Spectrum: bor chart for signal and distortion

*) Total inherent distortion af analyzer and generator (with option UPD-B1), analyzer with dynamic made precision.
>10 V: typ. reduced by 3 dB; <0.5 V: sensitivity reduced by inherent naise (typ. 0.25/1.25/2.5 µV for 22/100/300-kHz analyzers).

THD+N and SINAD

Fundamental		20 Hz to 110 kHz
Frequency tuning		– automatic to input signal – coupled to generator – fixed through entered value
Input voltage		>100 µV typ. with automatic tuning
Bandwidth		upper and lower frequency limit selectable, one additional weighting filter
Measurement error		
Bandwidth	<50 kHz	±0.5 dB
	<100 kHz	±0.7 dB
	<300 kHz	±1.5 dB
Inherent distortion*)		
Analyzer ANLG 22 kHz		
Bandwidth	20 Hz to 21.90 kHz	typ. –110 dB at 1 kHz, 2.5 V <–105 dB +2 µV typ. –108 dB +1.5 µV**)
Analyzer ANLG 100 kHz		
Bandwidth	142 Hz to 22 kHz	<–95 dB + 2.5 µV typ. –100 dB +1.75 µV
	142 Hz to 100 kHz	<–88 dB + 5 µV typ. –95 dB + 3.5 µV
Analyzer ANLG 300 kHz		
Bandwidth	427 Hz to 22 kHz	<–97 dB + 2.5 µV typ. –100 dB +1.75 µV
	427 Hz to 100 kHz	<–90 dB + 5 µV typ. –95 dB + 3.5 µV
	427 Hz to 300 kHz	<–85 dB +10 µV typ. –92 dB + 7 µV
Spectrum		post-FFT of filtered signal

*) Total inherent distortion of analyzer and generator (with optian UPD-B1), analyzer with dynamic mode precision, fundamental <100 kHz.
**) For full measurement range (<–100 dB + 2 µV with Auto Range).
<–100 dB + 2 µV for fundamental <100 Hz,
<–100 dB for input voltage >5 V.

Modulation distortion (MOD DIST)

Measurement procedure		selective to DIN IEC 268-3
Frequency range	Lower frequency	30 to 500 Hz
	Upper frequency	4 to 100 kHz*)
Measurement error		±0.50 dB
Inherent distortion**)		
Upper frequency	4 to 15 kHz	<–96 dB (–90 dB), typ. –103 dB
	15 to 20 kHz	<–96 dB (–85 dB)
Spectrum		bar chart for signal and distortion

*) For upper frequency >20 kHz the bottam limit of lawer frequency is reduced.
**) Input voltage >200 mV, typical values apply to 0.5 to 5 V.
Lower frequency >200 Hz, values in ( ) for lawer frequency <200 Hz.
Dynamic mode precision; level ratio LF:UF = 4:1.

Difference frequency distortion (DFD)

Measurement procedure		selective to DIN-IEC 268-3
Frequency range		
Difference frequency		80 Hz to 1 kHz
Center frequency		200 Hz to 100 kHz*)
Measurement error		±0.50 dB, center frequency <20 kHz
Inherent distortion**)	DFD d_2	<–115 dB, typ. –125 dB
	DFD d_3	<–96 dB, typ. –105 dB
Spectrum		bar chart for signal and distortion

*) Far center frequency >20 kHz the bottom limit far the difference frequency is reduced.
**) Input voltage >200 mV, typical values apply to 0.5 to 5 V.
Dynamic mode precision (at DFD d_2), center frequency 5 to 20 kHz.

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

Measurement procedure	selective weighting of all nine interfering lines to DIN-IEC 268-3
Test signal	square/sine 3.15 kHz/15 kHz ar 2.96 kHz/14 kHz, frequency talerance ±3%, any square/sine amplitude ratio (standard: 4:1)
Measurement error	±1 dB
Inherent distartion*)	<–85 dB, typ. –90 dB
Spectrum	bar chart for signal and distortion

*) Input voltage >200 mV, typ. values apply ta 0.5 to 5 V.
Tatal IM distortion af analyzer and generotor at full measurement range (<–80 dB in the case of Auto Range).

Wow and flutter (with analyzer ANLG 22 kHz only)

Measurement procedure		DIN IEC, NAB, JIS, 2-sigma to IEC-386
Weighting filter	OFF	highpass 0.5 Hz, bandwidth 600 Hz
	ON	bandpass 4 Hz to IEC-386
Measurement error		±3%
Inherent naise		<0.0005% weighted <0.001% unweighted
Spectrum		post-FFT af demadulated signal

WAVEFORM display

Trigger	rising/falling edge
Trigger level	–300 to +300 V, interpolated between samples
Trace length	max. 7424 points (standard mode), max. 65530 points (enhanced mode, single channel only)
Interpolation	1, 2, 4, 8, 16, 32 (standard mode)

Frequency

Frequency range	2 Hz to 300 kHz
Measurement error	±50 ppm
Input voltage	>5 mV

Phase

Measurement error	
at 1 kHz	±0.1° typ.
20 Hz to 25 kHz*)	±0.4°
10 to 20 Hz	±1.0°
25 to 100 kHz	±1.75°
Input voltage	>15 mV, two signals with almost same level
Display range	±180° or 0 to 360°

*) ±0.4° above 2 Hz, with analyzer ANLG 22 kHz and lawer limit of frequency range 2 Hz (min. freq. 2 Hz)

Polarity test

Measurement	polarity of a non-symmetricol input signal
Display	+POL, –POL

Analog generators

A 20-bit D/A converter is used for analog signal generation. Twa generators differing in frequency range, specifications and test signals are pravided:

Generator	Frequency range	Sample rate
ANLG 25 kHz	2 Hz to 25 kHz	96 kHz
ANLG 110 kHz	2 Hz ta 110 kHz	384 kHz

The characteristics af the basic generator model can be impraved and extended with a low-distortian RC oscillator (Law-Distortion Generator option UPD-B1):
- sine with reduced distortion
- improved intermodulation signals DFD and MOD DIST
- signal generation far dynamic intermadulation measurement DIM

Outputs

Balanced

	XLR connectors (male), 2 channels floating/grounded switchable, short-circuit-praof; external feed <120 mA
Voltage	0.1 mV to 24 V_{rms} (sine, open-circuit)
Crosstalk attenuation	>117 dB, frequency <20 kHz
Source impedance.	10 Ω, 30 Ω ±0.5 Ω, 200 Ω, 600 Ω, ±0.5% in each case, one user-selectable value >30 Ω
Load impedance	>400 Ω (incl. source impedance)
Output balance	>80 dB at 1 kHz
(output floating)	>60 dB at 20 kHz

Unbalanced

	BNC connectors (female), 2 channels, floating/grounded switchable, short-circuit-proof, externol feed <120 mA
Voltage	0.1 mV to 12 V_{rms} (sine, open-circuit)
Crosstolk attenuation	>117 dB, frequency <20 kHz
Source impedance	5 Ω, 15 Ω ±0.5 Ω, one user-selectable value >15 Ω
Lood impedance	>200 Ω

Signals

Sine

Frequency range	
Generotor ANLG 25 kHz	2 Hz to 25 kHz
Generotor ANLG 110 kHz	2 Hz to 110 kHz
Frequency error	±50 ppm
Level error	±0.1 dB ot 1 kHz
Frequency response (referred to 1 kHz)	
20 Hz to 20 kHz	±0.05 dB
2 Hz to 110 kHz	±0.1 dB
Inherent distortion THD+N	
Generotor ANLG 25 kHz, fundamental 20 Hz to 25 kHz	
Measurement bandwidth	
20 Hz to 22 kHz	<–92 dB, typ. –96 dB
20 Hz to 100 kHz	<–87 dB
Generator ANLG 110 kHz, fundamental 20 Hz to 100 kHz	
Measurement bandwidth	
20 Hz to 22 kHz	<–94 dB, typ –98 dB
20 Hz to 100 kHz	<–80 dB
Sweep parameters	frequency, level

Sine (with low-distortion generotor option)

Frequency range	2 Hz to 110 kHz
Frequency error	
PRECISION	±0.1 %
FAST	±0.5 % at 15 to 30 °C ±0.75 % at 5 to 45 °C
Level error	±0.1 dB ot 1 kHz
Frequency response (referred to 1 kHz)	
20 Hz to 20 kHz	±0.05 dB
10 Hz to 110 kHz	±0.1 dB
Hormonics	typ. <–120 dB (<–130 dB at 1 kHz), measurement bandwidth 20 Hz to 20 kHz, voltage 1 to 5 V
Inherent distortion	THD
Fundamental 1 kHz, 1 to 10 V	<–125 dB typ.
20 Hz to 2 kHz	<–113 dB
2 to 7 kHz	<–110 dB
7 to 20 kHz	<–105 dB
20 to 50 kHz	<–92 dB
50 to 100 kHz	<–86 dB

		THD + N*)	Meosurement bandwidth
Fundamental	1 kHz, 2.5 V	–110 dB typ.	22 kHz
	100 Hz to 20 kHz	<–105 dB +2 µV	22 kHz
	20 Hz to 100 Hz	<–100 dB +2 µV	22 kHz
	<100 kHz	<–90 dB +5 µV	100 kHz
	<20 kHz	<–88 dB +10 µV	300 kHz
	<100 kHz	<–85 dB +10 µV	300 kHz
Sweep parameters		frequency, level	

*) Total inherent distortion of onalyzer and generator; analyzer using dynamic mode precision. When the low-impedance source resistors are used (unbalanced 5 Ω, balanced 10 Ω), the measured THD+N value in level range 0.6 to 2.5 V balonced (0.3 to 1.25 V unbalanced) is reduced by typ. 3 dB because of noise.

MOD DIST

		for measuring the modulation distortion
Frequency range	Lower frequency	30 to 500 Hz
	Upper frequency	4 to 110 kHz (4 to 25 kHz with ANLG 25 kHz)
Level ratio (LF:UF)		from 10:1 to 1:1, selectable
Level error		±0.5 dB
Inherent distortion		<–80 dB, typ. –90 dB, upper frequency 4 to 25 kHz, level ratio LF:UF = 4:1
Sweep parameters		upper frequency, level

MOD DIST (with low-distortion generator option)

Frequency range	Lower frequency	30 to 500 Hz
	Upper frequency	4 to 110 kHz
Level ratio (LF:UF)		from 10:1 to 1:1, selectable
Level error		±0.50 dB
Inherent distortion*)		
Upper freqency	4 to 15 kHz	<–96 dB (–90 dB), typ –103 dB
	15 to 20 kHz	<–96 dB (–85 dB)
Sweep parameters		center frequency, level

*) Output voltage >200 mV, typ. values apply from 0.5 to 5 V. Lower frequency >100 Hz, value in ( ) for lower frequency <100 Hz. Level ratio LF:UF = 4:1.

DFD

		for difference tone measurement
Frequency range		
Difference frequency		80 Hz to 1 kHz
Center frequency		200 Hz to 109 kHz (max 24 kHz with ANLG 25 kHz)
Level error		±0.5 dB
Inherent distortion*)	DFD d_2	< –114 dB, typ. –120 dB
	DFD d_3	< –85 dB, typ. –95 dB
Sweep parameters		center frequency, level

*) Center frequency 5 to 20 kHz, DFD d_2 –95 dB (typ.) with DC offset

DFD (with low-distortion generator option)

Frequency range		
Difference frequency		80 Hz to 1 kHz
Center frequency		200 Hz to 109 kHz
Level error		±0.50 dB
Inherent distortion*)	DFD d_2	<–120 dB, typ. –125 dB
	DFD d_3	<–96 dB, typ. –105 dB
Sweep parameters		center frequency, level

*) Output voltage >200 mV, typ. values apply from 0.5 to 5 V. DFD d_3, total inherent distortion of analyzer and generator Center frequency 5 to 20 kHz

DIM (with option UPD-B1 only)

	for DIM measurements to DIN-IEC 268-3 (dynomic intermodulation distortion)
Waveform	squore/sine 3.15/15 kHz or 2.96/14 kHz, squore/sine amplitude ratio 4:1, bandwidth (3 dB) 30/100 kHz, selectable
Max level	50 V_{pp} (25 V_{pp} unbalanced)
Level error	±0.5 dB
Inherent distortion*)	<–85 dB, typ. –90 dB
Sweep parameter	level

*) Input voltage >200 mV, typ. values apply from 0.5 to 5 V Total inherent distortion of analyzer and generator at full measurement dynamic (<–80 dB with Auto Range).

Multi-sine

Characteristics	– 1 to 17 spectral lines – level and frequency individually selectable for each line – phase of individual components optimized for minimum crest factor – rms and peak value of total signal displayed
Generator ANLG 25 kHz	
Frequency range	5.86 Hz to 25 kHz
Frequency spacing	adjustable from 5.86 Hz with <0.01 % resolution or matching to FFT frequency spacing
Dynamic range	100 dB referred to total peak value
Generator ANLG 110 kHz	
Frequency range	23.44 Hz to 110 kHz
Frequency spacing	adjustable from 23.44 Hz with <0.01 % resolution or matching to FFT frequency spacing
Dynamic range	80 dB referred to total peak value

Squarewave with generator ANLG 25 kHz only
Frequency range 2 Hz to 10 kHz
Max. level 40 V_{pp} (20 V_{pp} unbalanced)
Level error ±0.2 dB_{rms}
Rise time 1.5 µs
Sweep parameters frequency, level

Sine burst, sine² burst
Burst time 1 sample up to 60 s, 1-sample resolution
Interval burst time up to 60 s, 1-sample resolution
Low level 0 to burst level, absolute or relative to burst level (0 with sine² burst)
Bandwidth 25/110 kHz with generator ANLG 25 kHz/110 kHz (elliptical filter)
Sweep parameters burst frequency, level and time, interval

Noise
Noise in time domain
Distribution Gaussian, triangular, rectangular
Noise in frequency domain
Frequency range
Generator ANLG 25 kHz 5.86 Hz to 25 kHz
Generator ANLG 110 kHz 23.44 Hz to 110 kHz
Frequency spacing adjustable from 5.86 Hz (above 23.44 Hz with ANLG 110 kHz) with <0.01% resolution or matching to FFT frequency spacing
Distribution white, pink, 1/3 octave, defined by file

Arbitrary waveform loaded from file
Memory size max. 16384
Clock rate 96/384 kHz with generator ANLG 25 kHz/110 kHz
Bandwidth 25/110 kHz with generator ANLG 25 kHz/110 kHz (elliptical filter)

Polarity test signal with generator ANLG 25 kHz only
Sine² burst with following characteristics:
Frequency 1.2 kHz
On time 1 cycle (0.8333 ms)
Interval 2 cycles (1.6667 ms)

FM signal with generator ANLG 25 kHz only
Carrier frequency 2 Hz to 25 kHz
Modulation frequency 2 Hz to 25 kHz
Modulation 0 to 100%

DC offset*) 0 to ±10.0 V (±5 V unbalanced), 18-bit resolution
Error ±2%
Residual offset <1% of rms value of AC signal (typ. <0.1%)

*) For all signals except squarewave and DIM; no DC offset in the case of signal generation with Low Dist ON.
The DC offset reduces the AC voltage swing; specified distortion values apply to DC offset = 0.

Digital analyzers

Three analyzers of different bandwidth and measurement functions are available for digital measurements:

Analyzer	Frequency range
DIG 48 kHz	2 Hz/10 Hz to 21.90 kHz
DIG 192 kHz	10 Hz/100 Hz to 87 kHz
DIG 768 kHz	10 Hz/100 Hz to 350 kHz

With analyzers DIG 192 kHz and DIG 768 kHz the number of samples is limited to 96000. This reduces the lower limit frequency and the maximum filter settling time. Frequency limits specified for the individual measurement functions apply to a sampling frequency of 48 kHz. For other sampling frequencies limits are calculated according to the formula: $f_{new} = f_{48\,kHz} \times$ sampling rate/48 kHz. Maximum values for analyzer DIG 768 kHz are specified in [ ].

Inputs

Serial (audio) with option UPD-B2
Channels 1, 2 or both
Audio bits 8 to 24
Clock rate 32/44.1/48 kHz
Format professional and consumer format to IEC-958 as well as user-definable formats at all inputs
Balanced input XLR connector (female), transformer coupling
Impedance 110 Ω, 10 kΩ, selectable
Level min. 200 mV_{pp} max. 12 V_{pp} into 110 Ω (24 V_{pp} into 10 kΩ)
Unbalanced input BNC connector, grounded
Impedance 75 Ω
Level min. 100 mV_{pp}, max. 5 V_{pp}
Optical input TOSLINK

Serial (universal) 15-contact DSUB connector (male)
Channels 1 and/or 2 separate or multiplexed
Word length 8/16/24/32 bits
Audio bits 8 to 28
Data format MSB/LSB first
Synchronization pos./neg. edge of bit clock and word clock selectable, position of word clock within word user-selectable, word select (MUX) low/high
Clock rate 100 Hz to 1 MHz (word clock)

Parallel 37-contact DSUB connector (male)
Channel 1/MUX channel 1 or channels 1 and 2 multiplexed
Channel 2 provided by option UPD-B3 (high-speed extension)
Word width 28 bits
Synchronization word clock with pos./neg. edge, word select (MUX) low/high
Clock rate 100 Hz to 1 MHz

Measurement functions

(all measurements at 24 bits, full scale)

RMS value, wideband
Measurement bandwidth up to 0.5 times the clock rate
Measurement error
AUTO FAST ±0.1 dB
AUTO ±0.01 dB
FIX ±0.001 dB

Integration time
AUTO FAST 4.2 ms, at least 1 cycle
AUTO 42 ms, at least 1 cycle
VALUE 1 ms to 10 s
Filter weighting filter and user-definable filters, up to 4 filters combinable
Spectrum post-FFT of filtered signal

RMS value, selective
Bandwidth (–0.1 dB) 1%, 3%, 1/12 octave, 1/3 octave and user-selectable fixed bandwidth, minimum bandwidth 10 Hz
Selectivity 100 dB, bandpass or bandstop filter, 8th-order filter, elliptical
Frequency setting
– automatic to input signal
– coupled to generator
– fixed through entered value
– sweep through user-selectable range
Measurement error ±0.1 dB + ripple of filter

Peak value with analyzer DIG 48 kHz only
Measurement peak max., peak min., peak-to-peak, peak absolute
Measurement error ±0.2 dB at 1 kHz
Interval 20 ms to 10 s
Filter weighting filter and user-definable filters, up to 3 filters combinable

Quasi-peak
Measurement, measurement error — with analyzer DIG 48 kHz only to CCIR 468-4
Filter — weighting filter and user-definable filters, up to 3 filters combinable;

S/N measurement routine — available for measurement functions
– rms, wideband
– peak
– quasi-peak
indication of S/N ratio in dB, no post-FFT

FFT analysis — see FFT analyzer section

Total harmonic distortion (THD)
Fundamental — 6 Hz to 21.90 kHz [100 Hz to 350 kHz]
Frequency tuning — – automatic to input signal
– coupled to generator
– fixed through entered value
Weighted harmonics — any combination of d_2 to d_9, up to max. 21.90 kHz [350 kHz]
Measurement error — ±0.1 dB
Inherent distortion[1]
Fundamental 42 Hz to 21.90 kHz — <–130 dB
24 to 42 Hz — <–112 dB
12 to 24 Hz — <–88 dB
Spectrum — bar chart for signal and distortion

THD+N and SINAD
Fundamental — 20 Hz to 21.90 kHz [320 Hz to 350 kHz]
Frequency tuning — – automatic to input signal
– coupled to generator
– fixed through entered value
Stopband range — fundamental ±28 Hz, but max. up to 1st harmonic
Bandwidth — upper and lower frequency limit selectable, one additianol weighting filter
Measurement error — ±0.3 dB
Inherent distortion[1]
Bandwidth 20 Hz to 21.90 kHz
Fundamental 28 Hz to 21.90 kHz — <–126 dB
24 to 28 Hz — <–109 dB
20 to 24 Hz — <–96 dB
Spectrum — past-FFT of filtered signal

Modulation distortion (MOD DIST)
Measurement pracedure — selective to DIN IEC 268-3
Frequency range
Lower frequency — 30 [400] to 500 Hz[2]
Upper frequency — 4[2] to 21.25 kHz [348 kHz]
Measurement error — ±0.2 dB
Inherent distortion[1]
Level LF:UF 1:1 — <–133 dB
4:1 — <–123 dB
10:1 — <–115 dB
Spectrum — bar chart for signal and distortion

Difference frequency distortion (DFD)
Measurement pracedure — selective to DIN IEC 268-3
Frequency range
Difference frequency — 80 [500] Hz to 1 kHz[2]
Center frequency — 200 Hz to 20.90 kHz [348 kHz]
Measurement error — ±0.2 dB
Inherent distortion[1] DFD d_2 — <–130 dB
DFD d_3 — <–130 dB
Spectrum — bar chart for signal and distortion

[1] Total inherent distortion of analyzer and generator.
[2] Fixed frequency independent of sampling rate.

Dynamic intermodulation distortion (DIM) — (with onalyzer DIG 48 kHz only)
Measurement procedure — selective weighting of all nine interfering lines to DIN IEC 268-3
Test signal — square/sine 3.15/15 kHz or 2.96/14 kHz, frequency tolerance ±3%, any square/sine amplitude ratio (standard: 4:1)
Measurement error — ±0.2 dB
Inherent distortion[1] — <–125 dB
Spectrum — bar chart of signal and distortion

Wow and flutter — with analyzer DIG 48 kHz only
Measurement pracedure — DIN IEC, NAB, JIS, 2-sigma to IEC-386
Weighting filter OFF — highpass 0.5 Hz, bandwidth 600 Hz
ON — bandpass 4 Hz to IEC-386
Measurement error — ±3%
Inherent noise — <0.0003% weighted
<0.0008% unweighted
Spectrum — post-FFT of demaduloted signol

WAVEFORM display
Trigger — rising/falling edge
Trigger level — –1 FS to +1 FS, interpolated between samples
Trace length — max. 7424 points (standard mode), max. 65530 points (enhanced made, single channel only)
Interpolation — 1, 2, 4, 8, 16, 32 (standard mode)

Frequency*)
Frequency range
with RMS value — 2 Hz to 21.90 kHz
with THD — 6 Hz to 21.90 kHz
with FFT, THD+N — 20 Hz to 20 kHz
Measurement error — typ. ±5 ppm
THD+N <–70 dB
Input signal — >–80 dB FS

*)With measurement functions RMS value, THD, THD+N and FFT analysis only.

Phase*)
Measurement error — ±0.1°, 20 Hz to 20 kHz
Display range — ±180° or 0 to 360°

*)With FFT analysis at serial audio inputs only (AES/EBU, S/P DIF or OPTICAL).

Polarity test
Measurement — polarity of a non-symmetrical input signal
Display — +POL, –POL

Digital generators

Three generators of different frequency range and test signals ore avoilable for digital signal generation.

Generator	Frequency range
DIG 48 kHz	2 Hz to 21.90 kHz
DIG 192 kHz	2 Hz to 87 kHz
DIG 768 kHz	2 Hz to 350 kHz

Frequency limits indicated for the signals apply to a sampling rate of 48 kHz. For other sampling rates frequency limits are calculated according to the formula: $f_{new} = f_{48kHz} \times$ sampling rate/48 kHz.
Maximum values for generator DIG 768 kHz are specified in [ ].

Outputs

Serial (audio) — with option UPD-B2
Channels — 1, 2 or both
Audio bits — 8 to 24
Clock rate — internol: 32 kHz, 44.1 kHz, 48 kHz or synchronization to analyzer
external: synchronization to word clock input (27 to 55 kHz)

Format	professional and consumer format to IEC-958 as well as user-definable formats at all outputs
Balanced output	XLR connector (male), transformer coupling
Impedance	110 Ω, short-circuit-proof
Level	20 mV_{pp} to 5.1 V_{pp} into 110 Ω, step size 20 mV_{pp}
Error	±1 dB (rms)
Unbalanced output	BNC connector, transformer coupling
Impedance	75 Ω, short-circuit-praaf
Level	10 mV_{pp} to 1.5 V_{pp} into 75 Ω, step size 10 mV_{pp}
Error	±1 dB (rms)
Optical input	TOSLINK

Serial (universal)	15-contact DSUB connector (female)
Channels	1 and/or 2 separate or multiplexed
Word length	8/16/24/32 bits
Audio bits	8 to 28
Data format	MSB/LSB first
Synchranization	pos./neg. edge of bit clock and word clock selectable, position of ward clock within word user-selectable, word select (MUX) low/high
Clock rate (ward clock)	internal: 32 kHz, 44.1 kHz, 48 kHz and multiples thereof up to max. 768 kHz external: 100 Hz to 768 kHz

Parallel	37-contact DSUB connector (female)
Channels	channel 1 or channels 1 and 2 multiplexed
Word width	28 bits
Synchronization	word clock with pos./neg. edge, word select (MUX) low/high
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), LSB rounded off
Dither*)	
Distribution	Gaussian, triangular, rectangular
Level	2^{-24} FS to 1 FS
Frequency error	±50 ppm (internal clock), ±1 ppm relative to clock rate
Frequency offset*)	0 or +1000 ppm
DC offset	0 to ±1 FS adjustable

*) With SINE, DFD and MOD DIST signals.
Dither not with generator DIG 768 kHz.

Sine		
Frequency range		2 Hz[1] to 21.90 kHz [350 kHz]
Total harmonic distortion (THD)		<–133 dB
Sweep parameters		frequency, level
MOD DIST		for measuring the modulation distortion
Frequency range		
Lower frequency		30 [50] to 500 Hz[1]
Upper frequency		4[1] to 21.90 kHz [350 kHz]
Level ratio (LF:UF)		from 10:1 to 1:1, user-selectable
Inherent distortion[2]		
LF:UF level ratio	1:1	<–133 dB
	4:1	<–123 dB
	10:1	<–115 dB
Sweep parameters		upper frequency, level

[1] Fixed frequency independent of sampling rate.
[2] Total inherent distortion of analyzer and generator.

DFD	for difference tone measurements
Frequency range	
Difference frequency	80 Hz [100 Hz] to 1 kHz[1]
Center frequency	200 Hz[1] to 20.90 kHz [350 kHz]
Inherent distortion[2]	
DFD d_2	<–130 dB
DFD d_3	<–130 dB
Sweep parameters	center frequency, level

DIM	for DIM measurements to DIN-IEC 268-3 (dynamic intermodulation distortion)
Waveform	square/sine 3.15 kHz/15 kHz or 2.96 kHz/14 kHz, square/sine amplitude ratio 4:1
Inherent distortion[2]	<–125 dB
Sweep parameter	level

Multi-sine	
Characteristics	– 1 to 17 spectral lines – level and frequency individually selectable for each line – phase of individual components optimized for minimum crest factor – rms and peak value of total signal displayed
Frequency range	2.93 Hz to 21.90 kHz [46.88 Hz to 350 kHz]
Frequency spacing	adjustable from 2.93 Hz [46 88 Hz] with <0.01% resolution or matching to FFT frequency spacing
Dynamic range	>133 dB FS

Squarewave	
Frequency	2 Hz[1] to 12 kHz [50 Hz to 192 kHz], 2-sample resolution
Sweep parameters	frequency, level

Sine burst, sine² burst	
Burst time*)	1 sample up to 60 s
Interval*)	burst time up to 60 s
Low level	0 to burst level, absolute or relative to burst level (0 with sine² burst)
Sweep parameters	burst frequency, level and time, interval

*) 1-sample resolution, duration max. 20 ms with generator DIG 768 kHz.

Noise	
Noise in time domain	not with generator DIG 768 kHz
Distribution	Gaussian, triangular, rectangular
Noise in frequency domain	
Frequency range	2.93 Hz to 21.90 kHz [46.88 Hz to 350 kHz]
Frequency spacing	adjustable from 2.93 Hz [46.88 Hz] with <0.01% resolution or matching to FFT frequency spacing
Distribution	white, pink, 1/3 octave, defined by file

Arbitrary waveform	loaded from file
Memory size	max. 16384
Clock rate	sampling rate of generator

Polarity test signal	with generator DIG 48 kHz only
Sine² burst with following characteristics:	
Frequency	1.2 kHz[1]
On time	1 cycle
Interval	2 cycles

FM signal	with generator DIG 48 kHz only
Carrier frequency	2 Hz[1] to 21.90 kHz
Modulation frequency	2 Hz[1] to 21.90 kHz
Modulation	0 to 100%

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	mnemonic entry with user-definable masks, predefined masks for professional and consumer format to IEC 958
Local time code	automatic generation selectable
CRC	automatic generation selectable
User data	loaded from file (max. 16384 Byte) 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
Error counter	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 350 kHz
	analog	2 Hz to 300 kHz
Dynamic range		
Digital		>135 dB
Analyzer ANLG 22 kHz		120 dB/105 dB (with/without analog notch filter)
Analyzers ANLG 100/300 kHz		115 dB/85 dB (with/without analog notch filter)
Noise floor		
Digital		–160 dB
Analyzer ANLG 22 kHz		–140 dB/110 dB (with/without analog notch filter)
Analyzers ANLG 100/300 kHz		–120 dB/90 dB (with/without analog notch filter)
FFT size		256, 512, 1 k, 2 k, 4 k, 8 k points (16 k with zoom factor 2)
Window functions		rectangular, Hann, Blockman-Harris, Rife-Vincent 1 to 3, Homming, flat top, Kaiser (ß = 1 to 20)
Resolution		from 0.023 Hz with zoom, from 5.86 Hz without 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
Averaging		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 32 bit floating point (exception: analog notch filter)

Weighting filters

– A weighting
– C message
– CCITT
– CCIR weighted, unweighted
– CCIR ARM
– deemphasis 50/15, 50, 75, J.17
– rumble weighted, unweighted
– DC noise highpass filter

User-definable filters

Design parameters:
8th order elliptical, type c, passband ripple +0/–0.1 dB, stopband attenuation approx. 20 to 120 dB, selectable in steps of approx. 10 dB (high- and lowpass filters: stopband attenuation 40 to 120 dB).

Highpass, lowpass filters	passband (–0.1 dB) user-selectable, stopband indicated
Bandpass, bandstop filters	passband (–0.1 dB) user-selectable, stopband indicated
Notch filter	center frequency and width (–0.1 dB) user-selectable, stopband indicated
Third and octave filters	center frequency user-selectable, bandwidth (–0.1 dB) indicated
File-defined filters	any 8th-order filter cascaded from 4 biquads, defined in the z 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 140 dB with 22-kHz analyzer or 120 dB with 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 made precision.

Charocteristics	available in analog analyzers with measurement functions – rms, wideband – quasi-peak – FFT analysis
Frequency range	10 Hz to 100 kHz center frequency (f_c)
Frequency tuning	– automatic to input signal – coupled to generator – fixed through entered value
Stopband range	typ. >30 dB, f_c ±0.5%
Possband ronge	typ. –3 dB at $0.77 \times f$ and $1.3 \times f_c$, ±0.5 dB outside $0.5 \times f_c$ to $2 \times f_c$

Audio monitor/parallel I/O interface (option UPD-B5)

Headphone connector	6.3-mm jack socket
Output voltage	max. 8 V_p
Output current	max. 50 mA_p
Source impedance	10 Ω, short-circuit-proof
Recommended headphone impedance	600 Ω
Parallel I/O interface	for signal routing switchers
Connector	25-contact DSUB connector (female)

Sweep

Generator sweep

Parameters	frequency, level, with bursts also interval and duration, one or two-dimensional
Sweep	lineor, logarithmic, tabular, single, continuous, manual
Stepping	– automatic after end of measurement – time delay (fixed or loaded table)

Analyzer sweep

Parameters	frequency or level of input signal
Sweep	single, continuous
Trigger	– delayed (0 to 10 s) after input level or input frequency variation, settling function selectable – time controlled
Settling	for level, frequency, phase, distortion measurement settling function. exponential, flat or averaging

Sweep speed
RMS measurement 20 Hz to 20 kHz, 30-point generator sweep, logarithmic (frequency meosurement and input display switched off, Law Dist off, UPD 04/05)

with AUTO FAST	1 s
AUTO	2.5 s

Result display

Units

Level (analag)	V, dBu, dBV, W, dBm, difference (Δ), deviotion (Δ%) and ratio (without dimension, %, dBr), to reference value
Level (digital)	FS, % FS, dB FS, LSBs deviation (Δ%) or ratio (dBr), to reference value
Distortion	% ar dB, referred to signal amplitude, THD and THD+N in all available level units (absolute or relative to selectable reference value)
Frequency	Hz, difference (Δ), deviation (Δ%) and ratia (as quotient f/f_{ref}, 1/3 octave, octave ar decade), to reference value (entered or stored, current generator frequency)
Phase	°, rad, difference (Δ), to reference value (entered or stared)

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 made curves (other troce ar loaded from file) can be used as reference too.

Graphical data display

Screen	9" LCD, monochrome or colour
Display modes	– sweep trace display – display af curve groups – bargraph display with min./max. values – spectrum, also as waterfoll display – result lists – bar chart for THD and intermodulation measurements
Display functians	– autoscale – X-axis zoom – full-screen and part-screen mode – 2 vertical, 1 horizontal cursor line – search function far max. values – marker for harmonics (spectrum) – user-labelling for graphs – change of unit and scale also possible for loaded curves

Test report

Functions	– screen copy to printer, plotter or file (PCX and HP-GL farmat) – result lists – sweep lists – tolerance curves – limit check – equalizer curves
Printer driver	supplied for approx. 130 printers
Plotter language	HP-GL
Interfaces	2 x RS-232, Centronics IEC 625 (option UPD-B4)

Storage functions
– instrument settings
– spectra
– sweep results
– sweep lists
– tolerance curves
– equalizer curves

Remote control
to IEC 625-2 (IEEE 488), commands mostly to SCPI (option UPD-B4)

General data

Operating temperature range	0 to +45°C
Storoge temperature ronge	–20 to +60°C
Humidity	max. 85 % for max. 60 days, below 65 % on average/year, no condensation
EMI	EN 50081-1
EMS	EN 50082-1
Power supply	100/120/220/230/240 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

Ordering information

Order designation
Audio Analyzer UPD
1030.7500.05 (colour LCD)
1030.7500.04 (monochrame LCD)

Accessories supplied
power cable, operating manual, back-up disk with MS-DOS operating system, backup program disk with operating and measurement software

Options

Low Distortion Generator	UPD-B1	1031.2601.02
AES/EBU Interface	UPD-B2	1031.2301.02
High-speed Extension	UPD-B3	1031.2001.02
IEC-625/IEEE-488-bus Interface	UPD-B4	1031.2901.02
Audio Monitar	UPD-B5	1031.5300.02
Universal Sequence Controller	UPD-K1	1031.4204.02
Arbitrary Waveform Designer	UPD-K2	1031.4404.02
Automatic Measuring System	UPD-K33	1031.5500.02

Recommended extras

19" Adapter	ZZA-95	0396.4911.00
Service manual		1030.7551.24
Service Kit	UPD-Z2	1031.3208.02

Certified Quality System
ISO 9001
DQS REG. NO 1954-02