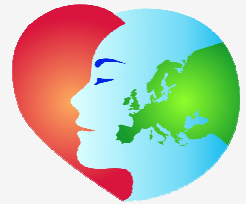


-90 -80 -70 -60 -50 -40 -30 -20 -10

-10

-20

HealthLab Flash-Master HFM-01



HealthLab - Next Generation

| | | |
|---|------------------------------|----|
| 1 | General Remarks | 2 |
| 2 | Operating Principle | 2 |
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1 General Remarks

Within the product family of HealthLab, the Flash - Master HFM denotes a further step towards enhanced mobility and universal applicability. To provide a wide range of variation of possible data acquisition at maximum mobility, the Flash - Master HFM is designed in modular construction. It combines the functions of a HealthLab Master with the basic functions of data capture of a HealthLab Satellite in a single device.

Caused by the modular design of the Flash - Master HFM, and the simple interchangeability of the device's lower part against a measuring module, which is equivalent to the respective measurement project (e.g. ECG), it is now possible to supply measuring systems with high mobility for most diverse purposes and tailored to the customers needs.

Up to 3 additional HealthLab satellites can be connected to the Flash - Master HFM-01 using the bus system (HealthLab Slave Serial Bus). The compatibility with existing HealthLab - systems is guaranteed.

Other new features / views:

- The storage of the measurement data of the HealthLab Flash - Master HFM is done on a micro-SD card with a capacity of up to 32 GB (accessible via the battery compartment).
- Different options are provided for data exchange between the master and a host computer, which is designated as monitoring and evaluation-system. Each HealthLab Flash - Master HFM is basically featured with the following two interfaces:

Bluetooth A Bluetooth Class2 Interface enables the wireless connection up to an operating range of 10 m. *Note:* Local influences may impair the Bluetooth radio range.

USB 2.0 Alternatively an USB interface can be used. This offers, especially when reading stored data from the device's memory (micro-SD card), the advantage of a distinctly higher data throughput. The access during measurement is made possible due to the use of the specific USB interface USB-01, which ensures a galvanic isolation compliant to medical directives. Along with this, an external power supply of the HFM-01 is realised via the USB-01.

- An integrated ISM module is designed to communicate with wirelessly communicating HealthLab satellites (in future available).

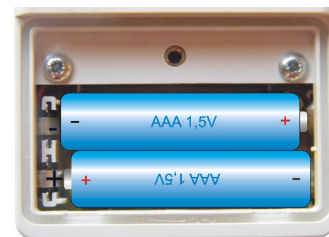
2 Operating Principle

2.1 Power Supply

The HealthLab Flash-Master HFM is equipped with an internal power supply, ensured by two batteries (*type: AAA*). Depending on the configuration of the device and the number and nature of possibly connected HealthLab measuring-satellites, the capacity of the internal power supply is sufficient for measurement series with a duration of 45 minutes up to 10 hours.



Note: The battery compartment is accessible from the underside of the device. When changing the batteries, observe the correct polarity (*see figure right*)!



To replace the batteries, the device always must be switched off. Data security is ensured by means of voltage buffering for a period of 5 days.

If the HFM-01, using the connection cable VMU-05, is connected via the USB interface USB-01 (*see chap. 2.4.1*) to a PC system, the power supply of the Master is done by means of the USB cable. Alternatively, the flash master HFM-01 can also be power-supplied by an external power source, which is to be connected to its USB connector (*standard: accu pack 'AP-5002', see chap. 2.4.2*). On loss of voltage from the USB-Interface, the device automatically switches over to the internal power supply.

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Important: To ensure data security during measurement, it is indispensable that the device contains charged batteries, even when the HFM-01 is fed by an external power supply.

2.2 Modules

Principally the HealthLab Flash-Master HFM consists of the two components base- and satellite-module, which are described below.

2.2.1 Base Module

The upper part of the device contains the base module of the flash - Master HFM-01 with HealthLab - Master functions. That is, recording of data from the internal measuring technique and the connected satellites, as well as storing and transmitting of data. The Flash - Master HFM-01 captures standardly data of barometric pressure and - using a 3-axis sensor - the 3D acceleration as an integrated feature of the base module (*upper part of device*).

Measuring data, which is captured by integrated or connected sensor technology of the bottom part of HFM-01, resp. recorded data from additionally connected HealthLab measuring-satellites, will be stored. The data can be displayed, exported and evaluated using the HealthLab-Software ('Heally Control', 'Heally', 'HLabExport', 'HLEplorer').

2.2.2 Satellite Module

Pursuant to the modular concept, the HFM-01 is available in variants with different satellite-modules (*bottom part of device*).

2.2.2.1 Heart Rate – Module

The standard version of the satellite module measures the heart rate and body core temperature using external sensors. *POLAR* chest straps are used as external data recorder for the heart rate. For temperature measurement, two NTC temperature sensors can be used. As a customer specific feature, the capturing of the body core temperature is done using a specific dual temperature sensor.



figure: POLAR WearLink chest strap with transmitter and dual temperature sensor (images not true to scale)

2.2.2.2 ISM Radio - Module *afar*

Additional to the measurement of body core temperature, (*see chap. 2.2.2.1*), this variant of satellite module provides the transmitting of measuring data of the HFM-01 to a radio set, and thus to a distantly positioned host computer, by means of a specific ISM module. Using this form of connection, an operating range up to 5 km can be realised. *Note:* Local influences may impair the radio range.

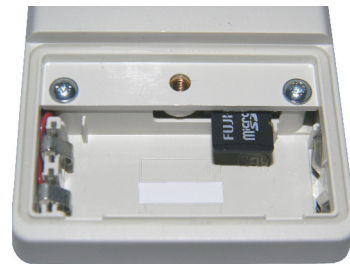
2.2.2.3 ISM Radio - Module *near*

A satellite module equipped with an ISM radio module for short range is scheduled for future usage with wirelessly communicating HealthLab measuring-satellites. This device is in preparation.



2.3 Memory Card

A micro-SD card is used as data storage of the Flash - Master HFM-01. The device provides storage capacities of 128 MB up to 32 GB. An optimum of read / write performance will be given on storage capacities of 1 – 2 GB. The slot for the memory card is accessible through the opened battery compartment (*pictured right*).



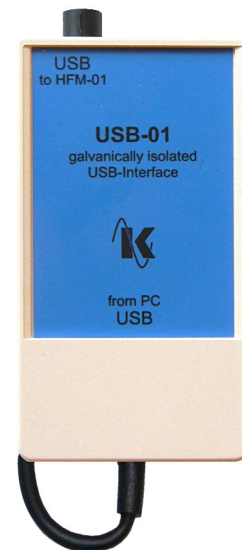
Note: The memory card must always be inserted during operation of HFM-01! Disconnect - if connected - the external power supply (accu pack / USB connection cable) from the Flash - Master HFM-01 and switch it off, to replace the card. The batteries of the internal power supply are also to remove from the device. Replace them, after card changing is done.

2.4 Accessories

The below described, for external connecting provided components may be used in combination with the HealthLab Flash-Master HFM-01.

2.4.1 USB Interface USB-01

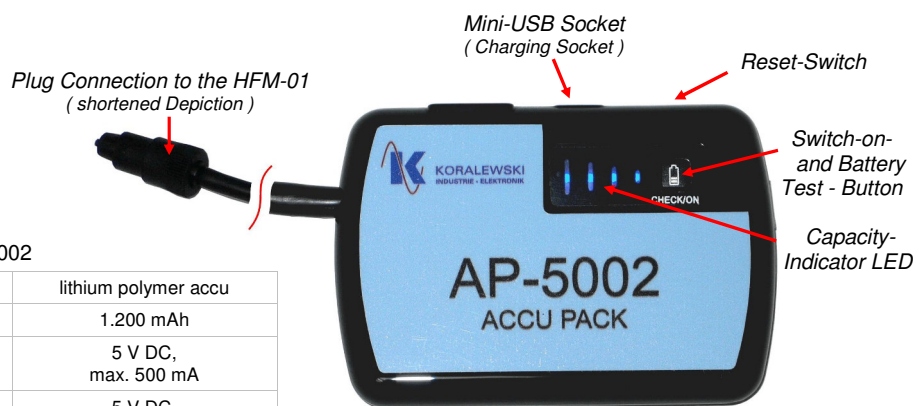
By using the galvanically isolated USB interface USB-01 (*pictured right*), the access on data and settings of the flash HealthLab Master HFM-01 is possible during operation, that means during a measurement. With an isolation voltage of 4,000 V AC, the device offers the, in this context required security to protect the proband against injuries.



Note: To avoid voltage damages, only the galvanically isolated USB interface USB-01 for the connection of the HFM-01 to the USB port of a PC system is to use!

2.4.2 Accu Pack AP-5002

In order to realise longer measurement periods with constant remaining mobility of the proband, the HFM-01 can be supplied with power by an external battery pack (*as standard AP-5002 - pictures below*), which is available as accessory.



Technical Data AP-5002

| | |
|----------------------------------|----------------------|
| type of battery | lithium polymer accu |
| accu-capacity at 5 V | 1.200 mAh |
| nominal input voltage / current | 5 V DC, max. 500 mA |
| nominal output voltage / current | 5 V DC, max. 500 mA |
| charging time | approx. 4 hrs. |
| dimensions w / h / d | 8,4 x 5,8 x 1,3 |
| weight | 71 g |

This device is to be connected to the USB port of the Flash-Master. On first use of the AP-5002, the device is to charge over a period of 8 hours. Then re-loading is done as required -



using an USB cable - via the charging socket on the top edge of the device (see figure above). By pressing the switch-on and battery test button (CHECK/ON), the AP-5002 is activated, or check of the charge status of the device is done. If capacity is low, only the right LED lits, all LEDs are on when it's fully charged. If no current ($I < 20 \text{ mA}$) is drawn from the battery over a period of more than 60 seconds, the device switches off automatically. In case of critical errors, such as a short circuit at the voltage output, the AP-5002 switches off itself. The device can be reactivated by use of the reset switch on the upper edge of the device (see figure above).



Attention: The device accu pack AP-5002 must not be charged, while it is connected to the measurement system (observe hints on the back of device)!

To ensure data security during measurement, it is indispensable that the device contains charged batteries, even when the HFM-01 is fed by an external power supply.

3 Putting into Operation

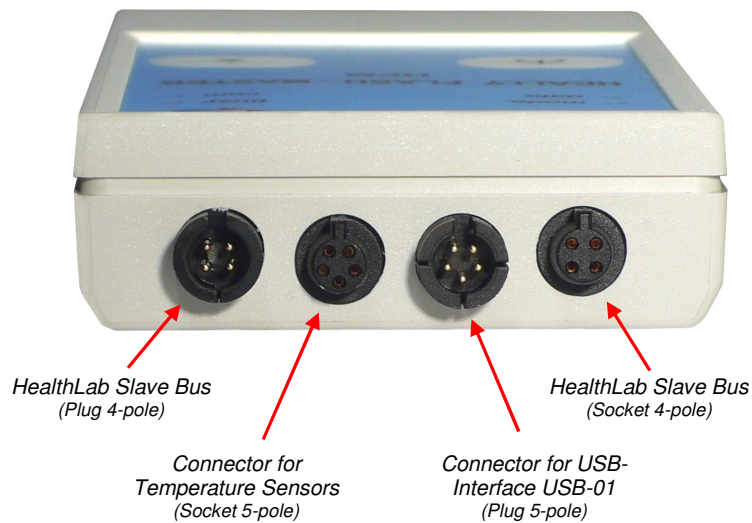
For putting into operation, the Flash-Master HFM-01 is to connect to the respective sensor technology, which is provided for the current planned measurements, as well as to eventually in addition used satellites. Thereby, the correct cabling is to be observed.

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

The PC software Heally Control (HL5_Heally.exe) allows it to select the channels to be measured, and to configure their parameters, such as sample rate, gain, filters, etc..

3.1 Connectors

The Flash-Master HFM provides the following Connectors:





3.2 Monitoring and Controls

For monitoring and control of the HFM-01, four LEDs as well as two buttons are arranged at the surface of the device. The LEDs indicate the operating states as described below:



| LED | Modus | Meaning |
|-------------------------|-----------------------|---|
| mode [green] | continuously on | passive (idle) state |
| | fast flashing | preparing measurement (Prepare) |
| | slow flashing | measurement with recording of data |
| data [yellow] | as per configuration | associated function / data channel configurable |
| | busy [red] | continuously on |
| busy [red] | continuously on | power supply via USB-01 |
| | continuously on | 'Power' - key is held down (while switching off the HFM-01) |
| | com [green] | continuously on |

Note: When switched on, all LEDs flash once briefly.

The following functions are assigned to the two buttons:



Power – actuating this button, the Flash-Master HFM-01 is switched on. In this context is to note, that if the HFM-01 is externally supplied with power from the accu pack AP-5002, this device is also to activate by pushing its switch-on button ('*CHECK/ON*' – see chap. 2.4.2). Holding the power button pressed down (more than 3 seconds) switches off the device.

Note: The USB connection is coercively to separate, to enable the switch-off of the master. If an USB connection to a PC system exists, the HFM-01 is furthermore supplied with voltage. In this case the LED **busy** is lit, and no further interaction (neither by actuating the buttons nor via the USB or Bluetooth connection) is possible.



Star – actuating this button while device is in the operating mode (*without measuring*) starts the measurement. During measurement, a marker in measuring data file is set by pressing this button. This enables the targeted search on measuring data of specific periods of measurement.

3.3 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 standard version of the HFM-01 the using of a *POLAR* - strap, as well as up to two temperature sensors is possible.

3.3.1 POLAR – Strap

For details on using of the *POLAR* - strap look up in the related manual for this component.

Each on a *POLAR* - strap working transmitter is provided with an individual address, which must be known to the associated master. An appropriate configuration is preset at condition on delivery of HealthLab Flash Master HFM-01. In the case of a necessary exchange of the transmitter, the master can be adjusted to the address of the new transmitter (see also chapter 4.2 Preparation / Configuration Satellite) using the software 'Heally Control' (HL5_Heally.exe).

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3.3.2 Temperature Sensors

Depending on the respective intended Measurement, different temperature sensors are used. The respective sensor cable is connected to the socket, which is provided for this purpose with the HealthLab Flash-Master HFM-01 (see chap. 3.1 Connectors).

The sensors are to be applied according to their intended use. Thus, for example skin temperature sensors with adhesive tape are affixed to the skin surface according to the specification of the measurement project. The dual temperature sensor (customer specific feature), which is especially developed to capture the body core temperature, is to be used in accordance to its experimental directives (see details there).



Note: To avoid the falsification of measurement data, the influence of the use of an measuring instrument to the recorded data must be basically prevented. Therefore it is necessary to observe, that positioning and fixing of the sensors will not be regarded as an annoyance by the proband. Otherwise this will inevitably lead to a change in his behaviour and thus lead to falsifications in the measurement result.

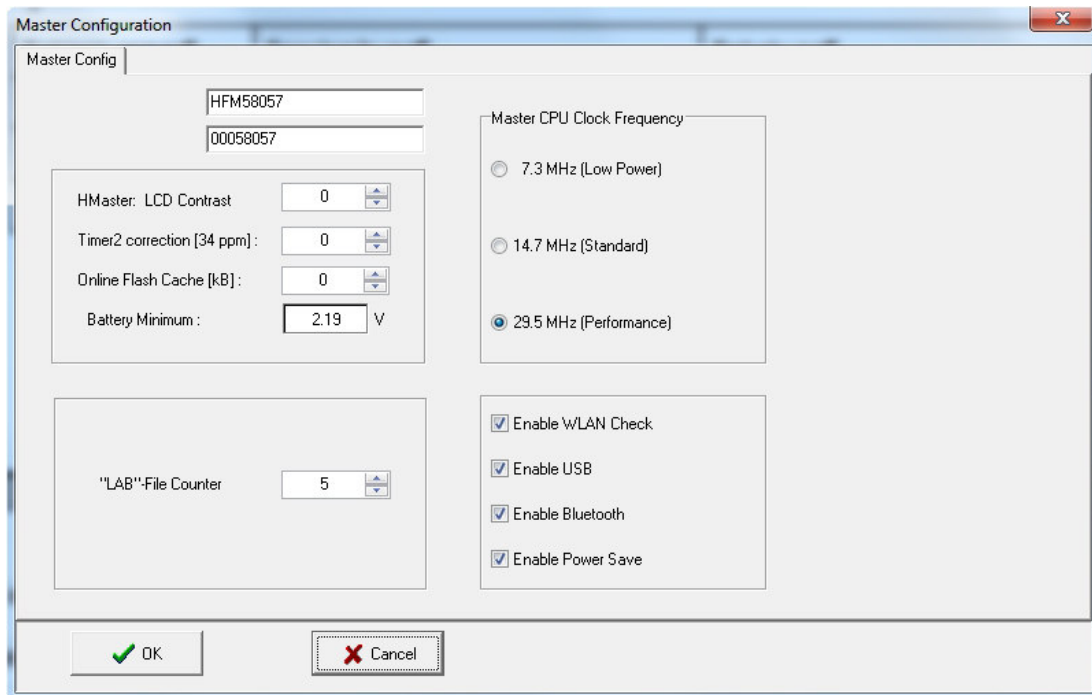




4 Measuring

4.1 Preparation / Configuration Master

The settings for the Master of the HFM-01 are viewed or modified - only by appropriately trained and authorised operators - using the program 'HL Calibration' (HL5_Caliber.exe). In doing so, the input dialog 'Master Configuration' is to call up.

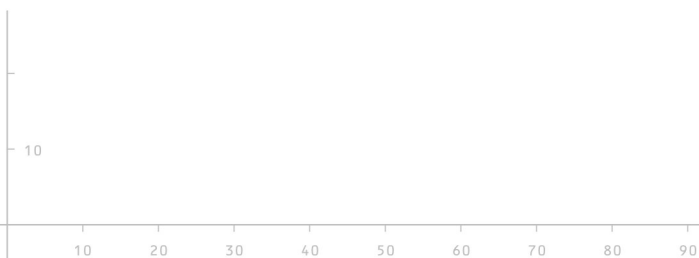


In addition to the device identifier and serial number of the HFM-01, the following values are adjusted in the left area of the above pictured configuration dialog:

- HMaster: LCD Contrast: not used by HFM-01;
- Timer2 correction [34 ppm]: not used by HFM-01;
- Online Flash Cache [KB]: not used by HFM-01;
- Battery Minimum: predefines, at what voltage the device switches into the error mode (see also chap. 0);
- "LAB"-File Counter indicates the number of made to date measurements; *Note:* Resetting or modification of the counter should only be done in combination with a new series of measurements;

In the right part of the configuration dialog, the following settings are done:

- Master CPU Clock Frequency: sets the clock speed of the processor;
- Enable WLAN Check: currently unused by HFM-01;
- Enable USB: turns the USB interface on;
- Enable Bluetooth: turns the Bluetooth module on;
- Enable Power Save: turns the energy saving mode on;





4.1.1 CPU Clock Speeds and Data Throughput

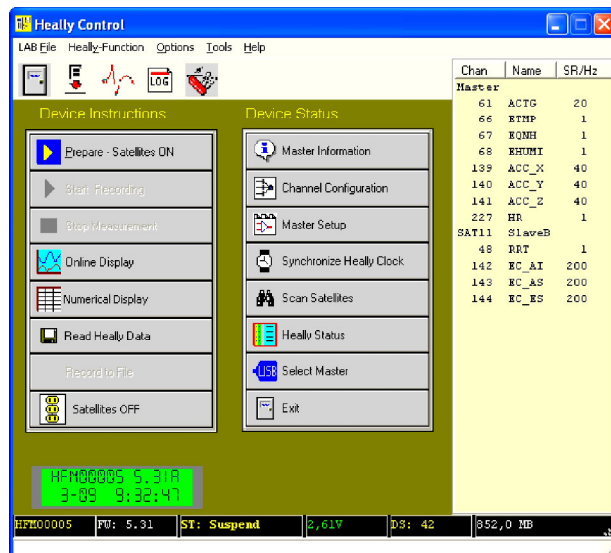
Depending on the configuration settings of the HFM-01, the connected active resources and the selected power supply, different operating parameters arise as result. Actual CPU clock speeds and data throughput under differing operating conditions are shown in the following table.

CPU clock speeds and data throughput in dependence on the configuration of the master:

| used Interface | Power | 'Enable USB' | 'Enable Bluetooth' | 'Master CPU Clock Frequency' | CPU Clock real (MHz) | max. Data Rate (kByte/s) |
|----------------|----------|--------------|--------------------|------------------------------|----------------------|--------------------------|
| USB | external | yes | yes/no | 7.3 MHz | 29.5 | 25 |
| USB | external | yes | yes/no | 14.7 MHz | 29.5 | 25 |
| USB | external | yes | yes/no | 29.5 MHz | 29.5 | 25 |
| USB | external | no | yes | n | n | invalid |
| USB | external | no | no | n | n | invalid |
| Bluetooth | external | yes | yes | 7.3 MHz | 29.5 | 25 |
| Bluetooth | external | yes | yes | 14.7 MHz | 29.5 | 25 |
| Bluetooth | external | yes | yes | 29.5 MHz | 29.5 | 25 |
| Bluetooth | external | no | yes | 7.3 MHz | 7.3 | 1 |
| Bluetooth | external | no | yes | 14.7 MHz | 14.7 | 15 |
| Bluetooth | external | no | yes | 29.5 MHz | 29.5 | 25 |
| Bluetooth | internal | yes/no | yes | 7.3 MHz | 7.3 | 1 |
| Bluetooth | internal | yes/no | yes | 14.7 MHz | 14.7 | 15 |
| Bluetooth | internal | yes/no | yes | 29.5 MHz | 29.5 | 25 |
| None | external | yes | yes/no | 29.5 MHz | 29.5 | 25 |
| None | external | no | yes/no | 7.3 MHz | 7.3 | 1 |
| None | external | no | yes/no | 14.7 MHz | 14.7 | 15 |
| None | external | no | yes/no | 29.5 MHz | 29.5 | 25 |

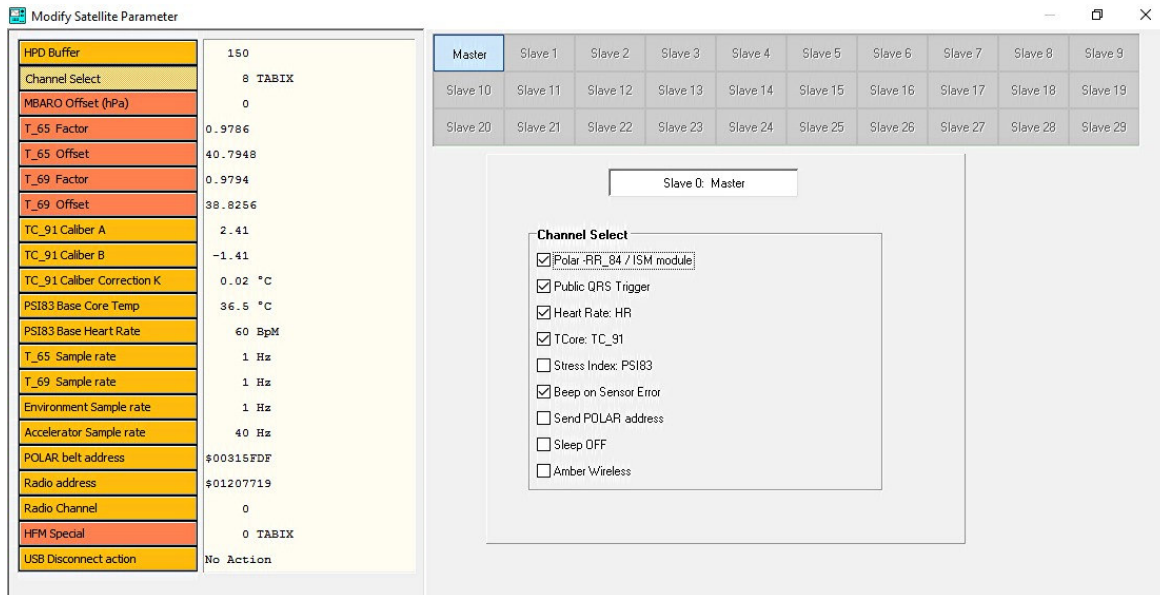
4.2 Preparation / Configuration Satellite

Within the control program 'Heally Control' (HL5_Heally.exe) the configuration of the measurement channels of the Flash-Master HFM-01 is called up by actuating the button 'Channel Configuration' (pictured right).





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 satellite (see chap. 4.2.2 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: Master and SAT18-01). After actuating of one of this buttons, the selection is highlighted in blue displayed in central range of the dialog box (shown here: Slave 0: Master) and the adjustable parameters of the satellite can be selected by orange buttons in the left part. With the Flash-Master HFM-01 the following parameters are available ('Cannel Select' is chosen in figure above):

- HPD Buffer: number of heart rate values, which are used for the continuous calculation of mean value and RMSSD;
- Channel Select: activation / deactivation of the required measuring channels;
- TC_91 Caliber A: calibration coefficient A for dual temperature sensor*;
- TC_91 Caliber B: calibration coefficient B for dual temperature sensor*;
- TC_91 Caliber Correction K: correction value K for dual temperature sensor*;
- PSI83 Base Core Temp: body core temperature - base for calculation of PSI (stress index equals 0 at measured base values);
- PSI83 Base Heart Rate: heart rate - base for calculation of PSI (stress index equals 0 at measured base values);
- T_65 Sample Rate: sample rate temperature sensor (inner sensor dual ts*);
- T_69 Sample Rate: sample rate temperature sensor (outer sensor dual ts*);
- Environment Sample Rate: sample rate environment sensor (barometric pressure);
- Accelerator Sample Rate: sample rate for acceleration sensor;
- POLAR belt address ¹ : address of the POLAR - strap ¹ (hexadecimal – if \$00000000 is set, all straps in range of the HFM-01 receiver will be indicated);
- Radio address ² : address of the masters radio module ²;
- Radio Channel: in preparation for ISM module;
- ISM update rate ² : 0,5 Hz – modification only in consultation with manufacturer ²;

¹ only available in standard version of HFM-01 ;

² only available in 'ISM radio' version of HFM-01 ;

* dual temperature sensor as customer specific feature;



4.2.1 Channel Select

The activation of check-boxes within the selection field 'Select Channel' (see figure above), have the following effects:

- Polar –RR_84 / ISM module ^{1,2} hereby the receiver for the POLAR - strap ¹, resp. for the ISM radio - module ² for radio devices is switched on;
- Public QRS Trigger ¹ provides the availability of the ECG trigger pulse for other measuring satellites;
- Heart Rate: HR ¹ output of the heart rate ¹;
- Tcore: TC_91 activates the calculation of the body core temperature (use only with dual temperature sensor*);
- Stress Index: PSI83 ¹ activates the calculation of stress index, based on body core temperature and heart rate, as well as on the respective resting values of this measuring data ¹;
- Beep on Sensor Error monitors the connected dual temperature sensor on line breakage (open-circuit) and short circuit;
- send POLAR Belt address ¹ transfers the received POLAR - strap addresses to the host computer ¹;
- Sleep OFF test feature (not active as standard);
- Amber Wireless ³ usage of wireless communicating satellites (not yet realised);

¹ available in standard version of HFM-01 ;
² available in 'ISM radio' version of HFM-01 ;
³ in preparation for 'ISM radio near' version of HFM-01 ;
 * dual temperature sensor as customer specific feature;

4.2.2 Channel Index

| Channel-Designation | Channel No. (=Identifier) | Signal | Unit | Range Accuracy | Sample Rate Hz | Gain | Offset |
|---------------------|---------------------------|---|------|-------------------------|----------------|------|--------|
| ACC_X | 139 | acceleration sensor x-axis | G | ±6 G | 40 | 340 | 2048 |
| ACC_Y | 140 | acceleration sensor x-axis | G | ±6 G | 40 | 340 | 2048 |
| ACC_Z | 141 | acceleration sensor z-axis | G | ±6 G | 40 | 340 | 2048 |
| ACTG | 61 | total acceleration | G | 0 ... 10 G | 20 | 340 | 0 |
| EQNH | 67 | barometric pressure | hPa | 300..1100 hPa ± 6,0 hPa | 1 | 1000 | 0 |
| T_65 ¹ | 65 | temperature sensor ¹ (inner dual sensor*) | °C | 0 ... +50 ± 0,05 | 1 | 100 | 0 |
| T_69 ¹ | 69 | temperature sensor ¹ (outer dual sensor*) | °C | 0 ... +50 ± 0,05 | 1 | 100 | 0 |
| TC_91 ¹ | 91 | body core temperature ^{1*} (DS : TI_65, TO_69) | °C | 0 ... +50 ± 0,5 | 0,5 | 100 | 0 |
| HR ² | 227 | heart rate ² | bpm | 30-300 | - | 10 | 0 |

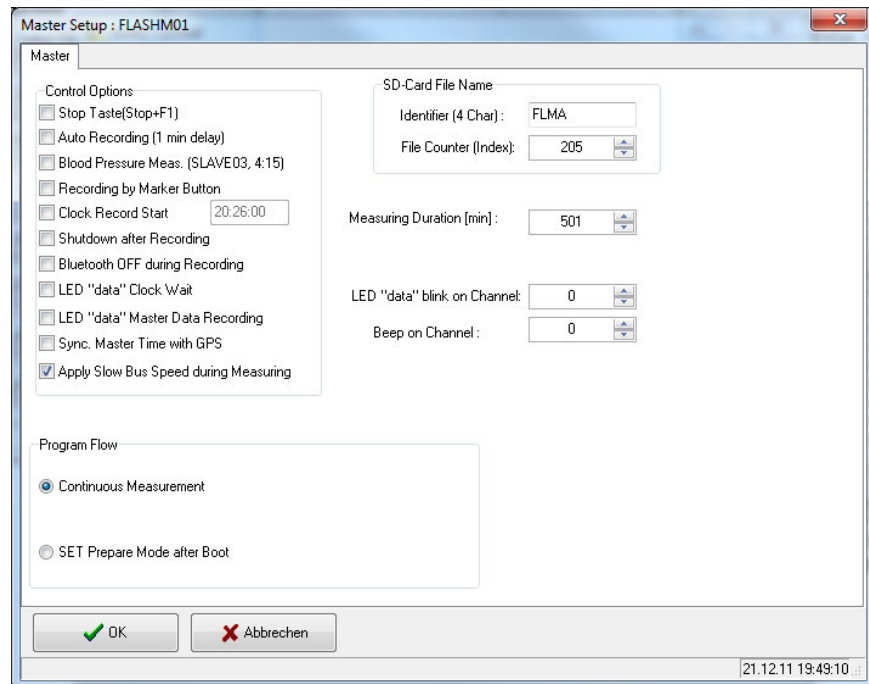
¹ measurement channel only available with the standard version of HFM-01 ;
² measurement channel available with the 'ISM radio' version and the standard version of HFM-01 ;
 * dual temperature sensor as customer specific feature;

4.3 Master - Setup

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The Master - Setup is used to configure the measuring procedure, particularly at offline - measurements. It includes the behavior at on and off of the device, the automatic start of measurings as well as the definition of the recording duration, presettings for a examination protocol (currently not active) and the usage of the LED *data* of the master.



4.3.1 Control Options

The following control functions can be activated within the selection field 'Control Options':

- Stop Taste [Stop+F1]¹ activates a security function: if this option is activated, the completion of measurement is done by simultaneously pressing the *Stop* - button and *F1* - button, instead of the sole pressing of the *Stop* - button;
Note: This function is only active on Flash-Master ¹ with display and keyboard;
- Auto Recording (1 min delay) automatically (delayed) start of data recording after turning on the master: this allows offline-measurements without a PC nor intervention of the user; in this case, the duration of the recording is to be specified by means of 'Measuring Duration [min]' (see chap. 4.3.4);
the recording does not start automatically, if - within the delay time of approx 1 minute - a connection from a PC is done; for this, the PC has to be connected to the respective Flash - Master either via a bluetooth connection, carried out by the software 'Heally Control' or an USB - adapter, which is connected to the Flash - Master;
Note: the function 'Auto Recording' can be combined with the options 'Shutdown after Recording', 'Bluetooth OFF during Recording', and 'Apply slow Bus Speed during Measuring' (descriptions see below);
- Blood Pressure Meas. (SLAVE03, 4:15)¹ – ¹
- Recording by Marker Button¹ – ¹
- Clock Record Start this – once - starts the recording of data at the point of time, set within the associated input field; the recording duration is to be specified using 'Measuring Duration [min]' (see below);
Note: the master remains active until the start of measurement;

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- Shutdown after Recording the system will be turned off after completion of data recording (measuring duration has expired), by means of this option;
Note: if an active connection to a PC exists, this function will be avoided;
- Bluetooth OFF during Recording using this option will turn off the Bluetooth - module during data recording, to reduce energy consumption, e.g. in long-term measurements;
Note: for the activation of this option, the coupling between the HealthLab Master HM-01 and the controlling host PC has to be disconnected (Select Master - cancel). The software 'Heally Control' will be unable to build up a Bluetooth connection from PC to the Flash-Master during measuring; however, a completion of measurement is possible at any time using the USB - adapter;
- LED "data" Clock Wait indicates the active waiting time of the master, when using the option 'Clock Start Record' (see above), due to the LED **data**;
- LED "data" Master Data Recording indicates a running data recording by means of the LED **data**, which is connected in flashing mode;
- Sync. Master Time with GPS ¹ –¹
- Apply Slow Bus Speed during Measuring activates a special mode for power-saving measurements: HealthLab Slave Serial Bus and the satellites operate at low clock speeds, transmission speed and computing capacity of the satellites are limited;
Note: currently this mode is available only for a few satellite - types: it will only be activated by switching into the 'Prepare Mode', if the Flash - Master and each of the connected satellites support the low clock speed mode;

¹ Option not available for HFM-01 ;

4.3.2 Program Flow

The choosing is possible between two program - modes:

- Continuous Measurement continuously measuring;
- SET Prepare Mode after Boot after turning on the master, it is automatically set in preparation state (Prepare Mode); the start of the recording is performed by actuating the star - button (*) of the Master;

4.3.3 SD-Card File Name

The presettings for the use of file names are specified within this field:

- Identifier (4 Char): * specifies the first 4 characters (letters) of the file names for the data records;
- File Counter (Index): * defines the starting value for the file counter (see also chap. 4.1 / Preparation / Configuration Master);

* The file names of the LAB-files will be formed by using 'Identifier' and 'File Counter'.

4.3.4 Further Settings

- Measuring Duration [min]: specifies the duration of a data recording, values from 1 up to 65,000 minutes can be adjusted; the temporal restriction of data recording is disabled by setting this value to '0';
Attention: if a value other than '0' is set here, each data recording (even those from PC-controlled measurements) by this feature is restricted in its time;
- LED "data" blink on Channel: using this option, the presence of data on the adjusted channel can be indicated; in this way can it be tested, whether - e.g. at offline-measurements - the satellite bus is connected;





- **Beep on Channel:** using this option, the presence of data on the adjusted channel can be indicated by a beep-tone of the master;
Note: this function works independently from that beep - mask, by which intact dual temperature sensors (*customer specific feature*) are indicated at their satellites;

4.4 Troubleshoot of occurring Errors

4.4.1 RTC – Error

The system clock of the Flash - Master HFM-01 may - caused for example by longer-term stocking without batteries - lose its date and time. In this case, LED **busy** and LED **data** are blinking in second intervals. Additionally, the melody 'Westminster chime' sounds out.

Reset of this error is performed using the program 'Heally Control': the system time of the HFM-01, which is connected to the PC, is updated by actuating the button 'Synchronize Heally Clock'.

4.4.2 Sensor Error

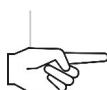
If the parameter 'Beep on Sensor Error' is activated (see figure page 10 *Modify Satellite Parameter* and chap. 4.2.1 *Channel Select*), the connected dual temperature sensor (*customer specific feature*) is continuously monitored on line breakage and short circuit during measurement. Then the occurrence of a corresponding error is indicated by a reoccurring acoustic warning signal of two consecutive tones (the second tone is slightly higher and takes about four times as long as the first). In this case, the faulty sensor has to be replaced by a functioning sensor.

4.4.3 Critical Errors

If an, for the operation of the HFM-01 critical error occurs, the device switches into error mode. All 4 LEDs will flash in this case synchronously in intervals, that is to say short blinks are repeated with a break of approx. 1 second. The number of blinks corresponds to the error number in the following table.

| Error Number | Cause | Troubleshooting |
|--------------|------------------------------------|--|
| 2 | SD card - error | check micro-SD card, reformat or replace, if necessary; |
| 3 | battery empty | replace empty batteries by charged ones; |
| 4 | data bus - error (e.g. bad packet) | check wiring and satellites, possibly too many satellites are connected; |
| 6 | file error | check micro-SD card, delete or reformat, if necessary; |
| 7 | hardware - error | check connectors, replace memory card, if necessary; try reboot (switch off and on, perhaps remove batteries temporarily), send the device for checking to service, if necessary; |
| >= 10 | internal error | try reboot (switch off and on), send the device for checking to service, if necessary; |

Note: In error mode, the HFM-01 is to be switched-off by pressing any button.



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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.

| | |
|--|---|
| Designation | HFM-01.62 / master, 3D acceleration, barometric pressure, heart rate and body core temperature (type of device: HFM01, hardware revision: 62, firmware revision: 5.32, or higher) |
| Power Supply | internal: 2,0 ... 3,0 V (2 accumulators / batteries type AAA) external: 5 V (via USB – Interface) |
| Power Consumption (without satellites) | max 120 mA at internal power supply (2V4) max 65 mA at external power supply (5V) |
| Dimensions / Weight | 60 x 100 x 20 mm / 100 g |
| Interfaces | USB connector (via USB – Interface USB-01) Bluetooth 2.0 'HealthLab Serial Bus' connector (2x for external HealthLab satellites) ISM module (provided for external wireless HealthLab satellites) |
| Data Storage | up to 32 GB on micro-SD card |
| Sensor Technology | internal in base module: 3-axis acceleration sensor, air pressure sensor; external at satellite module: body core temperature (as customer specific feature via dual temperature sensor) heart rate (received via radio from e.g. 'Polar WearLink' – strap) |
| Suppliers | Koralewski Industrie-Elektronik oHG / SpaceBit GmbH |

5.1 Ordering Information

| HealthLab Flash-Master | Part Number |
|---|-------------|
| HFM-01 | E1689 |
| Accessories | |
| NTC temperature sensor (2-channels) TPS-02 <i>dual temperature sensor on request</i> | E1288 |
| USB interface with galvanic isolation USB-01 | E1691 |
| USB connection cable VMU-05 | KC0216 |
| accu pack AP-5002 <i>other accu pack variants on request</i> | E1690 |
| connection cable sat.-sat. VSS-05, 0,5m | E1177 |
| connection cable master-sat. VMS-10, 1,0m | E1176 |

