CE3002 - Sensors, Interfacing and Control

Contents:-

1-Components used
2-AD625 Circuit connection
3-Software procedures, Troubleshooting
4-To obtain a waveform of 500 mHz at 40mVpp from Function Generator SDG800

1a)   Components used :-

1) **Resistors – ¼ W :-**

100K ohm – 2 pcs

1.2M ohm -1 pc

1.6K ohm – 1 pc

1K ohm – 4 pcs

½ W, 150 ohm – 2 pcs (size is bigger than ¼ W, Voltage divider)

2) **Capacitors :-**

Tantalum, polarised – 0.22 uF

Electrolytic, polarised – 10 uF

3) **Trimmer** – 10K ohm – 1 pc (square, single-turn, 3pin)

   Potentiometer – 10K ohm – 1 pc (Round Metallic, 3pin terminal)

4) **IC chip**

Op Amp - uA741, 8-pin – 2 pcs

Instrumentation Amp, AD625, 16-pin – 1 pc

5) **Plethysmograph,** PPG 1020FC – 1 set (Signal, Ground, 7.5V)

6) **Arduino Uno R3** with USB cable – 1 set

## 1b)   Some component cost :-

| S/N	Description	Qty	Unit Price (SGD)
1.	*Black customized Bag with Strap*	1	38.00
2.	*Project Breadboard GL 36*	1	34.00
3.	*Goot YS-2 Wire stripper cum cutter*	1	18.90
4.	*Goot YPS-2 long nose plier*	1	16.00
5.	*IC Extractor*	1	5.00
6.	*Screw driver (-)*	1	2.50
7.	*Power Supply cable, Pair*	2	10.00
8.	*Plethysmograph 1020 FC (ver 1 or 2)*	1	483.00
9.	*Arduino UnoR3 board with USB cable (A to B)*	1	30.00
10.	*LM741 8pin DIL ic chip*	2	2.80
11.	*AD625JNZ, 16 pin DIL ic chip*	1	37.35
12.	*Bag of components (resistors, capacitors, trimmer, Potentiometer)*	1lot	15.00

1c)   Pulse Plethysmograph Model 1020FC
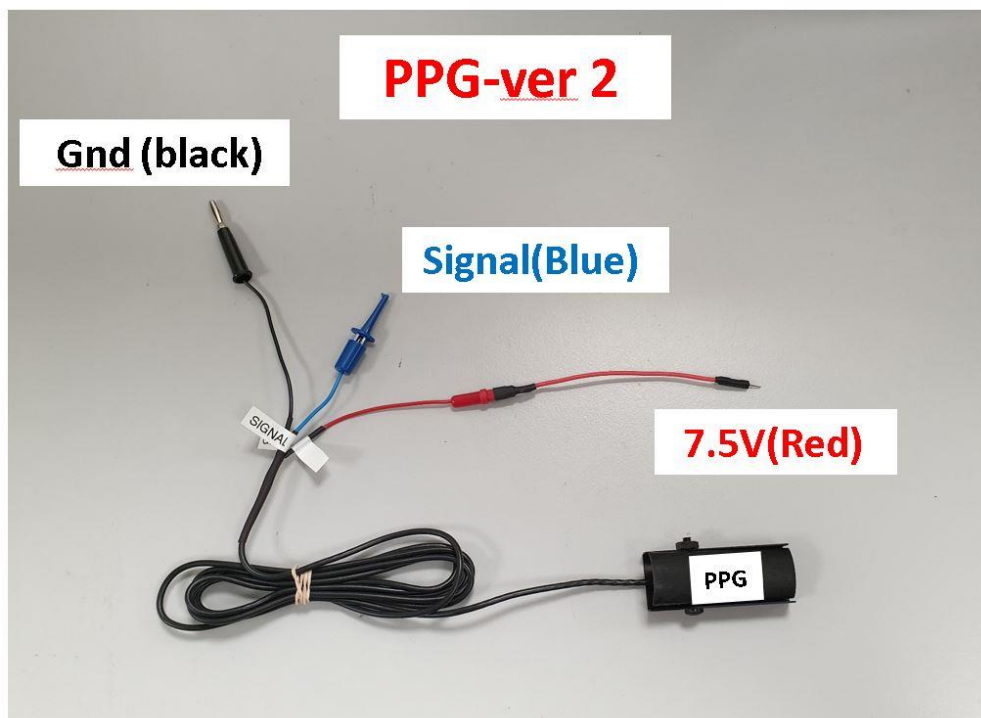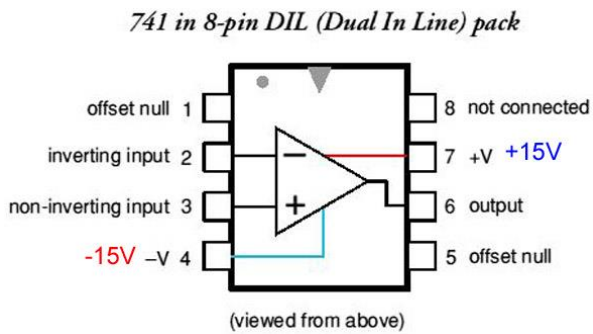

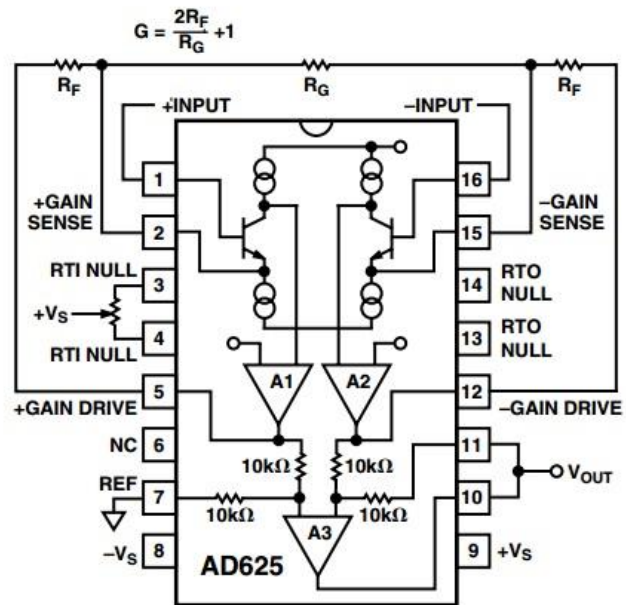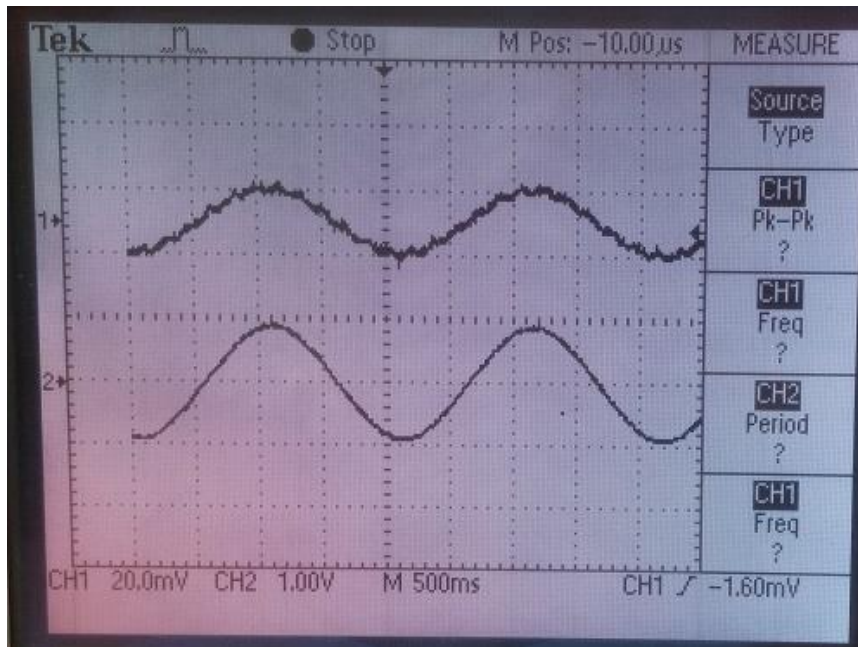## 2.   AD625 Circuit connection
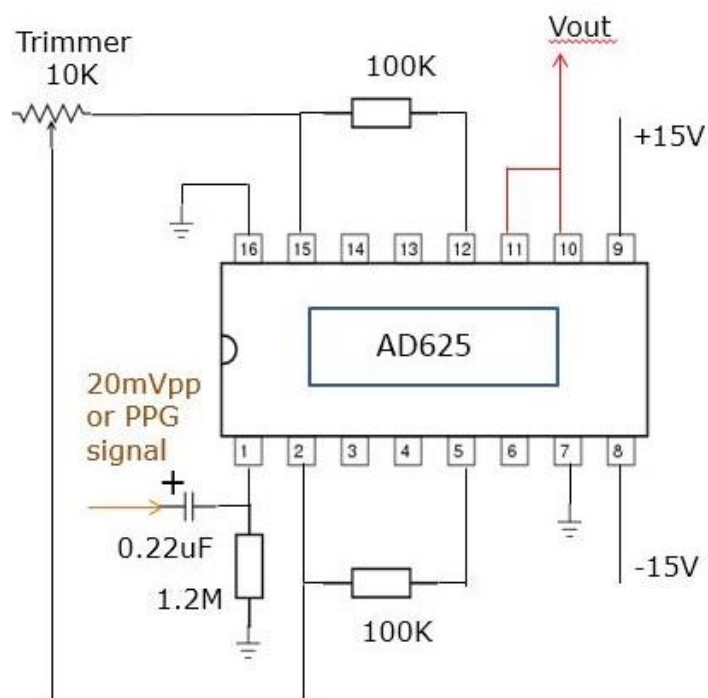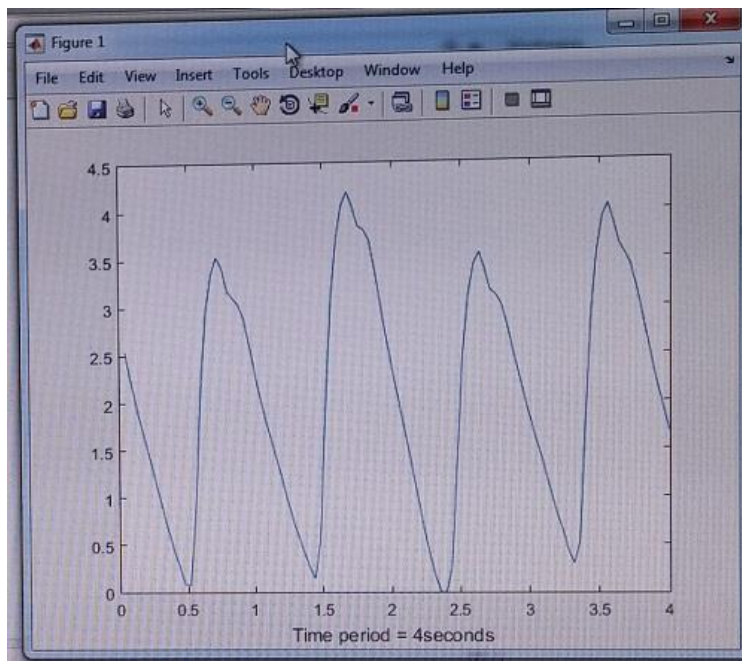

Fig 1: AD 625 circuit

**Note: You do not have to connect all 3 legs of the trimmer 10 K ohm, just left or right leg and the center leg.

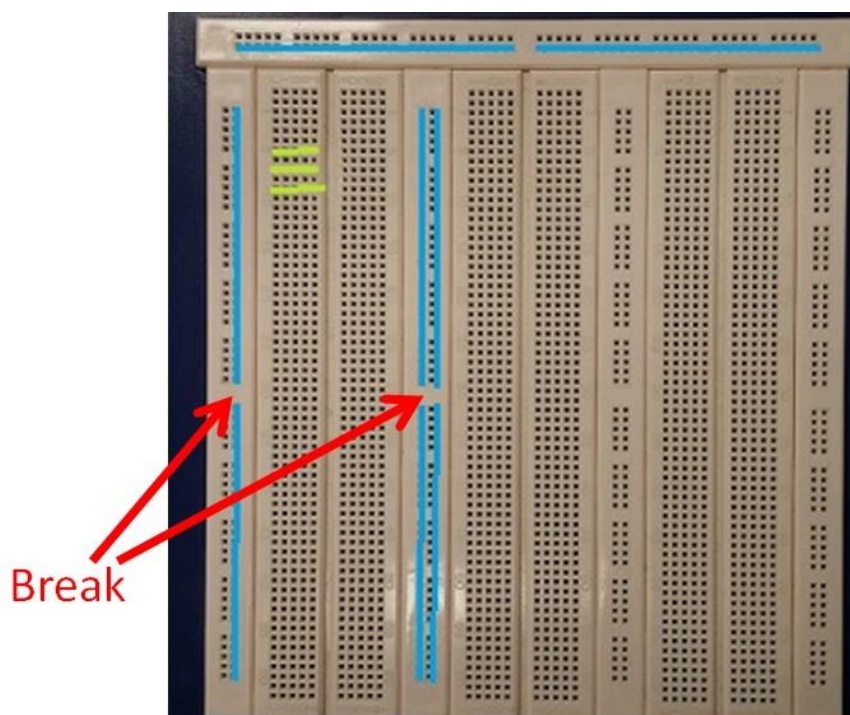**0.22uF tantalum capacitor has polarity, +ve terminal is indicated.**
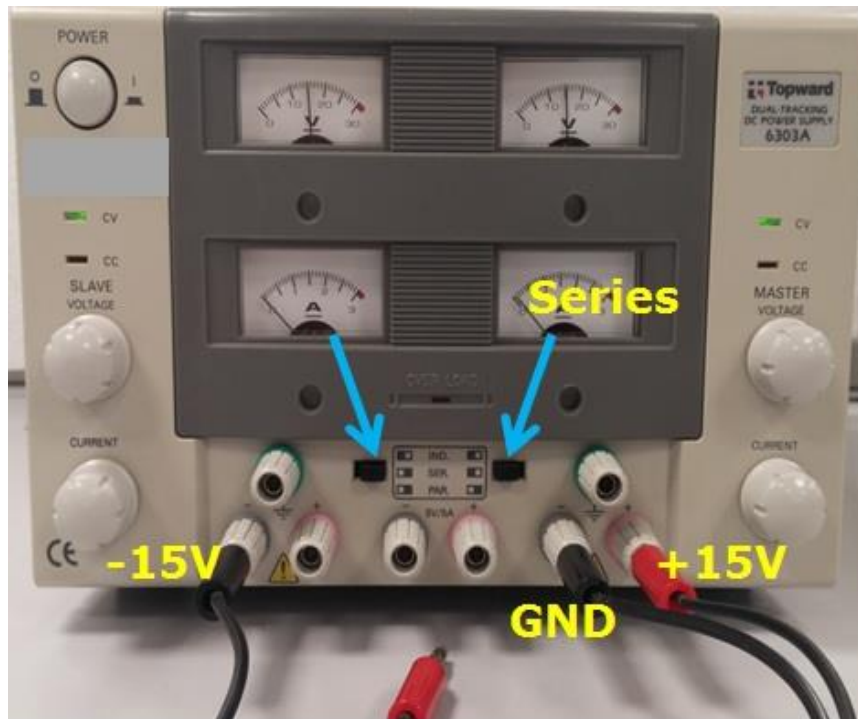
Fig 2. Power Supply Connection

$$G = \frac{2R_F}{R_G} + 1$$

Fig 3a. Op amp 741 pins layout   **Fig. 3b AD625 IC chip**

Fig 4a. Simulated output viewed in Oscilloscope

Fig 4b. Waveform displayed on Matlab program (from Arduino, Offset adjusted)
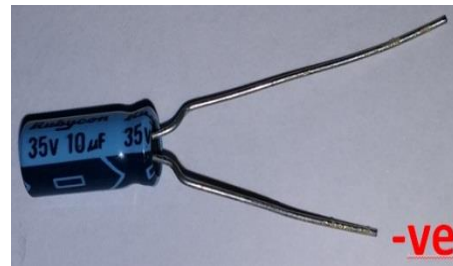

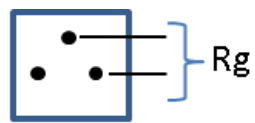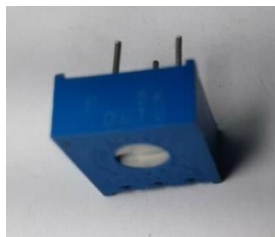**Fig 5a. Connections in the breadboard**   **Fig 5b. Internal pins of breadboard**

Fig.6 Tantalum capacitor(0.22uF)   **Fig. 7 Electrolytic Capacitor (10uF)**
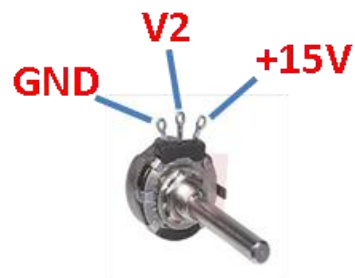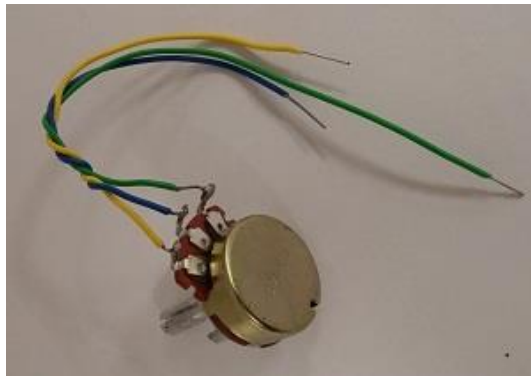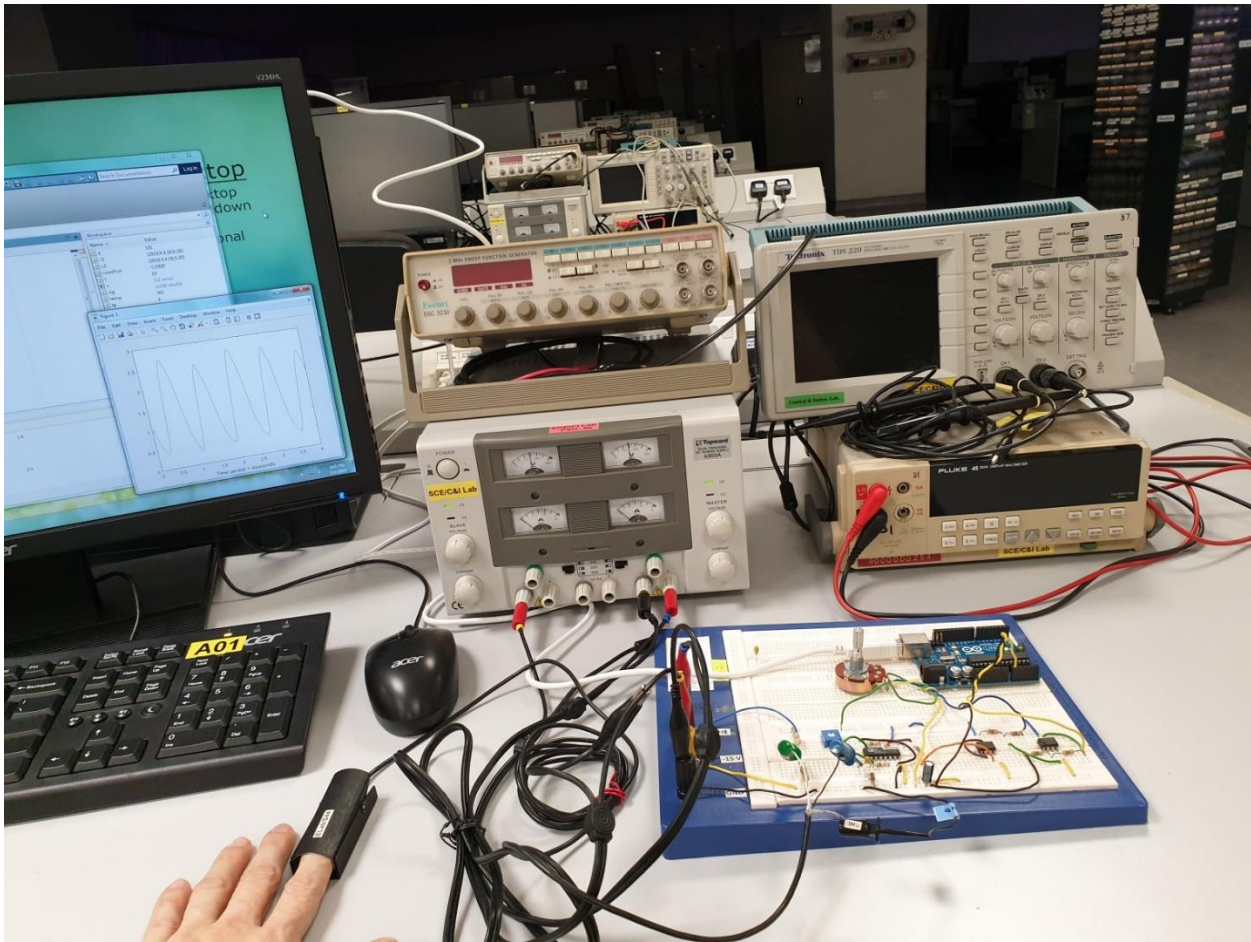

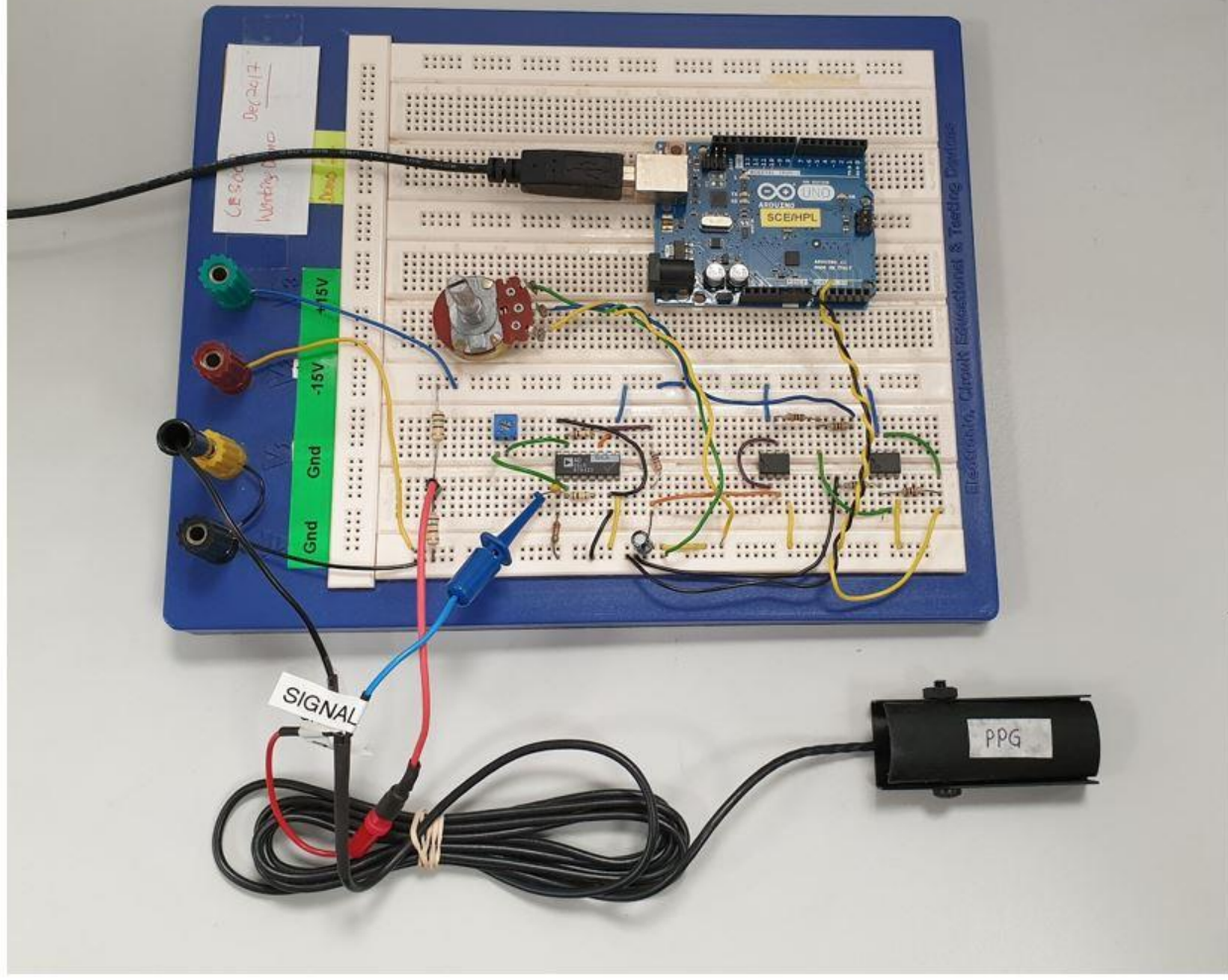**Fig. 8   Trimmer (10K ohm)   and   connections**

Fig. 9 Potentiometer   and   connections

Fig.10 Completed circuit and Screen capture of the signal

Fig.10-b Completed circuit with PPG-Ver2

3.   Software procedures

Arduino Uno R3

1)Open program in Arduino environment

2)Load program Analog1.ino

3)Let Arduino board detect the serial com port

4)Check serial com port number

5)Click 'Compile'

6)Click 'Verify'

7)Connect A0 and Gnd to Plethysmograph(PPG) circuit

Matlab with Arduino addon(in HW3 and HPL labs only)

1)Run Matlab2019b

2)Load the analog.m

3)Edit : comPort='Com5'; to the correct value of 5 or others

4)Place finger in PPG 1020FC

5)Cick 'Run'

6)Wait a few seconds for graph to appear

Troubleshoot the PPG 1012FC circuit

1) Check voltage supplies to AD625 pin8(-15V) and pin9(+15V),

   IC741 pin4(-15V) and pin7(+15V)

2) Estimate 2.02k ohm for Rg

3) Negative terminal of 0.22uF connected to pin1 of AD625

4) AD625 pin16 shorted to pin7

5) If signal output is about 2V then circuit wiring and components are working well.

6) For signal with Finger in PPG 1020FC –

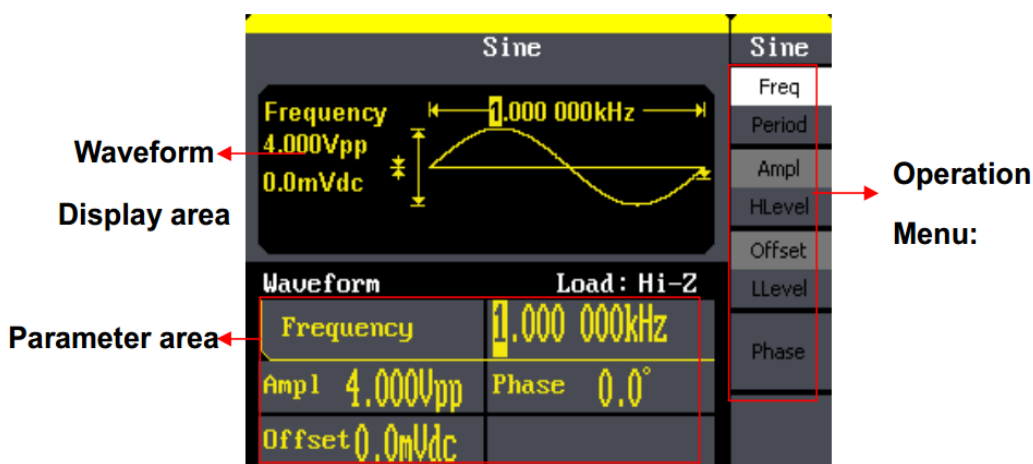a) Let power in the circuit warm up by 5 minutes.

b) Ensure AD625 circuit has short wiring

c) AD625 pins 7 and 16 shorted

d) Change 0.22uF to 1 uF if the PPG signal is too weak

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4.   To obtain a waveform of 500 mHz at 40mVpp from Function Generator SDG800
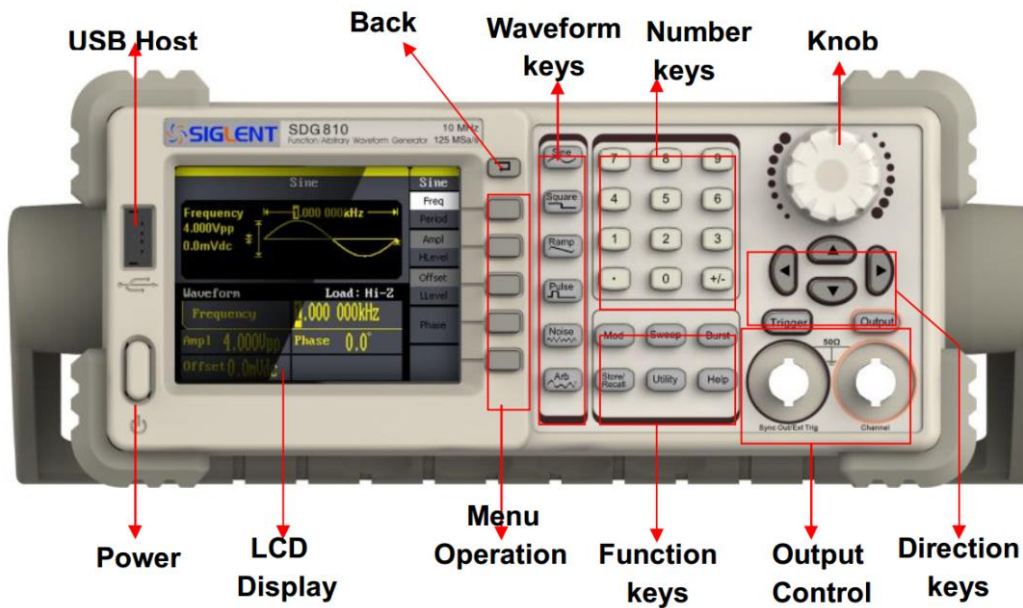
1) Press "Sine" button.
2) Press "Freq" button in Menu Operation (lighted up means selected).
3) Key in ".5" on the Number Keys and "Hz" (i.e. 0.5 Hz).
4) Select "Ampl" button.
5) Key in "40" and select "mVpp" (40mVpp signal).
6) Press "Offset" to 0.00mVdc.
7) Leave Phase to 0.0 deg.
8) Waveform of Sine wave 0.5 Hz at 40mVpp is achieved.
9) Press "Output" button to see a signal on the Oscilloscope [Connect to oscilloscope and select Chan1=20.0mV (Volts/Div scale), and time scale to 500ms(sec/Div)].

Output waveform of 0.5Hz, 20mVpp