SG2 Smart PLC USER Manual

SG2 Programmable Logic Smart Relay

4KA72X023 Version: 03 2009.07.03

Apply to: SG2 firmware version 3.0,

PC client program software version 3.0

Contents

Summary of changes

This user manual is modified by firmware V3.0 and SG2 Client programming software V3.0. SG2 V3.0 adds some new functions with firmware version V3.0 to strong SG2 function. The upgrade content is shown as the 2 tables below simply. More information about idiographic function to see function instruction.

Edit and Display

	SG2 V3.0	SG2 V2.x
Ladder	300 lines	200 lines
FBD	260blocks	99blocks
LCD	4 lines * 16 characters	4 lines * 12 characters

Contact and function block

	input	output	SG2 V3.0	SG2 V2.x
Auxiliary relay M	M	M	63(M01~M3F)	15(M1~MF)
Auxiliary relay N	N	N	63(N01~N3F)	Ladder: NO FBD: 15(N1~NF)
temperature input	AT		4(AT01~AT04)	NO
analog output		AQ	4(AQ01~AQ04)	NO
PWM		P	2(P01~P02, P01 adds PLSY mode)	1(P1: PWM)
HMI			31(H01~H1F)	15(H1~HF)
Timer	T	T	Ladder: 31(T01~T1F) FBD: 250(T01~TFA)	15(T1~TF)
Counter	C	C	Ladder: 31(C01~C1F) FBD: 250(C01~CFA)	15(C1~CF)
RTC	R	R	Ladder: 31(R01~R1F) FBD: 250(R01~RFA)	15(R1~RF)
Analog Comparator	G	G	Ladder: 31(G01~G1F) FBD: 250(G01~GFA)	15(G1~GF)
AS(Add-Sub)	NO	NO	Ladder: 31(AS01~AS1F) FBD: 250(AS01~ASFA)	NO
MD(Mul-Div)			Ladder: 31(MD01~MD1F) FBD: 250(MD01~MDFA)	NO
PID			Ladder: 15(PI01~PI0F) FBD: 30(PI01~PI1E)	NO
MX(Multiplexer)			Ladder: 15(MX01~MX0F) FBD: 250(MX01~MXFA)	NO
AR(Analog Ramp)			Ladder: 15(AR01~AR0F) FBD: 30(AR01~AR1E)	NO
DR(Data Register)			240(DR01~DRF0)	NO
MU(MODBUS)			Ladder: 15(MU01~MU0F) FBD: 250(MU01~MUFA)	NO
Block	B	B	Logic function: BOOLEAN	NO
			260(B001~B260)The capability of each block is alterable, and the total capability of block is 6000bytes	99(B01~B99)The capability of each block is fixed
PM05(3rd)			PM05(3rd) can be used with all version of SG2	PM05 can not be used with SG2 V3.x

Chapter 1: Getting Started

The SG2 tiny 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 SG2 Controller.

 WARNING: Personal injury may result from improper operation.

 CAUTION: The SG2 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 SG2 smart relay is open and exposed. For the open-board models, all electrical components are exposed. For this reason, it is recommended the SG2 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 SG2 smart relay should only be installed and wired by properly experienced and certified personnel.

 Make sure the wiring of the SG2 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 SG2 smart relay, complete functional and safety testing must be conducted. Only run the SG2 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 SG2 smart relay operation must be shut down immediately.

Examination before Installation

Every SG2 smart relay has been fully tested and examined before shipment. Please carry out the following examination procedures after unpacking your SG2 smart relay.

• Check to see if the model number of the SG2 matches the model number that you ordered.

• Check to see whether any damage occurred to the SG2 during shipment. Do not connect the SG2 smart relay to the power supply if there is any sign of damage.

Contact TECO if you find any abnormal conditions as mentioned above.

Environmental Precautions

The installation site of the SG2 smart relay is very important. It relates directly to the functionality and the life span of your SG2. 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 SG2 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 SG2 smart relay

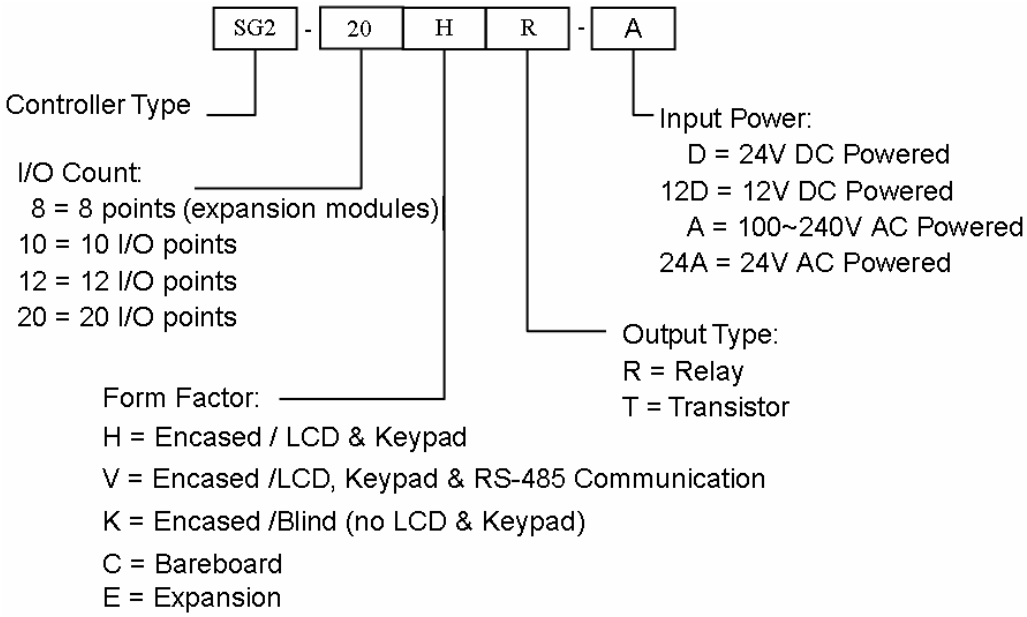
• Avoid electric-magnetic interference (soldering or power machinery)

• 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.

SG2 Model Identification

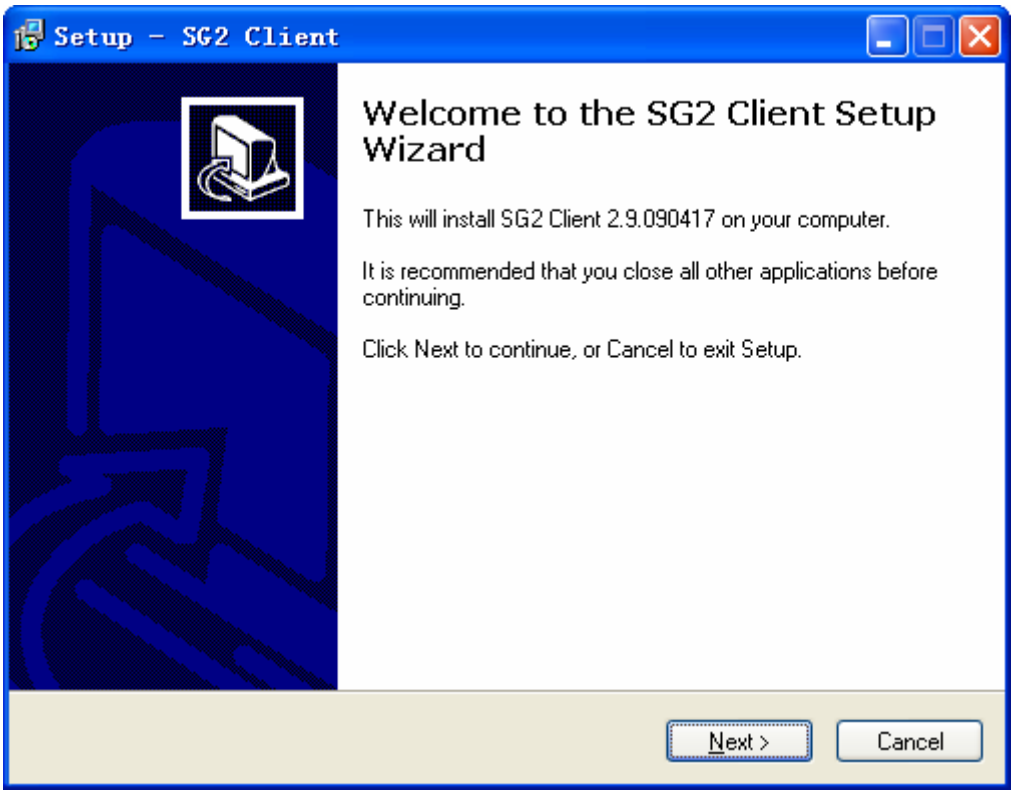


Quick Start Setup

This section is a simple 5-steps guide to connecting, programming and operating your new SG2 smart relay. This is not intended to be the complete instructions for programming and installation of your system. Many steps refer to other sections in the manual for more detailed information.

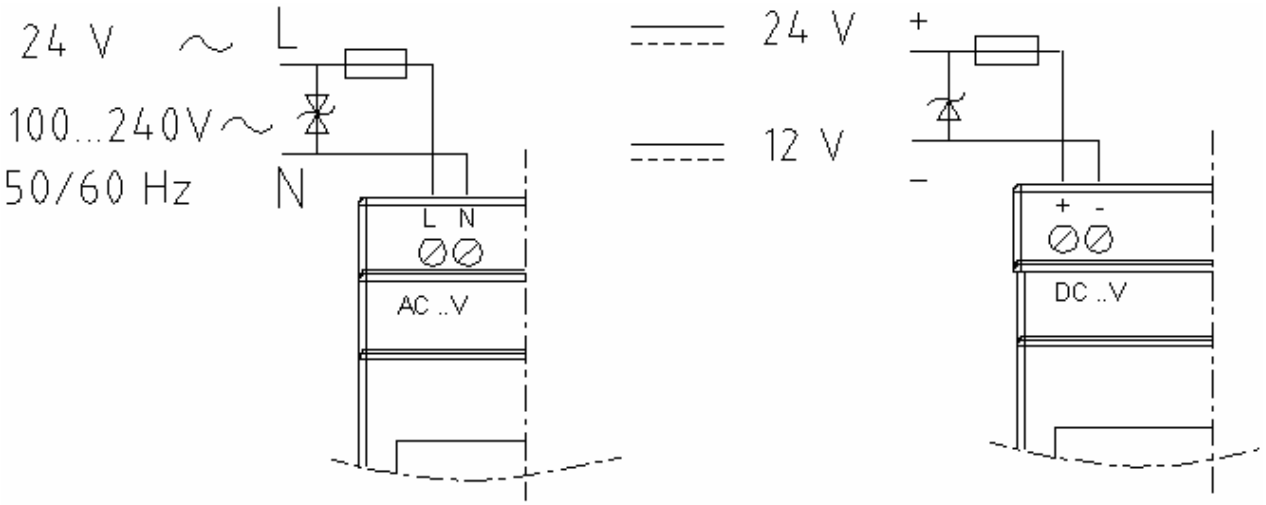
Install SG2 Client Software

Install the SG2 Client Software from CD or from the free internet download at www.taian-technology.com



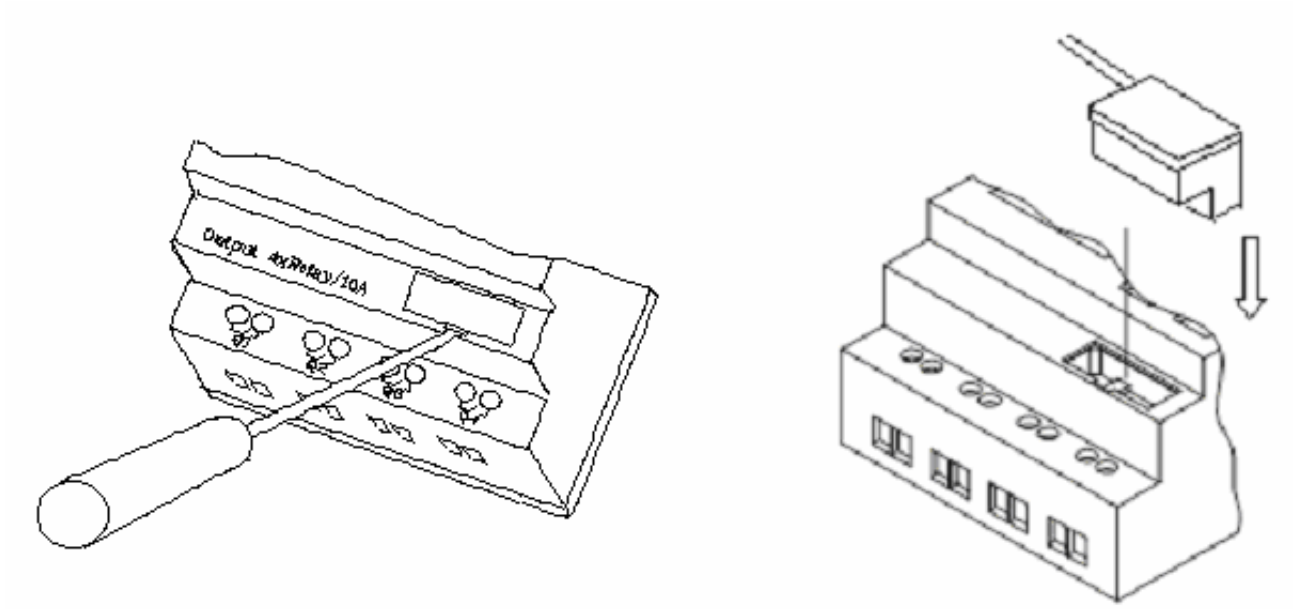
Connect Power to SG2 smart relay

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

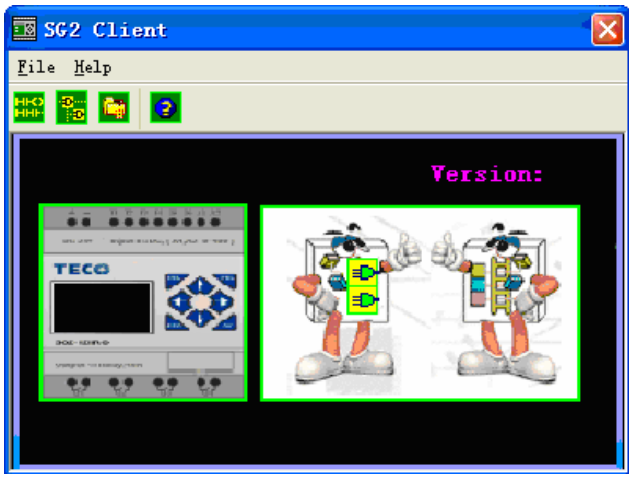
Remove the plastic connector cover from the SG2 using a flathead screwdriver as shown in the figure below. Insert the plastic connector end of the programming cable into the SG2 smart relay as shown in the figure below. Connect the opposite end of the cable to an RS232 serial port on the computer.

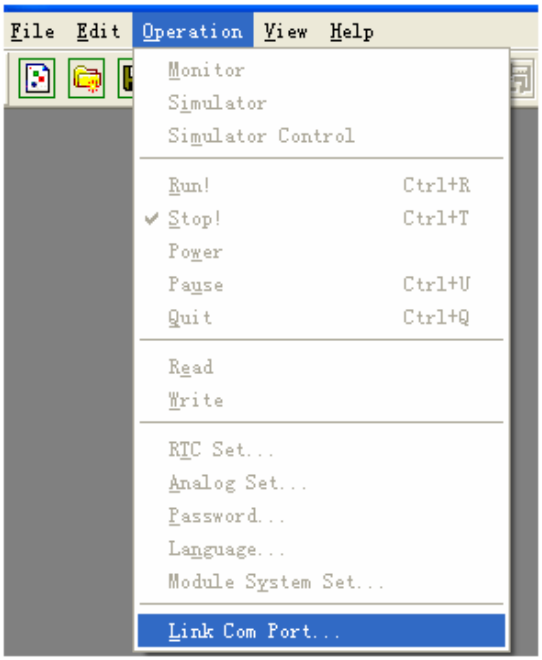


Establish Communication

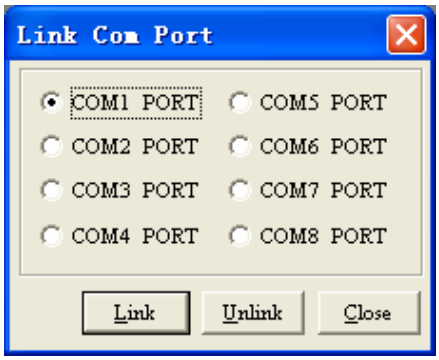
a. Open the SG2 Client software and select “New Ladder Document” as shown below left.

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





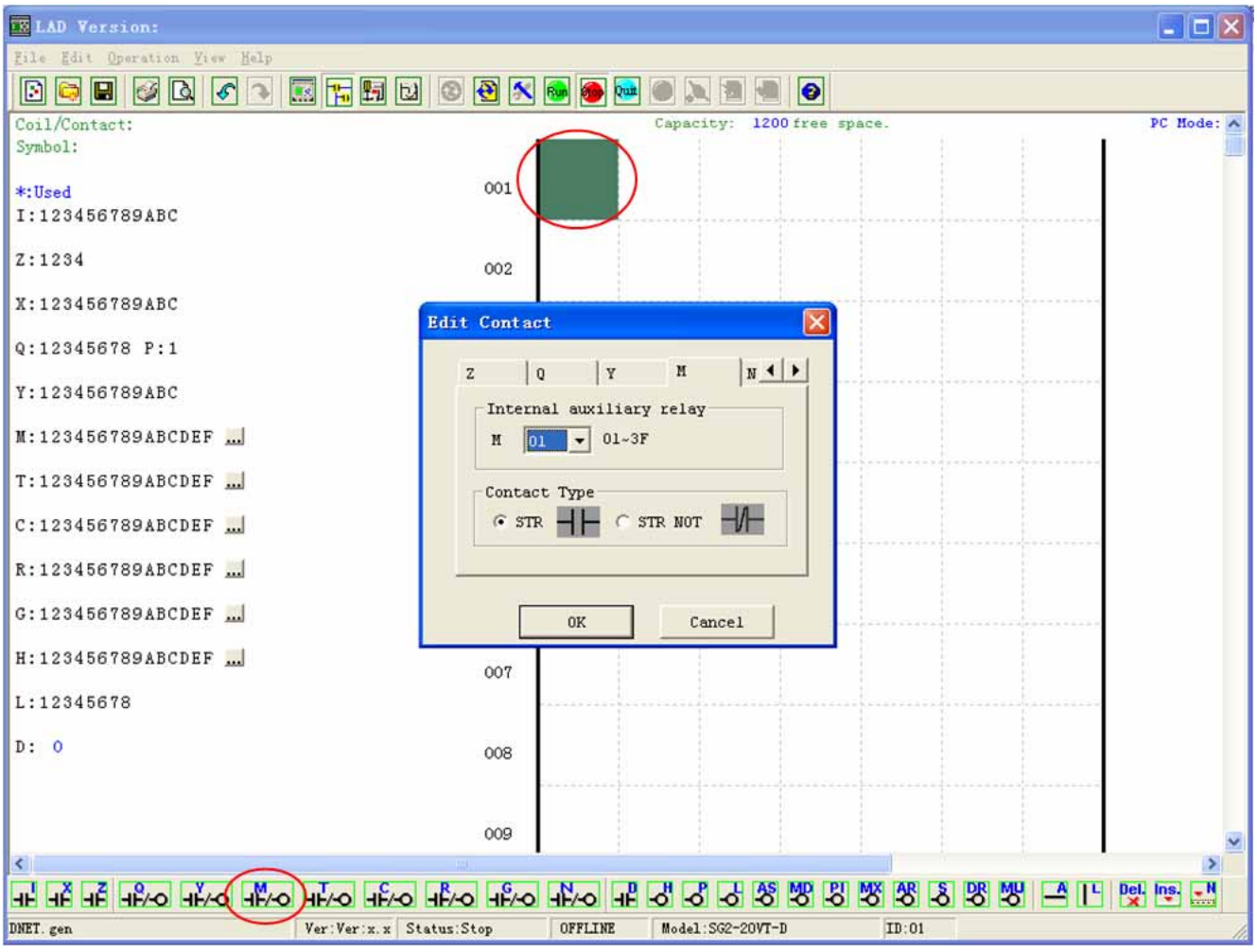
c. Select the correct Com Port number where the programming cable is connected to the computer then press the "Link" button.



d. The SG2 Client will then begin to detect the connected smart relay to complete its connection.

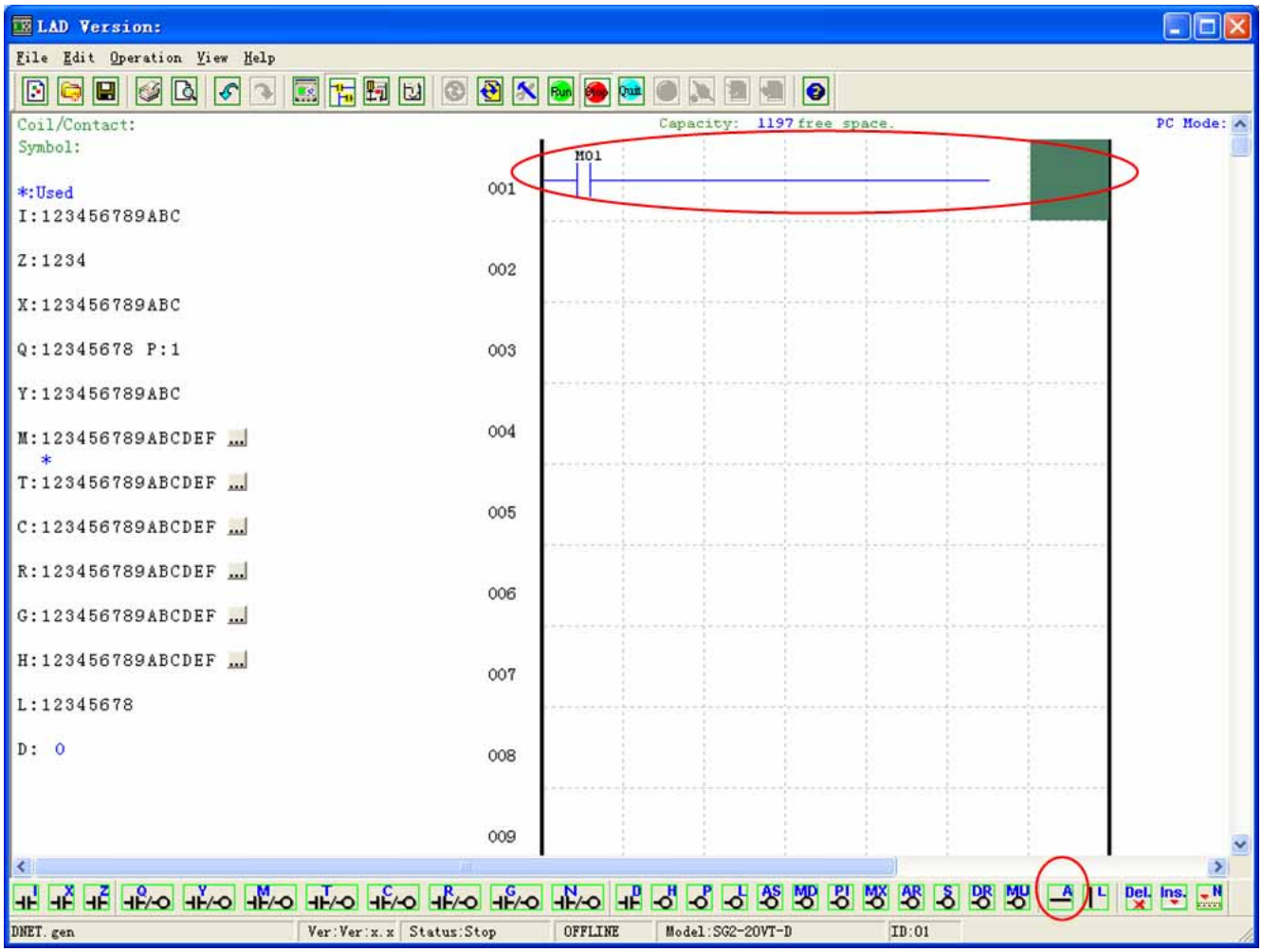
Write simple program

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.

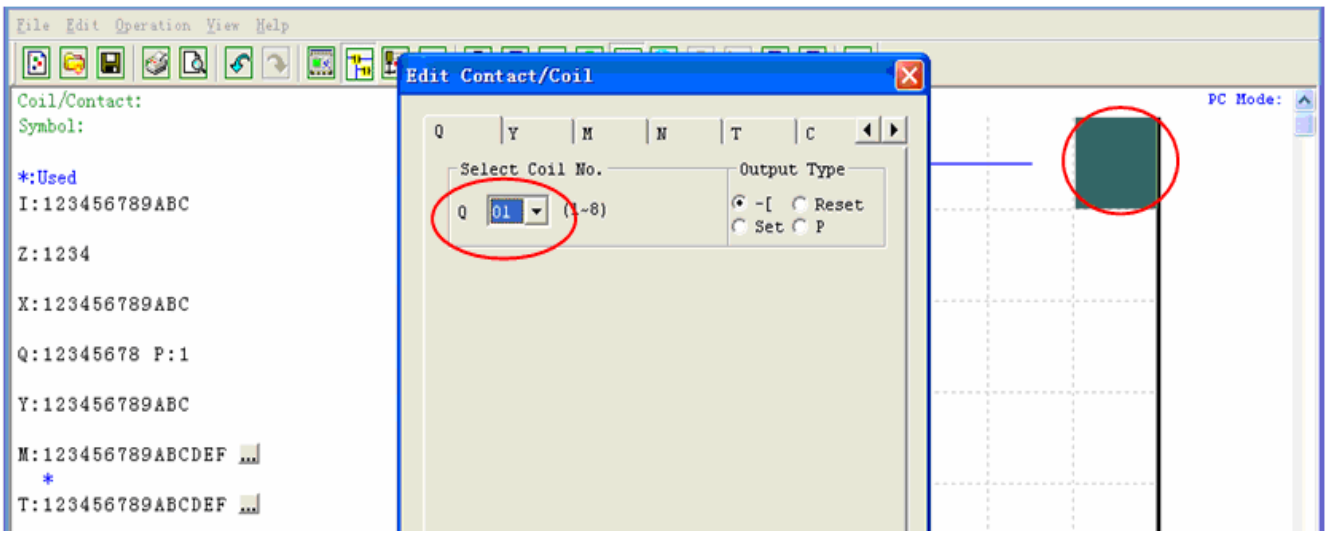


Note: If the ladder toolbar is not visible at the bottom of the screen, select **View>>Ladder** Toolbar from the menu to enable.

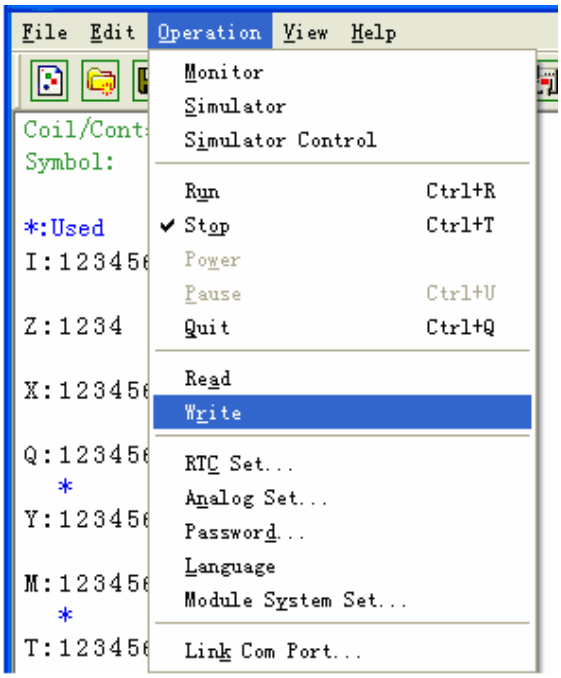
b. Use the “A” key on your keyboard (or the “A” icon on the ladder toolbar) to draw the horizontal circuit line from the M contact to the right most cell, as shown below.



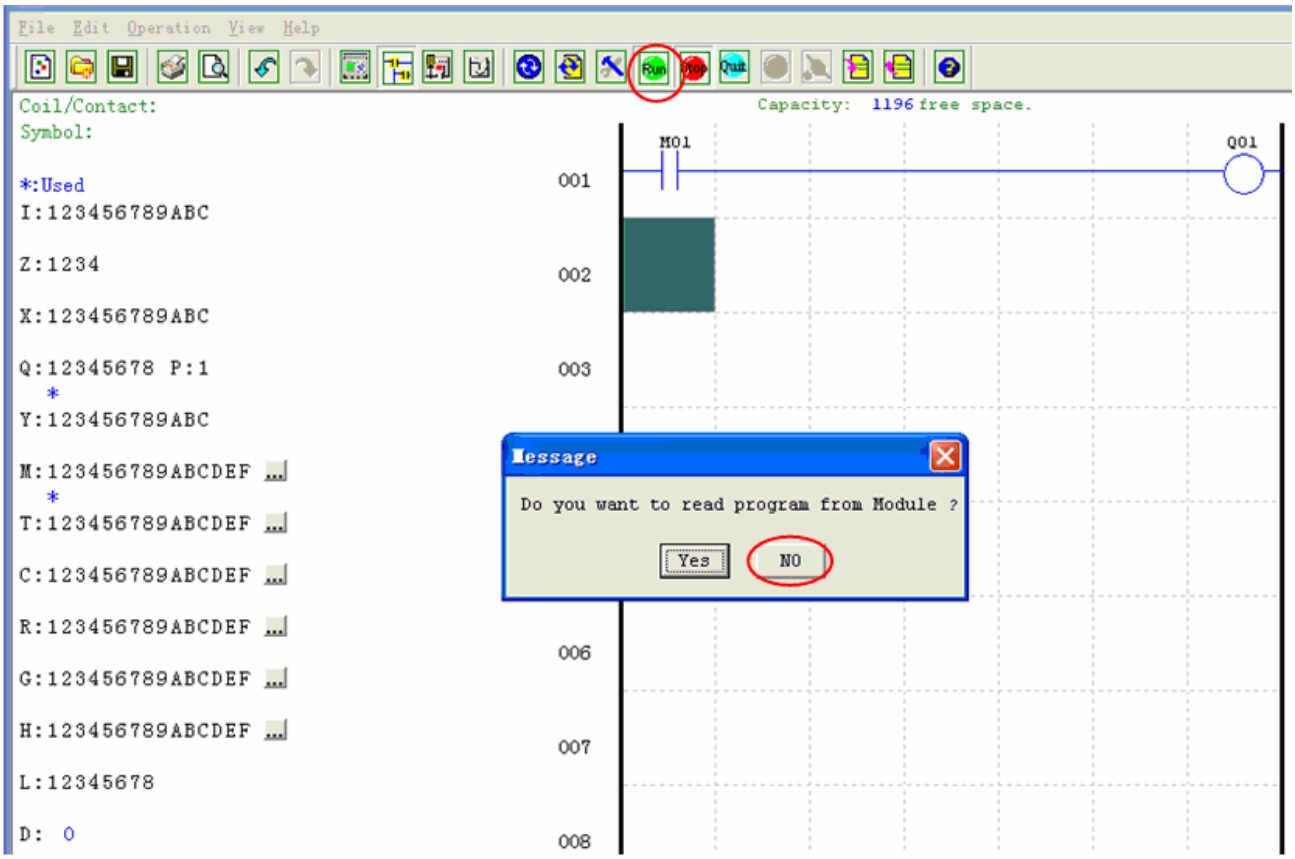
c. Select the “Q” coil icon from the ladder toolbar and drop it on the right most cells. Select Q01 from the dialog and press OK as shown below. See Chapter 4: Ladder Programming instructions for complete instruction set definitions.



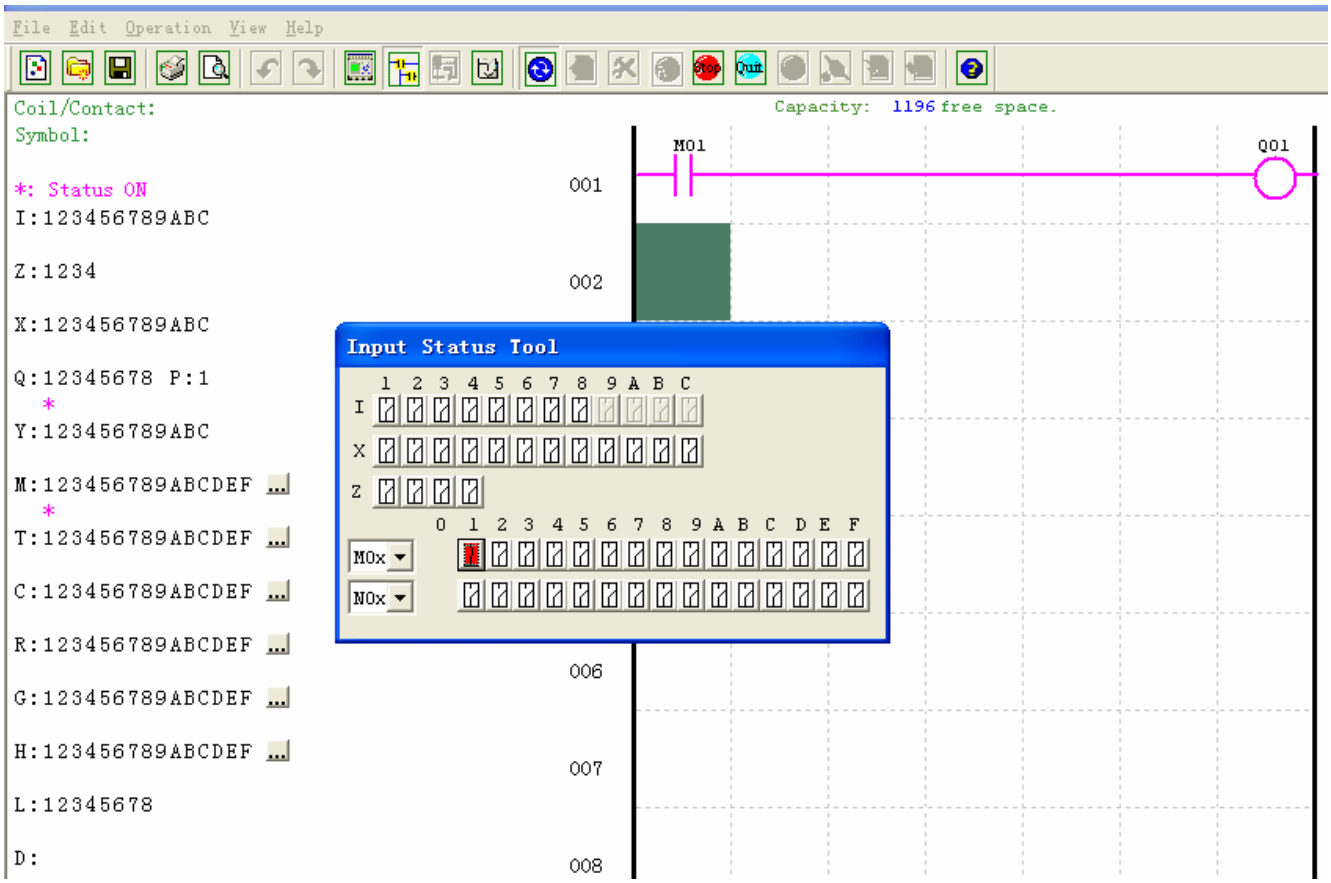
d. Test the simple program. From the Operation menu, select the Write function and write the program to the connected smart relay as shown below.



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 will show active 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

SG2 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 SG2 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	24V DC Models: 20.4-28.8V 12V DC Models: 10.4~14.4V AC Models: 85-265V 24V AC Models: 20.4-28.8V
Power Consumption	24VDC: 12-point :125mA 20-point: 185mA 12VDC: 12-point: 195mA 20-point: 265mA 100-240VAC: 100mA 24VAC: 290mA
Wire Size (all terminals)	26 to 14 AWG

Programming	
Programming languages	Ladder/Function Block Diagram
Program Memory	300 Lines or 260 Function Blocks
Programming storage media	Flash
Execution Speed	10ms/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
Compare Instructions (Analog, Analog*gain + Offset, Timer, Counter, Temperature Input (AT), Analog Output (AQ), AS, MD, PI, MX, AR and DR Values)	

Analog compare	
Maximum Number	Ladder: 31；FBD: 250
Compare versus other inputs	Analog, Timer, Counter, Temperature Input (AT), Analog Output (AQ), Analog*gain + Offset, AS, MD, PI, MX, AR , DR , or Numeric values

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 (C type: 160g) 20-point: 345g (C type: 250g)
Agency Approvals	CUL , CE, UL

Discrete Inputs	
Current consumption	3.2mA @24VDC 4mA @12VDC 1.3mA @100-240VAC 3.3mA @24VAC
Input Signal ”OFF” Threshold	24VDC: < 5VDC; 12VDC: < 2.5VDC 100-240VAC : < 40VAC 24VAC: <6VAC
Input Signal ”ON” Threshold	24VDC: > 15VDC; 12VDC: > 7.5VDC 100-240VAC : > 79VAC 24VAC: >14VAC
Input On delay	24, 12VDC: 5ms 240VAC: 25ms; 120VAC: 50ms 24VAC: 5ms
Input Off Delay	24, 12VDC: 3ms 240VAC: 90/85ms 50/60Hz ; 120VAC: 50/45ms 50/60Hz 24VAC: 3ms
Transistor device compatibility	NPN, 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 #	Input Power	Inputs	Outputs	Display & Keypad	RS-485 Communications	Max I/O
SG2-12HR-D	24 VDC	6 DC, 2 Analog	4 Relay	√, Z01-Z04	N/A	36 + 4 *1
SG2-12HT-D		6 DC, 2 Analog	4 Trans.	√, Z01-Z04	N/A	36 + 4 *1
SG2-20HR-D		8 DC, 4 Analog	8 Relay	√, Z01-Z04	N/A	44 + 4 *1
SG2-20HT-D		8 DC, 4 Analog	8 Trans.	√, Z01-Z04	N/A	44 + 4 *1
SG2-20VR-D		8 DC, 4 Analog	8 Relay	√, Z01-Z04	Built-in MODBUS	44 + 4 *1
SG2-20VT-D		8 DC, 4 Analog	8 Trans.	√, Z01-Z04	Built-in MODBUS	44 + 4 *1
SG2-12HR-12D	12 VDC	6 DC, 2 Analog	4 Relay	√, Z01-Z04	N/A	36 + 4 *1
SG2-20HR-12D		8 DC, 4 Analog	8 Relay	√, Z01-Z04	N/A	44 + 4 *1
SG2-20VR-12D		8 DC, 4 Analog	8 Relay	√, Z01-Z04	Built-in MODBUS	44 + 4 *1
SG2-10HR-A	100-240 VAC	6 AC	4 Relay	√, Z01-Z04	N/A	34+ 4 *1
SG2-20HR-A		12 AC	8 Relay	√, Z01-Z04	N/A	44 + 4 *1
SG2-12HR-24A	24VDC	8 AC	4 Relay	√, Z01-Z04	N/A	36 + 4 *1
SG2-20HR-24A		12 AC	8 Relay	√, Z01-Z04	N/A	44 + 4 *1
Expansion Modules						
SG2-8ER-D	24VDC	4 DC	4 Relay	N/A	N/A	N/A
SG2-8ET-D		4 DC	4 Trans.	N/A	N/A	N/A
SG2-8ER-A	100-240VAC	4 AC	4 Relay	N/A	N/A	N/A
SG2-8ER-24A	24VAC	4 AC	4 Relay	N/A	N/A	N/A
SG2-4AI	24 VDC	4 Analog	N/A	N/A	N/A	N/A
SG2-4PT		4 Analog	N/A	N/A	N/A	N/A
SG2-2AO		N/A	2 Analog	N/A	N/A	N/A
SG2-MBUS		Communications Module, RS-485 ModBus RTU slaver				
SG2-DNET		Communications Module, DeviceNet Group2 slaver				
SG2-PBUS		Communications Module, Profibus-DP slaver				
EN01		Communications Module, TCP/IP				
OEM “Blind” Models, No Keypad, No Display						
SG2-12KR-D	24VDC	6 DC, 2 Analog	4 Relay	X	N/A	36
SG2-12KT-D		6 DC, 2 Analog	4 Trans.	X	N/A	36
SG2-20KR-D		8 DC, 4 Analog	8 Relay	X	N/A	44
SG2-20KT-D		8 DC, 4 Analog	8 Trans.	X	N/A	44
SG2-12KR-12D	12VDC	6 DC, 2 Analog	4 Relay	X	N/A	36
SG2-10KR-A	100-240VAC	6 AC	4 Relay	X	N/A	34
SG2-20KR-A		12 AC	8 Relay	X	N/A	44
OEM “Baseboard” Models, No Keypad, No Display, No Expansion						
SG2-12CR-D	24VDC	6 DC, 2 Analog	4 Relay	X	N/A	12
SG2-12CT-D		6 DC, 2 Analog	4 Trans.	X	N/A	12
SG2-20CR-D		8 DC, 4 Analog	8 Relay	X	N/A	20
SG2-20CT-D		8 DC, 4 Analog	8 Trans.	X	N/A	20
SG2-10CR-A	100-240VAC	6 AC	4 Relay	X	N/A	10
SG2-20CR-A		12 AC	8 Relay	X	N/A	20
Accessories						
SG2-PL01	SG2 Programming Cable, SG2 Programming software					
SG2-PM05(3rd)	SG2 Memory cartridge					

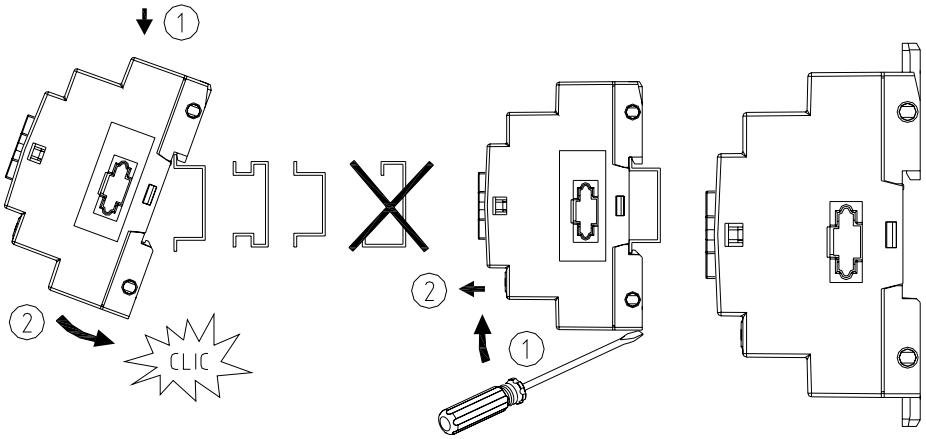
※ If module with keypad and display, Max IO can be added keypad input Z01-Z04.

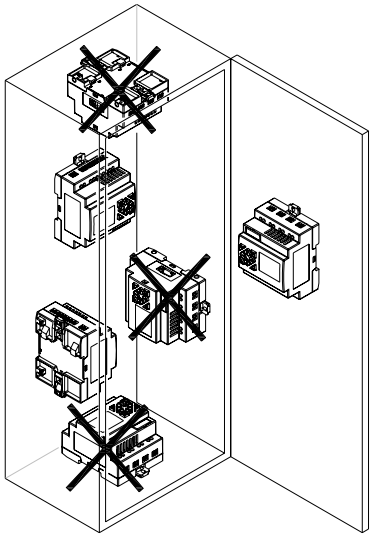
※ More information about Product Specifications to see “chapter 6: Product Specifications”.

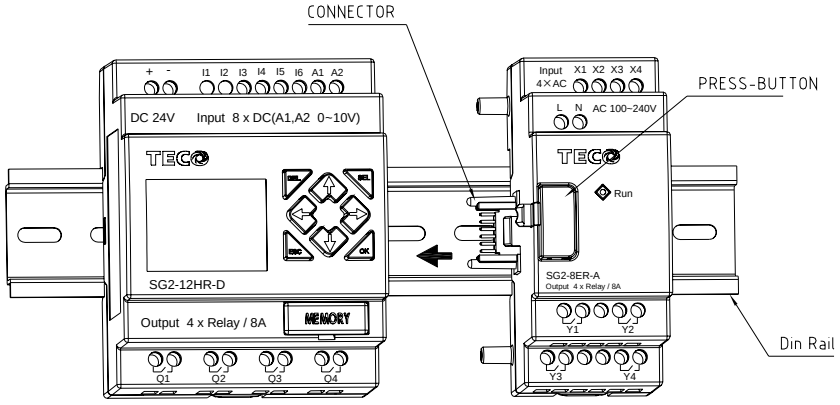
Mounting

DIN-rail Mounting

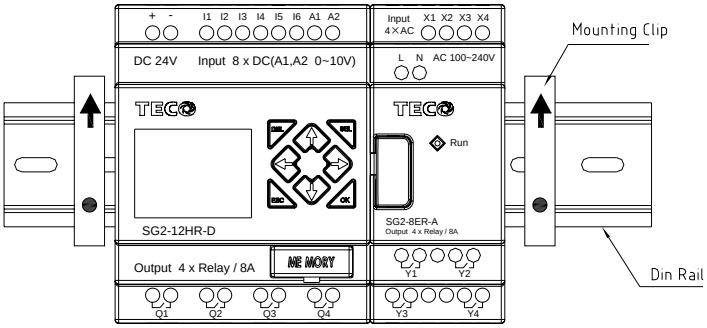
The SG2 smart relay should always be mounted vertically. Press the slots on the back of the SG2 and expansion module plug CONNECTOR onto the rail until the plastic clamps hold the rails in place. Then connect the expansion module and CONNECTOR with the Master (press the PRESS-BUTTON simultaneously)





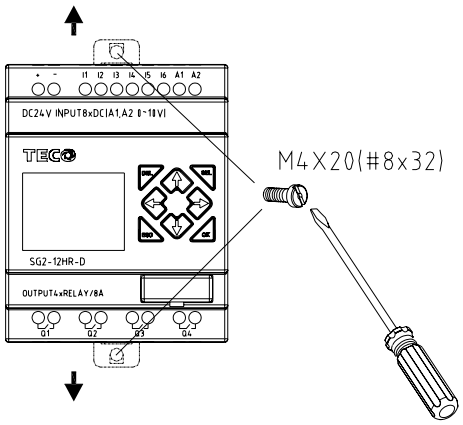


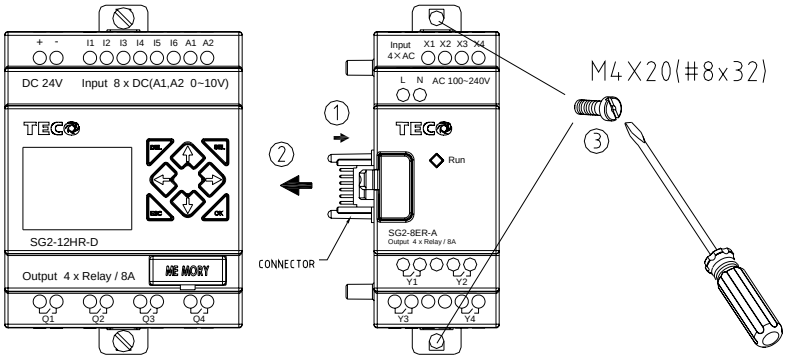
It is recommended to apply a DIN-rail end clamp to hold the SG2 in place.



Direct Mounting

Use M4 screws to direct mount the SG2 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.

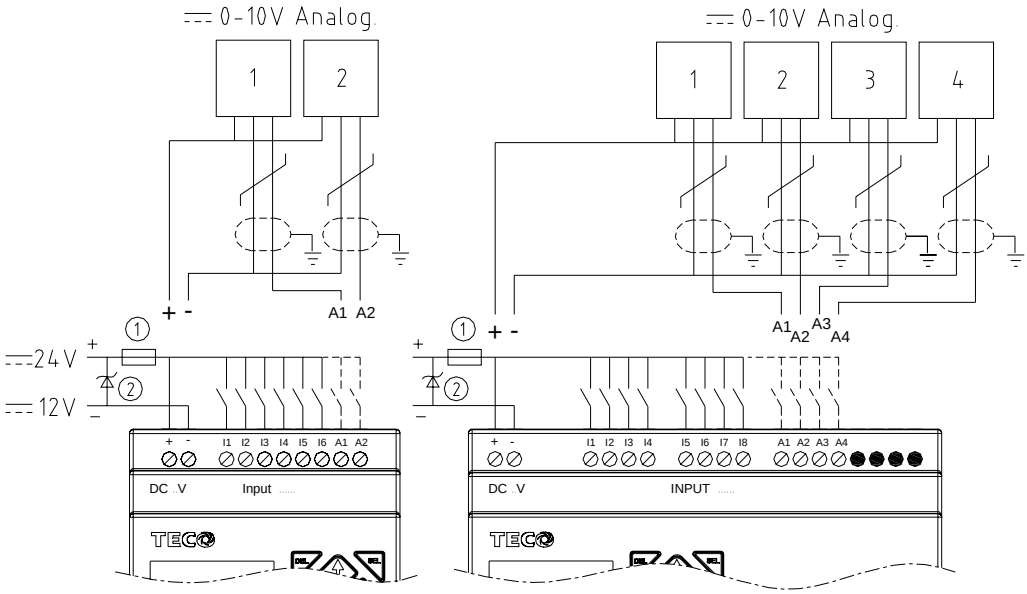
To avoid a short circuit on the load side, it is recommended to connect a fuse between each output terminals and loads.

Wire size and Terminal Torque

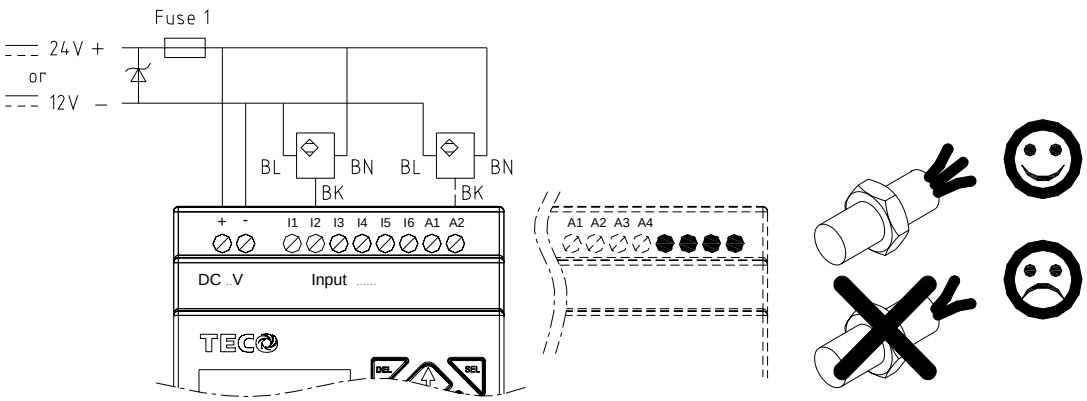
mm²	0.14...1.5	0.14...0.75	0.14...2.5	0.14...2.5	0.14...1.5
AWG	26...16	26...18	26...14	26...14	26...16

⌀3.5 (0.14in)	C	Nm	0.6
		lb-in	5.4

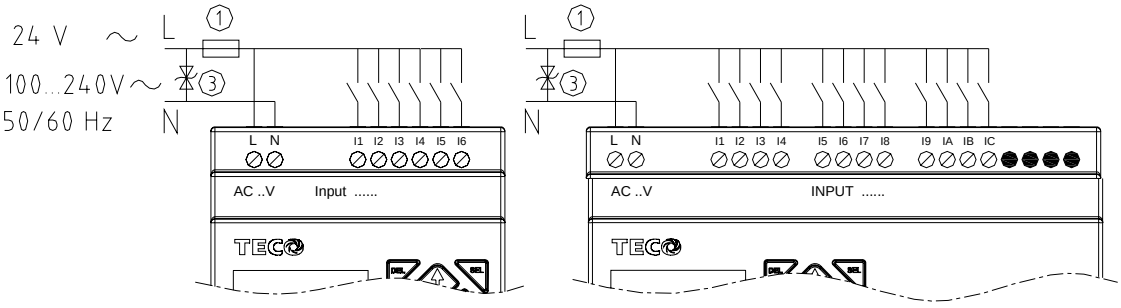
Input 12/24V DC



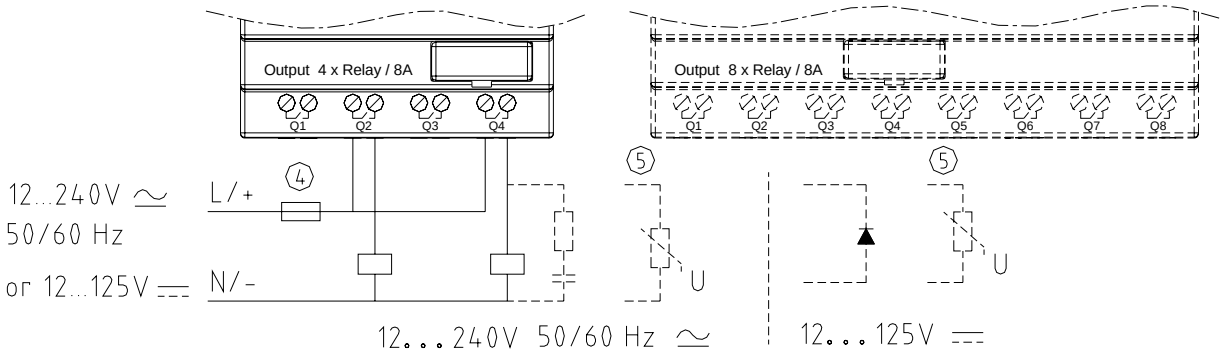
Sensor Connection



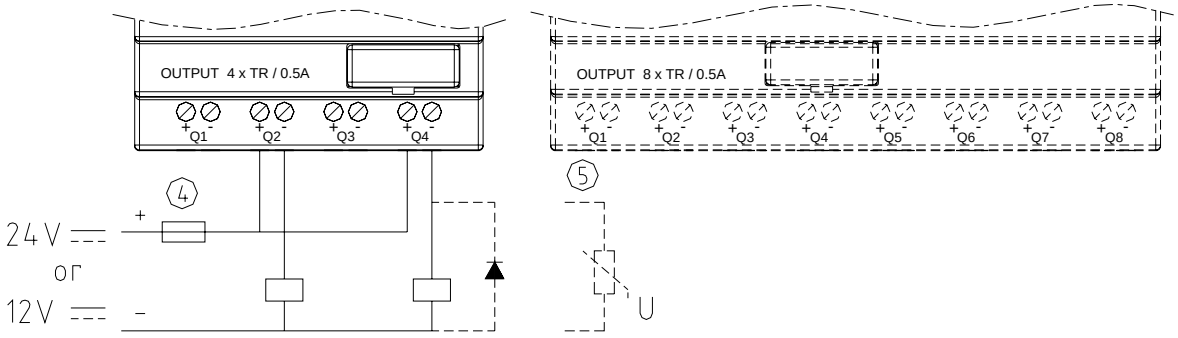
Input 100~240V /24V AC



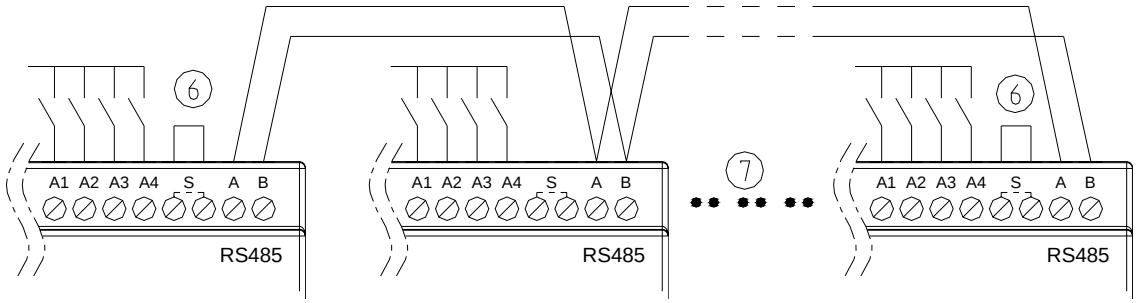
Output (Relay)



Output (Transistor)



Data 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).

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

②-Surge absorber (36V DC)

③-Surge absorber (400V AC)

④-Fuse, circuit-breaker or circuit protector

⑤-Inductive load

⑥-Only short circuit the first product and the last product

⑦-Comply with standard: EIA RS-485.

※ More information about V type communication to see "Chapter 7 20 Pointe V type High-powered Models Instruction".

K type Indicator Light

There is an indicator light to indicate the status of SG2 (K type) smart, and the below table shows the relationship between the light and the SG2 status.

State of light	Description
◆	Power up, SG2 is stopping
✦	Flicker slow(2Hz), SG2 is running
✸	Flicker quick(5Hz), SG2 is under failure status
	—ROM error —illogicality in user program —EEPROM error —expansion model error

Chapter 3: Program Tools

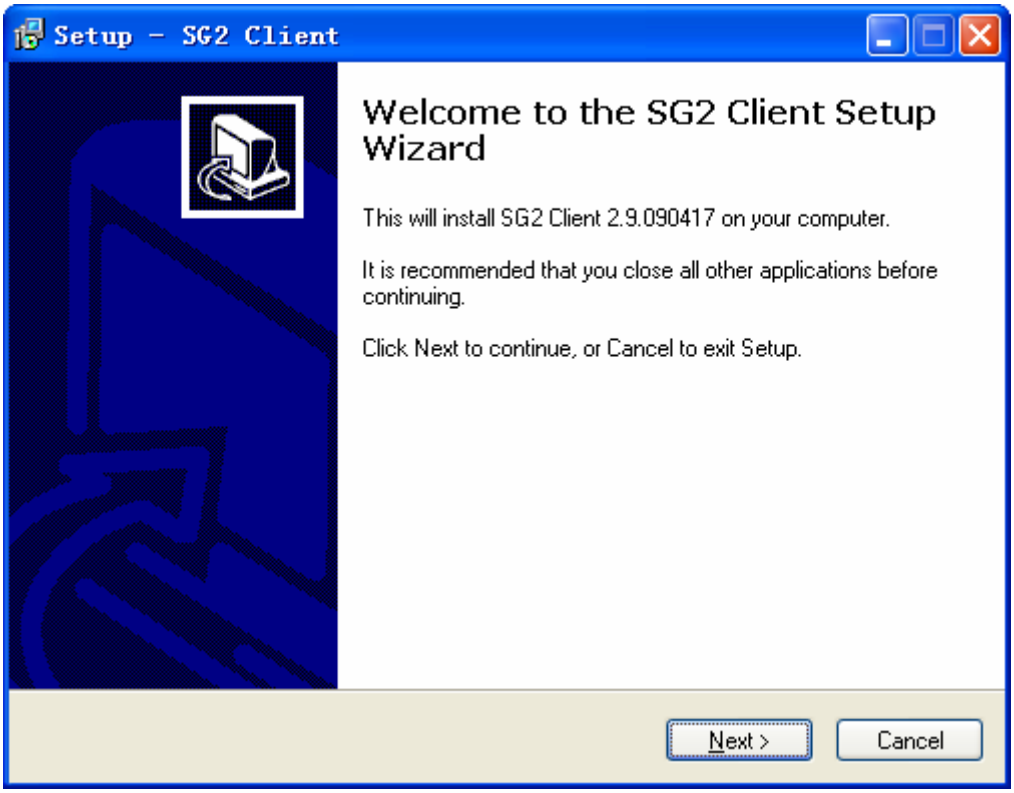
PC Programming Software "SG2 Client"

The SG2 Client programming software provides two edit modes, Ladder Logic and Function Block Diagram (FBD). The SG2 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 a SG2 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 SG2 smart relay operation during RUN mode.

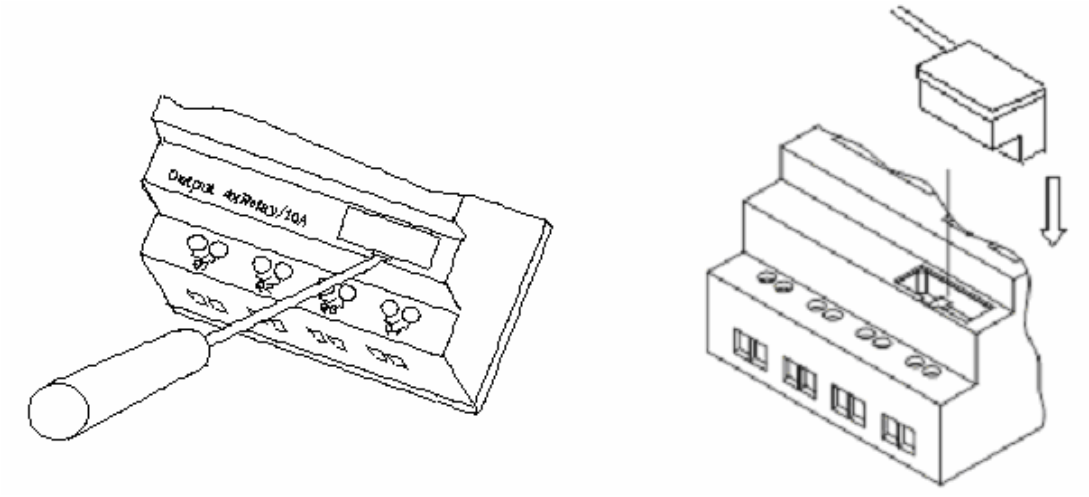
Installing the Software

Install the SG2 Client Software from CD or from the free internet download at
www.taian-technology.com



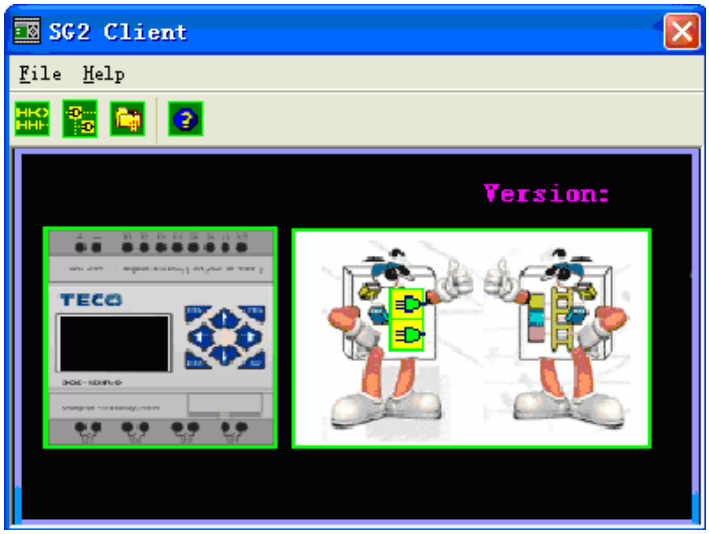
Connecting the Software

Remove the plastic connector cover from SG2 using a flathead screwdriver as shown in the figure below. Insert the plastic connector end of the programming cable into the SG2 smart relay as shown in the figure below. Connect the opposite end of the cable to an RS232C serial port on the computer.



Start Screen

Run the SG2 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

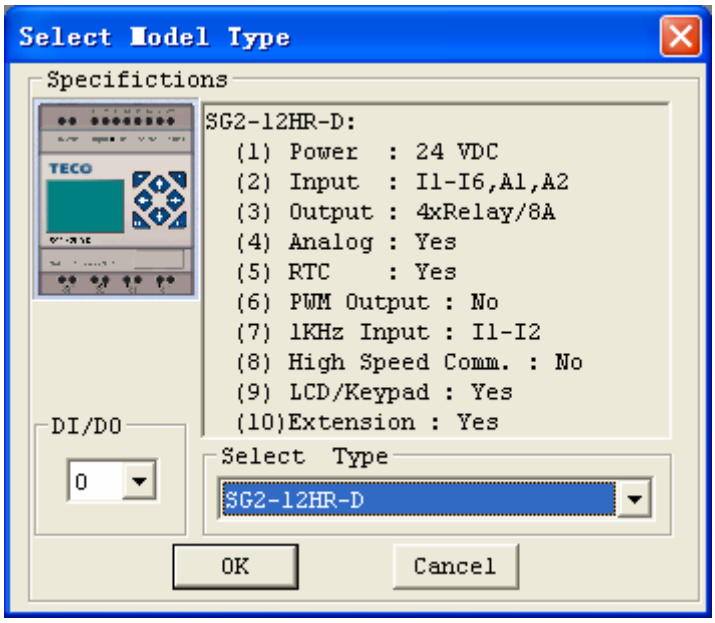
Select **File -->New -->New FBD** to enter the development environment for a new FBD (Function Block Diagram) program.

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 SG2 using the Ladder Logic programming language. To begin a new program select **File-->New**, and select the desired model of SG2, and the number of connected expansion units if applicable, as shown below.



Menus, Icons and Status Displays

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 SG2 smart relay.

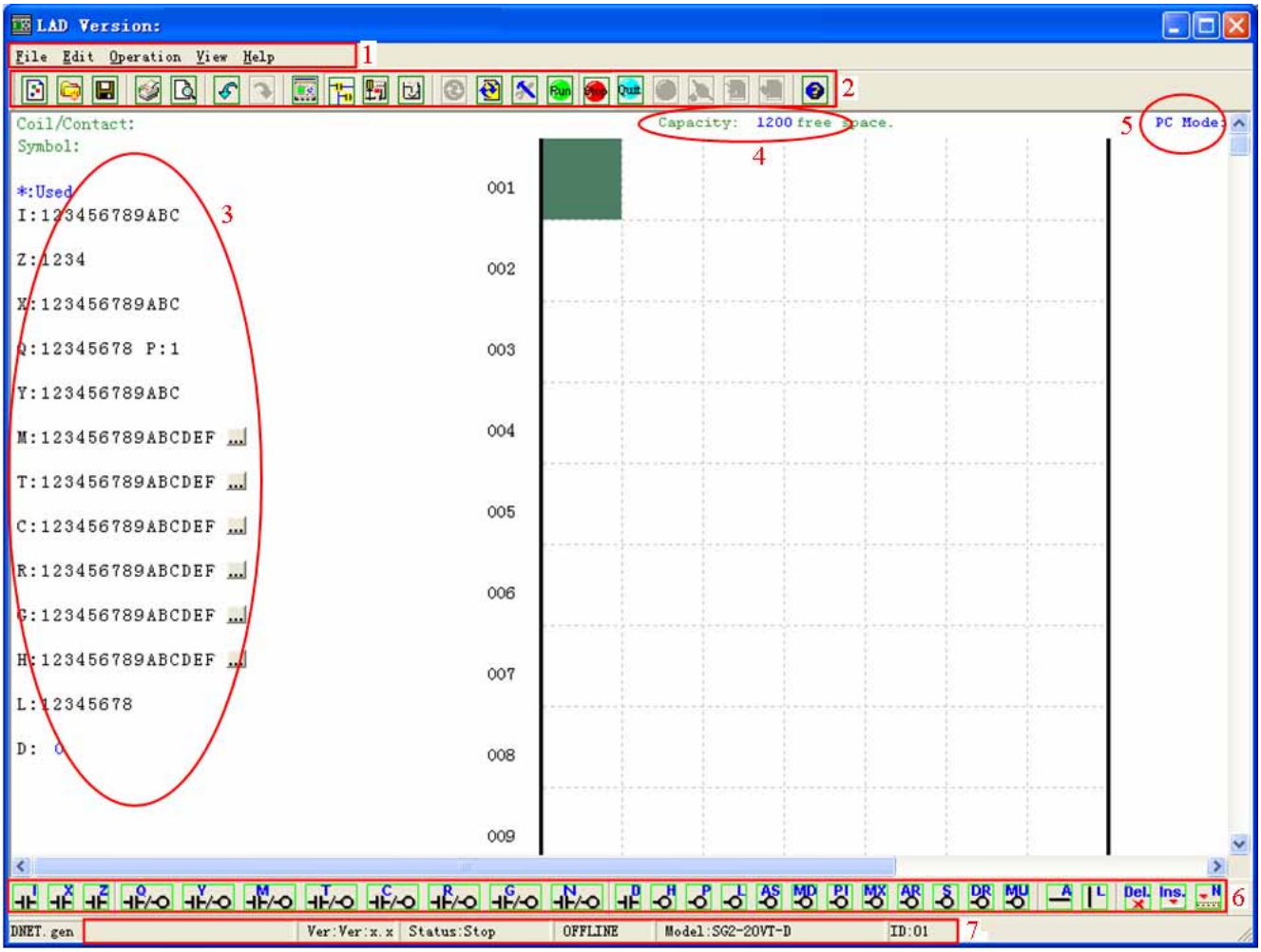
3. Usage List – List for all memory types and addresses used with the current open program. Used addresses are designated by a "*" symbol below each address.

4. Amount of free programming memory available.

5. Current Mode – operation mode of the controller, or simulator, from the connected PC.

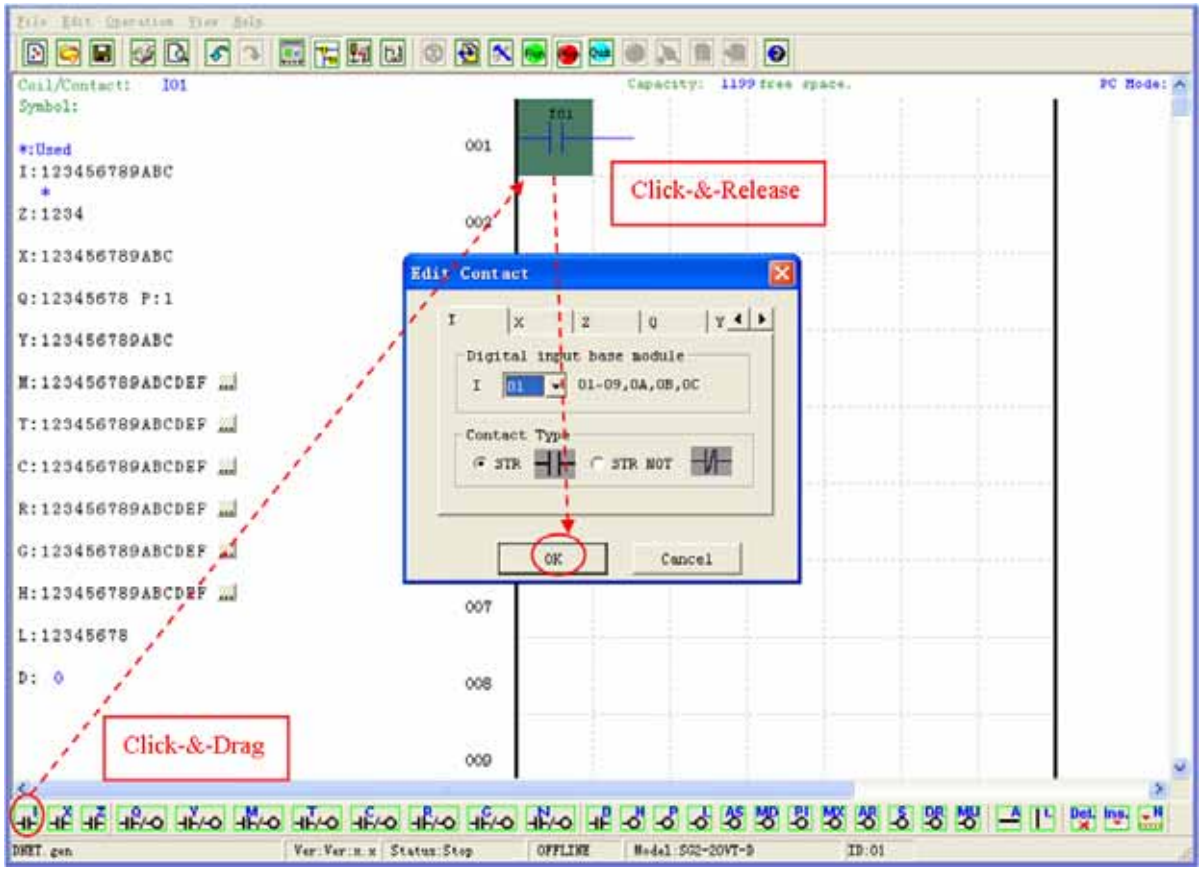
6. Ladder Toolbar – Icons for selecting and entering all available Ladder Logic instructions.

7. Status Bar – Status of current open project and connect SG2 smart relay.

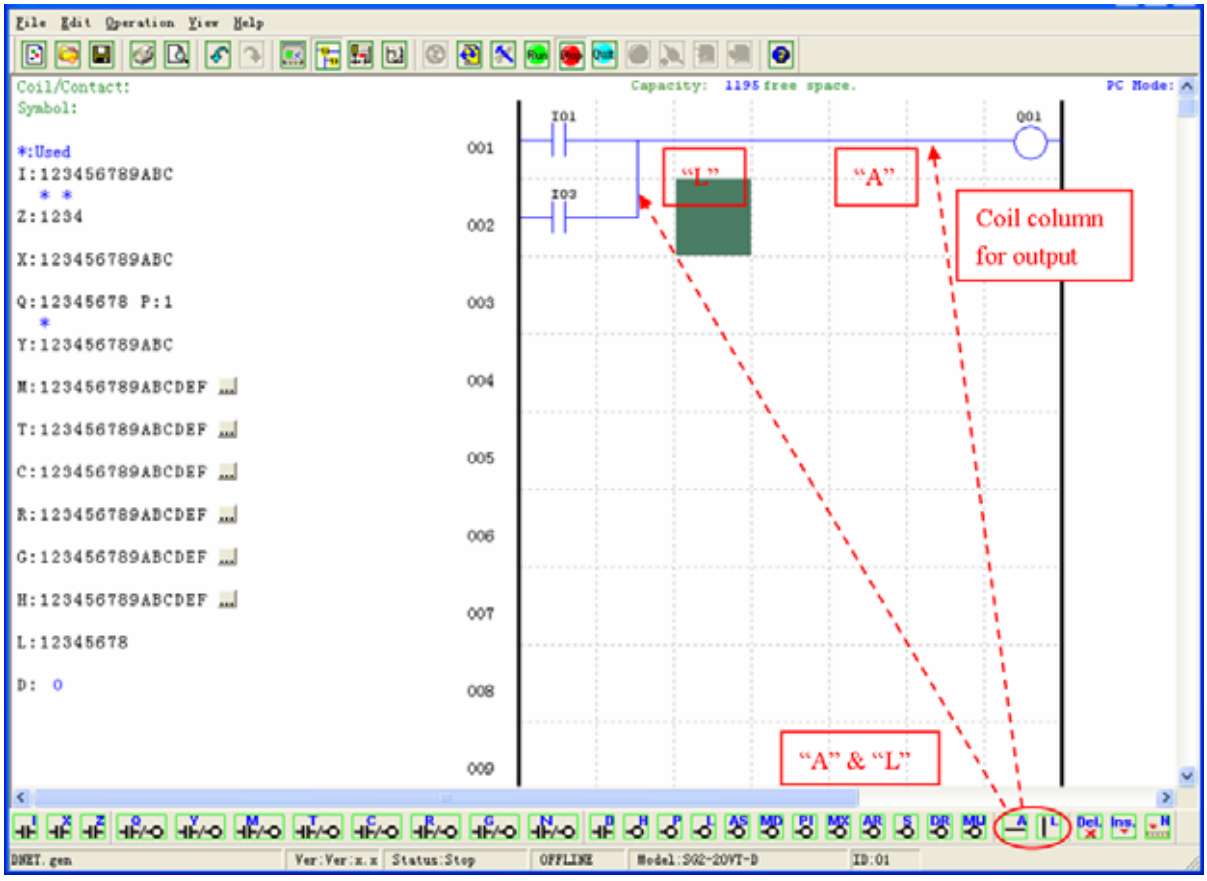


Programming

The SG2 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.

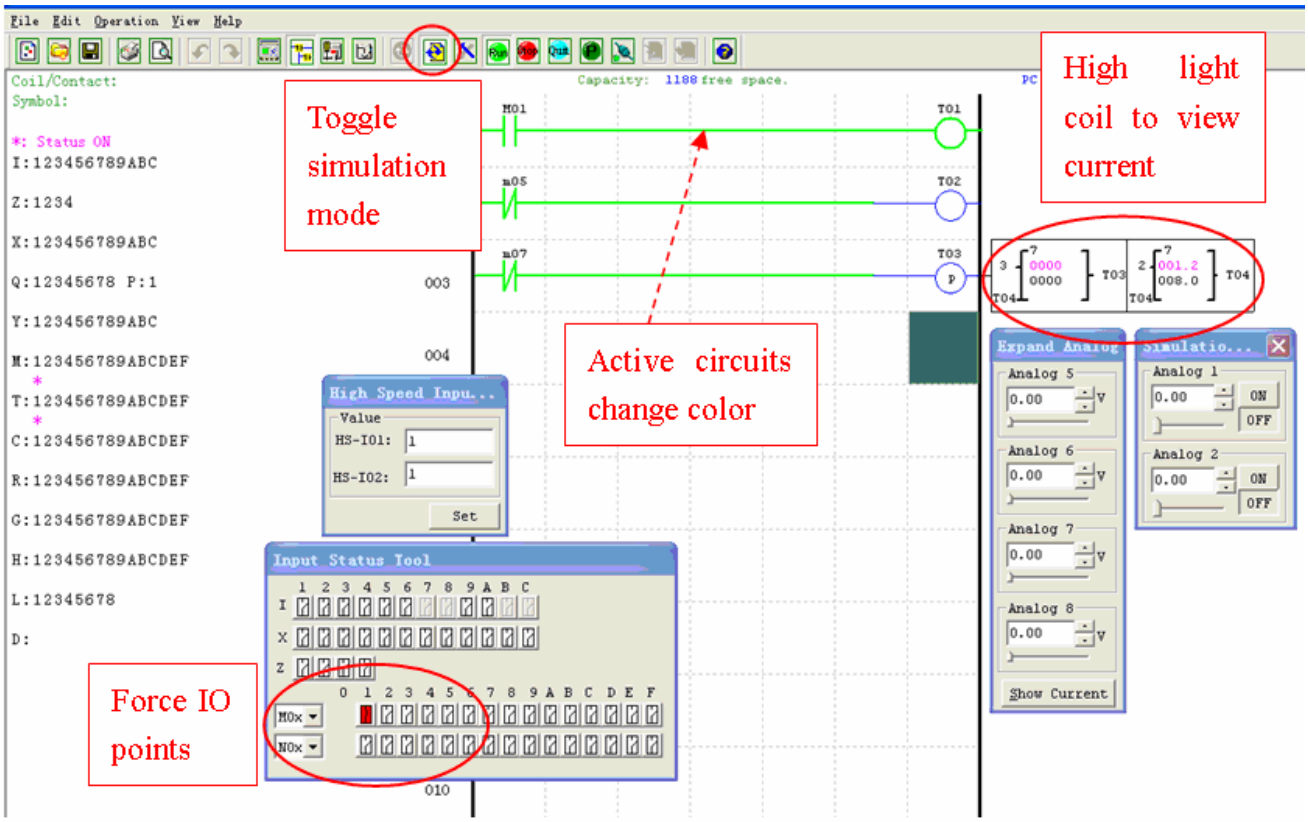


The “A” and “L” keys or icons are used to complete parallel and serial circuits. The right column is for output coils.



Simulation Mode

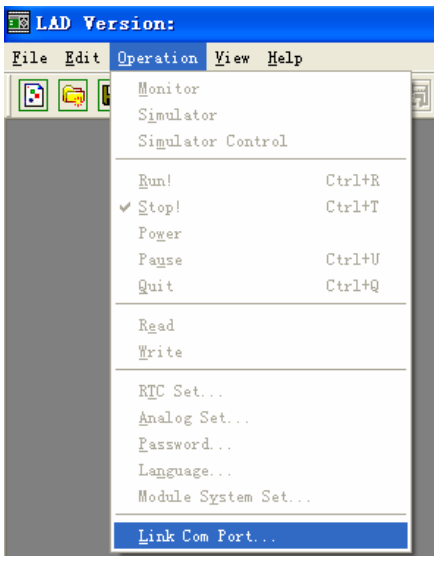
The SG2 Client software includes a built-in simulator to test and debug programs easily without the need for downloading to a controller. To activate simulation mode, simply press the red RUN icon. The program below is shown in simulation mode, identifying the significant available features.

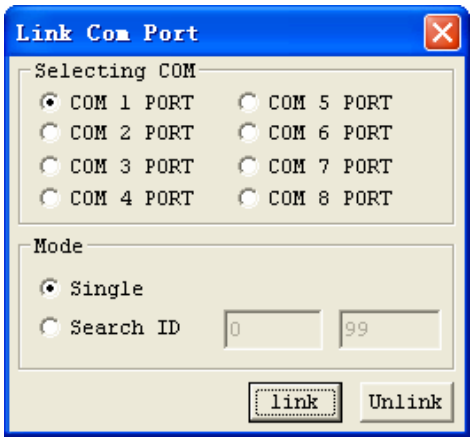


Establish Communication

The following is the simple procedure for establishing communication between PC and the SG2 smart relay.

a. Select “Operation/Link Com Port…” as shown below.



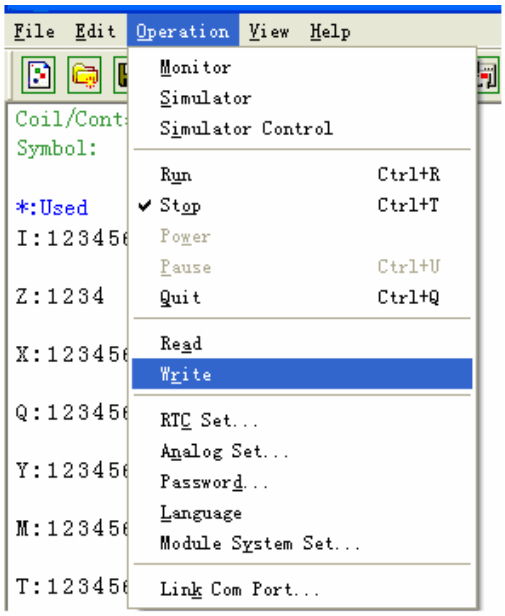


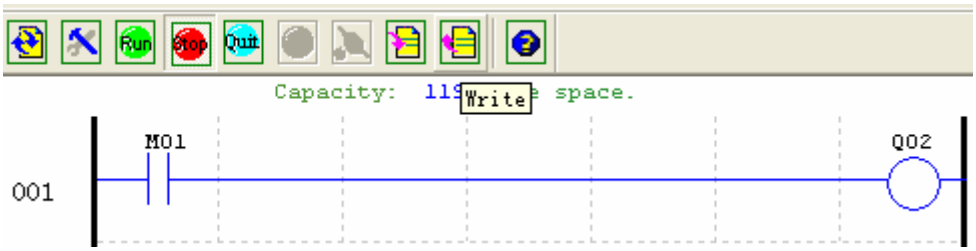
b. Select the correct Com Port number where the programming cable is connected to the computer then press the “Link” button.

c. The SG2 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.





Operation menu

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

Monitor – Online function for runtime monitor and editing when connected to a controller

Simulator – Offline function for testing and debugging a program.

Simulator Control – Self-motion simulator control

Run-Stop-Quit – Mode change selections for both runtime editing and simulation mode.

Read-Write – Reading and writing programs to and from a connected SG2 smart relay.

RTC Set – Online function for setup of the Real-time clock/calendar (see dialog below left)

Analog Set – setup analog input A01-A08 gain and offset (see dialog below right)

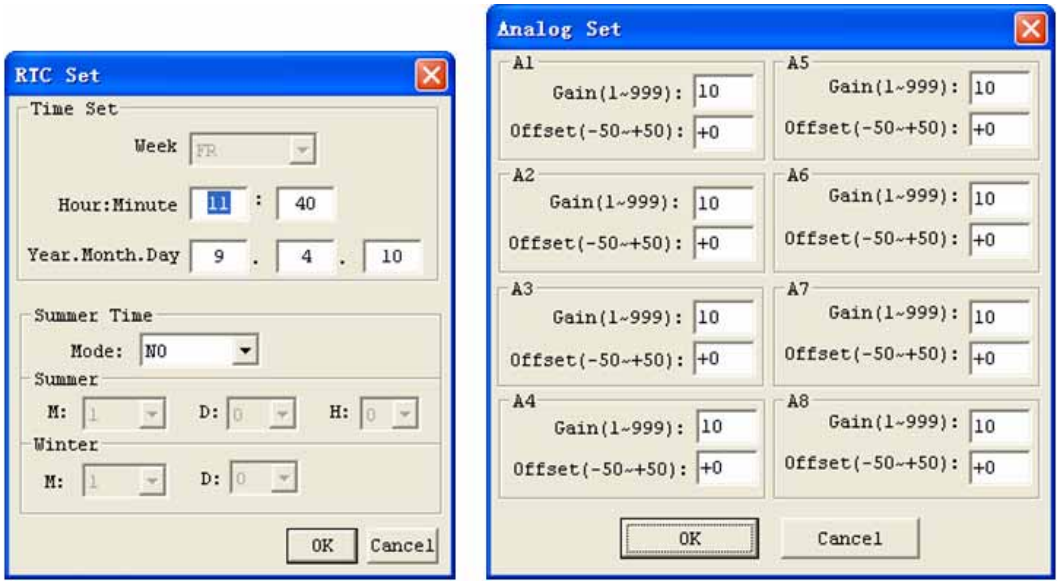
Password – Set a password for accessing the current program after upload to the smart relay

Language – Change SG2 smart relay menu language

Module System Set – Dialog for changing important system setup functions including Module ID,

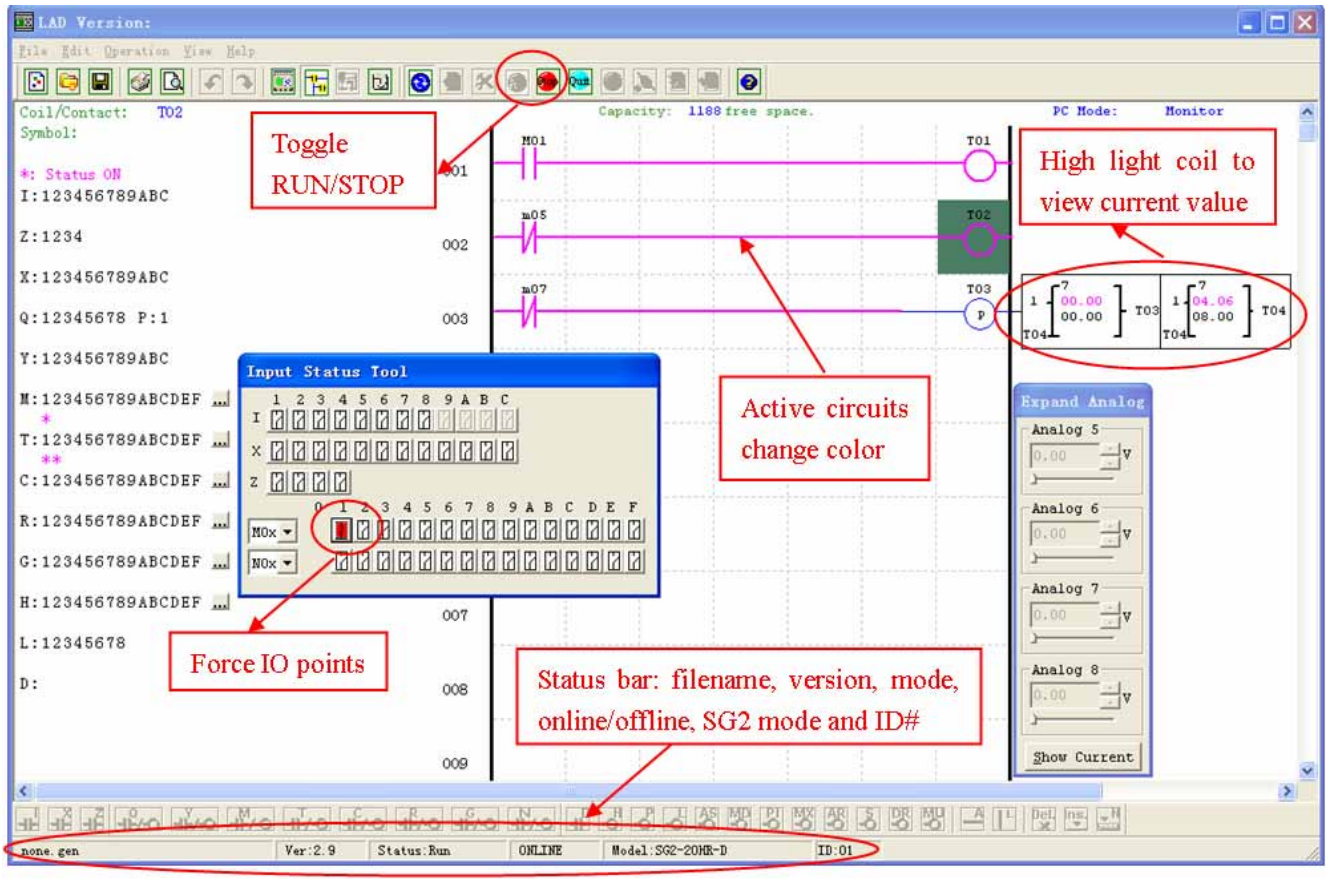
Remote I/O preferences, Expansion I/O settings, and Retentive memory preferences (Keeping) for (C) Counters, (M) Auxiliary Coils, and (Z) keypad input set and the LCD Backlight.

Link Com Port – Select the port communication with SG2 smart relay.



Online Monitoring/Editing

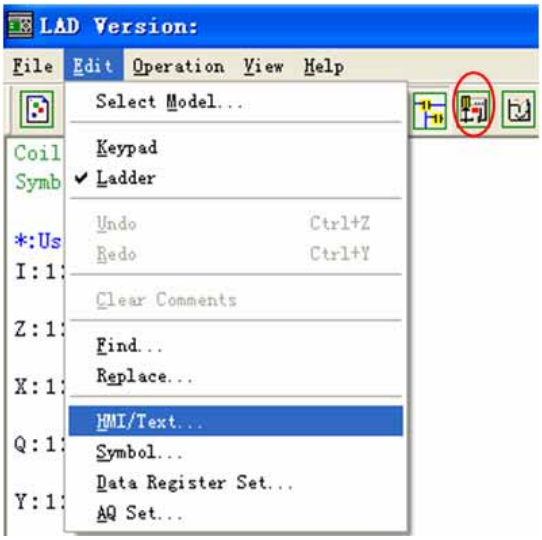
The SG2 Client software allows for online monitoring of the currently running program during runtime. Additional online functions include, I/O forcing, and Mode changes (Run/Stop/Quit).

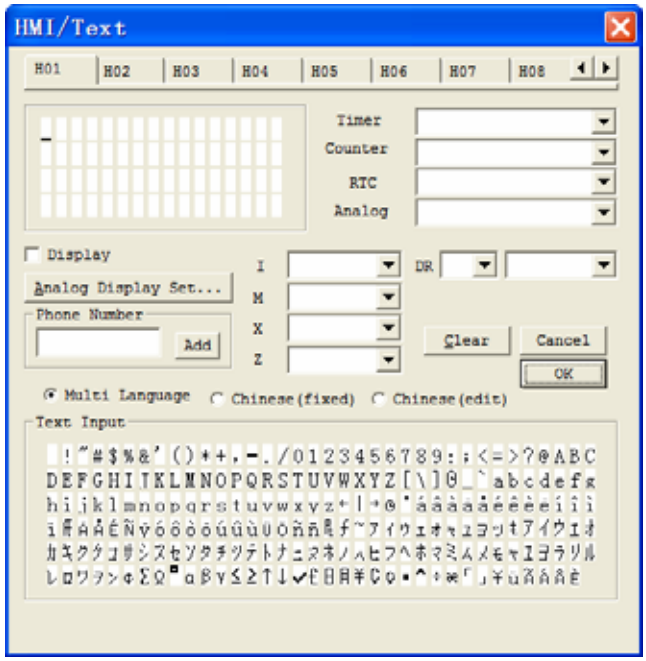


※ The SG2 Client software does not support runtime logic editing changes. All logic edits to contacts, coils, Timers/Counters, and circuit connecting lines must be written to the connected smart relay while in Stop mode.

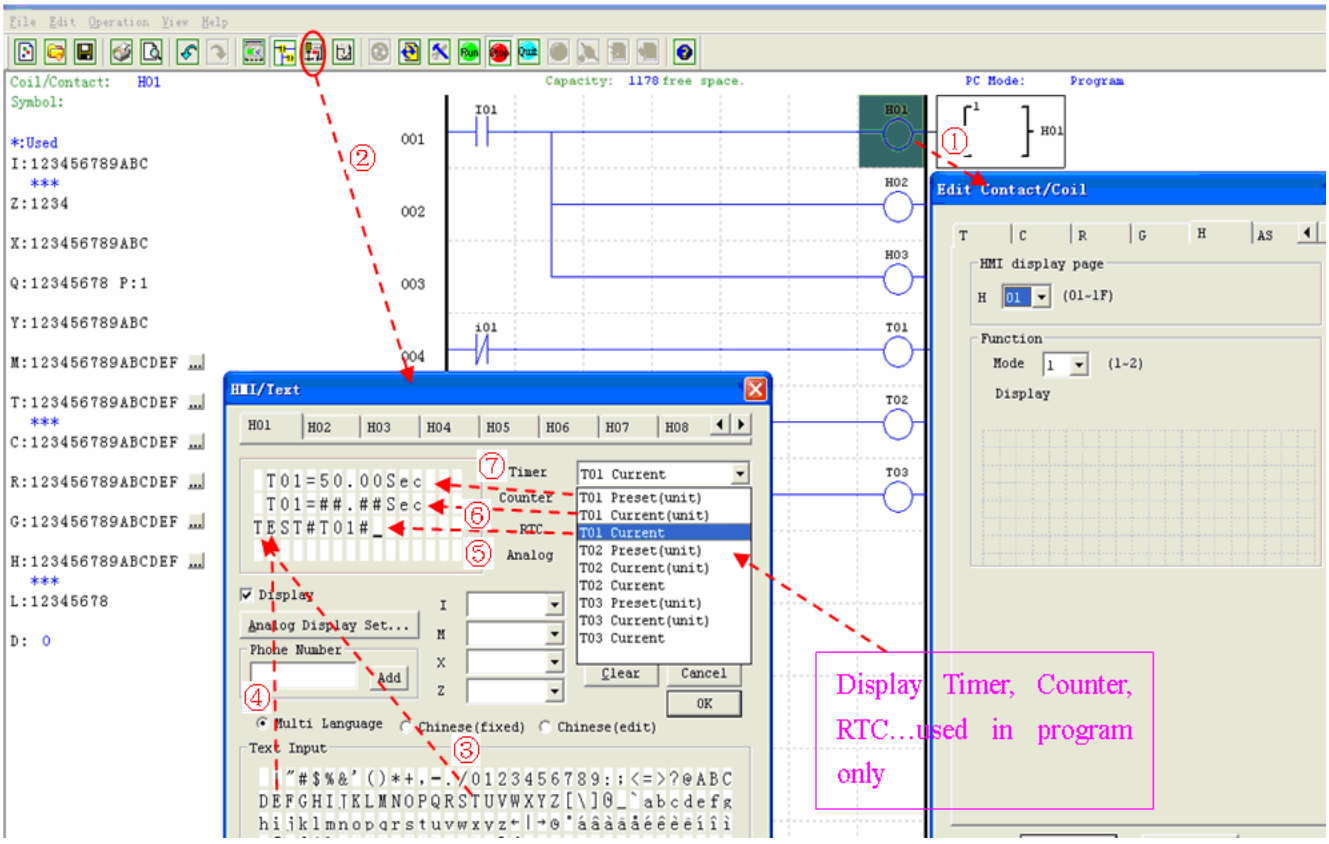
HMI/TEXT

This function block can display information on 16×4 LCD screen. Information displaying can be present value or target value of Counter, Timer, RTC and Analog comparator etc. Under running mode, to modify the target value of timer, counter and analog comparator via HMI is available. HMI can display the status of input terminal (I, Z, X) and Auxiliary terminal M, N (only FBD).





HMI/TEXT setting:



① Enter H01 coil

② Into HMI/TEXT edit frame

③ Choice the “T”

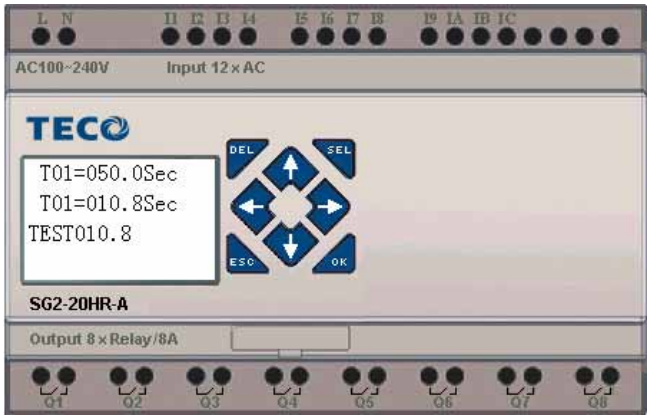
④ Choice the “E”

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

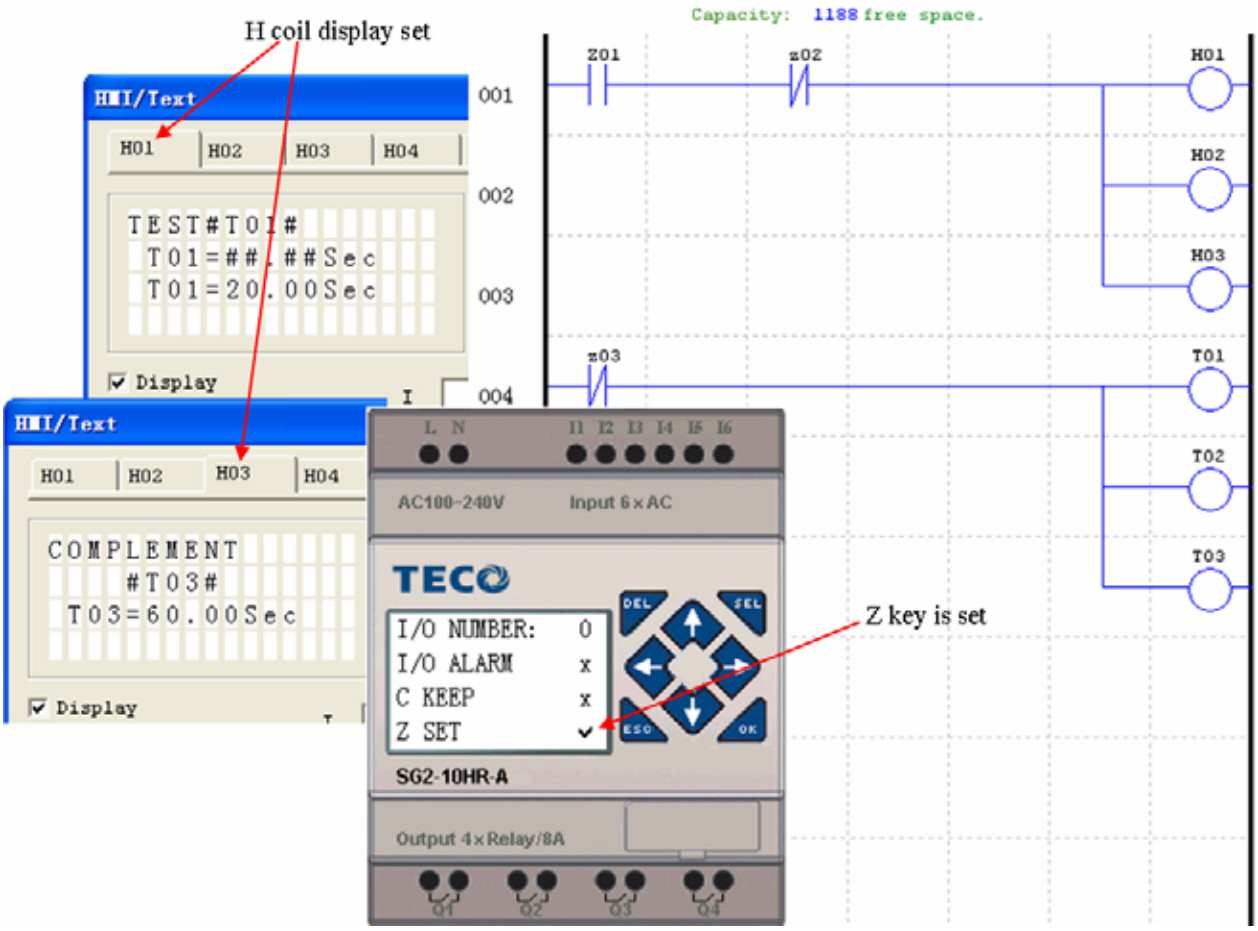
Download to SG2, and I01 turn ON, or press “SEL” if the H coils is set to mode 1, then the SG2 LCD will display the first H text as shown below.

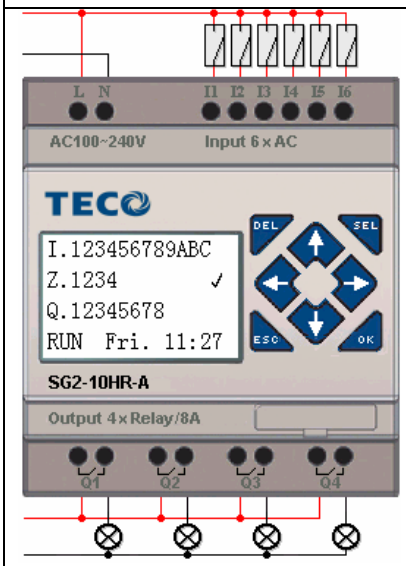
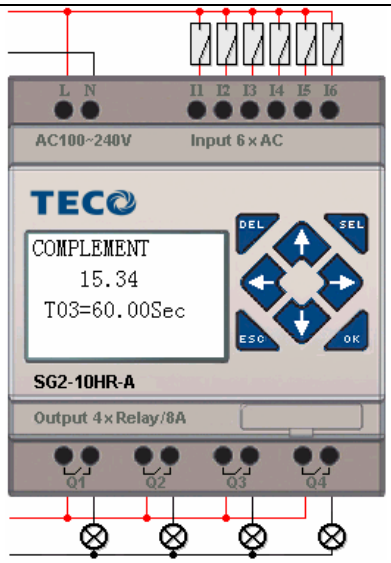


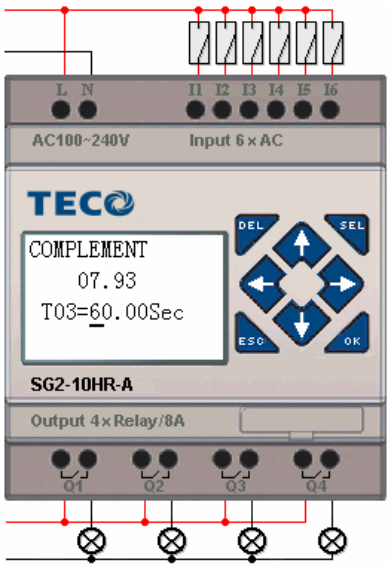
Ⅰ, Press “↑” or “↓” to choice the nearest H coil

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.)

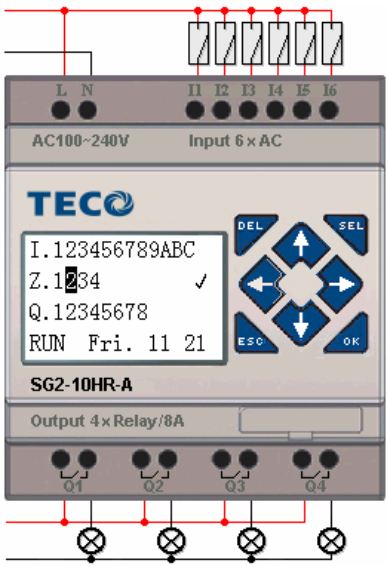
HMI/TEXT Example:



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



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 "↓" to reset Timer (T01、T02、T03) as program designed.

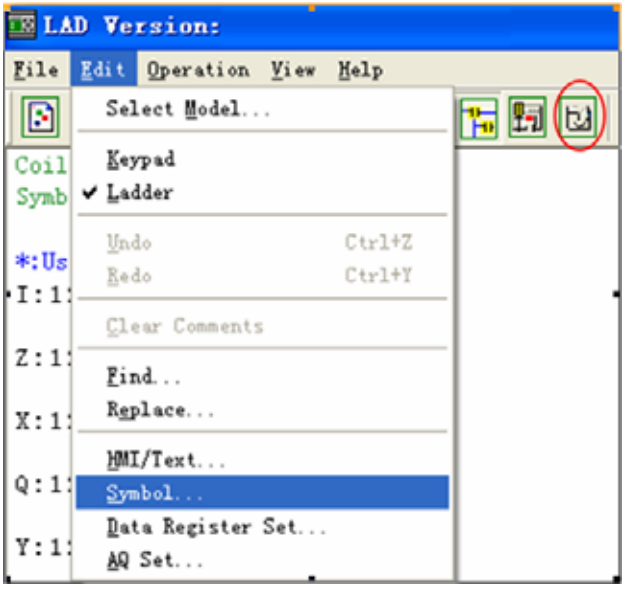
Program Documentation

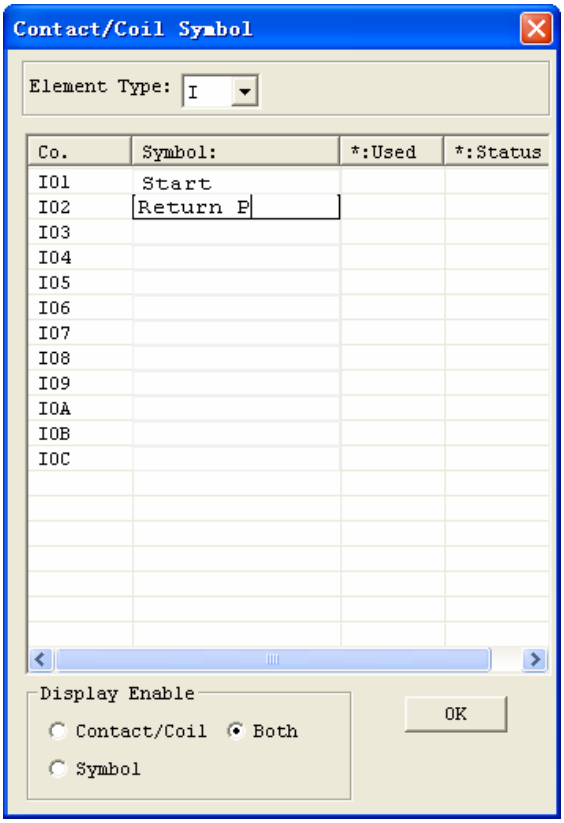
The SG2 Client software includes the ability to document a program using Symbols and Line Comments. Symbols are used to label each I/O address up to a length of 12 characters. Line Comments are used to document sections of a program. Each Line Comment can have up to 4 lines with each line containing 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.

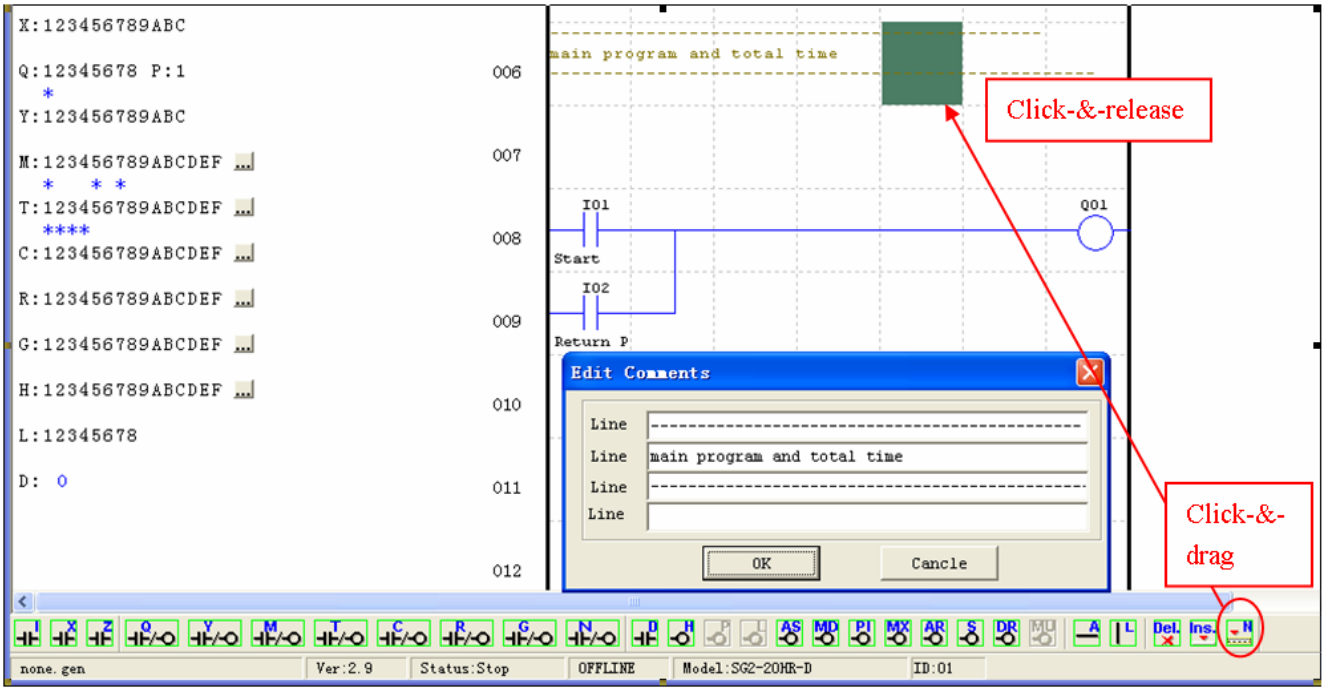
The Symbol editing environment allows for documenting all the contact and coil memory types, and selecting display modes as shown below.





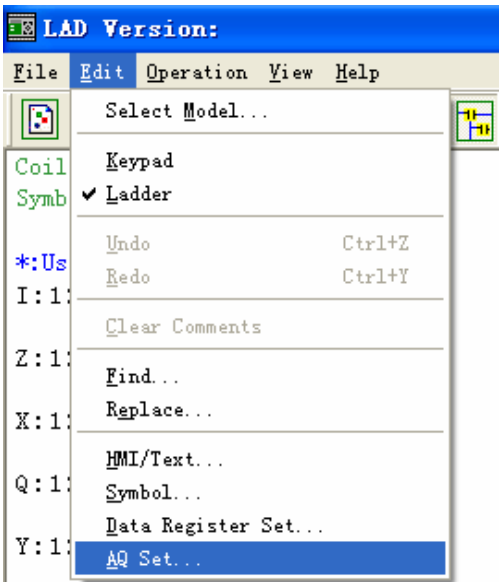
Line Comments

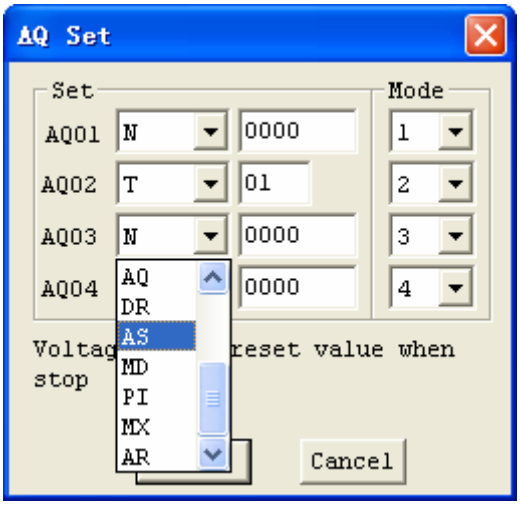
The Line Comment editor is accessed by clicking the "N" icon on the Ladder Toolbar. After clicking on the "N" icon, to drag the line number you want to comment and release, and then type the desired comments and press OK.



AQ Set…

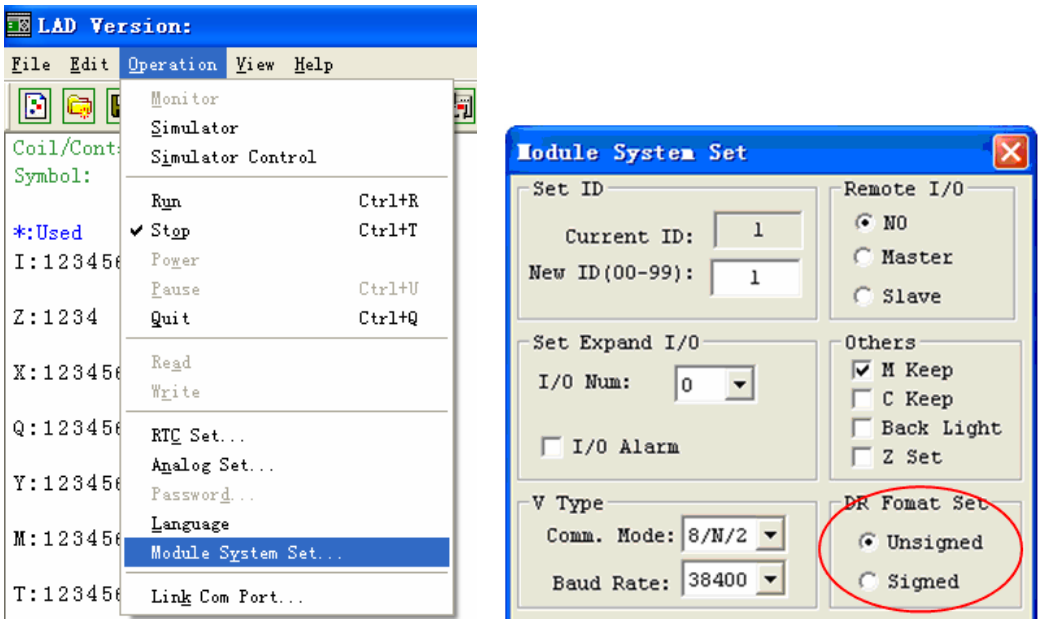
The AQ editing environment can be access through the menu using the **Edit>> AQ Set…** selection shown below. The range of AQ is 0~1000 if the output mode of AQ is voltage mode. And the range is 0~500 if the output mode is current mode. The preset value of AQ can be set as either a constant or a code 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



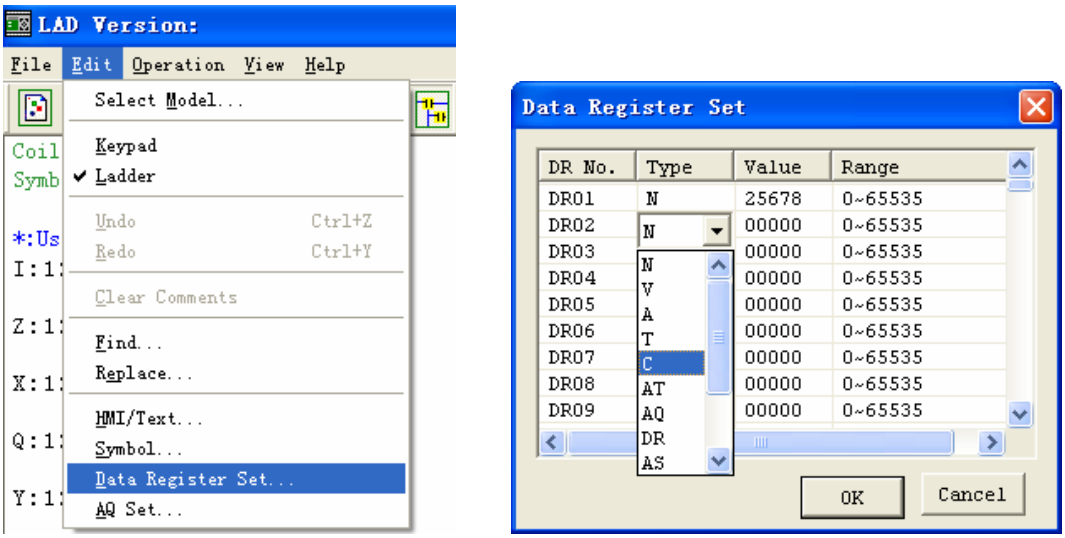


Data Register Set…

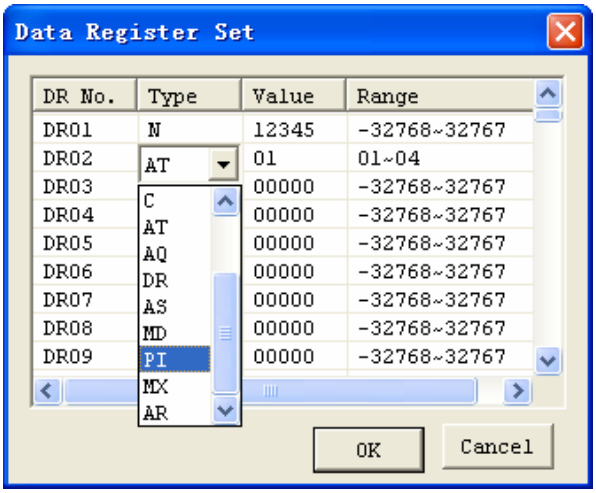
The content of Data Register is either unsigned or sign, it can be set as shown below. Selecting Unsigned, the range of DR is 0~65535; and selecting Signed, the range of DR is -32768~32767.



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.



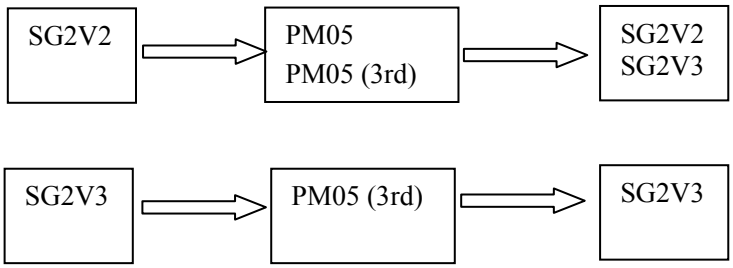
DR is set as signed shown below.



Memory Cartridge (sold separately)

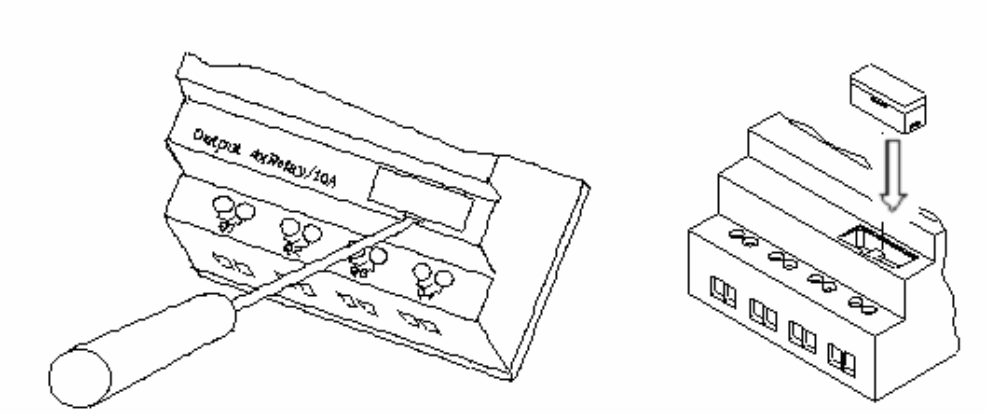
PM05 (3rd) is a special kind of PM05, it can be used in all version of SG2. There is an icon 3rd on SG2 V3 smart and side of PM05 (3rd).

About to use PM05 and PM05 (3rd) with SG2V2/3, see next figure:



The optional PM05 (3rd) memory cartridge is used to easily transfer programs from one smart relay to another. The PM05 (3rd) memory cartridge plugs into the same connector as the programming cable (see procedure below).

1. Remove the plastic connector cover from SG2 using a flathead screwdriver as shown in the figure below.
2. Insert the PM05 (3rd) memory cartridge onto the connector as shown below.



3. From the display keypad on the face of the SG2 smart relay, select either **WRITE** or **READ** to transfer the program to PM05 (3rd) or from the PM05 (3rd) memory cartridge to the smart relay.

4, K type and C type, electrify the product, the program in PM05 (3rd) will automatically download and executed.

5, Program in different types are not compatible, here are the regulations:

A-1: 10/12 point type program ---- available in 20 point type

A-2: 20 point type program ---- unavailable in 10/12 point type

B-1: AC type program ---- available in DC type

B-2: DC type program ---- unavailable in AC type

C-1: Relay type program ---- available in Transistor type

C-2: Transistor type program ---- unavailable in Relay type

D-1: Not-V type program ---- available V type

D-2: V type program ---- unavailable Not-V type

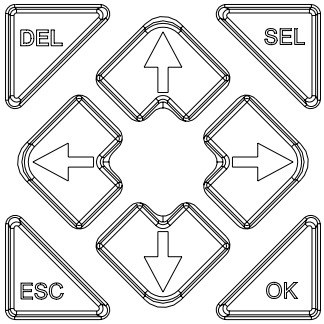
E-1: SG2V2 program ---- available SG2V3 type

E-2: SG2V3 program ---- unavailable SG2V2 type

LCD Display and Keypad

Keypad

Most SG2 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 SG2 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.

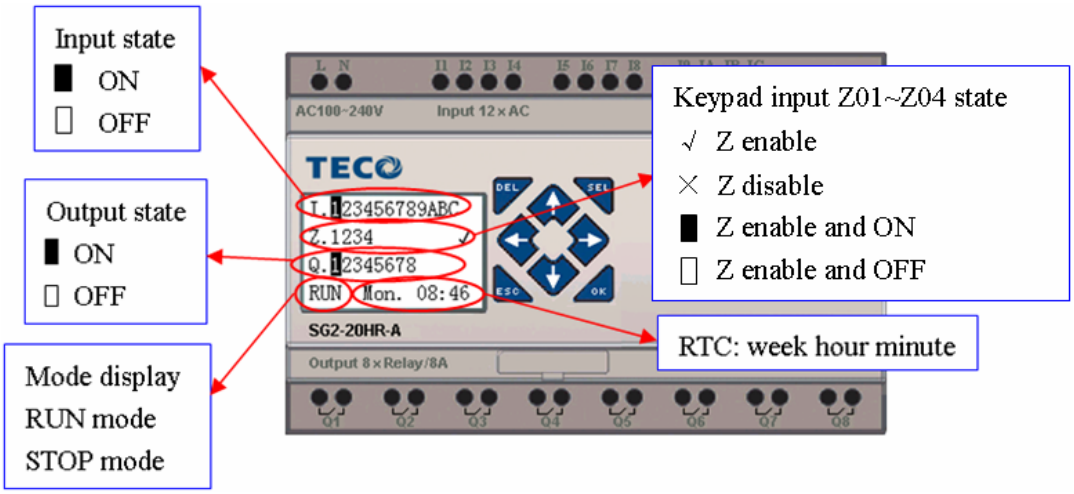
Delete – Used to delete an instruction or rung from the ladder program.

The 4 navigation buttons (↑←↓→) are used to move the cursor throughout the functions of the SG2 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

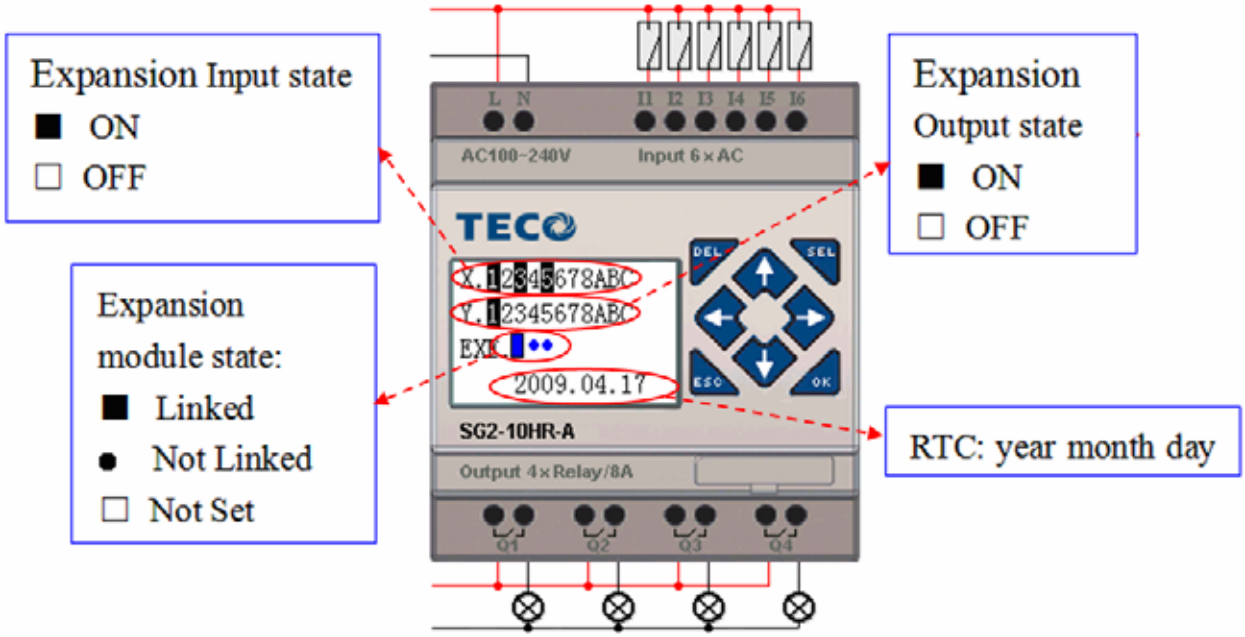
◎ Original screen as power on



Press the button:

ESC	Enter Main Menu screen
SEL+↑ ↓ ↑ ↓	Under LADDER Mode, display the state of relays (I ⇔ Z ⇔ Q ⇔ X ⇔ Y ⇔ M ⇔ N ⇔ T ⇔ C ⇔ R ⇔ G ⇔ A ⇔ AT ⇔ AQ) ⇔ Original Screen
	Under FBD Mode, display the state of relays (I ⇔ Z ⇔ Q ⇔ X ⇔ Y ⇔ M ⇔ N ⇔ A ⇔ AT ⇔ AQ) ⇔ Original Screen
SEL	H Function will be displayed whose mode is 1 as the button is pressed.
SEL+OK	Enter RTC setting screen

◎ Expansion display State

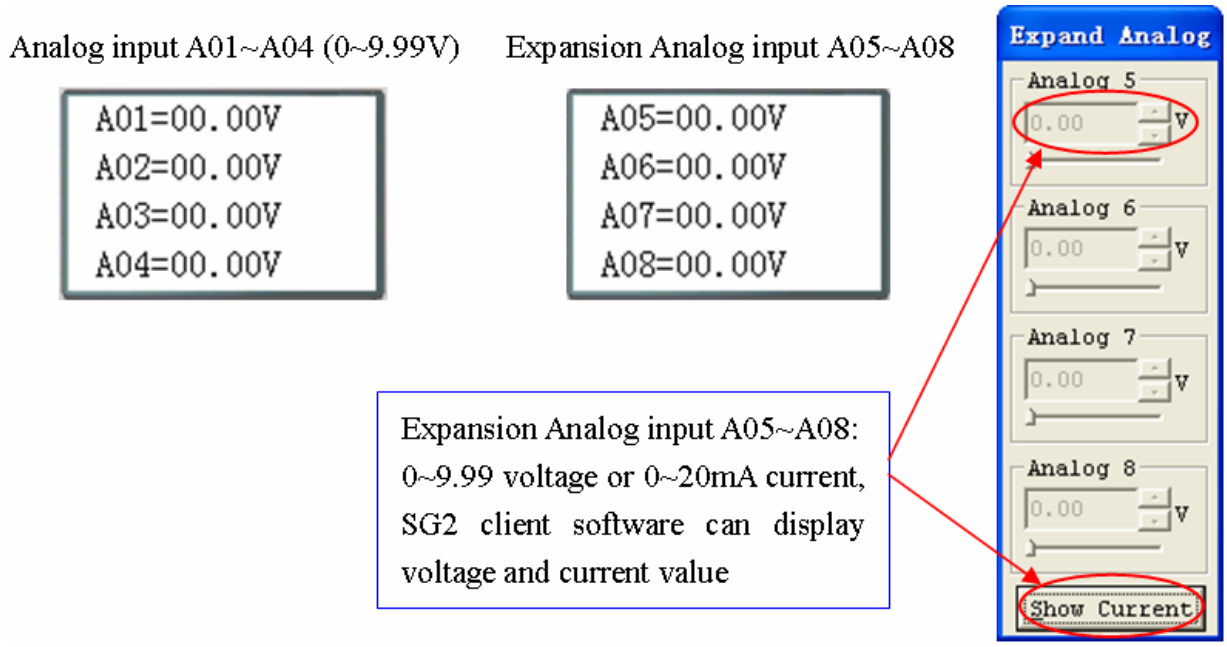


※ Expansion module setting: refer to Main Menu “SET”

◎ Other Display State

Ladder edit mode: Coil I, Z, X, Q, Y, M, N, T, C, R, G, D, Analog input A01~A04, Expansion Analog input A05~A08, temperature analog input AT01~AT04, analog output AQ01~AQ04;

FBD edit mode: Coil I, Z, X, Q, Y, M, N, Analog input A01~A04, Expansion Analog input A05~A08, temperature analog input AT01~AT04, analog output AQ01~AQ04;



LCD Display Main Menu

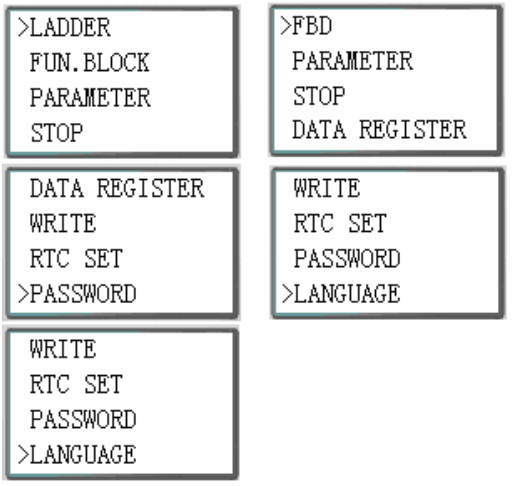
(1) The Main Menu as SG2 under 'STOP' Mode.

Into ladder main function to press ESC after power on when the user program is ladder type or empty program.

Into FBD main function to press ESC after power on when the user program is FBD type or empty program.

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
	WRITE	Save user program to PM05 (3rd)
	READ	Read user Program from PM05
	SET	System setting
	RTC SET	RTC setting
	ANALOG SET	Analog setting
	PASSWORD	Password setting
	LANGUAGE	Select the language
	INITIAL	initially set Edit method

(2) The Main Menu as SG2 under 'RUN' Mode.



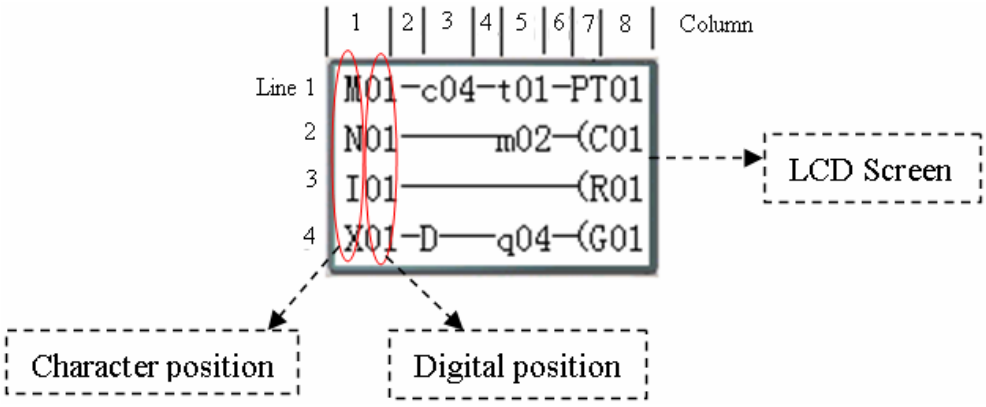
>	LADDER	FBD
	FUN.BLOCK	
	PARAMETER	
	STOP	
	DATA REGISTER	
	WRITE	
	RTC SET	
	PASSWORD	
	LANGUAGE	

Press the Button

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

※SG2 can be modified, edited, cleared and read user program only when it is under STOP Mode.
※As the program is modified, SG2 will automatically backup it to FLASH.

◎ Main Menu LADDER



Press the Button

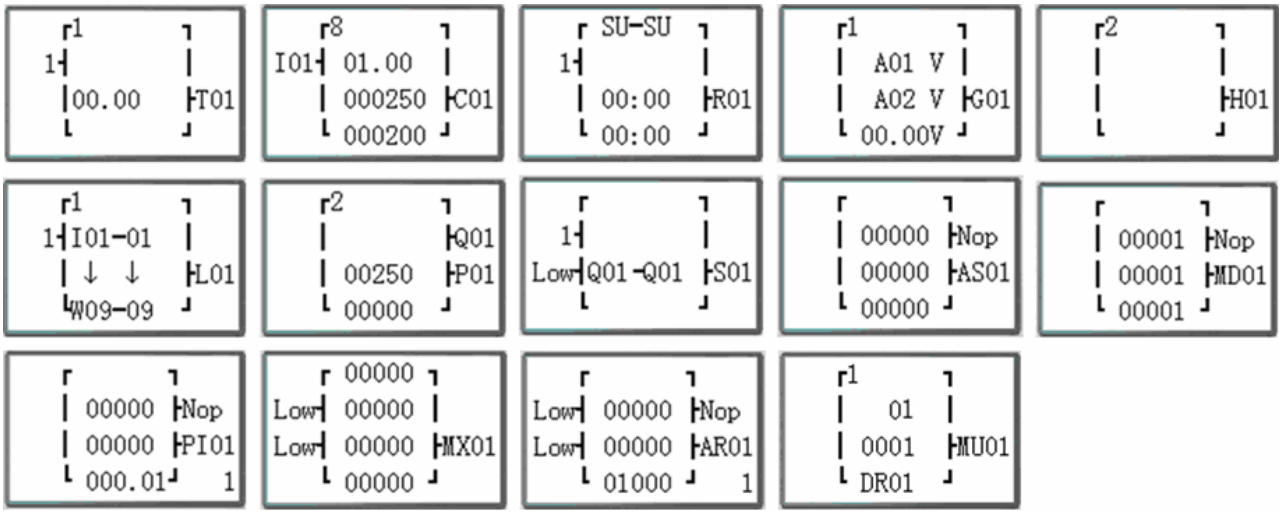
Button	Description
SEL	1. Ixx ⇒ ixx ⇒ — ⇒ space ⇒ Ixx (only for digital and character position of 1, 3, 5 column.) 2. Qxx ⇒ space ⇒ Qxx (only for digital and character position of 8 column.). 3. ⊤ ⇒ Space⇒ ⊤ (all available but the 2,4,6 column of the first line) ⊥ ⊥
SEL, then ↑/↓	1. I ⇔ X ⇔ Z ⇔Q ⇔ Y⇔ M ⇔ N ⇔ D ⇔ T ⇔ C ⇔ R ⇔ G ⇔ I (When 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 Column, and the 8 Column is set as Q, Y, M, N) 4. (⇔ P ⇔ ((When the cursor located at 7 Column, 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).
OK	1. Confirm the data and automatically save, the cursor moves to next input position. 2. When the cursor is on Column 8, Press the button to automatically enter the function block and set the parameters(such as T/C)。
SEL+DEL	Delete a Line of Instruction.
SEL+ESC	Display the number of the Lines and operation state of SG2 (RUN/STOP)。
SEL+↑/↓	Skip up/ down every 4-line program.
SEL+OK	Insert a space line

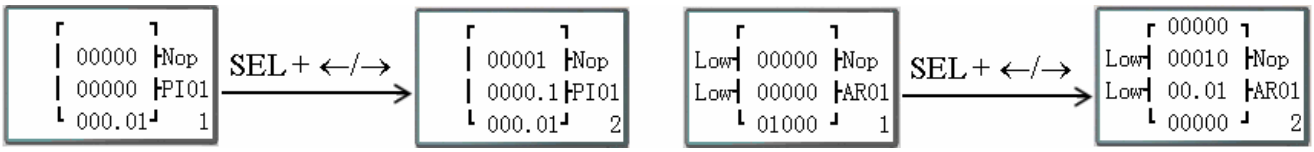
Operation Sample: more detailed to see appendix A.

◎ FUNCTION BLOCK program input

Into FUNCTION BLOCK, cursor flicker on “T”, press “SEL” key, Ladder function block display in sequence:

T→C→R→G→H→L→P→S→AS→MD→PI→MX→AR→MU→T…



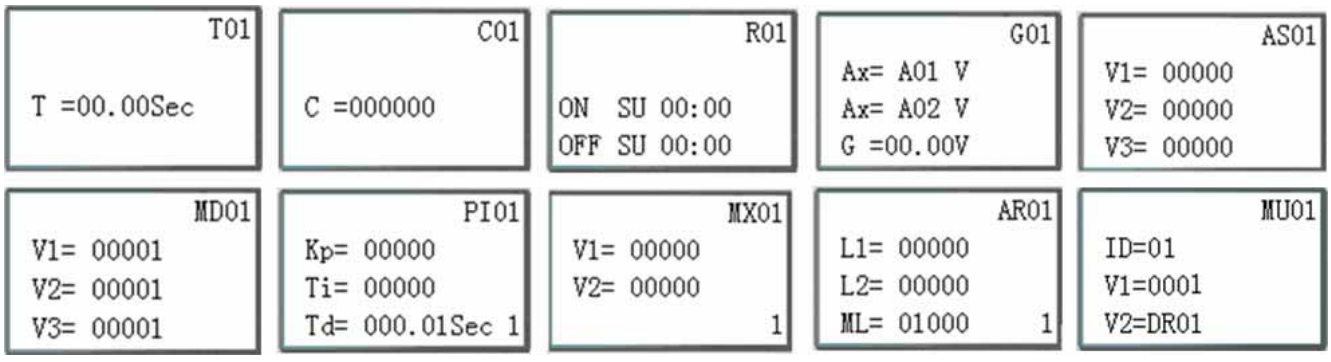


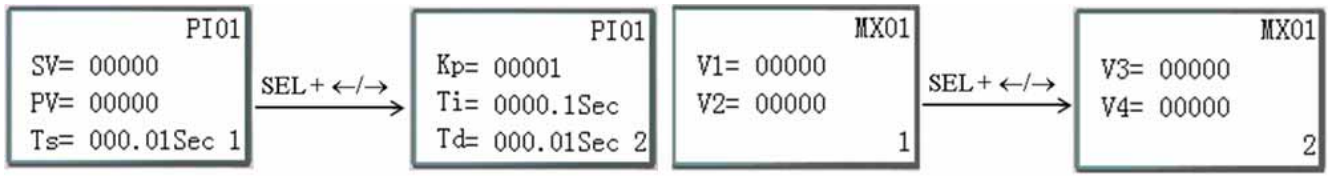
Operation Sample: more detailed to see Appendix B.

◎PARAMETER

Under Ladder mode, press “SEL” key, function block display in sequence:

T→C→R→G→AS→MD→PI→MX→AR→MU→T…





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

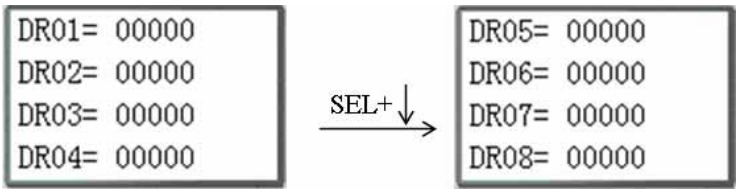
◎ RUN or STOP

(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 smart is 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, EEPROM and Password at the same time)

(2) WRITE: save the program (RAM) to PM05 (3rd) program spare cartridge

(3) READ: read the program from the PM05 or PM05 (3rd) program spare cartridge to SG2 (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	01	→	ID setting (00~99)
REMOTE I/O	N	→	Remote I/O Mode (N: none M: Master S: Slave)
BACK LIGHT	×	→	Back light mode (√: always light ×: light for 10s after pressed.)
M KEEP	√	→	M: non-Volatile (√:Volatile ×: Non- Volatile)
I/O NUMBER	0	→	Setting expansion I/O module number (0~3)
I/O ALARM	√	→	Siren setting when is not available to Expansion I/O Points (√:Yes ×:No)
C KEEP	×	→	in stop/run switching, Counter Present Value Keeping (√:Yes ×:No)
Z SET	×	→	Enable or disable keypad input Z01-Z04 (√:enable ×:disable)
V COMM SET	03	→	Setting the form and baud rate of RS-485
DATA REG.	U	→	Setting the Data Register type (U: 16bit-unsiged S: 16bit-sign)

※ 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 'V COMM 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. V COMM 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 DATALINK is selected, ID setting range is 0~7, which should be continuous.

ID=0 default as Master, ID=1~7 default as Slave.

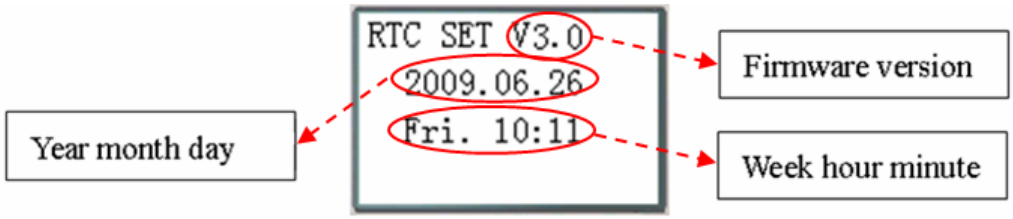
※ When REMOTE I/O is selected, the distribution of the remote I/O is as follows:

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

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

More detailed to see chapter 4: Relay Logic Programming: Data Link/Remote IO Instruction

(5) RTC SET



Now Press

↑ ↓	Enter RTC setting or Summer/Winter setting
SEL	Begin to input parameters
'SEL' then '←/→'	Move the Cursor
'SEL' then '↑/↓'	1. year=00~99, month=01~12, day=01~31 2. week: MO⇔TU⇔WE⇔TH⇔FR⇔SA⇔SU⇔MO 3. hour = 00~23 , minute = 00~59
'SEL' then 'SEL'	Summer/Winter 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.

※ RTC precision

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

RTC Summer/Winter setting

There are 2 fixed Summer/Winter, EUROPE and USA, 1 edit Summer/Winter in SG2.

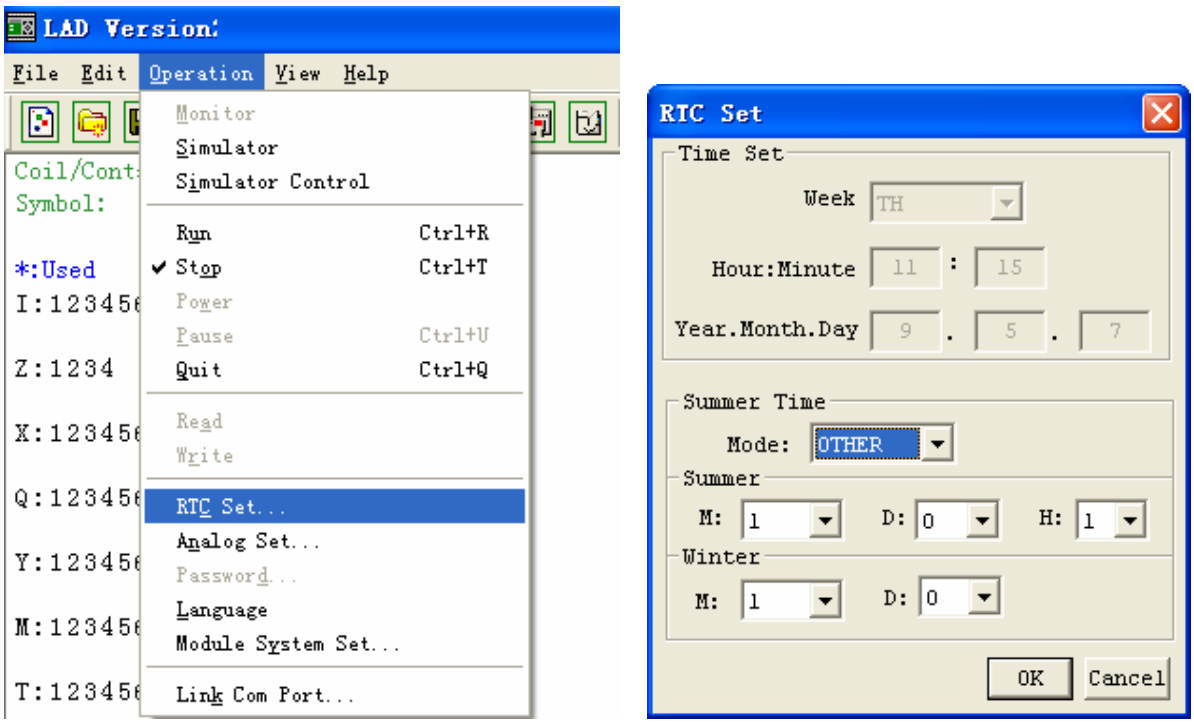
Edit rule: ①The last Sunday is defined as 0;

②Hour range: 1~22;

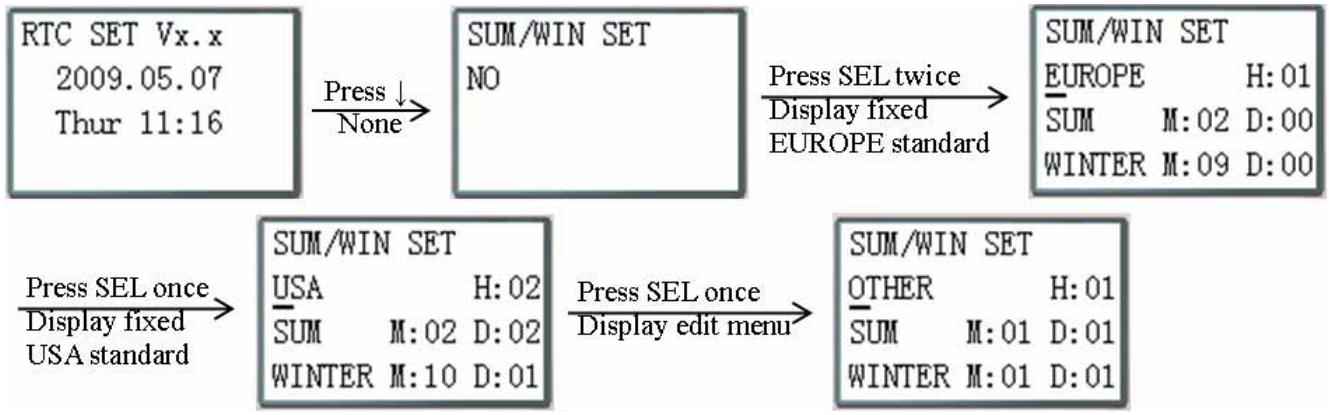
③Summer hour and Winter hour are the same.

Summer/Winter can be set through the two methods as shown below.

1) PC Client



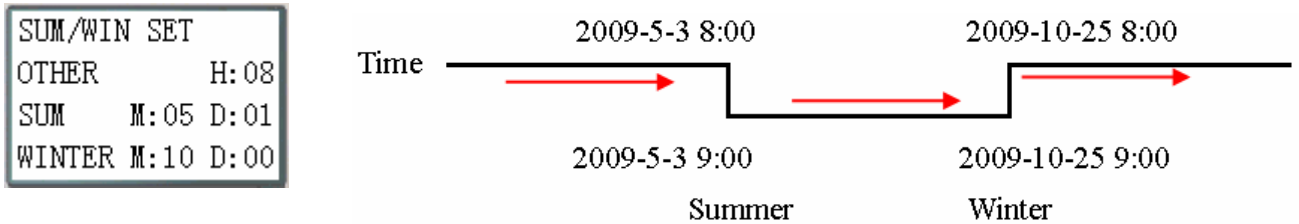
2) Keypad



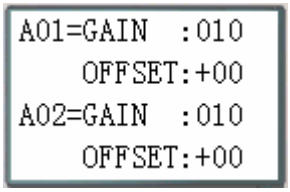
Then pressing "→" selects edit location, pressing "↑", "↓" edit content.

Example:

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



(6) ANALOG SET



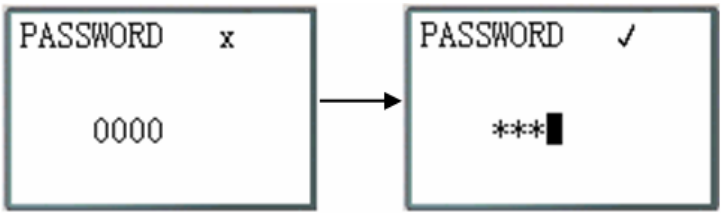
A 1=GAIN : 010	→	GAIN (0~999), default 10
OFFSET : +00	→	OFFSET (-50~+50), default 0
A 2=GAIN : 010		
OFFSET : +00		
A3~A8…Gain + Offset		

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.

A/B Class password Description (√：cannot use under password protected)

Menu	A Class	B Class
LADDER	√	√
FUN.BLOCK	√	√
FBD	√	√
PARAMETER		√
RUN/STOP		√
DATA REGISTER		√
CLEAR PROG.	√	√
WRITE	√	√
READ	√	√
SET		√
RTC SET		
ANALOG SET		√
LANGUAGE		√
INITIAL	√	√

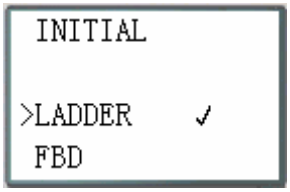
(8) LANGUAGE (Selection menu language)

→ English
→ French
→ Spanish
→ Italian
→ German
→ Portuguese
→ Simplified Chinese

Now Press

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

(9) INITIAL (select Ladder Logic and Function Block Diagram (FBD))



Now Press:

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

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

Chapter 4: Relay Ladder Logic Programming

Common Memory Types

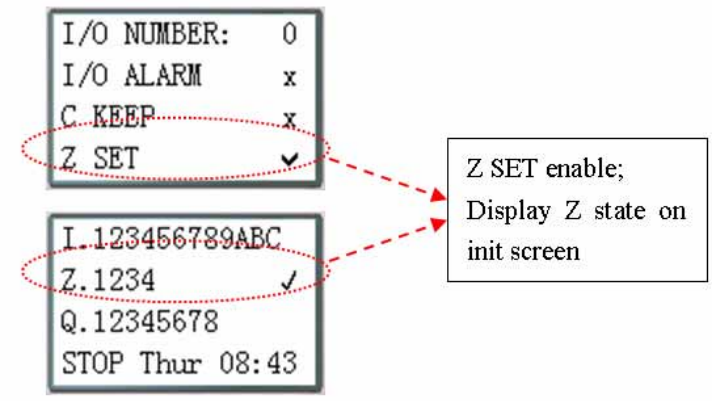
	General output	SET output	RESET output	PULSE output	N.O. contact	N.C. contact	Number
Symbol	[	⮝	⮟	P	┤├	┤/├	(N.O./N.C.)
Input contact					I	i	12(I01-I0C/i01-i0C)
Keypad input					Z	z	4(Z01-Z04/z01-z04)
Output coil	Q	Q	Q	Q	Q	q	8(Q01-Q08/q01-q08)
Auxiliary relay	M	M	M	M	M	m	63(M01-M3F/m01-m3F)
Auxiliary relay	N	N	N	N	N	n	63 (N01-N3F/n01-n3F)
Counter	C				C	c	31(C01-C1F/c01-c1F)
Timer	T			T	T	t	31(T01-T1F/t01-t1F)

Inputs (I memory Type)

The SG2 digital input points are designated I memory types. The number of digital I input points is 6, 8 or 12 depending on each SG2 model.

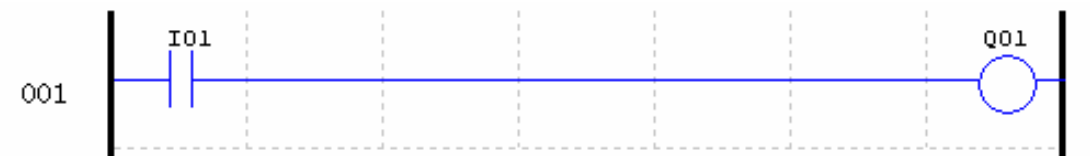
Keypad inputs (Z Memory type)

The SG2 keypad input points are designated Z memory types. The number of digital Z input points is 4 depending on SG2 H type model and V type model.



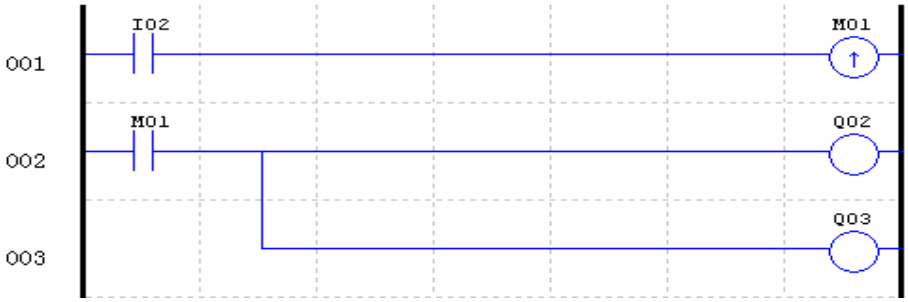
Outputs (Q Memory Type)

The SG2 digital output points are designated Q memory types. The number of digital Q output points is 4 or 8 depending on each SG2 model. In this example, output point Q01 will be turned on when input point I01 is activated.

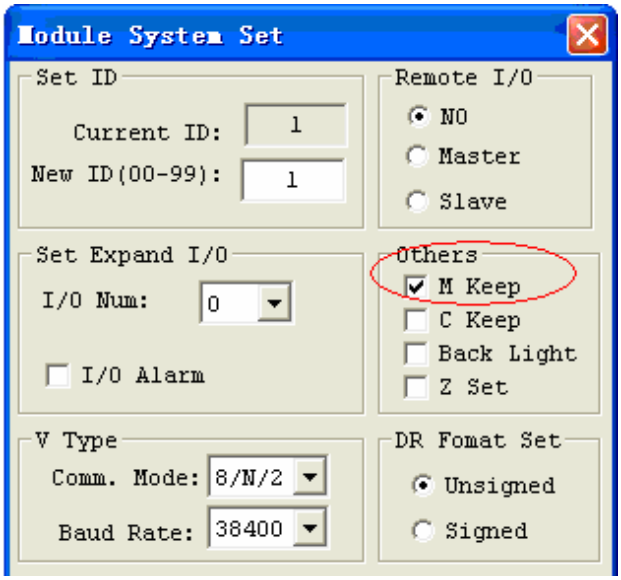


Auxiliary Relays (M memory type)

Auxiliary relays ate digital internal memory bits used to control a ladder logic program. The auxiliary relays are not physical inputs or outputs that can be wired to any external device, switches, sensors, relays, lamps, etc. The number of Auxiliary Relays M is 63. Since auxiliary relays are internal bits 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.



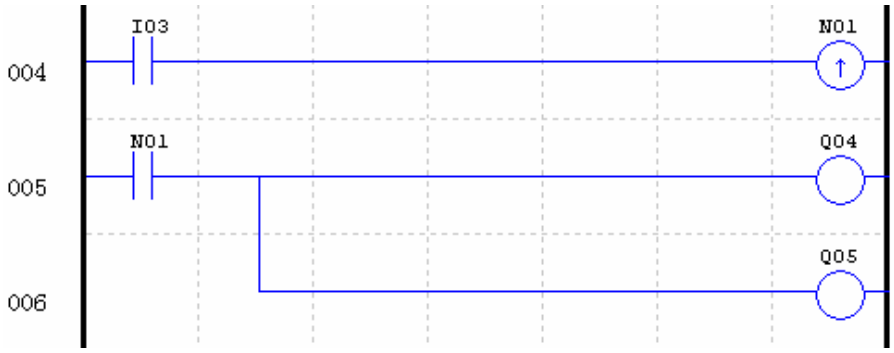
Special Auxiliary Relays: M31~M3F

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	1s blinking output	0.5s ON, 0.5s OFF
M33	Summer/Winter output	Summer time turn ON, winter time turn OFF, used as normal auxiliary relay.
M34	AT01 flag	Output ON when the first channel of SG2-4PT is error
M35	AT02 flag	Output ON when the second channel of SG2-4PT is error
M36	AT03 flag	Output ON when the third channel of SG2-4PT is error
M37	AT04 flag	Output ON when the fourth channel of SG2-4PT is error
M38~M3C	reserved	
M3D	Received	MODBUS function using
M3E	Error flag	
M3F	Time out	

Auxiliary Relays (N memory type)

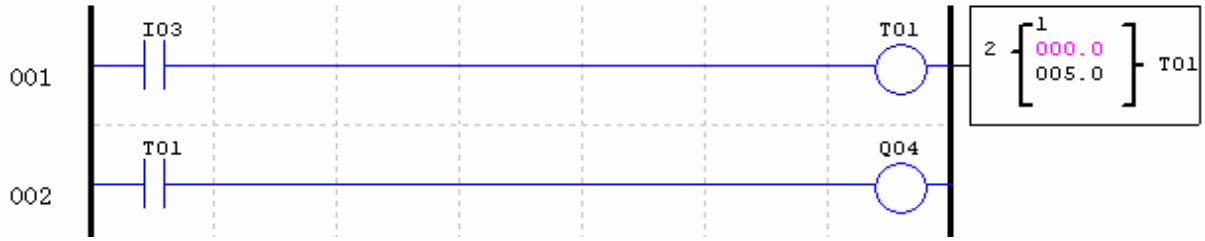
Auxiliary relays N is the same to auxiliary relays M, but it can't be kept when the smart powers down.

In the first rung of this example, auxiliary relay N01 is being used as an output coil and will energize when input I03 turns on. In the second rung auxiliary relay N01 is being used as an input and when energized, will turn on outputs Q04 and Q05.



Timers and Timer Status Bits (T Memory Type)

Timer status bits provide the relationship between the current value and the preset value of a selected timer. The timer status bit will be on when the current value is equal or greater than the preset 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 and Counter Status Bits (C Memory Type)

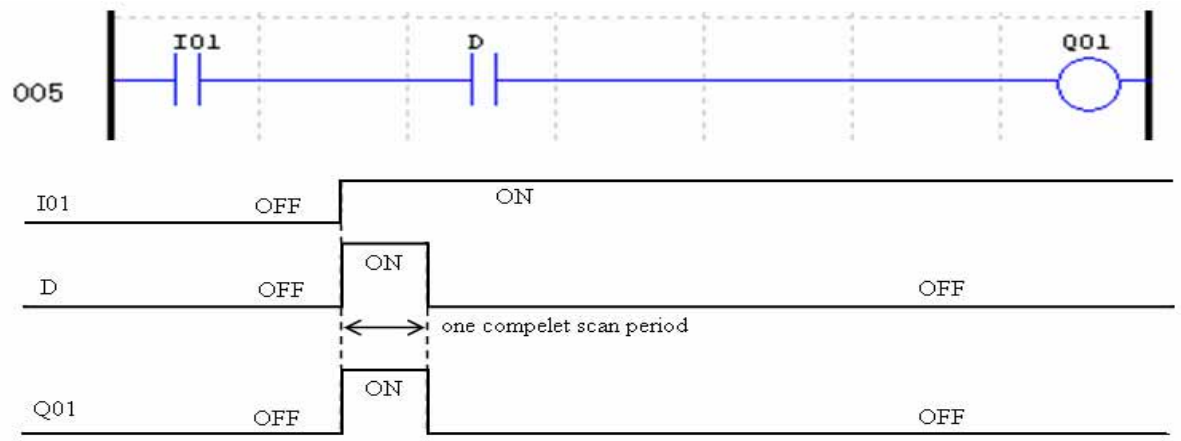
Counter status bits provide the relationship between the current value and the preset value of a selected counter. The counter status bit will be on when the current value is equal or greater than the preset value of a selected counter. In this example, each time the input contact I04 transitions from off to on, the counter (C01) increments by one. When the counter reaches the preset of 2 counts, 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.

Specialty Memory Types

	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)
Differential (one shot)					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)
DATA LINK	L						8(L01-L08)
SHIFT	S						1(S01)

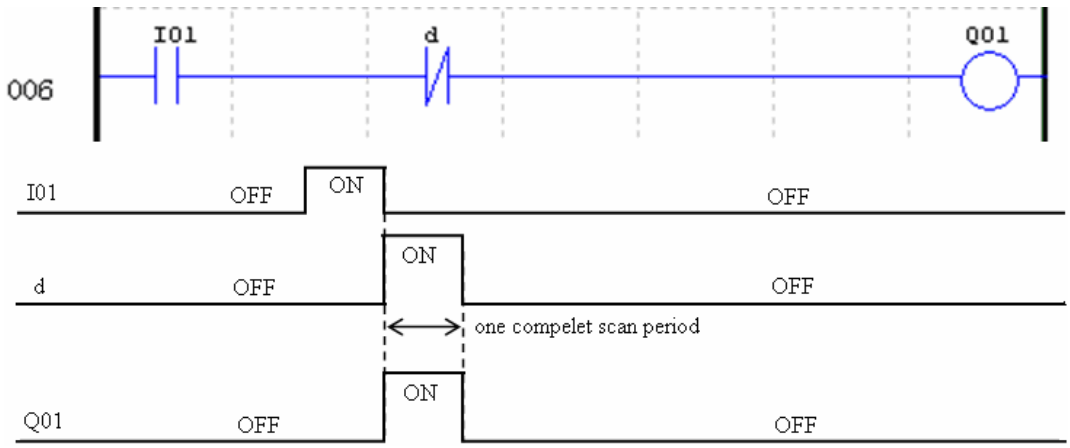
Positive input Differential Instruction (One-Shot)

A positive input differential instruction, or One-Shot, holds its status ON for one CPU scan when the preceding series contact transitions from OFF to ON. This transition from OFF to ON is called a Positive Input Differential.



Negative Input Differential Instruction (One-Shot)

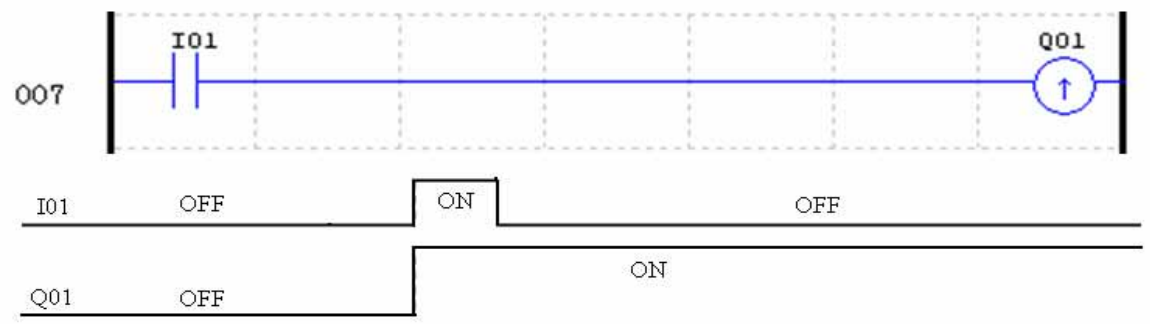
A negative input differential instruction, or One-Shot, holds its status ON for one CPU scan when the preceding series contact transitions from ON to OFF. This transition from ON to OFF is called a Negative Input Differential.



Output Instructions

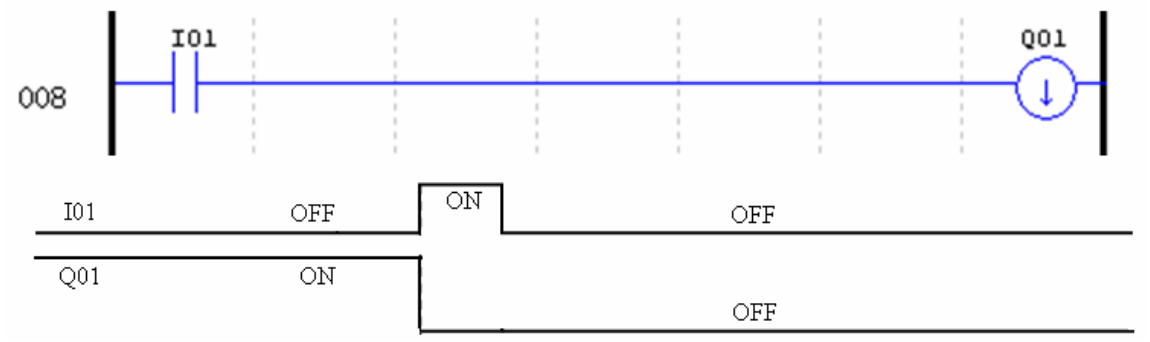
Set Output Instruction (Latch) (↑)

A set output instruction, or Latch, turns ON an output coil (Q) or an auxiliary contact (M) when the preceding input contact transitions 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 for the preceding input contact controlling the Set output instruction to remain ON.



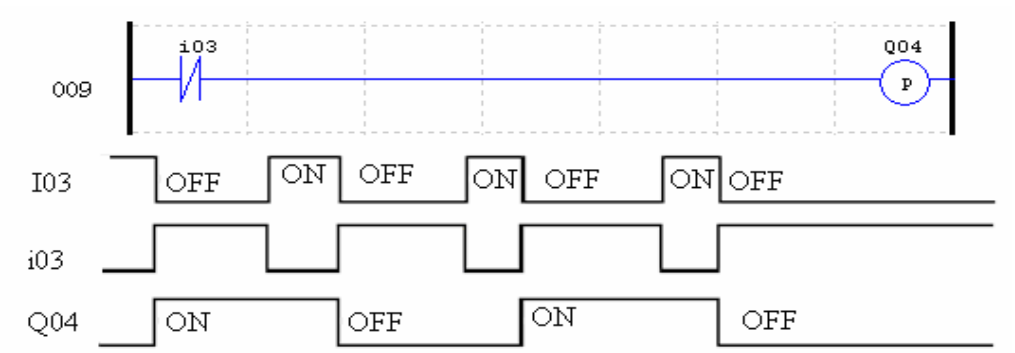
Reset Output Instruction (Unlatch) (↓)

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 if reset using another output instruction. It is not necessary for the preceding input contact controlling the Reset output instruction to remain ON.



Pulse Output Instruction (Flip-Flop) (P)

A pulse output instruction, or Flip-Flop, turns ON a coil (Q) or an auxiliary contact (M) when the preceding input contact transition from OFF to ON. Once the output is ON, it will remain ON until the preceding input contact transitions from OFF to ON a second time. In the example below, when Pushbutton I03 is pressed and released Motor Q04 will turn on and remain on. When Pushbutton I03 is pressed again, Motor Q04 will turn off and remain off. The pulse output instruction (P) will "flip-flop" its state from ON to OFF at each press of Pushbutton I03.



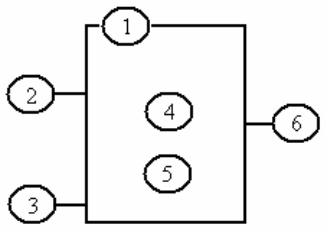
Analog memory type

	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 contrl	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)

Analog value (A01~A08, V01~V08, AT01~AT04, AQ01~AQ04) 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.

Timer Instruction

The SG2 includes a total of 31 separate Timers that can be used throughout a program. T0E and T0F keep their current value after a loss of power to the smart relay 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 memory type 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)

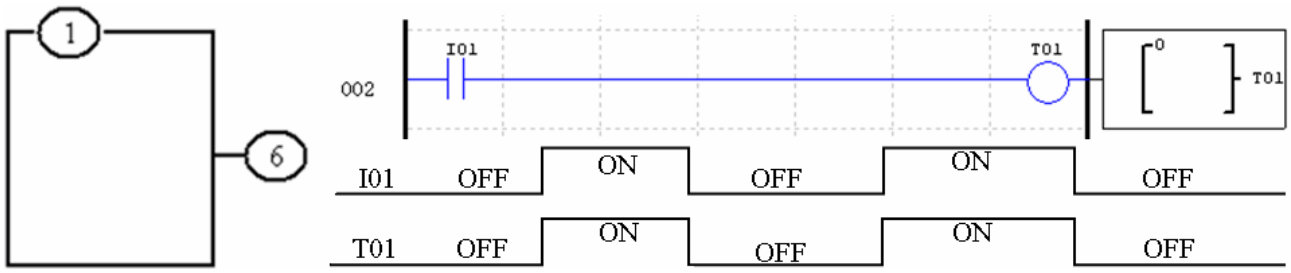
Compatible Instructions	Range
Input	I01-I0C/i01-i0C
Keypad input	Z01-Z04/z01-z04
Output	Q01-Q08/q01-q08
Auxiliary coil	M01-M3F/m01-m3F
Auxiliary coil	N01-N3F/n01-n3F
Expansion input	X01-X0C/x01-x0C
Expansion output	Y01-Y0C/y01-y0C
RTC	R01-R1F/r01-r1F
Counter	C01-C1F/c01-c1F
Timer	T01-T1F/t01-t1F
Analog comparator	G01-G1F/g01-g1F
Normal close contact	Hi

※ 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 SG2 on a loss of power if the "M-Keep" is active.

Timer Mode 0 (Internal Coil)

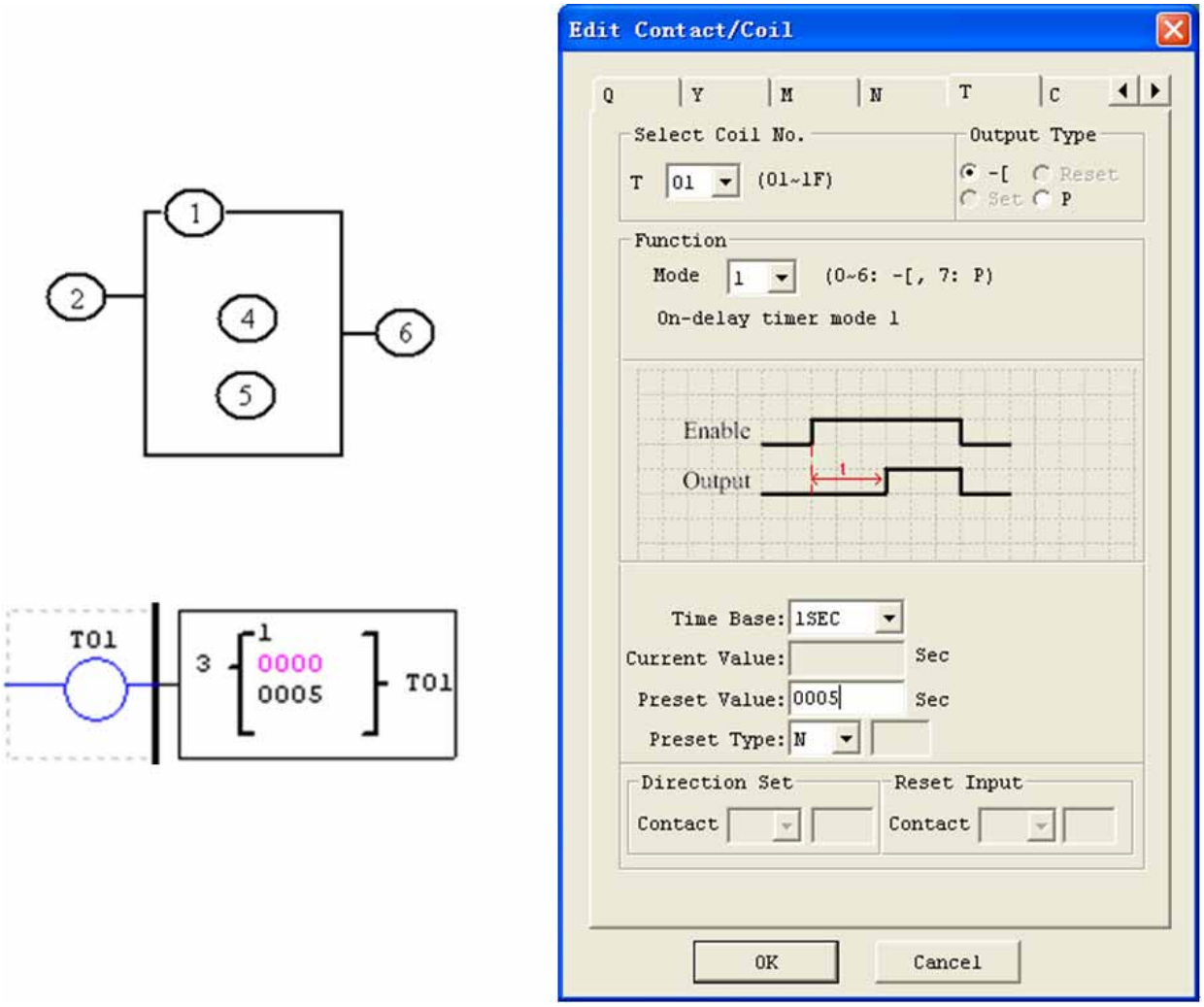
Mode 0 Timer (Internal Coil) used as internal auxiliary coils. No timer preset value. The status of T coil becomes with enable coil as shown below.

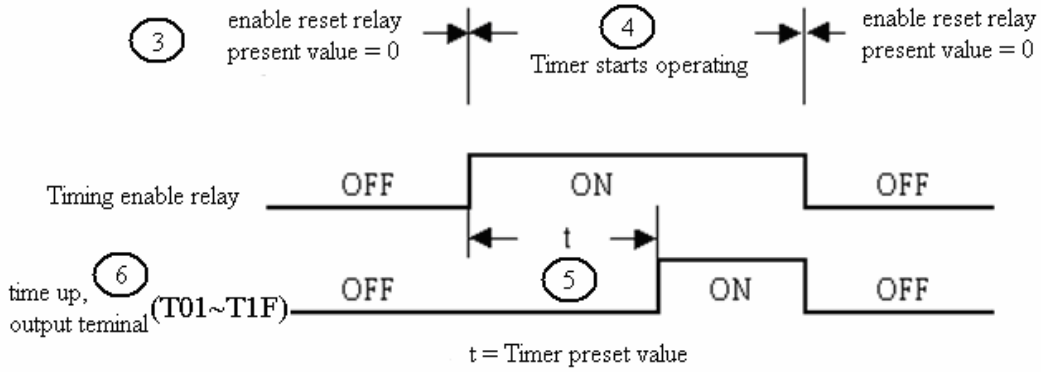


※ I01 is enable coil.

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 preset 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 status bit T01 will be ON when the current value is 5.

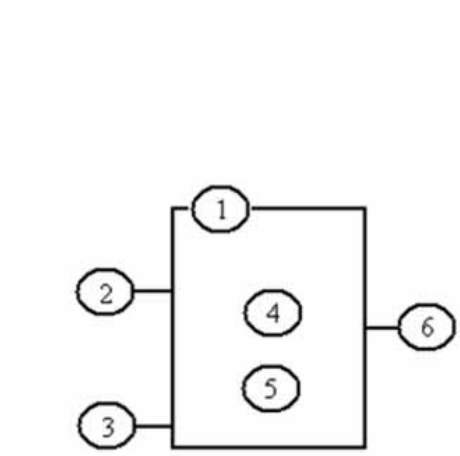


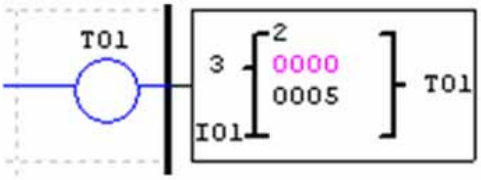


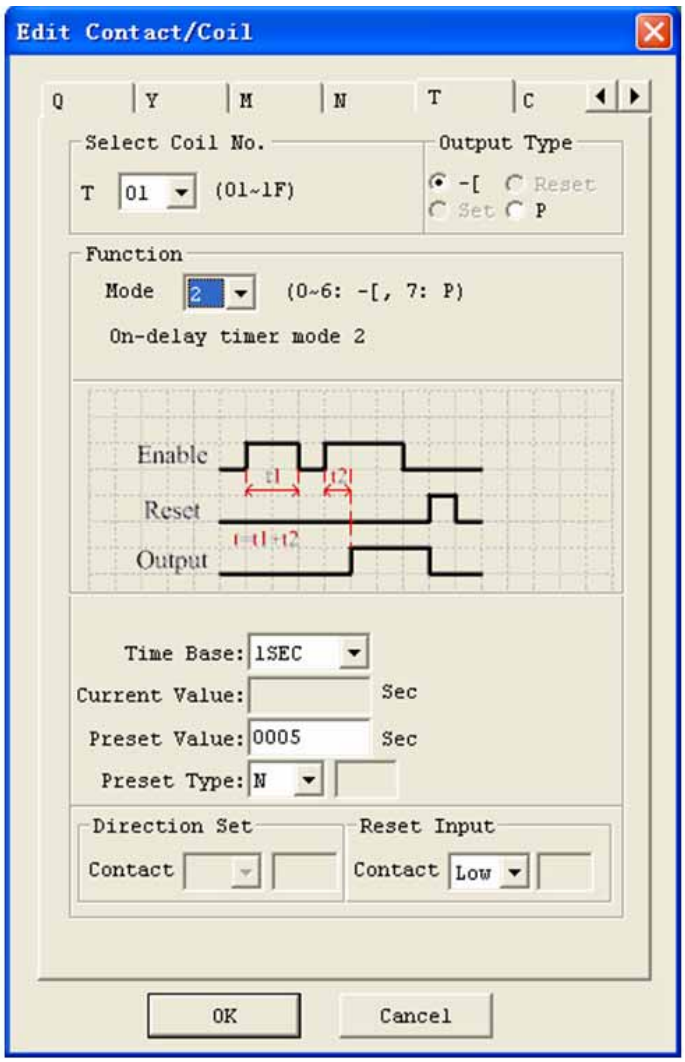
※ T0E and T0F keep their current value after a loss of power to the smart relay if "M Keep" is active, but the others' reset to 0.

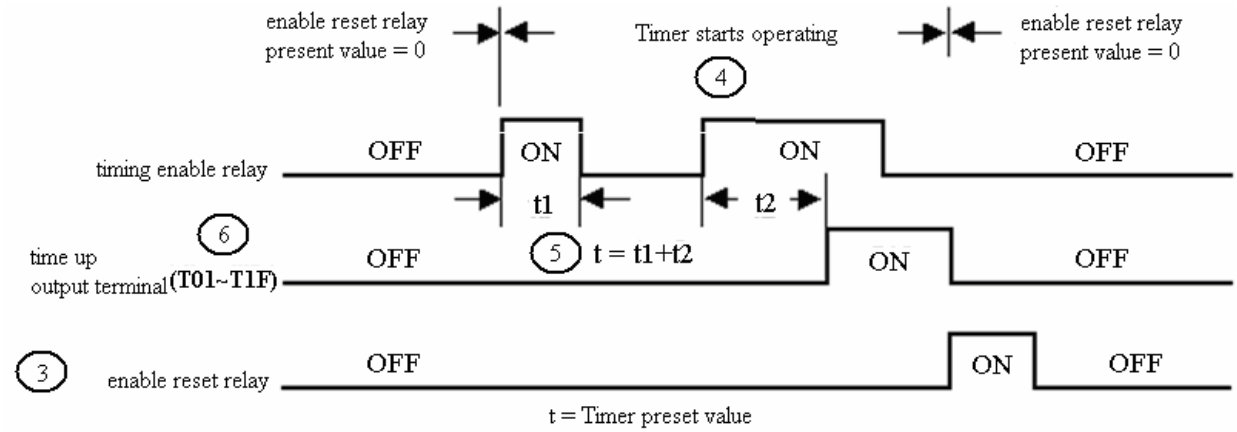
Timer Mode 2 (ON-Delay with Reset)

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 preset 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.





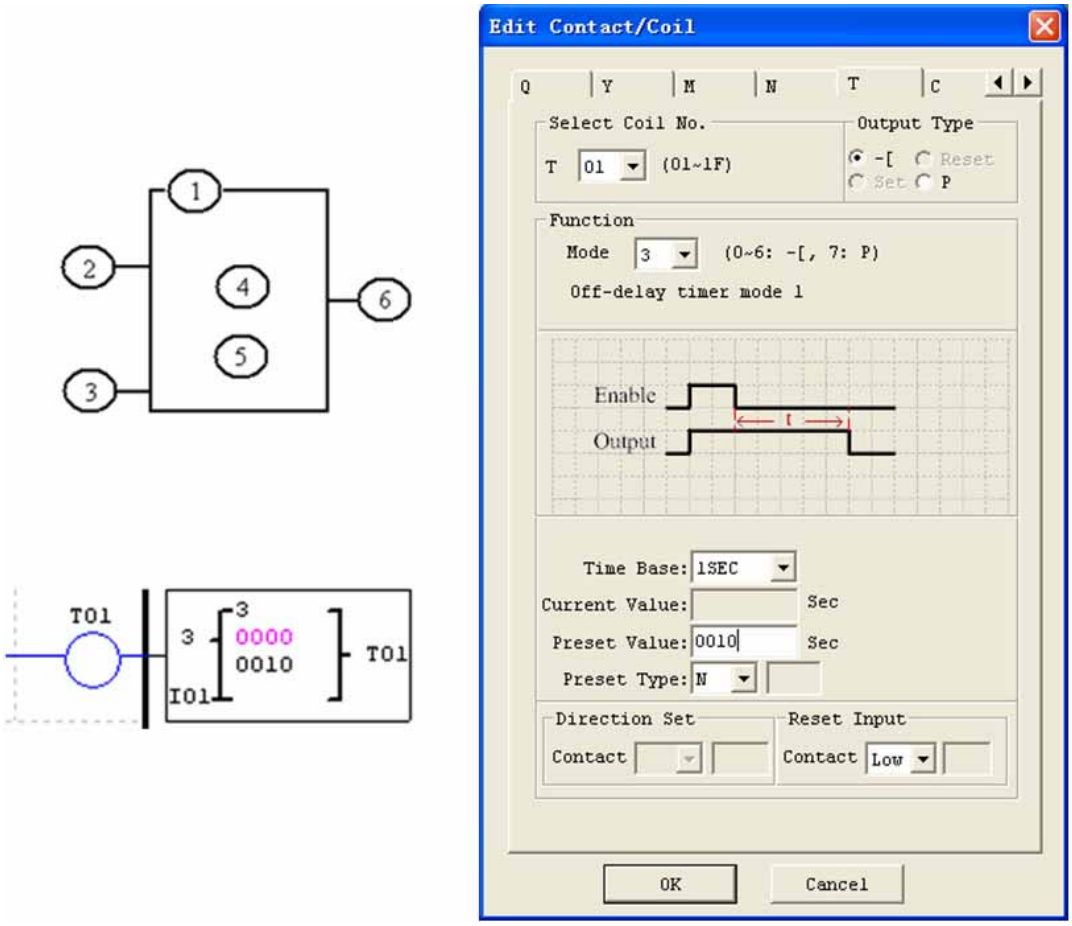


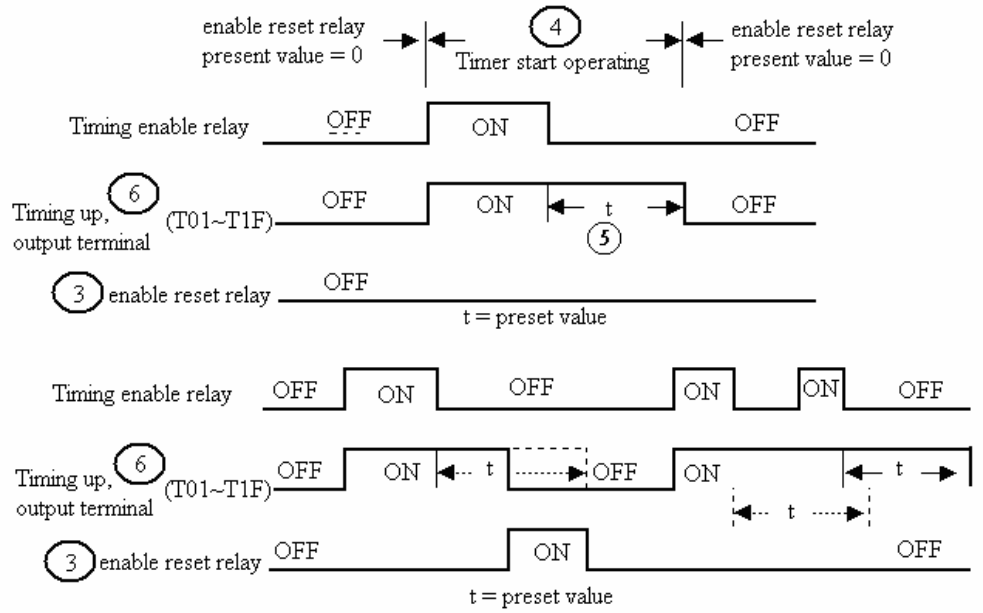


※ T0E and T0F keep their current value after a loss of power to the smart relay if "M Keep" is active, but the others' reset to 0.

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 preset 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.

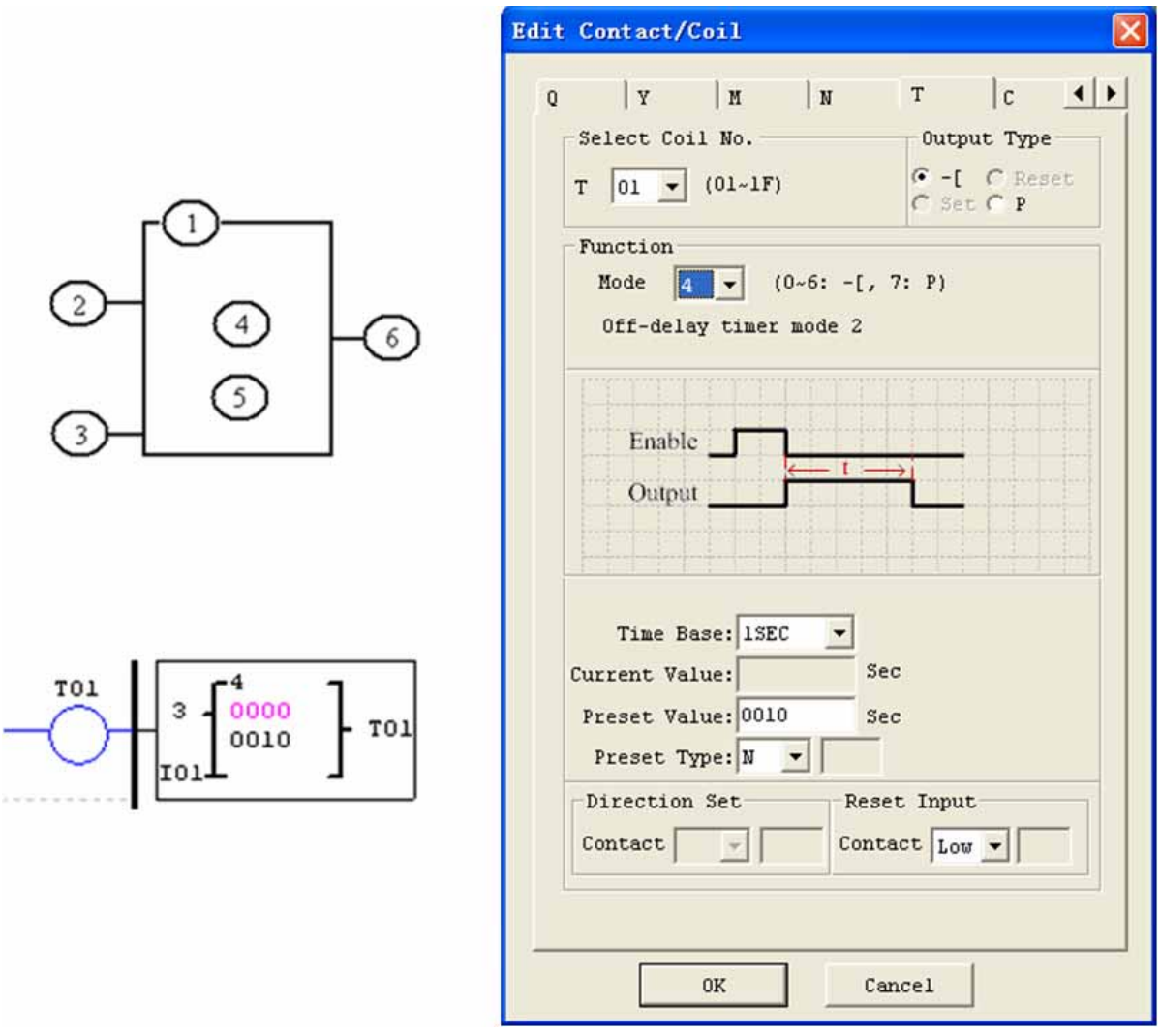


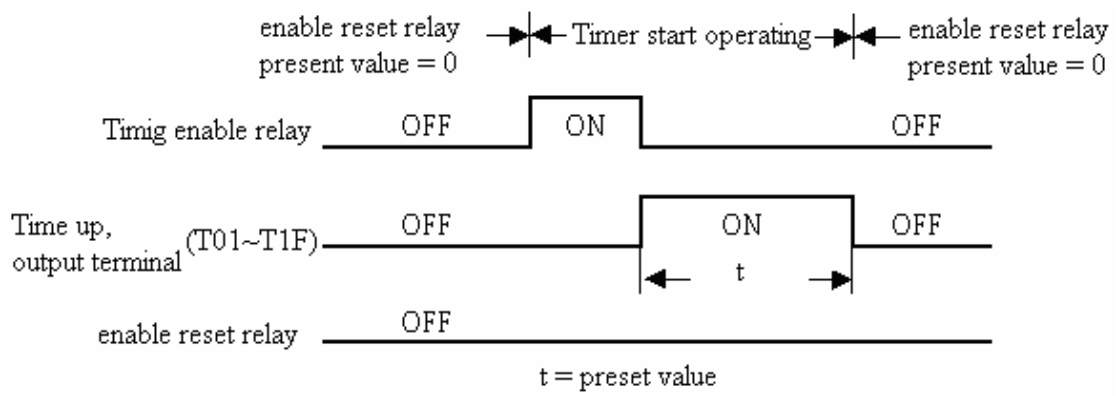


※ T0E and T0F keep their current value after a loss of power to the smart relay if "M Keep" is active, but the others' reset to 0.

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 preset 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.

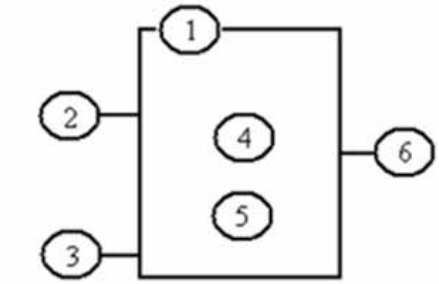


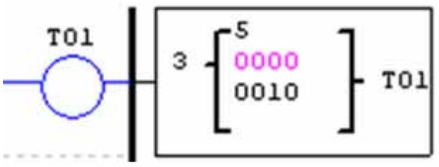


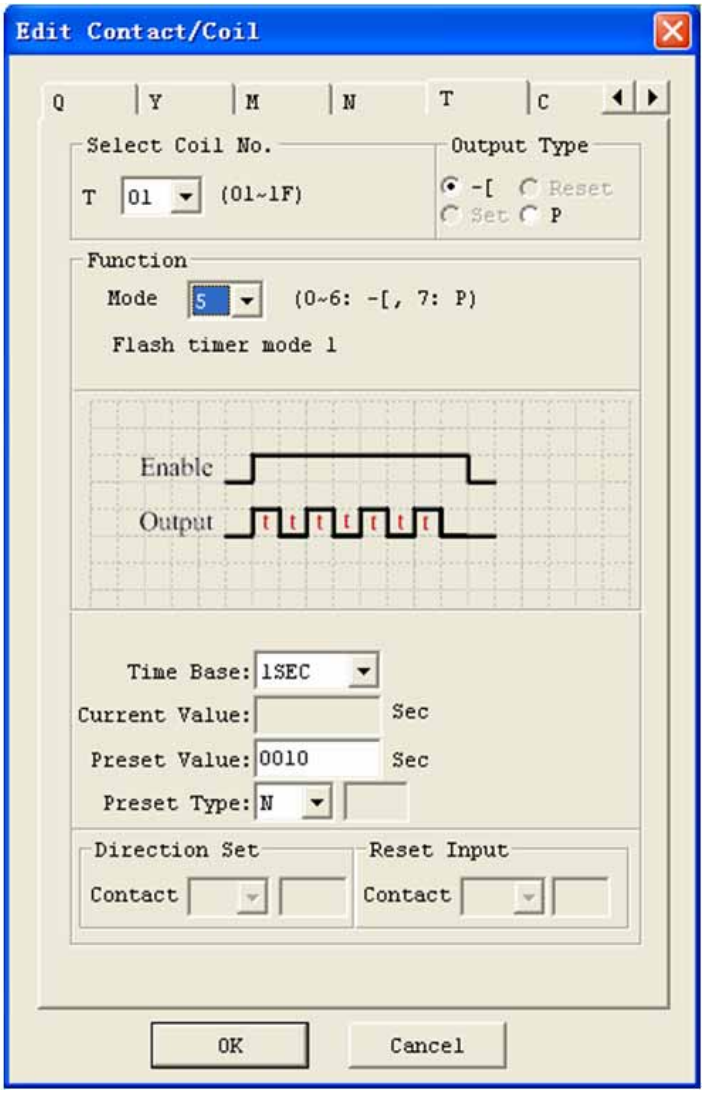
※ T0E and T0F keep their current value after a loss of power to the smart relay if "M Keep" is active, but the others' reset to 0.

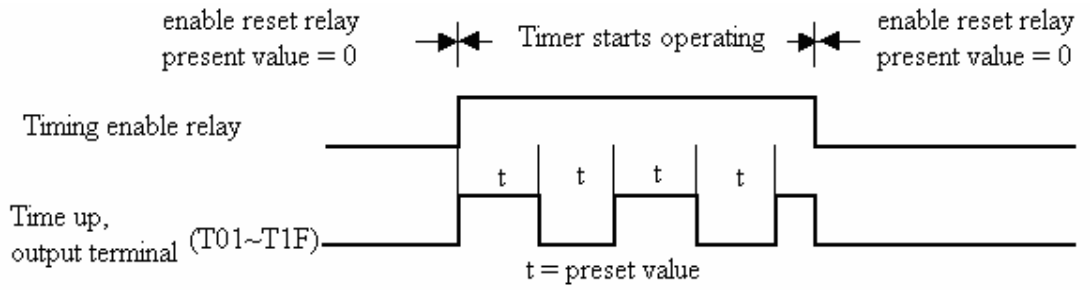
Timer Mode 5 (FLASH without reset)

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.





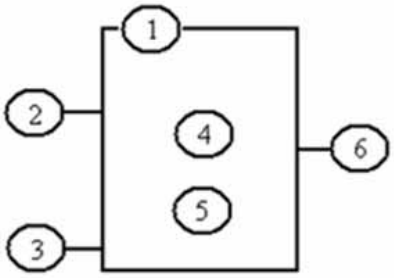


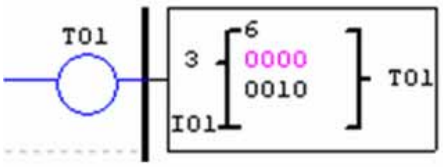


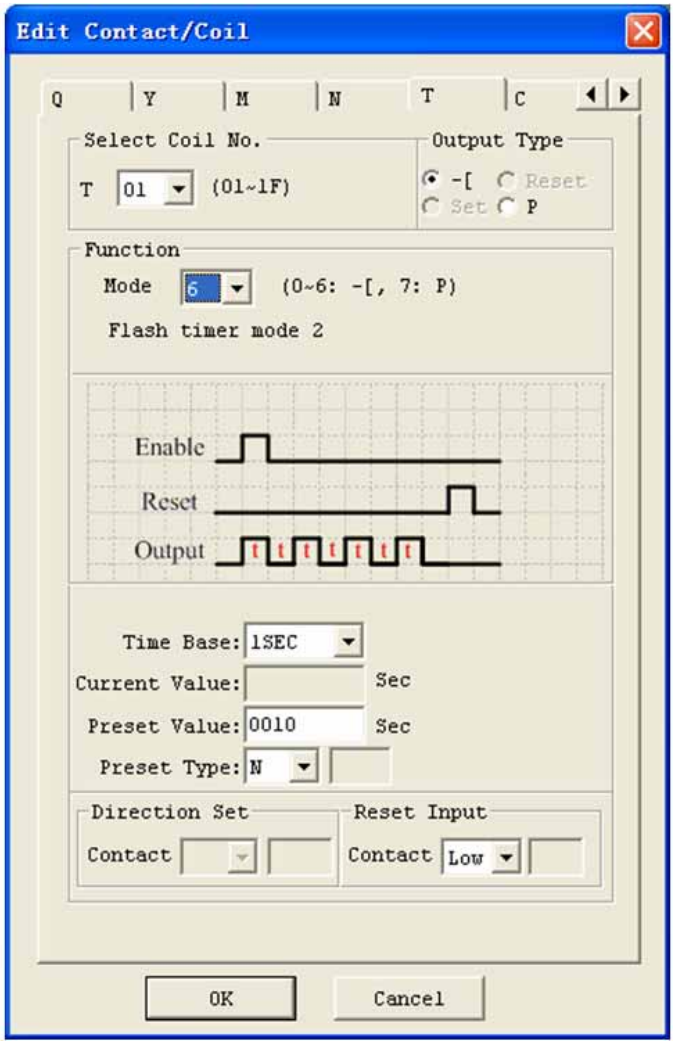
※ The current value of Timer can not be kept on a loss of power to smart.

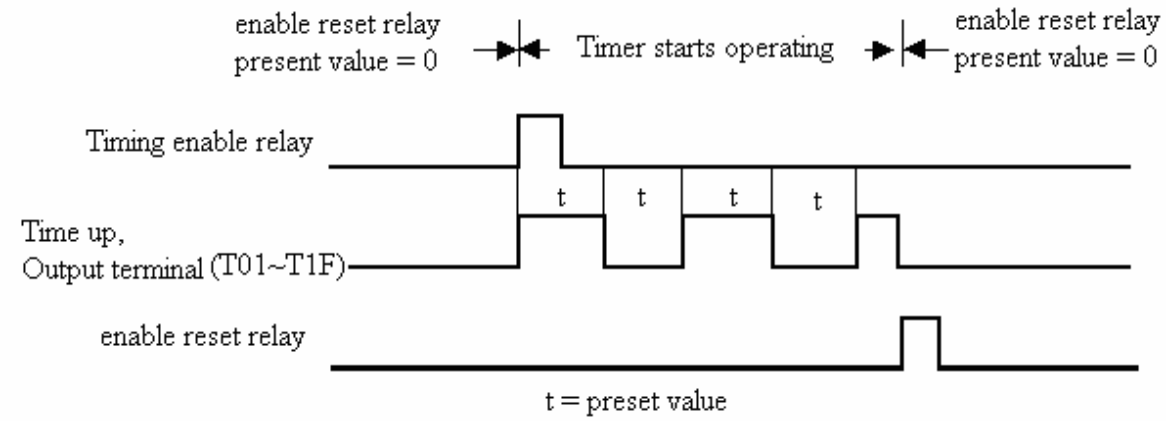
Timer Mode 6 (FLASH with Reset)

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 its rung remains true.







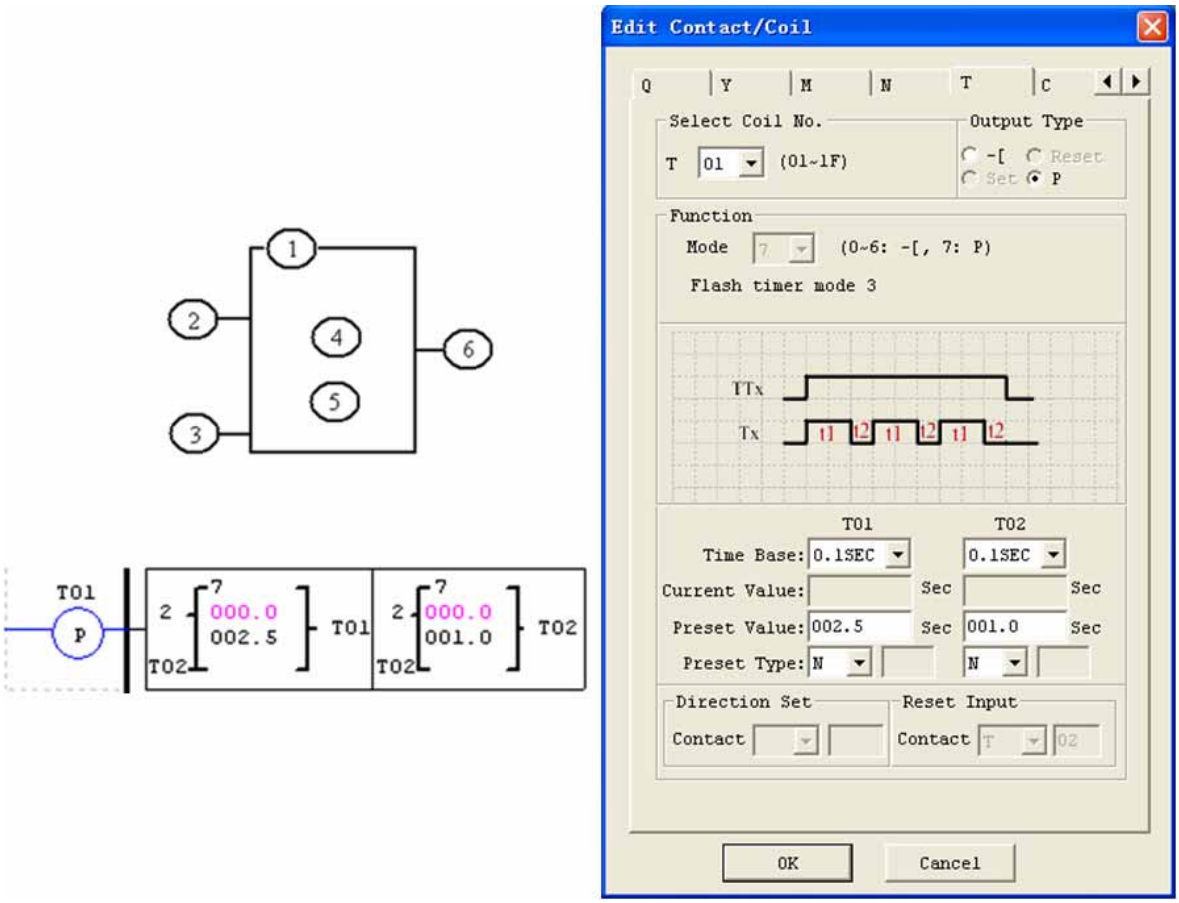


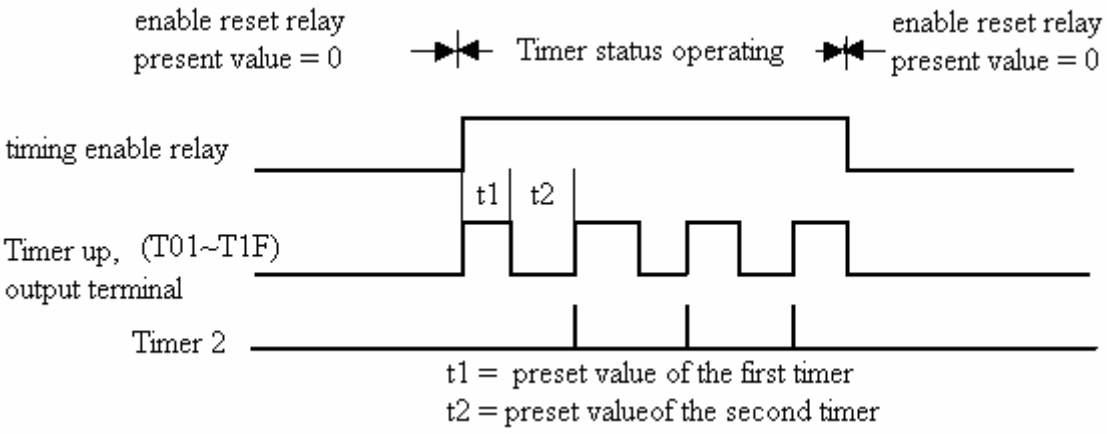
※ The current value of Timer can not be kept on a loss of power to smart.

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 preset 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 of ten used in combination with a counter in applications where it is necessary to count the number of time cycles completed.

※ The two Timers used in Timer Mode 7 cannot be reused as Timers for other modes in the same program.

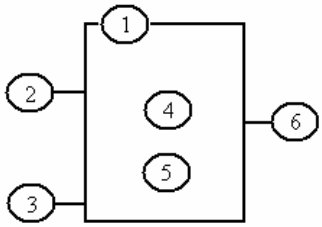




※ The current value of Timer can not be kept on a loss of power to smart.

Counter Instructions

The SG2 includes a total 31 separate 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.



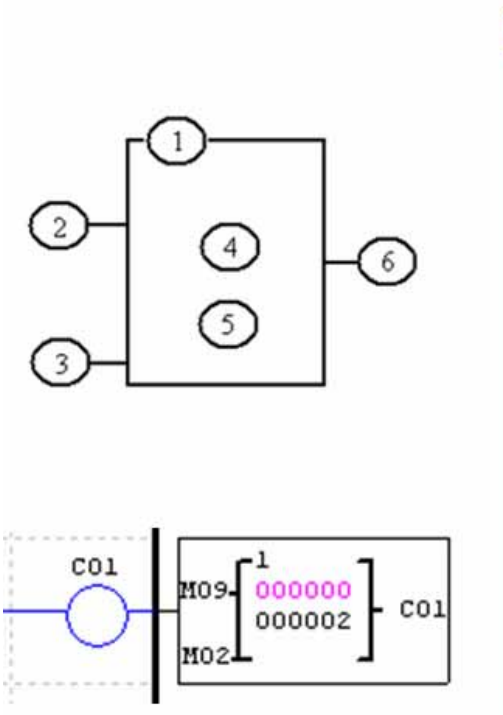
Common Counter

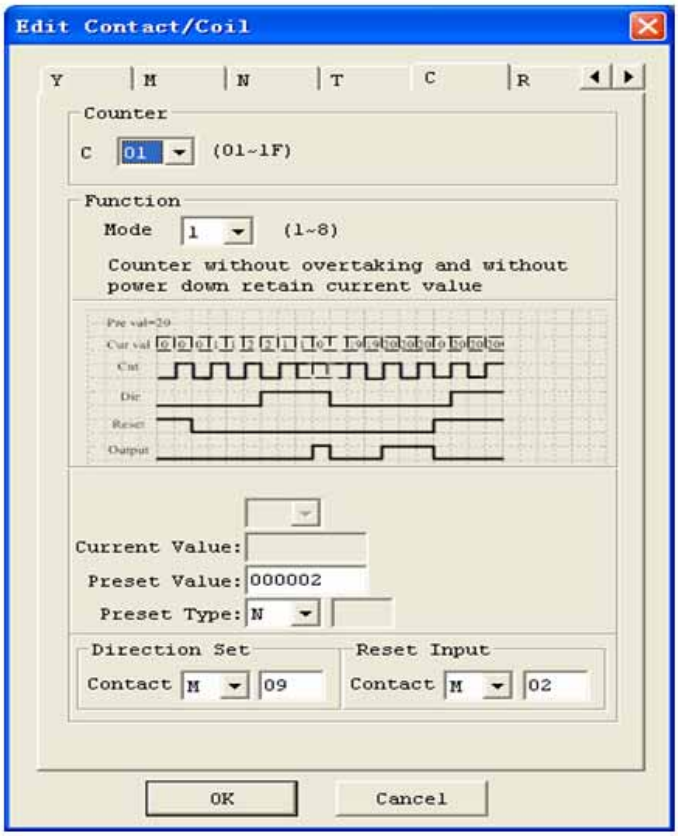
Symbol	description
①	Counting Mode (0-6)
②	Use (I01~g1F) to set counting up or down OFF: counting up (0, 1, 2, 3……) ON: counting down (……3, 2, 1, 0)
③	Use (I01~g1F) to reset the counting value ON: the counter value reset to 0 OFF: the counter continues to count
④	Counter current Value, range: 0~999999
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-M3F/m01-m3F
Auxiliary coil	N01-N3F/n01-n3F
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 close contact	Lo

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

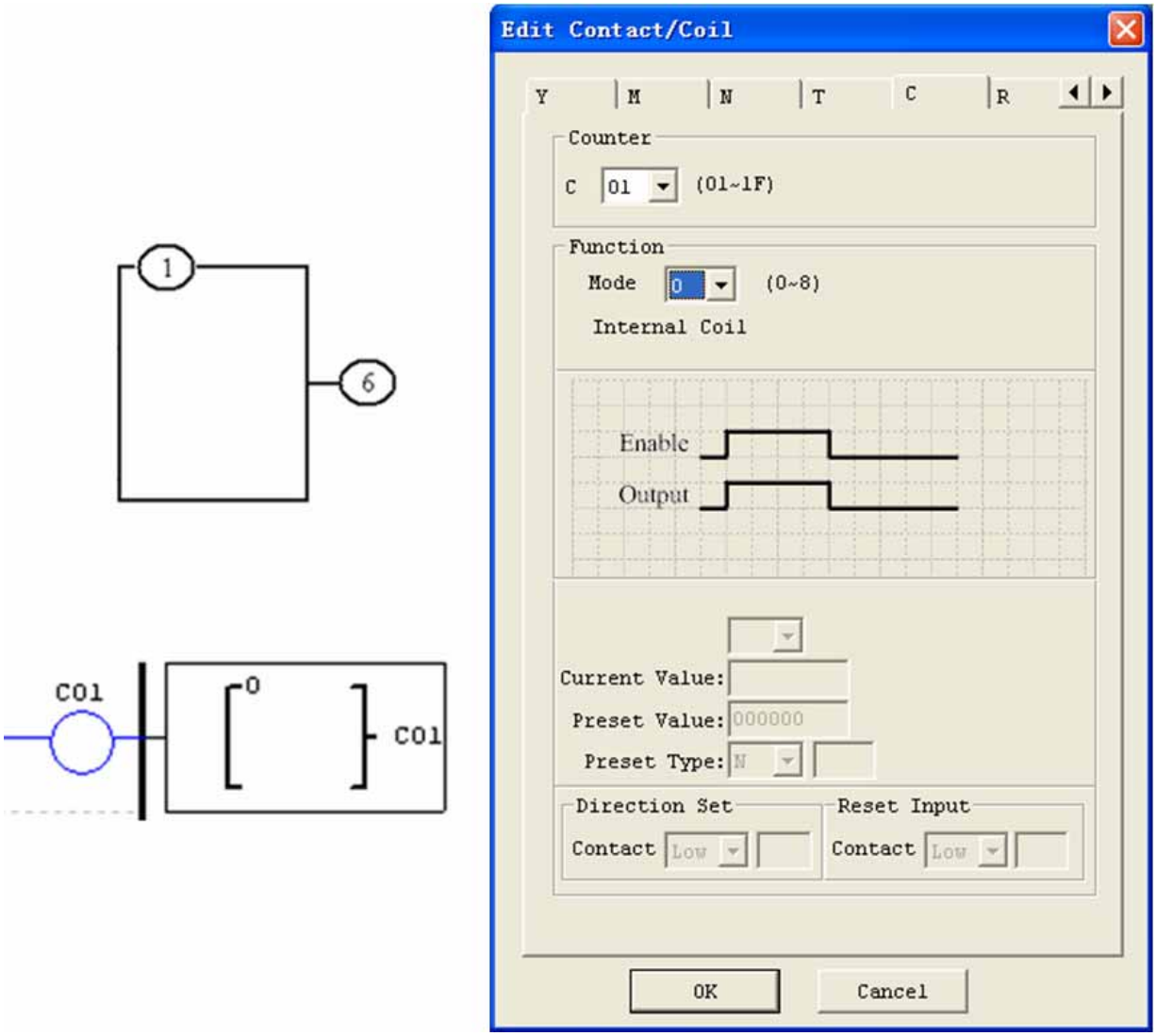
The figure below shows the relationship among the numbered block diagram for a Counter, the ladder diagram view, and the software Edit Contact/Coil dialog box.

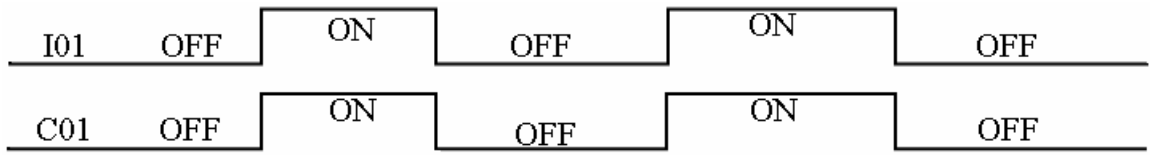




Counter Mode 0 (Internal coil)

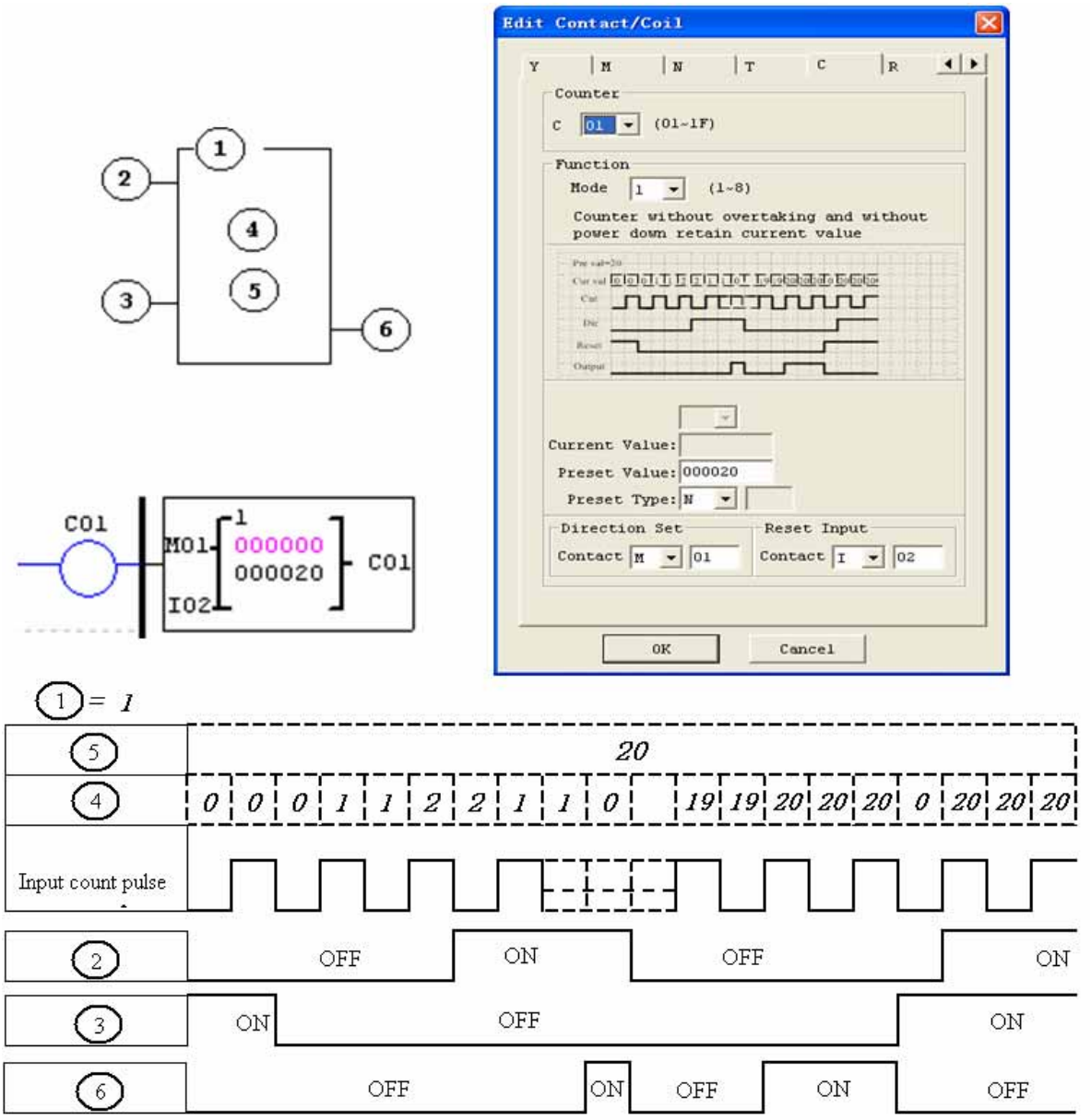
Mode 0 Counter (Internal Coil) used as internal auxiliary coils. No counter preset value. In the example below shows the relationship among the numbered block diagram for a mode 0 counter, the ladder diagram view, and the software Edit Contact/Coil dialog box.





Counter Mode 1 (Fixed Count, Non-Retentive)

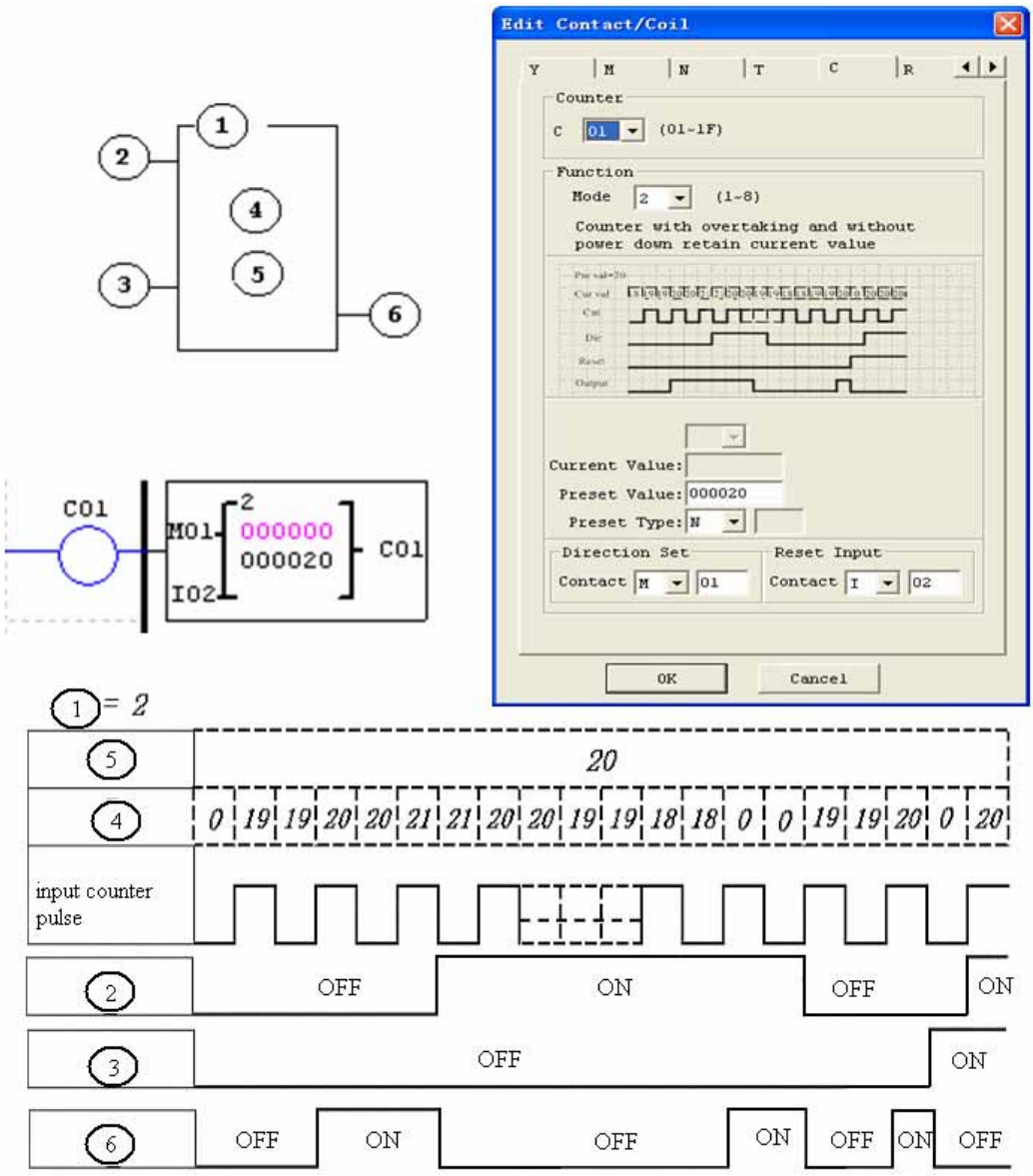
Mode 1 Counter will count up to a fixed preset value and stop counting when the current count is equal to the preset value, or count down to 0 and stop counting when the current count is equal to 0. Additionally, the current count value is non-retentive and will reset to init value on a powering up to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

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 won't count when the current value equals 0 if it's 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. 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.

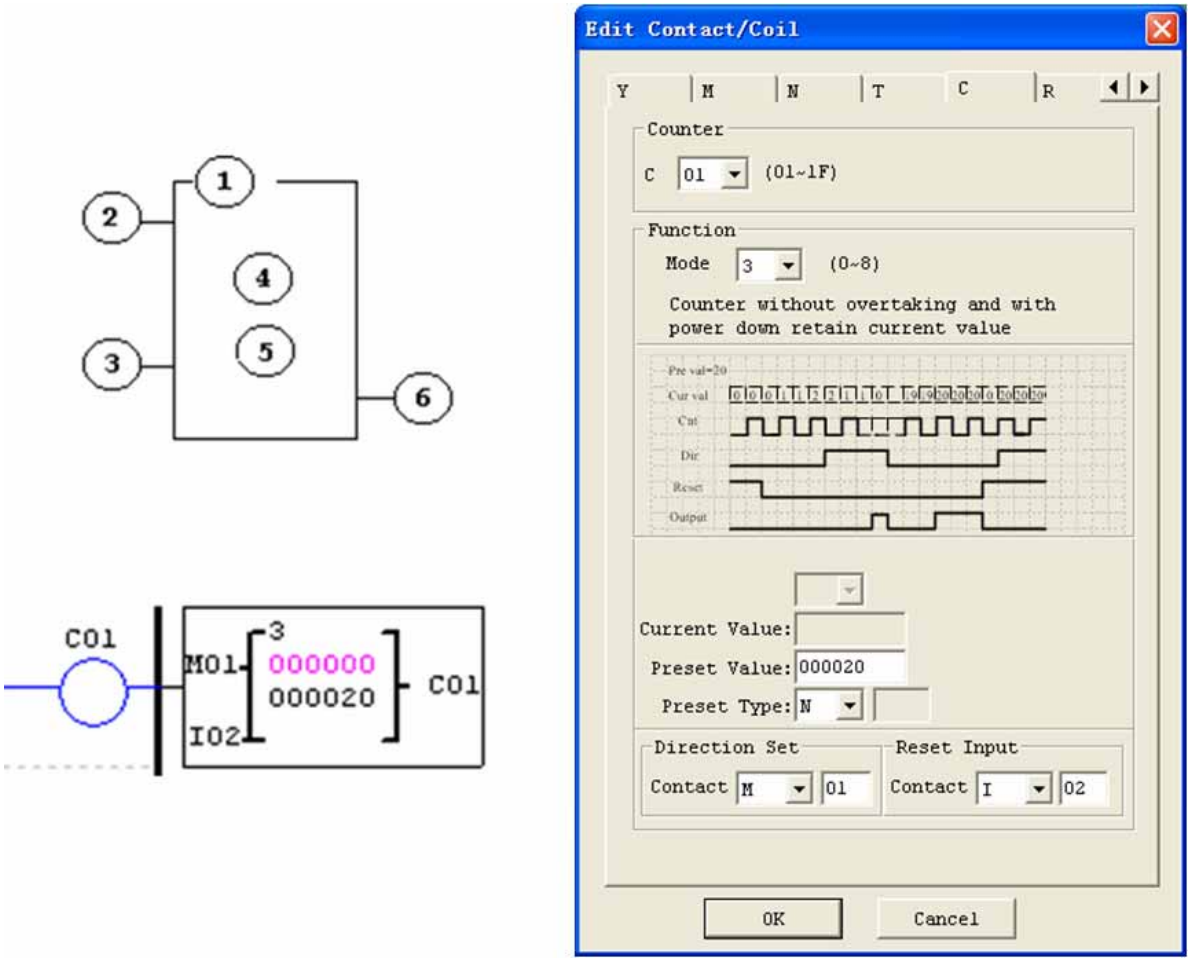


※ Under this mode, Counter will continue counting after reaching preset value if it's configured as counter up. But it stops counting when its current value is 0 if it's configured as counter down.

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

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 init 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. 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.



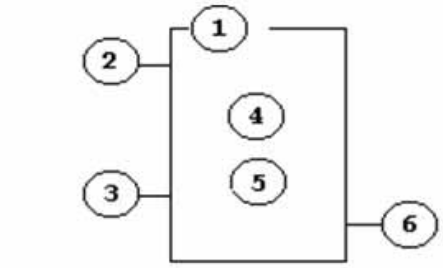
This mode is similar to mode 1, but:

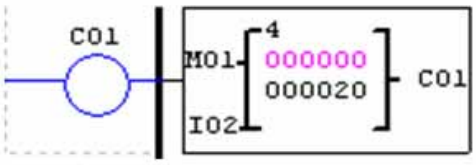
※ The current counter value will keep on a loss of power when the smart status is RUN;

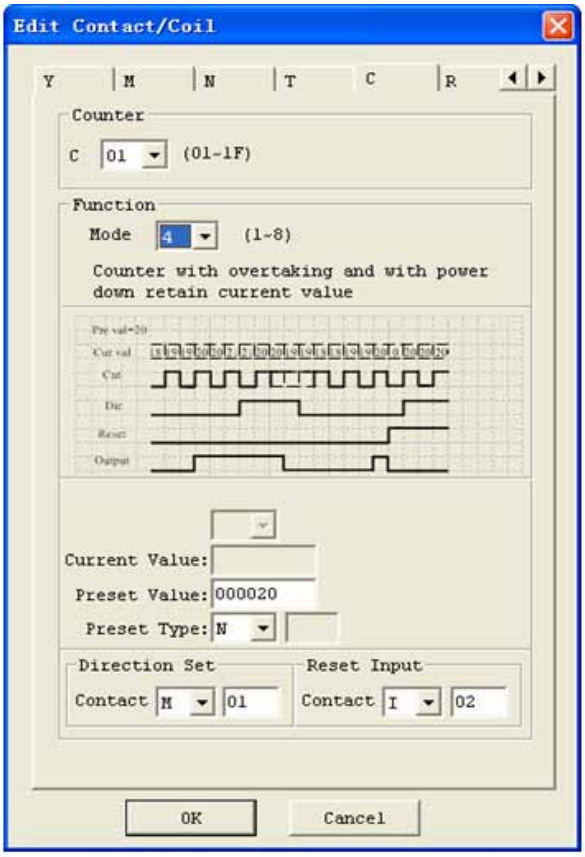
※ The current counter value will keep when the smart switches between RUN and STOP if C-keep is active.

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. 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 isn't less than 20.







This mode is similar to mode 2, but:

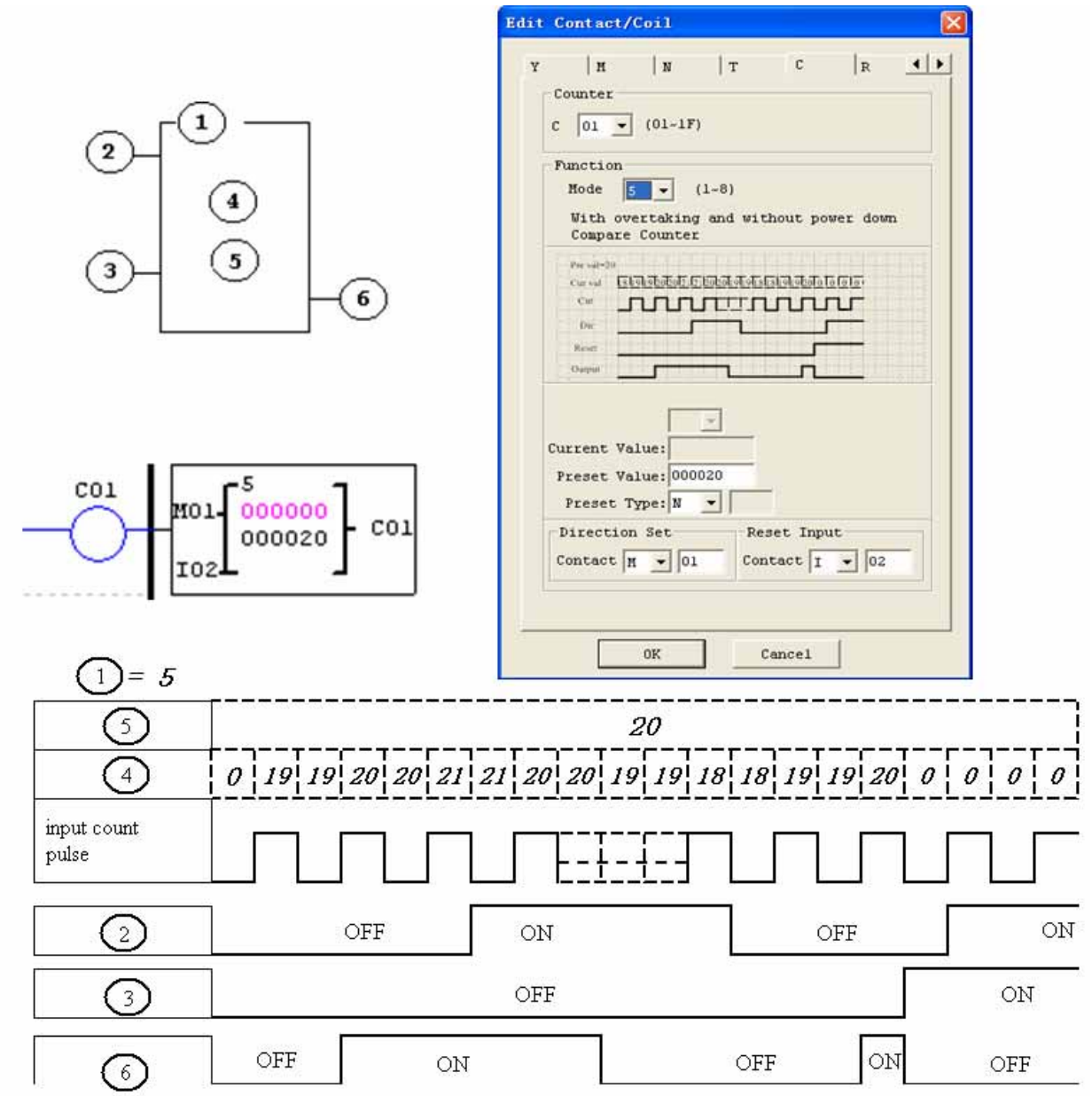
※ The current counter value will be kept on a loss of power when the smart status is RUN;

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

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 isn't 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 after the preset value. Additionally, the current count value is non-retentive and will reset to 0 on a loss of power to the smart relay. 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.



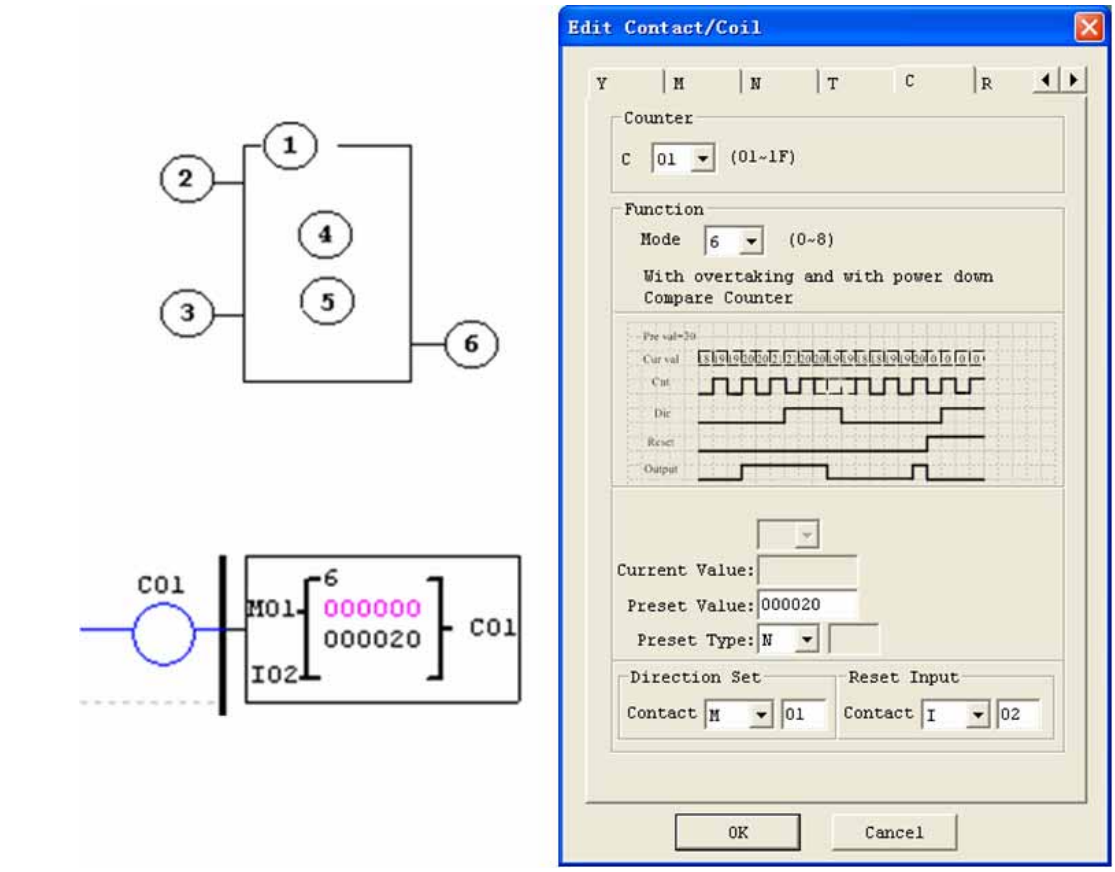
※ Under this mode, the count will continuous after reaching its preset value;

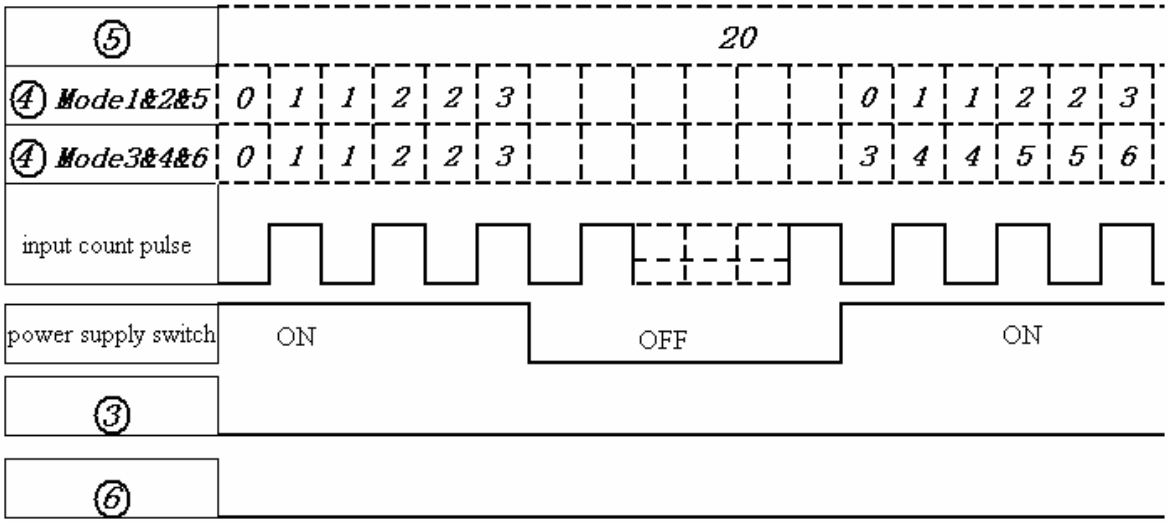
※ The current value is always 0 regardless of the state of its direction bit when the reset is availability;

※ 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 (Continuous Count, Up-Down Count, Retentive)

Mode 6 Counter's operation is similar to Mode 4 except its current count value is continuous and 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 isn't 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, unrelated to the state of its direction bit. The current count value is retentive and will keep its current count after a loss of power to the smart relay. 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 isn't less than 20.





This mode is similar to mode 5, but:

※ The current value is kept on a loss of power down to the smart when it status is RUN;

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

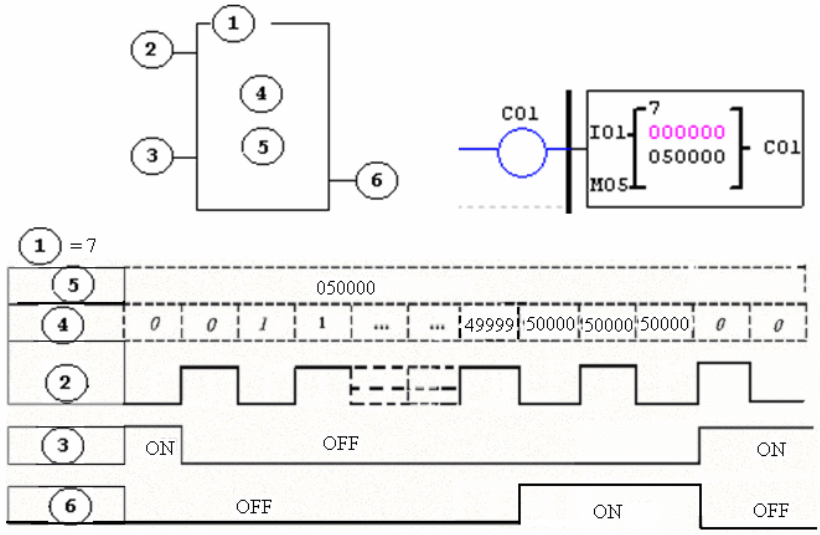
High Speed Counters (DC Version Only)

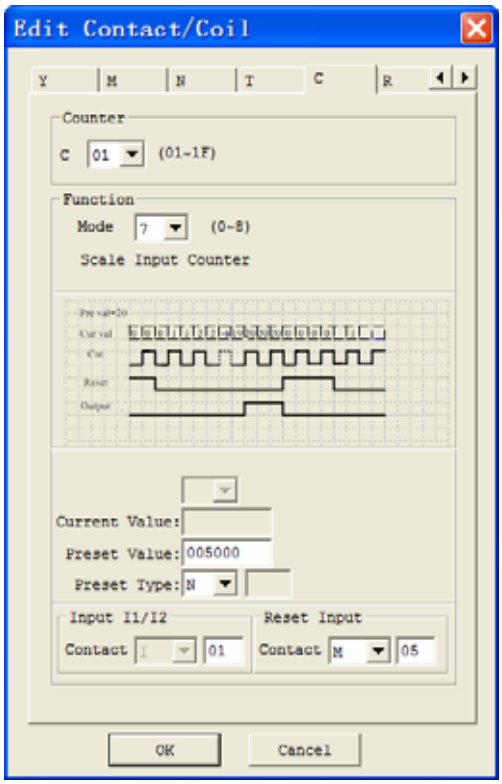
The DC powered version smart relays include two 1 KHz high speed inputs on terminal I01 and I02. These can be used as general purpose DC inputs or can be wired to a high speed input device (encoder, etc.) when configured for high speed counting. They are often used for counting something moving very fast (>40Hz) or used as a speed reference on a machine. The high speed counters are configured using the same software Edit Contact/Coil dialog box, except selecting Counter Mode 7 or Mode 8.

High Speed Counter Mode 7 (DC powered versions only)

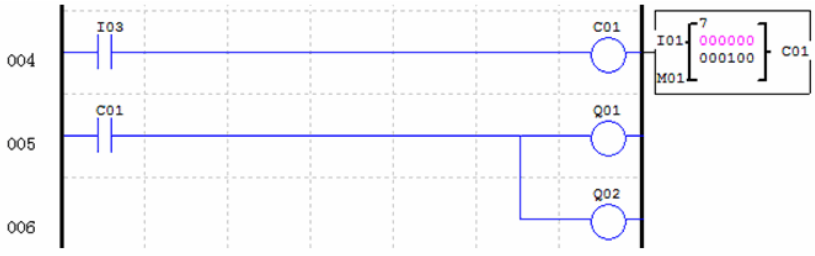
The Mode 7 High Speed Counter can use either input terminals I01 or I02 for forward up-counting to 1 KHz maximum at 24VDC high speed input signal. The selected Counter Coil (C01-C1F) will turn ON when the pulse count reaches preset value and remain ON. The counter will reset when the preceding rung is inactive or 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.

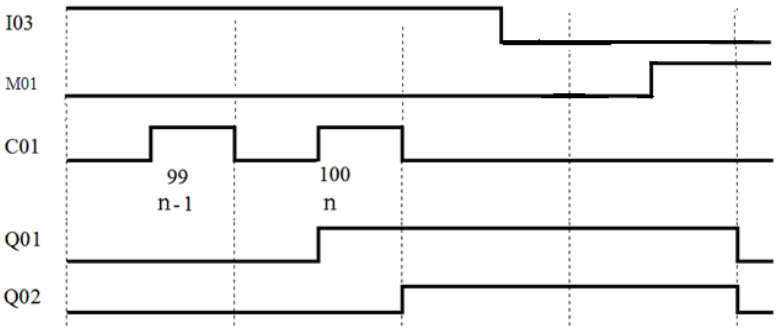
Symbol	Description
①	Counting Mode (7) high speed counting
②	High speed counting input terminal: I01 or I02 only
③	Use (I01~g1F) to Reset the counting value ON: the counter reset to 0 OFF: the counter continues to count
④	Current Count Value, range: 0~999999
⑤	Preset Value, range: 0~999999
⑥	Counter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





Example：

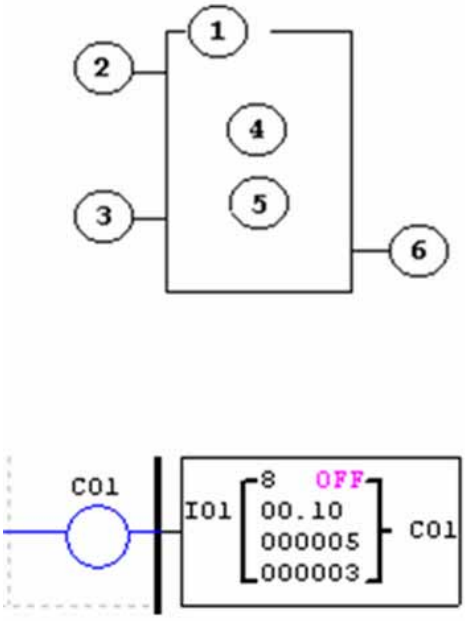


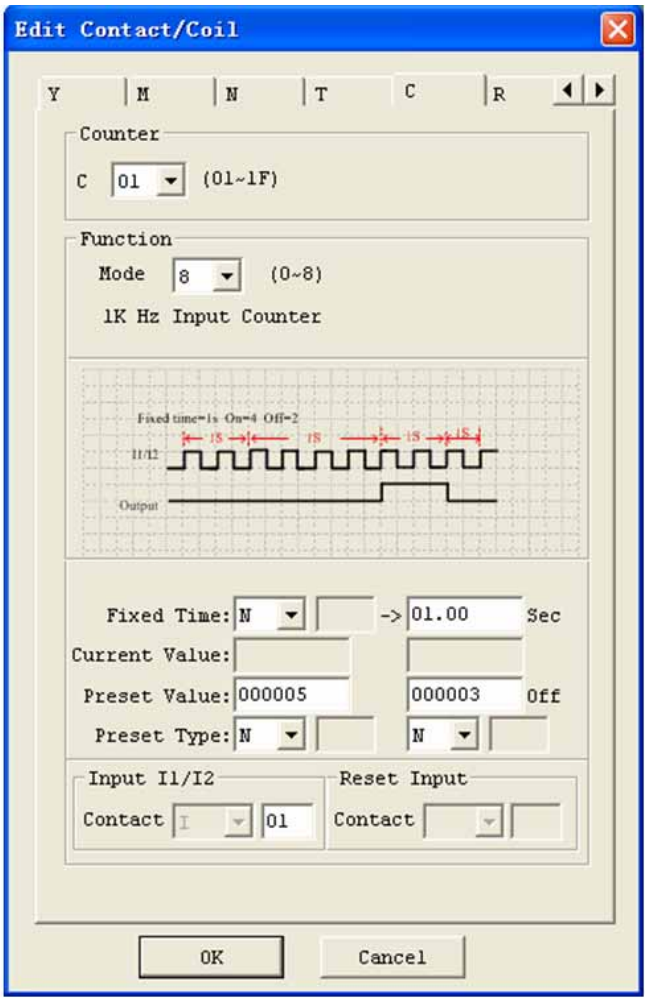


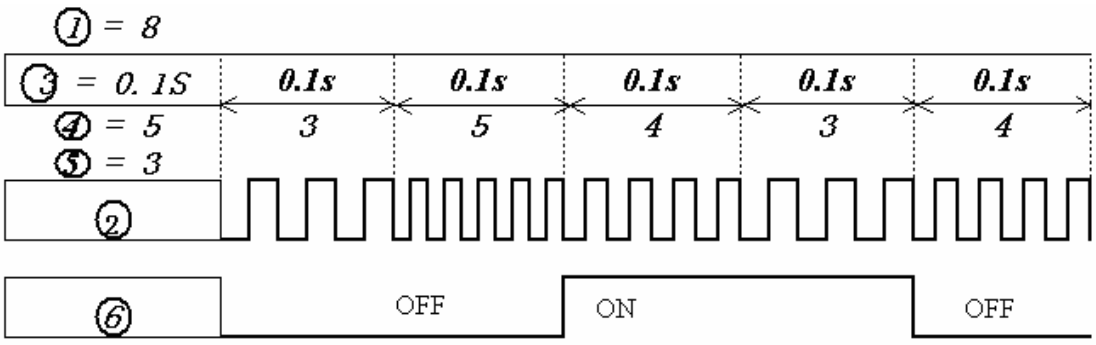
High Speed Counter Mode 8 (DC powered versions only)

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. 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. 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)

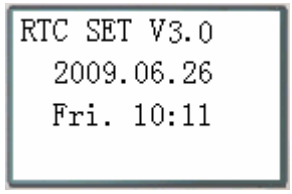


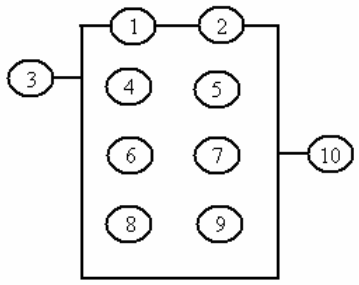




Real Time Clock (RTC) Instructions

The SG2 smart relay includes a total of 31 separate RTC instructions 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 SG2 is set using the **Operation»RTC Set** menu selection from the SG2 Client software.

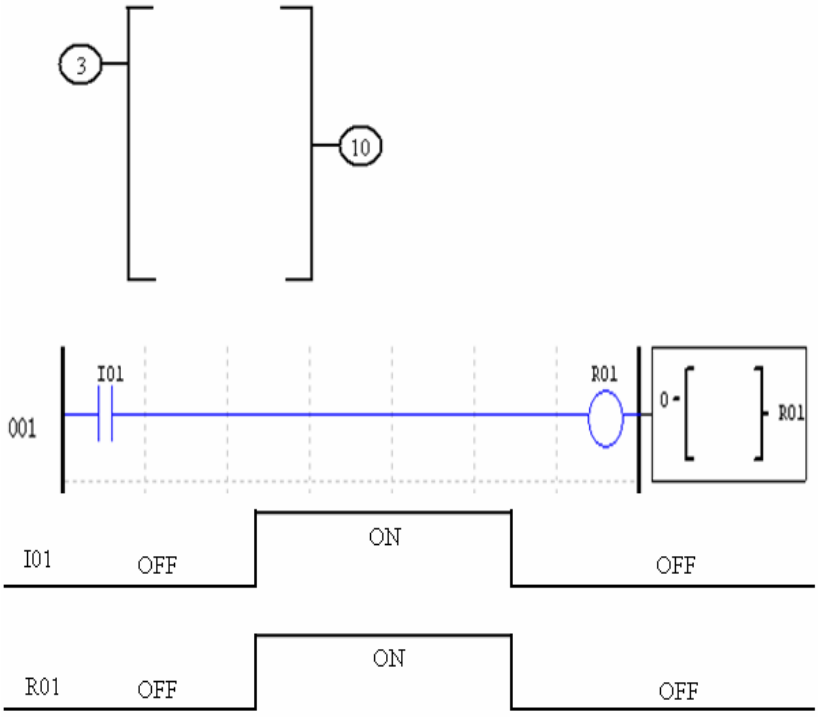


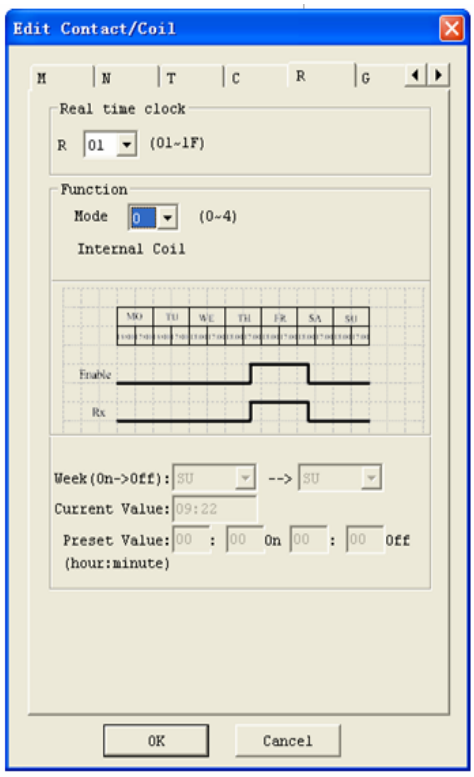


Symbol	Description
①	Input the first week to RTC
②	Input the second week to RTC
③	RTC mode 0~2, 0: internal coil 1:daily, 2:consecutive days
④	RTC displays the hour of present time.
⑤	RTC displays the minute of present time
⑥	Set RTC hour ON
⑦	Set RTC Minute ON
⑧	Set RTC Hour OFF
⑨	Set RTC Minute OFF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

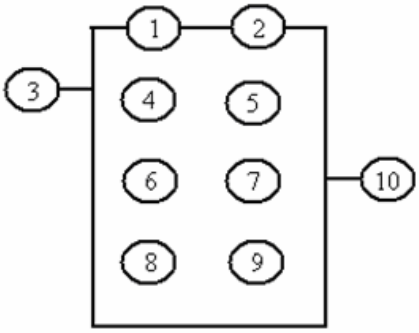


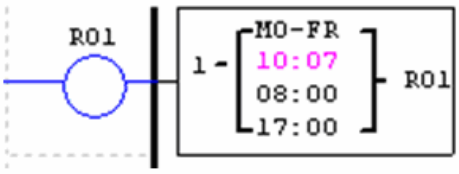


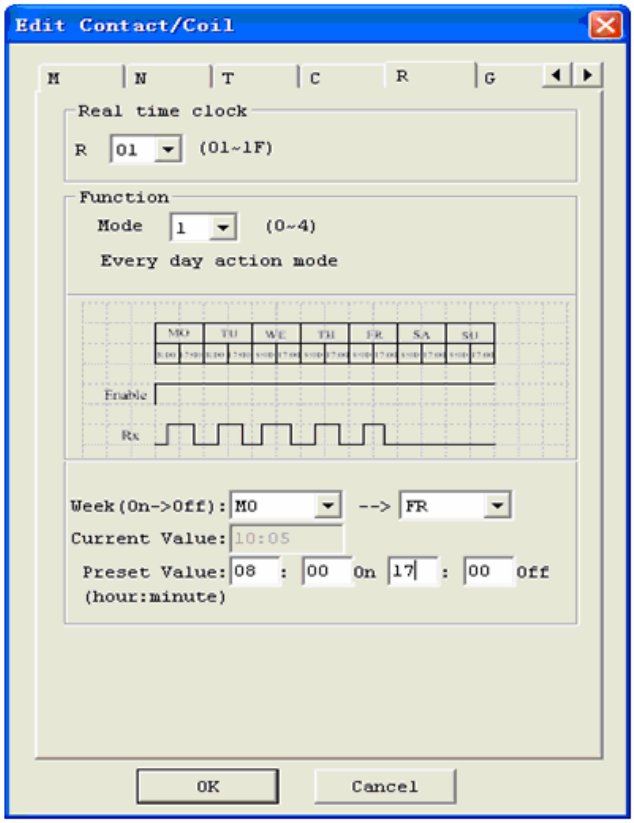
RTC Mode 1 (Daily)

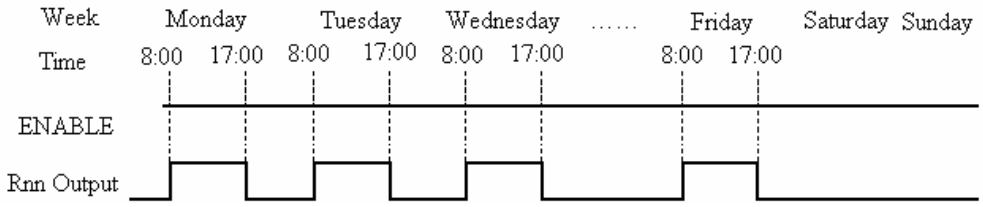
The Daily Mode 1 allows the Rxx coil to active based on a fixed time across a defined set of days per week. The configuration dialog below (example 1) allows for selection of the number of days per week (i.e. Mon-Fri) and the Day and Time for the Rxx coil to activate ON, and the Day and Time for the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

Example 1:



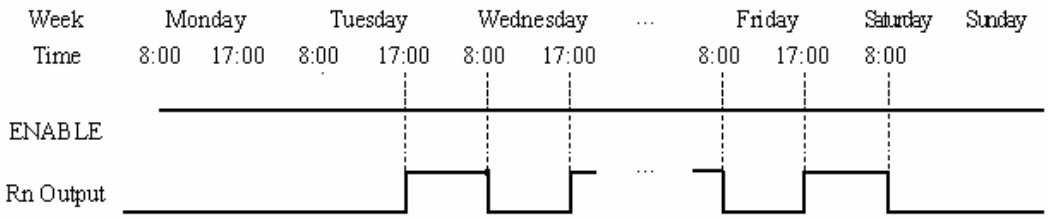






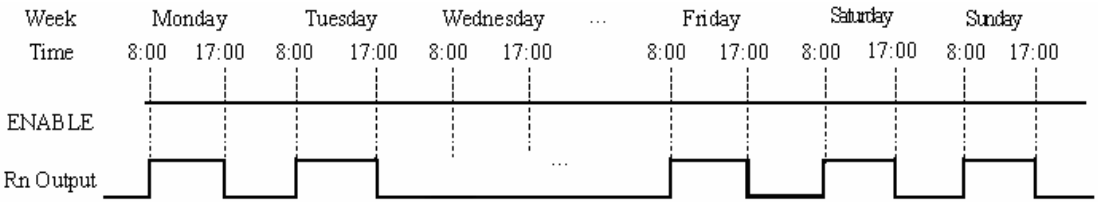
Example 2:

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



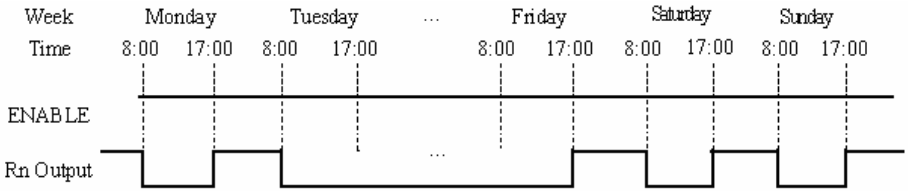
Example 3:

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



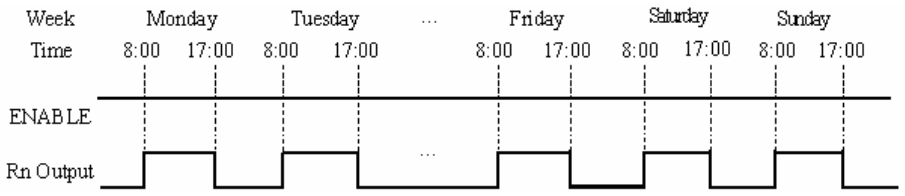
Example 4:

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



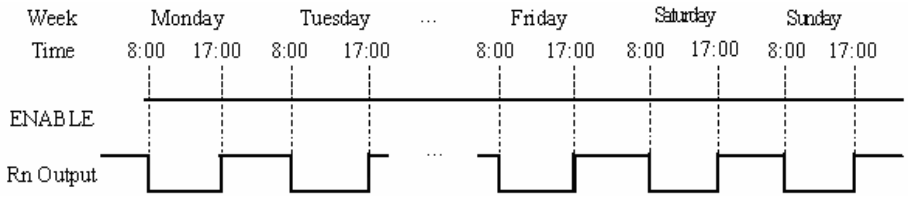
Example 5:

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



Example 6:

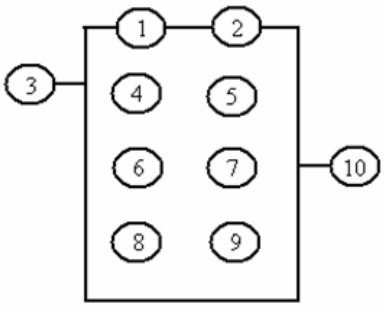
③	1
① : ②	SU-SU
⑥ : ⑦	17:00
⑧ : ⑨	8:00

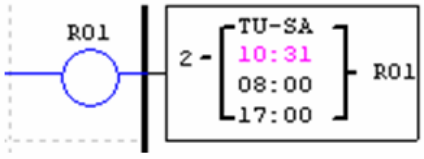


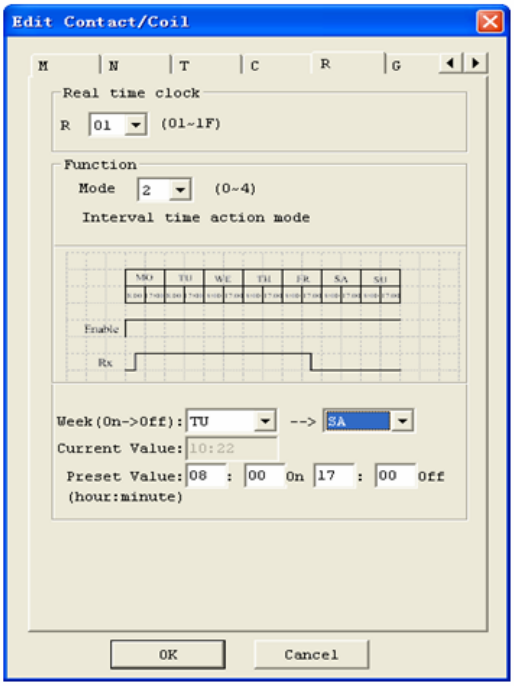
RTC Mode 2 (Interval weekly)

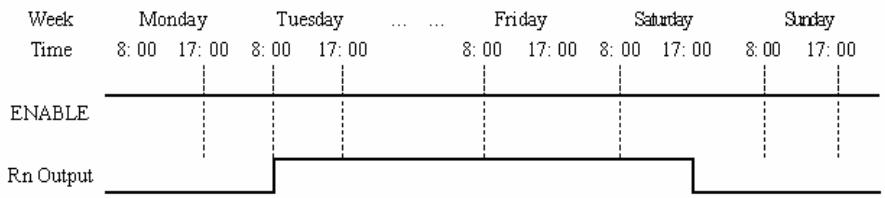
The Interval Time Mode 2 allows the Rxx coil to activate based on time and day per week. The configuration dialog below (example 1) allows for selection of Day and Time for the Rxx coil to activate ON, and Day and Time for the Rxx coil to deactivate OFF.

Example 1:



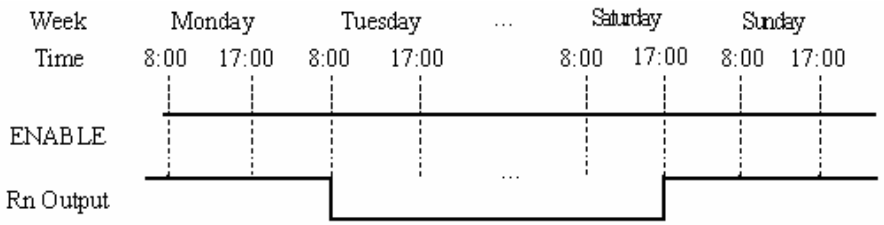






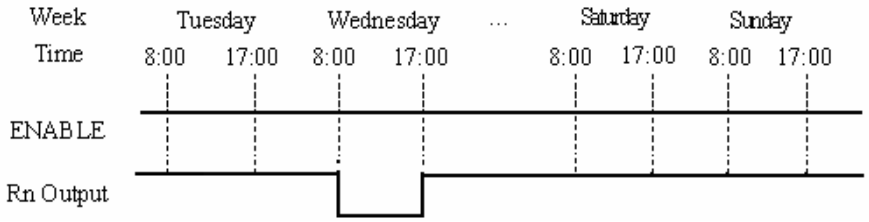
Example 2:

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



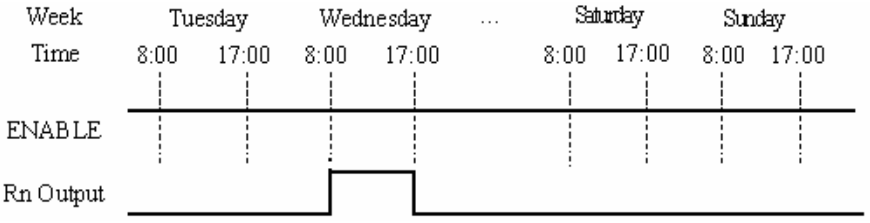
Example 3:

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



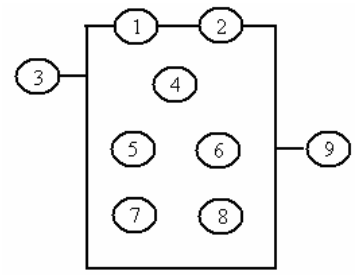
Example 4:

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



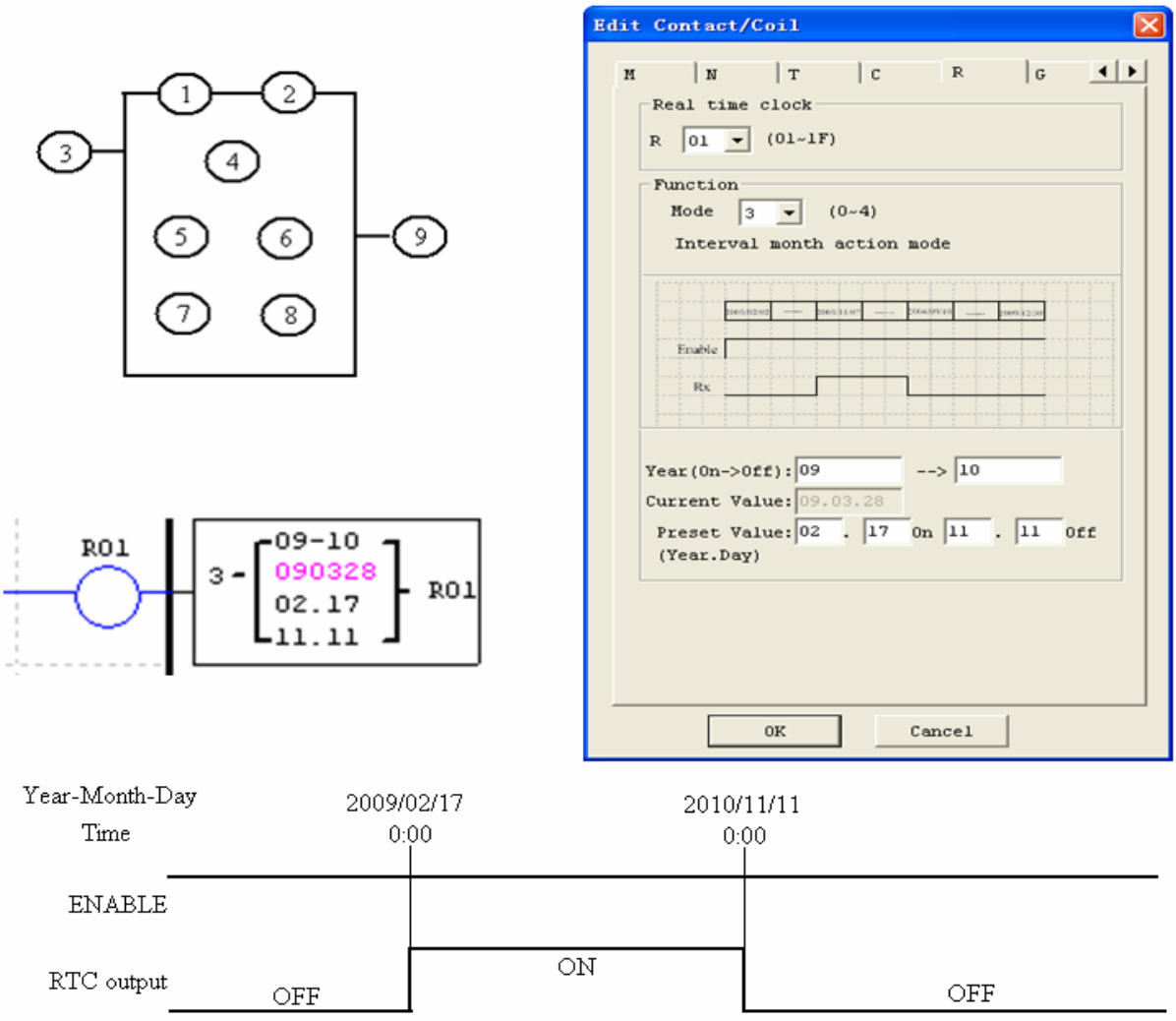
RTC Mode 3 (Year-Month-Day)

The Year-Month-Day Mode 3 allows the Rxx coil to activate based on Year, Month, and Date. The configuration dialog below (example 1) allows for selection of Year and Date for the Rxx coil to activate ON, and Year and Date for the Rxx coil to deactivate OFF.



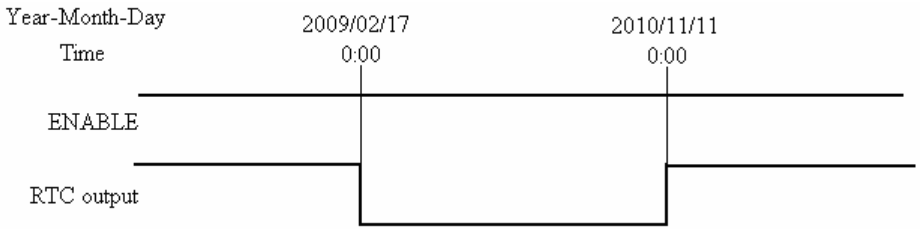
Symbol	Description
①	RTC Year ON
②	RTC Year OFF
③	RTC Mode 3, Year-Month-Day
④	Display RTC present time, Year-Month-Day
⑤	RTC month ON
⑥	RTC day ON
⑦	RTC month OFF
⑧	RTC day OFF
⑨	RTC code (R01~R1F, total 31 group)

Example 1:



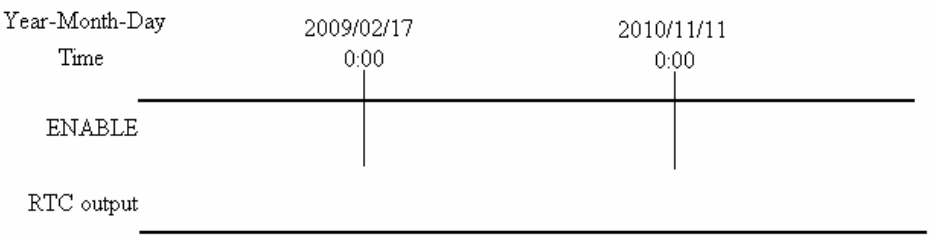
Example 2:

③	3
①/⑤/⑥	2010/11/11
②/⑦/⑧	2009/02/17



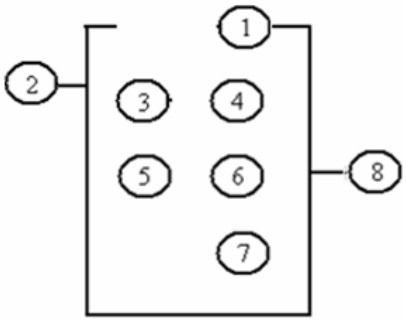
Example 3:

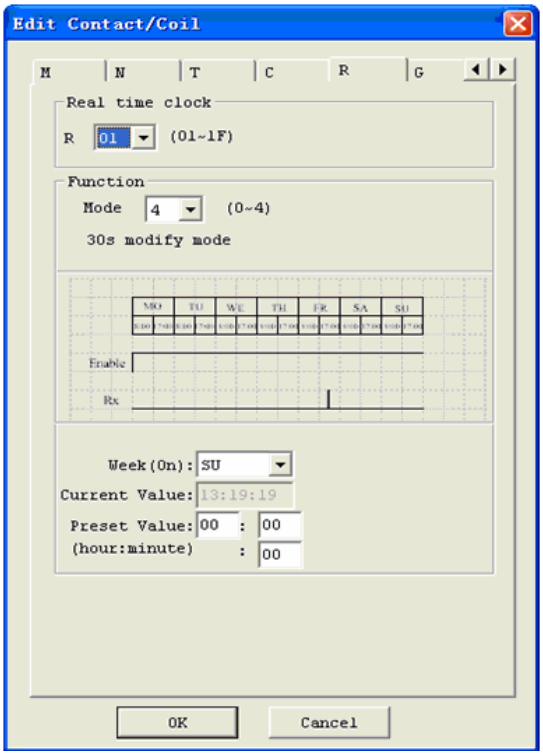
③	3
①/⑤/⑥	2010/11/11
②/⑦/⑧	2010/11/11



RTC Mode 4 (30-second adjustment)

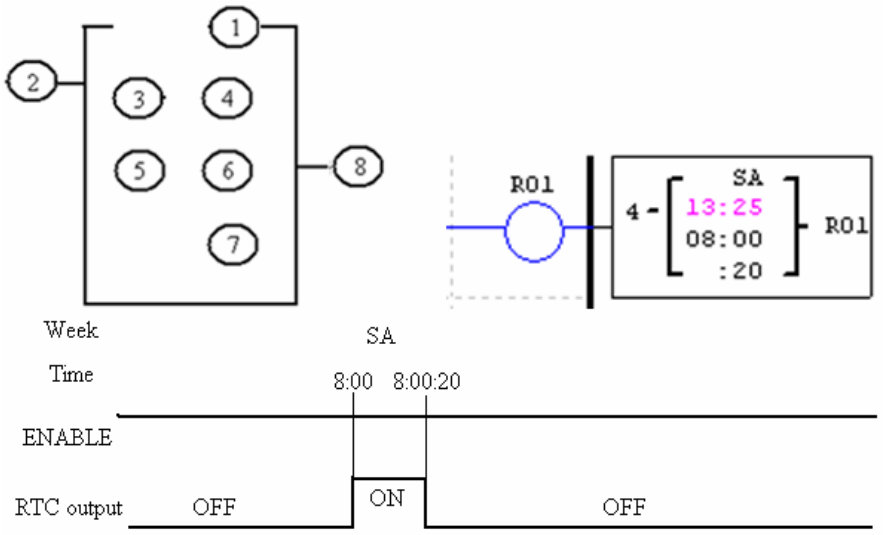
The 30-second adjustment Mode 4 allows the Rxx coil to activate based on week, hour, minute and second. The configuration dialog below shows for selection of week, hour, minute and second for the Rxx coil to activate ON, and 30-second adjustment then Rxx OFF.





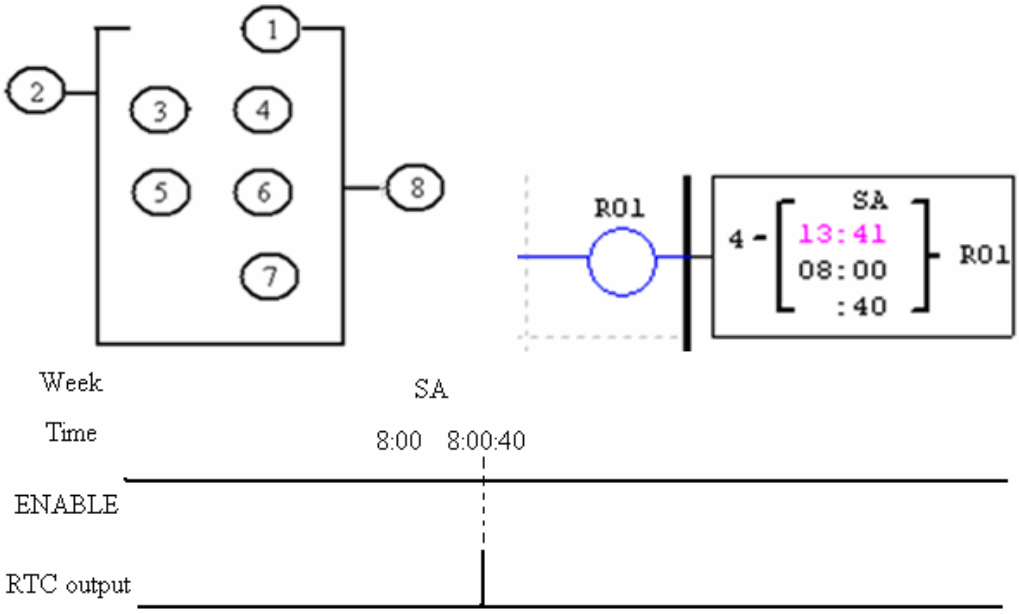
Symbol	Description
①	RTC adjustment week
②	RTC mode 4
③	RTC present hour
④	RTC present minute
⑤	RTC adjustment hour
⑥	RTC adjustment minute
⑦	RTC adjustment second
⑧	RTC code (R01~R1F, total 31 group)

Example 1: preset second < 30s



※ The present time will be 8:00:00 when it achieves 8:00:20 at first time, and RTC status bit R01 will be ON. RTC status bit 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.

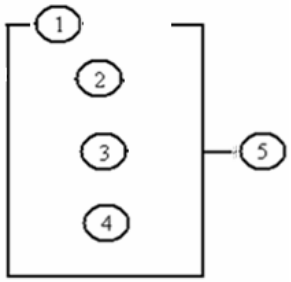
Example 2: preset second > 30s



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

Comparator Instructions

The SG2 smart relay includes a total of 31 separate comparator instructions that can be used throughout a program. Each comparator has a choice of 8 operation modes. Additionally, each comparator has 5 parameters for proper configuration. The table below describes each configuration parameter, and lists each compatible memory type for configuring Comparators.

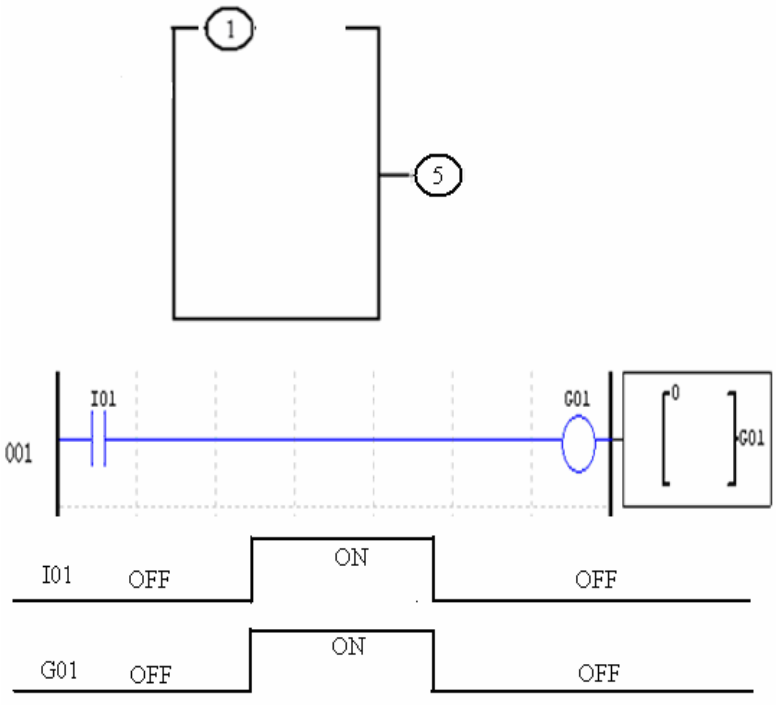


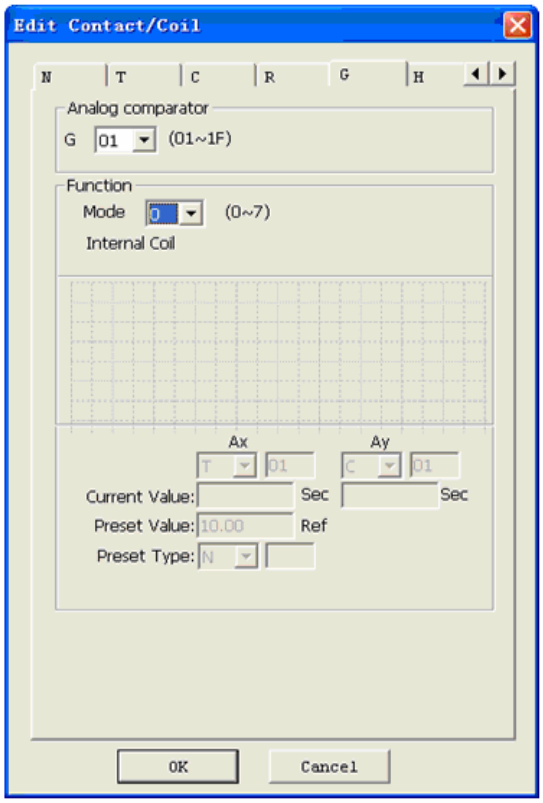
Symbol	Description
①	Comparison Mode (0~7)
②	Ax analog input value (0.00~99.99)
③	Ay analog input value (0.00~99.99)
④	Reference comparative value, could be constant, or other data code
⑤	Output terminal (G01~G1F)

※ The preset value ②, ③ and ④ can be a constant or 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: $④ \ge Ax, ⑤ON$;

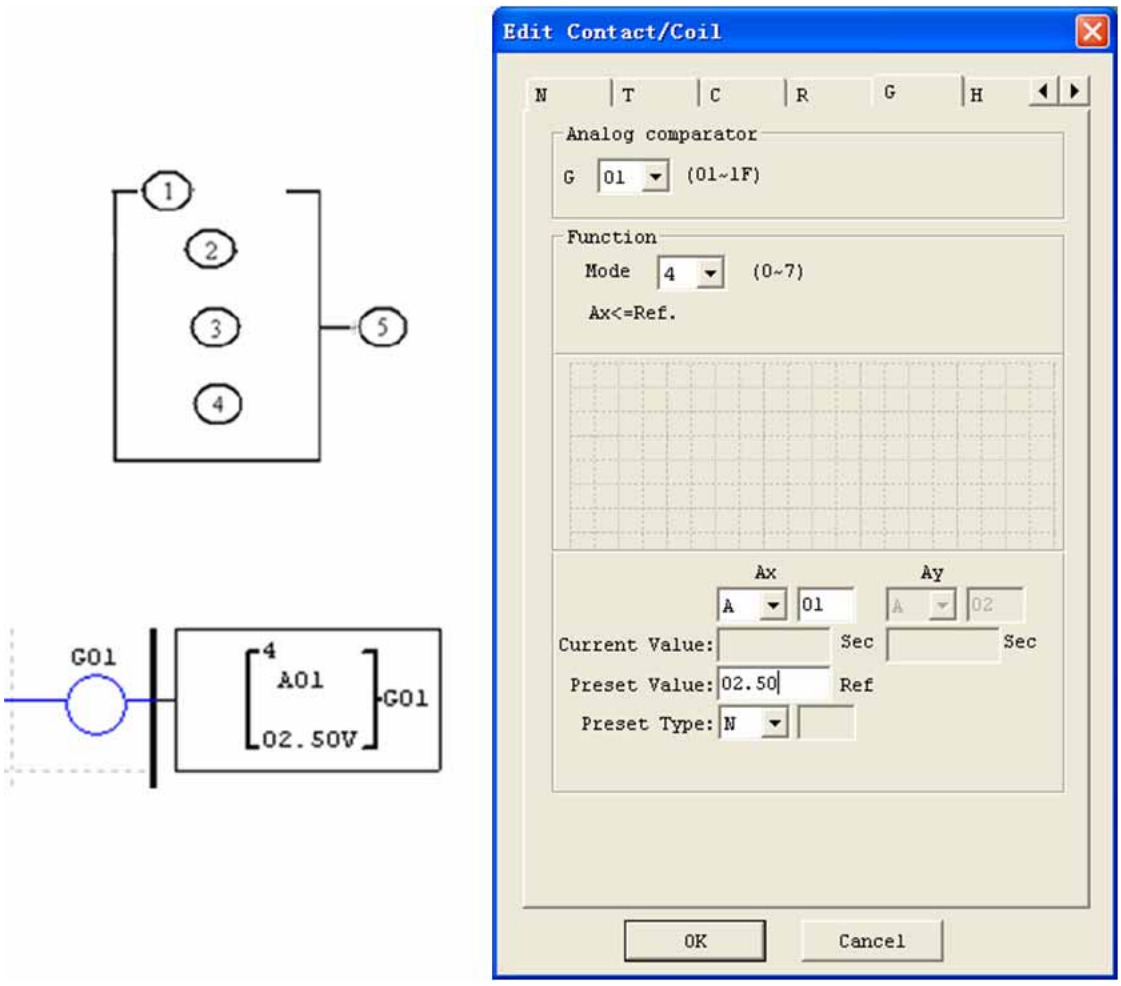
(5) Analog Comparator mode 5: $④ \le Ax, ⑤ON$;

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

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

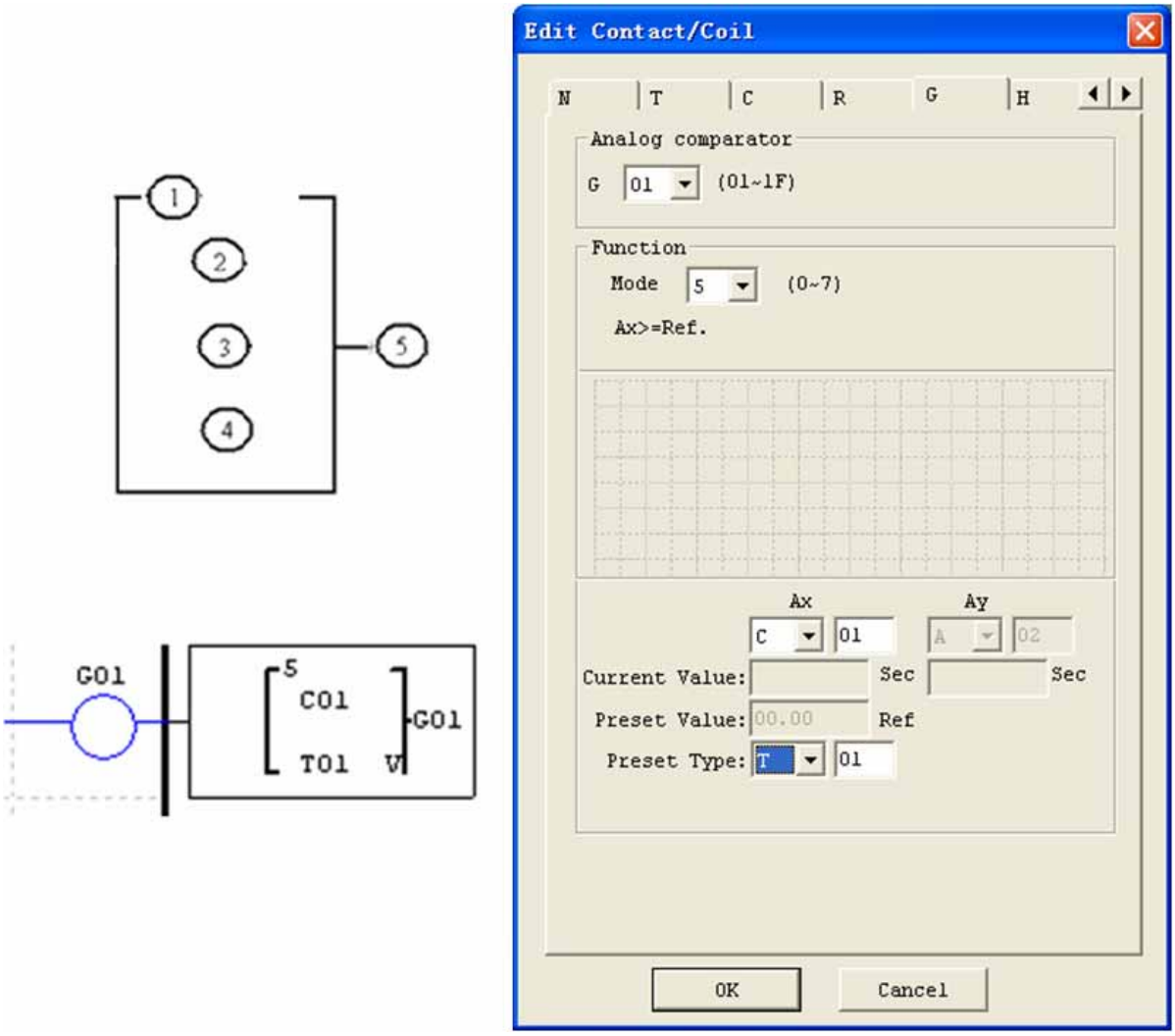
Example 1: Analog Signal Compare

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.



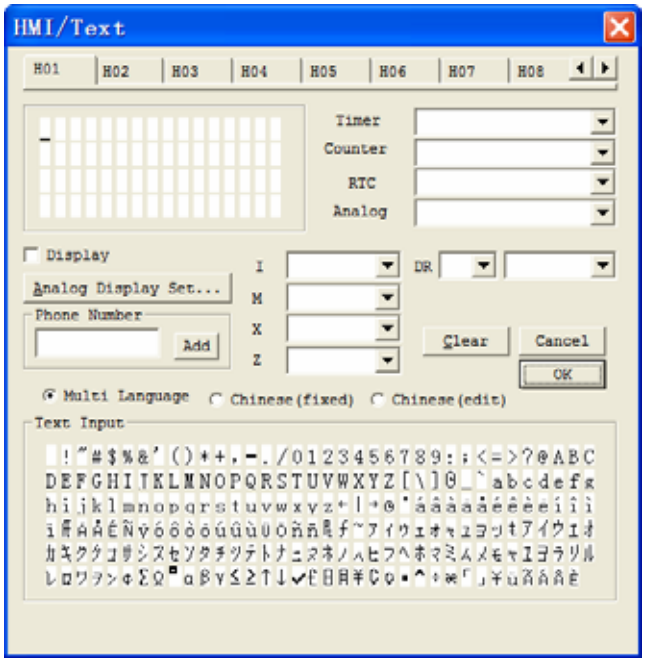
Example 2: Timer/Counter present value Compare

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.

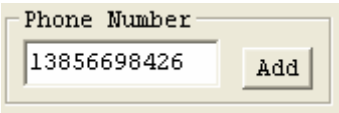


HMI Display Instructions

The SG2 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 SG2 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), Multi Language is shown in the adjacent example. Each HMI instruction can be configured separately using the **Edit>>HMI/Text** menu selection from the SG2 Client software. In the adjacent example, HMI instruction H01 is configured to display the value of T01, and some descriptive text.



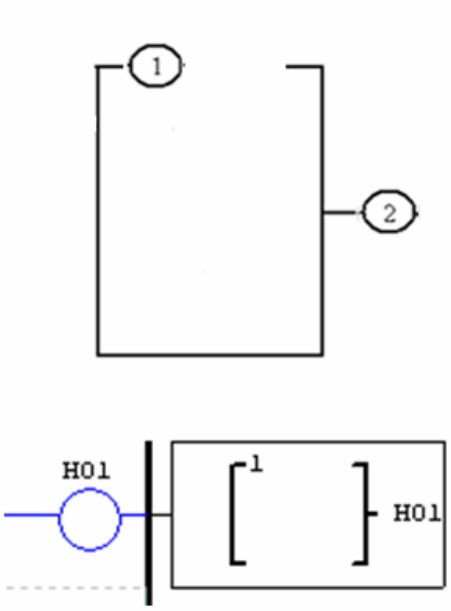
Allows the SEL button on the SG2 keypad to activate the selected message onto the LCD even the Hxx is inactive.

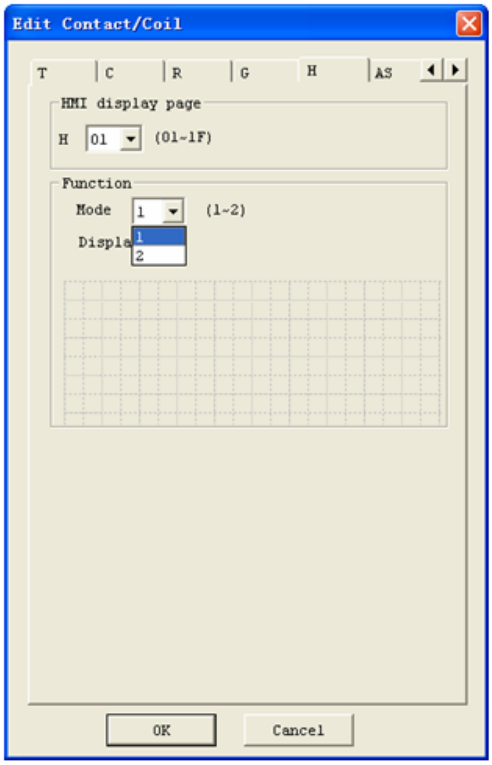


※ A phone number can be displayed on the screen to alert an operator to call for help. But the phone number field does not dial a modem or allow for a modem connection.

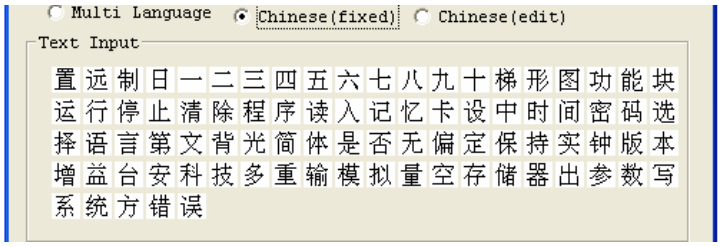
Each HMI instruction has a choice of 2 operation modes. The table below describes each configuration parameter.

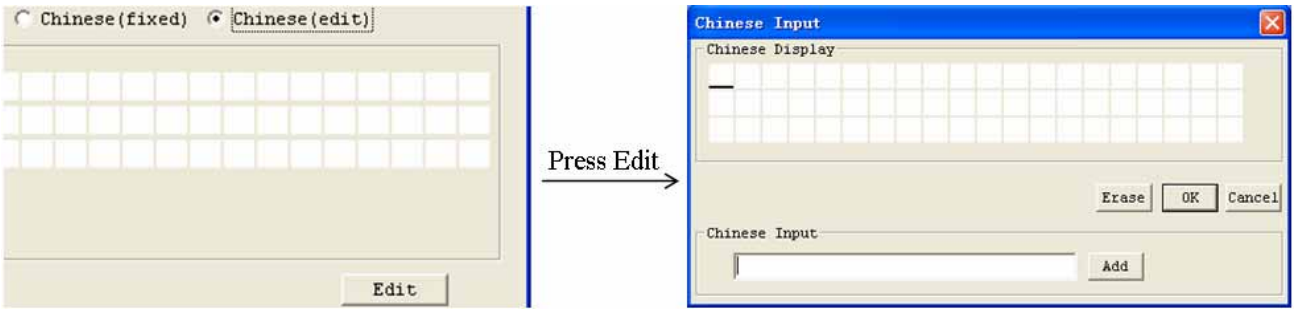
Symbol	Description
①	Display mode (1-2)
②	HMI character output terminal (H01~H1F)





The Chinese (fixed) and Chinese (edit) are shown below. The total number of Chinese (edit) is 60.



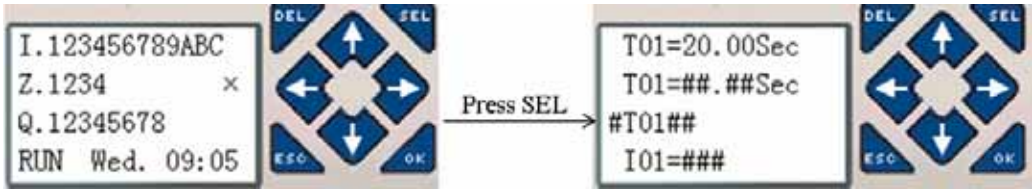


HMI function instruction

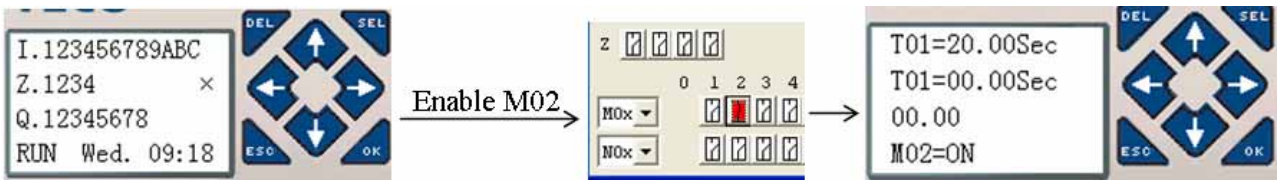
1. HMI can display character, built-in Chinese, user-defined Chinese and GSM telephone number. This information can not be edited through keypad.
2. HMI can display function current value (T, C, R, G and DR, classifying units and un-units). This information can not be edited through keypad.
3. HMI can 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 (only FBD)), state of M and N can be edited through keypad.

HMI status

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

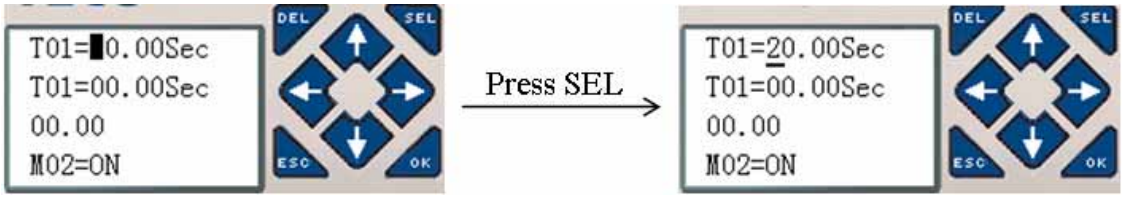


2. HMI running state, HMI is enabled at IO interface



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



Keypad instruction

ESC	Abrogate operation
SEL	Into status 3 if there is edited content at status 1 or 2 Into status 4 Change preset type under status 4
↑↓ (SEL+↑↓)	Under status 4, change data and number, function preset data; change coil state Not in status 4, move cursor up and down Under status 2, find the nearest enabled HMI Under status 1, find the nearest HMI whose mode is 1
←→	Move cursor lift and right
OK	Validate editing and store automatic

PWM Output Instruction (DC Transistor Output Models Only)

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.

	Mode	Output
P01	PWM, PLSY	Q01
P02	PWM	Q02

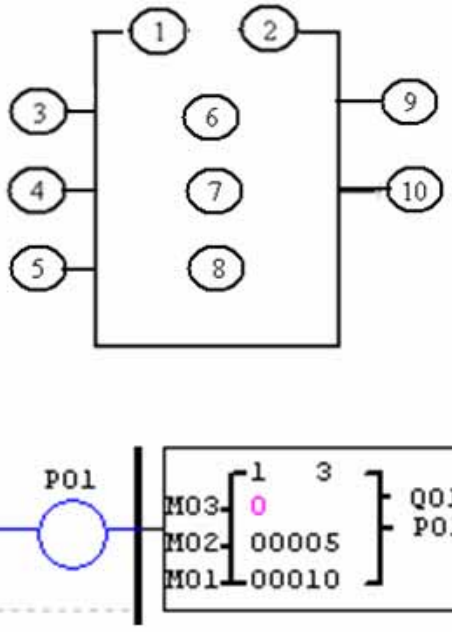
PWM mode

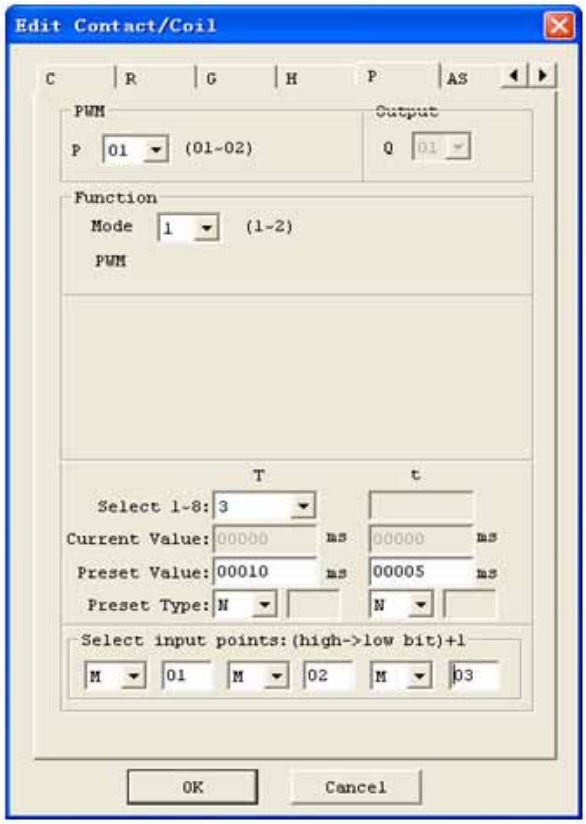
P01 and P02 both can work under this mode. Each PWM has 8 group preset stages which contents Width and Period. The 8 group preset values can be constant or other function current value. Each PWM has 10 parameters for proper configuration. The table below describes each configuration parameter, and lists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

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

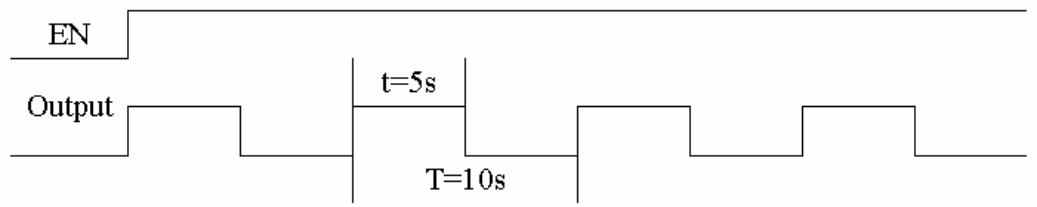
Enable	Select3	Select2	Select1	stage	PWM Output
OFF	X	X	X	0	OFF
ON	OFF	OFF	OFF	1	Preset stage 1
ON	OFF	OFF	ON	2	Preset stage 2
ON	OFF	ON	OFF	3	Preset stage 3
ON	OFF	ON	ON	4	Preset stage 4
ON	ON	OFF	OFF	5	Preset stage 5
ON	ON	OFF	ON	6	Preset stage 6
ON	ON	ON	OFF	7	Preset stage 7
ON	ON	ON	ON	8	Preset stage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

Example:





The state of M01, M02 and M03 are 010, so PWM output pulse is like this as setting above:



The state of M01, M02 and M03 decide 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.

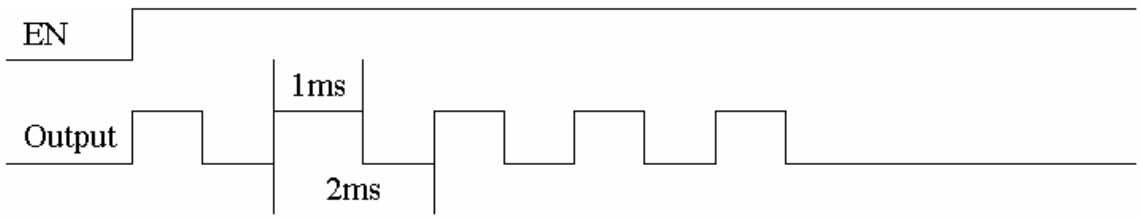
PLSY mode

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)
⑥	PWM code (P01)

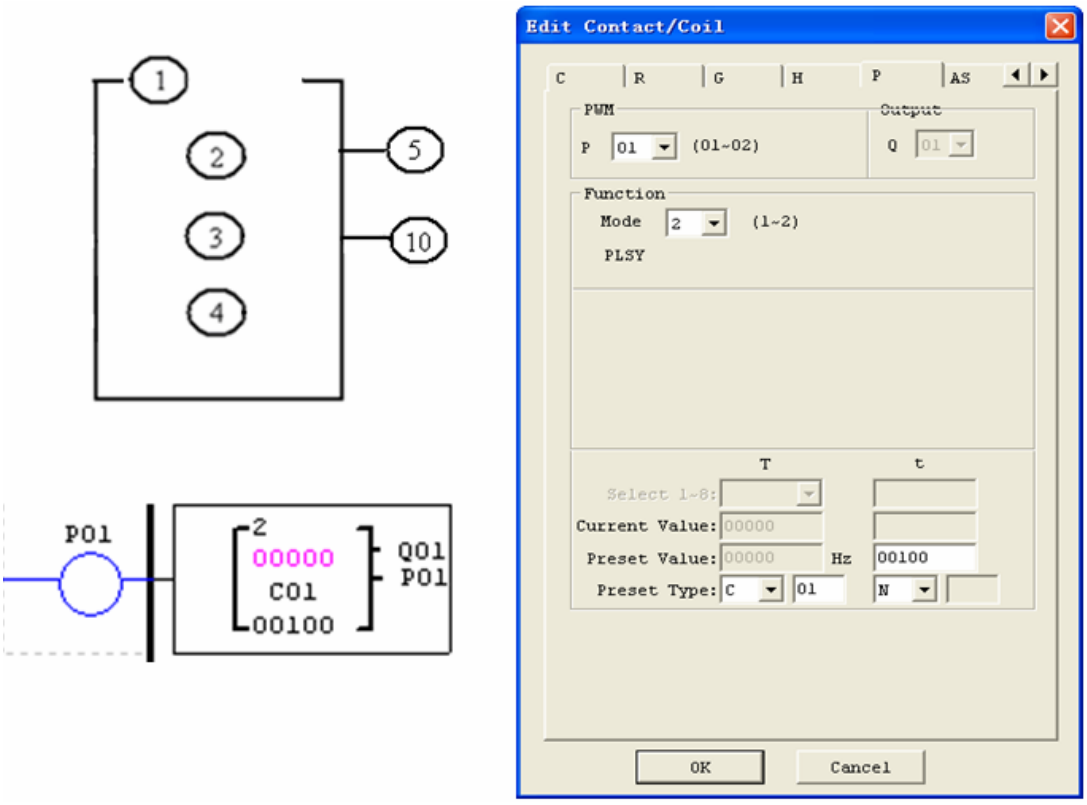
The preset frequency and pulse number could be constant or other function current value. They are variable if the preset are other data code. The PLSY will stop output if it has outputted the number of ④ pulse. PLSY will run again if it is enabled for a second time.

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



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

In the example below, the frequency is other data code (C01). So the wave's frequency will change following the current value of C01.



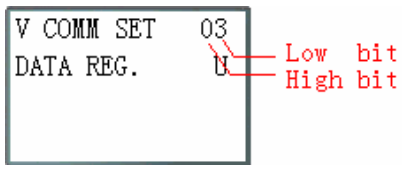
※ In the example above, frequency is 1000 if the current value of C01 is bigger than 1000.

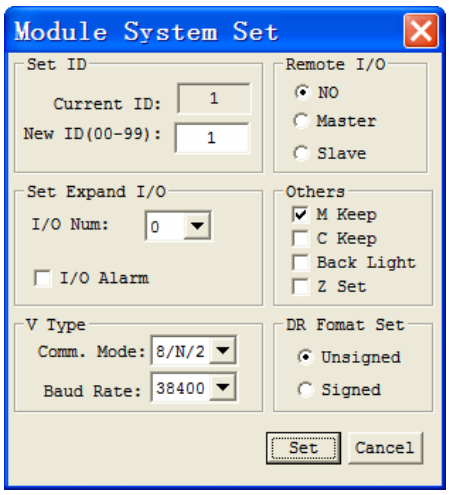
※ PLSY stops outputting pulse after it has output 100 pulses.

※ PLSY will be going on as long as it's enabled if ④ is 0.

Data Link/Remote I/O Instruction (SG2-20Vxxx model only)

The SG2-20Vxxx models include the capability to link additional SG2-20Vxx 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 SG2 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.

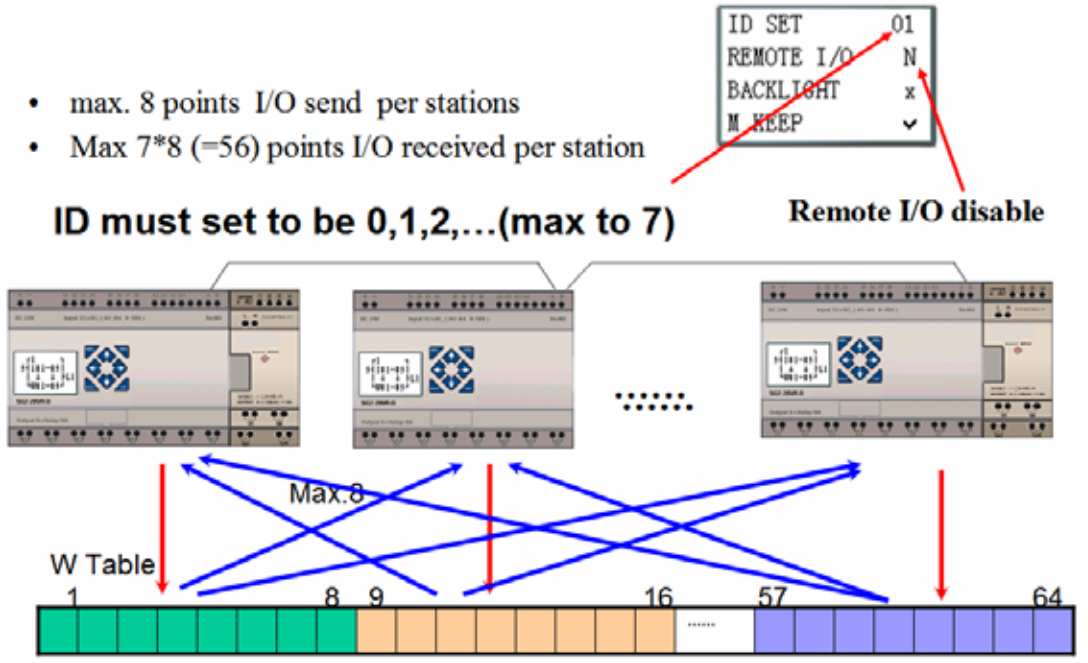




	Data	Meaning
High bit	0	8/N/2 Data 8bit, No Parity, 2 Stop bit.
	1	8/E/1 Data 8bit, Even Parity, 1 Stop bit.
	2	8/O/1 Data 8bit, Odd Parity, 1 Stop bit.
	3	8/N/1 Data 8bit, No Parity, 1 Stop bit.
Low bit	0	4800bps
	1	9600bps
	2	19200bps
	3	38400bps
	4	57600bps
	5	115200bps

Data Link

Up to 8 additional SG2 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 smart relay's ID must be 00, and Slave nodes' ID should start with 01 and be continuous. If nodes' ID isn't continuous, the Master won't communication 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.



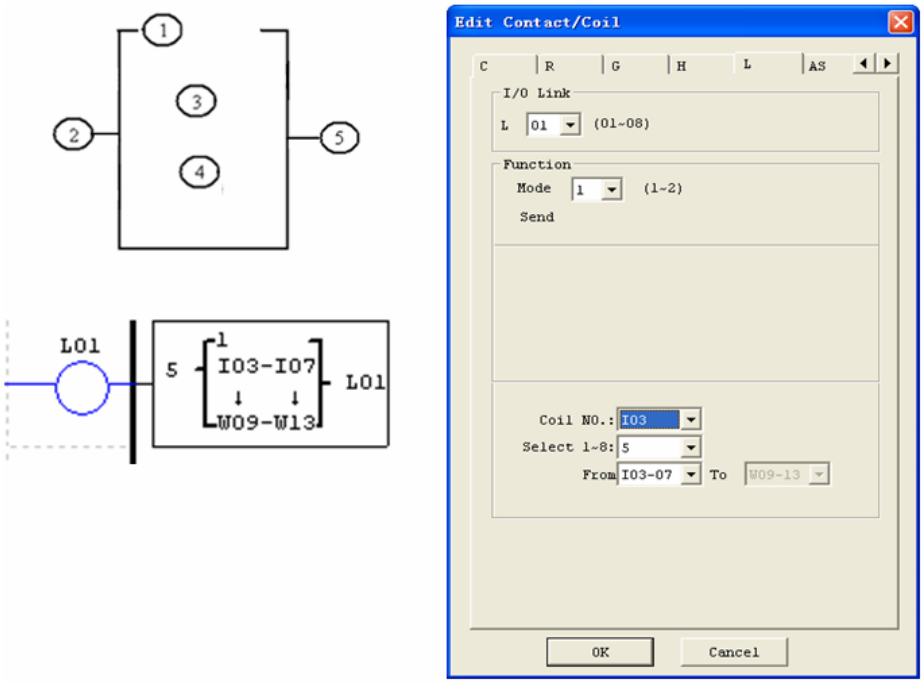
ID	Memory list location
0	W01~W08
1	W09~W16
2	W17~W24
3	W25~W32
4	W33~W40
5	W41~W48
6	W49~W56
7	W57~W64

The Mode 1 Send memory range is determined by the Controller ID. Each controller ID is allocated a range of 8 I/O points (Wxx - Wxx) that can be read into the Master smart relay using a Data Link instruction. The adjacent table show the memory range of Wxx locations associated with each controller ID.

Symbol	Description
①	Setting mode(1,2) 1:sending 2:receiving
②	Number of send/receive points (1~8)
③	Type of send/receive points
④	Send/Receive W Table list location
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
Expansion inputs	X01~X0C/x01~x0C
Expansion outputs	Y01~Y0C/y01~y0C

※ Only one Data Link instruction can work at Mode 1, and the other Data Link instructions must be Mode 2.



Example 1: Data Link Mode 1

Set ① = 1, ② = 5, set ③ as the initiate of 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:

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

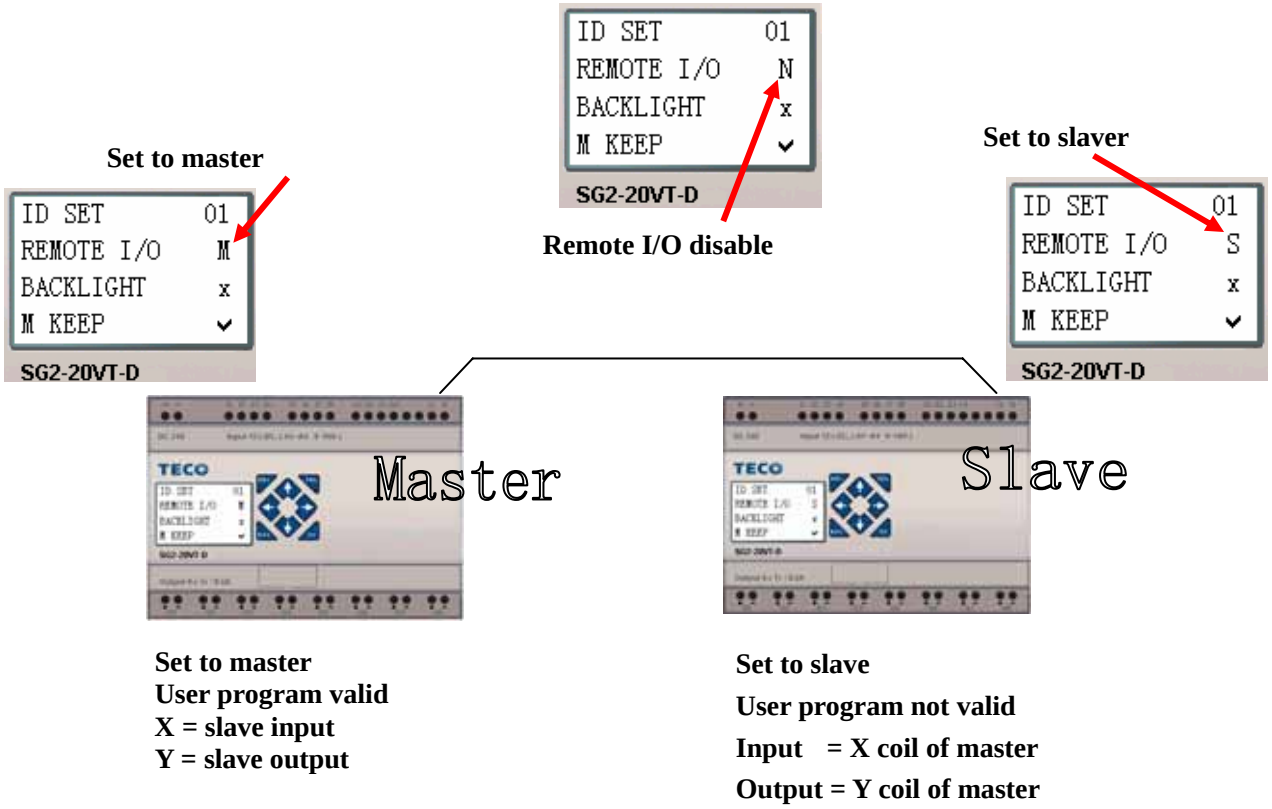
Example 2: Data Link Mode 2

Set ① = 2, ② = 5, set ③ as start from M03, set ④ as from W17, when enabling the Data Link, the state "ON/OFF" of M03~M07 is controlled by the state of memory list position 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

Up to 2 additional SG2 units can be configured as Remote I/O nodes, and linked to one master smart relay.



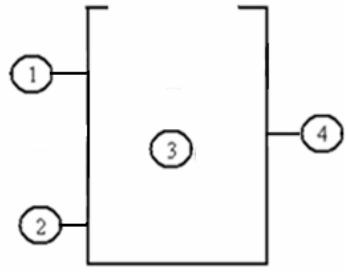
Set to master
User program valid
X = slave input
Y = slave output

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

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

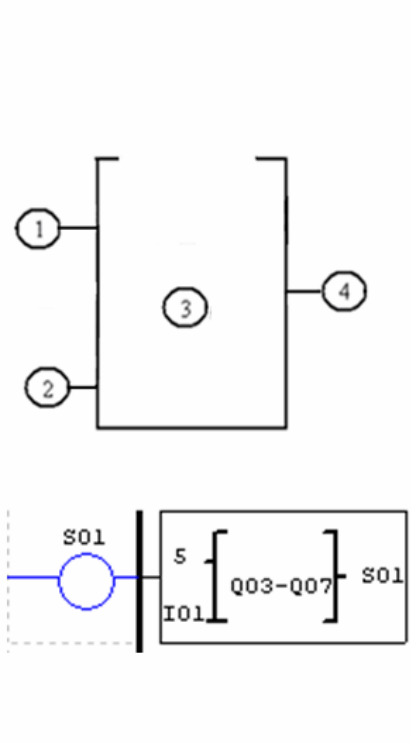
SHIFT (shift output)

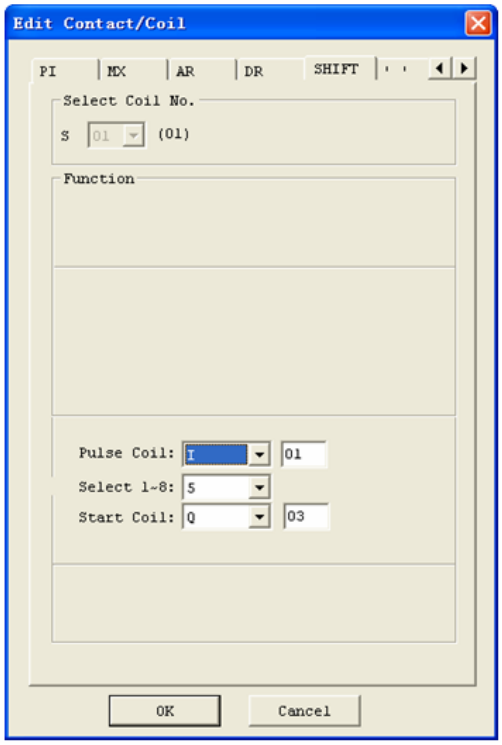
The SG2 smart relay includes only one SHIFT instruction that can be used throughout a program. This function output a serial of pulse on selection points depending on SHIFT input pulse. It has 4 parameters for proper configuration. The table below describes each configuration parameter, and lists each compatible memory type for configuring SHIFT.

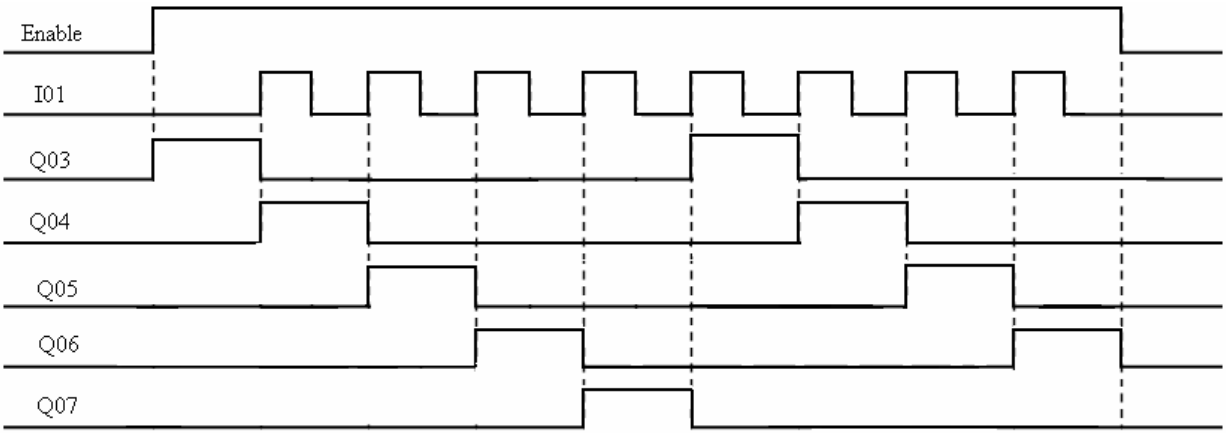


Symbol	Description
①	Preset number of output pulse (1~8)
②	SHIFT input coil (I01~g1F)
③	SHIFT output coils (Q, Y, M, N)
④	SHIFT code (S01)

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







※ Q03 is ON, and from Q04 TO Q07 are OFF when ENABLE is active. Q04 turns ON when I01's rising edge coming on, and others points turn OFF. The next coil turns ON at each rising edge of SHIFT input, and others turn OFF.

AQ (Analog Output)

The default output mode of AQ is 0-10V voltage, the corresponding value of AQ is 0~1000. It also can be set as 0-20mA current, the corresponding value of AQ is 0~500. The output mode of AQ is set by the current value of DRD0~DRD3 as shown below.

Number	Signification
DRD0	Setting the output of AQ01
DRD1	Setting the output of AQ02
DRD2	Setting the output of AQ03
DRD3	Setting the output of AQ04

Mode	DRD0~DRD3 data definition
1	0: voltage mode, AQ output value is 0 under STOP mode
2	1: current mode, AQ output value is 0 under STOP mode
3	2: voltage mode, AQ keeps output value under STOP mode
4	3: current mode, AQ keeps output value under STOP mode

※ It will be thought as 0 if the value of DR isn't in the range of 0~3. That means the output mode of AQ is mode 1. AQ displays preset value (constant of code of other data) under STOP mode, displays current value under RUN mode. AQ preset value can be a constant or other function current value.

AQ display

AQ displays the preset value under STOP mode, and displays the current value under RUN mode.

2 number of expansion analog output 2AO，AQ01～AQ04

```
AQ01=01.23V
AQ02=08.92mA
AQ03=  A01  V
AQ04=DR3F  mA
```

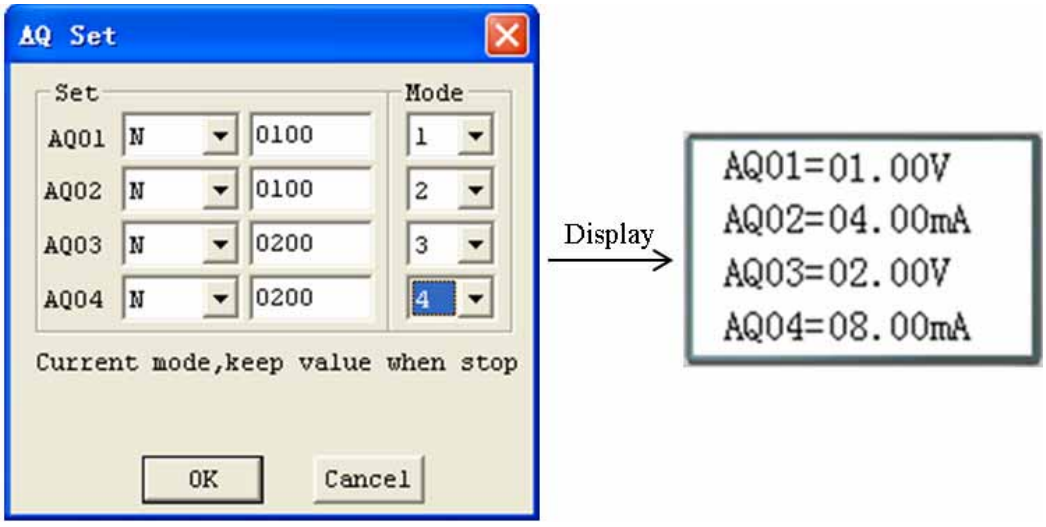
0～10VDC voltage mode (AQ value: 0～1000), depending on DRD0
0～20mA current mode (AQ value: 0～500), depending on DRD1

The value will be judged if it's over-flow when writing AQ preset value or current value through PC communication. So, output mode information should have been written before preset value.

AQ is current mode:

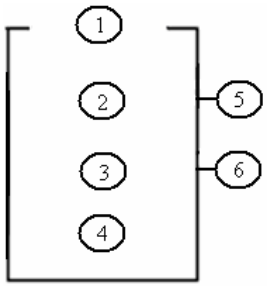
$$AQ\_current\_value : 500 = AQ\_display\_value : 20.00mA$$

AQ current value is different from display value, and current value is used in operation and storage. AQ display is shown below.



AS (Add-Subtract)

The SG2 smart relay includes a total of 31AS instructions that can be used throughout a program. The ADD-SUB Addition and/or Subtraction function enables simple operations to be carried out on integers. There are 6 parameters for proper configuration. The table below describes each configuration parameter, and lists each compatible memory type for configuring AS.

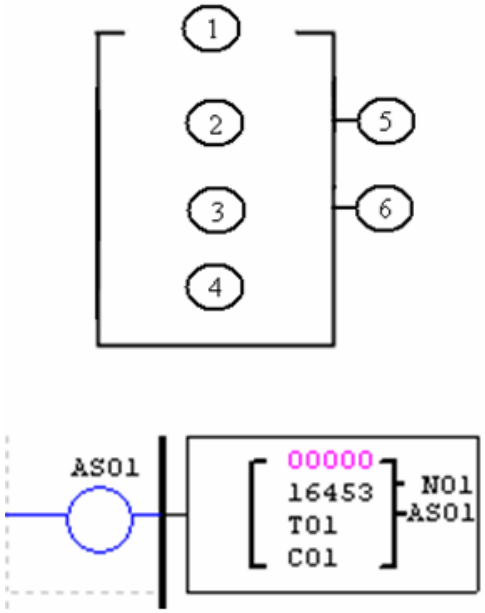


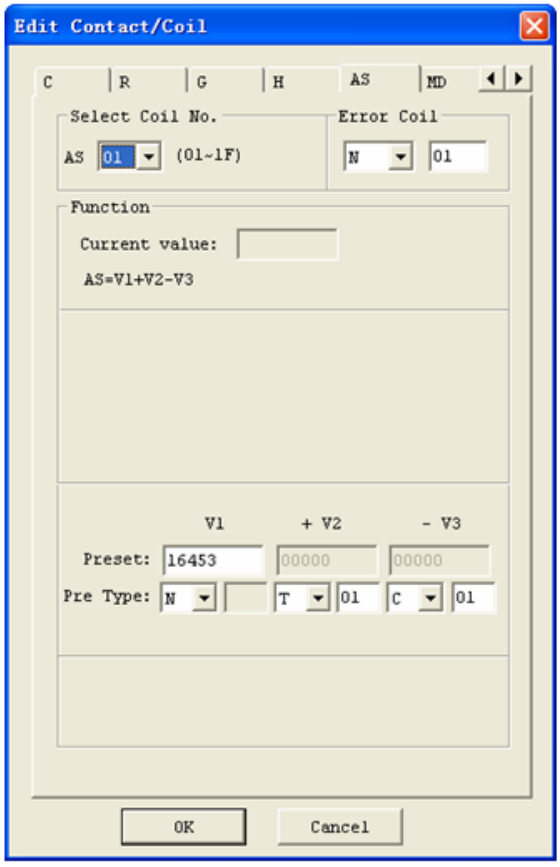
Symbol	Description
①	AS current value (-32768~32767)
②	V1 parameter (-32768~32767)
③	V2 parameter (-32768~32767)
④	V3 parameter (-32768~32767)
⑤	Error output coil (M, N, NOP)
⑥	AS code (AS01~AS1F)

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

AS current value is the result of compute. 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. And the current value is no meaning at this time. But it will do nothing if the output coil is NOP. The output coil will turns OFF when the result is right or the function is disabled.

The example below shows how to configure AS function.

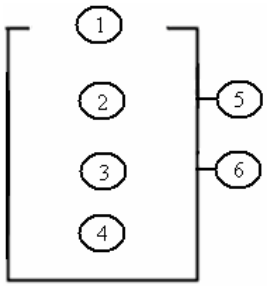




※ Error output coil N01 will turn ON when the compute result is overflow.

MD (MUL-DIV)

The SG2 smart relay includes a total of 31MD instructions that can be used throughout a program. The MUL-DIV Multiplication and Division function enables simple operations to be carried out on integers. There are 6 parameters for proper configuration. The table below describes each configuration parameter, and lists each compatible memory type for configuring MD.

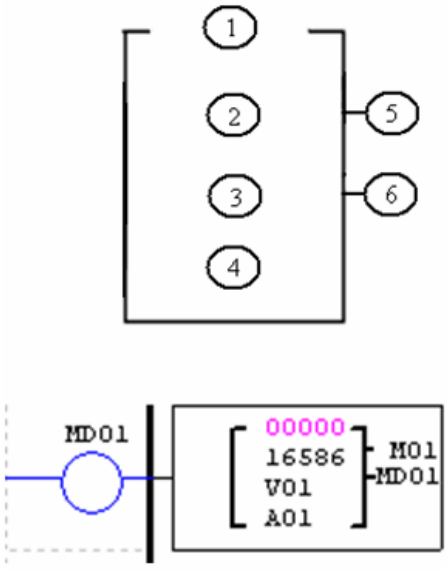


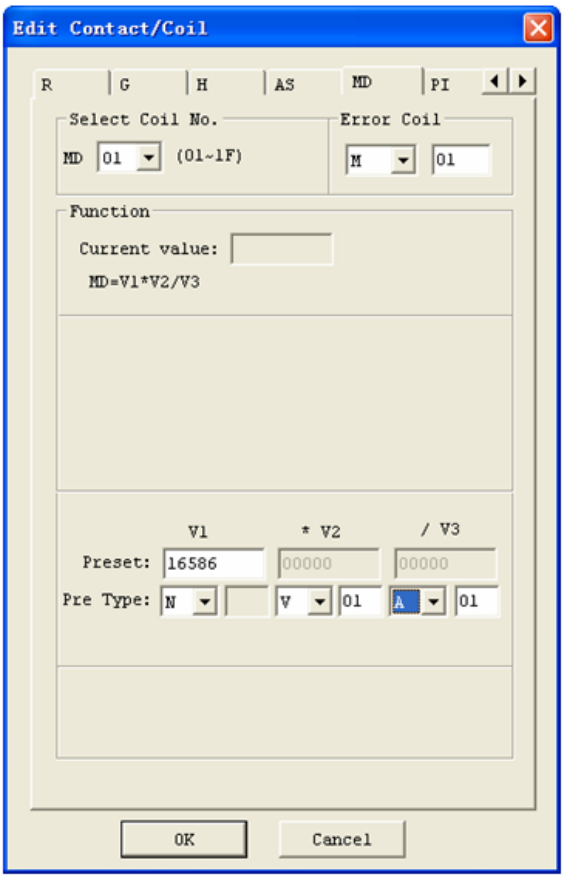
Symbol	Description
①	MD current value (-32768~32767)
②	V1 parameter (-32768~32767)
③	V2 parameter (-32768~32767)
④	V3 parameter (-32768~32767)
⑤	Error output coil (M, N, NOP)
⑥	MD code (MD01~MD1F)

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

MD current value is the result of compute. 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. And the current value is no meaning at this time. But it will do nothing if the output coil is NOP. The output coil will turns OFF when the result is right or the function is disabled.

The example below shows how to configure MD function.

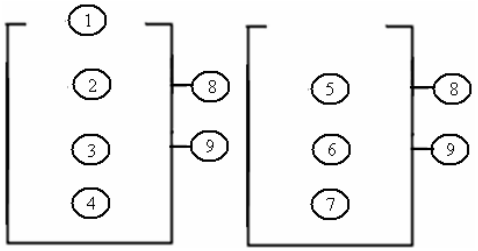




※ Error output coil M01 will turn ON when the compute result is overflow.

PID (Proportion- Integral- Differential)

The SG2 smart relay includes a total of 15 PID instructions that can be used throughout a program. The PID function enables simple operations to be carried out on integers. There are 9 parameters for proper configuration. The table below describes each configuration parameter, and lists each compatible memory type for configuring PID.



Symbol	Description
①	PI: PID current value (-32768~32767)
②	SV: target value (-32768~32767)
③	PV: measure value (-32768~32767)
④	T_S: sampling time (1~32767 * 0.01s)
⑤	K_P: Proportion (1~32767 %)
⑥	T_I: Integral 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 constant or other function current value. The error coil will turn ON when either T_S or K_P is 0. But it will do nothing if the output coil is NOP. The output coil will turns OFF when the result is right or the function is disabled.

PID computes formula:

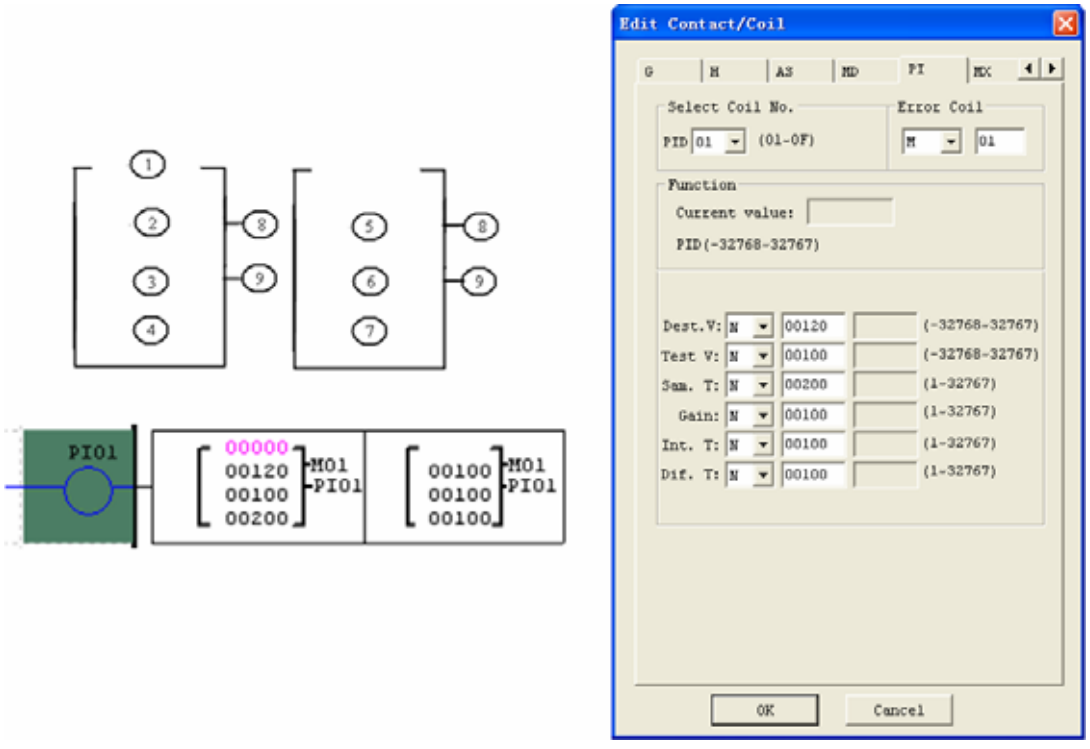
$$EV_n = SV - PV_n$$

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

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

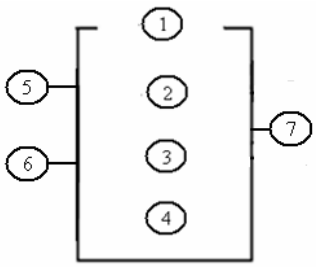
$$PI = \sum \Delta PI$$

The example below shows how to configure PID function.



MX (Multiplexer)

The SG2 smart relay includes a total of 15 MX instructions that can be used throughout a program. This special function transmits 0 or one of 4 preset values to MX current value memory. The MX function enables simple operations to be carried out on integers. There are 7 parameters for proper configuration. The table below describes each configuration parameter, and lists each compatible memory type for configuring MX.

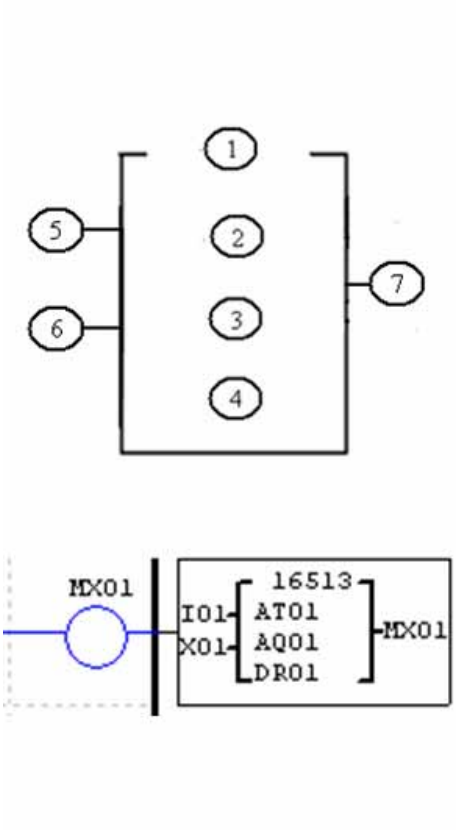


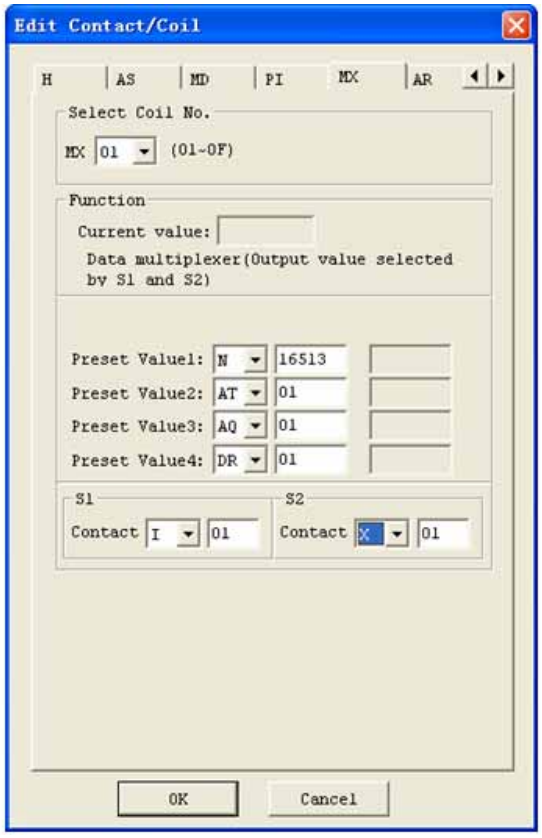
symbol	description
①	V1 parameter (-32768~32767)
②	V2 parameter (-32768~32767)
③	V3 parameter (-32768~32767)
④	V4 parameter (-32768~32767)
⑤	Selection bit 1: S1
⑥	Selection bit 2: S2
⑦	MX code (MX01~MX0F)

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

disable	MX = 0;
enable	S1＝0,S2＝0: MX = V1;
	S1＝0,S2＝1: MX = V2;
	S1＝1,S2＝0: MX = V3;
	S1＝1,S2＝1: MX = V4;

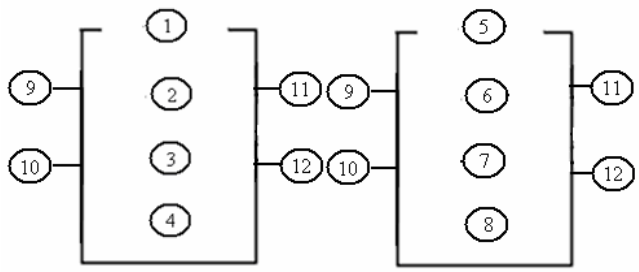
The example below shows how to configure MX function.





AR (Analog-Ramp)

The SG2 smart relay includes a total of 15 AR instructions that can be used throughout a program. The AR function enables simple operations to be carried out on integers. Analog Ramp instruction allows AR current level to be changed by step from starting level to target level at a specified rate. There are 12 parameters for proper configuration. The table below describes each configuration parameter, and lists each compatible memory type 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	Excursion (B): -10000~10000
⑨	Level selection coil (Sel)
⑩	Stop selection coil (St)
⑪	Error output coil (M, N, NOP)
⑫	AR code (AR01~AR0F)

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

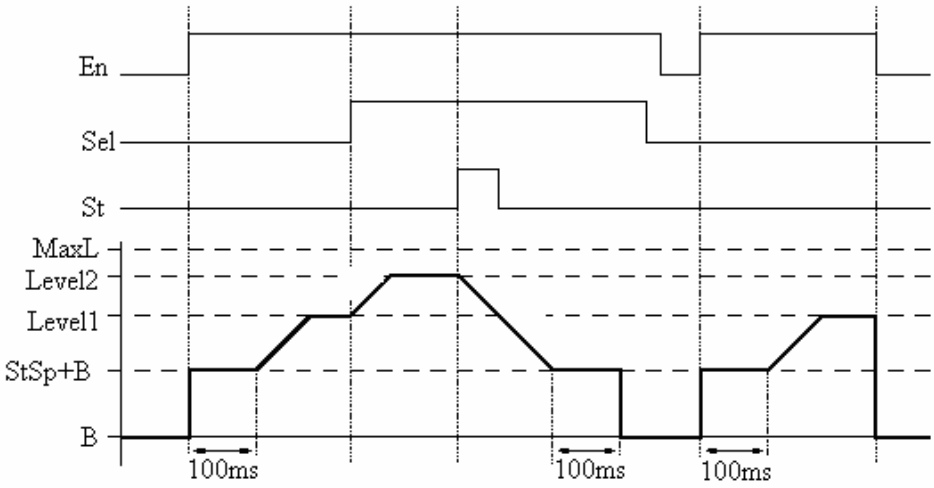
The parameters from ② to ⑧ can be constant or other function current value. The table below describes detail information of each parameter of AR.

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 A is 0.

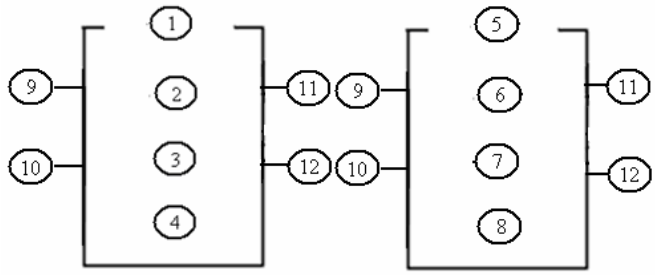
※ The output coil can be M, N or NOP. The output coil is set when the wrong thing happens, but it will do nothing if the output coil is NOP. And the current value is no meaning at this time.

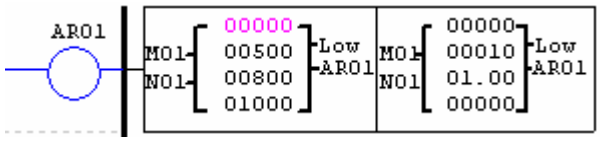
AR will keep the current level at "StSp + Offset "B"" for 100ms when it's enabled. Then the current level runs from StSp + Offset "B" to target level at enactment Rate. If St is set, the current level decreases from current level to level StSp + B at enactment Rate. Then AR holds the level StSp + Offset "B" for 100ms. After 100ms, AR current level is set to offset "B", which makes AR current value equals 0.

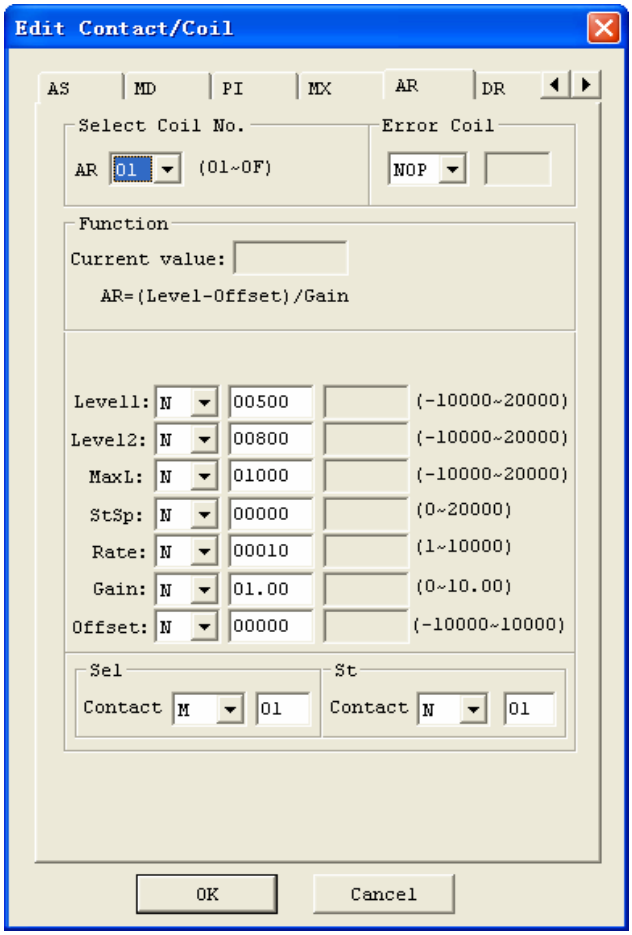
Timing diagram for AR



The example below shows how to configure AR function.

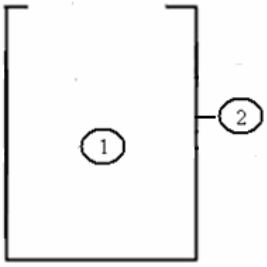






DR (Data register)

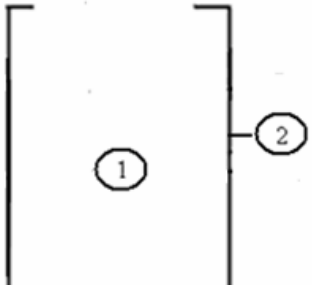
The SG2 smart relay includes a total of 240 DR instructions that can be used throughout a program. The DR function is transferring data. DR is a temp register. DR sends data from prevention registers to current register when it's enabled. The data can be sign or unsigned by setting DR_SET bit through **operation>>module system set** menu selection from the SG2 Client software. There are 2 parameters for proper configuration. The table below describes each configuration parameter, and lists each compatible memory type for configuring DR.

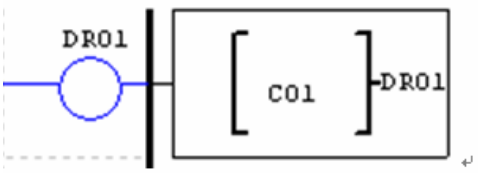


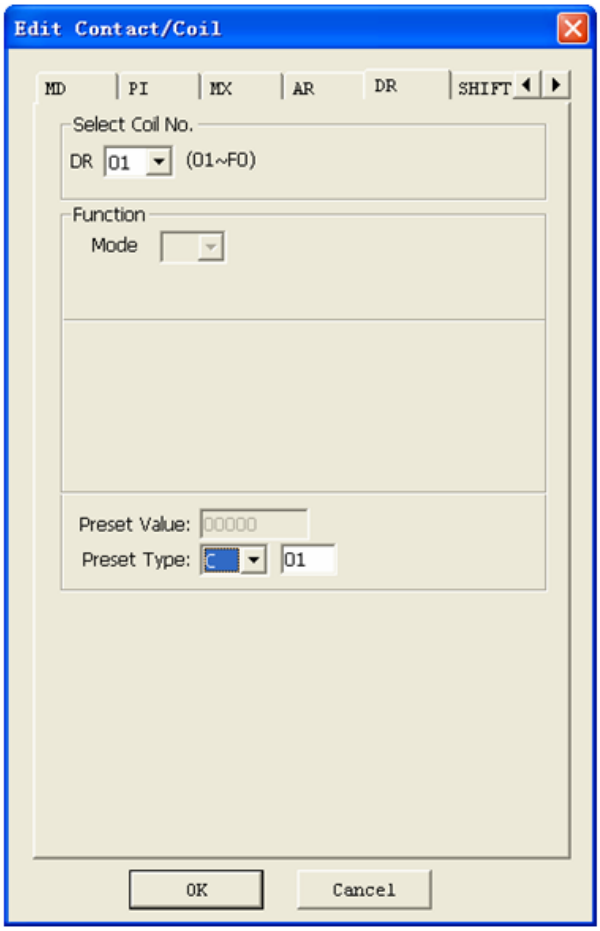
symbol	Description
①	Preset value: DR_SET = 0, 0~65535 DR_SET = 1,-32768~32767
②	DR code (DR01~DRF0)

The parameter ① can be a constant or other function current value.

The example below shows how to configure DR function.





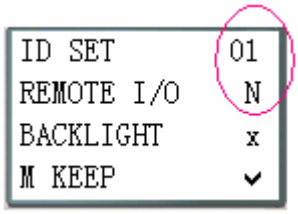


STOP	RUN (DR01 = C01 current value)
DR01= C01 DR02= 00000 DR03= 00000 DR04= 00000	DR01= 00009 DR02= 00000 DR03= 00000 DR04= 00000

The data registers from DR65 to DRF0 will be kept when the smart powers down. The last 40 DR that from DRC9 to DRF0 are special data register as shown below. The content of DRC9 is PLSY'S total number of pulse, and DRD0~DRD3 are output mode registers of AQ01~AQ04, and DRCA~ DRCF, DRD4~ DRF0 are reserved.

DRC9	PLSY total number
DRCA~DRCF	reserved
DRD0	AQ01 output mode register
DRD1	AQ02 output mode register
DRD2	AQ03 output mode register
DRD3	AQ04 output mode register
DRD4~DRF0	reserved

MU (MODBUS) (only V type model)



MODBUS function carries out Modbus RTU master communication at RS485 port. There are 15 MODBUS functions: MU01~MU0F. Remote IO and Date Link are precedence than MODBUS. MODBUS is executed when the system setting is N (No Remote IO) and ID isn't 0.

MODBUS comes into possession of communication port, release the port when disable and one MODBUS period is completed. There can be a number of communication orders in one program, but only one order can come into possession of communication port at the same time. And the others keep their enable state for executing function.

Function mode corresponding communication function code:

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

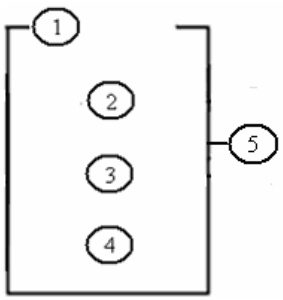
The coil used in MODBUS function:

Received (M3D)	M3D is set to 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 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 communication baud rate as shown in the table below:

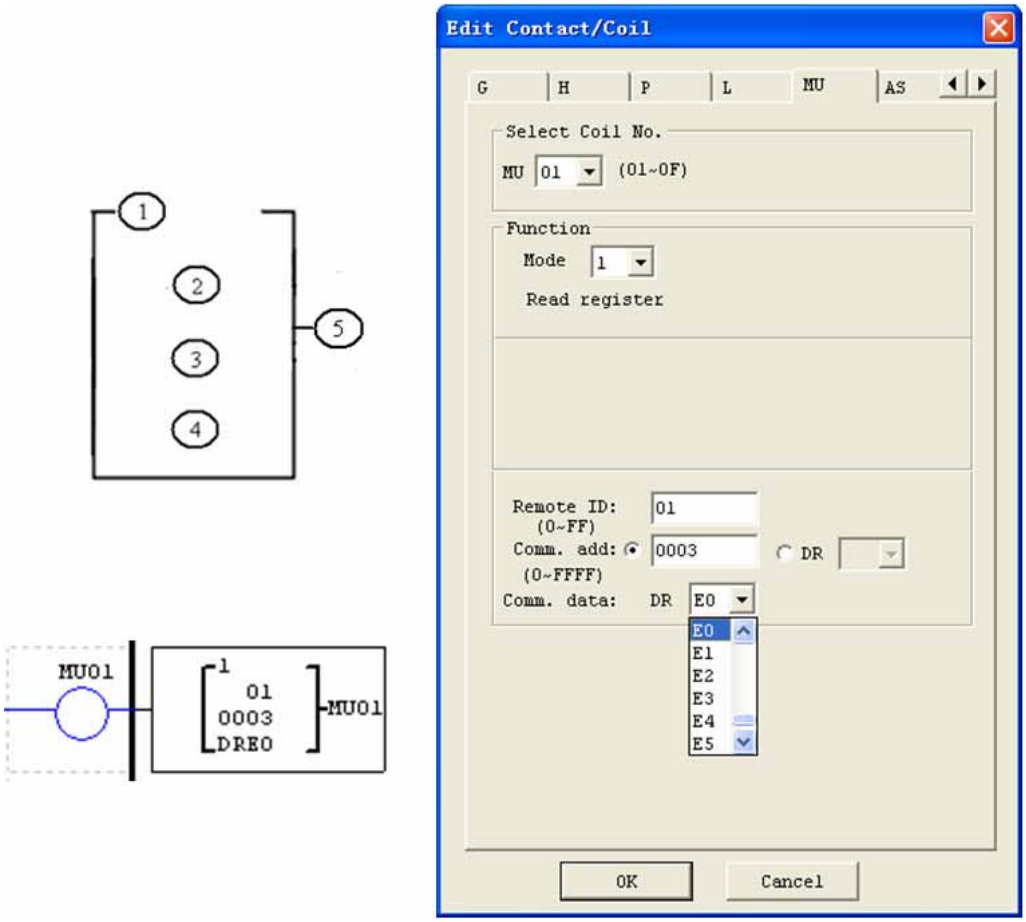
Baud rate (bps)	Time out (ms)
4800、9600、19200、38400	125
57600	100
115200	80

There are 5 parameters in MODBUS function as shown below.



symbol	Description
①	MODBUS mode (1~5)
②	Communication address: slave ID, range: 0~127
③	Communication content: address and data length: 1） address is constant, range: 0000~ffff; length must be 1 word； 2） DR code, get address and length from this DR and the next
④	DR code, store sending/receiving data from this DR
⑤	MODBUS code (MU01~MU0F)

The example below shows how to configure DR function.



Examples:

mode	display		
1 Read register		Address is constant: 0003, Length ≡ 1, Send: 01 03 00 03 00 01 CRC16;	Receive: 01 03 02 data1 data2 CRC16, data storage: DRE0= (data1<<8) | data2,
		Address is DR03=0001, Length is DR04=0002, Send: 01 03 00 01 00 02 CRC16;	Receive: 01 03 04 data1 data2 data3 data4 CRC16, data storage: DRE0= (data1<<8) | data2, DRE1= (data3<<8) | data4
2 Write single register		Address is constant: 0003, Length ≡ 1, data storage: DRE0=1234(hex: 04D2), Send: 01 06 00 03 04 D2 CRC16；	Receive: 01 06 00 03 04 D2 CRC16；
		Address: DR03=0001, data storage: DRE0=1234(hex: 04D2), Send: 01 06 00 01 04 D2 CRC16；	Receive: 01 06 00 01 04 D2 CRC16；

3 Write register		Address: 0003，Length ≡ 1, data storage: DRE0=1234(hex: 04D2)， Send: 01 10 00 03 00 01 02 04 D2 CRC16；	Receive: 01 10 00 03 00 01 CRC16；
		Address: DR03=0001， Length: DR04=0002， data storage: DRE0=1234(hex: 04D2), DRE1=5678(hex: 162E)， Send: 01 10 00 01 00 02 04 04 D2 16 2E CRC16；	Receive: 01 10 00 01 00 02 CRC16；
4 Read coil		Address: 0003， Length ≡ 10H, Send: 01 01 00 03 00 10 CRC16；	Receive: 01 01 02 data1 data2 CRC16， data storage: DRE0= (data1<<8) | data2；
		Address: DR03=0001， Length: DR04=0016， Send: 01 01 00 01 00 10 CRC16； Max value in DR04 is 400.	Receive: 01 01 02 data1 data2 CRC16， data storage: DRE0= (data1<<8) | data2；
5 Write single coil		Address: 0003， data storage: DRE0=65280(hex: FF00)， Send: 01 05 00 03 FF 00 CRC16；	Receive: 01 05 00 03 FF 00 CRC16；
		Address: DR03=0001， data storage: DRE0=65280(hex: FF00)， Send: 01 05 00 01 FF 00 CRC16；	Receive: 01 05 00 01 FF 00 CRC16；

Chapter 5: Function Block Diagram Programming

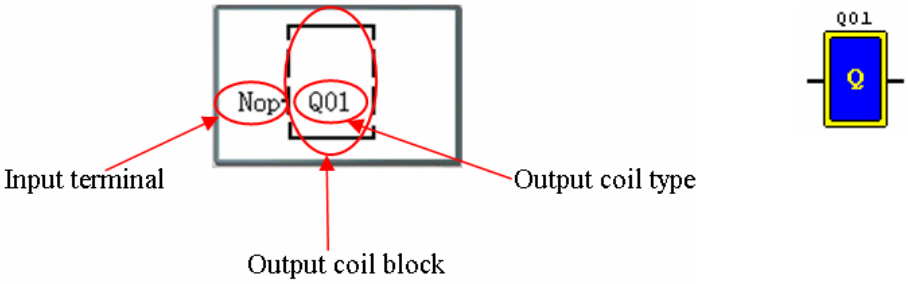
FBD Instructions

	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)

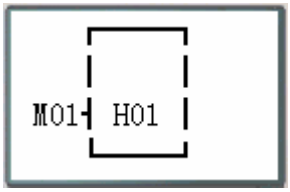
FBD program can only be edited and modified in the SG2 Client software and write to SG2 controlled equipments via communication cable. Via controlled equipment, FBD program is available for querying or the parameter of the function block of the program for modifying. The preset value of Block could be a constant or other block code. That means the preset value of this block is other block's current value.

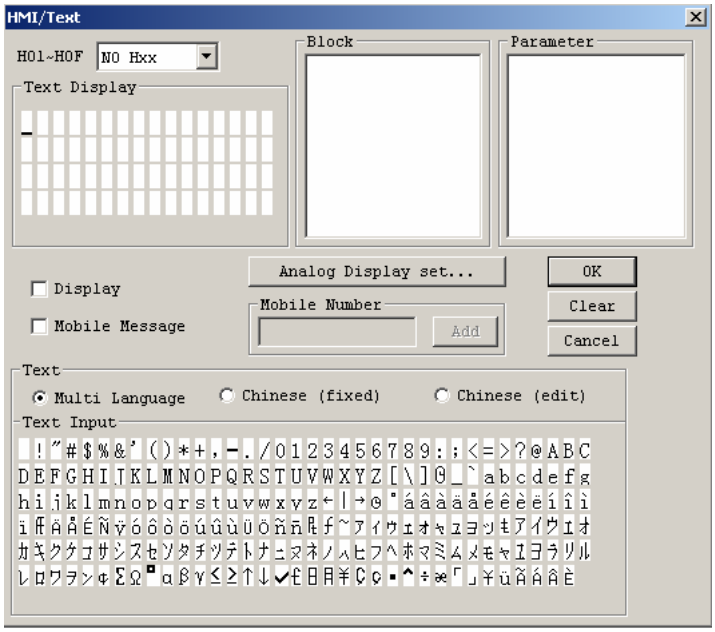
※ Each FBD block's size isn't restricted, it depends its function.

Coil Block Instruction



HMI

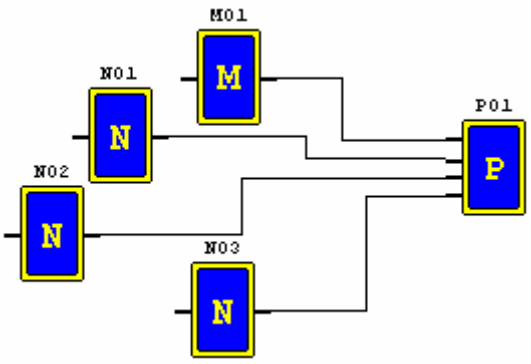


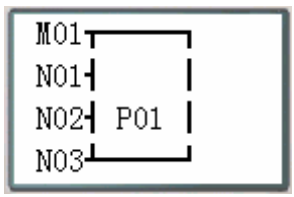


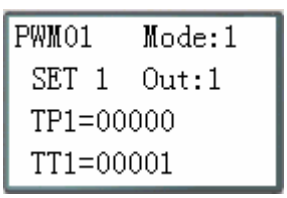
PWM function block (only transistor output version)

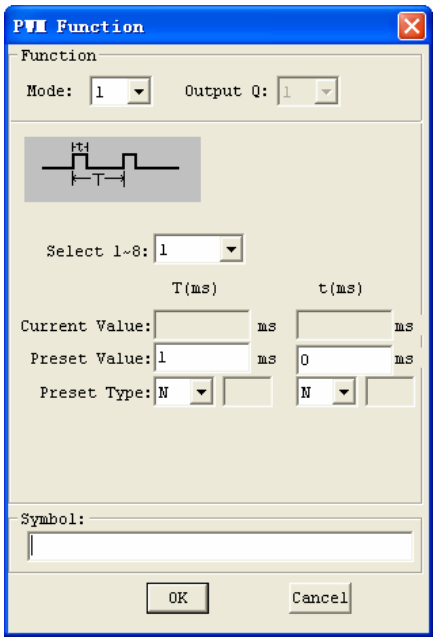
PWM mode

The PWM output terminal Q01 or Q02 can output 8 PWM waveforms.



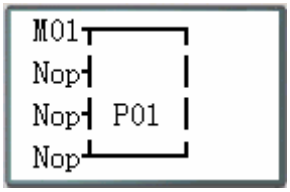


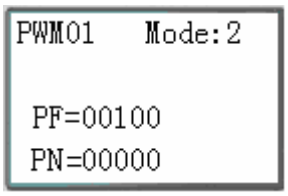


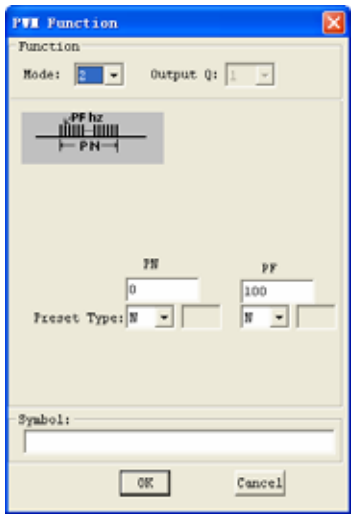


PLSY mode

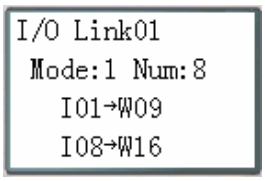
The PLSY output terminal Q01 can output preset number of pulse whose frequency is variable from 1 to 1000 Hz.

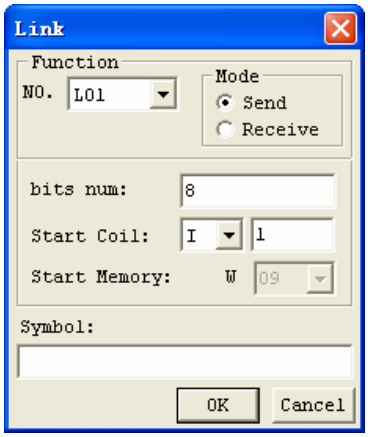




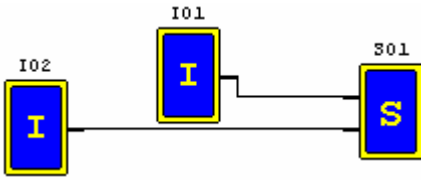


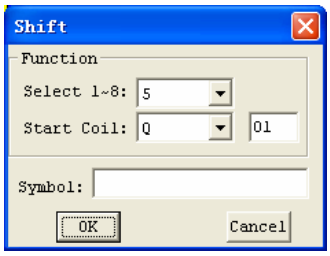
Data Link function block

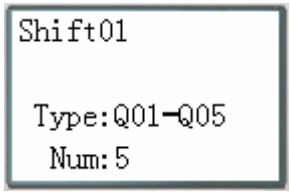




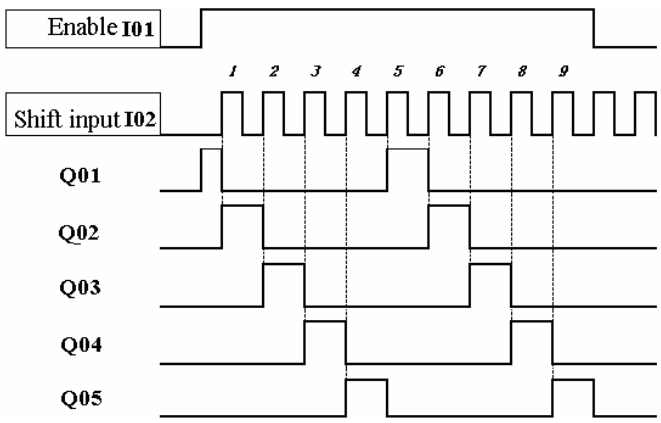
SHIFT function block



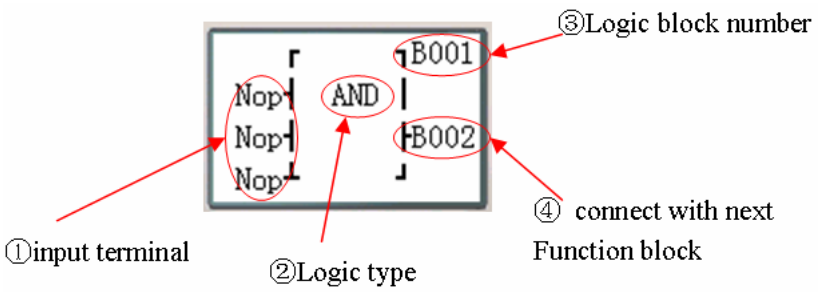




Timing diagram



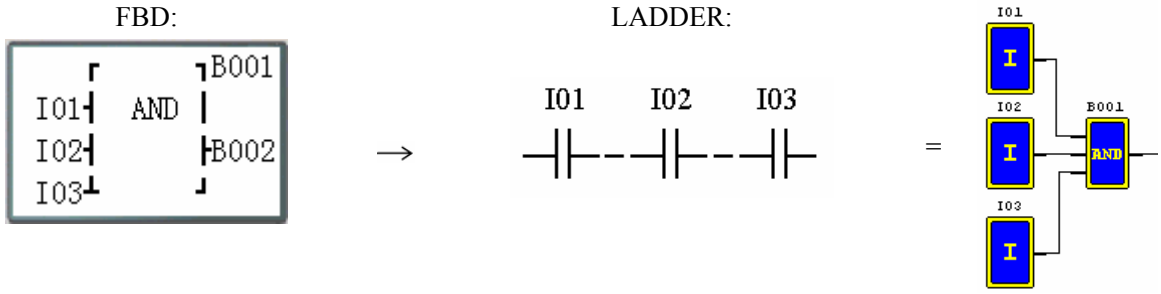
Logic Block Instructions



Logic function block source:

	block	Number(byte)
Total block	**260**	**6000**
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
PLUSE	1	4
BOOLEAN	1	12

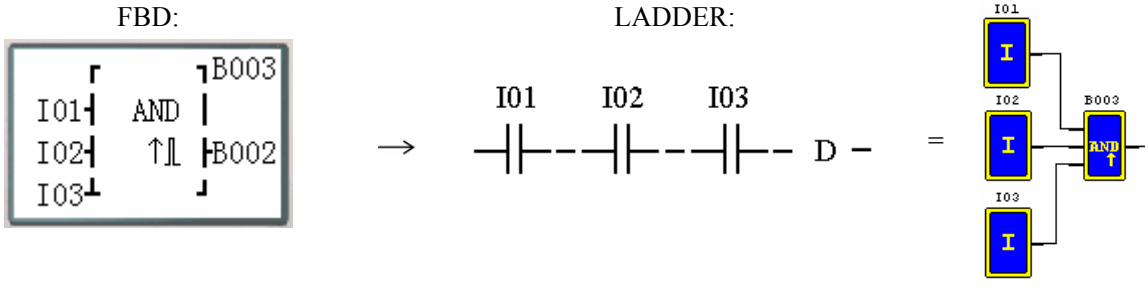
AND Logic Diagram



I01 And I02 And I03

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

AND (EDGE) Logic Diagram



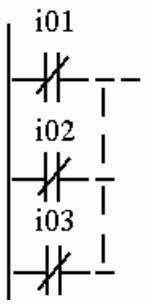
I01 And I02 And I03 And D

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

NAND Logic Diagram

FBD:

→ LADDER:



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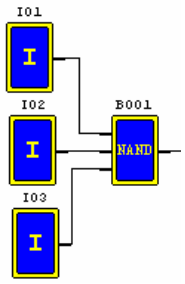
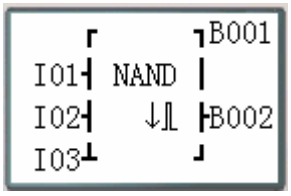


Not(I01 And I02 And I03)

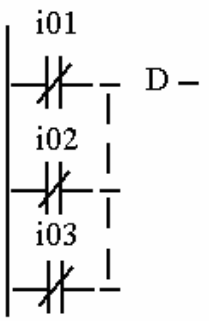
Note: The input terminal is NOP which is equivalent to 'Hi'

NAND (EDGE) Logic Diagram

FBD:



→ LADDER:



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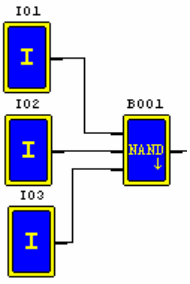
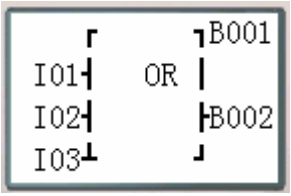


Not(I01 And I02 And I03) And D

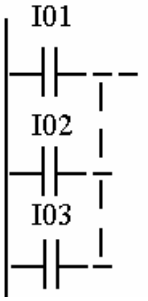
Note: The input terminal is NOP which is equivalent to ''Hi'

OR Logic Diagram

FBD:



→ LADDER:



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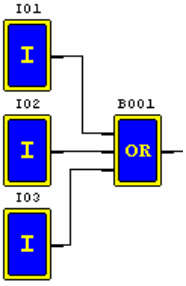
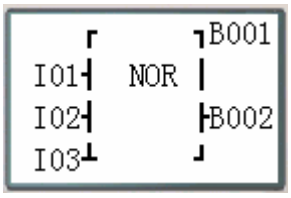


I01 or I02 or I03

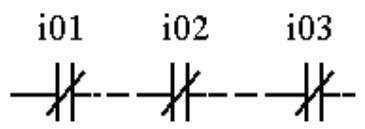
Note: The input terminal is NOP which is equivalent to ''Lo'

NOR Logic Diagram

FBD:



LADDER:



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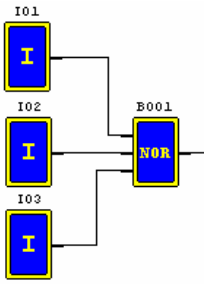
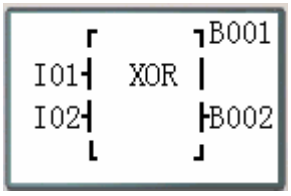


Not (I01 or I02 or I03)

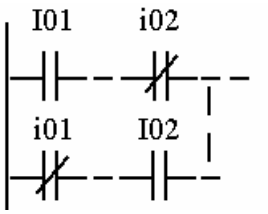
Note: The input terminal is NOP which is equivalent to "Lo'

XOR Logic Diagram

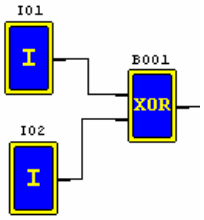
FBD:



LADDER:



=

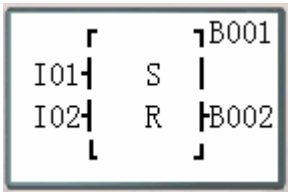


I01 XOR I02

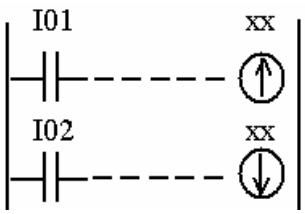
Note: The input terminal is NOP which is equivalent to 'Lo'

SR Logic Diagram

FBD:



LADDER:



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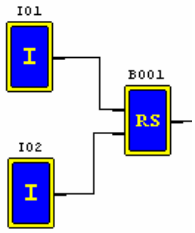


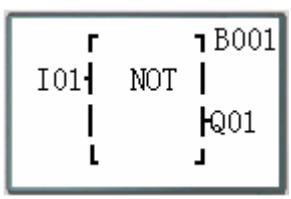
Logic Table

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'

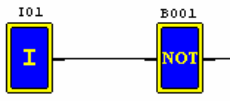
NOT Logic Diagram

FBD:



LADDER:

=

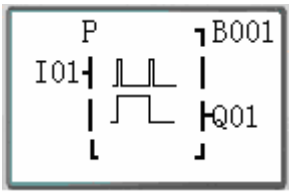


Not I01

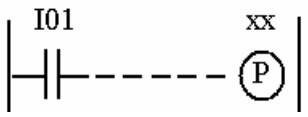
Note: The input terminal is NOP which is equivalent to "Hi'

Pulse Logic Diagram

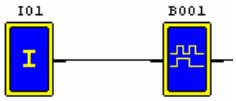
FBD:



LADDER:



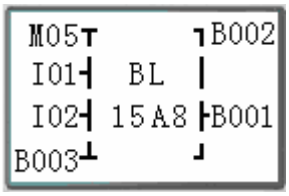
=



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

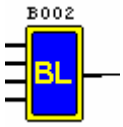
BOOLEAN Logic Diagram

FBD:



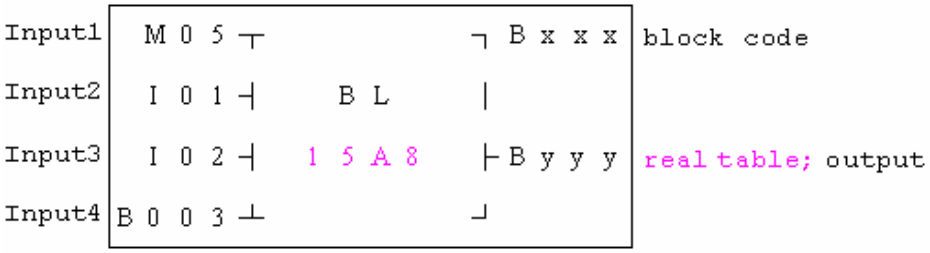
LADDER:
NO

=



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

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.

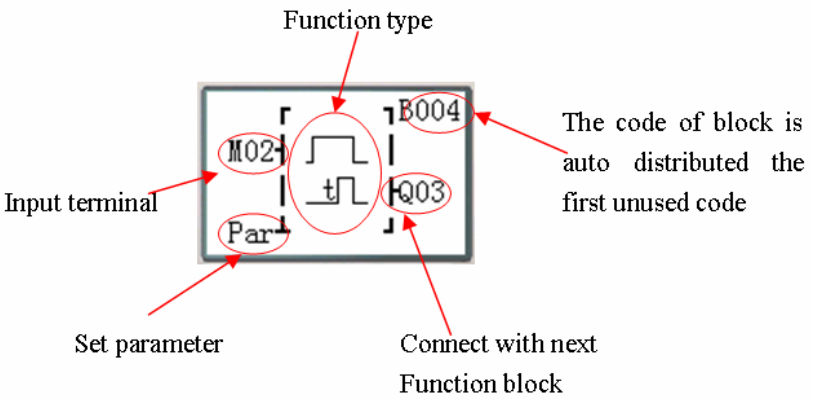
	Function type	number
special function	Timer	250
	Counter	250
	RTC	250
	Analog Comparator	250
adjust-controlling function	AS	250
	MD	250
	PID	30
	MX	250
	AR	30
	DR	240
communication function	MU	250

The capability of each block is alterable, it depends the type of function. There are total of 260 blocks, and the total capability of block area is 6000 bytes. For example, the block is Timer mode 7, the block seize is 12 bytes.

Source table:

	block	Number (byte)	Timer	Counter	RTC	Analog comparator	AS	MD	PID	MX	AR	DR	MU
Total source	260	6000	250	250	250	250	250	250	30	250	30	240	250
Timer mode0	1	5	1										
Timer mode1~6	1	10	1										
Timer mode7	1	12	2										
Counter mode0	1	5		1									
Counter mode1~7	1	14		1									
Counter mode8	1	16		1									
RTC mode0	1	5			1								
RTC mode1~4	1	11			1								
Analog mode0	1	5				1							
Analog mode1~7	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

Function displaying:



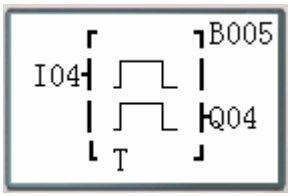
Timer Function Block

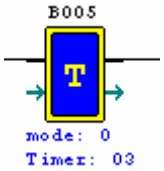
T0E and T0F keep their current value after a loss of power to the smart relay if "M Keep" is active. But the other Timers' current value is 0.

(1) Timer mode 0 (Internal coil Mode)

FBD display Parameter display Program display

Enable Input →



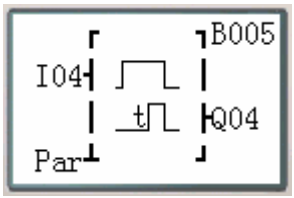


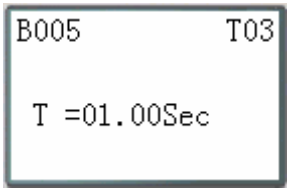
(2) Timer mode 1 (ON-Delay A Mode)

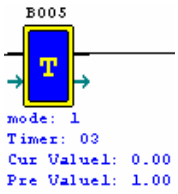
FBD display Parameter display Program display

Enable Input →

Timing Parameter →







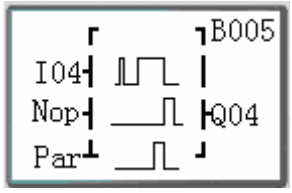
(3) Timer mode 2 (ON-Delay B Mode)

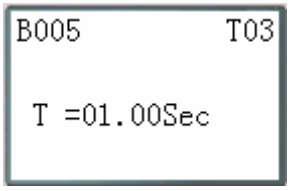
FBD display Parameter display Program display

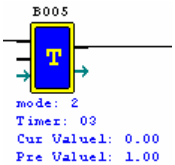
Enable Input →

Reset →

Timing Parameter →



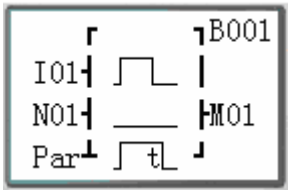


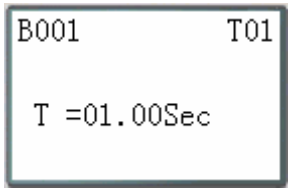


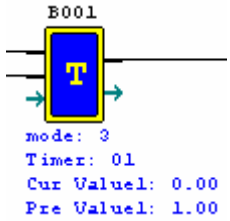
(4) Timer mode 3 (OFF-Delay A Mode)

FBD display | Parameter display | Program display

Enable Input →
Reset →
Timing Parameter →



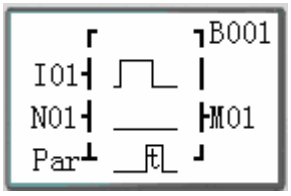


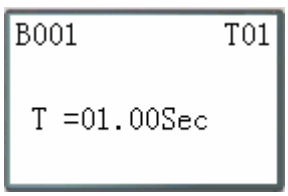


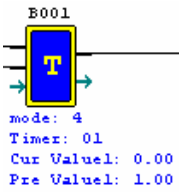
(5) Timer mode 4(OFF-Delay B Mode)

FBD display | Parameter display | Program display

Enable Input →
Reset →
Timing Parameter →



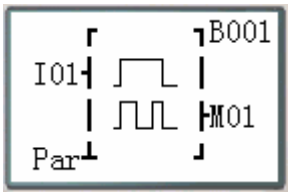


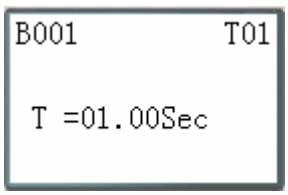


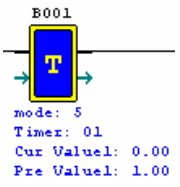
(6) Timer mode 5(FLASH A Mode)

FBD display | Parameter display | Program display

Enable Input →
Timing Parameter →



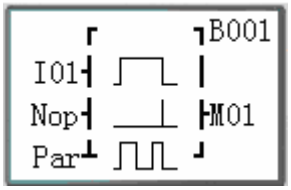


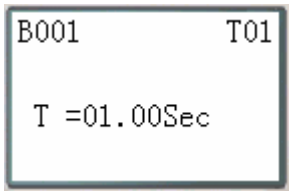


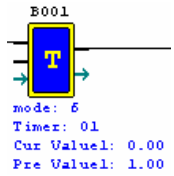
(7) Timer mode 6(FLASH B Mode)

FBD display | Parameter display | Program display

Enable Input →
Reset →
Timing Parameter →



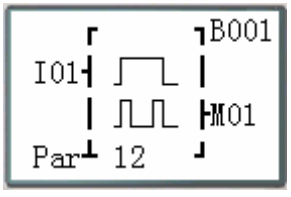


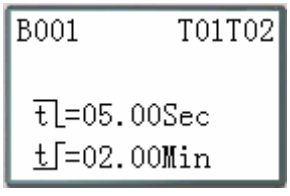


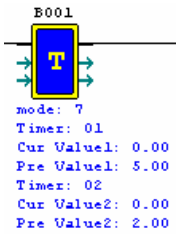
(8) Timer mode 7(FLASH C Mode)

FBD display | Parameter display | Program display

Enable Input →
Timing Parameter →





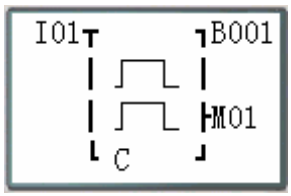


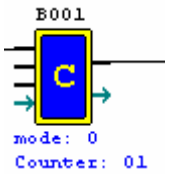
Common Counter function block

(1) Counter Mode 0

FBD display　　Parameter display　　Program display

Counting Input →

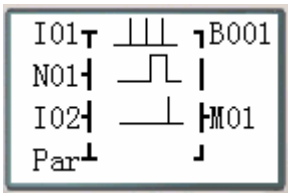


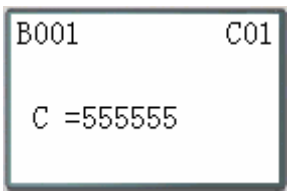


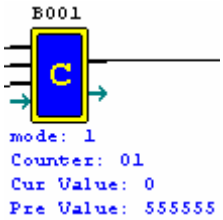
(2) Counter Mode 1

FBD display　　Parameter display　　Program display

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



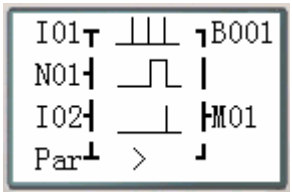


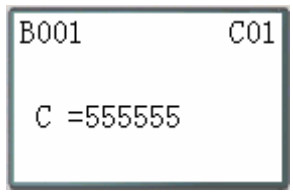


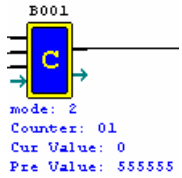
(3) Counter Mode 2

FBD display　　Parameter display　　Program display

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





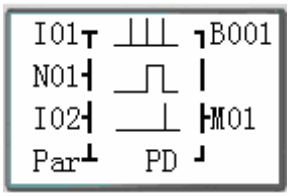


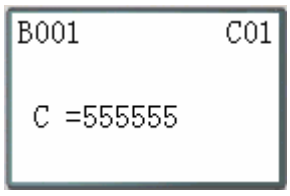
Note: The ">"means the current value appeared will be greater than present value.

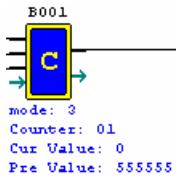
(4) Counter Mode 3

FBD display　　Parameter display　　Program display

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





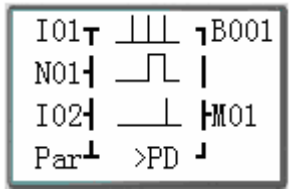


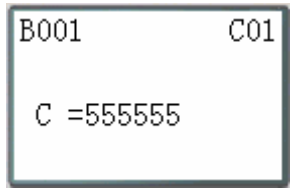
Note: The "PD" means the current value will be retain until the power recover；Counter keeps current value when the smart switches between RUN and STOP when C KEEP enable;

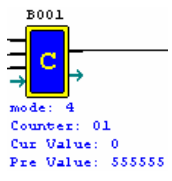
(5) Counter Mode 4

FBD display　　Parameter display　　Program display

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







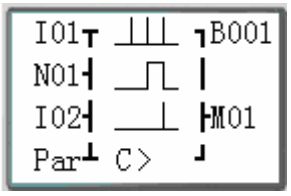
Note: The ">"means the current value appeared will be greater than present value;

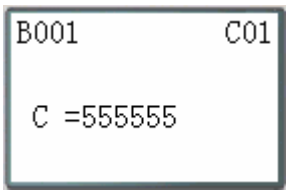
The "PD" means the current value will be retain until the power recover；Counter keeps current value when the smart switches between RUN and STOP when C KEEP enable;

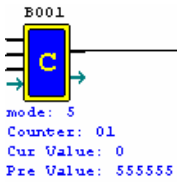
(6) Counter Mode 5

FBD display Parameter display Program display

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





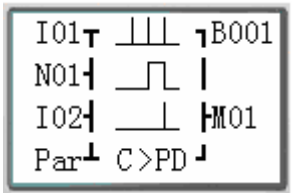


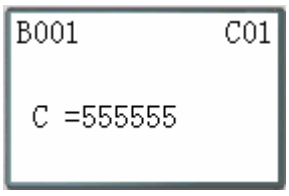
Note: The ">"means the current value appeared will be greater than present value.

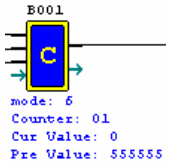
(7) Counter Mode 6

FBD display Parameter display Program display

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







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 ; Counter keeps current value when the smart switches between RUN and STOP when C KEEP enable;

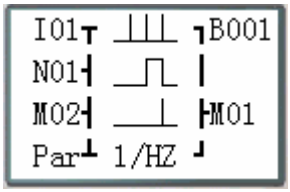
Note: Only first 31 Counter functions can keep their current value after a loss of power to the smart relay.

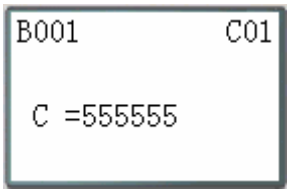
High Speed Counter Function Block

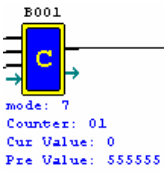
(1) Counter Mode 7

FBD display Parameter display Program display

High counting input →
Enable Input →
Reset →
Counter Parameter →





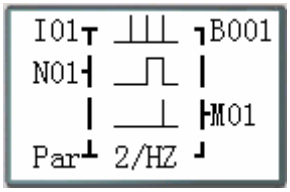


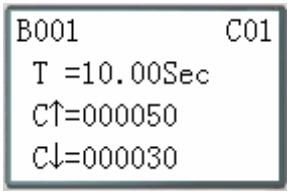
Note: High speed input terminal I01,I02

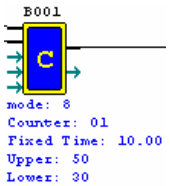
(2) Counter Mode 8

FBD display Parameter display Program display

High counting input →
Enable Input →
Counter Parameter →







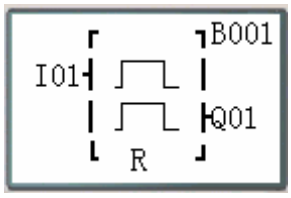
Note: High speed input terminal I01,I02

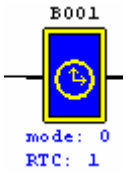
RTC Comparator Function Block

(1) RTC Mode 0(Internal Coil)

FBD display | Parameter display | Program display

Enable Input →



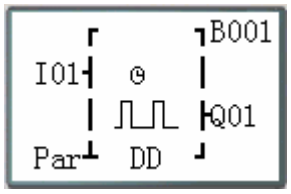


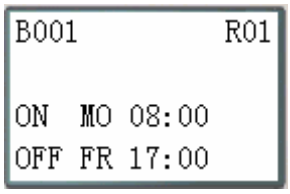
(2) RTC Mode 1(Daily)

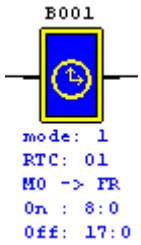
FBD display | Parameter display | Program display

Enable Input →

RTC Parameter →





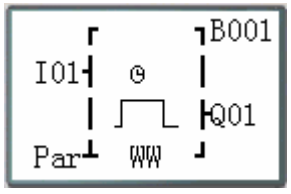


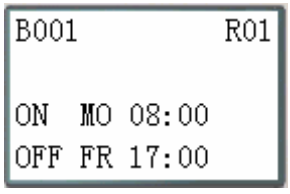
(3) RTC Mode 2 (Continuous)

FBD display | Parameter display | Program display

Enable Input →

RTC Parameter →



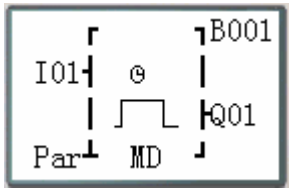


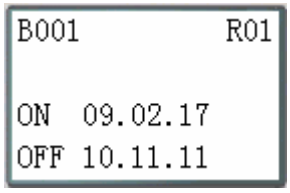
(4) RTC Mode 3 (Year Month Day)

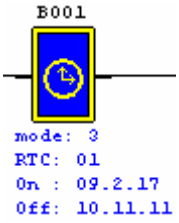
FBD display | Parameter display | Program display

Enable Input →

RTC Parameter →





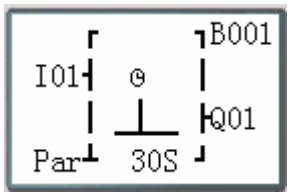


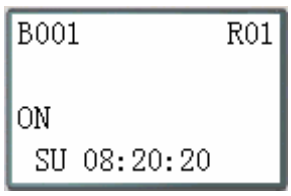
(5) RTC Mode 4(30-second adjustment)

FBD display | Parameter display | Program display

Enable Input →

RTC Parameter →



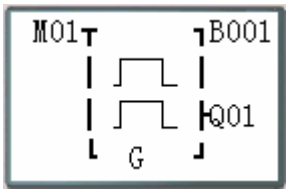


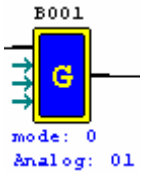
Analog Comparator Function Block

(1) Analog Comparison Mode 0 (Internal coil)

FBD display | Parameter display | Program display

Enable Input →

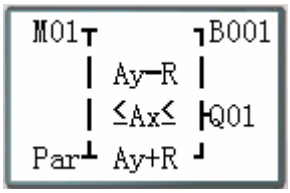


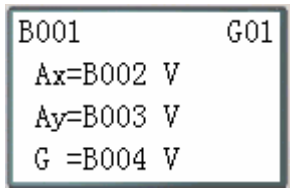


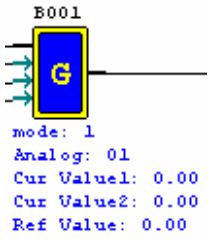
(2) Analog Comparison Mode 1

FBD display | Parameter display | Program display

Enable Input →
Analog Input →
Analog Input →
Reference →



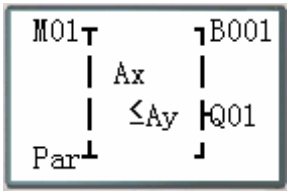


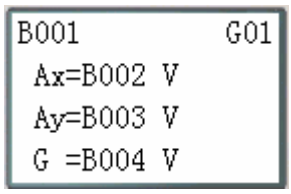


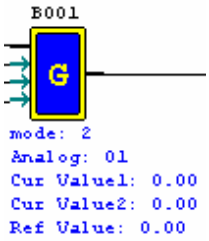
(3) Analog Comparison Mode 2

FBD display | Parameter display | Program display

Enable Input →
Analog Input →
Analog Input →
Reference →



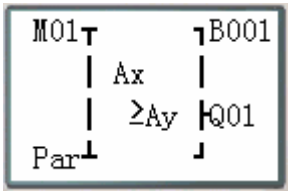


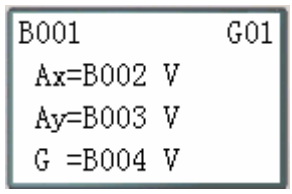


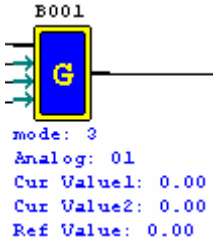
(4) Analog Comparison Mode 3

FBD display | Parameter display | Program display

Enable Input →
Analog Input →
Analog Input →
Reference →





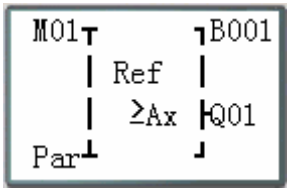


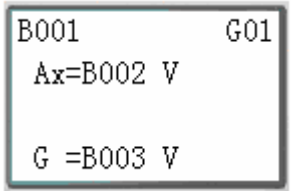
(5) Analog Comparison Mode 4

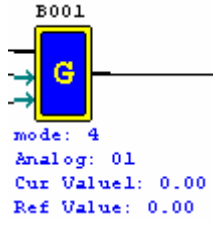
FBD display | Parameter display | Program display

Enable Input →

Analog Input →
Reference →

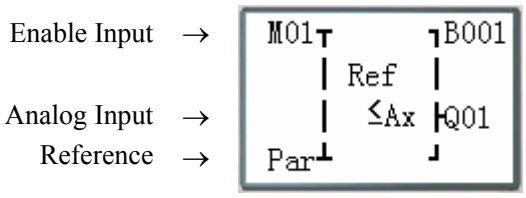




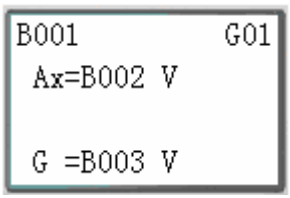


(6) Analog Comparison Mode 5

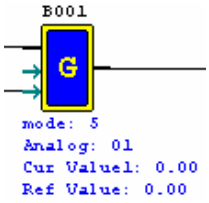
FBD display



Parameter display

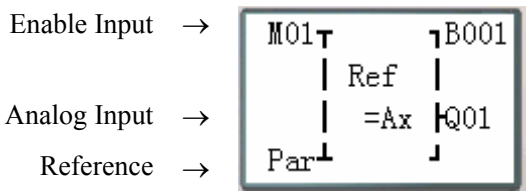


Program display

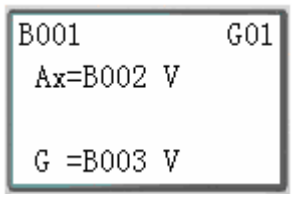


(7) Analog Comparison Mode 6

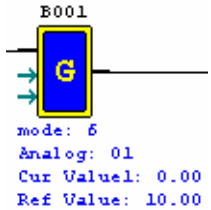
FBD display



Parameter display

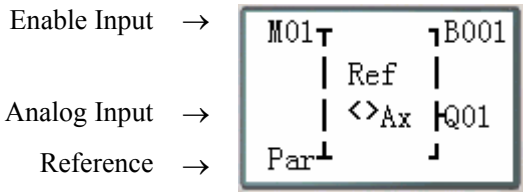


Program display

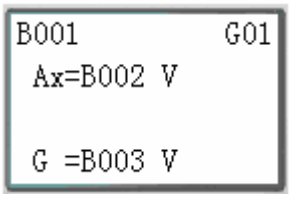


(8) Analog Comparison Mode 7

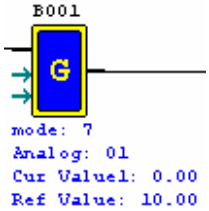
FBD display



Parameter display

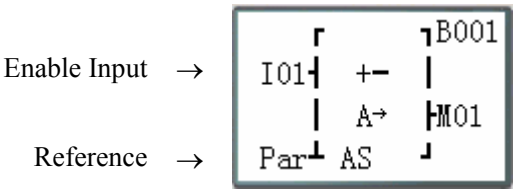


Program display

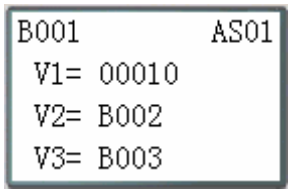


AS (ADD-SUB) function block

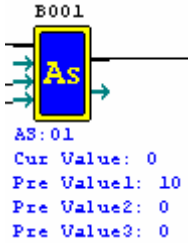
FBD display



Parameter display

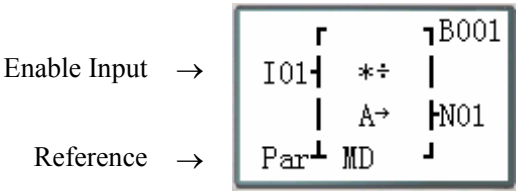


Program display

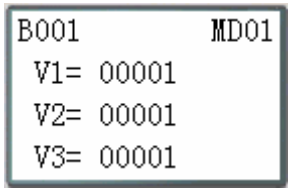


MD (MUL-DIV) function block

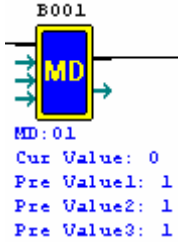
FBD display



Parameter display

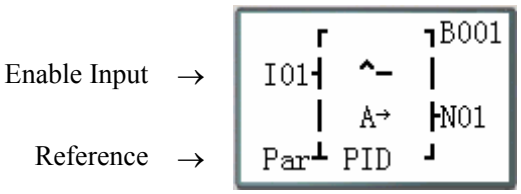


Program display

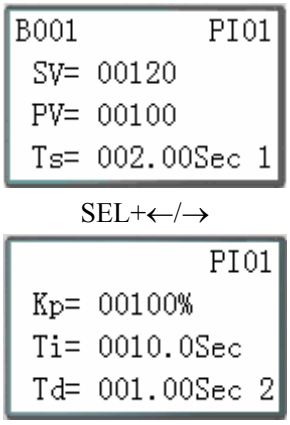


PID (Proportion- Integral- Differential) function block

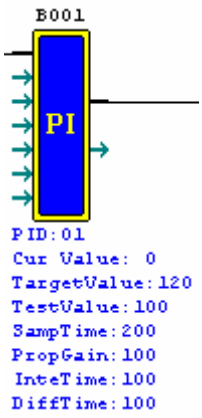
FBD display



Parameter display

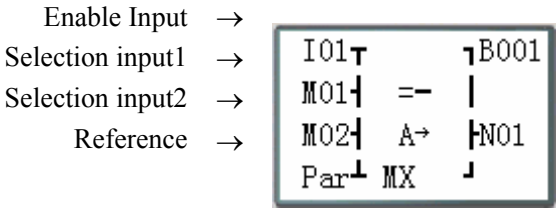


Program display

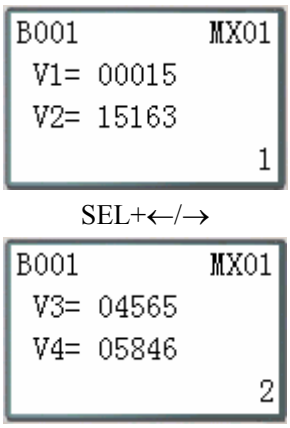


MX (Multiplexer) function block

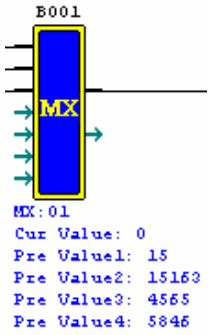
FBD display



Parameter display

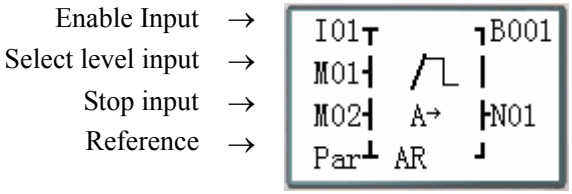


Program display

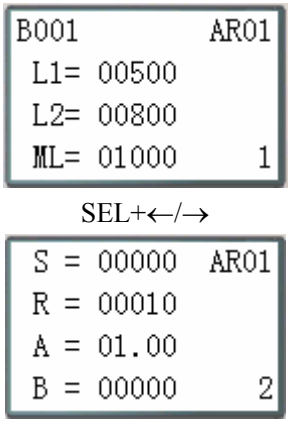


AR (Analog-Ramp) function block

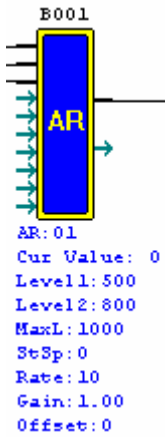
FBD display



Parameter display

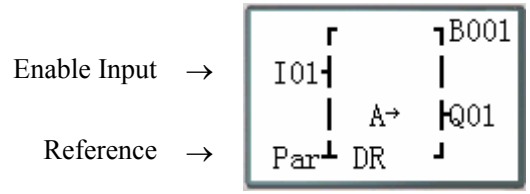


Program display

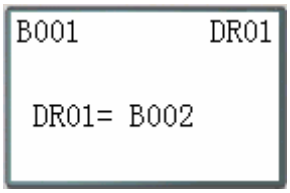


DR (Data-Register) function block

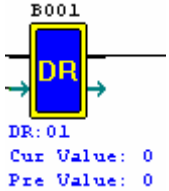
FBD display



Parameter display



Program display



MU (MODBUS) function block

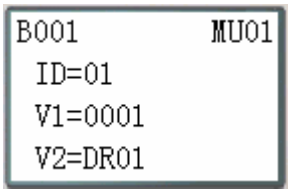
Mode1

Enable Input →

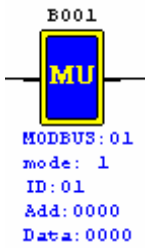
Reference →

FBD display

Parameter display



Program display



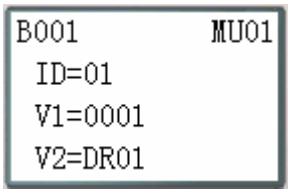
Mode2

Enable Input →

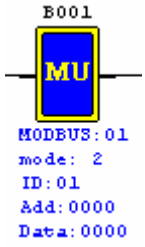
Reference →

FBD display

Parameter display



Program display



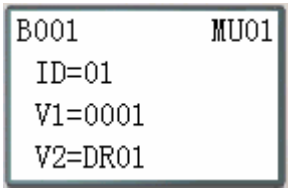
Mode3

Enable Input →

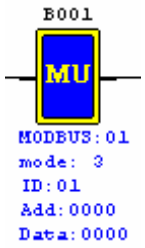
Reference →

FBD display

Parameter display



Program display



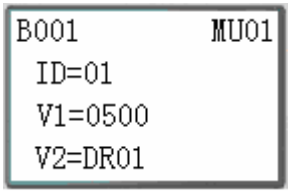
Mode4

Enable Input →

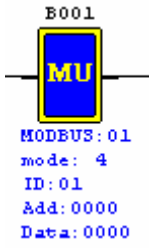
Reference →

FBD display

Parameter display



Program display



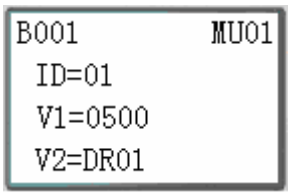
Mode5

Enable Input →

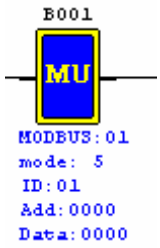
Reference →

FBD display

Parameter display



Program display



Chapter 6: 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
Main machine	Maximum Vibration	0.075mm amplitude, 1.0g acceleration according to IEC60068-2-6
	Maximum Concussion	peak value 15g, 11ms according to IEC60068-2-27
Maximum Noise	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

	MODE	Input Power				Input point	Output point		Analog input	RTC	LCD keypad	expansion	1KHz High speed input	PWM	I/O LINK
		AC 100~240V	AC 24V	DC 24V	DC 12V										
10 points	Expansion models														
	10HR-A	◎				6	4	relay		◎	◎	◎			
	12HR-D			◎		8*	4	relay	2	◎	◎	◎	◎		
	12HT-D			◎		8*	4	transistor	2	◎	◎	◎	◎	◎	
	12HR-12D				◎	8*	4	relay	2	◎	◎	◎	◎		
	12HR-24A		◎			8	4	relay		◎	◎	◎			
	OEM “Blind” Models, No Keypad, No Display														
	10KR-A	◎				6	4	relay		◎		◎			
	12KR-D			◎		8*	4	relay	2	◎		◎	◎		
	12KT-D			◎		8*	4	transistor	2	◎		◎	◎	◎	
	12KR-12D				◎	8*	4	relay	2	◎		◎	◎		
	12KR-24A		◎			8	4	relay		◎		◎			
	OEM “Baseboard” Models, No Keypad, No Display, No Expansion														
	10CR-A	◎				6	4	relay		◎					
	12CR-D			◎		8*	4	relay	2	◎			◎		
	12CT-D			◎		8*	4	transistor	2	◎			◎	◎	
	12CR-12D				◎	8*	4	relay	2	◎			◎		
20 points	Expansion models														
	20HR-A	◎				12	8	relay		◎	◎	◎			
	20HR-D			◎		12*	8	relay	4	◎	◎	◎	◎		
	20HT-D			◎		12*	8	transistor	4	◎	◎	◎	◎	◎	
	20HR-12D			◎		12*	8	relay	4	◎	◎	◎	◎		
	20HR-24A		◎			12	8	relay		◎	◎	◎			
	OEM “Blind” Models, No Keypad, No Display														
	20KR-A	◎				12	8	relay		◎		◎			
	20KR-D			◎		12*	8	relay	4	◎		◎	◎		
	20KT-D			◎		12*	8	transistor	4	◎		◎	◎	◎	
	20KR-12D			◎		12*	8	relay	4	◎		◎	◎		
	20KR-24A		◎			12	8	relay		◎		◎			
	OEM “Baseboard” Models, No Keypad, No Display, No Expansion														
	20CR-A	◎				12	8	relay		◎					
	20CR-D			◎		12*	8	relay	4	◎			◎		
	20CT-D			◎		12*	8	transistor	4	◎			◎	◎	
	20CR-12D			◎		12*	8	relay	4	◎			◎		
	V communication models														
	20VR-D			◎		12*	8	relay	4	◎	◎	◎	◎		◎
	20VT-D			◎		12*	8	transistor	4	◎	◎	◎	◎	◎	◎
	20VR-12D				◎	12*	8	relay	4	◎	◎	◎	◎		◎
	8ER-A	◎				4	4	relay							
	8ER-D			◎		4	4	relay							
	8ET-D			◎		4	4	transistor							
	8ER-24A		◎			4	4	relay							
	4AI			◎		4*			4						
	4PT			◎		4*			4						
	2AO			◎			2	analog							

◎ : exist

*: There are analog input points in.

Power Specifications

Normal model machine Specifications

content	**SG2-10HR-A** **SG2-10KR-A** **SG2-10CR-A**		**SG2-20HR-A** **SG2-20KR-A**		**SG2-20HR-D** **SG2-20KR-D** **SG2-20HT-D** **SG2-20KT-D**		**SG2-12HR-D** **SG2-12KR-D** **SG2-12CR-D** **SG2-12HT-D** **SG2-12KT-D** **SG2-12CT-D**	
operation Power range	AC 100~240V		AC 100~240V		DC 24V		DC 24V	
Voltage Rating	AC 85~265V		AC 85~265V		DC 20.4~28.8V		DC 20.4~28.8V	
Frequency Rating	50 / 60 Hz		50 / 60 Hz					
Frequency range	47～63Hz		47～63Hz					
instantaneous power down time allowable	10 ms(half cycle) / 20 times (IEC61131-2)		10 ms(half cycle) / 20 times (IEC61131-2)		1ms/10times (IEC61131-2)		10ms/10times (IEC61131-2)	
fuse	Need connect a fuse or breaker of current 1A		Need connect a fuse or breaker of current 1A		Need connect a fuse or breaker of current 1A		Need connect a fuse or breaker of current 1A	
Isolation	None		None		None		None	
Current average	AC 110V	AC 220V	AC 110V	AC 220V	DC 24V	DC 28.8V	DC 24V	DC 28.8V
	All inputs and relays are ON 90mA	All inputs and relays are ON 90mA	All inputs and relays are ON 100mA	All inputs and relays are ON 100mA	All inputs and relays are ON 145mA	All inputs and relays are ON 185mA	All inputs and relays are ON 115mA	All inputs and relays are ON 125mA
	All inputs and relays are OFF 85mA	All inputs and relays are OFF 85mA	All inputs and relays are OFF 90mA	All inputs and relays are OFF 90mA	All inputs and relays are OFF 80mA	All inputs and relays are OFF 120mA	All inputs and relays are OFF 75mA	All inputs and relays are OFF 85mA
Consume power	7.5 W		12.5 W		5 W		4.5W	

12V DC model Specifications

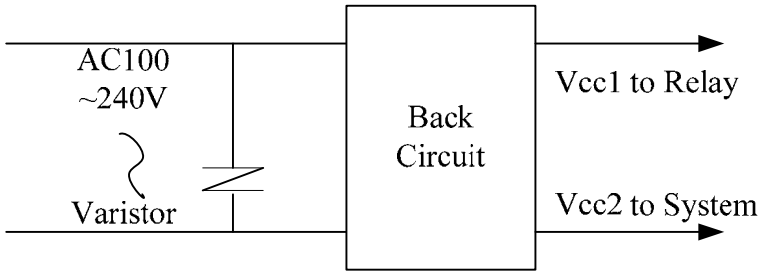
content	**SG2-12HR-12D**		**SG2-20HR-12D**	
Voltage Rating	DC 12 V		DC 12 V	
operation Power range	DC 10.4~14.4 V		DC 10.4~14.4 V	
instantaneous power down time allowable	10 ms / 10 times (IEC 61131-2)		1ms/ 10 times (IEC 61131-2)	
fuse	Need connect a fuse or breaker of Current 1A		Need connect a fuse or breaker of current 1A	
Isolation	None		None	
Current average	DC 12V	DC 14.4V	DC 12V	DC 14.4V
	All inputs and relays are ON 195mA	All inputs and relays are ON 195mA	All inputs and relays are ON 265mA	All inputs and relays are ON 265mA
	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	2.5W		3.5 W	

24V AC model Specifications

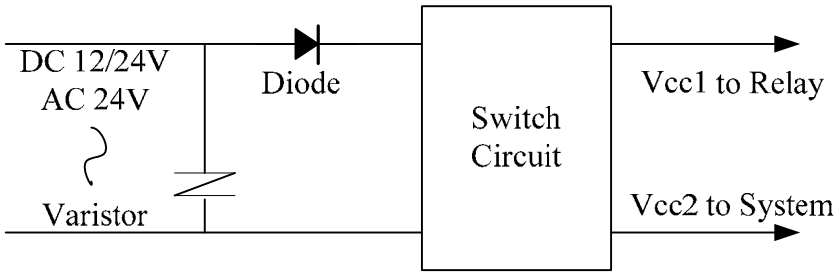
content	**SG2-12HR-24A** **SG2-12KR-24A**		**SG2-20HR-24A** **SG2-20KR-24A**	
Voltage Rating	AC 24V		AC 24V	
operation Power range	20.4~28.8V AC		20.4~28.8V AC	
instantaneous power down time allowable	10 ms(half cycle) / 20 times		10 ms(half cycle) / 20 times	
fuse	Need connect a fuse or breaker of Current 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

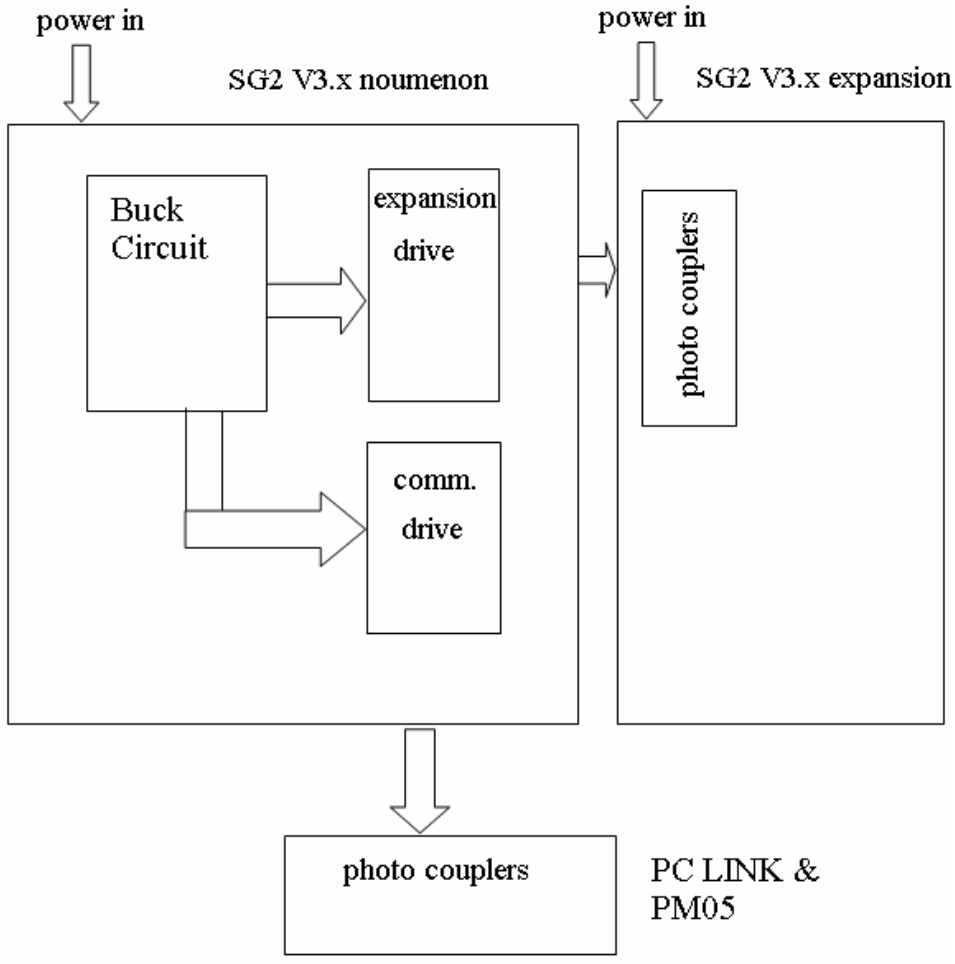
1) AC 10/20 points



2) DC 12V，DC 24V

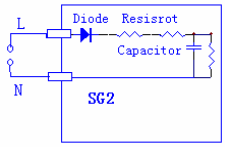


3) Mainframe, expansion and communication

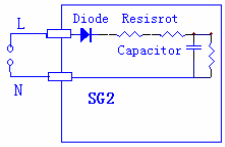


Input Specifications

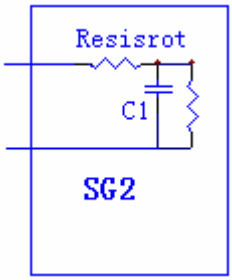
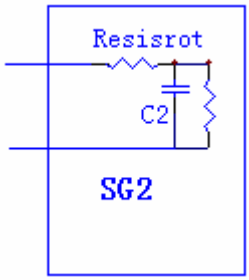
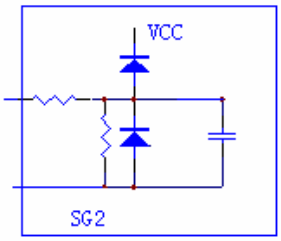
100~240V AC model

content	**SG2-10HR-A SG2-10KR-A SG2-10CR-A**		**SG2-20HR-A & SG2-20KR-A**	
Input circuitry				
number	6(digital input)		12(digital input)	
Signal current input	AC 110V 0.66 mA	AC 220V 1.3 mA	AC 110V 0.55mA	AC 220V 1.2 mA
ON current input	> AC 79 V /0.41mA		> AC 79 V/ 0.4mA	
OFF current input	< AC 40 V /0.28 mA		< 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)	

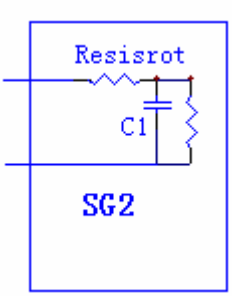
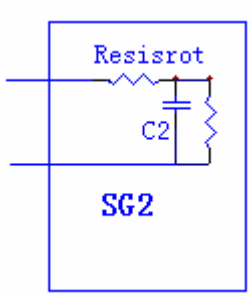
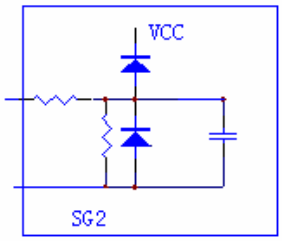
24V AC model

content	SG2-12HR-24A	SG2-20HR-24A
Input circuitry		
number	6(digital input)	12(digital input)
Signal current input	3 mA	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

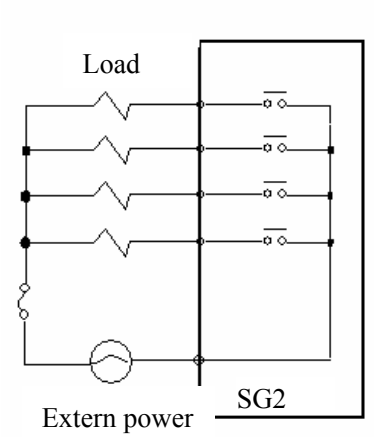
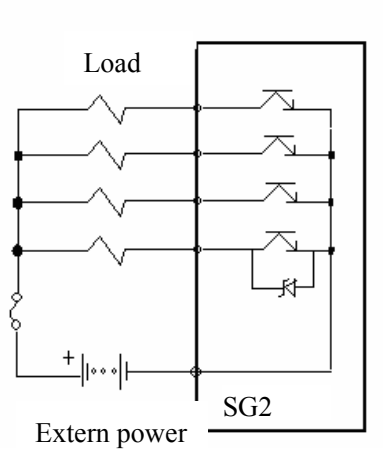
24V DC, 12I/O model

content	**SG2-12HR-D& SG2-12KR-D & SG2-12CR-D** **SG2-12HT-D&SG2-12KT-D&SG2-12CT-D**			
	Normal digital input	**High speed input**	**Analog input used as normal digital input**	**Analog input**
Input circuitry	I03~I06 	I01,I02 	I07,I08 	
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 3ms Off=>On 5ms	On=>Off 0.3ms Off=>On 0.5ms	On=>Off Typical: 5ms Off=>On Typical: 3ms	
Input voltage				0~10 V DC
Precision class				0.01V DC
bit of conversion				10
error				±2%±0.12V
Conversion time				1 cycle
sensor resistance				<1K ohm

24V DC, 20I/O model

content	**SG2-20HR-D& SG2-20KR-D** **SG2-20HT-D& SG2-20KT-D**			
	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				8
error				±2%±0.12V
Conversion time				1 cycle
sensor resistance				<1K ohm

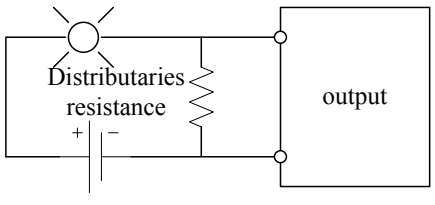
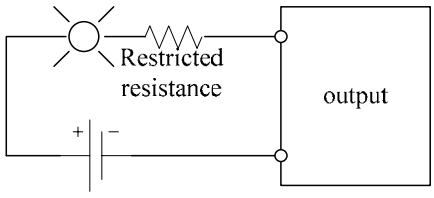
Output Specifications

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

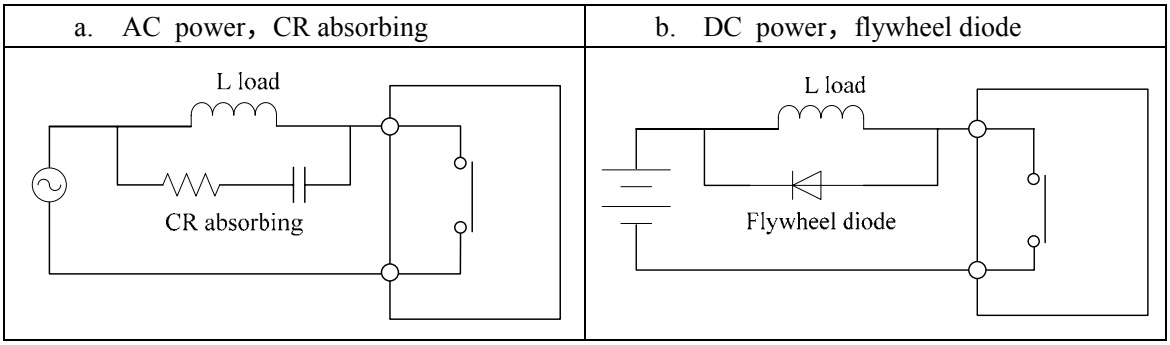
Light Load

The current value will be 10~20 times of normal value for several 10ms when filament is turning-on. A distributaries resistance or restricted current resistance is added at output port to reduce the concussion current value.

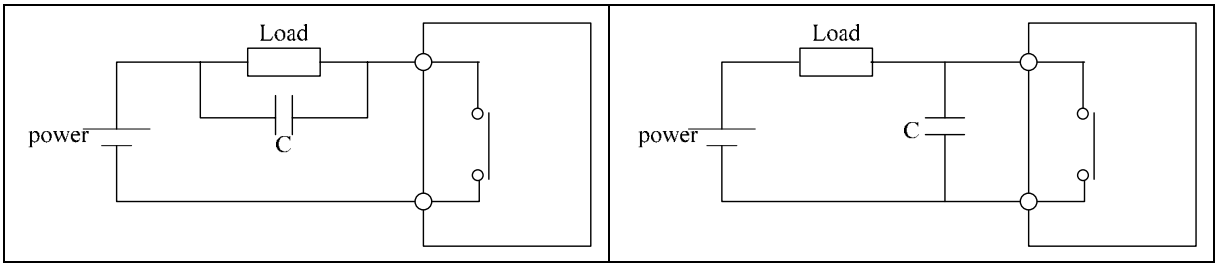
distributaries resistance	restricted current resistance
	
There is a little current makes light shine faintness, so the value of resistance must be careful.	The brightness will be described if the resistance value is too big.

Inductance Load

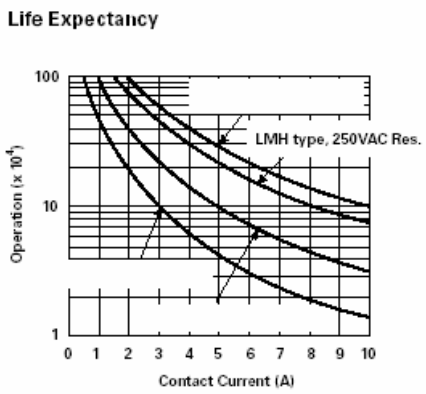
There will be a concussion voltage (KV) when the inductance load switches between ON and OFF, especially relay model. The methods of different power mode for absorbing the concussion voltage are shown below.



Please do can't 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

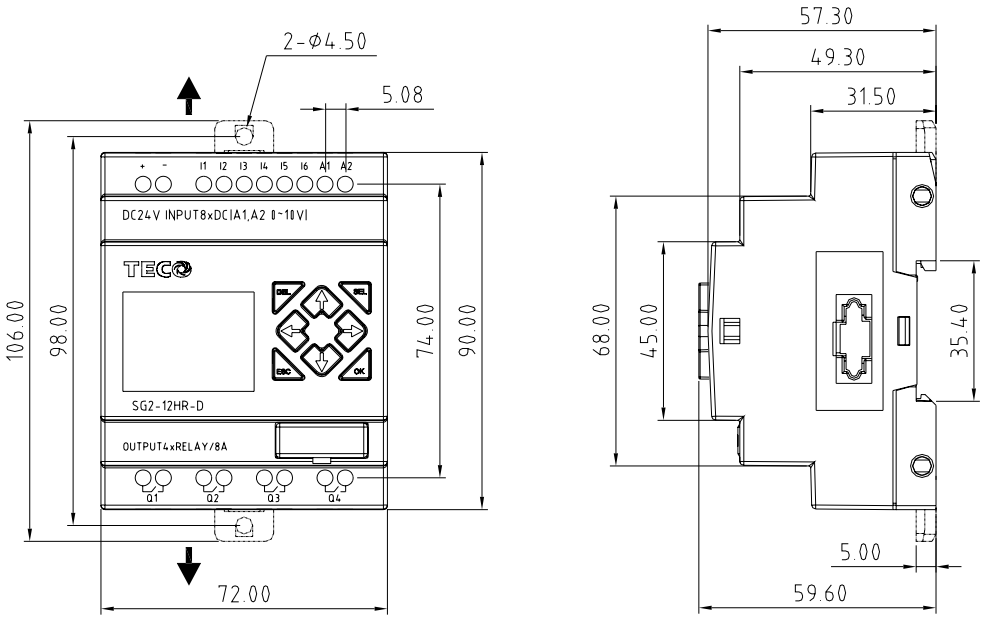
Mode	Input/Output
DC +12V	AC 100~240V / DC +12V
DC +24V	AC 100~240V / DC +24V

Accessory

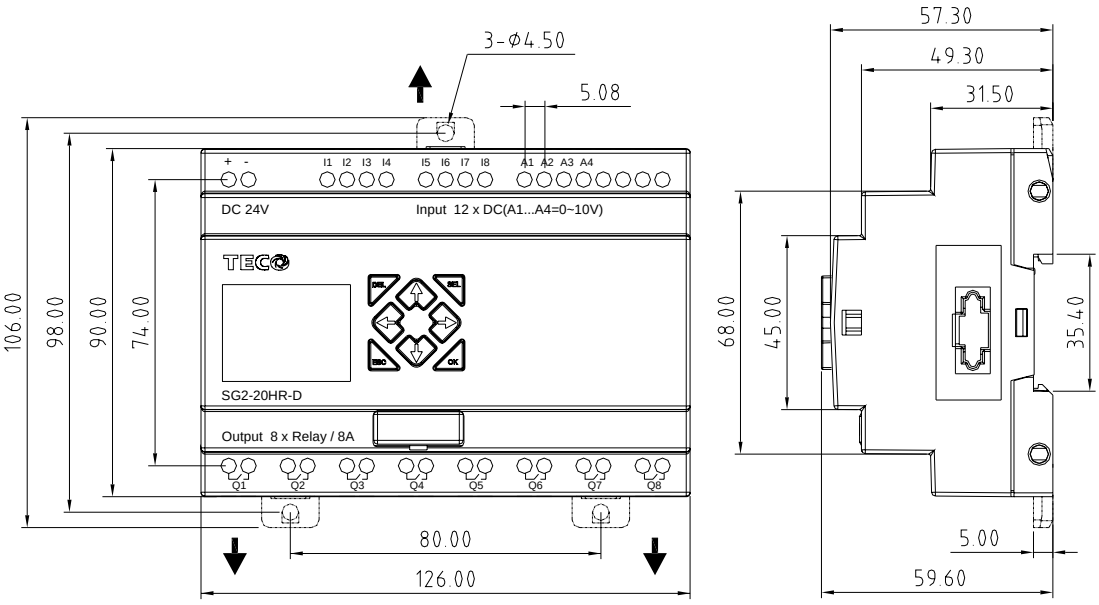
MODE	description
PM05(3rd)	memory cartridge
SG2 Client	SG2 program software

Size diagram of SG2

10/12 points



20 points



Chapter 7: 20 Points V type Models Instruction

Only SG2-20VR-D, SG2-20VT-D, SG2-20VR-12D do have V type special function. The setting takes effect after power up again if the smart if set to V type.

Function Summarization

Communication parameter	Communication mode parameter and baud rate.
Remote IO function	It can be used to communication between 2 SG2 units. For more information you could refer to Chapter 4: Remote IO.
I/O Link function	Up to 8 additional V type SG2 units can be configured as I/O Link nodes. Each SG2 can make used of the I/O information of other SG2.for detail, please refer to Chapter 4: Data Link.
Modbus RTU master	SG2 can be used as master
Modbus communication	SG2 can be controlled by computer or other controller with Modbus protocol via RS 485 port.

Detail instruction

Communication parameter

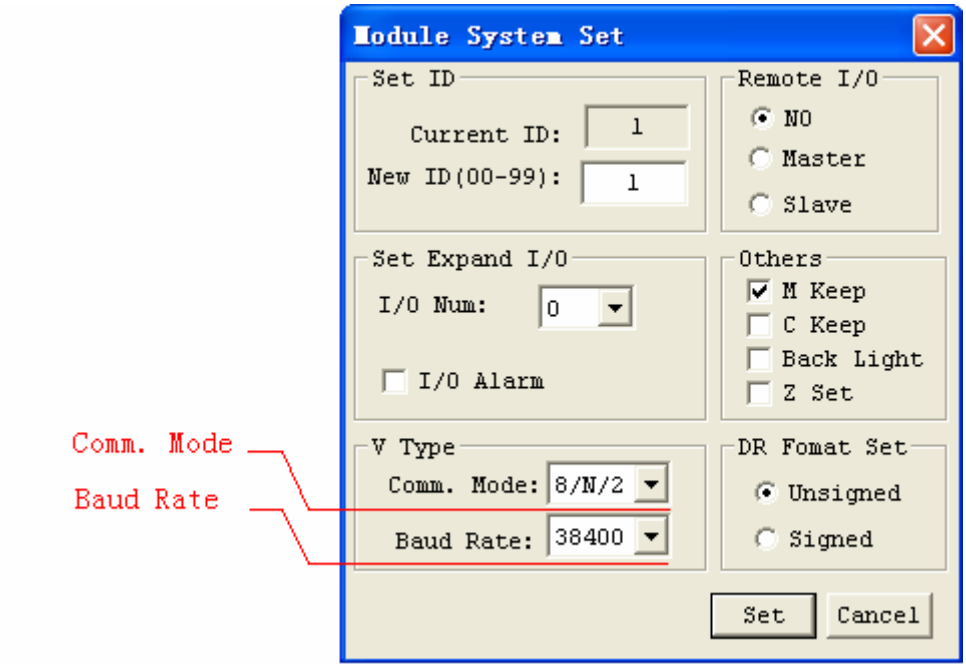
1. About SG2 communication parameter

   SG2 provides different communication parameter to satisfy your needs. And there are two ways to set that parameter.

   ●. Setting communication parameter via SG2 Client.

   i. Insert the plastic connector end of the programming cable into the SG2 smart relay. Connect the opposite end of the cable to an RS232 serial port on the computer.

   ii. In SG2 Client Soft Select **Operation>>Module System Set**, to open the dialog box as show below.



iii. As the illustration show, you can set Communication Mode and Baud Rate.

iv. In the table below, list the options which you can choose from.

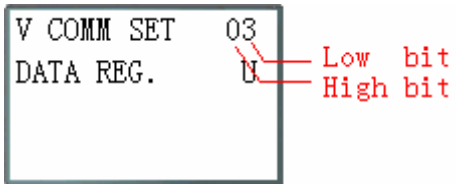
Comm. Mode	8/N/2 Data 8bit, No Parity, 2 Stop bit.
	8/E/1 Data 8bit, Even Parity, 1 Stop bit.
	8/0/1 Data 8bit, Odd Parity, 1 Stop bit.
	8/N/1 Data 8bit, No Parity, 1 Stop bit.
Baud Rate.	4800 bps 9600 bps 19200 bps 38400 bps 57600 bps 115200 bps

●. Set communication format and Baud Rate on SG2.

i. Press ESC to enter main menu.

ii. Press UP/DOWN to choose SET menu, and press OK to enter it.

iii. Press UP/DOWN makes the LCD to display the options as show below.



iv. Changing high bit would set Comm. Mode; changing low bit would set Baud Rate.

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

2. SG2 RS485 port default communication parameter as table show below:

Baud rate	38400bps
Data bit	8
Stop bit	2
Parity	No
Frame length maximum	128 bytes

※ SG2 V2 RS485 port communication parameter as table show above.

※ The communication parameter setting takes effect after power up again.

Remote IO function

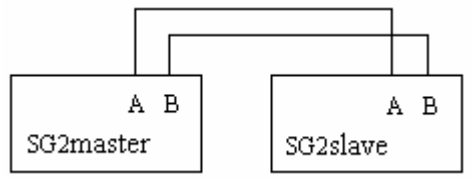
Function Description:

Up to 2 additional SG2 units can be configured as Remote I/O nodes, and linked to one master smart relay. The Master can run its programming, but the Slave can't. The Master writes its state of expansion output coil Y to Slaver's output coil Q. The Slaver writes its state of input coil I to Master's expansion input coil X.

I/O Address	Master	Slave
Input Coils	I01~I0C	
Output Coils	Q01~Q08	
Expansion Input Coils	X01~X0C	I01~I0C
Expansion Output Coils	Y01~Y0C	Q01~Q08

Hardware Configuration:

1. Link 2 V type SG2 as illustration show below.
2. Set left SG2 in the illustration to master.
3. Set another SG2 to Slave.



Example:

Create a Ladder program as show below in SG2 which is master.

X02————————— Y01
X03————————— Y02

If input coils I02 and I03 in the Slave are on. X02 and X03 in master will be on state with the influenceing of I01 and I02 in the Slave. Obviously, Y01 and Y02 in the master will be the on state. Then for the influenceing of Y01 and Y02 in master, Q01 and Q02 in slave will on. You can see the consequence on the IO interface show 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
```

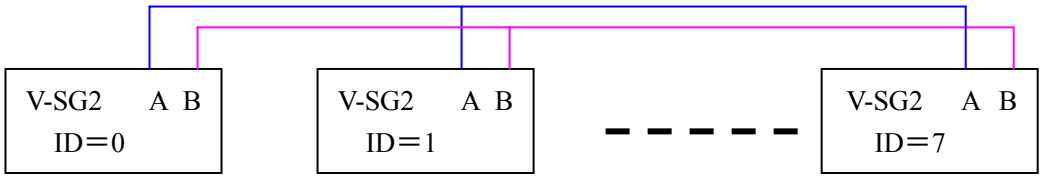
I/O State on Master Run mode

```
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

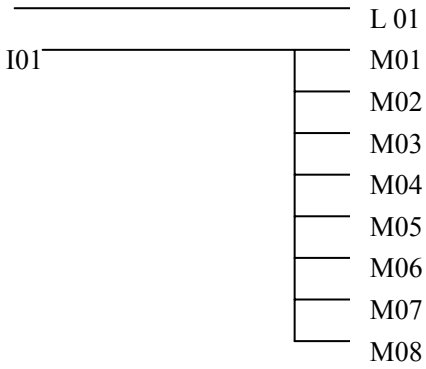
Hardware Configuration:

1. Link not more 8 V type SG2 as show below.
2. Set all the SG2 in SET menu to No Remote IO.
3. Set those SG2's ID continuously 00 ,01,02,… The max number of the ID is 07.

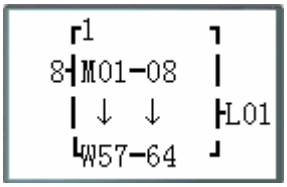


Example:

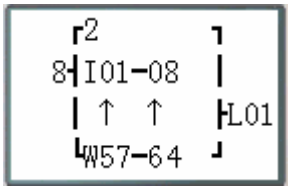
1. Link 8 20 pointe V type SG2 according to the steps of the Hardware Configuration.
2. Create a ladder program as show below in those 8 SG2.



3. Set L1 of the SG2 which's ID =7 as fellow illustration.



4. L1 of other 7 SG2 be set as fellow illustration.



5. Run program.Let I01 of the SG2 which's ID = 7 on. And M01~M08 will be on state.
6. You will find M01~M08 of other 7 SG2 will be controlled by the M01~M08 of the SG2 which's ID=7.

Modbus RTU master

MODBUS function carries out Modbus RTU master communication at RS485 port. There are 15 MODBUS functions: MU01~MU0F. Remote IO and Date Link are precedence than MODBUS. MODBUS is executed when the system setting is N Remote IO and ID isn't 0.

MODBUS comes into possession of communication port, release the port when disable and one MODBUS period is completed. There can be a number of communication orders in one program, but only one order can come into possession of communication port at the same time. And the others keep their enable state for executing function.

Function mode corresponding communication function code:

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

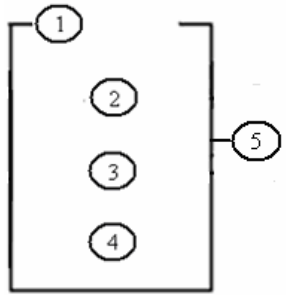
The coil used in MODBUS function:

Received (M3D)	M3D is set to 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 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 communication baud rate as shown in the table below:

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

There are 5 parameters in MODBUS function as shown below.



symbol	Description
①	MODBUS mode (1~5)
②	Communication address: slave ID, range: 0~127
③	Communication content: address and data length: 1） address is constant, range: 0000~ffff; length must be 1 word； 2） DR code, get address and length from this DR and the next
④	DR code, store sending/receiving data from this DR
⑤	MODBUS code (MU01~MU0F)

Examples:

mode	display		
1 Read register		Address is constant: 0003, Length ≡ 1, Send: 01 03 00 03 00 01 CRC16;	Receive: 01 03 02 data1 data2 CRC16, data storage: DRE0= (data1<<8) | data2,
		Address is DR03=0001, Length is DR04=0002, Send: 01 03 00 01 00 02 CRC16;	Receive: 01 03 04 data1 data2 data3 data4 CRC16, data storage: DRE0= (data1<<8) | data2, DRE1= (data3<<8) | data4
2 Write single register		Address is constant: 0003, Length ≡ 1, data storage: DRE0=1234(hex: 04D2), Send: 01 06 00 03 04 D2 CRC16；	Receive: 01 06 00 03 04 D2 CRC16；
		Address: DR03=0001, data storage: DRE0=1234(hex: 04D2), Send: 01 06 00 01 04 D2 CRC16；	Receive: 01 06 00 01 04 D2 CRC16；
3 Write register		Address: 0003， Length ≡ 1, data storage: DRE0=1234(hex: 04D2), Send: 01 10 00 03 00 01 02 04 D2 CRC16；	Receive: 01 10 00 03 00 01 CRC16；
		Address: DR03=0001， Length: DR04=0002， data storage: DRE0=1234(hex: 04D2), DRE1=5678(hex: 162E)， Send: 01 10 00 01 00 02 04 04 D2 16 2E CRC16；	Receive: 01 10 00 01 00 02 CRC16；
4 Read coil		Address: 0003， Length ≡ 10H, Send: 01 01 00 03 00 10 CRC16；	Receive: 01 01 02 data1 data2 CRC16， data storage: DRE0= (data1<<8) | data2；
		Address: DR03=0001， Length: DR04=0016， Send: 01 01 00 01 00 10 CRC16； Max value in DR04 is 400.	Receive: 01 01 02 data1 data2 CRC16， data storage: DRE0= (data1<<8) | data2；

5 Write single coil		Address: 0003， data storage: DRE0=65280(hex: FF00)， Send: 01 05 00 03 FF 00 CRC16；	Receive: 01 05 00 03 FF 00 CRC16；
		Address: DR03=0001， data storage: DRE0=65280(hex: FF00)， Send: 01 05 00 01 FF 00 CRC16；	Receive: 01 05 00 01 FF 00 CRC16；

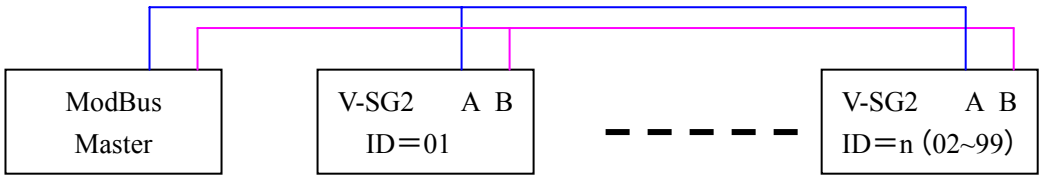
Slaver via Modbus RTU protocol

Function Description:

SG2 series PLC can be communication controlled by the computer or other controller with the communication. PC and other controller can read and write IO state, Function Block preset value. It also can use to read Function Block current value, control SG Run/Stop mode.

Hardware Configuration:

1. Line some SG2 RS485 port A, B as show below.
2. Set all the SG2 in the SET menu to No Remote IO.
3. Set SG2 ID = 01~99, each of those SG2's ID is different.



SG2 Modbus protocol

If SG2 receive a correct frame, it will carry out the command, it responses a correct frame to computer or other controller. If the command that SG2 received is not allowed, SG2 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 SG2 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 status	For detail please fefer 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:

Under communication linking, the controller responses the Exception Code and send Function Code add 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	Run mode and command disable
53	Secret mode and command disable
54	Data value over rang
55	SG2 system ROM error
56	SG2 RTC not exist, can't operate RTC
57	SG2 the other error
58	Commands do not match SG2 edit mode
59	Brand ID error

Get more protocol information form 'R09-SG2-C03V30(SG2 Modbus protocol)';

Chapter 8: Expansion Module

Summarize

Digital Input/Output module: SG2-8ER-A, SG2-8ER-D, SG2-8ET-D, SG2-8ER-24A

Analog Input module: SG2-4PT, SG2-4AI

Analog Output module: SG2-2AO

Communication module: MBUS, DNET, PBUS, TCP/IP

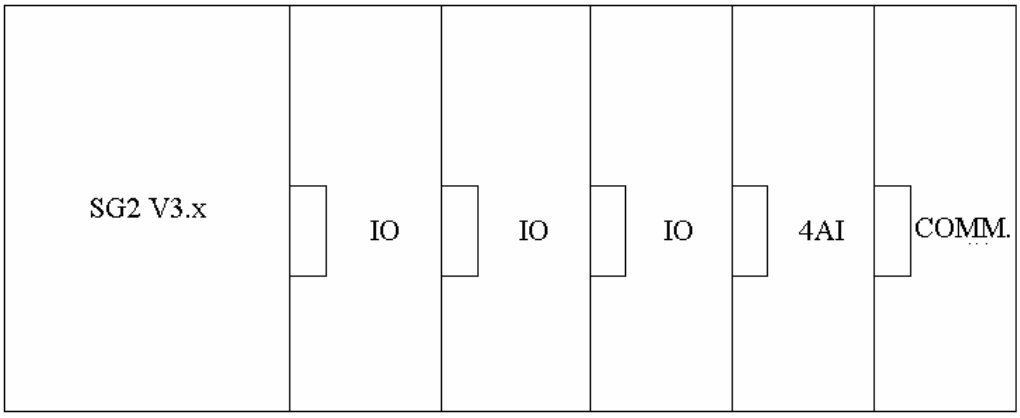
SG2 V type, H type and K type all can connect expansion module. And the maximal expansion team is 3 Digital modes, 2 Analog Output modes, 2 Analog Input modules (each of 4PT and 4AI) and 1 Communication module. The sequence of these expansion modules connect with SG2 is digital, analog and communication.

※ SG2-4AI must be the last one of analog module.

The digital models have 2 kinds: version 1.2 and version 3.0. They can connect with SG2 together.

There are 3 kinds of connecting of expansion modules as shown below.

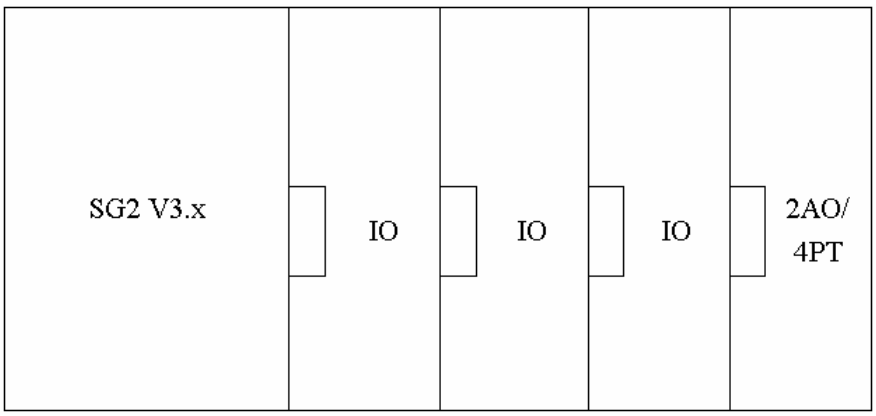
Mainframe + digital IO (V1.2/V3.0) * 3 + 4AI*1+COMM.*1



※ digital IO: SG2-8ER-A, SG2-8ER-D, SG2-8ET-D, SG2-8ER-24A

※ Digital IO version can be either 1.2 or 3.0

Mainframe + digital IO (V1.2/V3.0) * 3 + 2AO*1/4PT*1



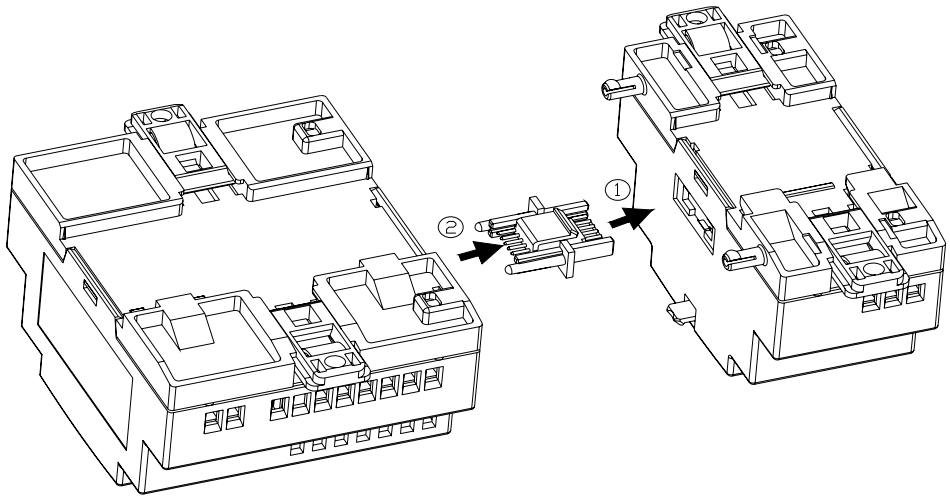
※ digital IO: SG2-8ER-A, SG2-8ER-D, SG2-8ET-D, SG2-8ER-24A

※ Either 2AO or 4PT.

Mainframe + digital IO (V3.0) * 3+2AO*2+4PT*1+4AI*1+ COMM.*1

SG2 V3.x	IO	IO	IO	2AO	2AO	4PT	4AI	COMM.

※ V3.0: Digital IO version is V3.0



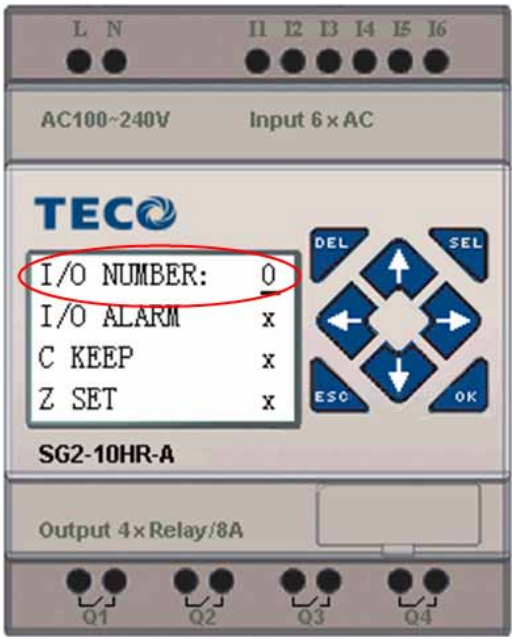
※ The method of all expansion modules connecting with SG2 is the same as shown above.

※ The number of digital module must be accord with IO number set if there are other modules after digital module,. But the IO number set can be less than connecting if there is no other expansion module after digital module.

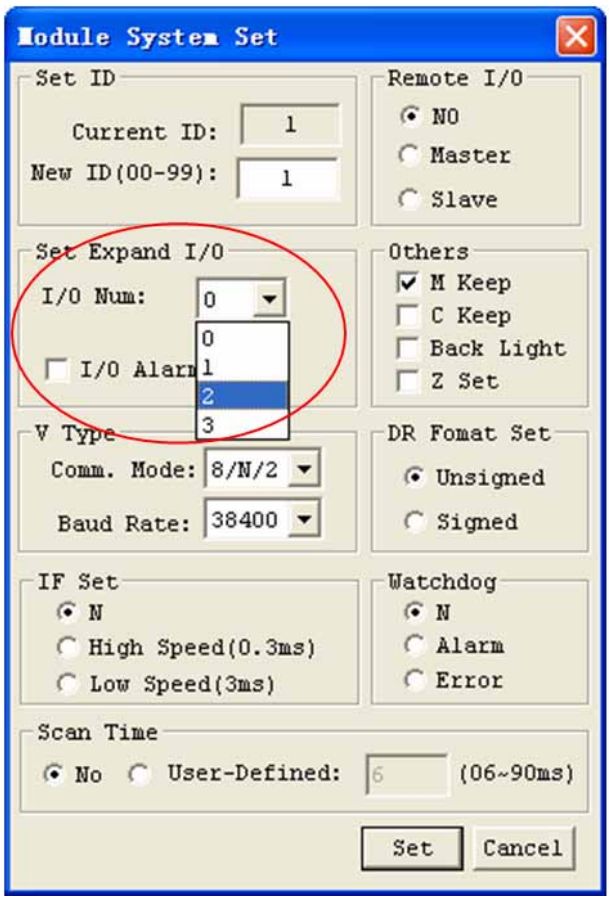
Digital IO module

The SG2 must set the number of expansion IO when connect expansion module. The method of setting IO number is shown below.

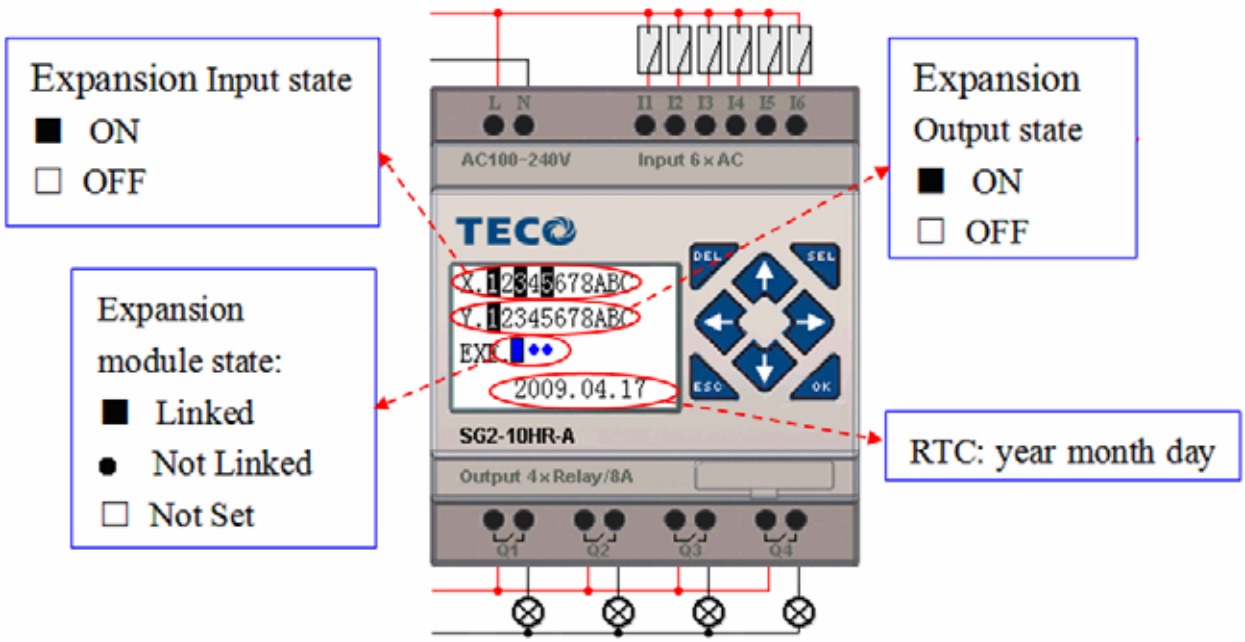
1) Keypad



2) SG2 Client software

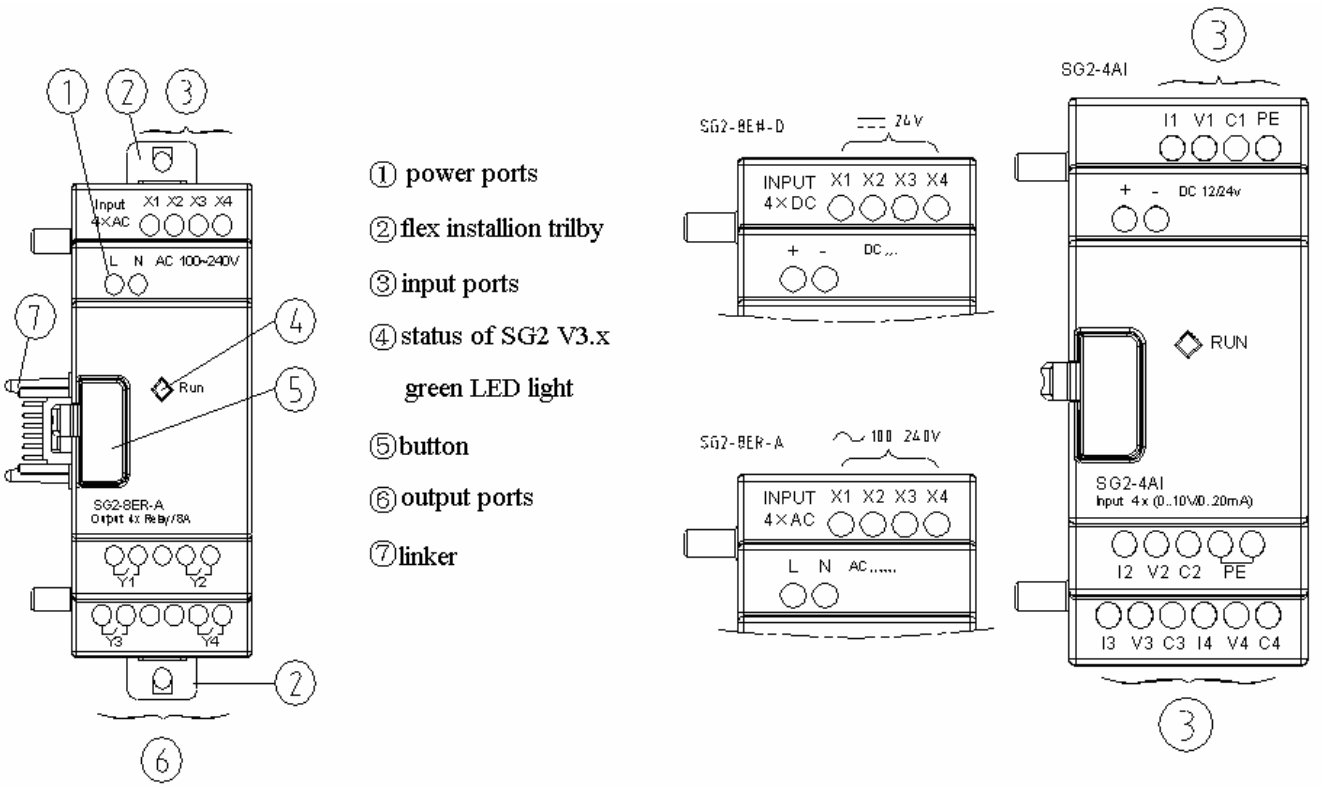


Expansion display State



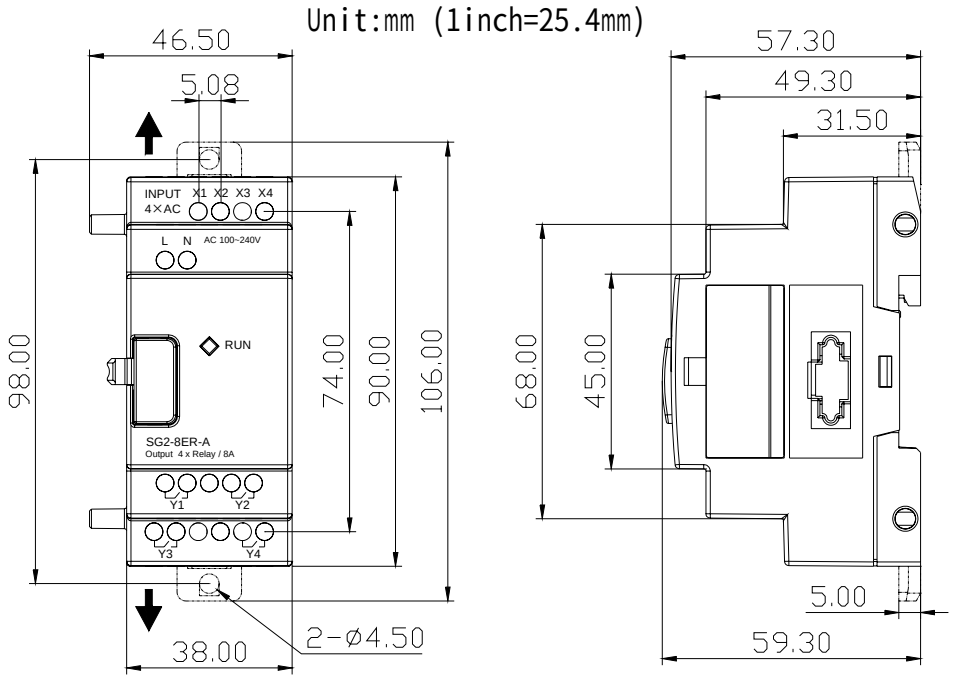
Installation and Wiring

E type of expansion module: SG2-8ER-D/8ET-D, SG2-8ER-A/8ER-24A



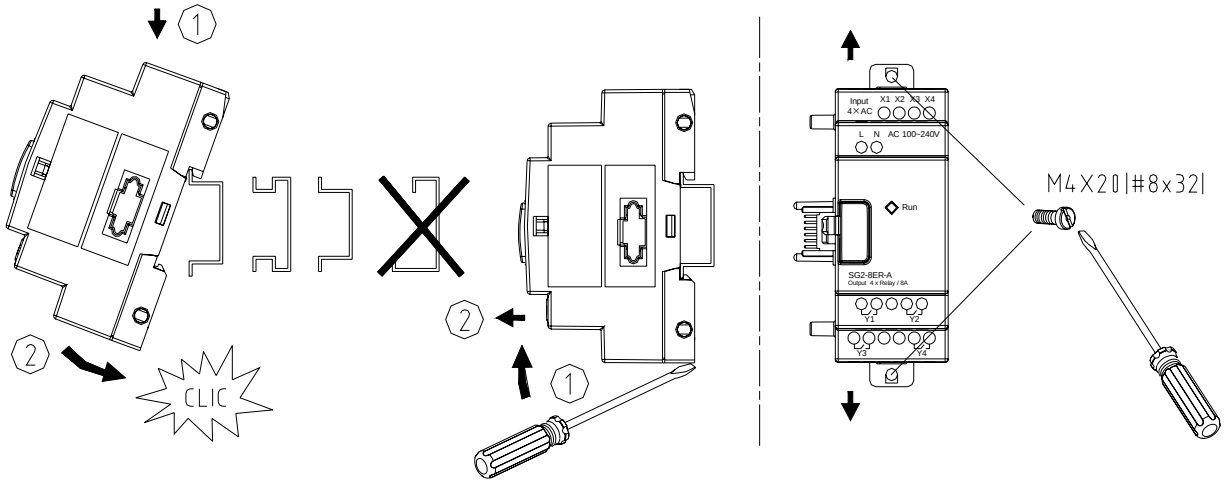
Size of expansion module

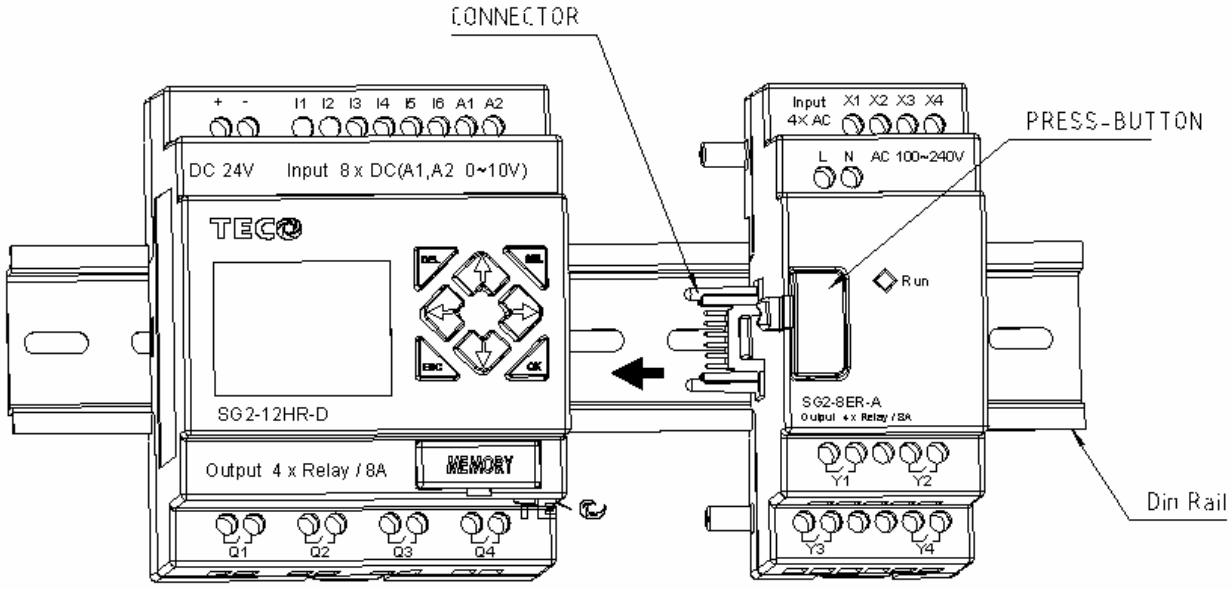
※ All the expansion modules' size is the same as shown below.

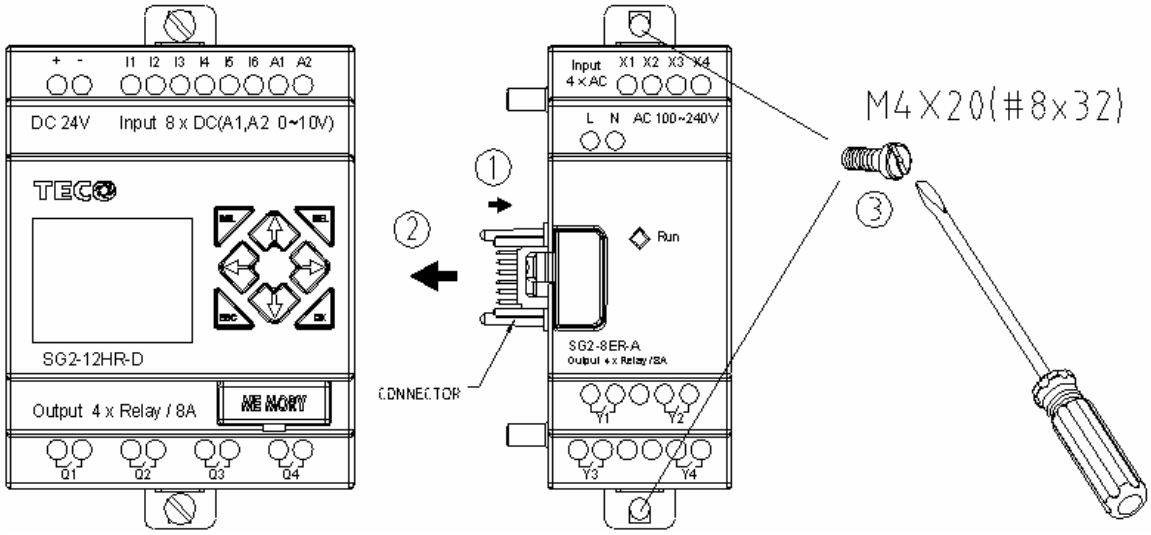


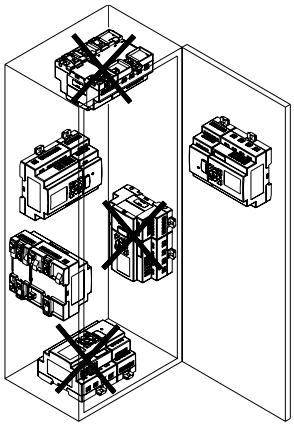
Installation

※ All the expansion modules' installation method is the same as shown below.









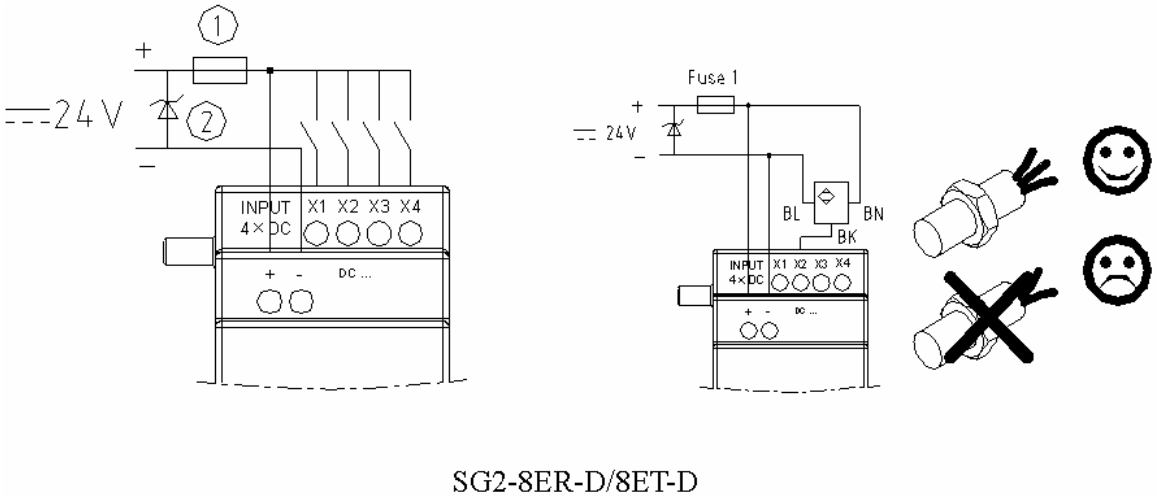
mm^2	0.14...1.5	0.14...0.75	0.14...2.5	0.14...2.5	0.14...1.5
AWG	26...16	26...18	26...14	26...14	26...16

	C		
⌀3.5 (0.14in)	C	Nm	0.6
		lb-in	5.4

※ Please do power down before maintaining equipment.

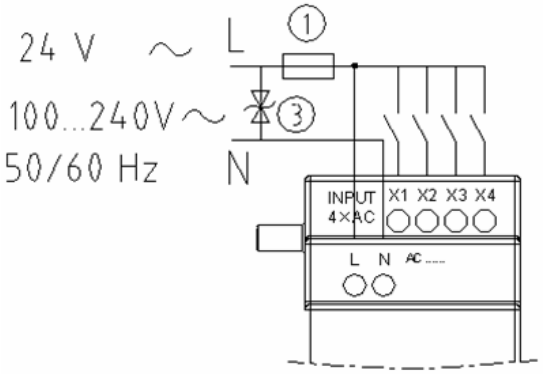
Wiring

1) 24V DC power input



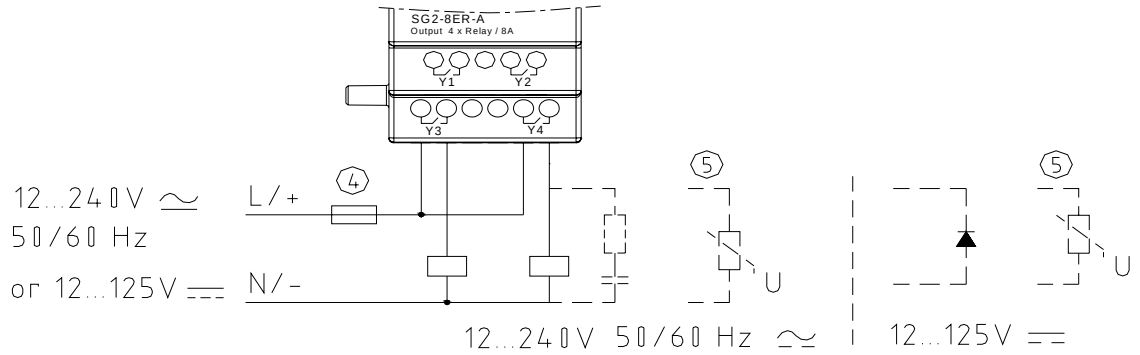
SG2-8ER-D/8ET-D

2) 24V/100~240V AC power input

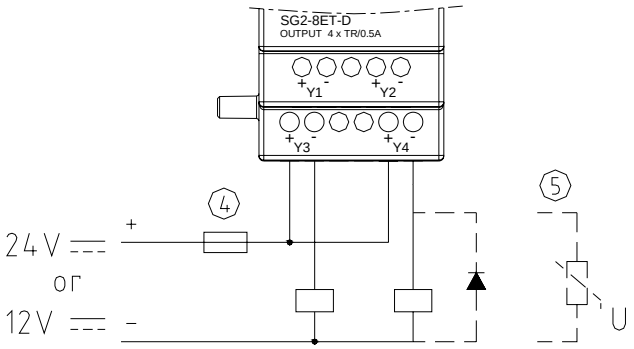


SG2-8ER-A/8ER-24A

3) relay output



4) Transistor output



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

②-Surge absorber (36V DC)

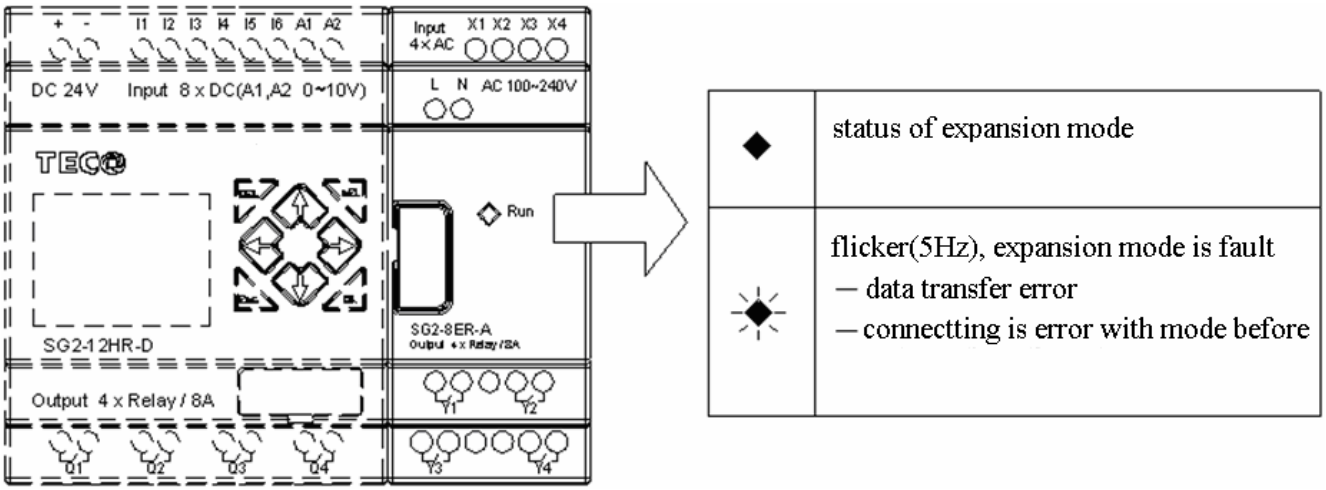
③-Surge absorber (400V AC)

④-Fuse, circuit-breaker or circuit protector

⑤-Inductive load

※ AC inductive load needs parallel connect Surge absorber to describe noise if the SG2 output is relay. DC inductive load needs parallel connect commute diode if the SG2 output is relay. The commute diode ‘s inverted voltage should be more than 5~10 times of load voltage, and the positive current should be more than load current. Inductive load needs parallel connect commute diode if the SG2 output is transistor.

Digital IO module and Analog module both have indicator light. The state of indicator light is the same
The state of indicator light is shown below.



Analog module

The maximal assembled of Analog expansion module to SG2 is 2 2AO, 1 4PT and 1 4AI. The nearer 2AO to SG2 corresponds with AQ01~AQ02, and the farer 2AO to SG2 corresponds with AQ03~AQ04. The 4 input of 4AI corresponds with A05~A08.

The current value of 2AO output displaying as shown below:

A	Q	0	1	=	0	0	.	0	0	V
A	Q	0	2	=	0	0	.	0	0	V
A	Q	0	3	=	0	0	.	0	0	V
A	Q	0	4	=	0	0	.	0	0	V

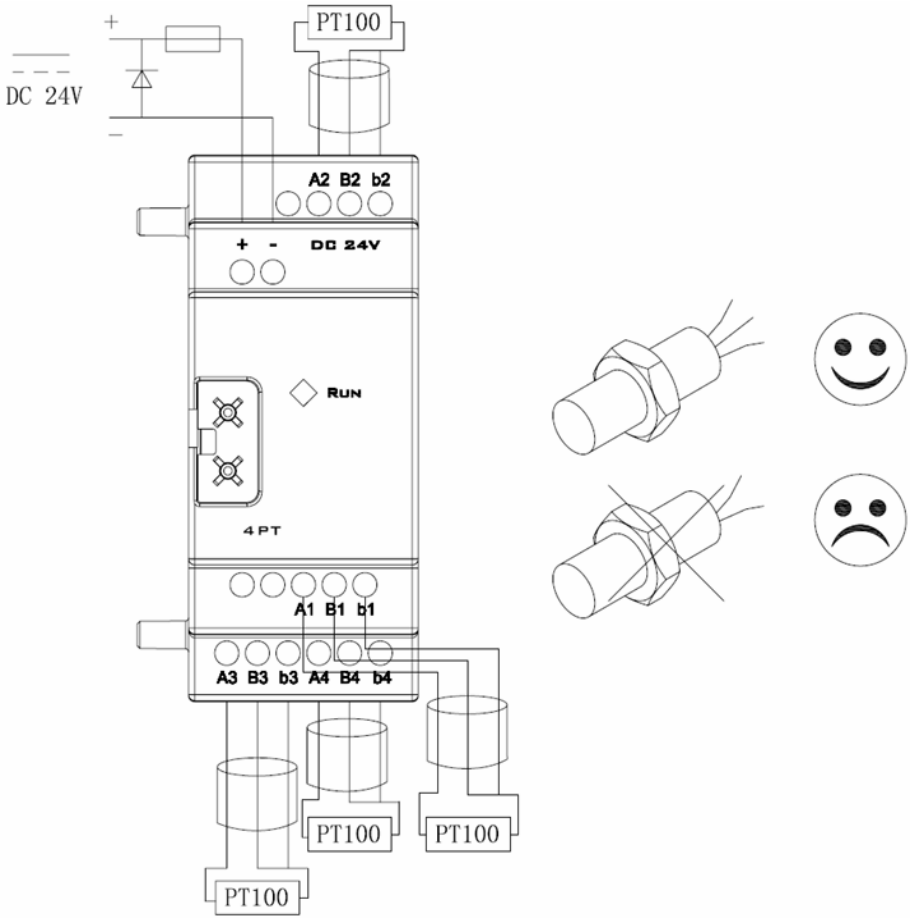
The current value of 4PT input displaying as shown below:

A	T	0	1	=	0	0	0	0	.	0	℃
A	T	0	2	=	0	0	0	0	.	0	℃
A	T	0	3	=	0	0	0	0	.	0	℃
A	T	0	4	=	0	0	0	0	.	0	℃

The current value of 4AI input displaying as shown below:

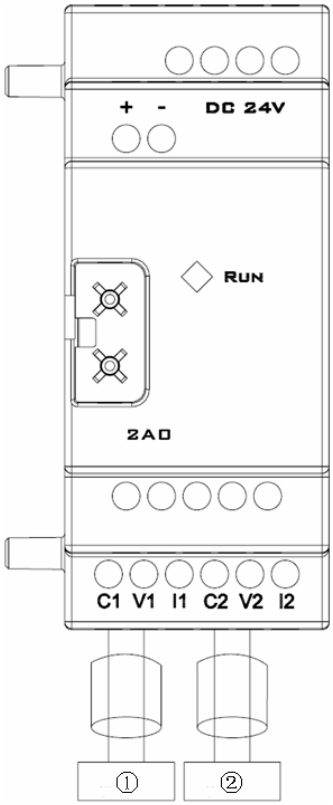
A	0	5	=	0	0	.	0	0	V
A	0	6	=	0	0	.	0	0	V
A	0	7	=	0	0	.	0	0	V
A	0	8	=	0	0	.	0	0	V

Wiring

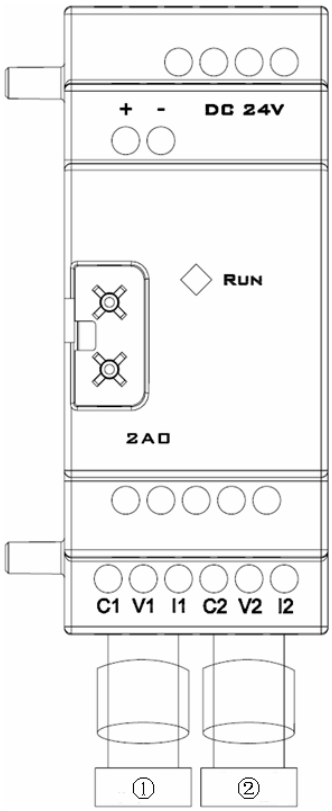


SG2-4PT

Voltage output



Current output

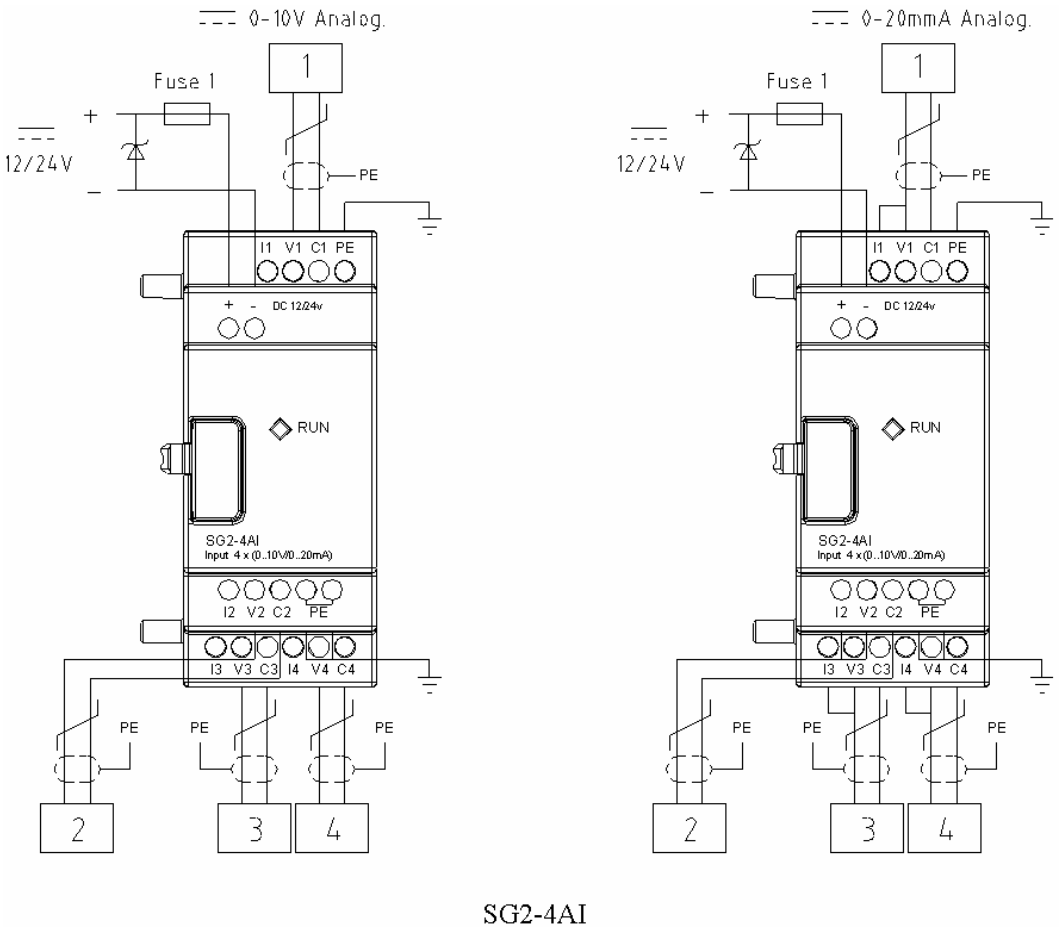


SG2-2AO

	content	standard	
4PT	Temperature input range	-100℃~600℃	
	Digital output	-100.0℃~600.0℃	
	Differentiation	2.5mV	
	Definition	±0.5%	
2AO		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	10μA
	Digital output	0.00V~10.00V	0.00mA~20.00mA
	Register value	0~1000	0~500
	Definition	±2.5%	±2.5%

The input value of SG2-4PT is over range if wiring error or no input, SG2 will not receive and store the value of corresponding channel, and the corresponding channel's coil M turns ON.

coil	AT number	
M34	AT01	SG2-4PT channel 1 error
M35	AT02	SG2-4PT channel 2 error
M36	AT03	SG2-4PT channel 3 error
M37	AT04	SG2-4PT channel 4 error



SG2-4AI

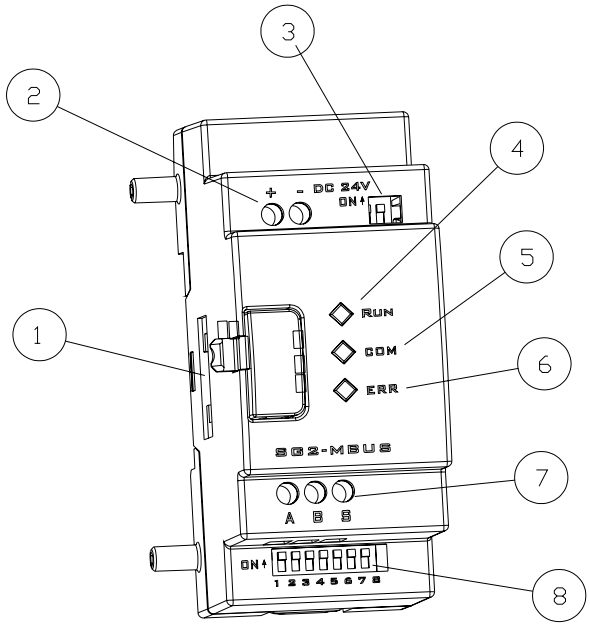
Communication module

ModBus module

Summarize

SG2-MBUS module makes SG2, which doesn't have communication ability, to communicate with other controller as master/slave mode. SG2-MBUS works as RTU slave node, responses RTU master node's request, but it can't communicate initiatively. SG2-MBUS makes the scan period of SG2 become long, it is different from difference communication order. Normally, the extend time is less than 20ms, but it will be 100ms if the order is to rework the preset value of function.

SG2-MBUS Cell Configuration



①: Connecting port

②: Power

③: SW2, 2-bit switch (terminal resistance selection)

④: RUN, running LED light

⑤: COMM. Communication LED light

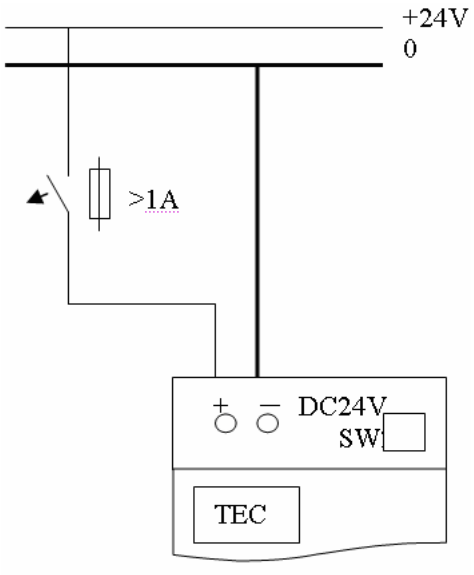
⑥: Error, state LED light

⑦: RS 485 port

⑧: SW1, 8-bit switch (set format of communication)

Connect with electrical source

SG2-MBUS uses 24V DC provide for oneself



Communication set

The SG2-MBUS communication baud rate and format can be set by 8 bits switch (DIP) SW1.

Baud rate

SW1-3~SW1-1 set communication baud rate is 57.6K, 38.4K, 19.2K, 9.6K, 4.8K as shown below.

SW1-6	SW1-3	SW1-2	SW1-1	Baud rate (Kbps)
OFF	OFF	OFF	OFF	4.8
OFF	OFF	OFF	ON	9.6
OFF	OFF	ON	OFF	19.2
OFF	OFF	ON	ON	38.4
OFF	ON	*	*	57.6
ON	*	*	*	38.4

※ *can be ON or OFF

Verifying bit and stop bit set

SW1-4, sets stop bit and verifying bit

SW1-5, sets verifying format (SW1-4＝1 availability)

SW1-6, assembled set

SW1-7～SW1-8, reserved

More information as shown below:

SW1-8	SW1-7	SW1-6	SW1-5	SW1-4	Stop bit, verifying bit, assembled set
*	*	OFF	*	OFF	2 stop bits, no verifying bit
*	*	OFF	OFF	ON	1 stop bit, 1 odd verifying bit
*	*	OFF	ON	ON	1 stop bit, 1 even verifying bit
*	*	ON	*	*	SW1-1 ～ SW1-5 are inefficacy, communication format is default as 38.4Kbps, 2 stop bits, no verifying bit

※ * can be ON or OFF

State indication and unconventionality manage

Error code	State indication	Error type and reason	Manage method	remark
56H	The error LED light flick slow (2Hz)	The connection between SG2 and COMM. Mode is improper	check-up connection among SG2, IO mode and COMM. Mode	The question is connection with the mode before it if there are many expansion modes.
55H	The error LED light is ON	SG2 set error: IO number set is different from factual.	check-up SG2 set	
51H、54H	The error LED light flick slow (2Hz)	ModBus order error: data frames, function code, address of register, CRC , data unseemliness, verifying error, etc.	check-up the order and communication set according COMM. protocol	
59H	The error LED light flick quickly(5Hz)	COMM. data error: Verifying bit error, Length of data respond error, CRC error	Make sure the connection between SG2 and COMM. Mode is credible, describe environment interfere.	

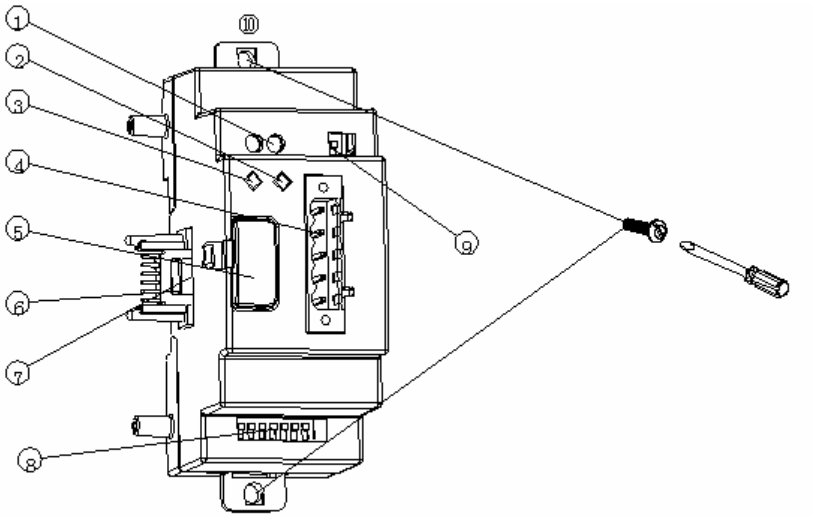
※ More information to see SG2-MBUS user manual.

DeviceNet COMM. Module

Summarize

SG2-DNET makes SG2, which doesn't have the ability of DeviceNet, to work in DeviceNet network. At DeviceNet side, SG2-DNET is a GROUP 2 ONLY equipment, slave equipment in this network. At PLC side, SG2-DNET communicate with SG2 through SG2 COMM. Port, it is point-to-point communication equipment.
SG2-DNET is together with SG2 as one slave equipment in DeviceNet network.

SG2-DNET Cell Configuration

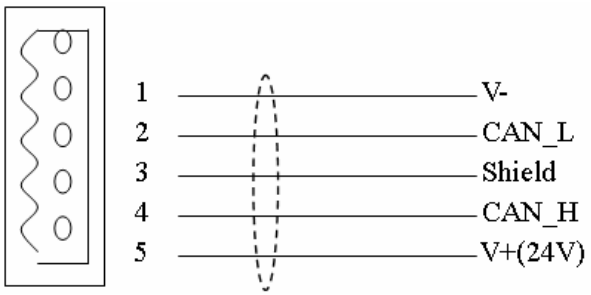


①: 24V DC power supply port
②: Network state LED light NS
③: Mode state LED light MS
④: 5-pin DeviceNet port
⑤: Button
⑥: Linker
⑦: Port connection with SG2
⑧: SW1, 8-bit switch (set network's ID and baud rate)
⑨: SW2, 2-bit switch (network terminal resistance selection)
⑩: Flexed installation feet

Connect with DeviceNet network

Using 5-pin network tie-in connect SG2-DNET to DeviceNet bus. Please use network tie-in and cable ordained by ODVA. The style of cable decides the maximal length of cable and baud rate of communication at more degree.

Ports assign



1 GND	black
2 CAN_L	blue
3 Shield	no color
4 CAN_H	white
5 24V	red

Address and COMM. Baud rate set

In equipment network, each slave node needs a difference MAC ID, and the maximal number of ID is 64 (0~63). The address of node can be set by SW1-1~SW1-6 of SG2-DNET oneself mode. And the baud rate of communication can be set by SW1-7 and SW1-8, the baud rate set must be the same as equipment network.

SW1 setting

ID in network	SW1_6~SW1_1	000000	ID: 0
		000001	ID: 1
		……	……
		111110	ID: 62
		111111	ID: 63
Baud rate	SW1_8~SW1_7	00	Baud rate: 125K
		01	Baud rate: 250K
		10	Baud rate: 500K
		11	standby (default baud rate: 125K)

LED state display

SG2-DNET has two LED lights, watching itself and COMM. Bus' state.

1) mode state LED (MS)

Double color LED (green and red) indicates SG2-DNET state.

Module status LED	Explanation	Correct or prevent fault
Off	No power	Power up
Green on	Normal operation status	No
Green flash	No connected with SG2 basic unit	Connected with SG2 correctly.
Red flash	Connect with SG2 but communication error.	Set SG2 IO number correctly.
Red on	Device hardware error.	Use a new module.

2) network state LED (NS)

Double color LED (green and red) indicates equipment network bus state.

Net status LED	Explanation	Correct or prevent fault
Off	·No power. ·The device is a single node in the net.	Power up. Add other device in the net.
Green on	Normal operation mode, and connected with master.	No
Green flash	Normal operation mode, but not connected with master or had be set free	No
Red flash	IO connection time out, waiting green flash after a few seconds.	No
Red on	·Dup_mac_id check error ·Communication error and restart	Replace node address and power up again.

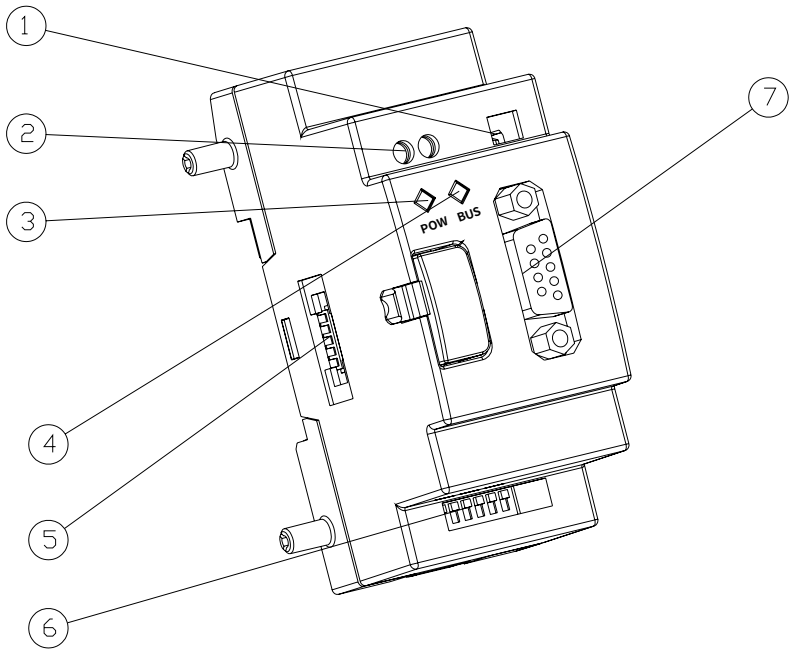
※ More information to see SG2-DNET user manual.

ProfiBus

Summarize

SG2-PBUS makes SG2, which can't work in ProfiBus DP network, to work in ProfiBus DP network. At ProfiBus DP side, SG2-PBUS mode is a gateway, a slave node in network. At PLC side, SG2-PBUS communicate with SG2 through SG2 COMM. Port, it is point-to-point communication equipment.
SG2-PBUS is together with SG2 as one slave equipment in ProfiBus DP network.

SG2-PBUS Cell Configuration

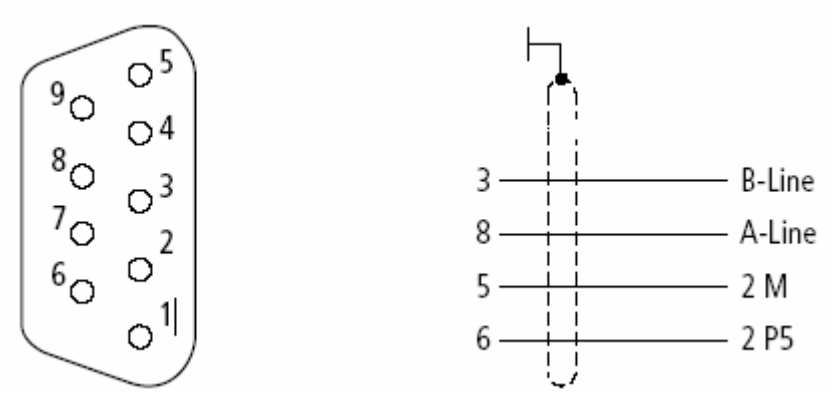


①: 2-bit switch (terminal resistance selection)
②: 24V DC power supply port
③: Power indicate light
④: BUS indicate light
⑤: Port connection with SG2
⑥: 8-bit switch (slave node ID set)
⑦: 9-hole PROFIBUS DP socket

Connection with Profibus Net

Using 9-hole pin to connect with PROFIBUS DP bus, please use the regulated pin and cable.

Ports assign



NO.	name	description
1	reserved	
2	reserved	
3	RxD/TxD-P (B- Line)	Send/receive data (positive)
4	reserved	
5	DGND (2M)	Digital GND
6	VP(2 P5)	+5V DC (supply bus expansion)
7	reserved	
8	RxD/TxD-N (A-Line)	Send/receive data (negative)
9	reserved	

Baud rate adapt oneself and address set

After SG2-PBUS mode powers up, it can identify the baud rate on Profibus automatically when at least one master sends right message. The baud rate range is: 9.6Kbit/s ~6Mbit/s. In equipment network, each slave node has a difference ID, and the maximal number of ID is 127 (0~126). Its ID can be set by 8-bit switch integration on itself.

SW_7	SW-6	SW-5	SW-4	SW-3	SW-2	SW-1	ID
OFF	OFF	OFF	OFF	OFF	OFF	OFF	0
OFF	OFF	OFF	OFF	OFF	OFF	ON	1
OFF	OFF	OFF	OFF	OFF	ON	OFF	2
OFF	OFF	OFF	OFF	OFF	ON	ON	3
OFF	OFF	OFF	OFF	ON	OFF	OFF	4
----	----	----	----	----	----	----	----
ON	ON	ON	ON	ON	OFF	ON	125
ON	ON	ON	ON	ON	ON	OFF	126

※ The eighth bit is reserved.

LED state display

SG2-PBUS mode has two number of double color LED (green and red) used for fast diagnostics, to indicate the state of COMM. Bus and itself.

1) power LED

State of LED	Description
Green ON	natural
Yellow (red and green) flash (4Hz)	Hardware error
Yellow (red and green) flash (2Hz)	IO number error
Red flash (2Hz)	Connection with SG2 error
Red flash (1Hz)	Read/write order COMM. With Network bus error
OFF	Power down

2) BUS LED

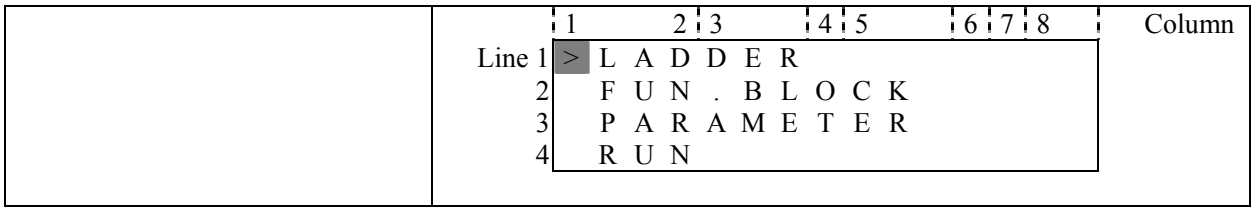
State of LED	Description
Green ON	Connect with DP Net and communication right
OFF	Not connect with DP Net

※ More information to see SG2-PBUS user manual.

Appendix: Keypad Programming

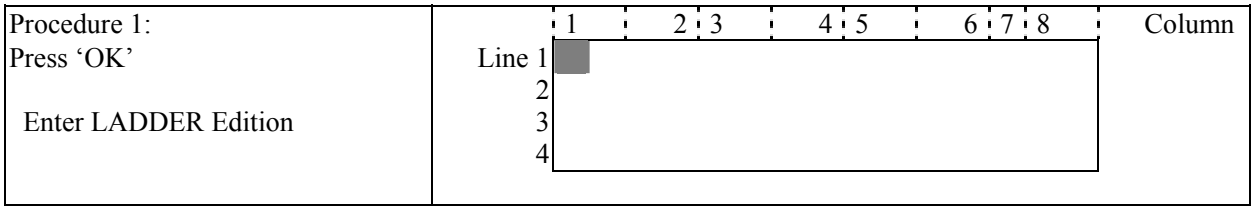
Appendix A: Keypad programming in Ladder mode

Operation Sample:



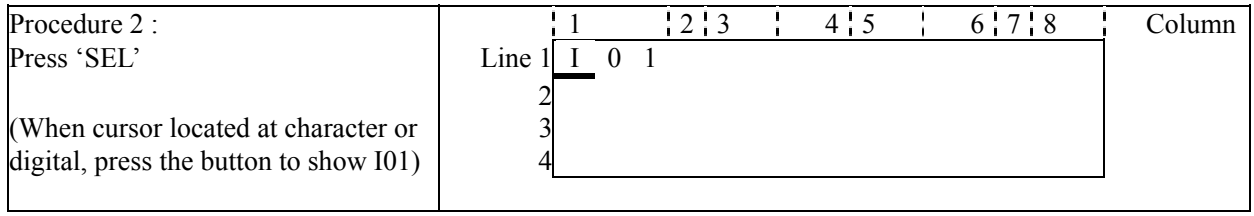
Procedure 1:
Press 'OK'

Enter LADDER Edition



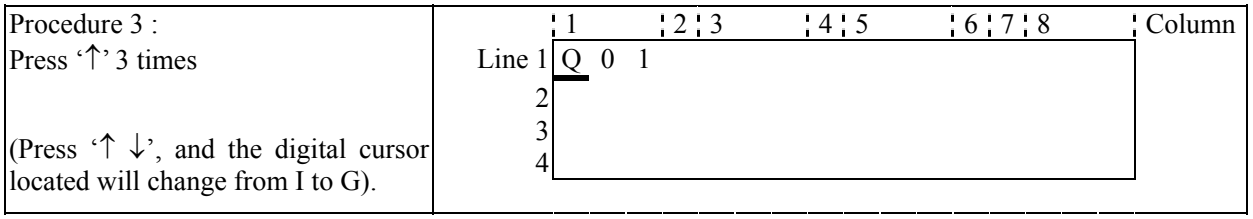
Procedure 2 :
Press 'SEL'

(When cursor located at character or digital, press the button to show I01)



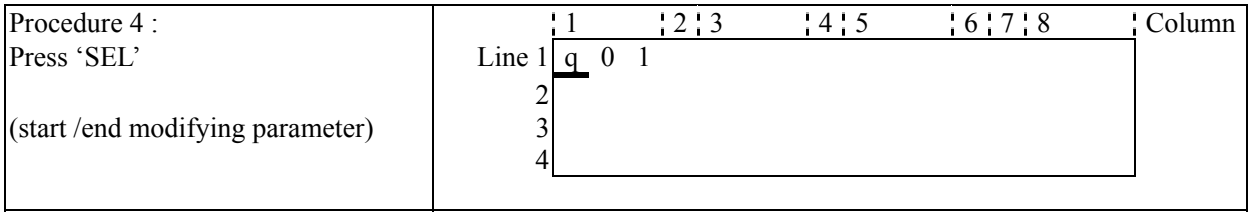
Procedure 3 :
Press '↑' 3 times

(Press '↑ ↓', and the digital cursor located will change from I to G).



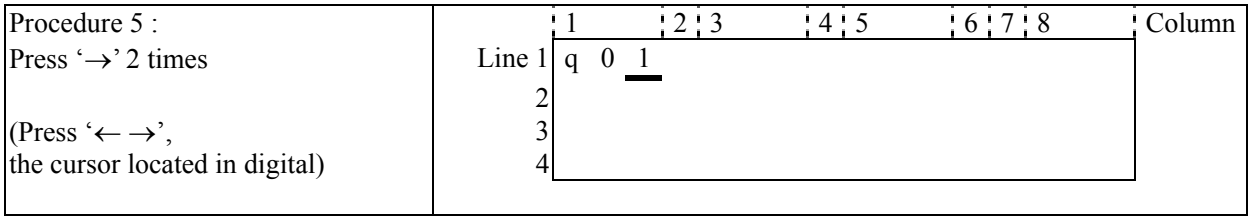
Procedure 4 :
Press 'SEL'

(start /end modifying parameter)



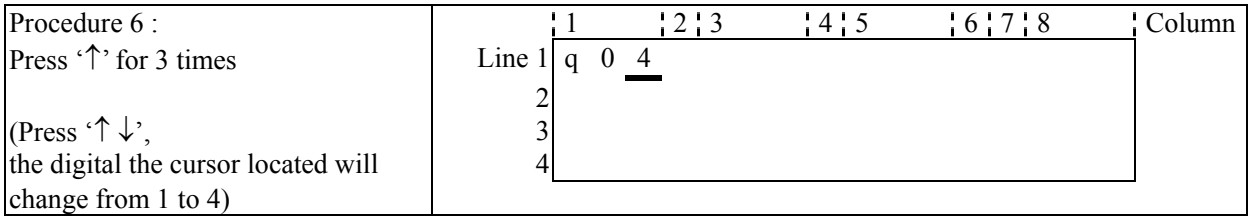
Procedure 5 :
Press '→' 2 times

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



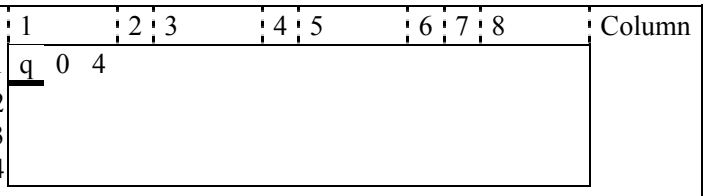
Procedure 6 :
Press '↑' for 3 times

(Press '↑ ↓',
the digital the cursor located will change from 1 to 4)



Procedure 7 :
Press '←' 2 times

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

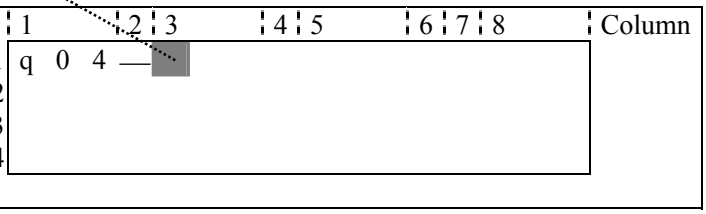


OR

Automatically Link

Procedure 7 :
Press 'OK'

(Move the cursor to character in
column 3)

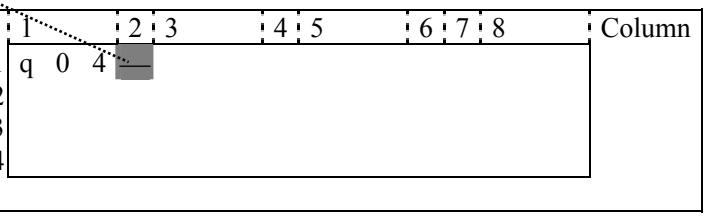


OR

Automatically Link

Procedure 7 :
Press '→'

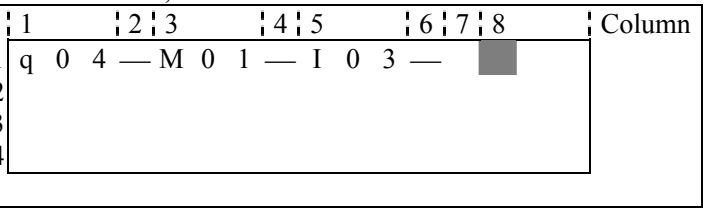
(move the cursor to the link location
in column 2)



Repeat the step1~7, and input M01, I03 Instruction to column 3, 5.

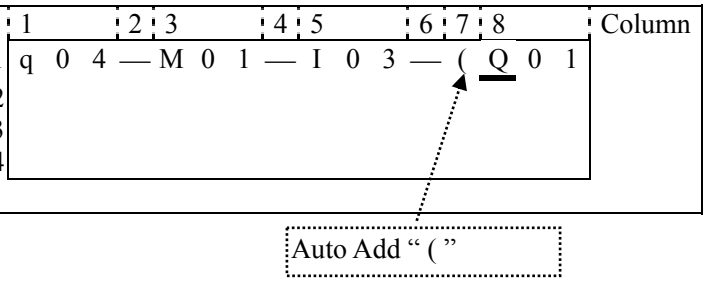
Procedure 8 :
Press 'OK' in Column 5

(move the cursor to the character in
column 8)



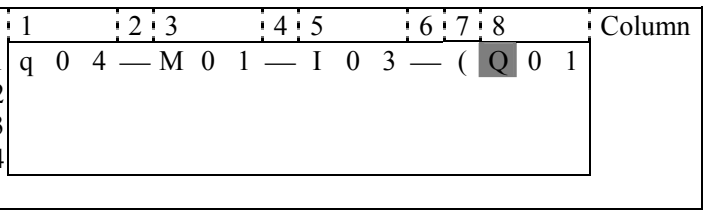
Procedure 9 :
Press 'SEL'

(when the cursor located at character
and digital, press 'SEL' to show
' (Q01'



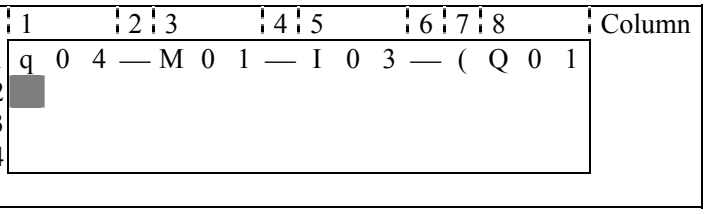
Procedure 10 :
Press 'OK'

Save the input program data, the
position of the cursor will not move.



Procedure 11 :
Press '→' 3 times

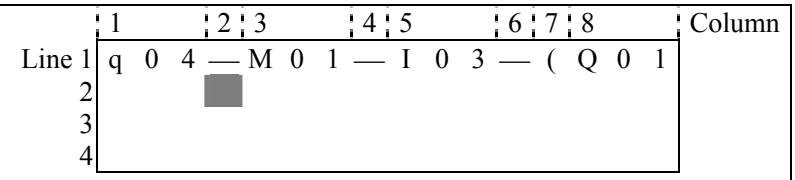
(Move the cursor to column 1 and
Line 2.)

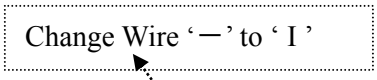


Procedure 12 :
Press '→' 3 times

(move the cursor to column 2)

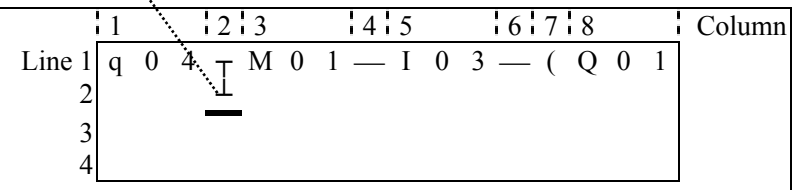
Note: never press 'SEL' before hand





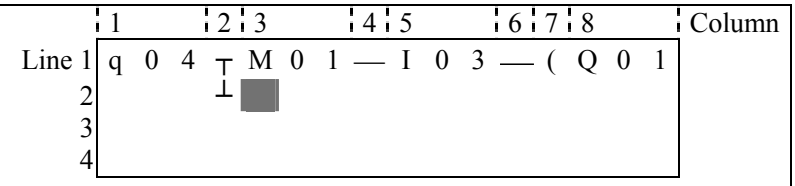
Procedure 13 :
Press 'SEL'

(A vertical line emerges)



Procedure 14 :
Press 'OK'

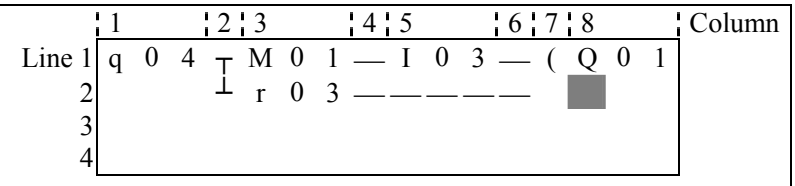
(Move the cursor to character in column 3.)



Repeat the step 1~7 and key in 'r0 3' , ' —' at Line 2 and column 3~6.

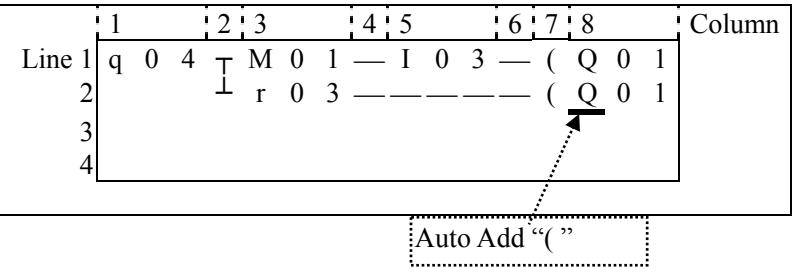
Procedure 15 :
Press 'OK' in column 5

(move the cursor to the character in Column 8)



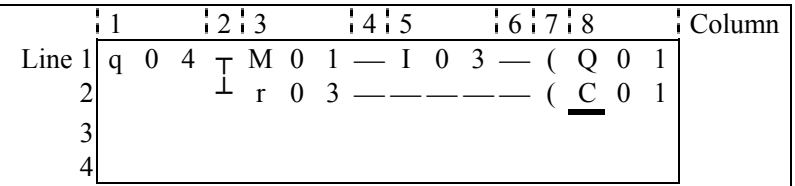
Procedure 16 :
Press 'SEL'

(When the cursor located in digital or character, press 'SEL', 'Q01' will emerges)

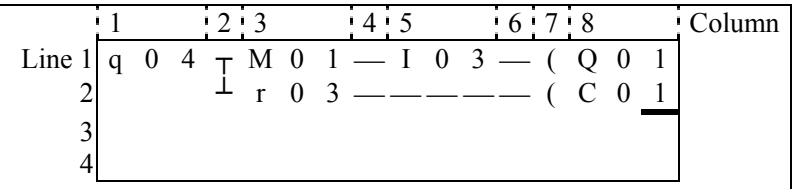


Procedure 17 :
Press '↑' for 5 times

(Press 'SEL' + '↑ ↓'
(The character Q the cursor locating will change to C.)

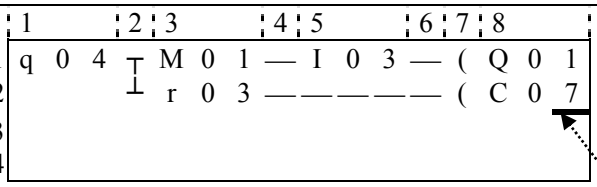


Procedure 18 :
Press '→' 2 times



Procedure 19 :
Press '↑' for 6 times

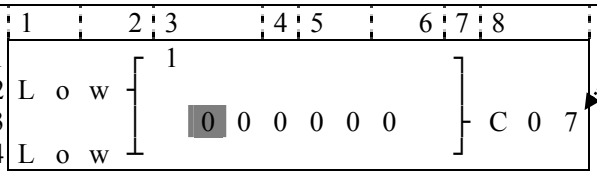
(The digital 1 the cursor locating will change to 7)



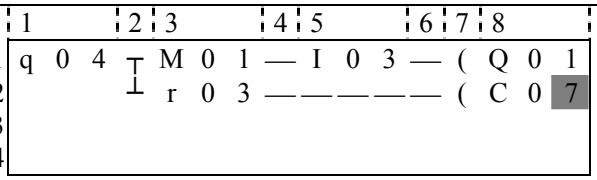
Auto Enter Function Block Edition

Procedure 20 :
Press 'OK'

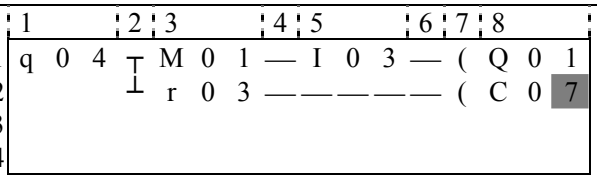
(Auto shift to FUNCTION BLOCK and the counter input parameter)



Procedure 21 :
Press 'ESC' back to LADDER edition screen

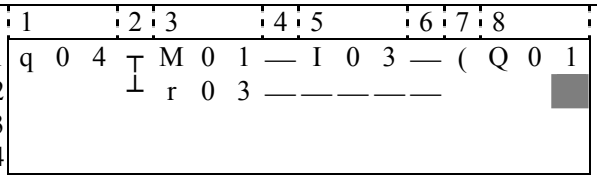


Delete the Program Element



Procedure :
Press 'DEL'

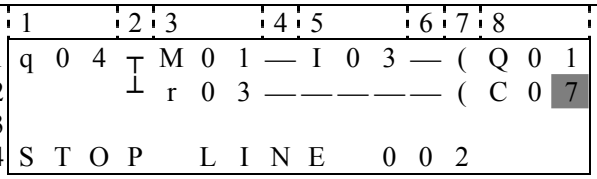
(to delete the element C07 the cursor locating)



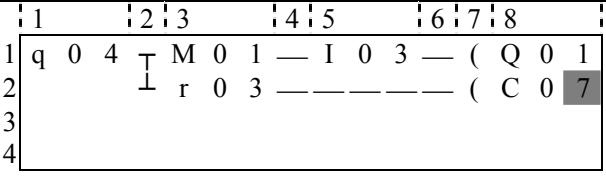
Display the present Line the cursor locating and operation state of SG2.

Procedure :
Press 'SEL+ESC' (simultaneously)

(The Line 4 displays where the cursor locating and operation state of SG2)

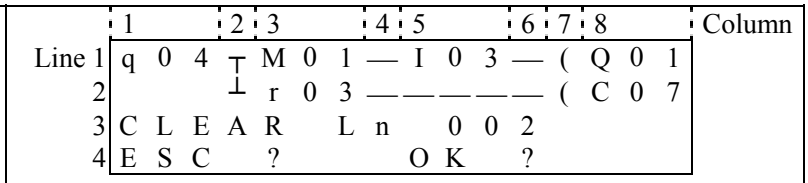


Delete the whole Line

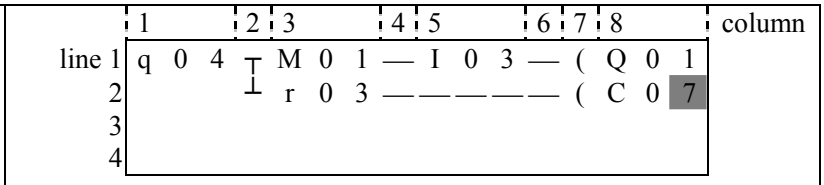


Procedure :
Press 'SEL+DEL' (Simultaneously)

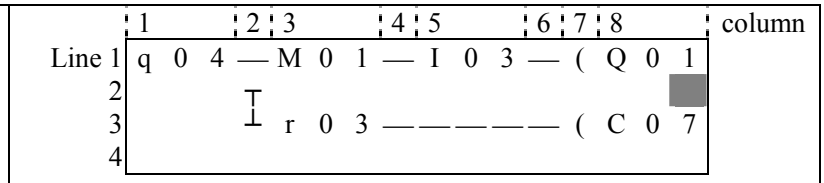
('ESC' Cancel , 'OK' Execute)



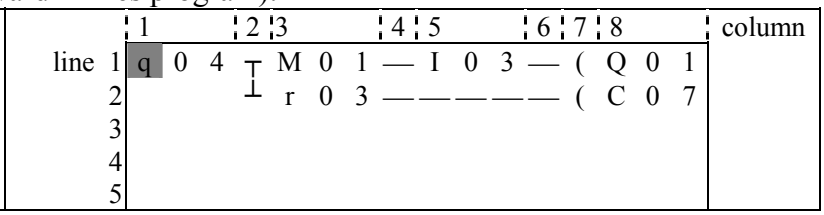
Insert a whole line.



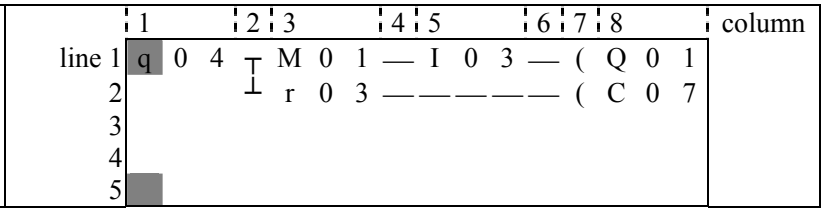
Step:
Press"SEL+OK" (at the same time)



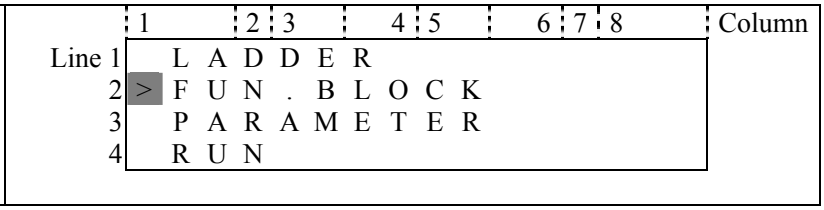
Turn page (move upward/ downward 4 lines program):



Step:
Press 'SEL+↑/↓'
(at the same time)



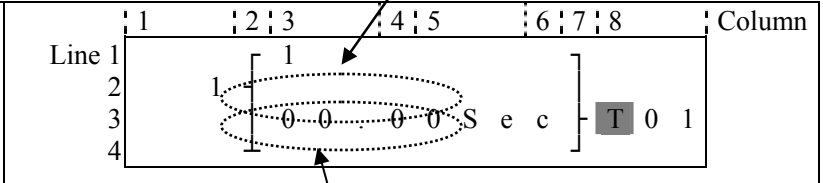
Appendix B: Keypad programming in Ladder FUNCTION BLOCK



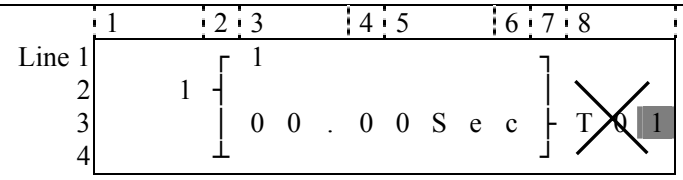
Present action area
The present value will appear when SG2 is under 'RUN' mode.

Procedure 1:
Press 'OK'

(Enter FUNCTION BLOCK edition)

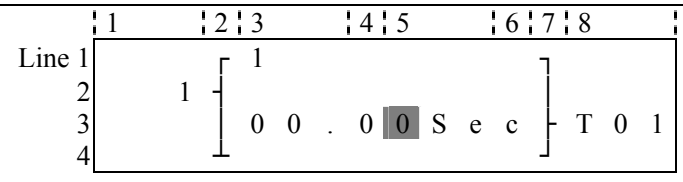


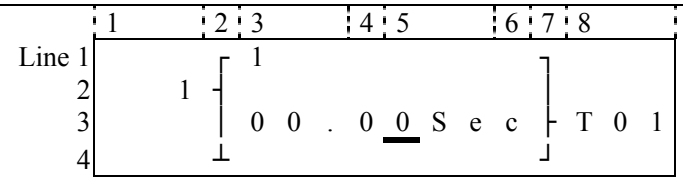
Preset action value area

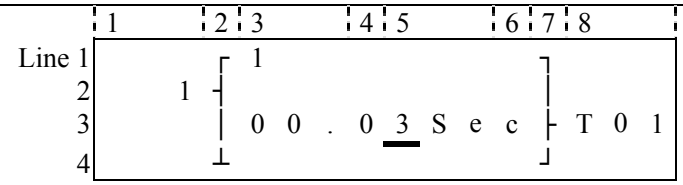
Never press '→' to move to the digital position. (If T02 is required to be changed, Press '↑'/'↓' and 'SEL' to execute.)	

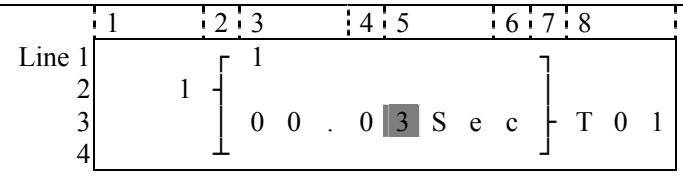
Step 2: modify ①present target value ②preset the action relay

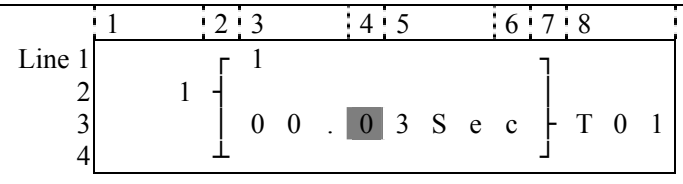
Preset the target value

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

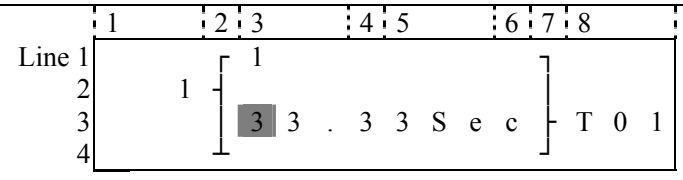
Procedure 2-2: Press 'SEL' (begin input the target value)	

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

Procedure 2-4: Press 'OK' (Save the input data)	

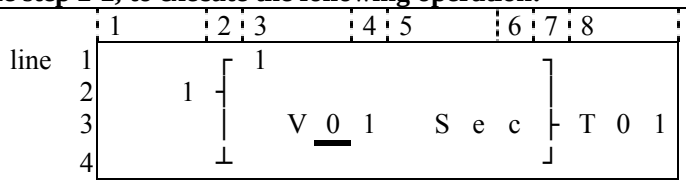
Procedure 2-5: Press '←'	

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

Procedure 2-6:	

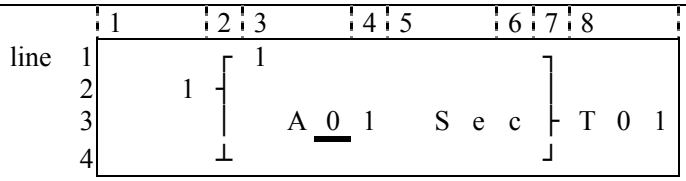
As the present value of the timer, counter, analog input (A01-A08) and analog gain value (V01-V08) is set as the preset value of them. Next to the step 2-2, to execute the following operation:

Step2-3A:
Press 'SEL'

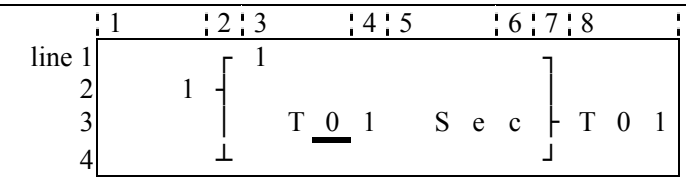


Repeat the step 2-3A, the following screen will be shown in turn:

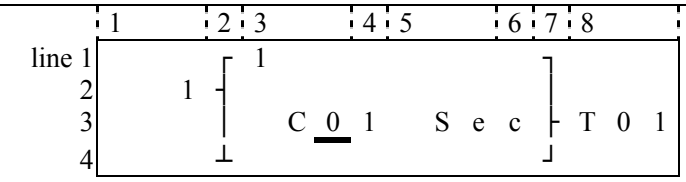
Step2-3B:
Press 'SEL'



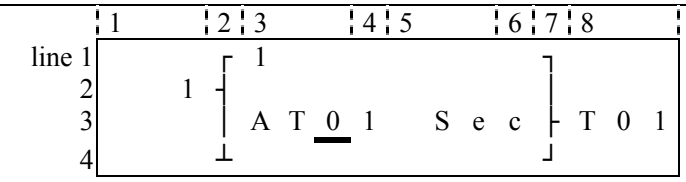
Step 2-3C:
press 'SEL'



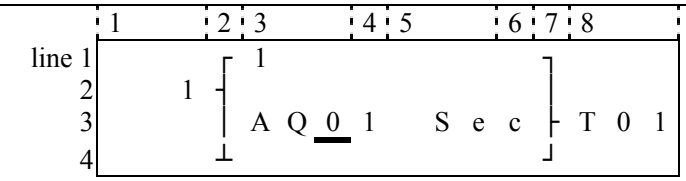
Step 2-3D:
Press 'SEL'



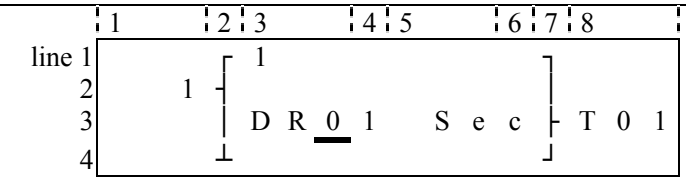
Step 2-3E:
Press 'SEL'



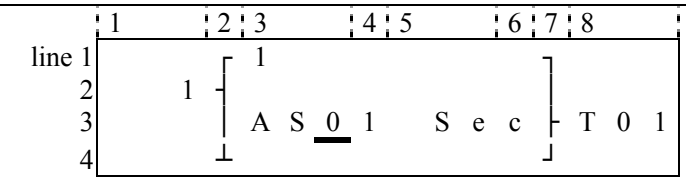
Step 2-3F:
Press 'SEL'

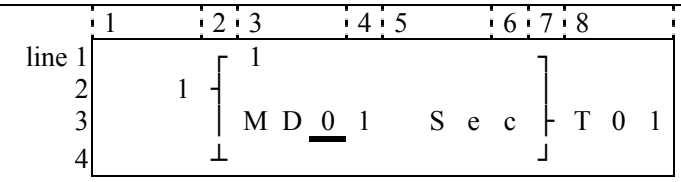
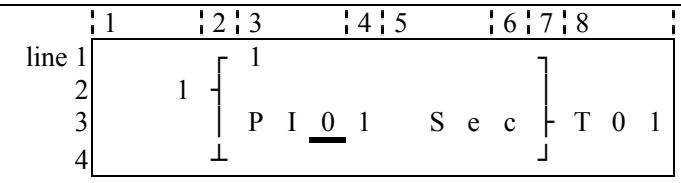
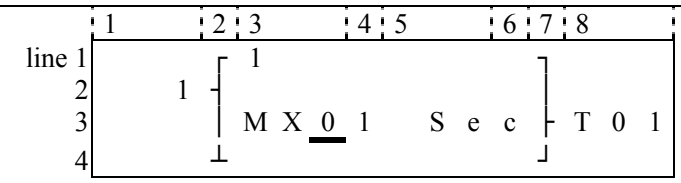
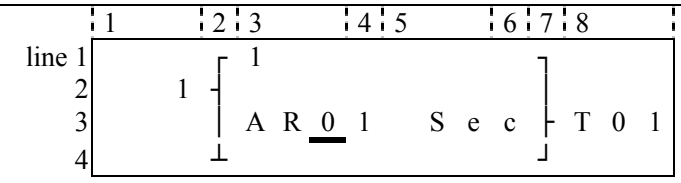


Step 2-3G:
Press 'SEL'

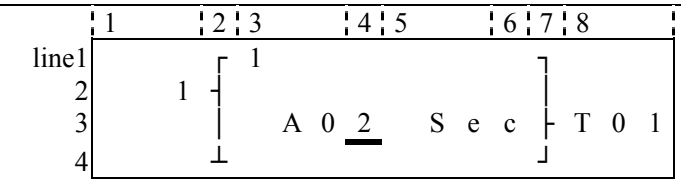


Step 2-3H:
Press 'SEL'

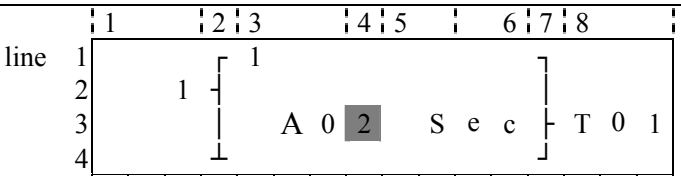


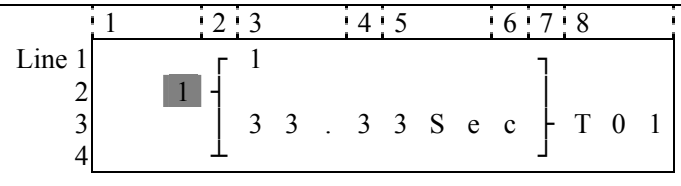
Step 2-3I: Press 'SEL'	
Step 2-3J: Press 'SEL'	
Step 2-3K: Press 'SEL'	
Step 2-3L: Press 'SEL'	

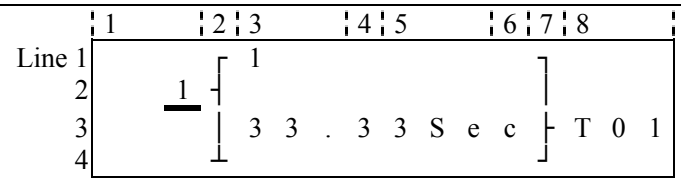
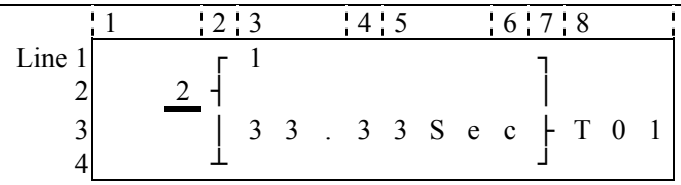
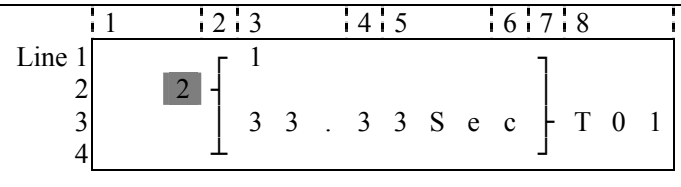
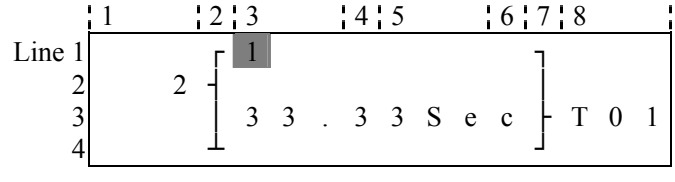
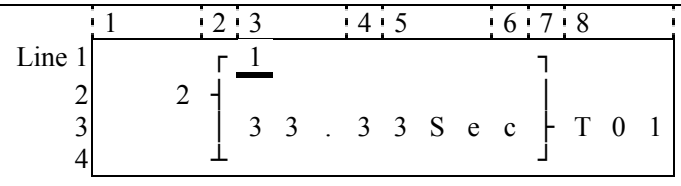
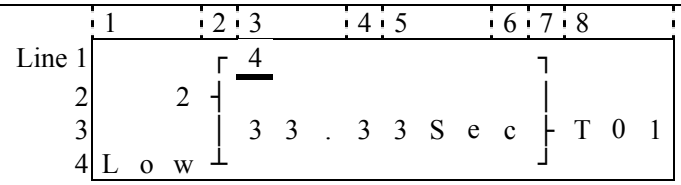
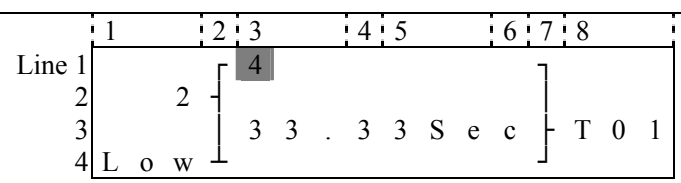
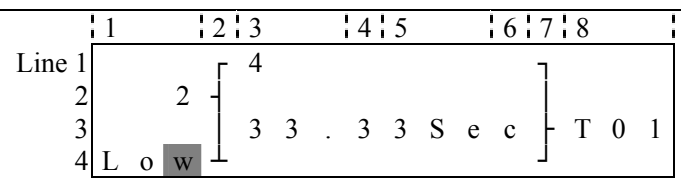
Next to step 2-3B, the following screen will be shown.

step 2-4B: Press '→', press '↑'	

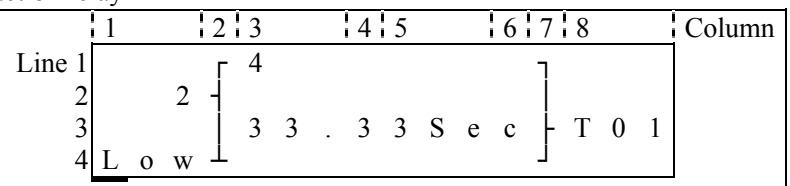
Repeat step2-4B (press '↓' is also available), the preset value of A01-A08 will be periodically changed. And so on. 'Analog*gain + offset' value (V01-V08) and the other function blocks (time, counter…) present value is set as preset value, to repeat the step to select T01-T1F, C01-C1F, V01-V08.

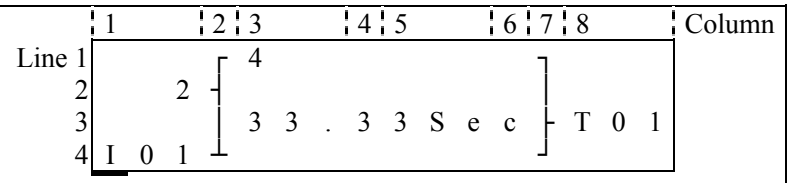
step 2-5B: press 'OK' Save the present data.	

Procedure 2-7: Press '↑'	

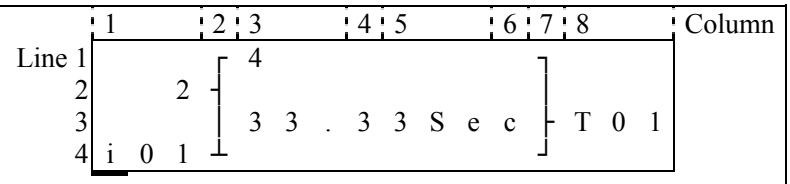
Procedure 2-8: Press 'SEL' (begin to edit data)	
Procedure 2-9: Press '↑' (Press 'SEL' + ' ↑/↓' to change '1' to ' 2')	
Procedure 2-10: Press 'OK' (save the input data)	
Procedure 2-11: Press '↑' (move the cursor to '1" position)	
Procedure 2-12: Press 'SEL' (begin to edit data)	
2-13: Press '↑' for 3 times (Press 'SEL' and followed by '↑ ↓' to change 1 to 4)	
Procedure 2-14: Press 'OK' (save input data)	
Procedure 2-15: Press '↓' for 3 times (this step leads to editing the action relay)	

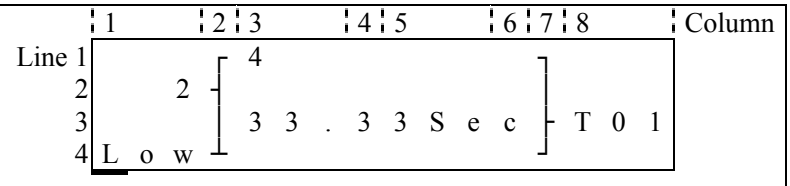
② Edit action program and preset the action relay

Procedure 2-16: Press "→" 2 times, Press 'SEL' (Begin to modify)	

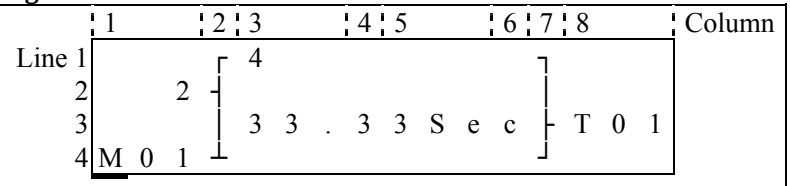
Procedure 2-16A: Press 'SEL' (Begin to modify)	

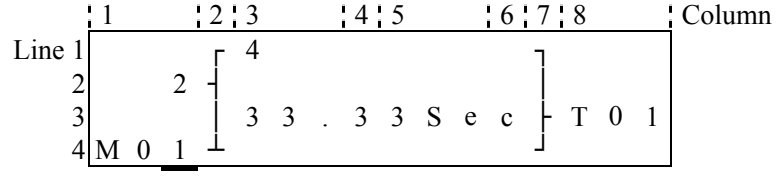
Repeat the step 2-16A, the following screen will be shown in turn:

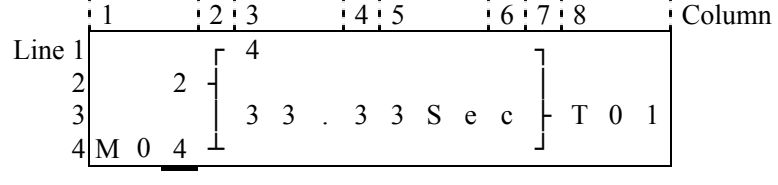
Procedure 2-16B: Press 'SEL'	

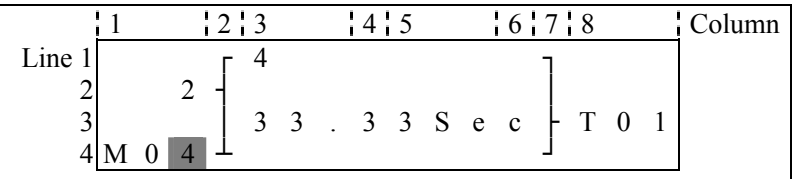
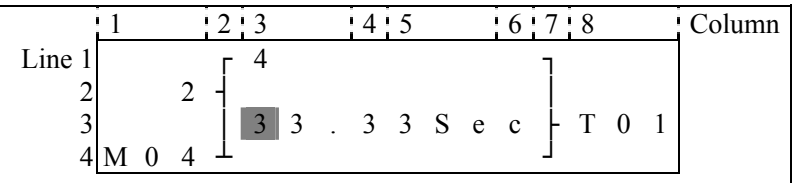
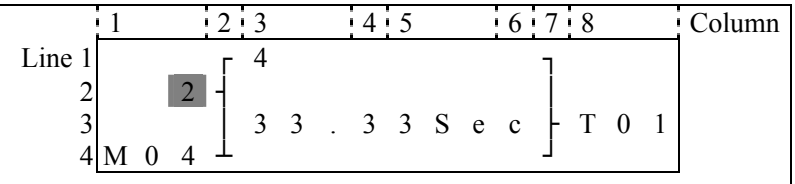
Procedure 2-16C: Press 'SEL'	

Next to step 2-16A, then '↑', the following screen will be shown.

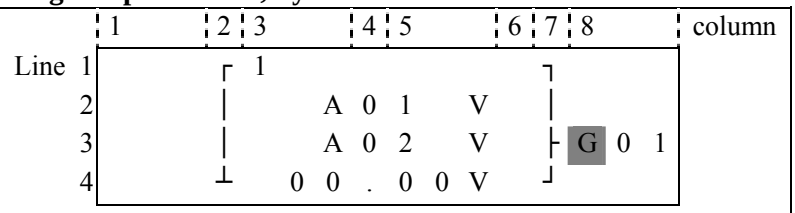
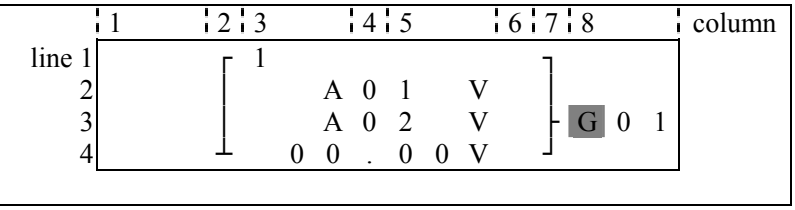
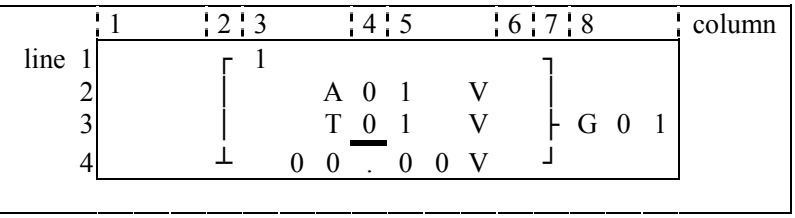
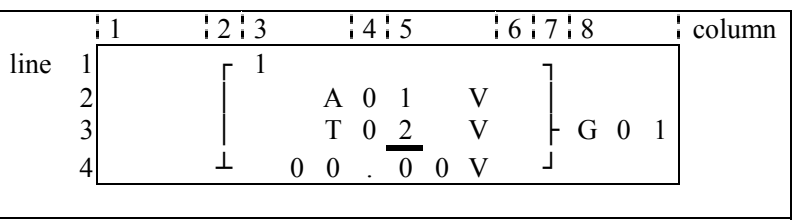
Procedure 2-17: Press '↑' for 5 times (Press 'SEL' + '↑ /↓' to change I to M)	

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

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

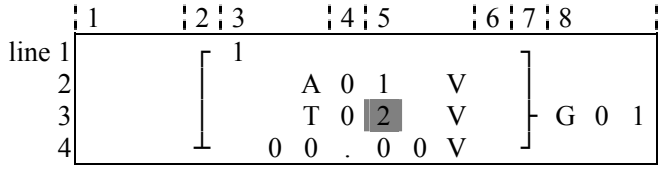
Procedure 2-20: Press 'OK' (save the input data)	
Procedure 2-21: Press '↑' (Move the cursor to preset action value area to repeat the step 2-1)	
Procedure 2-22: Press '↑' (Move the cursor to position '2' to repeat the 2-8)	

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

	
step 2-23: Press '←', press 'SEL' (press '↑ ↓',Select A01-A08)	
Step 2-24: Press '←', Press 'SEL' (press 'SEL' Select A02 – T01 – C01–AT01–AQ01–DR01–AS01–MD01–PI01–MX01–AR01–00.00–V01–A01)	
Step 2-25: Press '→', press '↑' (Select T01~T1F, C01~C1F, A01~A08, V01~V08…)	

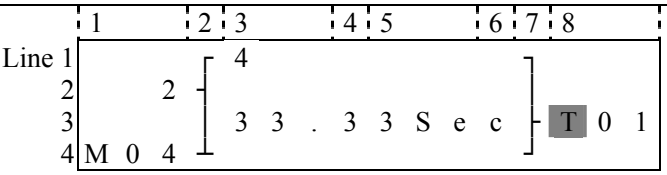
Step 2-26:
Press 'OK'

Save the present data

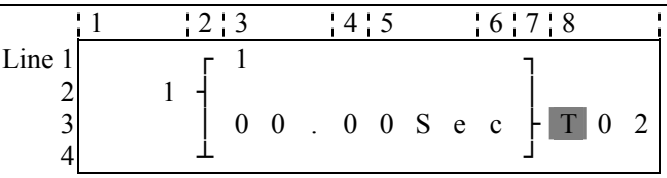


Continue to input Function Block

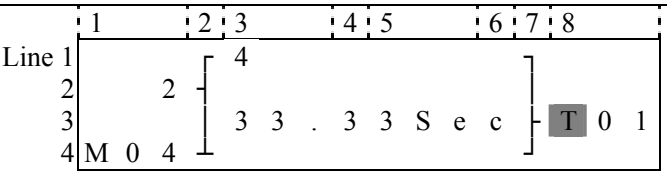
Next Function Block



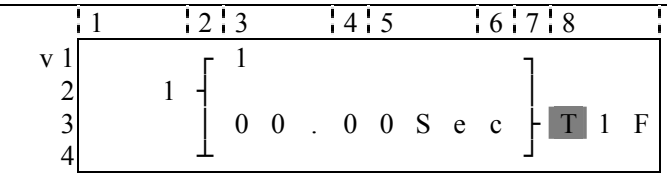
Procedure 1:
Press 'SEL+↑' (Simultaneously)



Last Function Block



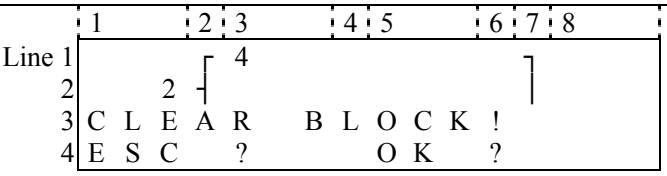
Procedure :
Press 'SEL+↓' (Simultaneously)



Delete Function Block

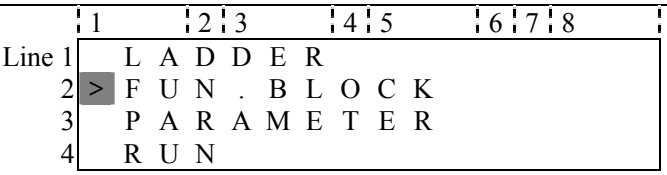
Procedure:
Press 'SEL+DEL' (Simultaneously)

('ESC': Cancel ;
'OK': Execute)

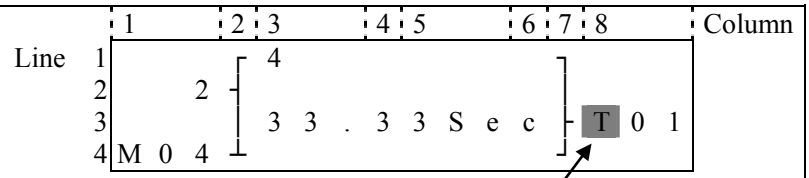


Back to Main Menu:

Press 'ESC'

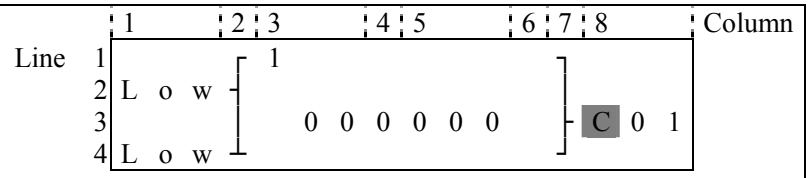


Change Function Block Category:

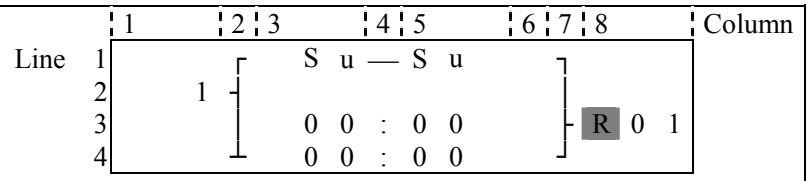


Move the cursor to change to T, C, R, G, H, L, P, S, AS, MD, PI, MX, AR

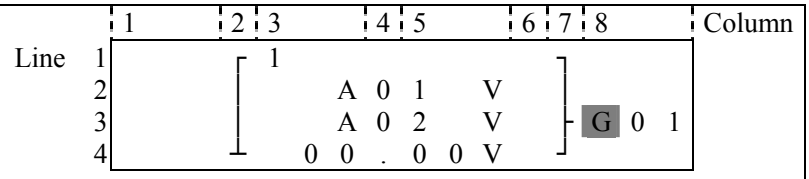
Step 1:
Press 'SEL'



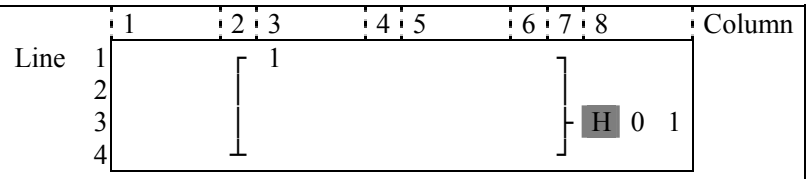
Step 2:
Press 'SEL'



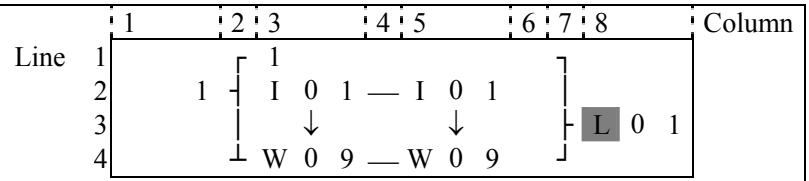
Step3:
Press 'SEL'



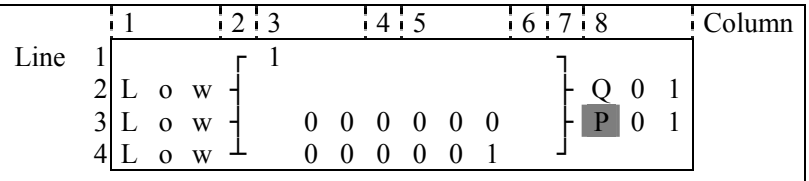
Step4:
Press 'SEL'



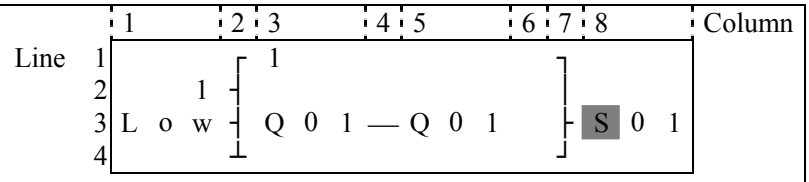
Step5:
Press 'SEL'



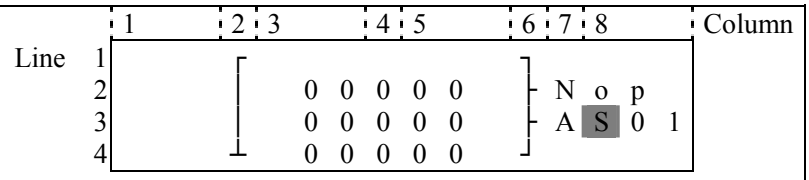
Step 6:
Press 'SEL'



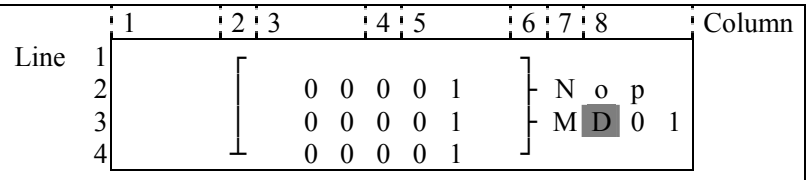
Step7:
Press 'SEL'



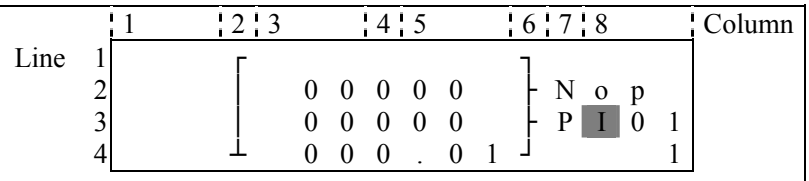
Step 8:
Press 'SEL'



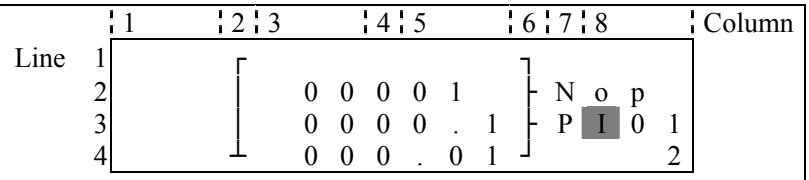
Step 9:
Press 'SEL'



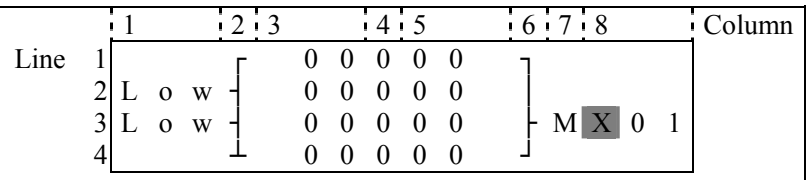
Step 10-A:
Press 'SEL'



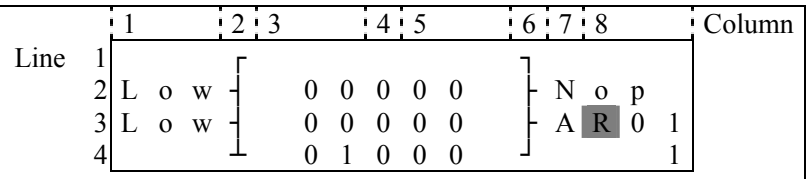
Step 10-B:
Press 'SEL + →'



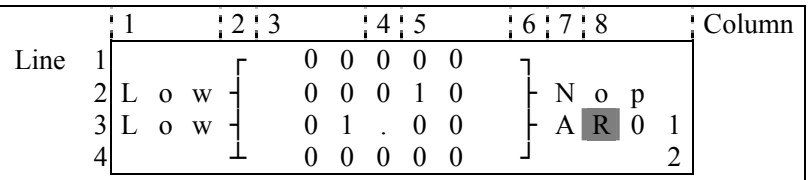
Step 11:
Press 'SEL'



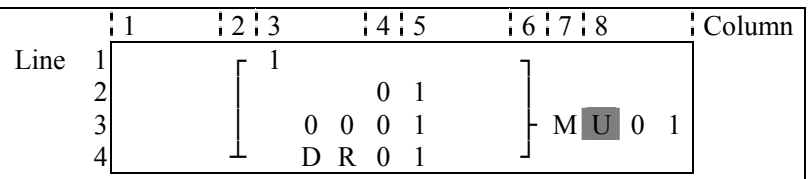
Step 12-A:
Press 'SEL'



Step 12-B:
Press 'SEL + →'



Step 13:
Press 'SEL'



SG2 Smart PLC USER Manual

SG2 Programmable Logic Smart Relay

4KA72X023 Version: 03 2009.07.03

0086-0510-8522-7555

Apply to: SG2 firmware version 3.0,

PC client program software version 3.0