

Indiana University – Purdue University Fort Wayne
Opus: Research & Creativity at IPFW

Computer and Electrical Engineering Technology &
Information Systems and Technology Senior Design
Projects

School of Engineering, Technology and Computer
Science Design Projects

12-1-1977

An Inexpensive Audio Equalizer

David W. Engel

Indiana University - Purdue University Fort Wayne

Follow this and additional works at: http://opus.ipfw.edu/etcs_seniorproj



Part of the [Computer Sciences Commons](#), and the [Engineering Commons](#)

Opus Citation

David W. Engel (1977). An Inexpensive Audio Equalizer.
http://opus.ipfw.edu/etcs_seniorproj/249

This Senior Design Project is brought to you for free and open access by the School of Engineering, Technology and Computer Science Design Projects at Opus: Research & Creativity at IPFW. It has been accepted for inclusion in Computer and Electrical Engineering Technology & Information Systems and Technology Senior Design Projects by an authorized administrator of Opus: Research & Creativity at IPFW. For more information, please contact admin@lib.ipfw.edu.

AN INEXPENSIVE AUDIO EQUALIZER

BY

David W. Engel

Advisor: Professor Nordlin
December 1, 1977

TABLE OF CONTENTS

	Page
1.0 Introduction	1
2.0 Text Interpretation	1
2.1 Gain	2
2.2 Ideal Operational Amplifier	2
2.3 Reference Designations	2
3.0 General Considerations and Conditions	2
3.1 Cost	2
3.2 Gain	2
3.3 Frequency Response	3
3.4 Input and Output Impedance	3
3.5 Integrated Circuit	4
4.0 Theory of Operation for the Unity Gain Amplifier	5
4.1 The Circuit	5
4.2 Circuit Equations	5
4.3 Linearity	6
4.4 Reciprocity	6
4.5 Resistor Values	7
4.6 Capacitor Values	8
5.0 Theory of Operation for Equalizer	10
5.1 The Circuit	10
5.2 Amplifier Equations	11
5.3 Simulated Inductor Equations	14

	Page
5.4 Resistor Values for the Amplifier	16
5.5 The Effects of Impedance on the Circuit	17
5.6 Determining Filter Q	18
5.7 Determining Filter Values	20
5.8 Determining Capacitor Values	21
6.0 The Input and Output Circuits	23
6.1 The Circuits	23
6.2 The Determining Capacitor Values	23
6.3 Determining Resistor Values	24
7.0 The Power Supply	25
7.1 The Circuit	25
7.2 Filter Capacitor Values	25
7.3 Determining Resistor Values	26
7.4 Miscellaneous	27
8.0 Bypass Switching	28
9.0 Design Modifications and Additions	29
9.1 Additions	29
9.2 Modifications	29
9.3 Parts List Changes	29
10.0 Specifications	31
11.0 Evaluation and Recommendations	35
11.1 Overall Performance	35
11.2 Noise	35
11.3 The Internal Resistance of the Simulated Inductor	36
12.0 Concluding Remarks	37
12.1 Potential	37

	Page
12.2 Price and Lead Time	37
12.3 Acknowledgements	37

APPENDIX

A. Schematic	38
B. Parts List and Price Breakdown	40
C. Printed Circuit Layouts	44
D. Integrated Circuit Specification Sheets	48
E. References	55

LIST OF TABLES

	Page
1. Linearity Data	7a
2. Perceived Resistance	17a
3. Equalizer's Linearity Data	17b
4. Data on the Effects of Z1 on H	18a
5. Data for Series Filters	20

LIST OF ILLUSTRATIONS

1. With and Without Equalization	1a
2. Unity Gain Amplifier	5
3. Linear Approximation	6a
4. Linearity	7b
5. Equalizer	10
6. Equivalent Amplifier	11
7. Nodal Equivalent Circuit	12
8. Circuit for Realization of Inductance	14
9. Active Inductor and Passive Equivalent	16
10. Perceived Resistance vs. Gain	17c
11. Linearity	17d
12. Gain vs. Filter Impedance	18b
13. Frequency vs. Gain	21a
14. The Input and Output Circuits	23
15. The Power Supply Circuit	25
16. Switching Arrangement	28