

# Designing an Electrocardiography Circuits

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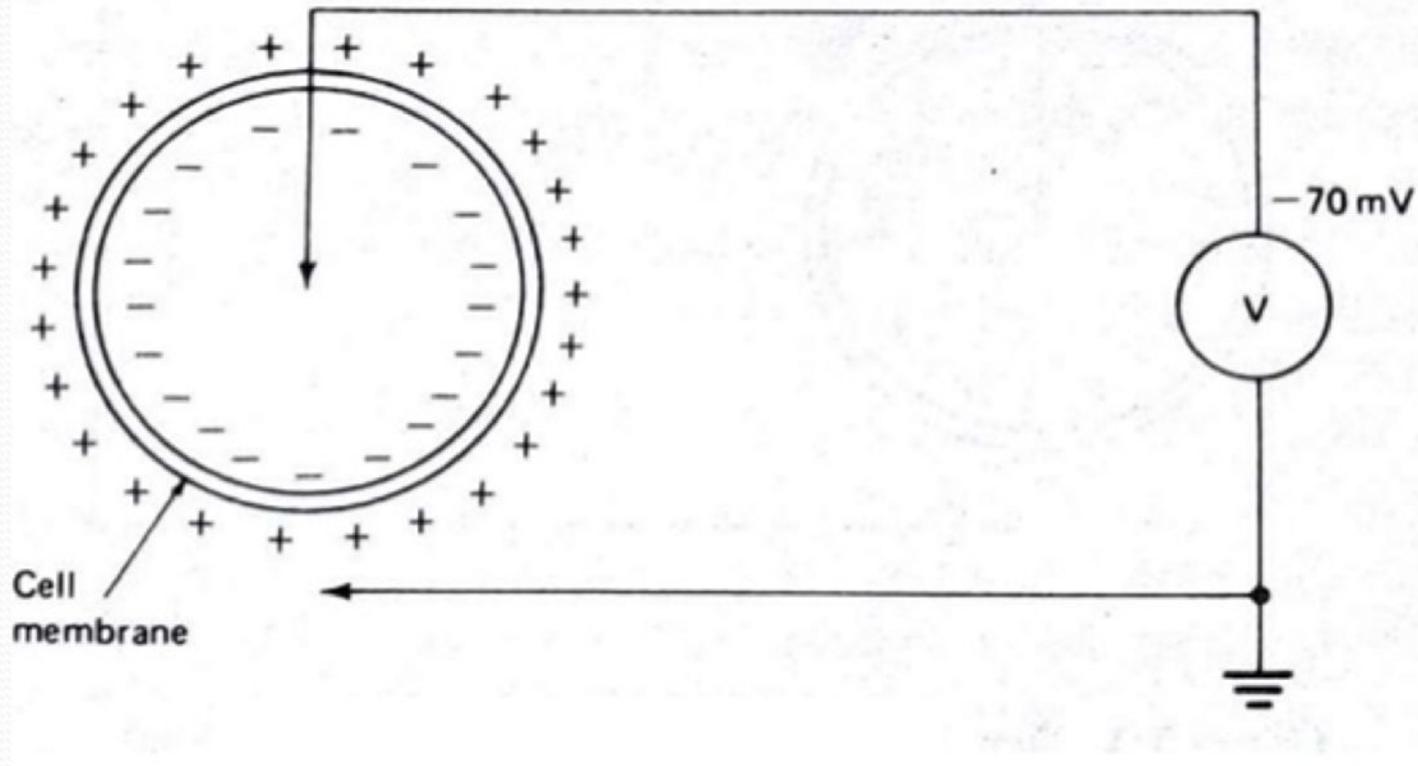
# Abstract

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

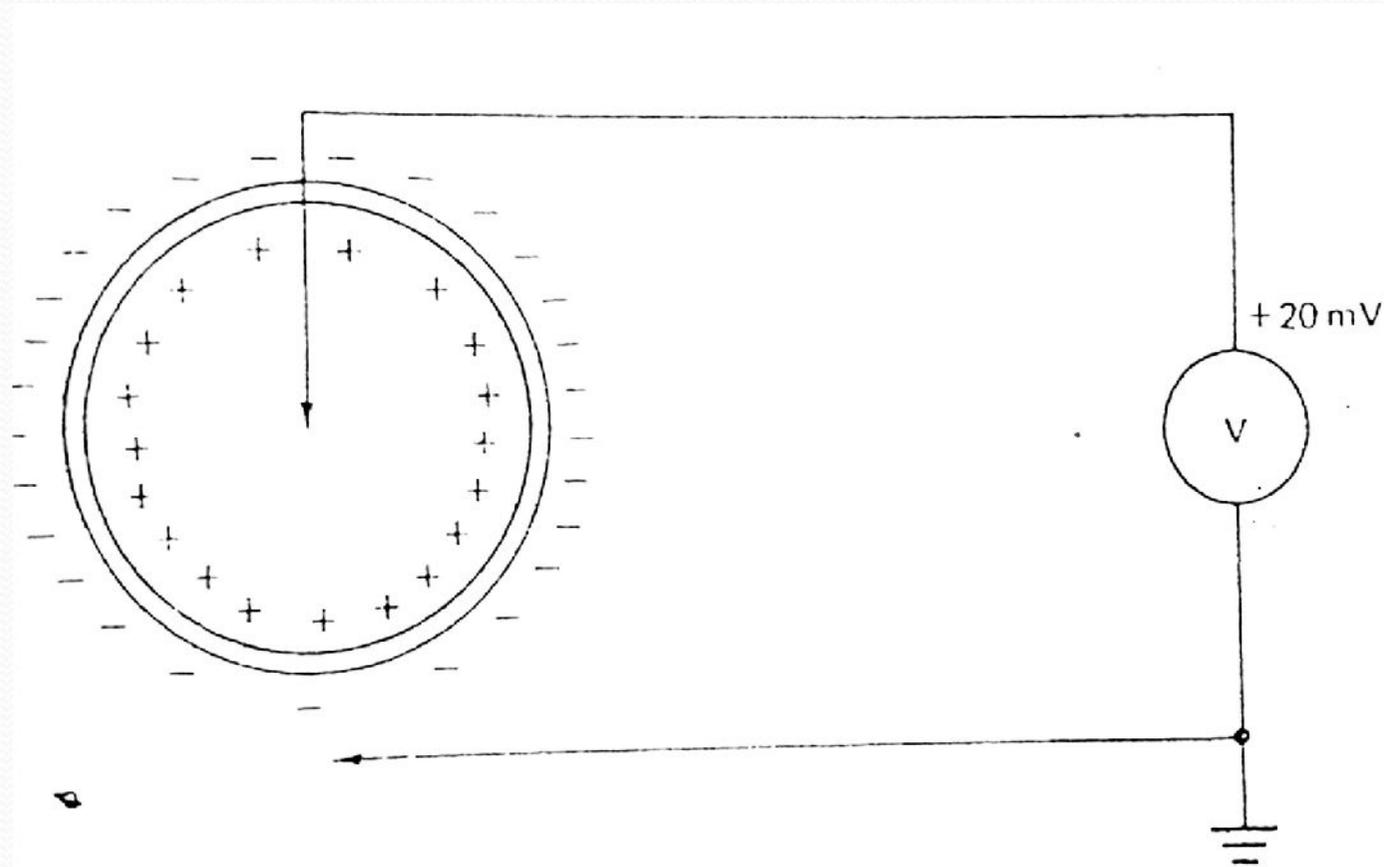


# Sources of Electrical Potentials

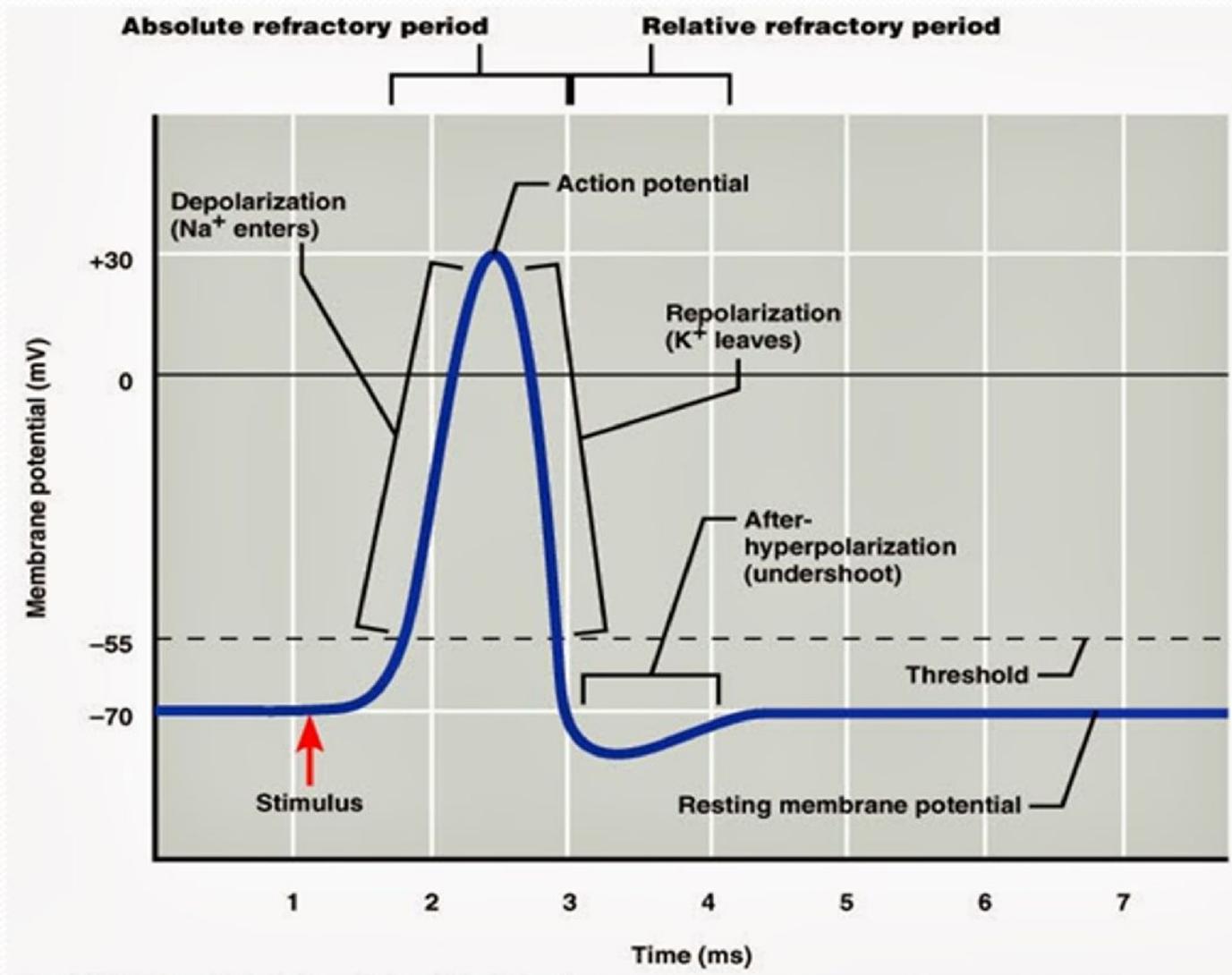
# Polarized cell with its resting potential



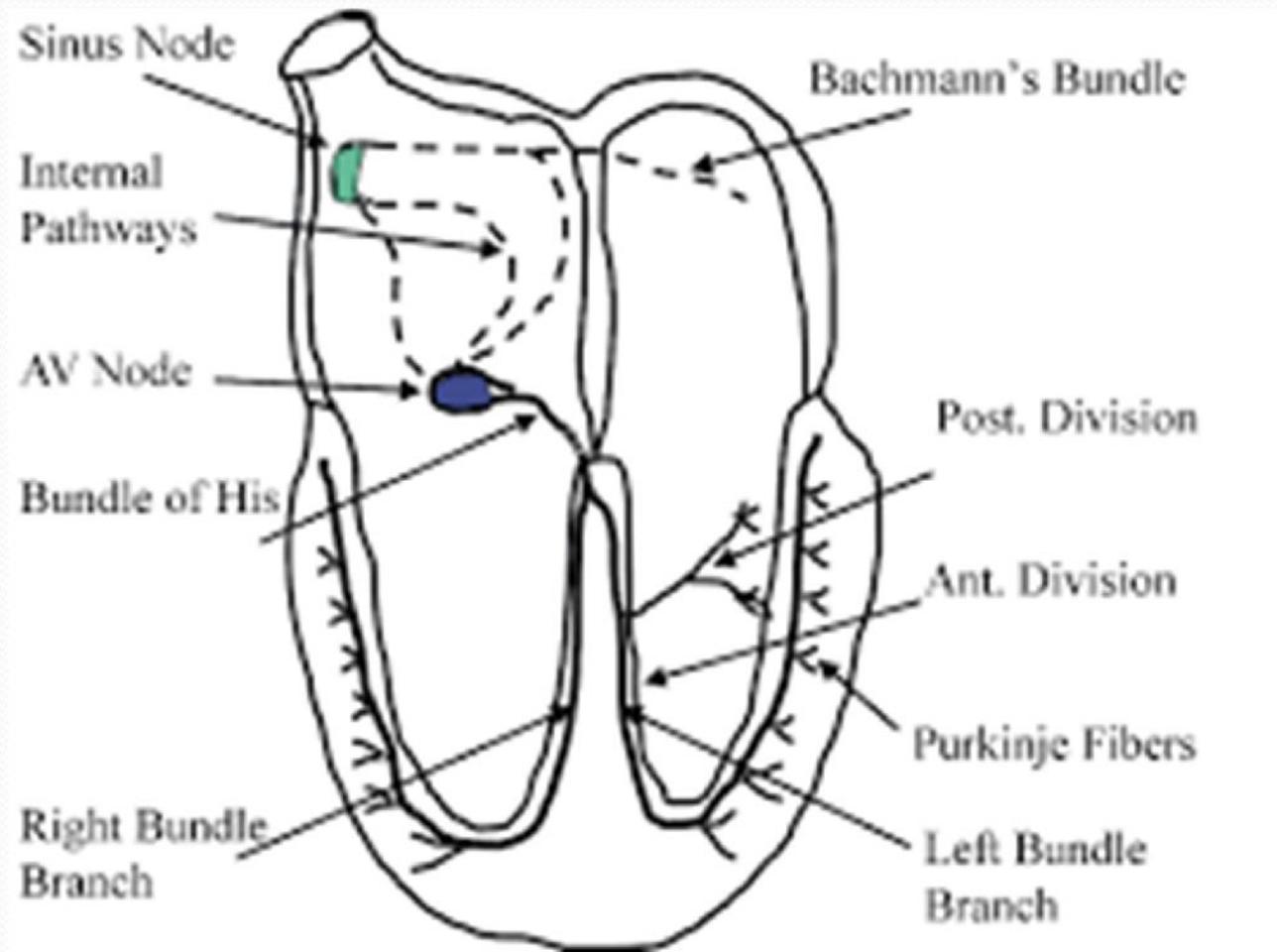
# Depolarize cell with action potentials



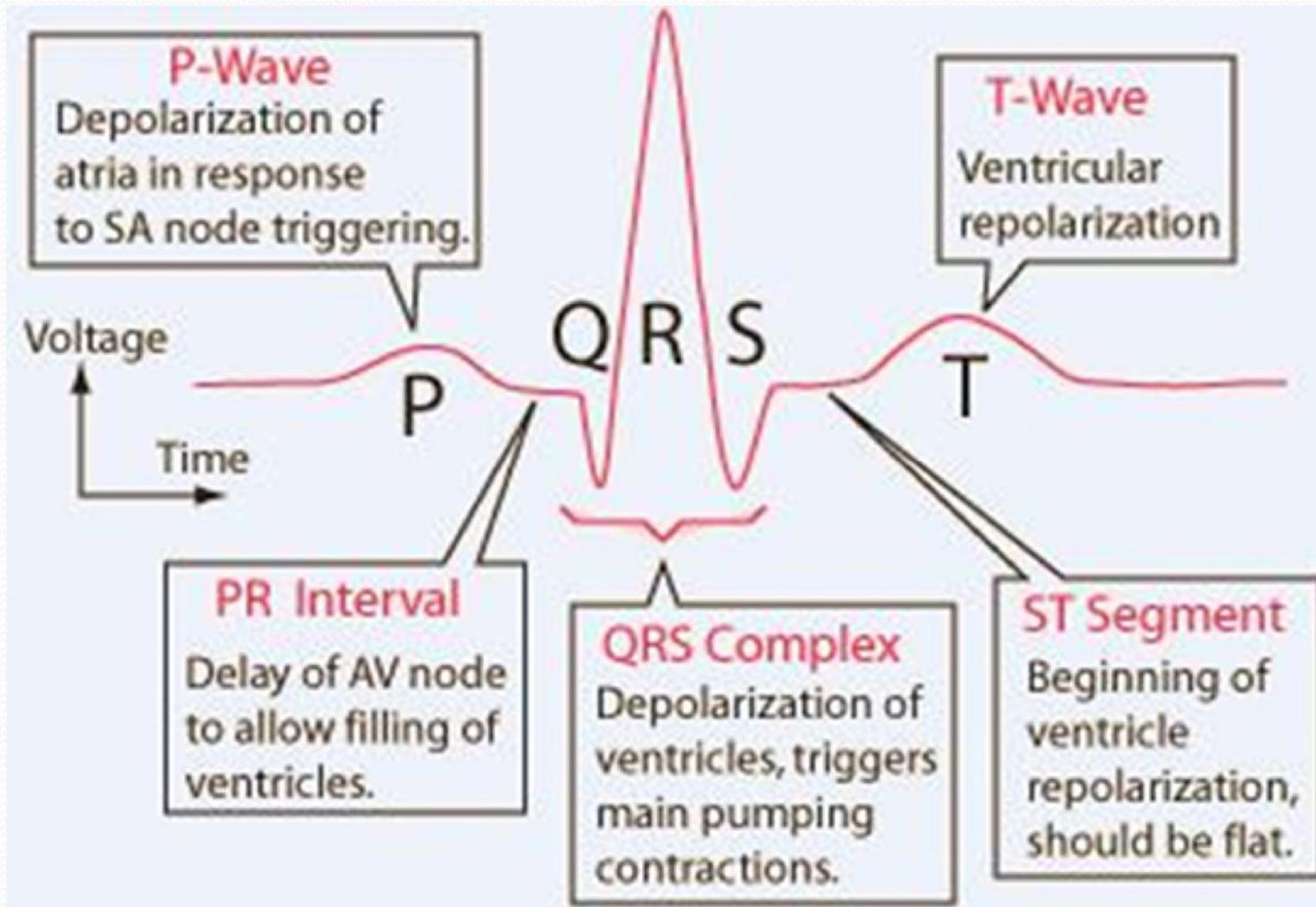
# Standard potentials wave



# Electrocardiogram ECG



# Normal ECG wave



# The normal amplitude range for ECG waves

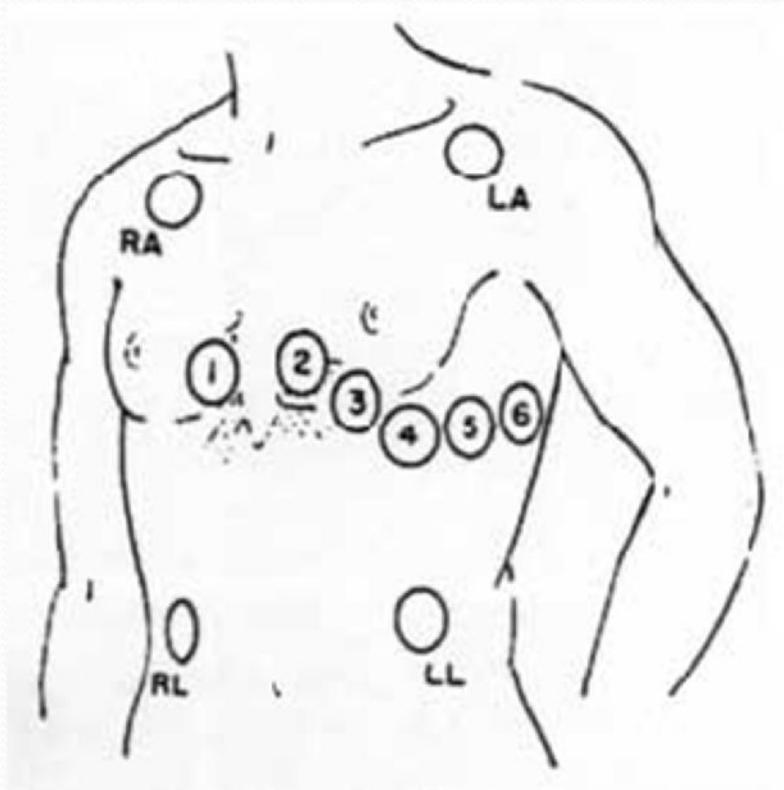
الموجة (WAVE)	مدى الاتساع (ملي فولت) Amplitude Range in mv		
	الجهد الفولتي Lead I potential	الجهد الفولتي Lead II potential	الجهد الفولتي Lead III potential
P	0.015 to 0.12	0.00 to 0.19	- 0.073 to 0.13
Q	0.0 to 0.16	0.0 to 0.18	0.0 to 0.28
R	0.02 to 1.13	0.18 to 1.68	0.03 to 1.31
S	0.0 to 0.36	0.0 to 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 <sub>1</sub>	الجهد الفولتي لـ V <sub>2</sub>	الجهد الفولتي لـ V <sub>3</sub>
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 <sub>4</sub>	الجهد الفولتي لـ V <sub>5</sub>	الجهد الفولتي لـ V <sub>6</sub>
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

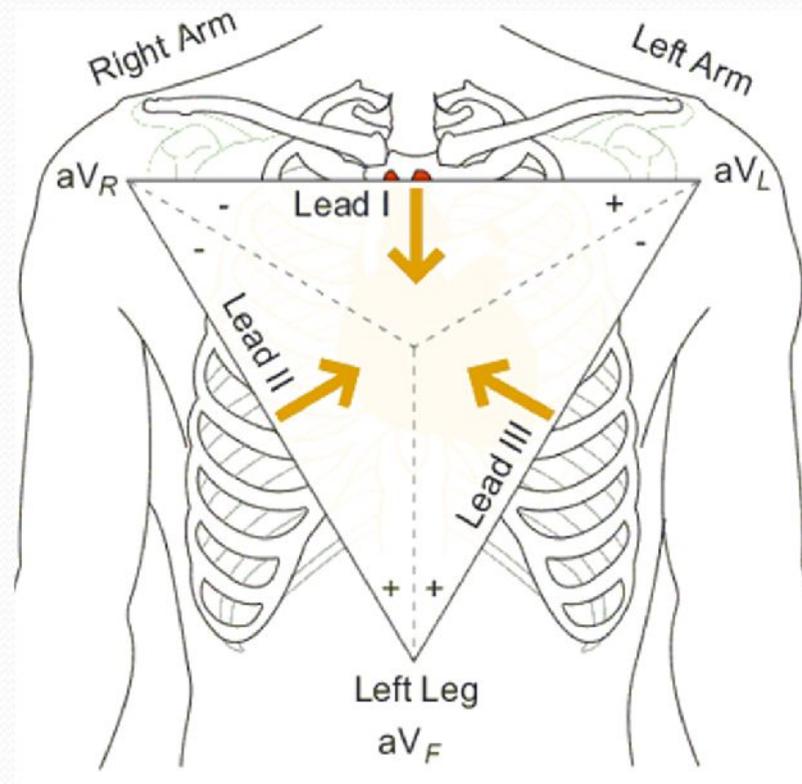
ECG Segment مقطع مخطط القلب	Normal durations (ثانية) لفترة الطبيعية	
	Average المعدل	Range المدى
PR Interval (PR مسافة )	0.18	0.12 to 0.20
QRS Duration (QRS مدة )	0.08	0.07 to 0.10
QT Interval (QT مسافة )	0.04	0.33 to 0.43
ST Interval (ST مسافة ) (QT - QRS)	0.32	

# Leads systems

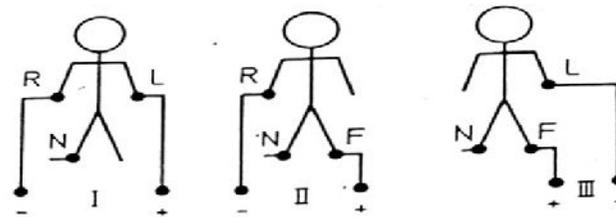
Unipolar chest leads



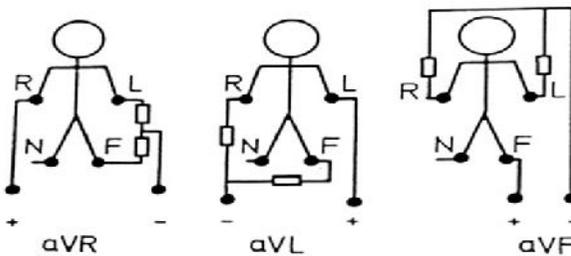
Frontal plane leads



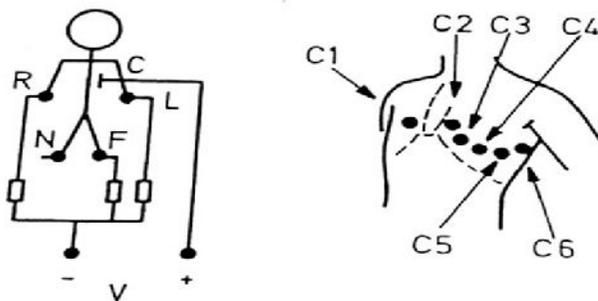
# Leads systems



الموصلات الطرفية احادية القطب

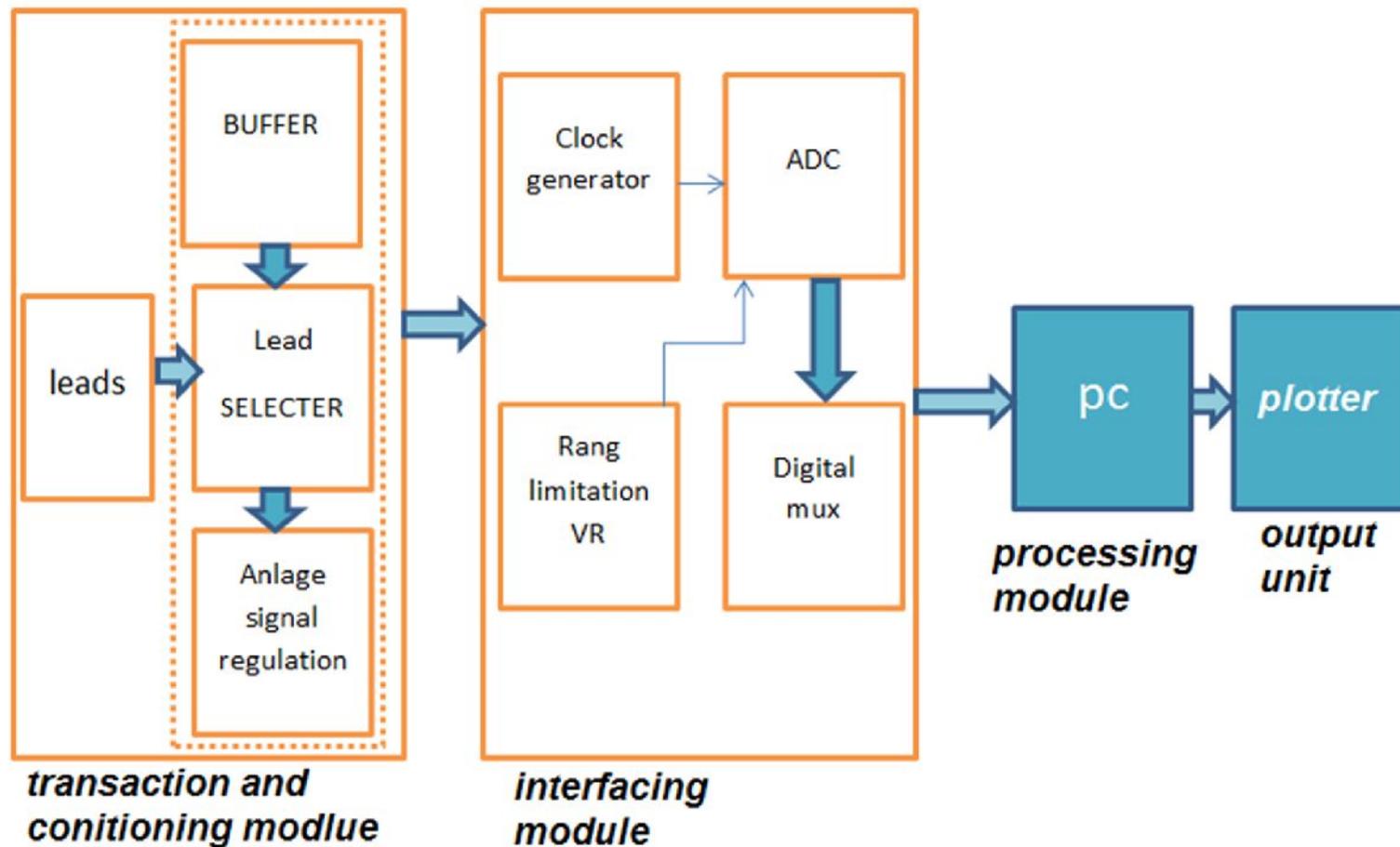


الموصلات الطرفية ثنائية القطب



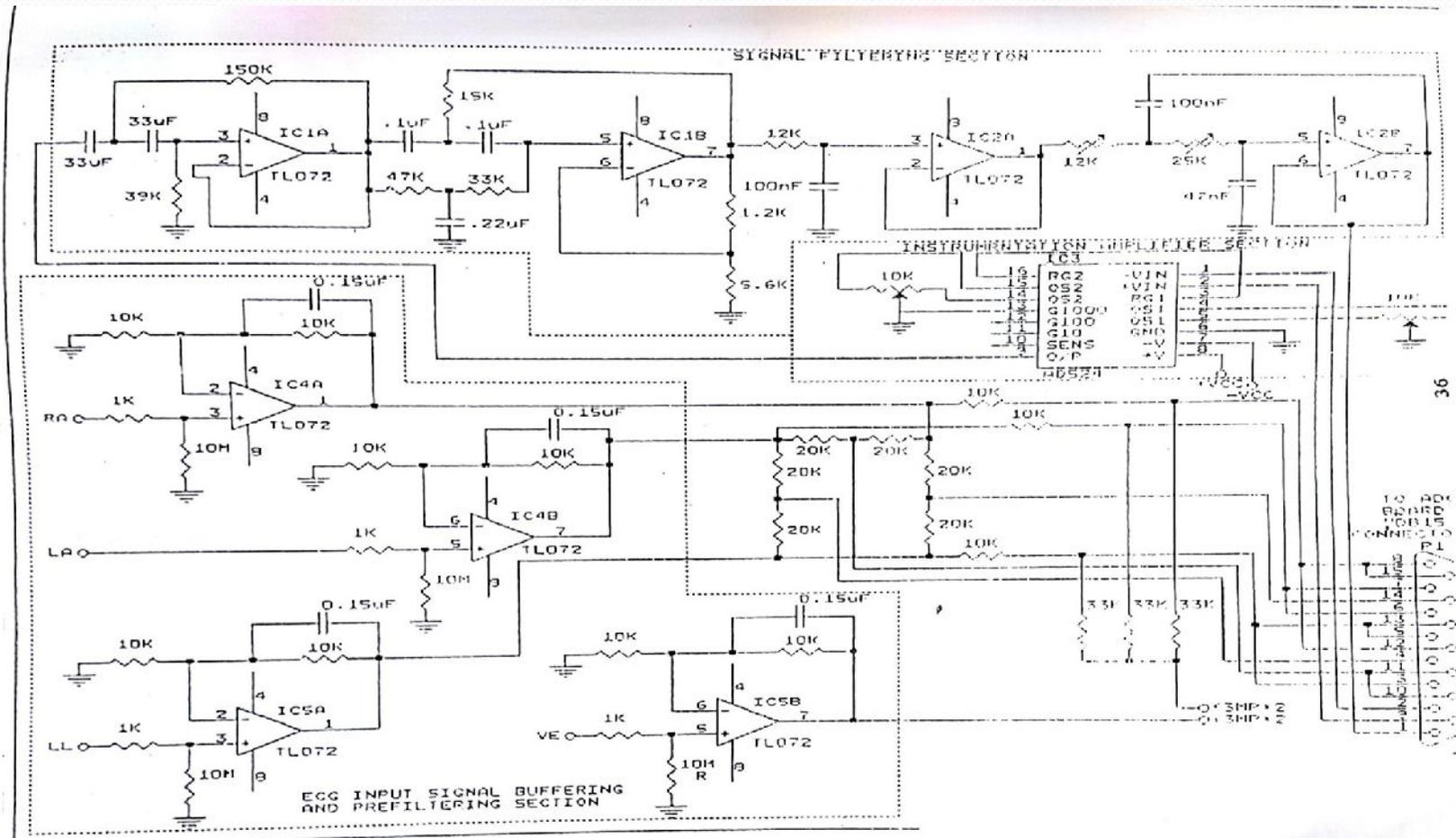
الموصلات الصدرية

# Block diagram of ECG hardware

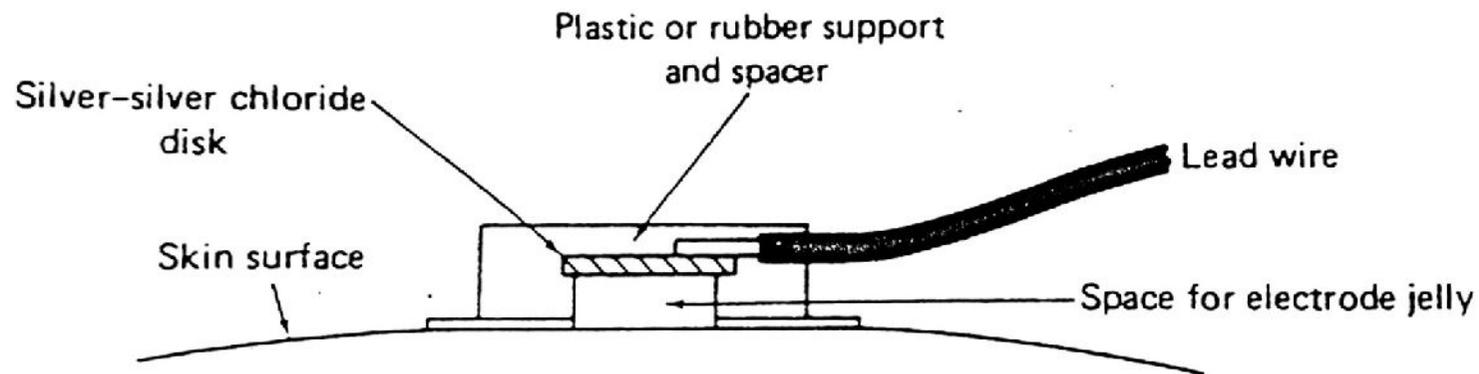


# The electronic circuit for ECG signal

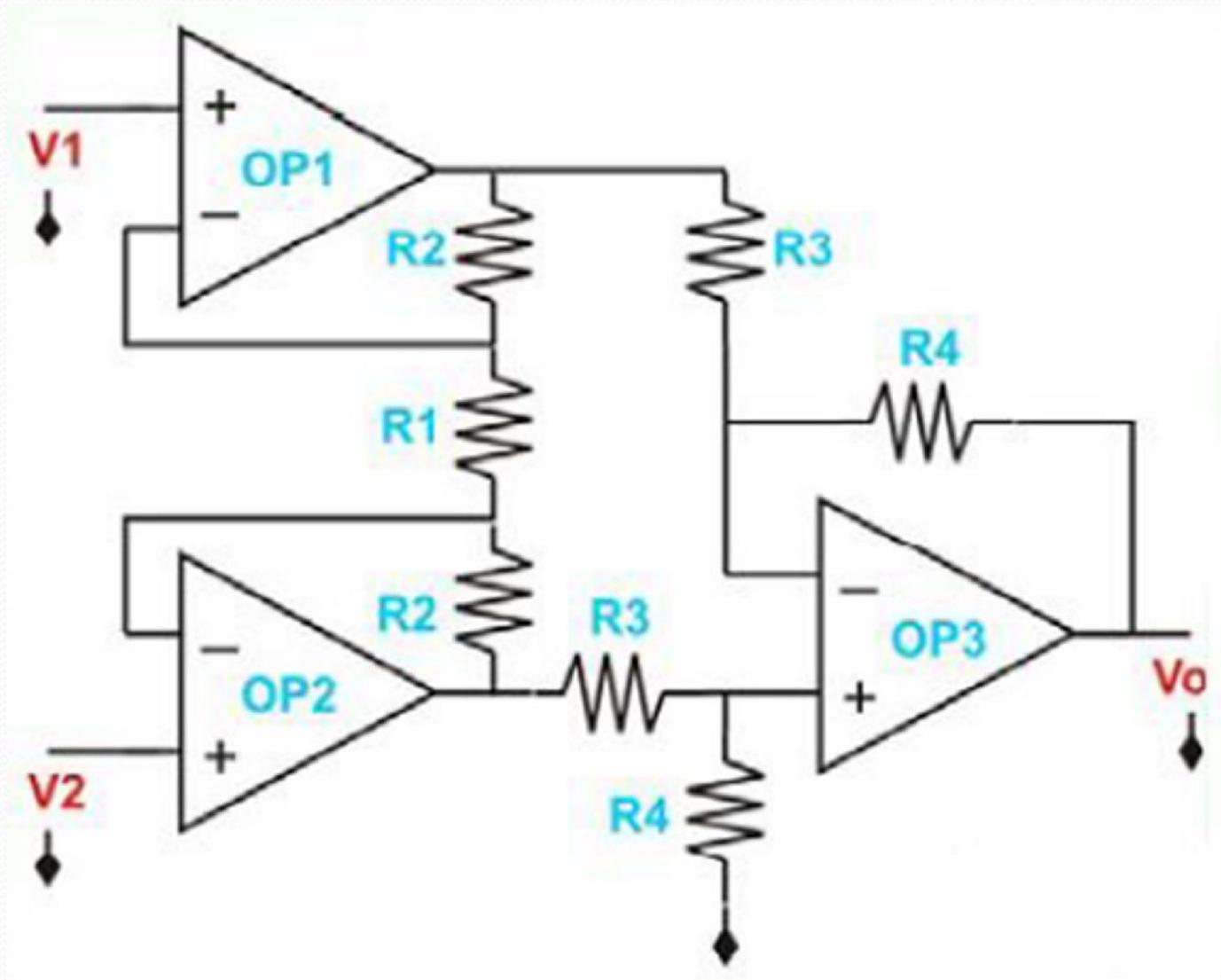
## transaction and conditioning



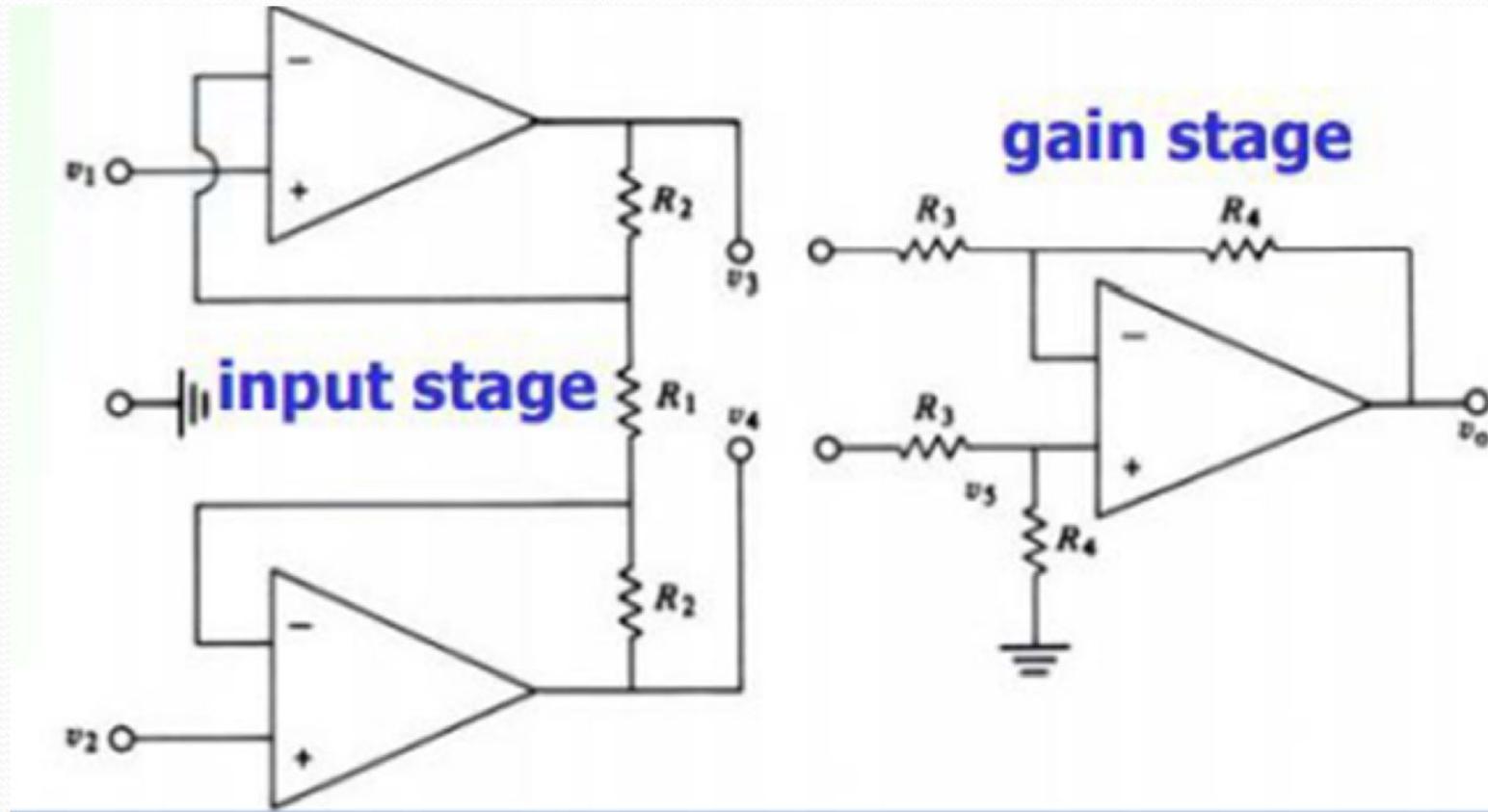
# Horizontal section for an electrode skin surface electrode type



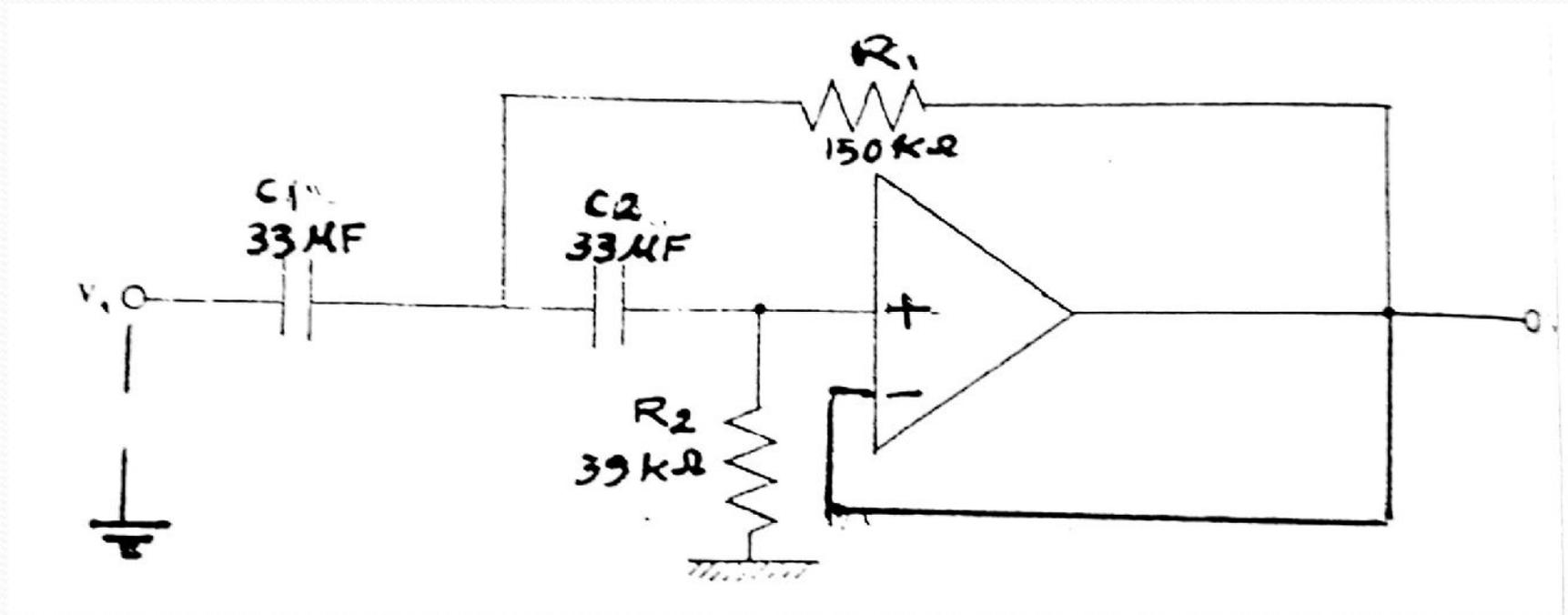
# Basic Instrumentation Amplifier



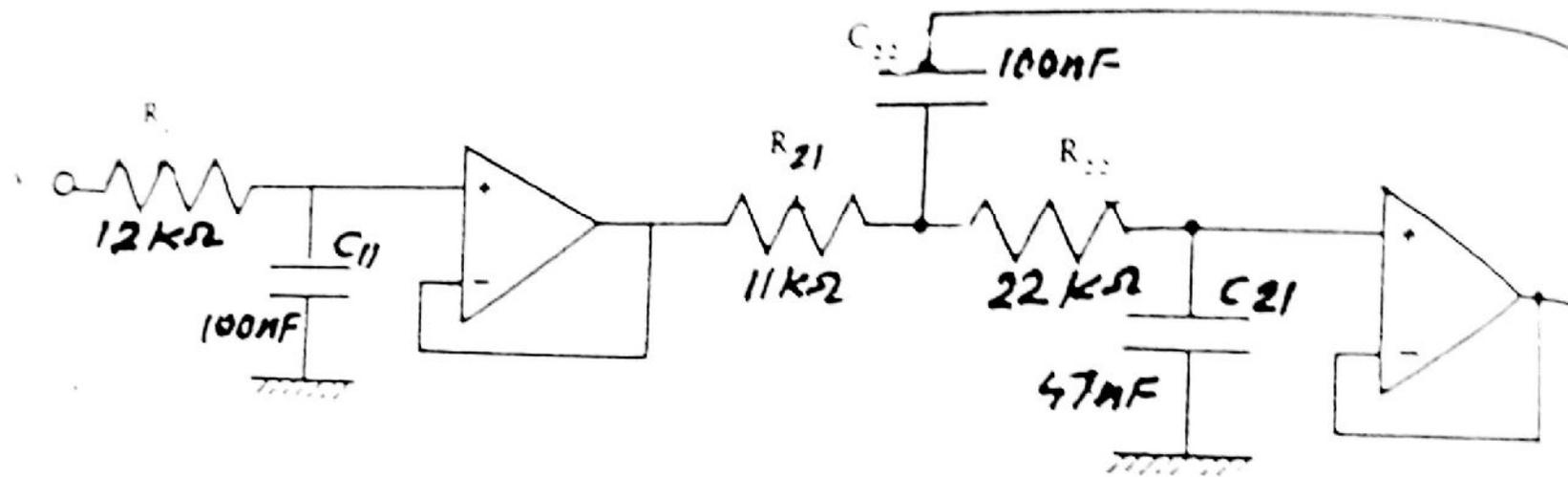
# Input and gain stages of instrumentation amplifier



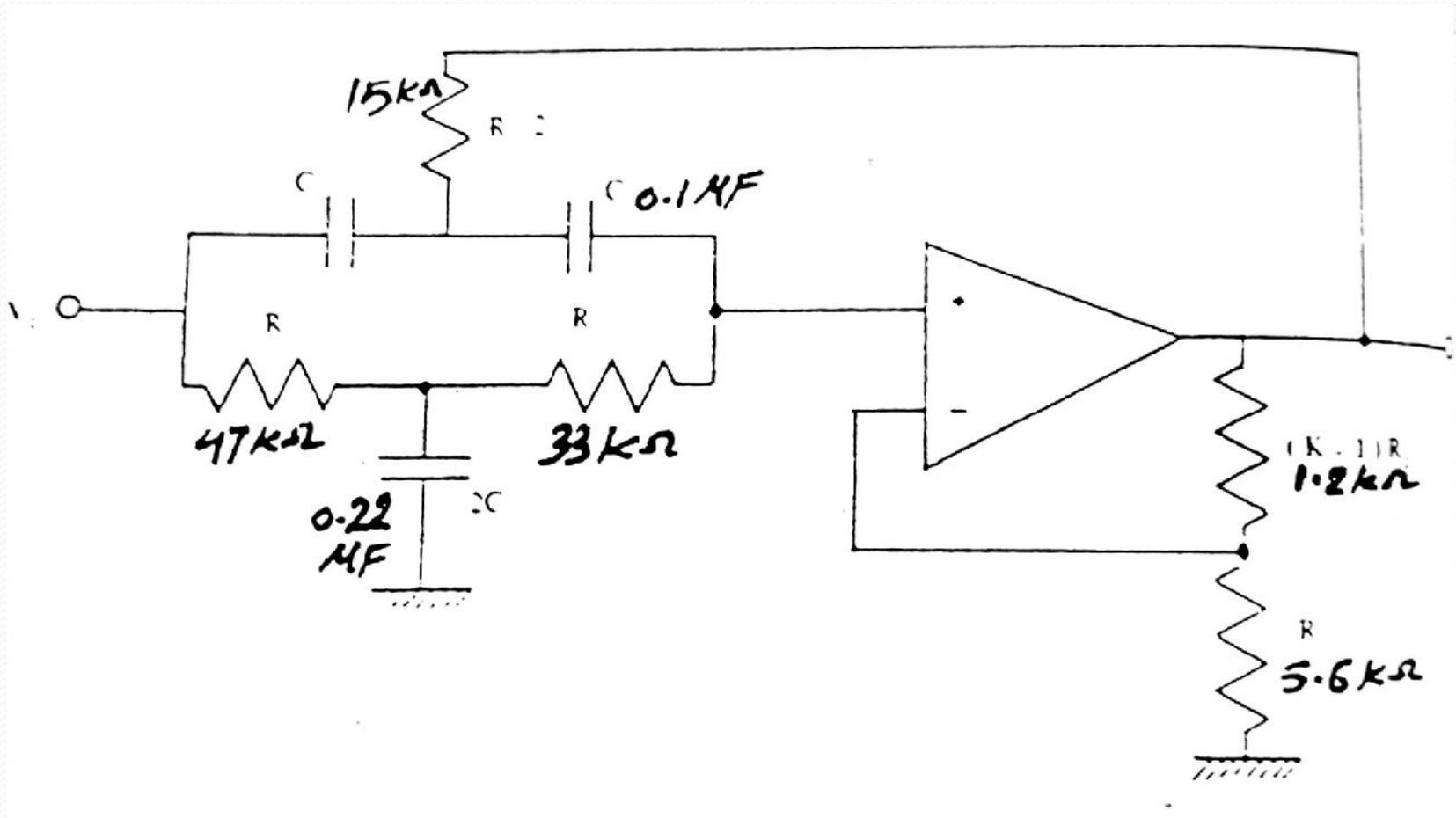
# High pass filter



# Low pass filter

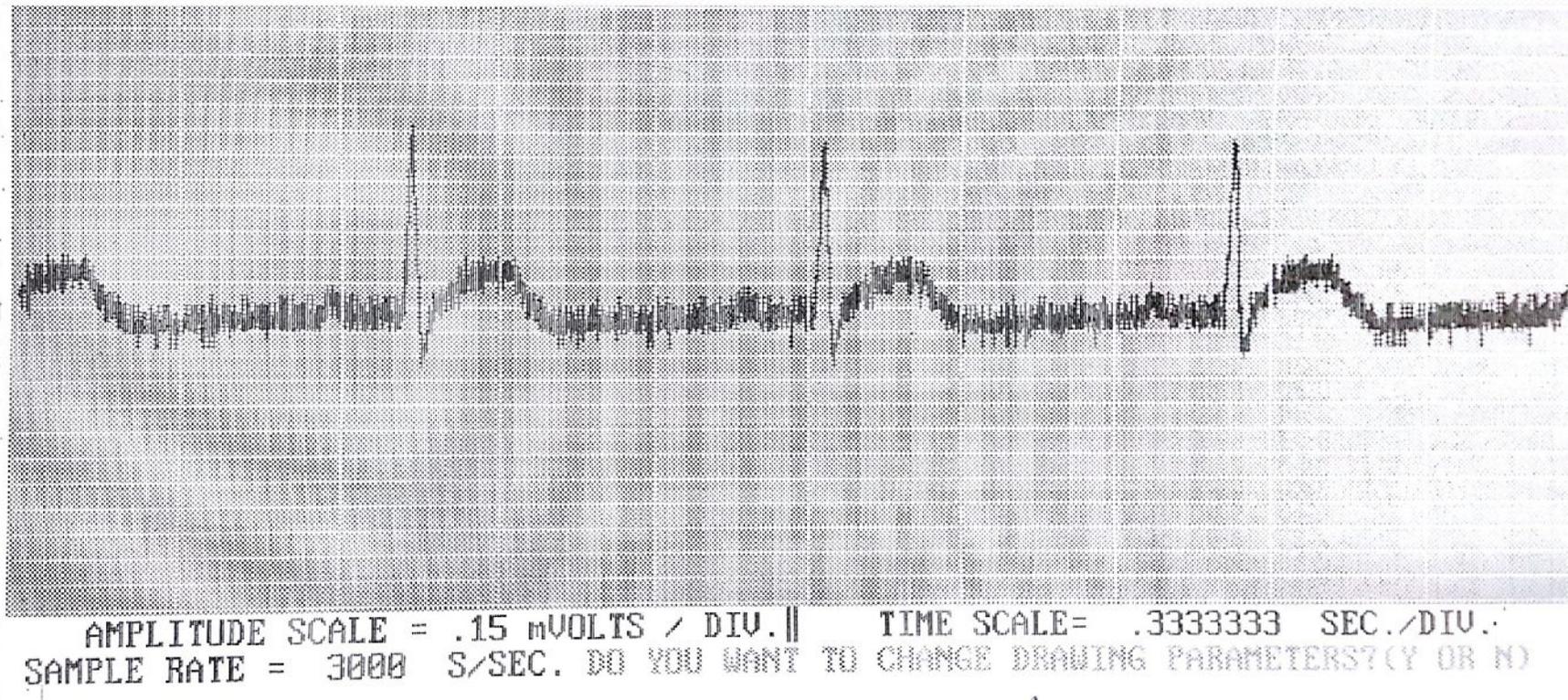


# Rejection filter (notch filter)

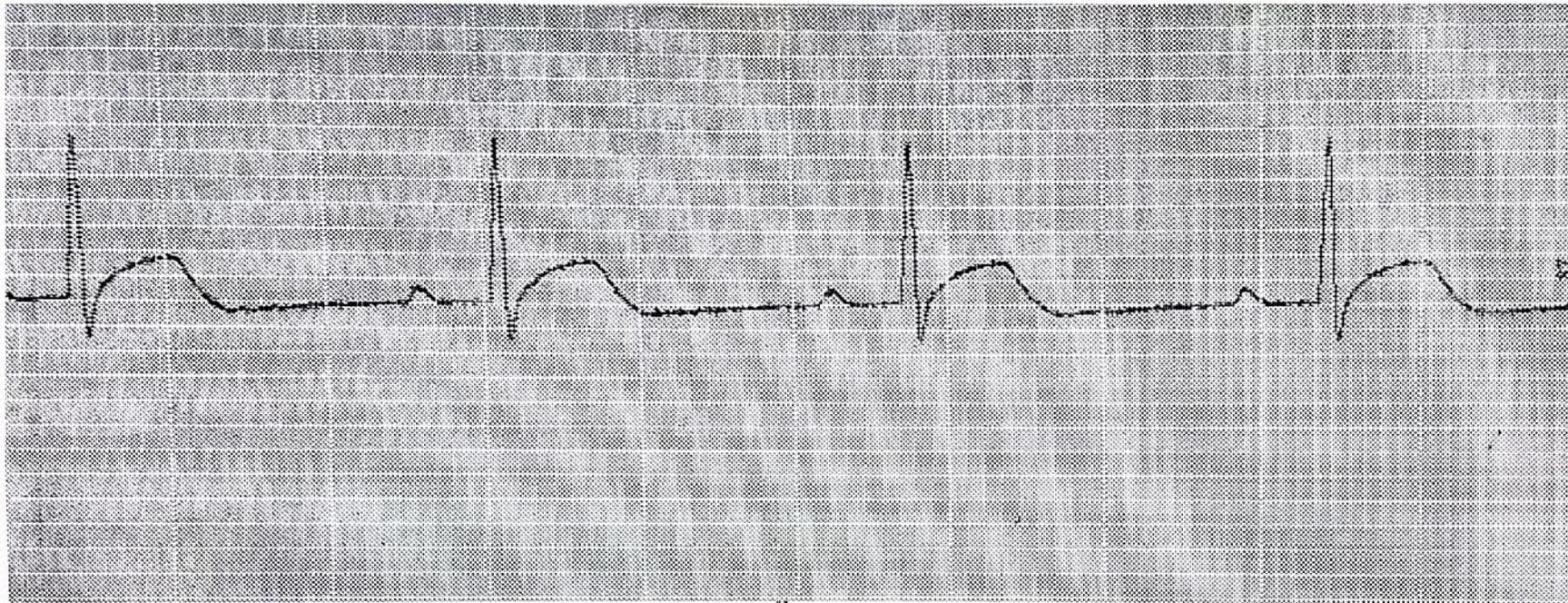




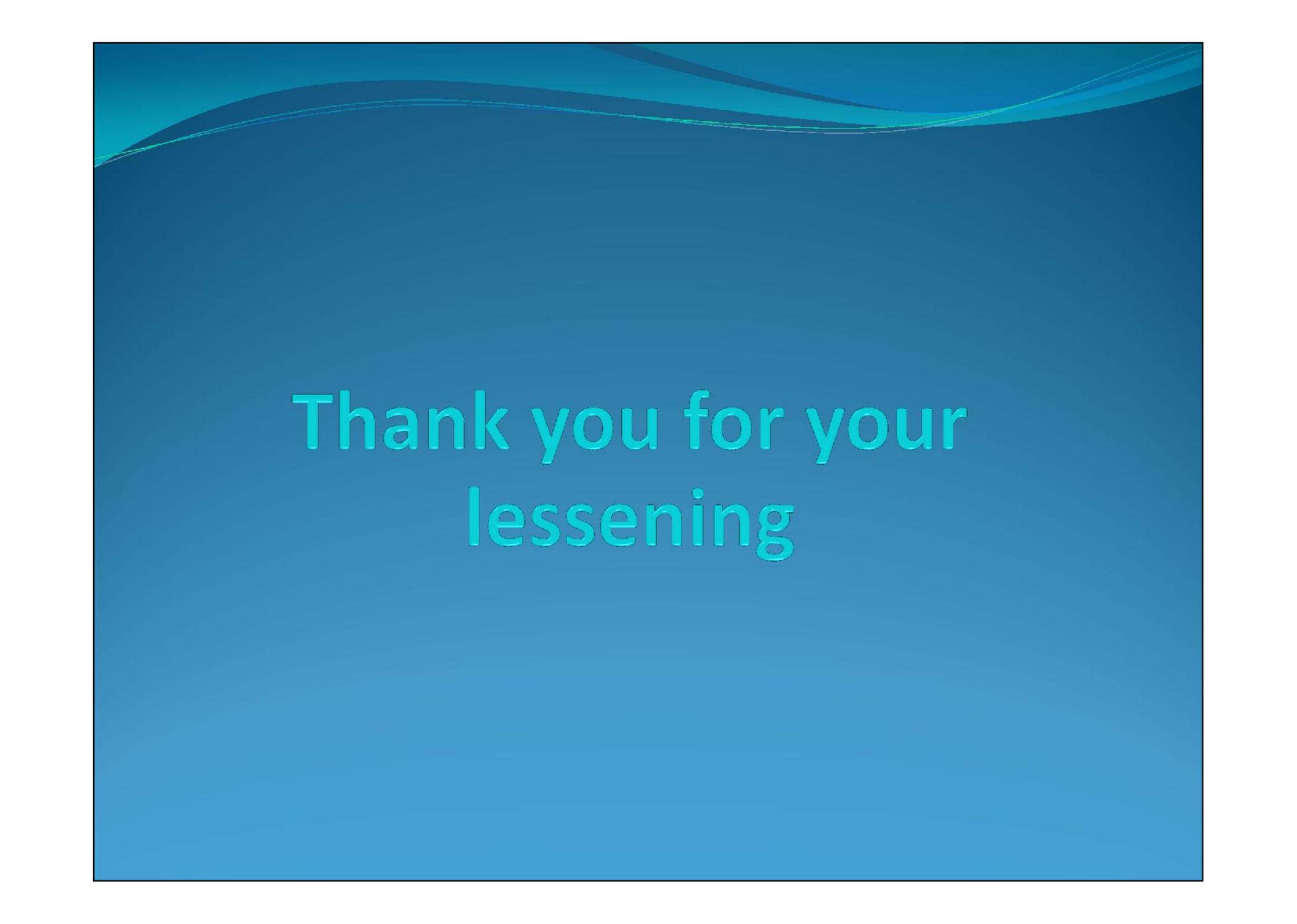
# ECG for lead I with noise



# 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)



Thank you for your  
lessening