PLC

(Relative Grading)

Date :

Page : 1

Unit - 1

PLC used for industrial control, home applications

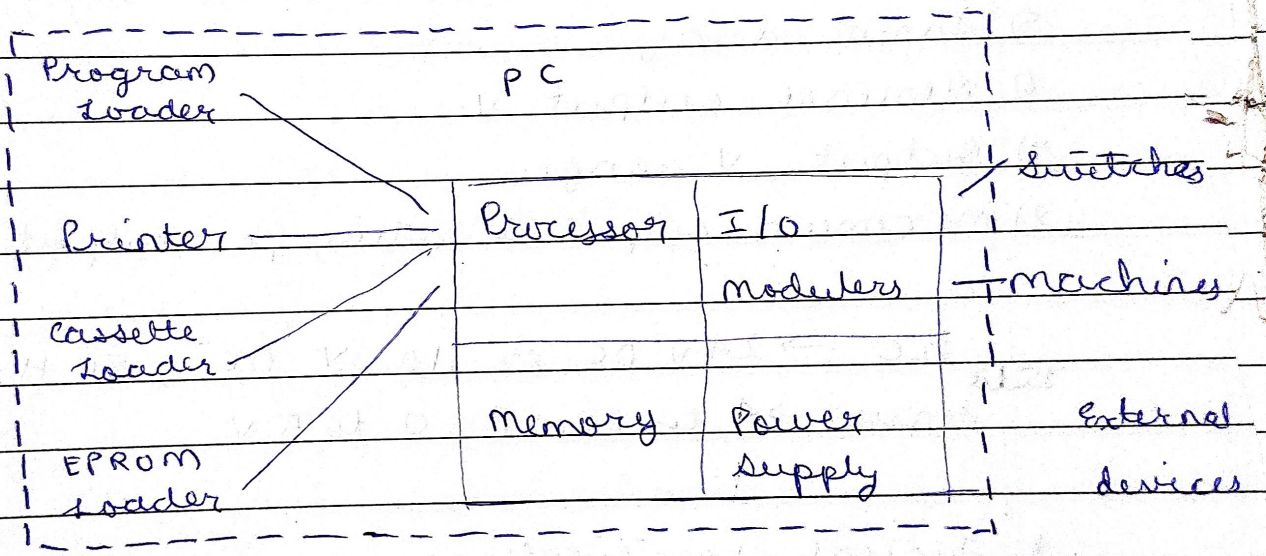
PLC: Programmable logic controller

microcontrollers and microprocessors

Input and output module.

Optical isolation, limit and proximity switches

* PLC architecture



* Components:

1) Power supply → AC and DC power

2) Peripheral → loader, CRT programmer, operator console, network communication interface, LAN, MAP

3) I/O → AC Voltage I/O, DC Voltage I/O, low level analog input, High level analog I/O, special

I/O → Input output
V → Voltage
I → Current

Date :
Page : 2

purpose modules eg: high speed timers, stepping motor controllers, eg: PID, motion.

limitation of PLC → Programming. (ladder diagram)

* I/O specifications: 1) Nominal input V.
2) on state input V range.
3) Nominal I per input
4) Ambient Temperature ranging.
5) Input delay.
6) Nominal output V.
7) Output V range.
8) Maximum output I rating per output and module.

PLC → 24 V DC or 110 V DC, 50 Hz
Field Sensors → 4 to 20 mA, 0 to 5 V

* Typical specifications
No of digital inputs: 120 (generally 2^n)
No. of digital outputs: 64
No. of timers: 40
No. of auxillary relays: 100

Memory, Backup storage
Input / output modules: 8 channel
↳ have status indicators

Input :

Output : 110 V, 50 Hz (Relays)
Lamp indicators (100 V)

SCADA : Supervisory control and data acquisition system
- self diagnostic function
- space available (700 mm × 500 mm)
- PLC programming software

MODBUS protocol
HART protocol
CAN protocol
} used in industries.

(Controllinary area network)
LIN protocol → Used in automobiles.
TCP/IP, Serial communication

Protocol → used / rule for communication.

PLC → Temperature : 30°C
Relative humidity : 90
Electro-magnetic compatibility
Warranty : 2 years with availability of spares guaranteed for 10 years

* Switches → Has a spring
Push button → Only one state

SPDT → single pole double throw
DPST → Double pole single throw.

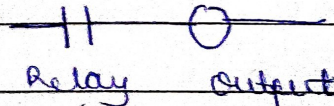

Normally open


Normally close

* Types of switches : 1) Basic switch
2) Push-button switch
3) Slide switch
4) Thumbwheel switch
5) Limit switch
6) Proximity switch
7) Photoelectric switch.
Output of switch is binary

Rating : Current and Voltage.

(control switch)
* Relay : It is on the output side
↳ operation is activated by an electromagnet.


Relay coil Output contact

(only on-off control)

PWM signal → Pulse width modulation
(Square wave of same frequency with

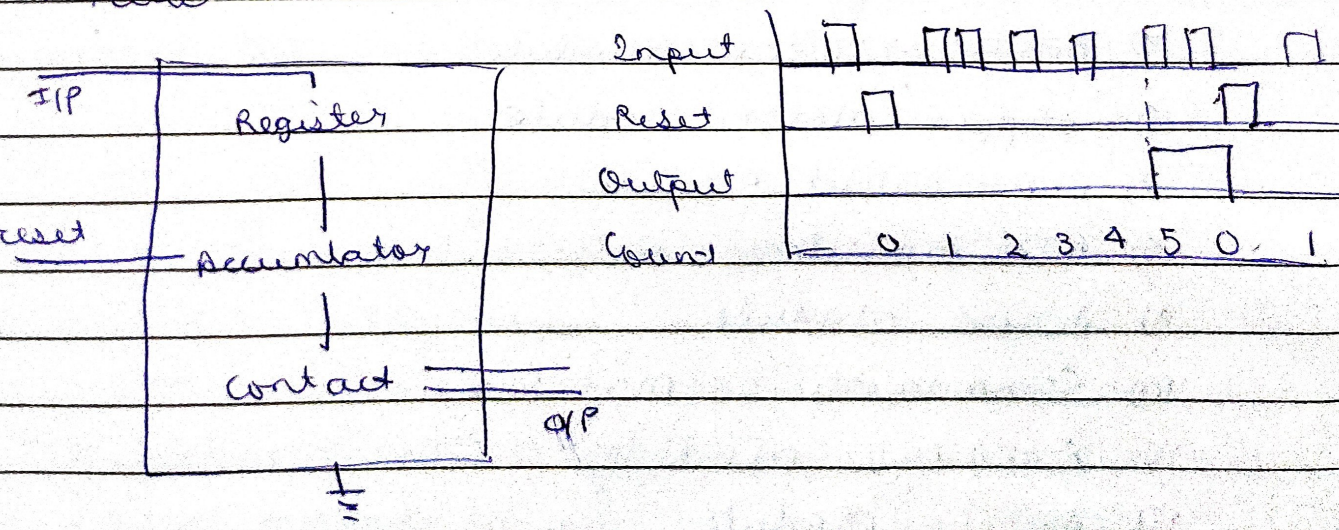
variable duty cycle.)

* Actuators : 1) Solenoid Valves
2) Lights
3) motor starters
4) Servo motors

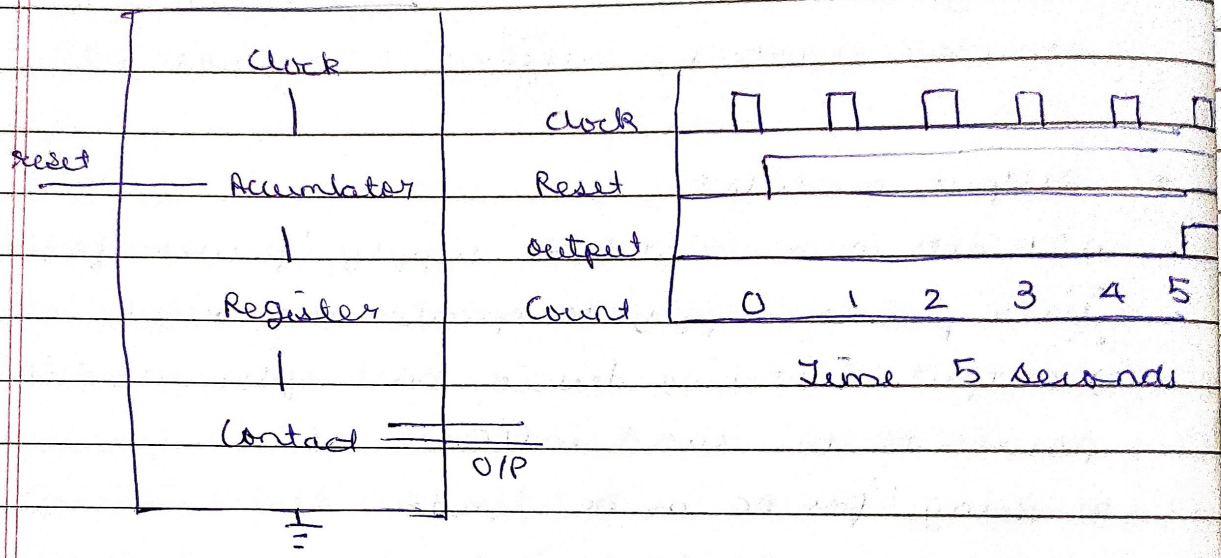
* Output module :
1) It acts as a switch to supply power from the user power supply to operate the output.
2) Output switching devices most often used to switch power to the load in PLC.
3) Relay for AC or DC load.
4) Triac for AC loads only.
5) Transistors for DC loads only.

30-01-24

* Counter : Digital Counter output in the form of a relay contact when a preassigned count value is reached.



* Timer: A timer consists of an internal clock, a count value register, and an accumulator. It is used for or some timing purpose



* Special Input / Output modules:

1) High - Speed Counter Module
2) Thumb - wheel module
3) TTL module
4) Encoder - Counter module
5) BASIC or ASCII module
6) Stepper - Motor module
7) BCD - Output module
8) PID module
9) Servo module
10) Communications module
11) Language module
12) Speech module

Note: Inputs are normally high impedance means that they will use very less current.

Sourcing : 24 V DC is applied to output.

Sinking : 0 V is provided to load output from supply. PLC. 24 V is already given from the external.

* PLC programming Languages:

1) Ladder diagram (LD)
2) Sequential function charts (SFC)
3) Function Block Diagram (FBD)
4) Structured Text (ST)
5) Instruction list (IL)

Rules to draw the ladder logic diagram.

1) Consists of 2 vertical lines representing the power rails. (Left power rail / Right power rail)
2) Circuits are connected as horizontal lines, i.e. the rungs of the ladder, between these 2 verticals.

05-02-24

* Ladder diagram : Simplest form of PLC.
2) Known as relay logic.
   ↳ Binary type system.
3) Functional Block Diagram (FBD) is a simple and graphical method to program multiple functions.
4) It is a symbolic set of instructions used to create the controller system.

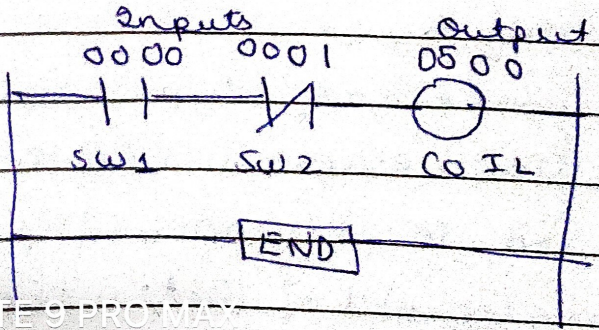
Advantages → 1) Easily programmed and understood
2) Flexibility in programming and reprogramming
3) Troubleshooting is easier and faster.

[Linear control] → MOSFETs, Transistors, IGBT]
[C language is a sequential executional program]

→ Ladder diagram executes sequentially:
Rung 1 → Rung 2 → Rung 3 → ..... → Rung n.

- Normally Open : EXAMINE IF CLOSED
(check whether the contact is ~~closed~~ open)
1 (ON) or 0 (OFF)
↳ TRUE ↳ FALSE. —]E—
- Normally closed : EXAMINE IF OPEN
(check whether the contact is closed)
1 (ON) or 0 (OFF)
↳ TRUE ↳ FALSE —]/[—
- Relay coil —( )—
- Ladder diagram → Contact symbology.

Eg:



[Check out → How to do addressing in PLC]

Scan cycle

* 7 step sequence for development and implementation of the logic.

1) Development of Block diagram or P&ID (Piping and Instrumentation diagram)
2) Listing of input and output devices.
3) Development of a flow chart of the process.
4) Developing a cause-and-effect diagram
5) Actual development of logic (ladder logic)
6) Validation of logic or simulators, debugging, safety interlocks.
7) Actual execution, optimization

06-02-24

* PLC Instructions :

1) Relay
2) Timer and Counter (Provide delay)
3) Program Control
4) Arithmetic (also logical)
5) Data manipulation
6) Data transfer
7) Others, such as sequencers.

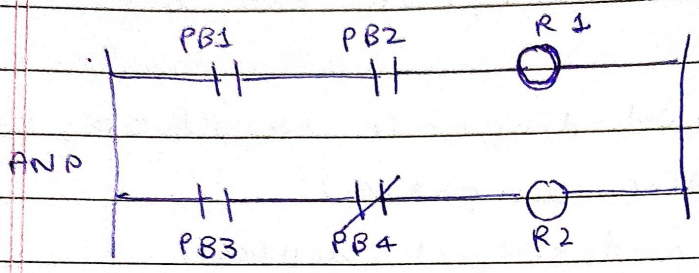
Counter → Counts the pulses generated.

Data manipulation can be done using binary left shift and binary right shift.

- Logic states

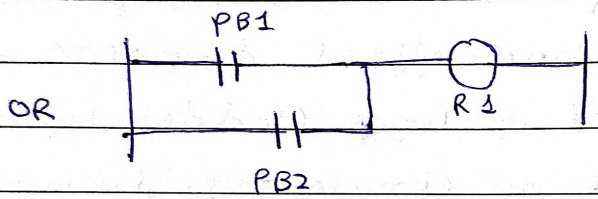
ON : TRUE, contact closure, energize.

OFF : FALSE, contact open, de-energize.

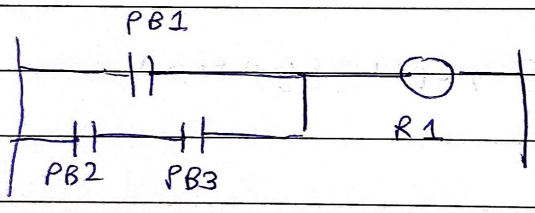


R1 = PB1 AND PB2

R2 = PB3 AND ~PB4

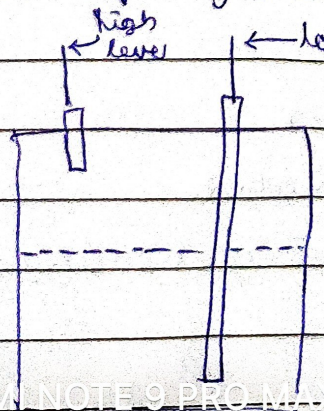


R1 = PB1 OR PB2



R1 = PB1 OR (PB2 AND PB3)

Q Oil in a tank should not go below low level and should not rise above high level. Write a PLC program. Level should be between the both.

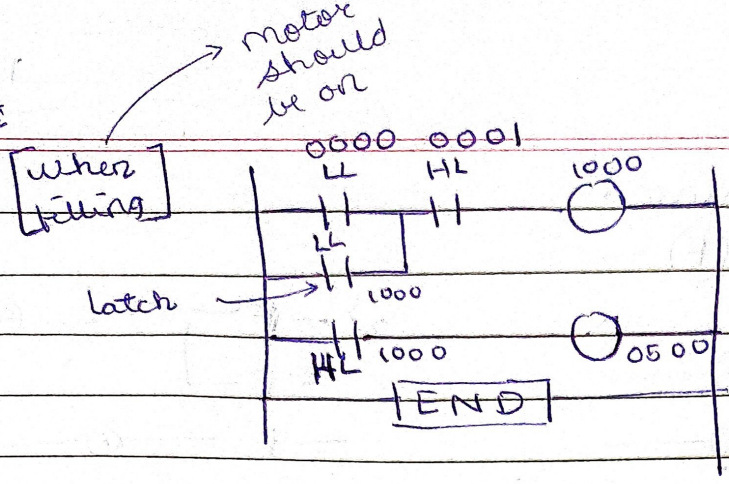


HL	LL		
1	1	→	1 (stop)
0	0	→	0 (fill)
0	1	→	0 (fill)
1	0	→	0 (fill)

AND

Date :
Page : 11

12-1-24



son for perevious q

1000 is a latch

TRUE → No liquid around sensor

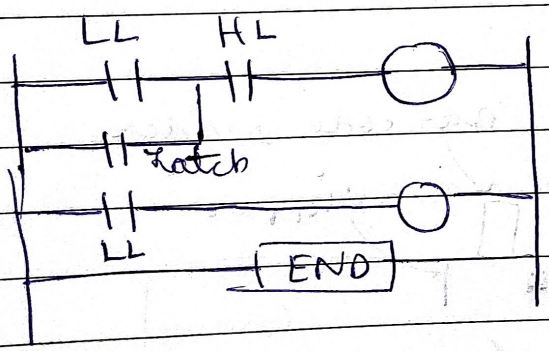
FALSE → Liquid around sensor

(motor should start)

Everything is TRUE → Tank is empty

Everything is FALSE → Tank is filled

(motor should stop)



[When draining]

Motor should be off

When Filling

1) (motor is off)

2)

3)

(motor is turned on)

When draining :

1) —F—F—(F)—
(motor is on) —T—

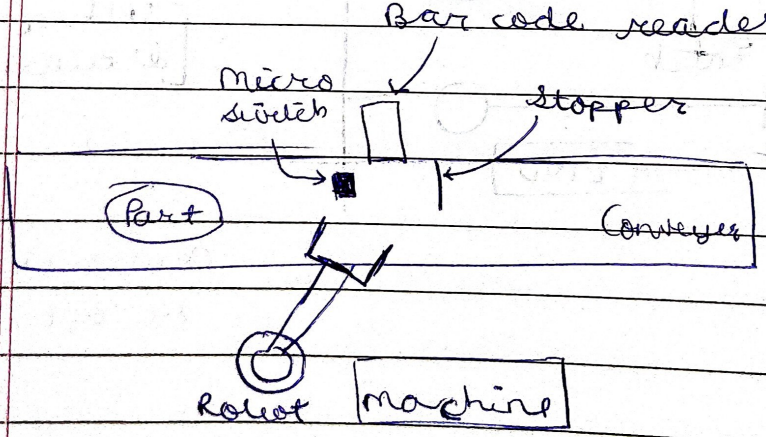
—F—(F)—

2) —F—F—(F)—
—F—
(motor is turned off) —F—(F)—

3) —F—T—(F)—
—F—
—F—(F)—

(How conveyer belt works)

* Programming example 1.



~~id description state Explanation~~