

Applications

- Evaluation of 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 inspections

User friendly

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

Features

- Class 2 integrating sound level meter meeting IEC 61672, IEC 60651:01 class 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 bands (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

***ATTENTION:** The Spectrum Analyser mode in octave bands is optional. Reference number SC160sb does not have this option. If you wish to incorporate it you should acquire module FB160. Reference number SC160cf does incorporate the analyser mode in octave bands.

The **SC160** is a user-friendly, low cost, class 2 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 mode (sound level meter or spectrum analyser*) with A, C, and Z frequency weightings . The **SC160**'s graphic screen provides graphical and numerical representation of the functions measured.

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).

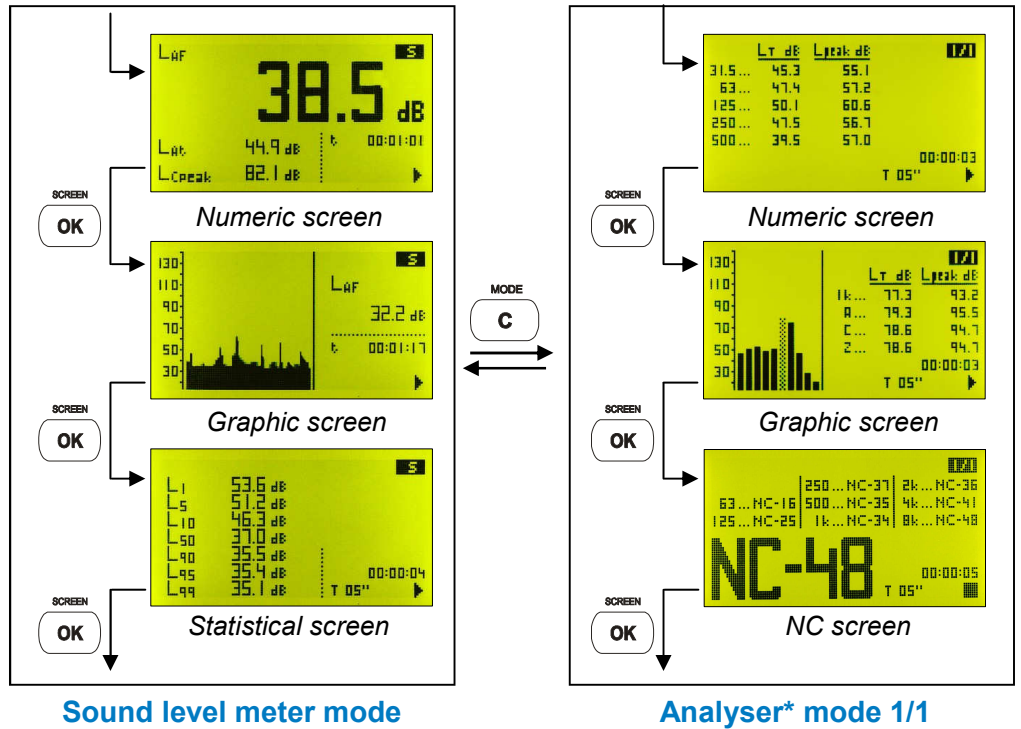
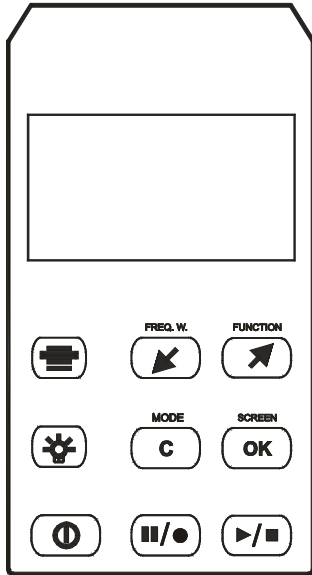
The **SC160** can be used as either a sound level meter or a spectrum analyser* and room noise evaluator by NC and NR curves.

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 A, C and Z with frequency weightings.

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





Sound level meter mode

Analyser* mode 1/1

Sound level meter mode

LAF	LCF	LZF
LAFmax	LCFmax	LZFmax
LAFmin	LCFmin	LZFmin
LAS	LCS	LZS
LASmax	LCSmax	LZSmax
LASmin	LCSmin	LZSmin
LAl	LCl	LZl
LAlmax	LClmax	LZlmax
LAlmin	LClmin	LZlmin
LAT	LCT	LZT
LATmax	LCTmax	LZTmax
LATmin	LCTmin	LZTmin
LAt	Lct	Lzt
LAE	LCE	LZE
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

LAT	LCT	LZT
LAT _f	LCT _f	LZT _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 T integration time
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 T integration time
L _{Xt_f}	Equivalent continuous sound pressure level with T integration time 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

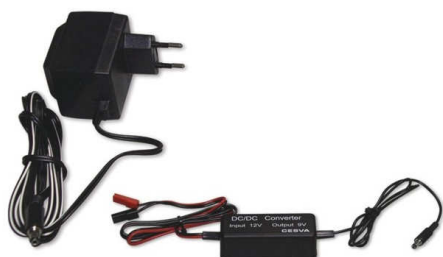




Extension cable for microphone, CNR-ITV



Audio cable for the sound level meter, CN-DAT



Mains feeder A-200 and battery converter

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

- CB006** Class 1 acoustic calibrator
- CB004** Class 2 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
- ML-50** Transport briefcase (49 x 36 x 14 cm)
- ML-10** Transport briefcase (39 x 32 x 12 cm)
- ML060** Special outdoors transport briefcase (51x38x15 cm)
- IM003** Printer 40 columns serial
- RT-030** Reverberation time module
- TK1000** Outdoor kit

Sound Level Meter mode

Kind of recording

All each second	1 hour	30 minutes
F1, F2 and F3 each second ⁽¹⁾	36 hour	21 minutes
F1 each second ⁽¹⁾	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 A, C and Z frequency weighting		
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	

⁽¹⁾ 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** can store in its internal memory the values of the functions measured. 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.

Standards and specifications

Complies with the following standards.

- EN 61672 class 2, EN 60651:94 (A1:94) (A2:01) class 2, EN 60804:00 type 2, EN 61260:95 (A1:01) class 2
- IEC 61672 class 2, IEC 60651:01 class 2, IEC 60804:00 type 2, IEC 61260:95 (A1:01) class 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 factor 10:	120	120	120
Lower limit:	19	21	32

- **L_{peak}**

Indicator limits:	0 – 140 dB		
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Peak detector L_{peak}

Onset time constant	< 75	μs
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Noise

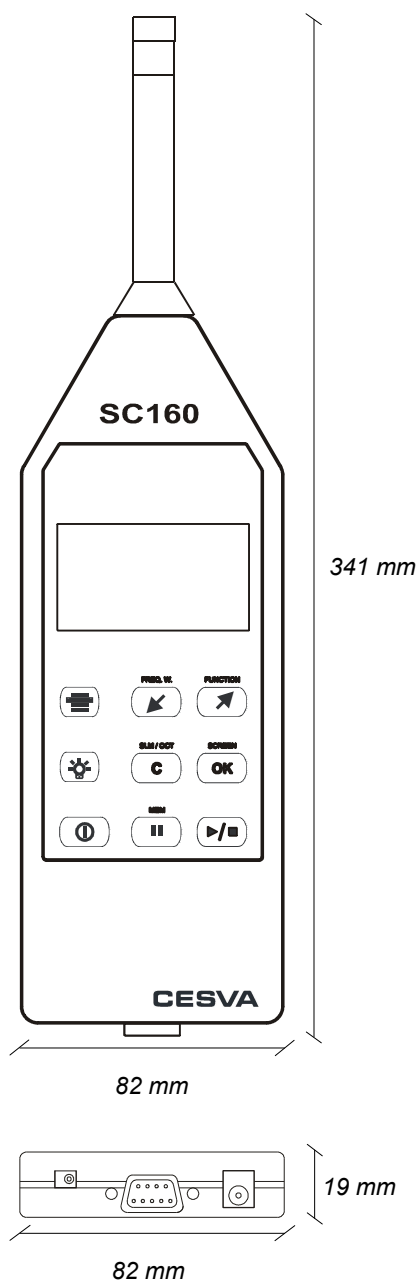
• Electrical noise:	A	C	Z
Maximum	12	12,1	23,1
Typical	9,1	11,4	18,5
• Total noise (electrical + thermic of the microphone):			
Maximum	27,1	31,0	39,0
Typical	25,3	29,0	35,0

Frequency weighting

Complies with the EN 61672, EN 60651 and EN 60804 type 2 standard Weightings A, C and Z

AC output

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



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

Class 2 according to 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:	25 to 90 %
Maximum error at 25%<R.H.<90% at 40 °C 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, a reading of less than 25dB(A) is given

Influence of temperature

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

Effects of vibrations

For frequencies between 20 and 1000 Hz and 1 m/s²: < 75 dB(A)

Battery

9 V Battery type 6LF22.

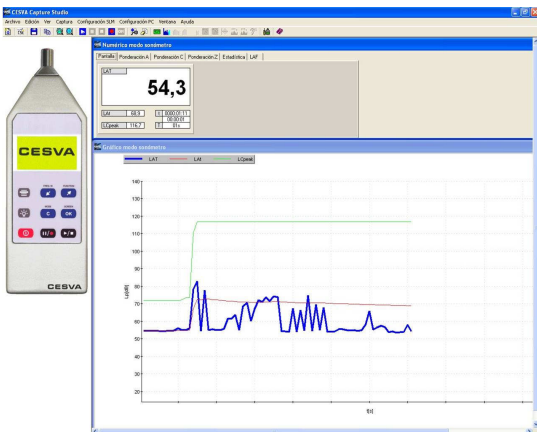
Battery life with continuous use:

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

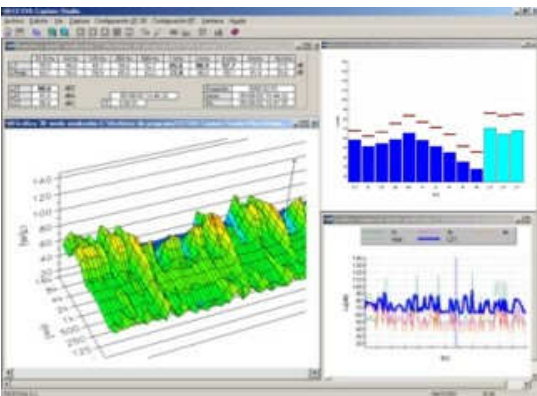
Mains feeder: A-200

Dimensions and weight

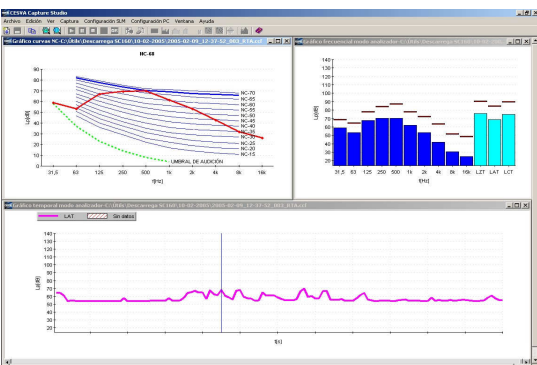
Dimensions:	294 x 82 x 19 mm
Weight:	
• With battery:	508 g
• Without battery:	466 g



Real time data acquisition



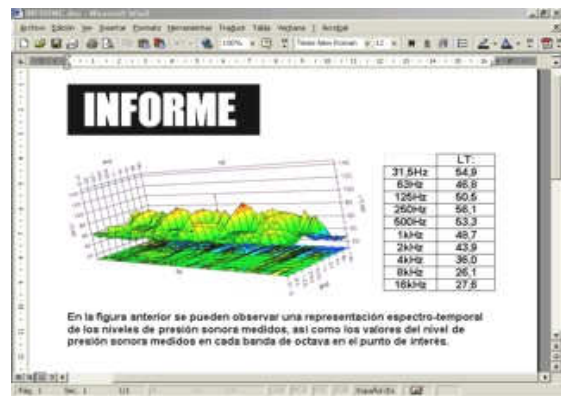
Graphical display of data



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 their own *.cfd format and cannot be changed which guarantees their total integrity and legality.



Data exportation to other applications

CAPTURE Studio provides you with a convenient, user-friendly environment for obtaining, in digital format, data acquired by the SC160, it runs in PC with Windows 9x/Me/2000/NT/XP/VISTA/7.

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

Reverberation time mode in 1/1 octave bands

LN	dB	Δ dB	T30 s	T20 s	RTV
63	42.0	59.0	0.69	0.56	
125	35.3	73.0	0.65	0.55	
250	38.1	78.2	0.64	0.58	
500	36.1	77.4	0.79	0.76	
1k	31.2	77.6	0.90	0.94	
2k	25.7	80.2	0.87	0.84	
4k	20.1	78.9	0.78	0.77	

Calculation and measurement standards

- ISO 3382-1:2009 Measurements of the reverberation time in performance spaces.
- ISO 3382-2:2009 Measurements of the reverberation time in ordinary 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
4. Progressively increase 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 to validate this level
6. Stop the noise emission
7. A few seconds after the noise emission stops the RT values will appear on the screen of the SC160.

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

- The simultaneous measurement of T_{20} and T_{30} reverberation times 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 by 60 dB. The T_{30} is the result of multiplying by 2 the time that it takes for the level to decrease by 30dB.

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

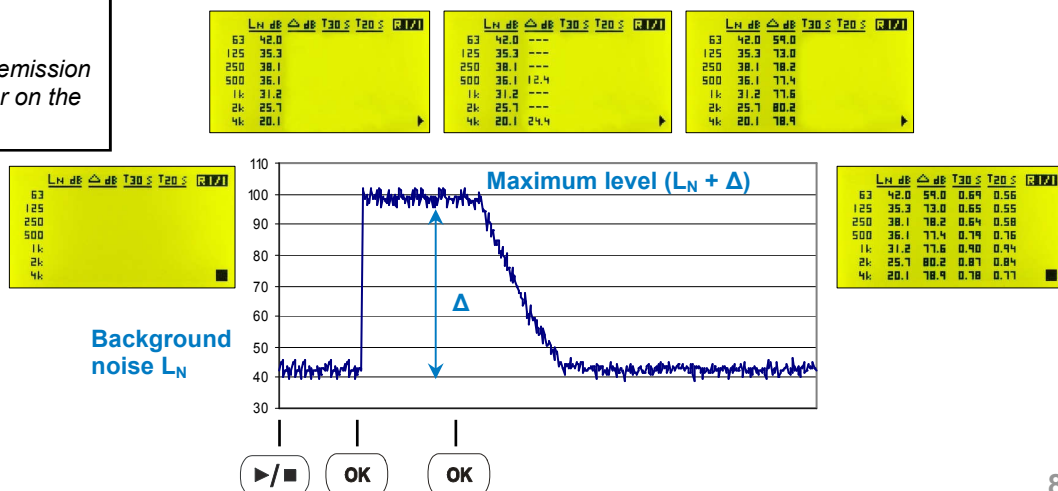
- Measurement range (depends on the frequency band):
TR minimum: 0,2 s
TR maximum: 10,0 s
- The automatic detection of the decay curve and its slope estimation through a least square approximation.
- Decay curves calculated from the averaging time between 10 ms and 40 ms depending on the frequency band.
- 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 ($L_N + \Delta$) + decay time history	100 measurements
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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.

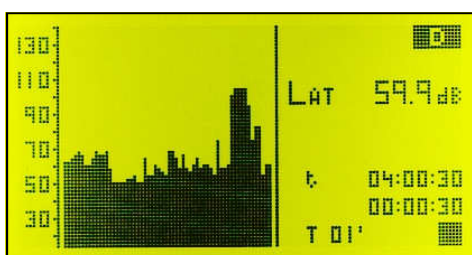
Below a graphic is shown with the steps that must be followed to make a reverberation time measurement.



Dosimeter module for the assessment of noise at workplace



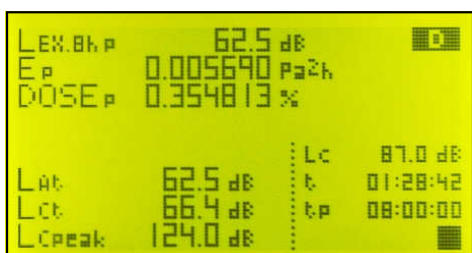
Numeric screen



Graphic screen



1/1 Spectrum analyser* screen



Numeric screen (projected parameters)

The dosimeter module of the **SC160** for the assessment of noise in the workplace adds a new measurement mode that is ideal for the application of Directive 2003/10/CE, which adapts the regulation on protection of the health and safety of workers from the risks of exposure to noise, to technical progress. In the member states, the corresponding transposition to national law applies.

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

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

Moreover, the **SC160** allows you to carry out the measurement during a time shorter than the exposure time, because it shows on the screen all parameters projected to the expected exposure 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**, besides measuring the equivalent level with A and C frequency weightings [L_{At} , L_{Ct}] (SNR and HML method), simultaneously carries out a real time frequency analysis with A frequency weighting and by octave bands from 63 Hz to 8 kHz (Octave method).

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

The **SC160** helps you to assess and measure the exposure to noise and also brings you all the data needed to inform and train workers with regard to 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 most suitable hearing protectors.

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