NoiseMeter

soundlevelmeter with Sigfox
- instructions -

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1 NoiseMeter – soundlevelmeter with Sigfox

Thank you for purchasing NoiseMeter.

1.1 NoiseMeter v1.0

Version 1.0 is the first series of NoiseMeter and still awaiting several improvements, marked by <v1.0 > throughout the manual.

Customers of v1.0 devices are entitled to free exchange once v1.1 devices are released.

The respective timeline is: v1.0 devices are released in August 2018. Planned release of v1.1 is february 2019.

1.2 scope of delivery

*   NoiseMeter including mount adaptor
*   Windscreen
*   Antenna

1.3 putting into service

If switch is off, battery is disconnected.

Abbildung 1: rear panel of NoiseMeter
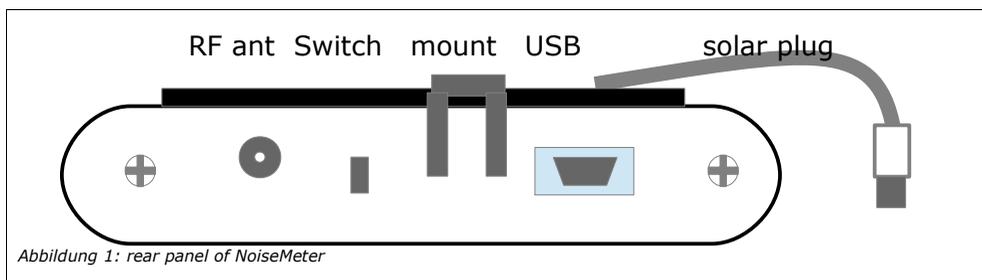
If switch is on, battery is connected.

Δ switch only applies to the battery, if you want to switch off NoiseMeter, additionally un-plug USB connector.

In total, there are three ways to power the device:

- USB cable Mini-B (max. 5V supply)
- USB plug from solar panel cable
- internal battery

Connect the antenna and use a USB cable to connect to your PC. NoiseMeter should register itself as a USB device. Use a **terminal program** to connect to the **serial port** (9600 – 8bit – 1 -1) Now the device is operating and running in „LOGGER" mode. After half an hour, it sends the first Sigfox message. You need ID and PAC to log into backend.sigfox.com

Δ **for transfer of sigfox devices (from LXE to you) you need the last PAC from us, which is labeled on the device.**

2 Operational modes

NoiseMeter comes with 3 modes

- LOGGER mode is default and sends regular sigfox messages of continuous soundlevel measurements
- TOGGLE mode for calibration
- SIGFOX mode for testing TX connectivity

2.1 LOGGER mode

After putting NoiseMeter into service, double click <ENTER>. NoiseMeter is operating in default mode LOGGER and showing:

```
20:90    737      L
20:89    784      L
20:88    883      H
20:87    873      H
                         HIGH    LOW
part second  87,3dB      range mode HIGH / LOW
```

The scheduling is fixed to one sigfox uplink per 30 minutes. We can upload 20 values. Each value represents a „part" of 90 seconds length. Measurement interval is 1 second. Only the maximum out of a 90 second „part" is transmitted.

After sending 24 telegrams or 12 hours, a 25th gives the battery

voltages. The scheduling is given in 4.
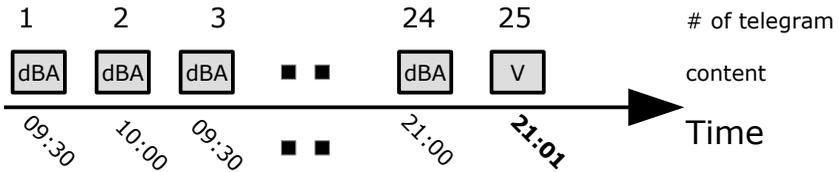

Abbildung 2: schedule of Logger Mode

Other parameters available in hardware :
- weighting function 'dBA' and 'dBC' <'dBA' v1.0>
- filter 'slow' 'fast' <'fast' v1.0>
- automatic high and low range switching

High and low range switching uses a threshold value of 80dB. A hysteresis is applied to avoid toggling around threshold value. If going from low to high, the threshold is about 88dB. If going from high to low, the threshold is about 71dB.

2.2 TOGGLE mode

Toggle mode allows calibration and testing NoiseMeter if connected to PC via USB cable. High and low mode pathes are toggled every 10 seconds.

2.3 SIGFOX mode

Sigfox mode is helpful if setting up a connection to sigfox network. It is sending 3 TX uplink messages towards the network and receives one.

3 How to use NoiseMeter

This chapter describes USB connection, power supply, sensor and calibration.

3.1 USB connection

Connect a USB cable (USB mini B connector) to USB jack, the

other side to a PC. Open a Serial Terminal programm (putty, Teraterm) and connect to the COM port.

Double-click <ENTER> opens and ends menu options.

3.2 Power supply

NoiseMeter uses a LiPo battery and a solar panel to be energy self-sufficient in outdoor installations. Additionally, the battery can be re-charged via USB cable. The nominal voltage of the LiPo cell is 3,7V. If it falls below 2,7V, the device is switched off automatically.

Δ immediately before installation, fully re-charge the device. It is best done from a PC where you can observe the voltage data.

3.3 Sensor and analog processing

NoiseMeter provides a high range measurement IC performing over 100dB. This is a huge span with the largest signal $10^{(100/10)}$ = 10.000.000.000 times the smallest. NoiseMeter uses overlapping ranges with Low Range from 30 to 100 dBA and High Range from 70 to 130 dBA.

3.4   Calibration

For calibration, use a sound level calibrator suitable for ½'' microphones. Remove the cover screws (polyamide) marked with H and L (High and Low). Insert microphone into calibrator chamber and apply calibrator signal (1kHz, 94 dB). Adjust the potentiometers below with a suitable screwdriver (slotted 2x0.4 mm)

3.5 Sigfox and data processing

Sigfox allows a maximum of 140 telegrams per day, each a maximum of 12 byte long. In order to compress the data, we split 10 out of the 12 byte in 4 bit words giving bins from 1 to 16.

After a „part" (see 2.1) is measured, only its **maximum** value is stored. After all „parts" are measured, Min and Max are determined. 16 bins are computed and every „part" is assigned to one bin.(6)

Abbildung 3: a) schematic sigfox data b) example
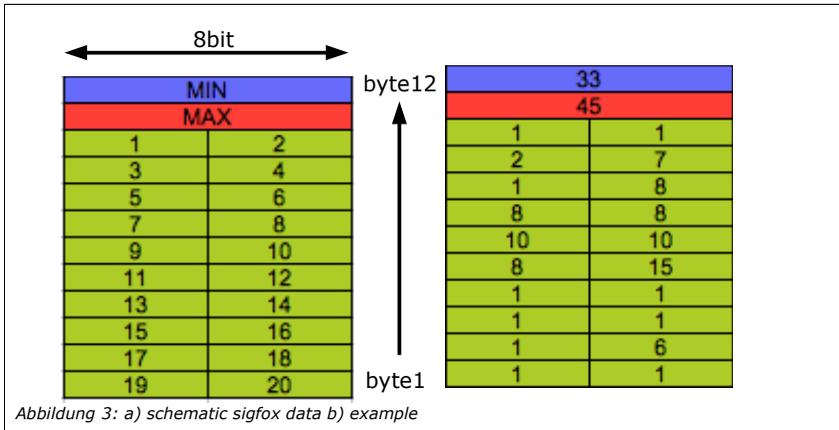
3.5.1 soundlevel postprocessing example

2019-01-30 04:15:11   570dd652233d000e10222f42

Abbildung 4: backend.sigfox.com sound level data example

In Sigfox backend, we find the timestamp and a string of 24 characters, in Hex numbers. Each represents a 4 bit word. The first 20 characters assign the bins, character 21-21 is Min and 23-24 is Max.

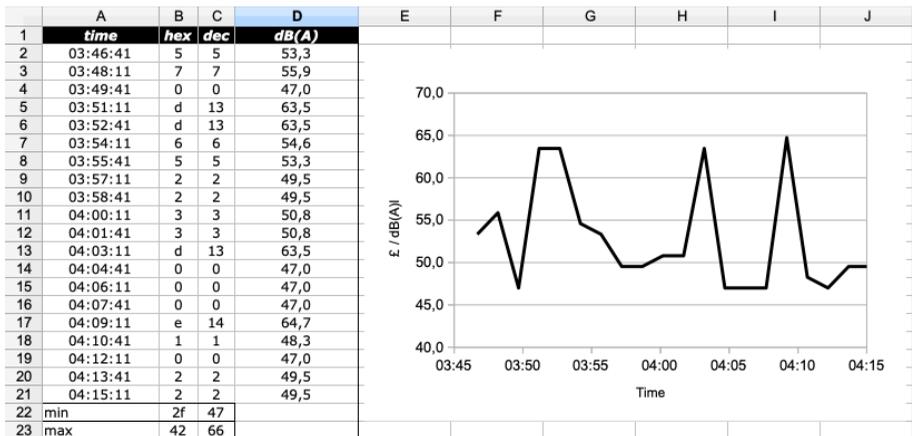Given that, we can calculate back the dB sound levels and display them over time:

	A	B	C	D	E	F	G	H	I	J
1	**time**	**hex**	**dec**	**dB(A)**						
2	03:46:41	5	5	53,3						
3	03:48:11	7	7	55,9						
4	03:49:41	0	0	47,0						
5	03:51:11	d	13	63,5						
6	03:52:41	d	13	63,5						
7	03:54:11	6	6	54,6						
8	03:55:41	5	5	53,3						
9	03:57:11	2	2	49,5						
10	03:58:41	2	2	49,5						
11	04:00:11	3	3	50,8						
12	04:01:41	3	3	50,8						
13	04:03:11	d	13	63,5						
14	04:04:41	0	0	47,0						
15	04:06:11	0	0	47,0						
16	04:07:41	0	0	47,0						
17	04:09:11	e	14	64,7						
18	04:10:41	1	1	48,3						
19	04:12:11	0	0	47,0						
20	04:13:41	2	2	49,5						
21	04:15:11	2	2	49,5						
22	min	2f	47							
23	max	42	66							

Abbildung 5: device 18ED2E data decoding example

3.5.2 battery voltage postprocessing example

After 24 soundlevel telegrams, one voltage level telegram is sent. The format is 12 bytes representing one measurement every hour.

2019-01-30 06:16:00   26c9c9c9c9c9c9c9c9c9c83c

Abbildung 6: backend.sigfox.com battery voltage data example

The number needs to be multiplied by 20 to get Voltage in mV.

Hex	dec	>>	dec * 20	=	mV
c9	201	>>	201* 20	=	4020 mV

With Sigfox ID and PAC you can register your device in Sigfox cloud.

Sigfox backend allows you to set up callbacks to several REST Api providers.

<v1.0 NoiseMeters v1.0 are under contract lxelectr_3a79_5b62 for one year. Please contact Sigfox how to access your prototype devices using ID and PAC.>

3.6 REST Api - IBM Watson

We provide an exemplary setup in IBM Watson IoT platform. As a customer you get access to our IBM Watson organization in the role of 'developer'. Please register on **internetofthings.ibmcloud.com** Once you provide us the email adress assigned to your IBMID, you will be added as member.

4 Technical data

frequency:	868	[MHz]
output power:	13	[dBm]
sigfox RC:	RCZ-1 (EU)	
USB 2.0 device	Mini B	
microphone:	½'' LXE M1	
sensitivity:	61	[dB]
protection:	Acoustic Vent ®Gore	GAW334
range:	30 - 130	[dB]
battery:	1S 900	[mAh]
voltage:	3.7 max. 4.2	[V]
solar panel:	0.19	[W]
	5.0	[V]
size:	210 x 70 x 25	[mm]
weight:	250	[g]
mounting adapter:	GoPro	