

The Refa for High Density EMG



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1 The Refa System

The Refa is a multi-channel amplifier system for stationary use. The Refa includes unipolar electrophysiological inputs (ExG) but can also include a number of bipolar electrophysiological inputs (BIP) and auxiliary inputs (AUX). The unipolar electrophysiological inputs are configured as a reference amplifier: all channels are amplified against the average of all connected inputs. Using these channels, signals like EEG, EMG, ECG, EOG, EGG, etc. can be measured. The bipolar electrophysiological inputs are used to measure two physiological signals differentially to each other. Signals like ECG, EMG or EOG can be measured this way. The auxiliary inputs can be used for measuring sensor signals like temperature, pH, respiration, movements, force, angle, etc. Each of these channels has a +5 V and -5 V output in order to use active sensors or sensor modules.

The Refa system can be delivered with different number of input channels. Refa's with 24, 32, 40, 72 and 136 channels are available. The last two are pictured together in figure 1. It is also possible to cascade two Refa's, resulting in a total channel count of 272 channels. The Refa is delivered including an external power supply, which plugs into the mains socket. The design of the Refa integrates the true DC reference amplifier. The active shielding guarantees optimal signal quality, no mains or other interference and no movement artifacts. Since the system includes no hardware filtering, all amplifier channels are identical and can be used for any desired signal. Each Refa system comes with 8 separate, optically isolated, trigger inputs. More information on the Refa can be found in the Refa brochure or on our website: www.tmsi.com.

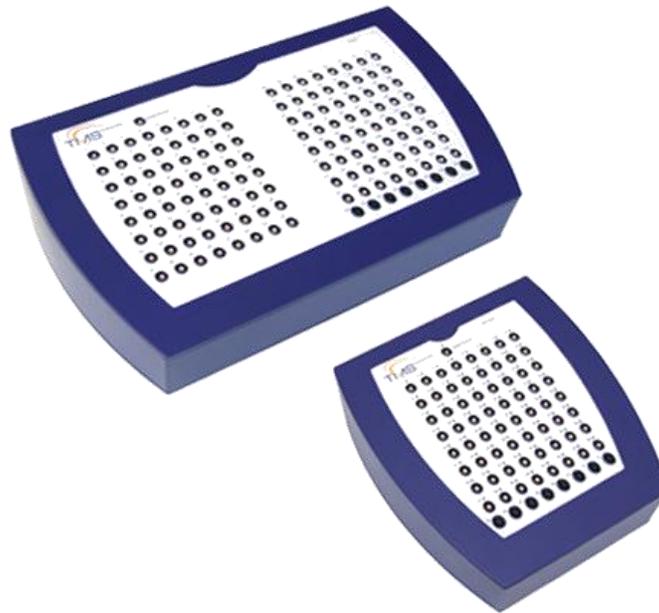


Figure 1: The Refa 136 and the Refa 72.

2 High Density EMG Measurements

To perform a high density EMG measurement, in addition to a Refa amplifier system, some more items are needed:

- EMG high density grid:
Disposable grid that is attached to the skin.
- Interface cable including interface connector box
- TMSi Polybench Software
For calculating all kind of derivatives using the acquired signals.

From the disposable grids several models are available:

- 64 channels (with 4mm or 8.5mm inter-electrode distance).
- It is also possible to combine two 64-channel grids parallel to measure 128 channels.

In figure 2, both sizes of a 64 channel disposable grid are shown.



Figure 2: Example of the two 64 channel disposable grids, both the 4mm and 8.5mm inter-electrode distance.

Grids are connected to the amplifier through a special 64 channel “click” connector and 64 channel pico cable, each lead with individual active shielding. The grids have a stiffener at the end, which clicks into the very lightweight connector on the first push and is released again on the second push. The mechanism is shown in figure 3.



Figure 3: 64 channel connector with click mechanism.

For 128 channel grids, 2 click connectors are used in parallel. The click connector is fixed in place with the help of an elastic band or medical tape (depending on the muscle under investigation).

Apart from using a standard grid, one could always want to configure own grid layouts. This is possible with the help of our micro-electrodes. An example of a non-standard configuration with micro-electrodes is shown in figure 4.



Figure 4: Example of a non-standard micro-electrode EMG configuration.

The software that is included in the High Density EMG measurement system is TMSi Polybench software package. TMSi Polybench is a software application toolbox, a veritable blank canvas for the creation of customized medical configurations; from basic measurements to sophisticated research applications. It can be considered a personalized “application factory”, allowing the user to control the high-quality raw data input from any TMSi amplifier to build the exact system they need. For the High Density EMG measurements we have a software configuration included (the High Density Surface EMG RECORDER) for real-time recording and review of HD EMG.

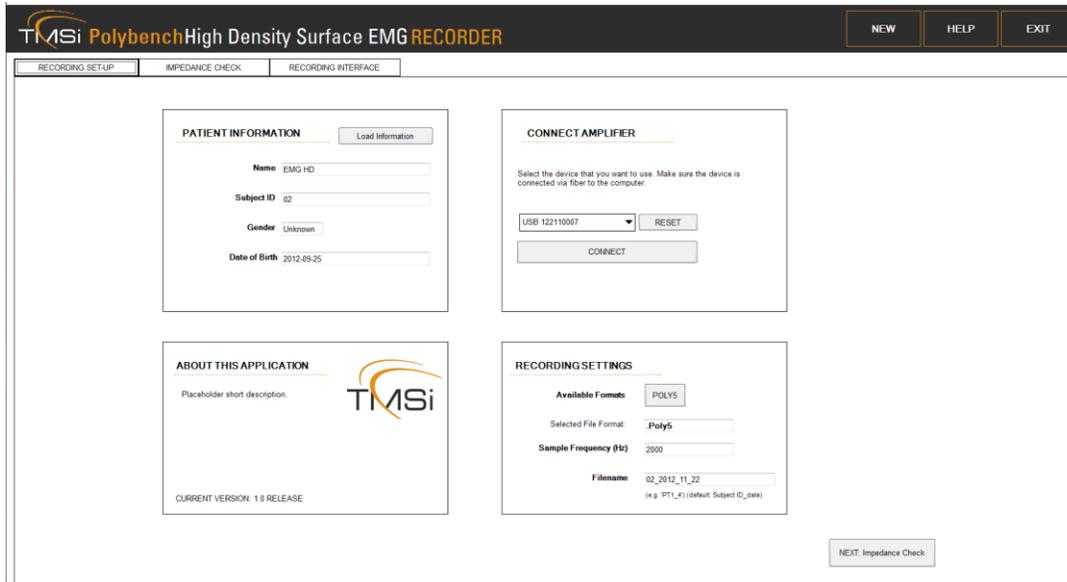


Figure 5: Start-up screen of the “High Density Surface EMG RECORDER”.

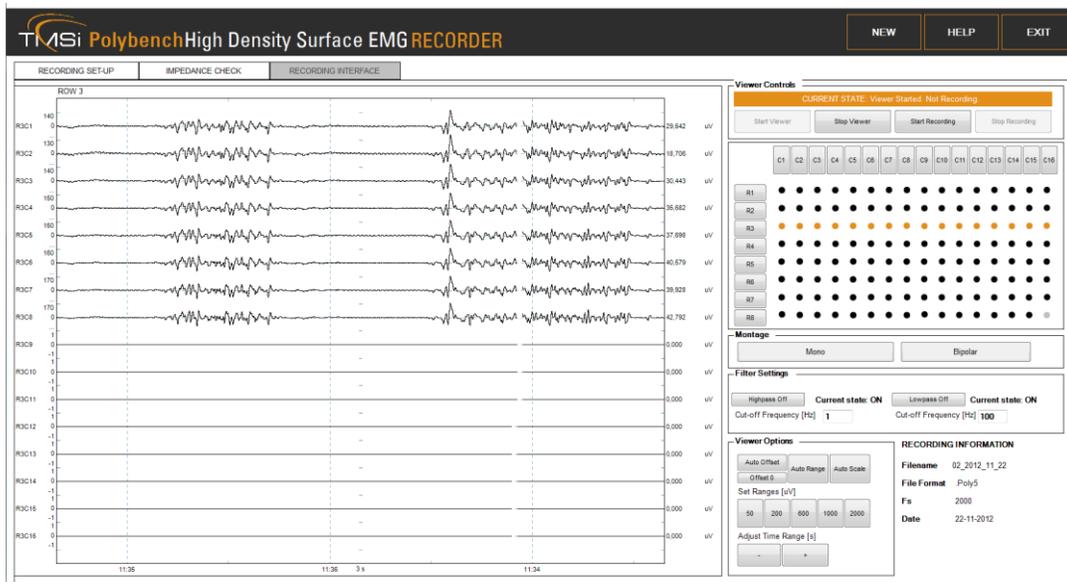


Figure 6: 8 EMG signals measured along one row of the matrix.