IMO *iSmart*

Operation Manual - Second Edition

IMO Precision Controls Ltd

Safety Precaution

Precautions for Installation:


Never install the product in the environment beyond the one specified in the brochure and user manual, such as high temperature, humidity, dust, erosive gas, vibration, impact condition resulting in the risk of inductive electricity, fire and error operation.


Please comply with the installation instruction in the user manual to avoid damage or operation error.


Pay close attention to avoid cable or conductor parts falling into the iSmart to prevent fire or electrical fault.

Precautions for Wiring:


Connect Class 3 grounding in accordance with the local Electricity Engineering Regulations.


Apply the rated power supply and specified cables. Incorrect power supply could result in damage to the unit.


The wiring shall be carried out by the certified electrician pursuant to the provisions set forth in the local Electricity Engineering Regulations.

Precautions for Operation:


When the power is on, never contact the terminal to avoid short circuit.


It is recommended to add safety protection such as an emergency stop and external protection to prevent the iSmart from electrical damage.


Run the iSmart after safety confirmation. Error operation will result in mechanical damage.


Please pay attention to the power linkage procedure. Wrong process flow would lead to mechanical damage or other hazards.

Table of Contents

Chapter 1 General

The iSmart is a tiny “smart” PLC having upto 44 I/O points and using either a ladder graphical or FBD program, and applicable to the small-scale automated systems. iSmart can have upto 3 expansion modules of 4-inputs & 4-outputs. The power and flexibility of the iSmart allows the user to automate smaller processes saving time and cost.

The special features of the iSmart are presented below:

Feature 1

Complete product range:

(1) Main Module Dimensions:

a. 10/12 point variant：72 x 90 x 57.3 (mm)

b. 20 point variant：126 x 90 x57.3 (mm)

(2) Expansion Module Dimensions:

a. Max. 3 units: 38×90×57.3 (mm)

(3) Real Time Clock

(4) Analog inputs (DC supply models)

(5) Models with or without Display and Keypad

Feature 2

Selective input and output

(1) Input:

a. 85 - 264Vac

b. 21.6 - 26.4Vdc (24Vdc supply)

c. 10.4 - 14.4Vdc (12Vdc supply)

(2) Output: Relay or Transistor

Feature 3

Easy to program and to operate

(1) Built-in 12 x 4 LCD display and 8 keys for inputting ladder program

(2) PC configuration software compatible with Windows 95/98/ME/NT/2000/XP

(3) PDA configuration software. (HP iPAC)

(4) Seven languages: English, French, Spanish, Italian, German, Portuguese and Chinese.

Feature 4

Easy installation and maintenance

(1) Screw mounting

(2) DIN rail mounting

(3) Spare program cartridge SMT-PM04 (optional)

(4) LCD display shows input and output status

Feature 5

(1) Two digital output types

   a. Relay, Max. 8A/point, with resistive load.

   b. Transistor output 0.5A/Point.

(2) Directly drive 1/3 HP motor.

(3) Large program memory

   a. Max. 200 step instructions (Ladder)

   b. Max. 99 Function blocks (FBD)

(4) Built-in Application Functions

a. Timer

b. Counter

c. Time comparison

d. Analog comparison

e. Upper and lower differentiation

f. PWM Function

g. DATALINK Function

h. REMOTE I/O Function

i. HMI Function

(5) Global certification:

a. CE

b. cUL/UL

Chapter 2 Operation Precaution

(1) Installation Environment

IMO recommend that you do not install iSmart in the following conditions:

a. In direct sunshine or when the ambient temperature is beyond 55 °C .

b. The relative humidity exceeds 90%.

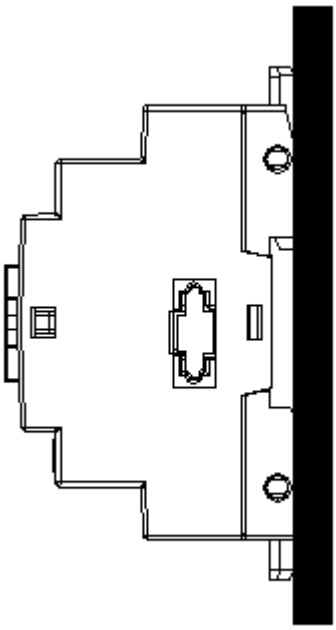
c. The environment is subject to rapid temperature change or condensation.

d. The area contains flammable or corrosive gases

(2) Installation

a. Firmly fasten the cable with lock screws to ensure proper contact.

Installation drawing



(3) Wiring

The I/O signal cables should not be routed parallel to the power cable, high current cable or in the same high current cable trays to avoid the signal interference.

(4) Static Electricity

In extremely dry areas, a persons body is susceptible to generate static electricity. Never touch the **iSmart** with hands to avoid static damage to the unit.

(5) Cleanness

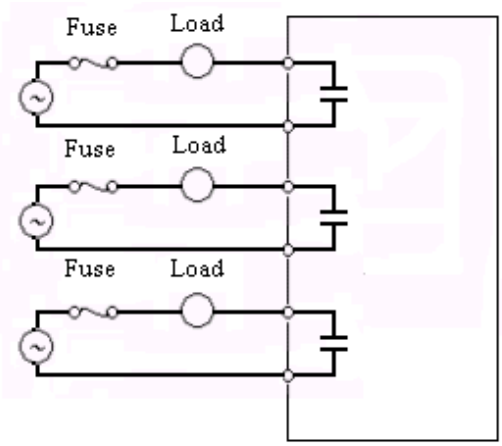
Use the clean and dry cloth to wipe the surface of the **iSmart**. Never clean the **iSmart** with water or volatile solvents to prevent structure deformation and discoloration.

(6) Storage

The time memory of **iSmart** RTC applies super capacity which is susceptible to high temperature and humidity. The **iSmart** RTC should be kept away from such conditions.

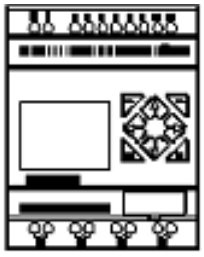
(7) Over-current Protection

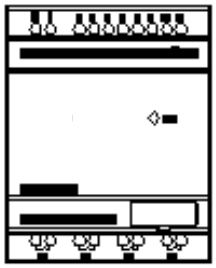
The **iSmart** does not incorporate a protective fuse at the output terminals. To avoid the short circuit on the load side, use of a fuse between each output terminals and load is recomended.

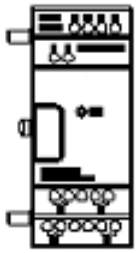


Chapter 3 System Configuration

3-1 Basic System Configuration







iSmart 10 points：

Expansion variant

□ SMT-EA-R10

□ SMT-ED-R12

□ SMT-ED-T12

Blind variant

□ SMT-BA-R10

□ SMT-BD-R12

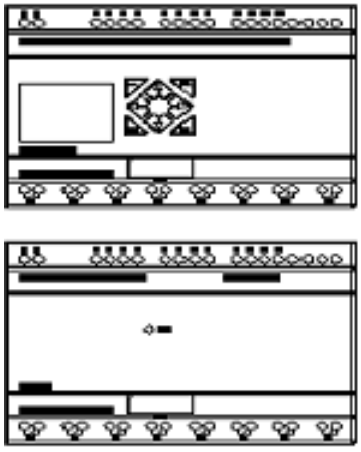
□ SMT-BD-T12

iSmart expand 8points：

□ SMT-MA-R8

□ SMT-MD-R8

□ SMT-MD-T8



iSmart 20 points：

Blind variant

□ SMT-BA-R20

□ SMT-BD-R20

□ SMT-BD-T20

High-Speed variant

□ SMT-CD-R20

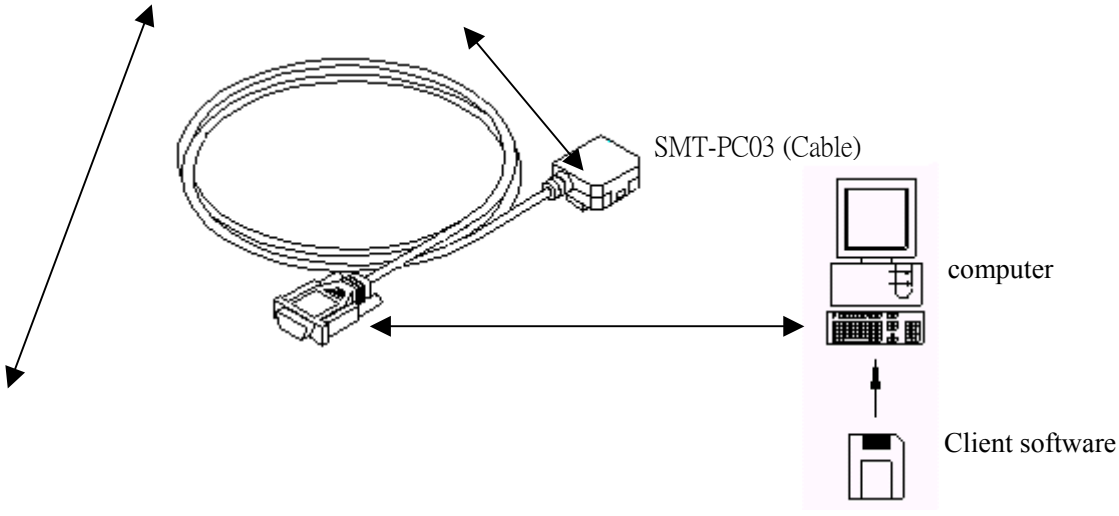
□ SMT-CD-T20

Expansion variant

□ SMT-EA-R20

□ SMT-ED-R20

□ SMT-ED-T20



3-2 Configuration for computer Connection and Spare Program Cartridge

(1) Link the computer and **iSmart** with SMT-PC03. Through the SMT-CONFIURATOR (software), the computer is ready to read and write the programs contained within the **iSmart** and monitor on line operation of the **iSmart**. (See the figure below)

PM04 (program spare cartridge)

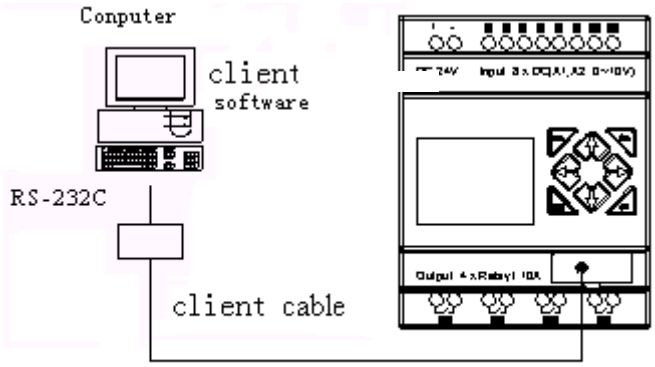


Figure 3-2-1

(2) Plug SMT-PM04 into the **iSmart** which, following the menu instructions is able to load and recover the programs from the SMT-PM04 (See the figure below)

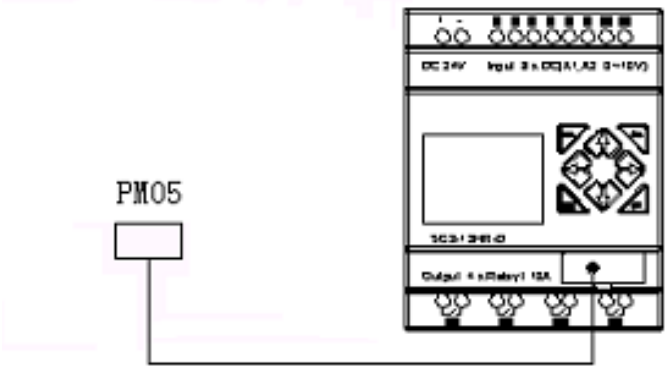


Figure 3-2-2

Chapter 4 Installation

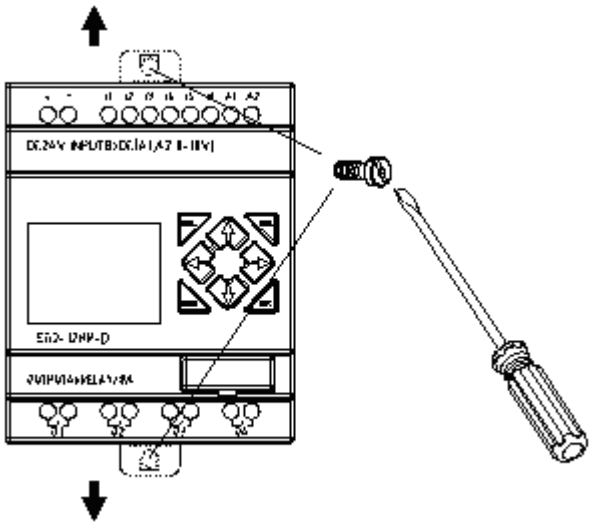
4.1 Installation Environment

The **iSmart** is not recommended to be installed under the following environments:

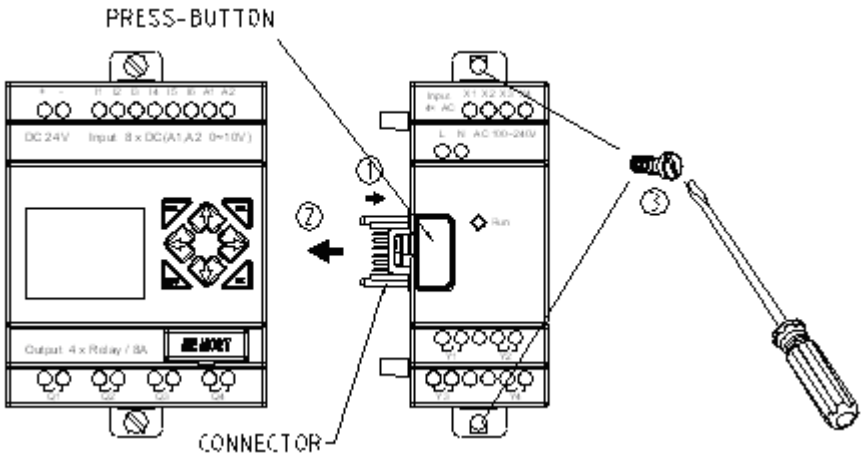
- If the ambient temperature is beyond 0-55Deg C.
- If the relative humidity exceeds 90%.
- The environment has high concentrations of dust, salt or iron powder.
- In direct sunlight.
- If the environment is subject to frequent vibration and impact.
- If the envirnment contains corrosive or flammable gases.
- If the environment contains volatile oil, gas, solvent, ammonia or electrolytic gas.
- Poor ventilation or close to heating source.

4.2 Direct Installation

Use M4×15mm screw to directly install the **iSmart** on the tray as shown below.



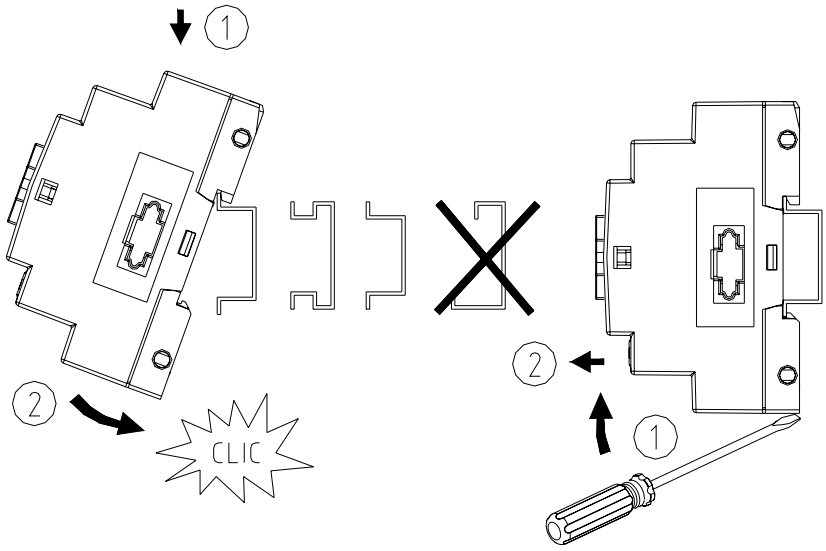
If the expansion module is to be installed, plug the module into the Master after the Master is fixed. Install with M4×15mm Screw.



To uninstall, repeat the process in reverse.

First loosen the expansion screw, then press expansion button to disconnect the module and the master. Finally, loosen the master screw to uninstall the master.

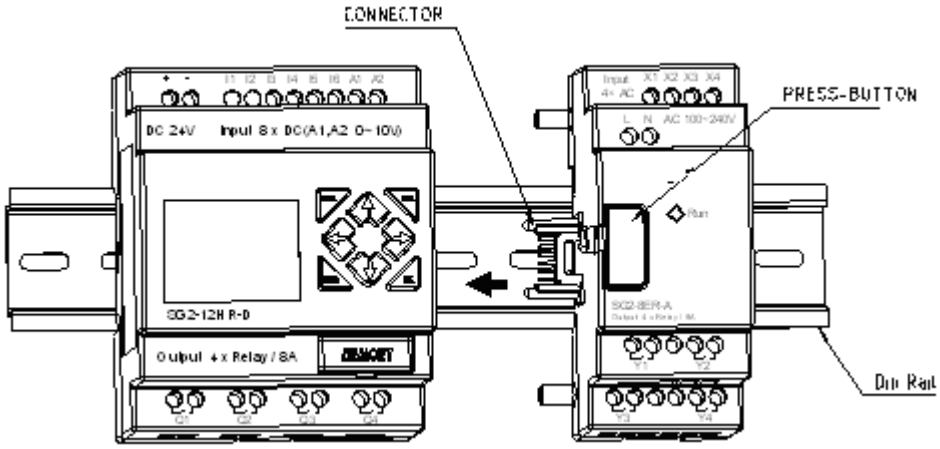
4-3 DIN Rail Installation



Installing on DIN Rail

To install

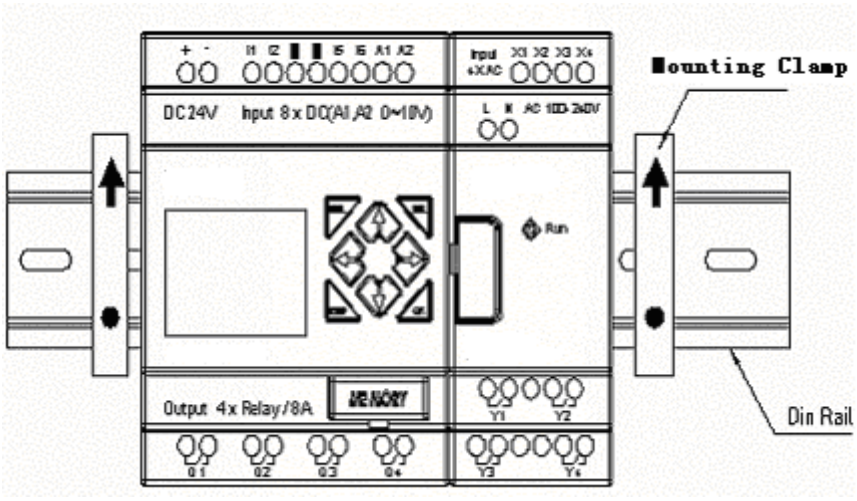
Press the slots on the back of the **iSmart** and expansion module plug connector onto the rail until the plastic clamps hold the rails in place. Then connect the expansion module and connector with the Master (press the PRESS-BUTTON simultaneously)



To uninstall

Press the expansion button and pull off the clamp, pull the **iSmart** upward till the unit free from the rail.

It is recommended to apply clamp to hold the **iSmart** in place.



Chapter 5 Wiring

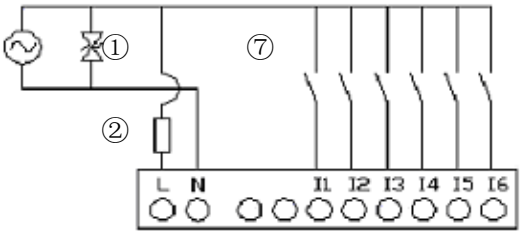
5.1 Precaution for Wiring

- The I/O signal wire should not be routed with the power wire or placed in the same tray.
- Use 0.75-3.5mm^2 cable as the external wire.
- Apply 4~6kgf.cm torques to tighten the lock screws.

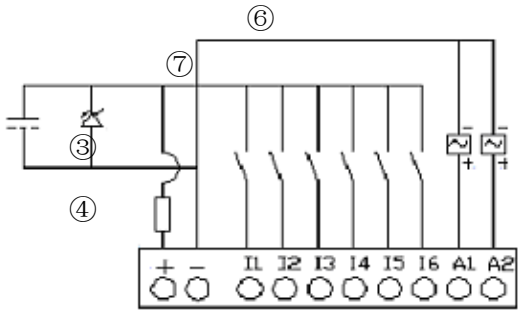
5-2 10/12 points Variant

Power Supply and Input Terminal

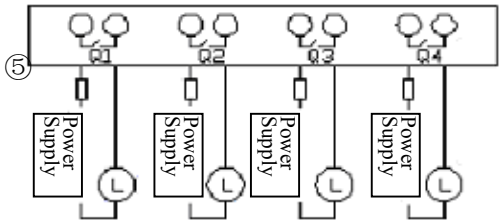
AC（100～240V AC)



DC（24V DC）



Output terminals



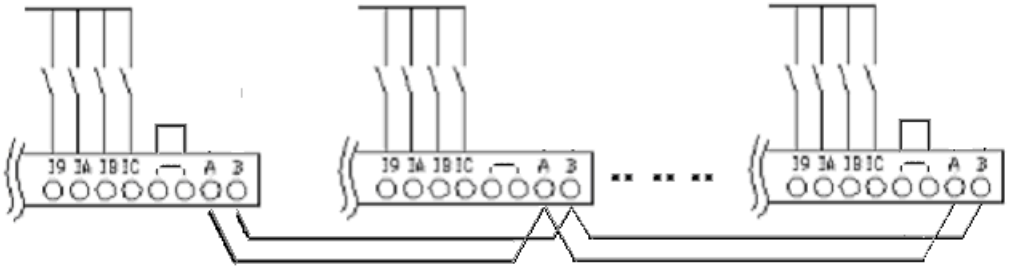
5-3 20 points Variant

Power Supply and Input Terminal

AC（100～240V AC）

DC（24V DC） （with Analog Voltage Input）

Data Link or Remote I/O Link



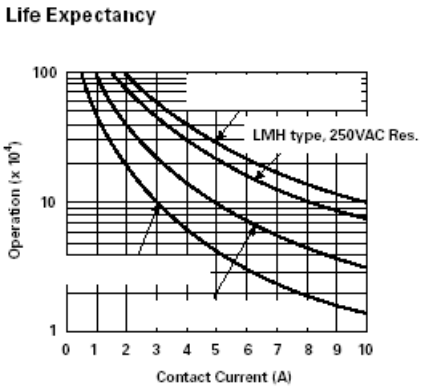
It is imperative to provide an external surge absorber and fuse to protect the power supply and output circuit.

1) Surge absorber (400V AC)
2) Fuse (2A)
3) Surge absorber (36V DC)
4) Fuse (2A)
5) AC output: Fuse or short circuit Protective Device
6) DC output: Fuse
7) Common terminal for analog voltage input should be connected with the same groundterminal of DC power supply.

The power supply and the input shall share the same power source.

In accordance to EIA RS-485 standard. Data Link can connect a Maximum of 8 modules (ID:1~8).
REMOTE I/O can only connect 2 modules（MASTER & SLAVE).

5-4 Relay Life



Note 1: The values illustrated in the above graph are standard. The service life of the relay will be adversely affected by high ambient temperature.

Note 2: When the current is kept less than 2A, the service life of the relay is about 100,000 operations.

Chapter 6 Operation Flow

6.1 After Power Supply Connection

(1) Initialisation of Data Memory

After the power supply is connected, initial data will appear in the data memory. Before the completion of the first scan cycle, the input relay will update the execution data in accordance with ON/OFF conditions, the output relay and the input relay will carry out the operations of the program.

(2) Transfer Programs from ROM -> RAM

After power is applied, the stored program in EEPROM will be transferred to RAM.

(3) Scan Time

The scan time refers to the time for processing input and output data and the process time of the program applied until the final result is obtained.

The scan time is related to the capacity of the Instruction:

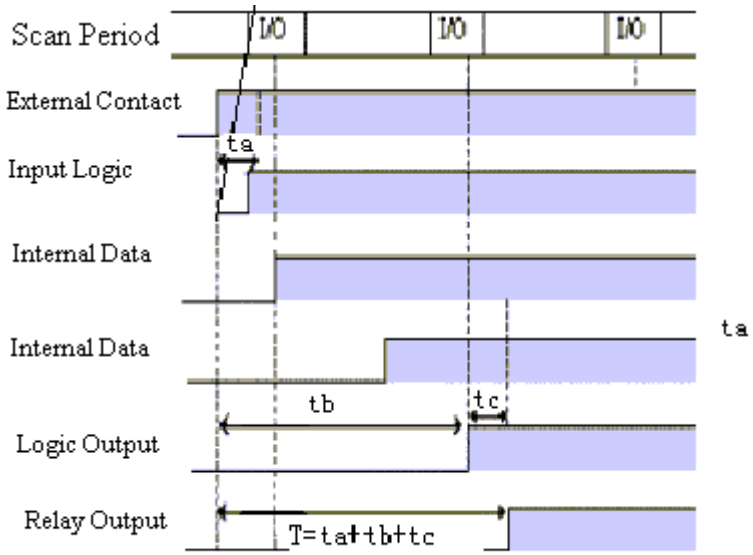
- Ladder mode: 5~20mS;
- FBD: 2~10mS
-

(4) Overall Response Time for **iSmart**

ta: Input OFF -> ON response time

tb: one scan time

tc: Output OFF-> ON response time



Chapter 7 Description for LADDER Instruction

7-1 **Basic Instruction**

	(	⮝	⮟	P	⊣⊢	⊣/⊢	NO. / NC
Input Instruction					I	i	I1~IC / i1~iC
Output Instruction	Q	Q	Q	Q	Q	q	Q1~Q8 / q1~q8
Auxiliary Instruction	M	M	M	M	M	m	M1~MF / m1~mF
RTC Instruction	R				R	r	R1~RF / r1~rF
Counter Instruction	C				C	c	C1~CF / c1~cF
Timer Instruction	T			T	T	t	T1~TF / t1~tF
Analog Comparing Instruction	G				G	g	G1~GF / g1~gF
HMI Instruction	H						H1~HF
PWM Instruction	P						P1
DATALINK	L						L1~L8

	Upper differential	**Lower differential**	**Other Instruction Symbol**
Differential Instruction	D	d	
SET Instruction			⮝
RESET Instruction			⮟
P Instruction			P

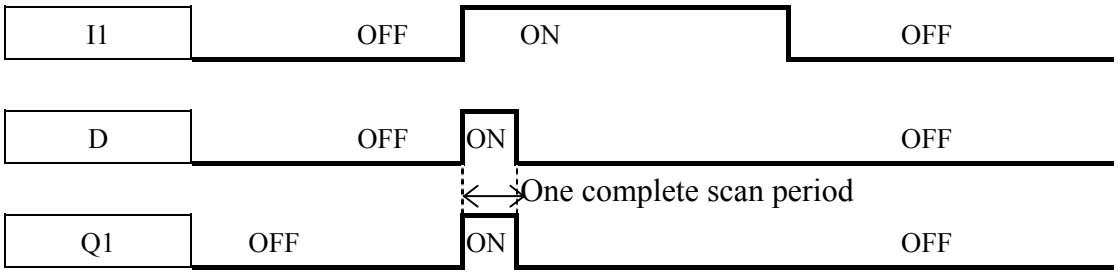
Open Circuit	“ ”	
Short Circuit	“--”	

Link Symbol	**Description**
─	Connecting left and right Components
┴	Connecting left, right and upper Components
┼	Connecting left, right, upper and lower Components
┬	Connecting left, right and lower Components

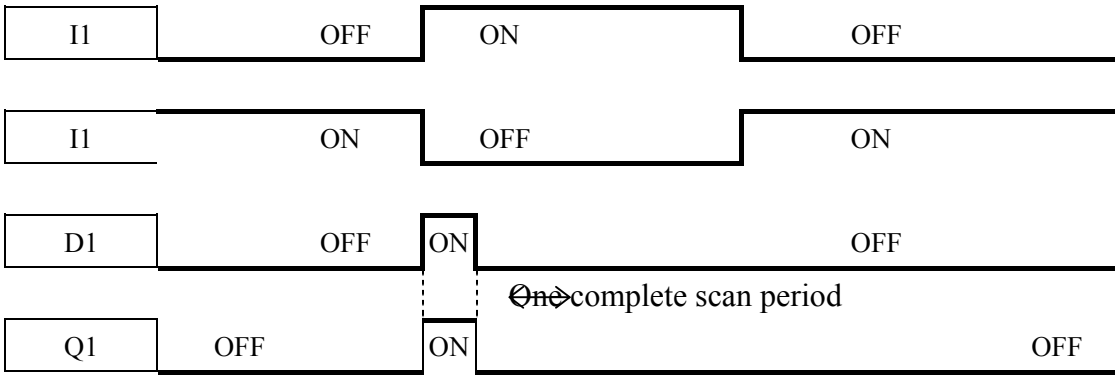
7-2 Function of Basic Instruction

Function D (d) Instruction

1: I1 – D ----[Q1

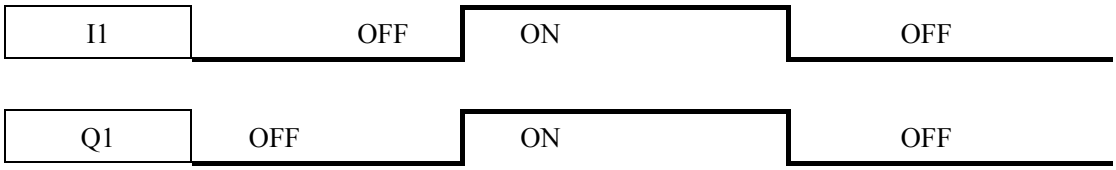


2: i1 – d ----[Q1



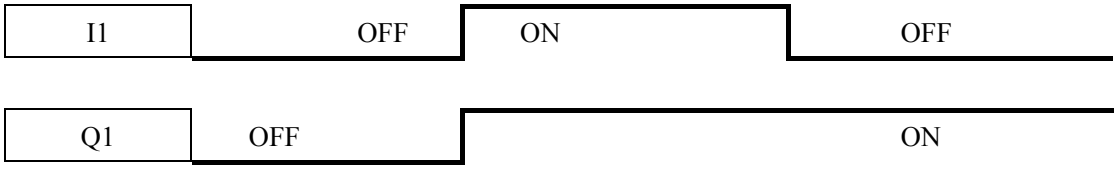
NORMAL (-[ ]output

I1 ----[Q1



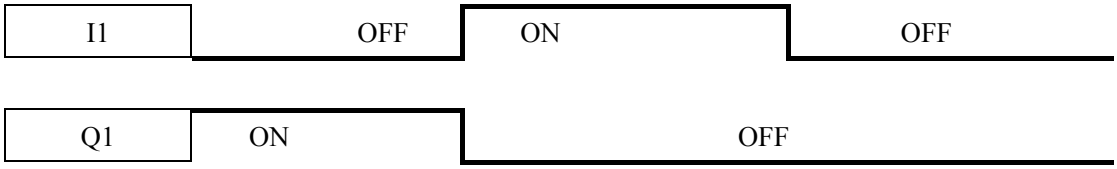
SET（ ）output

I1 ----Q1



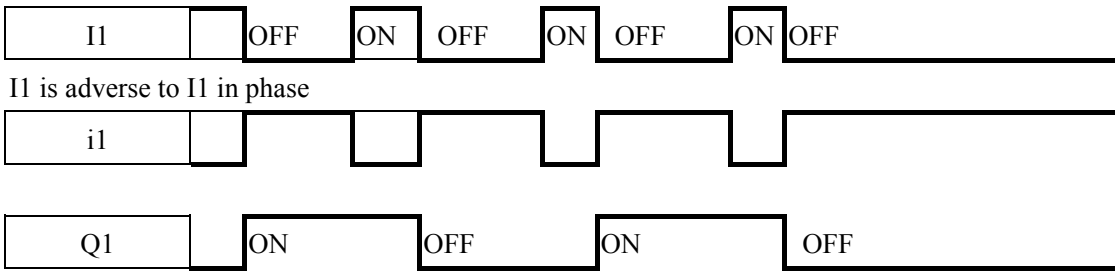
RESET（ ）output

I1 ----Q1



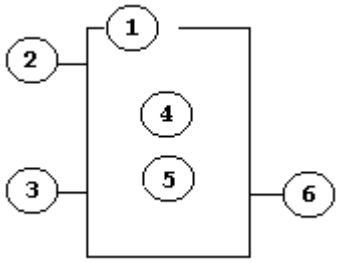
P output

i1 ----**P**Q1



7-3 Application Instruction

General Counter

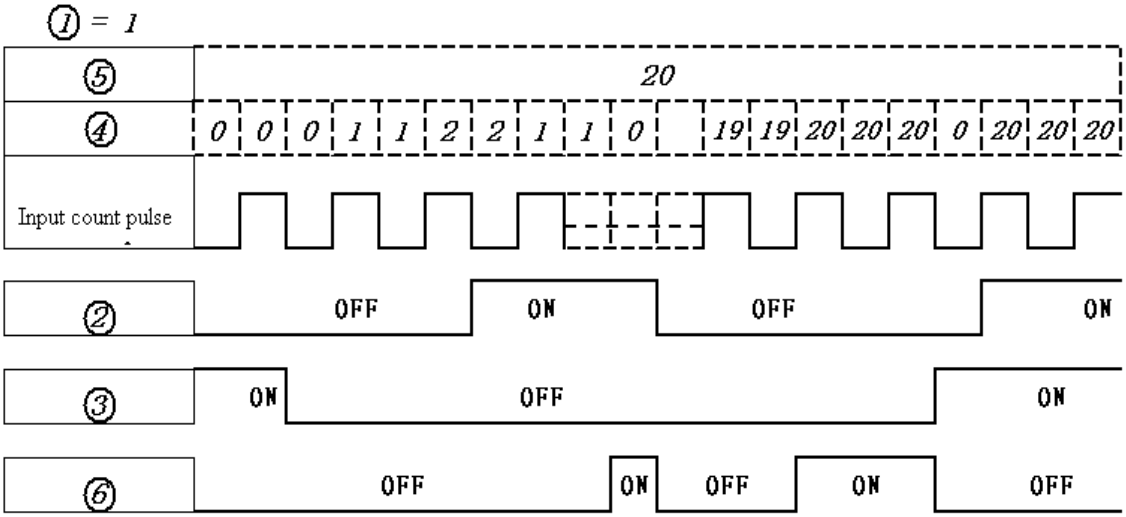


Symbol	Description
①	Counting Mode (1-6)
②	Use (I1 ~ gF) to set counting up or counting down OFF: counting up (0, 1, 2, 3, 4….) ON: counting down (….3, 2, 1, 0)
③	Use (I1 ~ gF) to RESET the counting value ON: the counter reset to zero and □ OFF OFF: the counter continues to count
④	Present Counting Value, range:0~999999
⑤	Target (Setting) Value, range:0~999999
⑥	Code of the counter (C1 ~ CF total: 15 groups).

Note：

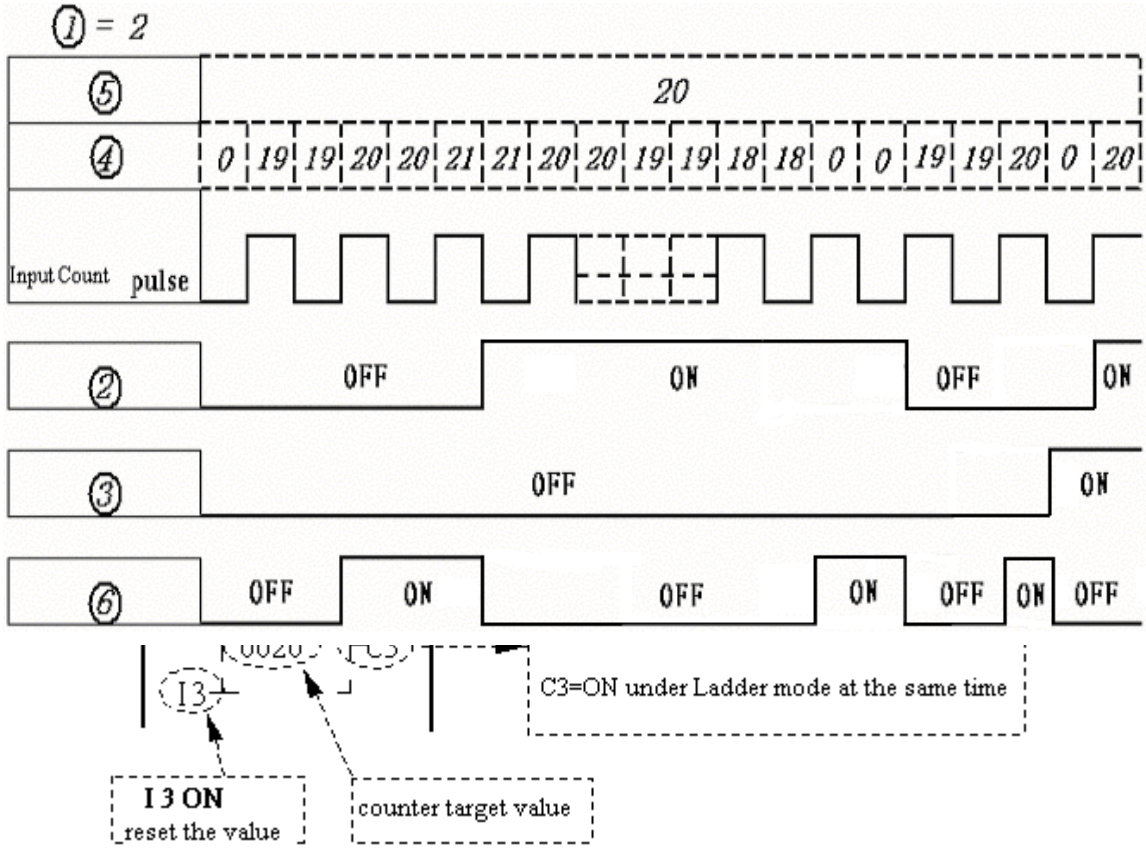
- The setting value of the counter can be a constant, present value of a timer, counter or analog input A1~A4.
- For I1~gF, Input terminal: I1~IC (I1~I12).
- Output terminal: Q1~Q8,
- Expansion Input Terminal: X1~XC (X1~X12).
- Expansion Output Terminal: Y1~YF (Y1~Y12).
- Counter: C1~CF (C1~C15), Timer: T1~TF (T1~T15).
- RTC Comparator: R1~RF (R1~R15).
- Analog Comparator: G1~GF (G1~G15),
- Auxiliary Terminal:M1~MF（M1~M15）.
- The upper case (I1) is Contact ‘a’ while the lower (i1) case is Contact ‘b’.

(1) Counter Mode 1



Example：

(2) Counter Mode 2



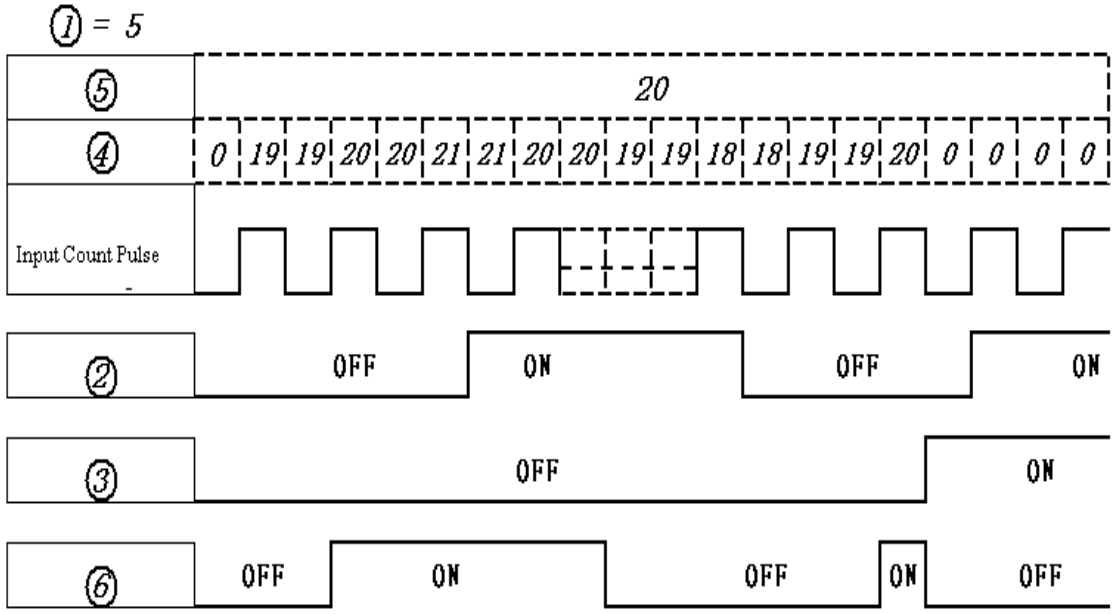
Note:

In this Mode, the counter present value can be greater than 20, unlike the Mode 1 in which the value is locked at 20.

(3) Counter Mode 3 is similar to the counter Mode 1 except that Mode 1 will store the recorded value after the power is cut off and continue counting when the power is restored.

(4) Counter Mode 4 is similar to the counter Mode 2 except that Mode 2 will store the recorded value after the power is cut off and continue counting when the power is restored.

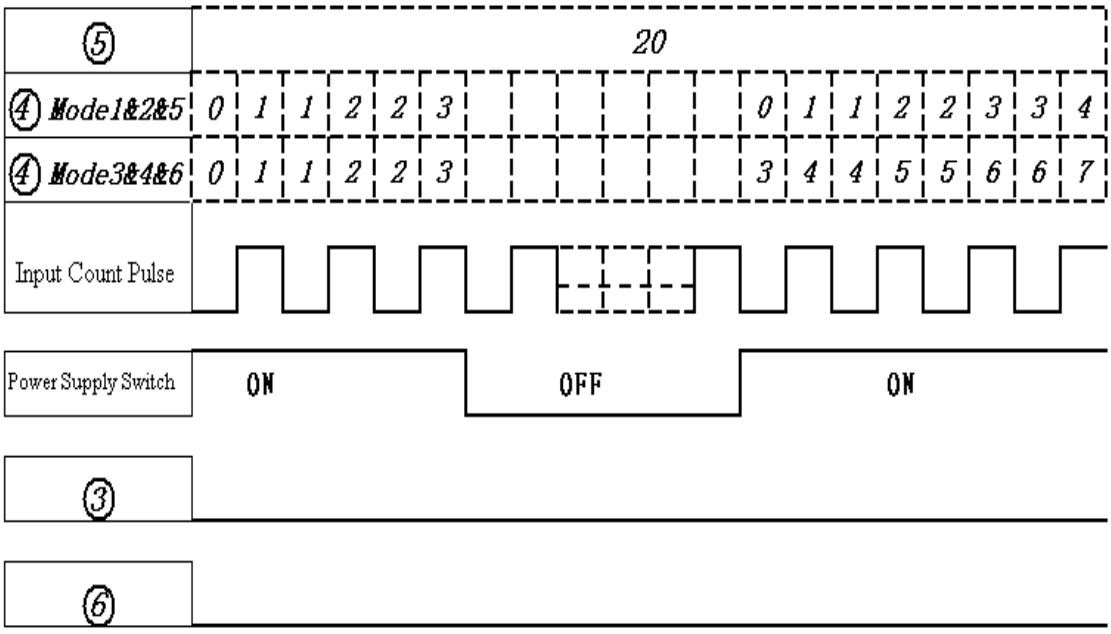
(5) Counter Mode 5



Note:

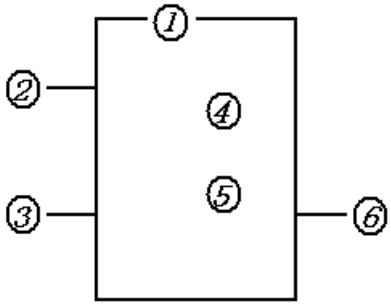
In this Mode the counter present value can be greater than 20, unlike the Mode 1 in which the value is locked at 20. If a reset is available, the present value will reset to 0, regardless of the counting direction.

(6) Counter Mode 6 is similar to counter Mode 5, except that Mode 5 can store the recorded value after the power is cut off and continue counting when the power is restored.

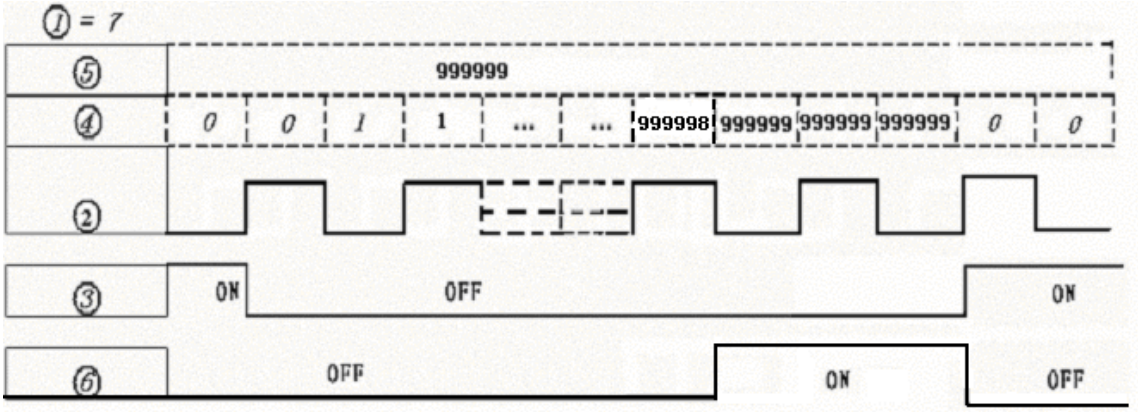


The DC power supply variant has two, 1 KHz High speed input terminals, I1 and I2. Two modes of high-speed counting function are available.

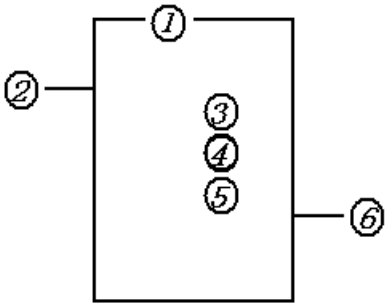
(1) Counter Mode 7



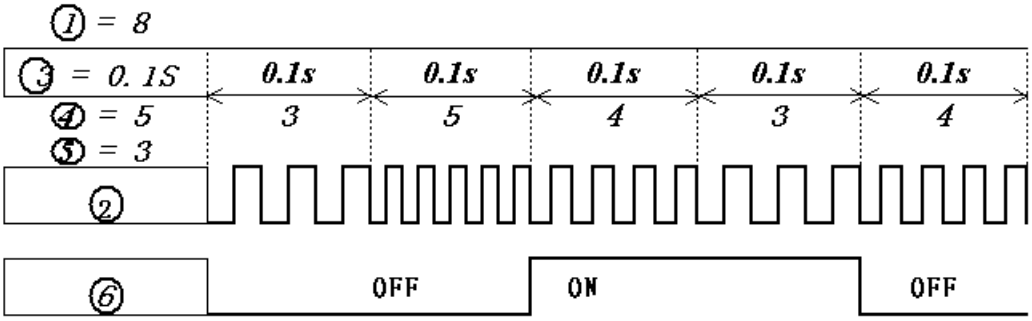
Symbol	Description
①	Counting mode(7)—high speed counting
②	High speed counting input terminal: only I1, I2 available.
③	Use I1~gF to reset counting value. ON: counter is reset to zero and ⑥OFF OFF: counter continues to count.
④	Counter present value: 0~999999
⑤	Counter target value: 0~999999
⑥	Code of Counter (C1~CF, Total: 15Groups)



(2) Counter mode 8



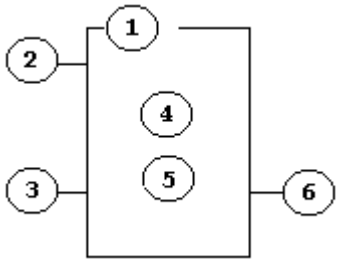
Symbol	Description
①	Counting Mode(8)—Frequency Comparison
②	High speed counting input terminal: only I1, I2 available.
③	Counting interval time:(0~99.99S)
④	Counter ‘on’ target value (000000~999999)
⑤	Counter ‘off’ target value (000000~999999)
⑥	Code of Counter (C1~CF Total :15Group)



Note：

As show in the diagram, the output will be delayed for one interval.

Timer



Symbol	Description
①	Timer Mode (1-7)
②	Timer Unit：1：0.00~99.99s 2：0.0~999.9s 3：0~9999s 4：0~9999m
③	Use I1~gF to reset the timer value. ON ：timer value is reset to Zero and ⑥ OFF OFF ：timer continues to timing
④	Timer present value
⑤	Timer target value
⑥	Code of timer (T1~TF total: 15Group)

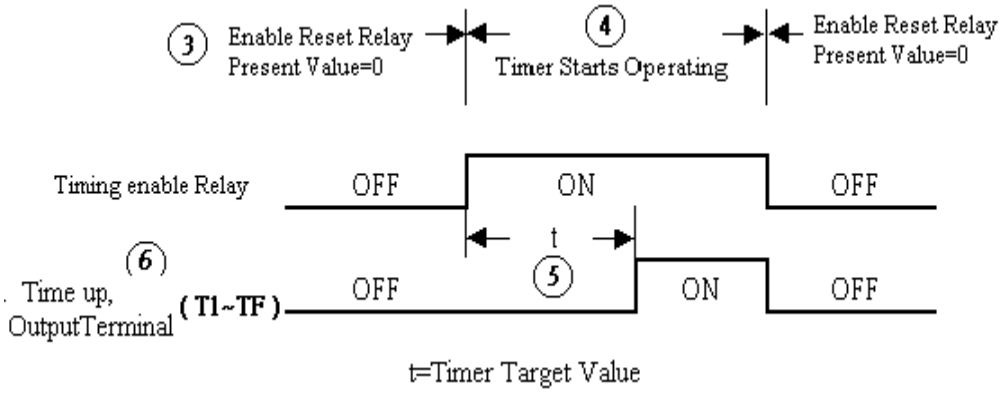
Note：

- The setting value of the timer can be a constant, the present value of a timer, counter

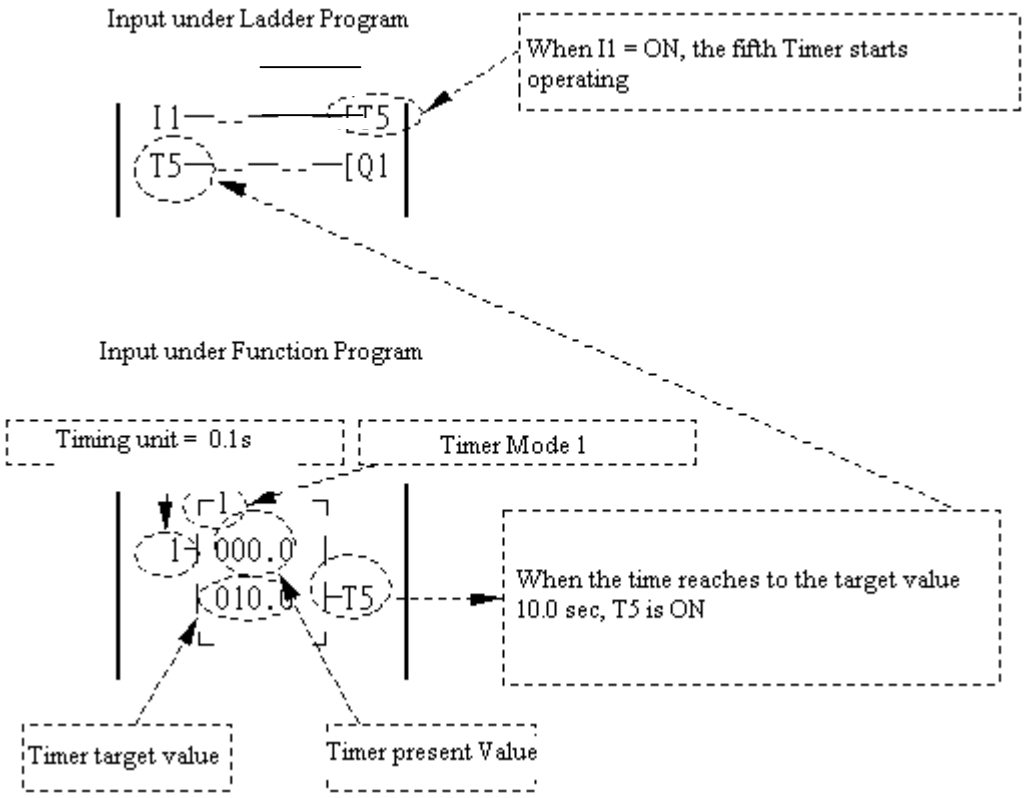
or analog input (A1~A4).

- For I1~gF, input terminal: I1~IC(I1~I12).
- Output terminal: Q1~Q8.
- Expansion input terminal: X1~XC(X1~X12).
- Expansion output terminal: Y1~YF(Y1~Y12).
- Counter: C1~CF(C1~C15).
- Timer: T1~TF(T1~T15).
- RTC Comparator: R1~RF(R1~R15).
- Analog Comparator: G1~GF(G1~G15).
- Auxiliary terminal: M1~MF（M1~M15）.
- The upper case (I1) is Contact ‘a’ while the lower (i1) case is Contact ‘b’.

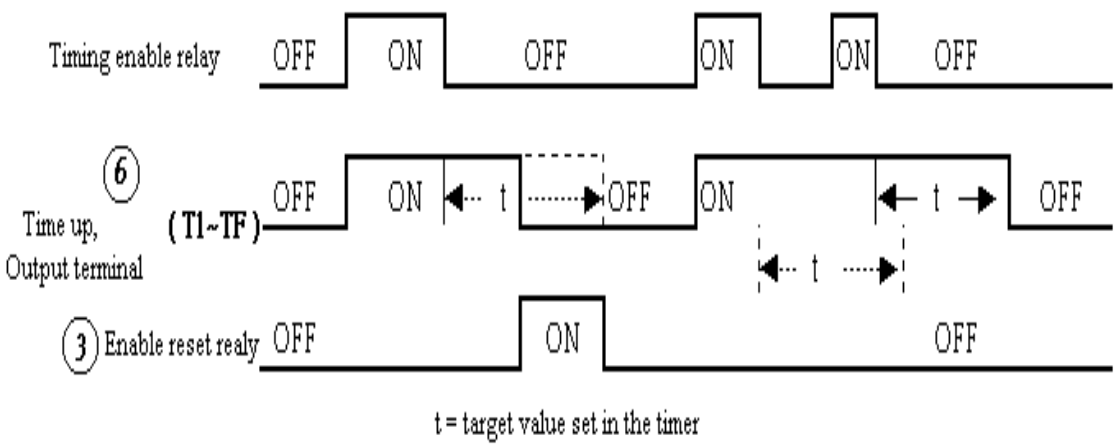
(1) Timer Mode 1(ON-Delay A mode)



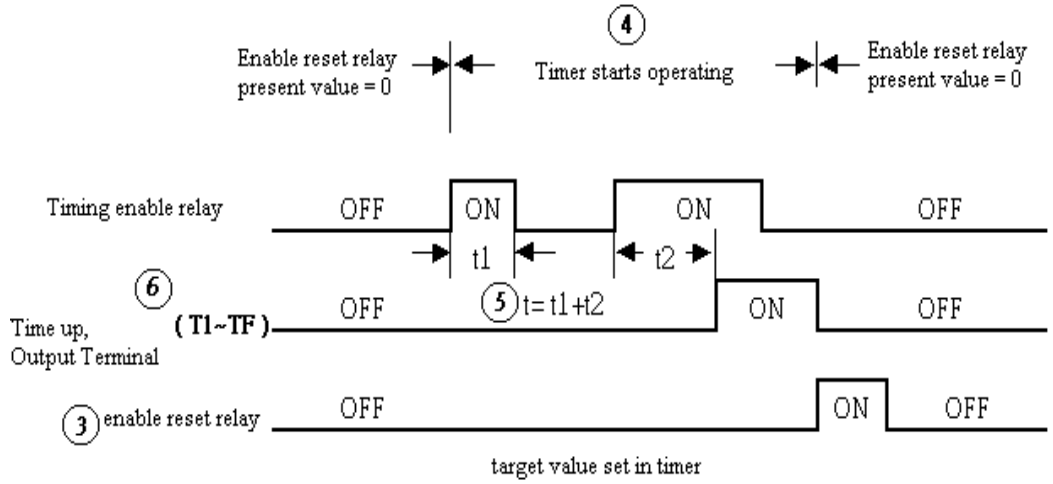
Example:



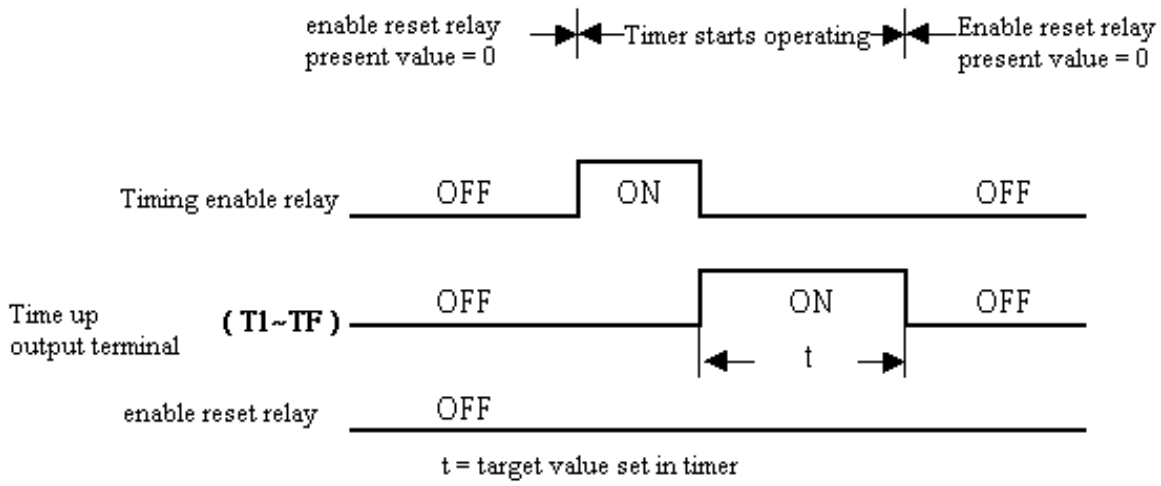
(2) Timer mode 2(ON-Delay B mode)



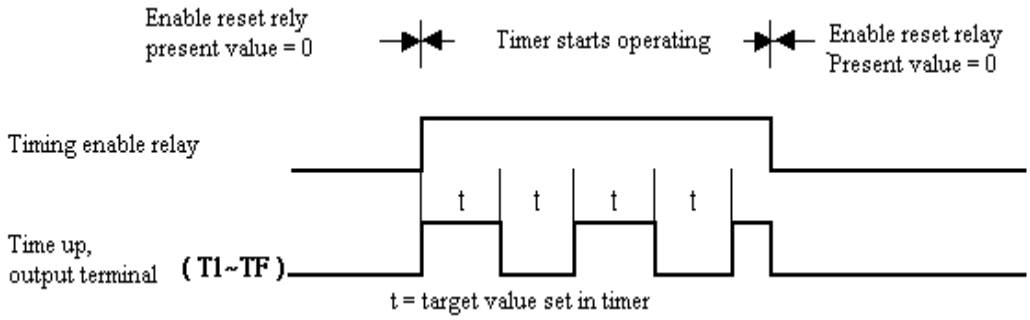
(3) Timer Mode 3(OFF-Delay A Mode)



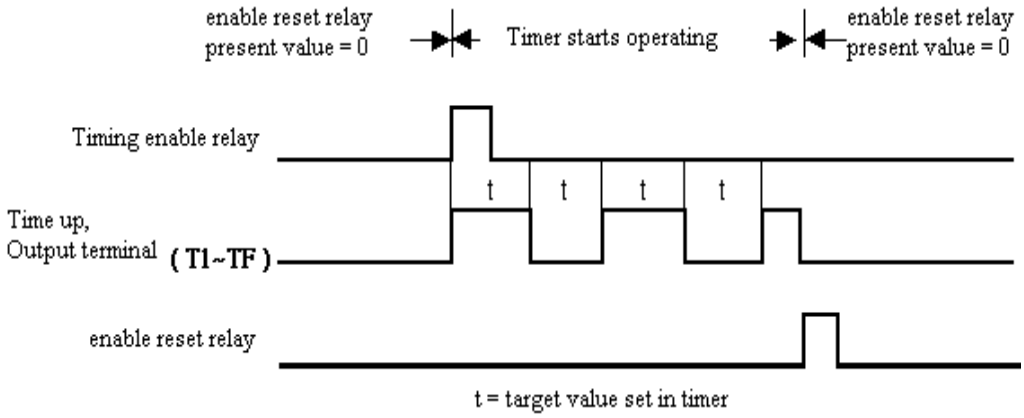
(4) Timer Mode 4(OFF-Delay B Mode)



(5) Timer Mode 5 (FLASH A Mode)



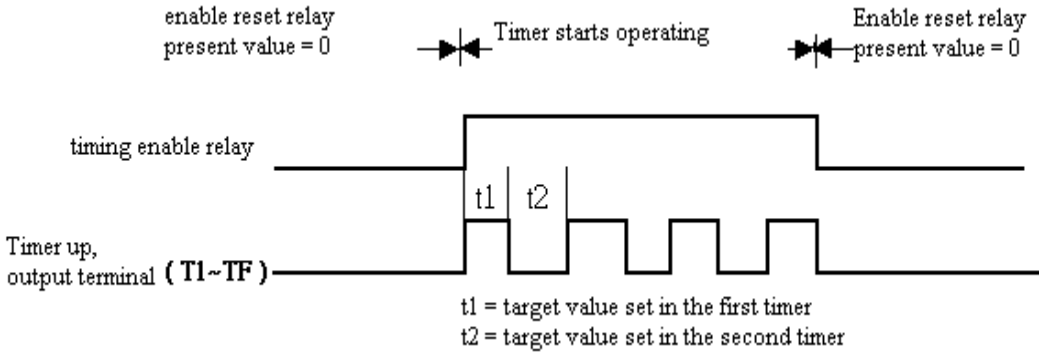
(6) Timer Mode 6 (FLASH B Mode)



(7) Timer Mode 7 (FLASH C Mode)

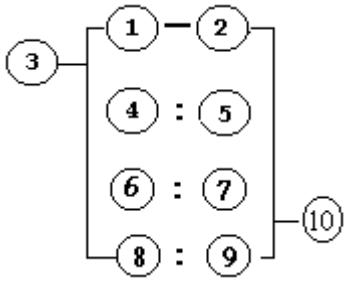
Note: This Mode will series connect two timers, t1 and t2. In addition, add PTn, where n=1, 2, 3, 4, ……, E. but Tn + 1 Timer can not be used for other functions.

Sample : I1--------PT1 , t1=T1 Target value；t2=T2 Target value.



RTC Instruction

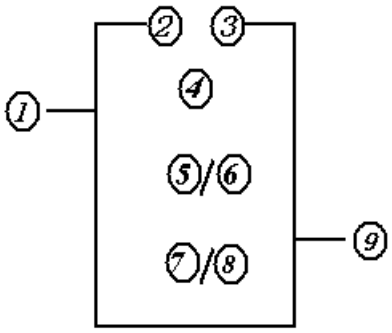
Weekly Mode



Symbol	Description
①	Input the first week to RTC
②	Input the second week to RTC
③	RTC mode(1~2) 1:daily ,2:consecutive days
④	RTC displays the hour of present time.
⑤	RTC displays the minute of present time
⑥	Set RTC hour ON
⑦	Set RTC Minute ON
⑧	Set RTC Hour OFF
⑨	Set RTC Minute OFF
□	Code of RTC (R1~RF Total: 15Group)

Description for Week Code：Monday ~Sunday=MO , TU , WE , TH , FR , SA , SU

Year-Month-Day Mode

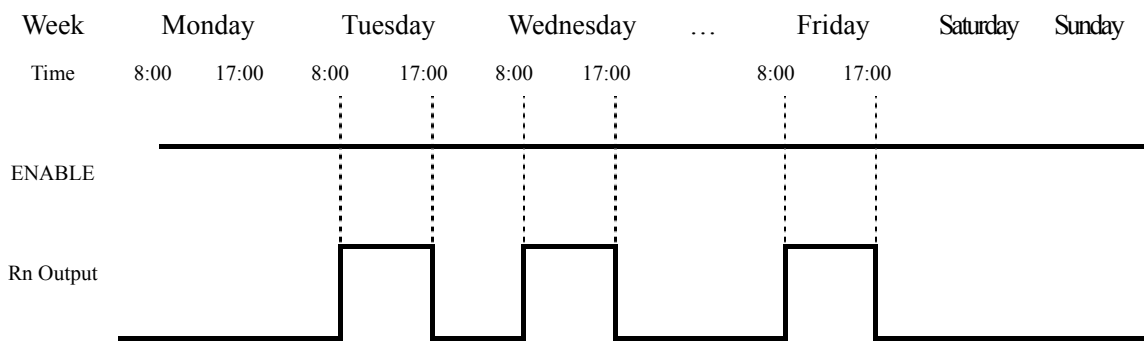


Symbol	Description
①	RTC mode 3, Year-Month-Day
②	Setting RTC Year ON
③	Setting RTC Year OFF
④	Display RTC Present time: Year-Month-Day
⑤	Setting RTC month ON
⑥	Setting RTC Day ON
⑦	Setting RTC month OFF
⑧	Setting RTC Day OFF
⑨	RTC Code (R1~RF, total 15 group)

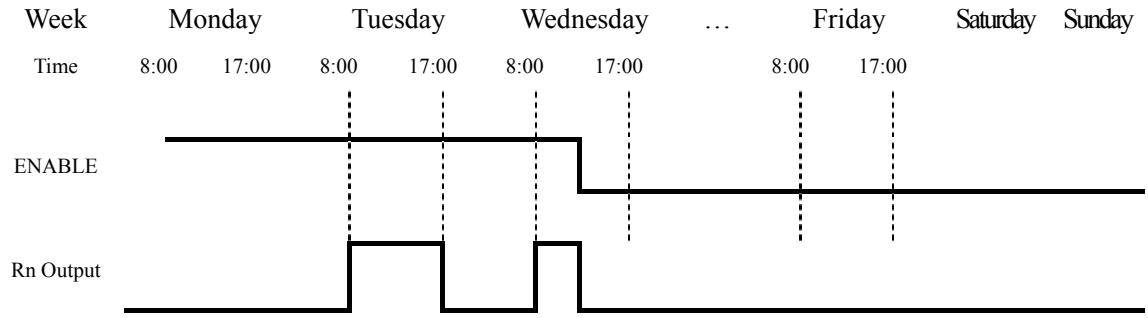
(1) RTC Mode 1

Example 1：

③	1
① ：②	TU-FR
⑥ ：⑦	08:00
⑧ ：⑨	17:00

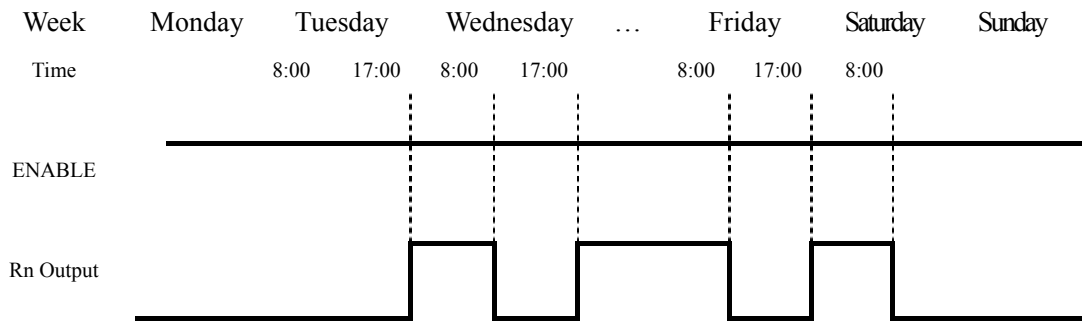


** Note：If ENABLE fails, output is OFF.



Example 2：

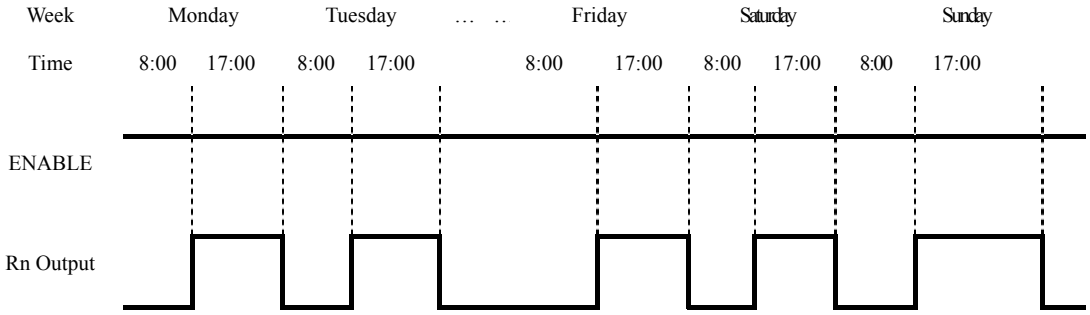
③	1
① ：②	TU-FR
⑥ ：⑦	17:00
⑧ ：⑨	8:00



Example 3：

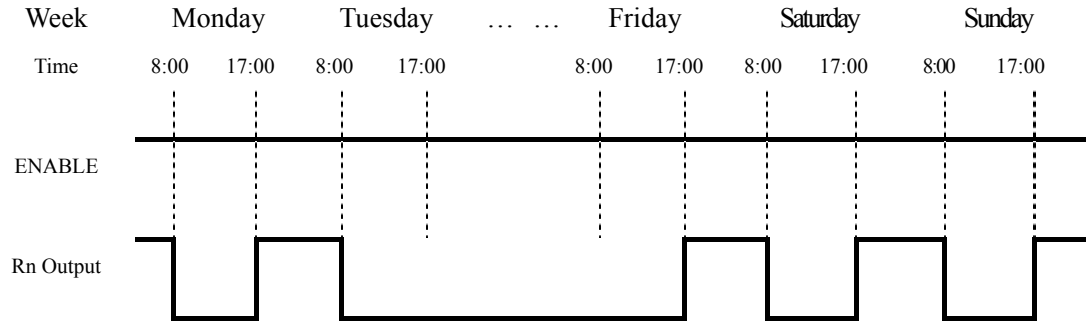
③	1

① ：②	FR-TU
⑥ ：⑦	08:00
⑧ ：⑨	17:00



Example 4：

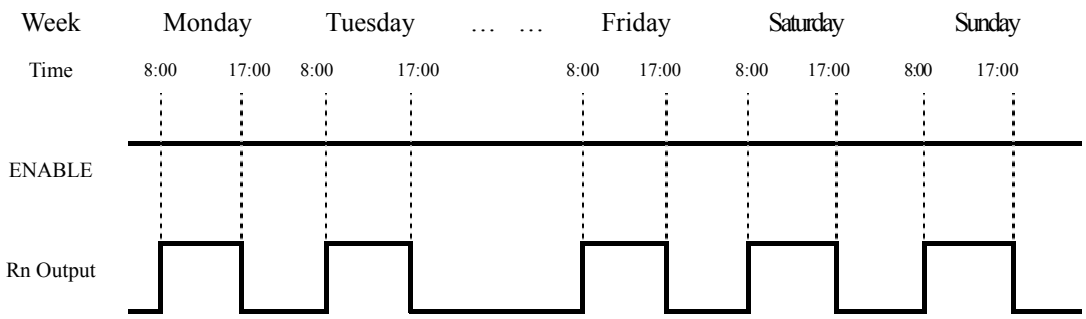
③	1
① ：②	FR-MO
⑥ ：⑦	17:00
⑧ ：⑨	8:00



Example 5：

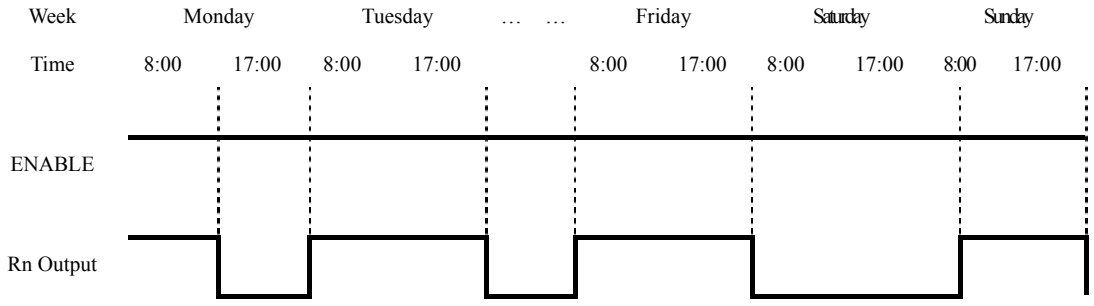
③	1
① ： ②	SU-SU
⑥ ： ⑦	08:00

⑧ ： ⑨	17:00



Example 6:

③	1
① ： ②	SU-SU
⑥ ： ⑦	17:00
⑧ ： ⑨	8:00

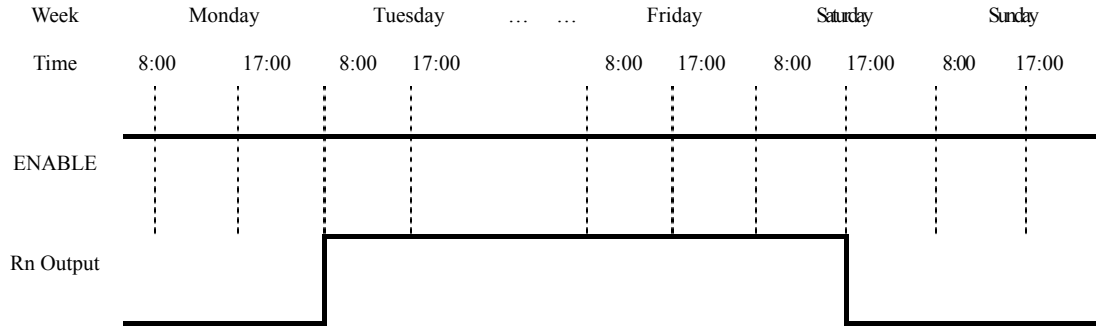


(2) RTC Mode 2

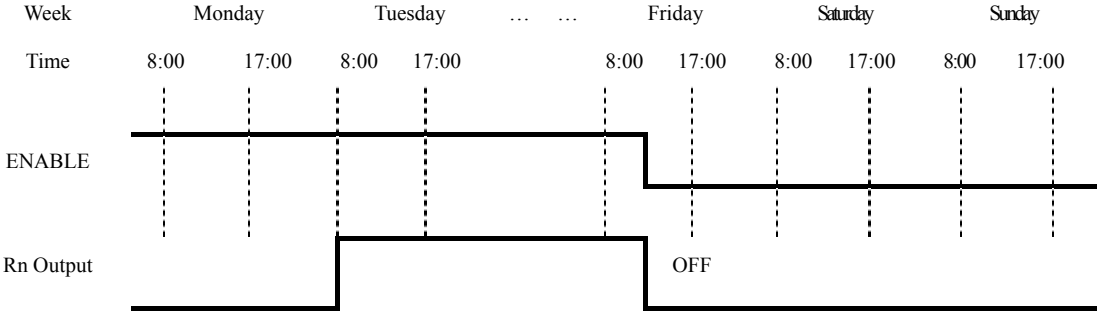
Example 1：

③	2
① ： ②	TU-SA

⑥ ： ⑦	08:00
⑧ ： ⑨	17:00

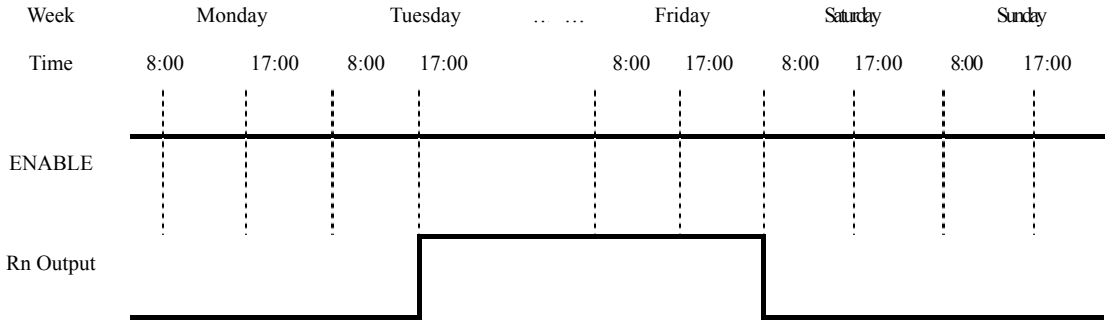


** Note: When ENABLE is unavailable, the output is OFF.



Example 2：

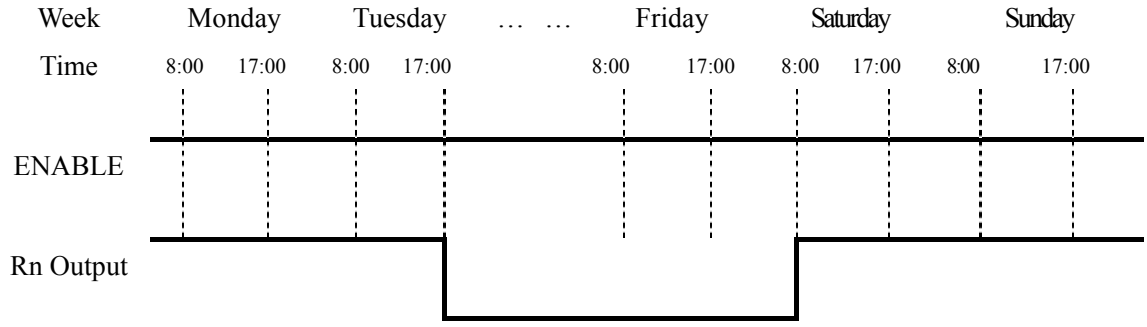
③	2
① ： ②	TU-SA
⑥ ： ⑦	17:00
⑧ ： ⑨	08:00



Example 3：

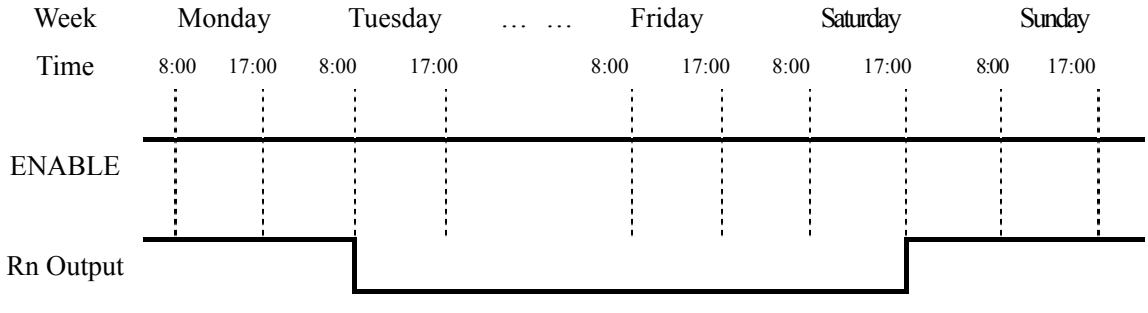
③	2

① ： ②	SA-TU
⑥ ： ⑦	08:00
⑧ ： ⑨	17:00



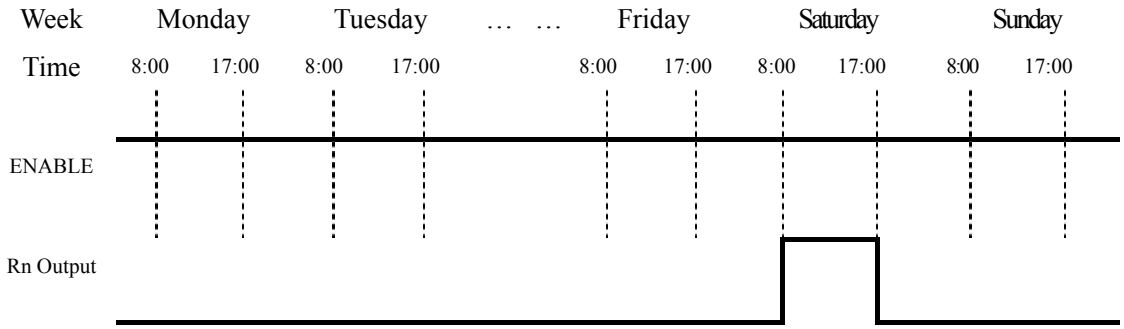
Example 4：

③	2
① ： ②	SA-TU
⑥ ： ⑦	17:00
⑧ ： ⑨	08:00



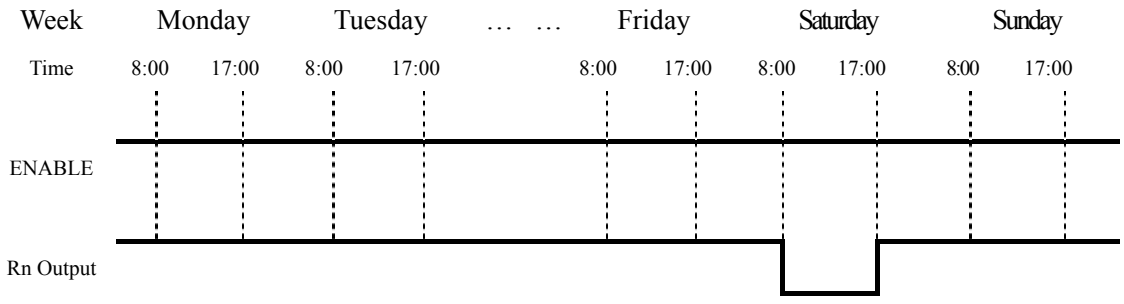
Example 5：

③	2
① ：②	SA-SA
⑥ ：⑦	08:00
⑧ ：⑨	17:00



Example 6：

③	2
① ：②	SA-SA
⑥ ：⑦	17:00
⑧ ：⑨	08:00

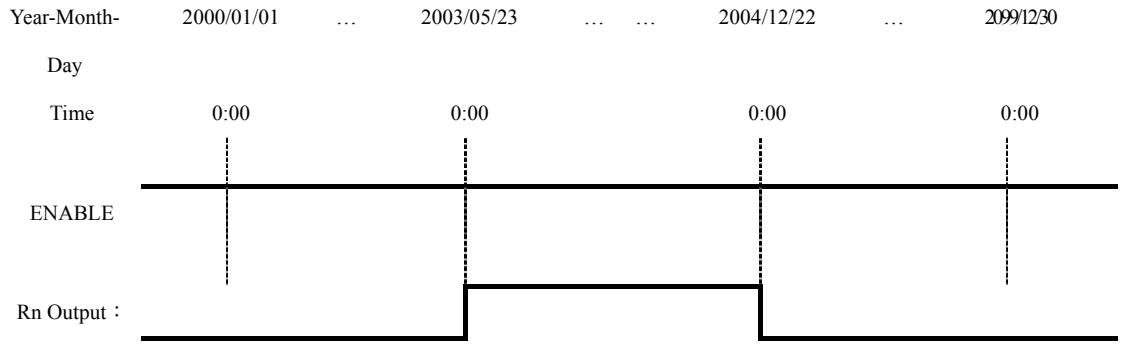


(3) RTC Mode 3

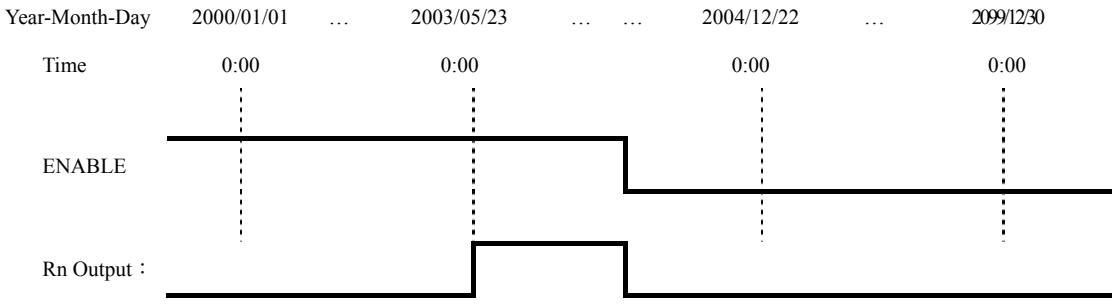
Example 1：

①	3

② / ⑤ / ⑥	03/05/23
③ / ⑦ / ⑧	04/12/22

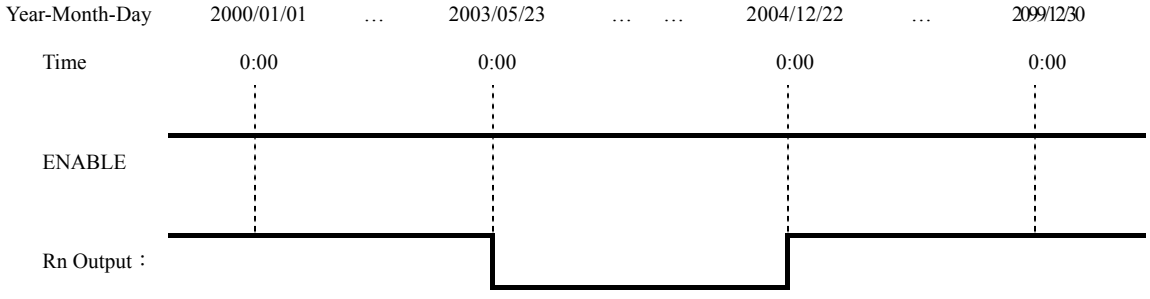


** Note：If ENABLE is fails, the output is OFF.



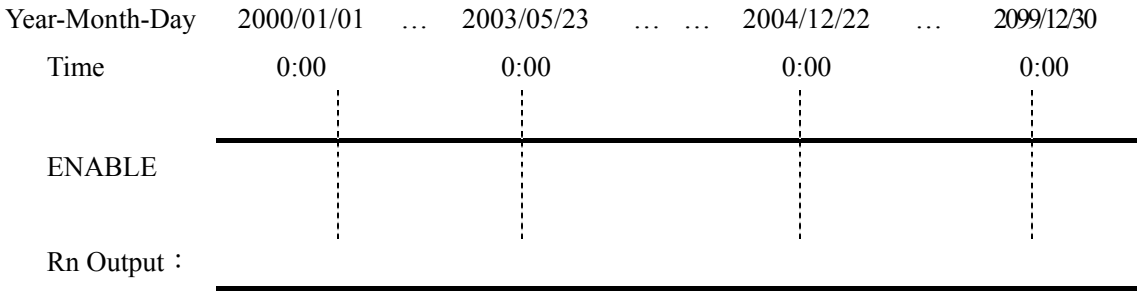
Example 2：

①	3
② / ⑤ / ⑥	04/12/22
③ / ⑦ / ⑧	03/05/23

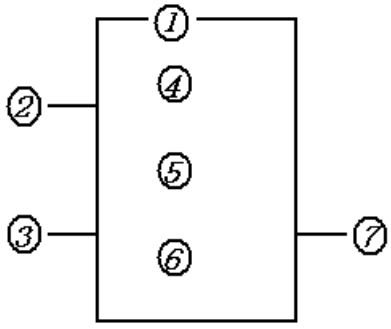


Example 3：

①	3
② / ⑤ / ⑥	03/05/23
③ / ⑦ / ⑧	03/05/23



Analog Comparator



Symbol	Description
①	Analog Comparison Mode(1~5)
②	A_X analog input (A1~A4), or the present value of the timer, counter.
③	A_Y analog input (A1~A4), or the present value of the timer, counter.
④	A_X analog input value(0.00~9.99)
⑤	A_Y analog input value (0.00~9.99)
⑥	Set reference comparative value: can be a constant, present value of a timer, counter or analog input.
⑦	Output terminal(G1~GF)

The ON or Off of analog output terminals (G1~GF) is determined by the comparison of the analog inputs of Ax and Ay.

When the relay of an analog comparator is ON, one of 5 modes have been set:

(1) Analog Comparator mode 1 (A_Y - ⑥ ≤ A_X≤ A_Y +⑥， ⑦ ON)

(2) Analog Comparator mode 2 ($A_X \leq A_Y$， ⑦ ON)

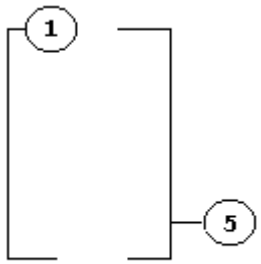
(3) Analog Comparator mode 3 ($A_X \geq A_Y$， ⑦ ON)

(4) Analog Comparator mode 4 (⑥ ≥ A_X， ⑦ ON)

(5) Analog Comparator mode 5 (⑥ ≤ A_X， ⑦ ON)

HMI Function

This function block can display the information as word information, present and target values of counters, timers, RTC and Analog comparators. In run mode, modification of timer, counter or analog comparator presets via the HMI is achievable. The HMI can display the status of input and output terminals, as well as Auxiliary relays.



Symbol	Description
①	Display mode（1~2）
⑤	HMI character output terminal (H1~H8)

(1) The Display mode can be changed via the function keys:

First page displayed =1

First page not displayed = 2.

The displayed information can only be set via the SMT-CONFIGURATOR. In run mode, modification of the target value of a timer, counter, RTC or analog comparator is available via the HMI of the controlled equipment.

For HMI configuration, please refer to SMT-CONFIGURATOR HELP file。

The following example shows how to modify the preset value of C1 in run mode.

To set the preset value of the counter as the present value of T2 via the HMI.

Step1：In the HMI screen, press 'SEL', the cursor blinks in the following location.

T	**1**	**=**	**0**	**0**	**.**	**0**	**0**	**S**	**e**	**c**
T	**1**	**=**	**0**	**0**	**.**	**0**	**5**	**S**	**e**	**c**
C	**1**	**=**	**0**	**0**	**0**	**0**	**1**	**0**		
0	**0**	**0**	**0**	**0**	**0**					

Step2：Press 'DOWN' and the cursor skips to C1 preset value position.

T	**1**	**=**	**0**	**0**	**.**	**0**	**0**	**S**	**e**	**c**
T	**1**	**=**	**0**	**0**	**.**	**0**	**5**	**S**	**e**	**c**
C	**1**	**=**	**0**	**0**	**0**	**0**	**1**	**0**		

0 0 0 0 0 0

Step3：Press ‘SEL’ three times, the preset value changes from 000000, A1 to T1.

T 1 = 0 0 . 0 0 S e c
T 1 = 0 0 . 0 5 S e c
C 1 = T 1
0 0 0 0 0 0

Step4：Press ‘UP’

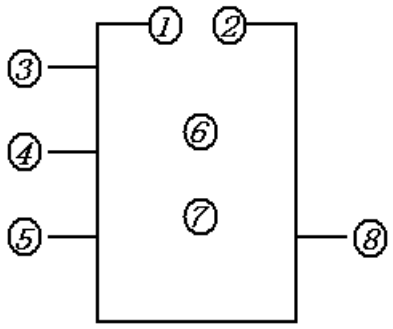
T 1 = 0 0 . 0 0 S e c
T 1 = 0 0 . 0 5 S e c
C 1 = T 2
0 0 0 0 0 0

Step5：Press ‘OK’ to save the setting.

T 1 = 0 0 . 0 0 S e c
T 1 = 0 0 . 0 5 S e c
C 1 = T 2
0 0 0 0 0 0

PWM Output Function (transistor output variant only)

The transistor output variant has a PWM output terminal ‘Q1’ which can output 8-stage PWM waveforms.



Symbol	Description
①	Set display stages (1~8)
②	Display the present stage as operation(0~8)
③	Input Selected Stage 1(I1~gF)
④	Input Selected Stage 2(I1~gF)
⑤	Input Selected Stage 3(I1~gF)
⑥	Set PWM pulse width (0~32768ms)
⑦	Set PWM Period(1~32768ms)
⑧	PWM output terminal P1

Note：

- For I1~gF, input terminal: I1~IC(I1~I12),

- Output terminal: Q1~Q8,
- Expansion input terminal: X1~XC (X1~X12),
- Expansion output terminal: Y1~YF (Y1~Y12)
- Counter: C1~CF (C1~C15),
- Timer: T1~TF (T1~T15),
- RTC Comparator: R1~RF (R1~R15),
- Analog Comparator: G1~GF (G1~G15),
- Auxiliary terminal: M1~MF（M1~M15）.

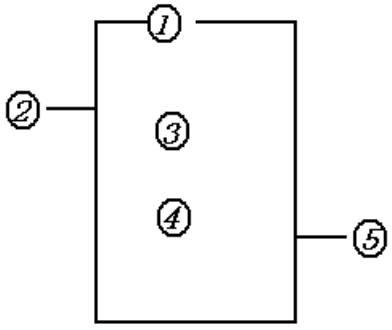
The upper case (I1) is Contact 'a' while the lower (i1) case is Contact 'b'.

The output waveform of output terminal 'P1-⑧' is determined by the preset waveform of input terminal 1-③, 2-④, 3-⑤ and PWM Enable.

Enable	⑤	④	③	②	⑧Output PWM
OFF	X	X	X	0	OFF
ON	OFF	OFF	OFF	1	Set stage 1
ON	OFF	OFF	ON	2	Set stage 2
ON	OFF	ON	OFF	3	Set stage 3
ON	OFF	ON	ON	4	Set stage 4
ON	ON	OFF	OFF	5	Set stage 5
ON	ON	OFF	ON	6	Set stage 6
ON	ON	ON	OFF	7	Set stage 7
ON	ON	ON	ON	8	Set stage 8

Note：X indicated ON/OFF input terminal is idle.

DATALINK Function (SMT-C variant only)



Symbol	Description
①	Mode setting (1,2) 1:sending 2:receiving
②	Set the send/receive points(1~8)
③	Set the send/receive points
④	Send/receive memory list location
⑤	Data link output terminal (L1~L8)

Note:

① Only one send mode can be set at L1~L8, others are for receiving mode.

② Selecting; input points I1~IC (I1~I12), output points Q1~Q8,
expansion input points X1~XC (X1~X12), expansion output points Y1~YF (Y1~Y12),
auxiliary points M1~MF (M1~M15)

③ Receiving mode is determined by the controller ID which can not be changed, as the

left list shows. The receiving mode can be selected:

W1,W9,W17,W25,W33,W41,W49 and W57.

ID	Memory List Location
0	W1~W8
1	W9~W16
2	W17~W24
3	W25~W32
4	W33~W40
5	W41~W48
6	W49~W56
7	W57~W64

Example 1:

DATALINK Mode 1

Set ① = 1, ② = 5, set ③ as start from I3, the state of actual sending terminal I3~I7 is sent to memory list; the controller ID = 3, the state of corresponding memory list position W17~W24-④ and relationship of sending terminal is as below:

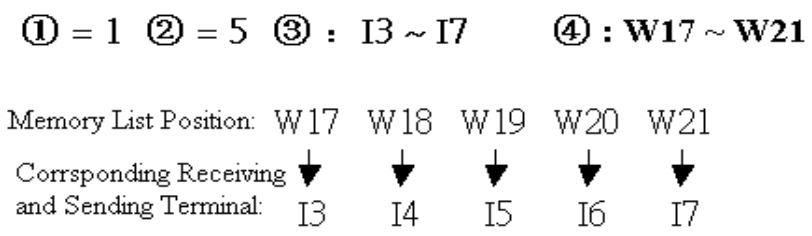
① = 1 ② = 5 ③ : I3 ~ I7 ID = 3 (④ : W17 ~ W24)

Memory List Position	W17	W18	W19	W20	W21	W22	W23	W24
Corresponding receiving and sending termainal	I3	I4	I5	I6	I7	0	0	0

Example 2:

DATALINK mode 2

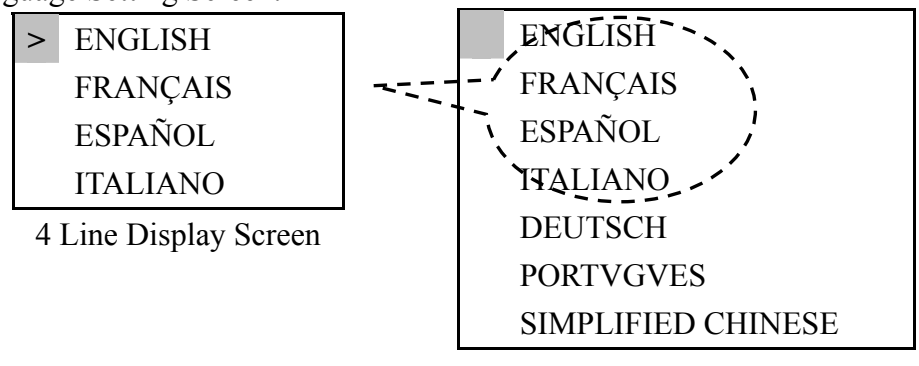
Set ① = 1, ② = 5, set ③ as start from I3, set ④ as start from W17, when enabling the Datalink, the state 'ON/OFF' of I3~I7 is controlled by the state of memory list position W17~W21-④, which is irrelative to the actual state of input terminal.



7-4 **Operation Method**

The Original Screen as Power is ON.

(1) Language Setting Screen:



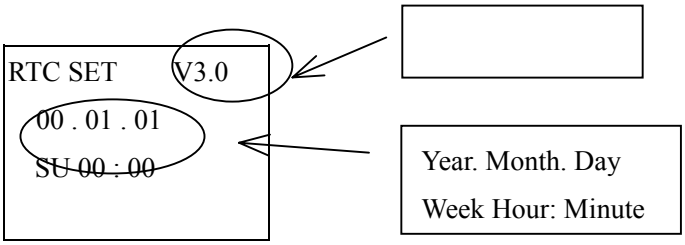
4 Line Display Screen

Language Selecting Menu.

Press the buttons

↑↓	Move the Cursor
OK	Enter the selected language, and display the screen for time setting.

(2) Present Time Setting Screen

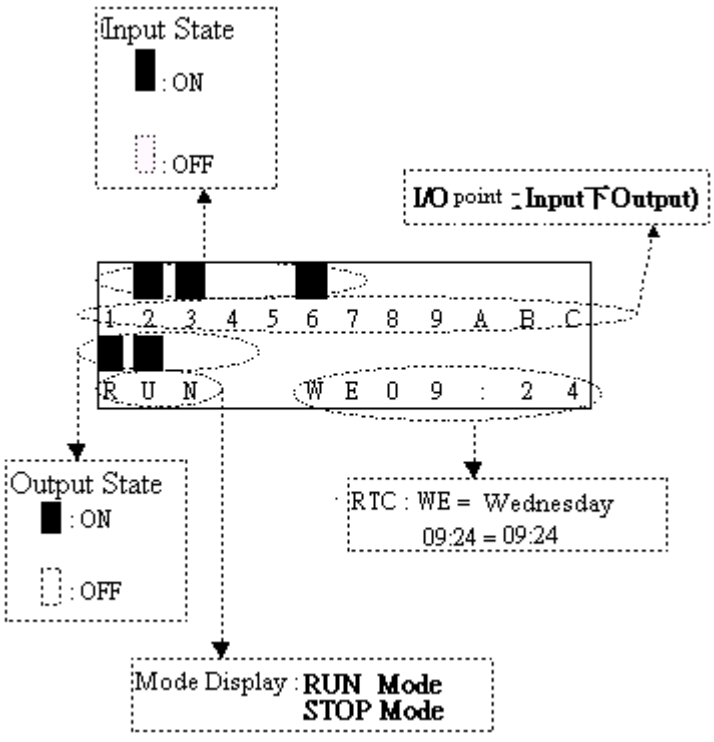


Press the button:

SEL	Begin to input the value
SEL + ←/ →	Move the Cursor
SEL + ↑ / ↓	1. Year = 00~99,Month = 01~12,Day = 01~31 2.Week ⇔TU⇔WE⇔TH⇔FR⇔SA⇔SU⇔MO 3. Hour = 00~23 or Minute = 00~59
OK	Save the RTC Time, Finish the original screen setting, then Display power Start Screen.

Note：The default method is LADDER Edit Mode as the original screen is set.

Original Screen as the power is on.

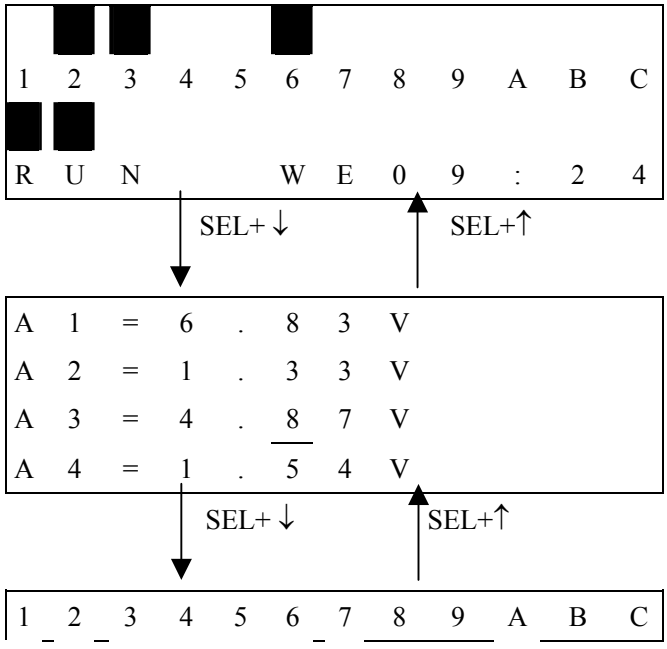


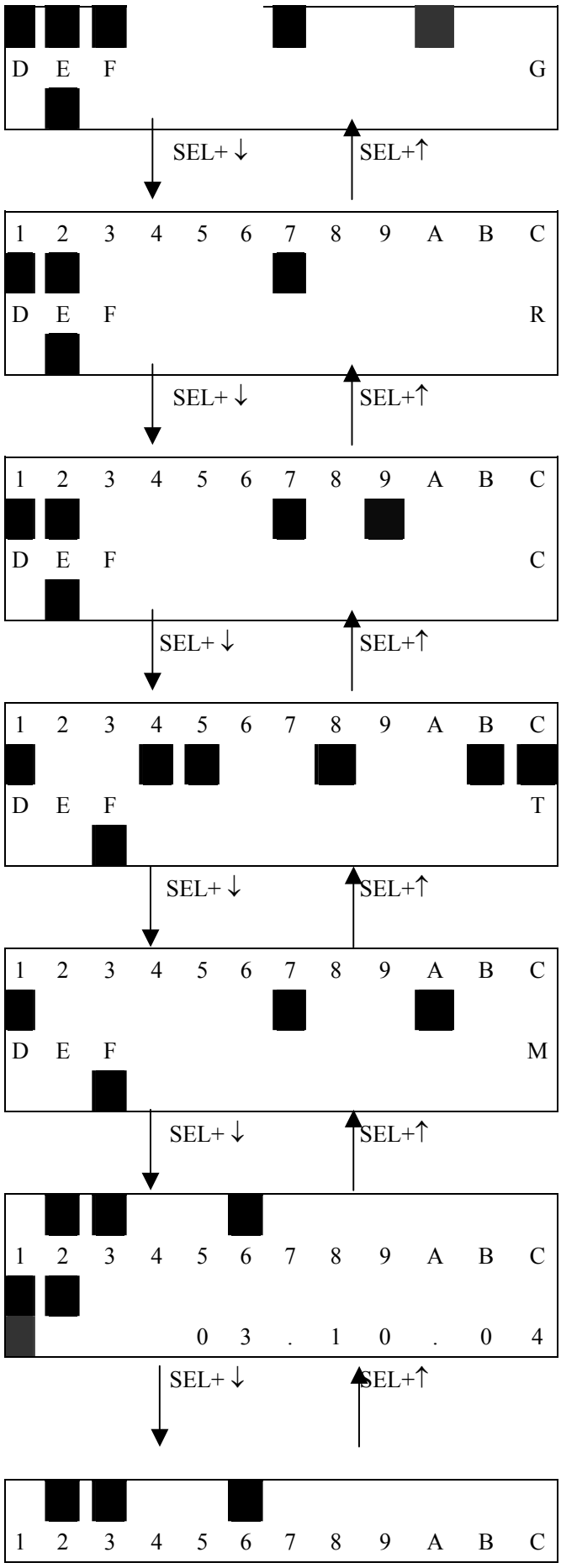
Press the button:

ESC	Back to Main Menu
SEL+↑ ↓	Under LADDER Edit Mode, display the state of other relays(expansion X&Y⇔M ⇔ T ⇔ C ⇔ R ⇔ G⇔A) ⇔ Original Screen
SEL	H Function will be displayed as the button is pressed for 3 seconds. If Mode 2 is selected for HMI, the H Function will not be displayed.

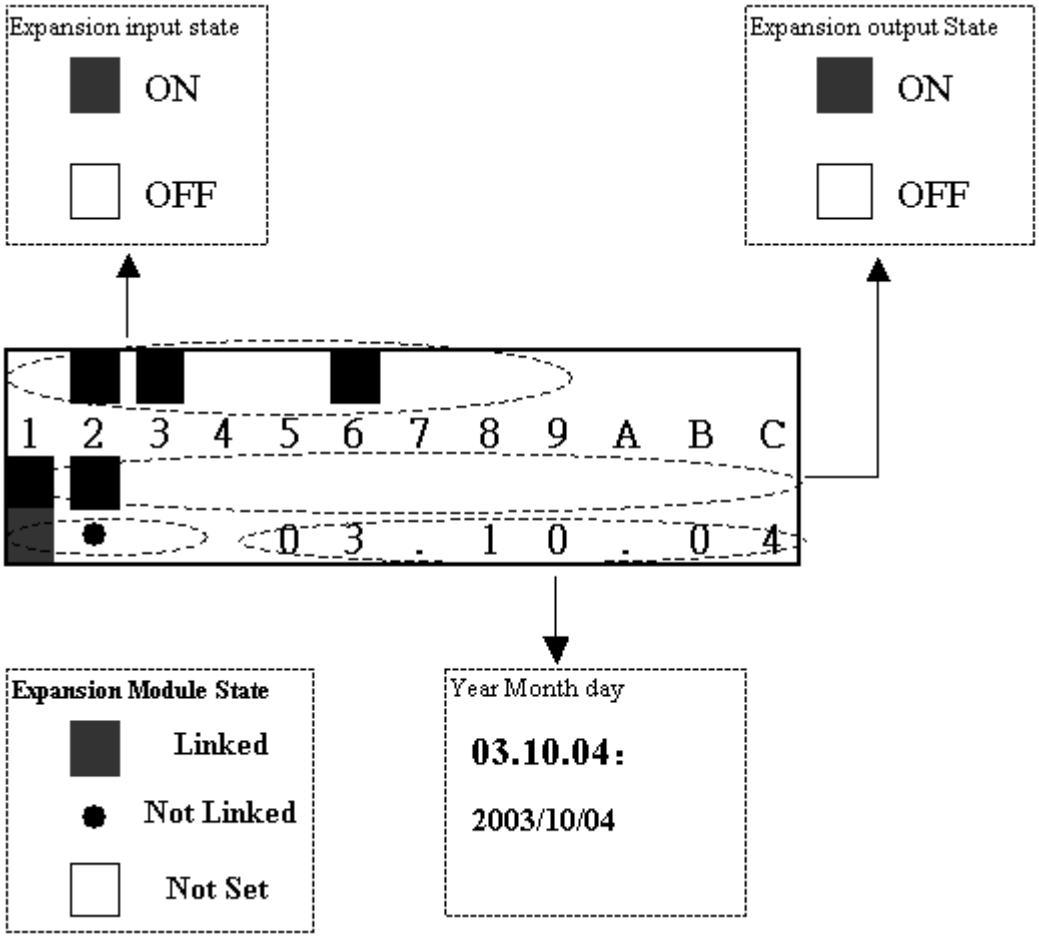
Example:

a) Display other relay operation:

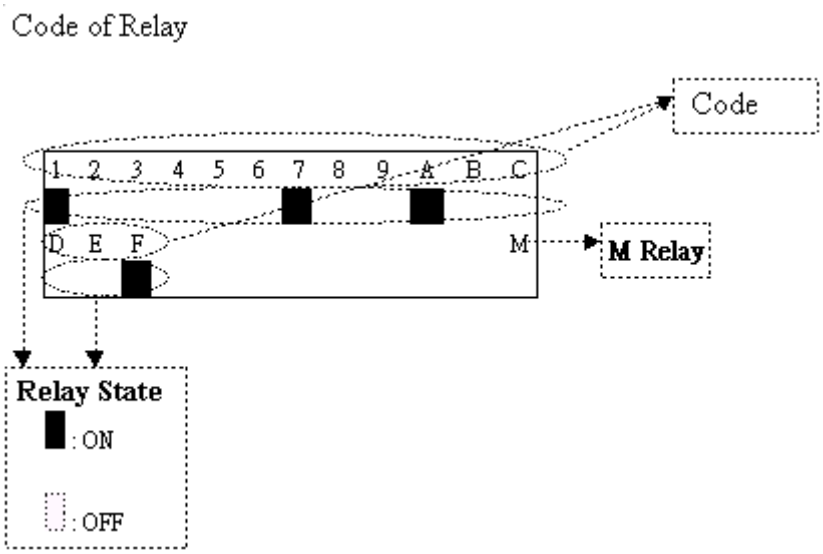



D E F G
SEL+↓
SEL+↑
1 2 3 4 5 6 7 8 9 A B C
D E F R
SEL+↓
SEL+↑
1 2 3 4 5 6 7 8 9 A B C
D E F C
SEL+↓
SEL+↑
1 2 3 4 5 6 7 8 9 A B C
D E F T
SEL+↓
SEL+↑
1 2 3 4 5 6 7 8 9 A B C
D E F M
SEL+↓
SEL+↑
1 2 3 4 5 6 7 8 9 A B C
0 3 . 1 0 . 0 4
SEL+↓
SEL+↑
1 2 3 4 5 6 7 8 9 A B C

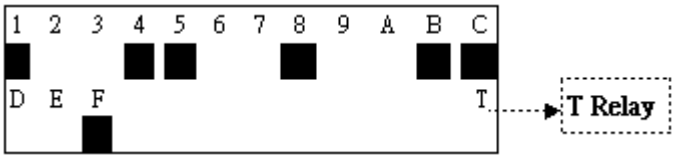
① Expansion display State



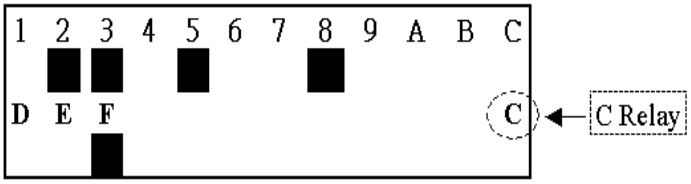
② M Display Status:



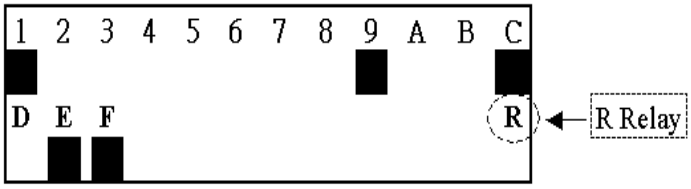
③ T Display State:



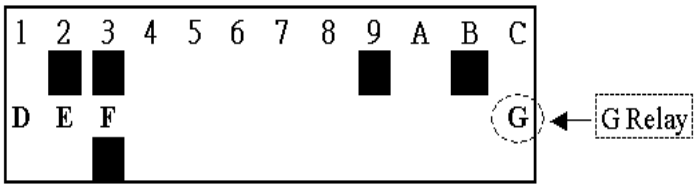
④ C Display State:



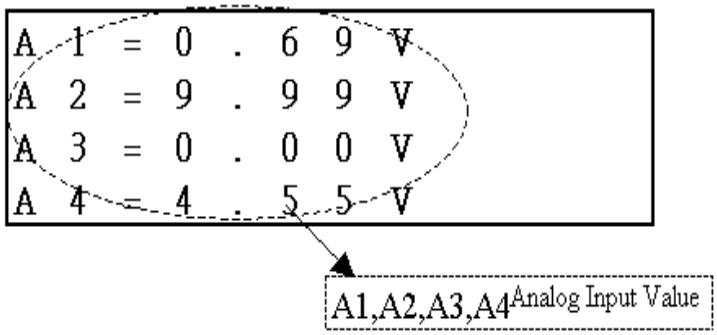
⑤ R Display State:



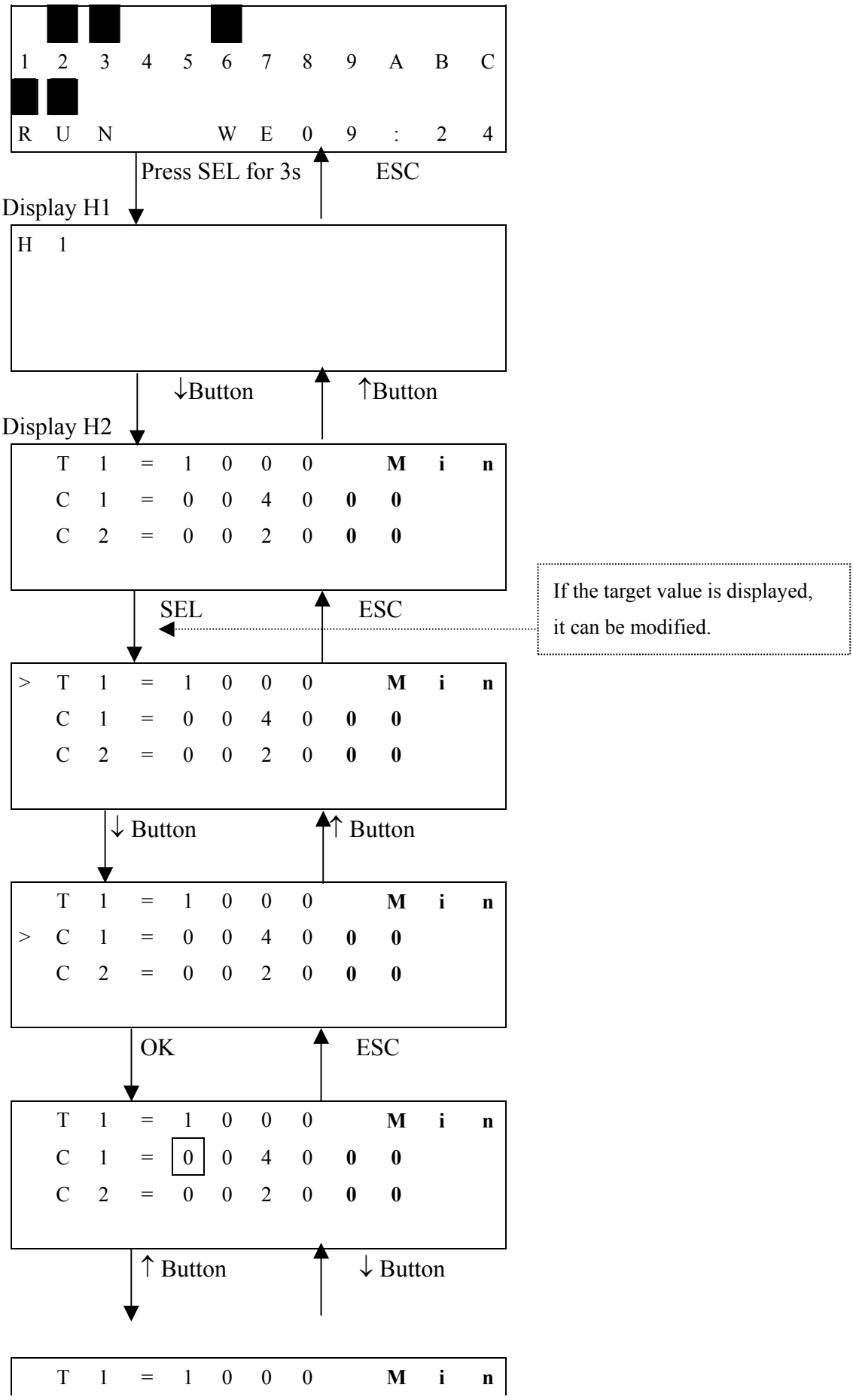
⑥ G Display State:

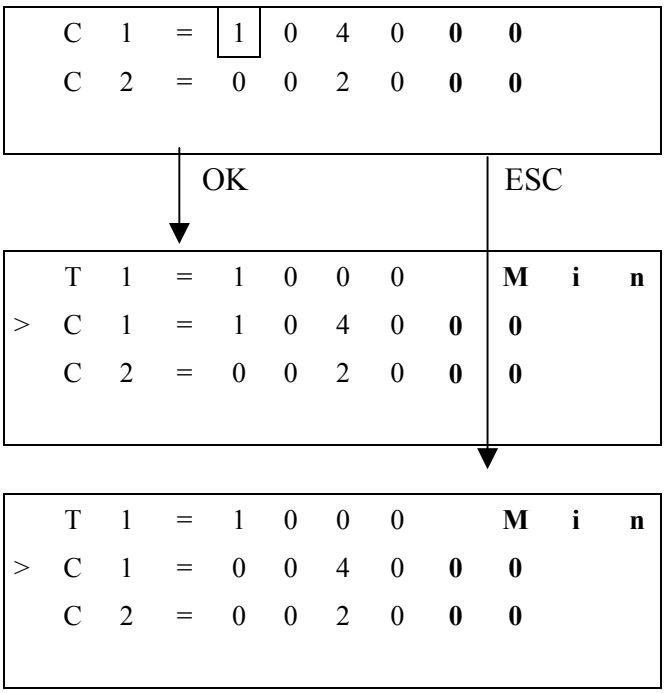


⑦ Analog Input Value:



b) Operation to Display H Function:


1 2 3 4 5 6 7 8 9 A B C
R U N W E 0 9 : 2 4
Press SEL for 3s
ESC
Display H1
H 1
↓Button
↑Button
Display H2
T 1 = 1 0 0 0 Min
C 1 = 0 0 4 0 0 0
C 2 = 0 0 2 0 0 0
SEL
ESC
If the target value is displayed, it can be modified.
> T 1 = 1 0 0 0 Min
C 1 = 0 0 4 0 0 0
C 2 = 0 0 2 0 0 0
↓ Button
↑ Button
T 1 = 1 0 0 0 Min
> C 1 = 0 0 4 0 0 0
C 2 = 0 0 2 0 0 0
OK
ESC
T 1 = 1 0 0 0 Min
C 1 = 0 0 4 0 0 0
C 2 = 0 0 2 0 0 0
↑ Button
↓ Button
T 1 = 1 0 0 0 Min



Main Menu

LCD displays 4-line Main Menu

(1) The Main Menu as iSmart under 'STOP' Mode.

>	LADDER		
	FUN.BLOCK		
	RUN		
	CLEAR PROG.	→	Clear the user program and the password
	WRITE	→	Save user program to PM04
	READ	→	Read user Program from PM04
	SET		
	RTC SET		
	ANALOG SET		
	PASSWORD		
	LANGUAGE	→	Select the language
	INITIAL	→	initially set Edit method

(2) The Main Menu as **iSmart** under 'RUN' Mode.

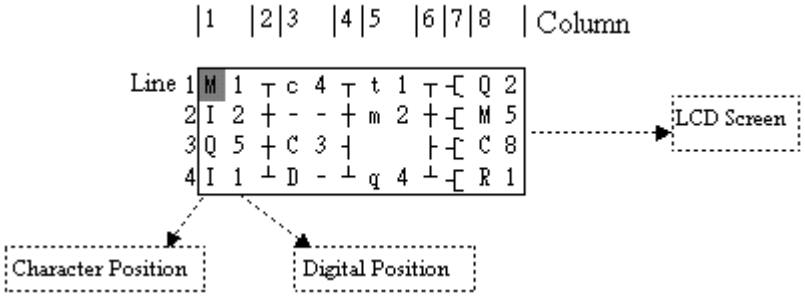
```
> LADDER
  FUN.BLOCK
  STOP
  WRITE
  RTC SET
  WRITE
  PASSWORD
  LANGUAGE
```

Press the Button

↑ ↓	Move the Cursor to select Main Menu
OK	Confirm the selected Function
ESC	Skip to Initial Screen

- **iSmart** can be modified, edited, cleared and read user program only when it is under STOP Mode.
- As the program is modified, **iSmart** will automatically backup it to EEPROM.(not PM04)

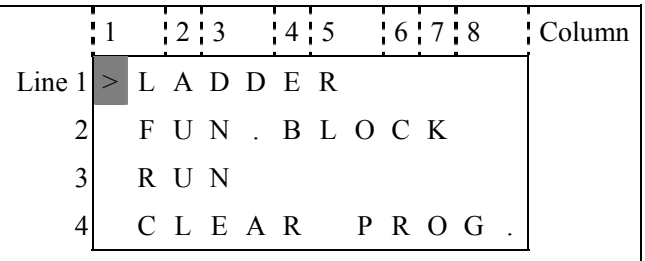
1.Main Menu LADDER

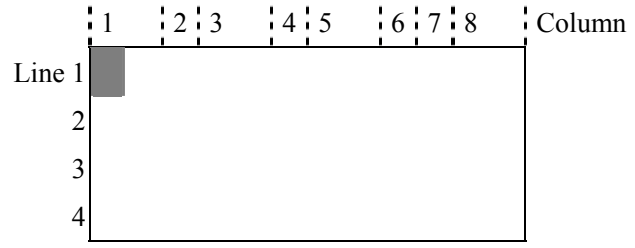


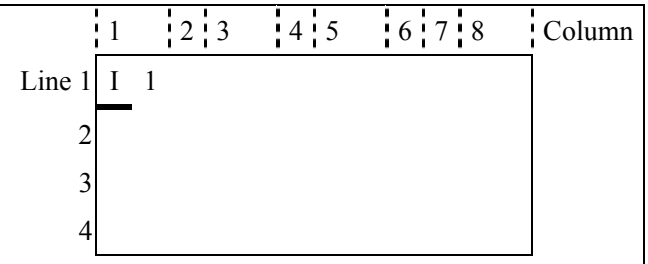
Press the Button

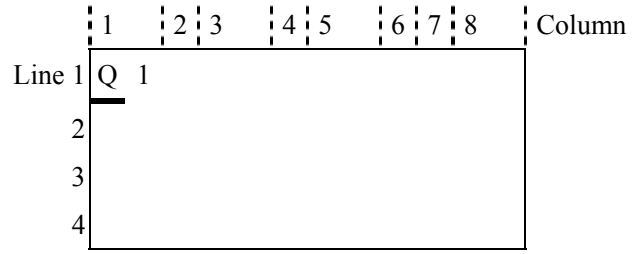
Button	Description
SEL	1. Ix ⇒ ix ⇒ — ⇒ space ⇒ Ix (only for digital and character position of 1,3,5 column.) 2. Qx ⇒ space ⇒ Qx (only for digital and character position of 8 column.). 3. ⊤⇒ space ⇒ ⊤ (all available but the 2,4,6 column of the first line) ⊥ ⊥ x : Digital: 1~F
SEL +↑/↓	1. 1...F, – (When the cursor locates the digital position, the range of digital is restricted by the relay type. 2. I ⇔ X ⇔ Q ⇔ Y⇔ M ⇔ D ⇔ T ⇔ C ⇔ R ⇔ G ⇔ I (When the cursor located at 1,3,5 Column). 3. Q ⇔ Y ⇔ M ⇔ T ⇔ C ⇔ R ⇔ G ⇔H ⇔ L ⇔P ⇔ Q (When the cursor located at 8 Column) 4. **(** ⇔ ⇔ ⇔ P ⇔ **(** (When the cursor located at 7 Column, and the 8 Column is set as Q,Y,M) 5. **(** ⇔ P ⇔ **(** ((When the cursor located at 7 Column, and the 8 Column is set as T)
SEL + ←/→	Confirm the input data and move the cursor
↑/↓	Vertically move the cursor
←/ →	Horizontally move the cursor
DEL	Delete an instruction
ESC	1. Cancel the Instruction or action under Edition. 2. Back to Main Menu after query the program.
OK	1. Confirm the data and automatically save, the cursor moves to next input position. 2. When the cursor is on Column 8, Press the button to automatically enter the function block and set the parameters(such as T/C)。
SEL+DEL	Delete a Line of Instruction.
SEL+ESC	Display the number of the Lines and operation state of **iSmart** (RUN/STOP)。
SEL+↑/↓	Skip up/ down every 4-line program.
SEL+OK	Insert a space line

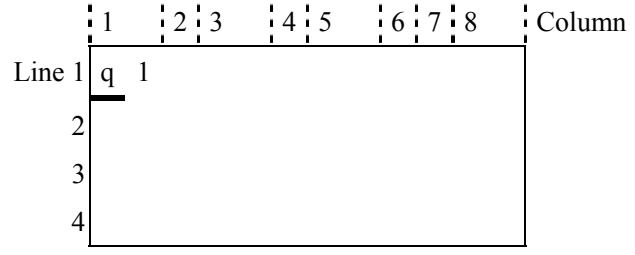
Operation Example:

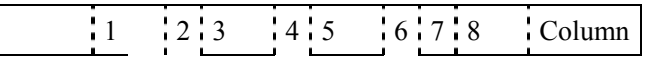
	

Procedure 1: Press ‘OK’ Enter LADDER Edition	

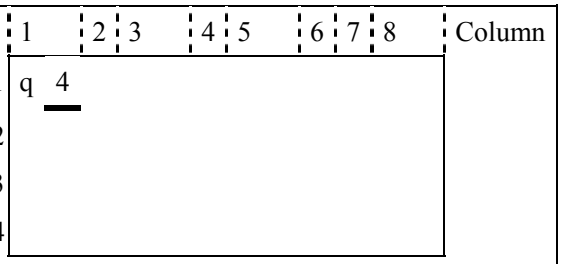
Procedure 2 : Press ‘SEL’ (When cursor located at character or digital, press the button to show I1)	

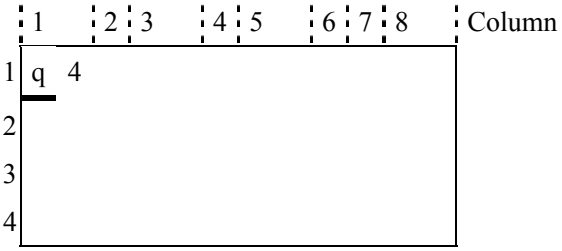
Procedure 3 : Press ‘↑’ twice. (Press ‘SEL’ + ‘↑ ↓’, and the digital cursor located will change from I to Q).	

Procedure 4 : Press ‘SEL’ (start /end modifying parameter)	

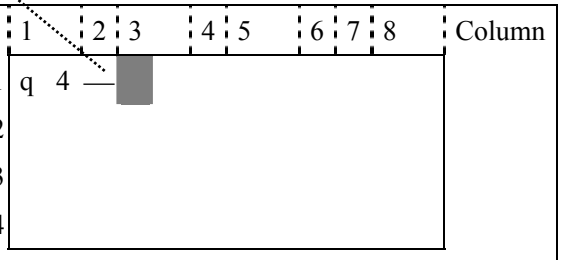
Procedure 5 :	

Press '→' ("Press 'SEL' + '← →', the cursor located in digital)	

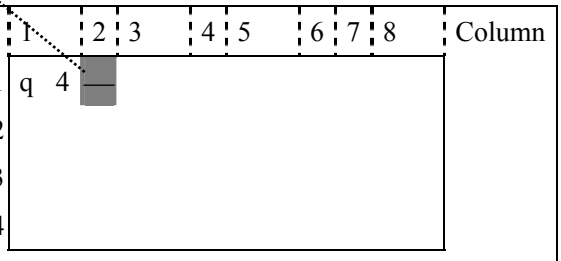
Procedure 6 : Press '↑' for 3 times ("Press 'SEL' + '↑ ↓' the digital the cursor located will change from 1 to 4)	

Procedure 7 : Press '←' (Press 'SEL' + '← →' to move the cursor to the position Required revision.	

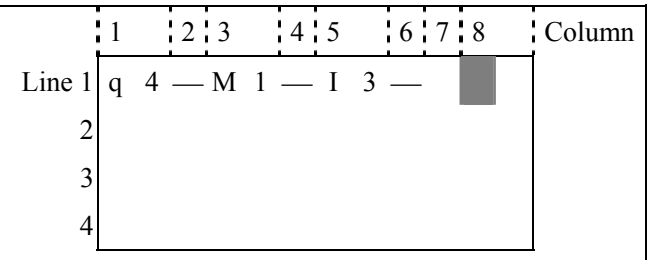
OR

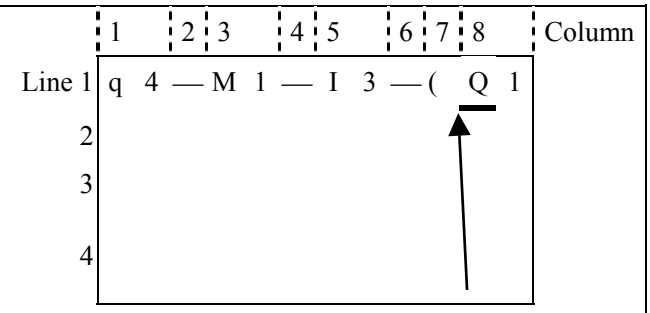
Procedure 7 : Press 'OK' (Move the cursor to character in column 3)	

OR

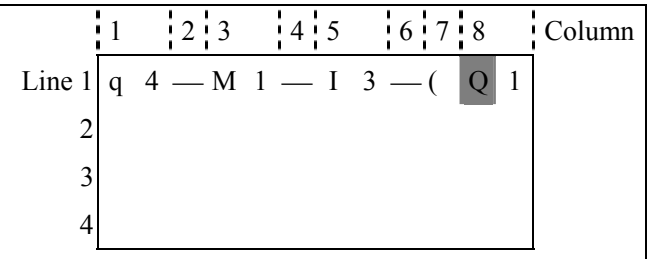
Procedure 7 : Press '→' (move the cursor to the link location in column 2)	

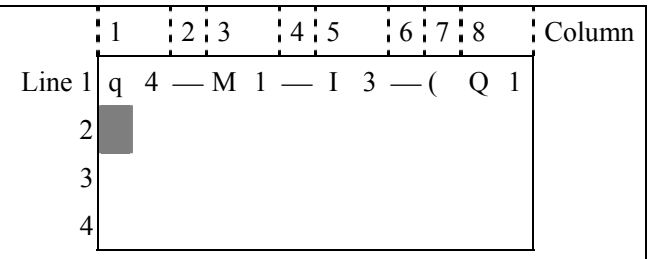
Repeat the step1~7, and input M1, I3 Instruction to column 3, 5.

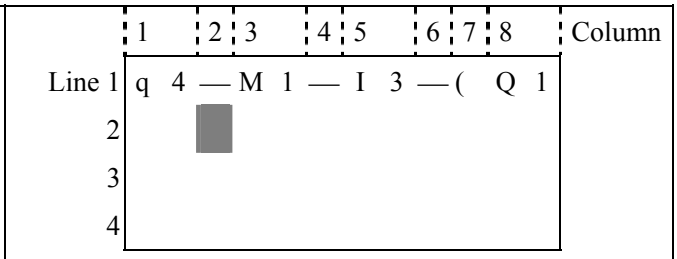
Procedure 8 : Press 'OK' in Column 5 (move the cursor to the character in column 8)	

Procedure 9 : Press 'SEL' (when the cursor located at character and digital, press 'SEL' to show ' –(Q1')	

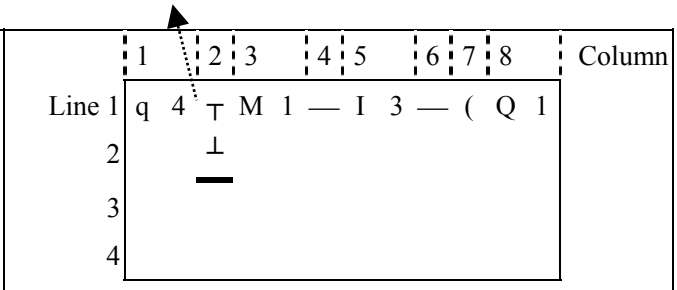
Auto Add " -("

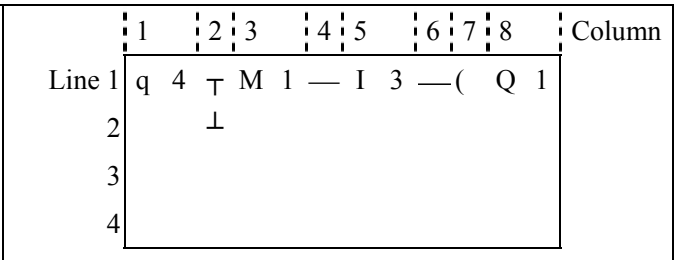
Procedure 10 : Press 'OK' Save the input program data, the position of the cursor will not move.	

Procedure 11 : Press '→' twice (move the cursor to column 1 and Line 2.)	

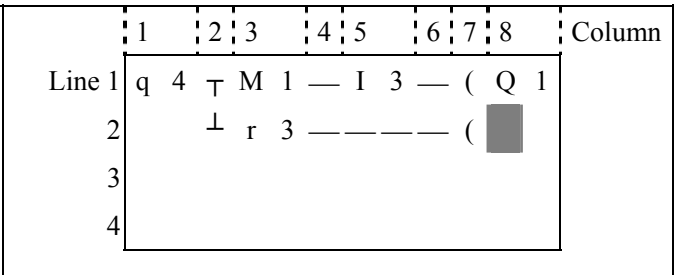
Procedure 12 : Press '→' twice (move the cursor to column 2) Note: never press 'SEL' before hand	

Change Wire '— ' to '⊤ '
⊥

Procedure 13 : Press 'SEL' (A vertical line emerges)	

Procedure 14 : Press 'OK' (Move the cursor to character in column 3.)	

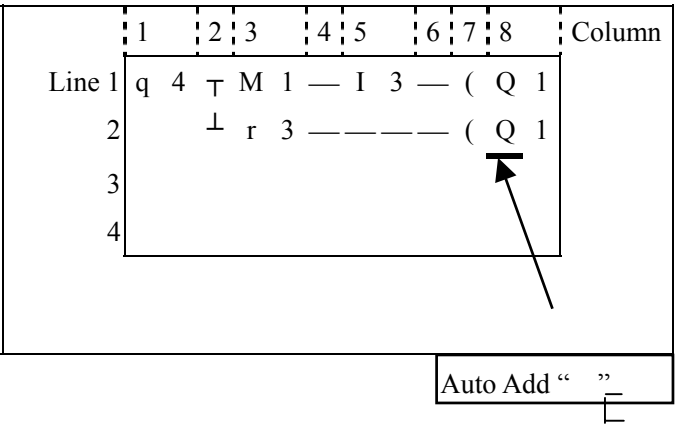
Repeat the step 1~7 and key in 'r 3' , —" at Line 2 and column 3~6.

Procedure 15 : Press 'OK' in column 5 (move the cursor to the character in Column 8)	

Procedure 16 :

Press 'SEL'

(When the cursor located in digital or character, press 'SEL', 'Q1' will emerges)

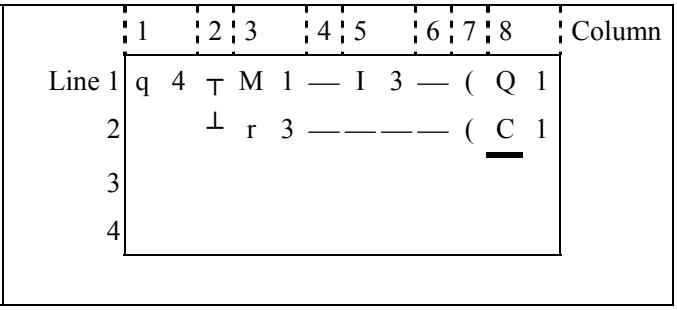


Procedure 17 :

Press '↑' for 4 times

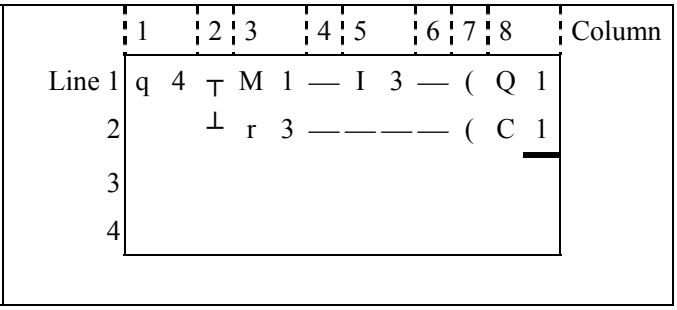
(Press 'SEL' + '↑ ↓'

(The character Q the cursor locating will change to C.)



Procedure 18 :

Press '→'

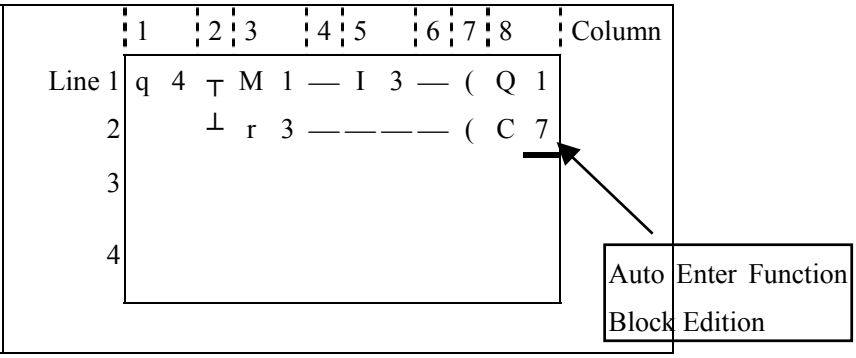


Procedure 19 :

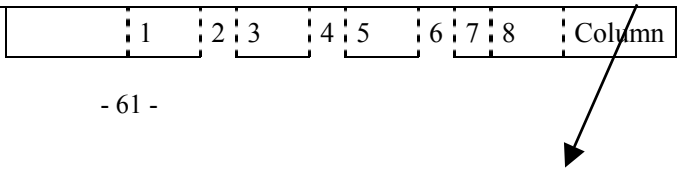
Press '↑' for 7 times

(Press 'SEL' + '↑ ↓'

The digital 1 the cursor locating will change to 7)

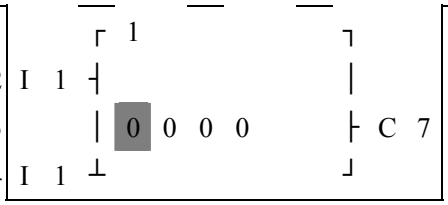


Procedure 20 :



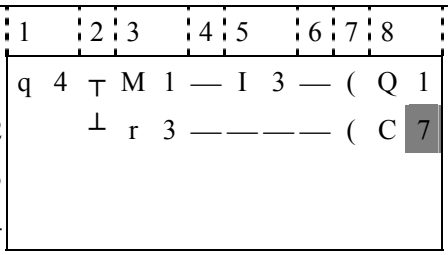
Press ‘OK’

(Auto shift to FUNCTION BLOCK and the counter input parameter)

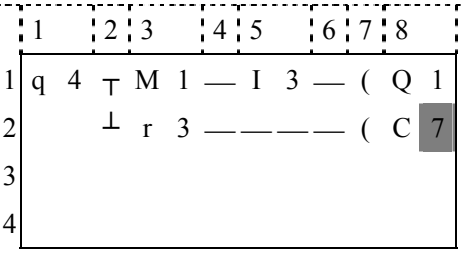


Procedure 21 :

Press ‘ESC’ back to LADDER edition screen



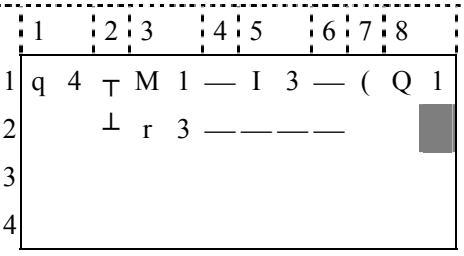
Delete the Program Element



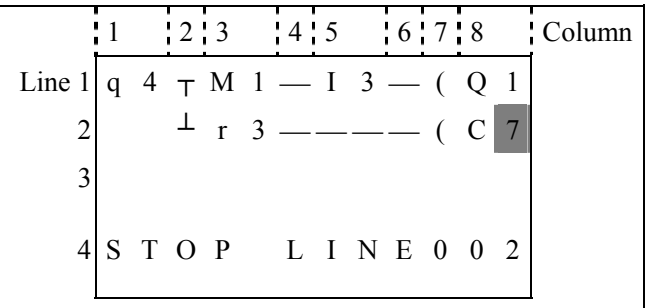
Procedure :

Press ‘DEL’

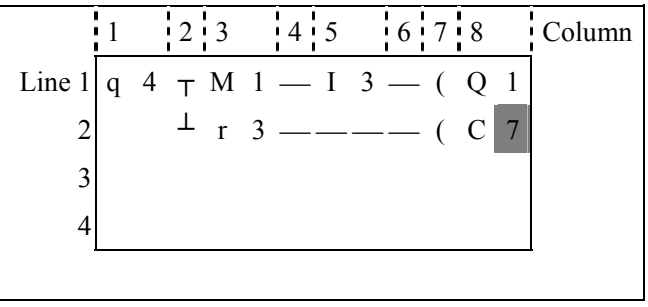
(to delete the element C7 the cursor locating)

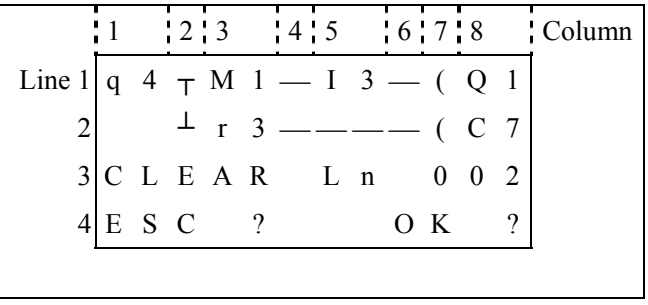


Display the present Line the cursor locating and operation state of SG2.

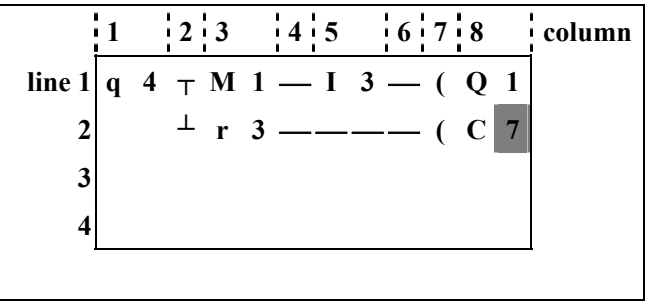
Procedure : Press ‘SEL+ESC’ (simultaneously) (The Line 4 displays where the cursor locating and operation state of **iSmart**)	

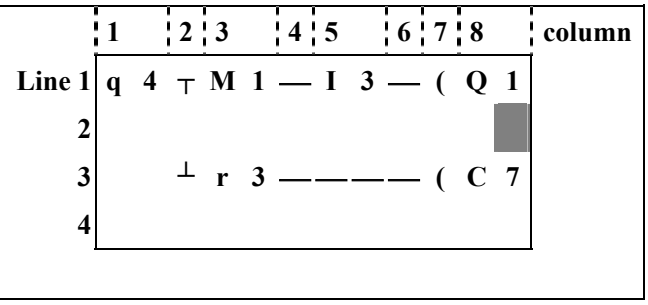
Delete the whole Line

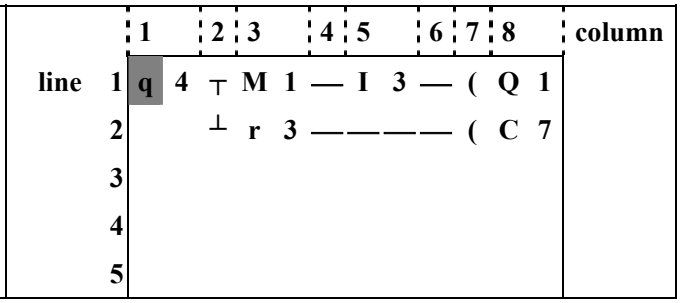
Procedure : Press ‘SEL+DEL’ (Simultaneously) (‘ESC’ Cancel , ‘OK’ Execute)	

Insert a whole line.:

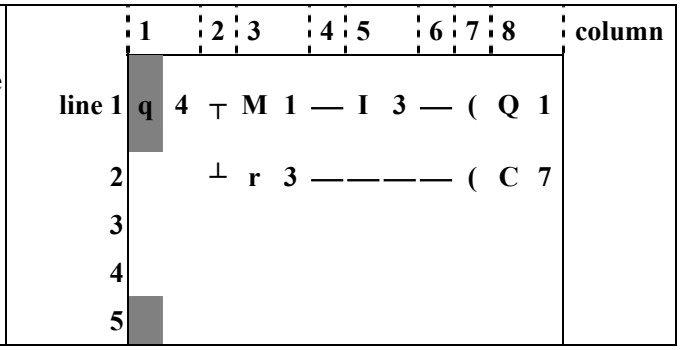
Step: **Press“SEL+OK” (at the same time)**	

Turnpage (move upward/ downward 4 lines program.)：

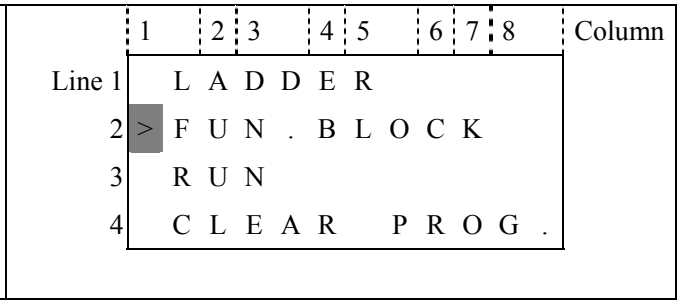


step：

Press ‘SEL+↑ ↓’（at the same time）



2. FUNCTION BLOCK program input

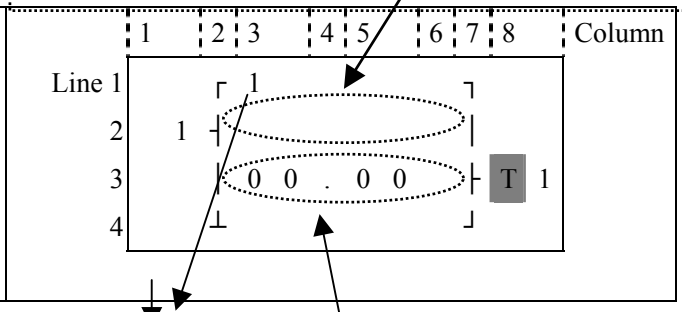


The present value will appear when **iSmart** is under ‘RUN’

Procedure 1:

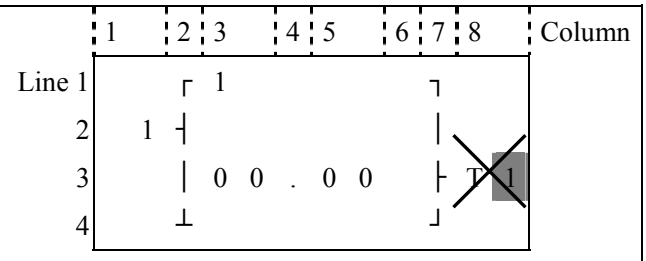
Press ‘OK’

(Enter FUNCTION BLOCK edition)



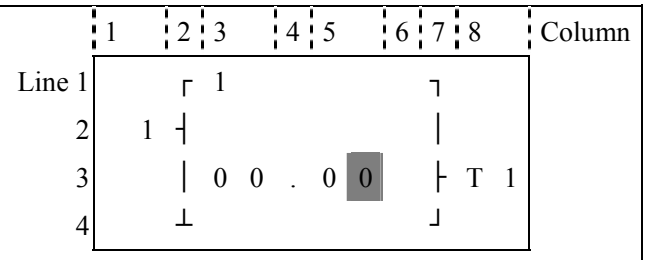
Preset action area

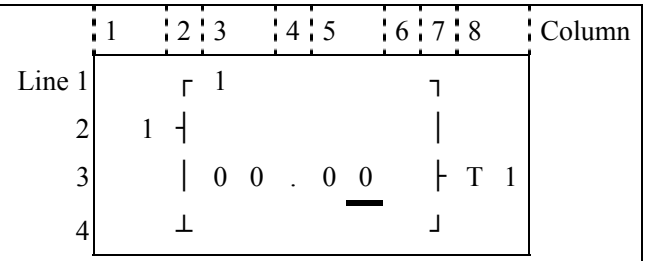
Preset action value area

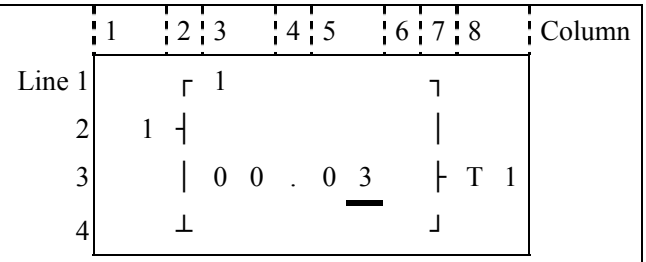
Never press '→' to move to the digital position. (If T2 is required to be changed, Press '↑'/'↓' and 'SEL' to execute.)	

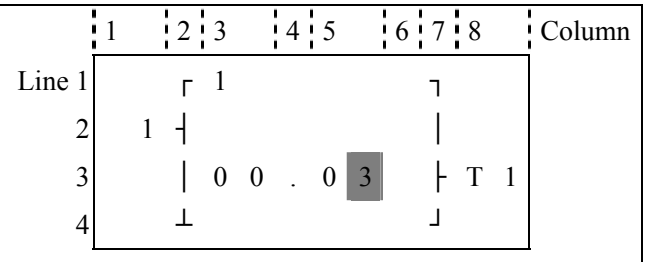
Step 2: modify ① preset target value ②preset the action relay

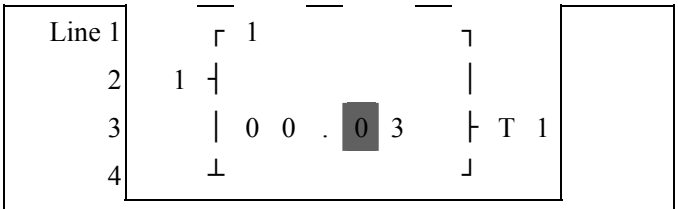
① Preset the target value

① Procedure 2-1: Press '←' (move the cursor to the preset action area)	

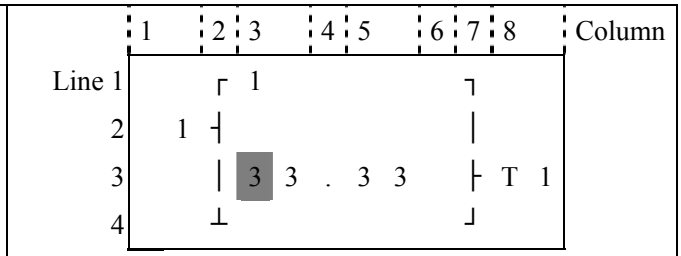
① Procedure 2-2: Press 'SEL' (begin input the target value)	

① Procedure 2-3: Press '↑' for 3 times (Press 'SEL' and followed by '↑,↓' The digital '0' is changed to '3')	

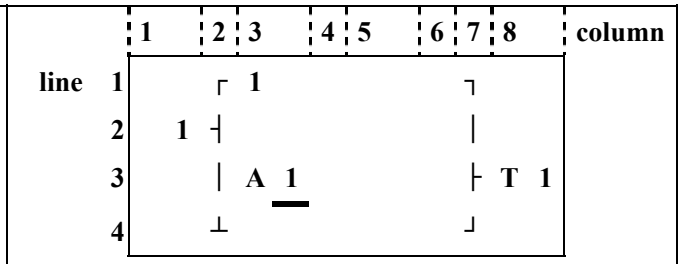
① Procedure 2-4: Press 'OK' (Save the input data)	
① Procedure 2-5:	1 2 3 4 5 6 7 8 Column

Press '←'	

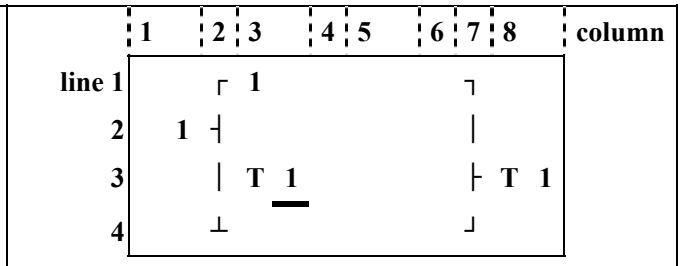
Repeat Step 2-2 ~ step 2-4 for 3 times, to enter the following screen:

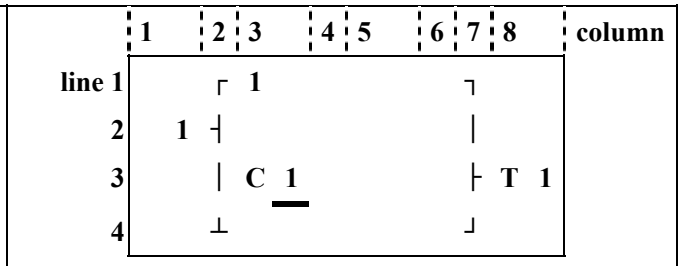
① Procedure 2-6:	

As the preset value of the timer, counter and analog comparator is set as the present value of them. next to the step 2-2, to execute the following operation:

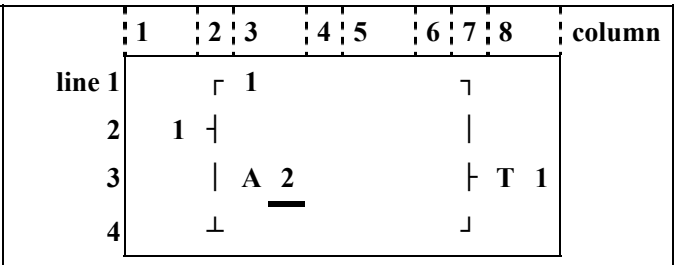
① Step2-3A: **Press 'SEL'**	

Repeat the step 2—3A, the following screen will be shown in turn:

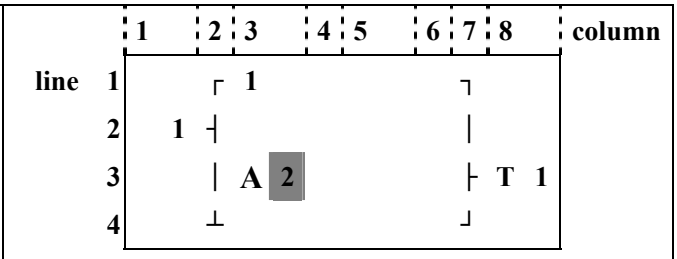
① step 2-3B: **press 'SEL'**	

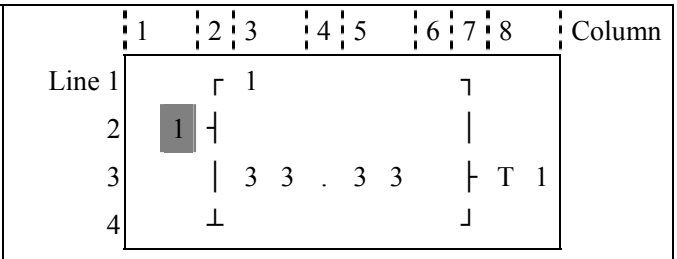
① step 2-3C: **Press 'SEL'**	

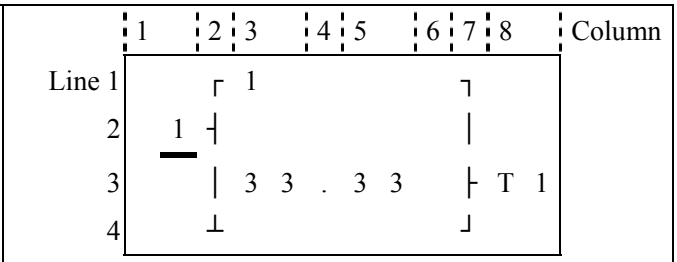
Next to step 2—3A, then '↑' , the following screen will be shown.

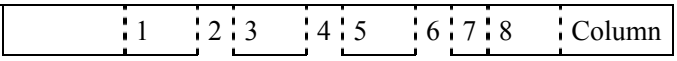
① step 2-4A: **Press '↑'**	

Repeat step 2－4A (press '↓' is also available)，the preset value of A1~A4 will be periodically changed. And so on. The other function blocks (time, counter) present value is set as preset value, to repeat the step to select T1~TF, C1~CF.

① step 2-5A: **press 'OK'** **Save the present data.**	

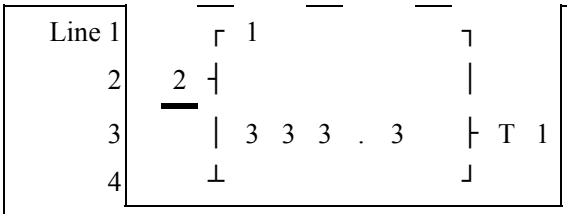
① Procedure 2-7: Press '↑'	

② Procedure 2-8: Press 'SEL' (begin to edit data)	

② Procedure 2-9:	

Press '↑'

(Press 'SEL' + ' ↑, ↓'
to change1' to ' 2')

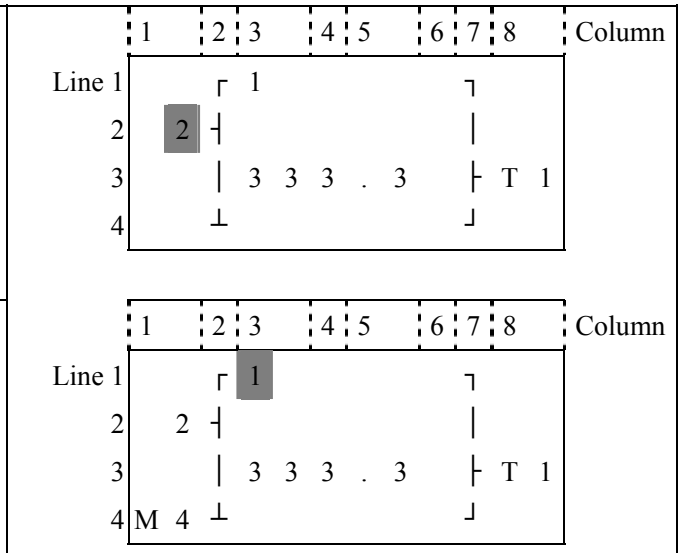


② Procedure 2-10:
Press 'OK'

(save the input data)

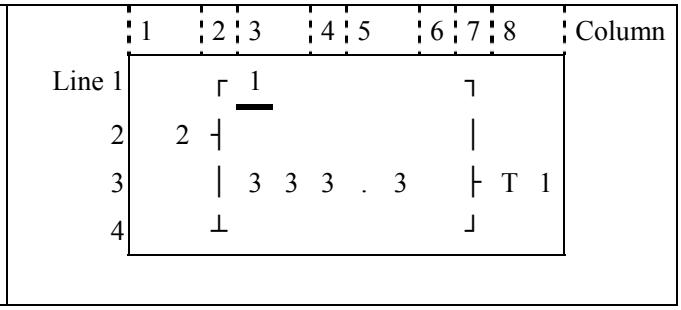
② Procedure 2-11:
Press '↑'

(move the cursor to '1" position)



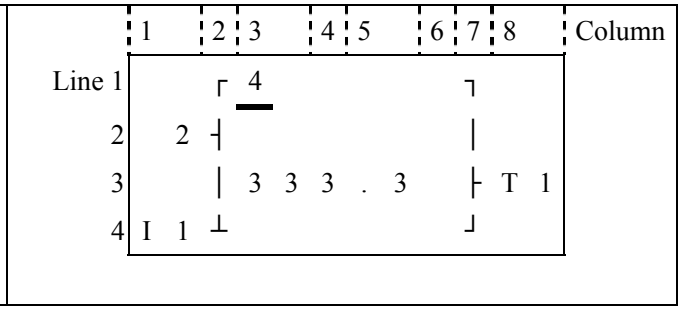
② Procedure 2-12:
Press 'SEL'

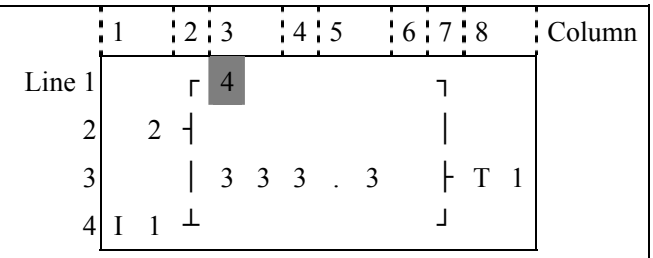
(begin to edit data)

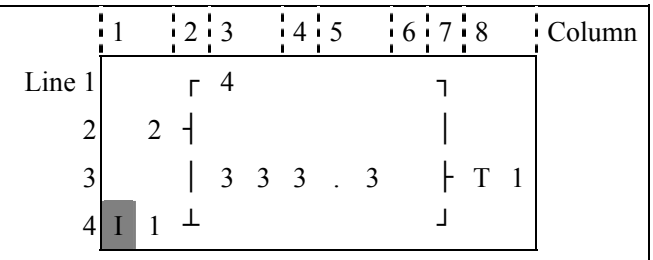


② c 2-13:
Press '↑' for 3 times

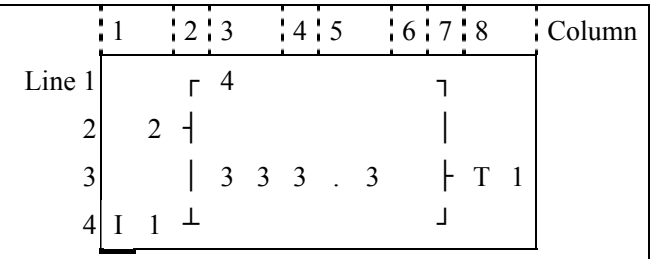
(Press 'SEL' and followed by '↑ ↓'
to change 1 to 5)

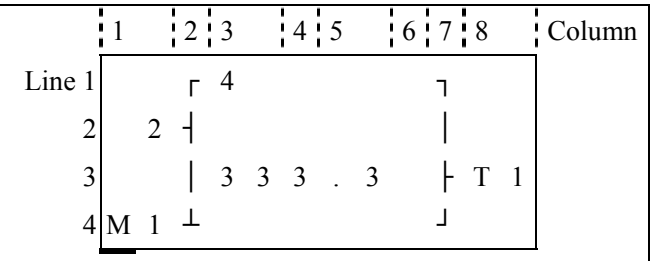


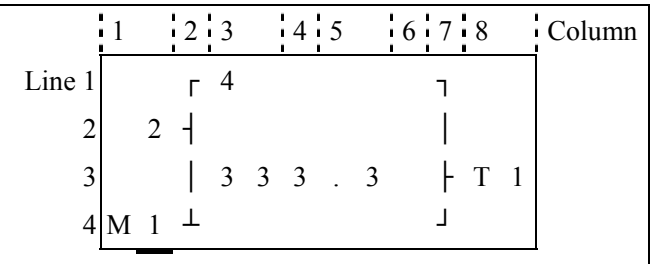
② Procedure 2-14: Press ‘OK’ (save input data)	

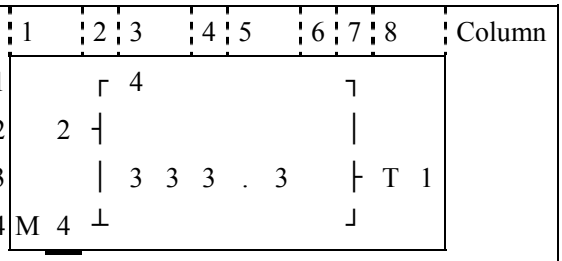
② Procedure 2-15: Press ‘↓’ for 3 times (this step leads to editing the action relay)	

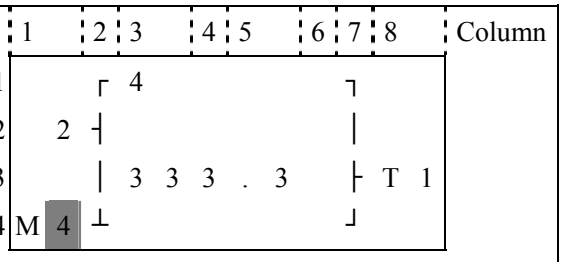
② Edit action program and preset the action relay

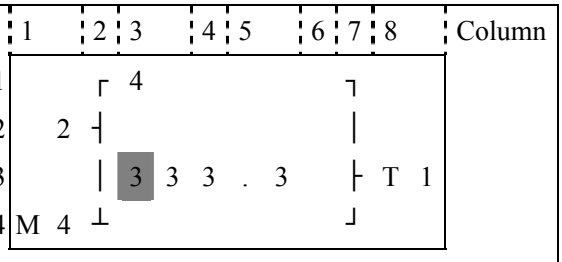
② Procedure 2-16: Press ‘SEL’ (Begin to modify)	

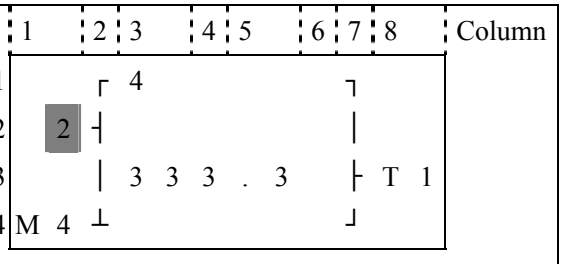
② Procedure 2-17: Press ‘↑’ for 4 times (Press ‘SEL’ + ‘↑ ↓’ to change I to M)	

② Procedure 2-18: Press ‘→’ (Press ‘SEL’ + ‘← →’ to move the cursor to digital location)	

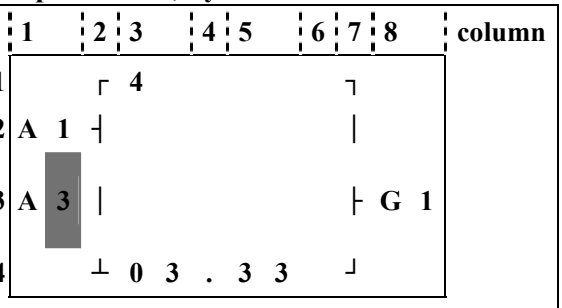
② Procedure 2-19: Press '↑'for 3 times (Press 'SEL' + '↑ ↓' to change '1' to '4')	

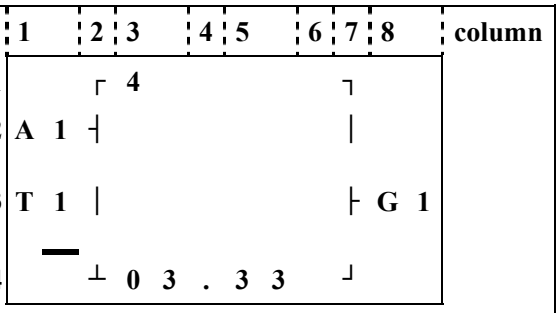
② Procedure 2-20: Press 'OK' (save the input data)	

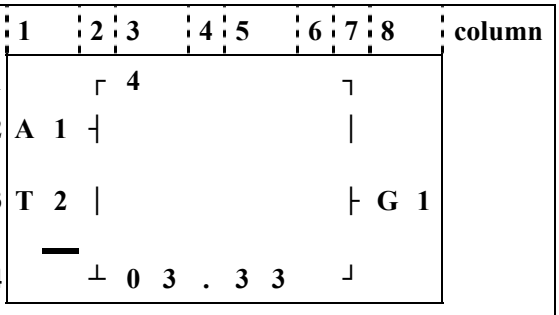
① Procedure 2-21: Press '↑' (Move the cursor to preset action value area to repeat the step 2-1)	

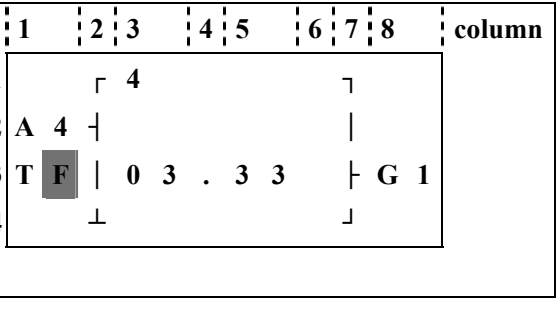
② Procedure 2-22: Press '↑' (Move the cursor to position '2' to repeat the 2-8)	

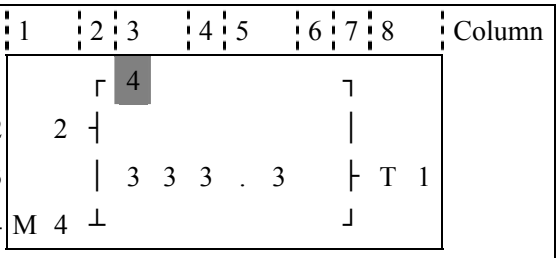
The detail operation of modify the analog comparator Ax, Ay:

② step 2-22A: **Press '↑'** **(Move the cursor to 2, or repeat the next step.** **Select A1~A4**	

② Step 2-22B: **Press 'SEL'** **(Move the cursor to 2 to repeat the above step.** **Select A2-T1-C1-A1)**	

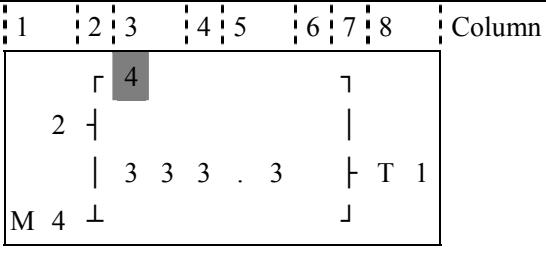
② Step 2-22C: **Press '↑'** **(Move the cursor to 2 to repeat the above step.** **Select T1~TF,C1~CF,A1~A4)**	

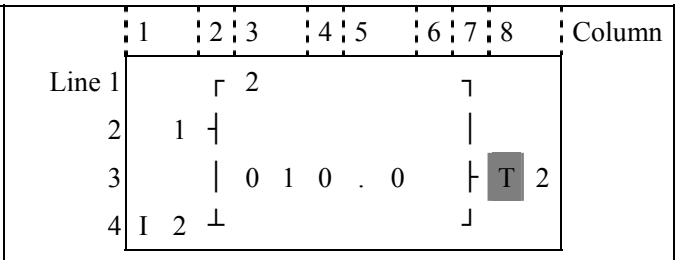
② Step 2-22D: **Press 'OK'** **Save the present data**	

② Procedure 2-23: Press '↑' (Move the cursor to position '4' to repeat the step 2-12)	

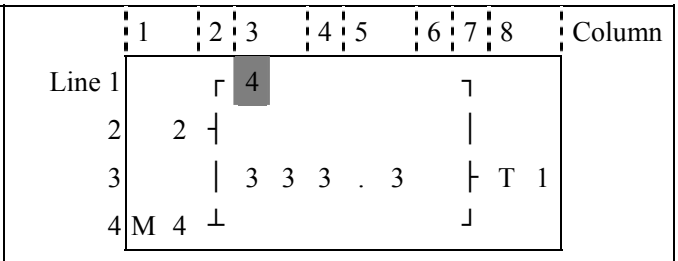
Continue to input Function Block

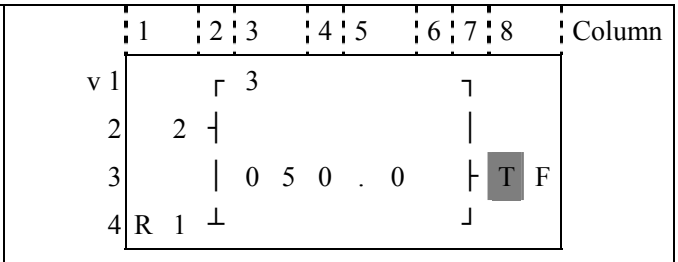
① Next Function Block

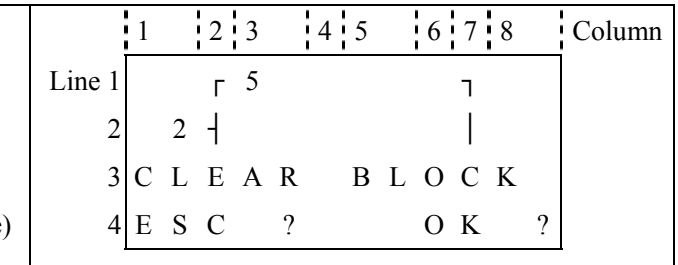
Procedure 1: Press ‘SEL+↑’ (Simultaneously)	

② Last Function Block

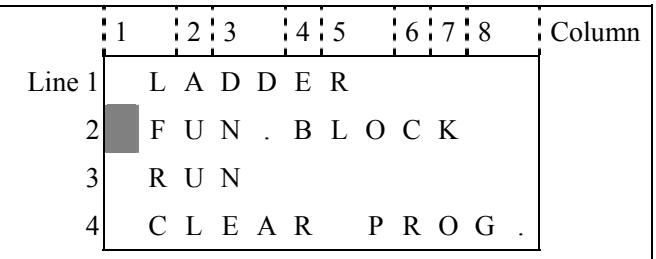
Procedure : Press ‘SEL+↓’ (Simultaneously)	

Delete Function Block

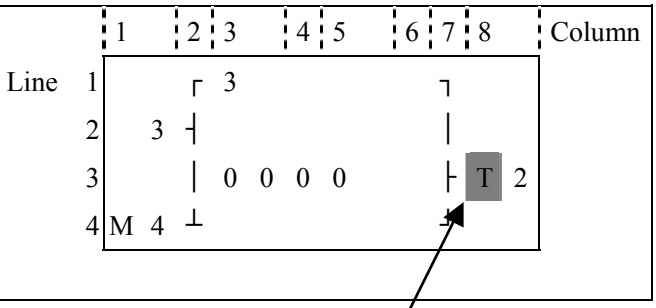
Procedure ： Press ‘SEL+DEL’ (Simultaneously) (‘ESC’: Cancel ; ‘OK’: Execute)	

Back to Main Menu:

Press 'ESC'

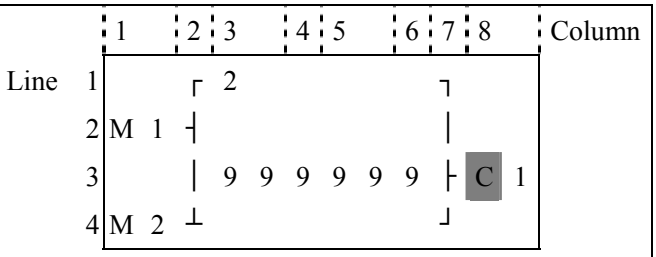


Change Function Block Category:



Step 1:

Press 'SEL'



3. RUN or STOP

(1) RUN Mode

RUN PROG.

>YES

NO

(2) STOP Mode

STOP PROG.

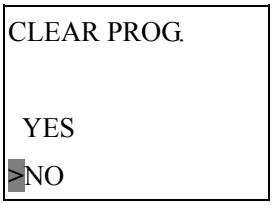
>YES

NO

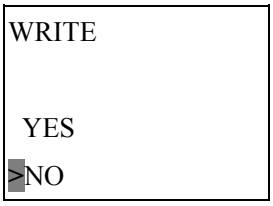
↑ ↓	Move the cursor
OK	Execute the instruction, then back to main menu
ESC	**B**ack to main menu

4. Other Menu Items

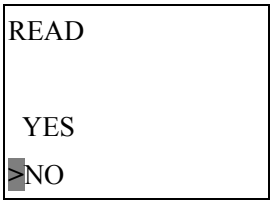
(1) CLEAR PROGRAM (Clear RAM, EEPROM and Password at the same time)



(2) WRITE (save the program (RAM) to the SMT-PM04 program spare cartridge)



(3) READ (read the program from the SMT-PM04 program spare cartridge to **iSmart** (RAM))



(1) ~ (3) Now Press:

↑ ↓	Move the cursor
OK	Execute the instruction, then back to main menu
ESC	Back to main menu

(4) SET (system setting)

ID SET 01	→	ID setting (00~99)
REMOTE I / 0 N	→	Remote I/O Mode (N: none M: Master S:S lave)
BACK LIGHT ×	→	Back light mode (√: always light ×: light for 5s after pressed.)
M KEEP √	→	M: non-Volatile (√:Volatile ×: Non- Volatile)
I/O NUMBER 0	→	Expansion I/O Points（0~3）
I/O ALARM √	→	Siren setting when is not available to Expansion I/O Points（√:Yes ×:No）
C KEEP ×	→	in stop/run switching, Counter Present Value Keeping（√:Yes ×:No）

Now Press:

↑↓←→	Move the cursor
SEL	Begin to edit.
Press ‘SEL’ and ‘←→’	Move the cursor for ‘ID SET item’
Press ‘SEL’ and ‘↑↓’	1. ID SET=00~99 ; I/O NUMBER=0~3 2. REMOTE I/O= N⇔M⇔S⇔N 3. BACK LIGHT ; C KEEP =×⇔√ 4. M KEEP; I/O ALARM =√√⇔××
OK	Confirm the Edition Data
ESC	1. Cancel the setting when pressed ‘SEL’ 2. Back to Main Menu

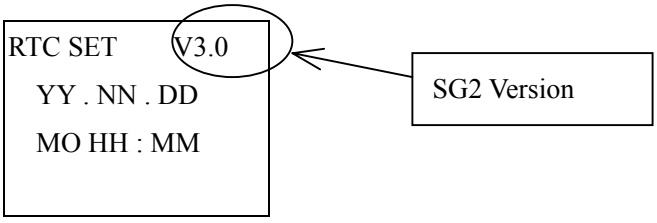
Note：

①When DATALINK is selected, ID setting range is 1~8 , which should be continuous。ID=1default as Master, ID=2~8 default as Slave

②When REMOTE I/O is selected， the distribution of the remote I/O is as follows:

Master			Slave
Remote Input	X1~X12	←	I1~I12
Remote Output	Y1~Y8	→	Q1~Q8

(5) RTC Setting



Now Press

SEL	Begin to input parameters
Press ‘SEL’ + ‘←→’	Move the Cursor
SEL then ↑ ↓	1. YY=00~99,NN=01~12,DD=01~31 2.MO⇔TU⇔WE⇔TH⇔FR⇔SA⇔SU⇔MO 3. HH = 00~23 or MM = 00~59
OK	Save the Input Data
ESC	1. Cancel the Input Data when press ‘SEL’. 2. Back to Main Menu.

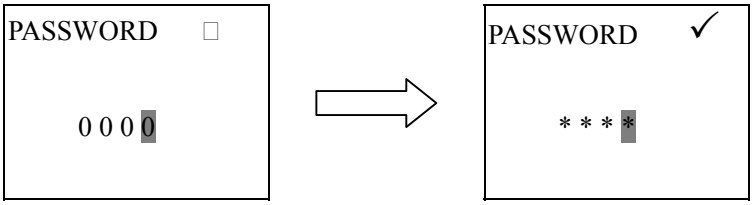
(6) ANALOG SETTING

A 1=GAIN : 010	→	GAIN (0~999)
OFFSET : + 00	→	OFFSET (-50~+50)
A 2=GAIN : 010		
OFFSET : + 00		

Now Press

↑↓	1. Move downward the Cursor 2. Switch the setting screen from A1, A2 to A3, A4.
SEL	Begin to input parameters
Press 'SEL' + '← →'	Move the Cursor
'SEL' + '↑↓'	1. GAIN =000~999 2. OFFSET=-50~+50
OK	Save the Input Data
ESC	1. Cancel the Input Data when press 'SEL'. 2. Back to Main Menu.

(7) SETTING PASSWORD



Now Press

SEL	1. Begin to input numeral 2. When the password is ON, it will not display 0000, but ****.
Press 'SEL' + '← →'	Move the cursor
Press 'SEL' + '↑↓'	0~9
OK	Save the input data, not 0000, as the PASSWORD is ON.
ESC	1. Cancel the Input Data when press 'SEL'. 2. Back to Main Menu.

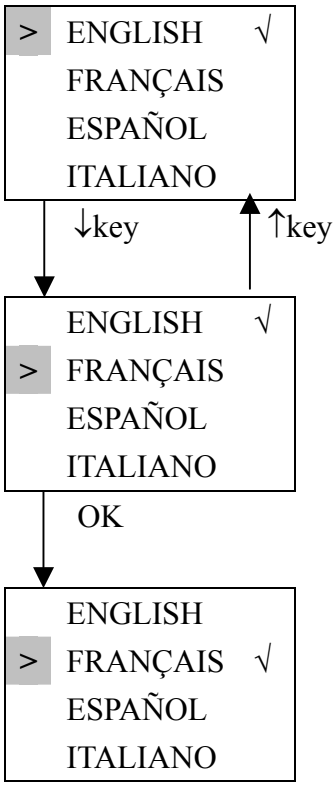
（8）LANGUAGE Selection

>	ENGLISH √	→	English
	FRANÇAIS	→	French
	ESPAÑOL	→	Spanish
	ITALIANO	→	Italian
	DEUTSCH	→	German
	PORTVGVES	→	Portuguese
	SIMPLIFIED CHINESE	→	Simplified Chinese

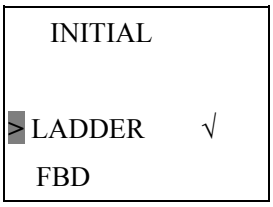
Now Press

Press '↑ ↓'	Vertically move the Cursor
OK	Select the language the cursor located
ESC	Back to Main Menu

Example:



(8) INITIAL



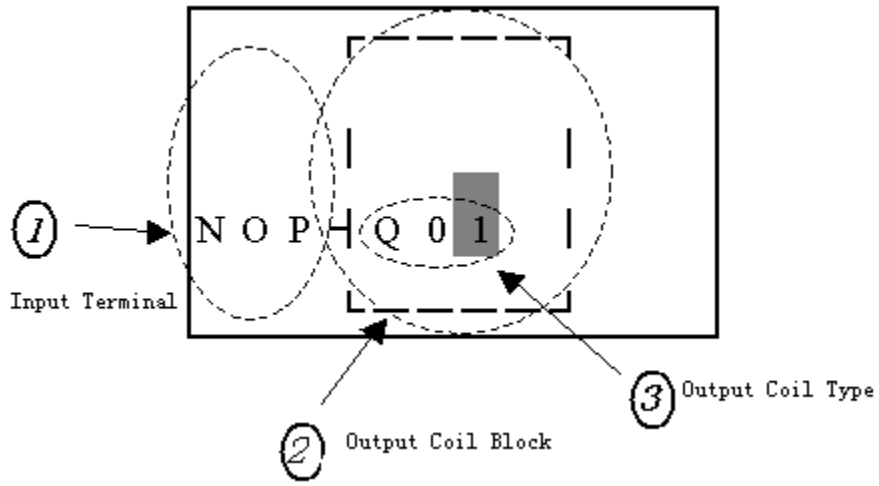
Now Press:

Press '↑ ↓'	Vertically move the Cursor
OK	Select the language the cursor located
ESC	Back to Main Menu

⚠ The origin program will be cleared as the change of edition method.

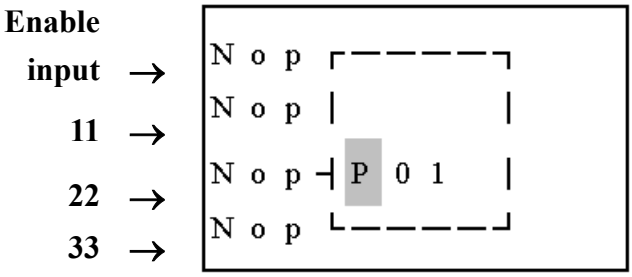
Chapter 8 FBD Block Description

8-1 Coil Block Diagram



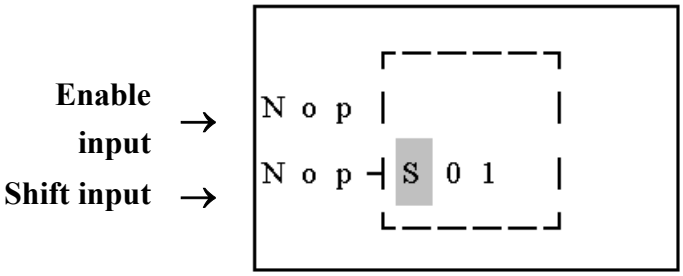
	□Input Terminal	□Output Coil	Range
Input	I		I01~I0C(12)
Expansion Input	X		X01~X0C(12)
Output	Q	Q	Q01~Q08(8)
Expansion Output	Y	Y	Y01~Y0C(12)
Auxiliary	M	M	M01~M0F(15)
Knob	N	N	N01~N0F(15)
HMI		H	H01~H0F(15)
PWM		P	P01(1)
SHIFT		**S**	**S01(1)**
DATALINK		L	L01~L08(8)
Logic /Function Block	B		B01~B99(99)
Normal ON	Hi		
Normal OFF	Lo		
No Connection	Nop		

(2) PWM Function Block Description



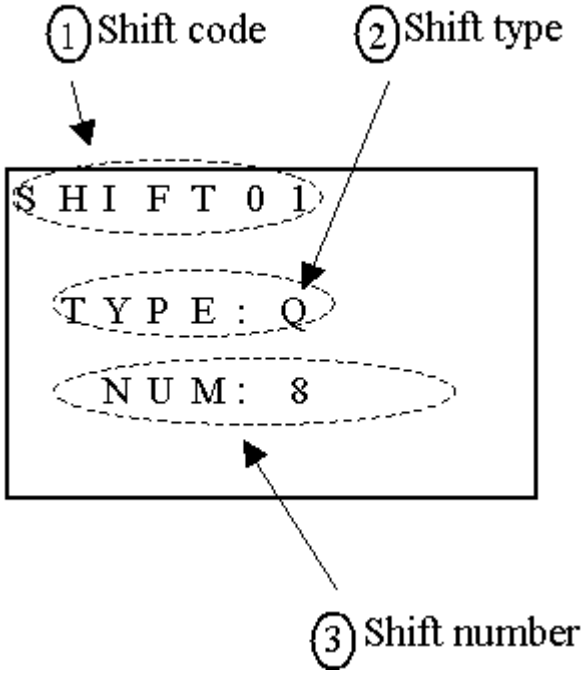
(3) SHIFT Function Block Description

Input terminal description



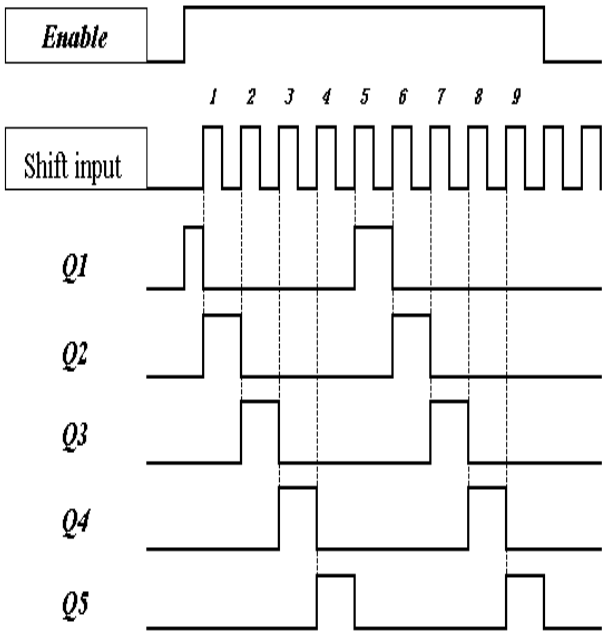
Setting parameter description:

Symbol	Description
①	SHIFT code (Total 1 group)
②	Setting output type (Q,Y)
③	Setting output shift number (1~8)



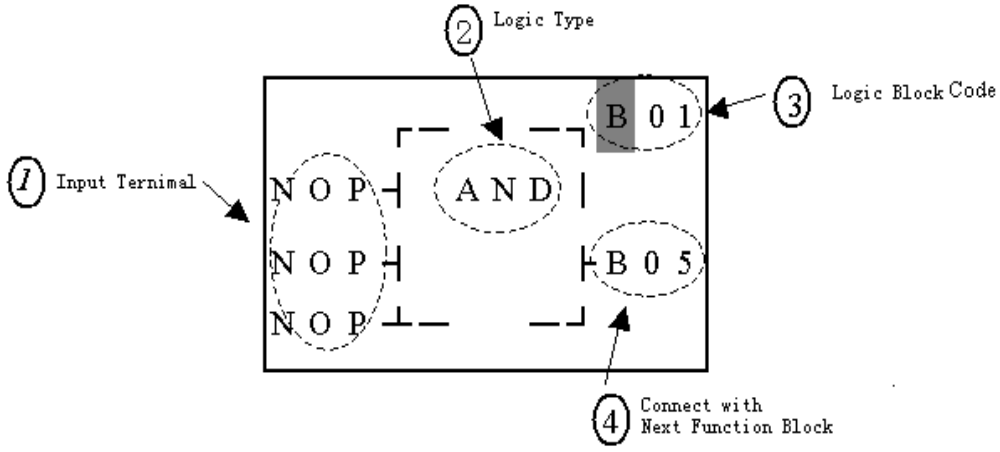
Example:

②= *Q* , ③= *5* Shift ouput range: *Q1~Q5*



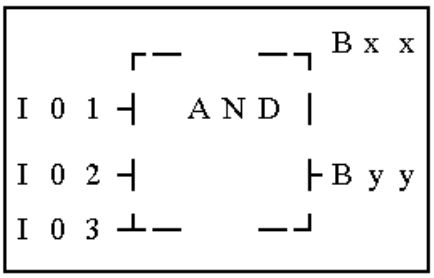
Note：When an enable input is used, Q1 ON, Q2~Q4 will be OFF, until the first shift input raise edge, Q2 ON, Q1 and Q3~Q5 OFF. The next output coil will be on when meeting each rising edge and others are OFF.

8-2 Edit Block

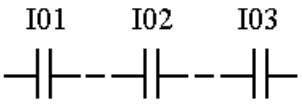


(1)AND Logic Diagram

FBD:



LADDER:

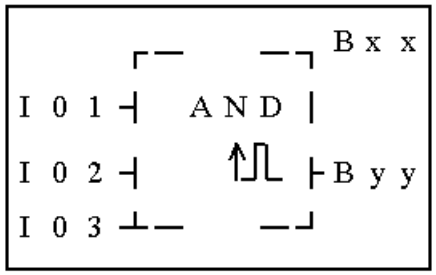


I01 And I02 And I03

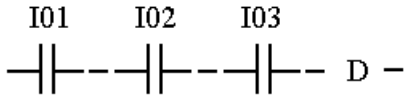
Note：The input terminal is NOP which is equivalent to 'Hi'

(2)AND (EDGE) Logic Diagram

FBD:



LADDER:

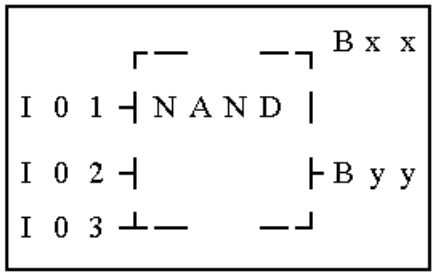


I01 And I02 And I03 And D

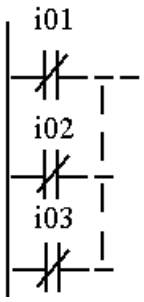
Note：The input terminal is NOP which is equivalent to 'Hi'

(3)NAND Logic Diagram

FBD:



LADDER:

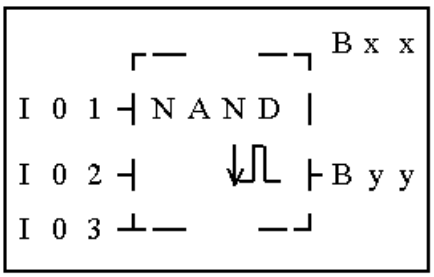


Not(I01 And I02 And I03)

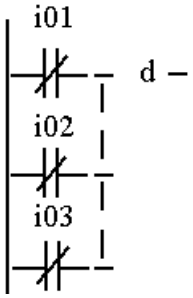
Note：The input terminal is NOP which is equivalent to 'Hi'

(4)NAND (EDGE) Logic Diagram

FBD:



LADDER:

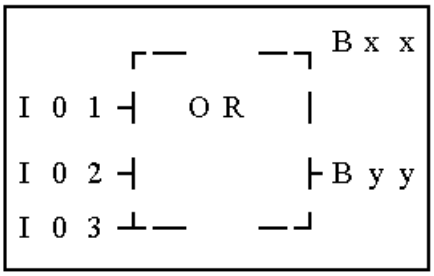


Not(I01 And I02 And I03) And d

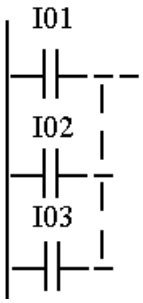
Note：The input terminal is NOP which is equivalent to ‘Lo’

(5)OR Logic Diagram

FBD:



LADDER:

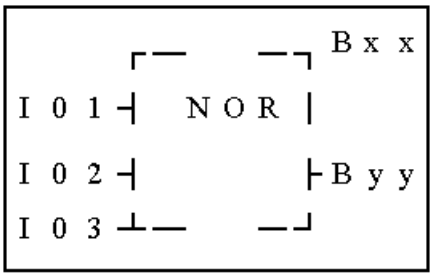


I01 or I02 or I03

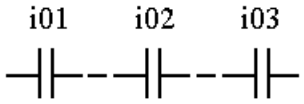
Note：The input terminal is NOP which is equivalent to ‘Lo’

(6)NOR Logic Diagram

FBD:



LADDER:

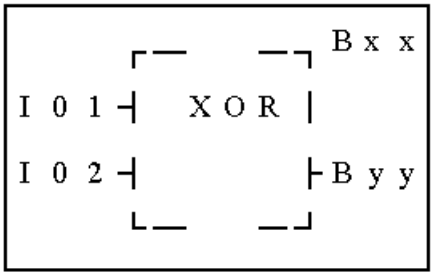


Not (I01 or I02 or I03)

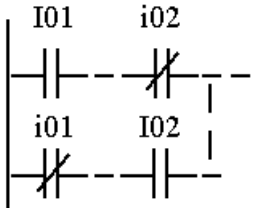
Note：The input terminal is NOP which is equivalent to ‘Lo’

(7)XOR Logic Diagram

FBD:



LADDER:

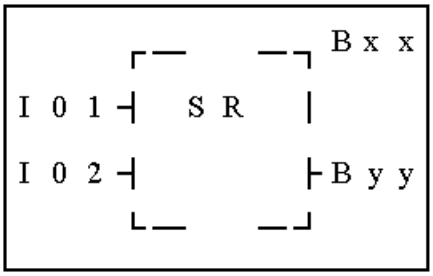


I01 Xor I02

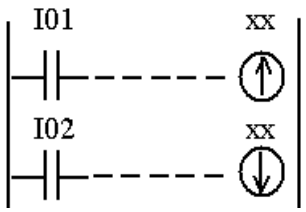
Note：The input terminal is NOP which is equivalent to ‘Lo’

(8)SR Logic Diagram

FBD:



LADDER:



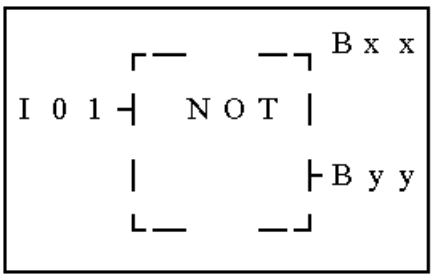
Logic Table

I01	I02	Bxx
0	0	holding
0	1	0
1	0	1
1	1	0

Note：The input terminal is NOP which is equivalent to ‘Lo’

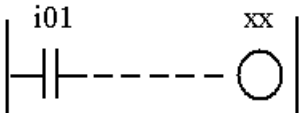
(9)NOT Logic Diagram

FBD:



Not I01

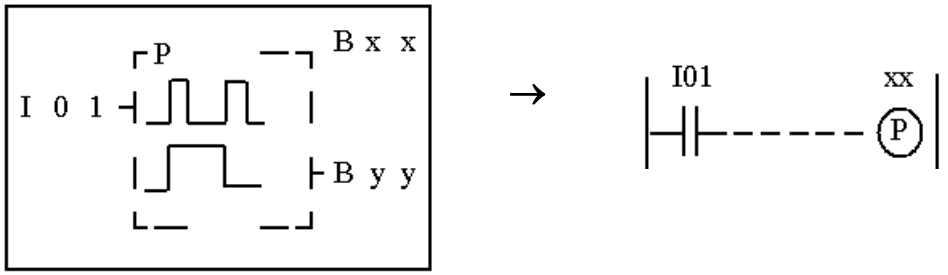
LADDER:



Note：The input terminal is NOP which is equivalent to ‘Hi’

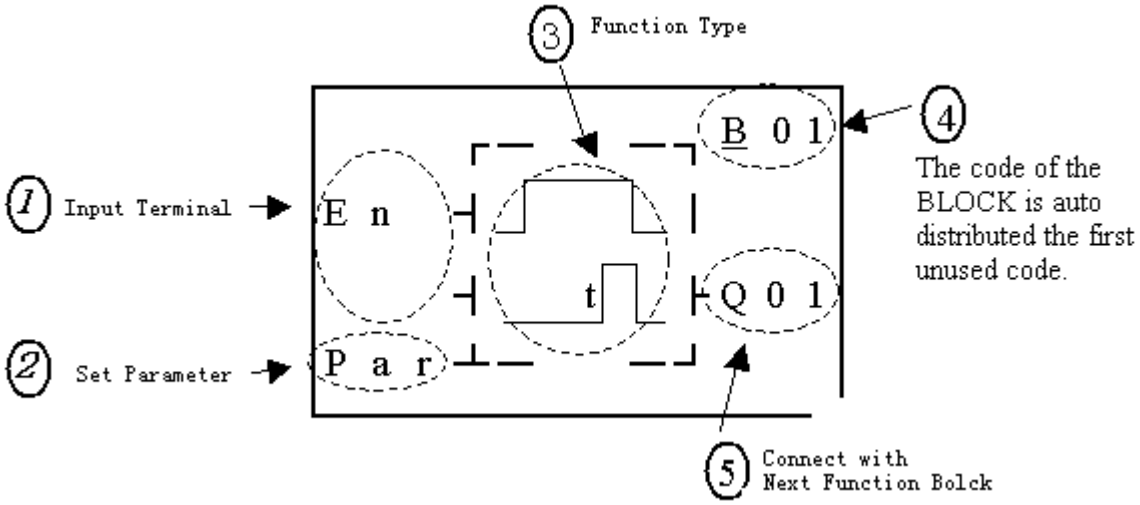
(10)Pulse Logic Diagram

FBD: LADDER:



Note：The input terminal is NOP which is equivalent to 'Lo'

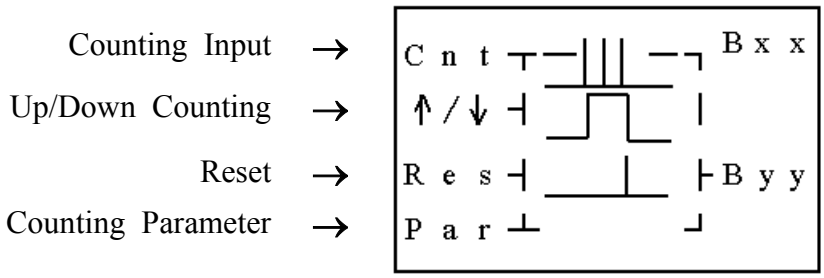
8-3 Function Block



The function blocks are classified into 4 sorts: Time, Counter, RTC Comparator 'R' and Analog Comparator 'G'. The Operation Fundamental is similar to Ladder Function Block's.

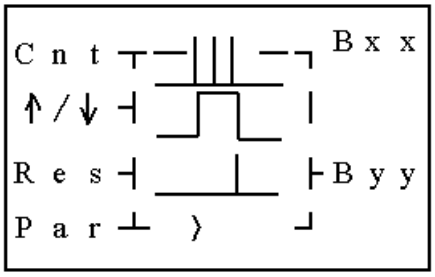
Common Counter Function Block

(1) Counter Mode 1



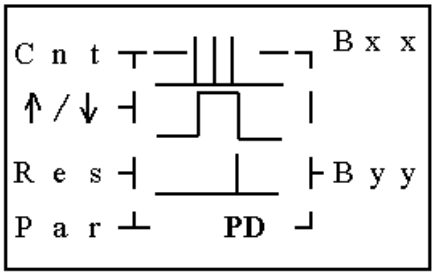
(2) Counter Mode 2

Counting Input →
Up/Down Counting →
Reset →
Counting Parameter →



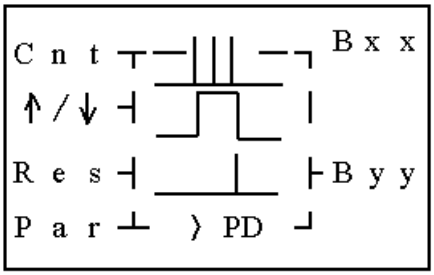
(3) Counter Mode 3

Counting Input →
Up/Down Counting →
Reset →
Counting Parameter →



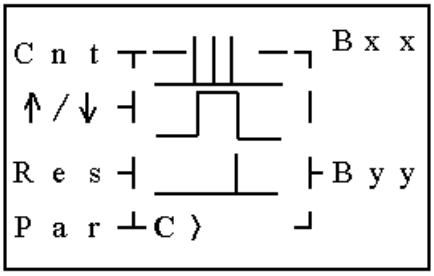
(4) Counter Mode 4

Counting Input →
Up/Down Counting →
Reset →
Counting Parameter →

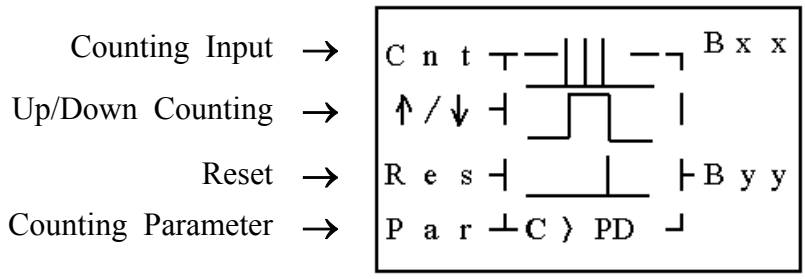


(5) Counter Mode 5

Counting Input →
Up/Down Counting →
Reset →
Counting Parameter →

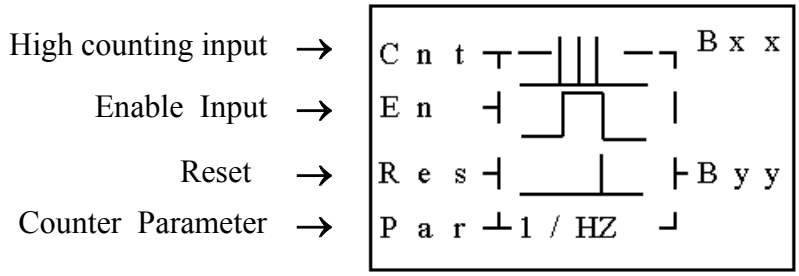


(6) Counter Mode 6



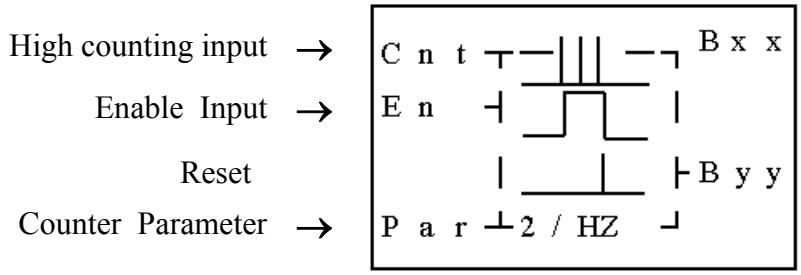
High Speed Counter Function Block

(1) Counter Mode 7



Note ：High speed input terminal I1,I2

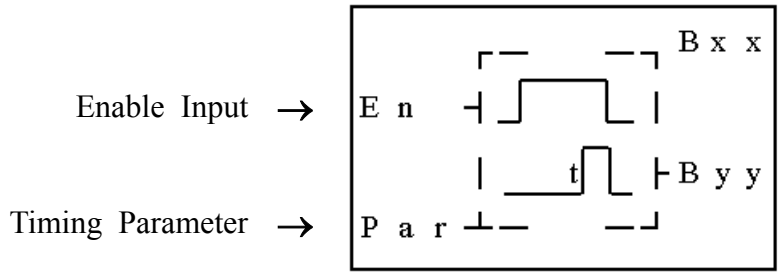
(2) Counter Mode 8



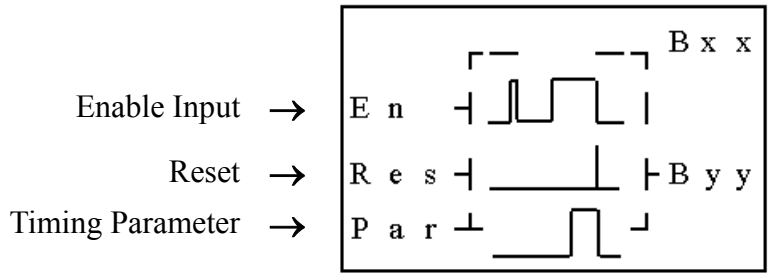
Note ：High speed input terminal I1,I2

Timer Function Block

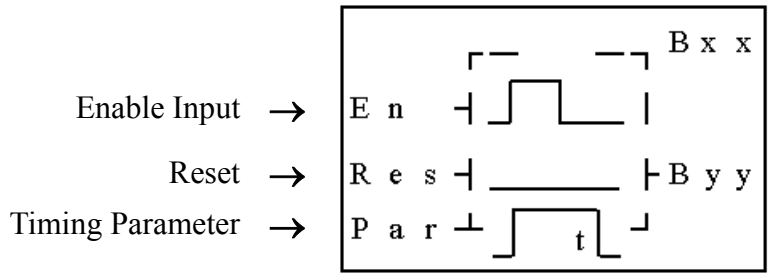
(1) Timer mode 1 (ON-Delay A Mode)



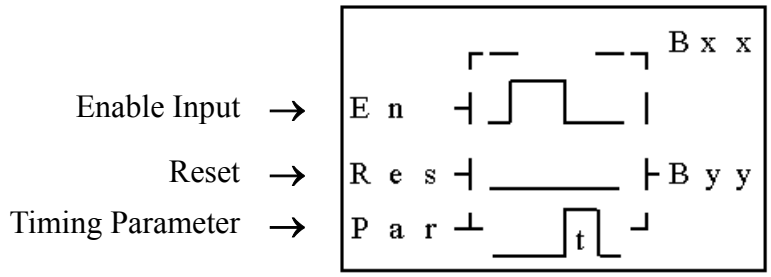
(2) Timer mode 2 (ON-Delay B Mode)



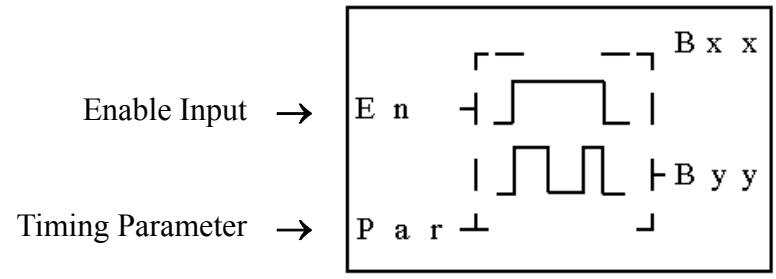
(3) Timer mode 3 (OFF-Delay A Mode)



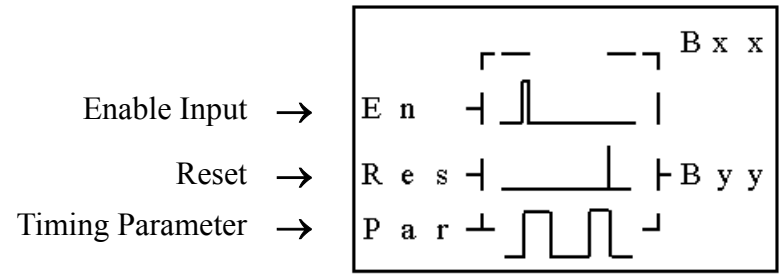
(4) Timer mode 4(OFF-Delay B Mode)



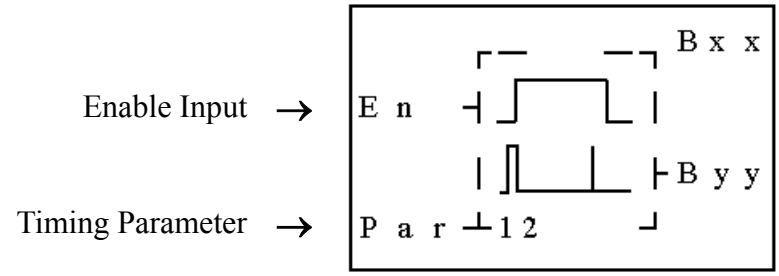
(5) Timer mode 5(FLASH A Mode)



(6) Timer mode 6(FLASH B Mode)

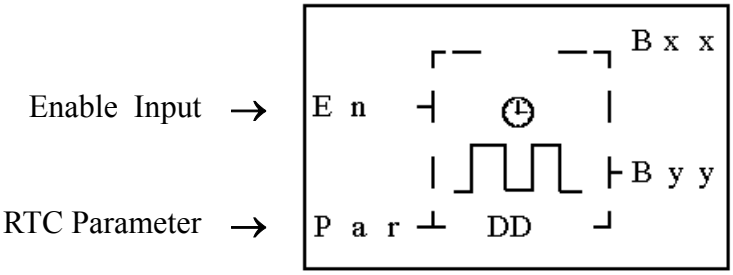


(7) Timer mode 7(FLASH C Mode)

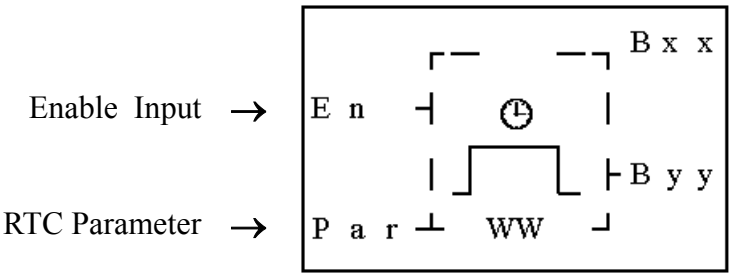


RTC Comparator Function Block

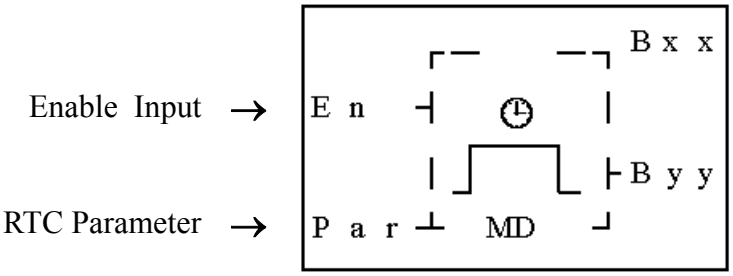
(1) RTC Mode 1(Daily)



(2) RTC Mode (Continuous)

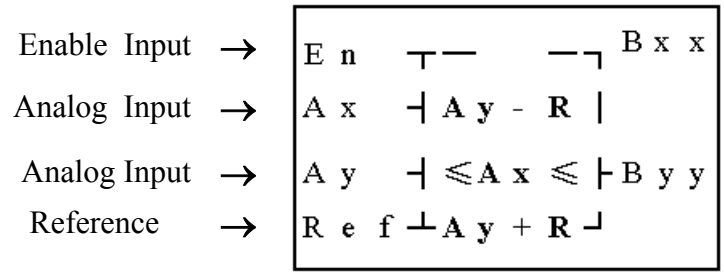


(3) RTC Mode 3 (Year Month Day)

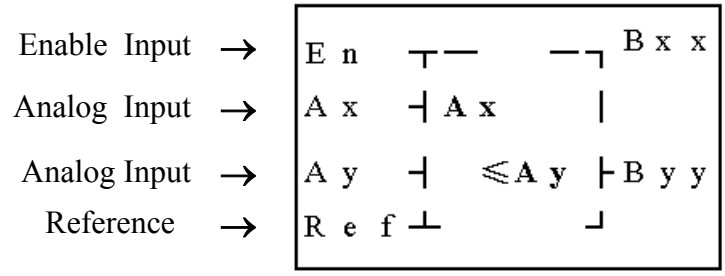


Analog comparator Function Bloc

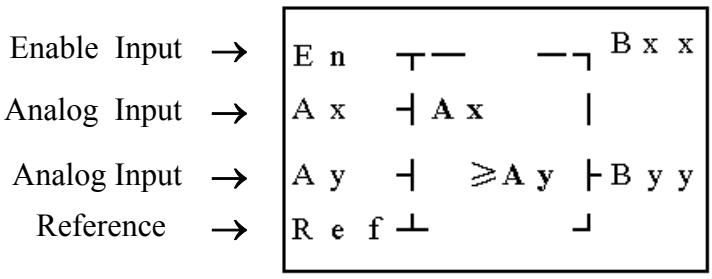
(1) Analog Comparison Mode 1



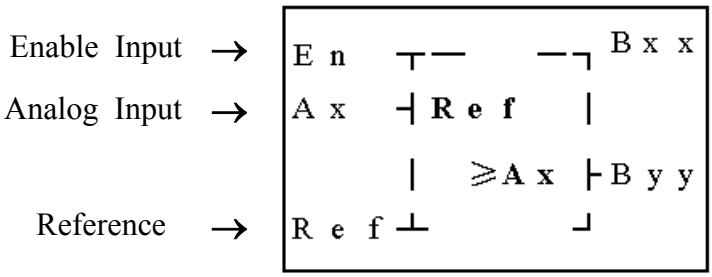
(2) Analog Comparison Mode 2



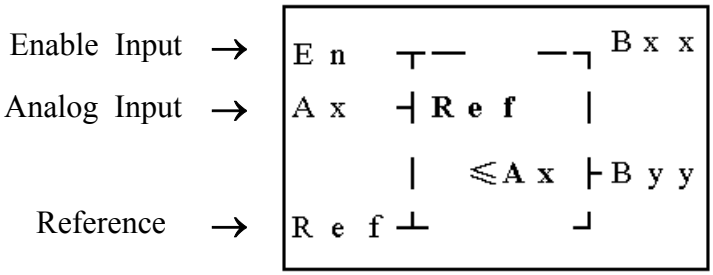
(3) Analog Comparison Mode 3



(4) Analog Comparison Mode 4



(5) Analog Comparison Mode 5



8-4 FBD Block Resource

Under FBD edition mode, the logic block and function block shared the system memory. The total memory and shared memory is showed below.

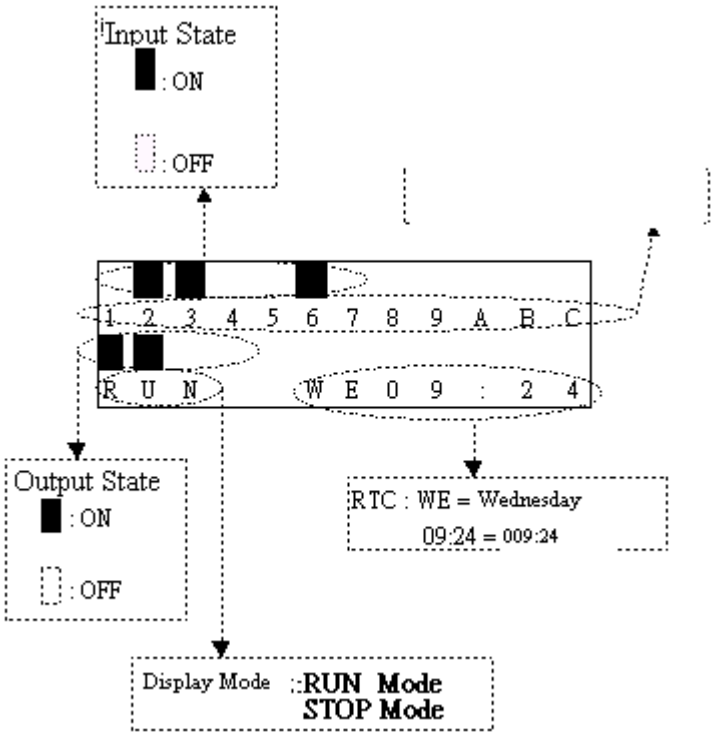
	Function Block	Timer	Counter	RTC Comparator	Analog Comparator
Total Memory	99	15	15	15	15
Logic Block	1				
Timer Mode 1~6	1	1			
Timer Mode 7	1	2			
Counter Mode 1~8	1		1		
RTC Comparator Mode 1~3	1			1	
Analog Comparator Mode 1~5	1				1

Sample for calculate the memory in using:

When the FBD program contains 2 AND, 1 OR (Logic Block), 2 Timers Mode 1, 1 Counter Mode 7, RTC comparator Mode 1(Function Block), the total Diagram Blocks used are 2+1+2+1+1=7, and the remained is 99-7=92. The timer used is 2+2=4, and the remained is 15-4=11. The counter used is 1, and the remained is 15-1=14. The RTC comparator used is 1, and the remained is 15-1=14. The analog comparator is unused, so the usable are 15.

8-5 FBD Edit Method

the origin screen when the power is on.

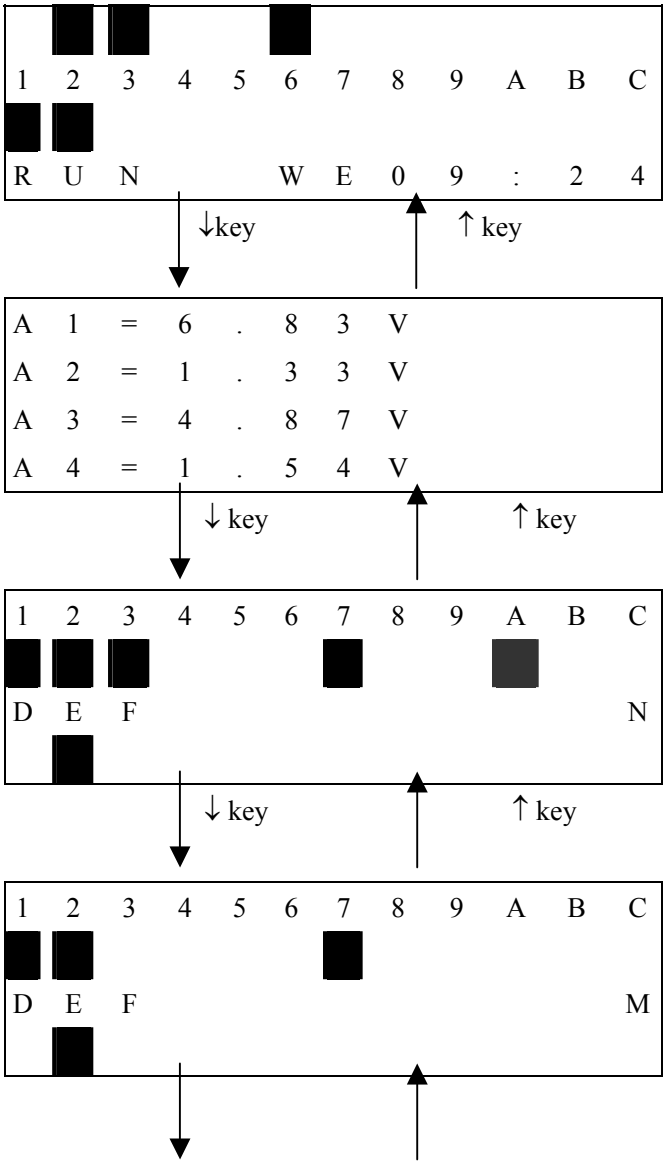


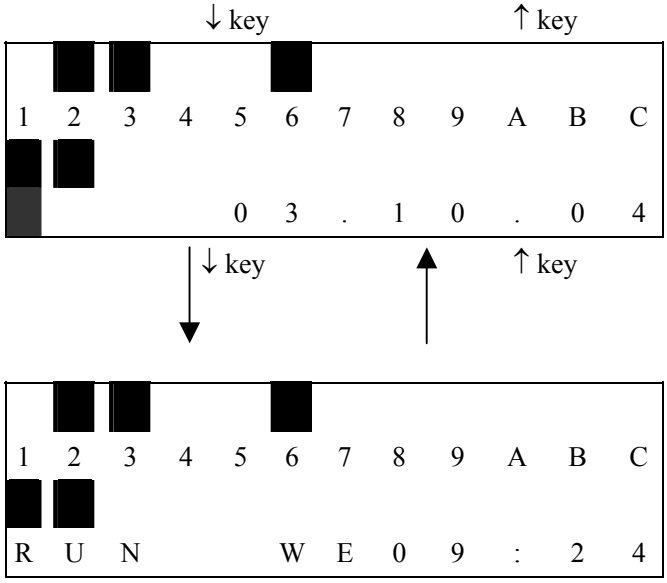
Now Press：

ESC	Back to Main Menu
↑↓	Display the state of the other relays(Expansion X&Y⇔M ⇔ N⇔A) ⇔ Original Screen
SEL	Press for 3s, H function content will be displayed, except the Mode 2 is selected in HMI.

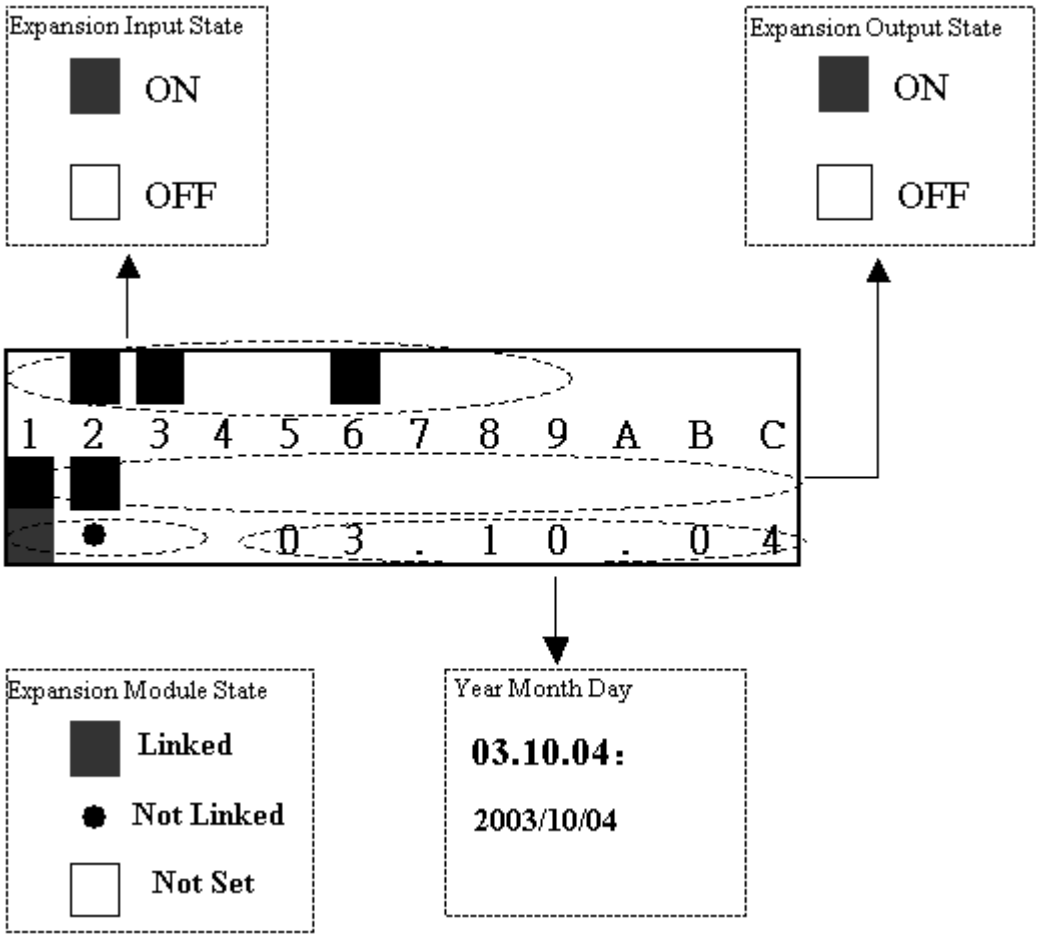
Sample：

a) operation for displaying the state of other relay.。

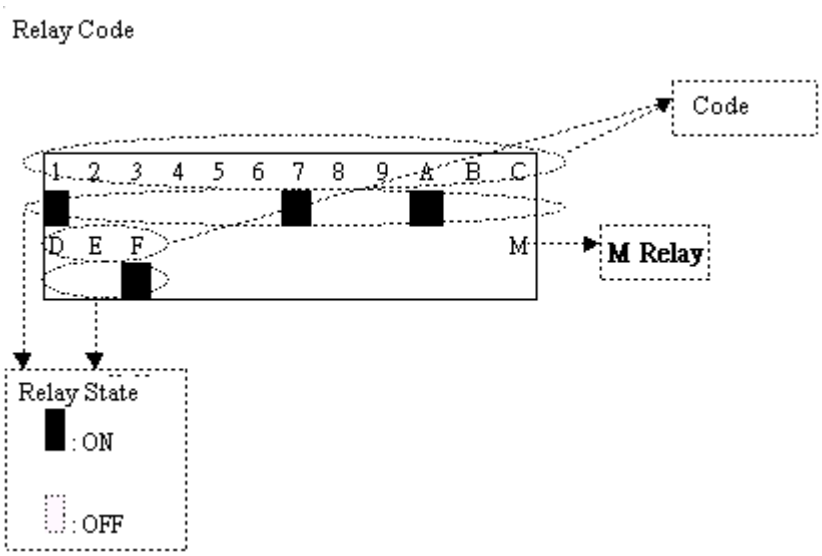




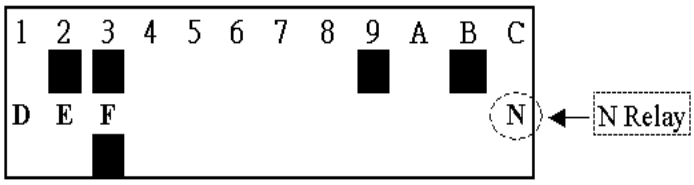
- Expansion Display State



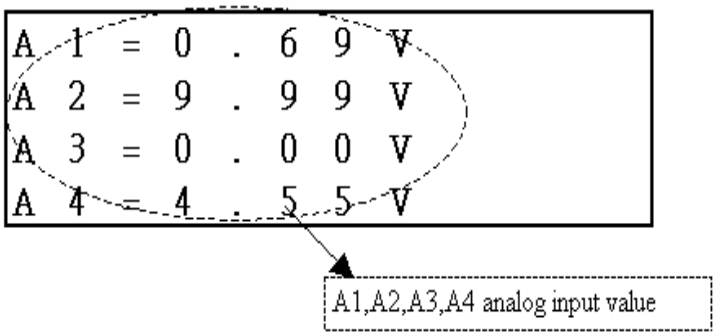
 M Display State：



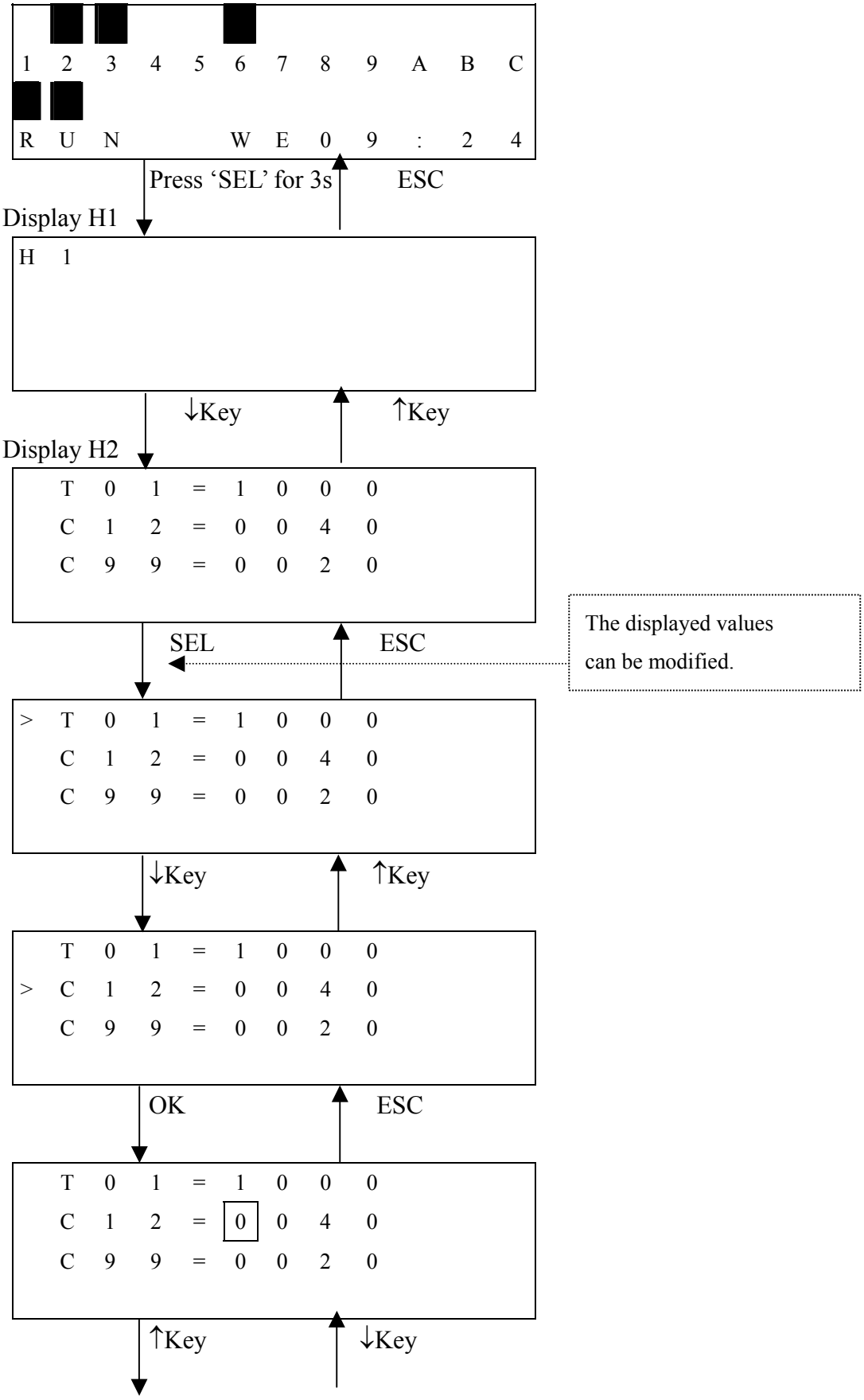
 N Display State：

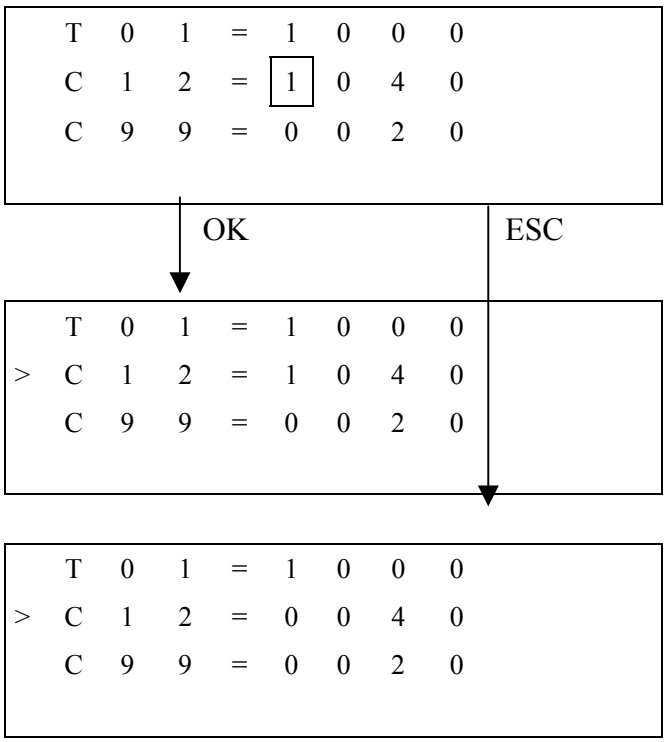


 Analog input



b) Operation for displaying H Function Block.

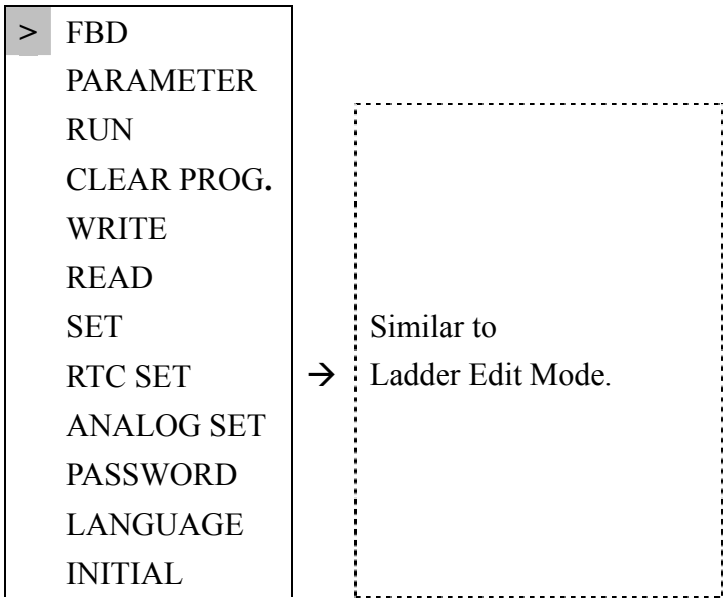




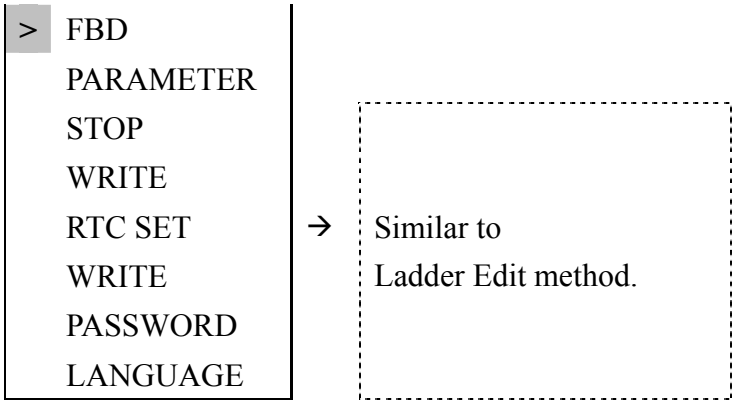
□ Main Menu Screen

LCD displays 4 lines Main Menu selection

(1) When iSmart is under STOP mode, the main selection displays:



(2) When iSmart is under RUN mode, the main selection displays:

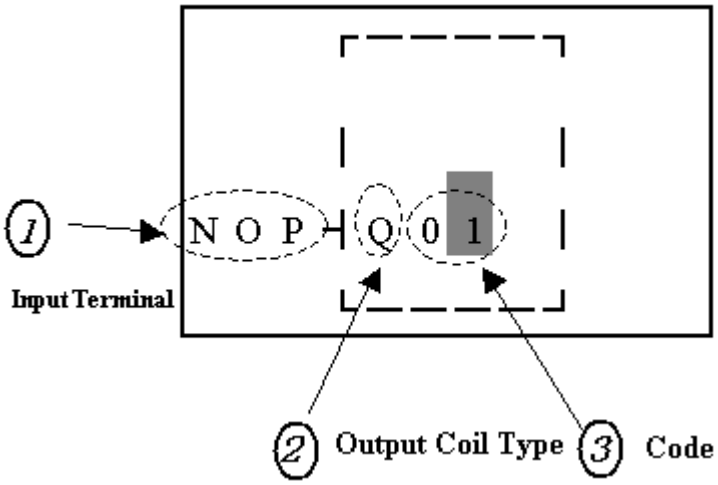


Now Press:

↑ ↓	Move the Cursor to select the Main Menu Items
OK	Confirm to enter the selected items
ESC	Back to original screen

1. FBD For Main Screen

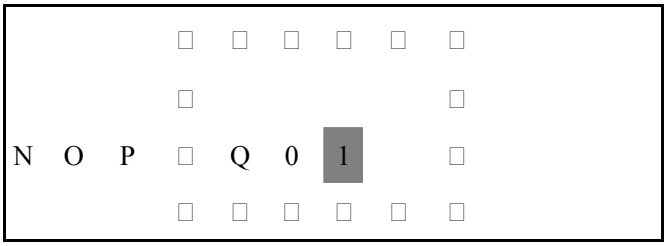
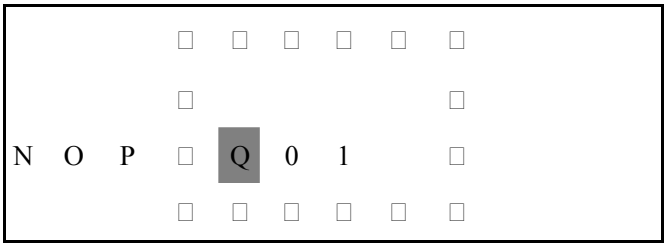
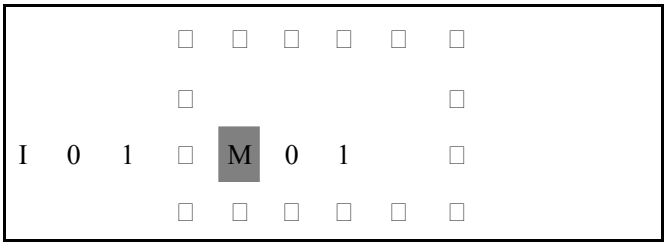
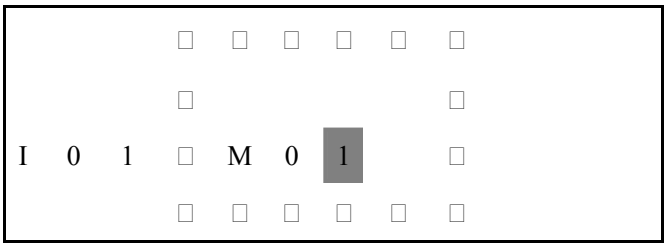
(1) Output coil display

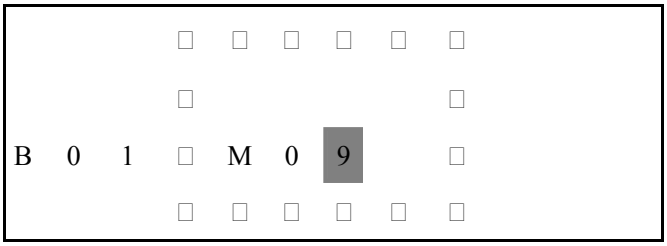


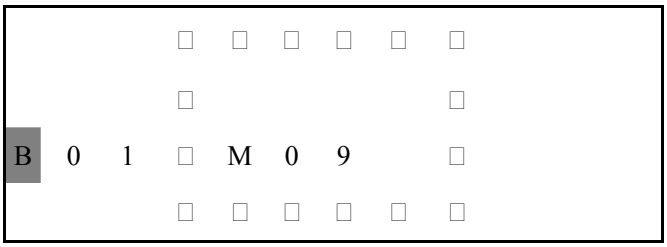
Now Press

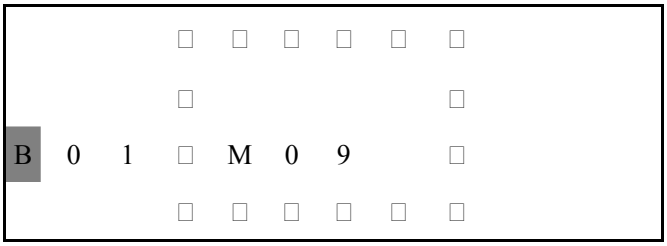
← →	1. Move the cursor①⇔②⇔③ 2. □ is Bxx, press '←' to enter Bxx screen
↑ ↓	1. Modify the code-□(Q : 01~08 , Y : 01~0C , M ,N , H : 01 ~ 0F , L : 01~08 , P : 01 ,S : 01) 2. modify output coil type-□ (Q⇔Y⇔M⇔N⇔H⇔L ⇔P⇔S ⇔Q)
OK	1. □, □ confirm the output coil (as Q,Y,M,N,), the cursor move to □. 2. When □ is H,L,P,S, enter H,L,P,S setting screen (6)(7) (8)
ESC	1. Back to Main Menu

Example:

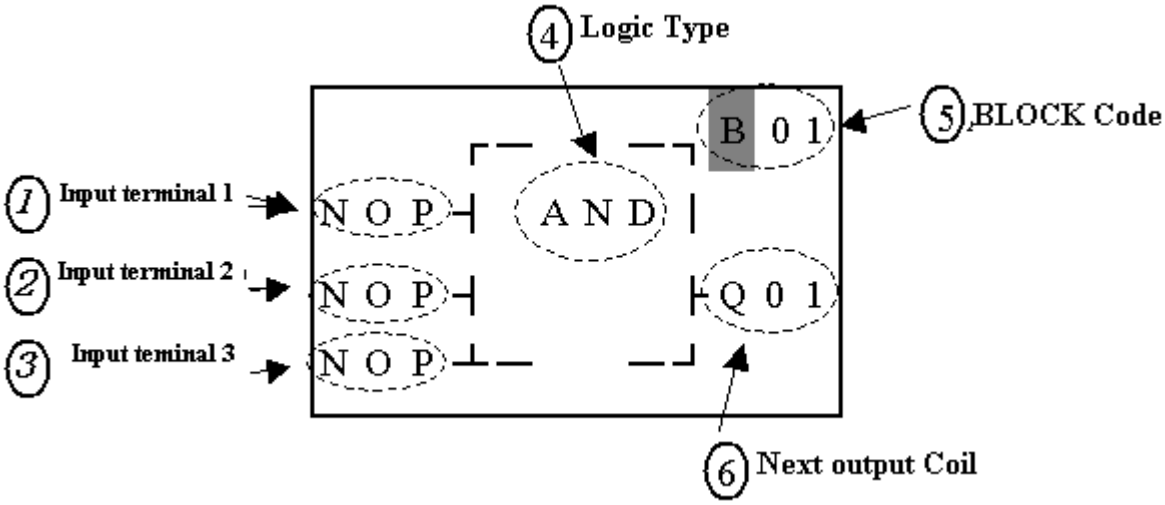
Procedure (1)-1 Original Screen	
Procedure (1)-2 Press '←'	
Procedure (1)-3 Press '↑' twice Press '↑ ↓' to modify Q to M	
Procedure (1)-4 Press '→'	

Procedure (1)-5 Press '↓' for 6 times Press '↑ ↓' to modify 1 to 9	

Procedure (1)-6 Press 'OK' Confirm coil M09, The cursor auto move to input terminal	

Procedure (1)-7 Press '←' Enter B01 Screen	

(2) Nr Input terminal Screen



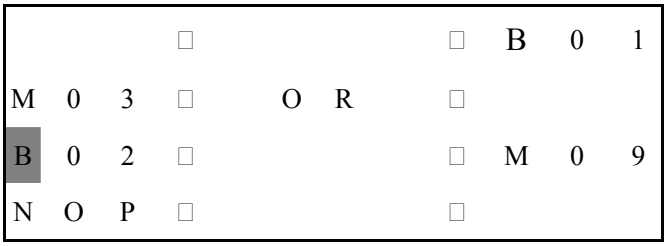
Now Press

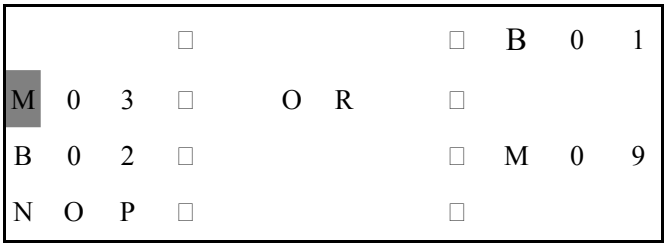
← → ↑ ↓	1. Move the cursor □⇔□⇔□⇔□⇔next output screen 2. If □□□ is Bxx, Press '←' to enter Bxx Screen.
ESC	1.Back to Main Menu

Example:

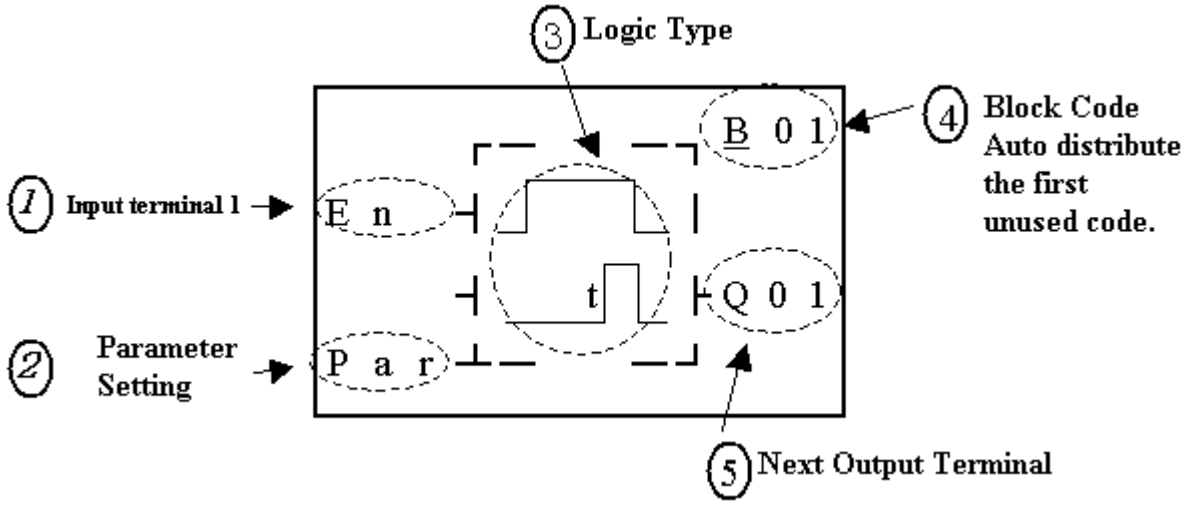
Following step (1)-7：

Procedure (2)-1 Press '←' or '↓'	□ □ B 0 1 M 0 3 □ O R □ B 0 2 □ □ M 0 9 N O P □ □

Procedure (2)-2 Press '↓' once	

Procedure (2)-3 Press '←' Enter B02 screen	

(3) Edit Screen for Bn input terminal

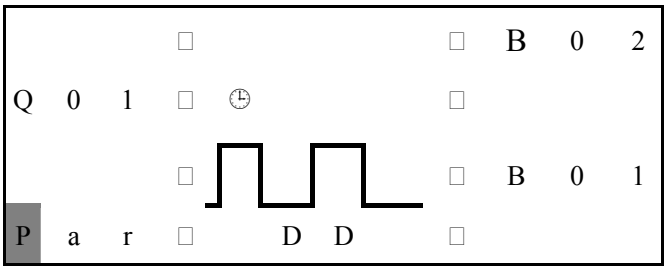


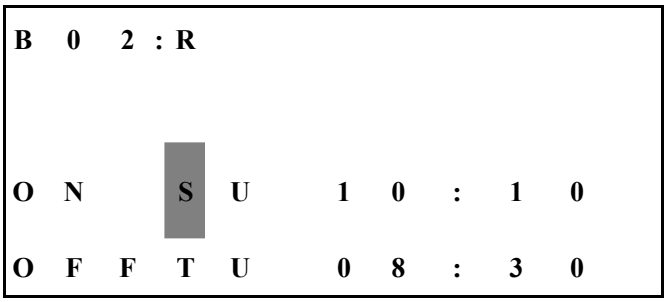
Now press

←→↑↓	Move the cursor □⇔□⇔□⇔ Output coil / Function block screen
OK	1. □ enter the parameter setting screen of the function block
ESC	1.Back to Main Menu

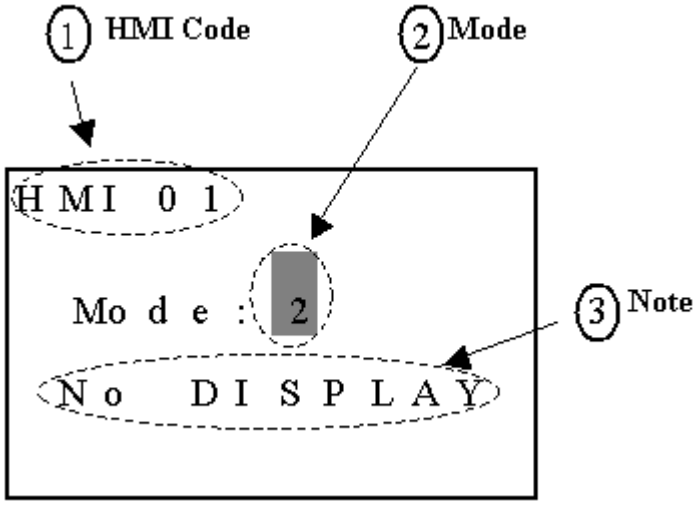
Example:

Following the procedure (2)-3,

Procedure (3)-1 Press '↓' twice	

Procedure (3)-2 Press 'OK' Enter Parameter setting screen Refer to 2 Parameter of Main Menu	

(4)HMI Setting Screen

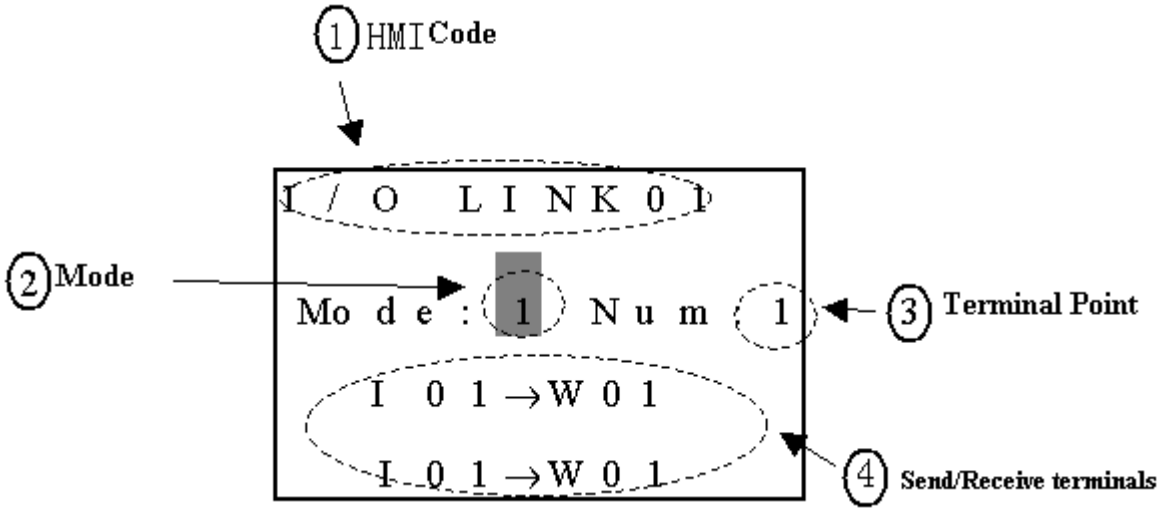


Now press

SEL	Edit the mode
SEL +↑ ↓	Modify the mode (1~2)
OK	Save the modified mode after press ‘SEL’.
ESC	1. Cancel the modified content after press ‘SEL’. 2. Back to edit screen for coil(1)

Note：HMI text content setting should use SMT-CONFIGURATOR only.

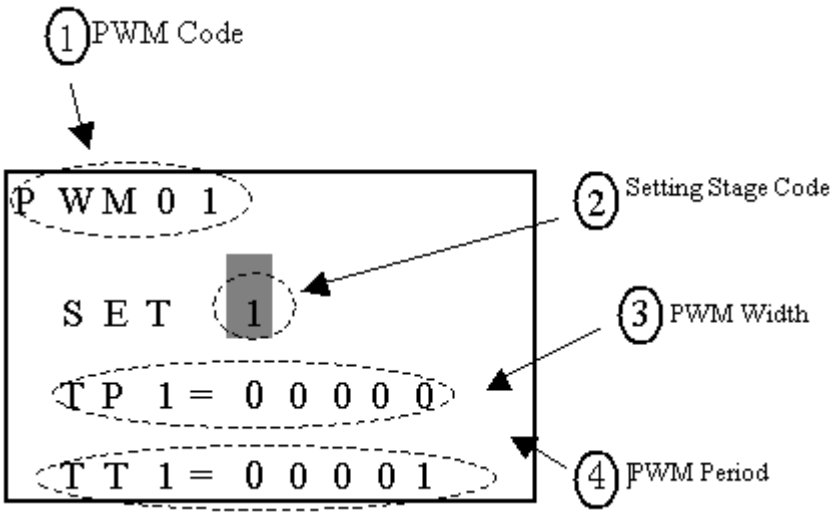
(5)DATALINK setting screen



Now press

← → ↑ ↓	Move the cursor □⇔□⇔□
SEL	Begin to edit
SEL + ↑ ↓	1. □ Modify the mode (1~2) 2. □modify the terminals point (1~8) 3. □ modify the send/ receive terminals (I01~I0C,X01~X0C,Q01~Q08, Y01~Y0C,M01~M0F,N01~N0F)
OK	Save the modified content after press ‘SEL’
ESC	1.Cancel the modified content after press ‘SEL’ 2. Back to edit screen(1) for coil

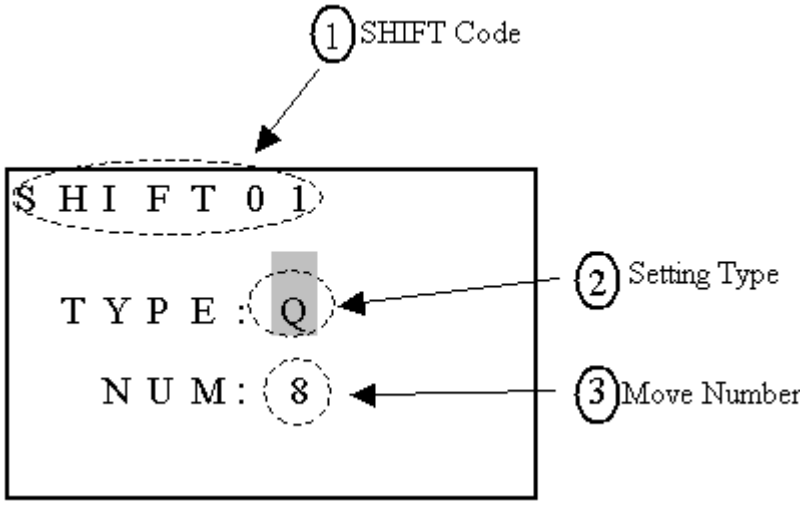
(6)PWM Setting screen



Now press

↑↓	Move the cursor □⇔□⇔□
← →	□,□ move the cursor
SEL	Begin to edit
SEL 後 ↑ ↓← →	1・□ modify the setting stage (1~8) 2・□ modify the pulse width(00000~32768) 3. □ modify the period (00001~32768)
OK	Save the modified content after press 'SEL'
ESC	1.Cancel the modified content after press 'SEL' 2. Back to edit screen(1) for coil

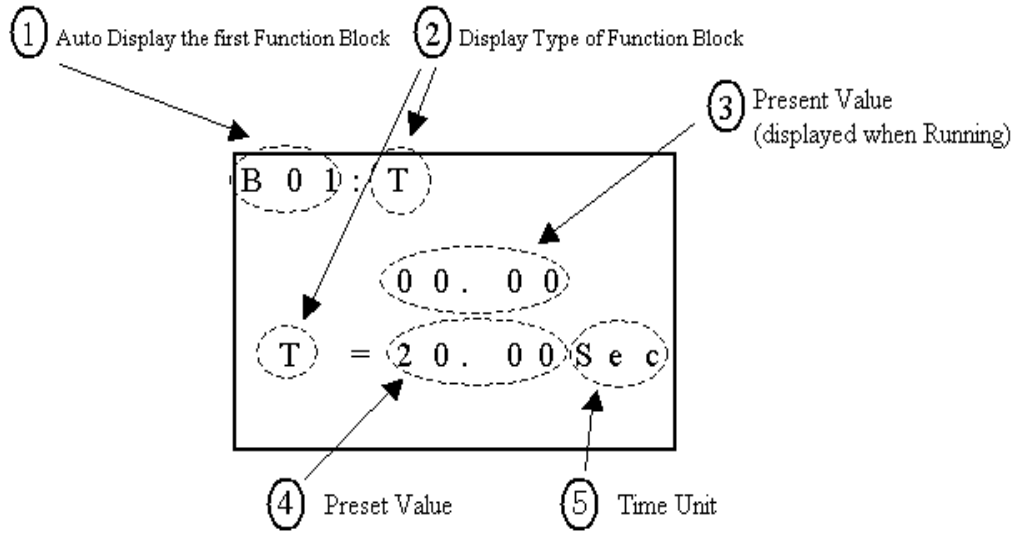
(7)SHIFT setting screen



Now press

↑↓	Move the cursor □⇔□
SEL	Begin to edit
SEL , then ↑ ↓	1・□ modify the output type Q⇔Y⇔Q 2・□ modify the move coil number (1~8)
OK	Save the modified content after press 'SEL'
ESC	1.Cancel the modified content after press 'SEL' 2. Back to edit screen (1) for coil

2 PARAMETER of Main Menu

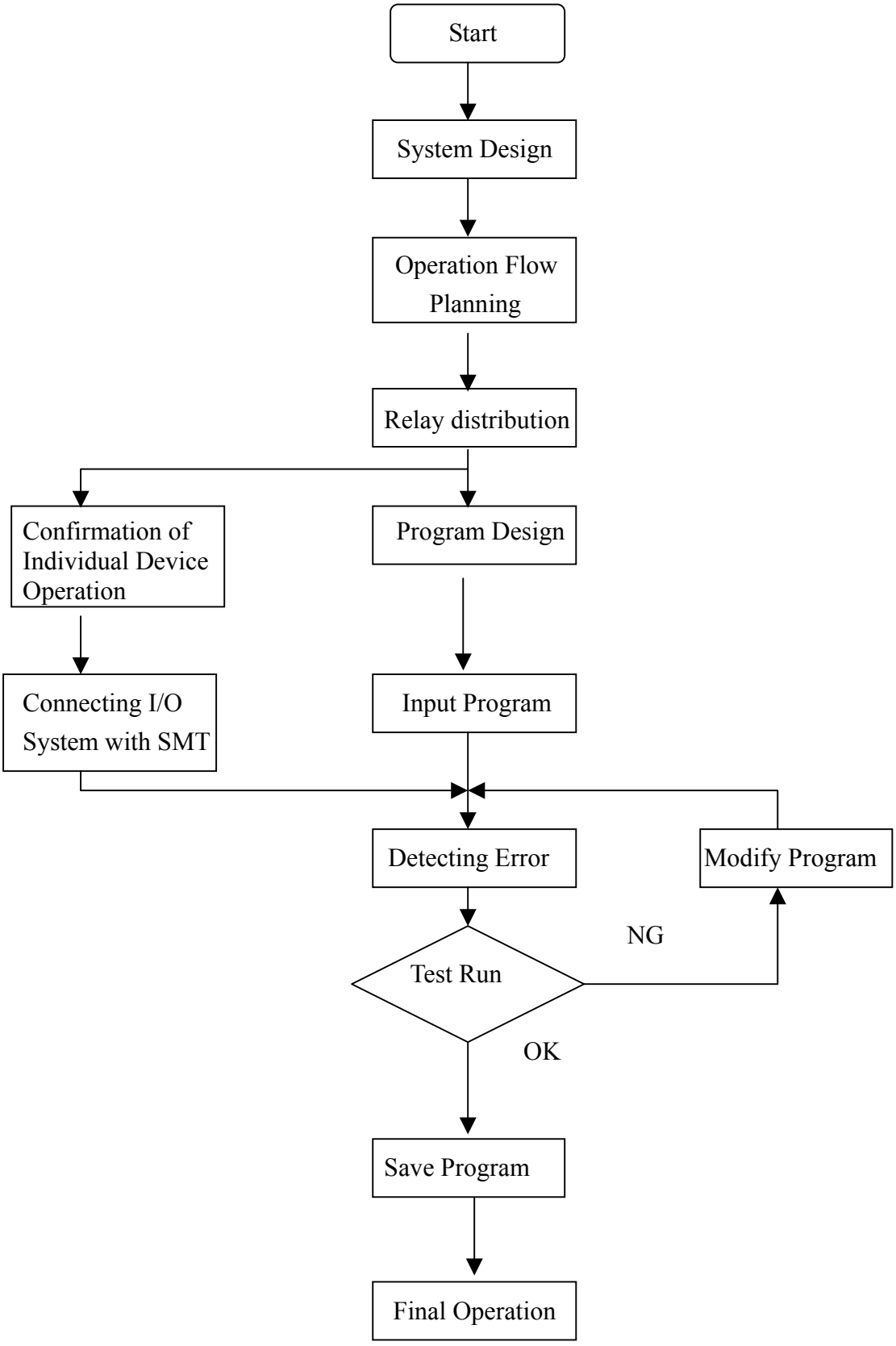


Now Press:

← →	1. □ display the previous / next Function Block Parameter 2. □, □ move the cursor
↑ ↓	1. move the cursor from □ to □ 2. move the cursor from □, □ to □
SEL then ↑ ↓	1. □modify the setting value 2. □modify the time unit(0.01s⇔0.1s⇔1s⇔1min)
OK	Save the modified data after press 'SEL'
ESC	1. Cancel the modified data after press 'SEL' 2. Back to Main Menu.

Chapter 9 System Design

9-1 Procedure for system design



9-2 Consideration for System Design

The iSmart differs fundamentally from the traditional Relay in control circuit. iSmart is periodical-loop controlled circuit (series controlled circuit), while Relay is parallel controlled circuit. Consequently, if failure were to take place, it is only single relay that would be affected whereas the whole system is affected with a device such as smart

Therefore, it is recommended the external protection devices are installed:

① Emergency-Stop Circuit

② Protection Circuit

③ Operation Circuit for High-Voltage Components

9-3 Code Distribution for Relay

(1) 10 Point:

① Input Code I =1~6

② Output Code Q=1~4

(2) 20 Point:

① Input Code: I =1~C (12)

② Output Code: Q=1~8

(3) Expansion Point:

① Input Code: X =1~C (12)

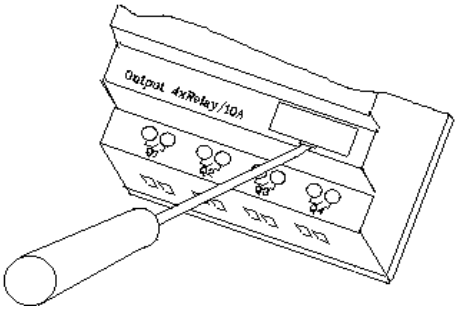
② Output Code: Y=1~C (12)

Chapter 10 Spare Program

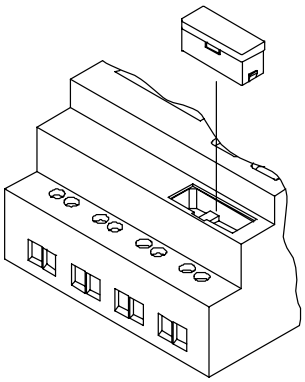
10-1 Spare Program Cartridge **(SMT-PM04)**

The installation method for PM04 (optional) is as follows**:**

Step 1：Remove the cover of SG2 with the screwdriver, as follows:



Step 2：Plug SMT-PM04 into the slot, as follows:

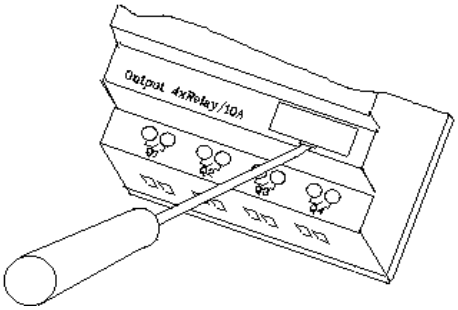


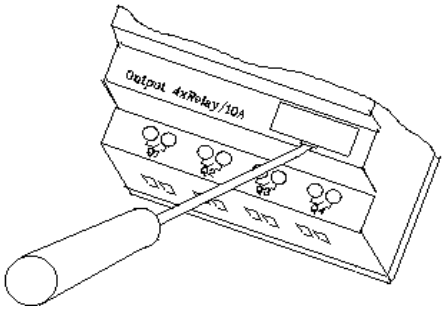
Step 3: In the operation function list, click "WRITE" to enter the confirmation interface and click YES to download the spare program.

Note： If it is desired to recover the spare program, click "READ" on the operation function list to confirm the choice then click "YES" to upload the spare program.

10-2 Computer Write Software (SMT-CONFIGURATOR)

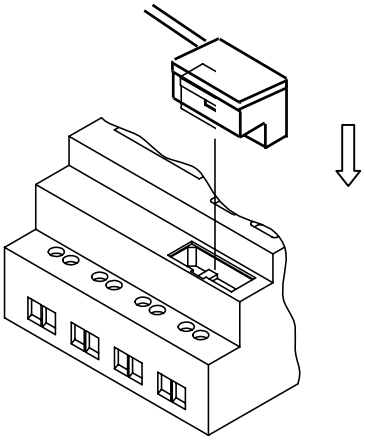
Step 1: Remove the port cover of iSmart with a screwdriver or similar device, as follows:





Step 2: Insert SMT-PC03 (Cable) to the slot, as follows:

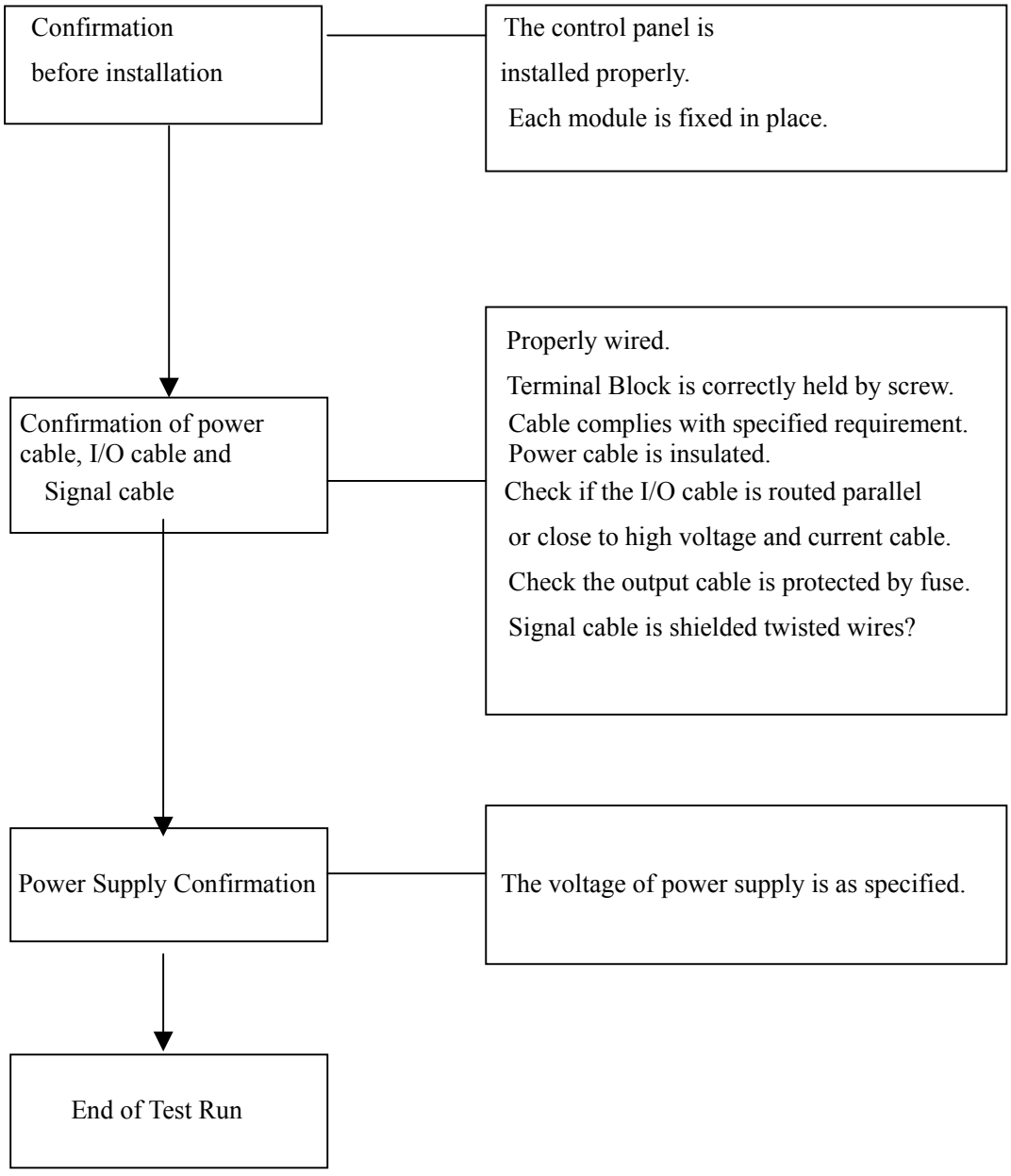
The other terminal of the cable is connected with the RS 232 communication port on computer.



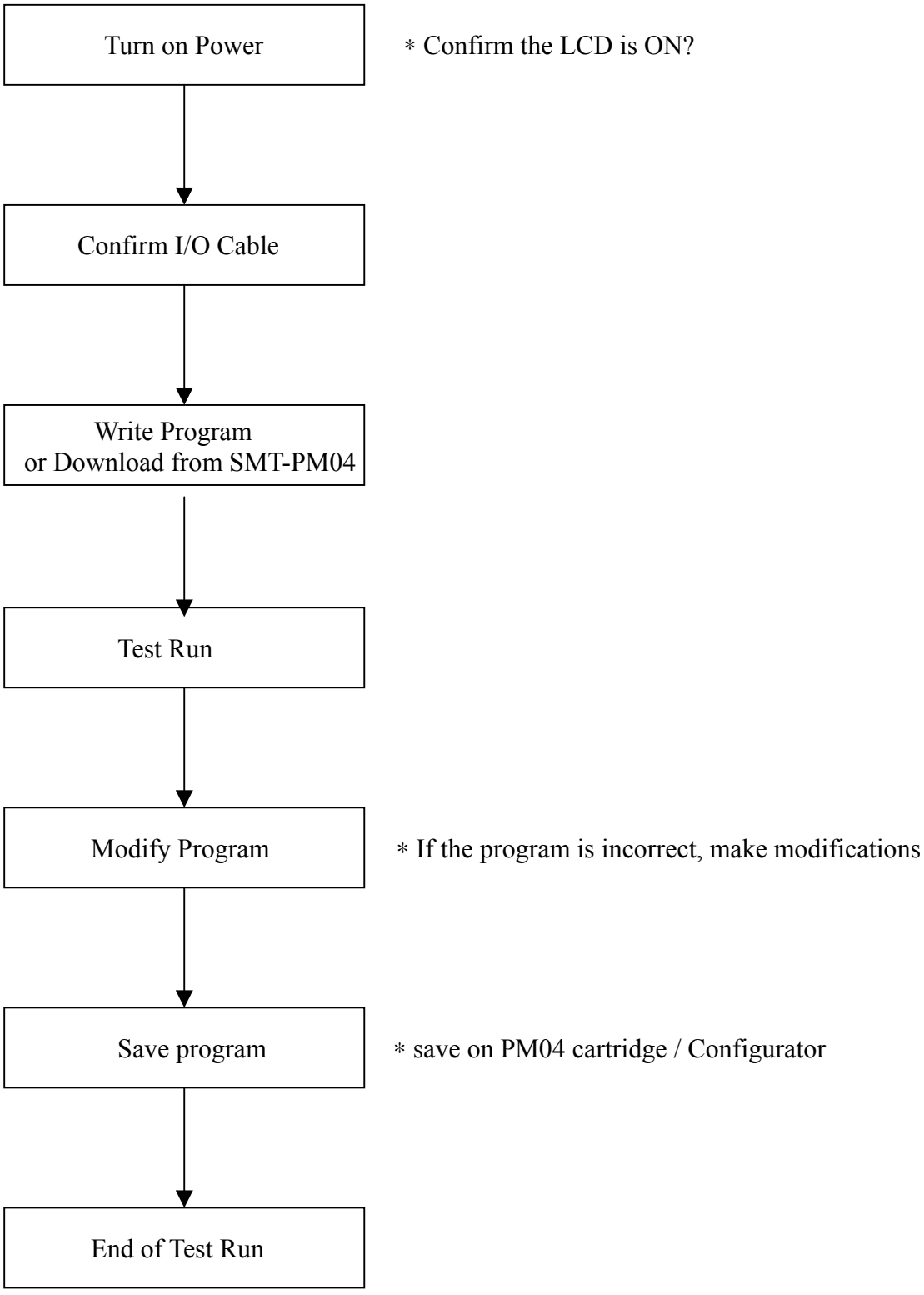
Step 3: With SMT-CONFIGURATOR software, the computer is ready to read a program from, or write a program to the iSmart.

Chapter 11 Test Run

11-1 Confirmation before Test Run



11-2 **Procedure of Test Run**



Chapter 12 Inspection and Maintenance

12-1 Periodic Inspection

General Items

Inspect Item	Inspect content	Standard	Remarks
Ambient temperature	They shall be limited to the specification, the temperature inside the control panel shall equal to the ambient temperature	0-55□	
Relative humidity		5-90% RH	No Frost
Gas		No corrosive gas exists	
Vibration		None	
Impact		None	

Master

Item	Contents	Standard	Remarks
Power voltage	Check the terminal voltage to ensure that it complies with specification	AC 100-240V	SMT AC model
DC 24V	Check the terminal voltage to ensure that it complies with specification	DC 24V±10%	SMT DC model
Input power	Check the input voltage to ensure that it complies with specification	AC 100 – 240V DC 10V – 26.4V	
Output power	Check the output voltage to ensure that it complies with specification	Below 250VAC Below 30VDC	
Installation	The iSMART is firmly fixed	No loose bolts	
	Check for loose screws on the terminal lock	No loose screws	

12-2 Trouble Shooting

◎ When there is no display, but the operation is normal, a possible LCD failure has occurred. **Consult IMO for help.**

◎ If there is no display and no action, after confirmation of Power Supply **consult the IMO for help**.

Chapter 13 Technical Specification

13-1 General Specification

Item		Specification
Method of input program		By means of Ladder / Function Block
Operation Environment	Operation temperature	0-55□
	Storage temperature	-40 - 70□
	Operation humidity	20-90% RH, no frost
	Environmental gas	No corrosive gas exists
Mail Structure	Vibration resistance	IEC60068-2-6 standard 0.075mm amplitude/1.0g acceleration
	Impact resistance	IEC60068-2-27 standard 15g peak, 11ms duration
Noise proofing	ESD	Contact ±4KV, air discharge ±8KV
	EFT	Power DC/AC: ±2KV
	CS	0.15~80MHz 10V/m
	RS	80~1000MHz 10V/m
	EMI	EN55011 class B
Installation	Enclosure Protection	IP20
	Fixing method	Direct or Din rail (35mm) installation
	Direction	No limit
Size of cable		AWG 12/ψ3.5mm^2
Dimension		72×90×59.6 mm (W×L×H)

13-2 I/O System Specification

Power Supply Module

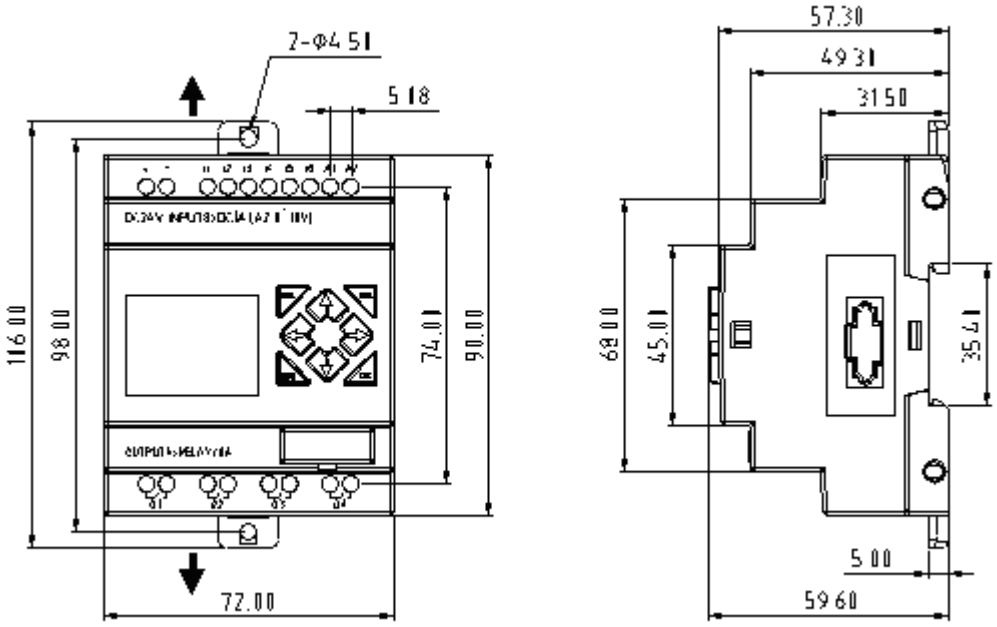
Module	Input/Output
DC +12V	AC 100~240V / DC +12V
DC +24V	AC 100~240V / DC +24V

Optional Devices

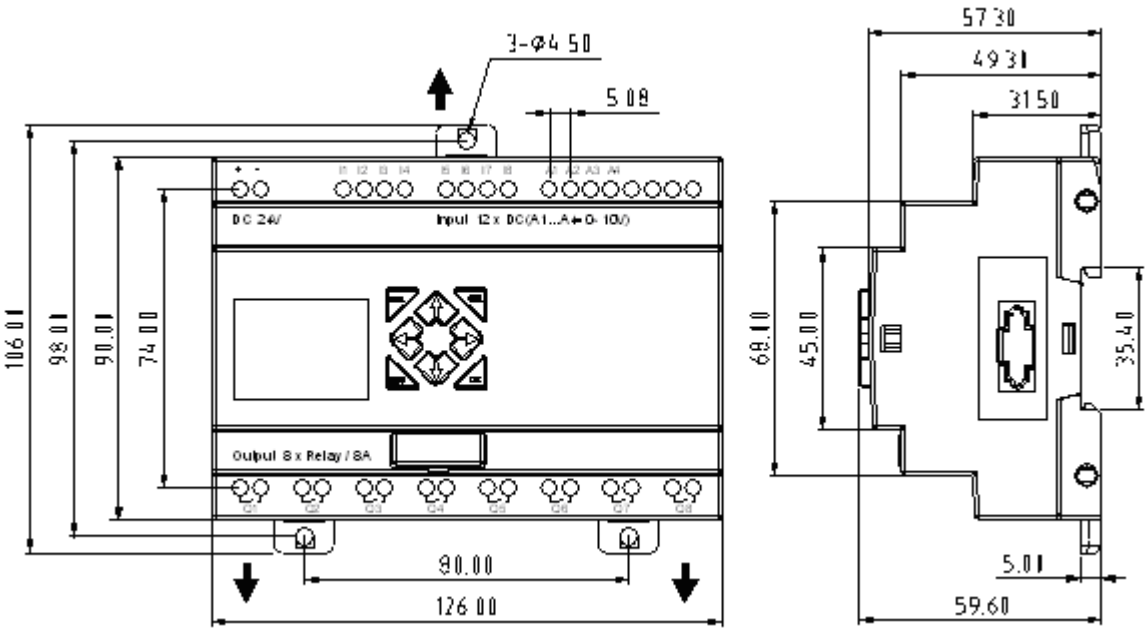
MODE	Description
PM05	Spare Program Cartridge
Client	Computer Edition Software

13-3 Dimension Diagram

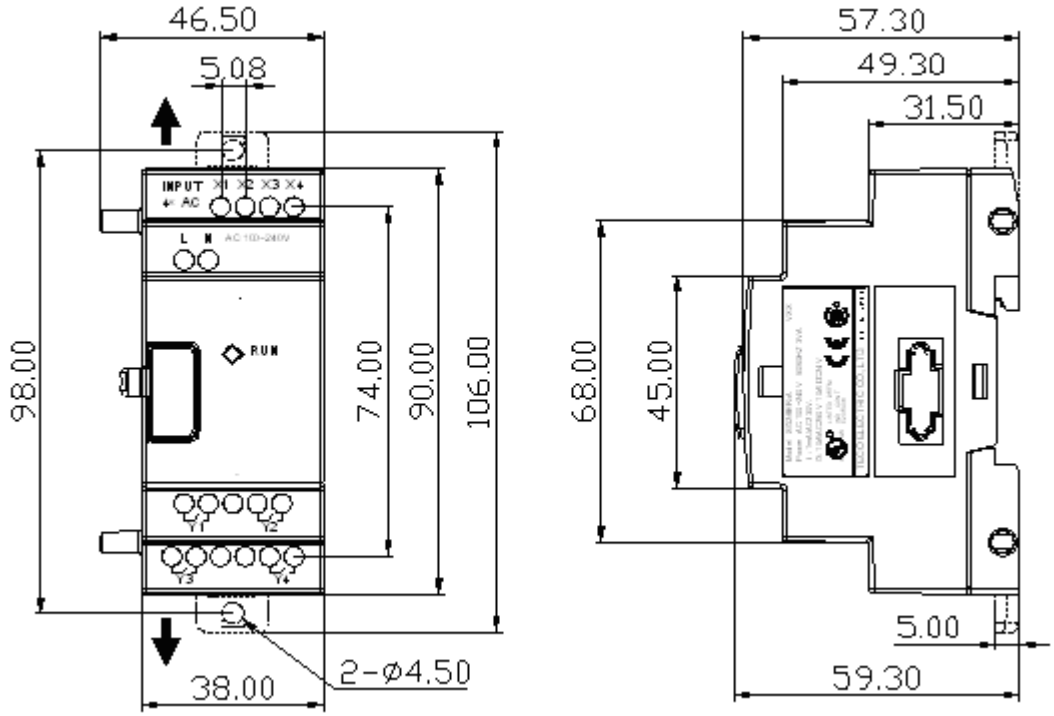
10/12 points



20 points



□ Expansion 8 points



Appendix Application Illustration

1. Lighting Control for Staircase

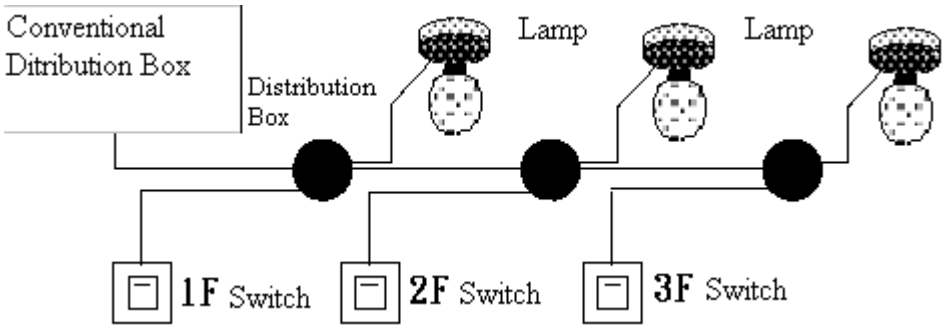
1.1 Requirement for Staircase Lighting

- When someone goes up or down-stairs, the lighting system shall be energized to provide sufficient luminance.
- After the person passes the staircase the lighting system shall be turned off in five minutes, either automatically or manually.

1.2 **Traditional Lighting Control**

There are two traditional controls available:

- Apply pulse relay
- Apply automatic timer to control the lighting system on the staircase



Components Applied

- Switches
- Auto lighting system or pulse relay for staircase

Applying the pulse relay as controller for staircase lighting system

- The lighting is on as long as any switch is turned on.
- Press any switch again to turn off the lighting system.

Shortcoming: It is a frequent action for the person to forget to turnoff the light at most cases.

Auto lighting control system for the staircase

- The light is on whenever the switch is turned on.
- Lighting system shall be turned off in a few minutes automatically or manually

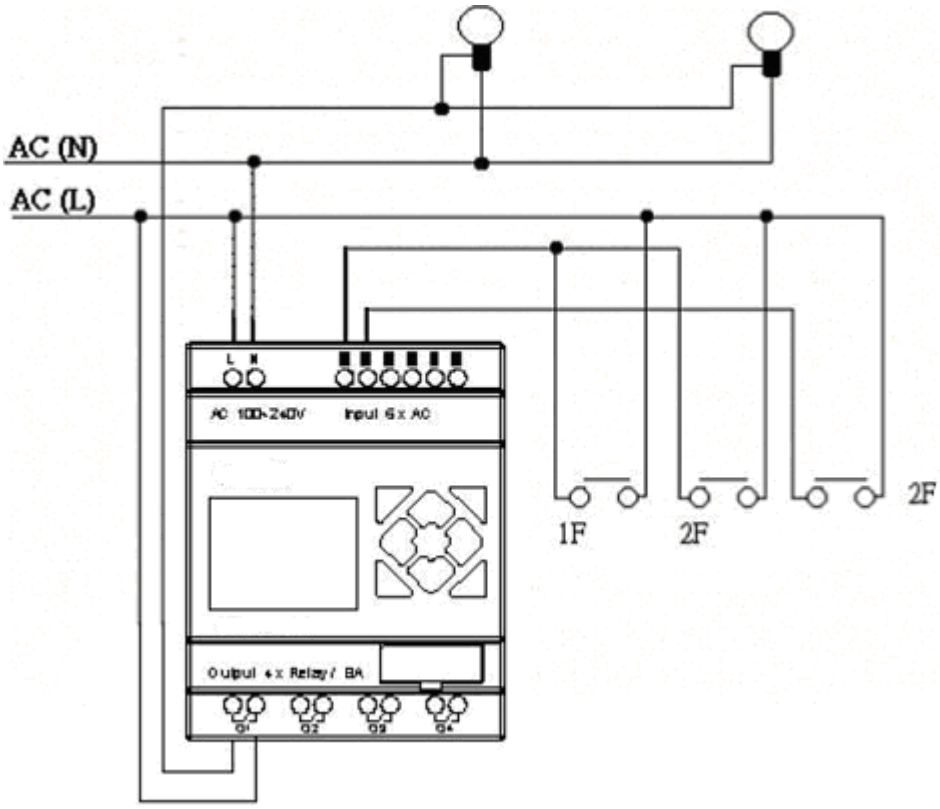
Shortcoming: The user has no way to reset the turn-off time.

1.3 Apply iSmart in Lighting System

Devices Applied

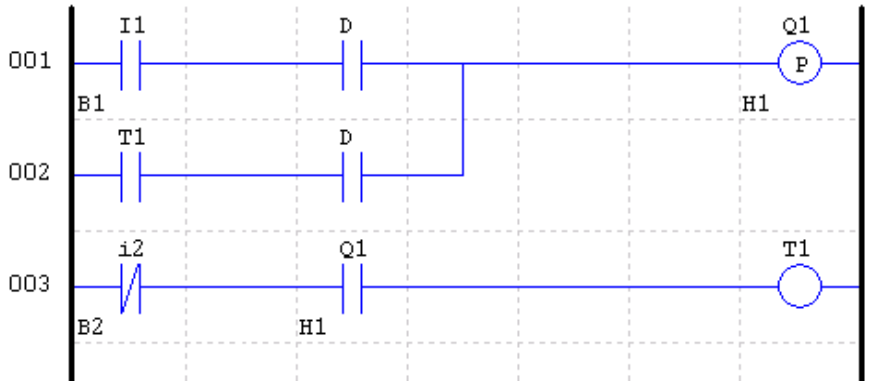
- Q1 Lamp H1
- I1 (No terminal) Switch B1
- I2 (No terminal) Infrared sensor for climbing

Wiring Diagram for Lighting System

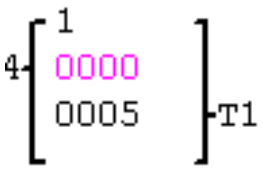


Illustrated program using iSmart in lighting system

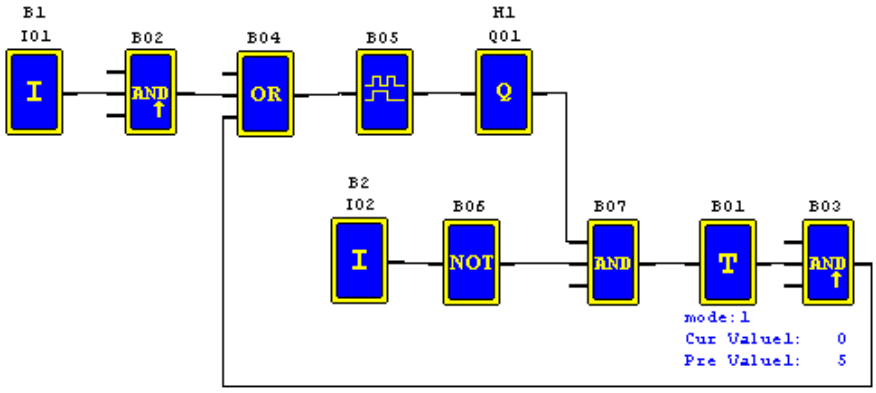
Ladder：



FUNCTION：



FBD：

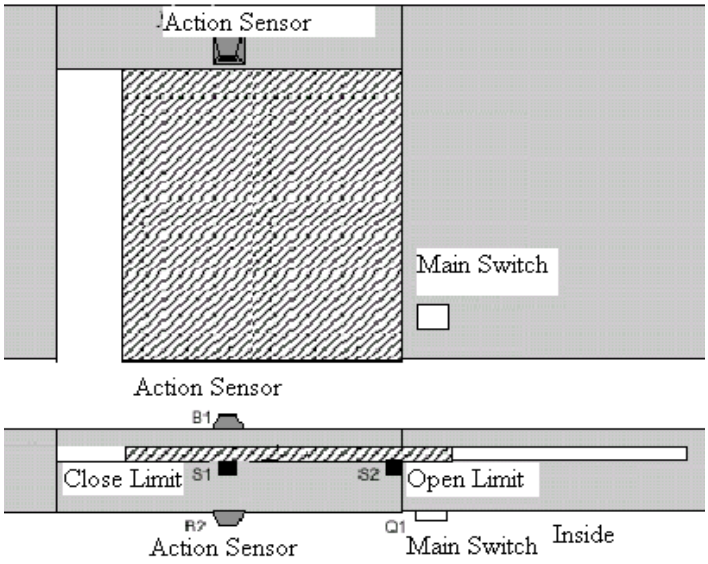


2 Auto Door Control

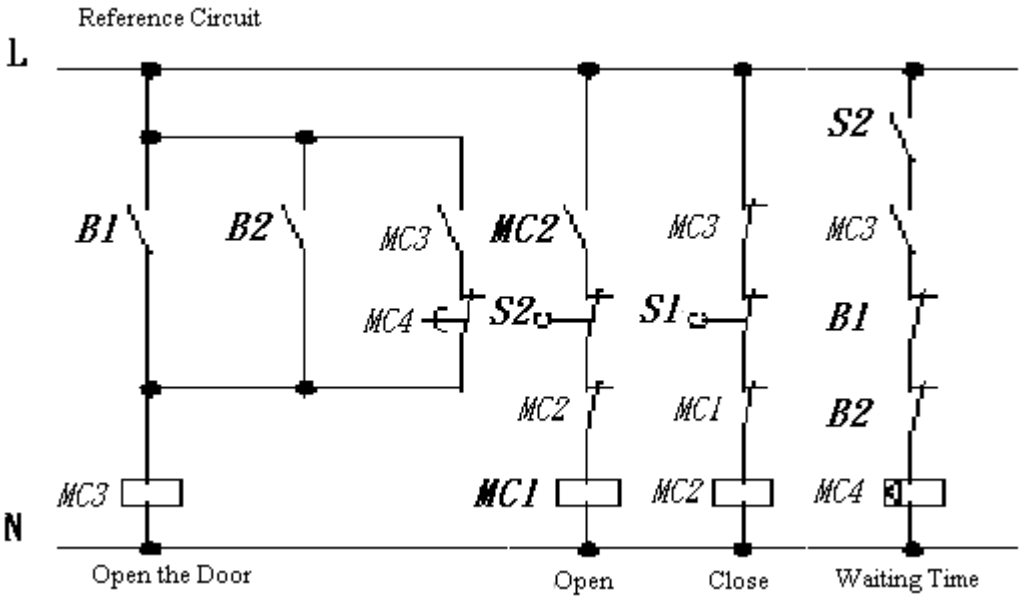
Automatic doors are very popular, installed at the entrance of supermarkets, banks and hospitals.

2.1 Requirement for Auto Door Control

- It automatically opens whenever a person is approaching.
- The door remains open for a certain period and closes if no person is present.



2.2 Traditional solution



Whenever B1 or B 2 senses the approach of a visitor, the door is actuated to open. After an elapsed time, B1 or B2 senses no presence of a visitor; MC 4 will close the door.

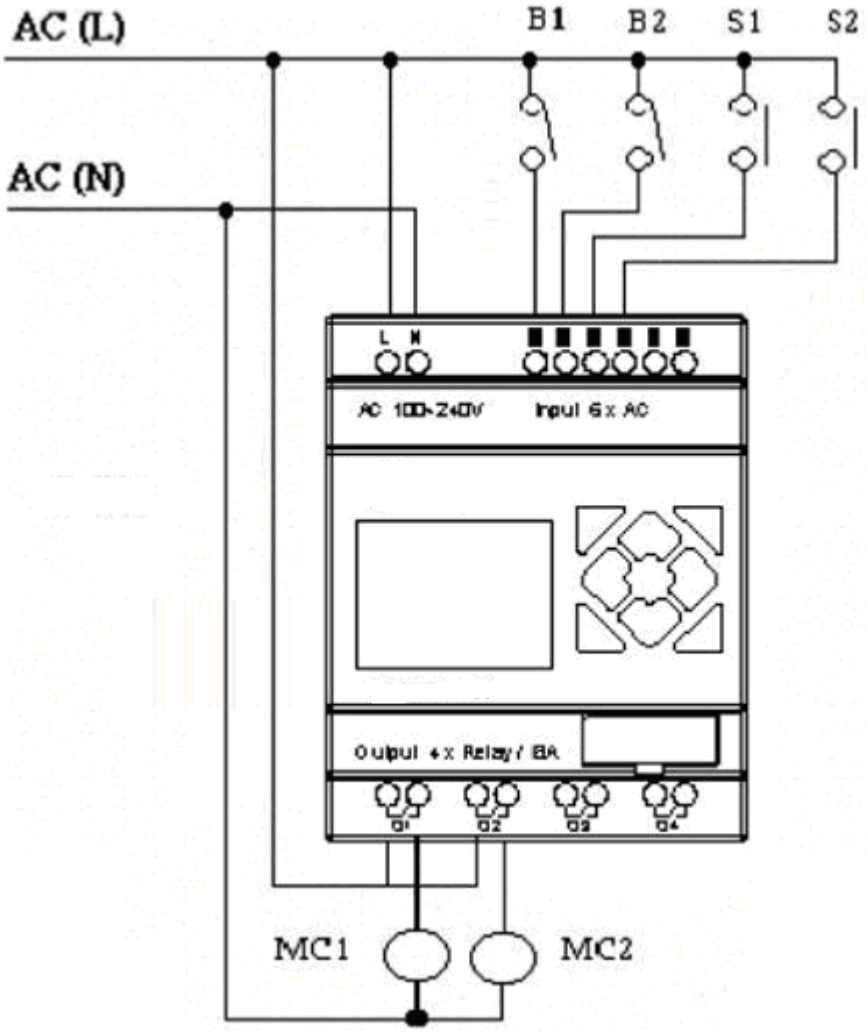
2.3 Apply iSmart in Door Control System

Applying iSmart in a door control system can simplify the circuit. All that one needs to do is connect the action sensor, limit switch and contactor with iSmart.

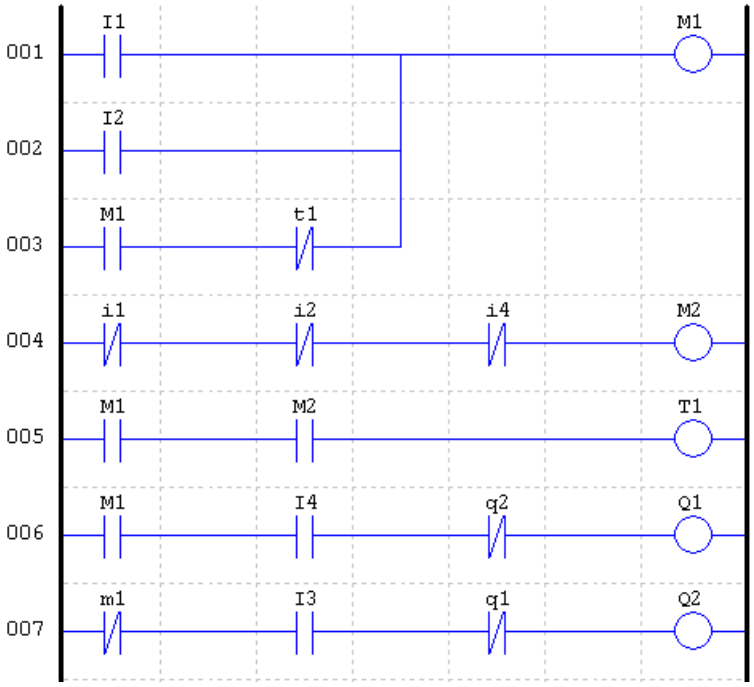
Devices Applied

- MC1 main door open contactor
- MC2 main door close contactor
- S1(NC contact) closing limit switch
- S2(NC contact) opening limit switch
- B1(NO contact) outdoor infrared sensor
- B2(NO contact) indoor infrared sensor

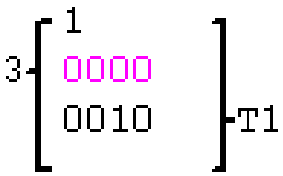
Wiring Diagram and Program with iSmart applied in door control system.



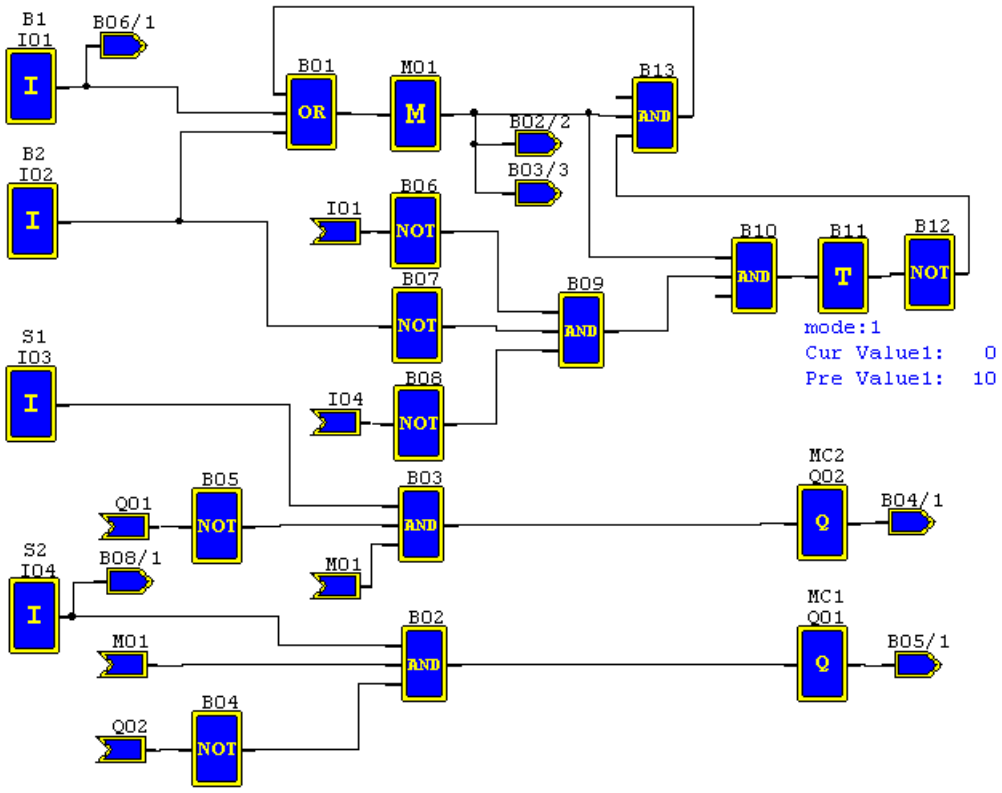
Ladder：



FUNCTION：



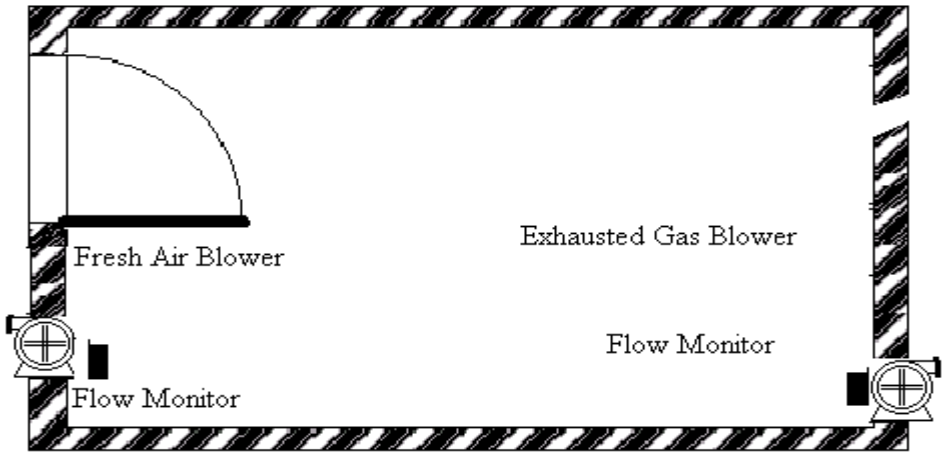
FBD Operation Flow：



3. **Ventilation Control**

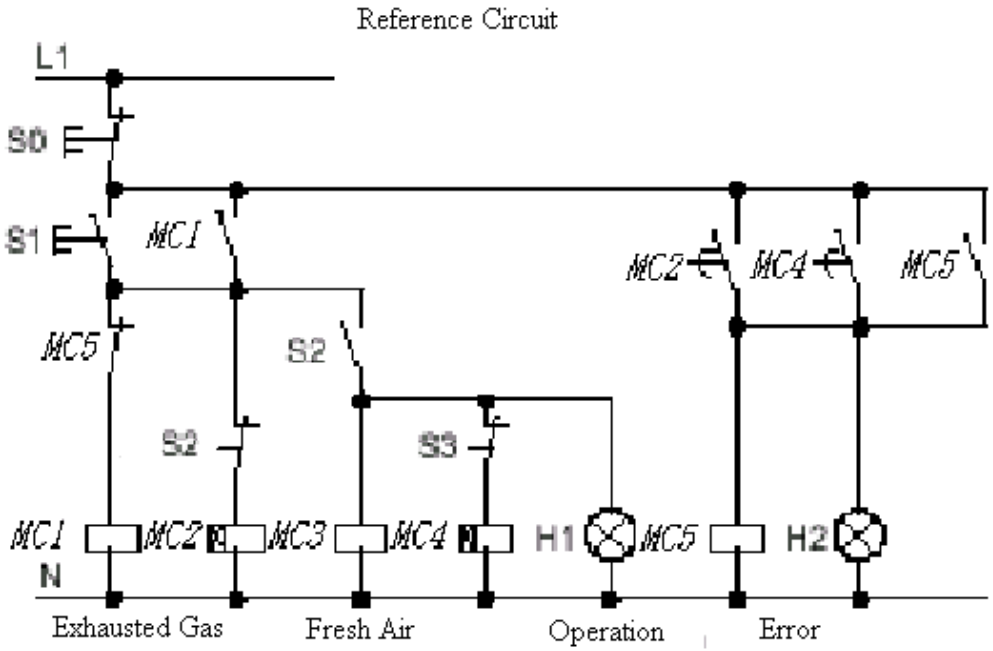
3.1 Ventilation System Requirement

The main function of the ventilation system is to blow in the fresh air and extract the waste air as shown in the below drawing



- The room is provided with exhausted gas blower and fresh air blower
- The flow sensor controls the air, input and extract operation.
- Over pressure is not permitted.
- The fresh air blower will run only if the flow monitor senses that the exhausted gas blower is working properly.
- If any irregularity takes place in fresh air blower or extract blower, the warning lamp will light.

The control circuit for the traditional ventilation system is shown below:

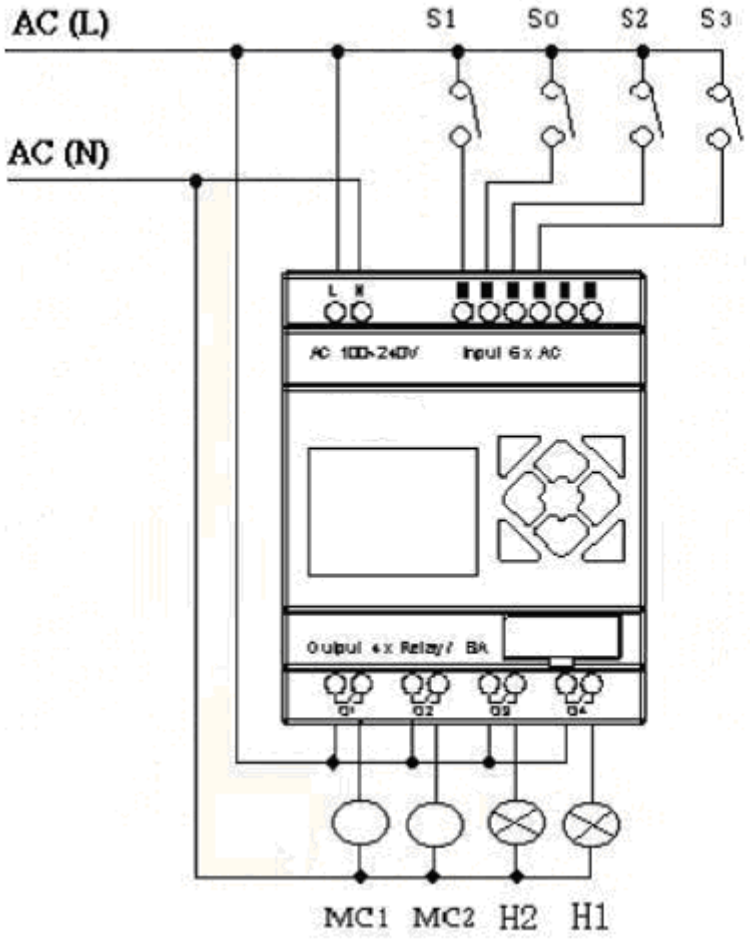


The airflow monitor controls the ventilation system. If there is no airflow in the room after a designated duration of time, the system will activate the warning system so the user can shut off the system.

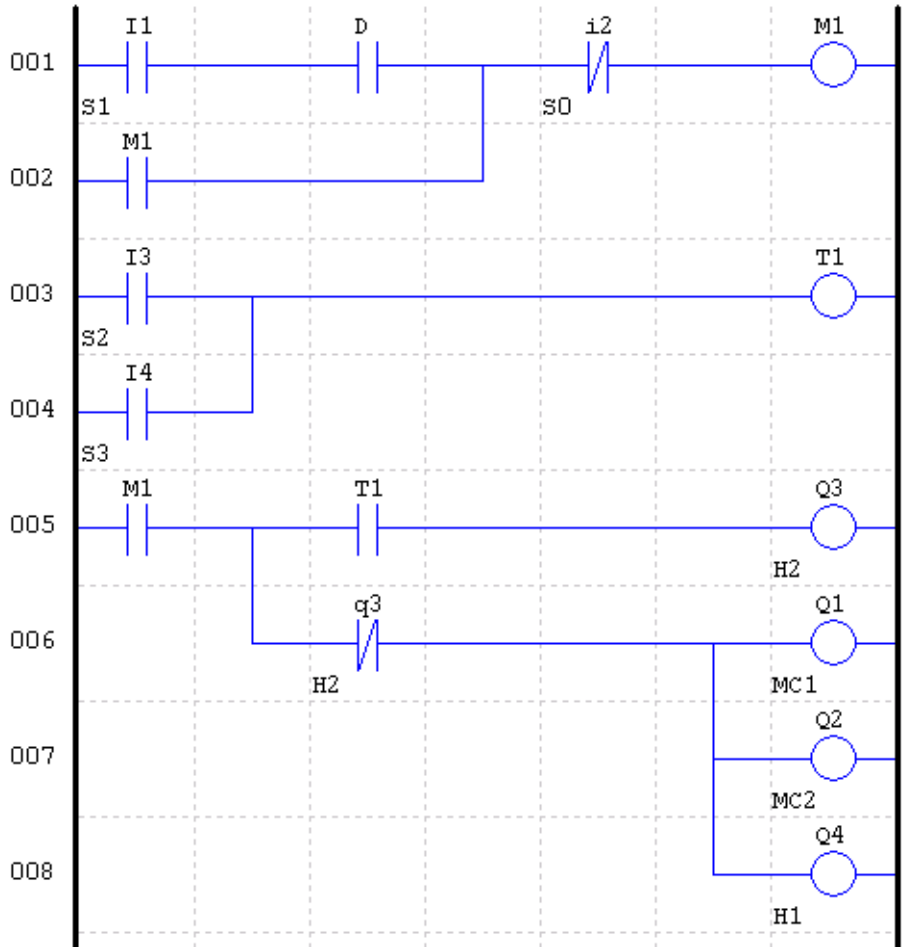
Devices Applied

- MC1 main contactor
- MC2 main contactor
- S0(NC contact) stop switch
- S1(NO contact) start switch
- S2(NO contact) air flow monitor
- S3(NO contact) air flow monitor
- H1operation indicator
- H2 alarm light

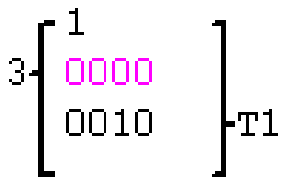
Wiring Diagram and Program with iSmart applied in Ventilation System.



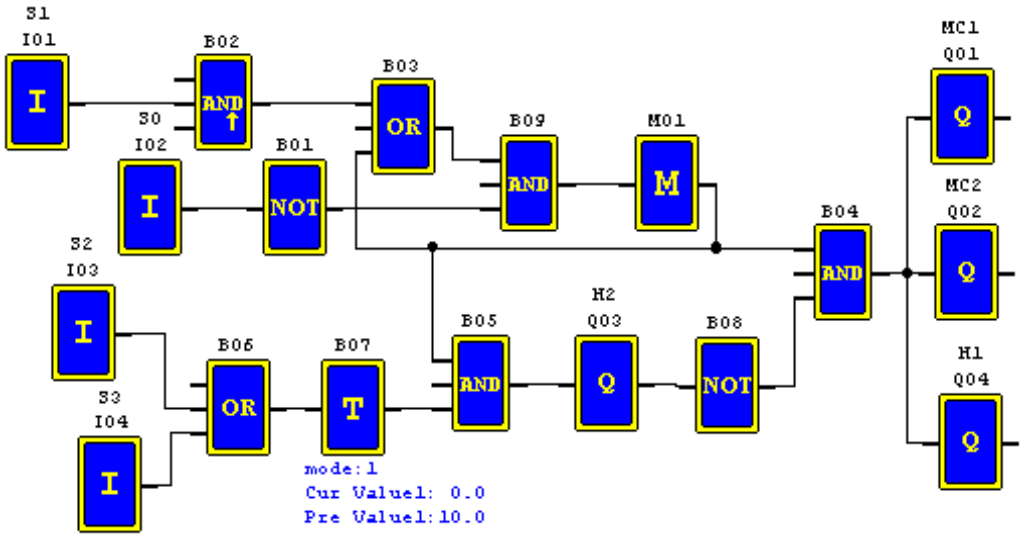
Ladder：



FUNCTION：



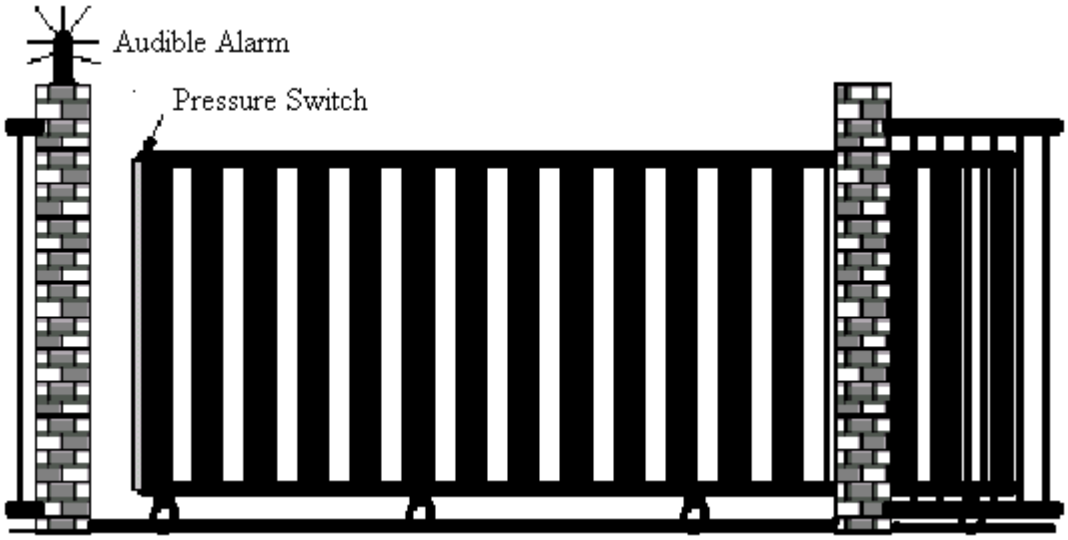
FBD Operation Flow：



4. **Plant Gate Control**

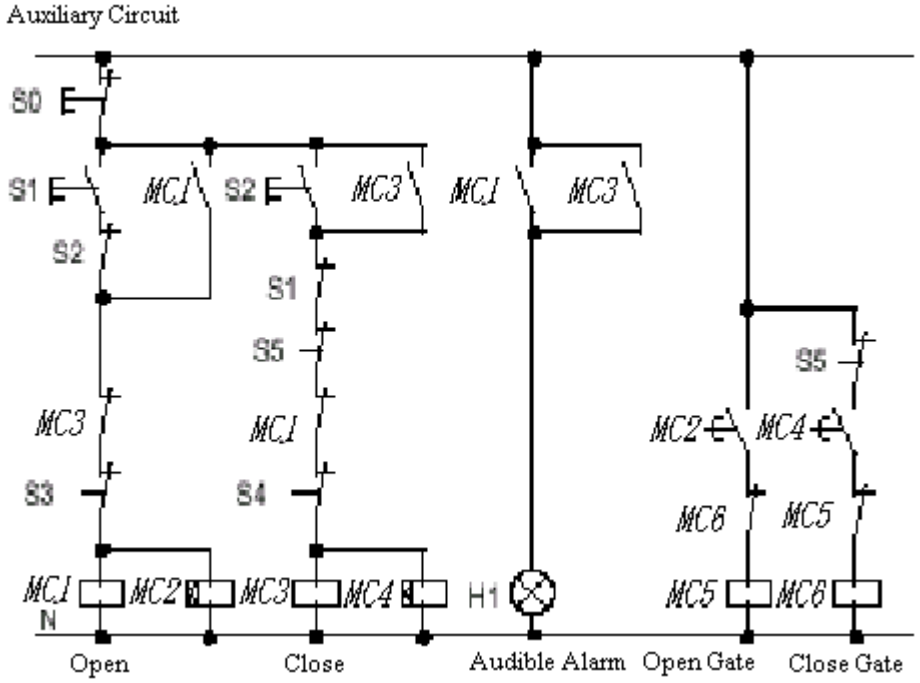
4.1 **Requirements for Plant Gate Control**

The main purpose of the plant gate is to control the access of vehicals, which is manually operated by the gate guard.



- The door guard controls and oversees the opening, closing of the plant door gate.
- The stop switch can be activated at any time regardless of whether the gate is fully open or in a closed condition.
- The alarm light will be activated for 5 seconds in advance before the gate begins an operation.
- A damper is fitted on the gate. In the closing operation the gate will stop if the damper makes contact with an object or gate post.

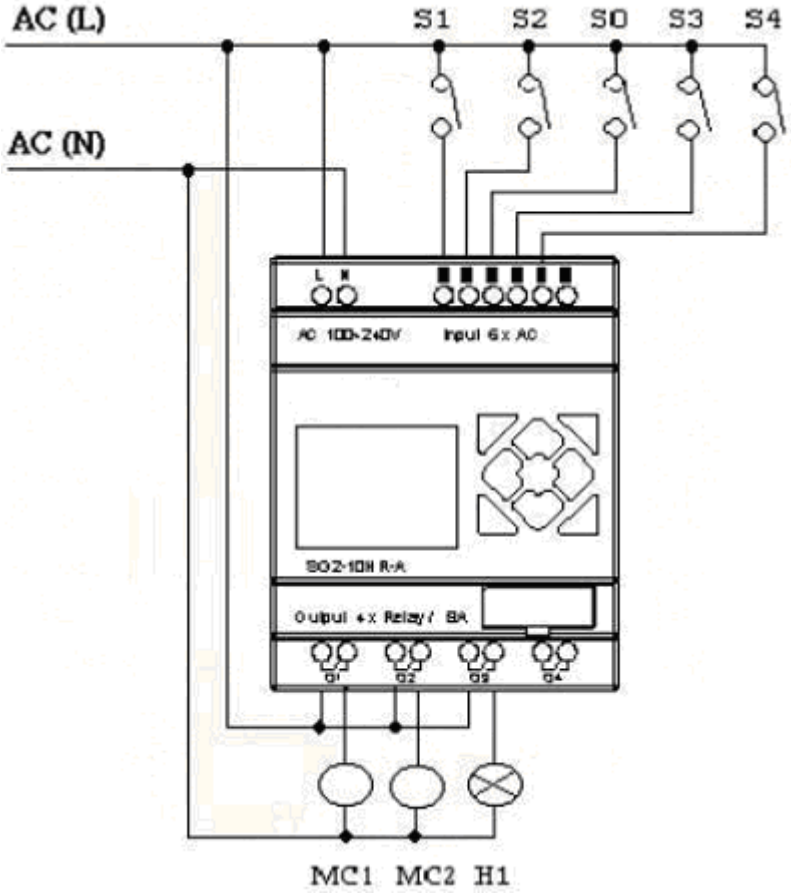
4.2 **Traditional Control Circuit for Gate System**



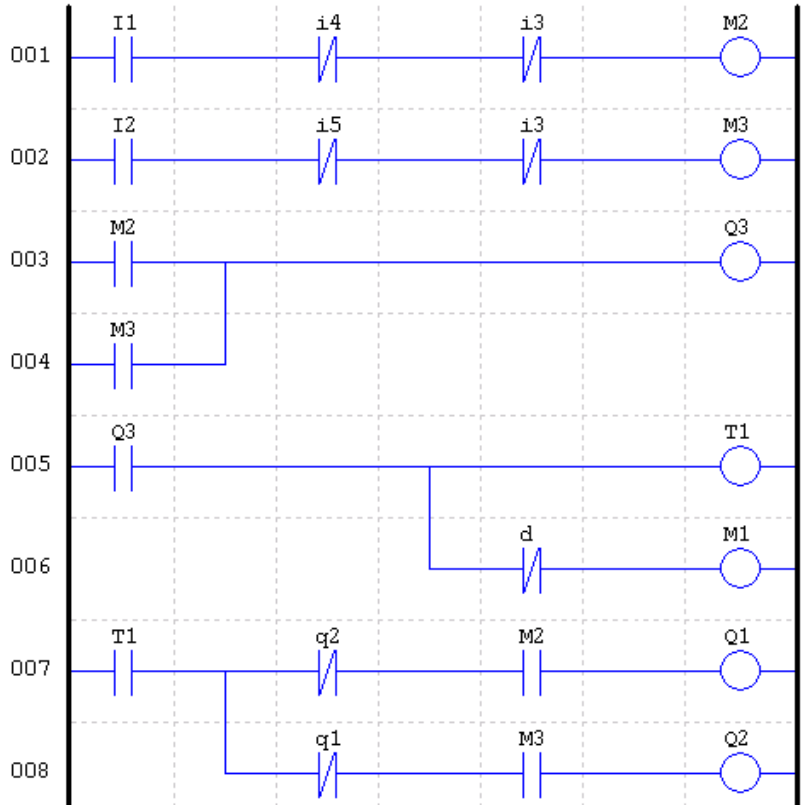
Devices Applied

- MC1 Main Electromagnetic Contactor
- MC2 Main Electromagnetic Contactor
- S0(NC contact) stop switch
- S1(NO contact) open switch
- S2(NO contact) close switch
- S3(NC contact) open safe damper
- S4(NC contact) close safe damper

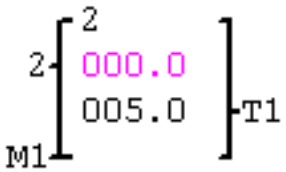
Wiring Diagram and Program with iSmart applied in Plant Gate



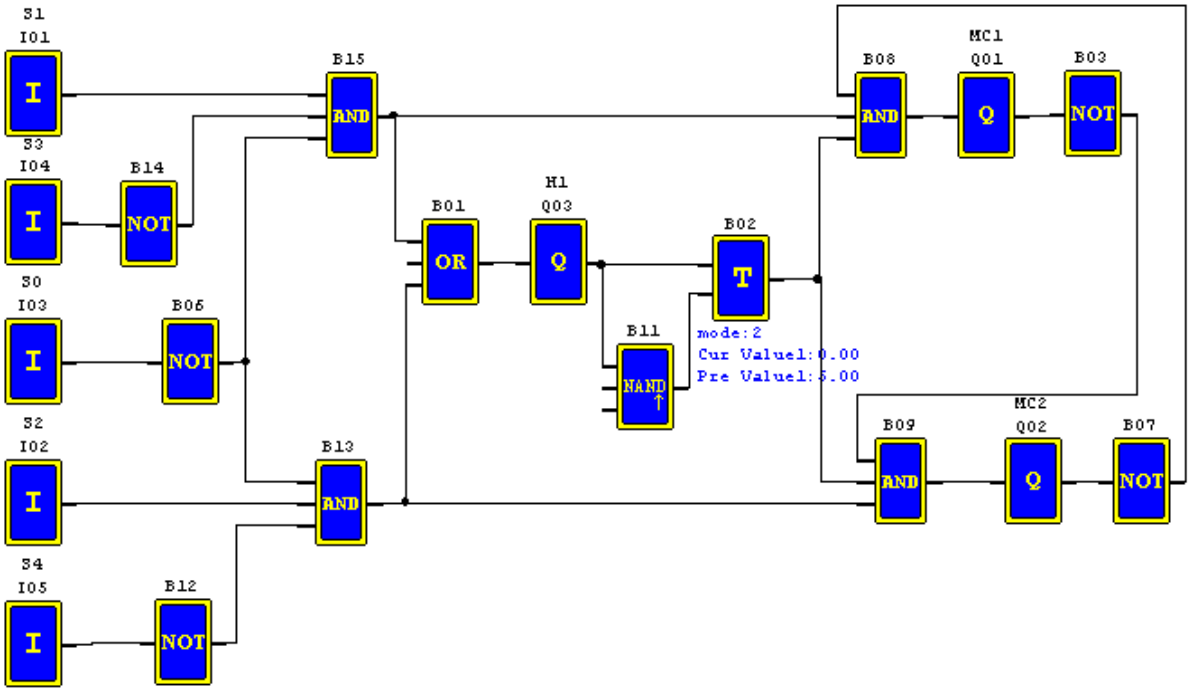
Ladder：



FUNCTION



FBD:


S1
I01
I
S3
I04
I
S0
I03
I
S2
I02
I
S4
I05
I
B14
NOT
B06
NOT
B12
NOT
B15
AND
B13
AND
B01
OR
H1
Q03
Q
B02
T
mode:2
Cur Value1:0.00
Pre Value1:5.00
B11
NAND
MC1
Q01
B08
AND
Q
B03
NOT
MC2
Q02
B09
AND
Q
B07
NOT

5. Counting Control for Packing Machine

5.1 Requirement for packaging machine:

1) The packing cycle begins counting the finished products in the assembly line, when the count value reaches 12 it continues the packing operation, which takes 5 seconds. After completion, it begins a new cycle.
2) It simultaneous counts the finished packs of product.
3) In case of power failure, the count remains unchanged.

Analysis：

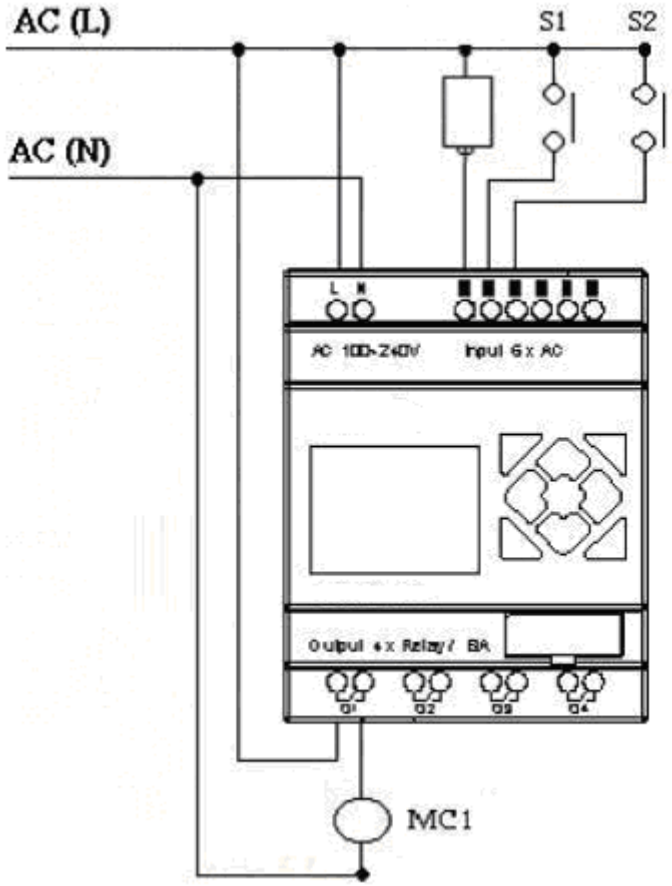
1) A sensor is used to produce the pulse signal, when the sensor detects the arrival of a product. A counter generates an output when the count value reaches 12 a timer is used, having a delay of five seconds.

2) The counter will be operated in mode 3 or mode 4 in an effort to keep the accurate counting even in case of power failure.

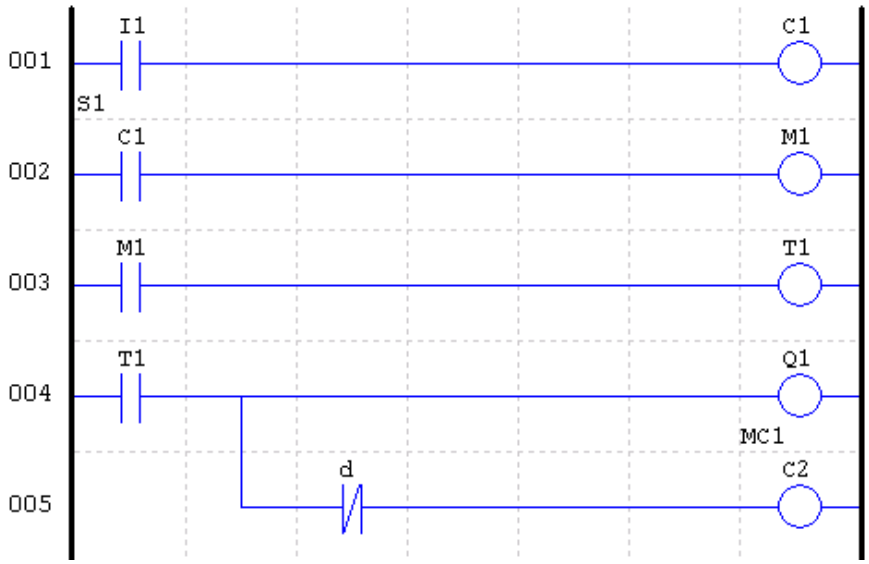
Devices Applied

I1: counting sensor;
S1: reset the counting value to zero;
MC1: packing

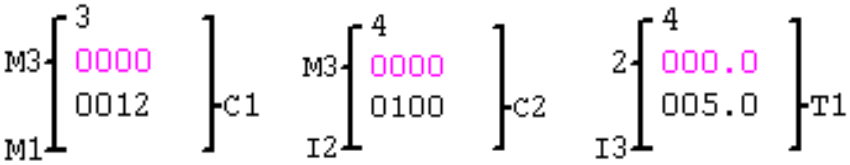
Wiring Diagram and Program using iSmart applied for Packing Machine



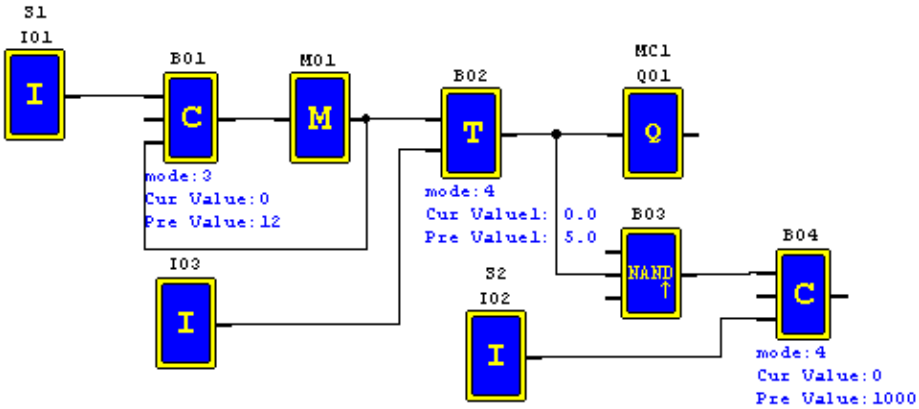
Ladder：



FUNCTION：



FBD：



IMO iSmart

Operation Manual - Second Edition

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