

# Calibration guidelines for SCA10h & 11h

## General:

The SCA10h and 11h products require calibration to produce meaningful results. Variation in measurement environments may result in major changes in the measured BCG waveform and noise conditions, which needs to be accounted for through a set of calibration parameters. What is common with all methods is the need of information from empty bed (noise floor) and the occupied bed situation (BCG waveform conditions, the range of expected amplitudes from this particular measurement setup). Furthermore, it is recommended to use long periods, e.g. overnight, to cover all typical postures. When the parameters are off, BCG readings can be measured even with the bed being empty or beats are being missed even with occupied bed.

## When to calibrate:

In practice, calibration parameters depend mostly on the bed type, sensor position and the external vibration present in the environment. Thus, all new sensor installations need to be calibrated to the environment. When a new person occupies the bed, the sensor should be re-calibrated, although change in parameters may not be significant. If person's weight & other physiological characteristics are similar, sensor will continue operating OK and re-adjustment of calibration doesn't need to be done with haste. General recommendation is to always integrate a background calibration scheme into the production environment using the Intelligent and Auto-calibration methods.

## Embedded calibration:

The 2-phase calibration script in the embedded MCU can be triggered via HTTP API in e.g. WinDemo GUI or through binary interface to SCA10h.

### Pros:

- Ease of use (no integration work required)
- Uses acceleration information-> can produce accurate calibration with small amount of data

### Cons:

- Cannot be modified to use longer periods of data than 60 s
- Sensitive to movements during both empty bed sequence (errors in noise floor setting) and occupied bed phase (results in amplitude range being set too high)
- Requires knowledge of bed occupancy status during calibration & semi-manual triggering of calibrations

### Where to use:

- For initial calibrations & testing
- For production environments, automated calibration schemes using Intelligent or Auto-calibration are recommended.

## Intelligent calibration:

A calibration script that analyzes measured BCG data output, separates given set into occupied and empty bed sequences, and calculates parameters. Usage is intended as a background application running on the receiving end of data collection system (C-code available for integration).

### Pros:

- Can use large sets of information
- Can be a fully automated background script

### Cons:

- Needs considerable amount of data (>1h) in order for separation to work reliably.
- User needs to know whether the input datasets have empty bed sequences in them
- Low BCG signal conditions & high external noise can make reliable data separation more difficult.
- Iterative method, requires typically multiple iterations for optimal parameter setting.

### Where to use:

- Cloud systems that conduct calibration through the OTA-interface (-> minimum calibration interval in the range of >1h).
- Local systems that can accept > 30 minutes per iteration calibration delay.

## Auto-calibration:

A calibration script for quick calibrations when local access to device (HTTP API) is available. Uses initial parameter setting and Bed Occupancy Detection code for data separation. See Android Demo App for reference (Java source codes and MATLAB code available for reference).

### Pros:

- Can calibrate in a relatively short time interval (~5 minutes)
- Can be a fully automated background script
- Code is configurable for specific use cases

### Cons:

- Sensitive to movement if short iteration period (<1min) is used.
- Requires local network access
- If Java environment not in use, will require more integration work as only partial C-code available.
- Requires knowledge of initial occupancy status of the bed.
- Iterative method, may require multiple iterations for optimal parameter setting.

### Where to use:

- Gateway/application that operates in local mode.
- When fast calibration (<1h) is required.