SONITUS
SYSTEMS

EM2030 Sound Level Monitor

User Guide

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1   The EM2030 Sound Level Monitor

This manual explains the operation of the EM2030 and the user interface for measurement configuration and data download. The user interface can also be used to calibrate the EM2030. Additionally, we provide a recommended installation procedure for permanent or semi-permanent deployments.

1.1   Monitor Description

The EM2030 is an automated sound level monitor, suitable for extended deployments where continuous measurement of sound levels is required.

Features

- Durable outdoor microphone
- Digital A-weighting and C-weighting filters
- Standalone operation
- Record L_{EQ}, L_{max} and multiple statistics at 1 - 30 minute intervals
- Up to 5 years of data storage
- Remote data transfer via GSM modem
- Wi-Fi connectivity for data download
- Simple user interface via web browser
- Rugged IP65 cast aluminium case
- Optional audio capture function
- Optional frequency analysis function

The EM2030 is designed for simplicity and ease of use. The main components of the unit are shown in Figure 1. The front panel of the EM2030 has two connectors, one for the 9V DC power supply and one for the microphone signal input. The external antennas boost the communications signals. If required, each of these communications signals can be boosted further by replacing the supplied antenna with one with a higher gain value.

1. Mains power connector
2. BNC microphone connector
3. Wi-Fi antenna
4. GSM antenna

Figure 1: EM2030 Sound Level Monitor

2   Installation

The EM2030 comprises a data processing and logging unit, an outdoor weatherproof microphone and a DC power supply. The processing unit is housed in a robust aluminium enclosure designed to IP65 standard. The microphone assembly includes a rain hat, windshield and bird-spike and when installed correctly provides full weather resistance for extended periods. The DC power supply is not weatherproof and should not be exposed to the elements. As such, it is recommended that the data processing unit and power supply be housed in a weatherproof cabinet or other similar enclosure.

2.1   EM2030 Installation

A typical long term installation consists of a free field microphone mounted at a distance not less than 1 metre from any façade or surface and at a height of approximately 4 metres above ground level. An example of a wall mounted microphone is shown in Figure 2. The microphone must be oriented in the vertical direction as shown. Ideally the microphone should be mounted in a free field position, away from any reflecting surfaces.
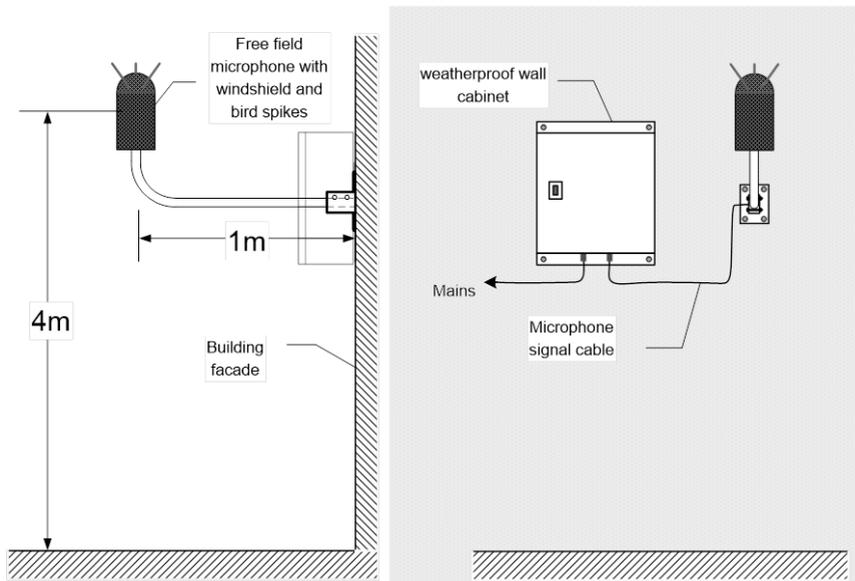
Figure 2: Typical long term EM2030 installation

2.2 Microphone installation

The microphone assembly must be mounted vertically in order to ensure full weather protection. Incorrect mounting of the microphone at an angle can result in damage to the microphone diaphragm.

2.3 Microphone Cabling

The microphone is connected to the sound level monitor instrumentation using 50 Ohm RG-174 signal cabling. It is recommended that the monitoring instrumentation shall not be located at a distance greater than 10 metres from the microphone. Microphone signal cable should not be laid in parallel to any mains cable or around high voltage sources such as transformers, fluorescent lighting etc. A separation distance of 50mm from other cabling is generally acceptable.

3   Operation

Once powered on, the unit will automatically begin logging sound levels. Results are calculated and logged at user defined intervals, synchronised to the internal clock.

The green LED light on the front of the EM2030 serves as a simple indicator of the boot sequence progress. Upon powering up, the following sequence should be observed:

1. When power is connected the light will come on for 3 seconds.
2. The light switches off while the software is initialised.
3. The light stays off until the next measurement epoch e.g. 5 minutes.
4. The light begins flashing indicating that data is being processed.

Once the unit is powered up and the green light is on or flashing it is possible to connect to the unit using the Wi-Fi interface.

3.1   Connecting to the Unit

The EM2030 has standard Wi-Fi communications capability and can communicate with any laptop or mobile device which has a Wi-Fi connection and a web browser.

Each EM2030 is labelled with a serial number. This serial number is the unique identifier of the unit, used for communication over the Wi-Fi link.

The EM2030 acts as an access point, generating a unique Wi-Fi network. The network name is linked to the device serial number. For example, if the serial number of the device is 00323 the unique Wi-Fi network will be named "Sonitus-Systems-EM2030-00323." To connect to the EM2030 simply join the Wi-Fi network and the appropriate settings will automatically be applied.

4   User Interface

Communications to the sound level monitor are handled through a standard web browser.

Note: It is recommended that you download the latest version of your web browser before logging in to the sound level monitor.

To log into the sound level monitor enter the IP address of the unit into the address bar of the web browser, as shown below:

http://10.1.1.2

Note: There should be no *www* preceding the number in the address bar.

Once you have correctly entered these details you will be logged into the EM2030 user interface and you will see the home page, as displayed below.
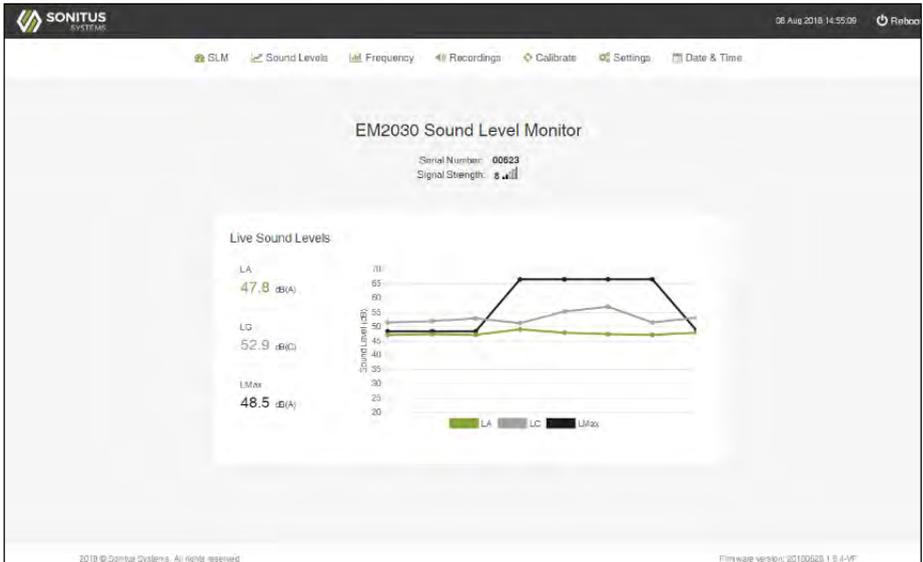
Figure 3: EM2030 User Interface Home Page

The home page displays some basic information about the unit such as the serial number, signal strength and the software version. Also displayed on the home page are links to pages which access some of the main features. These pages and their associated functionality are detailed below.

The home page also shows a live readout of the measured sound level. This allows you to remotely view the current sound level at the microphone.

At the bottom of the home page is the **Reboot** button. This button performs a manual reset of the monitoring unit. This should be used after making a change to the calibration or system settings, or during a troubleshooting process as outlined in the troubleshooting section of this manual.

4.1 Sound Level Data Page

This page displays a listing of all files contained in the memory of the monitoring unit. Filenames contain the name of the EM2030 unit and the date and time at which the monitoring run began. During normal operation there is a single noise data file produced each day. Click on the name of a file to view its contents.
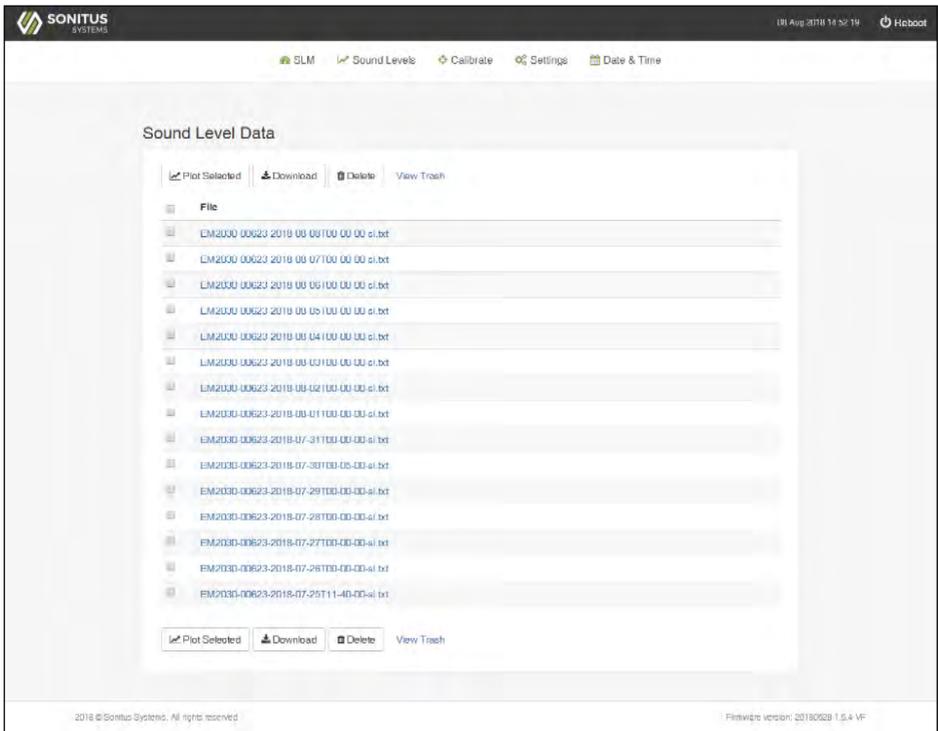
Figure 4: Sound Level Data Page

The file header (denoted by a # at the beginning of the line) gives information about the unit and the monitoring run. The data is logged at regular time intervals. The columns of data show the results for the available noise statistics. These include L_{EQ}, L_{05}, L_{10}, L_{50}, L_{90}, L_{95} and L_{max}. Statistics can be computed using both A-weighting and C-weighting (optional) filters.

```
# noise_analysis run from DEMO-NOISE-004002 at Thu Feb 21 23:56:00 2013
# Monitoring unit located at 53.344349N 6.250369W
# logfile   = /home/root/noise_analysis.log
# cfg_dir   = /home/root/config
# outputdir = /home/root/noise
# Sensitivity = -27.465473
# Gain = 1.000000
# Time should be in local format (i.e. daylight savings time)
# dd/mm/yyyy hh:mm:ss, A Leq,   A L05,   A L95,   C Leq,   C L05,   C L95
22/02/2013 00:00:00,   38.50,   38.71,   37.91,   44.62,   45.71,   42.70
22/02/2013 00:05:00,   38.40,   38.64,   38.00,   44.24,   45.37,   42.51
```

Example Sound Level Data Results

Clicking the box next to each file name allows you to select the file either for download or to be deleted. Press the "Select All" button to select all the listed files.

To download the data files to your computer click "Download Selected". This will download a zip file containing all selected files which you can save to a location of your choice.

To generate a plot of the data simply select the desired files and click "Plot Selected." This will generate a plot of A-weighted L_{EQ} Levels for the range of files chosen.

To delete files from the Noise Data folder select the appropriate files and click "Move to Trash". This will move the files to the Trash folder on the system. Click "View Trash" to see what files are contained here.

Note: Files in the Trash directory are still taking up space in memory. If you do not wish to keep these files, then enter the Trash folder by clicking "View Trash", select the files you wish to permanently delete and click "Delete Selected Files". Click "Empty Trash" to delete all files in the folder. Alternatively, you can restore files to the main sound

level data page for downloading by selecting the files and clicking "Restore Selected Files".

It is recommended that unwanted files be deleted regularly to avoid filling the unit's on-board memory.

To return to the home page from the sound level data page simply click on the Sonitus Systems logo at the top of any page.
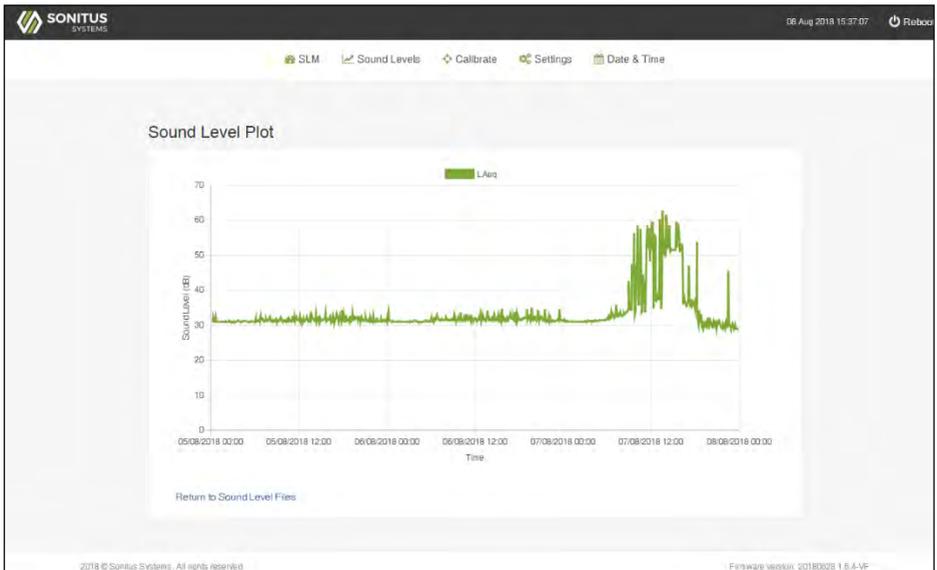
Figure 5: Sound Level Plot Page

4.2   Recordings Page

The recordings page allows you to view all audio files stored on the SD card in the EM2030 unit. Files are displayed in a listing similar to sound level results files shown in Figure 4. Select the checkbox next to a file listing and click "Download" to download the audio sample. You can listen back to the recording using your browser by clicking on the file name.

To delete a recording, select the checkbox next to the file and click the "Delete" button.

Note: Clicking the delete button will permanently erase the audio recording from the device storage.

During normal operation the audio files are automatically transferred to your online account, stored on the Sonitus Systems web server. Once the files have been successfully uploaded, the audio sample will be deleted from the device memory to automatically manage the storage capacity.

4.3   Calibration Page

The calibration page allows the user to set the calibration constant of the microphone being used with the sound level monitor. This is done by applying a known calibration signal to the microphone for a period of time.

Note: Microphone diaphragms are extremely fragile and precise pieces of equipment. Calibration procedures should only be calibrated in a controlled, clean environment. Any damage caused to microphones through misuse or mishandling will not be covered by normal maintenance agreements and warranty.

To run a calibration procedure, remove the weather protection kit and place an acoustic calibrator securely over the microphone. Set the time for the calibration procedure and the level of the calibration signal. Default values are 20 seconds and 94dB respectively. Click "Start Calibration" **once only**. Make sure that the calibrator remains in place and the calibration signal is applied constantly for the duration of the calibration run. Starting the calibration will stop the sound level analysis program. The system must be rebooted before the analysis program will resume. The browser will not advance until the calibration program has finished.
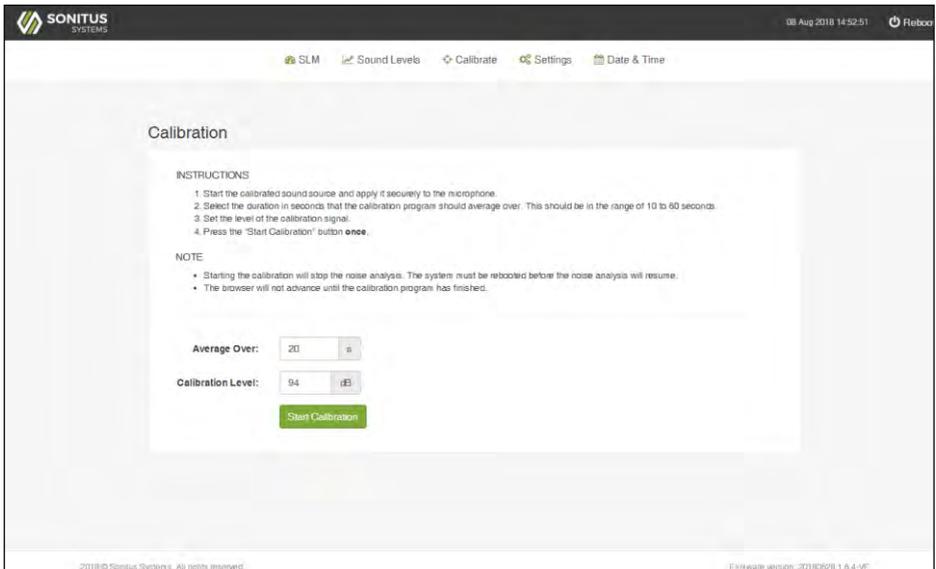
Figure 6: Calibration Page

4.4 Set Up Page

The set up page allows you to change the basic settings of the monitor. The settings which can be changed include the location coordinates, the microphone sensitivity setting and the time at which the EM2030 will reboot each day.

4.4.1 Microphone Sensitivity

The microphone sensitivity should not be changed manually unless required.

4.4.2 Windscreen Correction

This setting should be on if the windscreen is being used (default). The monitor will automatically apply a filter to correct for windscreen effects.

4.4.3 Measurement Parameters

The measurement options determine which parameters are logged to file during the automatic measurement sessions. The A-weighted L_EQ is logged by default. Additional measurement parameters can be added by selecting the relevant options. Available options include:

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- C-weighting (applied to all selected parameters)
- L95, L90, L50, L10, L05, LMAX
- Measurement logging intervals of 1, 5, 10, 15 or 30 minutes
- Fast or slow time weighting (for LMAX sound pressure level calculations)

4.4.4 Low Power Mode

This setting can be used when the EM2030 is being powered by batteries. When low power mode is enabled, the Wi-Fi connection will switch off after a user selected time. Switching off the Wi-Fi can result in approximately 20% reduction in power usage.

4.4.5 Reboot Time

The system reboot time is the time each day when the system resets and starts a new noise data file. Changing this value means the monitor will log one file each day beginning at this time. There is a gap of one measurement interval (e.g. 5 minutes) between each measurement run when the monitor is rebooting.

4.4.6 Audio Capture Trigger

The audio capture trigger settings allow you to control the audio recording functions of the EM2030. When the measured sound level meets the user-defined criteria then an audio sample is automatically captured and uploaded to your online account. The following parameters control the audio capture function:

Trigger Level: The sound pressure level that must be exceeded to start a recording.
Pre-record Time: The number of seconds before a trigger event that are captured to the recording.
Post-record Time: The number of seconds after a trigger event that are captured to the recording.
Trigger Length: The length of time in seconds that the Trigger Level must be exceeded in order to activate the recording (default is 1s).

An audio event containing 10s pre-event recording and 10s post-event recording takes approximately 2MB of disk space.

Once the changes are selected click "Submit Changes". The system must be rebooted for changes to take effect.

To abandon your changes and start again click "Reset Form".

To restore the original settings click "Restore Factory Defaults".

To return to the home page at any time click the logo at the top of the page.
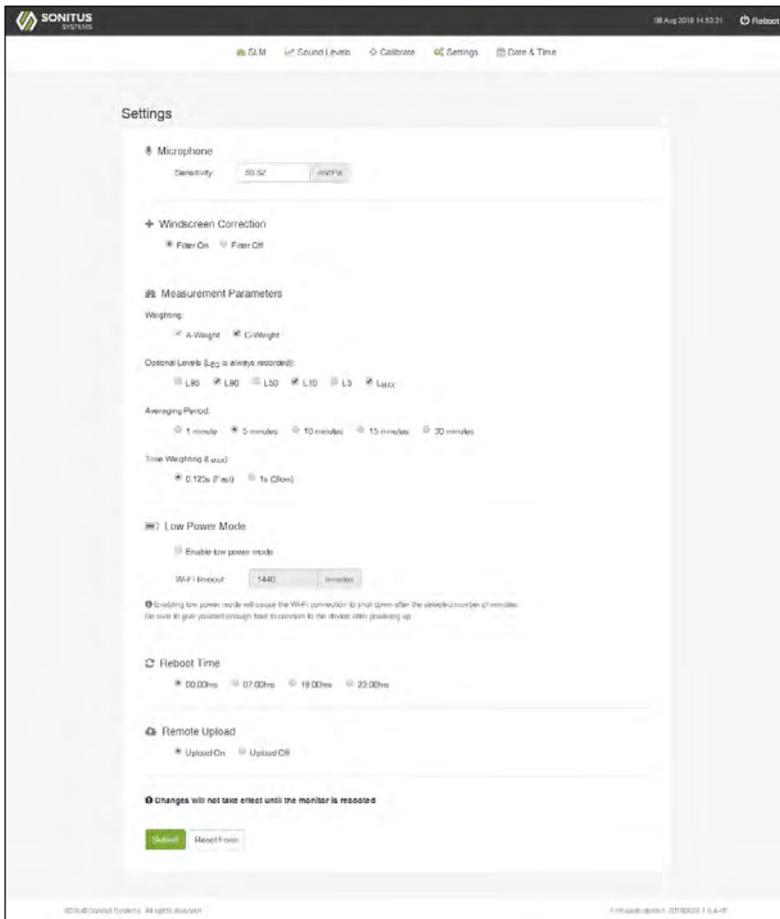
Figure 7: Set Up Page

4.5 Set Date and Time Page

The set date and time page allows you to manually set the system clock and date. Click on the "Enter New Date" box to display a calendar. Select the desired date and then enter the new time. The time format is a 24 hour clock in hh:mm:ss. Once this information is entered click the "Set" button. This will set the date and time to the new values and return you to the homepage.

Figure 8: Set Date and Time Page

5   Troubleshooting

The following section addresses some issues which may be encountered when installing and communicating with the sound level monitoring unit. A brief explanation of how to address each issue is given. In addition, Sonitus Systems' staff will always be happy to deal with your queries over the phone or by email.

I can see the "Sonitus-Systems" wireless network but I can't connect.
Ensure that the wireless network settings outlined earlier in this document have been applied correctly. These settings must be applied before connecting to the wireless network.

Note: The instructions below are for the Microsoft Windows 7 operating system. The procedure described here may vary for other operating systems.

To connect to the sound level monitor, go through the following steps:

- Change the IP address of wireless device by clicking on the wireless signal icon in the icon tray on the bottom right of the screen (beside the clock).
- At the bottom of the pop-up menu select "Open Network and Sharing Centre."
- In the Network and Sharing Centre click on "Change Adaptor Settings." This is located on the left hand side menu.
- Right click on the icon for the Wireless Connection and select "Properties" from the menu.
- On the "General" tab, scroll down the list and select the last option "Internet Protocol (TCP/IP)". Now click the Properties button.
- In the properties dialog menu select "Obtain an IP address automatically."
- Click OK to confirm the settings.

You should now be able to connect to the "Sonitus-Systems" wireless network.

The monitoring unit is powered on but I cannot see the wireless network.
Ensure that you are close enough to the sound level monitoring unit to detect the Wi-Fi signal, approximately 50m. There should be minimal obstruction between you and the monitor i.e. buildings, walls etc.

If you still cannot detect the wireless network, it may be necessary to inspect the monitor to ensure it is powered on. The green LED on the front of the unit allows for a simple check that the unit is powered up. A flashing LED indicates that the unit is operating and gathering data. A solid, constantly on LED indicates that the unit is powered on but not collecting sound level data. Ensure that the Wi-Fi antenna is properly connected. If the wireless network is still not available, it may be necessary to perform a full reset by powering down the unit and restarting.

The LED on the front of the unit is not on.
The unit is not powered on. Ensure that the mains supply is working. If possible, check the 9V signal on the power supply connector.

The clock on the monitor does not match my clock.
Over an extended period of time the system clock may drift by a small amount (<5 minutes per year). The time can be reset by going to the **Set Date and Time** interface page, accessible through the monitor's home page. Instructions on setting the time are given above. If the GSM connection is active, the time will be automatically synchronised with an online time server each day.

Changes to the clock or system settings are not applied.
The user interface requires that you use the most recent version of your internet browser. Certain versions of Internet Explorer (IE) are not fully compatible with the system interface, in particular IE 7. Using these versions means that not all functions are available, for instance, setting the clock through the **Set Date and Time** page may not alter the time. Update your internet browser to the most recent version, for example, the newest version of Google Chrome, Mozilla Firefox or Internet Explorer 8.

The sound levels contained in the data files do not match what I expected.
A badly connected or damaged microphone can give rise to sound level readings which are outside the range of expected values. If the levels observed in data files vary significantly from expectation or from comparable measurements, then ensure that the microphone assembly is properly connected. If possible, use the calibration feature to check the response of the microphone using an acoustic calibrator. Microphones also need proper maintenance. Contact Sonitus Systems to check if your microphone is due a maintenance recalibration.

6   Contact Details

Should you have any queries about your sound level monitoring system or any of our services please feel free to contact us.

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7 Technical Details

EM2030 Sound Level Monitor Specifications	
Microphone	Class 1 tolerances to IEC 61672
Sensitivity	50mV/Pa
Frequency weighting	Digital A-weighting and C-weighting
Frequency range	20Hz to 20kHz
Dynamic Range	16 to 121 dB(A)
Linear Measurement Range	30 to 120 dB(A)
Sampling Frequency	96kHz
Measurement parameters	L_{EQ}, L_{05}, L_{10}, L_{50}, L_{90}, L_{95}, L_{max} at user selected intervals
Measurement procedure	Measurement is automatic at power up
Data storage	5 years (5 minute logging)
Enclosure	IP65 die-cast aluminium
Operating temperature range	-10°C to +50°C
Humidity levels	0 to 95%
Microphone power supply	Constant current ICP supply, 18V 4mA
Microphone connection	BNC male to BNC male
EM2030 power supply	9V DC, 500mA
Communications	802.11 b/g (Wi-Fi) and HSPA/UMTS (3G)
Dimensions	110 x 140 x 60mm (W x L x H)
Weight	< 800g
Mounting holes	4 x 5mm