Preface

Thank you for purchasing AP-14 Programmable Logic Controller (PLC), which means you have got a comprehensive information of features and facilities of this product. But for your better use we kindly advise you to read the manual carefully before installation.

Attention

(1) The patent and related documents for the equipment belong to ARRAY ELECTRONIC CO., LTD and are not allowed to be copied or reprinted by the third party without permission.
(2) The manufacturer remains the right of designing and improving the equipment without notice.
(3) Please oblige us with your valuable comments if there is some defect in the manual, we'll write them in the next edition.

ARRAY ELECTRONIC CO.,LTD

PART ONE

AP-14M PLC

The new type of AP-14M Programmable logic controller (PLC) is especially designed for sophisticated industrial control. The simple and useful instructions ensure you to learn it easily within the short time.

Using traditional handheld programmer, user can edit and test PLC by single step. In addition, when the programming software of EASY2000 (developed for PLC) is in available, you can edit/read/write programs, step PLC and simulation by communicating with personal computer.

The compact size of AP-14 PLC is preciously designed for being assembled in machine for easy installation and remove.

Chapter 1 General Description of AP-14

1.1 Characteristics of AP-14

(1) The super-mini size of AP-14 is available to be assembled in the machine

The compact size of AP-14 is especially designed for being assembled in machine and the fixed screw terminal panel for easy installation and remove.

(2) Sufficient capacity of program memory

240-step program capacity provides an effective solution to the sophisticated control, compared with the traditional relays.

(3) Needn't the battery

Using EEPROM (can write 10,000,000 times), programming memory can restore the original information without back-up battery in event of power supply failure.

(4) The simplest instructions for easy learning and using

The simple and useful instructions ensure to use AP-14 easy and help you to save time and efforts.

(5) Provide programming software

Provide editing software running on compatible personal computer to program, edit, debug, simulate, restore, print, check etc.

1.2 Precautions of Operation

1.2.1 Fix the Screw Tightly and Connect to the Cable Contact

- Make sure to fix the screw tightly to avoid operation failure.
- Make sure to connect to the cable contact to avoid dropping.

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1.2.2 Guide Rail Mounting

- The rail is mounted to support DIN rail, so as it being mounted, please wedge the flexibal block of PLC bottom to the rail tightly, or the function of shock proof maybe weaken.

1.2.3 Do not Install Under the Following Environments:

- Direct sunlight or the temperature<-5¢Jσ >+55¢J
- Dust, conductive powder, corrosive gases, oil fogs or too much salt
- Condensation (due to sudden temperature variation) or the relative humidity<45% or >85%.
- Obvious vibration or shock on the product.

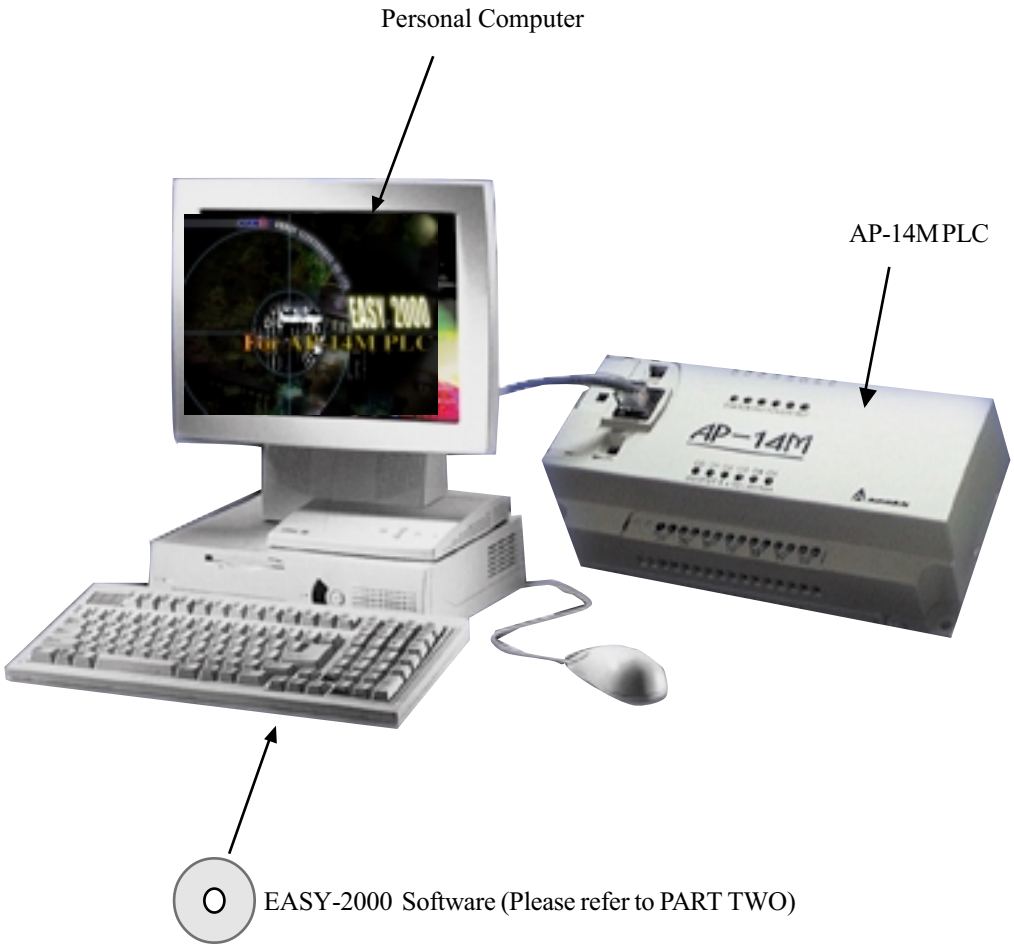
1.2.4 Available Power Supply (Please Refer to Chapter 2.5: Knob)

- Choose available A. C. power supply for PLC, adjust the power supply knob to proper version to energize.

1.3 Programming Tools

1.3.1 EASY2000 Programming Software

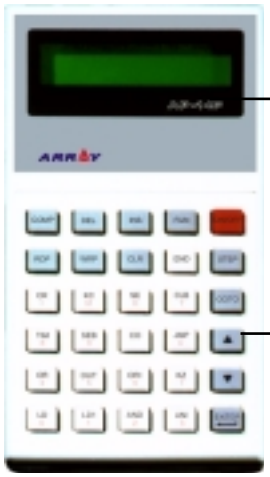
Program AP-14 on PC

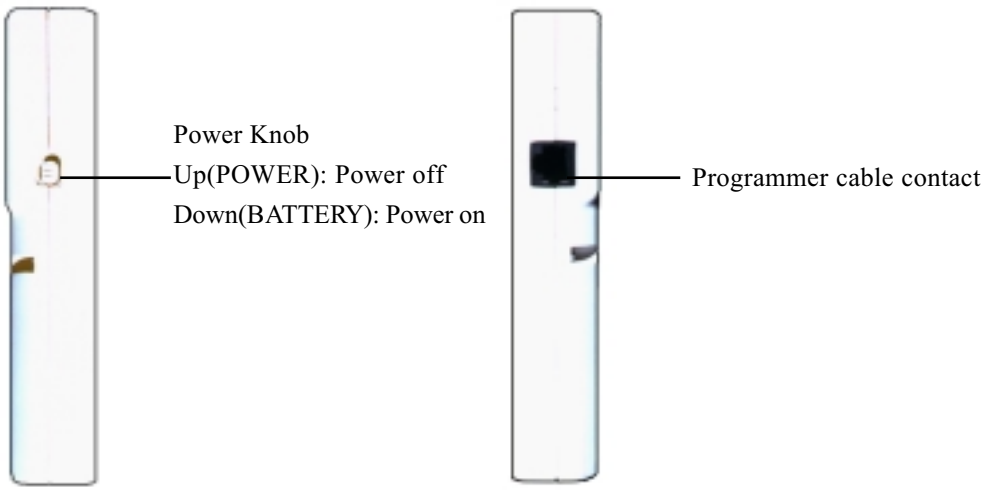


When EASY2000 is in available, you can program, communicate with AP-14M PLC, read/write programs, simulate or step PLC on Personal Computer.

1.3.2 Ap-14P Programmer

Combing portable AP-14P programmer and AP-14M PLC is available to programming edit, step test, and debug.





Chapter 2 Specification

2.1 General Specification

Item	Specification
Voltage	AC 110V/220V(50/60Hz single-phase)
Power	12W
Cooling method	Air cooling
Operating temperature	-5 ¢XC ~ +55 ¢XC
Ambient humidity	45~85%RH (non-condensing)
Storage temperature	-25 ¢XC ~ +75 ¢XC
Operating environment	no dust, no conductive powder, no corrosive
	gases, no oil fogs or no too much salt
Vibration-proof	16.7Hz, X, Y, Z direction 30min
Shock-proof	15G, X, Y, Z direction 3times
Sensor power supply	DC24V(±15%), max 50mA
Momentary interrupt of the power	Interrupt time < 0.5a.c. cycle, interval ¡Ù1s
Programmer	Handheld programmer, PC programming software(EASY2000)
Control panel indicator	ERR: red; others: Green
Installation method	direct installation (fixed with the screwdriver) or fixed with DIN rail
Program writing	≥ 10,000,000 times
Age of program storage	≥200 years
Electrostatic Discharge	6KV contact discharge (super class)
Pulse	2KV power wire
Insulation Resistance	≥100M£[

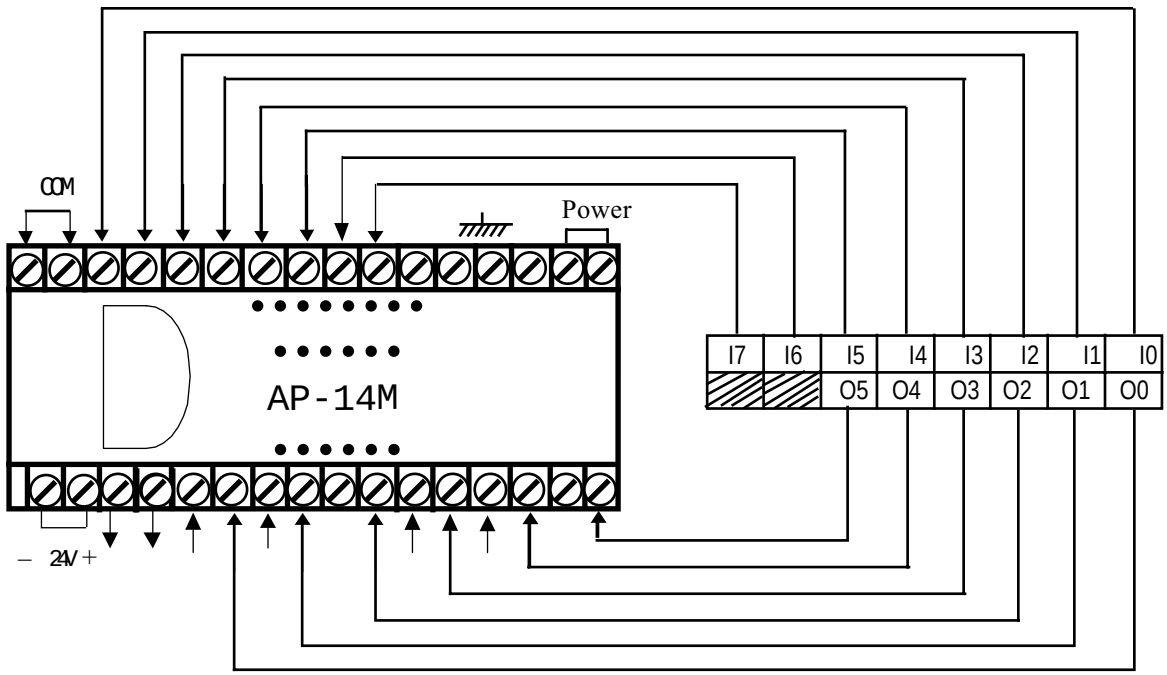
2.2 Function Specification

Item	Specification
Operating version	Program storage
Control method	Cyclic scan
Programming language	Special language for the controller(Ladder logic, Instruction list)
Program memory	EEPROM
Program memory capacity	240 steps
Instruction list	15 instructions(including Basic logic ,timer and counter instruction etc)
Input relay (I)	8 points I0~I7
Output relay (O)	6 points O0~O5
Internal relay (M)	32 points M00~M31
Timer (T)	4 points T0~T3 the presetting time range:[0.01~255s]
Counter(C)	4 point C0~C3 the presetting count range:[001~255T]
Self diagnostic module	program checking (Grammar, Circuit); WATCH DOG monitor

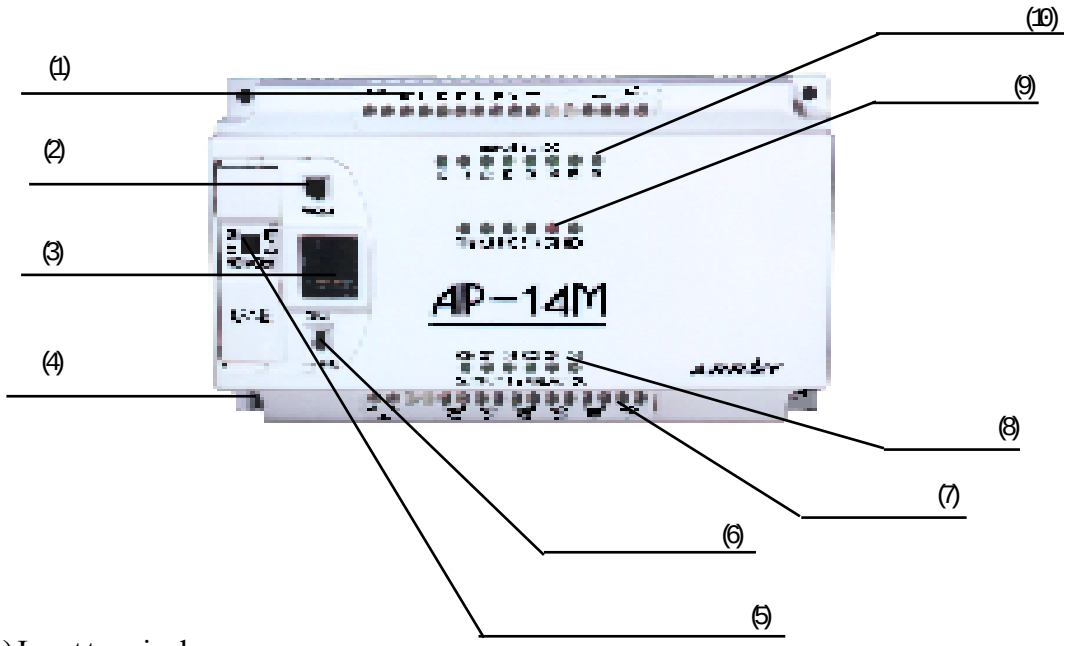
2.3 Input/Output Specification

Item		Input part	Output part
I/O version		photo coupler	relay output
I/O defined code		I0~I7	O0~O5
Input voltage		DC24V	
Single-point current			Resistance load:10A/point Inductance load:2A/point
Response time	ON/OFF	8mS	8mS
	OFF/ON	8mS	8mS
I/O signal indication		LED flashes green when input is active	LED flashes green when output is active
High level voltage range in input port (1)		DC10V~30V(typical value: 24V)	
Low level voltage range in input port (0)		DC0V~3V(typical value: 24V)	

2.4 Terminal Setting and Address Distributing



2.5 Name and Function of Sub-parts



(1) Input terminal row
Receive/refuse power and signal of input

(2) Program button
Press it when write the programs

(3) Program circuit contact
Combining programmer circuit is available to write programs

(4) Installation port
Available to install and fix screw

(5) Keeping memory knob
Choose MEMORY modules

(6) Normal/single-operation switch
Choose normal/single operation (combining with programmer/ EASY2000)

(7) Output terminal row
Receive/refuse the output signal

(8) Output display LED(green)
display output status, LED lights on when output is active

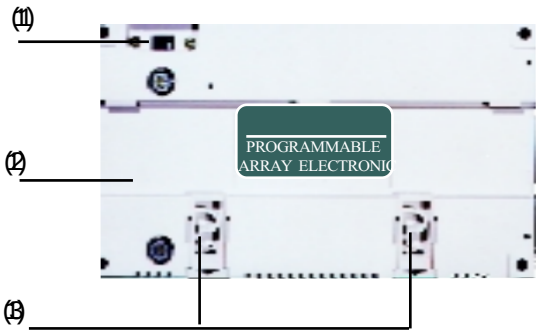
(9) Status display LED
POW(green): light on: normal power
RUN(green): light on: normal operate
PRO(green): light on: write/read programs
SIN(green): light on: single operate
ERR(red): light on: wrong operate
MEM(green): light on: choose MEMORY modules

(10) Input display LED(green)
Display input status, lights on when input is active

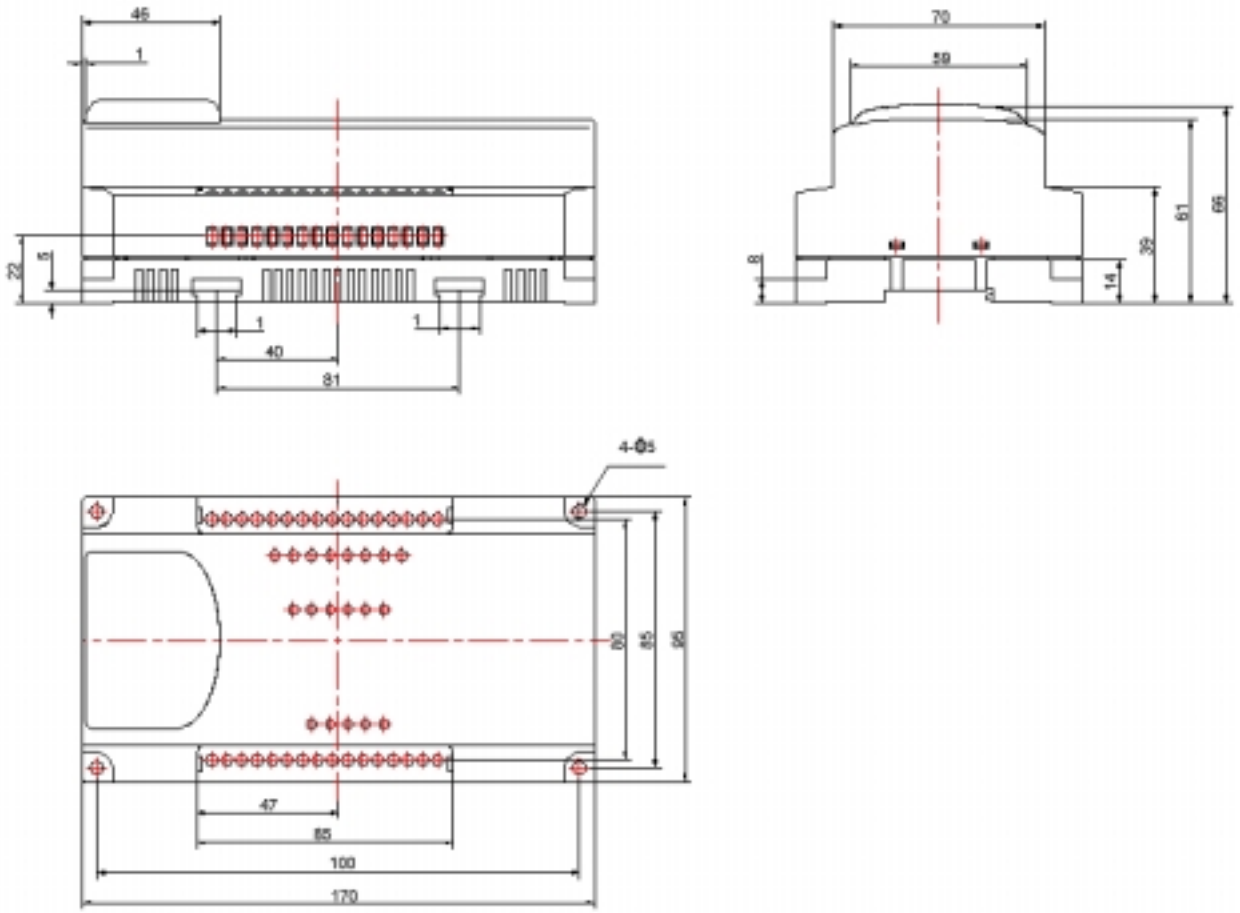
(11) Voltage knob
Choose 110V/220V

(12) DIN rail installation part
Install the rail which supportsDIN

(13) Slide module
tighten/loose DIN rail



2.6 Dimension and Setting Drawings



[MEASURE: mm]

Chapter 3 Structure and Description of AP-14 Hardware

3.1 The Devices Overview

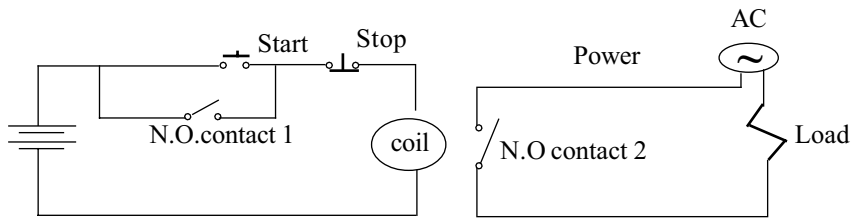
The designated capacity and the initial value are available for application as the following:

Device		Memory address range	Capacity	Initial value	Function
symbol	Name				
I	Input relay	I0-I7	8 points	the output data	Receive the input D.C signal
O	Output relay	O0-O5	6 points	OFF(keep the previous state with keeping module if power failure)	Operate out-load
M	Internal relay	M00-M31	32 points	Ditto	Control the midway status of I/O contact, timer, counter
T	Timer	T0-T3	4 points	Ditto	timer
C	Counter	C0-C3	4 points	Ditto	counter

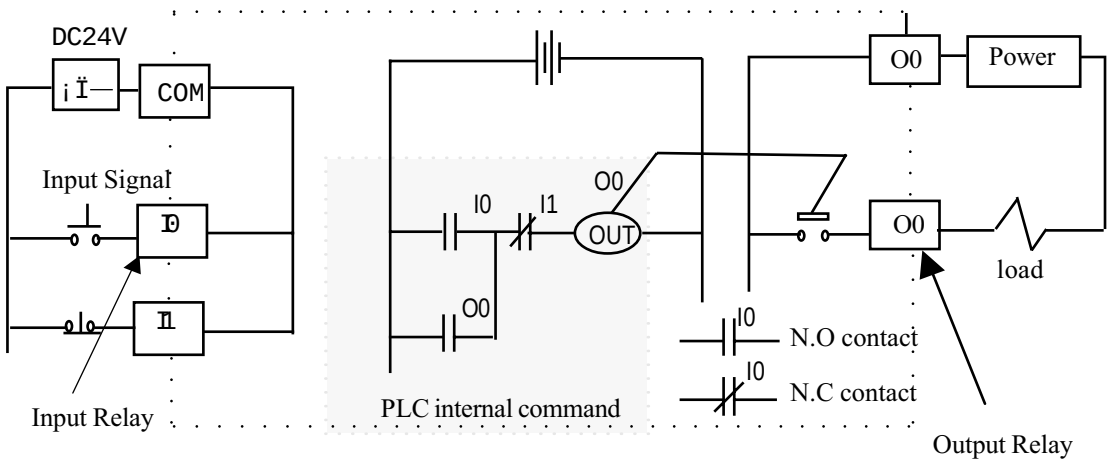
3.2 Description of Various Devices

3.2.1 Input/Output (I/O) Relay

- I stands for input relay, Symbol: 10-17, totaling 8, separately connecting positive power of inputting signal. COM is the public contact for I0-I7 negative terminals, connecting negative D.C.
- O stands for output relay, Symbol: O0-O5, totaling 6.
- Bus of programmable logic Controller is available to receive input signal of switch and send output signal to load.
- The normal open contact and normal close contact of I/O relay can be used without limit.
- Function of I/O relay is as the following diagram (3-1):



DIAGRAM(3-1)a: Self-keeping Circuit

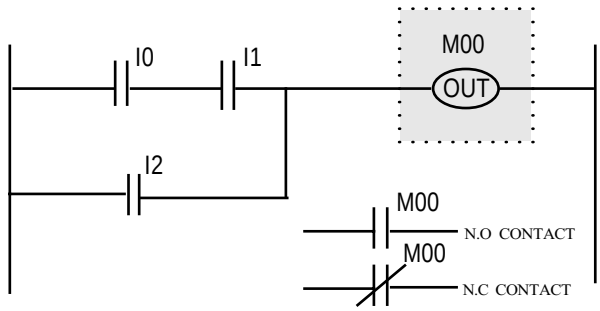


DIAGRAM(3-1)b: Self-keeping by PLC I/O Relay

3.2.2 Internal Relay

- M stands for internal relay, total 32 internal relays (M00-M31) are available. The N.O. contact of internal relay is off while the N.C.contact on when machine is powered. Please see diagram (3-2)
- Internal relay contact is unable to output directly

Please see diagram (3-2):

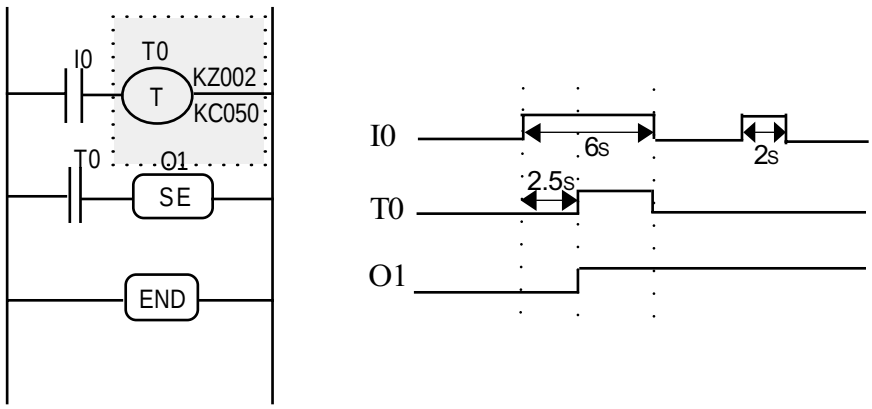


DIAGRAM(3-2)

- If want to change contact state, operate OUT, SE, CR, SEB, CLB etc commands.
- Any of PLC contact can operate internal relay, whose coil operates same as output relay.
- Internal relay is available to keep intermediate state as the internal contact.
- The N.O. contact and N. C. contact of the internal relay can be used without limit.

3.2.3 Timer

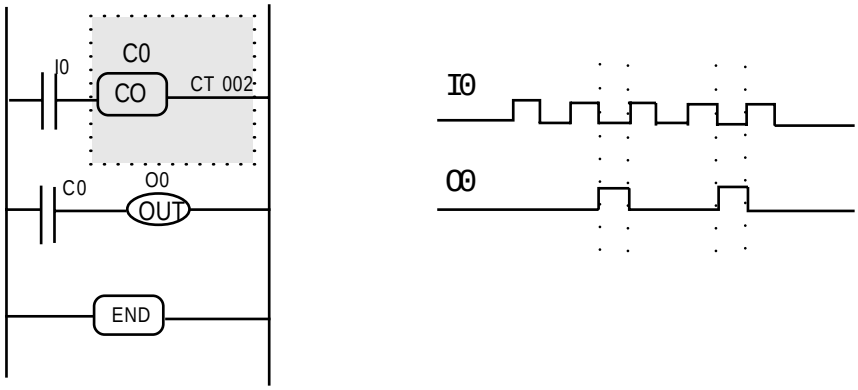
- Timer is the built-in time limit internal relay of the PLC. When it reaches the presetting data, the output contact operates.
- T stands for timer, 4 timers(T0-T3) are available and each with the time range of [0.01~255]seconds.
- Series-timers can time 4,228,250,625 seconds(1,174,514 hours).
- The N.O/N.C contact of timer can be used without limit.
- With memory module, PLC can keep timing status in event of power failure. (Refer to chapter 2.5 for more information about memory module)
- Timer operating diagram is as the following:



DIAGRAM(3-3)

3.2.4 Cycling Counter

- C stands for cycling counter, 4 counter (C0-C3)are equipped in PLC and each with a count range of [001~255]T.
- Series-counters can count 4,228,250,625 times.
- With memory module, PLC can automatically keep counting status in the event of power failure. (Refer to chapter 2.5 for more information about memory module)
- Cycling Counter operating diagram is as the following:

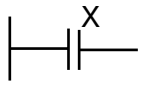
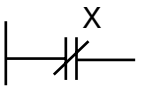
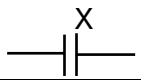
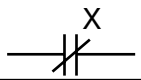
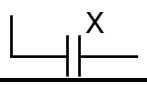
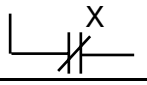
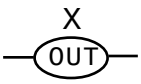
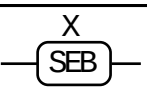
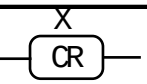
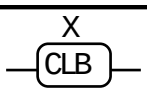
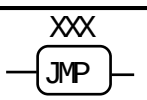
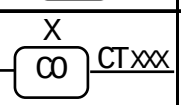


DIAGRAM(3-4)

Chapter 4 Instruction

4.1 Instruction Overview

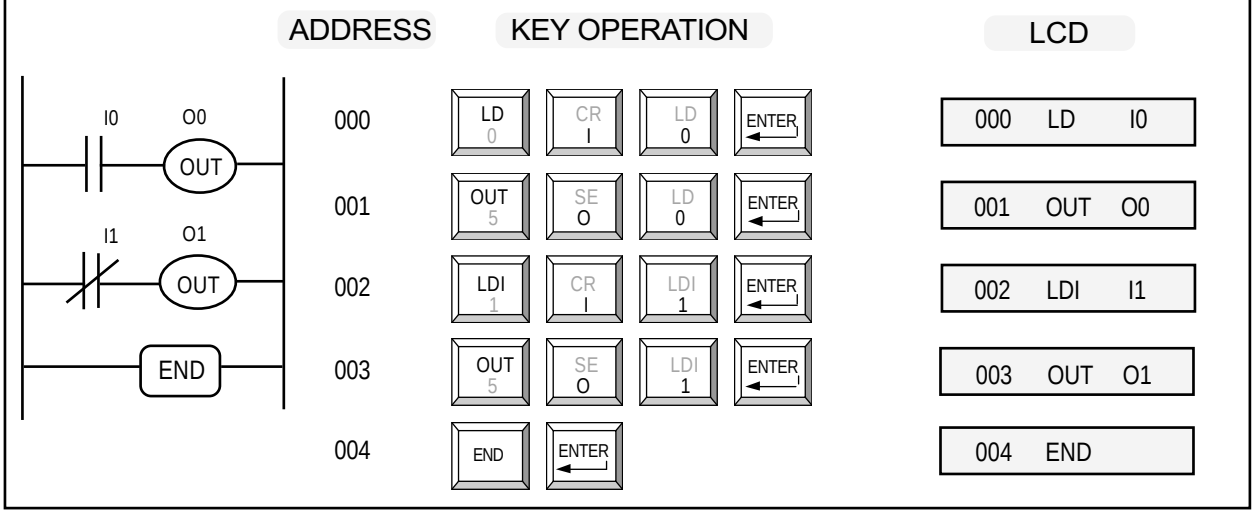
The following diagram shows the instructions of the AP-14 system, totaling 15.

command symbol	symbol	function	parameter	pages
LD		combine N.O. contact with the bus	I, M, O, T, C	4-2
LDI		combine N.C. contact with the bus	I, M, O, T, C	4-2
AND		series-connect an N.O. contact	I, M, O, T, C	4-3
ANI		series-connect an N.C. contact	I, M, O, T, C	4-3
OR		parallel-connect an N.O. contact	I, M, O, T, C	4-4
ORI		parallel-connect an N.C. contact	I, M, O, T, C	4-4
END		program ends	no operation parameter	4-3
OUT		output the operating result	O, M	4-3
SE		output relay or internal relay setting	O, M	4-5
SEB		internal relay setting	M	4-6
CR		output relay or internal relay resetting	O, M	4-7
CLB		internal relay resetting	M	4-8
JMP		program toggle command	XXX	4-9
CO		Cycling counter	C	4-10
TIM		Timer	T	4-11

4.2 Description of the Instructions

4.2.1 LD, LDI, OUT

LD	LD **combine N.O. contact with bus**
LDI	LDI **combine N.C. contact with bus**
OUT	OUT **output operating results**



DESCRIPTION

- LD, LDI commands are available to combine N.O and N.C contact with bus.
- The operating parameter of LD, LDI commands are available for: input relay ¡B output relay ¡B internal relay ¡B timer ¡B counter.
- OUT command is available to output the operating result to the internal relay and output relay.
- The operating parameter of OUT command is only available for the internal relay and output relay.

TECHNICAL ITEMS

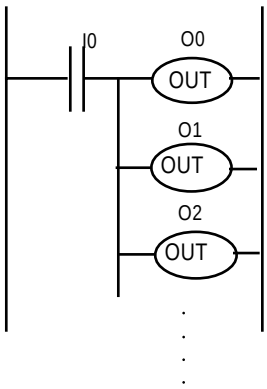
- N.O. contact: the contact which is open in static state, in ladder logic diagram it shows as the following:

- N.C. contact: the contact which is closed in static state, in ladder logic diagram it shows as the following:

- O: the simplest form of "OUTPUT"
- I: the simplest form of "INPUT"

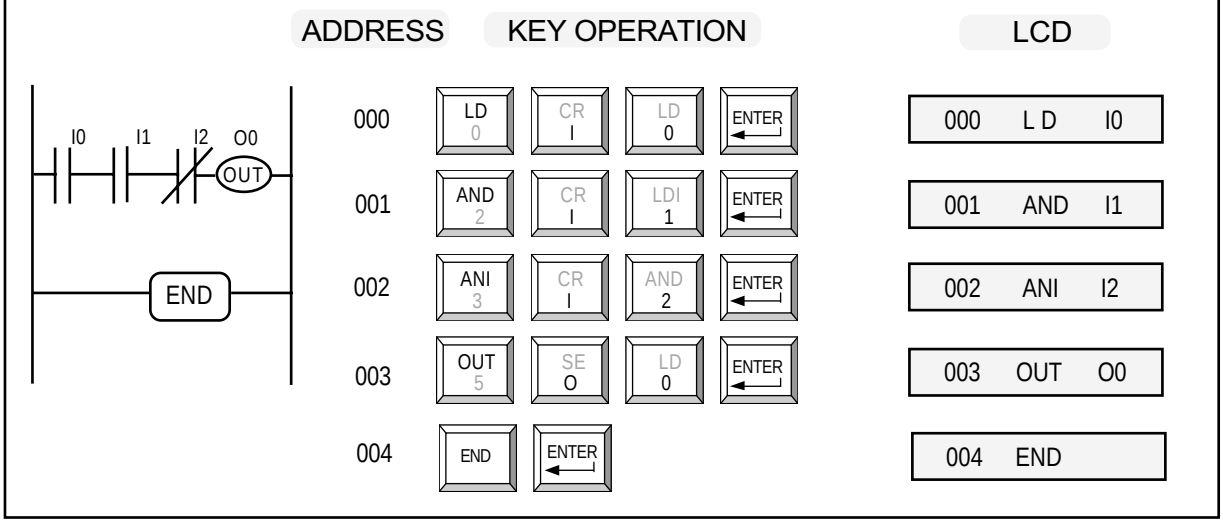
ATTENTION

- Do not use the OUT command continuously to form a circuit as the following diagram:



4.2.2 AND, ANI, END

AND	AND **series-connect an N.O. contact**
ANI	ANI **series-connect an N.C. contact**
END	END **program ends**

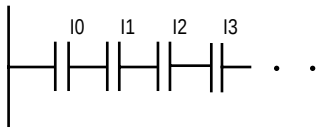


DESCRIPTION

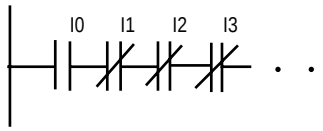
- AND: series-connect an N.O. contact
  ANI: series-connect an N.C.contact
- The operating parameter of AND ¡BANI command is available for any of these: input relay ¡Boutput relay ¡Binternal relay ¡Btimer ¡Bcounter.
- END command is for the end of a program. A program is unable to be executed without it.
- Enter END command at the end of each section before the program operates, thus it offers easy adjudgment of the operation, delete the command after the program confirms.

SUPPLEMENT

- AND command is available for continuous series-connection as needs, the diagram is as the following:

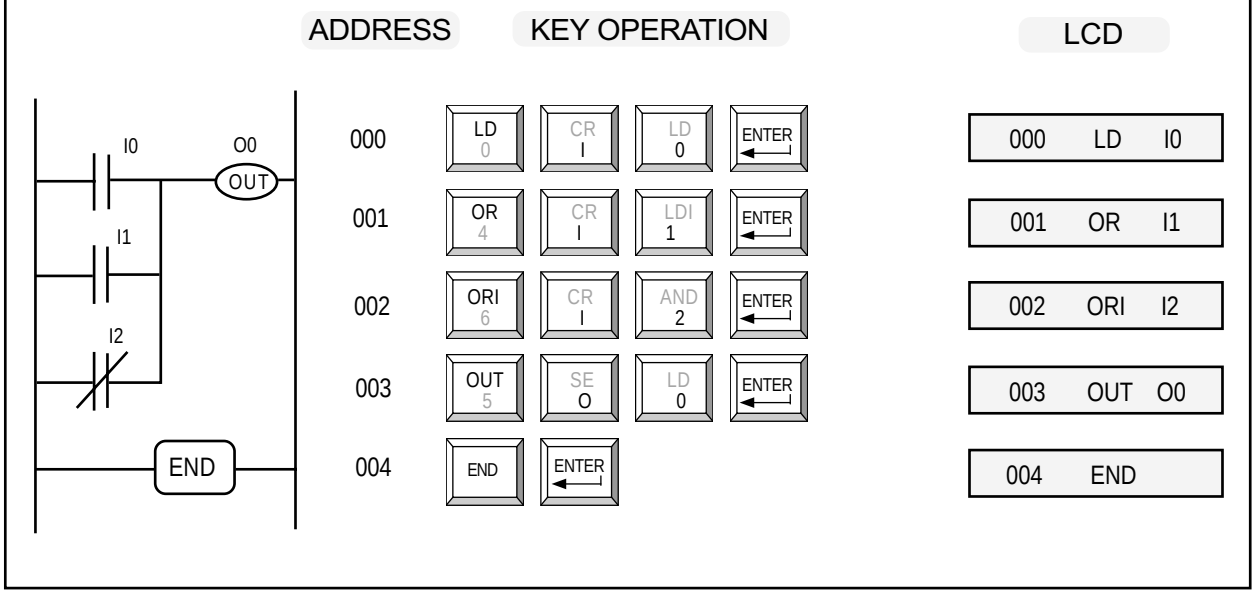


- ANI command is available for continuous series-connection as needs, the diagram is as the following:



4.2.3 OR, ORI

OR	OR **parallel-connect an N.O. contact**
ORI	ORI **parallel-connect an N.C. contact**



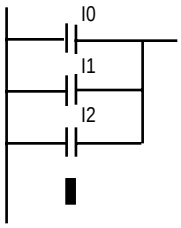
DESCRIPTION

- OR: parallel-connect an N.O. contact
  ORI: parallel-connect an N.C. contact

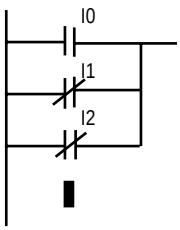
- The operating parameter of OR¡BORI command is available for any of these: input relay¡Boutput relay¡B internal relay¡Btimer counter

SUPPLEMENT

- OR command is available for continuous parallel-connection as needs, the diagram is as the following:

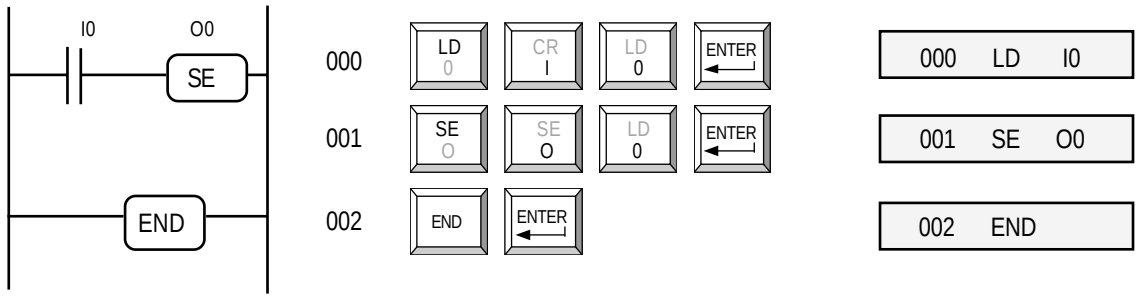


- ORI command is available for continuous parallel-connection as needs, the diagram is as the following:



4.2.4 SE

S E	**Internal relay and output relay setting command**

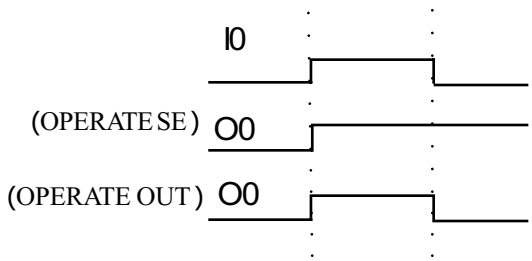


DESCRIPTION

- SE is the setting command for internal relay and output relay.
- SE command is available for deciding whether to execute this command or not by referring to the previous operating results, execute it when the result is 1, do not execute it when the result is 0.
- The operating parameter of SE command is available for internal relay or output relay.

SUPPLEMENT

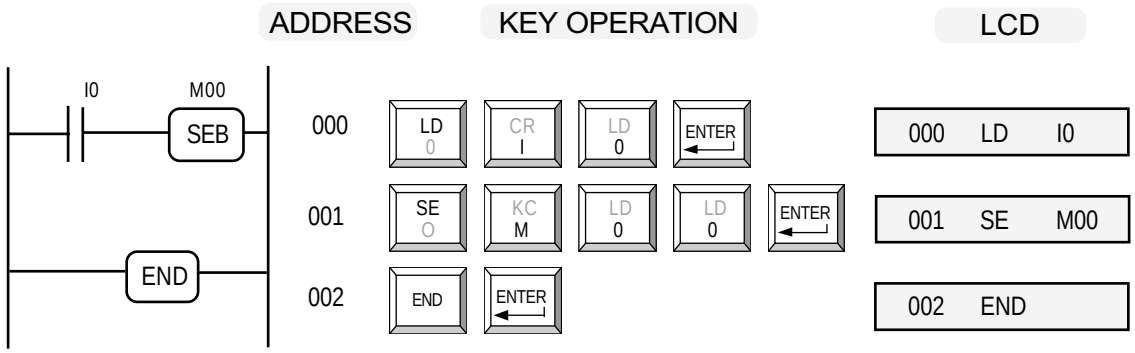
- The diagram result will be as following when replacing SE command by out command.



- The above diagram shows: when I0 changes from 1 to 0, execute SE command and the result remains 1 while it changes from 1 to 0 by executing OUT command. That is the difference between SE and OUT command.

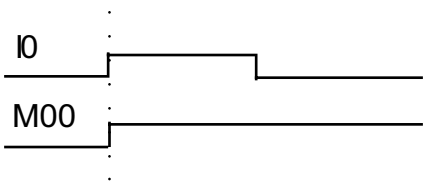
4.2.5 SEB

SEB	**internal relay setting command**



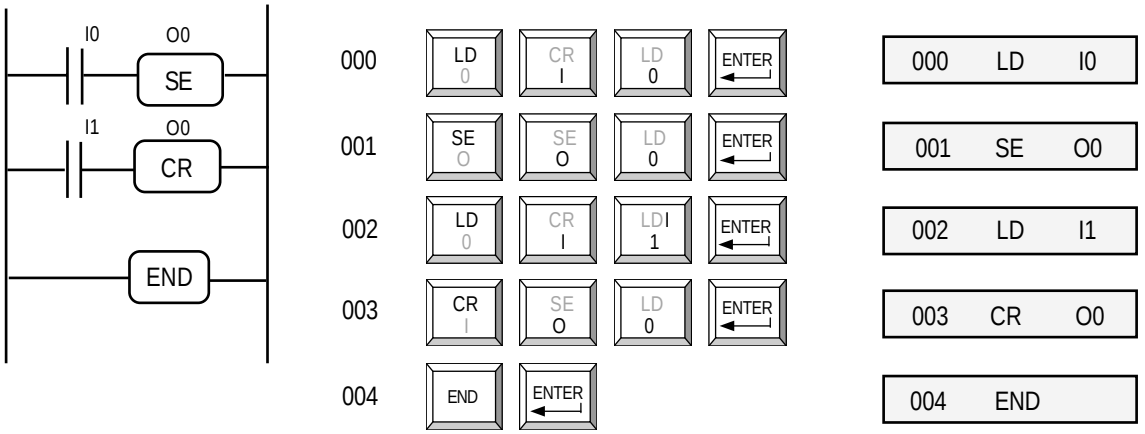
DESCRIPTION

- SEB is the setting command for internal relay.
- SEB command has the same function as SE, but the operating parameter of SEB command is only available for internal relay while SE for either internal relay or output relay.
- Operate the above-mentioned commands, the sequence diagram is as the following:



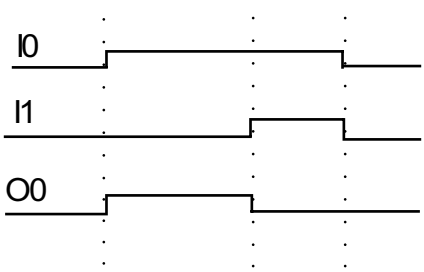
4.2.6 CR

CR	internal relay and output relay reset command



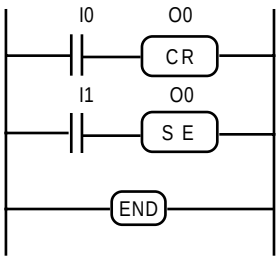
DESCRIPTION

- CR is the reset command for internal relay and output relay.
- CR command is available for deciding whether to execute this command or not by referring to the previous operating results, execute it when the result is “1”, do not execute it when the result is “O”.
- CR command is available for the internal relay or the output relay.
- Operate the above-mentioned commands, the sequence diagram is as the following:

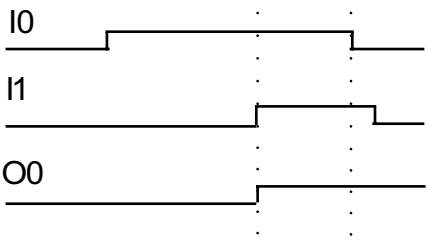


SUPPLEMENT

- Change the above-mentioned diagram as the following:



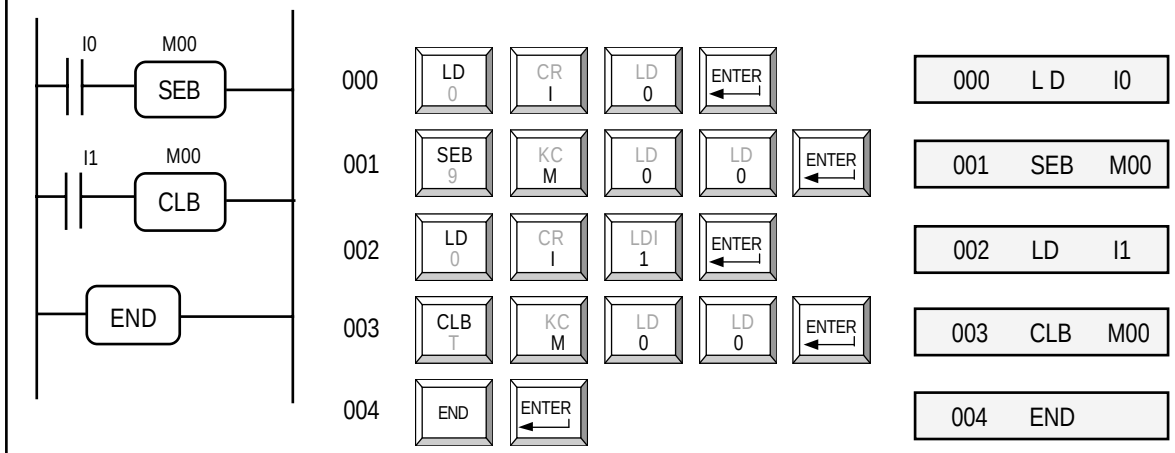
- The sequence diagram is as the following:



- When SE and CR are both available for operating number O0, operate the latter one.The rule is: the latter suppresses the former.

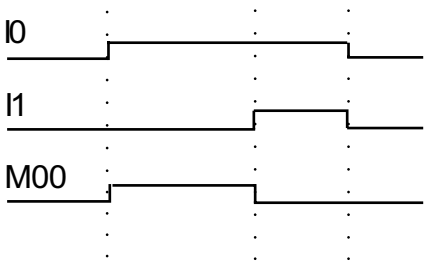
4.2.7 CLB

CLB	**internal relay reset**



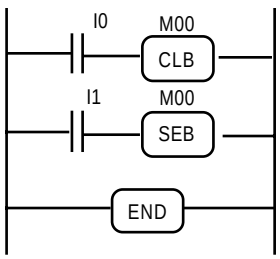
DESCRIPTION

- CLB is the reset command for internal relay.
- CLB command has the same function as CR, but the CLB operating parameter is only available for internal relay while CR for either internal relay or output relay.
- Operate the above-mentioned commands, the sequence diagram is as the following:

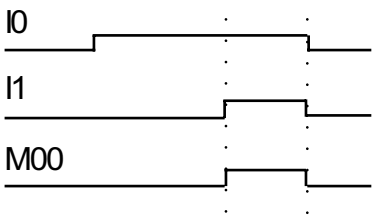


SUPPLEMENT

- Change the above-mentioned diagram as the following:

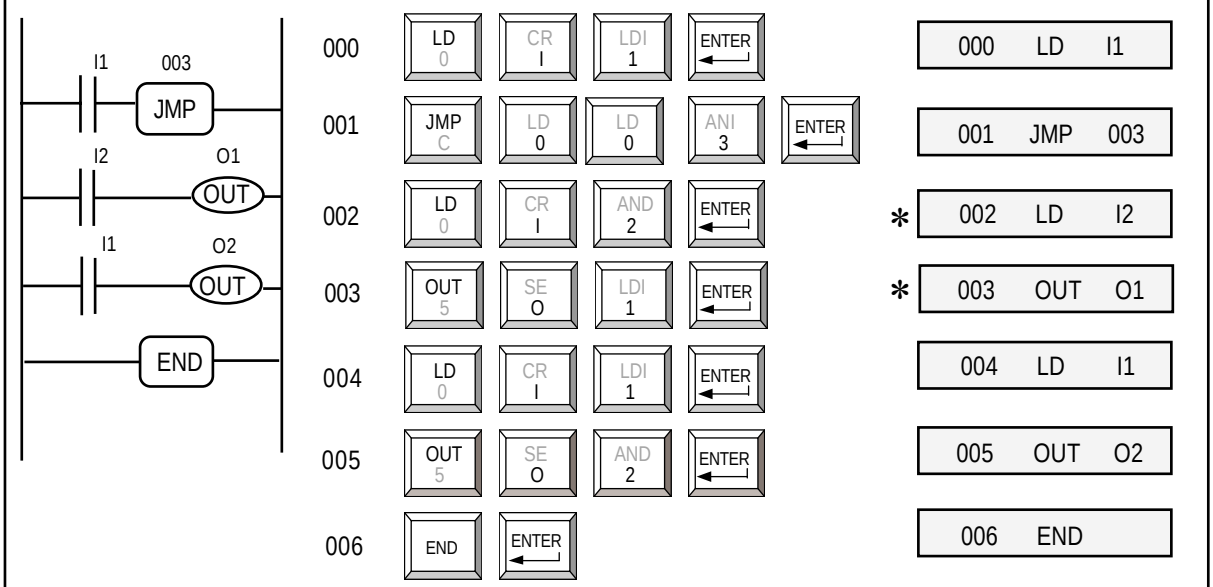


- Operate the above-mentioned commands, the sequence diagram is as the following:



4.2.8 JMP

JMP	XXX JMP	JMP command is available for transferring to the following relative XXX steps

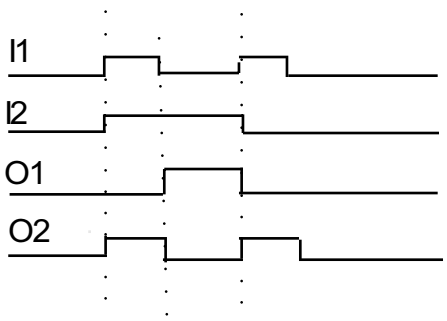


DESCRIPTION

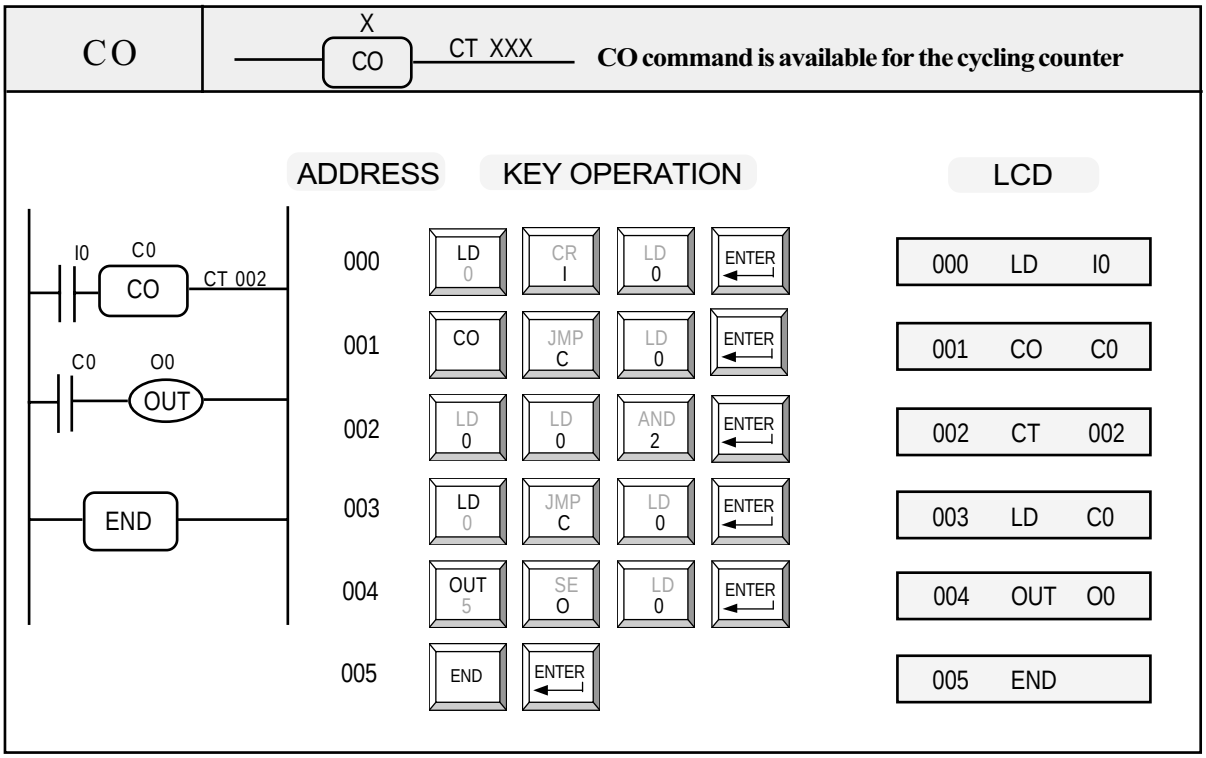
- JMP command is available for transferring to the following relative XXX steps.
- JMP command is available for deciding whether to execute this command or not by referring to the previous operating result, execute it when the result is "1", do not execute it when the result is "0".
- See the example: when I1 is 1 (condition of executing JMP is satisfied to demmand), the two commands with "*" fail to be operated.
- The range of XXX in JMP command is [000~239], it must be written as three figures, plus "0" to be three if it is less than three, e.g. "001" for "1", "011" for "11".

SUPPLEMENT

- The sequence diagram is as the following:



4.2.9 CO

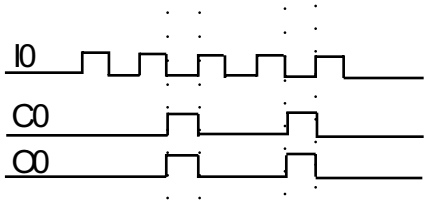


DESCRIPTION

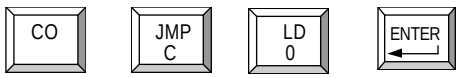
- CO command is available for the cycling counter, including two sub word commands: CO X and CT XXX. X stands for the cycling counter in this command and including such as C0, C1, C2, C3 in a total of 4pcs. XXX stands for presetting value of counter.
- CO command is available for deciding whether to execute this command or not by referring to the previous operating result. When the result changes from 1 to 0, execute it till it reaches the presetting value and the counter sets 1.
- When the data reaches the presetting one, the counter is 1, if still any active pulse on the former command and the following pulse comes, counter resets 0 and counts again. This action cycles on.
- The range of XXX in CO command is [000,255], it must be written as three figures, plus "0" to be three if it is less than three, e.g. "1" for "001", "11" for "011".

SUPPLEMENT

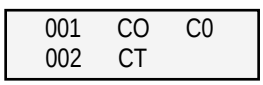
- Operate the above-mentioned commands, the sequence diagram is as the following:



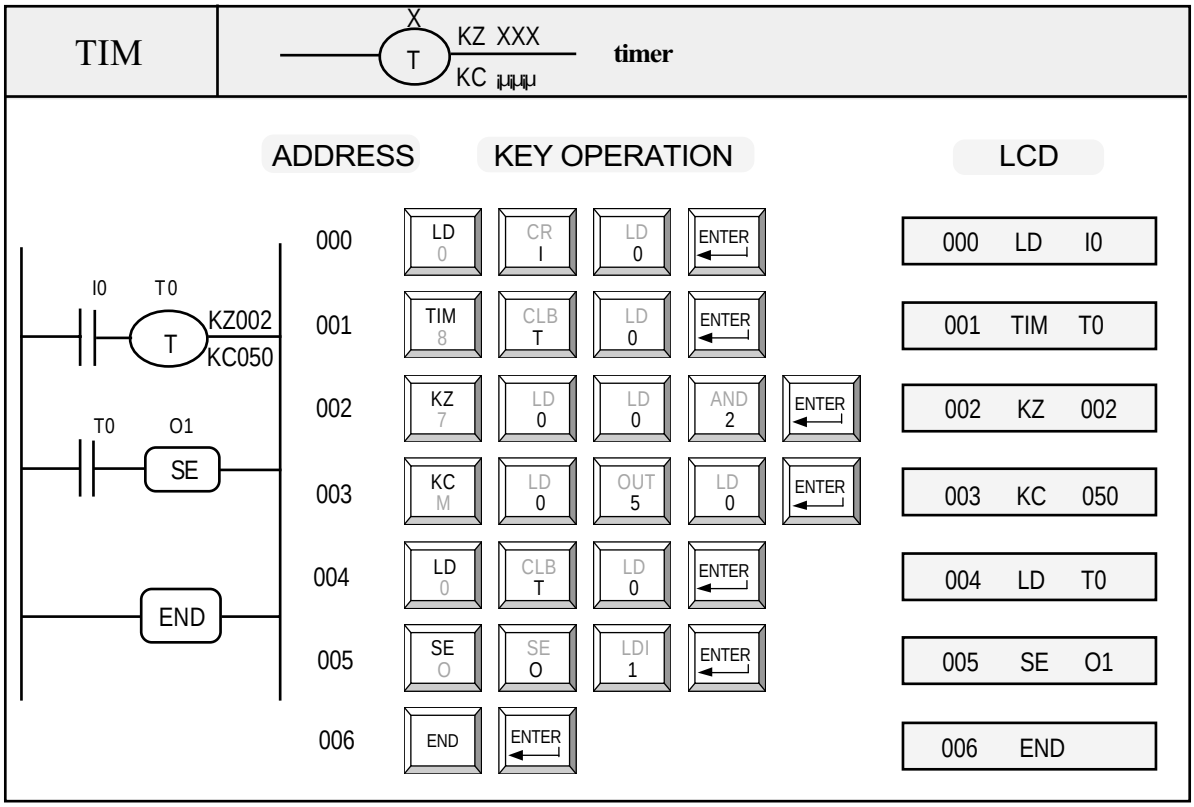
- While program with programmer, if input CO and press Enter button, the programmer will show CT automatically. No need to input CT



The diagram of the programmer LCD is as the following:

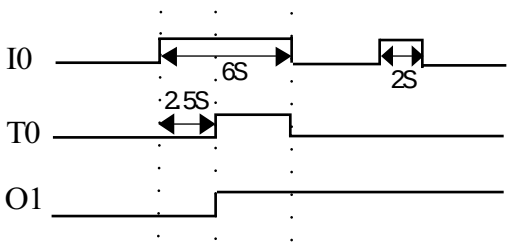


4.2.10 TIM



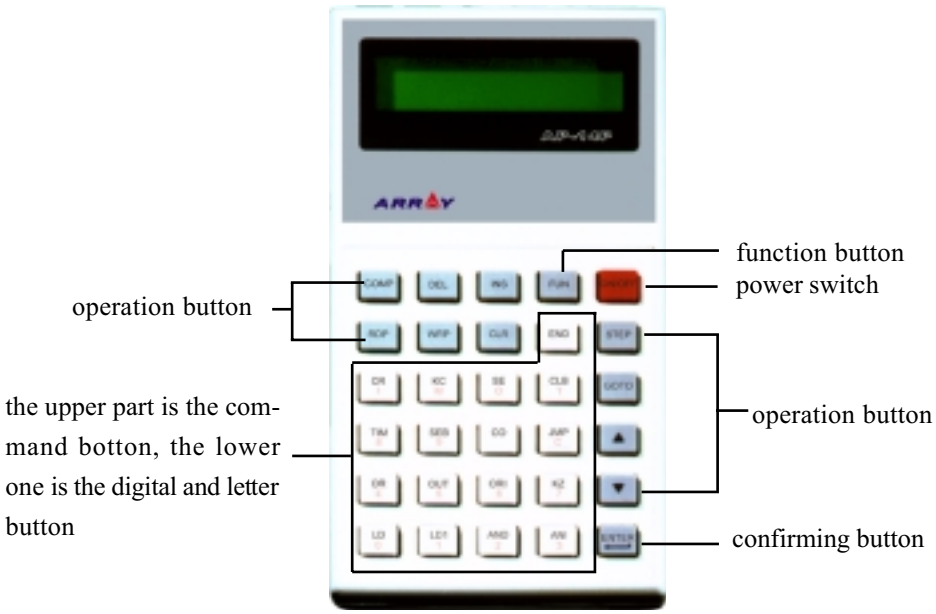
DESCRIPTION

- TIM command is available for the timer.
- TIM command is available for deciding whether to execute this command or not by referring to the previous operating result. When the result is 1, execute it till it gets to the presetting value. When the result is 0, the timer doesn't work.
- When time reaches presetting value, timer sets "1", if not , the result changes from 1 to 0, and timing will not be stored, when result comes to 1, timer runs on again.
- The predetermined integer part of XXX ranges from 000 to 255, it must be written as three figures, plus "0" to be three if it is less than three, e.g. "1" for "001", "11" for "011". The predetermined decimal part of ┘┘┘ ranges from 000 to 099, it also must be written as three figures, too. For example: "10.99S" for "KZ010, KC099 ".
- "X stands for the cycling counter in a total of 4pcs as T0, T1, T2, T3 with the range {0.01-255} S. Accuracy is 0.01S.
- TIM includes three essential sub-commands: TIM, KZ, KC. Everyone is necessary.
- The sequence diagram is as the following:



Chapter 5 Programmer

5.1 Description of the Programmer



DESCRIPTION

- **Function button** FUN
  ƒÜ
  The following two Function modes can be designated:
  (1) Select ON/OFF of the sound.
  (2) Select whether to charge the battery or not

- **Operation buttons:**

COMP	compare the programs in the programmer EEPROM with those in the PLC EEPROM.
DEL	delete the comands and addresses
INS	insert a line of command in front of the current address
RDP	read the program from the PLC EEPROM
WRP	write the programs in the PLC EEPROM
CLR	clear the contents at the current cursor address except line number.
GOTO	toggle to the designated address.
STEP	test by single-step

display the contents at the previous cursor address

display the contents at the following cursor address

- **confirming button** ENTER

  when finish one line command, press this button to comfirm. But be careful to press it to avoid the unnecessary correction under other situations

- **ON/OFF power switch** ON/OFF

  When the battery supplies the programmer, push the button down for 3 seconds for power on. Push the button down again for 3 seconds for power off .

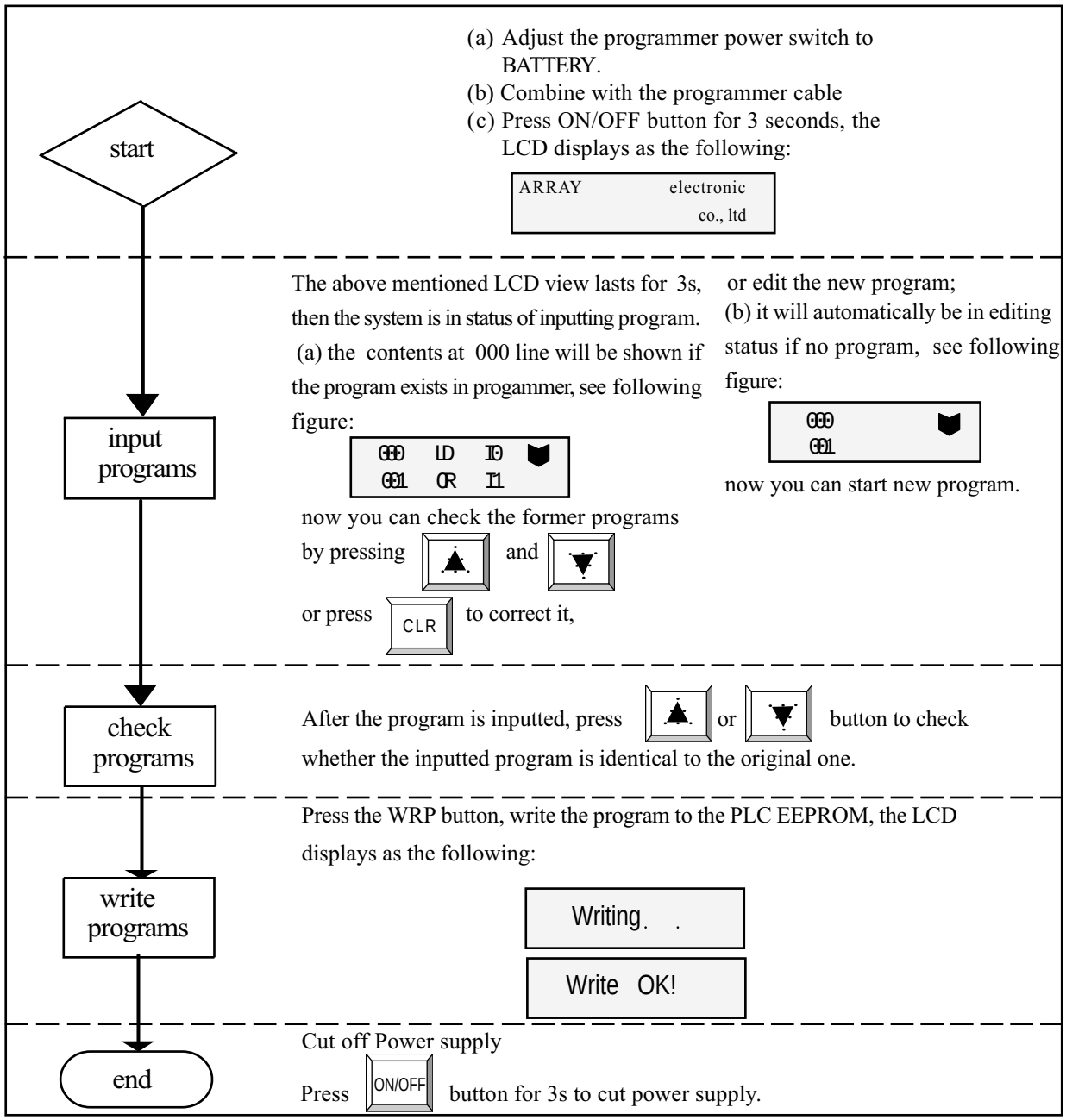
- **Instruction Button**

  The upper part of the button is the command button for inputting commands: LD/LDI/OR/ORI/AND/ANI/TIM/CO/SE/SEB/CR/CLB/JMP/OUT/END/KZ/KC, totaling 17. (refer to Chapter 4: Instruction for details)

- **digital button and letter button**

  The lower part consists of the ten digital keys: 1~9 and five letter keys: I, M, O, T, C. Available for setting address, input relay, output relay, internal relay,and data of timer and counter

5.2 The Operating Procedure of the Programmer



DESCRIPTION

In the process of editing programs, the poor light of the LCD will be turned off when no keys are pressed within 20 seconds, press any of the button, the light turns on. LCD will be turned off if no keys are pressed after 5 minutes. The power of the programmer will be cut off and in rest status when no keys are pressed within 10 minutes, as continue editing it must be started again.

● Description of the LCD displaying.

(1) graphic marks

Stands for inputting command.

Stands for result of inputting commands.

Available for digital keys and letter keys.

(2) For error displays

RomERROR: ROM error or wrong symbol for command.

RamERROR: RAM error

CodeERROR: Code error in RAM

Eeprom ERROR: no menory or some wrong with program memory

OperationERROR: operation data exceeds the range (¡Ù256) while running INS/DEL/GOTO; or other wrong operation, it will display with an alarm .

5.3 Description of the Function Button

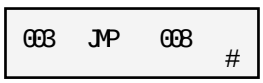
FUN	Function Button

	Function	LCD	Operating method
Press the FUN button at the first time 	Voice knob	Speaker (1 OR 0) 1=ON 0=OFF	Press  to turn on the sound switch Press  to turn off the sound switch
Press the FUN button at the second time 	battery charge knob	Charge (1 OR 0) 1=YES 0=NO	Press  to charge the battery Press  not to charge the battery

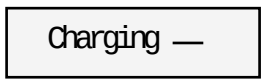
DESCRIPTION

- Press the FUN button, the system will return to the editing state automatically after 5 seconds when no selection is made.
- To decide if the battery needs charge or not, the system will check the battery voltage automatically. Please pay attention to the system recommadation

(1) As battery voltage<4.2V, the LCD displays alarm smybol: # on right bottom as the following:



(2) As battery voltage<3.8V, the system will switch off the poower automatically. Now the user should connect the charger to A.C. supply, plug the charger cable to programmer and start the programmer, press the button  twice,the programmer is turned into the state of selecting charging and then press the button  , select to charge, the LCD displays as the following:



After charging, the LCD displays as the following:

The user may take the charger away and edit.

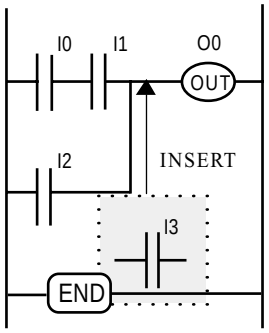
(3)When the energy of the battery is ran out, please connect the charger to A.C. supply, plug the charger cable to programmer to charge the battery. After 10 hours, take the charger away, the programmer is ready for programming.

5.4 Description of the Operation Button

5.4.1 Description of the Operation Button INS

INS	**Insert new command in the designated program address**

Basic operating procedure (example)



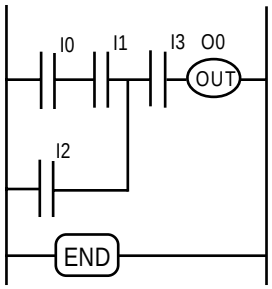
If insert 003 AND I3 below 002, do as the following:

(1) Press INS

(2) Press LD 0 LD 0 ANI 3

(3) Press AND 2 CR I ANI 3

(4) Press ENTER the result is as the following:



LCD

```
000   LD    I0
001   AND   I1
002   OR    I2
003   OUT   O0
004   END
```

```
INS
```

```
INS   003
003
```

```
INS   003
003   AND   I3
```

```
000   LD    I0
001   AND   I1
002   OR    I2
003   AND   I3
004   OUT   O0
004   END
```

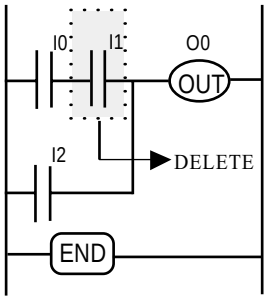
DESCRIPTION

- Insert new command in the designated address, the following command addresses will increase 1 automatically. If the inserted program exceeds the maximum address range, the system will show error.
- If press INS with no command being inserted, and press ENTER, a blank line will be inserted
- If no command is inserted when press INS, can not use ▲ ▼ to exit current state.

5.4.2 Description of the Operation Button DEL

DEL	**delete the contents at the current cursor address including the line number**

Basic operating procedure (example)



LCD

000 LD I0
001 AND I1
002 OR I2
003 OUT O0
004 END

If delete 001 AND I1, do as the following:

(1) press DEL

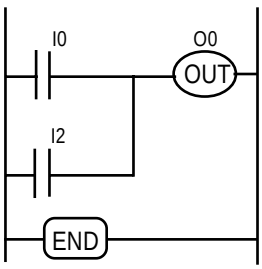
DEL

(2) press LD 0, LD 0, LDI 1

DEL 001

(3) press ENTER

Waiting for about 2s, the result will be as the following:



000 LD I0
001 OR I2
002 OUT O0
003 END

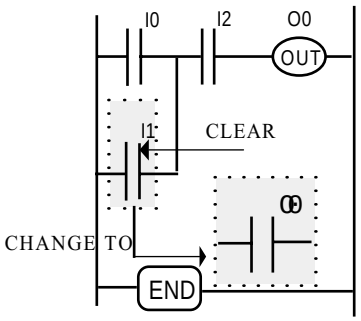
DESCRIPTION

- Delete the content at the designated address, thus the following address decreases 1 automatically and the next line moves forward.
- When deleting some commands, be sure to delete the relative commands, e.g. when deleting command CO, the relative command CT should be deleted too.

5.4.3 Description of the Operation Button CLR

CLR	clear the program contents instead of row number in order to input new program

Basic operating procedure (example)



LCD

000	LD	I0
001	OR	I1
002	AND	I2
003	OUT	O0
004	END	

If change 001 OR I1 to 001 OR O0 , do as the following:

(1) at 001, press CLR

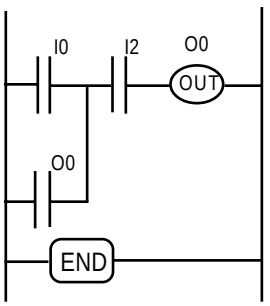
001

(2) press OR 4 SE O LD 0

001 OR O0

(3) press ENTER the result will be as the following:

(4) after the program is changed, press ▲ ▼ to browse and check the changed contents

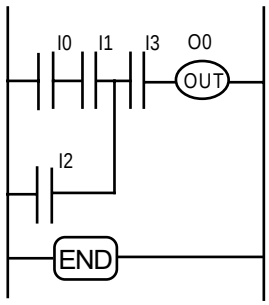


000	LD	I0
001	OR	O0
002	AND	I2
003	OUT	O0
004	END	

5.4.4 Description of the Operation Button GOTO

GOTO	**search the address**

Basic operating procedure (example):



LCD

000	LD	I0
001	AND	I1
002	OR	I2
003	AND	I3
004	OUT	O0
005	END	

the programmer is displaying the 004 address, if read the content of the 002 address, do as the following two methods:

(A) use [▲] , press [▼] continuously until display the contents at the 002

(B) use [GOTO]

(1) press [GOTO]

GO

(2) press [LD 0] [LD 0] [AND 2]

GO 002

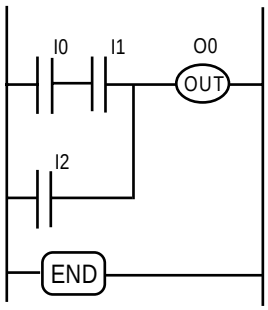
(3) press [ENTER] after 2 seconds displays the contents at 002 line address

002 OR I2

5.4.5 Description of the Operation Button COMP

COMP	**compare the contents in the programmer EEPROM with the program in the PLC EEPROM**

Basic operating procedure (example):



LCD

000	LD	I0
001	AND	I1
002	OR	I2
003	OUT	O0
004	END	

If compare the program in programmer EEPROM with the written program in PLC EEPROM, do as the following:

(1) Combine programmer with PLC by specified cable,and set programmer power switch for power supply

(2) press COMP , LCD displays: Comping . .

(3) Compare with the contents in programmer EEPROM and the PLC EEPROM, they are the same. LCD displays: COMP OK !

(4) Compare with the contents in programmer EEPROM and the PLC EEPROM, they are different; AP-14 and AP-14M PLC are in improper connection; "NORMAL/SINGLE" or "PROGRAM" is improperly set.

LCD displays: COMP ERROR !

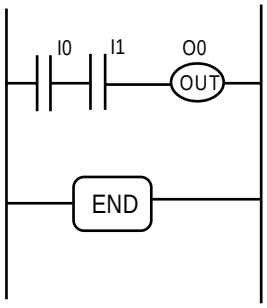
DESCRIPTION

- Notes: press "PROGRAM" switch on PLC before operating the above mentioned button, and PRO indicator is on, then set"NORMAL/SINGLE" switch to "NORMAL".
- The system will show error in such situations:
  (1) The programmer cable doesn't connect to the designated socket.
  (2) The programmer cable and the designated socket are in improper connection.
  (3) The program in the PLC EEPROM doesn't keep with that in the programmer EEPROM.
- Find out the reason first, then eliminate it in the event of system error.

5.4.6 Description of the Operation Button WRP

WRP	**write the programs in the programmer EEPROM to the PLC EEPROM**

Basic operating procedure (example):



LCD

000 LD I0
001 AND I1
002 OUT O0
003 END

If write programs in the programmer EEPROM to the PLC EEPROM, do as the following:

(1) Combine programmer with PLC by specified cable,and set programmer power switch for power supply

(2) Press WRP

(3) Writing , LCD displays: Writing . .

(4) Writing OK , LCD displays: Write OK !

(5) AP-14 and AP-14M PLC line are in improper connection; "NORMAL/SINGLE" or "PROGRAM" is improperly set. LCD displays: Write ERROR!

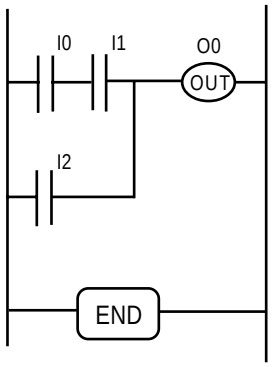
DESCRIPTION

- When writing, eliminate the unnecessary program content in the PLC EEPROM and at the same time write in new contents.
- Notes: press "PROGRAM" switch on PLC before operating the above mentioned button, and PRO indicator is on, then set "NORMAL/SINGLE" switch to "NORMAL".

5.4.7 Description of the Operation Button RDP

RDP	**read the program in the PLC EEPROM to the programmer EEPROM**

Basic operating procedure (example):



LCD

000	LD	I0
001	AND	I1
002	OR	I2
003	OUT	O0
004	END	

If read the program in the PLC EEPROM to the programmer EEPROM, do as the following:

(1) Combine programmer with PLC by specified cable,and set programmer power switch for power supply

(2) Press RDP

(3) Reading , LCD display: Reading · ·

(4) Reading ok , LCD displays: Read OK !

(5) AP-14 and AP-14M PLC wire are in improper connection; "NORMAL/SINGLE" or "PROGRAM" is improperly set. LCD displays: Read ERROR!

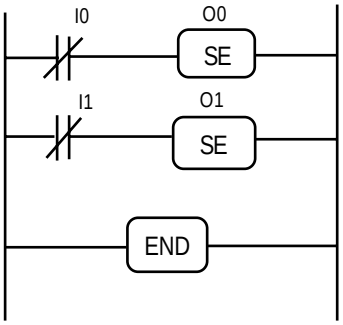
DESCRIPTION

- When altering the program, read the program in the PLC EEPROM to the programmer EEPROM.
- Notes: press "PROGRAM" switch on PLC before operating above mentioned the button, and PRO indicator is on, then set "NORMAL/SINGLE" switch to "NORMAL".

5.4.8 Description of the Operation Button STEP

STEP	**Send signal of single-step to PLC, which will operate program in EEPROM by single-step**

Basic operating procedure (example):



LCD

000 LDI I0

001 SE O0

002 LDI I1

003 SE O1

004 END

When finish writting program in PLC by WRP command, press STEP , programmer will send single-step signal to PLC, and program runs next step on receipt of the signal. LCD displays the operating result ¡ÌON/OFF¡Ì

(1) Combine programmer with PLC by specified cable,and set programmer power switch for power supply

(2) press STEP LCD displays:

STEP ¡Ì=ON
000 LDI I0

(3) press STEP LCD displays:

STEP ¡Ì=ON
001 SE O0

(4) press STEP LCD displays:

STEP ¡Ì=ON
002 LDI I1

(5) press STEP LCD displays:

STEP ¡Ì=ON
003 SE O1

(6) if AP-14 and AP-14M PLC are in improper connection; "NORMAL/SINGLE" or "PROGRAM" is improperly set. System will back to the beginning address and displays:

000 LDI I0
001 SE O0

- Notes: set "NORMAL/SINGLE" switch to "SINGLE" before operating the above mentioned command, and SIN indicator is on.

Chapter 6 Operation of PLC

Please operate as the following steps:

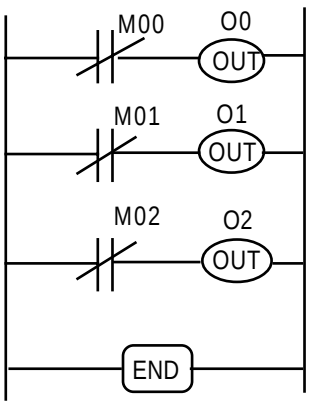
(1) Dual voltage 110/220V supply versions, and connect the power.

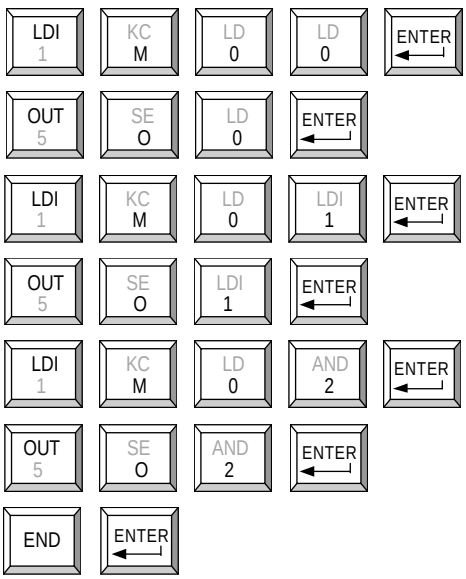
(2) Remove the cover on the left side.

(3) Combine with AP-14 programmer and the PLC programming interface, using the programming cable. As the following diagram:

DIAGRAM(6-1)

(4) Press the “PROGRAM” button, the “PRO” indicator on the control panel lights on, then write the following program in the programmer.(Referring to Chapter 5: the programmer for details)






```
000   LDI   M00
001   OUT   O0
002   LDI   M01
003   OUT   O1
004   LDI   M02
005   OUT   O2
006   END
```

(5) Press WRP , then write the program in the PLC EEPROM.

(6) Set “NORMAL/SINGLE” knob of AP-14 PLC into “SINGLE”, then back to “NORMAL” position again, PLC performs normally. At the same time, “RUN” indicator is on; If write programs improperly, e.g. missing “END”command, “RUN”indicator flashes constantly.

(7) If step PLC, set “NORMAL/SINGLE” knob of AP-14 PLC into “SINGLE”, the “SIN” indicator on the control panel lights on, then press STEP on AP-14P programmer to test by single-step(every time press the button, PLC will step the next command until come to “END” command, then steps from first line again), thus O0¡NO1¡NO2 LED of AP-14M PLC will be on. After stepping, set “NORMAL/SINGLE”knob to “NORMAL”for running PLC normally.

(8) If the system runs normally, pull down the AP-14P programmer cable.

ATTENTION

When the system functions normally, the “ERR” indicator on the PLC control panel doesn’t light on. If the lamp lights on, there must be problem in the PLC and must be eliminated immediately.

- Flashing of “ERR” indicator: there must be problem in the CPU of the PLC.
- Lighting on of the “ERR” indicator: there must be problem in the PLC memory.

Chapter 7 Installation and Wiring

7.1 Installation Environment

AP-14 products suit the environment badly, but to ensure the long and good operation quality please pay attention to the following items when installing:

- Make sure that the temperature and humidity are in the specified range.
- Reduce the vibration and shock to the minimum.
- Reduce noise interference as much as possible.
- The setting of the control cubicle should be reasonable for the convenience of regular checking.

7.2 Strategy for Different Operating Environments

¢J

7.2.1 Temperature

AP-14P system is available between -5¢J to +55¢J (storage temperature: -25¢J ã +75¢J), so make sure to use it in this range. Constant high/low temperature may effect its service life, to avoid this situation, you may adopt the following methods:

- Equip the fan in the control cubicle. Various fan options available: absorbing type ¡ Bdischarging type or cycling type according to the different environment.
- Equip the cooling device in addition to that no condensation may occur.
- Equip the radiator to improve the ventilation condition in the control cubicle.
- Equip the heating apparatus to keep suitable temperature when the ambient temperature is too low.

7.2.2 Humidity

Sudden temperature variation may cause condensing which may reduce the equipment endurance. To keep the humidity in the control cubicle in the specified range 45-85%, such measures noted below are necessary:

- Adopt sealing device and fill with hygroscope agent in the control cubicle.
- Equip the air conditioner to keep the air dry.

7.2.3 Specified Shock and Vibration

The continuous shock or vibration may cause the screw and the plug-in components become loose and the internal components may be damaged as well. Precaution noted below may be adopted:

- Equip the shockproof rubber in the control cubicle.
- Keep away from the shock sources or vibration sources as far as possible.

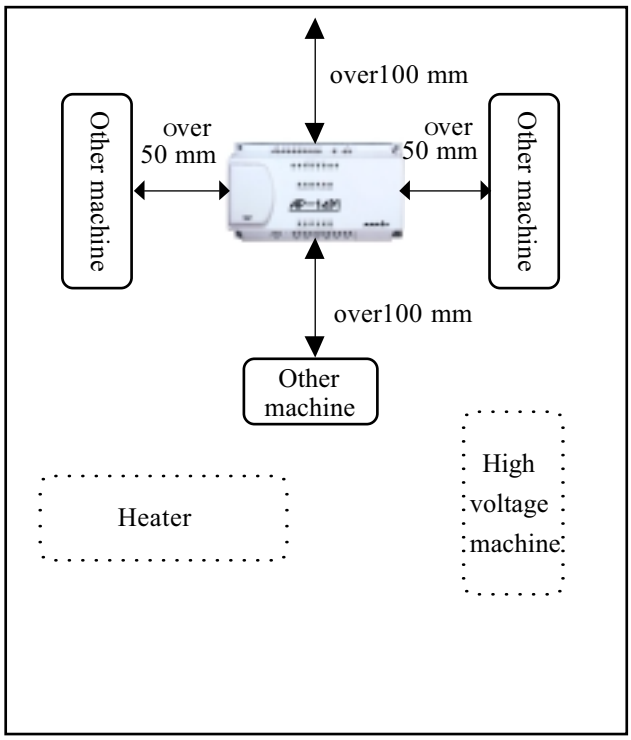
7.2.4 Atmosphere Environment

Too much dust in the operating place may cause such results: the switch may be in poor contact, the filter port may be blocked and the temperature in the control cubicle may rise up.
Conductive powder will lead to short circuit, Corrosive gases, oil fogs and salt, all of which will accelerate the age of the components and corrosive of the screw. Precautions noted below may be adopted:

- Seal the control cubicle.
- Equip the air conditioner in the control cubicle.
- Keep far away from severe environment.

7.3 The PLC Devices in the Control Cubicle

For the better ventilation and to avoid too high temperature in the control cubicle, please keep a distance over 100mm in vertical and over 50mm in horizontal between AP-14 and other machines. The heater must be avoided mounting under AP-14.(diagram).

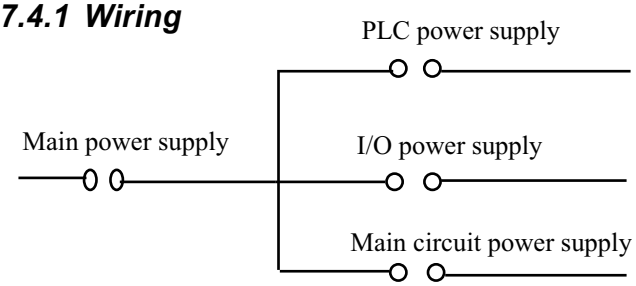


DIAGRAM(7-1)

7.4 Strategy for Interference

The AP-14 system has high interference resistance, but to make the system more stable and work at full capacity, such measures may be adopted:

7.4.1 Wiring

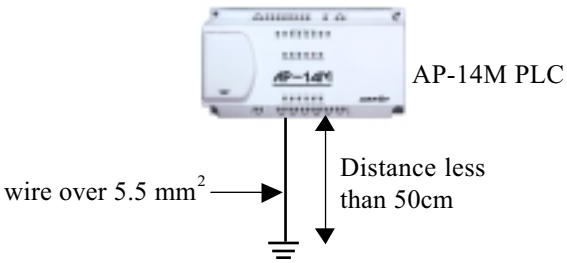


DIAGRAM(7-2)

- PLC power supply and I/O power supply must be mutually independent and be wired separately.
- Isolate DC24V I/O wire from AC110/220V and the distance must be over 300mm. Adopt mental shield.

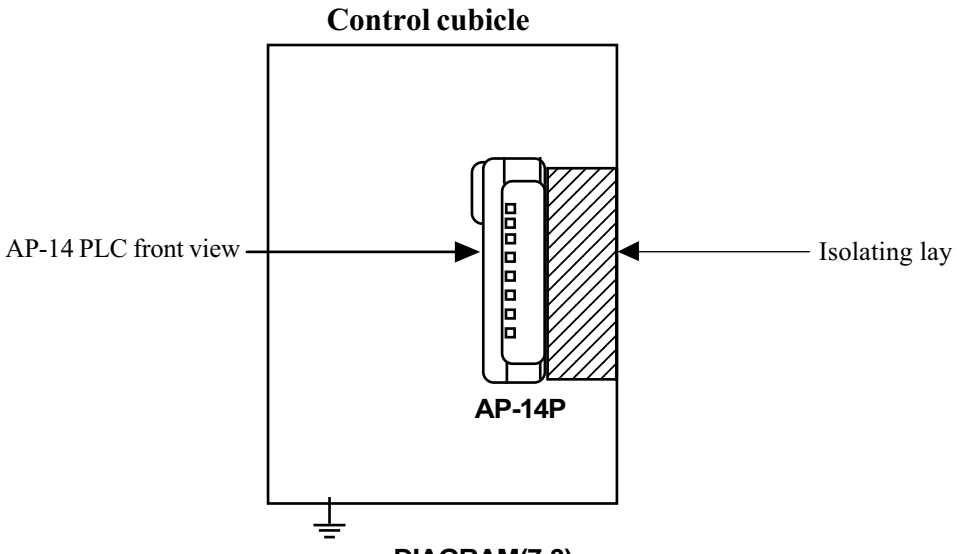
7.4.2 Ground (GND)

- Good ground can improve the reliability of the product, this equipment has adopted sufficient measures to resist the interference and is free ground except the special interference resource, it is usually grounded in this way:



DIAGRAM(7-3)

- The system can't ground with high power machines, in areas where there's too much thunder power, the equipment must be isolated from control cubicle and only the cubicle is grounded.



DIAGRAM(7-3)

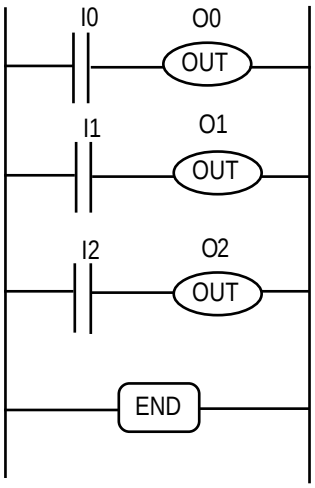
Chapter 8 Application

- **The following application will illustrate the AP-14M PLC in details.**

8.1 Application of I/O (Input/Output)

Control Demand: Display alarm information by PLC I/O

Ladder Diagram



Command List

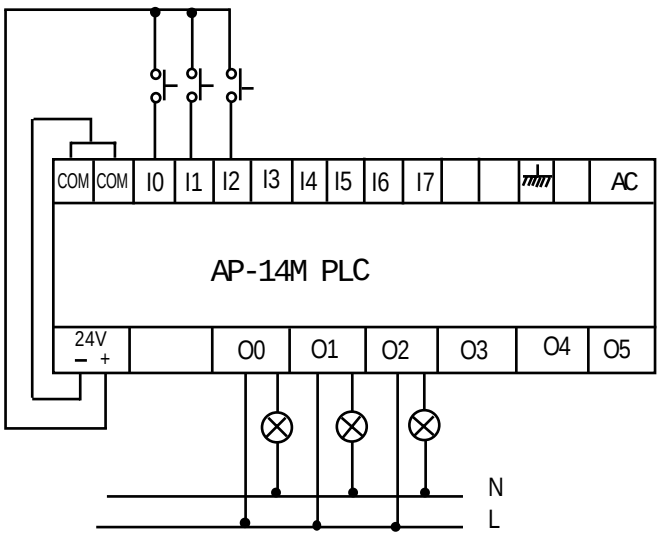
```
000     LD      I0
001     OUT     O0
002     LD      I1
003     OUT     O1
004     LD      I2
005     OUT     O2
006     END
```

DESCRIPTION

- I0, I1, I2 is available to input the corresponding alarm switch and contact.
- O0, O1, O2 is available for the state indicators of the coresponding switch.

SUPPLEMENT

PLC circuit diagram is as the following:

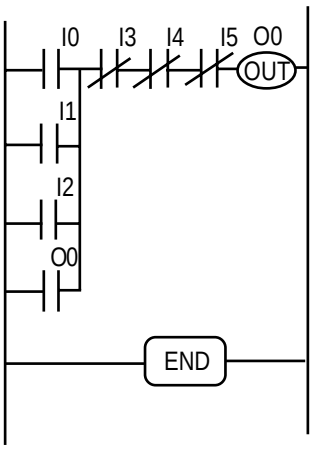


8.2 Application of Self-keeping + I/O

8.2.1 Control ON/OFF of the Motor in Three Directions

Control demand: There 's ON/OFF button in A,B,C, the motor is "ON"if any of the buttons is pressed. The motor keeps rotating, till any of the OFF button in A, B, C is pressed.

Ladder Diagram



Command List

000	LD	I0
001	OR	I1
002	OR	I2
003	OR	O0
004	ANI	I3
005	ANI	I4
006	ANI	I5
007	OUT	O0
008	END	

DESCRIPTION

- **Input ports:**
  I0: ON button in A I1: ON button in B
  I2: ON button in C I3: OFF button in A
  I4: OFF button in B I5: OFF button in C
- **Output ports:**
  O0: the contactor coil KM.
- In the program, ON buttons are all parallel -connection and OFF buttons are all series-connection. The motor is on if any button in I0 ¡BI1 ¡BI2 is pressed .Through O0 selfkeeping motor operates; and it is off if any button I3 ¡BI4 ¡BI5 is pressed.

- **Self-keeping**
  Please refer to DIAGRAM 2. When press I0 button, coil is energized. And N.O contact of relay, path 1and 2 are all close. When release I0 button, path 2 is open while 1 is still close to energizing coil, this keeps N.O contact close. This interaction of relay coil and contacts is named self-keeping circuit.

SUPPLEMENT

PLC circuit diagram is as the following:

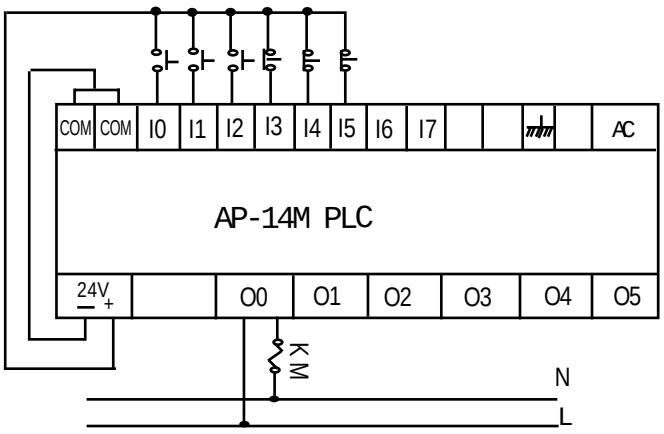


DIAGRAM 1

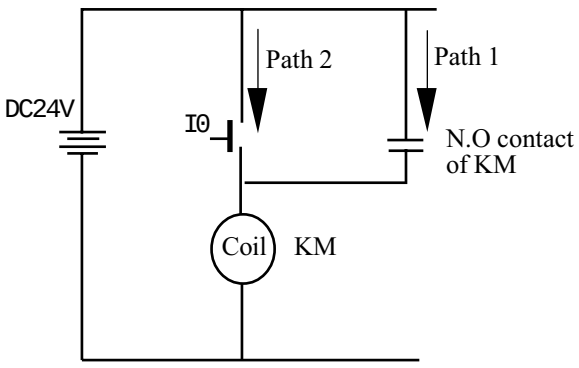
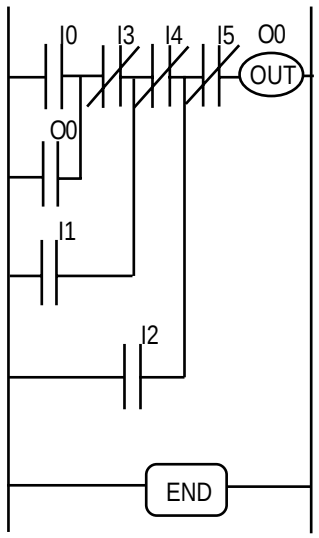


DIAGRAM2

This application can also be performed as the following

Control demand: There's ON/OFF button in A,B,C, the motor is on/off if any of the buttons is pressed.

Ladder Diagram



Command List

```
000     LD      I0
001     OR      O0
002     ANI     I3
003     OR      I1
004     ANI     I4
005     OR      I2
006     ANI     I5
007     OUT     O0
008     END
```

DESCRIPTION

- **Input ports:**

  I0: ON button in A I1: ON button in B
  I2: ON button in C I3: OFF button in A
  I4: OFF button in B I5: OFF button in C

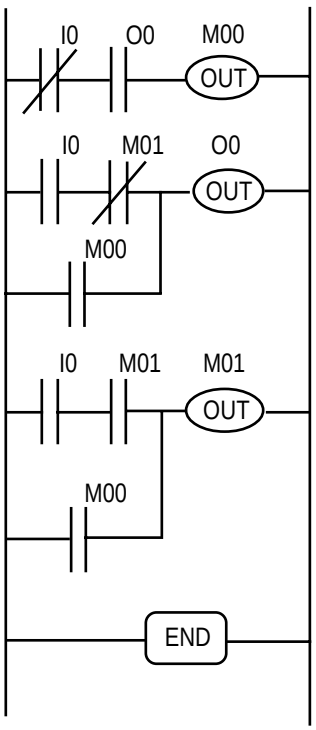
- **Output ports:**

  O0: the contactor coil KM.

8.2.2 Control ON/OFF of the Motor by One Button

Control demand: use one button to control ON/OFF of the motor.

Ladder Diagram



Command List

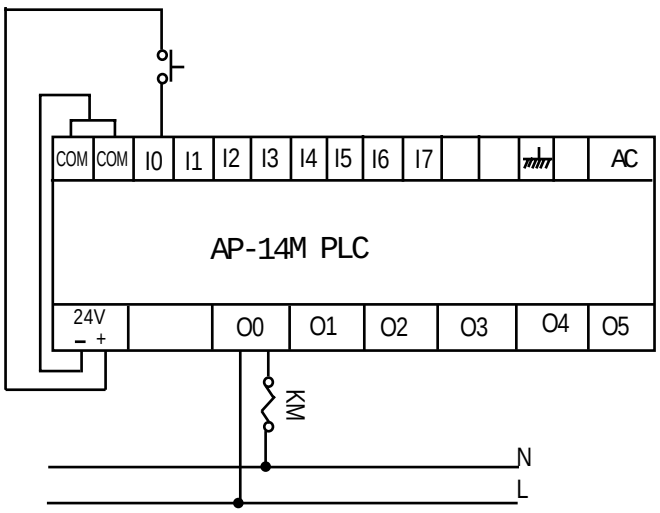
```
000     LDI    I0
001     AND    O0
002     OUT    M00
003     LD     I0
004     ANI    M01
005     OR     M00
006     OUT    O0
007     LD     I0
008     AND    M01
009     OR     M00
010     OUT    M01
011     END
```

DESCRIPTION

- I0: ON/OFF button
- O0: the contactor coil
- In this program the toggle button is available to control two states, and the internal relay M00,M01 are capable of reserving the intermediate operating result.
- In this program one contact can be converted to two and it is the fine reference in programming the complicated programs.

SUPPLEMENT

- PLC circuit diagram is as the following:

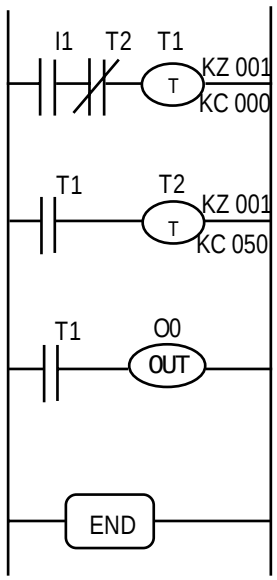


8.3 Application of TIM+ Self-keeping+I/O

8.3.1 Flicker Circuit

TIM	Form a flicker circuit

Ladder Diagram

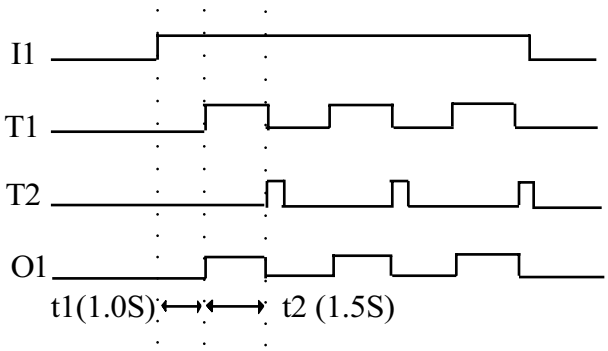


Command List

```
000     LD      I1
001     ANI     T2
002     TIM     T1
003     KZ      001
004     KC      000
005     LD      T1
006     TIM     T2
007     KZ      001
008     KC      050
009     LD      T1
010     OUT     O0
011     END
```

DESCRIPTION

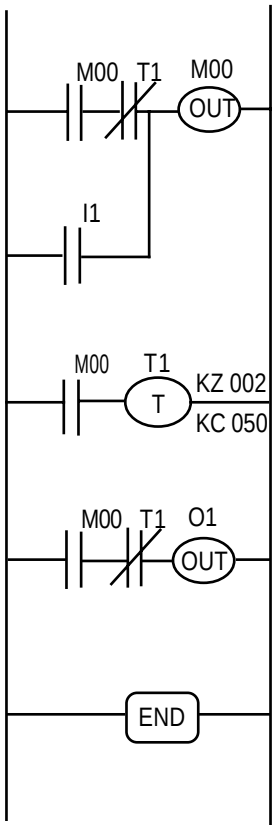
- After I1 on and T1 times for 1second, start T2 to time for 1.5seconds, then cut T1 off.
- After T1 is restored, then comes T2 to do the same action again.
- The sequence diagram is shown on the right:



8.3.2 Trigger Circuit

TIM	Form a trigger circuit (it outputs constant pulse width regardless of the length of input pulse).

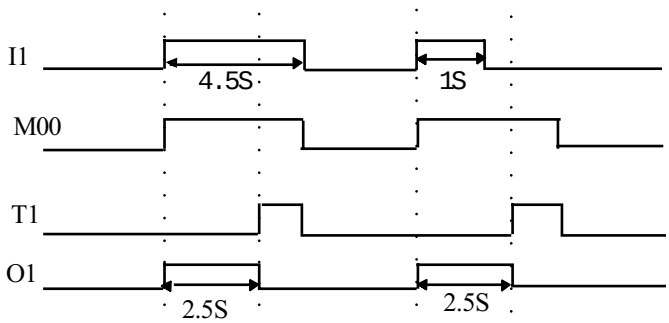
Ladder Diagram



Command List

```
000     LD      M00
001     ANI     T1
002     OR      I1
003     OUT     M00
004     LD      M00
005     TIM     T1
006     KZ      002
007     KC      050
008     LD      M00
009     ANI     T1
010     OUT     O1
011     END
```

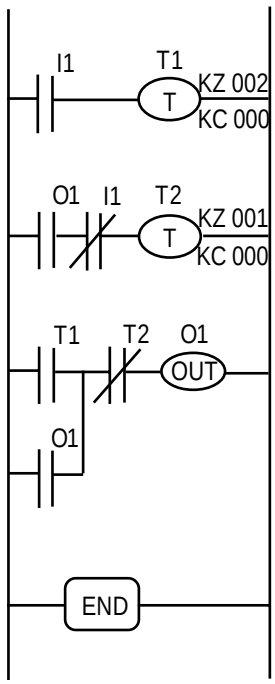
● **The operating sequence diagram is as the following:**



8.3.3 Delay Circuit

TIM	Form a start-delay and reset-delay circuit.

Ladder Diagram

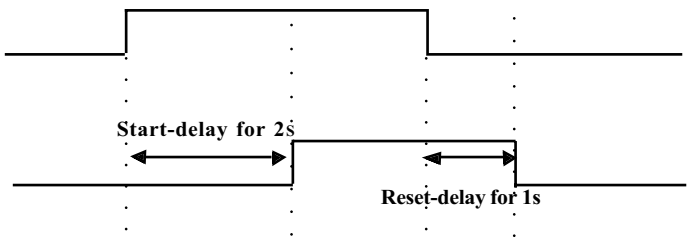


Command List

```
000     LD      I1
001     TIM     T1
002     KZ      002
003     KC      000
004     LD      O1
005     ANI     I1
006     TIM     T2
007     KZ      001
008     KC      000
009     LD      T1
010     OR      O1
011     ANI     T2
012     OUT     O1
013     END
```

DESCRIPTION

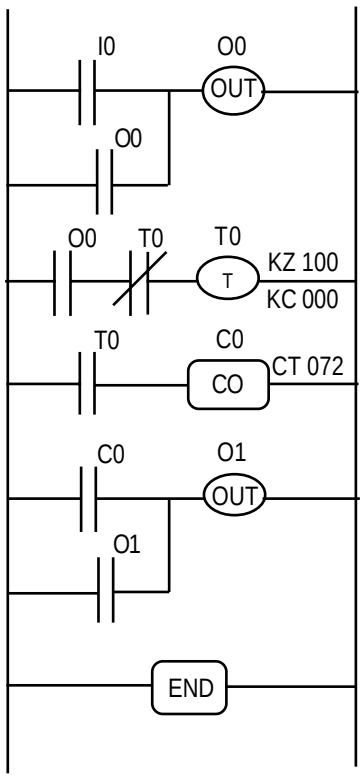
- **Start-delay circuit: after I1 is on, T1 delays 2 seconds to let O1 output self-keeping.**
- **Reset-delay circuit: after O1 is off, T2 times for 1second to cut off the self-keeping circuit of O1.**



8.4 Application of CO + TIM + I/O

Control demand: Turn on the electro-magnetic valve to input materials for 2 hours, then run agitator. Using CO to increase time-delay.

Ladder Diagram

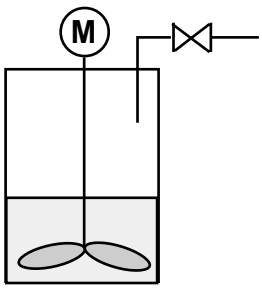


Command List

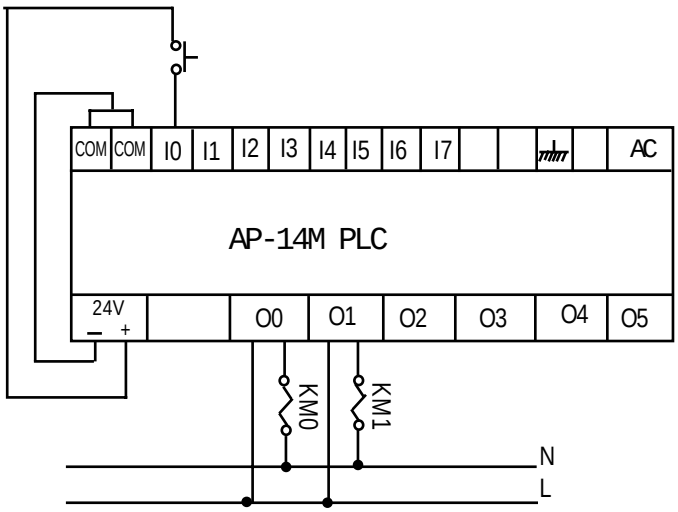
000	LD	I0
001	OR	O0
002	OUT	O0
003	LD	O0
004	LDI	T0
005	TIM	T0
006	KZ	100
007	KC	000
008	LD	T0
009	CO	C0
010	CT	072
011	LD	C0
012	OR	O1
013	OUT	O1
014	END	

DESCRIPTION

- O0 contacts electromagetic valve, O1 contacts start-relay of agitator's motor.



PLC circuit diagram is as the following:

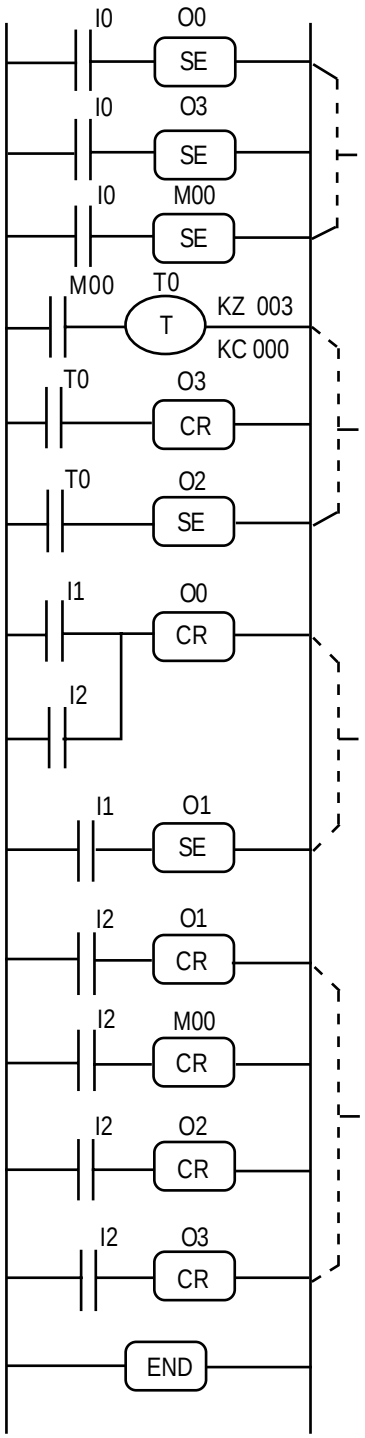


8.5 Multi-application

8.5.1 'Y-△' changeover and both Directions of Rotation of the 3-phase Asynchronous Motor

Control demand: press the start button PB1, the motor starts by Y version and changes to ¡µafter 3seconds at the same time rotating positively. Press the reverse button PB2, the motor runs on, then press the stop button PB3.

Ladder Diagram



Press PB1,the motor starts by Y version, rotating directly

Changes to △ after 3s

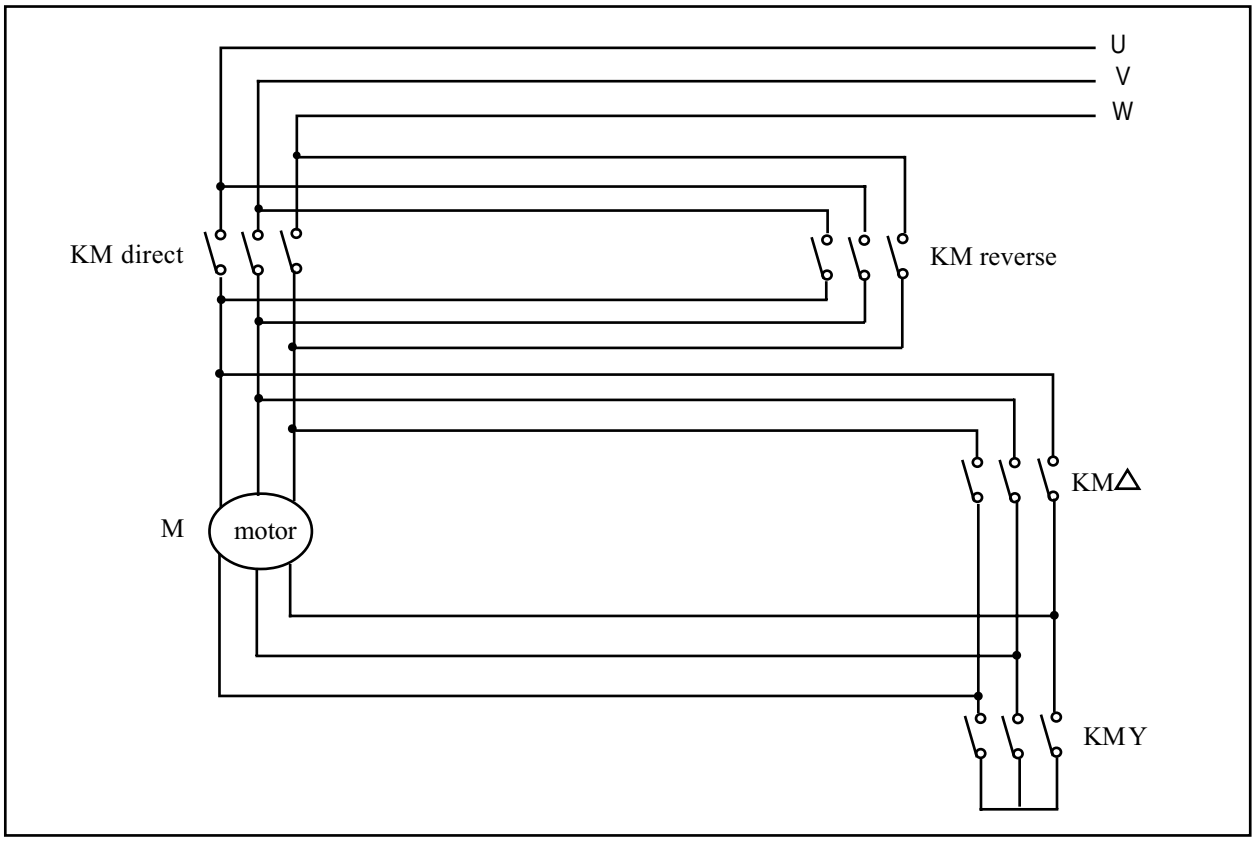
Press PB2, motor reverses

Press PB3, motor stops operating

Command List

```
000   LD    I0
001   SE    O0
002   LD    I0
003   SE    O3
004   LD    I0
005   SE    M00
006   LD    M00
007   TIM   T0
008   KZ    003
009   KC    000
010   LD    T0
011   CR    O3
012   LD    T0
013   SE    O2
014   LD    I1
015   OR    I2
016   CR    O0
017   LD    I1
018   SE    O1
019   LD    I2
020   CR    O1
021   LD    I2
022   CR    M00
023   LD    I2
024   CR    O2
025   LD    I2
026   CR    O3
027   END
```

The circuit diagram of operating motor:



DESCRIPTION

- Input ports:

  I0: the start button (PB1)

  I1: the reverse button (PB2)

  I2: the stop button (PB3)

- Output ports:

  O0: the positive rotating a.c.contactor coil

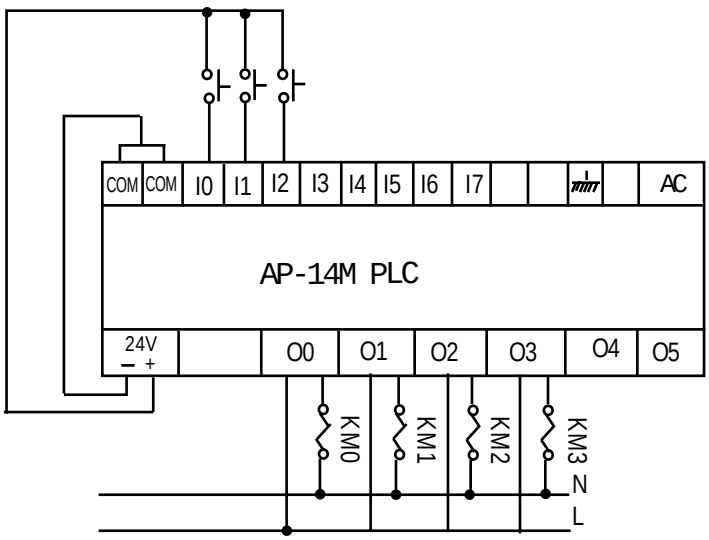
  O1: the reverse a.c. contactor coil

  O2: ¡µa.c. contactor coil

  O3: Y a.c. contactor coil

SUPPLEMENT

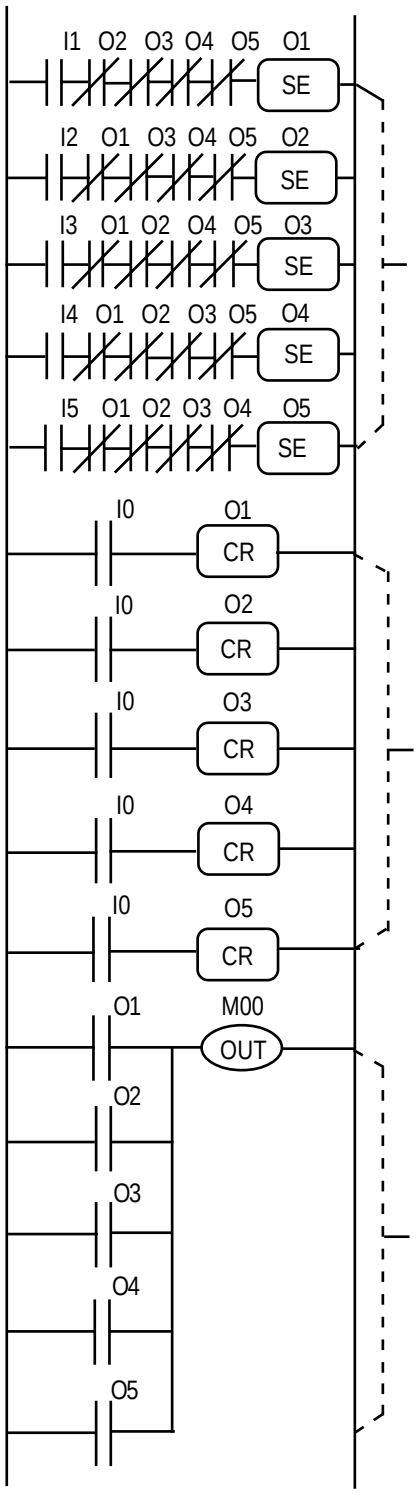
PLC circuit diagram is as the following:



8.5.2 Five Groups of the Rush-answer Control System

Control demand: in these five groups of the rush-answer system, if any button is pressed, the indicator of this group lights on, at the same time the buzzer voices for 3seconds, press the reset button to do the same action again.

Ladder Diagram



Press any button, the indicator of this group lights on

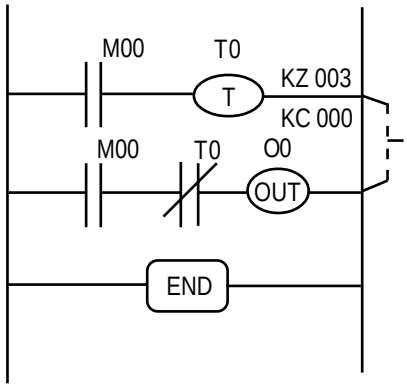
Press the reset switch, indicator is off.

Restore the intermediate result in the internal relay M00

Command List

000	LD	I1
001	ANI	O2
002	ANI	O3
003	ANI	O4
004	ANI	O5
005	SE	O1
006	LD	I2
007	ANI	O1
008	ANI	O3
009	ANI	O4
010	ANI	O5
011	SE	O2
012	LD	I3
013	ANI	O1
014	ANI	O2
015	ANI	O4
016	ANI	O5
017	SE	O3
018	LD	I4
019	ANI	O1
020	ANI	O2
021	ANI	O3
022	ANI	O5
023	SE	O4
024	LD	I5
025	ANI	O1
026	ANI	O2
027	ANI	O3
028	ANI	O4
029	SE	O5
030	LD	I0
031	CR	O1
032	LD	I0
033	CR	O2
034	LD	I0
035	CR	O3
036	LD	I0
037	CR	O4
038	LD	I0
039	CR	O5
040	LD	O1
041	OR	O2

Ladder Diagram



Any indicative lamp lights on, the buzzer voices for 3s

Command List

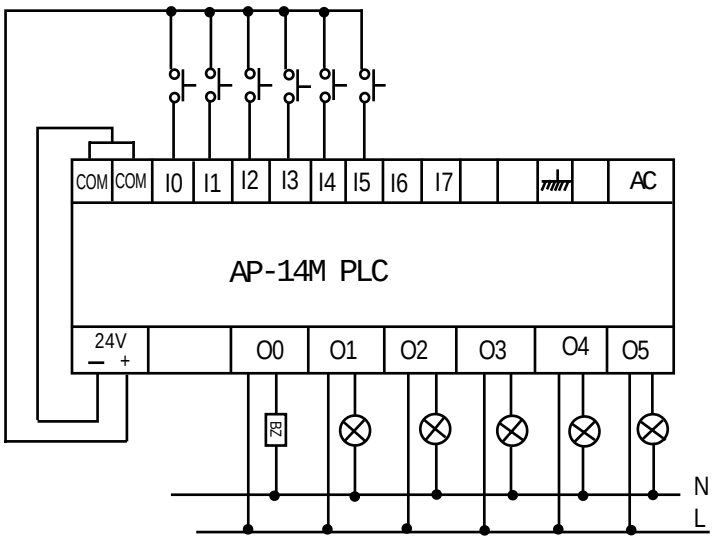
```
042    OR     O3
043    OR     O4
044    OR     O5
045    OUT    M00
046    LD     M00
047    TIM    T0
048    KZ     003
049    KC     000
050    LD     M00
051    ANI    T0
052    OUT    O0
053    END
```

DESCRIPTION

- Input point:
  - IO: the reset pushbutton
  - I1: the first group pushbutton
  - I2: the second group pushbutton
  - I3: the third group pushbutton
  - I4: the fourth group pushbutton
  - I5: the fifth group pushbutton
- Output point:
  - O0: buzzer
  - O1: the first group indicative lamp
  - O2: the second group indicative lamp
  - O3: the third group indicative lamp
  - O4: the fourth group indicative lamp
  - O5: the fifth group indicative lamp

SUPPLEMENT

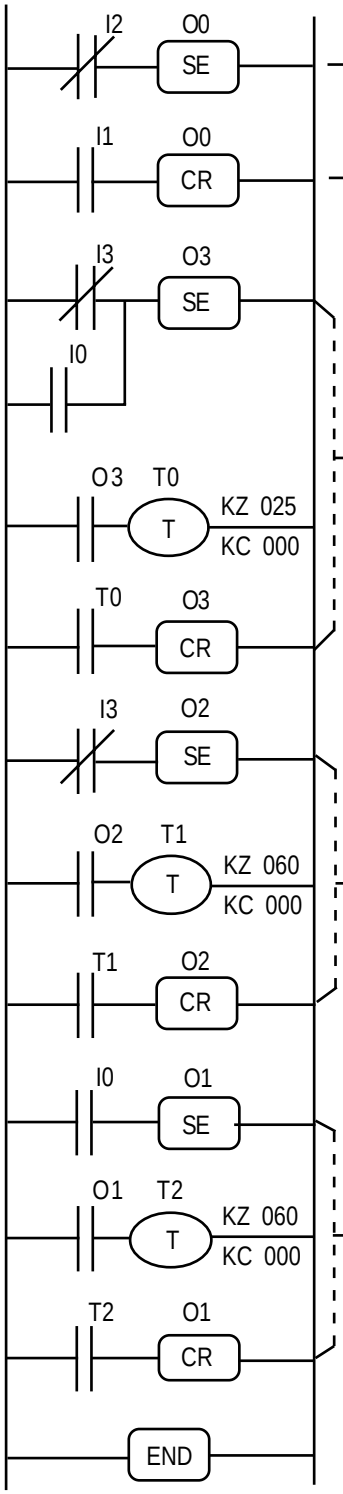
PLC circuit diagram is as the following



8.5.3 Automatic Control of the Water Tank Level with Alarm

Control demand: when the water is lower than the lower limit start sensor r, run motor M to water. When the level is lower than the lower limit alarm sensor R, the alarm lamp lights on for 60 seconds and the bell rings for 25 seconds.When the level is higher than the upper limit stop sensor h, switch off motor M to stop watering immediately. When the level is higher than the upper limit alarm sensor H, the alarm lamp lights on for 60 seconds and the bell rings for 25 seconds.

Ladder Diagram



the lower limit start sensor r is OFF, start motor to water

the upper limit stop sensor h is ON, stop motor watering

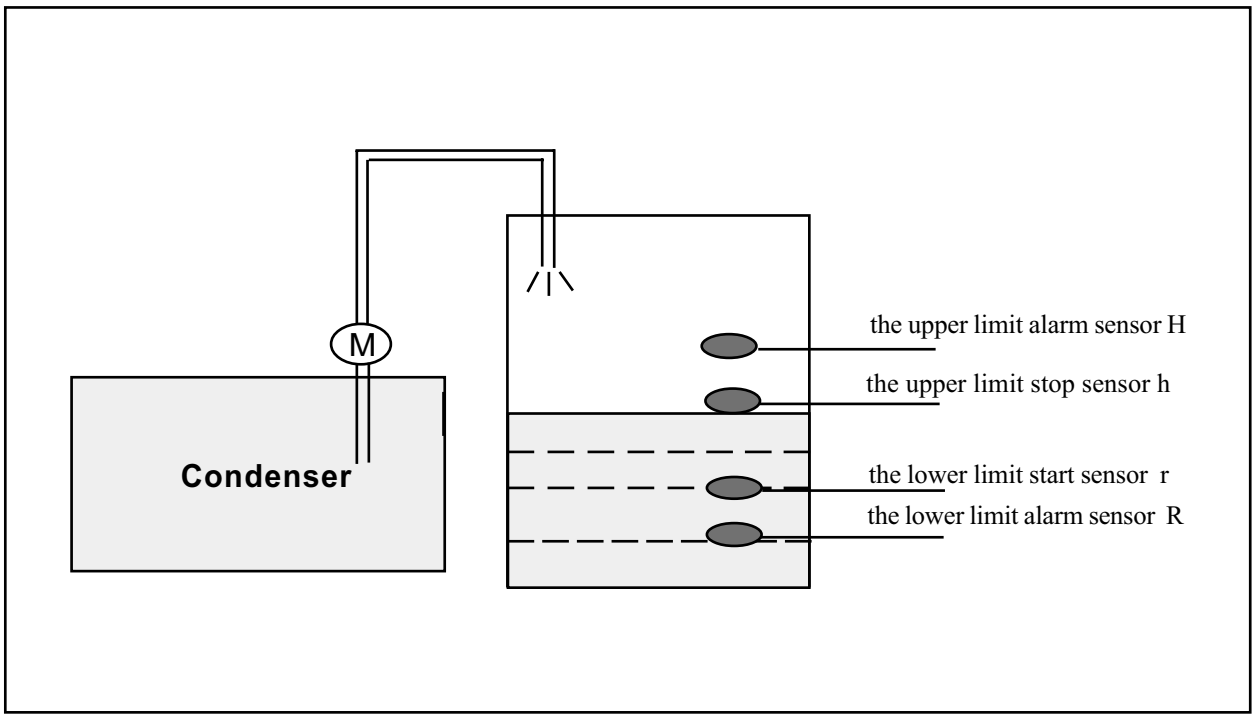
the lower limit alarm sensor R is OFF or the upper one H is ON, the alarm bell rings for 25 sceonds

the lower limit alarm sensor R is OFF, the alarm lights on for 60 seconds

the upper one H is ON, the alarm lights on for 60s

Command List

000	LDI	I2
001	SE	O0
002	LD	I1
003	CR	O0
004	LDI	I3
005	OR	I0
006	SE	O3
007	LD	O3
008	TIM	T0
009	KZ	025
010	KC	000
011	LD	T0
012	CR	O3
013	LDI	I3
014	SE	O2
015	LD	O2
016	TIM	T1
017	KZ	060
018	KC	000
019	LD	T1
020	CR	O2
021	LD	I0
022	SE	O1
023	LD	O1
024	TIM	T2
025	KZ	060
026	KC	000
027	LD	T2
028	CR	O1
029	END	



DESCRIPTION

- Input point:

  I0: the upper limit alarm sensorH

  I1: the upper limit stop sensor h

  I2: the lower limit start sensor r

  I3: the lower limit alarm sensor R

- Output point:

  O0:A.C contact of motor

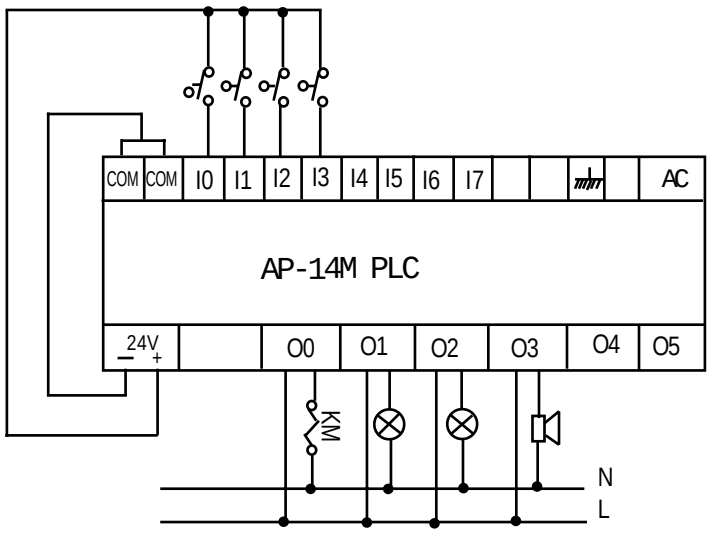
  O1:the upper limit alarm lamp

  O2:the lower limit alarm lamp

  O3:the alarm bell

SUPPLEMENT

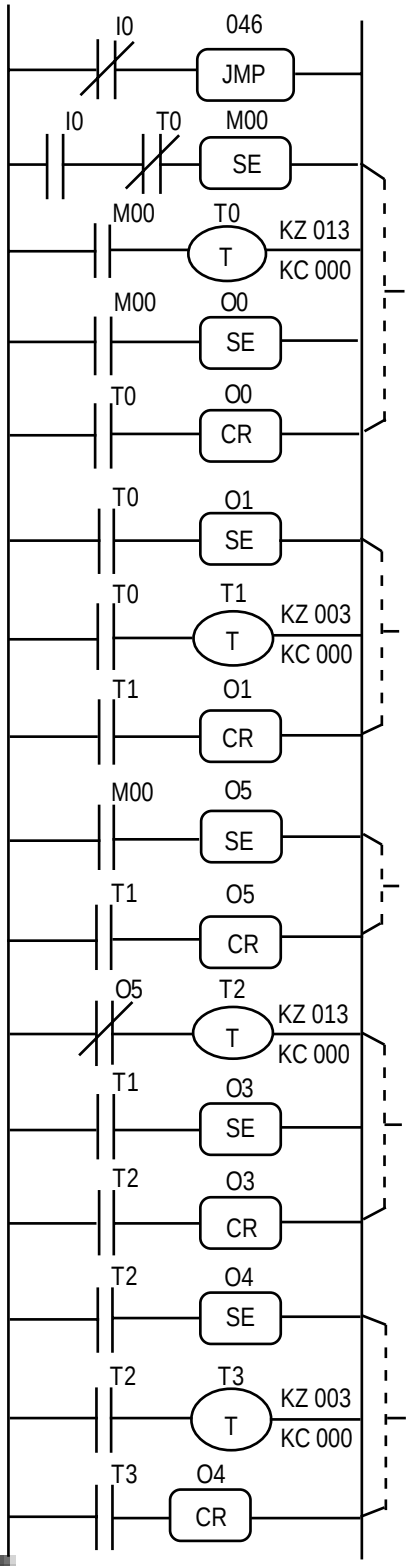
- PLC circuit diagram is as the following:



8.5.4 The Circuit Controls Traffic Lights at Crossroad

Control demand: switch on the button in east and west, the green light in east and west turns on; the red light in south and north turns on.Switch on the button in south and north, the green light in south and north turns on; the red light in east and west turns on.Switch on the automatic button, the green light in south and north turns on for 13 seconds;the yellow light for 3 seconds and the red light for 16 seconds. When the yellow light in east and west turns on, the corresponding red light ineast and west turns on for 16 seconds, then the green light for 13 seconds; yellow light f or 3 seconds and cycles on.

Ladder Diagram



press the automatic switch PBO, the green light in south and north turns on for 13s

the yellow one turns on for 3s

the corresponding red light in east and west turns on for 16s

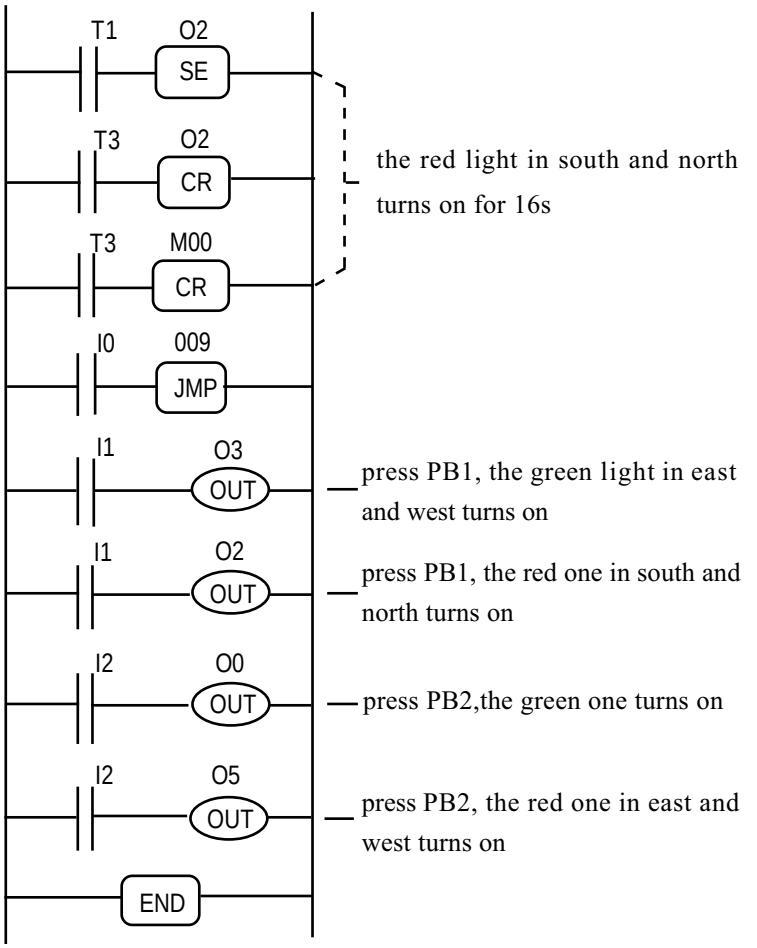
the green light turns on for 13s

the yellow one turns on for 3s

Command List

```
000    LDI   I0
001    JMP   046
002    LD    I0
003    ANI   T0
004    SE    M00
005    LD    M00
006    TIM   T0
007    KZ    013
008    KC    000
009    LD    M00
010    SE    O0
011    LD    T0
012    CR    O0
013    LD    T0
014    SE    O1
015    LD    T0
016    TIM   T1
017    KZ    003
018    KC    000
019    LD    T1
020    CR    O1
021    LD    M00
022    SE    O5
023    LD    T1
024    CR    O5
025    LDI   O5
026    TIM   T2
027    KZ    013
028    KC    000
029    LD    T1
030    SE    O3
031    LD    T2
032    CR    O3
033    LD    T2
034    SE    O4
```

Ladder Diagram



Command List

035	LD	T2
036	TIM	T3
037	KZ	003
038	KC	000
039	LD	T3
040	CR	O4
041	LD	T1
042	SE	O2
043	LD	T3
044	CR	O2
045	LD	T3
046	CR	M00
047	LD	I0
048	JMP	009
049	LD	I1
050	OUT	O3
051	LD	O2
052	OUT	O0
053	LD	I2
054	OUT	O0
055	LD	I2
056	OUT	O5
057	END	

DESCRIPTION

- **Inputpoint:**

I0:the automatic push button (PB0)

I1: the pushbutton in east and west (PB1)

I2: the pushbutton in south and north (PB2)

- **Output Point:**

O0: the green light in south and north

O1: the yellow light in the south and north

O2: the red light in south and north

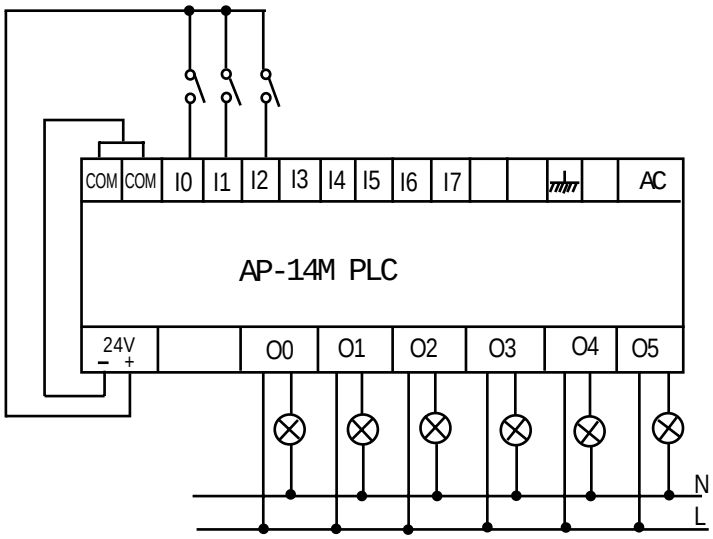
O3: the green light in east and west

O4: the yellow light in east and west

O5: the red light in east and west

SUPPLEMENT

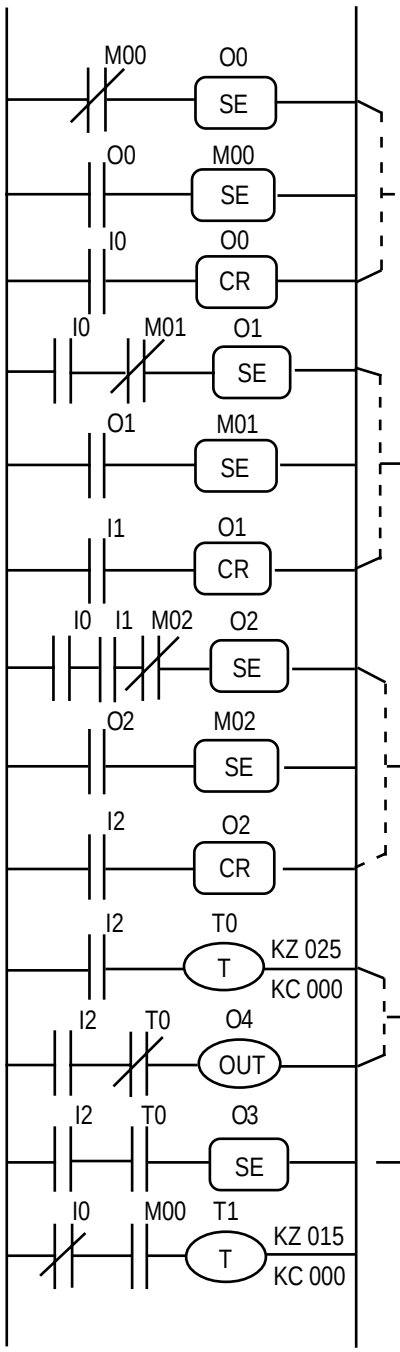
- PLC circuit diagram is as the following:



8.5.5 Three Kinds of Liquid Mixed Automatically

Control demand: put liquid A in a condenser, when it reaches the sensor L, shut off the electromagnetic valve A. Put in liquid B, when it reaches the sensor I, shut off electromagnetic valve B. Put in liquid C, when it reaches the sensor H, shut off the electromagnetic valve C. Start motor M and cut it off after 25 seconds, open the valve Y, when the liquid reaches the sensor and displays 0, open valve Y and shut it off after 15 seconds. The action cycles on.

Ladder Diagram



open the electromagnetic valve A, put in liquid A, when the sensor L is ON, close the valve

open the valve B, put in liquid B, when the sensor I is ON, close the valve

open the valve C, put in liquid C, when the sensor H is ON, close the valve

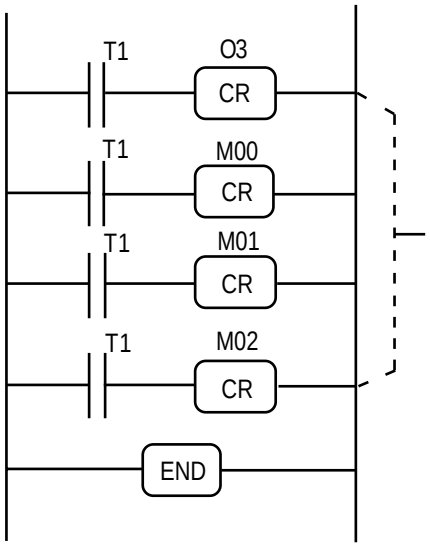
start motor for 25s, then cut it off

open the valve Y, output liquid

Command List

000	LDI	M00
001	SE	O0
002	LD	O0
003	SE	M00
004	LD	I0
005	CR	O0
006	LD	I0
007	ANI	M01
008	SE	O1
009	LD	O1
010	SE	M01
011	LD	I1
012	CR	O1
013	LD	I0
014	AND	I1
015	ANI	M02
016	SE	O2
017	LD	O2
018	SE	M02
019	LD	I2
020	CR	O2
021	LD	I2
022	TIM	T0
023	KZ	025
024	KC	000
025	LD	I2
026	ANI	T0
027	OUT	O4
028	LD	I2
029	AND	T0
030	SE	O3
031	LDI	I0
032	AND	M00
033	TIM	T1

Ladder Diagram



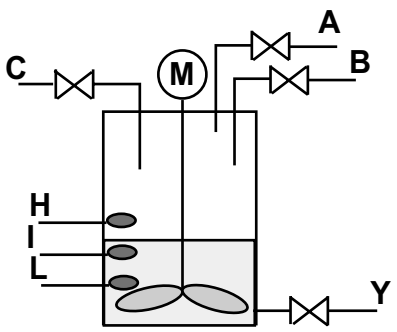
when the liquid level sensor L is OFF, close the valve Y after a delay of 15s

Command List

034	KZ	015
035	KC	000
036	LD	T1
037	CR	O3
038	LD	T1
039	CR	M00
040	LD	T1
041	CR	M01
042	LD	T1
043	CR	M02
044	END	

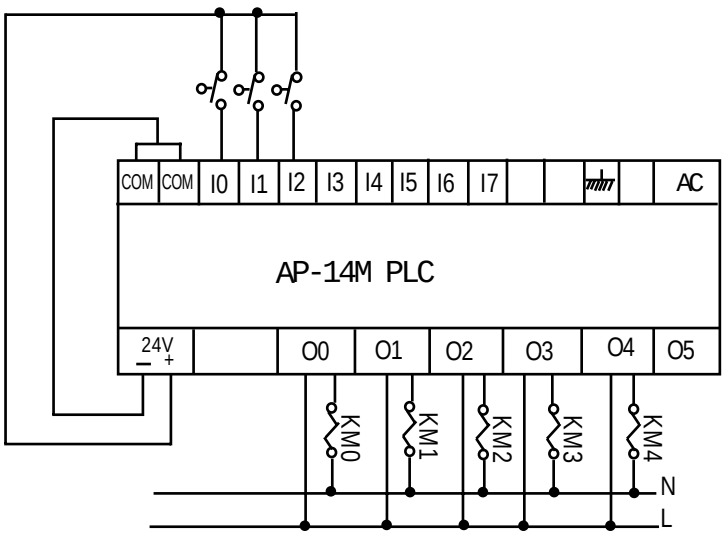
DESCRIPTION

- Input point:
  I0: the liquid level sensor L
  I1: the liquid level sensor I
  I2: the liquid level sensor H
- Output point:
  O0: the electromagnetic valve A
  O1: the electromagnetic valve B
  O2: the electromagnetic valve C
  O3: output valve Y
  O4: the contact of agitator's motor M



SUPPLEMENT

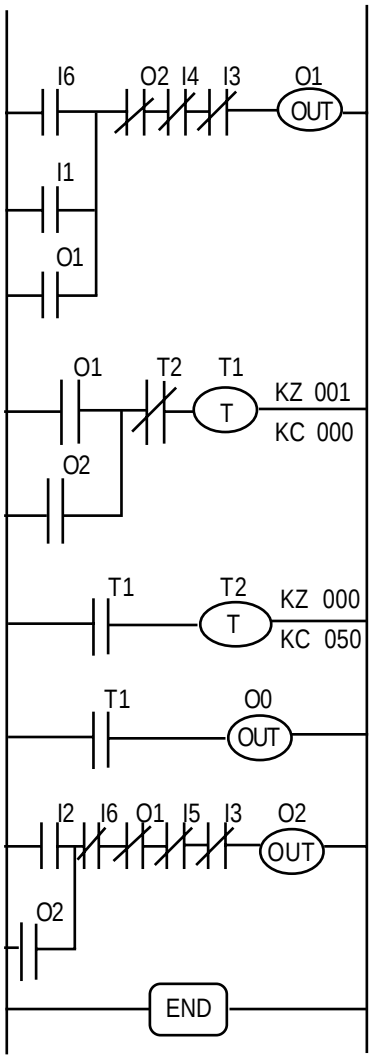
PLC circuit diagram is as the following:



8.5.6 Automatic Door Control System

control demand: 1.the guard in the office controls the gate through the buttons
2.the gate usual is open or close, but the status will be end at any time
3.the alarm bulb flashes (contact/uncontact) when the door is active
4.with the safe pressure baffle, the operation time is less and is available to avoid to injure or press person and damage other materials, the door will be open if one touches (when the safe pressure baffle is in available)

Ladder Diagram



· · open the door

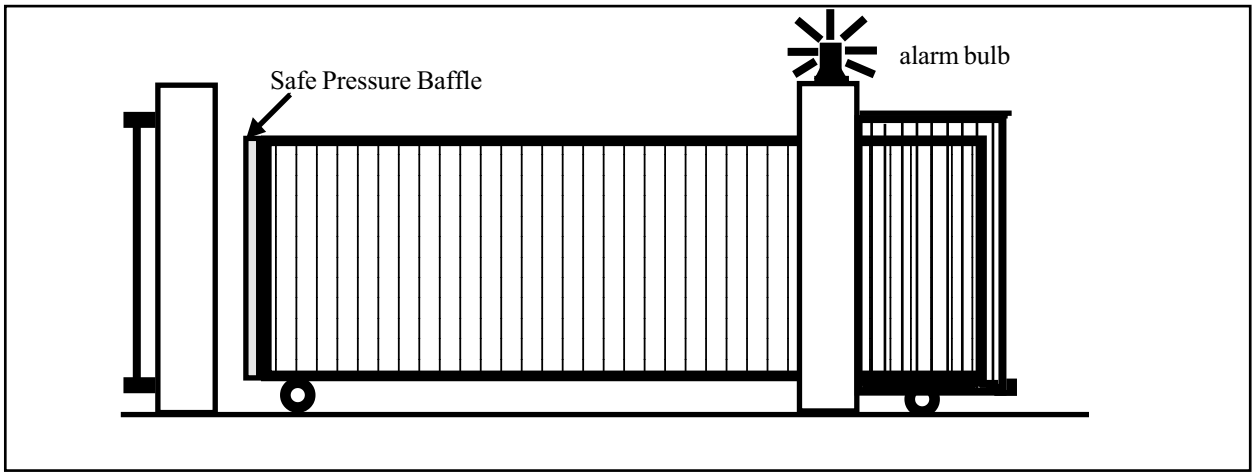
· · When the door is working, the light flashes for 0.5s, off for 1s.

· · close the door

Command List

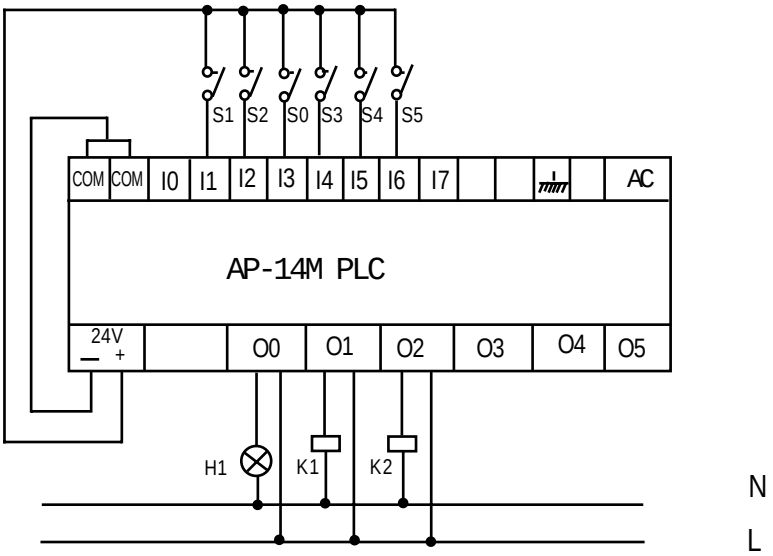
000	LD	I6
001	OR	I1
002	OR	O1
003	ANI	O2
004	ANI	I4
005	ANI	I3
006	OUT	O1
007	LD	O1
008	OR	O2
009	ANI	T2
010	TIM	T1
011	KZ	001
012	KC	000
013	LD	T1
014	TIM	T2
015	KZ	000
016	KC	050
017	LD	T1
018	OUT	O0
019	LD	I2
020	OR	O2
021	ANI	I6
022	ANI	O1
023	ANI	I5
024	ANI	I3
025	OUT	O2
026	END	

Operating the automatic door



SUPPLEMENT

PLC circuit diagram is as the following:



DESCRIPTION

- H1: flashing indicator
- K1: the main contact for opening door
  K2: the main contact for closing door
- S0: stop switch
  S1: open switch of the door
  S2: close switch of the door
  S3: limit switch for opening door
  S4: limit switch for closing door
  S5: safe pressure limit switch

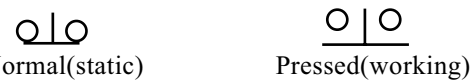
Chapter 9 The General Electrical Knowledge about PLC

9.1 Explanation of the Technical Items in Common Use

'a' contact: also calls N.O. (Normal Open) contact, means the contact of compnents is open or OFF in static state and is closed or ON when it is forced on. Please see the following diagram:

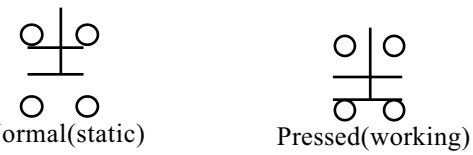
DIAGRAM(9-1)

'b' contact:also calls N.C.(Normal close) contact, means the contact of components is close or ON in static state and is open or OFF when it is forced on. Please see the following diagram:



DIAGRAM(9-2)

'c' contact: in-built one 'a' contact and one 'b' contact



DIAGRAM(9-3)

Changeover: the contact converts from ON to OFF or from OFF to ON.

9.2 Peripheral Input Components

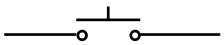
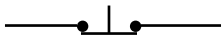
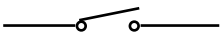
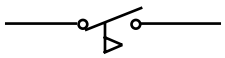
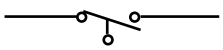
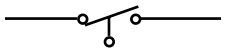
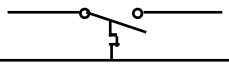
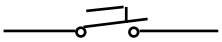
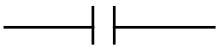
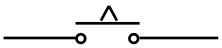
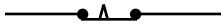
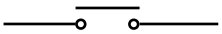
The most acceptable input components incorporating with the PLC includes pushbutton ¡Bshaky switch ¡B rotary knob ¡Blimit switch ¡Bplug-in switch ¡Bphoto switch ¡Btemperature switch etc. It also includes the sensors of current ¡Bvoltage ¡Bspeed ¡Bpressure ¡Bwater level ¡Bweight etc.

9.3 Peripheral Output Components

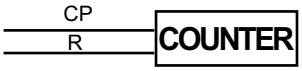
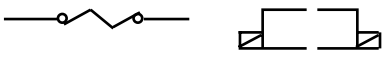
The rated capacity of the PLC output contact isn't very large, as to the larger load, it must output the component first, then drive the end load. The common output components include electromagnetic contact ¡Bsolid contact ¡Belectromagnetic valve ¡Bindicator ¡Bbuzzer ¡B7-step LED etc.

9.4 Table of the Component Symbol

9.4.1 Table of the Input Component Symbol

Name	Symbol	N.O. contact	N.C. contact
Pushbutton	PB		
Switch button	SW		
Limit switch	LS		
Flow breaking switch	Flow-SW		
Liquid level breaking switch	Level-SW		
Atmosphere pressure or vacuum breaking switch	Vac-SW		
Temperature breaking switch	Thermal-SW		
Foot switch	Foot-SW		
Relay switch	R-a/R-b		
Timer	T		
Counter	C		

9.4.2 Table the Loading Component Symbol

Name	symbol	sign
Relay switch	R	
Timer	T	
Counter	C	
Solenoid valve coil	Sol.A/Sol.B	
Motor	Motor	
Indicating lamp	Lamp	
BUZZER	Buzzer	

Chapter 10 Equipment Maintenance & Quality Guarantee

10.1 Regular Check and Maintenance

(1) The product consists of high accuracy electric components and are very reliable. Sometimes the environment affection will damage the components and affect the normal function, therefore, we recommend you to check it 2-3 times/year, and you may increase or reduce the checking time according to the environment and usage frequency.

(2) Item

Type	Checking item	Content	Standard	Checking method
Indicating lamp	ERR lamp	flashing or Lighting on of ERR Lamp	no light	sight check
Power source	Power switch	frequent power OFF or sharp rise/ drop of the voltage	within the voltage changing range	oscilloscope
	Output voltage	in the specified range or not	DC24V ¡Ó5%	Multi-meter
Environment	Temperature	in the specified range or not	-5℃~+55℃	thermometer
	Humidity	condense or not	45-85%RH	Hygrometer
	Shock or vibration	Shocks/vibration or not	non	sense of touch
	Dust or powder	dust/powder or not	non	sight check
Mounting	Installation screw	the fixed screw is firm or not	firm	screwdriver
	Programmer cable	the plug-in components is good or not	no loose	sight check
	External wring	broken or not	non	sight check
Program	Program	error or not	non	programmer or EASY2000

10.2 Quality Guarantee

The product has been strictly tested for quality before deliver from our plant and completely meet various requirements stipulated in this manual. Under proper installation it should work as expected.

10.2.1 Warranty Period

This equipment is warranted against defects in material and manufacturing for a period of one year from the date of shipment. During the warranty period, ARRAY is responsible for necessary repairs as long as the product can be proved to be defective.

10.2.2 Warranty Range

During the above-mentioned warranty period if any damage caused by the product quality, the repair charges are free for the user, but the following situation is expected:

- Improper installation or operation
- Damages caused by unauthorized dismantle
- The damages of consumable parts such as rubber cover ¡Bbuttons ¡Bbatteries ¡B relays etc.
- Damages caused by uncontrolled reason or natural force

10.2.3 Service Range

- For any service or repair of this product, buyer will pay shipping charges to ARRAY.
- The service charges of sending the technician are not included in the product price, but in the following condition, charges are excluded:

ƒÜ ¡°Give advice in Mounting ¡Bdebugging and running-in.

ƒÜ ¡°Technical recommendation and training.

Attachment: PLC Holding Unit without Power AP-14E

Our PLC has the unit of AP-14E (user can purchase this unit separately) for self-keeping in the event of power failure. When discover the left side of PLC, you can see a contact plug. Plug the contact in the socket on back of AP-14E, and then fix AP-14E on PLC. When run PLC,set the button on the unit to ON. However, if power is on again, PLC will continue to operate from the states that are stored on the moment of power failure(keeping all of the states except inputting). If unnecessary, release the button.

Notes: the keeping unit of AP-14E can work only from the moment when it is in available and set into ON. It cannot keep operating states in terms of power failure before available. What's more, it will not be ON when firstly powered.

The operation procedures:

(1) Connect AP-14E with AP-14M

(2) Set the button of AP-14E into OFF

(3) Supply power

(4) Programming

(5) Set the button of AP-14E into ON

If complete the five steps, the PLC has the function to self-keeping operating states (including all states of timer, counter and internal relay) in the event of power failure.