

ECG INTERPRETATION MANUAL

THE NORMAL ECG

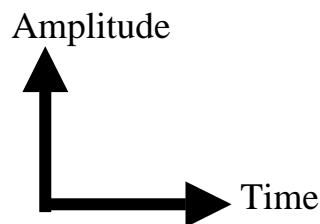
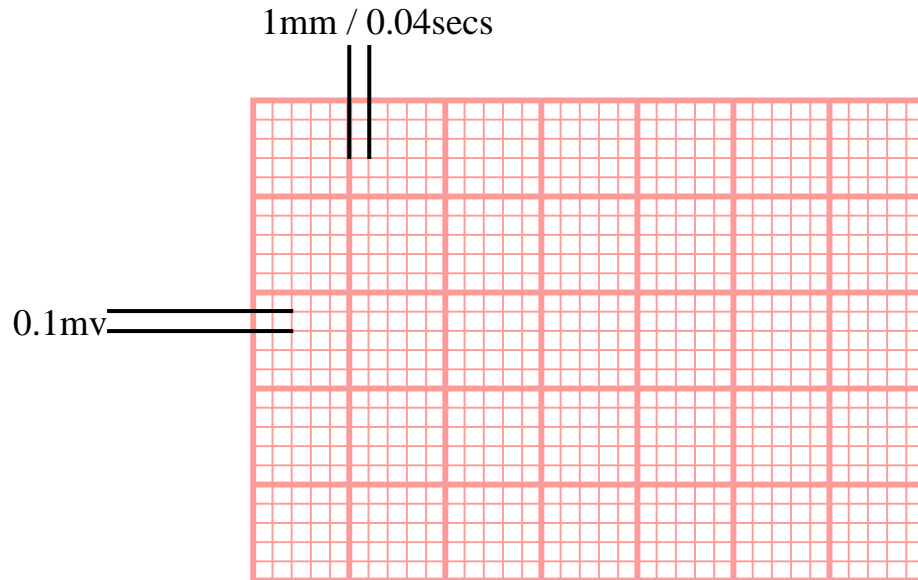
Lancashire And South Cumbria
Cardiac Physiologist Training Manual

THE NORMAL ECG

E.C.G CHECKLIST

- 1) Name, Paper Speed, Calibration.
- 2) Dangerous Arrhythmia's.
- 3) Rhythm P for every QRS.
- 4) P Wave amplitude, Duration (Lead II), Morphology Leads (II & V1).
- 5) PR Interval.
- 6) QRS Amplitude, Duration (Leads II & Chest Leads).
- 7) QRS Axis.
- 8) Chest Leads morphology (V1 ----- V6).
- 9) Progression of R waves through chest leads.
- 10) ST Segment in all Leads.

E.C.G MEASUREMENTS



Time :- 25mm per 1 second.
1mm = 1/25 second
1mm = 1 small square = 0.04 seconds

Amplitude :- 10 Divisions = 10mm = 1mv

Heart Rate :- 1500

Number of small squares between
R—R Interval

NORMAL RHYTHMS

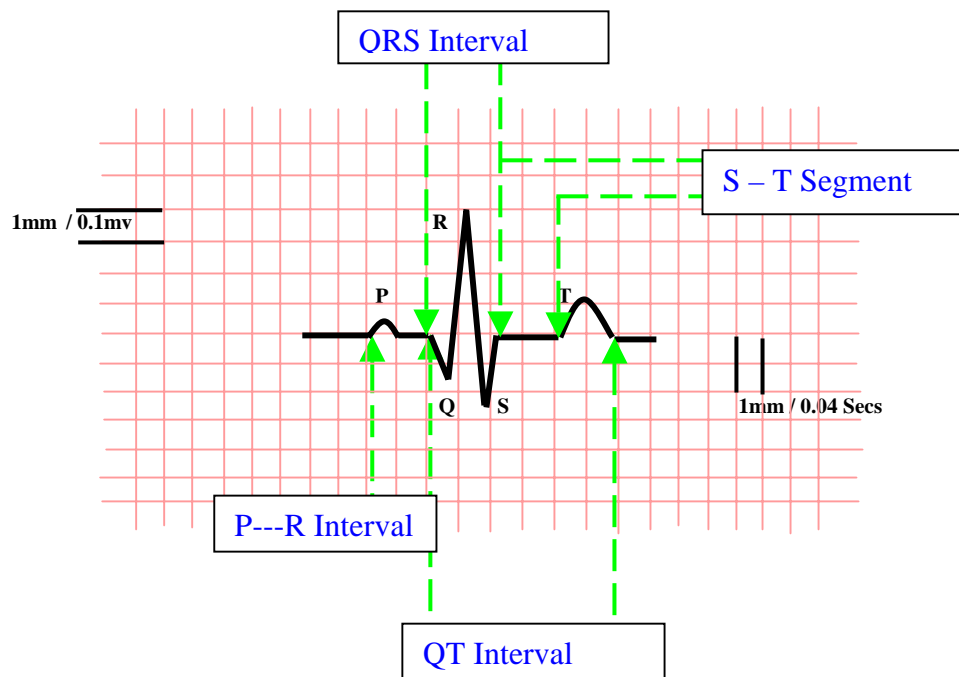
Sinus Rhythm :- P-wave preceding each QRS complex. Heart rate Between 60 ----- 100 bpm.

Normal P Wave :- An upright P-wave in leads II, III and AVF, and an Inverted P-Wave in AVR which precede each QRS Complex. Which does not exceed 2.5mm in height and 0.04 to 0.08 seconds in duration.

PR Interval :- 0.12 ----- 0.21secs.

QRS Complex :- Should not exceed 0.11 seconds.(0.08 – 0.11secs)

QTc Interval :- Should not exceed 0.42 seconds.



FRONTAL PLANE LEADS

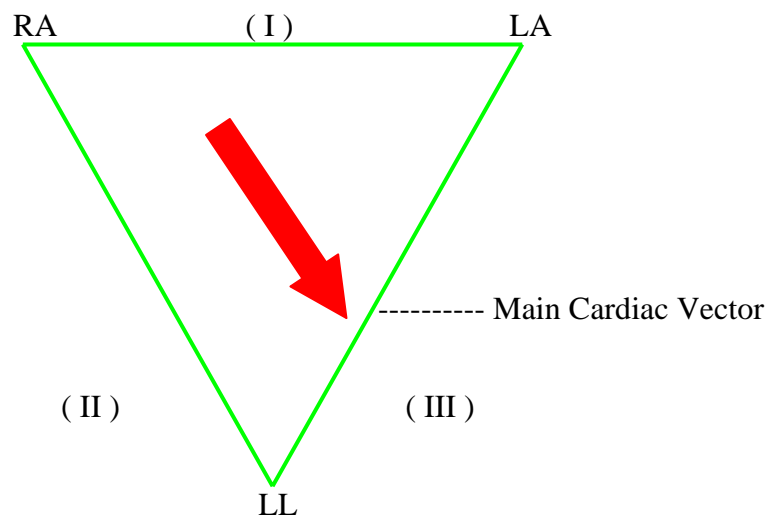
Augmented Limb Leads (Goldberger). These are the Unipolar leads

AVR = RIGHT ARM

AVL = LEFT ARM

AVF = LEFT FOOT

From the Unipolar limb leads, a system was devised by EINTHOVEN which allows the heart to be seen from 3 other leads known as the Bipolar Limb Leads of Einthoven's Triangle.



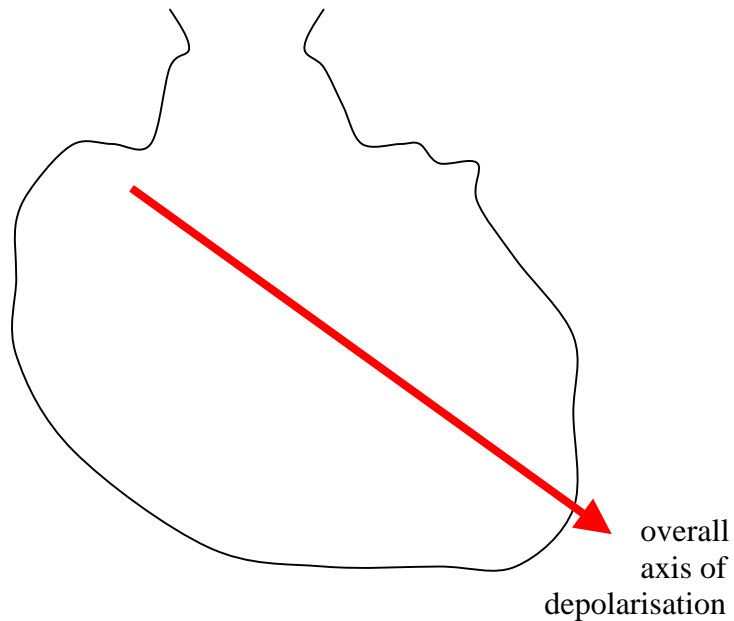
$$\text{LEAD I} = + (\text{AVL}) - (\text{AVR})$$

$$\text{LEAD II} = + (\text{AVF}) - (\text{AVR})$$

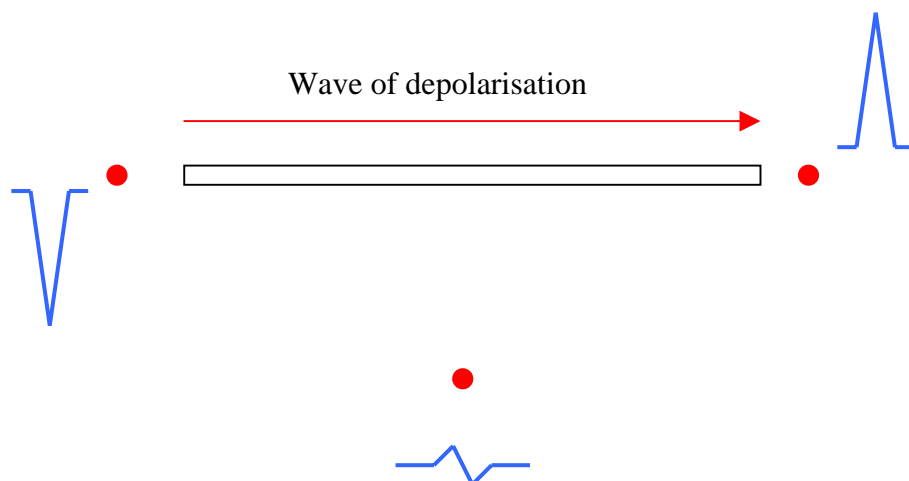
$$\text{LEAD III} = + (\text{AVF}) - (\text{AVL})$$

DETERMINATION OF QRS AXIS

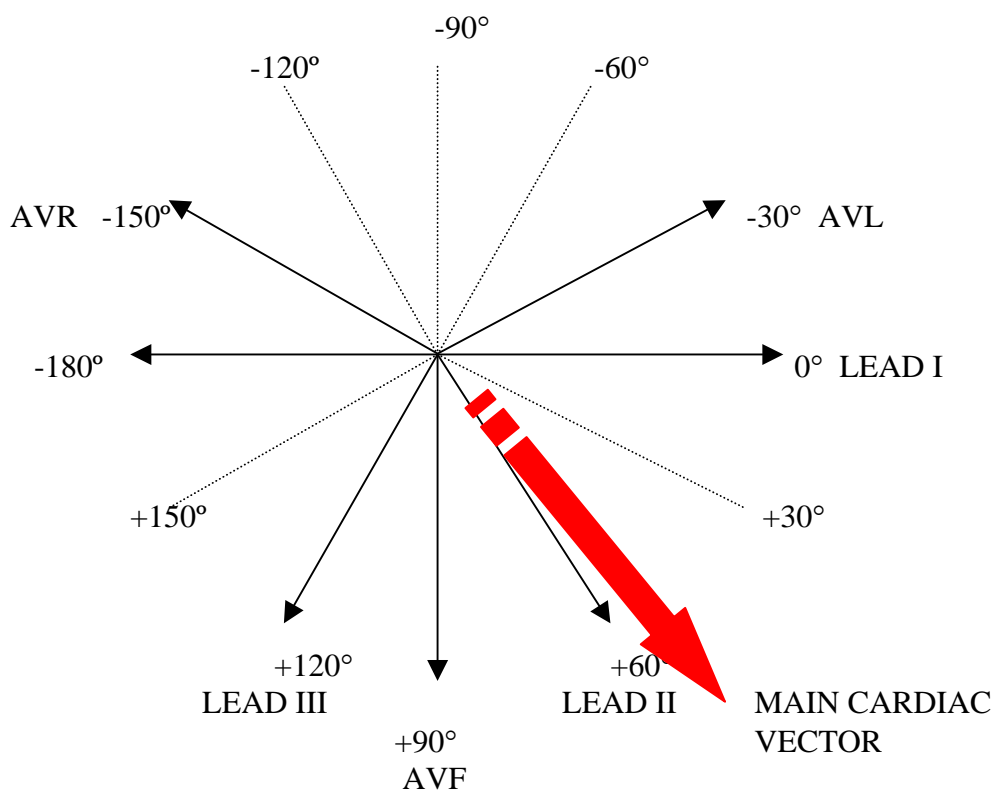
The cardiac axis is an indicator of the general direction the wave of depolarisation takes as it flows through the ventricles.



Forces travelling towards a positive lead will result in a positive deflection.
Forces travelling away from a positive lead will result in a negative deflection.
Forces perpendicular to a lead will result in an equi-phasic deflection.



QRS AXIS FRONTAL PLANE



Normal values for Frontal Plane mean QRS Axis fall in the range of -30° (AVL) to $+90^\circ$ (AVF).

Left Axis Deviation will fall in the range of -30° to -180° .

Right Axis Deviation will fall in the range of $+90^\circ$ to $+180^\circ$.

Sinus Bradycardia: Same findings as for Normal Sinus Rhythm except.

Heart Rate less than 60 bpm

Sinus Tachycardia: Same findings as for Normal Sinus Rhythm except.

Heart Rate greater than 100 bpm

Sinus Arrhythmia: Same findings as for Normal Sinus Rhythm except.

The R - - R Interval is Irregular

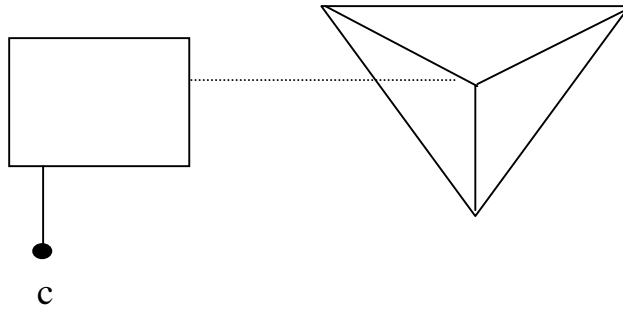
Sinus Arrest

Considered Sinus rhythm but is abnormal

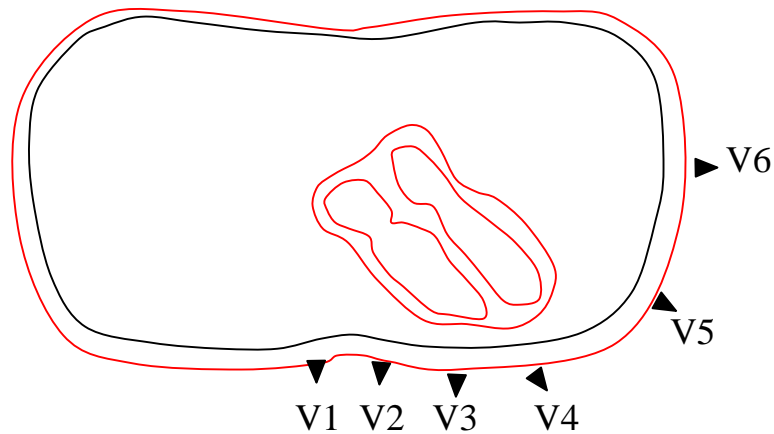
UNIPOLAR CHEST LEADS

Wilson V Leads (V1 - - - V6)

Relies on zero potential with an exploring chest electrode.



VENTRICULAR ACTIVATION

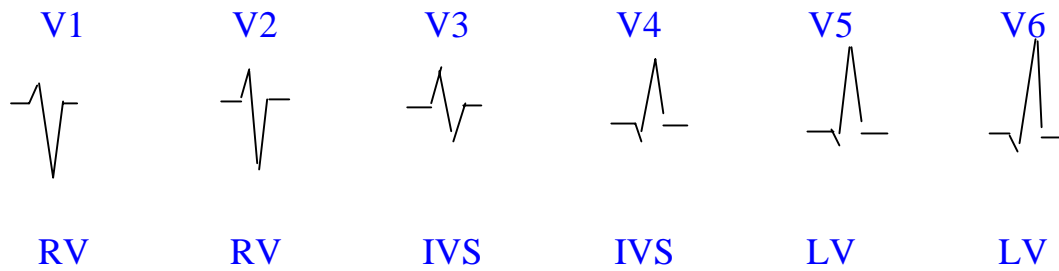


- V1 + V2 Lie close to the RV
- V3 + V4 Lie close to the IVS
- V5 + V6 Face towards the LV but separated by distance

Size of the R wave should increase from V1 - - - V6.

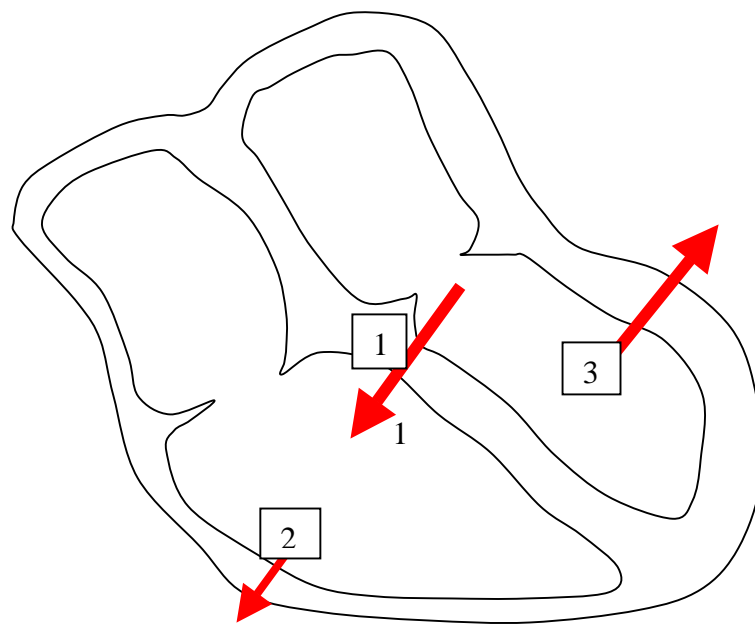
V4 Usually at the Apex (Transitional Zone where the first negative wave appears).

TYPICAL COMPLEXES OF PRECORDIAL LEADS



Size of R wave increases from V1 - - - V6

DEPOLARISATION STAGES



Phase 1:- Depolarisation of the IVS first and alone (left to right in normal).

Phase 2:- Depolarisation of the free wall of the RV and LV together.

KAP/LJR..N001.