



Wireless Surface Electromyograph System Starter Kit

Cedar Solutions' WiSEMG is a flexible wireless system specifically designed to acquire surface electromyography signals, but that can be easily extended to capture and process many other biological signals or motion-related signals.

The system consists of one or more base stations, connected by means of an USB interface to a control PC and several sensing nodes that acquire, amplify, digitise, and wirelessly transmit the biological or mechanical signals to a base station.

Each base station can handle a number of wireless transmitters, the exact limit depending on the type of signal being acquired (please refer to the particular transmitter datasheet for details).

The control software on the PC can also be remotely operated from a smartphone with our dedicated Android app.

1 System components

Currently, the system is composed of the following components, and more are being researched and will be added in the near future:

- SD-WMG-32001: user interface software, with system diagnostic, signal live-view, real-time signal analysis, and recording capabilities.
- CS-WMG-33002: Android application to operate the WiSEMG system from your smartphone, specifically designed and optimised for fitness applications and weight-room usage.
- CS-WMG-12001: wireless surface electromyograph and linear acceleration sensor transmitter node.
- CS-WMG-12003: USB wireless receiver with integrated multiple node charger and analog output ports.

2 Starter Kit

A low-cost starter kit is available to enable customers evaluate our solution or even perform basic measurements. It is also suitable for customers who plan to roll their own signal processing as the data analysis software is not included. The kit contains:

- 2 × CS-WMG-12001: EMG and acceleration sensors.
- 1 × CS-WMG-12003: USB wireless receiver with charger.
- basic control software with system monitoring and signal acquisition capabilities. For full signal analysis capabilities please see the complete system.

3 EMG sensor key features

- High input impedance: 20 M Ω differential, 5 M Ω common mode.
- Large bandwidth: 5 Hz–500 Hz.
- Adjustable gain: enables acquisition of signals with amplitudes from 25 μ V to 5 mV.
- CMRR exceeds 100 dB.
- 10 bit, 2 kHz ADC sampling.
- Optional 3-axes integrated accelerometer with selectable sensitivity of $\pm 4g$ or $\pm 9g$.
- Radio link: IEEE-802.15.4 compliant physical layer, using one of the 16 available channels in the 2.4 GHz ISM band.
- Proprietary highly-specialized radio protocol can achieve latencies as low as 40 ms.



- Low-power: more than 6 h of continuous acquisition when powered by industry-standard rechargeable LIR2450 Li-ion batteries.
- Battery: pre-installed soldered LIR2450 or optional connector for external battery.
- On-board battery charger and monitor with coulomb counter for accurate residual run time prediction.
- 4.50 V to 5.25 V, 100 mA (max) charging input socket, on a standard 2 mm barrel connector, allows direct charging by either a standard USB port or dedicated charger.
- PCB size: 41 mm × 26 mm, 12 mm height (with battery).
- cased product size: 52 mm × 32 mm, 15 mm height, excluding eyelets for straps.

4 Base station key features

- Radio link: IEEE-802.15.4 compliant physical layer, 2.4 GHz ISM band.
- Proprietary highly-specialized radio protocol suitable for CEDAR Solutions' WiSEMG system.
- USB 2.0 compliant bus-powered/self-powered full-speed device (micro USB connector).
- Integrated battery charger supply for up to 6 WiSEMG sensors.
- Power supply: micro USB or external 5 V—15 V from standard 5.5 mm/2.1 mm barrel connector.
- PCB size: 86 mm × 68 mm.
- cased product size:
130 mm × 100 mm × 30 mm..

5 Description

Cedar Solutions' CS-WMG-12001, an active electromyography sensor with integrated wireless transmitter, is the core of the WiSEMG system, which is comprised of active sensors, such as the CS-WMG-12001, that acquire, amplify, digitise, and wirelessly transmit the EMG signal to a base station (such as the CS-WMG-12002 or CS-WMG-12003) connected to a PC via an USB interface. Up to 4 CS-WMG-12001 sensors can be managed by a single base station, and up to 16 base stations can be in operation at the same time in the same radio-coverage area.

The sensors are completely remotely operated from the PC: they are normally in a deep stand-by mode in which they draw an extremely low current from the battery, allowing for months of storage without depleting the battery. They are awoken on demand by the base station and, after a few seconds, become completely operational and ready to start the measurement, which is triggered from the PC. Cedar Solutions' CS-WMG-12003 complements the WiSEMG system by offering a full-fledged solution to receive the data wirelessly transmitted from the active sensors (such as the CS-WMG-12001) to a PC via a simple USB connection. The CS-WMG-12003 acts as a complete digital base station, and can also recharge up to 6 WiSEMG sensors simultaneously. Up to 16 base stations can be in operation at the same time in the same radio-coverage area. Synchronization up to microsecond resolution between multiple nodes connected to the same base station is possible, and the base can optionally be equipped with 8-channel high-resolution 16 bit DACs to also output the received signals towards legacy apparatus (not included in the starter kit version).

The USB connection is all it's needed to operate the base station as a receiver. If the base station is also used to recharge multiple mobile nodes simultaneously, it needs a separated power supply, but it's then fully autonomous and can be operated as a charger without a PC.

Drivers for the USB receiver are included in the complimentary GPL-licensed software, which pro-



vides full control over the WiSEMG system, including battery charger status and operation, device identification and setup.

The complimentary GPL-licensed software provides full control of the WiSEMG system and enables the customer to easily roll out their signal processing algorithms. Acquired data is displayed in real time on the PC monitor and recorded in plain text files for later processing. Complete remote diagnostic of the sensors, including radio reception quality and battery run time, is also available.

More advanced features, such as processing of the incoming data in real time, extracting features such as repetition counts and contraction strength indicators, are not available in the starter-kit edition.

6 Pictures

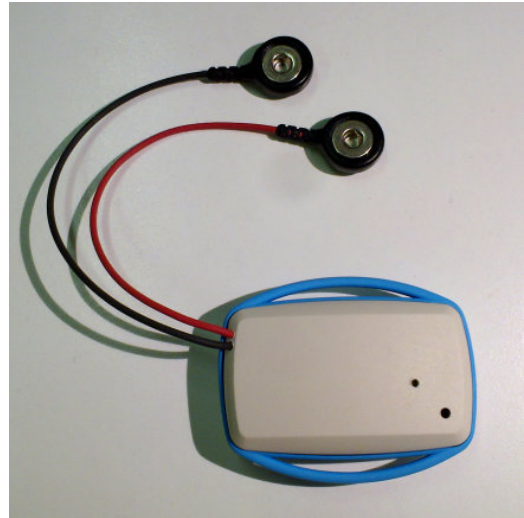


Figure 1. Encased WiSEMG Wireless Surface Electromyography transmitter with attached electrode clips.