

Experiment 2: introduction to control apparatus, and Intermittent Operation of Asynchronous motor with aid of PLC

1. GENERAL FEATURES OF Y-0030-A PLC APPLICATION MODULES

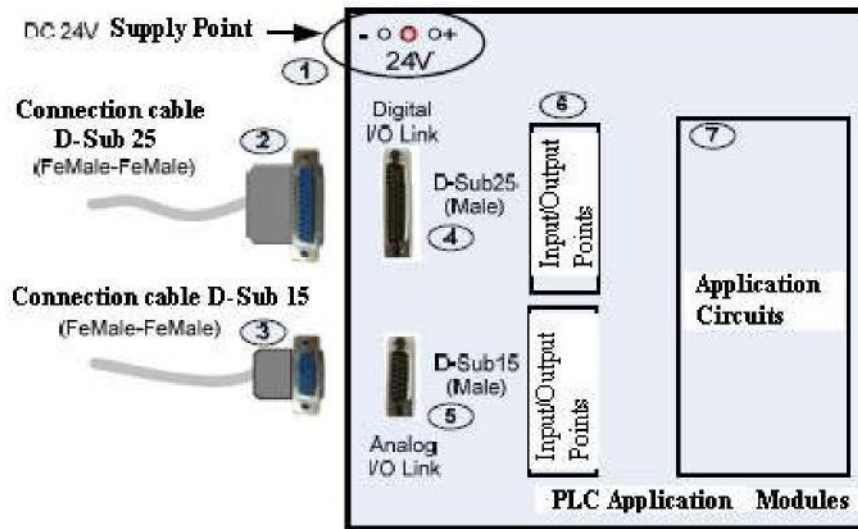


Figure 1: Module connection points with PLC I/O link cable

General structure of Y-0030A application modules is composed of components above. These components can show changes according to the type of the application module. Components and their usages are listed below.

1 . DC 24V power input. DC 24V power that is required for application circuits is applied with the external power supply. Pay attention to the polarity (+,- polars) when applying DC 24V power. If the application modules are to be used with D-sub25 connecting cable, there is no need to apply energy to the power input.

2 . Connecting cable provides the connection between 8 bit digital input/output points of PLC and the module. How inputs/outputs between the application and digital inputs/outputs from this cable are used is shown in input/output tables of the application. On the connecting cable, 24V DC supply voltage that is required for the module is available.

3 . Connecting cable provides the connection between 8 bit digital input/output points of PLC and the module. There are conductors for 2 analog input and 1 analog output in the cable. How inputs/outputs between the application and digital inputs/outputs from this cable are used is shown in input/output tables of the application.

4 . Digital inputs/outputs of the application are transferred to D-Sub25 Male connector in each application module. Input/output points on this socket and inputs and outputs that are used in the application are specified in application input/output table.

5 . Analog inputs/outputs of the application are transferred to D-Sub25 Male connector in application modules where analog input/output connections are used. Input/output connections that are used in the application are shown in application input/output table. In some application modules, there is no need of analog inputs/outputs so these connection sockets are not included in the module.

6 . When D-Sub25 and D-Sub15 connection cables are not used for input/output connections of the applications, connections can be made with the help of 2 mm sockets. For inputs and outputs that are used in the applications, 2 mm sockets on the board can be used.

(ATTENTION: If the application modules D-sub25 and/or D-sub15 are to be used with connection cables, you don't need to use these cables at the same time with 2 mm test cables between application circuits (7) and PLC input/output points (6) on the module.

7. It is the part where application circuits are present. All input/output points of the application can be externally connected to the PLC through 2 mm sockets.

1.1 . Connection Structures of Y-0030-A PLC Application Modules

They can make individual connections between PLC and input/output points of the applications. Besides, D-Sub connection cables and all inputs/outputs can be connected directly at a time over Digital I/O link (Y-0030-M04) and/or Analog I/O link (Y-0030-M06) module cards on modular PLC platform (Yıldırım Electronic product Y-0030M).

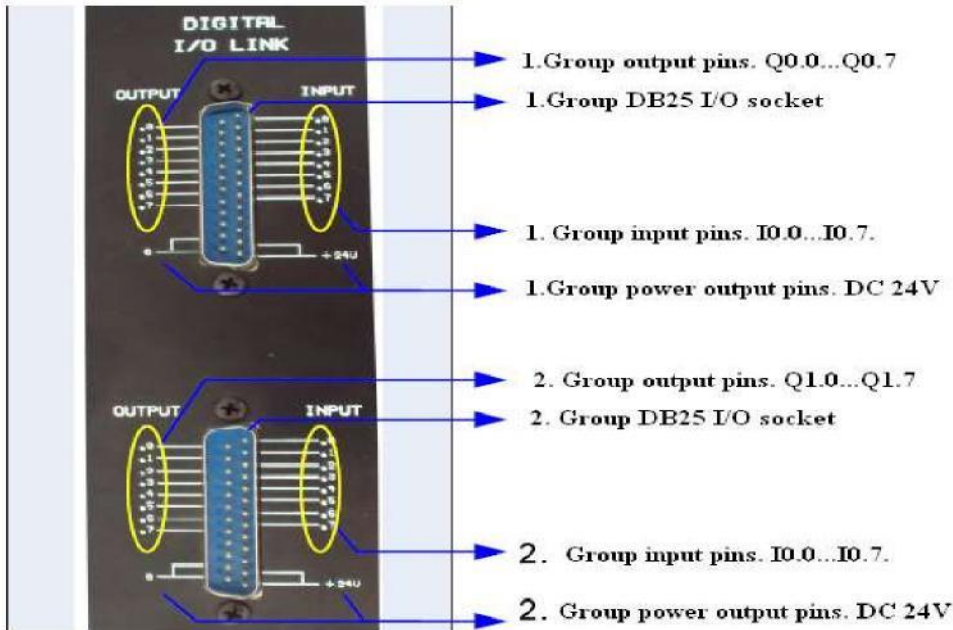


Figure 2: Modular PLC digital I/O link (Y-0030M-04) D-sub 25 male pin structure.

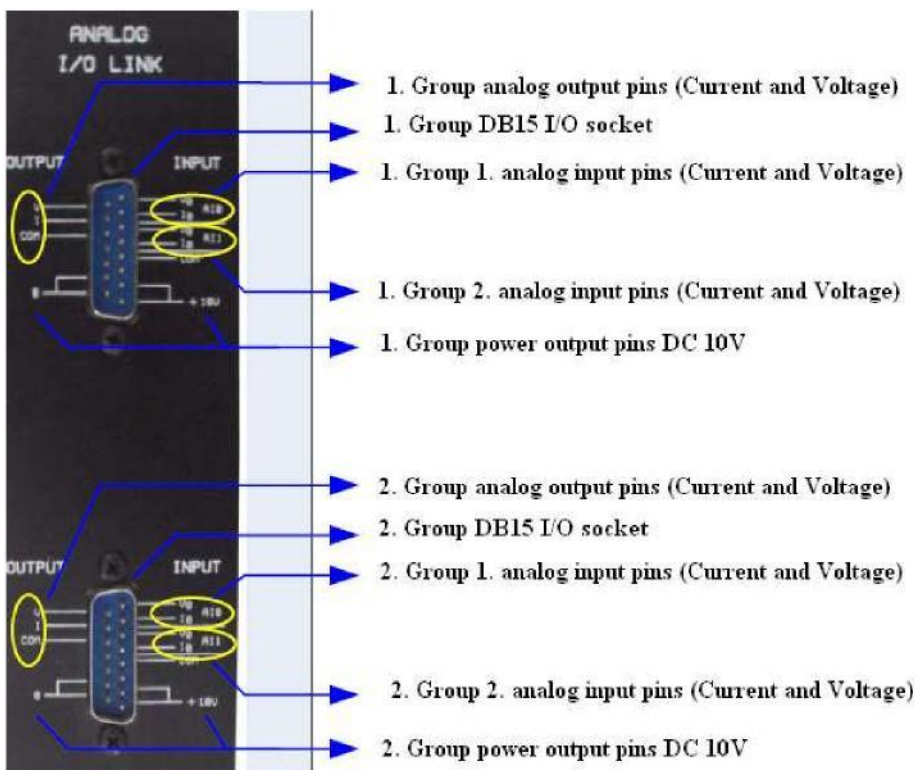


Figure 3: Modular PLC digital I/O link (Y-0030M-04) D-sub 15 male pin structure.

In Figure 4 and Figure 5, connection parts of D-sub 25/D-sub 15 male and female connectors that are used in PLC applications can be seen. In Figure 6, connection principles between application modules and I/O link modules can be seen.

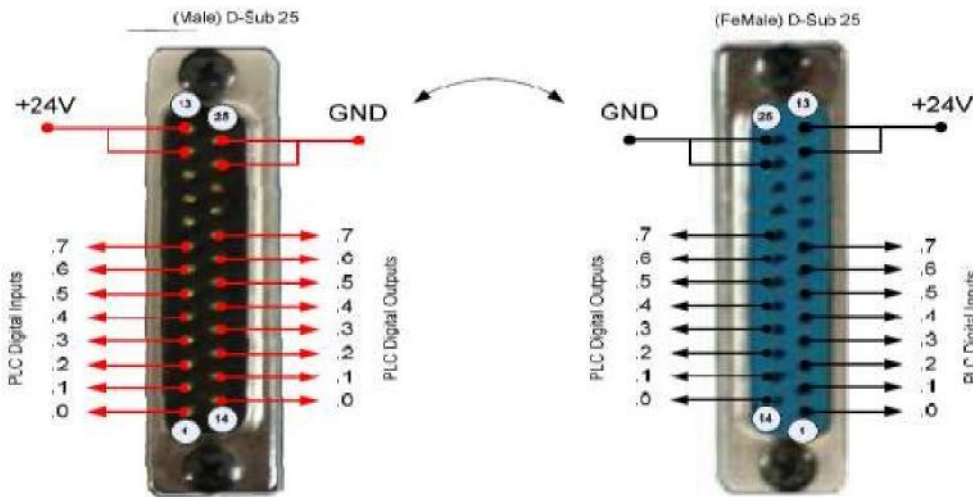


Figure 4: Digital I/O link D-sub 25 male/female pin structure.

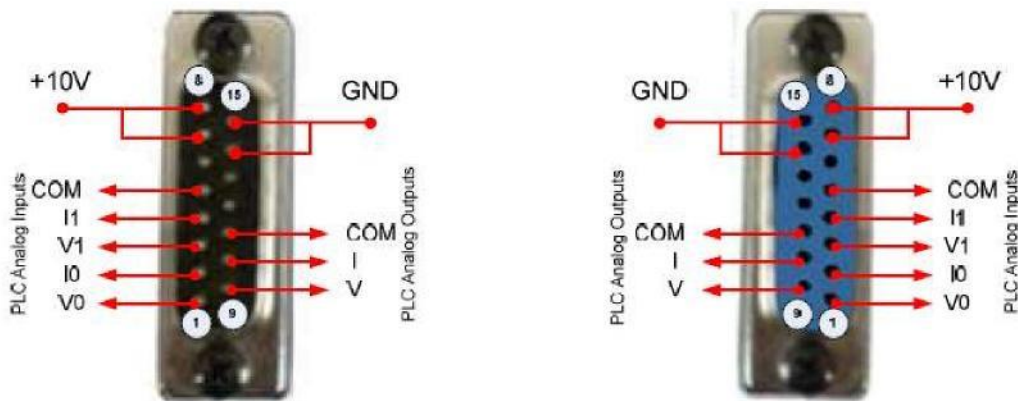


Figure 5: PLC application modules Analog I/O link D-sub 15 male pin structure.

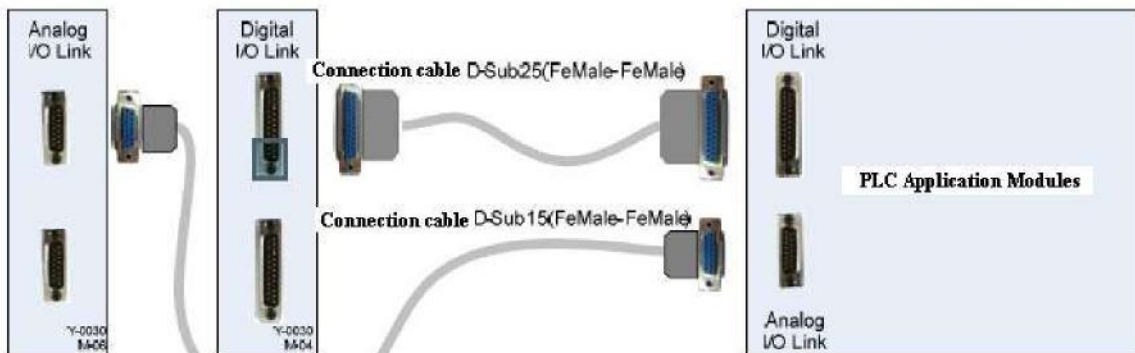


Figure 6: D-Sub connections between I/O link module and application nodules.

4 mm sockets are used for connections in asynchronous application modules. Y-0030-A01/06 PLC I/O LINK module should be used in order to make the connection between PLC and asynchronous application modules via 4 mm sockets.

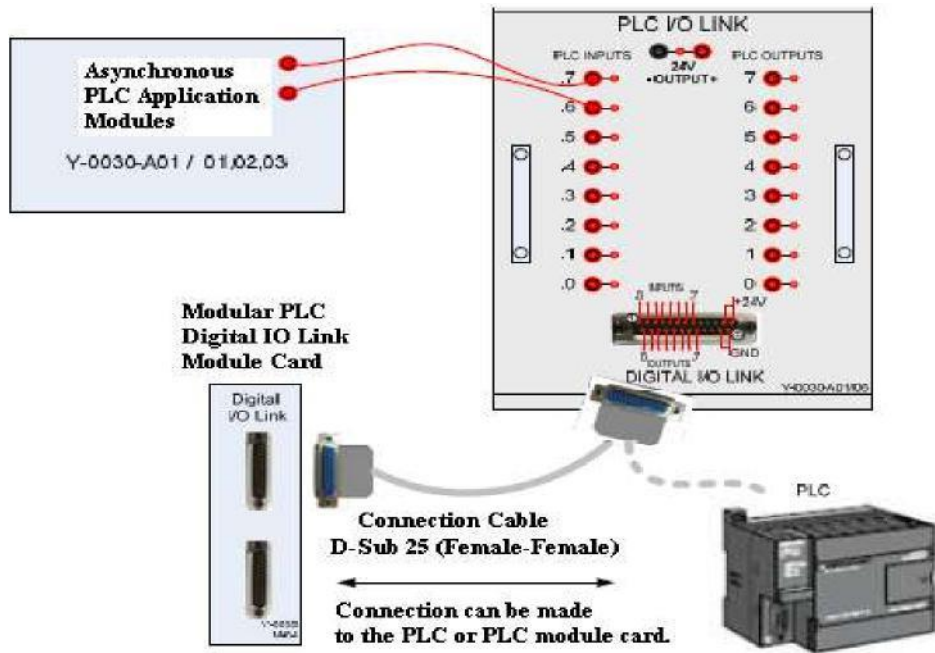


Figure 7: PLC i/O LINK module with Digital I/O LINK card, or PLC connection.

Structural diagram of input/output relation between any PLC and controlled system can be seen below.

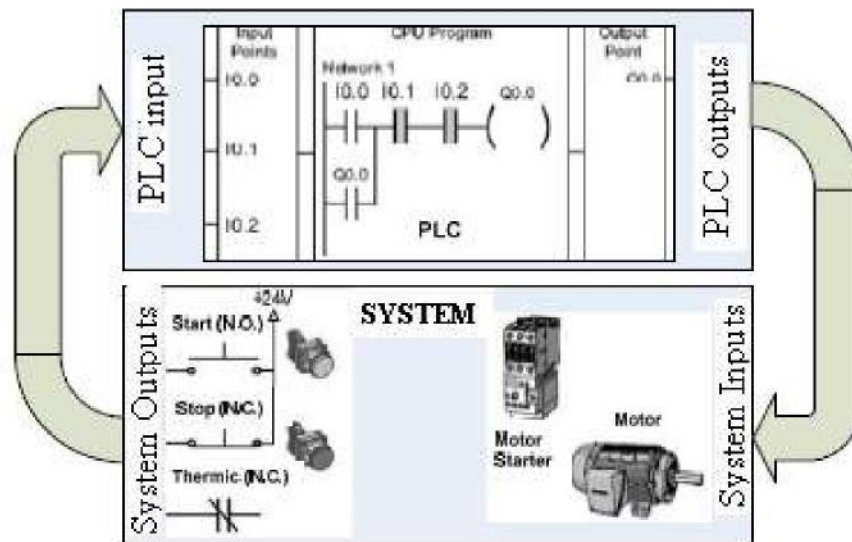


Figure 8: Input/output cycle between PLC's and systems they are connected to.

1.2 . D-sub 25 I/O Connection Structure of Connecting Cable.

Color codes and connection types of D-sub 25 I/O link connecting cable that is used in PLC application modules are shown below. Female D-Sub 25 connector connection of one side in PLC I/O link connecting cable is not made. The other connection is not done by taking different needs of the users into account. According to user's needs, other end of the cable;

-can be directly connected to input/output electric terminals on any PLC.

-can be transformed to be compatible with Modular PLC Training Set (T-0030M) platform by making Female D-Sub 25 connector connection.

- can be transformed to be compatible with our other PLC training sets by connecting/welding 2 mm test cables.

	PLC Inputs		PLC Outputs
Blue	0 (D-Sub Pin1)	Light Blue	.0 (D-Sub Pin14)
Brown	.1 (D-Sub Pin2)	Light Brown	.1 (D-Sub Pin15)
Green	.2 (D-Sub Pin3)	Light Green	.2 (D-Sub Pin16)
Purple	.3 (D-Sub Pin4)	Light Purple	.3 (D-Sub Pin17)
Pink	.4 (D-Sub Pin5)	Light Pink	.4 (D-Sub Pin18)
Yellow	.5 (D-Sub Pin6)	Light Yellow	.5 (D-Sub Pin19)
Orange	.6 (D-Sub Pin7)	Turquoise	.6 (D-Sub Pin20)
Translucent Blue	.7 (D-Sub Pin8)	Translucent	.7 (D-Sub Pin21)

Red	+24V (D-Sub Pin 13/14)
Black	GND (D-Sub Pin 24/25)

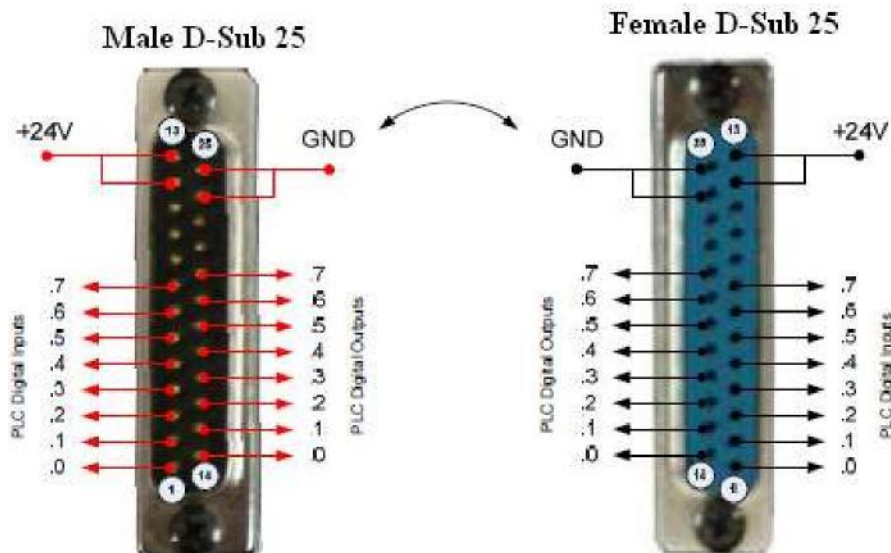


Figure 9: D-sub 25 I/O link connection cable pin structure.

2. Intermittent Operation of Asynchronous motor

Purpose: Using PLC instead of classic controller circuits. Apprehending advantages and disadvantages of PLC use against classic controller circuits. Developing the PLC program that is necessary for operating the application by using ladder programming method and installing to PLC. Making connections of PLC input/outputs, circuit components and energy lines.

Operating Principle of the Application:

Controller circuit of asynchronous motor's intermittent operation, which is performed by conventional methods, and power circuit are shown below. First of all, operate the circuit by installing according to the controller and power circuit below, without using PLC. Later we will perform the same application by using PLC. Modules and tools to be used in the application;

Modules to be used in the application:

- 1 . Y-0030-A01/01 (Contactor Module)
- 2 . Y-0030-A01/02 (Button, Switch, Signal Lamp Module)
- 3 . Y-0030-A01/05 (3 Phase Asynchronous motor Module)
- 4 . Y-0030-A01/06 (IO Link Module)
- 5 . 3 Phase Power Cable and 4 mm test cables

Controller Circuit Schema:

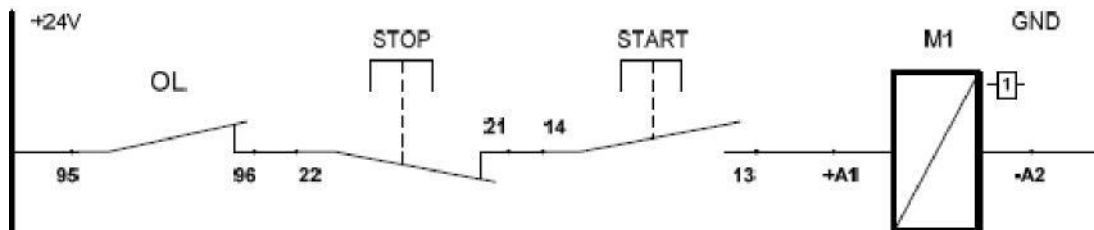


Figure 10: Controller circuit to operate the asynchronous motor intermittently

Power Circuit Schema:

Thermic relay connection that can be seen in power circuit schemas may not be made. Thermic relay use in industry will prevent motor windings from burning under high current/load. With the current adjustment on the thermic relay, opening limit value of thermic contacts can be changed.

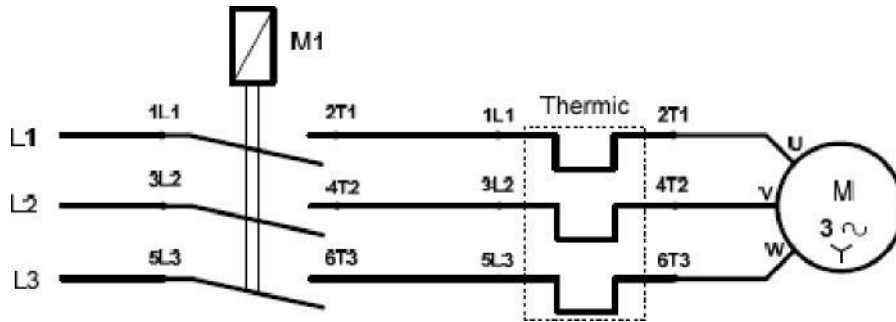
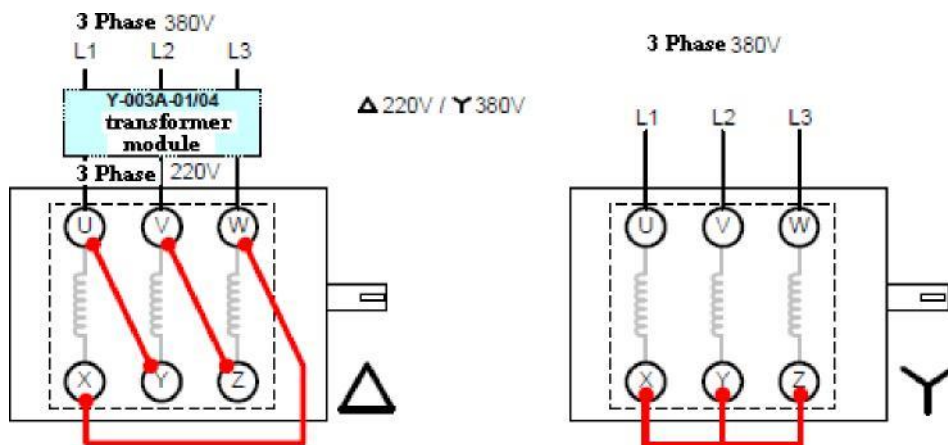


Figure 11: Power circuit to operate the asynchronous motor intermittently

Motor connection diagram for Y-0030A-01/05 module:

When the label of the motor on Y-0030A-01/05 module, it is observed that there is I220V/380V usage information. According to the information here, star connection can be made on 3 phase 380V and delta connection can be made on 3 phase, 220V. Our mains voltage is 3 phase 380V, therefore do not directly make delta connection on this motor. Unless otherwise stated, in our applications we will use asynchronous motor on Y-0030A-01/05 at 3 phase 380V with star connection. If you want to use the motor with delta connection, use Y-0030A-01/04 transformer module (3 phase 380V/220V reducer).

Figure 12: Coil ends of asynchronous motor, electric terminal structure, delta and star connection diagram on Y-0030A-01/05 module.



PLC Technology Schema:

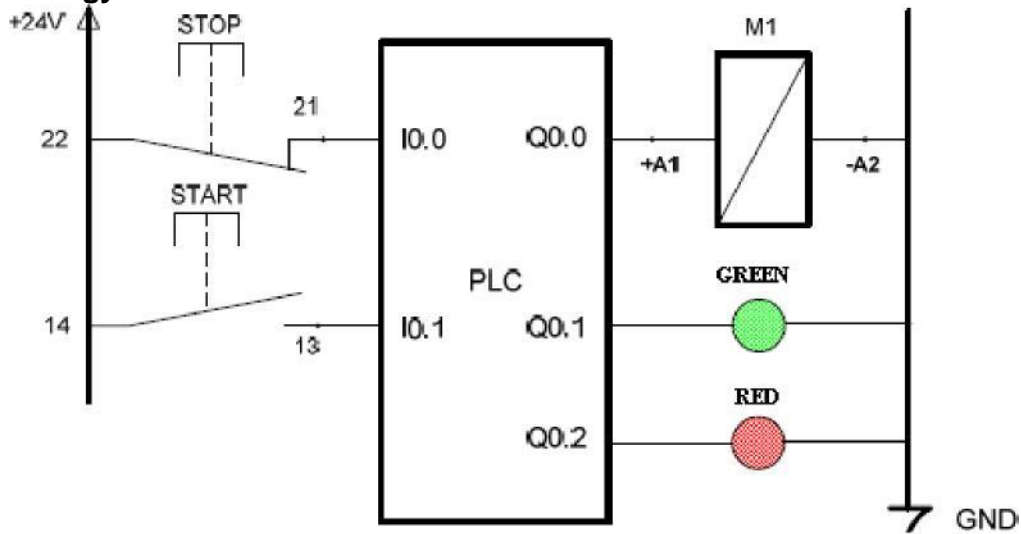


Figure 13: PLC connection to run an asynchronous motor intermittently with PLC.

PLC Ladder Diagram:

Symbol	Address	Comment
STOP_	I0.0	N.C. Buton
START_	I0.1	N.O. Buton
M1_CONTACTOR	Q0.0	3 Main Contact N.O 4 Additional Contact 2 N.O 2N.C
GREEN_LAMP	Q0.1	
RED LAMP	Q0.2	

INTERMITTENT OPERATION OF ASYNCHRONOUS MOTOR

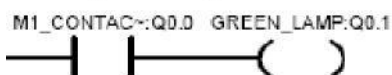
Network 1

As long as START button is pressed (opened switch is closed), Q0.0 stays set (contactor is energized). As long as STOP button is pressed (closed switch is opened), Q0.0 stays reset (Energy of the contactor is cut).



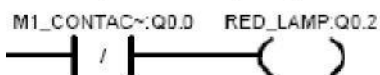
Network 2

When Q0.0 is set (M1 contactor is energized) Q0.1 becomes active (Green lamp lights)



Network 3

When Q0.0 is reset (energy of M1 contactor is cut) Q0.2 is active. (Red lamp lights).



Process Steps:

1. Make the connections with 4 mm test cables according to controller circuit in the figure 10.
2. Make motor electric terminal connection according to the star connection.
3. Make the connections with 4 mm test cables according to power circuit in the figure 11.
4. After taking the necessary measures, apply DC 24V energy to the controller circuit and apply 3 phase AC 380V to the power circuit.
5. Press START button. Examine the movement of the motor.
6. Press stop button when STOP button is pressed and observe the operation of the motor.
7. Discuss and research when overcurrent relay will activate. (Note:We can also use the overcurrent relay by pressing test button without waiting motor to draw over current.)
8. Close all energy sources on the circuit.
9. Undo the controller circuit in Figure 10 however leave power circuit as it is. In place of controller circuit, install the circuit again according to the PLC technology schema in figure 13. Make PLC inputs/outputs with 4 mm test cables over PLC I/O LINK module.
10. Open Step 7-Micro/Win program. Open ...A01 Uygulamaları\A01Uyg1.mwp file in the application CD and install it to the PLC.
Set PLC to the RUN position. (Application program is prepared for CPU 224XP. Program lines for different PLC's must be taken as samples and must be arranged for various PLC's.)
11. After taking the necessary measures, apply DC 24V energy to the controller circuit and apply 3 phase AC 380V to the power circuit.
12. Press START button. Examine the movement of the motor.
13. Press stop button when STOP button is pressed and observe the operation of the motor.
14. Discuss how N.C contact of overcurrent relay will be connected to the PLC.
15. Was there a change in the operation of the circuit with a warning signal from the contact of overcurrent relay which is connected to the PLC input without making any change in PLC program? Discuss.