HCMC University of Technology   Laboratory 01:
Faculty of Mechanical Engineering
Department of Mechatronics

Discrete and Analog I/O Connection

1. Objective

- Connect the discrete/digital devices (switch, sensor, relay) to discrete/digital I/O on PLC FX1N-24MT.

- Connect the analog devices (variable resistor-variable resistor, Voltage meter) to analog I/O on FX0N-3A module (Special Function Block).

- Write Ladder programs to process the signals and explain the operation of these programs.

2. Lab devices

2.1. PLC Mitsubishi FX1N-24MT:

Combines the benefits of a micro sized controller with the modularity and processing power of larger PLC's. The modular construction gives an I/O range from 14 to 128 and up to two special functions modules e.g. analogue I/O, can also be added to meet individual application requirements. In addition to the features already listed, the FX1N also offers the following:

- Choice of 4 I/O sizes, expandable up to 128 I/O

- 89 applied instructions, 1536 auxiliary relays, 256 timers, 235 counters, 8000 data registers

- Two 100kHz pulse trains on transistor output type for motor positioning applications

Fig. 1: FX1N-24MT and FX0N-3A module

2.2. FX0N-3A (2A/D and 1D/A) module

- The FX0N-3A analog special function block has two input channels and one output channel.

- The input channels receive analog signals and convert them into digital values.

- The output channel takes a digital value and outputs an equivalent analog signal.
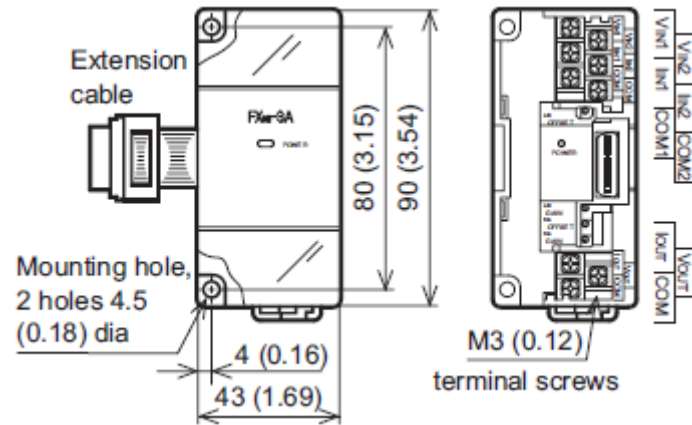
- The FX0N-3A has a maximum resolution of 8 bits.

Fig. 2: FX0N-3A module

2.3. USB FX-SC09 (CH340) cable

Mitsubishi PLC Programming USB FX-SC09 cable used to communicate between PC and PLC.

Fig. 3: USB FX-SC09 cable

2.4. Digital and analog devices

- 1 Proximity sensor SN04-N: Detection distance 5mm

Brow — +V

Black — Signal

Blue — 0V

Sensor

Fig. 4: SN04-N sensor

- 4 switches:

Fig. 5: Switch

- 2 relays:

Fig. 6: Relay

- 1 variable resistor:

Fig. 7: Variable resistor

- Voltmeter:

Fig. 8: Voltmeter

2.5. Power supply 12VDC:

Fig. 9: Power supply

3. Lab contents

3.1. Duration: 5 class hours / group.

**3.2. According to PLC information, please answer**:

- How many discrete inputs does PLC have? What type of inputs (sink/source)?
- How many discrete outputs does PLC have? What type of outputs (sink/source)?

3.3. Connecting the input/output devices to PLC FX1N-24MT

- Draw a wiring diagram of I/O devices with PLC.

Input		Output	
X3	Push button	Y2	Relay
X5	Proximity sensor		

- Write a program as the following code:
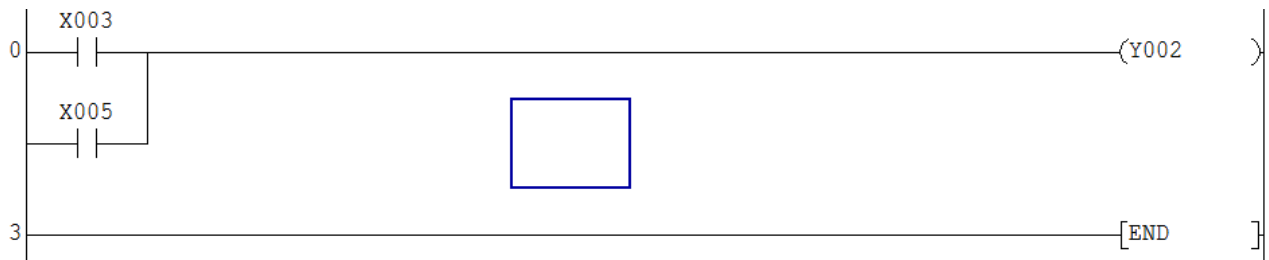
3.4. Connecting the variable resistor to analog input of FX0N-3A module (read User's Guide, Part 7.2)

- Draw a wiring diagram.
- Write a program as shown in part 7.2.1, page 4 to read a value (digital) from variable resistor (analog).
- Calibrate the Offset of A/D input as shown in Part 7.2.2, page 4.
- Calibrate the Gain of A/D input as shown in Part 7.2.3, page 4.

3.5. Connecting the voltmeter to analog output of FX0N-3A module (read User's Guide, Part 7.3)

- Draw a wiring diagram.
- Write a program as shown in part 7.3.1, page 5 to write a value (digital) to voltmeter (analog).
- Calibrate the Offset of D/A output as shown in Part 7.3.2, page 5.
- Calibrate the Gain of D/A output as shown in Part 7.3.3, page 5.