

TECHNICAL NOTE: Somnify SM-100 connectivity

Somnify is the world's most accurate non-invasive sleep monitoring system. The Somnify SM- 100 is a small stationary device (wall mount or table stand) that automatically measures and analyses a user's sleep without any manual interaction.

The Somnify SM-100 requires a connection to the Somnify Cloud over the internet through a local WiFi network for advanced sleep analysis and alerting features. Initial WiFi-configuration is done through the companion smartphone app.

Wireless interface

IEEE 802.11b/g/n @ 2.4GHz — Internal antenna

Network requirements

A local IPv4 network and a nearby 2.4GHz (802.11b/g/n) WiFi access point broadcasting a SSID with supported security protocol and authentication scheme is required for connectivity. A DHCP server on the network has to provide IPv4 address, subnet mask, gateway/router and DNS-servers to the Somnify.

Bandwidth requirements

The Somnify SM-100 requires very little bandwidth, about 0.5Mbit/s is recommended. During a normal day with 8 hours of sleep tracking and 16 hours idle the total traffic is about 25MB.

Security

Factory installed certificates, No default passwords, 802.1x, HTTPS/TLS encryption
WPA-PSK (TKIP)
WPA2-PSK (AES-CCMP) WPA2-Enterprise (AES-CCMP)

IEEE 802.1X:

EAP-PEAP: PEAPv0/EAP-MSCHAPv2
EAP-TTLS: Not supported
EAP-TLS: Not supported

HTTPS:

TLSv1.2, AES 256bit encryption, SHA 384 hashing algorithm
TLS_ECDHE_RSA_WITH_AES_256_GCM_SHA384

Required firewall configuration

The firewall(s) should allow outgoing packets to the internet on the following outgoing ports as well as established/related incoming packets:

TCP/443 (HTTPS)
TCP/80 (HTTP)
UDP/53 (DNS)
TCP/123 (NTP)

Firmware upgrades

The Somnify SM-100 is OTA (over the air) upgradeable, and accepts only signed firmware from the Somnify Cloud.

Network protocols

ARP, DHCP, IPv4, TCP, UDP, SSL/TLS, DNS, NTP, HTTP, HTTPS, MQTT

Companion App

The Somnify Research app can be downloaded for Android or iOS here: <https://goto.somnify.com/srapp>

Connectivity accessories

The Somnify SM-100 can be bundled with a pre-configured LTE/4G WiFi router with a subscription from VitalThings.

Data ownership

The data is owned by the owner of the specific Somnify unit. If you purchase the unit or rent it for a defined time period, the data collected is legally owned by you. VitalThings signs a Data Handling Agreement and will be regarded as the data handler providing the client with cloud-based signal handling. VitalThings keeps the right to use collected data completely anonymized for internal statistical use and visualizations. Further detail to be agreed upon in the Data Handling Agreement.

Data access

The client has automatic access through the companion app and the Web API. The detailed parameters on the next page are available for statistical analysis and export. **High resolution data** is available in 1 sec resolution and can be captured directly from the Web API.

For specific research projects and collaborations, VitalThings can be of service providing respiration waveform data at 17Hz collected through a special data collection device and analysed in hindsight. Please contact VitalThings directly, if this option is of interest.

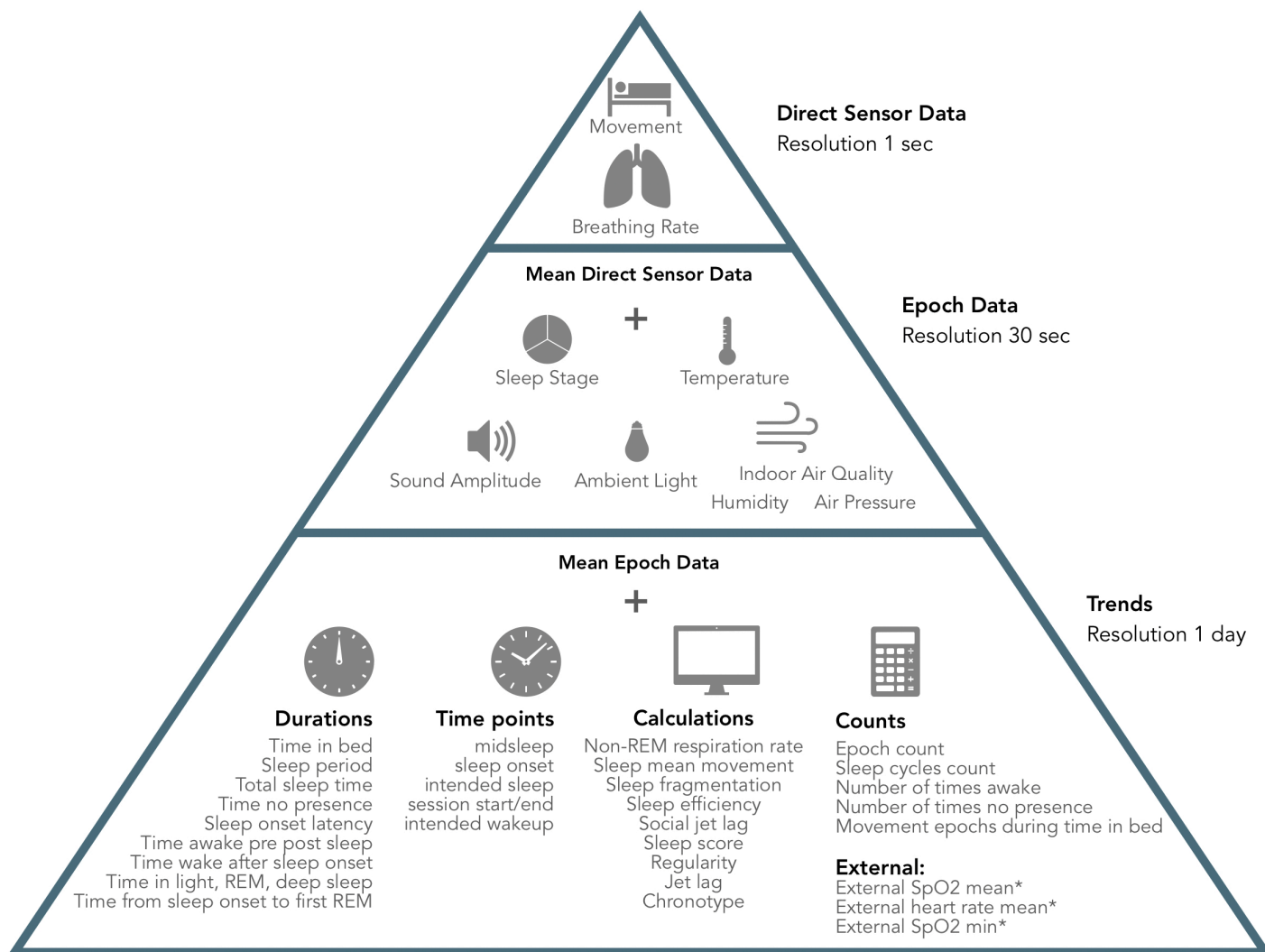
Data resolution

The below image depicts the logical build-up of the extractable data available for researchers with their respective resolution. The raw sensor data can be extracted at 1Hz and comprises movement information and breathing rate. Those two measurements feed the cloud-based algorithms which in turn

The resolution degree is presented in the graphic below. Starting at the top of the below pyramid, **Direct Sensor Data** is being collected at 1Hz and is subject to our algorithmic calculations which are performed in the cloud (upon special request, direct sensor data can be extracted at 17Hz, as mentioned above).

A sleep session analysis comprises average **Direct Sensor Data** plus the additional parameters mentioned in the central tier of the depiction with **Epoch Data** available at a 30s resolution.

The variables available for long term sleep analysis (**Trends**) include one data point per sleep session. **Trends** include average epoch data plus additional variables listed in the bottom tier of the pyramid.



* Somnify connects to external sensors to collect additional data. Somnify reads data from heart rate belts (e.g. Polar H10) and pulse oximeters (e.g. Nonin 3150).

Somnify is CE and FCC approved. WiFi and Bluetooth connected. Somnify products and services are not medical devices, and are not intended to diagnose, treat, cure or prevent any disease.



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