



PROJECT REPORT

"POLISHING PROCESS CONTROL USING  
PROGRAMMABLE CONTROLLERS"

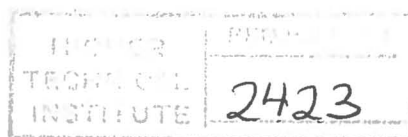
SUBMITTED BY:

ANNIVAS K. CONSTANTINOS

In partial fulfilment of the requirements of the  
award of the Diploma of the Technician Engineer  
in Electrical Engineering of the  
Higher Technical Institute  
CYPRUS

PROJECT SUPERVISOR: Mr. J. Demetriou BSc, MSc  
Lecturer in Electrical  
Engineering, H.T.I.

JUNE - 1995



# CONTENTS

	<u>PAGES</u>
Acknowledgements	2
Summary	3
Introduction	4
 <b><u>CHAPTER 1 (Introduction to PLC)</u></b>	
1.0 Introduction	6-7
1.1 Definition	8
1.2 Terminology - PC or PLC?	9
1.3 Types of PLC system	10
1.4 Background Information	11-13
1.5 Comparison with other control systems	14-15
 <b><u>CHAPTER 2 (System Description and Internal Operation)</u></b>	
2.0 Introduction	18
2.1 Hardware Design Major Sections of a PLC	19
2.2 Central Processing Unit (CPU)	20-23
2.3 Input/Output Units	23-27
2.4 Power Supplies	28-29
2.5 Programming Units	30-31
 <b><u>CHAPTER 3 (Ladder Diagram Language)</u></b>	
3.0 Introduction	35
3.1 Programming Languages in General	35-37
3.2 Ladder Language	37-38
3.3 Programming Symbols/Instructions	38
3.4 Logical Continuity	39
3.5 Memory Organisation and Addressing	39-46
 <b><u>CHAPTER 4 (Basic PLC Functions)</u></b>	
4.0 Introduction	48
4.1 Relay Logic (Bit) Instructions	48-50
4.2 Timer and Counter Instructions	50-54
4.3 Comparison Instructions	54-56
4.4 Compute and Math Instructions	56-57

4.5	Move and Logical Instructions	57
4.6	Bit Shift Instructions	57-58
4.7	Sequencer Instructions	58
4.8	Control Instructions	58-60
4.9	Other Advance Functions	60

#### CHAPTER 5 (Application Case Study)

5.0	Introduction	64
5.1	Program Planning Steps	64-77

#### CHAPTER 6 (Program Analysis)

6.0	Introduction	93
6.1	General Explanation of the program	93-98
6.2	Explanation of program Step by Step	99
6.3	Main File (2)	99-105
6.4	Subroutine File (3)	105-110
6.5	Subroutine File (4)	110-112
6.6	The Control Panel	112

#### CHAPTER 7 (Costing)

7.0	Introduction	114
7.1	Cost Analysis	114
7.2	Selection of the CPU-User Memory	115
7.3	Costing Estimation of the PLC System Used	115
7.4	Comparison with the Convetional Method Costs	116

<u>CONCLUSION</u>	118-119
-------------------	---------

<u>APPENDIX</u>	120-164
-----------------	---------

## PREFACE

In today's competitive world, a company must be efficient, cost-effective and flexible if it wishes to survive. In the manufacturing and process industries, this has resulted in a greatly increased demand for industrial control systems in order to streamline operations in terms of speed, reliability and versatility.

Established control media, including relay, logic and computer systems can and do provide effective control of industrial processes and plant. However, each of the above control media has limitations or disadvantages that may often be overcome through the use of a programmable controller (PC or PLC).

## ACKNOWLEDGEMENTS

I would like to express my appreciation to my project supervisor Mr J. Demetriou, lecturer in Electrical Engineering Department of H.T.I., for its valuable contribution and guidance throughout the preparation of this project.

THANK YOU,

Constantinos Annivas  
3rd year student in  
Electrical Engineering  
Department of H.T.I.

## SUMMARY

TITLE: "Polishing process control by the use of PLCs"

AUTHOR: Constantinos Annivas

The report examines the characteristics and capabilities of programmable controllers (PCs or PLCs) and furthermore investigates the programming capabilities of the "ladder language" to be used, by the development of an application program using the programmable controllers for the control of a polishing process.

Finally the program analysis, costing and comparison with conventional methods are given.

The application program developed is based on the Allen-Bradley SLC 500 programmable controller's instruction techniques and is developed and programmed using the Allen-Bradley SLC 500 PLC provided by the H.T.I.

The unique feature of this report is that it does, not depend on the reader's background knowledge on PLCs. Also the language used is of very simple technical terms with the aid of illustrating diagrams and pictures for making it easier and more pleasant to the reader.

## INTRODUCTION

This project mainly deals with the development of an application program for a polishing process by the use of PLCs.

Therefore, throughout this project, before the program listing and its explanation, an overall description of the PLCs as far as their characteristics, capabilities and programming abilities is given and discussed.

More Analytically, the main body of this project consists of seven chapters.

Chapter 1 is an introduction to PLCs. It explains briefly what is a PLC, gives the historical development of PLCs and finally compares PLCs to other control systems showing its advantages as well as its disadvantages.

Chapter 2 deals with and describes the main sections of a PLC.

Chapter 3 describes briefly the different languages used for programming PLCs and explains and discusses in detail the ladder diagram programming language as it is shown and explained by the Allen-Bradley SLC 500 User's manual.

Chapter 4 describes and discusses the basic PLC functions. More emphasis is given on the functions used in the application case study.

Chapter 5 refers to and explains the actual case study problem, to be tackled and also provides the program listing.

Chapter 6 explains and analyses the program developed step by step.

Chapter 7 shows how the whole PLC system is costed and compares it with the cost of other control systems.

Finally a small conclusion is provided as well as a set of appendices.