IPE 301

Measurement, Instrumentation and Control

Programmable Logic Controller

Chapter 1

An Overview

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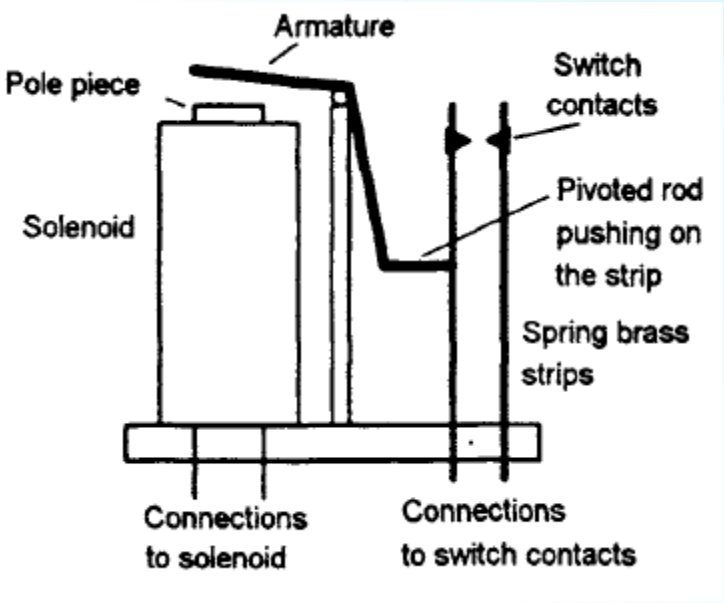
Introduction

- **A programmable logic controller (PLC) is an industrial grade computer that is capable of being programmed to perform control functions.**
- **The programmable controller has eliminated much of the hardwiring associated with conventional relay control circuits.**
- **The programmable logic controller is designed for multiple input and output arrangements, extended temperature ranges, immunity to electrical noise, and resistance to vibration and impact.**

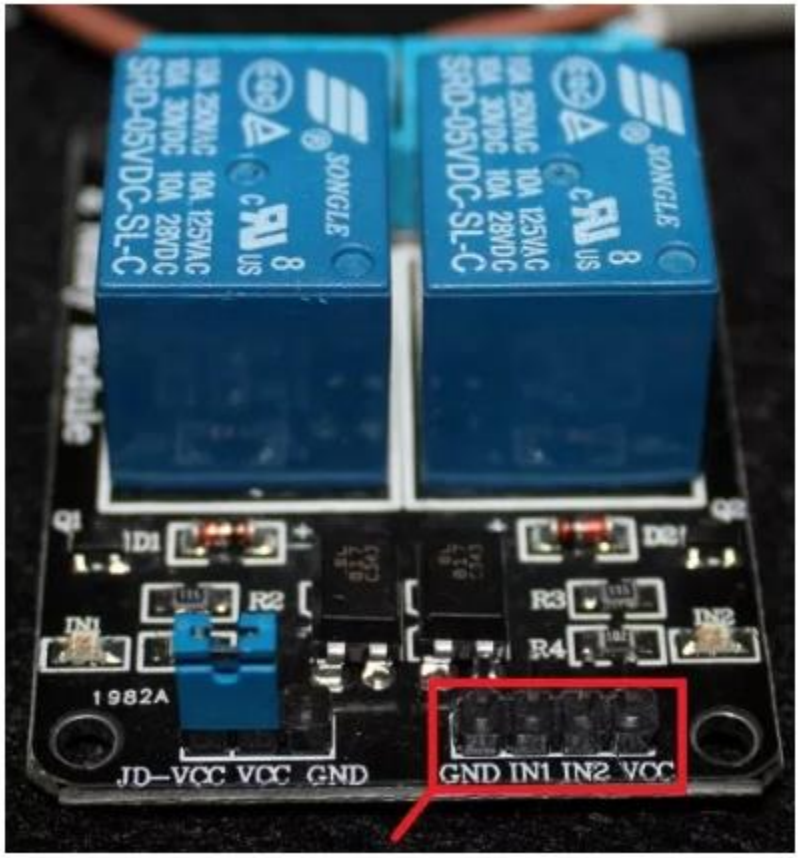
Introduction

- **The programmable logic controller is, then, basically a digital computer designed for use in machine control.**
- **Unlike a personal computer, it has been designed to operate in the industrial environment and is equipped with special input/output interfaces and a control programming language.**
- **Relays have to be hardwired to perform a specific function. When the system requirements change, the relay wiring has to be changed or modified.**

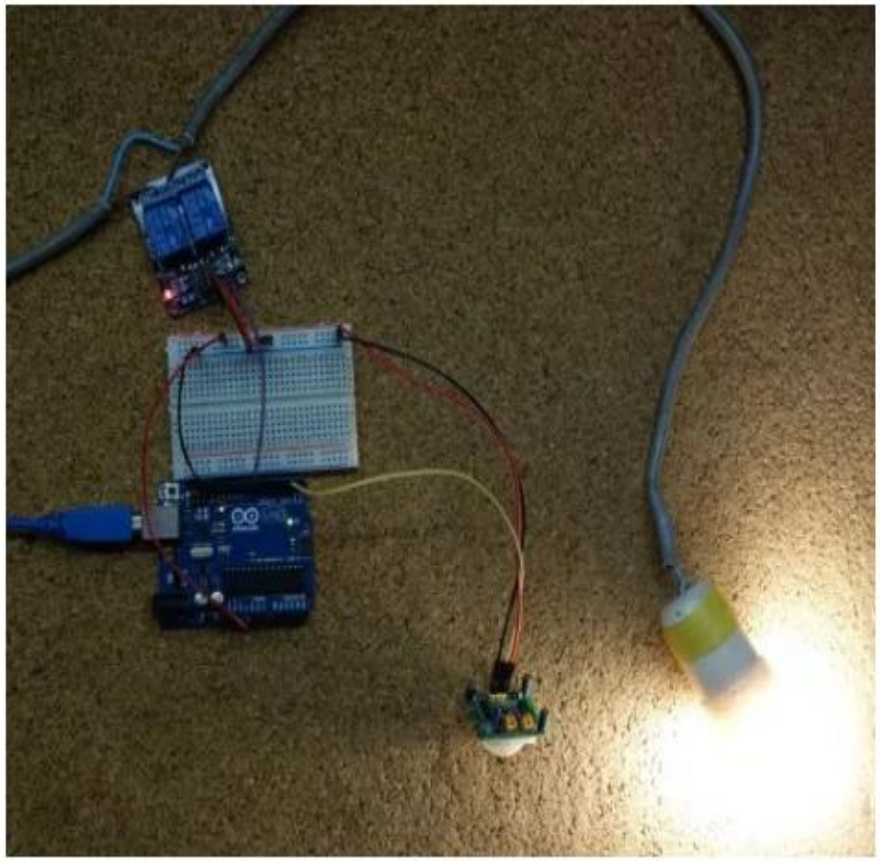
Relays


Armature
Pole piece
Switch contacts
Solenoid
Pivoted rod pushing on the strip
Spring brass strips
Connections to solenoid
Connections to switch contacts

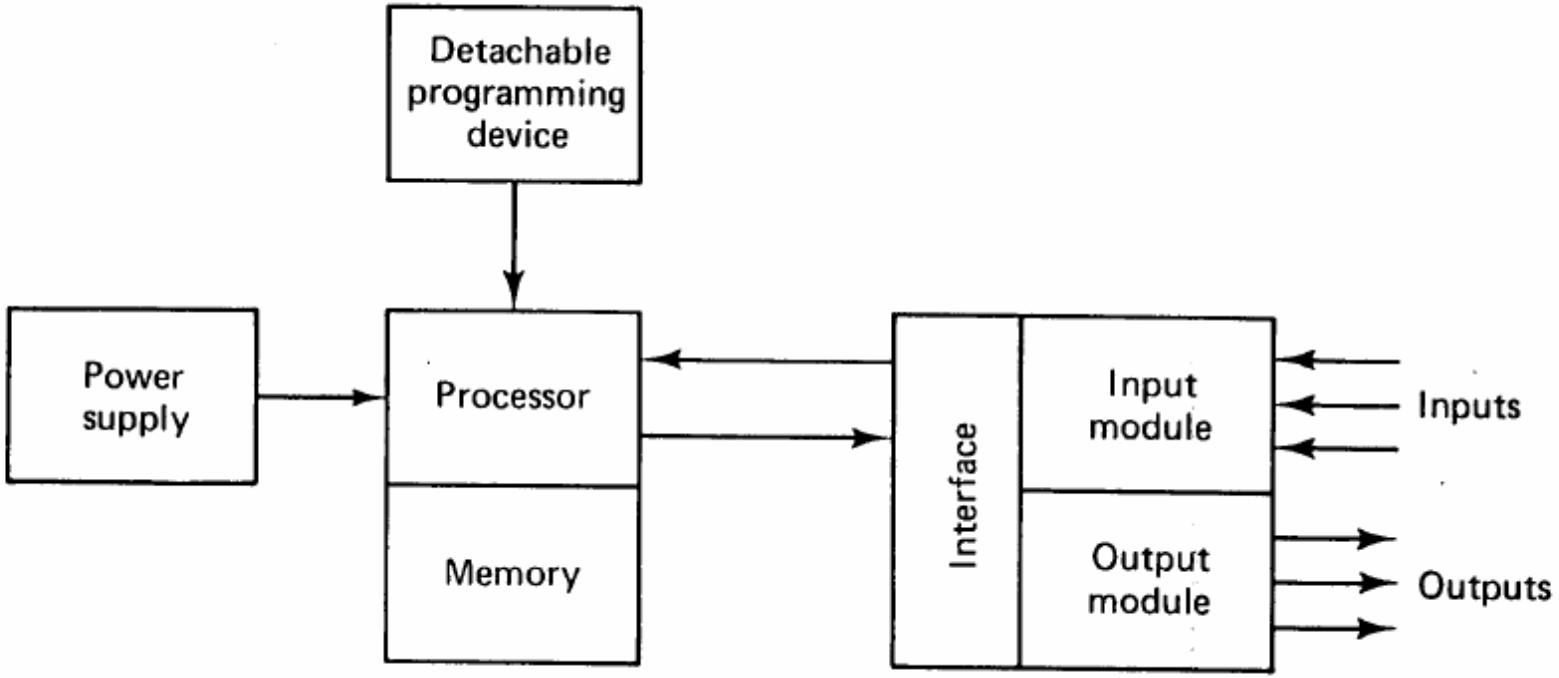
Relay


SRD-05VDC-SL-C
SONGLE
10A 125VAC
10A 28VDC
SRD-05VDC-SL-C
SONGLE
10A 125VAC
10A 28VDC
D1
D2
R2
R3
R4
IN1
IN2
1982A
JD-VCC VCC GND
GND IN1 IN2 VCC

Wiring of Relay



Components of a PLC

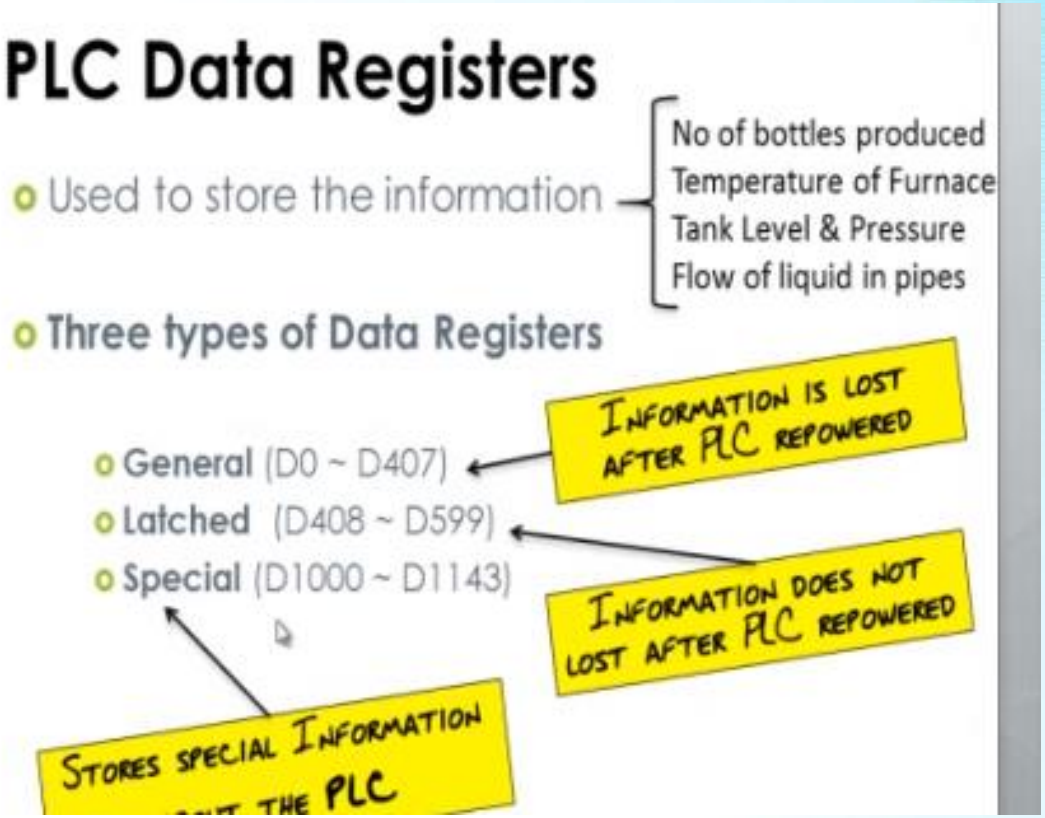


A programming device is used to enter the desired program into the memory of the processor. The program can be entered using relay ladder logic, which is one of the most popular programming languages. Instead of words, ladder logic programming language uses graphic symbols that show their intended outcome. Relay ladder logic (RLL) is the standard programming language used with PLCs.

Components of a PLC

- **We can actually consider the PLC to be a box full of hundreds or thousands of separate relays, counters, timers and data storage locations.**
- **Do these counters, timers, etc. really exist?**
- **No, they don't "physically" exist but rather they are simulated and can be considered software counters, timers, etc.**
- **These are simulated through bit locations in registers. For 8 bit there are 2^8 bit locations**

Data Registers



Advantages of PLC

There are significant advantages in using a PLC rather than conventional hardwired relays, timers, counters, and other hardware elements. These advantages include:

(1) Programming the PLC is easier than wiring the relay control panel;

(2) The PLC can be reprogrammed whereas conventional controls must be rewired and are often scrapped instead;

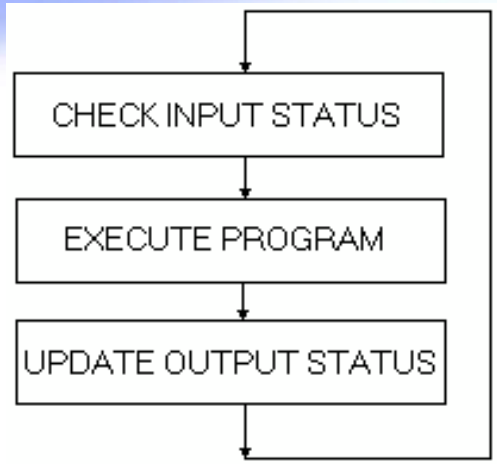
(3) PLCs take less floor space than do relay control panels;

(4) Reliability of the PLC is greater and maintenance is easier;

(5) The PLC can be connected to computer systems more easily than relays

(6) PLCs can perform a greater variety of control functions than can relay controls

PLC Scan Cycle



- A PLC works by continually scanning a program. We can think of this scan cycle as consisting of 3 important steps.
- Step 1-CHECK INPUT STATUS-First the PLC takes a look at each input to determine if it is on or off. In other words, is the sensor connected to the first input on? How about the second input? How about the third... It records this data into its memory to be used during the next step.
- Step 2-EXECUTE PROGRAM-Next the PLC executes your program one instruction at a time. Maybe your program said that if the first input was on then it should turn on the first output. Since it already knows which inputs are on/off from the previous step it will be able to decide whether the first output should be turned on based on the state of the first input. It will store the execution results for use later during the next step.
- Step 3-UPDATE OUTPUT STATUS-Finally the PLC updates the status of the outputs. It updates the outputs based on which inputs were on during the first step and the results of executing your program during the second step.