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An Investigation Into Frequency Counting

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"AN INVESTIGATION INTO FREQUENCY COUNTING"

Prepared For

Electrical Engineering Technology 499
(Senior Project)

By

Richard R. Weingart
May 14, 1970

ABSTRACT

This report covers the components, circuits, and theory involved with frequency counters. The problems encountered, along with efforts toward solutions are discussed. Frequency range expansion techniques are compared for advantages and disadvantages. The logic of counting is discussed by parts and by assemblies. Included in the report are the experiences encountered in constructing a binary coded decimal frequency counter. A discussion of counter accuracies is also covered.

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DETAILED OUTLINE

- I. Introduction
 - A. Statement of Subject
 - B. Statement of Purpose
 - C. Statement of Plan of Development
- II. Definition of the Problem
- III. Description of Frequency Counters
 - A. Counter Elements
 - B. Totalizing
 - C. Frequency Measurements
 - D. Period Measurements
 - E. Multiple Period Averaging
 - F. Ratio Measurements
 - G. Rate Measurements
 - H. Time Interval Measurements
- IV. Theory of Operation of Digital Counters
 - A. Logic Symbols
 - 1. And
 - 2. Or
 - 3. Not
 - 4. Memory
 - 5. Input Amplifiers
 - 6. Schmidt Triggers

- IV. Continued.
 - B. Basic Frequency Counter
 - 1. Input Amplifier
 - 2. Count Gate...Clock
 - 3. Time Base Generator
 - 4. Gate Binary
 - 5. Display

- V. Inputs-Outputs-Applications
 - A. Inputs
 - B. Outputs
 - C. Three Applications of Reversible Counters
 - D. Synergy with a Computer Counter H.P.5326B
 - E. Tachometer
 - F. Time Interval Measurements

- VI. Project
 - A. Block Diagram
 - B. 1 MHz Clock
 - C. Time Base Frequency Division
 - D. Gate
 - E. Counting Chain
 - F. Readout
 - G. 4-Bit SN7493 I. C.

- VI. Continued.
 - H. Material List and Costs
 - I. Alternatives
 - 1. Costs
 - 2. Frequency Expansion
 - 3. Automation
 - 4. Assembly Techniques
 - 5. Displays

- VII. Frequency Range Improvements
 - A. RCL, DCL, TTL, ECL
 - B. Heterodyning
 - C. Transfer Oscillators
 - D. Prescaling

- VIII. Counter Accuracy
 - A. Trigger Errors
 - B. One Count Ambiguity
 - C. Time Base Stability
 - 1. Long Term
 - 2. Short Term
 - D. Aging
 - E. Line Voltages
 - F. Temperature
 - G. Total Measurements Error

IX.

Conclusions

A. Comments

B. Summary

C. Projections

D. Close

X.

Bibliography