# Gas Pressure Control System for Air-assisted Extrusion Based on PLC

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**Abstract.** A gas pressure control instrument for air-assisted extrusion has been manufactured by us. The principle, hardware connection and software design of this controller are introduced in this paper. The PLC micro controller is assembled in hard connection with pressure sensor and control valve. The 24V power supply is chosen as the main control power. Software design with codes is shown through the successful experimental tests. It is obtained that the gas pressure error controlled is less 2%. The design optimization with hard and soft item in the system will be carried out in the future research.

## Introduction

Gas assisted extrusion is a kind of polymer processing technology [1]. In air-assisted extrusion of polymer, the controlling of the gas pressure is a very key problem. The precision of the pressure of gas directly affects the stability of extrusion process [2]. There are usually two control methods: one method is using the IPC (Industrial Personal Computer) as the control kernel, another is using the PLC (Programmable Logic Controller) [3-5]. The cost of the latter is lower and the stability is as well as the former. Thus, the PLC is selected as our control kernel.

In this paper, the principle, hardware and software of the controller is introduced. In section 1, the principle of the instrument is introduced. In section 2, the hardware connection is introduced. In section 3, the software design is introduced.

## Principle of the Gas Pressure Controller

Fig. 1 shows the gas pressure controller's principle diagram. The controller is composed of the components in the dashed line box. It includes a touch screen, a PLC with AD/DA module, a gas pressure sensor and a electromagnetic pneumatic valve. The pressure sensor is mounted in a polymer extrusion die. In the process of plastic extrusion, if the gas pressure is not controlled, it will continue to change. Before the extruder begins to work, we first open the air pump and the gas pressure controller.

The pressure value and PID parameters can be set and adjusted by touch screen. When the pressure value detected by the sensor is different from the value set by touch screen, a PID control algorithm will be calculated in PLC, which will output an analog signal through the DA module to control the opening of the electropneum valve, thus to adjust the output gas pressure.

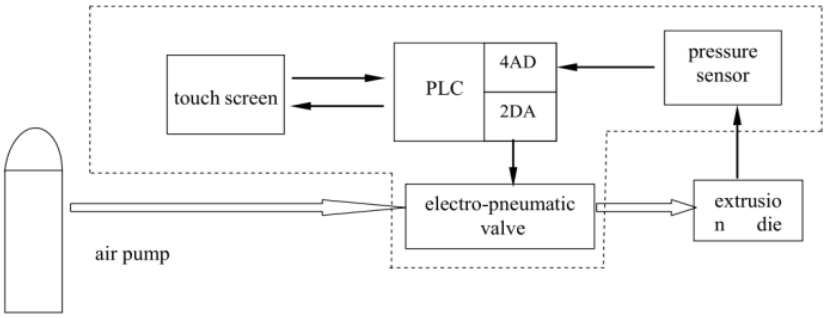


Figure 1. Gas pressure controller's principle diagram

## Hardware Connection of the Controller

Fig. 2 shows the gas pressure controller's hardware connection diagram. In order to facilitate future system expansion, the FX1N-24MT PLC, FX2N-4AD and FX2N-2DA are chose. The pressure sensor and the electro-pneumatic valve separately belong to current output type and current input type. An additional 24V power supply is used.

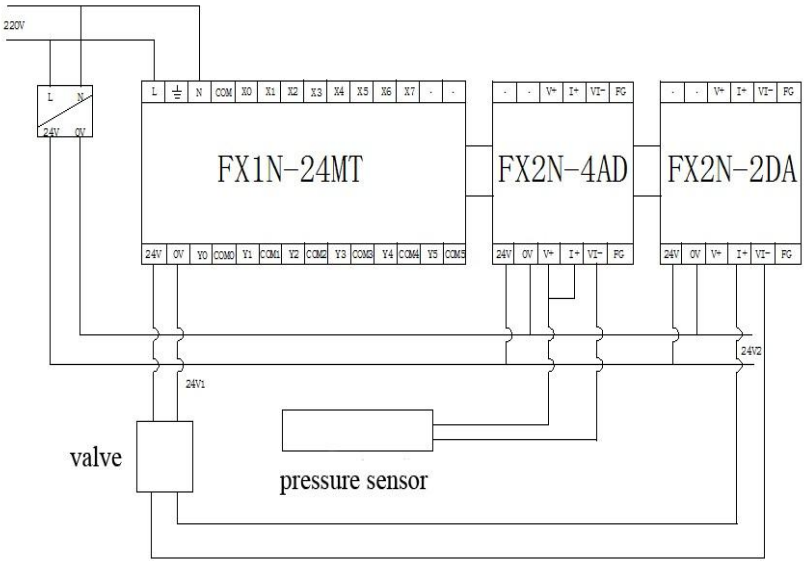


Figure 2. Hardware connection diagram

## Software Design of the Controller

```
0     LD    M8000
1     MOV     D310   D200
6     MOV     D300   D100
11     MOV     H1  D101
16     MOV     D302   D102
21     MOV     D303   D103
26     MOV     D304   D104
31     MOV     D305   D105
36     MOV     D306   D106
41     MOV     K2000  D204
46     LD   M8002
47     FROM    K0  K30D4  K1
56     CMP K2010   D4  M0
63     LD   M1
```

```
64      TO   K0  K0  H3331   K1
73      TO   K0  K1  K4  K1
82      FROM    K0  K29K4M10 K1
91      ANI  M10
92      ANI  M20
93      FROM    K0  K5  D202    K1
102      LD  M8000
103      MOV    K0  D107
108      PID D200    D202    D100    D204
117      LD  M8000
118      MOV    D204    K4M100
123      TO  K1  K16K2M100     K1
132      TO  K1  K17H4  K1
141      TO  K1  K17H0  K1
150      TO  K1  K16K1M108     K1
159      TO  K1  K17H2  K1
168      TO  K1  K17H0  K1
177      END
```

The codes above show the software design of the controller. The parameters set by touch screen will be saved in the data registers such as D310, D300 and others. For example, the pressure value is saved in D310 that will be sent to D200. The initial output value (2000) is saved in D204. The detected value is saved in D202. The codes from 46 to 102 implement the signal acquisition from the pressure sensor. The code 108 implement the PID control. The codes from 117 to 177 implement the DA transmit and control of electro-pneumatic valve.

## Summary

A gas pressure control instrument based on PLC and touch screen is designed for the air-assisted. The extrusion experiment shows that the gas pressure error is controlled within 2%.

## Acknowledgements

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