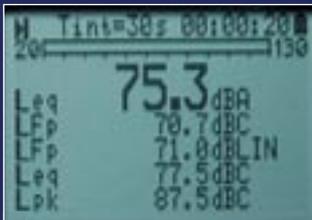




HD2110

Integrating Sound Level Meter
Analyser



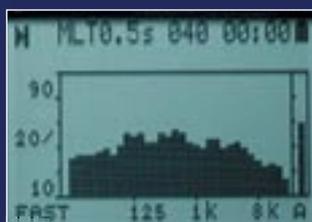
▶ Basic screen



▶ Time profile



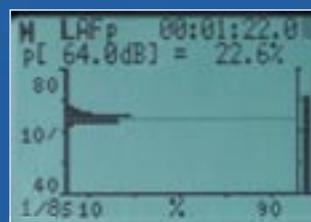
▶ Octave band spectrum



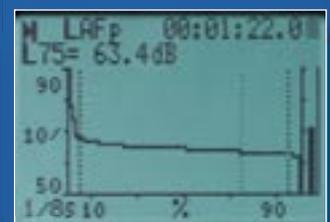
▶ Third octave band spectrum



▶ Narrow band spectrum analysis
(FFT option)



▶ Statistical analysis: probability
distribution of sound levels



▶ Statistical analysis: percentile
levels



HD 2110

Integrating Sound Level Meter – Portable Analyzer

The HD2110 is a precision integrating portable sound level meter, with data logging functions, performing both spectrum and statistical analysis. The instrument has been designed in order to offer high-performance analysis of acoustic phenomena, with particular regard to Italian legislation on environmental noise. Attention has been paid to the possibility of adjusting the instrument to regulatory modifications and to the necessity of meeting its users' needs of today and tomorrow. The HD2110 can be integrated with other options to extend its application scope at any time; the firmware can be updated directly by the user by means of the DeltaLog5 program supplied with the instrument.

Technical regulations:

- Class 1 sound level meter according to IEC 61672-1, 2002 (Certificate of Compliance I.E.N. No. 37035-01C), IEC 60651 and IEC 60804.
- Class 0 octave and third octave filters according to IEC 61260.
- Microphone complying with IEC 61094-4.
- Class 1 acoustic calibrator according to IEC 60942:1988.

Applications:

- Noise monitoring with sound event capture and analysis function,
- Real-time octave and third octave band spectrum analysis from 16 Hz to 20 kHz,
- Statistical analysis with calculation of all percentile levels from L_1 to L_{99} ,
- **Environmental noise measurement according to the decree of 16/03/1998,**
- **Identification of tonal components even at the standard third octave band crossing point,**
- **Estimate of the audibility of spectral components through comparison with equal loudness curves in real time,**
- Measurement at the workplace,
- Selection of personal protective equipment (SNR, HML, and OBM methods),
- Sound insulation and reclamation,
- Production quality control,
- Measurement of machine noise,
- Optional architectural acoustics and building measurements.

Application Kits

Environmental noise monitoring and measurement of noise pollution according to the decree of 16/03/1998,

- **HD2110 kit 1:** Includes HD2110 Sound Level Meter, HD9101 calibrator, MK221 microphone for free field, windscreen, 5m extension cable and RS232 serial or USB connection cable. DeltaLog5 PC program.
- **HD2110 kit 1/E:** Version for indoor and outdoor measurements. It includes HD2110 Sound Level Meter, HD9101 calibrator, HD WME950 weatherproof microphone unit with MK223 cartridge for free field, windscreen, HD2110P preamplifier, 5m extension cable and RS232 serial or USB connection cable. DeltaLog5 PC program.

Building acoustic measurements

- **HD2110 kit 1:** Includes HD2110 Sound Level Meter, HD9101 calibrator, MK221 microphone for free field, windscreen, 5m extension cable and RS232 serial or USB connection cable. DeltaLog5 PC program.
- **Option 4:** "Reverberation Time"

Accessories

Option 4 "Reverberation Time": Measurement by sound source interruption or impulse response integration.

Option 6 "FFT": $\frac{1}{2}$ s Short Leq profile, narrow band spectrum analysis (FFT).

Option 7 "SIT Calibration": SIT calibration replaces ISO 9001 reports. For new instruments only.

MK231: Class 1 microphone for diffuse field, type WS2D according to IEC 61094-4:1995.

HD2110/CSM: MiniDin to DB25 serial cable for interconnection modem.

HD2110/CSP: MiniDin to DB9 cable for a serial printer connection.

SWD10: Stabilized mains power supply $V_{in}=100\div 230V_{ac}$ $V_{out}=12V_{dc}/1000mA$.

CPA/10: 10m extension cable.

CPA/20: 20m extension cable.

CPA/50: 50m extension cable.

VTRAP: Tripod, max. height 1550 mm.

HD2110/SA: Support for fixing the preamplifier to the tripod.

S'print-BT: Portable serial printer.

HD2110/MC: SD and MMC memory card interface.

Software for Windows® 95/98/ME/2000/XP operating systems

DeltaLog5Monitor: Acoustic monitoring and PC remote control. Scheduler and synchronized audio recording.

DeltaLog5Environment: Data analysis according to the decree of 16/3/98.

DeltaLog5Building: Room acoustics evaluation according to D.P.C.M. of 5/12/1997 (**Option 4: "Reverberation Time" is required**).

DeltaLog5 Noise Studio: The analysis functions are supplied as modules for specific applications:

- **Worker protection:** analysis according to Legislative Decree No. 195/2006, European Directive 2003/10/CE of 06/02/2003 and UNI standard 9432:2002.
- **Railway Traffic:** Analysis of sound events due to passing trains. The module processes the sound levels according to D.M. of 16/03/1998 and D.L. No.194 of 19/8/2005.

Using the HD2110 sound level meter you can log the time profile of 6 simultaneous parameters choosing freely temporal or frequency weightings. The possibility of displaying, storing and even printing the multi-parameter sound level analysis allows the sound level meter to log sound level and store for more than 46 hours. For sound level monitoring, you can store 5 programmable parameters and the average spectrum at intervals of 1 second to 1 hour, both by octave and third octave bands. Thanks to its high dynamic range, long integrations can be carried out with a minimum possibility of under- or over-range indications. The measurement dynamic range exceeds 110 dB and



HD SAV2

it is limited downwards only by the instrument intrinsic noise. For example, if you set the measuring upper limit at 140 dB, you can carry out measurements at the typical sound levels of a quiet office, with high accuracy and without overload indications, peak levels up to 143 dB.

The sound level meter can also log report sequences with dedicated parameters, at programmable intervals of 1 second to 1 hour, average spectra and full statistical analysis, in addition to sound level profiles. Moreover, a versatile trigger function can identify sound events and record their analysis with 5 dedicated parameters, average spectrum and statistical analysis.

The spectrum analysis is carried out simultaneous with the logging of the 6 profiles in real time, both by octave and third octave bands. The spectrum of sound signal is calculated twice a second and integrated linearly for up to 99 hours. Alternatively, the instrument can perform multi-spectrum analyses, even maximum or minimum, both with linear and exponential weighting. Spectra are displayed together with an A, C or Z -weighted wideband level. The third octave band spectrum analysis can be carried out, in addition to standard bands from 16 Hz to 20 kHz, also with bands shifted downwards by $1/6^{\text{th}}$ octave, from 14 Hz to 18 kHz. This feature is useful for finding tonal components hidden at the standard band crossing point. While the third octave band spectrum is displayed, you can enable the calculation of equal loudness curves in real time, for quickly estimating the audibility of spectral components.

As a statistical analyzer, the HD2110 samples the sound signal 8 times per second with A-frequency weighting and FAST constant, and it analyses it in 0.5 dB classes. You can program 4 percentile levels from L_1 to L_{99} and choose to sample L_{Fp} , L_{eq} or L_{pk} with A, C and Z-weightings (only C and Z for L_{pk}).

The Digital Audio interface allows recording the sound sample on tape, for further analysis. Recording in digital format guarantees the best accuracy. Audio tracks recorded with other instruments can also be analyzed using the Line input. For further analysis, the LINE unweighted output allows recording the sound sample either on tape or directly on a PC equipped with a data acquisition card.

Recordings can be located in memory and viewed on the graphic display using the "Replay" function, which reproduces the time trend of the sound track. The high-speed USB interface, combined with the flexible RS232 interface, allows quick data transfers from the sound level meter to the PC mass memory, as well as controlling a modem or printer. For example, should the supplied memory not be enough, this is the case for lengthy recordings, you can activate the "Monitor" function. This function allows sending the displayed data to a PC via the serial interface and storing them directly on the PC mass memory.

The HD2110 can be completely controlled by a PC through the multistandard serial interface (RS232 and USB) by using a special communication protocol. Through the RS232 interface, the sound level meter can also be connected to a PC via modem.

The calibration can be made using both the provided acoustic calibrator (IEC 60942 class 1) and the built-in reference generator. The electrical calibration employs a special preamplifier and it checks the sensitivity of the measuring channel, microphone included. A protected area in the non-volatile memory, reserved for factory calibration, is used as a reference in the user's calibrations, and it allows keeping instrument drifts under control and preventing the instrument from "going out of calibration".

The complete sound level meter functionality can be checked directly by the user, in the field, thanks to a diagnostic program. Most damage occurred to the instrument, microphone included, can be promptly identified thanks to a complete analysis program that includes the frequency response measurement of the whole measuring chain: microphone, preamplifier and sound level meter. The regular execution of diagnostic programs allows making reliable sound measurements, avoiding any repetition due to a malfunction later discovered.

The HD2110 sound level meter can perform the measurements required to evaluate workers' noise exposure (Legislative Decree 10.04.06 No. 195). The personal protective equipment can be selected through octave band spectrum analysis (OBM method) and a comparison of the A and C-weighted equivalent levels that can be measured simultaneously (SNR method). If an undesired sound event produces an overload indication, or simply alters the result of an integration, its contribution can be excluded using the versatile Back-Erase function.

The HD2110 sound level meter is suitable for sound level monitoring, acoustic mapping and the assessment of the acoustic climate with capture and

analysis of sound events. When measuring traffic noise near airports, railways and roads, the sound level meter can be used as a multi-parameter sound recorder, combining statistical and spectrum analyzer features. Remote electrical calibrations and diagnostic tests can be executed using its remote control capabilities.

The HD2110 can also perform the measurements required to evaluate environmental noise (Decree of 16 March 1998, GU No.76 of 1 April 1998). Impulsive events can be easily identified thanks to the possibility of analysing the profile of the A-weighted level with FAST, SLOW, and IMPULSE constants. All measuring parameters can be stored for subsequent analysis. The identification of tonal components is also easy and certain as it allows displaying and recording the minimum spectrum with any wideband weightings (Z, C or A) both by third octave bands with standard nominal frequencies 16 Hz to 20 kHz, and with central frequencies shifted on the former crossing point 14Hz to 18 kHz. The audibility of the tonal component can be evaluated in the field thanks to the real-time calculation of equal loudness curves. The audibility of the tonal component, to be compared with that of the remaining spectrum, can also be evaluated using the DeltaLog5 program supplied with the instrument, thanks to the calculation of the equal loudness curves.

The HD2110 sound level meter with the "Reverberation Time" option can perform any measurement prescribed by the regulations on the room acoustics evaluation (D.P.C.M. of 5/12/1997). The sound level meter powerful DSP calculates 32 spectra/second, and it can measure reverberation times both using the sound source interruption method and the integration of impulse response technique. The analysis is carried out simultaneously by both octave and third octave bands.

Inputs and outputs

Digital audio input/output (IEC 60958:1999 type II) with RCA connector (S/PDIF).

LINE unweighted input/output (Ø 3.5 mm jack).

TRIGGER input/output (Ø 3.5 mm jack).

Standard RS232C serial port in compliance with EIA/TIA574. Baud Rate 300 to 115200 baud.

USB 1.1 serial port.

External power supply 9÷12Vdc (Ø 5.5 mm jack).

Italian Laws

Workplace noise: D. Lgs 195/2006 and European Directive 2003/10/CE.

Noise pollution: Law 447 of 26/10/95, D.P.C.M. of 1/3/91, Decree of 16/03/98, Decree No. 194 of 19/08/2005 and European Directive 2002/49/CE.

Airport noise: Decree of 31.10.97.

Entertainment noise: D.P.C.M. 215 of 16.04.99.

Noise emission from machines D. Lgs 262 of 4/9/2002 and European Directive 2000/14/CE.

Room acoustics evaluation: D.P.C.M. of 05.12.97.

Options and accessories:

HD2110MC reader

It allows interfacing SD and MMC memory cards with the sound level meter.

This device is connected to the sound level meter through the serial interface that also gives the required power supply. In addition to its remarkable storing capacity, the interface allows quickly downloading the data stored in the sound level meter internal memory. Cards with a maximum capacity of 2 GB can be connected.

Option 4 "Reverberation Time"

Reverberation time measurement using the sound source interruption and the impulsive source method.

The reverberation time measurement is made simultaneously by wideband, octave band from 125 Hz to 8 kHz, and third octave band from 100 Hz to 10 kHz. Sampling interval $1/32$ s.

Automatic calculation of reverberation times EDT, T10, T20 and T30 by all bands, and decay profile analysis with the possibility of calculating the reverberation time over a chosen interval.

Option 5 "Advanced Analyzer"

(included in new sound level meters only)

This option combines the sound level analyzer functions with the following: Statistical analysis available graphically, both as probability distribution and cumulative distribution.

Trigger for noise event capture with level threshold and duration filter.

Recording of measurement reports at intervals of 1s to 1 hour, with a dedicated set of parameters that includes average spectra and full statistical analysis.
 Recording of event parameters with the possibility of setting the maximum time resolution for event recording and a lower resolution for background noise recording.
 Possibility of storing markers.
 Timer for a delayed start of the capture.

Option 6 "FFT"

(only for HD2110 sound level meters with "Advanced Analyzer" option)

This option adds:
 Leq profile at 1/32 s intervals.
 Narrow band spectrum analysis (FFT) over the whole audio range with variable resolutions according to the frequency from 1.5Hz to 100Hz.

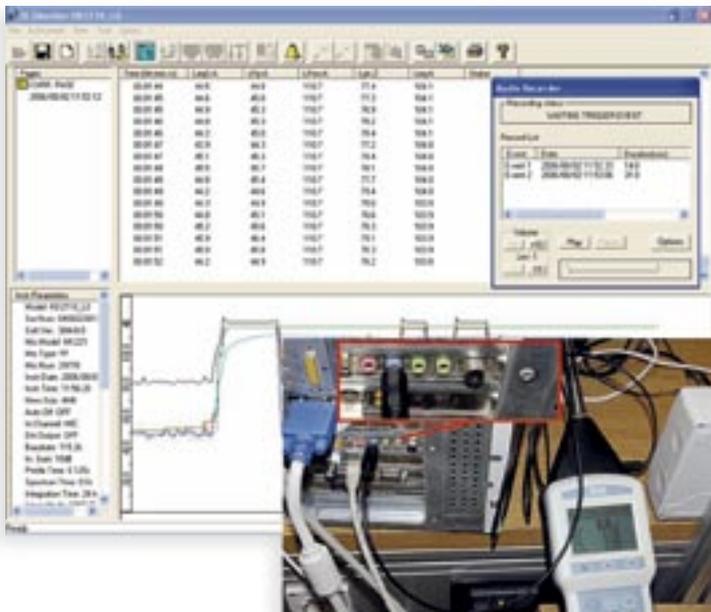
Software:

DeltaLog5

The DeltaLog5 program allows easily interfacing the sound level meter with the PC. Its main functions are:
 Data transfer from the sound level meter to the PC memory.
 Display of logged data as a table or as a graph.
 Export to Excel.
 Comparison of third octave band spectra with equal loudness curves.
 PC acquisition control.
 Sound level meter setup.
 Sound level meter firmware upgrade.
 Writing reports is easier thanks to a convenient function that allows copying the DeltaLog5 graphs or tables to other applications.

DeltaLog5 Monitor (optional)

In addition to the functions provided by DeltaLog5, the DeltaLog5Monitor program, allows the complete control of the sound level meter using the PC. Its additional functions are:
 Possibility of connecting the sound level meter via modem.
 Management of the monitor function.
 Management of the calibration and diagnostic functions.
 Programming of automatic acquisitions and monitoring.
Possibility of recording the audio synchronized with the sound measurements, using a versatile trigger function.
 Real-time display of the captured data as a table or a graph.



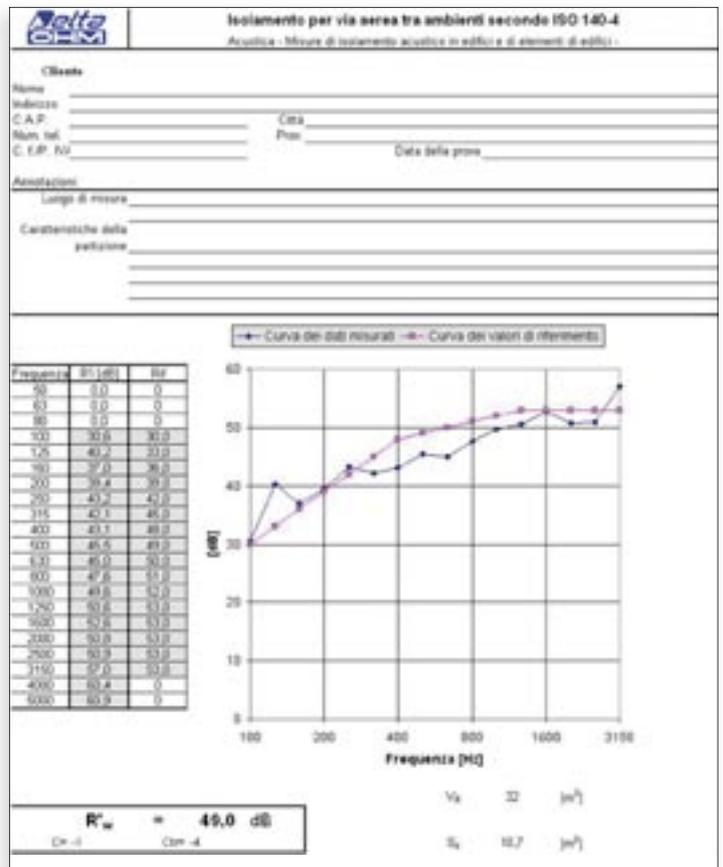
DL5 Monitor: PC logging with synchronized audio recording.

DeltaLog5 Environment (optional)

The DeltaLog5Environment program allows analyzing the data logged by the sound level meter, thus helping write measurement reports. Its main functions are:
 Automatic search of impulsive and tonal components according to the Decree of 16/03/98.
 Statistical analysis.
 Management of measurement archive.
 Recalculation of equivalent level with masking function.
 Display of the logged data as a table or a graph.

DeltaLog5 Building (optional)

DeltaLog5Building uses the data logged by the sound level meter and it performs the necessary calculations for room acoustics evaluation according to ISO standards, in compliance with D.P.C.M. of 5/12/1997.
 The necessary measurements for the analysis of a building can be grouped into a project so as to help file and locate them. Moreover, it may be useful to add technical reports, comments, graphs, pictures, etc. to the actual measurements (being an integral part of the job) in order to easily recover them when required.
 An updatable database, divided into walls and ceilings, contains all sound-proofing properties of the main structures. The data contained in the database can be graphically compared with the measurements in the field.
 The program allows calculating:
 Average reverberation time.
 Equivalent absorption area and sound absorption coefficient (ISO 354).
 Airborne noise insulation: R, R' and D_{nt} indices (ISO 140/III and IV).
 Airborne sound insulation of facades and facade elements: D_{2m,nT} and R₀ indices (ISO 140/V).
 Impact noise insulation: L_n, DL, L'_n and L'_{nT} indices (ISO 140/VI, VII and VIII).
In order to calculate some indices, option 4: "Reverberation Time" is required.



DL5 Building: ISO report writing.



SWD10

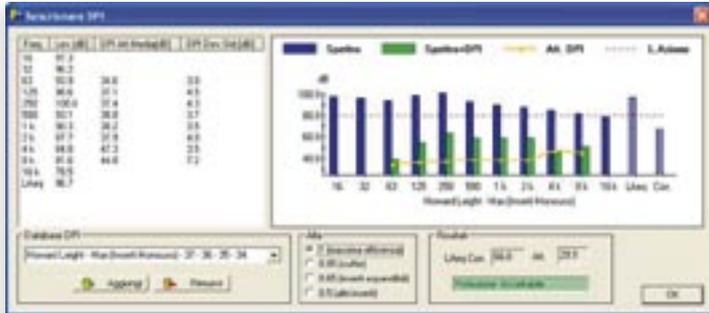
DeltaLog5 Noise Studio (optional)

DeltaLog5 Noise Studio is a post-processing program that can perform different types of analyses. The various analysis functions, specifically designed for a given application, are grouped in software modules that can be enabled using a licence.

The analysis environment gives several display functions (as a table or a graph) of the different sound measurements and processed results. All graphs and tables can be exported to other applications in the Windows® environment.

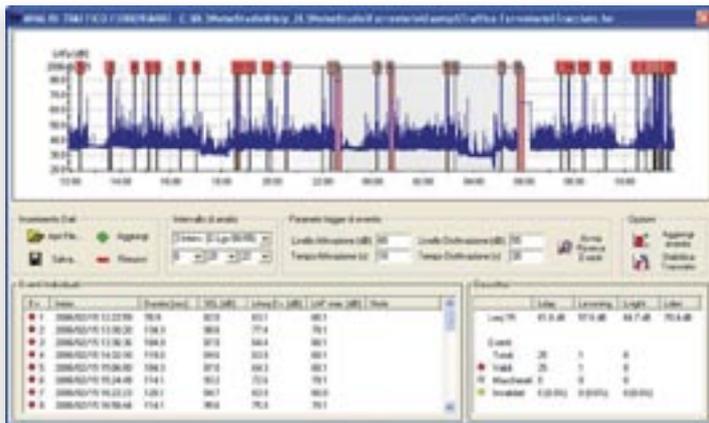
The modules currently available are:

Worker protection: Noise analysis in the workplace according to legislative decree 195/2006, European Directive 2003/10/CE and UNI 9432:2002 standard. The module can be updated in case of new law requirements.



DL5 Noise Studio: Worker protection: analysis of PPE efficacy

Railway Traffic: Analysis of the sound profiles captured over a 24-hour span, with automatic search and analysis of the sound events due to passing trains. The module processes sound levels according to D.M. of 16/03/1998 and D.L. No. 194 of 19/8/2005.



DL5 Noise Studio: Railway traffic module: 24-hour analysis with automatic transit search.

Order codes of kits and accessories

HD2110 kit 1: Includes HD2110 Sound Level Meter, "Advanced Analyzer" option, carrying case, HD2110P preamplifier, HD9101 calibrator, MK221 microphone, CPA/5 5m extension cable, HD SAV windscreen, DeltaLog5 software and serial cable for connection to a PC with COM (HD2110/CSNM) or USB (HD2101/USB) interface.

HD2110 kit1/E: Version for outdoor measurements. It includes also:
HDWME950/3: Weatherproof microphone protection
HD2110PW: Heated preamplifier in place of HD2110P and CPA/5
MK223: Microphone with coated membrane in place of MK221

HD2110 kit1/IE: Version for outdoor and indoor measurements. It includes also:
HDWME950/2: Weatherproof microphone protection with HD2110PW heated preamplifier
MK223: Microphone with coated membrane in place of MK221

Option 4 "Reverberation Time": Reverberation time measurement by source interruption and the impulsive source method.

Option 6 "FFT": Short Leq profiles at 1/32 s, narrow band spectrum analysis (FFT). It requires the "Advanced Analyzer" option.

Option 7 "SIT Calibration": SIT calibration replaces ISO 9001 reports. For new instruments only.

MK231: Class 1 microphone for diffuse field, type WS2F, according to IEC 61094-4:1995.

HD2110/CSM: MiniDin to DB25 serial cable for interconnection modem.

HD2110/CSP: MiniDin to DB9 cable for a serial printer connection.

SWD10: Stabilized mains power supply Vin=100-230Vac, Vout=12Vdc/1000mA.

CPA/10: 10m extension cable for HD2110P preamplifier.

CPA/20: 20m extension cable for HD2110P preamplifier.

CPA/50: 50m extension cable for HD2110P preamplifier.

VTRAP: Tripod, max. height 1550 mm.

HD2110/SA: Support for fixing the preamplifier to the tripod.

S'print-BT: Portable serial printer.

HD2110/MC: SD and MMC memory card interface.

Codes of spare parts and other accessories

Option 5 "Advanced Analyzer": Profile+report+event data logging, capture and analysis of events, full statistical analysis. This option is included in new instruments.

HD9101: Class 1 calibrator according to IEC60942:1988. Frequency 1000Hz; sound level 94dB/114dB.

CPA/5: 5m extension cable for HD2110P preamplifier.

HD2101/USB: MiniDin to USB-A serial cable.

HD2110/CSNM: MiniDin to DB9 null-modem serial cable for interconnection.

HD SAV: Windscreen for 1/2" microphone.

HD SAV2: Windscreen with bird spike for HDWME950 microphone unit.

HD SAVP: Rain shield for HDWME950 microphone unit.

HD2110P: Microphone preamplifier with standard connection for 1/2" microphones. Provided with CTC device for electrical calibration and driver for extension cable up to 100m.

HD2110PW: Microphone preamplifier for HDWME950 unit with standard connection for 1/2" microphones. Heated and provided with CTC device for electrical calibration and a driver for extension cable up to 100m. Ending in a 5m connection cable (other lengths on request).

MK223: Class 1 microphone type WS2F with coated membrane for free field, according to IEC 61094-4:1995.

MK221: Class 1 microphone, type WS2F for free field, according to IEC 61094-4:1995.



Technical characteristics

Standards	Class 1 group X according to IEC 61672:2002 and class 1 according to IEC 60651:2001 and IEC 60804:2000 Class 0 according to IEC 61260:1995 Type 1 according to ANSI S1.4-1983 and S1.43-1997 Class 1-D, order 3, Extended range according to ANSI S1.11-1986
½ inch Microphones	<ul style="list-style-type: none"> • MK221 condenser microphone, polarized (200V), for free field, high stability, type WS2F according to IEC 61094-4 • MK223 condenser microphone with coated membrane, polarized (200V), for free field, high stability, type WS2F according to IEC 61094-4 (combined with the HDWME950 weatherproof microphone unit) • MK231 condenser microphone, polarized (200V), for diffuse field, high stability, type WS2D according to IEC 61094-4
Dynamic range	23 dBA ÷ 143 dB Peak
Linear range	110 dB
Acoustic Parameters	Spl, L_{eq} , SEL, $L_{EP,d}$, L_{max} , L_{min} , L_{pk} , Dose, L_n
Frequency Weighting	Simultaneous A, C, Z (only C and Z for L_{pk})
Temporal Weighting	Simultaneous FAST, SLOW, IMPULSE
Integration	From 1s to 99 hours with Back-Erase function
Spectrum Analysis	Parallel filters in real time complying with IEC61260 class 0 specifications. <ul style="list-style-type: none"> • Octave bands from 16 Hz to 16 kHz • Third octave bands from 16 Hz to 20 kHz • Third octave bands from 14 Hz to 18 kHz • Optional FFT from 7 Hz to 22 kHz with variable resolutions from 1.5 Hz to 100 Hz Average spectrum (AVR) mode, multi-spectrum analysis (MLT), maximum spectrum (MAX), and minimum spectrum (MIN)
Audibility	Real-time comparison of third octave band spectrum with equal loudness curves according to ISO 266:2003
Statistical Analysis	Probability distribution and percentile level calculation from L_1 to L_{99} Parameter: $L_{F,p}$, L_{eq} , L_{pk} , A, C or Z weighted (only C or Z for L_{pk}) Sampling frequency: 8 samples/second Classification: 0.5 dB classes
Event Analysis	Calculation of 5 freely programmable event parameters Calculation of octave and third octave band average spectra Calculation of statistical levels from L_1 to L_{99} Event identification trigger with programmable threshold and duration filter External and manual trigger
Reverberation Time (opt.)	Reverberation time measurement by sound source interruption and impulse response integrated
Profile Data Logging	1 profile with programmable sampling from 1/8 s to 1 hour and 5 profiles with 2 samples/second
Spectrum Data Logging	Programmable sampling from 0.5s to 1 hour (MLT, MAX, or MIN modes)
Display	Backlit graphic display 128x64 <ul style="list-style-type: none"> • 5 numerical parameters • Profile of a selectable parameter with sampling time from 1/8 s to 1 hour • Octave band spectrum from 16 Hz to 16 kHz • Third octave band spectrum from 16 Hz to 20 kHz or 14 Hz to 18 kHz • Graph of sound level probability distribution • Graph of percentile levels from L_1 to L_{99} • Optional narrow band spectrum analysis (FFT) from 7Hz to 22 kHz
Memory	Internal, equal to 8 MB (1 profile for 72 hours or over 46 recording days of 5 parameters + spectra per minute) External, via the HD2110MC memory card interface, using MMC or SD cards up to 2 GB
Input/Output	RS232 serial and USB interfaces AC input and output (LINE) S/PDIF digital audio input and output External event identification trigger
PC Programs	DeltaLog5: PC interface for data download, setup and sound level meter management (supplied with the sound level meter) DL5 Environment: For analyses according to the Decree of 16.03.98 DL5 Monitor: For real-time acquisition in the PC mass memory, scheduler, audio recording DL5 Building: For room acoustics evaluation in compliance with D.P.C.M. of 05.12.97 (it requires the "Reverberation Time" option) DL5 Noise Studio: modular program analysis "Worker protection": Analysis module according to the Decree 195/2006 "Railway Traffic": Analysis module of train noise according to the Decree of 16/03/1998
Operating conditions	Working temperature -10÷50°C, 25÷90%RH (without condensation), 65÷108kPa. Protection degree: IP64
Power supply	4 alkaline or rechargeable NiMH type AA batteries or external 9÷12Vdc 300mA
Dimensions and weight	445x100x50 mm equipped with preamplifier, 740 g (with batteries)

Manufacture of portable and bench top instruments.

Current and voltage loop transmitters.

Temperature - Humidity - Pressure - Air speed - Light - Acoustics

pH - Conductivity - Dissolved Oxygen - Turbidity - Elements for weather stations - Thermal Microclimate



SIT CENTRE N°124

Temperature - Humidity - Pressure - Air speed - Photometry/Radiometry - Acoustics



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