

Designing an Electrocardiography Circuits

DR.NISREEN KHAMMAS

15/12/2015



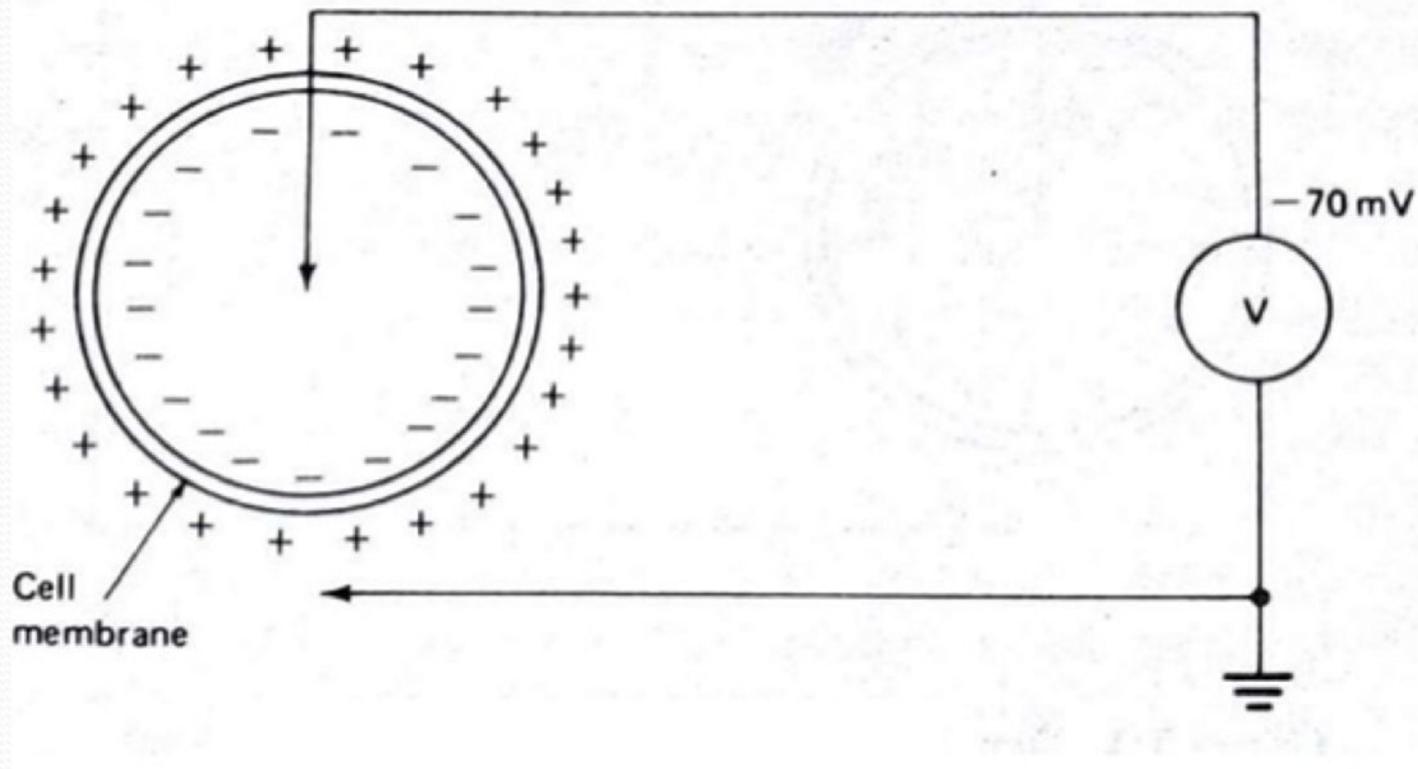
Abstract

Electrocardiography (ECG) is the interpretation of the electrical activity of one's heart over a period of time. Recently, there has been increased interest and demand in ECG measurement devices called Electrocardiograms (also abbreviated ECG) for use in the medical and research fields. This application note will attempt to give the reader a background on ECG signals as well the methods and design techniques that go into designing an ECG demonstration board. It will focus on amplifiers for the small ECG signals as well as some of the various ways of reducing various noises

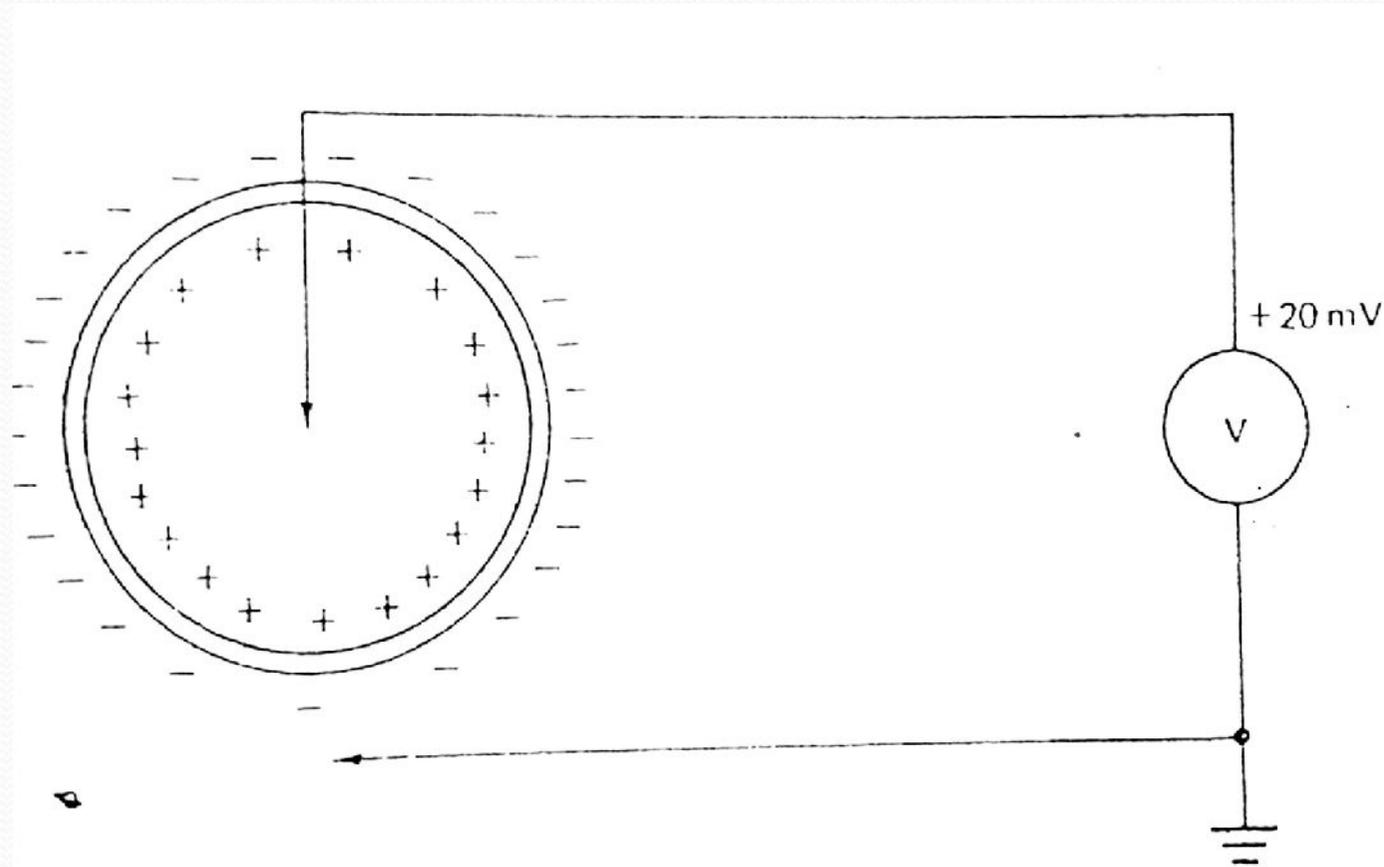


Sources of Electrical Potentials

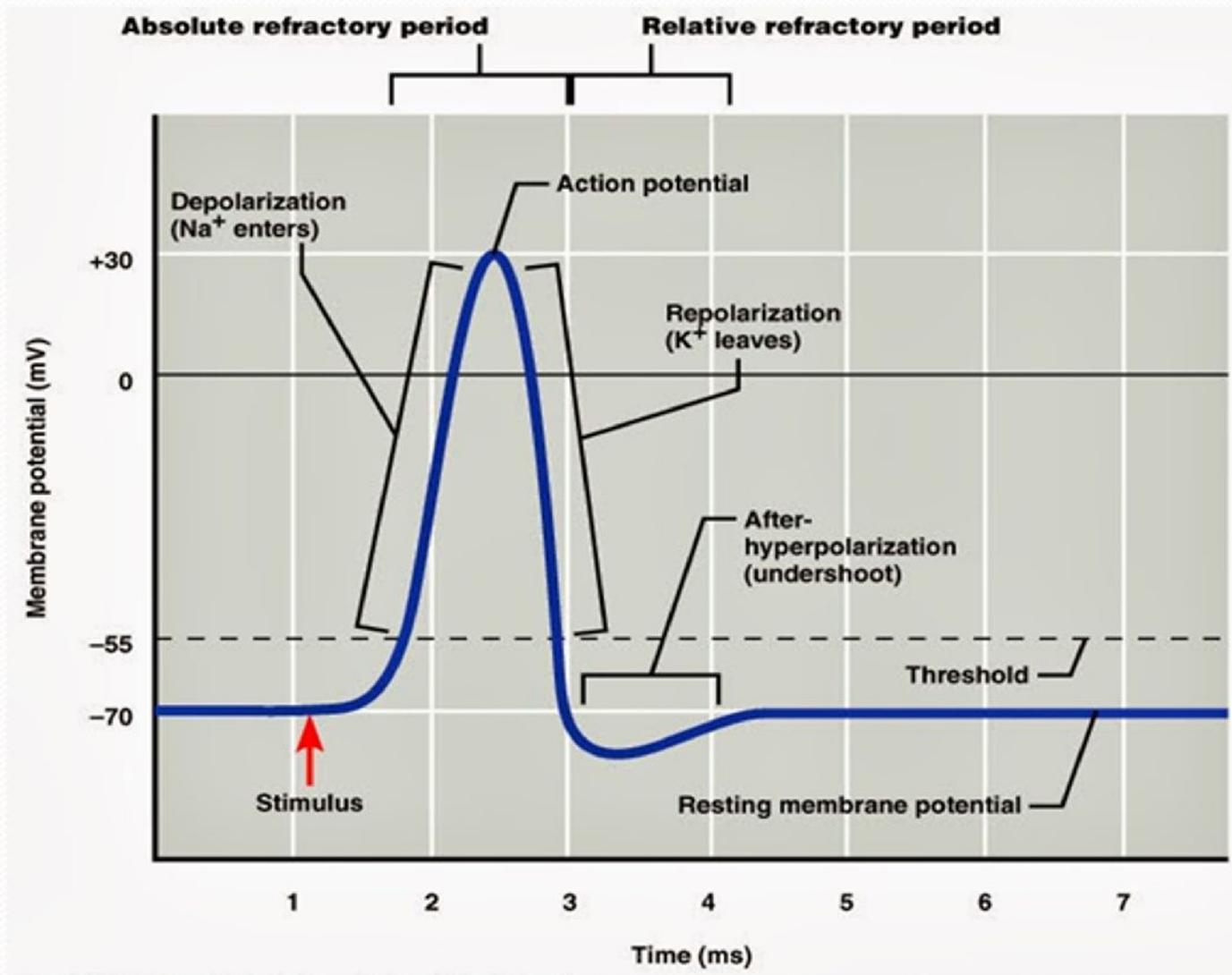
Polarized cell with its resting potential



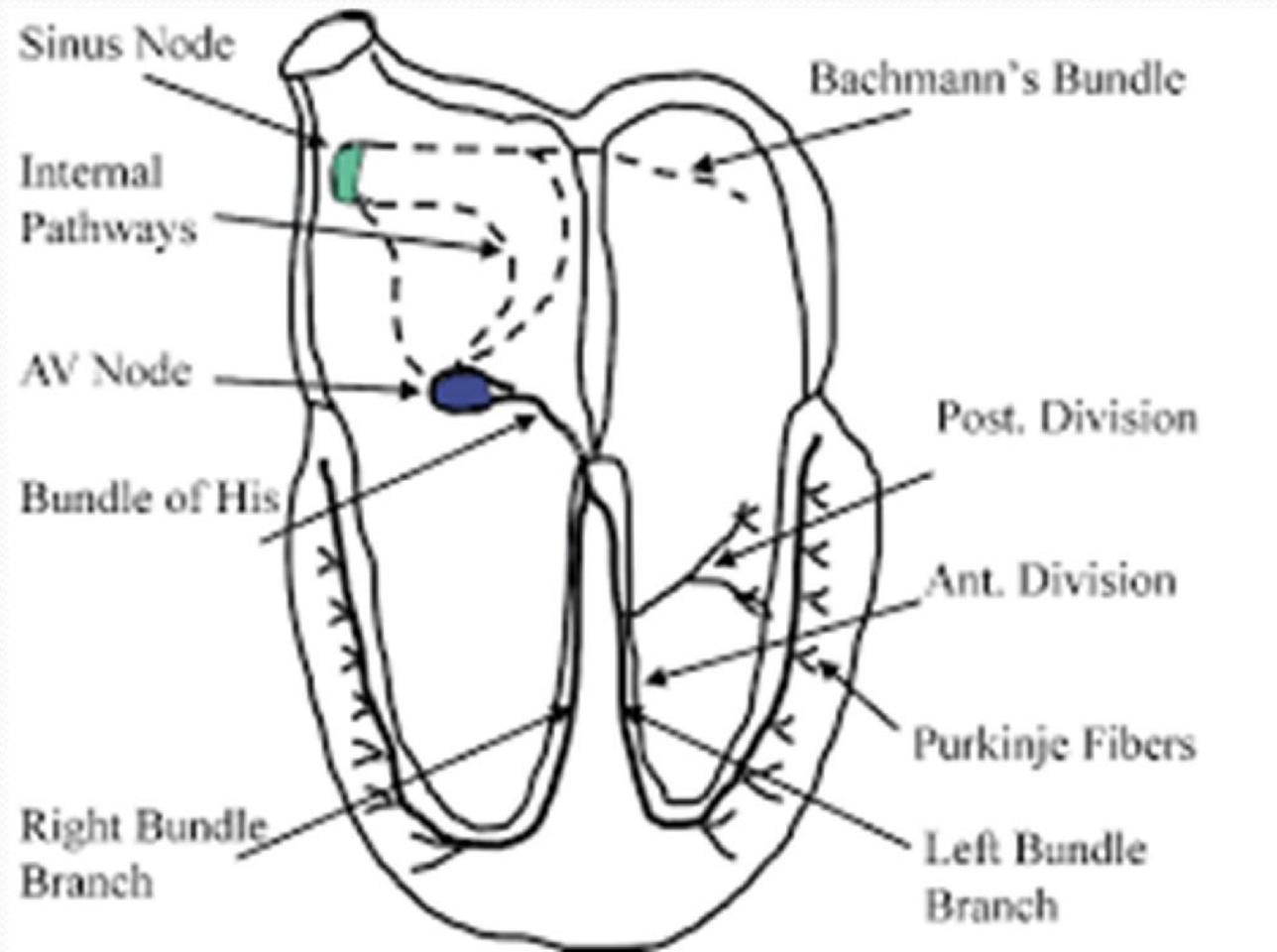
Depolarize cell with action potentials



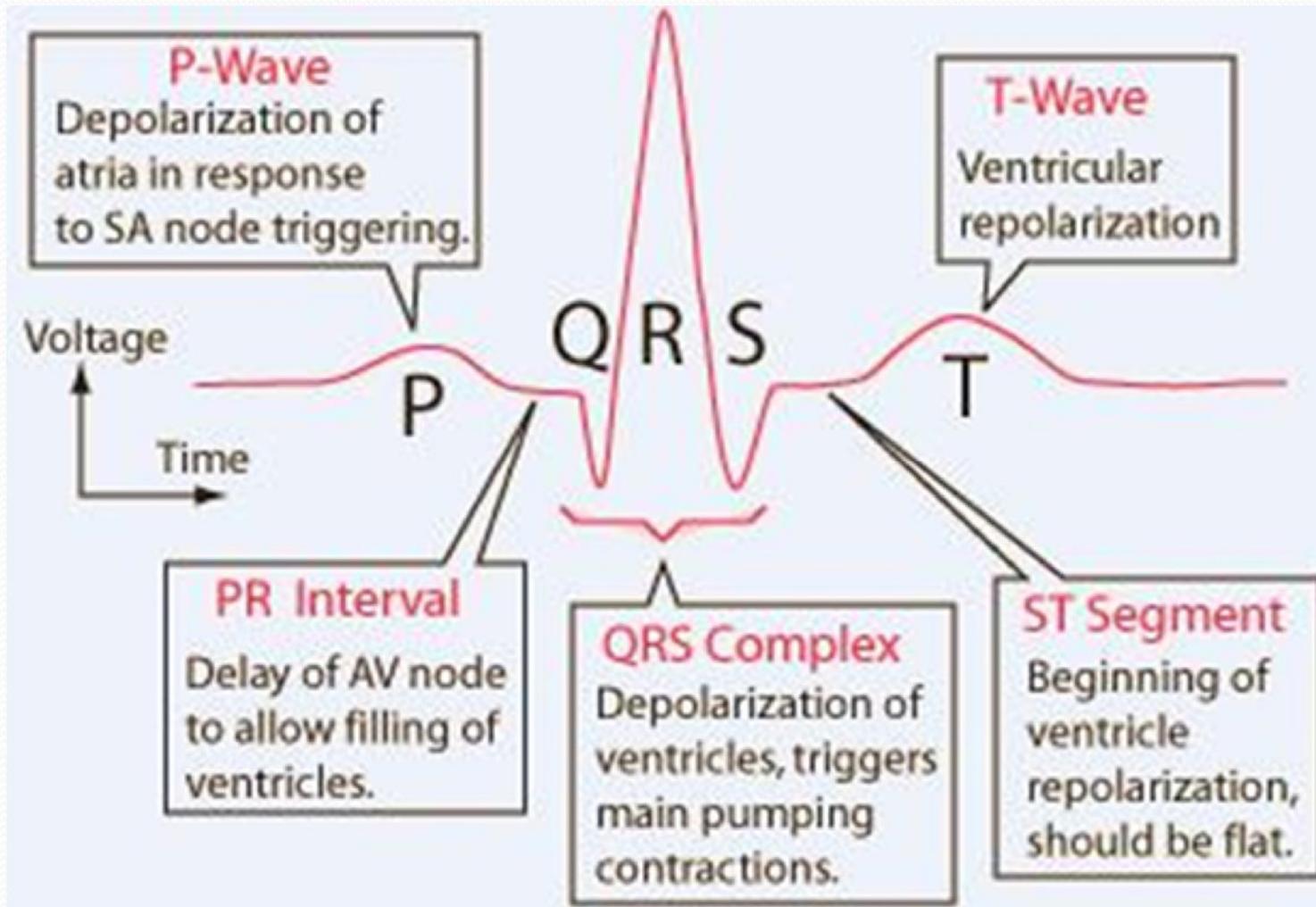
Standard potentials wave



Electrocardiogram ECG



Normal ECG wave



The normal amplitude range for ECG waves

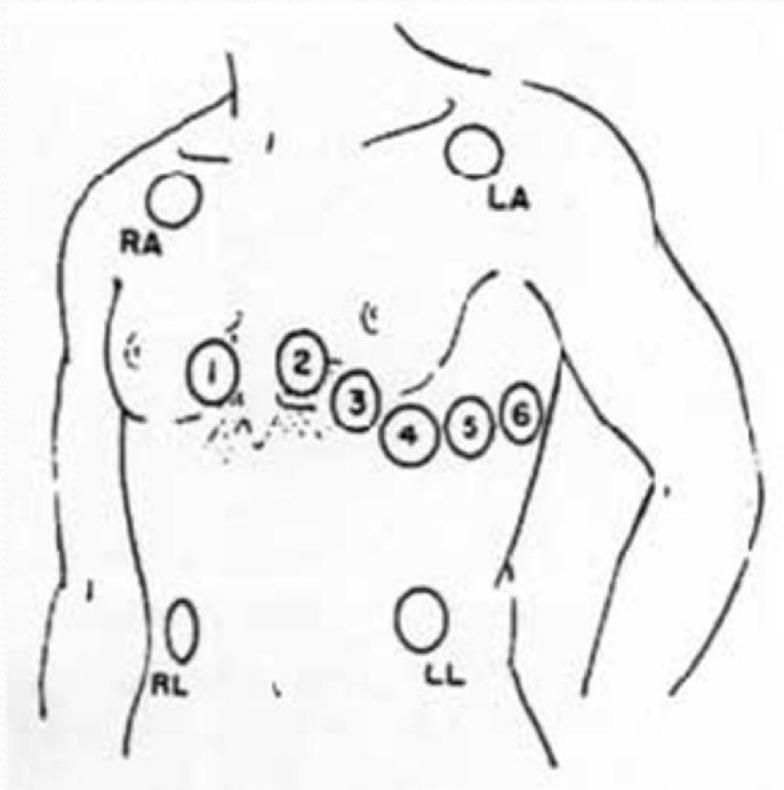
الموجة (WAVE)	مدى الاتساع (ملي فولت) Amplitude Range in mv		
	الجهد الفولتي Lead I potential	الجهد الفولتي Lead II potential	الجهد الفولتي Lead III potential
P	0.015 to 0.12	0.00 to 0.19	- 0.073 to 0.13
Q	0.0 to 0.16	0.0 to 0.18	0.0 to 0.28
R	0.02 to 1.13	0.18 to 1.68	0.03 to 1.31
S	0.0 to 0.36	0.0 to 0.49	0.0 to 0.55
T	0.06 to 0.42	0.06 to 0.55	0.06 to 0.3
	الجهد الفولتي لـ avr	الجهد الفولتي لـ avl	الجهد الفولتي لـ avf
P	- 0.179 to 0.01	-0.085 to 0.140	- 0.06 to 0.160
Q	0.0 to 0.90	0.0 to 0.22	0.0 to 0.19
R	0.0 to 0.33	0.0 to 0.75	0.02 to 0.15
S	0.0 to 0.15	0.0 to 0.90	0.0 to 0.71
T	0.54 to 0.0	- 0.16 to 0.27	0.04 to 0.46
	الجهد الفولتي لـ V ₁	الجهد الفولتي لـ V ₂	الجهد الفولتي لـ V ₃
P	- 0.08 to 0.18	0.15 to 0.16	0.0 to 0.18
Q	--	--	0 to 0.05
R	0.0 to 0.94	- 0.04 to 1.52	0.06 to 2.24
S	0.08 to 2.13	0.19 to 2.74	0.09 to 2.22
T	0.03 to 1.22	- 0.14 to 1.44	0.0 to 1.60
	الجهد الفولتي لـ V ₄	الجهد الفولتي لـ V ₅	الجهد الفولتي لـ V ₆
P	0.01 to 0.23	0.0 to 0.24	0.0 to 0.19
Q	0.0 to 0.16	0.0 to 0.21	0.0 to 0.27
R	0.18 to 3.20	0.42 to 2.42	0.25 to 2.60
S	0.02 to 2.09	0.0 to 0.97	0.0 to 0.84
T	0.05 to 1.31	0.0 to 0.96	0.0 to 0.67

Time duration for ECG waves

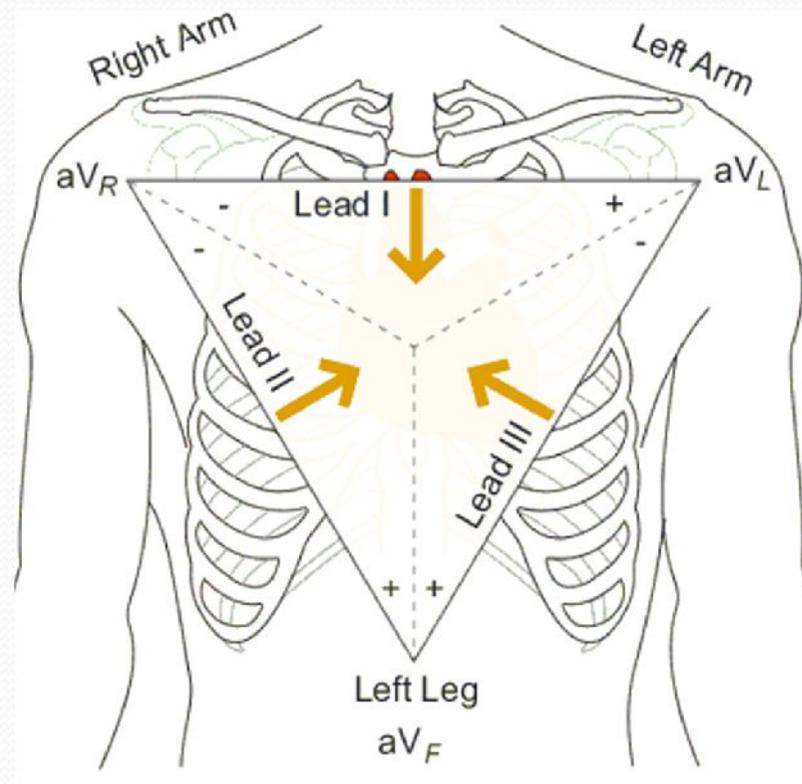
ECG Segment مقطع مخطط القلب	Normal durations (ثانية) لفترة الطبيعية	
	Average المعدل	Range المدى
PR Interval (PR مسافة)	0.18	0.12 to 0.20
QRS Duration (QRS مدة)	0.08	0.07 to 0.10
QT Interval (QT مسافة)	0.04	0.33 to 0.43
ST Interval (ST مسافة) (QT - QRS)	0.32	

Leads systems

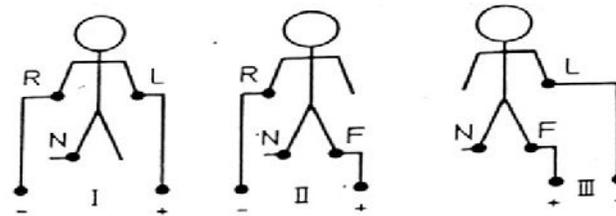
Unipolar chest leads



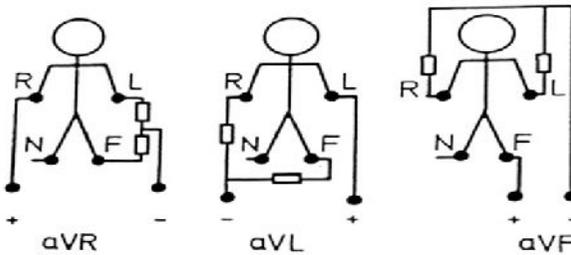
Frontal plane leads



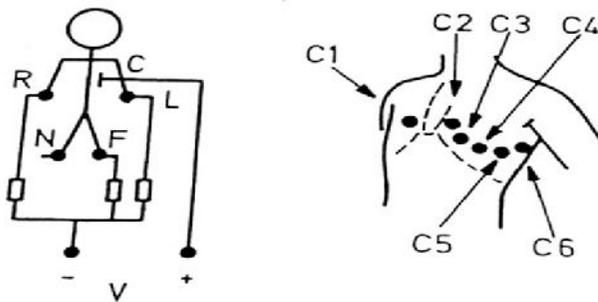
Leads systems



الموصلات الطرفية احادية القطب

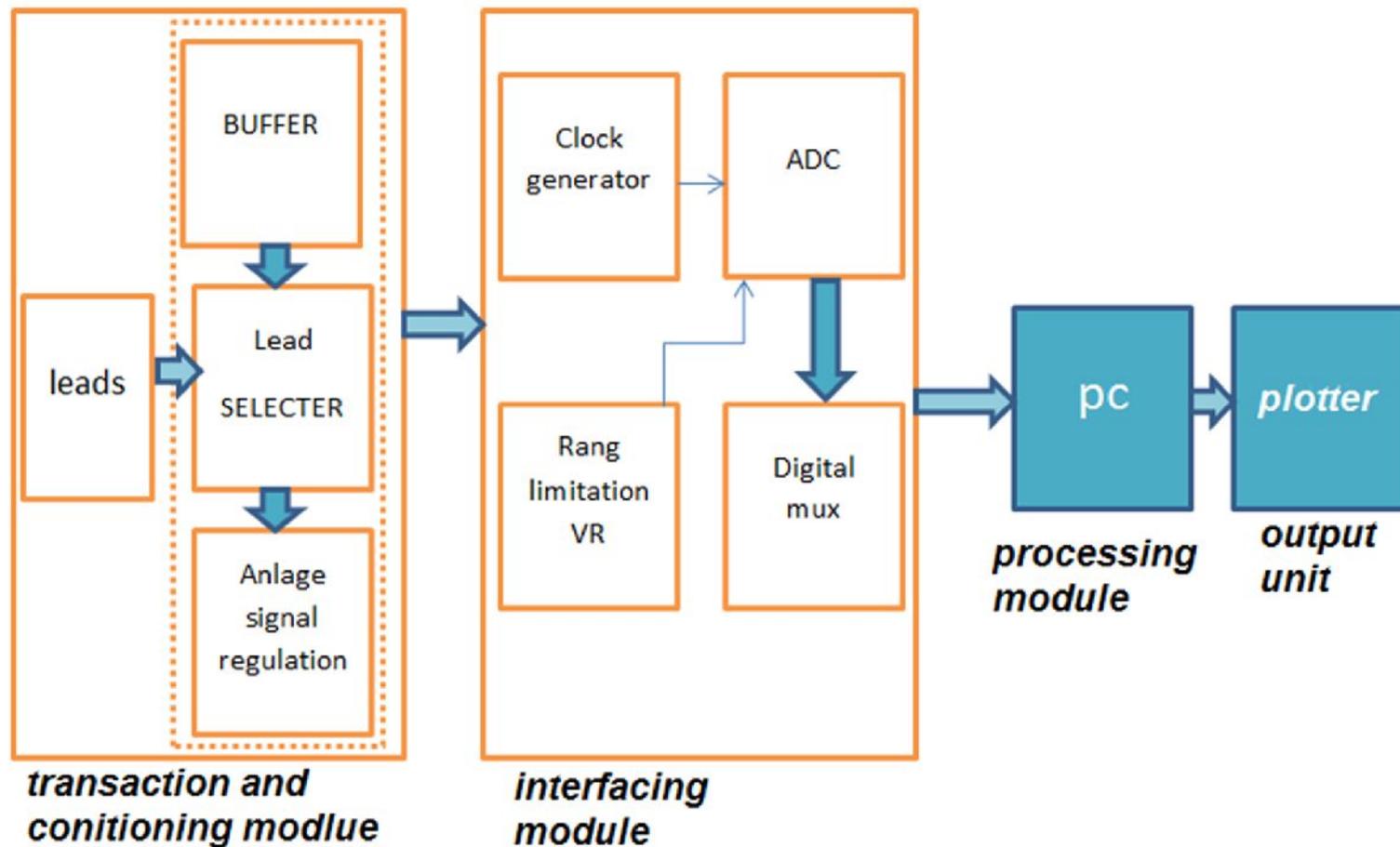


الموصلات الطرفية ثنائية القطب



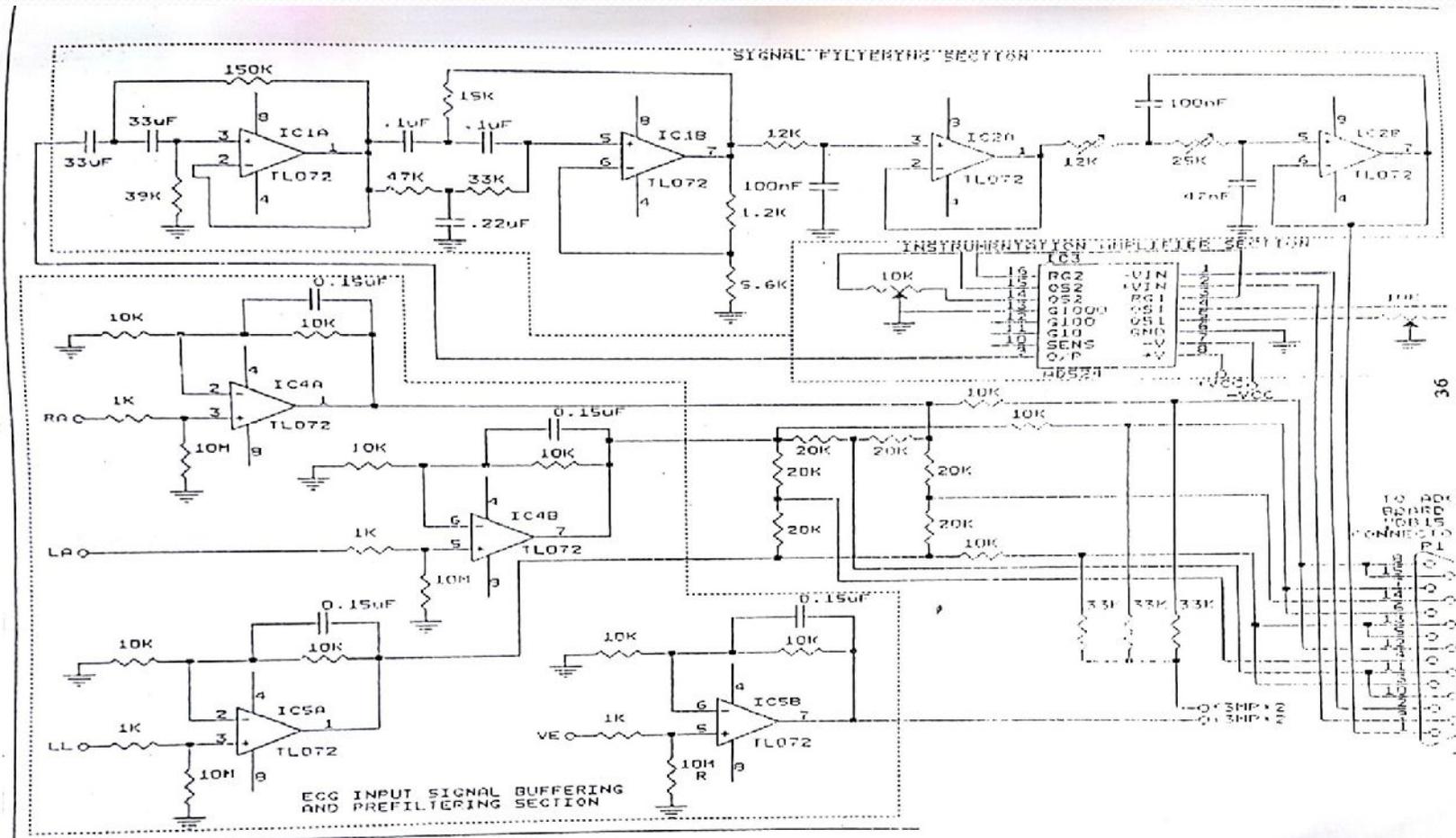
الموصلات الصدرية

Block diagram of ECG hardware

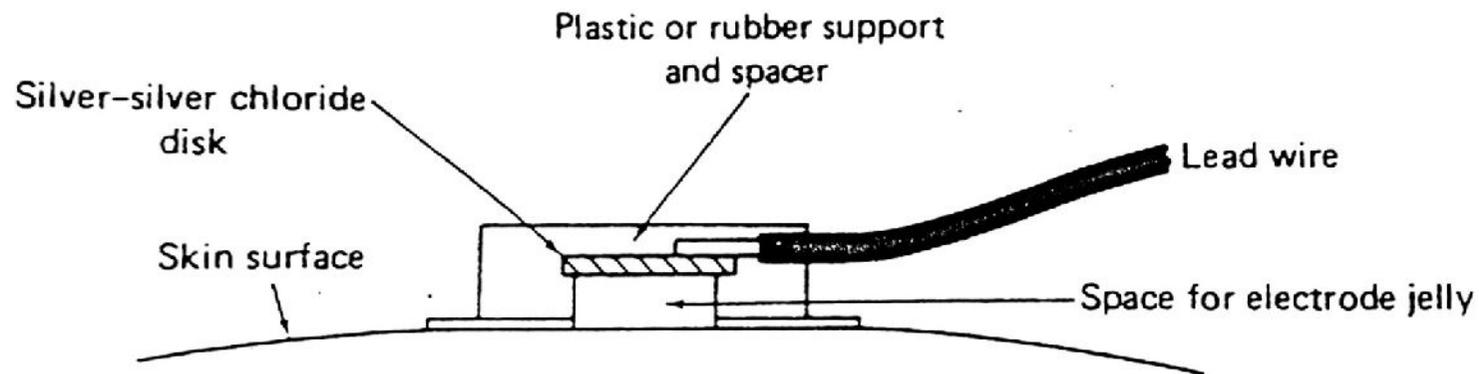


The electronic circuit for ECG signal

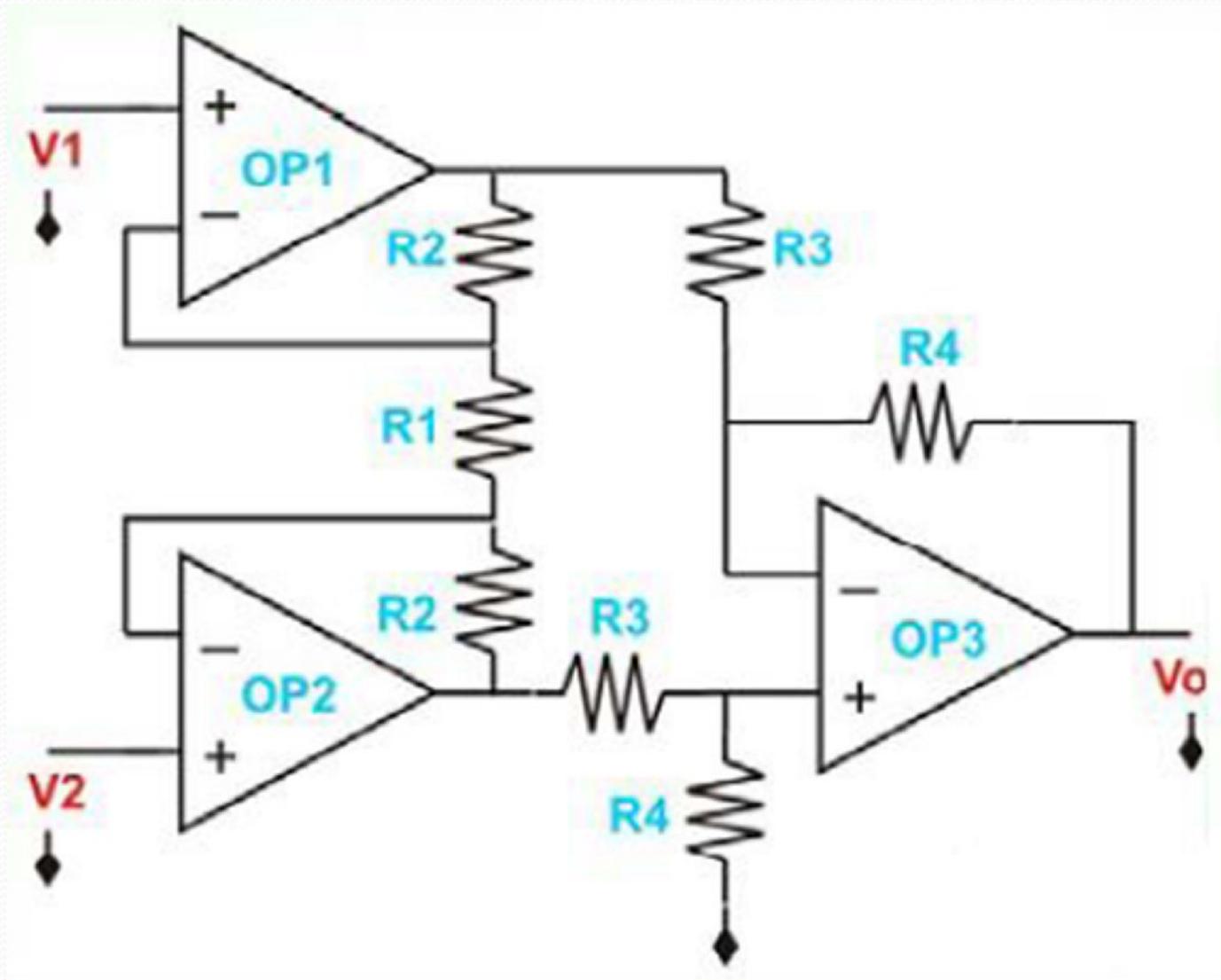
transaction and conditioning



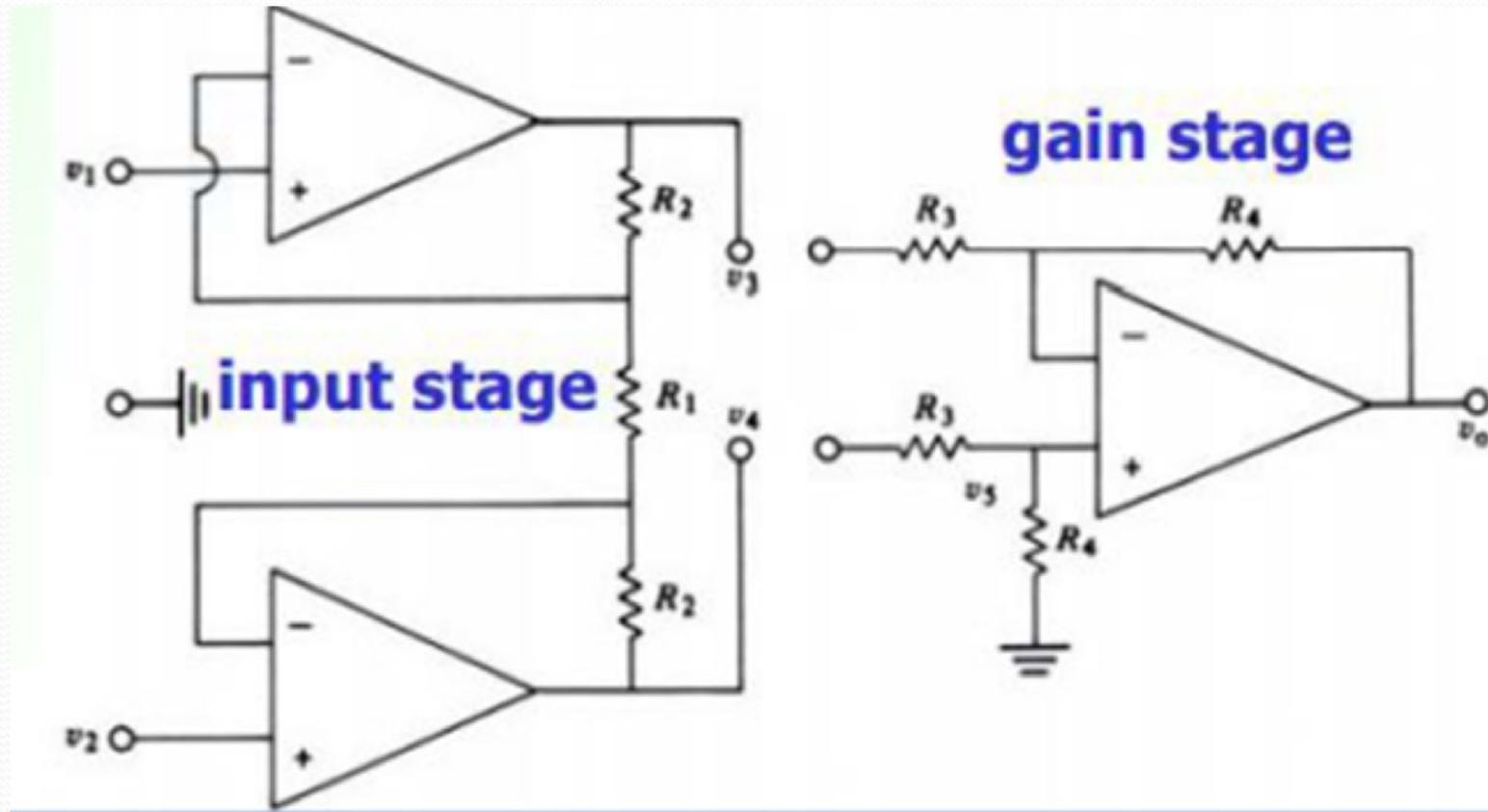
Horizontal section for an electrode skin surface electrode type



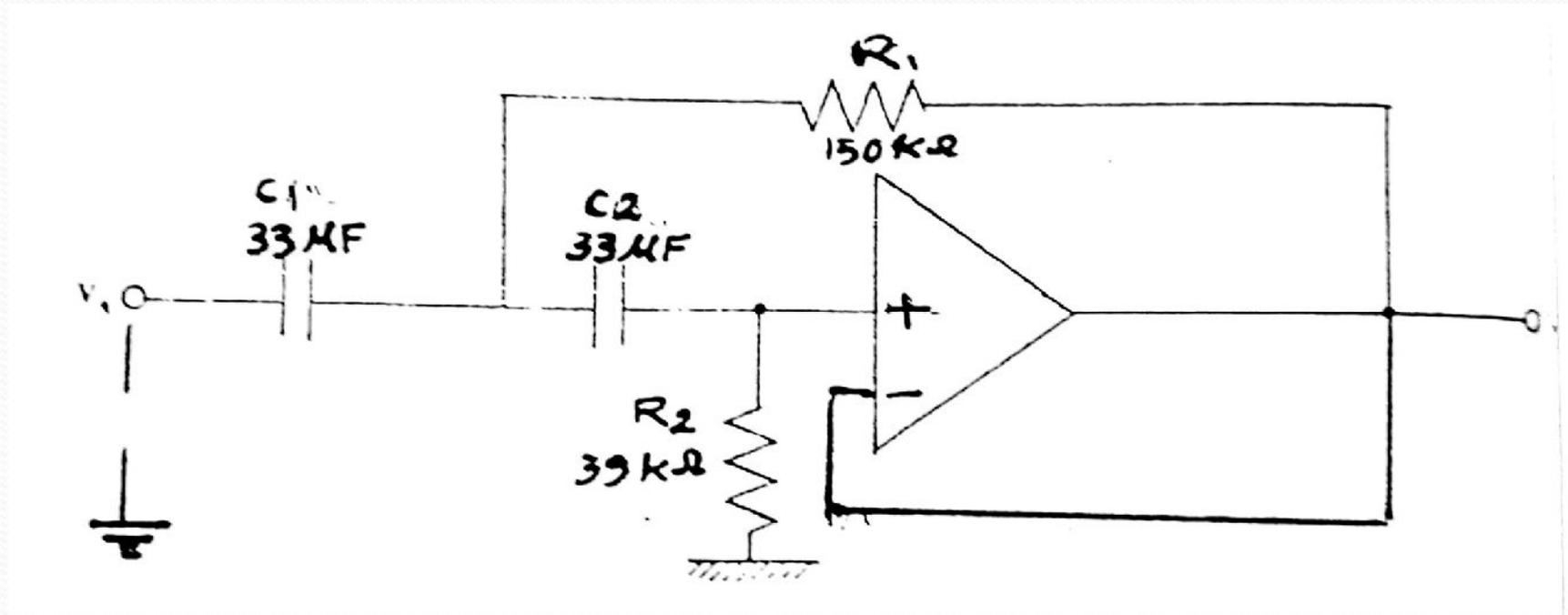
Basic Instrumentation Amplifier



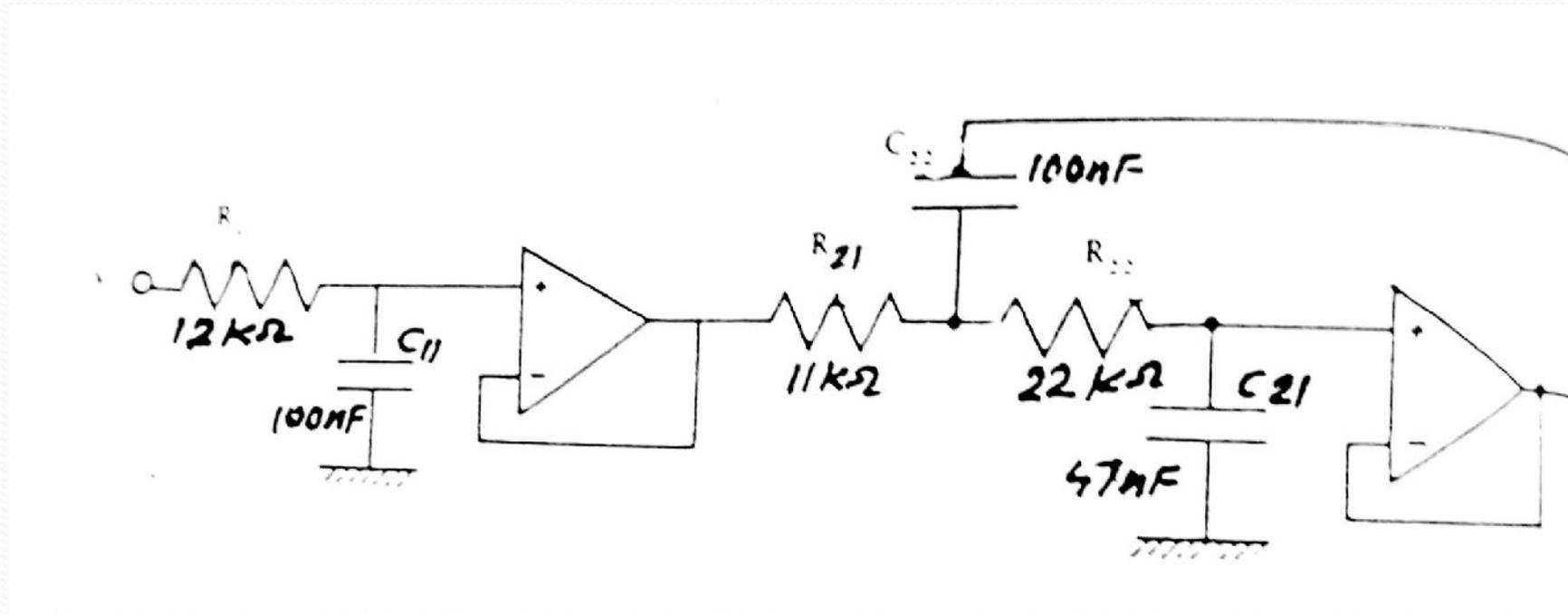
Input and gain stages of instrumentation amplifier



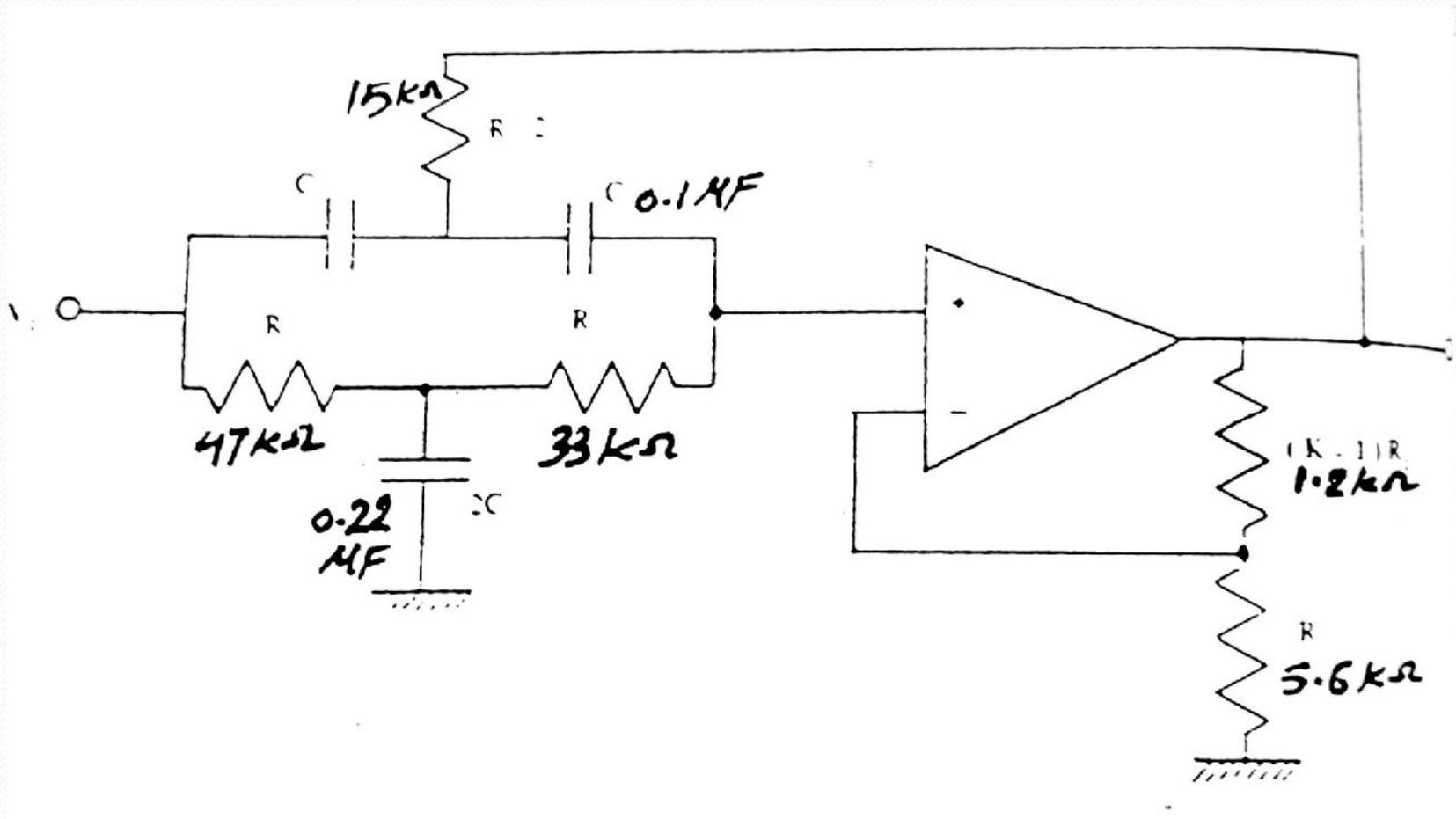
High pass filter



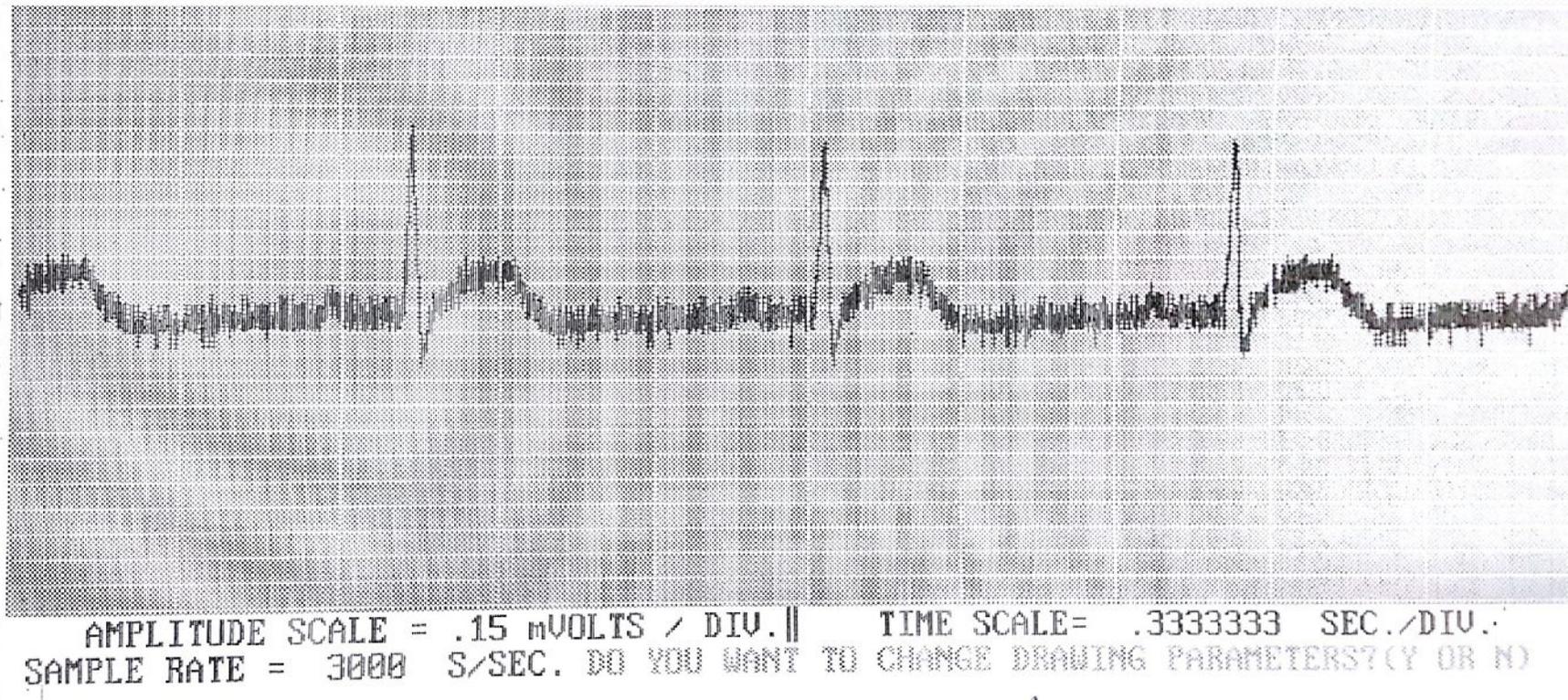
Low pass filter



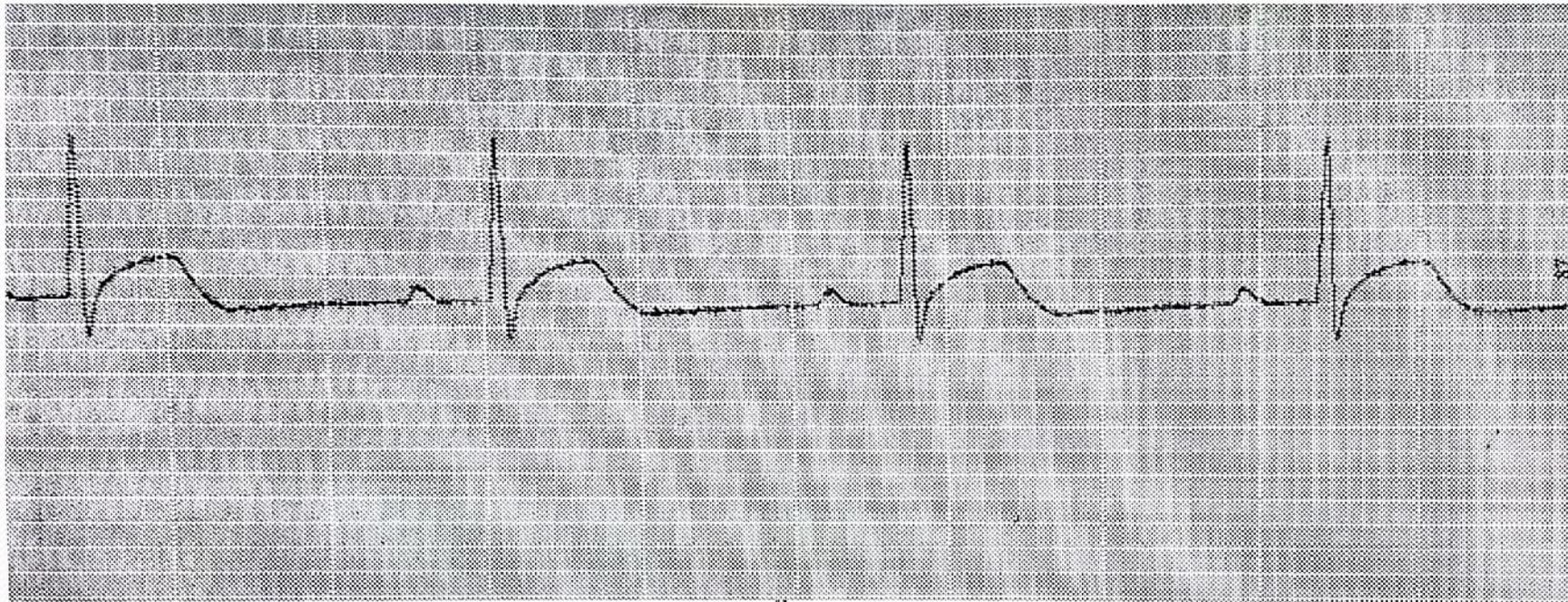
Rejection filter (notch filter)



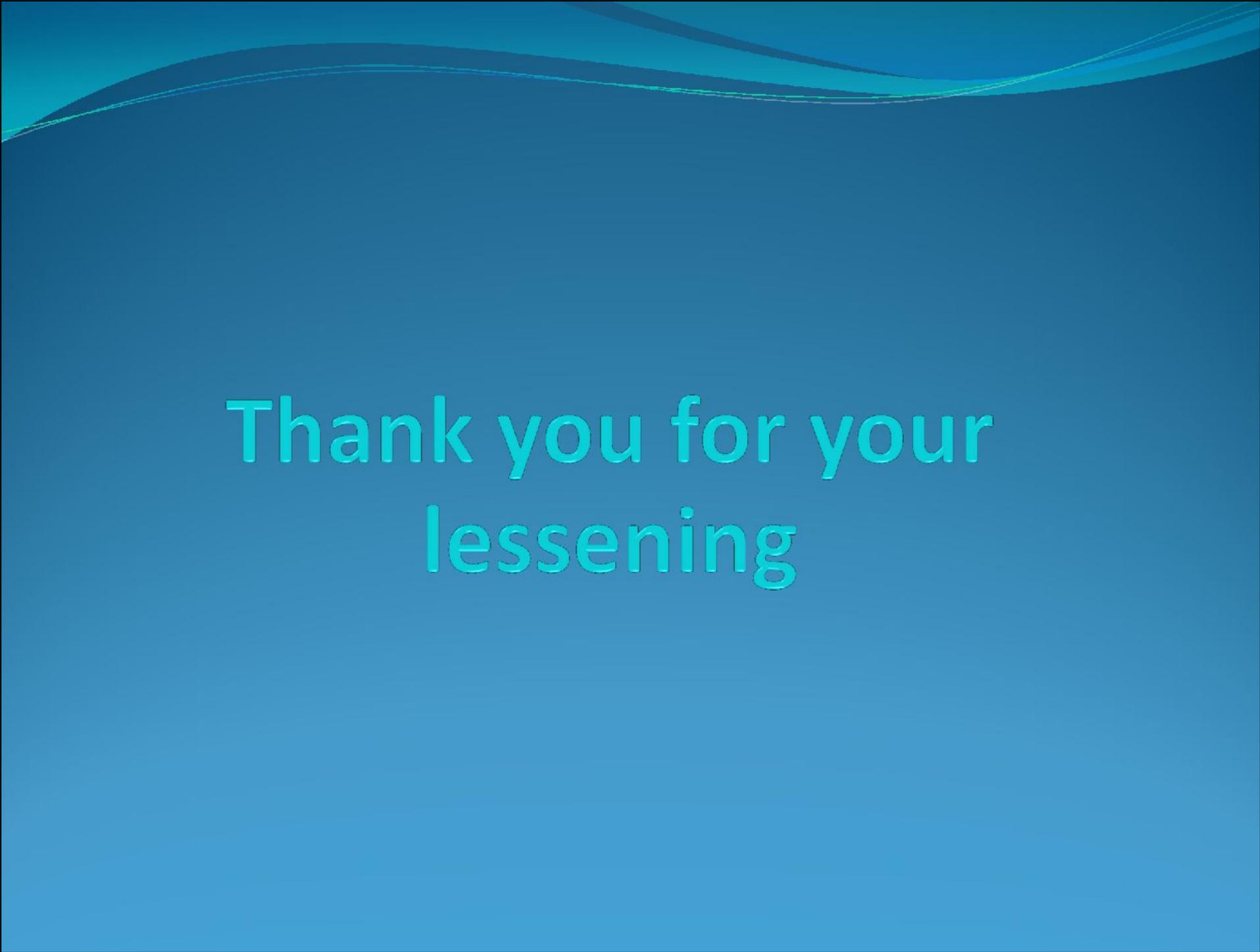
ECG for lead I with noise



ECG for lead I without noise



AMPLITUDE SCALE = .15 mVOLTS / DIV. || TIME SCALE = .333333 SEC./DIV.
SAMPLE RATE = 3000 S/SEC. DO YOU WANT TO CHANGE DRAWING PARAMETERS?(Y OR N)

The background is a solid blue color. At the top, there are several wavy, overlapping lines in various shades of blue, creating a decorative header effect.

Thank you for your
lessening