Chapter 2
Introduction to PLC controllers

KJE555 - PLC

Introduction to PLC controllers

- Automated industrial production line in the sixties and seventies
  - huge electrical board for system controls
  - great number of interconnected electromechanical relays to make the whole system work
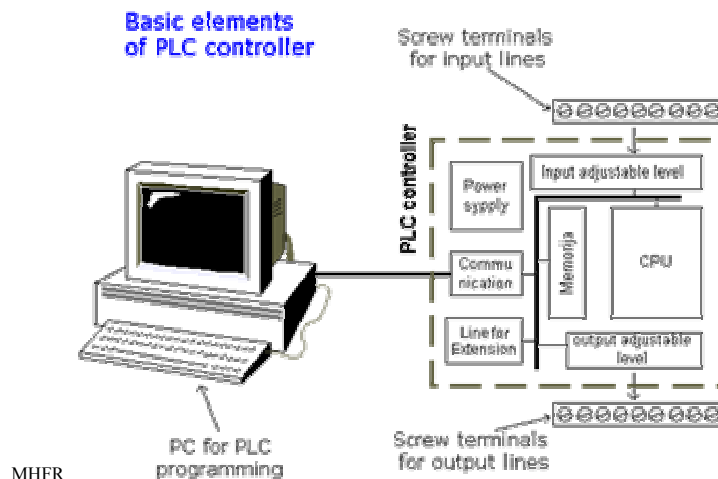
Central Processing Unit

- Central Processing Unit (CPU) is the brain of a PLC controller - microcontroller
- CPU also takes care of communication, interconnectedness among other parts of PLC controller, program execution, memory operation, overseeing input and setting up of an output

Central Processing Unit (2)

- PLC controllers have complex routines for memory checkup in order to ensure that PLC memory was not damaged (memory checkup is done for safety reasons)

Central Processing Unit (3)

Basic elements of PLC controller

Screw terminals for input lines

PLC controller

- Power supply
- Commu nication
- Line for Extension
- Input adjustable level
- Memorija
- CPU
- output adjustable level

Screw terminals for output lines

PC for PLC programming

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Memory

- System memory (today mostly implemented in FLASH technology) is used by a PLC for a process control system

- Aside from this operating system it also contains a user program translated from a ladder diagram to a binary form

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Memory (2)

- FLASH memory contents can be changed only in case where user program is being changed

Programming a PLC controller

- PLC controller can be reprogrammed through a computer (usual way), but also through manual programmers (consoles)
- Each PLC controller can programmed through a computer if you have the software needed for programming

Power supply

- Electrical supply is used in bringing electrical energy to central processing unit
- Most PLC controllers work either at 24 VDC or 220 VAC
- This electrical supply is usually not used to start external inputs or outputs

Power supply (2)

- User has to provide separate supplies in starting PLC controller inputs or outputs

PLC controller inputs

- Intelligence of an automated system depends largely on the ability of a PLC controller to read signals from different types of sensors and input devices
- Keys, keyboards and by functional switches are a basis for man versus machine relationship

PLC controller inputs (2)

- Smaller PLC controllers usually have only digital input lines while larger also accept analogue inputs through special units attached to PLC controller
- One of the most frequent analogue signals are a current signal of 4 to 20 mA and milivolt voltage signal generated by various sensors

PLC controller inputs (3)

- Sensors are usually used as inputs for PLCs e.g. measuring temperature, pressure, or some other physical dimension
- Other devices also can serve as inputs to PLC controller
- Intelligent devices such as robots, video systems, etc. often are capable of sending signals to PLC controller

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Input adjustment interface

- Adjustment interface also called an interface is placed between input lines and a CPU unit
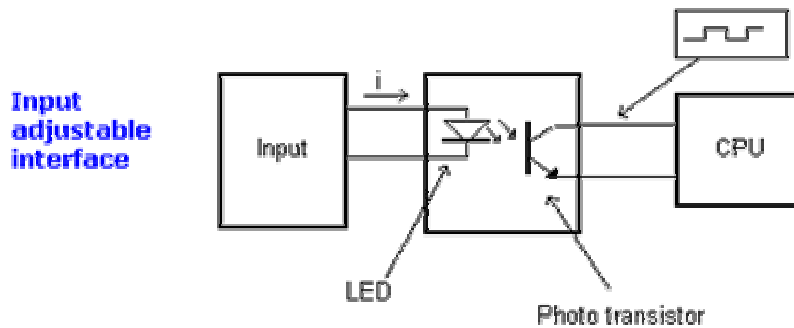- The purpose of adjustment interface to protect a CPU from disproportionate signals from an outside world

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Input adjustment interface (2)

- Input adjustment module turns a level of real logic to a level that suits CPU unit
- *Example*: input from a sensor which works on 24 VDC must be converted to a signal of 5 VDC in order for a CPU to be able to process it

Input adjustment interface (3)

- This is typically done through opto-isolation, and this function you can view in the following picture

Input adjustment interface (4)

Input adjustable interface

Input

i →

LED

Photo transistor

CPU

Input adjustment interface (5)

- Opto-isolation means that there is no electrical connection between external world and CPU unit
- They are "optically" separated, or in other words, signal is transmitted through light
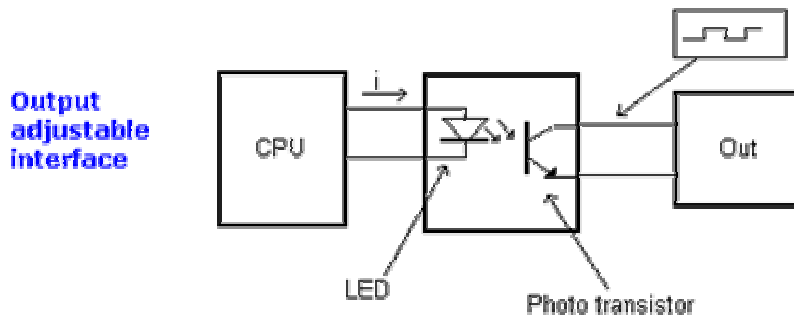
PLC controller output

- Automated system is incomplete if it is not connected with some output devices
- Some of the most frequently used devices are motors, solenoids, relays, indicators, sound signalization and similar
- Output can be of analogue or digital type

PLC controller output (2)

- Digital output signal works as a switch; it connects and disconnects line
- Analogue output is used to generate the analogue signal (ex. motor whose speed is controlled by a voltage that corresponds to a desired speed)

Output adjustment interface

- Output interface is similar to input interface

Output adjustable interface

CPU — i — LED — Photo transistor — Out

Extension lines

- Every PLC controller has a limited number of input/output lines
- If needed this number can be increased through certain additional modules by system extension through extension lines
- Each module can contain extension both of input and output lines

END OF CHAPTER 2