NEGATIVE FEEDBACK

OBJECTIVES

After performing this experiment, you will be able to:

1) Observe the reduction in waveform distortion due to the application of negative feedback.
2) Measure the reduction in gain due to the application of negative feedback
3) Measure the effect on input and output impedance due to the application of negative feedback.

REFERENCE READING

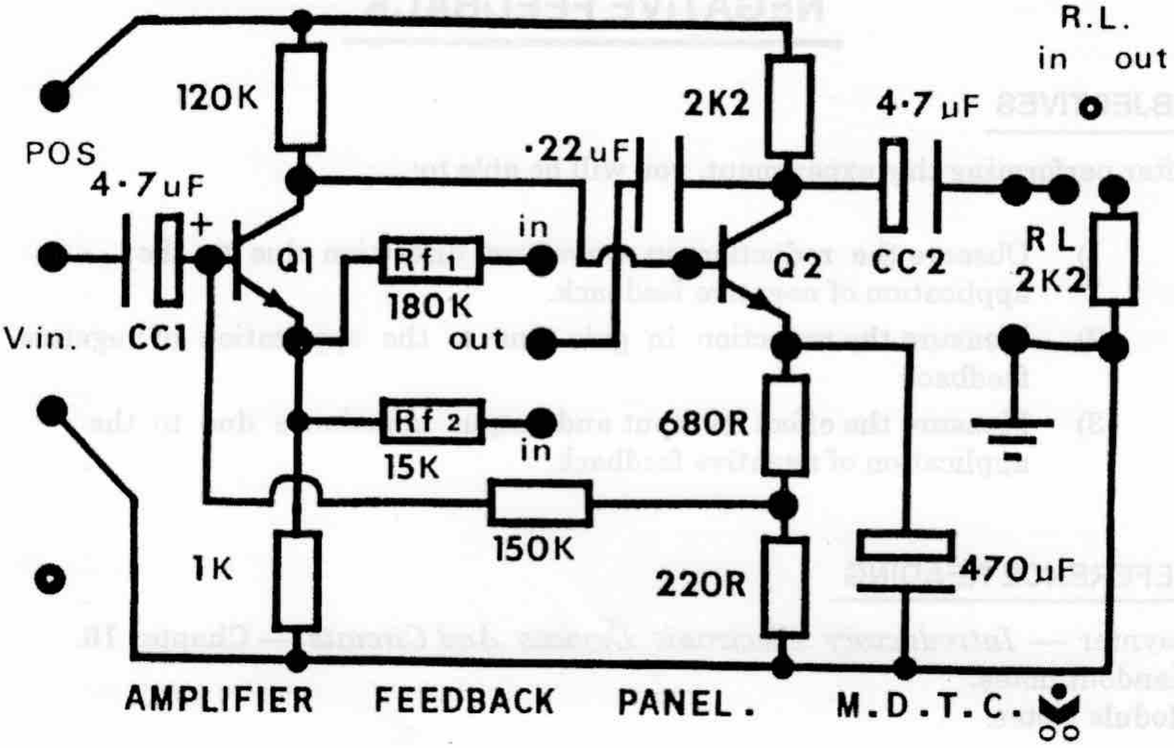
Paynter — *Introductory Electronic Devices And Circuits* — Chapter 16.
Handout notes.
Module Notes.

SUMMARY OF THEORY

Negative feedback is produced by feeding a portion of an amplifier's output back to the input in opposition to the input signal. The result is stabilised gain, extended bandwidth, reduced noise and distortion and modified input and output impedances.

MATERIALS REQUIRED

1 Motherboard.
1 Negative feedback amplifier panel.
1 Function generator.
1 CR0 and leads.
1 10k Resistor.
3 4mm/4mm leads (short).



Circuit for Laboratory.

PROCEDURE

1) Prepare the feedback amplifier panel. Set the positive supply to +18V. Set the load resistor R_L to OUT and the feedback switch to OUT.

2) Set the function generator to a frequency of 1kHz and apply to the input of the amplifier. Monitor the input and output of the amplifier and set the input amplitude to achieve 6Vp-p at the output terminal. Measure/record the input amplitude.

   $V_{(in)}$ = ____________

3) From the measured results, calculate the voltage gain of the amplifier and record.

   A_v = ____________________

4) Check that the output amplitude is still 6Vp-p and record this value as V_{o1}.

   V_{o1} = __________________

5) Monitor the output and switch the value of R_L into circuit. Measure the output amplitude and record this value as:

   V_{o2} = ___________________

6) Calculate the output impedance (Z_o) by:

$$Z_0 = R_L \times \frac{(V_{o1} - V_{o2})}{V_{o2}} = \_\_\_\_\_\_\_\_\_\_$$

7) Remove R_L from circuit and check the output is still 6Vp-p and record this value as:

V_{o1} = ______________

8) Keep the input amplitude constant and place the 10k resistor in series with the input terminals of the amplifier. Measure and record the output voltage as:

V_{o2} = ______________

9) Calculate the input impedance (Z_i) by:

$$Zi = 10k \times \frac{V_{o2}}{(V_{o1} - V_{o2})} = \_\_\_\_\_\_\_\_\_\_$$

10) Remove the 10k resistor and set the input signal to achieve an output amplitude of 8Vp-p (Full CR0 screen) at 1KHz sinewave.

11) Keeping the input at a constant amplitude, change the input FREQUENCY downwards until the output falls to the -3dB value. Record this frequency as:

f_1 = ______________

12) Change the frequency upwards until the output again falls to the -3dB point and record this frequency as:

f_2 = ______________

13) Reset the frequency to 1kHz and set the feedback switch UP to select the 180k R_{f1}. Repeat steps 2 to 12 inclusive and record the results in the spaces provided.

QUANTITY	RESULT	QUANTITY	RESULT
$V_{(out)}$		$V_{(in)}$	
A_v			
V_{o1}		V_{o2}	
Z_o			
V_{o1}		V_{o2}	
Z_i			
f_1		f_2	

14) Reset the feedback switch so that R_{f1} = 15k, and repeat steps 2 to 12 inclusive. Record the results in the spaces provided.

QUANTITY	RESULT	QUANTITY	RESULT
$V_{(out)}$		$V_{(in)}$	
A_v			
V_{o1}		V_{o2}	
Z_o			
V_{o1}		V_{o2}	
Z_i			
f_1		f_2	

REVIEW QUESTIONS

Q.1 Compare the results of steps 2 to 12 with steps 13 & 14 for input and output impedance. State why the results were obtained.

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Q.2 With the aid of a sketch, briefly describe the reasons for the change of bandwidth experienced in steps 13 & 14.

Q.3 Using the approximation $\mathbf{A_v} = \frac{\mathbf{1}}{\mathbf{B}}$, estimate the gain of the circuit from steps 13 & 14.

$A_{v(step13)}$ = ______________

$A_{v(step14)}$ = ______________