MINDFIELD®

eSense MUSCLE

QUICK GUIDE

Version 1.0.0 | 12.05.2021

We are glad that you chose our product. With the eSense Muscle and the accompanying eSense (Web) App, you have chosen a high-quality product that benefits from our years of experience with biofeedback.

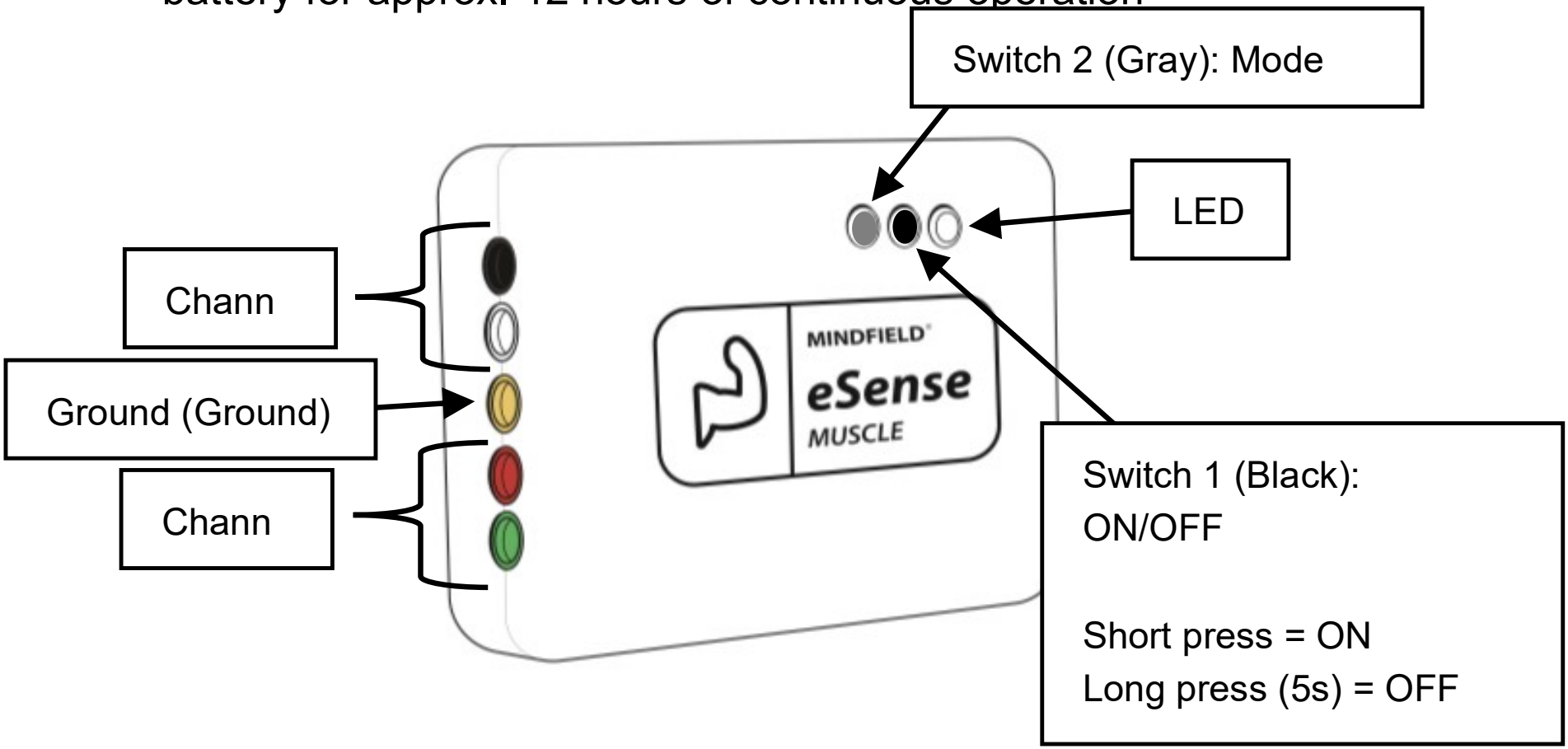
The instructions for use include essential information. Please read this Quick Start Guide carefully. See the website www.esense-muscle.com for further instructions or find them inside the eSense mobile app.

You can find a complete product description on our website
www.mindfield.de
under "Biofeedback" => "Products" => "eSense" => "eSense Muscle"

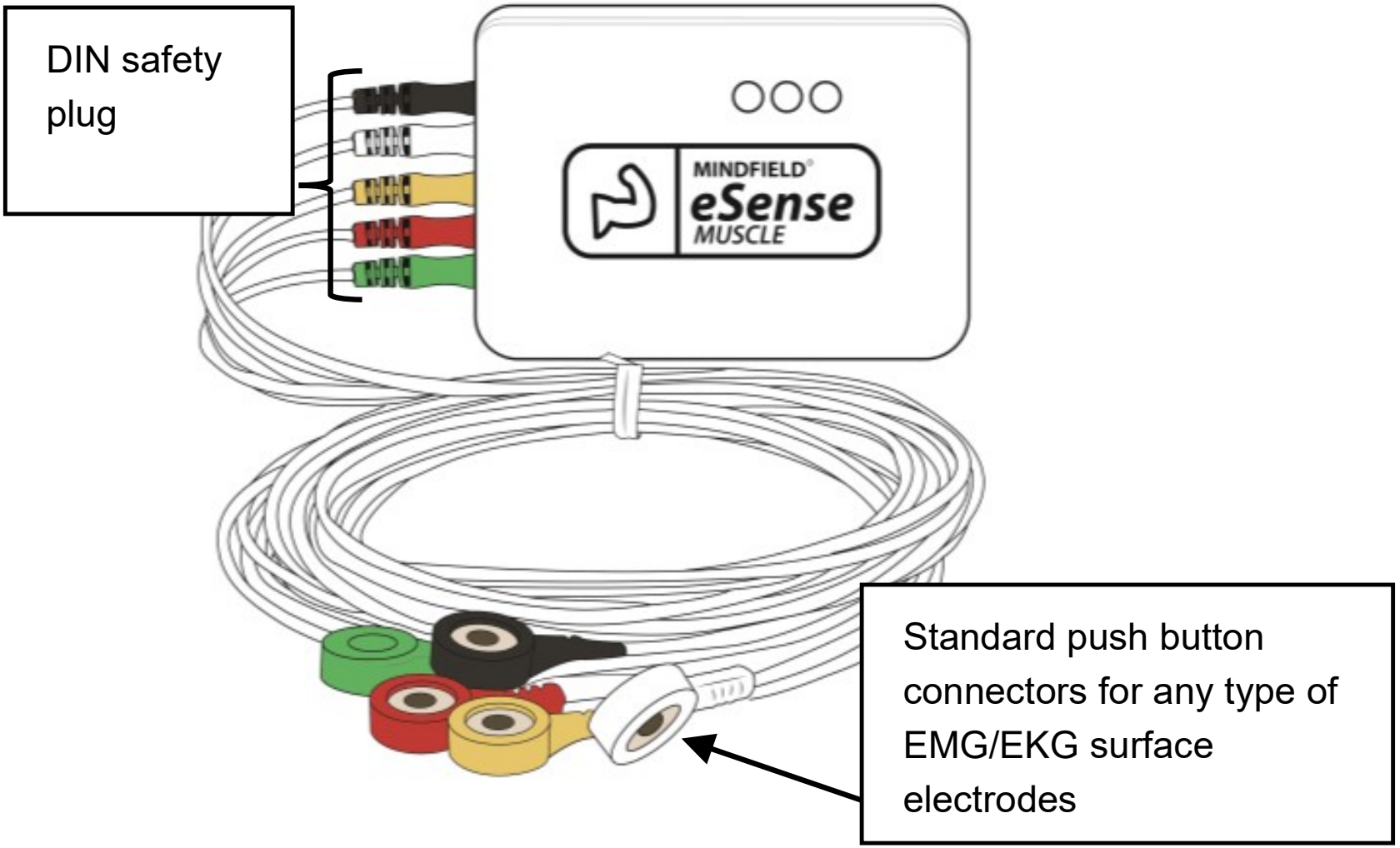
Content

Scope of delivery of the eSense Muscle:

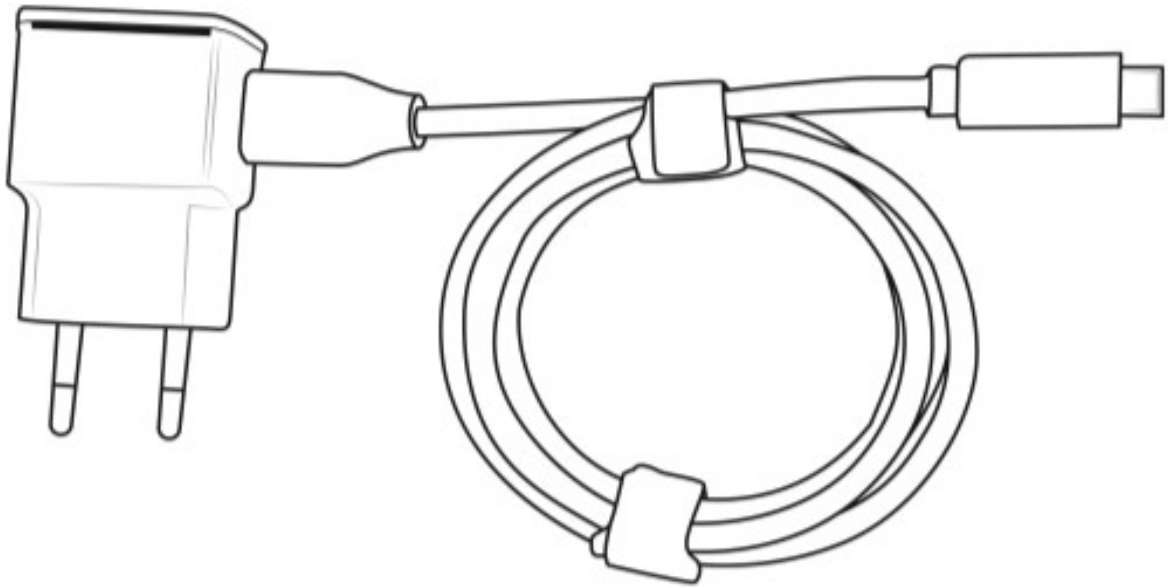
- Mindfield® eSense Muscle Sensor incl. 1600mAh Lithium Polymer battery for approx. 12 hours of continuous operation



- Electrode cable set for a connection of up to five electrodes



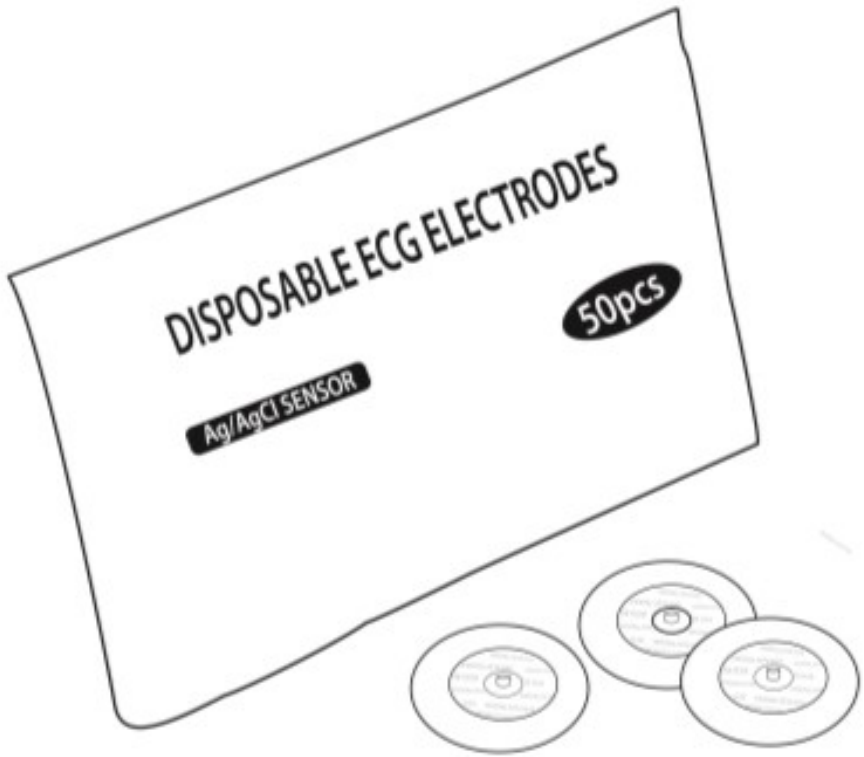
- USB-C charging cable and charger



Please only use the enclosed charger!
Fully charge the eSense Muscle before first use! Observe the notes in the manual!

- Bluetooth dongle for PCs that do not have Bluetooth (please refer to the enclosed instructions)

- 50 pieces EMG surface electrodes

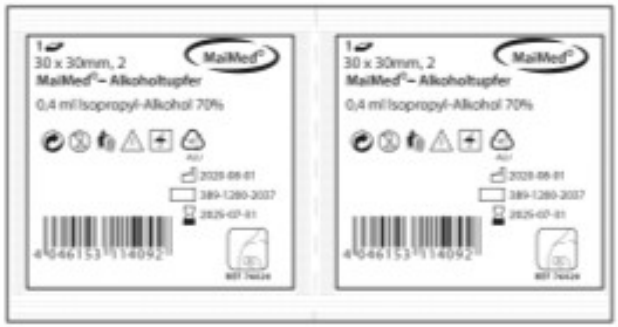


These are **disposable electrodes** for single use!

Please **always** close the package airtight so that the electrodes do not dry out.

First press the electrodes against the cables before sticking them to the skin.

- 50 pieces alcohol swabs for skin cleansing



Clean the skin before sticking on the EMG disposable electrodes. These alcohol swabs degrease the skin. This results in better signal quality.

- eSense Muscle Web App by Mindfield, available at **www.esense-muscle.com**

  First, read this Quick Start Guide entirely before using the eSense Muscle Web!

Commissioning: eSense Muscle

1. Please remove all products from the packaging.

2. **Recharging: P**lease fully charge the eSense Muscle before use. To do this, use the included USB-C cable and the charger. **Then press once briefly on the black switch 1 on the top of the eSense Muscle.** Then the LED should light up red. Charge the eSense Muscle until the LED turns green or goes out.

3. After the eSense Muscle is fully charged, you can start using it for the first time. A full charge can take up to five hours. During an ongoing charging process, the eSense Muscle cannot **be** used for measurement for safety reasons. If you plug in the charger during a running measurement, the running operation is terminated and the device switches to the charging mode.

4. Apply the electrode cables and electrodes:

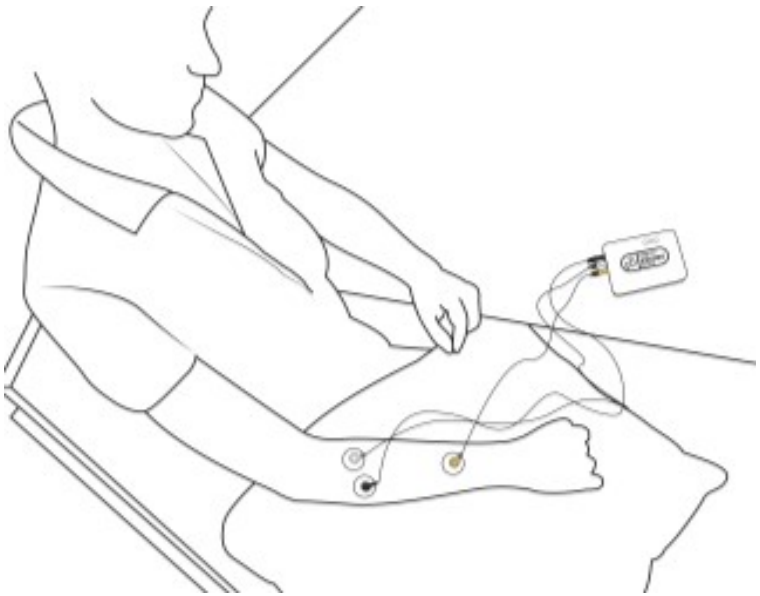
Remove the electrode cable set from the package. There are five electrode cables included: black, white, yellow, red and green.

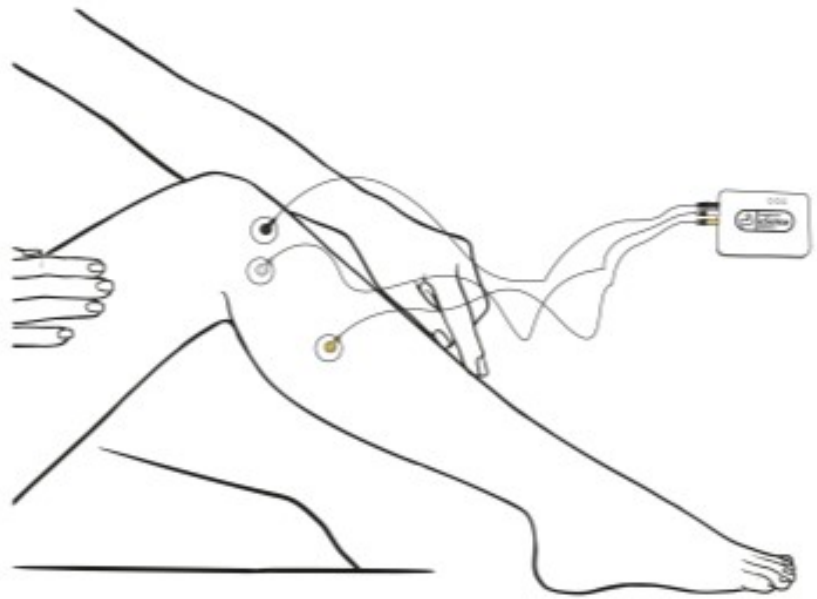
The yellow electrode cable is the ground electrode!

For a 1-channel measurement, please use the electrodes black (channel 1+), white (channel 1-) and yellow (ground).

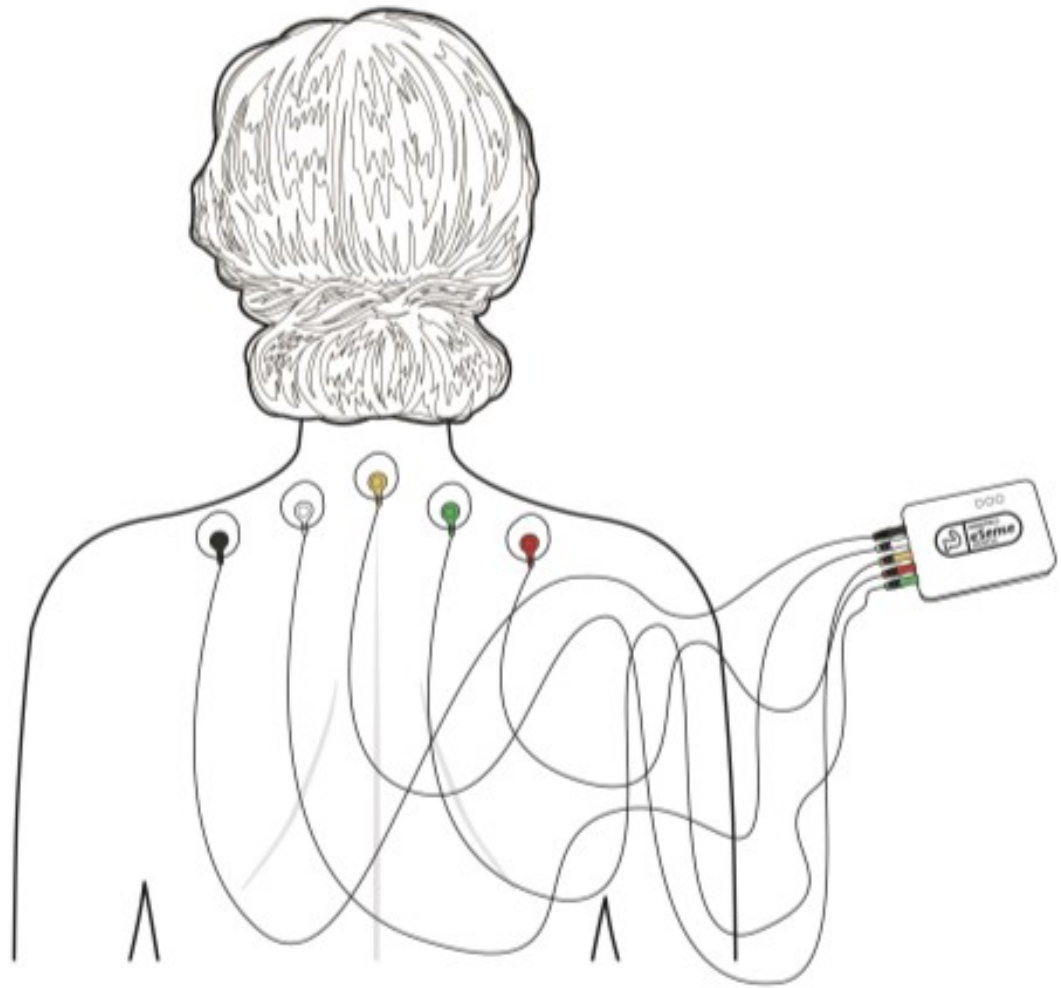
For a 2-channel measurement, please use the electrodes black (channel 1+), white (channel 1-), yellow (ground), red (channel 2+) and green (channel 2-).

Two examples of a one-channel measurement:





An example of a two-channel measurement:



5. Clean the skin areas where you want to place the electrodes with the enclosed alcohol swabs or isopropyl alcohol.

6. Take the appropriate number of EMG surface electrodes from the enclosed package. Clip the electrodes to the cable ends before placing them on cleansed skin.

7. Remove the protective film from the electrodes and stick them to the skin. If you have not already done so, plug the electrode cables into the matching colored sockets on the eSense Muscle.

8. Necessary: close the package of the EMG surface electrodes airtight again! Otherwise, they will dry out in a short time and stop providing correct values.

9. Now the eSense Muscle is ready for use and connected to the eSense (web) app. For more information, please refer to the corresponding chapter.

Notes on the internal battery

The eSense Muscle uses an internal Lithium Polymer battery with 3.7V operating voltage. The eSense Muscle is charged with five volts via the included USB-C cable and USB charger.
You can read the current state of charge in the eSense (web) app. To save the battery, the device switches off after two minutes of inactivity; i.e., without Bluetooth connection or recording to SD card.

Changing the battery by the user is not provided. The manufacturer can only replace the battery.

Important:

1. Never open the eSense Muscle. This is not provided for.
2. Use the included charger to charge the eSense Muscle as other chargers may damage it.

3. If you do not use the eSense Muscle for a more extended period, always store it in the enclosed case. Charge it fully first when you start it up again.

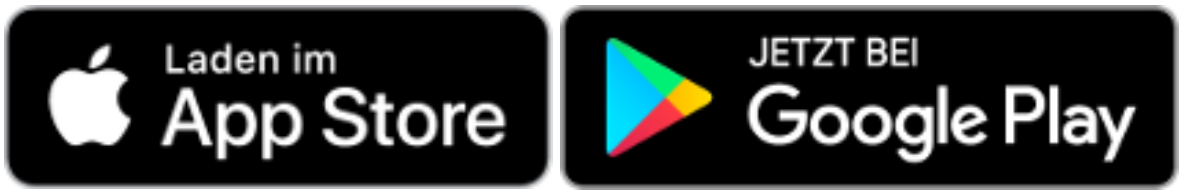
Cleaning and care

For cleaning and care, there are the following essential tips:

- Do not drop or use force on the eSense Muscle.
- Avoid exposing the eSense Muscle to hot temperatures or sunlight.
- If the eSense Muscle is stored near freezing, allow it to warm to room temperature before subsequent use.
- Do not try to open the housing of the eSense Muscle.
- Avoid dirt getting into the connection sockets.
- If you do not use the eSense Muscle for a long time, you must fully charge it before using it again.
- The enclosed EMG surface electrodes are disposable and should not be reused.

Mindfield eSense Mobile App

The eSense Muscle includes the Mindfield eSense Mobile App, which you can download for free from the Google Play Store (Android) or Apple App Store (iOS). **Just search for "Mindfield eSense".**



The app offers a wealth of features for practical biofeedback training. Essential functions are displaying measured values as a bar graph and oscilloscope, feedback via video, music, using sounds, vibration and light with the help of smart bulbs (Bluetooth and Philips Hue). You receive a comprehensive evaluation after each measurement and compare measurements with each other in the archive and export them as CSV files and PDF reports.

The manual explains the app in detail with all its functions. Please read it carefully before the first session.

You can find the complete manual on our website **www.mindfield.de** under "Biofeedback" => "Products" => "eSense" => "eSense Muscle"

Mindfield eSense Web App for Desktop Devices (Windows, Mac, Linux)

For the first time, the eSense Muscle comes with new software—a web app that runs exclusively in a web browser.

You do not need to install any software. All you need is:

1. A PC or notebook with Windows 10, Mac or Linux.

2. A working Bluetooth connection in this PC or notebook.

3. A web browser that supports "Web Bluetooth" so you can connect to our eSense Muscle via Bluetooth. As of April 2021, these are:

    a. Google Chrome

b. Microsoft Edge
c. Opera

We recommend that you use the latest version of "Google Chrome."

Mozilla Firefox and Apple's Safari are NOT SUPPORTED!

So, if you have a computer with Bluetooth and one of the mentioned browsers, please go to the website:

https://www.esense-muscle.com

You can then launch the web application on this web page and get further instructions on how to use it (please watch the instruction video). You then connect directly to the (switched on) eSense Muscle via Bluetooth in your web browser.

You are offered different representations of the measurement (oscilloscope, different animations, different games, etc.)

We update the eSense Muscle Web App regularly.

Mindfield eSense Web App for mobile devices (Android or iOS)

For the first time, the eSense Muscle comes with new software—a web app that runs exclusively in a web browser. This is also usable for mobile devices, but we recommend using the Mindfield eSense Mobile App once it supports the eSense Muscle.

To use the web app on mobile devices (smartphones or tablets), you need:

1. A smartphone or tablet with iOS (version 12.5 or higher) or Android (version 7.0 or higher) and Bluetooth 4.0 or higher.

2. A working Bluetooth function that is turned on.
3. A web browser that supports "Web Bluetooth" so that you can connect to our eSense Muscle via Bluetooth.

On Android, you need to use "Google Chrome" for this. On iOS, Web Bluetooth is not supported by Safari. You need to download the app "eSense Muscle" from the Apple App Store, a minimal browser that supports Web Bluetooth. It will take you directly to our website after the start.

If you are using Google Chrome on Android or the "eSense Muscle" app on iOS, please navigate to:

https://www.esense-muscle.com

You can then launch the web application on this web page and get further instructions on how to use it (please watch the instruction video). You will then connect directly to the (switched on) eSense Muscle via Bluetooth in your Chrome browser on Android or the "eSense Muscle" browser app on iOS.

You are offered different representations of the measurement (oscilloscope, different animations, different games, etc.)

We update the eSense Muscle Web App regularly. We recommend using the desktop version of the eSense Web App with a desktop PC, notebook with Windows, Mac or Linux. The mobile version of the web app comes with reduced content due to technical reasons.

General information about EMG (electromyography) biofeedback training

The musculature of the human being plays an essential role in the body. Our muscles are the largest energy consumer and are responsible for about 70-80% of our body weight. Muscle activity is manifested along the fibers of a striated muscle in the form of permanent, electrical potential shifts. This electrical activity can be measured at the skin surface in the form of more considerable summation potentials. This form of measurement is called (surface) electromyography, and the result is an electromyogram.

The eSense Muscle can measure and evaluate this electromyographic activity and transmit it to a terminal device via Bluetooth.

Transverse striated muscles are controlled by our somatic nervous system and are subject to voluntary control. Therefore, every volitional action of a muscle can be observed in an electromyogram. Thus, the tension of a muscle on which

surface EMG electrodes are placed immediately leads to increased trace in the EMG signal.

However, involuntary reactions, such as stress, inner tension and emotional experience, can also be measured as (tonic) activity in the EMG. EMG biofeedback can also report the general psychophysiological tension.

The interplay between the autonomic and somatic nervous systems can be depicted particularly well in the EMG. Increased muscle tone is mainly based on an increase in sympathetic activity. A decrease can be attributed to more robust parasympathetic activation.

The EMG signal

With EMG, we measure a voltage curve over time. We pay attention to the amplitude (the magnitude) of the signal and the frequency. Depending on the musculature, considerable differences become plain. An EMG signal from a small muscle; e.g. from a finger on the hand, is significantly lower in amplitude and frequency range than the signal from the large thigh muscle.

The eSense Muscle can measure the EMG raw signal and transmit it via Bluetooth, as well as already three preset bandpass signals (RMS) in the frequency ranges:

20 Hz to 950 Hz, 20 Hz to 300 Hz and 100 Hz to 200 Hz

You can select and use these in the eSense web app and the mobile app. In biofeedback, we work exclusively with the bandpass RMS

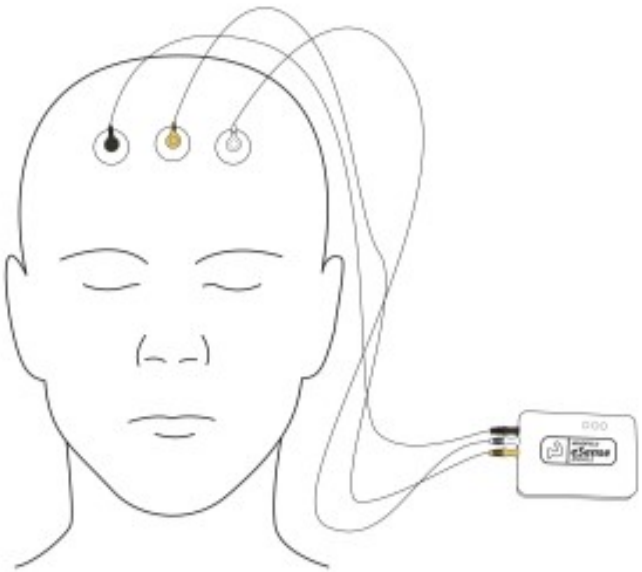
signals, as these are related to amplitude and applied muscle force. The amplitude ranges from a few μV (millionths of a volt) to several hundred μV in particularly strong muscles.

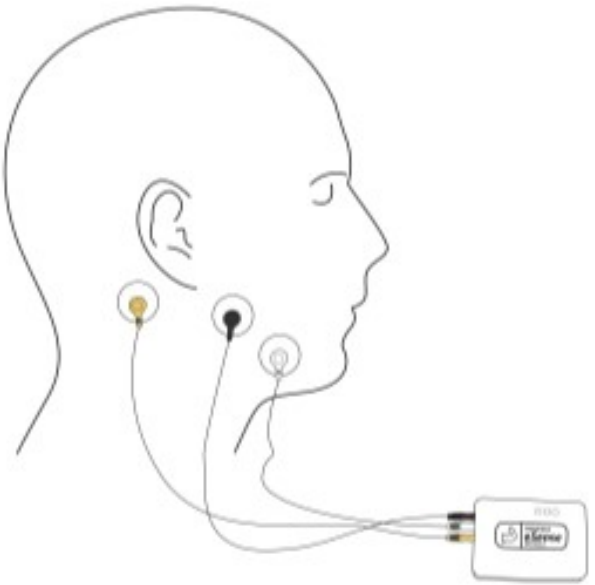
The frequency range of the EMG signal does not play a significant role in EMG biofeedback. It only emphasizes the signal part you want to look at. EMG activity has a broad frequency spectrum, from 10 Hz to 500 Hz, focusing between 25 and 300 Hz. Choose a wide filter (20-950 Hz) if you want to capture and feedback all components in the EMG and choose a narrow filter (100-200 Hz) if you're going to capture the majority and filter out possible sources of interference such as pulse artifacts or mains hum.

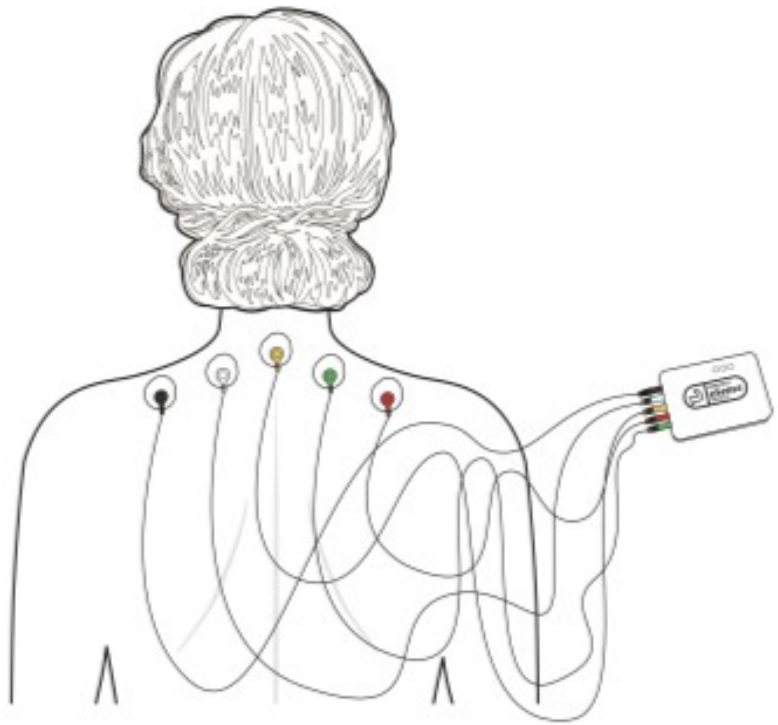
Abstract of an EMG Biofeedback Training

EMG biofeedback training can be performed to reduce stress and its vegetative symptoms by decreasing **the muscle tone of specific "stress muscles."**

Typical stress muscles are the frontal muscles (M.Frontali), the jaw muscles (M.Masseter) and the shoulder muscles (M. Trapezius). Possible derivation positions for this are:







Exercises that include targeted contraction and relaxation (like progressive muscle relaxation) can lower the baseline tone of these muscles, resulting in a concomitant reduction in stress.

A variety of possible derivations can build up muscles and strengthen individual muscles or muscle groups. The closer the two electrodes of a channel are placed to each other, the more precisely the underlying muscle is recorded. With increasing distance, you reach the activity of larger muscle groups. The training then tries to increase muscle tone, increase maximum values and improve endurance. For this purpose, tension phases can be prolonged and intensified as training progresses. However, always include sufficient rest periods.

For coordination exercises and targeted separation of muscle groups (e.g., lifting the arm without "pulling up" the shoulder with it), channel one and channel two can be cleverly combined.

For example, channel one can be placed on the muscle to be tensed, while channel two "monitors" an adjacent muscle so that it is not tensed during the movement. Each muscle movement generates a characteristic pattern under an EMG measurement, which can be practiced and repeated in the software.

The possibilities of using EMG biofeedback are remarkably diverse. Have a professional help you with this if you have any questions.

Necessary: if you suffer from a disease, do not perform a treatment independently and always consult a therapist. The eSense Muscle is not a medical device and may only be used for stress reduction, muscle building, tension relief and coordination exercises.

Troubleshooting connection problems

In case of Bluetooth connection problems between the eSense Muscle and your end device, please check the following steps:

1. Is the eSense Muscle charged and ready to use? Is the blue LED lit? Turn the eSense Muscle off once (5s pressure on the black switch 1) and then, when the LED has gone out, turn it on again by briefly pressing switch 1. Wait approximately 15-20 seconds for the eSense Muscle to start entirely.
2. Is Bluetooth Low Energy (from Bluetooth 4.0) available on your end device? Check the technical data of your PC, smartphone and tablet.
3. Is Bluetooth switched on and ready for operation?
4. The connection between the eSense Muscle is **only** established within the eSense Web App or eSense Mobile App and **NOT** in the Bluetooth settings of your operating system. Please do **NOT** pair the eSense Muscle in the Bluetooth settings of Windows, iOS or

Android, because then no access can be made through the web app or mobile app. If you have done so, disconnect entirely.

5. If you still have problems with the Bluetooth connection, please try another device to rule out general issues with your PC, smartphone, or tablet.

Technical data about the Mindfield eSense Muscle

Bluetooth	
Bluetooth version:	5.0 Low Energy, downward compatible up to 4.0
Frequency range:	2402-2480 MHz
Data rate (up to):	2 Mbps
Several channels:	40
Channel spacing:	2 MHz
Antenna type:	Integrated antenna
Antenna Gain:	0.5dBi

eSense Muscle:

- Two-channel EMG biofeedback device
- Bluetooth 5.0 transmission to PC or smartphone/tablet (Android and iOS)
- Fixed Li-Ion battery 1600mAh for up to 12h continuous operation
- Two bipolar EMG inputs (CH1+, CH1-, CH2+, CH2-); one Analog Ground
- Two multifunction buttons for using the device
- One RGB LED to show the operating status
- 24-bit ADC and preamplifier for each channel
    - A native sampling at 2 kHz per channel.
- Three bandpass filters (Bessel, 8th order) per channel. -3dB cut-off frequencies: BP1: 20..950Hz, BP2: 20..300Hz, BP3: 100..200Hz
- RMS calculation and moving average over 0.5 seconds. Decimation to 100 RMS samples per second

- 200mV differential measuring range per channel
- 0.024 µV ADC resolution per LSB
- < 1.7 µV RMS noise BP1
- < 1.3 µV RMS noise BP2
- < 0.8 µV RMS noise BP3
- Channel 1 and 2 CMRR at 50Hz and 60Hz: better -105dB
- Protection against electrostatic discharge (ESD) up to +-15kV according to the "Human Body Model," IEC 1000-4-2, Air-Gap Discharge
- HF filter
- Operating mode: continuous operation
- Measurement accuracy EMG amplifier / ADC
    - Reinforcement: ± 5 % basic accuracy, ± 0.2 % after calibration
    - The band passes lower and upper cut-off frequency: ± 0.1 %
    - Sampling frequency: better than ± 0.1 % (resonator)
- Operating range: 5-40 °C, <= 95% relative humidity

EC Declaration of Conformity for the Mindfield eSense Muscle

According to the following guidelines:
2014/30/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 26 February 2014 on harmonizing the laws of the Member States relating to electromagnetic compatibility.
RoHS substance bans (2011/65/EU)
WEEE Waste Electrical and Electronic Equipment (2002/96/EC & 2008/34/EC)

The manufacturer/distributor/authorized representative
Mindfield Biosystems Ltd.
Hindenburgring 4
D-48599 Gronau
Germany

WEEE-Reg.-Nr. DE 24465971

hereby declares that the following product:
"Mindfield® eSense Muscle"
follows the provisions of the guidelines identified above and their amendments in force at the time of the declaration.

The following harmonized standards have been applied:

DIN EN 62368-1:2016-05 Equipment for audio and video, information and communication technology - Part 1: Safety requirements

DIN EN 61326-1; VDE 0843-20-1:2013-07 Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements (IEC 61326-1:2012); German version EN 61326-1:2013

DIN EN 61326-2-2; VDE 0843-20-2-2:2013-08 Electrical equipment for measurement, control, and laboratory use - EMC requirements - Part 2: Electrical equipment for measurement, control, and laboratory use

Part 2-2: Particular requirements - Test arrangement, operating conditions and performance characteristics for the portable test, measurement and monitoring equipment for use in low-voltage power supply systems (IEC 61326-2-2:2012); German version EN 61326-2-2:2013

Location: Gronau, 05 May 2021

The Mindfield eSense must be disposed of as electronic waste following legal requirements.

WEEE Reg. No. DE 24465971

Niko Rockensüß, Managing Director

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