

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 to 100 kHz
ANLG 300 kHz	50 Hz to 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 response*)	
20 Hz to 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 to 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 to 10 Hz. Additional error ± 0.1 dB for voltages > 60 V unbalanced (> 10 V balanced) and frequencies > 50 kHz.

Inputs

Balanced	2 independent channels, each floating, XLR connectors (female)
Voltage range	0.1 μ V to 35 V_{rms} (sine)
Input impedance	300 Ω , 600 Ω , 20 k Ω , $\pm 0.5\%$ each, one value < 20 k Ω 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 μ V to 300 V_{rms} (sine)
Input impedance	1 M Ω shunted by 200 pF
Crosstalk attenuation	> 120 dB, frequency < 22 kHz
Common-mode rejection ($V_{in} < 3$ V)	> 100 dB at 1 kHz
Common-mode voltage (V_p)	max. 50 V (safety regulation), protected by surge protector
Generator output	each input switchable to any output, input impedance: balanced 200 k Ω , unbalanced 100 k Ω

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 μ V
with CCIR unweighting filter	< 2 μ V (typ. 1.6 μ V)
Filter	weighting filter and user-definable filters, up to 4 filters combinable; additional analog notch filter (dynamic range expanded by up to 30 dB) post-FFT of filtered signal
Spectrum	

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	
Measurement	with analyzer ANLG 22 kHz only peak max., peak min., peak-to-peak, peak absolute
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 μ V 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	$\pm (1.5\% + 2$ mV)
Measurement range	100 mV to 300 V (balanced 30 V), 10-dB steps

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

FFT analysis	see FFT analyzer section
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Total harmonic distortion (THD)	
Fundamental	6 Hz to 110 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. 300 kHz
Measurement error, harmonics	
< 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 to 20 Hz < -96 dB

Analyzer ANLG 100 kHz	
Fundamental	50 Hz to 20 kHz < -97 dB, typ. -105 dB 20 to 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	bar chart for signal and distortion
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*) Total inherent distortion of analyzer and generator (with option UPD-B1), analyzer with dynamic mode precision.
 > 10 V: typ. reduced by 3 dB; < 0.5 V: sensitivity reduced by inherent noise (typ. 0.25/1.25/2.5 μ V 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 μ V 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 μ V typ. -108 dB + 1.5 μ V**)

Analyzer ANLG 100 kHz	
Bandwidth 142 Hz to 22 kHz	<-95 dB + 2.5 μ V typ. -100 dB + 1.75 μ V
142 Hz to 100 kHz	<-88 dB + 5 μ V typ. -95 dB + 3.5 μ V

Analyzer ANLG 300 kHz	
Bandwidth 427 Hz to 22 kHz	<-97 dB + 2.5 μ V typ. -100 dB + 1.75 μ V
427 Hz to 100 kHz	<-90 dB + 5 μ V typ. -95 dB + 3.5 μ V
427 Hz to 300 kHz	<-85 dB + 10 μ V typ. -92 dB + 7 μ V
Spectrum	post-FFT of filtered signal

- *) Total inherent distortion of analyzer and generator (with option UPD-B1), analyzer with dynamic mode precision, fundamental <100 kHz.
**) For full measurement range (<-100 dB + 2 μ V with Auto Range).
 <-100 dB + 2 μ V 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 bottom limit of lower frequency is reduced.
**) Input voltage >200 mV, typical values apply to 0.5 to 5 V.
Lower frequency >200 Hz, values in () for lower 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

- *) For center frequency >20 kHz the bottom limit for 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 or 2.96 kHz/14 kHz, frequency tolerance $\pm 3\%$, any square/sine amplitude ratio (standard: 4:1)
Measurement error	± 1 dB
Inherent distortion*)	<-85 dB, typ. -90 dB
Spectrum	bar chart for signal and distortion

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

Wow and flutter

Measurement procedure	with analyzer ANLG 22 kHz only DIN IEC, NAB, JIS, 2-sigma to IEC-386 highpass 0.5 Hz, bandwidth 600 Hz bandpass 4 Hz to IEC-386
Weighting filter	OFF ON
Measurement error	$\pm 3\%$
Inherent noise	$<0.0005\%$ weighted $<0.001\%$ unweighted
Spectrum	post-FFT of demodulated 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	$\pm 0.1^\circ$ typ.
20 Hz to 25 kHz*)	$\pm 0.4^\circ$
10 to 20 Hz	$\pm 1.0^\circ$
25 to 100 kHz	$\pm 1.75^\circ$
Input voltage	>15 mV, two signals with almost same level
Display range	$\pm 180^\circ$ or 0 to 360°

- *) $\pm 0.4^\circ$ above 2 Hz, with analyzer ANLG 22 kHz and lower limit of frequency range 2 Hz (min. freq. 2 Hz)

Polarity test

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

Analog generators

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

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

The characteristics of the basic generator model can be improved and extended with a low-distortion RC oscillator (Low-Distortion Generator option UPD-B1):

- sine with reduced distortion
- improved intermodulation signals DFD and MOD DIST
- signal generation for dynamic intermodulation measurement DIM

Outputs

Balanced

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

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

Signals

Sine

Frequency range	
Generator ANLG 25 kHz	2 Hz to 25 kHz
Generator ANLG 110 kHz	2 Hz to 110 kHz
Frequency error	±50 ppm
Level error	±0.1 dB at 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	
Generator 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 generator 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 at 1 kHz
Frequency response (referred to 1 kHz)	
20 Hz to 20 kHz	±0.05 dB
10 Hz to 110 kHz	±0.1 dB
Harmonics	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
Fundamental 1 kHz, 2.5 V	THD + N*)
100 Hz to 20 kHz	-110 dB typ.
20 Hz to 100 Hz	<-105 dB + 2 μV
<100 kHz	<-100 dB + 2 μV
<20 kHz	<-90 dB + 5 μV
<100 kHz	<-88 dB + 10 μV
<100 kHz	<-85 dB + 10 μV
Sweep parameters	frequency, level

*) Total inherent distortion of analyzer 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 balanced (0.3 to 1.25 V unbalanced) is reduced by typ. 3 dB because of noise.

MOD DIST

Frequency range	for measuring the modulation distortion
Lower frequency	30 to 500 Hz
Upper frequency	4 to 110 kHz
Level ratio (LF:UF)	(4 to 25 kHz with ANLG 25 kHz)
Level error	from 10:1 to 1:1, selectable
Inherent distortion	±0.5 dB <-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 frequency	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

Frequency range		for difference tone measurement
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 d₂ -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 d₃: total inherent distortion of analyzer and generator.
Center frequency 5 to 20 kHz.

DIM (with option UPD-B1 only)

Waveform	for DIM measurements to DIN-IEC 268-3 (dynamic intermodulation distortion) square/sine 3.15/15 kHz or 2.96/14 kHz, square/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 sine ² 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	
Memory size	loaded from file 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
Sine ² 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: $f_{\text{new}} = f_{48 \text{ kHz}} \times \text{sampling rate}/48 \text{ kHz}$. 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 for- mats 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 multi- plexed
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 fil- ters, 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; mini- mum 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 fil- ters, up to 3 filters combinable

Quasi-peak
Measurement, measurement error
Filter

with analyzer DIG 48 kHz only
to CCIR 468-4
weighting filter and user-definable fil-
ters, 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 distortion¹⁾
Fundamental 42 Hz to 21.90 kHz
24 to 42 Hz
12 to 24 Hz
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 se-
lectable, one additional weighting filter
Measurement error ± 0.3 dB
Inherent distortion¹⁾
Bandwidth 20 Hz to 21.90 kHz
Fundamental 28 Hz to 21.90 kHz
24 to 28 Hz
20 to 24 Hz
Spectrum post-FFT of filtered signal

Modulation distortion (MOD DIST)

Measurement procedure selective to DIN IEC 268-3
Frequency range
Lower frequency 30 [400] to 500 Hz²⁾
Upper frequency 4²⁾ to 21.25 kHz [348 kHz]
Measurement error ± 0.2 dB
Inherent distortion¹⁾
Level LF:UF 1:1
4:1
10:1
Spectrum bar chart for signal and distortion

Difference frequency distortion (DFD)

Measurement procedure selective to DIN IEC 268-3
Frequency range
Difference frequency 80 [500] Hz to 1 kHz²⁾
Center frequency 200 Hz to 20.90 kHz [348 kHz]
Measurement error ± 0.2 dB
Inherent distortion¹⁾ DFD d_2
DFD d_3
Spectrum bar chart for signal and distortion

Dynamic intermodulation distortion (DIM)

Measurement procedure (with analyzer DIG 48 kHz only)
selective weighting of all nine interfer-
ing lines to DIN IEC 268-3
square/sine 3.15/15 kHz
or 2.96/14 kHz,
frequency tolerance $\pm 3\%$,
any square/sine amplitude ratio
(standard: 4:1)
Test signal ± 0.2 dB
Measurement error < -125 dB
Inherent distortion¹⁾
Spectrum bar chart of signal and distortion

Wow and flutter

Measurement procedure with analyzer DIG 48 kHz only
DIN IEC, NAB, JIS,
2-sigma to IEC-386
highpass 0.5 Hz, bandwidth 600 Hz
bandpass 4 Hz to IEC-386
Weighting filter OFF
ON
Measurement error $\pm 3\%$
Inherent noise $< 0.0003\%$ weighted
 $< 0.0008\%$ unweighted
Spectrum post-FFT of demodulated signal

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 mode,
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 $\pm 0.1^\circ$, 20 Hz to 20 kHz
Display range $\pm 180^\circ$ 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 are available 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: $f_{\text{new}} = f_{48\text{kHz}} \times \text{sampling rate} / 48 \text{ kHz}$. 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 internal: 32 kHz, 44.1 kHz, 48 kHz or
synchronization to analyzer
external: synchronization to word clock
input (27 to 55 kHz)

¹⁾ Total inherent distortion of analyzer and generator.

²⁾ Fixed frequency independent of sampling rate.

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-proof
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
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 (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	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

Frequency range	for measuring the modulation distortion
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

DFD

Frequency range	for difference tone measurements
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

Waveform	for DIM measurements to DIN-IEC 268-3 (dynamic intermodulation distortion) 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	<ul style="list-style-type: none"> - 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 sine ² 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

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

Polarity test signal

Sine ² burst with following characteristics:	with generator DIG 48 kHz only
Frequency	1.2 kHz ¹⁾
On time	1 cycle
Interval	2 cycles

FM signal

Carrier frequency	with generator DIG 48 kHz only
Modulation frequency	2 Hz ¹⁾ to 21.90 kHz
Modulation	2 Hz ¹⁾ to 21.90 kHz
	0 to 100%

¹⁾ Fixed frequency independent of sampling rate.

²⁾ Total inherent distortion of analyzer and generator.

Digital audio protocol (option UPD-B2)

Generator

Validity bit	NONE, L, R, L+R
Error simulation	parity/block error/sequence error/ CRC error
Channel status data	correctly or with adjustable error rate mnemonic entry with user-definable masks, predefined masks for profes- sional 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 pro- fessional and consumer format to IEC 958, binary and hexadecimal for- mat
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, Blackman-Harris, Rife-Vincent 1 to 3, Hamming, flat top, Kaiser ($\beta = 1$ 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 re-
quired. 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 bi- quads, 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 mode preci-
sion.

Characteristics	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, $f_c \pm 0.5\%$
Passband range	typ. –3 dB at $0.77 \times f_c$ 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

Connector	for signal routing switchers 25-contact DSUB connector (female)
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Sweep

Generator sweep

Parameters	frequency, level, with bursts also interval and duration, one or two-dimensional
Sweep	linear, 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 measurement and input display switched off, Low Dist off, UPD 04/05)

with AUTO FAST 1 s
 AUTO 2.5 s

Result display

Units

Level (analog)	V, dBu, dBV, W, dBm, difference (Δ), deviation ($\Delta\%$) and ratio (without dimension, %, dBr), to reference value
Level (digital)	FS, % FS, dB FS, LSBs deviation ($\Delta\%$) or ratio (dBr), to reference value
Distortion	% or 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 ($\Delta\%$) and ratio (as quotient f/f_{ref} , 1/3 octave, octave or decade), to reference value (entered or stored, current generator frequency)
Phase	$^\circ$, 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	<ul style="list-style-type: none"> - sweep trace display - display of curve groups - bargraph display with min./max. values - spectrum, also as waterfall display - result lists - bar chart for THD and intermodulation measurements
Display functions	<ul style="list-style-type: none"> - 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

Test report

Functions	<ul style="list-style-type: none"> - screen copy to printer, plotter or file (PCX and HP-GL format) - 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
Storage temperature range	-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 \pm 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 (monochrome LCD)

Accessories supplied

power cable, operating manual, backup 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 Monitor	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





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