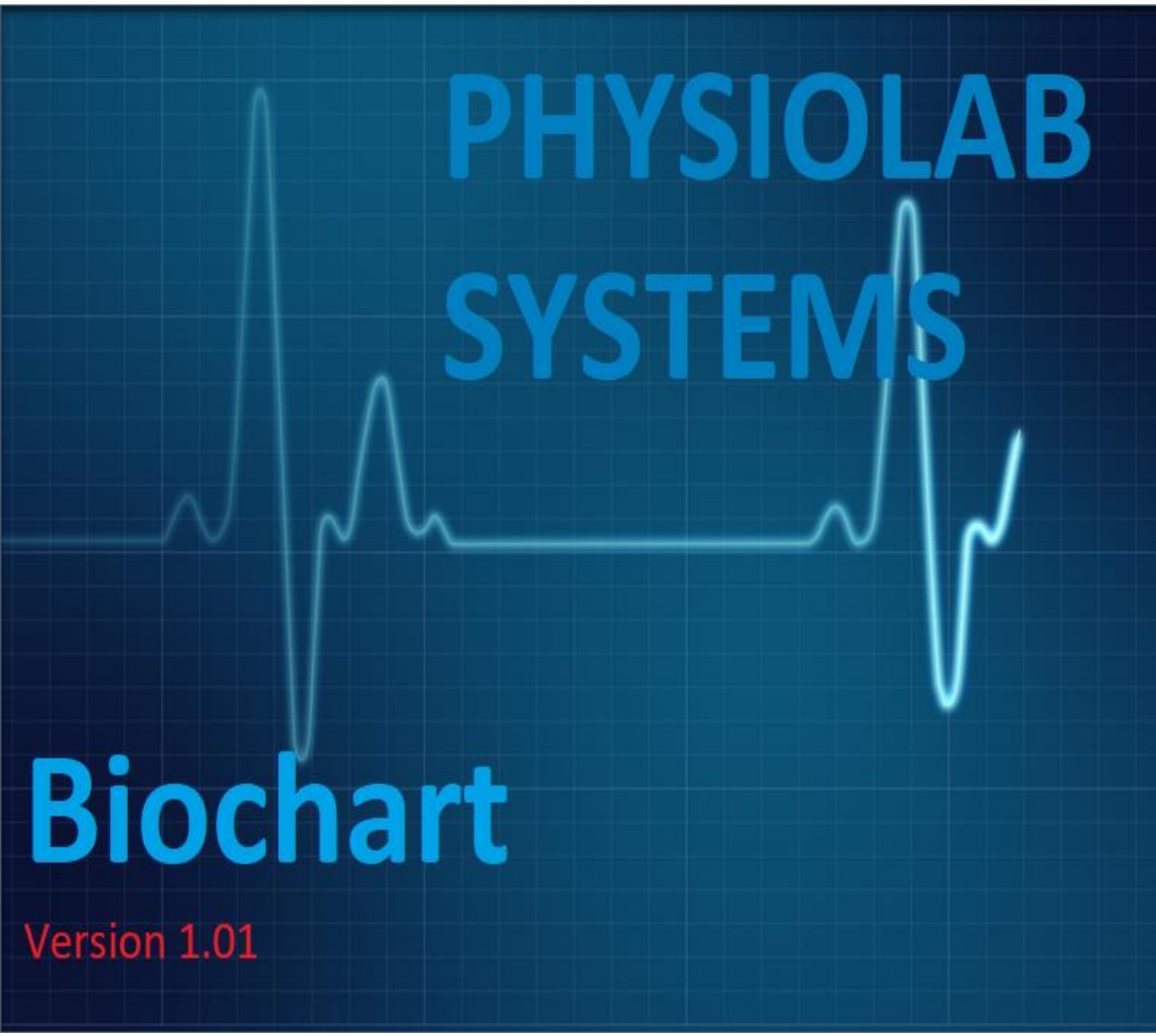
Biostar Healthcare Pvt. Ltd.



PHYSIOLAB
Instruction manual

For 1 to 8 Channel

⚠ In order to assure safe and effective operation, we ask for a careful reading of chapters 1-3 of this manual before first use of the product.

PhysioLab is the trademark of Biostar healthcare Pvt. Ltd.

IMPORTANT NOTICE: PhysioLab equipment is not a medical product. It is intended for physiological experiment and research application. Mostly used in Lab of Medical & Biomedical Institutes.

This product is the subject to EU legal regulations for Waste Electrical and Electronic Equipment. For the sake of environmental protection and recycling, WEEE should be collected separately and not be mixed with unsorted municipal waste. Holders have important role in the collection process. They should return WEEE to civic amenity, recycling centre or a retailer.

Biostar Healthcare Pvt. Ltd. Company reserves the right to introduce development changes in the product and its firmware & software without previous notification.

Important symbols used in this manual:

⚠ - requirements concerned with safety,
⃠ - warnings connected with operation.

INTRODUCTION

This manual helps you to know how we can use PhysioLab devices and how we can perform different experiment by using BioChart Software application. It will guide you, how to install a device, use it and how to perform and record different experiments.

Technical Specifications:

- Channel : 1,2,3,……..8
- ADC : 24 bit
- CMMR : 115Db
- Sample : 400KHz & more
- Connectivity : USB
- Inbuilt Display : TFT
- Sweep Speed : 0.5 to 100 div/sec

Features:

- BioChart Powerful Software
- AC, DC Input Coupling
- External Triggering
- User Selectable Gain
- Sample Rate Selection
- Inbuilt Stimulator
- Isolation for Human Safety
- Extendable Display

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1. Safety

- DO NOT CONNECT THIS DEVICE TO ANY EQUIPMENT NOT INTENDED FOR THAT PURPOSE BY THIS DEVICE'S MANUFACTURER.

  PARTICULARLY, DO NOT CONNECT DEVICES POWERED FROM THE MAINS POWER NETWORK OR CONNECTED TO ANY SUCH DEVICES, FOR EXAMPLE POWER SUPPLY ADAPTOR, COMPUTER EQUIPMENT AND MEASUREMENT EQUIPMENT.
- Do not connect measurement wires to any devices that are not intended for it.
- Do not use this product in industrial environment, or in means of transportation. It is intended for use in office environment and at home.
- Never use electrodes or conductive paste on damaged or irritated skin.
- Keep clean electrodes and other sensors applied to the skin.
- Do not use electrodes and other sensors with damaged wire insulation.
- Do not wrap the measurement wires around one's neck.
- To prevent cross-infections, the electrodes manufacturers recommend that electrodes used by persons with HIV, AIDS, Creutzfeldt-Jacob disease or comparable infections should not be used by any other people.
- Avoid eye contact with the electrode paste. If this happens, rinse the eyes with 0.9% saline solution. Avoid rubbing the eyes.
- Before application of electrode paste to persons prone to cosmetics allergies consultation with a doctor is required.
- Consult a doctor right away in the event of long-lasting redness, soreness, or swelling at the site of electrode paste application.

2. Product characteristics

PhysioLab is advanced, portable, versatile equipment for physiological measurements. It can be used in many applications, including:

- Types of biofeedback, e.g. ECG, EEG, sEMG, HRV, GSR, EMP, HEARTSOUND, STETHOGRAPHY, PULSE
- Scientific Research,
- Hi-tech user interfaces.

PhysioLab distinguishes, among other things, by multimodal measurement channels, which functions can be individually selected by a user.

Product highlights

- 1 to 8 versatile, channels enabling measurements of voltage, conductance, resistance and temperature signals.
- a function of each channel is specified by a user (For example, EEG + sEMG + GSR + TEMP, or 2 x EEG + 2 x sEMG etc.)
- built-in test of electrode-skin impedances and input circuit continuity,
- independent reference inputs for each channel,
- 24-bit resolution of measurements,
- 1% accuracy of
- characteristics enable to minimize signal delay or maximize frequency bandwidth,
- high immunity to electrical interferences,
- option of active shielding of sensor cables to reduce movement artifacts,
- configurable filter of power mains interferences (50/60 Hz or off),
- full galvanic isolation of the subject's body,
- USB connection to a computer,
- real-time transmission of data to a computer,
- interoperation with many computer applications making possible flexible signal processing and visualization (also in real time), as well as storage in a computer,
- application programming interface (API),
- device extension with digital signal processor (DSP) executing client-defined algorithms (custom-made option),
- long work without any interruption,
- indicators of power and handshaking,
- small size and weight,
- Remote firmware upgrade.

3. How to Start:

To use a PhysioLab device, firstly, you need to install BioChart Software Application on your system. For this, check the BioChart installation manual. You can download it from following link:

http://www.biostarhealthcare.com/

4. The basics of usage

Power

After installation of BioChart application on your system, connect the PhysioLab device with your system by using USB cable. PhysioLab device is powered by a USB cable by connecting with computer

🚫 "Ordinary" USB cable should not be used

The device is turned on (or off) by plugging USB cable on both sides. After turning on the **Power** indicator should light green.

REMARK: Give sometime for handshaking, when data will send to bulk the start the experiment. If the device will not be used for long time, USB should be taken out.

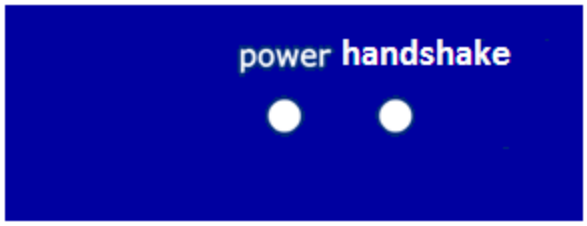
Kindly unplug and plug again if handshake is not completed.

Signaling

PhysioLab is equipped with multilevel input channels and visual signaling of operation states, giving high degree of control.

Device indicators

Further information about operational state is passed on by indicators on the device front plate:



- **Power** – Status of USB:
  - does not shine - the device is off,
  - red - the device is on, the status of USB is correct,

- **Handshake** – Status of USB:
  - does not shine - the device is not connected with software
  - green - the device is detected by software

The device will turn ON until the USB is inserted. In order to avoid such situation, it is recommended to replace USB cable.

Measurement inputs

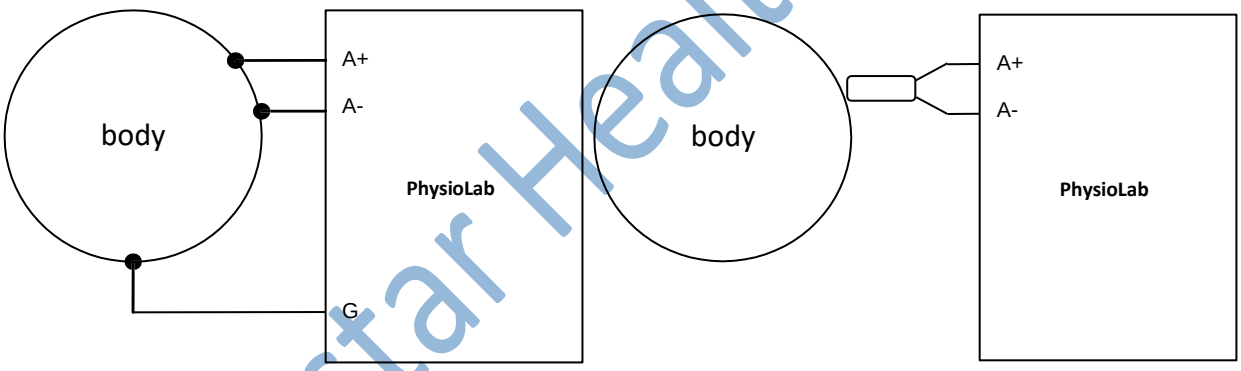
Depending on a model, PhysioLab has 1 to 16 identical, highly versatile channels. Each channel has two differential inputs marked as „+" and „-". Apart from that the device has a VG socket (virtual ground. Each connector has 5 pins. Sensors with shielded cables are available on special request.

Wires of electrodes and other sensors should be ended with plugs compatible with that standard.

Connections

For measurements of electrophysiological signals (e.g. EEG, sEMG, HRV, GSR) „+" and „−" inputs of a channel are connected to two electrodes applied on the skin surface. Furthermore, a connection of the subject's body to **VG** socket with a separate electrode is necessary.

Apart from electrophysiological signals PhysioLab can measure non-electrical quantities (for example temperature) with resistive sensors. They are connected between both inputs of a channel.



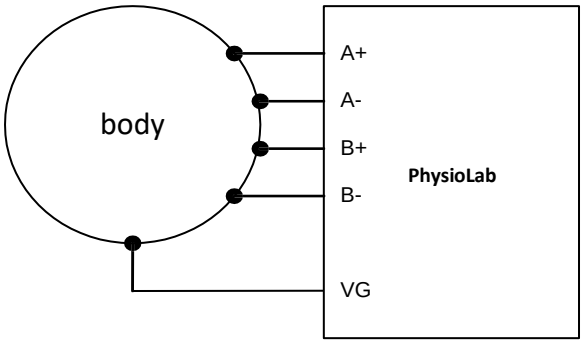
Connection of electrodes for measurement of electrophysiological signals

Connection of resistive sensor of non-electrical Quantity

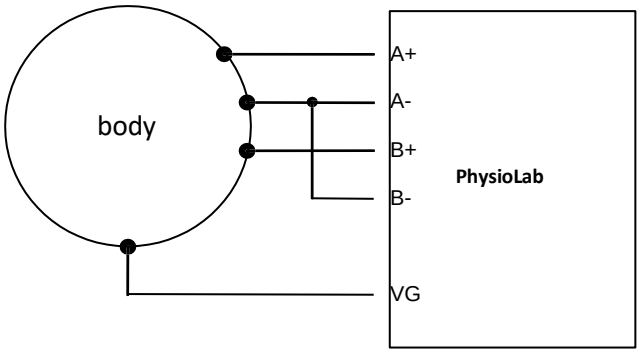
For electrophysiological measurements both main types of derivations (montages) can be used:

- bipolar (measurement of potential difference between two sites), and
- referential, also known as monopole (measurement of voltages in reference to common electrode).

For referential derivations „−" inputs of used channels are connected to a single reference electrode with special splitter.



Bipolar derivations



Referential derivations

Simultaneous measurement of different physical quantities and types of signals in individual channels is possible.

The following measurement rules should be obeyed:

1. All not used channels should be turned covered.
2. In all cases of measurement with electrodes on the skin (EEG, HRV, GSR etc.) the **VG** Socket has to be connected to the body with a separate electrode.
3. When none of used channels is set to voltage measurement (**Channel function** not set to „Voltage") and is not galvanically connected to the body (e.g. only temperature sensors are used).
4. Measurements of impedance/resistance/conductance between electrodes on the skin (e.g. GSR) should be always bipolar, i.e. done with two separate electrodes for a given channel (none of its inputs should be connected to reference electrode common for a few channels).
5. When you connect sensors to the device, check if their plugs are inserted into full depth of measurement sockets. (Otherwise there may be no electrical contact.)
6. If possible, try not to touch sensors and their wires during measurements.
7. Control possible sources of artifacts, such as body movements, cell phones etc. It is especially important for measurements of subtle EEG signals (amplitudes of the order of microvolt's).
8. ⚠ Measurement sockets cannot be connected to any devices powered from mains power Sockets of the device (including **VG**) cannot be connected to real electrical ground.

Sensors

For electrophysiological measurements (e.g. ECG, EEG, sEMG, HRV) virtually all electrodes routinely used for individual modalities (passive), ended with 5pin din connector plugs or standard snaps, can be used. They may be both disposable and reusable electrodes, made of various materials (AgAgCl, Ag, Au, Sn). A user can also choose a method of their montage and a way to ensure electrical contact, e.g. with self-adhesive collars, caps, headbands etc., using adhesive-conductive paste (such as Ten20), gel or saline solution.

REMARK: Electrodes used on „+” and „−” inputs of a given measurement channel should be made of the same material.

REMARK: Dry electrodes can be used with PhysioLab device for GSR (skin conductance).

For measurements of non-electrical quantities special sensors delivered by the device manufacturer are required.

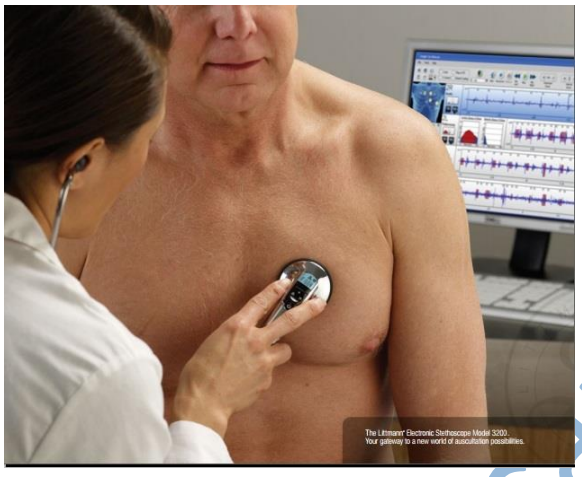
Operational remarks

- **Do not open the device**. **Do not remake it.** Incompetent intervention may cause damage and violate safety; it also causes loss of warranty.
- **Do not drop the device and do not expose it to strong bumps.** These may cause damage to the case and electronic components.
- **The device should always be dry.** Precipitation, high humidity or mineral solutions can disturb operation and cause corrosion of the electronic components.
- **Do not use or store the device in dirty or dusty places.** Accumulation of contaminants inside the device may disturb its operation.
- **Do not store the device at high temperatures. Do not leave it in direct sunlight for prolonged periods of time.** It shortens the life of electronic components and operational materials and may warp the case.
- **Do not store the device at low temperatures.** It causes accumulation of moisture inside, which condenses after heating and may disrupt work of the equipment.
- **If the device will not be used for a long time, take the USB cable out of port.**
- **Do not use solvents or strong detergents for cleaning.** They may damage the case.
- Use a soft, dry cloth for cleaning the device. If necessary, use a soft pad moistened with isopropyl alcohol.
- **Operational materials and accessories:**
  Electrodes, cables with TP 1.5mm plugs, electrode paste, and similar accessories and materials can be purchased, among other things:
  - Alcohol pads used for skin preparation and cleaning are available in drugstores.

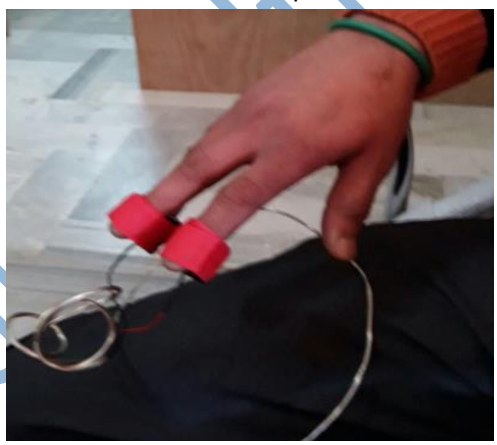
  REMARK: electrodes used on „+” and „−” inputs of a given measurement channel should be made of the same material (for example both Ag).

SENSORS

PHONOCARDIO: This sensor is used to measure heart sounds. To measure the sound simply places the sensor at appropriate place on chest.



GSR PROBE: This sensor is used to measure the galvanic resistance of skin. In this probe two sensors are attached with single cable. Place the both sensors on the tips of two radial fingers.



PHOTOPULSE TRANSDUCER: This transducer is used to measure the pulse. This transducer is made up of single sensor attached with single wire. Place the sensor on tip of single radial finger and let your hand relax.

ECG CABLE: This is also a single cable sensor but at the end there are 3to5 clamps to attach with different electrodes placed on both hands and leg. All the clamps are named like where they will attach, simply like right arm (RA), Left arm (LA), right leg (RL). RL is grounded mostly.

TEMPERATURE PROBE: This probe is mainly used to measure the temperature. Din side Connector connects it with PhysioLab and thermistor transducer on the body side (other end) to measure the temperature.

STETHOGRAPH: This sensor is used to check the respiratory measurements. A respiratory belt place around the chest. This belt has two pipes, a Pressure transducer will attach with one pipe and hand air pump with the other pipe. Fill some air in the belt with hand air pump and lock it.

4. BioChart Software

PhysioLab devices are PC based and comes with Software in the form of auto run CDs and pre-installed in the Physiograph.

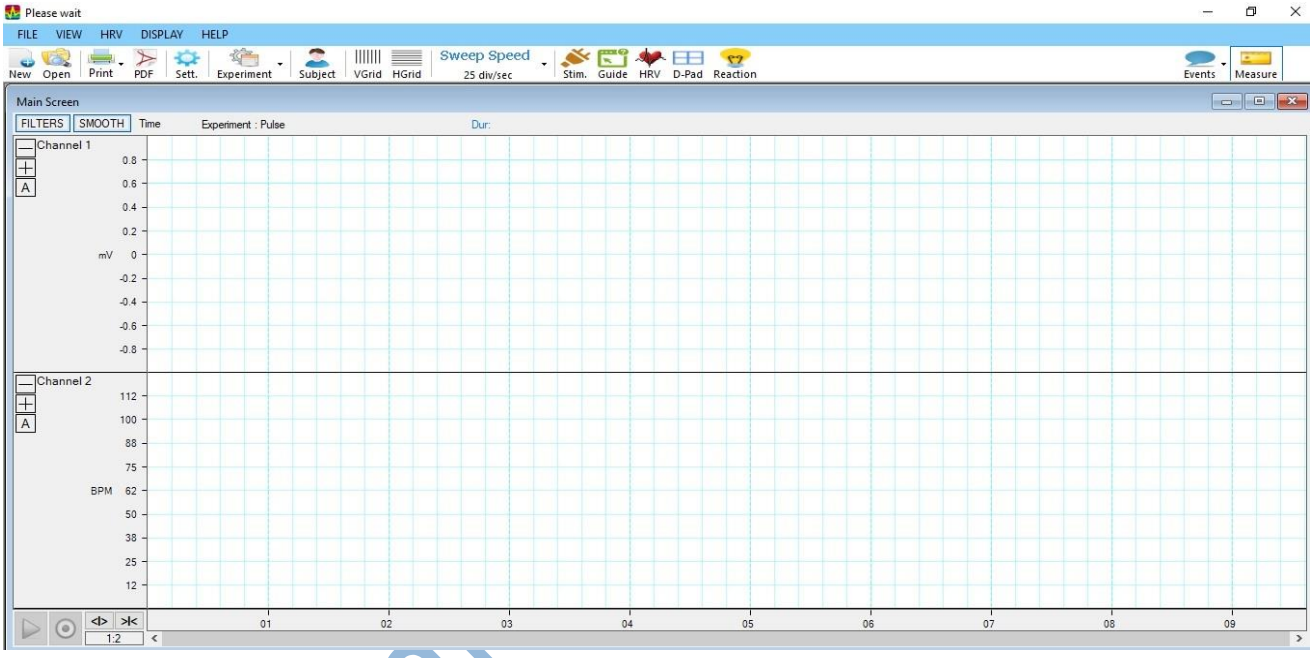
- **BioChart** –It comes with Inbuilt Experiments and factory default setting for ease of student. It is used to record experiments and data.

BioChart Functionality

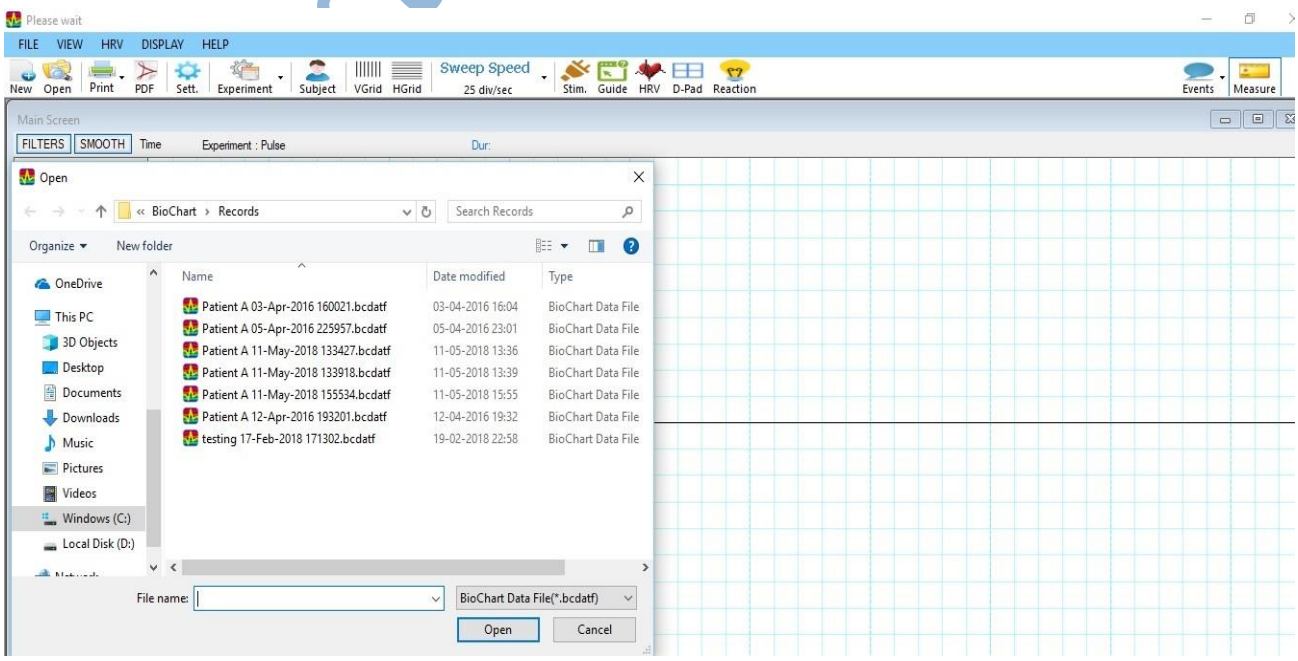
BioChart interoperate with PhysioLab devices via **USB**. The functions that can be performed in BioChart are mentioned below:

New tab

The very first tab is new when you click to open application. As the name implies this tab is used to start a new experiment. When you click this tab the page in the form of graph will open as in the picture shown below:



Open tab



The second one is the open tab. when you click this tab it will open the experiments record of patients that you had saved by patient name. It will also tell the date and time when the experiment had taken. If you want to see the history of the patient reports again just click on open tab. You can open the all experiments number of times you want.

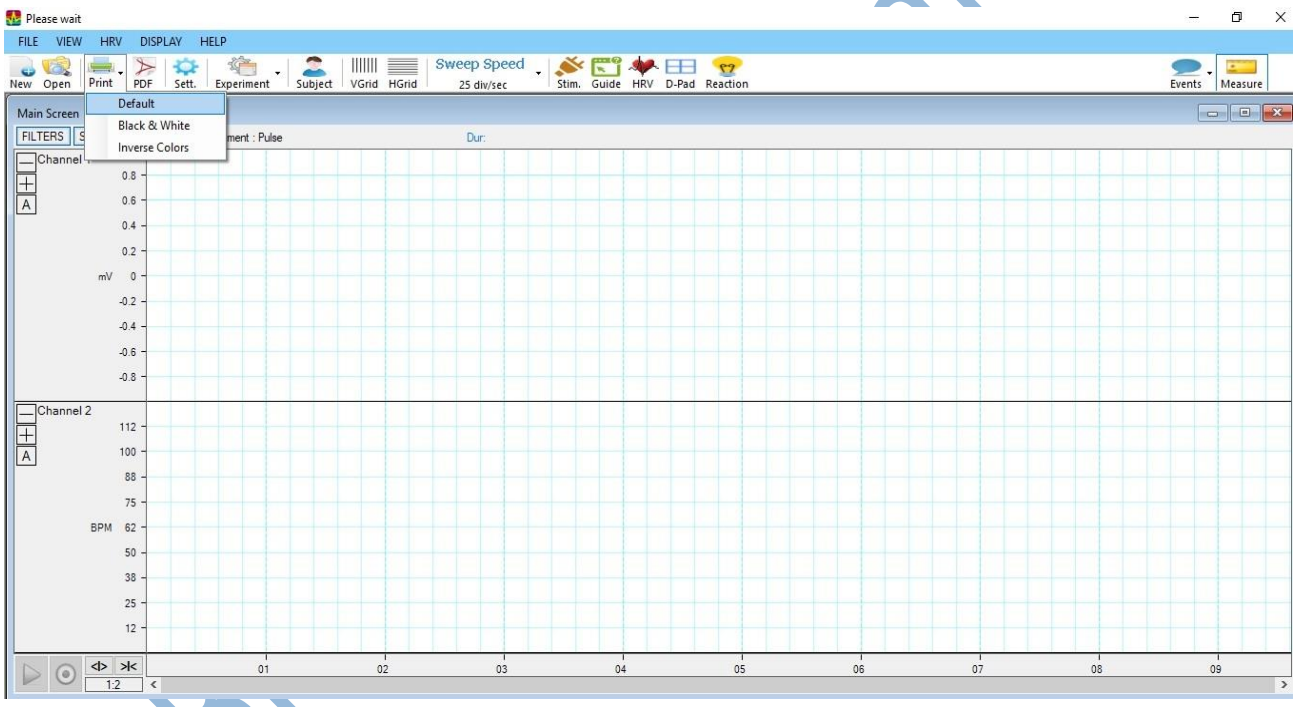
Print tab

Next, we have print tab. this tab is used to print the experiments in different colors. The options after clicking the print tab are mentioned below.

Default This will print experiment in the default pattern and color as by the BioChart.

Black & White if you want your experiments in black & white form the click this option.

Inverse Colors you can also give the other effects to the output of experiment.



PDF tab

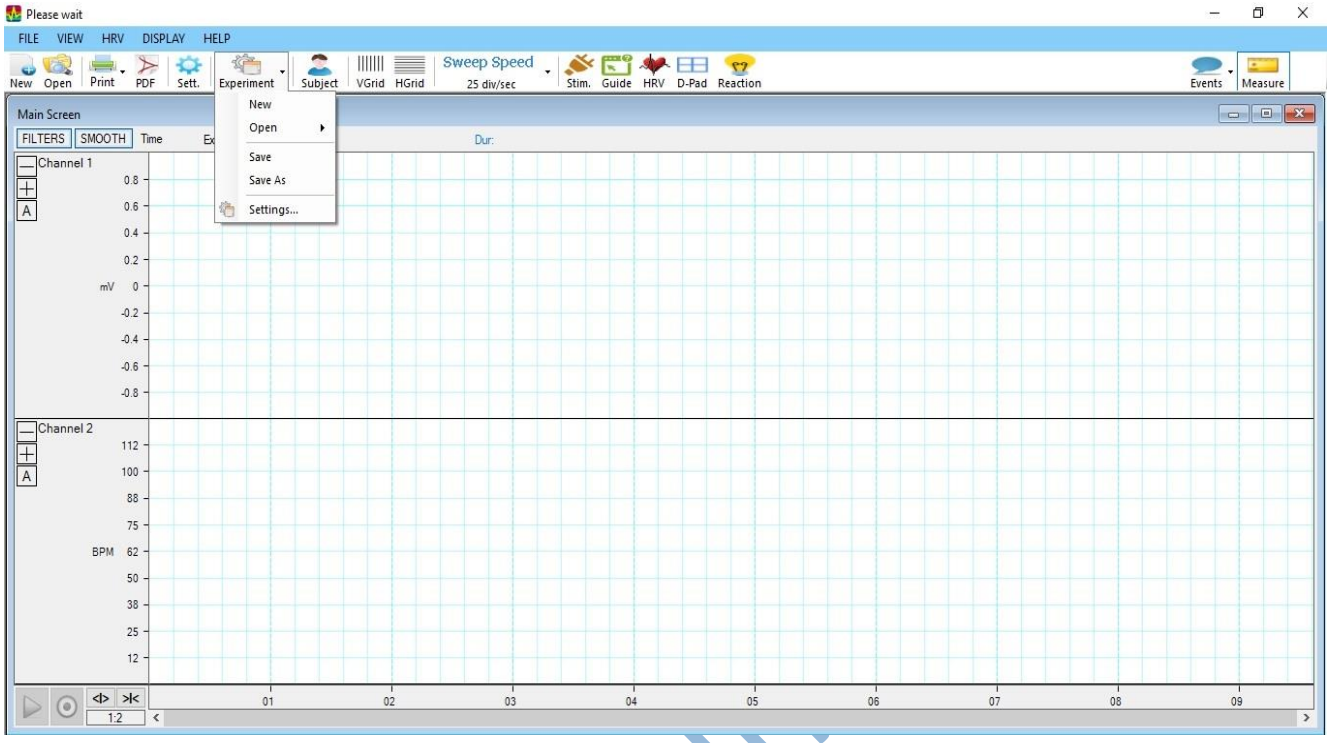
The use of this tab to convert the output of experiment into Pdf format. If you want to create a file of the records of patients use this tab. You can easily make pdf and port the data easily and frequently from one place to another.

Experiment tab

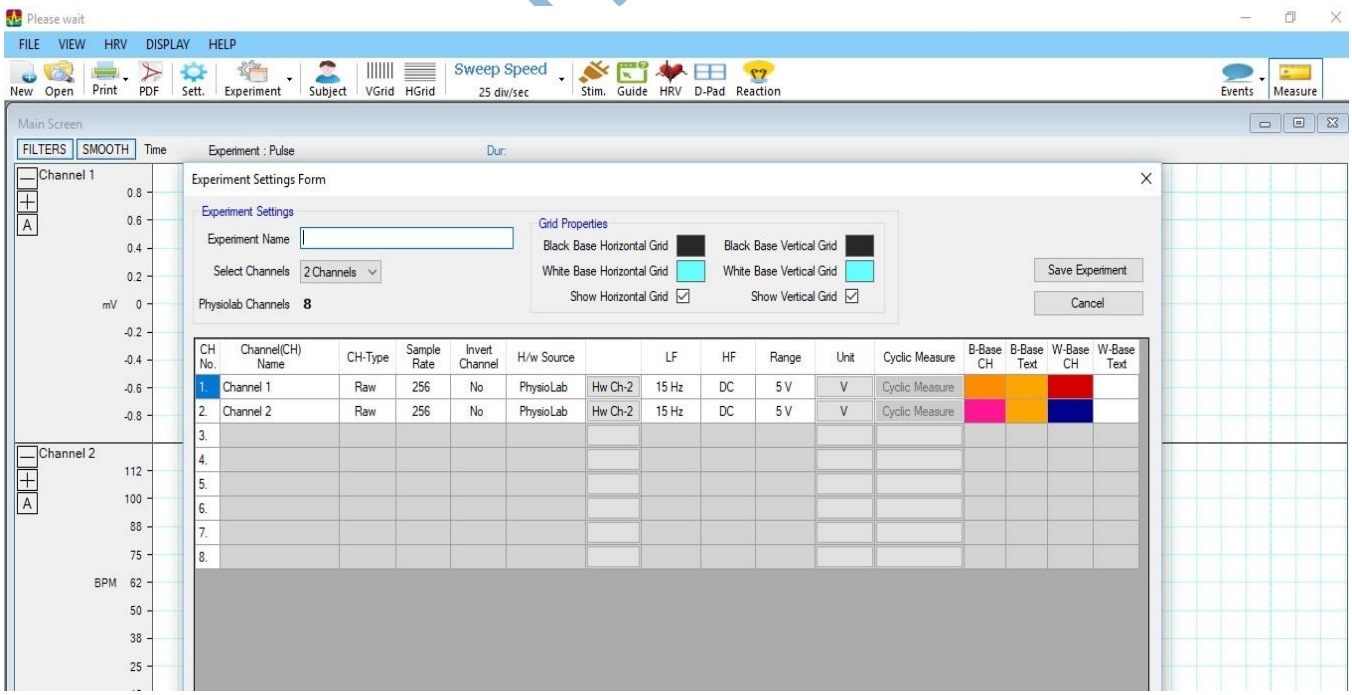
All the factory settings will be set from this tab, settings like channel, filters, frequencies, range etc.

First when you enter the experiment tab the further options will also open. The functions of all other

options are mentioned below.



New This option is used to make a new experiment. You can give the names according to your Experiments.



1. After clicking new the manual setting page will open. Firstly, enter the experiment name that you want to make.
2. Then select the number of channels you want to make.

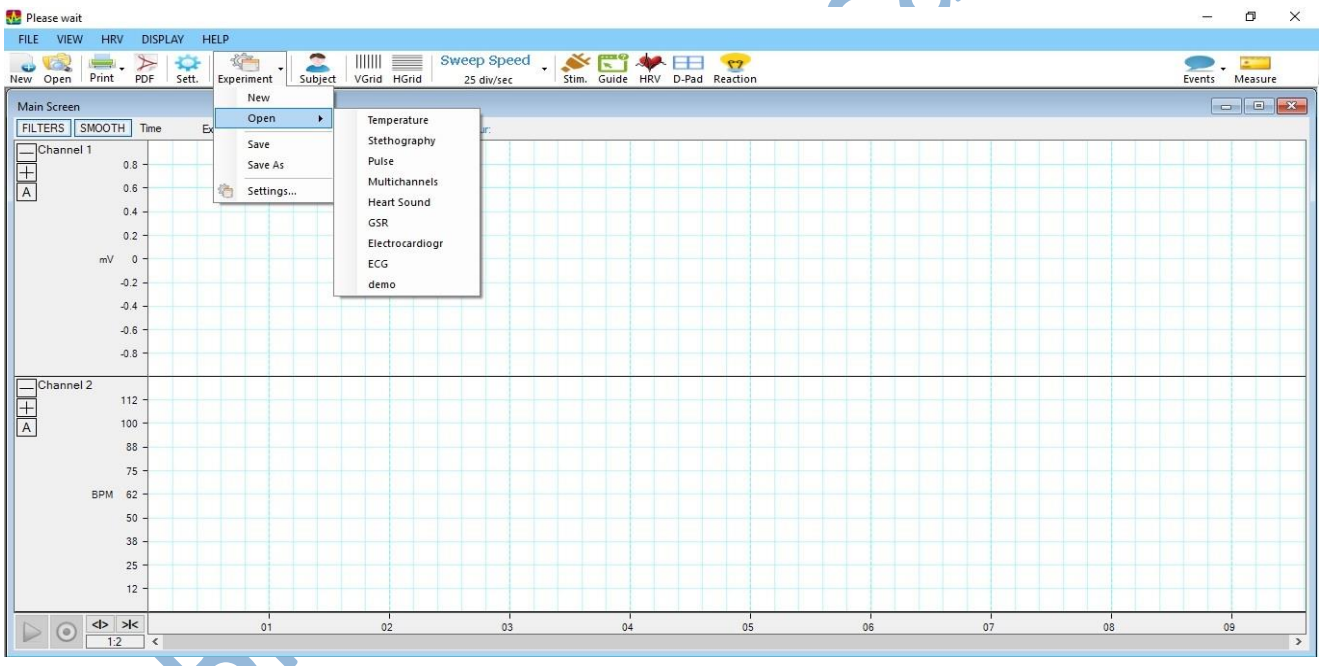
3. Going down to the table channel name will appear automatically as you given to the newly made experiment.

Going one column to next column we must set the hardware channel (H/w CH). Set the channel according to the hardware connected channel no otherwise transducer will not give the output.

1. Then we have filter settings, set the LF & HF according to the desired frequencies.
2. Range will also set according to the experiment.
3. Save Experiment.

Note: The filter and range settings will set by Biostar healthcare itself because all the transducers will work on different frequencies and ranges. You don't need to set the frequencies and range of the default experiments. Only check the channel number where you connect the transducer. Channel number should be same as the hardware.

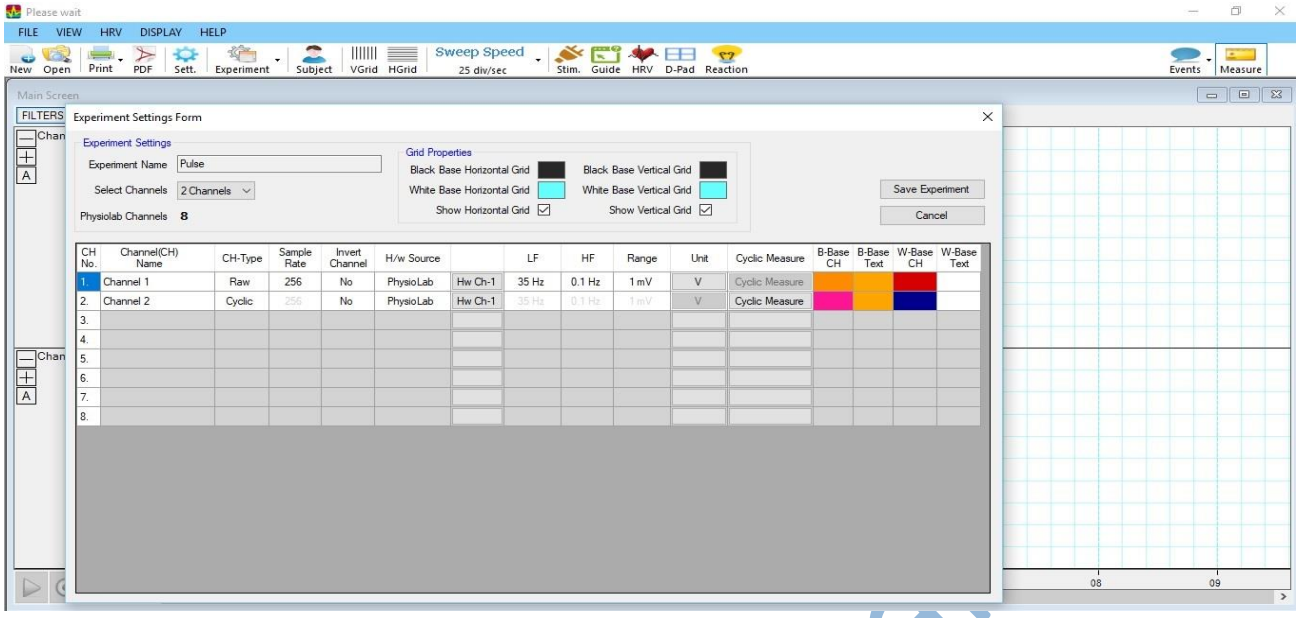
Open: When you click open, all default experiment names will open and then click the experiment which you want to work on.



Select any experiment you want to work on and it will open and adopt all the settings automatically.

Save As: you can save the experiment with your given name that you can find the experiment records easily.

Settings: By clicking on settings the manual setting page will open. Change the settings only if desired.



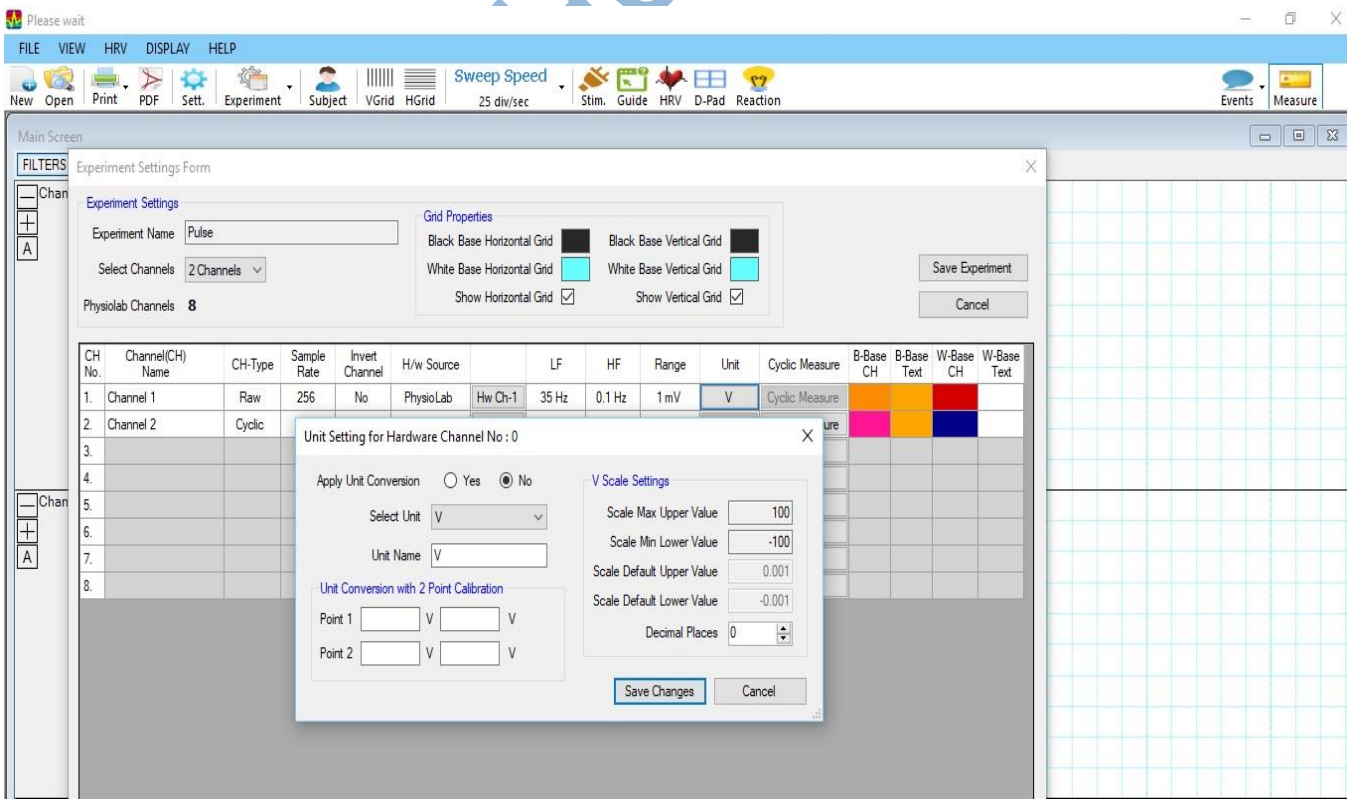
Select channels: There are 8 number of channels on which PhysioLab can work simultaneously. Select the number of channels on which you want to work simultaneously.

H/w CH: Set the hardware channel according to the transducer connected channel number.

LF & HF: Set filter frequencies if required otherwise these had set by default.

Range : Range will also set if required.

Unit : to set the desired unit of experiment and to collaborate the experiment select under Unit.



Firstly, select yes to apply unit conversion.

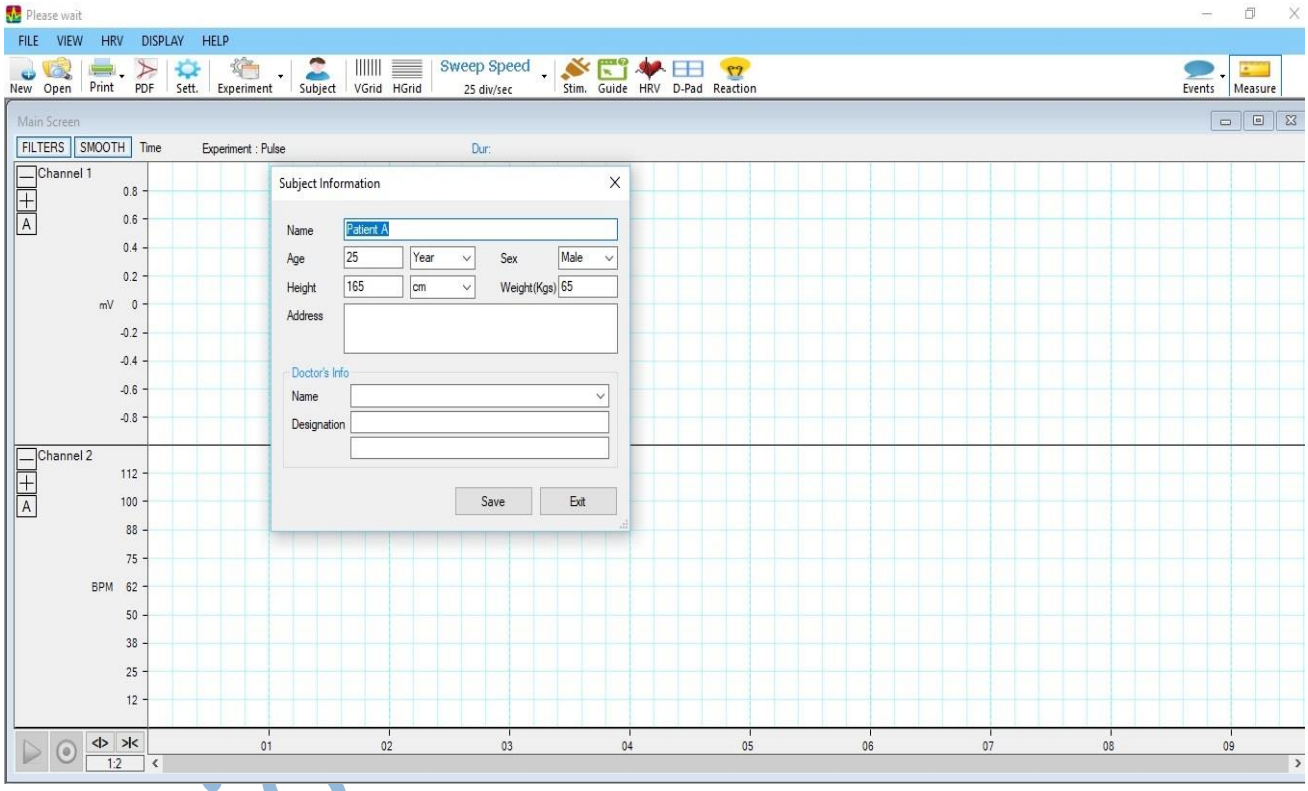
Then select the desired, unit name according to the proceeding experiment.

Then we have Unit conversion with two point's means to calibrate the experiment values. Give the desired calibration values from point 1 to point 2.

Select save changes after settings.

Subject tab

By using subject tab, we can add information about a Particular Patient and Doctor.



In this tab we need to fill the details about the patient that includes: Name, Age, Height, weight, Sex and Address of the patient. Name and Designation of the doctor.

Guide tab

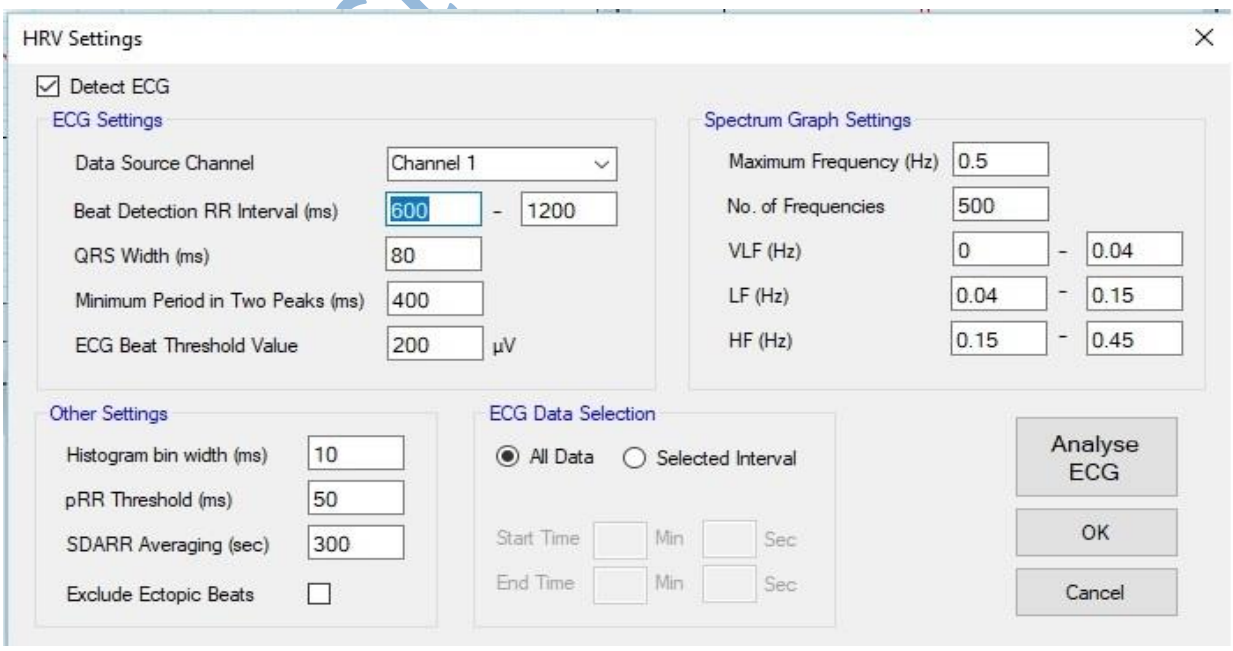
There is a guide tab in BioChart. If someone need to read about any type of experiment, then he can find out the details about it in guide tab. To read the details about any sensor, firstly select type from experiment and then, click the guide tab. After that, an information box will open that contain details about it.

HRV (Heart Rate Variability)

HRV analyses the beat to beat variations in heart rate in a time. HRV (Heart Rate Variability) calculated from ECG by determining the time intervals of heart beat and the unit of measurement is milliseconds (ms). HRV more beneficial than Heart rate, because it gives us closer look to the heart beats than Heart rate that calculates only number of heart beats per minute. Biochart has a feature that calculates the HRV.

1. To calculate the HRV, firstly, you need to open the ECG from which you want to calculate the HRV.
2. Go to Open in Biochart and select the ECG experiment.

3. Then Click on HRV icon.
4. After that, HRV setting window will open as shown below:

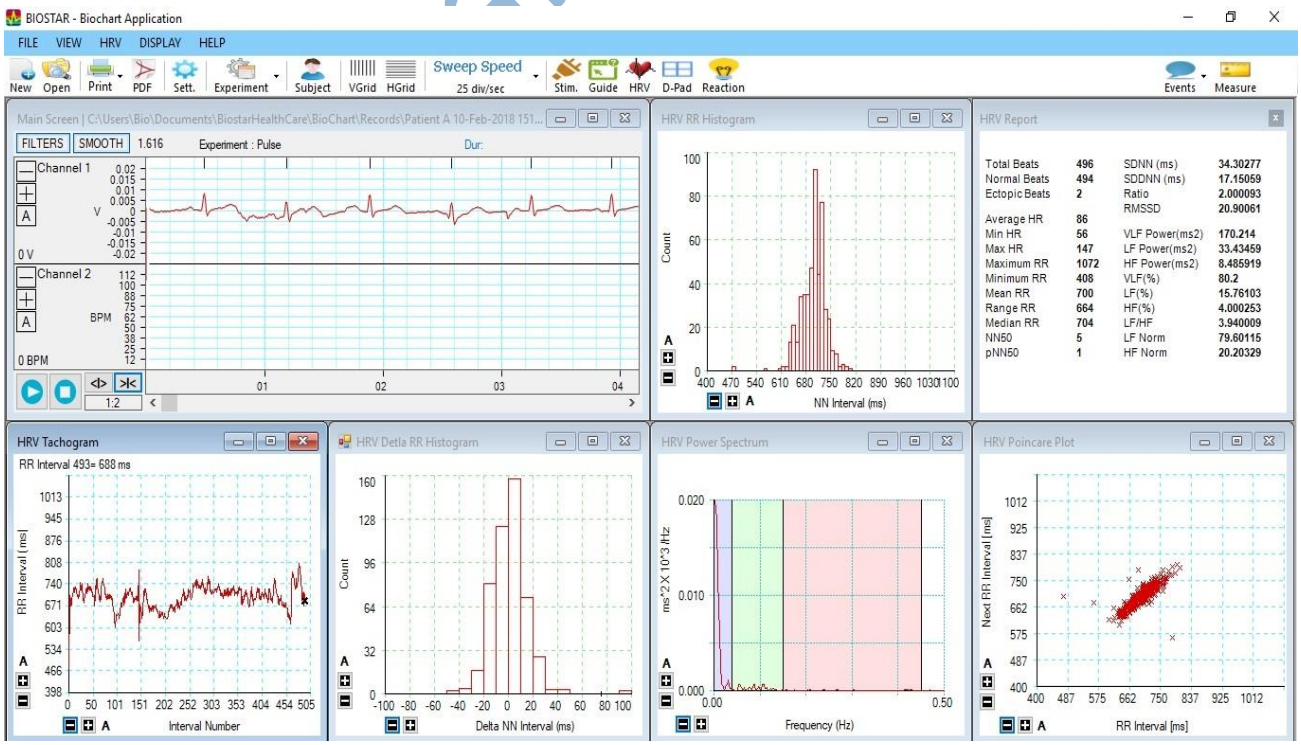


5. After that you need to set the following thing:

    - Channel Name on which the ECG experiment is running
    - Beat Detection RR Interval (ms)
    - QRS Width (ms)
    - Minimum period in two peaks (ms)
    - ECG beat threshold value

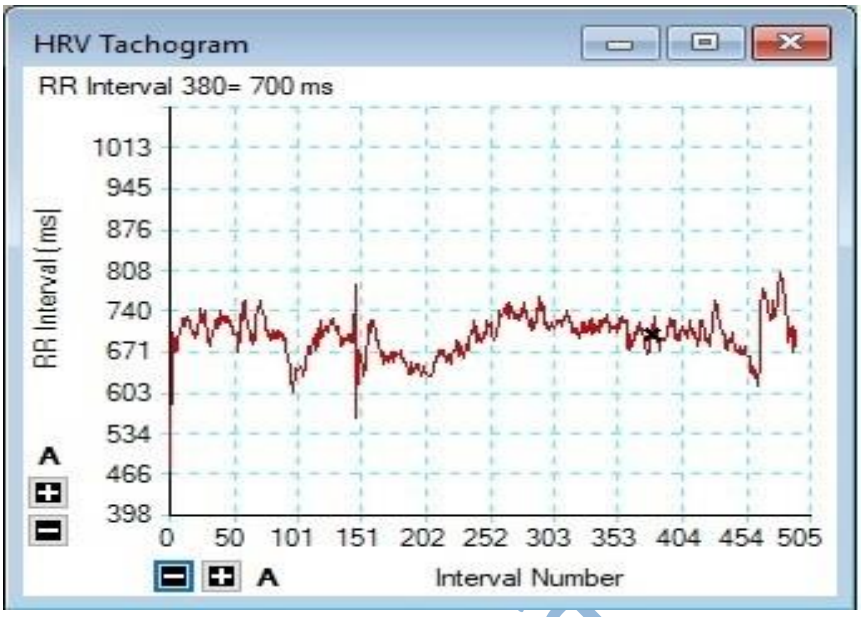
6. Now, click on the Analyse ECG
7. To view the results of HRV, click on Display and select HRV View:

8. After clicking of HRV View, following window will open with results:

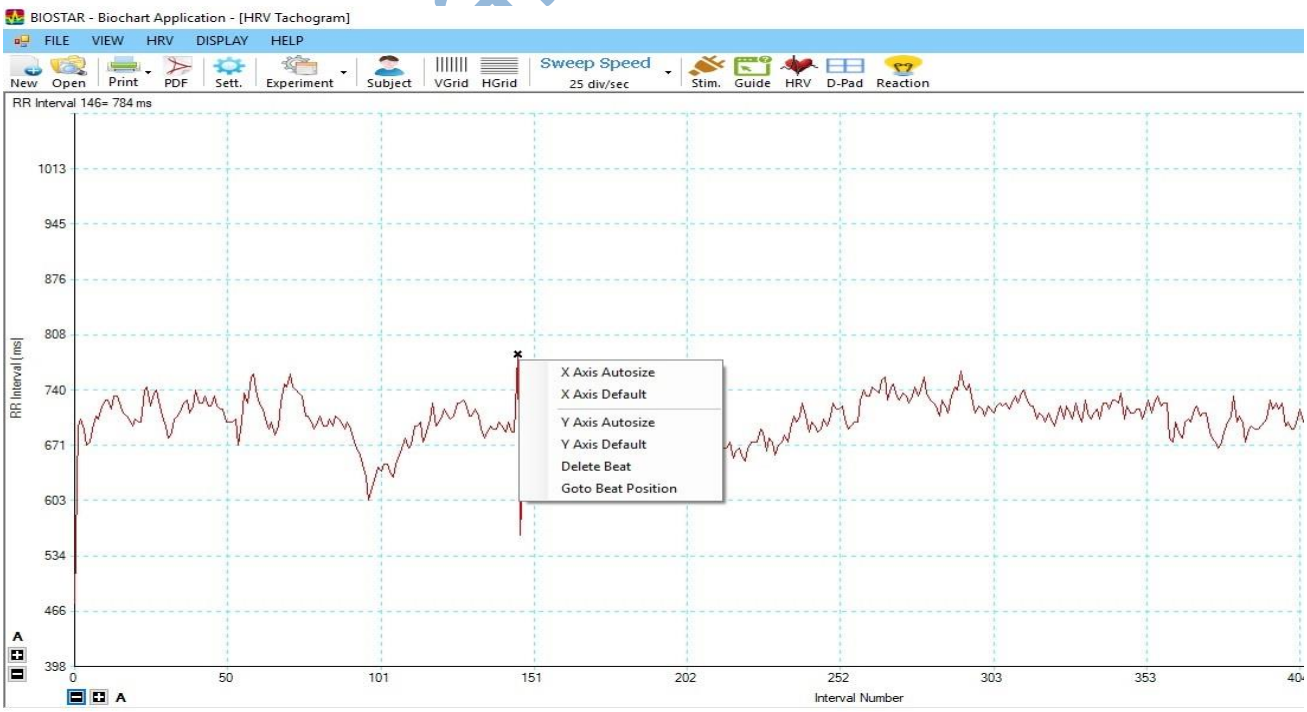


HRV Tachogram:

HRV Tachogram shows the RR Interval (ms) time according to interval number. For example, first RR Interval (ms) time was 700, then, at 1 interval number the pointer will appear on 700 RR interval (ms).

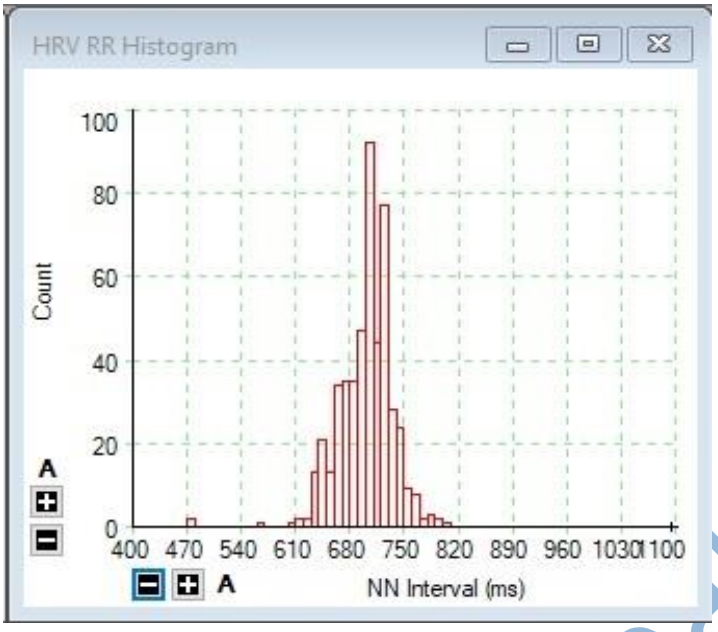


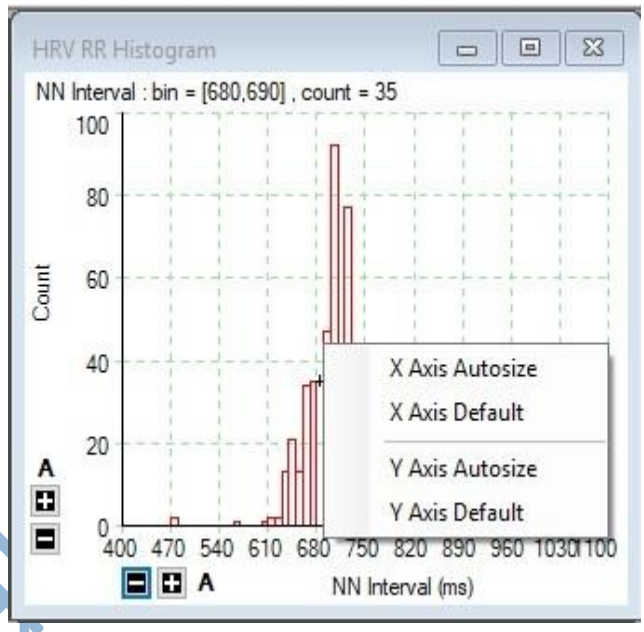
You can also make modifications in Tachogram. You can set X Axis and Y Axis value to automated or default. Furthermore, you can also delete beats by pointing a beat in Tachogram and then click on **Delete Beat** option. By using **Goto Beat Position** option, you can move on the position of beat in ECG.



HRV RR Histogram:

HRV RR Histogram counts the number of RR Intervals (ms) according to time. For example, in 500 times intervals, 700 RR Interval (ms) appeared approximately 90 times, then the bar of 700 NN Interval (ms) will have drawn at count 90.

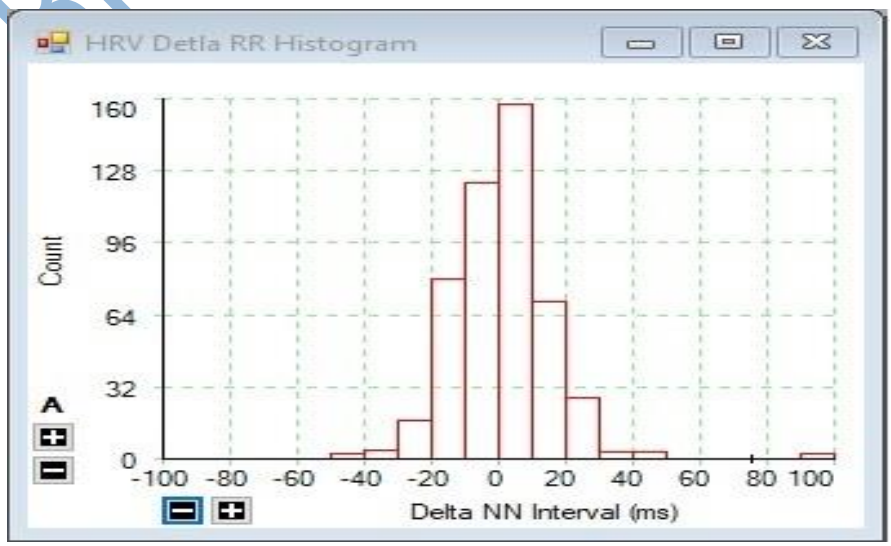




Like HRV Tachogram, you can set X Axis and Y Axis value to automated or default in HRV RR Histogram.

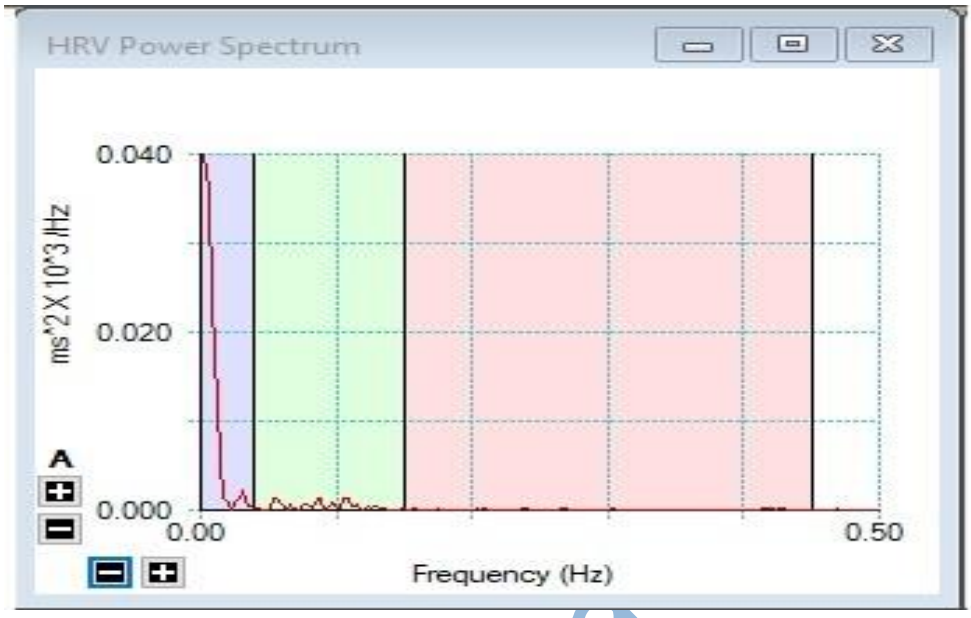
HRV Delta RR Histogram:

HRV Delta RR Histogram counts the difference betyouen RR Intervals (ms). For example, first RR Interval time is 700 ms and next one is 720 ms, then there is a difference of 20 ms. This Histogram counts that difference and draws how many times it has been occurred at which value. As shown in picture, 10 ms difference has been noticed 160 times in RR intervals (ms).



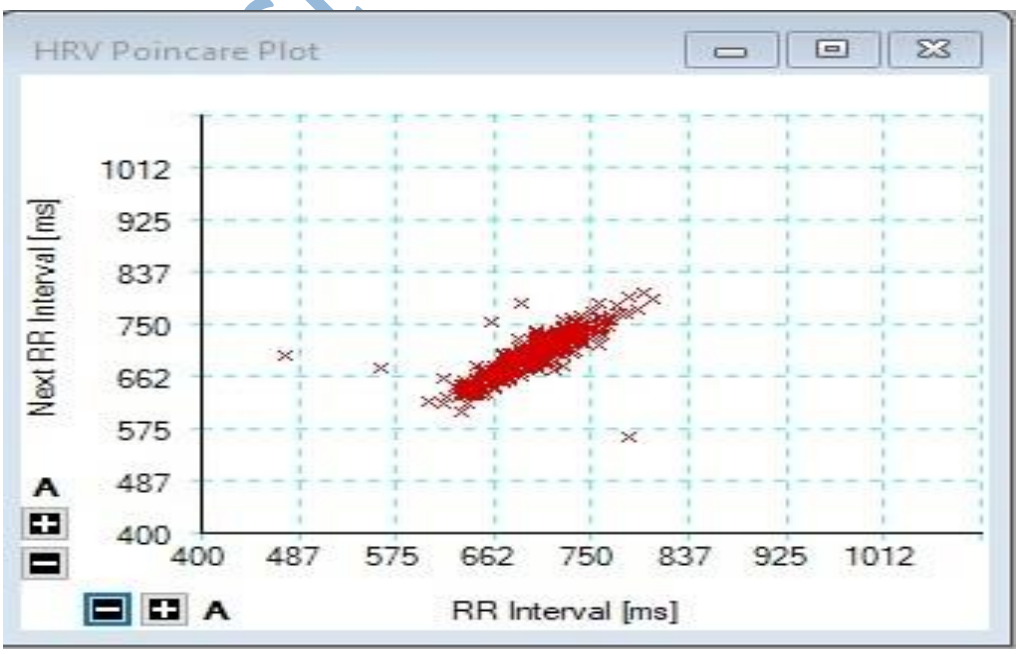
HRV Power Spectrum:

HRV Power Spectrum calculates the value of frequencies that includes: Very Low Frequency (VLF), Low Frequency (LF), and High Frequency (HF) and draws them according to their value.



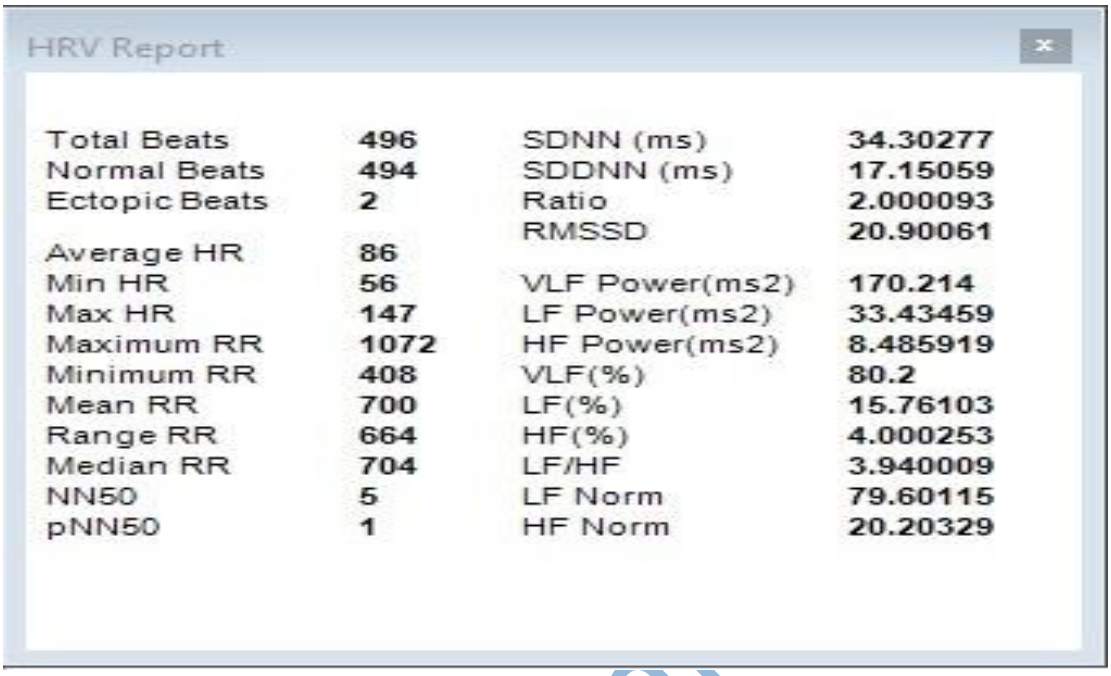
HRV Poincare Plot:

HRV Poincare Plot is graph, in which each RR Interval (ms) has been plotted against next RR Interval (ms).



HRV Report:

HRV Report includes the result of all graphs in theoretical form, as shown in figure:



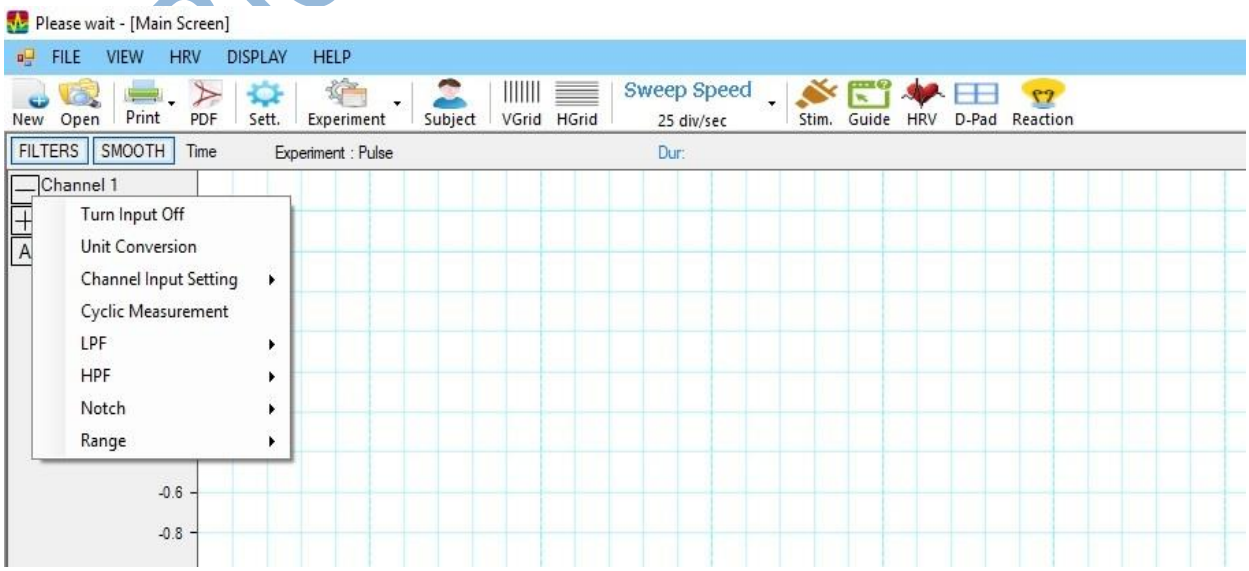
HRV Report

Total Beats	496	SDNN (ms)	34.30277
Normal Beats	494	SDDNN (ms)	17.15059
Ectopic Beats	2	Ratio	2.000093
		RMSSD	20.90061
Average HR	86		
Min HR	56	VLF Power(ms2)	170.214
Max HR	147	LF Power(ms2)	33.43459
Maximum RR	1072	HF Power(ms2)	8.485919
Minimum RR	408	VLF(%)	80.2
Mean RR	700	LF(%)	15.76103
Range RR	664	HF(%)	4.000253
Median RR	704	LF/HF	3.940009
NN50	5	LF Norm	79.60115
pNN50	1	HF Norm	20.20329

Temporary Settings

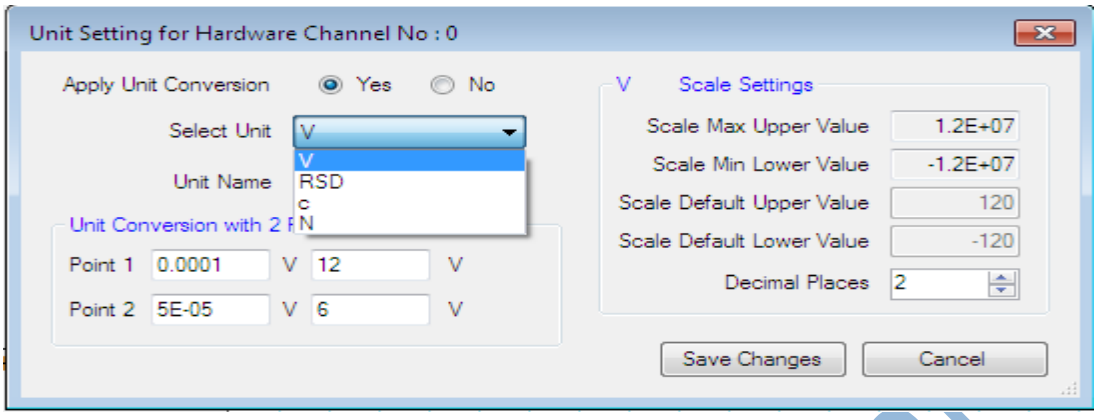
NOTE: Experiment should be pause before every kind of settings.

You can set the values temporary while doing an experiment simultaneously. But after finishing the experiment when you close or change experiment settings will change automatically.
Click on the experiment name showing in the left top corner like in the picture below experiment name is ECG so click on ECG.
For temporary settings first you have to stop the experiment.



These further options will open after clicking on experiment name in the corner.

Unit conversion:



Select the appropriate unit and set calibration values.

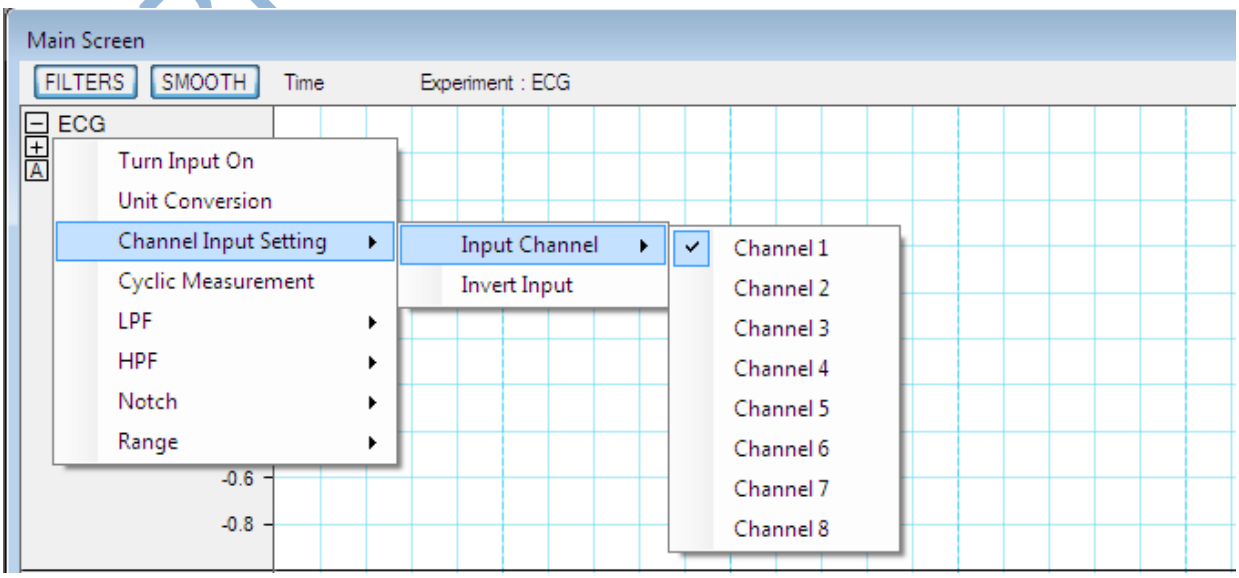
Calibration settings:

TEMPERATURE: Point 1- 0.027 point 1- 2
Point 2- 0.063 point 2- 50

GSR: Point 1-1.890v point 1-100k
Point 2- 2.493v point 2- 51k

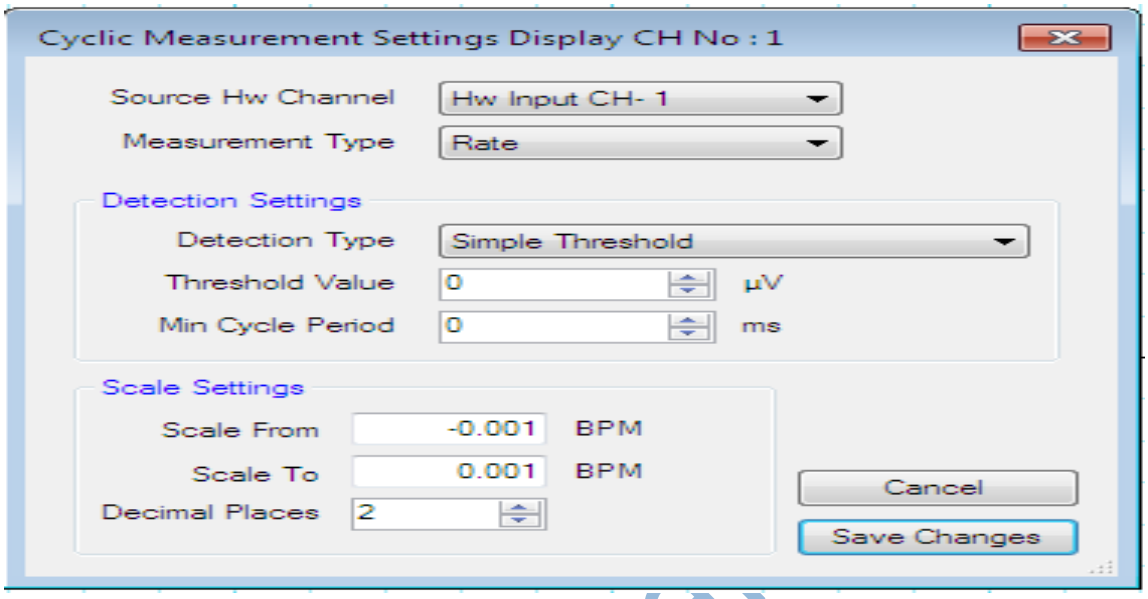
PRESSURE: Point 1- 40mg point 1-0.71v
Point 2 -150mg point 2- 2v

Channel input:



Select the appropriate input channel number where the transducer is connected.

CYCLIC MEASURMENT:



Select the source input hardware channel number

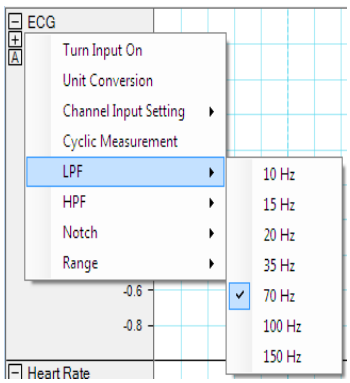
Select measurement type for example- Rate, maxima, minima, mean, count, frequency and period.

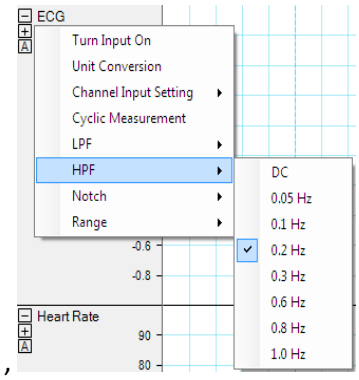
Detection type will remain simple threshold

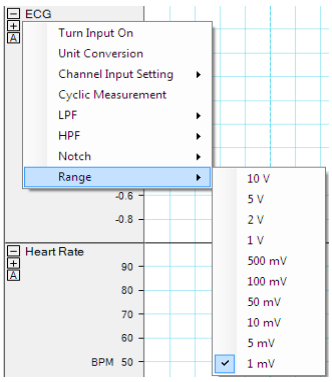
Select the threshold value up to which the output waveform peak will touch higher standard.

Select the appropriate min cycle period to avoid the wrong detection of output waveform, like in the output of ECG and other experiment there is more than one wave in one complete cycle. So, in the cyclic measurement the other waves can also be detected in one cycle. To avoid the measurement of other waves in a cycle of a wave select the desired min cycle period.

LPF, HPF & RANGE:

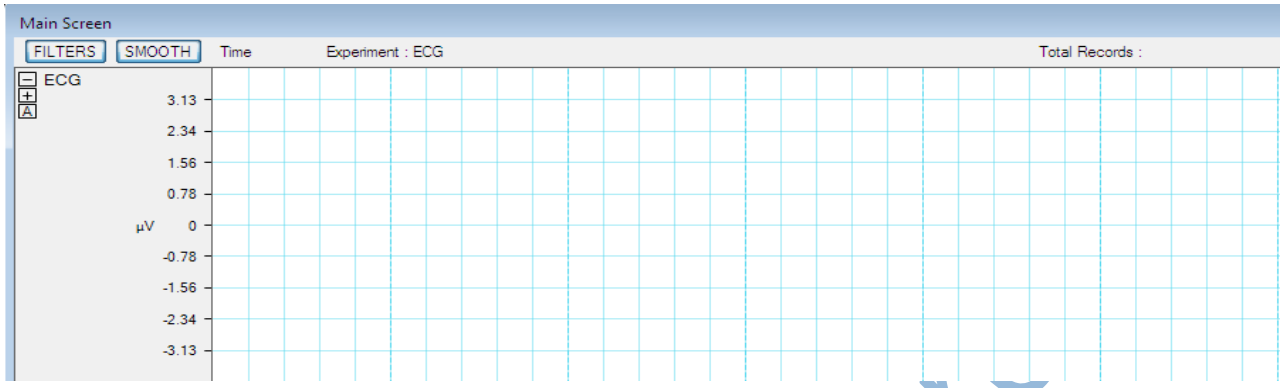






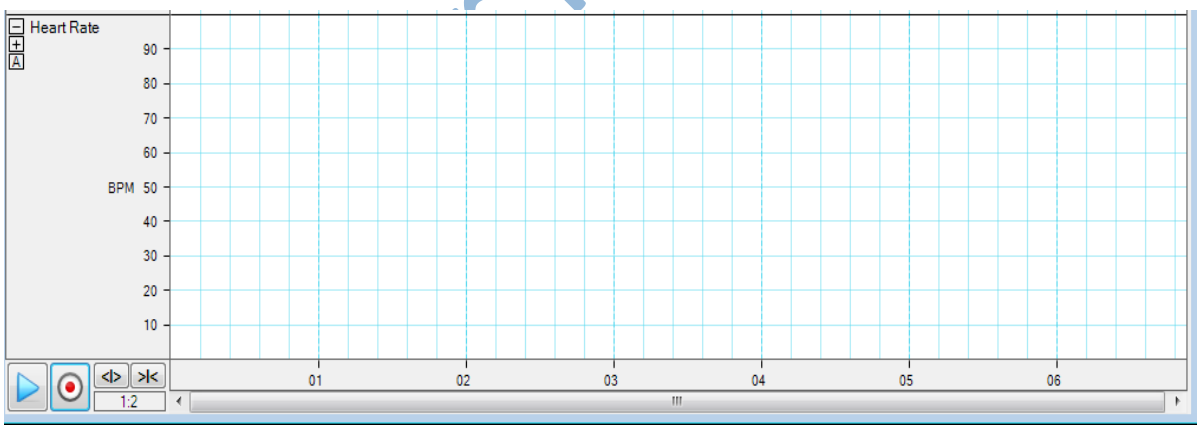
Select the low pass ,high pass filters and range according to the experiment or transducer you are working on.

Increase or decrease output voltage:



To increase or decrease the output voltage of experiment, continuously click on +, - icon on the left corner.
If your output is in linear form means there is need to increase the voltage by +, and if the output waveform is exceeding the screen then decrease the voltage by - icon.
The icon A below the -, + is to place the waveform on its place automatically.

PLAY & PAUSE:
To play and pause the experiment click the play icon shown in the lower left corner. Beside play pause you can also record the experiment by clicking the red dotted icon just near the play icon.
And to extract the output waveform click the icon with arrows going in opposite direction, and to compress the waveform click the icon with arrows intersecting at a line.



Experiments Procedure

ARTERIAL PULSE TRACING

INTRODUCTION

Arterial pulse is the pressure wave that travels along the arteries due to forceful ejection of blood during systole into the arterial system. Arterial pulse can be only recorded by the device called PhysioLab, it gives the important details like nature and pattern of pulse wave. Arterial waves are of two types Central and Peripheral pulse. The pulse recorded from aorta and bigger arteries is the central pulse and the other pulse can record by peripheral arties.
Peripheral pulse can be recorded by noninvasive techniques by using Photo Transducer.

METHOD

Transmission of pressure waves along the walls of vessels are interlinked with each ventricular contraction. Transducers placed on the finger detect the pressure waves and further switched to the recorder device Polygraph.

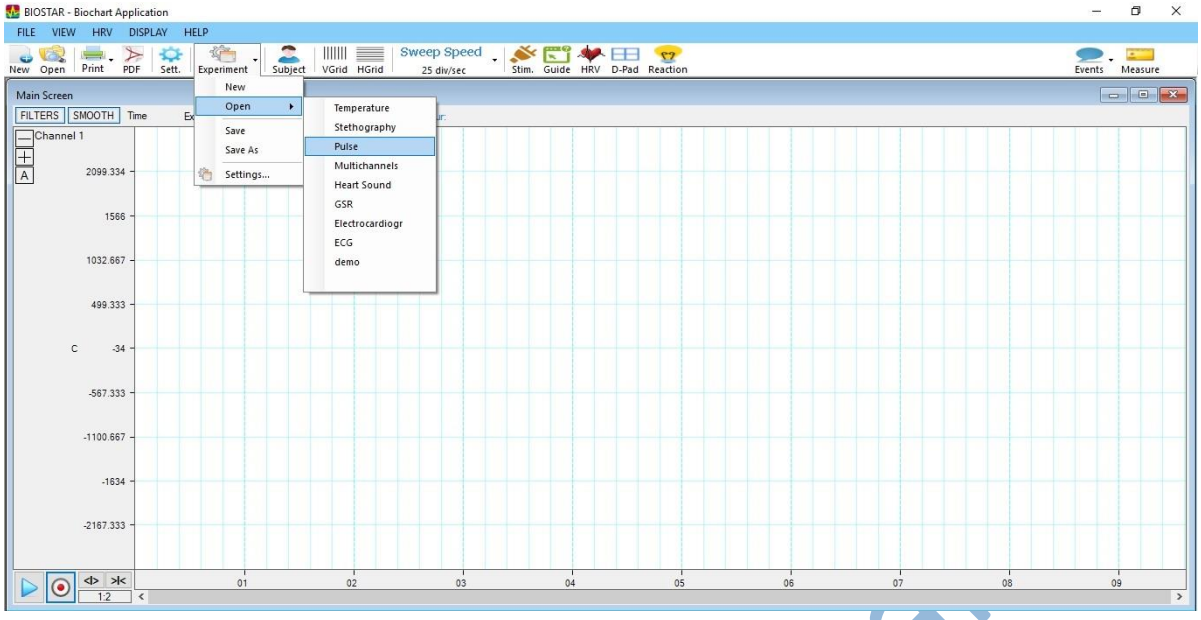
ACCESSORIES

POLYGARPH – (PHYSIOLAB)
This is a device used for multi data system comes with various transducer and sensor.
TRANSDUCER –The Transducer used to determine the arterial pulse is ***PHOTOPULSE Transducer (BSPL507)***. One side of transducer is connected with polygraph.

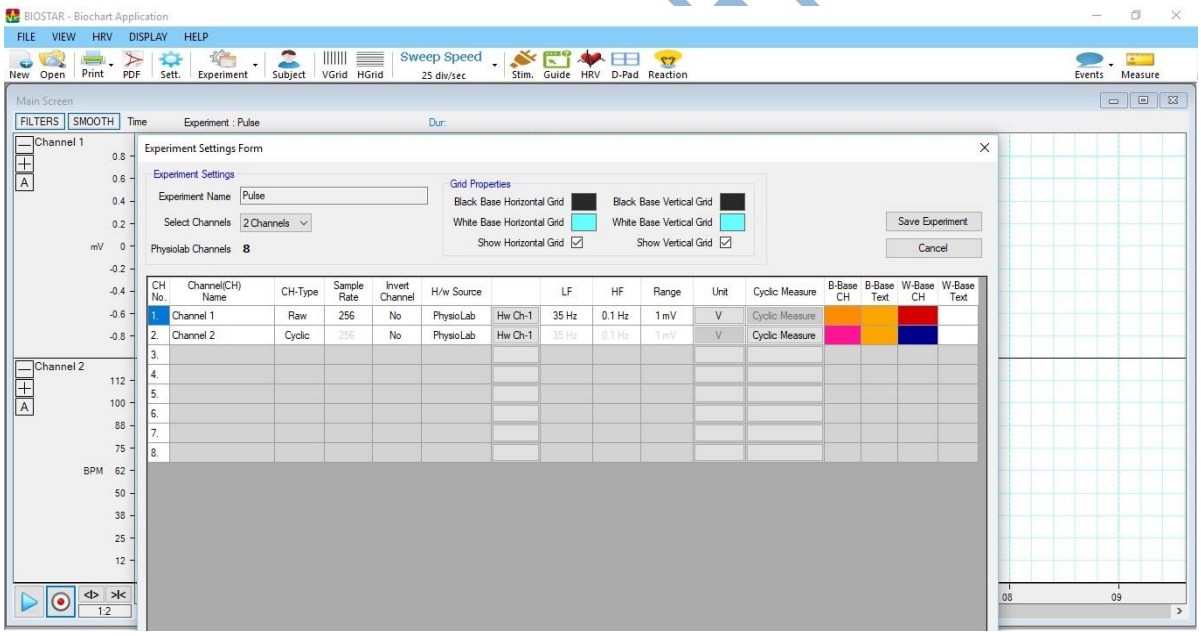
Placement of sensor-

EXPERIMENT

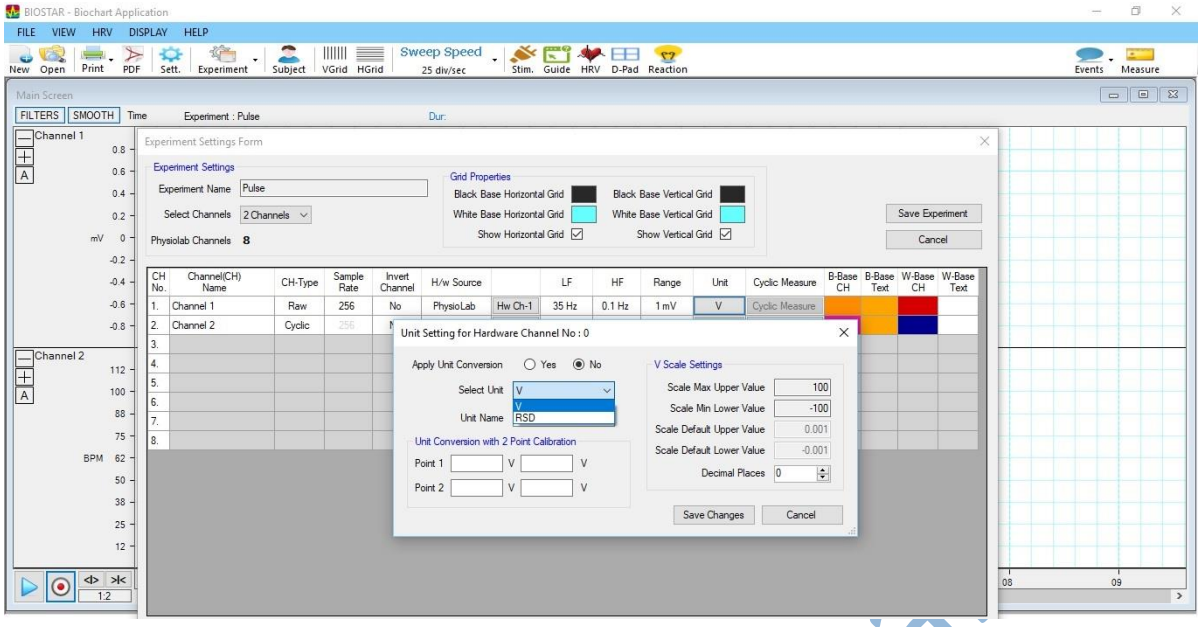
1. Place the sensor on the tip of the radial finger and let your hand relax.
2. Click new and open pulse experiment.



Go to Experiment setting and select the input channel, where we connect transducer, set other parameter like filter and gain if require. Save settings.



To calibrate and set the unit of experiment select under unit.



After all settings then click play icon on the screen and get the output wave.

ELECTROCARDIOGRAPHY

The method or recording Electrocardiogram (ECG) by a machine Electrocardiograph is called Electrocardiography.
ECG is the recordings of Electrical fluctuations of heart during the cardiac cycle.

ACCESSORIES

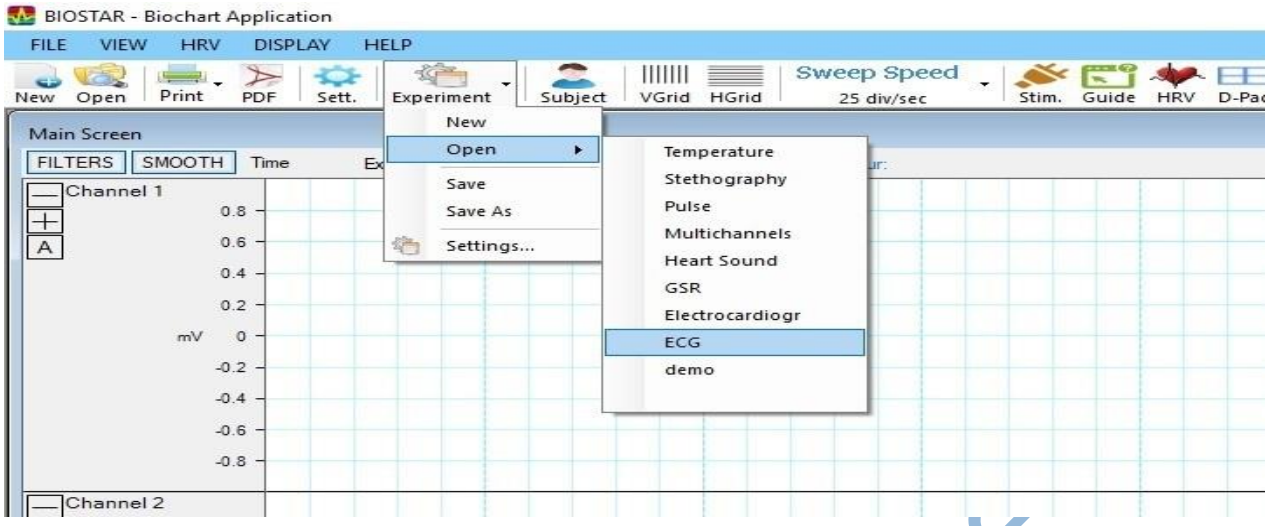
1. PhysioLab Machine used to record the Electrical activities of Heart.
2. Cardiac jelly to clean the body surface where electrodes will place.
3. ECG Lead for standard lead recording
4. Optional item ECG lead selector is available for recording Pericardial and augmented lead.

Placement of Electrode.

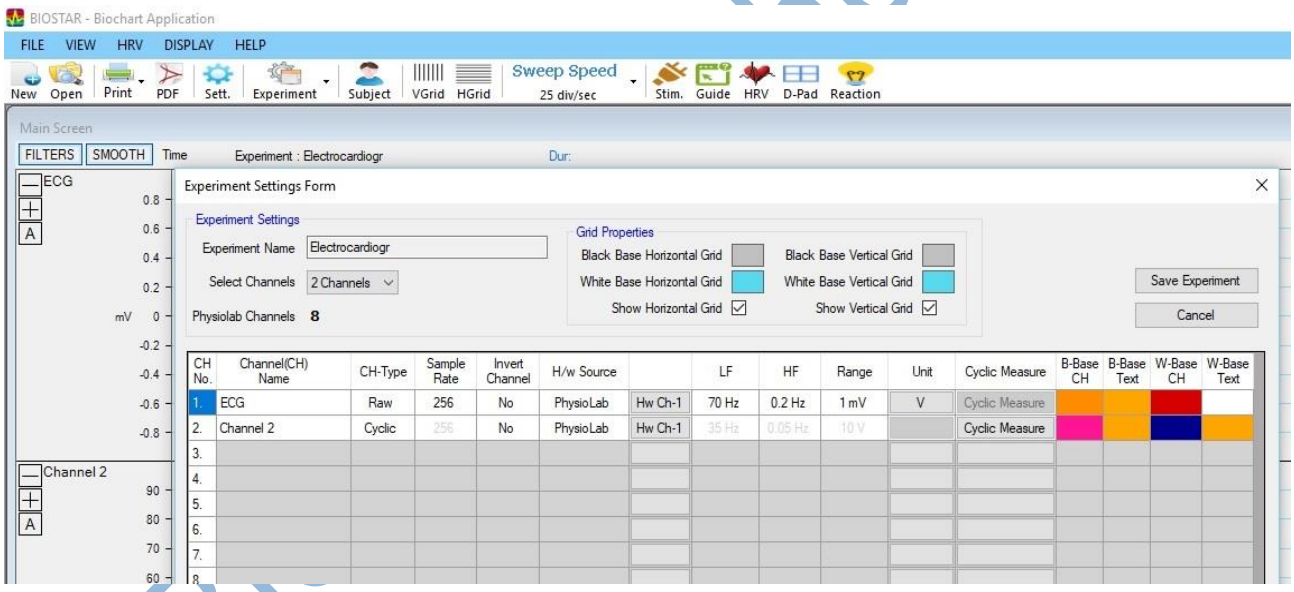
1. Prepare the skin
2. Use disposable ECG electrode
3. For Recording Standard Lead I, we need to connect Right Arm RA, Left Arm LA, Ground Right Leg RL

EXPERIMENT

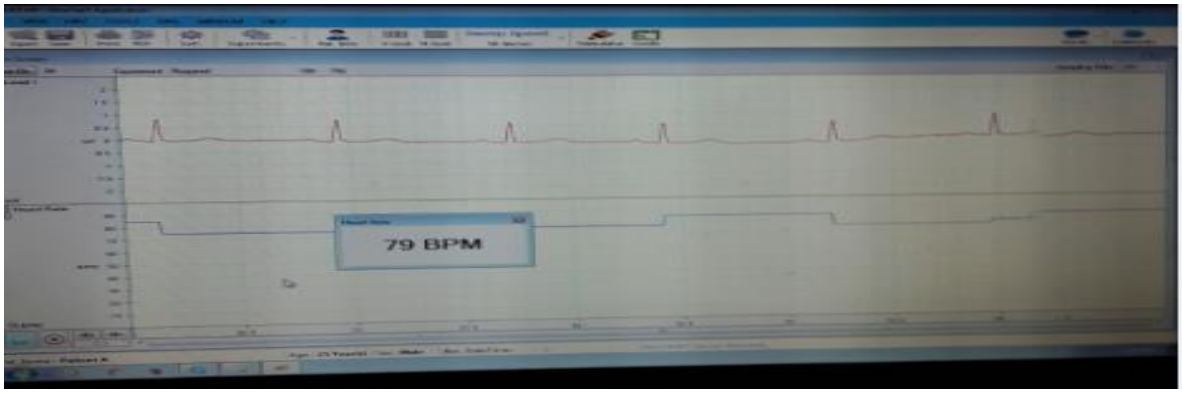
1. Connect PhysioLab Machine with PC through USB cable and open BioChart.
2. Go to Experiments and select ECG (Electrocardiography).



1. Go to experiment settings, if you want to change any recoding any component. Select the input channel, range and filters if require. Save experiment. Select two channels, one for ECG Wave and other for Heart Beat per Minute.



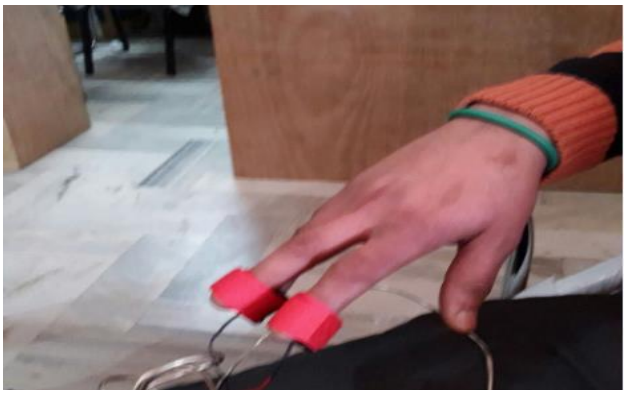
No need to clabirate ECG signal . it is already factory clibirated.
After all the settings click on play icon and ECG will appear on screen. Press record button for further View.



GALVANIC SKIN RESPONSE
(GSR)

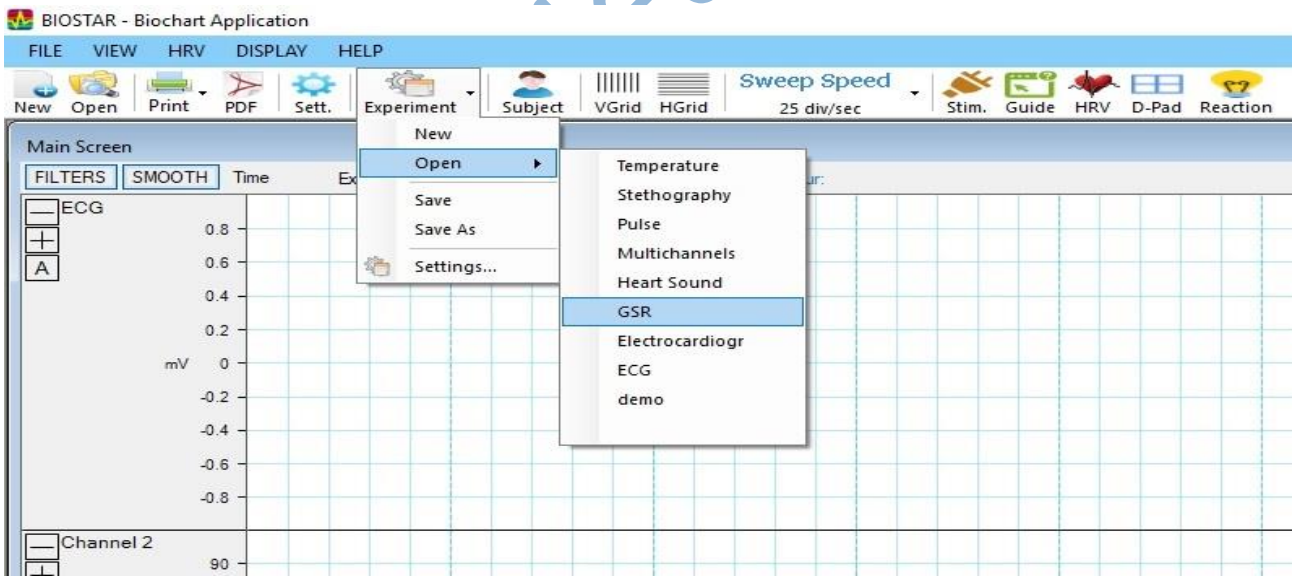
Silver Chloride Electrode probe is used as a transducer.

Placement of sensors on fingers-

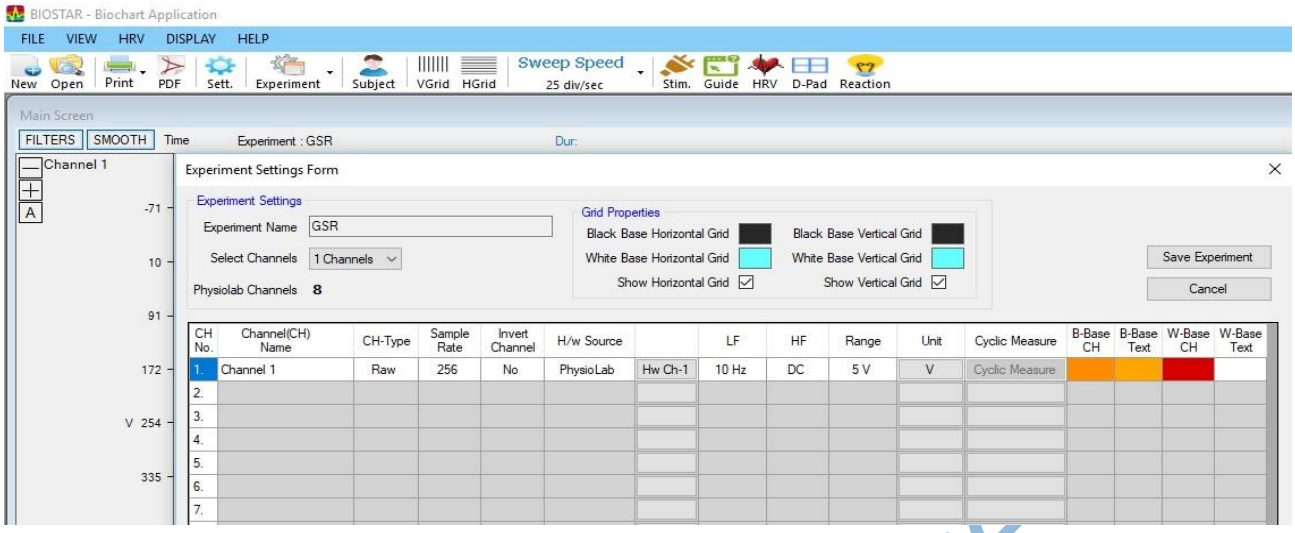


EXPERIMENT

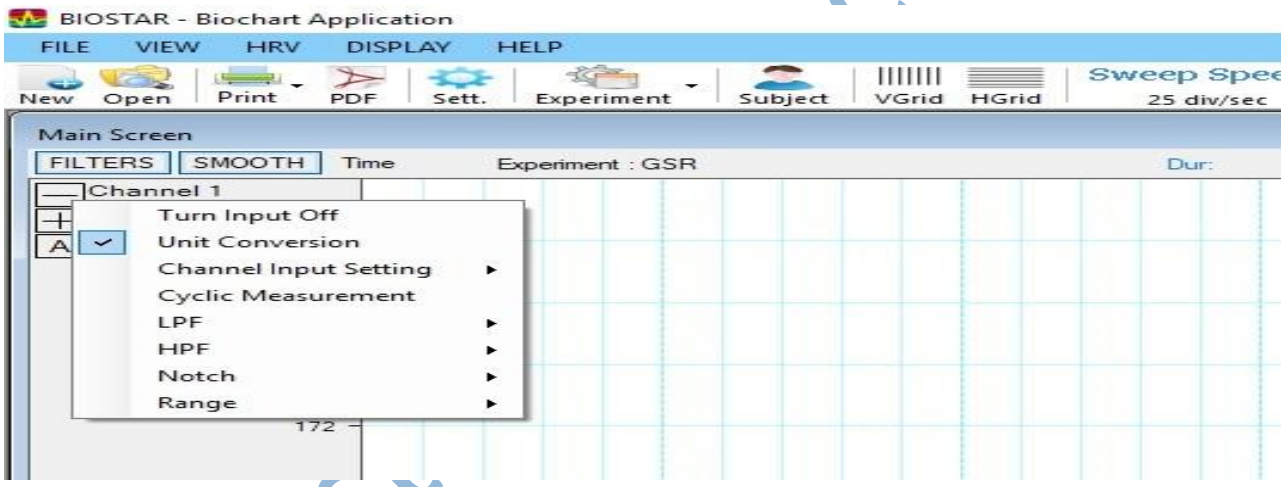
1. Place the sensors on the tip of the fingers, relax your hand.
2. Open the software BioChart and select the GSR experiment.



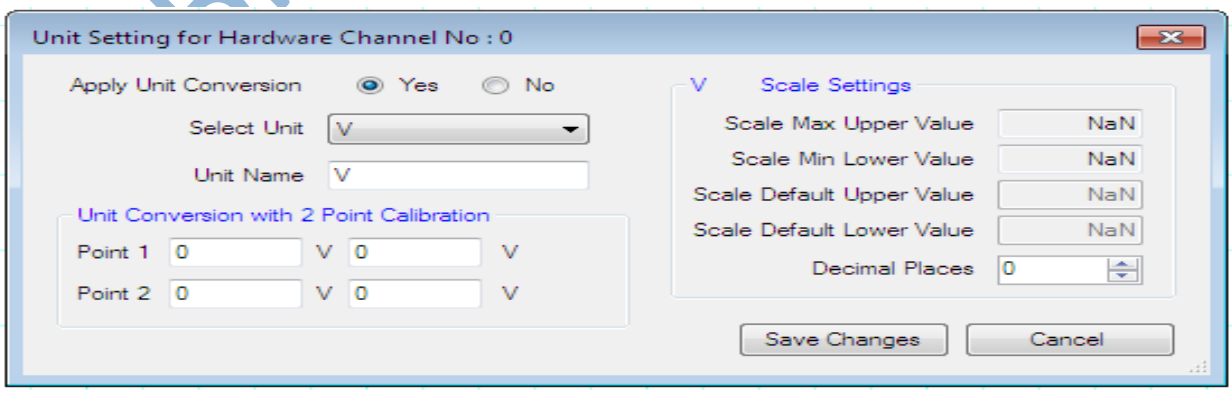
Select the appropriate channel and range and filters if required.



Click on GSR and select unit conversion to change the units and set the collaboration to collaborate the values.



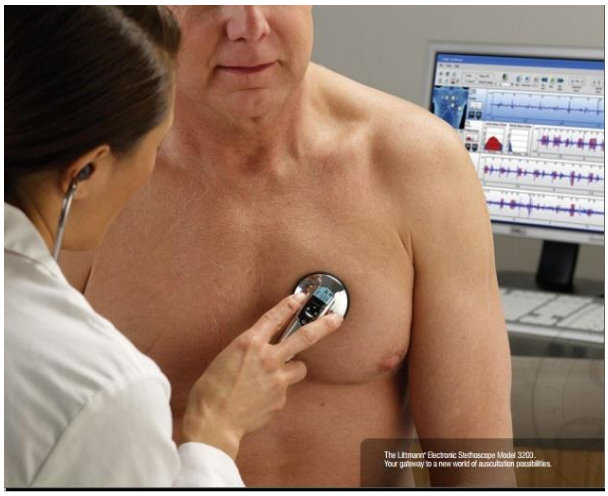
Select the unit required for output and select calibrations from point 1 to point 2 for calibrate.



Factory Calibration
-0.262v= 51k
-0.358v= 100k
After all settings click on play button to start the experiment.

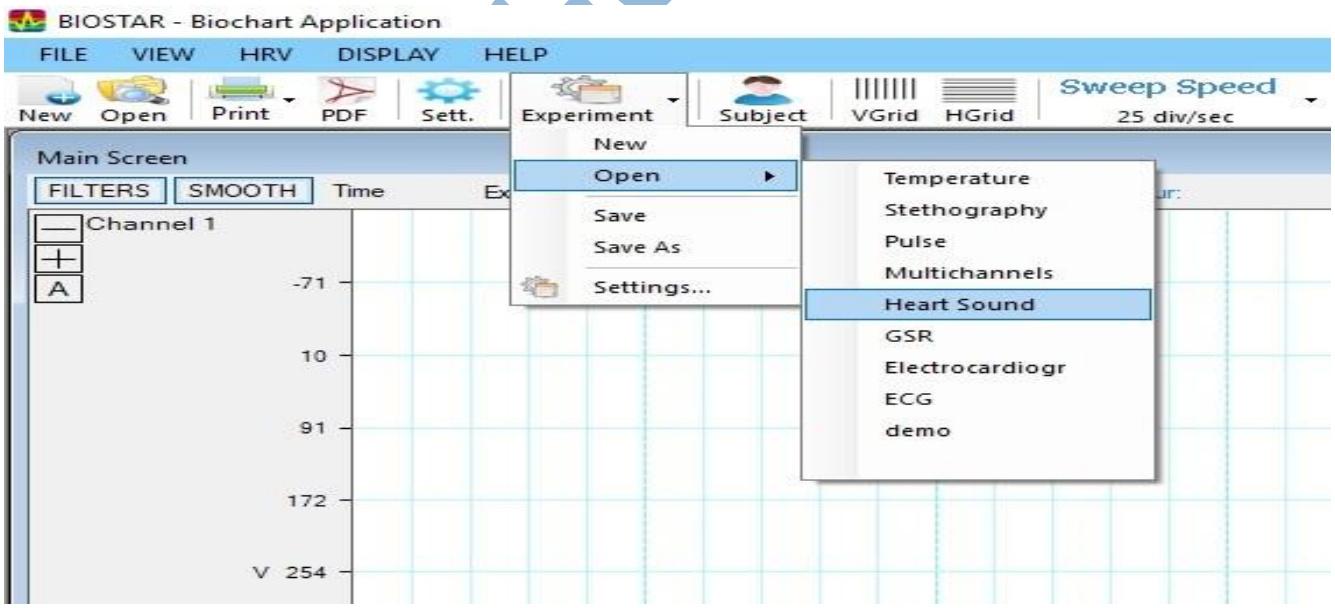
PHONOCARDIO (HEART SOUND)

Placement of Phonocardio

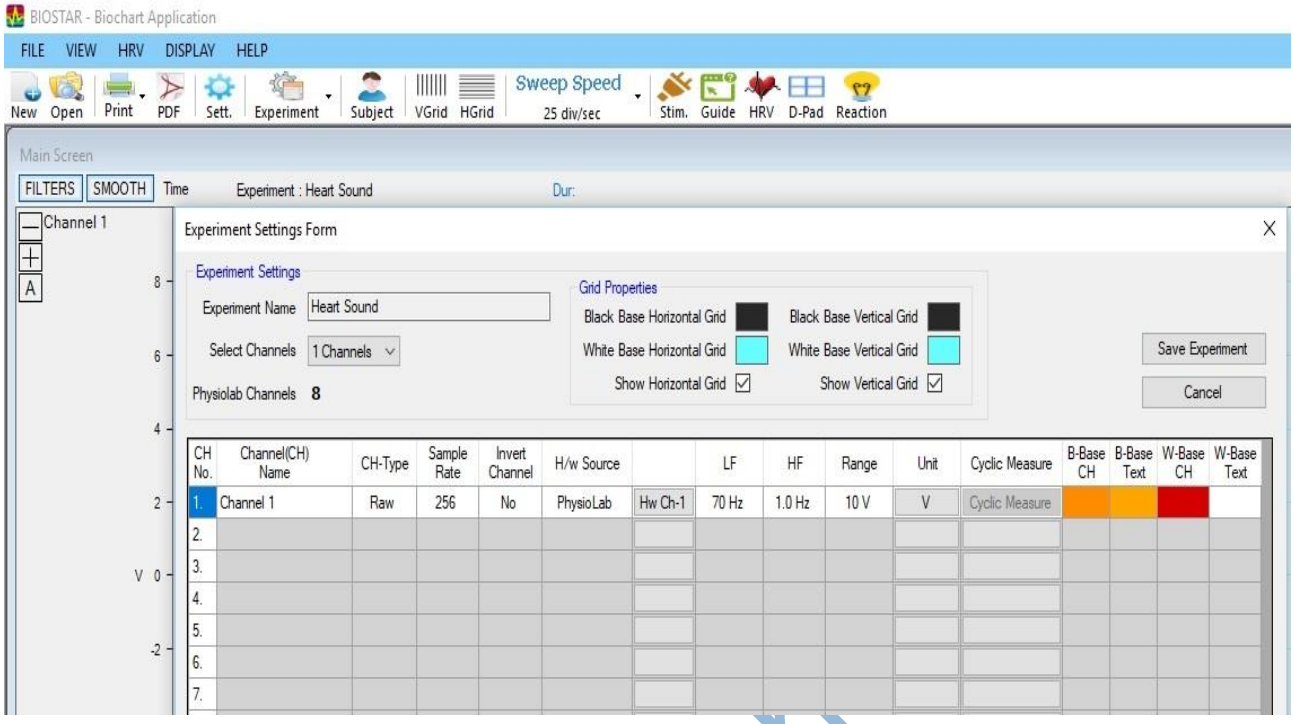


EXPERIMENT

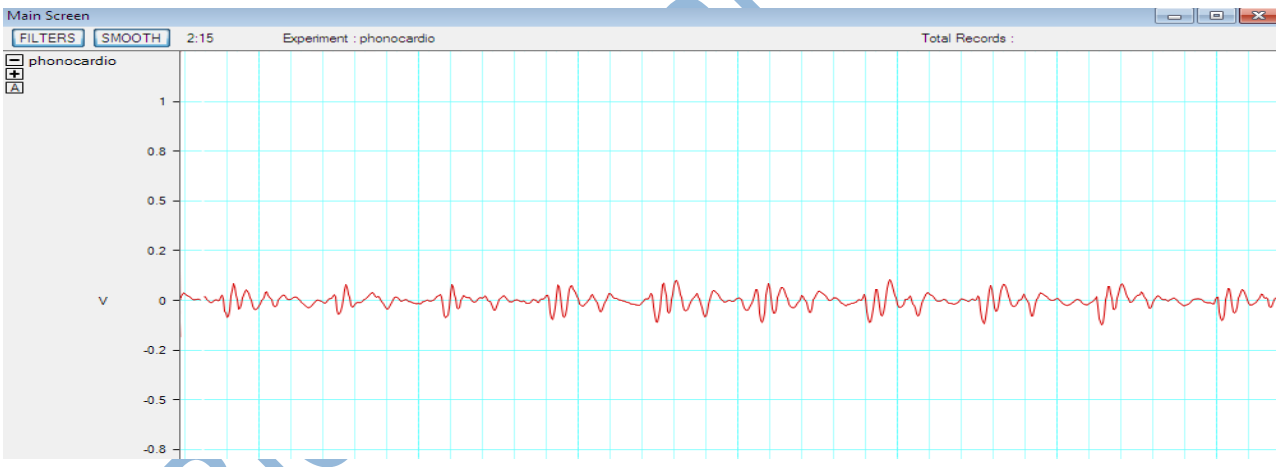
1. Phono cardio transducer should be used to record heart sound.
2. Open BioChart.
3. Select Heart Sound from Experiments



4. Go to settings from the experiment icon then select the desired filter frequencies, range and channel number if required, save settings.



Select play icon to start the experiment



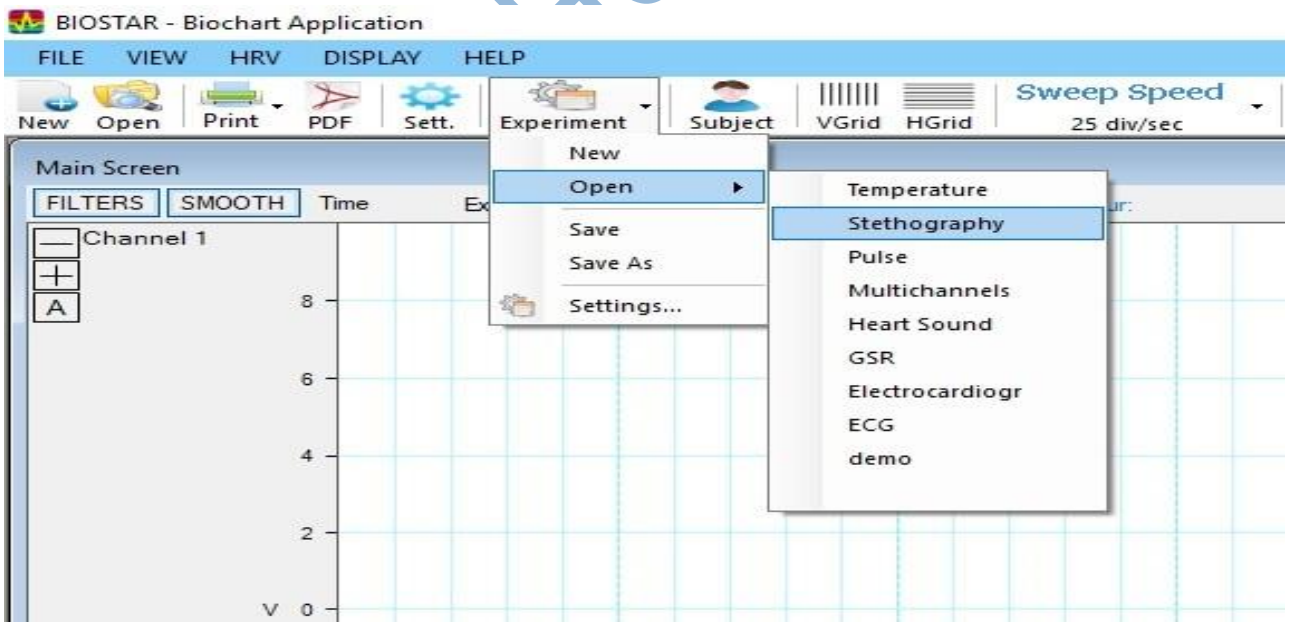
STETHOGRAPHY

1. Stethography is the method by which respiratory movements are recorded.
2. Stethograph transducer will be used for this experiment.
3. Turn on PHYSIOLAB machine and open BioChart.

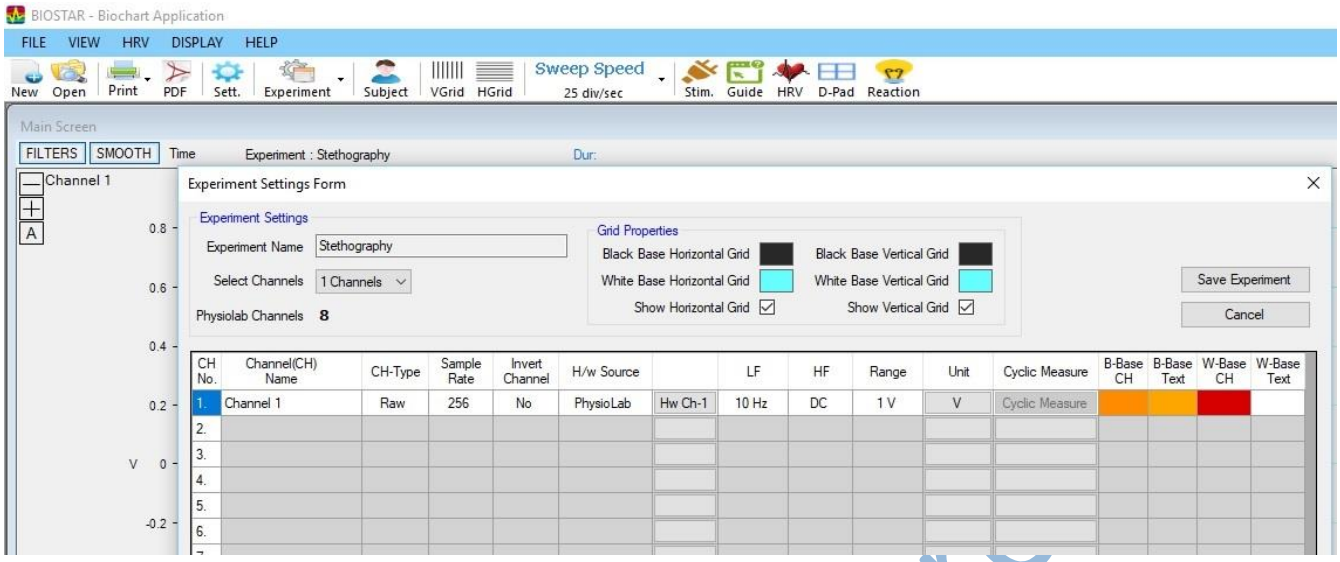
Placement of respiration belt-

EXPERIMENT

1. Tie the respiration belt around your chest
2. Connect one pipe with hand air pump and other with transducer.
3. Click on experiments and open stethograph experiment.



Set all the settings if needed for the experiment like range, frequencies and channel number from settings.



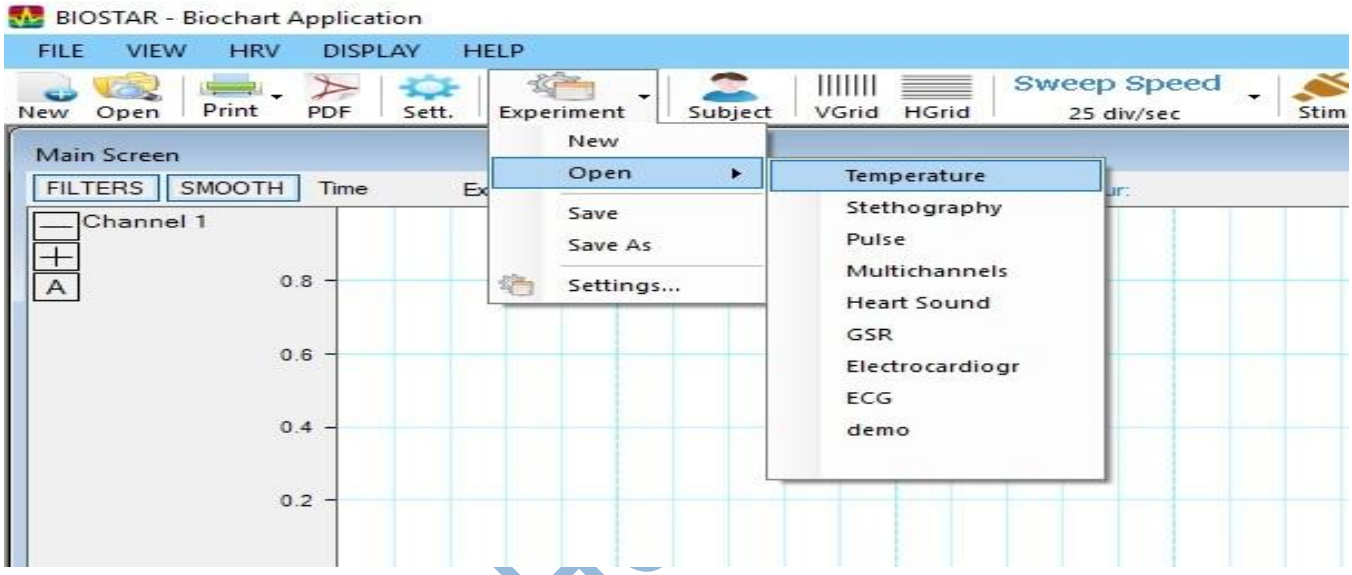
Click play button to start experiment and record for further analysis

TEMPERATURE

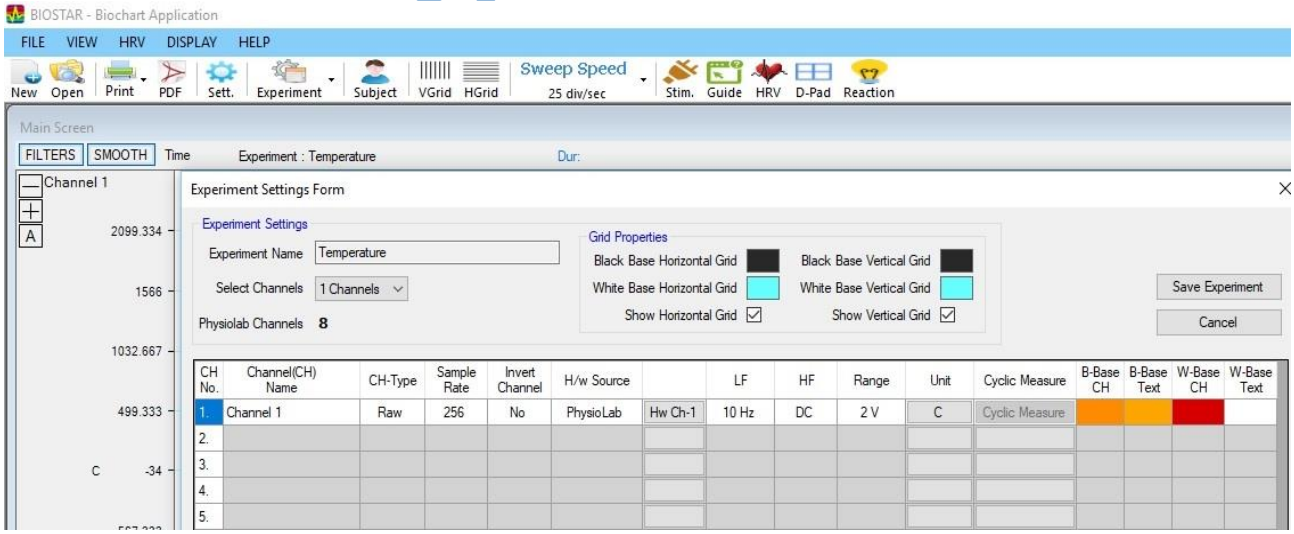
Thermistor is used as a transducer

EXPERIMENT

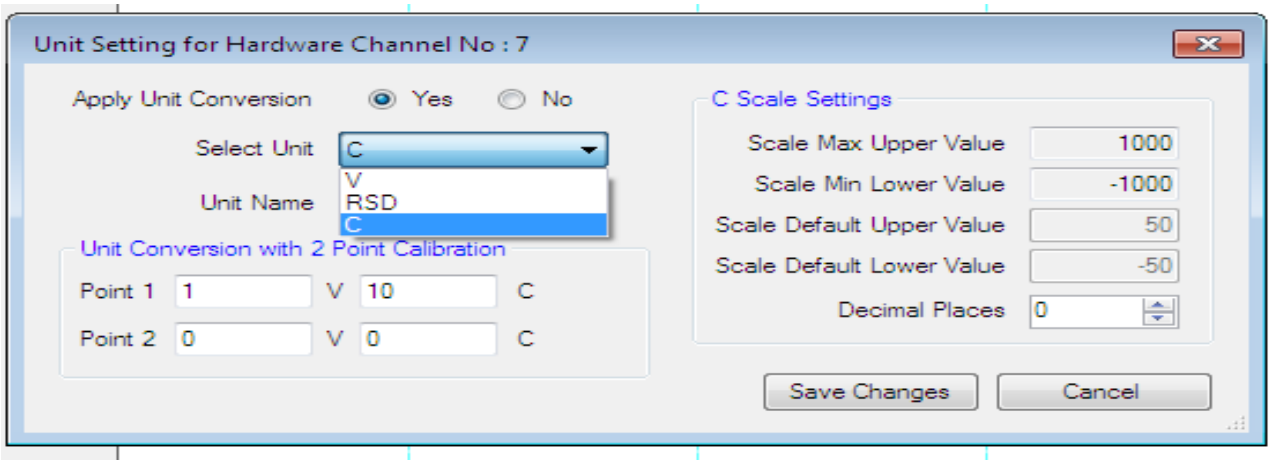
1. Turn on PhysioLab and BioChart.
2. Go to temperature option through experiment icon.



Select the appropriate channel, range and filters if required.



To set the unit conversion and to calibrate the experiment select under unit



Factory Calibration Value
0.027V =2 C
0.068V = 50 C
After settings Experiment, click on play icon to start the experiment. Double click on meter for zooming on Screen