

## HealthLab-Satellite SAT-07



1	General Remarks.....	2
2	Operating Principle.....	2
3	Putting into Operation.....	3
4	Measurement.....	4
5	Technical Data.....	8



## 1 General Remarks

The HealthLab measuring satellite SAT-07 is a measurement module of the psycho-physiological monitoring system HealthLab. As part of measurements with HealthLab, the satellite SAT-07 records the base frequency of voice, step length and the 3-D acceleration of a study participant. The device transmits the captured data to a HealthLab-Master, where they will be stored and transferred to a host computer (Windows), which is provided as monitoring and evaluation-system.

A maximum of 26 satellites are able to communicate with the Master via a serial bus (HealthLab Serial Slave Bus). An unique address (1 ... 26) is assigned to each satellite. This slave address is factory set and can be modified by manufacturer if necessary.

## 2 Operating Principle

The HealthLab measuring satellites detect the measuring signals by integrated or attached sensors. The measurement data is displayed, exported and analysed using the software HealthLab ('Heally Control', 'Heally', 'HLabExport', 'HLEplorer'). The satellite SAT-07 measures the signals described below.

### 2.1 Body Activity

Measurement data of physical activity of a proband are captured by satellite SAT-07 using a built-in 3-axis accelerometer. In so doing, acceleration and position are measured quantitatively in three axes in the unit 'G' (gravitational acceleration).

### 2.2 Fundamental Frequency $f_0$



Conclusions about the mental and physical arousal of a proband can be drawn from fluctuations in the base frequency of the probands voice. This biometric parameter is captured by the SAT-07 with a throat microphone MKF-02 (pictured left), available as accessory.

### 2.3 Step Measurement



Using a step sensor (pictured left) the SAT-07 detects the time it takes the proband to do a step.

Similarly the period is measured over which the foot stays on the ground while walking.





### 3 Putting into Operation

For putting into operation, each HealthLab measuring satellite is to connect to the respective sensor technology, which is provided for the current planned measurements. Similarly the device is to connect with eventually in addition used satellites and the HealthLab-Master. Thereby, the correct cabling is to be observed.

The sensors used are to be placed in accordance to their intended use.

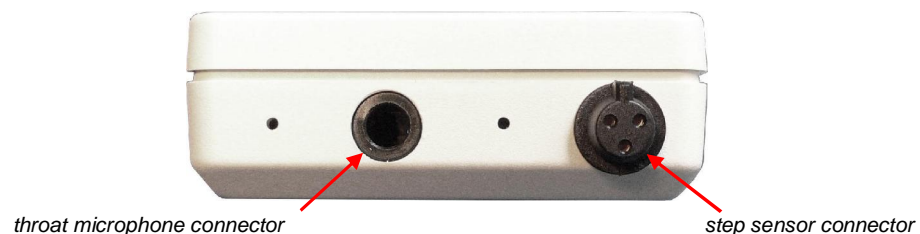
The PC software Heally Control (HL5\_Heally.exe) allows to select the channels to be measured, and to configure their parameters, such as sample rate, gain, filters, etc..

#### 3.1 Connectors

The SAT-07 provides the following connectors:

##### 3.1.1 Microphone and Step Sensor

At the lower end face of the measuring satellite SAT-07 are the connectors for throat microphone and step sensor.



##### 3.1.2 Master and Measuring-Satellites

At the upper end face of the device are the connectors for the serial bus.



The connection of the device with the HealthLab-Master and with additional measuring satellites is done using the connection cables (see left) type VMS-10 and VSS-05, which are available as accessories. Socket and plug on the satellite (pictured above) are connected in parallel. They are used for connection to the above described serial slave bus, resp. for the forwarding of the slave bus. A number of slaves may be connected to the bus, but only one Master is allowed to be connected. An unique address (slave-address, address-range 1 up to 26) is assigned to each connected slave.



**Note:** the bus also provides the power supply to the entire system. The required batteries or accumulators are part of the respectively used Master. Look up for details in the separate description for the respective HealthLab Master.

10



## 3.2 Preparation of the Proband

---

The sensors of a HealthLab measuring satellite, which are respectively provided for use, are to be placed at the proband in accordance to their intended use. With the SAT-07 the using of a throat microphone and a step sensor is possible.

### 3.2.1 Throat Microphone

For the determination of the fundamental frequency of the voice, a throat microphone is used. This ensures that both, ambient noise and voices of people, who are in the immediate vicinity of the proband, remain excluded from the measurement, and thus can not falsify the measurement results.

The throat microphone is to be connected to the socket of the SAT-07, which is assigned to this purpose (*see chap. 3.1 Connectors*). The microphone is equipped with a spring clamp. The clamp is to bend up as far as is necessary to it lead over the neck of the proband. Now it's to set around the neck from behind, so that the microphone-capsules - left and right - contact the side of the larynx.

### 3.2.2 Step Sensor

A pressure-sensitive step sensor is used to determine the movement behaviour during walking. It is used either under the right or left foot of the proband.

The step sensor is to be connected to the socket of the SAT-07, which is assigned to this purpose (*see chap. 3.1 Connectors*). Following its own form, it is to be positioned in the cushion of the shoe, which is used by the proband. After tightening of the shoe with inserted sensor, the proband can move as normal.



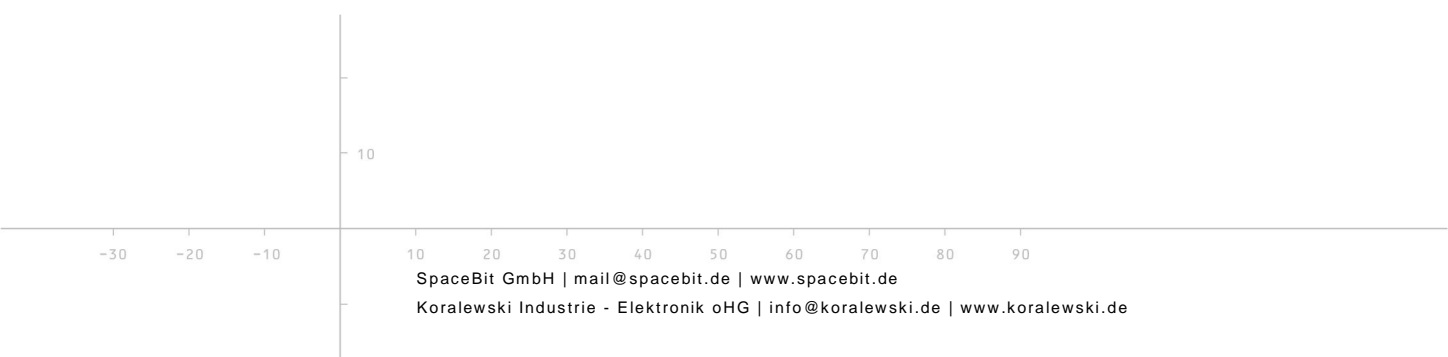
*Note:* To avoid the falsification of measurement data, the influence of the use of a measuring instrument to the recorded data must be basically prevented. This means for the step sensor it is to ensure, that neither in the sensor nor in the sock wrinkling occurs. Otherwise - albeit unconscious - this disturbance without fail will lead to a targeted change of the walking behaviour of the proband.

## 4 Measurement

---

After the SAT-07 is connected to a switched off Master, resp. to other measuring satellites with connection to the Master, the device will be supplied with power on activation done by the Master and goes in operation with starting of measurement. Look up for details in the separate description for the respective HealthLab Master.

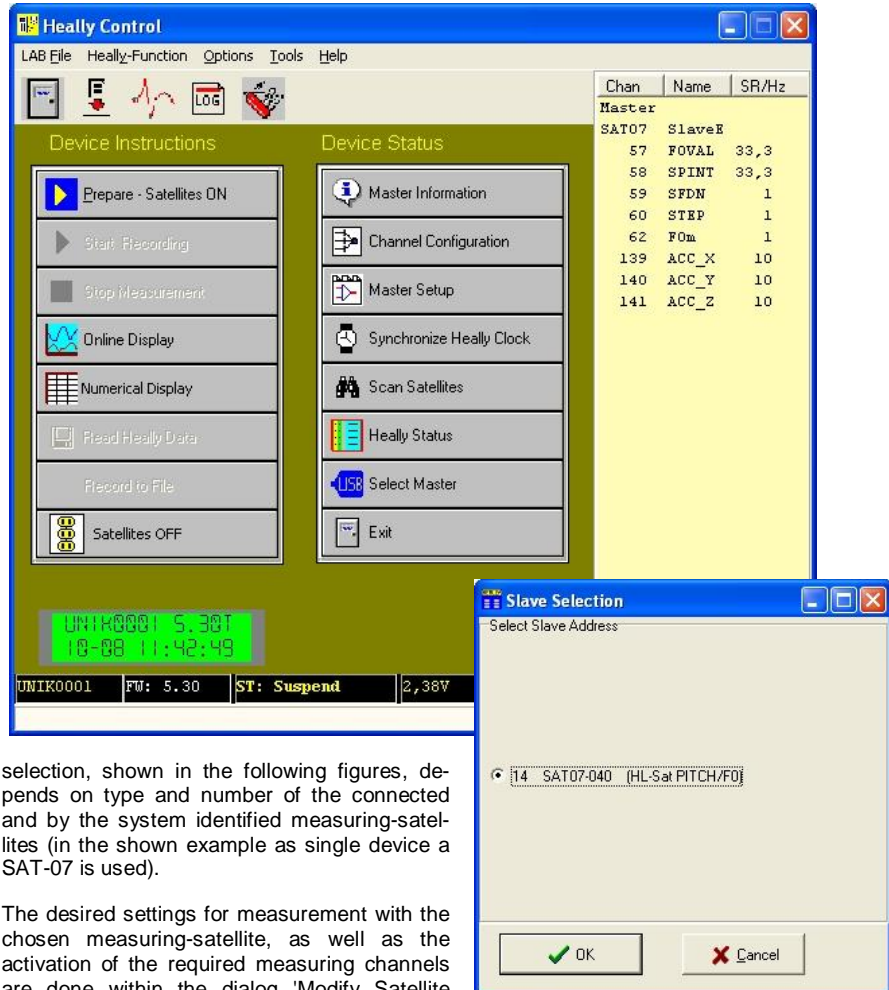
Using the software 'Heally Control' (HL5\_Heally.exe) the relevant settings for measurements will be done and transmitted to the respective measuring-satellite. The HealthLab software transmits all data, captured and recorded by the monitoring system HealthLab, to the PC system which is provided as monitoring and evaluation-system. Even the analysis of measurement data is done by the software. Look up for details in the separate description for the HealthLab software.





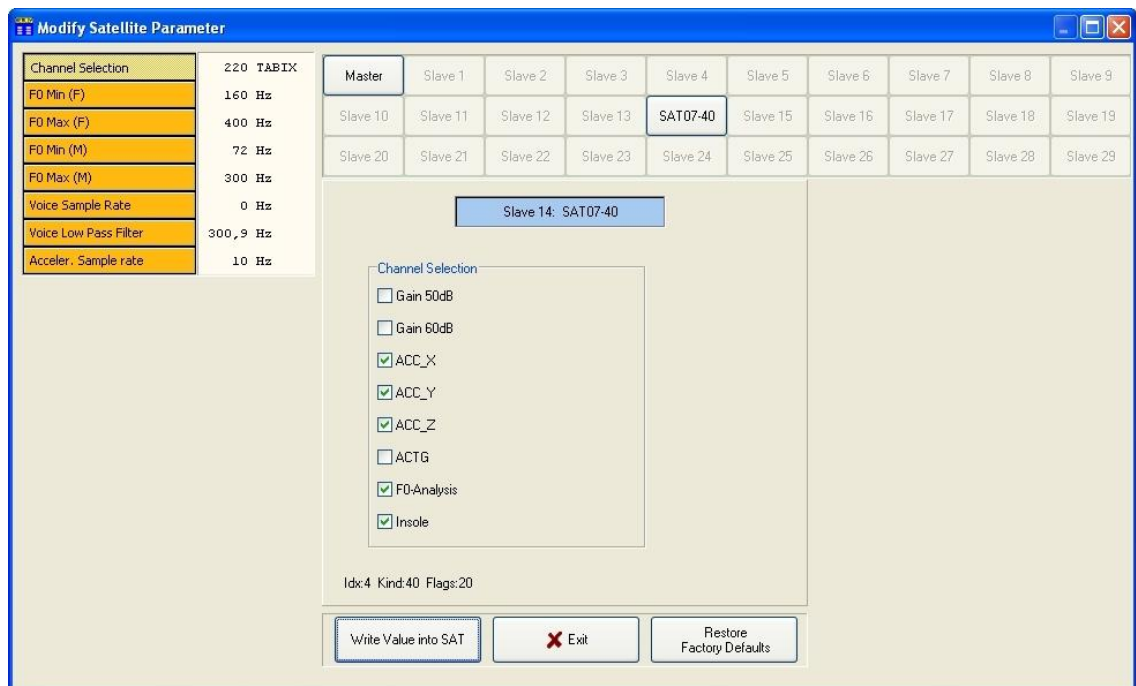
## 4.1 Preparation / Configuration

Within the control program 'Heally Control' the configuration of the measuring-satellite is called up by actuating (clicking) the button 'Channel Configuration' (see fig. below). The



selection, shown in the following figures, depends on type and number of the connected and by the system identified measuring-satellites (in the shown example as single device a SAT-07 is used).

The desired settings for measurement with the chosen measuring-satellite, as well as the activation of the required measuring channels are done within the dialog 'Modify Satellite







Parameter', which follows after the selection of the satellite (*see also chap. 4.1.1 Channel Index*). The selection of the device, which currently is to be configured, is done via the block in the upper range of the input-dialog, in which the applied satellites are displayed in form of buttons (*shown here: SAT-07.40*). After actuating of one of this buttons, the selection is highlighted in blue displayed in central range of the dialog box (*shown here: Slave 14: SAT07-40*) and the adjustable parameters of the satellite can be selected by orange buttons in the left part ('*Channel Selection*' is chosen in figure above). With the Satellite SAT-07 the following parameters are available:

- Channel Selection: activation / deactivation of the required measuring channels;
- F0 Min (F): operating area voice frequency: lower limit (female voice);
- F0 Max (F): operating area voice frequency: upper limit (female voice);
- F0 Min (M): operating area voice frequency: lower limit (male voice);
- F0 Max (M): operating area voice frequency: upper limit (male voice);
- Voice Sample Rate: sample rate of the voice measurement;
- Voice Low Pass Filter: low pass filter for voice;
- Acceler. Sample Rate: sample rate of the acceleration sensor;

Now, depending on the chosen parameter (*pictured above: selection field 'Channel Selection'*), the desired settings can be inputted. The parameters are mainly real numbers (decimal separator '.'). Selection boxes, text strings or hexadecimal inputs are provided for specific parameters. It should be noted that the setting of sampling rate, gain and filter frequency for each channel is bound to integer dividers of a basic value. Therefore, when changed settings are transferred to the device, the values will be corrected to the next possible setting value.

Each changed parameter is separately to transmit to the satellite by clicking the button 'Write value into SAT'. Thereby the previously in the device stored values will be overwritten. Leave the configuration-dialog with 'Exit'. All satellites are preconfigured ex works. Resetting of all parameters to the factory setting is made by actuating the button 'Restore Factory Defaults'.



**Note:** The settings of satellites for the data capturing by HealthLab are to be chosen corresponding to the respective measuring method and the hereby resulting requirements, as well as in coordination to all measurements, which are simultaneously performed at the Master. Doing so, optimally results while minimising the risk of a system overload will be ensured.

#### 4.1.1 Channel Index

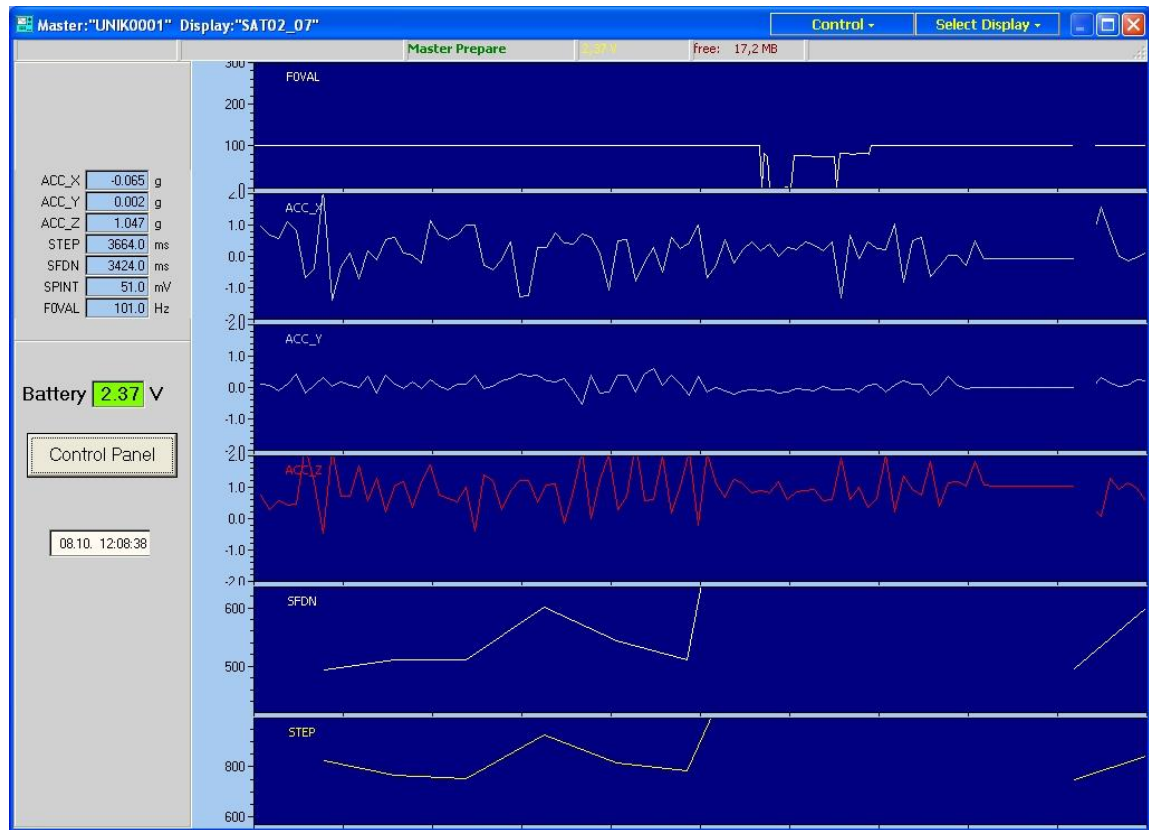
Channel-Designation	Channel No. (=Identifier)	Signal	Unit	Range	Sample Rate Hz	Gain	Offset
ACC_X	139	acceleration sensor x-axis	G	±2 G	4 ... 500	666,5	2048
ACC_Y	140	acceleration sensor y-axis	G	±2 G	4 ... 500	666,5	2048
ACC_Z	141	acceleration sensor z-axis	G	±2 G	4 ... 500	666,5	2048
ACTG	61	total acceleration	G	0 ... 4 G	4 ... 10	10.664	0
F0VAL	57	base frequency voice	Hz	68 ... 400 Hz	33	1	0
SPINT	58	voice intensity	mV	0 ... 127 mV	33	1	0
SPVAL	127	voice amplitude	mV	-128 ... 127 mV	0 ... 4.000	50 dB	128
SFDN	59	on-ground time	ms	100 ... 65.000 ms	-	1	0
STEP	60	step duration	ms	100 ... 65.000 ms	-	1	0



**Important:** The adjustable sample rate for voice (SPVAL) corresponds to the data rate, which is transmitted to the bus. High values burden the bus significantly! Therefore this value should be set to 0 (*no external output of the speech signal*) to ensure an optimally determining of the base frequency.



## 4.2 Evaluating the Measurement Results



By actuating the button 'Read Heally Data' within 'Heally Control', the in the Master stored measurement data are transferred to the PC system, which is used as monitoring and evaluation-system, and can then be evaluated by using the HealthLab software. In the above pictured example, various measured values of the HealthLab satellite SAT-07 on the graphical output of the program are shown:

- ACC\_X, ACC\_Y and ACC\_Z are mapping the data from the 3 axes of the integrated acceleration sensor;
- STEP and SFDN depict the step duration and the length of time, for which the foot stays on the ground while walking;
- SPINT shows - based on the signal strength - the intensivity of voice; FOVAL indicates the voice's frequency;



## 5 Technical Data



*Note:* The psycho-physiological monitoring system HealthLab is manufactured and delivered in configurations according to customer's request. The HealthLab components are not certified for use in the medical field. Therefore they shall be used solely for research purposes in scientific area.

<b>Designation</b>	SAT-07.40 / acceleration sensor, step- and voice sensor ( satellite-type: SAT07, hardware revision: 40, firmware revision: 5.xx, channels: 6 )	
<b>Power Supply</b>	3,3V ( via HealthLab Master )	
<b>Power Consumption</b>	max. 35 mA	
<b>Dimensions / Weight</b>	85 x 46 x 17 mm / 80 g	
<b>Capturing of Data:</b>		
<b>Actogram</b>	number of channels :	3
	measuring range :	+/- 2G
<b>Base Frequency Voice <math>f_0</math></b>	number of channels :	1
	input impedance :	4 K $\Omega$
	sensitivity :	23 $\mu$ V/Bit $\wedge$ 92 $\mu$ V F.S. (V = 26) 56 $\mu$ V/Bit $\wedge$ 230 $\mu$ V F.S. (V = 10400)
	sample rate :	0 ... 4000 1/s
	resolution :	12 Bit
<b>Step Measurement</b>	measurement principle :	resistive sensor
	resistivity without load :	> 1 M $\Omega$
	resistivity at 10 kg load :	7,5 K $\Omega$
	maximum load :	100 kg
<b>Suppliers</b>	Koralewski Industrie-Elektronik oHG / SpaceBit GmbH	

### 5.1 Ordering Information

HealthLab Measuring-Satellite	Part Number
SAT-07.40	E1531
<b>Accessories</b>	
throat microphone MKF-02	E1385
step- / foot sensor	AD0068
connection cable sat.-sat. VSS-05, 0,5m	E1177
connection cable master-sat. VMS-10, 1,0m	E1176

10

-30 -20 -10

10 20 30 40 50 60 70 80 90

SpaceBit GmbH | mail@spacebit.de | www.spacebit.de

Koralewski Industrie - Elektronik oHG | info@koralewski.de | www.koralewski.de