

DEVELOPMENT OF A MICROPROCESSOR
IN-CIRCUIT EMULATOR

Project Report

Submitted by KYRIAKIDES ANTONIS

to the

Department of ELECTRICAL ENGINEERING

of the

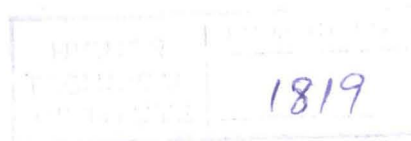
HIGHER TECHNICAL INSTITUTE
NICOSIA CYPRUS

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE AWARD
OF THE DIPLOMA

OF

TECHNICIAN ENGINEER
IN ELECTRICAL ENGINEERING

JUNE 1991



INTRODUCTION

Anyone who designs microprocessor-based systems needs some kind of software-development method to make the hardware do its intended task. Basic requirements are an editor to construct the source code, an assembler to convert this into the microprocessor's native machine code and a means of testing and debugging this code on the target system—an eprom, an eprom emulator or an in-circuit emulator (ICE). In this project a small in-circuit emulator was constructed.

The emulator is connected through an 8255 PPI to the AMSTRAD CPC464 personal computer.

The idea was to construct a stand alone troubleshooting system rather than a system which required a PC and an RS232 to work. The disadvantage of the PC is that first it requires the appropriate software which might not work with every PC and second it is more convenient to carry the ICE to the faulty computer than the opposite.

Although the AMSTRAD computer is a bulky system to carry around, a small and cheap Z80 based microprocessor can be built having an LCD display and a keyboard connected to the emulator through the 8255 peripheral, can do the job perfectly.

CONTENTS

INTRODUCTION 1

CHAPTER 1 WHAT IS IN-CIRCUIT EMULATION

1.1 The In-Circuit Emulator 3

1.2 Features of commercial In-circuit Emulators 8

1.3 Debugging Tools 9

CHAPTER 2 VARIOUS METHODS OF MICROPROCESSOR FAULT FINDING TECHNIQUES

2.1 Logic Analyzer 12

2.2 Signature Analyzer 14

2.3 Self-Test Programs (Diagnostic Software) ... 15

CHAPTER 3 CONSTRUCTION OF AN I.C.E.S

3.1 Description of the Constructed Emulator ... 18

3.1.1 How the addressing of memory and I/O works 18

3.1.2 Bit Assignment - Status Lines 22

3.1.3 Bit Assignment - Control Lines 23

3.1.4 Forcing and Interrupt Lines 24

3.1.5 How the Status line are controled 25

3.1.6 Testing and Troobleshooting of the ICE 26

CHAPTER 4 THE INTERFACE CARD

4.1 Description of the Interface Card 31

4.1.1 The 8255 Programmable Peripheral Interface 33

4.1.2 Control Logic 35

4.1.3 Interfacing the 8255 with the AMSTRAD . 36

4.1.4 Description of Circuit 37

4.1.5 Specifying the Control Word 38

CHAPTER 5 THE Z80A MICROPROCESSOR

5.1 The Z80A Processor 43

CONCLUSIONS	51
REFERENCES	52
APPENDIX A	BLOCK DIAGRAM OF THE CONSTRUCTED EMULATOR
APPENDIX B	SPECIFICATION OF CONSTRUCTED UNIT
APPENDIX C	I.C.E OPERATING SYSTEM
APPENDIX D	Z80A CPU TECHNICAL SPECIFICATIONS
APPENDIX E	BLOCK DIAGRAM OF THE FLUKE 9010A EMULATOR
APPENDIX F	MANUFACTURERS' SPECIFICATION SHEETS