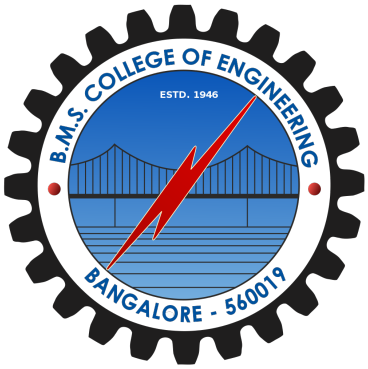
Diagnostic and Therapeutic Equipments Lab Report

Karthik Dani

2024-06-11

Table of Contents

Certificate



Department of Medical Electronics

B.M.S College of Engineering

Autonomous college, Affiliated to VTU Belgaum

Bangalore - 560019

2023 - 24

Lab Report on:

Diagnostic and Therapeutic Equipments

By

Karthik Dani (1BM22MD022)

Course Instructor:

Dr.R.Kalpana

Associate Professor, Dept of Medical Electronics

1 Blood Pressure Measurements

1.1 Aim:

To determine the blood pressure of the subject using mechanical and electronic BP meters.

1.2 Apparatus:

Sphygmomanometer, sthethoscope, and a digital BP monitor.

1.3 Theory:

1.3.1 Sphygmomanometer

Sphygmomanometer is a medical device used to measure blood pressure. It typically consists of an inflatable cuff that is wrapped around the upper arm, a measuring unit (mercury) and a mechanism for inflating the cuff, usually a bulb and a valve.

1.3.2 Digital BP Monitor

A digital blood pressure (BP) monitor is an electronic device designed to measure blood pressure and heart rate. It automates the process of inflating the cuff, measuring the blood pressure, and displaying the results, making it easier to use compared to traditional manual sphygmomanometers.

1.4 Procedure

1.4.1 Sphygmomanometer

- Subject is made to sit parallel to the mercury level of the monitor. The mercury knob is made opened.
- Rough side of the cuff is placed on top of the left hand and is tied tightly on the brachial artery (point on left hand, where pulse is felt).
- Stethoscope is placed on brachial artery just below the cuff's sensor to record Korotkoff's sounds (Heard when medical personnel listen for when they are taking blood pressure using a non invasive procedure).
- The pressure is increased till 180mmHg using rubber bulb or inflator.

1.4.1.1 Note

- Onset point of Korotkoff sound is the Systolic pressure
- Dying of the Korotkoff sound is Diastolic pressure

  and the readings are taken accordingly.

1.4.2 Digital Blood Pressure Monitor

Digital sphygmomanometers are automated, providing blood pressure reading without needing someone to operate the cuff or listen to the blood flow.

1.5 Observation

Observation table for Mechanical BP meter
Data taken from Mechanical BP meter

Student Name	BP Readings	Mean Arterial Pressure (MAP)	Analysis
Kulkarni sir	120/80	93.33	Normal
Monika	110/70	83.33	Normal
Kushaal	130/90	103.33	Pre-hypertension
Namyatha	120/83	95.33	Normal
Karthik	125/85	98.33	Pre-hypertension
Janane	110/65	80.00	Normal
Omar	110/70	83.33	Normal
Hasan	100/70	80.00	Normal
Saad	120/85	96.66	Normal
Manasa	90/86	87.33	Normal
Mayuri	110/75	86.66	Normal
Nidhi	110/90	96.66	Normal
Lakshita	100/70	80.00	Normal

Source: DTE Lab, 4th floor, Dept of Medical Electronics

Observation table for Digital BP meter
Data taken from Digital BP meter

Student Name	BP Readings	Mean Arterial Pressure (MAP)	Analysis
Kulkarni sir	117/85	95.66	Normal
Monika	99/64	75.66	Hypotension
Kushaal	112/80	90.66	Normal
Namyatha	126/74	91.33	Normal
Karthik	119/80	93.00	Normal
Janane	112/70	84.00	Normal

Omar	117/67	83.66	Normal
Hasan	98/70	79.33	Hypotension
Saad	115/76	89.00	Normal
Manasa	82/69	73.33	Hypotension
Mayuri	115/76	89.00	Normal
Nidhi	100/80	86.66	Normal
Lakshita	85/73	77.00	Hypotension

Source: DTE Lab, 4th floor, Dept of Medical Electronics

1.6 Calculations

$$MAP = \frac{1}{3}(SP - DP) + DP$$

where MAP is Mean Arterial Pressure

Sphygmomanometer

$$\frac{1}{3}(120 - 80) + 80 = 93.33$$

Digital BP meter

$$\frac{1}{3}(117 - 85) + 85 = 95.66$$

1.7 Analysis

- We observe that there is a change in `MAP` with change in BP levels.
- Generally, if there's a difference between systolic and diastolic pressure is `40 mmHg`, the subject is considered to be normal.
- If the difference between systolic and diastolic pressure ranges between `30 - 50 mmHg`, the subject is considered to be `normal` depending on the conditions.
- If systolic and diastolic pressure difference is $< 30mmHg$, the subject has low BP which leads to hypotension.
- If difference is $> 50mmHg$, the subject has high BP which leads to hypertension.

1.8 Result

The working and analysis of mechanical and electronic BP meters are analyzed.

2 Electrocardiogram (ECG) Measurement

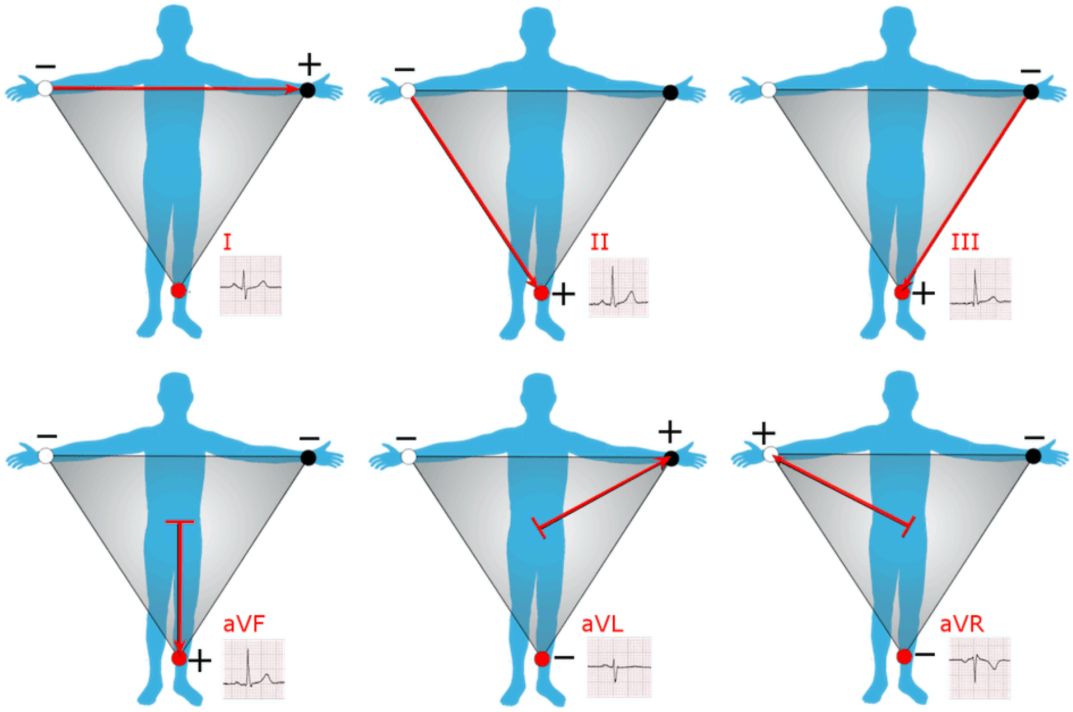
2.1 Aim

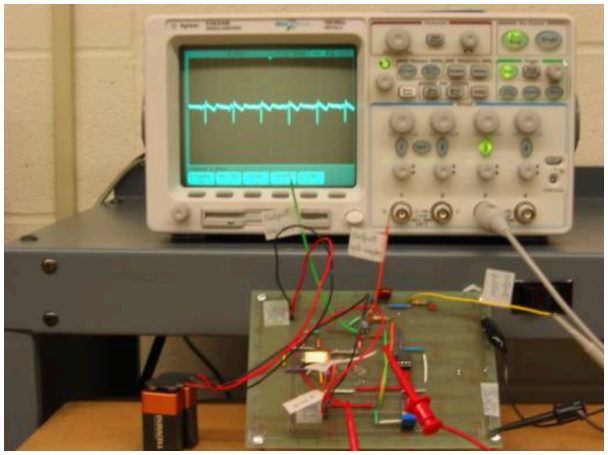
Aquisition of ECG signal with the help of Power lab and Bio-pac systems.

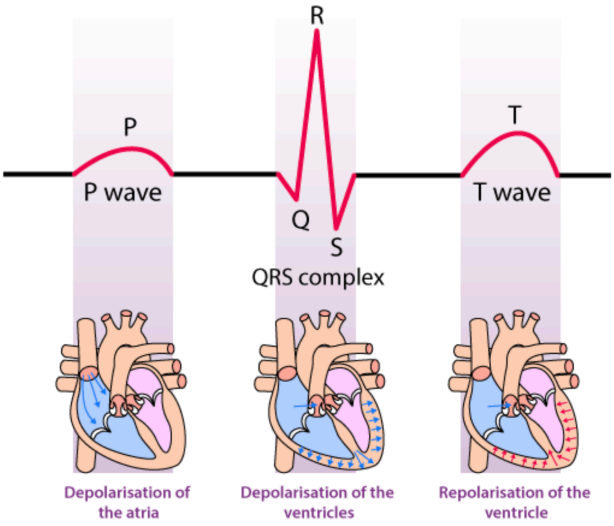
2.2 Theory

Electrocardiogram records from the body surface and registers the differences in electrical potential generated by the heart. Signal recorded is determined by action potentials generated by millions of individual cells and their sequence of activation. A multitude of factors (both cardiac and extracardiac) alter the final electrical signal. For instance, the electrical forces generated by heart are subsequently altered by the position of the heart within the body, the nature of intervening tissue and the distance to the recording electrode.

- Lead 1 = RA, LA, RL
- Lead 2 = RA, LL, RL
- Lead 3 = LA, LL, RL

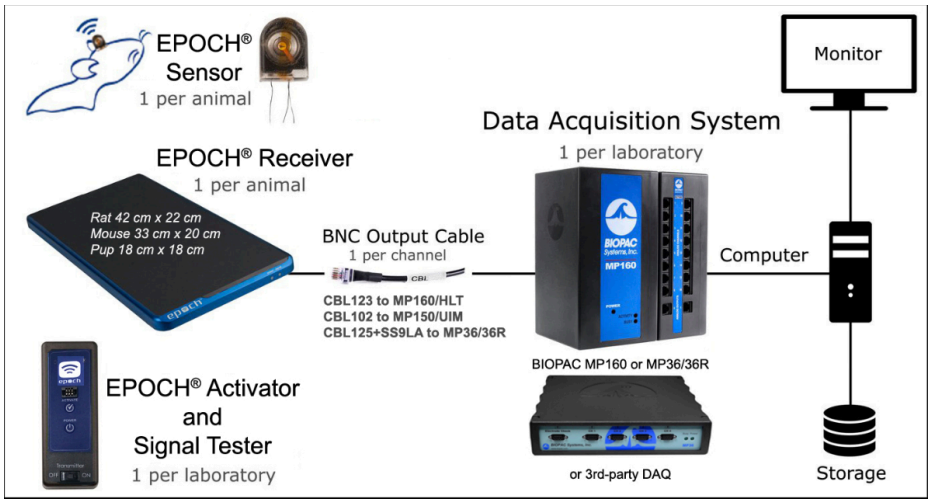






2.2.1 Bio-pac system

We aquire ECG signal using the Bio-pac system



2.3 Procedure

1. BIOPAC lessons are opened on the PC
2. Select `ECG1` and click OK.
3. Electrodes are placed on respective channel (CH:2) according to lead configurations. Transducer used is SS2L and subject should be at rest.
4. System is first calibrated and checked for proper contact of electrodes.
5. ECG setup is thus simulated, and the readings are recorded for each lead configuration
6. After recording the signals, BIOPAC lessons is clicked to save readings, which display the peak to peak voltage.
7. L1 + L3 = L2 is thus verified.

2.4 Observation

ECG Lead analysis

Peak-to-Peak Values, Frequencies, Time Intervals, and Beats per Minute (BPM) for ECG Leads

Lead Number	Peak to Peak	Frequency f (in Hz)	Time (in sec) = 1/f	Beats per Min = 60/T
Lead 1	0.47	1.27	0.78	76.92
Lead 2	0.55	1.25	0.80	75.00
Lead 3	0.08	1.26	0.79	75.94

Source: DTE Lab, 4th floor, Dept of Medical Electronics

2.5 Analysis

The Biopac software shows consistent heart rate readings across all leads (75-77 bpm) indicating accurate and stable heart rate rhythm detection.

ECG analysis if the subject is acquired and Lead1 + lead3 = Lead2 was verified. Using frequency of the signal acquired, the bpm was also found.

Lead 1 = 0.47

Lead 3 = 0.08

Lead 2 = 0.47 + 0.08 = 0.55

$\frac{1}{f} = T = 0.78$ and $\frac{60}{0.78} = 76.92$

2.6 Result

The ECG signal was aquired and L1 + L3 = L2 is verified.