

## Research Article

# The Applied Research of Full-automatic Computer Food Controlling System Based on PLC

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**Abstract:** This study researched from the introduction of PLC, combined with the characteristic of PLC, it discusses the design of full-automatic computer food controlling system based on PLC. Programmable Logic Controller (PLC) is automation equipment with microprocessor as the key and an electronic system working with figure in working environment. It can be easily interfaced and the programming language is easy to be accepted by engineering technicians. Graphic symbol and means of expression of ladder diagram language is rather close to circuit diagram of relay.

**Keywords:** Food controlling system, programmable logic controller

## INTRODUCTION

Programmable Logic Controller-PLC for short is automatic equipment with microprocessor as the key and an electronic system working with figure in working environment. It uses programmable storage to store the instruct designed by users. And it uses these instructs to realize logical operation, sequential operation, timing, as well as arithmetic operation and it controls various machinery and processes through figures and simulation I/O (Lewis, 2002). In 1987, PLC standard draft issued by International Electrical Committee defined PLC: PLC is an electronic device through digital operation in industrial environment. It adopts storage that can compose program to carry out logical operation, sequential operation; timing, as well as arithmetic operation (Grundas, 2002). It controls various machinery and productive process through digital or analogous input and output. PLC and relative peripheral equipment should be designed according to the condition that they are easy to form an integral whole with industrial control system and extend their functions.

## MATERIALS AND METHODS

### Characteristic of PLC:

**High reliability and antijamming capability:** High reliability is the key performance of electrical control equipment. Because PLC adopts large scale integrated circuit and strict manufacturing technique as well as advanced anti-jamming technique, it has high reliability. For example, F series PLC produced by

Mitsubishi Company has more than 0.3 million hours' average failure-free time. Some use PLC of excessive CPU and have more failure-free working time.

**Complete facilities and functions strong applicability:** PLC has formed products of various scales. They can be used in all kinds of industrial control occasion. Besides logical processing, modern PLC has perfect operational capability and can be used in all digital control fields. In recent years, functional units of PL emerge in large amount, which makes PLC involve in position control, temperature control, CNC and various industrial control. With the enhancement of communication capability and development of human-computer interface, it's easy to use PLC to constitute different control system.

**It's easy to be studied and used and welcomed by engineering technicians:** As common industrial control computer, PLC is industrial control equipment facing industrial and mining enterprises. Using little switching value logical control instruction of PLC can realize the function of circuit. The work of design and construction is small, so it's easy to maintain and remake (Bonfatti *et al.*, 1997).

**Programming language and development environment:** PLC is designed by designers through PLC programmed language according to requirement of control system. According to programmed language standard made by IEC, PLC programmed language includes these five types: LD, IL, FBD, SFC and ST (Van Der Wal, 1998).

Table 1: Resource allocation for PLC (5) program

Data area		Word/position	Function
IR zone	Inputting zone	IR 000 00~IR 000 08	Hall sensor input
		IR 002 03~IR 002 08	
		IR 000 09~IR 000 11	
	Outputting area	IR 002 09~IR 002 11	Photoelectric sensor input
		IR 001 01 ~IR 001 08	
		IR 010 00~IR 013 03	
Working area	IR 020 00 ~IR 025 02	Pressure relay input	
	SR 236 08~SR 236 09	Relay output	
SR zone		AR 010 01	Semi-automatic/manual control intermediate relay
AR zone		TC 001~TC 004	Step action of completion spot
Timer/timer area		TC 030~TC 073	Program loop initialization spot
			Reset action timing
			Mechanical hand movement time range

LD is the most common programmed language. It is similar to relay circuit. Because designers are familiar to relay control, LD is widely welcomed and used by people. The characteristic of it is that it is relative to electric operating schematic diagram, has intuition and allelism; and it is consistent with the original relay control, which is easy to be controlled.

IL is a mnemonic programmed language similar to assembly language. It is formed by operation code and operand. On the condition of no computer, it is proper to use handheld programmer to compile programmed. Meanwhile, IL is correspondent to LD; under PLC software they can be interred conversed.

FBD is a programme language similar to DLC. It adopts functional module to show the function of module. Different function module has different functions.

SFC is designed to satisfy sequential logical control. When programming it divides sequential programme process into step and conversion condition and makes distribution according to the order of functional procedure and acts in order. This is used in large-scale system and occasion with complicated programme relationship.

ST uses structural description to describe programme. It is similar high-level language. In PLC system of large and medium scale, it uses structural text to describe the relationship of variables. It is mainly used in user programme that other programme language hard to realize.

**Development environment of PLC:** PLC of OMRON is designed in CX-Programmer. CX-Programmer is a tool to established text and maintain programme for OMRON, PLC of CS1 series, PLC of CV series and PLC of C series. It is a convenient tool for supporting the correspondence of PLC device and address information, OMRON PLC and network equipment supported by PLC (Canet *et al.*, 2000).

**Resource allocation of PLC:** Firstly it is necessary to accurately calculate resource demand of controlled object according to actual demand so that it can satisfy requirement of controlled object. Therefore, the key of pre-design phase is resource allocation. It includes the allocation of I/O and internal storage. According to actual control state, and considering the characteristic

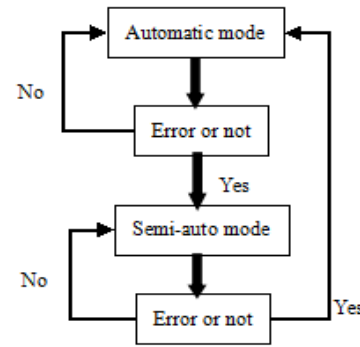


Fig. 1: The process of PLC modules changing

of I/O and internal storage. Take PLC programme as example. The structure is as shown in Table 1.

## RESULTS AND DISCUSSION

### Resource allocation of PLC

**Control mode of PLC:** According to necessary demand of control system, in order to make design debugging convenient, it needs to conduct automatic, semi-automatic and manually operated control operation to all devices. Therefore, PLC needs to change modules respectively as follows in Fig. 1.

**The design full-automatic computer food controlling system based on PLC based on PLC:** Software is the key of control system, which is responsible for control scheduling, data processing, logical operation and status display and parameter storage. It mainly includes PLC program, master control PC program, interface PC program and animation PC program, in which PLC program and master PC program is the most important.

**PLC program design:** PLC program design is mainly responsible for sequential control, data collection, data processing and logical operation in the process of performing action in production line.

**Interior structure and operating principle of PLC:** PLC includes CPU, power module, input/output unit and internal storage; these modules can be combined according some rules, in Fig. 2.

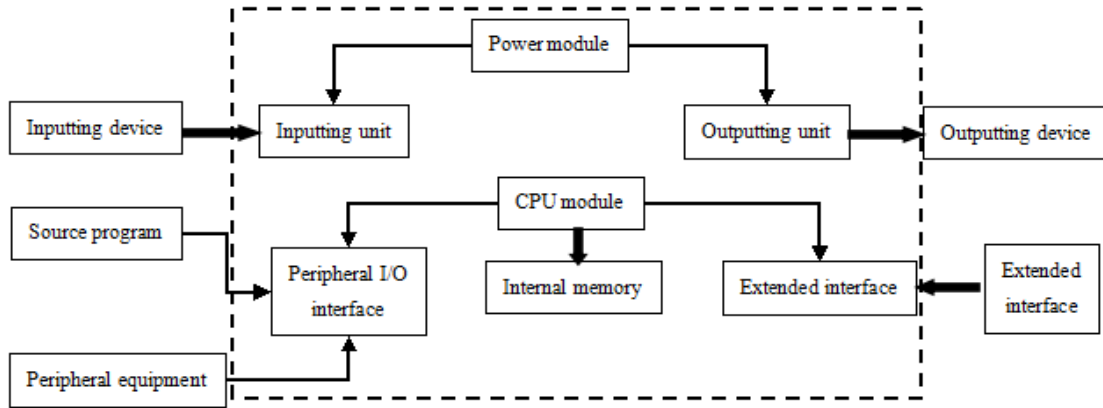


Fig. 2: The internal structure of PLC

**CONCLUSION**

PLC uses storage logic instead of wire logic, which reduces external wire of equipment, shortens period of design and construction of control system and makes the maintenance easier. The most important point is that it makes possible to change procedure and productive process, which is suitable for many productive occasion with multi species and small amount.

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