DC112d / DC112

Dosimeter / Dosimeter Spectrum Analyser

User's Manual

ENGLISH

1. GENERAL DESCRIPTION

The DC112 is a high performance dosimeter, in accordance with standards: IEC 61252:2002 and UNE-EN 61252:1998/A1:2003. Los dos modelos DC112d y DC112 disponen exactamente de las mismas características como dosímetro. The difference between the two models lies in the fact that only the DC112 is also a real time spectrum analyser in octave bands with filters in accordance with IEC 61260:1995/A1:2001 and UNE-EN 61260:1997/A1:2002.

The DC112d/DC112 is the ideal instrument for measuring noise in accordance with Directive 2003/10/CE which adapts to recent technical progress, the regulation on the health and safety requirements regarding the exposure of workers to the risks arising from noise. In The Member States, this applies to the corresponding transposition to national law.

The DC112d can be converted into a DC112, for which it is necessary to acquire the module EF112, either when purchasing the DC112, or subsequently. To acquire it, simply contact your official CESVA distributor, give them the serial number of your SLM and place an order for the module. Within a few days you will receive a CD containing the activation programme.

The DC112d/DC112 enables you to measure simultaneously all the parameters needed to assess the levels of noise to which workers are exposed when wearing or not wearing hearing protectors (SNR, HML).To do this it measures simultaneously the equivalent level with A and C frequency weightings [L_{At}, L_{Ct}], daily noise exposure level with frequency weighting A[$L_{EX,8h}$] (ISO 1999), Noise exposure in Pa^{2}h [E] and noise dose [DOSE] with respect to a programmable Criterion Level [L_C], and, of course, also the Peak Level with C frequency weighting [L_{Cpeak}] (ISO 1999).

Moreover, the DC112d/DC112 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 DC112, besides measuring the equivalent level with A and C frequency weightings [L_{At}, L_{Ct}] (SNR and HML method) like the DC112d, simultaneously carries out a real time frequency analysis by octave bands from 63 Hz to 8 kHz (Octave method) with or without frequency weighting.

In line with the philosophy that characterises CESVA instruments, the DC112d/DC112 is a user-friendly instrument, with a single range, (no changes of scale), and simultaneous measurement of all its parameters.

The large memory of the DC112d/DC112 allows you to store the time history of the parameters measured (time periods longer than a week), and afterwards recalculate them for any time interval required.

The DC112d/DC112 comes with the Capture Studio software. This application will enable you to download measurements made with the instrument via the USB port, and analyse the results quickly and simply.

The DC112d/DC112 does not only make the job of measuring and evaluating noise simpler, it also brings you all the data needed to inform and train workers with regard to the significance and potential risks arising from the results of the measurement and assessment.

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

1.1 Activation of the frequency analysis in octaves module for the DC112d

To activate the frequency analysis in octaves module for the DC112d (EF112):

- Insert el CD the you have received into the CD-ROM unit. The 'EF112 module Activator' activation programme will run automatically. If this does not happen, run the SETUP.EXE file of the CD-ROM unit.

- Follow the steps indicated.

1.2 Main Characteristics of the DC112d/DC112

- The DC112 carries out a frequency analysis in octave bands (63 Hz to 8 kHz) to determine exposure to noise, taking into account the reduction attained by the individual hearing protectors used by the workers.

- The projection of parameters makes it possible to evaluate the exposure to noise for measurement times less than the exposure time.

- The large memory (64 MB) of the DC112d/DC112 enables you to save the time history of all the functions measured for long periods of time. The capacity is 1 month, saving functions every second, irrespective of the number of measurements being saved.

- The DC112d/DC112 has a USB port to download data to a PC at high speed. While the DC112d/DC112 is connected to the USB port of a PC it does not need batteries as it is powered by the USB port of the PC.

- The keypad of the DC112d/DC112 can be blocked to avoid accidental interventions. While the keypad is blocked, the values of the functions measured do not appear on the screen to avoid the deliberate generation of noise to distort the measurements.

- The DC112d/DC112 adapts to any work shift. As it allows you to stop a recording in progress (pause), switch off the instrument, switch it back on again later, and restart the measurement (recording), making all the information available in just one measurement. Ideal for measuring split shifts, and evaluating weekly levels.

- The graphic screen is very practical for the evaluation of a noise event: its time history, spectral content or its variability.

- The DC112d/DC112 has a register of the date of the last sensitivity adjustment carried out; in this way, any unauthorised manipulation is registered.

- The battery status indicator that appears on the screen of the DC112d/DC112 shows the current state of the battery at all times.

- The DC112d/DC112 screen lights up at the touch of a button, meaning that work can be carried out in atmospheres of poor lighting.

- The DC112d/DC112 supports multiple languages.

- The DC112d/DC112 includes the Capture Studio software with which it can be programmed and measurements can be downloaded. The software enables you to work with data in electronic format, export it to other programmes, and display it in numerical and graphic format, in order to create your own reports.

- The DC112d/DC112 microphone incorporates a clip to attach it to the worker's lapel so that they can carry out their working activities naturally.

- The DC112d/DC112 is a personal pocket-sized instrument. Its reduced weight and robustness make it the ideal instrument for the evaluation of noise at work for those workers whose work requires them to move about the workplace.

1.3 Functions

The DC112d/DC112 measures the following functions simultaneously in all the dynamic range (one single scale):

- Equivalent continuous sound pressure level with A and C frequency weighting, corresponding to the measurement time t, (L_{At} y L_{Ct}).
- Peak sound pressure level with C frequency weighting corresponding to the measurement time t, (L_{Cpeak}).
- Equivalent continuous sound pressure level with or without A frequency weighting, corresponding to measurement time t for each one of the octave bands centred on the frequencies 63, 125, 250, 500, 1000, 2000, 4000 y 8000 Hz. (Only DC112).
- Equivalent daily exposure level corresponding to the measurement time t, ($L_{EX,8h}$) with frequency weighting A.
- Sound exposure (E), corresponding to measurement time (t).
- Noise dose (DOSE), corresponding to measurement time t, evaluated according to the criterion level (L_C).
- Measurement time t.
- Projected equivalent daily exposure level ($L_{EX,8hp}$) with frequency weighting A, Projected sound exposure (E_p), Projected noise dose ($DOSE_p$) evaluated according to the value of the projected time (t_p).
- Time history of the equivalent continuous sound pressure level with A frequency weighting and integration time T.

Apart from the aforementioned functions corresponding to the measurement time, when it carries out a recording, the DC112d/DC112 saves the time history of the following functions every T period:

- Equivalent continuous sound pressure level with A and C frequency weighting, corresponding to the integration time (T), (L_{AT} y L_{CT}).
- Peak sound pressure level with C frequency weighting corresponding to the integration time (T), ($L_{Cpeak,T}$).
- Equivalent continuous sound pressure level with or without A frequency weighting, corresponding to integration time (T) for each one of the octave bands centred on the frequencies 63, 125, 250, 500, 1000, 2000, 4000 y 8000 Hz. (Only DC112).

1.4 Description of the DC112d/DC112

The most important parts of the DC112d/DC112 are detailed in the following diagram.

1. **Microphone** Prepolarised lapel condenser microphone: CESVA P007.

2. **Support clip**. Adjustable clip to fix the microphone to a lapel or helmet.

3. **Microphone extension cable**. 1m flexible extension cable for the CESVA P007 microphone.

4. **LEMO type microphone connector**. Male LEMO type coaxial connector for the CESVA P007 microphone.

5. **LEMO type dosimeter connector**. Female LEMO type coaxial connector for the CESVA DC112d/DC112 dosimeter analyser.

6. **Screen**. Backlit LCD graphic screen.

7. **Soft-touch membrane keypad**. Extra flat anti-dust keypad especially designed for work in industrial environments.

8. **USB connector**. Mini-B type USB connector for full-speed bidirectional USB 1.1 digital communication.

9. **Characteristics plate**. On this plate the brand, model and all the standards with which the instrument complies are detailed.

10. **CE mark**. European conformity mark.

11. **Serial number**. Here the dosimeter's serial number is given.

12. **Tripod support**. Tripod support with standard ¼'' W screw. (TR-40 or TR050).

13. **Support clip**. Support clip to attach the DC112d/DC112 to the worker's belt.

14. **WEEE mark**. Symbol that indicates the selective collection of electric and electronic devices.

15. **Battery protection cover**. Cover for battery protection; only to be removed to change it.

16. **Manufacturer**. Here the details of the manufacturer are given.
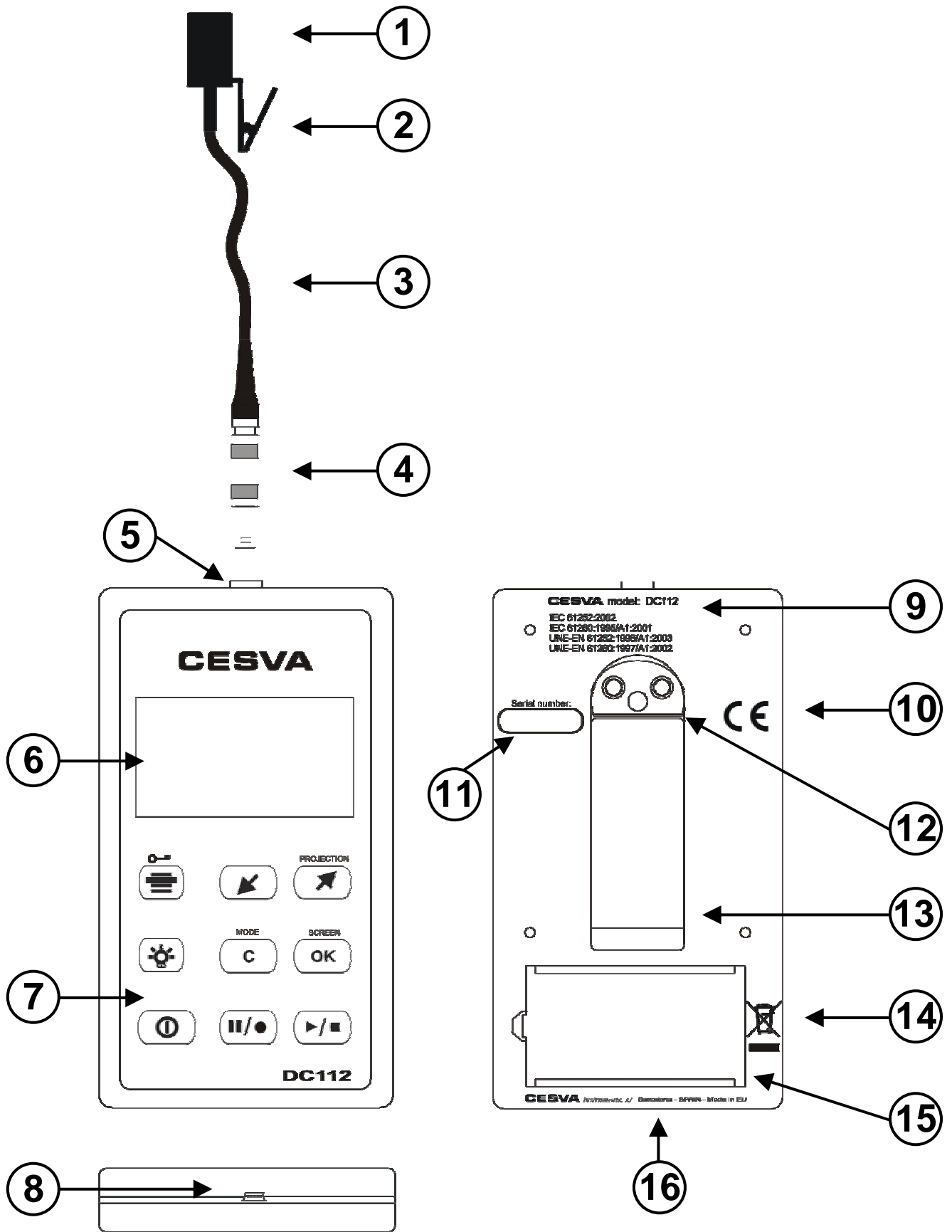
1.5 Screen

While the DC112d/DC112 is carrying out a measurement the following information is shown in the bottom right-hand corner of the screen:
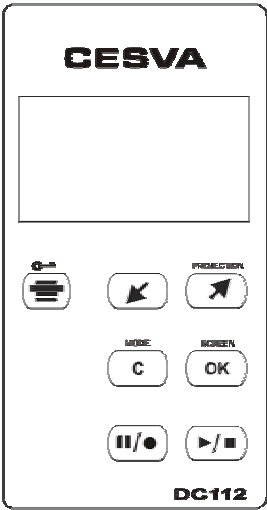
- Measurement time lapsed t
- Battery status indicator
- Measurement status indicator:
  - ■ measurement finished
  - ▶ measurement in progress
  - ● (flashing) measurement with recording in progress
  - ‖ measurement paused

1.6 Use of the keypad

GENERIC KEYS:	
⏻	On/Off key of the DC112d/DC112
☀	On/Off key of the screen light

MENU KEYS:	
☰	DC112d/DC112 menu access key
↙	Key to move down the menu
↗	Key to move up the menu
OK	Key to validate or modify the selected option
C	Key to return to the previous menu or cancel

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MEASUREMENT KEYS:		
▶/■		a) Key to begin or end a measurement b) Key to continue a measurement (when the DC112d/DC112 is on ❚❚)
❚❚/●		a) Key to interrupt (PAUSE) a measurement (while the DC112d/DC112 is on ▶ or ●) b) Or to begin a recording in the memory (when the DC112d/DC112 is on ■)
◤		Key to return to the previous octave band
PROJECTION ◤		Key to move on to the next octave band, or to move on to the numerical screen with projected parameters.
SCREEN OK		Key to select the desired Dosimeter mode screen: numerical screen, 1/1 spectrum analyser screen or graphic screen
⌂		Key to block the keypad. To unblock it press this same key + OK.

2. USING THE DC112d/DC112

2.1 Initial steps

This chapter contains all the information necessary to configure, adjust and carry out measurements with the DC112d/DC112 dosimeter.

2.1.1 Material and documentation

The first step is to check the material and documentation provided with the DC112d/DC112:

Material included:

- DC112d/DC112 dosimeter spectrum analyser
- Case
- One 6LF22 type 9 V alkaline battery
- Connection cable for communication with the PC
- CESVA Capture Studio Software

Documentation included:

- User's manual for the DC112d/DC112 dosimeter spectrum analyser
- Guarantee

If any of these elements should be missing, contact your official CESVA distributor.

2.1.2 DC112d/DC112 Power source

The first operation to carry out, before switching on the DC112d/DC112, is to supply power.

The DC112d/DC112 dosimeter is powered by a 6LF22 type 9V alkaline battery, or via the USB port [8].

To fit the battery, remove the battery protection cover [15] which can be found at the back of the DC112d/DC112. Insert the battery and press until the contacts fit perfectly (see figure).

The battery indicator symbol in the bottom right hand corner of the dosimeter screen shows the status of the battery (see figure).

When the battery is fully charged the ▄▄ symbol shows on the screen. As the battery is discharged, the symbol empties.

When the battery is not sufficiently charged for the DC112d/DC112 to work correctly the ▭ symbol will start to flash. Then, if there is a measurement or recording in progress it will be paused, and the message "BATTERY FLAT" will appear on the screen and the device will switch off. The battery must be replaced.

To replace the batteries, the device must be switched off. To remove the battery of the DC112d/DC112, open the battery compartment and pull upwards on the back of the battery, as shown in the figure.

Once the batteries have been replaced, simply switch on the device by pressing ⓪ and press ▶/■ to continue the measurement.

The DC112d/DC112 can also be powered via the USB port. To do this connect the USB port of the DC112d/DC112 [8] to a USB port of a PC with the cable provided. When it is connected the ▦ symbol will appear where the battery symbol was.

RECOMMENDATIONS:

If the DC112d/DC112 is likely to be unused for an extended period of time, remove the batteries from the DC112d/DC112 in order to prevent damage caused by battery leakage.

We recommend that you always carry new replacement batteries

2.1.3 Connection and disconnection of the microphone

Before connecting or disconnecting the P007 microphone of the DC112d/DC112 dosimeter, make sure the DC112d/DC112 is switched off.

To connect the microphone to the dosimeter, hold the male plug of the microphone [4] in the middle. Insert it into the female socket [5] of the dosimeter, and press until it clicks.

To disconnect the microphone, hold the male plug of the microphone in the middle [4]. Pull upwards on the plug until disconnects.

IMPORTANT: Do not pull on the end of the plug by the cable, as it will not disconnect. Similarly, do not try to disconnect it by twisting the plug. In both cases the device could be damaged.

2.1.4 Fixing the DC112d/DC112 on the user (worker)

The DC112d/DC112 has a support clip [13] to fix it to the user's belt (see figure) and an adjustable metal clip [2] to attach the microphone to their collar or helmet.

Any excess wire should be wound in a figure 8.
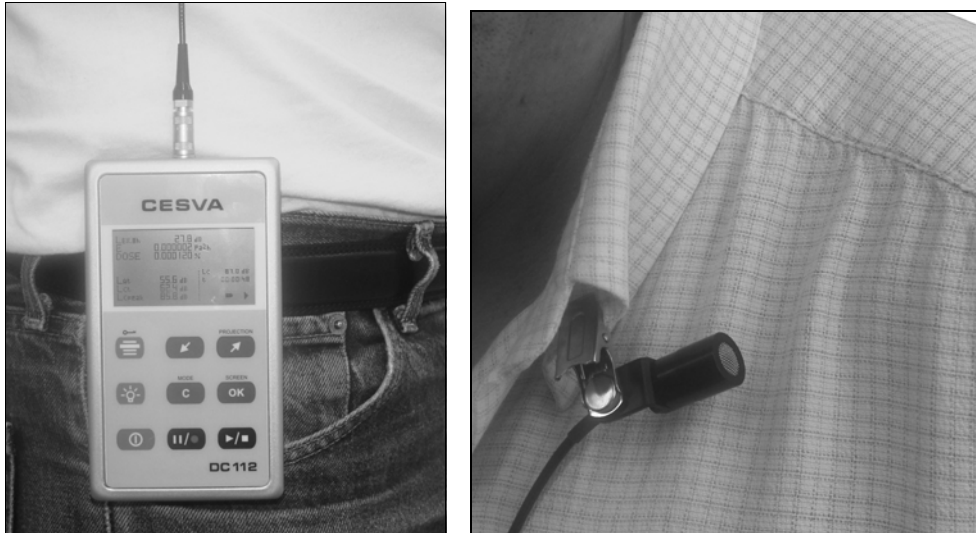
2.2 Beginning a measurement

2.2.1 Switching on the DC112d/DC112

To switch on the DC112d/DC112 press: ⏻

A screen will appear, showing the **CESVA** logo, along with the DC112d/DC112 model. After a few seconds the numerical screen of the DC112d/DC112 will appear (see 2.2.2).

If the DC112d/DC112 fails to come on, check that it is correctly connected to a power source.

2.2.2 Display screen selection

Once the dosimeter has been switched on it shows the numerical screen.

To change from one measurement screen to another, simply press [OK] (SCREEN) and the new screen will appear.

The following are the screens of the DC112d/DC112:

- NUMERICAL SCREEN
- NUMERICAL SCREEN PROJECTED PARAMETERS
- 1/1 SPECTRUM ANALYSER SCREEN (Only DC112)
- TIME HISTORY SCREEN

Numerical screen

Numerical screen projected parameters

1/1 Spectrum analyser screen (only DC112)

Time history screen

2.2.3 Testing the DC112d/DC112

We recommend that you test the DC112d/DC112 before beginning a measurement, adjust the sensitivity (if necessary), and test it again after the measurement has finished.
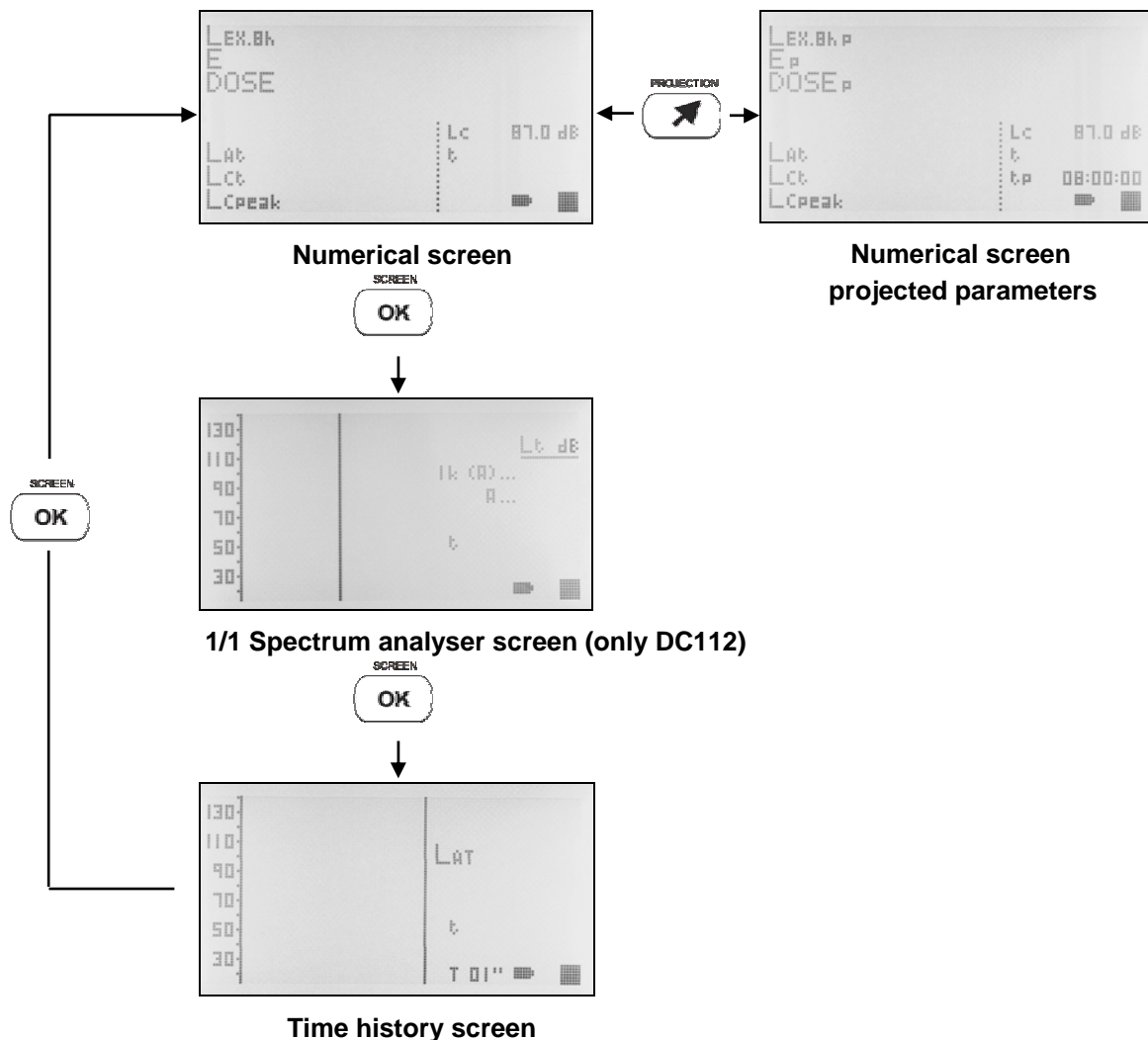
To test the DC112d/DC112 use the **CESVA** CB-5 sound calibrator and proceed as follows:

1) Insert the microphone of the DC112d/DC112 in the cavity of the calibrator. Make sure it has been fully inserted, and is parallel to the axis of the calibrator (see figure). This may require a little force, as the microphone must fit into the calibrator perfectly. Do not insert the DC112d/DC112 microphone roughly, as it may be damaged.

2) Switch on the calibrator and check the battery status. The indicator must be lit at all times during the calibration process. The calibrator generates a tone of 94 dB at 1 kHz.

3) Apply the pressure to free field corrections to the microphone at 1 kHz and the corresponding ones to the influence of atmospheric pressure, temperature and humidity in the calibrator. The free field pressure correction of the **CESVA P007** microphone is 0.1 dB. That means the DC112d/DC112 should indicate a level of 93.9 dB.

4) Switch the DC112d/DC112 to the numerical screen (2.2.2), by pressing: $\boxed{\text{OK}}$ SCREEN

5) Start the measurement: $\boxed{\blacktriangleright/\blacksquare}$

6) Check that the value of the L_{At} function coincides with the value of 94.0 dB with the corresponding corrections (93.9 dB).

Should the value of the reading differ by more than ±0.3 dB from the calculated value, the sensitivity of the dosimeter will need to be adjusted. If not, the dosimeter is measuring correctly, and the sensitivity does not need adjusting.

If the testing procedure is not satisfactory contact an official **CESVA** service, before adjusting it

To adjust the sensitivity, proceed as follows.

1) Press $\boxed{\blacktriangleright/\blacksquare}$ to end the measurement process.

2) Do not switch off the CB-5 calibrator, and keep it in the calibration position.

3) Next press $\boxed{\equiv}$ to access the menu of the **DC112d/DC112**.

4) Access the option SETTINGS ➔ SENSITIVITY ADJUST.

5) The sound pressure level measured by the **DC112d/DC112** will appear on the screen, along with the time and date of the last time the sensitivity was modified.

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```
_SENSITIVITY ADJUST. _

L AF          99.9 dB

2005-03-15   17:15:39
```
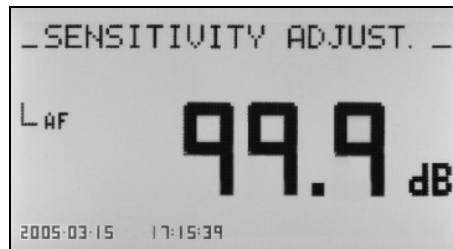
6) Use the [◤] and [◢] keys to adjust the value calculated (94 dB + corrections)

7) Confirm with the [OK] key (the sensitivity will be modified, and the time and date will be updated). If you do not want update the sensitivity then press [C] to return to the DC112d/DC112 menu.

```
_SENSITIVITY ADJUST. _

L AF          93.9 dB

2007-03-15   17:35:39
```
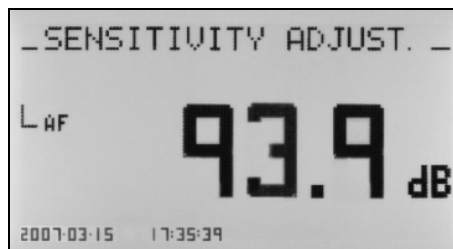
RECOMMENDATIONS:

The CB-5 calibrator has two sound levels. We recommend that you use the 94 dB level to test the DC112d/DC112, using the 104 dB level to test its linearity.

When the test is finished, switch off the calibrator.

2.3 Measuring with the DC112d/DC112

The DC112d/DC112 measures the following parameters for the evaluation of noise at work: equivalent daily exposure level ($L_{EX,8\ h}$), sound exposure (E) and noise dose (DOSE). In addition the DC112d/DC112 facilitates the projection of these parameters to the expected exposure time (t_p) for measurements shorter than the exposure time. It also measures the equivalent continuous sound pressure level with A and C frequency weightings (L_{At} y L_{Ct}) and the peak level with C weighting (L_{Cpeak}).

Only the DC112 carries out a frequency analysis, measuring, in real time, the equivalent continuous sound pressure levels for the octave bands between 63 Hz and 8 kHz with A frequency weighting.

The time history analysis shows the evolution of the equivalent continuous sound pressure level with and without A frequency weighting for the programmable continuous integration time (T).

2.3.1 Prior adjustments

Before beginning a measurement, the following parameters should be set:

- Criterion level (L_C), constant exposure to this level for eight hours would result in a 100 % noise DOSE
- Projection time (t_p), predicted noise exposure time
- Integration time (T). Integration time for the measurement of equivalent continuous sound pressure level. The DC112d/DC112 saves the time history for the parameters (L_{Cpeak}, L_{AT}, L_{CT}, and L_{Toct}).
- The frequency weighting applied to the spectrum measured.

To set these parameters select the SETTINGS ➔ MEASURING ➔ DOSIMETER option from the DC112d/DC112 menu.

```
_____ MEASURING _____
 Lc:            87.0 dB
 tP :     07:30:00
 T:              01 '
```
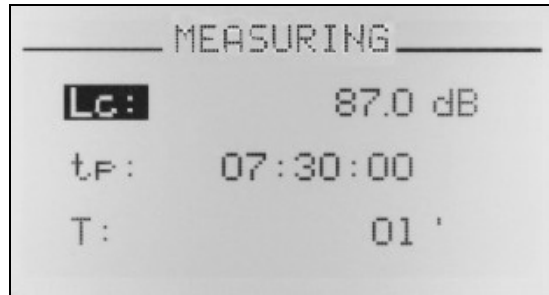
When the previous screen appears, select the parameter you want to configure L_C, t_p or T using the [◣] and [◥] keys, then press [OK]. Use the [C] key to cancel.

To modify the L_c parameter, proceed as follows:

- Select the numerical value using [◣] and [◥] keys and press [OK].

To modify the t_p parameter, proceed as follows:

- Set the hours value using [◣] and [◥] and press [OK] to confirm, repeat this process to set the minutes value. The projection time t_p is set from (HH:mm:00):
    - o   0 to 99 for HH (Hours)
    - o   0 to 59 for mm (minutes)

The minimum projection time is 1 minute.

To modify the T parameter, proceed as follows:

- Select the numerical value using [◣] and [◥] and confirm by pressing [OK]. T integration time may be set from
    - o   1 to 59 seconds (1'' – 59 '')
    - o   1 to 59 minutes (1' – 59')
    - o   1 to 99 hours (1H – 99 H)

- Finally select the time units: seconds ("), minutes (') or hours (H) with the help of [◣] and [◥] and press [OK] to confirm. Use [C] to cancel or return to the menu.

To set the frequency weighting applied to the spectrum access the menu of the DC112 and select SETTINGS ➔ MEASURING ➔ SPECTRUM ANALYSER

```
___ SPECTRUM ANALYSER ___
A FREQ. WEIGHTING:
            NO
            YES
```
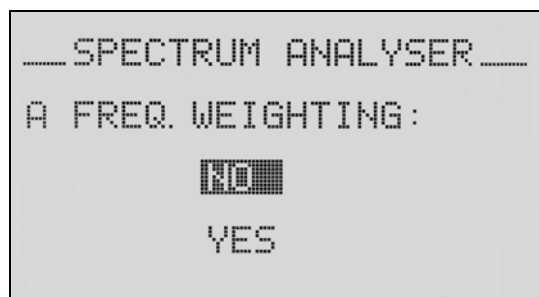
When the above screen appears, select YES or NO using the [◣] and [◥] keys, depending on whether you wish to apply A frequency weighting or not, and press [OK].

2.3.2 Beginning a measurement

First of all, ensure that the sound level meter has no measuring process in progress (■). If it has (▶ or ❚❚), press ▶/■ to stop it.

Next, set the DC112d/DC112 to dosimeter mode and choose the screen you want to display (numerical, numerical with projected values, spectrum analyser or time history), with the SCREEN OK key.

Once you have selected your screen, press ▶/■ to start the measurement process.

2.3.3 Function display

The DC112d/DC112 measures all functions simultaneously.

Described below are the different ways of displaying the acoustic functions for the assessment of noise in the workplace while measurement is taking place. If you change the kind of display (screen) or the octave band selected (spectrum analyser screen), measurement will continue uninterrupted.

Numerical screen

This screen shows, in real time, the following information:
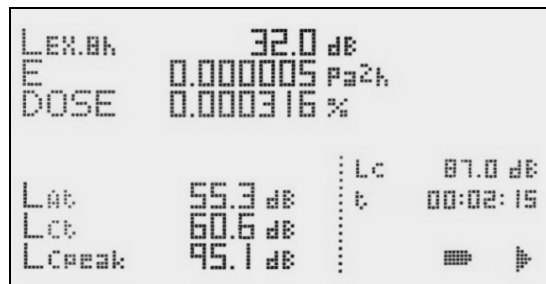
- Daily noise exposure level ($L_{EX,8h}$) with frequency weighting A.
- Sound Exposure (E).
- Noise dose (DOSE).
- Equivalent continuous sound pressure level with A and C frequency weightings corresponding to the measurement time (L_{At} and L_{Ct}).
- Peak sound pressure level with C frequency weighting corresponding to the measurement time (L_{Cpeak}).
- Criterion level (L_C)
- Measurement time (t).

By pressing ↗ the projected parameters are displayed.

The projected parameters determine the sound exposure if the level measured remains constant during the projection time.

The projected parameters allow the evaluation of the sound exposure for measurement times shorter than the set projection time t_p.
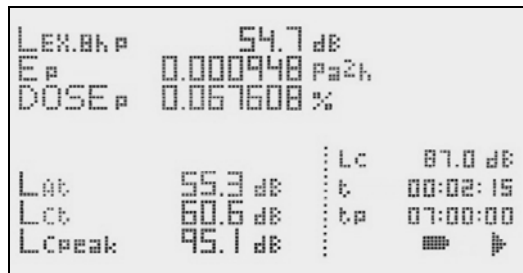
- Projected daily noise exposure level ($L_{EX,8h\,p}$) with frequency weighting A.
- Projected sound exposure (E_p)
- Projected noise dose ($DOSE_p$)
- Measurement time (t) and projected time (t_p)

To return to the previous screen, press [↗].

When a register recovered from the memory is displayed on the screen, the sound level meter uses the L_C criterion level and the t_p projection time set. This feature allows evaluations for a register according to the criterion level L_C and the projection time t_p set on the sound level meter.

1/1 Spectrum analyser screen (only DC112)

This screen shows, in real time, the following information:
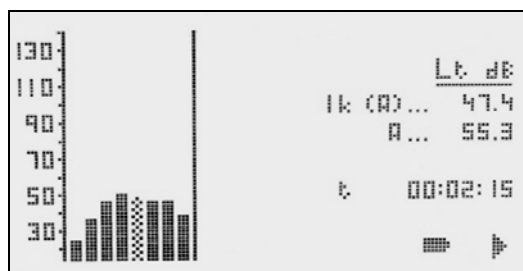
- Graph of the equivalent continuous sound pressure level with the integration time corresponding to the measurement time (█ bars) in real time for the octave bands centred on frequencies 63, 125, 250, 500, 1000, 2000, 4000 and 8000 Hz (with A frequency weighting).
- Numerical value of the equivalent continuous sound pressure level with the integration time equal to the measurement time for the selected octave band (▒ bar) (with A frequency weighting).
- Central frequency of the selected octave band (▒ bar)
- Overall equivalent continuous sound pressure level with the integration time corresponding to the measurement time and with A frequency weighting.
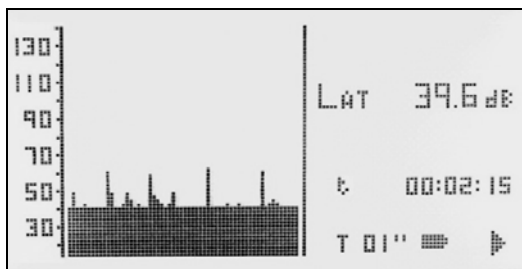- Measurement time (t)

Time history screen

This screen shows, in real time, the following information:

- Time history (60 values) of the equivalent continuous sound pressure level with integration time (T) and A frequency weighting.
- Numerical value of the equivalent continuous sound pressure level with integration time (T) and A frequency weighting.
- Measurement time (t) and integration time elapsed.

2.3.4 Blocking the keypad

While a measurement or recording is in progress, the keypad of the DC112d/DC112 can be blocked; this way accidental interventions in the process can be avoided.

To block the keypad, press . The message KEYPAD BLOCKED will appear on the screen.

Next, the information of the functions measured will disappear from the screen, leaving just:

- The measurement time (t) elapsed
- The battery status indicator
- The measurement status indicator
- The symbol in the top right-hand corner of the screen, indicating that the keypad is blocked
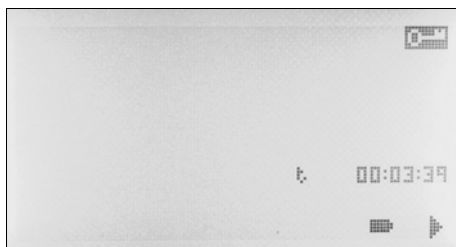
While the keypad is blocked, the values of the functions measured do not appear on the screen, to avoid the deliberate generation of noise to distort the measurement.

To unblock the keypad, press followed by OK.

2.3.5 Interrupting the measurement

By pressing you temporarily interrupt the measurement. The measurement status indicator will change from ▶ to ❚❚.

While a measurement is paused (❚❚) you may continue to consult the functions measured prior to the temporary interruption of measurement.

While a measurement is paused (❚❚) the device can be switched off. To do this press . When it is switched on again, the measurement will remain on pause (❚❚) and can be resumed. To resume measurement, press .

This characteristic of the DC112d/DC112 allows measurements to be carried out for workers with split shifts or special shifts (eg. weekends). It also enables the battery to be changed without the need to make two measurements.

2.3.6 Ending a measurement

By pressing ►/■ you end the measurement or recording. The measurement status indicator will change from ► to ■.

2.3.7 Consulting measured data

While the DC112d/DC112 is not measuring (■), you may consult all the functions measured.

To consult them, apply the same procedure as described in section 0 on viewing data while measurement is in progress.

2.4 Overload indicator

The DC112d/DC112 is equipped with an overload indicator for each function. If overloading occurs during a measurement, the **^** symbol will appear before the function affected by overloading. When a function registers overload its corresponding measurement may be incorrect.

During the overload the ⌂ indicator appears in the bottom right-hand corner of the screen.

2.5 Menu of the DC112d/DC112: Register management and settings

This section details the options that are accessible from the DC112d/DC112 menu, among them; memory management, setting the measurement parameters, setting the language, the time and date and, only in the DC112 selection of frequency weighting for the spectrum analyser.

The DC112d/DC112 comes with an initial configuration which makes it possible to carry out measurements without having to reset it in advance.
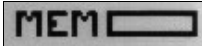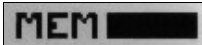
2.5.1 Menu access

To access the DC112d/DC112 menu, make sure that no measurement is in progress (■) and press ☰.

The following screen will appear:
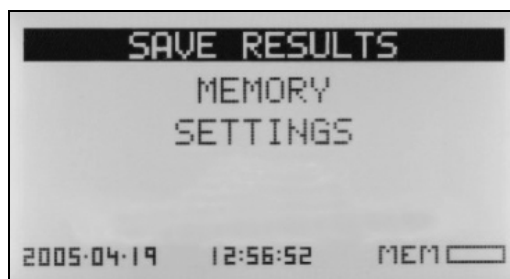
This menu shows the main settings screen along with the time and date of the DC112d/DC112's clock. The memory status is also shown, indicating the available memory remaining.

- Memory empty ➔

- Memory full ➔

2.5.2 Menu of the DC112d/DC112

The memory of the DC112d/DC112 has the following structure

(only DC112)
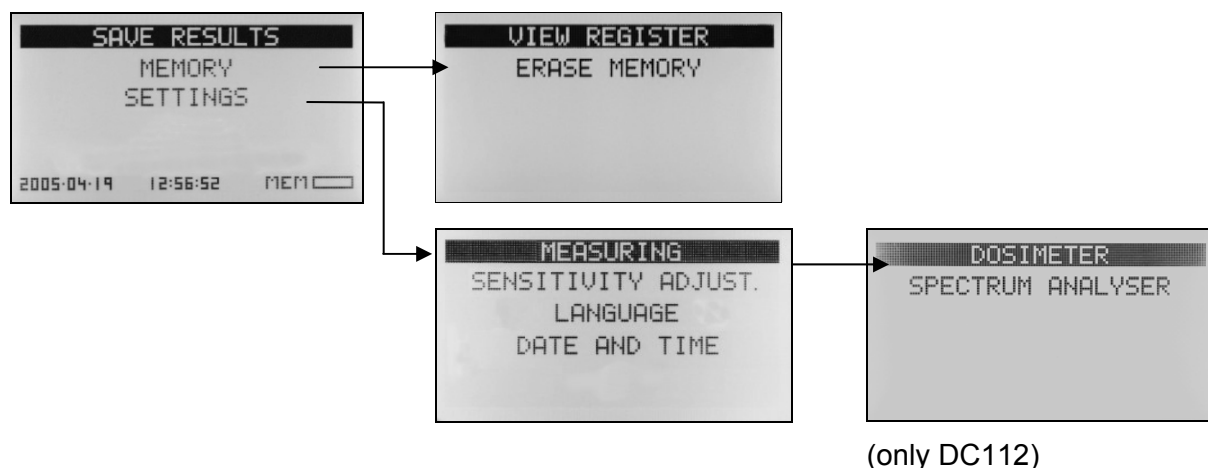
To move through the settings menu use the keys described in section 1.6.

2.5.3 Register management

- SAVING RESULTS:

  When this option is selected the DC112d/DC112 records in its memory the final results of all the functions measured. The DC112d/DC112 indicates the number of the register in which the registers have been recorded. For more information see section 3.4.

- MEMORY:

  This option facilitates the management of the DC112d/DC112 memory.

  - MEMORY ➔ VIEW REGISTER
    Shows the registers recorded in the dosimeter. For more information see section 3.3.

  - MEMORY ➔ ERASE MEMORY

  This option erases the memory of the DC112d/DC112 completely. All the registers stored in the memory (results and recordings) will be deleted. For more information see section 3.4.

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2.5.4 Settings

- SETTINGS:

   This option enables you to set a number of features of the DC112d/DC112, eg. Time/date adjustments, language or sensitivity of the DC112d/DC112.

  - SETTINGS ➔ MEASURING
    With this option the acoustic parameters for the evaluation of noise at work: level of criterion L_C, projection time t_p and integration time T are defined (see 2.3.1).

  - SETTINGS ➔ MEASURING (only DC112)

    - DOSIMETER.
    With this option the acoustic parameters for the evaluation of noise at work are defined; criterion level L_C, projection time t_p and integration time T (see 2.3.1).

    - SPECTRUM ANALYSER.

    Allows to select the frequency weighting (A or without) which will be used for the spectrum analyser(see 2.3.1).

  - SETTINGS ➔ SENSITIVITY ADJUST:
    This option enables you to adjust the sensitivity of the DC112d/DC112. For more information see section 2.2.3 Testing the DC112d/DC112.

  - SETTINGS ➔ LANGUAGE
    Allows the language to be selected in which all the messages and menus of the DC112d/DC112 are displayed. Select the language with (◤) and (◥).

  - SETTINGS ➔ TIME AND DATE
    This option allows the time and date of the DC112d/DC112 to be adjusted.

```
        MEASURING
     SENSITIVITY ADJUST.
         LANGUAGE
       DATE AND TIME
```
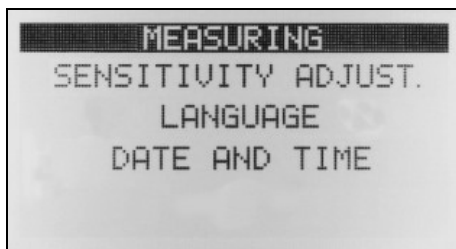
2.6 Switching the DC112d/DC112 off

To switch off the DC112d/DC112, check that no measurement is in progress (■) and press: (⏻).

3. REGISTERING DATA

The DC112d/DC112 can record in the internal memory the values of the functions measured. When the equipment is switched off the recorded data is not lost and can be retrieved and displayed directly from the DC112d/DC112 or transmitted to a PC. The memory can be erased directly from the DC112d/DC112.

Two kinds of registers may be saved in the memory:

- The final results of a measurement.
- Continuous recordings of functions with programmable integration time.

3.1 Saving final results

Once you have completed a measurement (■), the results may be stored in the memory by selecting the SAVE RESULTS option from the main menu. The DC112d/DC112 will indicate the register number in which to save the data.

The DC112d/DC112 stores the following information.

- Equivalent continuous sound pressure level with A frequency weighting corresponding to the measurement time (t) (L_{At}).
- Equivalent continuous sound pressure level with C frequency weighting corresponding to the measurement time (t) (L_{Ct}).
- Equivalent continuous sound pressure level with the integration time corresponding to the measurement time (t), with or without A frequency weighting for each one of the octave bands centred on frequencies 63, 125, 250, 500, 1000, 2000, 4000 and 8000 Hz. (Only DC112).
- Overall peak sound pressure level with C frequency weighting corresponding to the measurement time t (L_{Cpeak}).
- Equivalent daily noise exposure level ($L_{EX,8h}$).
- Equivalent continuous sound pressure level with A frequency weighting corresponding to the last integration interval (T) (L_{AT}).
- Equivalent continuous sound pressure level with C frequency weighting corresponding to the last integration interval (T) (L_{CT}).
- Equivalent continuous sound pressure level corresponding to the last integration interval (T), with or without A frequency weighting for each one of the octave bands centred on frequencies 63, 125, 250, 500, 1000, 2000, 4000 and 8000 Hz.(Only DC112)
- Peak sound pressure level of the integration interval (T) with C frequency weighting.
- Measurement time (t), integration time (T) and the integration time elapsed.
- Date and time of the beginning of the measurement.

DOSE, $DOSE_p$, $L_{EX,8h\ p}$, E and E_p functions are not saved. Every time a register is displayed with the MEMORY➔ SEE REGISTER option, these functions are calculated according to the L_C and t_p values.

3.2 Making a recording

A recording consists of making a measurement and storing the parameters measured by the DC112d/DC112 in the memory.

Before beginning a recording, make sure there is no measurement in progress (■).

To begin a recording, press ⏸/⏺ . The screen will display the register number. The functions selected for the type of recording will be saved periodically in the memory until you

stop the recording by pressing ▶/■ .

During the recording process the recording icon (●) will appear on the screen.

The DC112d/DC112 saves the following values once each integration period (T) has finished:

- Equivalent continuous sound pressure level with A frequency weighting (L_{AT}).
- Equivalent continuous sound pressure level with C frequency weighting (L_{CT}).
- Equivalent sound pressure level corresponding to the last T integration interval, with or without frequency weighting (A) for each one of the octave bands centred on frequencies 63, 125, 250, 500, 1000, 2000, 4000 and 8000 Hz. (Only DC112)
- Peak sound pressure level of the T integration interval with C frequency weighting ($L_{Cpeak, T}$).

When the measurement ends, the final results are saved:

- Equivalent continuous sound pressure level with A frequency weighting corresponding to the measurement time (L_{At}).
- Equivalent continuous sound pressure level with C frequency weighting corresponding to the measurement time (L_{Ct}).
- Equivalent continuous sound pressure level with the integration time corresponding to the measurement time, with or without A frequency weighting for each one of the octave bands centred on frequencies 63, 125, 250, 500, 1000, 2000, 4000 and 8000 Hz. (Only DC112).
- Overall peak sound pressure level with C frequency weighting corresponding to the measurement time (L_{Cpeak}).
- Equivalent daily noise exposure level ($L_{EX,8h\,p}$).

  Equivalent continuous sound pressure level with A frequency weighting corresponding to the last integration interval (T) (L_{AT}).
- Equivalent continuous sound pressure level with C frequency weighting corresponding to the last integration interval (T) (L_{CT}).
- Equivalent continuous sound pressure level corresponding to the last integration interval (T), with or without A frequency weighting for each one of the octave bands centred on frequencies 63, 125, 250, 500, 1000, 2000, 4000 and 8000 Hz. (Only DC112)
- Peak sound pressure level of the integration interval with C frequency weighting (L_{Cpeak}).
- Measurement time (t), integration time (T) and the integration time elapsed.
- Date and time of the beginning of the measurement.

DOSE, $DOSE_p$, $L_{EX,8h\,p}$, E and E_p functions are not saved. Every time a register is displayed via the MEMORY ➔ SEE REGISTER option, these functions are calculated according to the L_C and t_p.

The storage capacity according to the programmable integration time is shown in the following table.

Storage capacity	
T= 1 s	1 month 3 days
T= 10 s	11 months 7 days

The storage times for each type of recording correspond to one single recording, until the memory is completely full.

When the built-in memory is full, no more recordings can be made and no more final results saved. If you attempt to do this, the 'MEMORY FULL' message will appear on screen.

If the battery of the DC112d/DC112 runs out during a recording, the DC112d/DC112 will interrupt the recording (PAUSE), show the message "BATTERY FLAT" on the screen and switch off. To continue the measurement, see section 3.2.1.

If the power source of the DC112d/DC112 is cut off suddenly during a recording, (removal of the battery, or the USB connection), the recording will be incomplete. It will not be able to be

viewed with the DC112d/DC112; the message "RECORDING INCOMPLETE" will appear on screen when this is attempted. However it will be possible to download it to a computer using Capture Studio. Following these measurements, more registers can be recorded as long as the capacity allows.

3.2.1 Continuing a recording after the DC112d/DC112 has been switched off

The DC112d/DC112 allows for a recording that has been interrupted (pause ▐▐) to be continued after switching off the dosimeter. To do this, proceed as follows:

- Interrupt the recording in progress by pressing ▐▐/●.
- The recording will stop and the recording status indicator will change from ● to ▐▐.
- Switch off the DC112d/DC112 by pressing ⏻.

When you wish to restart the measurement

- Switch on the DC112d/DC112 by pressing ⏻.
- The measurement will appear on pause (▐▐).
- Press ►/■ to continue the measurement. The DC112d/DC112 will continue saving the values measured in the same register.

3.3 Viewing the register

This option allows you to display on screen the final result of the registers stored in the DC112d/DC112 memory. Access the option by selecting MEMORY ➔ VIEW REGISTER from the DC112d/DC112 menu.

By pressing ↙, ↗ and OK, the DC112d/DC112 allows you to select the register you want to view. The screen will display an index of all the registers stored in the memory (register number + date and time when the measurement process began).

To view the different functions, follow the procedure described in section 2.3.3.

3.4 Erasing the memory

This option enables you to wipe the memory completely. The DC112d/DC112 asks for confirmation before erasing. MEMORY ➔ ERASE MEMORY.

4. DATA TRANSFER

The DC112d/DC112 has the following data outputs (see figure).

- <u>USB communications port</u>: bidirectional digital USB 1.1 full speed port for communication with a personal computer

The USB communication port allows real time transmission of the functions measured and those saved in the memory of a computer with a high transfer speed

4.1 Transfer of data to a PC: Communication software

The communication software supplied with the DC112d/DC112 (**CESVA** Capture Studio), allows the following operations to be carried out:

- Real time transmission of the data measured by the DC112d/DC112 to a computer.
- Downloading the registers saved by the DC112d/DC112.
- Register management (erasing, etc.).
- Programming the dosimeter (time, parameters, etc.).

To carry out these functions the DC112d/DC112 must be connected to the USB port of a computer with the cable supplied.

For more information about **CESVA** Capture Studio, use the help that it incorporates.

5. PRECAUTIONS AND WARNINGS

- Keep the microphone away from dust and sharp objects.

- Avoid excessive humidity and sudden changes of temperature which may produce condensation on the microphone.

- The microphone must never be dismantled, as this may cause permanent damage.

- Any knocks on the DC112d/DC112 will be picked up by the microphone, and this may affect the value of the measurement.

- We recommend that you test the DC112d/DC112 before and after every measurement, using the sound calibrator. See section 2.2.3. If the testing procedure is not satisfactory contact an official CESVA service, before adjusting it.

- Remove the batteries if the DC112d/DC112 will not be used for an extended period of time.

- The CESVA DC112d/DC112 dosimeter is designed to be very reliable for a long time. If any malfunction cannot be resolved by changing the battery or consulting the manual, send the DC112d/DC112 to an official CESVA service. Under no circumstances allow it to be repaired by unauthorised personnel.

- The DC112d/DC112 has an internal clock powered by a 3 V CR2032 type lithium button battery which enables it to save the time and programme. This lithium battery has an average lifespan of 10 years. When it runs out, the internal calendar/clock returns to 00:00 on the 01/01/2000. Go to the menu of the DC112d/DC112 to consult the calendar. The battery must be replaced immediately: Remove it from the slot which is accessed from the battery compartment (see photo) and replace it with a new one, or contact your official CESVA technical service.
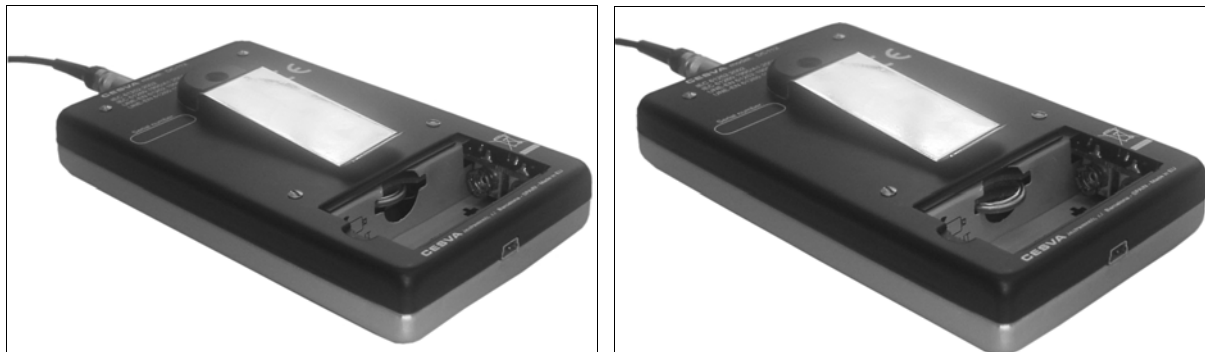
This equipment can only be used with the accessories specified in the Accessories section. If any unauthorised accessories are used, and this results in a failure of the equipment, CESVA will not accept responsibility for this failure, and the equipment will be out of warranty.

6. TECHNICAL SPECIFICATIONS

6.1 Measurement range

Measurement range			
Function	**Lower limit**	**Upper limit**	**Units**
t	0000:00:00	1999:59:59	HHHH:MM:SS
E	0	9999999	Pa^2h
L_{At}	50	140	dB
L_{Ct}	60	140	dB
L_{Cpeak}	70	143	dB
DOSE	0	9999999	%
$L_{EX,8h}$	0	999,9	dB

Total Maximum Noise at 20 ⁰C	
Frequency Weighting	**Total Maximum Noise**
A	43 dB
C	53 dB

Margin of frequencies maintained when the frequency response extends to frequencies below 63 Hz or above 8 kHz	31,5 Hz a 12,5 Khz

6.2 Peak detector - L_{peak} function

Onset time constant:	< 75 μs

6.3 Frequency weighting

Frequency weightings available	
Function	**Weighting**
L_{peak}	C
L_T	A and C
L_t	A and C

The following table shows the A and C frequency weightings along with their tolerance.

Frequency (Hz)	A Weighting (dB)	C Weighting (dB)	Tolerance (dB)
63	- 26,2	- 0,8	± 2,0
125	- 16,1	- 0,2	± 1,5
250	- 8,6	- 0,0	± 1,5
500	- 3,2	- 0,0	± 1,5
1,000	0	0	± 1,5
2,000	+ 1,2	- 0,2	± 2,0
4,000	+ 1,0	- 0,8	± 3,0
8,000	- 1,1	- 3,0	± 5,0

6.4 Sound pressure level range according to frequency

Typical values for A weighting frequency		
Frequency (Hz)	Maximum level (dB)	Minimum level (dB)
63	113,8	50
125	123,9	50
250	131,4	50
500	136,8	50
1,000	140,0	50
2,000	140,0	50
4,000	140,0	50
8,000	138,9	50

Typical values for C weighting frequency		
Frequency (Hz)	Maximum level (dB)	Minimum level (dB)
63	139,2	60
125	139,8	60
250	140,0	60
500	140,0	60
1,000	140,0	60
2,000	139,8	60
4,000	139,2	60
8,000	137,0	60

6.5 Octave band filters

Frequency evaluation system	Base 10
Reference attenuation	0 dB
Margin of frequencies for real time operation	31,5 Hz a 16 kHz

Octave band central frequencies	
Nominal central frequency	**Exact central frequency**
63 Hz	63,096 Hz
125 Hz	125,89 Hz
250 Hz	251,19 Hz
500 Hz	501,19 Hz
1 kHz	1.000 Hz
2 kHz	1.995,3 Hz
4 kHz	2.511,9 Hz
8 kHz	7.943,3 Hz

6.6 Microphone

CESVA P007			
Prepolarised ½" condenser microphone with preamplifier incorporated			
Nominal sensitivity (typical)	11,2 mV/Pa		
Length of cable	1 m		
Constant pressure to free field correction			
Frequency (Hz)	**Correction (dB)**	**Frequency (Hz)**	**Correction (dB)**
63	0.5	1.000	0.1
125	0.0	2.000	0.4
250	0.1	4.000	1.3
500	0.0	8.000	4.1
Typical frequency response			
Frequency (Hz)	**Relative response (dB)**	**Frequency (Hz)**	**Relative response (dB)**
63	1.3	1.000	0.0
125	0.5	2.000	0.0
250	0.3	4.000	0.4
500	0.1	8.000	0.4

6.7 Reference conditions

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Type of sound field:	Free
Reference direction	Perpendicular to the microphone diaphragm
Reference frequency:	1 kHz
Reference sound pressure level:	94 dB (ref a 20 μPa)
Reference integration time:	1 hour
Reference sound exposure:	1,0 Pa^{2}h

6.8 Electrical signal insertion

Can be carried out with a Coaxial LEMO [5] connector situated at the top of the DC112d/DC112. The ADM0P007 adapter must be used.
The devices connected must have an electrical impedance of less than 100 Ω.

6.9 Single pole pulse response

Typical E deviation with positive and negative pulses	0 %

6.10 Warm-up time

Warm-up time	30 seconds

6.11 Influence of temperature

Operation range	0 a +40 °C
Storage without batteries	-20 a +60 °C

6.12 Influence of humidity

Operation range:	30 to 90 %
Storage without batteries:	< 93 %

6.13 Influence of atmospheric pressure

Operation range:	91,2 a 111,4 kPa

6.14 Electromagnetic compatibility

Configuration for the normal operation mode.	Numerical screen in dosimeter mode, and with Lc = 87dB
Influence of Magnetic Fields	In a magnetic field of 80 A/m (1 oersted) at 50 Hz, the reading will be under 52 dB(A). With the instrument positioned perpendicular to the magnetic field propagation direction and the microphone cable extended around the instrument. In addition the USB communication cable without connector will be connected.
L_{At} Sound pressure level at which the DC112d/DC112 meets the requirements of a radiated electromagnetic field.	74 dB
Set of accessories tested in the verification of the electromagnetic compatibility requirements.	P007 Microphone and USB connection cable (CN1US)
Configuration for the reference orientation.	DC112d/DC112 perpendicular to the ground, and the microphone following the main axis of the dosimeter, with 50cm of cable extended, and any excess cable wound in a figure 8.
No emission difference is observed from the normal operation mode with the equipment in a vertical position, with the microphone cable fully extended perpendicular to the main axis of the DC112d/DC112 with all cables connected and with the USB feeder	
The equipment shows no degradation or loss of function after being exposed to electrostatic discharges.	
The DC112d/DC112 shows a slight variation with respect to the electric field with the instrument perpendicular to the propagation direction and the cables extended perpendicular to the main axis of the instrument	
The application of sinusoidal vibrations of 1 m/s^2 between 20 Hz and 1000 Hz does not limit the operation of the instrument.	

6.15 Batteries and external supply

Battery	
One 6LF22 type 9 volt battery	
Typical battery life with continuous use: *The typical battery life with the display lit may be reduced by up to 50% with respect to the previous value*	20 hours

External Supply
By USB port

6.16 Dimensions and weight

Dimensions:	144 x 82 x 23 mm	
Weight:	With battery	361 g
	Without battery	320 g

6.17 Calibration

Use the **CB-5** calibrator and consult section 2.2.3.

6.18 Standards

Standards
UNE-EN 61252:1998/A1:2003; UNE-EN 61260:1997/A1:2002
EN 61252:1995/A1:2001; EN 61260:1995/A1:2001
IEC 61252:2002 ; IEC 61260:1995/A1:2001
DIRECTIVE 2003/10/CE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 6 February 2003 on the minimum requirements for the health and safety related to the exposure of workers to risks derived from physical agents (noise)
$\mathsf{C}\mathsf{E}$ mark. Complies with 73/23/CEE and CEM 89/336/CEE low-tension regulations, the latter amended by 93/68/CEE.
CESVA *instruments.s.l.* as manufacturer of electric or electronic equipment gives notice that the product you have purchased was put on the market later than 13 August 2005 and complies with 2002/96/CE and 2003/108/CE directives on Waste from Electrical and Electronic Equipment (WEEE). In addition, the product is marked with the following symbol, which indicates that it is subject to separate collection.

6.19 Notes

Notes	34
Should your **DC112d/DC112** cease to comply with any of these specifications, contact your nearest official **CESVA** service technicians, who will gladly check, adjust and/or repair it for you.	
It is obligatory to send the **DC112d/DC112** to an authorised laboratory annually, to test its acoustic and electric characteristics are working correctly (periodic testing).	

6.20 Accessories

Standard accessories
FNS-011 Case
SFT030 Computer programme
CN1US Connection cable
9 volt battery
Optional accessories
CB-5 Calibrator
TR-40 Tripod: Max height 1,2 m
TR050 Tripod: Max height 1,5 m
ML-50 Carrying case (49x36x14 cm)
ML-10 Carrying case (38x30x8 cm)

7. Appendix A: Functions

7.1 Definition of functions

7.1.1 Continuous equivalent sound pressure level

L_T and L_t This is the linear average of the instantaneous sound pressure square from the beginning (t_1) to the end (t_2.) The duration of the measurement is therefore $T = t_2 - t_1$

$$L_{eqT} = 10 \cdot \log\left(\frac{1}{T} \int_{t_1}^{t_2} \frac{p^2(t)}{p_0^2} dt \right)$$

pt: instantaneous sound pressure

p_0: reference sound pressure (20 μPa)

T: duration of the averaging

The equivalent continuous sound pressure level function is ideal for measuring variable sound events such as compressors or sound events that due to their long duration cover a wide range of sound pressure levels, such as machinery measurements.

The DC112d/DC112 measures the equivalent continuous sound pressure level **L_t** and **L_T**.

The equivalent (**L_t**) level is the equivalent level of the interval measured, that is, for each instant it gives us the value of the equivalent level from the beginning of the measurement to that instant. When a measurement has been completed, the **L_t** value corresponds to the equivalent level of the entire measurement from beginning to end.

The equivalent level (**L_T**) is the equivalent level corresponding to T integration time (a programmable parameter). It is displayed every T time period. In other words, every T time period the DC112d/DC112 shows the equivalent level of the last T time period.

7.1.2 Peak sound pressure level

L_{peak} (Peak) The highest absolute instantaneous sound pressure value since the beginning of the measurement, in decibels.

7.1.3 Equivalent daily exposure level

L $_{EX,8h}$ Equivalent daily noise exposure level normalized to 8 hours, with A frequency weighting

$$L_{EX,8h} = L_{At} + 10 \lg(t/T_0)$$

L_{At}: Equivalent continuous sound pressure level with A frequency weighting corresponding to the measurement time

t: Measurement time

T_0: Normalization time (8 Hours)

Sound exposure

E   Sound exposure, time integral of the instantaneous squared sound pressure with A frecuency weighting over a specified measurement time, expressed in $Pa^2 \cdot h$.

$$E = \left(\int_0^t p_A^2(t) \cdot dt \right)$$

$p_A t$:   Instantaneous sound pressure with A frequency weighting.

7.1.4 Dose

DOSE   Relationship between the energy of the measurement interval and the maximum energy allowed, with a criterion level L_c for 8 hours. Expressed as a percentage (%).

$$DOSE = 10^{\frac{(L_{EX,8h} - L_c)}{10}} \cdot 100$$

$L_{EX,8h}$: Daily noise exposure level.

L_C: Criterion level.

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