INSTRUCTION MANUAL

IMO *iSmart V4*

Intelligent Relay

IMO Precision Controls Ltd

www.imopc.com

Contents

Summary of changes

This user manual is modified by firmware V4.0 and SMT Client programming software V4.0. SMT V4.0 adds some new functions with the firmware to strong SMT function. The upgrade content is shown as the 2 tables below simply. More information about idiographic function to see function instruction.

Edit and Display

	SMT V3.0	SMT V4
Ladder	300 lines	600 lines
FBD	260blocks	500blocks
LCD	4 lines * 16 characters	4 lines * 16 characters

Contact and function block

	input	output	SMT V3.0	SMT V4.0
Auxiliary relay M	M	M	63(M01~M3F)	127(M01~M7F)
Auxiliary relay N	N	N	63(N01~N3F)	127(N01~N7F)
temperature input	AT		4(AT01~AT04)	4(AT01~AT04)
analog output		AQ	4(AQ01~AQ04)	4(AQ01~AQ04)
PWM		P	2(P01~P02, P01 adds PLSY mode)	P01~P02(PWM/PLSY)
HMI			31(H01~H1F)	31(H01~H1F)
Timer	T	T	Ladder: 31(T01~T1F) FBD: 250(T01~TFA)	Ladder: 31(T01~T1F) FBD: 250(T01~TFA)
Counter	C	C	Ladder: 31(C01~C1F) FBD: 250(C01~CFA)	Ladder: 31(C01~C1F) FBD: 250(C01~CFA)
RTC	R	R	Ladder: 31(R01~R1F) FBD: 250(R01~RFA)	Ladder: 31(R01~R1F) FBD: 250(R01~RFA)
Analog Comparator	G	G	Ladder: 31(G01~G1F) FBD: 250(G01~GFA)	Ladder: 31(G01~G1F) FBD: 250(G01~GFA)
Filter	F	F	\	Ladder: 31(F01~F1F) FBD: 250(F01~FFA)
AS(Add-Sub)	NO	NO	Ladder: 31(AS01~AS1F) FBD: 250(AS01~ASFA)	Ladder: 31(AS01~AS1F) FBD: 250(AS01~ASFA)
MD(Mul-Div)			Ladder: 31(MD01~MD1F) FBD: 250(MD01~MDFA)	Ladder: 31(MD01~MD1F) FBD: 250(MD01~MDFA)
PID			Ladder: 15(PI01~PI0F) FBD: 30(PI01~PI1E)	Ladder: 15(PI01~PI0F) FBD: 30(PI01~PI1E)
MX(Multiplexer)			Ladder: 15(MX01~MX0F) FBD: 250(MX01~MXFA)	Ladder: 15(MX01~MX0F) FBD: 250(MX01~MXFA)
AR(Analog Ramp)			Ladder: 15(AR01~AR0F) FBD: 30(AR01~AR1E)	Ladder: 15(AR01~AR0F) FBD: 30(AR01~AR1E)
DR(Data Register)			240(DR01~DRF0)	240(DR01~DRF0)
MU(MODBUS)			Ladder: 15(MU01~MU0F) FBD: 250(MU01~MUFA)	Ladder: 15(MU01~MU0F) FBD: 250(MU01~MUFA)
Block	B	B	Logic function: BOOLEAN	Logic function: BOOLEAN
			260(B001~B260)The capability of each block is alterable, and the total capability of block is 6000bytes	500(B001~B500)The capability of each block is alterable, and the total capability of block is 10000bytes
External storage			PM04(3rd) can be used with all version of SMT	SD CARD can be used with all version of SMT

NET I/O	J		\	Ladder: 63(J01~J3F)
		K	\	Ladder: 63(K01~K3F)
	NAI		\	Ladder: 31(NAI 01~ NAI 1F)
		NAQ	\	Ladder: 15(NAQ 01~ NAQ 0F)

Chapter 1: Getting Started

The ***i***Smart Relay is an electronic device. For safety reasons, please carefully read and follow the paragraphs with "WARNING" or "CAUTION" symbols. They are important safety precautions to be aware of while transporting, installing, operating, or examining the ISMART Controller.

WARNING: Personal injury may result from improper operation.

CAUTION: The ***i***Smart relay may be damaged by improper operation.

Precaution for Installation

Compliance with the installation instructions and the user manual is absolutely necessary. Failure to comply could lead to improper operation, equipment damage or in extreme cases even death, serious bodily injury or considerable damage to property.

When installing the open-board models, insure that no wiring or foreign materials can fall into the exposed circuits and components. Damage to equipment, fire, or considerable damage to property could result.

Always switch off power before you wire, connect, install, or remove any module.

The wiring for the ***i***Smart relay is open and exposed. For the open-board models, all electrical components are exposed. For this reason, it is recommended the ***i***Smart relay be installed in an enclosure or cabinet to prevent accidental contact or exposure to the electrical circuits and components.

Never install the product in an environment beyond the limits specified in this user manual such as high temperature, humidity, dust, corrosive gas, vibration, etc.

Precaution for Wiring

Improper wiring and installation could lead to death, serious bodily injury or considerable damage to property.

The ISmartrelay should only be installed and wired by properly experienced and certified personnel.

Make sure the wiring of the ***i***Smart relay meets all applicable regulations and codes including local and national standards and codes.

Be sure to properly size cables for the required current rating.

Always separate AC wiring, DC wiring with high-frequency switching cycles, and low-voltage signal wiring.

Precaution for Operation

To insure safety with the application of the ***i***Smart relay, complete functional and safety testing must be conducted. Only run the ***i***Smart after all testing and confirming safe and proper operation is complete. Any potential faults in the application should be included in the testing. Failure to do so could lead to improper operation, equipment damage or in extreme cases even Death, serious bodily injury or considerable damage to property.

When the power is on, never contact the terminals, exposed conductors or electrical components. Failure to comply could lead to improper operation, equipment damage or in extreme cases even death, serious bodily injury or considerable damage to property.

It is strongly recommended to add safety protection such as an emergency stop and external interlock circuit in case the ***i***Smart relay operation must be shut down immediately.

Examination before Installation

Every *i*Smart relay has been fully tested and examined before shipment. Please carry out the following examination procedures after unpacking your *i*Smart relay.

• Check to see if the model number of the ISMART matches the model number that you ordered.

• Check to see whether any damage occurred to the ISMART during shipment. Do not connect the *i*Smart relay to the power supply if there is any sign of damage.

Contact IMO Precision Controls Ltd if you find any abnormal conditions as mentioned above.

Environmental Precautions

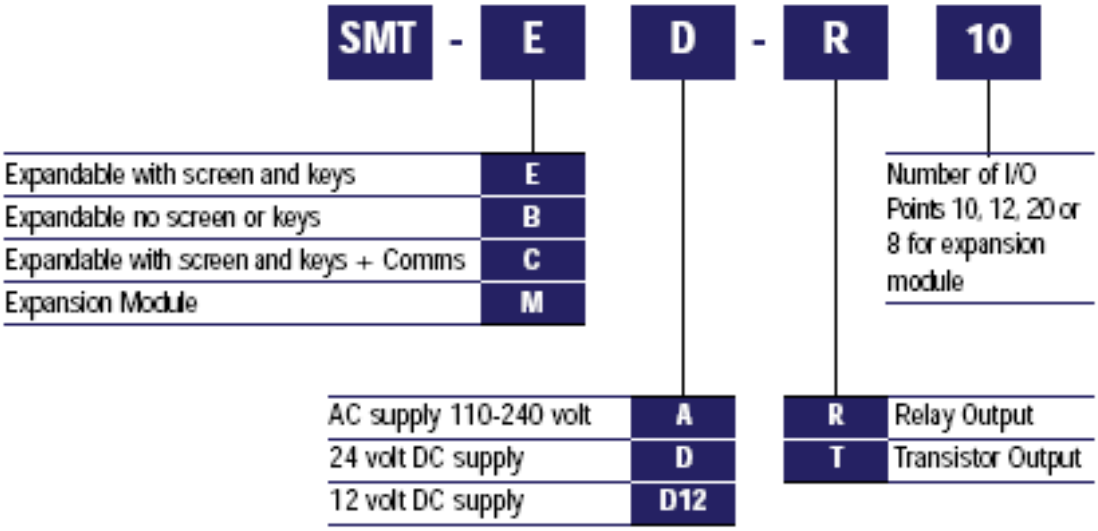
The installation site of the ISmart relay is very important. It relates directly to the functionality and the life span of your ISMART. Please carefully choose an installation site that meets the following requirements:

• Mount the unit vertically
• Environment temperature: -4°F - 131°F (-20°C - 55°C)
• Avoid placing ISMART close to any heating equipment
• Avoid dripping water, condensation, or humid environment
• Avoid direct sunlight
• Avoid oil, grease, and gas
• Avoid contact with corrosive gases and liquids
• Prevent foreign dust, flecks, or metal scraps from contacting the ***i***Smart relay
• Avoid electric-magnetic interference (soldering or power machinery)
• Avoid excessive vibration; if vibration cannot be avoided, an anti-rattle mounting device should be installed to reduce vibration.

Disclaim of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

ISMART Model Identification

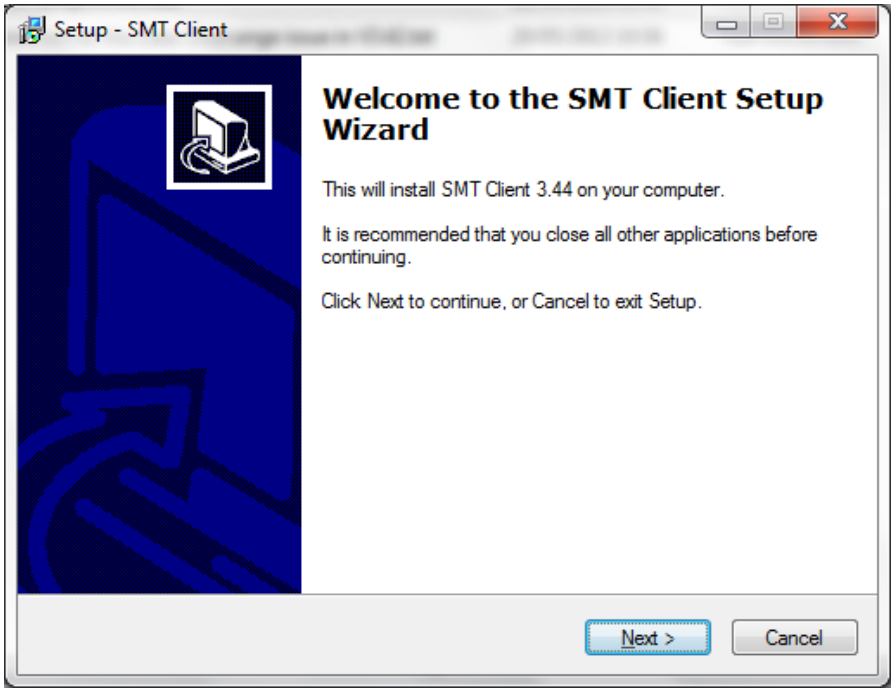


Quick Start Setup

This section is a simple guide for connecting, programming and operating your new ***i***Smart relay. This is not intended to be the complete instructions for programming and installation of your system. Refer to other sections in the manual for more detailed information.

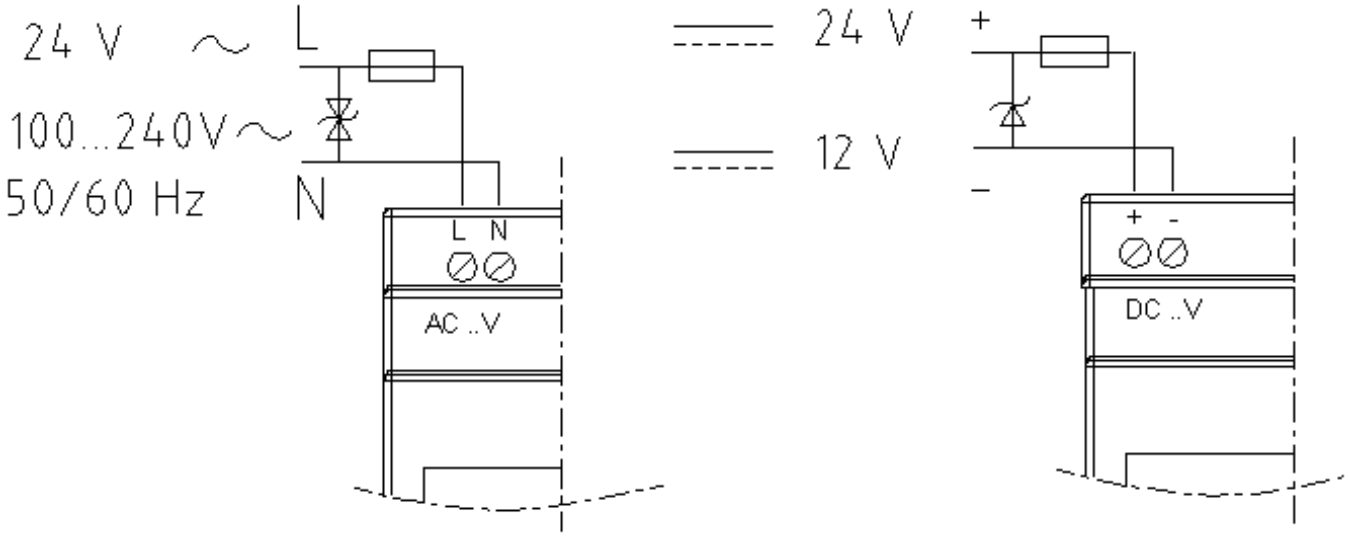
Install ISMART Client Software

Install the ISMART Client Software from CD or from the free internet download at www.imopc.com



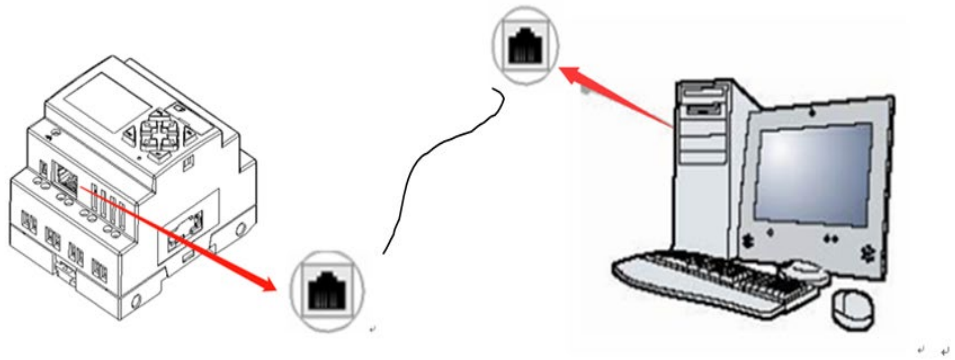
Connect Power to *i*Smart relay

Connect power to the Smart Relay using the below wiring diagrams for AC or DC supply for the applicable modules. See "Chapter 2: Installation" for complete wiring and installation instructions.



Connect Programming Cable

Please put the cable in connection port of two sides.



Network connection setup

1. *i*Smart IP address setup

When ISMART is setting for slave

>IP ADDRESS
SUBNET MASK
GETEWAY
MASTER IP

Please set IP address, subnet mask, gateway address and master IP, then click “OK” to setup *i*Smart network connection

> IP ADDRESS
SUBNET MASK
GETEWAY
MASTER IP

For example, edit IP address

Please click “OK” to enter interface, move the cursor to "Set IP address" and click "SEL" to enter setting mode.

IP ADDRESS
255.255.255.25

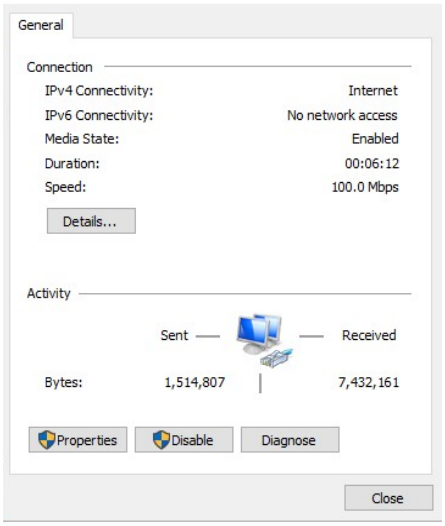
When cursor becomes to “_”, please use "Up" and "Down" button to set correct value then click "OK" to save new IP address, then click "ESC" to return to main menu.

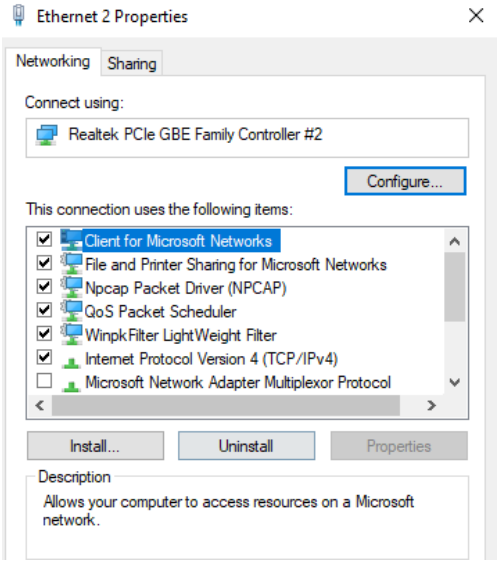
IP ADDRESS
255.255.255.255

#The maximum default value is 255, if setting value is higher than 255, default value will be 255 also.

2. Set IP address on PC

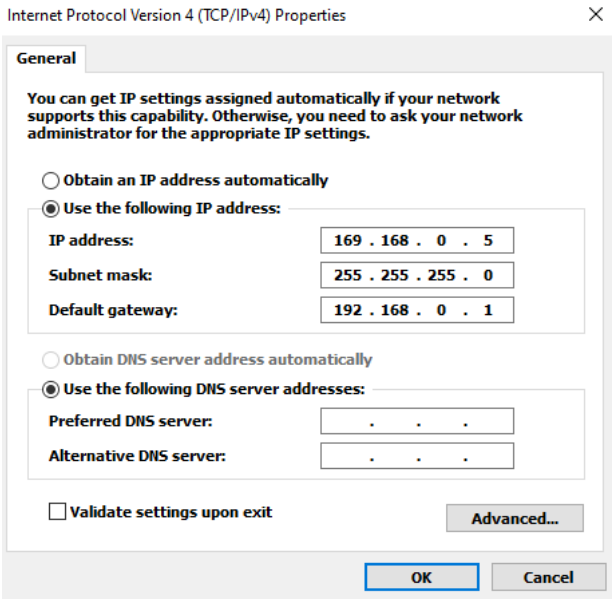
Click “Properties” to select your Internet protocol version





Set IP address, subnet net, gateway address

For example：



PC setup：

IP address：192.168.0.5

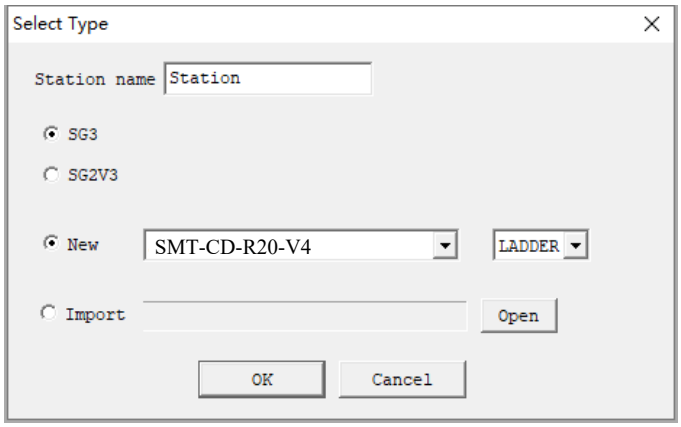
Subnet mask： 255.255.255.0

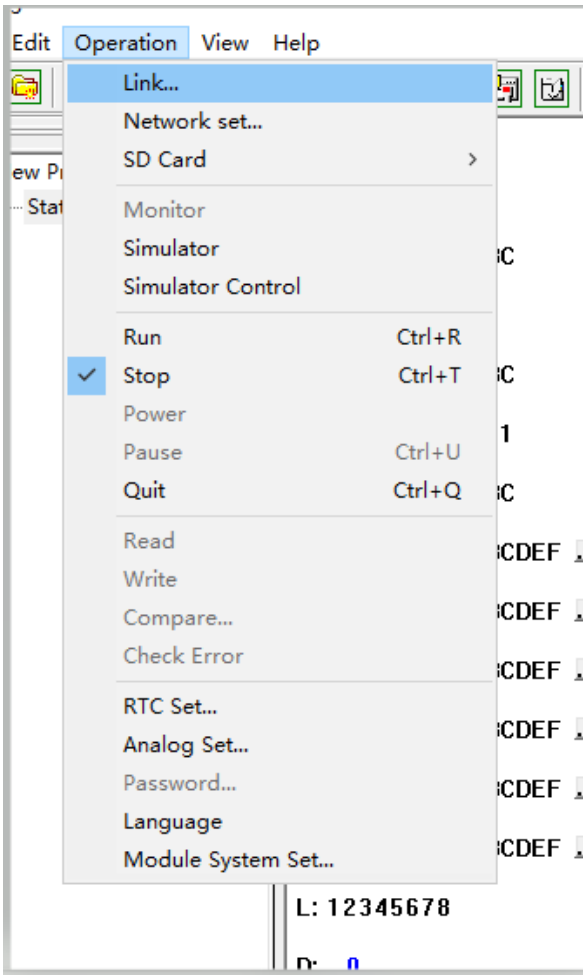
Default gateway address：192.168.0.1

Establish Communication

a. Open the ***i***Smart Client software and select "New LAD" as shown below left.

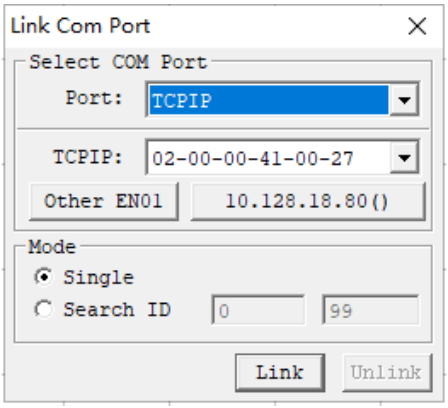
b. Select "Operation/Link Com Port…" as shown below right.

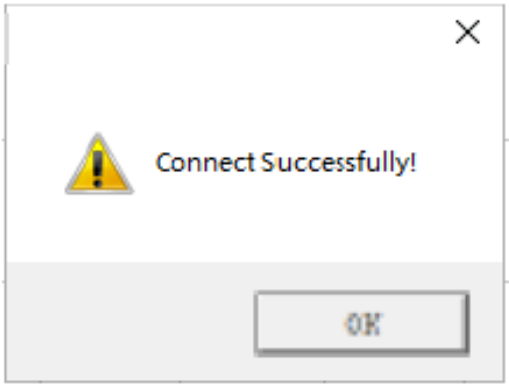




c.

c.Select the correct Com Port number where the programming cable is connected to the computer then press the "link" button.

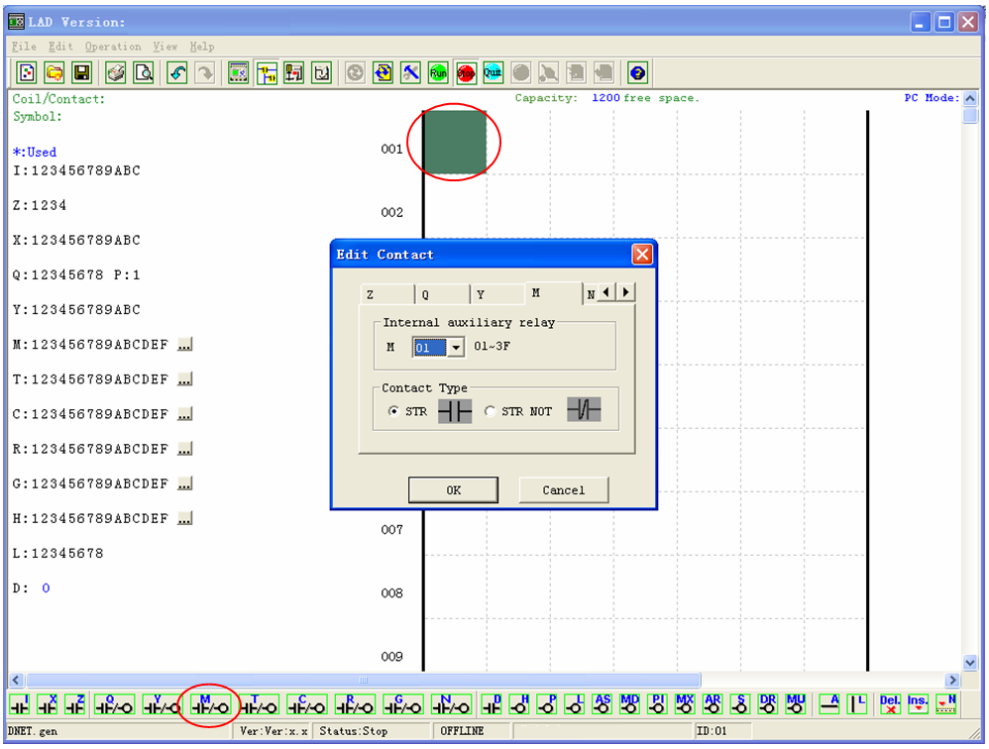




d. The ***i***Smart Client will then begin to detect the connected smart relay to complete its connection.

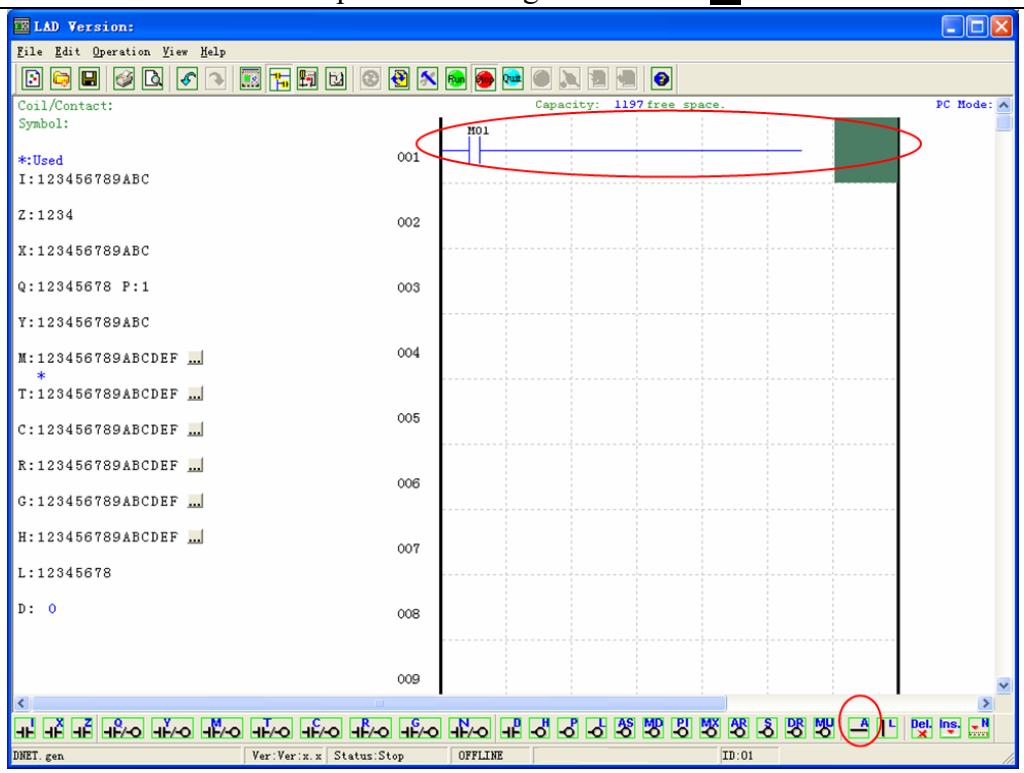
Write simple program

a. Write a simple one rung program by clicking on the leftmost cell at line 001 of the programming grid, then click on the "M" contact icon on the ladder toolbar, as shown below. Select M01 and press the OK button.
See "Chapter 4: Ladder Programming instructions" for complete instruction set definitions.

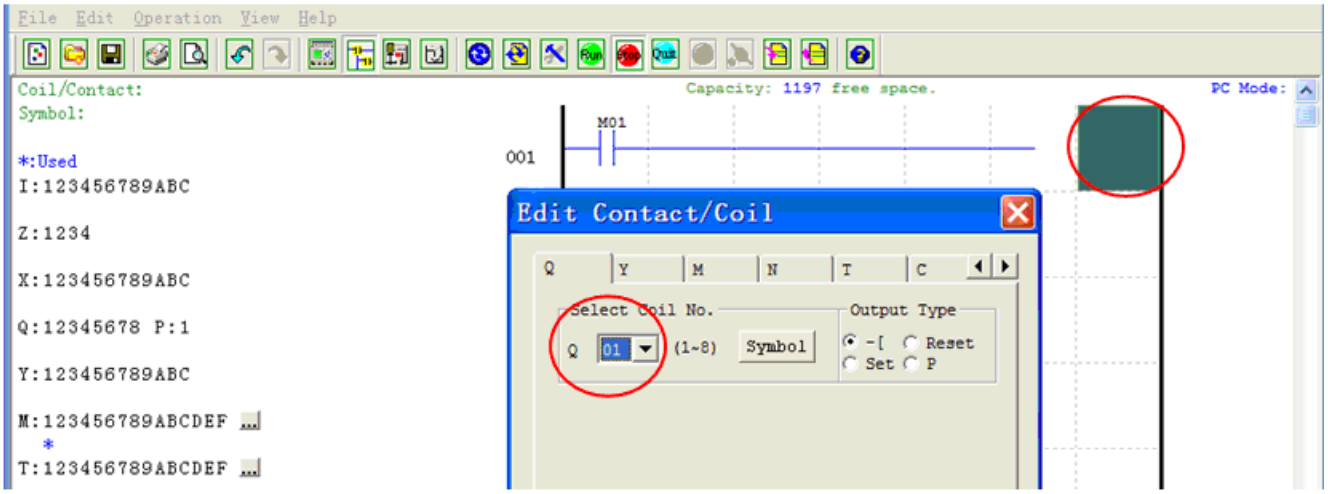


Note: If the ladder toolbar is not visible at the bottom of the screen, select **View/Ladder Toolbar** from the menu to enable.

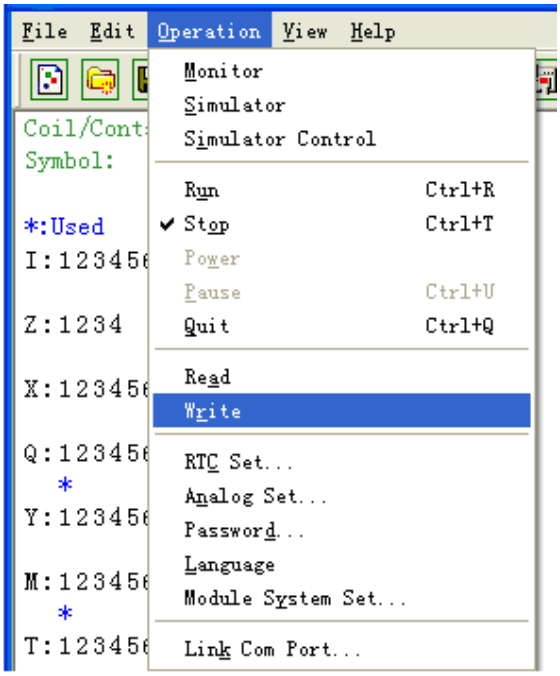
b. Use the "A" key on your keyboard (or the "A" icon on the ladder toolbar) to draw the horizontal circuit line from the M contact to the right most cell, as shown below.



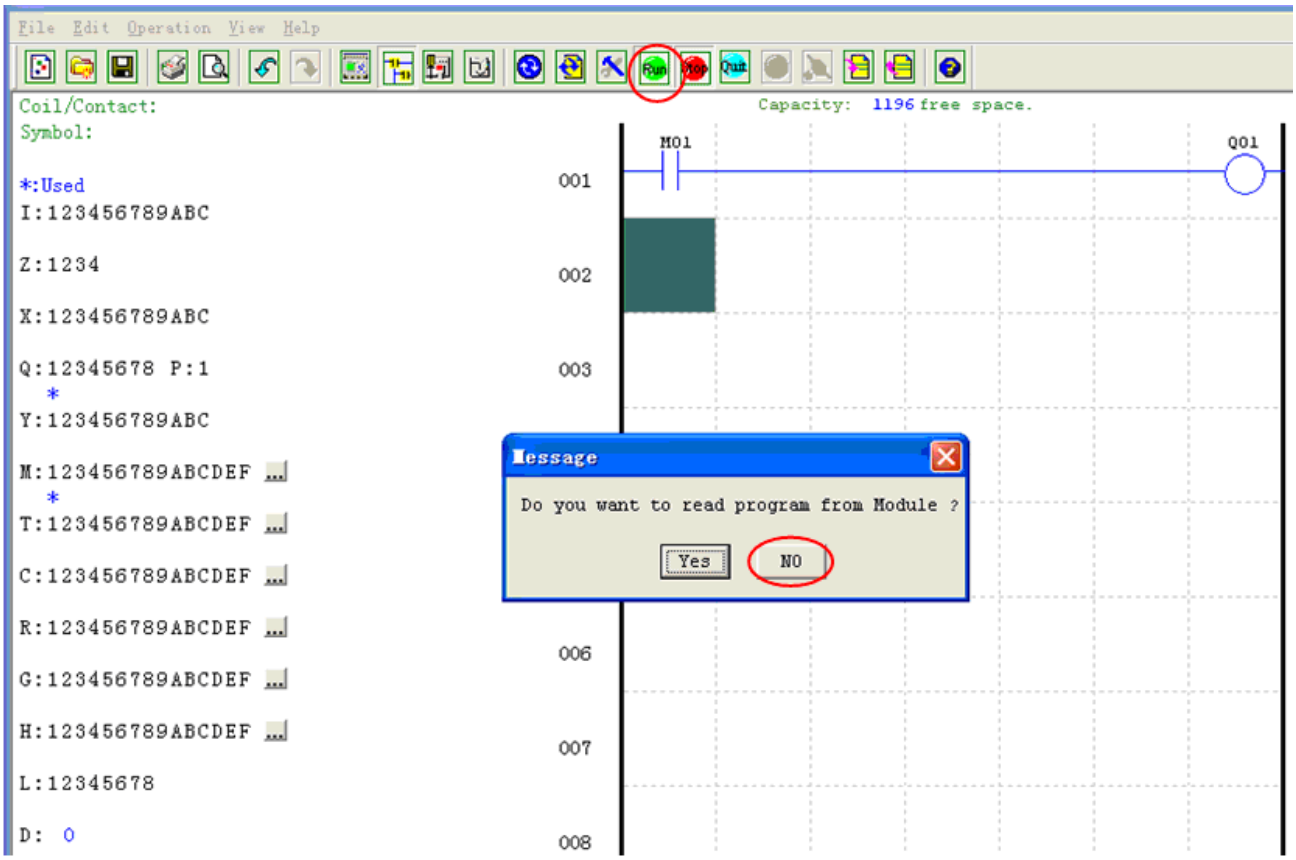
c. Select the "Q" coil icon from the ladder toolbar and drop it on the right most cells. Select Q01 from the dialog and press OK as shown below. See "Chapter 4: Ladder Programming instructions" for complete instruction set definitions.



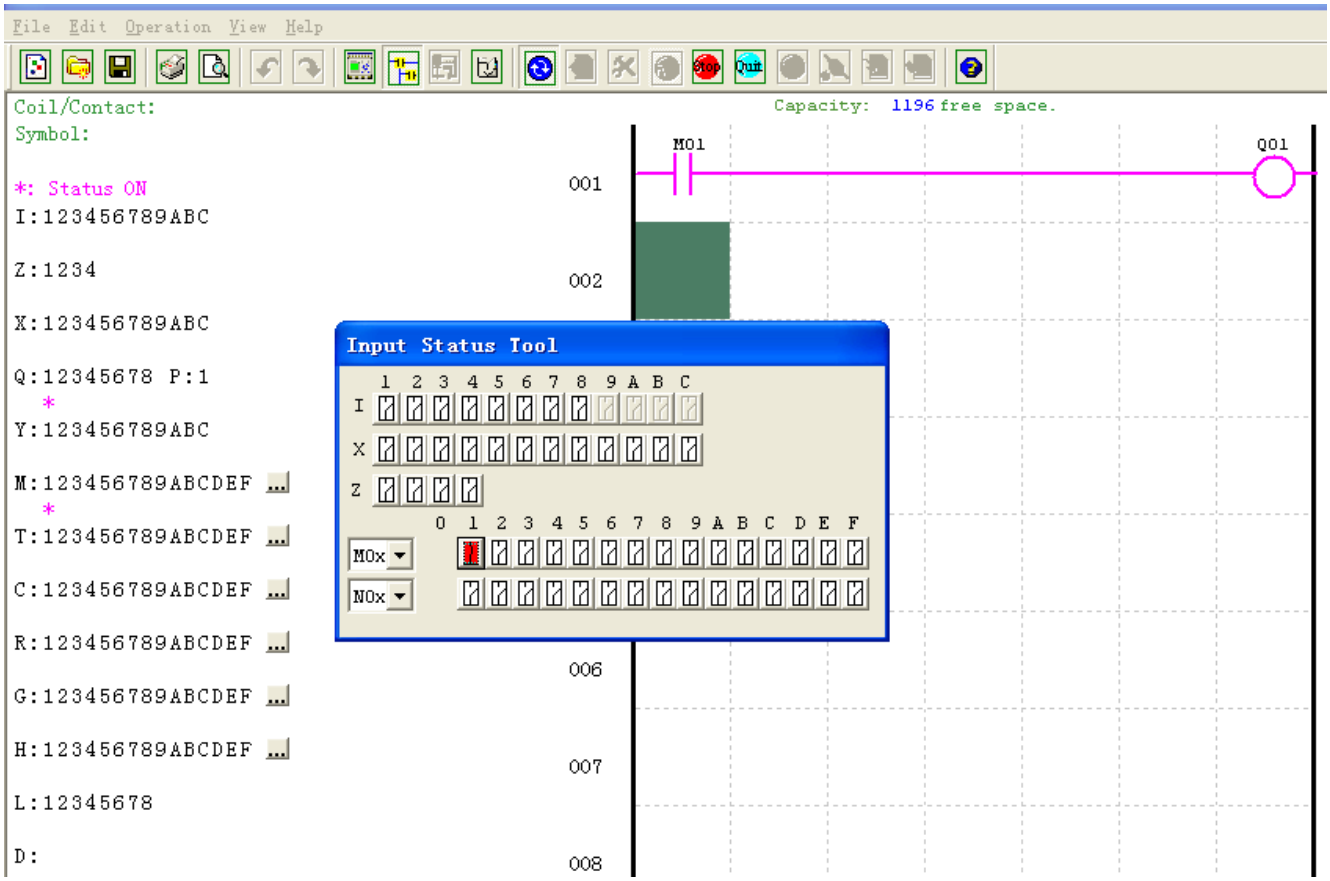
d. Test the simple program. From the Operation menu, select the Write function and write the program to the connected smart relay as shown below.



e. Select the RUN icon from the toolbar, and select “No” when the pop-up message asks “Do you want to read program from module?”, as shown below.



f. On the Input Status dialog, click on M01 to activate the contact M01 which will turn ON the Output Q01 as shown below. The highlighted circuit shows the active part, and the first Output (Q01) on the connected smart relay will be ON. See "Chapter 3: Programming Tools" for more detailed software information.



Chapter 2: Installation

General Specifications

iSmart is a miniature smart Relay with a maximum of 44 I/O points and can be programmed in Relay Ladder Logic or FBD (Function Block Diagram) program. The iSmart can expand to its maximum I/O count by adding 3 groups of 4-input and 4-output modules.

Power Supply	
Input Power Voltage Range	DC Models: 12-28.8V AC Models: 85-265V 24V AC Models: 20.4-28.8V
Power Consumption	24VDC: 12-point :125mA 20-point: 185mA 100-240VAC: 100mA 24VAC: 290mA
Wire Size (all terminals)	AWG 14/ψ2.6mm^2

Programming	
Programming languages	Ladder/Function Block Diagram
Program Memory	600 Lines or 500 Function Blocks
Programming storage media	Flash
Execution Speed	5ms/cycle
LCD Display	4 lines x 16 characters
Timers	
Maximum Number	Ladder: 31; FBD: 250
Timing ranges	0.01s–9999min
Counters	
Maximum Number	Ladder: 31; FBD: 250
Highest count	999999
Resolution	1
RTC (Real Time Clock)	
Maximum Number	Ladder: 31; FBD: 250
Resolution	1min
Time span available	week, year, month, day, hour, min
Analog compare	
Maximum Number	Ladder: 31; FBD: 250
Compare versus other inputs	Numeric values or function block current value, such as Analog input(A), Timer, Counter, Temperature Input (AT), Analog Output (AQ), Analog*gain + Offset, AS, MD, PI, MX, AR , DR …

Environmental	
Enclosure Type	IP20
Maximum Vibration	1G according to IEC60068-2-6
Operating Temperature Range	-4° to 131°F (-20° to 55°C)
Storage Temperature Range	-40° to 158°F (-40° to 70°C)

Maximum Humidity	90% (Relative, non-condensing)
Vibration	0.075mm amplitude, 1.0g acceleration
Weight	8-point:190g 10,12-point: 230g 20-point: 345g
Agency Approvals	CUL, CE, UL

Digital Inputs	
Current consumption	3.2mA @DC; 1.3mA @100-240VAC 3.3mA @24VAC
Input Signal ”OFF” Threshold	DC: < 5VDC; 100-240VAC : < 40VAC 24VAC: <6VAC
Input Signal ”ON” Threshold	DC: > 15VDC 100-240VAC : > 79VAC 24VAC: >14VAC
Input On delay	DC: 5ms 240VAC: 25ms 120VAC: 50ms 24VAC: 5ms
Input Off Delay	DC: 3ms 240VAC: 90/85ms 50/60Hz 120VAC: 50/45ms 50/60Hz 24VAC: 3ms
Transistor device compatibility	PNP, 3-wire device only
High Speed Input frequency	1kHz
Standard Input frequency	< 40 Hz
Required protection	Inverse voltage protection required

Analog Inputs	
Resolution	Basic unit: 12 bit Expansion unit: 12bit
Voltage Range acceptable	Basic unit: Analog input: 0-10VDC voltage, 24VDC when used as discrete input; Expansion unit: Analog input: 0-10VDC voltage or 0-20mA current
Input Signal ”OFF” Threshold	< 5VDC (as 24VDC discreet input)
Input Signal ”ON” Threshold	> 9.8VDC (as 24VDC discreet input)
Isolation	None
Short circuit protection	Yes
Total number available	Basic unit: A01-A04 Expansion unit: A05-A08

Relay Outputs	
Contact material	Ag Alloy
Current rating	8A
HP rating	1/3HP@120V 1/2HP@250V

Maximum Load	Resistive: 8A /point Inductive: 4A /point
Maximum operating time	15ms (normal condition)
Life expectancy (rated load)	100k operations
Minimum load	16.7mA

Transistor Outputs	
PWM max. output frequency	1.0kHz (0.5ms on,0.5ms off)
Standard max. output frequency	100Hz
Voltage specification	10-28.8VDC
Current capacity	1A
Maximum Load	Resistive: 0.5A/point Inductive: 0.3A/point
Minimum Load	0.2mA

Product Specifications

	Part Number	Power	Digital In	Digital Out	Analogue In	Analogue Out	HMI	Comments
BASE MODELS	SMT-EA-R10-V4	100-240VAC	6 AC	4 (8A Rly)	-	-	Yes	
	SMT-EA-R20-V4	100-240VAC	12 AC	8 (8A Rly)	-	-	Yes	
	SMT-ED-R12-V4	24VDC	8 DC*1	4 (8A Rly)	2 (0-10V)	-	Yes	2 High Speed Inputs (up to 1kHz)
	SMT-ED-R20-V4	24VDC	12 DC*1	8 (8A Rly)	4 (0-10V)	-	Yes	2 High Speed Inputs (up to 1kHz)
	SMT-ED12-R12-V4	12VDC	8 DC*1	4 (8A Rly)	2 (0-10V)	-	Yes	2 High Speed Inputs (up to 1kHz)
	SMT-BA-R10-V4	100-240VAC	6 AC	4 (8A Rly)	-	-	No	
	SMT-BA-R20-V4	100-240VAC	12 AC	8 (8A Rly)	-	-	No	
	SMT-BD-R12-V4	24VDC	8 DC*1	4 (8A Rly)	2 (0-10V)	-	No	2 High Speed Inputs (up to 1kHz)
	SMT-BD-R20-V4	24VDC	12 DC*1	8 (8A Rly)	4 (0-10V)	-	No	2 High Speed Inputs (up to 1kHz)
	SMT-CD-R20-V4	24VDC	12 DC*1	8 (8A Rly)	4 (0-10V)	-	Yes	2 HSI (1kHz), RS485 Modbus, Link
	SMT-ED-T12-V4	24VDC	8 DC*1	4 (0.5A Trn)	2 (0-10V)	-	Yes	2 PWM (0.5kHz)
	SMT-ED-T20-V4	24VDC	12 DC*1	8 (0.5A Trn)	4 (0-10V)	-	Yes	2 PWM (0.5kHz)
	SMT-CD-T20-V4	24VDC	12 DC*1	8 (0.5A Trn)	4 (0-10V)	-	Yes	2 PWM (0.5kHz), RS485 Modbus
	SMT-ED12-R20-V4	12VDC	12 DC*1	8 (8A Rly)	4 (0-10V)	-	Yes	2 High Speed Inputs (up to 1kHz)
EXPANSIONS / EXTRAS	SMT-MA-R8	100-240VAC	4 AC	4 (8A Rly)	-	-	-	Maximum 3 per Base Unit
	SMT-MD-R8	24VDC	4 DC	4 (8A Rly)	-	-	-	Maximum 3 per Base Unit
	SMT-MD-T8	24VDC	4 DC	4 (0.5A Trn)	-	-	-	Maximum 3 per Base Unit
	SMT-MD-4AI	24VDC	-	-	4 (V, mA)	-	-	Maximum 1 per Base Unit
	SMT-4PT	24VDC	-	-	4 (PT100)	-	-	Maximum 1 per Base Unit
	SMT-2AO	24VDC	-	-	-	2 (V, mA)	-	Maximum 2 per Base Unit
	SMT-PC03	-	-	-	-	-	-	PC-Link Programming Cable
	SMT-PM04-V4	-	-	-	-	-	-	32K Flash Memory Moduole
	SMT-USB	-	-	-	-	-	-	USB Programming Cable
MADE TO ORDER	SMT-BD-T12-V4	24VDC	8 DC*1	4 (0.5A Trn)	2 (0-10V)	-	No	2 PWM (0.5kHz)
	SMT-BD-T20-V4	24VDC	12 DC*1	8 (0.5A Trn)	4 (0-10V)	-	No	2 PWM (0.5kHz)
	SMT-CD12-R20-V4	12VDC	12 DC*1	8 (8A Rly)	4 (0-10V)	-	Yes	RS485 Modbus, Link Function
	SMT-EA24-R12-V4	24VAC	6 AC	4 (8A Rly)	-	-	Yes	24VAC Inputs and Power
	SMT-EA24-R20-V4	24VAC	12 AC	8 (8A Rly)	-	-	Yes	24VAC Inputs and Power
	SMT-MA24-R8	24VAC	4 AC	4 (8A Rly)	-	-	-	24VAC Inputs and Power

*1 Analogue inputs can be used as digital inputs. Number shown includes this.

※ If module with keypad and display, Max IO can be added keypad input Z01-Z04.

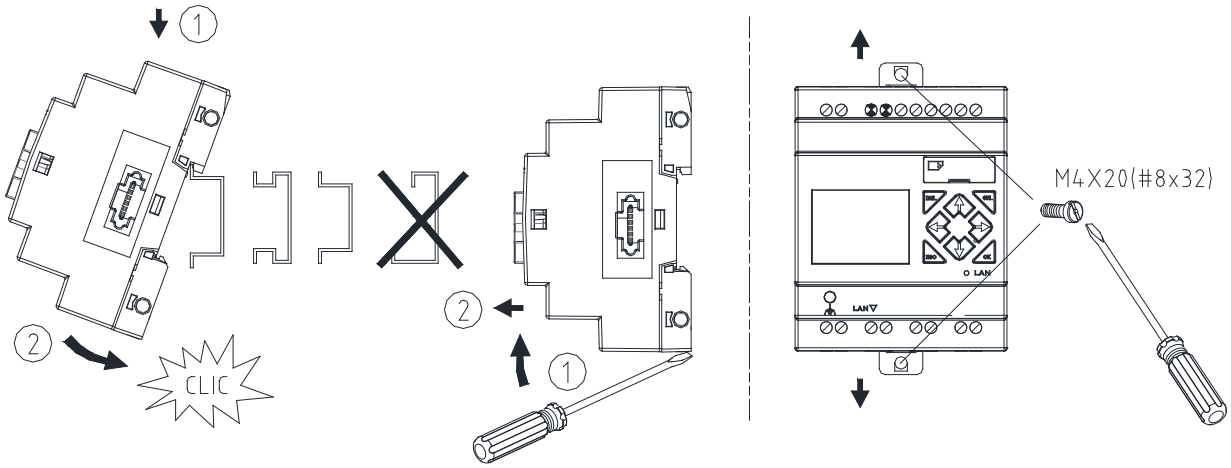
※ More information about Product Specifications to see “chapter 6: Hardware Specification”.

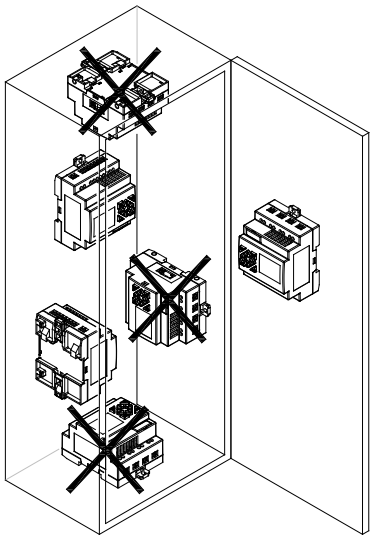
※ iSmart series compatible with iSmart V3 series

Mounting

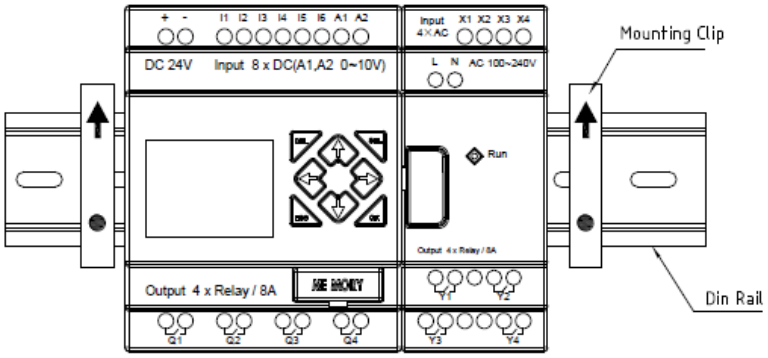
DIN-rail Mounting

The iSmart relay should always be mounted vertically. 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)



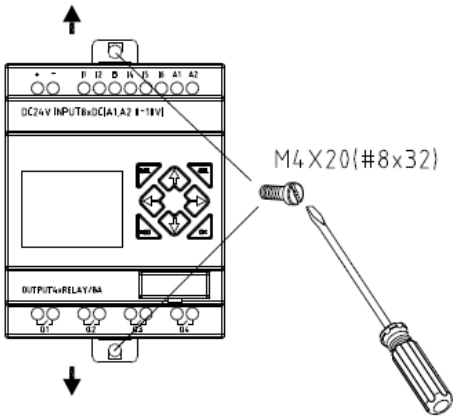


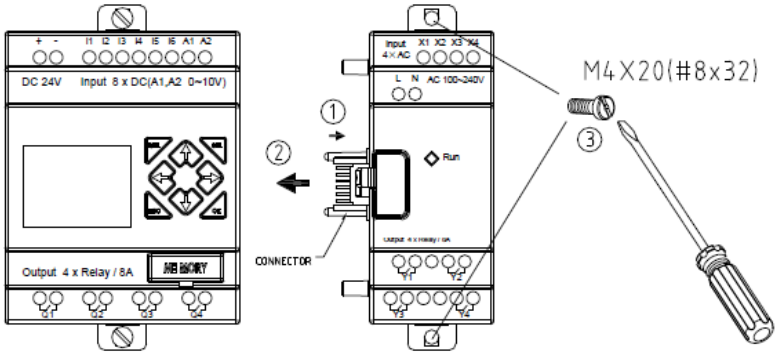
It is recommended to apply a DIN-rail end clamp to hold the iSmart in place.



Direct Mounting

Use M4 screws to direct mount the iSmart as shown. For direct installation of the expansion module, slide the expansion module and connect with the Master after the Master is fixed.





Wiring

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

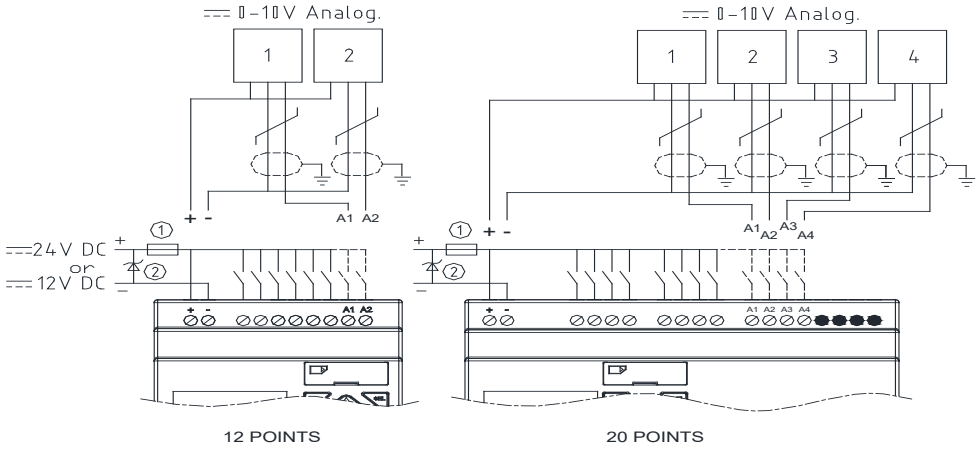
To avoid a short circuit on the load side, it is recommended to connect a fuse between each output terminals and loads.

Wire size and Terminal Torque

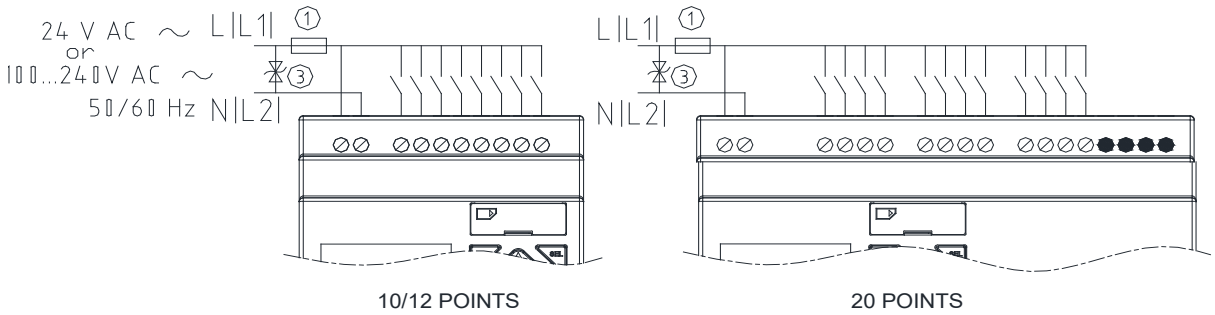
mm^2	0.14...1.5	0.14...0.75	0.14...2.5	0.14...2.5	0.14...1.5
AWG	26...16	26...18	26...14	26...14	26...16

⌀3.5 (0.14in)	C	Nm	0.6
		lb-in	5.4

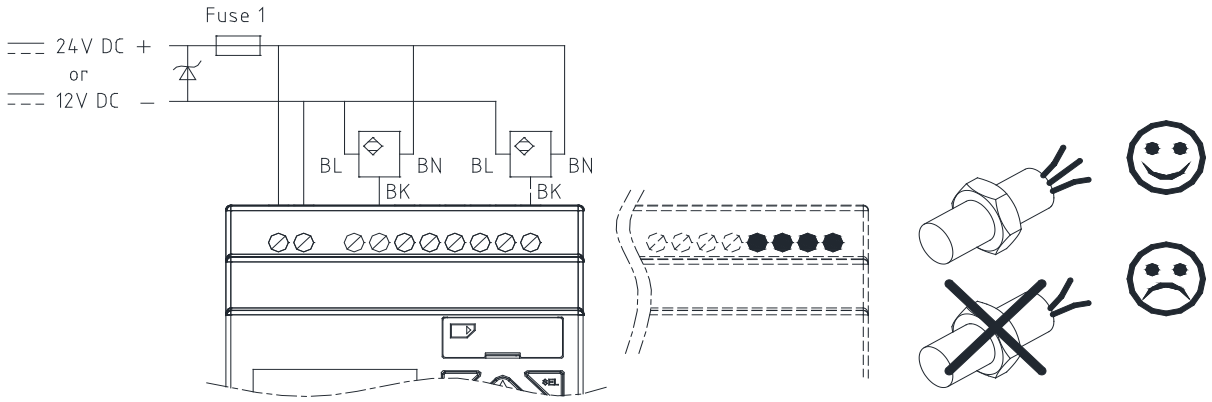
Input 12/24V DC



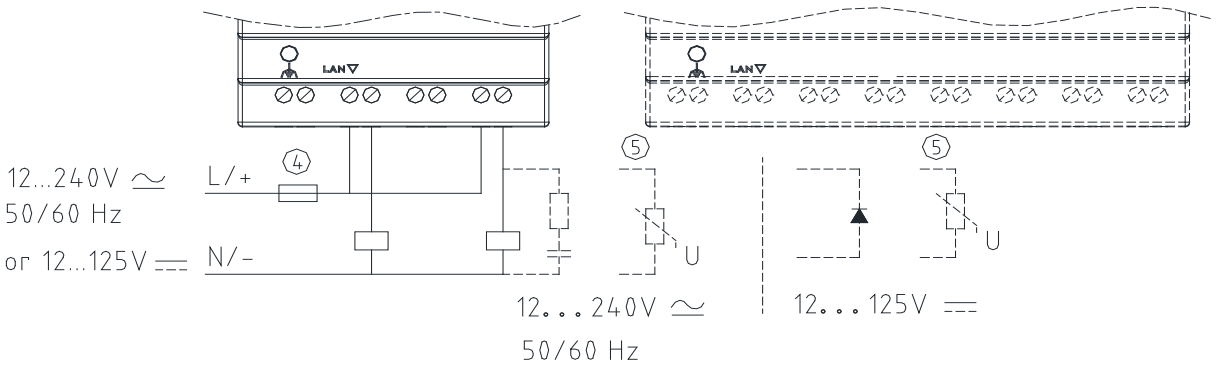
Input 100~240V /24V AC



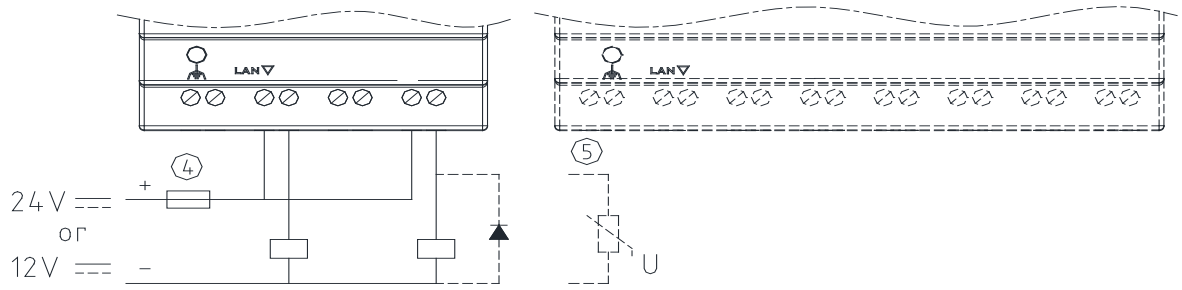
Sensor Connection



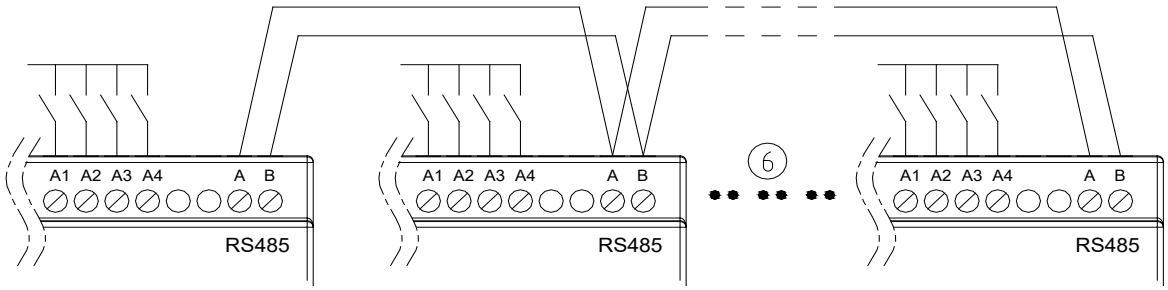
Output (Relay)



Output (Transistor)



IO Link OR Remote I/O Link



The power supply and the I/O supply should share the same power source. Only short circuit the first and the last module.

When I/O link, the net can connect 8 products in max. (ID: 0-7).

When Remote I/O is available, it only can connect 2 products max (Master & Slave).

※ More information about RS485 Model communication to see "Chapter 7 20 Points RS485 type Models Instruction".

①-1A quick-blowing fuse, circuit-breaker or circuit protector

②-Surge absorber (43V DC)

③-Surge absorber (Input 24VAC:43V; Input 100~240VAC:430V AC)

④-Fuse, circuit-breaker or circuit protector

⑤-Inductive load

⑥-Comply with standard: EIA RS-485.

B type Indicator Light

There is an indicator light to indicate the status of iSmart (B type) smart, and the below table shows the relationship between the light and the iSmart status.

State of light	Description
◆	Power up, iSmart is stopping
✦	Flicker slow(1Hz), iSmart is running
✸	Flicker quick(5Hz), iSmart is under failure status
	—Flash error —Illogicality in user program —Expansion model error —RTC error

Chapter 3: Program Tools_Toc72326534

PC Programming Software “SMT Client”

The SMT Client programming software provides two edit modes, Ladder Logic and Function Block Diagram (FBD). The SMT Client software includes the following features:

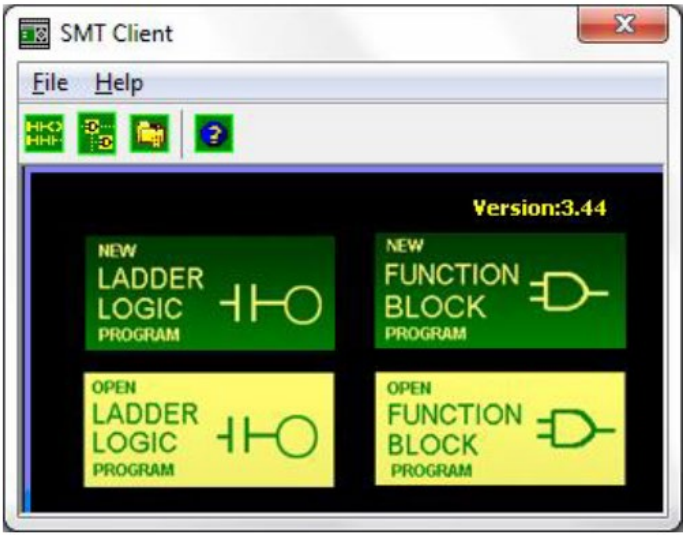
1. Easy and convenient program creation and editing.
2. Programs can be saved on a computer for archiving and reuse. Programs can also be uploaded directly from an iSmart and saved or edited.
3. Enables users to print programs for reference and review.
4. The Simulation Mode allows users to run and test their program before it is loaded to the controller.
5. Real-time communication allows the user to monitor and force I/O on the iSmart relay operation during RUN mode.

Installing the Software

Install the SMT Client (free download from the IMO website):

Start Screen

Run the SMT Client software and the below Start screen will be displayed. From this screen, you can perform the following functions



New Ladder Program

Select **File -->New -->New LAD** to enter the development environment for a new Ladder program

.

New FBD Program

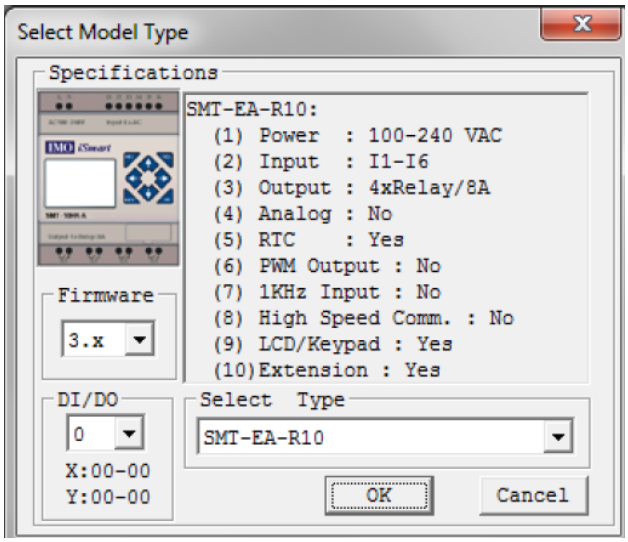
Select **File -->New -->New FBD** to enter the development environment for a new FBD (Function Block Diagram) program.

Open Existing File

Select **File -->Open** to choose the type of file to open (Ladder or FBD), and choose the desired program file, and then click Open.

Ladder Logic Programming Environment

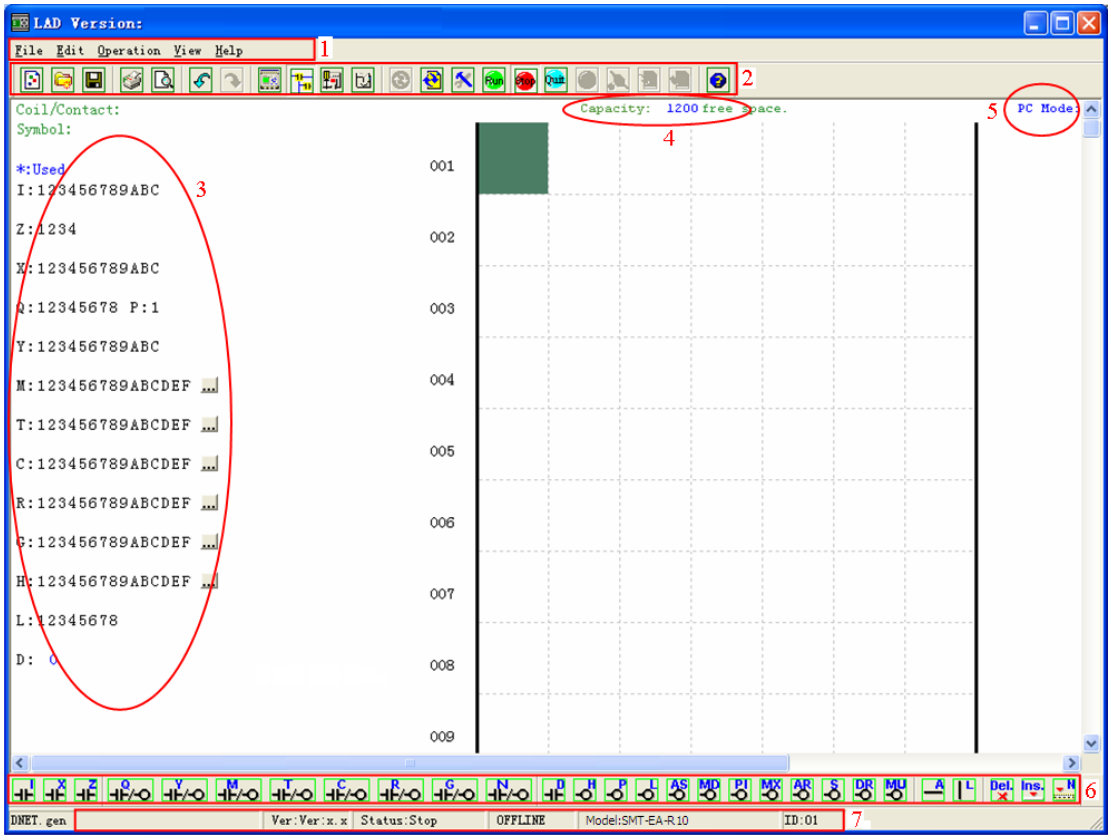
The Ladder Logic Programming Environment includes all the functions for programming and testing the iSmart using the Ladder Logic programming language. To begin a new program, select **File-->New**, and select the desired model of iSmart, and the number of connected expansion units if applicable, as shown below.



Menus, Icons and Status Bar

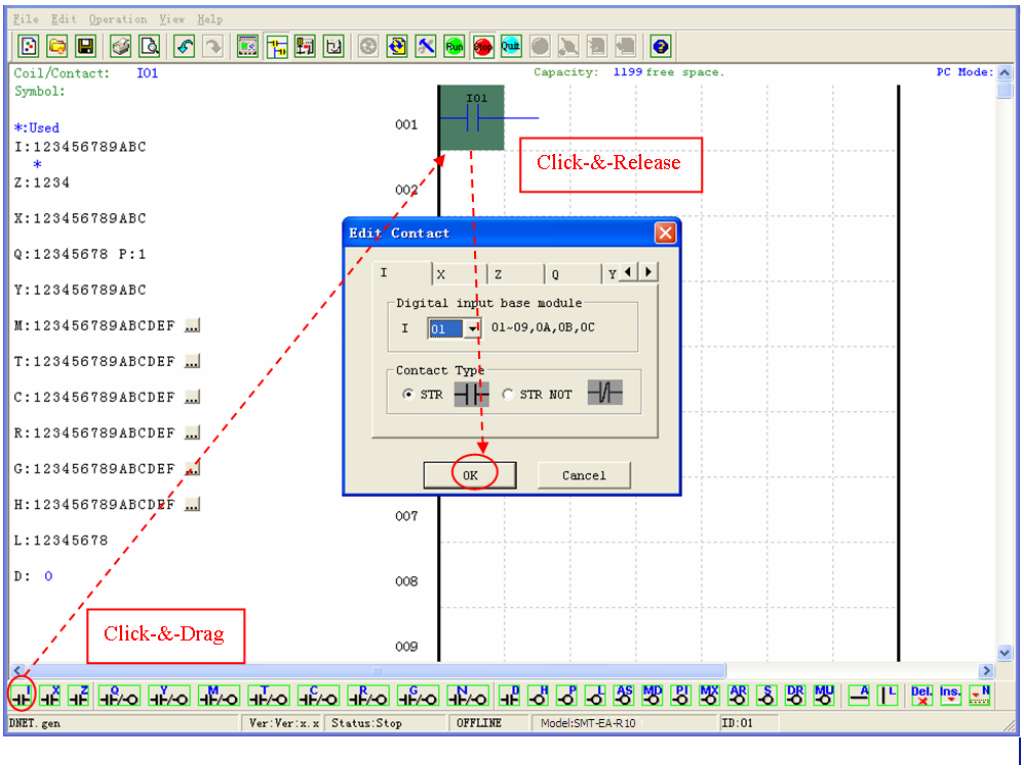
The Ladder programming environment includes the following Menus, Icons and Status Displays

1. Menu bar – Five menu selections for program development and retrieval, editing, communication to connected controllers, configuration of special functions and viewing preference selections.
2. Main Toolbar – (From Left to Right)
   Icons for create a new program, open a program, save a program and print a program.
   Icons for Keypad, Ladder view, HMI/Text edit and Symbol (comments) edit.
   Icons for Monitor, Simulator, Simulator Controller, Controller Mode changes (Run, Stop, and Quit), and Read/Write programs from/to the iSmart smart relay.
3. Usage List – List for all memory types and addresses used with the current open program. Used addresses are designated by a "*" symbol below each address.
4. Amount of free programming memory available.
5. Current Mode – Program mode, Simulator mode, Monitor mode.
6. Ladder Toolbar – Icons for selecting and entering all available Ladder Logic instructions.
7. Status Bar – Status of current open project and connect iSmart smart relay.

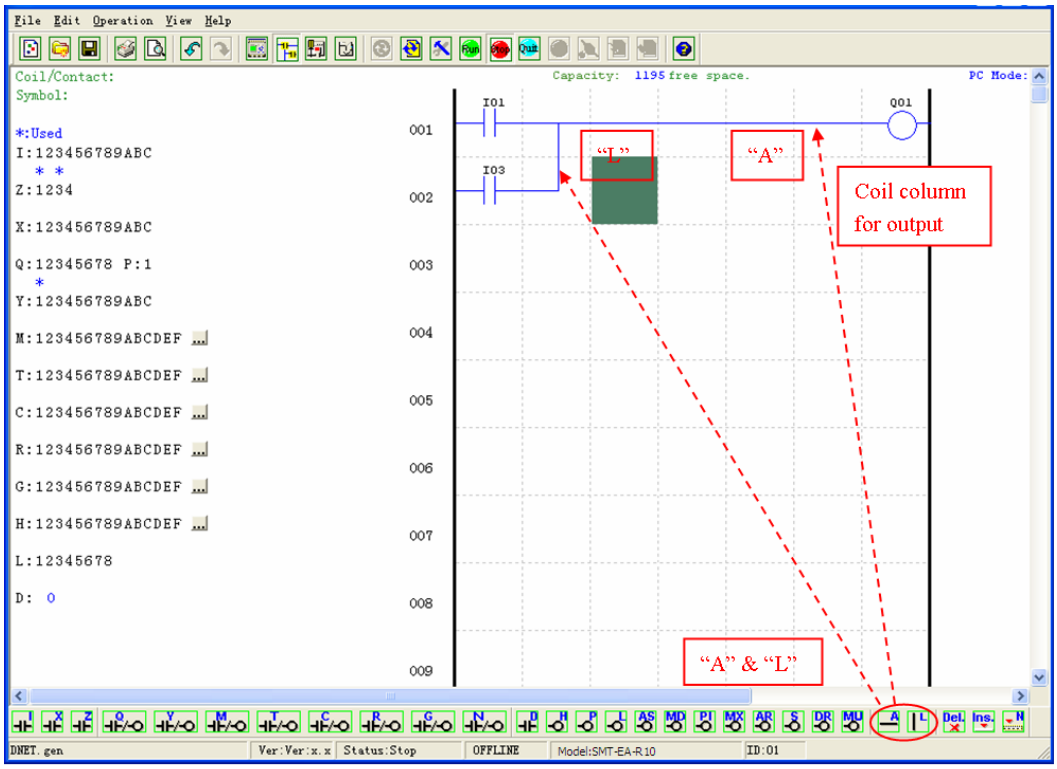


Programming

The SMT Client software can be programmed by either drag-and-drop of instructions or by using keyboard entry commands. Below is an example of some common methods of entering programming instructions.

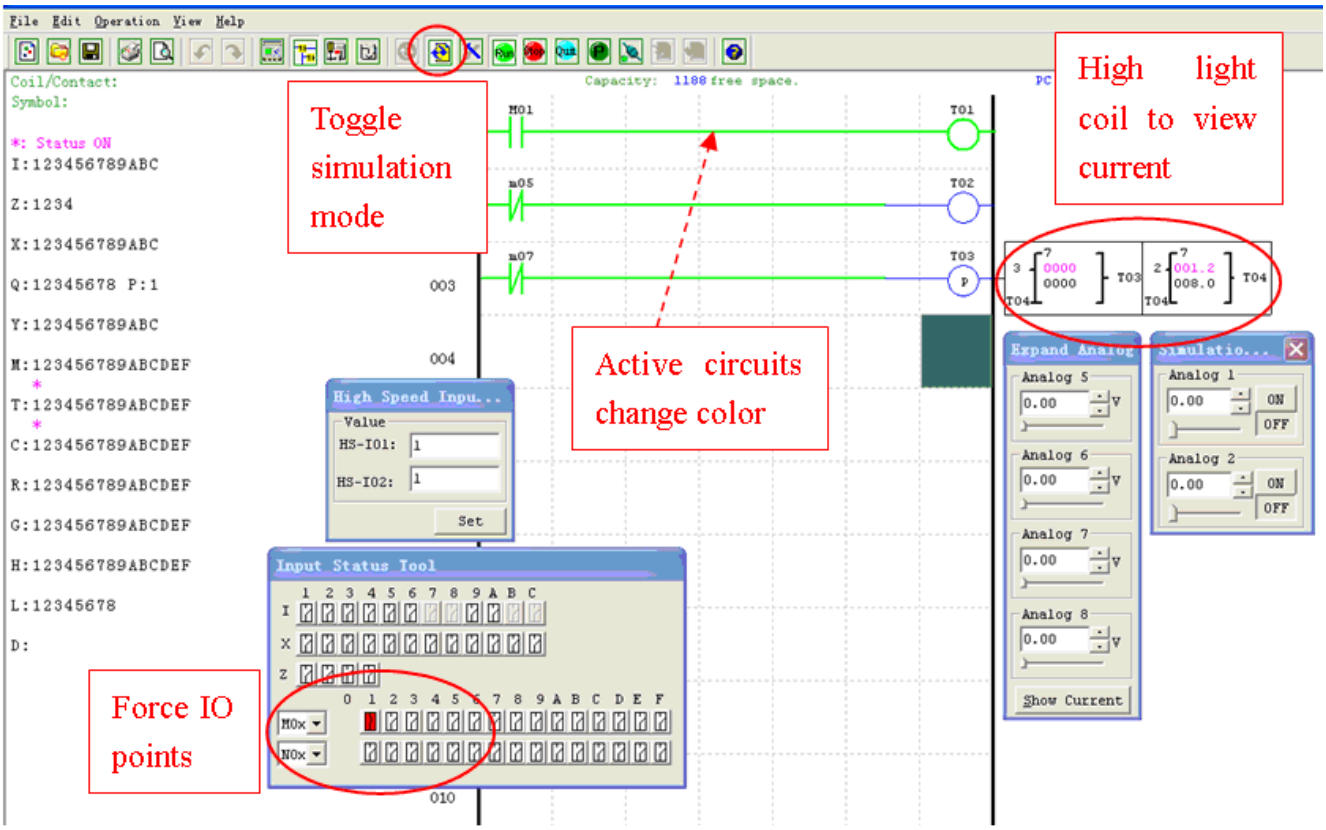


The “A” and “L” keys or icons are used to complete parallel and serial circuits. The right column is for output coils.



Simulation Mode

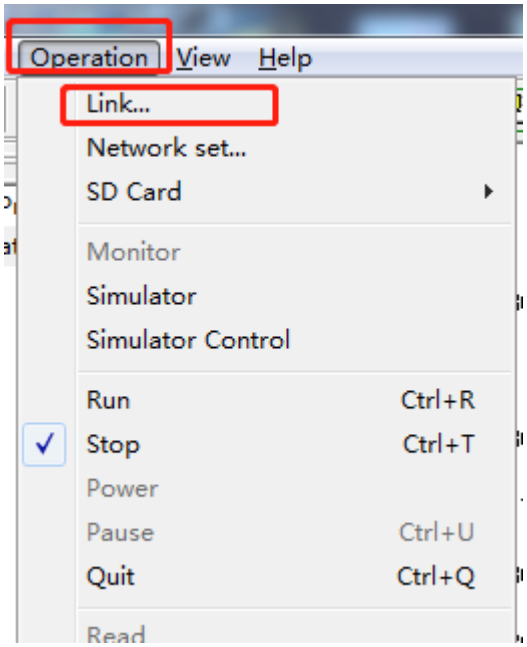
The SMT Client software includes a built-in simulator to test and debug programs easily without the need for downloading to a controller. To activate simulation mode, simply press the RUN icon. The program below is shown in simulation mode, identifying the significant available features.

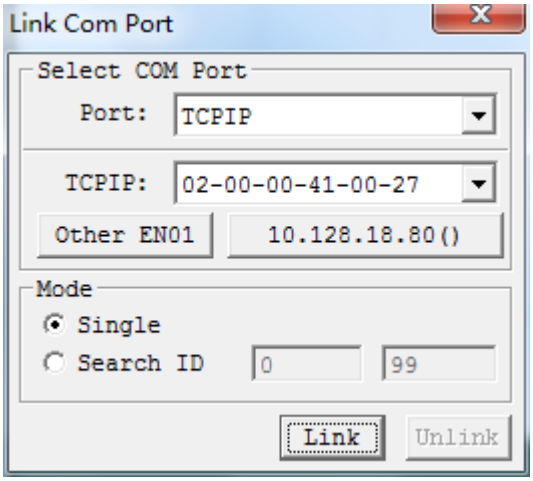


Establish Communication

The following is the simple procedure for establishing communication between PC and the iSmart smart relay.

a. Select "Operation/Link…" as shown below.



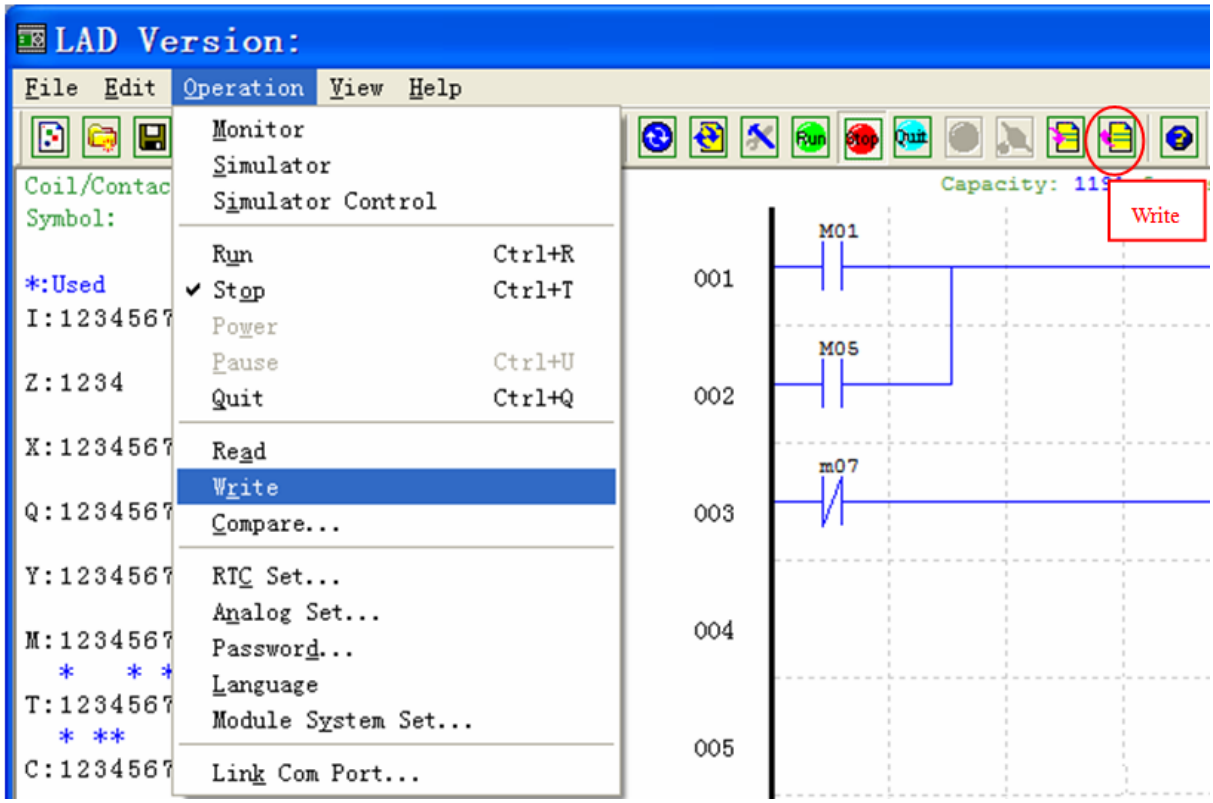


b. Select the correct IP address where the programming cable is connected to the computer then press the "link" button.

c. The SMT Client software will then begin to detect the connected smart relay to complete its connection.

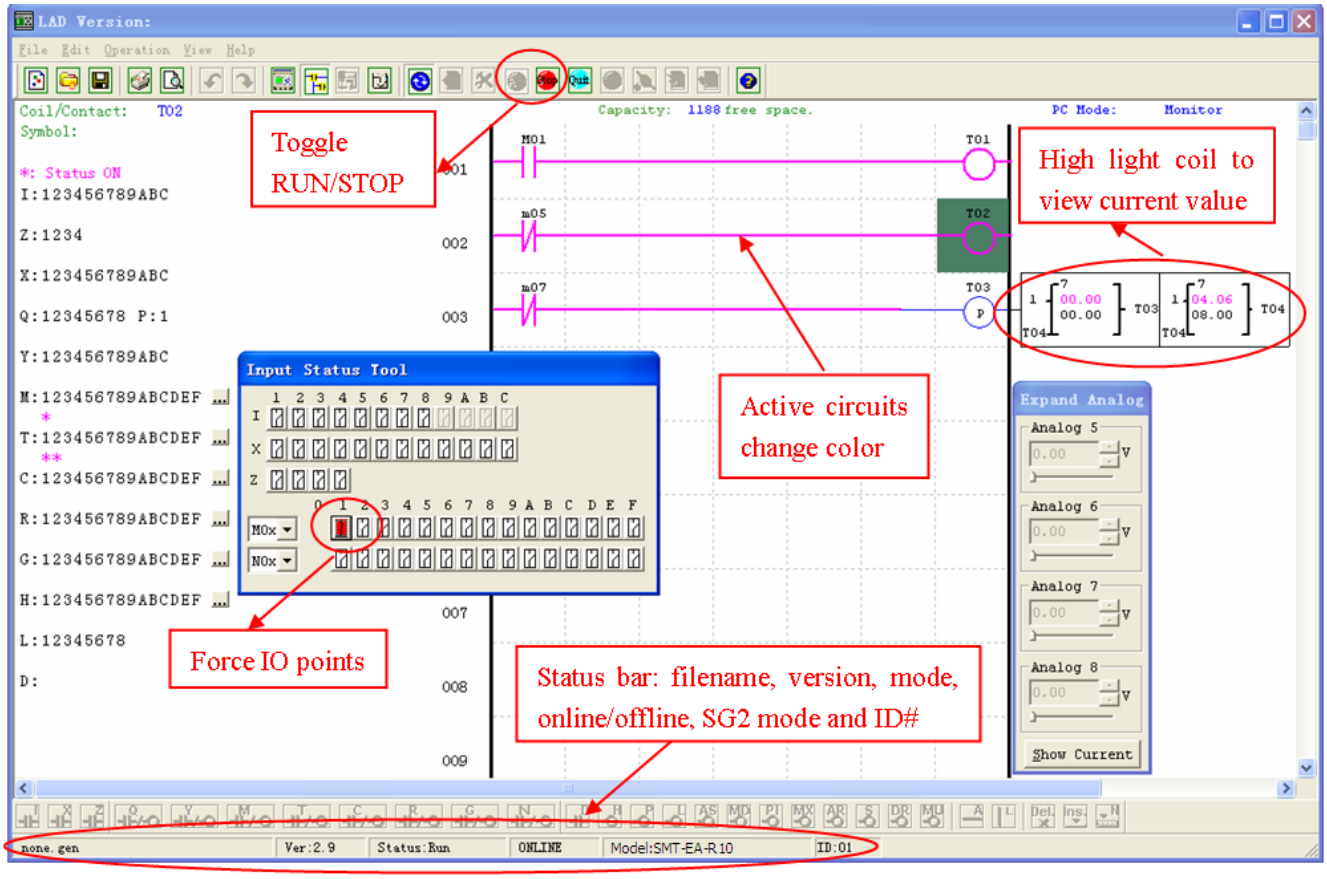
Writing Program to smart relay

From the Operation menu, select the Write function and write the program to the connected smart relay as shown below, or press Write button to write program to connected smart relay as shown below.



Online Monitoring/Editing

The SMT Client software allows for online monitoring of the currently running program during runtime. Additional online functions include, I/O forcing, and Mode changes (Run/Stop/Quit).

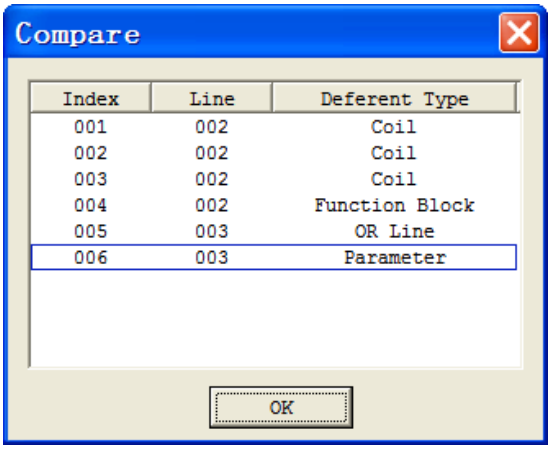


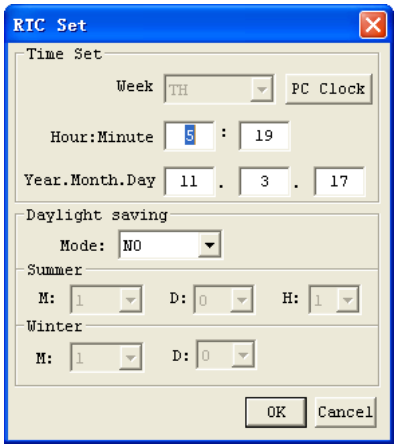
※ The SMT Client software does not support runtime logic editing changes. All logic edits to contacts, coils, Timers/Counters, and circuit connecting lines must be written to the connected smart relay while in Stop mode.

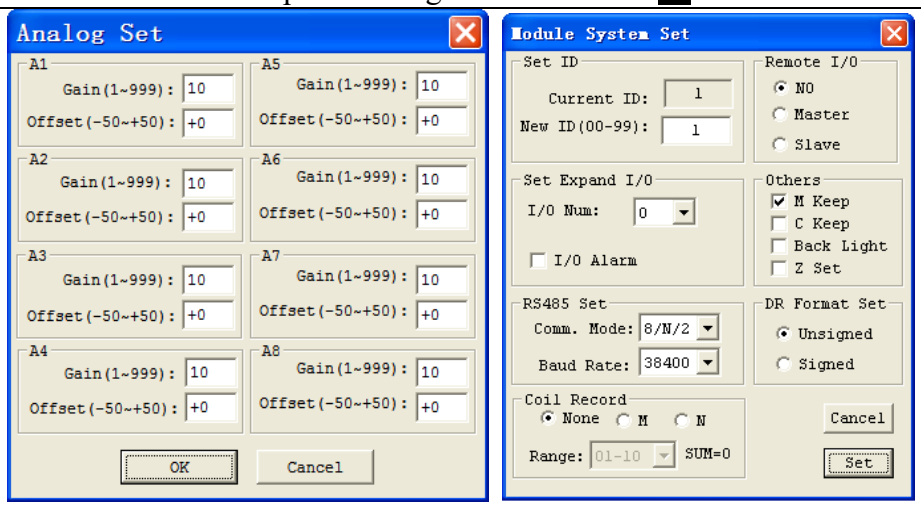
Operation menu

The Operation menu includes several system configurations functions for both online and offline setup. The following explains the details of each function.

Operation	Functional Description
Link…	Select the communication port between PC software and controller
Network set…	Network communication related parameters setting, network input and output mapping setting
SD Card	Memory card related operation Settings
Monitor	Stop running or stop simulator
Simulator	Self-motion simulator control
Simulator Control	Control running or simulator if not connect a smart relay
Run	Run plc
Stop	Stop plc
Power	Simulator control power down
Pause	Pause simulator
Quit	Quit monitor or simulator mode
Read	Read program form smart relay
Write	Write program to iSmart smart relay
Compare…	Read program form smart relay and compare difference with PC program
Check Error	Check the user program for errors
RTC Set…	Online function for setup of the Real-time clock/calendar
Analog Set…	Setup analog input A01-A08 gain and offset
Password…	Set a password for accessing the current program after upload to the smart relay
Language	Change iSmart smart relay menu language
Module System Set…	Important setting functions of iSmartsystem, including module ID, RS485 model function setting, expansion setting, etc.





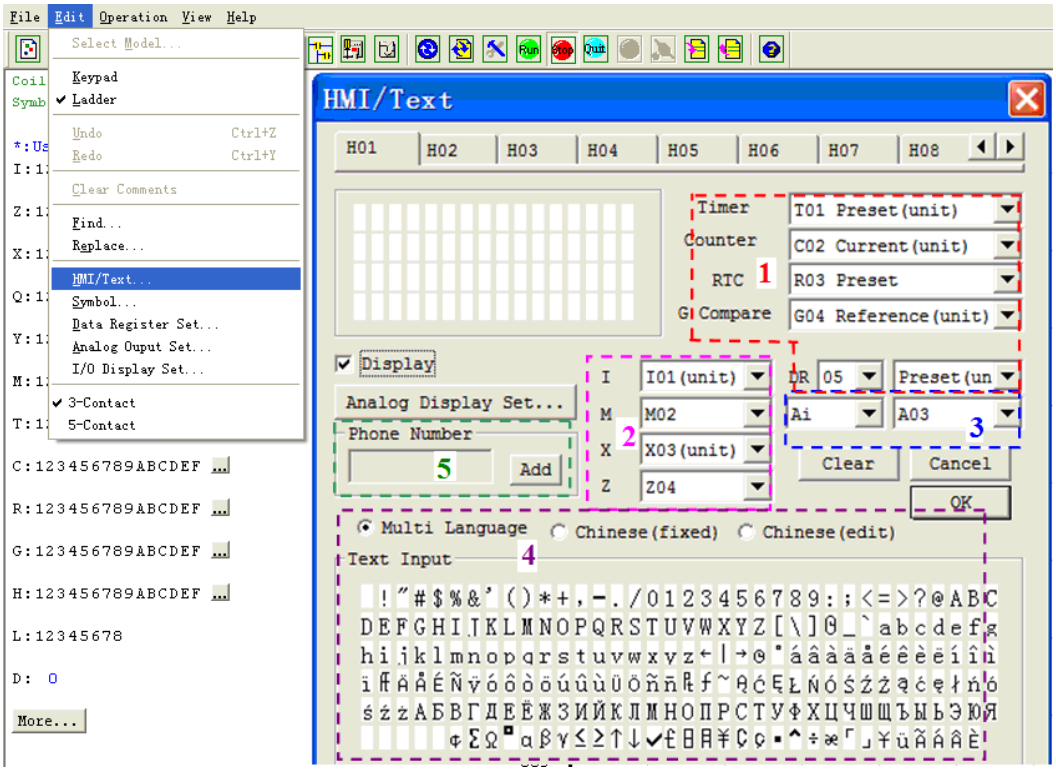


HMI/TEXT

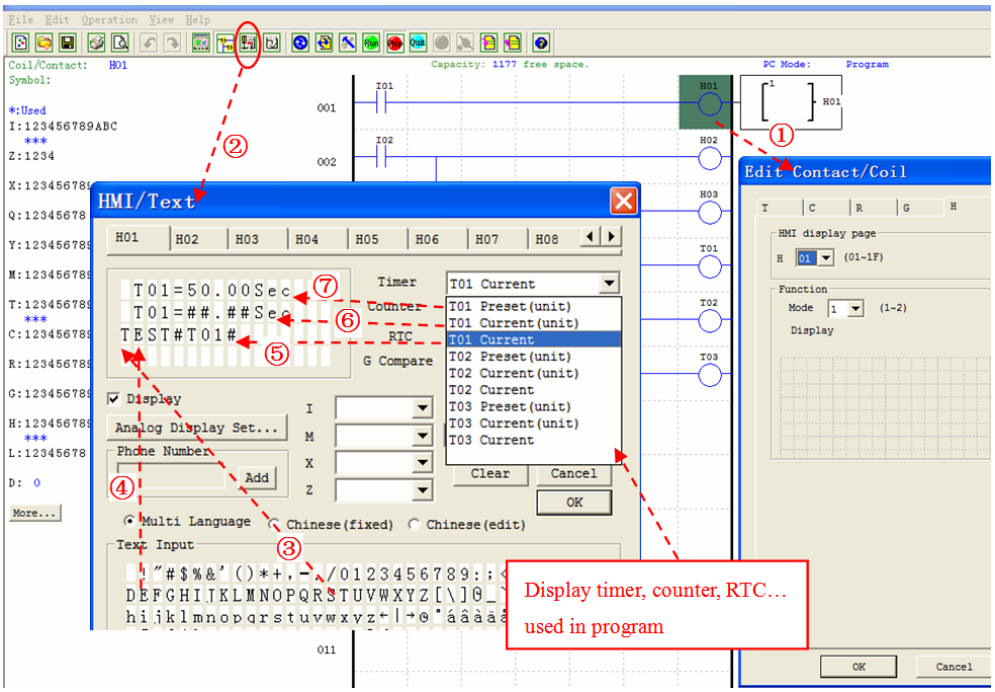
This function block can display information on 16×4 LCD screen:

1. Preset value or current value of function blocks, such as Counter, Timer, RTC, Analog comparator and DR register etc. Under running mode, to modify the preset value via HMI is available.
2. Coils status, such as input coils I, Z, X and auxiliary coils M. Under running mode, to modify the M status via HMI is available.
3. Analog input value (A, AT) and analog output value (AQ);
4. Build-in ASCII code and multi-language characters; Build-in Chinese characters; User-defined Chinese characters.
5. Telephone number.

HMI/TEXT editing and parameter setting interface, as shown below.



HMI/TEXT setting (step 1~7):



① Enter H01 coil

② Into HMI/TEXT edit frame

③ Choice the “T”

④ Choice the “E”

⑤ Choice T01 current

⑥ Choice T01 current (unit)

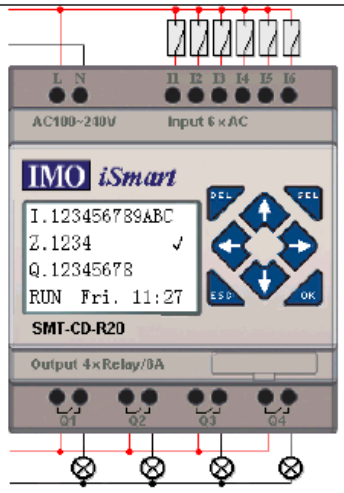
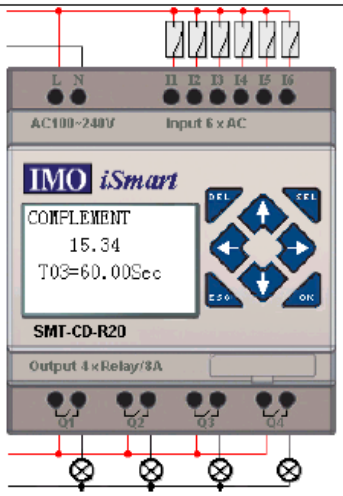
⑦ Choice T01 present (unit), user can modify T01 preset value when H coil enable and display on LCD.

Download to iSmart, and I01 turn ON, or press “SEL” if the H coils is set to mode 1, then the iSmart LCD will display the first H text as shown below.

Ⅰ, Press “ ” or “ ” to choose the nearest H coil

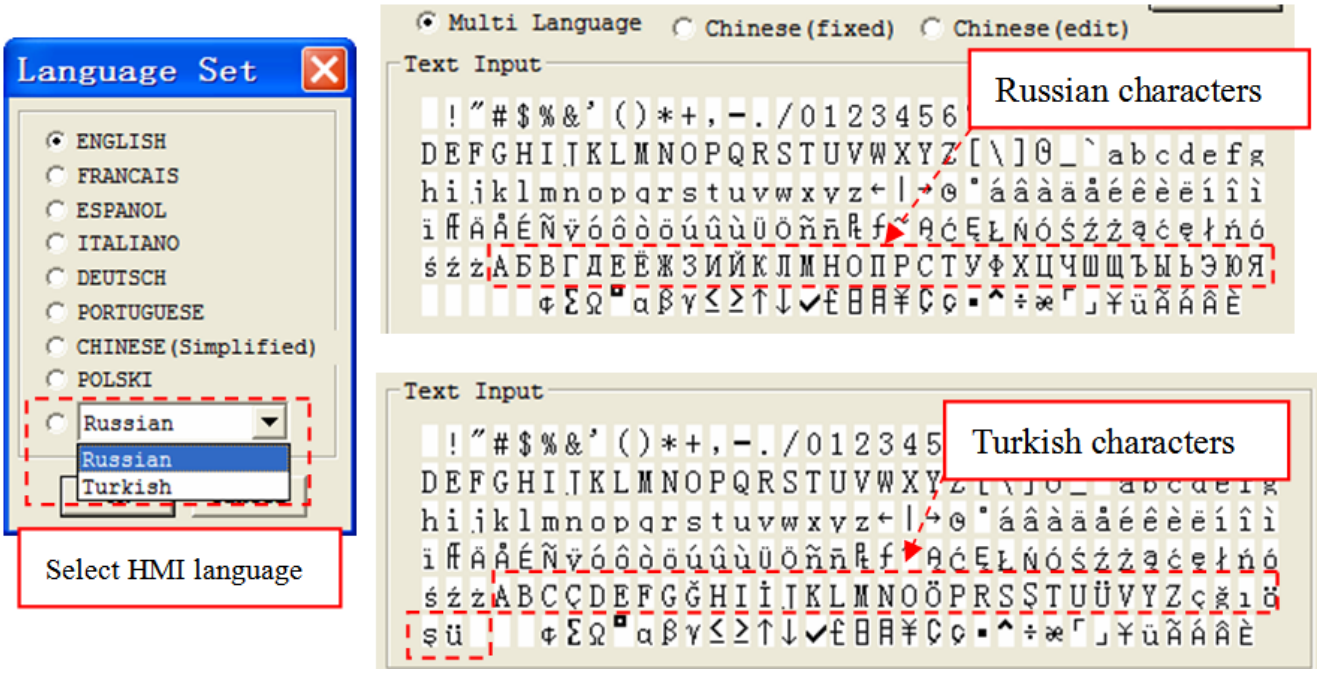
Ⅱ, Press “SEL”+“↑” or “↓”and “OK” update T01 preset value (In this example, 050.0 can update, T01 preset value depends on HMI/TEXT edit frame setting.)

HMI/TEXT Example:

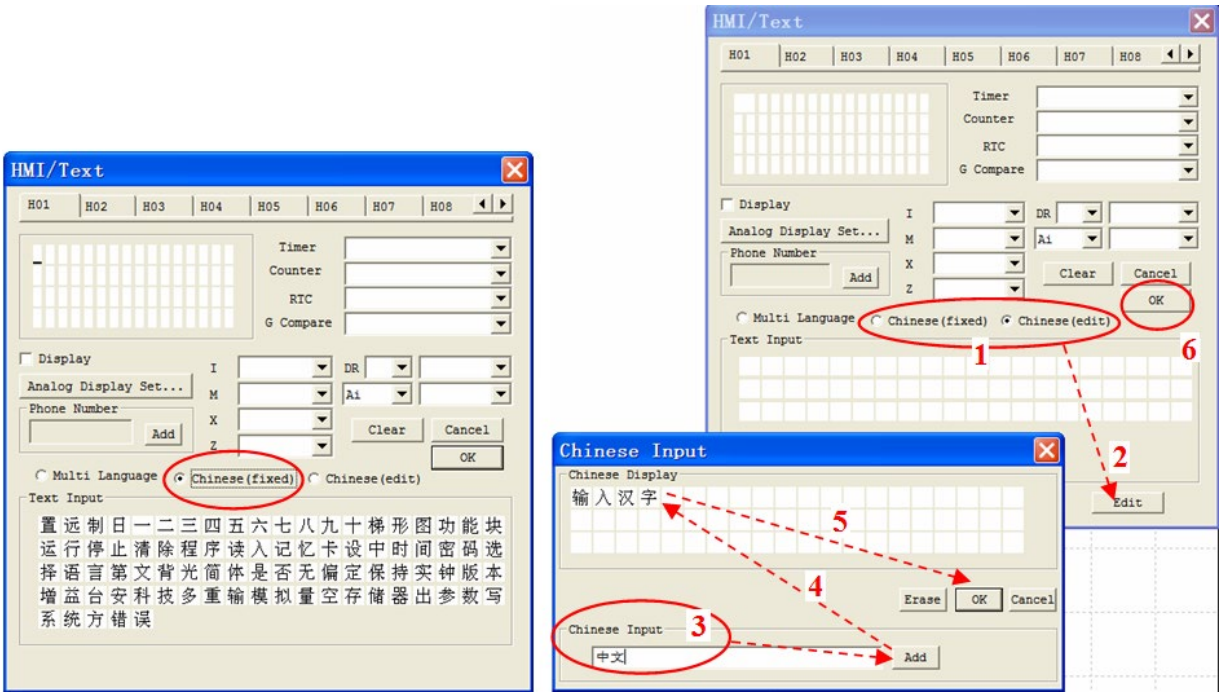
Power ON and RUN (initial display)	Press “↑” (Z01) and display H03 coil
	

Build-in ASCII code and multi-language characters:

Multi-language characters including English, French, Spanish, Italian, German, Portuguese, Polish;
Also, according to the different settings, you can display Russian or Turkish characters.

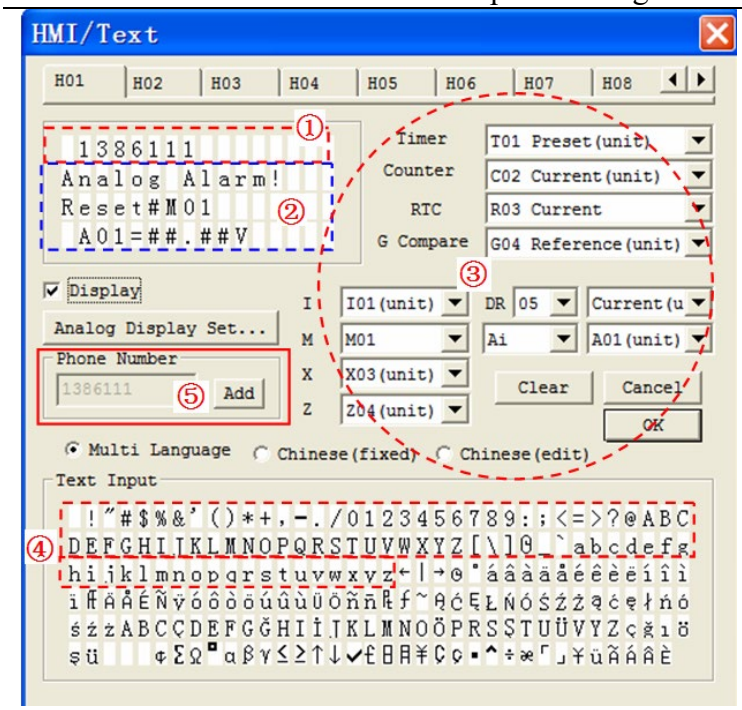


85 Built-in Chinese characters, which read as following left of the HMI/TEXT editor window;
60 characters which user define, edit step 1~6 as follows right of the HMI/TEXT editor window.



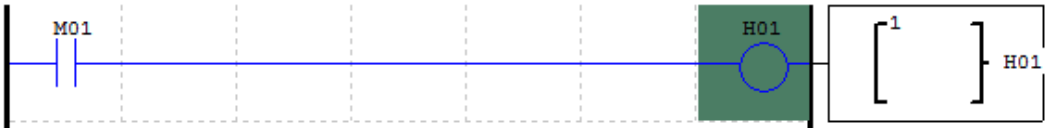
Setting telephone number (GSM module SMS function):

Build-in 20 HMI (H01~H14) can be set telephone number for SMS alarm. When HMI which set telephone is enabled, iSmart save text information. Extension GSM module send this HMI text to telephone after reading this HMI text.



Line1 set telephone number (shown as ①). Only set by dialog ⑤ and max 15 number characters.

Line2~line4 set text information (show as ②), include preset value and current value of function block, coil status (shown as ③) and ASCII characters (shown as ④).



Stop display

```
 1386111
Analog Alarm!
Reset#M01
 A01=##.##V
```

Run display

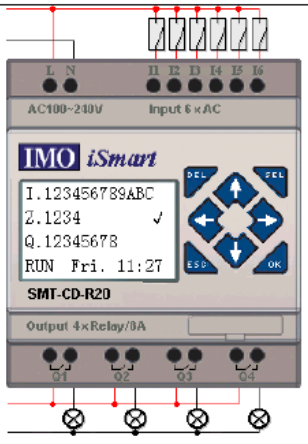
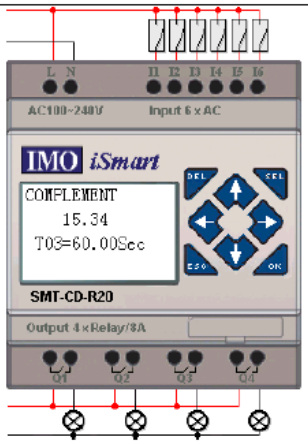
```
PHONE
Analog Alarm!
Reset OFF
 A01=09.00V
```

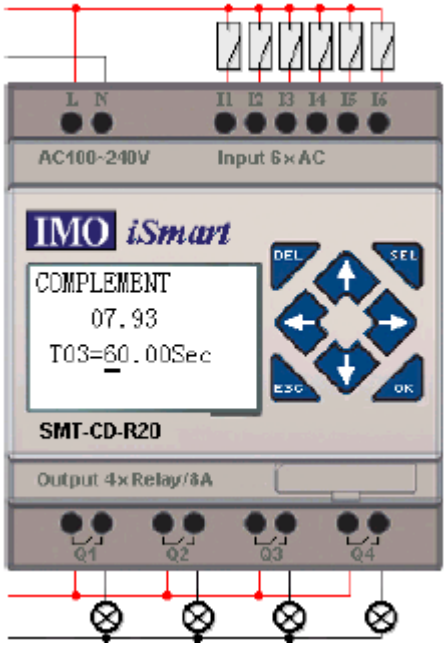
Example:

1, iSmart saved H01 display information (M01 status and A01 value) when M01 is enabled rising edge.

2, Extension GSM module send SMS to telephone (H01 line1 number) after reading message (H01 line2~line4 text information).

Example: HMI/TEXT and Z keypad input function

Power ON and RUN (initial display)	Press "↑" (Z01) and display H03 coil
	



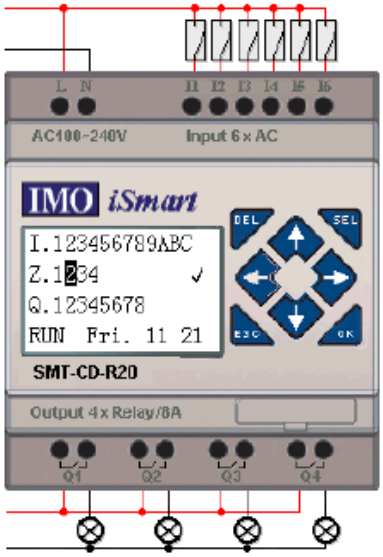
① Press “SEL” to display cursor

② Press “↑”, “↓”, “←”, “→” to move cursor

③ Press “SEL” again to choice modified position

④ Press “↑”, “↓” to change number and press “←”, “→” to move cursor

⑤ Press “OK” to make sure the modify value



Press “←” (Z02) to disable H03 coil, and the LCD display changes to initial frame.

Press “↓”(Z03) to reset Timer (T01、T02、T03) as program designed.

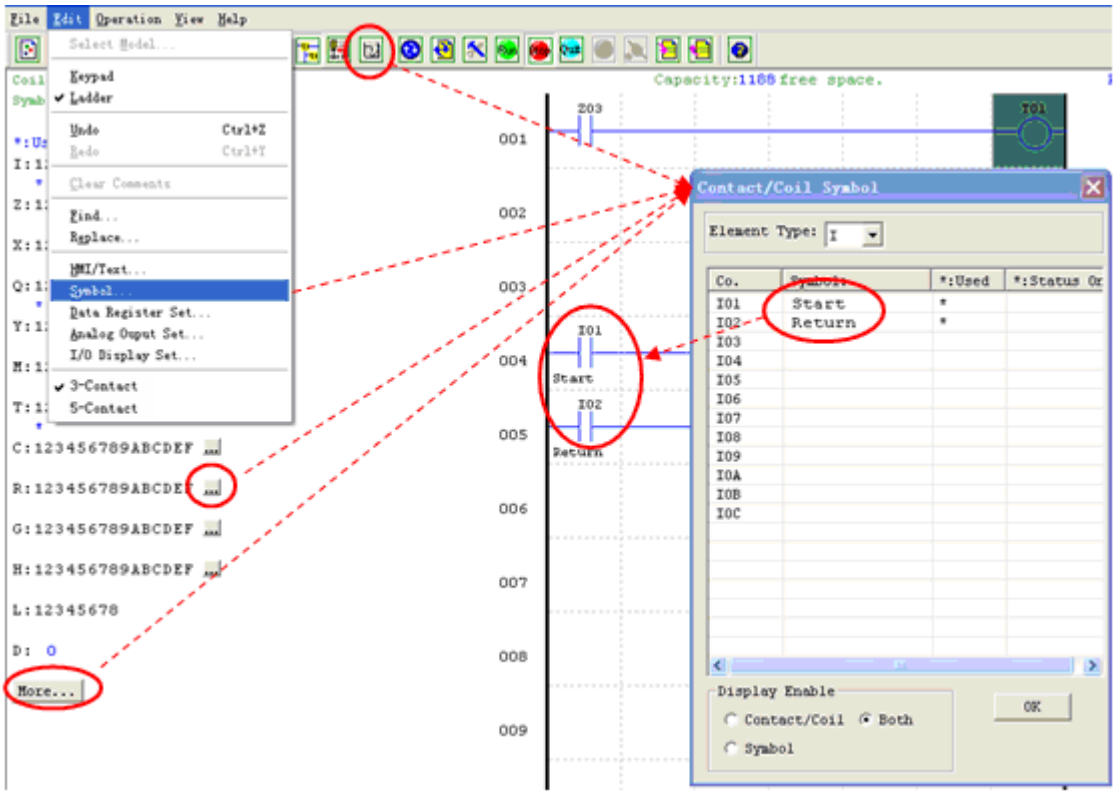
Program Documentation

The SMT Client software includes the ability to document a program using Symbols and Line Comments. Symbols are used to label each I/O address up to a length of 12 characters. Line Comments are used to document sections of a program. Each Line Comment can have up to 4 lines with each line containing up to 50 characters in length. Below are examples of entering Symbols and Line Comments.

Symbol…

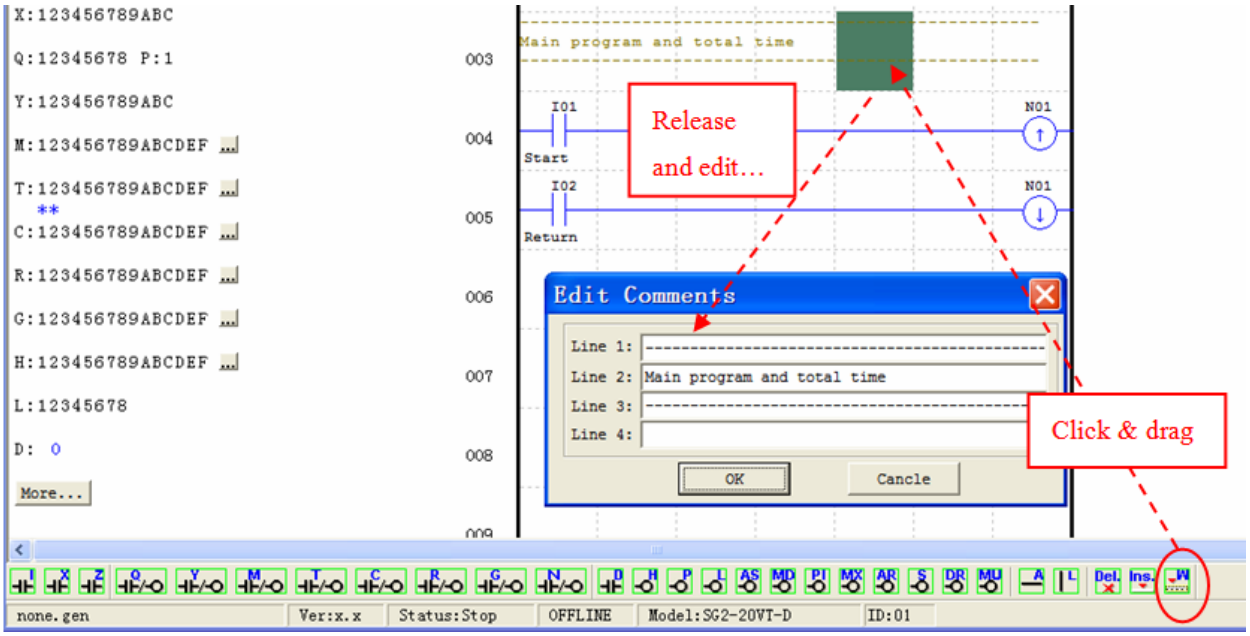
The Symbol editing environment can be access through the menu using the **Edit>>Symbol…** selection or using the symbol icon on the main toolbar shown below.

The Symbol editing environment allows for documenting all the contact and coil memory types and selecting display modes as shown below.



Line Comments

The Line Comment editor is accessed by clicking the "W" icon on the Ladder Toolbar. After clicking on the "W" icon, to drag the line number you want to comment and release, and then type the desired comments and press OK.



Analog Output Set…

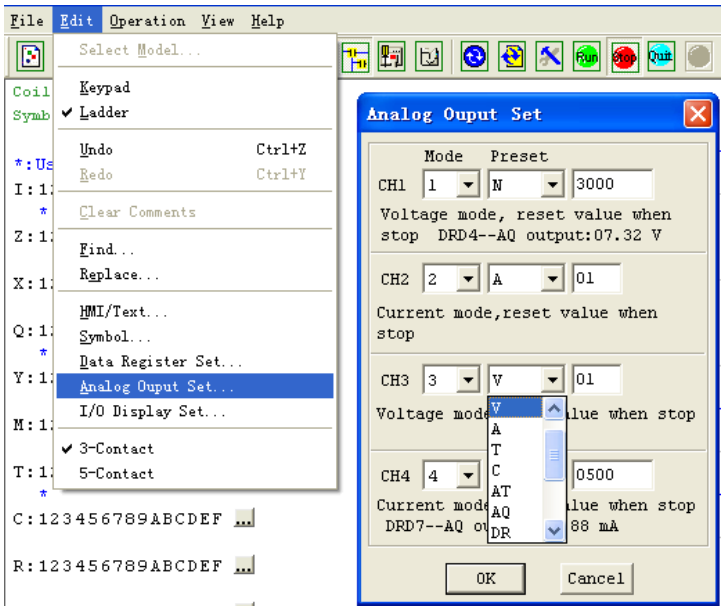
The AQ editing environment can be access through the menu using the **Edit>> Analog Output Set…** selection shown below. CH1~CH4 correspond to analog output AQ01~AQ04.

The range is 0~4095 if the output mode is voltage mode.

The range is 0~2047 if the output mode is current mode.

The preset value of AQ can be set as either a constant or a code of other data. The output mode of AQ and preset value are set as below. More information about output mode and displaying to see: Chapter 4: Relay Ladder Logic Programming-AQ (Analog Output).

AQ output mode (current or voltage) depends on the current value of DRD0~DRD3 register. The current value of DRD4~DRD7 decides the AQ output value!



The below table show an example for the setting value and output results.

	Mode Register	Output Value Register	AQ output value
Channel1	DRD0=0 AQ output mode 1: voltage mode and reset value when stop;	DRD4=3000	AQ01=732 (DRD4/4.095) AQ output 7.32V
Channel2	DRD1=1 AQ output mode 2: Current mode and reset value when stop;	DRD5=A01*4.095 Current mode 0~2047	AQ02=A01 Current mode 0~500
Channel3	DRD2=2 AQ output mode 3: voltage mode and keep value when stop;	DRD6= V01*4.095 Voltage mode 0~4095	AQ03=V01 Voltage mode 0~1000
Channel4	DRD3=3 AQ output mode 4: Current mode and keep value when stop;	DRD7=2047	AQ04=500 (DRD7/4.095) AQ output 20.00mA

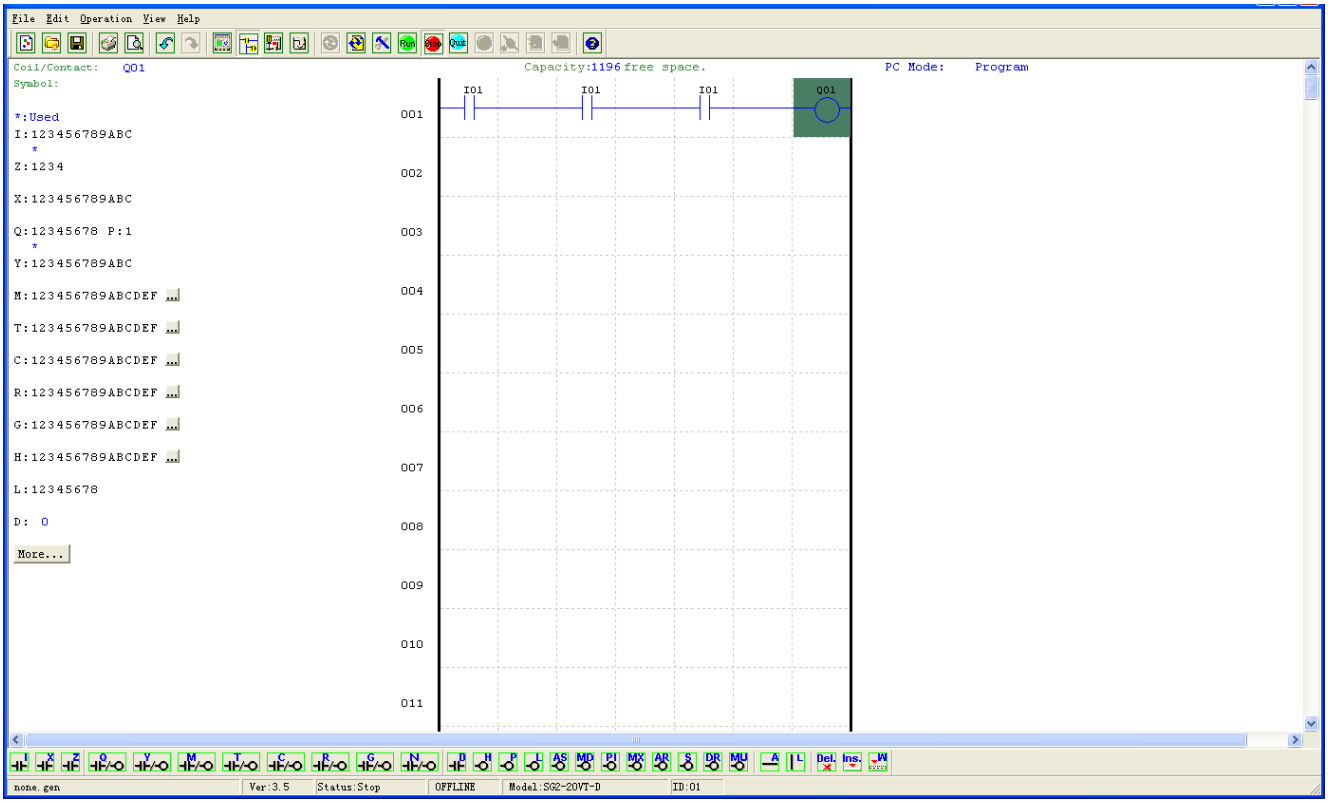
※ When output value type of AQ is set to constant, AQ output value changed by DR value (AQx=DRx/4.095);

※ When output value type of AQ is set to other parameters variables, DR value changed by AQ output value (DRx=AQx*4.095).

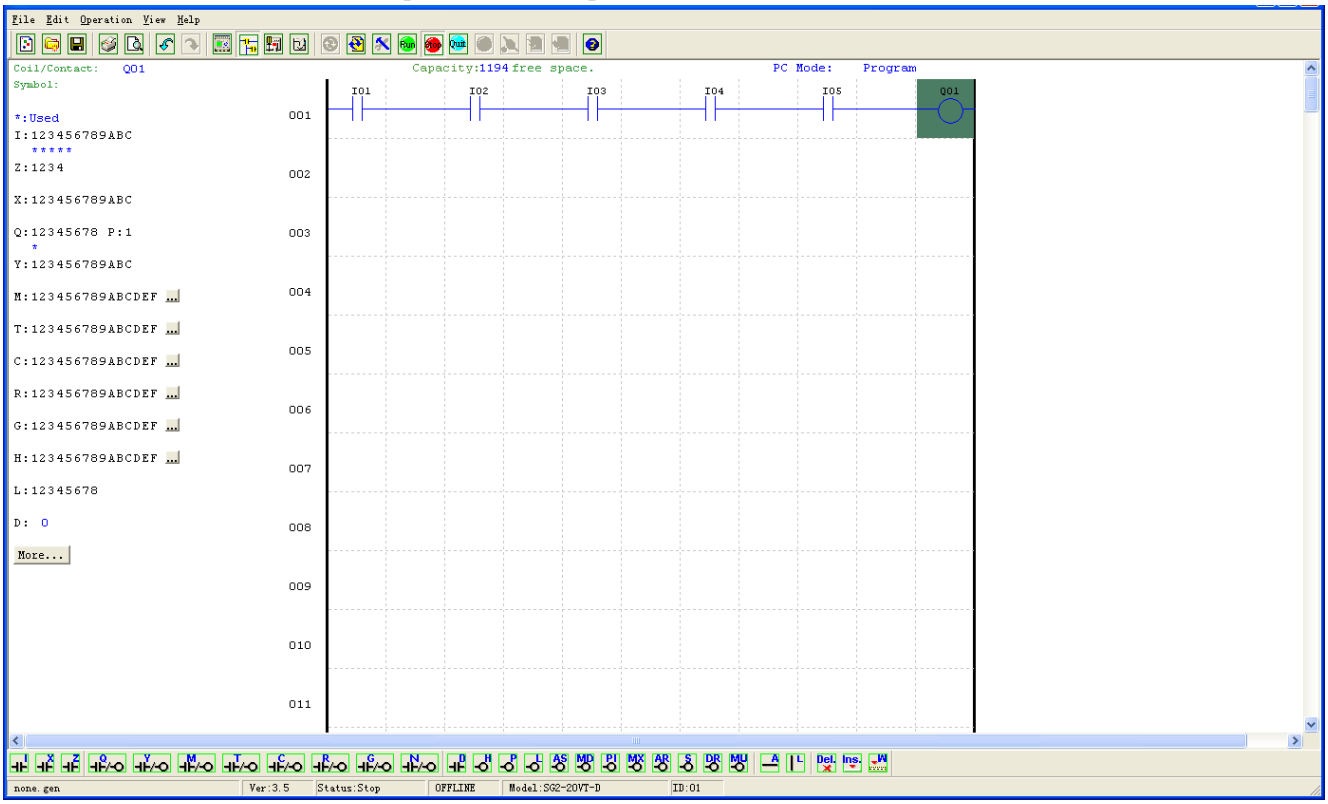
3-Contact/5-Contact

There are 3-contact and 5-contact edit modes available in iSmart LADDER mode.

In 3-Contact mode, there are three inputs and one output available in one ladder line. And the maximum line number is 600.



In 5-Contact mode, there are five inputs and one output available in one ladder line

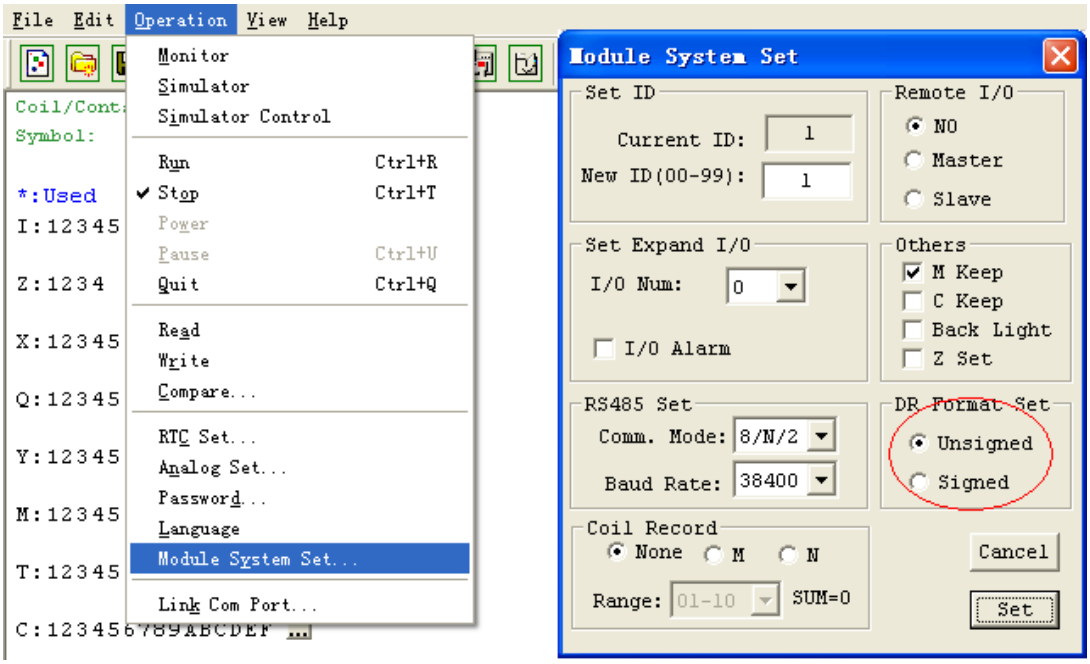


In 3-Contact mode, if the ladder line is more than 200, the mode cannot change to 5-Row.

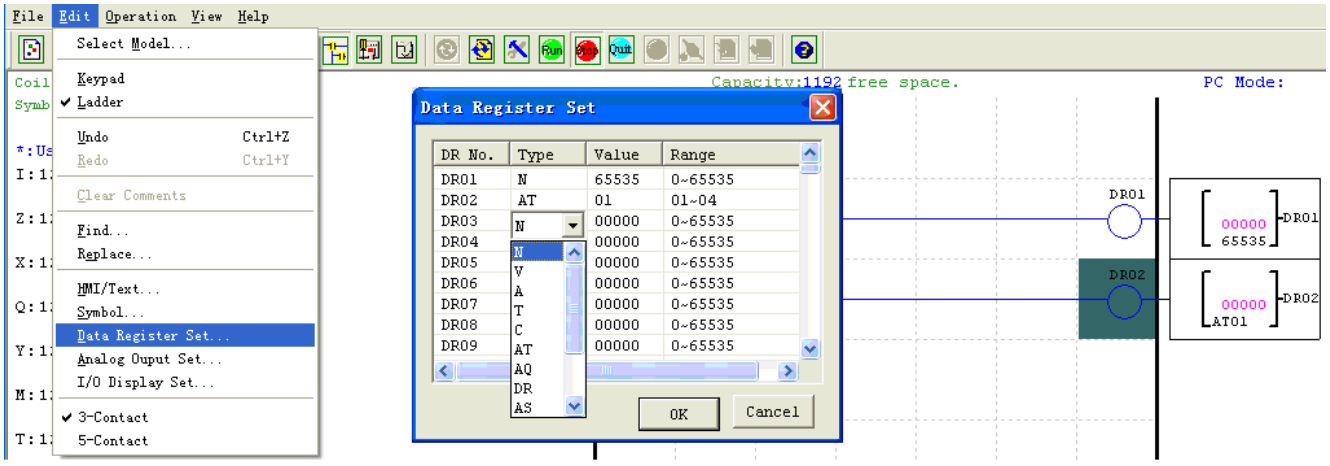
In 5-Contact mode, if the input coil number is more than three, the mode cannot change to 3-Ros.

Data Register Set…

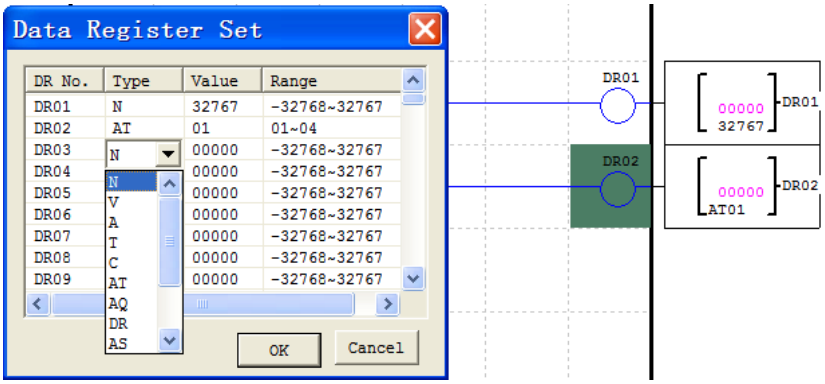
The content of Data Register is either unsigned or signed, it can be set as shown below. Selecting Unsigned, the range of DR is 0~65535; and selecting Signed, the range of DR is -32768~32767.



After the operating above, the Data Register editing environment can be access through the menu using the **Edit>> Data Register Set…** selection shown below. The preset value of DR can be set as either a constant or a code of other data type. For more information about DR to see: Chapter 5: Relay Ladder Logic Programming-DR (Data Register).



DR is set as signed shown below.



Special DR Register Function

If the special DR coil, DR65~DRF0, is used as a special register, it does not need to be enabled; it works as common register (its current value will equal to the pre-set value) once it is enabled.

The DR65~DRF0 can retain the current value when stop or power down.

DRD0 ~ DRE3 as special registers used to set parameters, the output value function is as follows:

No.	Function description	
DRD0	AQ01 output mode	0, voltage mode and reset value when stop; 1, current mode and reset value when stop; 2, voltage mode and keep value when stop; 3, current mode and keep value when stop;
DRD1	AQ02 output mode	
DRD2	AQ03 output mode	
DRD3	AQ04 output mode	
DRD4	AQ01 output value	Analog output value 0~4095;
DRD5	AQ02 output value	
DRD6	AQ03 output value	
DRD7	AQ04 output value	
DRD8	I/O interface hidden	Refer to "Chapter3:LCD Display and Keypad > Original screen"
DRE1~DRE3	Reserved;	

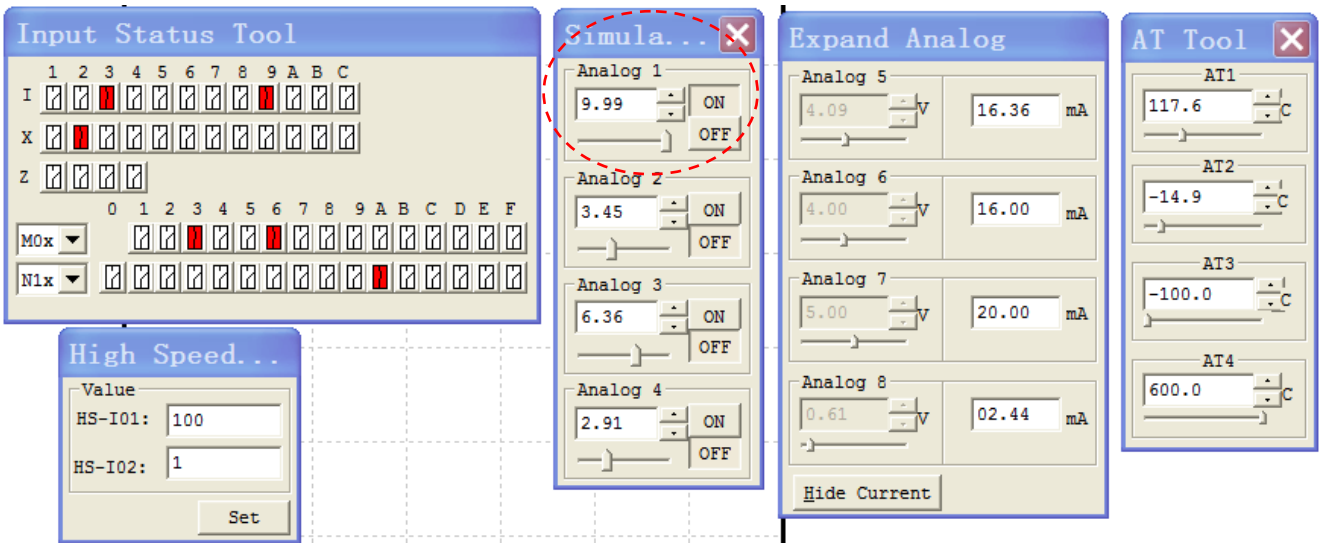
DRC9~DRCF and DRD9~DRF0 as special registers used to store status, the output current value function is as follows:

No.	Function description	
DRC9	Output pulse number of instructions PLSY	
DRCA	AT01 current degree Fahrenheit	Used as normal registers when no AT01~AT04 input, such as don't connect with extension module 4PT;
DRCB	AT02 current degree Fahrenheit	
DRCC	AT03 current degree Fahrenheit	
DRCD	AT04 current degree Fahrenheit	
DRCE	Save RTC function mode5 sunrise time	
DRCF	Save RTC function mode5 sunset time	
DRD9~DRDF	Keep RCT value	Year/Month/Day/Week/Hour/Min/Sec
DRE0	Keep No. of last enable M/N	The configuration is in Model System Set Dialog. When running, the number of last enable M/N will be kept in DRE0.
DRE1~DRE3	Reserved	
DRE4	A05 input electric current 0~2000	Used as normal registers when no A05~A08 analog input, such as don't connect with extension module 4AI;
DRE5	A06 input electric current 0~2000	
DRE6	A07 input electric current 0~2000	
DRE7	A08 input electric current 0~2000	
DRE8	A01 current value 0~4095	Used as normal registers when no A01 and A02 analog input, such as AC type;
DRE9	A02 current value 0~4095	
DREA	A03 current value 0~4095	Used as normal registers when no A03 and A04 analog input, such as AC type or 12points DC type;
DREB	A04 current value 0~4095	
DREC	A05 current value 0~4095	Used as normal registers when no A05~A08 analog input, such as don't connect with extension module 4AI.
DRED	A06 current value 0~4095	
DREE	A07 current value 0~4095	
DREF	A08 current value 0~4095	
DRF0	Reserved	

View menu

The view menu includes software display option selection. The following explains the details of each function.

View Help	Functional Description
✔ I/O	Display usage list
✔ Function	Display function block and parameter
✔ Capacity	Display capacity left space
✔ Input Status Tool	Monitoring or Simulation coil status (I, X, Z, M, N)
Data Link Status Tool...	Simulation IO Link W status(only RS485 type)
✔ Simulation Analog Tool...	Monitoring or Simulation analog input A01~A04(only DC type)
✔ Expand Analog Tool...	Monitoring or Simulation expand analog input A05~A08
✔ High Speed Input Tool...	Simulation high speed input(only DC type)
✔ AT Tool...	Monitoring or Simulation expand temperature input AT01~AT04
✔ Ladder Toolbar	Display Ladder Toolbar



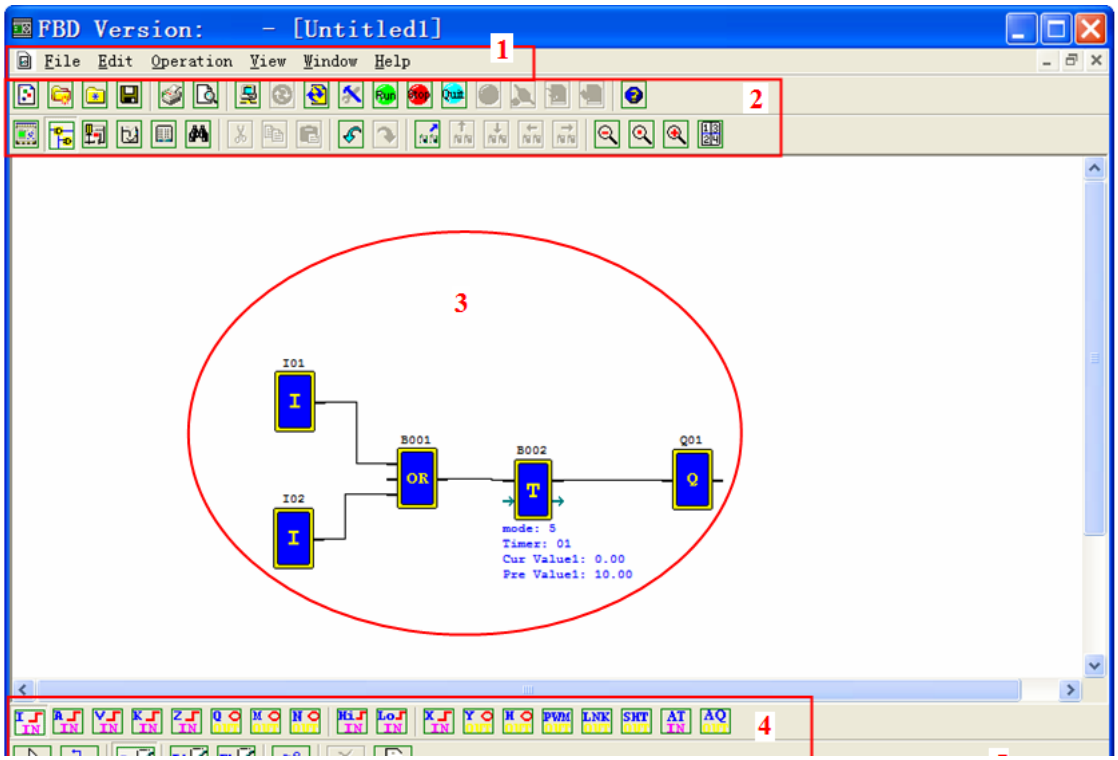
- Analog input A01~A04, correspond to coil input I09~I0C;
  When analog input increased to 9.98v, the coil input set ON;
  When analog input reduced to 5.00v, the coil input set OFF;
- Expand analog input A05~A08, the input data value 0~9.99v, and current display mode 0~20.00mA;
- Expand temperature input AT01~AT04, the input data value -100.0~600.0℃;
- High speed input tools, used for simulation high speed input I01&I02.

FBD Programming Environment

The FBD Programming Environment includes all the functions for programming and testing the iSmart using the FBD programming language. To begin a new program, select **File-->New**, and select the desired model of iSmart, as shown right. FBD programming operation is same as Ladder.

Menu, Icons and Status Bar

FBD environment include menu, icon and status bar refer to below figure.



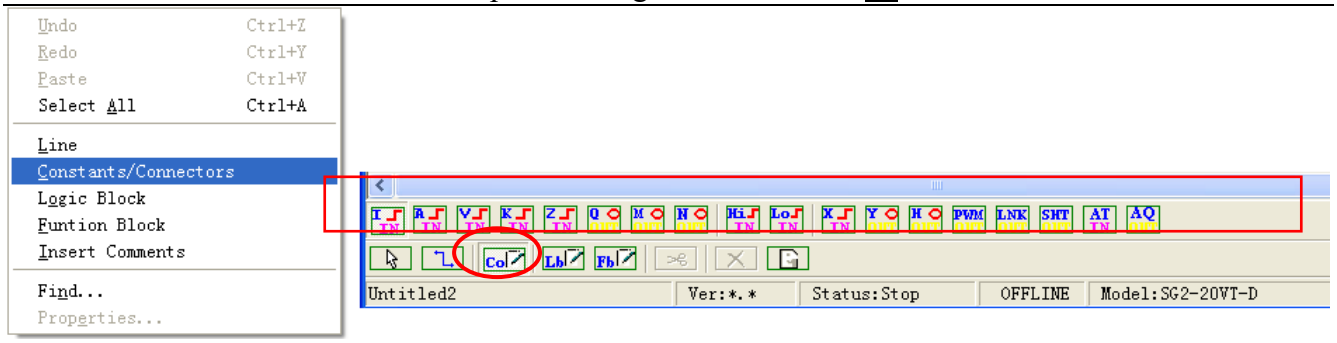
1. Menu: 6 menu options, including file operations, editing, and iSmart communications settings, configure the special features, display settings, help information and other functions.
2. Tools bar: The first line of icons from left to right in turn is expressed as: new, open, save program icons, monitoring, simulation, control mode change (RUN, STOP, QUIT), read program from iSmart, write program to iSmart; The second line of icons from left to right in turn is expressed as: button panel displays, FBD display, HMI / TEXT editor, comments Symbol Editor icon, the parameter list, etc.;
3. Programming Area: Coils and logic function blocks which need to be edited should put into this area and use the connection to connect.
4. FBD tools bar: Each option can be chosen to edit the coil and function block instructions.

From left to right for normal selection operation, connection, coil, logic function blocks, special function blocks, scissors operation, deletion, and annotation tools.

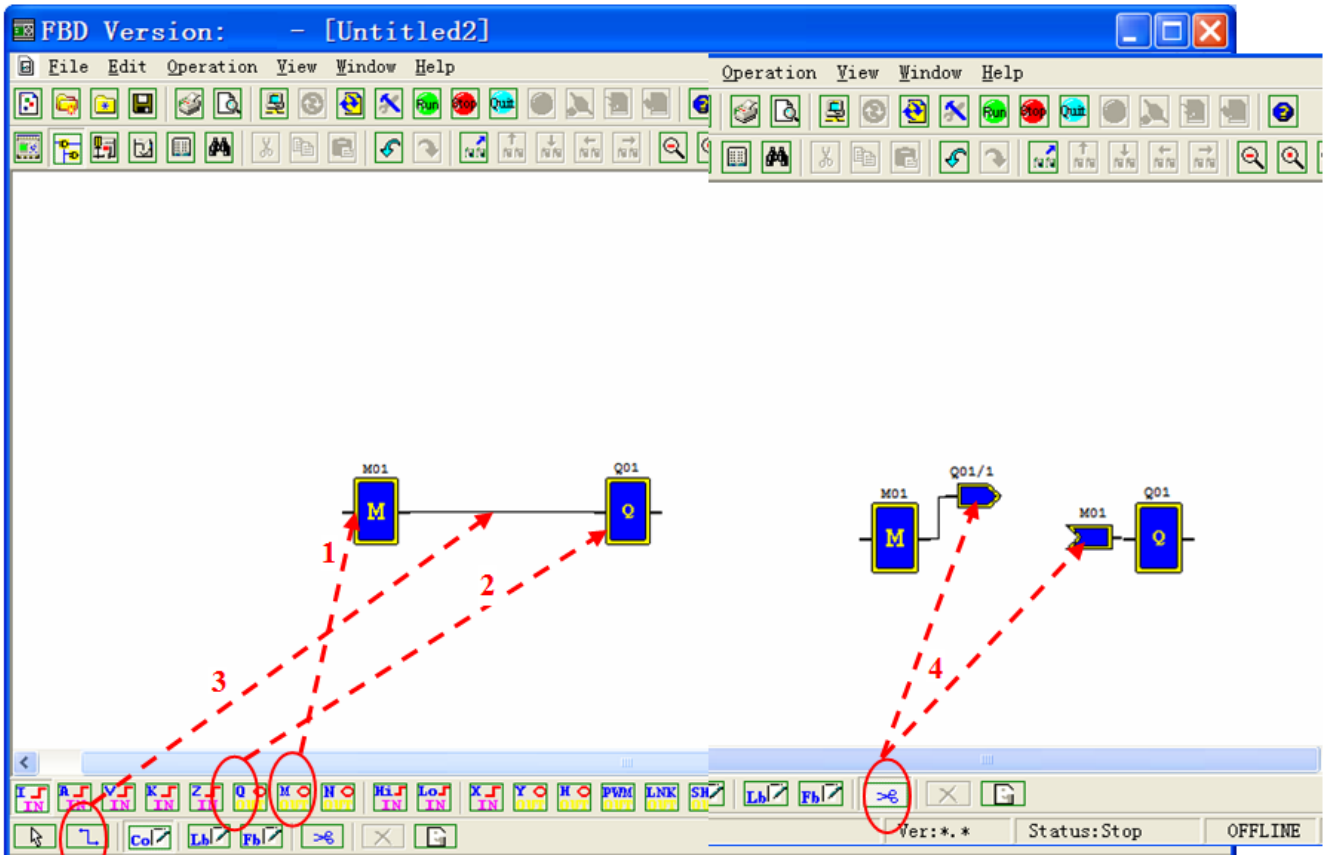
5. Status bar: Indicates that the current program and the connection status and other information iSmart .

Programming

The program can be edited by mouse, the following example describes the instructions for programming. Click the right mouse button, selecting "**Constants/Connectors**" on the appearing screen like below left one, or simply click on the FBD the toolbar (see below right), then all available coil icons will come out.

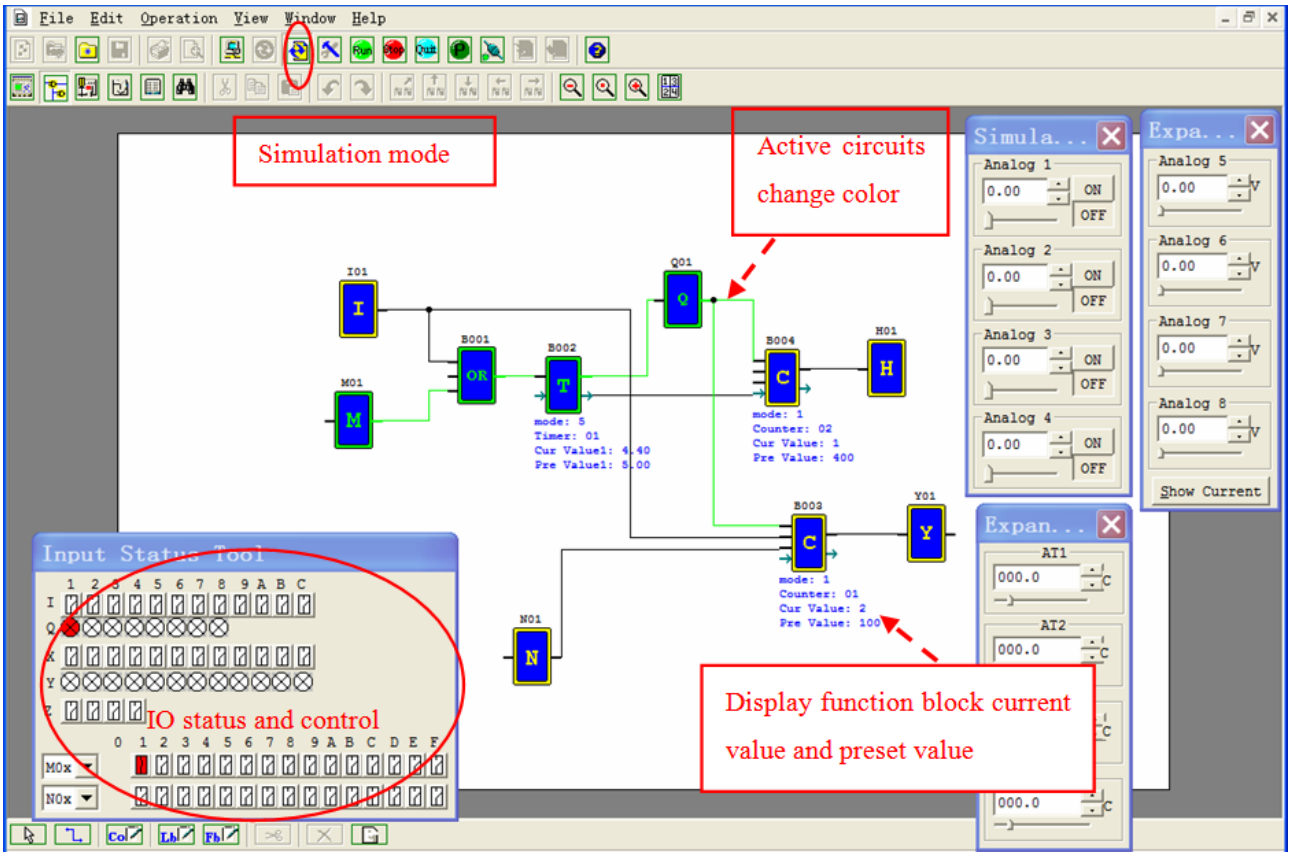


Were selected symbol "M" and the "Q", the icon will be put to the editor area, and used to connect the two coils connected as the left part of (Operation 1~3); if multiple cross-connections, they can use "scissors" functional separation of the connection shown in the following figure the right part (operation 4);

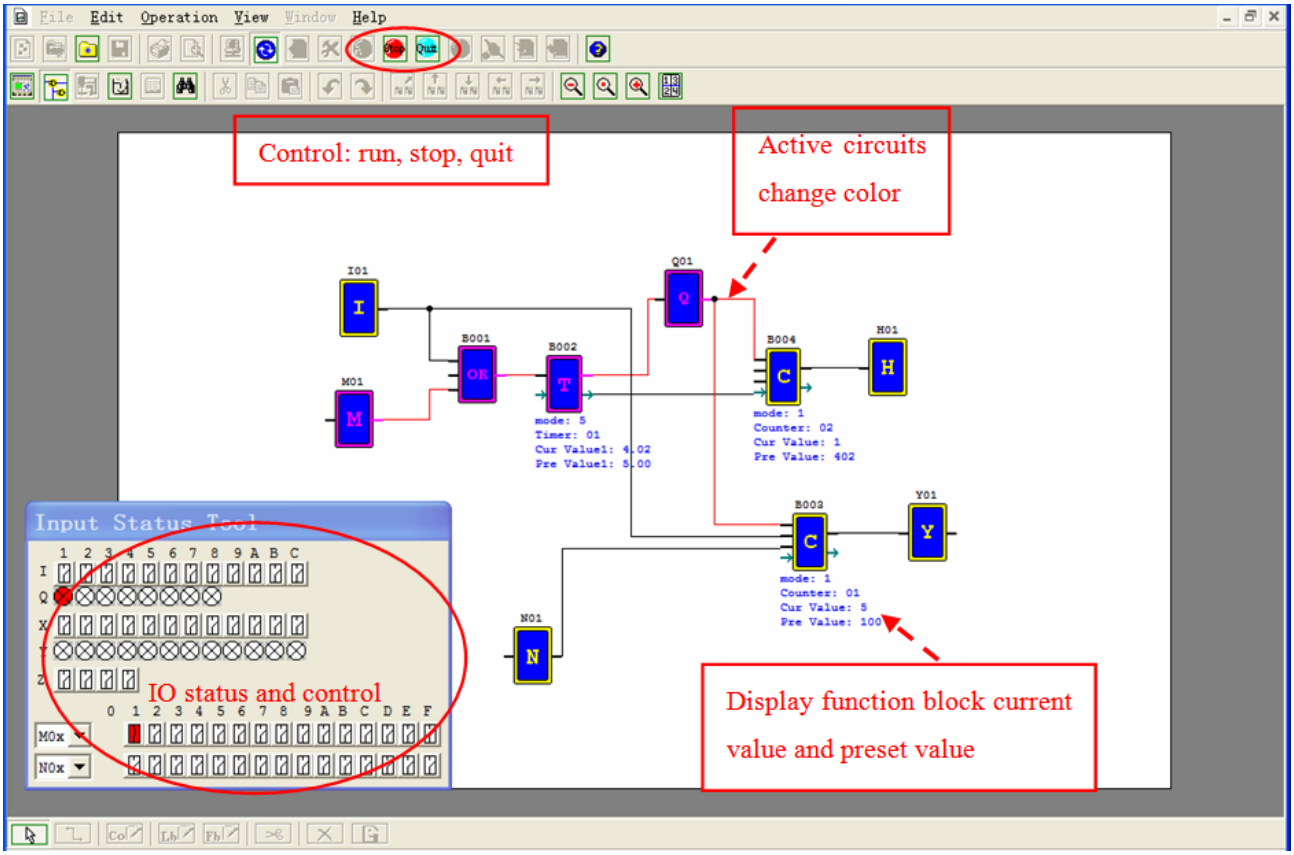


Simulation Mode

SMT Client build-in simulation test function, the following diagram shows the display characteristics in simulation mode.

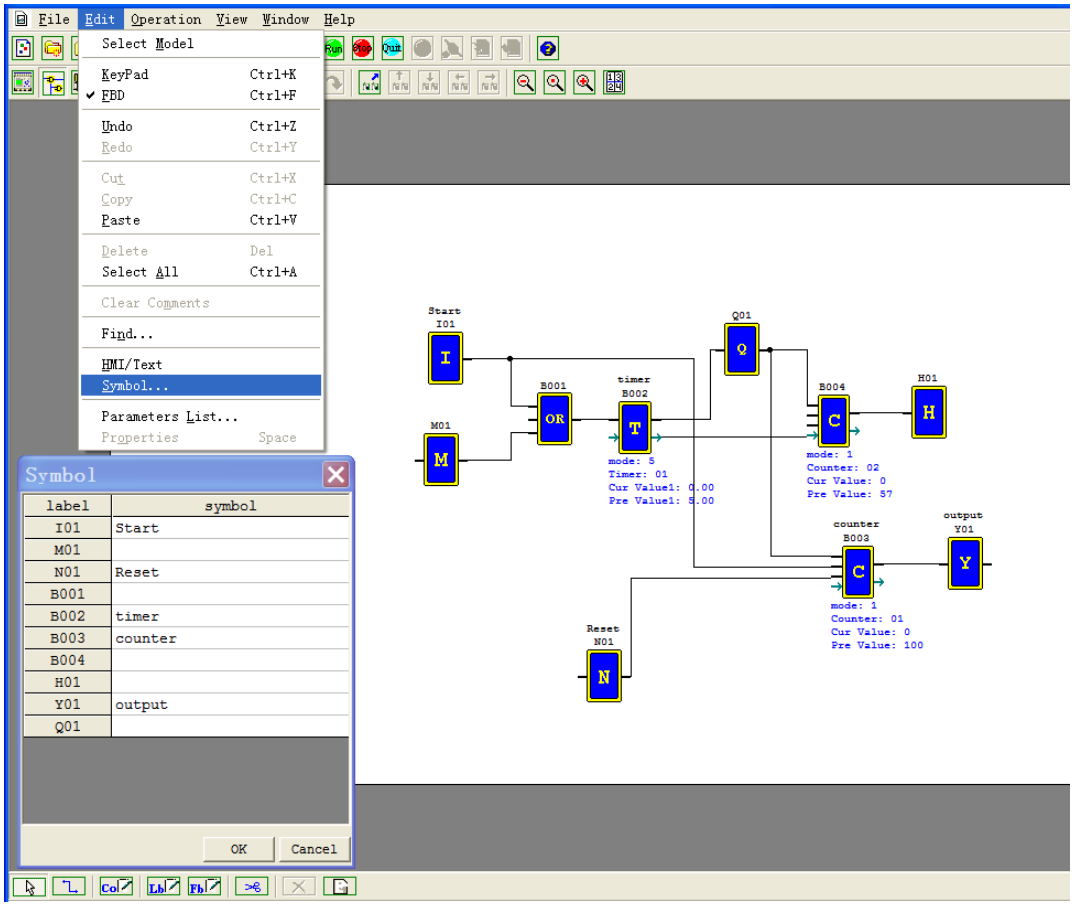


Online Monitoring/Editing

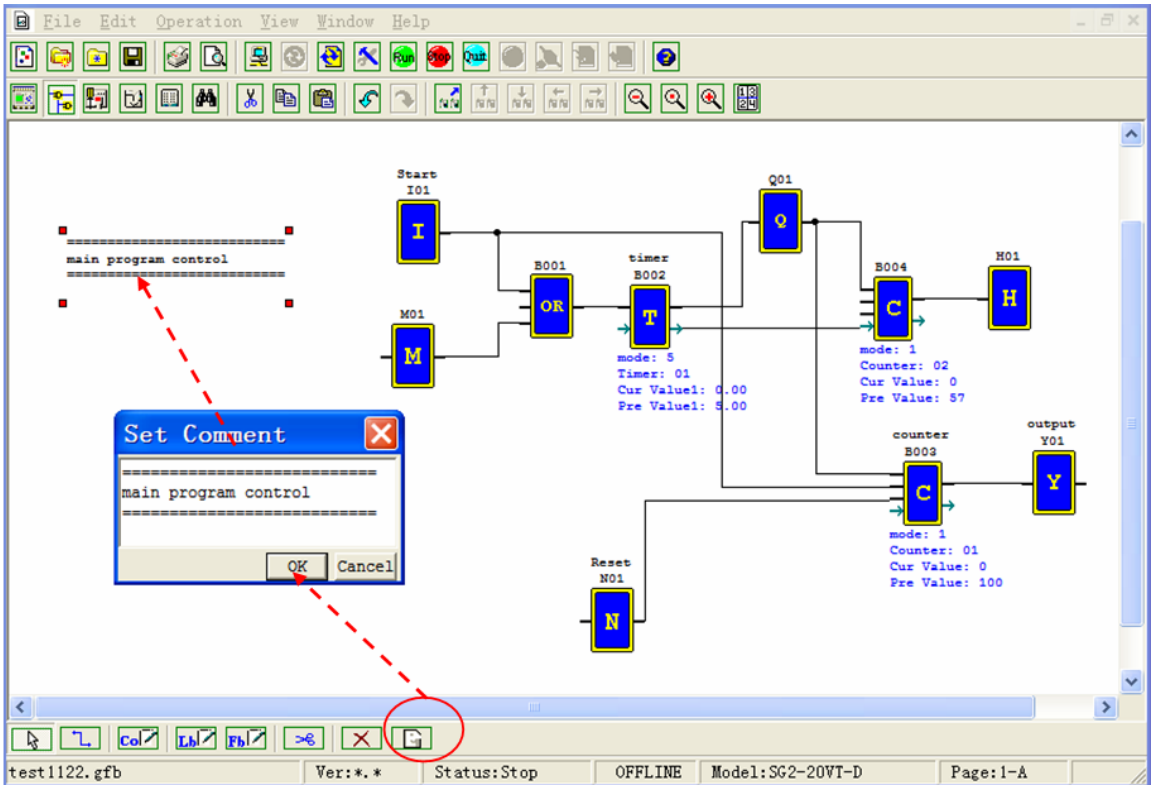


Symbol and Parameters list

FBD list symbols for coils and function blocks which only been used in program and will comment tags appear in the program.

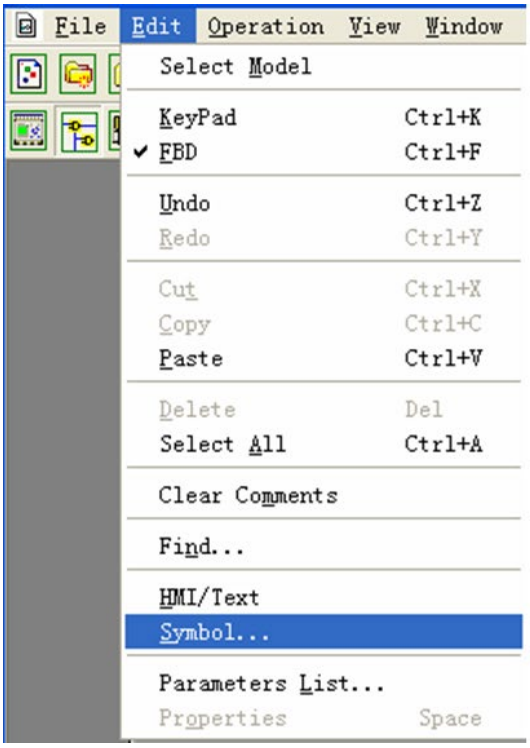


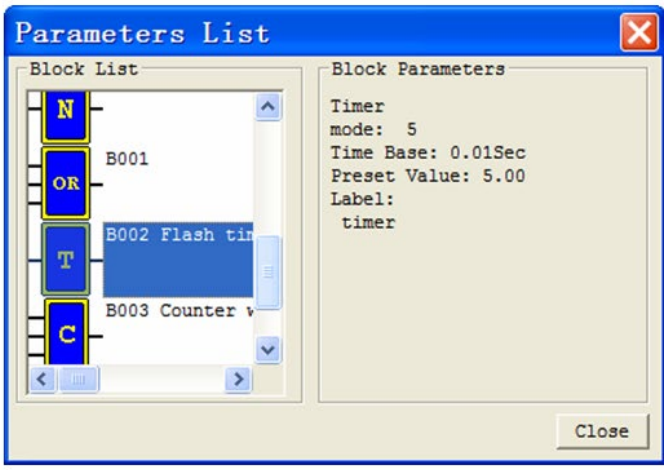
Symbol also can describe the function of main program. The following diagram operation, click the toolbar "Comments", Comments configuration dialog box appears, edit and click "OK", notes will be displayed in the programming interface, and can be moved by dragging the mouse position.



Parameters List:

Parameters list display coils and functional blocks which used in program and explain coil functions and tags, function block settings and markings and other information, as shown below.

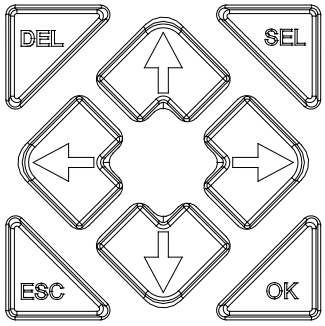




LCD Display and Keypad

Keypad

Most iSmart CPU units include the built-in LCD Display and Keypad. The keypad and display are most often used for changing timer/counter set points, controller mode changes (Run/Stop), uploading/downloading to the PM05 memory cartridge, and updating the RTC (Real Time Clock/Calendar). Although, logic programming can be performed from the keypad and display, it is highly recommended to only perform logic changes using the SMT Client software. Below is an overview of the basic keypad and display functions.



Select (SEL) – Used to select the available memory and instruction types for editing. Holding the Select button will display all "H" HMI/Text messages on the LCD.

OK – Used to accept the selection displayed of an instruction or function. It is also used to select any of the Main Menu options on the LCD.
Note: Press the "SEL" and "OK" simultaneously to insert a rung above the current active cursor position.

Escape – Used to exit a selected display screen and go to the previous screen. When in a ladder display screen, press the ESC to display the main menu.

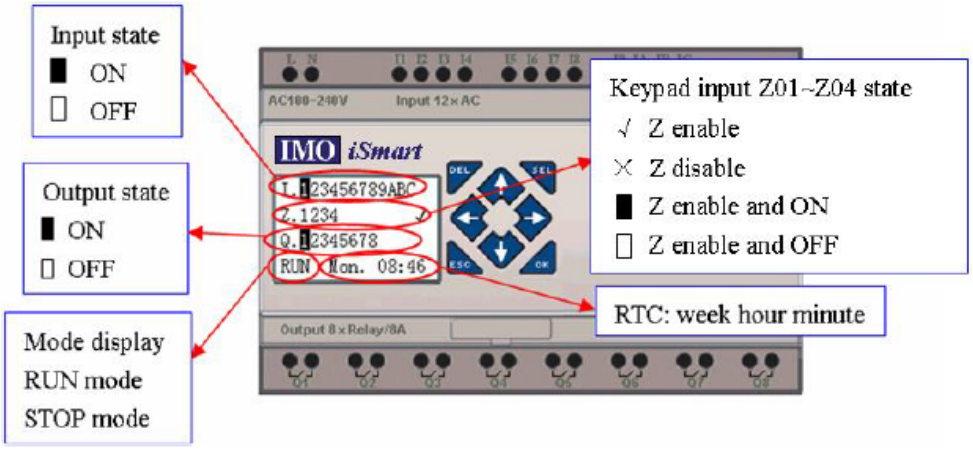
Delete – Used to delete an instruction or rung from the ladder program.

The 4 navigation buttons (↑←↓→) are used to move the cursor throughout the functions of the iSmart display or active program. The 4 buttons also can be set programmable input coils Z01-Z04 ('↑'= Z01, '←'=Z02, '↓'=Z03, '→' =Z04);

Original Screen

LCD displays 4-line state

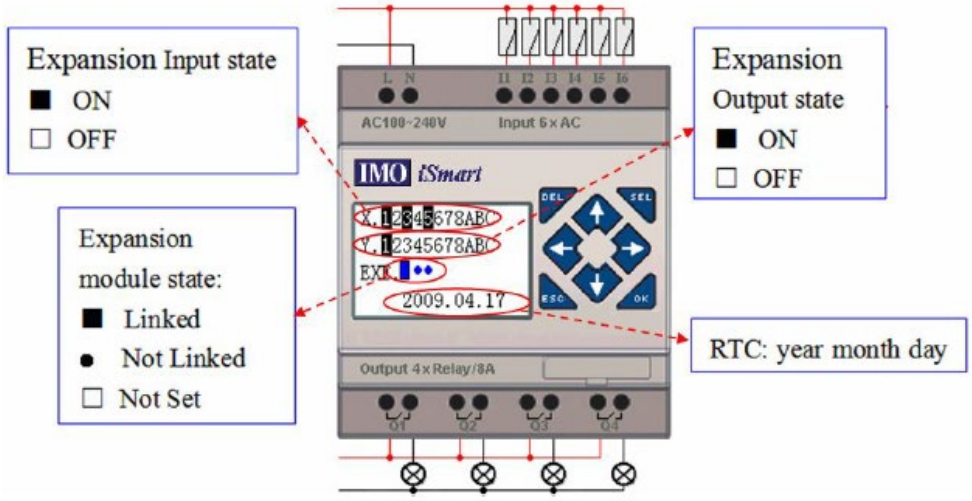
◎ Original screen as power on



Press the button:

ESC	Enter Main Menu screen
SEL+↑ ↓ Or ↑ ↓	Under LADDER Mode,DRD8 current value=0, display the state of relays (I/Z/Q ⇔ X/Y ⇔ M ⇔ N ⇔ T ⇔ C ⇔ R ⇔ G ⇔ A ⇔ AT ⇔ AQ) ⇔ Original Screen Under FBD Mode, DRD8 current value=0, display the state of relays (I/Z/Q ⇔ X/Y ⇔ M ⇔ N ⇔ A ⇔ AT ⇔ AQ) ⇔ Original Screen
SEL+← → Or ← →	When display A05~A08 value, change voltage or current mode When display AT01~AT04 value, change Celsius display or Fahrenheit display
SEL	H Function will be displayed whose mode is 1 as the button is pressed.
SEL+OK	Enter RTC setting screen

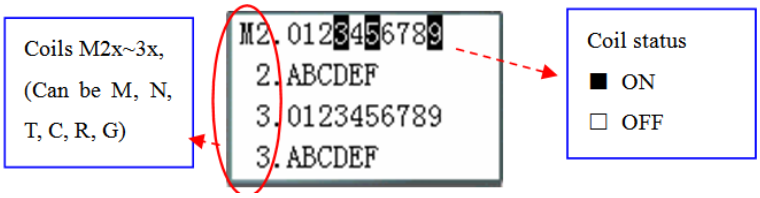
◎ Expansion display State



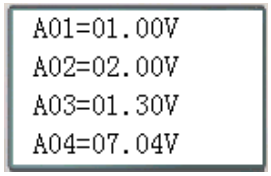
※ Expansion module setting: refer to Main Menu “SET”

◎ Other Display State

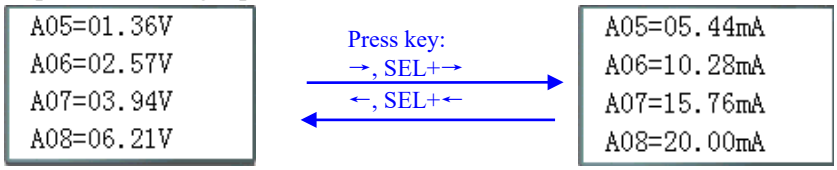
Coils M、N、T、C、R、G status: (T/C/R/G display only Ladder mode)



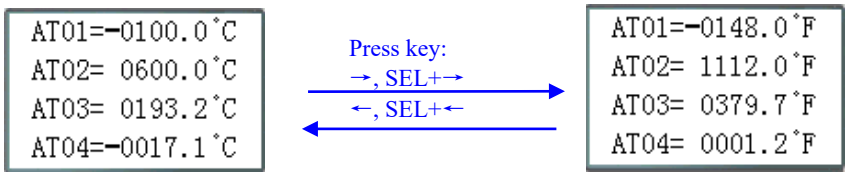
Analog input A01~A04: 0~9.99V



Expansion Analog input A05~A08: 0~9.99V or 0~20.00mA

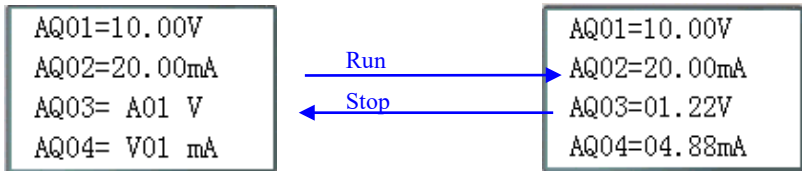


Expansion temperature analog input AT01~AT04: -100.0~600.0 Cent degree or -148.0~1112.0 Fahrenheit degree



Expansion analog output AQ01~AQ04: 0~10.00V or 0~20.00mA

※ Setting voltage mode or current mode, more information to see: Chapter 4: Relay Ladder Logic Programming-AQ(Analog Output).



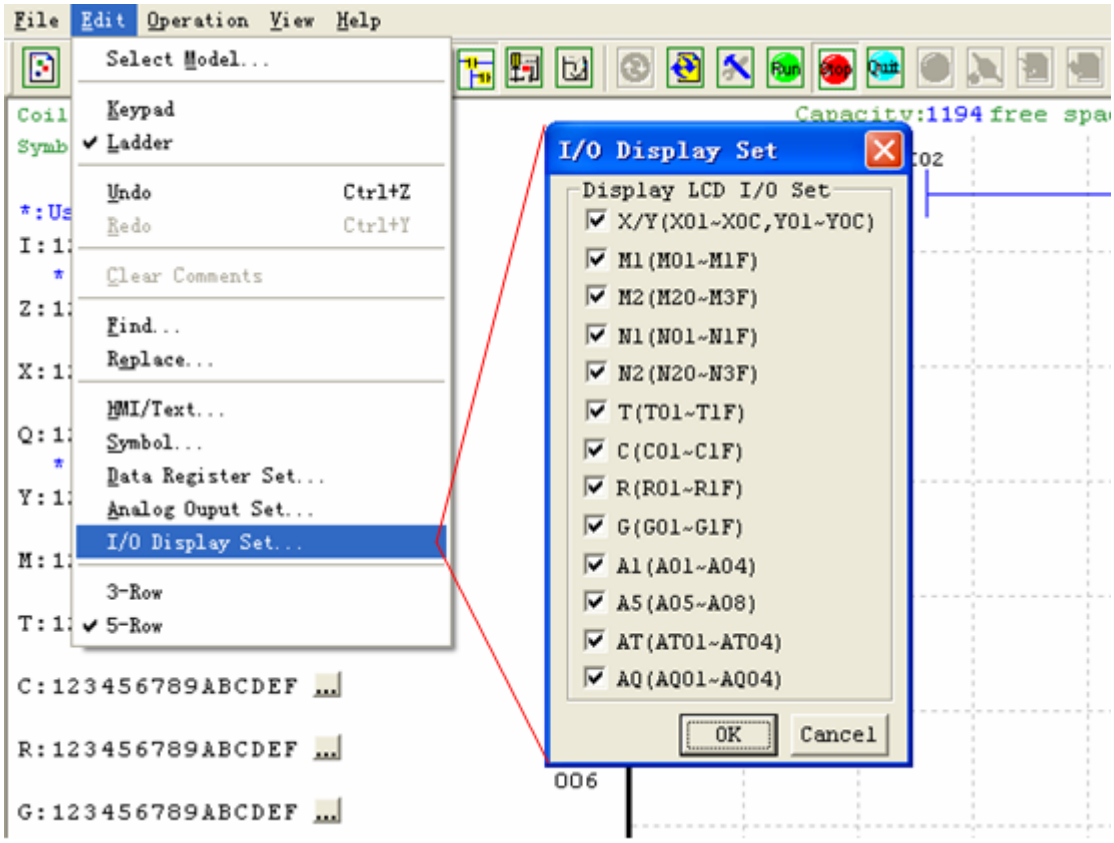
◎ Hidden I/O interface function:

iSmart can display the states for 14 sorts of coil, as shown in below table. Each bit of DRD8 current value (except bit 14 and 15) determines the corresponding IO interface to be displayed or not. When one bit equal 1, the corresponding I/O interface is hidden (mean you cannot display the I/O interface by pressing SEL+↑ ↓ or ↑ ↓).

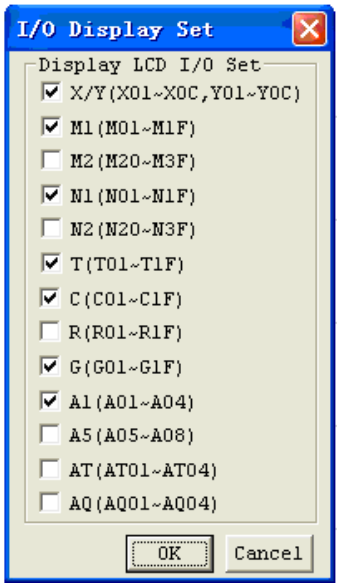
Num	I/O interface		DRD8 current value
0	I/Z/Q	I01~I0C，Z01~Z04，Q01~Q08	**Bit0:* always display**
1	X/Y	X01~X0C， Y01~Y0C	Bit1:=0 Display; =1 Not displayed
2	M1	M01~M1F	Bit2:=0 Display; =1 Not displayed
3	M2	M20~M3F	Bit3:=0 Display; =1 Not displayed
4	M3	M40~M5F	Bit4:=0 Display; =1 Not displayed
5	M4	M60~M7F	Bit5:=0 Display; =1 Not displayed
6	N1	N01~N1F	Bit6:=0 Display; =1 Not displayed
7	N2	N20~N3F	Bit7:=0 Display; =1 Not displayed
8	N3	N40~N5F	Bit8:=0 Display; =1 Not displayed
9	N4	N60~N7F	Bit9:=0 Display; =1 Not displayed
10	T	T01~T1F	Bit10:=0 Display; =1 Not displayed
11	C	C01~C1F	Bit11:=0 Display; =1 Not displayed
12	R	R01~R1F	Bit12:=0 Display; =1 Not displayed
13	G	G01~G1F	Bit13:=0 Display; =1 Not displayed
	A1	A01~A04	**always display**
	A5	A05~A08	**always display**
	AT	AT01~AT04	**always display**
	AQ	AQ01~AQ04	**always display**

e.g., In order to hide some, I/O interfaces. You can set DRD8 current value through running a Ladder/FBD program, you also can set it by PC-LINK as shown below:

1. Open “Edit>I/O Display Set…”:



2. Setting “I/O Display Set” as the picture shown below, and click OK :



3. Download the program.

This time I/O interface “M20~M3F, N20~N3F, R01~R1F, A05~A08, AT01~AT04, AQ01~AQ04” are hidden:

SEL+↑ ↓ Or ↑ ↓	Under LADDER Mode,DRD8 current value=1750, display the state of relays (I/Z/Q ⇔ X/Y ⇔ M 1⇔ N2 ⇔ T ⇔ C ⇔ G ⇔ A1) ⇔ Original Screen

※ I/O interface can be hide in the same way in FBD.

LCD Display Main Menu

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

Press "ESC" key on keypad after power on for entering into the Ladder main menu or FBD main menu, which depends on the program format, Ladder or FBD mode in iSmart.

LADDER	FBD
FUN.BLOCK	PARAMETER
PARAMETER	RUN
RUN	DATA REGISTER
DATA REGISTER	CLEAR PROG.RAM
CLEAR PROG.RAM	PLC->CARD
PLC->CARD	CARD-> PLC
CARD-> PLC	SET
SET	RTC SET
RTC SET	ANALOG SET
ANALOG SET	PASSWORD
PASSWORD	LANGUAGE
LANGUAGE	INITIAL
INITIAL	OUTPUT RECORD
OUTPUT RECORD	FORMAT Card
FORMAT Card	IP ADDRESS
IP ADDRESS	SUBNET MASK
SUBNET MASK	GATEWAY
GATEWAY	MASTER IP
MASTER IP	IAP SET
IAP SET	

Menu		Description
>	LADDER	Ladder edit
	FUN.BLOCK	Ladder function block (timer/counter/RTC …) edit
	FBD	FBD display
	PARAMETER	FBD block or LADDER function block parameter display
	RUN	RUN or STOP
	DATA REGISTER	DR display
	CLEAR PROG.	Clear the user program and the password
	PLC->CARD	Save user program to SD card
	CARD-> PLC	Read user Program from SD card
	SET	System setting
	RTC SET	RTC setting
	ANALOG SET	Analog setting
	PASSWORD	Password setting
	LANGUAGE	Select the language
	INITIAL	initially set Edit method
	OUTPUT RECORD	output Save r files to the card
	FORMAT Card	Format SD card
	IP ADDRESS	Set ip address
	SUBNET MASK	Set subnet mask
	GATEWAY	Set gateway
	MASTER IP	Set master station ip address
	IAP SET	Set IAP update flag

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

LADDER	LADDER	>	LADDER	FBD
FUN.BLOCK	PARAMETER		FUN.BLOCK	
PARAMETER	RUN		PARAMETER	FBD block or LADDER function block parameter display
RUN	DATA REGISTER		STOP	RUN or STOP
DATA REGISTER	PLC->CARD		DATA REGISTER	DR display
PLC->CARD	RTC SET		WRITE	Save user program to card
RTC SET	PASSWORD		RTC SET	RTC setting
PASSWORD	LANGUAGE		PASSWORD	Password setting
LANGUAGE	OUTPUT RECORD		LANGUAGE	Select the language
OUTPUT RECORD	NET IO STATUS		OUTPUT RECORD	output Save r files to the card
NET IO STATUS			NET IO STATUS	Monitor J K NAI NAQ

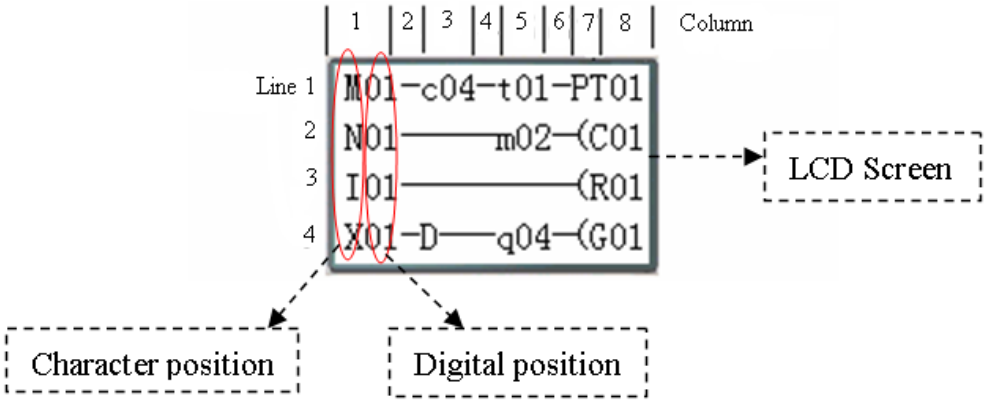
Press the Button

↑ ↓	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 FLASH.

◎ Main Menu LADDER



Press the Button

Button	Description
SEL	1. Ixx ⇒ ixx ⇒ — ⇒ space ⇒ Ixx (only for digital and character position of 1, 3, 5 column) 2. Qxx ⇒ space ⇒ Qxx (only for digital and character position of 8 column) 3. ⊤ ⊥ ⇒ Space⇒ ⊤ ⊥ (all available but the 2,4,6 column of the first line)
SEL, then ↑/ ↓	1. I ⇔ X ⇔ Z ⇔Q ⇔ Y⇔ M ⇔ N ⇔J⇔K⇔ D ⇔ T ⇔ C ⇔ R ⇔ G ⇔ F⇔ I (the cursor located at 1, 3, 5 column) 2. Q ⇔ Y ⇔ M ⇔ N ⇔ T ⇔ C ⇔ R ⇔ G ⇔H ⇔ L ⇔P ⇔ S ⇔ AS ⇔ MD ⇔ PI ⇔ MX ⇔ AR ⇔ DR ⇔ MU ⇔Q (When the cursor located at 8 column) 3. (⇔ ⇔ ⇔ P ⇔ ((When the cursor located at 7 columns, and the 8 column is set as Q, Y, M, N) 4. (⇔ P ⇔ ((When the cursor located at 7 columns, and the 8 column is set as T)
SEL , then ←/→	Confirm the input data and move the cursor.
↑ ↓ ← →	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 (save program to flash).
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 blocks 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 Sample: more detailed to see Appendix A: Keypad programming in Ladder mode.

◎ FUNCTION BLOCK program input

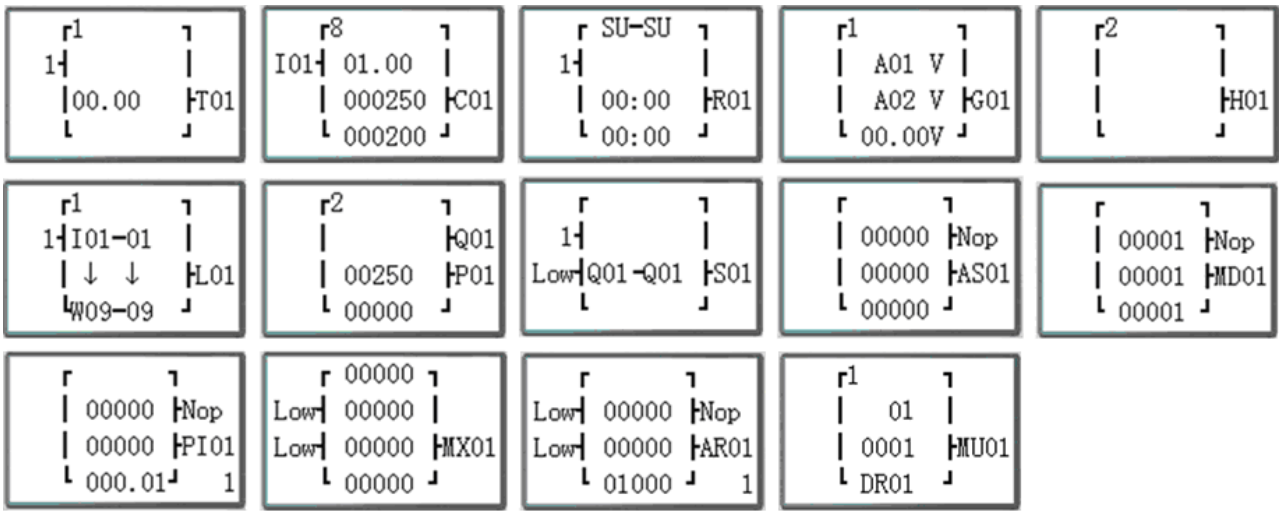
After into FUNCTION BLOCK, cursor flicker on “T”, press “SEL” key, cursor will into edit mode.

This time if press “SEL” key continuously. Ladder function block display in sequence:

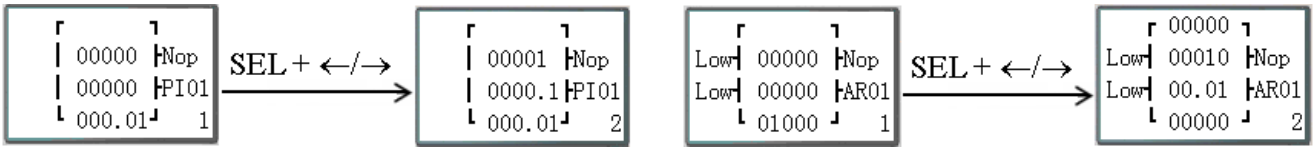
T→C→R→G→H→L→P→S→F→AS→MD→PI→MX→AR→MU→T…

This time if cursor flicker on “T”, press “↑ /↓”. Ladder function block display in sequence:

T↔C↔R↔G↔H↔L↔P↔S→F ↔AS↔MD↔PI↔MX↔AR↔MU↔T…



Function PI and AR, more key display:



Operation Sample: more detailed to see Appendix B: Keypad programming in Ladder FUNCTION BLOCK.

◎PARAMETER

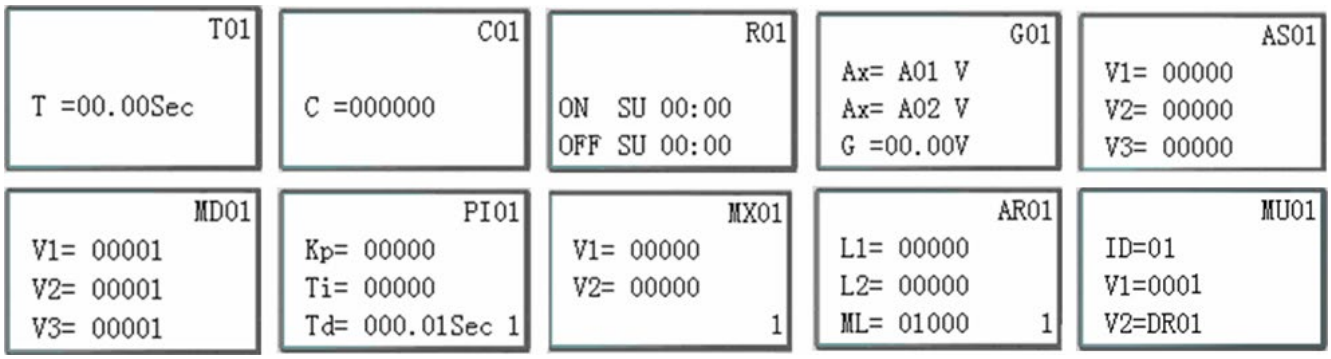
Under Ladder mode into PARAMETER, press “SEL” key, cursor will into edit mode.

This time if press “SEL” key continuously. Function blocks display in sequence:

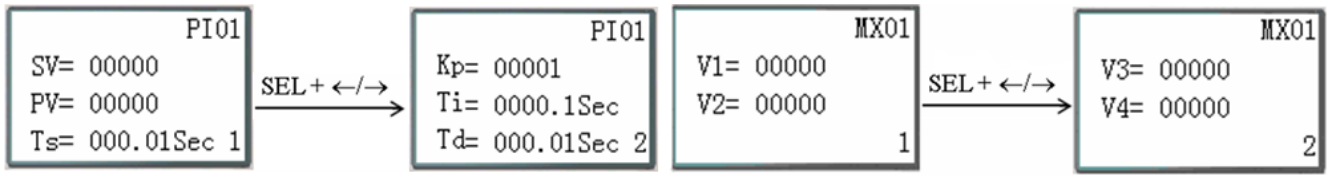
T→C→R→G→AS→MD→PI→MX→AR→MU→T…

This time if cursor flicker on “T”, press “↑ /↓”. Function blocks display in sequence:

T↔C↔R↔G↔AS↔MD↔PI↔MX↔AR↔MU↔T…



Function PI and AR, more key display:



Under FBD mode, Press “SEL” key, Block which used in program displays in sequence.

◎ RUN or STOP

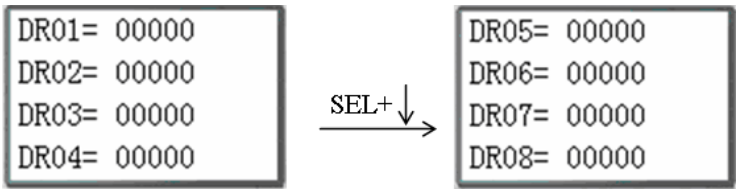
(1) RUN Mode

(2) STOP Mode

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

◎DATA REGISTER

Displaying preset value when the smart is STOP status and displaying current value when the iSmart is in RUN status.



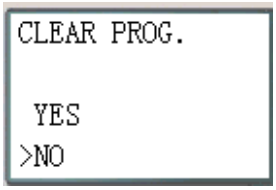
↑↓←→	Move the cursor
OK	Ensure the edit
SEL	Enter edit (edit DR display number or DR preset value)
'SEL' then 'SEL'	Edit DR preset value type
'SEL' then '↑↓'	1. Edit DR display number (only first line) 2. Edit DR preset value
ESC	1. Cancel edit. 2. Back to main menu (save DR preset data)
SEL+↑/↓	Tip-up/down page

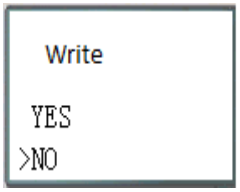
◎Other Menu Items

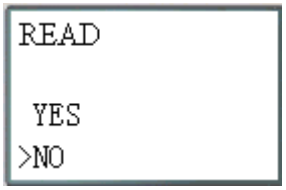
(1) CLEAR PROGRAM (Clear RAM, Program in flash and Password at the same time)

(2) PLC->SD CARD: save the program (RAM) to SD card program spare cartridge

(3) SD CARD ->PLC: read the program from the SD card program spare cartridge to iSmart (RAM)







(1) ~ (3) Now Press:

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

(4) SET (system setting)

	content	default		
ID SET	ID SET	01	→	ID setting (00~99)
REMOTE I/O	REMOTE I/O	N	→	Remote I/O Mode (N: none M: Master S: Slave)
BACK LIGHT	BACK LIGHT	×	→	Back light mode (√: always light ×: light for 10s after pressed.)
M KEEP	M KEEP	√	→	M: non-Volatile (√:Volatile ×: Non- Volatile)
I/O NUMBER	I/O NUMBER	0	→	Setting expansion, I/O module number (0~3)
I/O ALARM	I/O ALARM	√	→	Siren setting when is not available to Expansion I/O Points (√:Yes ×:No)
C KEEP	C KEEP	×	→	in stop/run switching, Counter Present Value Keeping (√:Yes ×:No)
Z SET	Z SET	×	→	Enable or disable keypad input Z01-Z04 (√:enable ×:disable)
RS485 SET	RS485 SET	03	→	Setting the form and baud rate of RS-485
DATA REG.	DATA REG.	U	→	Setting the Data Register type (U: 16bit-unsiged S: 16bit-sign)
MEMORY SET				
M/S SET				

※ M KEEP function is available for keeping M status and current value of T0E/T0F when power is re-supplied after loss.

Now Press:

↑ ↓ ← →	Move the cursor
SEL	Begin to edit.
'SEL' then '←/→'	Move the cursor for 'ID SET' item and 'RS485 SET' item
'SEL' then '↑ /↓'	1. ID SET = 00~99 ; I/O NUMBER = 0~3 2. REMOTE I/O = N⇔M⇔S⇔N 3. BACK LIGHT ; C KEEP ; Z SET = ×⇔√ 4. M KEEP; I/O ALARM = √⇔× 5. RS485 SET = (0~3)(0~5) 6. DATA REG. = U⇔S
OK	Confirm the Edition Data
ESC	1. Cancel the setting when pressed 'SEL' 2. Back to Main Menu(save edit data)

※ When IO LINK is selected, ID setting range is 0~7, which should be continuous.
ID=0 default as Master, ID=1~7 default as Slave.

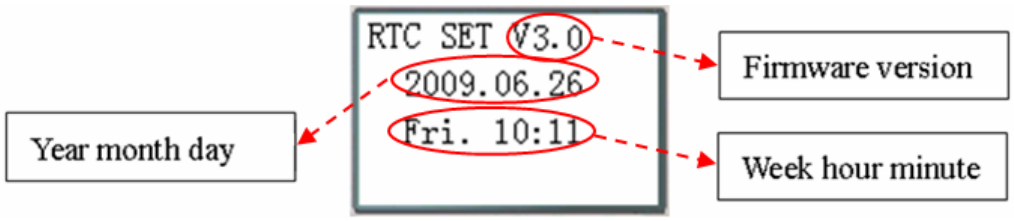
※ When REMOTE I/O is selected, the distribution of the remote I/O is as follows:

	Master		Slave
Remote Input	X01~X0C	←	I01~I0C
Remote Output	Y01~Y08	→	Q01~Q08

※ The high bit of RS485 SET detects the form of RS-485, and the low bit detects the baud rate of RS-485.

More detailed to see chapter 7: 20 Points RS485 type Models Instruction.

(5) RTC SET



Now Press

↑↓	Enter RTC setting or Daylight saving setting
SEL	Begin to input parameters
'SEL' then '←/→'	Move the Cursor
'SEL' then '↑/↓'	1. year=00~99, month=01~12, day=01~31 2. hour = 00~23 , minute = 00~59
'SEL' then 'SEL'	Daylight saving setting: NO – EUROPE – USA – OTHER – NO …
OK	Save the Input Data
ESC	1. Cancel the Input Data when press 'SEL'. 2. Back to Main Menu.

※ According to set the date automatically calculate weeks

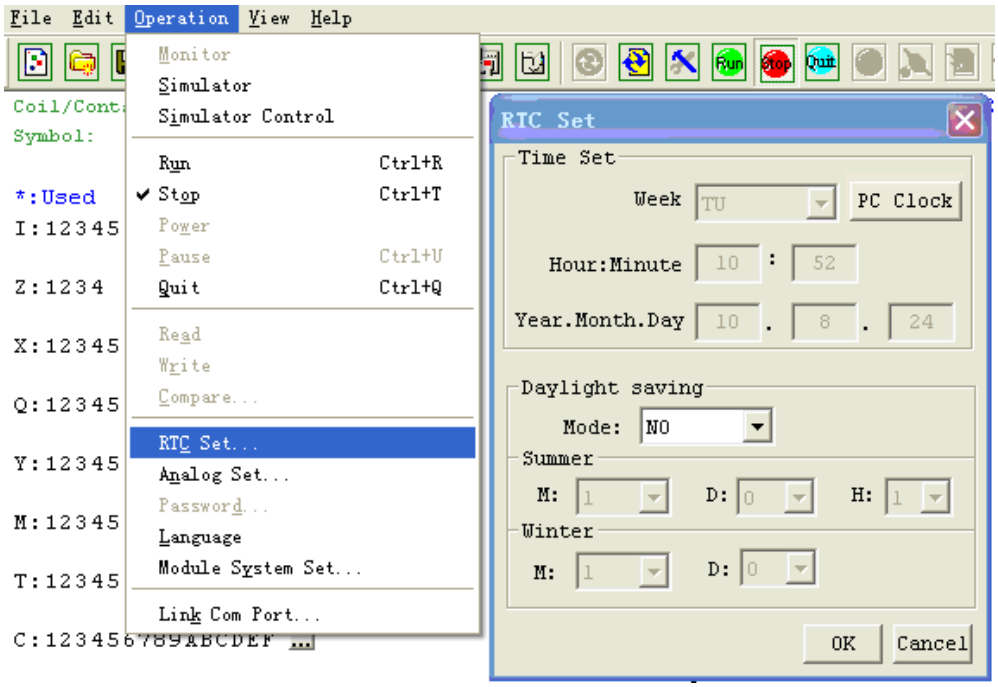
※ RTC precision:

Temperature	Error
+25℃	±3s/day
-20℃/+50℃	±6s/day

RTC Daylight saving setting

There are 2 fixed Daylight saving options, EUROPE and USA, 1 editable Daylight saving option in iSmart. Daylight saving options can be set through the two methods as shown below.

1) PC Client

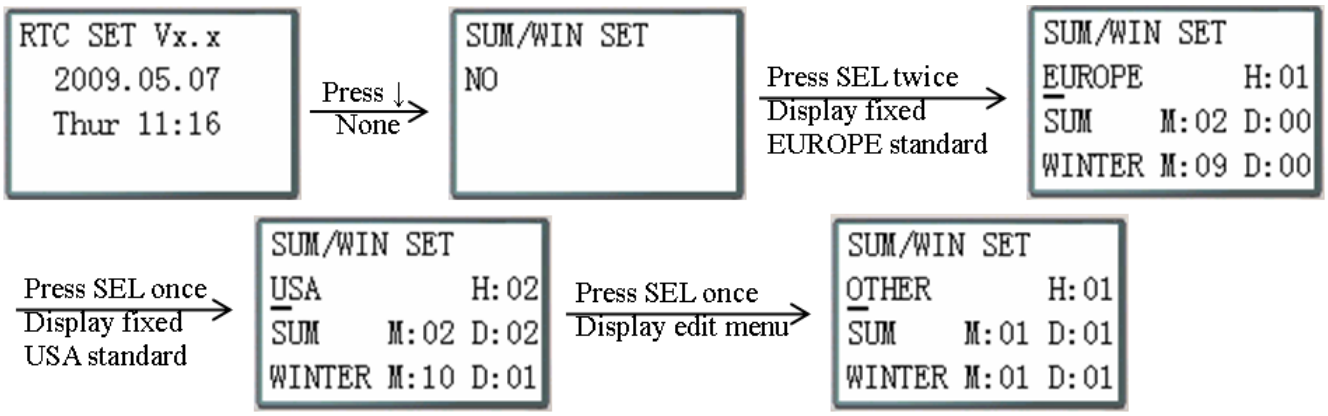


Edit rule: ①M: Month range 1~12;

②D: Week range 0~5, means the 0 to 5th Sunday of the setting month and 0 said the last Sunday of the setting month;

③H: Hour range 1~22; summer hour and winter hour are the same.

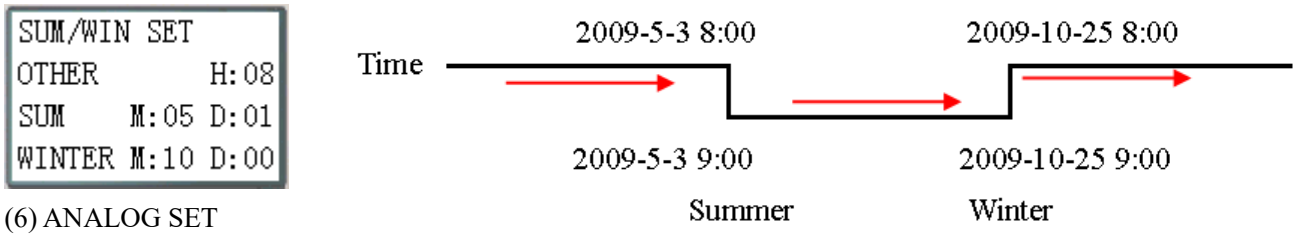
2) Keypad



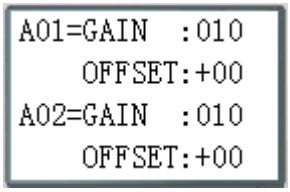
Then pressing "→" selects edit location, pressing "↑", "↓" edit content.

Example:

Year 2009, SUM M: 05 D: 01 → 2009-5-3; M: 10 D: 00 → 2009-10-25.



(6) ANALOG SET



A 1=GAIN : 010	→	GAIN (0~999), default 10
OFFSET : +00	→	OFFSET (-50~+50), default 0
A 2=GAIN : 010		
OFFSET : +00		
A3~A8…Gain + Offset		

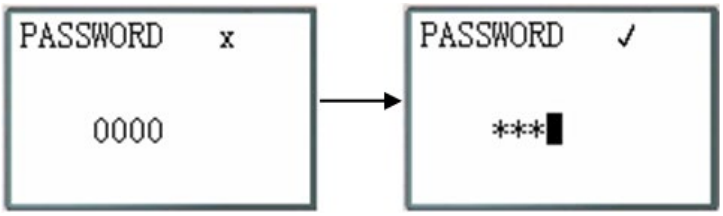
Now Press

↑ ↓	1. Move downward the Cursor 2. Switch the setting screen from A01/A02→ A03/A04→ A50/A06 → A07/A08
SEL	Begin to input parameters
'SEL' then '←/ →'	Move the Cursor
'SEL' then '↑/ ↓'	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 (save edit data).

※ V01 = A01*A01_GAIN + A01_OFFSET

V08 = A08*A08_GAIN + A08_OFFSET

(7) PASSWORD (setting password)



Now Press

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

※ A Class: Password number is set to 0001~9FFF.

B Class: Password number is set to A000~FFFE.

Password number = 0000 or FFFF is disabled Password function, Default setting: 0000.

If there are H coils(HMI coils) enable, A/B Class password have same access right; If there are no H coils enable, A/B password have different access right. A/B Class password Description:

	No H coil ON		H coil ON	
Menu	A Class	B Class	A Class	B Class
LADDER	√	√	√	
FUN.BLOCK	√	√	√	
FBD	√	√	√	
PARAMETER		√	√	
RUN/STOP		√	√	
DATA REGISTER		√	√	
CLEAR PROG.	√	√	√	
WRITE	√	√	√	
READ	√	√	√	
SET		√	√	
RTC SET		※	※	
ANALOG SET		√	√	
LANGUAGE		√	√	
INITIAL	√	√	√	

√: cannot accessed under password protecting

※:SEL+OK to enter RTC SET

(8) LANGUAGE (Selection menu language)

→ English
→ French
→ Spanish
→ Italian
→ German
→ Portuguese
→ Simplified Chinese
→ Polish
→ Russian
→ Turkish

Now Press

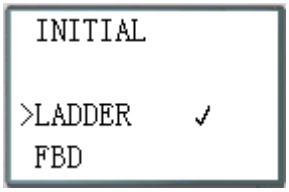
↑↓	Vertically move the Cursor
OK	Select the language the cursor located
ESC	Back to Main Menu

※ Language display "√" means current selection for menu language.

※ Language display"*"means current selection for HMI multi-language characters, only Russian or Turkish.

※ Press key "↑" or "↓" to move cursor and press OK key to select language, if select Russian or Turkish, HMI multi-language characters also changed; if select other language, HMI multi-language characters don't change.

(9) INITIAL (select Ladder Logic or Function Block Diagram (FBD) programming environment)



Now Press:

↑↓	Vertically move the Cursor
OK	Select the mode the cursor located
ESC	Back to Main Menu

⚠ The origin program will be cleared when changing the programming enviroment.

iSmart system error

After power on, iSmart keep detecting the running state. Once system error occurred, the error code will display on LCD. At the same time, iSmart will stop or just give error-warning base on the error type. Error types are show in the table below:

Error code	Explain	Error action	Why and How
ROM ERROR	System ROM/Flash memory check error	iSmart STOP	If the version of the firmware is older than 3.4, update to 3.4 or newer; then if the error occurs again, contact with suppliers
Vpd ERROR	Power down circuits check error	iSmart STOP	Voltage is too low; apply the appropriate voltage
PROG ERROR	Ladder / FBD code invalid in EEPROM.	iSmart STOP	Download the user program and try again.
LOGIC ERROR	FBD code logic check error	iSmart STOP	There is same logic error in the user program, modify it and try again.
EXT. ERROR	Expansion I/O error (When disable I/O alarm in “SET” of the main function, The alarm cannot appear.)	iSmart STOP	Extend module set number is not same with the actual number, check the system set.
COMM ERROR	RS485 type communication error	Warning only	CD type module communication error, check the COMM protocol.
RTC ERROR	RTC check or work error	Warning only	Contact with suppliers.

Chapter 4: Parameter passing

In the iSmart, almost all the function block can use other function block's current value as its preset value. This process we called data transmission. This chapter will describe some regulation about data transmission.

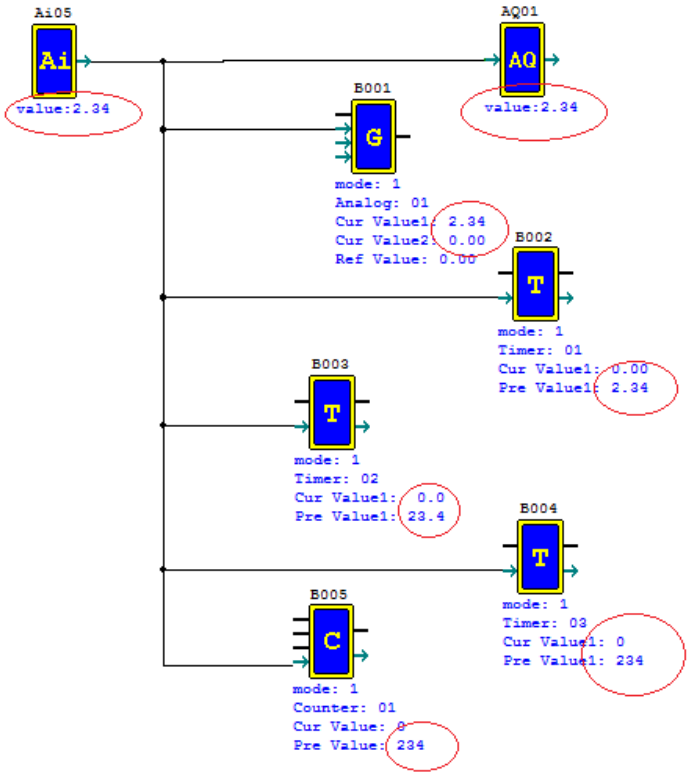
iSmart inner data type

All the data stored in SMT inner system are integer. Even through some parameter likes "A01 = 9.99V" display in LED, in fact "9.99" stored in SMT inner system is "999". Only in display stage, the decimal point of "9.99" added according to its physical significance. **When analog variable and other function block current value passed to other function block or analog output as preset value, essentially just integers passed. When need to display those passed integer preset value in LED, decimal point will be added according to physical significance.**

Example1:

A05 current value passing to other function block as preset value:

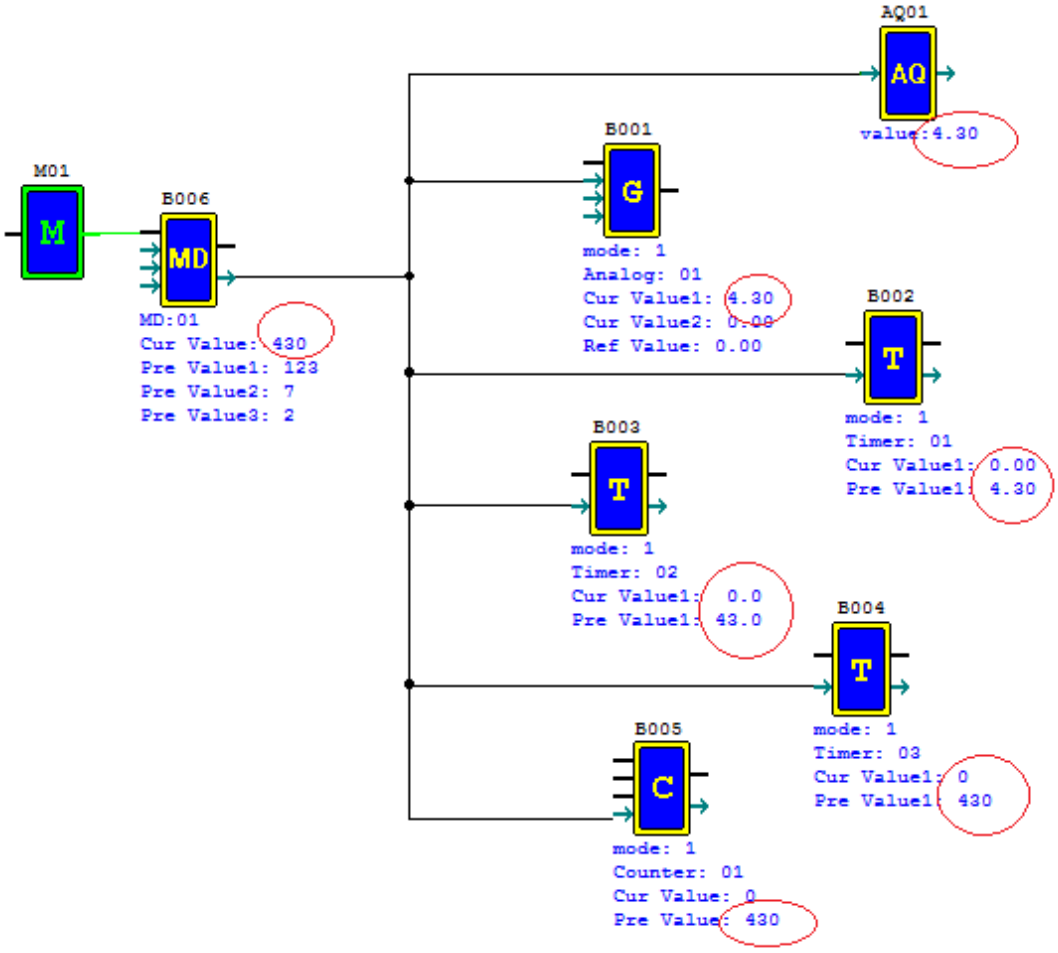
When A05=2.34V, A05's inner value 234 is passed to other function block as preset value. Passing to AQ01 automatically as 2.34V, Passing to B001 (G01) automatically as 2.34V, Passing to B002(T01 time base is 0.01s) automatically as 2.34s, Passing to B003(T02 time base is 0.1s) automatically as 23.4s, Passing to B004(T03 time base is 1s) automatically as 234s, Passing to B005(C01) automatically as 234:



Example2:

MD01 current value passing to other function block as preset value:

When B006(MD01)=430, MD01's inner value 430 is passed to other function block as preset value. Passing to AQ01 automatically as 4.30V, Passing to B001(G01) automatically as 4.30, Passing to B002(T01 time base is 0.01s) automatically as 4.30s, Passing to B003(T02 time base is 0.1s) automatically as 43.0s, Passing to B004(T03 time base is 1s) automatically as 430s, Passing to B005(C01) automatically as 430:


M01
M
B006
MD
MD:01
Cur Value: 430
Pre Value1: 123
Pre Value2: 7
Pre Value3: 2
AQ01
AQ
value:4.30
B001
G
mode: 1
Analog: 01
Cur Value1: 4.30
Cur Value2: 0.00
Ref Value: 0.00
B002
T
mode: 1
Timer: 01
Cur Value1: 0.00
Pre Value1: 4.30
B003
T
mode: 1
Timer: 02
Cur Value1: 0.0
Pre Value1: 43.0
B004
T
mode: 1
Timer: 03
Cur Value1: 0
Pre Value1: 430
B005
C
mode: 1
Counter: 01
Cur Value: 0
Pre Value: 430

Passing parameter out of range

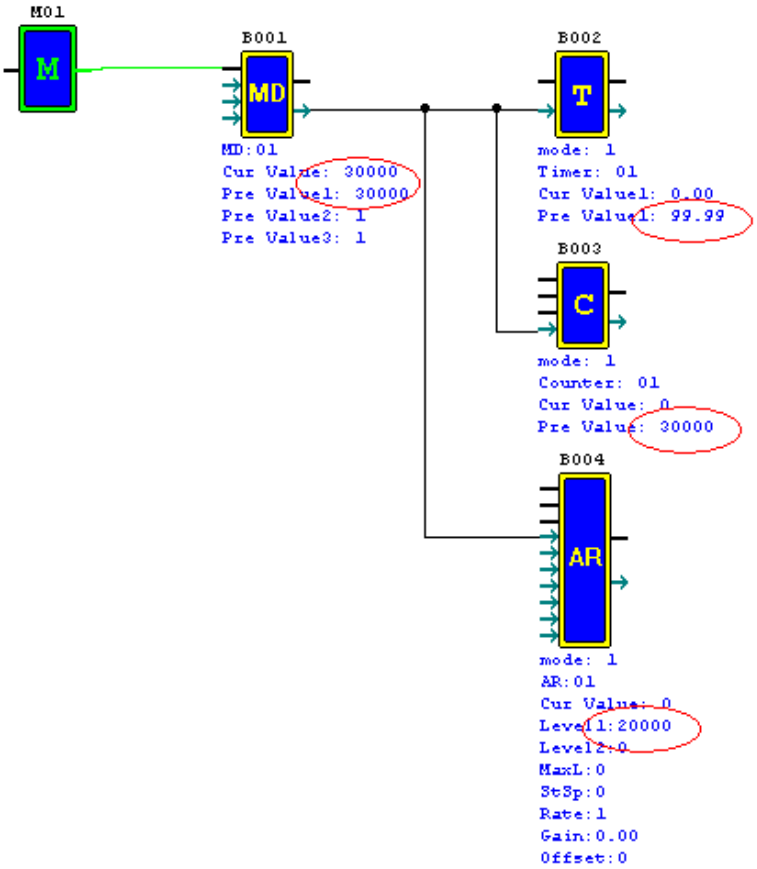
MD current value data range is -32768~32767, T preset value data range is 0~9999. If MD current value is passed to T as preset value, obviously sometimes MD current may greater T preset value upper limit, or less than T preset value down limit. This moment SMT will use upper limit or down limit value as its preset value. Similar situation of passing parameter, SMT will use the same processing method.

Example1:

When B006(MD01)=30000, MD01's value 30000 is passed to other function block as preset value. Passing to B002(T01 time base is 0.01s) as preset value. 30000 is greater than upper limit of T01 9999, so automatically as 99.99;

Passing to B003(C01) as preset value. The number 30000 is not out of data range of C01, so C01 preset value automatically as 30000;

Passing to B004(AR01) as preset value. The number 30000 is greater than upper limit of AR01 20000, so automatically as 20000;

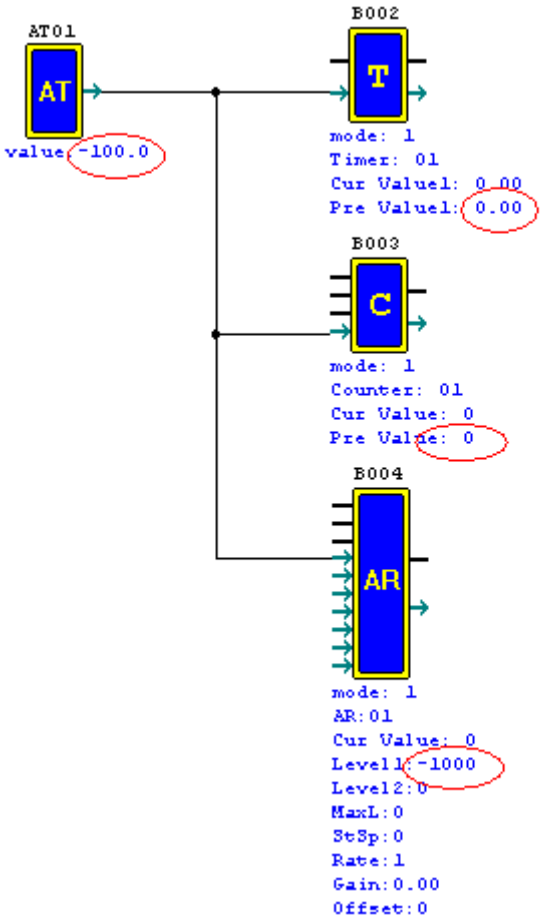


Example2:

When AT01=-100.0, AT01's inner value -1000 is passed to other function block as preset value. Passing to B002(T01 time base is 0.01s) as preset value. -1000 is less than lower limit of T01 0, so automatically as 00.00;

Passing to B003(C01) as preset value. -1000 is less than lower limit of C01, so C01 preset value automatically as 0;

Passing to B004(AR01) as preset value. -1000 is not out of data range of AR01 -10000, so automatically as -1000;



Chapter 5: Relay Ladder Logic Programming

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Basic Elements

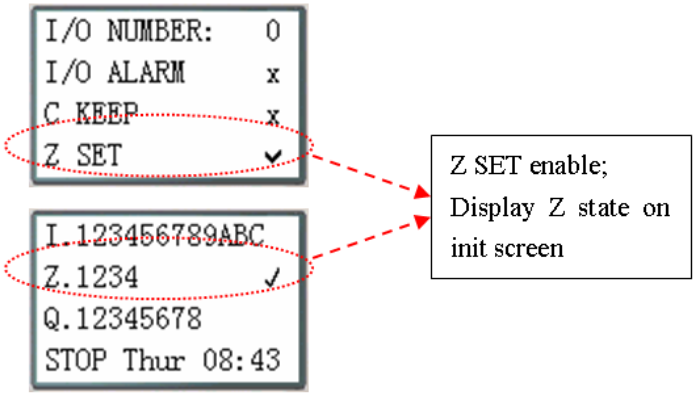
	General output	SET output	RESET output	PULSE output	N.O. contact	N.C. contact	Number
Symbol	[	⮝	⮟	P	⊣⊢	⊣/⊢	(N.O./N.C.)
Digital Input					I	i	12(I01-I0C/i01-i0C)
Keypad Input					Z	z	4(Z01-Z04/z01-z04)
Digital Output	Q	Q	Q	Q	Q	q	8(Q01-Q08/q01-q08)
Auxiliary Coil	M	M	M	M	M	m	127(M01-M7F/m01-m7F)
Auxiliary Coil	N	N	N	N	N	n	127 (N01-N7F/n01-n7F)
Counter	C				C	c	31(C01-C1F/c01-c1F)
Timer	T			T	T	t	31(T01-T1F/t01-t1F)
Network Input					J	j	63(J01-J3F/j01-j3F)
Network Output	K	K	K	K	K	k	63(K01-K3F/k01-k3F)

Digital Inputs (I)

The iSmart digital input points are designated as I contacts. The number of digital input points is 6, 8 or 12 depending on each iSmart model.

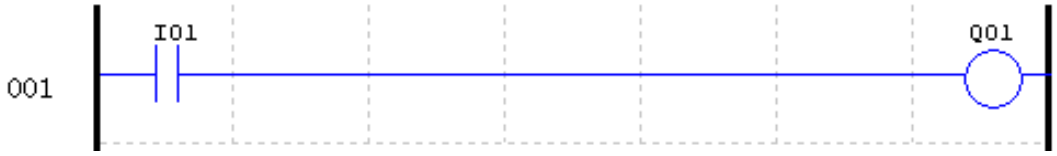
Keypad Inputs (Z)

The iSmart keypad input points are designated as Z contacts. The number of keypad input points is 4 which only exist on SMT CD type model and ED type model.



Digital Outputs (Q)

The iSmart digital output points are designated as Q coils/contacts. The number of digital output points is 4 or 8 depending on each iSmart model. In this example, output point Q01 will be turned on when input point I01 is activated.



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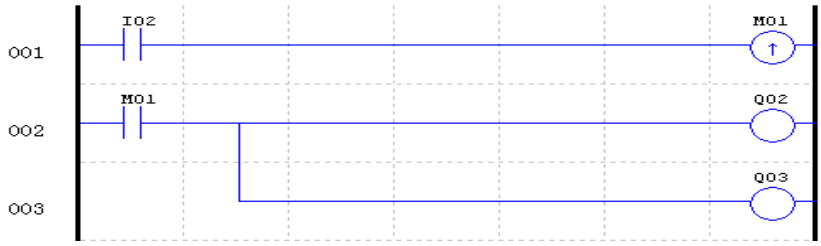
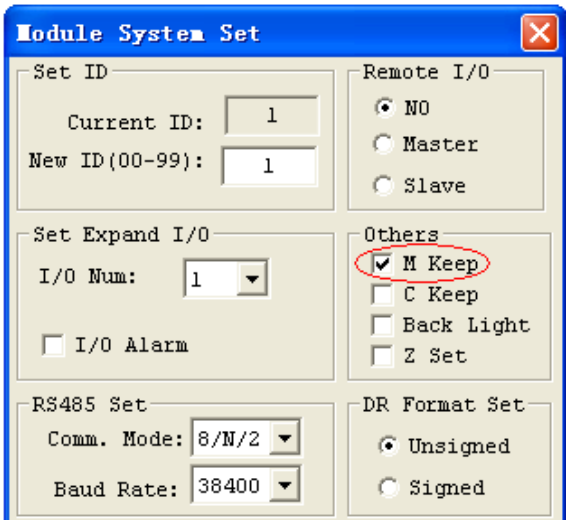
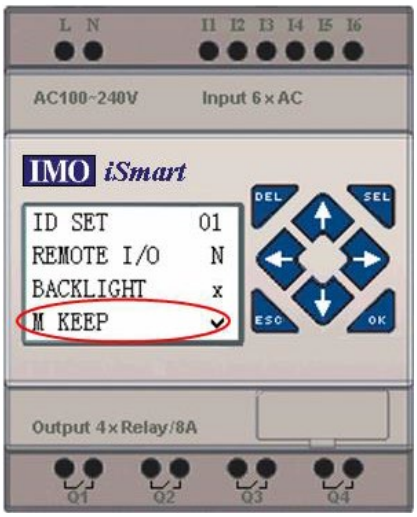
Auxiliary Coils (M)

Auxiliary Coils are the virtual coils inside the iSmart unit; they are not the real physically inputs or outputs that can be wired to any external devices, switches, sensors, etc. The number of Auxiliary Relays M is 127. Since auxiliary relays are internal elements within the CPU, they can be programmed as digital inputs (contacts) or digital outputs (coils). In the first rung of this example, auxiliary relay M01 is being used as an output coil and will energize when input I02 turns on. In the second rung auxiliary relay M01 is being used as an input and when energized, will turn on outputs Q02 and Q03.



※ The state of auxiliary relays “M01~M3F” will be kept when the smart powers down if “M Keep” is active. “M Keep” can be set by the two ways below.





Special Auxiliary Relays: M31~M3F

Code	Signification	Description
M31	User program upstart flag	Outputting ON during the first scanning period; and used as normal auxiliary relay at other scan period.
M32	1second blinking output	0.5s ON, 0.5s OFF
M33	Summer/Winter output	Summertime turn ON, winter time turn OFF, used as normal auxiliary relay.
M34	AT01 flag	Output ON when the first channel of SMT-4PT error is
M35	AT02 flag	Output ON when the second channel of SMT-4PT is error
M36	AT03 flag	Output ON when the third channel of SMT-4PT is error
M37	AT04 flag	Output ON when the fourth channel of SMT-4PT is error
M38	RS485 received flag	Output ON when the RS485 port has received data.
M39	RS232 received flag	Output ON when the RS232 port has received data.
M3A	Counter direction flag	Counter mode9 “high speed input counter” Counter direction
M3B~ M3C	Reserved	
M3D	Received flag	MODBUS function using (MU instruction)
M3E	Error flag	
M3F	Time out flag	

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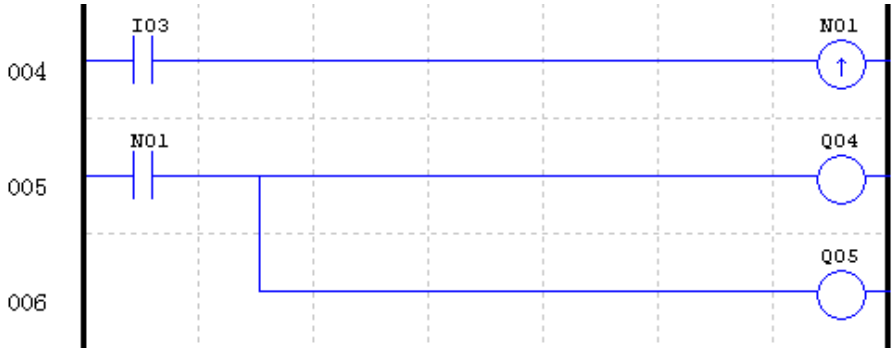
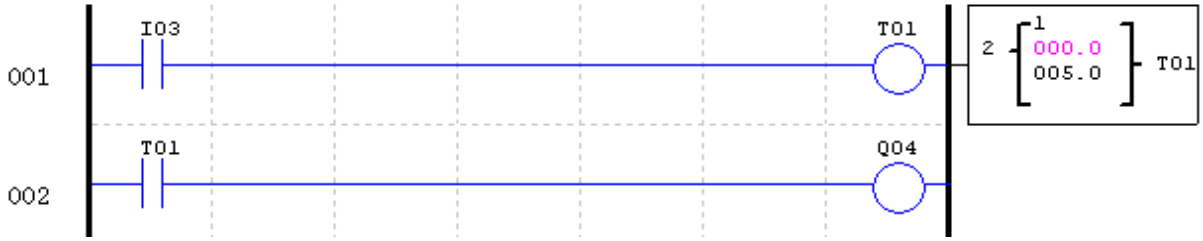
Auxiliary Coils (N)

The function of auxiliary coils, N, is the same as auxiliary coils M, but it can't be kept when the smart powers down. In the first rung of this example, auxiliary relay N01 is being used as an output coil and will be energized when input I03 turns on. In the second rung auxiliary relay N01 is being used as an input, and outputs Q04 and Q05 will be turned ON once N01 is conducted.



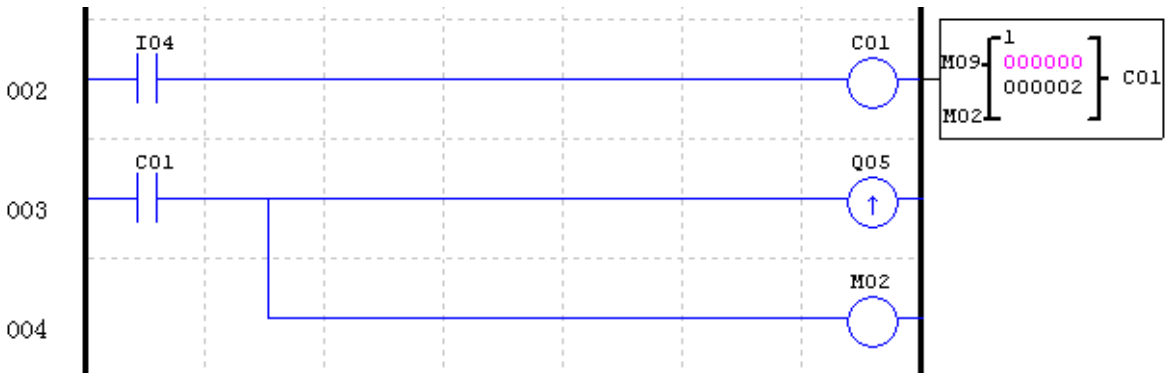
Timer Elements (T)

Timer coil provides the relationship between its current value and the preset value of a selected timer. The timer contacts will turn on when the current value is equal or greater than the pre-set value of a selected timer. In this example, when input I03 turns on, timer T01 will start. When the timer reaches the preset of 5 seconds, timer status contact T01 turns on. When T01 turns on, output Q04 will turn on. Turning off I03 will reset the Timer.



Counters Elements (C)

Counter coil provides the relationship between its current value and the preset value of a selected counter. The counter contact will turn on when the current value is equal or greater than the pre-set value of a selected counter. In this example, each time the input contact I04 changes its state from off to on, the counter (C01) increments by one. When the counter value reaches the preset value, 2, the counter status contact C01 turns on. When C01 turns on, output Q05 will turn on. When M02 turns on counter C01 will reset. If M09 is turned on, the counter will change from a count-up to a count-down counter.



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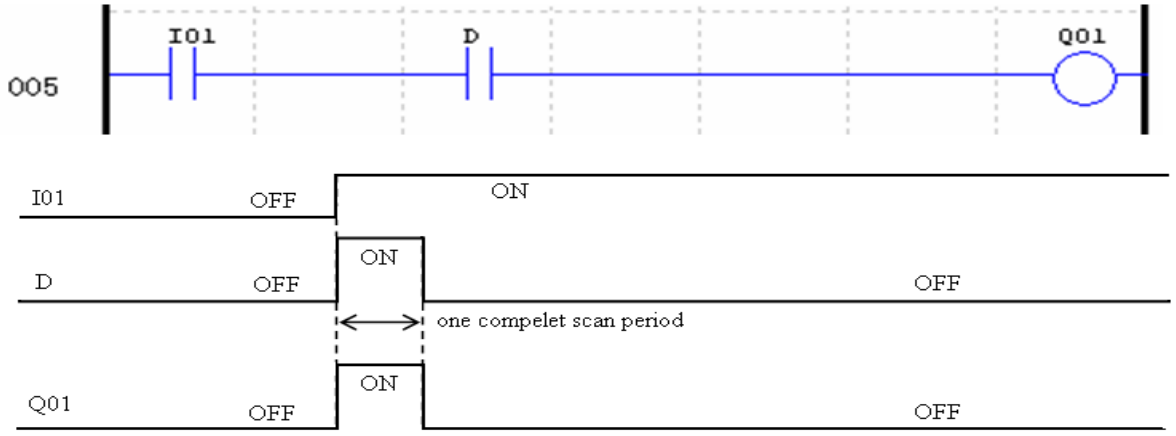
Specialty Elements

	General output	SET output	RESET output	PULSE output	N.O. contact	N.C. contact	Number
Symbol	[			P	┤├	┤/├	(N.O./N.C.)
					Lo	Hi	Used in function block
Expansion input coil					X	x	12(X01-X0C/x01-x0C)
Expansion output coil	Y	Y	Y	Y	Y	y	12(Y01-Y0C/y01-y0C)
Edge trigger (pulse output)					D	d	
RTC	R				R	r	31(R01-R1F/r01-r1F)
Analog comparator	G				G	g	31(G01-G1F/g01-g1F)
HMI	H						31(H01-H1F)
PWM	P						2(P01-P02)
IO LINK	L						8(L01-L08)
SHIFT	S						1(S01)
Filter	F						31(R01-R1F/r01-r1F)

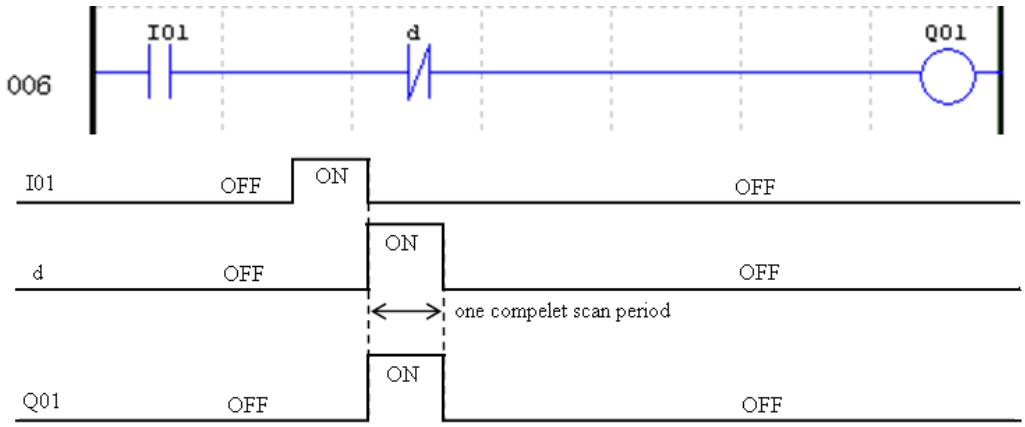
Positive Edge Trigger - Pulse Output (D)

A positive edge trigger (D) holds its status ON for one CPU scan time when the preceding series contact changes its state from OFF to ON. The transition from OFF to ON is called the “Positive Edge Trigger”.



Negative Edge Trigger - Pulse Output (d)

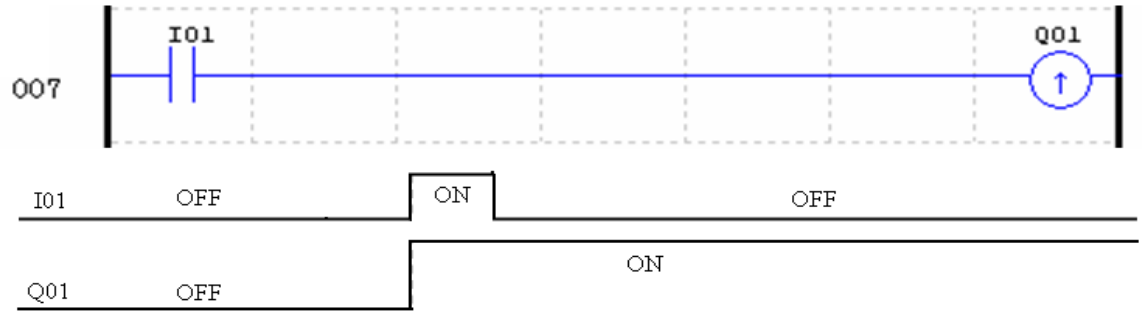
A negative edge trigger (d) holds its status ON for one CPU scan time when the preceding series contact changes its state from ON to OFF. The transition from ON to OFF is called the “Negative Edge Trigger”.



Output Instructions

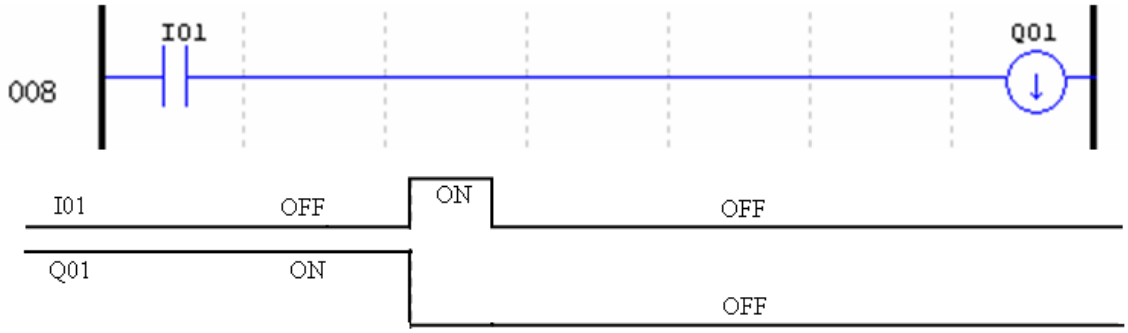
Set Output Instruction (Latch) (↑)

A set output instruction, or Latch, turns ON an output coil (Q) or an auxiliary contact (M) when the preceding input contact turns from OFF to ON. Once the output is ON or set, it will remain ON until it is reset using the "Reset output" instruction. It is not necessary to retain the input contact at ON state once the output is at ON state.



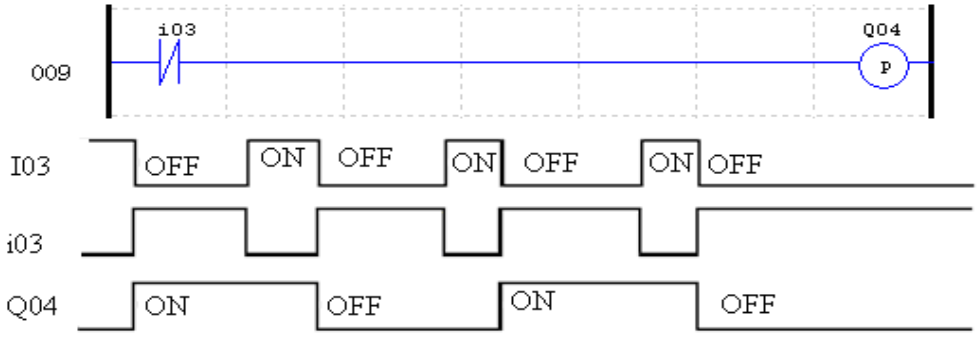
Reset Output Instruction (Unlatch) (↓)

A reset output instruction, or Unlatch, turns OFF a previous set output coil (Q) or an auxiliary contact (M) when the preceding input contact transitions from OFF to ON. Once the output is OFF or reset, it will remain OFF until it be "Set" again.



Pulse Output Instruction (Flip-Flop) (P)

Flip-Flop changes the ON/OFF state of the coil (Q) or an auxiliary contact (M) when the preceding input contact turns from OFF to ON. Once the output is ON, it will remain ON until the next time the preceding input contact turns from OFF to ON. In the example below, when Pushbutton I03 is pressed and released coil, Q04, it will turn on and remain on. When Pushbutton I03 is pressed again, coil Q04 will turn off and remain off.



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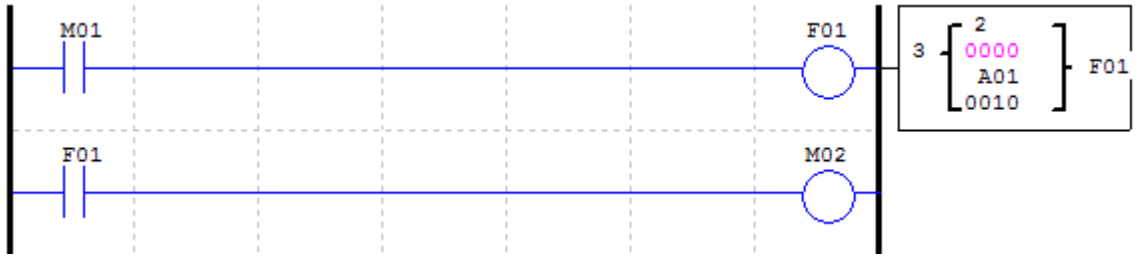
Filter coil (F)

The status of filter decided by the setting of Filter conditions;

If the filter reaches filter conditions, function block current will be updated, filter current value will display filter result, filter coil will be ON.

According to the photo below, coil (F01) will be output when enabled coil (M01) 10 seconds, current value will be updated.



Analog Elements

	Analog input	Analog output	number
Analog input	A		8 (A01~A08)
Analog input parameter	V		8 (V01~V08)
Temperature input	AT		4 (AT01~AT04)
Analog output		AQ	4 (AQ01~AQ04)
Add-Subtract control	AS	AS	31 (AS01~AS1F)
Multiply-Divide control	MD	MD	31 (MD01~MD1F)
PID control	PID	PID	15 (PI01~PI0F)
Data Multiplexer control	MX	MX	15 (MX01~MX0F)
Analog Ramp control	AR	AR	15 (AR01~AR0F)
Data Register	DR	DR	240 (DR01~DRF0)
MODBUS			15 (MU01~MU0F)
Network analog input	NI		31 (NI01~NI1F)
Network analog output		NQ	15 (NQ01~NQ0F)

Analog value (A01~A08, V01~V08, AT01~AT04, AQ01~AQ04, (NI01~NI1F, NQ01~NQ0F)) and current value of functions (T01~T1F, C01~C1F, AS01~AS1F, MD01~MD1F, PI01~PI0F, MX01~MX0F, AR01~AR0F, and DR01~DRF0) can be used as other function's preset value. And the parameter preset value is its limit value when the current value of those functions is bigger or less than parameter's limit value.

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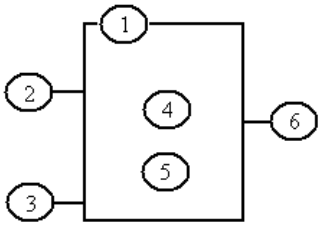
Timer Instruction

The iSmart includes 31 Timer coils that can be used throughout a program. T0E and T0F keep their current value after power lost if "M Keep" is active, but the other Timers' current value is non-retentive. Each Timer has a choice of 8 operation modes, 1 for a pulse Timer and 7 for general purpose Timer. Additionally, each Timer has 6 parameters for proper configuration. The table below describes each configuration parameter and lists each compatible element for configuring Timers.



Symbol	Description
①	Timer Mode (0-7)
②	Timer Unit 1: 0.01s, range: 0.00 - 99.99 sec 2: 0.1s, range: 0.0 - 999.9 sec 3: 1s, range: 0 - 9999 sec 4: 1min, range: 0 - 9999 min
③	ON: the Timer reset to 0 OFF: the Timer continues timing
④	Timer current value
⑤	Timer preset value
⑥	Timer code(T01~T1F total: 31 Timers)

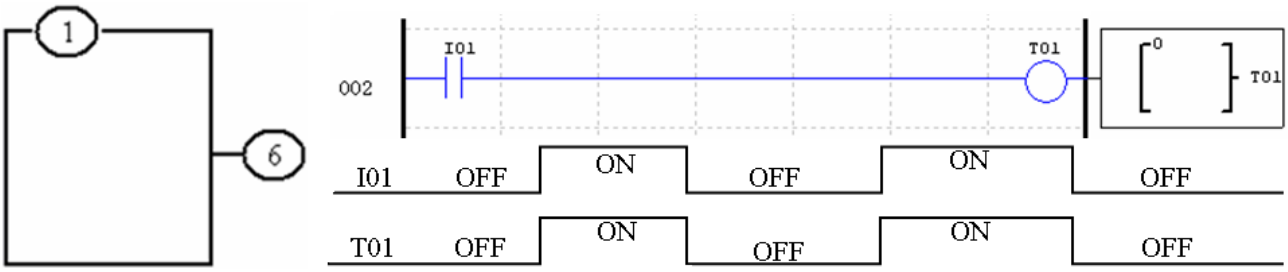
Compatible Instructions	Range
Input	I01-I0C/i01-i0C
Keypad input	Z01-Z04/z01-z04
Output	Q01-Q08/q01-q08
Auxiliary coil	M01-M7F/m01-m7F
Auxiliary coil	N01-N7F/n01-n7F
Expansion input	X01-X0C/x01-x0C
Expansion output	Y01-Y0C/y01-y0C
RTC	R01-R1F/r01-r1F
Counter	C01-C1F/c01-c1F
Timer	T01-T1F/t01-t1F
Analog comparator	G01-G1F/g01-g1F
Normal open contact	Lo
Filter Coil	F01-F1F/f01-f1F
Network Input Coil	J01-J3F/j01-j3F
Network Output Coil	K01-K3F/k01-k3F

※ The preset value of Timer could be a constant or other function current value.

※ The current value of T0E and T0F will be kept when iSmart on a loss of power if the "M-Keep" is active.

Timer Mode 0 (Internal Coil)

Mode 0 Timer (Internal Coil) used as internal auxiliary coils. No timer preset value. The status of T coil becomes with enable coil as shown below.



※ I01 is enable coil.

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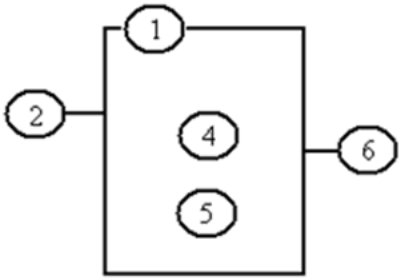
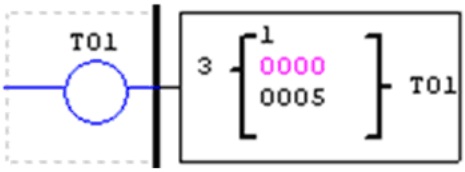
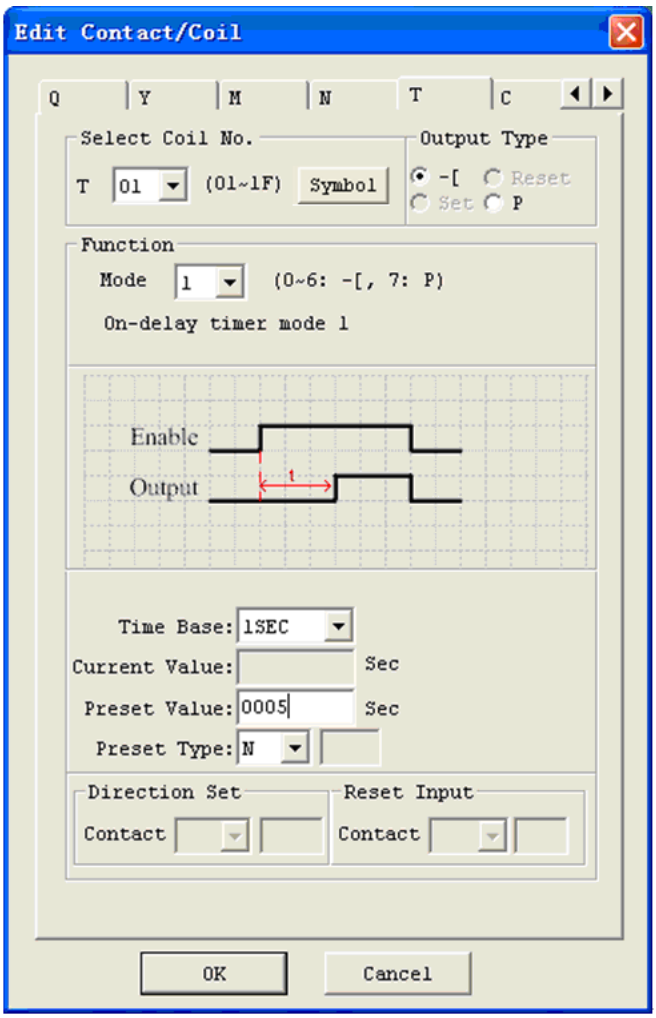
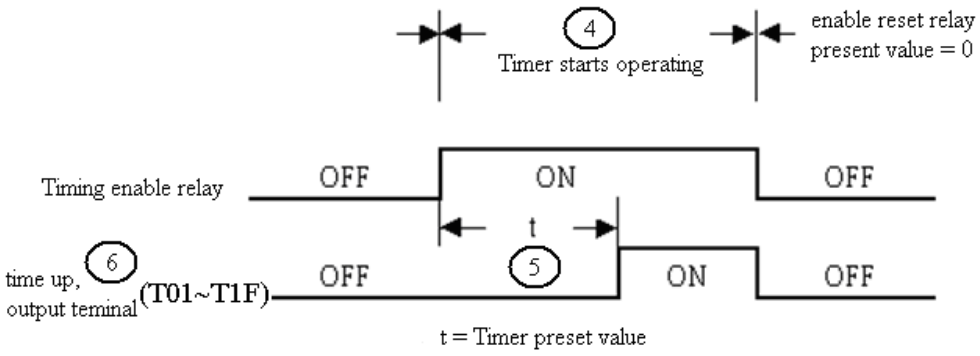
Timer Mode 1 (ON-Delay)

Mode 1 Timer (ON-Delay) will time up to a fixed value and stop timing when the current time is equal to the pre-set value. Additionally, the Timer current value will reset to zero when Timer is disabled. In the example below, the timer will stop timing when it reaches the preset value of 5 seconds. Timer contact T01 will be ON when the current value is 5.







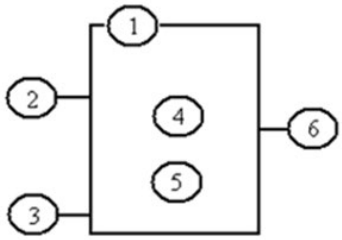


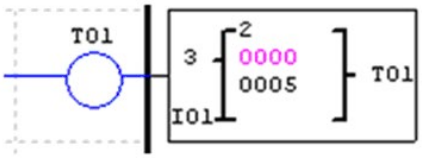
※ T0E and T0F keep their current value after a loss of power to the smart relay if "M Keep" is active, but the others' reset to 0.

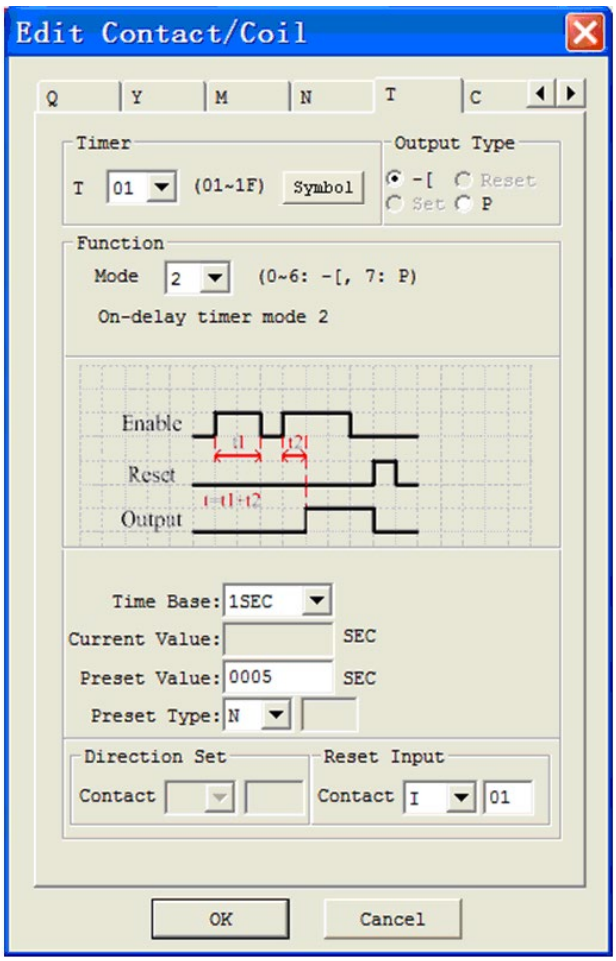
-

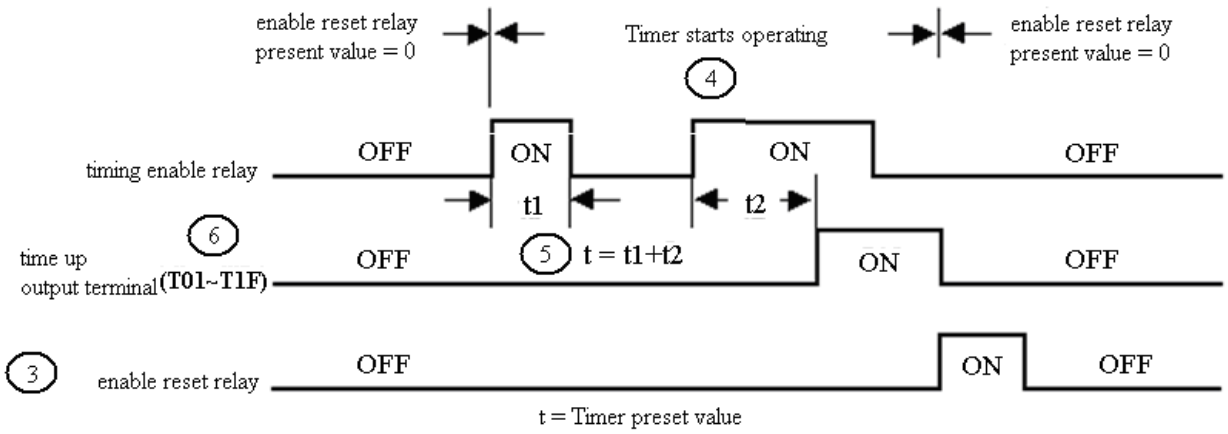
Timer Mode 2 (ON-Delay with Reset)

Mode 2 Timer is an ON-Delay with reset that will time up to a fixed preset value and stop timing when the current time is equal to the pre-set value. Additionally, the Timer current value will be kept when Timer is disabled. In the example below, the Timer will stop timing when it reaches its preset value of 5 seconds. Timer status bit T01 will be ON when the current value is 5. The timer reset input is input I01. The timer current value will reset to 0, and Timer status bit T01 will turn off when I01 is ON.









※ T0E and T0F keep their current value after a loss of power to the smart relay if "M Keep" is active, but the others' reset to 0.

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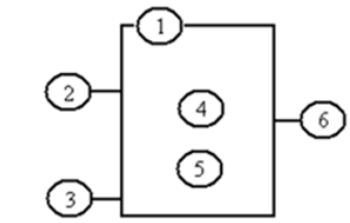
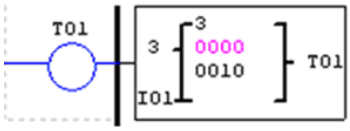
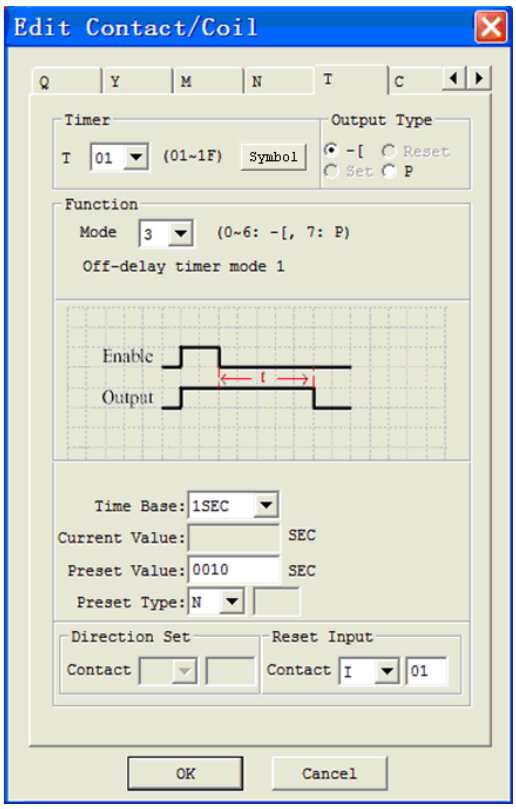
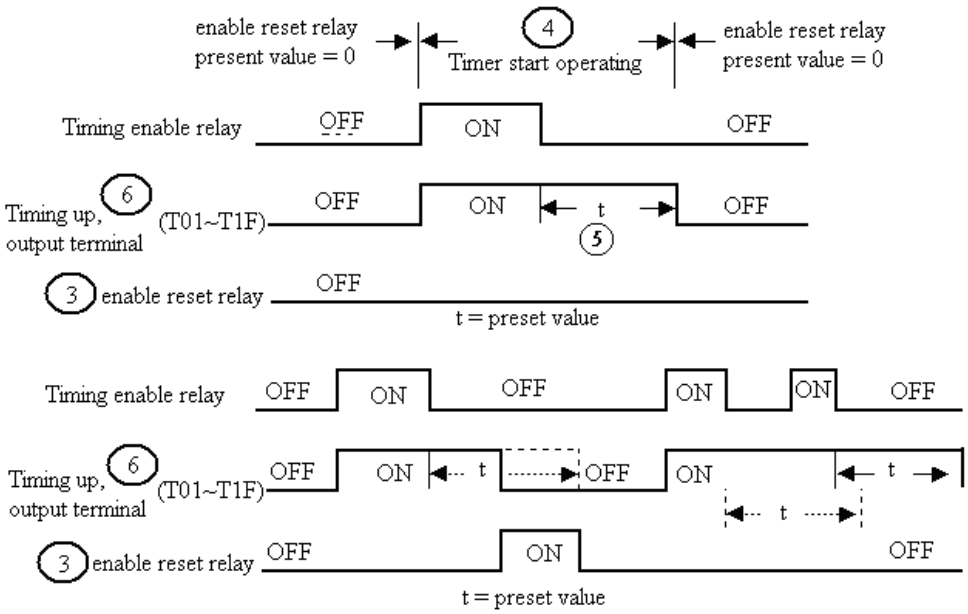
Timer Mode 3 (OFF-Delay)

Mode 3 Timer is an OFF-Delay with reset that will time up to a fixed preset value and stop timing when the current time is equal to the pre-set value. Additionally, the Timer current value will reset to zero when Timer is disabled. In the example below, the timer reset input is Input I01.Timer status bit T01 will be ON immediately when its rung is true. The timer will only begin timing up when its rung changes to false. Timer status bit T01 will turn OFF when the current time value reaches its preset value of 10 seconds.







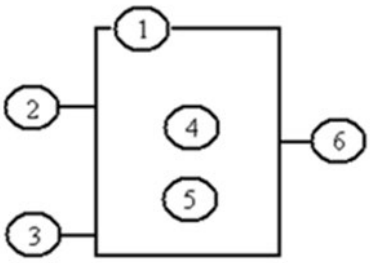


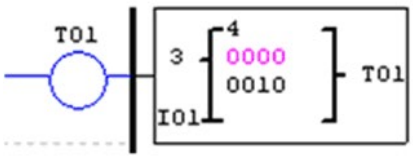
※ T0E and T0F keep their current value after a loss of power to the smart relay if “M Keep” is active, but the others’ reset to 0.

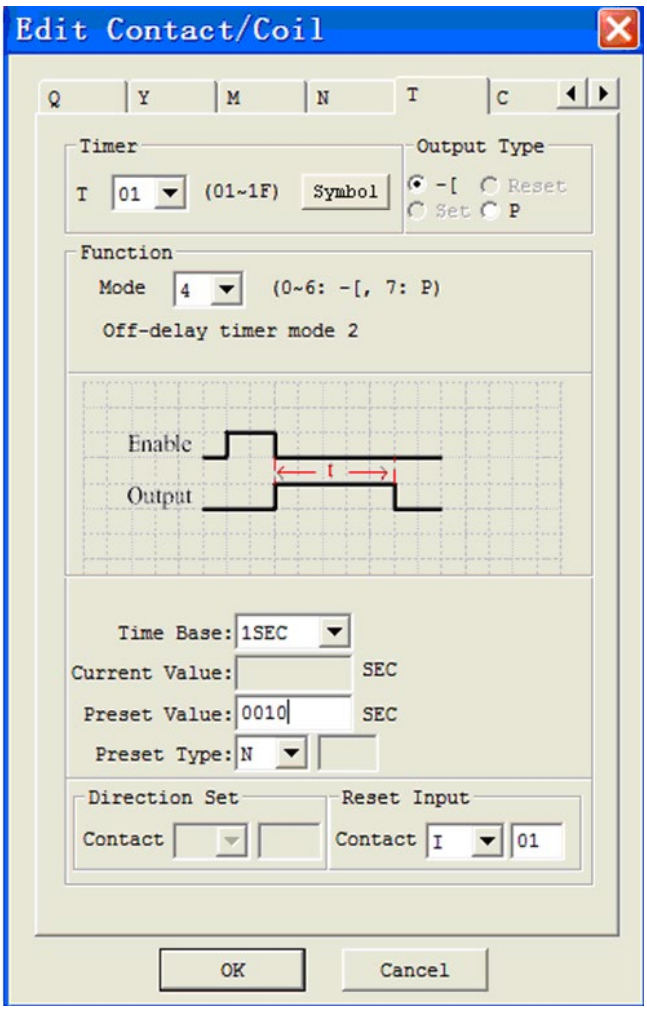
-

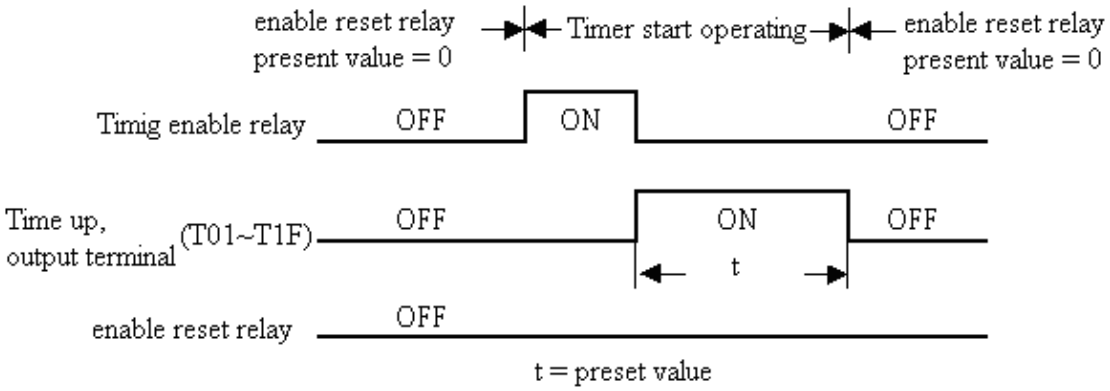
Timer Mode 4 (OFF-Delay)

Mode 4 Timer is an OFF-Delay with reset that will time up to a fixed preset value and stop timing when the current time is equal to the pre-set value. Additionally, the Timer current value will reset to zero when Timer is disabled. In the example below, the timer reset input is Input I01. The timer status bit T01 will turn ON only after its rung transitions from true to false. Timer status bit T01 will turn OFF when the current time value reaches its preset value of 10 seconds.









※ T0E and T0F keep their current value after a loss of power to the smart relay if “M Keep” is active, but the others’ reset to 0.

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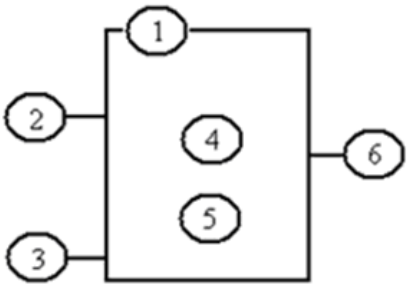
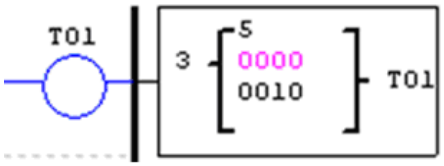
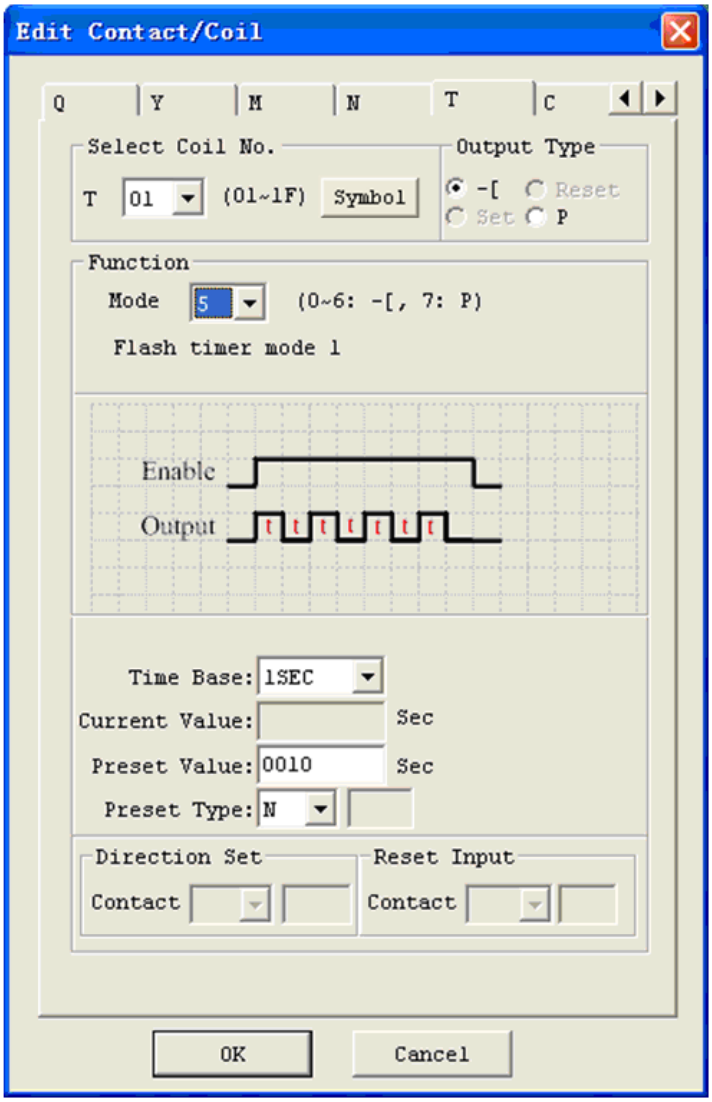
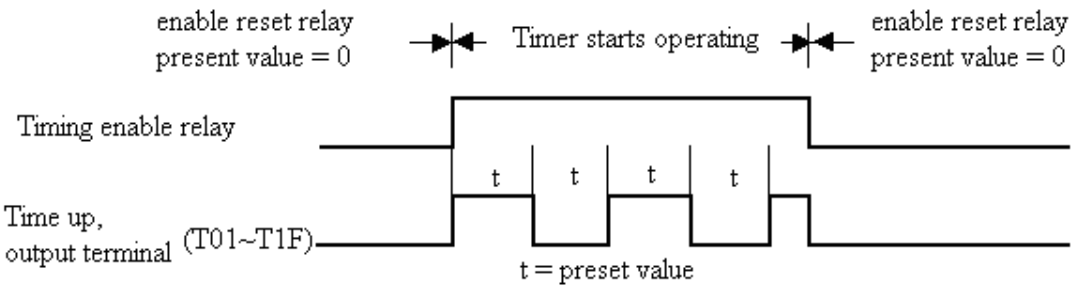
Timer Mode 5 (FLASH without reset)

Mode 5 Timer is a Flash timer without reset that will time up to a fixed preset value and then change the state of its status bit. Additionally, the Timer current value will reset to zero when Timer is disabled. In the example below, timer status bit T01 will be ON immediately when its rung is true and begin its timing sequence. Timer status bit T01 will turn OFF when the current time value reaches its preset of 10 seconds. This Flash sequence of the Timer status bit T01 will continue as long as its rung remains true.









※ The current value of Timer cannot be kept on a loss of power to smart.

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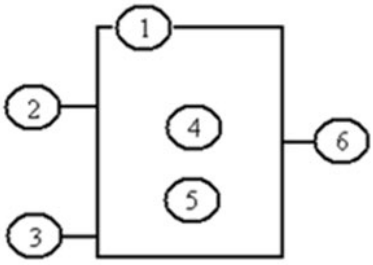
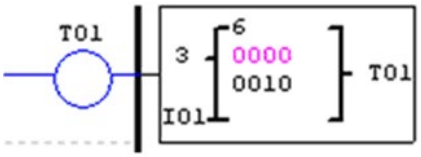
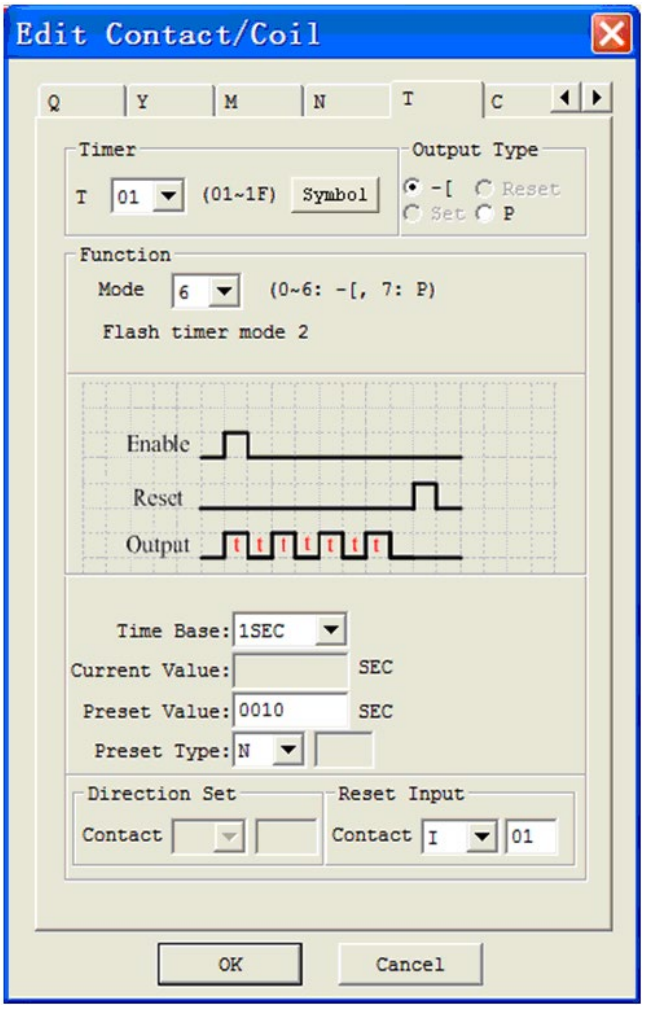
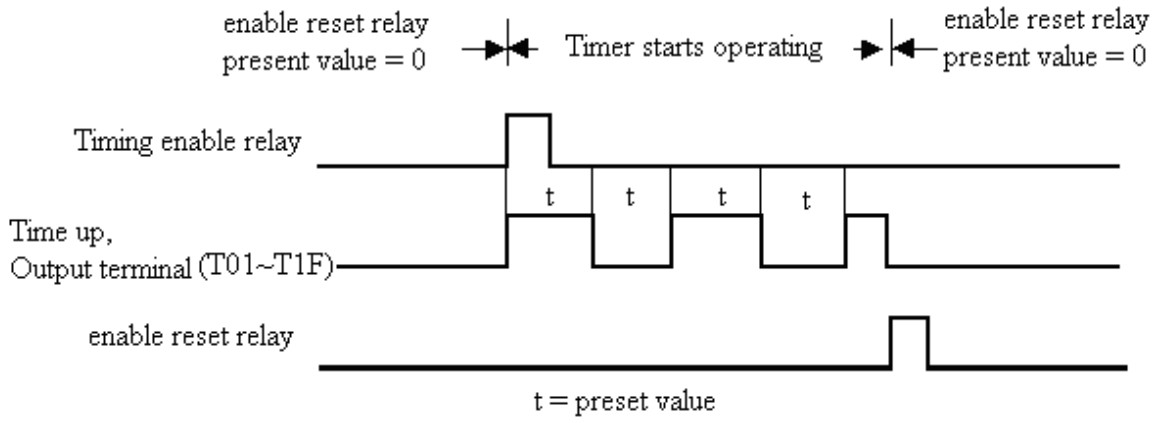
Timer Mode 6 (FLASH with Reset)

Mode 6 Timer is a Flash timer with reset that will time up to a fixed preset value and then change the state of its status bit. Additionally, the Timer current value will reset to zero when Timer is disabled. In the example below, the timer reset input is Input I01. Timer status bit T01will be ON immediately when its rung is true and begin its timing sequence. Timer status bit T01 will turn OFF when the current time value reaches its preset of 10 seconds. This Flash sequence of the timer status bit T01 will continue as long as the reset input signal does not be triggered.









※ The current value of Timer cannot be kept on a loss of power to smart.

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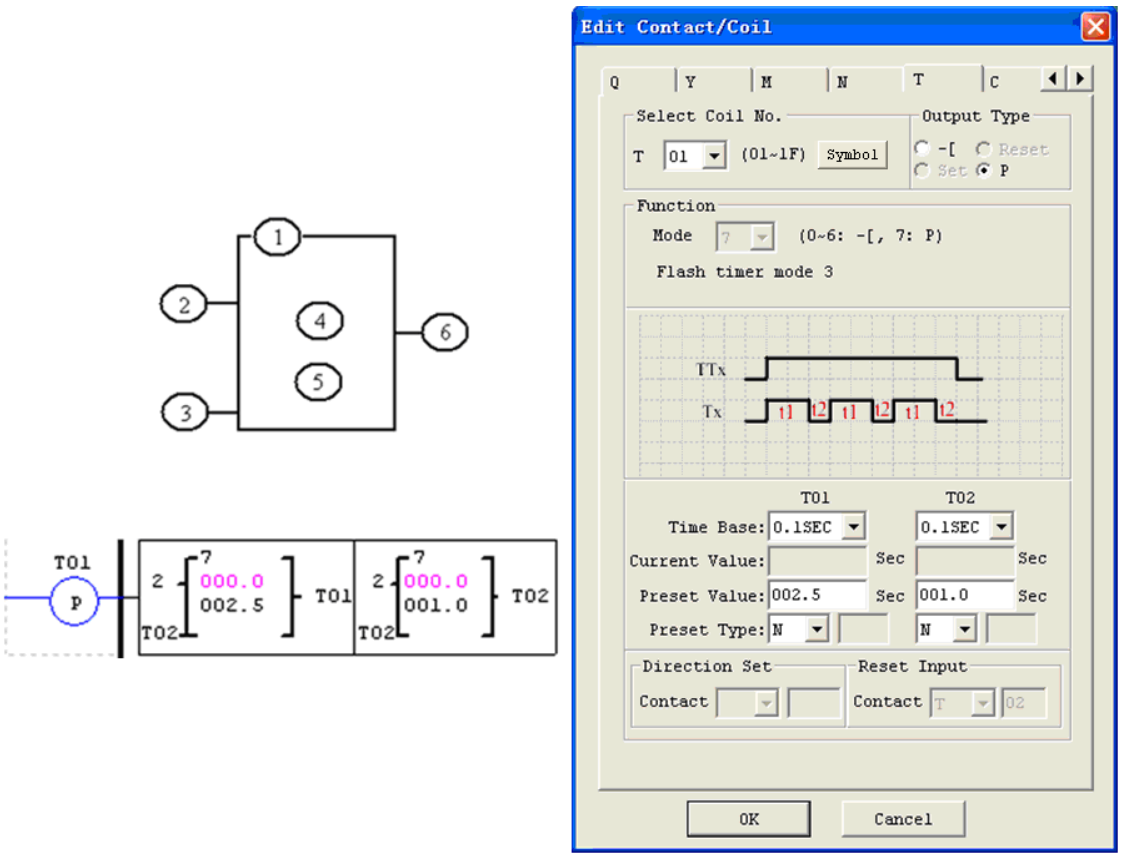
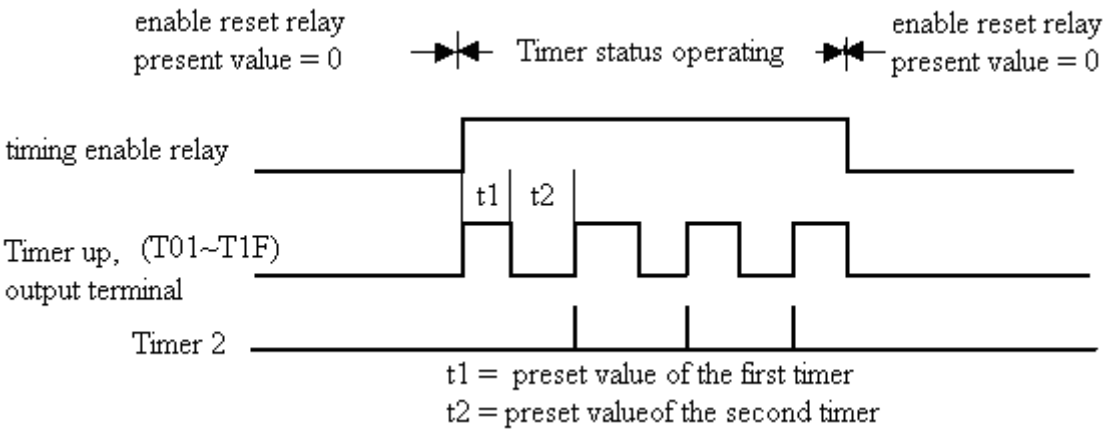
Timer Mode 7 (FLASH Cascade without Reset)

Mode 7 Timer is a Flash Timer which using two Timers in a cascade configuration without reset. The second Timer number follows the first Timer. The cascade configuration connects the timer status bit of first timer to enable the second timer. The second timer will time up to its pre-set value then flash and its timer status bit will enable the first timer. Additionally, the Timer current value will reset to zero when Timer is disabled. In the example below, timer status T01 will be ON after it completes its timing sequence of 2.5 seconds. Timer 2 will then begin its timing sequence of 1 second. When the current time value of Timer 2 reaches its preset of 1 second, its status bit T02 will flash, and Timer 1 will begin timing again. This type of cascade timer is often used in combination with a counter in applications where it is necessary to count the number of time cycles completed.

※Those two timers of Timer Mode 7 that cannot be double used as Timers for other modes in the same program.





※ The current value of Timer cannot be kept on a loss of power to iSmart.

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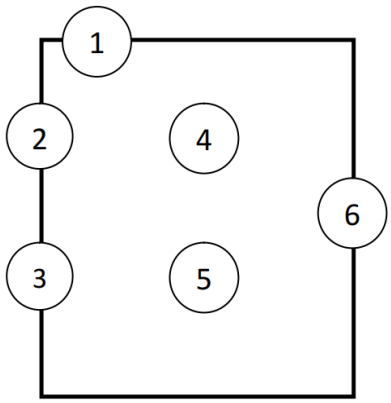
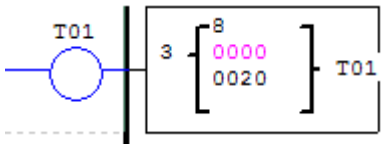
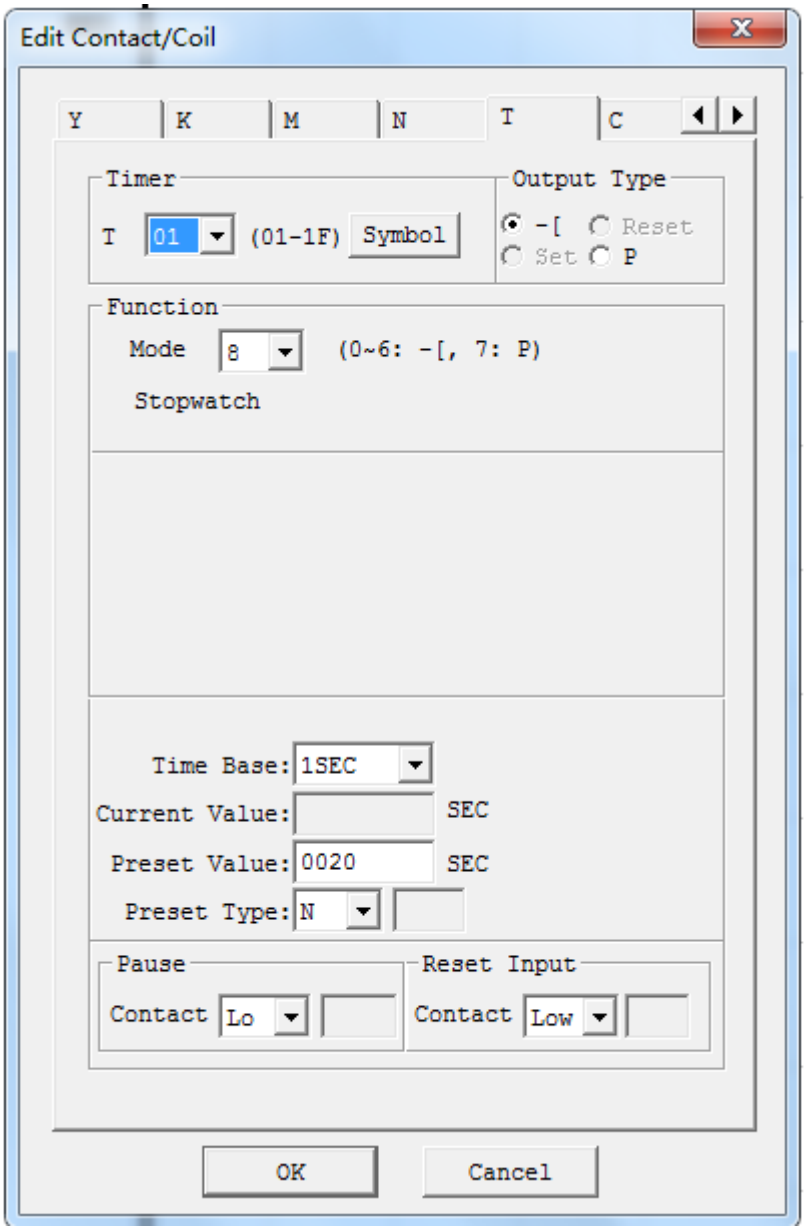
Timer Mode 8 (second chronograph mode)

- Timer mode 8 is stopwatch mode with reset control and pause control. When control condition from OFF to ON, The timer starts ticking; When the timer reaches the preset value, the output coil will change its state, and the current value of the timer will be displayed as the preset value, and the timing will not continue. When the reset control is effective, the current value of the timer and the output coil will be reset to 0. When the input is paused ON, the current value will no longer be updated (the timing will continue). When the input is paused OFF, the current value will be updated (the current actual value). If the input is paused ON, the actual value will reach the preset value, the current value will be displayed as 9999 and the timing will not continue.







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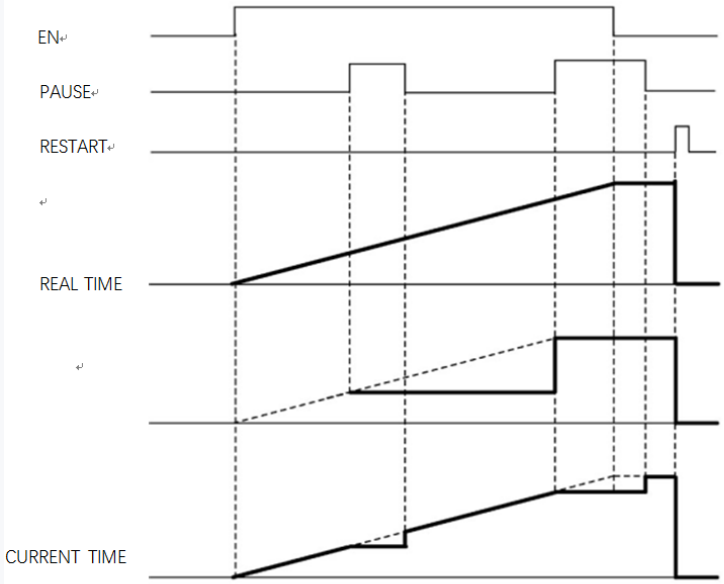
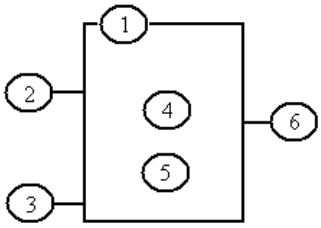


Counter Instructions

The iSmart includes 31 counters that can be used throughout a program. Each counter has a choice of 9 operation modes, 1 for pulse counter, 6 for general purpose counting and 2 for high speed counting. Additionally, each counter has 6 parameters for proper configuration. The tables below describe each configuration parameter and lists each compatible memory type for configuring counters.



Common Counter

Symbol	description
①	Counting Mode (0-6)
②	Use (I01~g1F) to set counting up or down OFF: counting up (0, 1, 2, 3……) ON: counting down (……3, 2, 1, 0)
③	Use (I01~g1F) to reset the counting value ON: the counter value reset to 0 OFF: the counter continues to count
④	Counter current Value, range: 0~999999
⑤	Counter preset Value, range: 0~999999
⑥	Counter Code (C01~C1F total: 31 Counters)

Compatible Instructions	Range
Input	I01-I0C/i01-i0C
Keypad input	Z01-Z04/z01-z04
Output	Q01-Q08/q01-q08
Auxiliary coil	M01-M7F/m01-m7F
Auxiliary coil	N01-N7F/n01-n7F
Expansion input	X01-X0C/x01-x0C
Expansion output	Y01-Y0C/y01-y0C
RTC	R01-R1F/r01-r1F
Counter	C01-C1F/c01-c1F
Timer	T01-T1F/t01-t1F
Analog comparator	G01-F1F/g01-g1F
Normal open contact	Lo
Filter Coil	F01-F1F/f01-f1F
Network Input Coil	J01-J3F/j01-j3F
Network Output Coil	K01-K3F/k01-k3F

※ The preset value of Counter could be a constant or other function current value.

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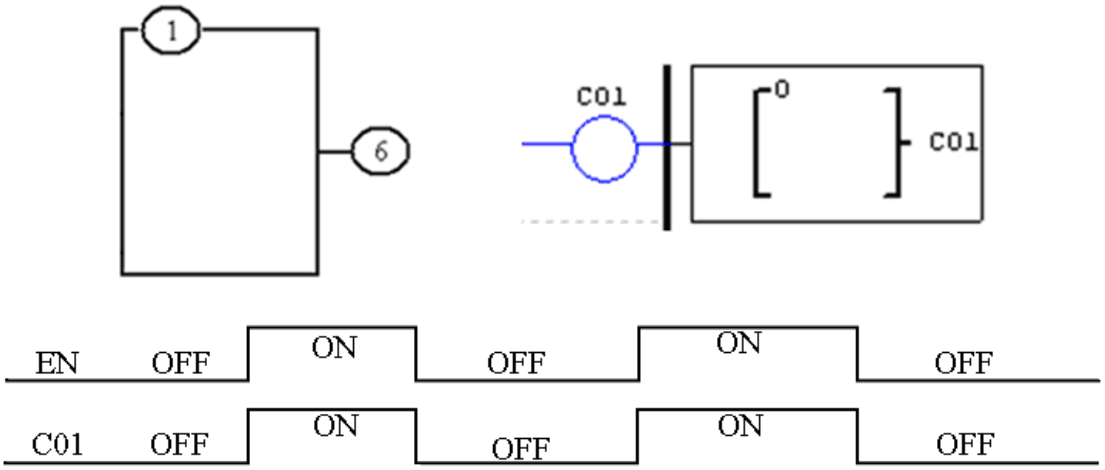
Counter Mode 0 (Internal coil)

Mode 0 Counter (Internal Coil) used as internal auxiliary coils. No counter preset value. In the example below shows the relationship among the numbered block diagram for a mode 0 counter, the ladder diagram view, and the software Edit Contact/Coil dialog box.



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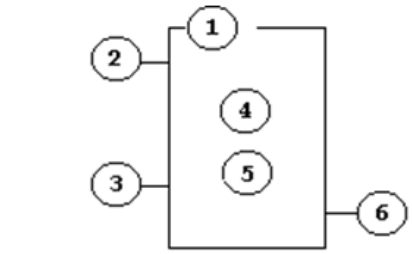
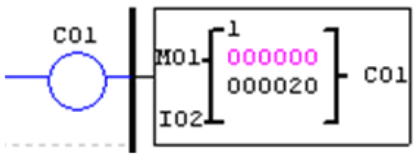
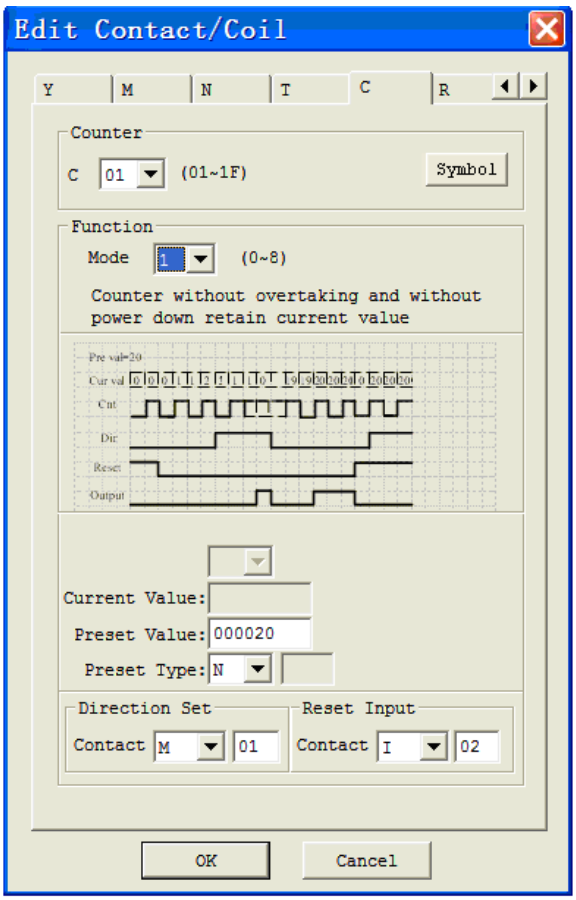
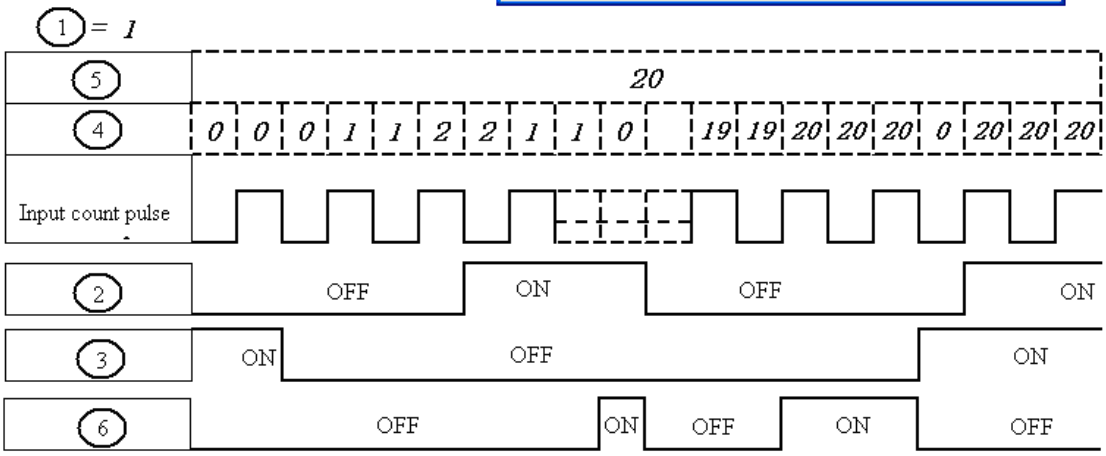
Counter Mode 1 (Non-Overtake, Non-Retentive)

Mode 1 Counter will count up to a fixed preset value and stop counting when the current count is equal to the preset value or count down to 0 and stop counting when the current count is equal to 0. Additionally, the current count value is non-retentive and will reset to zero or preset value when restart the iSmart unit or change the Run/Stop mode, reset to zero or preset value depends on the counting direction. In the example below, the counter will stop counting when it reaches the preset value of 20. Counter status bit C01 will be ON when the current value is 20.









※ Under this mode, the counter current value will be init value when the smart is power up or switching between RUN and STOP. The initial value equals to zero if the counter is in counting-up mode, but the preset value in counting-down mode.

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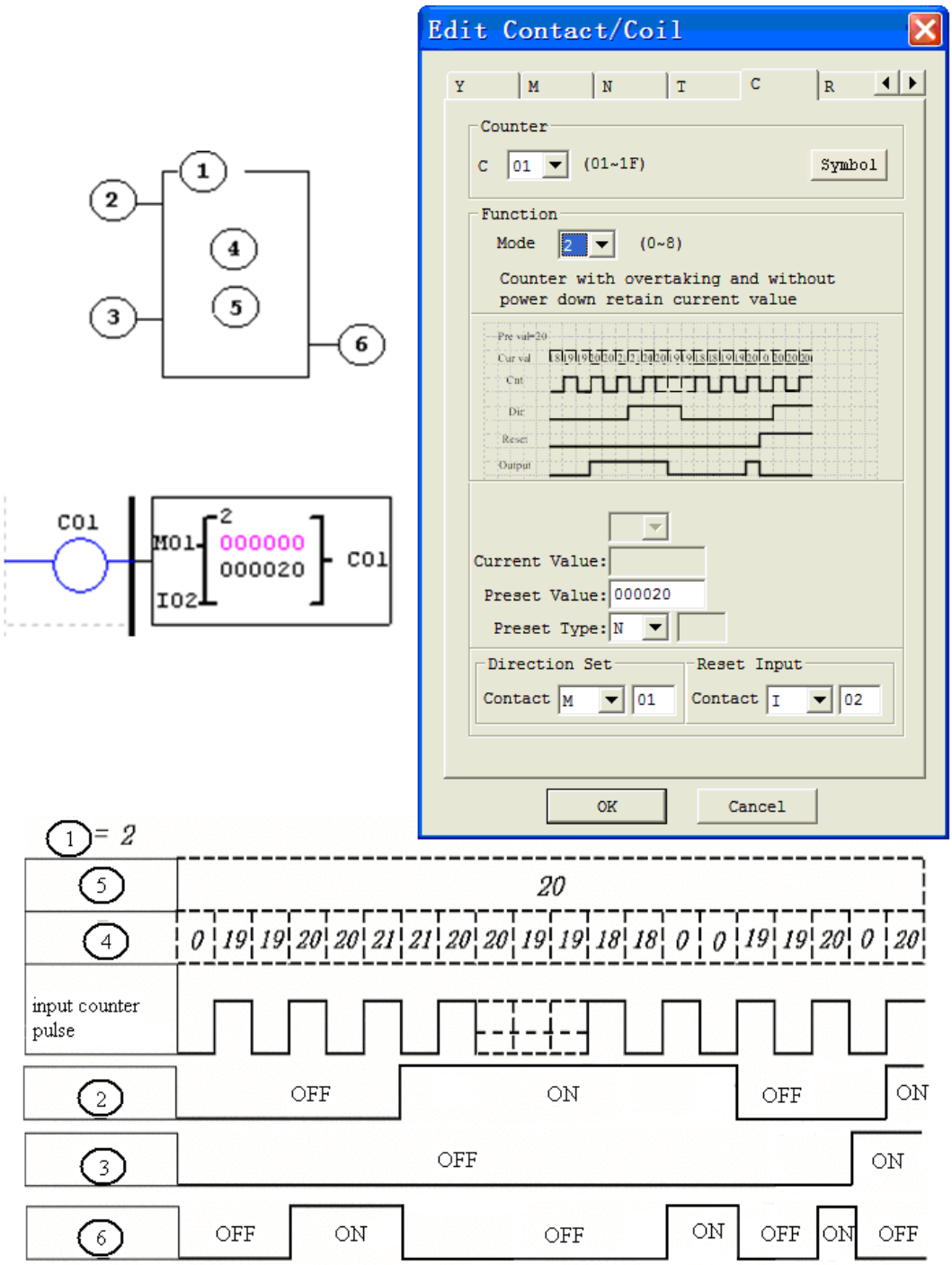
Counter Mode 2 (Overtaking, Non-Retentive)

Mode 2 Counter will count up to a fixed preset value and continue counting even reach the preset value, but it will not count when the current value equals 0 in counting-down mode. Additionally, the current count value is non-retentive and will reset to init value on a powering up to the smart relay or switching between RUN and STOP. In the example below, the counter will continuously count when reach its preset value of 20. Counter status bit C01 will be ON when the current value is 20.



※ Under this mode, Counter will continue counting after reaching preset value if it is configured as counting-up mode. But it stops counting when its current value is 0 if it is configured as counting-down mode.

※ The counter current value will be initiate value when the smart's status switches between RUN and STOP or the

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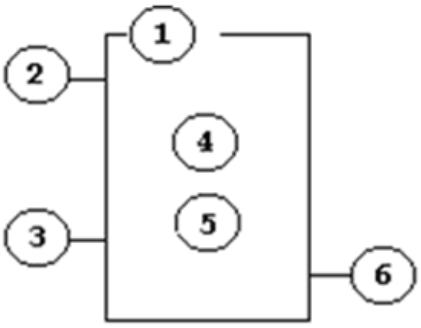
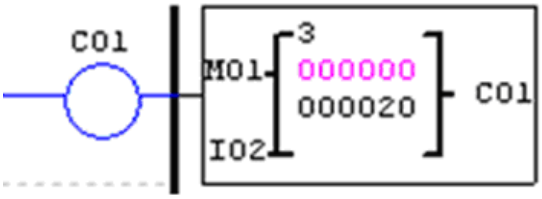
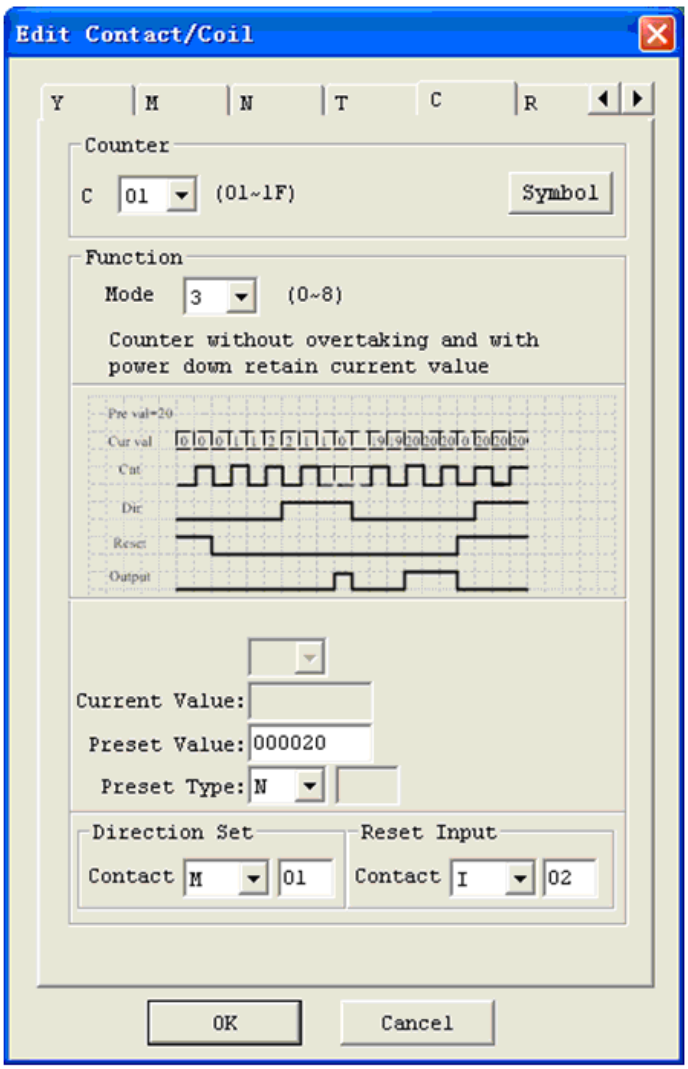
smart is power up. The initial value equals to zero if the counter is in counting-up mode, but the preset value in counting-down mode.

Counter Mode 3 (Non-Overtaking, Retentive)

Mode 3 Counter operation is similar to Mode 1 except its current count value is retentive when restart the power. Mode 3 Counter will count up to a fixed preset value and stop counting at that value or stop counting when its current value is 0 if it's configured as counting-down mode. Additionally, the current count value is retentive when the smart switches between RUN and STOP if "C Keep" is active. In the example below, the counter will stop counting when it reaches the preset value of 20. Counter status bit C01 will be ON when the current value is 20.







This mode is similar to mode 1, but:

※ The current value will be kept when iSmart is in "Run" mode once the power is lost.

※ The current counter value will be kept when the iSmart is switched between RUN and STOP if C-keep is active.

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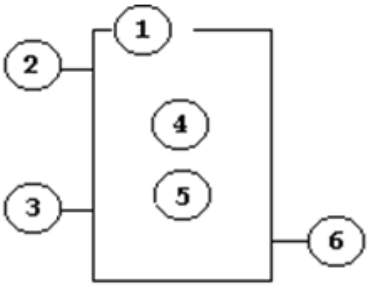
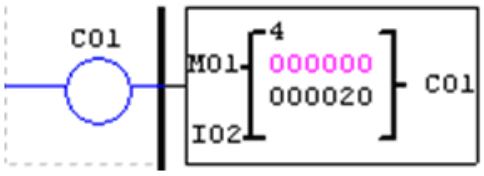
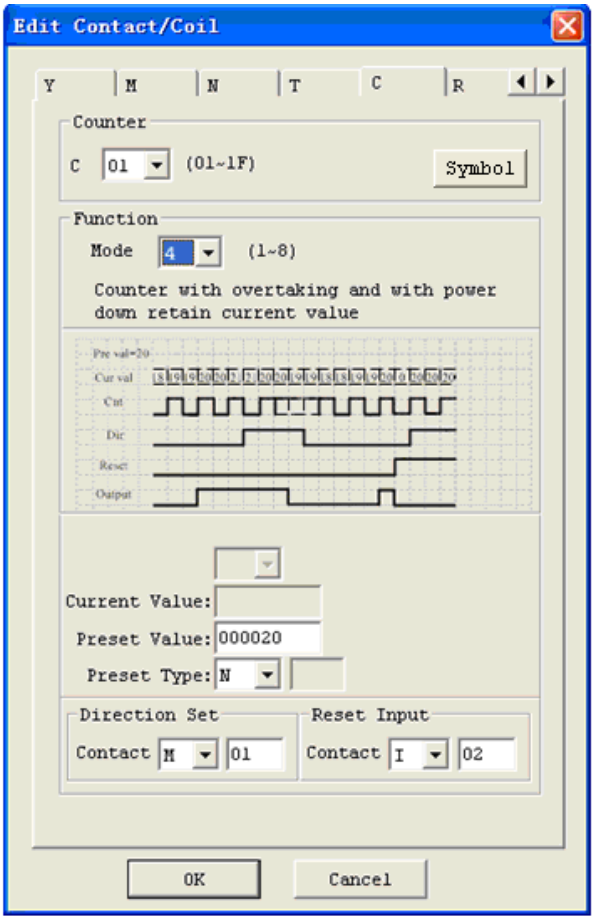
Counter Mode 4 (Overtaking, Retentive)

Mode 4 Counter operation is similar to Mode 2 except its current count value is retentive. The current count value is retentive and will keep its current count after power lost. Mode 4 Counter will count up to a fixed preset value and then continue counting after the preset value, but it will not count when the current value equals 0 if it's configured as counting-down mode . Additionally, the current count value is retentive when the smart switches between RUN and STOP if "C Keep" is active. In the example below, the counter will continue counting after its preset value of 20. Counter status bit C01 will be ON when the current value is not less than 20.







This mode is similar to mode 2, but:

※ The current counter value will be kept when iSmart is in "Run" mode once the power is lost.

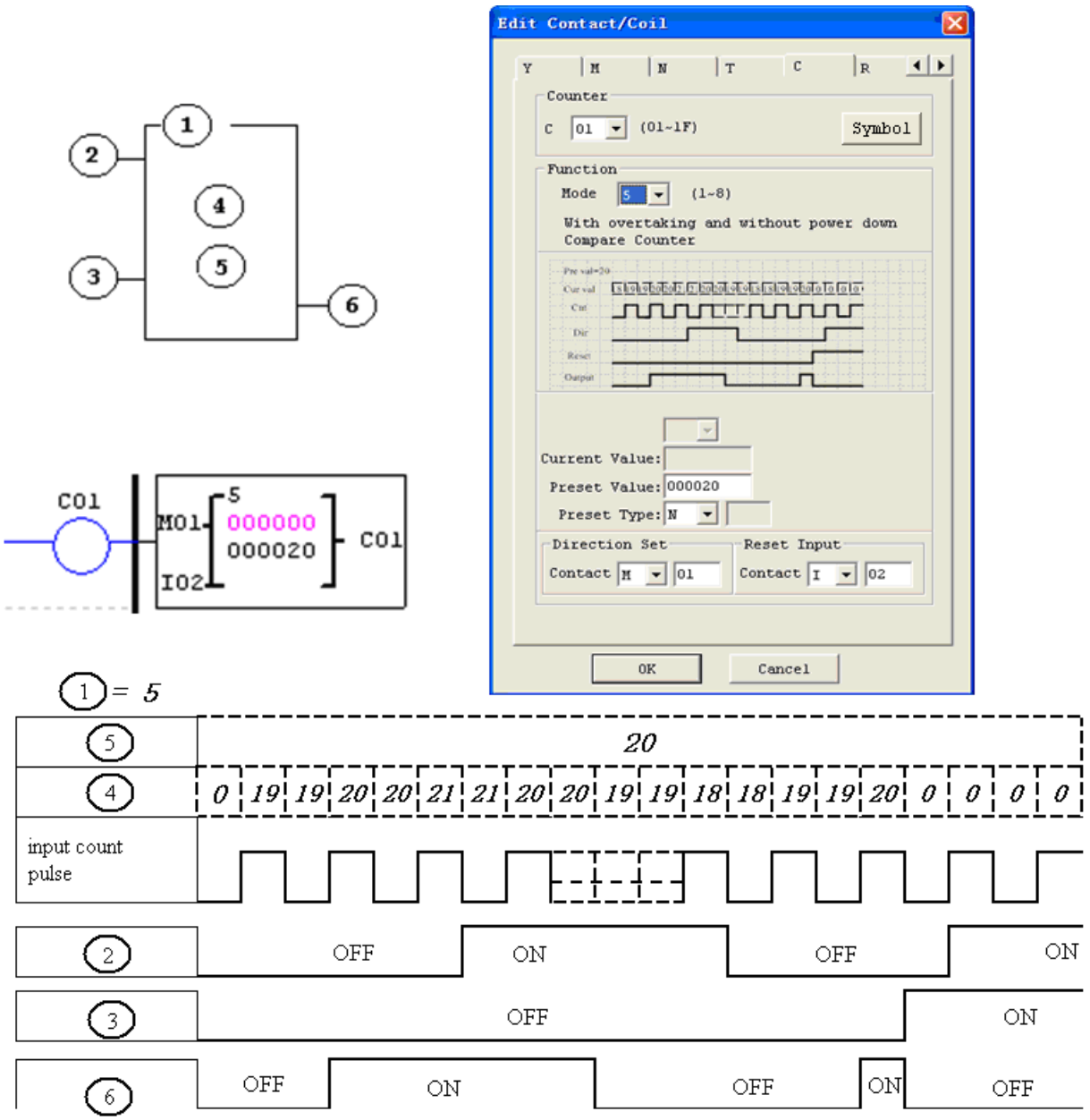
※ The current counter value will be kept when the iSmart is switched between RUN and STOP if "C-keep" is active.

-

Counter Mode 5 (Overtaking, Up-Down Count, Non-Retentive)

Mode 5 Counter's operation is similar to Mode 2, overtaking and non-retentive. Its status bit will be ON when the counter current value is not less than its preset value and will be OFF when the current value is less than its preset value.

The Mode 5 Counter will count up to a fixed preset value and continue counting even reach the preset value. Additionally, the current count value is non-retentive and will reset to 0 when power lost. Additionally, the Mode 5 counter is always reset to zero, and the current value also is always 0 when the smart switches between RUN and STOP unrelated to the state of its direction bit. In the example below, the counter will continue counting after its preset value of 20. Counter status bit C01 will be ON when the current value is 20.



※ Under this mode, the count will continuous after reaching its preset value.

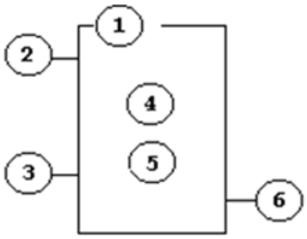
※ The current value is always 0 regardless of the state of its direction bit when the reset is availability.

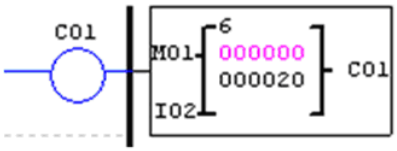
※ The current value is always 0 regardless of the state of its direction bit when the smart switches between RUN and STOP.

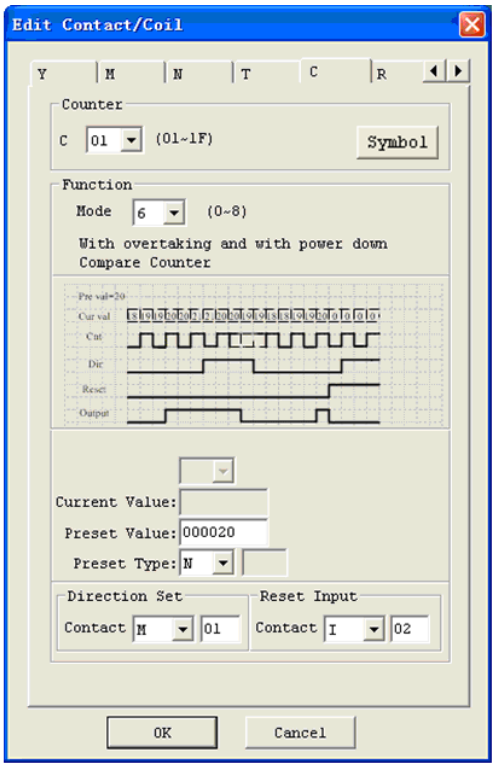
-

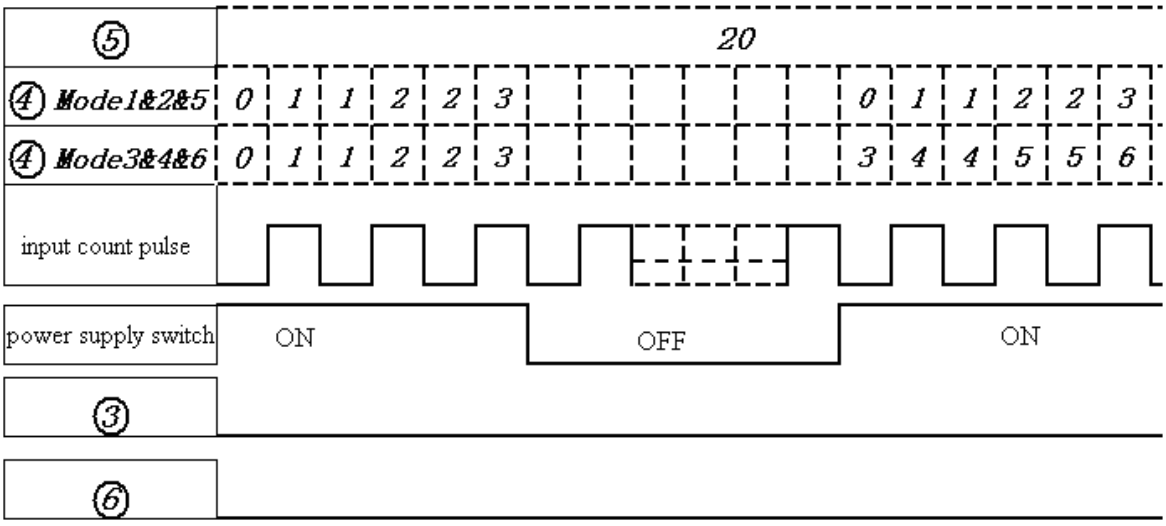
Counter Mode 6 (Overtaking, Up-Down Count, Retentive)

Mode 6 Counter's operation is similar to Mode 4, its current count value is overtaking and retentive. Its status bit will be ON when the counter current value is not less than its preset value and will be OFF when the current value is less than its preset value. Additionally, the Mode 6 counter is always reset to zero, regardless of the state of its direction bit. The current count value is retentive and will keep its current count after power lost. And Counter will keep current value if "C Keep" is active. In the example below, the counter will continue counting after its preset value of 20. Counter status bit C01 will be ON when the current value is not less than 20.









This mode is similar to mode 5, but:

※ The current value is kept when power lost in Run mode.

※ The current value is kept when change the mode between RUN and STOP if "C Keep" is active.

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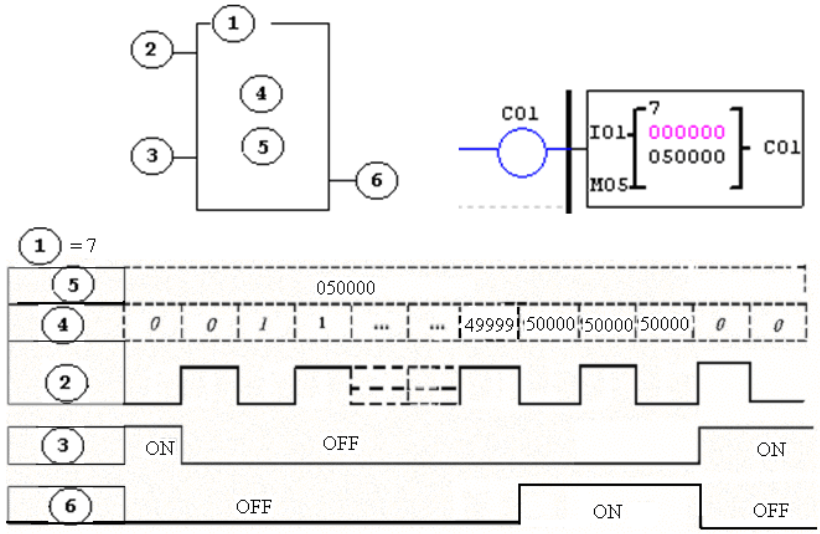
High Speed Counters (DC Version Only)

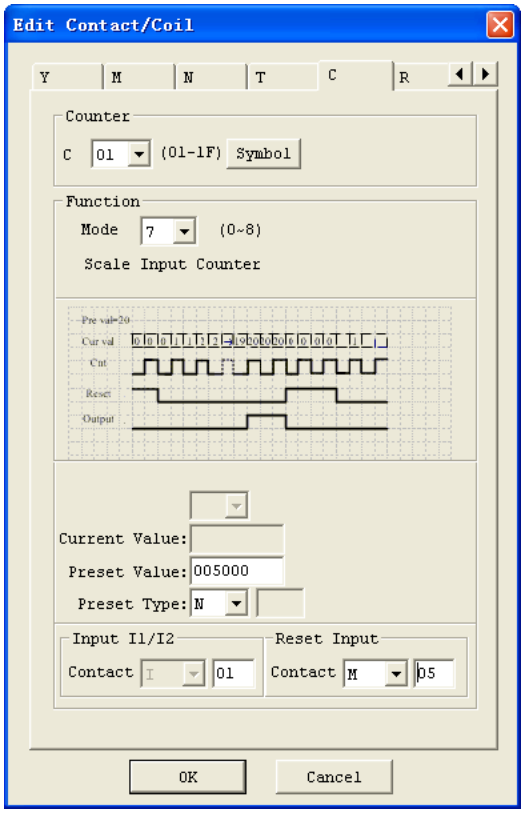
The DC powered version smart relays include two 1 KHz high speed inputs on terminal I01 and I02. These can be used as general purpose DC inputs or can be wired to a high speed input device (encoder, etc.) when configured for high speed counting.

High Speed Counter Mode 7 (DC powered versions only)

The Mode 7 High Speed Counter can use either input terminals I01 or I02 for forward up-counting to 1 KHz maximum at 24VDC high speed input signal. The selected Counter Coil (C01-C1F) will turn ON when the pulse count reaches preset value and remain ON. The counter will reset when the Reset Input is active. In the example below shows the relationship among the numbered block diagram for a Mode 7 Counter, the ladder diagram view, and the software Edit Contact/Coil dialog box.

Symbol	Description
①	Counting Mode (7) high speed counting
②	High speed counting input terminal: I01 or I02 only
③	Use (I01~g1F) to Reset the counting value ON: the counter reset to 0 OFF: the counter continues to count
④	Current Count Value, range: 0~999999
⑤	Preset Value, range: 0~999999
⑥	Counter Coil Number (C01~C1F total: 31 counters)





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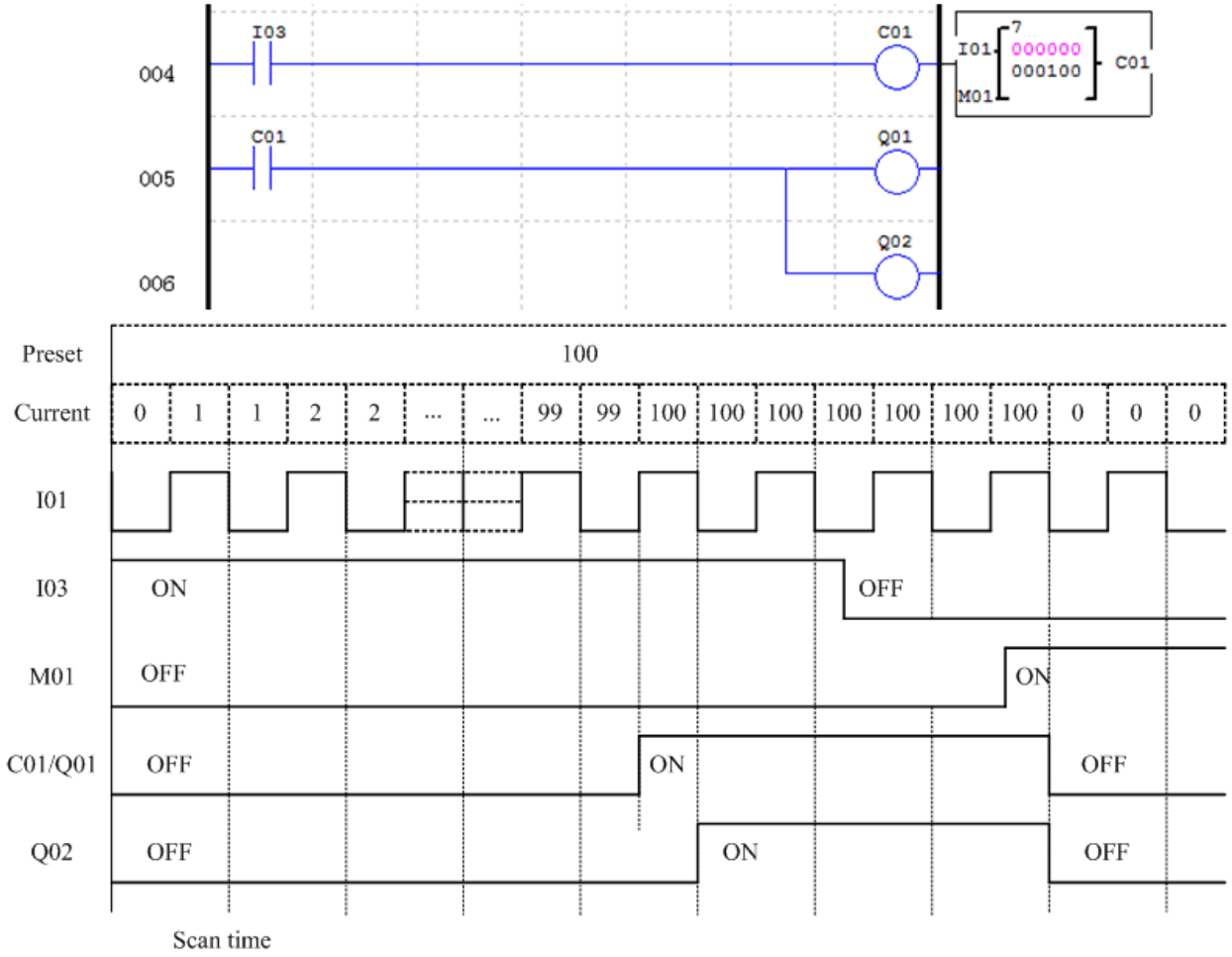
Example：Q01 output ON with C01, and Q02 output ON with scan time.



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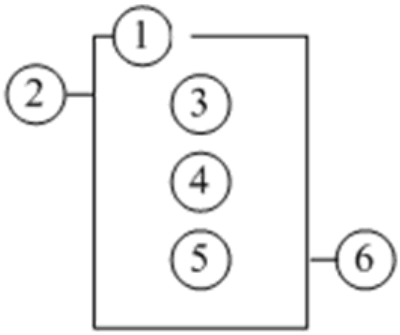
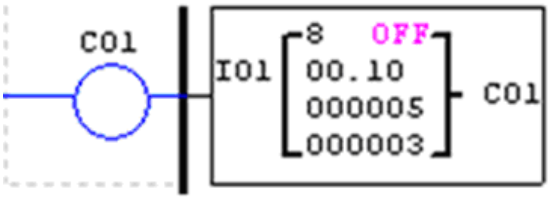
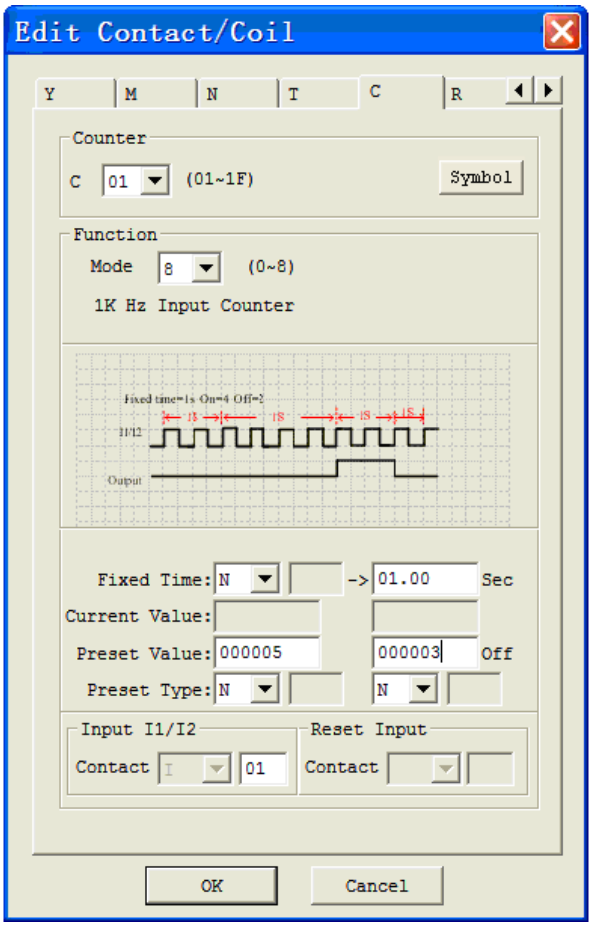
High Speed Counter Mode 8 (DC powered versions only)

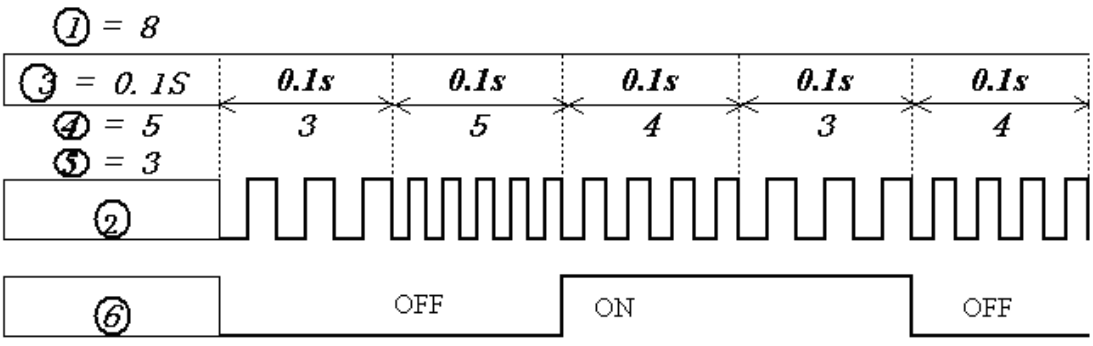
The Mode 8 High Speed Counter can use either input terminals I01 or I02 for forward up-counting to 1 KHz maximum at 24VDC high speed input signal. It will reflash its counted value in each "fixed time". When the counted value reaches or excesses the "Preset ON", then the selected counter coil turns ON at the next cycle. If the counted value change to a value less than "Preset ON" but still large than "Preset OFF", it still retains ON state. The counter coil does not turn OFF at next cycle until the counted value less than "Preset OFF". The counter will reset when the preceding rung is inactive. The table below describes each configuration parameter for High Speed Counter Mode 8.

Symbol	Description
①	Counting Mode (8) high speed counting
②	High speed counting input terminal: I01 or I02 only
③	Counting interval time: 0~99.99 sec
④	Counter 'on' preset Value, range: 0~999999
⑤	Counter 'off' preset Value, range: 0~999999
⑥	Counter Coil Number (C01~C1F total: 31 counters)









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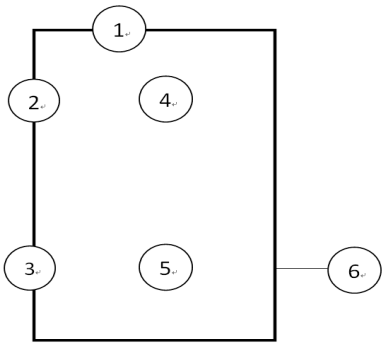
High Speed Counter Mode 9 (1KHZ Input A/B Phase counter)

Mode 9 is A/B phase high speed counter is the two phases counter, same bandwidth for pulse period, but pulse is 90 degrees difference.

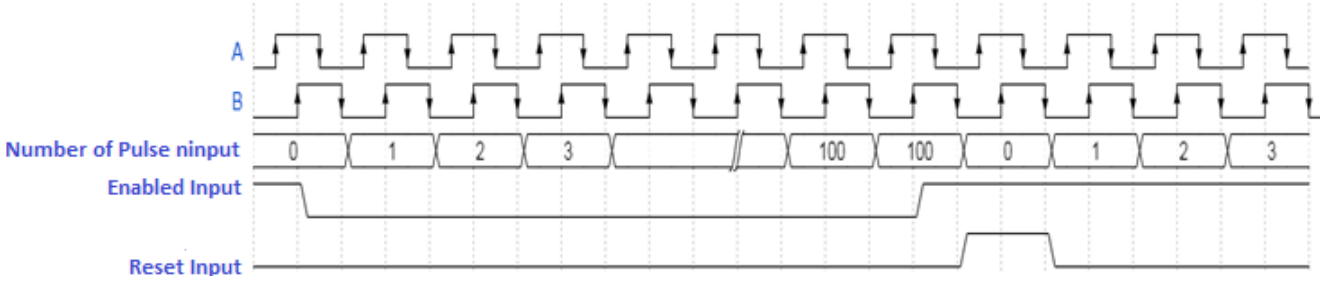
A/B phase high speed counter functions are same as high speed counter, but parameters are different.

In DC type model, the high speed counter mode 9 will start to count two of 1KHz A/B phase when I01 (A) leads I02 (b), counter current value will be 0-999999, high speed counter will stop counting when preset value is reached. When output coil is ON, counter current value will reset to 0 when the count is reset, output coil will OFF.



Symbol	Instruction
①	High Speed Counter Model9
②	High Speed Counter Input，I01、I02
③	Reset Coil ON：Countercurrent value reset to 0 OFF：Counter keeps counting
④	Current value of Counter：0~999999
⑤	Preset value of Counter0~999999
⑥	Counter Code（C01~C1F, 31 sets counters）

Coil M39 is the special coil, A/B is the counting direction flag. When Phase A leads phase B, M39 coil will be OFF, when phase B leads phase A,M39will be ON;



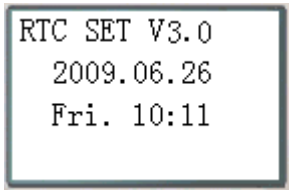
Counter current value will reset to 0 when the count is reset.

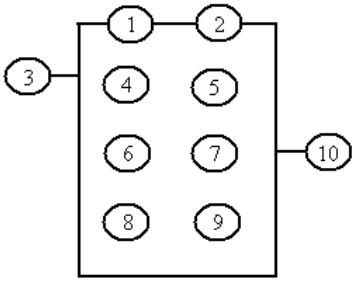
When the current value overflows(The current value is greater than 999999);And next Phase A leads phase B，The current value will be 0； When the current value overflows(The current value is less than 0);And next Phase B leads phase A, current value will be 999999.

-

Real Time Clock (RTC) Instructions

The iSmart smart relay includes 31 RTC coils that can be used throughout a program. Each RTC instruction has a choice of 5 operation modes and has 10 parameters for proper configuration. The initial clock/calendar setting for each connected iSmart is set using the **Operation» RTC Set** menu selection from the SMT Client software.

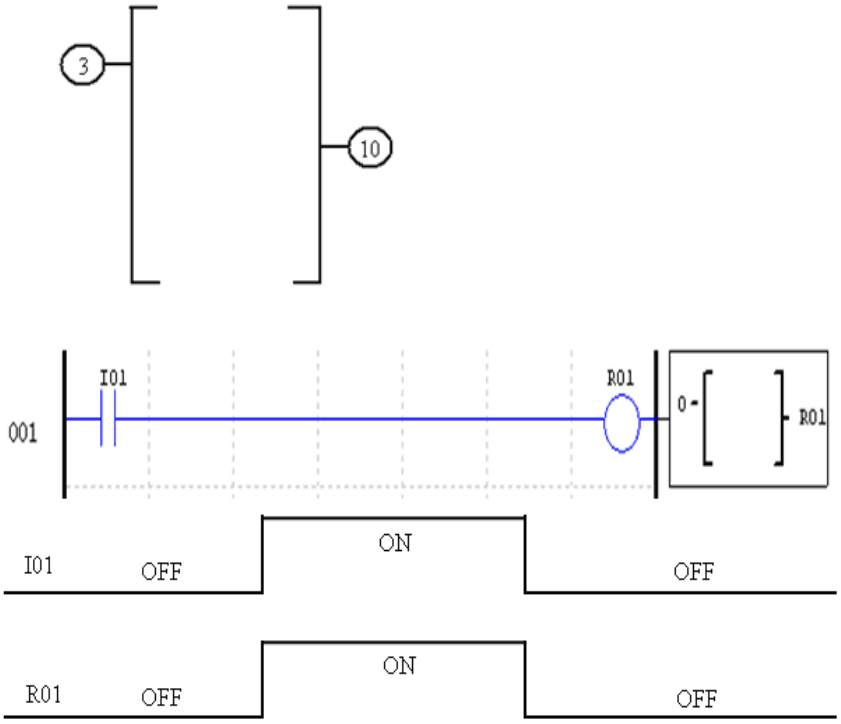


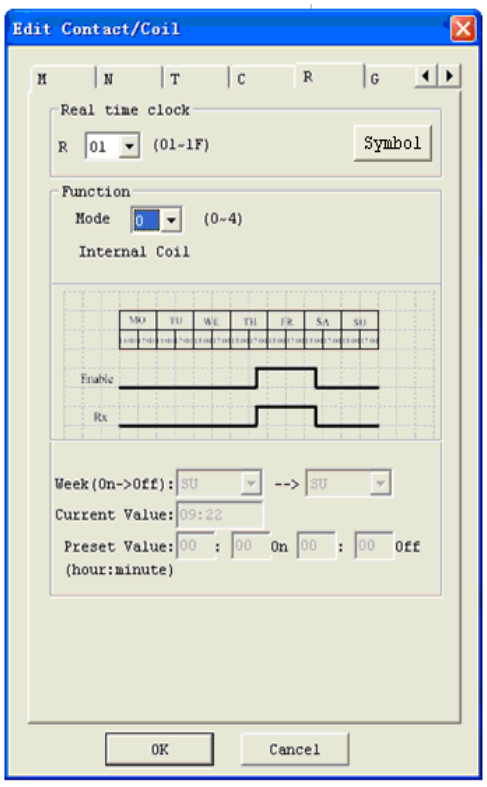


Symbol	Description
①	Input the first week to RTC
②	Input the second week to RTC
③	RTC mode 0~2, 0: internal coil 1:daily, 2:consecutive days
④	RTC displays the hour of present time.
⑤	RTC displays the minute of present time
⑥	Set RTC hour ON
⑦	Set RTC Minute ON
⑧	Set RTC Hour OFF
⑨	Set RTC Minute OFF
⑩	RTC Coil Number (R01~R1F Total: 31 RTC)

RTC Mode 0 (Internal Coil)

Mode 0 RTC (Internal Coil) used as internal auxiliary coils. No preset value. In the example below shows the relationship among the numbered block diagram for a Mode 0 RTC, the ladder diagram view, and the software Edit Contact/Coil dialog box.





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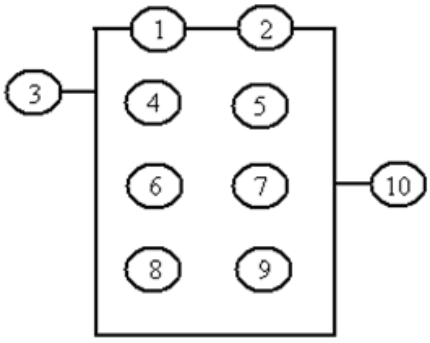
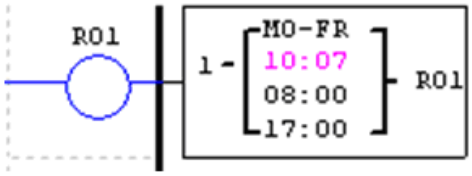
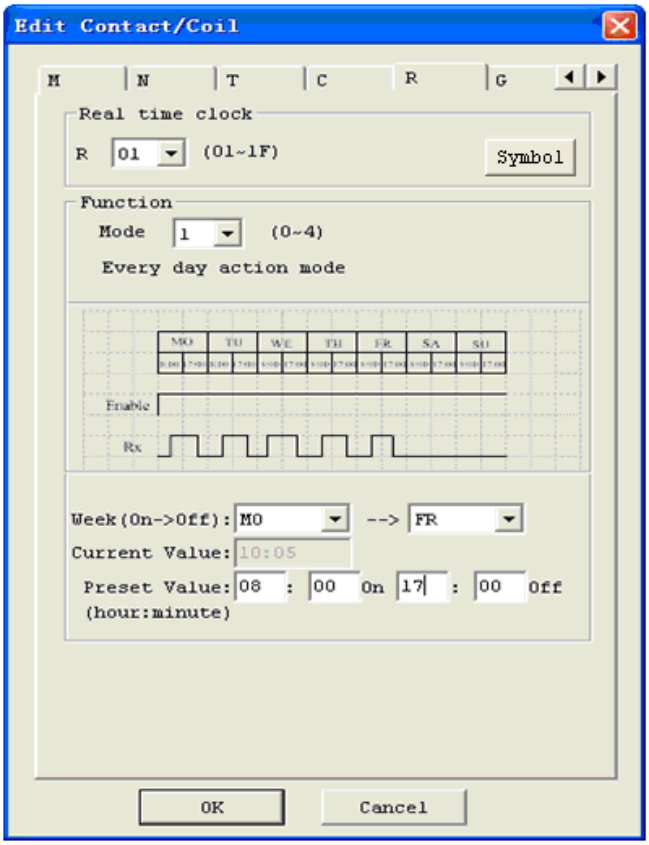
RTC Mode 1 (Daily)

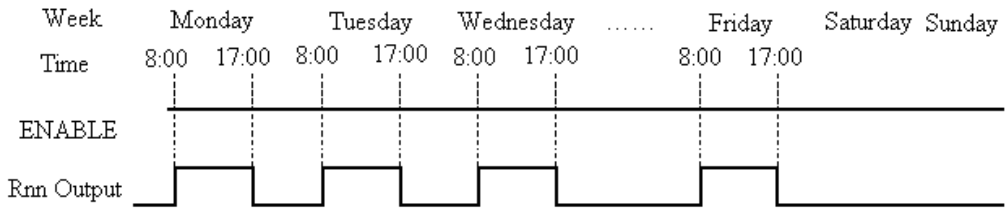
The Daily Mode 1 allows the RTC coil acting based on a fixed time across a defined set of days per week. The configuration dialog below (example 1) allows setting the workdays per week (i.e., Mon-Fri) and the work hours per day. RTC coil/contact turns on in the work-hour of the workday.

Example 1:



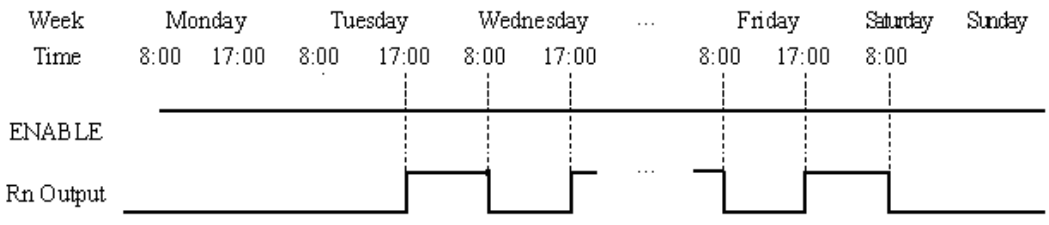






Example 2:

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



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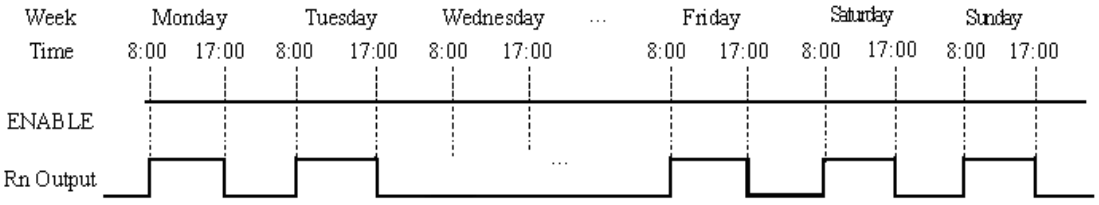
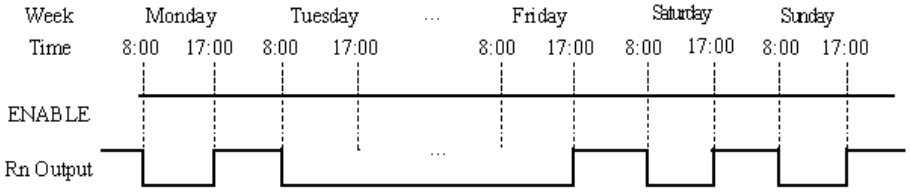
Example 3:

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



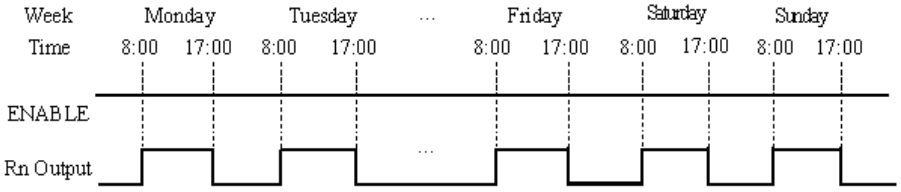
Example 4:

③	1
① : ②	FR-MO
⑥ : ⑦	17:00
⑧ : ⑨	8:00



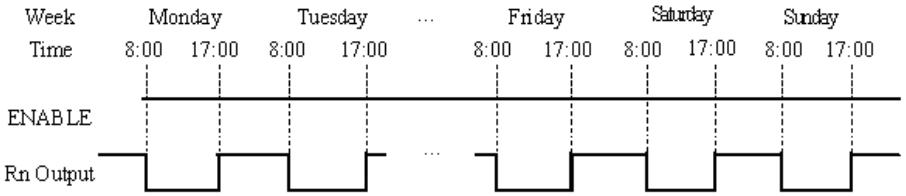
Example 5:

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



Example 6:

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



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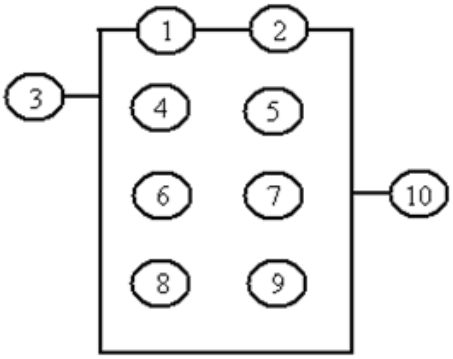
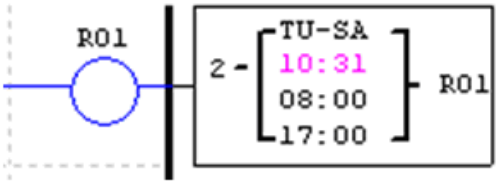
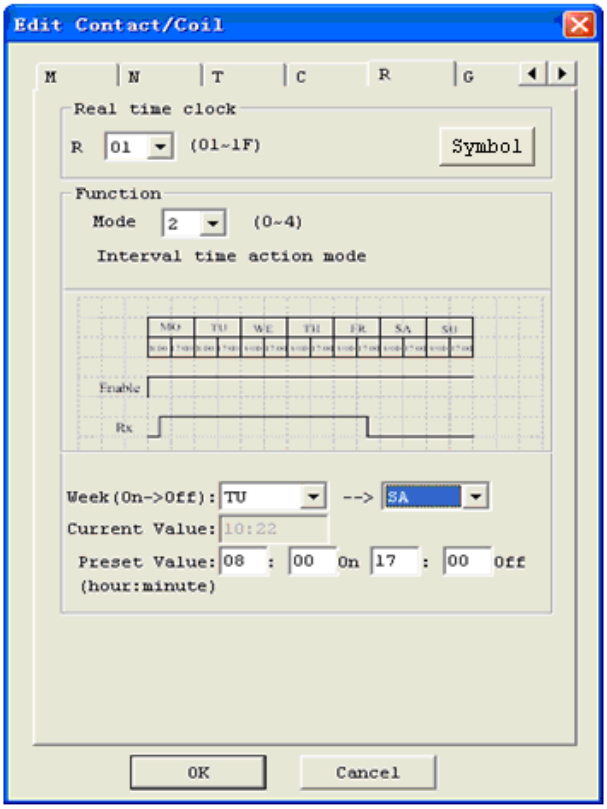
RTC Mode 2 (Interval weekly)

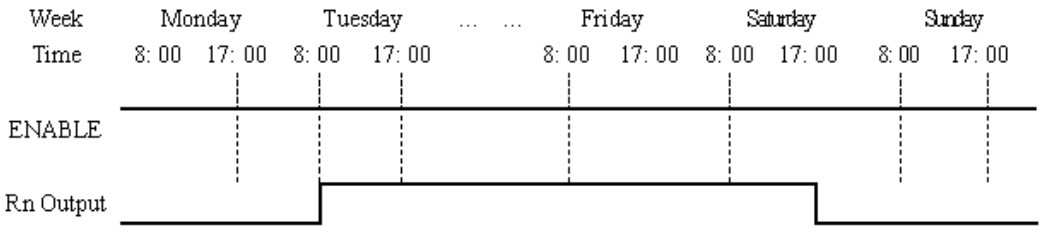
The Interval Time Mode 2 allows the RTC coil acting based on time and day per week. The configuration dialog below (example 1) allows setting the start-working time and stop-working time between two days in each week.

Example 1:



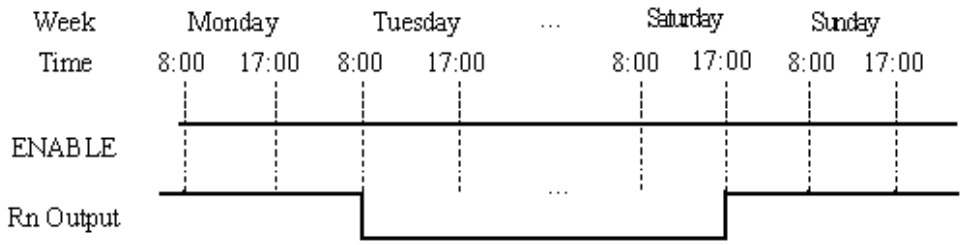






Example 2:

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



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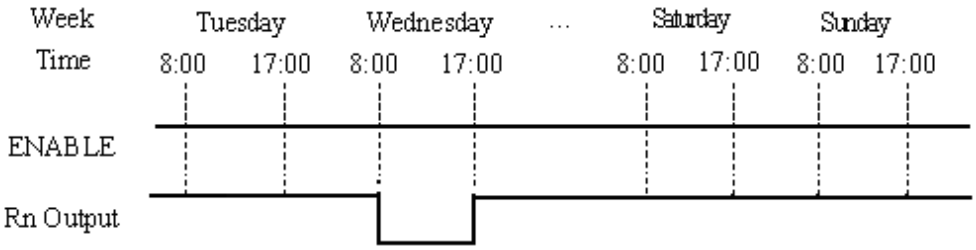
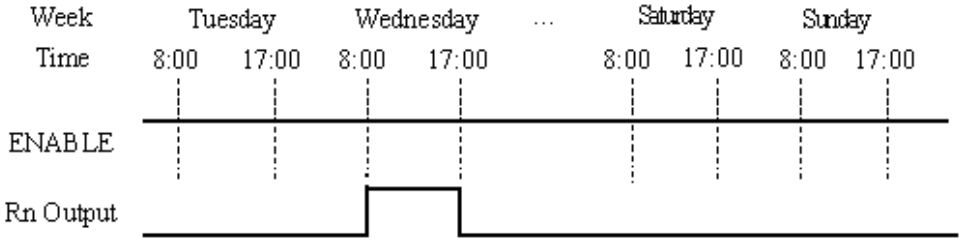
Example 3:

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



Example 4:

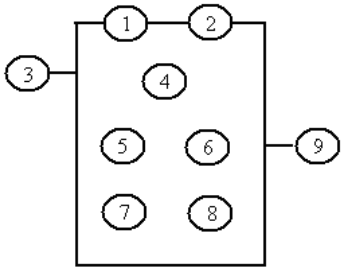
③	2
① : ②	WE-WE
⑥ : ⑦	8:00
⑧ : ⑨	17:00



RTC Mode 3 (Year-Month-Day)

The Year-Month-Day Mode 3 allows the RTC coil acting based on Year, Month, and Date. The configuration dialog below (example 1) allows setting the workday between two different dates.

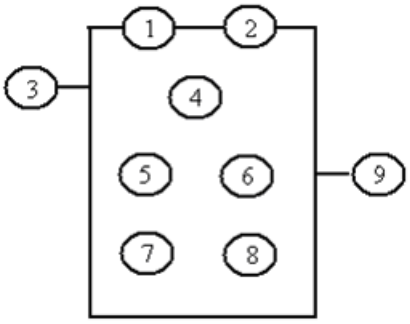
If the year is set as 00-00, the particular mode is available. The RTC is ON from the start date to the end date every year. More refer to example 4.

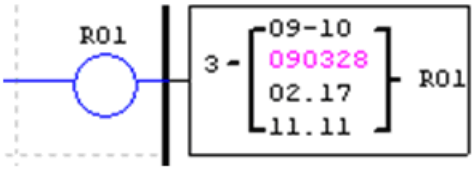


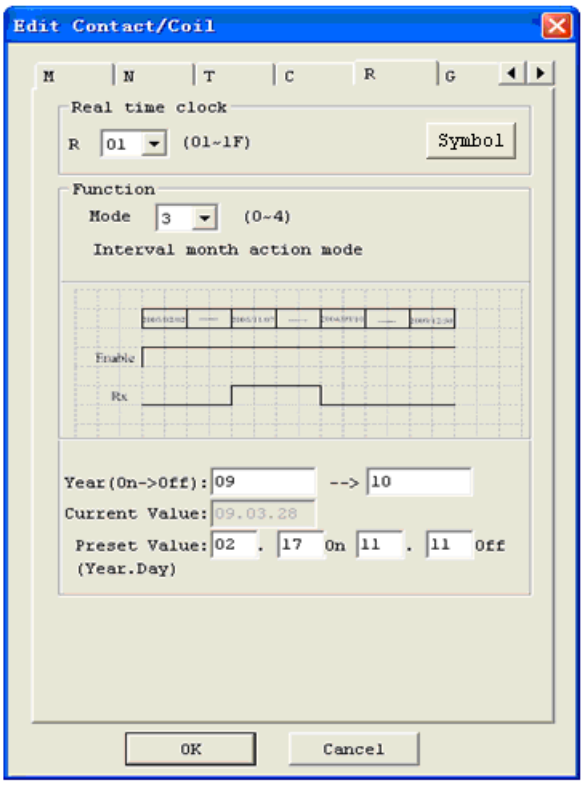
Symbol	Description
①	RTC Year ON
②	RTC Year OFF
③	RTC Mode 3, Year-Month-Day
④	Display RTC present time, Year-Month-Day
⑤	RTC month ON
⑥	RTC day ON
⑦	RTC month OFF
⑧	RTC day OFF
⑨	RTC code (R01~R1F, total 31 group)

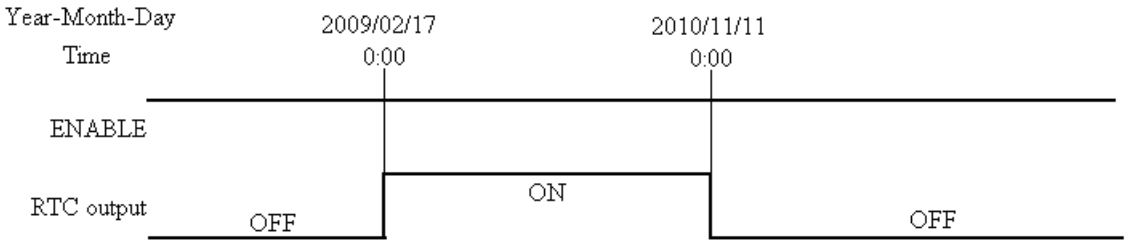
-

Example 1:



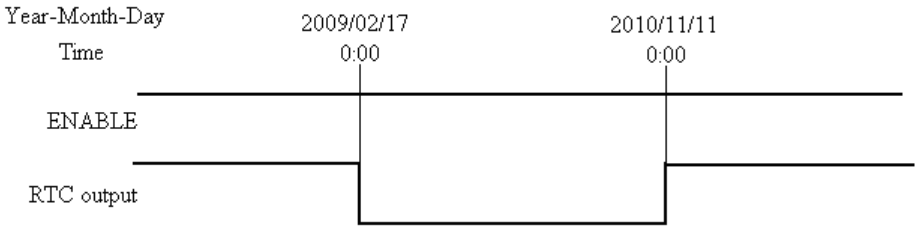






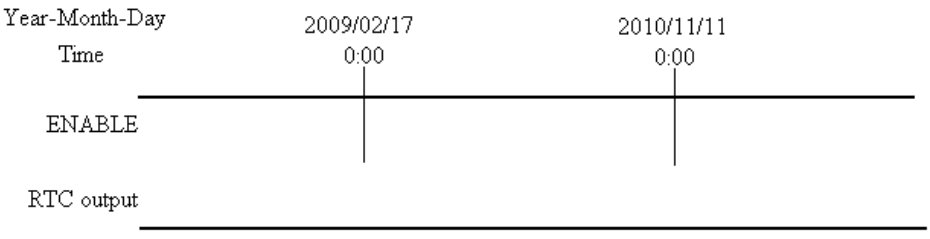
Example 2:

③	3
①/⑤/⑥	2010/11/11
②/⑦/⑧	2009/02/17



Example 3:

③	3
①/⑤/⑥	2010/11/11
②/⑦/⑧	2010/11/11



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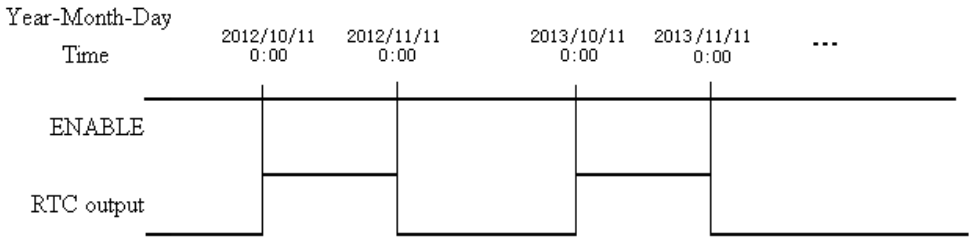
Example 4：

③	3
①/⑤/⑥	2000/10/11
②/⑦/⑧	2000/11/11



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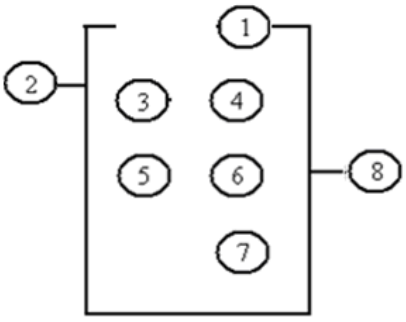
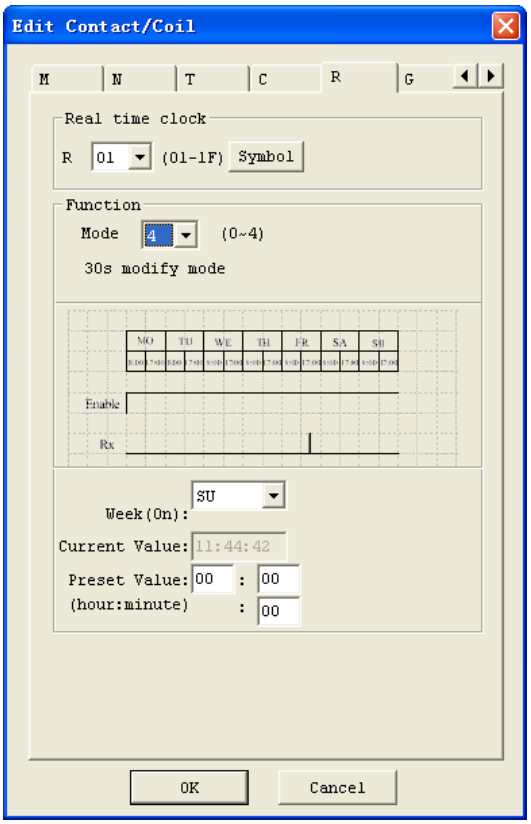
RTC Mode 4 (30-second compensator)

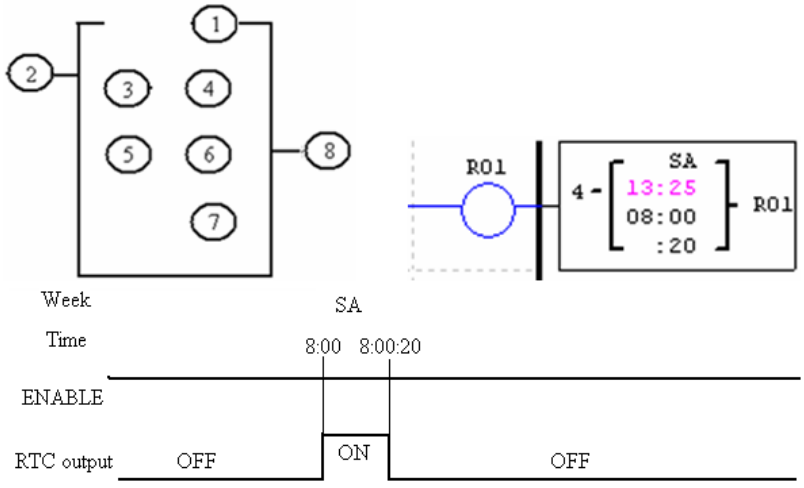
The 30-second compensator, Mode 4, allows the RTC coil acting based on week, hour, minute and second. The configuration dialog below shows the setting of week, hour, minute and second for the TRC mode 4.





Symbol	Description
①	RTC adjustment week
②	RTC mode 4
③	RTC present hour
④	RTC present minute
⑤	RTC adjustment hour
⑥	RTC adjustment minute
⑦	RTC adjustment second
⑧	RTC code (R01~R1F, total 31 group)

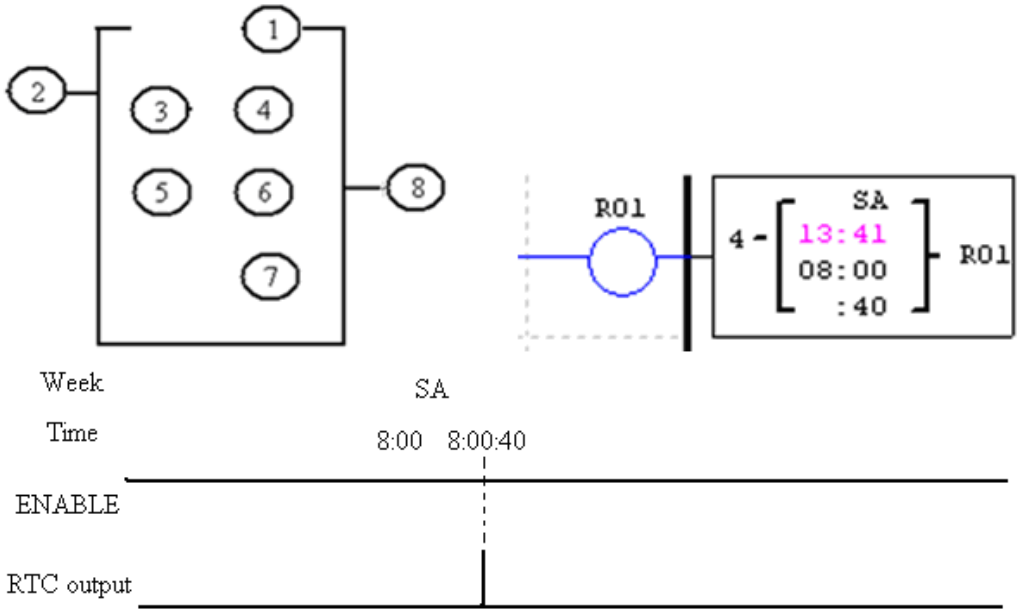
Example 1: preset second < 30s



※ The current time will return to 8:00:00 when it achieves 8:00:20 at first time, and RTC contact, R01, will turn ON, then it does not turn OFF until the present time achieves 8:00:20 again. Then time keeps going. So, this means that RTC status bit is ON for 21 seconds.

Example 2: preset second >= 30s

-

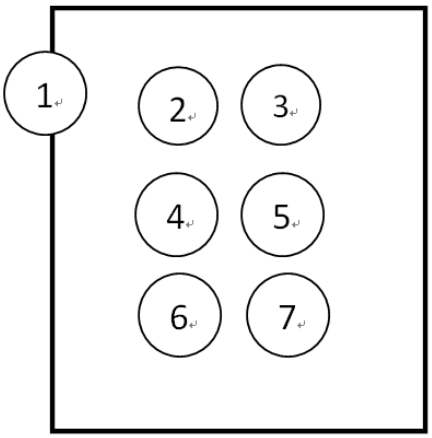


※ The present time will change to be 8:01:00 when it achieves 8:00:40, and RTC status bit R01 turns ON in one scan time. Then time keeps going and R01 turns OFF.

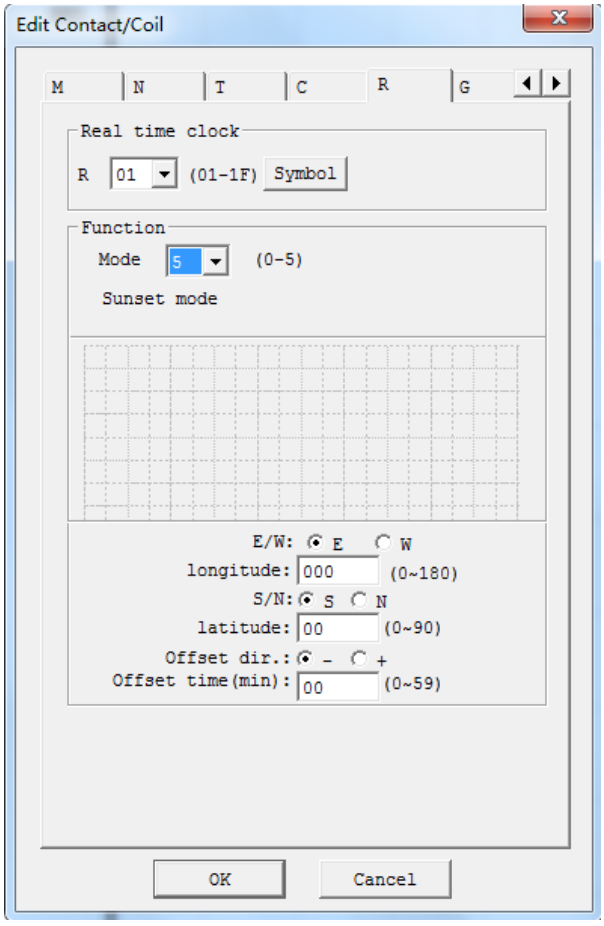
RTC Mode 5 (Astronomical Clock）

RTC mode 5 is "Astronomical Clock Mode", which uses the set of longitude, latitude, and offset time to control the output of RTC coil.

The following figure and table illustrate the display from parameter meaning of RTC mode 5 and the programming interface in Ladder mode.



Symbol	Instruction
①	RTC Mode 5
②	RTC sets longitude E/W
③	RTC sets the value of longitude E/W
④	RTC sets latitude S/N
⑤	RTC sets the value of latitude S/N
⑥	RTC sets offset (+/-)
⑦	RTC sets the value of offset



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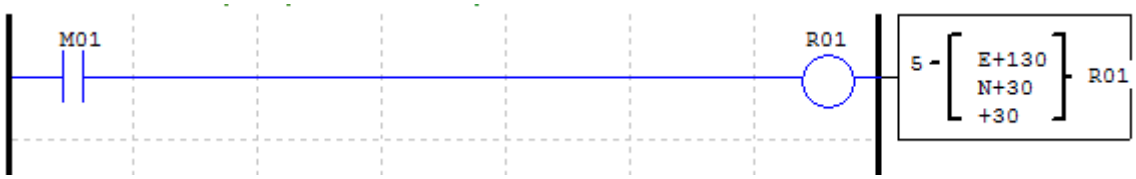
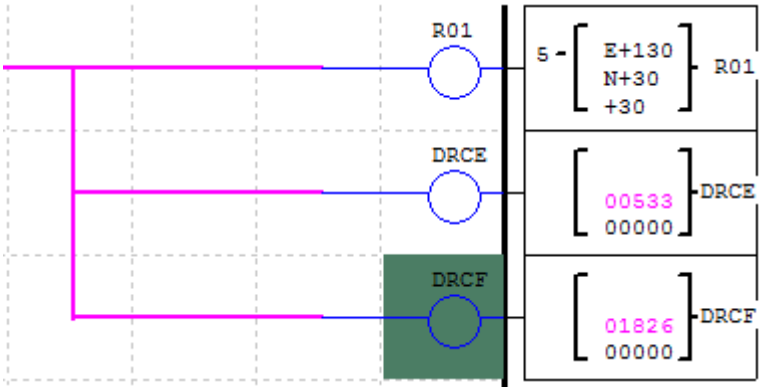
According to the table, set correspond parameter such as longitude (E/W) and latitude (S/N). R function block will calculate sunset and sunrise of current season, sunset and sunrise offset will base on the value of (-) and (+), the offset time range is 0-59 minutes. R function block will turn ON during sunrise to sunset, it will turn OFF during sunset to sunrise.

Example 1：Set East longitude 130°, North latitude 30°, offset +30min



※According to RTC current value to calculate sunrise and sunset, R01 will be ON during sunrise to sunset.



※DRCE and DRCF are special register, calculation value will be saved in this register. (Offset value will not be saved)

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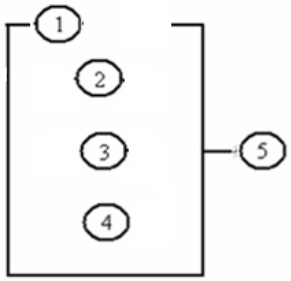
Comparator Instructions

The iSmart smart relay includes 31 comparator coils that can be used throughout a program. Each comparator has 8 different operation modes. Additionally, each comparator has 5 parameters for proper configuration. The table below describes each configured parameter and lists each compatible element for configuring Comparators.

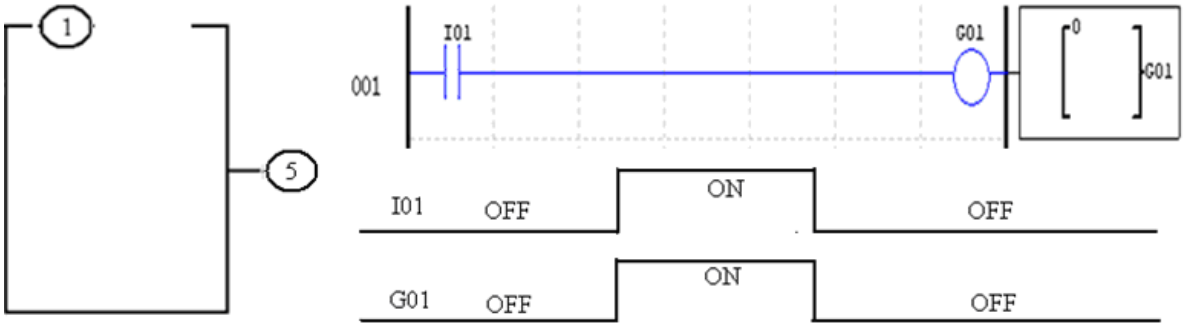


Symbol	Description
①	Comparison Mode (0~7)
②	Ax analog input value (0.00~99.99)
③	Ay analog input value (0.00~99.99)
④	Reference comparative value, could be constant, or other data code
⑤	Output terminal (G01~G1F)

※ The preset value ②, ③ and ④ can be a constant or refer to other function current value.

Comparator Mode 0 (Internal Coil)

Mode 0 Comparator (Internal Coil) used as internal auxiliary coils. No preset value. In the example below shows the relationship among the numbered block diagram for a Mode 0 Comparator, the ladder diagram view, and the software Edit Contact/Coil dialog box.



Analog comparator Mode 1~7

(1) Analog Comparator mode 1: $Ay - ④ \le Ax \le Ay + ④, ⑤ON$;

(2) Analog Comparator mode 2: $Ax \le Ay, ⑤ON$;

(3) Analog Comparator mode 3: $Ax \ge Ay, ⑤ON$;

(4) Analog Comparator mode 4: $④ \ge Ax, ⑤ON$;

(5) Analog Comparator mode 5: $④ \le Ax, ⑤ON$;

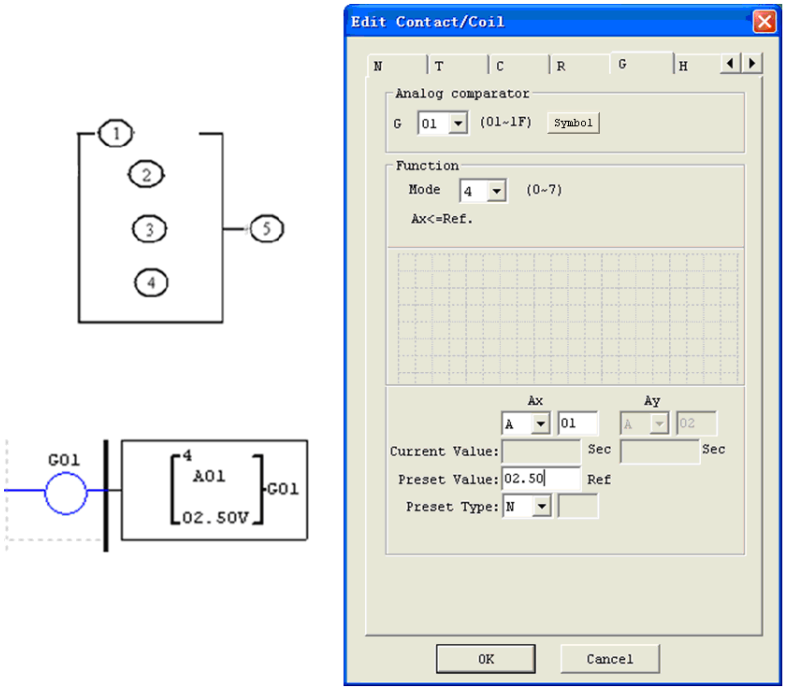
(6) Analog Comparator mode 6: $④ = Ax, ⑤ON$;

(7) Analog Comparator mode 7: $④ \ne Ax, ⑤ON$;

Example 1: Analog Signal Compare

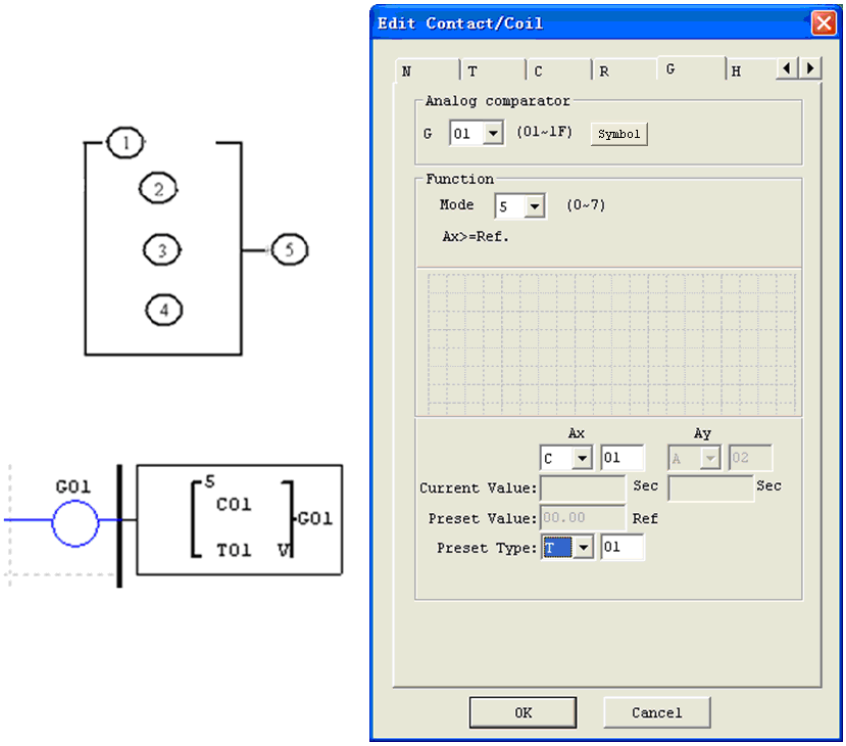
-

In the example below, Mode 4 is the selected function that compares the value of analog input A01 to a constant value (N) of 2.50. Status coil G01 turns ON when A01 is not less than constant 2.50.



Example 2: Timer/Counter present value Compare

The Comparator instruction can be used to compare Timer, Counter, or other function values to a constant value or each other. In this example below, Mode 5 is the selected function that compares the value of Counter (C01) with the value of Timer (T01). Status coil G01 turns ON if present value of C01 isn't less than present value of T01.



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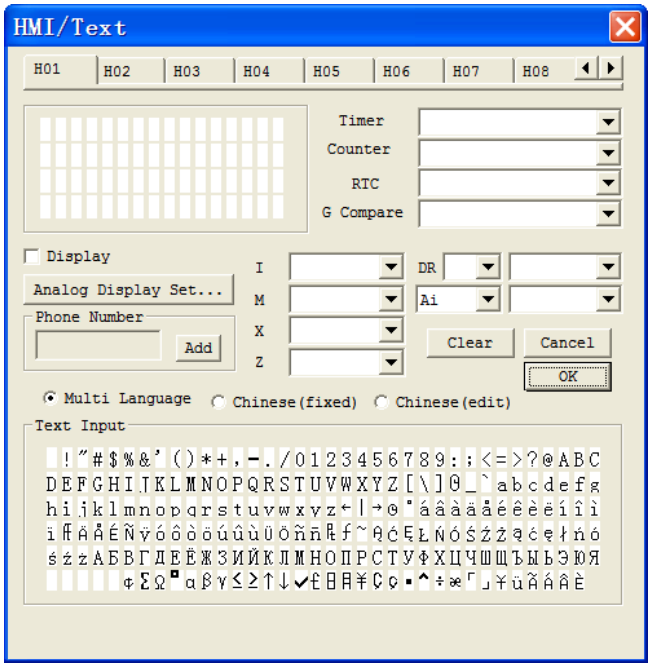
HMI Display Instructions

The iSmart smart relay includes 31 HMI instructions that can be used throughout a program. Each HMI instruction can be configured to display information on the iSmart 16×4 character LCD in text, numeric, or bit format for items such as current value and preset value for functions, Input/Output bit status, and text. There are three kinds of text in HMI, Multi Language, Chinese (fixed) and Chinese (edit). Each HMI instruction can be configured separately using the **Edit>>HMI/Text** menu selection from the SMT Client software.

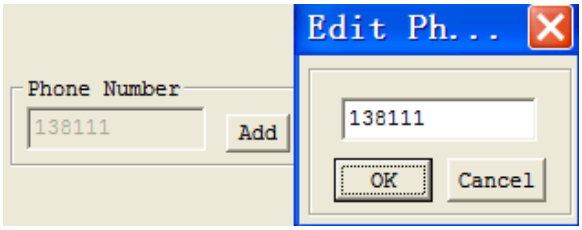


Allows the SEL button on the iSmart keypad to activate the selected message onto the LCD even the Hxx is inactive.

※More information about HMI/TEXT to see:

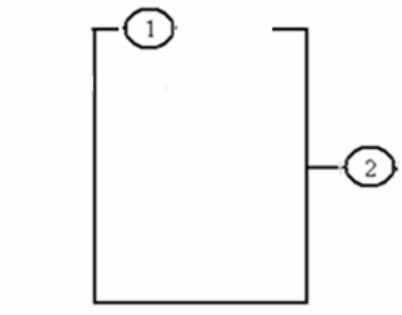
Chapter 3: Program Tools—Ladder Logic Programming Environment —HMI/TEXT.

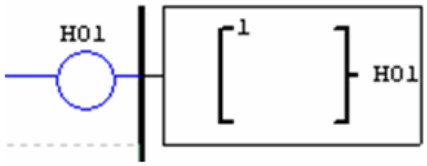
H01~H14 can display the setting telephone number and send alarm message to the setting number by GSM module.



Each HMI instruction has a choice of 2 operation modes. The table below describes each configuration parameter.

Symbol	Description
①	Display mode (1-2)
②	HMI character output terminal (H01~H1F)





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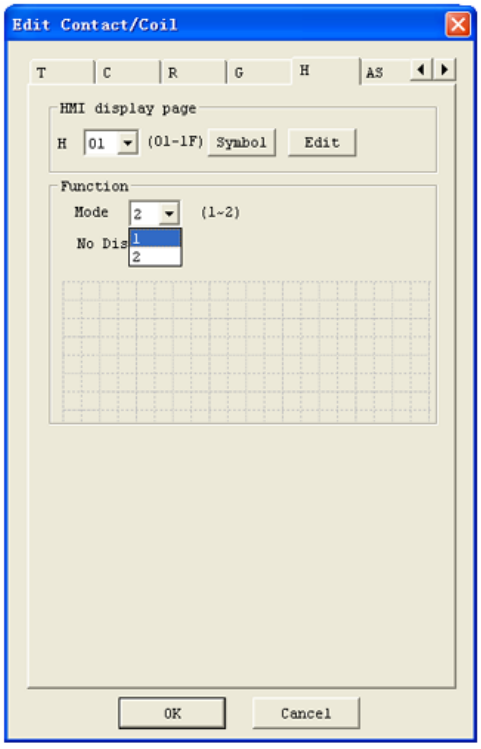


HMI function instruction

1. HMI can display character, built-in Chinese, user-defined Chinese.This information cannot be edited through keypad.
2. HMI can display function current value (T, C, R, G and DR), analog input/output value (A, AT, AQ). This information cannot be edited through keypad.
3. HMI can display preset value of function (T, C, R, G and DR). This information can be edited through keypad.
4. HMI display state of coil (I, X, Z, M and N), state of M and N can be edited through keypad.
5. Once more than one HMI enabled at the same time, press changing page button to display other HMI screen.
6. When another HMI is enabled, iSmart can auto-determine whether does HMI screen display the present page or change to the new HMI screen; it depends on the HMI code. For example, HMI keeps H01 screen as the present screen even though H02 coil be exercised.

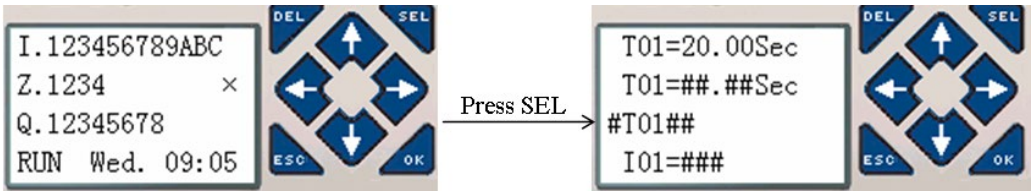
Keypad instruction

SEL	Under status 1 or 2, go into status 3. Under status 3, go into status 4. Under status 4, change function preset type.
↑ or ↓	Under status 1, find the nearest HMI whose mode is 1. Under status 2, find the nearest enabled HMI. Under status 3, move cursor up or down. Under status 4, change data and number, function preset data; change coil state
(SEL+↑ or ↓)	Under status 1, find the nearest HMI whose mode is 1. Under status 2, find the nearest enabled HMI. Under status 3, move cursor up or down.
← or →	Under status3 or 4, move cursor lift or right.
OK	Validate editing and store automatic.
ESC	Abrogate operation.

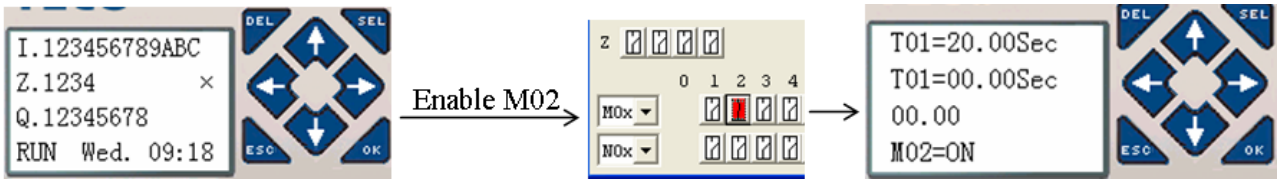
-

HMI status 1~4:

1. HMI scanning state, press SEL into HIM at IO interface

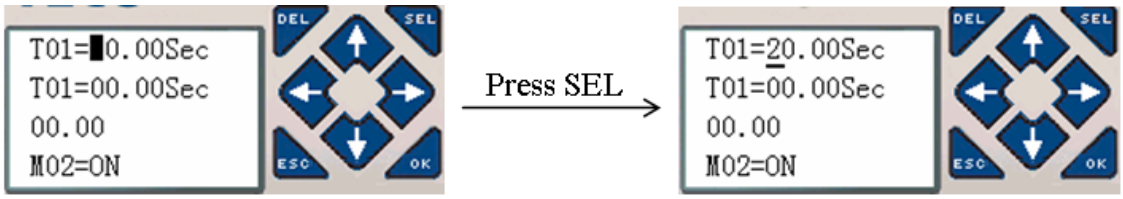


2. HMI running state, HMI is enabled at IO interface



3. HMI edit preparing state, press SEL when HMI is scanning or running state, flicker cursor will show if there is edited content.

4. HMI editing state, press SEL again under status 3.



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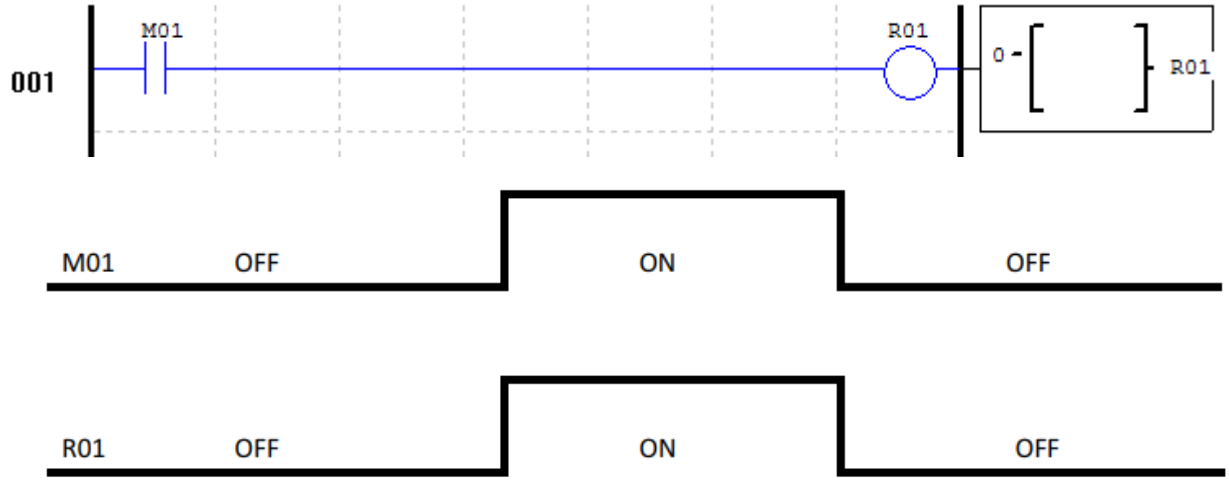
Filter Function Block (Filter)

iSmart includes 31 independent filter (Filter) command, 5 working mode in each comparator, please see instruction of comparators and parameters.

Filter Mode 0 (Analog filter)

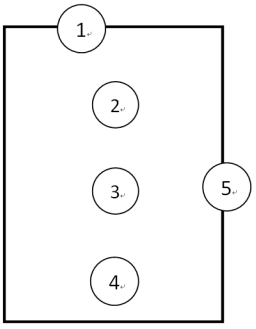
Mode 0 Comparator (Internal Coil) used as internal auxiliary coils. No preset value. In the example below shows the relationship among the numbered block diagram for a Mode 0 Comparator, the ladder diagram view, and the software Edit Contact/Coil dialog box.



Filter Mode 1 (Analog filter)

Function instruction

When parameters setup finished, analog filter function will be enabled once enable coil status from 0 to 1. This will start to do Ax analog value filter according to select sampling mode, the value after filter will be the current value of F coil.



Symbol	Instruction
①	F sample mode selection
②	Ax analog input
③	Current value
④	Sampling mode
⑤	Filter encoder（F01~F1F）

Software Filter Mode

(Mode 1)

The value will be updated by each scan cycle, it will use last 5 AD average value except maximum and minimum one.

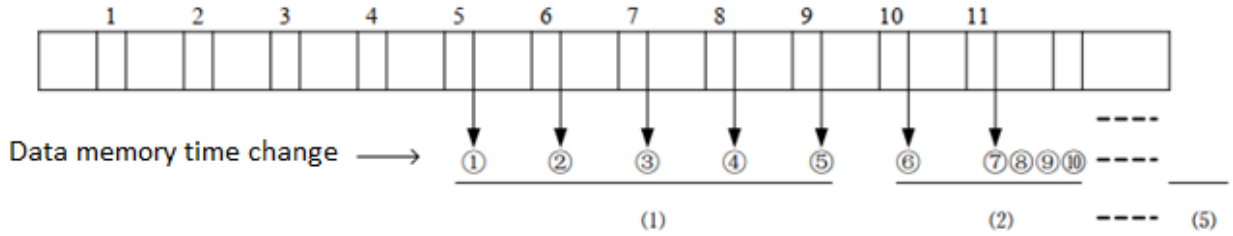
(Mode 2)

The value will be updated by each 5 scan cycles, it will use 5 time mode 1 value to do average.

(Mode 3)

The value will be updated by each 25 scan cycles, it will use 5 time mode 2 value to do average of maximum and minimum value.

-



Example : Data 1=161, Data 2=120, Data 3=154, Data 4=160, Data 5=190， Data 6=169，
Data 7=110, Data 8=121, Data 9=150， Data 10=198, Data 11=199。

Mode 1 :

① Updated data=(161＋154＋160) / 3=158 - filter (1, 2, 3, 4, 5), the maximum value 190 and minimum value 120 will be deleted.

② Updated data=(154＋160＋169) / 3=161 - filter (2, 3, 4, 5, 6), the maximum value 190 and minimum value 120 will be deleted.

③ Updated data=(154＋160＋169) / 3=161 - filter(3, 4, 5, 6, 7), the maximum value 190 and minimum value 110 will be deleted.

⑦ Updated data=(121＋150＋198) / 3=156 - filter(7, 8, 9, 10, 11), the maximum value 199 and minimum value 110

Mode 2 :

It will use 5 time mode 1 value to do average. (①＋②＋③＋④＋⑤) / 5

Mode 3 :

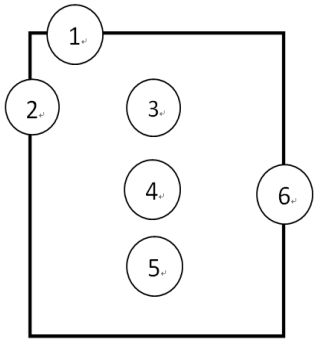
It will use 5 time mode 2 value to do average of maximum and minimum value.
(This mode is effective to filter ripple and ripple noise.)
(Maximum value + Minimum value) / 2, the range of these two values is ①②③④⑤.

Filter Mode 2 (Average)

Function instruction

Enable coil ON, average function will start.

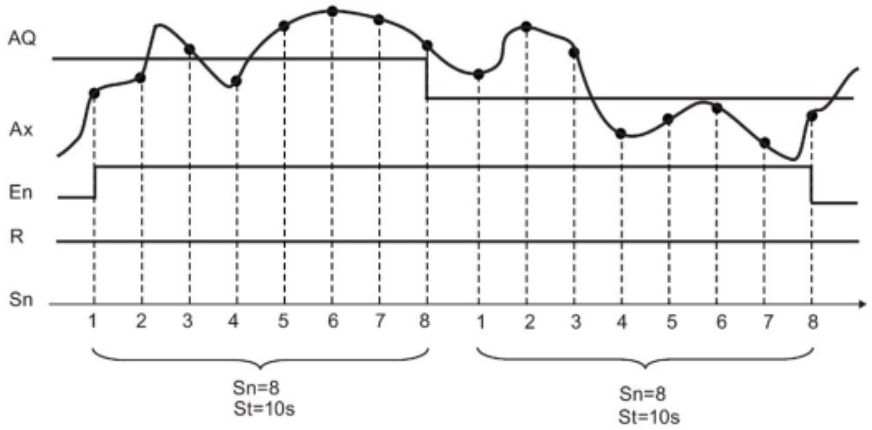
This mode is used to calculate analog input average value of time period.

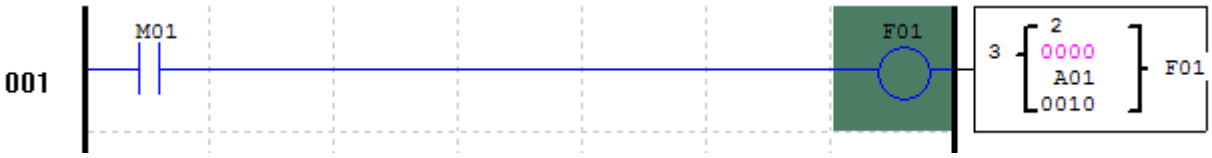


Symbol	Instruction
①	F Mode
②	Time base
③	Current value
④	Analog input
⑤	Sampling time
⑥	Filter encoder（F01~F1F）

Timing diagram (example)

-





For example :

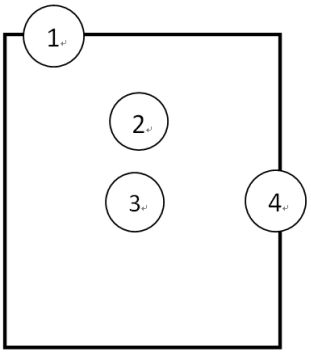
F01 current value will update per 10s, when current value updated, F01 coil will turn ON.

Filter Mode 3 (Maximum value)

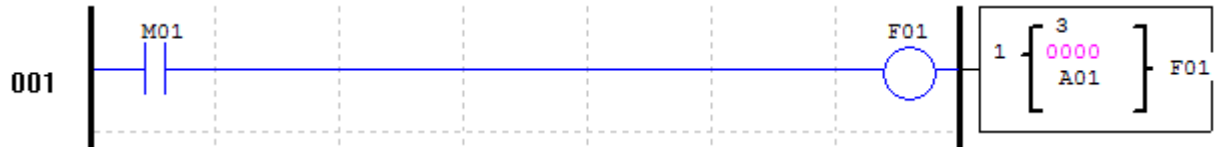
When enable coil is ON, maximum function will start, the status of output coil and enable coil is same.

When enable coil is OFF, maximum function will close, the status of output coil and enable coil is same.

In enable coil ON status, F function block current value will save the maximum value of analog input Ax.



Symbol	Instruction
①	F Mode
②	Current Value
③	Ax Analog input
④	Filter encoder（F01~F1F）



For example :

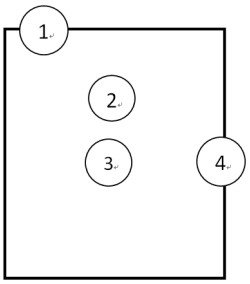
F01 current value will update every scan cycle； F01 will save the max value as F block current value。

Filter Mode 4 (Minimum value)

When enable coil is ON, maximum function will start, the status of output coil and enable coil is same.

When enable coil is OFF, maximum function will close, the status of output coil and enable coil is same.

In enable coil ON status, F function block current value will save the minimum value of analog input Ax.



Symbol	Instruction
①	F Mode
②	Current Value
③	Ax Analog input
④	Filter encoder（F01~F1F）

-

PWM Output Instruction (DC Transistor Output Models Only)

The transistor output model, T type, includes the capability to provide a PWM (Pulse Width Modulation) output on terminal Q01 and Q02. The PWM instruction is able to output up to an 8-stage PWM waveform. It also provides a PLSY (Pulse output) output on terminal Q01, whose pulse number and frequency can be changed. The table below describes number and mode of PWM.

	Mode	Output
P01	PWM, PLSY	Q01
P02	PWM, PLSY	Q02

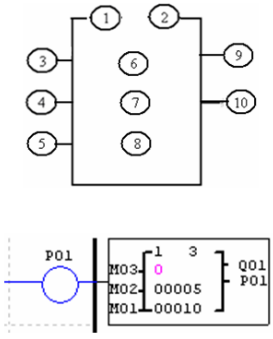
Mode1 PWM Mode

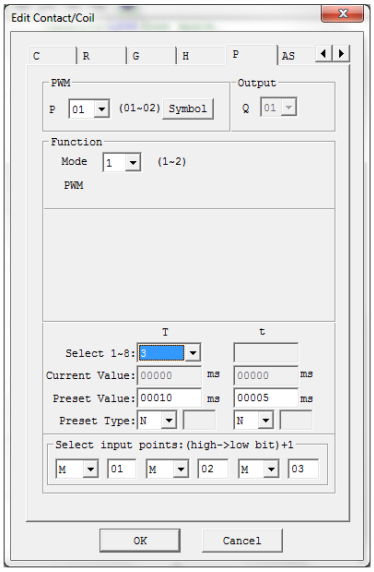
P01 and P02 both can work under this mode. Each PWM has 8 group preset stages which contents Width and Period. The 8 group preset values can be constant or other function current value. Each PWM has 10 parameters for proper configuration. The table below describes each configuration parameter and lists each compatible memory type for configuring PWM.

Symbol	Description
①	PWM mode (1)
②	present stages as operating (1~8)
③	Select1 (I01~g1F)
④	Select2 (I01~g1F)
⑤	Select3 (I01~g1F)
⑥	present stages as operating (1~8)
⑦	Width of preset stage ② (0~32767 ms)
⑧	Period of preset stage ② (1~32767 ms)
⑨	Output port (Q01~Q02)
⑩	PWM code (P01~P02)

Enable	Select3	Select2	Select1	stage	PWM Output
OFF	X	X	X	0	OFF
ON	OFF	OFF	OFF	1	Preset stage 1
ON	OFF	OFF	ON	2	Preset stage 2
ON	OFF	ON	OFF	3	Preset stage 3
ON	OFF	ON	ON	4	Preset stage 4
ON	ON	OFF	OFF	5	Preset stage 5
ON	ON	OFF	ON	6	Preset stage 6
ON	ON	ON	OFF	7	Preset stage 7
ON	ON	ON	ON	8	Preset stage 8

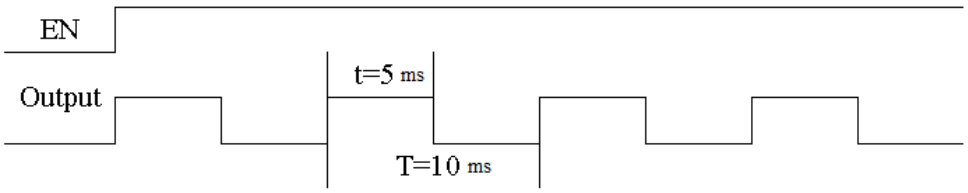
Example:





The state of M01, M02 and M03 are OFF-ON-OFF, so that PWM output pulse is at stage3 like this as setting above.

-



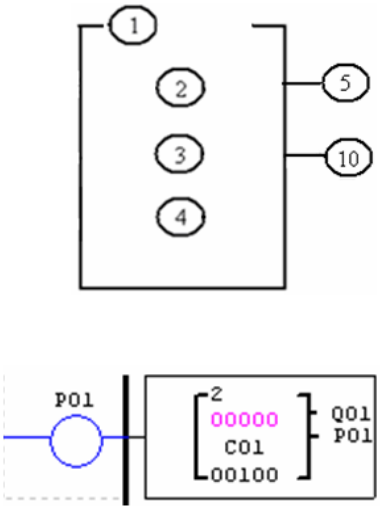
The state of M01, M02 and M03 decide the duty cycle and frequency of PWM output. PWM stages can be changed by the status of M01, M02 and M03 when P01 is running. ⑥ displays the number of pulse when P01 is running, but ⑥ equals 0 when P01 is disabled.

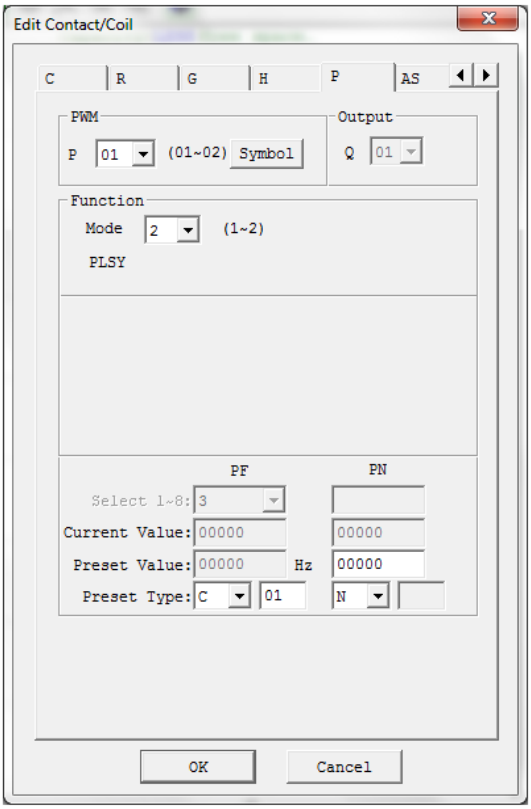
Mode2 PLSY

Only P01 can work under this mode, and the output is Q01. PLSY has 6 parameters for proper configuration. The table below describes the information of PLSY parameters.

Symbol	Description
①	PLSY mode (2)
②	Total number of pulse (storing in DRC9)
③	Preset frequency of PLSY (1~1000Hz)
④	Preset pulse number of PLSY(0~32767)
⑤	Output port (Q01/Q02)
⑥	PWM code (P01/P02)

Example:





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The preset frequency and pulse number could be constant or the current value of other function. They are variable if the preset are other data code. The PLSY will stop output if it has outputted the number of ④ pulse. PLSY will run again if it is enabled for a second time.

※ In the example above, the frequency refers to data code (C01). So, the wave's frequency will change following the current value of C01.

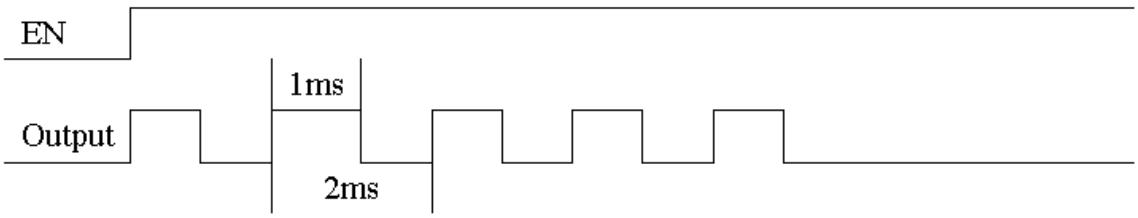
※ In the example above, frequency is 1000 Hz if the current value of C01 is bigger than 1000 Hz.

※ PLSY stops outputting pulse after it has output 100 pulses.

※ PLSY does not stop sending the pulse out as long as ④ equal to 0.

Example:

Parameter setting: ③ = 500Hz, ④ = 5, output as shown below:



PLSY stops outputting when the number of output pulse is completed.

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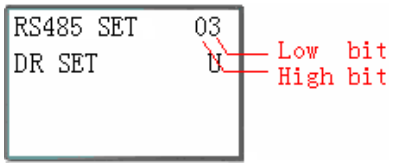
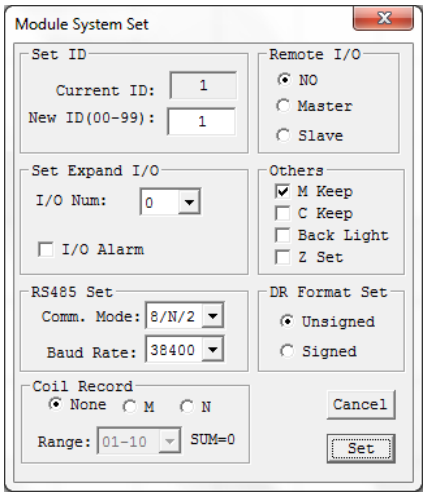
IO Link/Remote I/O Instruction (SMT-CD model only)

The SMT-CD models include the capability to link additional SMT-CD units via the RS-485 connection terminals. The baud rate and communication format both can be set using the **Operation» Module System Set…** menu selection from the SMT Client software. They also can be set through keypad like adjacent picture. The two bits of keypad how to decide the communication format and baud rate like describing below.



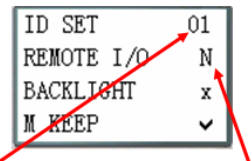


	Data	Meaning
High bit	0	8/N/2 Data 8bit, No Parity, 2 Stop bit.
	1	8/E/1 Data 8bit, Even Parity, 1 Stop bit.
	2	8/O/1 Data 8bit, Odd Parity, 1 Stop bit.
	3	8/N/1 Data 8bit, No Parity, 1 Stop bit.
Low bit	0	4800bps
	1	9600bps
	2	19200bps
	3	38400bps
	4	57600bps
	5	115200bps

IO Link

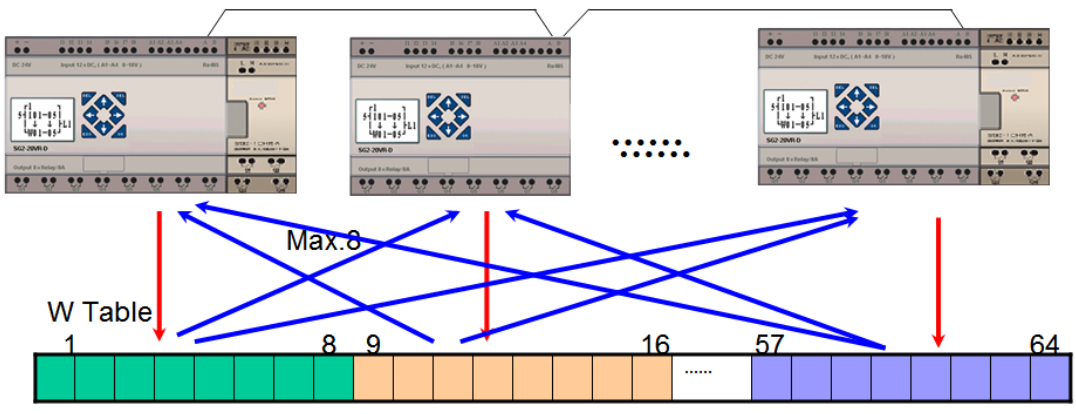
Up to 8 iSmart units can be linked together as the IO Link Network. Each unit runs their own logic program; In a set of devices, the IDs should be different between the members; the ON/OFF state of input, output points, and Auxiliary Coils in each one can be assigned to "W Table", see the next page for more information. There must be one master (ID=00) and several slavers with the continuous ID number starting from 01 in the network. The master one does not perform the IO Link function to the units with the ID behind the first broken number once the ID numbers are not continuous. For example, the slavers' ID are 01, 02, 04 and 05, the master just can recognize only two slave, ID 01 and 02, the ID 04 and 05 will be skipped.

- max. 8 points I/O send per stations
- Max 7*8 (=56) points I/O received per station



ID must set to be 0,1,2,…(max to 7)

Remote I/O disable



ID	Memory list location
0	W01~W08
1	W09~W16
2	W17~W24
3	W25~W32
4	W33~W40
5	W41~W48
6	W49~W56
7	W57~W64

-

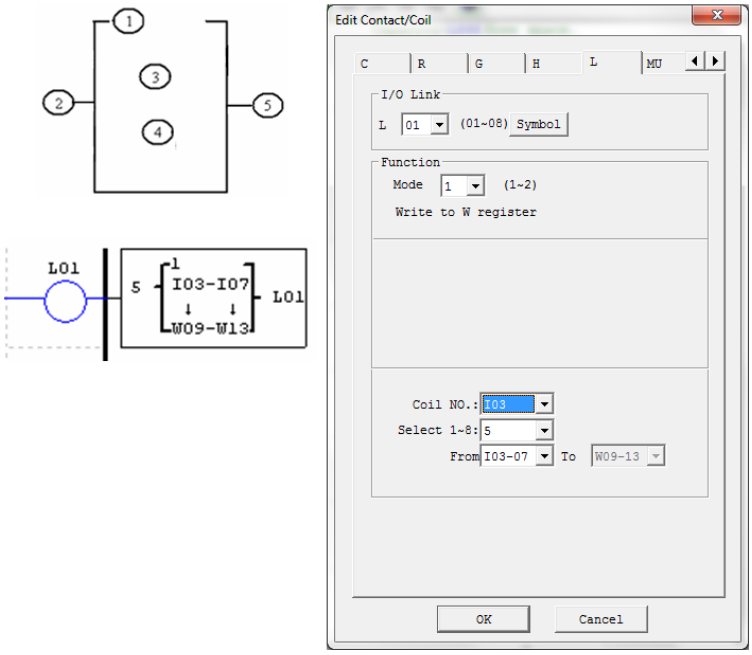
※ One controller can use 8 IO Link (L01~L08). Only one IO Link instruction can work at Mode 1(Send mode), and the other IO Link instructions must be Mode 2 (Receive mode).

The Mode 1: Send the ON/OFF states of the selected coils into the chosen W elements. The available W elements in the mode 1 depend on the ID setting of that unit, refer to the table in the previous page for more information.

The Mode 2: Receive the states of the selected W elements and substituting the state of the selected coil. If the select coil type is input coil I or X, coil status cannot be changed by the state of W elements.

Symbol	Description
①	Setting mode(1,2) 1:Writing 2:Grading
②	Number of send/receive points (1~8)
③	Chosen coil elements for Write/Grab mode
④	Selected W elements for Write/Grab mode
⑤	I/O link output terminal (L01~L08)

Type of points	Range
Inputs	I01~I0C/i01~i0C
Outputs	Q01~Q08/q01~q08
Auxiliary coil	M01~M3F/m01~m3F
Auxiliary coil	N01~N3F/n01~n3F
Expansion inputs	X01~X0C/x01~x0C
Expansion outputs	Y01~Y0C/y01~y0C



Example 1: IO Link Mode 1

Set ① = 1, ② = 5, ③ = I03~I07 and ID of this unit equal to 01; the state of terminals, I03~I07, will be written into the corresponding W elements, W09~W13 as shown in below table.

①=1, ② = 5, ③ = I03~I07, ID=1 (④:W09~W13)								
Memory List Position	W09	W10	W11	W12	W13	W14	W15	W16
Corresponding receiving	↑	↑	↑	↑	↑	↑	↑	↑
Or sending terminal	I03	I04	I05	I06	I07	0	0	0

-

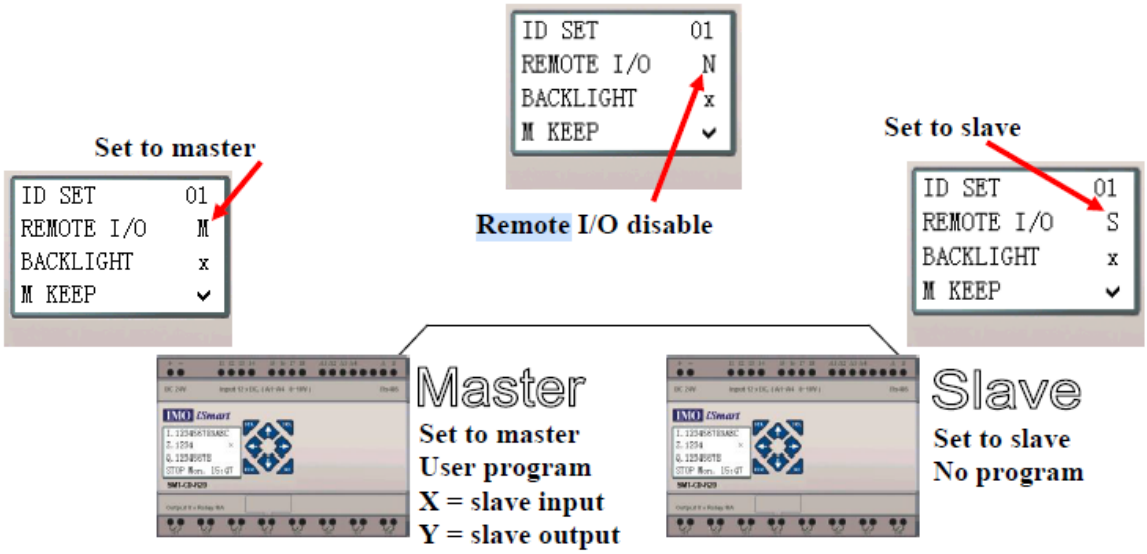
Example 2: IO Link Mode 2

Set ① = 2, ② = 5, ③ = M03~M07 and ④ =W17~W21; when enabling the IO Link, the ON/OFF state of M03~M07 is controlled by the W17~W21.

①=1, ② = 5, ③ = M03~M07, ④:W17~W21					
Memory List Position	W17	W18	W19	W20	W21
Corresponding receiving	↓	↓	↓	↓	↓
Or sending terminal	M03	M04	M05	M06	M07

Remote I/O

Remote IO function can make one iSmart as master link to another iSmart as slave; the slave can't perform its program. Below figures show how to configure the remote IO system.



Don't use expansion DI/DO modules, when remote I/O function is enabled.

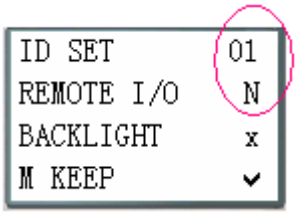
Set to master
User program valid
X = slave input
Y = slave output

Set to slave
User program not valid
Input = X coil of master
Output = Y coil of master

Do not use expansion DI/DO modules, when remote I/O function is enabled.

-

MU (Modbus) (Only CD type model)



MU function performs Modbus RTU communication at RS485 port. There are 15 MU coils: MU01~MU0F.

Remote IO and IO Link have higher priority than MU to use RS485 port. MU is executed when the remote IO setting in the system is disabled (No Remote IO) and ID is not 0.

There can be several MU commands executed at the same time, but only one command can be performed, the rest are postponed until the performed one is accomplished.

Function mode corresponding communication function code:

mode	Communication function code
1	03 (read registers)
2	06 (write single register)
3	10 (write multiple registers)
4	01 (read coils)
5	05 (write single coil)

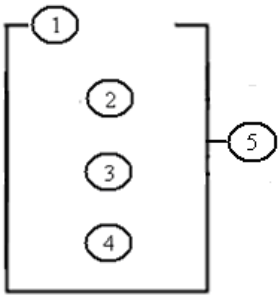
The coils used for MU function:

M3D: Received	M3D turns ON after received, then check-up for error. Transferring data to target address if there is no error.
M3E: Error flag	communication error flag
M3F: Time out flag	M3F turns ON when the master does not get any response from slave within certain time. M3F will automatically reset if M3D reset.

The time of time out depends on the baud rate as shown in the below table.

Baud rate (bps)	Time out (ms)
4800、9600、19200、38400	125
57600	100
115200	80

There are 5 parameters in MU function as shown below.



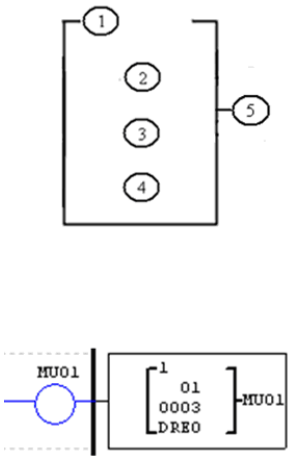
symbol	Description
①	MU mode (1~5)
②	ID number of the target unit: range from 0 to127
③	The address of target register in that unit: 1) address is assigned to a constant, range from 0000 to ffff; • Just do the read/write function to the register with one data length/address in mode 1 and 3. • Do the read/write function to the coil with one data length/address in mode 4 and 5. 2) The address refers to the content of DR coil, and the value of coil behind this one determines how many registers or coil will be read or write, see the next five pages for more information.
④	DR code, store sending/receiving data from this DR
⑤	MU code (MU01~MU0F)

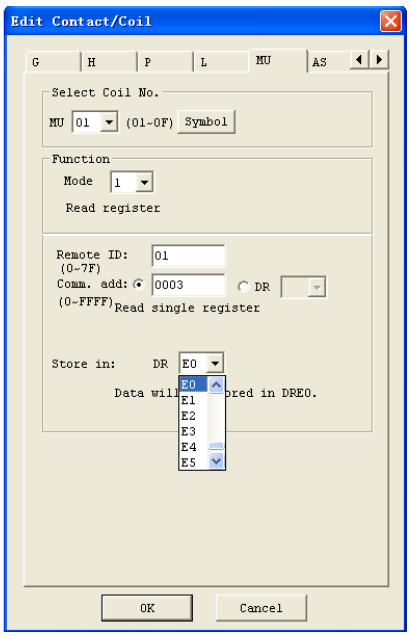
-

※ The max data length for Mode 1 and 3 is 25 words, it means 25 continuous addresses. The max data length for Mode 4 is 400bits.

MU mode1: Read Registers

Set parameter ③, address, to be constant: as show in below figure, the data length is fixed at 1 (it means read signal register only).





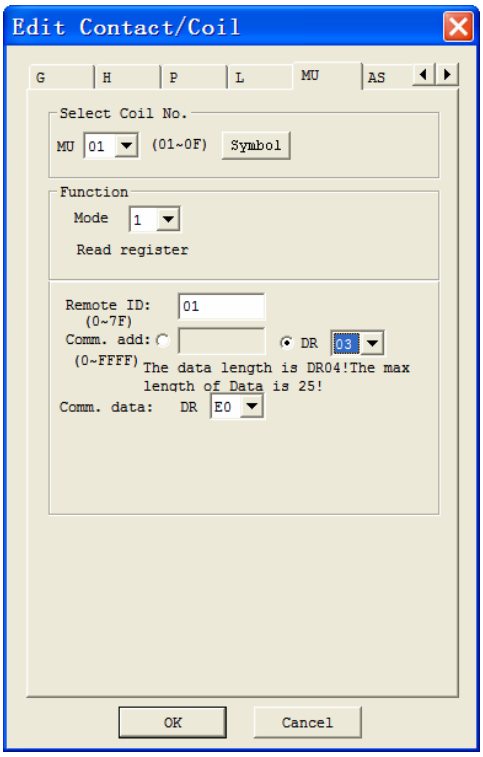
Address is a constant, 0003.
Data length is fixed at 1word, in other word, just one address.
The sending out Modbus command will be:
Received response from slave:

01 03 02 data1-1 data1-2 CRC16;
Saving date to DRE0:
DRE0 = data1-1 + data1-2

※ Note:

The completed data in a register is a 16 bits type. When using Modbus protocol, this 16 bit data is going to be divided into high 8 bits and low 8 bits. In above example:
Data1-1 is the high 8 bits
Data1-2 is the low 8 bits

Setting parameter ③, address refers to the value of DR register:



Function parameter display:

Setting DR03=0001 for the address
Setting DR04=0002 for the data length
(means how many data will be read)
The sending out Modbus command will be:
01 03 00 01 00 02 CRC16;

Received response from slave:
01 03 04 data1-1 data1-2 data2-1 data2-2 CRC16;
Saving data to DRE0~DRE1:
DRE0 = data1-1 + data1-2
DRE1 = data2-1 + data2-2

※the max length of data is 25.

The above example shows how to read two data from two different (but continuous) registers/addresses. For more information, see the SMT Modbus protocol manual.

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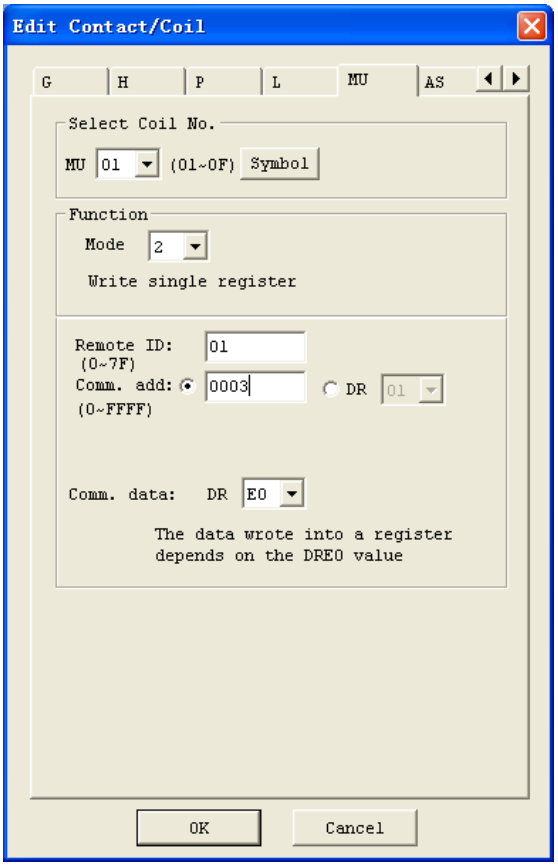
MU mode2: Write single register

Set parameter ③, address, to be constant:



Function parameter display:

Set a constant address as 0003,

Set DRE0=1234 (hex: 04D2) as the content which would be written into other register.

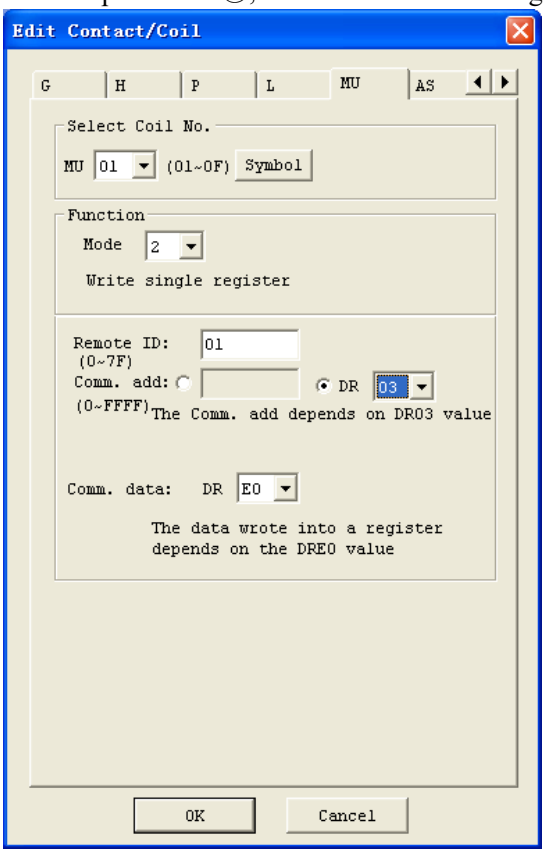
When enable the MU function, the sending out Modbus command will be

01 06 00 03 04 D2 CRC16;

Received response from slave:

01 06 00 03 04 D2 CRC16;

Set parameter ③, address refers to data register DR:



Function parameter display:

Set DR03=0001 for data address

Set DRE0=1234 (hex: 04D2) as the content which would be written into other register.,

When enable the MU function, the sending out Modbus command will be

01 06 00 01 04 D2 CRC16;

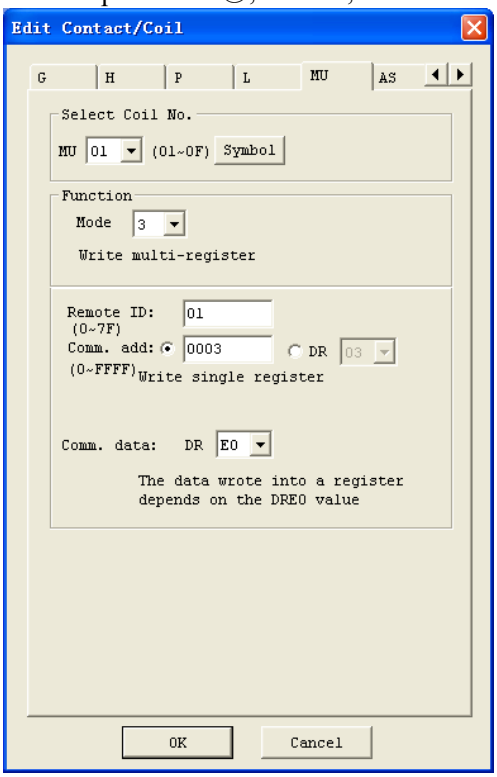
Received response from slave:

01 06 00 01 04 D2 CRC16;

-

MU mode3: Write Multiple Registers

Set parameter ③, address, to be constant:

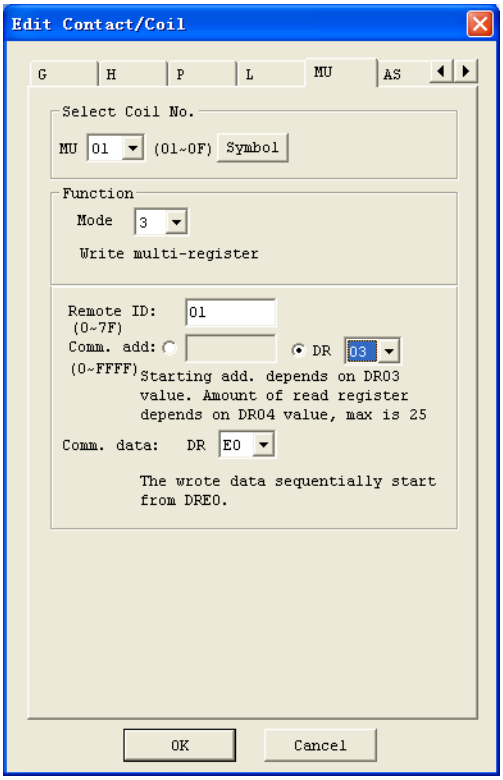


Function parameter display:

Set a constant address, 0003.
Data length is fixed at 1word, means writing single register.
Set data DRE0=1234 (hex: 04D2) as the content which would be written into other register.
When enable the MU function, the sending out Modbus command will be
01 10 00 03 00 01 02 04 D2 CRC16;

Received response from slave:
01 10 00 03 00 01 CRC16;

Set parameter ③, address, refer to data register DR:



Function parameter display:

Set DR03=0001 for address
Set DR04=0002 for data length
(means how many data will be written)
Set data DRE0=1234 (hex: 04D2),
Set data DRE1=5678 (hex: 162E),

When enable the MU function, the sending out Modbus command will be:
01 10 00 01 00 02 04 04 D2 16 2E CRC16;

Received response from slave:
01 10 00 01 00 02 CRC16

※ the max length of data is 25.

The above example shows how to write two data into two different (but continuous) registers/addresses. For more information, see the SMT Modbus protocol manual.

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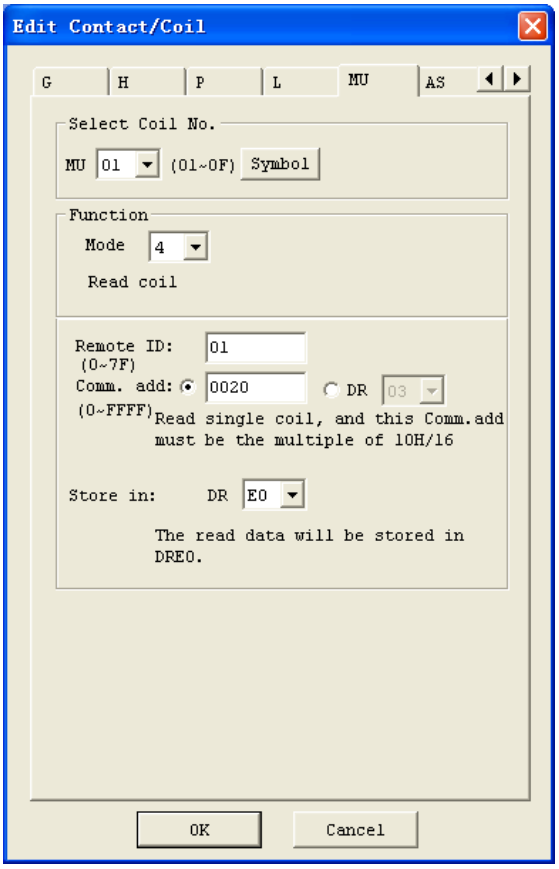
MU mode4: Read Coils

Set parameter ③, address, to be constant:



Function parameter display:

Set a constant address 20 (here is a Hex number)

Data length is a constant value: 10 in Hex format

When enable the MU function, the sending out Modbus command will be:

01 01 00 20 00 10 CRC16;

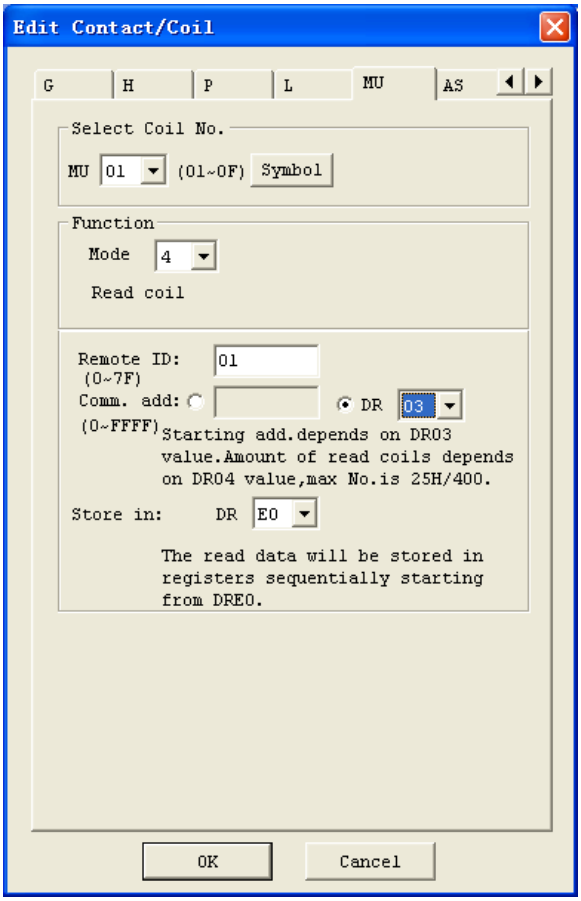
Received response from slave:

01 01 02 data1-1 data1-2 CRC16;

Saving data to DRE0:

DRE0 = data1-1 + data1-2

Set parameter ③, address, refer to data register DR:



Function parameter display:

Set DR03=0001 for address

Set DR04=0015 (hex: 000F) for data length;

(means how many coil's state will be read)

When enable the MU function, the sending out Modbus command will be:

01 01 00 01 00 0F CRC16;

Received response from slave:

01 01 02 data1-1 data1-2 CRC16;

Saving data to DRE0:

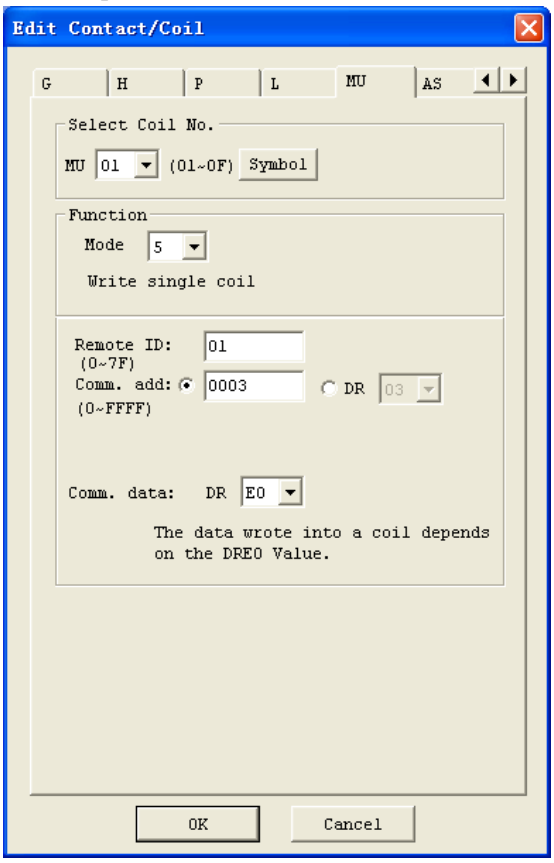
DRE0 = data1-1 + data1-2

※ the max length of data is 400.

-

MU mode5: Write single coil

Set parameter ③, address to be constant:



Function parameter display:

Set a constant address as 0003

Set DRE0=65280 (hex: FF00) as the content which would be written into other coil.

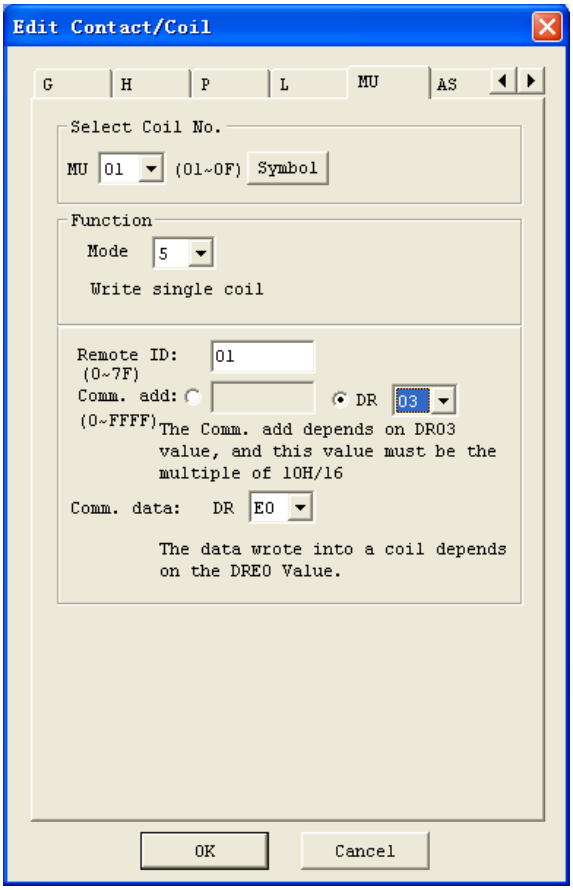
When enable the MU function, the sending out Modbus command will be:

01 05 00 03 FF 00 CRC16;

Received response from slave:

01 05 00 03 FF 00 CRC16;

Setting parameter ③, address, refer to data register DR:



Function parameter display:

Set DR03=0001 for address

Set DRE0=65280 (hex: FF00)

When enable the MU function, the sending out Modbus command will be:

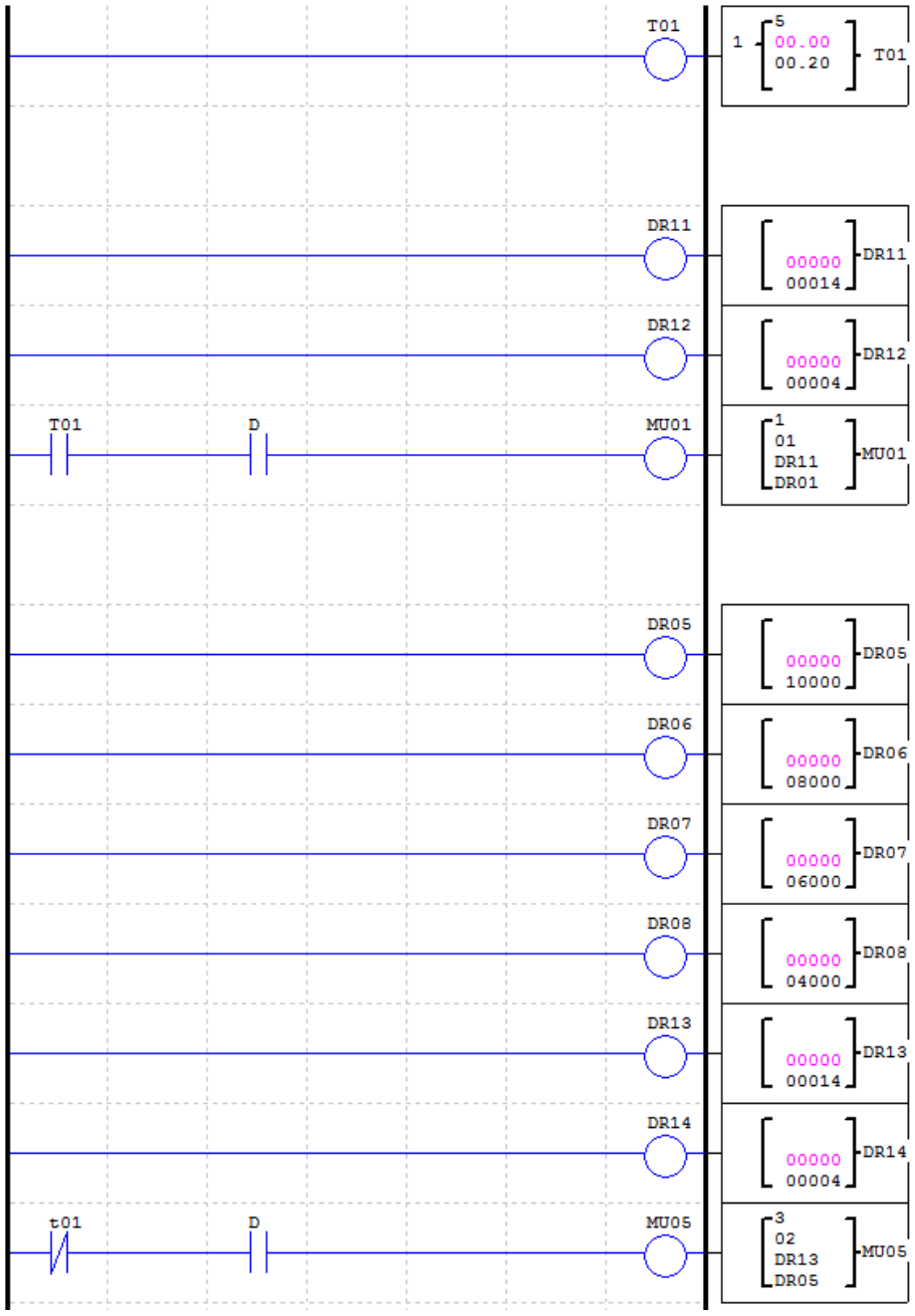
01 05 00 01 FF 00 CRC16;

Received response from slave:

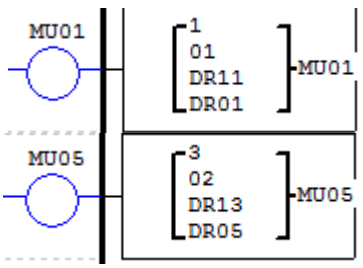
01 05 00 01 FF 00 CRC16;

Example：

MU sending and receiving data via RS485 port when it is enabled. Here recommends user to put the D-trigger element in front of the MU coil.



MU01 and MU05 coils are controlled by T01 as shown in above figure. Set MU01 as mode1, read registers mode, address starts from DR11=14=0x0E, data length DR12=4, and saving data to the registers from DR01 to DR04.



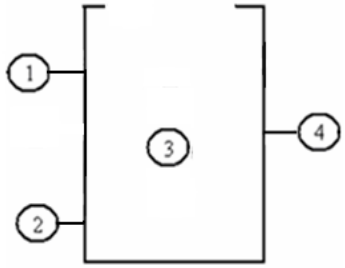
Setting MU05 as mode3, write multiple registers mode, address DR13=14=0x0E, data length DR14=4, and the data which want to write into target registers refer to the value of the register, from DR05 to DR08 (DR05=10000=0x2710, DR06=8000=0x1F40, DR07=6000=0x1770, DR08=4000=0x0FA0);

When T01 turns ON, MU01 is going to be triggered to send command 01 03 00 0E 00 04 CRC16, then saving the received data to DR01~DR04. After 0.2s T01 OFF, then trigger MU05 sending command 01 10 00 0E 00 04 08 27 10 1F 40 17 70 0F A0 CRC16, writing 4 sets data to the registers (0x0E~0x11) in the slave.

-

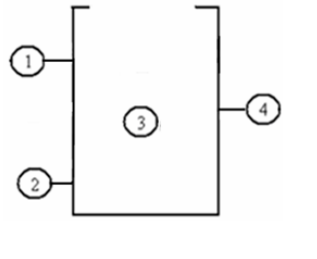
SHIFT (shift output)

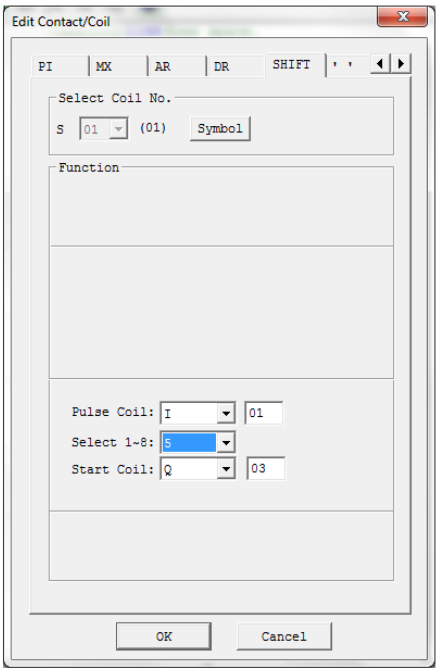
The iSmart smart relay includes only one SHIFT coil that can be used throughout a program. This function switches a set of serial coils sequentially by trigger a certain input pulse coil. It has 4 parameters for proper configuration. The table below describes each configured parameter and lists each compatible element for configuring SHIFT.

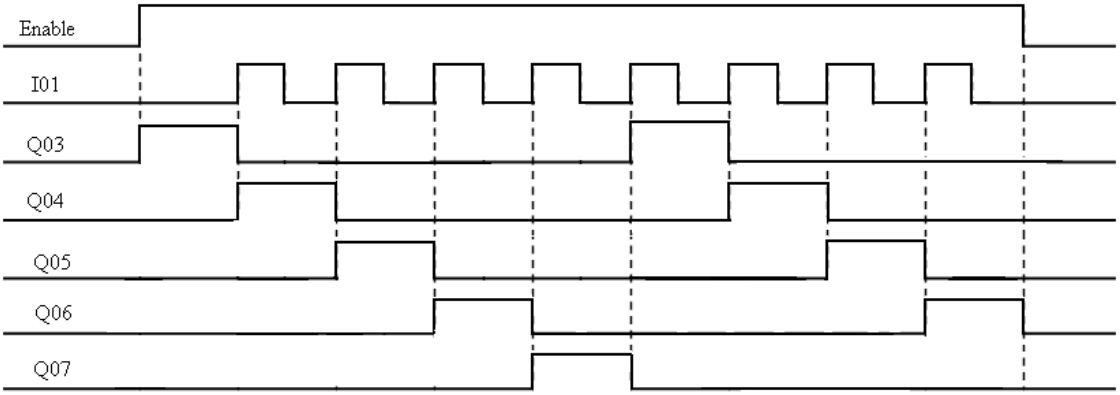


Symbol	Description
①	Preset number of output pulse (1~8)
②	SHIFT input coil (I01~g1F)
③	SHIFT output coils (Q, Y, M, N)
④	SHIFT code (S01)

In the example below, ① = 5, ② = I01, ③: Q03~Q07.







※ When shift function is enabled, the Q03 will auto-turn ON first, and the rest of the coils still retain the OFF state. The ON state shifts to Q4 once the input pulse coil was triggered, then Q03 turns OFF. When triggered signal happened again, the ON state shifts again from Q04 to Q05, and so on. See the above timing diagram for more information.

-

AQ (Analog Output)

The AQ instructions must be used with extension analog out module, 2AO.The default output signal of AQ is 0~10V, the AQ value and the corresponding 12 bits data value are in the range of 0~1000 and 0~4095. It also can be assigned to output 0~20mA, in current mode; the AQ value and the corresponding 12 bits data value are within the range of 0~500 and 0~2047. The 12bits data saved in DRD4~DRD7. The output mode of AQ is set by the current value of DRD0~DRD3

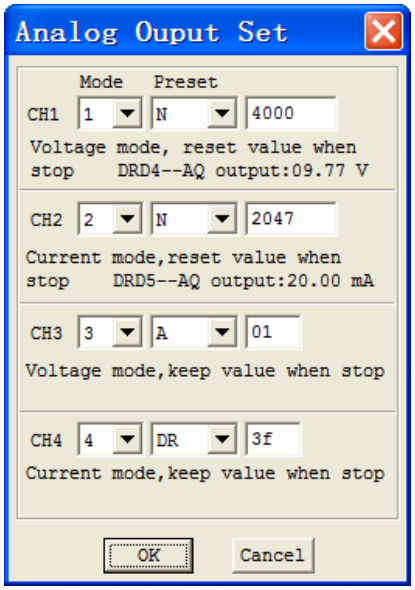
	Output register	Mode register
Channel 1: AQ01	DRD4	DRD0
Channel 2: AQ02	DRD5	DRD1
Channel 3: AQ03	DRD6	DRD2
Channel 4: AQ04	DRD7	DRD3

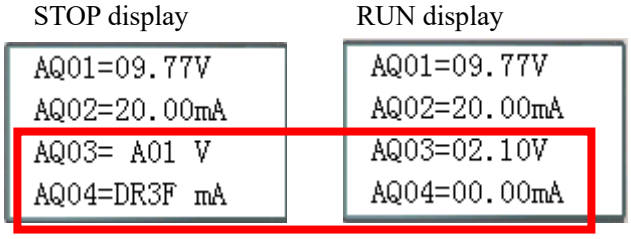
Mode	DRD0~DRD3 data definition
1	0: voltage mode and reset value when stop;
2	1: Current mode and reset value when stop;
3	2: voltage mode and keep value when stop;
4	3: Current mode and keep value when stop;

※ Analog output works in mode 1 if the value of the mode register, DRD0~DRD3, is larger than 3.

The appearance of AQ value on the HMI screen

The HMI on iSmart displays the code of selected coil when the unit at STOP mode, and showing the current value at RUN mode, see the below figure to get more information.





When AQ mode is in current mode, the relationship among the DR, AQ output and display value is shown as below:

DRD5=2047, AQ02=500, display: 20.00mA

※ When the preset value in "Analog Output Set" screen is a constant, this value will be stored in DR register, (DRD4~DRD7) and the AQ value equals to (DRx/4.095). For example, CH1 is configured as mode 1, set a constant value, 4000, then the value of AQ01 will be 977, and HMI displays 9.77V.

※ Once the preset value refers to other variable, its value is also stored in DR register, (DRD4~DRD7), but it will be equal to AQx * 4.095. (DRx=AQx*4.095).

※ More information about expansion analog input to see: Chapter 8 Expansion Module-Analog Module.

Example 1: AQ01 preset value is a constant; the preset value of DRD4 refers to V01.

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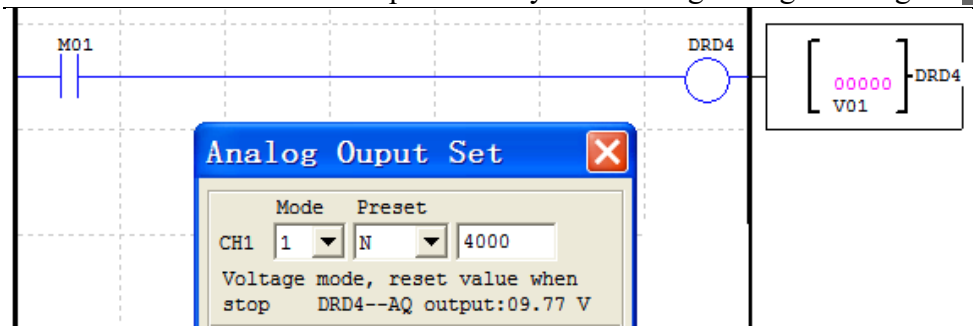
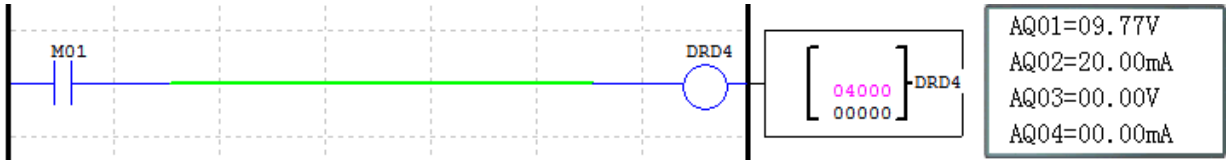
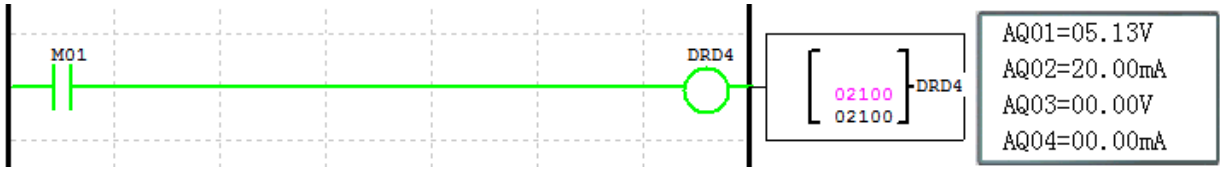


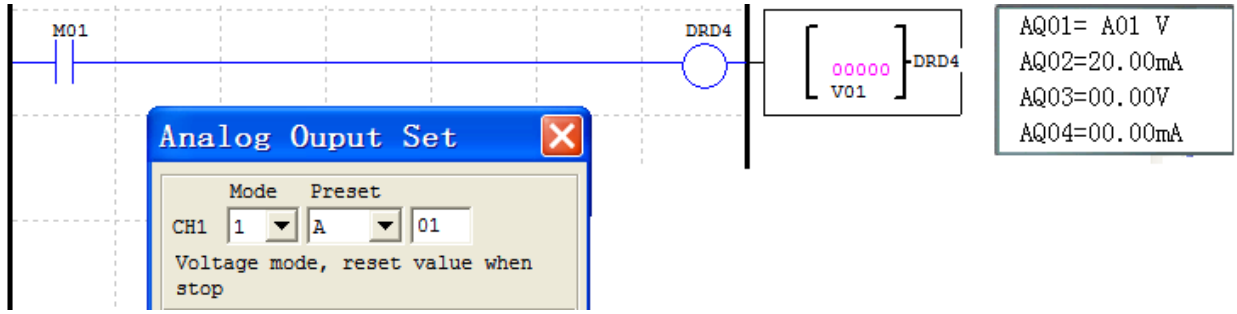
Run the program and don't conduct the M01 contact, DRD4 output value, now, equals to the constant preset value of AQ01, and AQ01 outputs 9.77V.



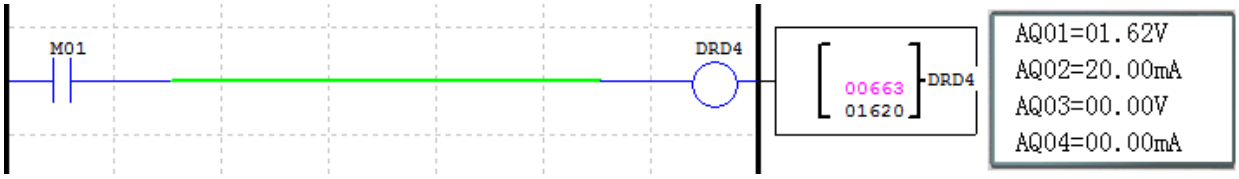
Then enable the M01, the DRD4 output value is depending on the value of V01, changing the value of V01 also influences the output value of AQ01 and DRD4.

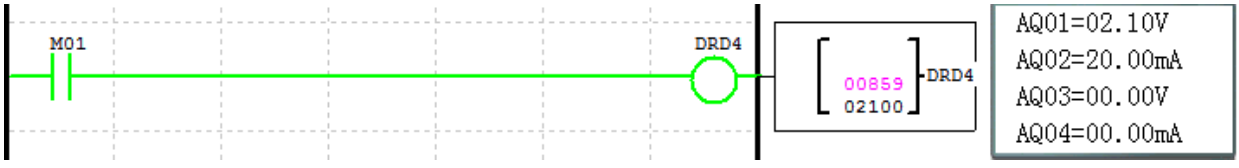


Example 2: AQ01 preset value refers to other parameters, and the preset value of DRD4 refers to V01.



Run the program, the current/output value of DRD4 will not be affected by V01 even the M01 turns ON, it only depends on the A01 (AQ01 * 4.095=DRD4).





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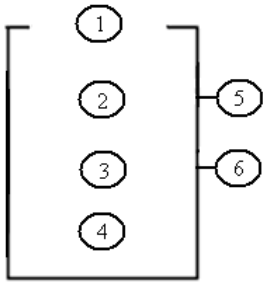
AS (Add-Subtract)

The iSmart smart relay includes 31AS coils that can be used throughout a program. The AS function performs a simple integral-math-calculation: Addition and Subtraction. There are 6 parameters for proper configuration. The table below describes each configuration parameter, and lists each compatible element for configuring AS.

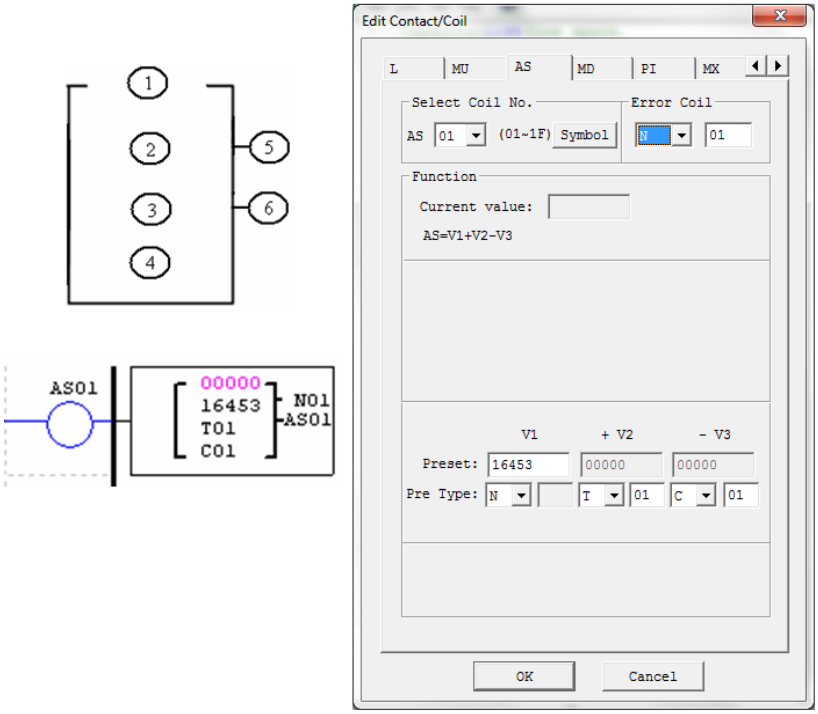


Symbol	Description
①	AS current value (-32768~32767)
②	V1 parameter (-32768~32767)
③	V2 parameter (-32768~32767)
④	V3 parameter (-32768~32767)
⑤	Error output coil (M, N, NOP)
⑥	AS code (AS01~AS1F)

Compute formula: $AS = V1 + V2 - V3$

AS current value is the calculated result. Parameters V1, V2, and V3 can be a constant or current value of other function. The “Error Coil” turns ON when the calculated result is overflowed, the current value keeps at 32767 or -32768, which depends on the direction of the overflow. But it will do nothing if the output coil is NOP. The output coil will turn OFF when the result is in the range or the function is disabled.

The example below shows how to configure AS function.

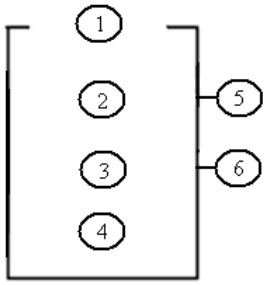


※ Error output coil N01 will turn ON when the compute result is overflow.

-

MD (MUL-DIV)

The iSmart smart relay includes 31MD coils that can be used throughout a program. The MD function performs a simple integral-math-calculation, Multiplication and Division. There are 6 parameters for proper configuration. The table below describes each configuration parameter, and lists each compatible element for configuring MD.

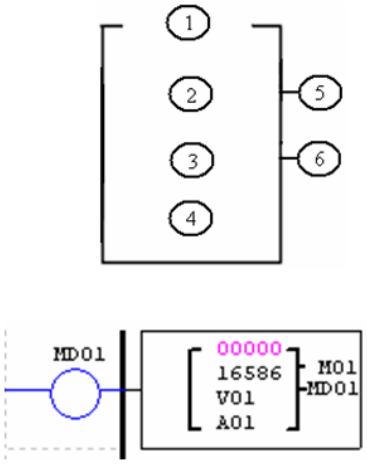


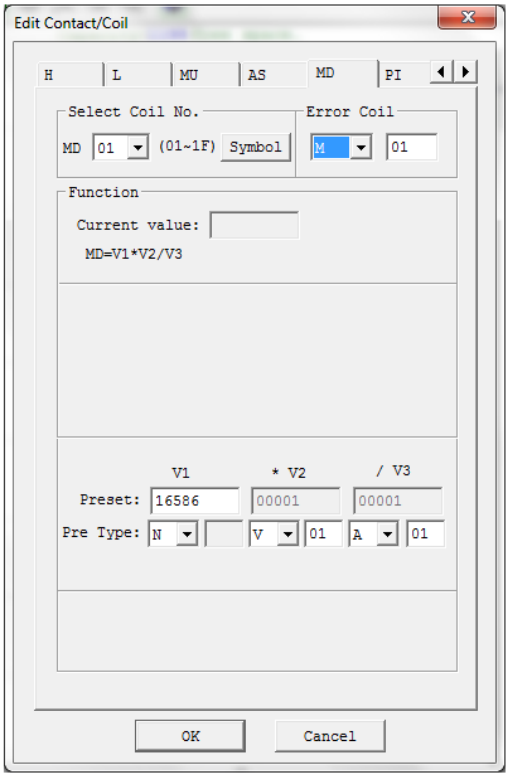
Symbol	Description
①	MD current value (-32768~32767)
②	V1 parameter (-32768~32767)
③	V2 parameter (-32768~32767)
④	V3 parameter (-32768~32767)
⑤	Error output coil (M, N, NOP)
⑥	MD code (MD01~MD1F)

Compute formula: $MD = V1 * V2 / V3$

MD current value is the calculated result. Parameters V1, V2, and V3 can be a constant or other function current value. The “Error Coil” turns ON when the calculated result is overflowed or V3 equals to zero. The current value keeps at 32767 or -32768, which depends on the direction of the overflow, and keeps zero when V3 is zero. But it will do nothing if the output coil is NOP. The output coil will turn OFF when the result is in the range, or the function is disabled.

The example below shows how to configure MD function.



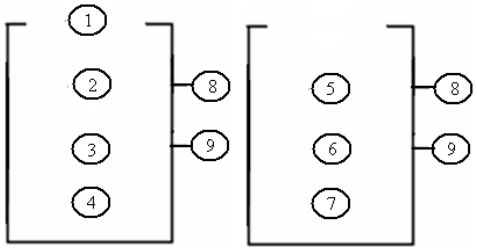


※ Error output coil M01 will turn ON when the compute result is overflow.

-

PID (Proportion- Integral- Differential)

The iSmart smart relay includes 15 PID coils that can be used throughout a program. The PID function performs a simple integral-math-calculation which is according to the equation as shown in below. There are 9 parameters for proper configuration. The table below describes each configuration parameter and lists each compatible element for configuring PID.



Symbol	Description
①	PI: PID current value (-32768~32767)
②	SV: Set value (-32768~32767)
③	PV: Feedback value (-32768~32767)
④	T_S: Sampling time (1~32767 * 0.01s)
⑤	K_P: Proportional gain (1~32767 %)
⑥	T_I: Integration time (1~32767 * 0.1s)
⑦	T_D: Differential time (1~32767 * 0.01s)
⑧	Error output coil (M, N, NOP)
⑨	PID code (PI01~PI0F)

The parameters from ① to ⑦ can be a constant or refer to the current value of other function The error coil will turn ON when either T_S or K_P equal to 0. But it will do nothing if the output coil is NOP. The output coil will turn OFF when the result is in the range, or the function is disabled.

PID computes formula:

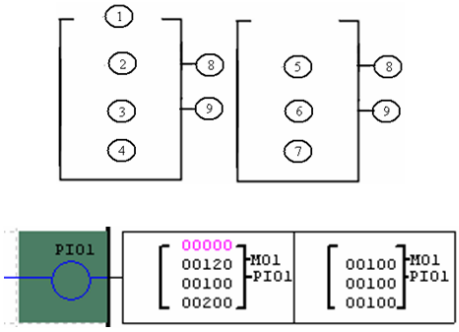
$$EV_n = SV - PV_n$$

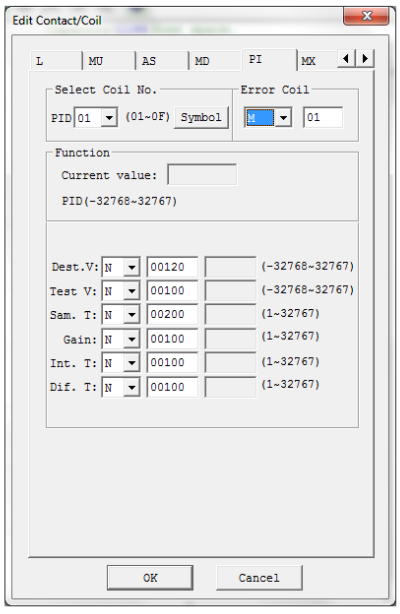
$$\Delta PI = K_P\left\{\left(EV_n - EV_{n-1}\right) + \frac{T_s}{T_I}EV_n + D_n\right\}$$

$$D_n = \frac{T_D}{T_S}\left(2PV_{n-1} - PV_n - PV_{n-2}\right)$$

$$PI = \sum \Delta PI$$

The example below shows how to configure PID function.





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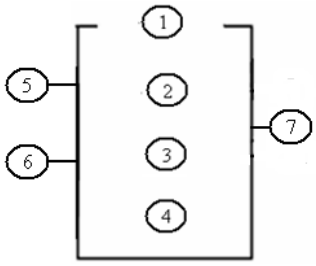
MX (Multiplexer)

The iSmart smart relay includes 15 MX coils that can be used throughout a program. This function set its current value to be 0 or one of 4 preset values which depends on the state of selection bit 1 and 2. There are 7 parameters for proper configuration. The table below describes each configuration parameter and lists each compatible element for configuring MX.

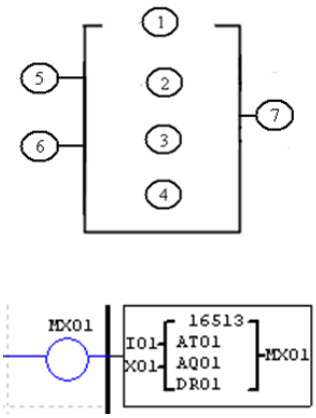


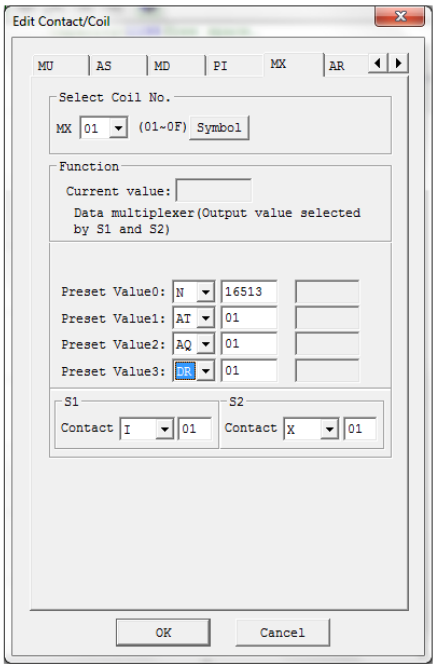
symbol	description
①	V0 parameter (-32768~32767)
②	V1 parameter (-32768~32767)
③	V2 parameter (-32768~32767)
④	V3 parameter (-32768~32767)
⑤	Selection bit 1: S1
⑥	Selection bit 2: S2
⑦	MX code (MX01~MX0F)

The parameters from ① to ④ can be constant or refer to the current value of other function. The table below describes the relationship between parameter and MX current value.

disable	MX = 0;
enable	S1＝OFF, S2＝OFF: MX = V0; S1＝OFF, S2＝ON: MX = V1; S1＝ON, S2＝OFF: MX = V2; S1＝ON, S2＝ON: MX = V3;

For example, assign S1 and S2 to refer to the I01 and X01, and V0=16513 (preset value 0), V1= AT01 (preset value 1), V2=AQ01 (present value 2) and V3=DR01 (preset value 3). When turns I01 ON and X01 OFF, then MX=AQ01; if I01 is at OFF and X01 is at ON state, the MX =AT01, and so on.





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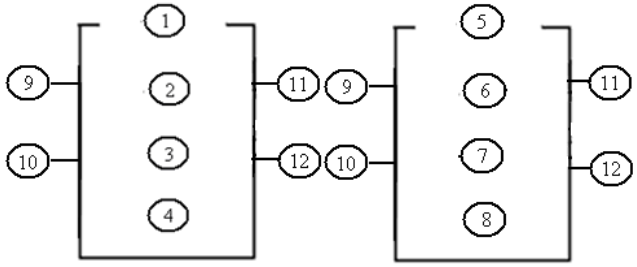
AR (Analog-Ramp)

The iSmart smart relay includes 15 AR coils that can be used throughout a program. Each AR coils has 2 modes.

AR mode 1

In mode1, AR current level is changed to either Level 1 or Level 2 according to the ON/OFF state of "Sel coil" at a specified rate. There are 12 parameters for proper configuration. The table below describes each configuration parameter, and lists each compatible element for configuring AR.



symbol	Description
①	AR current value: 0~32767
②	Level1:-10000~20000
③	Level2:-10000~20000
④	MaxL (max level):-10000~20000
⑤	Start/Stop level (StSp): 0~20000
⑥	stepping rate (rate): 1~10000
⑦	Proportion (A): 0~10.00
⑧	Offset (B): -10000~10000
⑨	Level selection coil (Sel)
⑩	Stop coil (St)
⑪	Error output coil (M, N, NOP)
⑫	AR code (AR01~AR0F)

$$AR\_current\_value = (AR\_current\_level - B) / A$$

The parameters from ② to ⑧ can be constant or refer to the current value of other function. The table below describes detail information of each parameter of AR.

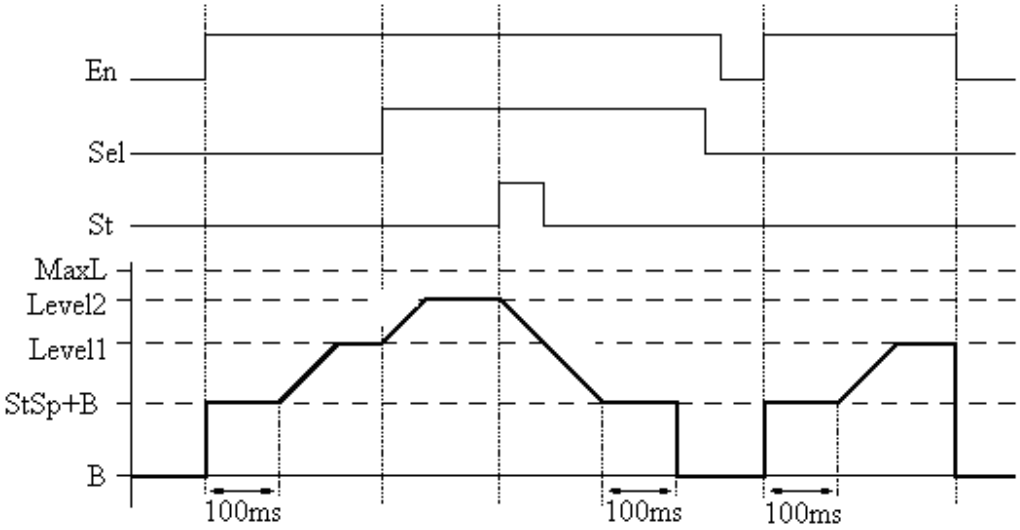
Sel	Selection level "Sel coil" is at OFF state: target level = Level1 "Sel coil" is at ON state: target level = Level2 ※ The AR current value just can reach the MaxL if the target level is over it.
St	Stop coil can start-up to decrease the current level to ⑤, start/stop level (StSp + Offset) once it turns on, and keeping this level for 100ms. Then AR current value goes to 0.
Error output coil	The Error coil turns ON when A is 0.

※ The Error output coil can be M, N or NOP. It will do nothing if select the NOP.

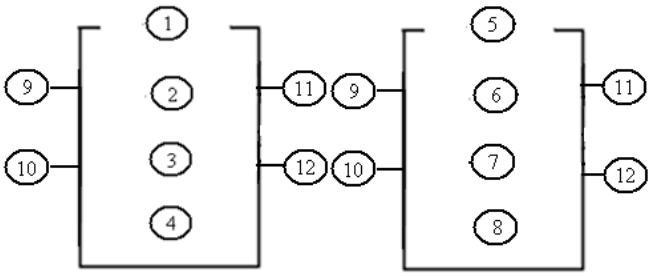
AR will keep the current level at "StSp + Offset "B"" for 100ms when it's enabled. Then the current level raises from StSp + Offset "B" to target level according to the ⑥,Stepping Rate. If St turns ON, the current value decreases from current level to the level, StSp + B, in the stepping rate. Then AR stays at this level for 100ms. After 100ms, AR current level is going to 0, which means AR current value will equal to 0.

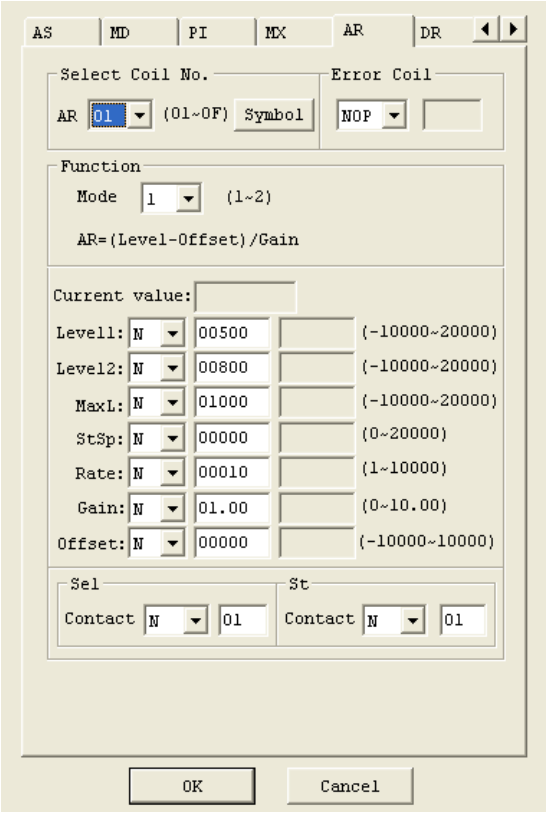
-

Timing diagram for AR



The example below shows how to configure AR function.





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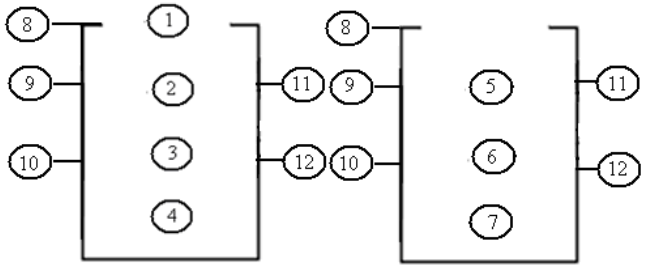
AR mode2

In mode 2, it supports four different preset levels, but only one of these 4 preset levels can be target level at one time. The current level will change to target level at a designed rate. There are 12 parameters for proper configuration. The table below describes each configuration parameter and lists each compatible element for configuring AR mode2.



symbol	Description
①	AR current value:0~32767
②	Level0:0~32767
③	Level1:0~32767
④	Level2:0~32767
⑤	Level3:0~32767
⑥	MaxL(max level): 0~32767
⑦	Ta(acceleration time):0.1~3276.7
⑧	AR mode
⑨	Level selection coil(Sel1)
⑩	Level selection coil(Sel2)
⑪	Error output coil(M,N,NOP)
⑫	AR code(AR01~AR0F)

The parameters from ② to ⑦ can be constant or refer to the current value of other function. The rate designed by user: $Rate = \frac{MaxL}{Ta}$. The table below describes detail information of each parameter of AR mode2.

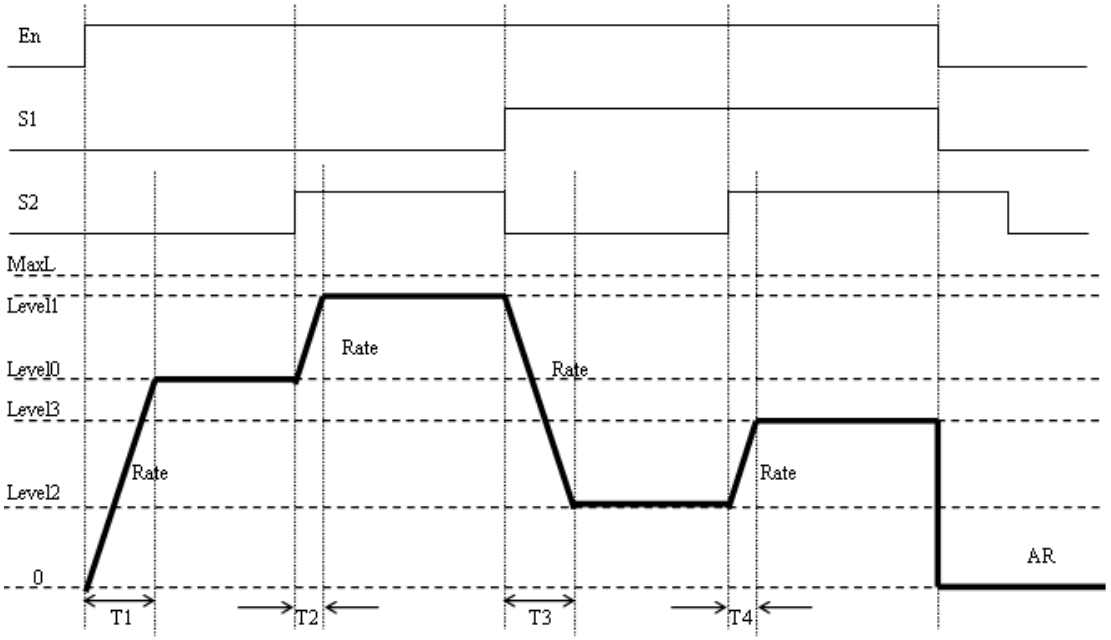
Sel1 Sel2	S1＝OFF,S2＝OFF: target level = Level 0; S1＝OFF,S2＝ON: target level = Level 1; S1＝ON, S2＝OFF: target level = Level 2; S1＝ON, S2＝ON: target level = Level 3;
MaxL	The AR current value just can reach the MaxL if the target level is over it.
Ta	The result of MaxL divided by Ta is the raising/lowering rate from current level to target level.
Error output coil	The error coil turns ON when Ta is 0.

※The error output coil can be M,N or NOP, it will do nothing if it was selected as NOP.

AR current value will vary from one level to another lever according to the ON/OFF state of “Sel 1” and “Sel 2”, and the raising/lowering rate depends on Ta. When AR is disabled, current value goes to 0 immediately. For detail, you can see the “Timing diagram” show next page.

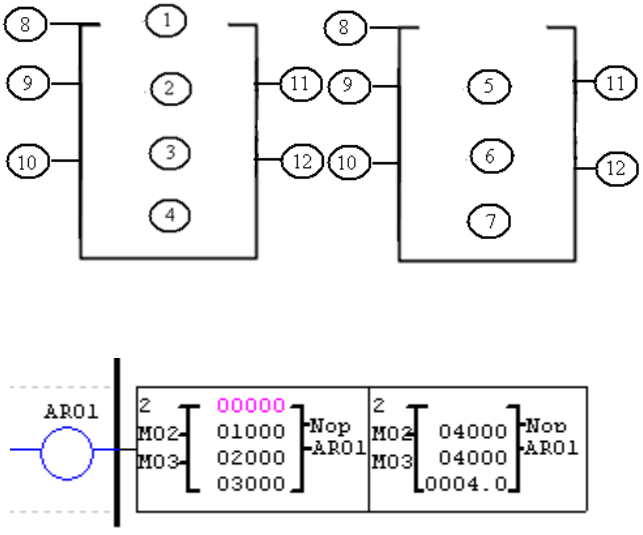
-

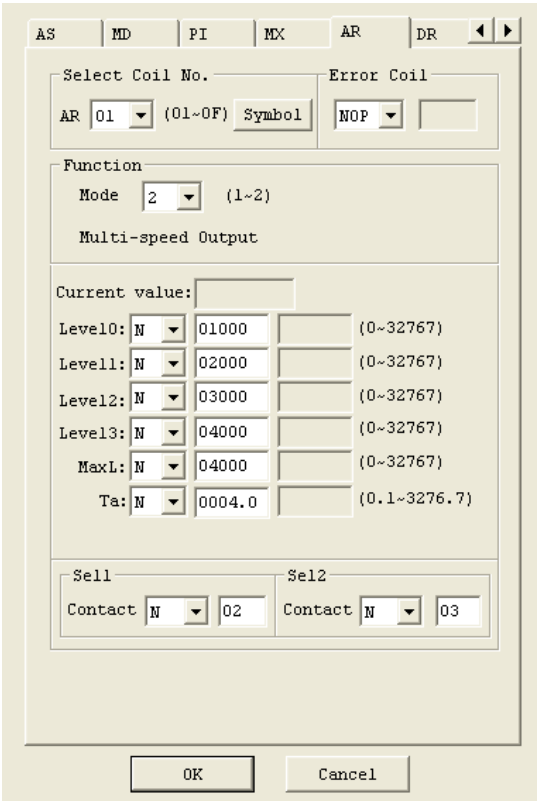
Timing diagram for AR



Rate = MaxL/Ta; T1=Level0*Ta/MaxlL; T2=（Level1-Level0）*Ta/MaxL;
T3=（Level1-Level2）*Ta/MaxL; T4=（Level3-Level2）*Ta/MaxL;

The example below shows how to configure AR function.





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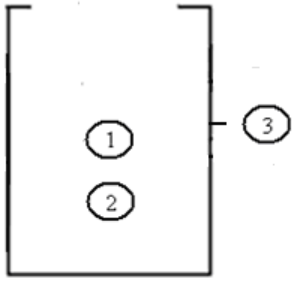
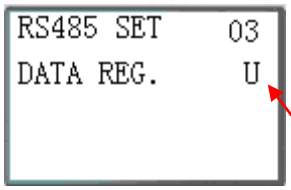
DR (Data register)

The iSmart smart relay includes 240 DR coils that can be used throughout a program. The DR function plays an important role in data-transmission. Its current value equals to preset value once it's enabled. The data can be signed or unsigned by **Operation>>module system set…**menu selection from the SMT Client software **or keypad set**. There are 3 parameters for proper configuration. The table below describes each configuration parameter, and lists each compatible element for configuring DR.

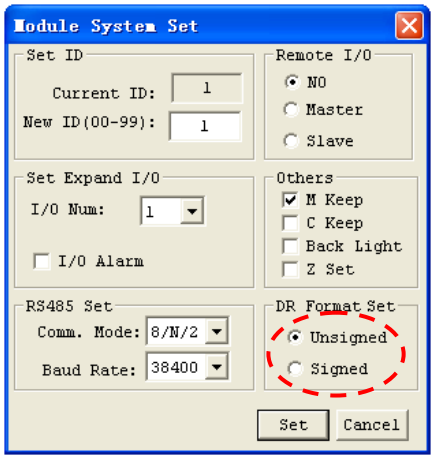


symbol	Description	
①	Current value	Unsigned: 0~65535
②	Preset value	Signed: -32768~32767
③	DR code (DR01~DRF0)	

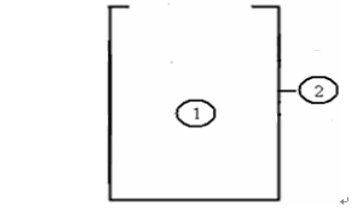
The parameter ① can be a constant or refer to the current value of other function.

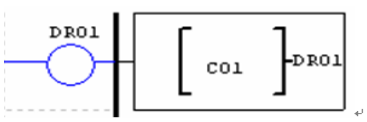


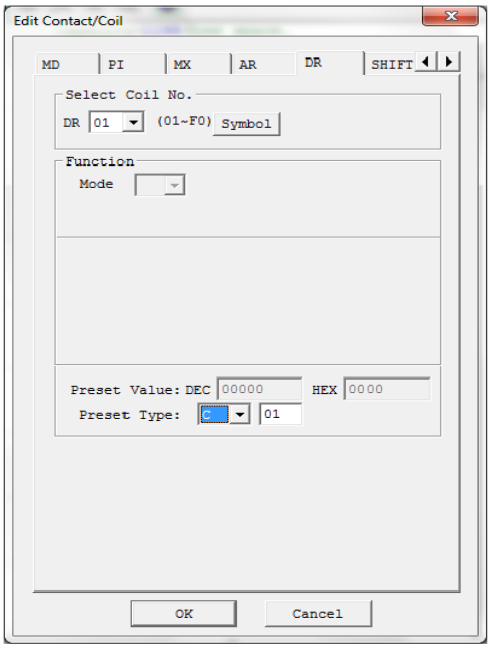
U: unsigned data
S: signed data



The example below shows that the preset value refers to C01, when DR01 is conducted, the current value of DR01 will be the current value of C01.







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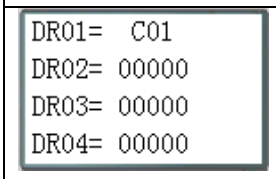
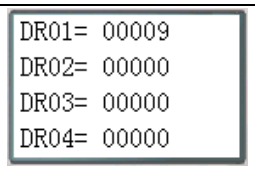
Data register screen on HMI display DR preset value in stop mode and display DR current value in run mode.

STOP	RUN (DR01 = C01 current value)
	

DR65~DRF0 can retain the current value when iSmart is stopped or powered down.

The last 40 DR registers that from DRC9 to DRF0 are special data register as shown below.

DRD0 ~ DRE3 as special registers used to set parameters, the output value function is as follows:

No.	Function description	
DRD0	AQ01 output mode	0, voltage mode and reset value when stop; 1, current mode and reset value when stop; 2, voltage mode and keep value when stop; 3, current mode and keep value when stop;
DRD1	AQ02 output mode	
DRD2	AQ03 output mode	
DRD3	AQ04 output mode	
DRD4	AQ01 output value	Analog output value 0~4095;
DRD5	AQ02 output value	
DRD6	AQ03 output value	
DRD7	AQ04 output value	
DRD8	I/O interface hidden	Refer to “Chapter3:LCD Display and Keypad > Original screen”
DRE1~DRE3	Reserved;	

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DRC9~DRCF and DRD9~DRF0 as special registers used to store status, the output current value function is as follows:

No.	Function description	
DRC9	Output pulse number of instructions PLSY	
DRCA	AT01 current degree Fahrenheit	Used as normal registers when no AT01~AT04 input, such as don't connect with extension module 4PT;
DRCB	AT02 current degree Fahrenheit	
DRCC	AT03 current degree Fahrenheit	
DRCD	AT04 current degree Fahrenheit	
DRCE	RTC mode5 Sunrise time	
DRCF	RTC mode5 Sunset time	
DRD9~DRDF	Keep RTC Time	Year/month/date/week/hour/minute/second
DRE0	The last enable M/N coil number	The range is set in system set menu. When SMT is running, the last enable M/N coil number is kept in DRE0. When M1F is on, the DRE0 is 1F.
DRE1~DRE3	Reserved	
DRE4	A05 input electric current 0~2000	Used as normal registers when no A05~A08 analog input, such as don't connect with extension module 4AI;
DRE5	A06 input electric current 0~2000	
DRE6	A07 input electric current 0~2000	
DRE7	A08 input electric current 0~2000	
DRE8	A01 current value 0~4095	Used as normal registers when no A01 and A02 analog input, such as AC type;
DRE9	A02 current value 0~4095	
DREA	A03 current value 0~4095	Used as normal registers when no A03 and A04 analog input, such as AC type or 12points DC type;
DREB	A04 current value 0~4095	
DREC	A05 current value 0~4095	Used as normal registers when no A05~A08 analog input, such as do not connect with extension module 4AI.
DRED	A06 current value 0~4095	
DREE	A07 current value 0~4095	
DREF	A08 current value 0~4095	
DRF0	Reserved	

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Chapter 6: FBD Block Diagram Programming

FBD Instructions

	Input	Output coil	Range
Input	I		12 (I01~I0C)
Keypad input	Z		4 (Z01~Z04)
Expansion input	X		12 (X01~X0C)
Output	Q	Q	8 (Q01~Q08)
Expansion output	Y	Y	12 (Y01~Y0C)
Auxiliary coil	M	M	63(M01~M3F)
Auxiliary coil	N	N	63(N01~N3F)
HMI		H	31 (H01~H1F)
PWM		P	2 (P01~P02)
SHIFT		S	1 (S01)
I/O LINK		L	8 (L01~L08)
Logic/Function Block	B	B	260 (B001~B260)
Normal ON	Hi		
Normal OFF	Lo		
No connection	Nop		
Analog input	A		8 (A01~A08)
Analog input parameter	V		8 (V01~V08)
Analog output		AQ	4(AQ01~AQ04)
Analog temperature input	AT		4(AT01~AT04)
Network Input	J		63(J01~J3F)
Network Output		K	63(K01~K3F)
Network analog input	NI		31（NI01~NI1F）
Network analog output		NQ	15（NQ01~NQ0F）

FBD program can only be edited and modified in the SMT Client software and write to iSmart controlled equipment via communication cable. Via controlled equipment, FBD program is available for querying or the parameter of the function block of the program for modifying. The preset value of Block could be a constant or other block code. That means the preset value of this block is other block's current value.

FBD system memory space

The size of a FBD program in the iSmart is limited by the memory space (memory used by the blocks).
Resources available in iSmart:

Block number	System memory (byte)
500	**10000**

※ Each FBD block's size is not restricted, it depends on its function.

※ Function Block includes three kinds of function: special function, adjust-controlling function, and communication function. Function type and number are shown in the table below.

	Function type	Number
special function	Timer (T)	250
	Counter (C)	250
	RTC (R)	250
	Analog Comparator (G)	250
adjust-controlling function	Addition and Subtraction (AS)	250
	Multiplication and Division (MD)	250
	PID control (PI)	30
	Multiplexer (MX)	250
	Analog Ramp control (AR)	30
	data register (DR)	240
communication function	Modbus instruction (MU)	250

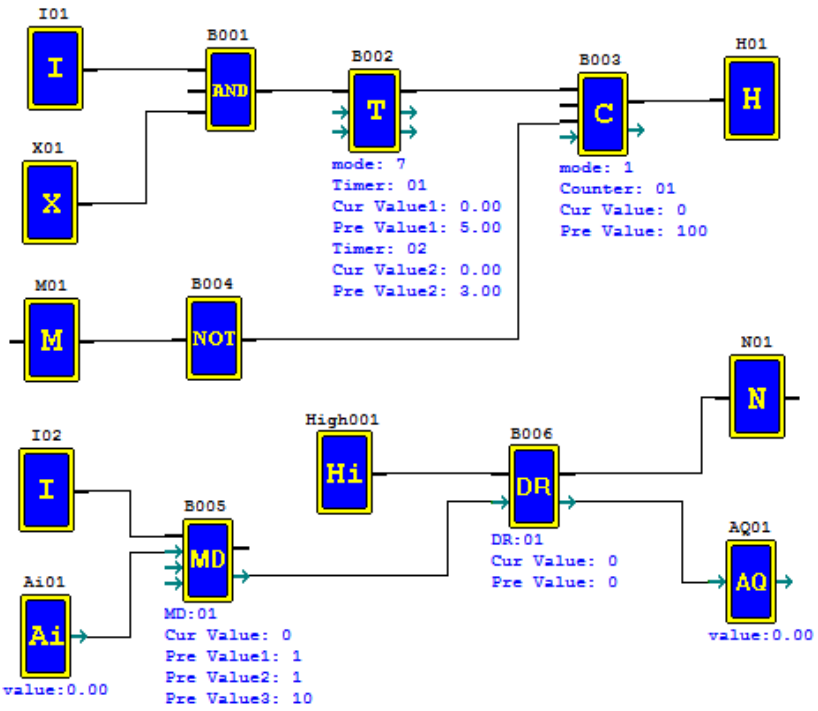
※ Each function block occupied a BLOCK; the available number is limited by the number of B, system memory space and function block number.

	Block number	System memory (byte)	Function Block number													
			T	C	R	G	AS	MD	PI	MX	AR	DR	MU	F	NAI	NAQ
Total source	500	10000	250	250	250	250	250	250	30	250	30	240	250	250	250	250
Timer mode 0	1	5	1													
Timer mode1~6	1	10	1													
Timer mode 7	1	12	2													
Counter mode 0	1	5		1												
Counter mode 1~7	1	14		1												
Counter mode 8	1	16		1												
RTC mode 0	1	5			1											
RTC mode 1~4	1	11			1											
Analog mode 0	1	5				1										
Analog mode 1~7	1	12				1										
AS	1	11					1									
MD	1	11						1								
PID	1	17							1							
MX	1	17								1						
AR	1	23									1					
DR	1	6										1				
MU	1	12											1			
Filter mode0	1	5												1		
Filter1~4	1	10												1		
NAI	1														1	
NAQ	1															1

※ Logic Block include AND, AND EDGE, NAND, NAND EDGE, OR, NOR XOR, NOT, RS, PULSE, BOOLEAN. Each logic block occupied a BLOCK; the available number is limited by the number of B and system memory space. Logic function blocks source show as blow table:

Logic	Block number	System memory (byte)
AND	1	8
AND(EDGE)	1	8
NAND	1	8
NAND(EDGE)	1	8
OR	1	8
NOR	1	8
XOR	1	6
RS	1	6
NOT	1	4
PULSE	1	4
BOOLEAN	1	12

Example: calculating resources



Input coils: I01, X01, M01, I02;
Output coils: H01, N01;
Normal ON: Hi001;
Analog input: A01;
Analog output: AQ01;
Logic and function block: B001~B006.
Coil input/output and analog input/output don't occupy B number and memory space.

Number	Function / Logic	Memory bytes	Function number
B001	AND	8	
B002	Timer mode 7	12	T01, T02
B003	Counter mode 1	14	C01
B004	NOT	4	
B005	MD	11	MD01
B006	DR register	6	DR01

	B number	Memory bytes	
Memory space limits in iSmart	500	10000	
Resource used by program	6	55	
Still available in iSmart	494	9945	

Analog

Analog include:

Analog input	A01~A04
Expansion analog input	A05~A08
Analog input count value	V01~V08
Expansion temperature input	AT01~AT04
Expansion analog output	AQ01~AQ04

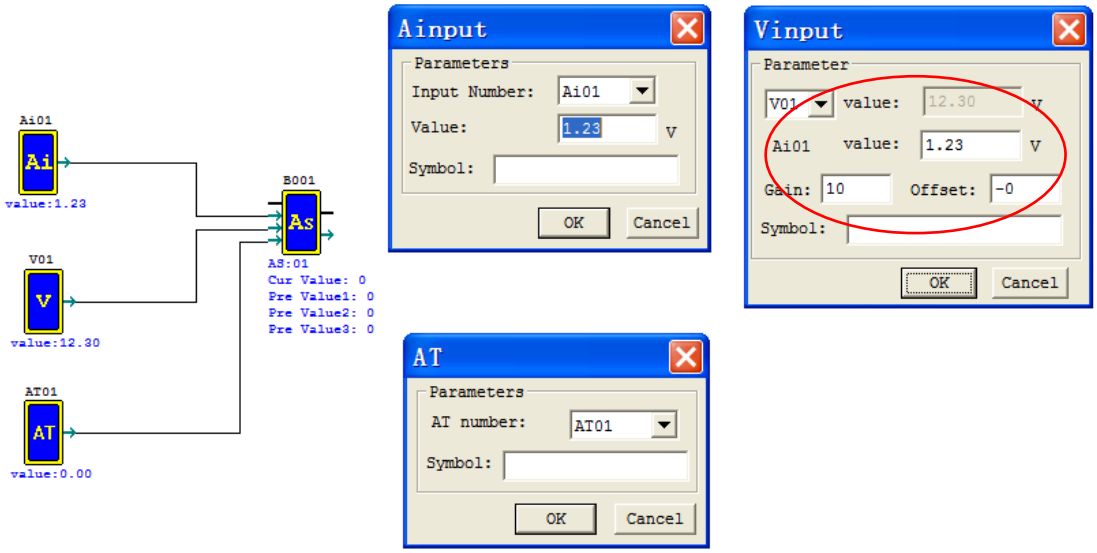
Analog input and output value can be used as preset value of other function blocks.

Analog Input

	Number	Range	Meaning
Analog input value	A01~A04	0~999	0~9.99V
Expansion analog input value	A05~A08	0~999	0~9.99V
Analog input count value	V01~V08	0~999999	
Expansion temperature input value	AT01~AT04	-1000~6000	-100.0~600.0℃

V0x = A0x * Gain + OffSet

Example: A01=1.23, V01=A01*10-0=12.30;
B001(AS01)=A01+V01-AT01;



More information about expansion analog input to see: Chapter 8 Expansion Module-Analog Module.

Analog Output

AQ instructions need to use with extension analog out module 2AO.

The default output of AQ is 0~10V voltage, the 12bits data is 0~4095 and the corresponding value of AQ is 0~1000. It also can be set as 0~20mA current output, the 12bits data is 0~2047 and the corresponding value of AQ is 0~500. The 12bits data saved in DRD4~DRD4. The output mode of AQ is set by the current value of DRD0~DRD3.

	Output register	Mode register
Channel 1: AQ01	DRD4	DRD0
Channel 2: AQ02	DRD5	DRD1
Channel 3: AQ03	DRD6	DRD2
Channel 4: AQ04	DRD7	DRD3

Mode	DRD0~DRD3 data definition
1	0: voltage mode and reset value when stop;
2	1: Current mode and reset value when stop;
3	2: voltage mode and keep value when stop;
4	3: Current mode and keep value when stop;

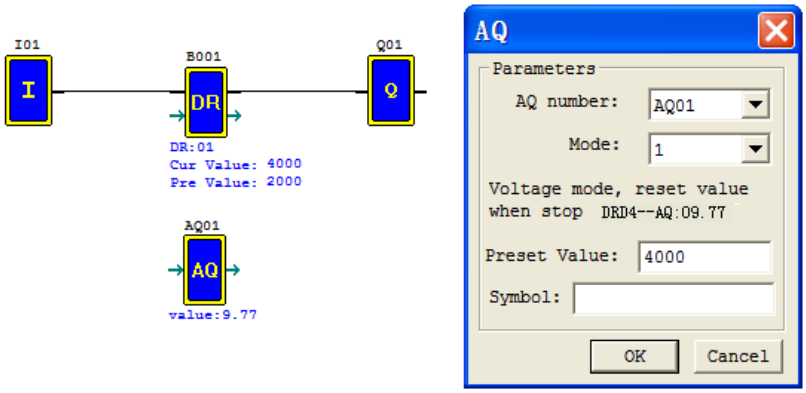
※ It will be thought as 0 if the value of DR is not in the range of 0~3. That means the output mode of AQ is mode 1.

※ When output value type of AQ is set to constant, AQ output value changed by DR value (AQx=DRx/4.095);

※ When output value type of AQ is set to other parameters variables, DR value changed by AQ output value (DRx=AQx*4.095).

※ More information about expansion analog input to see: Chapter 8 Expansion Module-Analog Module.

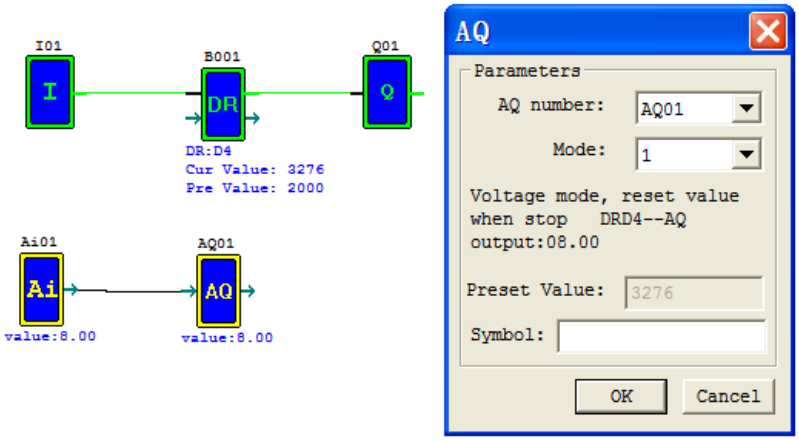
Example 1: AQ01 preset value is constant;



When running and disable M01, DRD4 output value is AQ01 setting value 4000, and AQ01 output 9.77V;

When running and enable M01, adjust the value of DRD4, AQ01 output value changed with DRD4;

Example 2: AQ01 preset value is other parameters;

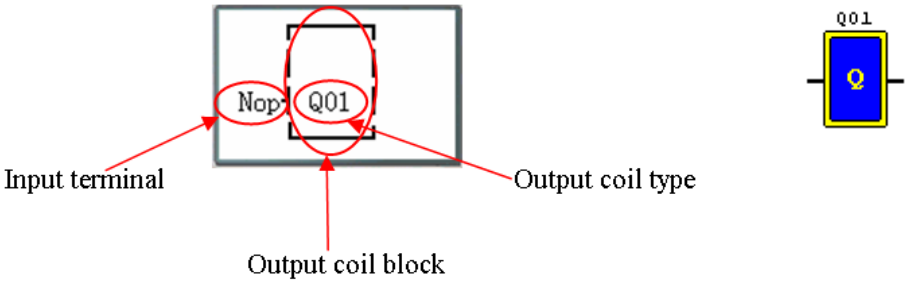


When running, DRD4 output value is out control of I01. AQ01 output value is A01, adjust the value of A01, DRD4 output value changed with A01;

Coil Block Instruction

Output coils including Q, Y, M, N, H, L, P, S.

FBD menu display:



H, L, P, S is special function coil, and press “OK” button into function display.

Press the button:

OK	Into function display when cursor address is output coil and coil type is H, L, P, S.
→	Move cursor: input terminal → output coil type → output coil number
←	Move cursor: output coil number → output coil → input terminal → Logic/Function display (input terminal is block)
↑↓	Change output coil type when cursor address is output coil: Q ⇔ Y ⇔ M ⇔ N ⇔ H ⇔ L ⇔ P ⇔ S ⇔ Q…; Change output coil number when cursor address is output coil number;

HMI

The iSmart smart relay includes a total of 31 HMI instructions that can be used throughout a program. Each HMI instruction can be configured to display information on the iSmart 16×4 character LCD in text, numeric, or bit format for items such as current value and preset value for functions, Input/Output bit status, and text. There are three kinds of text in HMI. They are Multi Language, Chinese (fixed) and Chinese (edit).

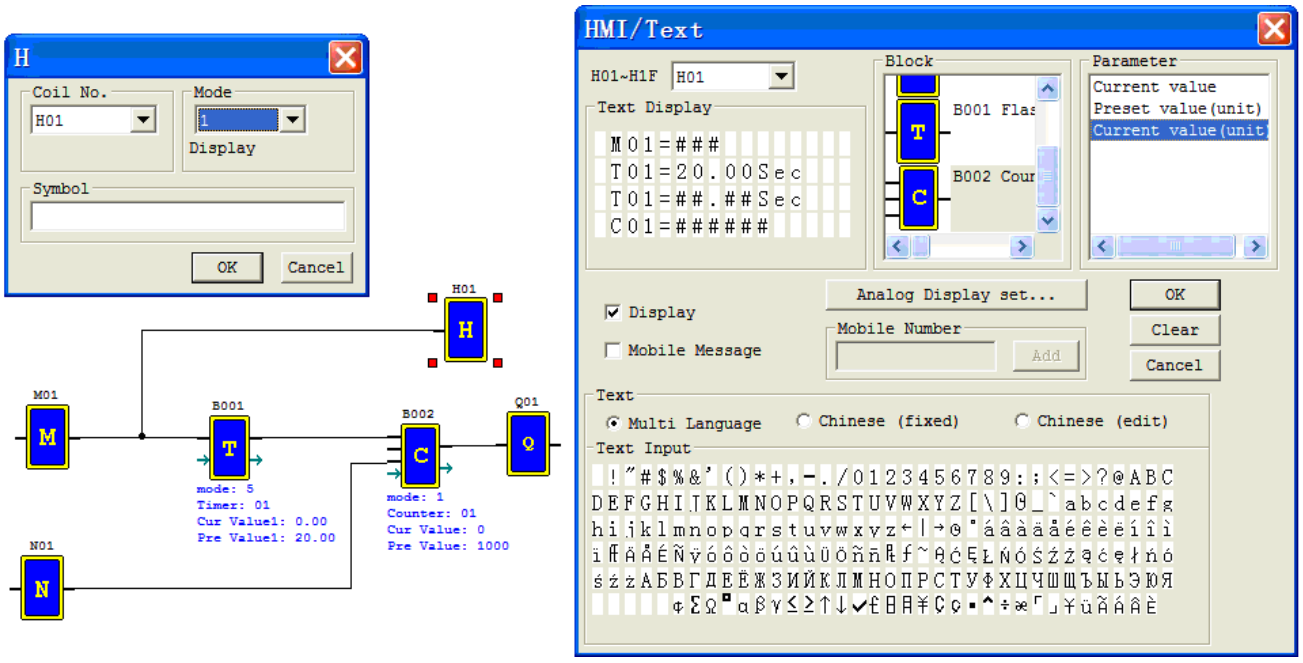
※ Only the coils, function blocks and analog value which used in the program can be set in HMI to display status, preset value and current value.

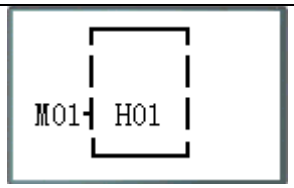
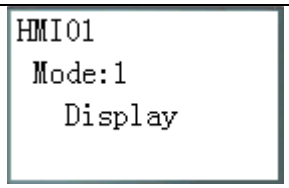
Each HMI instruction has a choice of 2 operation modes.

Mode1, display mode when pressing key "SEL" can display HMI preset.

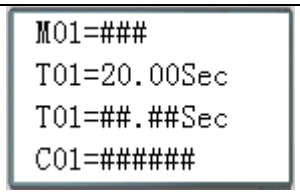
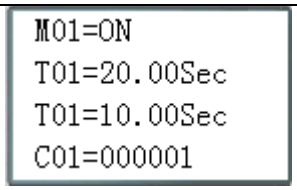
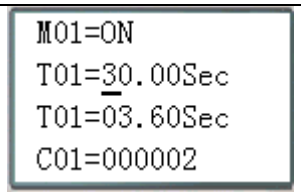
Mode2, no display mode when pressing key "SEL" cannot display HMI preset. Displays preset only be enabled.

Example: H01 controlled by M01, and setting H01 mode1, display M01 status, preset value and current value for block B001 (Timer T01), current value for block B002 (Counter C01).



FBD output coil display M01: enable input coil	Press "OK" button into function display	Press "SEL" , "↑ ↓" and "OK" to edit HMI mode
		

HMI display and keypad function, same as ladder mode HMI function.

Press "SEL" button when stopping	Enabled display when running	Press "SEL" , "↑ ↓" and "OK" to edit preset value, coil status
		

※ More information about HMI/TEXT to see:

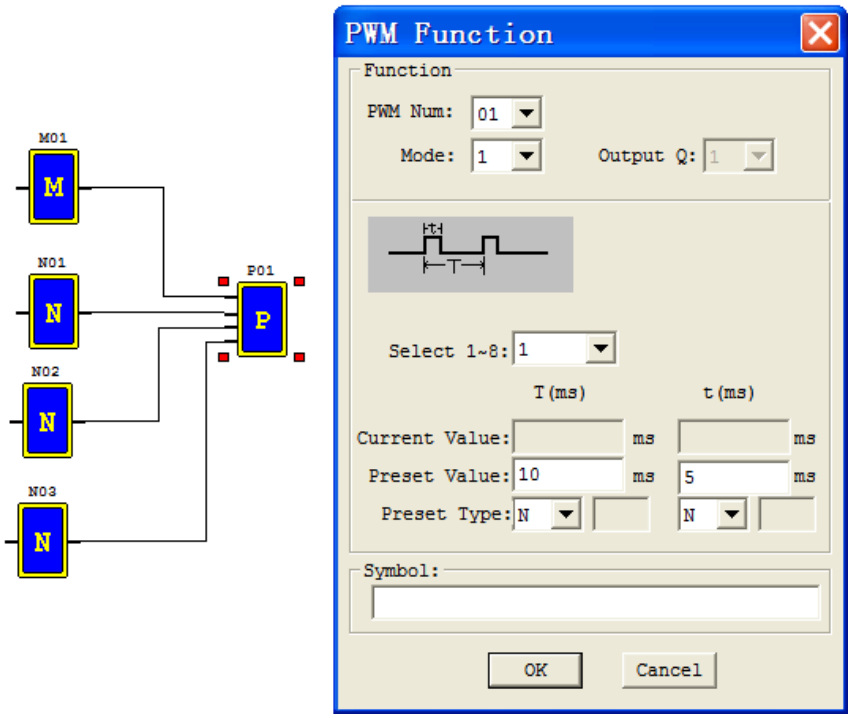
Chapter 3: Program Tools—Ladder Logic Programming Environment —HMI/TEXT.

PWM function block (only transistor output version)

The transistor output model smart relay includes the capability to provide a PWM (Pulse Width Modulation) output on terminal Q01 and Q02. The PWM instruction is able to output up to an 8-stage PWM waveform. It also provides a PLSY (Pulse output) output on terminal Q01, whose pulse number and frequency can be changed. The table below describes number and mode of PWM.

Mode1 PWM

The PWM output terminal Q01 or Q02 can output 8 PWM waveforms. Each PWM has 8 group preset stages which contents Width and Period. The 8 group preset values can be constant or other function current value.



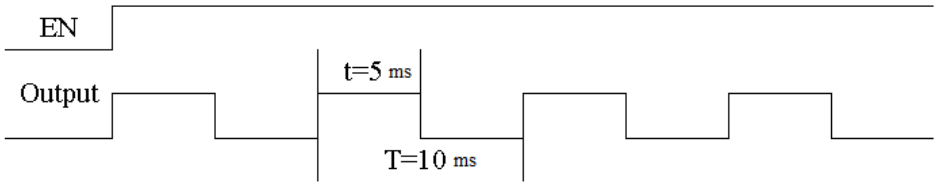
FBD output coil display M01: enable input coil	Press "OK" button into function display	Press "SEL" , "↑ ↓" and "OK" to select stage and edit preset value
M01 N01 N02 P01 N03	PWM01 Mode:1 SET 1 Out:Q01 TP1=00005 TT1=00010	PWM01 Mode:1 SET 2 Out:Q01 TP2=00002 TT2=00011

Display Description
P01: PWM code (PWM01~PWM02)
M01: Enable Input (I01~ B260)
N01: Select1 (I01~ B260)
N02: Select2 (I01~ B260)
N03: Select3 (I01~ B260)
Mode: PWM mode (1)
SET x: present stages as operating (1~8)
Out: Output port (Q01~Q02)
TPx: Width of preset stage (0~32767 ms)
TTx: Period of preset stage (1~32767 ms)

Enable	Select3	Select2	Select1	stage	PWM Output
OFF	X	X	X	0	OFF
ON	OFF	OFF	OFF	1	Preset stage 1
ON	OFF	OFF	ON	2	Preset stage 2
ON	OFF	ON	OFF	3	Preset stage 3
ON	OFF	ON	ON	4	Preset stage 4
ON	ON	OFF	OFF	5	Preset stage 5
ON	ON	OFF	ON	6	Preset stage 6
ON	ON	ON	OFF	7	Preset stage 7
ON	ON	ON	ON	8	Preset stage 8

Example:

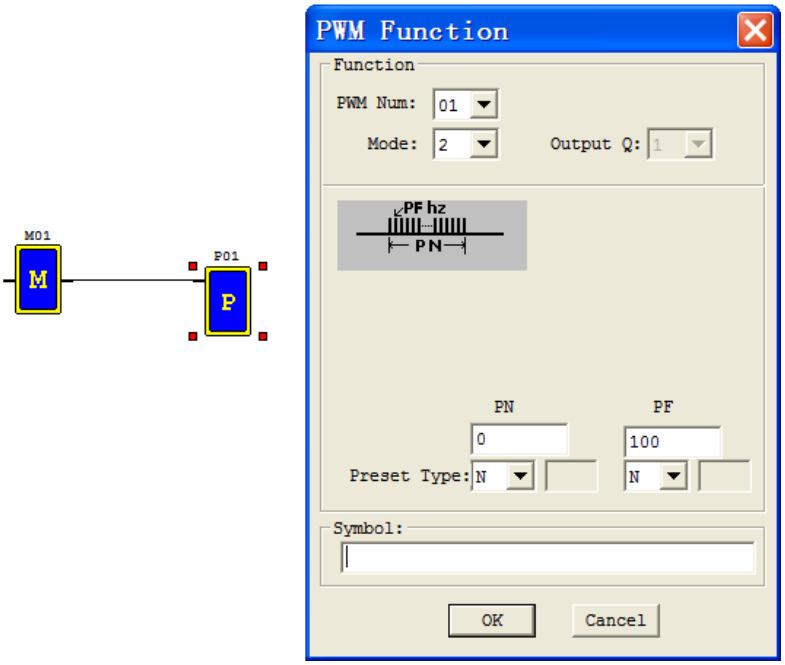
The state of N01, N02 and N03 are 000, so PWM output pulse is stage1 like this as setting above:

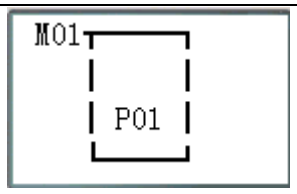
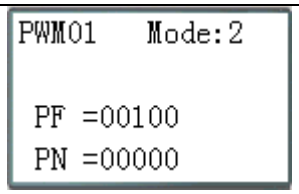
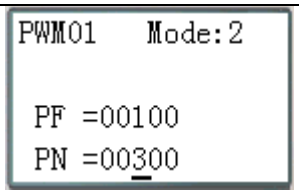


The state of N01, N02 and N03 decide PWM output. PWM stages can be changed by the status of N01, N02 and N03 when P01 is running.

Mode2 PLSY

The PLSY output terminal Q01 can output preset number of pulse whose frequency is variable from 1 to 1000 Hz.



FBD output coil display M01: enable input coil	Press "OK" button into function display	Press "SEL" , "↑ ↓" and "OK" to edit preset value
		

※ PF: Preset frequency of PLSY (1~1000Hz); PN: Preset pulse number of PLSY (0~32767);

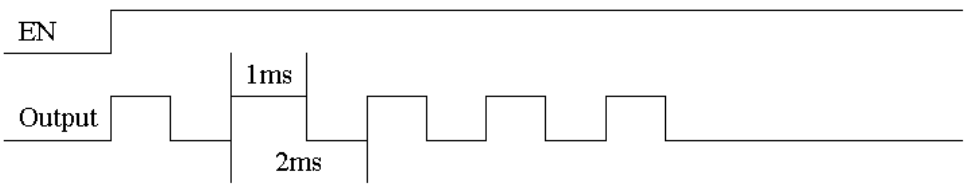
※ Total number of pulses storing in DRC9;

※ PLSY stops outputting pulse after it has output PN pulses.

※ PLSY will be going on as long as it is enabled if PN is 0.

Example:

Parameter setting: PF= 500Hz, PN = 5, output as shown below:



PLSY stops outputting when the number of output pulse is completed.

Mode 3 PWM Output Simultaneously Mode

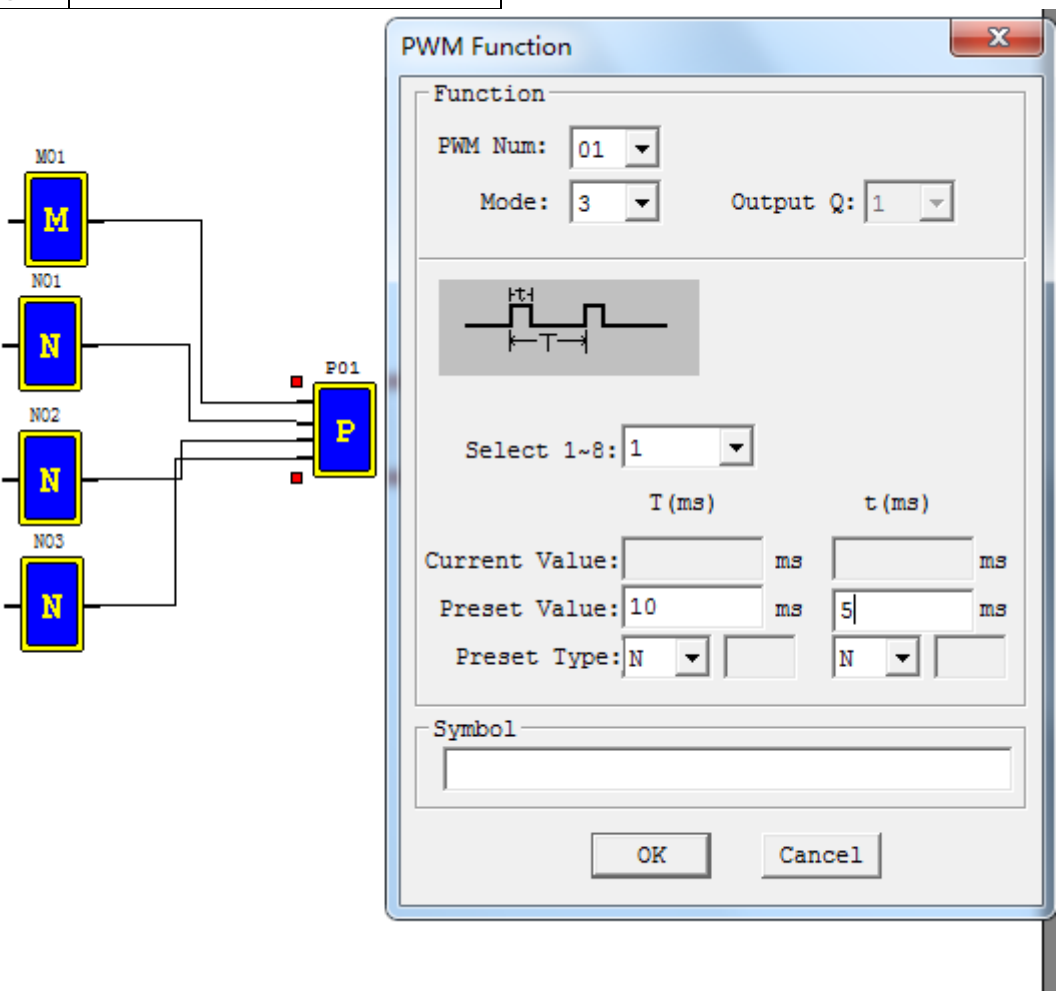
Same as normal PWM mode, but the pulse will be sent via Q1, Q2, P01 and P02 channel, PWM mode 3 built-in 8 sets preset value of bandwidth and period.

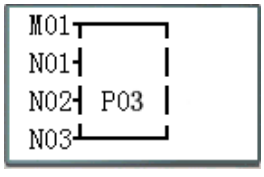
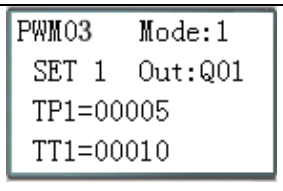
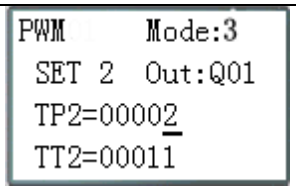
When PWM mode operation, PWM coil status will be changed and output curve.

There are 10 parameters in PWM mode, please see attached table :

Symbol	Instruction
①	PWM Mode 3
②	Current Value Output (1~8)
③	Input SelectionS1（I01~g1F）
④	Input SelectionS2（I01~g1F）
⑤	Input SelectionS3（I01~g1F）
⑥	Display Current Value Output (1~8)
⑦	Bandwidth (0~32767 ms)
⑧	Period (1~32767 ms)
⑨	Output Port (Q01Q02)
⑩	PWM Encoder (P01)

Enable	S3	St2	S1	Set	Output
OFF	X	X	X	0	OFF
ON	OFF	OFF	OFF	1	Set 1
ON	OFF	OFF	ON	2	Set 2
ON	OFF	ON	OFF	3	Set 3
ON	OFF	ON	ON	4	Set 4
ON	ON	OFF	OFF	5	Set 5
ON	ON	OFF	ON	6	Set 6
ON	ON	ON	OFF	7	Set 7
ON	ON	ON	ON	8	Set 8



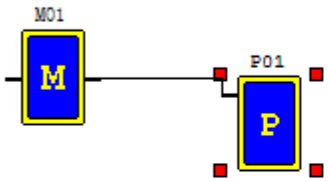
Coil output display in FBD mode	Click "OK" to enter function display	Click "SEL" to select "SET" and revise preset value.
		

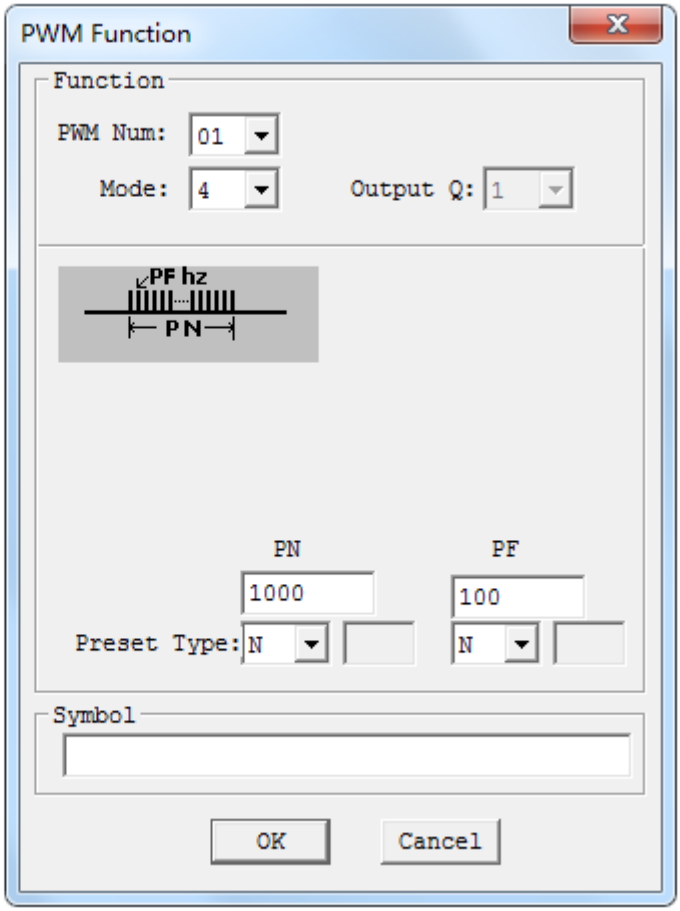
Mode 4 PLSY Simultaneously Output Mode

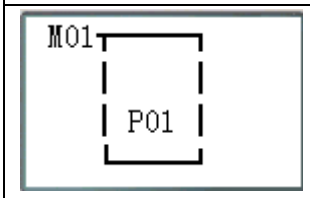
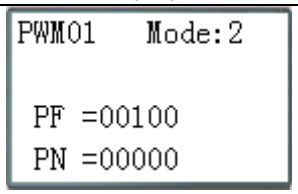
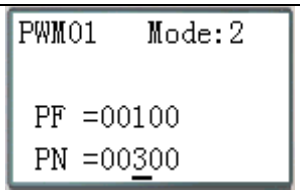
PLSY function, output port Q01 and Q02, there are 6 parameters in PLSY mode.

Symbol	Instruction
①	PLSY Mode 4
②	Number of PLSY output pulse (saved in DRC9 register)
③	PF： PLSY output frequency (1~1000Hz)
④	PN： Setting value for number of PLSY output pulse (0~32767)
⑤	Output Port (Q01)
⑥	PWM Encoder (P01)

For example：





Coil output display in FBD mode	Click “OK” to enter function display	Click “SEL” to select preset value.
		

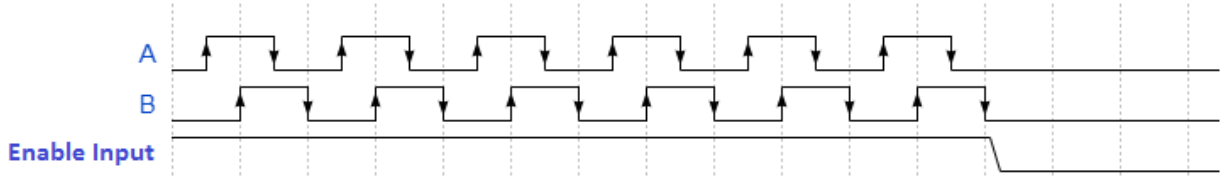
The preset of PLSY output frequency and number of outputs could be a constant, and other encoder code either. PLSY will stop output once the number of output pulse reaches setting value. If PLSY enabled again, the setting value of output pulse will be increased from current pulse output number.

※If the setting value of pulse output is 0, PLSY will keep sending output pulse until PLSY disabled.

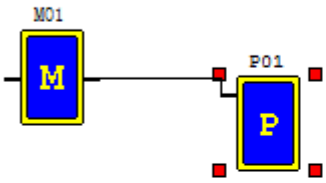
PWM Mode 5(AB Phase PLSY Mode)

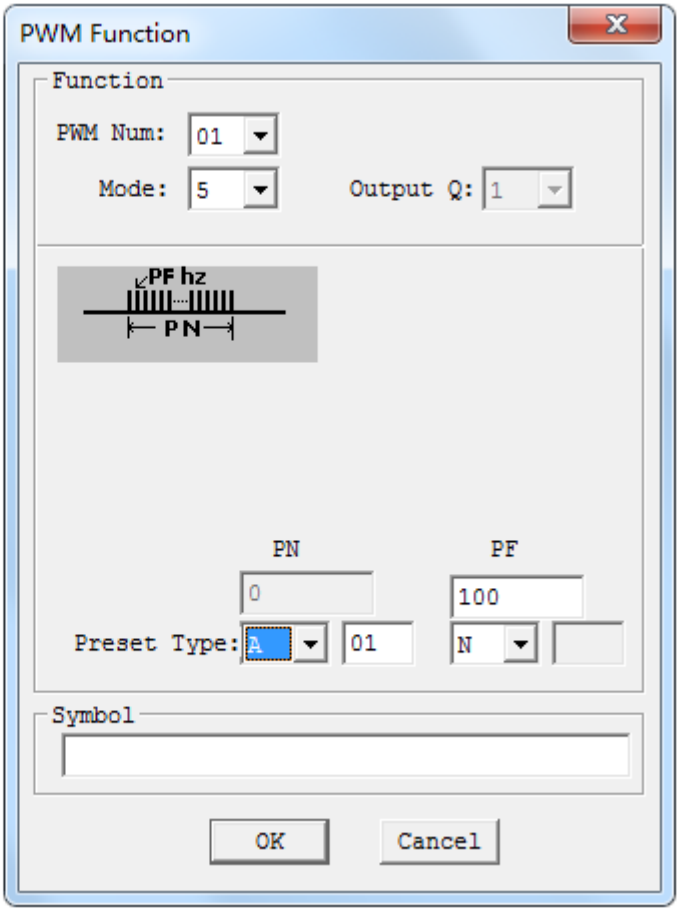
AB phase PLSY function is similar normal PLSY function, but A/B phase PLSY mode is used Q1 and Q2 port at same time, it will send the pulse which Q1(phase A) leads Q2 (phase B).

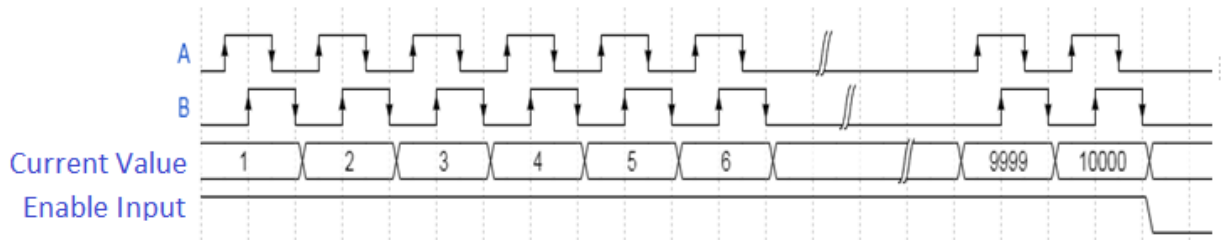
PWM mode 5 built-in 6 parameters, please see the photo below.

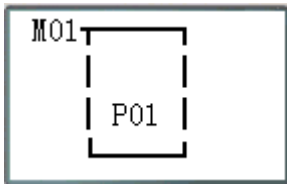
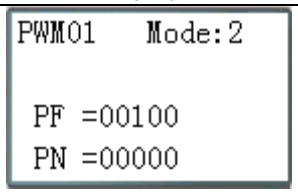
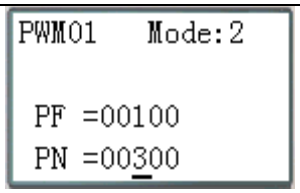


Symbol	Instruction
①	PLSY Mode 5
②	Number of PLSY output pulse
③	PF : PLSY output frequency (1~1000Hz)
④	PN : Setting value of PLSY output pulse (0~32767)
⑤	Output port : (Q01Q02)
⑥	PWM encoder (P01P02)







Coil output display in FBD mode	Click "OK" to enter function display	Click "SEL" to select preset value.
		

The preset of A/B phase PLSY output frequency and number of outputs could be a constant, and other encoder code either. PLSY will stop output once the number of output pulse reaches setting value. If PLSY enabled again, the setting value of output pulse will be increased from current pulse output number.

※Pulse frequency can be changed during PLSY operation, the default number of output pulse is 100.

※When mode 5 is operation, if output frequency is higher than 1000, mode 5 will use 1000 to be pulse output frequency setting value.

※Mode 5 will stop output once the pulse output reaches preset value.

※If the setting value of pulse output is 0, PWM mode 5 will keep sending output pulse until PLSY disabled.

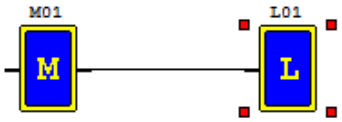
IO Link function block

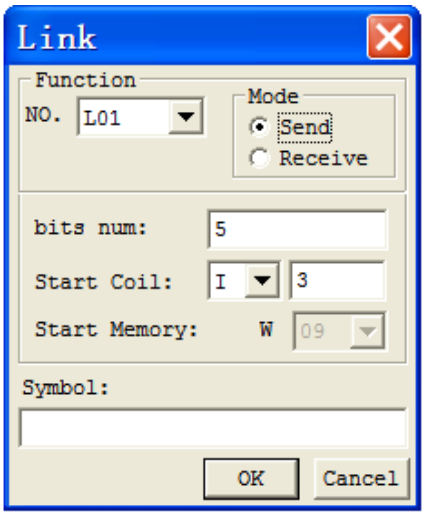
Up to 8 additional iSmart units can be configured as independent Slave nodes, each running their own logic program and their I/O linked to one Master smart relay. The Master iSmart smart relay's ID must be 00, and Slave nodes' ID should start with 01 and be continuous. If nodes' ID is not continuous, the Master will not communicate with those nodes which are behind the first broken. For example, the nodes' ID is 01, 02, 04 and 05. The Master thinks there are only two Slave nodes whose ID is 01 and 02, and communication with them.

Each controller can use 8 IO Link (L01~L08). Only one IO Link instruction can work at Mode 1(Send mode), and the other IO Link instructions must be Mode 2 (Receive mode).

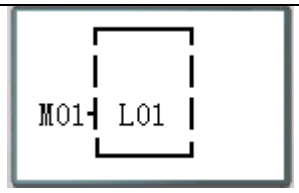
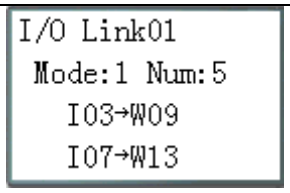
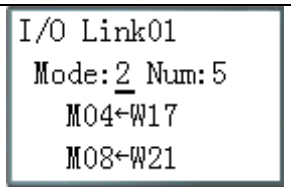
The Mode 1: Send memory range is determined by the Controller ID. The adjacent table show the memory range of Wxx locations associated with each controller ID.

The Mode 2: read the selected Wxx status and write to the selected coil. If the select coil type is input coil I or X, coil status cannot be changed by Wxx status.





ID	Memory list location
0	W01~W08
1	W09~W16
2	W17~W24
3	W25~W32
4	W33~W40
5	W41~W48
6	W49~W56
7	W57~W64

FBD output coil display M01: enable input coil	Press "OK" button into function display	Press "SEL" , "↑ ↓" and "OK" to modify mode, coil number, coil type and W address
		

Display Description
L01: I/O link output terminal (L01~L08)
M01: Enable Input (I01~ B260)
Mode: Setting mode(1,2) 1:sending; 2:receiving
Num: Number of send/receive points (1~8)
I03…I07: Type of send/receive points
W09…W13: Send/Receive W Table list location

Type of points	Range
Inputs	I01~I0C/i01~i0C
Outputs	Q01~Q08/q01~q08
Auxiliary coil	M01~M3F/m01~m3F
Auxiliary coil	N01~N3F/n01~n3F
Expansion inputs	X01~X0C/x01~x0C
Expansion outputs	Y01~Y0C/y01~y0C

Example 1: IO Link Mode 1

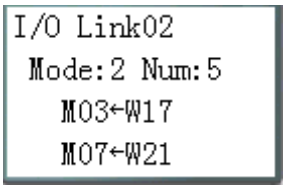
Set mode=1, num=5, set type of points as I03, the state of actual sending terminal I03~I07 is sent to memory list; the controller ID=1, the state of corresponding memory list position W09~W13, and relationship of sending terminal is as below:

mode=1, num=5, type=I03~I07, ID=1 (W09~W13)								
Memory List Position	W09	W10	W11	W12	W13	W14	W15	W16
Corresponding receiving Or sending terminal	↑ I03	↑ I04	↑ I05	↑ I06	↑ I07	↑ 0	↑ 0	↑ 0

Example 2: IO Link Mode 2

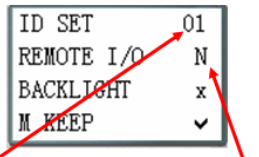
Set mode=2, num=5, set type of points as start from M03, set W table as from W17, when enabling the IO Link, the state "ON/OFF" of M03~M07 is controlled by the state of memory list position W17~W21.

Mode=1, num=5, type=M03~M07, W=W17~W21					
Memory List Position	W17	W18	W19	W20	W21
Corresponding receiving Or sending terminal	↓ M03	↓ M04	↓ M05	↓ M06	↓ M07



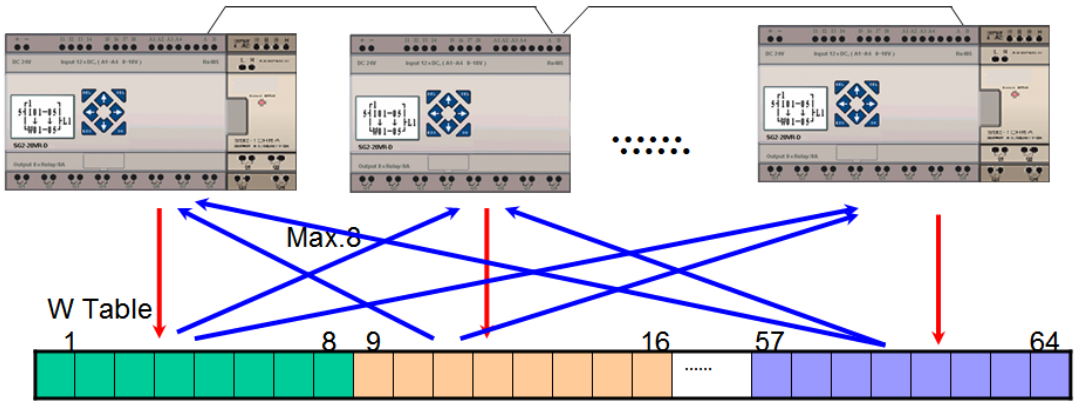
IO Link diagram as blow:

- max. 8 points I/O send per stations
- Max 7*8 (=56) points I/O received per station



ID must set to be 0,1,2,…(max to 7)

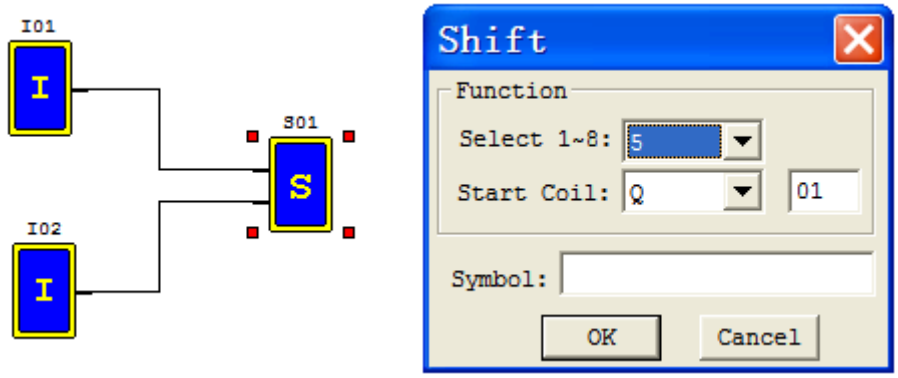
Remote I/O disable

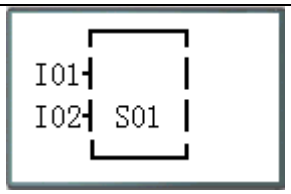
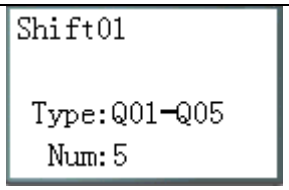
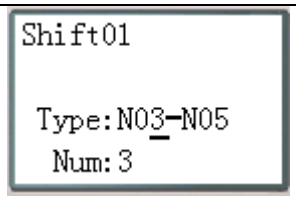


※ More information about IO Link to see "Chapter 7 20 Points RS485 type Models Instruction".

SHIFT function block

The iSmart smart relay includes only one SHIFT instruction that can be used throughout a program. This function output a serial of pulse on selection points depending on SHIFT input pulse.

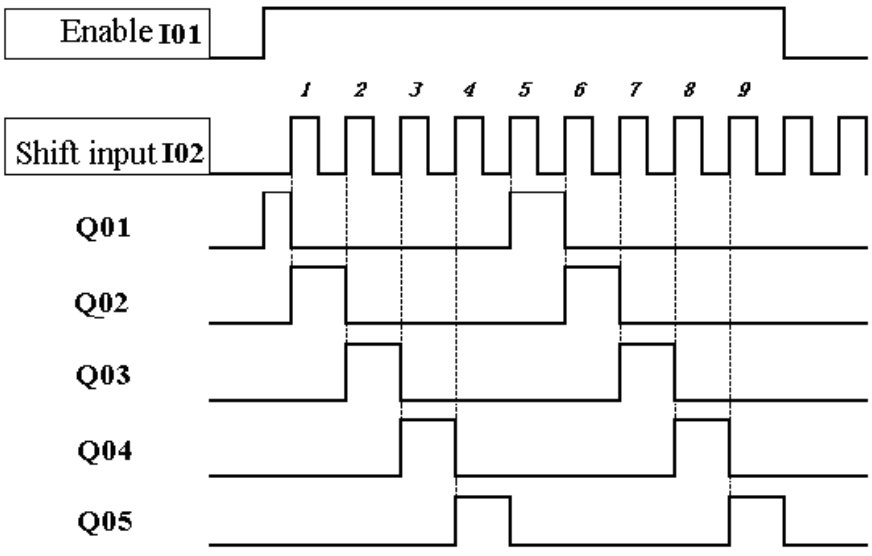


FBD output coil display I01: enable input coil	Press "OK" button into function display	Press "SEL" , "↑ ↓" and "OK" to modify coil number and coil type
		

Display Description
S01: Shift code (S01)
I01: Enable Input (I01~ B260) I02: Shift input (I01~ B260)
Type: Shift output coils
Num: Preset number of output pulse (1~8)

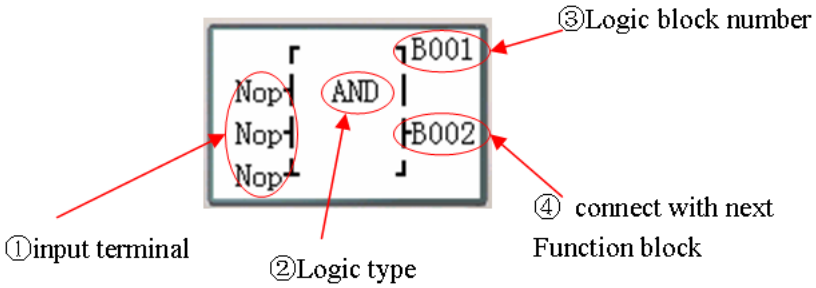
Shift output coils	Range
Outputs	Q01~Q08
Expansion outputs	Y01~Y0C
Auxiliary coil	M01~M3F
Auxiliary coil	N01~N3F

Timing diagram



Logic Block Instructions

Logic blocks display in FBD:

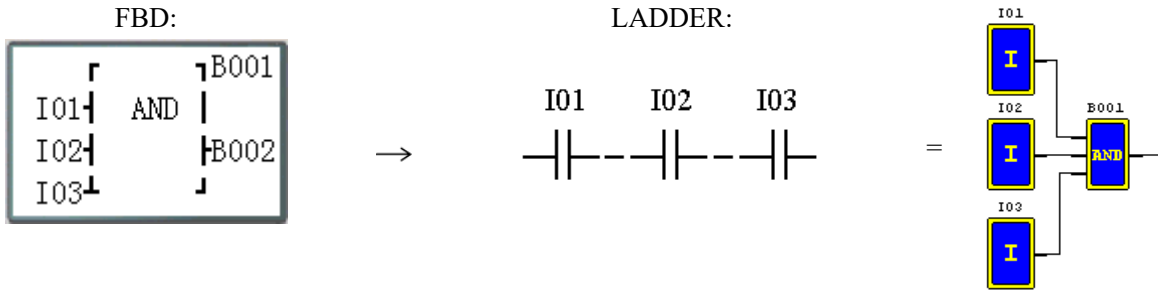


Press the button:

→	Move cursor: input terminals ① → Logic block number ③ → display next connected block or coil
←	Move cursor: Logic block number ③ → input terminals ① → Logic/Function display (input terminal is block)
↑↓	Move cursor up or down (when multiple input terminals)

※ Logic Block include: AND, AND EDGE, NAND, NAND EDGE, OR, NOR, XOR, NOT, RS, PULSE, BOOLEAN.

AND Logic Diagram

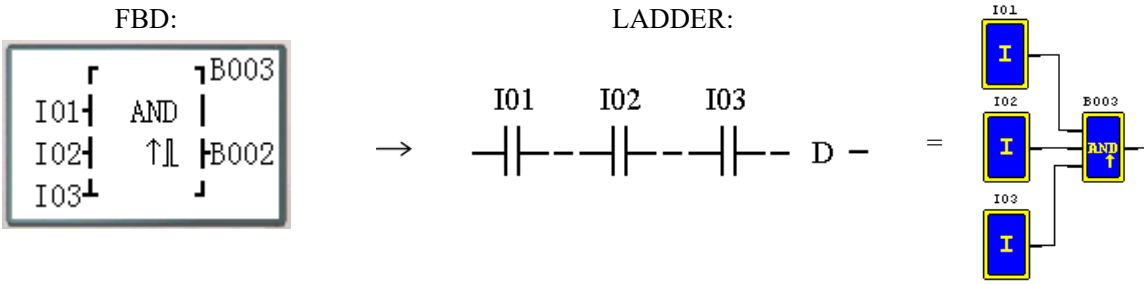


I01 And I02 And I03

Note: The input terminal is NOP which is equivalent to "Hi";

The B output ON when all input terminals status are ON;

AND (EDGE) Logic Diagram



I01 And I02 And I03 And D

Note: The input terminal is NOP which is equivalent to "Hi";

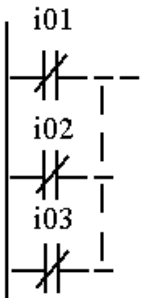
The B output ON a scan cycle time when all input terminals status are ON;

NAND Logic Diagram

FBD:

→

LADDER:



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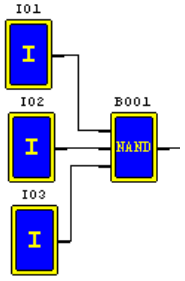


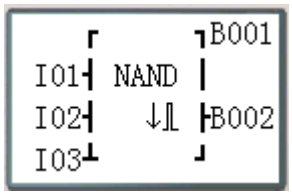
Not(I01 And I02 And I03)

Note: The input terminal is NOP which is equivalent to "Hi";

The B output ON when one of the input terminals status is OFF;

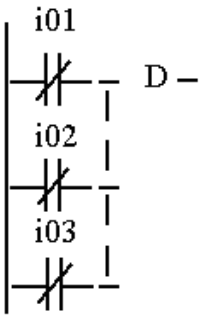
NAND (EDGE) Logic Diagram

FBD:



→

LADDER:



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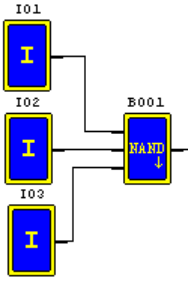


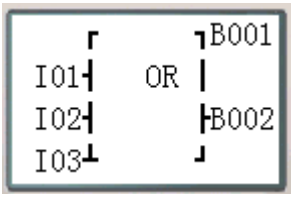
Not(I01 And I02 And I03) And D

Note: The input terminal is NOP which is equivalent to "Hi";

If change one input terminal to OFF when all input terminals are ON, the B output ON a scan cycle time;

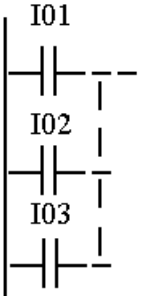
OR Logic Diagram

FBD:



→

LADDER:



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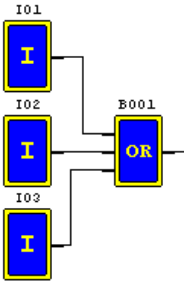


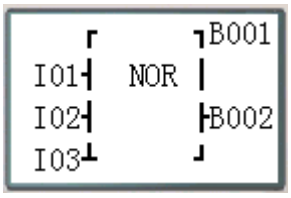
I01 or I02 or I03

Note: The input terminal is NOP which is equivalent to "Lo";

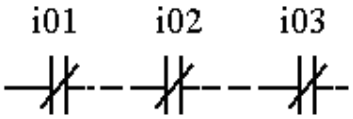
The B output ON when one of the input terminals status is ON;

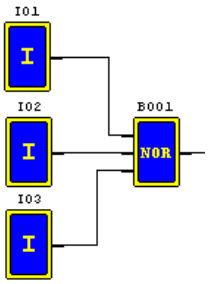
NOR Logic Diagram

FBD:



LADDER:





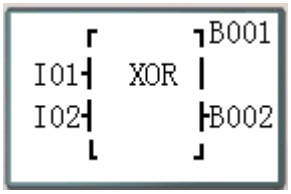
Not (I01 or I02 or I03)

Note: The input terminal is NOP which is equivalent to “Lo”;

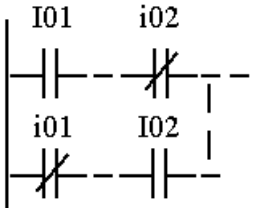
The B output ON when all input terminals status are OFF;

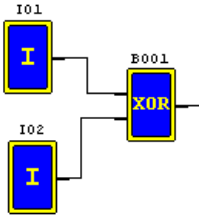
XOR Logic Diagram

FBD:



LADDER:





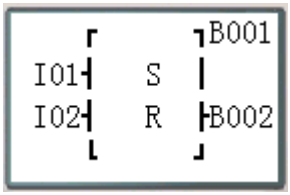
I01 XOR I02

Note: The input terminal is NOP which is equivalent to “Lo”;

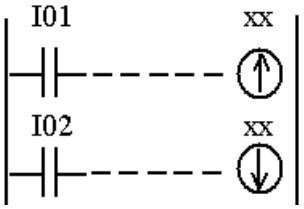
The B output ON when the input terminals status are different;

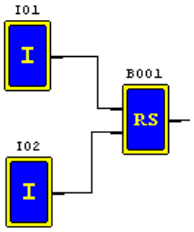
SR Logic Diagram

FBD:



LADDER:





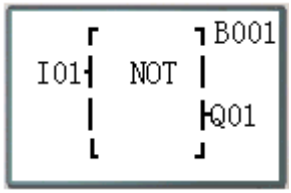
Logic Table

I01	I02	B001
0	0	holding
0	1	0
1	0	1
1	1	0

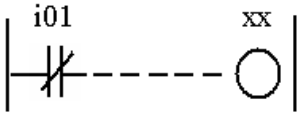
Note: The input terminal is NOP which is equivalent to “Lo”;

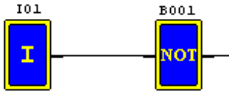
NOT Logic Diagram

FBD:



LADDER:



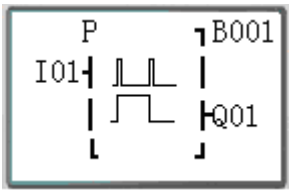


Not I01

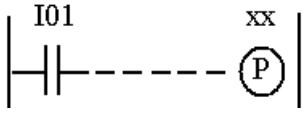
Note: The input terminal is NOP which is equivalent to “Hi”;

Pulse Logic Diagram

FBD:



→ LADDER:



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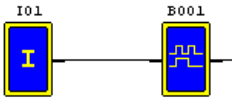
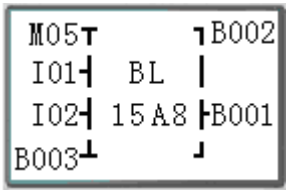


Note: The input terminal is NOP which is equivalent to "Lo";

The B output change status when input terminal OFF→ON;

BOOLEAN Logic Diagram

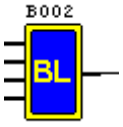
FBD:



→ LADDER:

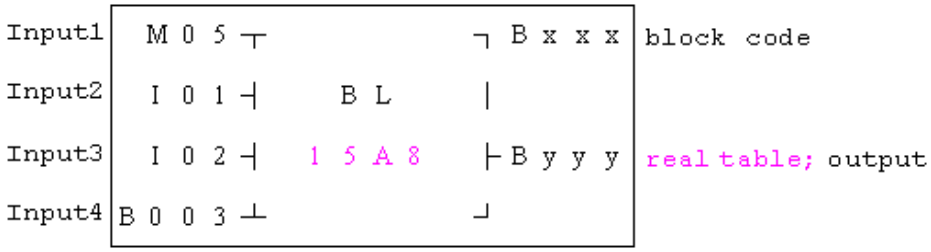
NO

=



Note: The input terminal is NOP which is equivalent to "Lo";

Description:



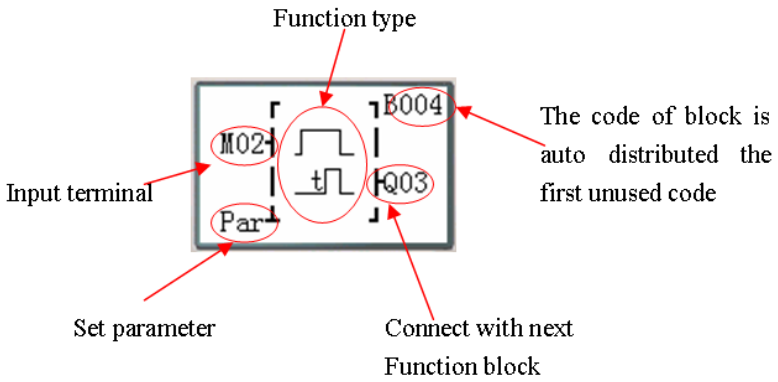
The relationship between input and real table is shown below.

Input1	Input2	Input3	Input4	Output (edit)	Example	Real table
0	0	0	0	0/1	0	8
1	0	0	0	0/1	0	
0	1	0	0	0/1	0	
1	1	0	0	0/1	1	
0	0	1	0	0/1	0	A
1	0	1	0	0/1	1	
0	1	1	0	0/1	0	
1	1	1	0	0/1	1	
0	0	0	1	0/1	1	5
1	0	0	1	0/1	0	
0	1	0	1	0/1	1	
1	1	0	1	0/1	0	
0	0	1	1	0/1	1	1
1	0	1	1	0/1	0	
0	1	1	1	0/1	0	
1	1	1	1	0/1	0	

Function Block

Operation rules of FBD function blocks is basically same as ladder mode.

Function blocks display in FBD:

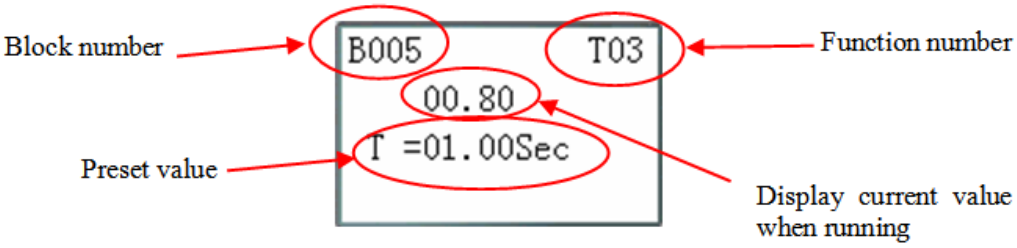


If cursor address is “Par”, user can press “OK” button into parameter display and edit preset value.

Press the button:

→	Move cursor: input terminals or Parameter → Function block number → display next connected block or coil
←	Move cursor: Logic block number → input terminals or parameter → Logic/Function display (input terminal is block)
↑↓	Move cursor up or down (input terminals ⇔ set parameter)
OK	Enter parameter display when cursor address is Set parameter

Parameter display:



Press the button:

← →	Find and display previous or next function block when cursor address is Block number; Move cursor left or right when cursor address is Preset value;
SEL+↑↓	Find and display previous or next function block when cursor address is Block number;
SEL+← →	Display parameter1 or parameter2 when B function is PI, MX or AR;
↑↓	Move cursor up or down (Block number ⇔ Preset value); Modify data or number when in edit mode;
SEL	Enter edit mode when cursor address is Preset value; Modify preset value type when in edit mode;
ESC	Cancel the current edit; Quite parameter display;
OK	Save the current edit;

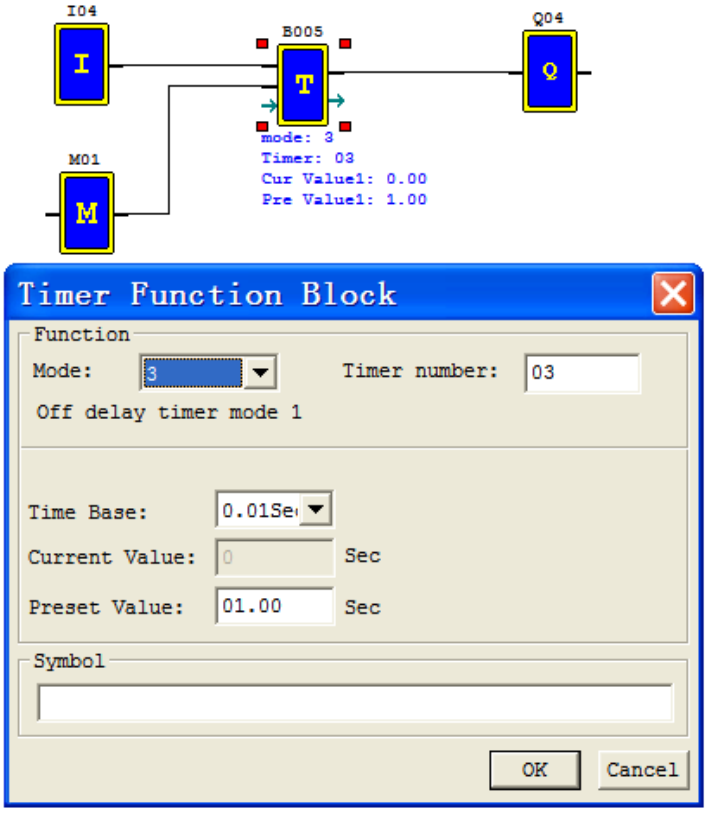
Timer Function Block

There is a maximum of 250 timers function blocks under FBD mode, can be set mode 0~7 and the function is same as Ladder mode.

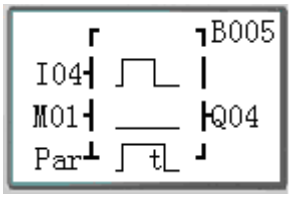
※ Timer Mode7 occupied one blocks and two timers.

※ T0E and T0F keep their current value after a loss of power to the smart relay if "M Keep" is active.

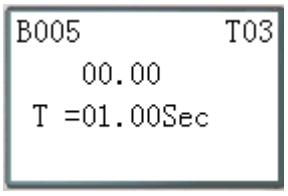
Timer edit and display:



FBD display:



Parameter display:

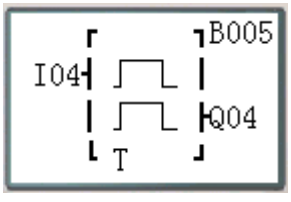


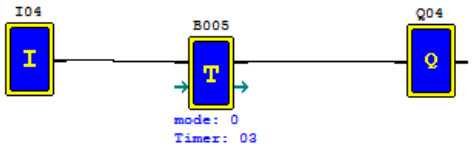
(1) Timer mode 0 (Internal coil Mode)

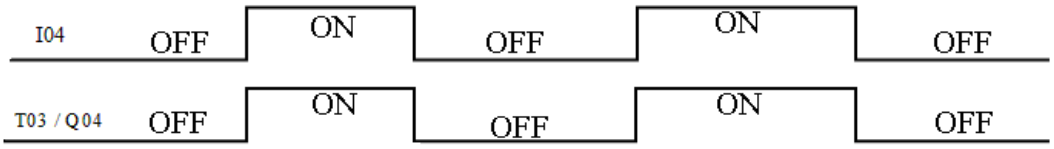
Mode 0 Timer (Internal Coil) used as internal auxiliary coils. No timer preset value and no parameter display.

FBD display

Enable Input →

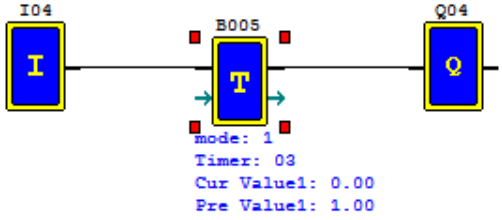


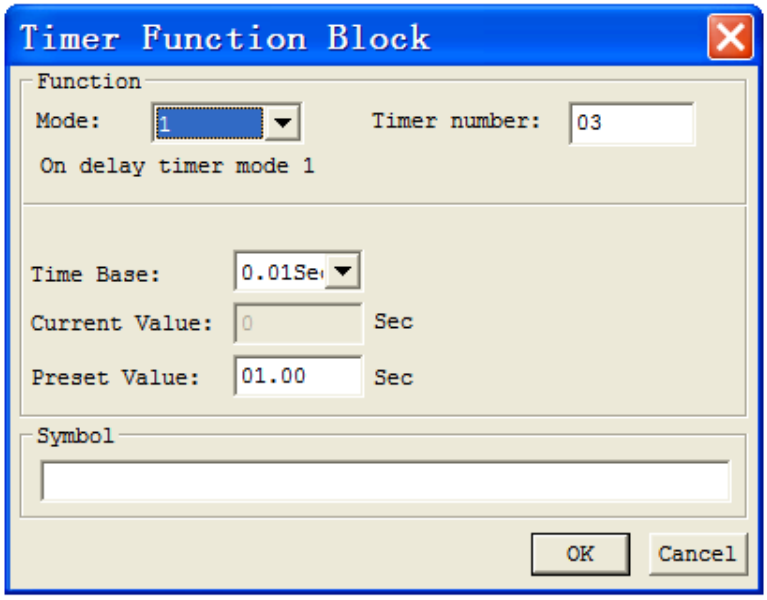


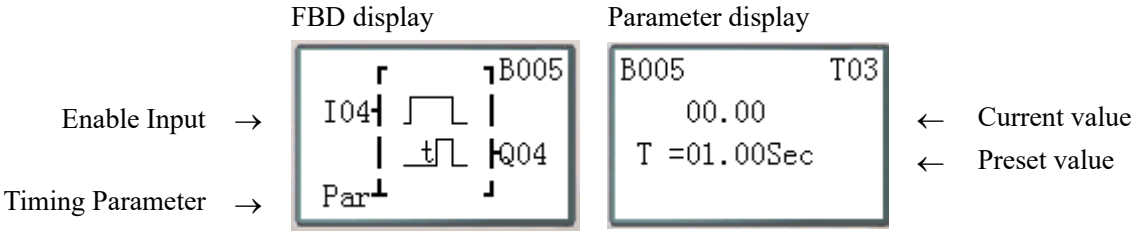


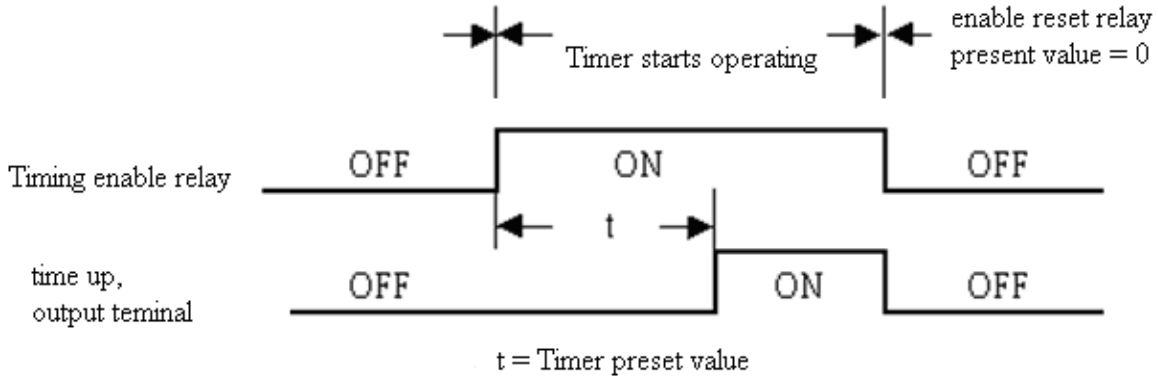
(2) Timer mode 1 (ON-Delay A Mode)

Mode 1 Timer will time up to a fixed value and stop timing when the current time is equal to the preset value. Additionally, the Timer current value will reset to zero when Timer is disabled.



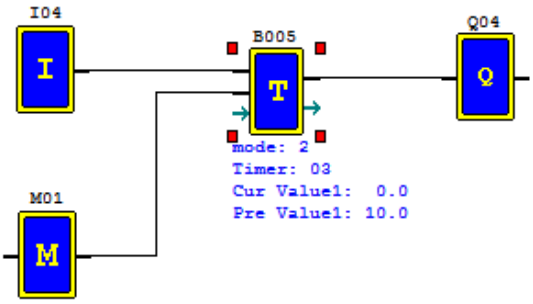


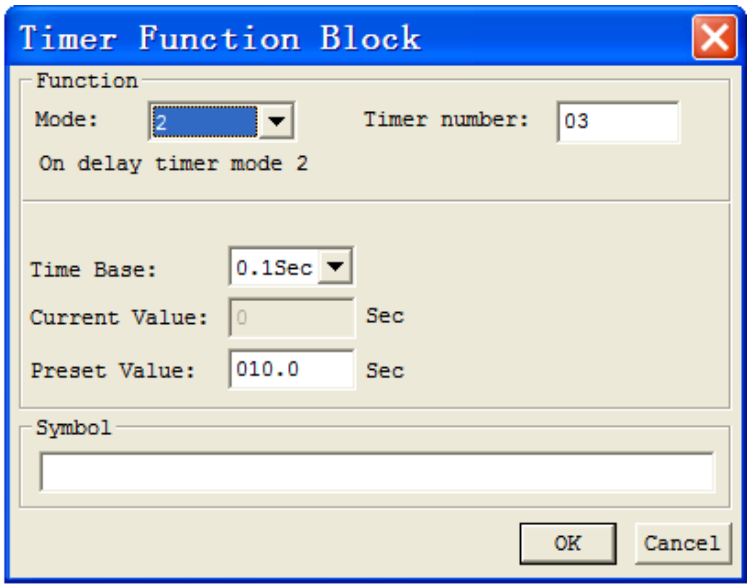


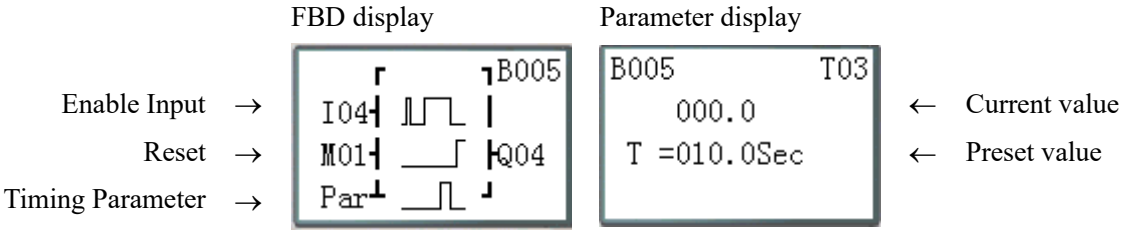


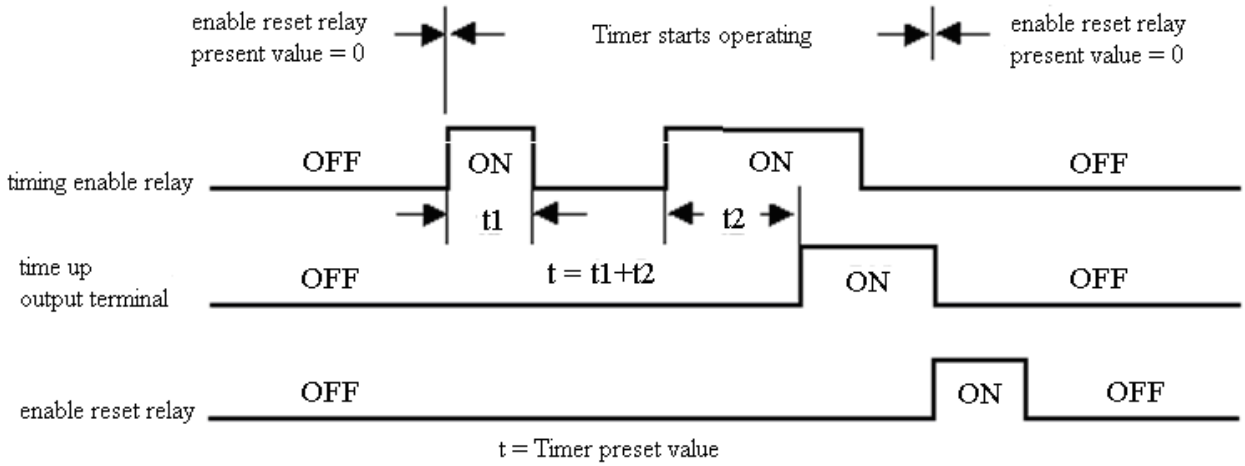
(3) Timer mode 2 (ON-Delay B Mode)

Mode 2 Timer is an ON-Delay with reset that will time up to a fixed preset value and stop timing when the current time is equal to the pre-set value. Additionally, the Timer current value will be kept when Timer is disabled.



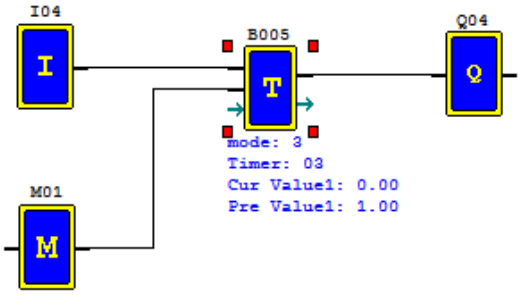


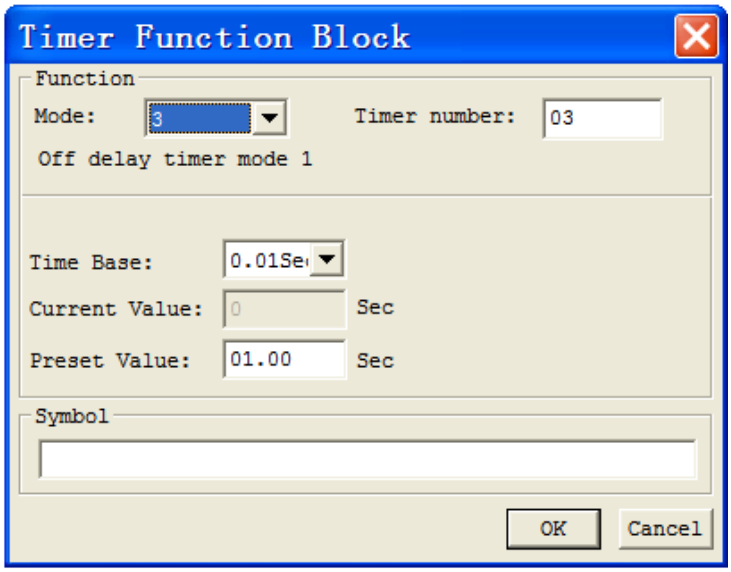


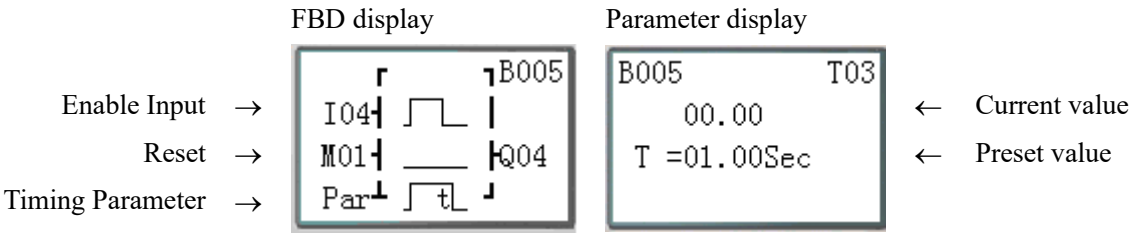


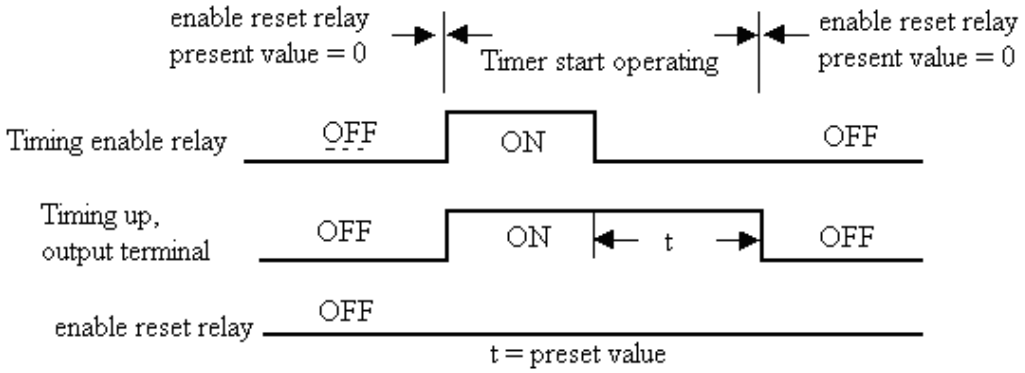
(4) Timer mode 3 (OFF-Delay A Mode)

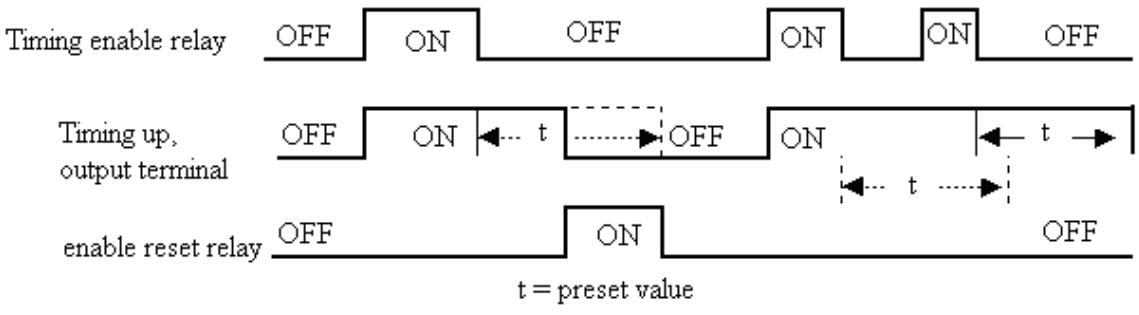
Mode 3 Timer is an OFF-Delay with reset that will time up to a fixed preset value and stop timing when the current time is equal to the pre-set value. Additionally, the Timer current value will reset to zero when Timer is disabled.





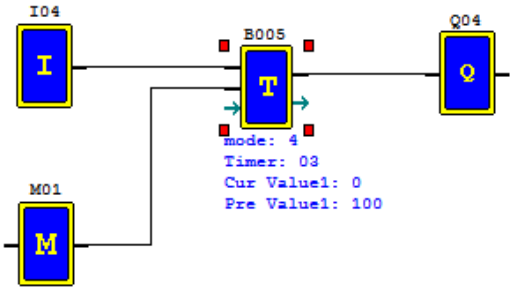


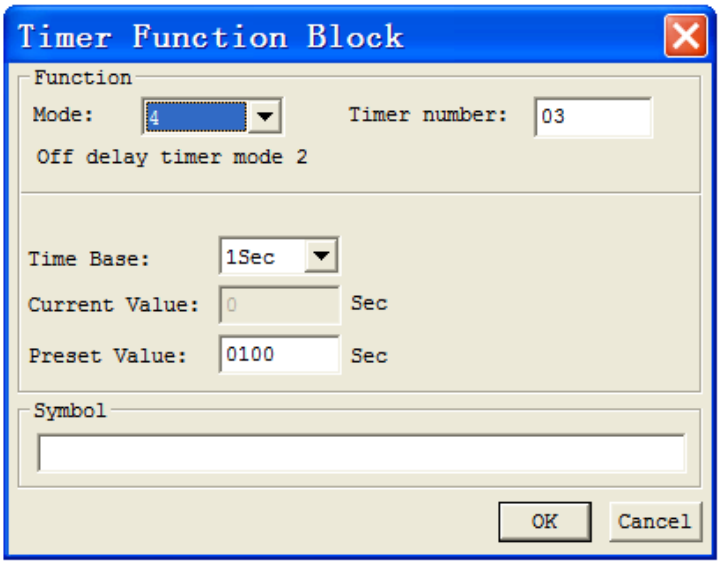


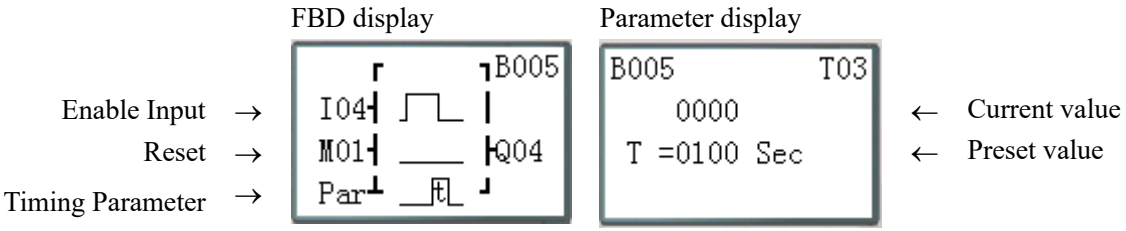


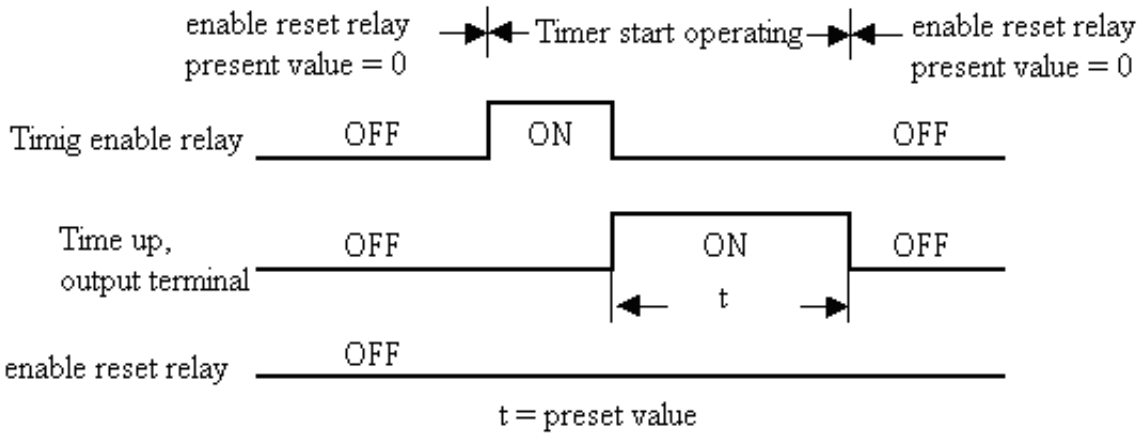
(5) Timer mode 4(OFF-Delay B Mode)

Mode 4 Timer is an OFF-Delay with reset that will time up to a fixed preset value and stop timing when the current time is equal to the pre-set value. Additionally, the Timer current value will reset to zero when Timer is disabled.



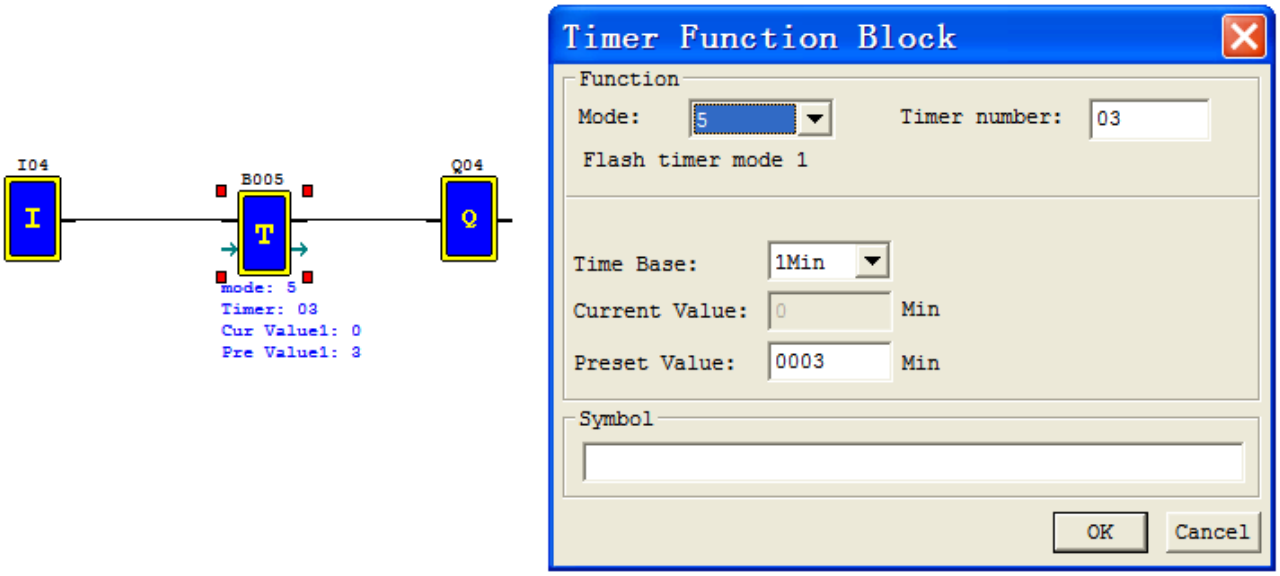


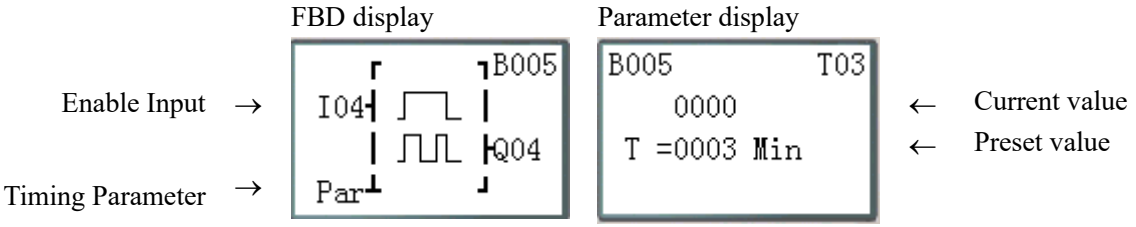


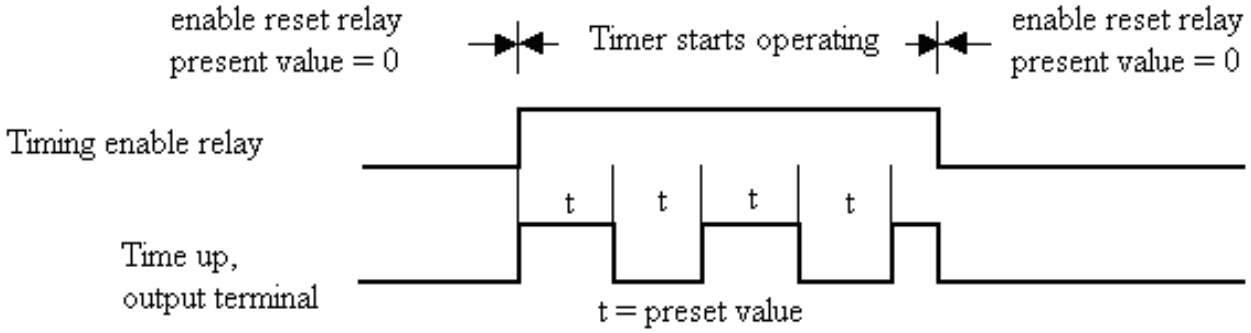


(6) Timer mode 5(FLASH A Mode)

Mode 5 Timer is a Flash timer without reset that will time up to a fixed preset value and then change the state of its status bit. Additionally, the Timer current value will reset to zero when Timer is disabled.

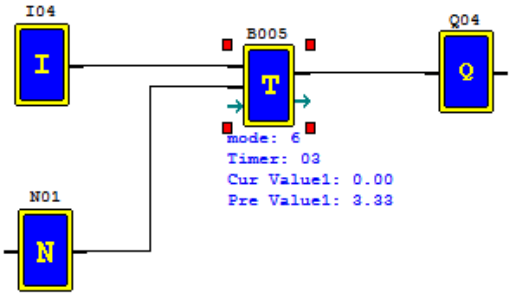


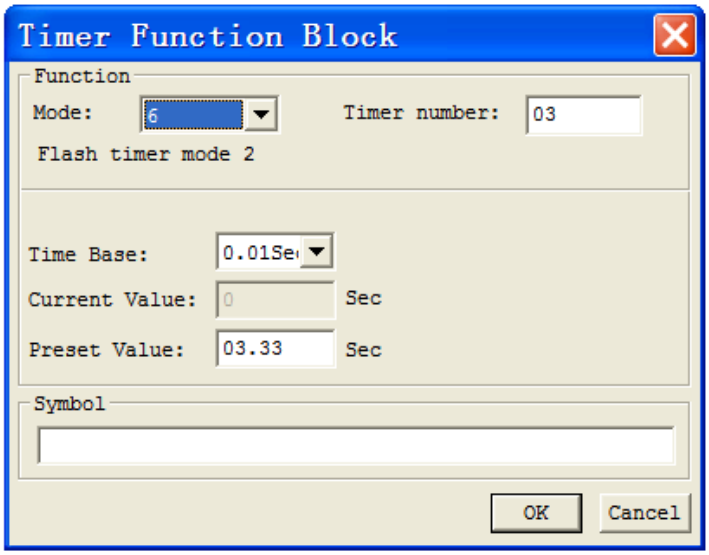


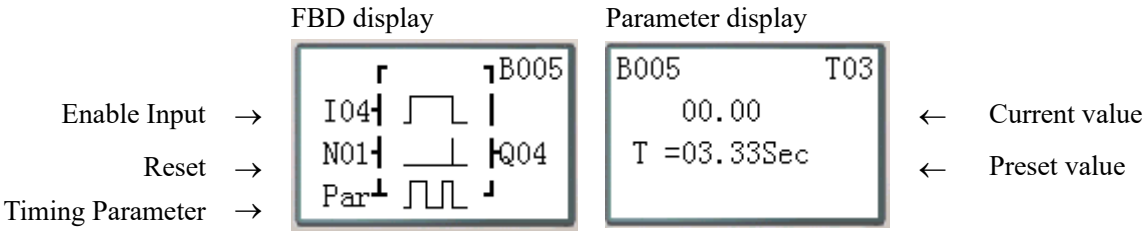


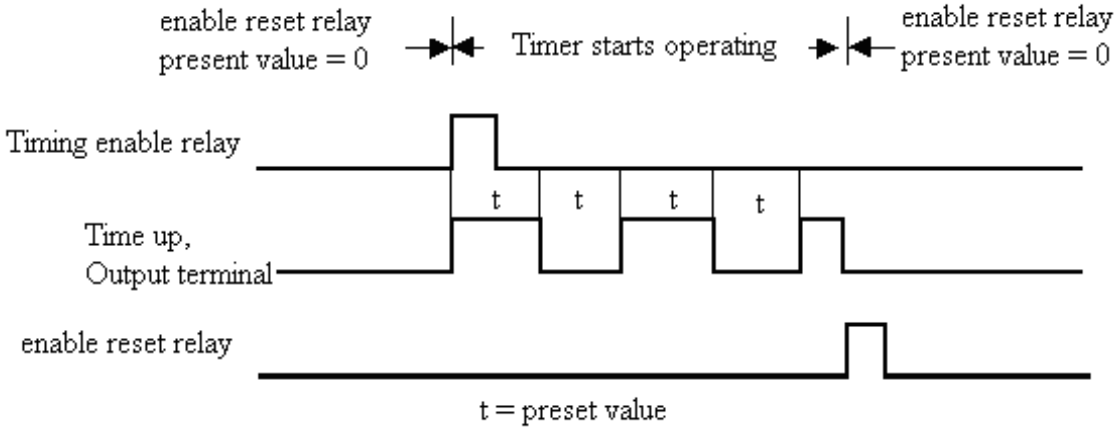
(7) Timer mode 6(FLASH B Mode)

Mode 6 Timer is a Flash timer with reset that will time up to a fixed preset value and then change the state of its status bit. Additionally, the Timer current value will reset to zero when Timer is disabled.



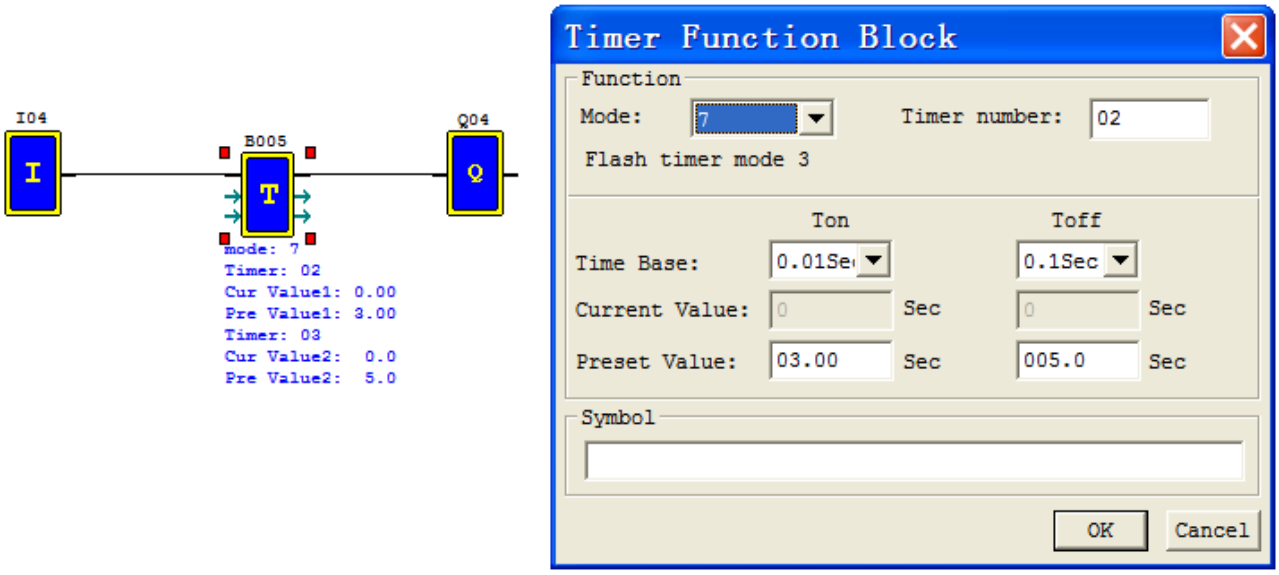


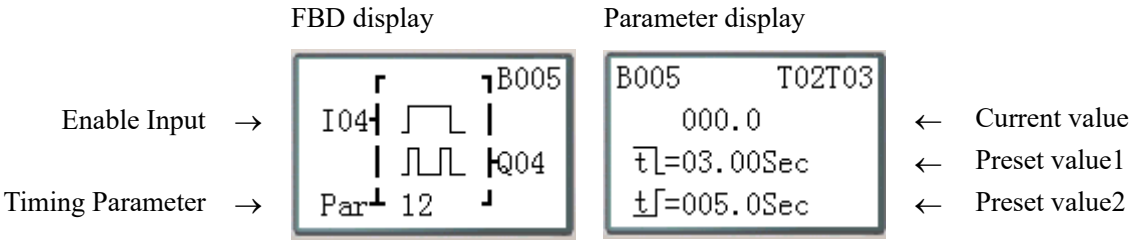


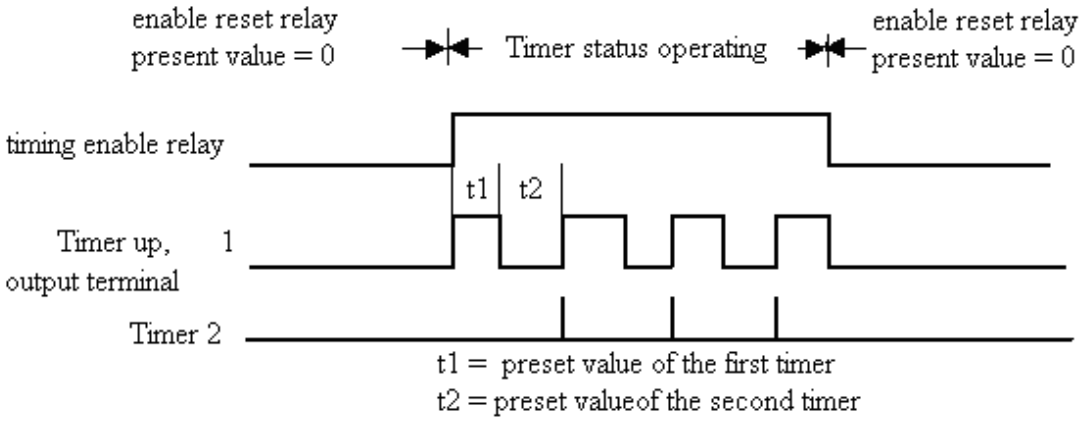


(8) Timer mode 7(FLASH C Mode)

Mode 7 Timer is a Flash Timer which using two Timers in a cascade configuration without reset. The second Timer number follows the first Timer. The cascade configuration connects the timer status bit of first timer to enable the second timer. The second timer will time up to its pre-set value then flash and its timer status bit will enable the first timer. Additionally, the Timer current value will reset to zero when Timer is disabled.



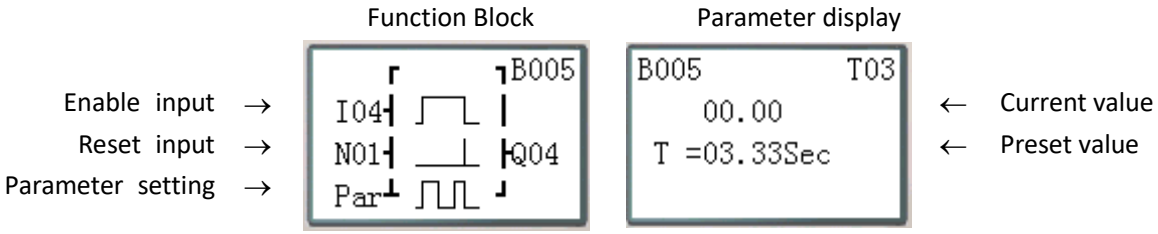


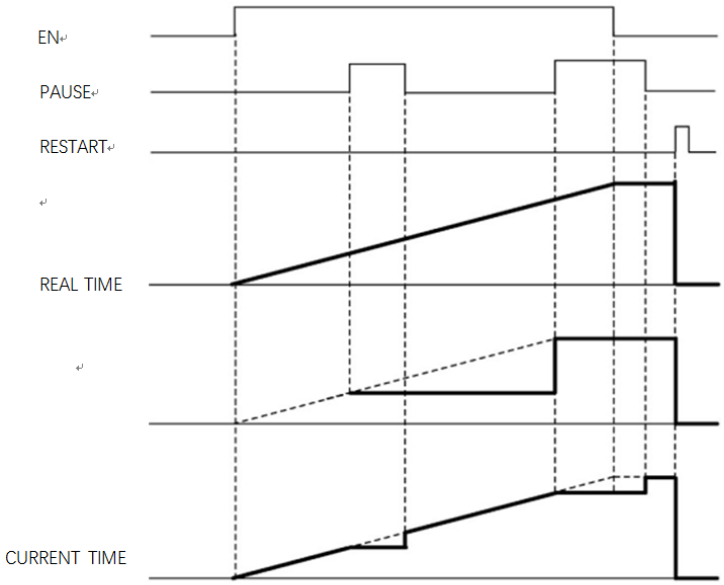


(9) Timer Mode 8

Timer mode 8 is including reset control and suspend control, control condition is from OFF to ON. When timer start to time until preset value, output coil will change the status, timer current value will display preset value and stop timing, when reset control is valid, the current value and output coil of timer will reset to 0.

When suspend control turns ON, current value will not update (keep timing); when suspend control turns OFF, current value will update (current real value); if the suspend control turns ON, but real value reaches preset value, current value will display "9999" and stop counting.

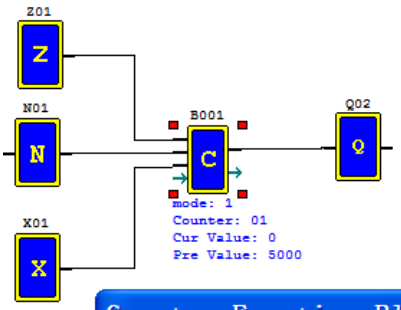


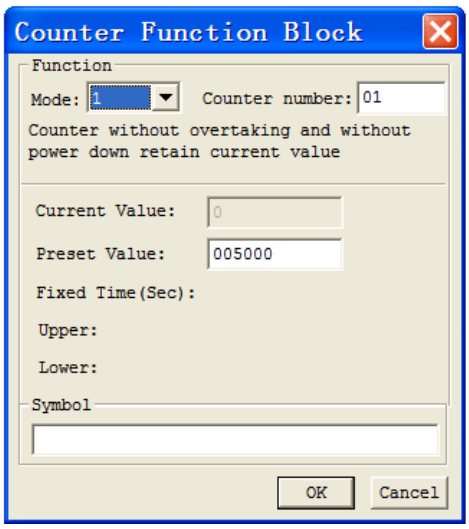


Common Counter function block

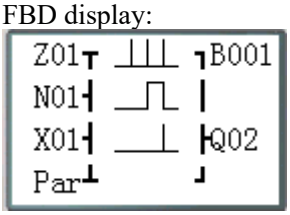
There is a maximum of 250 counter function blocks under FBD mode, can be set mode 0~6 as common counter and mode 7~8 as high-speed counter, and the function is same as Ladder mode.

Counter edit and display:

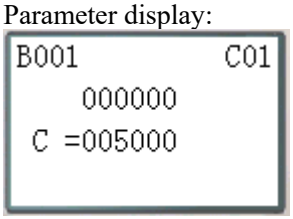




FBD display:



Parameter display:

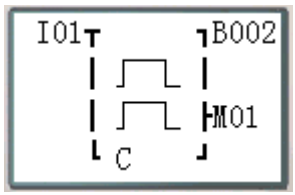


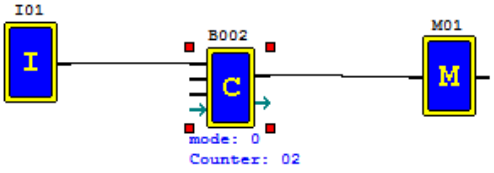
(1) Counter Mode 0 (internal coil)

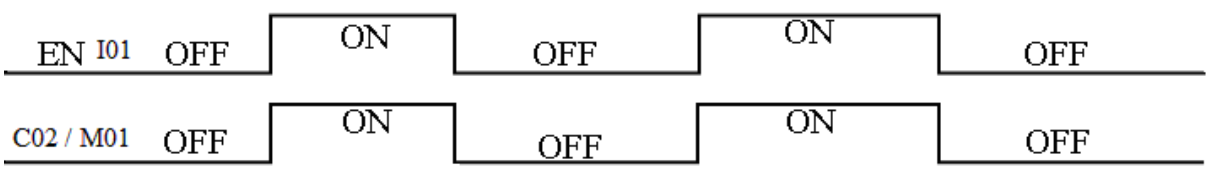
Mode 0 counter (Internal Coil) used as internal auxiliary coils. No timer preset value and no parameter display.

Enable Input →

FBD display

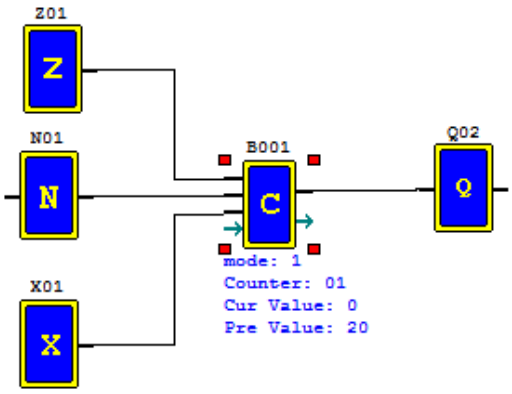


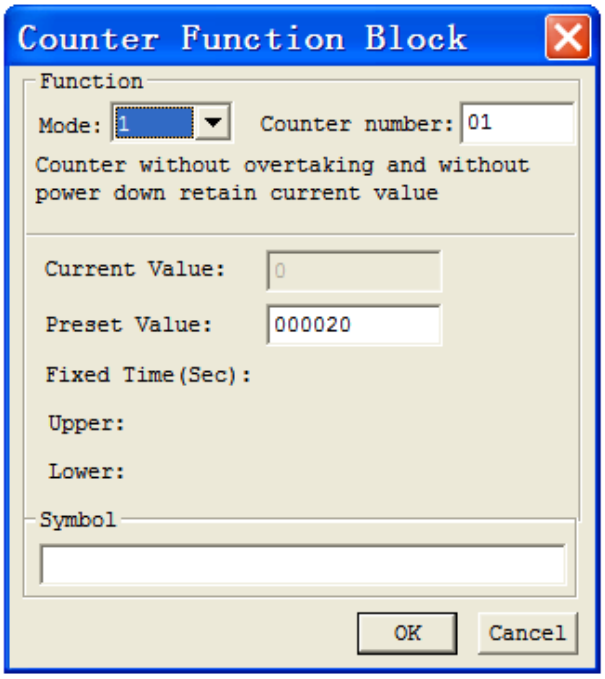


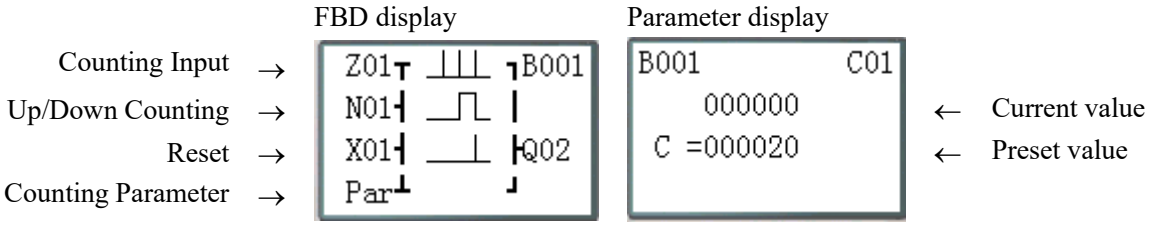


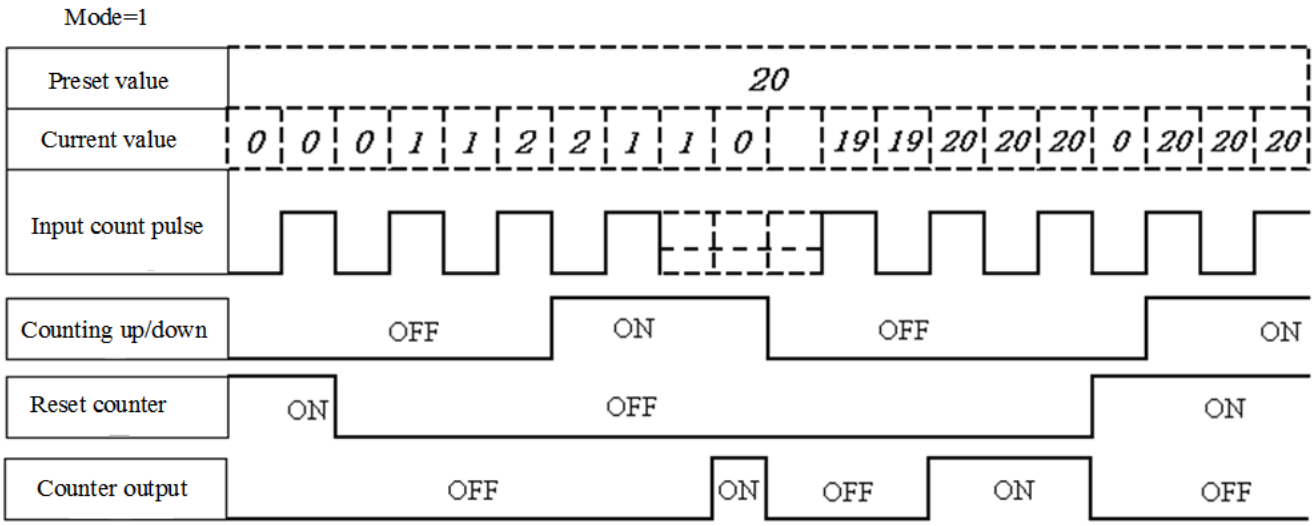
(2) Counter Mode 1 (Fixed Count, Non-Retentive)

Mode 1 Counter will count up to a fixed preset value and stop counting when the current count is equal to the preset value, or count down to 0 and stop counting when the current count is equal to 0. Additionally, the current count value is non-retentive and will reset to init value on a powering up to the smart relay.





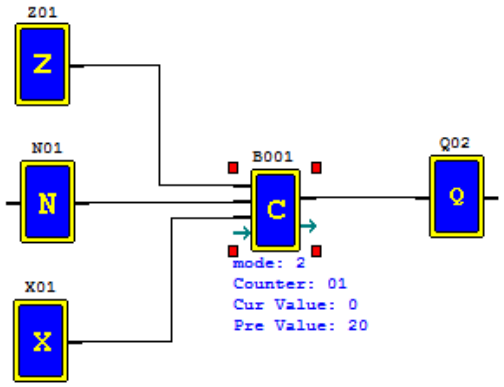


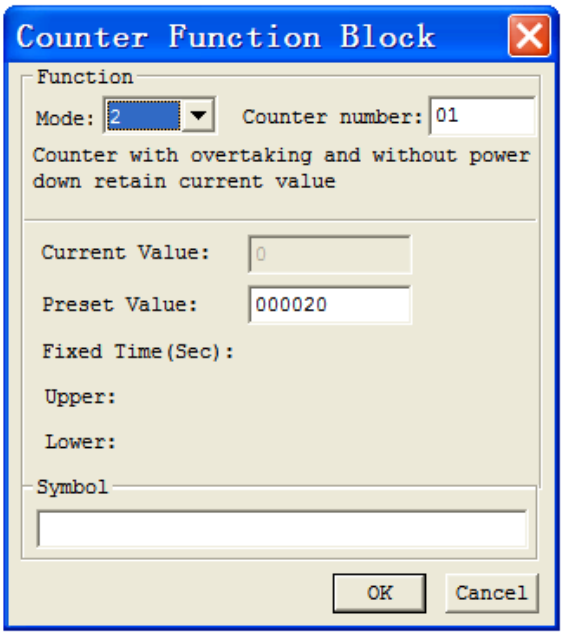


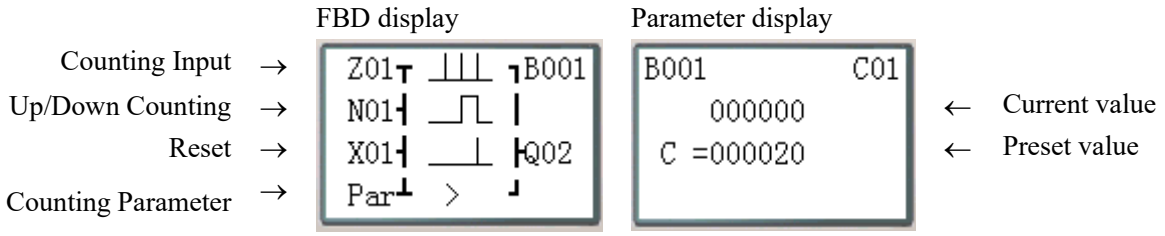
※ Under this mode, the counter current value will be initial value when the smart is power up or switching between RUN and STOP. The init value is 0 if the counter configured as counting up, else, it is preset value.

(3) Counter Mode 2 (Continuous Count, Non-Retentive)

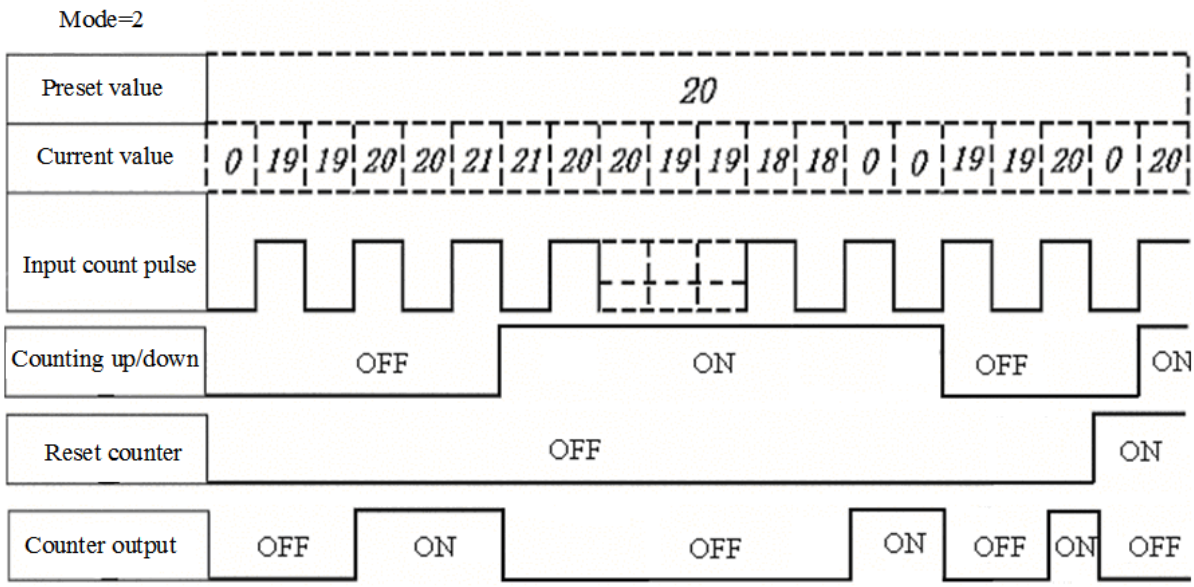
Mode 2 Counter will count up to a fixed preset value and continue counting after the preset value, but it will not count when the current value equals 0 if it is configured as down Counter. Additionally, the current count value is non-retentive and will reset to init value on a powering up to the smart relay or switching between RUN and STOP.







Note: The ">"means the current value appeared will be greater than present value.

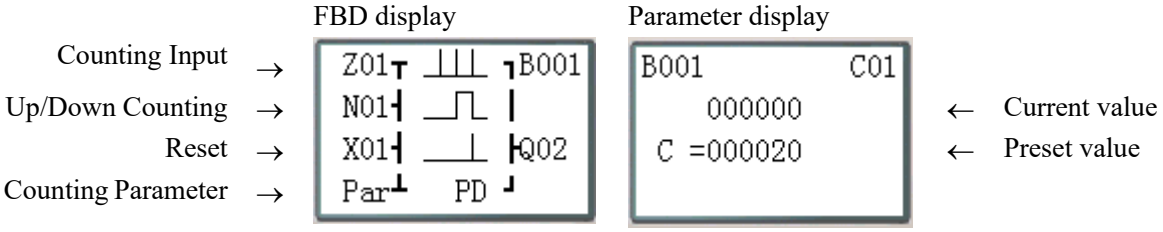


※ Under this mode, Counter will continue counting after reaching preset value if it is configured as counter up. But it stops counting when its current value is 0 if it is configured as counter down.

※ The counter current value will be initial value when the iSmart's status switches between RUN and STOP or the iSmart is power up. If the counter configured as counting up, the init value is 0, else, it is preset value.

(4) Counter Mode 3(Fixed Count, Retentive)

Mode 3 Counter operation is similar to Mode 1 except its current count value is retentive when Counter powers down. So, the current value won't be initiate value when Counter powers up but be the value when it powering down. Mode 3 Counter will count up to a fixed preset value and stop counting at that value or stop counting when its current value is 0 if it's configured as down counter.



Note: The "PD" means the current value will be retain until the power recover;

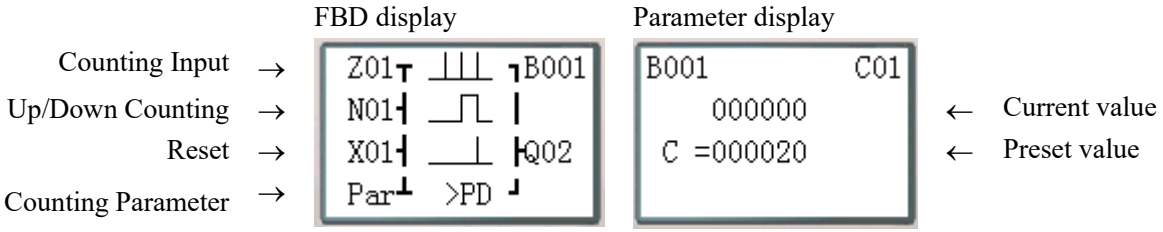
This mode is similar to mode 1, but:

※ First 31 Counter functions (C01~C1F) can keep their current value after a loss of power to the smart relay.

※ The current counter value will keep when the smart switches between RUN and STOP if C-keep is active.

(5) Counter Mode 4(Continuous Count, Retentive)

Mode 4 Counter operation is similar to Mode 2 except its current count value is retentive. The current count value is retentive and will keep its current count after a loss of power to the smart relay. Mode 4 Counter will count up to a fixed preset value and then continue counting after the preset value, but it won't count when the current value equals 0 if it's configured as down Counter.



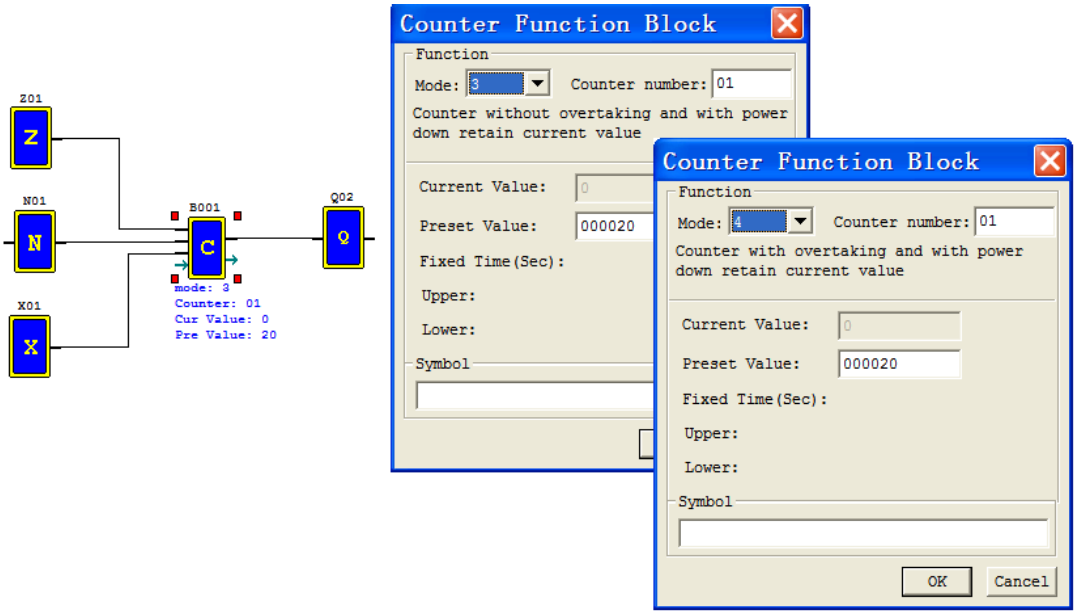
Note: The ">"means the current value appeared will be greater than present value;

The "PD" means the current value will be retain until the power recover;

This mode is similar to mode 2, but:

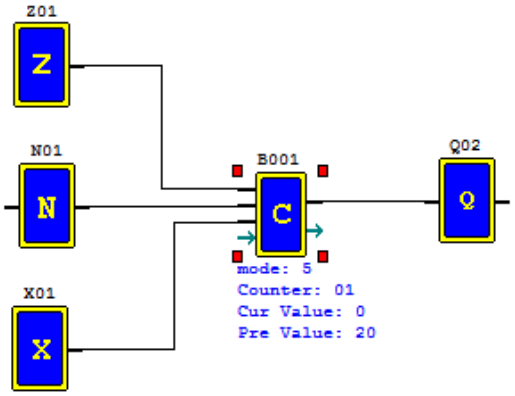
※ First 31 Counter functions (C01~C1F) can keep their current value after a loss of power to the smart relay.

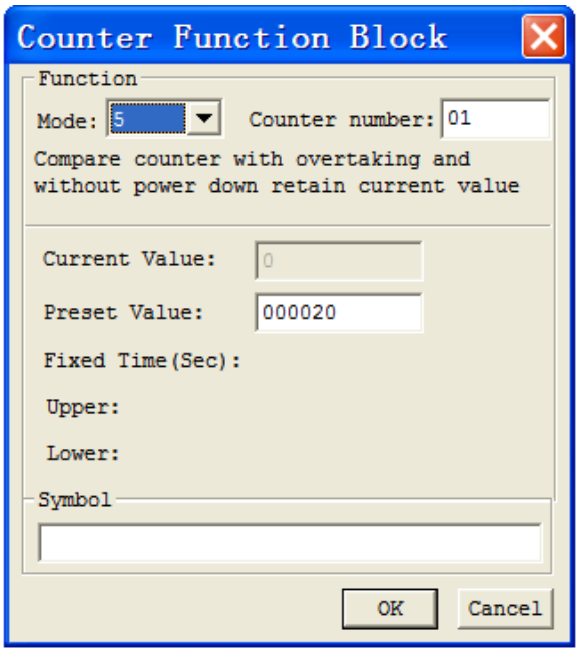
※ The current counter value will be kept when the smart switches between RUN and STOP if "C-keep" is active.

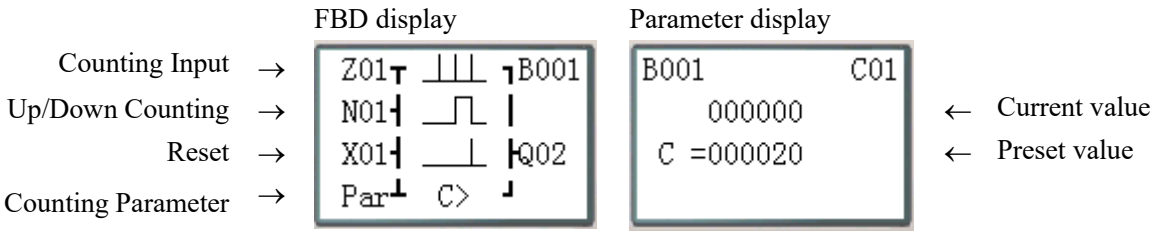


(6) Counter Mode 5 (Continuous Count, Up-Down Count, Non-Retentive)

Mode 5 Counter's operation is similar to Mode 2 except its current count value is continuous and non-retentive. The status bit is fixed to the non-zero preset value regardless of the state of the direction bit. Its status bit will be ON when the counter current value is not less than its preset value and will be OFF when the current value is less than its preset value.

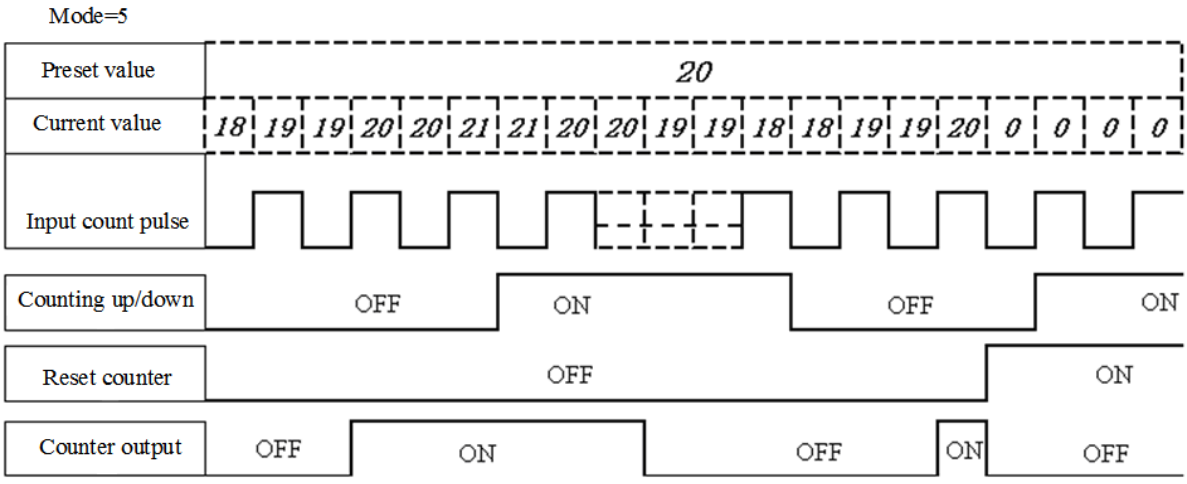






Note: The "C" means compare count;

The ">"means the current value appeared will be greater than present value.



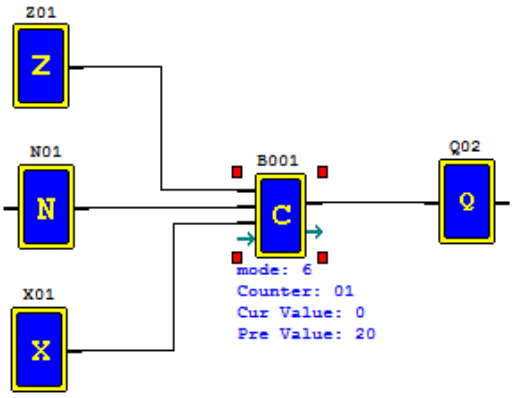
※ Under this mode, the count will continuous after reaching its preset value;

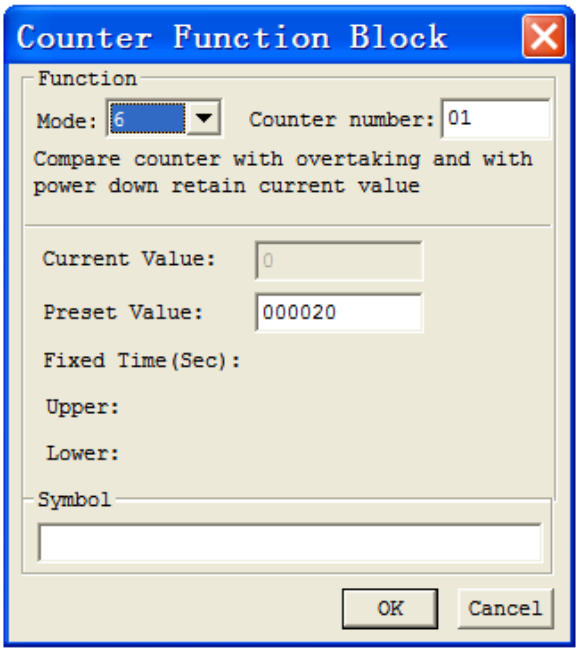
※ The current value is always 0 regardless of the state of its direction bit when the reset is availability;

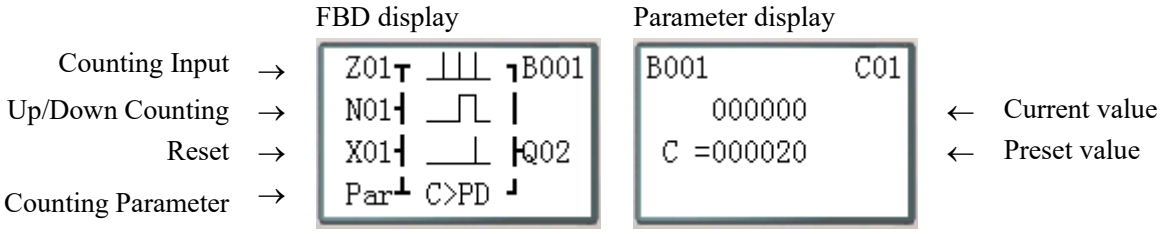
※ The current value is always 0 regardless of the state of its direction bit when the smart switches between RUN and STOP.

(6) Counter Mode 6(Continuous Count, Up-Down Count, Retentive)

Mode 6 Counter's operation is similar to Mode 5 except its current count value is continuous and retentive.



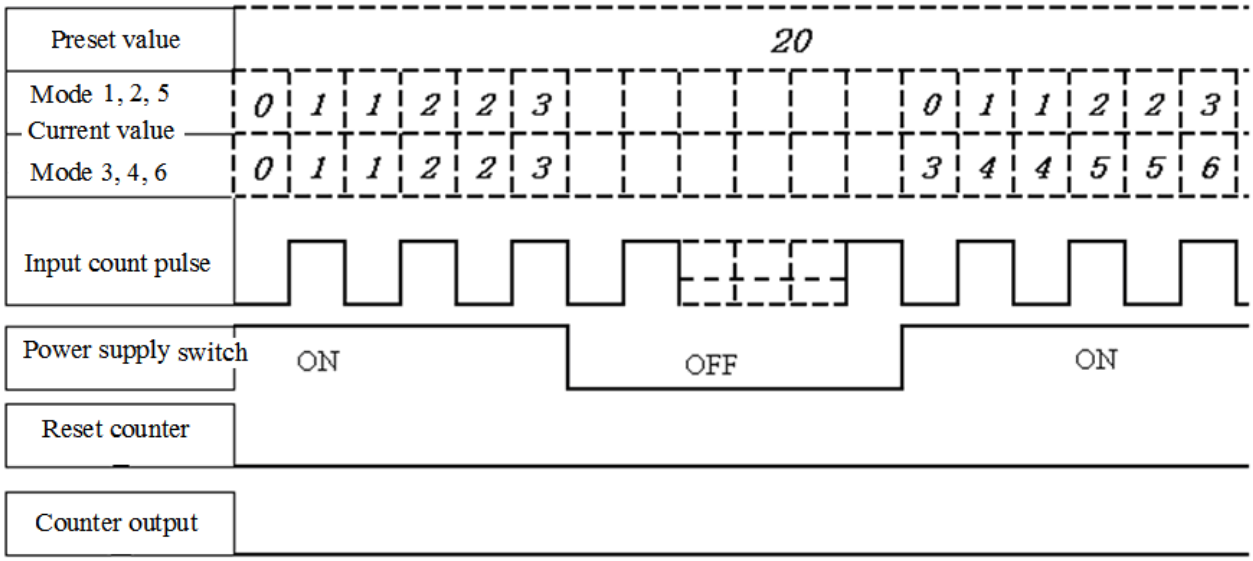




Note: The "C" means compare count;
The ">"means the current value appeared will be greater than present value;
The "PD" means the current value will be retain until the power recover;

※ First 31 Counter functions (C01~C1F) can keep their current value after a loss of power to the smart relay.

※ The current counter value will be kept when the smart switches between RUN and STOP if "C-keep" is active.

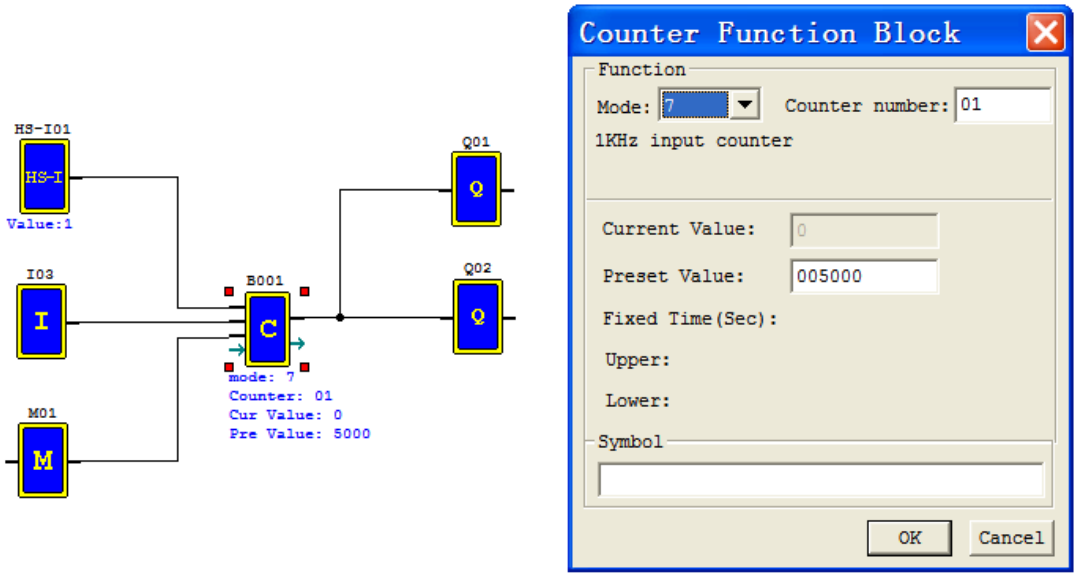


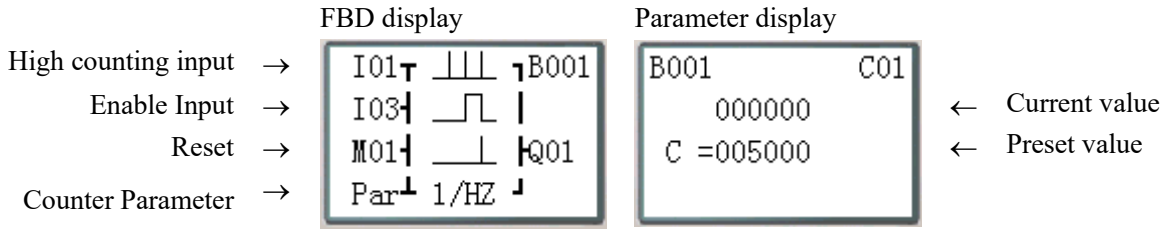
High Speed Counter Function Block (DC Version Only)

The DC powered version smart relays include two 1 KHz high speed inputs on terminal I01 and I02. These can be used as general purpose DC inputs or can be wired to a high speed input device (encoder, etc.) when configured for high speed counting.

(1) Counter Mode 7 (DC powered versions only)

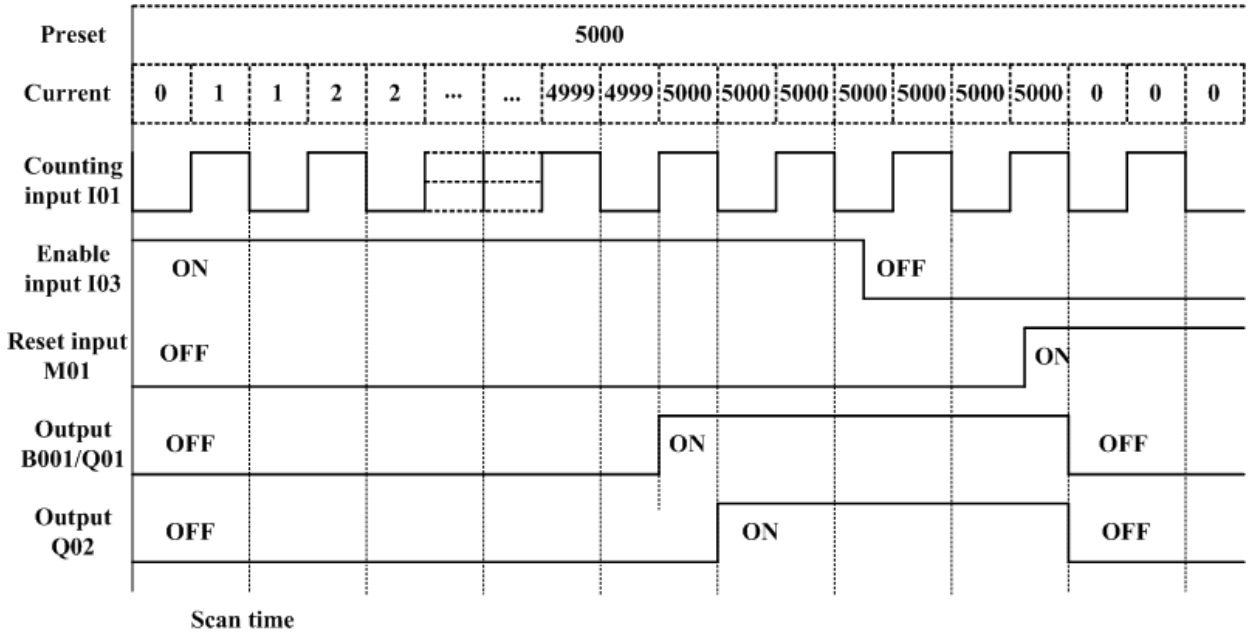
The Mode 7 High Speed Counter can use either input terminals I01 or I02 for forward up-counting to 1 KHz maximum at 24VDC high speed input signal. The selected Counter Coil (B) will turn ON when the pulse count reaches preset value and remain ON. The counter will reset when the Reset Input is active.





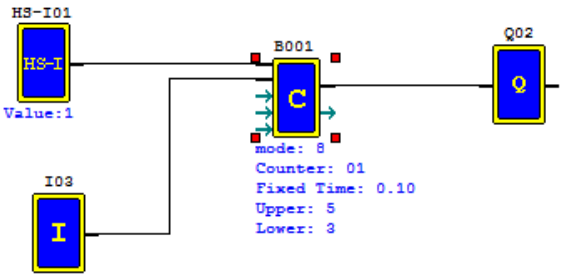
Note: High speed input terminal I01,I02

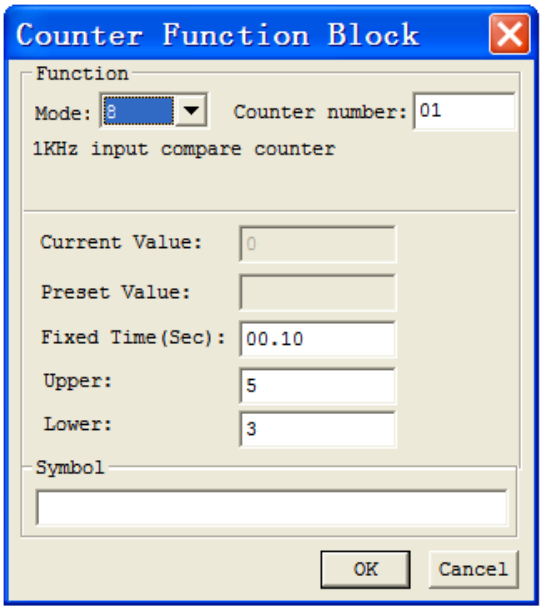
Example as shown: Q01 output ON with C01 (B001), but Q01 output with scan time.

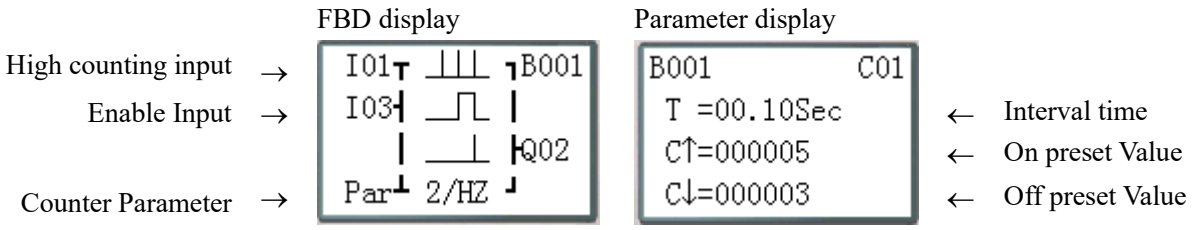


(2) Counter Mode 8 (DC powered versions only)

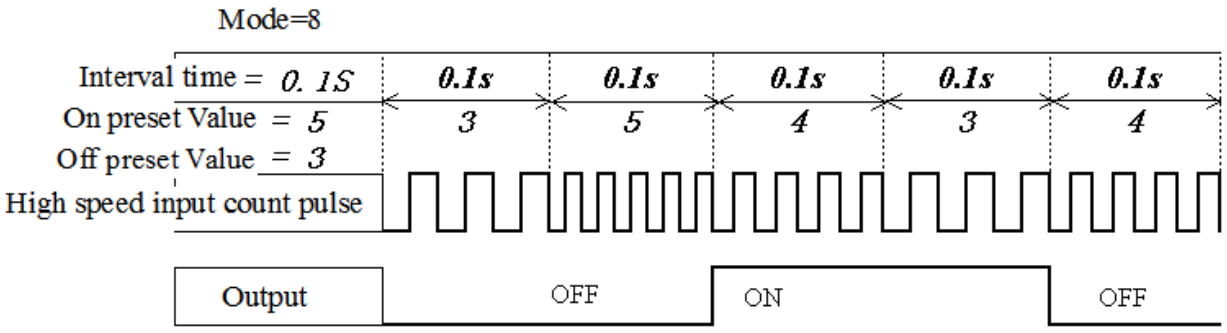
The Mode 8 High Speed Counter can use either input terminals I01 or I02 for forward up-counting to 1 KHz maximum at 24VDC high speed input signal. The selected Counter Coil (C01-C1F) will turn ON when the pulse count reaches the target “Preset ON” value and remain ON until the pulse count reaches the target “Preset OFF” value. The counter will reset when the preceding rung is inactive.







Note: High speed input terminal I01,I02

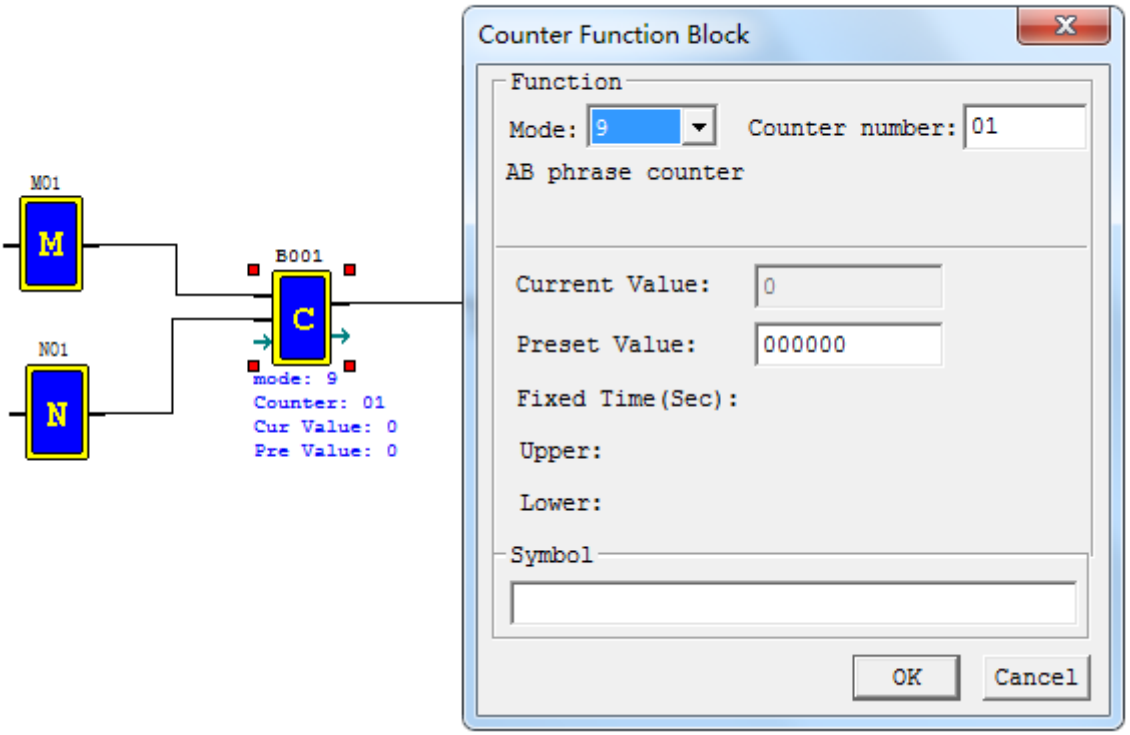


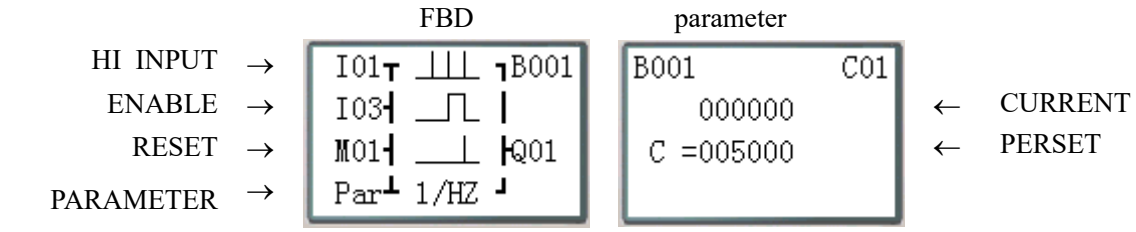
（3）High Speed Counter Mode 8 (1KHZ AB phase Input Counter)

Mode 9 is the AB phase high-speed counting function, which counts two pulses with the same periodic pulse width but a phase difference of 90°. The editing method of AB phase high-speed counting function is the same as that of ordinary high-speed counting function, but the parameters are different.

In DC models, high speed counter mode 9 counts I01 (A) ahead of I02 (B) for two AB phase high speed input counts of up to 1kHz. The counter is currently at (0~999999) until the count reaches the preset value, and the output coil is ON. When reset, the current value of the counter is reset to 0, and the output coil is OFF.

As A special coil, M3A marks the counting direction of the AB phase counter. When phase A is ahead of phase B, M3A is OFF; when phase A is behind phase B, M3A is ON.





※HI INPUT：I01（A）and I02（B）

RTC Comparator Function Block

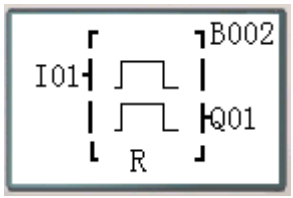
There is a maximum of 250 RTC function blocks under FBD mode, can be set mode 0~4 and the function is same as Ladder mode.

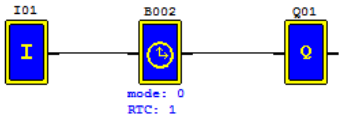
(1) RTC Mode 0(Internal Coil)

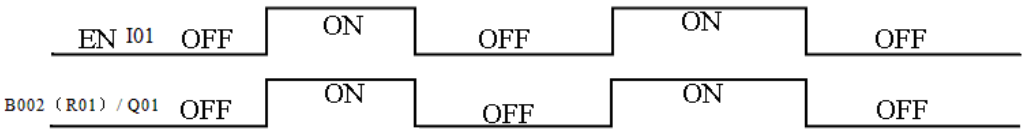
Mode 0 RTC (Internal Coil) used as internal auxiliary coils. No timer preset value and no parameter display.

FBD display

Enable Input →



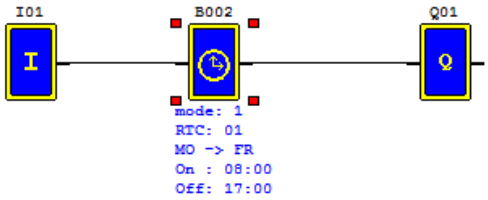


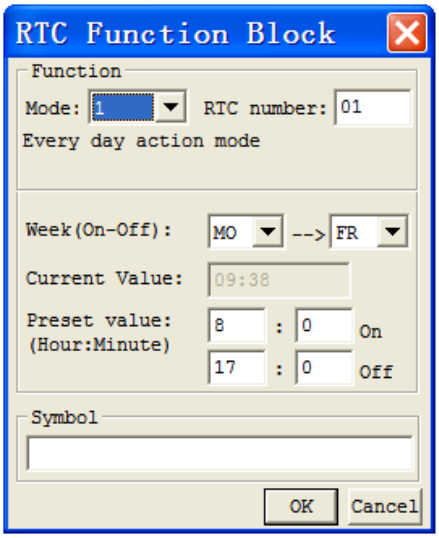


(2) RTC Mode 1(Daily)

The Daily Mode 1 allows the Rxx coil to active based on a fixed time across a defined set of days per week. The below example1 allows for selection of the number of days per week (i.e., Mon-Fri) and the Day and Time for the B002 (R01) coil to activate ON, and the Day and Time for the B002 (R01) coil to deactivate OFF.

Example 1:



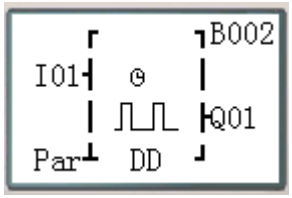


FBD display

Parameter display

Enable Input →

RTC Parameter →

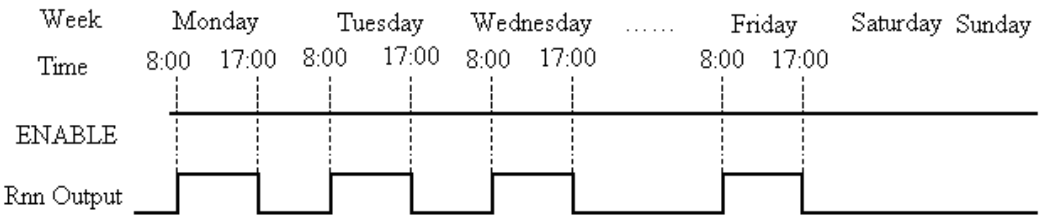


← Current time

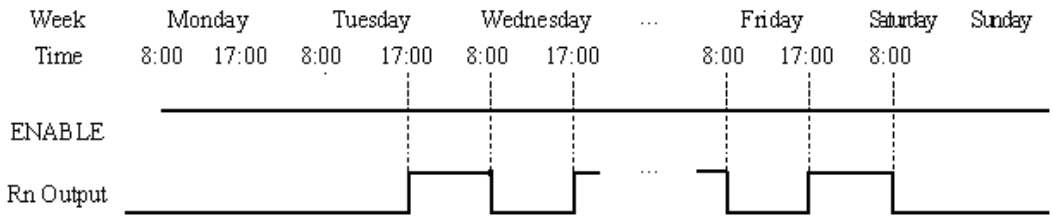
← ON preset value

← OFF preset value

Note: Parameter display current time: week, hour and minute;
Parameter display ON/OFF preset value: week, hour and minute.



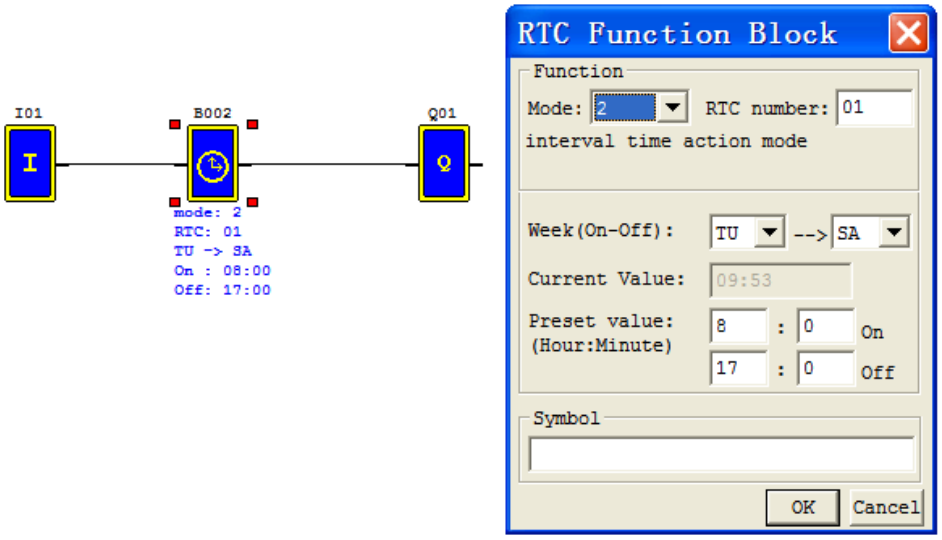
Example 2:

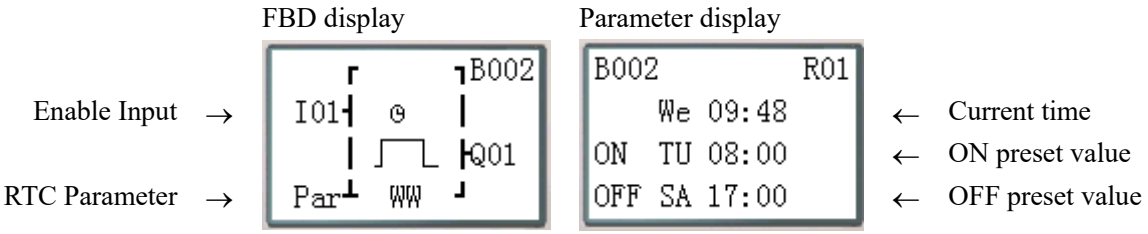


(3) RTC Mode 2 (Continuous)

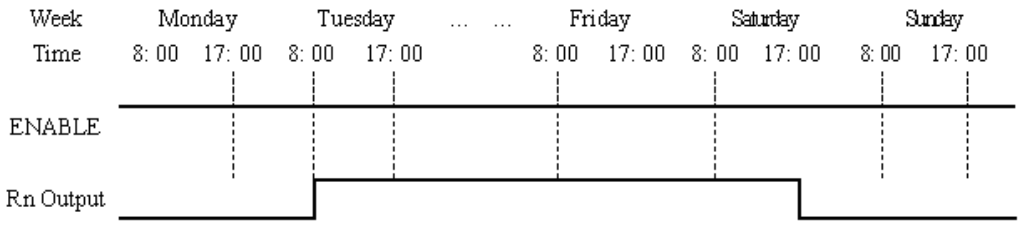
The Interval Time Mode 2 allows the Rxx coil to activate based on time and day per week. The below example1 allows for selection of Day and Time for the B002 (R01) coil to activate ON, and Day and Time for the B002 (R01) coil to deactivate OFF.

Example 1:

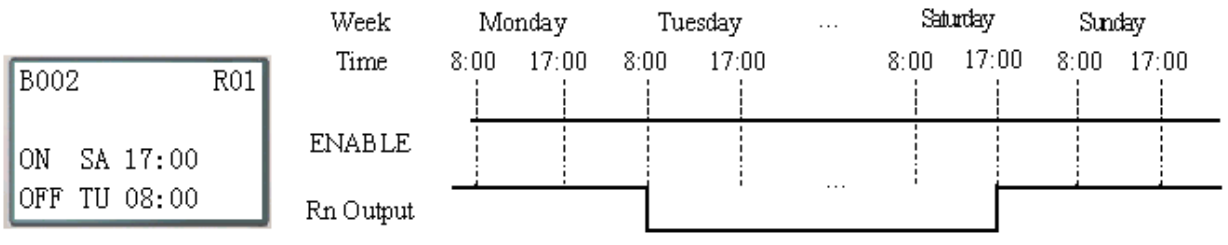




Note: Parameter display current time: week, hour and minute;
Parameter display ON/OFF preset value: week, hour and minute.



Example 2:

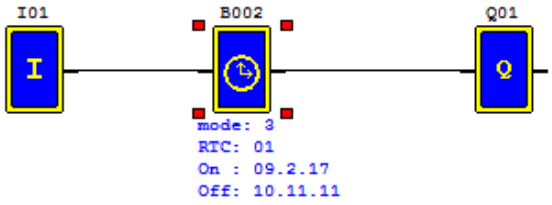


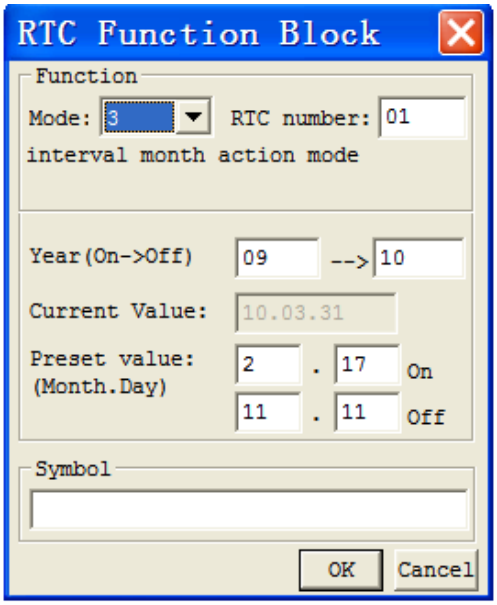
(4) RTC Mode 3 (Year Month Day)

The Year-Month-Day Mode 3 allows the Rxx coil to activate based on Year, Month, and Date. The below example1 allows for selection of Year and Date for the B002 (R01) coil to activate ON, and Year and Date for the B002 (R01) coil to deactivate OFF.

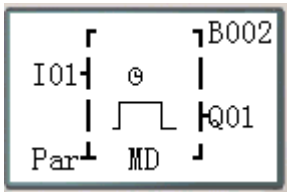
If the year is set as 00-00, the particular mode is available. The RTC is ON from the start date to the end date every year. More refer to example 3.

Example 1:

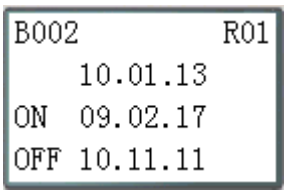




FBD display



Parameter display



Enable Input →

RTC Parameter →

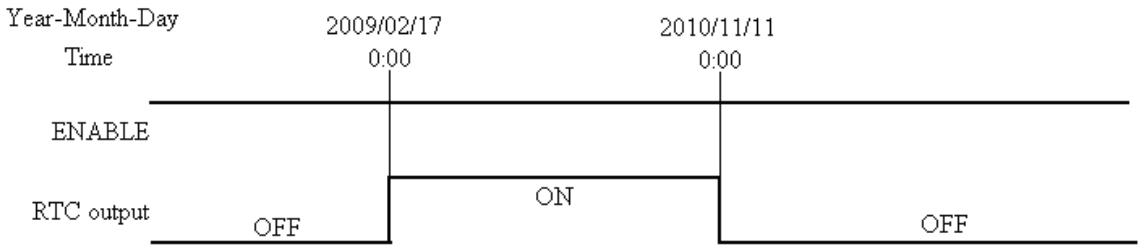
← Current time

← ON preset value

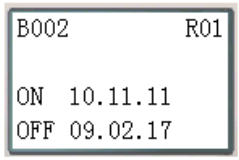
← OFF preset value

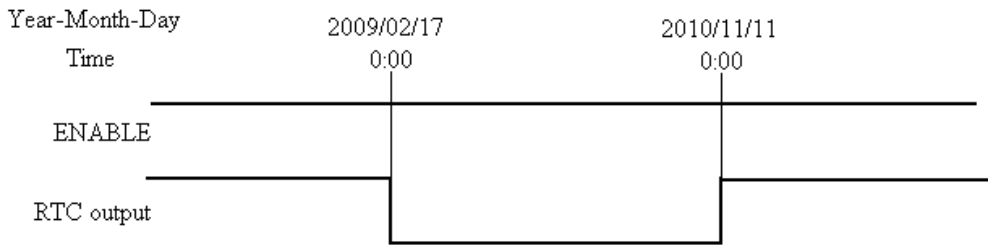
Note: Parameter display current time: year, month, and day;

Parameter display ON/OFF preset value: year, month, and day.



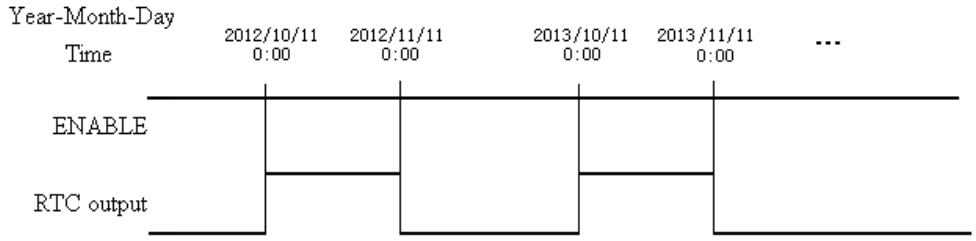
Example 2:





Example 3：

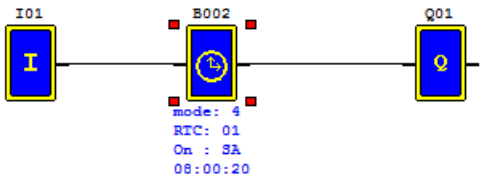
③	3
①/⑤/⑥	2000/10/11
②/⑦/⑧	2000/11/11

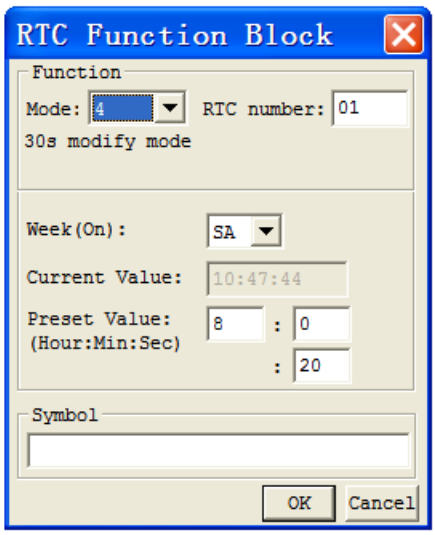


(5) RTC Mode 4(30-second adjustment)

The 30-second adjustment Mode 4 allows the Rxx coil to activate based on week, hour, minute and second. The below examples show for selection of week, hour, minute and second for the B002 (R01) coil to activate ON, and 30-second adjustment then B002 (R01) OFF.

Example 1: adjustment preset second < 30s



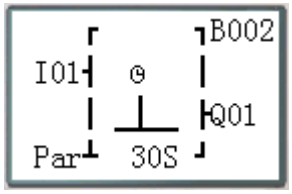


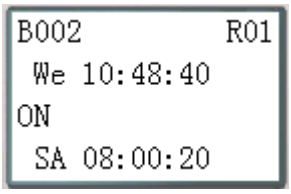
FBD display

Parameter display

Enable Input →

RTC Parameter →



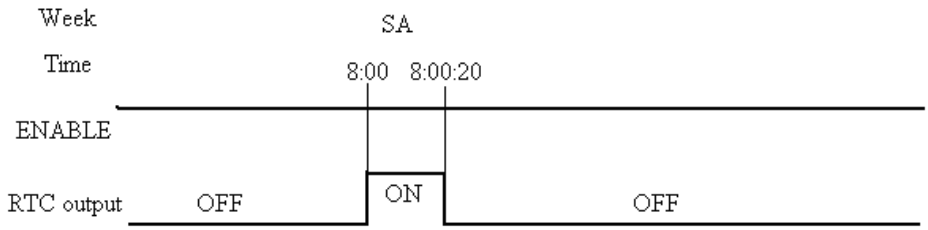


← Current time

← Adjustment preset value

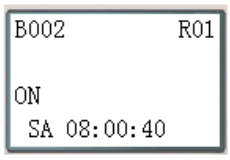
Note: Parameter display current time: week, hour, minute and second;

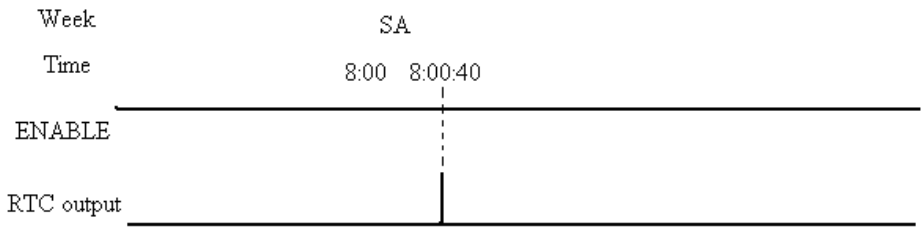
Parameter display adjustment preset value: week, hour, minute and second.



※ The present time will be 8:00:00 when it achieves 8:00:20 at first time, and RTC status bit B002 (R01) will be ON. RTC status bit B002 (R01) will be OFF when the present time achieves 8:00:20 at second time. Then time continuous going. So, this means that RTC status bit is ON for 21 seconds.

Example 2: adjustment preset second >= 30s

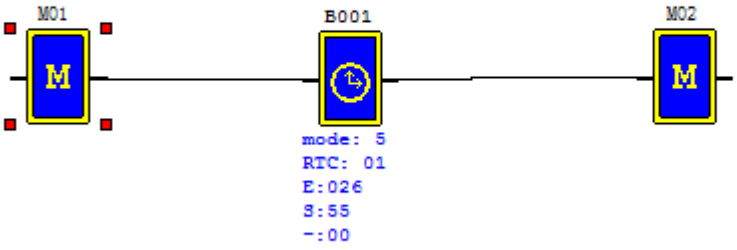


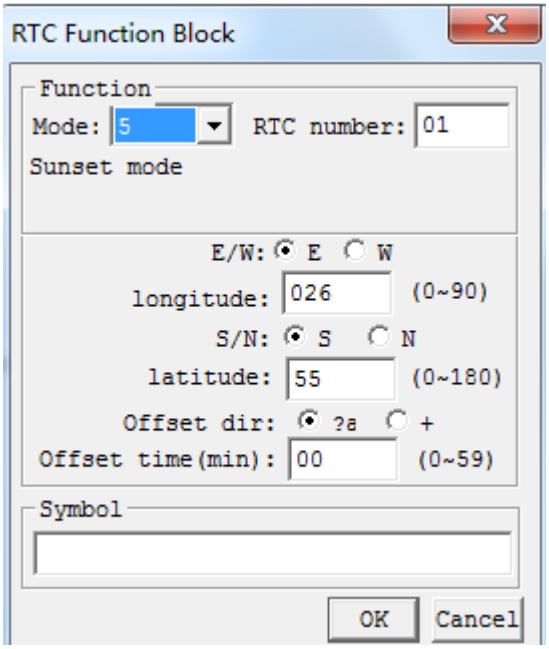


※ The present time will change to be 8:01:00 when it achieves 8:00:40, and RTC status bit B002 (R01) turns ON. Then time is gonging on and B002 (R01) turns OFF. This means that the RTC status bit will be ON for one pulse.

(6) Real-time clock mode 5 (astronomical clock)

RTC mode 5 is astronomical clock mode, using the set latitude and longitude, offset time, to control the output of the RTC coil. The following figures and tables illustrate the display form and parameter meaning of RTC mode 5 and the programming interface in FBD mode.





Set E/W(east and west longitude) and longitude values as well as S/N(south and north latitude) values. The RTC function block will calculate the sunrise and sunset time of the current season at the set location. By setting the offset direction, the sunrise and sunset time can be set to move forward (-) or backward (+) at the same time (0~59min).The R coil will output ON after sunrise to before sunset, and OFF the rest of the time.

※ Calculate sunrise and sunset time according to the current value of RTC. Set R01 ON after sunrise and before sunset time.

※DRCE and DRCF are special registers, which can store the sunrise, sunset and time calculated by longitude and latitude (excluding offset).

Analog Comparator Function Block

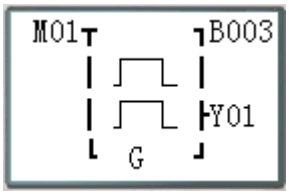
There is a maximum of 250 analog comparator function blocks under FBD mode, can be set mode 0~7 and the function is same as Ladder mode.

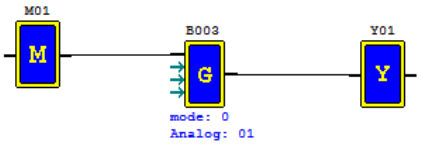
(1) Analog Comparison Mode 0 (Internal coil)

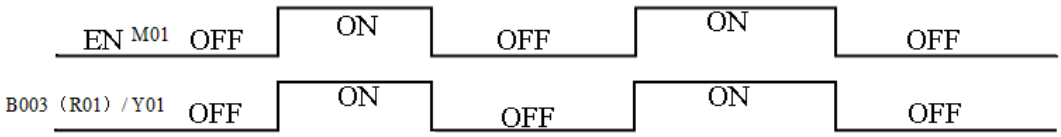
Mode 0 analog comparator (Internal Coil) used as internal auxiliary coils. No timer preset value and no parameter display.

FBD display

Enable Input →







(2) Analog Comparison Mode 1~7

Analog comparator mode 1~7, setting three parameters, analog input Ax, analog input Ay and reference value G.

Analog Comparator mode 1: (Ay- reference value G)≤Ax≤(Ay+ reference value G) , output ON;

Analog Comparator mode 2: Ax≤Ay, output ON;

Analog Comparator mode 3: Ax≥Ay, output ON;

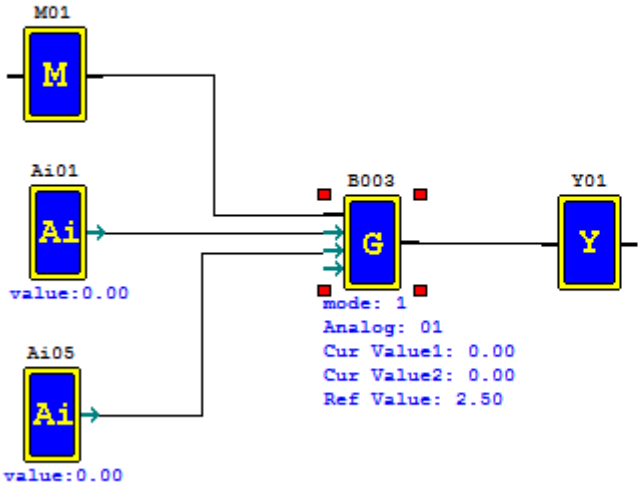
Analog Comparator mode 4: reference value G≥Ax, output ON;

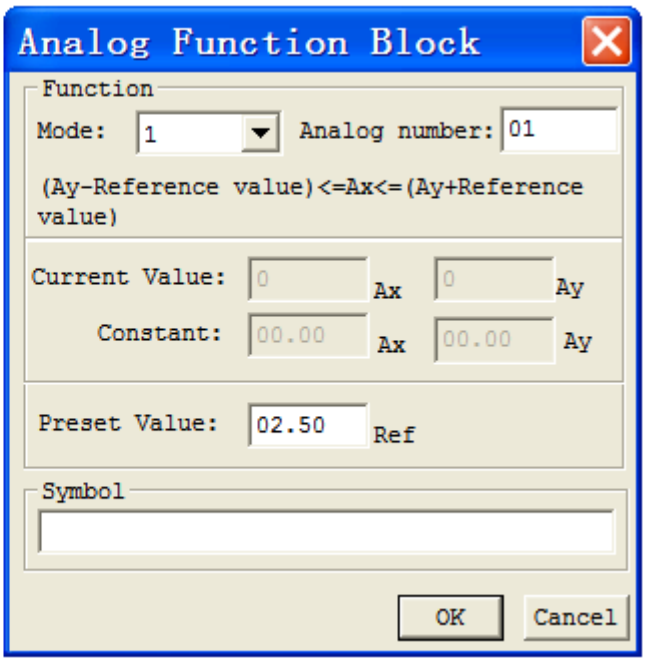
Analog Comparator mode 5: reference value G≤Ax, output ON;

Analog Comparator mode 6: reference value G=Ax, output ON;

Analog Comparator mode 7: reference value G≠Ax, output ON;

Example for program and edit:





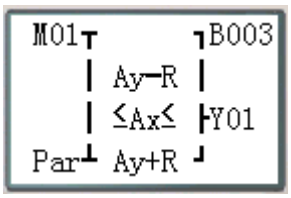
Analog Comparison Mode 1

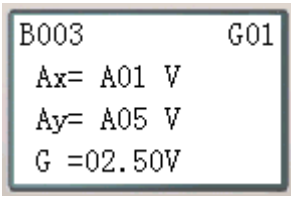
FBD display

Parameter display

Enable Input →

Parameter →





← Analog Input

← Analog Input

← Reference

B003 (G01) output ON when the value of A01 in between (A05-2.50) ~ (A05+2.50);

Parameter display current value of Ax and Ay when running mode;

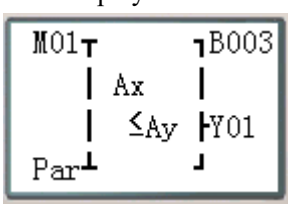
Analog Comparison Mode 2

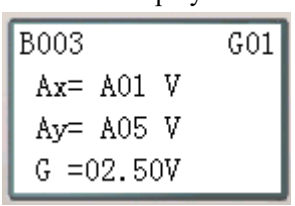
FBD display

Parameter display

Enable Input →

Parameter →





← Analog Input

← Analog Input

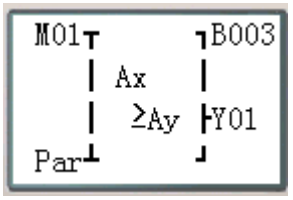
← Reference

B003 (G01) output ON when the value of A01 is not greater than the value of A05;

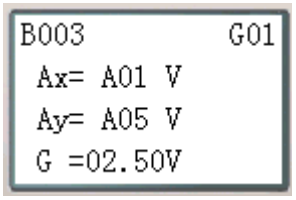
Parameter display current value of Ax and Ay when running mode;

Analog Comparison Mode 3

FBD display



Parameter display



Enable Input →

Parameter →

← Analog Input

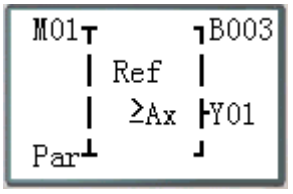
← Analog Input

← Reference

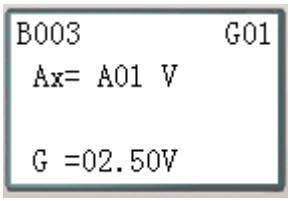
B003 (G01) output ON when the value of A01 is not lower than the value of A05;
Parameter display current value of Ax and Ay when running mode;

Analog Comparison Mode 4

FBD display



Parameter display



Enable Input →

Parameter →

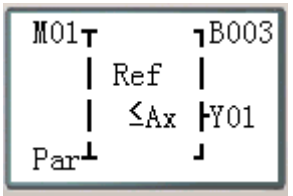
← Analog Input

← Reference

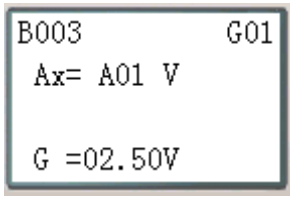
B003 (G01) output ON when the value of A01 is not greater than 2.50;
Parameter display current value of Ax when running mode;

Analog Comparison Mode 5

FBD display



Parameter display



Enable Input →

Parameter →

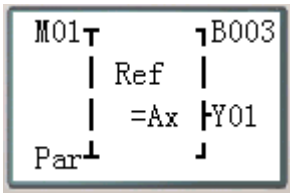
← Analog Input

← Reference

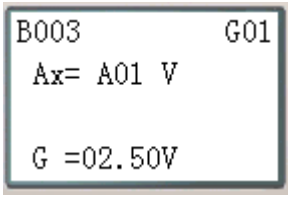
B003 (G01) output ON when the value of A01 is not low than 2.50;
Parameter display current value of Ax when running mode;

Analog Comparison Mode 6

FBD display



Parameter display



Enable Input →

Parameter →

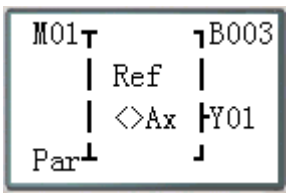
← Analog Input

← Reference

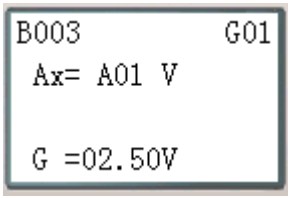
B003 (G01) output ON when the value of A01 is equal to 2.50;
Parameter display current value of Ax when running mode;

Analog Comparison Mode 7

FBD display



Parameter display



Enable Input →

Parameter →

← Analog Input

← Reference

B003 (G01) output ON when the value of A01 is not equal to 2.50;
Parameter display current value of Ax when running mode;

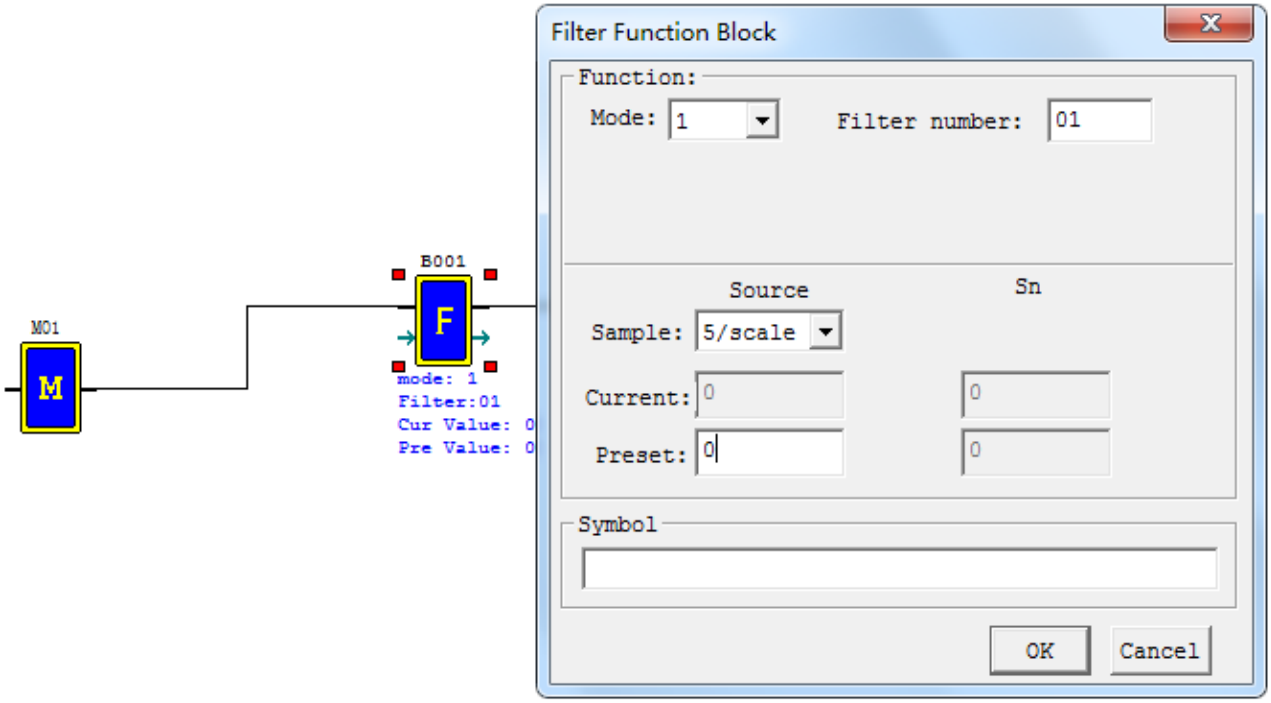
Filter Function Block

FBD function can use 250 filter blocks in mode 1-4 (same as Ladder mode)

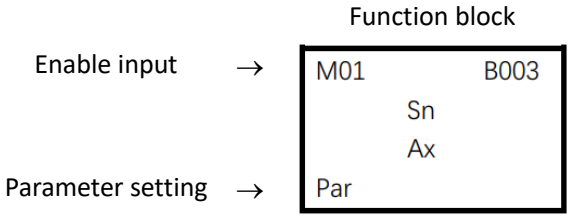
Filter Mode 1 (Analog filter)

Function instruction

When parameters setup finished, analog filter function will be enabled once enable coil status from 0 to 1. This will start to do Ax analog value filter according to select sampling mode, the value after filter will be the current value of F coil.



Output : Sampling number Sn, calculation value of Ax analog input



Software Filter Mode

(Mode 1)

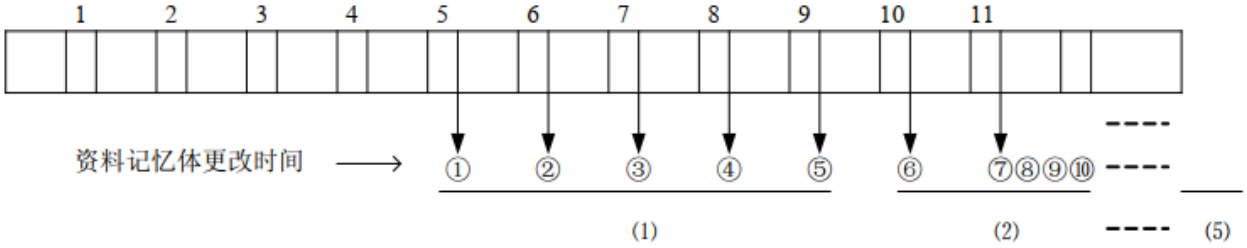
The value will be updated by each scan cycle, it will use last 5 AD average value except maximum and minimum one.

(Mode 2)

The value will be updated by each 5 scan cycles, it will use 5 time mode 1 value to do average.

(Mode 3)

The value will be updated by each 25 scan cycles, it will use 5 time mode 2 value to do average of maximum and minimum value.



Example : Data 1=161, Data 2=120, Data 3=154, Data 4=160, Data 5=190， Data 6=169，
Data 7=110, Data 8=121, Data 9=150， Data 10=198, Data 11=199

Mode 1 :

① Updated data=(161＋154＋160) / 3=158 - filter (1, 2, 3, 4, 5), the maximum value 190 and minimum value 120 will be deleted.

② Updated data=(154＋160＋169) / 3=161 - filter (2, 3, 4, 5, 6), the maximum value 190 and minimum value 120 will be deleted.

③ Updated data=(154＋160＋169) / 3=161 - filter(3, 4, 5, 6, 7), the maximum value 190 and minimum value 110 will be deleted.

⑦ Updated data=(121＋150＋198) / 3=156 - filter(7, 8, 9, 10, 11), the maximum value 199 and minimum value 110

Mode 2 :

It will use 5 time mode 1 value to do average. (①＋②＋③＋④＋⑤) / 5

Mode 3 :

It will use 5 time mode 2 value to do average of maximum and minimum value.

(This mode is effective to filter ripple and ripple noise.)

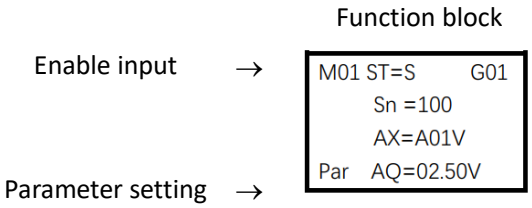
(Maximum value + Minimum value) / 2, the range of these two values is ①②③④⑤.

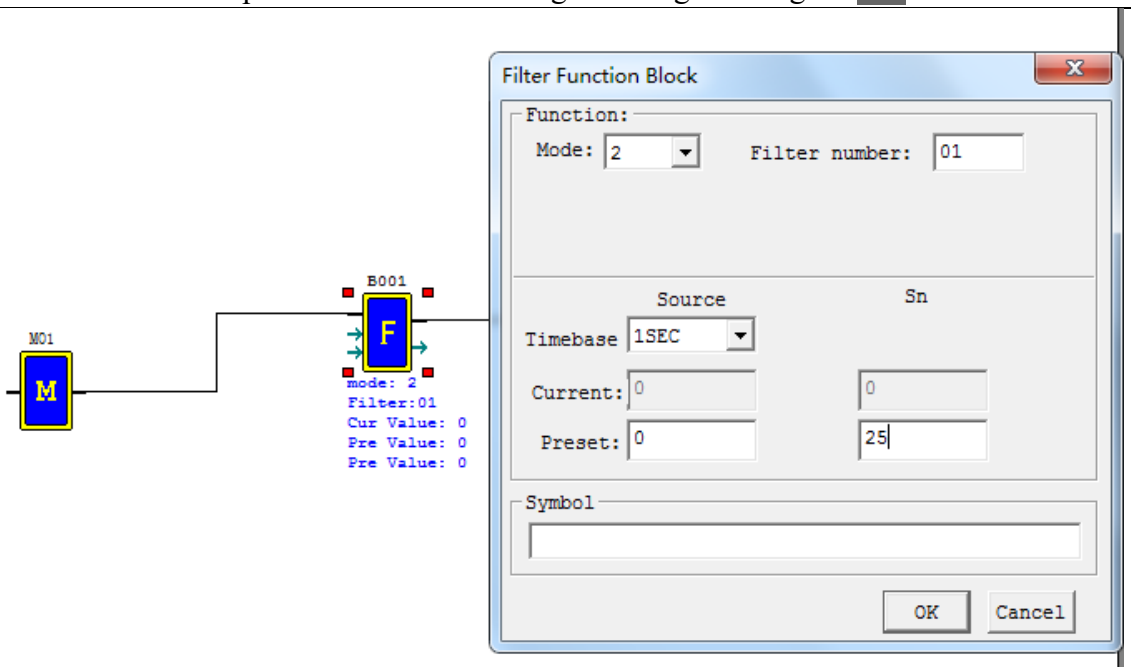
Filter Mode 2 (Average)

Function instruction

Enable coil ON, average function will start.

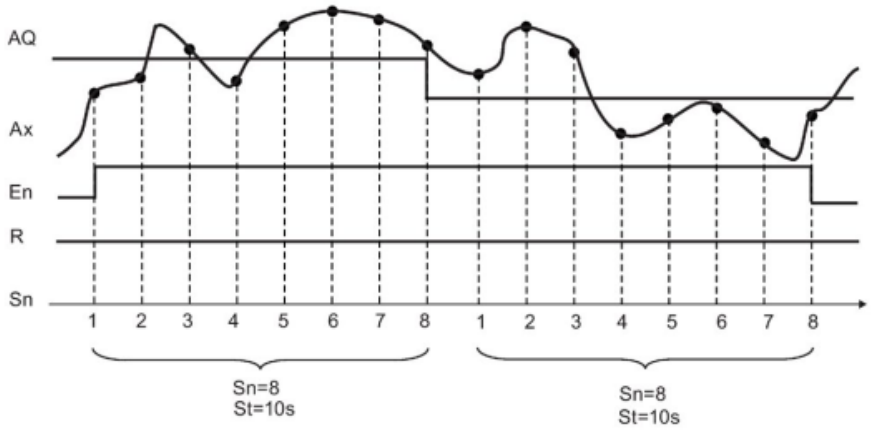
This mode is used to calculate analog input average value of time period.





When enable input turns ON, according to parameter setting, unit will start to calculate the analog average value and update the current value of function block. Output coil will turn ON at same time.

Timing diagram (example)

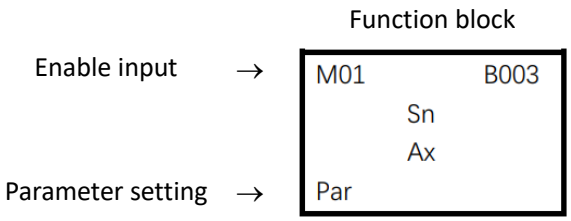


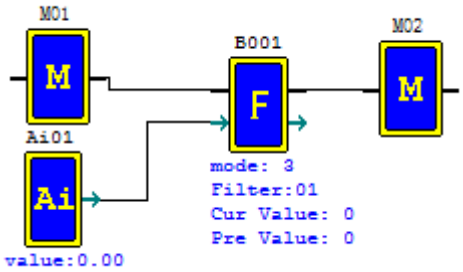
Filter Mode 3 maximum value

When enable coil is ON, maximum function will start, the status of output coil and enable coil is same.

When enable coil is OFF, maximum function will close, the status of output coil and enable coil is same.

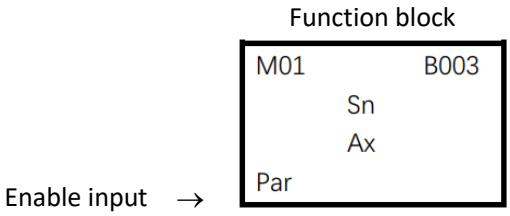
In enable coil ON status, F function block current value will save the maximum value of analog input Ax.

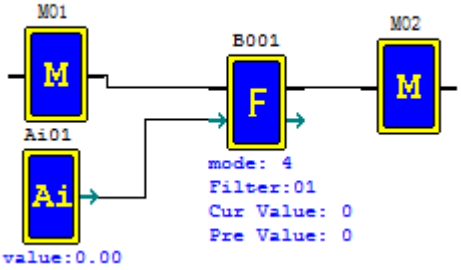




Filter Mode 4 (Minimum value)

When enable coil is ON, maximum function will start, the status of output coil and enable coil is same.
When enable coil is OFF, maximum function will close, the status of output coil and enable coil is same.
In enable coil ON status, F function block current value will save the minimum value of analog input Ax.





AS (ADD-SUB) function block

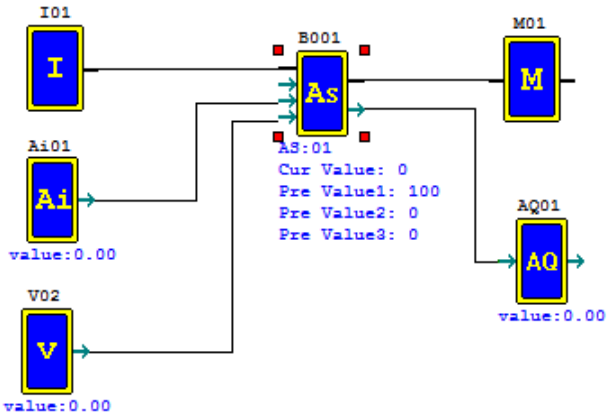
There is a maximum of 250 AS (Addition and Subtraction) function blocks under FBD mode, and the function is same as Ladder mode.

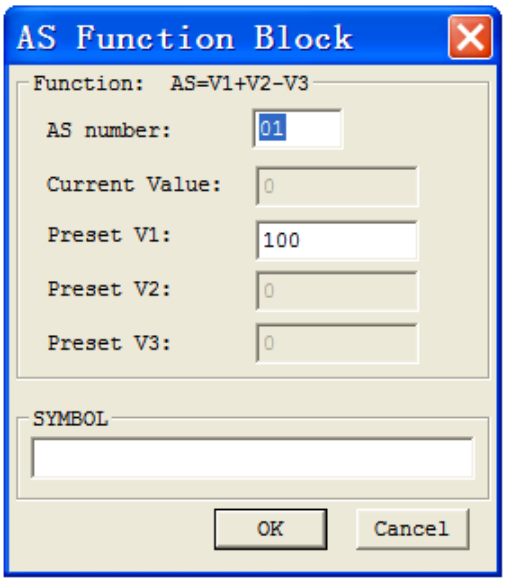
Compute formula: $AS = V1 + V2 - V3$

Parameters V1, V2, and V3 can be a constant or other function current value. The output coil will be set to 1 when the result is overflow.

Example:

AQ01 = AS01 = 100 + A01 - V02

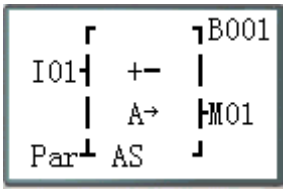




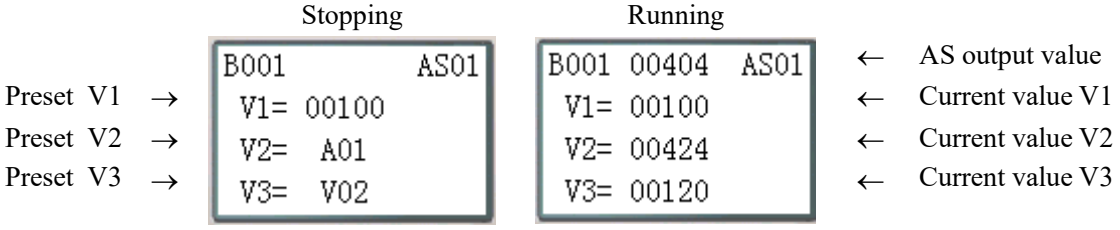
FBD display:

Enable Input →

Parameter →



Parameter display:



AS and V1~V3, values range from -32768~32767

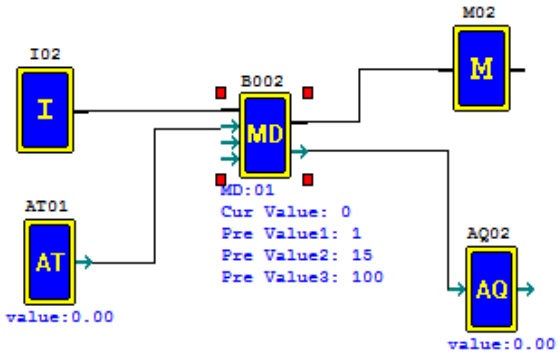
MD (MUL-DIV) function block

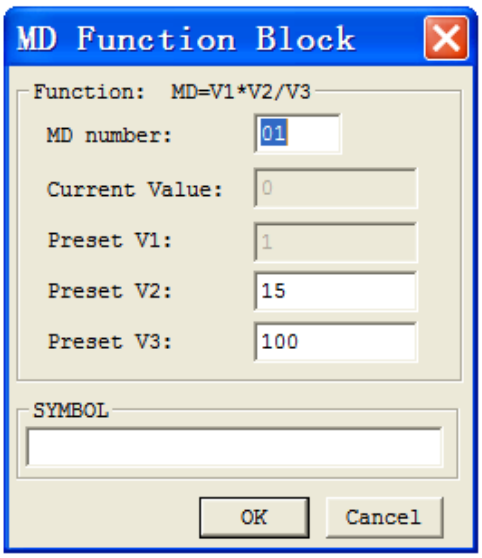
There is a maximum of 250 MD (Multiplication and Division) function blocks under FBD mode, and the function is same as Ladder mode.

Compute formula: $MD = V1 * V2 / V3$

Parameters V1, V2, and V3 can be a constant or other function current value. The output coil will be set to 1 when the result is overflow or parameter V3 is zero.

Example:
AQ02 = MD01 = AT01*15/100

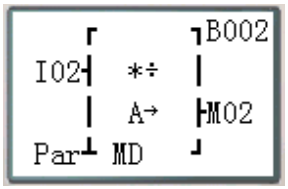




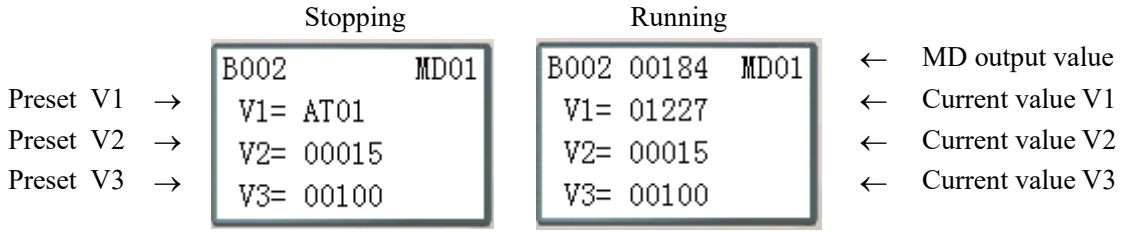
FBD display:

Enable Input →

Parameter →



Parameter display:



MD and V1~V3, values range from -32768~32767

PID (Proportion- Integral- Differential) function block

There is a maximum of 30 PI (PID) function blocks under FBD mode, and the function is same as Ladder mode.

PID computes formula:

$$EV_n = SV - PV_n$$

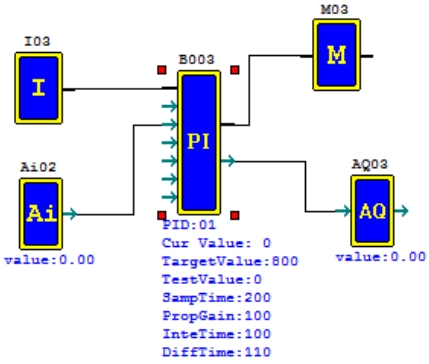
$$\Delta PI = K_P\left\{\left(EV_n - EV_{n-1}\right) + \frac{T_s}{T_I}EV_n + D_n\right\}$$

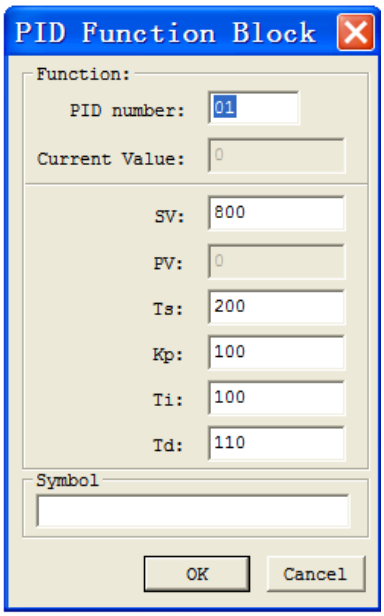
$$D_n = \frac{T_D}{T_S}\left(2PV_{n-1} - PV_n - PV_{n-2}\right)$$

$$PI = \sum \Delta PI$$

Parameters can be constant or other function current value. The output coil will turn ON when either T_S or K_P is 0.

Example:



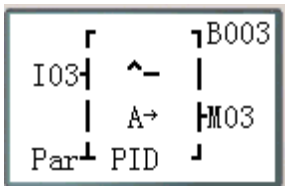


PI: PID current value (-32768~32767)
SV: Destination value (-32768~32767)
PV: Test value (-32768~32767)
T_S: Sampling time (1~32767 * 0.01s)
K_P: Proportional gain (1~32767 %)
T_I: Integration time (1~32767 * 0.1s)
T_D: Differential time (1~32767 * 0.01s)

FBD display:

Enable Input →

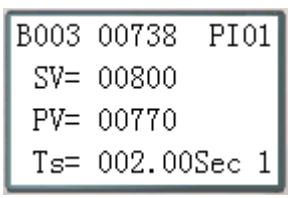
Parameter →



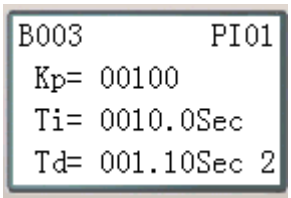
Parameter display:

Parameter display 1

PID current value →
Destination value →
Test value →
Sampling time →



Parameter display 2



← Proportional gain
← Integration time
← Differential time

※ Display PID current value when running mode;

※ Test value (PV) display code A02 when stopping mode and display current value (as example PV= 00770) when running mode.

※ Press "SEL+←→" button can convert between display1 and display2.

※ More information about PID function to see Chapter 4: Relay Ladder Logic Programming—PID.

MX (Multiplexer) function block

There is a maximum of 250 MX (Multiplexer) function blocks under FBD mode, and the function is same as Ladder mode.

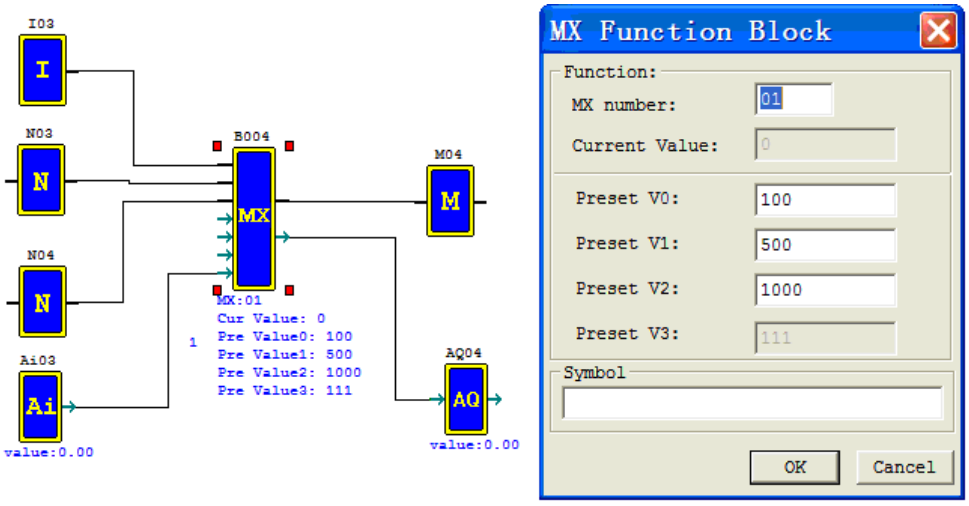
This special function transmits 0 or one of 4 preset values to MX current value memory by selection control coils S1 and S2. The MX function enables simple operations to be carried out on integers.

The preset value V1~V4 can be constant or other function current value.

The table below describes the relationship between parameter and MX current value.

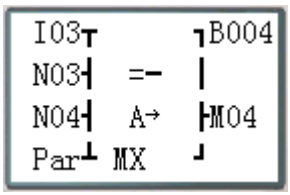
Control status		MX output coil	MX output value
MX disable		0	MX = 0
MX enable	S1＝0, S2＝0	1	MX = V0
	S1＝0, S2＝1	1	MX = V1
	S1＝1, S2＝0	1	MX = V2
	S1＝1, S2＝1	1	MX = V3

Example:

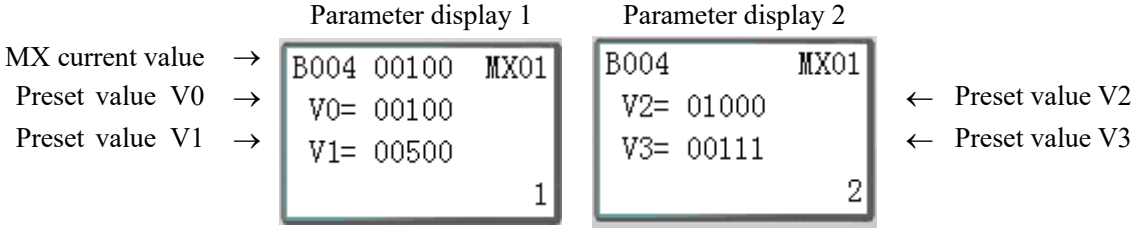


FBD display:

Enable Input →
Selection coil S1 →
Selection coil S2 →
Parameter →



Parameter display:



※ Display MX current value when running mode;

※ Preset Value V3, display code A03 when stopping mode and display current value (as example V3=00111) when running mode;

※ Press “SEL+←→” button can convert between display1 and display2.

※ MX and V0~V3, values range from -32768~32767

AR (Analog-Ramp) function block

There is a maximum of 30 AR (analog ramp control) function blocks under FBD mode, and the function is same as Ladder mode.

(1)AR mode1

Function description:

AR will keep the current level at “StSp + Offset "B"” for 100ms when it’s enabled. Then the current level runs from StSp + Offset "B" to target level at enactment Rate. If St is set, the current level decreases from current level to level StSp + B at enactment Rate. Then AR holds the level StSp + Offset "B" for 100ms. After 100ms, AR current level is set to offset "B", which makes AR current value equals 0.

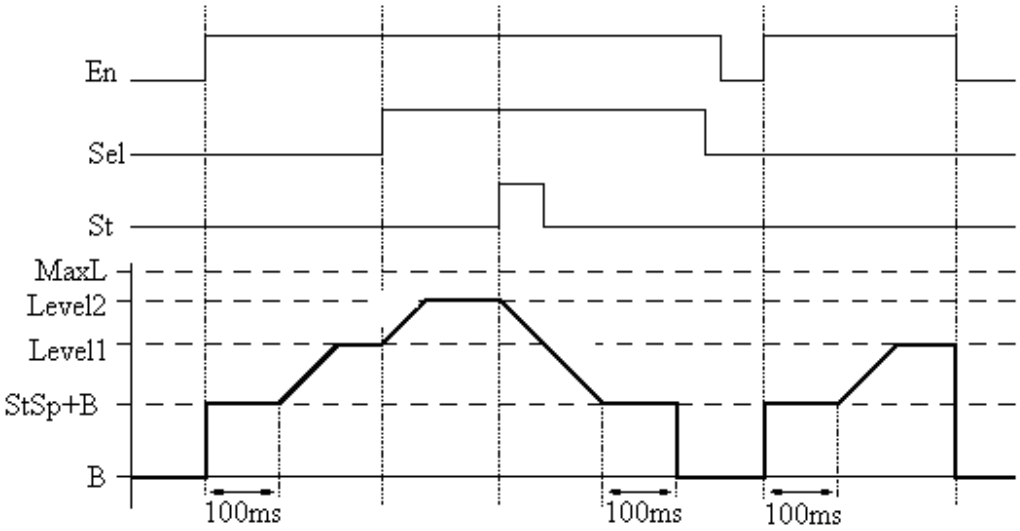
AR current value: 0~32767
Level1:-10000~20000
Level2:-10000~20000
MaxL (max level):-10000~20000
Start/Stop level (StSp): 0~20000
stepping rate (rate): 1~10000
Proportion (A): 0~10.00
Excursion (B): -10000~10000

$$AR\_current\_value = (AR\_current\_level - B) / A$$

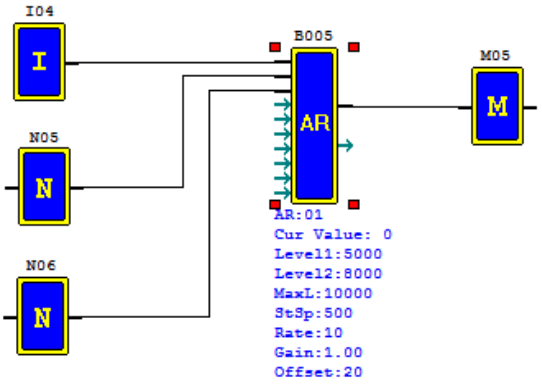
The parameters can be constant or other function current value.

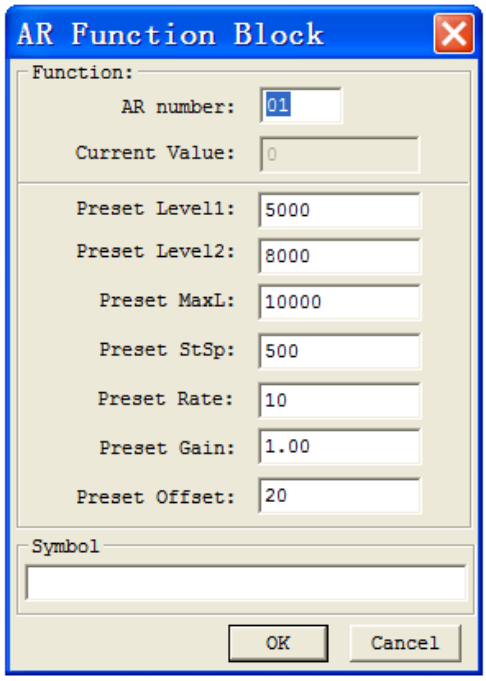
Sel	Selection level Sel = 0: target level = Level1 Sel = 1: target level = Level2 ※ MaxL is used as target level if the selected level is bigger than MaxL.
St	Selection stop coil. The St’s state becomes from 0 to 1 will startup the current level decrease to start/stop level (StSp + excursion “B”), and then keep this level for 100ms. Then AR current level is set to B which will make AR current value equals 0.
Output coil	The output coil turns ON when Proportion (A) is 0.

Timing diagram for AR



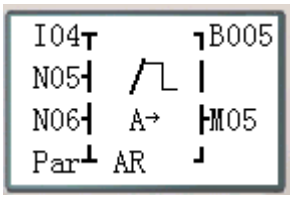
Example:





FBD display:

Enable Input →
Select level input Sel →
Stop input St →
Parameter →



Parameter display:

	Parameter display 1	Parameter display 2	
AR current value →	B005 00528 AR01	S = 00500 AR01	← Start/Stop level
Preset level1 →	L1= 05000	R = 00010	← Stepping rate
Preset level2 →	L2= 08000	A = 01.00	← Proportion value
Max level →	ML= 10000 1	B = 00020 2	← Excursion value

※ Display AR current value when running mode;

※ Press “SEL+←→” button can convert between display1 and display2.

(2)AR mode2

Function description:

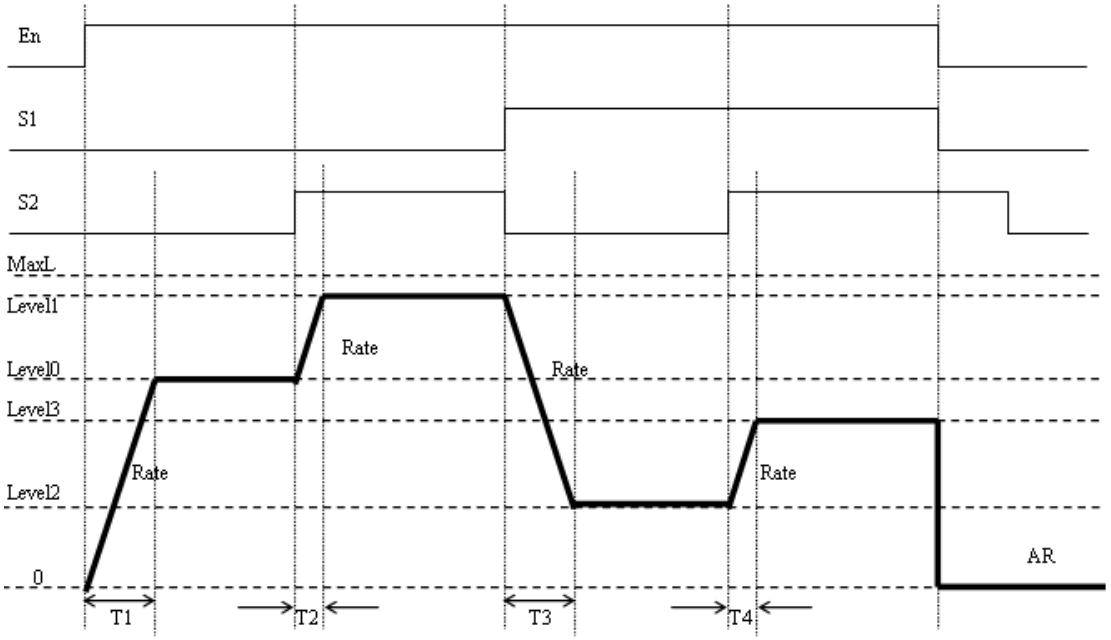
AR will vary from 0 to current level at a preset rate when it is enabled. Based on the state of Sel1 and Sel2, Current level will change to other preset level at the preset rate. When AR is disabled, current output vary to 0 immediately.

AR current value: 0~32767
Level0:0~32767
Level1:0~32767
Level2:0~32767
Level3:0~32767
MaxL:0~32767
Ta: 0~3276.7

The rate designed by user: $Rate = \frac{MaxL}{Ta}$. The table below describes detail information of each parameter:

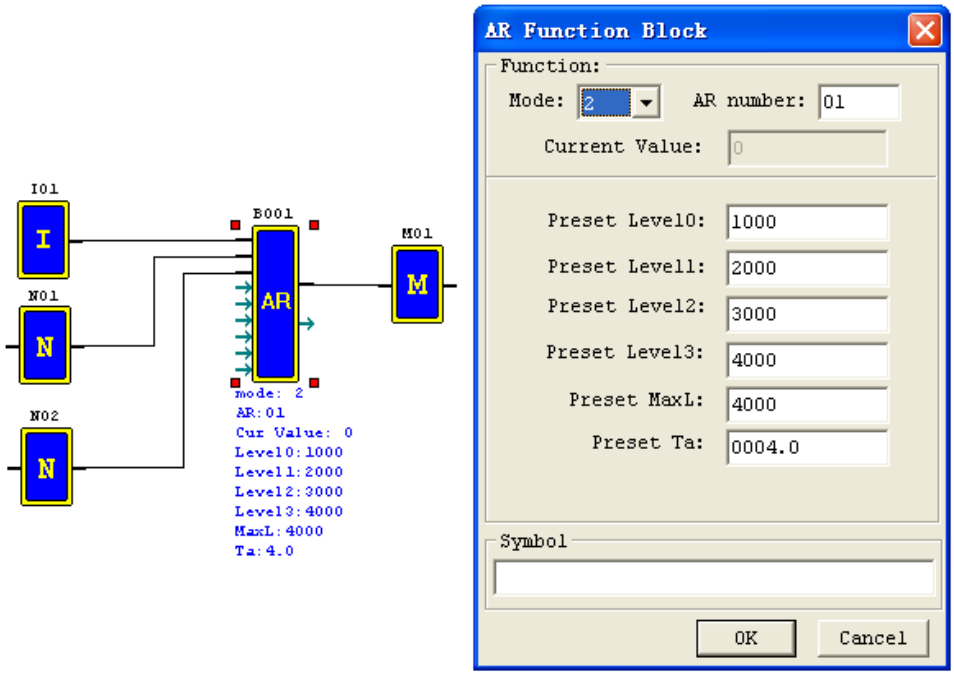
Sel1 Sel2	S1＝0,S2＝0: target level = Level 0; S1＝0,S2＝1: target level = Level 1; S1＝1,S2＝0: target level = Level 2; S1＝1,S2＝1: target level = Level 3;
MaxL	MaxL is used as target level if the selected level is bigger than MaxL.
Ta	The result of MaxL divided by Ta is the change rate from current level to target level.
Output coil	The output coil turns ON when A is 0.

Timing diagram for AR



Rate = MaxL/Ta; T1=Level0*Ta/MaxlL; T2=（Level1-Level0）*Ta/MaxL;
T3=（Level1-Level2）*Ta/MaxL; T4=（Level3-Level2）*Ta/MaxL;

Example:

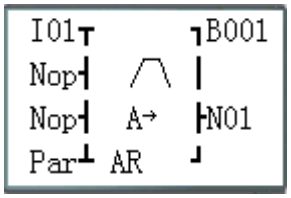


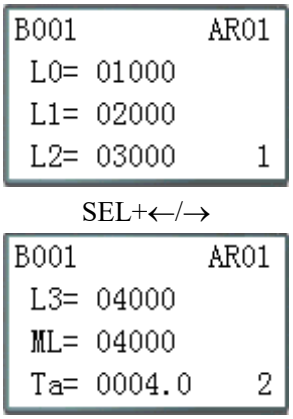
FBD display

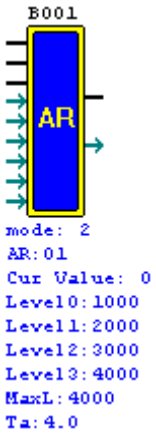
Parameter display

Program display

Enable Input →
Select 1 →
Select2 →
Parameter →







※ Display AR current value when running mode;

DR (Data-Register) function block

There is a maximum of 240 DR (data register) function blocks under FBD mode, and the function is same as Ladder mode.

The DR function is transferring data. DR sends data from prevention registers to current register and output coil Bxxx ON when it is enabled. DR holding the out value and output coil Bxxx OFF when it is disabled.

The data can be signed or unsigned by **Operation>>module system set…**menu selection from the SMT Client software **or keypad set**.

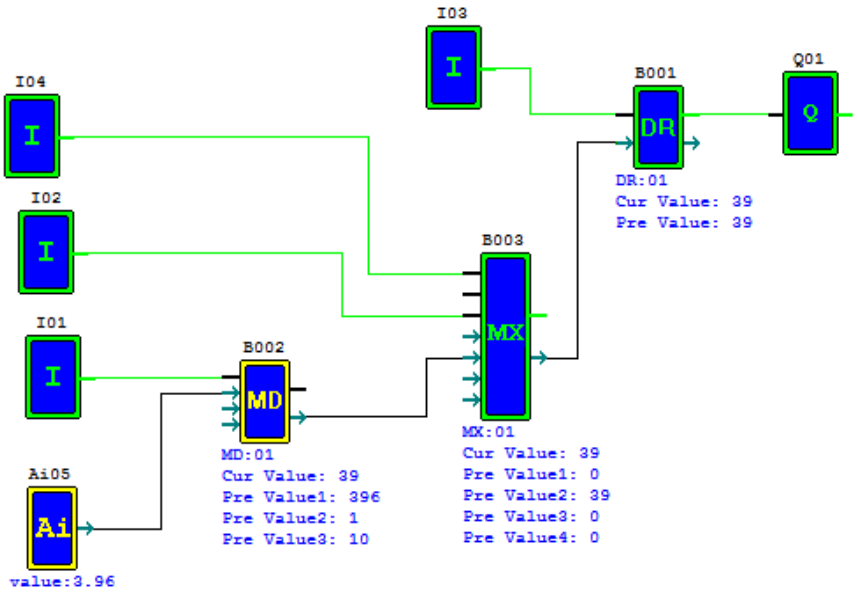
The data registers from DR65 to DRF0 will be kept when the smart stop or powers down.

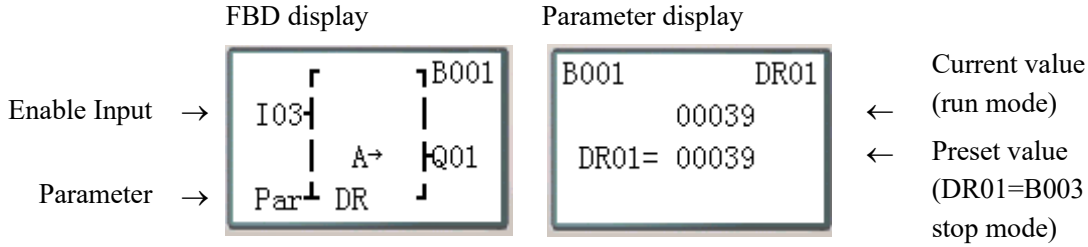
The last 40 DR that from DRC9 to DRF0 are special data register, more information to see Chapter 3 Program Tools—Data Register Set.

Example:

Setting I02 ON, B001 (DR01) output (A05*1/10) count value;

Setting I02 OFF, B001 (DR01) output 0;





MU (Modbus) function block

There is a maximum of 250 MU (Modbus) function blocks under FBD mode, can be set mode 1~5 and the function is same as Ladder mode.

Remote IO and IO Link are precedence than MU. MU is executed when the system setting is N (No Remote IO) and ID isn't 0.

Function mode corresponding communication function code:

mode	Communication function code
1	03 (read registers)
2	06 (write single register)
3	10 (write multiple registers)
4	01 (read coils)
5	05 (write single coil)

※ The max data length for Mode 1 and 3 is 25words. The max data length for Mode 4 is 400bits.

The coil used in MU function:

M3D: Received	M3D is set to ON after received, then check-up for error. Transferring data to target address if there is no error.
M3E: Error flag	communication error flag
M3F: Time out flag	M3F is set to 1 when the time from after sending to start receiving is longer than setting, and M3D also be set to 1. M3F is automatically reset if M3D reset.

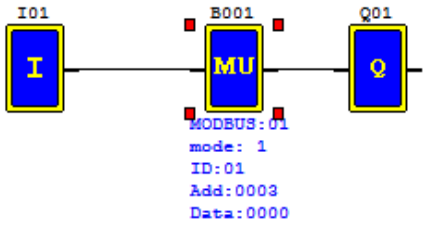
The time out time is depending on communication baud rate as shown in the table below:

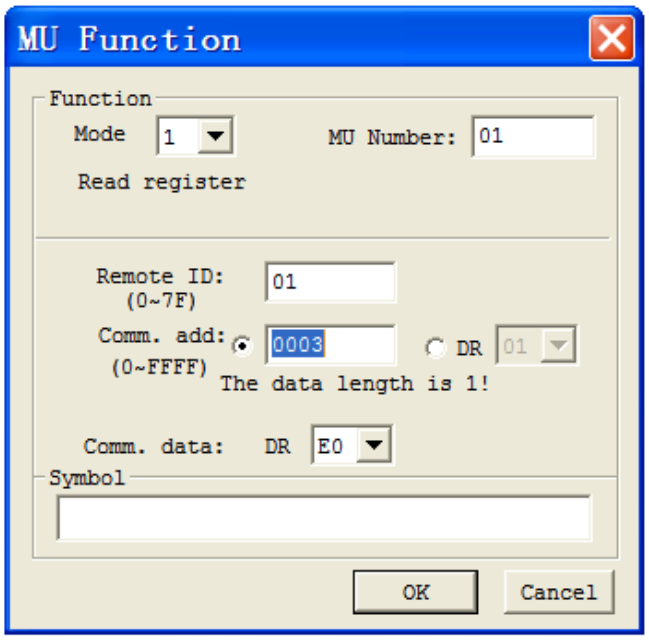
Baud rate (bps)	Time out (ms)
4800、9600、19200、38400	125
57600	100
115200	80

※ More information about communication to see: Chapter 7 20 Points RS485 type Models Instruction.

MU mode1: Read Registers

Setting communication address is constant:



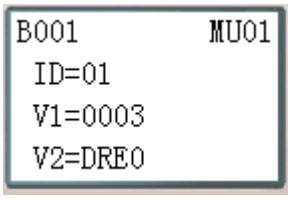


Address is constant 0003,
Data length is fixed at 1word,
Send data:
01 03 00 03 00 01 CRC16;

Received response form slave1:
01 03 02 data1 data2 CRC16;
Saving date to DRE0: DRE0 = data1~2

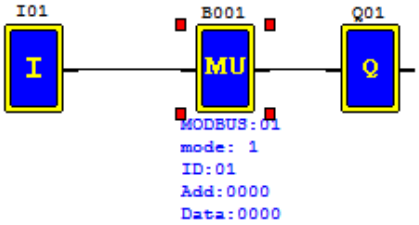
Mode1 FBD display Parameter display

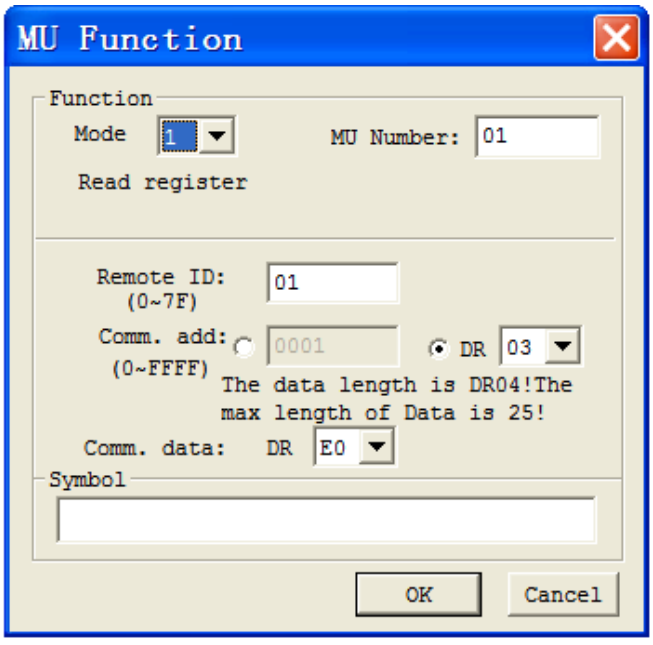
Enable Input →
Parameter →



← slave ID
← Register address
← Saving data address

Setting communication address is data register DR:



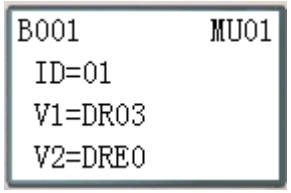


Setting address DR03=0001,
Setting data length DR04=0002,
Send data:
01 03 00 01 00 02 CRC16;

Received response from slave1:
01 03 04 data1 data2 data3 data4 CRC16;
Saving data to DRE0~DRE1:
DRE0 = data1~2, DRE1 = data3~4
※ the max length of data is 25.

Mode1 FBD display Parameter display

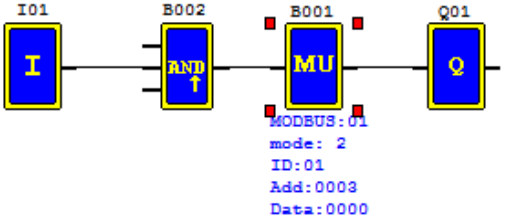
Enable Input →
Parameter →

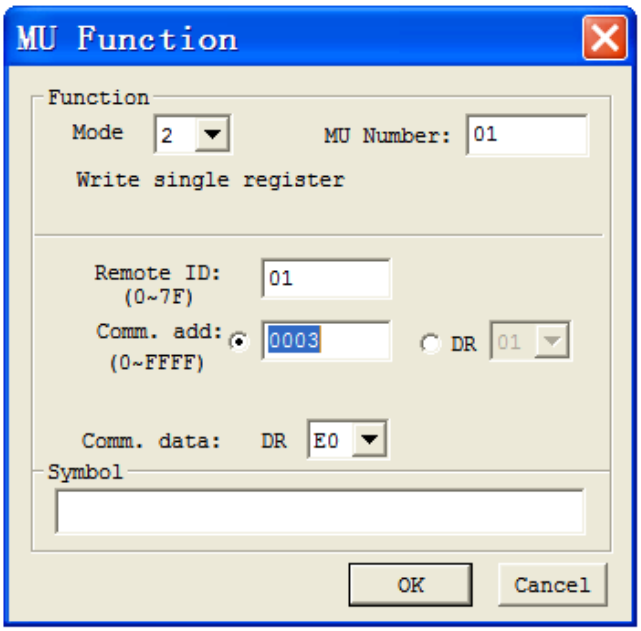


← slave ID
← Register address
← Saving data address

MU mode2: Write single register

Setting communication address is constant:



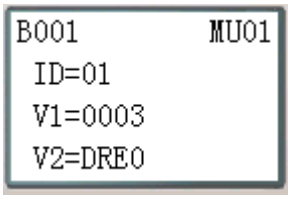


Address is constant 0003,
Setting data DRE0=1234 (hex: 04D2),
Send data:
01 06 00 03 04 D2 CRC16;

Received response from slave1:
01 06 00 03 04 D2 CRC16;

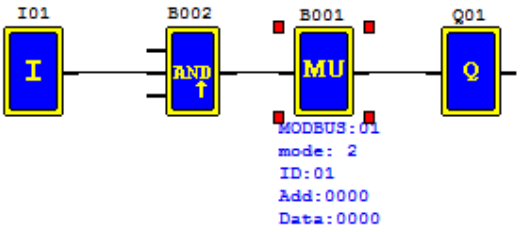
Mode2 FBD display Parameter display

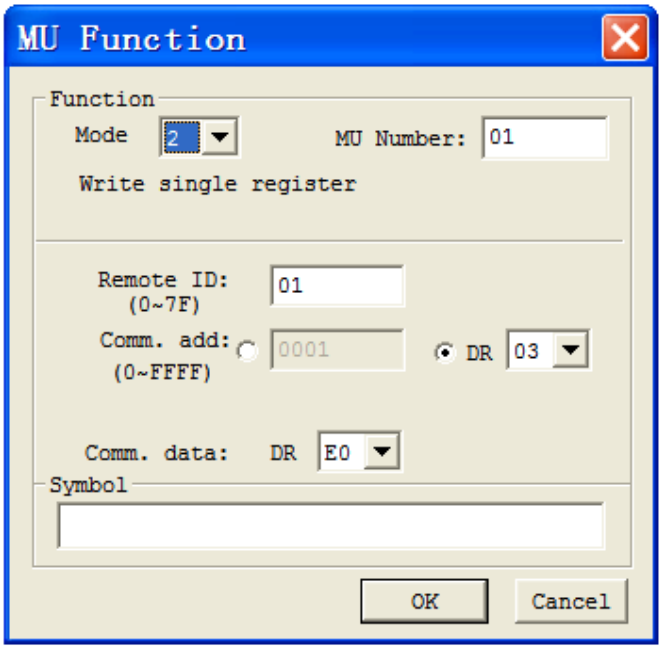
Enable Input →
Parameter →



← slave ID
← Register address
← Source data address

Setting communication address is data register DR:



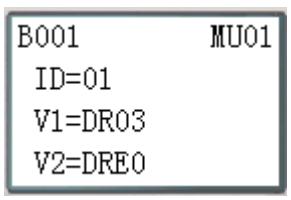


Setting address DR03=0001,
Setting data DRE0=1234 (hex: 04D2),
Send data:
01 06 00 01 04 D2 CRC16;

Received response from slave1:
01 06 00 01 04 D2 CRC16;

Mode2 FBD display Parameter display

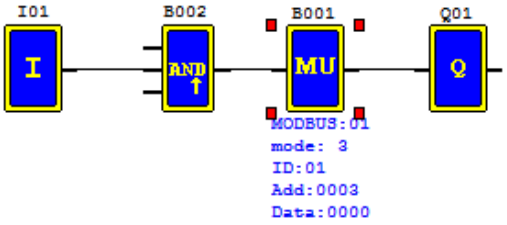
Enable Input →
Parameter →

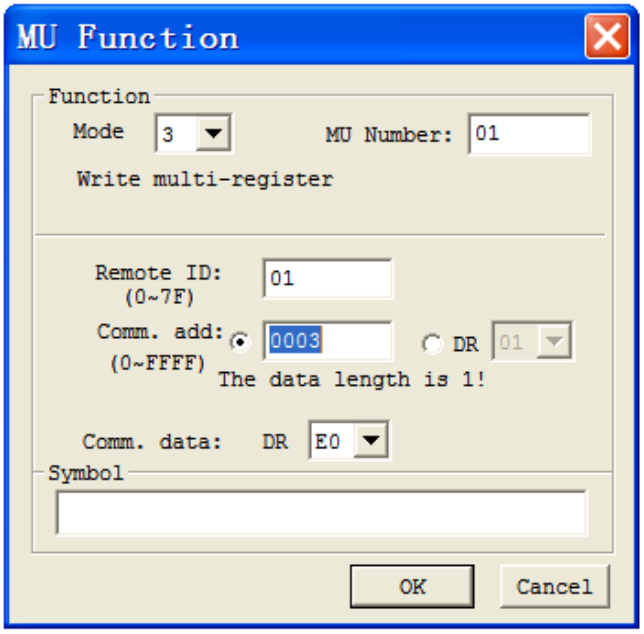


← slave ID
← Register address
← Source data address

MU mode3: Write Multiple Registers

Setting communication address is constant:

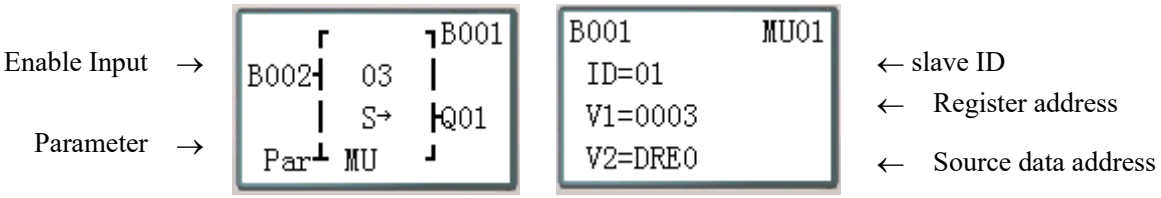




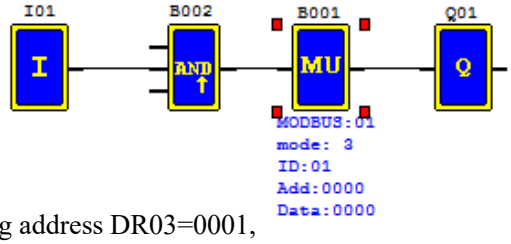
Address is constant 0003,
Data length is fixed at 1word,
Setting data DRE0=1234 (hex: 04D2),
Send data:
01 10 00 03 00 01 02 04 D2 CRC16;

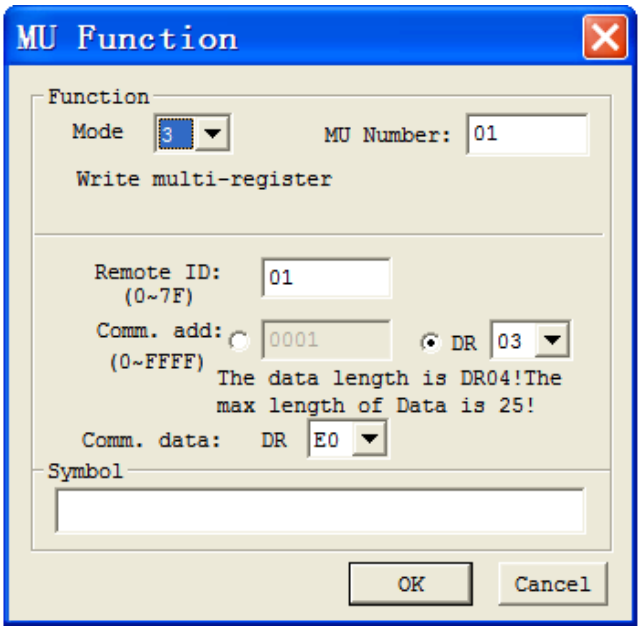
Received response from slave1:
01 10 00 03 00 01 CRC16;

Mode3 FBD display Parameter display



Setting communication address is data register DR:

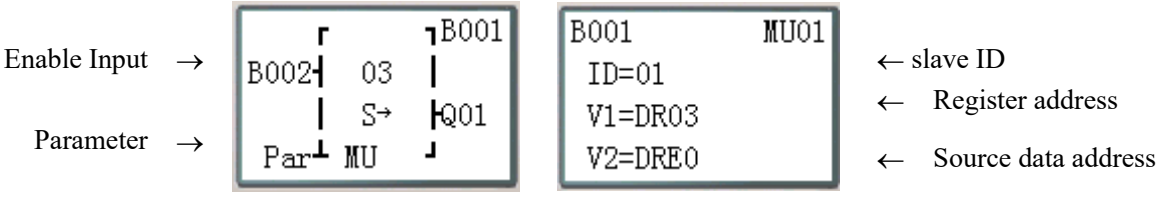




Setting address DR03=0001,
Setting data length DR04=0002,
Setting data DRE0=1234 (hex: 04D2),
Setting data DRE1=5678 (hex: 162E),
Send data:
01 10 00 01 00 02 04 04 D2 16 2E CRC16;

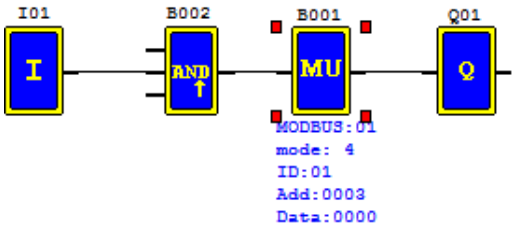
Received response from slave1:
01 10 00 01 00 02 CRC16;
※ the max length of data is 25.

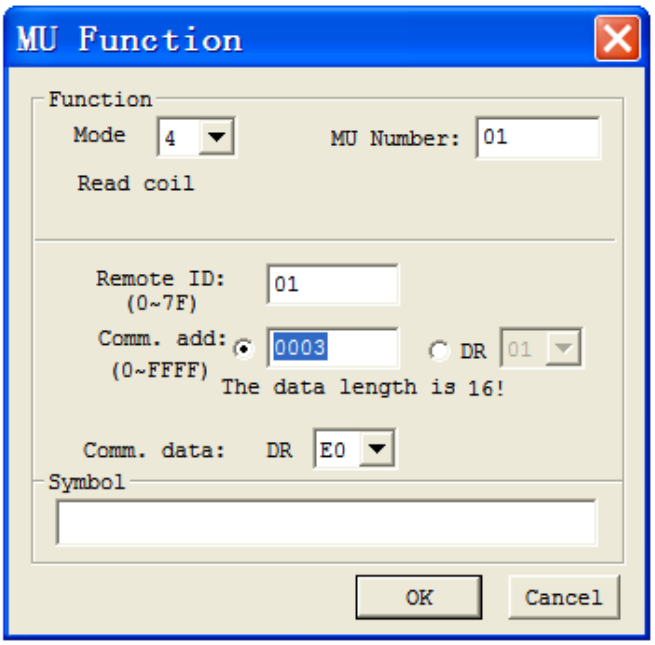
Mode3 FBD display Parameter display



MU mode4: Read Coils

Setting communication address is constant:



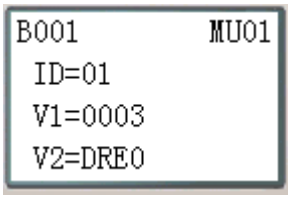


Address is constant 32 (hex: 0020),
Data length is fixed at 16 (hex: 10H, 1word),
Send data:
01 01 00 20 00 10 CRC16;

Received response from slave1:
01 01 02 data1 data2 CRC16;
Saving data to DRE0: DRE0 = data1~2

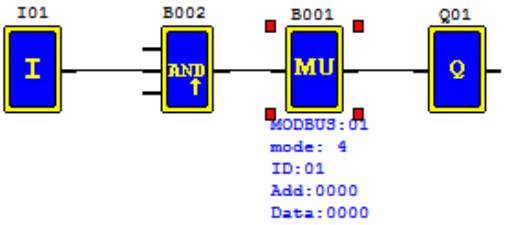
Mode4 FBD display Parameter display

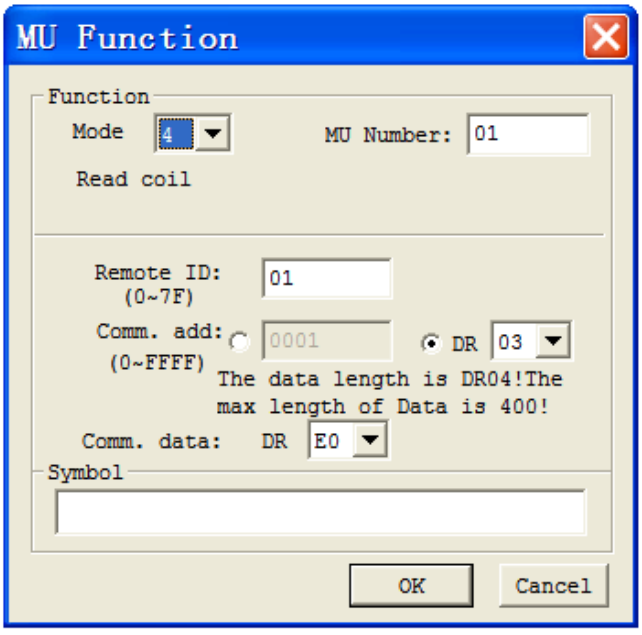
Enable Input →
Parameter →



← slave ID
← Register address
← Saving data address

Setting communication address is data register DR:



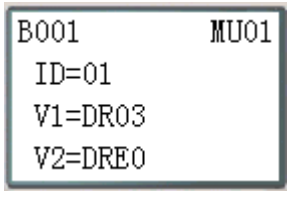


Setting address DR03=0001,
Setting data length R04=0015 (hex: 000F);
Send data:
01 01 00 01 00 0F CRC16;

Received response from slave1:
01 01 02 data1 data2 CRC16;
Saving data to DRE0: DRE0 = data1~2
※ the max length of data is 400.

Mode4 FBD display Parameter display

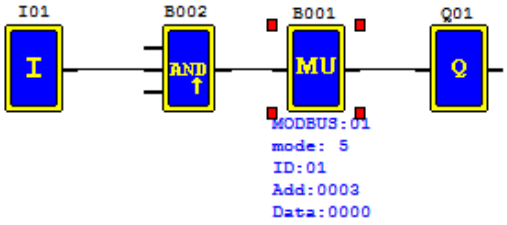
Enable Input →
Parameter →

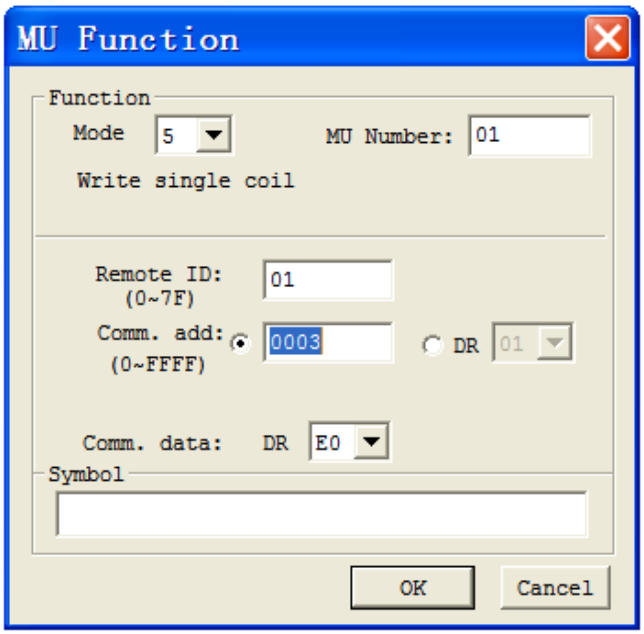


← slave ID
← Register address
← Saving data address

MU mode5: Write single coil

Setting communication address is constant:

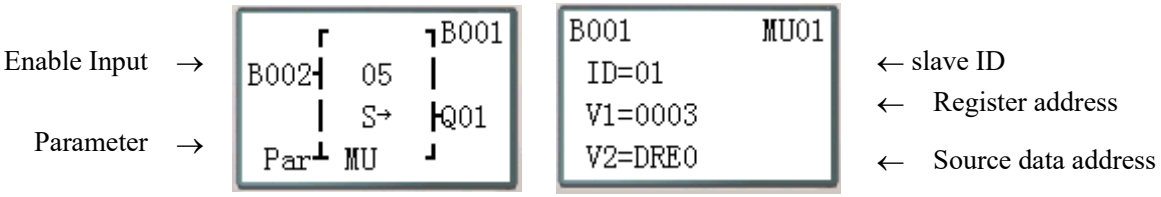




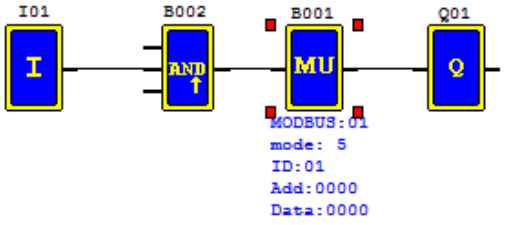
Address is constant 0003,
Setting data DRE0=65280 (hex: FF00),
Send data:
01 05 00 03 FF 00 CRC16;

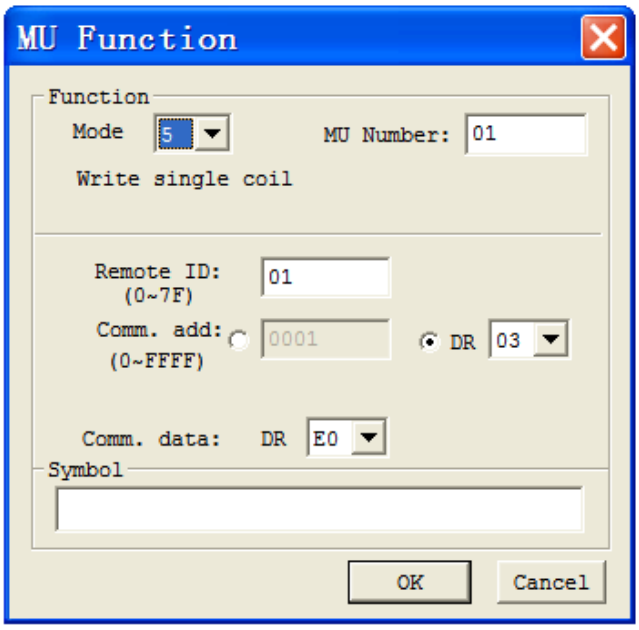
Received response from slave1:
01 05 00 03 FF 00 CRC16;

Mode5 FBD display Parameter display



Setting communication address is data register DR:

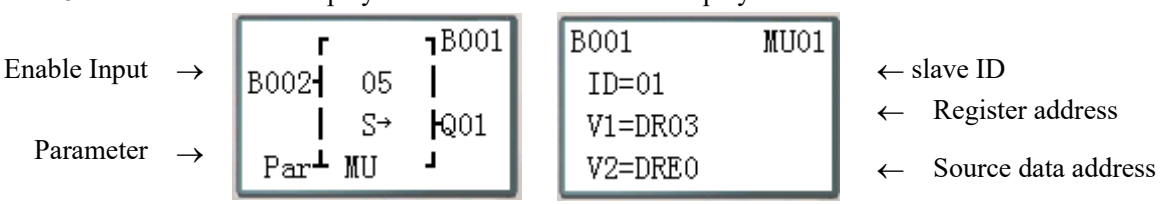




Setting address DR03=0001,
Setting data DRE0=65280 (hex: FF00),
Send data:
01 05 00 01 FF 00 CRC16;

Received response from slave1:
01 05 00 01 FF 00 CRC16;

Mode5 FBD display Parameter display



Chapter 7: Hardware Specification

Normal Specification

Content		Specification
Mode of user program		Ladder & FBD
Environmental	Operation temperature	-4° to 131°F (-20° to 55°C)
	Storage temperature	-40° to 158°F (-40° to 70°C)
	Maximum Humidity	90% (Relative, non-condensing)
	Operation Gas	No corrosive gases
Maximum Noise	Maximum Vibration	0.075mm amplitude, 1.0g acceleration according to IEC60068-2-6
	Shock Resistance	peak value 15g, 11ms according to IEC60068-2-27
	ESD	Contact ±4KV, air discharge ±8KV
	EFT	Power AC: ±2KV DC: ±1KV
	CS	0.15~80MHz 10V/m
	RS	80~1000MHz 10V/m
	EMI	EN55011 class B
installation	Enclosure Type	IP20
	Mounting mode	Direct Mounting or DIN-rail (35mm) Mounting
	Direction	According to chapter 2: Installing
Wiring		AWG 14/ψ2.6mm^2
size		2×90×59.6 mm(W×L×H) Din rail 72×126×59.6 mm(W×L×H) Direct

Product Specifications

	Part Number	Power	Digital In	Digital Out	Analogue In	Analogue Out	HMI	Comments
BASE MODELS	SMT-EA-R10-V4	100-240VAC	6 AC	4 (8A Rly)	-	-	Yes	
	SMT-EA-R20-V4	100-240VAC	12 AC	8 (8A Rly)	-	-	Yes	
	SMT-ED-R12-V4	24VDC	8 DC*1	4 (8A Rly)	2 (0-10V)	-	Yes	2 High Speed Inputs (up to 1kHz)
	SMT-ED-R20-V4	24VDC	12 DC*1	8 (8A Rly)	4 (0-10V)	-	Yes	2 High Speed Inputs (up to 1kHz)
	SMT-ED12-R12-V4	12VDC	8 DC*1	4 (8A Rly)	2 (0-10V)	-	Yes	2 High Speed Inputs (up to 1kHz)
	SMT-BA-R10-V4	100-240VAC	6 AC	4 (8A Rly)	-	-	No	
	SMT-BA-R20-V4	100-240VAC	12 AC	8 (8A Rly)	-	-	No	
	SMT-BD-R12-V4	24VDC	8 DC*1	4 (8A Rly)	2 (0-10V)	-	No	2 High Speed Inputs (up to 1kHz)
	SMT-BD-R20-V4	24VDC	12 DC*1	8 (8A Rly)	4 (0-10V)	-	No	2 High Speed Inputs (up to 1kHz)
	SMT-CD-R20-V4	24VDC	12 DC*1	8 (8A Rly)	4 (0-10V)	-	Yes	2 HSI (1kHz), RS485 Modbus, Link
	SMT-ED-T12-V4	24VDC	8 DC*1	4 (0.5A Tm)	2 (0-10V)	-	Yes	2 PWM (0.5kHz)
	SMT-ED-T20-V4	24VDC	12 DC*1	8 (0.5A Tm)	4 (0-10V)	-	Yes	2 PWM (0.5kHz)
	SMT-CD-T20-V4	24VDC	12 DC*1	8 (0.5A Tm)	4 (0-10V)	-	Yes	2 PWM (0.5kHz), RS485 Modbus
	SMT-ED12-R20-V4	12VDC	12 DC*1	8 (8A Rly)	4 (0-10V)	-	Yes	2 High Speed Inputs (up to 1kHz)
EXPANSIONS / EXTRAS	SMT-MA-R8	100-240VAC	4 AC	4 (8A Rly)	-	-	-	Maximum 3 per Base Unit
	SMT-MD-R8	24VDC	4 DC	4 (8A Rly)	-	-	-	Maximum 3 per Base Unit
	SMT-MD-T8	24VDC	4 DC	4 (0.5A Tm)	-	-	-	Maximum 3 per Base Unit
	SMT-MD-4AI	24VDC	-	-	4 (V, mA)	-	-	Maximum 1 per Base Unit
	SMT-4PT	24VDC	-	-	4 (PT100)	-	-	Maximum 1 per Base Unit
	SMT-2AO	24VDC	-	-	-	2 (V, mA)	-	Maximum 2 per Base Unit
	SMT-PC03	-	-	-	-	-	-	PC-Link Programming Cable
	SMT-PM04-V4	-	-	-	-	-	-	32K Flash Memory Moduole
	SMT-USB	-	-	-	-	-	-	USB Programming Cable
MADE TO ORDER	SMT-BD-T12-V4	24VDC	8 DC*1	4 (0.5A Tm)	2 (0-10V)	-	No	2 PWM (0.5kHz)
	SMT-BD-T20-V4	24VDC	12 DC*1	8 (0.5A Tm)	4 (0-10V)	-	No	2 PWM (0.5kHz)
	SMT-CD12-R20-V4	12VDC	12 DC*1	8 (8A Rly)	4 (0-10V)	-	Yes	RS485 Modbus, Link Function
	SMT-EA24-R12-V4	24VAC	6 AC	4 (8A Rly)	-	-	Yes	24VAC Inputs and Power
	SMT-EA24-R20-V4	24VAC	12 AC	8 (8A Rly)	-	-	Yes	24VAC Inputs and Power
	SMT-MA24-R8	24VAC	4 AC	4 (8A Rly)	-	-	-	24VAC Inputs and Power

*1 Analogue inputs can be used as digital inputs. Number shown includes this.

Power Specifications

iSmart Specifications

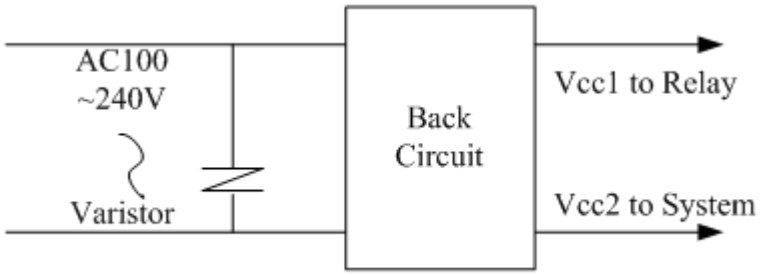
	AC Models		DC Models		Expansion Units
	Power	Digital In	Digital Out	Analogue In	
Operating Temperature	-20 to +55°C				
Storage Temperature	-40 to +70°C				
Humidity	5 - 90% RH no frost				
Vibration	IEC60068-2-6 (0.075mm Amplitude / 1G Acceleration)				
Impact Resistance	IEC60068-2-28 (15g peak, 1ms duration)				
Installation	IP20, Direct or DIN Rail Mount (TS35 - 35mm)				
Noise Resistance	ESD: ±4kV, Air Discharge: ±8kV, EFT: Power AC: ±2kV, AC: ±1kV, CS: 0.15-80mHz 10V/m, RS: 80-1000mHz 10V/m, EMI: EN55011 Class B				
Approvals	CE, UL, cUL				
RTC Clock Accuracy	Max. 6 minutes/month, 1 Farad Capacitor for 200hr run-on after power-down				
Dimensions	72x90x59.6mm	126x90x59.6mm	72x90x59.6mm	126x90x59.6mm	38x90x59.6mm
Weight	230g	335g	220g	345g	150g
Power Supply	85-260VAC, 19.6-28.8VAC (24V)		19.6-28.8VDC (24V0, 10.2-13.8VDC (12V)		Same as equivalent Base Unit
Power Consumption	3.2W	12W	2W	3.1W	1W
Input Threshold	ON: >79VAC, OFF: <40VAC		ON: >15VDC, OFF: <5VDC		Same as equivalent Base Unit
Input Current	1.3mA		3.2mA		Same as equivalent Base Unit
Input Impedance	200kΩ		8kΩ		Same as equivalent Base Unit
Inpupt Response Time	50-90ms (240-120VAC)		3.5ms		Same as equivalent Base Unit
Input Max. Voltage	260VAC		30VDC		Same as equivalent Base Unit
High Speed Input (Hz)	-		1000 (I1), 500/500 (I1/I2)		-
Standard Input (Hz)	-		<40		<40
Max. Digital Output Current	Relay: 8A (Resistive), 2A (Inductive)		Relay: 8A(R), 2A(I), Trans: 0.5A(R), 0.2A(I)		Same as equivalent DC model
Min. Digital Output Current	16.7mA		0.2mA		Same as equivalent Base Unit
PWM Transistor O/P (Hz)	-		500 (1ms ON, 1ms OFF)		-
Relay Life (No Load)	10 million operations				
Analogue Input Range	-		0.00 to 9.99V		0.00 to 9.99V
Analogue Input Resolution	-		12 bit nominal (0.01V)		12 bit nominal (0.01V)
Analogue Input Impedance	-		45kΩ		22.5kΩ
RTD Input Range	-				-100 to +600°C
RTD Input Resolution	-				0.1°C
RTD Excitation Current	-				0.33mA
Analogue Output Range	-				0-10V, 4-20mA
Analogue Output Resolution	-				0.01V, 0.01mA
Program Size	1200 Steps (600 Lines of Ladder), 500 Function Blocks				-

24V AC model Specifications

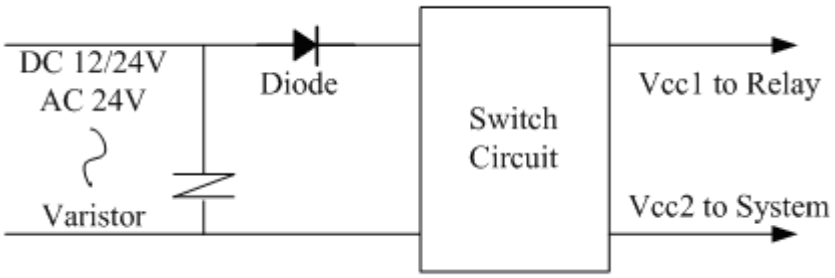
content	**SMT-EA-R10-V4**		**SMT-EA24-R20-V4**	
Voltage Rating	AC 24V		AC 24V	
operation Power range	20.4~28.8V AC		20.4~28.8V AC	
instantaneous power down time allowable	10 ms(half cycle) / 20 times		10 ms(half cycle) / 20 times	
fuse	Need connect a fuse or breaker of Current 1A		Need connect a fuse or breaker of current 1A	
Isolation	None		None	
Current average	AC 24V	AC 28.8V	AC 24V	AC 28.8V
	All inputs and relays are ON 270mA	All inputs and relays are ON 250mA	All inputs and relays are ON 290mA	All inputs and relays are ON 260mA
	All inputs and Relays are OFF 160mA	All inputs and Relays are OFF 160mA	All inputs and Relays are OFF 200mA	All inputs and Relays are OFF 200mA
Consume power	6.5W		7 W	

Power circuitry diagram

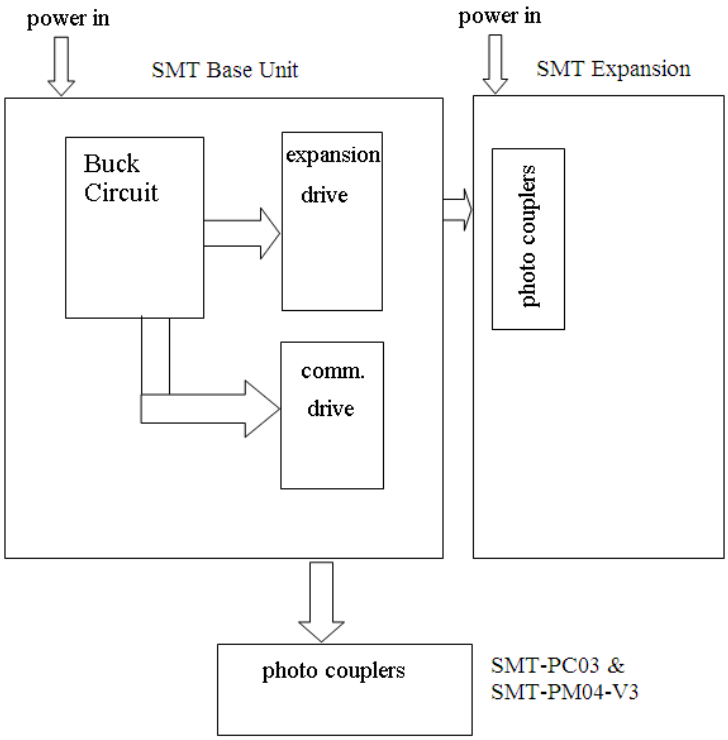
1) AC 10/20 points



2) DC 24V

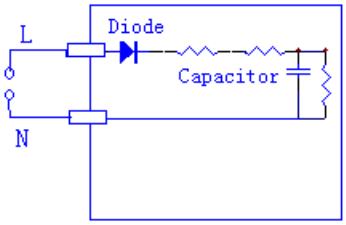


3) Mainframe, expansion, and communication

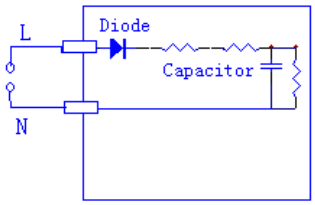


Input Specifications

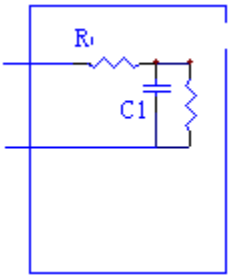
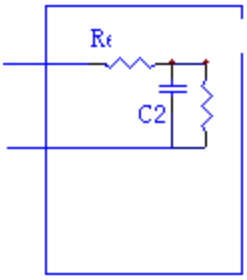
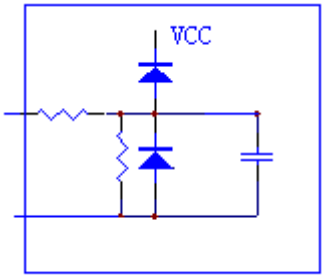
100~240V AC model

content	SMT-EA-R10-V4 SMT-BA-R10		SMT-EA-R20-V4 SMT-BA-R20	
Input circuitry	I01~I06		I01~I09, I0A, I0B, I0C	
				
number	6(digital input)		12(digital input)	
Signal current input	AC 110V 0.66mA	AC 220V 1.3mA	AC 110V 0.55mA	AC 220V 1.2mA
ON current input	> AC 79 V /0.41mA		> AC 79 V/ 0.4mA	
OFF current input	< AC 40 V /0.28mA		< AC 40 V / 0.15mA	
wire length	< / = 100 m		< / = 100 m	
response time of input	On=>Off		On=>Off	
	Typical 50/60 Hz 50/45 ms(AC 110 V)		Typical 50/60 Hz 50/45 ms(AC 110 V)	
	Typical 50/60 Hz 90/85 ms(AC 220 V)		Typical 50/60 Hz 90/85 ms(AC 220 V)	
	Off=>On		Off=>On	
	Typical 50/60 Hz 50/45 ms(AC 110 V)		Typical 50/60 Hz 50/45 ms(AC 110 V)	
	Typical 50/60 Hz 22/18 ms(AC 220 V)		Typical 50/60 Hz 22/18 ms(AC 220 V)	

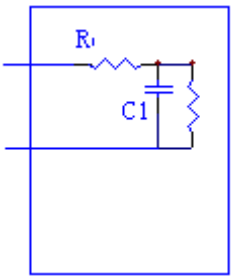
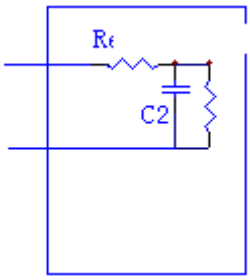
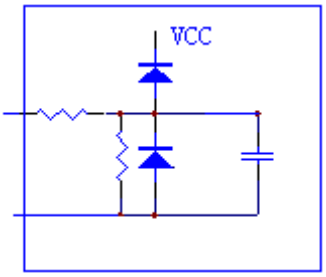
24V AC model

content	SMT-EA24-R10-V4	SMT-EA-R20-V4
Input circuitry	I01~I06, I09,I0A	I01~I09, I0A, I0B, I0C
		
number	6(digital input)	12(digital input)
Signal current input	3mA	3mA
ON current input	> AC 14 V /3mA	> AC 14 V/ 3mA
OFF current input	< AC 6 V /0.85 mA	< AC 6 V / 0.85mA
wire length	< / = 100 m	< / = 100 m
response time of input	On=>Off	On=>Off
	Typical 50/60 Hz 90/90ms	Typical 50/60 Hz 90/90ms
	Off=>On	Off=>On
	Typical 50/60 Hz 90/90ms	Typical 50/60 Hz 90/90ms

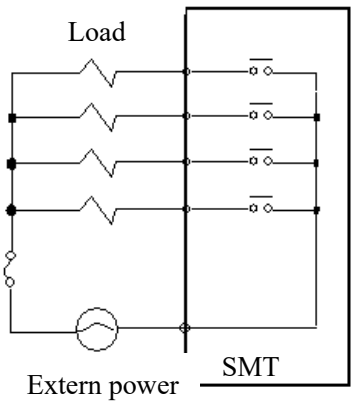
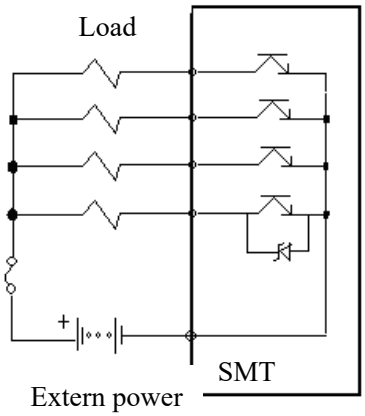
24V DC, 12 I/O model

content	**SMT-ED-R12-V4 & SMT-ED-T12-V4**			
	Normal digital input	**High speed input**	**Analog input used as normal digital input**	**Analog input**
Input circuitry	I03~I06 	I01,I02 	I09,I0A 	
number	4	2	2	2
Signal current input	3.2mA/24V DC	3.2mA/24V DC	0.63mA/24V	<0.17 mA/10V
ON current input	>1.875mA/15V	>1.875mA/15V	>0.161mA/9.8V	
OFF current input	< 0.625mA/5V	< 0.625mA/5V	< 0.085mA/5V	
wire length	< / = 100 m	< / = 100 m	< / = 100 m	< / = 30 m(shield wire)
response time of input	On=>Off	On=>Off	On=>Off	
	3ms	0.3ms	Typical: 5ms	
	Off=>On	Off=>On	Off=>On	
	5ms	0.5ms	Typical: 3ms	
Input voltage				0~10 V DC
Precision class				0.01V DC
bit of conversion				12
error				±2%±0.12V
Conversion time				1 cycle
sensor resistance				<1K ohm

24V DC, 20 I/O model

content	**SMT-ED-R20-V4 & SMT-CD-R20-V4 & SMT-CD-T20-V4**			
	Normal digital input	**High speed input**	**Analog input used as normal digital input**	**Analog input**
Input circuitry	I03~I08 	I01,I02 	I09,I0A,I0B,I0C 	
number	6	2	4	4
Signal current input	3.1mA/24V DC	3.1mA/24V DC	0.63mA/24V	<0.17 mA/10V
ON current input	>1.875mA/15V	>1.875mA/15V	>0.163mA/9.8V	
OFF current input	< 0.625mA/5V	< 0.625mA/5V	< 0.083mA/5V	
wire length	< / = 100 m	< / = 100 m	< / = 100 m	< / = 30 m(shield wire)
response time of input	On=>Off	On=>Off	On=>Off	
	5ms	0.5ms	Typical: 5ms	
	Off=>On	Off=>On	Off=>On	
	3ms	0.3ms	Typical: 3ms	
Input voltage				0~10 V DC
Precision class				0.01V DC
bit of conversion				12
error				±2%±0.12V
Conversion time				1 cycle
sensor resistance				<1K ohm

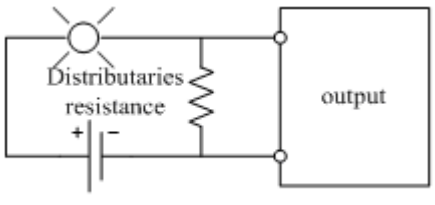
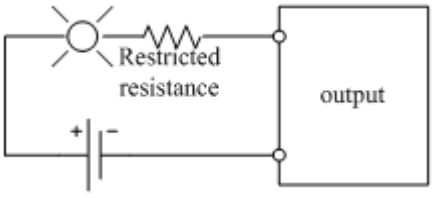
Output Specifications

content		relay	transistor
output circuitry			
Extern power		Less than AC265，DC30V	23.9~24.1V
circuitry isolation		mechanism isolation	Photo couplers isolation
Maximal Load	Resistive	8A/point	0.3A/point
	Inductive	—	—
	light	200W	10W/DC 24V
Open drain current		—	<10uA
Minimum Load		—	—
Response time	OFF⟶ ON	15 ms	25 us
	ON ⟶OFF	15 ms	Less than 0.6 ms

Output Port wiring notice

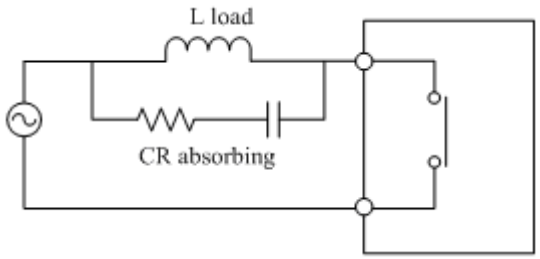
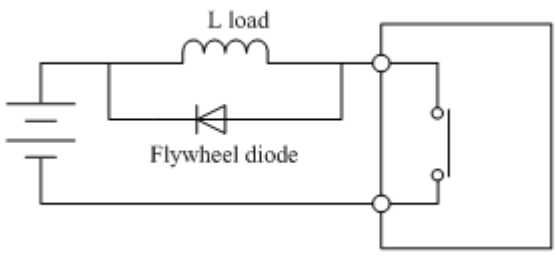
Light Load

The current value will be 10~20 times the normal rated value for several milliseconds when the filament is first powered. A distributed resistance or current choke should be added to the circuit to reduce the in-rush current level.

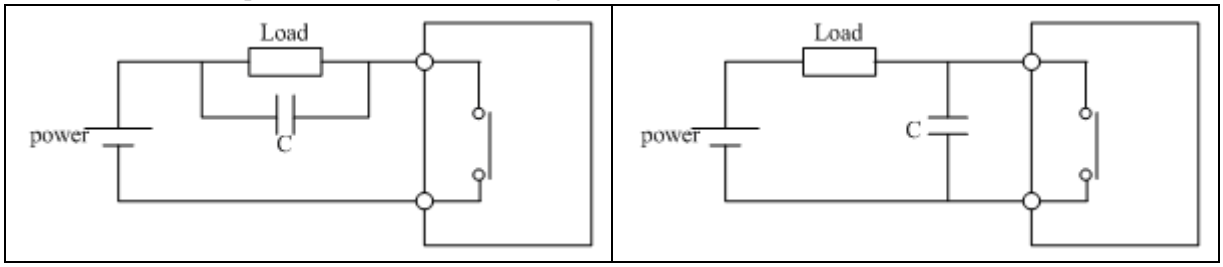
distributaries resistance	restricted current resistance
	
There is a little current makes light shine faintness, so the value of resistance must be careful.	The brightness will not be bright if the resistance value is too big.

Inductance Load

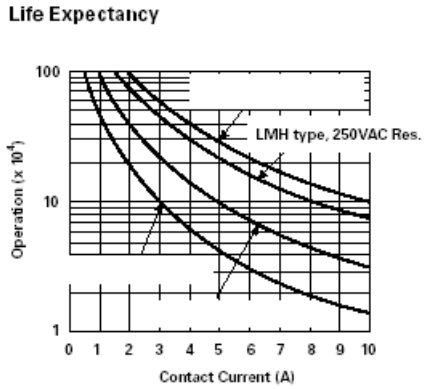
There will be a surging voltage (KV) when the inductance load switches between ON and OFF, especially for the relay model. The methods to different power mode to absorb the surging voltage are shown below.

a. AC power，CR absorbing	b. DC power，flywheel diode
	

Please do note use capacitance alone as absorbing as shown below.



Life of relay



※ The data of picture above is standard, but the life of relay is influenced by the temperature of operation environmental.

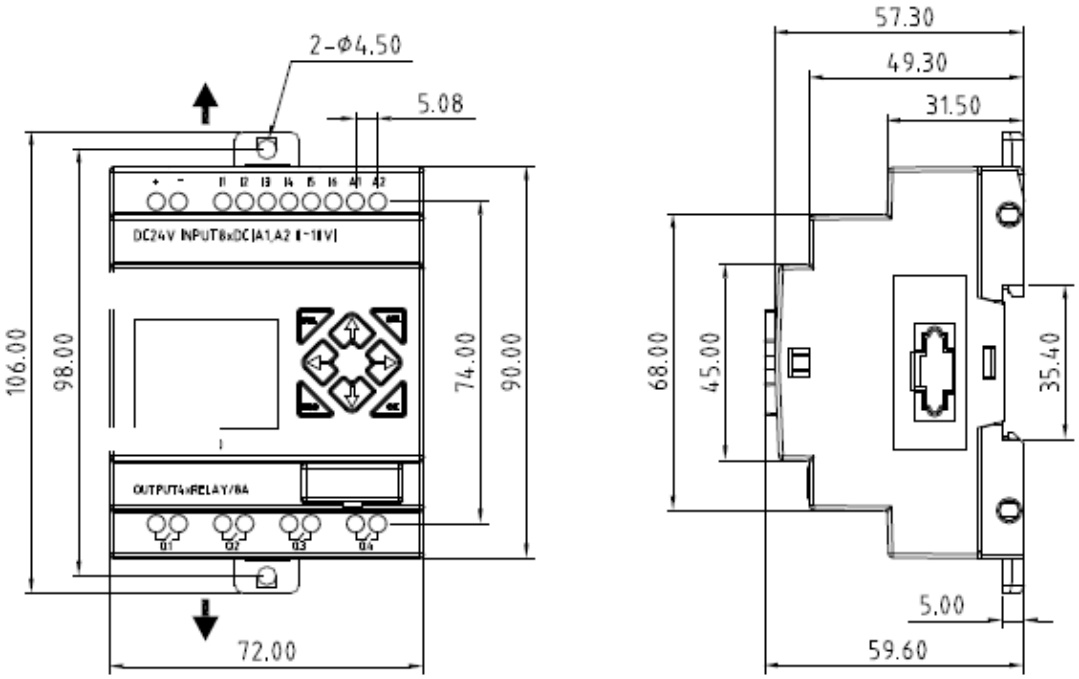
※ The life is more than 100K times if the current is less than 2A.

Power mode

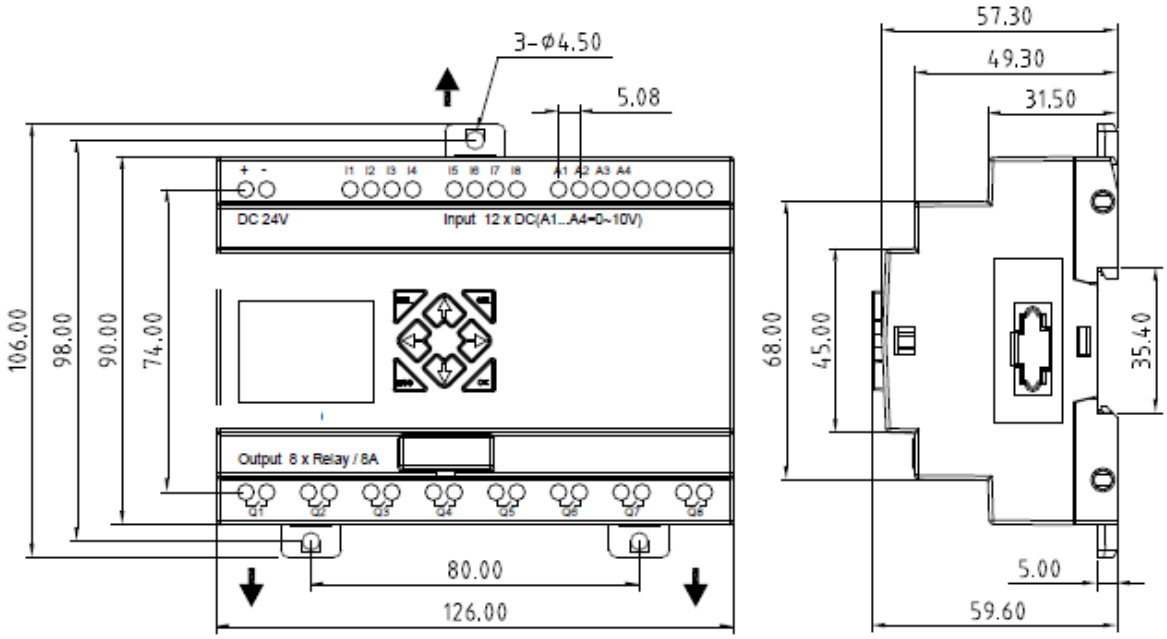
Mode	Input/Output
DC +12V	AC 100~240V / DC +12V
DC +24V	AC 100~240V / DC +24V

Size diagram of iSmart

10/12 points



20 points



Chapter 8: 20 Points RS485 type Models Instruction

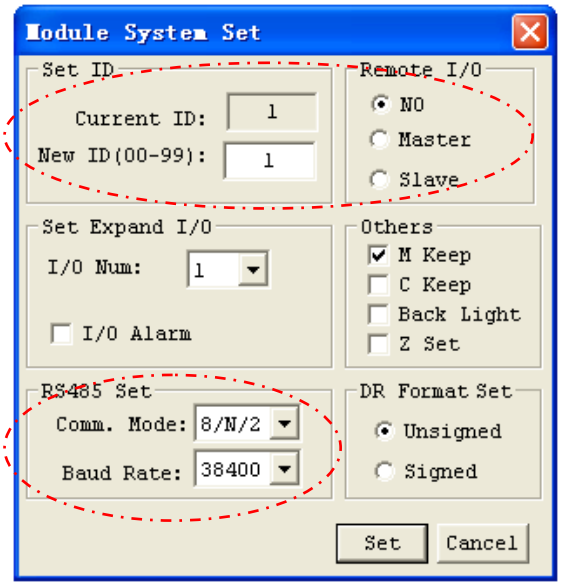
Only SMT-CD-R20-V4, SMT-CD-T20-V4 -do have RS485 communication function.

Communication function

There are many parameters needed to be set before user uses the RS485 communication function. And there are two ways to set that parameter.

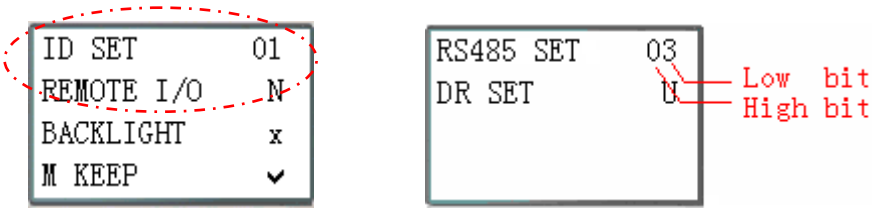
●. Setting parameters via SMT Client software:

1. In SMT Client Soft Select **Operation**>>**Module System Set**;
2. Open the dialog box as show below, setting parameters **SET ID**, **Remote I/O** and **RS485 Set**.



●. Setting parameters via keypad button on iSmart.

1. Press button to enter main menu.
2. Press UP/DOWN to choose SET menu and press OK to enter it.
3. Press UP/DOWN makes the LCD to display the options as show below, setting parameters **ID SET**, **REMOTE I/O** and **RS485 SET**.



4. Parameter **RS485 SET**, high bit means communication format and low bit means Baud Rate.
5. Press OK button to save setting.

Function parameters:

ID SET	01	→	ID setting (00~99)
REMOTE I/O	N	→	Remote I/O Mode (N: none M: Master S: Slave)

Function description:

Function	ID SET	REMOTE I/O	Description
Remote IO function	00~99	M & S	Up to 2 additional iSmart units can be configured as Remote I/O nodes (master and slave);
IO Link function	0~7	N	Up to 8 additional iSmart units can be configured as IO Link and ID must be continuous 0~7;
MU instruction	1~99	N	MU can be enabled only when no remote IO function and IO Link function;
Modbus RTU slave	1~99	N	Modbus RTU slave is effective when no remote IO function, IO Link function and MU instruction;

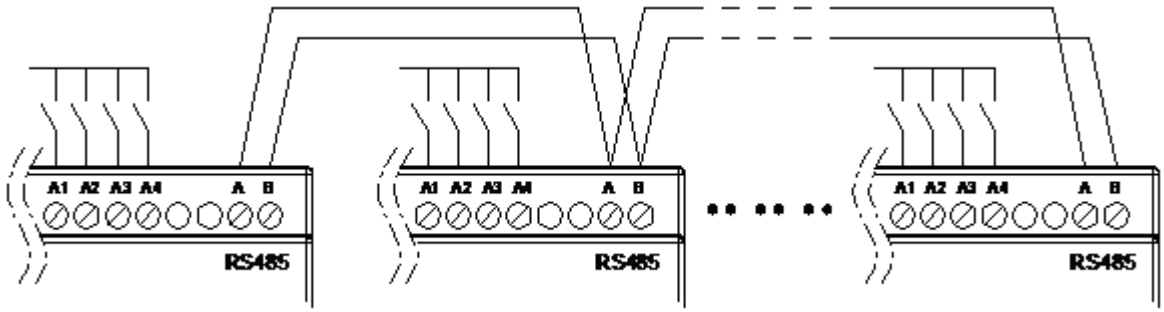
Communication parameters:

Content	Data	Meaning
Format	0	8/N/2 Data 8bits, No Parity, 2 Stop bits.
	1	8/E/1 Data 8bits, Even Parity, 1 Stop bit.
	2	8/0/1 Data 8bits, Odd Parity, 1 Stop bit.
	3	8/N/1 Data 8bits, No Parity, 1 Stop bit.
Baud Rate	0	4800 bps
	1	9600 bps
	2	19200 bps
	3	38400 bps
	4	57600 bps
	5	115200 bps

※ iSmart default ID SET=1, and REMOTE I/O=N (no remote I/O).

※ iSmart RS485 port default communication format is 8/N/2 (Data 8bits, No parity, 2 stop bits) and baud rate is 38400bps.

※ The communication parameter setting takes effect after power up again.



Detail instruction

Remote IO function

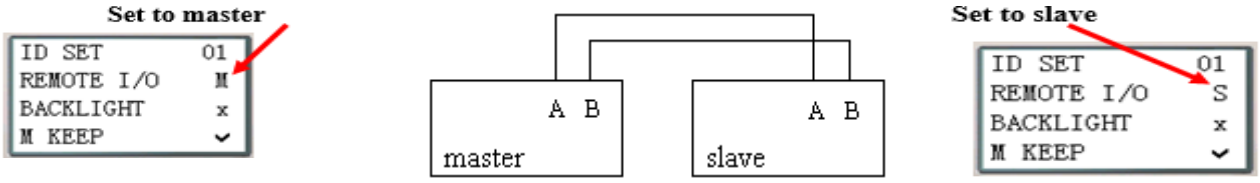
Function Description:

Remote IO function can make one iSmart as master link to another iSmart as slave; the master can perform its program, but the slave cannot. The ON/OFF state of the output coil Q in slave will affect the ON/OFF state of the expansion output coil Y in master. In addition, the ON/OFF state of input coil X in master depends on the state of the input coil I in slave.

I/O Address	Master	Slave
Input Coils	I01~I0C	
Output Coils	Q01~Q08	
Expansion Input Coils	X01~X0C	I01~I0C
Expansion Output Coils	Y01~Y08	Q01~Q08

Hardware Configuration:

1. Link two “CD” type iSmart as illustration show below.
2. Assign left iSmart in the illustration as master.
3. Set another iSmart to Slave.



The program in master is valid, but the one in slave is not.

Do not use expansion DI/DO modules, when remote I/O function is enabled.

Example:

Create a Ladder program as show below is written in master.

X02————————— Y01
X03————————— Y02

If input coils I02 and I03 in the Slave turn ON. X02 and X03 in master will also turn ON due to the influence of I02 and I03 in the Slave. Obviously, Y01 and Y02 in the master will turn ON, and then it causes Q1 and Q2 switching ON. See the consequence on the IO interface as shown in below.

I/O State on Slave Run mode

```
I .1 2 3 4 5 6 7 8 9 0 A B C
Z.1 2 3 4
Q.1 2 3 4 5 6 7 8 9 0 A B C
            MO 14 : 42
```

I/O State on Master Run mode

```
X. 1 2 3 4 5 6 7 8 9 0 A B C
Y. 1 2 3 4 5 6 7 8 9 0 A B C
EXE
            2010.05.09
```

IO Link Function

Function Description:

Up to 8 iSmart units can be linked together as the IO Link Network. Each unit runs their own logic program; the ON/OFF state of input, output points, and Auxiliary Coils in each one can be assigned to "W Table", see the next page for more information. There must be one master (ID=00) and several slaves with the continuous ID number starting from 01 in the network. The master one does not perform the IO Link function to the units with the ID behind the first broken number once the ID numbers are not continuous. For example, the slaves' ID are 01, 02, 04 and 05, the master just can recognize only two Slave, ID 01 and 02, the ID 04 and 05 will be skipped.

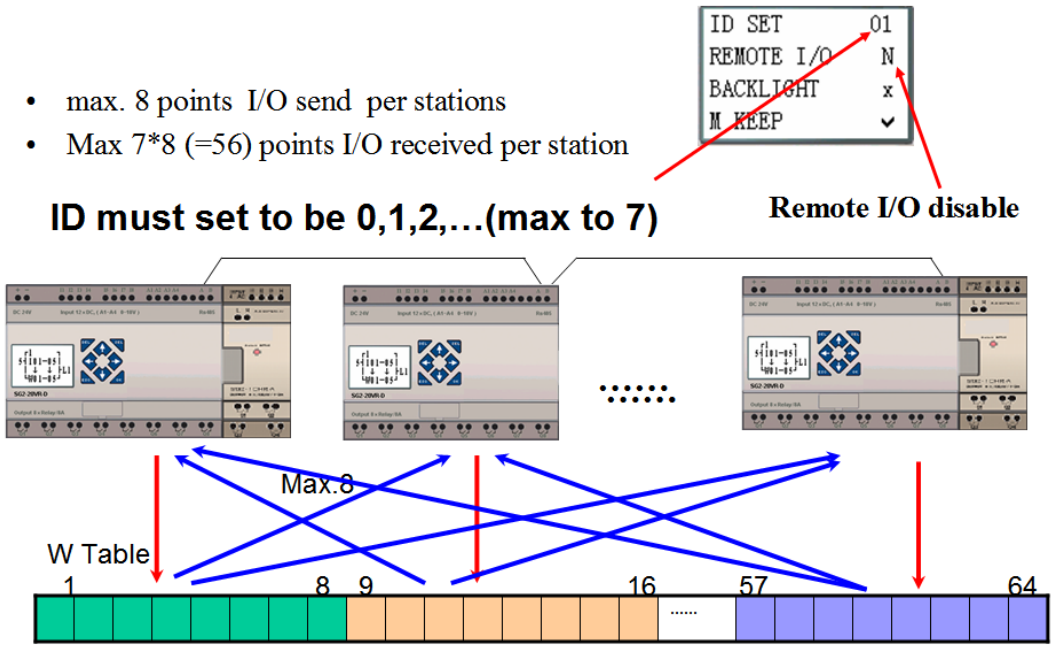
One controller can use 8 IO Link (L01~L08). Only one IO Link instruction can work at Mode 1(Write mode), and the other IO Link instructions must be Mode 2 (Grab mode).

The Mode 1: Write the ON/OFF states of the selected coils into the chosen W elements. The available W elements in the mode 1 depend on the ID setting of that unit, refer to the table in the previous page for more information.

The Mode 2: Grab the states of the selected W elements and substituting the state of the selected coil. If the select coil type is input coil I or X, coil status cannot be changed by the state of W elements.

Hardware Configuration:

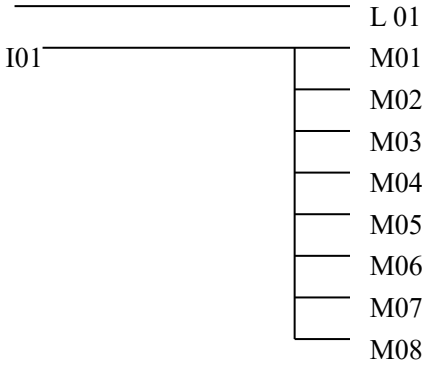
1. Link not more 8 RS485 iSmart units as show below.
2. Set all the iSmart in SET menu to No Remote IO.
3. Set those iSmart's ID continuously 00, 01, 02… The max number of the ID is 07.



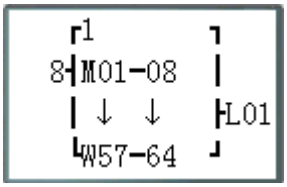
ID	Memory list location
0	W01~W08
1	W09~W16
2	W17~W24
3	W25~W32
4	W33~W40
5	W41~W48
6	W49~W56
7	W57~W64

Example:

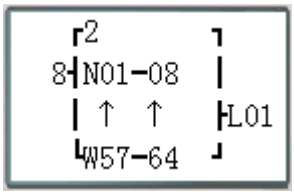
1. Link 8 20 pointes RS485 models iSmart according to the steps of the Hardware Configuration.
2. Create a ladder program as show below in those 8 iSmart.



3. Set L01 of the iSmart which's ID =7 as fellow illustration.



4. L01 of other 7 iSmart set as fellow illustration.



5. Run program and let I01 of the iSmart which's ID = 7 on. And M01~M08 will be on state.
6. You will find N01~N08 of other 7 iSmart will be controlled by the M01~M08 of the iSmart which's ID=7.

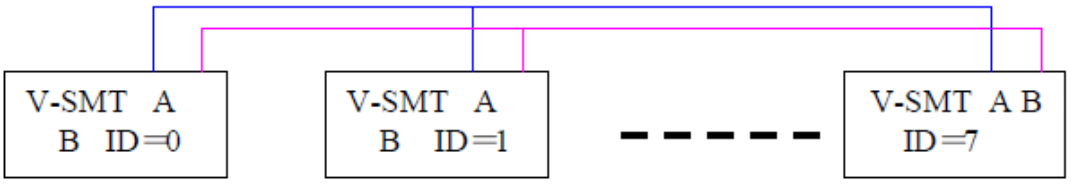
MU instruction (Modbus RTU master)

MU function performs Modbus RTU communication at RS485 port. There are 15 MU coils can be used in ladder mode, MU01~MU0F, and up to 250 MU function blocks diagram in FBD mode.

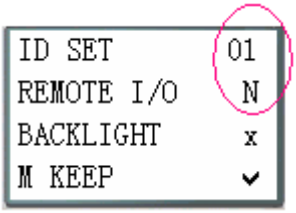
There can be several MU commands executed at the same time, but only one command can be performed, the rest are postponed until the performed one is accomplished.

Hardware Configuration:

1. Connect the RS485 port A on each iSmart unit together, also do it to port B, as shown in below figure.



2. Set iSmart in the SET menu to No Remote IO.
3. Set iSmart ID = 01~99.



Function mode corresponding communication function code:

mode	Communication function code
1	03 (Read Registers)
2	06 (Write Single Register)
3	10 (Write Multiple Registers)
4	01 (Read Coils)
5	05 (Write Single Coil)

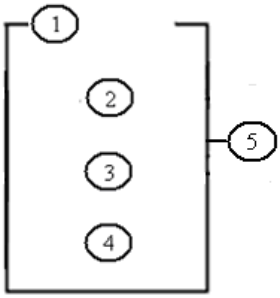
The M coil used for Modbus function:

Received (M3D)	M3D turns ON after received, then check-up for error. Transferring data to target address if there is no error.
Error flag (M3E)	communication error flag
Time out flag (M3F)	M3F turns ON when the master does not get any response from slave within certain time. M3F will automatically reset if M3D reset.

The time of time out is depending on communication baud rate as shown in the table below:

Baud rate (bps)	Time (ms)
4800、9600、19200、38400	125
57600	100
115200	80

In Ladder mode, there are 5 parameters in Modbus function as shown in below.

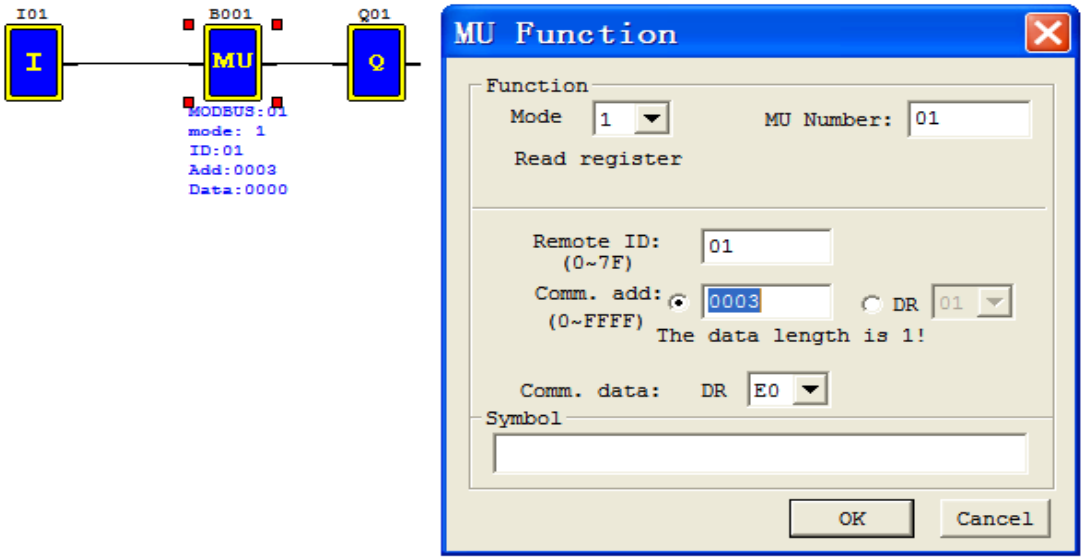


symbol	Description
①	MU mode (1~5)
②	ID number of the target unit: range from 0 to127
③	The address of target register in that unit: 1) address is assigned to a constant, range from 0000 to ffff; • Just do the read/write function to the register with one data length/address in mode 1 and 3. • Do the read/write function to the coil with one data length/address in mode 4 and 5. 2) The address refers to the content of DR coil, and the value of coil behind this one determines how many registers or coil will be read or write, see the next five pages for more information.
④	DR code, store sending/receiving data from this DR
⑤	MU code (MU01~MU0F)

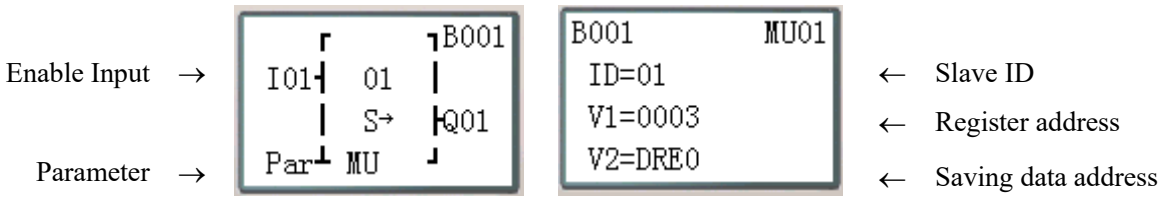
More description and examples to see Chapter5: Relay Ladder Logic Programming-MU (Modbus).

※ The max data length for Mode 1 and 3 is 25words. The max data length for Mode 4 is 400bits.

In FBD mode, program, edit and parameter display as shown blow;



Mode1 FBD display Parameter display



More description and examples to see Chapter6: FBD Block Diagram Programming-MU (Modbus) function block.

※ The max data length for Mode 1 and 3 is 25words. The max data length for Mode 4 is 400bits.

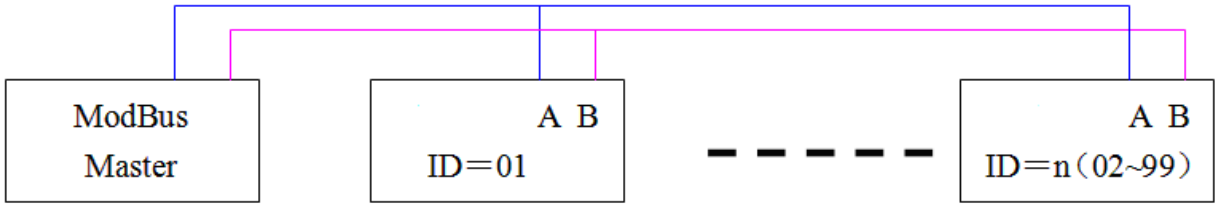
Modbus RTU slave function

Function Description:

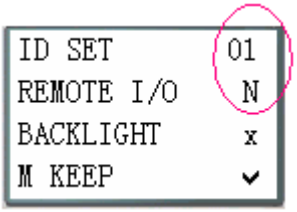
iSmart unit can be controlled by the computer or other controller using the communication control. PC and other controller can read and write IO state, preset value of the elements and the setting of the unit. It also can use to read the current value of the element and control the Run/Stop mode of iSmart. The maximum frame length in communication format is 128bytes.

Hardware Configuration:

1. Connect the RS485 port A on each iSmart unit together, also do it to port B, as shown in below figure.



2. Set iSmart in the SET menu to No Remote IO.
3. Set iSmart ID = 01~99.



iSmart Modbus protocol

If iSmart receive a correct frame, it will carry out the command, its responses a correct frame to computer or other controller. If the command that iSmart received is incorrect, iSmart responses Exception code to computer or controller.

● Command format and Response format

CRC verifying range ⟷			
Slave address	Function code data	Data	CRC-16

● The Response command format, once iSmart receive an unexpected command.

CRC verifying range ⟷			
Slave address	Function code	Exception code	CRC-16

Command Format:

Slave address	Function code		Data	CRC-16	Exception code
00H: broadcast to all the drivers	01H	Read coils	For detail please refer register address	CRC verifying range contain Slave Address Function Code Exception Code	For detail, please refer Exception Code Instruction
01H: to the No.01 driver	05H	Write single coil			
0FH: to the No.15 driver	03H	Read registers			
10H: to the No.16 driver	06H	Write single register			
….	10H	Write multiple registers			
63H: to the No.99 driver	08H	diagnostic			

Exception Code

The controller responses the Exception Code and send Function Code added 80H to main system if there is error happened.

Exception Code	Description
51	Frame error (Function Code error, Register Encoding error, Data Quantity Error)
52	Command can not be carried out in the RUN mode
53	Command can not be carried out in Cipher mode
54	Data value is over range
55	Reserved
56	Reserved
57	Other error
58	Commands do not match the present edited mode (Ladder or FBD)
59	Reserved

Register Address

Register address	Function	Usable command	
0000H~0016H	Coil status (word) address	03H, 06H, 10H	
0100H~012FH	Control register	03H, 06H, 10H	
0200H~0237H, 0260H	Current value of register	03H	
0300H~033BH	User character address	03H, 0H	
0400H~043EH	Preset value of register	03H, 10H	
0500H~05FFH	Coil status (bit) address	01H, 05H	
0600H~0630H	Coil status (word) address	03H, 06H, 10H	New command for iSmart
0700H~072FH	Control register	03H, 06H, 10H	
0800H~11EFH	Current value of register	03H	
1200H~2703H	Preset value of register	03H, 06H, 10H	
2B00H~2E0FH	Coil status (bit) address	01H, 05H	

.

Chapter 9: Expansion Module

Summarize

Digital Input/Output module:SMT-MA-R8 , SMT-MD-8 ,SMT-MD-T8

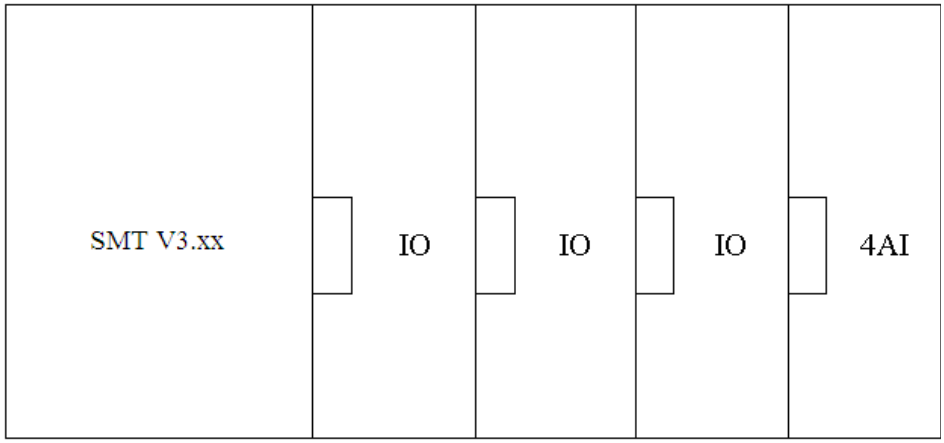
Analog Input module: SMT-4PT, SMT-4AI

Analog Output module: SMT-2AO

iSmart can connect with expansion module. The maximal connectible number to the expansion module is: 3 Digital IO modes, 2 Analog Output modes, 2 Analog Input modules (one 4PT and one 4AI). If the iSmart system is combined with digital IO, analog IO and communication module, it must follow the standard arrangement, "SMT + digital IO module + analog IO module ", otherwise it cannot work correctly.

※ SMT-4AI must be the last one of analog module.

※ **Mainframe + digital IO * 3 + 4AI*1**



※ To all expansion modules, the connecting way is the same as shown in above picture.

※ The number of digital module must be the same with the setting of IO number in the system setting. Otherwise, The iSmart will work incorrectly.

※ The scan time of iSmart main unit is about 2~20ms without any expansion module. The scan time will be longer once connecting with expansion module. Connecting different expansion module gets different influence on scanning cycle. For details, see the table below.

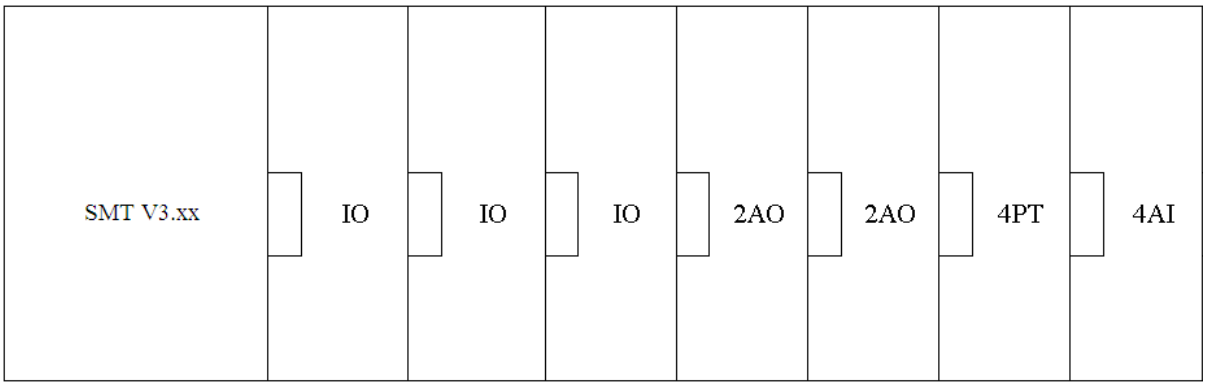
Expansion module	Add single module Influence	Max connecting num	Max influence to scanning cycle
Digital I/O module	scanning cycle +1ms	3	+1 ms*3=3ms
4PT module	scanning cycle +7ms	1	+7 ms*1=7ms
2AO module	scanning cycle +8ms	2	+8 ms*2=16ms
4AI module	scanning cycle +13ms	1	+13ms*1=13ms

* When setting the preset value of a function block via communication module, the scan time extends about 50ms.

* When iSmart connects with 4PT module, the corresponding 4PT register in iSmart unit will be updated, one scan cycle update one channel, so four Channels will be update within four scanning cycles.

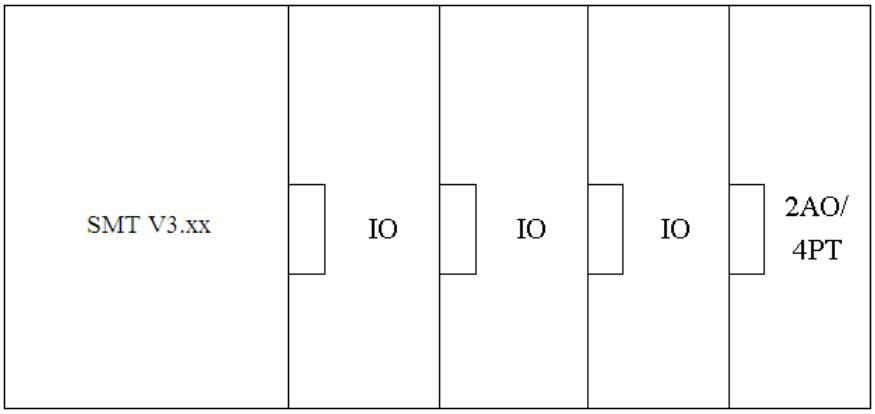
There are 3 kinds of connecting way for expansion modules as shown below.

Mainframe + digital IO * 3 + 4AI*1+



digital IO: SMT-MA-R8 , SMT-MD-8 ,SMT-MD-T8

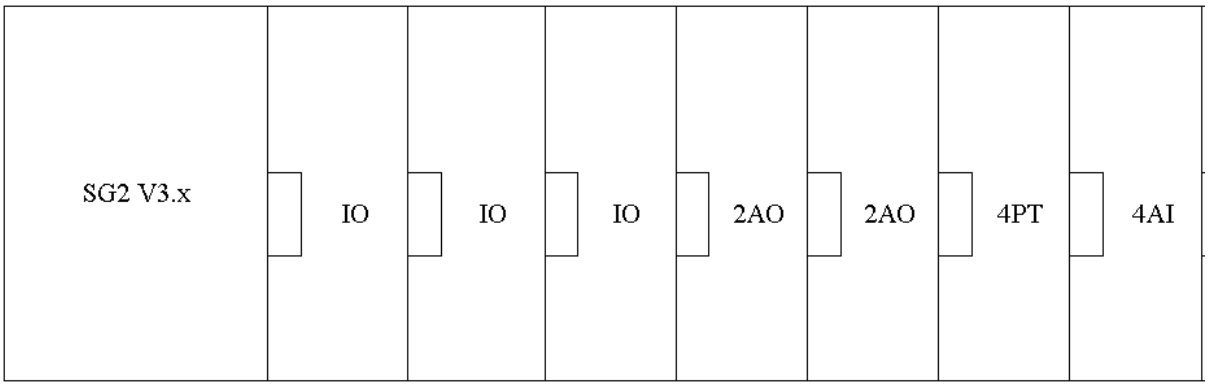
Mainframe + digital IO * 3 + 2AO*1/4PT*1



※ digital IO: SMT SMT-MA-R8, SMT-MD-R8, SMT-MD-T8, SMT-MA24-R8

※ Either 2AO or 4PT.

Mainframe + digital IO (V3.0) * 3+2AO*2+4PT*1+4AI*1



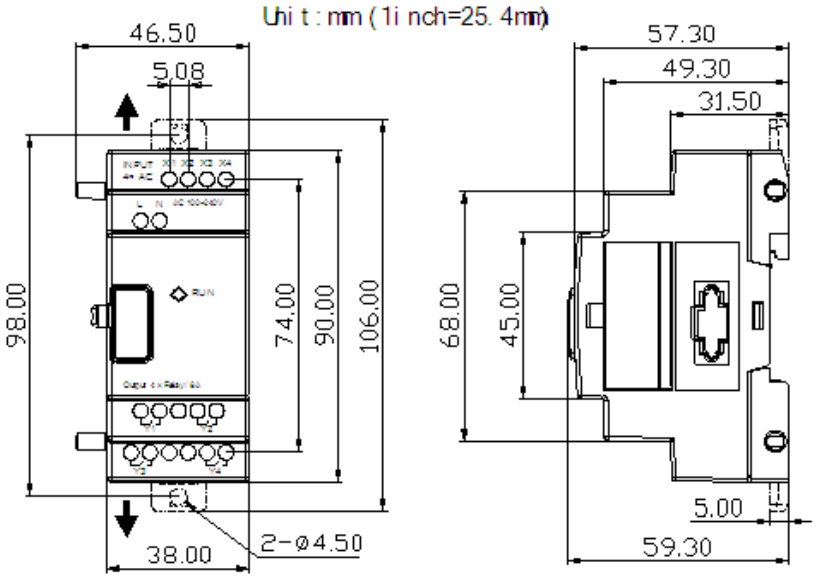
Power

The input voltage, current and power consumption for each expansion module is listed as below table:

Module	Voltage	Current	Power
SMT-4AI	24 Vdc	70 mA	1.68w
SMT-2AO	24 Vdc	85 mA	2.04w
SMT-4PT	24 Vdc	55 mA	1.32w

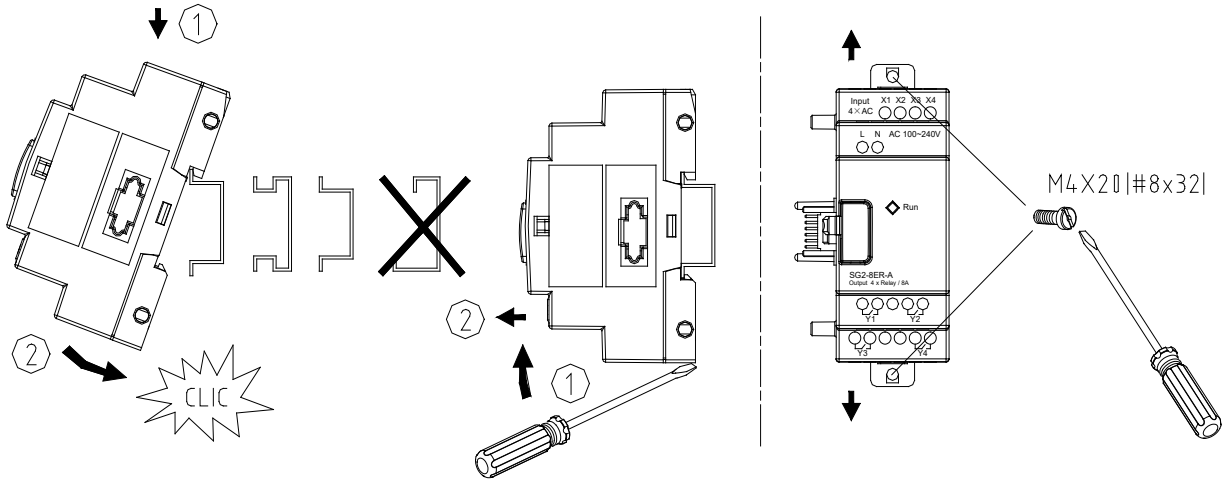
Size

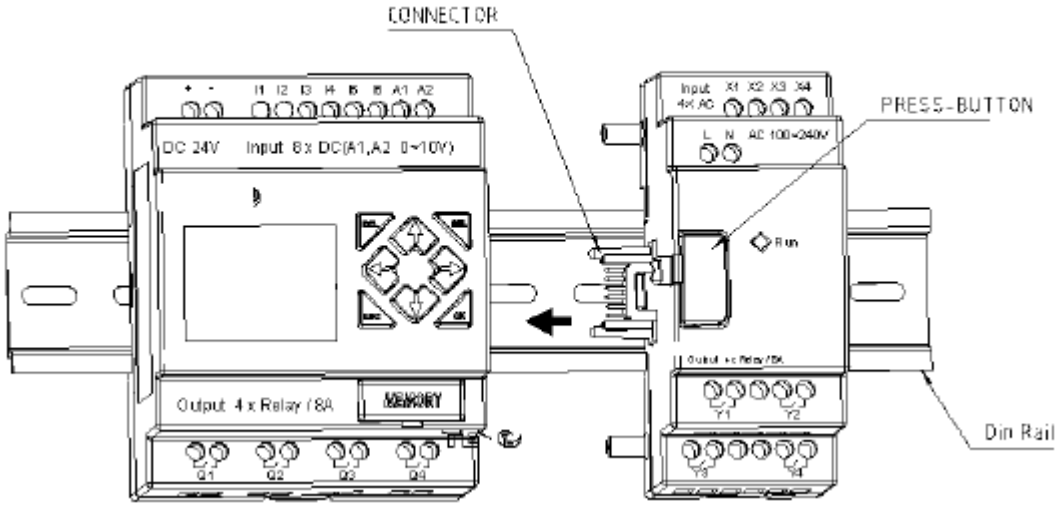
※ All the expansion modules' size is the same as shown below.

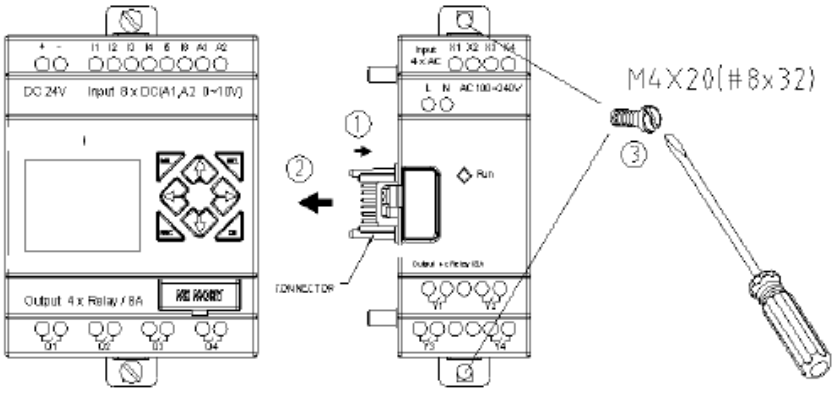


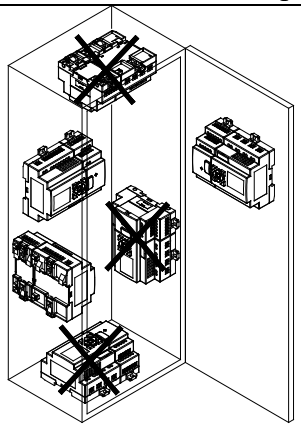
Installation

※ All the expansion modules installation method is the same as shown below.









mm^2	0.14...1.5	0.14...0.75	0.14...2.5	0.14...2.5	0.14...1.5
AWG	26...16	26...18	26...14	26...14	26...16

∅3.5 (0.14in)	C	Nm	0.6
		lb-in	5.4

DANGER:

HAZARDOUS VOLTAGE

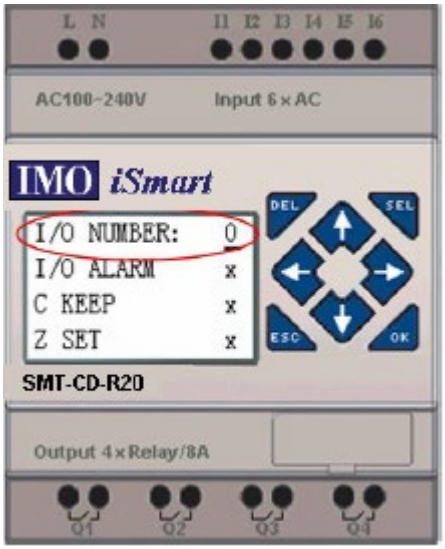
Cut off all power before maintenance

Electric shock will result in death or serious injury.

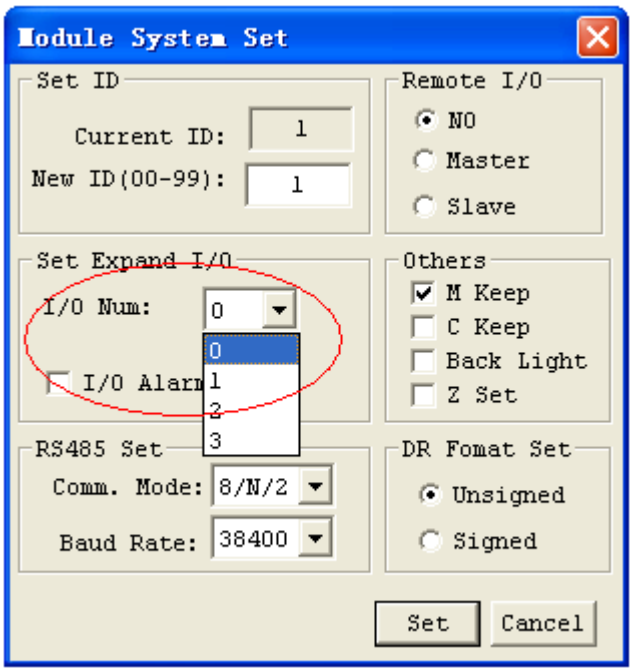
Digital IO Module

The iSmart must set the number of expansion IO when connect with expansion module. The method of setting IO number is shown below.

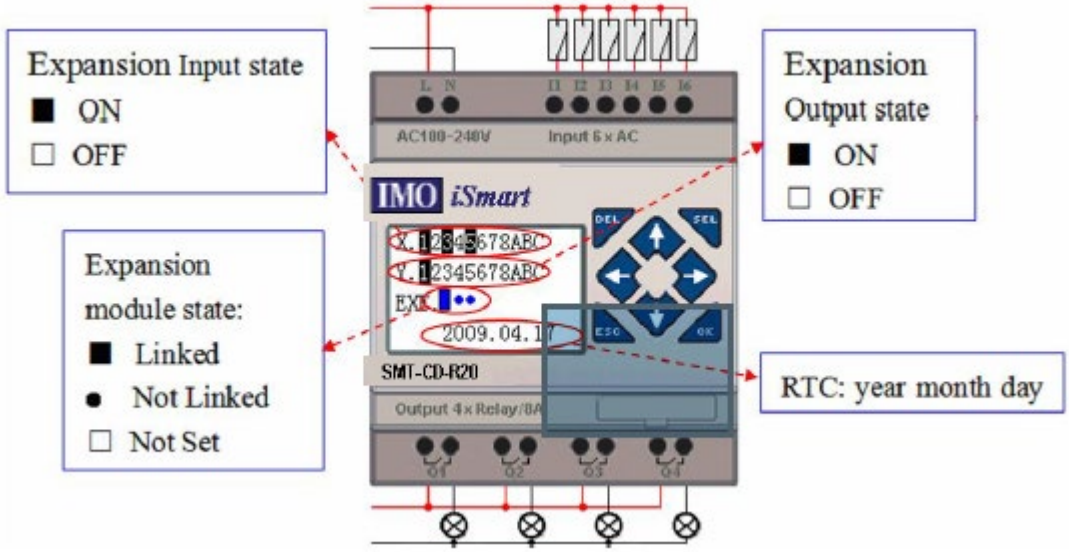
1) Keypad



2) SMT Client software

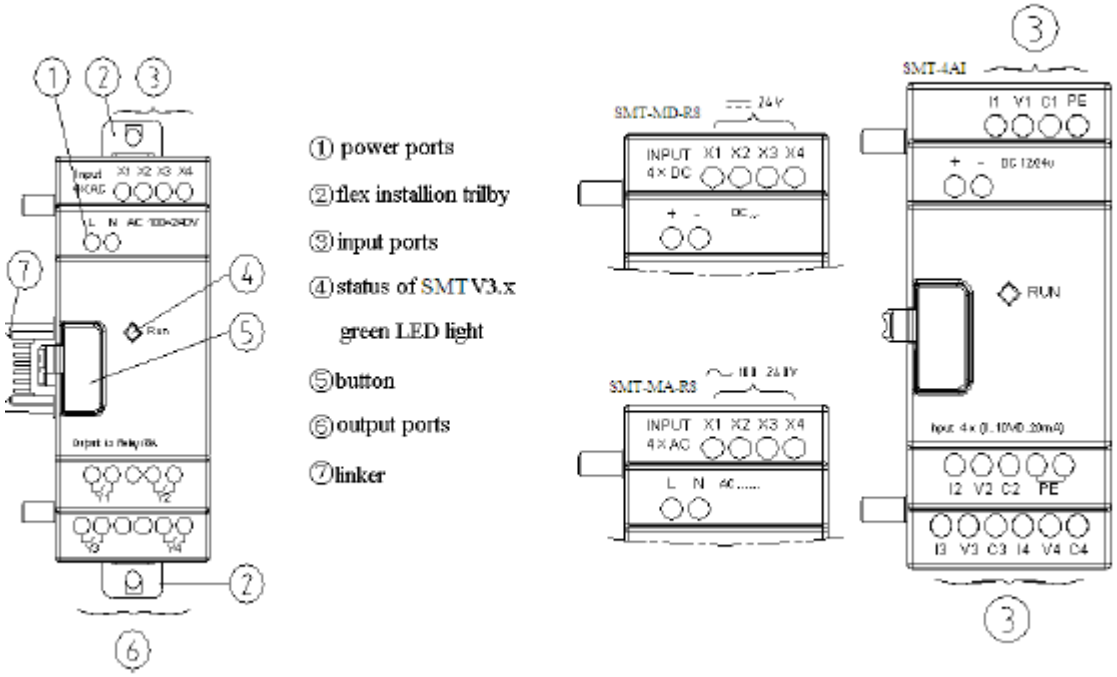


Expansion display State



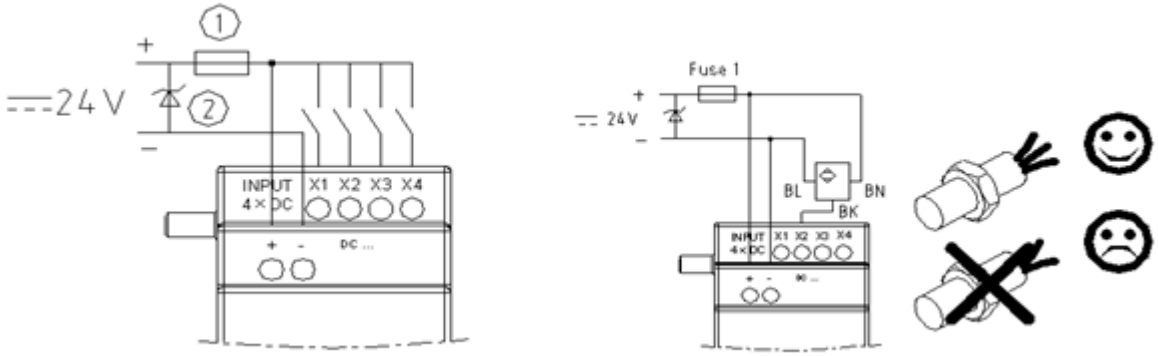
Installation and Wiring

Expansion module: SMT-MD-R8/T8, SMT-MA-R8/MA24-R8

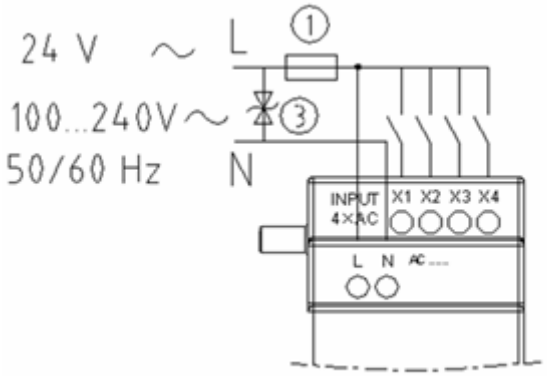


Wiring

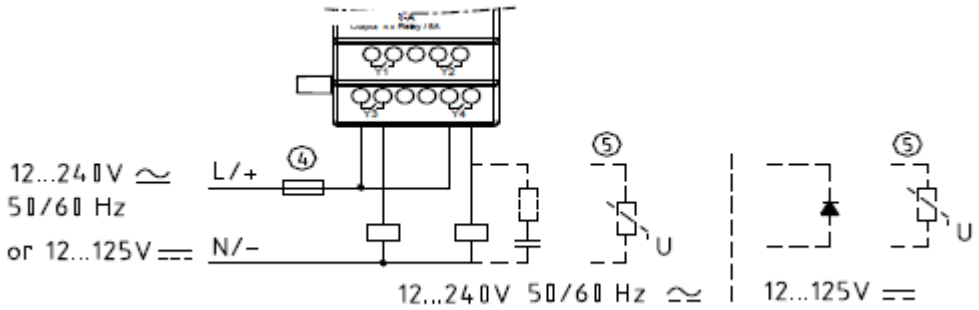
1) 24V DC power input



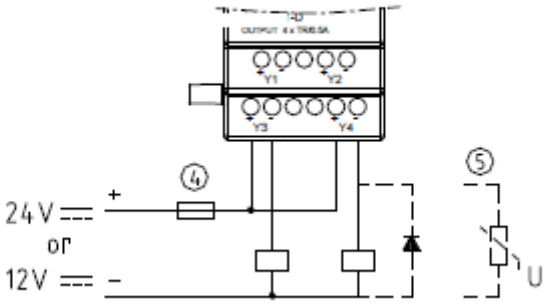
2) 24V/100~240V AC power input



3) Relay Output



4) Transistor output



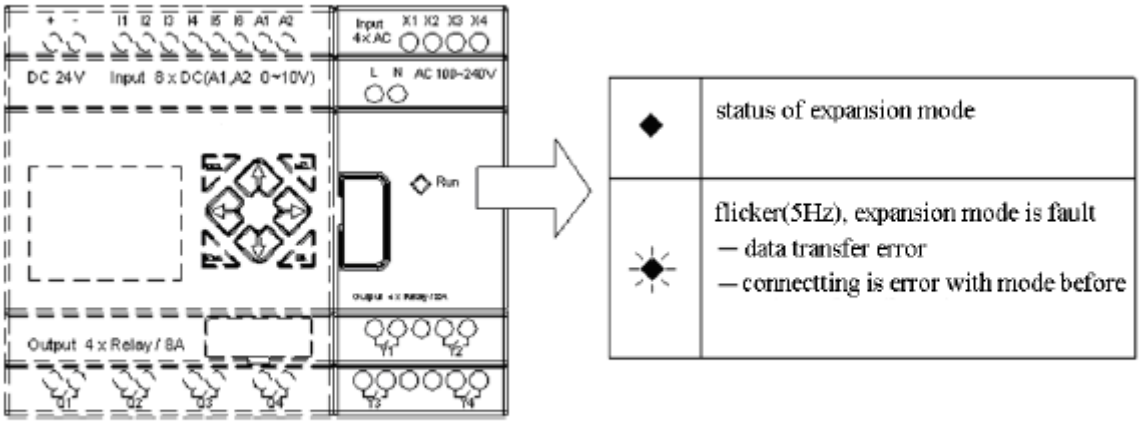
①-1A quick-blowing fuse, circuit-breaker or circuit protector

②-Surge absorber (43V DC)

③-Surge absorber (Input 24VAC:43V; Input 100~240VAC:430V AC)

④-Fuse, circuit-breaker or circuit protector

⑤-Inductive load



※ A

C inductive load needs to connect Surge absorber in parallel way to absorb the noise if the iSmart output terminal is the relay type. DC inductive load needs parallel connect commute diode if the iSmart output terminal is the relay type. The specification of inverse voltage for commute diode should be more than 5~10 times the rated current of the circuit, and the specification of positive current of diode should be more than load current. Inductive load needs parallel connect commute diode if the iSmart output is transistor.

Digital IO module and Analog module both have indicator light in orange color. The state of indicator light in different operation state is the same. The state of indicator light is shown below.

Analog Module

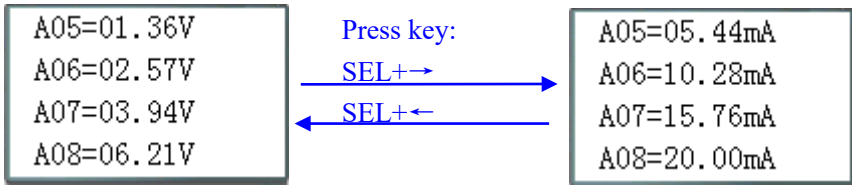
The maximal connectible number of Analog expansion module to SMT is 2*2AO, 1*4PT and 1*4AI.

Analog Input Module 4AI

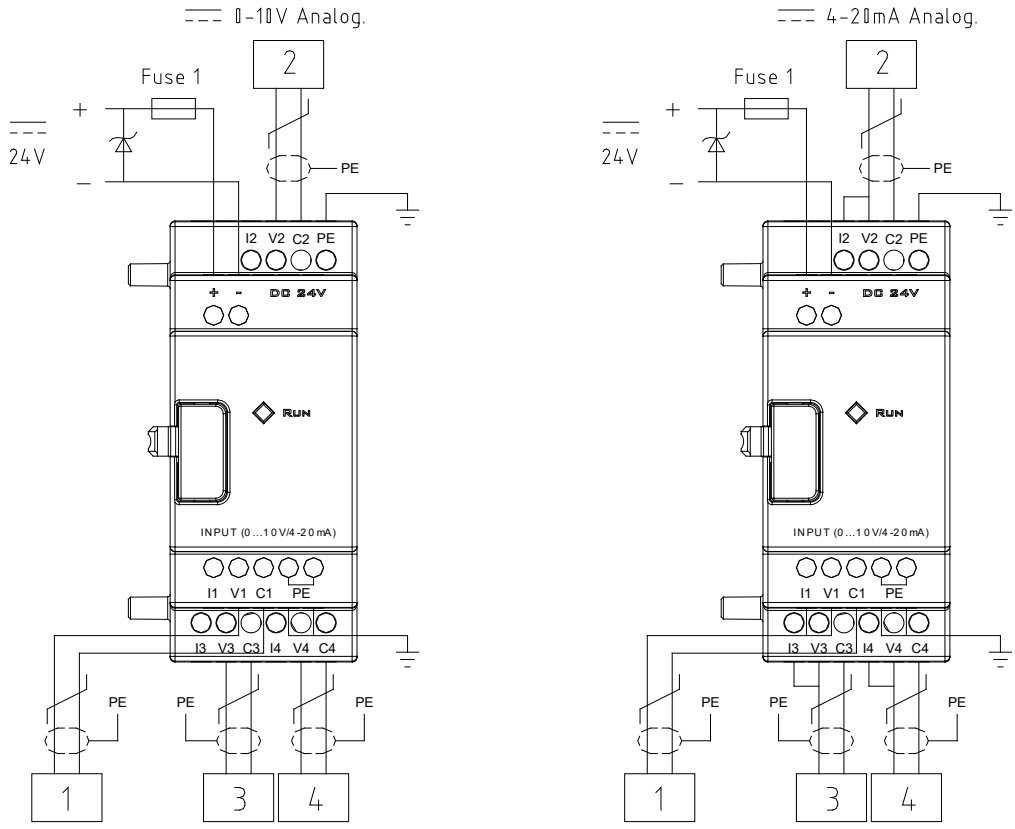
The 4 channel 12bits analog input module, 4AI, has the corresponding registers, A05~A08, DREC~DREF, DRE4~DRE7. It can accept either 0~10V or 0~20mA signal, the range of the measured value is different which depends on the input signal mode. See the below table for more information.

content		standard	
Mode		voltage	current
Analog output range		0V~10V	0mA~20mA
Differentiation		10mV	40μA
Digital output		0.00V~9.99V	0.00mA~20.00mA
Register value	A05~A08	0~999	0~500
	DREC~DREF	0~4095	0~2047
	DRE4~DRE7		0~2000
Definition		±2.5%	±2.5%

The current value of 4AI input displaying as shown below:



Wiring



Temperature Input Module 4PT

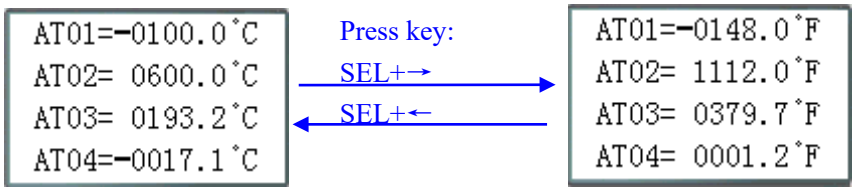
The 4 channel 12bits temperature (PT100) analog input module, 4PT, has the corresponding registers with AT01~AT04.

content	standard
Temperature input range	-100℃~600℃
Digital output	-100.0℃~600.0℃
Differentiation	0.1℃
Definition	±1%

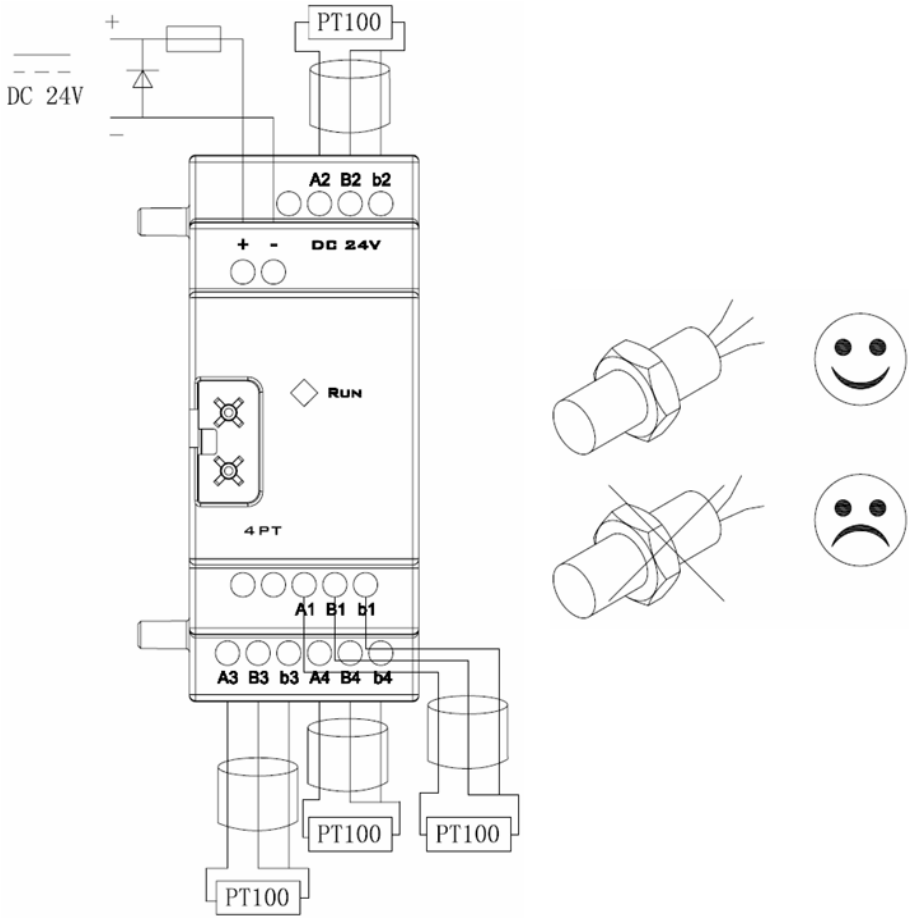
The input value of SMT-4PT is over range if wiring error or no input, SMT will not update the corresponding channel, and the corresponding Error coil (M) turns ON.

coil	AT number	
M34	AT01	SMT-4PT channel 1 error
M35	AT02	SMT-4PT channel 2 error
M36	AT03	SMT-4PT channel 3 error
M37	AT04	SMT-4PT channel 4 error

The current value of 4PT input displaying as shown below:



Wiring



Analog Output Module 2AO

iSmart main unit can connect with two 2-channel, 12bits analog output module, 2AO, at the same time. The close one will be auto-assign to AQ01~AQ02, and the other is distributed to AQ03~AQ04. It can out 0~10V voltage signal or 0~20mA current signal, and the data in the 12bits data register, DRD4~DRD7, will determined the output of AO channel. See the below table for more information.

content		standard	
Mode		voltage	current
Analog output range		0V~10V Load impedance should be bigger than 500Ω	0mA~20mA Load impedance should be smaller than 500Ω
Differentiation		10mV	40μA
Digital output		0.00V~10.00V	0.00mA~20.00mA
Register value	AQ01~AQ04	0~1000	0~500
	DRD4~DRD7	0~4095	0~2047
Definition		±2.5%	±2.5%

The output mode of AQ is set by the current value of DRD0~DRD3

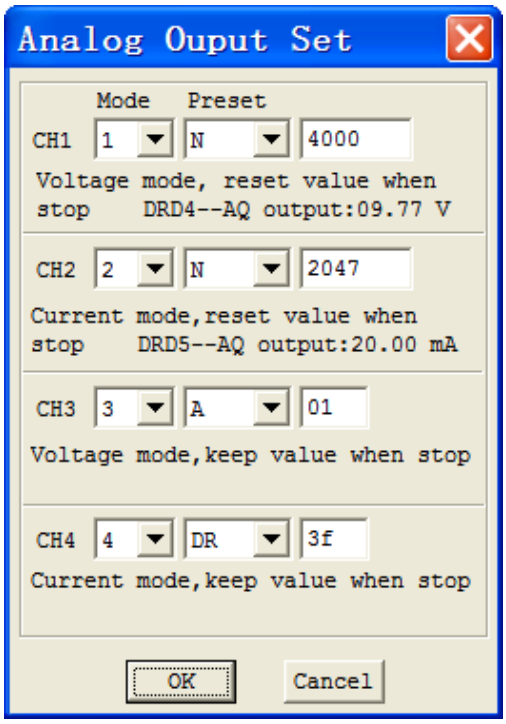
	Output Register	Mode Register
Channel 1: AQ01	DRD4	DRD0
Channel 2: AQ02	DRD5	DRD1
Channel 3: AQ03	DRD6	DRD2
Channel 4: AQ04	DRD7	DRD3

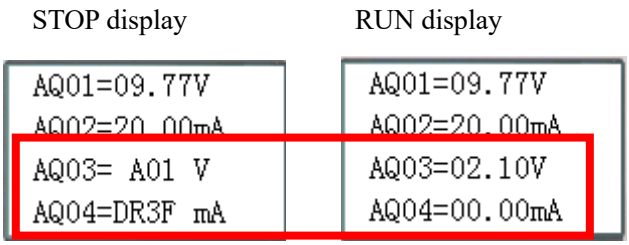
Mode	DRD0~DRD3 data definition
1	0: voltage mode and reset value when stop;
2	1: Current mode and reset value when stop;
3	2: voltage mode and keep value when stop;
4	3: Current mode and keep value when stop;

※ Analog output works in mode 1 if the value of the mode register, DRD0~DRD3, is larger than 3.

The appearance of AQ value on the HMI screen

The HMI on SMT displays the code of selected coil when SMT at STOP mode, and showing the current value at RUN mode, see the below figure to get more information.





When AQ mode is in current mode, the relationship among the DR, AQ output and display value is shown as below:

DRD5=2047, AQ02=500, display: 20.00mA

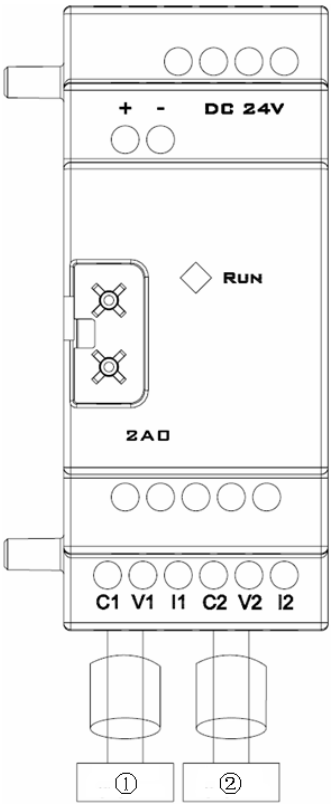
※ When the preset value in “Analog Output Set” screen is a constant, this value will be stored in DR register, (DRD4~DRD7) and the AQ value equals to (DRx/4.095). For example, CH1 is configured as mode 1, set a constant value, 4000, then the value of AQ01 will be 977, and HMI displays 9.77V.

※ Once the preset value refers to other variable, its value is also stored in DR register, (DRD4~DRD7), but it will be equal to AQx * 4.095. (DRx=AQx*4.095).

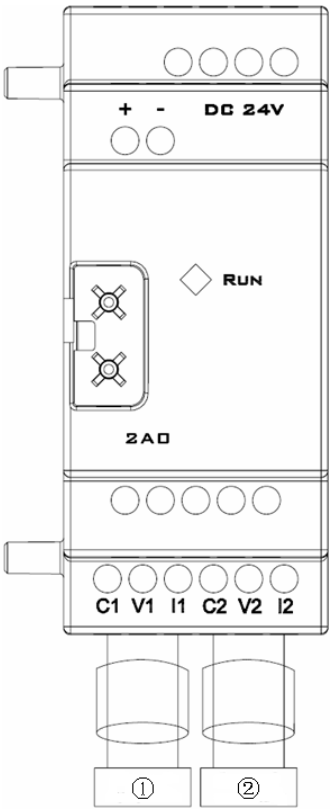
※ More information about expansion analog input to see: Chapter 5 Relay Ladder Logic Programming –AQ (Analog output).

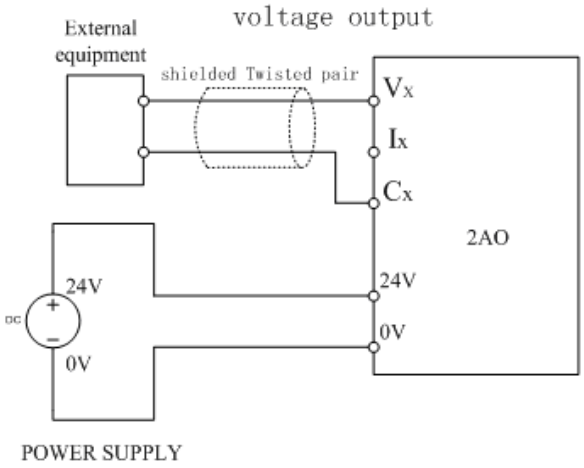
Wiring

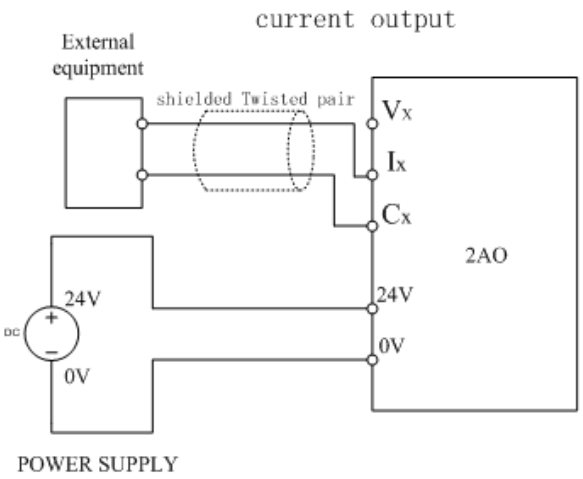
Voltage output



Current output







Chapter 10 External memory

iSmart Storage Card Instruction

iSmart can use SD card as External memory for data transfer:

1. Read-write card: copy user programs (screen keys, PC upper computer, iSmart automatic operation) by reading and writing SD card.
2. Record and output data: iSmart can record some data in operation according to the user's program and output it in a fixed format.
3. Formatting card: iSmart only supports the micro SD card in the format of FAT32 file system to store programs. If the memory card is used in other formats, please format the card into FAT32 format first.
4. Read configuration file: read SD configuration file to set iSmart, such as IP address, gateway and so on.

iSmart only supports standard capacity SD and high capacity SDHC standard cards, the maximum card capacity is 32GB

Read/Write program with SD card

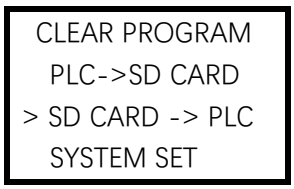
1.Read program from SD card to SMT(keypad)

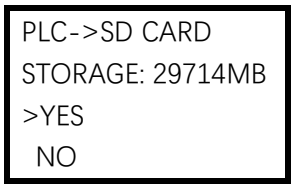
Use standard type (with LCD display and rubber key) ; You can directly use the LCD screen and button menu to SD card operation; select "card-->PLC" , you will get in next menu, you will find SD card information on display, if SD card is installed inside, click "OK", user program will write into iSmart from SD card.

The current status of SD card will be displayed on sub-menu.

a. Whether the SD card is detected in card slot

b. The remaining capacity of SD card





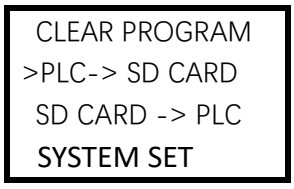
Note :

#It is allowed to write user program from SD card to iSmart when iSmart is in the STOP status.

#If there is any problem during program update, please re-start the input power and re-update it again.

2. Write user program into SD card(keypad)

Using iSmart with LCD display and button function , Please select "PLC-->card" , you will get in next menu, you will find SD card information on display, if SD card is installed inside, please click "OK", user program will write into SMT from SD card.



```
PLC->SD CARD
DISK: 29714MB
>YES
 NO
```

Note :

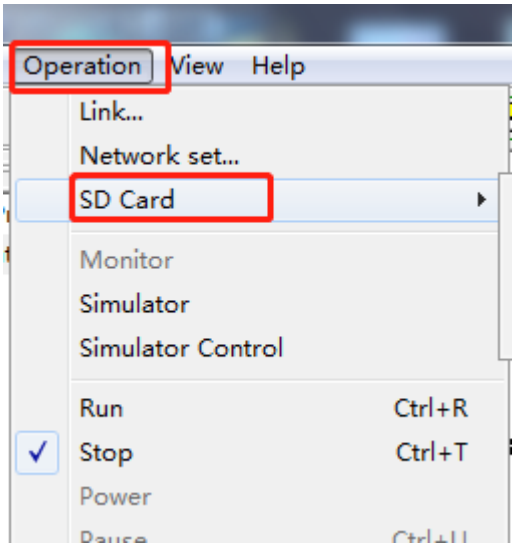
If there is any problem during program update, please re-start the input power and re-update it again.

#The protected password in iSmart is also effective for the program on the card

It is allowed to store only one program in card, please change other card to store second program if necessary.

3. Use SMT PC Client computer to operate SD card(PC client)

For the iSmart which have no on-screen buttons. you can use SMT Client for SD card operation.



Select "Collection" then click "SD" item, start to do operate with store card.SMT will Automatically perform the corresponding function;

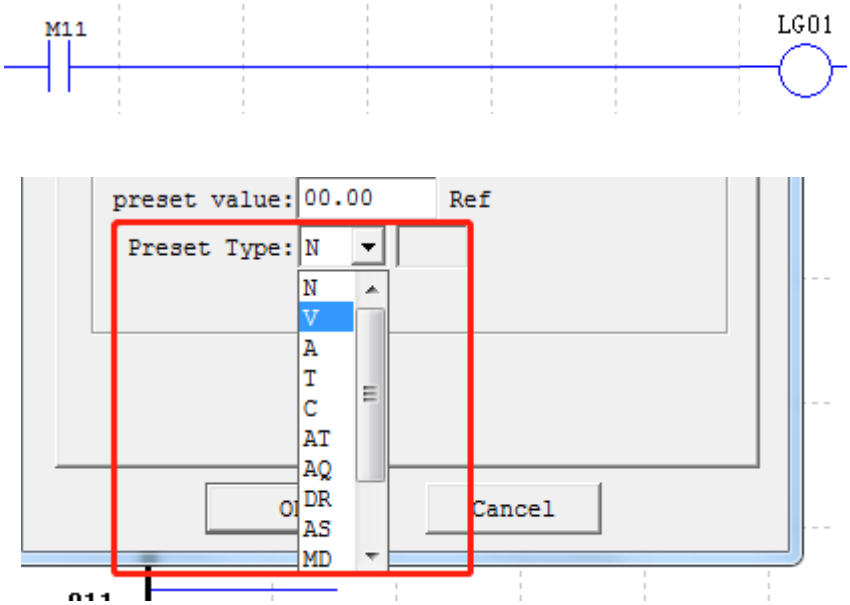
4. Automatic reading

Use B model (no LCD, no keyboard);When iSmart is in the STOP state, after inserting the SD card, change states from STOP to RUN. SMT will automatically read the correct format of the user program stored in the SD card.

Data Record And Output （Log function）

1、Edit data record

Edit data record function as following photo：



For example, these types can be set to target register of data record function.The value in per-set value target register could be stored in iSmart or micro SD card once M11 coil enabled.

If micro SD card already put into slot, the data record will write into SD card directly; if iSmart did not put SD card in slot, iSmart provides 1K space to store the data.(SMT can store 50 data records, new data record will be overwritten from first data once record space is full)

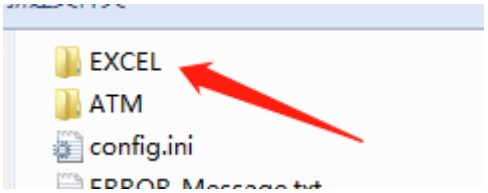
Note :

To avoid data loss, please apply the enable signal to data recording function block not less than 500ms period, data will be loss once enable signal period shorter than 500ms.

2、Data Storage Location and Format

The new data will be stored after previous stored data, the maximum capacity of SD card is 20 thousand lines, the real store capacity should be based on SD card.

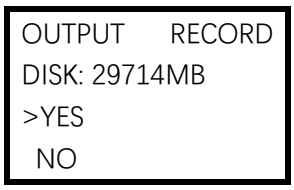
A. When using the data logging function for the first time, iSmart will generate a folder named EXCEL in the root directory of the memory card. The EXCEL folder is used to store the recorded data files。



B. The iSmart data recording file is named according to the current date (year-month-day).For new data entries recorded on the same day, it will be stored after previous data in same file. The size of the data record is limited by remaining space.

C. Generate a data record table, select the **OUTPUT RECORD** function to write the cached data records to memory card.

The default stored format will be ".xls" file, it can be opened on PC. Each line in this EXCEL file contains a check point, function block number, and recorded actual value.

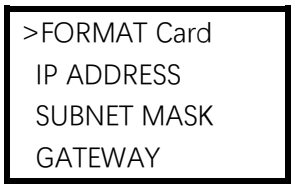


A	B	C	D
FUN_Number:144	Current_Value:35	Coil_Name:M11	Time0/0 0:0:0
FUN_Number:147	Current_Value:35	Coil_Name:M14	Time0/0 0:0:0
FUN_Number:149	Current_Value:35	Coil_Name:M16	Time0/0 0:0:0
FUN_Number:151	Current_Value:35	Coil_Name:M18	Time0/0 0:0:0

Format SD card

iSmart only supports FAT32 file system format micro SD card to store the program. If the memory card used is other format, please format the card to FAT32 first.

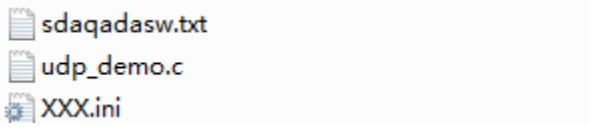
The "Format" item in main menu can format SD card, all the data in SD card will be deleted once format item selected. Formatting will erase all the data stored in the card. Please backup the data in the card first.



Read Setup Document

iSmart blind type models(B Type) can set the configuration through read XXX.ini document.：

XXX.ini document can be used to set iSmart configuration, it's stored under sub-menu of SD card.(User will get "error" on display when move the document out of original location or re-write file name.)

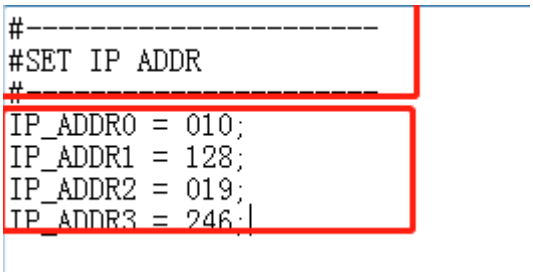


When iSmart changes the status from STOP to RUN, it will read the content from setup document and re-write the data for target register.

Instruction of setup document：

Set Default IP ADDRESS

SMT blind type models(B Type) have no keypad , iSmart Provide a way that using SD card to set Default IP ADDRESS;



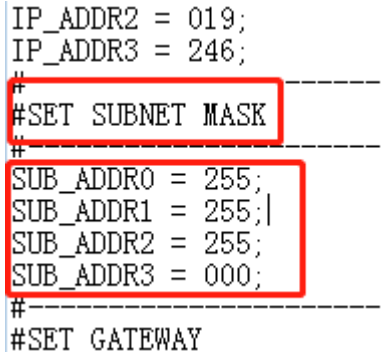
Open “XXX.ini” file under root directory of SD card； Edit according to these rules。

RULES：

1. The values should be put between "=" and " ; " symbols.
2. The contents after "//" symbol are note, the contents will not be read.
3. IF you want to set “10,128,19,246”as IP address; Divide the string of numbers into four fields:”010”、”128”、”019”、”246”. Then fill in the corresponding lines for each of these four sections as shown above;
4. IF you fill in a number greater than 255, The corresponding field is automatically set to 255;
5. Insert SD card ;when SMT change mode form “STOP ” to “RUN”,IP ADDRESS will be set automatically.

Set Default SUBNET MASK

SMT blind type models(B Type) have no keypad , iSmart Provide a way that using SD card to set Default SUBNET MASK;



Open “XXX.ini” file under root directory of SD card with Notepad。 Edit according to these rules。

RULES：

1. The values should be put between "=" and " ; " symbols.
2. The contents after "//" symbol are note, the contents will not be read.

3. you want to set “255,255,255,000”as SUBNET MASK; Divide the string of numbers into four fields:”255”、”255”、”255”、”000”. Then fill in the corresponding lines for each of these four sections as shown above;
4. IF you fill in a number greater than 255, The corresponding field is automatically set to 255;
5. Insert SD card ;when SMT change mode form “STOP ” to “RUN”,IP ADDRESS will be set automatically.

Set Default GATEWAY and SET MASTER IP ADDR

```
SUB_ADDR0 = 255;
SUB_ADDR1 = 255;
SUB_ADDR2 = 255;
SUB_ADDR3 = 000;
#--------------------
#SET GATEWAY
#--------------------
GATE_ADDR0 = 192;
GATE_ADDR1 = 168;
GATE_ADDR2 = 000;
GATE_ADDR3 = 002;
#--------------------
#SET MASTER IP ADDR
#--------------------
IP_ADDR0 = 010;
IP_ADDR1 = 128;
IP_ADDR2 = 019;
IP_ADDR3 = 245;
```

Set Default GATEWAY and SET MASTER IP ADDR also follow the rules（like setting IP ADDRESS 、SUBNET MASK）。

Chapter 11: Ethernet function Instruction

summary

iSmart series products support Ethernet communication function. Users can use the Ethernet function to achieve the following operations:

Read ,Write, and monitor user program

Expand device and configure network IO module

Network server

Device program upgrade

connect

iSmart has an Ethernet connector and an Ethernet status LED.

You can connect the equipment to PC, router, or switch with Ethernet connections.

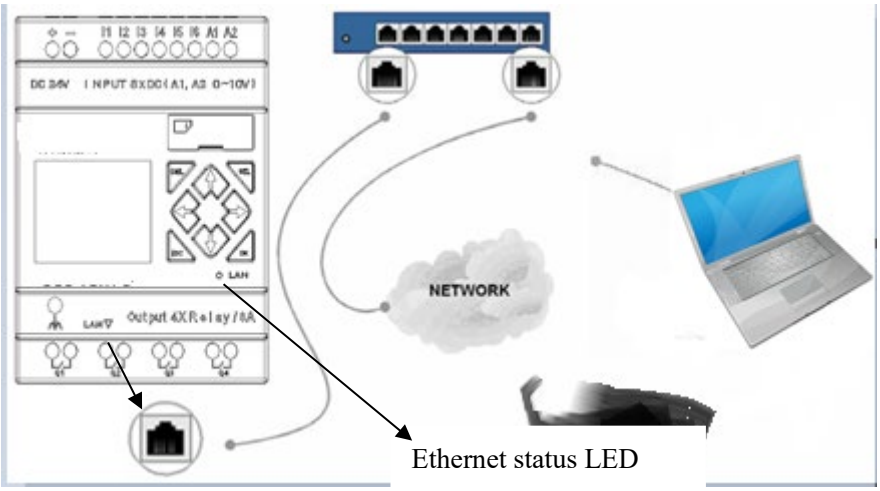
The network status LED:

When the network is disconnected, the LED is off;

When the network connection is normal, the green LED is always on;

When there is data transmission, the LED flashes.

Ethernet connections:



iSmart supports multiple devices to realize network expansion connection through routers or switches. An expansion network can only have one master device and can expand up to eight slave devices.

Ethernet setup

iSmart can display local IP address, subnet mask, gateway address, master / slave mode and remote master IP address in slave mode on LCD interface. And can be modified with keypad. If the network information is modified, press OK to confirm, the device will restart automatically, enable the modified information to reestablish the network connection.

-> IP ADDRESS->

IP ADDRESS
192.168.000.003

-> SUBNET MASK->

SUBNET MASK
255.255.255.000

-> GATEWAY->

GATEWAY
192.168.000.001

-> MASTER IP ->

MASTER IP
192.169.000.005

-> SET->M/S SET

（MASTER）

RS485 SET	03
DR SET	S
COIL REC	/
M/S SET	M

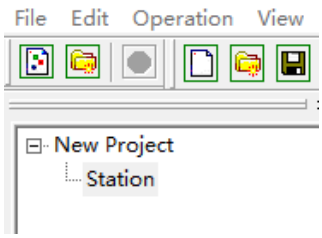
（SLAVE）

RS485 SET	03
DR SET	S
COIL REC	/
M/S SET	S

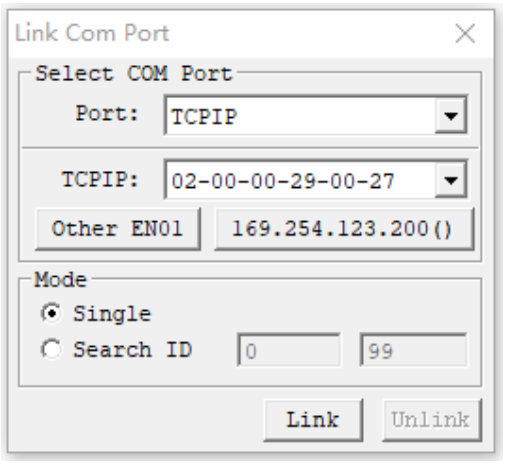
PC Client link setup

Connect iSmart and PC with Ethernet cable, open SMT Client and choose LADDER or FBD editing environment.

Right click "station" under the project and Select the pop-up "link" option. Or click "link" under "operation" in the menu.



Popup “Link Com Port”：



Note: it is necessary to modify the IP address of PC and iSmart device in the same network segment.

Select the MAC address of the iSmart to be linked, click “Link”, and the PC client will link with the iSmart controller.

Network inputs and outputs function setting and Application

iSmart provides network digital inputs/outputs and network analog inputs/outputs.

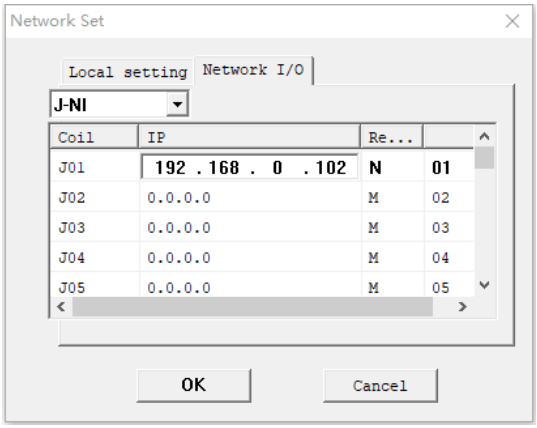
The master iSmart can communicate with the slave iSmart using the network inputs and outputs.

Blocks	Function	Number
J01 ~ J3F	Network digital inputs	63
K01 ~ K3F	Network digital outputs	63
NI01 ~ NI1F	Network analog inputs	31
NQ01 ~ NQ0F	Network analog outputs	15

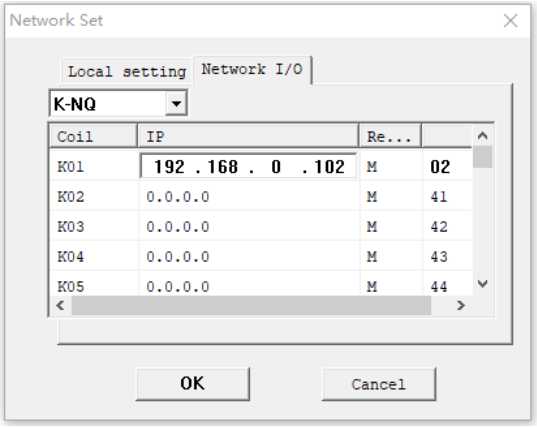
If the PC client and iSmart are linked, the network information of iSmart and the communication configuration of the network inputs and outputs can be set.

Menu of PC client: " Operation " - > " Network Set " to enter the Network Set.

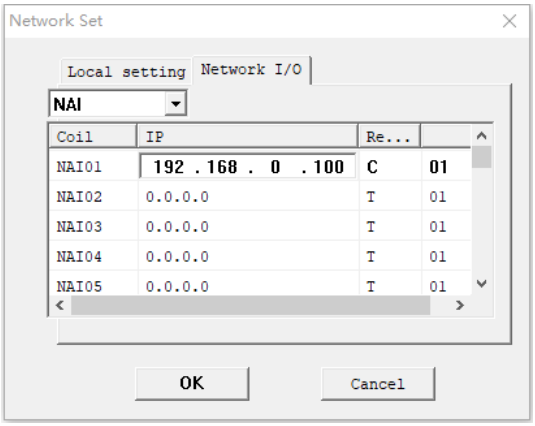
In " Network IO" column, the master station can be set the communication configuration of network inputs and outputs.



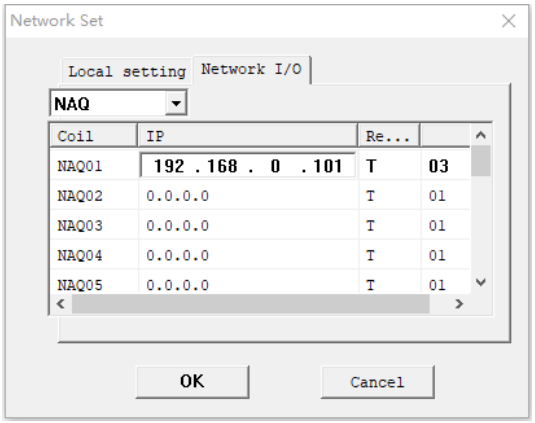
Legend: The network digital input J01 reads the status of N01 from the slave device 192.168.0.102.



Legend: The status of network digital output K01 is output to M02 of slave device 192.168.0.102.



Legend: The network analog input NAI01 reads the value of C01 of the slave device 192.168.0.100.



Legend: The value of network analog output NAQ01 is output to T03 of slave device 192.168.0.101.

Examples in LADDER:

Line 001: Network digital output K01 is used as output point

Line 002: Network digital input J01 is used as input point

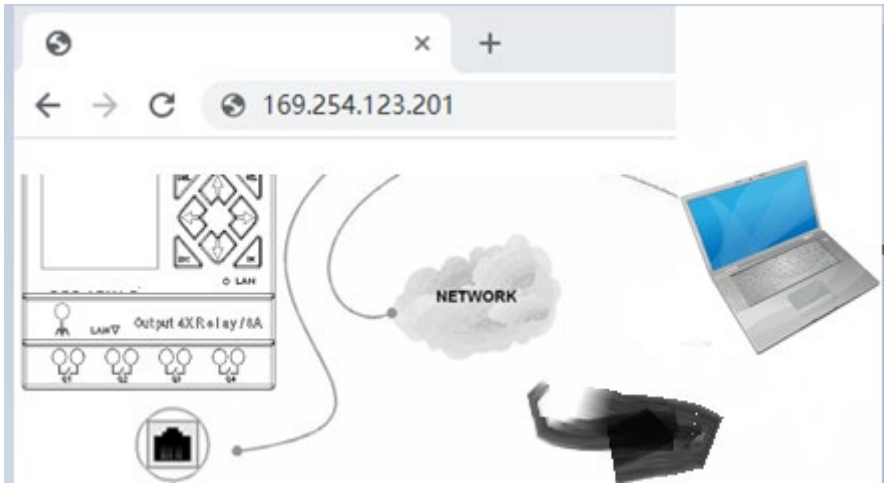
Line 003: The network analog input NI01 is used as the preset value of the counter C01

Line 004: The network analog output NQ01 is used as the preset value of timer T01

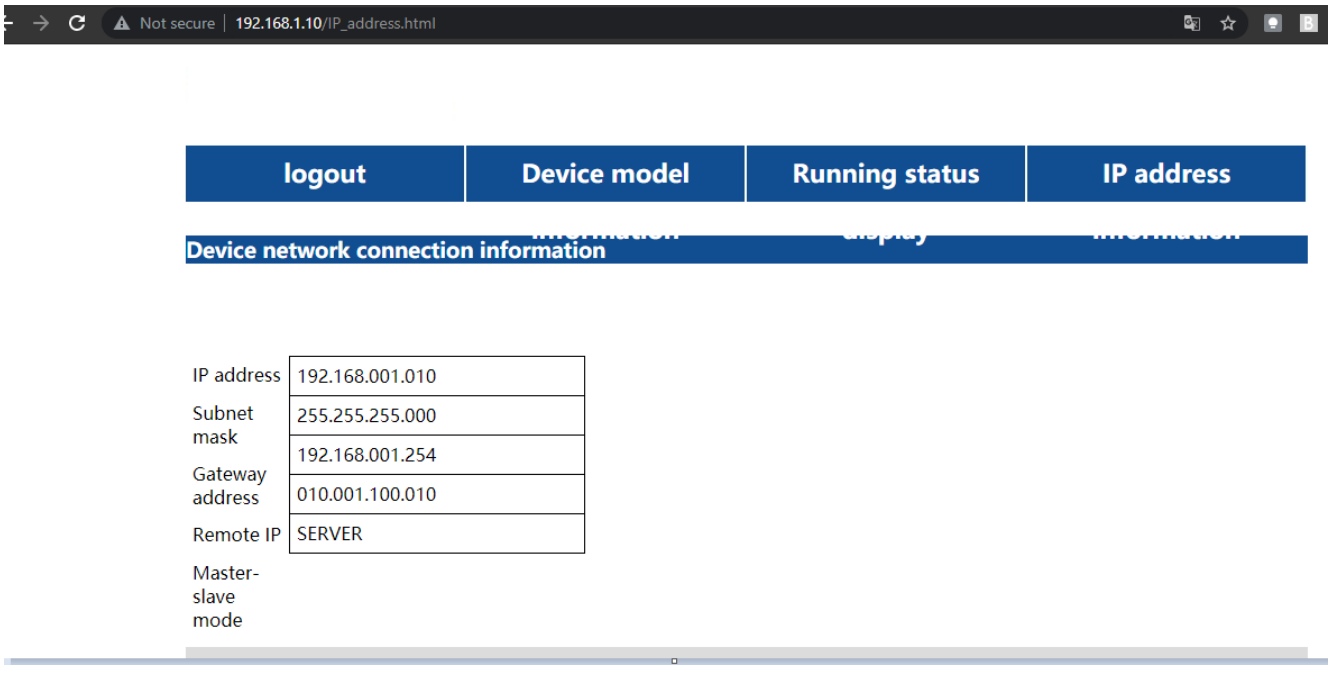
Web server

iSmart has built-in web server function. Users can view the equipment information and working status of iSmart through PC or mobile devices in Ethernet. The display of the equipment status only supports English and Numeric character display, Chinese and other special characters are not supported temporarily.

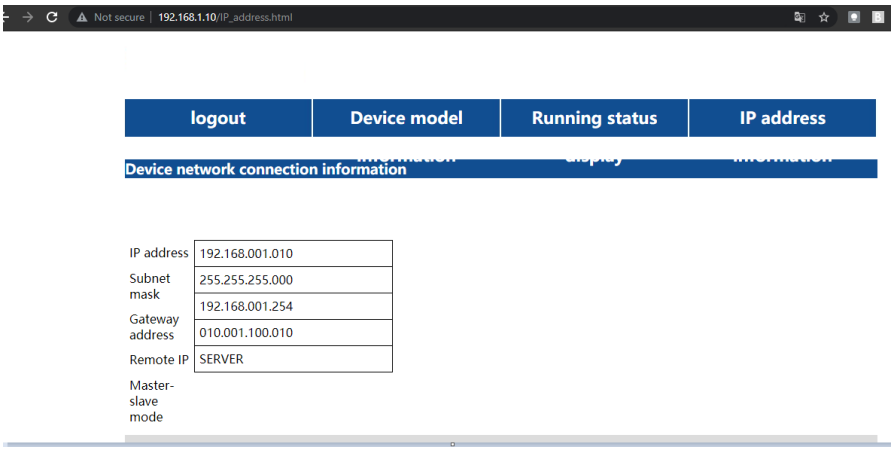
Open the browser, enter the IP address of the iSmart device, and open the iSmart web server page.



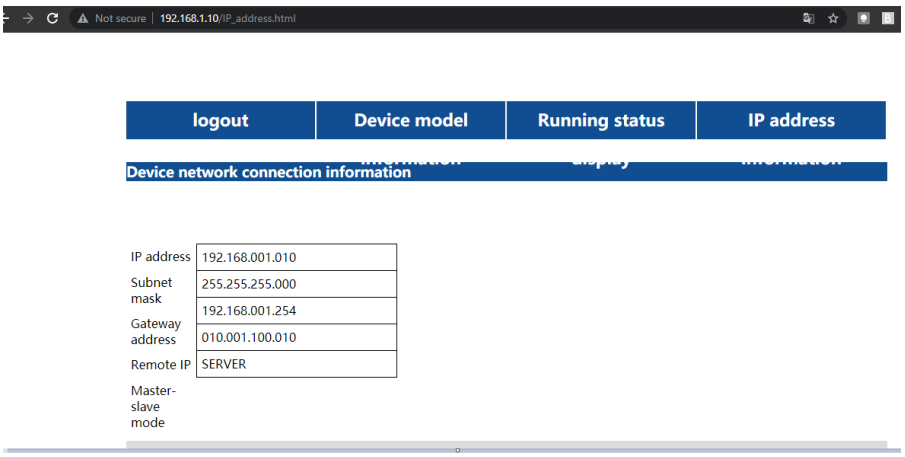
Enter the username and password (username: IMO, password: IMO), log in and get permission to view the information and working status of the device.



When the username or password is entered incorrectly, you will be prompted to re-enter the correct information.

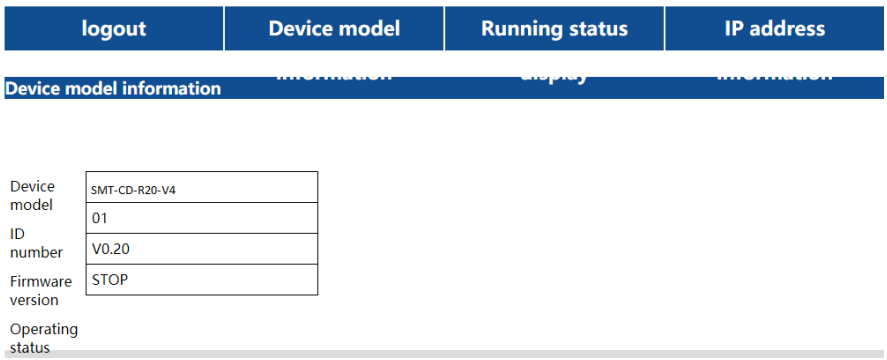


Equipment model and version information:



The running status information of the device:

When i/o status is displayed, press the "previous page" or "next page" button to switch the display page. When setting information is displayed, the page cannot be changed, and only English and Numeric character can be displayed.



SMTIP address, Subnet mask, Gateway, Remote master IP and master/slave mode:

IP address	192.168.001.010
Subnet mask	255.255.255.000
Gateway address	192.168.001.254
Remote IP	010.001.100.010
Master-slave mode	SERVER

Log out:

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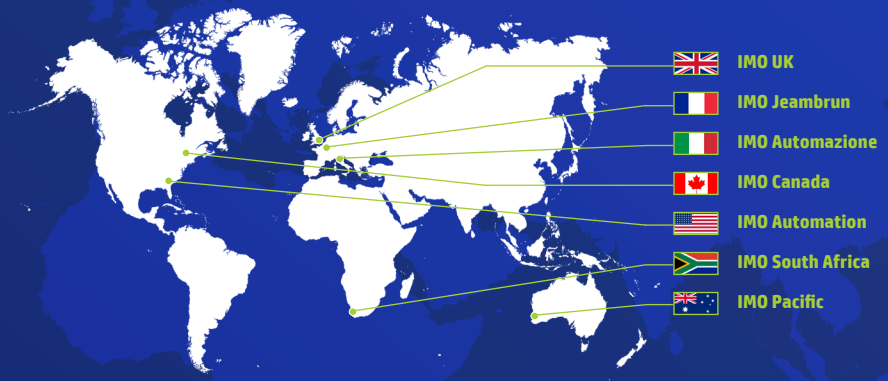

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