CESVA
acoustic instruments

SC160

Integrating sound level meter real time frequency analyser in octave band

Applications

- **Evaluation the noise exposure of workers at workplace simultaneously to the verification of PPE (Personal Protective Equipment)**
- **Room acoustics: NC and NR evaluation, measurement of the reverberation time**
- **Evaluation of noise from machinery**
- **Sound insulation survey**

User friendly

- **Measures all parameters simultaneously with frequency weightings A, C and Z**
- **One single range 30-137 dBA; up to 140 dB peak**
- **Back Light graphic screen and membrane keyboard for easy use**

Features

- **Type 2 integrating sound level meter meeting IEC 60651:01 type 2, IEC 60804:00 type 2, ANSI S1.4:83 (A1 :85), ANSI S1.43:97 standards**
- **Real time octave band spectrum analyser 31.5 Hz–16 kHz. ANSI S1.11:86**
- **Real time room noise evaluator by NC and NR curves**
- **Reverberation time measurement in real time for octave band (Optional)**
- **Measurement results can be stored in the memory**
- **Includes software and cable for real time retrieval of all the measured and recorded data and their transmission to a PC**
- **Real time data transmission through wireless communication system Bluetooth®**
- **Detachable microphone for use of the extension cable (CNR-ITV)**
- **Stores in memory the time and date of the last time the sensitivity was modified**

The **SC160** is a Type 2, low cost, easy to use, integrating sound level meter and real time octave band spectrum analyser that allows you to make sound measurements quickly, conveniently and easily. It has a single range, so there is no need to make any range adjustments.

The **SC160** simultaneously measures all the functions for each function modes (sound level meter or spectrum analyser) with frequency weightings A, C, and Z. The **SC160**'s graphic screen provides graphical and numerical representation of the measured functions.

The data measured and recorded by the **SC160** can be transferred to a personal computer so that they are available in electronic format. The AC output allows you to obtain the signal from the preamplifier and make a calibrated recording on D.A.T.

The microphone is detachable. It can therefore be uncoupled and moved away from the **SC160** by means of an extension cable (CNR-ITV).

The **SC160** can be used as either a sound level meter or a spectrum analyser and room noise evaluator by NC and NR curves.

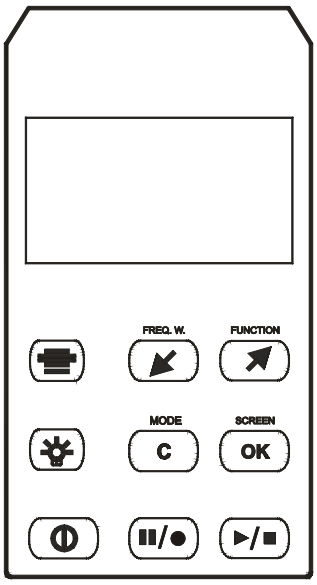
The sound level meter mode is ideal for measuring overall sound pressure levels. The **SC160** simultaneously measures all functions with all frequency weightings and calculates statistical data as maximum and minimum values and percentiles.

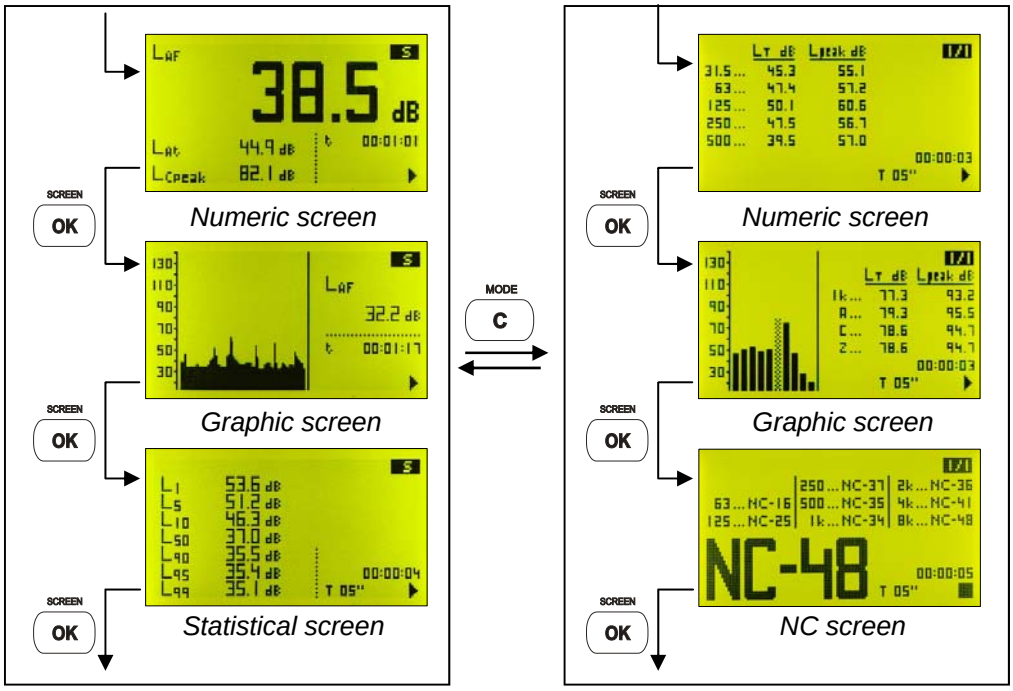
The spectrum analyser mode allows you simultaneously and in real time to measure the sound levels and peak levels for octave bands from 31,5 Hz to 16 kHz and the overall sound pressure levels and peak levels with frequency weightings A, C and Z.

Inside the analyser mode there is a special screen to evaluate room noise, specially designed for HVAC system installers, engineers, and consultants, that allows you to asses noise in real time using the NC and NR curves criterion.

SC160

Diagram of the screens structure
Available functions





Sound level meter mode | **Analyser mode 1/1**

Sound level meter mode

L_{AF}	L_{CF}	L_{ZF}
L_{AFmax}	L_{CFmax}	L_{ZFmax}
L_{AFmin}	L_{CFmin}	L_{ZFmin}
L_{AS}	L_{CS}	L_{ZS}
L_{ASmax}	L_{CSmax}	L_{ZSmax}
L_{ASmin}	L_{CSmin}	L_{ZSmin}
L_{AI}	L_{CI}	L_{ZI}
L_{AImax}	L_{CImax}	L_{ZImax}
L_{AImin}	L_{CImin}	L_{ZImin}
L_{AT}	L_{CT}	L_{ZT}
L_{ATmax}	L_{CTmax}	L_{ZTmax}
L_{ATmin}	L_{CTmin}	L_{ZTmin}
L_{At}	L_{Ct}	L_{Zt}
L_{AE}	L_{CE}	L_{ZE}
L_{Apeak}	L_{Cpeak}	L_{Zpeak}

t, T

L_1, L_5, L_{10}, L_{50}, L_{90}, L_{95}, L_{99}

Analyser mode 1/1

L_{AT}	L_{CT}	L_{ZT}
L_{AT_f}	L_{CT_f}	L_{ZT_f}
L_{Apeak}	L_{Cpeak}	L_{Zpeak}
L_{Apeak_f}	L_{Cpeak_f}	L_{Zpeak_f}

NC, NC_f

NR, NR_f

where f: [31,5 .. 16 kHz]

Nom	Description of sound level meter mode functions
L_{XF}	Sound pressure level with fast time weighting (Fast)
L_{XS}	Sound pressure level with slow time weighting (Slow)
L_{XI}	Sound pressure level with impulse time weighting (Impulse)
L_{XT}	Equivalent continuous sound pressure level with integration time T
L_{Xt}	Equivalent continuous sound pressure level of the entire measurement
L_{XE}	Sound exposure level S.E.L.
L_{Xpeak}	Peak sound pressure level
t	Measurement time
T	Integration time
$L_{n\ [n=1, 5, 10, 50, 90, 95, 99]}$	Percentiles, with A frequency weighting

Nom	Description of analyser mode 1/1 functions
L_{XT}	Equivalent continuous sound pressure level with integration time T
L_{XT_f}	Equivalent continuous sound pressure level with integration time T for the f octave band selected. (See graphic below)
L_{Xpeak}	Peak Sound pressure level
L_{Xpeak_f}	Peak Sound pressure level for the f octave band selected. (See graphic below)
NC	NC curve not exceeded by the measured spectrum
NR	NR curve not exceeded by the measured spectrum
NC_f	NC curve not exceeded by the measured spectrum in the f band. (See graphic below)
NR_f	NR curve not exceeded by the measured spectrum in the f band. (See graphic below)

X: Frequency weighting A, C and Z

31,5	63	125	250	500	1k	2k	4k	8k	16k

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SC160

Accessories

Bluetooth® device for wireless communication for the sound level meter, BT001

Bluetooth® device for wireless communication for the PC, BT002

Audio cable for the sound level meter, CN-DAT

Mains feeder A-200 and battery converter A-100

Extension cable for microphone, CNR-ITV

Standard accessories

FNS-020	Case
PVM-05	Windscreen
STF030	Program for PC
CN-201	Cable for connection to a PC
	9 volts battery

Optional accessories

CB-5	Acoustic calibrator
CNR-ITV	Microphone extension cable
CN-USB	Serial-USB converter cable
CN-DAT	AC output audio cable
TR-40	Tripod (height 1.1 m)
TR050	Tripod (height 1.55 m)
TR002	Tripod support for cable CNR-ITV
A-200	Mains feeder 230 V 50 Hz to 9 V
A-100	Battery converter 12 V to 9 V
BT001	Bluetooth® device for the Sound Level Meter
BT002	Bluetooth® device for the PC
ML-50	Transport briefcase (49 x 36 x 14 cm)
ML-10	Transport briefcase (30 x 38 x 8 cm)
IM003	Printer 40 columns serial
RT-030	Reverberation time module

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SC160

Storage capacity

Sound level meter mode

Kind of recording

All each second	1	hour	30	minutes
F1, F2 and F3 each second*	36	hour	21	minutes
F1 each second *	84	hour	50	minutes
L_T and partial percentiles every T				
T= 1 s	12	hours		
T= 1 min	1	month		
T= 1 hour	5	years		

Spectrum analyser mode in 1/1 octave band

Kind of recording

$L_T + L_{peak}$ of each octave band				
$L_T + L_{peak}$ global with frequency weighting A, C and Z				
Each T				
T=1 s	4	hours	45	minutes
T=1 min	11	days	21	hours
T=5 min	2	months		
T=1 hour	2	years		

** F1, F2 and F3 are the acoustic functions selected by the user on the preferential screen. They may be any of the 54 different functions the SC160 measures in sound level meter mode.*

The **SC160** may store in its internal memory the values of the measured functions. When the unit is switched off, the data is saved and may be retrieved and displayed directly from the **SC160** or transferred to a PC. The memory may be erased directly from the **SC160**.

In the memory of the **SC160** may be stored the final results of a measurement or continuous recordings of functions with programmable register time.

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Standards and specifications

Complies with the following standards.

- EN 60651:94 (A1:94) (A2:01) type 2, EN 60804:00 type 2, EN 61260:95 (A1:01) type 2
- IEC 60651:01 type 2, IEC 60804:00 type 2, IEC 61260:95 (A1:01) type 2
- ANSI S1.4:83 (A1:01) type 2, ANSI S1.43:97 (A2:02) type 2, ANSI S1.11:04
- CE Mark complies with 73/23/CEE and CEM 89/336/CEE low-tension regulations, the latter amended by 93/68/CEE.

Measurement range

- **L_F, L_S, L_I, L_T and L_t**

Indicator limits:	0 – 137 dB		
Primary range	A	C	Z
Upper limit	113	113	113
Lower limit	36	36	40
Measurement range:			
Upper limit:	137	137	137
Crest factor 3:	130	130	130
Crest factor 5:	126	126	126
Crest factor10:	120	120	120
Lower limit:	19	21	32

- **L_{peak}**

Indicator limits: 0 – 140 dB

Noise

	A	C	Z
• Electrical noise:			
Maximum	12	12,1	23,1
Typical	9,1	11,4	18,5
• Total noise (electrical + thermic of the microphone):			
Maximum	27,1	31,0	39,0
Typical	25,3	29,0	35,0

Frequency weighting

Complies with the EN 60651 type 2 standard
Weightings A, C and Z

AC output

Frequency weighting: linear
Sensitivity to 137 dB and 1 kHz (Gain = 0dB): 3,8 Vrms (max)
Upper limit: 7 Vpeak ; Output impedance: 100 Ω
Gain: 0 and 40 ± 0,2 dB

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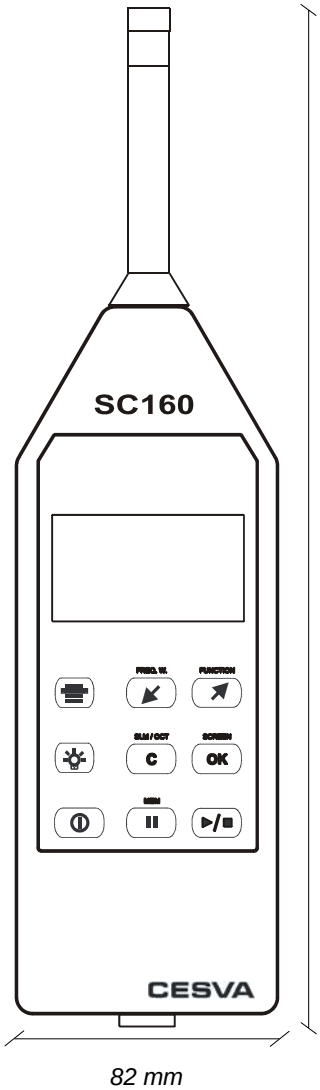
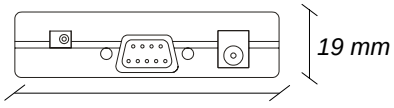
SC160

Technical specifications





Microphone

- Model CESVA **P-05**: ½" Condenser microphone with preamplifier. Equivalent impedance: 3000 Ω. Nominal sensitivity: 16,0 mV/Pa in reference conditions.

Time weighting

L_F, L_S, L_I according class 2 tolerances

Parameters

See table| Resolution: 0,1dB

Octave filters

Type 2 according EN 61260:95/ A1:01. Nominal octave bands central frequency: 31,5, 63, 125, 250, 500, 1000, 2000, 4000, 8000, 16000 Hz

Influence of humidity

Operation range:	30 to 90	%
Maximum error at 30%<R.H.<90% at 40 ºC and 1 kHz:	0,5	dB
Storage without batteries:	< 93	%

Effects of magnetic fields

In an 80 A/m magnetic field (1 oersted) at 50 Hz, all gives a reading of less than dB(A) is given

Influence of temperature

Operation range:	-10 to +50	ºC
Maximum error (-10 to +50ºC):	0,5	dB
Storage without batteries:	-20 to +60	ºC

Effects of vibrations

For frequencies between 20 and 1000 Hz and 1 m/s^2: < 75 dB(A)

Battery

9 V Battery type 6LF22.
Battery life with continuous use:

- Sound Level Meter mode: 8 hours
- Spectrum Analyser mode: 6 hours

Mains feeder: A-200

Dimensions and weight

Dimensions:	341 x 82 x 19	mm
Weight:		
• With battery:	627	g
• Without battery:	573	g

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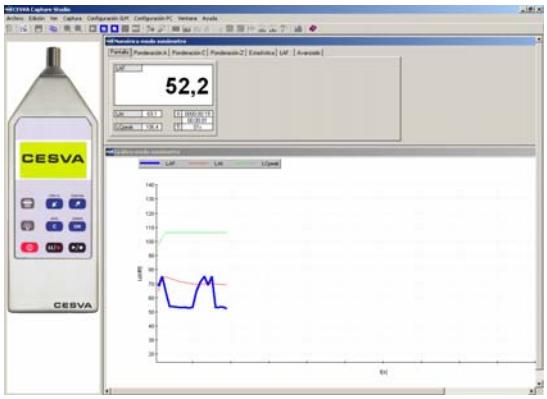
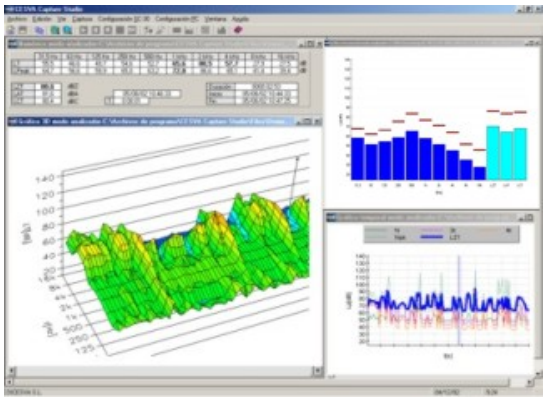
SC160

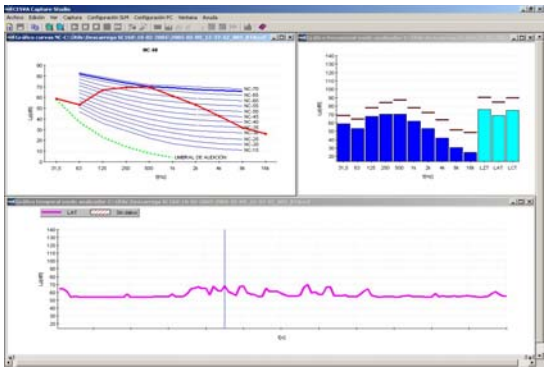
Cesva Capture Studio Software



Real time data acquisition



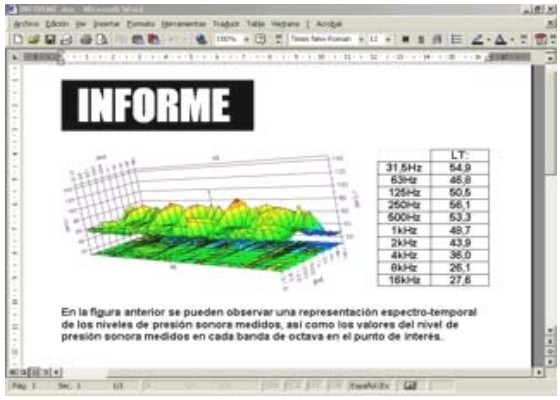
Graphical display of data



Room noise evaluation (NC curves)

The SC160 is supplied with the software application **CAPTURE Studio** that allows you to:

- Configure the SC160
- Retrieve data from the SC160 in real time.
- Download registers from the SC160 memory to a PC.
- Erase the SC160 memory.
- Display graphically and numerically the data files and convert them into different formats (.txt, .xls, .mdb)
- System of encrypted file. The files are saved in *.ccf own format and can not be changed and it guarantees the total integrity and legality of those.



Data exportation to other applications

CAPTURE Studio provides you with a convenient, easy-to-use environment for obtaining, in digital format, data acquired by the SC160, it runs in PC under Windows 9x/Me/2000/NT/XP/VISTA.

The characteristics, technical specifications and accessories may vary without prior notice

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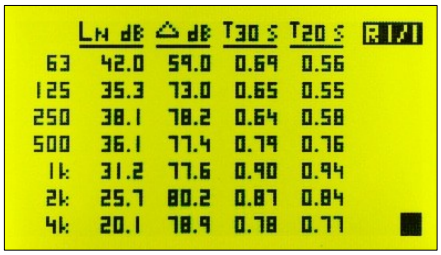
SC160

Reverberation time module

Reverberation time mode in 1/1 octave bands



Calculus and measurement standards

- ISO 3382:1997: Measurement of the reverberation time of rooms.
- ISO 354:1985: Measurement of the coefficient absorption in a reverberation room.
- ISO 140:1998: Measurement of sound insulation in buildings and of building elements.

Procedure for the RT measurement

1. *Switch the SC160 to RT mode*
2. *Press* ►/■ *to start the measurement process*
3. *Validate the background noise by pressing* OK
4. *Increase progressively the sound pressure level by starting the sound source*
5. *When the source emits the necessary sound pressure level and the acoustic field reaches the stationary state, press* OK *to validate this level*
6. *Stop the noise emission*
7. *After a few seconds from the noise emission stop it will appear at the screen of the SC160 the RT values*

The module of reverberation time measurement of the **SC160** Sound Level Meter allows:

- The simultaneously measurement of the reverberation time T_{20} and T_{30} by the interrupted noise method for the octave bands of 63, 125, 250, 500, 1000, 2000, and 4000 Hz.

  T_{30} Is the time, expressed in seconds, that it is required for the sound pressure level to decrease 60 dB. The T_{30} is the result of multiply by 2 the necessary time that takes the level to reduce 30dB.

  T_{20} Is the time, expressed in seconds, that it is required for the sound pressure level to decrease 60 dB. The T_{20} is the result of multiply by 3 the necessary time that takes the level to reduce 20dB.

- Measurement range (depends on the frequency band):

  TR minimum: 0,1 s

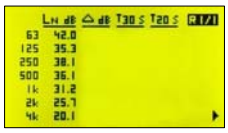
  TR maximum: 10,0 s

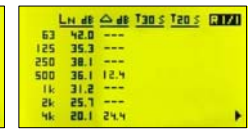
- The automatic detection of the decay curve and its slope estimation through a least square approximation.
- Decay curves calculated from the averaging time between 10 ms and 40 ms depending on the frequency band.
- The possibility of storing the results in memory: Values of T_{20}, T_{30} and decay curves, for all octave bands.

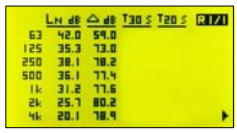
Storage Capacity	
Reverberation time (T_{20} and T_{30}) + Background noise (L_N) + maximum level (L_N + Δ) + decay time history	100 measurements

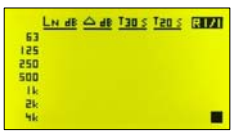
The reverberation time module for the **SC160** is optional and may be purchased when buying the **SC160** or later. All **SC160** purchased before this date may be upgraded with this module.

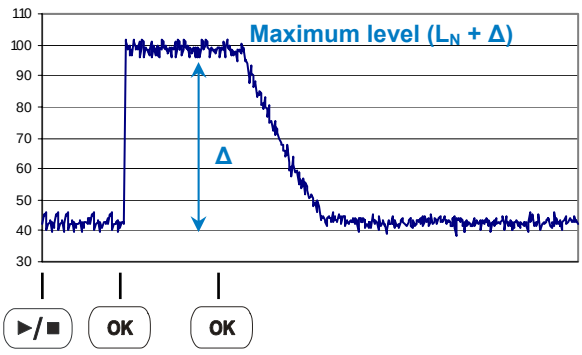
Next it is appears a graphic with the steps that have to be followed to be able to make a reverberation time measurement.

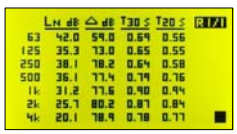












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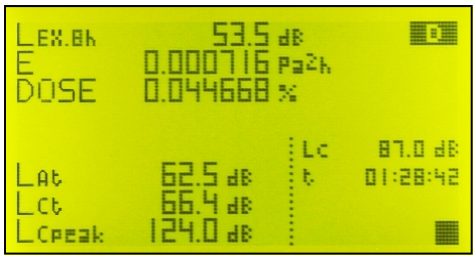
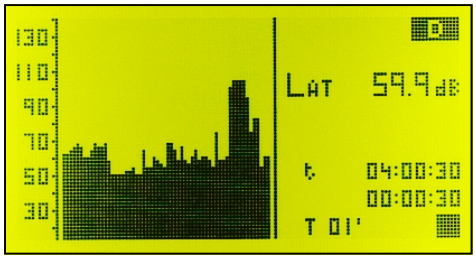
Dosimeter module for the assessment of noise at workplace

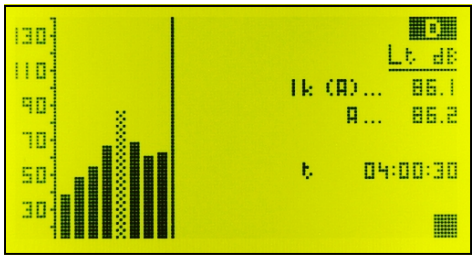
Dosimeter module for the assessment of noise at workplace



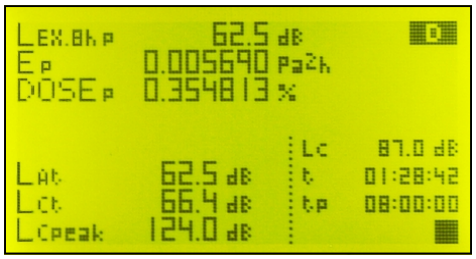
Numeric screen



Graphic screen



1/1 Spectrum analyser screen



Numeric screen (projected parameters)

The dosimeter module for the assessment of noise at workplace of the **SC160** adds a new measurement mode that is perfect for the application of the Directive 2003/10/CE which adapts to the technical progress the regulation on protection of the health and safety of workers against the risks regarding the exposure to noise. In The Member States, the corresponding transposition to national law.

This dosimeter module allows you to simultaneously measure all parameters needed to assess the levels of noise to which workers are exposed when wearing or not hearing protectors (SNR, HML, Octaves).

The **SC160** measures simultaneously the equivalent level with frequency weighting A and C [L_{At}, L_{Ct}], daily noise exposure level [$L_{EX,8h}$] (ISO 1999), Noise exposure in Pa^2h [E] and noise dose [DOSE] referred to a programmable Criterion Level [L_C], and, of course, also the Peak Level with frequency weighting C [L_{Cpeak}] (ISO 1999).

Moreover, the **SC160** allow you to carry out the measurement during a time shorter than the exposition time, because it shows on the screen all parameters projected to the expected exposition time (programmable projection time [t_p]).

To evaluate the exposure to noise taking into account the attenuation of the individual hearing protectors worn by the worker, the **SC160**, beside measuring the equivalent level with frequency weighting A and C [L_{At}, L_{Ct}] (SNR and HML method), simultaneously carries out a real time frequency analysis with frequency weighting A and by octave bands from 63 Hz to 8 kHz (Octave method).

The huge memory of the **SC160** allows you to store the time history of the measured parameters, and afterwards recalculating them for any desired time interval.

The **SC160** helps you to asses and measure the exposure to noise and also brings you all data needed to inform and train about the significance and potential risks of the results of the assessment and measurement.

Moreover, It helps you to design and run a reduction programme and to choose the suitable hearing protectors.

The dosimeter module for the assessment of noise at workplace is not included with the **SC160**. It is an optional module and it can be acquired when buying the **SC160** or later.

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