

The NIHR Southampton Biomedical Research Centre (BRC) has a tight quality assurance system for the writing, reviewing and updating of Standard Operating Procedures. As such, version-controlled and QA authorised Standard Operating Procedures are internal to the BRC.

The Standard Operating Procedure from which information in this document has been extracted, is a version controlled document, managed within a Quality Management System. However, extracts that document the technical aspects can be made more widely available. Standard Operating Procedures are more than a set of detailed instructions; they also provide a necessary record of their origination, amendment and usage within the setting in which they are used. They are an important component of any Quality Assurance Framework, but in themselves are insufficient and need to be used and interpreted with care.

Alongside the extracts from our Standard Operating Procedures, we have also made available here an example Standard Operating Procedure and a word version of a Standard Operating Procedure template. Using the example and the Standard Operating Procedure template, institutions can generate their own Standard Operating Procedures and customise them, in line with their own institutions.

Simply offering a list of instructions to follow does not assure that the user is able to generate a value that is either accurate or precise so here in the BRC we require that Standard Operating Procedures are accompanied by face-to-face training. This is provided by someone with a qualification in the area or by someone with extensive experience in making the measurements. Training is followed by a short competency assessment and performance is monitored and maintained using annual refresher sessions. If you require any extra information, clarification or are interested in attending a training session, please contact Dr Kesta Durkin (k.i.durkin@soton.ac.uk).

This document has been prepared from Version 2 of the BRC Standard Operating Procedure for bioelectrical impedance using the Bodystat QuadScan 4000. It was last reviewed in May 2014 and the next review date is set for May 2016. The version number only changes if any amendments are made when the document is reviewed.

NIHR Southampton Biomedical Research Centre

Procedure for using the BODYSTAT QUADSCAN 4000 BIOELECTRICAL IMPEDANCE MACHINE

BACKGROUND

This procedure is to be used for circumference measurements of children between the ages of 12 months and 12 years.

PURPOSE

To ensure correct and uniform use of the *Bodystat QuadScan 4000* body composition monitoring unit when measuring hand-to-foot whole body electrical impedance.

SCOPE

This procedure applies to any study requiring measurements of bioelectrical impedance using the *Bodystat QuadScan 4000*, within the BRC.

RESPONSIBILITIES

It is the responsibility of the measurer to use this procedure when measuring bioelectrical impedance using the *Bodystat QuadScan 4000*. It is the responsibility of the principle investigator to ensure that staff members who are working on specific studies have adequate experience to do so.

PROCEDURE

<http://www.bodystat.com/products/quadscan-4000/>

What information can the Bodystat QuadScan 4000 give you?

- ECW % and ECW Volume
- ICW% and ICW Volume
- TBW % and TBW
- 3rd Space Water
- Body Cell Mass
- ECW/TBW Nutrition Index
- Plus Normal % Levels
- Body Fat % and Fat Weight
- Body Lean Mass
- Dry Lean Mass
- Basal Metabolic Rate (BMR)
- BMR/Body Weight
- Average Daily Calorie Requirement
- Waist/Hip Ratio
- Body Mass Index - Plus Normal Range
- Body Fat Mass Index (BFMI)
- Fat Free Mass Index (FFMI)
- Illness Marker™
- Impedance Values at 5, 50, 100 and 200 kHz
- Resistance 50 kHz/Reactance 50 kHz
- Phase Angle 50 kHz

Bodystat QuadScan 4000

Not recommended for females in the early stages of **pregnancy** or for participants with **pacemakers**.

Before testing

For accurate and reproducible results on repeat tests, it is important to ensure that the participant is as normally hydrated as possible. This should be based on a clinical assessment of the patient by the research nurse. They should refrain from:

- Eating for 4-5 hours before the test.

- Exercise for 12 hours before the test.
- Caffeine (i.e. normal tea, coffee and energy drinks) and alcohol consumption 24 hours before the test.

Calibration of the *Bodystat QuadScan 4000*

The *Bodystat QuadScan 4000* should be calibrated at the beginning of each day of use.

The calibrator is supplied with the *Bodystat QuadScan 4000* machine. Calibration is performed following the instructions below:

1. Attach one pair of red and black leads to any one terminal of the calibration unit.
2. Attach the other pair of red and black leads to the other terminal of the calibration unit.
3. Switch the unit on and make a note of the test number.
4. Accept the "default" values on the display.
5. Continue as normal to make the measurement.
6. Scroll using the down arrow to the values of impedance. You should find that the results at 5 kHz, 50 kHz, 100 kHz and 200 kHz should reflect readings of between 496 to 503, approximately a 0.5% variance on either side of the high precision 500 ohm resistor in the Bodystat calibrator.
7. If the results are incorrect, replace the battery with a Duracell or Procell. If this does not rectify the problem, contact *Bodystat QuadScan 4000* or your local supplier.

Before using the *Bodystat QuadScan 4000*:

1. Explain the procedure to the participant.
2. Clean the machine using a detergent wipe and then wash your hands.
3. Obtain accurate measurements of the participant's height (in cm, rounded-up or -down to the nearest whole number) and weight (in kg, to the nearest 0.1 of a kg) following appropriate SOPs.
4. Check that there is sufficient battery power in the machine prior to commencing by switching on the machine and checking the battery indicator (series of bars on the left of the display).
5. Instruct the participant to remove their shoe and sock from their right foot, remove any watches or bracelets on the right wrist which may impede the correct placing of electrodes,
6. Lie participant in the **supine position for 5 minutes** before taking the measurements.
7. Ensure that the legs and arms are spread out so they are not in contact with any other part of the body.

8. Thoroughly wipe (using alcohol wipes/sterettes) the area of the skin where the electrodes are to be attached as products such as body moisturiser, can affect the results.

Using the Bodystat QuadScan 4000:

1. Place two electrodes on to the right foot (it might be helpful to draw an imaginary straight line between the protruding bones on the ankle, then place each electrode in the centre of that line). Place one just below the base of the toes and the other on the ankle between the medial and lateral malleoli (the large protruding bones on the side of the ankle) (figure 1).

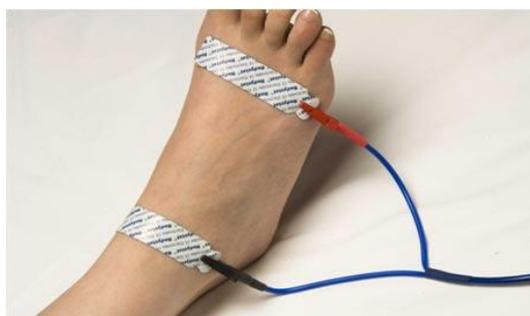


Figure 1. Placement of electrodes on foot

- Foot electrodes:** Electrodes are placed sideways so that the non-stick electrode connector point is facing the researcher. One electrode is placed centrally, directly where the second and third toe meet the foot. Place the second (black) electrode at the crease of the ankle (midline to the 'boney' landmarks).
2. Attach two alligator clips to the electrodes (red to the electrode nearest the toes, figure 1).
 3. Place two electrodes on to the right hand (it might be helpful to draw an imaginary straight line between the protruding bones on the wrist, then place each electrode in the centre of that line). Place one behind the knuckle of the middle finger and the other on the wrist next to the ulnar head (figure 2).

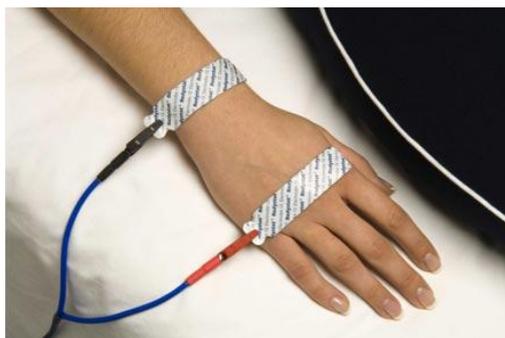


Figure 2. Placement of electrodes on hand

Hand electrodes: Electrodes are placed sideways so that the non-stick electrode connector point is facing the researcher. One electrode is placed centrally, directly below the third knuckle of the middle finger. The second (black) electrode is placed on the crease of the wrist (midline to the 'boney' landmarks).

4. Attach two alligator clips to the electrodes (red to the electrode nearest the fingers, figure 2).
5. Turn on the *Bodystat QuadScan 4000*.
6. 'test number' appears on the screen (used to identify subjects). Make a note of the number and then press enter ↵ to continue
7. Key in accurate data using the up and down buttons (↑/↓) (age, height, weight, and measurements of hip and waist circumference).
8. It is **not necessary** to enter waist and hip measurements or to select an activity level. You can leave these as the default setting.
9. Ensure that the participant has been in the supine position for 5 minutes.
10. Press enter to perform the measurement.
11. The *Bodystat Quad Scan 4000* will tell you to 'connect electrodes'.
12. Press enter again to commence the measurement and 'measuring' will appear on the screen.
13. The results will appear on the screen, the top line will display the actual measured result and the bottom line displays the recommended range.