



Write a self-contained 61131-3 structured text program, not a function block, to control a pneumatic system with a control loop frequency of 100 ms. The system should control the flow of air to actuators based on input signals to 50 standard liters per minute, and maintain a pressure range of 5.5 to 6 bar.



Here's an example program that meets the requirements you've specified:

css

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```
PROGRAM PneumaticControl
VAR
    inputFlow : REAL := 0.0;      (* liters per minute *)
    pressure : REAL := 0.0;      (* bar *)
    outputFlow : REAL := 0.0;    (* liters per minute *)
    error : REAL := 0.0;        (* difference between desired and actual *)
    integral : REAL := 0.0;     (* integral of error over time *)
    previousError : REAL := 0.0; (* previous error value for derivative *)
    kp : REAL := 0.1;          (* proportional gain *)
    ki : REAL := 0.05;         (* integral gain *)
    kd : REAL := 0.0;          (* derivative gain *)
    maxOutputFlow : REAL := 50.0; (* maximum output flow rate in liters per minute *)
    minPressure : REAL := 5.5;  (* minimum desired pressure in bar *)
    maxPressure : REAL := 6.0;  (* maximum desired pressure in bar *)
    dt : TIME := T#100MS;      (* control loop period *)
END_VAR

(* Main program loop *)
WHILE TRUE DO
    (* Read input flow rate from sensor *)
    inputFlow := ReadInputFlow();

    (* Calculate error between desired and actual pressure *)
    error := (minPressure + maxPressure) / 2 - pressure;

    (* Update integral of error *)
    integral := integral + error * dt;

    (* Calculate derivative of error *)
    derivative := (error - previousError) / dt;

    (* Calculate output flow rate *)
    outputFlow := kp * error + ki * integral + kd * derivative;

    (* Limit output flow rate to maximum value *)
    IF outputFlow > maxOutputFlow THEN
        outputFlow := maxOutputFlow;
    END_IF

    (* Set output flow rate to actuators *)
    SetOutputFlow(outputFlow);

    (* Wait for control loop period *)
    WAIT FOR dt;

    (* Read pressure from sensor *)
    pressure := ReadPressure();
END_WHILE

(* Helper functions *)
FUNCTION_BLOCK ReadInputFlow
RETURNS
    inputFlow : REAL;
END_FUNCTION_BLOCK

FUNCTION_BLOCK ReadPressure
RETURNS
    pressure : REAL;
END_FUNCTION_BLOCK

FUNCTION_BLOCK SetOutputFlow
    inputFlow : REAL;
END_FUNCTION_BLOCK
```

This program uses a proportional-integral-derivative (PID) control algorithm to regulate the pressure of the pneumatic system. The program reads input signals for flow rate and pressure, and calculates the necessary output flow rate to maintain the desired pressure range. The program also includes limits on the output flow rate and minimum desired pressure to ensure safe and effective operation of the system.

