

# MASTERING ECG LEADS

## BIPOLAR LIMB LEADS

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ECG leads is a set of electrode with wires connecting one side with ECG recording machine and the other with body surface. The purpose of these electrodes is to record the electrical activity of heart.

When we apply positive and negative terminals of electrodes to the body, the galvanometer will record the electrical potential difference between the positive and negative terminal by currents generated by cardiac electrical activity. Positive electrode is also called **Exploring electrode**.

### CIRCUIT OF THE LEAD

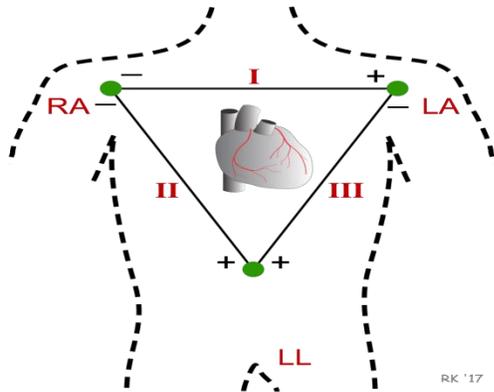
Two electrodes (positive and negative) along with their wires connected on one side to ECG machine and on the other side to body forms a circuit called **circuit of the lead**.

### BIPOLAR LIMB LEADS

Since the leads have two poles, positive and negative, and these leads are placed on limbs, hence such leads are called **bipolar limb leads**.

There are three bipolar limb leads are Lead I, II and III.

- Lead I – positive electrode on left arm, negative electrode on right arm
- Lead II – measures potential difference between right arm and left leg
- Lead III – measures potential difference between left arm and left leg



Limb leads (three bipolar, three unipolar) scan electrical activity of heart in frontal plane.

Chest leads (six in number) scan electrical activity of heart in horizontal plane.

All the leads are recording same electrical activity of heart but due to their different locations, their recordings turn out to be slightly different. These different angles help see a bigger image in case of cardiac pathologies which alter electrical activity of heart.

The leads are arranged in such a way that the major QRS complex deflection is given as positive. As major ventricular depolarization vector is directed downward and leftward so to get positive deflection in all leads, the positive electrode should be placed either leftward or downward.

## AXIS OF THE LEAD

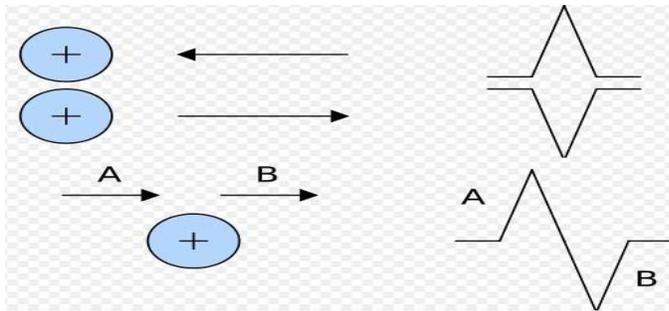
An imaginary line between positive and negative electrodes is called **Axis of the lead**. Axis of the lead is determined by placement of electrode on the body. Axis of the lead is an imaginary line drawn from the reference electrode towards the positive electrode, also called exploring electrode.

## DEFLECTION ON ECG

When positive charges move towards positive electrode, deflection is positive (i.e. upwards on graph)

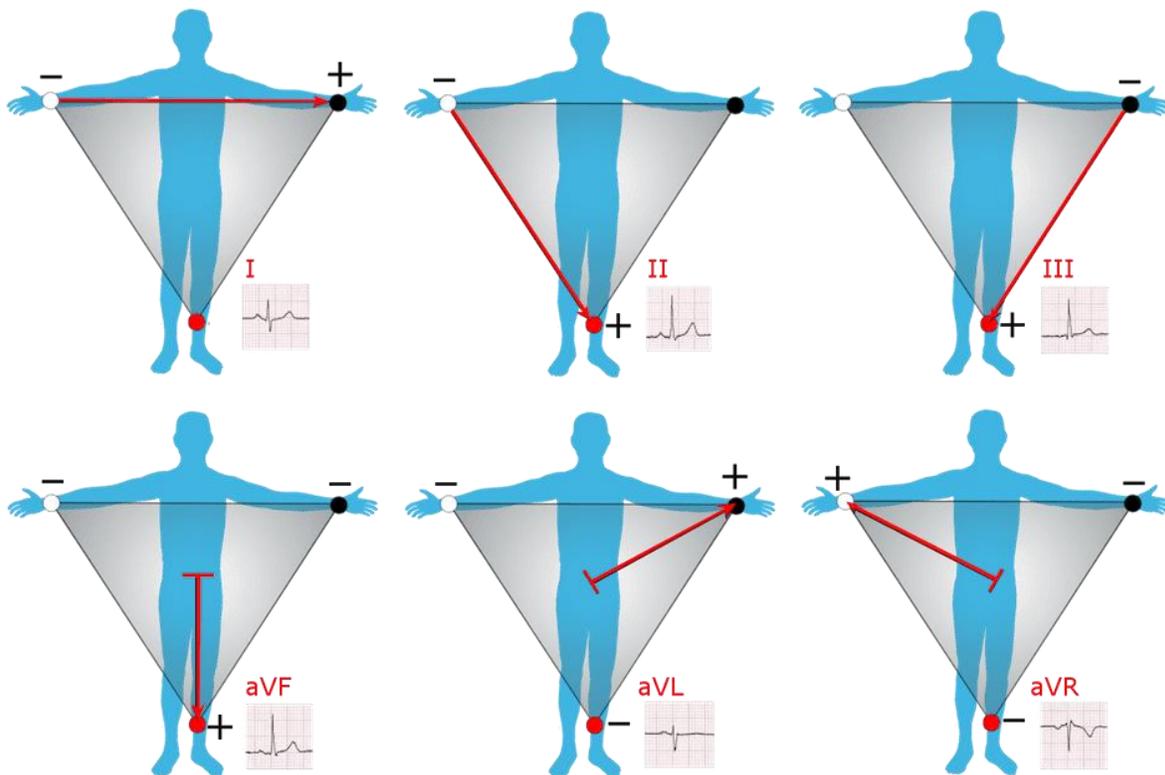
When positive charges move away from positive electrode, deflection is negative.

When electrical vector moves perpendicular to axis of the lead, net deflection is zero.



## LEAD PATTERN

The ECG pattern recorded by a specific lead is called lead pattern. Lead pattern of specific leads is formed by the projection of vectors on that specific lead.



## EINTHOVEN'S TRIANGLE

Einthoven's triangle is an equilateral triangle, formed by the three bipolar limb leads, drawn around the heart.

## EINTHOVEN'S LAW

It states that, "The electrical potential or voltage recorded by Lead I and lead III when added together is equal to the voltage recorded by lead II"

## TRI-AXIAL REFERENCE SYSTEM

The figure resulting from re-arranging the lines of derivation of the three standard (bipolar) limb leads of the ECG so that, instead of forming the sides of an equilateral triangle, they bisect one another.

