

## Experiment (4)

### Electromyography (EMG)

#### ➤ The Objective

Electromyography (EMG) is used to detect and record of the electrical signal produced by muscle tissue during activation.

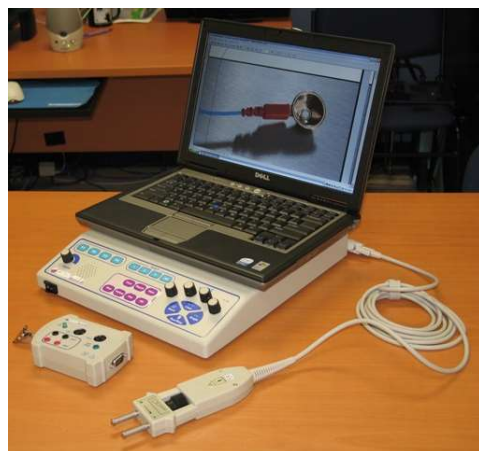
#### ➤ Theory:

Electromyography is measuring the electrical signal associated with the activation of the muscle. This may be voluntary or involuntary muscle contraction. The EMG activity of voluntary muscle contractions is related to tension. The functional unit of the muscle contraction is a motor unit, which is comprised of a single alpha motor neuron and all the fibers it enervates. This muscle fiber contracts when the action potentials (impulse) of the motor nerve which supplies it reaches a depolarization threshold. The depolarization generates an electromagnetic field and the potential is measured as a voltage. The depolarization, which spreads along the membrane of the muscle, is a muscle action potential. The motor unit action potential is the spatial and temporal summation of the individual muscle action potentials for all the fibers of a single motor unit. Therefore, the EMG signal is the algebraic summation of the motor unit action potentials within the pick-up area of the electrode being used.

#### ➤ The Configuration and Parts of the System:

EMG system consist of:

- Input from electrodes
- Instrumentation amplifier
- Filter section
- Main amplifier section
- EMG simulator section



**Fig (14) EMG device**

## ➤ System Block Diagram

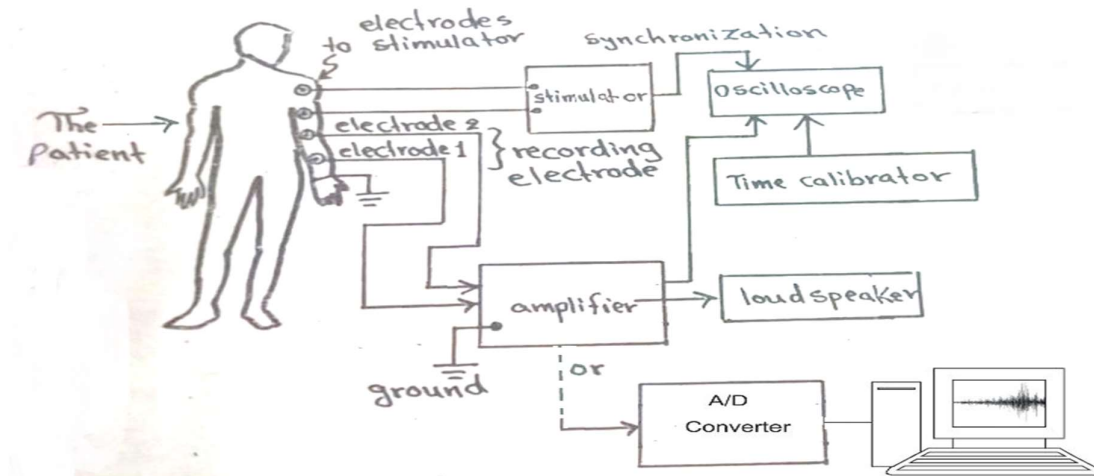


Fig (15) EMG block diagram

## ➤ The Principle Work of the System

EMG signal is generated by the electrical activity of the muscle fibers active during a contraction. The signal sources located at the depolarized zones of the muscle fibers are separated from the recording electrodes by biological tissues, which act as spatial low-pass filters on the (spatial) potential distribution. It is closely related to the muscle activity, muscle size and a measure of the functional state of muscle fibers.

This section presents a brief explanation about the anatomy, physiology and the electrical properties of the muscle and the composition of EMG.

## ➤ The Procedure of Operation

EMG is usually performed by stimulating a nerve in the arm, leg or back with a very small current and then recording the electrical response both at rest and with activity by placing specialized electrodes close to the muscle group.

The signal can then be amplified, filtered, and displayed on an oscilloscope or may be displayed audibly through a loud speaker.