



NexSleep™

Hardware Technical Specification

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Document Revision History

Rev.	Date	Author	Page(s)	Description
01	February 20, 2007	Vladimir Ravich	All	Hardware Specification
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1. Introduction

NexSleep™ is the household device for an improving of the sleep quality, a prevention of the snoring and an estimation health condition of two persons simultaneously. NexSleep™ is not a medical device and may not be used for the diagnostic purposes.

1.1. Highlights

NexSleep™ has followed main tasks:

1. Non-contact detection of the snore, breath and movement of both persons in the bed.
2. Sending to the person the special biofeedback signals in the form of slight vibrations.
3. Every morning indication of the sleep quality of both persons for the last night.

In addition, NexSleep™ has followed service features:

1. Self-testing with messages about malfunctions.
2. The Batteries need to be charged every day.

1.2. Abstract

This document gives a detailed explanation about the NexSleep™ requirements and features. The system requirement, the features and the architecture are described. Additional information about all components of the device is contained in the correspond documents.

1.3. System Specifications

The device has to detect snores, respiration and movements without any mechanical contact with human body.

1. The device has to work properly when being placed under any mattress with area density in the range 3-16kg/m² and height in the range 10-40cm.
2. The device has to work properly for weight of adult person in the range 40-150kg.
3. The device has to recognize periodic mechanical vibrations as the human snores.
4. The frequency range of the vibration is 30-90Hz.
5. The period of repetition is 4-30 snore/min.
6. The system has to recognize low frequency periodic movement as human breath.
7. The period is 4-30 breath/min.

1.4. Related documents

- 1.4.1. Nexense NexSleep™ NX-SC00-0000 specification!!!

2. General

2.1. Structure

NexSleep™ system includes the following main Sub-contents:

- 1 Main plate "A" which contains sensor board, main board, metal springs and silicone springs. From the main board there are 3 cables coming out:
 - 1.1 Cable connected to plate "B".
 - 1.2 Cable connected to Charger.
 - 1.3 Cable connected to "Communication Unit (the Antenna device)".
- 2 Slave plate "B" which contains sensor board, Analog board, metal springs and silicone springs. From the Analog board there is one 3 cable coming out to plate "A".
- 3 "Communication Unit" – the Antenna assembly which contains a flat inductive coil as the transmitter for wireless inductive communication.
- 4 Two vibration units Ratat "A" and Ratat "B" which contains Ratat Board with the wireless receiver, the processing unit and the interface unit for wire communication as well as miniature electrical Motor attached with eccentric weight, a rechargeable L-Ion Battery and housing with the wristband.
- 5 Charger which contains Charger Board with the charging circuits for recharging of the Ratat's batteries, 5 slots LED's indicators for indication of sleep quality and the current detectors for communication with Ratat's.
- 6 Power Adapter from AC to DC 7.5v / 660mA auto range with DC cable 2.5mm.

NexSleep Analog board contains only hardware. The system can be described as follows:

2.2. Arrangement

Master Plate "A" and Slave Plate B are placed under the mattress on the area of the human chest. They are interconnected with a cable. In addition Master Plate "A" is connected with Antenna and with Adaptor via Charger.

Antenna is placed under the mattress in the center axis X and near the legs in axis Y.

Each Ratat is placed during the sleep time on the arm (exact as normal clock watch).

At day time the Ratat's must be placed in the special cavities of the Charger.

Charger may be placed anywhere near the bed, e.g. on the bedside-table etc.

Adapter is connected to a wall outlet.

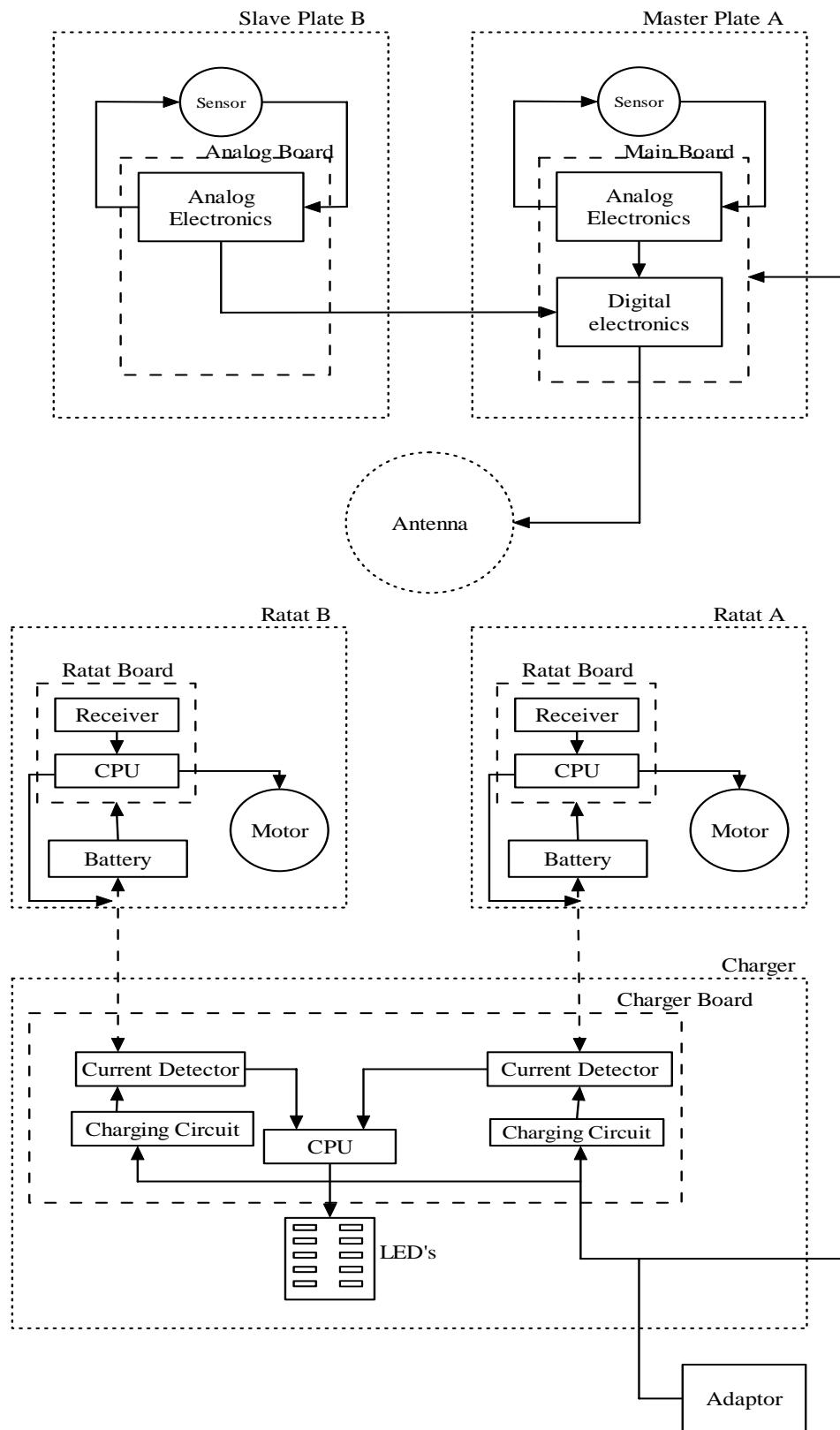


Fig. 1

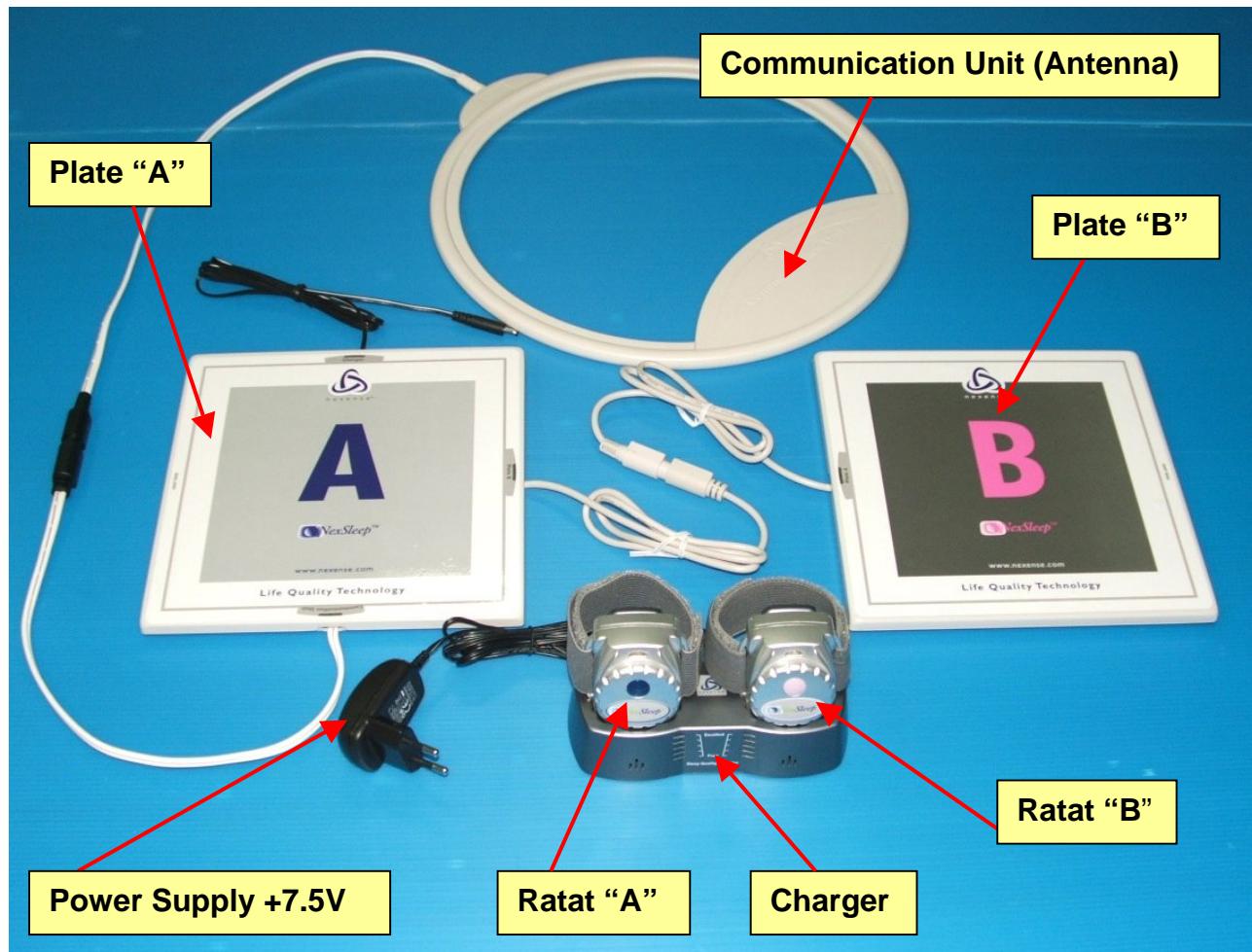


Fig. 2

2.3. Performance

Master Plate "A" and Slave Plate "B" contain the sensitive Sensors which may detect mechanical displacements in wide dynamic range from tens of nanometers up to several millimeters. Main Board and Analog Board contain the Analog electronics that transforms the signal of Sensor to high frequency about 1MHz. The digital electronics of Main Board measures the deviation of this frequency. The rate and the span of the deviation correspond to the frequency and the amplitude of mechanical vibrations.

CPU of the Main Board has the software module that performs filtering and detects the frequencies corresponding to snores. When the snore is detected CPU sends the command to the corresponding Ratat. The inductive coil of the Antenna is used to excite the magnetic field with very low level and frequencies about 100kHz. In order to transmit the commands the FSK modulation with rate 1kbaud is used.

The receiver of Ratat senses the oscillation of the magnetic field and reconstructs the bit sequence of the command that is sent. CPU of Ratat decodes the command and sends the control signal to Ratat Motor that starts to rotate. Because of the eccentric mass the vibrations are produced. In addition, CPU counts the snores and calculates average values that characterize the sleep quality.