



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Control of X-Y Table Using Siemens PLC

**Thesis submitted in accordance with the requirements of Universiti Teknikal
Malaysia Melaka for the Bachelor of Manufacturing Engineering (Robotic &
Automation)**

By

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Faculty of Manufacturing Engineering

May 2007



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

BORANG PENGESAHAN STATUS TESIS*

JUDUL: CONTROL OF X-Y TABLE USING SIEMENS PLC

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APPROVAL

This thesis submitted to the senate of UTeM and has been accepted as partial fulfillment of the requirements for the degree of Bachelor of Manufacturing Engineering (Robotic & Automation). The member of the supervisory committee are as follow:

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ABSTRACT

Programmable logic control (PLC) is the most common automation controller that being used in industry. It is universally applied for factory automation, process control and manufacturing systems. The system is originated from the creation of computerized versions of relay control systems which is used to control machines. There are several types or models PLC used. Ladder logic is a program method which is used to allow the sequences of logical actions to be set up, inter-linked and timed. This project being use SIMATIC S7 as a medium controller for controlling XY table education training kit. The program will be developing to control positioning axis and functioning switch and buttoning XY table. Ladder diagram (LD) and function block diagram (FBD) are chosen as program languages. There are four phase methodology of rapid application development (RAD) is applied and will be more presses and absorbed in the methodology flow chart program to ensure the objectives are achieved. The appropriate instruction control programming of XY table will be recommended as result, then several suggestion will be recommend from the observation and analysis program developed closely to the project report.

ABSTRAK

Kebiasaannya, aktiviti perindustrian menggunakan *kawalan logik program* atau **programmable logic control (PLC)** bagi kaedah pengawalan sistem berautomasi seperti sistem pemrosesan dan pembuatan. Perihal permulaan sistem logik merupakan ciptaan daripada *versi pengganti sistem kawalan pengkomputeran* bagi tujuan pengawalan mesin. Terdapat pelbagai model *kawalan logik program* digunakan. *Tangga turutan logik* atau **Ladder logic** merupakan kaedah aturan program bagi membenarkan rangkaian tindakan logik dalam pembinaan struktur program, perhubungan dalaman, dan pemasaan. Dalam melaksanakan latihan ilmiah ini, *Kawalan logic program SIMATIC S7* digunakan sebagai medium kawalan perlaksanaan *peralatan latihan pembelajaran XY table*. Program yang akan dibina berfungsi sebagai pengawalan kedudukan paksi dan butang XY table. **Ladder diagram (LD)** dan **function block diagram (FBD)** antara dua pilihan perantaraan bahasa program. Terdapat empat fasa utama pembinaan program ditekankan melalui kaedah metodologi, *ketangkasan aplikasi pembangunan* atau **rapid application development (RAD)** bagi memastikan pencapaian objektif. Proses program kawalan XY table akan dibentangkan sebagai keputusan, seterusnya penyusunan cadangan daripada pemerhatian dan analisis program mengakhiri laporan latihan ilmiah ini.

DEDICATION

For my beloved family and friends.

ACKNOWLEDGEMENTS

First and foremost I would like to express my sincere gratitude and appreciation to my supervisor, En. Azrul Azwan b. Abdul Rahman who provided me a lot of ideas on how to do and success in this final year project. As a principle lecturer at Universiti Teknikal Malaysia Melaka (UTeM), he has relentlessly showed his supports and intelligence in helping me to solve my problems during this project is under construction.

Then, not forgetting Pn. Aidawatty who had enthusiastic support of the report revision. With her help and guidance I'm able to gain better understanding about the project structure.

I would like to express the profound gratitude to my beloved family for incessant love and support in undergoing graduate study. They have contributed a lot by their continuous encouragement and understanding that made this research work possible.

Finally, I'm also happy to present my gratefully acknowledge to anybody who have helped directly or indirectly in writing this report for their contribution in guidance me finished this report.

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LIST OF ABBREVIATIONS, SYMBOLS, SPECIALIZED NOMENCLATURE

AC	-	Alternating Current
ALU	-	Arithmetic and Logic Unit
BCD	-	Binary Coded Decimal
C	-	Function
CNC	-	Control Numerical Controller
CP	-	Continuous Path System
CPU	-	Central Processing Unit
CTD	-	Down Counter
CTU	-	Up Counter
CTUD	-	Up/Down Counter
DC	-	Direct Current
EPROM	-	Erasable and Programmable Read-Only-Memory
FBD	-	Function Block Diagram
FC	-	Function
FC1	-	Start Condition Function
FC10	-	Step Chain Function,
FC3	-	Counter Function
FC90	-	Output Wire Function
I	-	Input,
IL	-	Instruction List
ILS	-	Incremental Linear Scales
LD	-	Ladder Diagram
M	-	Memory
mA	-	mili Ampere
MCU	-	Machine Control Unit

MW	-	Memory Word.
NC	-	Normally Closed
NC	-	Numerical Control
NO	-	Normally Open
OB	-	Organization Block
PC	-	Personal Computer
PID	-	Proportional Integral Derivative
PL1	-	Pilot Light
PLC	-	Programmable Logic Control
PTP	-	Point to Point System
Q	-	Output,
RAD	-	Rapid Application Development
RAM	-	Random Access Memory
RIE	-	Rotary Incremental Encoder
ROM	-	Read Only Memory
S1	-	Switch
S7	-	SIMATIS Step 7
SFC	-	Sequential Function Chart
ST	-	Statement List
TR1	-	Timer

CHAPTER 1

INTRODUCTION

There are various types of XY table being used in machine technology. The apparatus is applied in positioning element mechanism of lathe, milling and other machine. The most was applied in control numerical controller (CNC) machining center. The XY table is use for moves to work of marking, cutting, drilling and others. The named of XY table is because of the prime activity X and Y axis. Then, there is also Z axis which is for the vertical axis.

The XY table that used on the project is a just an education training kit and located to the manufacturing engineering laboratory. There is no any automated controller have been explore on it. This (manually operate) makes more weakness in controlling performance of positioning. The suitable controller with familiar and popular in the productivity industry, PLC is used as a medium improvement the system.

The program being developing to controlling the movement XY table with functioning the buttoning with consider the bulbs and the safety regulation, then positioning the axis to the point that make with functioning the magnet to pick and place an object.

PLC offer five medium language but there are only three in Siemens PLC and the project will done two from it. There are ladder and functional block diagram. The education training kit of XY table is installing to the program software and connected to

the brain module PLC called central processing unit (CPU) which is analyzing the program setup.

A PLC is a computer, having connection to external input and output. The program of a PLC has the task to set the output, depending on the input and the program. PLC diagram is performing by Boolean logic gates which are work on the equal logic equation.

The sequences of PLC working is an input accepts a variety of digital or analog signals from various field devices and converts them into a logic signal that can be used by the CPU. While the CPU responsible to make the decisions and executes control instructions based on program instructions in memory. Output modules convert control instructions from the CPU into a digital or analog signal that can be used to control various field devices for example actuators.

A program device is used to input the desired instructions. These instructions will determine what the PLC will do for a specific input. The conventional relay/ contractor control system perform all controlling processes at the same time. The program sequence is executed step by step and is repeated cyclically.

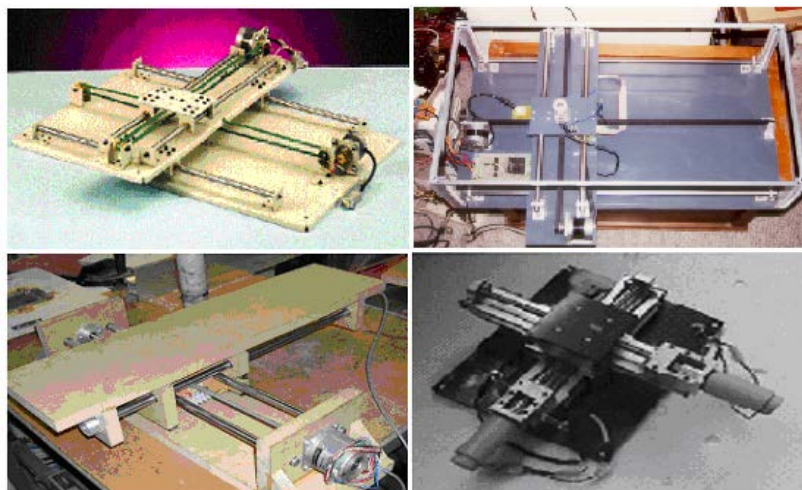


Figure 1.1: The Various Type of XY Table

1.1 Problem Statements

The trend toward automation of production equipment is putting great demands on people since the early of 1970s. The manufacturers have worked to increase productivity, capability, reliability, and flexibility by using technologies. In order to achieve these are making use more and more automation in manufacturing. PLC is one of the solutions.

The positioning element mechanism numerically controlled XY table using manually is quietly popularly. Toward the project, although in just an education training kit its will applies controller system as same as a truly machine. These of developing program considering to the precaution rule as same in the machine production operation.

1.2 Objectives

By according to the title, the objectives of this project are:

- To recommend new program system to control the positioning axis and functioning button of XY table.
- To develop new program to control the positioning axis and functioning button of XY table.

1.3 Scope of Project

The aim of this project is to develop new program that would be control the positioning of axis. At this stage basic there is important to recognize the hall of thing inside. The

scope is consists in three main parts of XY table, PLC and Siemens S7. Below shown the element scope:

XY Table

- Learn the basic operation.
- Investigate the structure of input and output (switches button and components) and their address.

PLC and Siemens PLC

- Analyze the features and identify the components on PLC program.
- Investigate and describe the function of each device such as the counter and relay.
- Study ladder diagram and function block diagram program structure and learn how to program then minimize the program language to be a simple network program.
- Investigate the address uses and develop new program regarding to both mode control.
- Develop the new program which positioning the axis with magnet pick and place an object to the point making.

1.4 Project Planning

Project planning or methodology is the one thing should give consideration to ensure the project have been done in well condition. There are including the planning on the first and second stage of project.

Table 1.1: Project Planning for PSM I

No	Activity Weeks	JULY			AUG					SEPT				OCT				
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
1	Proposal proposed (title, objective, scope)									Semester Break								
2	Data collection																	
3	Literature review																	
4	Methodology																	
5	Draft report																	
6	Submit draft to supervisor											1st draft	2nd draft	3rd draft				
7	Presentation preparation																	
8	Presentation																	

Table 1.2: Project Planning for PSM II

No	Activity Weeks	DEC			JAN				FEB			MARCH			APR		
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	PSM I corection								Semester Break								
2	Observation structure CPU, XY table and programming(input/output)																
3	Study the functional components programming																
4	Programming and testing																
5	Result																
6	Discussion																
7	Conclusion and suggestion																
8	Draft report																
9	Submit draft to supervisor											1st draft	2nd draft	3rd draft			
10	Presentation preparation																
11	Presentation																