DermaLab Beginner's Guide

Please note: The DermaLab Combo/Mini is laboratory/research equipment intended for non-clinical skin characterization and investigational use only. It is not intended for diagnosis, treatment, monitoring, or prevention of disease and is not a medical device.

It is recommended to become thoroughly familiarized with DermaLab probes and software before performing official measurements. For detailed information on measurement principles, maintenance, and technical applications, please refer to the *DermaLab Combo Instruction Manual*. Additional video tutorials and guidance are available on our YouTube channel "Cortex Technology", as well as on our website: cortex.dk/company/downloads.

Measurement setup

To ensure accurate and reproducible results, measurements should be performed by a trained operator using consistent settings in a stable environment (20-22°C and 30-50% humidity). The participant should acclimate to these conditions for 15-20 minutes minimum, particularly for TEWL and hydration measurements.

The participant should be in a relaxed position during measurements, and we recommend the participant lay down. Alternatively, the participant can be seated, provided the measurement area is fully relaxed - for example by letting the arm rest on surface, or by tilting the head. More importantly, the position should be the same for any follow up measurements, especially for elasticity, since any change in tension on the skin can influence the measurement. For all probes that use water (ultrasound or pH), it is important to use distilled or deionized water that is free of minerals.

It is important to consider the order of probe usage to prevent the influence of water or skin deformation.

We recommend the following measurement order:

1. TEWL, Hydration, Temperature, Dermascope, or Color (in any order)
2. Sebum
3. Elasticity
4. pH
5. Ultrasound

TEWL

At least **3 repeat measurements** at the same location are recommended to create reproducible results, allowing the skin to rest for approximately 1 minute between measurements. During this time, clear the measurement chamber by gently waving it in the air for 5-8 seconds.

TEWL measurements are initiated by pressing “Sample” and stop automatically when the measurement has stabilized upon reaching the Stop Criterion. A TEWL measurement typically takes 30-40 seconds. During the measurement, there should be minimal pressure on the probe, and the probe face should rest flat on the skin to create a seal.

Instrument performance may be verified by placing the probe in the DermaLab unit and performing a measurement - a reading of 0 ± 1.5 g/m^2/h is considered within normal range under the recommended temperature and humidity conditions.

Measure ambient

- Environmental conditions are measured when entering the TEWL screen, but may be re-measured by pressed “Measure Ambient”
- Recommended ambient **temperature** is room temperature (20-22 °C)
- Recommended **room humidity** (RH) is 30-50%

Stop Criterion

- Default stop criterion is set to a SD of 0.2 but may be adjusted using the buttons. An SD between 0.2 and 0.3 is most commonly sufficient
- “Time” and “Slope” may alternatively be set as stop criterion. “Time” ends the measurement after a fixed duration, while “Slope” ends the measurement upon reaching a steady-state diffusion. Please note: slope is not recommended for TEWL values < 10 g/m^2/h

Extended View

- Extended View may be selected to enable sensor data and absolute humidity for all 5 sensor layers

Hydration

At least **5 repeat measurements** at the same location are recommended to create reproducible results. Ensure the probe is held at a consistent angle for each measurement.

Standard deviation (SD) may be used to evaluate measurement success. It should be noted that SD is typically lower on dry skin than on more hydrated skin. The accompanying calibration checker may be used

to verify instrument performance – a reading of 1000 ± 30 µS using the calibration checker is considered within normal range.

Extended View

- Extended View may be selected to enable statistics and visualize bar charts
- Up to 50 measurements may be performed in extended view
- Clicking the "Setup" button allows users to predefine a measurement protocol for hydration measurements
- Mark the Zone or measurements that should be displayed on the chart by clicking on them

Skin Color

At least **3 repeat measurements** at the same location are recommended to create reproducible results. Calibration is performed using the supplied calibrator. The software will display a warning signal on the "Calibration" button when it is time for calibration – usually after approximately 100 measurements. During calibration, the software will indicate which calibrator slot to use.

Settings

- Click "Measurement Type" to choose between All, No Gloss, or Gloss only options. Disabling unused parameters increases the speed of future measurements
- Click "Optimization" to choose whether to perform a skin color measurements or color measurements elsewhere. Please note: if the skin is red, use the "Full Color" option

Sample Rate

- Choose between "Single" and "Continuous" Sample Rates to determine whether the system should make one measurement or perform measurements every 2 seconds until stopped by the user

Extended View

- Extended View may be selected to enable more measurement info panels and a data presentation panel of skin color
- An indefinite number of measurements may be performed in extended view

Sebum

We recommend a **single measurement**. Sebum measurements are typically performed along the hairline or in the T-zone of the face.

Follow the instructions on the screen during measurements, paying attention to the correct orientation of the Sebum Strip. Ensure that the entire collecting area of the Sebum Strip is in contact with skin for 5-10 seconds before re-inserting into the Tape Reader.

Elasticity

A single measurement with **3 cycles**, using the **Normal** skin firmness setting, and the default skin thickness setting of **1.00 mm** is recommended as a starting point. Each measurement should be carried out using a fresh sticker to guarantee proper adhesion. The probe cable should be supported during the measurement to prevent the probe from pulling on the skin.

A correctly performed measurement produces graph curves with a clearly defined elevation phase, plateau, retraction phase, and intermediate resting period. Measurements should be repeated if the curves appear abnormally flattened or exhibit jitter, as this may indicate an air leak caused by improper probe placement.

Skin Firmness

- *Soft* setting is recommended for very thin skin, e.g. skin under the eyes
- *Firm* setting is recommended for very thick and stiff skin, e.g. scars
- *Normal* setting is recommended elsewhere
- The optimal setting results in skin elevation of min. 1 mm to approximately 3.5 mm

Cycles

- Selects the number of elevation/retraction cycles (1, 3, or 5)
- 3 cycles are recommended to enable analysis of skin fatigue across cycles and to serve as validity check for correct probe application
- Results from each individual cycle can be seen under “Cycle Info” on the left-hand side of the screen by clicking on the cycle number. Alternatively, the average of the cycles can also be selected

Skin Thickness (mm)

- Default thickness is set to 1.00 mm
- May optionally be adjusted before performing elasticity measurements
- Influences calculation of Young’s Modulus

pH

We recommend **1-3 repeat measurements** at the same location.

When performing measurements, wet the probe tip with a bit of distilled water, place it on the skin, and gently move it in small circular motions before initiating the measurement. Re-wetting the probe tip

between repeated measurements is not necessary. Instead, remove the probe after each measurement and reapply it to the same moist skin area.

pH measurements are initiated by pressing “Sample” and stop automatically when the measurement has stabilized. A pH measurement may take up to a few seconds. During this time, ensure not to move the probe.

Ensure the probe is always stored in its holder and always covered by the KCl storage buffer solution. The tip of the probe must never dry out. We recommend cleaning the pH electrode with demineralized water to dissolve and remove any crystals that may have formed from the buffer solution.

Calibration

- Calibrate the pH probe each morning before use
- Calibrate the probe at pH 7.0 first and then at pH 4.0 by dipping the probe in the respective pH sachets and pressing the “Calibrate” button. Please note: each calibration can take up to 20 seconds
- Instrument performance can be verified by placing the probe in a pH sachet and pressing “Sample.” The measured value should closely match the stated pH of the sachet. If it does not, repeat the calibration
- pH probe sensitivity decreases over time, and the typical lifetime for a well-maintained pH-probe is 2 years

Ultrasound

At least **3 repeat measurements** at the same location are recommended to create reproducible results. This requires saving multiple files. Two ultrasound measurements can be performed at a time to compare different anatomical sites or the same location on contralateral sides.

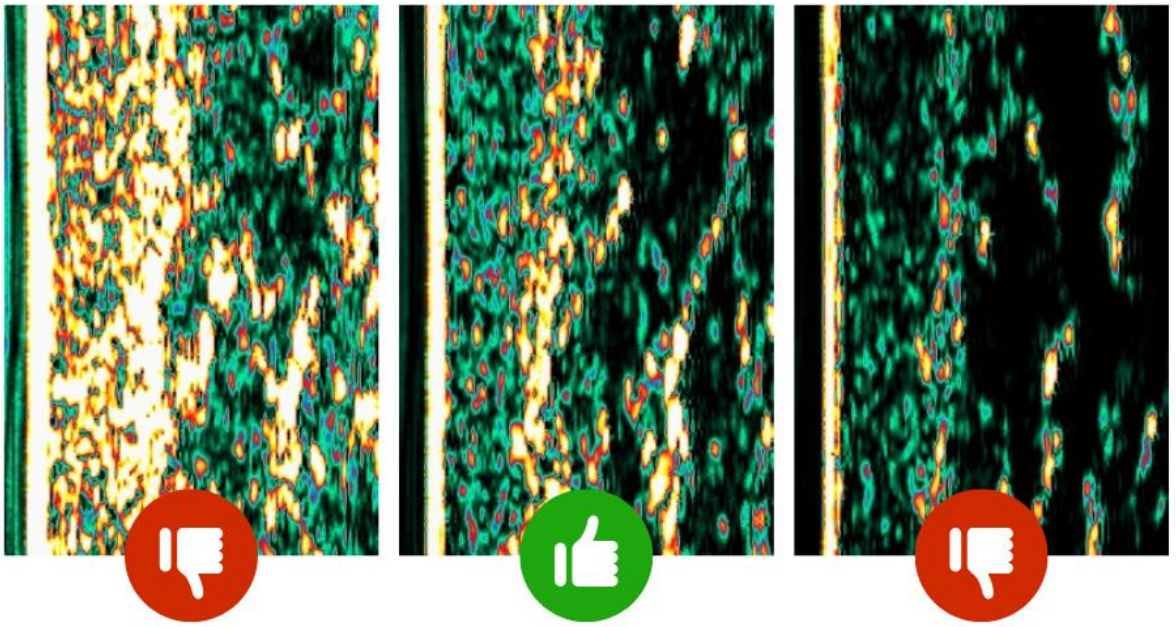
Before performing each measurement, **dip the probe face in distilled water** while making sure not to submerge the bonded section or button. Place the probe on the skin and gently move it in small circular motions before initiating the measurement. Ensure the probe is held in an **upright position** when performing measurements to avoid influence from air bubbles in the probe. Performing ultrasound measurements requires training of the operator.

Repeat the measurement if the ultrasound image appears unclear, noisy, or contains artifacts such as shadowing caused by air bubbles or insufficient probe contact.

Gain (ultrasound sensitivity)

Gain may be adjusted before measurements to create an image that is neither too bright nor too dark. To ensure reliable results, **use a consistent gain setting** for the same participant and when comparing skin intensity measurements across individuals.

Hypoechoic (dark) areas may need higher gain settings. We **recommend using gain setting 0** as a starting point and eventually increasing if images are too dark to visualize clear skin layer contrast. Too high gain setting leads to overexposed images with blurred details. Please refer to the image below for guidance.



Too high gain level with blurred details. Press Gain "arrow down" to lower intensity level.

Normal gain. Good intensity level and distribution with many details. No gain adjustment needed.

Too low gain image with loss of details. Press Gain "arrow up" to increase intensity.

Show Graph

Clicking the "Show Graph" button visualizes a superimposed graph:

- The *high peak of the red left* part originates from the combined probe surface/epidermal reflection
- The *yellow part* indicates the Low Echogenic Band (LEB) of the dermis
- The *green part* indicates the reflective part of dermis
- The *right red part* indicates the subcutaneous layers

If the graph is red all over it might be due to incorrect gain setting or a natural consequence of a physical skin condition – e.g. differences in tissue composition. Try adjusting the gain setting and repeat the measurement.

Show Grid

- Clicking the “Show Grid” button visualizes an adjustable grid that may be used to quantify intensity and distance within certain areas – e.g. upper or lower dermis.
- The grid may be adjusted by pressing the arrows of “First line” and “Second line”. Data within the grid appears under “Grid Thickness” and “Grid Intensity”, and the data automatically calculated will not change.

Subcutaneous

We recommend a **single measurement**. Prepare the Subcutaneous probe according to the guide provided in section 6.5.2 of the *DermaLab Combo Instruction Manual*. Ensure the transducer is allowed to dry after scanning, or at minimum after eight hours of operation. Remove the film and discard the water.

Before performing each measurement, **dip the probe face in distilled water**. Place the probe on the skin and gently move it in small circular motions before initiating the measurement. Ensure the probe is held in a **still and upright position** when performing measurements to avoid influence from air bubbles in the probe. Performing ultrasound measurements requires training of the operator.

Gain (ultrasound sensitivity)

Gain may be adjusted before measurements to create an image that is neither too bright nor too dark. Hypoechoic (dark) areas may need higher gain settings. We **recommend using gain setting 0** as a starting point and eventually increasing if images are too dark to visualize clear skin layer contrast. Gain may be adjusted using the left/right arrows in the bottom left.

To ensure reliable results, **use a consistent gain setting** for the same participant and when comparing skin intensity measurements across individuals.

Zoom

- Click “Zoom” to zoom the image to 20 mm width
- The zoomed image can be dragged left or right

Measure

- Click “Measure” to superimpose two vertical cursor lines that may be used to measure distance between layers of tissue
- Adjust the measurement area by repositioning the curser lines using the arrows below the image
- “Distance (mm)” below the image updates accordingly

Intensity

- Click “Intensity” to visualize an intensity curve

- A concentration of high intensities appears as peaks on the curve, thus serving as an indicator for positioning of layers in the tissue
- Intensity curves can be used to **estimate the thickness of the adipose layer below dermis**. This is done by placing the first vertical curser line at the second intensity peak (dermis) and the second vertical curser line at the third intensity peak (connective tissue)

Saving data

Ensure data is saved before disconnecting the computer from the DermaLab unit. Clicking **"Save"** in any menu will save the specific skin parameter selected, while clicking **"Save all data"** in the main menu will save measurement data for all kinds of measurements done. Make sure to click **"Clear all data"** before starting a new measurement session to prevent data from being overwritten or mixed between sessions.

When pressing "Save" a default filename is proposed containing the actual date and time. We recommend including subject ID and/or measurement location in the filename to improve organization and traceability.

When saving measurement data, SkinLab may save up to 15 files with the same filename but using different file type extensions. **.cmf is the Cortex Measurement File that contains all measurement data**. This file can be imported to Excel, other spread sheet programs, or opened in any word processing editor. The remaining file types contain graphs, images, charts, etc. depending on the probes used.

Extractor output

- Click "Extract data" to combine data from several cortex measurement files into a single .csv file, enabling efficient comparison of measurements over time or across anatomical locations.
- Select a target folder and tick the desired skin measurement parameters to produce the file
- The .csv file can be imported to Excel or other spread sheet programs for analysis

