INSTRUCTION MANUAL

INSTRUMENT SOFTWARE VERSION 1.2

Nor131 is a versatile IEC Class 1 sound level meter. The combination of only one large measurement range with a lot of parameters measured in parallel makes the sound level meter easy to operate and facilitate reliable measurements. The optional real time octave analysis and stochastic level analysis further enhance the range of application. A detachable microphone with preamplifier is included. USB and a large internal memory makes it easy to download the results to a PC for report generation.

Nor132 is a IEC Class 2 instrument with similar features, except for a fixed microphone.

nor**131**
nor**132**

nor**131**
nor**132**

Nor131/Nor132 User Guide – March 2011 Edition

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Finding the information you need

Thank you for choosing Norsonic! The sound level meters Nor131 and Nor132 have been designed to give you many years of safe, reliable operation.

The *User Guide* has been divided into eleven chapters or sections. Each chapter provides different information. Depending on your requirements and your familiarity with sound measurements as such, you may find that you use some parts of this manual often and others not at all.

The very first chapter acquaints you with the Nor131/Nor132 and describes its features and possibilities. This may be a good starting point so that you know more about what to look for and what you maybe should learn more about.

The next section provides a closer look at the instrument with a presentation of all major parts and the keys of the keyboard.

Calibration is a vital point ensuring that your measurements are sufficiently correct for the purpose. Therefore, a separate chapter has been devoted to this.

How to measure with the sound level meter is described in the following chapters. The first measurement description outlines the use of the instrument as a simple sound level meter. The second description extends the description to also include frequency analysis.

Detailed information about the instrument is found in the chapter covering Technical specifications.

Note that the instruction manual describes a fully equipped instrument. Your version may not have all the optional extensions available. Extensions may, however, be installed as retrofit any time.

Our objective with this manual has been to address your goals and needs. Please let us know how well we succeeded!

Contents

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Introducing the sound level meters Nor131 and Nor132

The sound level meter Nor131 and Nor132 comes in different versions dependent on the number of optional functions installed. Even in the basic version the instrument is able to measure an extensive number of functions characterizing the measured sound. This include:

- SPL The Instantaneous Sound Pressure Level
- L_{MAX} The Maximum Sound Pressure Level
- L_{MIN} The Minimum Sound Pressure Level
- L_{eq} The Integrated Equivalent SPL
- L_E The Sound Exposure Level
- L_{PEAK} The Maximum Peak Level

The time-weighting can be F, S or I. While the measurement is running the instantaneous SPL is available for inspection, but as soon as the measurement is terminated, the SPL becomes meaningless and therefore not listed in the result tables.

Two spectral weighting functions: A- and C- or A- and Z-weighting, are simultaneously available for all functions listed above including the L_{PEAK}.

The Z-weighting defined in the International Standard IEC 61672-1 replaces Lin or Flat as these have not been properly defined by any standard.

Time and date. The instrument contains a real time calendar and clock. For each measurement, the time and date for the measurement as well as the measurement duration, are stored with the results. The measurement duration may be set from 1 second to 100 hours.

No range setting. Only one level range with a dynamic range in excess of 120 dB makes the setup easy and ensures reliable measurements in all situations – specially useful for unattended measurements. With the normal microphone this means a measurement range covering levels from the self noise of the microphone (typically less than 20 dB A-weighted) to sound with peak values up to 140 dB.

Storing and retrieving of results. The results from a measurement may be stored – either automatically or manually – in the non-volatile memory of the instrument

together with information of instrument set-up. The information may later be displayed on the instrument screen or transferred to an external device like a PC.

Back-erase. The back-erase feature deletes the ten most recent seconds of acquired data prior to pressing the pause button. The measurement may be resumed after a second operation of the button.

Microphone included. Both instruments are delivered fully equipped with a microphone. Nor132 comes with a fixed microphone and Nor131 with a detachable microphone. This microphone has a preamplifier of the ICP®-type which allows an extension cable (not included) up to 5 m between the preamplifier and the instrument.

Battery operation. The instrument is normally powered from internal batteries which typically lasts for more than eight hours. For noise monitoring and other long time operation the instrument may be powered from an external DC-supply or mains adaptor Nor340.

Setting up is easy to do. After you've defined the duration of the measurement, all you need to do before you press the start key, is to define a few parameters like the time constant and whether to use Z- or C-weighting as the secondary spectral weighting function. The selection last used is automatically selected when you power the instrument, but you may also store and later retrieve a particular setup. During the measurement you have instant access to the analysis.

Excellent for noise monitoring. With the Nor131 and Nor132 you are able to do nearly all types of noise measurements – community noise, industrial hygiene, product control, noise mapping and more.

But, you don't need to attend the measurement sessions all the time. In fact, the instruments are able to do a lot on their own.

The measurement time can be preset to e.g. 30 minutes or an hour and the instrument put in a mode where it measures and stores the results, then starts measuring again, stores the results, starts measuring again and so on. Each measurement will be stored in a separate file, but all files are stored in the same directory, which has the name of today's date. In this way the instrument will measure the periods you need.

The instrument will spend a little time storing the data. Therefore, if you start the session with hourly measurements exactly on the hour, long "store and go" sessions will – after a while – experience a small, but significant time shift, so that each period no longer starts exactly on the hour. The synchro mode solve this problem (standard in all models). When selected, this mode stops the measurement slightly earlier to provide time for store and restart. By sacrificing a little at the end of a measurement the synchronisation with the time of day is retained, a feature important to many of our customers (E.g L_{DEN}).

Accessories. The Norsonic product range contains a wide range of equipment and accessories for use with acoustic measurements and noise monitoring. We supply enclosures for permanent monitoring installations, environmental cases for semi-permanent installations, microphones for applications in tough environments, cables, modems, weather stations and post-processing software. A detailed presentation of this is available in a separate leaflet and on the Norsonic home page: www.norsonic.com.

Real time frequency analysis

As an option, the instrument may be delivered with octave band, real time frequency analysis. The analysis is done for all filter bands in parallel and centre frequency span the range 8 Hz to 16 kHz in octave bands or 6.3 - 20 kHz in third-octaves.

The same functions as for the frequency weightings – except peak – are available for each octave band:

- SPL The Instantaneous Sound Pressure Level
- L_{MAX} The Maximum Sound Pressure Level
- L_{MIN} The Minimum Sound Pressure Level
- L_{eq} The Integrated Equivalent SPL
- L_E The Sound Exposure Level

The graphical level indications for all frequency bands measured are visible in one display with no need for horizontal scrolling.

Furthermore, the instrument measures the full frequency range – every time! Given the high dynamic range (120 dB), which eliminates the need for adjusting the gain, there is very little to set up before a frequency analysis can be made – successfully!

The measured functions are also available in tabulated form as numerical values. By pressing the tbl key during or after a measurement you have instant access to the numerical version. Another push on the key will restore the graphical display.

Level statistics

The optional extension ***level statistics*** adds statistical functions to the instruments. The F-time weighted level is sampled ten times per second and the statistical distribution of these samples are calculated for each frequency weighting and each octave-band, if available. The F-time weighting is used irrespective of which time weighting the instrument otherwise employs.

The class width is always 0.2 dB to ensure sufficient resolution and the results are presented in the form of eight percentiles. One of these percentiles is subject to user-definition and can be set to anything from 0.1% to 99.9%, both extremes included. You don't have to define the percentile prior to the measurement. You may redefine the percentile as many times as you like – even after the measurement – for every frequency band measured!

However, for results stored in the instrument's memory, only the selected percentiles will be available to keep the amount of stored data lower.

The fixed percentiles. The fixed percentile levels offered by the statistic option are 1.0%, 5.0%, 10.0%, 50%, 90%, 95% and 99%.

For the statistical sampling the instrument makes use of the F time weighting.

The options available.

- Opt. 0: LTax5 and LeqI measurements according to German Standards.
- Opt. 1: 1/1-octave real-time filters 8–16.000 Hz
- Opt. 2: Statistical calculation
- Opt. 3: Level vs Time measurements
- Opt. 4: 1/3-octave real-time filters

The principle of optional extensions

The capabilities and setup options of your sound level meter will depend on which of the available extensions it has been equipped with.

Extensions are modules – made as software, in the instrument or e.g. as software for your PC – available for your instrument. Norsonic extensions are always optional and hence often referred to as options. In this way you do not have to pay for features you're not going to use anyway.

However, you may find that your tasks are expanding into new areas of acoustics as time goes by. Therefore a typical Norsonic extension will be available for installation as retrofit.

Check which extensions are installed

Unless you are certain about the extensions installed in your sound level meter, we recommend that you spend a little time looking into the matter.

The extension menu. Press **SETUP** > **1** > **0**, although you won't find the 0 listed as an option in the Instrument setup menu.

The menu contains a unique Id code which identifies the very individual instrument. In addition, the menu contains three codes. These codes enable the extensions activated for this instrument. The codes take the Id number into account and are valid for this individual instrument only.

- To leave the menu without restarting, press exit and then **ENTER** twice.
- To leave the menu and let changes made take effects, press enter. Note that the instrument will restart as a consequence of this.

Note! The codes are unique for each instrument and will not work in other instruments. Do not change these codes as you will then loose the optional extensions installed and activated!

Taking a closer look at the instrument

You may have to assemble the instrument the first time you use it. Be sure to take utmost care when mounting the microphone cartridge onto the preamplifier.

Always keep the preamplifier disconnected whenever you are screwing the cartridge onto the preamplifier and screw only finger tight! We recommend that the microphone is always mounted on the preamplifier as this will prevent dust and dirt to enter the insulator around the sensitive signal terminal on the microphone.

The instrument is powered from four AA size batteries which are inserted as shown on the figure.

On the use of batteries

The sound level meter comes with four AA batteries (LR6, 1.5 V each). Battery lifetime is typically 8–12 hours (depends on measurement mode and brand of batteries). If you switch to lithium batteries the life time will increase to 15–20 hours. The use of alkaline or lithium batteries is strongly recommended to avoid leakage.

Rechargeable batteries may also be used, but with reduced operating time. Connecting an external DC-source (11–16V) to the instrument will not charge rechargeable batteries, but power the instrument in lieu of the internal batteries.

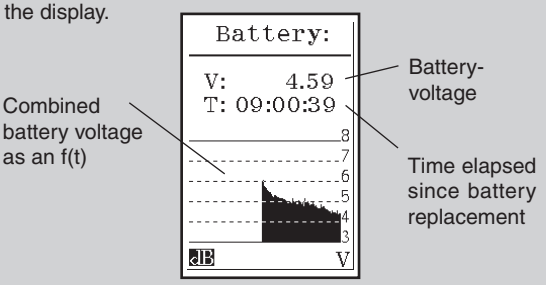
If the instrument is in regular use, always keep the batteries in the instrument. Even nearly flat batteries will contain sufficient power to supply the internal calendar/clock. During change of batteries the clock is powered by an internal capacitor. The capacitor will supply the clock for nearly an hour, but we recommend to install new batteries immediately after the old batteries were removed.

If the instrument is stored for a prolonged period of time, we recommend to remove the batteries to avoid damage from leaky batteries. However, you then need to adjust the calendar/clock before you start to use the instrument again. Note that the date is used as a part of the automatically generated file name when measurement results are stored in the instrument. Having set a wrong day may therefore lead to mixing old and new measurements.

Data are stored in a nonvolatile memory and will retain its content independent of the batteries.

Battery voltage

Battery voltage is presented graphically as f(t). Press the batt key to produce this display and press again to exit the display.



Switch on the instrument

Press the on/off button in the lower right corner of the instrument. A bargraph is displayed during initiation of the instrument. A second operation will switch the instrument off.

Battery Voltage vs. Time

The sound level meter offers a graphic presentation of the battery voltage-versus-time history.

To display the battery voltage vs. time:

- Press the batt key. Press again or **ENTER** to exit the menu.

The display will now indicate the combined voltage of the four batteries and the use-time elapsed. Each pixel corresponds to seven minutes in the horizontal direction and 0.25V in the vertical direction.

When the combined battery voltage drops below 3.9V, a battery low indicator appears in the display and the instrument will start to shut itself off. Any ongoing measurement will be terminated and the results stored in a directory called BATLOW. Memory contents is retained without the use of electrical power (flash memory).

If the instrument is connected to an external DC-source, the battery voltage vs. time diagram will be halted and information about the external supply (Ev) is given.

If powered from internal batteries and left unattended and unoperated, the sound level meter will switch itself off after ten minutes. A warning will be displayed on screen during the last minute before switch-off. However, this does not apply if the instrument is measuring (including being paused during a measurement), or when powered from an external source. See the Technical specification for details.

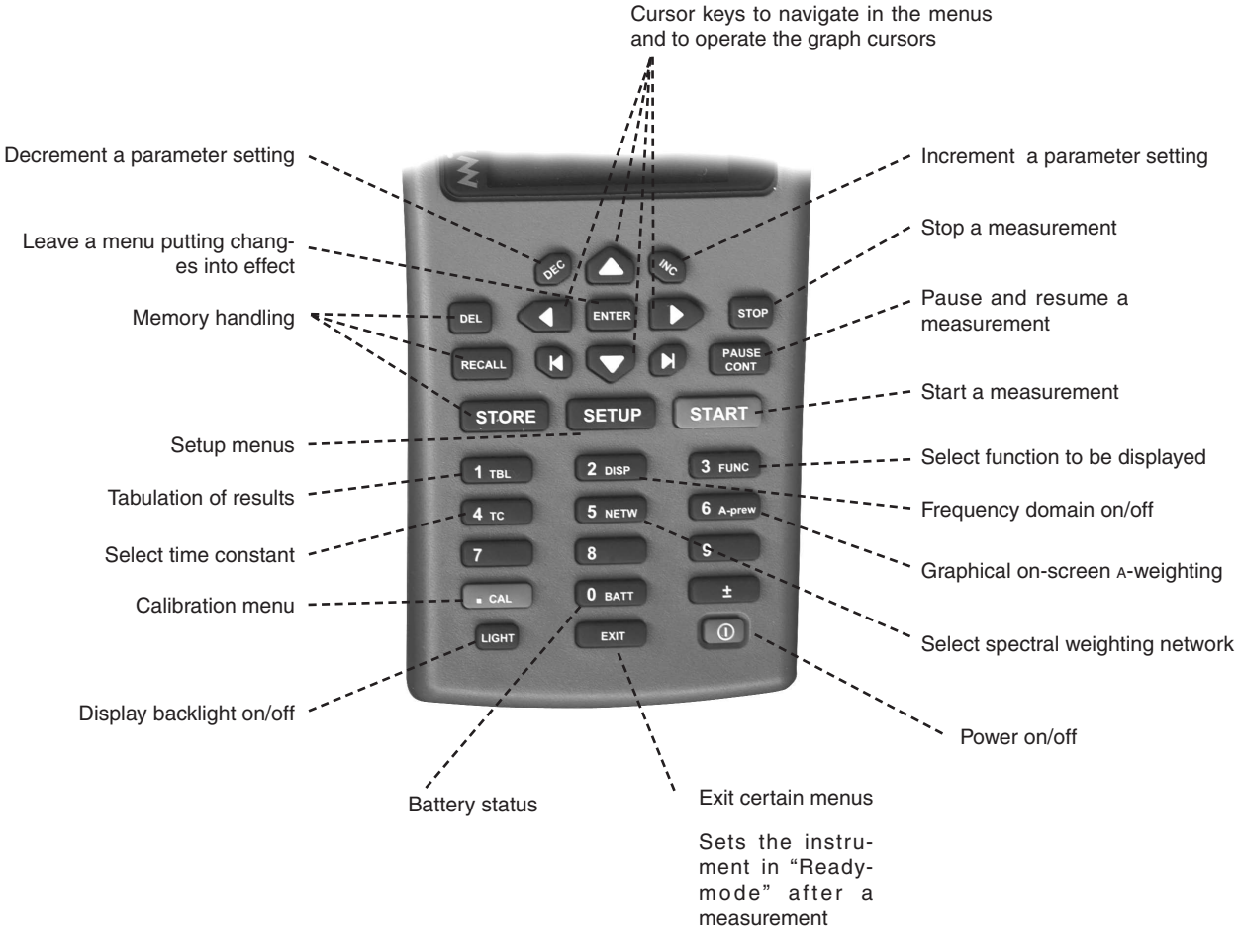
No recharging. Connecting an external DC-source (11–16V) to the instrument, will not charge rechargeable batteries, but power the instrument in lieu of the internal batteries

Front panel overview

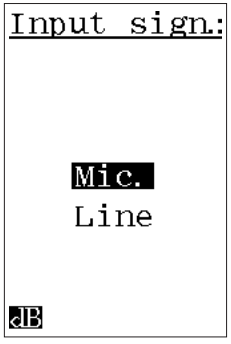
Navigating in the menus. Observe the following general guidelines applicable to every instrument menu:

- To navigate between editable parameter fields in the menu, use the cursor keys
- The editable field currently selected is shown inverted (white text on black background)
- Use the Modifier keys below the display (the **INC** and **DEC** keys) to increment or decrement the current setting of the parameter. Alternatively use the keypad to key in the required value, whenever applicable. The # sign will appear in the lower line of the display whenever the instrument accepts numerical inputs
- If you use the numerical keypad, be sure to press enter (Request for Enter is marked as #E in the display) before moving to the next field to alter. This is not needed when you use the **INC** and **DEC** keys.
- To leave a menu putting changes into effect, press enter.
- There is no cancel function available.

The front panel keys



Powering the microphone preamplifier



The detachable microphone preamplifier on Nor131 is powered through the terminal on the TNC-connector. If the input terminal is connected to other types of signal sources, the supplied current may be switched on or off dependent on the application. To set the supply current on to accommodate the normal microphone with preamplifier, do as follows:

- Press **SETUP** > **1** (Instr.) > **5** (Signal) and use the vertical cursor keys to select Mic.
- Press enter to leave the menu putting changes into effect.

When the microphone is selected, a compensation for the signal attenuation in the microphone preamplifier is automatically activated. See the section about *Calibration* for further information.

To set the supply current OFF to accommodate a normal signal source, do as follows:

- Press **SETUP** > **1** (Instr.) > **5** (Signal) and use the vertical cursor keys to select LINE. Press **ENTER** to leave the menu putting changes into effect.

The microphone is prepolarised and needs no externally supplied polarisation voltage.

Setting the time and date

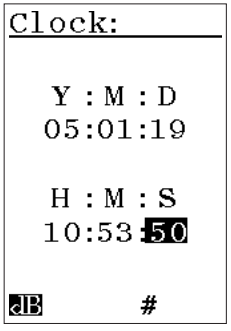
To set the time and date:

- Press **SETUP** > **1** (Instr.) >**2** (Clock). Use the cursor keys to navigate in the menu and **INC** and **DEC** to alter a setting or use the numerical keypad to key in a value. Numerical inputs must be terminated by enter to enable navigation between the parameter fields again. Press **ENTER** to leave the menu putting changes into effect (i.e. setting the time and date).

The following letters are used for day and time:

Y : M : D = year : month : day
H : M : S = hour : minute : second

Note that only two digits are used to designate the year.



Calibrating the instrument

Calibration is the normal way of ensuring that the sound level meter measures the level with sufficient accuracy. To calibrate we need a sound calibrator.

The use of sound calibrators dates back to the days when it was easier to design a stable sound calibrator than a stable sound level meter. Today, sound measuring instruments are, in general, as stable as the sound calibrators.

However, measuring microphones are very delicate devices designed to fulfil very rigid specifications. This makes them vulnerable and subject to damage unless proper care is taken.

One may therefore say that a sound calibrator is just as much a verification of proper operation as it is a device of adjusting the sensitivity of sound measuring instruments.

The Nor131 and Nor132 are calibrated by means of menus and key pushes – there is no need for a screwdriver to turn a potentiometer!

When to calibrate

Calibration of the sound level meter should preferably take place before and after a measurement session is commenced, or whenever required by applicable standards. If you know the combined sensitivity of the microphone cartridge and the preamplifier, you may key this in using the numerical keypad. However, doing so will never replace calibration with a sound calibrator, as the sensitivity adjustment procedure will be unable to reveal possible microphone, preamplifier or extension cable malfunctions.

No need to adjust the full scale setting

Since the sound level meter has a dynamic range of more tan 120 dB, the 80 dB bar graph range is a display limitation only. Hence, you won't have to bother with setting the full scale before you enter the ***Calibration*** menu.

Furthermore, since the sound level meter automatically enters C-weighted mode, you won't have to bother with the calibrator frequency either if your calibrator apply a frequency between 250 Hz and 1 kHz.

However, you may have to adjust the display top scale setting to ***see*** the top of the bar graph. Use the **INC** and **DEC** keys for this after the calibrator is switched on and ***before*** you enter the calibration menu.

The microphone and the preamplifier should be considered as one unit. The preamplifier attenuates the open-circuit voltage from the microphone in order allow sound with peak level up to 140 dB to be measured without overloading the preamplifier of the ICP-type®. The attenuation in the preamplifier is typically 6 dB. This attenuation is specified in a correction menu. The calibration value should therefore be close to the open-circuit sensitivity for the microphone.

Carrying out the calibration

You will need a sound calibrator of sufficient accuracy, i.e. a class 1 or class 2 sound calibrator as defined by the International standard for sound calibrators: IEC 60942. In general we recommend a class 1 calibrator for Nor131 (such as the Norsonic sound calibrator Nor1251 or Nor1253) and a class 1 or class 2 calibrator (Nor1252) for Nor132. Do as follows:

1 **Mount the calibrator.** Mount the sound calibrator onto the microphone as shown to the right. Switch on the sound calibrator and wait until the level has stabilised. Information on how long time this will take should be available from the documentation accompanying your sound calibrator. Adjust the displayed range by the **INC** or **DEC** keys to display the level (The numeric value is independent of this adjustment).

2 **Enter calibration mode**. Press the **CAL** key to gain access to the Calibration menu. The display will typically look as shown on the figure.

3 **Know the output level of your sound calibrator.** Some sound calibrators have an output level of 94dB, while others (like the Nor1251 which is used in the example to the right) have an output level of 114dB or even 124dB (like the Nor1253). Unless you know the output level of your sound calibrator you won't be able to know what level the measuring instrument is supposed to show. The output level is normally printed on the sound calibrator or stated in its accompanying user documentation or calibration certificate.

The sensitivity specified in the Calibration menu is the microphone sensitivity in dB relative to 1 volt/pascal, e.g. 50 mV/Pa corresponds to –26.0 dB.

Field calibration. The recommended sound calibrator for verification of the sound level meter Nor131 is the Norsonic Nor1251, class 1 calibrator, with a nominal sound pressure level of 114.0 dB @ 1 kHz.
The recommended sound calibrator for the sound level meter Nor132 is either is the Norsonic Nor1251, class 1 calibrator, or the Norsonic Nor1252 class 2 calibrator also with a nominal sound pressure level of 114.0 dB @ 1 kHz.

In order to compensate for diffraction effects around the microphone, we recommend adjusting the sound level meter to indicate 113.8 dB (diffuse/random correction off).

If other types of calibrators are to be used for the calibration, we recommend adjusting the sound level meter to indicate the following levels referred to the sound pressure level acting on the microphone's diaphragm (random incidence correction off):

f [Hz]	125	250	1000	4000	8000
Corr. [dB]	0.0	0.0	–0.2	-0.8	–2.8

If the random incidence (diffuse) correction is on, use the sound pressure level stated on the calibrator for any of the above mentioned frequencies.

The correction is activated and deactivated in the Corrections menu. Press **SETUP** > **1** (instr.) > **4** Correct.) Navigate in the menu using the arrow keys and use **INC** or **DEC** to activate/deactivate the Random setting. Activated Random setting is indicated by an R in the lower line of the display.

4 **Free-field microphones require lower settings.** Be aware of the fact that instruments using free-field microphones – as normally delivered with Nor131 and Nor132 – shall be adjusted to a value slightly lower than the output level of the sound calibrator. For a half-inch cartridge this will typically amount to 0.2 dB lower for calibrators producing a 1000 Hz calibration signal (e.g. the sound level meter should then be set to 113.8 dB when using a 114 dB @ 1 000 Hz sound calibrator) Other frequencies will require different correction values, see the Field calibration side bar for more on this.

5 **Set the sensitivity.** To set the sensitivity correctly use the **INC** and **DEC** keys (below the display) while at the same time watching the level read-out. Alternatively, you may key in the required sensitivity using the numerical keypad. Always use a figure before the decimal sign (e.g. 0.3). Once the correct level reading is established press enter to leave the menu.

The windscreen correction **W** is automatically switched off during calibration.

For line input selected, by setting the sensitivity to -26.0, a reading of 0 dB corresponds to 1 microvolt and 120 dB to 1 volt on the input terminal.

Sound measurements

Due to the wide measurement range and all the functions measured in parallel, the Nor131 and Nor132 are easy to use. The only thing you really need to set up is the measurement duration, which at least must be set up to match the amount of time you intend to be measuring. If it is set to a longer time, this will constitute no problem – just press the stop key when you want to terminate an ongoing measurement.

However, you should consider the settings of the time constant and the spectral weighting (C- or Z-weighting, see *Setting c or z as spectral weighting network* for more on this) also, but once they are set, the instrument will remember these until they are changed to something else.

Setting the measurement duration

Press **SETUP** > **2**. Use the cursor keys to move the cursor to the requested field. The fields are the time in hours: minutes: seconds. Adjust the value by using the **INC** or **DEC** buttons. Alternatively, key in the numeric value and press **ENTER**. To leave the menu press the **ENTER** key again.

Navigating in the menus. Observe the following general guidelines applicable to every Nor131/Nor132 menu:

- To navigate between editable parameter fields in the menu, use the **CURSOR** keys
- The editable field currently selected is shown inverted (white text on black background)
- Use the **ARROW** keys to right of the display (the **INC** and **DEC** keys) to increment or decrement the current setting of the parameter. Alternatively use the keypad to key in the required value, whenever applicable. The # sign will appear in the lower line of the display whenever the instrument accepts numerical inputs
- If you use the numerical keypad, be sure to press **ENTER** before moving to the next field to alter. This is not needed when you use the **INC** and **DEC** keys.
- To leave the menu putting changes into effect press **ENTER**.
- There is no **CANCEL** function available.

Setting the time weighting

The time weighting is used for the SPL, the L_{MAX} and the L_{MIN} measurements, but neither the L_{eq}, the L_E nor the L_{PEAK} makes use of it. Instruments configured for German-speaking markets will also measure the L_{eql}.

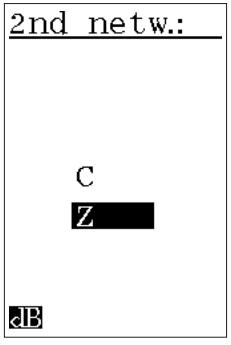
To set the time constant press the **TC** key until the required time constant appears in the display. To see this, be sure to operate the **FUNC** key until any of the functions SPL, the L_{MAX} or the L_{MIN} appears in the display first.

Observe that the statistics buffers (optional extension) will always be based on sampling using time weighting F. This cannot be changed by the user.

C or Z as spectral weighting

The Nor131 and Nor132 have three spectral weighting functions in addition to the optional filter bands. These are A-, C- and Z-weighting. A-weighting is always selected, the second network has to be selected C or Z. The Z-weighting is a replacement for the previous Flat or Linear spectral weighting functions.

To specify whether to use z- or c-weighting:



- Press **SETUP** > **1** (instrument) > **3** (2nd netw) and navigate in the menu as usual. To leave the menu, press the **ENTER** key.

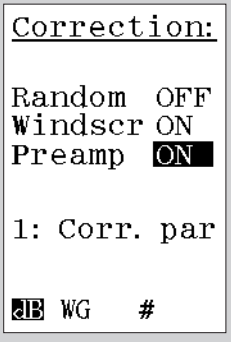
Corrections In order to improve the accuracy, you may add corrections to the frequency response of the sound level meter. Press **SETUP 1** > **4** (corrections) to access the menu for the corrections.

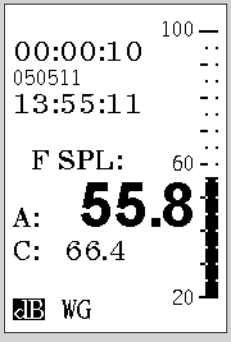
Random response

The microphone normally supplied with the sound level meter is made optimal for sound approaching the microphone from the front (Flat free-field response). This will reduce the sensitivity for sound in other directions. In order to obtain a flat random-response, a spectral correction may be applied. Marked with an **R** in the display when selected.

Windscreen correction

Wind noise may be reduced by mounting the windscreen Nor1451 supplied with the instrument. We recommend to switching on the windscreen spectral correction while the windscreen is mounted. Marked with an **W** in the display when selected





Making a measurement

To start a measurement:

- Press the start key. The **R** in the display indicates that a measurement is running.

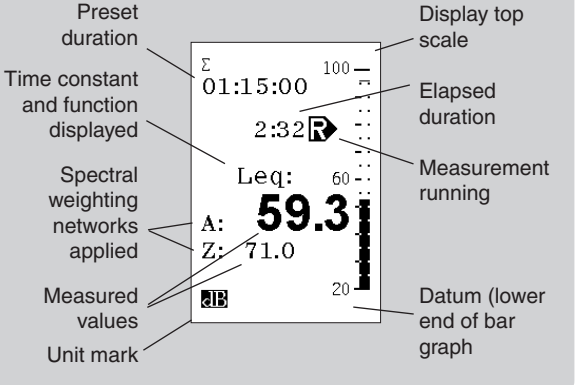
To temporarily halt an ongoing measurement:

- Press the **PAUSE/CONT** key.

To resume a paused measurement:

- Press the **PAUSE/CONT** key again. Upon resuming, the instrument will go on measuring until the total measurement time elapsed equals the preset duration. Observe that data acquired the ten seconds immediately preceding the pause will be erased because of the back-erase function (see below).

The sound level meter display



To terminate an ongoing measurement:

- Press the **STOP** key.

To resume a terminated measurement:

- To resume a terminated measurement press the **PAUSE/CONT** key again. Upon resuming the instrument will go on measuring until the total measurement time elapsed equals the preset duration. When a terminated measurement is resumed, the back-erase feature (see below) will not be activated.

To display other functions measured,

- Use the **FUNC** key. For the German-speaking markets these functions will include L_{eqI} and T_{Max5}

To adjust the display top scale:

- If the bar graph fails to match the level measured use the **INC** and **DEC** keys to alter the display top scale setting. (Note: This will also affect AC-out level, see *chapter 8, Signal out.*)

To switch between the spectral weighting functions:

- Use the **NETW** key to switch between A-weighted and C- or Z-weighted or the A-weighted and the C–A (Z–A) weighted functions.

To produce the results in tabulated form:

- Press **TBL** to produce a result table. See *Displaying the result tables for more on this.*

Resuming an ended measurement

Assume that you have set up the instrument to measure for 5 minutes and that you start the measurement. After 5 minutes the measurement will end since the measurement time elapsed equals the preset duration. The measurement has now ended successfully, as opposed to if you press the stop key to forcefully terminate an ongoing measurement.

If you now press the **PAUSE/CONT** key, the instrument will resume the measurement and go on measuring for another 5 minutes so that the total measurement time assumes 10 minutes, i.e. twice the initial setting. If you do this again, the total measurement time will be 15 minutes, i.e. three times the initial setting and so on.

This way of prolonging a measurement will not activate the back-erase feature (see below for more on this).

The back-erase feature

When you press the **PAUSE/CONT** key during an ongoing measurement, the instrument will temporarily halt the measurement. Pressing the key again will cause the instrument to resume the measurement while at the same time erasing the data acquired during the last 10 seconds immediately preceding the pause. This feature allows you to remove untypical events from the measurement.

If the measurement has been running for less than 10 seconds when you press the **PAUSE/CONT** key, the entire measurement will be erased upon resuming the measurement.

If less than 10 seconds have elapsed since the last time you resumed a paused measurement, only the part of the measurement acquired since the last resume will be erased. Data acquired earlier are assumed to be accepted by you.

Make a level average!
The resume function may be used to obtain the averaged level at different locations or conditions. As an example, you want to obtain the averaged value from three measurement positions. Make the first measurement by pressing START. Start the second and the third measurement by pressing the **PAUSE**/**CONT** key. The L_{eq}-value after the last measurement will be the averaged level.

The measurement time elapsed counter will be updated to reflect the back-erase. Note that the statistics buffers (optional extension) will be updated similarly.

Displaying the functions measured

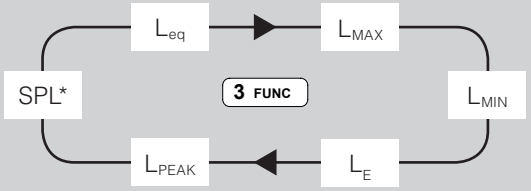
The instrument measures the SPL, L_{MAX}, L_{MIN}, L_{eq}, L_E and the L_{PEAK}. Note that the SPL, L_{MAX} and L_{MIN} are all measured with the selected time constant while the rest do not make use of the time constant at all.

During measurements the numeric SPL value is updated every second. Once the measurement is over, the SPL becomes meaningless. A single SPL value cannot be used to characterise the measurement unless it represents some kind of maximum, minimum or time-integrated average. It is thus not accessible post measurement.

To return to READY mode, i.e. how the instrument behaved before the measurement was started, press the **EXIT** key. You will be prompted to store the data or press **EXIT** again. In both cases the instrument will go back to READY mode. The SPL will now be displayed again.

The functions are available sequentially

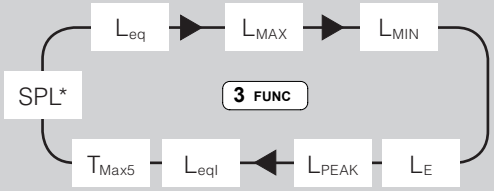
To display a certain function, press the **FUNC** key repeatedly until the function appears. The sequence is as follows:



*Accessible during measurement only – not after!

Units configured for the German-speaking markets

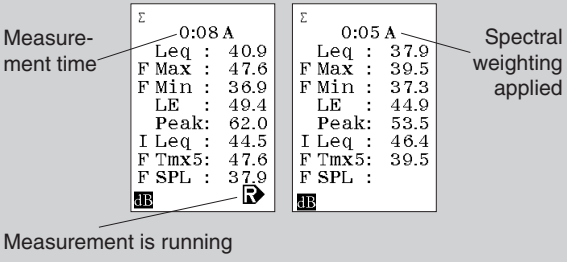
If also equipped with LeqI and TMax5, the sequence is as follows (press **FUNC** key repeatedly):



*Accessible during measurement only – not after!

The result table

Once you've pressed the **TBL** key, the display will typically look like this:



Observe that once the measurement no longer is running, no SPL value is available.

Units *not* configured for the German speaking markets will have tables not containing the I L_{eq} (L_{eqI}) and T_{mx5} values.

If you choose not to store the data (i.e. you did press **EXIT** a second time) the measured data will be lost beyond retrieval. Storing is dealt with later.

Displaying the result tables

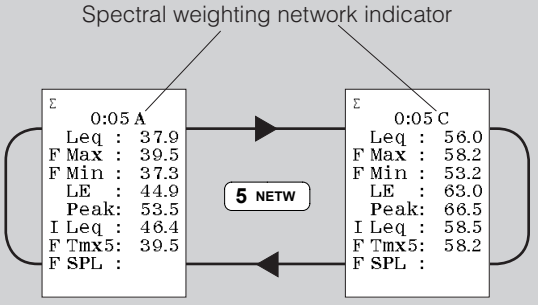
As an alternative to the above procedures, you may display all the data in a single table. Press the **TBL** key to produce the result table. This feature is available during as well as after a measurement. Do not forget that SPL values are only shown during a measurement – never once the measurement is over!

To produce the table of measured results using the other spectral weighting function press the **NETW** key while in the table.

There are two spectral weighting functions available A- and C- or A- and Z-weighting. The latter should be set by you prior to the measurement.

Even before you enter the table you may use the **NETW** key to view the results of applying the two spectral weighting functions.

Displaying the result table using the other spectral weighting function



The actual spectral weighting function used in the table depends on the setting active before the **TBL** key was pressed. Press **NETW** to toggle between primary and secondary weighting function.

Statistics – displaying the percentiles

Instruments equipped with the optional extension 2 – statistics – will measure the statistics every time. This cannot be switched off.

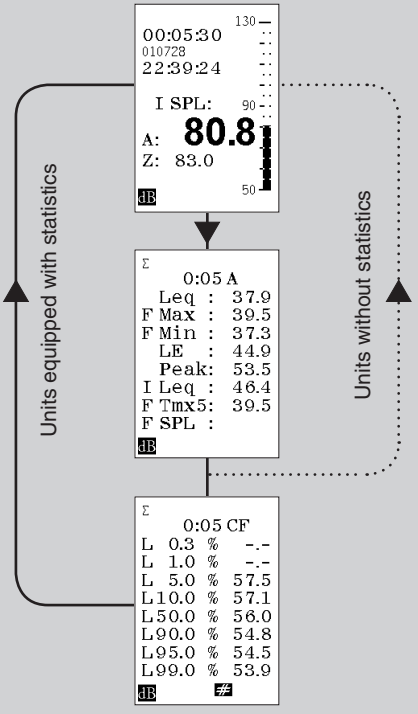
The sampling for the statistical calculations is made with F time constant and the class width is 0.2 dB over the entire 120 dB dynamic range – always!

You may think that storing all these data will require a huge memory, and you're absolutely right. Therefore, we refrain from that, we store just eight percentiles instead. Seven of them are fixed and one is user-editable.

Your user-editable percentile can be set to anything in the range 0.1–99.9 %, both extremes included. The procedure is explained overleaf.

Only measured data, but not data retrieved from stored values may be subject to changes in the user-defined percentile. This means that as long as you have the last measured data in the display, you may change the percentile as many times as you want, but once the data are stored and later retrieved any changing of the user-editable percentile is no longer possible.

The percentiles table sequence

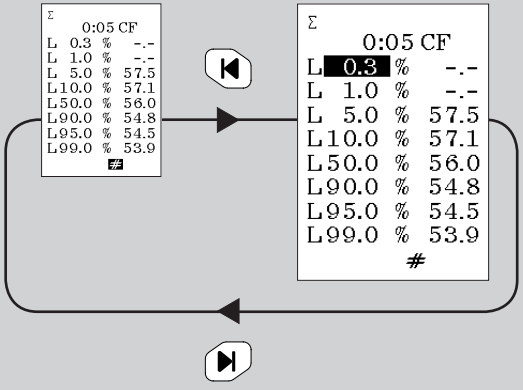


Editing the user-defined percentile

To enable the editing the instrument must display the percentiles table. In the percentiles table press the ⏮ key (the end-left key) to enable this.

Once the percentile field is shown inverted (with white text on black background) the text can be edited using the numerical keypad or **INC** and **DEC**. If you use the numerical keypad you must press **ENTER** to confirm that you have keyed in the new percentile.

To terminate the editing process press the ⏭ (end-right key). The corresponding percentile value will now be displayed, given that the measurement duration was long enough to provide a sufficient number of samples. Using **ENTER** will not work here.



The user-defined setting applies to both spectral weighting settings. The two cannot have individual settings!

Displaying the percentiles table

To produce the percentiles table press **TBL** to enter the result table and **TBL** again to enter the percentiles table. Units not equipped with the statistical extension will exit the table upon the second push on **TBL** and return to the sound level meter display mode. The sequence is shown in the side bar.

Storing the acquired data

The Nor131/Nor132 has a large, non-volatile memory to hold the measurements. The memory structure resembles the memory structure of a personal computer in the sense that both use folders and files.

All aspects of the memory handling are discussed in detail in *Memory handling.*

Missing percentiles? There may be percentiles that fail to produce values in the table. This is because you have not measured for a time long enough to provide the necessary number of samples.

Statistical sampling – which should not be confused with the sampling of the analogue-to-digital conversion – takes place 10 times a second. For comparison, the sampling of the analogue-to-digital conversion runs at 48 kHz!

Since the statistical sampling takes place 10 times a second, it will take 10 seconds to produce 100 samples. You will need at least 100 samples to be able to calculate the 1% percentile. Likewise, for the 0.1% percentile the minimum time required will be 100 seconds.

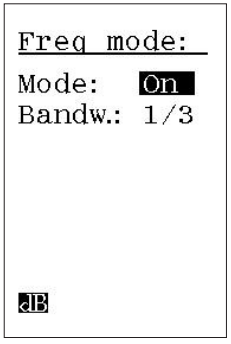
Frequency analysis

As an optional extension 1, you may have your Nor131 or Nor132 equipped with parallel octave band filters. By adding the optional extension 4, third-octave band filters become available as well. The frequency range, expressed as centre frequencies, is 8–16 000 Hz for the octave band filters and 6.3–20 000 Hz for the third-octave band filters.

When you make a frequency analysis, this comes in addition to the traditional sound level measurements as described in the chapter *Sound measurements*.

Setting up

The frequency range is fixed and cannot be changed by the user. Bearing in mind that the dynamic range of the instrument is in excess of 120 dB and that the instrument measures a fixed set of functions (which cannot be altered by you), there is not much left to set up before the instrument is ready to make a frequency analysis, besides selecting the band width. This is selected by pushing **SETUP > 3 :** Frequency.



In the Frequency mode menu you can select between 1/1- or 1/3-octave band width and switch the filters ON/OFF.

Statistics

If your instrument is equipped with the optional extension *Statistics*, the statistical functions will be calculated for each octave or third-octave band, as for the ordinary frequency weightings A- and C- or A- and Z-weighting.

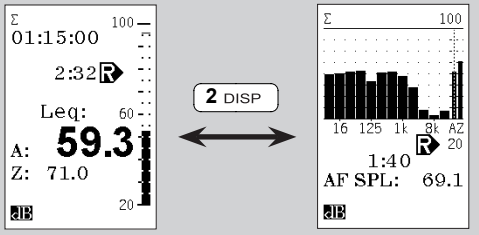
Displaying the spectrum

Press the key **DISP** to display the octave-band spectrum. This key is used to toggle between the normal display and the graphical octave-band display.

Since no measurement has been made the only function producing frequency band bar graphs will be the SPL with the selected time constant. If you press the **FUNC** key this will produce empty displays only. If you did, just keep pressing the **FUNC** key until the SPL reappears.

When the frequency analysis extension has been installed, frequency analysis will be made during every measurement. This means that the instrument will combine a “traditional” sound level meter measurement and a real time frequency analysis in octave or third-octave bands. Whether the instrument is set to show the spectrum or the classic sound level meter display will not affect the measurement.

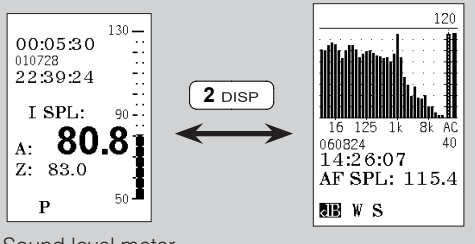
Switching between sound level meter display and spectrum display
1/1 octave display



Sound level meter display

Spectrum display

Switching between sound level meter display and spectrum display
1/3 octave display



Sound level meter display

Spectrum display

Making a frequency analysis

To start a frequency analysis measurement:

- Press the **START** key. The **R** in the display indicates that a measurement is running. The measurement is running and data acquired irrespective of whether the frequency spectrum is shown or not.

To temporarily halt an ongoing measurement:

- Press the **PAUSE/CONT** key.

To resume a paused measurement:

- Press the **PAUSE/CONT** key again. Upon resuming the instrument will go on measuring until the total measurement time elapsed equals the preset duration. Observe that data acquired the ten seconds immediately preceding the pause will be erased because of the back-erase function (see below).

To terminate an ongoing measurement:

- Press the **STOP** key.

To resume a terminated measurement:

- To resume a terminated measurement press the **PAUSE/CONT** key. Upon resuming the instrument will go on measuring until the total measurement time elapsed equals the preset duration. When a terminated measurement is resumed, the back-erase feature (see the section Measuring Sound) will not be activated.

To display other functions measured:

- Use the **FUNC** key. For the German-speaking markets these functions will include L_{eql} and T_{Max5}

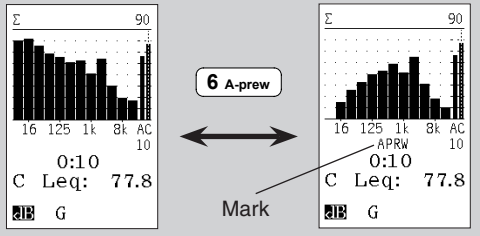
To switch between sound level meter display and spectrum display:

- Press the **DISP** key

To make the spectrum appear A-weighted

- Press the **A-PREW** key. The display will now appear a-weighted. This is purely a display function and it has no effect whatsoever, on the measured data.

A-weighted spectrum



Normal Spectrum display

A pre-weighted Spectrum display

To move the graph cursor about the frequency bands

- Use the ◀ and ▶ cursor keys. Use the ⏮ and ⏭ keys to move to the extreme left and extreme right.

To adjust the display top scale:

- If the bar graph fails to match the level measured use the **INC** and **DEC** keys to alter the display top scale setting.

Displaying the result tables

You may display all the measured data in tables. Press the **TBL** key to enter table mode. Note that the look of the tables depends on whether you start from sound level meter display mode or from frequency spectrum mode.

The tables are available during, as well as after a measurement. Remember that SPL values are shown during the measurement only.

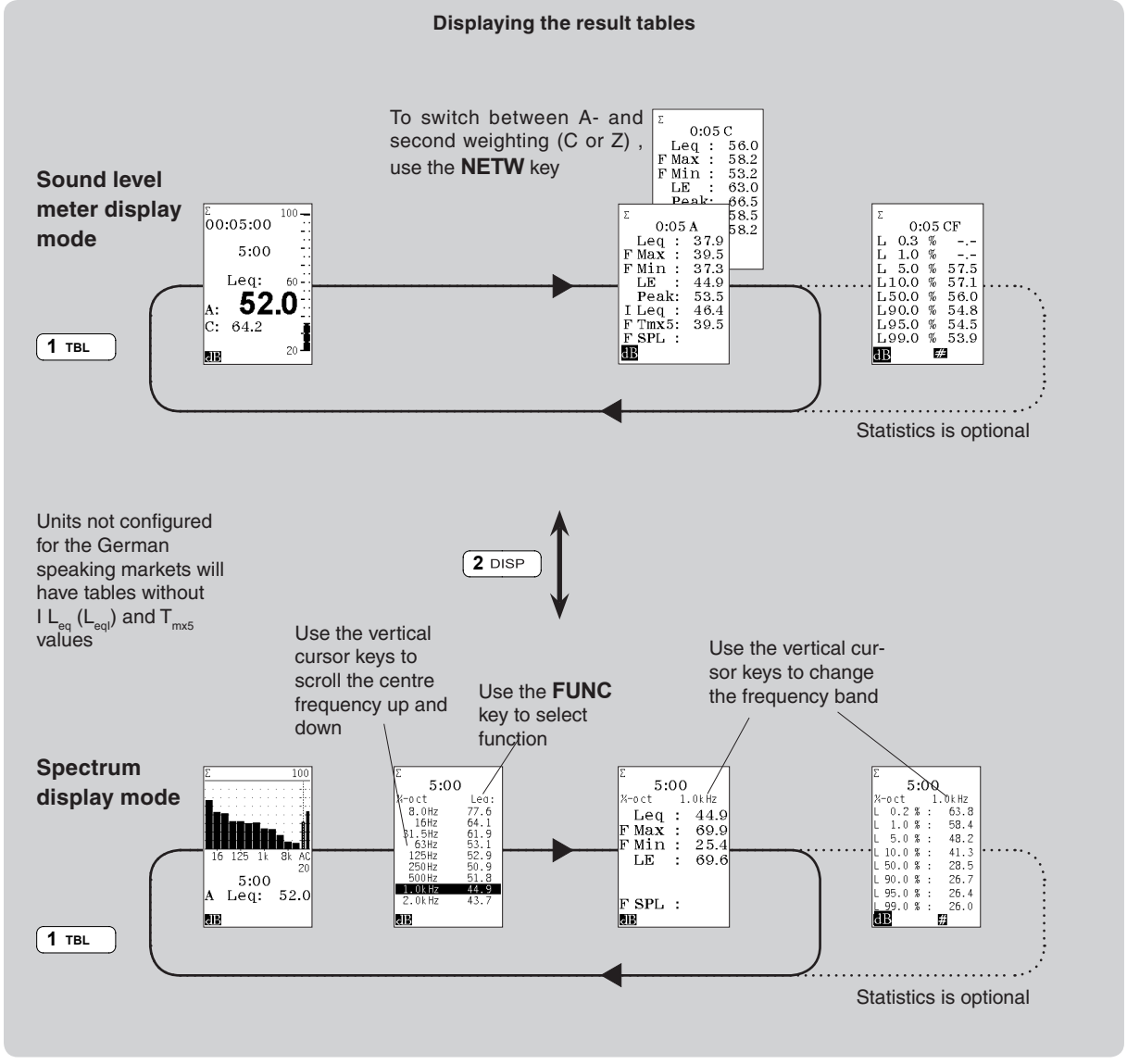
The tables available are shown in the side bar *Displaying the result tables.*

Storing the acquired data

The Nor131 and Nor132 have a large, non-volatile memory to hold the result of the measurements. When the instrument is equipped with the optional Octave-band analysis, all measured functions for every octave-band are also stored together with the rest of the measurement. As for the frequency-weightings, the statistical percentiles are stored – for every octave-band.

All aspects of the memory handling are discussed in detail in *Memory handling*.

The L_{PEAK} and T_{Max5} are not measured for the octave-bands!


Displaying the result tables
To switch between A- and second weighting (C or Z) , use the **NETW** key
Sound level meter display mode
1 TBL
Statistics is optional
Units not configured for the German speaking markets will have tables without I L_{eq} (L_{eqI}) and T_{mx5} values
2 DISP
Use the vertical cursor keys to scroll the centre frequency up and down
Use the **FUNC** key to select function
Use the vertical cursor keys to change the frequency band
Spectrum display mode
1 TBL
Statistics is optional

Basic time profile measurements

Instruments equipped with the optional extension 3, level vs. time will be able to log the time profile like the classic level recorders used to do.

The time profile is measured by dividing a total measurement into smaller periods of time, all having the same duration. Extension 3 allows the period length to be from 1 second and upwards in 1 second steps. Each value is stored in the instrument memory, and at the end of the measurement the logged profile is stored together with the overall Global Measurement.

The logged profile may be transferred to a PC for further analysis. Software like Nor1026 NorReview may be used for extensive analysis of the result. A view of the profile is not available in the instrument display itself.

Global vs. profile

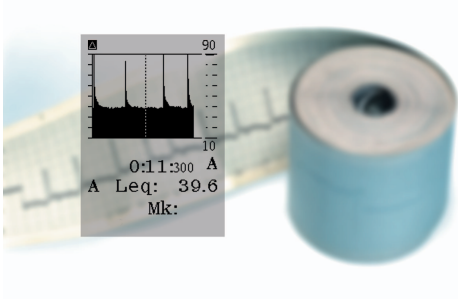
The traditional sound level measurement and the frequency analysis both consider the entire measurement as a whole without dividing it into smaller parts. One may therefore consider these two measurements as global measurements, while the level vs. time measurements represent the ***profile***.

The L_{Aeq}, L_{AEmax} and L_{Cpeak} are measured for every period separately and stored in a memory buffer as a profile measurement.

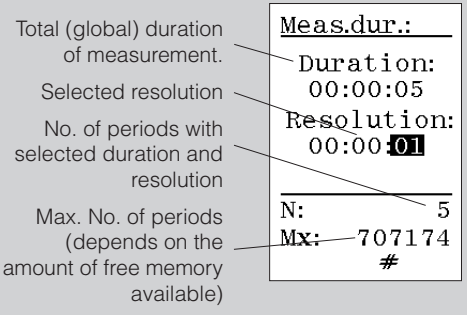
Profile measurements may be made in parallel with global frequency analysis and in parallel with the traditional sound level measurement.

This chapter deals with profile measurements only. For details on global frequency analysis see the chapter ***Frequency analysis***.

The time profile is no less than an electronic level recorder!



The measurement duration setup menu



The profile resolution does not have to be selected so that the global duration becomes a multiple of the profile resolution. The last period will be truncated if the duration divided by the profile is not an integer.

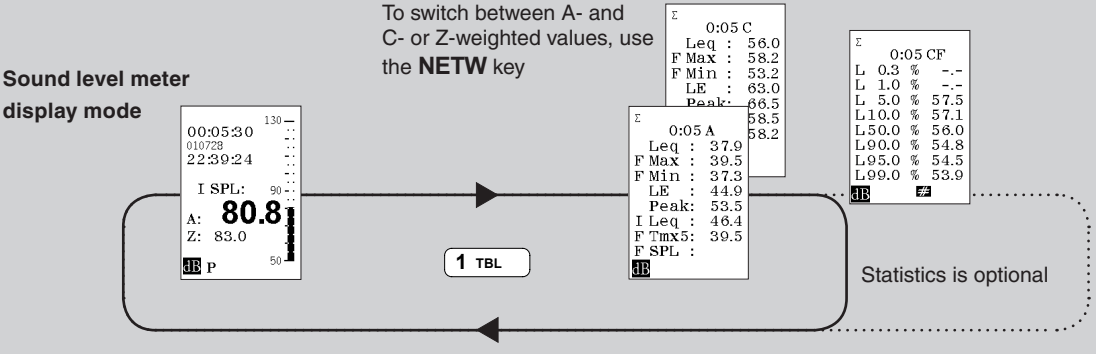
Which resolution should you use?

This will always be a trade-off between the need for information and the amount of data generated. You should also take into consideration the global duration of your measurement.

For example, you may want a higher resolution in a 1 minute measurement than in a 24 hour measurement. Will you need a 1 second resolution for 24 hours? It's going to be a lot of information to go through afterwards.

No absolute rules or guidelines can be given since there are so many different applications and requirements.

Displaying the result tables of the Global measurement



Units *not* configured for the German speaking markets will have tables without I Leq (Leql) and Tmx5 values

Making measurements

All you need to do to set up the Nor131/132 to expand the measurements to also include the time profile is to define the time resolution.

To define the duration and the resolution:

1 Press **SETUP > 2**. Units with the option 3 installed will then produce the measurement duration menu. See side bar for details.

2 Set the global duration.

3 Move down to resolution and set as required. Make sure that number of periods, N, is below the maximum value. Navigate and leave the menu as usual.

If you've set up a profile resolution different from (i.e. shorter than) the global measurement duration, the instrument will log the time profile in addition to the global measurement.

The effect of pressing STOP before resuming. If you terminate an ongoing measurement prematurely by pressing the **STOP** key and later resume the measurement by pressing **PAUSE/CONT** an S marker will be added to the period within which the **PAUSE/CONT** key was pressed – i.e. we mark out the first period after resumption.

Functions measured in the basic time profile mode. In the basic time profile mode, the instrument logs the A-weighted equivalent level, the A-weighted maximum sound pressure level and the Z- or C-weighted peak level.

At the same time, the global mode measures the instantaneous SPL, the maximum and the minimum SPL, the equivalent level, the sound exposure level and the maximum peak level. All the global levels are measured as A-weighted and Z- or C-weighted levels.

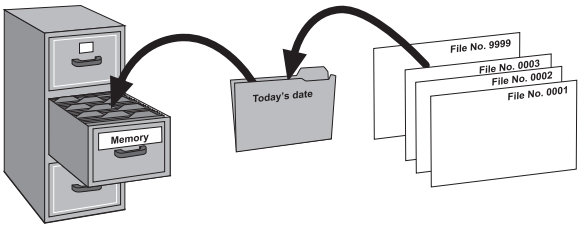
Memory handling

The instruments Nor131 and Nor132 have a large built-in, non-volatile memory which can hold large amounts of measured data and measurement setups. These data can be transferred to a remote PC for further processing.

Memory structure

The memory structure of the Nor131/Nor132 is quite similar to that of a PC. They both have folders and files. However, as simplicity in operation is a keyword in the Nor131/Nor132 memory handling, you don't have to give the folders available for storage a name. It is automatically given the name of today's date. Neither needs you to give the files a name: They are automatically numbered consecutively in ascending order as they are stored, starting at 0001. After a storage, the picked file name (number) is displayed in the heading of the display.

A memory structure metaphor



Storing a measurement setup

Measurement setups can be stored for future use. This can be handy feature when the instrument is used by several people or for many different tasks.

To store a measurement setup:

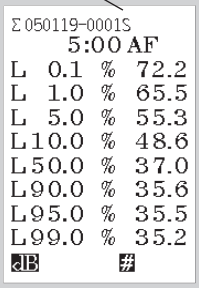
- Set up the instrument as required and press **STORE** without making a measurement. Setups are stored in a separate folder called **SETUP**.
- If a measurement has been made or a result was recalled, so a result is shown on the display, press the key **EXIT** to clear the result in order to be able to store a **SETUP.**

All settings are stored, but upon recall of a setup all settings affecting the hardware is not read back into the instrument. Hardware settings such as preamplifier gain and calibration sensitivity are examples of settings not read back.

However, all settings of functions and parameters used in the measurements are read back.

When data is stored

Folder and file number of data stored.
The S indicates Stored.



Storing a measurement

Once a measurement has been made, it can be stored in the non-volatile memory for future use.

To store the data:

- Press the **STORE** key after a measurement.

The data will now be stored in a folder with the name of today's date. If this folder doesn't exist, it will be created by the instrument. The first file gets the number 0001, the next gets the number 0002 etc.

If you choose to delete one of the files already stored you will leave a gap in the file list. This gap will not be filled with a file stored later, but be left open. Otherwise, you will easily loose track of which file contains what.

Retrieving stored setups and data

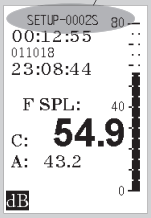
Measurements stored are easily retrieved.

To retrieve a stored setup or stored data:

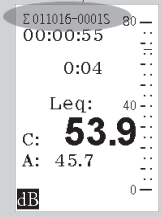
1. Press the **RECALL** key.
2. Follow the procedure explained in the side bar.

If you retrieved a stored setup this is now available for use, if you retrieved a stored measurement this is now available for inspection. The fact that you have retrieved something from the memory is reflected in the text line appearing at the top of the display – see Fig.

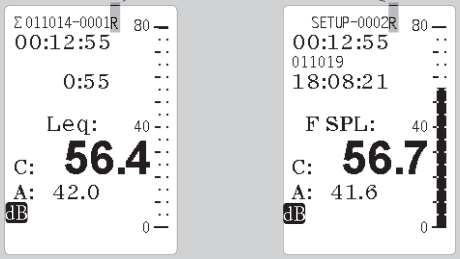
This is setup No. 2 stored in this instrument (S for stored)



This measurement has been stored as file No. 1 in today's folder (S for stored)



The uppermost text line in the display which file has been retrieved. The little R denotes Recalled, just like S denotes Stored



Clearing files and folders in the memory

To delete files and folders in the directory:

- Press the **DEL** key. The display will now produce the clear file menu.

In order to successfully locate the files and folders you want to delete, you must apply the procedures discussed in *Retrieving stored setups and data* (including the side bar on this page).

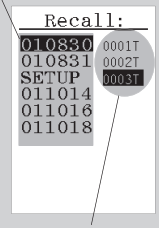
Clearing a single file

To clear a single file:

- Make sure that the file to be cleared is selected, i.e. highlight (shown as white text on a black background). Press the **ENTER** key. You will now be prompted to confirm your action. However, as default the cursor is positioned on the cancel field to avoid erasing the wrong file.

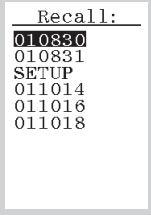
Retrieving stored setups and data

Folders

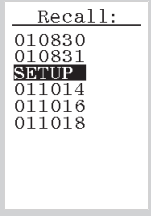


Files in selected folder

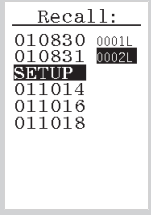
Once you've pressed the **RECALL** key, the display will show a list of folders and the contents of one of them (here this is the folder 010830). Use the vertical cursor keys to move up and down in the file list of this folder.



To be able to scroll in the folder list, press the ◀ key once and then use the vertical cursor keys to move to the wanted folder

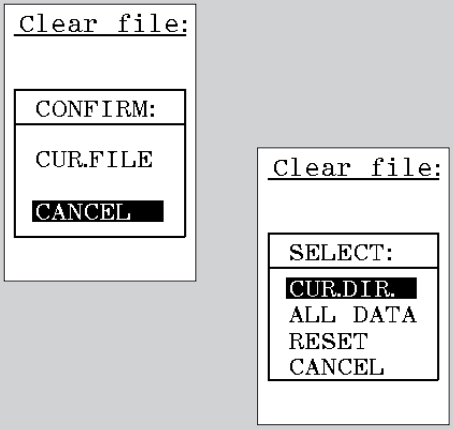


For example the folder containing all the setups…



To display the files contained in the selected folder, press the ▶ key and locate the file in question by means of the vertical cursor keys.
Press **ENTER** to recall the located file/setup and **EXIT** to leave the menu without recalling any file/setup

The menus for clearing files, folders and the entire memory



- Use the cursor keys to move the cursor to cur.file and press **ENTER** again. The file is now deleted.
- Press **EXIT** if you want to leave the menu without deleting any file.

Clearing folders or the entire memory

To clear a folder:

- Select the folder using the cursor keys and press enter. You will now be prompted to select between clearing the cur.dir. (i.e. the current folder or directory, all data in the entire memory or to reset the entire memory. The option cancel is also included to avoid unintended actions. If so, use exit to leave the menu.

You cannot delete the file that you are displaying. Therefore, in order to clear this file press exit before you enter the DEL menu.

If you select to delete all data, all measured values will be deleted, but the setup information will be retained.

Noise monitoring

Microphone outdoor protection kit Nor1212.

Due to its large memory and the high dynamic range, the Nor132 and Nor132 are well-suited for unattended noise monitoring applications. Some installations, semi-permanent or permanent, are based on tight computer control, while others leave more of the job to the measuring instrument itself. The instruments can be used with success in both types of systems.

For outdoor monitoring, the Nor131 is recommended since its detachable microphone may be separated from the instrument and placed in a microphone protection system like Nor1212.

The Norsonic environmental solutions contain a complete range of equipment and accessories for environmental noise measurements and monitoring, all the way from outdoor microphone units, via enclosures and transmission cables to controlling and post-processing software. A detailed presentation is available on www.norsonic.com.

Automated storage of measured data

The Nor131 and Nor132 can be set up to measure for a predefined period in time and then store the measured data and start over again automatically.

The snag, however, is that a little time will always be spent on storing the acquired data. This means that if you, for example, set up the instrument to measure in periods of one hour and start the measurement exactly on the hour, the measurement period start time will exhibit a lag after some hours of measuring – typically 3–4 seconds per individual measurement.

If this lag is unacceptable to you, we recommend that you use the ***synchro*** feature. When activated, the synchro will stop the measurement a few seconds earlier to give room for data storage and housekeeping so that the next measurement will start exactly on the hour.

Available storage modes

The Nor131 and Nor132 will always operate in one of the four available storage modes. These are:

- **Manual,** which requires that acquired data are stored manually by the operator before the next measurement is made
- **Automatic,** which causes the acquired data to be stored automatically upon measurement termination, regardless of the reason for termination – irrespec-

tive of whether termination took place because the duration expired or because you pressed **STOP**.

- **Repeat,** which causes the instrument to store the acquired data and then restart immediately and make another measurement using the same measurement setup and duration. Repeat applies to measurements terminated by themselves only. If you terminate a measurement by pressing **STOP**, the instrument will not restart. Note that some time will be spent on storing the acquired data, Therefore a slight delay in the restart moment will be observed. *Use at least 2 seconds measurement time if you use* REPEAT!

What can be done to the measured data?
Data acquired are available for inspection, during or after a measurement.

You may:

- Switch between sound level meter display and frequency spectrum display
- Display the functions measured
- Display the result tables
- Change the spectral weighting function between A- and C- or Z-weighting, this depends on which one you measured
- Display the eight percentiles (requires the presence of the optional extension 4) and set one of them as you like
- Store them for future use

- **Synchro,** which compensates for the time spent on housekeeping (i.e. storage of data etc.) to maintain synchronisation with the time of day. This works in the way that the instrument synchronises itself with the full hour of the time of day. To be active, synchro requires a minimum measurement time (duration) of 30 seconds per individual measurement.

Synchro – an example

Assume that you set up the instrument to measure in periods of one hour and that you start the measurement at 08:52:40. The first period will be truncated and last a little less than 7 minutes and 20 seconds to give room for storage before 09:00:00. The succeeding period will then each be very close to an hour long to enable restart again at 10:00:00, 11:00:00 etc.

Now, what happens if you select a period duration whose multiples fail to match one hour? If you set up the period duration to, say 7 minutes, and start the measurement, the instrument will measure in periods of 6 minutes and 54 seconds to enable a restart exactly 7 minutes after the previous period started.

However, the first time the full hour is reached, one period will be truncated (if needed) to lock the measurement onto the full hour at least once. The odd choice of period length will, however, fail to make the full hour synchronisation work in a sensible way. The principle has been designed with period lengths of an hour, half an hour, 15 minutes etc. in mind.

Keyboard lockout – locking the keyboard to prevent unauthorized operation. You may lock the keyboard to prevent the instrument from being tampered with while it is left on its own.

To lock the keyboard:

Press ⏮, ▶, ⏭, ◀ to lock the keyboard

To unlock a locked keyboard:

Press ◀, ⏭, ▶, ⏮ to unlock the keyboard

Note that the instrument must show the sound level meter display for this to work (in this display the cursor keys are not used).

Setting the storage mode

To set the storage mode:

- Press **SETUP** > **1** (Instr.) > **1** (Storing). Use the cursor keys (located below the display) to navigate in the menu as usual and set the storage mode as required.

Other setup aspects

The setup for a monitoring job will depend on the task, so no absolutes can be given here. However, you should consider such things as

- What information will you need, and how detailed should it be?

Menu for storing the measurement results

- Measurement period length
- The type of outdoor microphone unit (for semi-permanent or permanent installations)
- Adaptors and cables needed (if applicable)
- Cabinet or casing required for the sound level meter
- External power to the instrument (batteries or mains connection)
- Type of connection to remote PC

The setup of Nor131/Nor132 will be found in this manual, while all the accessories can be found in a separate leaflet or on www.norsonic.com.

Using windscreen? Using a windscreen reduces the unwanted noise generated by the wind, but will slightly alter the frequency response. To retain the high measurement accuracy you may switch on the windscreen correction. (Setup menu). The effect of using a windshield is discussed in Windscreen in the chapter Technical specifications.

Signal out

The sound level meters Nor131 and Nor132 are equipped with a signal out terminal. The signal is a replica of the microphone- or input signal. You may use the terminal for listening to the measured signal, or you may use it for recording purposes.

The gain is set via the selection of displayed full scale. Full scale on the display corresponds to 100 mV on the signal out terminal. Although the selection of full scale will not affect the measurement, it will determine the sensitivity for the signal out. Use the **INC** and **DEC** keys to adjust the gain. The gain may be varied over a range of 60 dB in 10 dB steps.

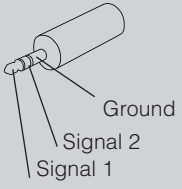
The signal out terminal can drive loads with an impedance down to less than 16 ohm, but we normally recommend a headset with 32 ohm impedance. Even a short-circuit will not affect the measurements, but should be avoided due to an excess power consumption.

The signal output terminal is a 3,5 mm stereo-jack. Both channels have the same signal, but are driven from separate amplifiers and should therefore not be connected together.

Use a stereo plug! Never use a mono plug for the signal output jack as this will short-circuit one of the outputs.

Listen to the vibrations! You may connect an ICP®-type of accelerometer to the instrument instead of the microphone. With the signal out feature, you may listen to the vibration signal.

Jack-plug for signal out



Transfer of data to a PC

To transfer measured data from the Nor131 and Nor132 to a PC you will need a USB cable (available separately, contact your local representative or the factory).

The recommended way to transfer data to a PC is by means of the software program NorXfer, (available separately) which includes the necessary USB driver.

The instrument can also be remotecontrolled. For a complete list of remote control commands contact your local representative or the factory.

NorXfer installation procedure

1. Insert Norsonic Application CD into the CD drive. A menu will appear. Select installation of NorXfer.

2. After a successful installation of NorXfer, start the program. License codes are normally installed automatically. However, if the program prompts you to key in license codes, key in following:

   Company: NORXFER
   User Name: NORXFER
   Registration Code: BW9NVQUBNH79UM

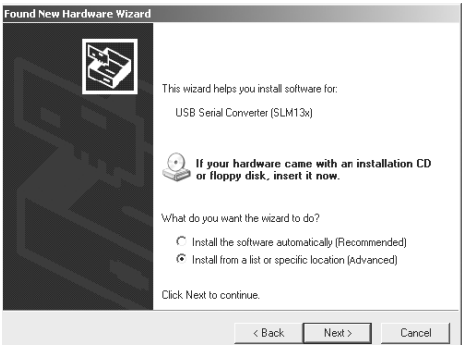
   Note! Special codes are required if you have ordered Option 1 – Modem control or Option 2, Remote control

3. Switch on the instrument and connect it to the PC.

4. Instruments using RS232 or parallel port are now ready to use the NorXfer. Instruments using USB (Nor13x/Nor140) needs some USB drivers to be installed on your PC before you can use the program. Please follow the instructions given below.

5. The PC will tell you that a new device is found and prompt you for a USB driver to be installed. Windows will suggest looking for the driver itself. Select the option “no, not this time”. See pictures below

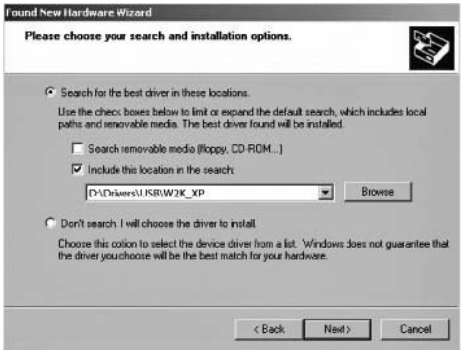
Select “No, not this time”



Select “install from a list or specify location (Advanced)”

Browse and find the driver located on the application XP: CD \Drivers\USB\W2K_XP
Vista: CD \Drivers\USB\Vista

If you download the driver from www.norsonic.com, unzip the driver. Browse and find the driver in
XP: <download folder> x \Drivers\USB\W2K_XP
Vista: <download folder> x \Drivers\USB\Vista
where <download folder> is the folder where you unzipped the driver.



Some computers will recommend you not to install the driver. The following box will appear. Ignore the message and select “Continue Anyway” in order to install the driver.

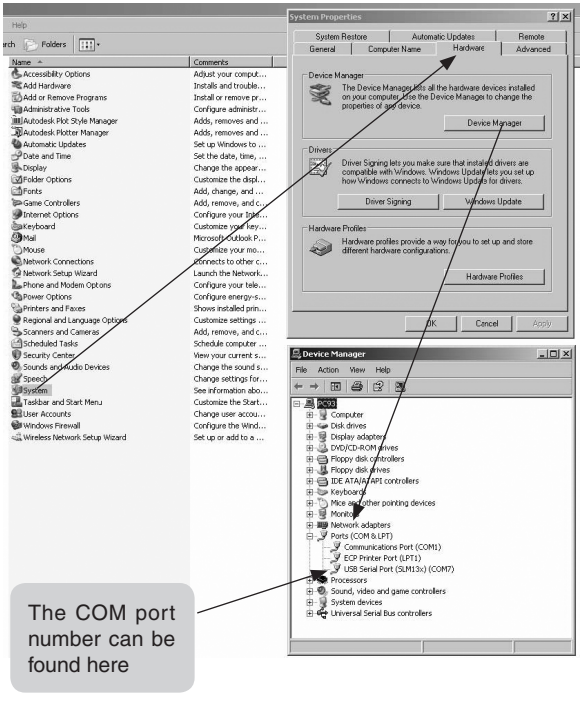
6. The installation of the USB driver is complete when this picture appears.

7. The PC will prompt you for a Port Driver to be installed. Repeat the procedure described in point 4 and 5 above.

8. The Nor13x has now been routed to a fixed COM port on your PC. This COM port must be used each time you connect this particular instrument to your PC. In case you got several Nor13x you must repeat the procedure from 5 to 7. Each new Nor13x you connect to the PC will get its own COM port.

9 Use the Device manager to find the COM port.

The device manager can be found under control panel, system, and hardware. Click on the device manager Icon. Expand the Ports / Com tree. See picture below.



Technical specifications

Unless stated otherwise, the specifications are for the complete sound level meter Nor131/Nor132 equipped with microphone.

Nor131 is equipped with detachable preamplifier type Nor1207 and microphone Nor1228. Nor132 comes with a fixed preamplifier and microphone Nor1229.

Values are based on the nominal value for the microphone sensitivity, –26.0 dB relative to 1V/Pa, and 6 dB attenuation in the preamplifier. Each sound level meter is individually calibrated.

A microphone cable Nor4531 of length 5 m may be used between the microphone preamplifier and the instrument body without loss of performance (Nor131 only). Longer cables may be used if maximum sound pressure level or frequency is reduced.

The definition of terms is based on IEC 61672-1: 2002-05. The options included in the basic instrument may vary. Please check with your local supplier for the latest information.

Type of instrument

Nor131: Sound level meter IEC 61672-1, class 1, group X, measuring exponential time-weighted levels, integrating-averaging levels and sound exposure levels. The instrument also complies with requirements in the previous International standards for sound level meters: IEC 60651 type 1 and IEC 60804 type 1

If 1/-1 or 1/3- octave band filters are installed, the instrument complies with IEC 61260, class 1.

Nor132: Sound level meter IEC 61672-1, class 2, group X, measuring exponential time-weighted levels, integrating-averaging levels and sound exposure levels. The instrument also complies with requirements in the previous International standards for sound level meters: IEC 60651 type 2 and IEC 60804 type 2. Note that the instrument may be applied in the extended temperature range -10°C to +50°C compared to the requirements for IEC 61672-1, class 2

If 1/1- or 1/3-octave band filters are installed, the instrument complies with IEC 61260, class 1.

Analogue input

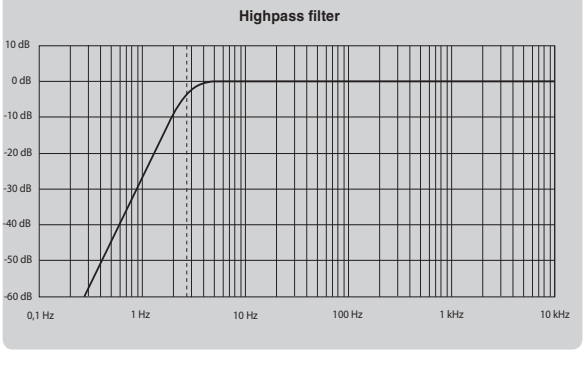
Number of channels: 1
Input connector: TNC-connector for Nor131, no connector for Nor132.
Preamplifier supply: ICP®-type, 3 mA /24 V
Polarisation voltage: 0 V (prepolarised microphone).
Maximum input signal: ± 11 V peak
Input impedance (Nor131): More than 800 kohm, less than 250 pF

Measurement range (line input): 0.3 mV to 7 V (RMS) in one range corresponding to –10 dB to 137 dB with a microphone sensitivity of 50 mV/Pa. The maximum peak value ±10 V corresponds to 140 dB. Lower limits depend on the network/filter applied.

Highpass filter

The input section is equipped with a highpass filter to reduce noise from wind or other sources with frequencies below the frequency range for measurements.

Filter type: 3rd order HP filter (-3 dB at 2.7 Hz, Butterworth response, see figure below).



Analogue to digital conversion

The analogue input signal is converted to a digital signal by a multirange sigma-delta converter with an effective sampling frequency of 48 kHz. The anti-aliasing filter is a combination of an analogue and a digital filter.

Frequency weightings

Simultaneous measurement of A- and C-weighting or A- and Z-weighting. 1/1 octave band levels may be measured simultaneously if options providing these weightings are installed.
1/1-filters: 8, 16, ...16000 Hz, class 1, digital IIR filters, base 10 system according to IEC 61260.
1/3-filters: 6.3, 8, 10, 12.5, 16, ...20000 Hz, class 1, digital IIR filters, base 10 system according to IEC 61260.

Level detector

Detector type: Digital true root-mean-square (RMS) detection and peak detection, resolution 0.1 dB.

Crest factor capability: The crest factor is only limited by the peak-value of the signal.

Time weightings and measured functions

Measurement of the following functions:

- F–time-weighted sound pressure level, instantaneous
- Maximum F–time-weighted sound pressure level
- Minimum F–time-weighted sound pressure level
- S–time-weighted sound pressure level, instantaneous
- Maximum S–time-weighted sound pressure level

- Minimum S–time-weighted sound pressure level
- I–time-weighted sound pressure level, instantaneous
- Maximum I–time-weighted sound pressure level
- Minimum I–time-weighted sound pressure level
- Integrated-averaged sound pressure level
- Sound exposure level
- Peak sound level

As an option, the sound level meter may also measure:

- Integrated-averaged I–time-weighted sound pressure level
- I–time-weighted sound exposure level
- Taktmaximalpegel – DIN 45657, F time response, 5 seconds Takt.

Level distribution

As an optional extension, the instrument may be fitted to calculate the exceeding level (cumulative level distribution) for the F time weighted level. The calculation is done for frequency weightings A and C or Z and for 1/1 octave band levels (if filter option is installed).

Class width: 0.2 dB
Number of classes: 652 for levels between 10 dB above full scale (140 dB) and 120 dB below full scale (10 dB). The classes for the highest and lowest levels are extended to also include levels above and below, respectively.
Sampling frequency for level: 10 samples per second

Display resolution: 0.1 dB based on interpolation

Indication range

The calibration of the instrument allows microphones with sensitivity in the range –84 dB to +15.9 dB relative to 1 volt/pascal to be applied. The corresponding display range for the indicated sound level is –50 dB to +180 dB. Preamplifier attenuation is assumed to be in the range 0 to 9,9 dB.

Self-noise levels

The self-noise is measured with the calibration set to –26.0 dB corresponding to a microphone sensitivity of 50 mV/Pa. For voltage input, the level 0 dB then corresponds to 1µV. Typical values for the self-noise are 3 to 5 dB lower than the values stated.

Dummy microphone: Noise measured with 18 pF microphone dummy and microphone preamplifier Nor1207 with a nominal attenuation of 6 dB, averaged over 30 s of measurement time:
A-weighted: 18 dB, C-weighted: 20 dB, Z-weighted: 25 dB

Real microphone: Noise measured with Nor1228 microphone and preamplifier Nor1207 with a nominal attenuation of 6 dB, averaged over 30 s of measurement time:
A-weighted: 20 dB, C-weighted: 27 dB, Z-weighted: 35 dB.

Line input: Noise measured with the input terminal on the sound level meter short-circuited to ground, line input selected, averaged over 30 s of measurement time:
A-weighted: 8 dB, C-weighted: 10 dB, Z-weighted: 15 dB.

Field calibration

The recommended sound calibrator for verification of the sensitivity of the sound level meter Nor131 is Norsonic Nor1251 with a nominal sound pressure 114.0 dB at 1 kHz. Recommended sound calibrator for Nor132 is Nor1251 or Nor1252 (Class 2, also with a nominal sound pressure 114.0 dB at 1 kHz). In order to compensate for effects due to diffraction around the microphone, we recommend adjusting the sound level meter to indicate 113.8 dB (random incidence correction off). If random incidence correction is on, the sound level meter shall be adjusted to 114.0 dB.

If other types of calibrators are used for the calibration, we recommend adjusting the sound level meter to indicate the following levels referred to the sound pressure acting on the diaphragm of the microphone (random incidence correction off):

Freq	**125 Hz**	**250 Hz**	**1 kHz**	**4 kHz**	**8 kHz**
Level	0.0 dB	0.0 dB	–0.2 dB	–0.8 dB	–2.8 dB

Measurement duration and resolution

The total time period for a measurement may be set from 1 second up to 100 hours less 1 second with 1 second resolution.

Total range for measurement of A-weighted levels

The linear operating range is identical to the total range.

Frequency	**31.5 Hz**	**1 kHz**	**4 kHz**	**8 kHz**	**12.5 kHz**
Upper level	98 dB	137 dB	138 dB	136 dB	133 dB
Lower level	24 dB	24 dB	24 dB	24 dB	24 dB
Ref level test	94 dB	114 dB	114 dB	114 dB	114 dB

The primary indicator range for compliance with IEC 60651 type 1 is 24 dB to 117 dB. For compliance with IEC 60804 type 1, the linearity range is 24 to 137 dB, and the pulse range 24 dB to 140 dB, respectively.

Total range for measurement of C-weighted levels

The linear operating range is identical to the total range.

Frequency	**31.5 Hz**	**1 kHz**	**4 kHz**	**8 kHz**	**12.5 kHz**
Upper level	134 dB	137 dB	136 dB	134 dB	131 dB
Lower level	30 dB	30 dB	30 dB	30 dB	30 dB
Ref level test	114 dB	114 dB	114 dB	114 dB	114 dB

Total range for measurement of Z-weighted levels

The linear operating range is identical to the total range.

Frequency	**31.5 Hz**	**1 kHz**	**4 kHz**	**8 kHz**	**12.5 kHz**
Upper level	137 dB	137 dB	137 dB	137 dB	137 dB
Lower level	40 dB	40 dB	40 dB	40 dB	40 dB
Ref level test	114 dB	114 dB	114 dB	114 dB	114 dB

Measurement range for C-weighted peak levels

Frequency	**31.5 Hz**	**1 kHz**	**4 kHz**	**8 kHz**	**12.5 kHz**
Upper level	137 dB	140 dB	139 dB	137 dB	134 dB
Lower level	45 dB	45 dB	45 dB	45 dB	45 dB
Ref level test	114 dB	114 dB	114 dB	114 dB	114 dB

Power supply

Battery: 4 cells, IEC LR6, AA-sized, Alkaline batteries are recommended (e.g. Duracell Ultra M3). AA-sized NiCd or NiMH rechargeable batteries may be used, but must be charged outside the instrument. Battery voltage and time on battery since last change of batteries are indicated.

Typical battery life time (Duracell Ultra M3)**:** 8 – 12 hours.

External dc: 11 – 16 volt. Power consumption approximately 1.2 watt dependent on selected modes of operation. External DC source should have source-impedance less than 1 ohm and be able to supply at least 300 mA. The mains adaptor Nor340 is recommended for use with the instrument.

If the external supply falls below 9 V, the instrument will use the internal batteries if available. If the instrument has switched off due to loss of power or insufficient supply voltage, the instrument will automatically switch on after reapplying the external DC supply.

Socket for external dc: 1.3 mm plug, negative voltage on centre-terminal.

The instrument will automatically switch off if the battery or external voltage is too low for operation within the stated specifications. The maximum battery voltage for conformance testing is 4 × 1.6 V = 6.4 V.

The instrument has a calendar clock supplied from the batteries or external DC-supply. The clock is supplied from a charged capacitor during change of batteries.

Display

The display is a monochrome, transreflective LCD graphical display with 160×240 pixels (W×H) with automatic temperature compensation for contrast and viewing angle. Pressing the light key illuminates the display. The light switches off automatically 2 minutes after the last operation of any key.

The bar graph display covers 80 dB, which may be scrolled in 10 dB steps to cover the total range.

Keyboard

The keyboard is of silicon-rubber type.

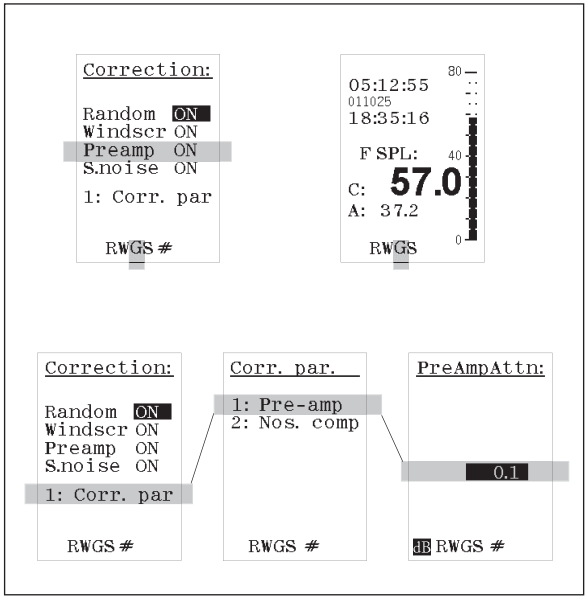
Adjustment of indicated levels

Random response. The instrument is normally equipped with a microphone with flat free-field response and satisfies the class 1 and class 2 requirements in IEC 61672-1 to free-field response for Nor131 and Nor132 respectively. By selecting the random response correction network included, the instrument will satisfy the similar class requirements in IEC 61672-1 and ANSI S1.4-1997 to random response. The nominal correction to obtain flat random response is shown in the adjacent figure.

Activating random response correction:

(Not available in German version)

- Press **SETUP** > **1** (Instr.) > **4** (Correct.) to gain access to the Corrections menu. Navigate in the menu as usual and activate the correction parameter Random by means of the **INC** and **DEC** keys. Do the same to deactivate. Random response correction activated is indicated by an **R** in the lower line of the display.



Windscreen

The instrument may be used with windscreen Nor1451. The windscreen correction has to be switched on to obtain the stated specifications. The nominal correction for the windscreen correction network is shown in the figure below.

Activating windscreen correction

- Press **SETUP** > **1** (Instr.) > **4** (Correct.) to gain access to the Corrections menu. Navigate in the menu as usual and activate the correction parameter Windscr by means of the inc and dec keys. Do the same to deactivate. Windscreen correction activated is indicated by a **W** in the lower line of the display.

Preamplifier attenuation

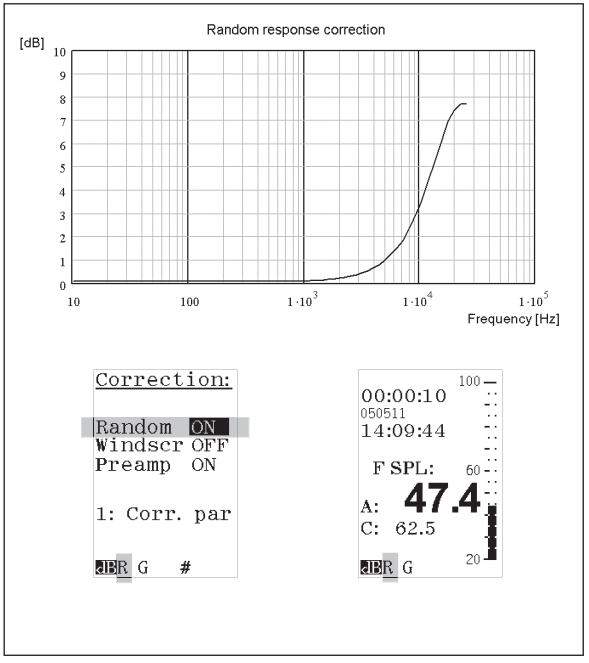
The instrument has the ability to correct for the attenuation in the preamplifier. Typical values of the attenuation is 6 dB. The correction can be set in the range 0.0 to 9.9 dB. The correction can be switched on/off when microphone is selected as the source. When Line is selected, the preamplifier correction is automatically switched off.

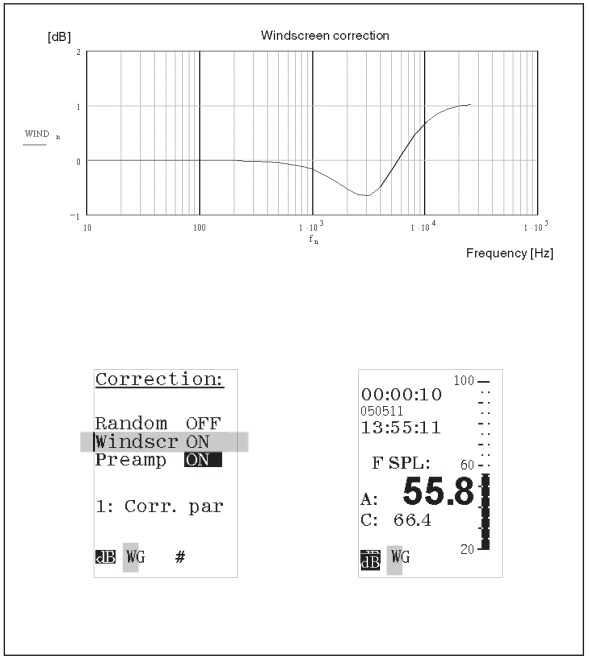
Activating the preamplifier attenuation:

- To activate the preamplifier attenuation press **SETUP** > **1** (Instr.) > **4** (Correct.) to gain access to the Corrections menu. Navigate in the menu as usual and activate the correction parameter Preamp by means of the **INC** and **DEC** keys. Do the same to deactivate. Preamplifier attenuation activated is indicated by a **G** (for Gain) in the lower line of the display. (In the German version of the program correction is not accessible from the user interface.)

Setting the amount of attenuation:

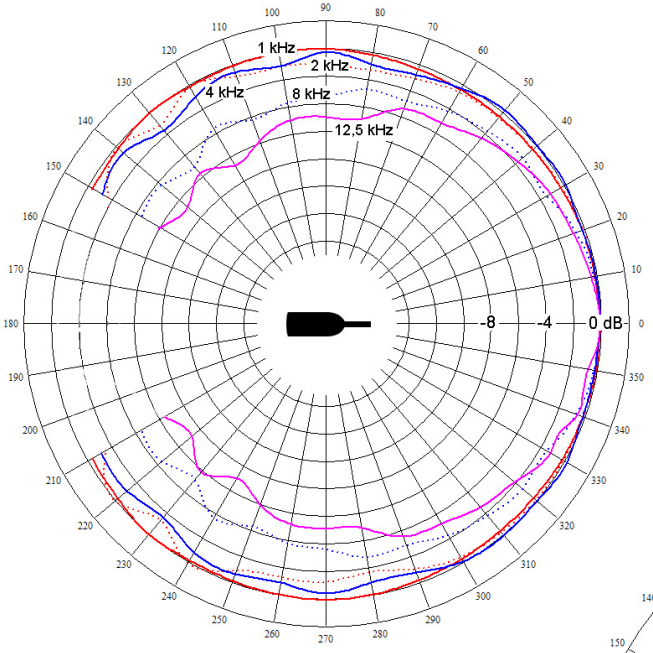
- In the Correction menu, press **1** (Corr.par) to gain access to the correction parameter setup menu. Press **2** to gain access to the attenuation setting itself. Never change this setting unless you know what you're doing! Use the numerical keypad to set the attenuation value. Press enter twice to leave the menu. See Fig. on the previous page for menu details





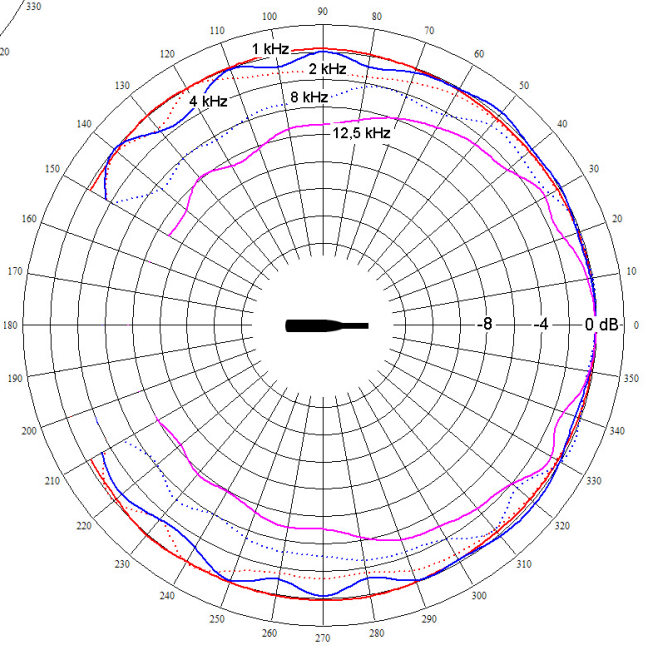
Diffraction around the instrument casing

The instrument casing is designed to have low effects on the sound measured at the microphone. The figures on following pages shows the measured effect of the instrument casing at reference environmental conditions.



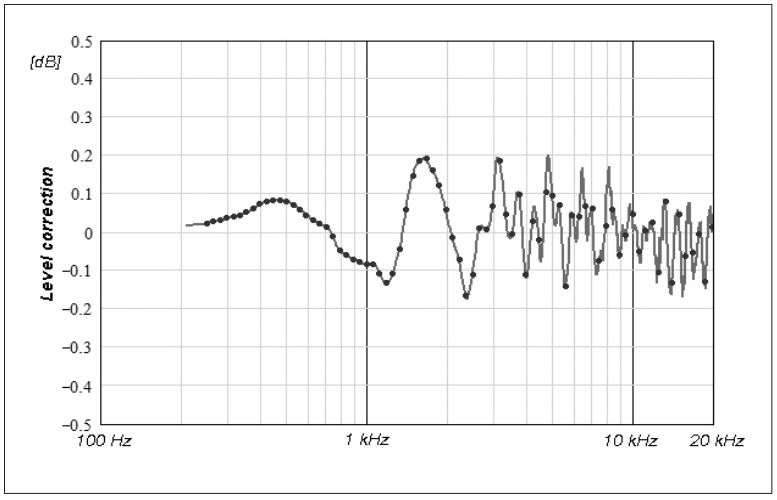
Nor131 (Hor)

Nor131 directional response, measured in the horizontal plane through the centre of the microphone. 0 ° corresponds to sound approaching the microphone from the front along the axis of symmetry. The instrument display faces upwards.



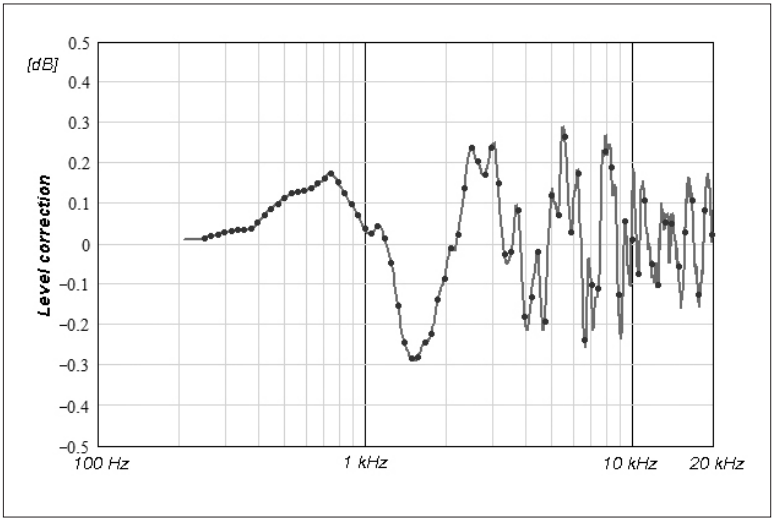
Nor131 (Vert)

Nor131 directional response, measured in the vertical plane through the centre of the microphone. 0 ° corresponds to sound approaching the microphone from the front along the axis of symmetry. The instrument display faces upwards.



Case reflections for Nor 131 for sound approaching the microphone from the front along the axis of symmetry. The diagram shows the level difference between the response for the microphone-preamplifier alone (extension cable) and when mounted on the instrument

Case reflections for Nor 132 for sound approaching the microphone from the front along the axis of symmetry. The diagram shows the level difference between the response for the microphone-preamplifier alone and when mounted on the instrument.



Analogue output

The analogue output is a reproduction of the digitized input signal from the microphone (or input connector) obtained by a digital to analogue converter.
Output voltage: Full scale on the display corresponds to 100 mV.
Output impedance: The loading impedance shall be 16 ohm or greater. The output is short-circuit proof to GND**.**
Gain accuracy at 1 kHz: ±0.2 dB.
Frequency response re. 1 kHz:
±0.5 dB for 20 Hz < f < 16 kHz.

USB port

USB type1.1

Data storage

Measured data is stored in the internal memory of the sound level meter. The memory is of the "flash" type retaining the information without battery supply. Approximately 5 Mbyte is available for the data storage. This corresponds more than 10000 measurement for sound level meters without octave analysis and more than 2500 for sound level meters with octave analysis.

Environmental conditions

Reference conditions. The reference conditions for the instrument are as specified by IEC 61672-1
Temperature: 23°C
Humidity: 50% RH
Atmospheric pressure: 101.325 kPa

Environmental condition for operation

Temperature: –10°C to +50°C
Humidity: 5% to 90% RH, dewpoint less than 40°C
Atmospheric pressure: 85 kPa to 108 kPa

Environmental condition for storage

Temperature: –30°C to +60°C
Humidity: 5% to 90% RH, dewpoint less than 40°C
Atmospheric pressure: 50 kPa to 108 kPa

Warm-up time

The warm-up time for the main instrument is very short and the instrument obtains the stated accuracy as soon as the self-test is made (20 sec). Before a re-calibration is attempted, at least two minutes for warm-up is recommended.

Sensitivity for vibration

If the instrument is used under strong vibrational conditions, it is recommended to use an extension cable between the preamplifier and the instrument body (Nor131). The vibration will mainly affect the microphone, which is most sensitive if the vibration is applied perpendicular to the diaphragm. Typical values are 55 dB to 65 dB for acceleration values of 1 ms^{-2} perpendicular to the diaphragm.

Sensitivity for magnetic fields

The maximum indication for exposure to magnetic field of 80 A/m and any orientation is typically less than 20 dB.

Size and weight

Depth: 29 mm
Width: 74 mm
Length, excl. microphone/preamplifier: 215 mm
Length, incl. microphone/preamplifier: 305 mm
Weight incl. batteries: 380 g

Information for conformance testing

Reference Sound Pressure Level: 114.0 dB re 20 µPa. The reference frequency is 1000 Hz.

Reference Level Range: The instrument has one level range only.

Microphone Reference Point and Direction: The microphone reference point is the geometric centre of the diaphragm of the microphone. The microphone reference direction is from the microphone and along the axis of rotational symmetry for the microphone and preamplifier.

Battery voltage: The instrument will automatically switch off if the battery or external voltage is too low for operation within the stated specifications. The max. battery voltage for conformance testing is 4 ×1.6 V = 6.4 V.

Electromagnetic Compatibility: When the instrument is tested for conformance to electromagnetic compatibility requirements, the instrument should be in the measurement mode, as this normally will generate the highest levels of emissions. The highest susceptibility is normally observed when the display faces the principal direction of propagation for the electromagnetic field.

Norsonic

Declaration of Conformity

We, NORSONIC AS, GUNNERSBRÅTAN 2, N-3408 TRANBY, NORWAY, declare under our sole responsibility that the product:

Sound Level Meter / Real Time Analyser Nor131 and Nor132

to which this declaration relates, is in conformity with the following standards or other normative documents

Standards:

IEC61672-1 CLASS 1[1] OR 2[2]
IEC 60651 TYPE 1[1] OR 2[2]
IEC 60804 TYPE 1[1] OR 2[2]
IEC 61260 CLASS 1
ANSI S 1.4 1983 TYPE 1[1] OR 2[2]
ANSI S 1.43 1997 CLASS 1[1] OR 2[2]
ANSI S1.11-2004 CLASS1[1] OR 2[2]
EN 61010-1: FEBRUARY 2001

Note: 1: Nor131
2: Nor132

following the provisions of the EMC-DIRECTIVE.

This product has been manufactured in compliance with the provisions of the relevant internal Norsonic production standards. All our products are tested individually before they leave the factory. Calibrated equipment – traceable to national and international standards – has been used to carry out these tests.

During the RF emission test the following was connected: USB cable (1m), mains adapter NOR 340, microphone preamplifier NOR 1207 and microphone NOR 1228. Setup: Measurement duration 1h, Frequency mode parallel; 1/1 octave, 2nd network Z.

During the RF immunity test the following was connected: USB cable (1m), microphone preamplifier, NOR 1207 and microphone NOR 1228. Setup: Frequency mode parallel; 1/1 octave, 2nd network Z. Orientation: Laying face up on the table and the microphone was pointing towards the antenna.

During the AC power frequency field test the following was connected: microphone preamplifier NOR 1207 and microphone NOR 1228. Setup: Frequency mode parallel; 1/1 octave, 2nd network Z.

The orientation of the instrument in the magnetic field had no influence. During the ESD test the SPL value may show some fluctuations from the ESD pulse. Power supply: Battery voltage 4-6.4V. External DC voltage 11-16V.

This Declaration of Conformity does not affect our warranty obligations.

Tranby, April 2005

Dagfinn Jahr
Quality Manager

The declaration of conformity is given according to EN 45014 and ISO/IEC GUIDE 22.

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Norsonic AS supplies a complete range of instrumentation for acoustics – from sound calibrators, microphones and preamplifiers; via small handheld sound level meters to advanced, yet portable, real time analysers, but also building acoustics analysers and complete community, industry and airport noise monitoring systems. Contact your local representative or the factory for information on our complete range of instrumentation.