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 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 impedance	1 MΩ 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 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 combinable; 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 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 ANLG 22 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
Filters	weighting filter and user-definable filters, up to 3 filters combinable

Quasi-peak
	with analyzer ANLG 22 kHz only
Measurement, measurement error	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 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

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

*) 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 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 se-
	lectable, 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 option
    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 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 interfer-
	ing lines to DIN-IEC 268-3
Test signal	square/sine 3.15 kHz/15 kHz
	or 2.96 kHz/14 kHz,
	frequency tolerance ±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

	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 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	±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 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 extend-
ed 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
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, 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

	THD + N*)	Measurement 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 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 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 (dynamic intermodulation distortion)
Waveform	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
Frequency range
Max. level
Level error
Rise time
Sweep parameters

with generator ANLG 25 kHz only
2 Hz to 10 kHz
40 V_{pp} (20 V_{pp} unbalanced)
±0.2 dB_{rms}
1.5 µs
frequency, level

Sine burst, sine² burst
Burst time

Interval

Low level

Bandwidth

Sweep parameters

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

Noise
Noise in time domain
   Distribution
Noise in frequency domain
   Frequency range
      Generator ANLG 25 kHz
      Generator ANLG 110 kHz
   Frequency spacing

   Distribution

Gaussian, triangular, rectangular

5.86 Hz to 25 kHz
23.44 Hz to 110 kHz
adjustable from 5.86 Hz (above
23.44 Hz with ANLG 110 kHz) with
<0.01 % resolution or matching to FFT
frequency spacing
white, pink, 1/3 octave, defined by file

Arbitrary waveform
Memory size
Clock rate

Bandwidth

loaded from file
max. 16384
96/384 kHz with generator
ANLG 25 kHz/110 kHz
25/110 kHz with generator
ANLG 25 kHz/110 kHz
(elliptical filter)

Polarity test signal
Sine² burst with following
characteristics:
   Frequency
   On time
   Interval

with generator ANLG 25 kHz only

1.2 kHz
1 cycle (0.8333 ms)
2 cycles (1.6667 ms)

FM signal
Carrier frequency
Modulation frequency
Modulation

with generator ANLG 25 kHz only
2 Hz to 25 kHz
2 Hz to 25 kHz
0 to 100%

DC offset*)
Error
Residual offset

0 to ±10.0 V (±5 V unbalanced),
18-bit resolution
±2%
<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)
Channels
Audio bits
Clock rate
Format

Balanced input

   Impedance
   Level

Unbalanced input
   Impedance
   Level
Optical input

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

Serial (universal)
Channels
Word length
Audio bits
Data format
Synchronization

Clock rate

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

Parallel
Channel 1/MUX

Channel 2

Word width
Synchronization

Clock rate

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

Measurement functions

(all measurements at 24 bits, full scale)

RMS value, wideband
Measurement bandwidth
Measurement error
   AUTO FAST
   AUTO
   FIX

Integration time
   AUTO FAST
   AUTO
   VALUE
Filter

Spectrum

up to 0.5 times the clock rate

±0.1 dB
±0.01 dB
±0.001 dB

4.2 ms, at least 1 cycle
42 ms, at least 1 cycle
1 ms to 10 s
weighting filter and user-definable fil-
ters, up to 4 filters combinable
post-FFT of filtered signal

RMS value, selective
Bandwidth (–0.1 dB)

Selectivity

Frequency setting

Measurement error

1%, 3%, 1/12 octave, 1/3 octave and
user-selectable fixed bandwidth; mini-
mum bandwidth 10 Hz
100 dB, bandpass or bandstop filter,
8th-order filter, elliptical
– automatic to input signal
– coupled to generator
– fixed through entered value
– sweep through user-selectable range
±0.1 dB + ripple of filter

Peak value
Measurement

Measurement error
Interval
Filter

with analyzer DIG 48 kHz only
peak max., peak min., peak-to-peak,
peak absolute
±0.2 dB at 1 kHz
20 ms to 10 s
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 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
Inherent distortion[1]

±0.1 dB

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 additional weighting filter

Measurement error
Inherent distortion[1]
Bandwidth 20 Hz to 21.90 kHz

±0.3 dB

Fundamental 28 Hz to 21.90 kHz	<–126 dB
24 to 28 Hz	<–109 dB
20 to 24 Hz	<–96 dB

Spectrum

post-FFT of filtered signal

Modulation distortion (MOD DIST)
Measurement procedure
Frequency range

selective to DIN IEC 268-3

Lower frequency
Upper frequency

30 [400] to 500 Hz[2]
4[2] to 21.25 kHz [348 kHz]

Measurement error
Inherent distortion[1]

±0.2 dB

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 procedure
Frequency range

selective to DIN IEC 268-3

Difference frequency
Center frequency

80 [500] Hz to 1 kHz[2]
200 Hz to 20.90 kHz [348 kHz]

Measurement error
Inherent distortion[1]

±0.2 dB

	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)
Measurement procedure

(with analyzer DIG 48 kHz only)
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
Inherent distortion[1]
Spectrum

±0.2 dB
<–125 dB
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

Weighting filter   OFF
               ON

highpass 0.5 Hz, bandwidth 600 Hz
bandpass 4 Hz to IEC-386

Measurement error
Inherent noise

±3%
<0.0003% weighted
<0.0008% unweighted

Spectrum

post-FFT of demodulated signal

WAVEFORM display
Trigger
Trigger level

rising/falling edge
–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
with THD
with FFT, THD+N

2 Hz to 21.90 kHz
6 Hz to 21.90 kHz
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
Display range

±0.1°, 20 Hz to 20 kHz
±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 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: $f_{new} = f_{48kHz} \times$ sampling rate/48 kHz.
Maximum values for generator DIG 768 kHz are specified in [ ].

Outputs

Serial (audio)
Channels
Audio bits
Clock rate

with option UPD-B2
1, 2 or both
8 to 24
internal: 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	**DFD**	for difference tone measurements
		Frequency range	
Balanced output	XLR connector (male), transformer coupling	Difference frequency	80 Hz [100 Hz] to 1 kHz[1]
		Center frequency	200 Hz[1] to 20.90 kHz [350 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-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 | 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

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 %

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[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 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, Blackman-Harris, Rife-Vincent 1 to 3, Hamming, 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 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 precision.

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 ±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	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	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 (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	% 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 (Δ%) and ratio (as quotient f/f_{ref}, 1/3 octave, octave or decade), to reference value (entered or stored, current generator frequency)
Phase	°, rad, difference (Δ), to reference value (entered or stored)

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

Graphical data display

Screen	9" LCD, monochrome or colour
Display modes	– 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	– 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	– 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 ±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, 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 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

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

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