# Industrial Automation (ICE 3252)

## PLC Programming- PID, Example problems

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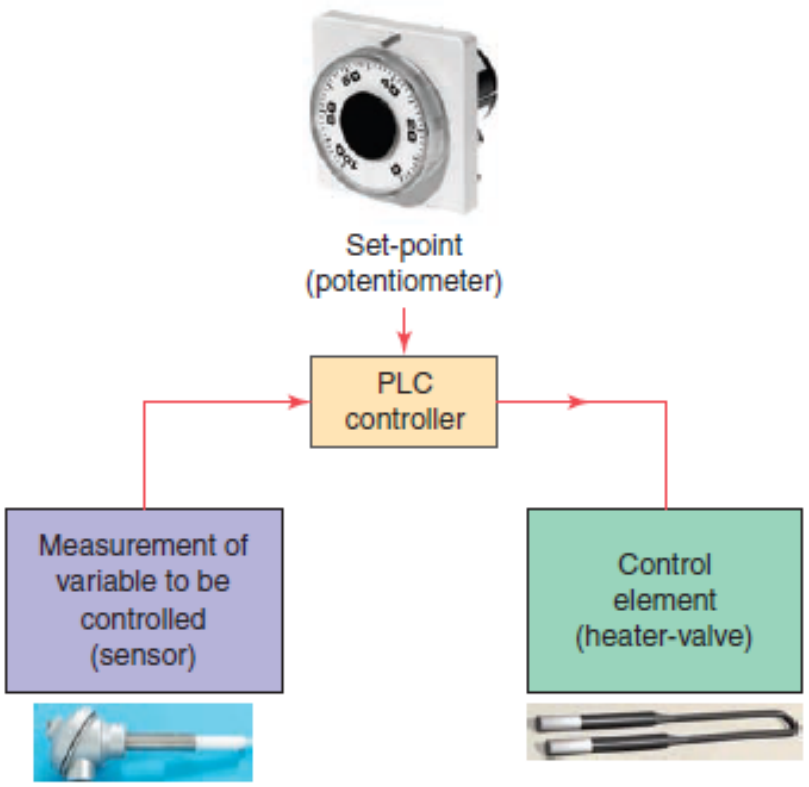
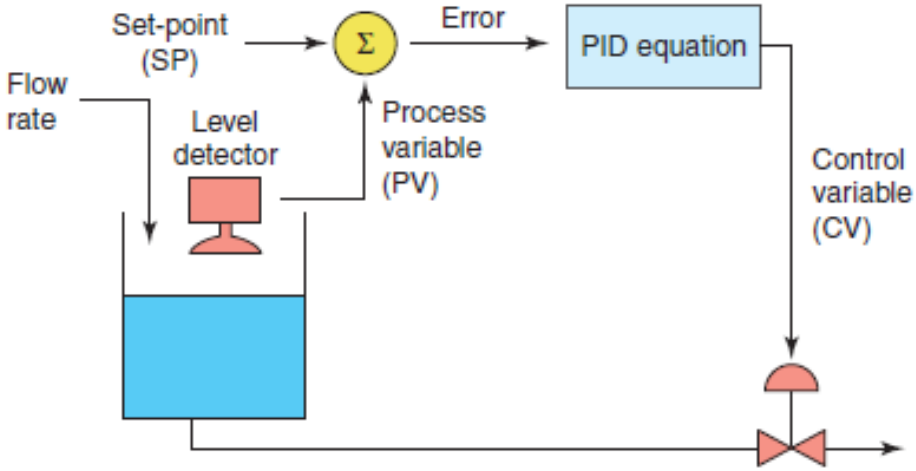
# PID Control



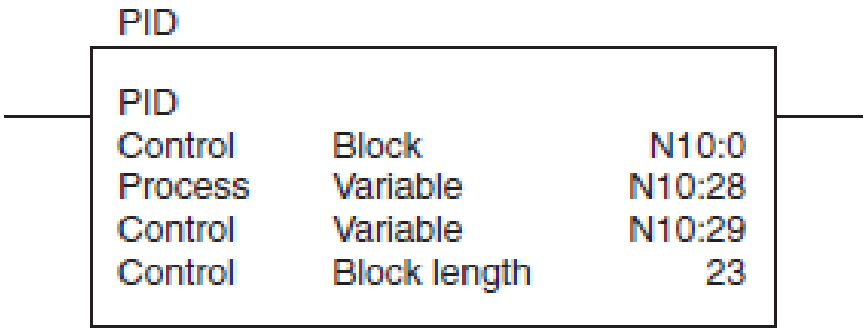

Closed-loop control system.




Typical PID control loop.

# PID instruction

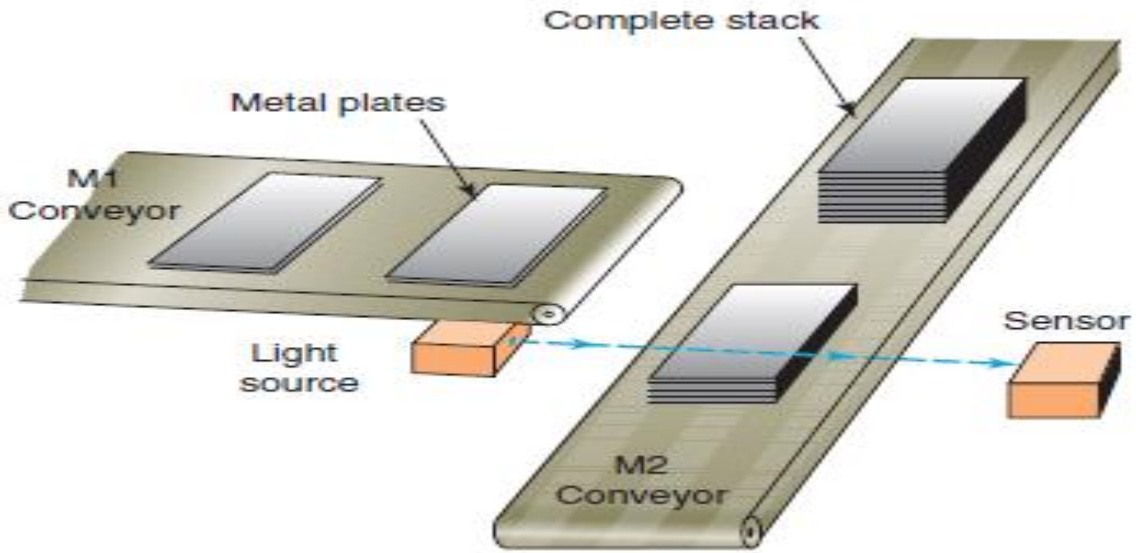
- The PID instruction normally controls a closed loop using inputs from an analog input module and provides an output to an analog output module.
- Control Block is the file that stores the data required to operate the instruction.
- Process Variable (PV) is an element address that stores the process input value.
- Control Variable (CV) is an element address that stores the output of the PID instruction.

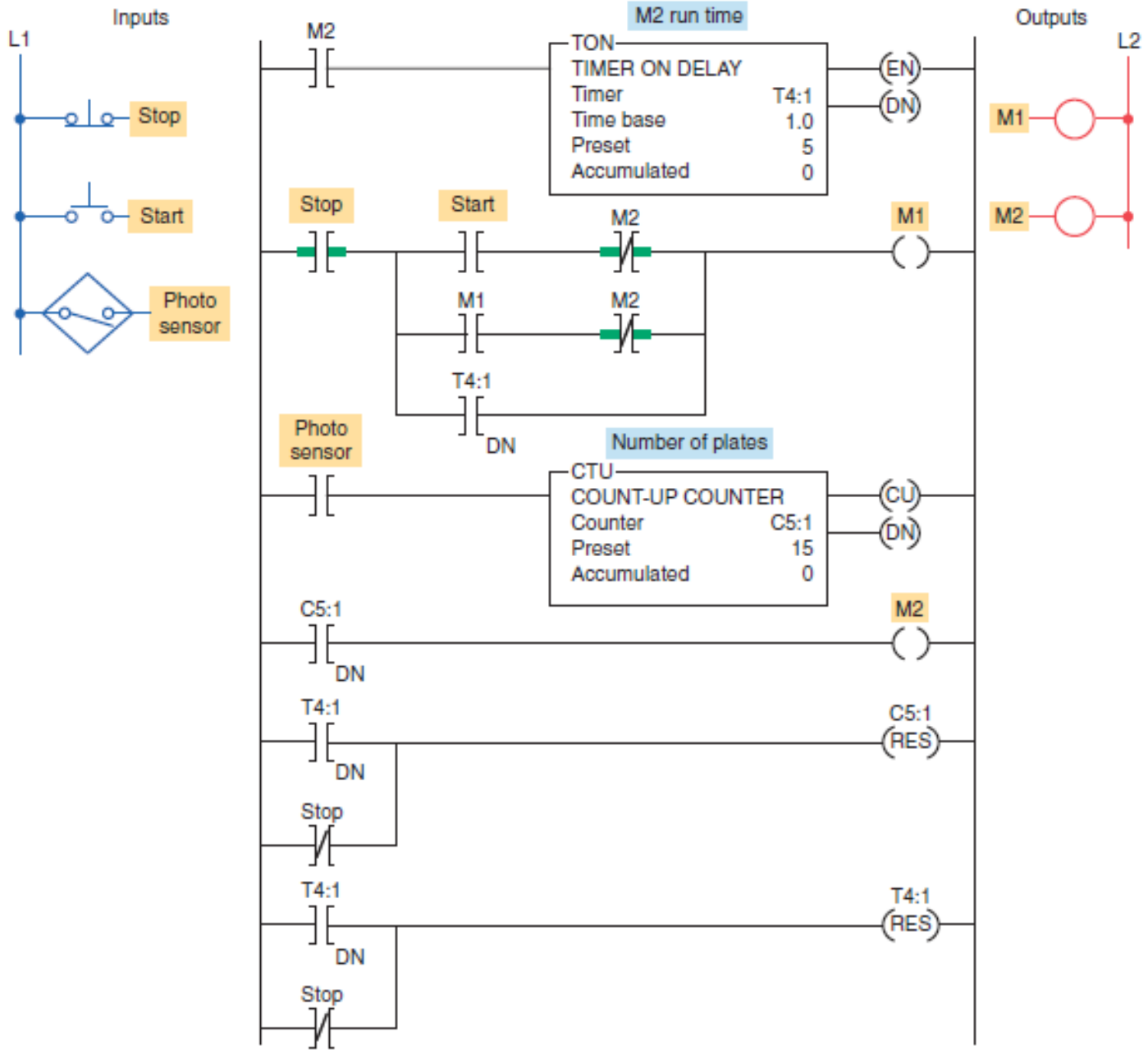



PID instruction.

# Example 1: Automatic stacking program.

- Conveyor M1 is used to stack metal plates onto conveyor M2. The photoelectric sensor provides an input pulse to the PLC counter each time a metal plate drops from conveyor M1 to M2. When 15 plates have been stacked, conveyor M2 is activated for 5 s. Start button is used to start the conveyor M1, Stop button should stop the entire process.




Inputs
L1
Stop
Start
Photo sensor
M2
M2 run time
TON
TIMER ON DELAY
Timer T4:1
Time base 1.0
Preset 5
Accumulated 0
EN
DN
Outputs
L2
M1
M2
Stop
Start
M2
M1
M1
M2
T4:1
DN
Photo sensor
Number of plates
CTU
COUNT-UP COUNTER
Counter C5:1
Preset 15
Accumulated 0
CU
DN
C5:1
DN
M2
T4:1
DN
C5:1
RES
Stop
T4:1
DN
T4:1
RES
Stop



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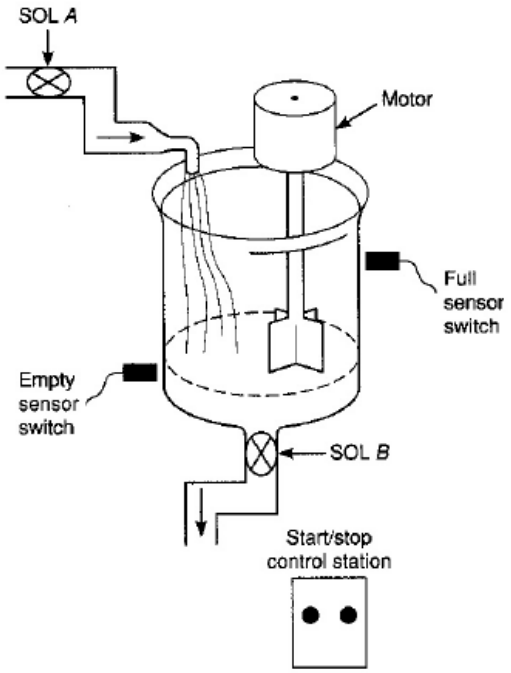
# Example 2:

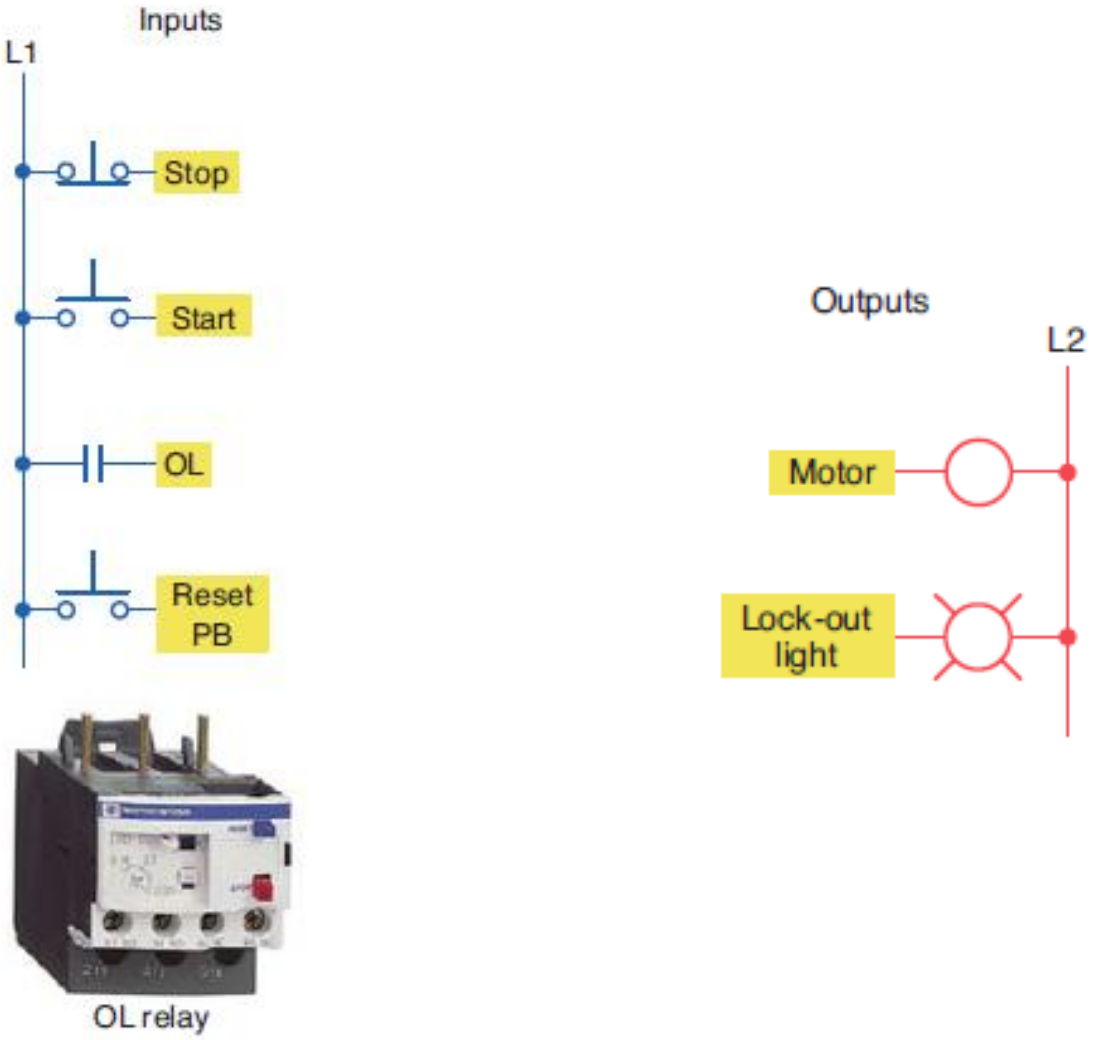
Write a program to implement the process illustrated in Figure . The sequence of operation is to be as follows:

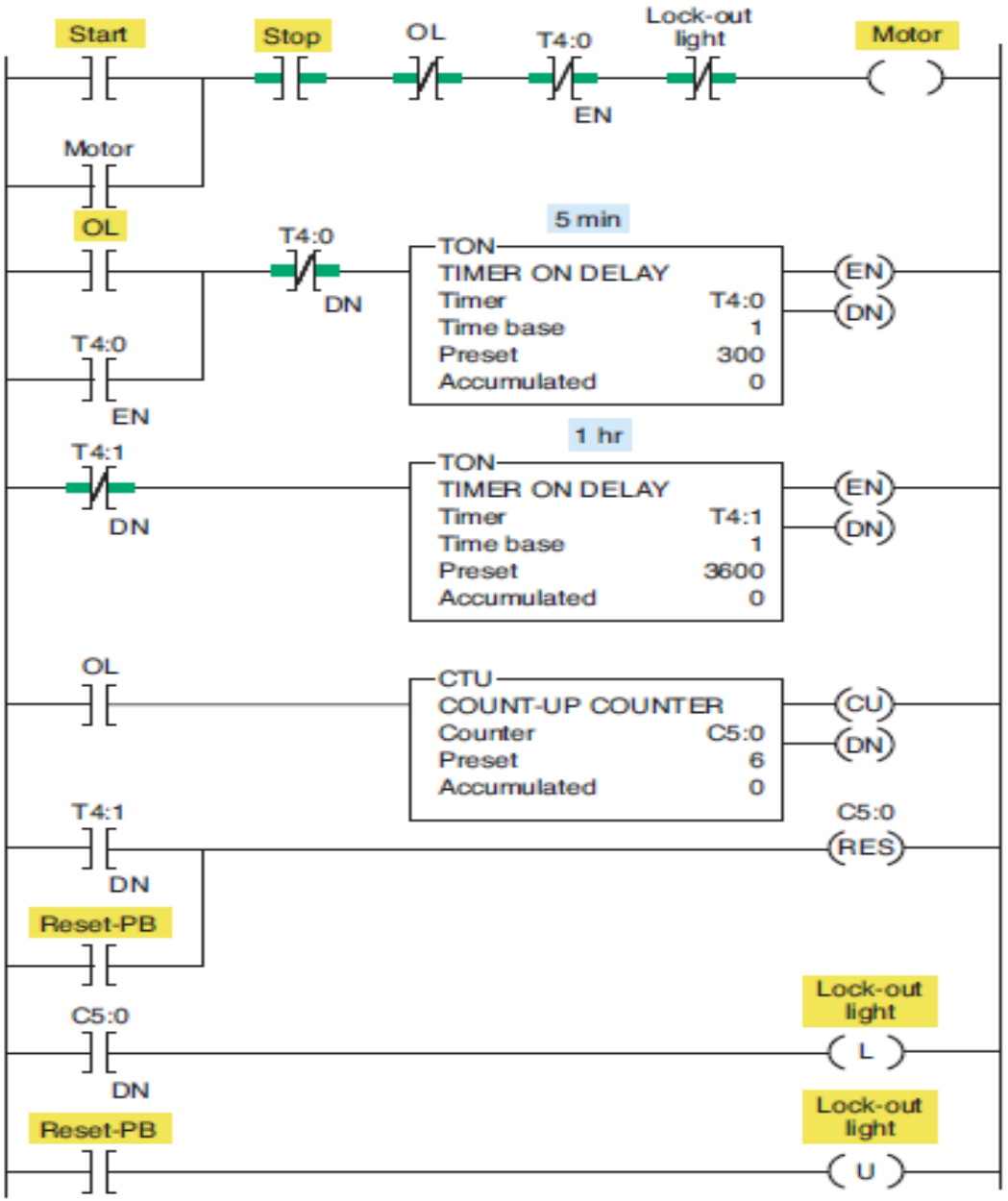
- Normally open start and normally closed stop pushbuttons are used to start and stop the process.
- When the start button is pressed, solenoid A energizes to start filling the tank.
- As the tank fills, the empty level sensor switch closes.
- When the tank is full, the full level sensor switch closes.
- Solenoid *A* is de-energized.
- The agitate motor starts automatically and runs for 3 min to mix the liquid.
- When the agitate motor stops, solenoid B is energized to empty the tank.
- When the tank is completely empty, the empty sensor switch opens to de-energize solenoid *B*.
- The start button is pressed to repeat the sequence.



# Example 3: Motor lock-out program

- Create a ladder diagram to prevent a machine operator from starting a motor that has tripped off more than 5 times in an hour.
- The normally open overload (OL) relay contact momentarily closes each time an overload current is sensed.
- Every time the motor stops due to an overload condition, the motor start circuit is locked out for 5 min.
- If the motor trips off more than 5 times in an hour, the motor start circuit is permanently locked out and cannot be started until the reset button is actuated.
- The lock-out pilot light is switched on whenever a permanent lock-out condition exists.


Inputs
L1
Stop
Start
OL
Reset
PB
OL relay
Outputs
L2
Motor
Lock-out
light


Start
Stop
OL
T4:0
EN
Lock-out light
Motor
Motor
OL
T4:0
DN
5 min
TON
TIMER ON DELAY
Timer T4:0
Time base 1
Preset 300
Accumulated 0
EN
DN
T4:0
EN
T4:1
DN
1 hr
TON
TIMER ON DELAY
Timer T4:1
Time base 1
Preset 3600
Accumulated 0
EN
DN
OL
CTU
COUNT-UP COUNTER
Counter C5:0
Preset 6
Accumulated 0
CU
DN
T4:1
DN
C5:0
RES
Reset-PB
C5:0
DN
Lock-out light
L
Reset-PB
Lock-out light
U

# Reference


- Frank D. Petruzella, *Programmable Logic Controllers,* MGH, (2e), 1997.