Starter Kit
Application Examples

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Starter Kit Application Examples

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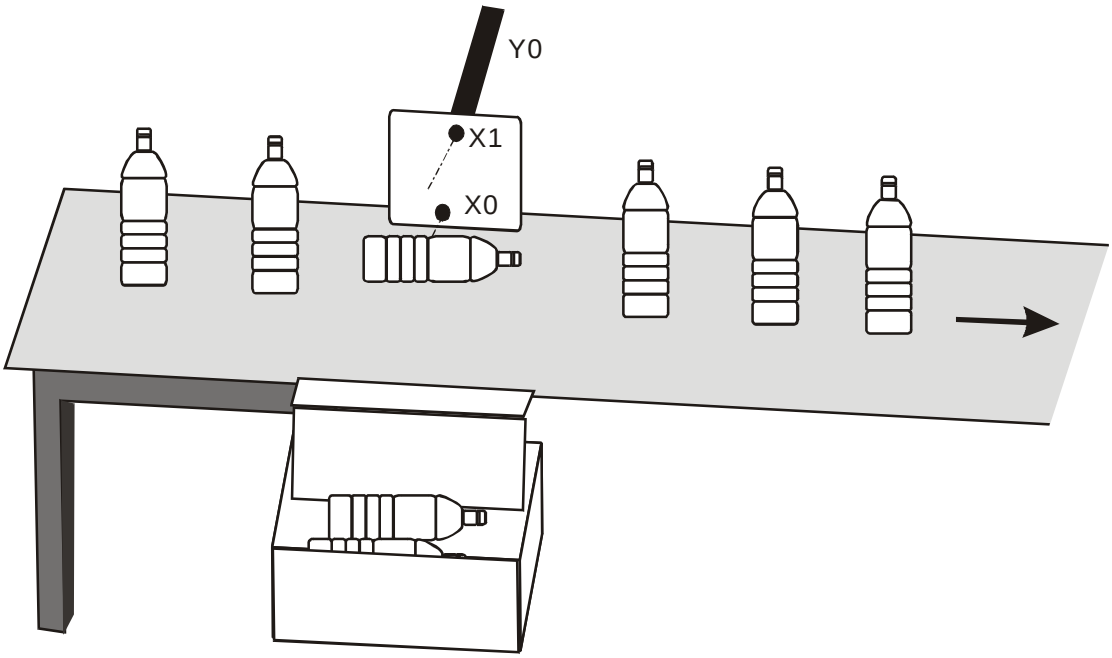
1.1 Normally Closed Contact in Series Connection



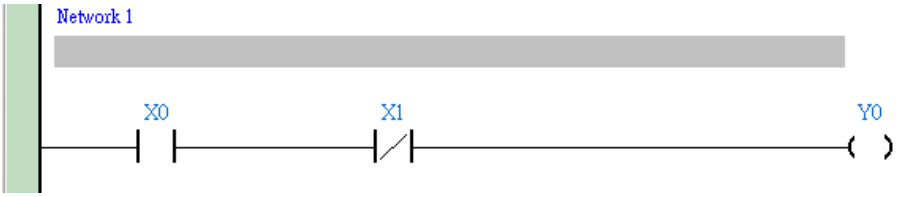
Control Purpose:

- Detecting the standing bottles on the conveyor and pushing the fallen bottles out

Devices:

Device	Function
X0	X0 = ON when the detected input signal from the bottle-bottom is sheltered.
X1	X1 = ON when the detected input signal from the bottle-neck is sheltered.
Y0	Pneumatic pushing pole

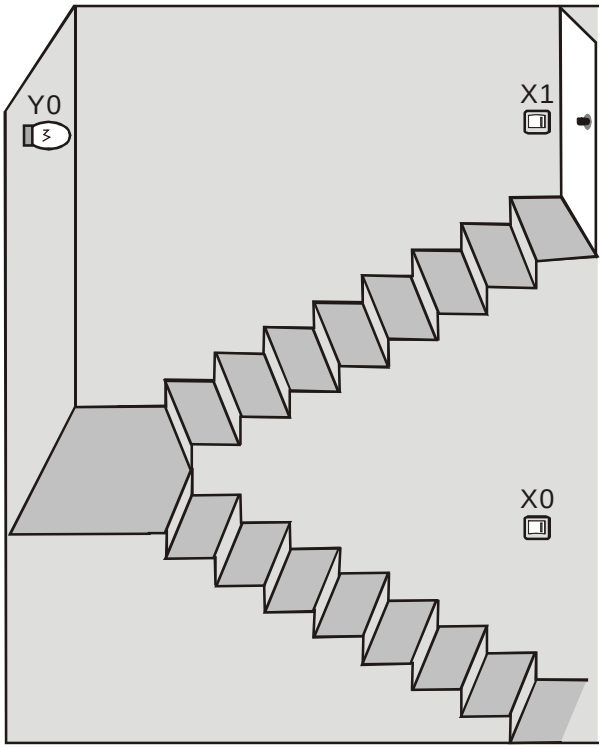
Control Program:



Program Description:

- If the bottle on the conveyor belt is upstanding, the input signal from monitoring photocell at both bottle-bottom and bottle-neck will be detected. In this case, X0 = ON, and X1 = ON. The normally open (NO) contact X0 will be activated as well as the normally closed (NC) contact X1. Y0 remains OFF and pneumatic pushing pole will not perform any action.
- If the bottle from the conveyor belt is down, only the input signal from monitoring photocell at the bottle-bottom will be detected. In this case, X0 = ON, X1 = OFF. The state of output YO will be ON because the NO contact X0 activates and the NC contact X1 remains OFF. The pneumatic pushing pole will push the fallen bottle out of the conveyor belt.

1.2 Block in Parallel Connection



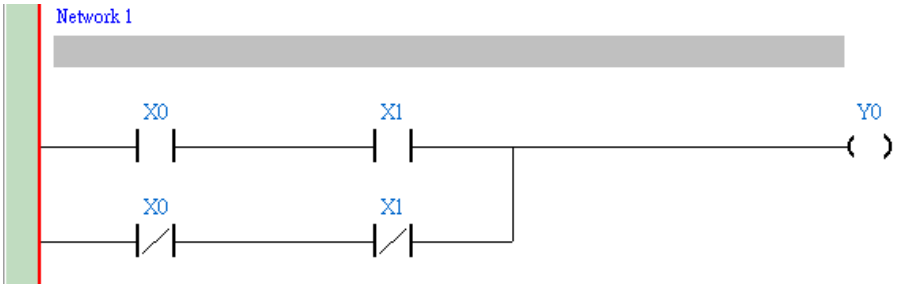
Control Purpose:

- Setting up a lighting system for users to switch on/off the light whether they are at the bottom or the top of the stairs.

Devices:

Device	Function
X0	X0 turns ON when the bottom switch is turned to the right
X1	X1 turns ON when the top switch is turned to the right.
Y1	Stair light

Control Program:



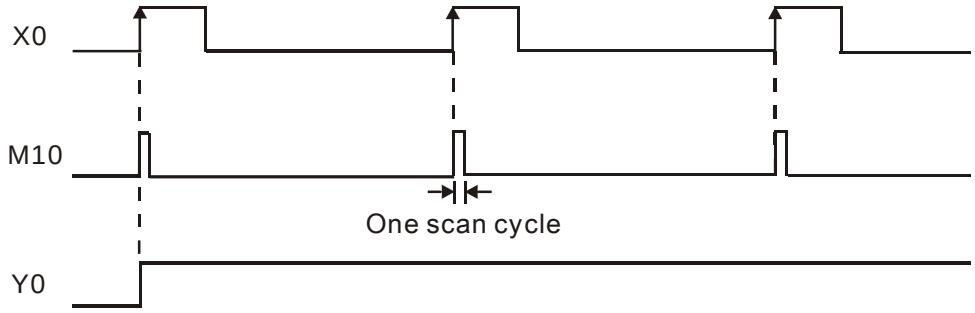
Program Description:

- If the states of the bottom switch and the top switch are the same, both ON or OFF, the light will be ON. If different, one is ON and the other is OFF, the light will be OFF.
- When the light is OFF, users can turn on the light by changing the state of either top switch at the bottom switch of the stairs. Likewise, when the light is ON, users can turn off the light by changing the state of one of the two switches..

1.3 Rising-edge Pulse Output for One Scan Cycle

Control Purpose:

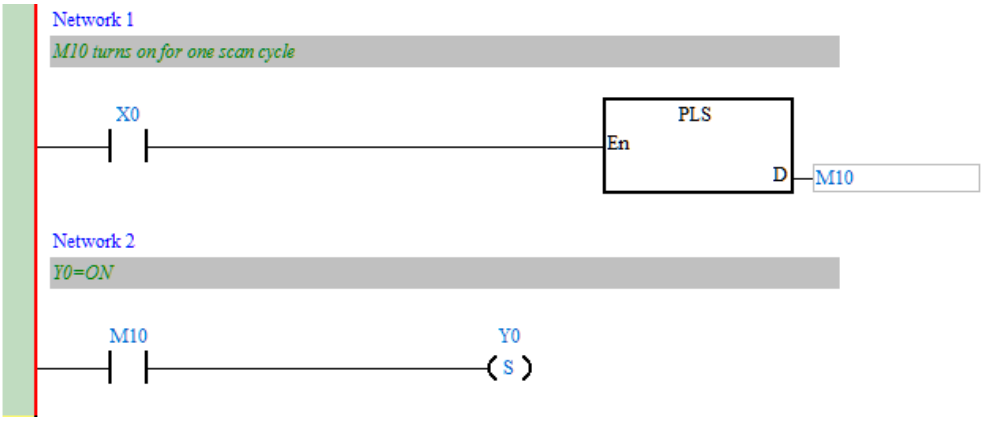
- Creating a pulse of one program scan cycle as the condition to trigger the indicator or other devices when the switch (X0) is turned on.



Devices:

Device	Function
X0	Switch (OFF→ON)
M10	Creating a trigger pulse for one program scan cycle
Y0	Indicator

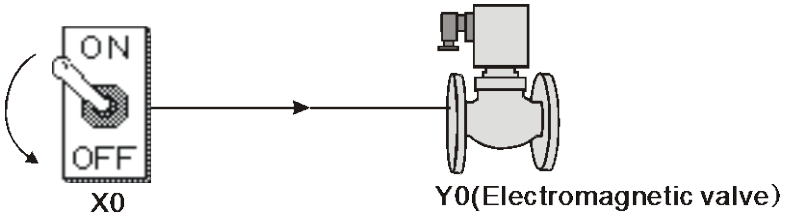
Control Program:



Program Description:

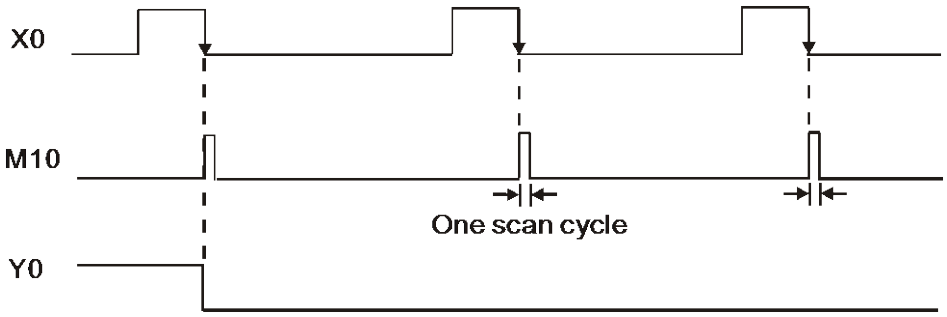
- When X0 is turned on (Rising-edge triggered), PLS instruction will be executed, and M10 will send a pulse for one program scan cycle.
- When M10 = ON, [SET Y0] instruction will be executed and Y0 will be ON. In this case, the indicator will be lighted, and other devices will be activated as well.

1.4 Falling-edge Pulse Output for One Scan Cycle



Control Purpose:

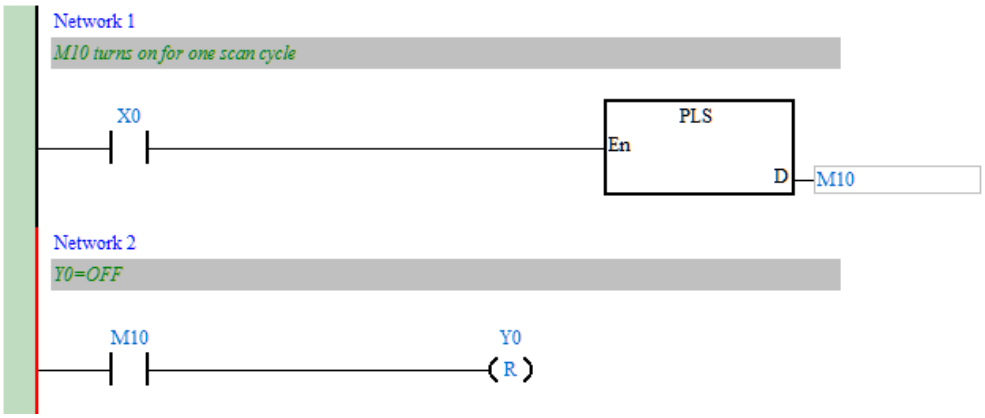
- Creating a pulse of one program scan cycle as the condition to trigger the electromagnetic valve or other devices when the switch is turned off.



Devices:

Device	Function
X0	Switch(ON→OFF)
M10	Creating a trigger pulse for one program scan cycle
Y0	Electromagnetic valve

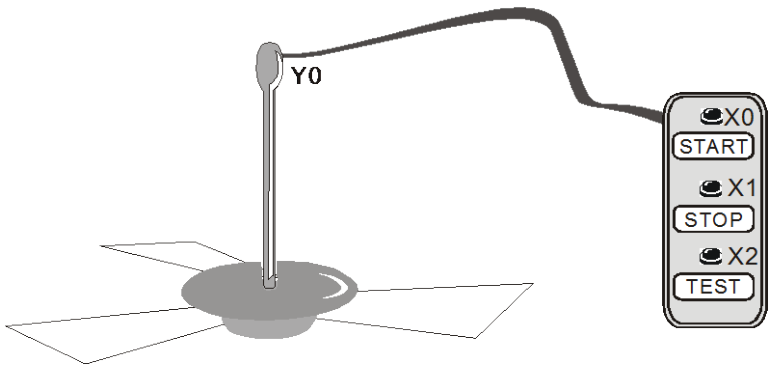
Control Program:



Program Description:

- When X0 is turned on (Falling-edge triggered), PLF instruction will be executed, and M10 will send a pulse for one program scan cycle.
- When M10 = ON, [RST Y0] instruction will be executed and Y0 will be OFF. In this case, the electromagnetic valve will be shut down.

1.5 Latching Control Circuit



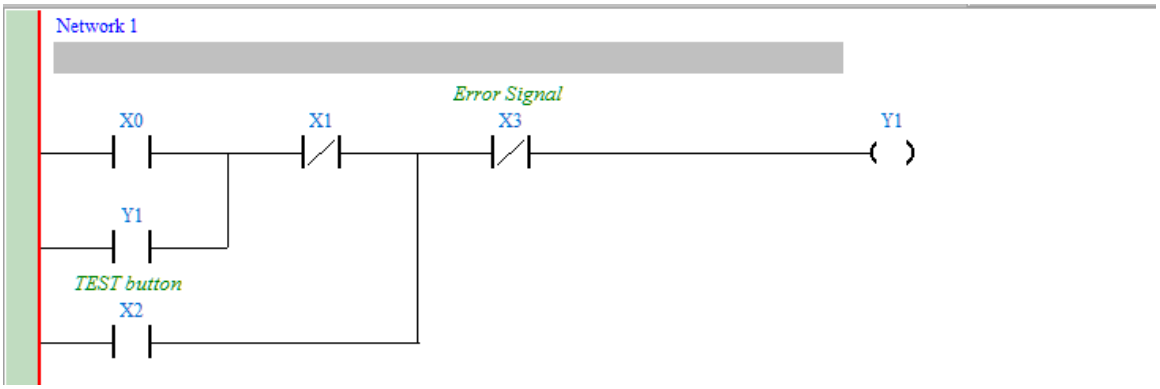
Control Purpose:

- Controlling the running state of the ceiling-fan by pressing START and STOP.
- Checking if the ceiling-fan is running normally by pressing TEST.

Devices:

Device	Function
X0	Press START, X0 = ON.
X1	Press STO, X1 = ON.
X2	Press TEST, X2 = ON.
X3	Error signal
Y1	Ceiling-fan motor control signal

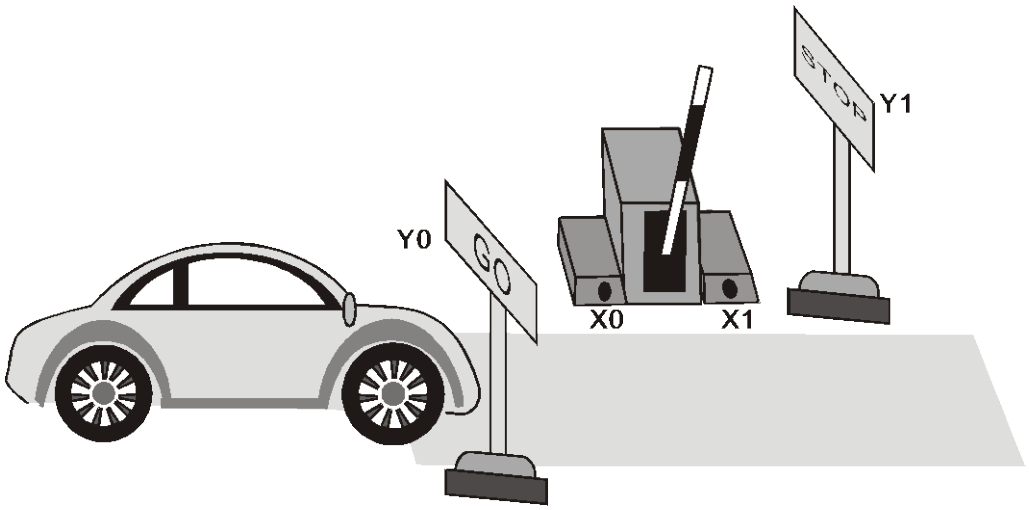
Control Program:



Program Description:

- Press START lightly and X0 = ON. The ceiling-fan will keep running if no error occurred (X3 = OFF). The action can be practiced by a latching circuit which takes output Y1 as one of the input condition to keep the fan running even if the START button is not pressed.
- When STOP is pressed, X1 = ON and Y1 = OFF. The ceiling-fan will stop running.
- If error occur (X3 = ON), Y1 will be OFF and the ceiling-fan will stop running.
- When TEST is pressed (X2 = ON), Y1 = ON. The ceiling-fan will start running if no error occurred (X3 = OFF). On the contrary, when TEST is released, the ceiling-fan will stop running. The testing function is performed by this process.

1.6 Interlock Control Circuit



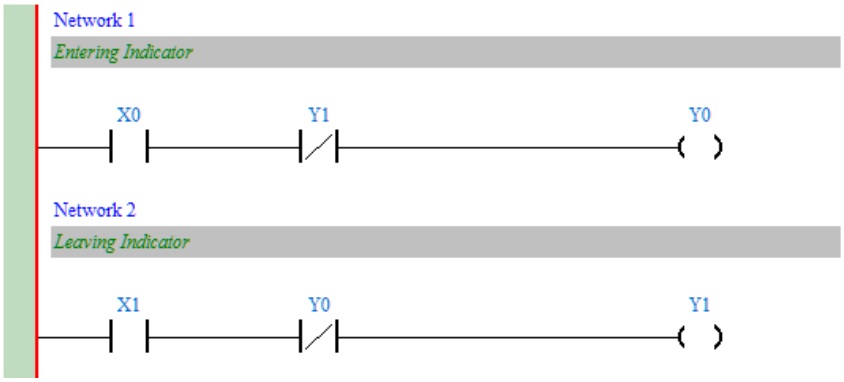
Control Purpose:

- The Entry/Exit of the parking lot is a single lane passage. By controlling the indicators, the program ensures that only one car can pass through the Entry/Exit so as to prevent car accident between entering and leaving cars

Devices:

Device	Function
X0	Car entering sensor. When a car passes through the sensor, X0 = ON.
X1	Car leaving sensor. When a car passes through the sensor, X1 = ON.
Y0	Entering car indicator（ON means “GO”, OFF means “STOP”）
Y1	Leaving car indicator（ON means “GO”, OFF means “STOP”）

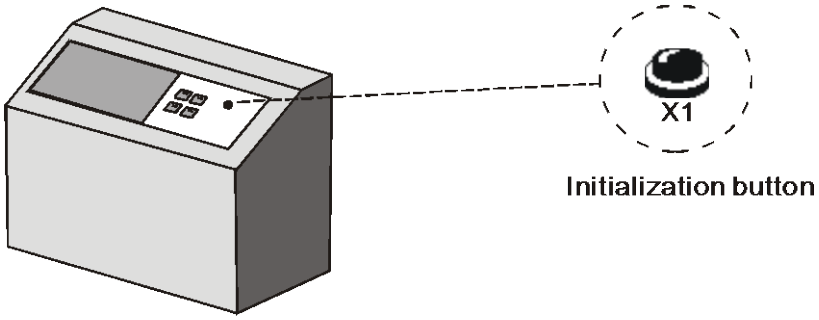
Control Program



Program Description:

- In the parking lot, there are two indicators individually directing the entering and leaving cars. By the interlock control circuit, only one indicator will show “GO” signal and the car accident will thus be prevented.
- When an entering car draws near the vehicle control barrier, X0 will be ON and so will Y0. The entering car indicator will show “GO”. At the same time, the leaving car indicator will show “STOP.” Car entering is allowed but leaving is prohibited in this case.
- When a leaving car draws near the vehicle control barrier, X1 will be ON and so will Y1. The leaving car indicator will show “GO” and the entering car indicator will show “STOP.”

1.7 Automatic Parameter Initialization When Powered Up



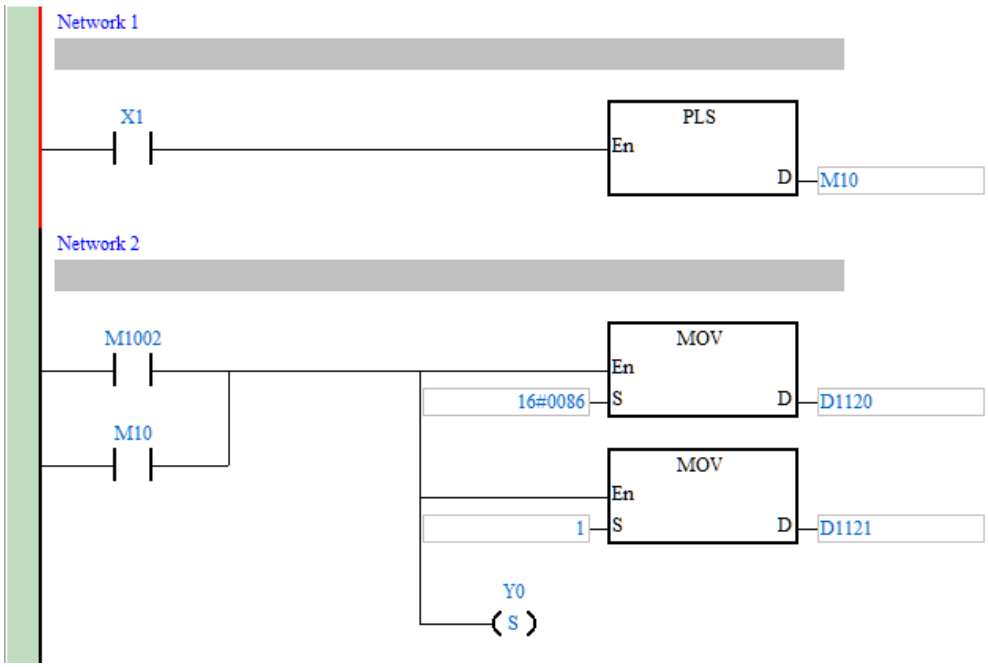
Control Purpose:

- When the machine is powered up, all the parameters will be initialized automatically and the machine will be ready. Users don't need to set the parameters manually.
- Users can initialize parameters by pressing Initialization button at any time when the machine is running.

Devices:

Device	Function
X1	Initialization button. X1 will be ON when pressed
M1002	Creating a pulse when PLC is powered on
M10	Creating a trigger pulse for one scan cycle
D1120	PLC COM2 communication protocol
D1121	PLC communication address
Y0	Parameter initialization completed signal

Control Program:



Program Description:

- When PLC begins running, M1002 will be ON once and create a pulse with the width of one scan cycle. This action will be executed for just once during the PLC running process and is generally used to initialize devices such as D (data register), C (counter) and S (step point)
- By pressing X1, users can initialize parameters at any time during the program running process, that is, setting PLC Slave ID as No. 1, COM2 communication format as 9600, 7, E, 1 and Y0 to be ON.

1.8 Common Latched Circuit and SET/RST Instructions Application

Control Purpose:

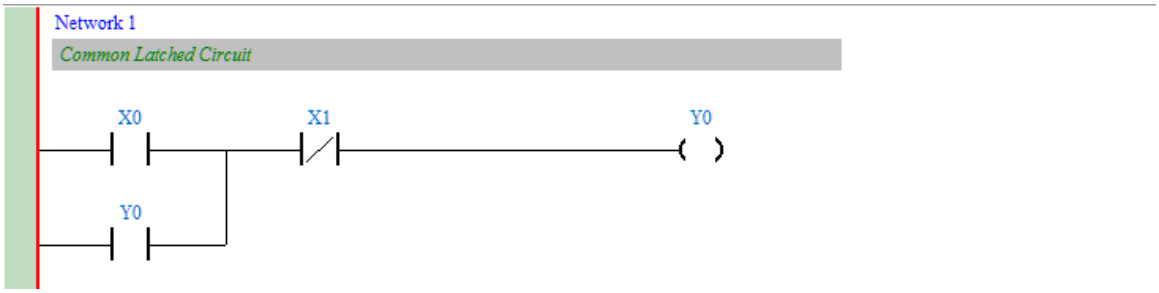
- Turn on the switch, the light will be ON; turn off the switch, the light will be OFF.

Devices:

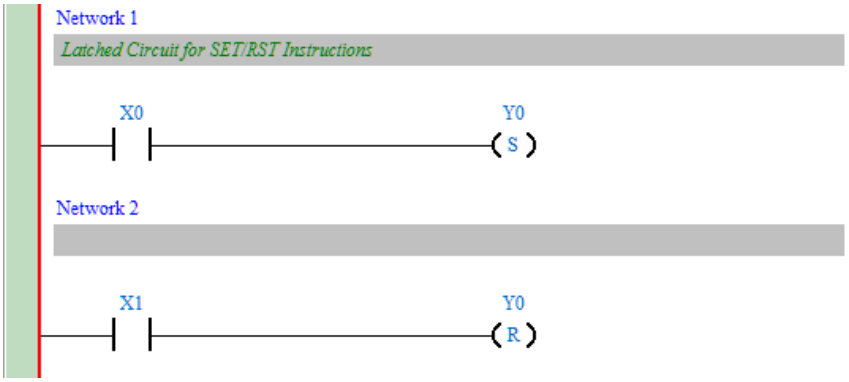
Device	Function
X0	Switch-on button. X0 will be ON when pressed
X1	Switch-off button. X1 will be ON when pressed
Y0	Indicator

Control Program:

- Common Latched Circuit



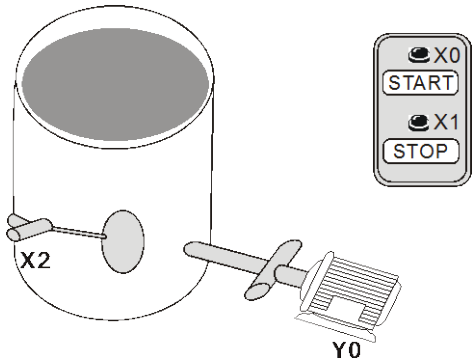
- Latched Circuit for SET/RST Instructions



Program Description:

- In the above examples, when X0 goes from OFF to ON, Y0 will stay in ON state. When X1 goes from OFF to ON, Y1 will stay in OFF state
- When X0 and X1 are enabled at the same time, it will be “Stop First”, that is, Y1 and the indicator will be OFF.

1.9 SET/RST - Latched and Unlatched Circuit



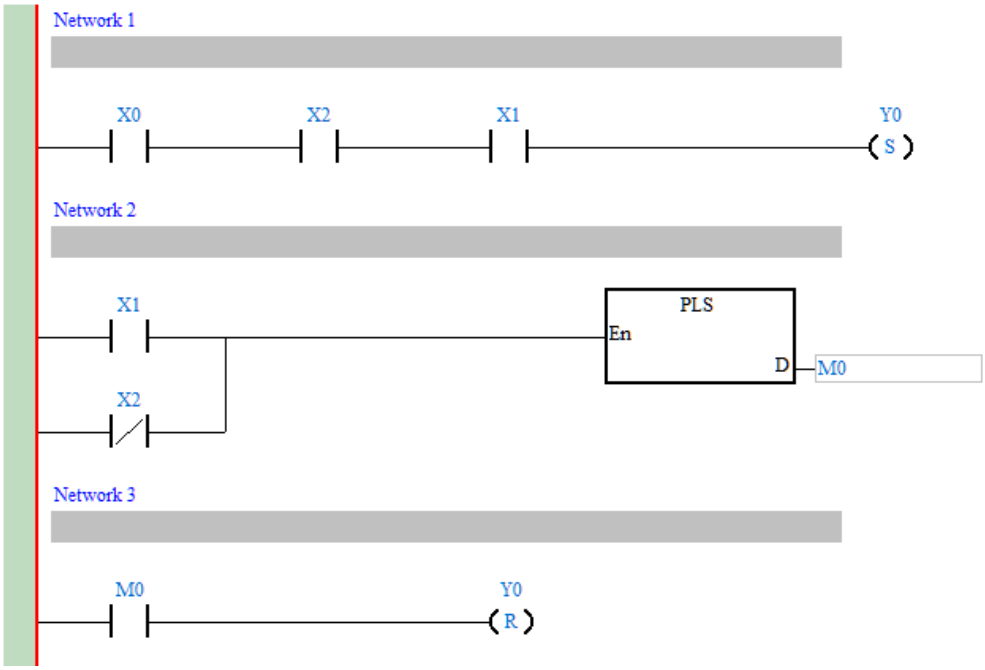
Control Purpose:

- Press START, the pump begins to pump out the water; press STOP or when the water is empty, the pump stops working.

Devices:

Device	Function
X0	START button. X0 will be ON when pressed
X1	STOP button. X1 will be ON when pressed
X2	Level detector. X2 will be ON if there is water in the container
M0	Trigger pulse for one scan cycle
Y0	Pump motor

Control Program:



Program Description:

- X2 will be ON If there is water in the container. When START is pressed, X0 = ON, and SET instruction will be executed. Y0 will be set, and the pump motor begins pumping the water.
- There are two situations for stopping the motor. First, when STOP is pressed, X1 = ON. PLS instruction will be executed and M0 will be ON for one scan cycle. RST instruction will thus

be executed, and Y0 will be reset to stop pumping. Second, when the water in the container is empty, X2 will be OFF and PLS instruction will be executed to trigger M0 for resetting Y0. In this case, the pump motor will stop pumping as well.

1.10 Alternate Output Circuit (With Latched Function)

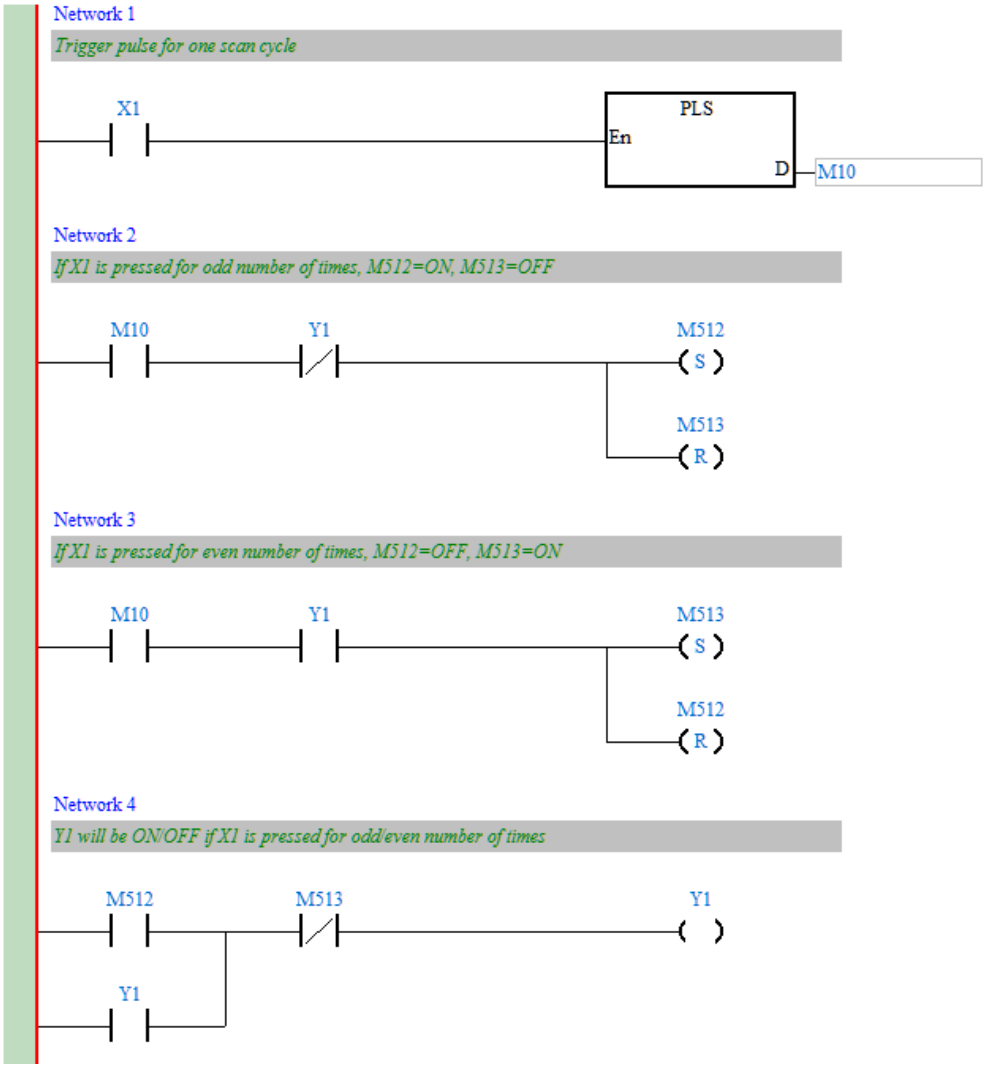
Control Purpose:

- Setting the light ON by pressing the switch for the 1st time, the 3rd time, 5th time, etc.; setting the light OFF by pressing the switch for the 2nd time, 4th time, 6th time, etc.
- Restoring the indicator to the state before power off when the device is powered up again.

Devices:

Device	Function
X1	Light switch. X1 will be ON when the button is pressed
M10	Trigger pulse for one scan cycle
M512	If X1 is pressed for odd number of times, M512 ON, M513 = OFF.
M513	If X1 is pressed for even number of times, M512 = OFF, M513 = ON.
Y1	Indicator

Control Program:



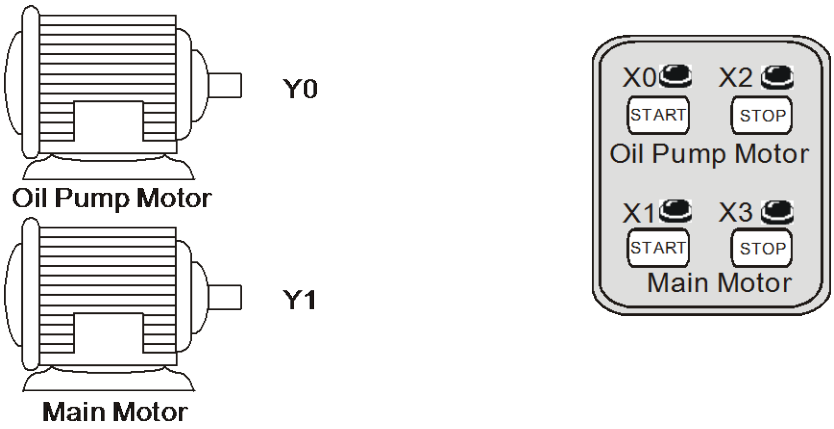
Program Description:

- Pressing X1 for the 1st time (or odd number of times):

When the switch X1 is pressed, X1 will be ON and the [PLS M10] instruction will be executed for triggering M10 to be ON for one scan cycle. In this case, M10 is ON and Y1 is OFF, SET and RST instructions at line 2 will thus be executed. On the contrary, SET and RST instructions at line 3 will not be executed due to the open loop of Y1. At line 4, coil Y1 is ON because of the results of Line 2: M512 is ON and M513 is OFF. When the 2nd scan cycle is started, SET/RST at both line 2 and line 3 will not be executed because M10 is OFF in this scan cycle. As a result, the light will be ON until the switch is pressed next time.

- Pressing X1 for the 2nd time (or even number of times):
  When the switch X1 is pressed again, X1 will be ON and M10 will be ON for one scan cycle. According to the result of pressing X1 for the first time, the state of Y1 has been ON. SET/RST instructions at line 3 will thus be executed. In addition, SET/RST instructions at line 2 won't be executed due to the open loop of Y1. In this case, M513 will be ON and M512 will be OFF. When the 2nd scan cycle is started, SET/RST at both line 2 and line 3 will not be executed because M10 is OFF in this scan cycle. As a result, the light will remain OFF until the switch is pressed next time.
- Alternate output(ON/OFF) function can also be performed by using API 66 ALT instruction

1.11 Conditional Control Circuit



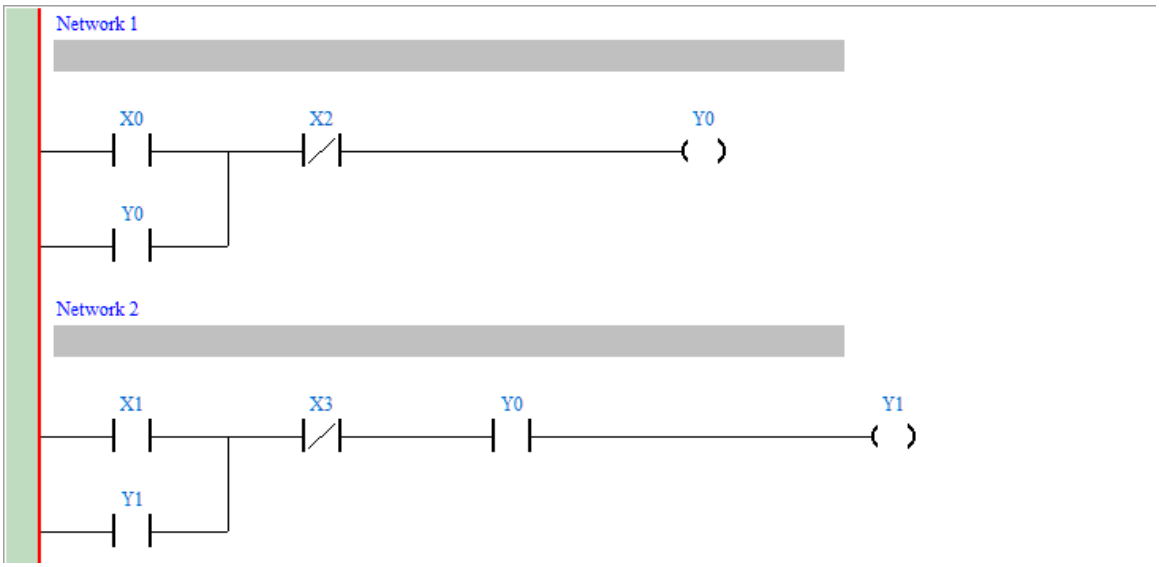
Control Purpose:

- Providing lube for the gear box before the lathe spindle starts to run which aims to ensure that the oil pump motor starts first and the main motor starts subsequently.

Devices:

Device	Content
X0	Oil pump START button. X0 will be ON when pressed.
X1	Main motor START button. X0 will be ON when pressed.
X2	Oil pump STOP button. X2 will be ON when pressed.
X3	Main motor STOP button. X3 will be ON when pressed.
Y0	Oil pump motor
Y1	Main motor

Control Program:

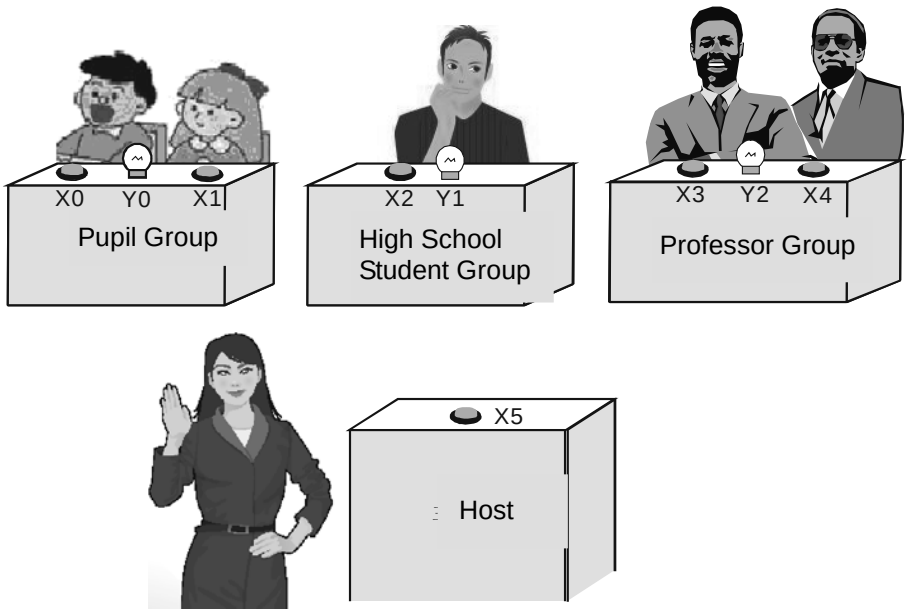


Program Description:

- This program is a typical application of the conditional control circuit. Y0 = ON when Oil Pump START button is pressed. Therefore, the oil pump will start to provide lube for the gear box of main motor(Y1)

- Under the precondition of the operating state of the Oil pump, the main motor (Y1) will be ON when the Main motor START button is pressed.
- During the operation of main motor (Y1), oil pump (Y0) needs to provide lube continuously.
- The oil pump will be stopped when Oil pump STOP button X2 is activated, and the main motor will be stopped when Main motor STOP button X3 is activated.

1.12 First-in Priority Circuit



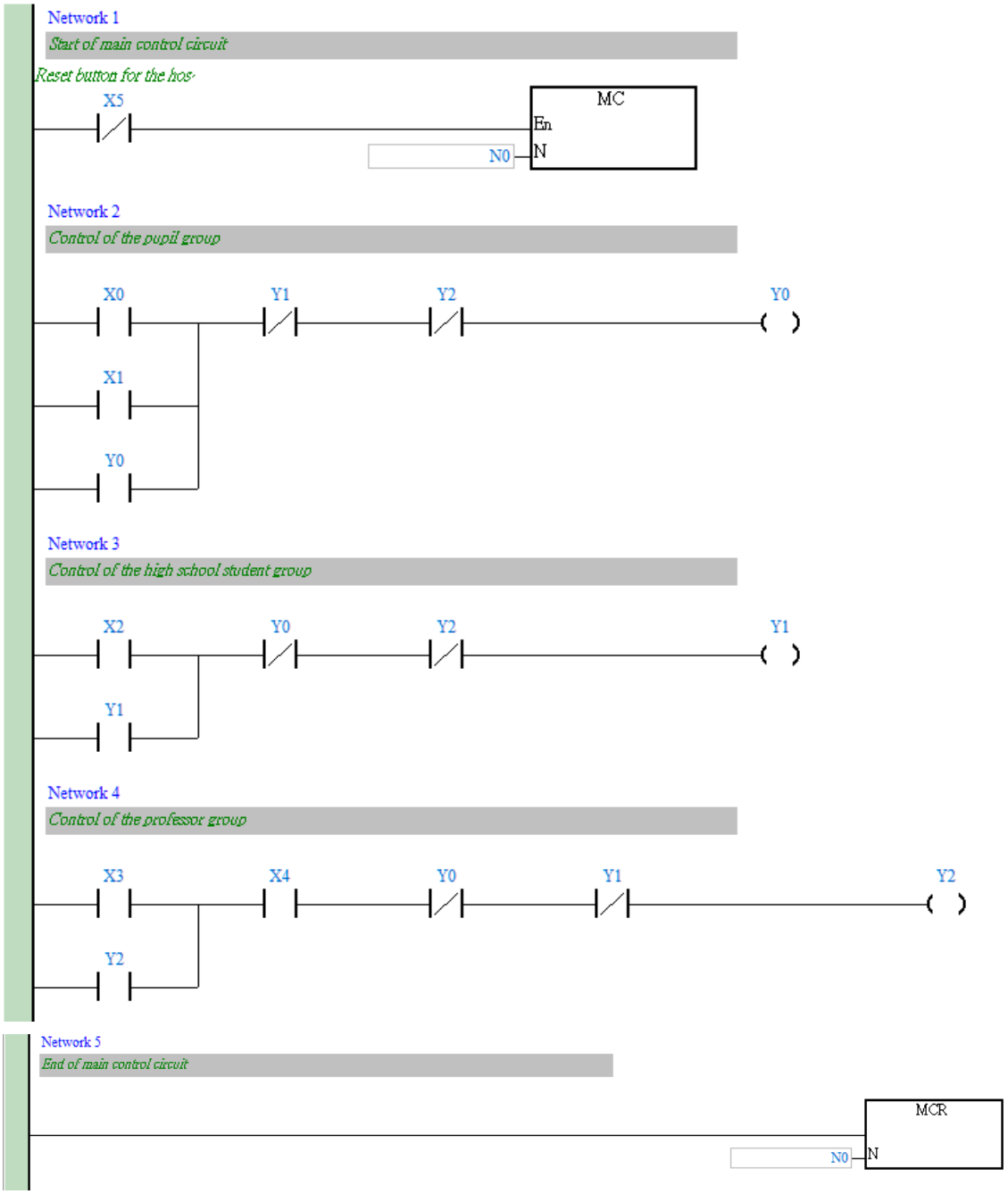
Control Purpose:

- There are 3 groups participating in the quiz game: pupils, high school students and professors. If they want to get the chance of answering the question from the host, they must press the answer button on their table first**.** Other groups' pressing will be invalid if any group gets the chance successfully
- There are 2 answer buttons for the pupil group and professor group and 1 answer button for the high school student group. In order to give preferential treatment to the pupil group, Y0 will be ON if any one of X0 or X1 is pressed. However, in order to limit the professor group, Y2 will be ON when X3 and X4 are pressed at the same time. For the high school student group, Y1 will be ON when X2 is pressed.
- If the host presses X5 (Reset button), Y0, Y1 and Y2 will be OFF.

Devices:

Device	Function
X0	Answer button for pupil group
X1	Answer button for pupil group
X2	Answer button for high school student group
X3	Answer button for professor group
X4	Answer button for professor group
X5	Reset button for host
Y0	Indicator for pupil group
Y1	Indicator for high school student group
Y2	Indicator for professor group

Control Program:



Program Description:

- If the host didn't press the reset button X5, [MC N0] instruction will be executed and the program between MC and MCR will also be executed normally.
- The answer buttons are connected in parallel connection for the pupil group, and in series connection for the professor group. For the high school student group, there is only one answer button. If one group presses the answer button successfully, its indicator will form a latching circuit, that is, the indicator will be ON even the button is released.
- Through the interlock circuit, any other button pressings will be invalid as long as one indicator is ON
- When the host presses the reset button, X5 = ON. [MC N0] instruction and the program

between MC and MCR will not be executed. Y0, Y1 and Y2 will be out of power, and all the indicators for the 3 groups will be OFF. When the host releases the button, X5 = OFF. The program between MC and MCR will be executed normally again, and the new round will begin as well.

1.13 Last-in Priority Circuit

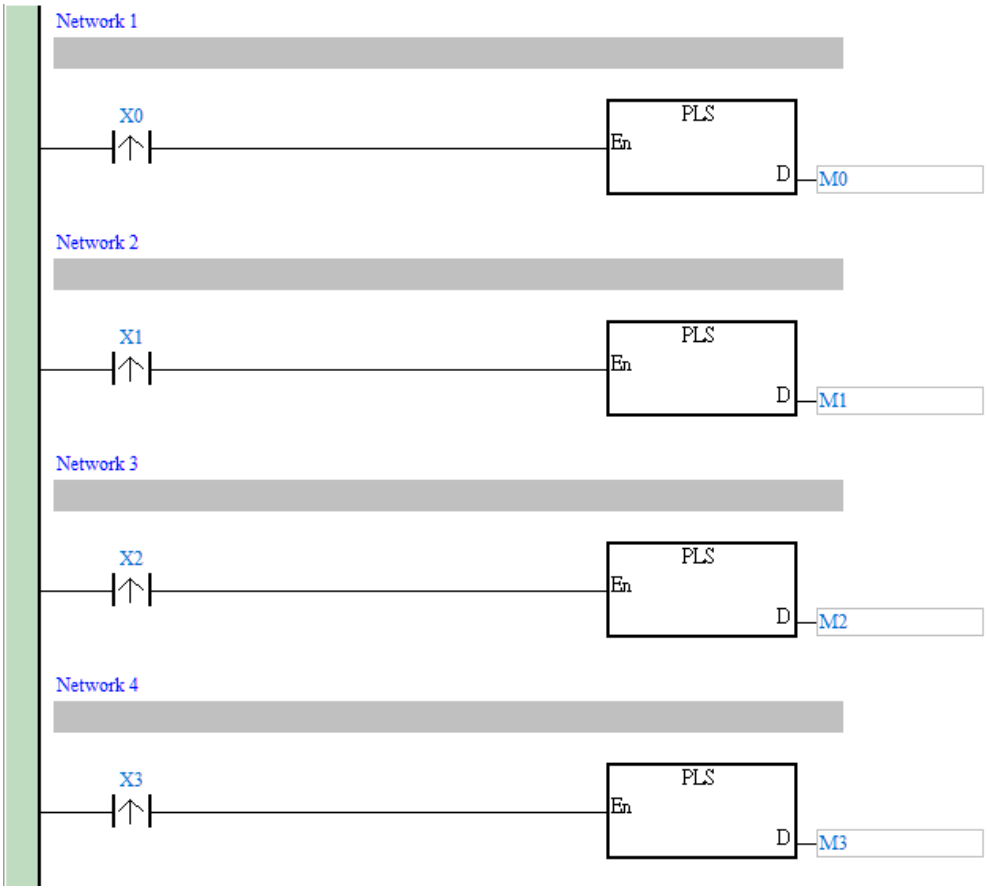
Control Purpose:

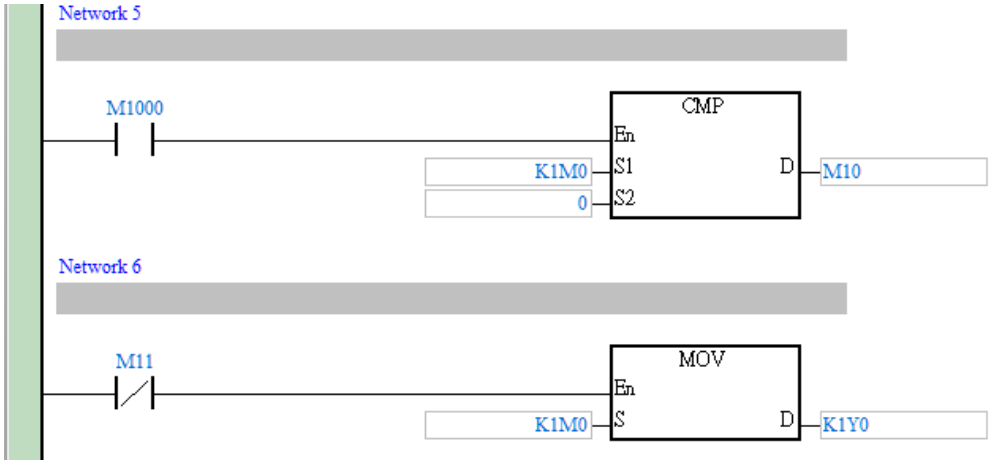
- There are 4 buttons corresponding to 4 indicators. The program is to turn on the indicators corresponding to pressed buttons and to turn off the previous ON indicators.

Devices:

Device	Function
X0	Button 1. X0 will go from OFF to ON when pressed
X1	Button 2. X1 will go from OFF to ON when pressed
X2	Button 3. X2 will go from OFF to ON when pressed
X3	Button 4. X3 will go from OFF to ON when pressed
Y0	Indicator 1
Y1	Indicator 2
Y2	Indicator 3
Y3	Indicator 4

Control Program:

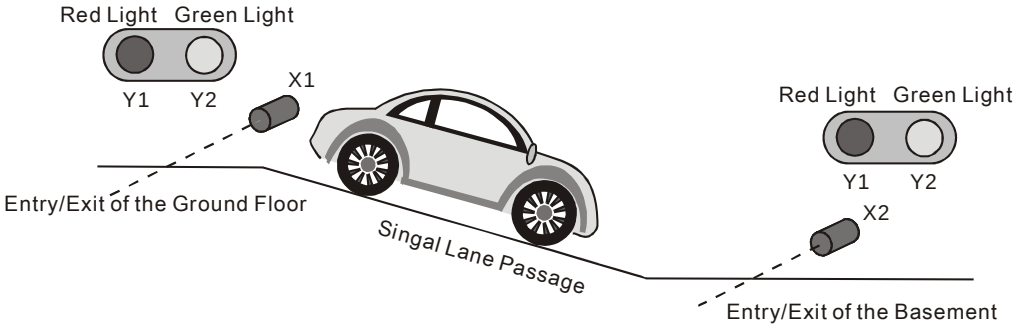




Program Description:

- When a button is pressed, the corresponding device X will go from OFF to ON. In this scan cycle, PLS instruction is executed, and the corresponding internal relay M is enabled as well. CMP instruction will be executed and the compared result is K1M0>0 which makes M10 ON but M11 OFF. [MOV K1M0 K1Y0] instruction will then be executed and sent out the state of M to its corresponding output Y. At the same time, the previous ON indicator(Y) will be turned off.
- When it comes to the 2nd scan cycle, PLS instructions will not be executed and the value of M0~M3 will be 0. Therefore, the CMP instruction will be executed and set M11 to be ON (K1M0 = 0). [MOV K1M0 K1Y0] instruction will not be executed, and the 0 state of device M will not be sent out, either. In this case, Output Y will remain its original state until any other button is pressed next time.

1.14 Entry/Exit Control of the Underground Car Park



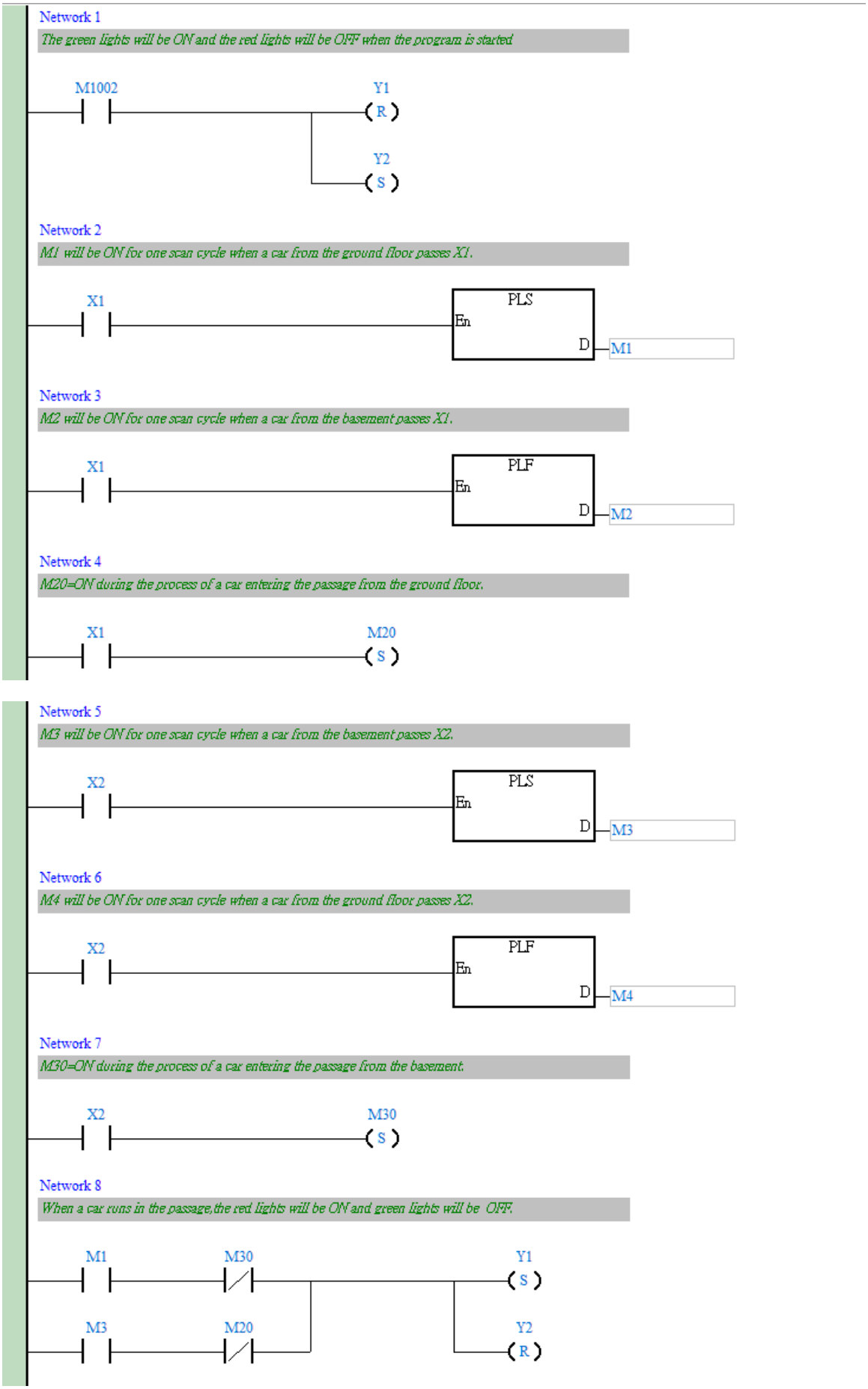
Control Purpose:

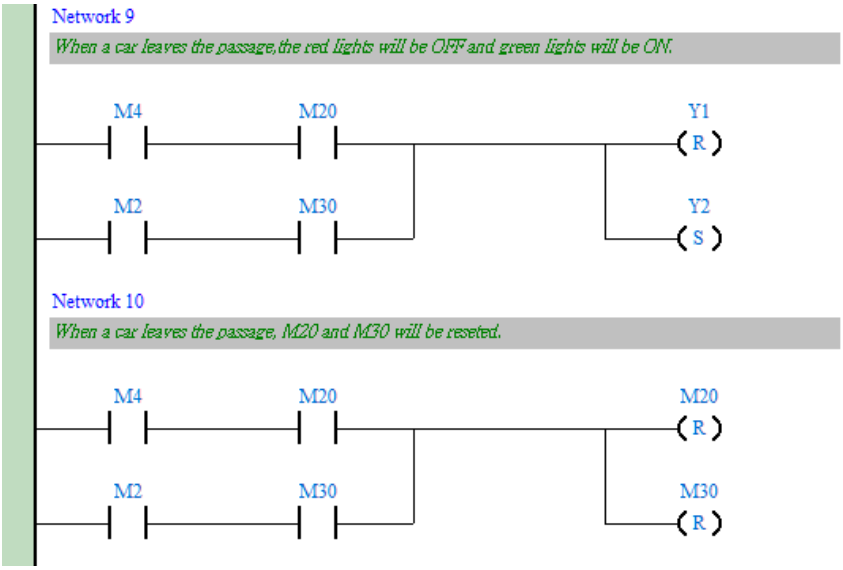
- The entry/exit of the underground car park is a single lane passage which needs the traffic lights to control the cars. Red lights prohibit cars entering or leaving while green lights allow cars to enter or leave.
- When a car enters the passage from the entry of the ground floor, the red lights both on the ground floor and the basement will be ON, and the green lights will be OFF. Any car entering or leaving is prohibited during the process till the car passes through the passage completely. When the passage is clear, the green lights will be ON again and allow other cars entering from the ground floor or the basement.
- Similarly, when a car leaves the basement and enters the passage, any other car entering or leaving is prohibited till the car passes from the passage to the ground completely.
- When PLC runs, the initial setting of traffic lights will be green lights ON and red lights OFF.

Devices:

Device	Function
X1	Photoelectric switch at the ground floor entry/exit. X1 will be ON when a car passes.
X2	Photoelectric switch at the basement entry/exit. X2 will be ON when a car passes.
M1	M1 will be ON for one scan cycle when a car from the ground floor passes X1.
M2	M2 will be ON for one scan cycle when a car from the basement passes X1.
M3	M3 will be ON for one scan cycle when a car from the basement passes X2.
M4	M4 will be ON for one scan cycle when a car from the ground floor passes X2
M20	M20 = ON during the process of a car entering the passage from the ground floor.
M30	M30 = ON during the process of a car entering the passage from the basement.
Y1	Red lights at the entry/exit of the ground floor and the basement
Y2	Green lights at the entry/exit of the ground floor and the basement

Control Program:

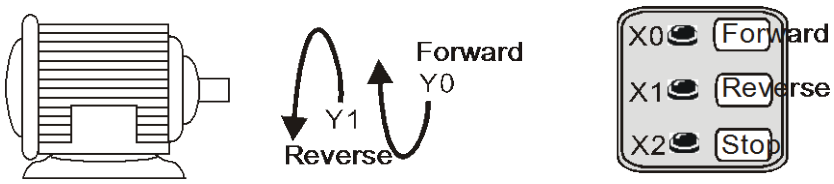




Program Description:

- The ground floor and the basement share the same red light signal Y1 and green light signal Y2.
- The key of the program is to identify that the car is entering or leaving the passage at the ground floor entry/exit when M1 is ON to activate Y1 because [PLS M1] will be executed in both entering and leaving conditions. Therefore, the confirming signal M20 is required for confirming that the car is entering the passage from the ground floor.
- Also, it needs to identify that the car is entering or leaving the passage at the basement entry/exit when M3 is ON because [PLS M3] will be executed in both entering and leaving conditions. Therefore, the confirming signal M30 is required for confirming that the car is entering the passage from the basement.

1.15 Forward/Reverse Control for the Three-Phase Asynchronous Motor



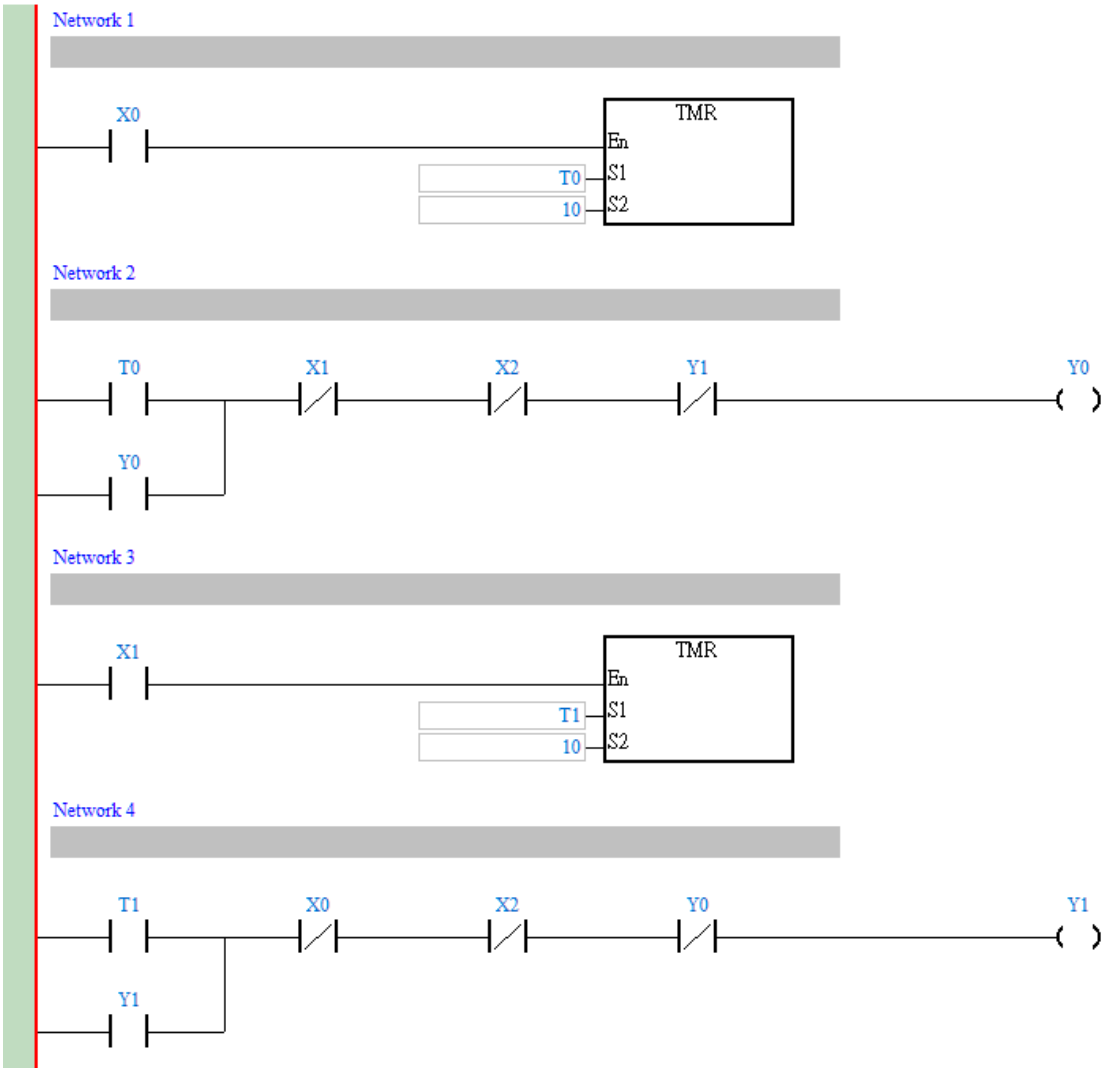
Control Purpose:

- Controlling the motor to run forward when Forward is pressed, run reverse when Reverse is pressed and stop when Stop is pressed.

Devices:

Device	Function
X0	Forward button of the motor. X0 will be ON when pressed
X1	Reverse button of the motor. X1 will be ON when pressed
X2	Stop button. X2 will be ON when pressed.
T1	1 sec timer
T2	1 sec timer
Y0	Forward contactor
Y1	Reverse contactor

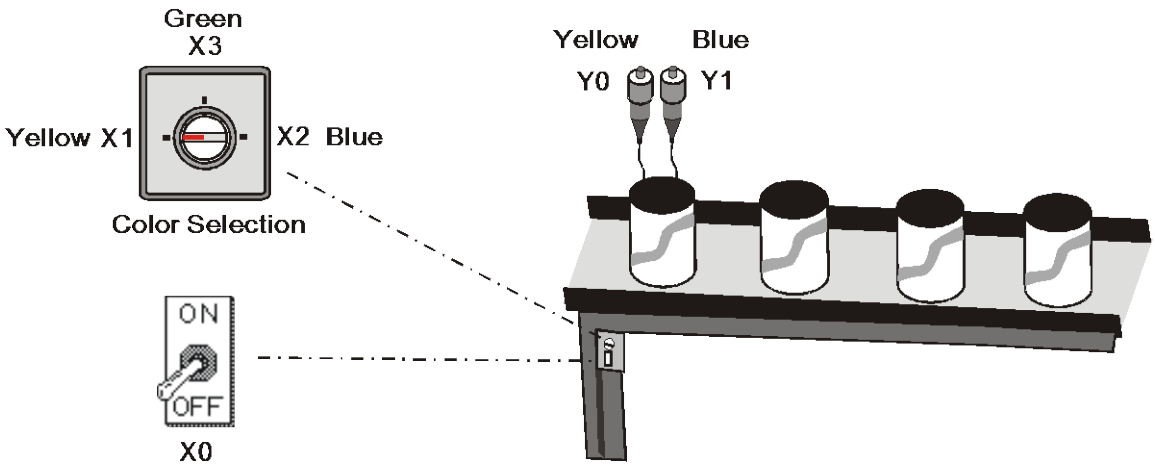
Control Program:



Program Description:

- X0 = ON when Forward is pressed. After 1 second, contactor Y0 will be enabled, and the motor begins to run forward. On the other hand, X1 = ON when Reverse is pressed. After 1 second, contactor Y1 will be enabled, and the motor begins to run reverse. Besides, Y0 and Y1 will be disabled and the motor will stop running when X2 is pressed.
- The two timers in the program are used to avoid the interphase short-circuit when the motor changes its running mode. The short circuit may occur if another contactor is enabled instantly while the electric arc in the disabled contactor still exists.

1.16 Selective Execution of Programs



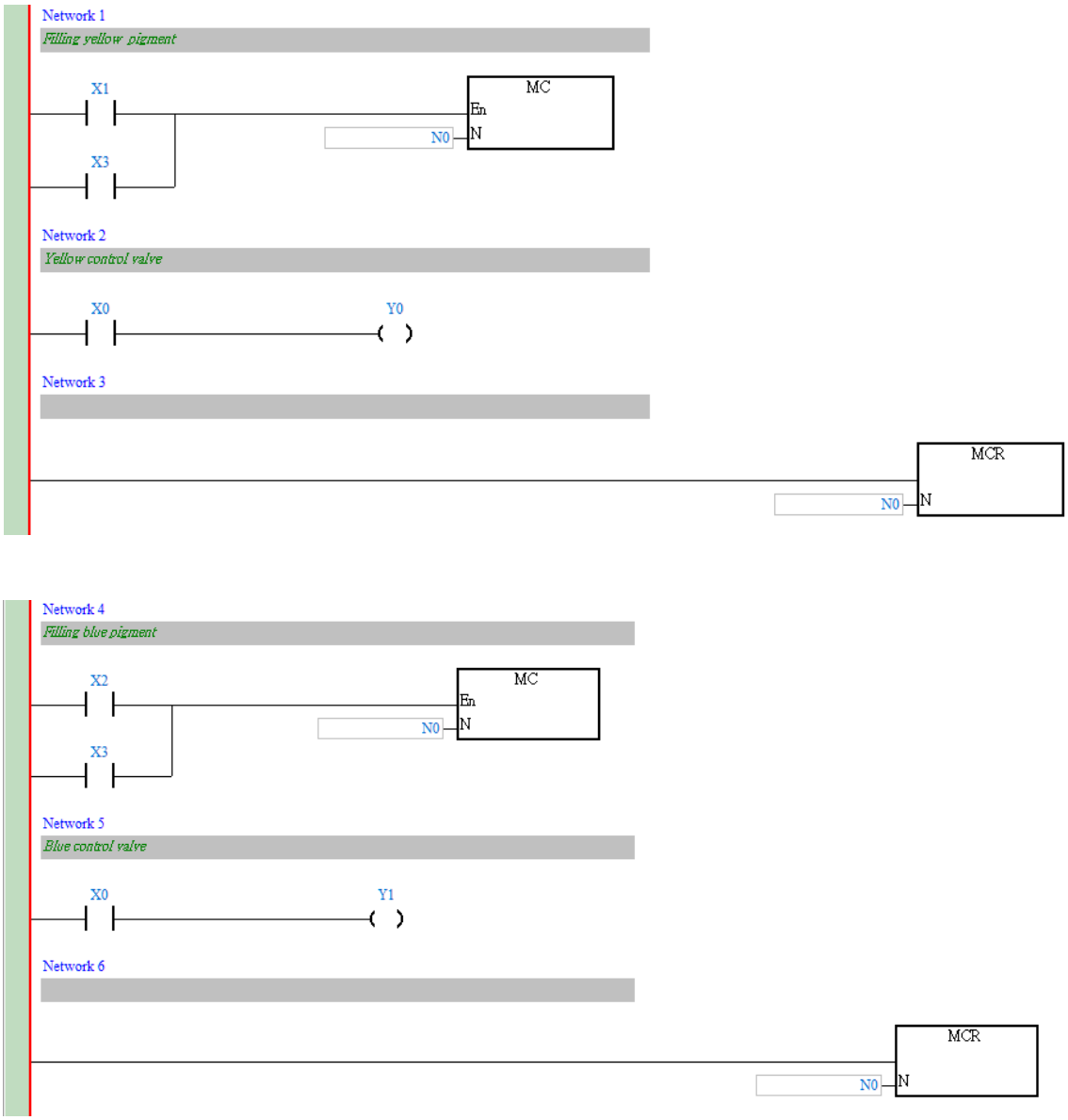
Control Purpose:

- There are pigments of 3 colors. By controlling different switches, operators can fill the cans with corresponding pigments.

Devices:

Device	Function
X0	Filling Start switch. X0 will be ON when turned on.
X1	Yellow control switch. X1 will be ON when turned on.
X2	Blue control switch. Turn it on, X2 will be On
X3	Green (mixing of yellow and blue) control switch. X3 will be ON when turned on
Y0	Yellow control valve
Y1	Blue control valve

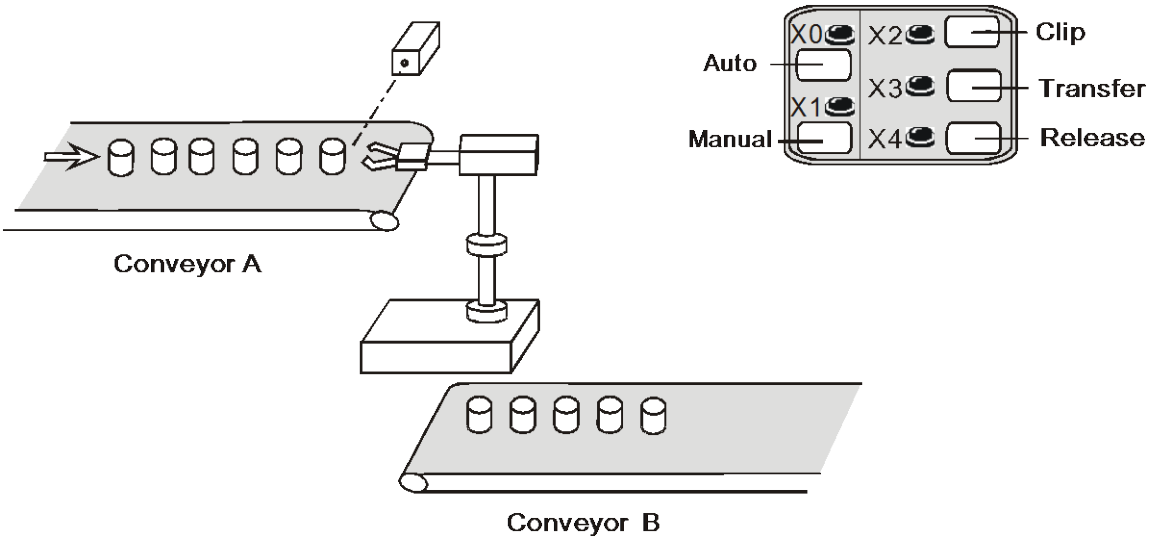
Control Program



Program Description:

- The master switch of filling control needs to be turned on (X0 = ON) before filling started. When both yellow and blue are filled at the same time, it will become green.
- When the switch of filling yellow pigment is turned on, X1 = ON. The first MC ~ MCR instruction will be executed. Y0 = ON, and the system begins to fill the yellow color.
- When the switch of filling blue pigment is turned on, X2 = ON. The second MC ~ MCR instruction will be executed. Y1 = ON, and the system begins to fill the blue color.
- When the switch of filling green pigment is turned on, X3 = ON, both of the two MC ~ MCR instructions will be executed, and the system begins to fill the green color.

1.17 MC/MCR - Manual/Auto Control



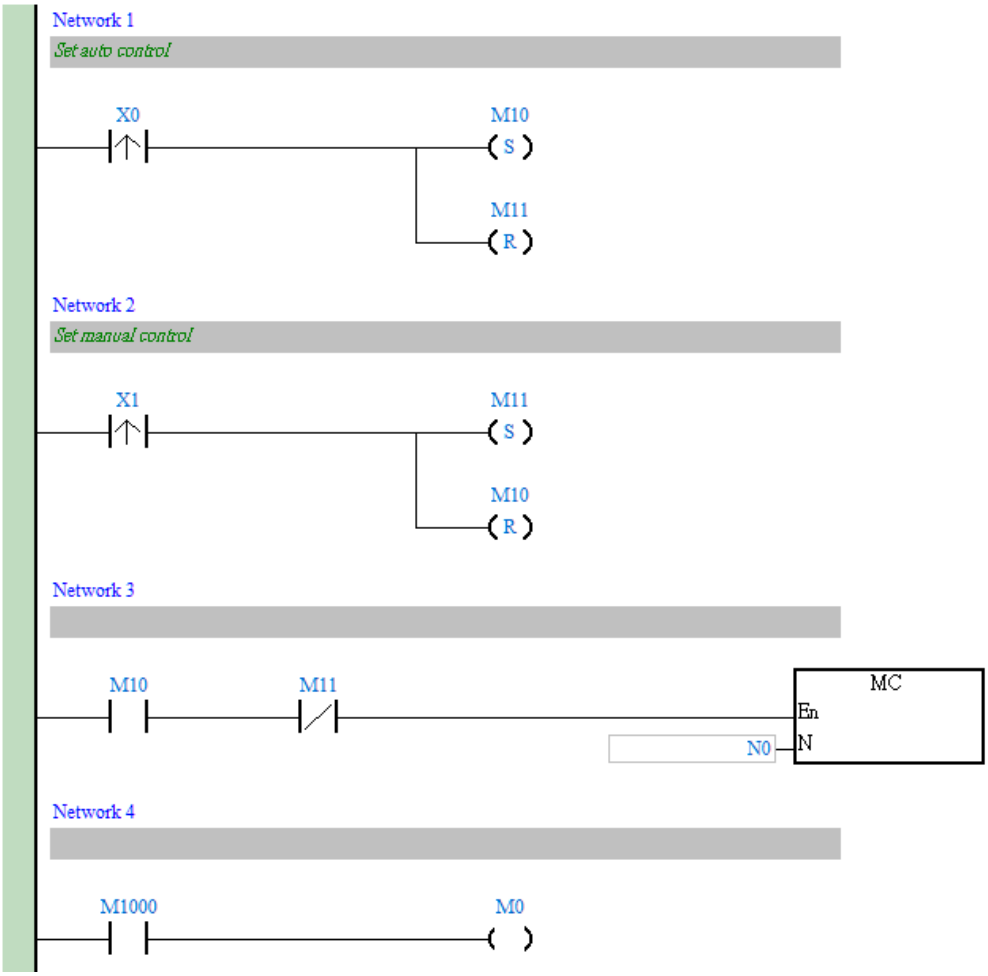
Control Purpose:

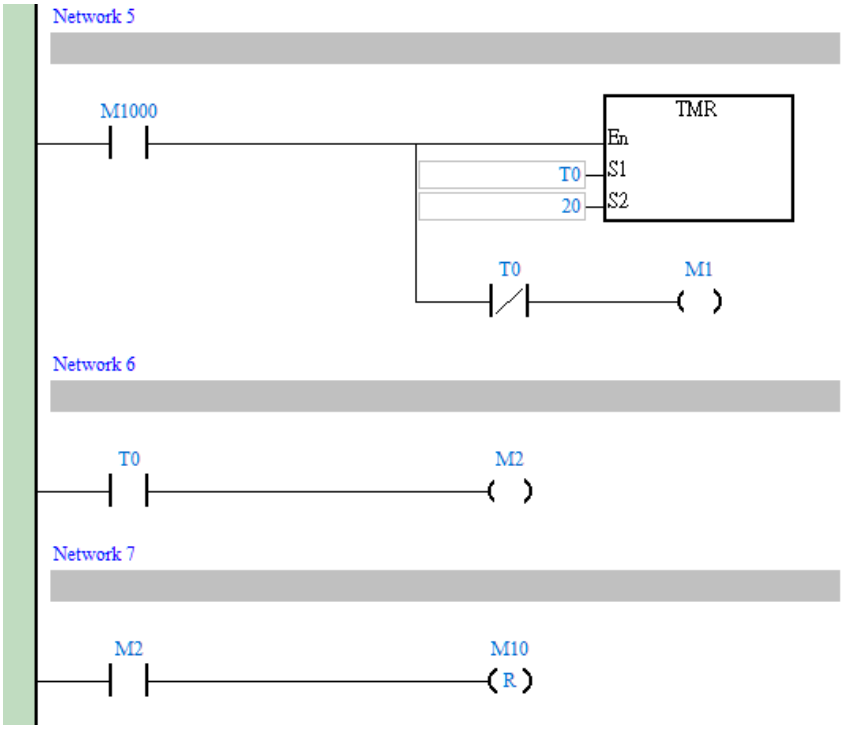
- When the button Manual is pressed, the robotic arm will begin to execute the manual control process: pressing Clip to clip the product from conveyor A, pressing Transfer to move the product to the conveyor B, and pressing Release to release the product and send it away by conveyor B.
- When the button Auto is pressed, the robotic arm will begin to execute the auto control process once: clip product (keep holding this product before releasing) → transfer product (the action takes 2 sec) → release the product. Auto control process can be performed one more time if the button Auto is pressed again.
- Manual control process and auto control process are interlocked.

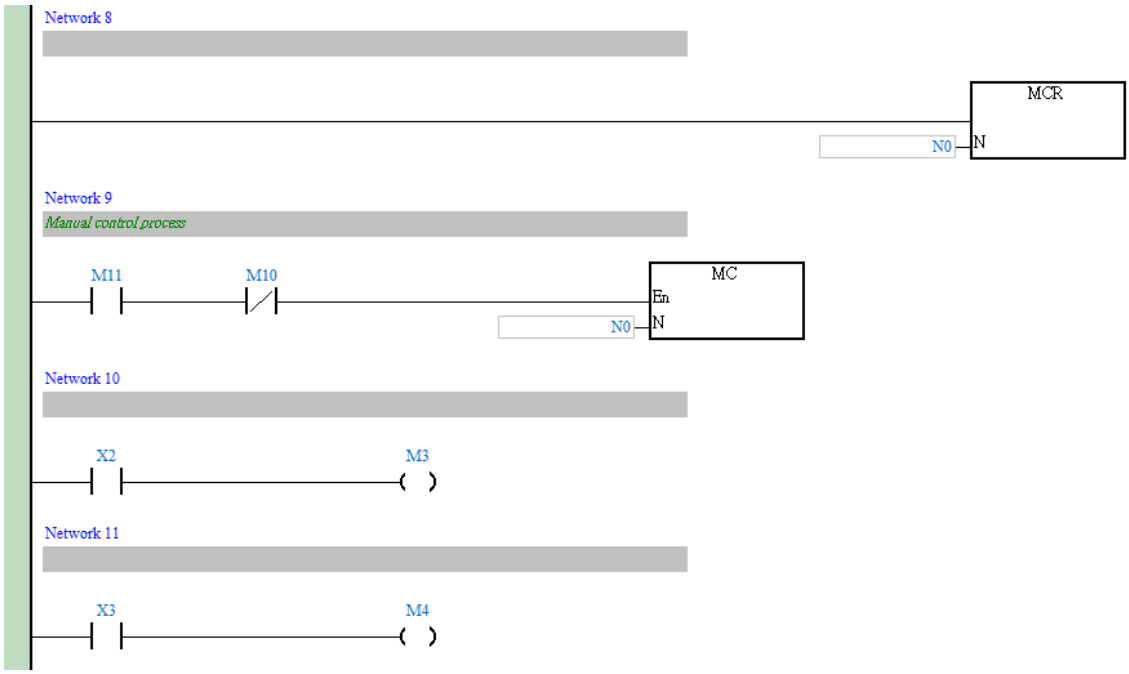
Devices:

Device	Function
X0	Auto button. X0 goes from OFF to ON when pressed.
X1	Manual button. X1 goes from OFF to ON when pressed
X2	Clip button. X2 will be ON when pressed.
X3	Transfer button. X3 will be ON when pressed.
X4	Release button. X4 will be ON when pressed.
M0~M2	Auto control process
M3~M5	Manual control process
M10	Auto control selection
M11	Manual control selection
T0	2 sec timer
Y0	Product clipping/releasing. Y0 is ON/OFF when clipping/releasing the product.
Y1	Product transferring

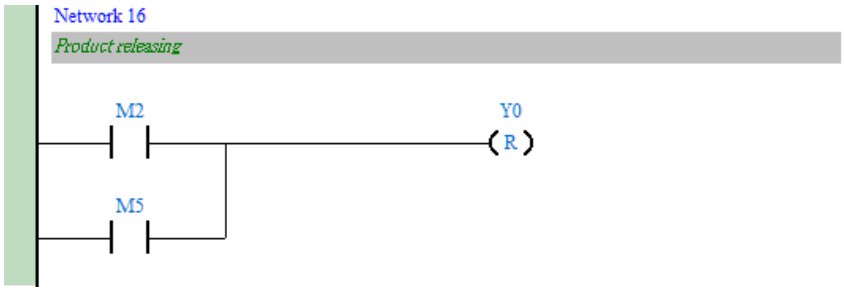
Control Program:






Network 8
MCR
N0
N
Network 9
Manual control process
M11
M10
MC
En
N0
N
Network 10
X2
M3
Network 11
X3
M4


Network 12
X4
M5
Network 13
MCR
N0
N
Network 14
Product clipping
M0
Y0
S
M3
Network 15
Product Transferring
M1
Y1
M4

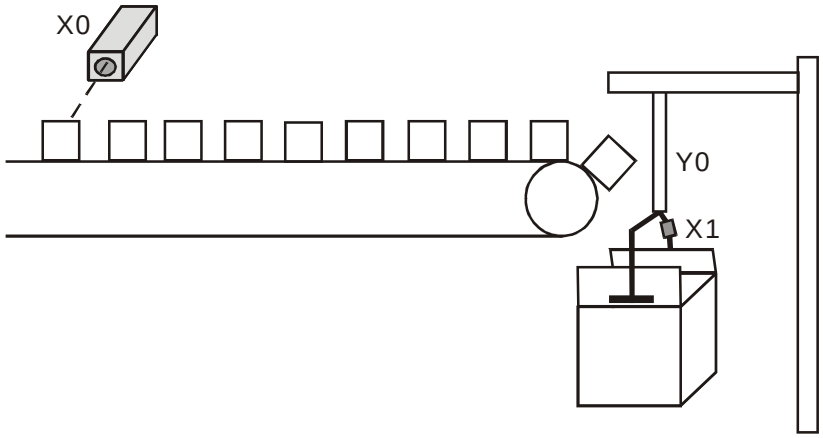

Network 16
Product releasing
M2
Y0
R
M5

Program Description:

- When X0 goes from OFF to ON, the auto control process will be executed once, whereas when X1 goes from OFF to ON, the manual control process will be executed. In the manual control, the clipping and releasing actions require pressing the corresponding button for one time. However, the button Transfer should be pressed for 2 sec during the moving process till the product is moved to Conveyor B.
- X0 and X1 are interlocked. When the auto control process is executed, the robotic arm will perform the following actions: first “clipping”, then “transferring” (for 2 sec.), and “releasing.” When the manual control process is executed, the controlling actions will be performed by 3 corresponding buttons: clipping product by turning on Y0, transferring product by pressing Y1 and releasing product by turning off Y0.

MEMO

2.1 Product Mass Packaging



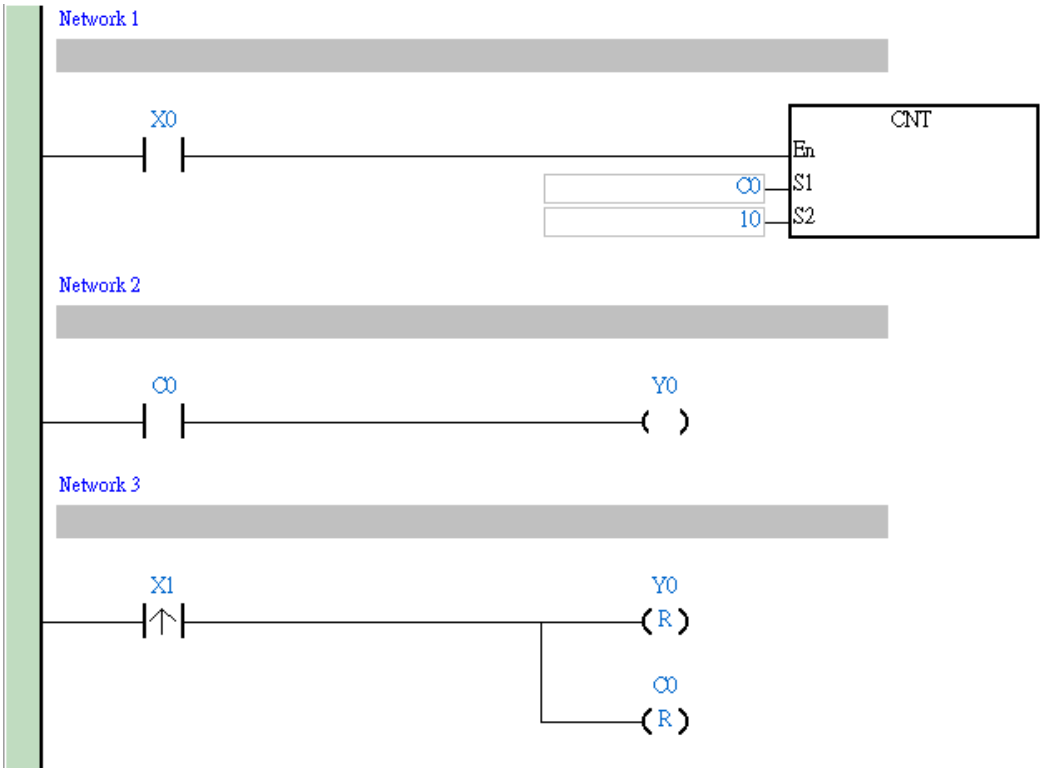
Control Purpose:

- Once the photoelectric sensor detects 10 products, the robotic arm will begin to pack up. When the action is completed, the robotic arm and the counter will be reset.

Devices:

Device	Function
X0	Photoelectric sensor for counting products. X0 = ON when products are detected.
X1	Robotic arm action completed sensor. X1 = ON when packing is completed.
C0	Counter: 16-bit counting up (general purpose)
Y0	Robotic arm for packing

Control Program:

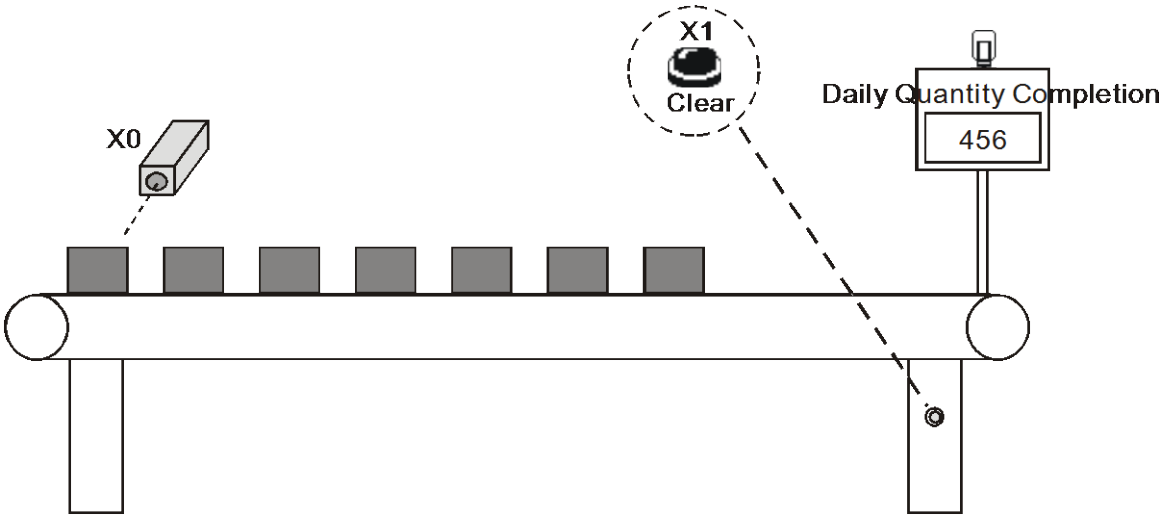


2. Counter Design Examples

Program Description:

- Once the photoelectric sensor detects a product, X0 will go from OFF to ON once, and C0 will count for one time.
- When the present value in C0 reaches 10, the Normally Open contact C0 will be closed. Y0 = ON, and the robotic arm will begin to pack.
- When the packing is completed, the robotic arm action completed sensor will be enabled. X1 will go from OFF to ON and RST instruction will be executed. Y0 and C0 will be reset for the next packing task.

2.2 Daily Production Record (16-bit Counting Up Latched Counter)



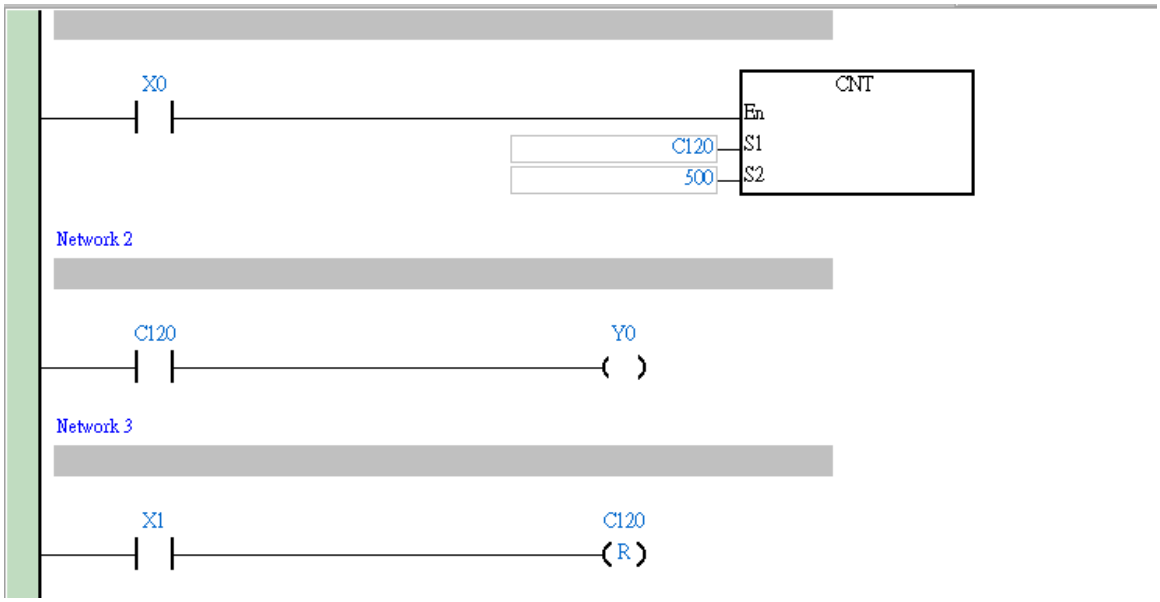
Control Purpose:

- The production line may be powered off accidentally or turned off for noon break. The program is to control the counter to retain the counted number and resume counting after the power is ON again.
- When the daily production reaches 500, the target completed indicator will be ON to remind the operator for keeping a record.
- Press the Clear button to clear the history records. The counter will start counting from 0 again.

Devices:

Device	Function
X0	Photoelectric sensor. Once detecting the products, X0 will be ON.
X1	Clear button
C120	Counter: 16-bit counting up (latched)
Y0	Target completed indicator

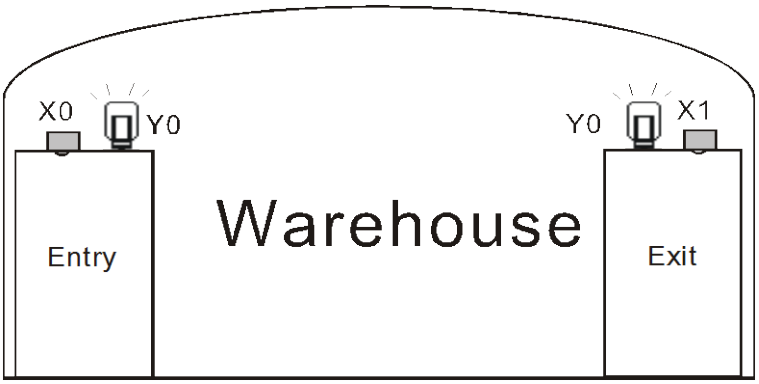
Control Program:



Program Description:

- The latching counter is demanded for the situation of retaining data when power-off.
- When a product is completed, C120 will count for one time. When the number reaches 500, target completed indicator Y0 will be ON.
- For different series of DVP-PLC, the setup range of 16-bit latching counter is different. C112 ~ C127 for ES/EX/SS series, C96 ~ C199 for SA/SX/SC series and C100 ~ C199 for EH series.

2.3 Products Amount Calculation (32-bit Counting Up/Down Counter)



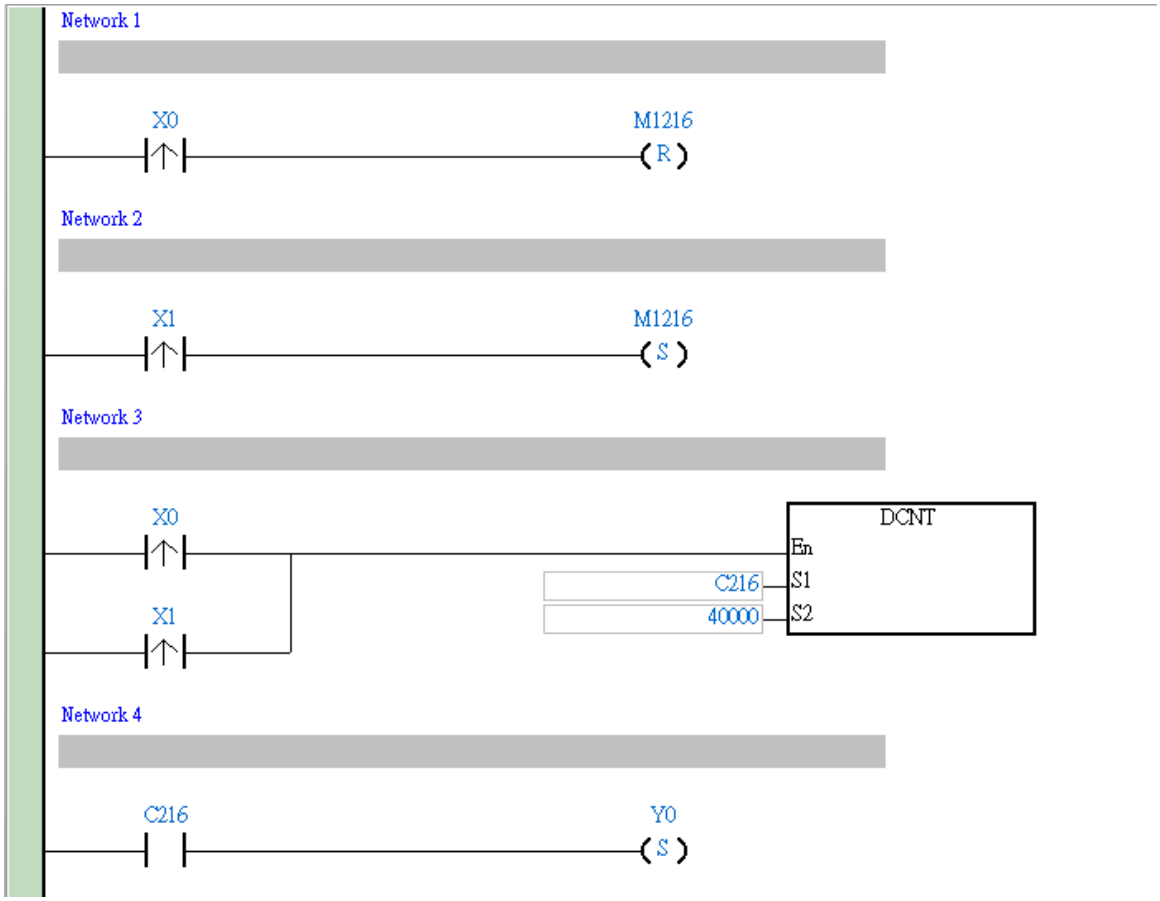
Control Purpose:

- This program is used for monitoring the product amount in the warehouse by photoelectric sensors at both entry and exit. When the amount reaches 40,000, the alarm will be enabled.

Devices:

Device	Function
X0	Photoelectric sensors for monitoring incoming goods. X0 = ON when incoming detected.
X1	Photoelectric sensors for monitoring outgoing goods. X1 = ON when outgoing detected.
M1216	Counting mode of C216(ON: counting down)
C216	32-bit counting up/down counter
Y0	Alarm

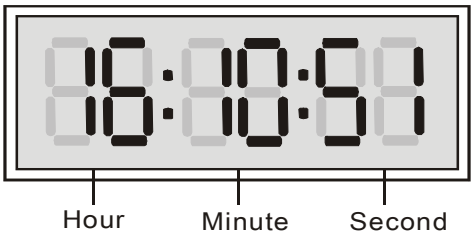
Control Program:



Program Description:

- The key of this example is using the 32-bit addition/subtraction flag M1216 to control the counting up/ down of C216. When X0 goes from OFF to ON, M1216 = OFF, and C216 will count up; when X1 goes from OFF to ON, M1216 = ON, C216 will count down.
- When the present value of C216 reaches 40,000, C216 = ON, and the alarm Y0 will be enabled.

2.4 24-hour Clock Operated by 3 Counters



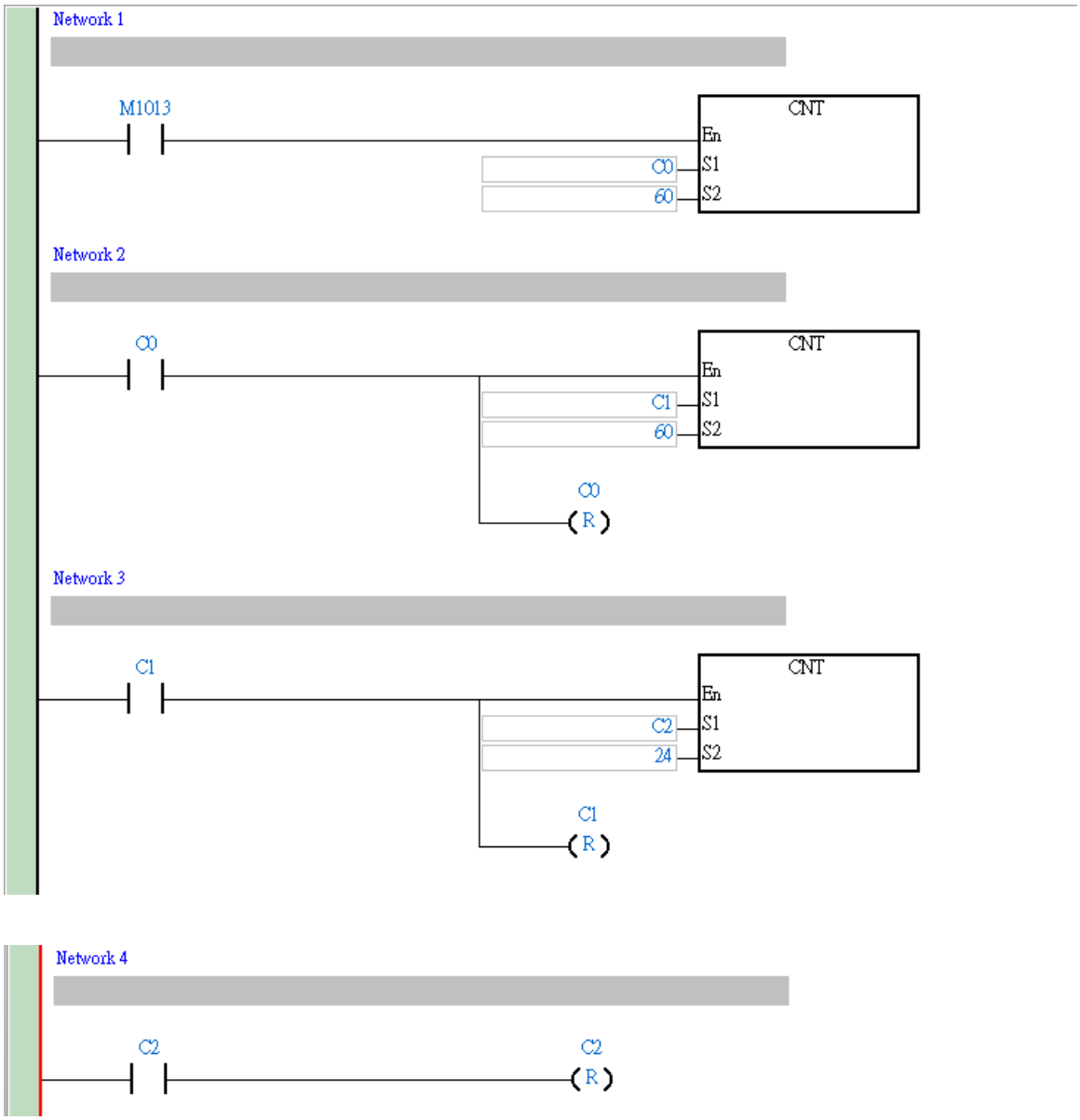
Control Purpose:

- Using 3 counters together with the flag of M1013 (1s clock pulse) to operate a 24-hour clock.

Devices:

Device	Function
C0	count per second
C1	count per minute
C2	count per hour
M1013	1s clock pulse

Control Program:



Program Description:

- The key of operating a 24-hour clock is to use M1013 (1s clock pulse). When the program is executed, C0 will count once per second. When the counted number reaches 60(1 minute), C0 = ON. C1 will count once, and C0 will be reset at the same time; similarly, when the counted number in C1 reaches 60(1 hour), C1 = ON. C2 will count once, and C1 will be reset at the same time. Furthermore, when the present value in C2 reaches 24, C2 will be reset, and the 24-hour counting process will start again.

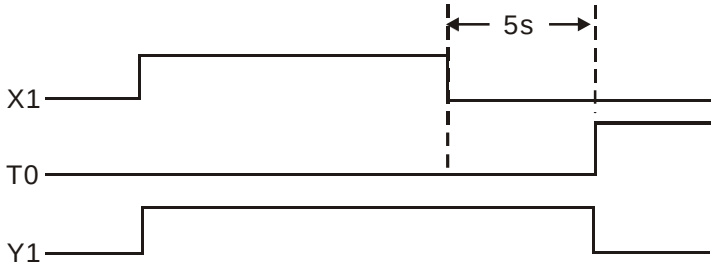
- The 24-hour clock operates by using C0 to count “second”, C1 to count “minute” and C2 to count “hour.” In this clock, the value of “second”, “minute” and “hour” can be read by C0, C1 and C2 correspondingly. When the set value of C2 is 12, the clock will be a 12-hour clock.

MEMO

3.1 Delay OFF Program

Control Purpose:

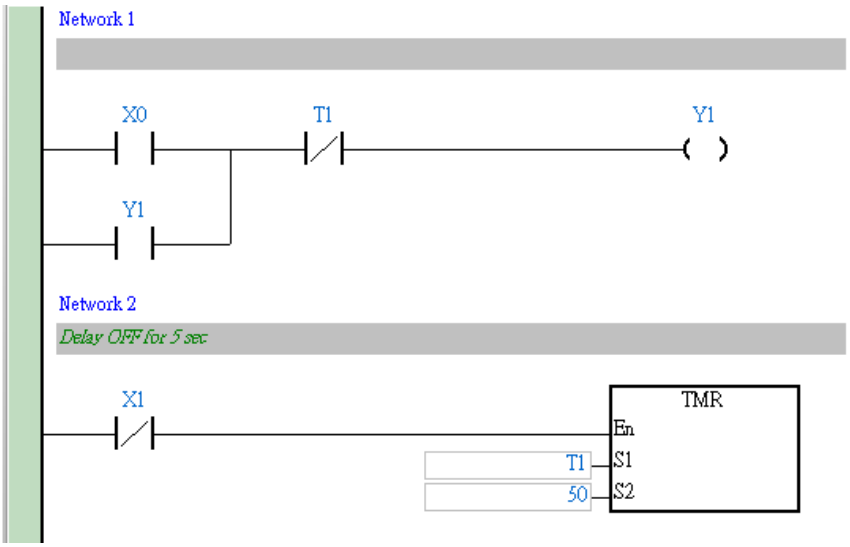
- Enabling the indicator to be ON immediately and OFF after a 5 sec delay by the switch



Devices:

Device	Function
X1	X1 = OFF when the switch is turned off
T1	5 sec timer. Time base = 100ms
Y1	Output indicator

Control Program:



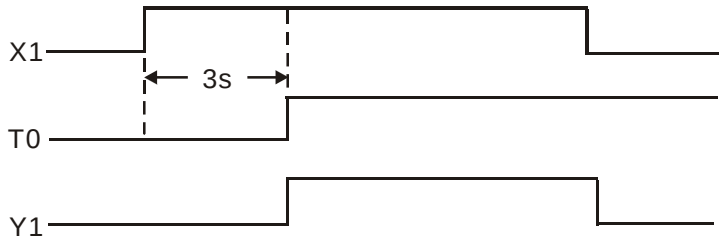
Program Description:

- X1 = ON when the switch is turned on. The NC (Normally Closed) contact X1 will be activated, and TMR instruction will not be executed. Coil T1 will be OFF and so will the NC contact T1. Because X1 = ON, the indicator Y1 will be ON and latched.
- X1 = OFF when the switch is turned off. The NC contact X1 will not be activated, which makes TMR instruction executed. Indicator Y1 will remain ON by the latched circuit until T1 reaches its set value.
- When timer T1 reaches its set value of 5 seconds, coil T1 will be ON. The NC contact T1 will be activated, which makes the indicator Y1 OFF.
- Delay OFF function can also be performed by using API 65 STMR instruction.

3.2 Delay ON Program

Control Purpose:

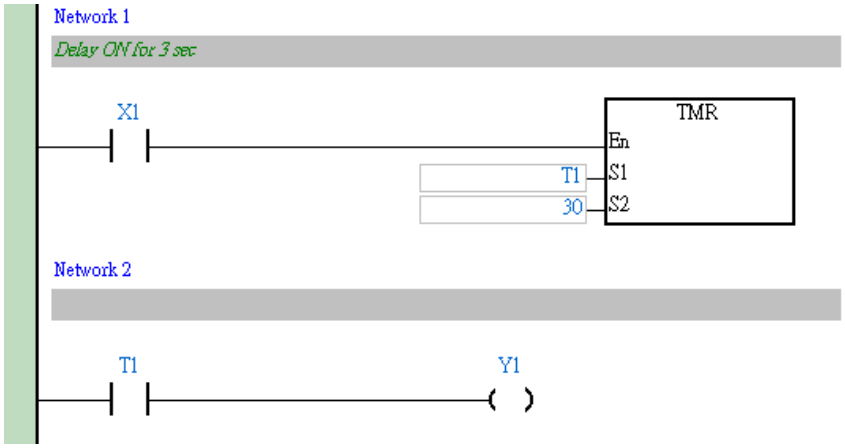
- Enabling the indicator to be ON after a 3 sec delay and OFF immediately by the switch



Devices:

Device	Function
X1	X1 = ON when the switch is turned on
T1	3 sec timer, time base = 100ms
Y1	Output indicator

Control Program:



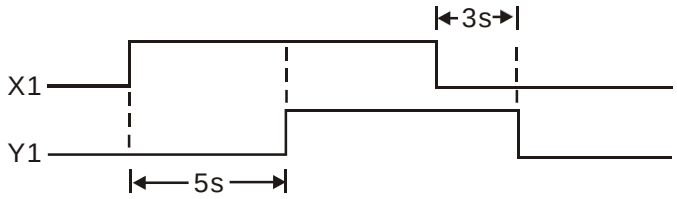
Program Description:

- When X1 = ON, TMR instruction will be executed. Timer T1 will be ON and start counting for 3 sec. When T1 reaches its set value, the NO (Normally Open) contact T1 will be activated and indicator YI will be ON.
- When X1 = OFF, TMR instruction will not be executed. Timer T1 will be OFF and so will NO contact T1. Therefore, the indicator Y1 will be OFF.

3.3 Delay ON/OFF Program

Control Purpose:

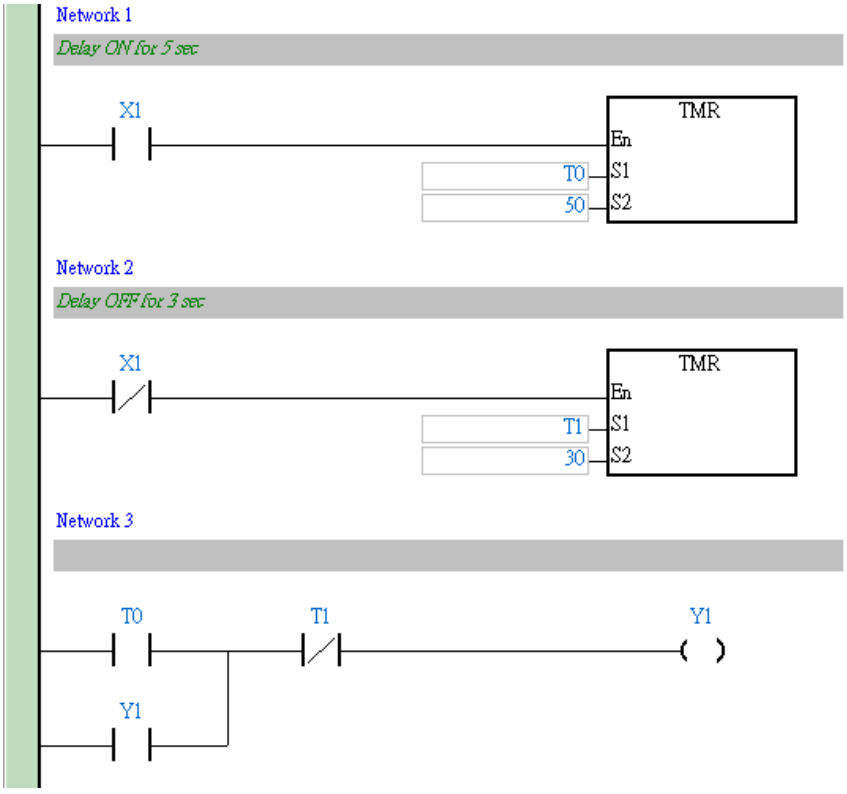
- Enabling the indicator to be ON after a 5 sec delay and OFF after a 3 sec delay by the switch



Devices:

Device	Function
X1	X1 = ON when the switch is turned on.
T0	5 sec timer, time base = 100ms
T1	3 sec timer, time base = 100ms
Y1	Output indicator

Control Program:

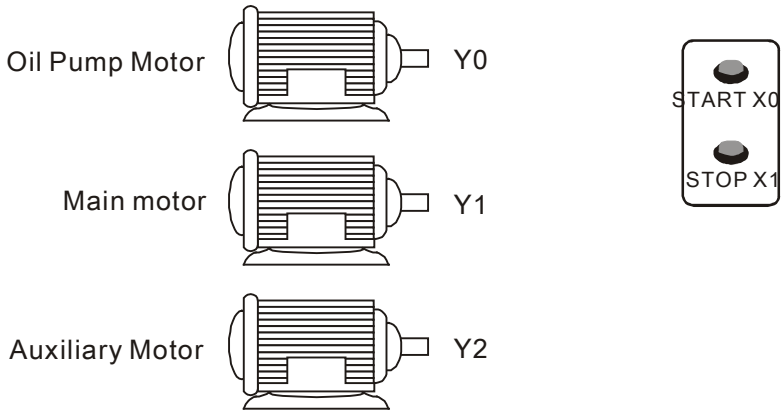


Program Description:

- When X1 = ON, T0 will start counting for 5 sec. When T0 reaches its set value, the NO contact T0 will be ON while NC contact T1 will remain OFF, which makes the indicator Y1 to be ON and latched.

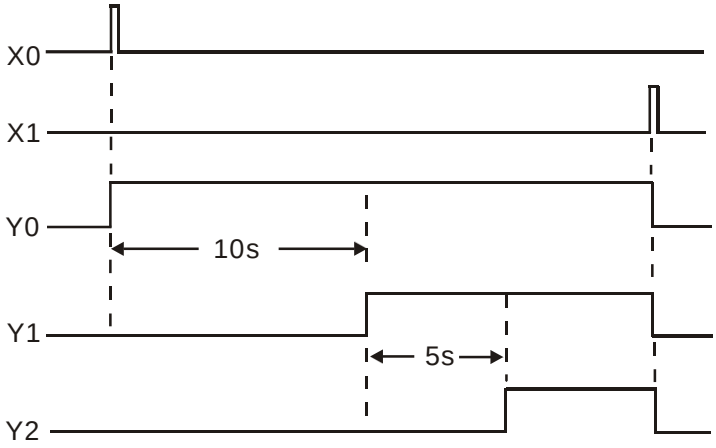
- When X1 = OFF, T1 will start counting for 3 sec. When T1 reaches its set value, the NC contact T1 will be activated while the NO contact T0 will remain OFF, which makes the indicator Y1 to be OFF.

3.4 Sequential Delay Output (Starting 3 Motors Sequentially)



Control Purpose:

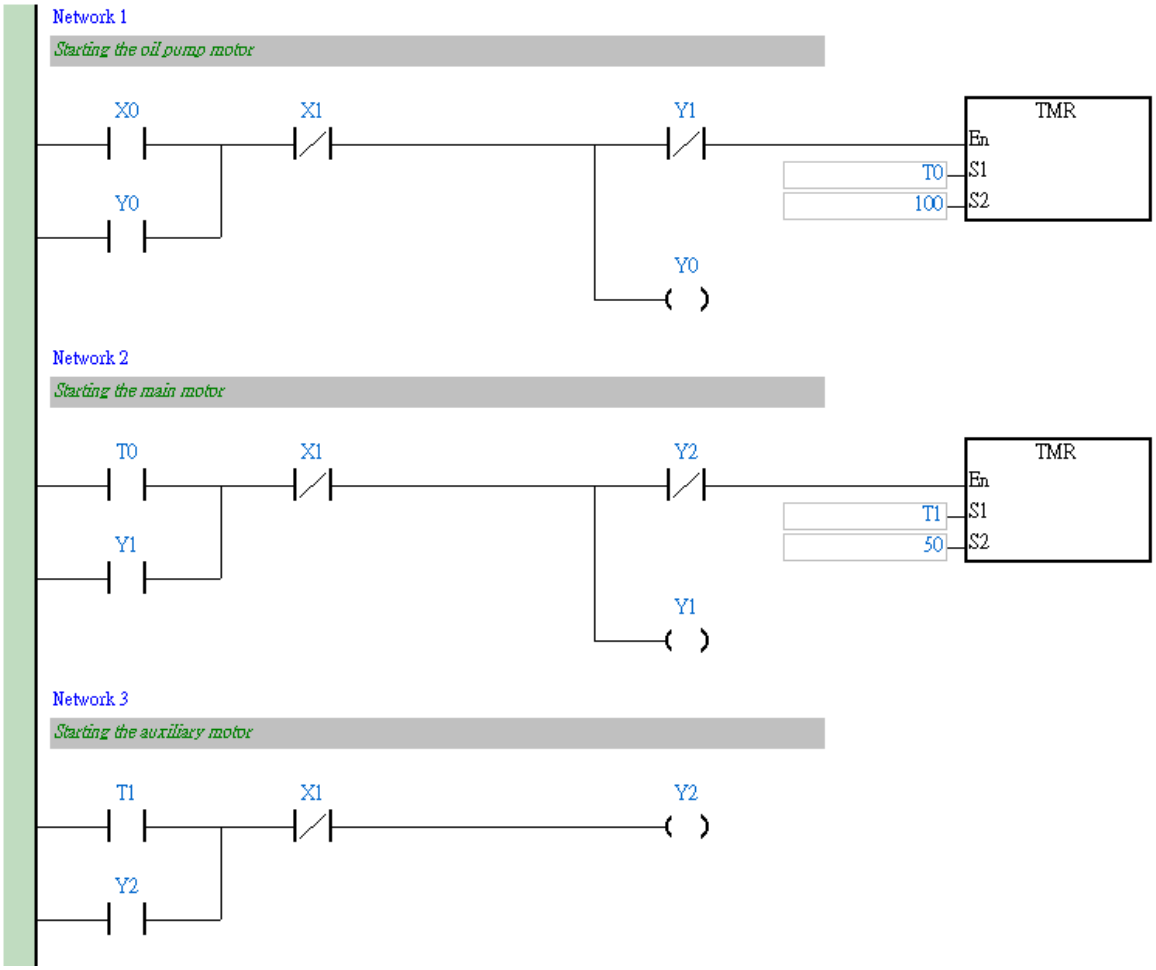
- Starting the oil pump motor immediately when START is pressed. The main motor will be started after a 10 sec delay and then the auxiliary motor after a 5 sec delay. In addition, stopping all motors immediately when STOP is pressed.



Devices:

Device	Function
X0	X0 = ON when START is pressed.
X1	X1 = ON when STOP is pressed.
T0	10 sec timer. Time base: 100ms
T1	5 sec timer. Time base: 100ms
Y0	Starting the oil pump motor
Y1	Starting the main motor
Y2	Starting the auxiliary motor

Control Program:



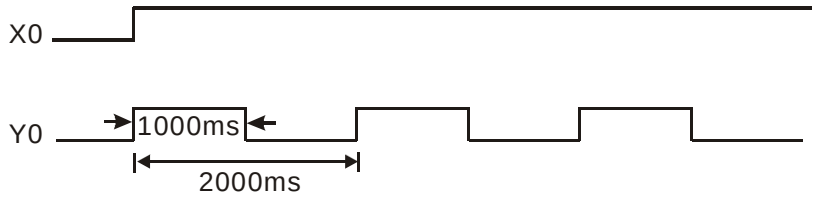
Program Description:

- When START is pressed, the NO contact X0 will be activated, which makes Y0 to be ON and latched. The oil pump motor will start the lube system. At the same time, [TMR T0 K100] instruction will be executed. When T0 reaches its set value of 10 sec, the NO contact T0 will be ON.
- When the NO contact T0 is ON, Y1 will be ON and latched, which starts the main motor and stops timer T0. At the same time, [TMR T1 K50] is executed, and the NO contact T1 will be ON when timer T1 reaches its set value.
- When the NO contact T1 is ON, Y2 will be ON and latched, which starts the auxiliary motor and stops T1.
- When STOP is pressed, the NC contact X1 will be activated, which makes Y0, Y1 and Y2 OFF. The oil pump motor, main motor and auxiliary motor will stop working.

3.5 Pulse-Width Modulation

Control Purpose:

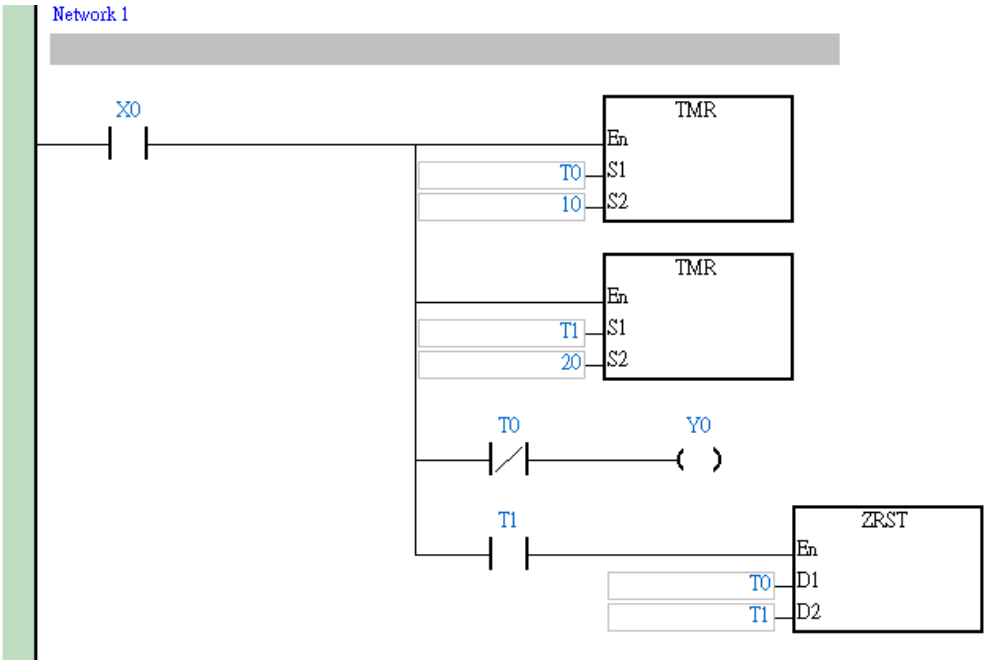
- Performing Pulse Width Modulation function by changing the set value of the timer in the program. The oscillating pulse is as below: (Y0 = ON for 1 sec. The cycle = 2 sec)



Devices:

Device	Function
X0	X0 = ON when the switch is turned on
T0	1 sec timer. Time base: 100ms
T1	2 sec timer. Time base: 100ms
Y0	Oscillating pulse output

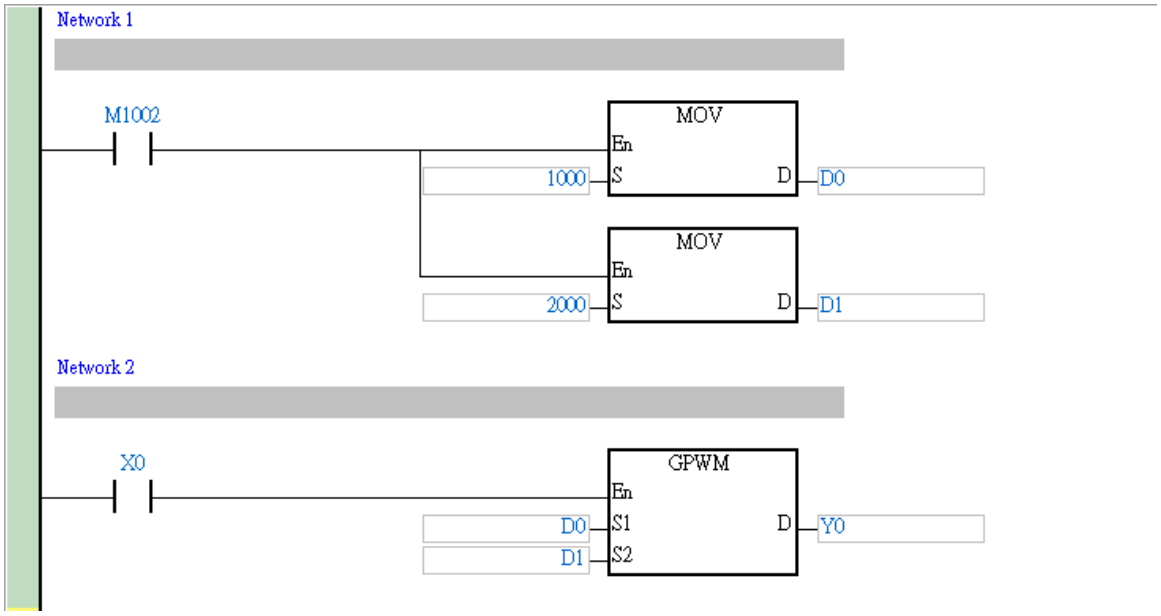
Control Program:



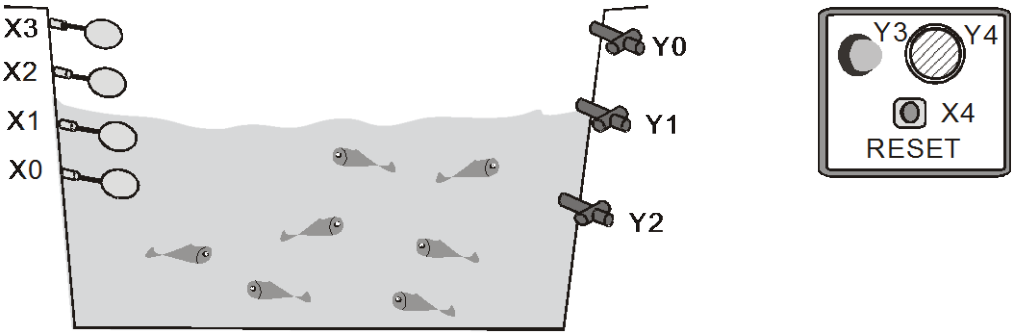
Program Description:

- When X0 = ON, timer T0/T1 will be activated. Y0 will be ON until timer T0 reaches its set value. When timer T1 reaches its set value, T0/T1 will be reset. Therefore, Y0 will output the above oscillating pulse continuously. When X0 = OFF, the output Y0 will be OFF as well.
- Pulse Width Modulation function can be modified by changing the set value of the timer in the program.
- Pulse Width Modulation function can also be performed by using API 144 GPWM

instruction.

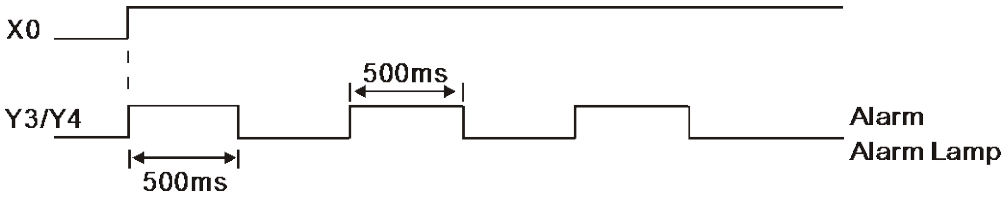


3.6 Artificial Fishpond Water Level Monitoring System (Flashing Circuit)



Control Purpose:

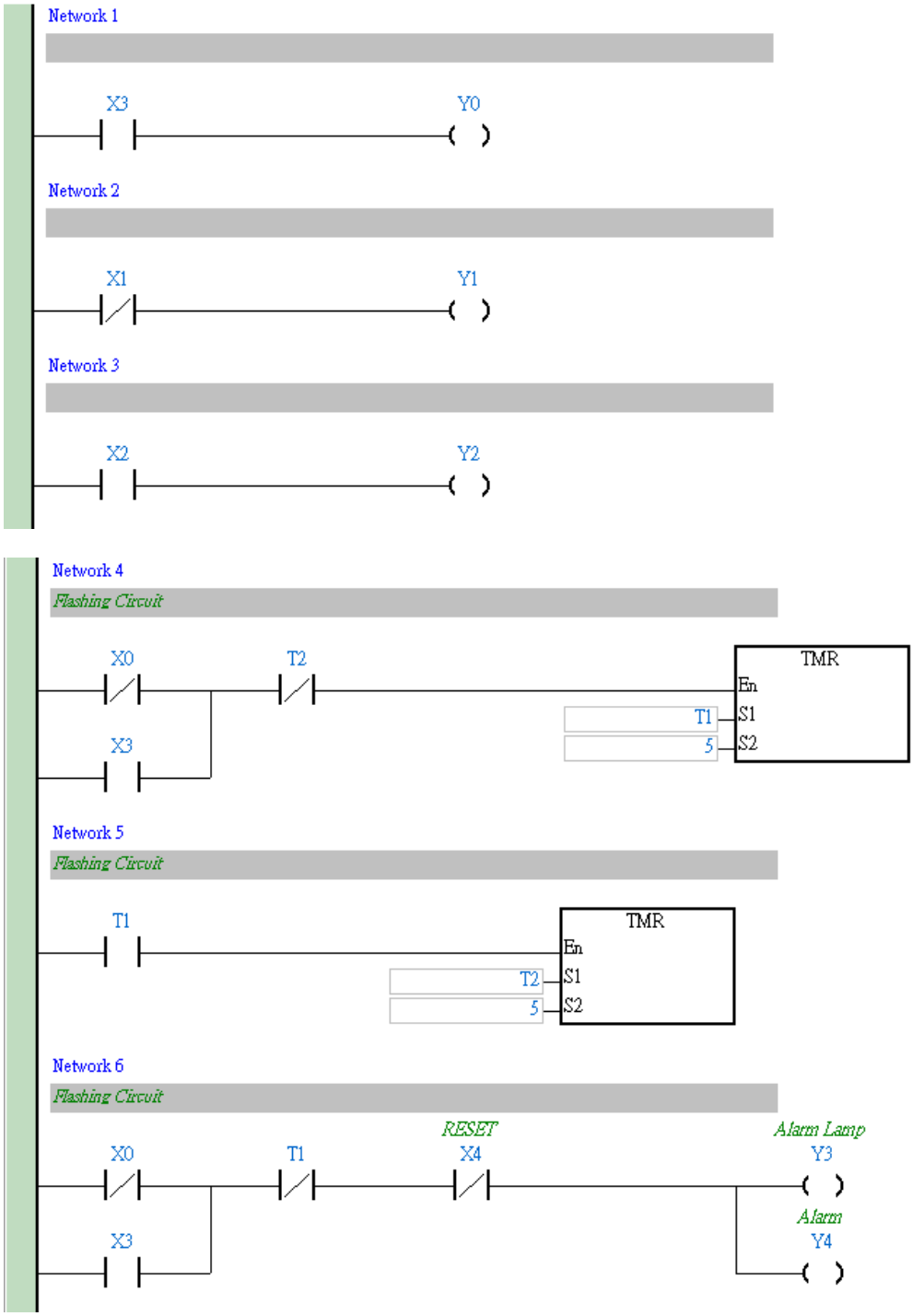
- Feeding or draining water automatically when the water level of artificial fishpond is not at the normal level. In addition to feeding / draining water, enabling the alarm and alarm lamp when the water is above or below the alarm level.
- Stopping the alarm when RESET is pressed.



Devices:

Device	Function
X0	X0 = ON when the water is above the lowest level of alarm level.
X1	X1 = ON when the water is above the lowest level of normal level.
X2	X2 = ON when the water is above the highest level of normal level.
X3	X3 = ON when the water is above the highest level of alarm level.
X4	X4 = ON when RESET is pressed.
T1	500ms timer. Time base: 100ms.
T2	500ms timer. Time base: 100ms.
Y0	1# drainage pump
Y1	Feeding pump
Y2	2# drainage pump
Y3	Alarm lamp
Y4	Alarm

Control Program:



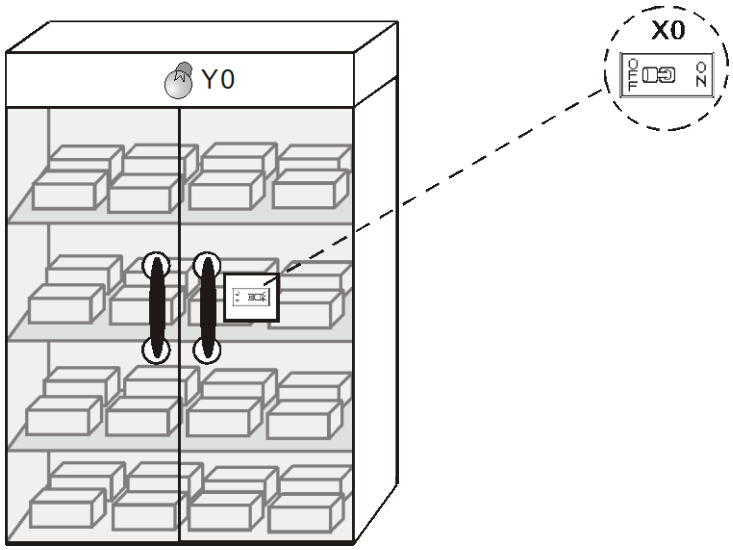
Program Description:

- When the water is at normal level: X0 = ON, X1 = ON, X2 = OFF and X3 = OFF. Therefore, Y0 and Y2 will be OFF. Both the drainage pump and the feeding pump will not work.
- When the water is lower than the normal level, X0 = ON, X1 = OFF, X2 = OFF and X3 = OFF. Because X1 = OFF, Y1 will be ON. The feeding pump will start working.
- When the water is below the lowest of alarm level, X0 = OFF, X1= OFF, X2 = OFF and X3 = OFF. Because X1 = OFF, Y1 will be ON. The feeding pump will start working. In addition, because X0 = OFF, the flashing circuit will be activated, which makes Y3 = ON and Y4 = ON,

The alarm lamp will flash and the alarm will ring.

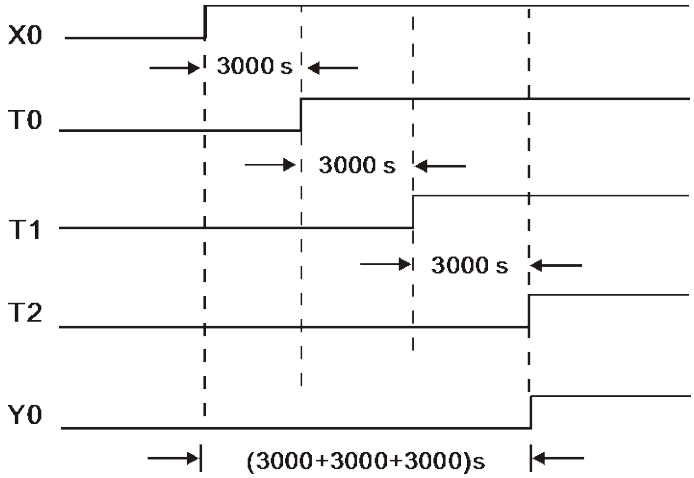
- When the water is above the normal level, X0 = ON, X1 = ON, X2 = ON, X3 = OFF. Because X2 = ON, Y2 will be ON. 2# drainage pump will drain water from the fishpond.
- When the water is above the highest of alarm level, X0 = ON, X1 = ON, X2 = ON, X3 = ON. Because X2 = ON, Y2 will be ON. 2# drainage pump will work. In addition, because X3 = ON, Y0 will be ON. 2# drainage pump will work. Besides, the alarm circuit will be executed, which makes Y3 = ON and Y4 = ON. The alarm lamp will flash and the alarm will ring.
- When Reset is pressed, the NC contact X4 will be activated. Y3 = OFF and Y4 = OFF. Both the alarm and the alarm lamp will stop working.

3.7 Burn-in Test System (Timing Extension)



Control Purpose:

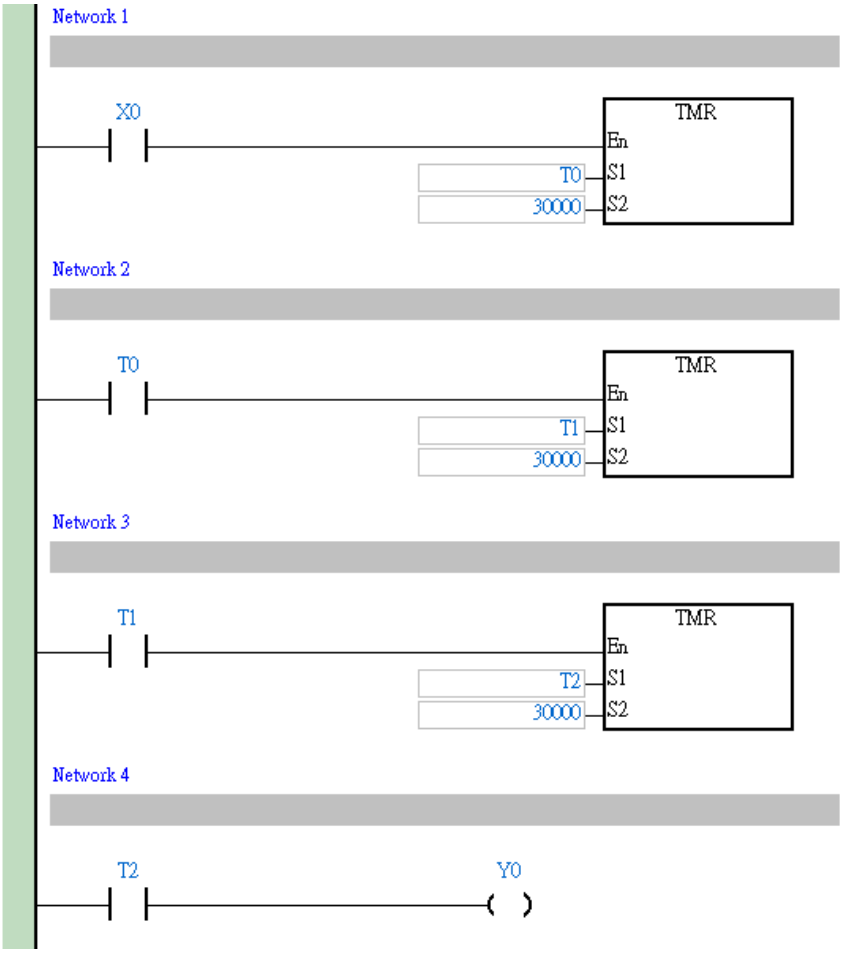
- Warning the operator to take out PLC from the burn-in room by the test completed indicator after 2.5 hours burn-in process.



Devices:

Device	Function
X0	When X0 = ON, the burn-in test starts
T0	3,000 sec timer. Time base: 100ms
T1	3,000 sec timer. Time base: 100ms
T2	3,000 sec timer. Time base: 100ms
Y0	Burn-in test completed indicator

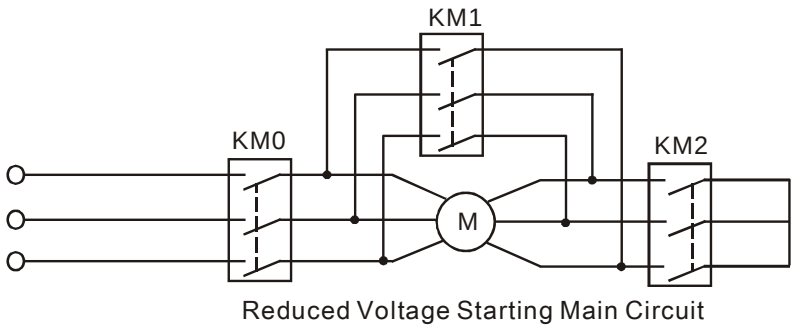
Control Program:



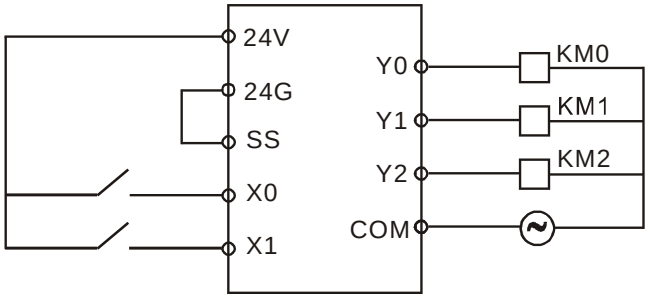
Program Description:

- The upper bound value for a 16-bit timer is 100ms × 32767 = 3276.7s, so it needs several timers to work together for a timing extension application which is more than 1 hour (3600 sec.) The total time is the sum of each timer's set value.
- When the burn in test is started, X0 = ON. The timer T0 will start to count for 100ms × 30000 = 3000sec. When T0 reaches its set value, the NO contact T0 will be ON and T1 will start to count for another 100ms × 30000 = 3000sec. When T1 reaches its set value, T2 will count one more 3000 sec and turn on the NO contact T2. Finally, the burn-in test completed indicator Y0 will be ON. The total time of the test is 3000s + 3000s + 3000s = 9000s = 150min = 2.5h.
- The timing extension function can also be performed by using API 169 HOUR instruction.

3.8 Star-Delta Reduced Voltage Starter Control



Reduced Voltage Starting Main Circuit



PLC External Wiring

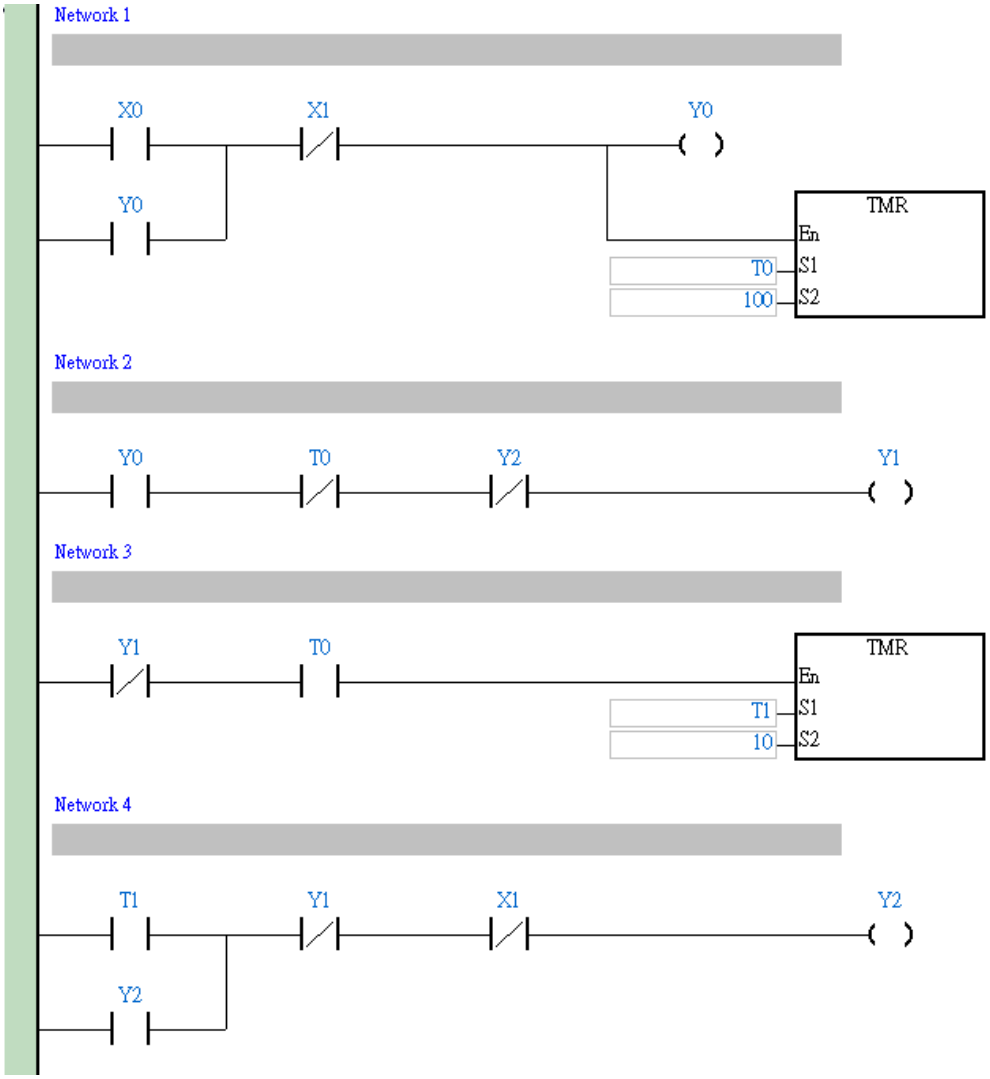
Control Purpose:

- Usually the starting current of the three-phase AC asynchronous motor is 5 ~7 times larger than the rated current. To reduce the effect of the starting current on the electrified wire fence, a star-delta reduced voltage starter should be applied.
- Starting process of a star-delta reduced voltage starter:
  When the switch is turned on, the contactors of both motor starter and “Star Reduced Voltage Starter**”** will be enabled first. After a 10 sec delay, the contactor of “Star Reduced Voltage Starter**”** will be disabled. Finally, the contactor of “Delta Reduced Voltage Starter” will be enabled after 1 sec, which operates the main motor circuit normally. The control purpose in this process is to assure the contactor of **“**Star Reduced Voltage Starter**”** is disabled completely before the contactor of **“**Delta Reduced Voltage Starter**”** is enabled.

Devices:

Device	Function
X0	X0 = ON when START is pressed.
X1	X1 = ON when STOP is pressed.
T1	10 sec timer. Time base: 100ms
T2	1 sec timer. Time base: 100ms
Y0	Motor starting contactor KM0
Y1	“Star Reduced Voltage Starter**”** contactor KM1
Y2	“Delta Reduced Voltage Starter” conntactor KM2

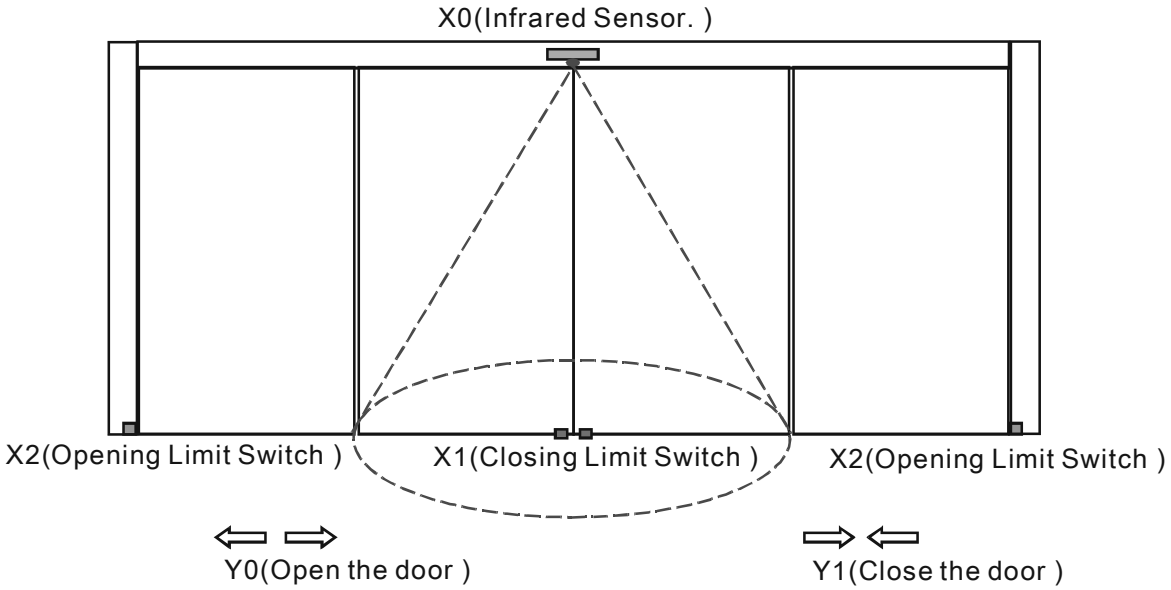
Control Program:



Program Description:

- X0 = ON when START is pressed. Y0 will be ON and latched. The motor starting contactor KM0 will be ON and the timer T0 will start to count for 10 sec. At the same time, because Y0 = ON, T0 = OFF and Y2 = OFF, Y1 will be ON. The “Star Reduced Voltage Starter**”** contactor KM1 will be activated.
- When timer T0 reaches its set value, T0 will be ON and Y1 will be OFF. Timer T1 will start to count for 1 sec. After 1 sec, T1 = ON and Y2 = ON. “Delta Reduced Voltage Starter” contactor KM2 will be activated.
- X1 = ON when STOP is pressed. Y0, Y1 and Y2 will be OFF and the motor will stop running no matter it is in starting mode or running mode.

3.9 Automatic Door Control



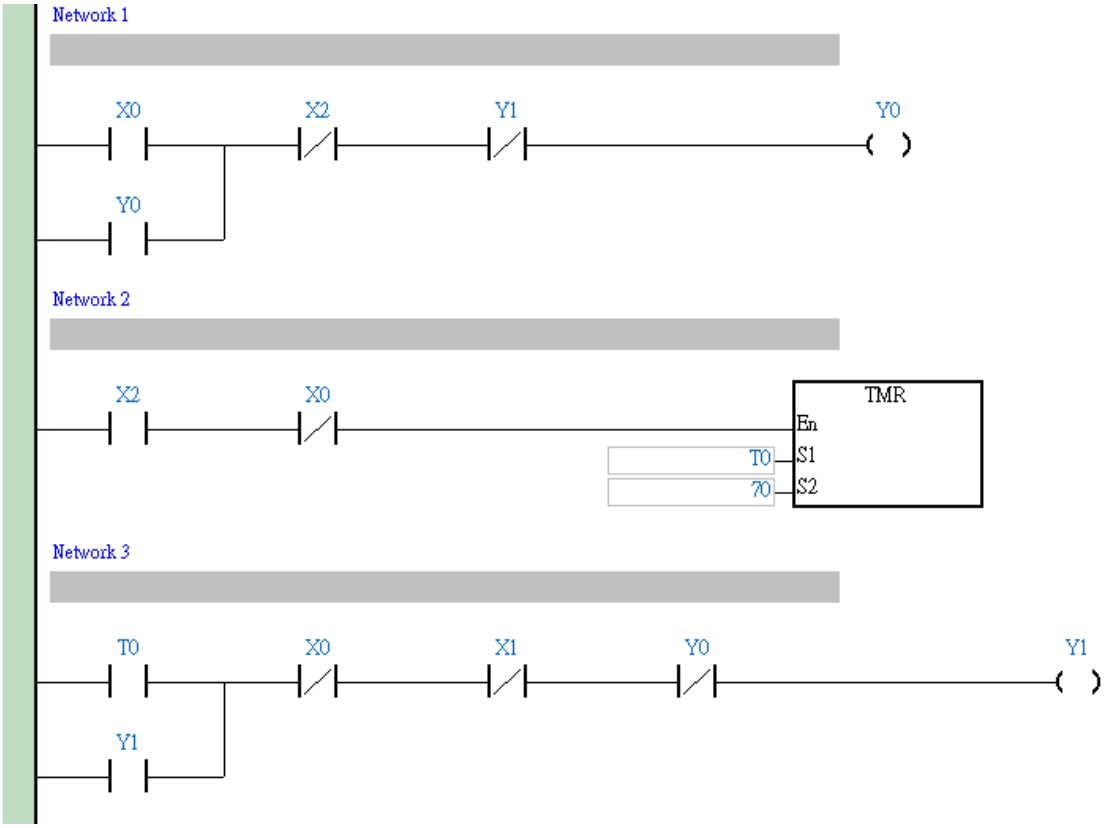
Control Purpose:

- When someone enters the infrared sensing field, opening motor starts working to open the door automatically till the door touches the opening limit switch
- If the door touches the opening limit switch for 7 sec and nobody enters the sensing field, the closing motor starts working to close the door automatically till the closing limit switch touched together.
- Stop the closing action immediately if someone enters the sensing field during the door closing process.

Devices:

Device	Function
X0	X0 = ON when someone enters the sensing field.
X1	Closing limit switch. X1 = ON when 2 switches touched together.
X2	Opening limit switch. X2 = ON when the door touched the switches.
T0	7 sec timer. Time base: 100ms
Y0	Opening motor
Y1	Closing motor

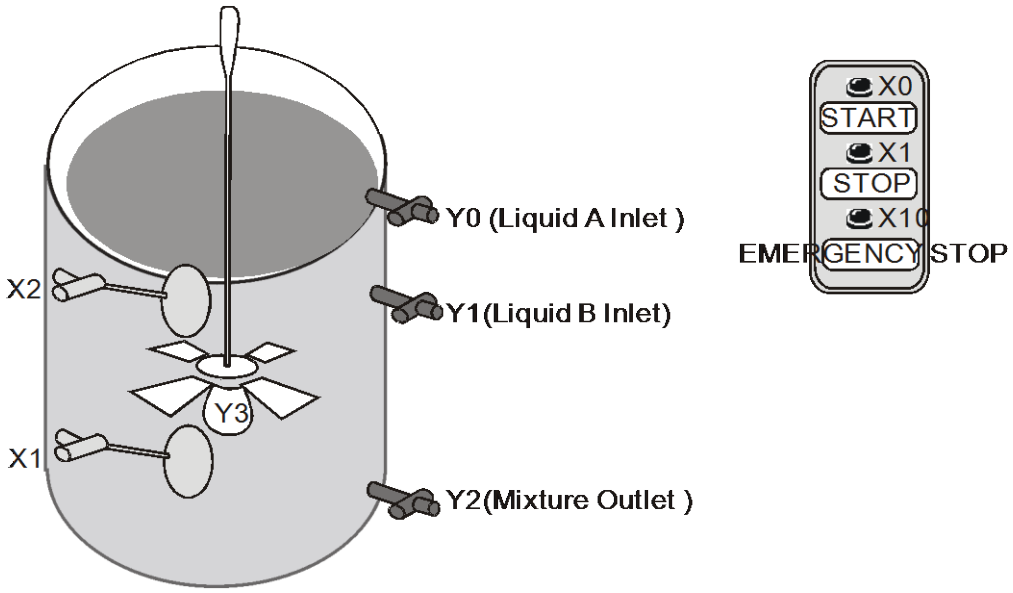
Control Program:



Program Description:

- X0 = ON if someone enters the sensing field of the infrared sensor. Y0 will be ON and latched, and the door will be opened as long as the opening limit switches X2 = OFF.
- When the door touches the opening limit switches, X2 = ON. The timer T0 will start to count for 7 sec if no one enters the sensing field (X0 = OFF). After 7 sec., Y1 will be ON and latched and the door will be closed.
- During the closing process, X0 = ON if someone enters the sensing field. The NC contact X0 will be activated to turn Y1 off. Because X0 = ON, X2 = OFF and Y1 = OFF, Y0 will be ON and the door will be opened once again.

3.10 Automatic Liquids Mixing Control System



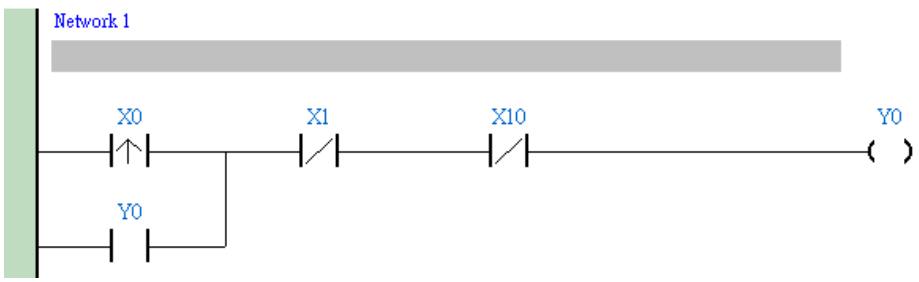
Control Purpose:

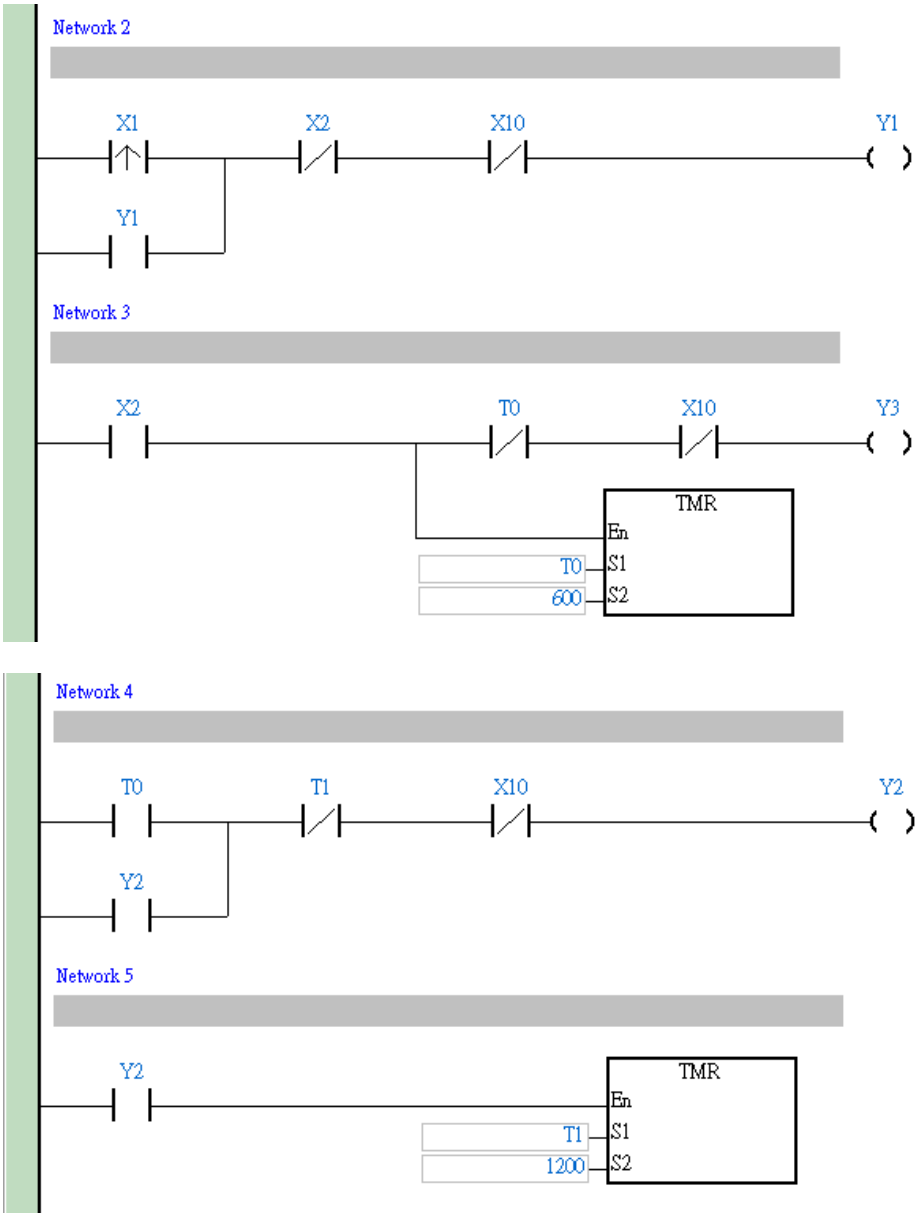
- Automatically infusing the container with liquids A and B in order when START is pressed. When it reaches the set level, mix the two liquids evenly then open the valve to let out the mixture.

Devices:

Device	Function
X0	X0 = ON when START is pressed.
X1	Low level float sensor. X1 = ON when the liquid level reaches X1.
X2	High level float sensor. X2 = ON when the liquid level reaches X2.
X10	EMERGENCY STOP button. X10 = ON when the button is pressed.
T0	60 sec timer. Time base: 100ms
T1	120 sec timer. Time base: 100ms
Y0	Liquid A inlet
Y1	Liquid B inlet
Y2	Mixture outlet
Y3	Agitator

Control Program:



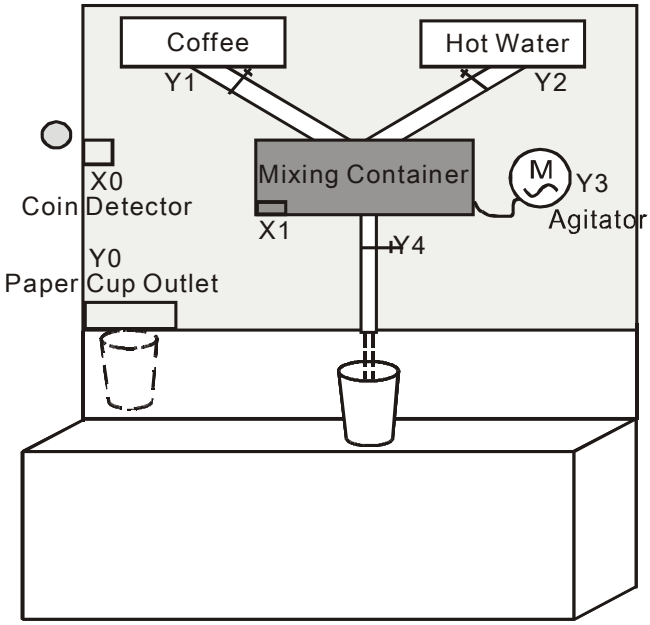


Program Description:

- X0 = ON when START is pressed. Y0 will be ON and latched, and the valve will be opened for infusing liquid A until the level reaches the low-level float sensor.
- X1 = ON when the level reaches the low-level float sensor. Y1 will be ON and latched, and the valve will be opened for infusing liquid B until the level reaches the high-level float sensor.
- X2 = ON when the level reaches the high-level float sensor. Y3 will be ON and activates the agitator. Also, timer T0 will start to count for 60 sec. After 60 sec, T0 will be ON, and the agitator motor Y3 will stop working. Y2 will be ON and latched, and the mixture will drain out of the container.
- When Y2 = ON, timer T1 will start to count for 120 sec. After 120 sec, T1 will be ON and Y2 will be OFF. The draining process will be stopped.
- When an error occurs, press EMERGENCY STOP button X10. The NC contact X10 will be

ON to disable all the outputs. The system will then stop running.

3.11 Automatic Coffee Maker



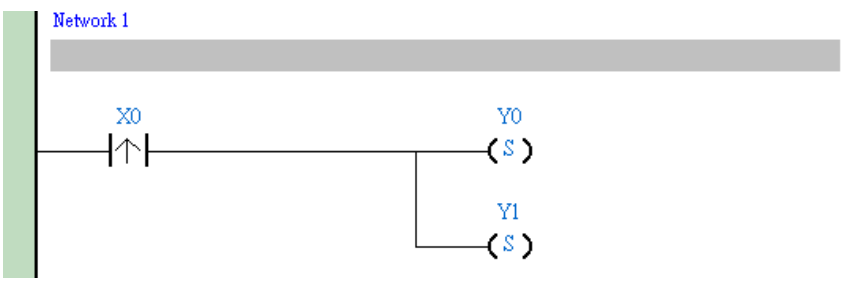
Control Purpose:

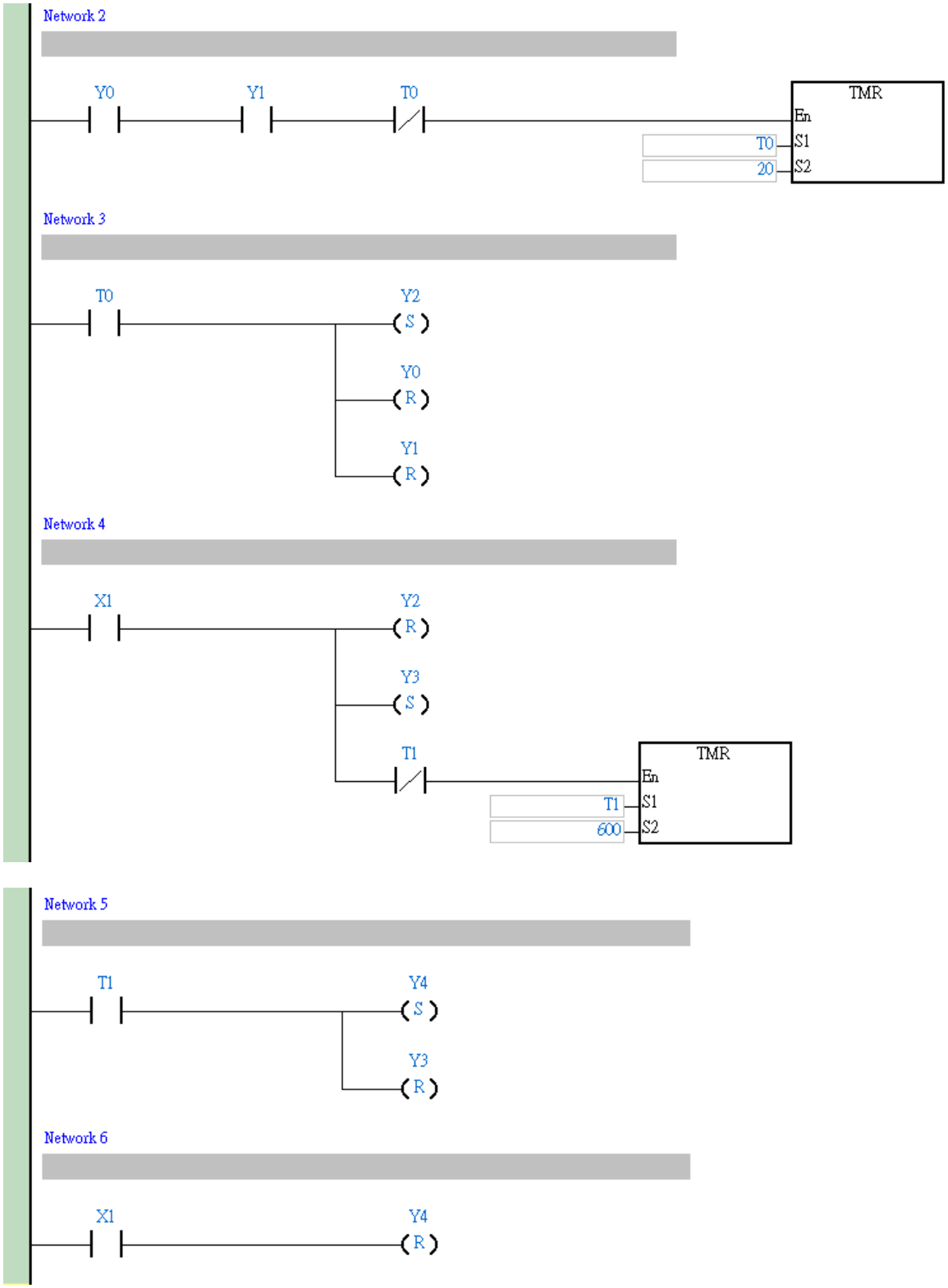
- Making the paper cup come out of the outlet when a coin is inserted. At the same time, the coffee pours in the mixing container. After 2 sec, the hot water pours in. 60 sec later, the ready-made coffee will be pouring out from the coffee outlet.

Devices:

Device	Function
X0	Coin detector. X0 = ON when a coin is inserted.
X1	Pressure detector. X1 = ON when the liquid in the container reaches a certain amount of pressure.
T0	2 sec timer. Time base: 100ms
T1	60 sec timer. Time base: 100ms
Y0	Paper cup outlet
Y1	Coffee outlet
Y2	Hot water outlet
Y3	Agitator
Y4	Ready-made coffee outlet

Control Program:





Program Description:

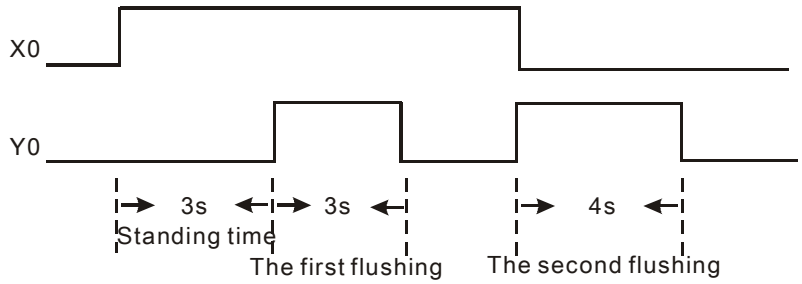
- X1 = ON when a coin is inserted. Y0 and Y1 will be ON and latched. A paper cup will be sent out, and a certain amount of coffee will be poured into the container at the same time.
- Y0 and Y1 will be ON for 2 sec which is the set value of timer T0. When NO contact T0 is ON, Y2 will be activated and the hot water will be poured in the container. At the same time, the outlets of both paper cup and coffee will be closed.

- When the liquid in the container reaches a certain amount of pressure, X1 = ON. Therefore, the hot water outlet Y2 will be reset, and the agitator Y3 will be ON for 60 sec. After 60 sec, NO contact T1 will be ON. Y4 will be ON and latched, and Y3 will be reset at the same time. The agitator will stop working, and the ready-made coffee will be pouring out from the outlet.
- When the coffee is poured into the paper cup completely, X1 will be OFF and Y4 will be reset. The ready-made coffee outlet will be closed.

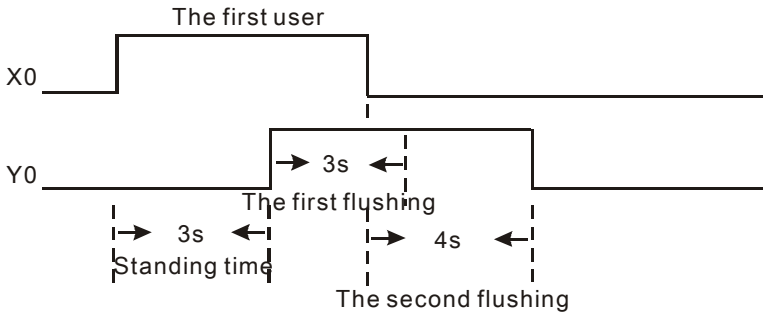
3.12 Automatic Urinal Flushing Control Program

Control Purpose:

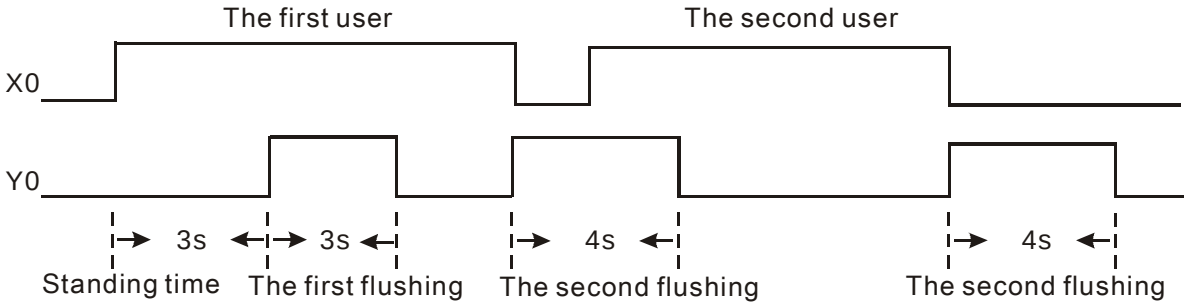
- If a user stands in front of the urinal for more than 3 sec, the flushing control device will flush the urinal for 3 sec (the first flushing). When the user leaves the urinal, flush for another 4 sec then stop automatically (the second flushing).



- Stopping the first flushing and starting the second flushing if the first user leaves the urinal during the first flushing process.



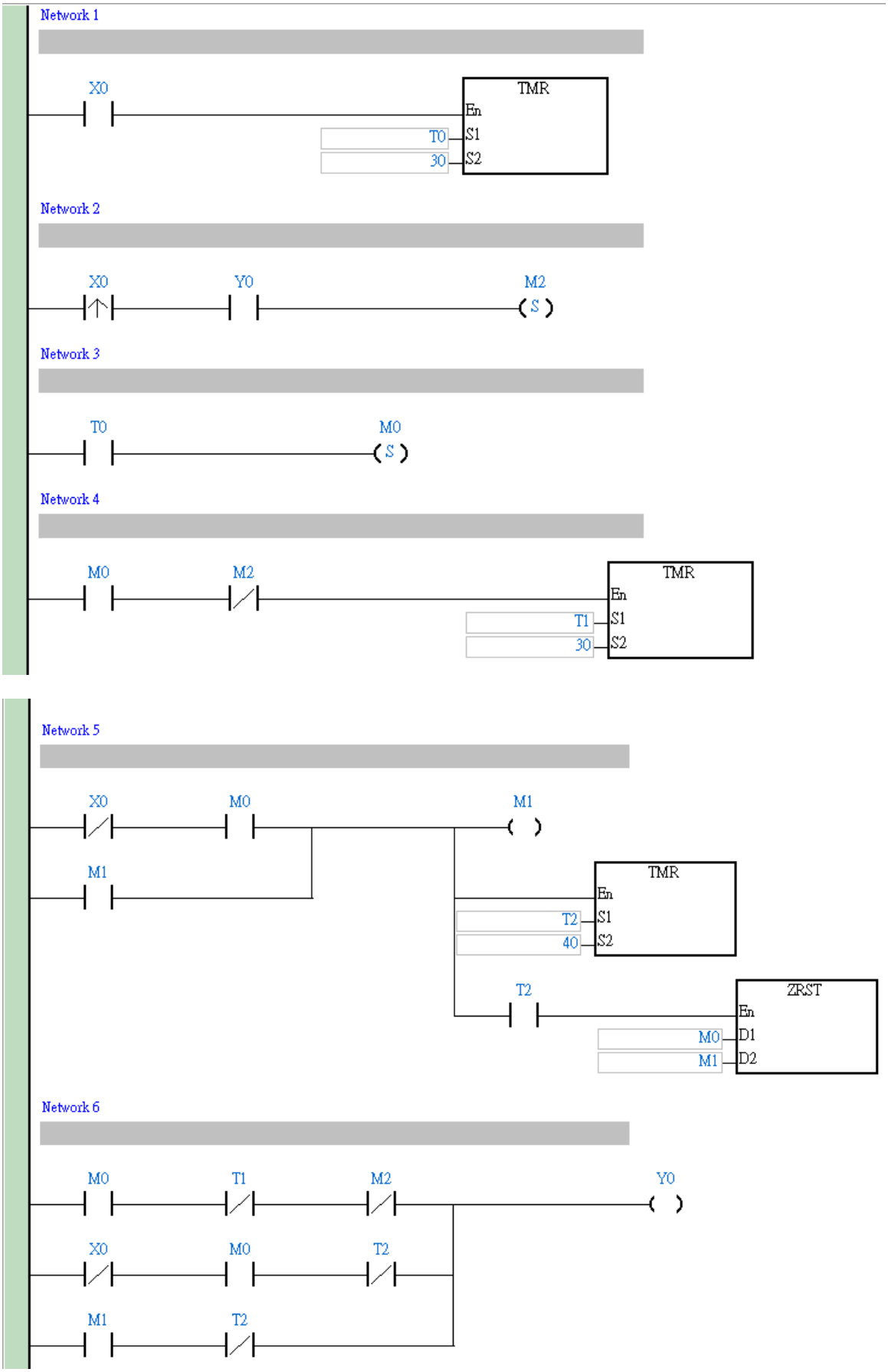
- If the second user comes before the finishing of the 4 sec flushing, the flusher will finish the 4 sec flushing process and skip the first 3 sec flushing process. When the second user leaves the urinal, the flusher will perform another 4 sec flushing.

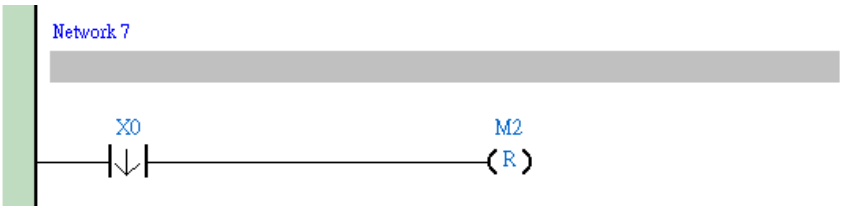


Devices:

Device	Function
X0	Infrared sensor. X0 = ON when a user is detected.
M0 ~ M2	Internal auxiliary relay
T0	3 sec timer. Time base: 100ms
T1	3 sec timer. Time base: 100ms
T2	4 sec timer. Time base: 100ms
Y0	Flushing valve

Control Program:

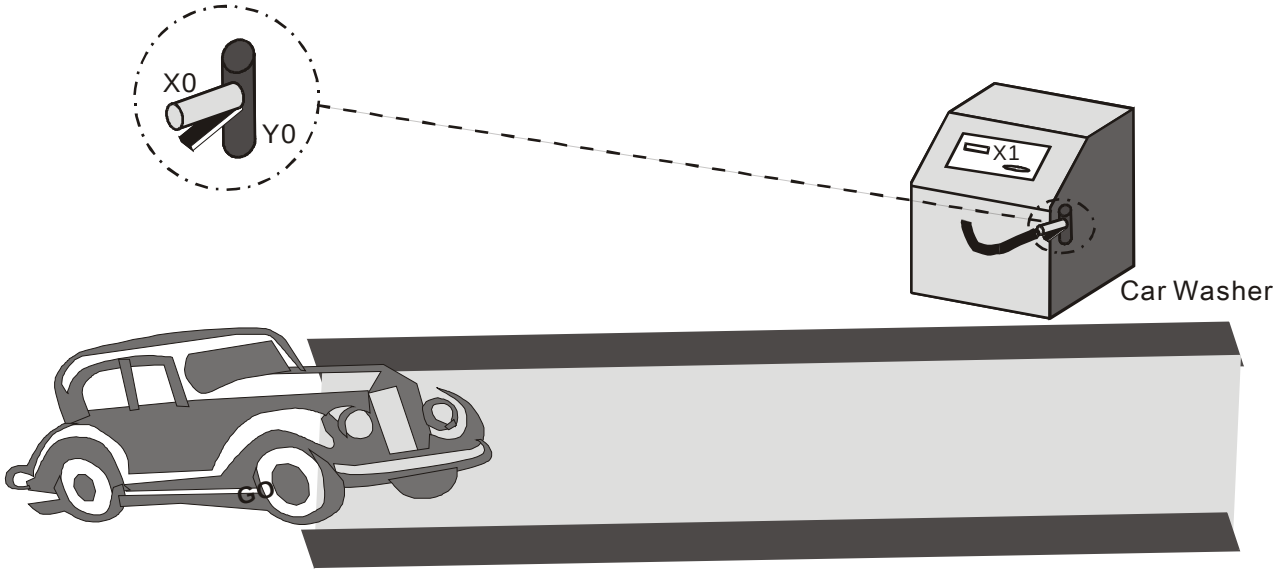




Program Description:

- When a user is detected, infrared sensor X0 will be ON. In this case, T0 will be ON and start to count for 3 sec. If the user leaves in 3 sec, X0 = OFF, and T0 will be OFF. No action will be performed. If the user stands for more than 3 sec, the NO contact T0 will be activated, which turns on M0. The first flushing will start (Y0 = ON).
- M1 is latched in this program. If the user leaves after 3 sec, which means the NO contact M0 = ON and the NC contact X0 is OFF, M1 will be ON and latched. The second flushing will then be started. After 4 sec, both the NO contact and the NC contact of T2 will be activated. Therefore, Y0 will be OFF, and the flushing will be stopped. M0 and M1 will be reset. Because M1 is latched, the second flushing process will certainly be executed whether X0 changes its state or not.

3.13 Performing Accumulative Function with Normal Timer



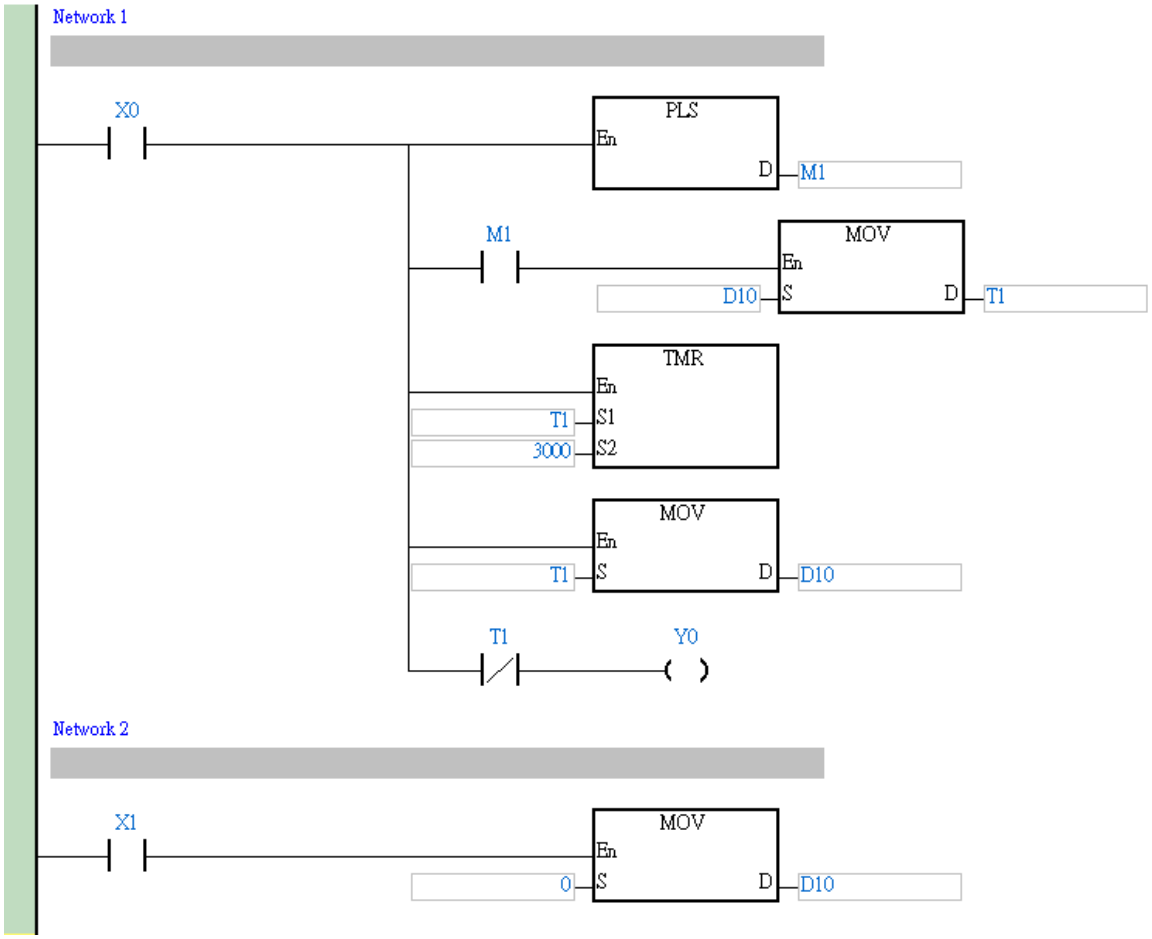
Control Purpose:

- Ensuring that the customers wash their cars for entire 5 minutes no matter how many times the sprayer valve stops. .

Devices:

Device	Function
X0	Sprayer valve switch. X0 = ON when the sprayer handle is held on tightly.
X1	Coin detector. X1 = ON when an inserted coin is detected.
M1	Creating a trigger pulse for one program scan cycle
T1	Timer. Time base: 100ms
D10	Storing present value of T1
Y0	Sprayer valve

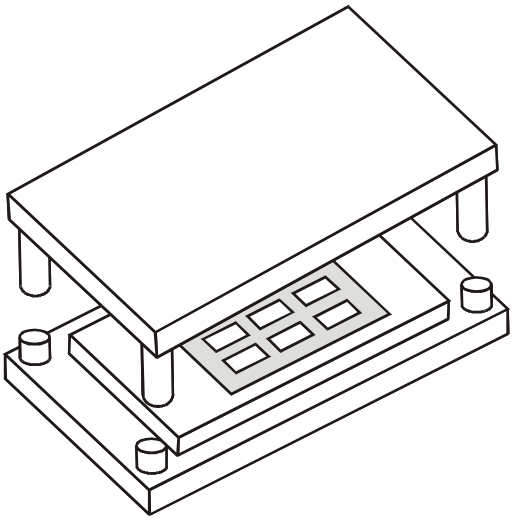
Control Program:

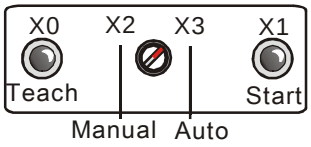


Program Description:

- When customers insert coins in the slot, X1 = ON. The time value of D10 will be cleared.
- When customers compress the sprayer handle, X0 = ON. PLS instruction will be executed. M1 will be ON for one program scan cycle, which starts T1 to count from 0 to 5 min (T1 = K3000). In this case, Y0 = ON, and the sprayer valve is open.
- If the sprayer handle is released, the timer will stop counting. The present value in the timer will be saved and the water spraying will be interrupted.
- When customers compress the sprayer handle again, the timer will start to count from the value saved in D10. Because the present value of T1 is sent to D10 and saved when T1 is working, the saved value will be sent to T1 as its present value when T1 is activated again. Therefore, even if there are some interruptions of the sprayer valve in the washing process, the program assures customers of entire 5 minutes car washing service.

3.14 Performing Teaching Function with Normal Timer





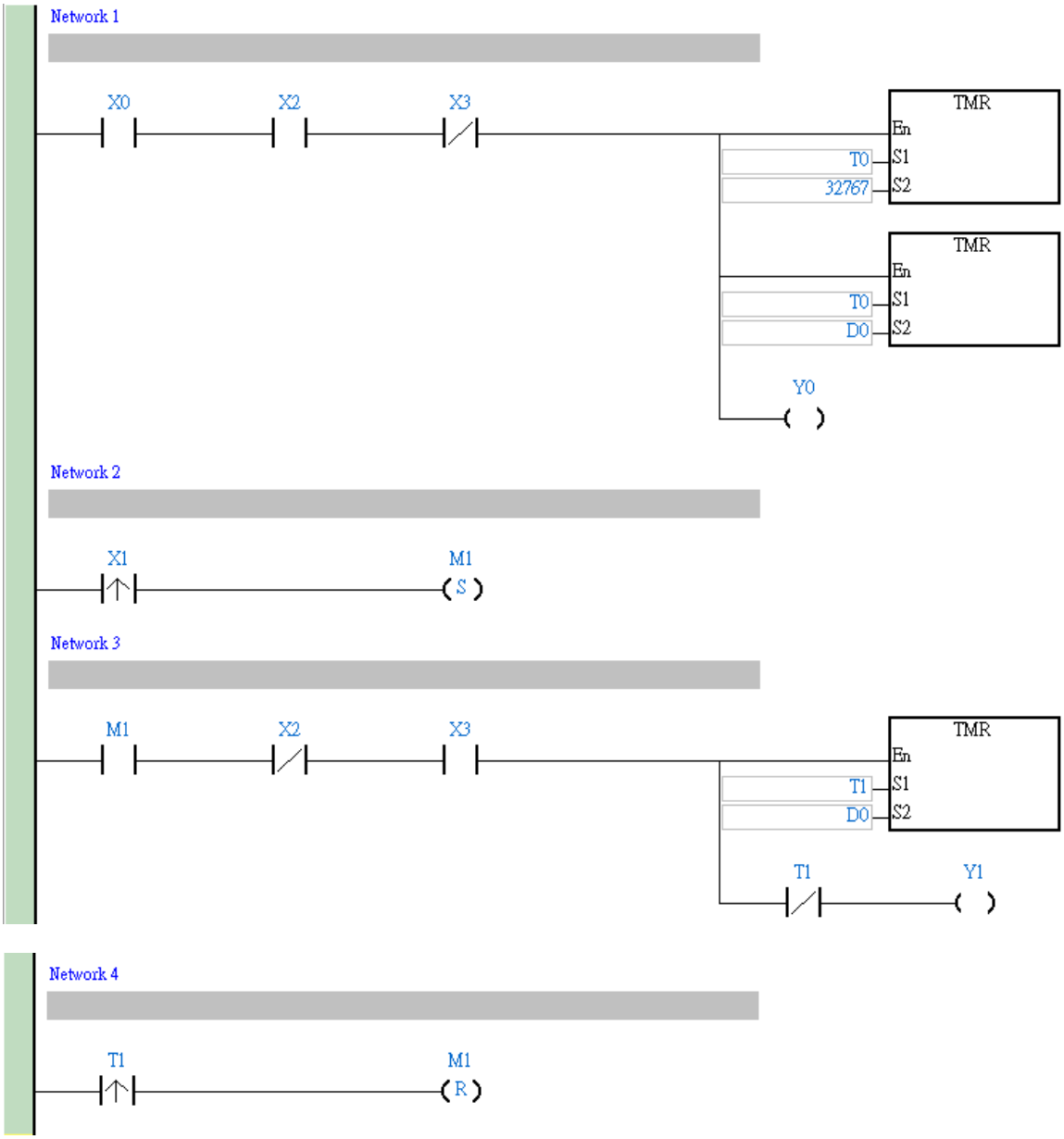
Control Purpose:

- In Manual mode, the engineers should adjust stamping time according to their experience. The stamping time depends on the time of pressing Teach.
- In Auto mode, if Start is pressed, the machine will perform stamping process once according to the time value saved by Teach process.

Devices:

Device	Function
X0	Teach Button. X0 = ON when the button Teach is pressed.
X1	Start button. X1 = ON when the button Start is pressed.
X2	Manual mode
X3	Auto mode
M1	Start trigger in auto mode
T0	Timer. Time base: 100ms
T1	Timer. Time base: 100ms
D0	Data register. Saving the time value of stamping
Y0	Starting the punch when Teach is pressed
Y1	Starting the punch when Start is pressed in Auto mode

Control Program:

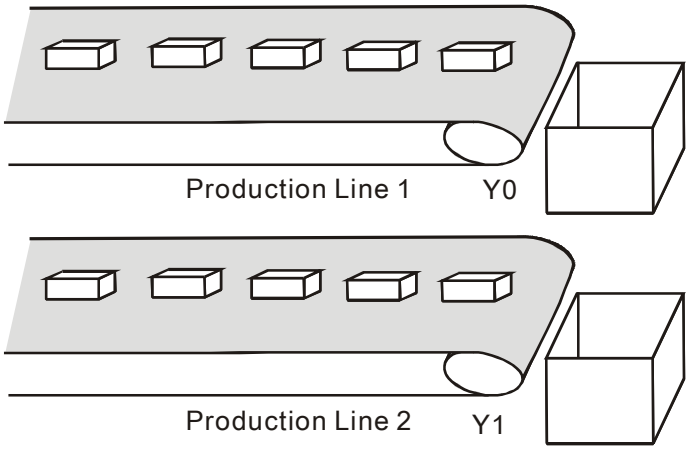


Program Description:

- X2 = ON when the switch is turned to Manual mode. X0 = ON when Teach is pressed. In this case, coil Y0 will be ON and start the stamping process. At the same time, T0 will be executed and its present value will be sent to D0. Release the button Teach when the stamping process is completed. Y0 will be OFF, and the stamping process will be stopped.
- X3 = ON when the switch is turned to Auto mode. Each time when X1 is pressed, Y1 will be ON and the stamping process will be executed. At the same time, T1 will be activated to count until it achieves the target value (the saved value in T0). When the stamping time is achieved, the NC contact T1 and the rising edge trigger T1 will be activated and enable both M1 and Y1 to be OFF. The stamping process will thus be stopped. When the button Start is pressed again, M1 will be ON and repeats the same stamping process.

- The timer teaching function can also be performed by using API 64 TTMR instruction.

3.15 Auto Interruption Timer



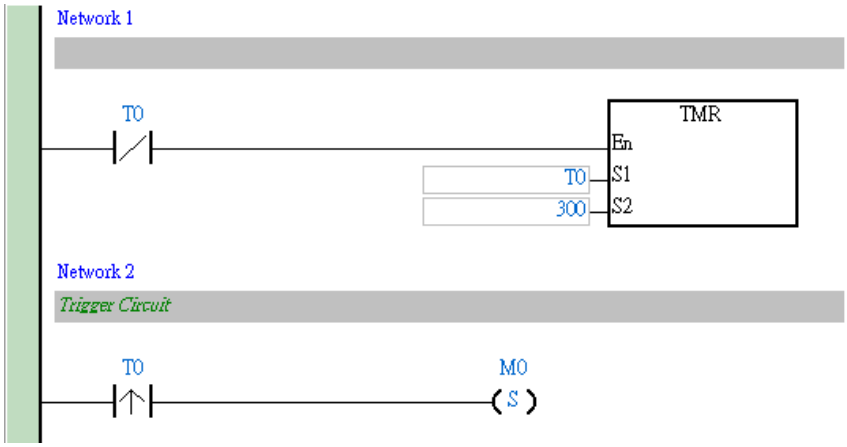
Control Purpose:

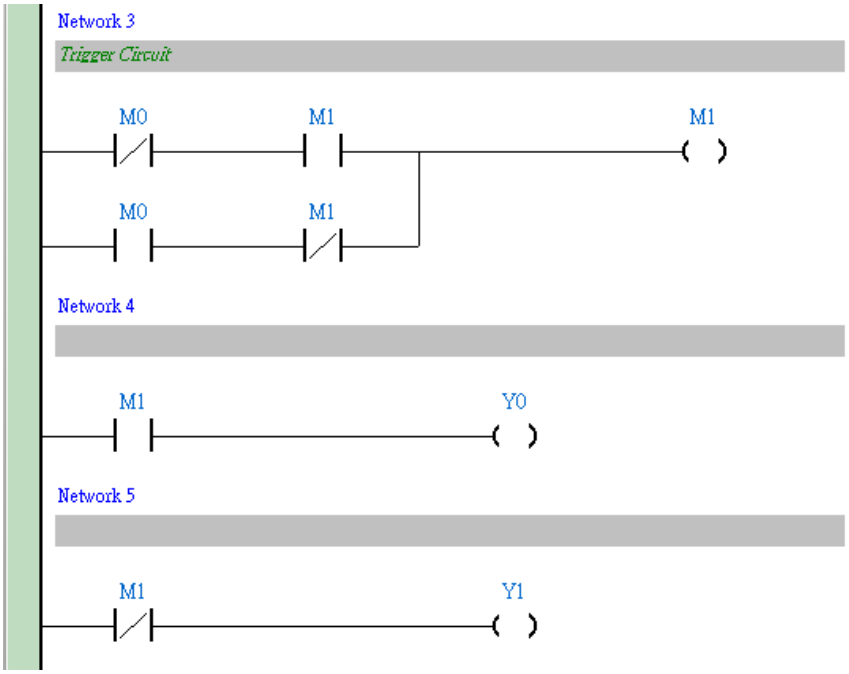
- In PLC production lines, an operator should be in charge of packing products on two conveyor belts into 2 boxes. For ensuring that operators have sufficient time for packing, the program is designed to control two conveyor belts to be running alternatively: stops one conveyor after 30 sec running and then starts another conveyor for 30 sec running.

Devices:

Device	Function
T0	30 sec timer. Time base: 100ms
M0	Controlling the trigger circuit
M1	Alternating the conveyor belt
Y0	Executing the production line 1
Y1	Executing the production line 2

Control Program:

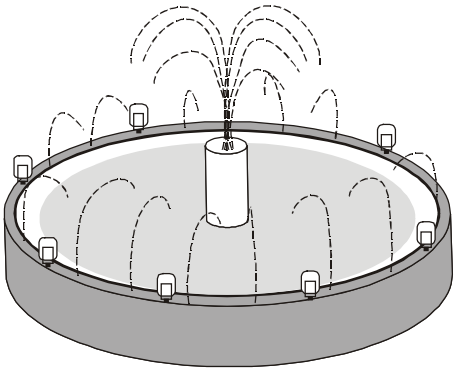


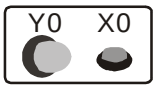


Program Description:

- This program uses the NC contact T0 as the executing condition of the timer T0. When T0 reaches its set value, 30 sec, it will be activated. The trigger circuit will be executed to change the state of M1. Production line 1 will then start working.
- After 30 sec counting, T0 turns ON. The NC contact T0 will be activated. At the same time, timer T0 will thus be OFF, which makes the NC contact T0 to be OFF again. In the next scan period, because the NC contact T0 is OFF, timer T0 will start counting. After 30 sec counting, T0 will be activated and so will the trigger circuit. In this case, M1 changes its state again. Production line 1 will be stopped and production line 2 will start working.
- By using the trigger circuit to activate Y0 and Y1 alternatively, the program makes the two production lines to convey products alternatively.

3.16 Interesting Fountain





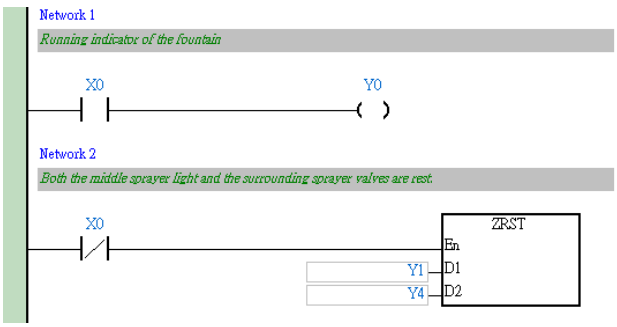
Control Purpose:

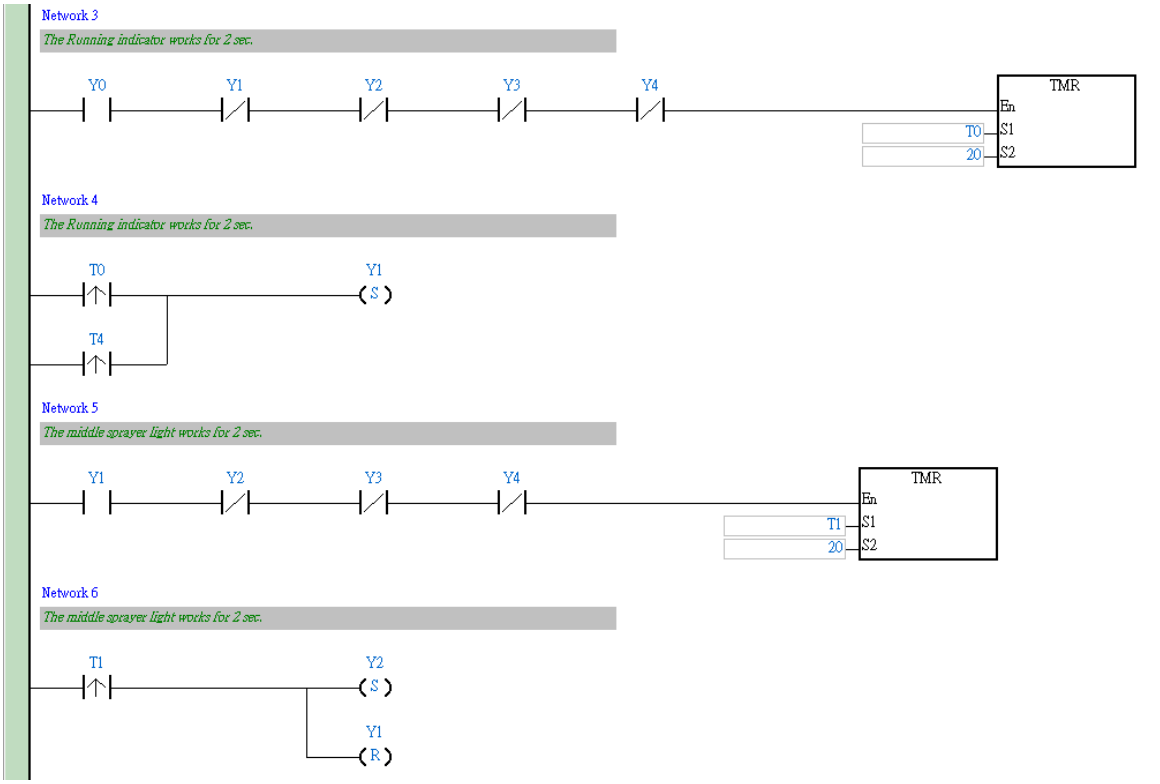
- Keeping the Running indicator in ON state when the Start button is pressed.
- Enabling the following devices to start in order after Running indicator is ON for 2 sec: middle sprayer light **>** middle sprayer valve **>** surrounding lights **>** surrounding sprayer valves. Each of them will be ON for 2 sec.

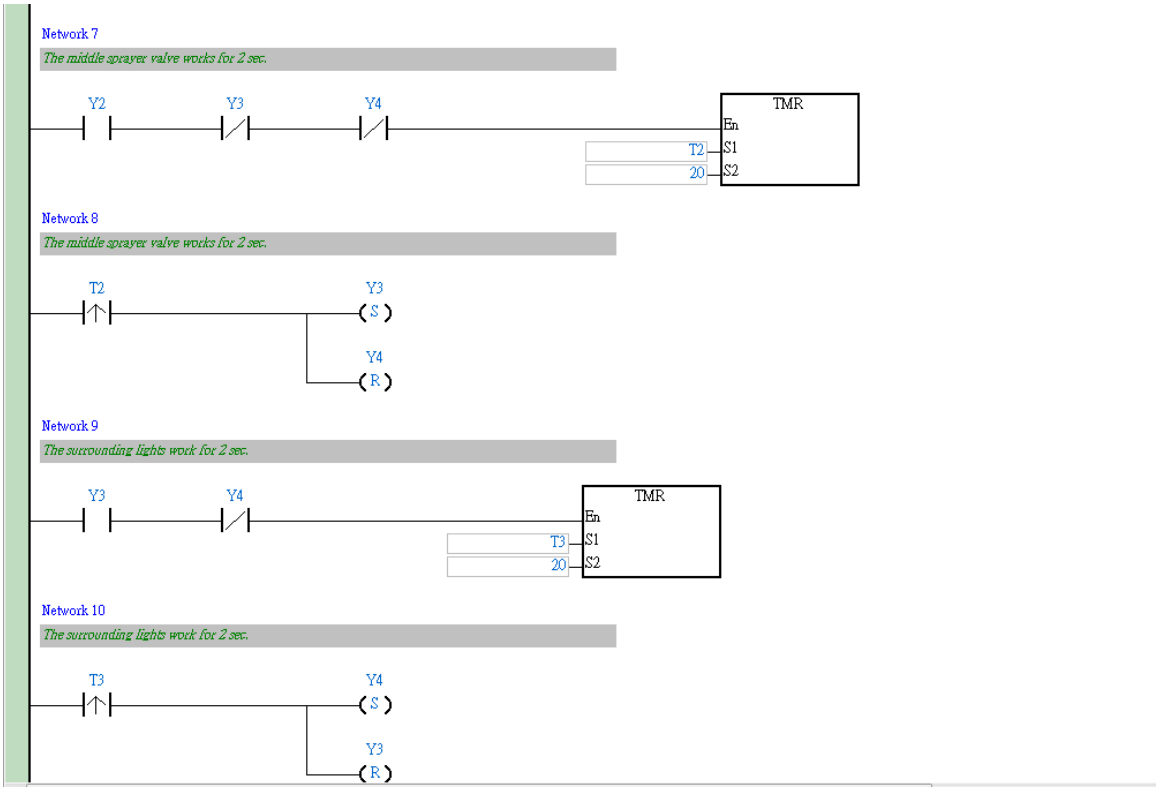
Devices:

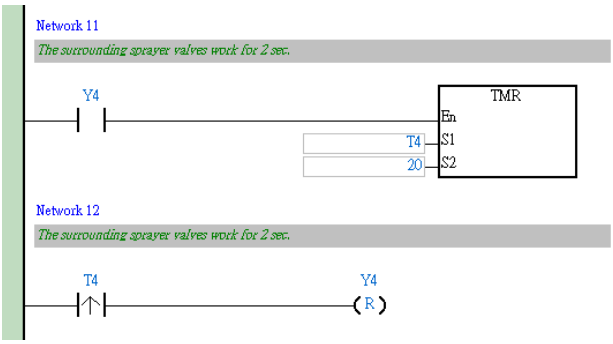
Device	Function
X0	X0 = ON when the Start button of the fountain is pressed.
T0	2 sec timer. Time base: 100ms
T1	2 sec timer. Time base: 100ms
T2	2 sec timer. Time base: 100ms
T3	2 sec timer. Time base: 100ms
T4	2 sec timer. Time base: 100ms
Y0	Running indicator of the fountain
Y1	Middle sprayer light
Y2	Middle sprayer valve
Y3	Surrounding lights
Y4	Surrounding sprayer valves

Control Program:




Network 3
The Running indicator works for 2 sec.
Y0
Y1
Y2
Y3
Y4
TMR
En
T0
S1
20
S2
Network 4
The Running indicator works for 2 sec.
T0
Y1
S
T4
Network 5
The middle sprayer light works for 2 sec.
Y1
Y2
Y3
Y4
TMR
En
T1
S1
20
S2
Network 6
The middle sprayer light works for 2 sec.
T1
Y2
S
Y1
R


Network 7
The middle sprayer valve works for 2 sec.
Y2
Y3
Y4
TMR
En
T2
S1
20
S2
Network 8
The middle sprayer valve works for 2 sec.
T2
Y3
S
Y4
R
Network 9
The surrounding lights work for 2 sec.
Y3
Y4
TMR
En
T3
S1
20
S2
Network 10
The surrounding lights work for 2 sec.
T3
Y4
S
Y3
R



Program Description:

- X0 = ON when the button Start is pressed. Coil Y0 will be ON to activate the Running indicator. Y0 = ON is used as the executing condition for the timer T0. After 2 sec counting down, T0 goes from OFF to ON and executes [SET Y1] instruction. The middle sprayer light Y1 will be ON. The Running indicator Y0 will be kept in ON state through the whole working process.
- Likewise, Y1 = ON is used as the executing condition for the timer T1, and so does Y2 = ON for the timer T2 as well as Y3 = ON for the timer T3. The executions will be assured in the following order: Y1, Y2, Y3, and Y4.
- The middle sprayer light, middle sprayer valve, surrounding lights, and surrounding sprayer valves need to be started in order. Therefore, when T1, T2 and T3 go from OFF to ON and set the next execution, they also reset the present execution. In addition, the NC contacts of Y1, Y2, Y3 and Y4 are used for turning off timers T0, T1, T2 and T3.
- After the completion of the last execution, the rising edge switch T4 will reset Y4 and set Y1. The second round of fountain display will then be started again.
- When X0 = OFF, coil Y0 will be OFF to turn off the Running indicator. In addition, ZRST instruction will be executed at the same time. Y1, Y2, Y3 and Y4 will be reset and all the valves and lights in the fountain will be stopped immediately.

4.1 Summation of Continuous D Registers

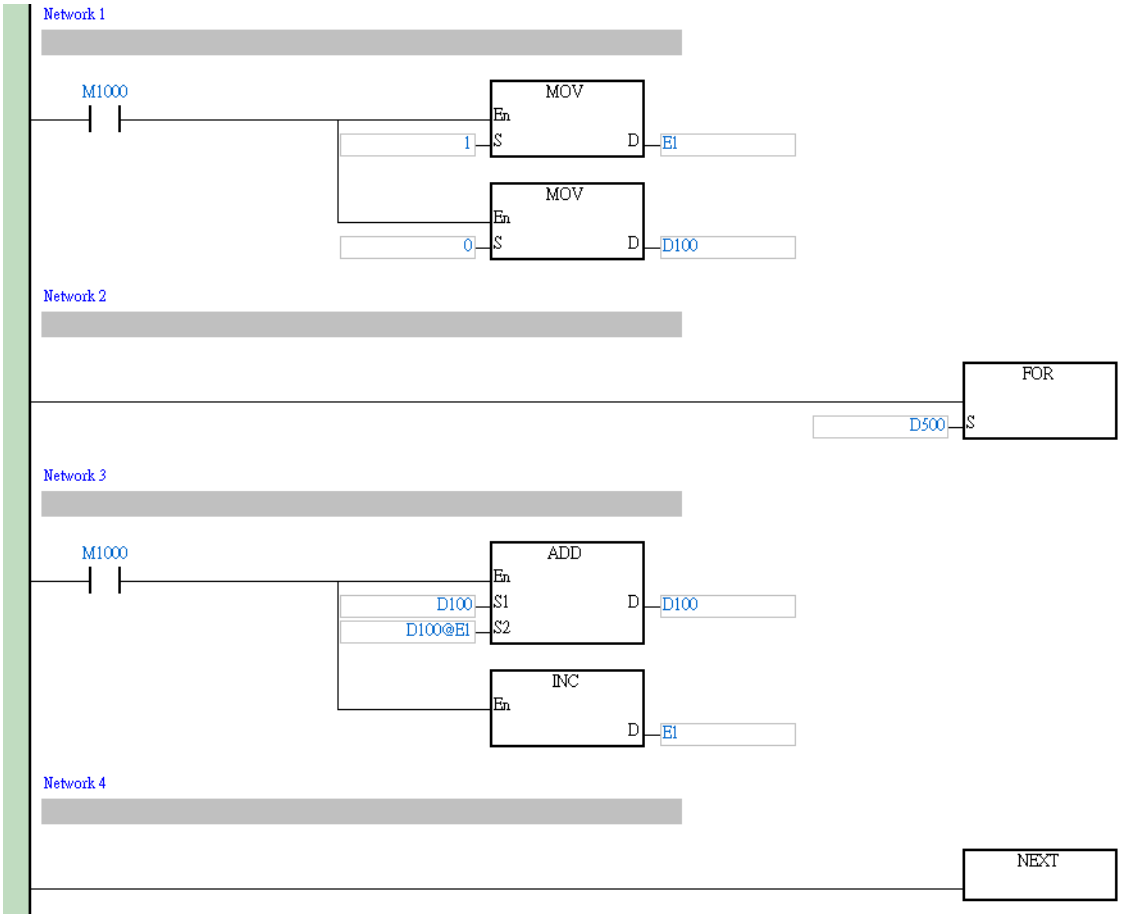
Control Purpose:

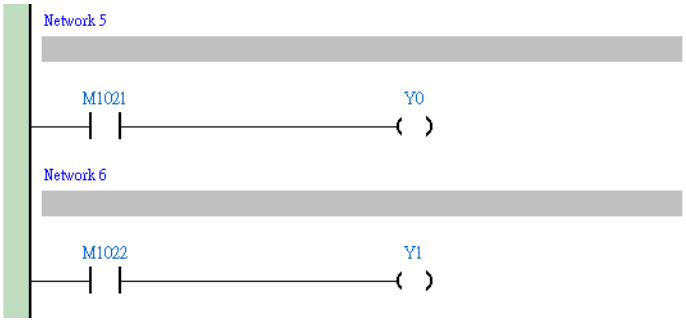
- Summing up the values of D registers from D101 to DN (the number of N is determined by users) and storing the operation result in D100. If the result < K-32768, the borrow flag = ON; if the result > K32767, the carry flag = ON.

Devices:

Device	Function
Y0	Borrow flag indicator. When the value in D100 < K-32768, Y0 = ON
Y1	Carry flag indicator. When the value in D100 > K32767, Y1 = ON
E1	Index register
D100	Storing the sum of all D registers
D500	Storing the executing times of FOR-NEXT loop

Control Program:





Program Description:

- The key of the program is to use the index register E1 together with FOR ~ NEXT loop to vary the addend D100E1. When E1 = K1, D100E1 represents D101; when E1 = K2, D100E1 represents D102. Also, when E1 = K10, D100E1 represents D110.
- The number of continuous D registers is determined by the execution times of FOR ~NEXT loop which is set by D500. If the value in D500 ≤ 1, the loop will execute 1 time. If the value in D500 = K10, the loop will execute 10 times first and then execute the instructions behind the loop.
- In the first FOR ~ NEXT loop, E1 = K1, so D100E1 represents D101. ADD instruction is executed, and the operation result of D100 plus D101 is stored in D100. Since the summand D100 = K0, the value stored in D100 equals to the value in D101. At the same time, INC instruction is executed to set E1 = K2.
- In the second FOR ~ NEXT loop, E1 = K2, so D100E1 represents D102. ADD instruction is executed, and the operation result of the values of D100 plus D102 is stored in D100. Since the summand D100 = D101, the value stored in D100 is the sum of the D101 and D102.
- According to the same process, by the 10^{th} FOR ~ NEXT loop the value in D100 will be the sum of D101, D102, D103, D104, D105, D106, D107, D108, D109 and D110.
- If the operation result < K-32768, M1021 will be ON to activate the output coil Y0. Borrow flag indicator will be ON. On the contrary, if the operation result > K32767, M1022 will be ON to activate output coil Y1. Carry flag indicator will be ON in this case.

4.2 Parameter Setting for Product Recipe

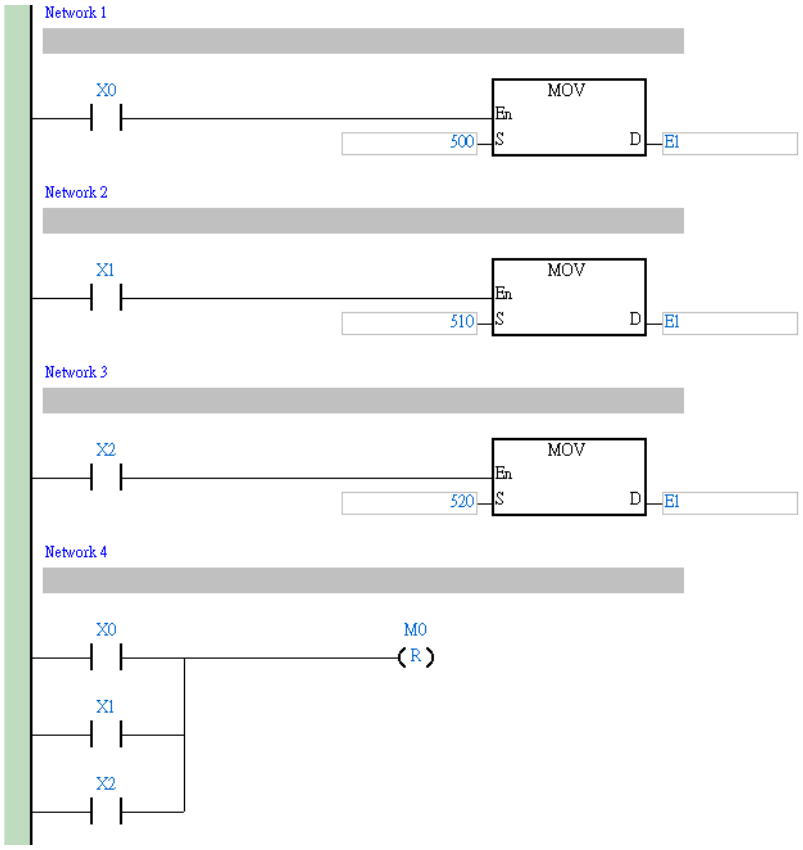
Control Purpose:

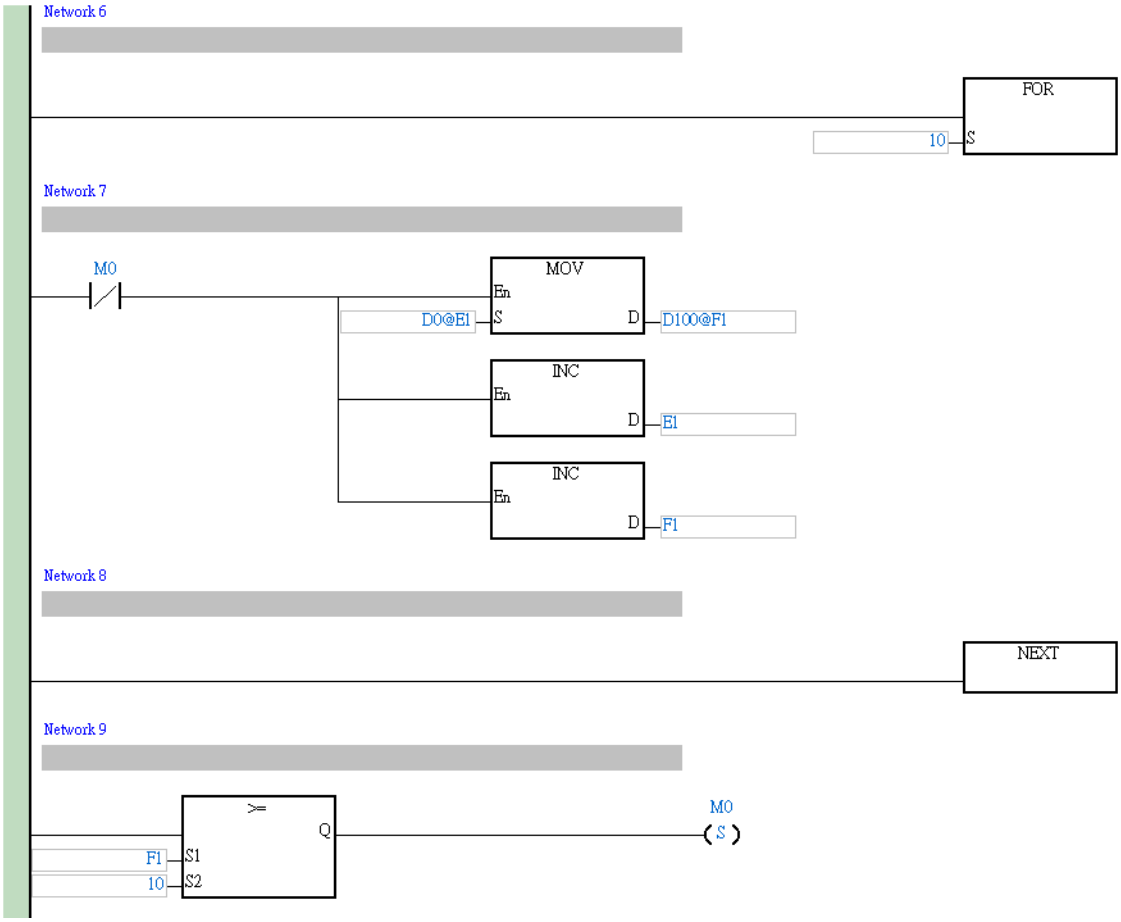
- For one product, there are 3 models which correspond to 3 sets of recipes. Each recipe includes 10 parameters. The program executes the set parameters according to the selected recipe switch.

Devices:

Device	Function
X0	Switch of the first recipe
X1	Switch of the second recipe
X2	Switch of the third recipe
D500 ~ D509	Parameters of the first group
D510 ~ D519	Parameters of the second group
D520 ~ D529	Parameters of the third group
D100 ~ D109	The present parameters

Control Program:





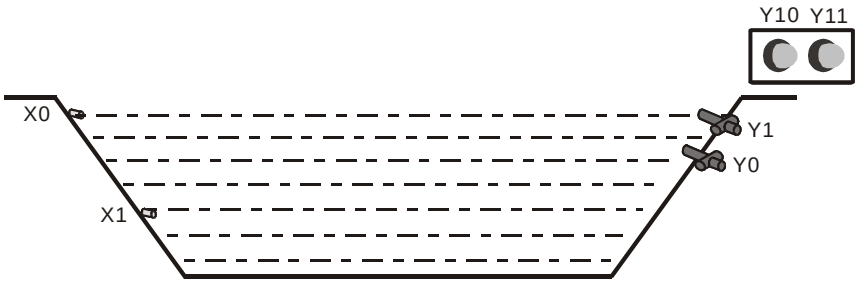
Program Description:

- The key to this program is to use index register E1, F1 together with FOR ~ NEXT loop to vary the numbers of D registers. In addition, the program transfers the parameters of the selected recipe to the register of present parameters
- When one recipe is selected, the corresponding switch X0, X1 or X2 will be ON. According to the selected value of E1, the number of register D0E1 would be D500, D510 or D520. [RST M0] will be executed to reset F1, and FOR ~ NEXT will be executed. Because F1 is reset as K0, D100F1 represents D100 in this case.
- The FOR ~ NEXT loop is executed for 10 times in this program. If the first recipe is selected, D0E1 will vary from D500 to D509 and D100F1 will vary from D100 to D109.
- In addition, the value of D500 will be sent to D100 in the first FOR ~ NEXT loop. The value of D501 will be sent to D101 in the second loop. By the same process, the value of D509 will be sent to D109 in the 10^{th} loop.
- When the executing time reaches its set value, which means F1 = K10, [SET M0] instruction will be executed. The Normally Closed contact M0 will be activated to stop FOR ~ NEXT loops.
- The program performs the transferring of 10 parameters of each recipe. The numbers of parameters can easily be changed by setting the executing times of FOR ~ NEXT loop. Besides, if it requires adding more recipes, the program can also meet this requirement by

adding one more MOV instruction as [MOV K530 E1].

MEMO

5.1 Reservoir Level Control



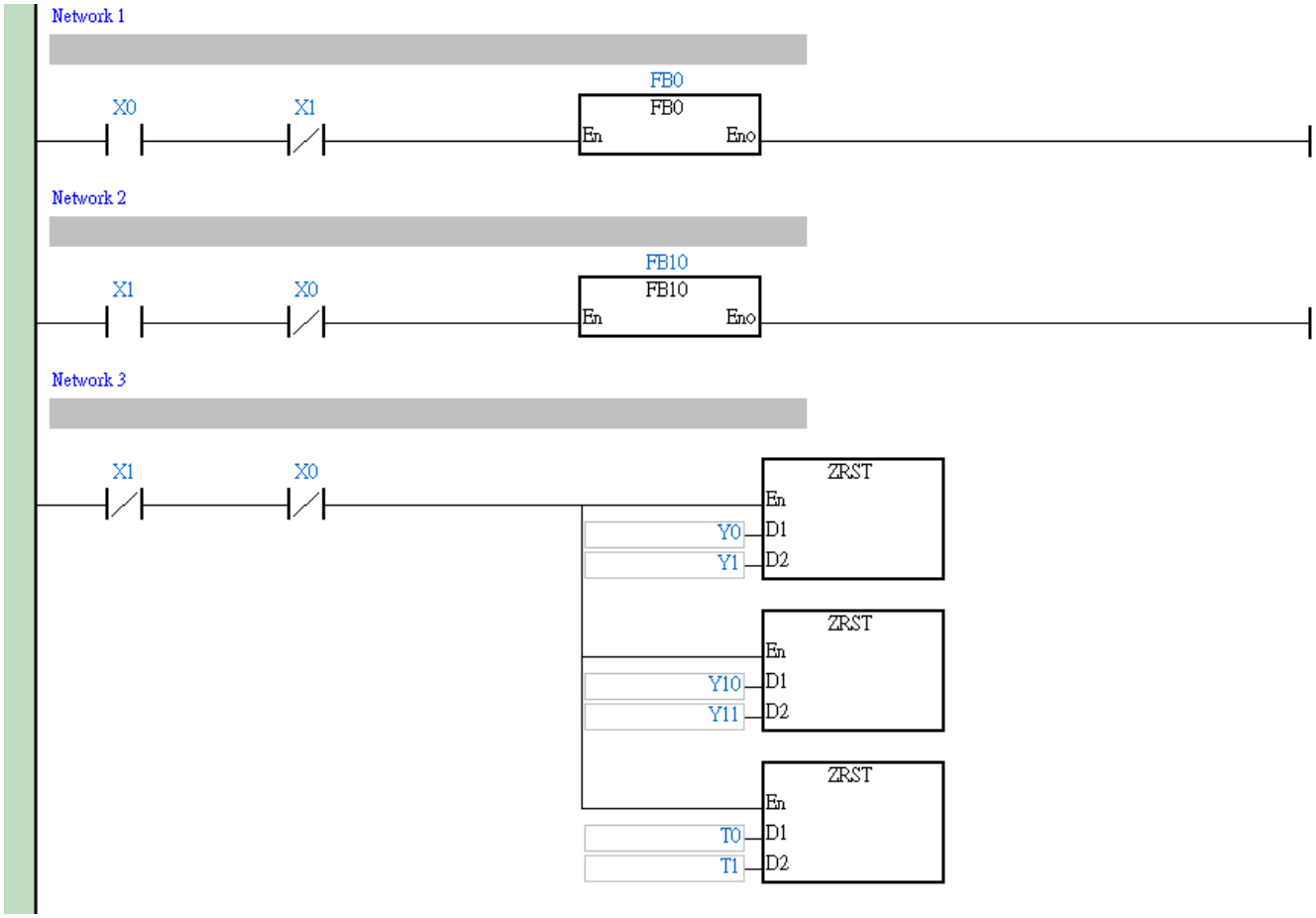
Control Purpose:

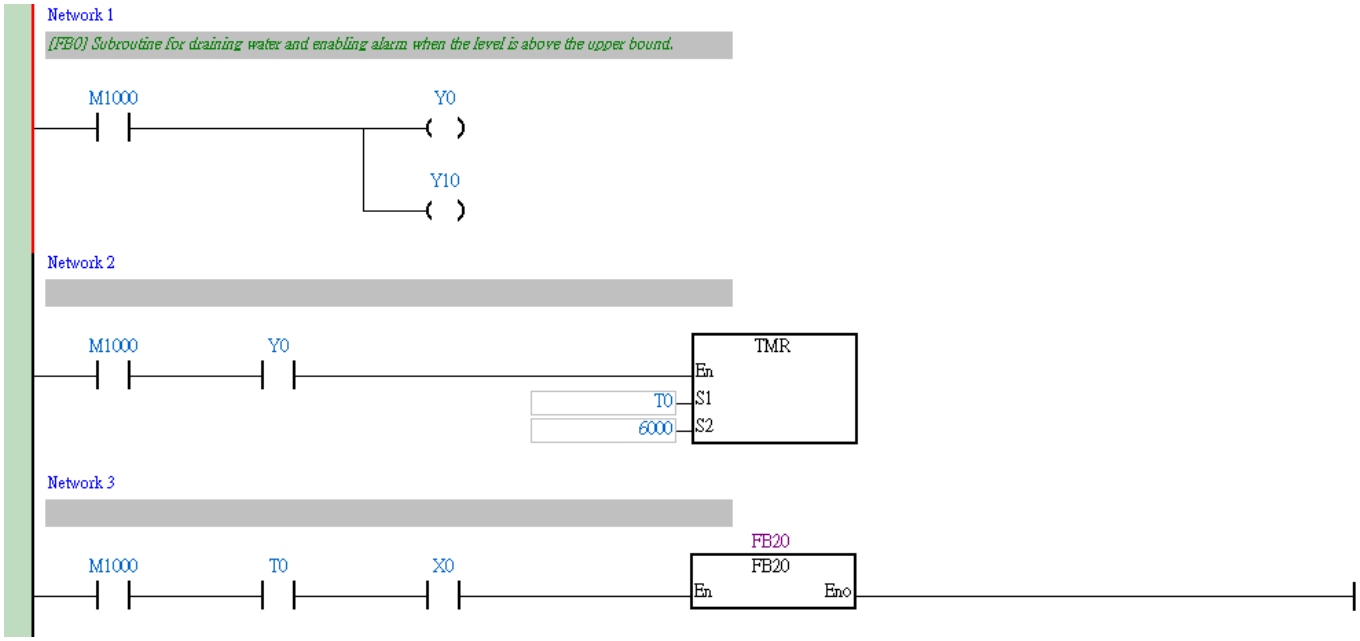
- Enabling the abnormal situation alarm and draining water from the reservoir when the level is above the upper bound.
- Enabling the abnormal situation alarm and pouring water into the reservoir when the level is below the lower bound.
- Enabling the mechanical failure alarm if the upper bound sensor X0 is still ON after draining water for 10 minutes.
- Enabling the mechanical failure alarm if the lower bound sensor X1 is still ON after pouring water for 5 minutes.
- Resetting all the alarms and valves when the level is in normal position.

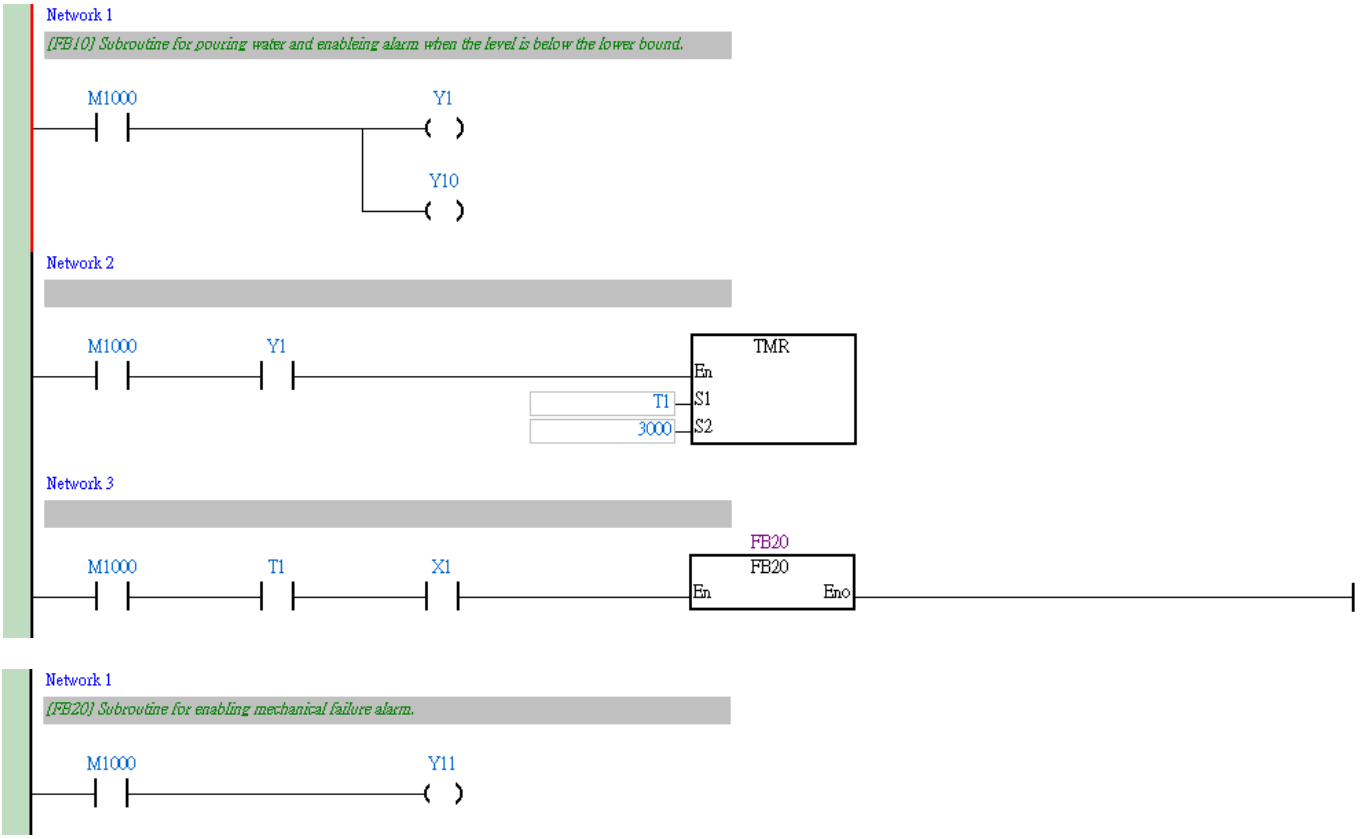
Devices:

Device	Function
X0	X0 turns ON when the level reaches the upper bound.
X1	X1 turns ON when the level reaches the lower bound.
Y0	Draining valve
Y1	Pouring valve
Y10	Abnormal situation alarm
Y11	Mechanical failure alarm

Control Program:







Program Description:

- When the level is above the upper bound, X0 will be ON to execute [CALL FB0] instruction. The abnormal situation alarm Y10 and the draining valve Y0 will start working until the level is below the upper bound.
- When the level is below the lower bound, X1 will be ON to execute [CALL FB10] instruction. The abnormal situation alarm Y10 and the pouring valve Y1 will start working until the level is above the lower bound.
- CALL FB20 subroutine is nested both in FB0 and FB10 subroutines. If the upper bound sensor is still on after draining water for 10 minutes, subroutine FB20 will be executed. Coil Y11 will be ON and the mechanical failure alarm will be enabled.
- Likewise, if the lower bound sensor is still ON after pouring water for 5 minutes, subroutine FB20 will be executed. Coil Y11 will be ON and the mechanical failure alarm will be enabled.
- If the level is at normal position, X0 = OFF, X1 = OFF, ZRST instruction will be executed. Y0, Y1, Y10, Y11, T0, and T1 will be reset. All valves as well as alarms will be disabled.

5.2 Fire Alarm in the Office (Interruption Application)

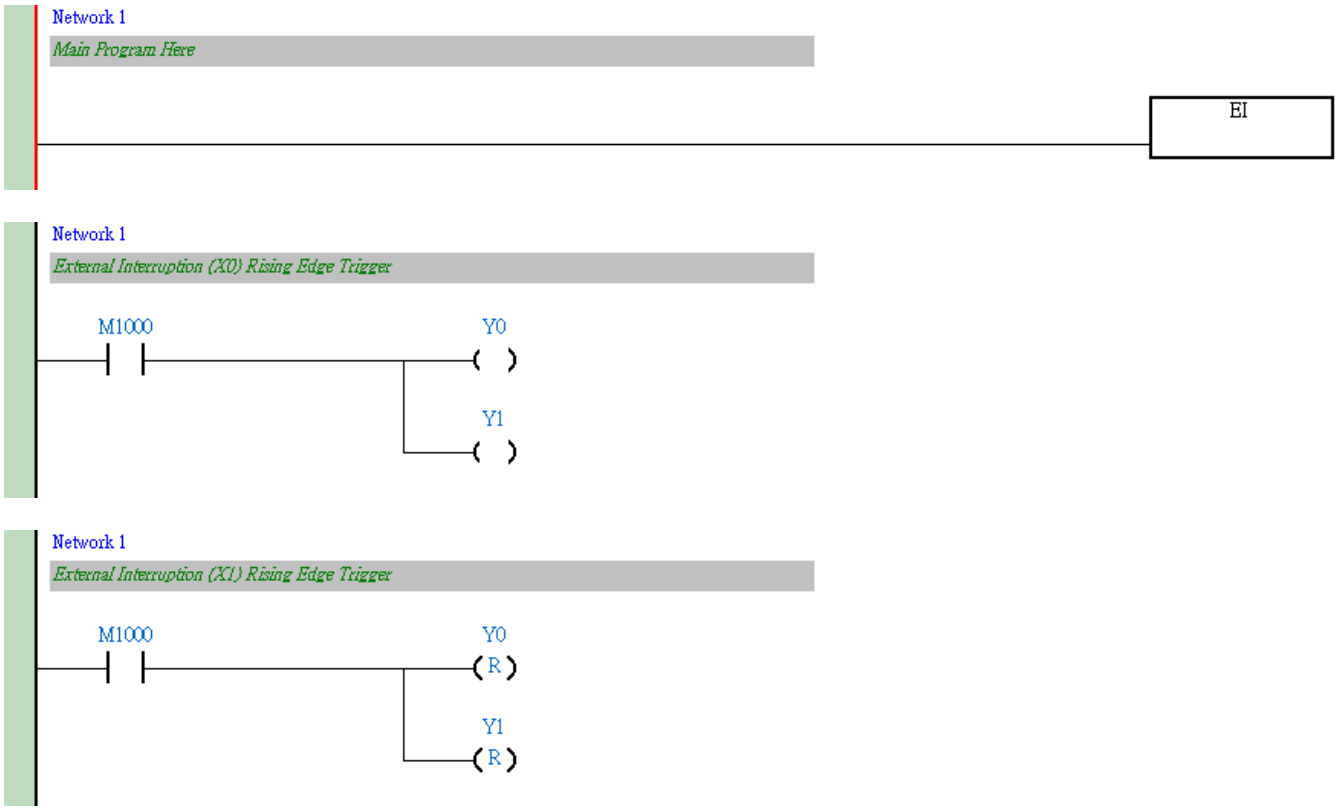
Control Purpose:

- Starting the alarm and sprayer when the temperature alarm detects high temperature.
- Stopping the alarm and sprayer when the alarm reset button is pressed.

Devices:

Device	Function
X0	Temperature alarm. X0 = ON when the temperature is too high.
X1	Alarm reset button. X1 = ON when the button is pressed.
Y0	Sprayer
Y1	Fire alarm

Control Program:



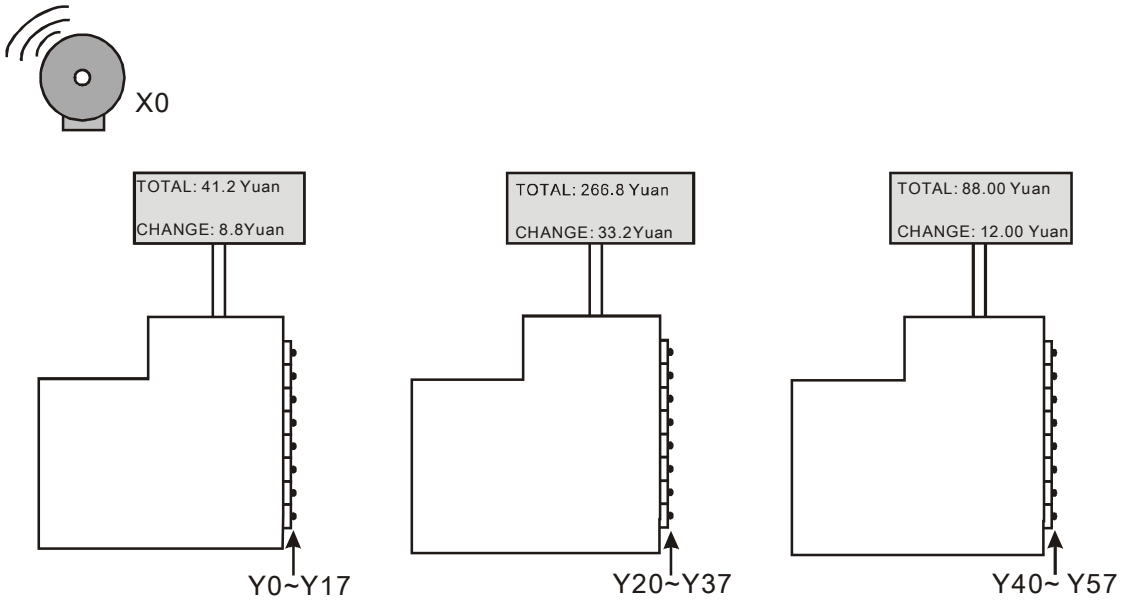
Program Description:

- In the program, the interruption pointers I001, I101 correspond to the external input points X0, X1. When X0, X1 is ON, the subroutines corresponding to I001, I101 will be executed.
- If the temperature in the office is normal, X0 = OFF. The temperature alarm will not perform any action. No interruption signal is generated, and no interruption subroutine will be executed in this case.
- If the temperature in the office is too high, X0 = ON, the temperature alarm will be enabled. The PLC will stop the main program to execute the interruption subroutine I001. In this case,

sprayer valve Y0 and alarm Y1 will be enabled. After the execution of I001, the program will return to the main program and resume execution from the interruption point.

- Press the alarm reset button if the alarm situation is cleared. X1 = ON, the PLC will stop the main program to execute the interruption subroutine I101. In this case, sprayer Y0 and alarm Y1 will be shut down. After the execution of I101, the program will return to the main program and resume execution from the interruption point.

5.3 Auto Lock up system in the Supermarket (FOR ~ NEXT)



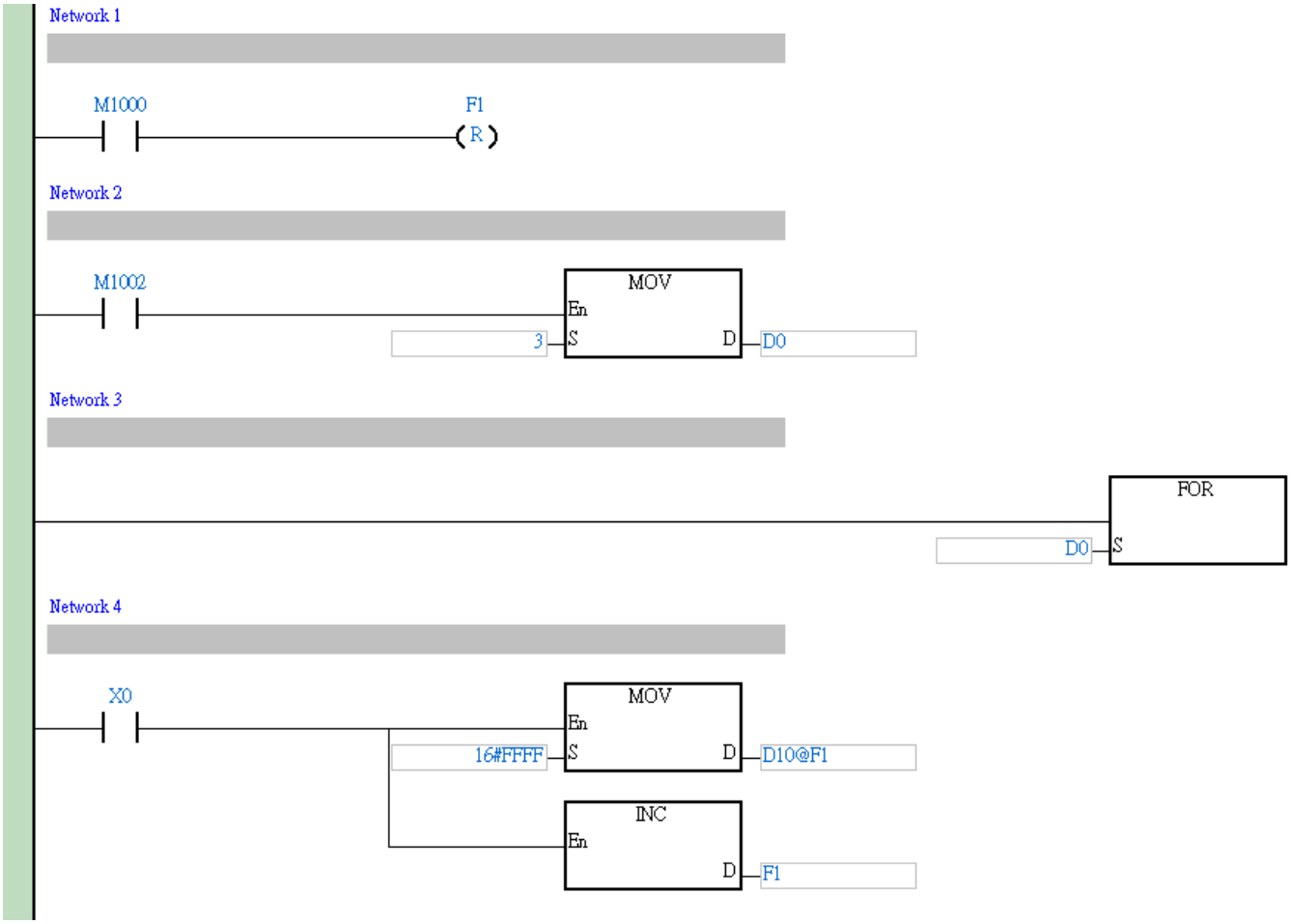
Control Purpose:

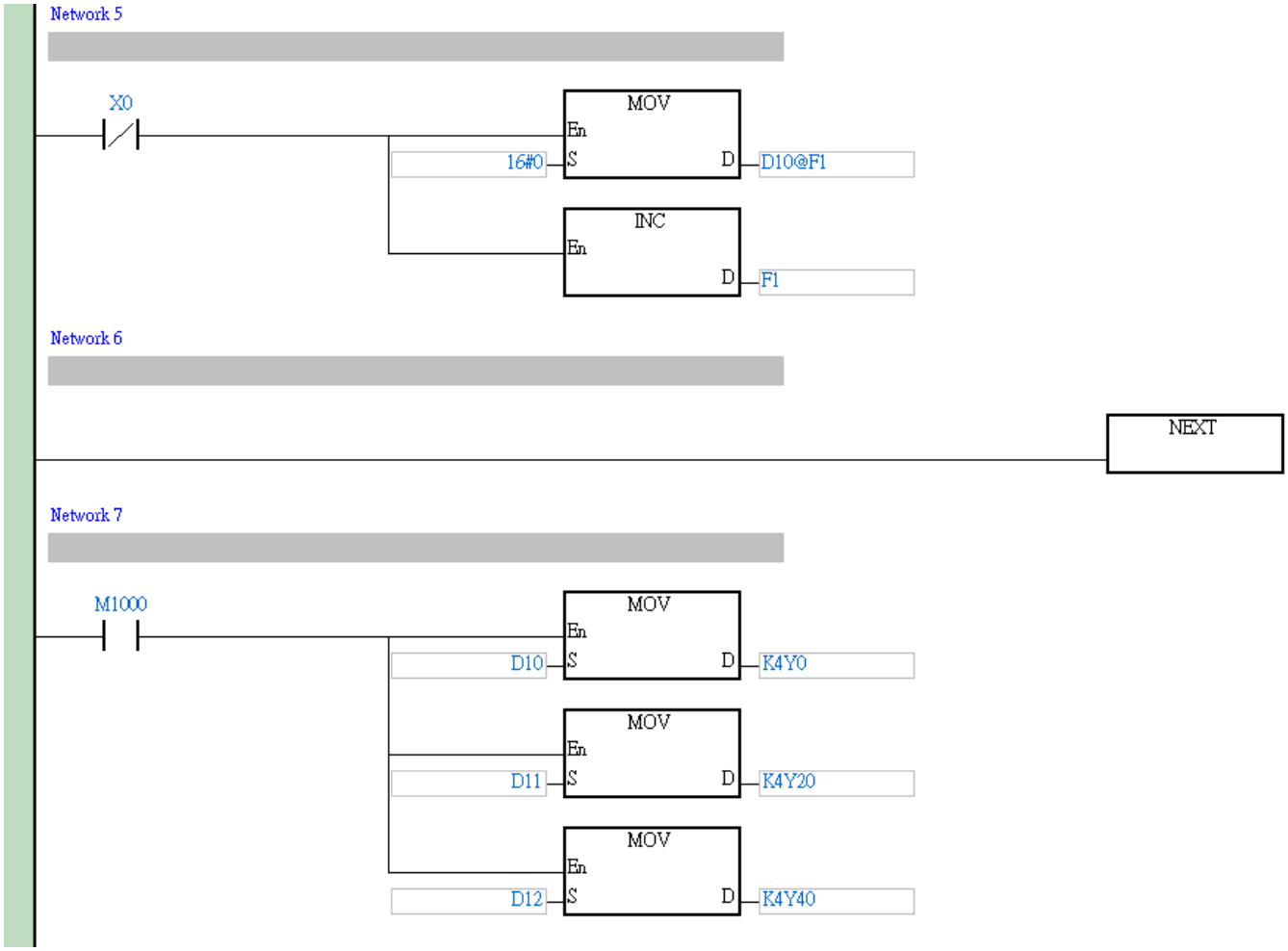
- Once fire or robbery happened in the supermarket, locking up all cash drawers until the alarm situation is cleared.

Devices:

Device	Function
X0	X0 = ON when the alarm is activated.
D0	The number of cash drawers
D10	Start address of destination register

Control Program:





Program Description:

- The execution times of FOR~NEXT loop which decide the number of controlled cash counters can be controlled by the value in D0. Each cash counter has 16 drawers. In this program, D0 = K3, which means it can control 48 cash drawers in 3 counters.
- F10 = K0, D10F1 represents D10; F10 = K1, D10F1 represents D11; F0 = K2, D10F1 represents D12; F0=K3, D10F1 represents D13.
- When the alarm rings, X0 = ON. FOR ~ NEXT loop will be executed for 3 times and HFFFF will be sent to D10 ~ D12 in order. After the execution, the value in D10 ~ D12 will be sent to the external outputs. All the outputs Y will be set to be ON in this case. The system will lock up all the cash drawers.
- When the alarm situation is cleared, X0 = OFF. FOR ~ NEXT loop will be executed for 3 times and H0 will be sent to D10 ~ D12 in order. After the execution, the value in D10 ~ D12 will be sent to the external outputs. All the outputs Y will be reset to be OFF in this case. The system will unlock all the cash drawers.
- In this program, the index register F1 is used for storing single value in a data stack (series D registers). According to different application situations, users can make use of the data stack for controlling timers or counters.

6.1 CMP - Material Mixing Machine

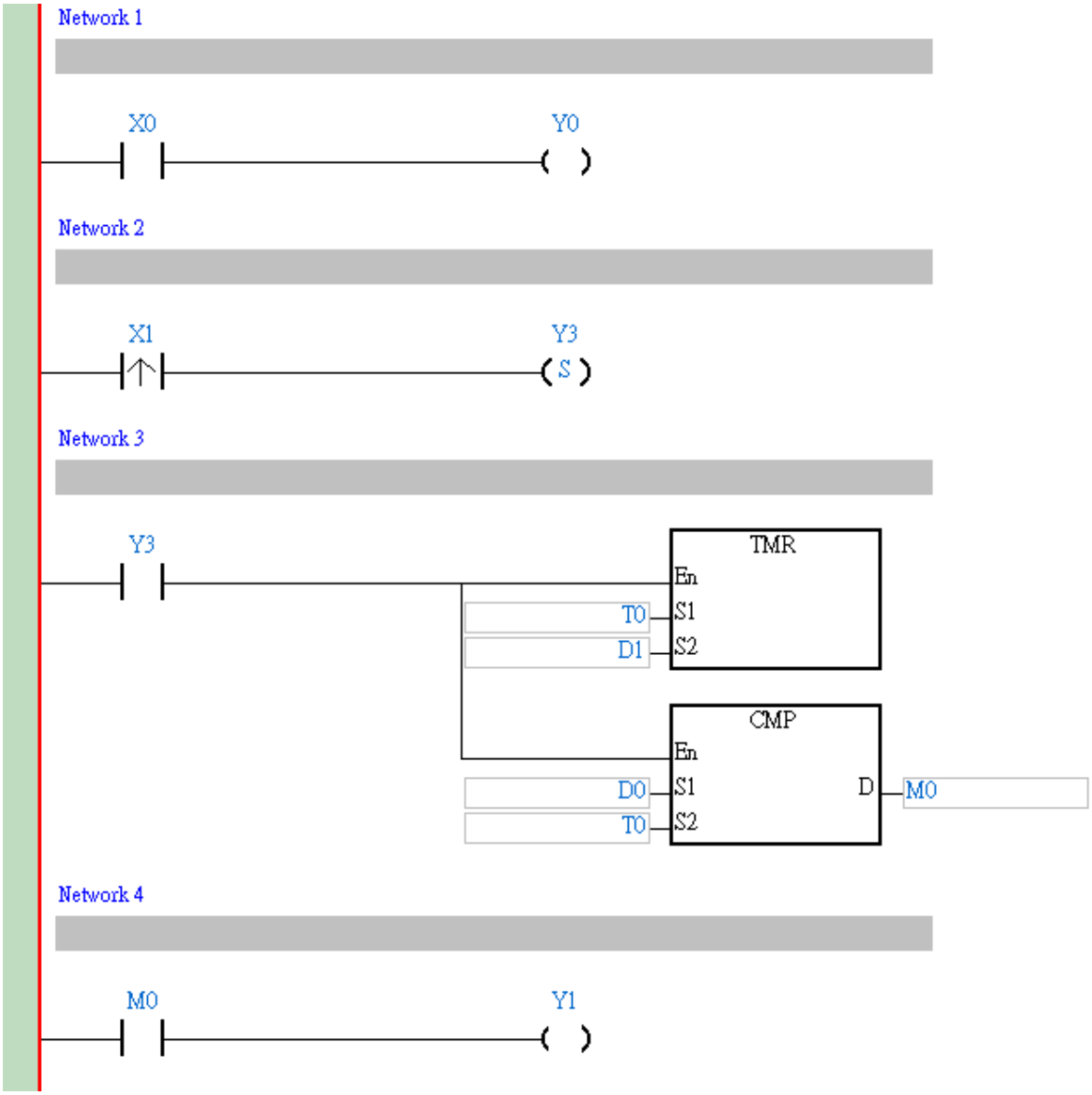
Control Purpose:

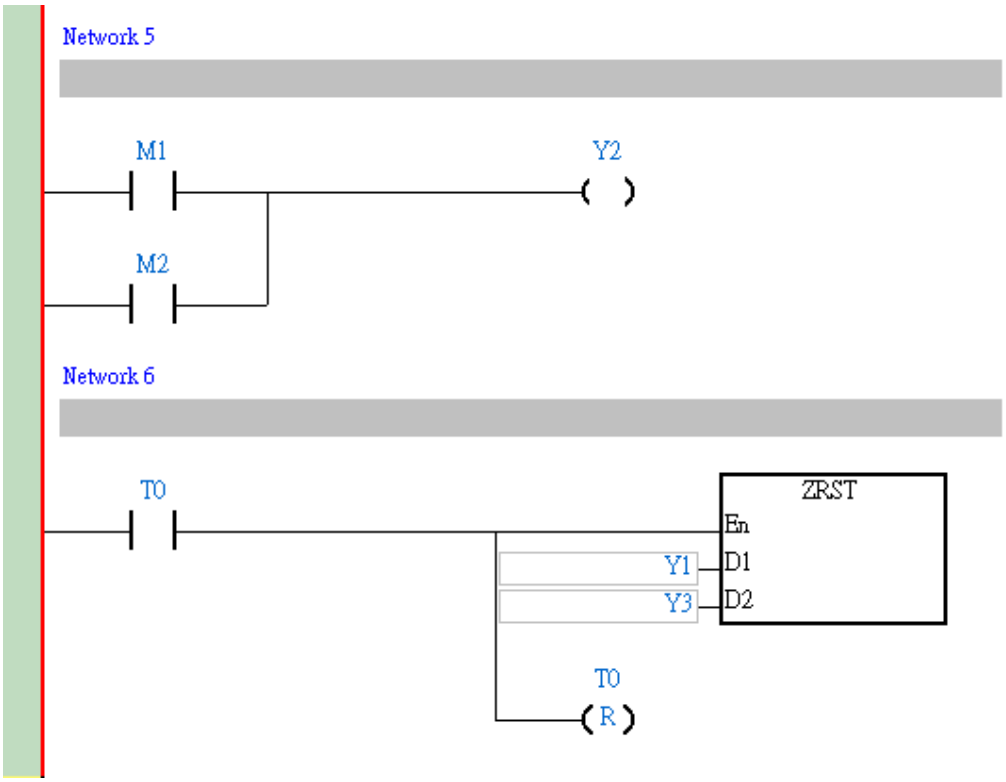
- There are materials A and B in the mixing machine. Enabling the indicator(Y0) when the Power On switch is pressed. Controlling the material A outlet (Y1) to start feeding and starting the agitator Y3 by pressing the button Process(X1). When material A feeding process reaches the set time D0, enabling the material B outlet(Y2) to start feeding while the agitator keeps working. Stopping all processes when the whole mixing time(D1) is achieved.

Devices:

Device	Function
X0	X0 = ON when the Power On switch is pressed.
X1	X1 = ON when the button Process is pressed.
Y0	Power On Indicator
Y1	Material A outlet
Y2	Material B outlet
Y3	Agitator
D0	Feeding time of material A
D1	Total feeding time of material A and B

Control Program:





Program Description:

- When the Power On switch is pressed, X0 = ON. The Power On indicator Y0 will be ON. .
- When Process button is pressed, X1 = ON. SET Y3 instruction will be executed so as to execute TMR instruction. Timer T0 will be activated in this case.
- At the same time, CMP instruction will also be executed. When the PV(present value) in T0 is smaller than the SV(set value) in D0, M0 = ON. Therefore, M0 will be ON to turn on coil Y1. Material A feeding process will start. However, when the PV in T0 ≥ the SV in D0, M1 and M2 will be ON but M0 will be OFF. Y2 will be ON in this case and the material B feeding process will start while process A is stopped.
- When the PV in T0 reaches the SV in D1, the NO(Normally Open) contact T0 will be ON to execute ZRST and RST instructions. Y1, Y2, Y3 and T0 will be reset, and the agitator will stop until the Process button is pressed again.

6.2 BMOV - Multiple History Data Backup

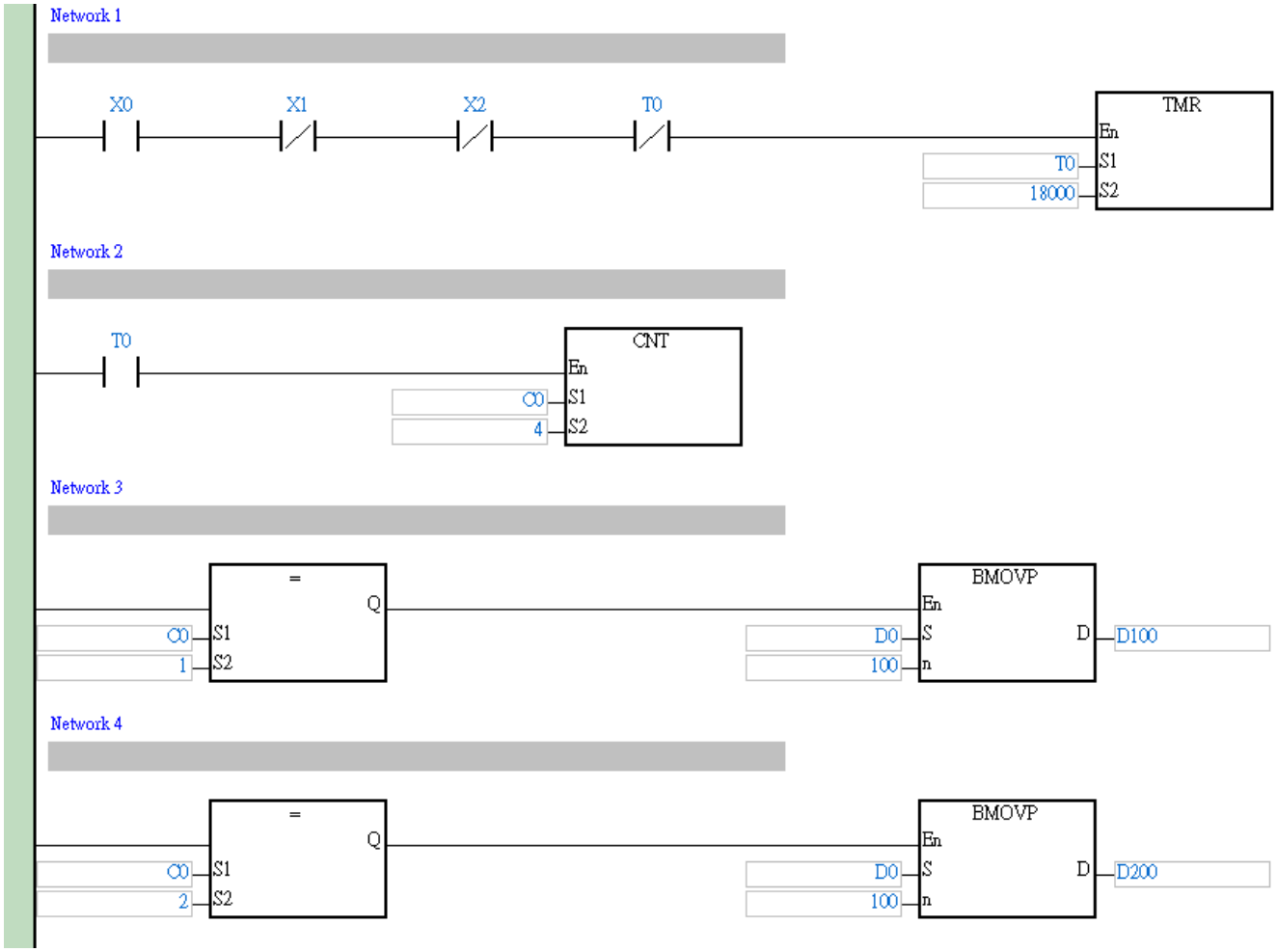
Control Purpose:

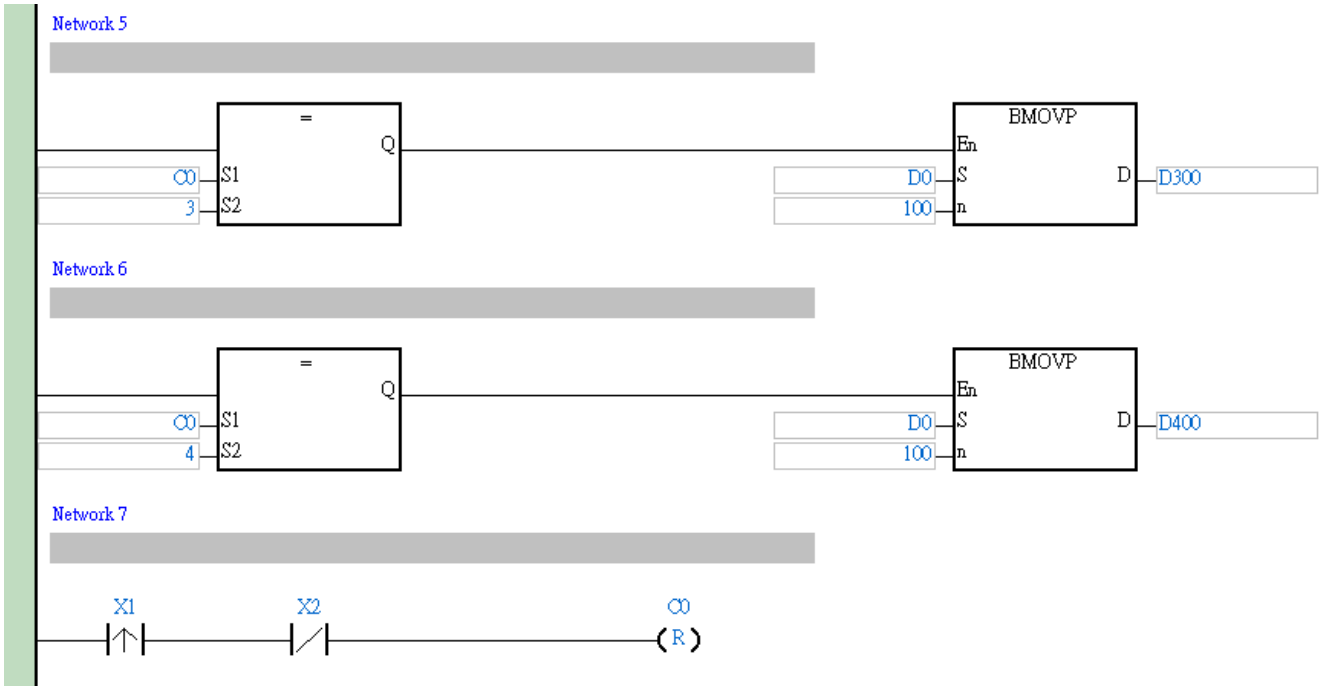
- Recording the data of the DUT(Device Under Test) in register D0~D99 on the experimental test bed first, then backup the data in other registers every 30 min by DVP-PLC so that registers D0~D99 can compile new data again. The test cycle of DUT is 2 hours.

Devices:

Device	Function
X0	X0 turns ON when START is pressed.
X1	X1 turns ON when RETEST is pressed.
X2	X2 turns ON when STOP is pressed.
D0~D99	Data compiling
D100~D499	Data backup

Control Program:

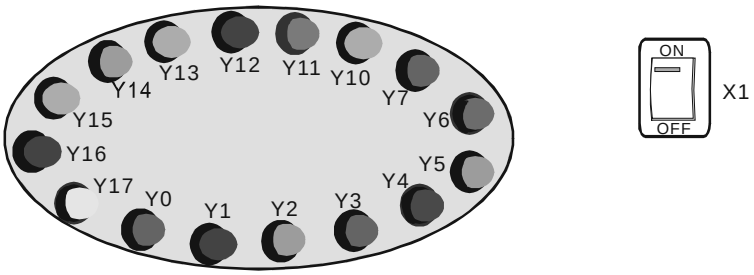




Program Description:

- When X0 = ON, T0 starts to count up, and the NO contact T0 will be ON every 30 minutes.
- In the program, counter C0 is used for counting the ON times of NO contact T0. When C0 = 1, the data in D0~D99 will be sent to D100~D199; when C0 = 2, the data in D0~D99 will be sent to D200~D299; when C0 = 3, the data in D0~D99 will be sent to D300~D399; when C0 = 4, the data in D0~D99 will be sent to D400~D499 and the test process ends here.
- If the operator needs to retest the DUT, just activate X1 one more time.
- When X2 = ON, the test will be stopped. In this case, no data compiling will be done on DUT by PLC, and Counter C0 will be cleared as well.

6.3 CML - Color Lights Flashing



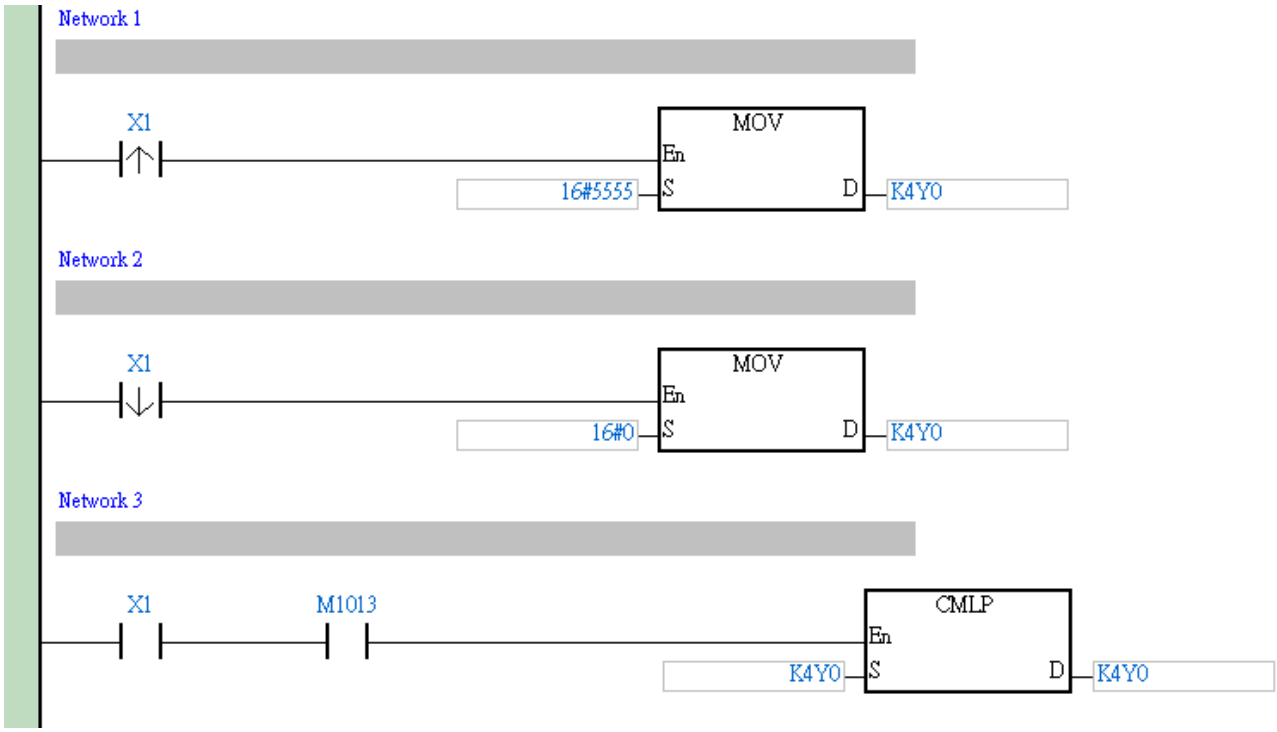
Control Purpose:

- Turning on the even-numbered lights and odd-numbered lights alternately for 1 sec when the switch is turned ON.
- Turning off all color lights when the switch is turned off.

Devices:

Device	Function
X1	Flashing control switch. X1 = ON when the switch is turned to ON.
M1013	1s clock pulse, 0.5s ON / 0.5s OFF
Y0~Y17	16 color lights

Control Program:



Program Description:

- When the switch is turned ON, K4Y0 = H5555 and the state of Y17~Y0 will be “0101 0101 0101 0101,” which means the even-numbered lights will be ON. When M1013 = On, CMLP

instruction will be executed to reverse the state of K4Y0. Y17~Y0 will be “1010 1010 1010 1010,” which means the odd-numbered lights will be ON. The state will last for 1 sec.

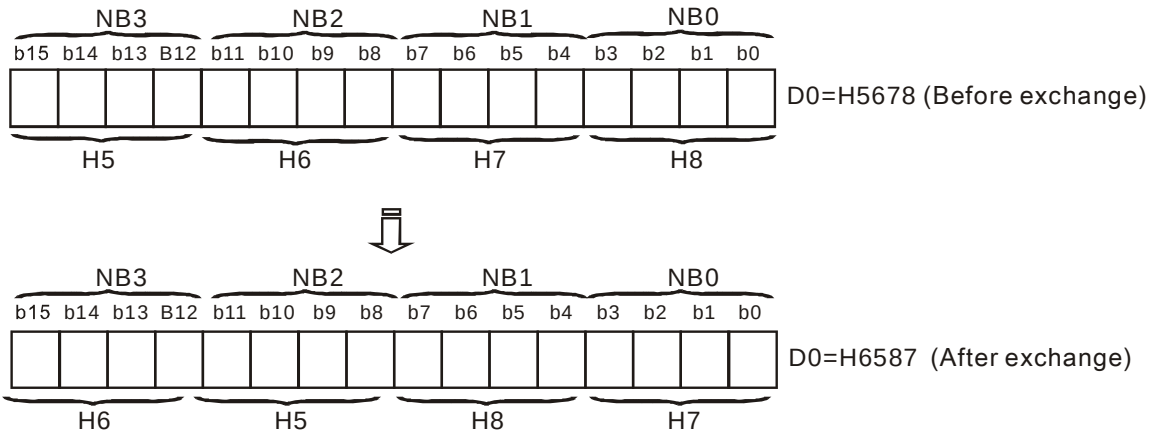
- When M1013 is ON again, CMLP instruction will be executed and the state of K4Y0 will be reversed again. In this case, the even-numbered lights will be ON.
- Every time when M1013 is ON, the state of Y0~Y17 will be reversed and lasts for 1 sec. The lights will flash alternatively as this cycle.

6.4 XCH - Exchanging the Upper and Lower 8 bits in a Register

Control Purpose:

- Exchanging the data NB(Nibble)0 with NB1, NB2 with NB3 in a register every 1 sec.

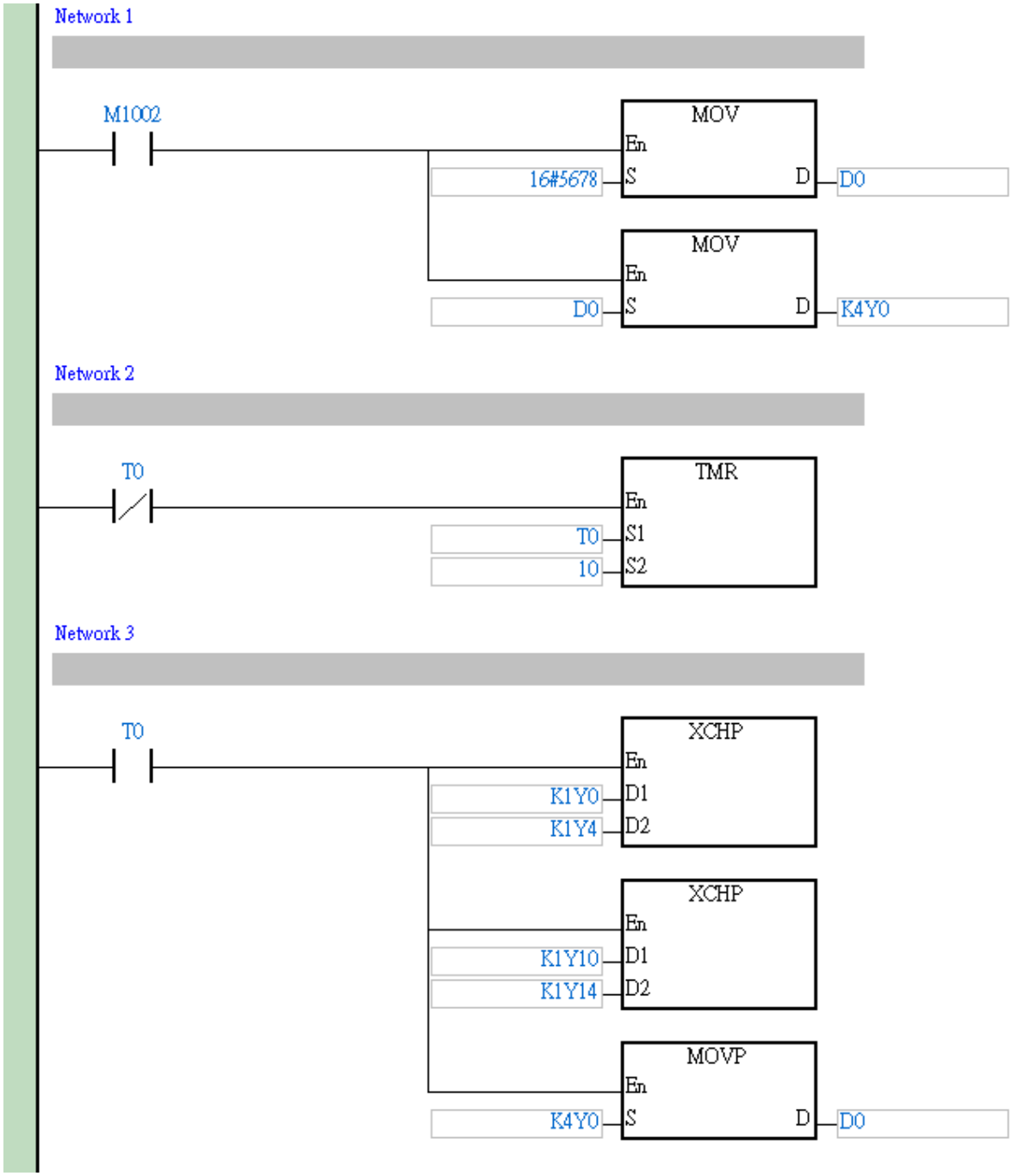
The data length of D register is Word (16 bits), and a Word is made up of 4 Nibbles.



Devices:

Device	Function
T0	1 sec timer. Time base: 100ms
D0	Data register
Y0~Y17	Storing 4 nibbles

Control Program:

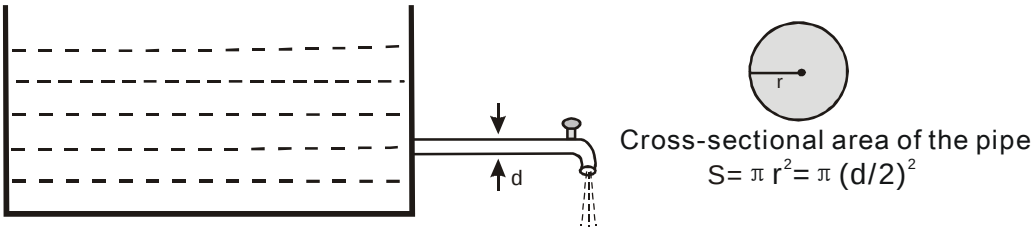


Program Description:

- First, the program will store the 16 bits (4 Nibbles) data in D0 to Y0~Y17. After 1 sec, the NO contact T0 will be activated to execute XCHP instruction. The data in K1Y0 will be exchanged with K1Y4 and so will K1Y10 with K1Y14. Then, these data will be sent to D0. Finally, The data exchange between NB0/NB1 and NB2/NB3 is completed.

MEMO

7.1 Accurate Pipe Flow Measurement



Control Purpose:

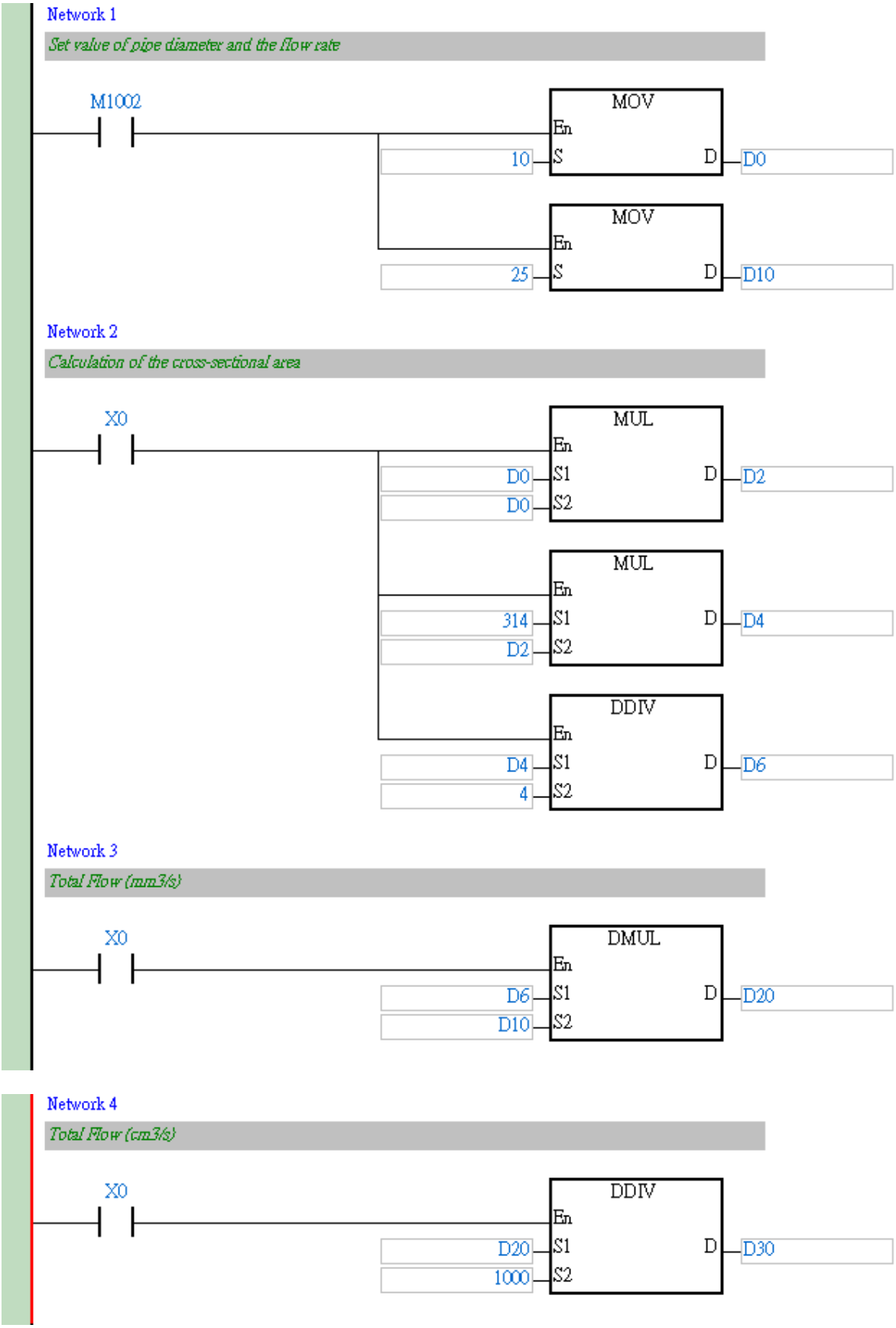
- Measuring the flow to an accuracy of 2 decimal places.

In this example, the diameter of the pipe is measured by *mm*, the flow rate is measured by *dm/s*, and the flow is measured by cm^3/s. The cross-sectional area of the pipe = $\pi r^2 = \pi(d/2)^2$ and the flow = cross-sectional area × flow rate.

Devices:

Device	Function
X0	Starting the measurement
D0	Diameter of the pipe (unit: *mm*; set value: 10mm)
D6	Operation result of the cross-sectional area (unit: mm^2)
D10	Flow rate (unit: dm/s; set value: 25dm/s)
D20	Operation result of the flow (unit: mm^3/s)
D30	Operation result of the flow (unit: cm^3/s)

Control Program:

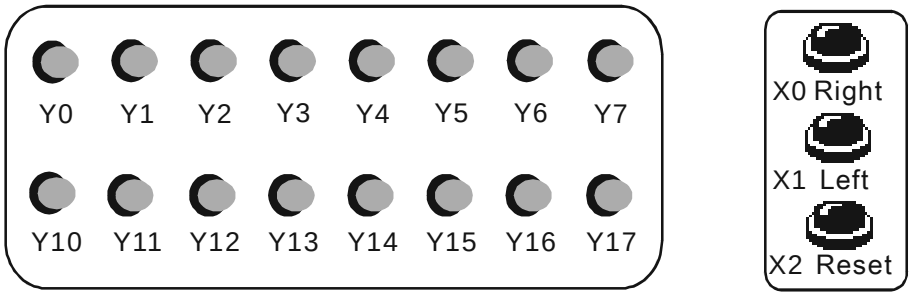


Program Description:

- The floating point operation is usually applied to perform decimal calculation. However, it needs to be converted and is more complicated. Therefore, we use elementary arithmetic operation instructions to perform decimal calculation in this example.
- The units of *mm*, *cm* and *dm* are used in the program. For calculation requirement, the program sets these units into mm^3 and then converts them into cm^3.
- π ($\pi \approx 3.14$) is required when calculating the cross-sectional area of the pipe. In order to get the calculation accuracy of 2 decimal places, the program increases π 100 times to be K314 instead of increasing the unit *dm/s* 100 times to be *mm/s*.
- In the end, the program divides the value in D20 (unit: mm^3/s) with 1000 so as to convert the unit into cm^3/s. (1 cm^3 = 1 *ml,* 1*l* = 1000 *ml* = 1000 cm^3 = 1 dm^3)
- .Assume the pipe diameter D0 is 10 *mm* and the flow rate D10 is 25 *dm/s*, the operation result of the total flow will be 196 cm^3/s.

MEMO

8.1 ROL/ROR - Neon Lamp Design



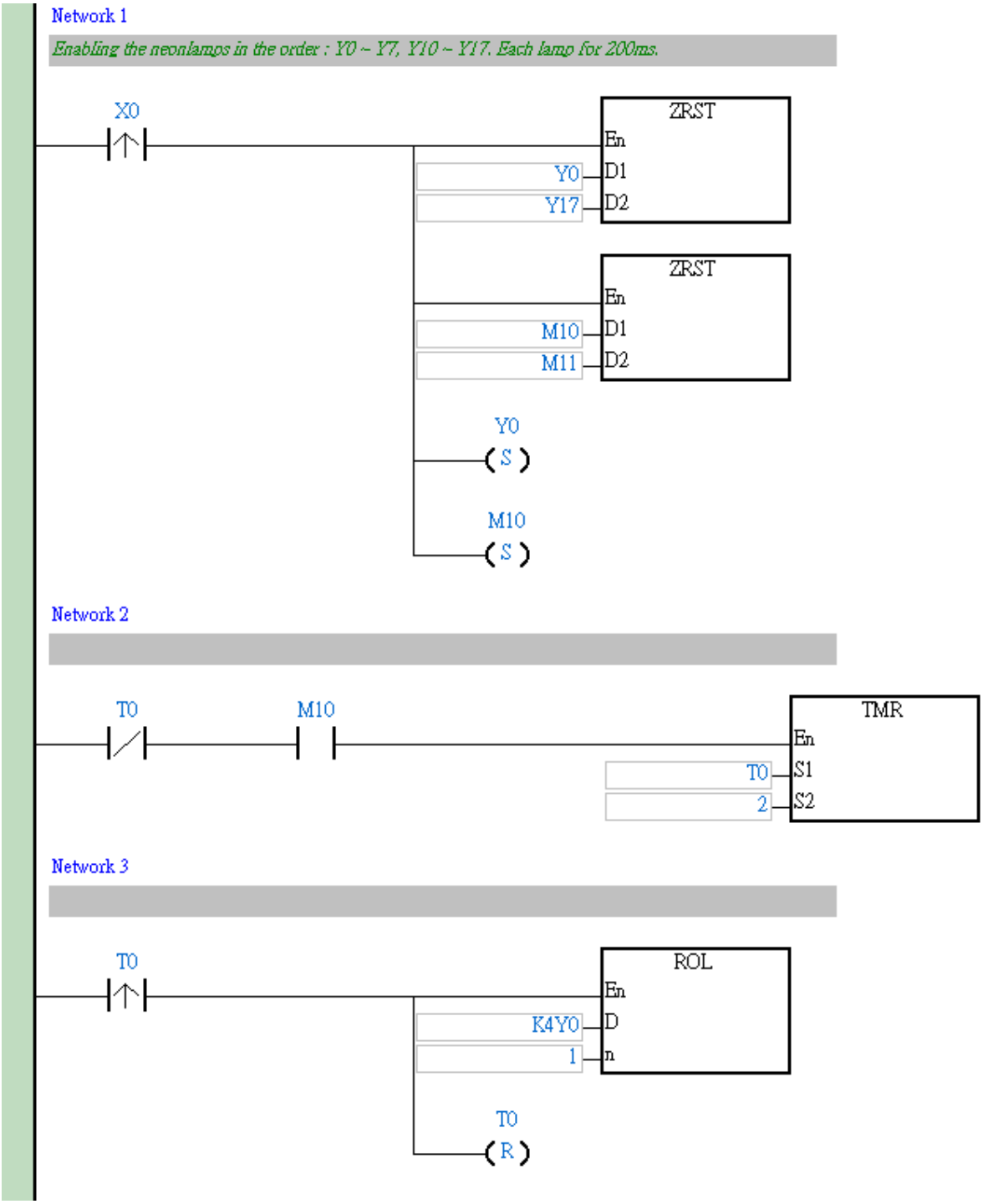
Control Purpose:

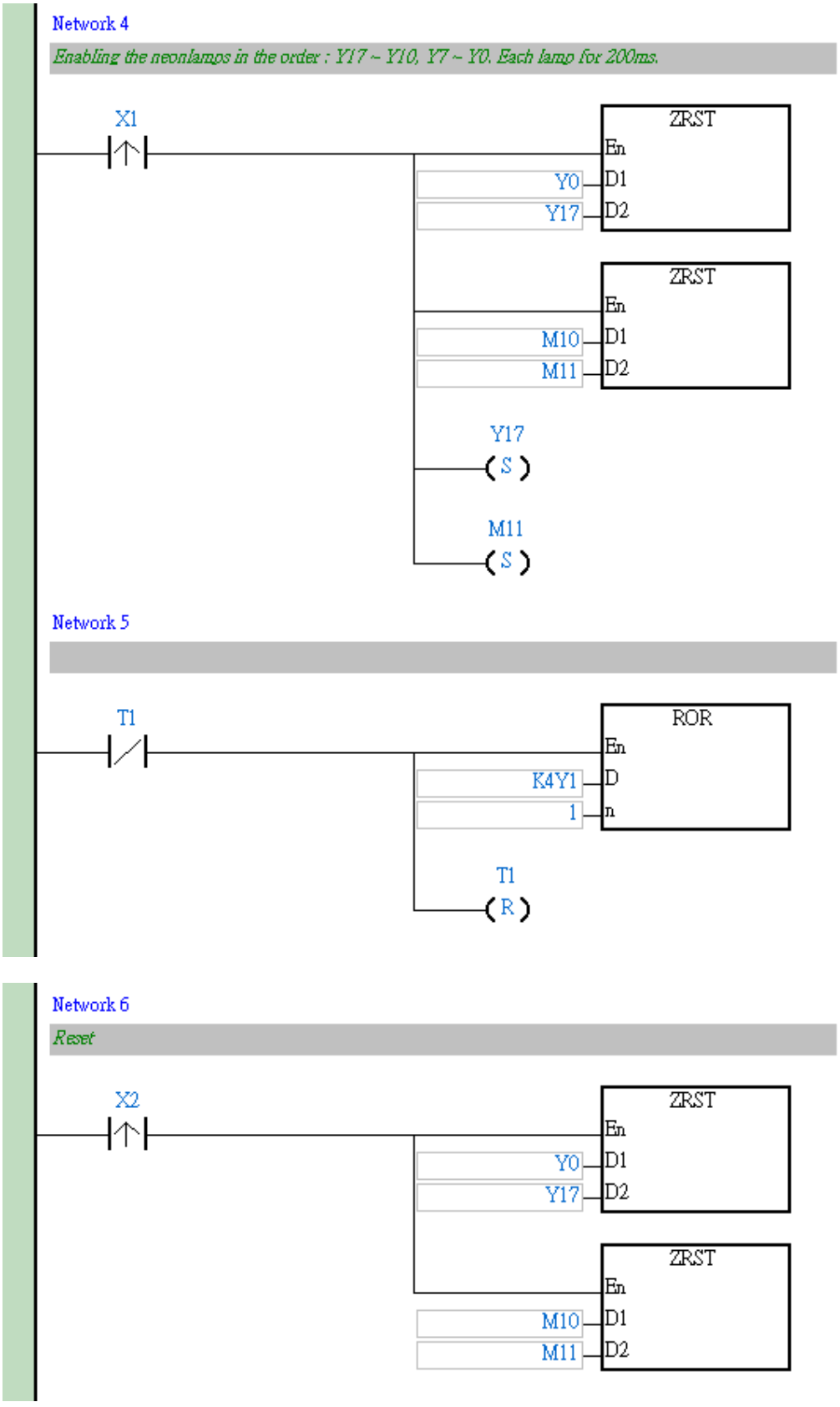
- Enabling the 16 neon lamps in the order: Y0~Y7, Y10~Y17 when Rotation Right button is pressed. Each lamp turns on for 200ms.
- Enabling the 16 neon lamps in the order: Y17~Y10, Y7~Y0 when Rotation Left button is pressed. Each lamp turns on for 200ms.
- The action of Reset is unnecessary when switching between Rotation Right and Rotation Left.
- When RESET is pressed, turn off all working neon lamps.

Devices:

Device	Function
X0	Rotation Right button. X0 = ON when the button is pressed.
X1	Rotation Left button. X1 = ON when the button is pressed.
X2	X2 turns ON when RESET is pressed.
T0/T1	200ms timer. Time base: 100ms.
Y0~Y17	16 neon lamps

Control Program:





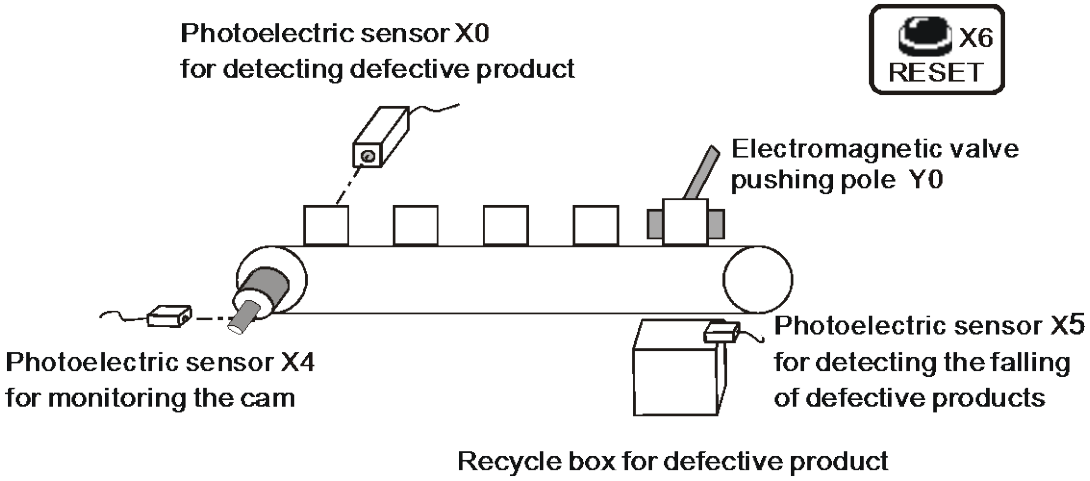
Program Description:

- When Rotation Right is pressed, X0 = ON to execute ZRST and SET instructions. Y0~Y17 and M10~M11 will be reset first, then Y0 and M10 will be ON. TMR instruction will be

executed. After 200ms, the contact T0 will be activated once to execute ROL instruction. The ON state of Y0 will be shifted to Y1, and T0 will then be reset.

- In the next scan cycle, timer T0 starts counting again. After 200ms, ROL instruction will be executed one more time and the ON state of Y1 will be shifted to Y2. By the same process, Y0~Y17 will be ON for 200ms in order.
- The rotation left process is similar to the above process. However, the rotation right program uses ROR instruction to enable the lamps in the order: Y17~Y10, Y7~Y0
- When RESET is pressed, X2 = ON to reset Y0~Y17 and M10~M11. All neon lamps will be OFF. (Note: in this program, the purpose of placing ZRST instruction after the rising-edge contacts of X0 and X1 is to ensure that all the neon lamps start flashing from Y0 or Y17.)

8.2 SFTL - Defective Product Detect



Control Purpose:

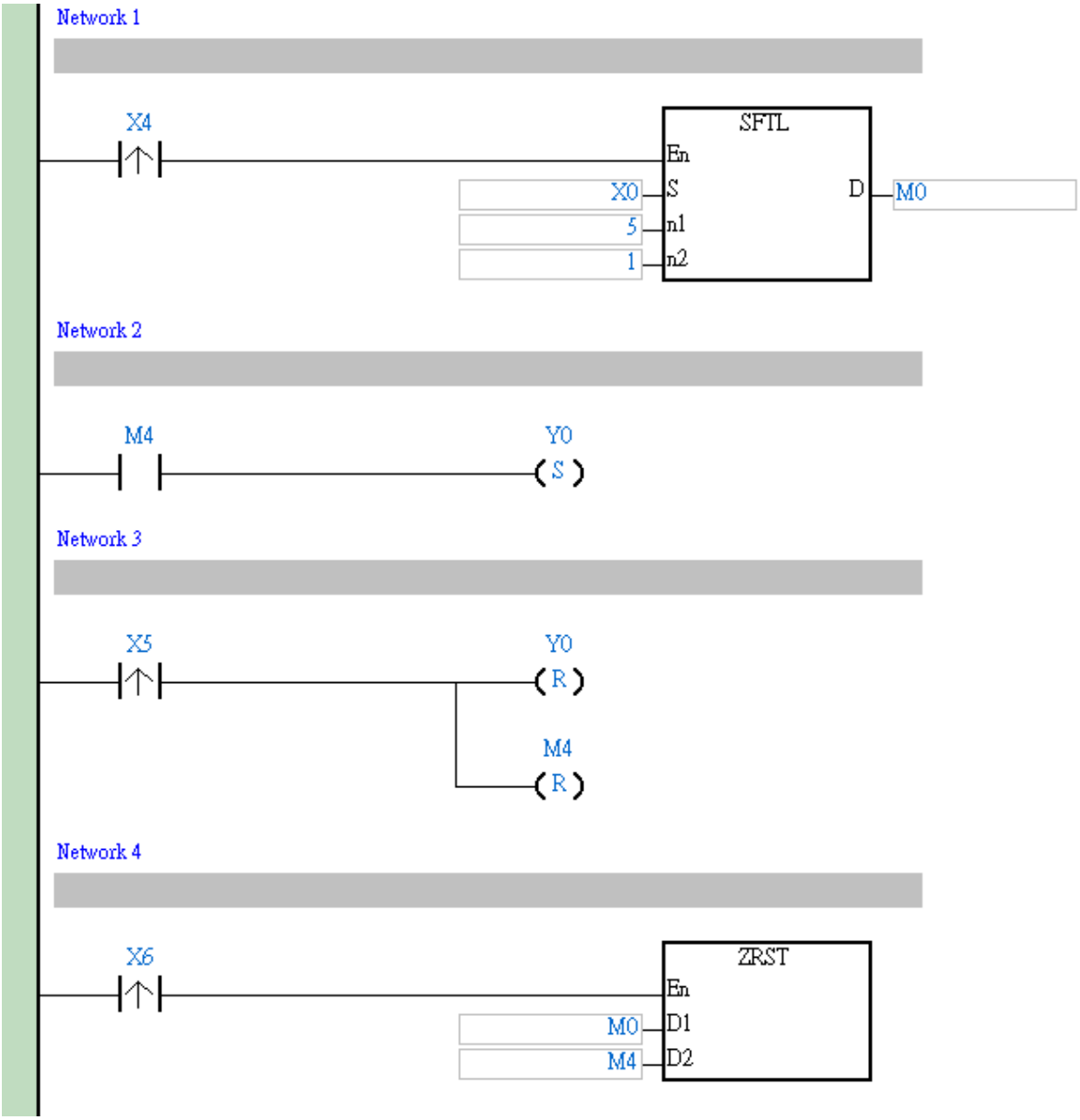
- Detecting the defective products (taller than normal dimension) on the conveyor belt by photoelectric sensor and pushing them into the recycle box at the 5th position.

The pushing pole will be reset when the falling of defective product is detected. When errors occur, the disorder memory can be cleared and the system can be restarted by pressing RESET.

Devices:

Device	Function
X0	Photoelectric sensor for detecting defective products
X4	Photoelectric sensor for monitoring the cam
X5	Photoelectric sensor for detecting the falling of defective products
X6	RESET
Y0	Electromagnetic valve pushing pole

Control Program:

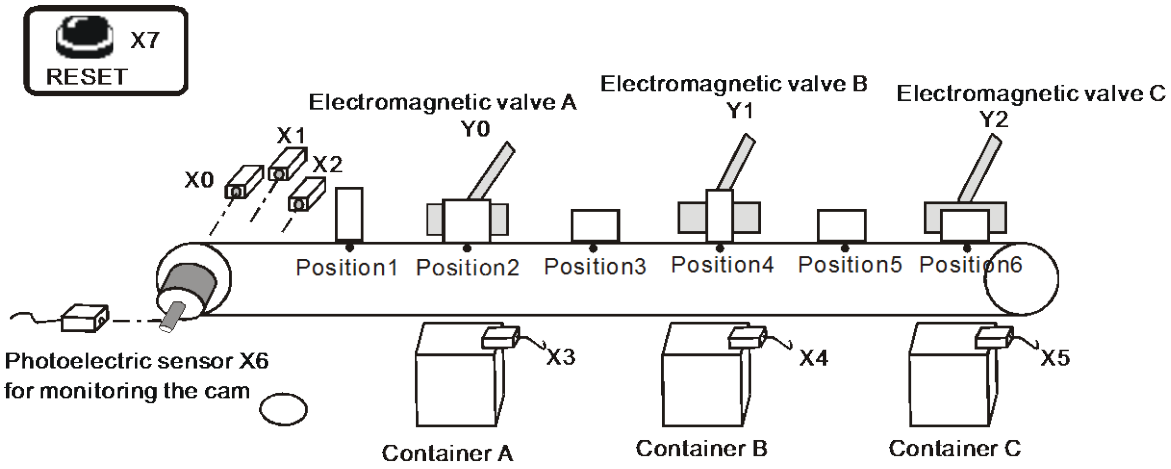


Program Description:

- Every time the cam rotates once, the product will be moved from one position to another position. X4 will be activated to execute SFTL instruction once. The content in M0~M4 will be shift to left for one bit and the state of X0 will be sent to M0.
- When X0 = ON (defective products detected), the value “1” will be sent to M0 and achieve the 5th position after 4 times of shift. In this case, M4 = ON and the electromagnetic valve Y0 will be ON to push the defective product into the recycle box.
- When the falling of the defective product is detected, X5 will be activated to execute [RST Y0] and [RST M4] instructions. Y0 and M4 will be reset. The electromagnetic valve will be OFF till next defective product is detected.

- When RESET is pressed, X6 will be activated to reset M0~M4, so as to ensure that the system restart the detecting process when the memory which records defective products is in disorder.

8.3 WSFL - Automatic Sorting Mixed Products



Control Purpose:

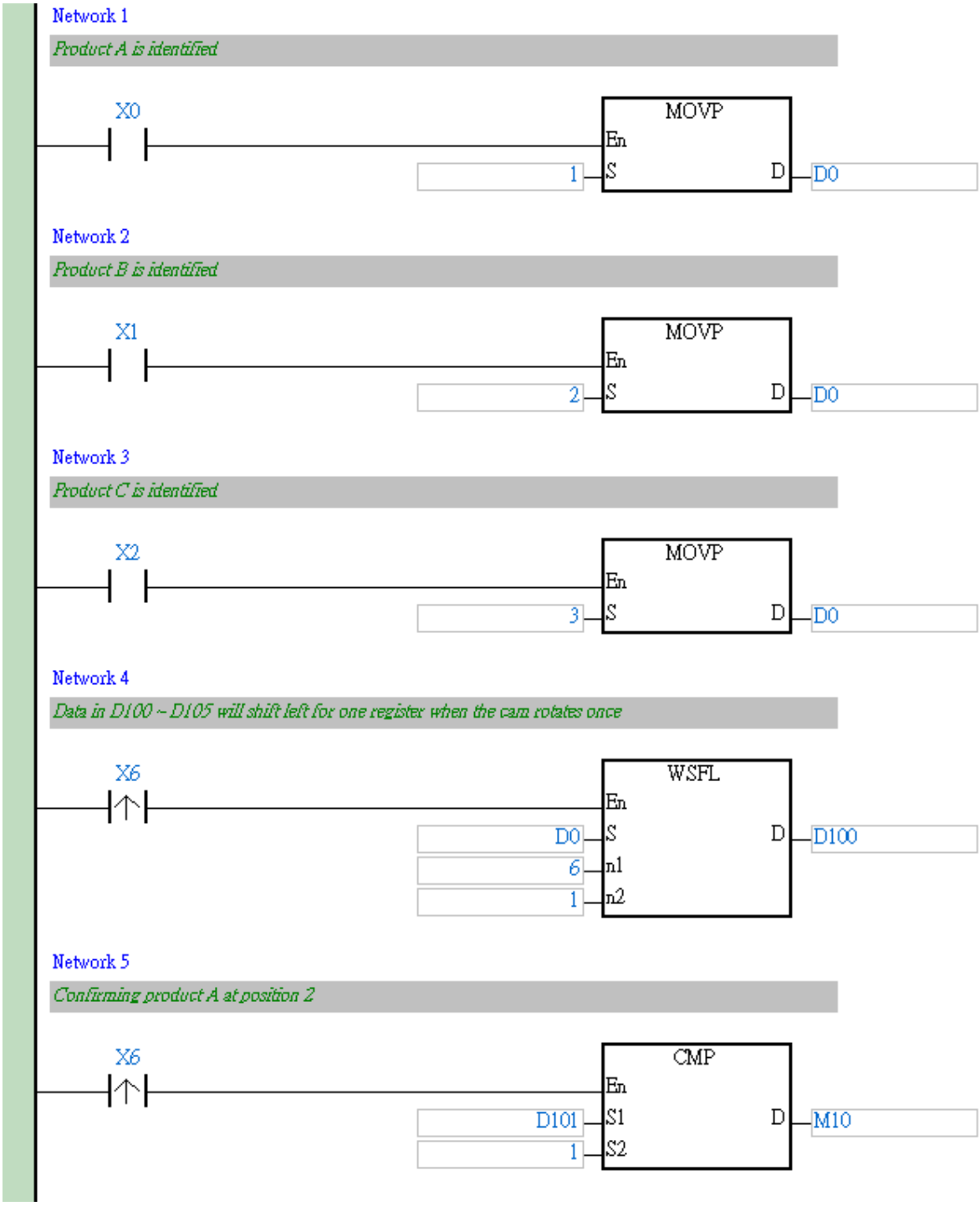
- Sorting different products on the conveyor belt and pushing each product into its corresponding container.

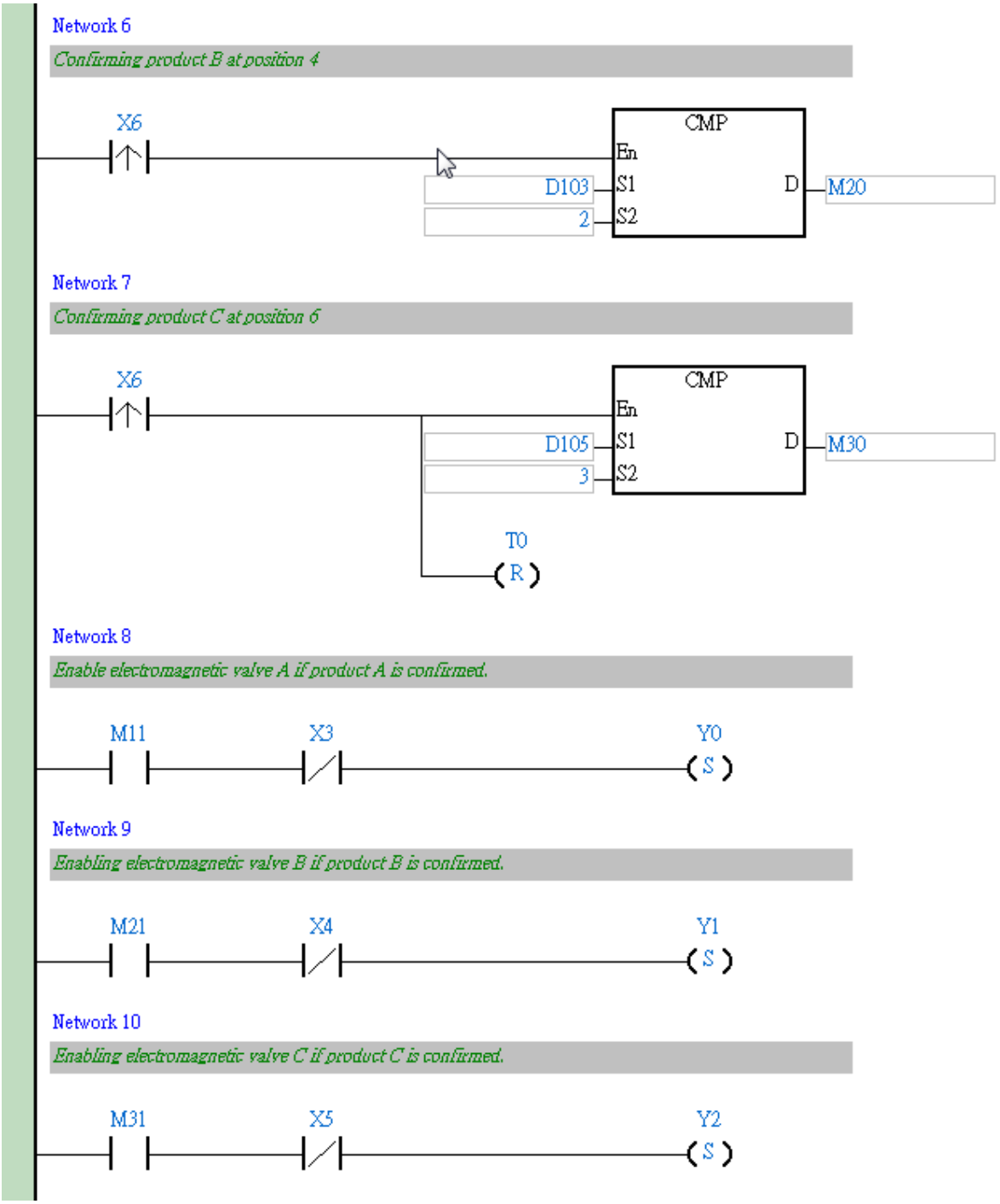
1. There are three kinds of products, A, B and C and 6 positions for each product are set on the conveyor. Products will move forward for one position when the cam rotates once.
2. Sorting each product by product ID (Identification) sensors. Product A will be pushed in container A at position 2. And so forth, product B in container B at position 4; product C in container C at position 6.
3. When the product falling is confirmed by sensors, the electromagnetic valve will be reset. When RESET is pressed, all memory will be cleared and the system will restart the identifying and sorting process.

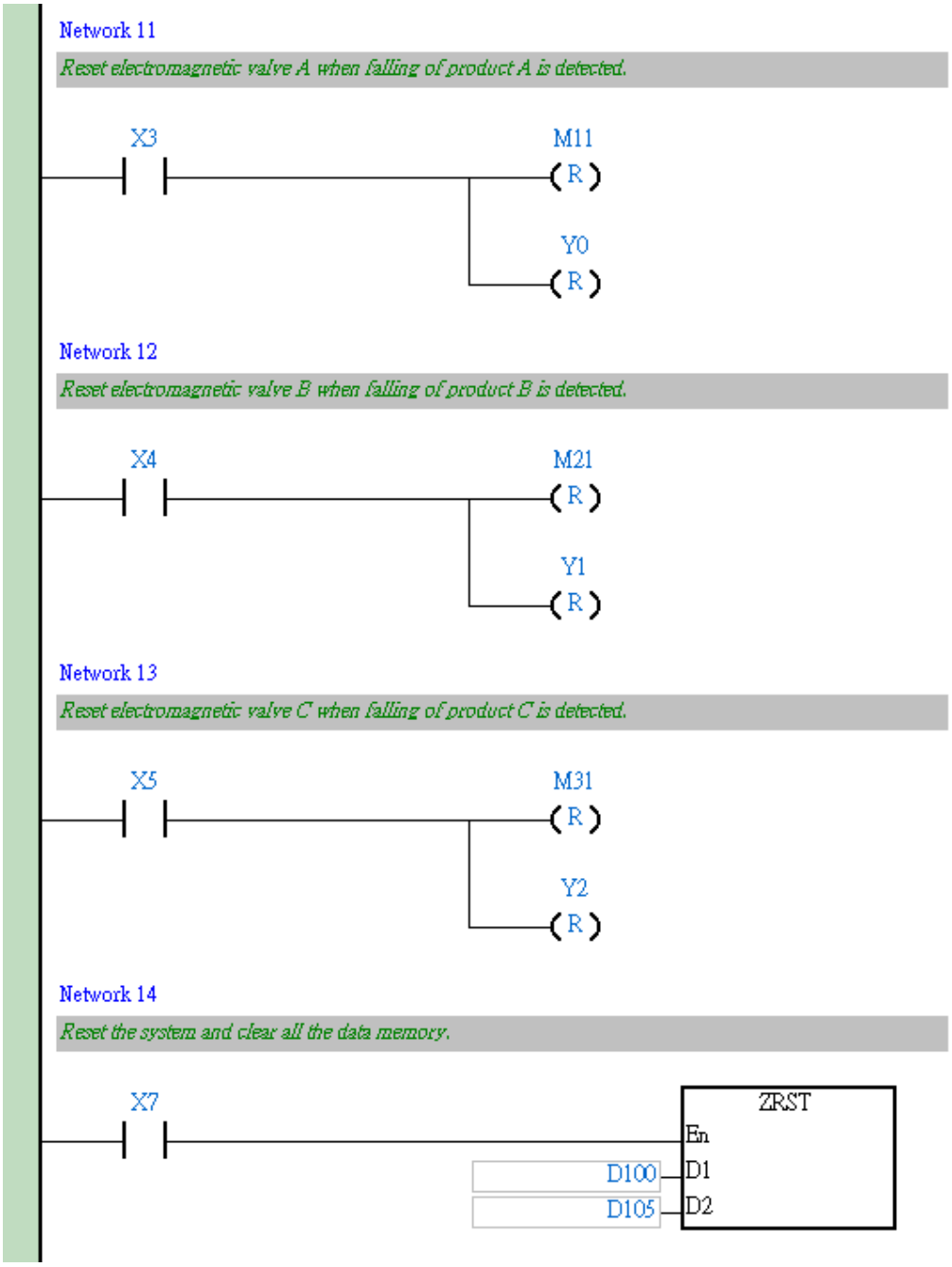
Devices:

Device	Function
X0	Product A ID sensor. X0 = ON when Product A is detected.
X1	Product B ID sensor. X1 = ON when Product B is detected.
X2	Product C ID sensor. X2 = ON when Product C is detected.
X3	Product A falling sensor. X3 = ON when Product A falls in container A
X4	Product B falling sensor. X4 = ON when Product B falls in container B
X5	Product C falling sensor. X5 = ON when Product C falls in container C
X6	Sensor for the cam. X6 activates 1 time when the cam rotates once.
X7	RESET. X7 = ON when the button is pressed
Y0	Electromagnetic valve A
Y1	Electromagnetic valve B
Y2	Electromagnetic valve C

Control Program:




Network 6
Confirming product B at position 4
X6
CMP
En
D103
S1
D
M20
2
S2
Network 7
Confirming product C at position 6
X6
CMP
En
D105
S1
D
M30
3
S2
T0
R
Network 8
Enable electromagnetic valve A if product A is confirmed.
M11
X3
Y0
S
Network 9
Enabling electromagnetic valve B if product B is confirmed.
M21
X4
Y1
S
Network 10
Enabling electromagnetic valve C if product C is confirmed.
M31
X5
Y2
S

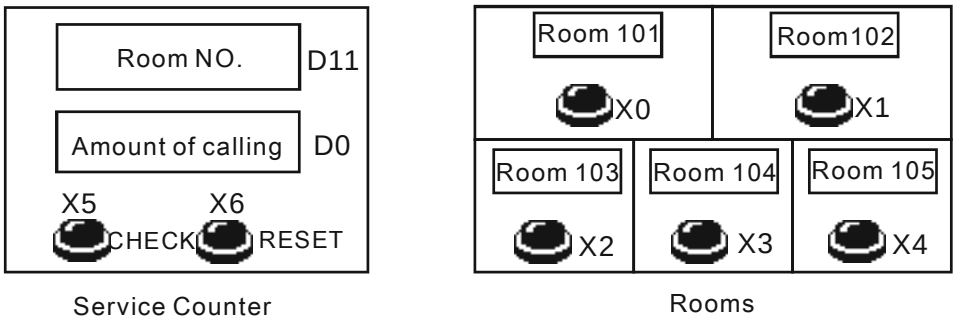


Program Description:

- When product A is identified on the conveyor belt, X0 activates for one time to execute MOVP K1 D0 instruction. The value in D0 = K1. Likewise, when product B and C is on the conveyor, the value in D0 will be K2 and K3.
- Products will move forward for one position when the cam rotates once. X6 activated one time to execute WSFL instruction. Data in D100~D105 will shift left for one register. At the same time, CMP instructions will be executed to confirm product A at position 2 (D101), product B at position 4 (D103) and product C at position 6 (D105). After each CMP instruction, RST instruction will be executed to clear D0.
- If product A , B or C is confirmed at position 2, 4 or 6, the corresponding M11, M21 or M31 will be ON to enable electromagnetic valve A, B or C to push the products in the containers.

- When the falling of each product is detected by sensors, X3, X4 or X5 will be ON to reset electromagnetic valve A, B or C.
- When RESET is pressed, X7 = ON to execute ZRST instruction. The value in D100~D105 will be 0, which means all data memory will be cleared.

8.4 SFWR/SFRD - Room Service Call Control



Control Purpose:

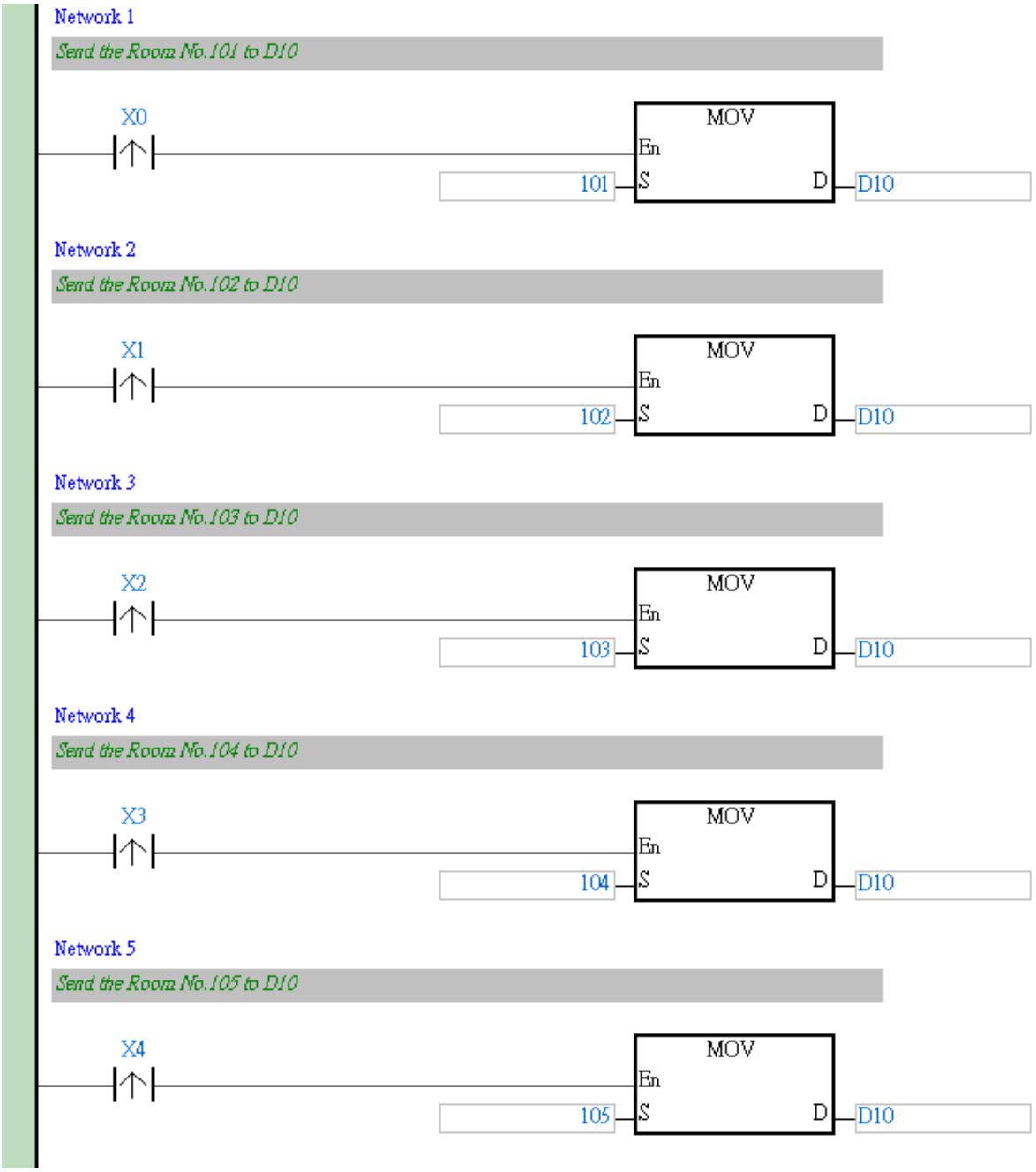
- Recording the calling room numbers and the amount of calling then checking the numbers in first-in first-out principle, which means the room first called will be first served.
- Clearing all the data memory when RESET is pressed.

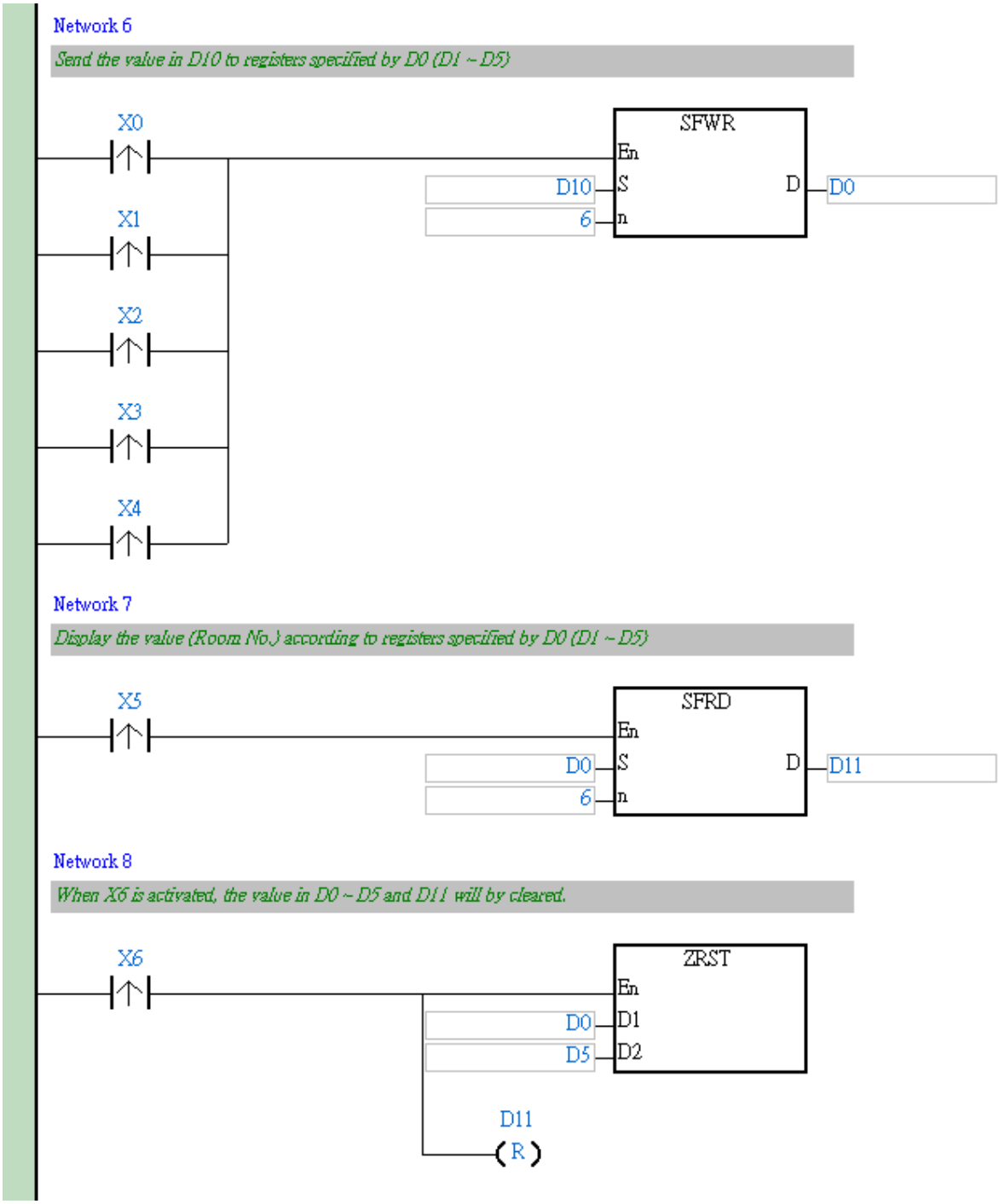
The amount of calling will be increased by the pressing times of call buttons, and decreased by the checking times of CHECK button. If all room numbers are checked, the displayed amount of calling would be 0.

Devices:

Device	Function
X0	Call button of Room 101. X0 = ON when the button is pressed
X1	Call button of Room 102. X1 = ON when the button is pressed
X2	Call button of Room 103. X2 = ON when the button is pressed
X3	Call button of Room 104. X3 = ON when the button is pressed
X4	Call button of Room 105. X4 = ON when the button is pressed
X5	Check button. X5 = ON when CHECK is pressed.
X6	Reset button. X6 = ON when RESET is pressed.
D0	Displaying the amount of calls
D1 ~ D5	Storing the room numbers under check
D10	Storing the input room numbers temporarily
D11	Displaying the room number (First-in first-out)

Control Program:





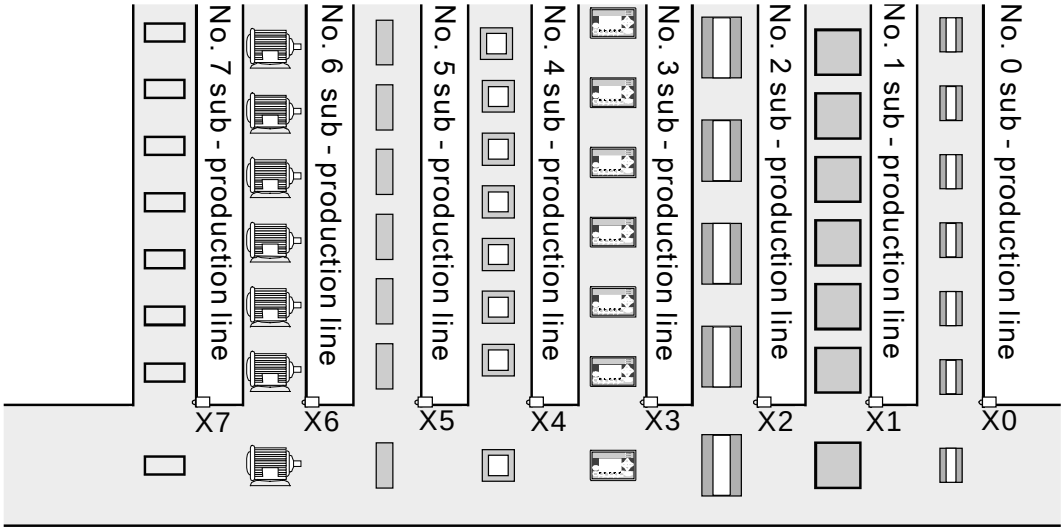
Program Description:

- By using API38 SFWR instruction together with API39 SFRD instruction, the program performs data stack writing and reading control in FIFO(first in, first out) principle. In this example, the room number first called will be first checked.
- When Call buttons are pressed, the numbers of the five rooms will be stored in D10 first and then sent to data stack D1~D5 according to the time order.
- When CHECK is pressed, the room number first called will be read to D11 first and the amount of calling will be decreased corresponding to D0. In addition, by using Delta TP04, the system can easily monitor the value of D0 (Amount of calling) and D11 (Displaying

Room No.)

- The program clears D0~D5 and D11 by ZRST and RST instructions, which means Amount of calling and Room number displayed on TP04 will be 0.

9.1 ENCO/DECO - Encoding and Decoding



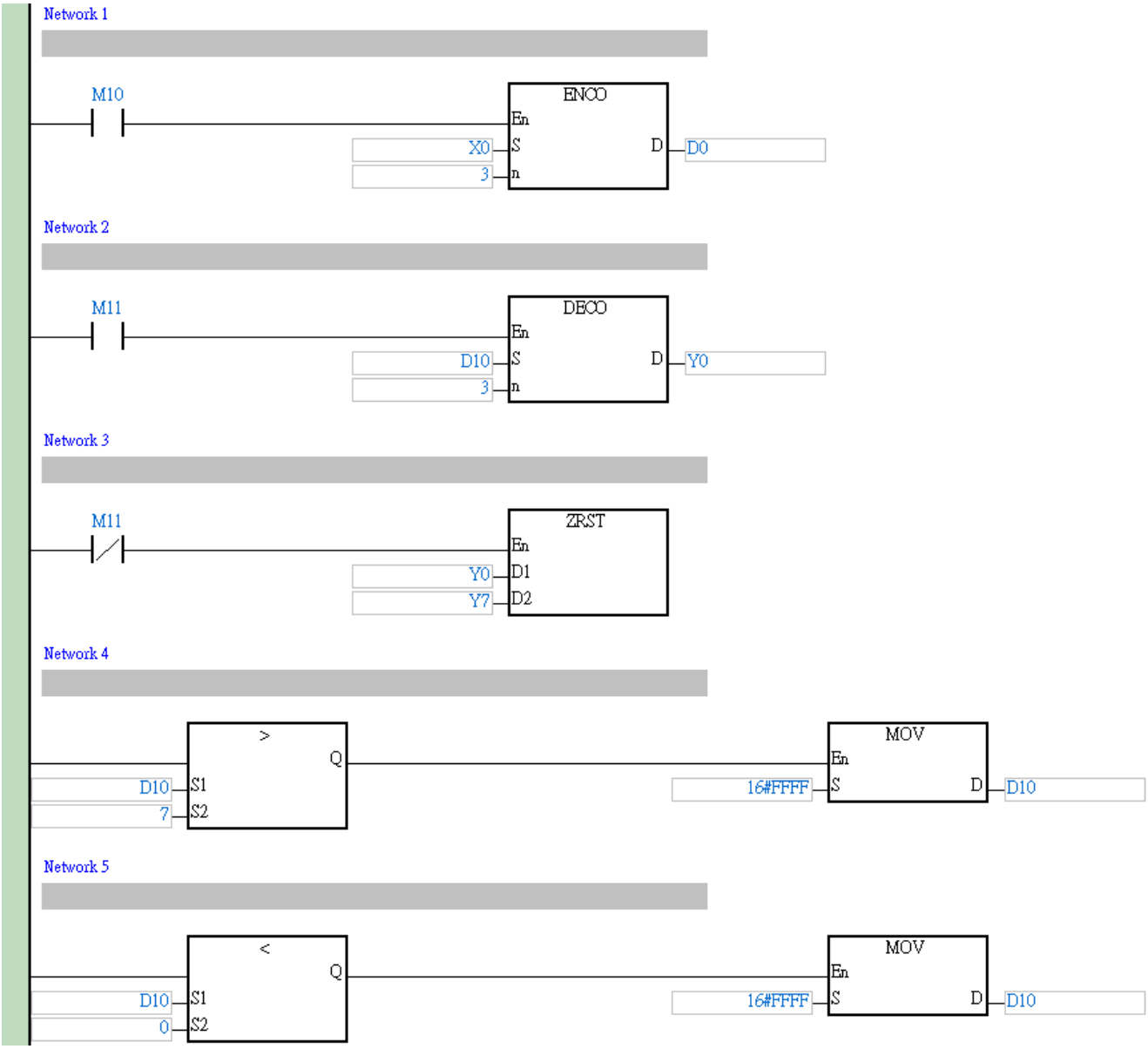
Control Purpose:

- Monitoring the entering products from sub-production lines No.0~7 to main production line by the value in D0 and disabling certain sub-production lines by setting the value in D10 as K0~K7.

Devices:

Device	Function
X0~X7	Product detecting sensor to identify each entering product.
Y0~Y7	Disabling the corresponding sub production line (No.0~7)
M10	Executing ENCO instruction
M11	Executing DECO instruction
D0	Indicating the entering product from sub-production line No.0~7
D10	Disabling the specified sub-production line

Control Program:



Program Description:

- When M10 = ON, ENCO instruction will be executed. Any product entering main production line will be encoded with its sub-production line number, and the result will be saved in D0. By monitoring the value in D0, the operator can identify the type of the entering product.
- When M11 = ON, DECO instruction will be executed to decode the specified value in D10 into Y0~Y7 so as to disable the corresponding sub-production line. For example, when D10 = K5, the decoding result will be Y5 = ON. In this case, No. 5 sub-production line will be disabled. When M11 = OFF, ZRST instruction will be executed and Y0~Y7 will be OFF. All sub-production lines will operate normally.
- If the set value in D10 is out of the range between K0~K7, HFFFF will be written in D10, so as to prevent the production line interruption due to other written value in D10.

9.2 SUM/BON - Checking and Counting the Number of “1”

Control Purpose:

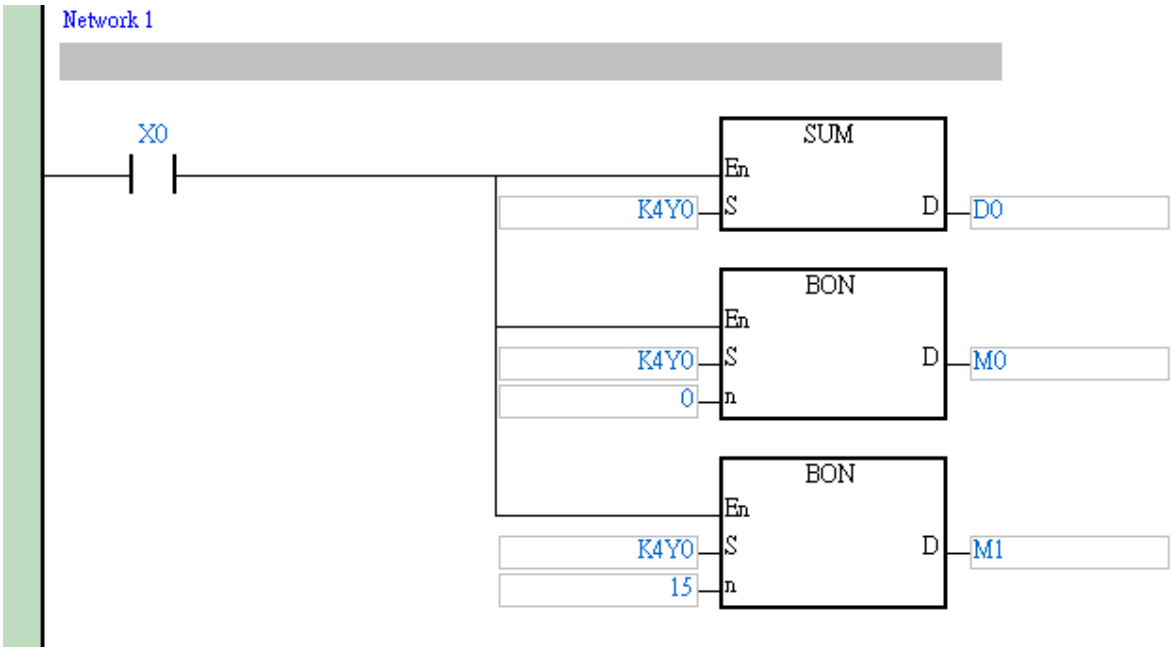
When X0 = ON,

- Executing SUM instruction to count active bits among Y0~Y17 and to store the value in D0.
- Executing BON instruction to check the ON/OFF state of LSB (Least Significant Bit) and MSB (Most Significant Bit) and to store the result in M0 and M1
- Indicating the value in D0 and the state of M0 and M1.

Devices:

Device	Function
X0	Executing SUM and BON instructions
Y0~Y17	Device for checking and counting
D0	Storing the sum of active bits among Y0~Y17
M0	Storing the ON/OFF state of LSB
M1	Storing the ON/OFF state of MSB

Control Program:



Program Description:

- When X0 = ON, the program will count the active bits (numbers of “1”) among Y0~Y10 and check the active state (“1”) of the LSB and MSB.

9.3 MEAN/SQR - Mean Value and Square Root

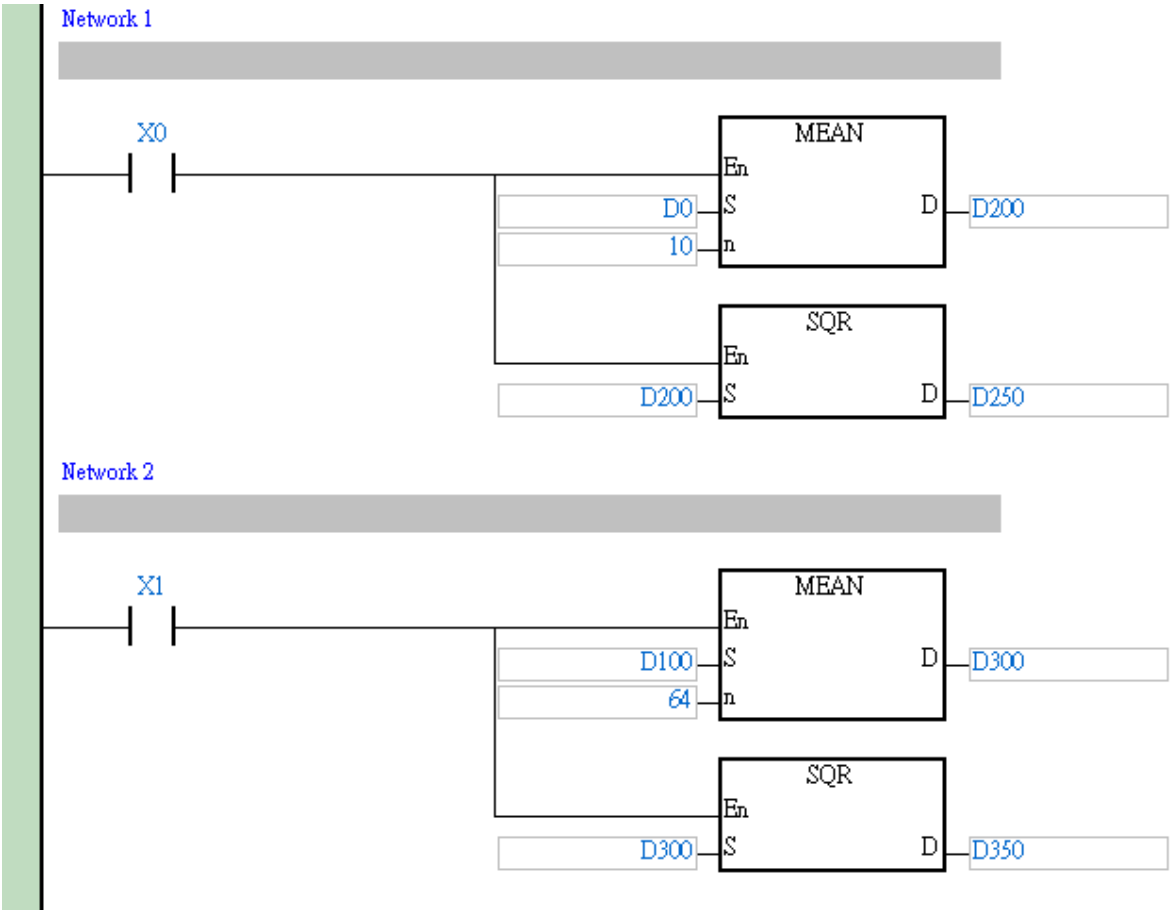
Control Purpose:

- When X0 = ON, calculate the mean of values in D0~D9 and store the value in D200; calculate the square root of D200 and save the value in D250.
- When X1 = ON, calculate the mean of values in D100~D163, store the value in D300; calculate the square root of D300 and save the value in D350.

Devices:

Device	Function
X0	Executing MEAN/SQR instruction to calculate 10 continuous data
X1	Executing MEAN/SQR instruction to calculate 64 continuous data
D0~D9	Storing historical data
D200	Storing mean value
D250	Storing square root of the mean value
D100~D163	Storing historical data
D300	Storing mean value
D350	Storing square root of the mean value

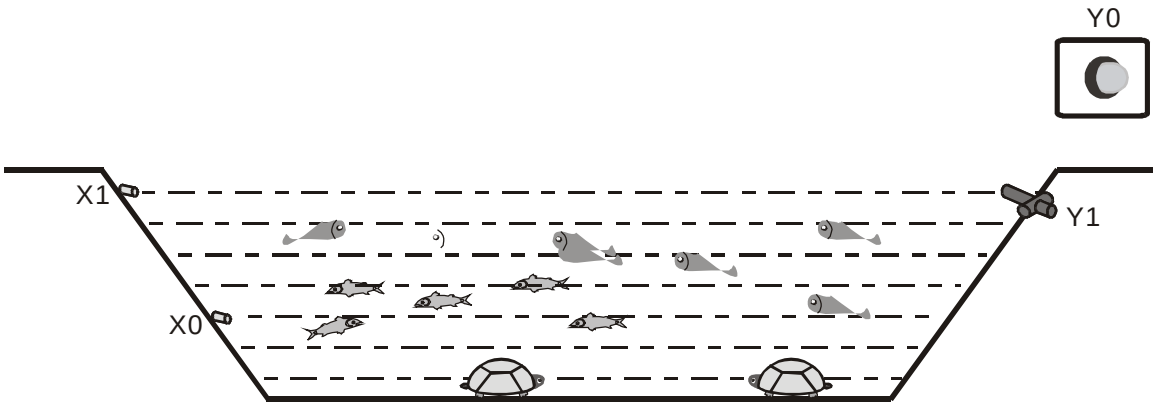
Control Program:



Program Description:

- If the data number falls out of the range between 1~64 in MEAN instruction, or if the SQR instruction specifies a negative value, PLC will regard it as an “instruction operation error.”

9.4 ANS/ANR - Level Monitoring Alarm System



Control Purpose:

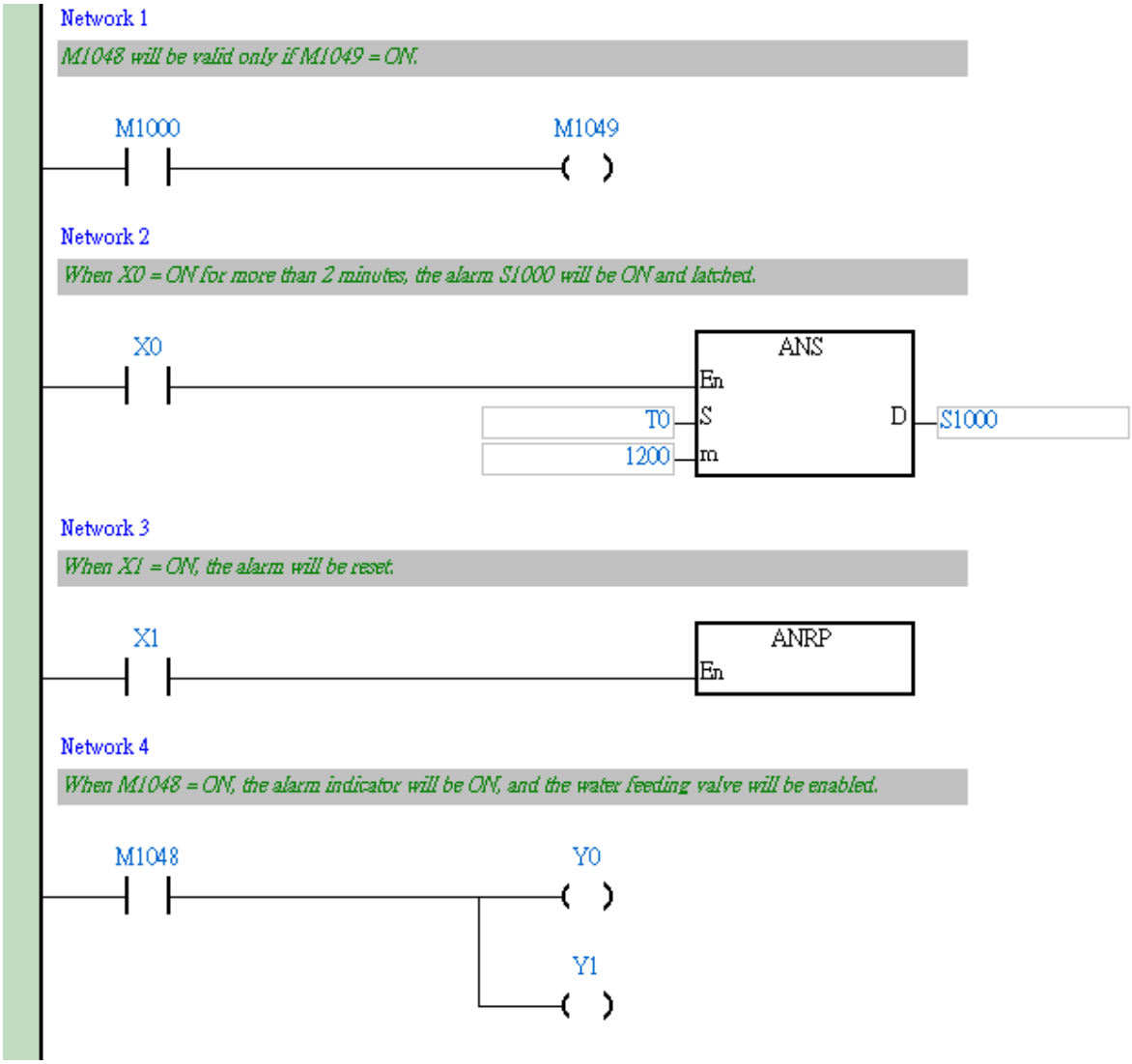
- Monitoring the water level of an aquaculture farm by alarm and indicator system.

When the level is below the lower bound for 2 minutes, the alarm and the indicator will be ON. At the same time, the water feeding valve will start working until the level is back to normal range.

Devices:

Device	Function
X0	Level lower bound sensor
X1	Normal level sensor
Y0	Alarm indicator
Y1	Water feeding valve

Control Program:



Program Description:

- When the level is below the lower bound (X0 = ON) for 2 minutes, Y0 and Y1 will be ON. The alarm indicator will be ON and the water feeding valve will be enabled.
- When the level reaches normal range (X1 = ON), Y0 and Y1 will be OFF. The alarm will be reset.

9.5 SORT - Sorting Acquired Data

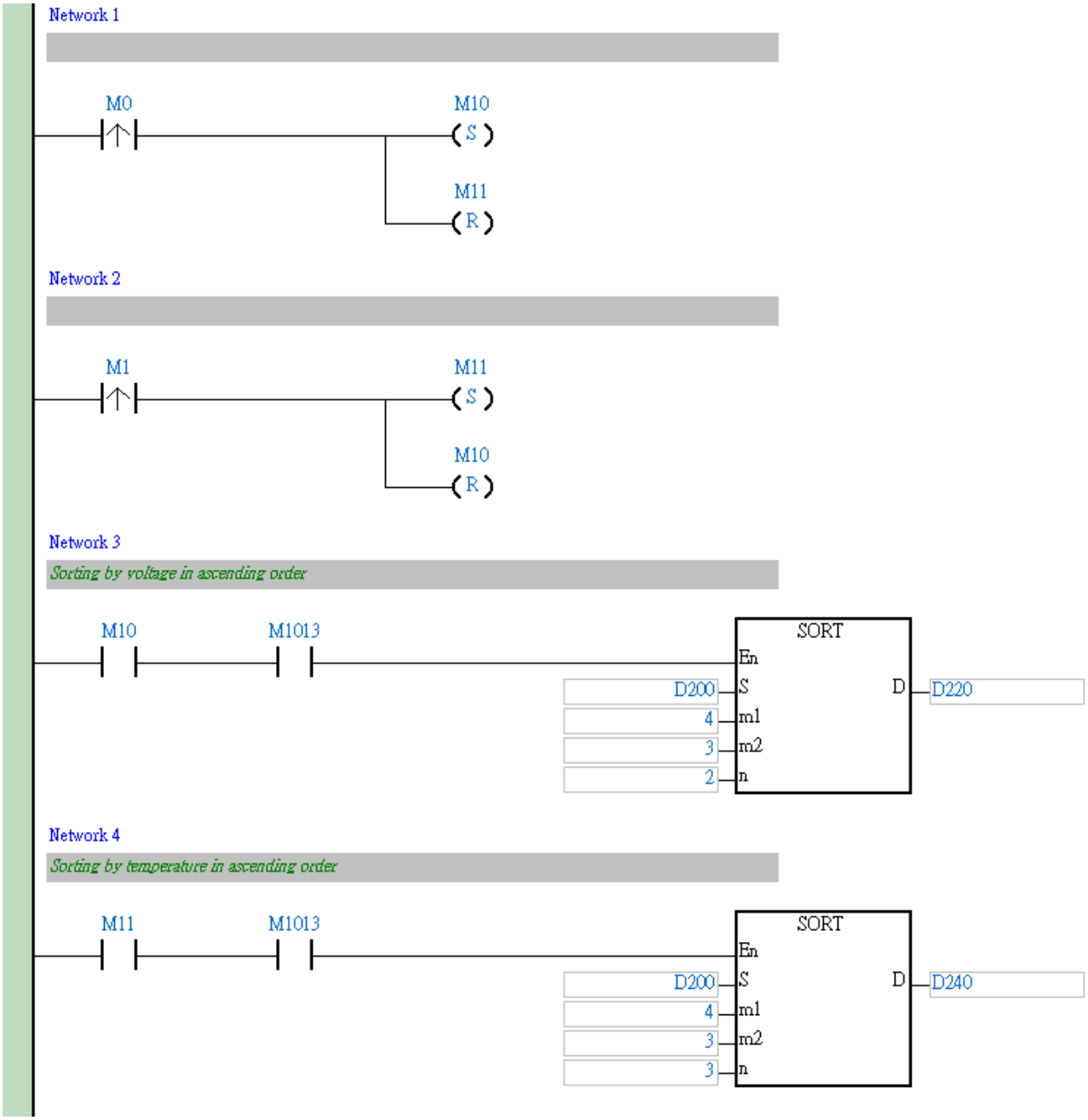
Control Purpose:

- Collecting 4 voltage data (Corresponding to frequency of AC motor) by DVP04AD-S analog module and 4 temperature data by DVP04TC-S thermocouple module.
- Sorting the 4 channels by voltage in ascending order when M0 = ON and by temperature in ascending order when M1 = ON.
- Sorting the data and displaying the sorting result.

Devices:

Device	Function
M0	Sorting voltage data
M1	Sorting temperature data
D200~D203	Numbers of channels to be sorted
D204~D207	Storing 4 voltage data
D208~D211	Storing 4 temperature data
D220~D231	Displaying voltage sorting result
D240~D251	Displaying temperature sorting result

Control Program:



Program Description:

- Acquired data before sorting:

	1	2	3
	Channel (CH1~CH4)	Voltage (DVP04AD-S)	Temp. (DVP04TC-S)
1	(D200)1	(D204)57	(D208)47
2	(D201)2	(D205)59	(D209)42
3	(D202)3	(D206)55	(D210)46
4	(D203)4	(D207)53	(D211)43

1）Sorted voltage data in ascending order when M0 = ON:

	1	2	3
	Channel (CH1~CH4)	Voltage (DVP04AD-S)	Temp. (DVP04TC-S)
1	(D220)4	(D224)53	(D228)43
2	(D221)3	(D225)55	(D229)46
3	(D222)1	(D226)57	(D230)47
4	(D223)2	(D227)59	(D231)42

The voltage sorting result is: channel 4, channel 3, channel 1, and channel 2. The minimum value is K53 and the maximum value is K59.

2）Sorted temperature data in ascending order when M1 = ON:

	1	2	3
	Channel (CH1~CH4)	Voltage (DVP04AD-S)	Temp. (DVP04TC-S)
1	(D240)4	(D244)59	(D248)42
2	(D241)1	(D245)53	(D249)43
3	(D242)2	(D246)55	(D250)46
4	(D243)3	(D247)57	(D251)47

The temperature sorting result is: channel 4, channel 1, channel 2, and channel 3. The minimum value of is K42 and the maximum value is K47.

- The purpose of using M1013 (1s clock pulse) after the drive contacts M10 and M11 is to assure that sorting result can be refreshed in 1s so as to prevent rising edge triggering M10 and M11 when SORT instruction needs to be executed one more time.
- Users can monitor the sorting result and the minimum/maximum value of voltage and temperature.

10.1 REF/REFF - DI/DO Refreshment and DI Filter Time Setting

Control Purpose:

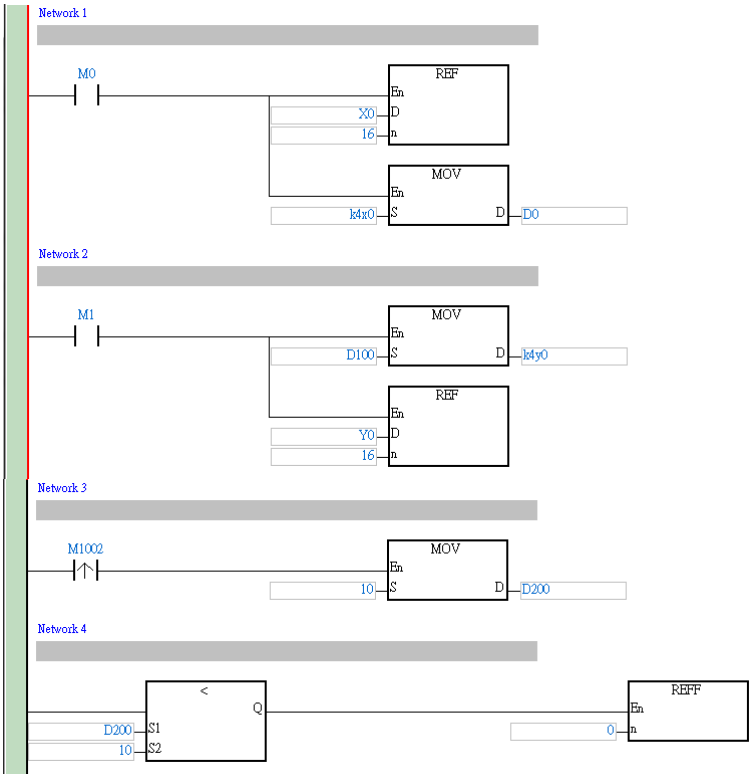
Refreshing DI/DO status immediately and setting/displaying DI filter time.

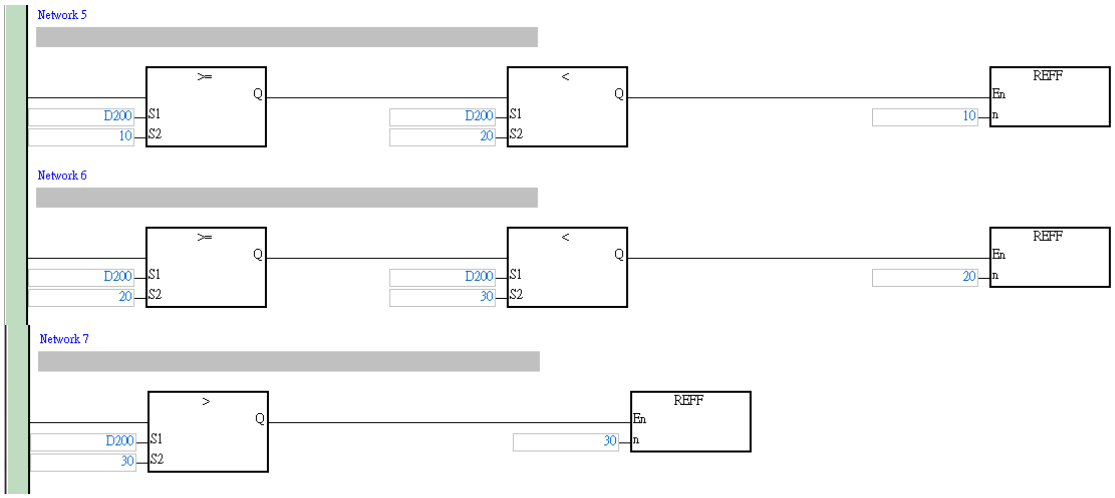
- When M0 = ON, refresh the status of input points X0~X17 and send the status to D0. When M1 = ON, transmit the value in D100 to the output points Y0~Y17 and send the output state to output terminals immediately before END instruction.
- By controlling the value in D200 according to the interference degree, users can set the filter time of DI as 0 (actual min. value = 50μs), 10ms, 20ms and 30ms.

Devices:

Device	Function
M0	Starting to refresh the status of input points X0~X17
M1	Starting to refresh the status of output points Y0~Y17
D200	Storing the filter time of the input points

Control Program:

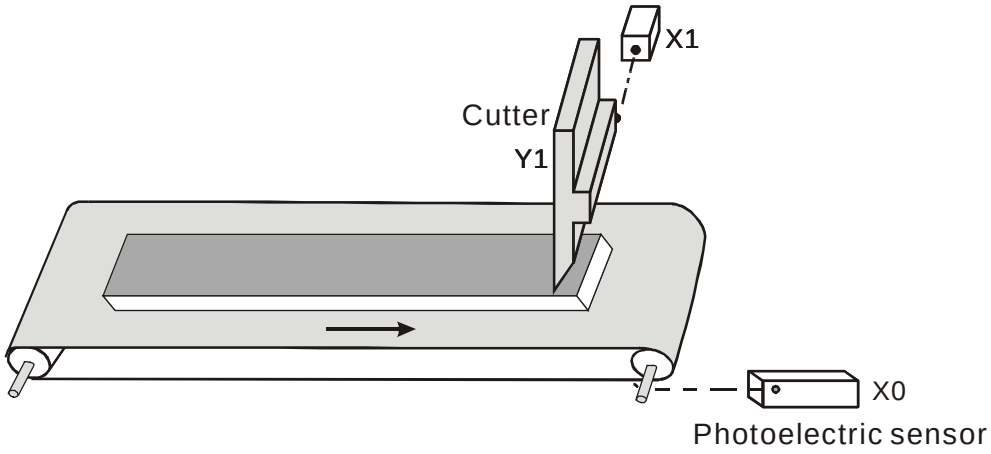



Network 5
>=
Q
D200
S1
10
S2
<
Q
D200
S1
20
S2
REFF
En
10
n
Network 6
>=
Q
D200
S1
20
S2
<
Q
D200
S1
30
S2
REFF
En
20
n
Network 7
>
Q
D200
S1
30
S2
REFF
En
30
n

Program Description:

- Generally the input state (X) is refreshed at the beginning of program scan cycle, and the output state (Y) is refreshed at the end of END instruction. However, the immediate state refreshing during the program execution process can be performed by Ref instruction.
- Due to severe operating environment, PLC DI signal is frequently interfered and error operations would thus occur. Usually, the interference will not last for a long time. We can apply a filter to DI signals so that the interference would be decreased in principle.
- When D200<K10, the filter time of DI signal = 0 (Actual value = 50μs). When K10≤D200<K20, the filter time = 10ms. When K20≤D200<K30, the filter time = 20ms. When K30<D200, the filter time = 30ms. The initial setting of this program in D200 = K10, so the filter time of DI signal in this case is set as 10ms.
- Users can apply MOV instruction to transmit the filter time of DI signal to D1020 (corresponding to X0~X7) and D1021 (corresponding to X10~X17).
- The filter time changed by REFF instruction during program executing process can be modified in next program scan cycle.

10.2 DHSCS - Cutting Machine Control



Control Purpose:

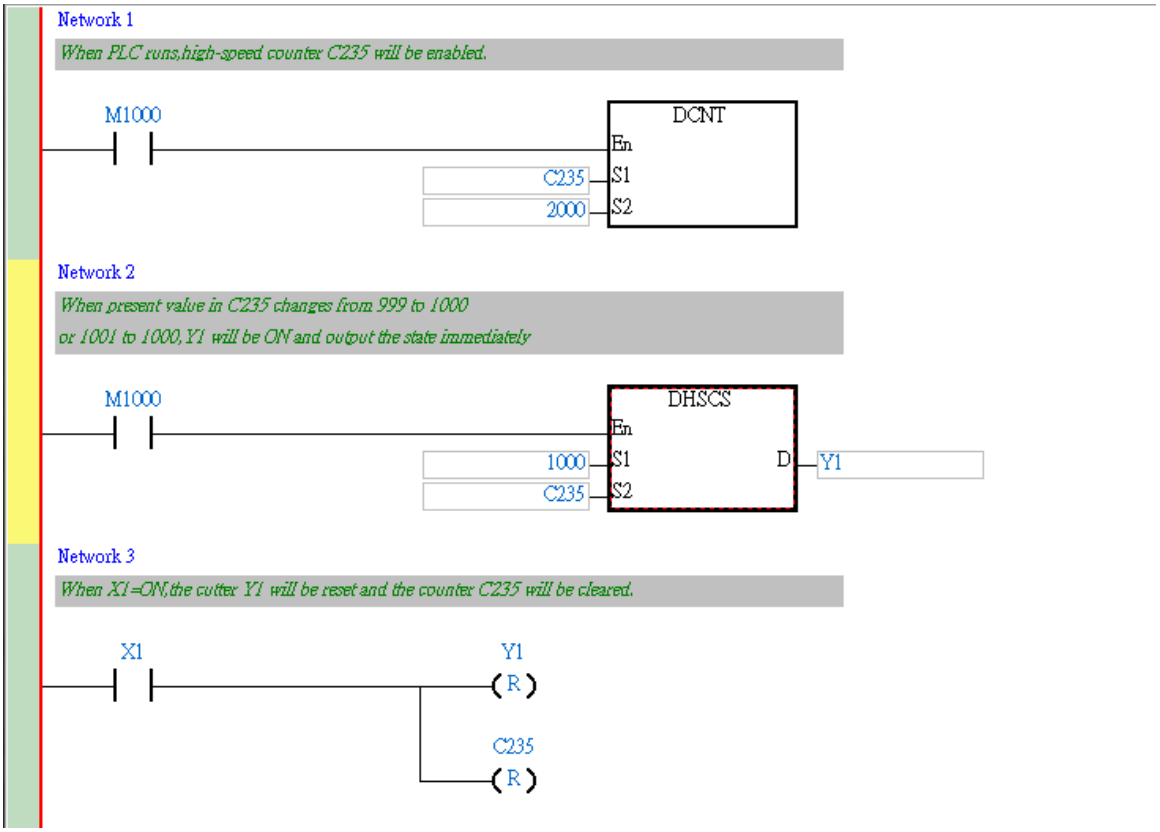
- Counting the number of rotations and controlling the cutter according to the value in C235.

X0 counts once when the axis rotates once. When C235 counts to 1000, the cutter will perform cutting process once.

Devices:

Device	Function
X0	Photoelectric sensor. X0 turns on once when the axis rotates once
X1	Photoelectric sensor. X1 = ON when cutter is released (Y1 = OFF).
Y1	Cutter
C235	Counting the number of axis rotations

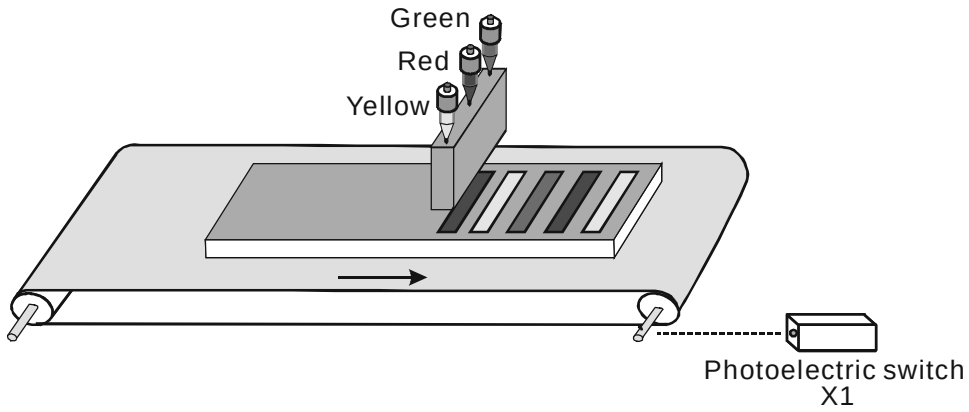
Control Program:



Program Description:

- The photoelectric sensor X0 is the external input point of C235. X0 turns on once when the axis of conveyor belt rotates once and therefore C235 counts once.
- During the execution of DHSCS instruction, Y1 will be ON when the value in C235 reaches 1000 (Axis rotation =1000 times) and then output the state immediately to the external output terminals. Therefore, the cutter will be enabled.
- When the cutter is released, X1 = ON. C235 will be cleared and the cutter Y1 will be reset. In this case, X1 turns off. C235 will restart counting and the above process will be repeated.

10.3 DHSZ/DHSCR - Multi-segment Coater Control



Control Purpose:

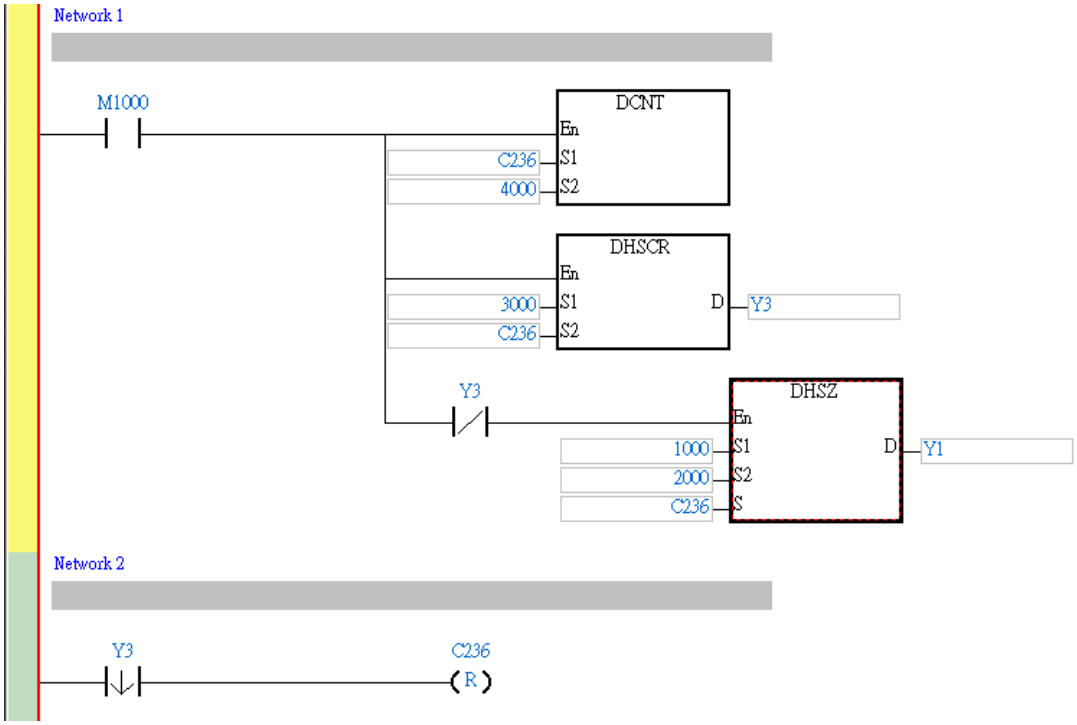
- Painting the products with pigments of three colors: red, yellow and green.

When the axis of conveyor rotates 1000 times, the pigment will be changed and therefore the painting process will be executed as the following order: red, yellow, green, red yellow, green…

Devices:

Device	Function
X1	Photoelectric sensor. X1 turns on once when the axis rotates once.
Y1	Painting red pigment
Y2	Painting yellow pigment
Y3	Painting green pigment
C236	Counting the number of axis rotations

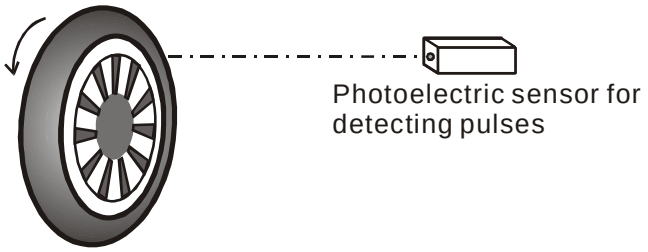
Control Program:



Program Description:

- The photoelectric sensor X1 is the external input point of C235. X1 turns on once when the axis of conveyor belt rotates once and therefore C236 counts once.
- When the PV (present value) in C236<K1000 (the number of axis rotations<1000), Y1 = ON and the red pigment will be painted.
- When K1000≤ PV in C236≤K2000 (1000≤axis rotations≤2000), Y1 = OFF and Y2 = ON. The yellow pigment will be painted.
- When K2000＜PV in C236＜K3000 (2000<axis rotations<3000), Y1 = Y2 = OFF and Y3 = ON. The green pigment will be painted. Because Y3 = ON, the NC (normally closed) contact Y3 is activated to disable DHSZ instruction. However, Y3 will remain ON.
- When the PV in C236 reaches K3000, DHSCR instruction will be executed and Y3 will be reset. Counter C236 will be cleared because the falling trigger of Y3. On the other hand, the NC contact Y3 is OFF and therefore the DHSZ instruction is executed again. C236 starts counting from 0 and the pigment will be painted again as the specified cycle: red, yellow, green, red, yellow, green, etc.

10.4 SPD - Wheel Rotation Speed Measurement



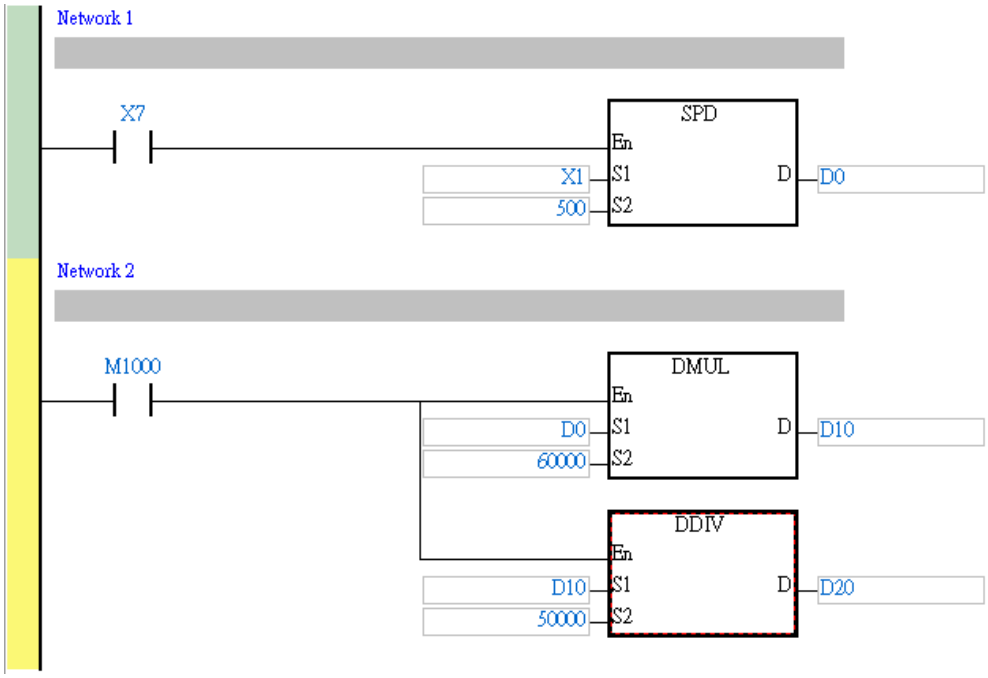
Control Purpose:

- Calculating the wheel rotation speed by the equation based on the counted input pulses

Devices:

Device	Function
X1	Photoelectric sensor for detecting pulses
X7	Executing SPD instruction

Control Program:



Program Description:

- When X7 = ON, SPD instruction will be executed. D2 will calculate the high-speed input pulses by X1 and stop the calculation after 500ms. The result will be stored in D0 and D1.
- The following equation is for obtaining the rotation speed of the car:

$$N = \frac{D0}{nt} \times 60 \times 10^3 (rpm)$$

N: Rotation speed (unit: rpm).

n: The number of pulses produced per rotation

t: Pulse receiving time (ms)

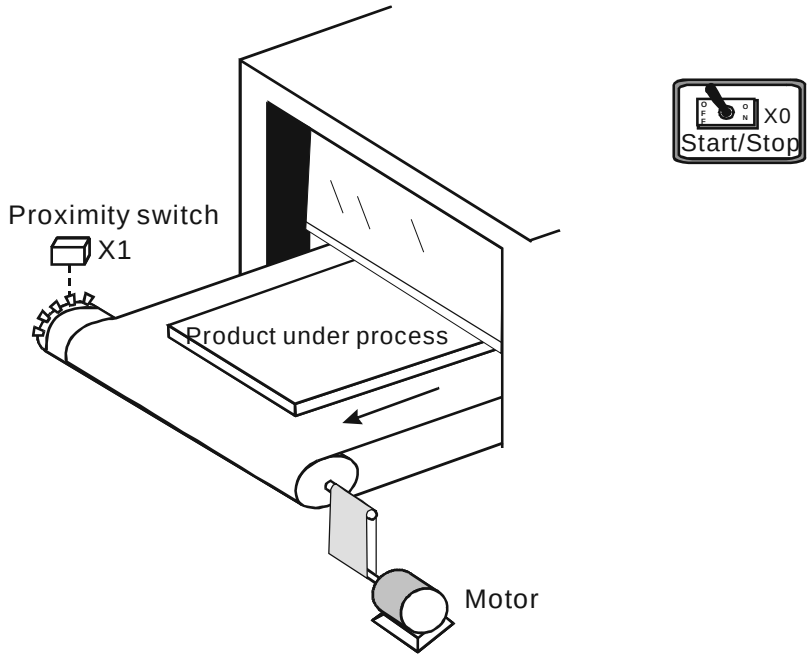
If the number of pulses produced per rotation is K100 and the number of pulses within 500ms is K750, the rotation speed will be:

$$N=\frac{D0}{nt}\times 60\times 10^{3}=\frac{750\times 60\times 10^{3}}{100\times 500}\times(rpm)=900\ rpm$$

- The rotation speed N is stored in D20 and D21.

MEMO

11.1 Elementary Arithmetic for Integer and Floating Point



Control Purpose:

- When the production line runs, the production control engineer needs to monitor its real-time speed. The target speed is 1.8 m/s.
- The motor and the multi-tooth cam rotate with the same axis. There are 10 teeth on the cam, so the proximity switch will receive 10 pulse signals when the motor rotate once and the production line will move forward for 0.325m. The equations are as follows:

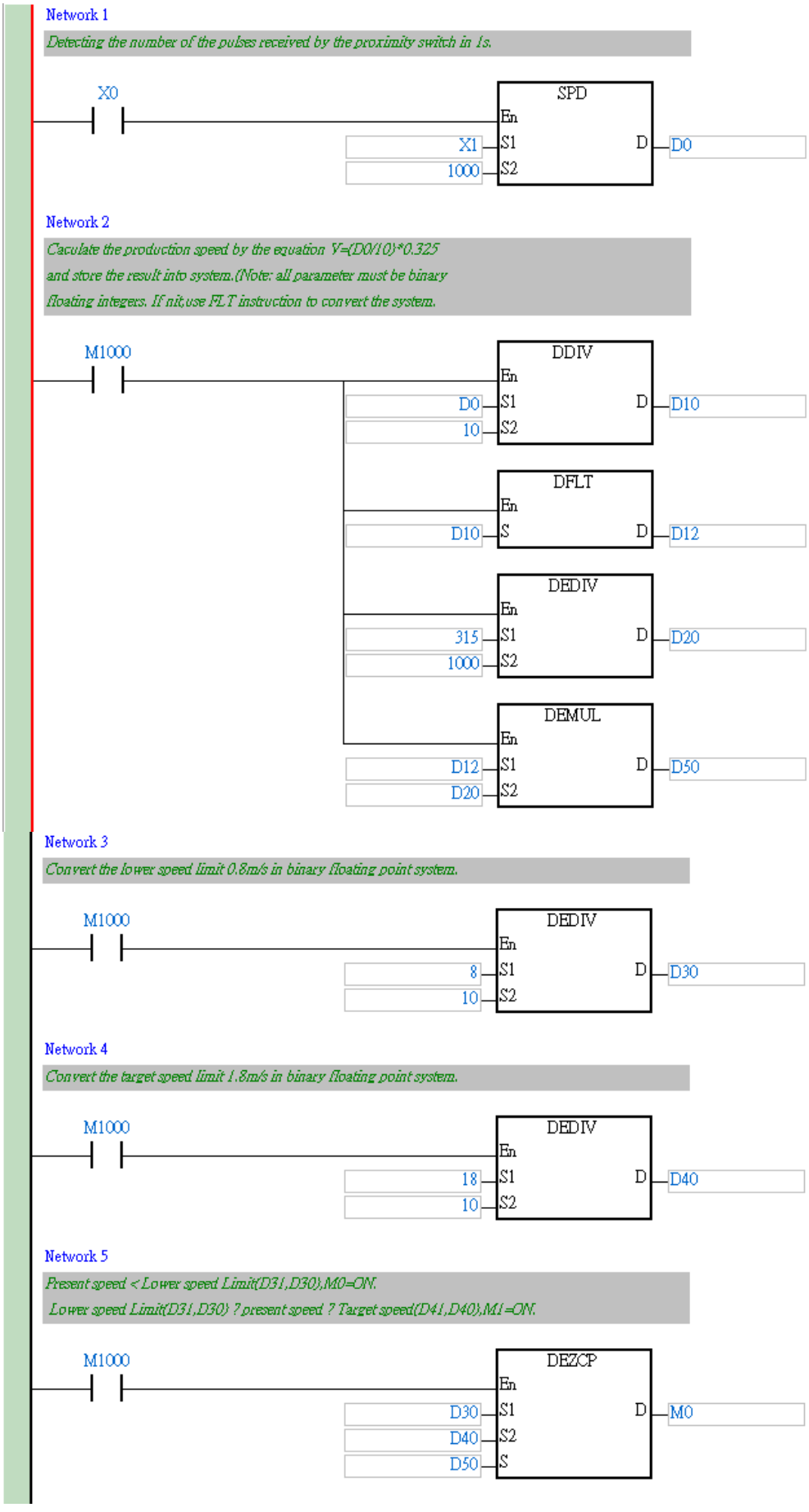
  Motor rotation speed (r/min) = the received pulses in 1 min/10

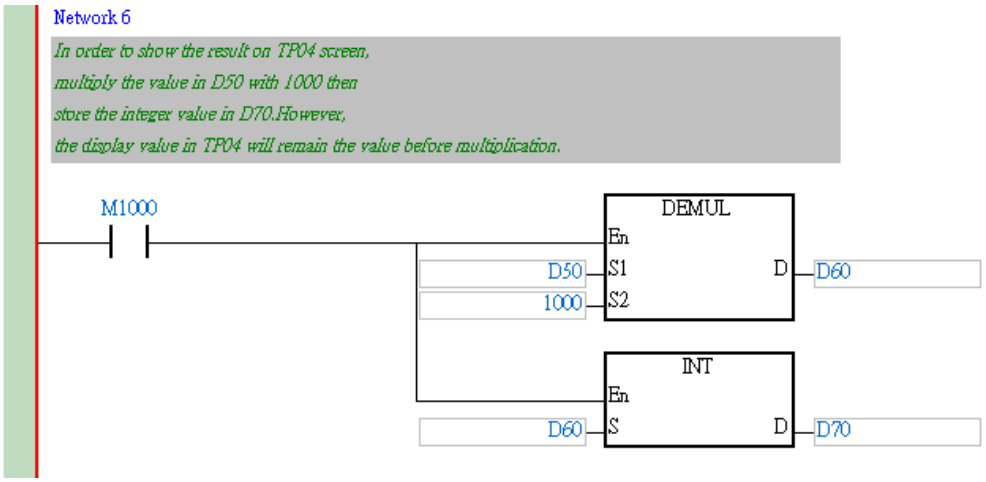
  The speed of the production line = the rotation times of motor in 1s × 0.325 = (Motor rotation speed/60) × 0.325.
- Indicator status: Production line speed < 0.8 m/s, the Speed Low indicator will be ON. 0.8 m/s ≤ production line speed ≤ 1.8m/s, the Normal indicator will be on. Production line speed >1.8m/s, the Speed High indicator will be on.
- Display the production line speed for production control engineers to monitor.

Devices:

Device	Function
X0	Pulse frequency detecting switch. X0 = ON when Start is switched on.
X1	Proximity switch. X1 creates a pulse when a tooth on cam is detected.
D0	Storing the detected pulse frequency
D50	Storing the present speed of the production line

Control Program:





Program Description:

- Calculate the motor rotation speed (r/min) by using SPD instruction to detect the pulse frequency (D0) from the proximity switch. Motor rotation speed = the receiving pulses in 1min/10 = (pulse frequency × 60)/10 = (D0×60)/10.
- The following equation is for obtaining the production line speed through D0:

$$v=\frac{N}{60}\times 0.325 = \frac{D0\times 60 \diagup 10}{60}\times 0.325\,\text{m/s}=\frac{D0}{10}\times 0.325\,\text{m/s}$$

V: Production line speed (unit: m/s)
N: Motor speed (unit: r/min)
D0: Pulse frequency

If the detected pulse frequency D0 = K50, the production line speed = $\frac{50}{10}\times 0.325\,\text{m/s}$

=1.625m/s by the above equation

- The parameter of present production line speed contains decimal points during calculation, therefore the binary floating point operation instruction is needed for performing the calculation. .
- DEZCP instruction is used to compare the present speed with the upper/lower speed limits and the comparison results will be stored in M0~M2.
- There are integers and floating points mixed in the operation. If the operational parameters are not binary floating point values before calculating the production line speed, they have to be converted by FLT instruction
- For monitoring easily, the speed value is multiplied with 1000 to obtain the integer in the end of this program

11.2 Elementary Arithmetic for Floating Point

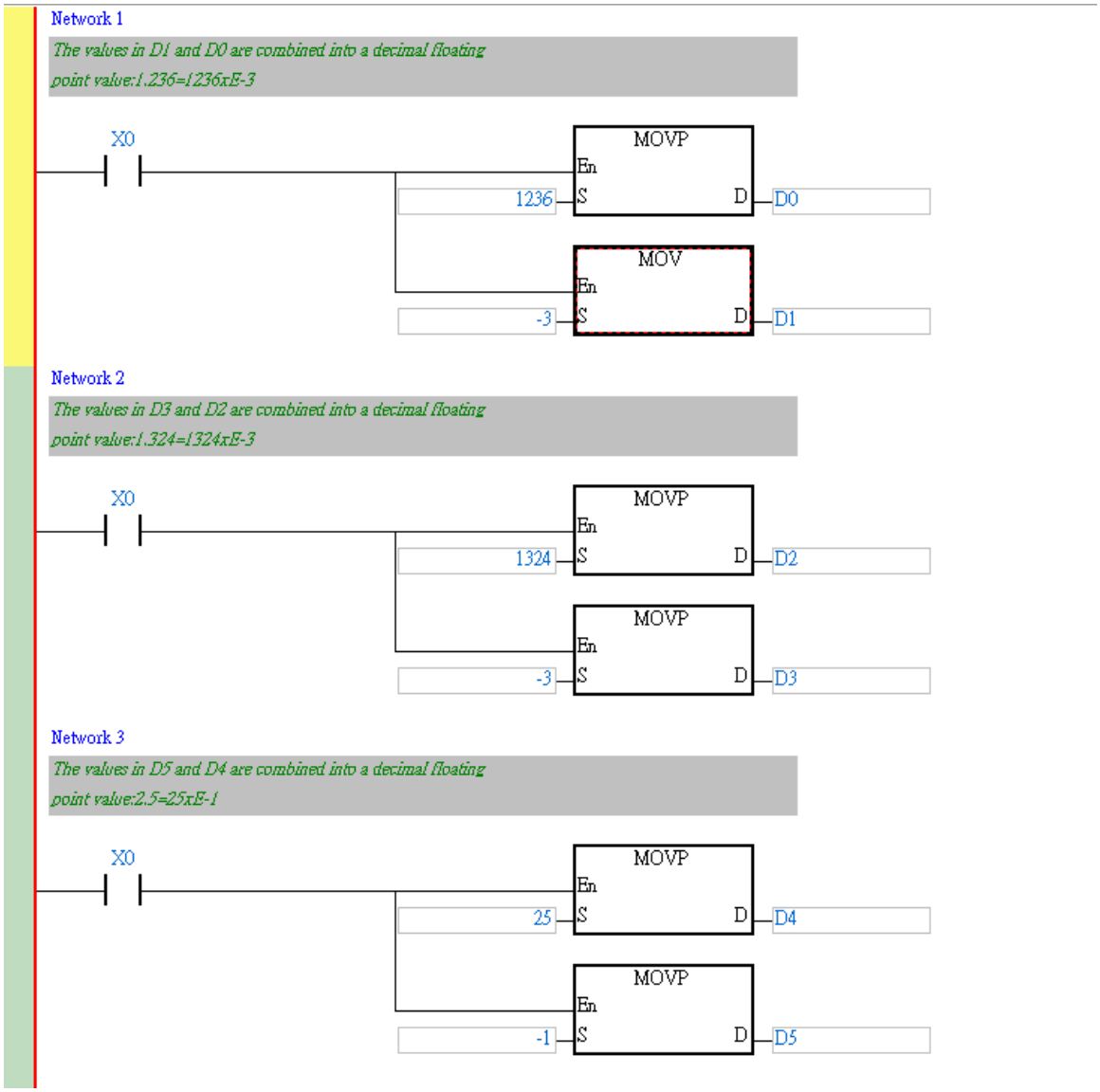
Control Purpose:

- Perform the operation (1.236+1.324)×2.5÷10.24 by Delta's binary floating point operation instruction.

Devices:

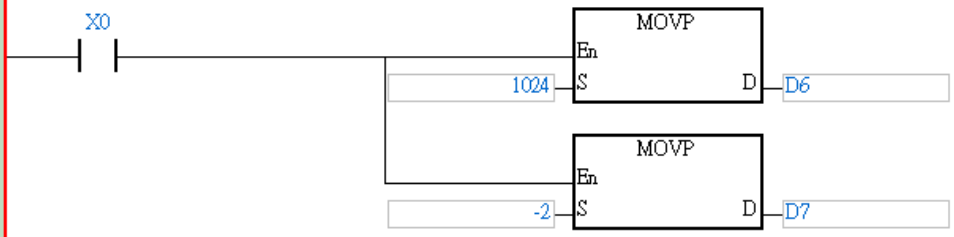
Device	Function
X0	Initialization switch
X1	Operation control switch

Control Program:



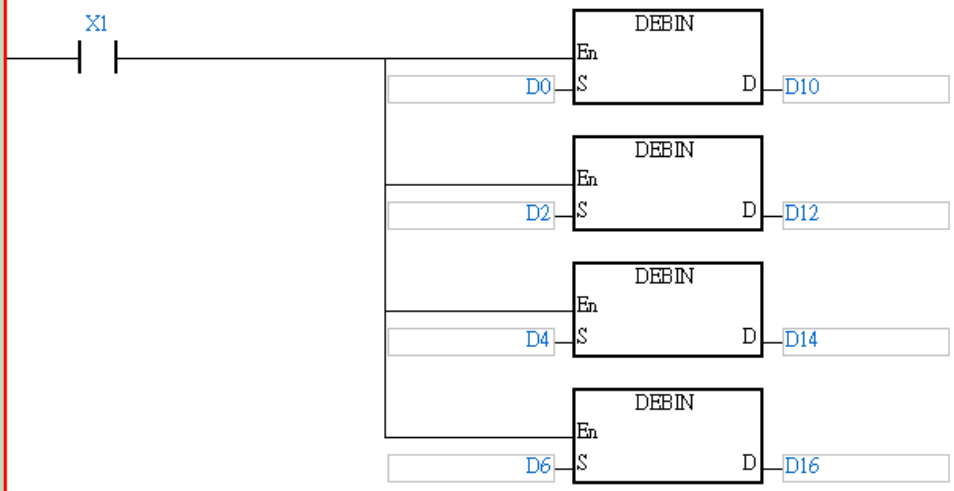
Network 4

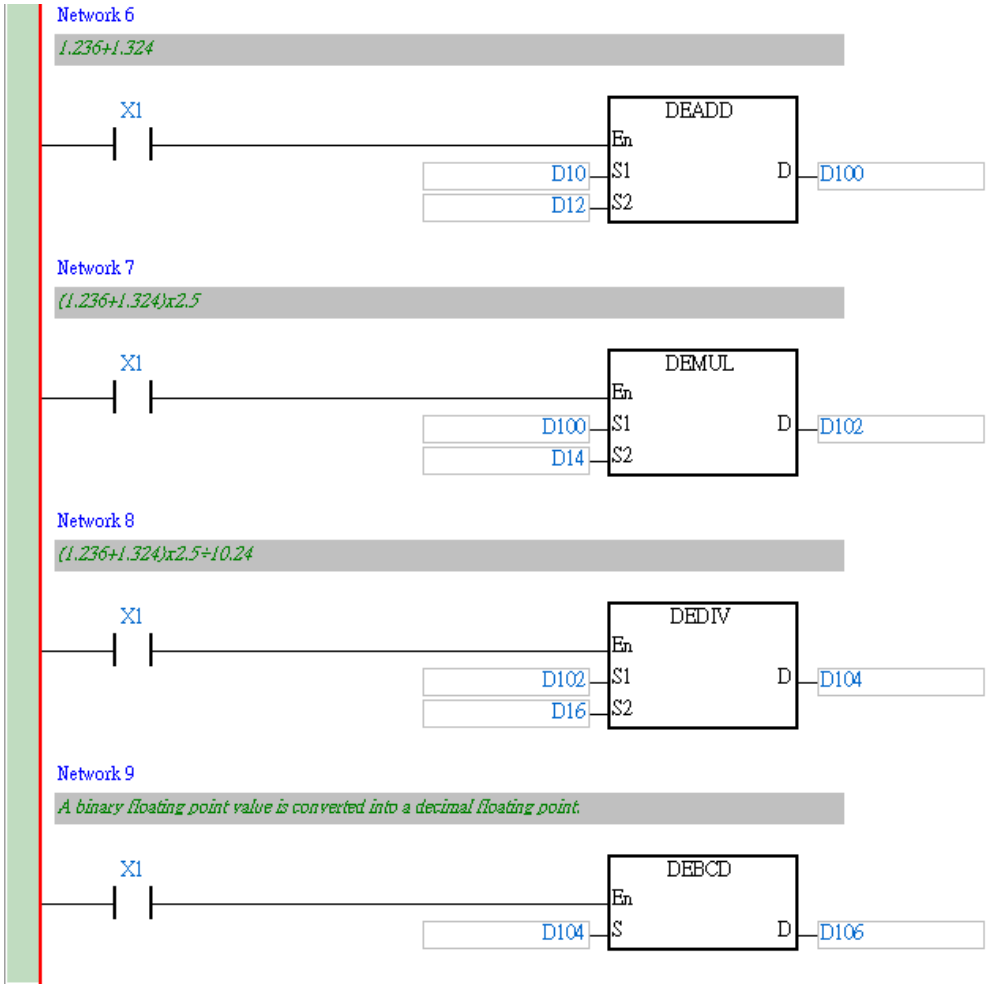
The values in D7 and D6 are combined into a decimal floating point value:10.24=1024xE-2



Network 5

A decimal floating point value is converted into binary floating point.





Program Description:

- When X0 = ON, sent the values of decimal integers to D0~D7 to form 4 decimal floating points.
- When X1 = ON, elementary arithmetic operations for binary floating points will be executed.
- The binary operational results are not intuitively understandable. Therefore, the binary floating point value would generally be converted into decimal floating point value. In this program, the binary values in (D105, D104) are converted into decimal values in (D107, D106) D106 = K6250, D107 = K-4, so the decimal floating point value $6250 \times 10^{-4} = 0.625$.

12.1 TRD/TWR/TCMP - Office Bell Timing Control

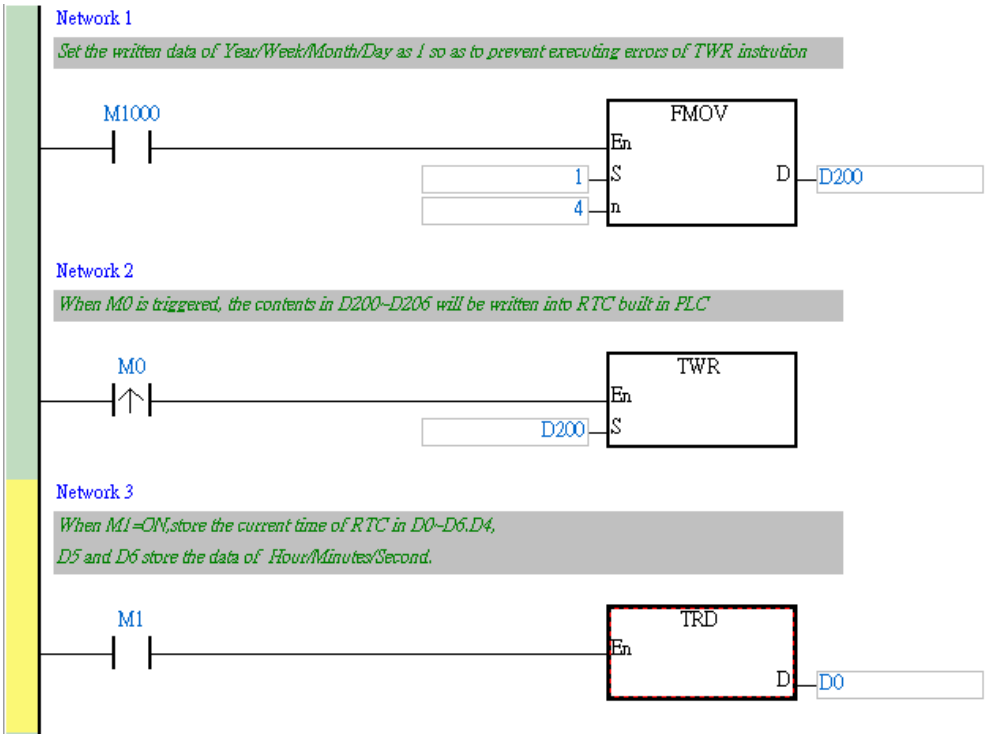
Control Purpose:

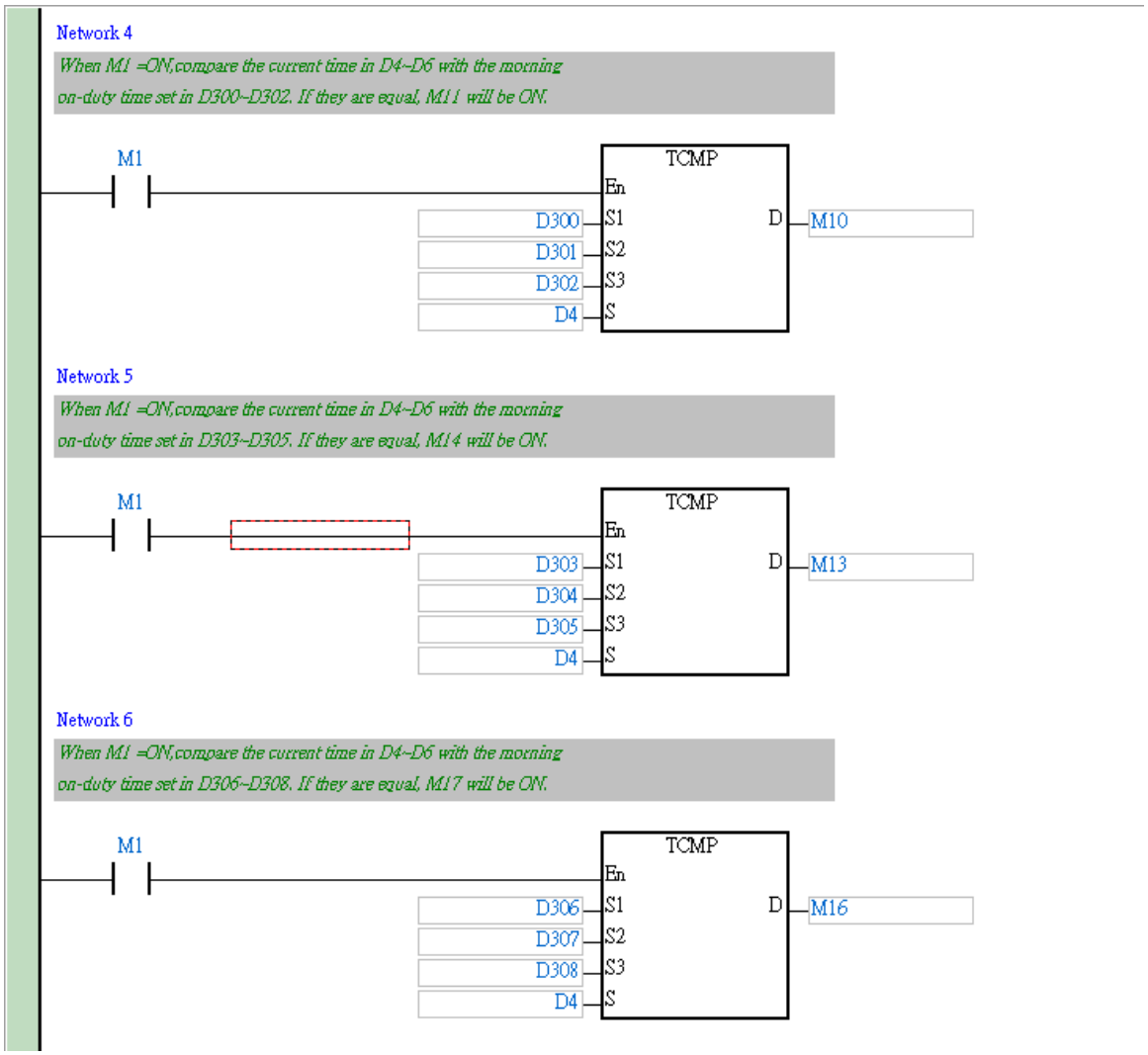
- There are 4 moments the office bell will ring: on-duty / off-duty time in the morning and on-duty / off-duty time in the afternoon. When the time is reached, the bell will ring immediately and last for 1 minute. Users can set the 4 moments and adjust the current time at any time.
- Set the ringing time and adjust the current time.

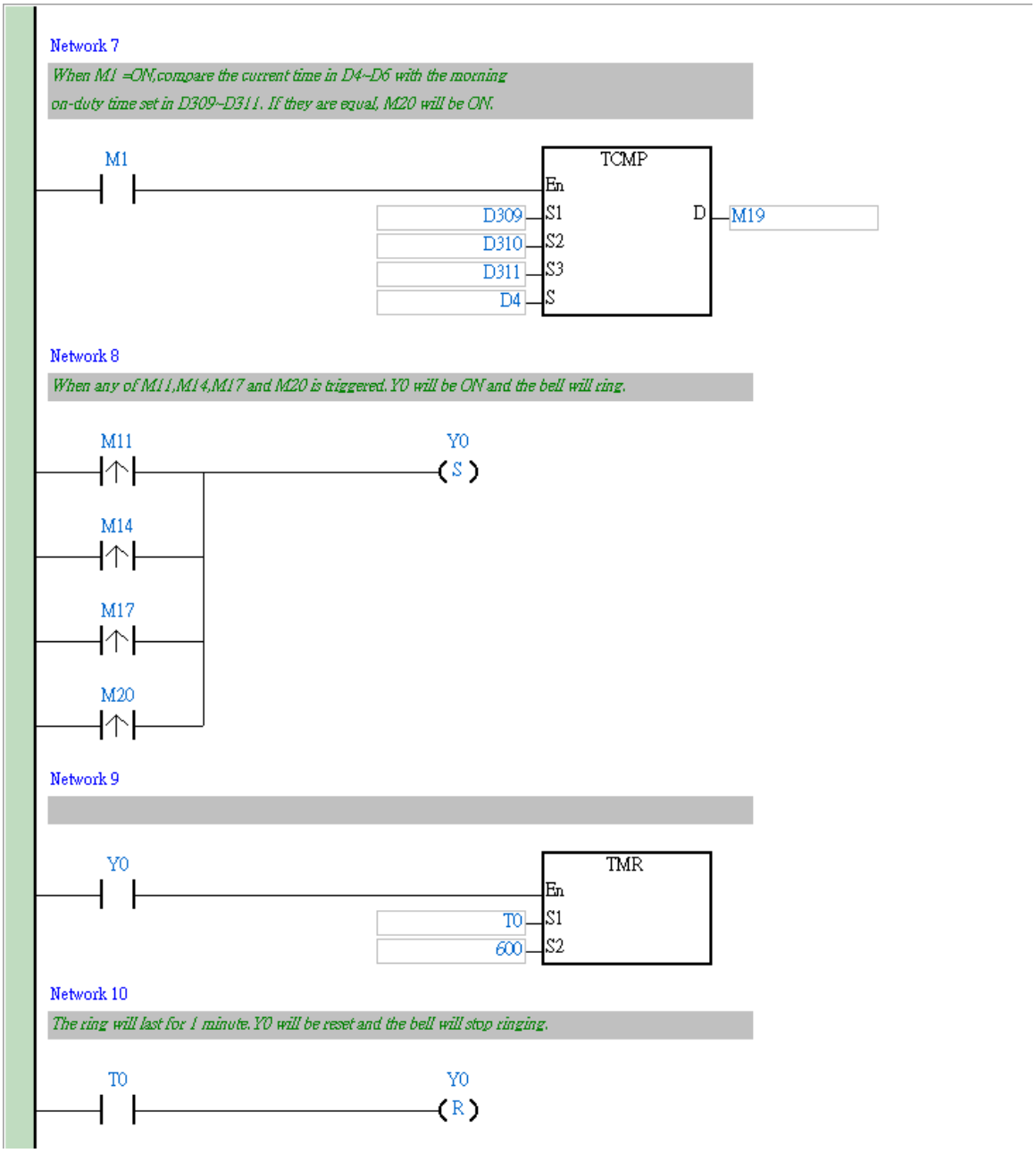
Devices:

Device	Function
M0	Adjust current time
M1	Start the office bell
Y0	Ring the office bell
D0~D6	Store the read Real Time Clock (RTC) data
D200~D206	Store the RTC data to be written in PLC
D300~D311	Store the on-duty / off-duty time

Control Program:



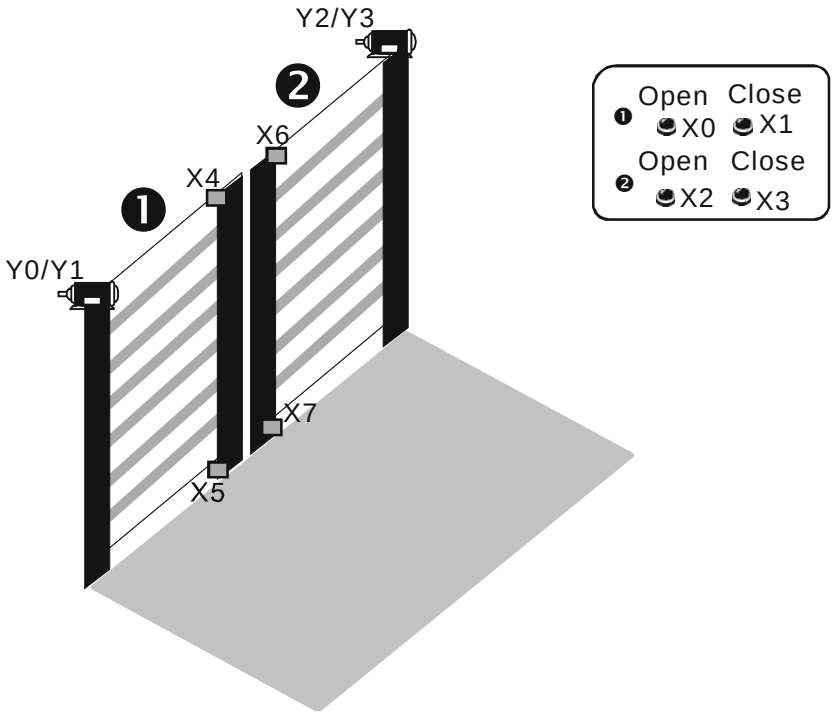

Network 4
When M1 =ON,compare the current time in D4~D6 with the morning
on-duty time set in D300~D302. If they are equal, M11 will be ON.
M1
TCMP
En
D300
S1
D
M10
D301
S2
D302
S3
D4
S
Network 5
When M1 =ON,compare the current time in D4~D6 with the morning
on-duty time set in D303~D305. If they are equal, M14 will be ON.
M1
TCMP
En
D303
S1
D
M13
D304
S2
D305
S3
D4
S
Network 6
When M1 =ON,compare the current time in D4~D6 with the morning
on-duty time set in D306~D308. If they are equal, M17 will be ON.
M1
TCMP
En
D306
S1
D
M16
D307
S2
D308
S3
D4
S



Program Description:

- The value in D200~D206 and D300~D311 can be set by WPLSoft or HMI.
- To avoid the execution error of TWR instruction, the program uses [FMOV K1 D200 K4] instruction at the beginning. This program operates only the data of Hour/Minute/Second in D204~D206 but not the data of Year/Day/Month/Date in D200~D203. For TWR instruction, the setting range: 00~99 for Year, 1~7 for Day(Mon ~Sun), 1~12 for Month and 1~31 for Date. If the values in D200~D203 are out of the above range, the program will regard it as an operation error and the instruction will not be executed and the Hour/Minute/Second data can't be written either. Therefore, the program sets the Year/Week/Month/Day to K1 to fit the above range and makes sure TWR instruction can be executed for writing in Hour/Minute/Second data.
- D4, D5 and D6 store the Hour/Minute/Second of the current time read form RTC.

12.2 TRD/TZCP - Control of Warehouse Automatic Door



Control Purpose:

- The opening hours of the warehouse are from 7:30~22:30, so the door should open at 7:30 and close at 22:30 automatically.
- There are 2 sets of control buttons(Open/Close) in the control room for opening or closing the door manually for special situations.

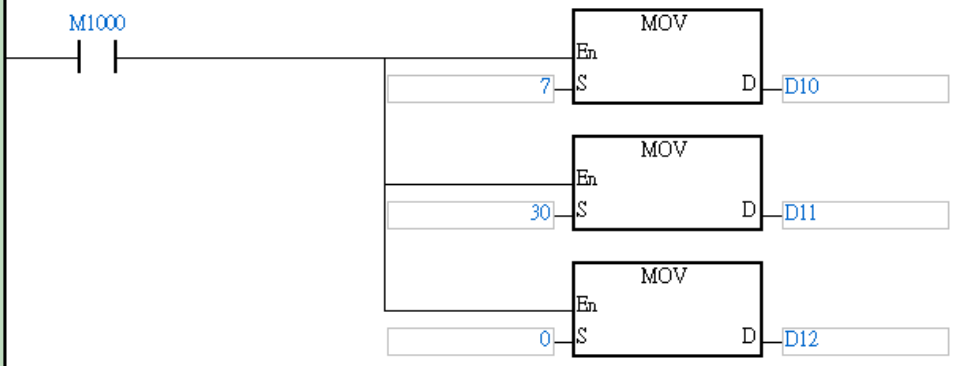
Devices:

Device	Function
X0	Manual open button for door 1 .
X1	Manual close button for door 1
X2	Manual open button for door 2
X3	Manual close button for door 2
X4	Upper sensor of door 1.
X5	Lower sensor of door 1.
X6	Upper sensor of door 2.
X7	Lower sensor of door 2.
Y0	Motor of door 1 run forward to open the door
Y1	Motor of door 1 run reverse to close the door
Y2	Motor of door 2 run forward to open the door
Y3	Motor of door 2 run reverse to close the door

Control Program:

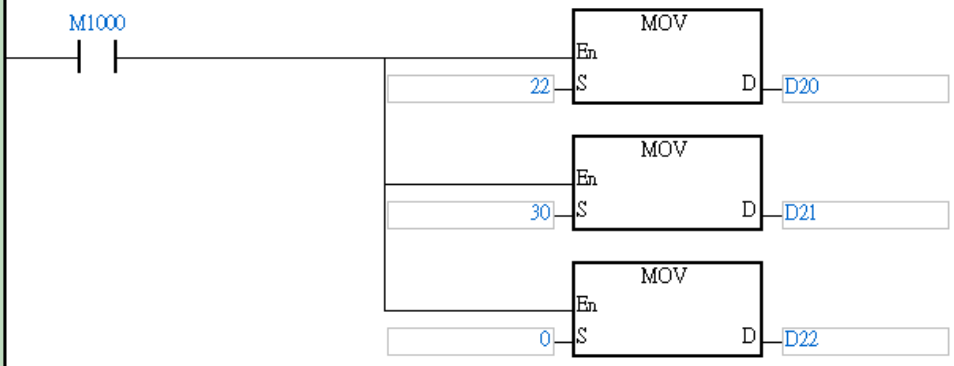
Network 1

Set the lower limit of warehouse opening hours as 7:30



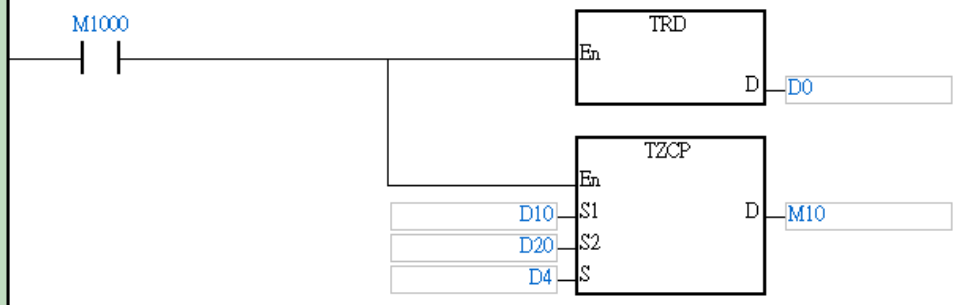
Network 2

Set the upper limit of warehouse opening hours as 22:30



Network 3

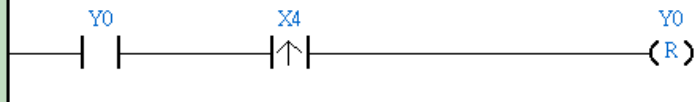
Read the RTC of PLC. And store the data in D0~D6. D4~D6 store Hour/Min/Sec data
Time zone compare the set time with the read current tiome

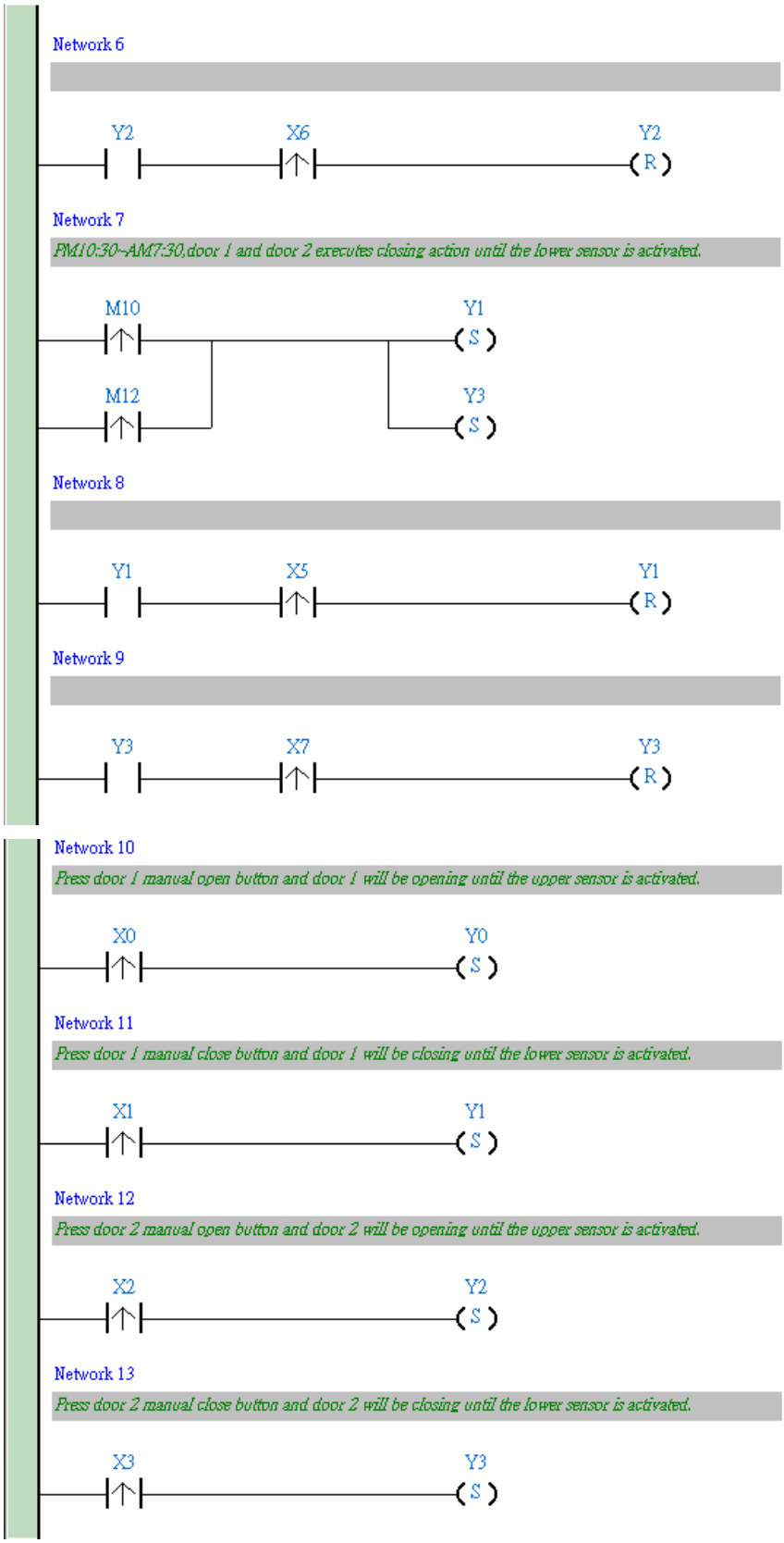


Network 4

AM7:30~PM10:30,door 1 and door 2 executes opening action until the upper sensor is activate.

Network 5





Program Description:

- The program performs control of warehouse automatic door by a RTC Time Zone Compare instruction (TZCP). Through the Time Read instruction (TRD), the current time in RTC can be read in D0~D6. D4, D5 and D6 store the Hour/Min/Sec data.

- When Y0 = ON, the motor of door 1will run forward to execute opening action until upper sensor is activated (X4 = ON).
- When Y1 = ON, the motor of door 1 will run reverse to execute closing action until the lower sensor in activated (X5 = ON).
- The opening and closing actions of door 2 are the same with that of door 1.
- For some special situations, the opening and closing actions of door 1 and door 2 can also be performed by pressing manual open buttons (X0/X2) and manual close buttons (X1/X3) in the control room.

12.3 HOUR - Control of Switching Motors after a Long Time Running

Control Purpose:

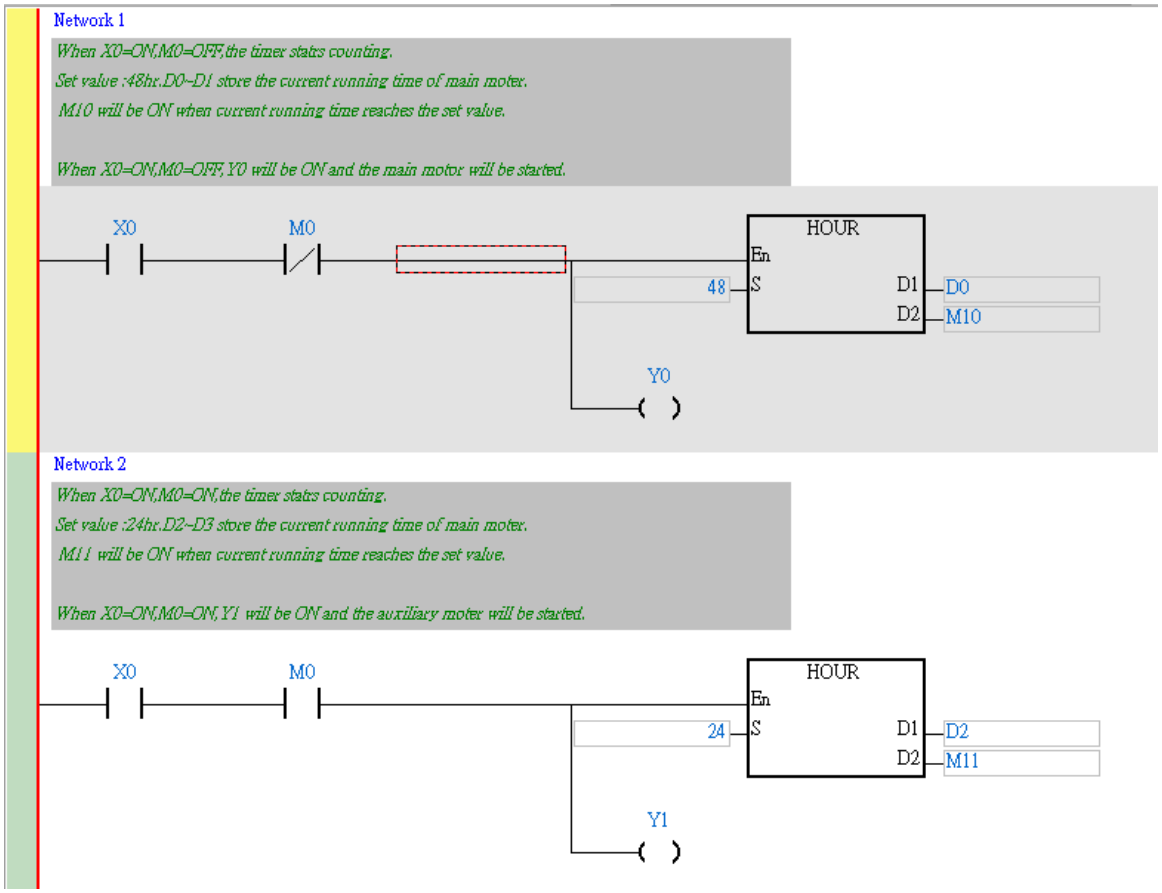
- Controlling the automatic motor switching between main motor and auxiliary motor.

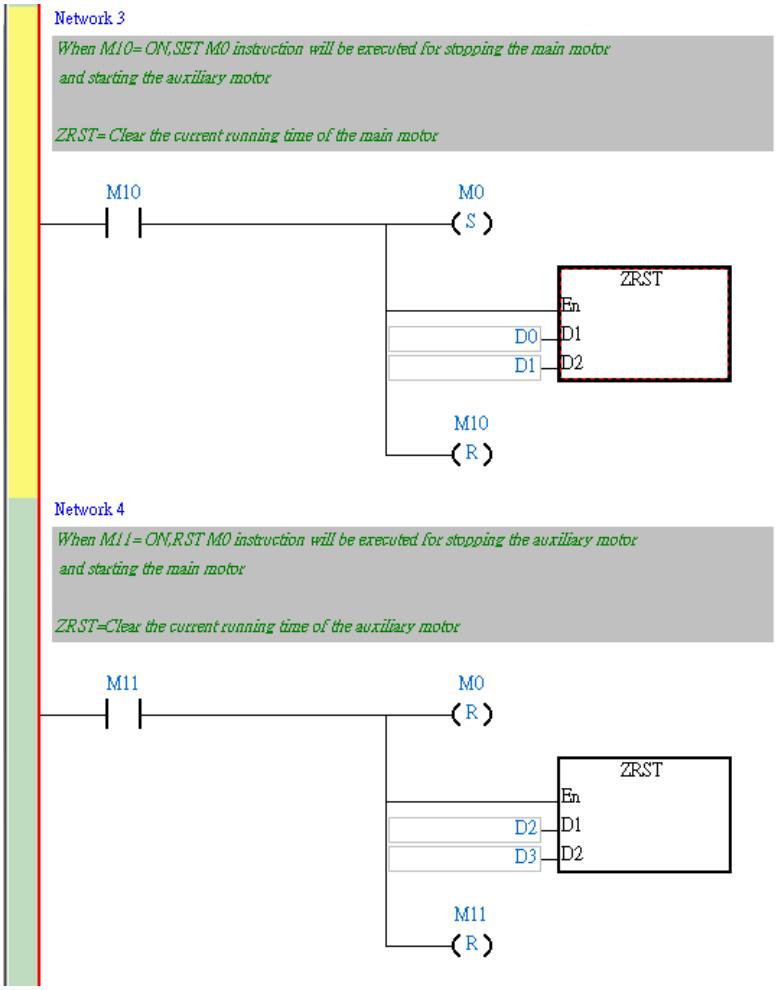
In some special applications, we use several motors running by turns to protect each motor and extend their service life. In this program, there are 2 motors running by turns in the cycle: 2 days (48 hours) for the main motor, then 1 day (24 hours) for the auxiliary motor.

Devices:

Device	Function
X0	Start/Stop of the motor
Y0	Starting the main motor
Y1	Starting the auxiliary motor
M10	M10 = ON when set time of the main motor reached
M11	M11 = ON when set time of the auxiliary motor reached
D0~D1	Storing the current running time of the main motor
D2~D3	Storing the current running time of the auxiliary motor

Control Program:



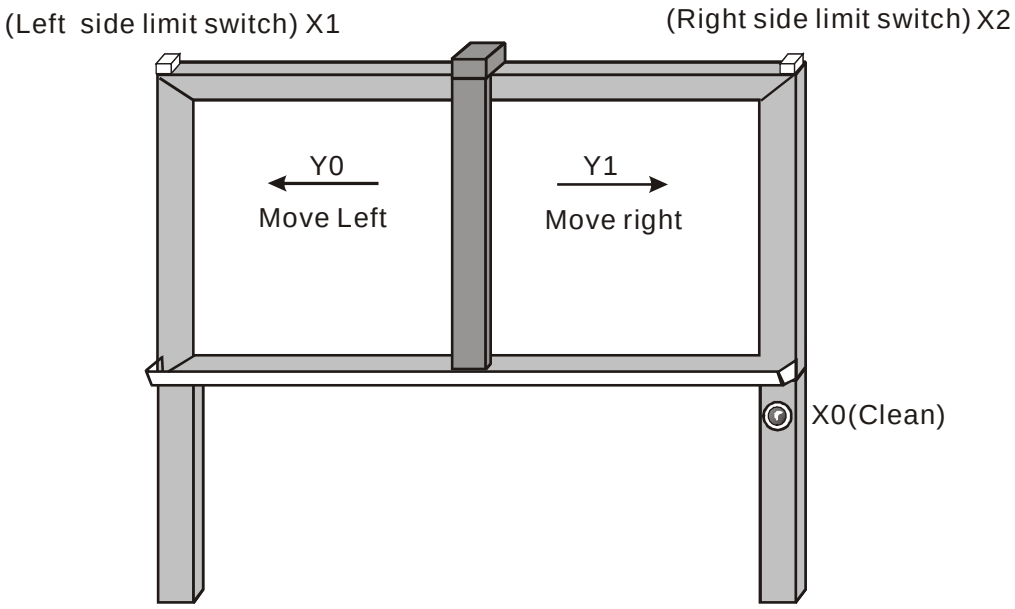


Program Description:

- When X0 = OFF, Y0 and Y1 = OFF, both main / auxiliary motor will not run.
- When X0 = ON, the running status of Y0 (main motor) and Y1 (aux. motor) will be decided by the ON/OFF status of M0 so as to control the two motors running in turns.
- For main motor, D0 and D1 record the current time measured in hour and the current time that is less than an hour (0~3599s). For auxiliary motor, D2 and D3 record the current time measured in hour and the current time that is less than an hour (0~3599s).
- 16-bit instruction supports the set time up to 32,767 hours and 32-bit instruction supports the set time up to 2,147,483,647 hours.
- The timer will go on timing after the set time is reached. For restart timing, users need to clear the current time stored in D0~D3 and reset flag M10 and M11.

MEMO

13.1. ALT - Auto Blackboard Cleaner



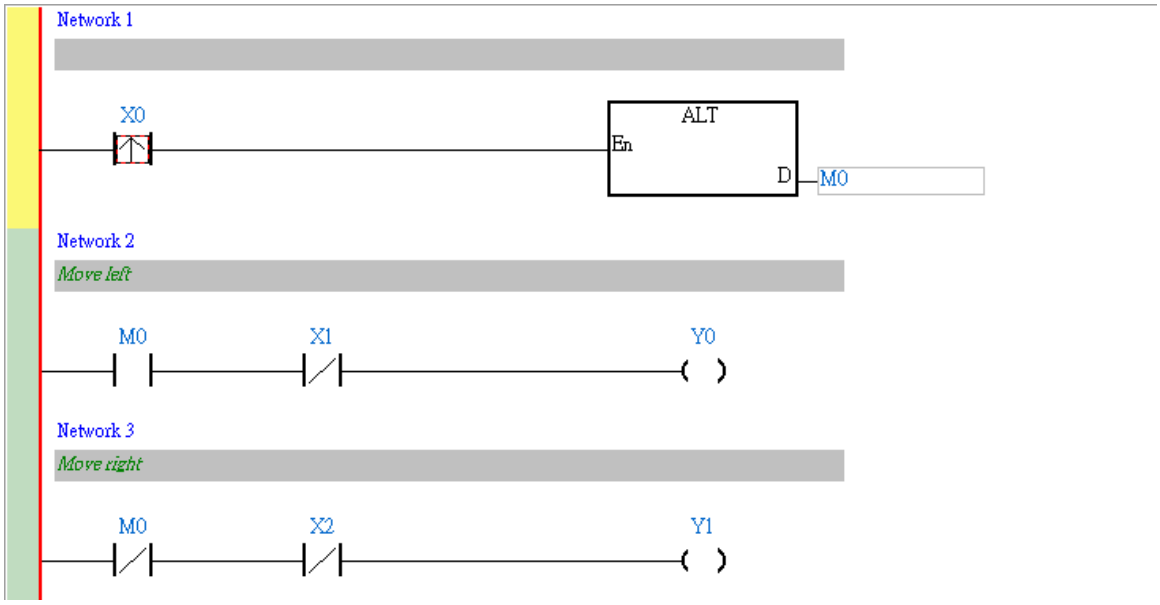
Control Purpose:

- Controlling the auto cleaner to move left / move right when Clean is pressed.
- When the auto cleaner touches the limit switches of left side or right side, the cleaner will stop. Next time when Clean is pressed again, the cleaner will move to the opposite direction.

Devices:

Device	Function
X0	X0 = ON when Clean is pressed.
X1	X1 = ON when left side limit switch is touched.
X2	X2 = ON when right side limit switch is touched.
Y0	Move left
Y1	Move right

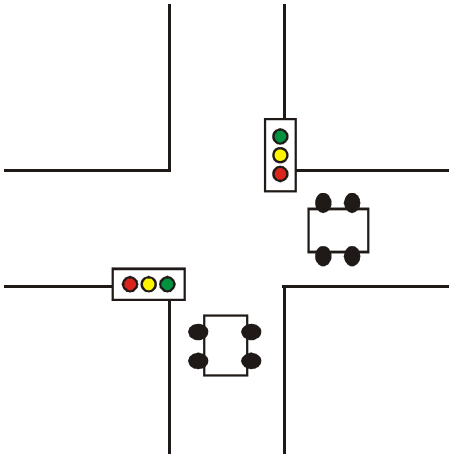
Control Program:

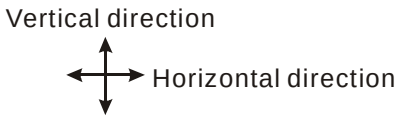


Program Description:

- When Clean is pressed, X0 will be activated one time to execute ALT instruction. M0 will be ON, the cleaner will move left until it touches the left side limit switch. X1 = ON, and Y0 will be OFF. The cleaner will stop working.
- When Clean is pressed again, X0 will be activated again to switch the ON status of M0 to be OFF. Therefore, Y1 will be ON and the cleaner will move right until it touches the right side limit switch. X2 = ON, and Y1 will be OFF. The cleaner will stop at the current position.
- Wherever the location of the cleaner is, the cleaner will move to the opposite direction every time when Clean is pressed.

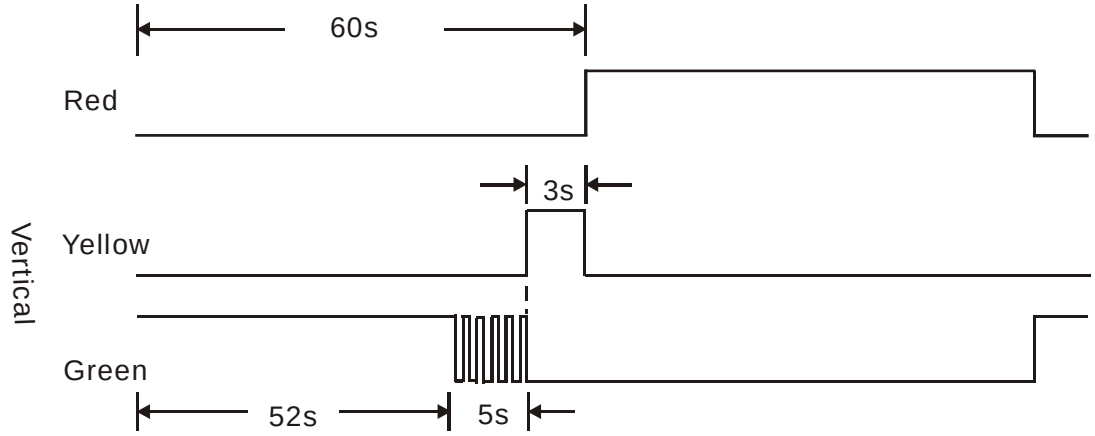
13.2. INCD - Traffic Lights Control (Incremental Drum Sequencer)

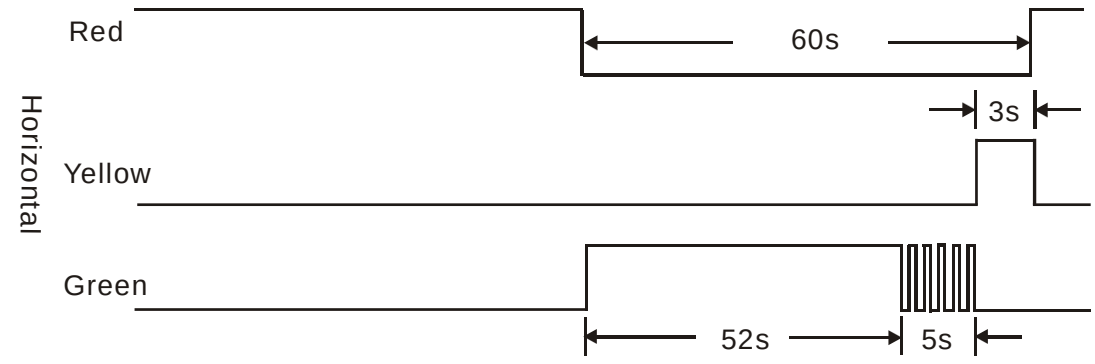




Control Purpose:

- Performing traffic lights sequence control at the intersection. In both vertical and horizontal directions, the traffic lights are set as the following sequence: Red lights ON for 60s , Yellow lights ON for 3s and green lights ON for 52s and green lights flashing for 5s.
- The timing diagrams are as follows:

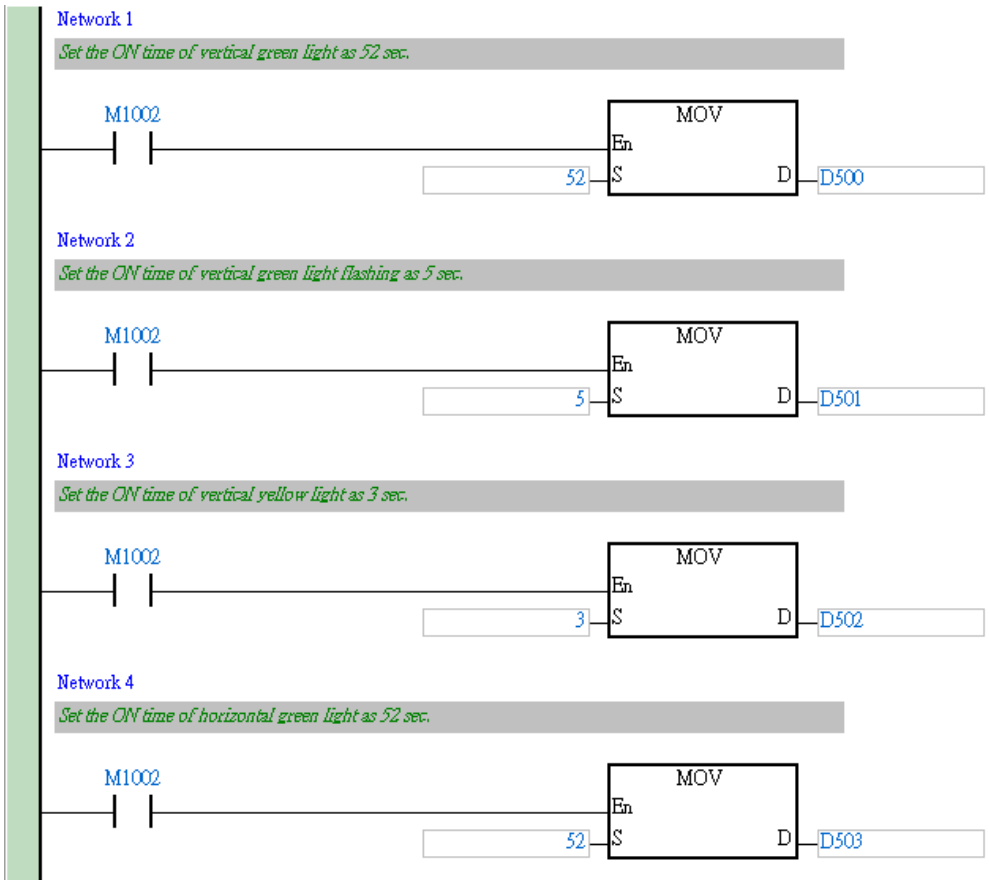


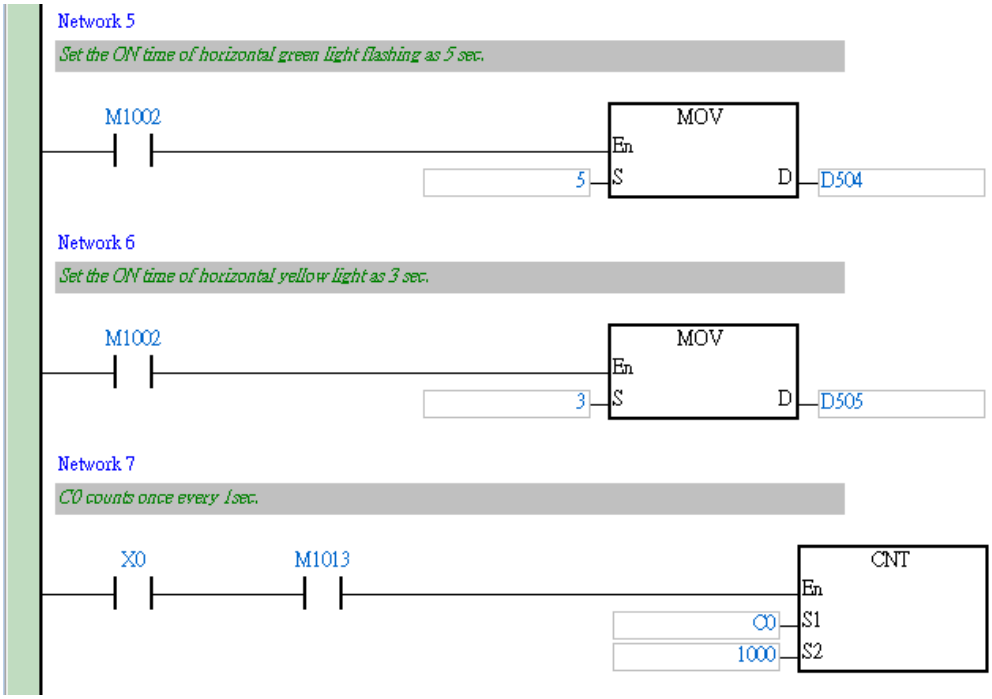


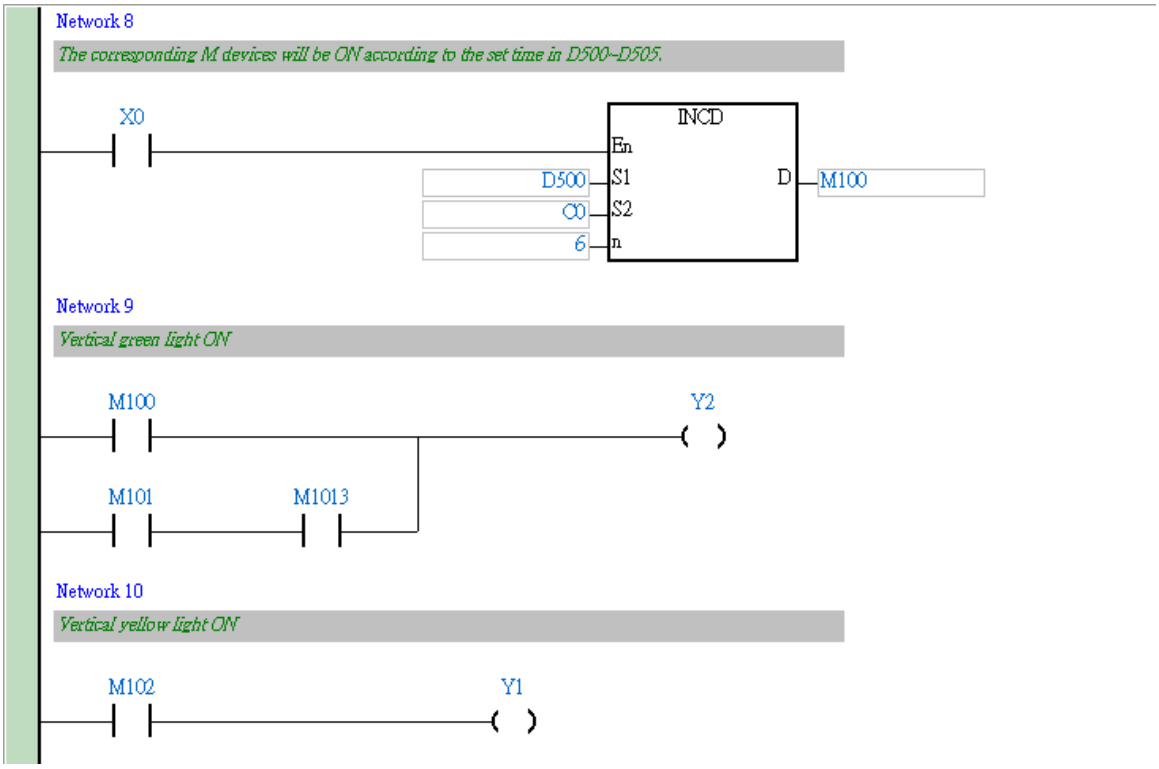
Devices:

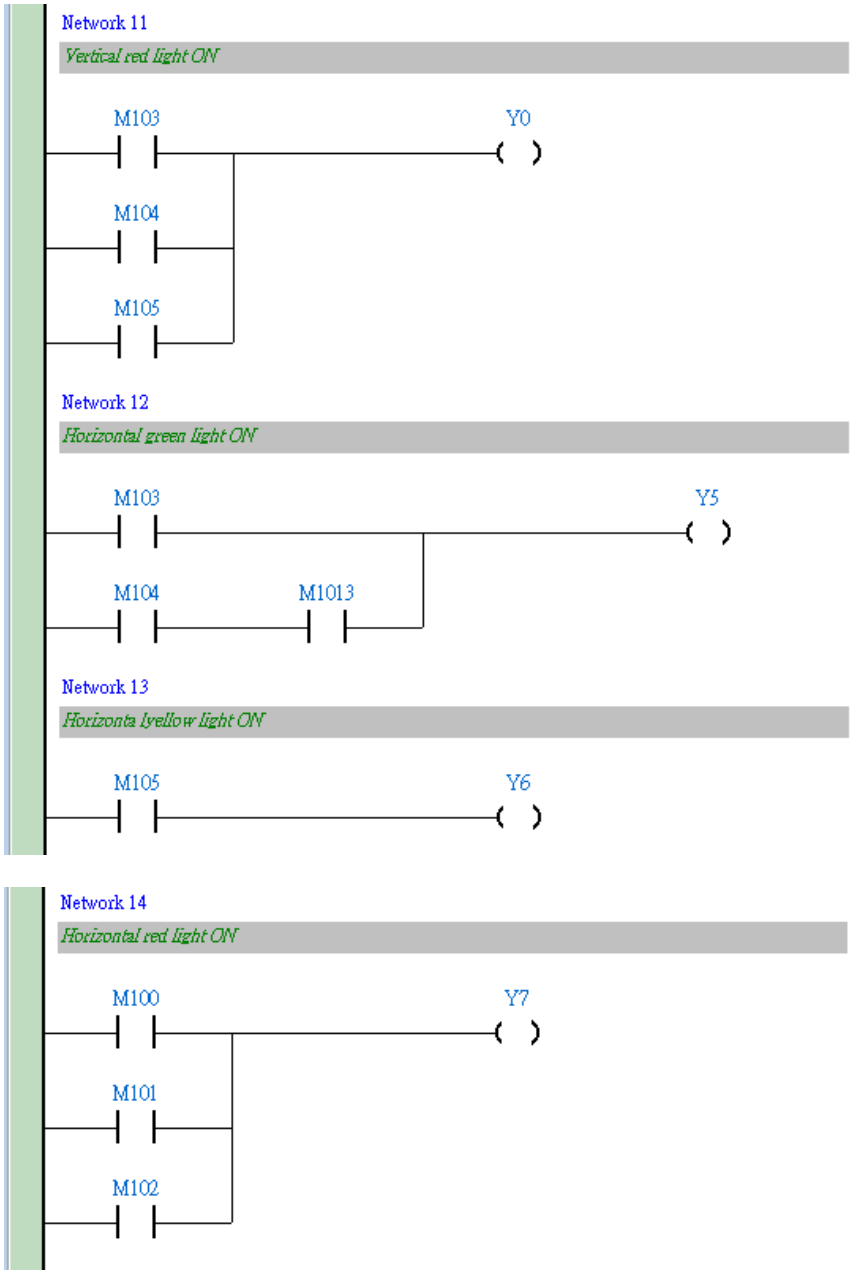
Device	Function
X1	Switch of the traffic lights control program
Y0	Red light (vertical)
Y1	Yellow light (vertical)
Y2	Green light (vertical)
Y5	Red light (horizontal)
Y6	Yellow light (horizontal)
Y7	Green light (horizontal)

Control Program:




Network 5
Set the ON time of horizontal green light flashing as 5 sec.
M1002
MOV
En
5
S
D
D504
Network 6
Set the ON time of horizontal yellow light as 3 sec.
M1002
MOV
En
3
S
D
D505
Network 7
C0 counts once every 1sec.
X0
M1013
CNT
En
C0
S1
1000
S2


Network 8
The corresponding M devices will be ON according to the set time in D500~D505.
X0
INCD
En
D500
S1
D
M100
C0
S2
6
n
Network 9
Vertical green light ON
M100
Y2
M101
M1013
Network 10
Vertical yellow light ON
M102
Y1



Program Description:

- "Incremental Drum Sequencer" is a concept performing repetitive step-by-step process. In this program, when present value in counter C0 reaches the set value in D 500~D505, the corresponding output devices M100~M105 will be ON and counter C0 will be reset for executing next step.
- In order to simplify the program, INCD (Incremental Drum Sequencer) instruction is used here to control the traffic lights.
- Before the execution of INCD instruction, use MOV instruction to write all the set values into D500 ~ D505 in advance.

Set value	Output device	Set value	Output device
D500 = 52	M100	D503 = 52	M103

D501 = 5	M101	D504 = 5	M104
D502 = 3	M102	D505 = 3	M105

13.3. ABSD - Adding Materials in Different Intervals (Absolute Drum Sequencer)

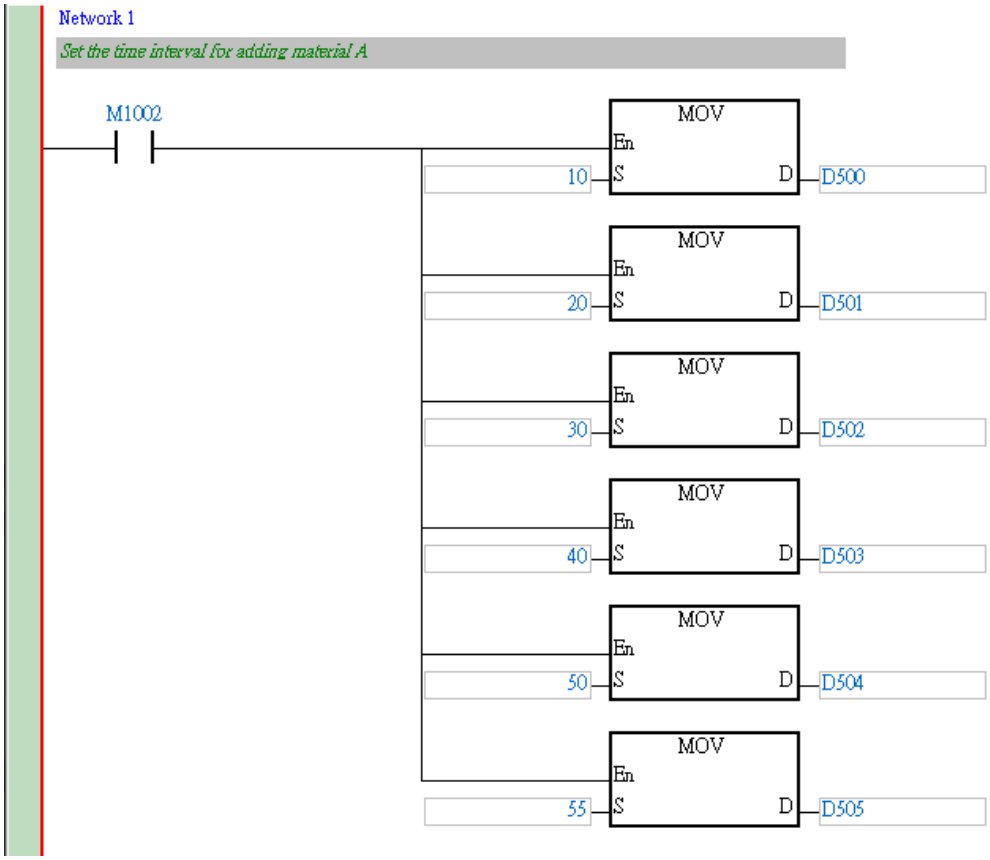
Control Purpose:

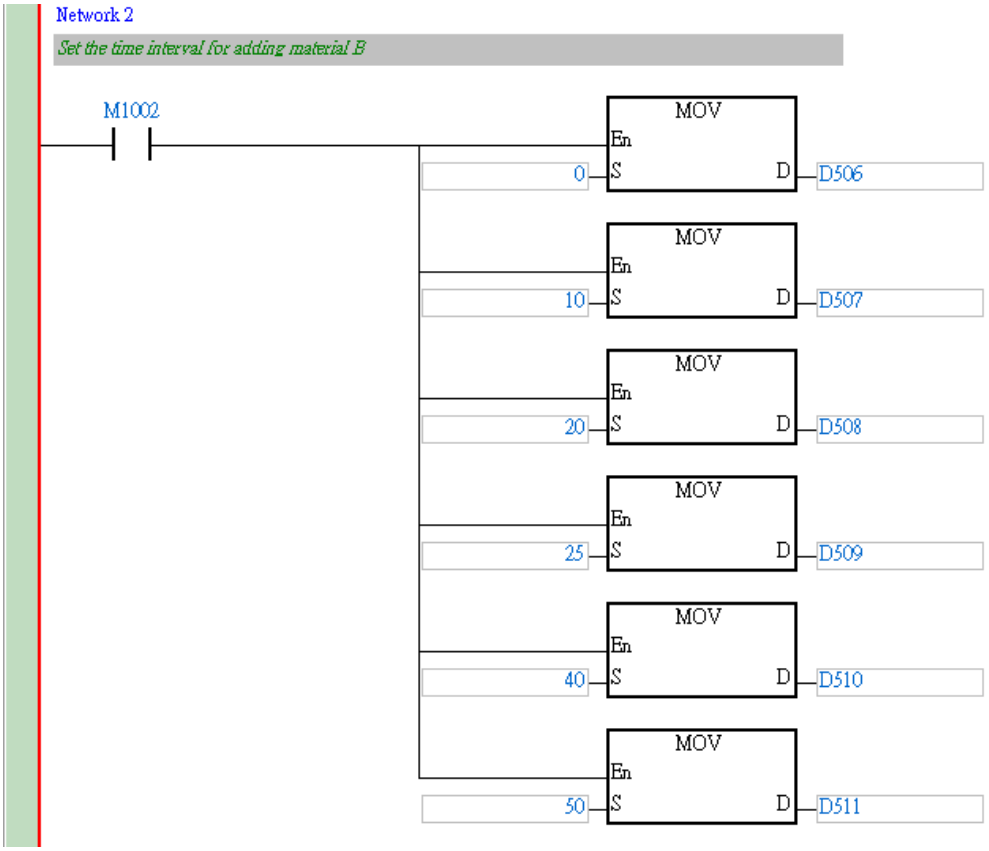
- Adding A, B, C materials for production during specified intervals within 60 sec.
- Adding material A in the intervals of 10s~20s, 30s~40s and 50~55s, material B in the interval of 0~10s, 20s~25s and 40s~50s, and material C in the interval of 20s~25s, 30s~35s and 40s~45s.

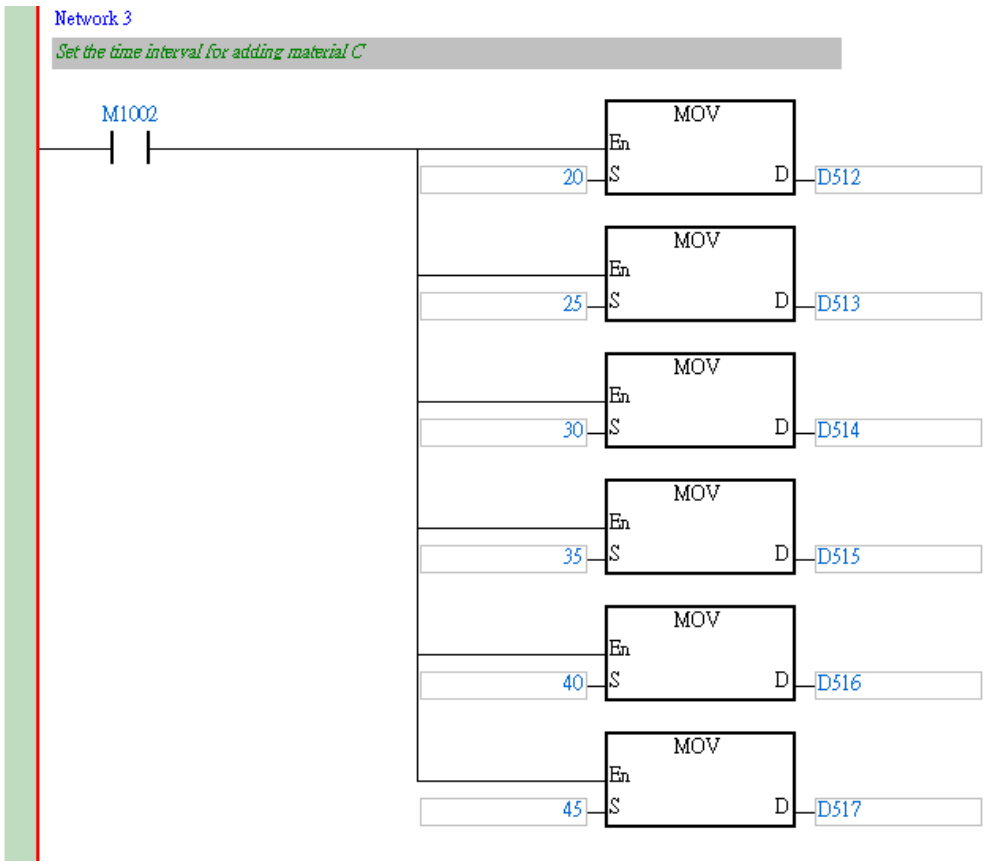
Devices:

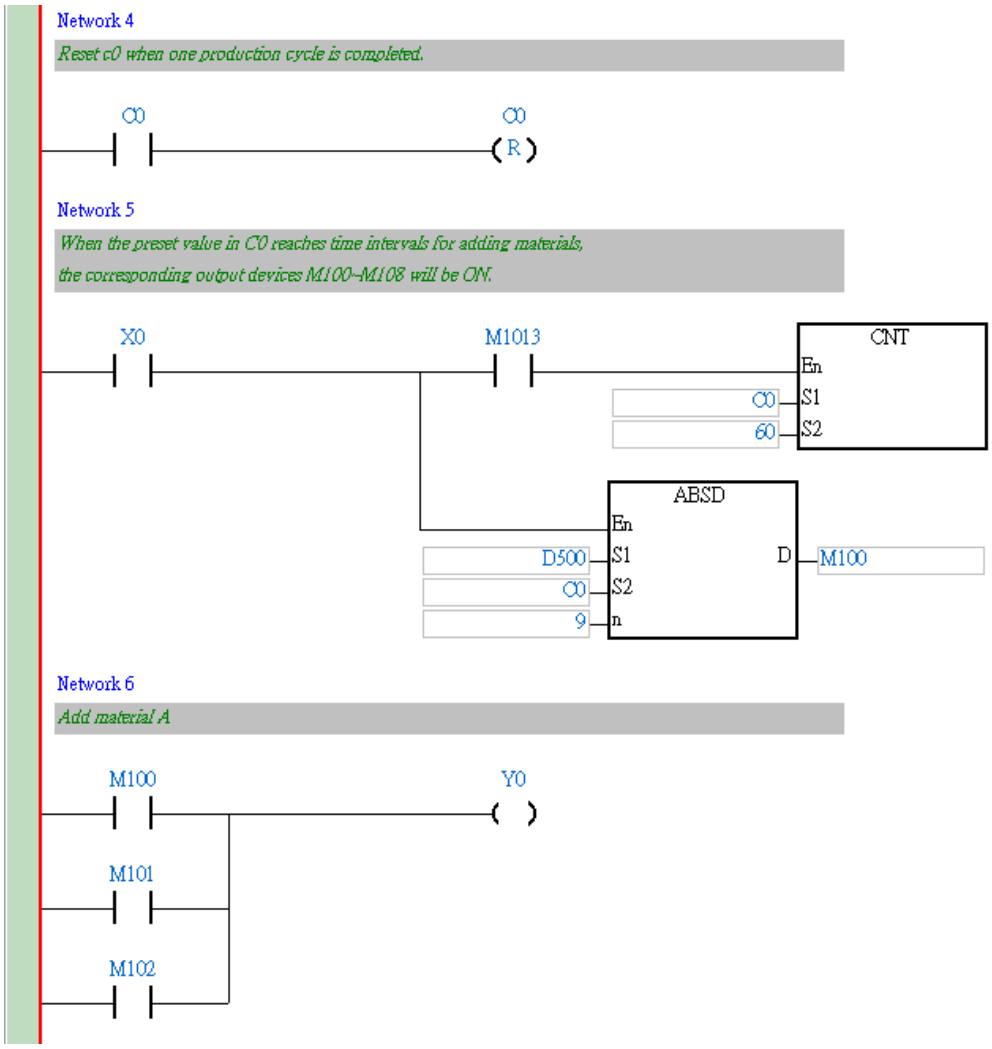
Device	Function
X0	Switch of material adding control program
Y0	Adding material A
Y1	Adding material B
Y2	Adding material C

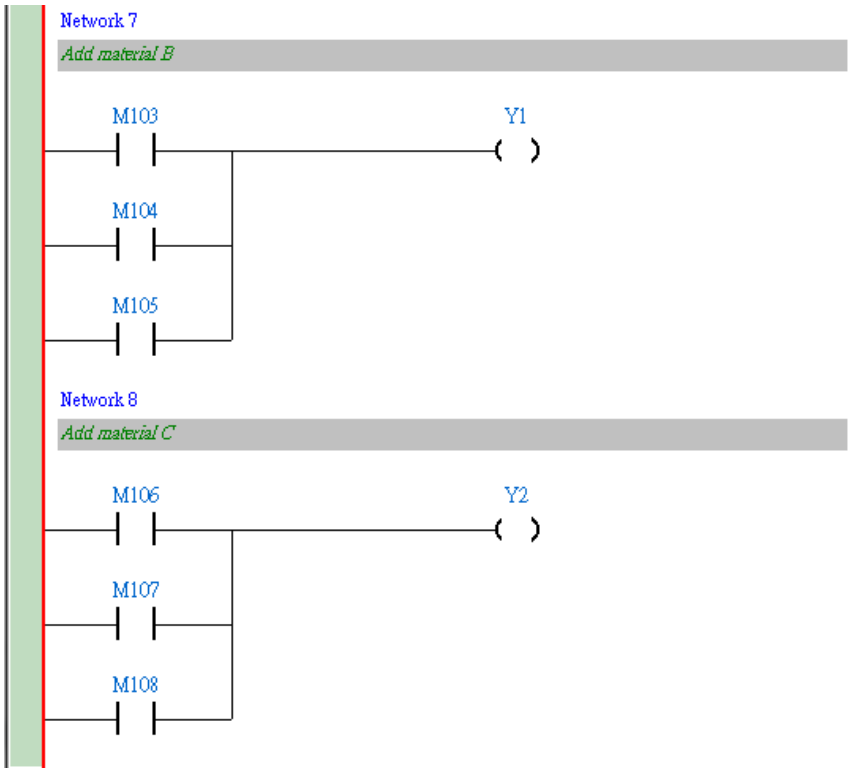
Control Program:




Network 2
Set the time interval for adding material B
M1002
MOV
En
S
D
0
D506
MOV
En
S
D
10
D507
MOV
En
S
D
20
D508
MOV
En
S
D
25
D509
MOV
En
S
D
40
D510
MOV
En
S
D
50
D511


Network 3
Set the time interval for adding material C
M1002
MOV
En
S
D
20
D512
MOV
En
S
D
25
D513
MOV
En
S
D
30
D514
MOV
En
S
D
35
D515
MOV
En
S
D
40
D516
MOV
En
S
D
45
D517


Network 4
Reset c0 when one production cycle is completed.
C0
C0
R
Network 5
When the preset value in C0 reaches time intervals for adding materials,
the corresponding output devices M100~M108 will be ON.
X0
M1013
CNT
En
C0
S1
60
S2
ABSD
En
D500
S1
D
M100
C0
S2
9
n
Network 6
Add material A
M100
Y0
M101
M102


Network 7
Add material B
M103
Y1
M104
M105
Network 8
Add material C
M106
Y2
M107
M108

Program Description:

- "Absolute Drum Sequencer" is a concept performing repetitive process consists of multiple steps which could be executed in the same interval. In this program, when present value in counter C0 reaches the set value in D 500~D517, the corresponding output devices M100~M108 will be ON to execute specified actions within single interval.
- Before the execution of ABSD instruction, use MOV instruction to write all the set values into D500 ~ D517 in advance.

Set value	Output device	Set value	Output device
D500 = 10	M100	D509 = 25	M104
D501 = 20	M100	D510 = 40	M105
D502 = 30	M101	D511 = 50	M105
D503 = 40	M101	D512 = 20	M106
D504 = 50	M102	D513 = 25	M106
D505 = 55	M102	D514 = 30	M107
D506 = 0	M103	D515 = 35	M107
D507 = 10	M103	D516 = 40	M108
D508 = 20	M104	D517 = 45	M108

MEMO