

IEC 60268-16 rev. 4

IEC 61672 Class 2 / ANSI S1.4 Type 2



Bedrock SM50

Operating manual



Contact information and support

The Bedrock SM50 is designed and manufactured by Embedded Acoustics BV in the Netherlands, by the very team that originally developed the Speech Transmission Index.

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Updates of the system's firmware and documentation are released online :

www.bedrock-audio.com

NOTE: Screenshots and product pictures shown in this manual correspond to the SM50 hardware platform 1.0 running firmware version 1.2. Once you update the firmware, the screenshots may not fully correspond to what is being displayed on your device's screen.

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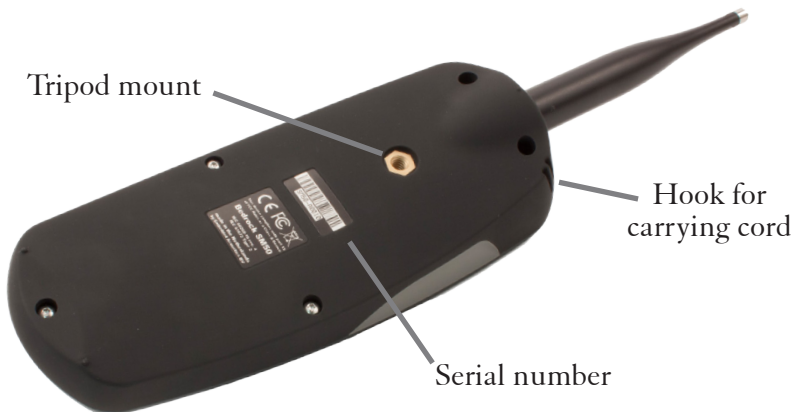
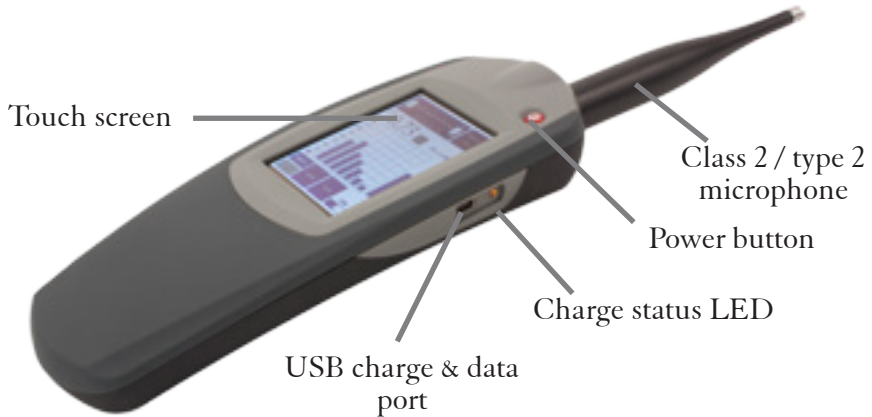
Contents

Contact information and support	2
1. Introduction	4
2. General use and safety precautions	5
Safety precautions when charging	5
Safety precautions related to connectors	6
3. Getting started	7
4. Using the SM50	8
Quick STIPA	8
STIPA pro	11
SPL meter	14
Real-Time Analyzer (RTA)	17
Settings	19
Calibration	22
Status	24
Accessing saved measurements from a PC	24
5. Power and charging	26
Charging instructions	26
Power saving recommendations	27
Use of power banks and external battery packs	27
6. Cleaning, maintenance and calibration	28
Battery disposal	28
7. Product warranty	29
8. Firmware updates	31
9. Technical specifications	32
10. Troubleshooting	33
EC declaration of conformity	34

1. Introduction

Congratulations on purchasing the Bedrock SM50 STIPAmeter, the most advanced instrument for measuring the Speech Transmission Index ever built, designed and manufactured by the inventors of STIPA. The SM50 is also a fully compliant Class 2 / Type 2 Sound Pressure Level meter and a 1/1 and 1/3 octave Real-Time Analyzer.

Using the SM50 is quite easy, thanks to its touch-screen operation and intuitive menu structure. Most users will get the hang of doing measurements with the SM50 without spending much time with this manual. Nonetheless, we strongly recommend that you do read through this manual before starting to use your SM50, in order to get acquainted with the various features of the device and the procedures for charging and maintaining your device. With a little care, you can expect years and years of reliable and trouble-free operation from the SM50.



2. General use and safety precautions

The SM50 is a sophisticated electronic measuring instrument that should be used, maintained and stored with care:

- We recommend that you always use a lanyard to secure your device against dropping, by suspending it around your neck or wrist. If you use a tripod to mount the device during measurements, we recommend that you use a sturdy model with a sufficiently wide base.
- Do not expose the device itself, the measuring microphone or charger to rain, moisture or liquids of any kind. Take special care to prevent liquids to permeate into the device through the connectors or along the display bezel.
- Do not operate at ambient temperatures over 35°C/95F
- Do not use close to flames or open fire.
- Do not use in environments where flammable or explosive materials are used.
- Do not keep the device powered on while unattended for prolonged periods of time.
- Use the charger only with the international adapter suitable for your region.
- Make sure that the device is switched off before transportation and storage.
- During transportation and storage, keep the device in a suitable casing or container – preferably its original case. The device needs to be protected from shocks and vibration (due to transportation or falling), excessive temperatures, liquids and moisture, and any other external conditions that could do damage to the device. Care should be taken that other objects cannot come into direct contact with the display during transportation.

Safety precautions when charging

The SM50 is a battery-powered rechargeable device, with an internal low self-discharge NiMH battery pack. This battery pack is designed for many years of operation, and therefore cannot be swapped out by the user. Recharging takes place through the mini USB connector found on the left side of the device.



The SM50 is charged through the USB connector using high currents of up to 1500 mA. While being charged, the device will heat up. **DO NOT CHARGE THE DEVICE WHILE IT IS INSIDE A CLOSED CONTAINER (BOX, BRIEFCASE, ETC.).** Please make sure that the device can shed excess heat while charging.



The supplied charger includes adapters for use worldwide, and operates on a wide AC-voltage range of 100 – 240V. Do not use the charger if the casing appears cracked or broken, or if it has been exposed to fluids or moisture. Contact with components inside the charger while this is plugged in may result in serious injury or death.

Safety precautions related to connectors



The SM50 features a USB connector and an XLR connector (to which the microphone is attached). If you connect external devices to these connectors, please ensure that these connections are protected against overvoltage and power surges. The voltage supplied to the USB port should not exceed 5.5V. As the USB power circuitry is connected to the battery pack, excessive voltage applied to the USB port may cause the battery pack to catch fire or explode.



The XLR connector supplies 48V phantom power to the microphone. This phantom voltage can be switched on and off through the hardware settings menu. **IMPORTANT:** connecting equipment not designed for 48V phantom power to the SM50 XLR connector (with phantom power switched on) will permanently damage the connected device and/or the SM50. The manufacturer explicitly denounces responsibility for any damages to third-party hardware resulting from exposure to the SM50's phantom power.

3. Getting started

You should receive your SM50 with sufficiently charged batteries to start the device and get acquainted with its features. We do recommend that you fully charge the device using the supplied charger before starting your first real measurement session.

First of all, connect the microphone to the instrument using the XLR connector at the top of the device. Next, the device is powered on by pressing the red power button once.

Note: the power button can also be used to power the device off. If you press the button while the device is in operation, you will see a dialog window asking confirmation before powering off. If the power button is kept pressed for 10 seconds in the “power on” state, the device will be forced into the “off” condition. This can be used to reset the device if it becomes unresponsive (keep pressed to 10 seconds to switch off, then press again to restart).

The SM50 will boot into the main menu. You can launch its different modules from this menu.



STIPA pro: app that gives you access to all STI measurement details

Quick STIPA: simple app to quickly do STIPA measurements

SPL meter: Sound Pressure Level meter app

Settings: change the system’s hardware configuration

Calibration: calibrate the SM50 and its microphone

Status: general information on the measurement system

RTA: Real-time analyzer

All modules will be explained in detail in the following sections of this manual. Apart from these modules, the SM50 has two specific operating modes: charging via USB, and data transfer via USB. These modes will also be explained further on in this manual.

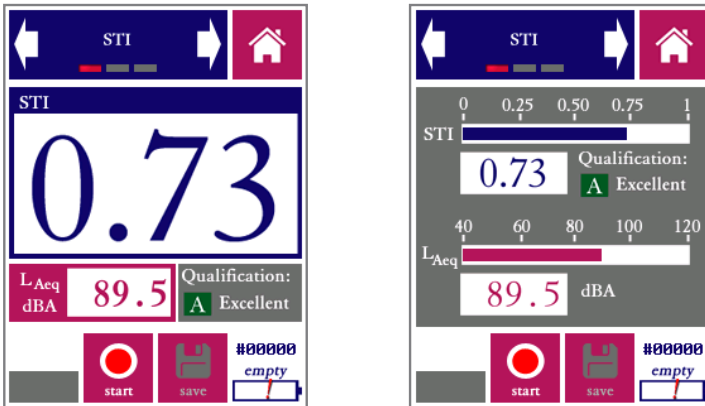
4. Using the SM50

Quick STIPA

The Quick STIPA module is intended to do simple and straightforward STI measurements using the STIPA test signal. A comprehensive explanation of the STI method is beyond the scope of this device manual; there are several online and offline resources that provide guidance and information on doing STI measurements. In this manual, we will briefly explain how to set up your equipment for measuring the STI. The Quick STIPA module makes the process as simple as possible.

For any STI measurement, you need a source of the STIPA test signal as well as an STI analyzer. In your case, the analyzer is your SM50. What the signal source is, depends on what kind of measurement you aim to carry out.

The Embedded Acoustics reference STIPA test signal is included with the SM50 (on a USB flash drive) and can also be downloaded from the Bedrock website, free of charge. This is a fully IEC-60268-16 rev.4 compliant test signal, compatible with all STIPA meters that conform with the standard.



Measurement screen of the Quick STIPA module, in digit mode (left) and bar mode (right)

In order to carry out an STI measurement, complete the following steps:

- Power on your SM50 and go to Quick STIPA
- Now start playback of the STIPA test signal through the channel or system which you intend to test. Note that the STI that you will now measure, will characterize all parts of your transmission path, from playback device up to the microphone of your SM50.

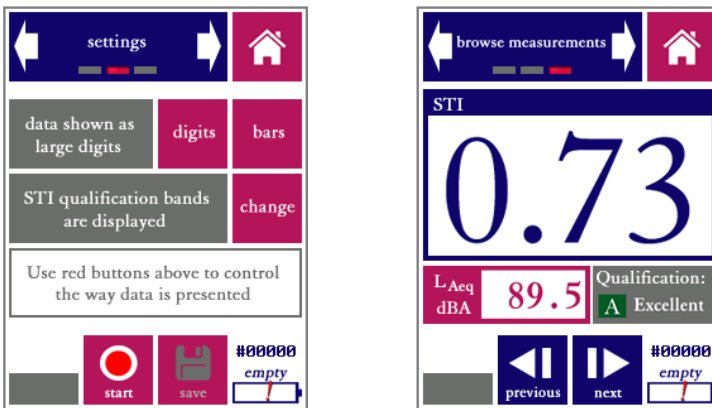
- Tap “Start” on the SM50
- Wait for 25 seconds while the measurement takes place. Make sure that signal playback is not interrupted, and that the acoustic environment is stable and free from impulsive sounds (such as door slams).
- You will see that the STI on your screen stabilizing towards its end value.
- Optionally, you can press “save” once the measurement is finished to store the data, to be browsed or downloaded to PC later. A measurement number is assigned to each saved measurement. This number is displayed at the bottom right of the screen (preceded by a “#” character), above the battery indicator.

That is really the entire procedure. If you are new to STIPA measurements, please consult tutorials and standards to make informed decisions about the STIPA signal playback level, measuring positions, number of repeated measurements, etc.

The Quick STIPA module also shows some additional measurement information:

- The A-weighted sound pressure level
- The qualification band (a letter between A and U) that is used in some standards and defined in IEC 60268-16 rev. 4.
- A label (“bad”-“excellent”) the characterizes intelligibility based on the STI

The arrows in the blue bar on the top of the display can be used to navigate through the different screens for each module. The Quick STIPA module has three screens: “STI”, “settings”, and “browse measurements”.



“Settings” screen and “browse measurements” screen. The latter screen is nearly identical to the STI measurement screen, but with previous/back buttons instead of start/stop and save buttons.

The “settings” screen give you some options to control the appearance of your measurement results:

- Choose between presentation of the STI in large digits or as a bar plot
- Choose whether or not you want to see the qualification bands displayed

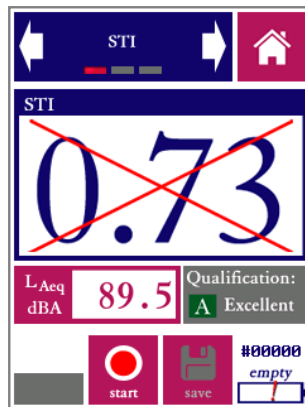
The “browse measurements” screen allows you to review earlier (saved) measurements without having to download your data to a PC first.

- Use the blue buttons at the bottom of the screen to scroll back and forth through your saved measurements.
- Note that the measurement number displayed above the battery indicator corresponds to the measurement currently shown on the screen.

Interpreting larger numbers of STIPA measurements by using the “browse measurements” screen will be inefficient; we recommend downloading the data to a PC for this.

Please take note of the following features of the Quick STIPA module:

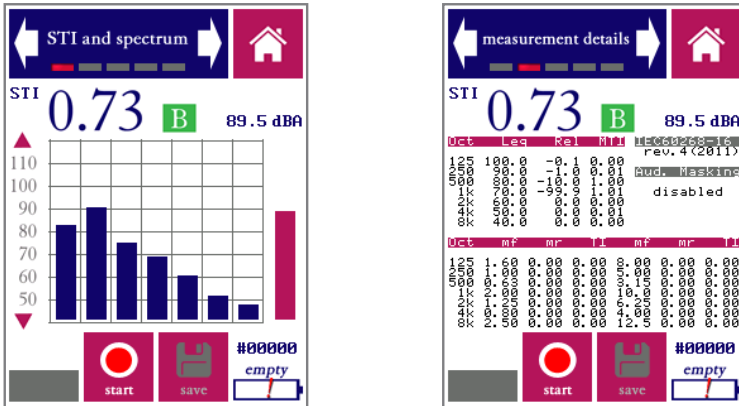
- On the bottom left of the screen, a red “recording dot” is displayed whenever a measurement is running. Below this red dot, the progress of the current measurement is indicated by a progress bar.
- The “save” button is only operational when new (unsaved) measurement data is available from a finished measurement. If this is not the case, the save icon is colored gray.
- The SM50 calculates a heuristic reliability metric for each STI measurement. If the measurement is found to be unreliable (e.g. due to disturbance by impulsive sounds), then a red cross is displayed across the STI value. Crossed-out STI values are often seen at the beginning of measurements, when the calculation has not ran long enough to compute a reliable STI. As soon as the cross disappears, the STI value can be trusted to be within the usual STI measurement error of 0.03.



A crossed-out STI value means that the measurement is not (yet) sufficiently reliable

STIPA pro

The STIPA pro module is also used to measure the Speech Transmission Index, but unlike the quick STIPA module, it also comprises features that allow you to analyse and manipulate your measurement data in greater detail.



“STI and spectrum” and “measurement details” screen in the STIPA pro module

The STIPA pro module has five screens:

- STI and spectrum:** display measured STI, octave spectrum and dB level
- Measurement details:** display all measurement details including the MTF
- Settings:** configure the STIPA pro module.
- Additive noise:** enter and enable/disable a noise spectrum to add to data
- Browse measurements:** review saved measurements

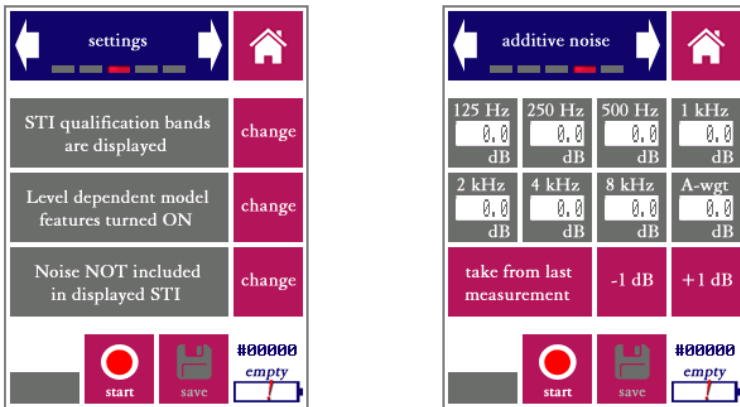
Measurements are usually started from the “STI and spectrum” or the “measurement details” screen. STI measurements are set up and started in the same way as when using the Quick STIPA module (see above). However, in the STIPA pro module, more details about the measurement are shown, and the user has more elaborate options to configure the measurement. Measurements are started, stopped and saved in the same way as with the Quick STIPA module (by using the buttons at the bottom of the screen).

The “STI and spectrum” screen shows not only the current STI value and the A-weighted sound pressure level, but it also shows an octave band spectrum of the measured signal in the 7 octave bands from 125 Hz to 8 kHz. The STI analysis is carried out in these octave bands. The scale of the octave band spectrum plot can be modified by tapping on the triangular arrows to the left of the plot.

The “measurement details” screen shows all the diagnostic details of an individual STI measurement:

- OCT: The octave center frequency (Hz)
- REL: The octave band levels relative to the STIPA signal spectrum (this is effectively the frequency transfer function of the tested channel in octaves).
- MTI: Modulation Transfer Index. This quantifies the contribution to the overall STI from each octave band.
- mr: the m-values (modulation transfer function in octave band OCT for modulation frequency mf). These m-values are uncorrected, not adjusted for masking effects and additive noise. Since the STIPA signal features two modulation frequencies per octave band, there are also two m-values per octave band. The modulation frequencies are also shown (mf)
- TI: the Transmission Index per octave band for each modulation frequency

These measurement details will enable more experienced operators to determine not only the speech intelligibility of the tested channel, but also the *causes* of intelligibility reduction induced by the channel.



Settings screen (left) and additive noise screen (right)

The settings screen gives the user three options:

- Choose whether or not to display STI qualification bands (A-U) as standardized in IEC-60268-16. These bands are used in certain applications.
- Choose to enable or disable the level dependent model features: level-dependent masking and the speech reception threshold. *For standard measurements, these features should be turned ON.* Only when all-electric transmission chains are tested (without any acoustics involved) should these features be turned off, since there is no acoustic level reference in those cases.
- Choose whether or not to (computationally) add noise to the measurement.

There are two ways to include the influence of background noise in your STI measurement:

- Simply do your measurement in the actual noise environment. The STI method is designed to incorporate the effects of any noise present during the measurement representatively in the measured STI. This approach works well if the noise field is stable and free from fluctuating and impulsive components.
- If you have the option to physically “turn the noise off,” then it is often more accurate to add the noise computationally in a so-called post-hoc calculation. The SM50 does this for you, if you enter the noise spectrum in the “additive noise” screen and change the setting to “Noise included in displayed STI.”

If you wish to add noise computationally, the screen “additive noise” should be used to enter the noise spectrum. Note that the noise spectrum that you enter is only used if you also select the corresponding option in the settings menu.

You can browse through all measurements saved earlier in the “browse measurements” screen.

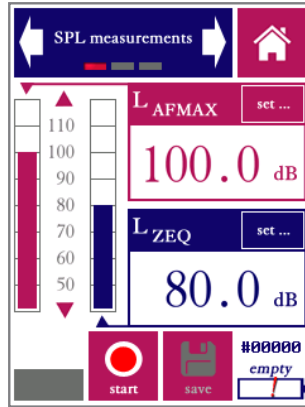
The following tips and pointers may be useful to remember when browsing STI measurements with Quick STIPA and STIPA Pro:

- Measurements saved in Quick STIPA can be browsed in STIPA pro, and vice versa. The measurement numbering range is shared between these modules. This means that you can use STIPA pro to investigate measurements done with Quick STIPA in more detail using the browsing screen in STIPA pro.
- The settings you choose in STIPA pro (additive noise, level dependent masking) affect the current measurement, but also affect which data is shown in the measurement browser. This means that you can always enter a noise spectrum and see how this affects measurements you did earlier on. Similarly, you can go back later on and see what affect level dependent masking has for a certain measurement.
- This implies that all data for each measurement is always saved - including any data not actually shown during the measurement itself.
- Measurements can also be retrieved over USB; please refer to the section “accessing saved measurements on a PC” for further instructions. For larger numbers of measurements, processing of these saved data files (e.g. through worksheet software) may be more efficient than inspection through the measurement browser.

SPL meter

The SM50 is also Sound Pressure Level meter (also known as SPL meter or SLM) that complies with IEC 61672 Class 2 and ANSI S1.4 Type 2. In fact, the SM50 electronics far exceed the requirements for a Class 2/Type 2 device.

The layout and buttons of the SPL meter module are similar to the STIPA modules, featuring three screens: SPL measurements, settings and browse measurements.



SPL measurements screen

The following sound pressure level measurement settings are supported:

- Time weighting: Fast (F) and Slow (S)
- Frequency weighting: Z (linear, unweighted), A-weighted, C-weighted
- Max hold (holds and displays the maximum level during the measurement interval; used with either Fast or Slow time weighting)
- Equivalent continuous (EQ): computes the time-integrated level over the measurement interval; the level shown corresponds to the level of a continuous signal containing the same amount of energy as the measured signal.

Once a measurement has started, each combination of the above settings is measured simultaneously. However, not all of these combinations are displayed: only two level measurements are displayed at the same time.

Each of these two levels is shown in its own bar graph and its own digit field. The red graph corresponds to the red field, the blue bar graph to the blue field. You are free to select which level to display in each of the two fields. Tap the “set” button in the level field to choose time weighting, frequency weighting, max hold and time integration settings for the corresponding field.

The SM50 will warn you if the signal level is outside the linear range of the microphone. This occurs if the signal level is too low in comparison to the noise floor of the microphone (underrange) or if it approaches the maximum acoustic level that the microphone can handle (overload). Both types of range warnings are shown as a yellow warning label (exclamation point) next to the corresponding measurement value.



Range warnings (yellow labels with exclamation points) are shown in both level fields if the signal level is either too low (such as in this example) or too high.



The limiting factor for the overall dynamic range of the measuring system is usually the microphone. If the standard microphone is replaced by a microphone of a different type, the displayed overload and underrange warnings may not be reliable. Please check the Bedrock audio online support pages to find out for which microphone types (besides the standard microphone) range warnings are supported. If you replace the microphone, it may be necessary to patch the system firmware with a specific update package.

For MAX and EQ measurements, the range warnings will be displayed from the moment the underrange or overload condition occurs until the measurement is restarted. For FAST and SLOW measurements, the range warning will disappear once the overload/underrange condition has passed.

The settings screen in the SPL module allows you to set the measurement time. Once you press start, the measurement will run for as many seconds as you choose here. You may also choose to let measurements run continuously; you then determine the measurement time manually, by choosing the moment you press “stop.”

The SPL meter module also features a measurement browser, that lets you review previously saved sound pressure level measurements. Note that the measurement browser will not display FAST or SLOW values, only MAX and EQ. The reason for this is that FAST and SLOW values are fluctuating measures; these are not single values characterizing the measuring interval corresponding to any measurement number, and therefore cannot be displayed except in real-time, during the measurement itself.

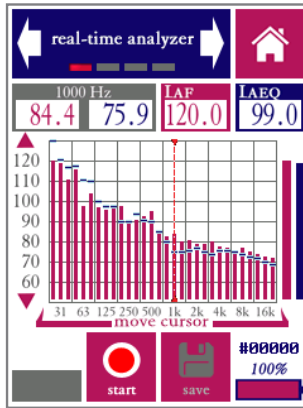
A few things to note about SPL measurements and the SPL meter module:

- By definition, “max hold” and “EQ” are mutually exclusive settings.
- The elapsed measurement time is shown above the progress bar. If the measurement interval is set to “continuous,” the measurement will run until it is manually stopped. The progress bar itself is not used when measuring continuously.
- When you press “save,” data from the current measurement is stored. Results based on all time and frequency weightings supported by the module are saved; not just the results that are currently displayed. However, as remarked above, since the instantaneous levels fluctuate throughout the measurement, these cannot be saved as a single number representing the entire measurement interval. So for each saved measurement, just the maximum level (max hold) and equivalent continuous level (EQ) are saved.
- As a logical consequence, the measurement browser can only display Max Hold and EQ results from earlier measurements. If you set a display field to show instantaneous values, the measurement browser will leave this display field blank.
- You can use the measurement browser to look go back to earlier measurements, and see what the level is with different time- and frequency weightings applied.
- The measurement number series used for SPL measurement is separate from the STIPA measurement numbers. An SPL measurement and a STIPA measurement can have the same number, without data being overwritten.

Real-Time Analyzer (RTA)

The RTA module has two main modes of operation: as a 1/1 octave band analyzer (spanning the octave bands from 31 Hz to 16 kHz) and as a 1/3 octave band analyzer (25 Hz through 20 kHz).

The operation is generally similar to the SPL module, but instead of just the overall signal level, a frequency analysis (into 1/1 or 1/3 octave bands) is also shown.



RTA main measurement screen (1/3 octave band mode)

The RTA app has the ability to present two different spectral views at the same time, differing in frequency weighting (A, C or Z) and time averaging and integration (FAST, SLOW, MAX, or EQ). The main spectrum is presented in red bars, while a second (auxiliary) spectrum is shown in blue lines. The corresponding broadband levels are also shown, to the right of the spectrum.

While the spectrum graph already gives a first impression of the spectral content of the measured signal, you may wish to read the exact value in each band. This is done by placing the cursor (dashed line) over the band of interest. The cursor can be moved left and right by pressing on the left or right side of the frequency axis (or the area of the graph above the axis). The values for the selected band are shown in the grey field on the top left of the screen (main weighting shown in red, aux weighting in blue - same color as the spectrum bars).

The “measuring time” screen can be used to set the duration of a measurement to a fixed value. The measurement can also be set to run until stopped manually. The “settings” screen allows you to switch between 1/1 and 1/3 octave band resolution, and to change the weightings for the main and auxiliary spectrum views.

By pressing the “save” button in the main measurement screen, you store the current measurement on the device's internal storage, using the measurement number indicated above the battery indicator.

Some remarks about the RTA module:

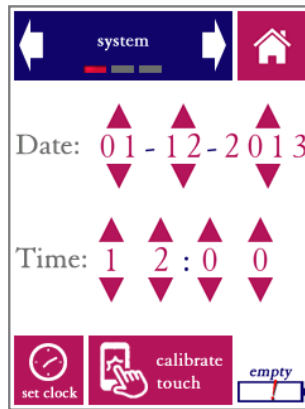
- By definition, “max hold” and “EQ” are mutually exclusive settings.
- The elapsed measurement time is shown above the progress bar. If the measurement interval is set to “continuous,” the measurement will run until it is manually stopped. The progress bar itself is not used when measuring continuously.
- Measurements saved as 1/1 octave cannot be retrieved as 1/3 or vice versa. However, data recalled through the measurement browser are shown with the frequency weightings selected at the time the measurement is recalled - even if these are different from the settings that were in effect during the measurement. This allows you to inspect the effect of frequency weightings on all measurements saved previously.
- Note that the spectrum and its corresponding broadband level are affected by the same time- and frequency weightings. In other words, if the main spectrum is A-weighted, then the level shown in the red field is also A-weighted (and vice versa). If you wish to display a Z-weighted spectrum and an A-weighted level at the same time, you need to display these in different channels (main and aux).
- Note that the measurement number range for the RTA results is separate from the SPL and STI measurement number range.

Settings

The settings app will allow you to configure the generic settings of the device, in addition to the module-specific settings found in each module. The following attributes can be set:

- Time and date
- Time interval before the backlight automatically switches off to save power
- Brightness of the display (*only on specific versions of the SM50*)
- Phantom power to the microphone
- Microphone pre-amplifier gain
- Calibration of the touch screen digitizer

The system date and time are changed by means of the arrows (up/down). Remember that you changes are not applied until you press “set clock.”



Date and time in the settings module

The SM50 has an internal real-time clock that keeps running even when the device is powered off. The clock needs to be adjusted if the battery has been depleted completely, for instance when the device has not been used for a very long time. The system date and time are used for time-stamping the saved data. If you download measurement data over USB, the file creation date/time are only accurate if the internal real-time clock of the SM50 was updated to the right date and time.

Press the “calibrate touch” button if the response of the touch screen appears to be inaccurate. Calibration takes place by pressing exactly on the indicated marks near the corners of the screen.



We strongly recommend that you use a stylus for calibration, to obtain calibration settings that are as accurate as possible. Not that false responses during the calibration procedure (tapping completely in the wrong place) may render the touch screen unusable.

From the “microphone” screen, the 48V phantom power can be switched on and off. If the SM50 is used with its own (bundled) microphone, phantom power should be switched on. Turn the phantom power off when measuring (line) levels from external electronic devices.



IMPORTANT: connecting equipment not designed for 48V phantom power to the SM50 XLR connector (with phantom power switched on) will permanently damage the connected device. Use this setting with discretion. When in doubt, turn the phantom power off.



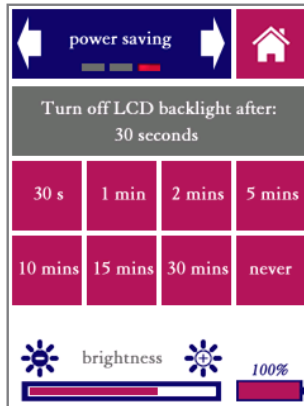
Microphone pre-amp settings

The internal microphone amplifier of the SM50 features an adjustable gain setting. Adjustment of the pre-amp gain is hardly ever necessary, since the system has a very wide (linear) dynamic range of 130 dB. However, if you wish to connect an external signal source which operates at much higher signal levels than the SM50 microphone, you can choose adjust the pre-amp gain, by choosing between 0 dB and +20 dB (default). Note that recalibration may be needed when changing. With the standard microphone, this setting should be +20 dB.

You can also set the backlight to automatically switch off if the touch screen has not been touched for a while. This time-out can be set between 30 seconds and 30 minutes, or the backlight can be set to never turn off at all.



The backlight time-out option saves a considerable amount of battery power. But keep in mind that it will cause the screen to black out *without turning the device off*. Don't forget to turn the device off when you finish working with the device; the fact that the screen is dark does not necessarily mean that the device is turned off. If the LED next to the USB port burns, then the device is still turned on. To turn the backlight back on again if a backlight time-out has occurred, press the power button. The touch screen will not respond to presses while the backlight is turned off, but measurements will continue to run whether the backlight is on or off.



Power saving settings. Note that backlight brightness can only be set on hardware devices with serial numbers starting with SM50B.

With some versions of the SM50, the brightness of the backlight can be adjusted. This gives you the option to save power when using the device in conditions with low ambient light levels (indoors). Only devices with serial numbers starting with SM50B support this setting. The brightness controls as shown in the above picture will not be displayed with other hardware versions.

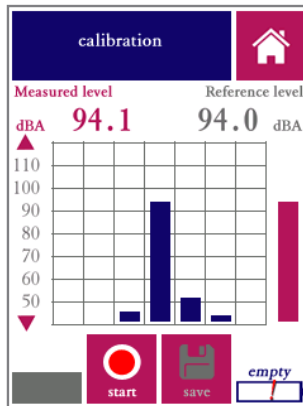
Calibration

The SM50, the instrument itself as well as the microphone, is calibrated before leaving the factory. A calibration certificate is included with the device. However, it is recommended that you carry out your own “user calibrations” from time to time, especially under the following conditions:

- You are using the device in temperatures considerably above or below room temperature
- You are planning to use the device again after a prolonged period of storage
- You are planning to do measurements for which a high degree of accuracy is required, e.g. certification measurements

Compact calibrators (with Class 2 / Type 2 compliance) are available from a number of vendors. These calibrators generate a test tone which is adaptively adjusted to a fixed, accurately known signal level (usually 94.0 dB). This makes calibration relatively easy: insert the microphone tip into the port of the calibrator, using an adapter with suitable dimensions for the microphone tip (1/4" / 7mm). The device should now measure the nominal signal level produced by the calibrator.

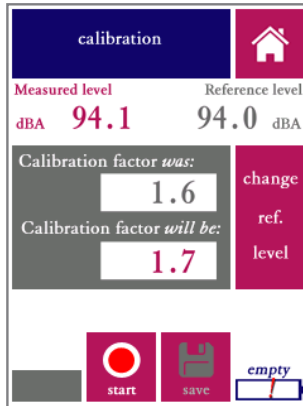
The SM50 is easily calibrated with any stable sound source of a known reference level. This can be a calibrator, but a steady sound field (the level of which is measured by another, calibrated, SPL meter) will also work. Please refer to the Bedrock audio website for information on recommended types of calibrators.



Calibration module while measuring a 1 kHz calibration tone

For formal measurements, it is considered good practice to verify if calibration is needed at the beginning and end of every measuring session.

To start calibrating, apply the calibrator to the microphone, or place the microphone in a known sound field. The press “start.” Do not worry if the reference level shown is incorrect; you can change this after the measurement. An octave band spectrum will be shown while the equivalent-continuous A-weighted sound level is measured. Once this measurement is finished, the SM50 will show the results.



Calibration module showing calibration results.

The new calibration factor (sensitivity adjust) of the device is shown, as well as the original calibration factor as currently used in the device. The differences between the old and new value are typically small (less than 5 dB), unless you have connected a different signal source or microphone than the device is currently calibrated for.

The calibration factor is derived from the measured LAeq, as well as the reference level of your calibration signal source. You can now change the reference signal level; press the corresponding button on the right of the screen, and enter the correct value through the keypad that will appear on your screen. The calibration factor will be re-calculated.

If you are satisfied that the new calibration factor is correct, press save. Note that the new calibration settings only take effect once you press save.

We recommend that you verify your new calibration in the SPL meter app. Re-apply your calibration signal source, and check that the correct reference level is measured.



Once you press “save,” the measured calibration factor is committed permanently to the device’s non-volatile memory. This overrides earlier calibrations.

Status

System status information can be read using the status app. If you contact Embedded Acoustics for technical support, you may be asked to provide some of the information displayed here (such as the firmware version and hardware revision). The current capacity of the battery pack is also shown here, as well as the number of charge cycles to date.

The status app is not used to make changes to the system, but just to retrieve system information.

Accessing saved measurements from a PC

When you connect the SM50 to the USB port of a PC or Mac, a dialog window will appear on the SM50 asking if you wish to start data transfer. If the SM50 is powered off when you connect it through USB, it will power on automatically.

The SM50 will present itself to the USB host as a mass storage device. This allows you to access the internal file system of the SM50. You will see these directories/folders:

- Battery: battery status information
- Calibr: Calibration data
- SPL: SPL measurement results
- STIPA: STIPA measurement results
- RTA: RTA measurement results
- System: system files
- Updates: place update packages here to update the firmware upon reboot



IMPORTANT: you can access the SM50 system files so that you can easily backup and restore the device. However, keep in mind that some of the internal software of the SM50 is run directly from the files displayed here. If you remove or change any of these files, your SM50 will not work properly anymore.



Changes to files in the system folder may render the device inaccessible through USB, making it impossible to repair or update the system firmware through the normal procedure. The instrument may have to be returned to the factory to reinstall the firmware. *Please note that service necessary due to changes applied to files in the “system” folder is not covered by warranty.*

Instructions on how to perform firmware updates is given in the section 8 of this manual.

In order to process and analyze the results further, copy all results files from the SM50 to a local folder on your PC. If you leave the measurements on the SM50, then the SM50 will simply continue its measurement numbering series where it left off. If you remove the measurements, the SM50 will start over with measurement #1.

The measurement files are saved in .csv format. These files can be imported in almost all worksheet applications, such as Microsoft Excel. This will allow you to analyse the data further, and pre-process the data for the purpose of reporting.

Note that the .csv format is not a formal standard; differences in interpretation of the .csv file format exist even between different versions of MS Excel. This results in the fact that the output files from the SM50 may be imported very easily in some versions of Excel, and may require more attention in other versions of Excel. If you are having problems importing the output files into Excel, import the files as “text files” rather than .csv. It may help to rename the files to another extension than .csv (e.g. .txt).

5. Power and charging

Charging instructions

We recommend that you charge your SM50 only with the USB charger and the USB cable supplied with the instrument. Alternatively, you can charge the device through any external USB wall charger (“wall wart”) with a charge current of 1500 mA or higher. Some PCs allow increased charge currents to be drawn from their USB ports (sometimes through special ports marked “Boost” or “Charge”). These can then also be used to charge the instrument.



Note: the instrument will NOT charge from a standard USB port on a PC or Mac. The current supplied through a computer USB port is normally insufficient to charge the device. The fact that the device may be powered from such a USB port does not necessarily imply that there is sufficient current left to also charge the battery.

The SM50 has internal charge circuitry that optimizes your charge time while safeguarding the life span of your battery pack. If you are not using the SM50 for a prolonged period, you can safely keep the SM50 connected to a charger.

A few charging tips:

- A LED next to the USB shows the charge status. While blinking (alternating between green and orange), the battery is still charging. The LED burns constant green as soon as the battery is full.
- If you find, over time, that the battery capacity is reduced significantly compared to its original capacity, we recommend that you fully discharge the batteries, and then fully recharge them. If necessary, this procedure may be repeated a few times.
- If the battery charge indicator appears to become inaccurate (e.g., the battery is drained quickly from the point that the indicator still shows 50% charge), it also helps to completely discharge and recharge the battery.
- It is normal for the total battery capacity to slowly decrease over time. After 500 charge/recharge cycles, the battery capacity is normally at 80% to 90% of its original capacity, depending on the way the device is used and recharged.
- If you start using the SM50 after a long period of storage, we recommend that you first top off the charge before using the instrument. You may also want to check if the date and time settings were preserved.

- It is not possible to charge the batteries while measuring. Once you connect the charger, the instrument will ask whether you want to go into charge mode or operate on external power. If you answer “external,” then the batteries will not be charged. The current from the charger *will* be used to power the instrument, so that the batteries are not depleted.
- We advise to use discretion when powering the instrument externally from an AC source while measuring. The instruments’ measuring electronics are highly sensitive; the digital charging circuitry may have an impact on the noise floor of the pre-amplifier and microphone, while noise and hum from the AC charger may also be inserted. Although the electronics have been protected against such sources of interference, we recommend that you verify that electronic noise does not affect the measurement.

Power saving recommendations

How long the device can be used on a single charge depends on the mode and intensity of use. Power conservation settings can be controlled from the device’s “hardware settings” menu. With its default settings, approximately 350 STIPA measurements can be carried out over the course of an 8 hour day without recharging.

Some ways to extend the battery life:

- Switch off the device when you do not plan to use it for a while
- Choose conservative power settings in the hardware menu. The LCD back-light is a considerable factor in the overall drain on the battery.
- Disable “pre-amp phantom power” if you use a microphone that does not need it.

Use of power banks and external battery packs

For very long measurement sessions, the battery capacity of the internal battery may be insufficient. If you cannot spare a few hours of recharge time in the middle of your session, we recommend that you use an external USB battery pack (aka power bank). Even though the device has been certified to comply with the applicable EMC standards, also when connected to an AC source, the signal quality is always slightly better when powered from batteries.

When you connect the SM50 to an external battery pack, a dialog will appear asking you whether you want to charge the device or operate on external power. We recommend that you do not recharge the internal battery from the power bank, so choose “external.” This way, all power will be supplied by the external power bank. The internal battery will not be charged, nor discharged, while measuring. **Note that the battery pack should have an output current rating of at least 1500 mA.**

6. Cleaning, maintenance and calibration

With normal use, no further maintenance is needed beyond normal cleaning periodic recalibration of the device. We recommend that you have the device checked and calibrated at our factory or at an external calibration specialist at least once every 2 years.

We recommend having the battery pack replaced after approx. 500 charge/recharge cycles.

We recommend that you clean the instrument with a soft cloth. LCD display cleaner can be used to clean the touch screen, provided that the following precautions are taken:

- Do not spray cleaner directly onto the display
- Only use cleaning liquids specifically intended for LCD screens

Battery disposal



The device contains an 4.8v rechargeable NiMH battery pack. At the end of the life cycle of this product, care should be taken to dispose of this battery pack responsibly, in compliance with rules and regulations for recycling of batteries that apply in your region. **MAKE SURE THAT THIS BATTERY PACK IS REMOVED BEFORE DISPOSING OF THE DEVICE.** If you are unable to remove the battery pack yourself (by unscrewing the back lid of the device), make sure that you mention the presence of an NiMH battery pack when hand in the entire device for recycling.

7. Product warranty

The device is covered by a full-service, worldwide pick-up & return warranty until 24 months after the date of purchase. Please direct all warranty claims to:

Embedded Acoustics BV
Molengraaffsingel 12
2629 JD DELFT
THE NETHERLANDS
warranty@bedrock-audio.com

Please email us and wait for our response (typically within a business day) before shipping your hardware back. We may ask you to fill out an RMA form, and we will supply you with a reference number for your warranty claim. If you can provide a complete statement of the problems you are experiencing, this will help us solve your hardware issues as soon as possible. Always provide the ID number of your device (found on the bar code label on the back of the device), your name and address, and your date of purchase. If you did not purchase directly from the Bedrock webshop, also include dated proof of your purchase.

In general, our warranty programme covers all defects except for those resulting from accidents, misuse (including improper electrical connections) and improper maintenance. The following is explicitly excluded from product warranty:

- Any damage resulting from dropping, falling or excess vibration
- Any damage done by liquids, including damage resulting from excessive use of screen cleaning liquids
- Any damage resulting from incorrect electric connections to the device through the USB and/or audio connectors
- Any damage done by power surges or overvoltage on the USB power supply and/or audio connector
- Any mechanical damages to the display caused by mechanical forces applied to the screen surface, such as scratches.
- Any damage resulting from attempted changes to the system firmware, included changes to the files in the “system” folder.
- Normal wear and tear

The following voids warranty:

- Repair attempts by an unauthorized party
- Replacement of battery packs by an unauthorized party
- Removal of product stickers, tamper proof seals, bar codes or serial numbers
- Attempts to install firmware from any other source than the manufacturer

Malfunctions that are found to result from any of the above conditions are not covered by warranty. Repairs will take place only at the expense of the owner. If claimed under warranty, an examination fee may be charged and transportation costs will be charged to the owner.

Please do not attempt to open your SM50 yourself, as there are no user-serviceable parts inside. If you do see a legitimate need to open the device yourself, please contact [warranty@bedrock-audio](mailto:warranty@bedrock-audio.com) first, so we can discuss preserving your warranty rights. Please be aware that the product is protected by tamper-proof seals.

A worldwide pick-up&return service is included in the warranty. This means that we will have the defective unit picked up at your location at no charge, provided that it is presented in its original equipment case, packed in a cardboard box with suitable cushioning material.

8. Firmware updates

Firmware updates are released through the website Bedrock-audio.com. Before updating your firmware, always check:

- If the update you downloaded is intended for your device type (the SM50)
- If you have sufficient battery charge to complete the update cycle without interruption

Interrupting the power supply during the update process may render your device unusable. If this happens, try to repeat the update procedure. If this does not work, or if you can no longer access the device through USB, please contact support@bedrock-audio.com.

Executing a firmware update is easy:

- Choose and download the correct firmware update package from www.bedrock-audio.com
- Connect the SM50 to any PC or Mac through USB
- When prompted on the LCD screen, choose “connect through USB”
- The SM50’s internal file system can now be accessed from your computer in the same way as any mass storage device
- Copy the firmware updated package to the folder named “updates”
- Now restart the SM50 using its power button

The firmware update procedure will automatically start. You will be able to see the progress of the update procedure (which may take between 3 and 30 minutes, depending on the size of the update package) on the LCD display.



Never interrupt the firmwate update procedure. Make sure that the SM50 is fully charged or connected to a stable power source before starting the update procedure.

Please be aware that the update procedure may take a significant amount of time, depending on the update package that you are installing.

9. Technical specifications

Functionality	Speech Transmission Index (STIPA) Octave band Real-Time Analyzer (in STIPA pro mode) Sound Pressure Level meter (A, Z, slow, fast, Leq) 1/3 and 1/1 RTA, FFT analyzer
Standards compliance	IEC 60268-16 rev. 4, IEC 61672 (class 2), ANSI S1.4 (type 2), IEC 61260 (class 0).
Acoustic	Effective noise floor: < 26 dB(A) Linear range: 30 -124 dB (with supplied microphone) Linear range, electric input: 22 - 125 dB
Microphone	Omnidirectional free-field microphone Flat frequency transfer (conforms with class 2 / type 2 requirements) 48V phantom powered 30 mV/Pa sensitivity
Display	Resistive LCD touch screen 320x240 pixels, 65k colors Luminance typ. 250 Cd/m ² Durability: 100k finger slides, 1M taps
Data storage	4 GB internal storage for data and firmware Accessible from PC through USB (mass storage mode)
Environmental	Temperature: 5 -35°C (41-95F) Relative humidity: 5% - 90% (non-condensing)
Power	NiMH battery pack 4.8V nominal, typ. 2200 mAh Typical battery lifetime > 4h Max. charge current 1.8A
Electromagnetic compatibility	Complies with EN 61326-1:2006 - EN 61326-1:2006 FCC part 15 compliant (class A device)
Mechanical specs	Size approx. 210 x 85 x 55 mm (excl. microphone) Weight 530 g (including microphone) Rear-mounted tripod adapter Hook for carrying cord
Bundled items	Carrying case, measuring instrument, class 2 microphone, USB charger, int. charger adapters (US, EU, UK,AU), USB charging/data cable, manual, carrying cord, USB flash drive with test signals

10. Troubleshooting

Problem	Possible cause	Solution
System does not power on after pressing power button	Battery empty	Connect wall charger for at least 30 minutes
System does not recharge after connecting through USB	Charge current too low	Use bundled wall charger and USB cable; standard PC USB ports do not supply enough current to charge
Display shows error messages (green text).	Error on display processor or in communication between DSP and display processor	If the problem persists, contact support.
Battery lifetime is too short	Battery not fully charged Battery is worn	Keep device on charger for at least 4 hours Have battery replaced after approx. 400 charge cycles
Battery indicator is inaccurate	Battery charge measurement system poorly calibrated (e.g. due to self-discharge after prolonged shelving)	Completely drain the battery, and then fully recharge. Repeat if necessary.
Device warms up during use	Lack of ventilation	Warming up of the device to temperatures of approx. 35C/95F is normal. If the device runs considerably hotter than that, check ventilation and contact support if the problem persists
Device not recognized by PC when connected through USB	Driver problem Device in measurement mode	Update PC drivers (SM50 is approached as a mass storage device) Select USB data transfer mode when dialog window appears on the SM50 screen
Display backlight turns off, no response to touch screen	Backlight time-out event	Adjust backlight time-out in power saving settings. Pressing power button turns the display back on
Device “hangs,” becomes unresponsive, or will not power up after resetting, and/or LED next to USB port burns red.	Internal software problem	Keep the power button pressed for 10s. This forces the device to shut down. Then press the power button again to restart. If the problem persists, contact support

EC Declaration of Conformity



We, Embedded Acoustics BV

(Supplier's name)

This Declaration of Conformity is suitable to the European

Standard EN 45014 *General Criteria for supplier's Declaration of Conformity.*

The basis for the criteria has been found in international documentation, particularly in ISO/IEC, Guide 22, 1982, *Information on manufacturer's Declaration of Conformity with standards or other technical specifications*

Molengraaffsingel
N/A Delft
N/A

(Supplier's address)

Declare under our sole responsibility that the product:

SM50
Bedrock SM50 STIPA meter

(Name, type or model, batch or serial number, possibly source and number of items)

To which this declaration relates is in conformity with European Harmonised Standards as published in:

Official Journal
of the EC, Issue: N/A

(Issue of publication of the list of harmonised standards)

The compliance of the product has been based on the following standards:

EN 61326:2006 [EMC - Emissions]
EN 61326:2006 [EMC - Immunity]

EUT is suitable to be applied in residential and light industrial environments.

(Title and or number and date of issue of the applied standard(s))

Following the provisions of the Directives (if applicable):

EMC-directive 2004/108/EC

20	13
Year of Introduction on the market	

(Reference of appropriate directive)

These conclusions are based on test reports:

Report number: 2316/SM50/EMC
ce-test, qualified testing bv
Kiotoweg 363 3047 BG Rotterdam

(Test report number, date and name of test house)

Delft, 2013-10-21

(Place and date of issue)

S. van Wijngaarden

(name of responsible for CE-marking)

(signature or responsible person)

