

**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

---

4-20-1984

# An Electrophysiological D.C. Voltage to Sound Converter

Timothy D. Zeser

*Indiana University - Purdue University Fort Wayne*

Follow this and additional works at: [http://opus.ipfw.edu/etcs\\_seniorproj](http://opus.ipfw.edu/etcs_seniorproj)



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

---

## Opus Citation

Timothy D. Zeser (1984). An Electrophysiological D.C. Voltage to Sound Converter.  
[http://opus.ipfw.edu/etcs\\_seniorproj/486](http://opus.ipfw.edu/etcs_seniorproj/486)

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](mailto:admin@lib.ipfw.edu).

# **SENIOR DESIGN**

## **TECHNICAL REPORT**

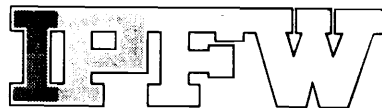
AN ELECTROPHYSIOLOGICAL D.C. VOLTAGE TO SOUND CONVERTER

title

in partial fulfillment of the requirements

for the degree of

### **BACHELOR OF SCIENCE**



presented to the

**ELECTRICAL ENGINEERING TECHNOLOGY FACULTY**

**INDIANA UNIVERSITY-PURDUE UNIVERSITY AT FORT WAYNE**

APRIL 20, 1984

date

by

TIMOTHY D. ZESER

GRADE: \_\_\_\_\_

APPROVED: \_\_\_\_\_

## TABLE OF CONTENTS

	<u>Page</u>
Acknowledgements . . . . .	ii
List of Illustrations . . . . .	iv
Abstract . . . . .	v
Introduction . . . . .	1
Background . . . . .	1
Statement of Problem . . . . .	1
Solution . . . . .	1
Purpose . . . . .	2
Methods . . . . .	3
Plan of Procedure . . . . .	3
Overview of Design . . . . .	4
General Description of System . . . . .	4
Hardware System . . . . .	5
Software System Interaction . . . . .	5
Potential Voltage of a Cell Membrane . . . . .	8
Membrane Potentials Defined . . . . .	8
Electrical and Chemical Properties of a Resting Cell . . . . .	9
Diffusion Potentials . . . . .	10
Equilibrium Potentials . . . . .	12
Input Stages . . . . .	13
Power Supply and Regulators . . . . .	13
Input Network . . . . .	15
Analog to Digital Converter . . . . .	16
Reference Circuitry . . . . .	18
Output Stages . . . . .	19
Microprocessor . . . . .	19
Voice Synthesizer . . . . .	21
Output Filter Network . . . . .	25
Amplifier, Volume Control and Speaker . . . . .	28
Conclusion . . . . .	29
Summary . . . . .	29
Future Additions . . . . .	30
References . . . . .	31
Appendix A - Look Up Table . . . . .	32
Appendix B - Software Listing . . . . .	35
Appendix C - Digital and Hex Code for Each Millivolt . . . . .	38
Apeendix D - Components Listing . . . . .	41

## LIST OF ILLUSTRATIONS

	<u>Page</u>
1. Design project on P.C boards . . . . .	4
2. Block diagram of millivoltmeter . . . . .	6
3. Flow chart of software . . . . .	7
4. Electric force of attraction . . . . .	9
5. Extracellular and intracellular experiment . . . . .	10
6. Diffusion potential . . . . .	11
7. Equilibrium potential . . . . .	13
8. Power supply schematic . . . . .	14
9. Gain circuit . . . . .	15
10. A/D test circuit . . . . .	18
11. Reference circuit . . . . .	18
12. Maps of memory location . . . . .	21
13. Digitaltalker connections . . . . .	22
14. Digitaltalker vocabulary list . . . . .	23
15. Digitaltalker test circuit . . . . .	25
16. Band pass filter . . . . .	26

Abstract  
of Report on the Design of an  
Electrophysiological D.C. Voltage  
to Sound Converter

by

Timothy D. Zeser

As technology knowledge increases so does the need for technological devices. During an experiment in the Electrophysiological Laboratory, many characteristics of the particular lab assignments must be monitored; therefore, the experimenter must devote his hands and eyes to these criteria. So to be able to monitor the voltage potential across nerve cell membranes without disturbing the operator's other aspects of the lab, I designed the talking millivoltmeter. This device will actually talk to the operator and tell him when the voltage level changes.