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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

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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)			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)	NO	NO	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 260(B001~B260)The capability of each block is alterable, and the total capability of block is 6000bytes	NO 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

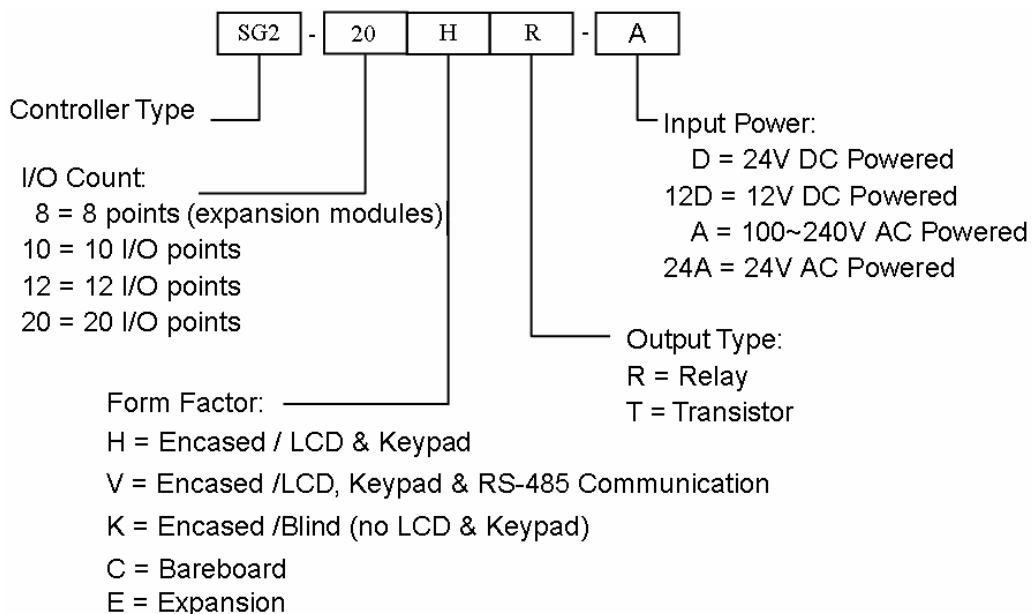
The installation site of the SG2 smart relay is very important. It relates directly to the functionality and the life span of your SG2. Please carefully choose an installation site that meets the following requirements:

- 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

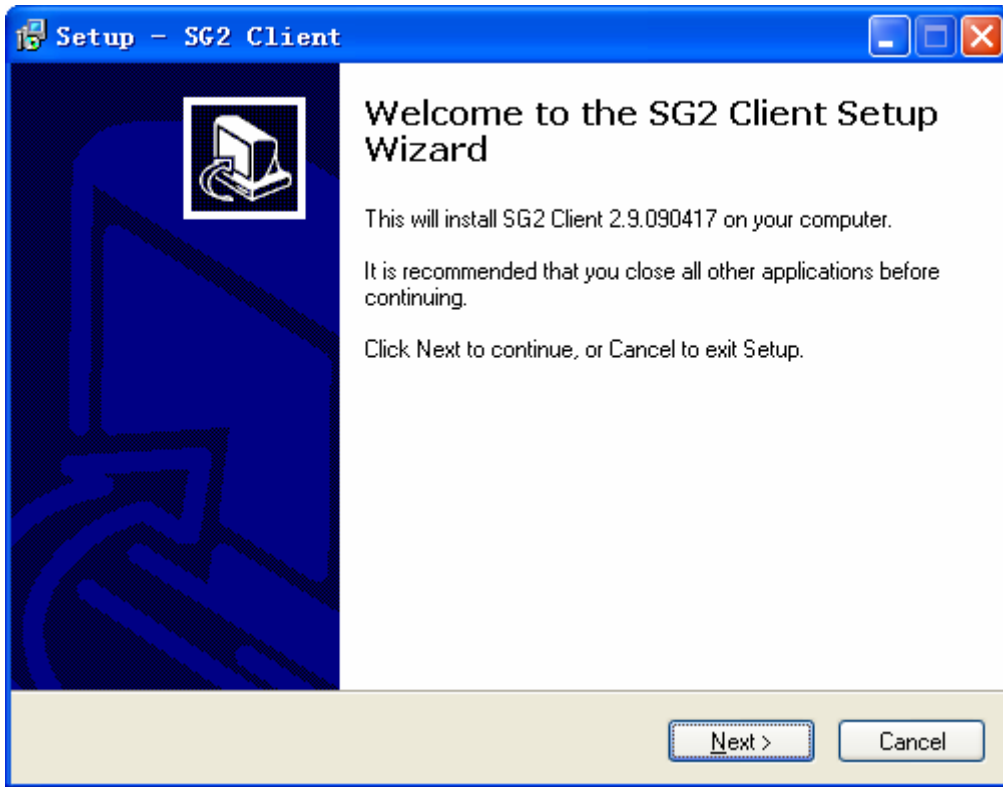


Quick Start Setup

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.

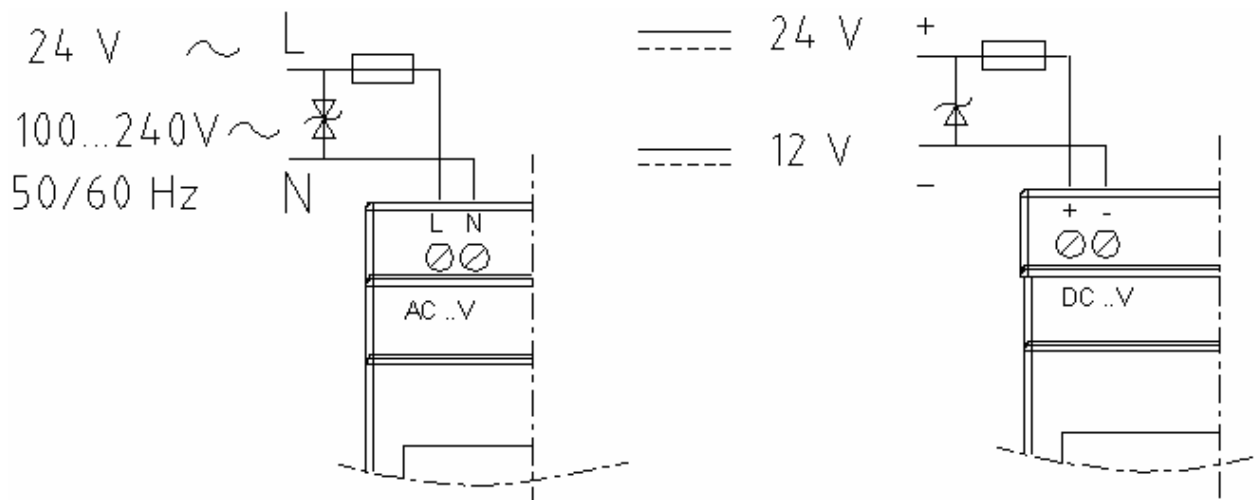
Install SG2 Client Software

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



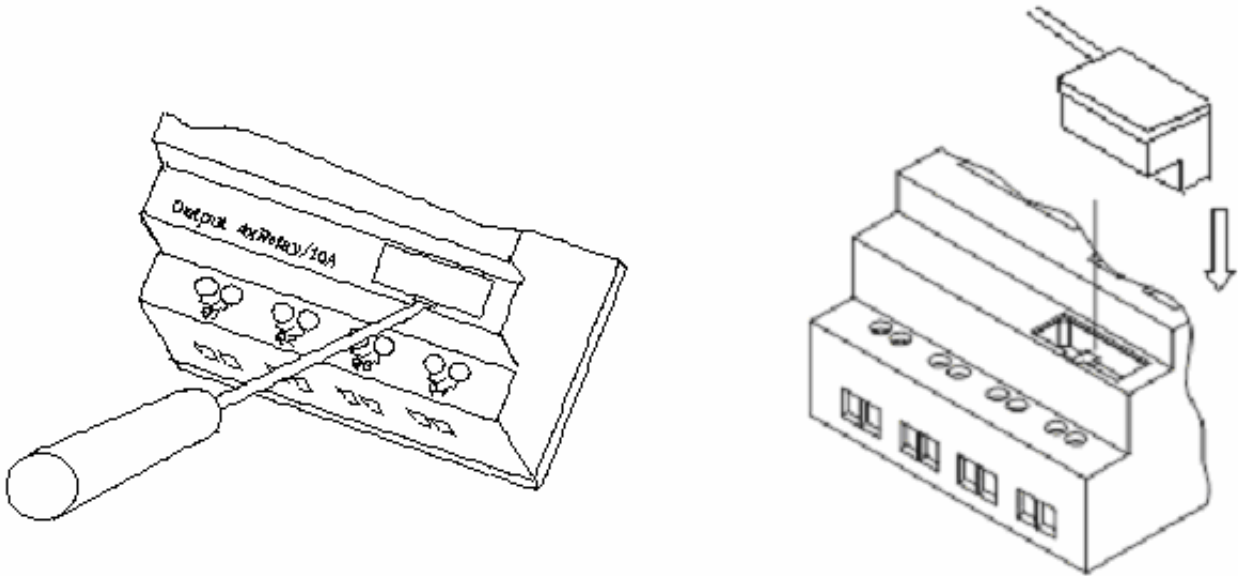
Connect Power to SG2 smart relay

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.



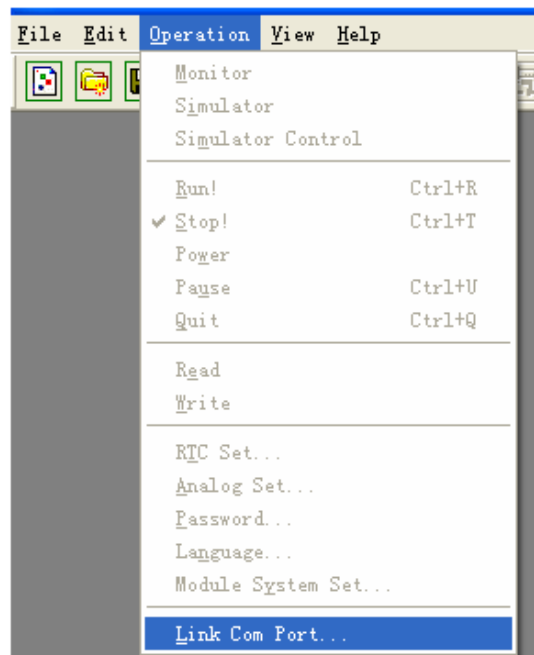
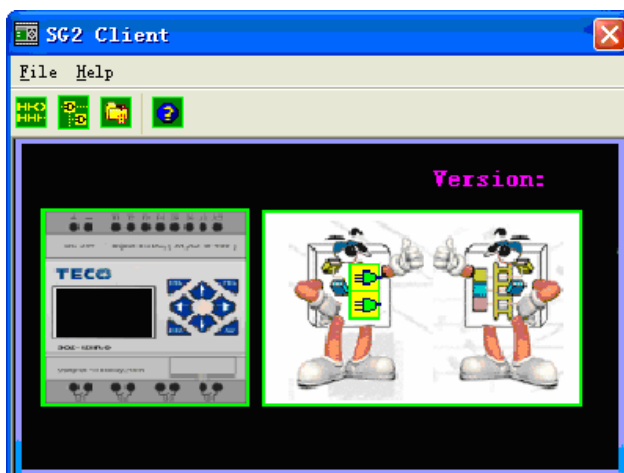
Connect Programming Cable

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.

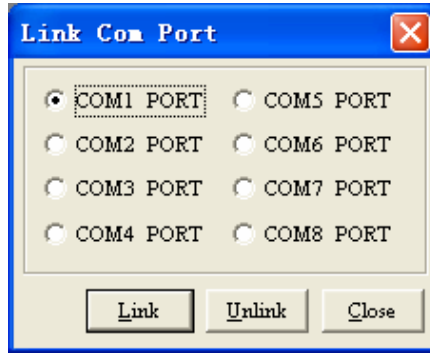


Establish Communication

- Open the SG2 Client software and select “New Ladder Document” as shown below left.
- Select “Operation/Link Com Port...” as shown below right.



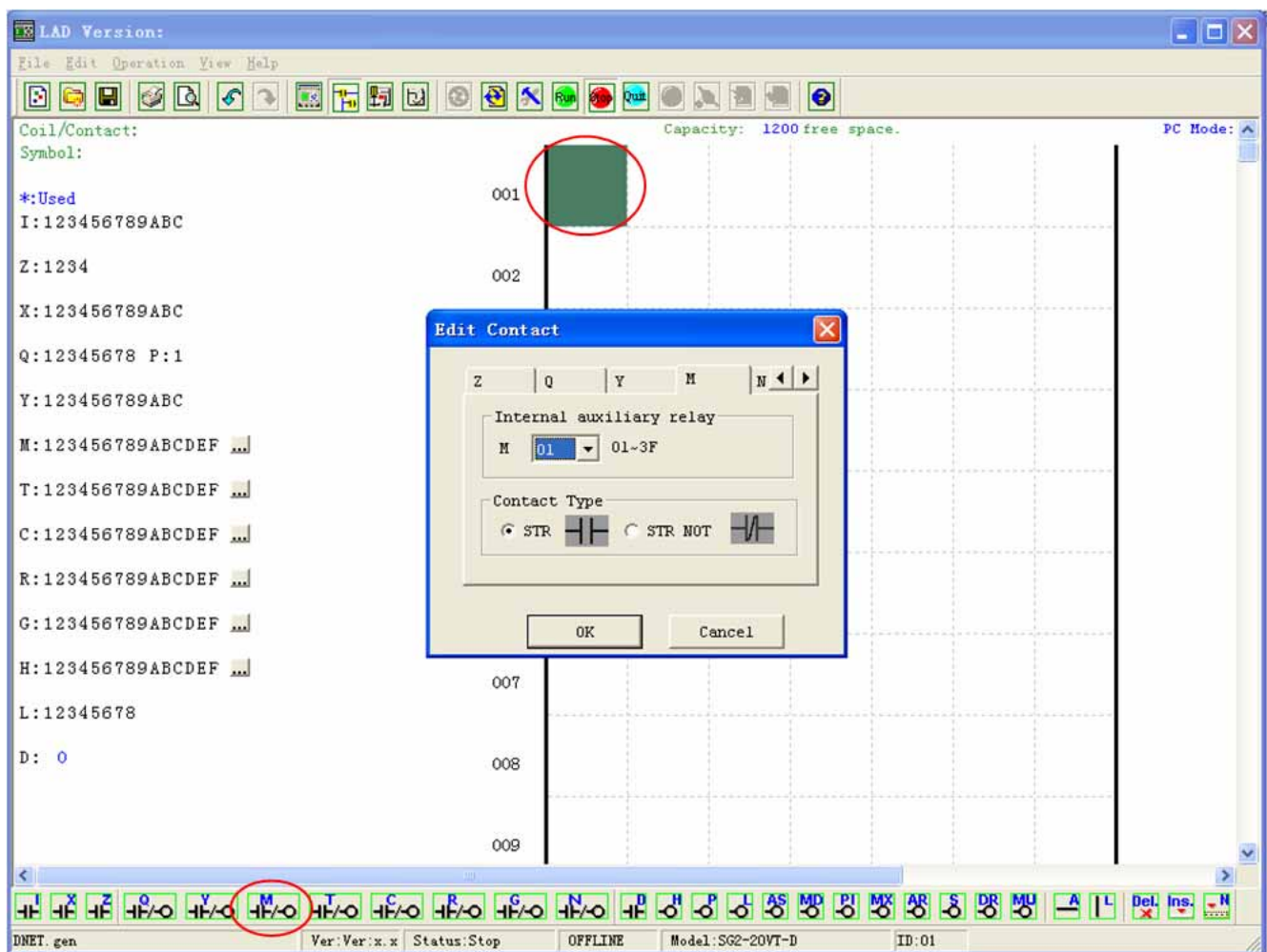
c. Select the correct Com Port number where the programming cable is connected to the computer then press the “Link” button.



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

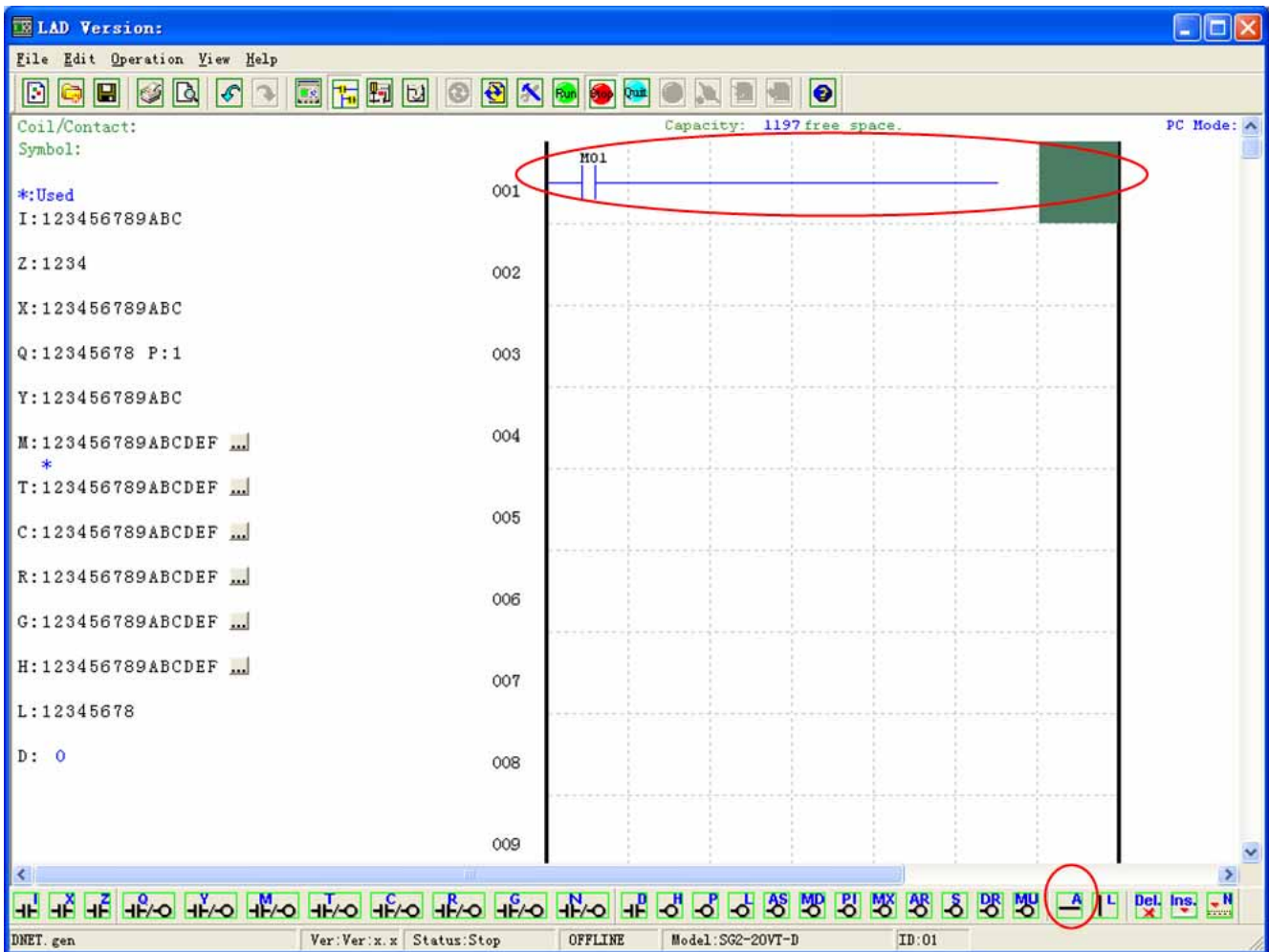
Write simple program

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.

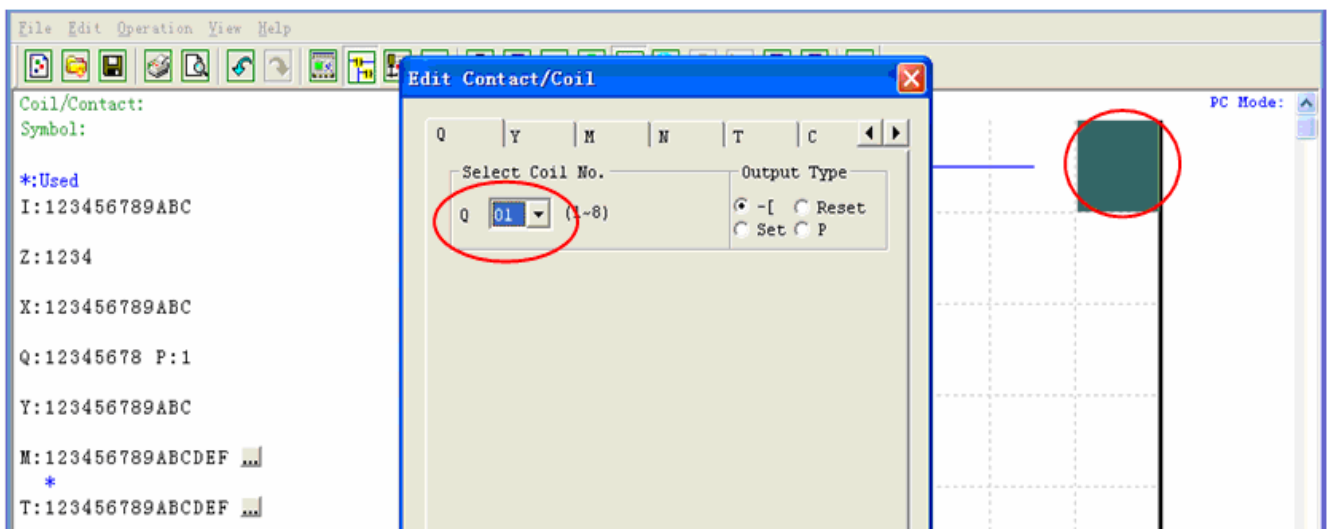


Note: If the ladder toolbar is not visible at the bottom of the screen, select **View>>Ladder** Toolbar from the menu to enable.

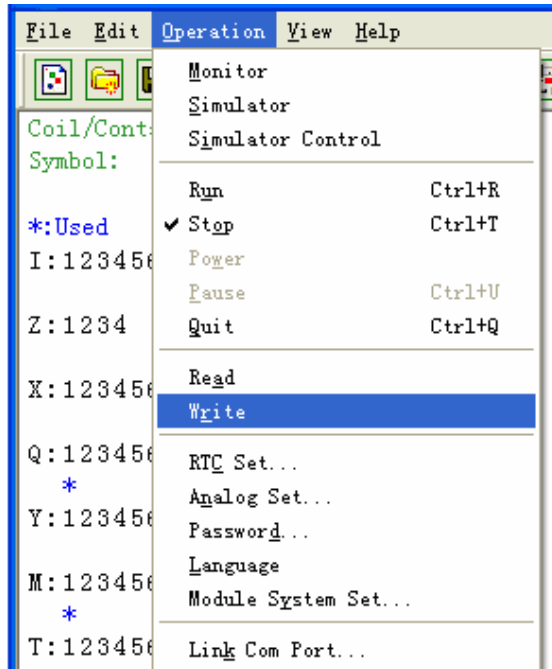
b. Use the “A” key on your keyboard (or the “A” icon on the ladder toolbar) to draw the horizontal circuit line from the M contact to the right most cell, as shown below.



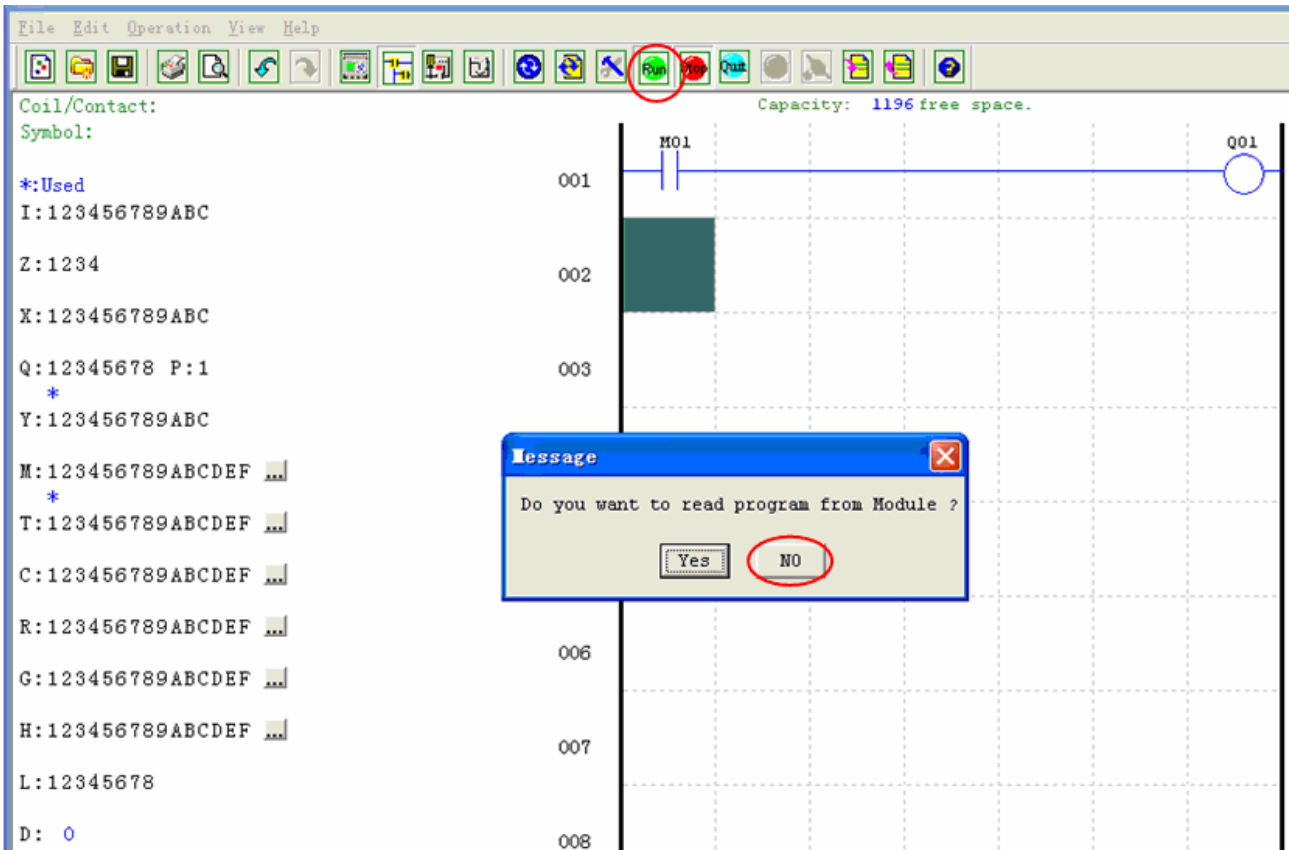
c. Select the “Q” coil icon from the ladder toolbar and drop it on the right most cells. Select Q01 from the dialog and press OK as shown below. See Chapter 4: Ladder Programming instructions for complete instruction set definitions.



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.

The screenshot shows a software interface for a relay control system. On the left, there is a list of inputs and outputs with their addresses and status:

```

Coil/Contact:
Symbol:
*: Status ON
I: 123456789ABC
Z: 1234
X: 123456789ABC
Q: 12345678 P: 1
*:
Y: 123456789ABC
M: 123456789ABCDEF ...
*:
T: 123456789ABCDEF ...
C: 123456789ABCDEF ...
R: 123456789ABCDEF ...
G: 123456789ABCDEF ...
H: 123456789ABCDEF ...
L: 12345678
D:
    
```

The main workspace displays a ladder logic diagram on a grid. A purple line represents a circuit starting from a contact labeled 'M01' at address 001, connected to an output coil labeled 'Q01'. A green shaded area is visible under the 'M01' contact. The status 'Capacity: 1196 free space.' is shown at the top right of the workspace.

An 'Input Status Tool' dialog box is overlaid on the workspace. It contains the following controls:

- Buttons for inputs I (1-9), X (1-9), and Z (1-4).
- Buttons for outputs M0x (0-9) and N0x (0-9).
- A status indicator for input 1, which is currently lit (red).

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 discrete input)
Input Signal "ON" Threshold	> 9.8VDC (as 24VDC discrete 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					

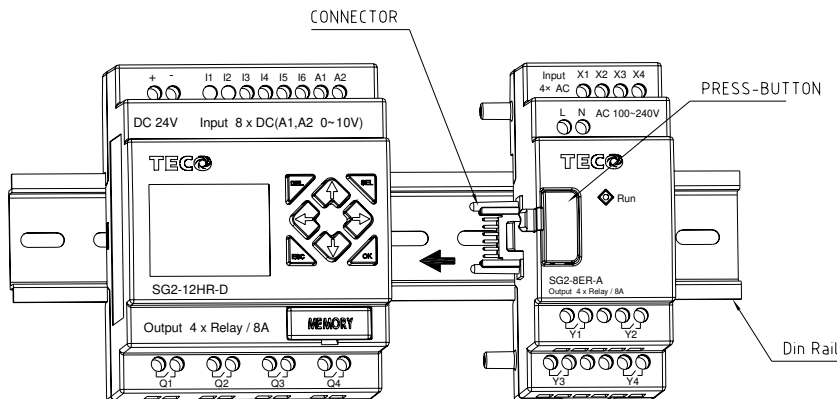
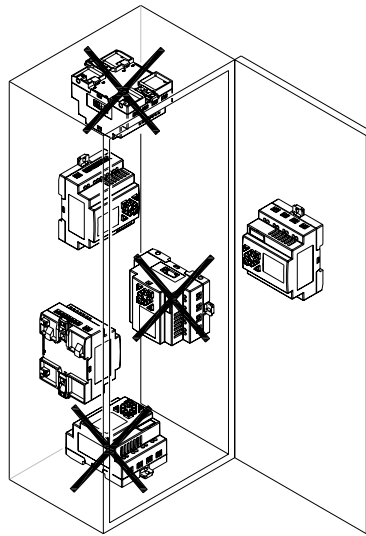
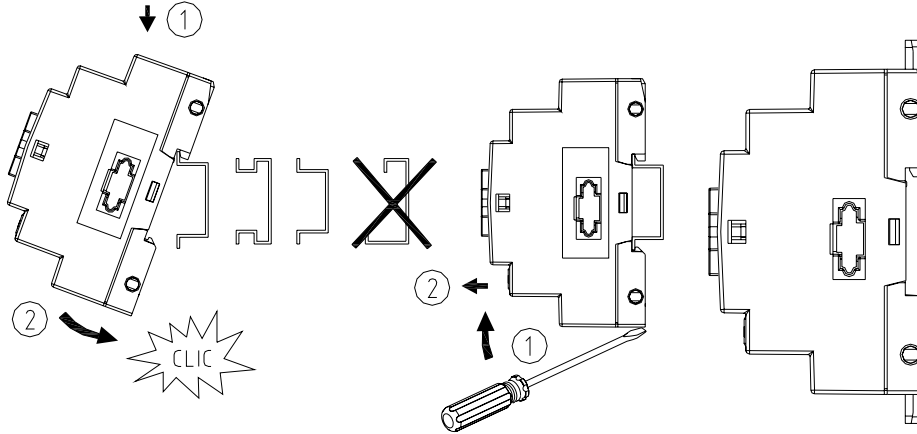
* If module with keypad and display, Max IO can be added keypad input Z01-Z04.

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

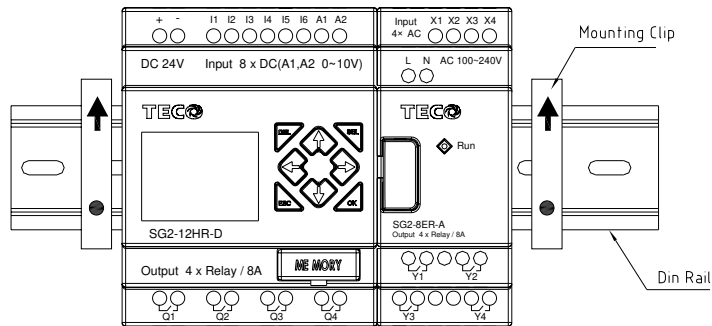
Mounting

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)

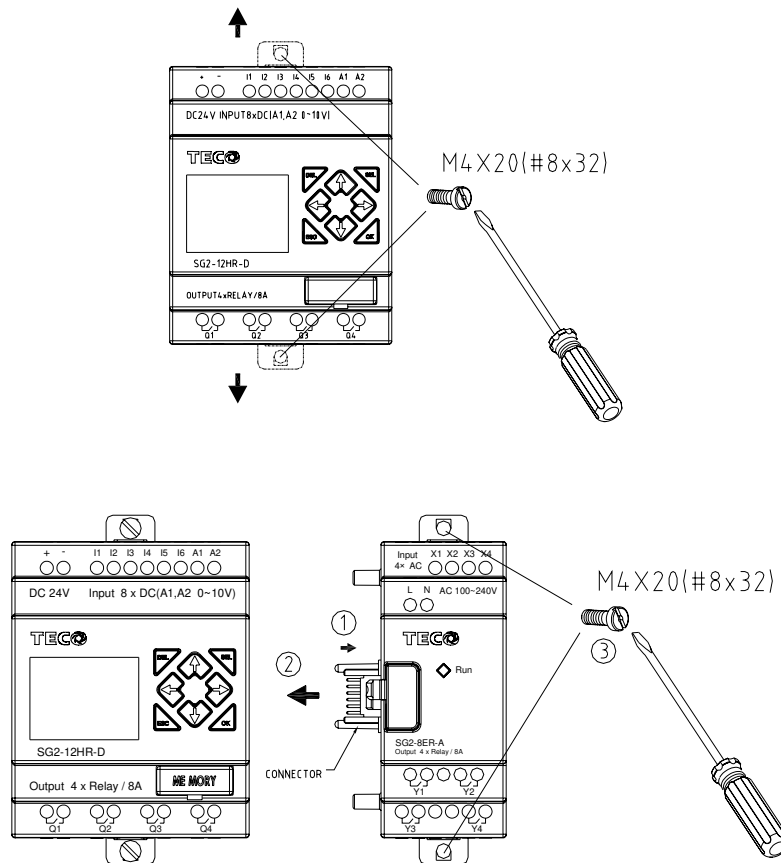


It is recommended to apply a DIN-rail end clamp to hold the SG2 in place.



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

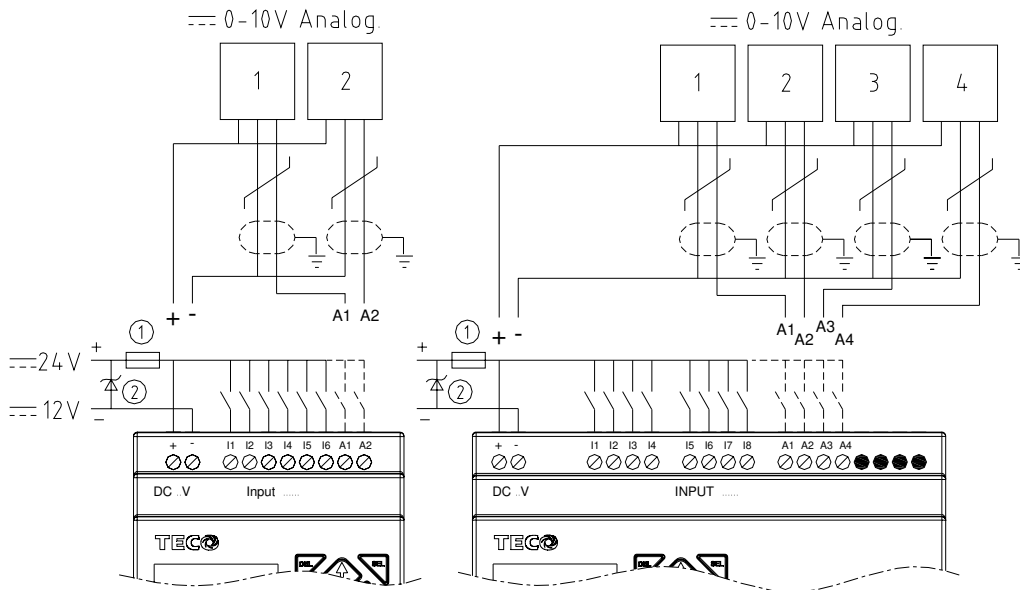
! WARNING: The I/O signal cables should not be routed parallel to the power cable, or in the same cable trays to avoid the signal interference.

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

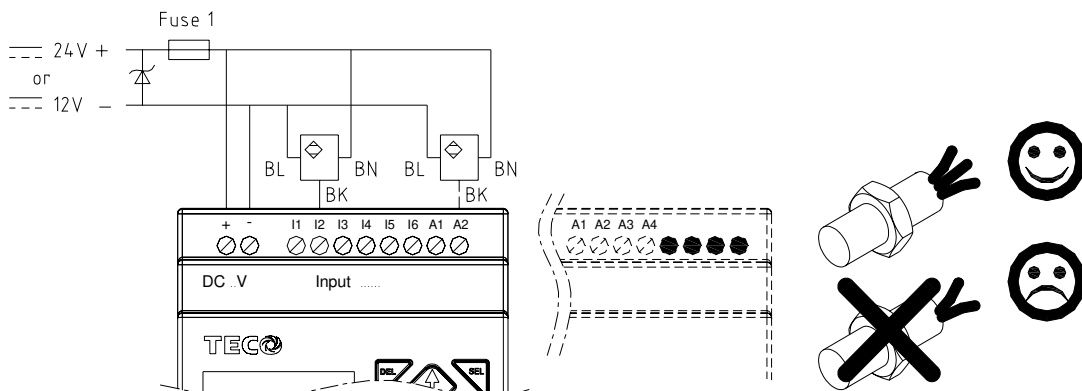
Wire size and Terminal Torque

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

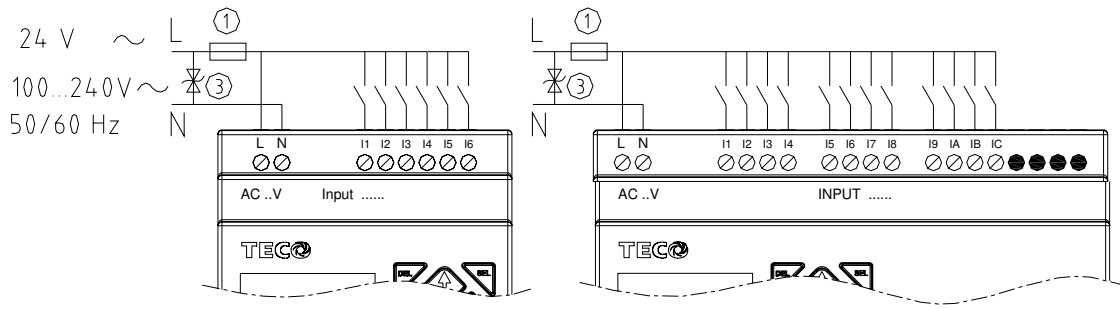
Input 12/24V DC



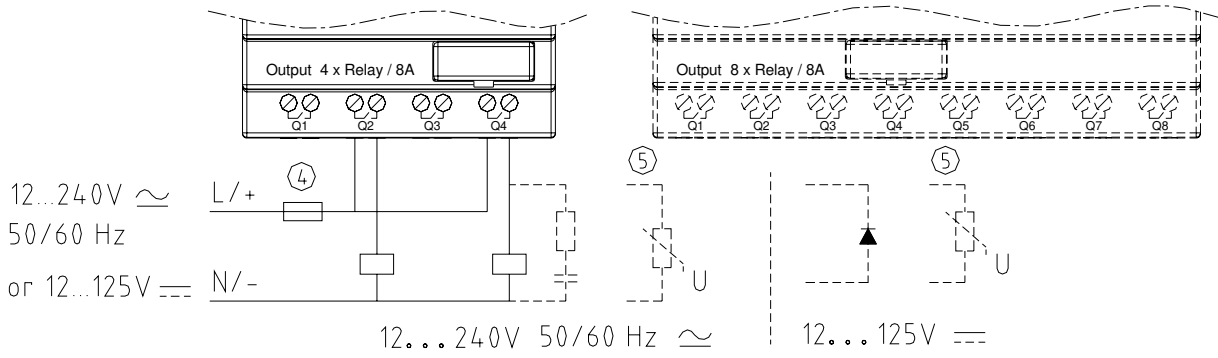
Sensor Connection



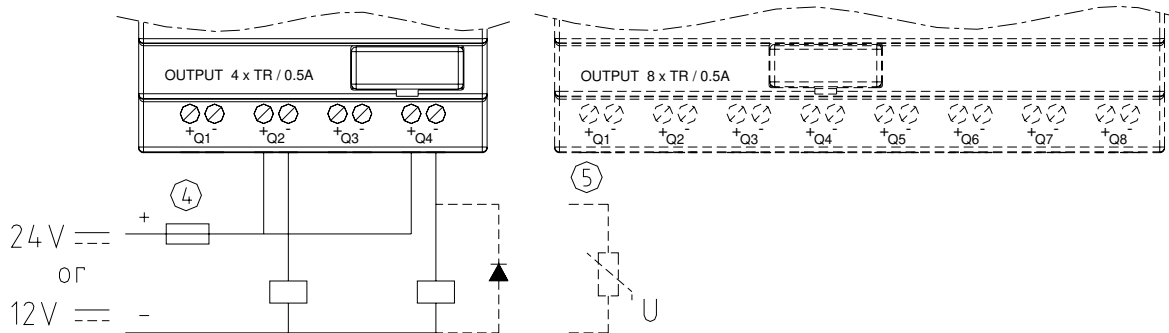
Input 100~240V /24V AC



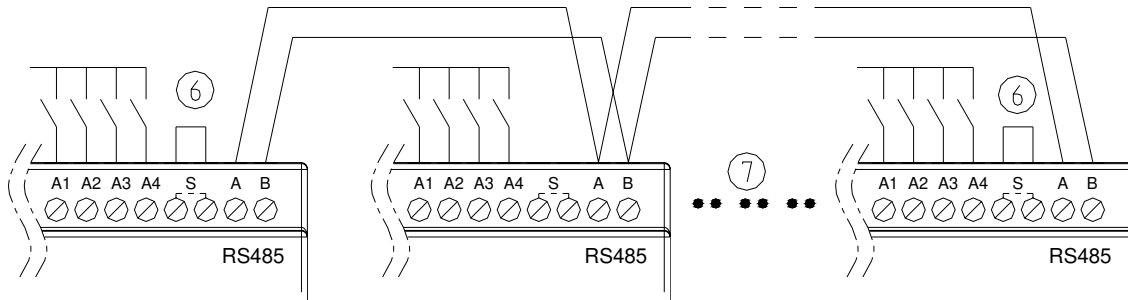
Output (Relay)



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”

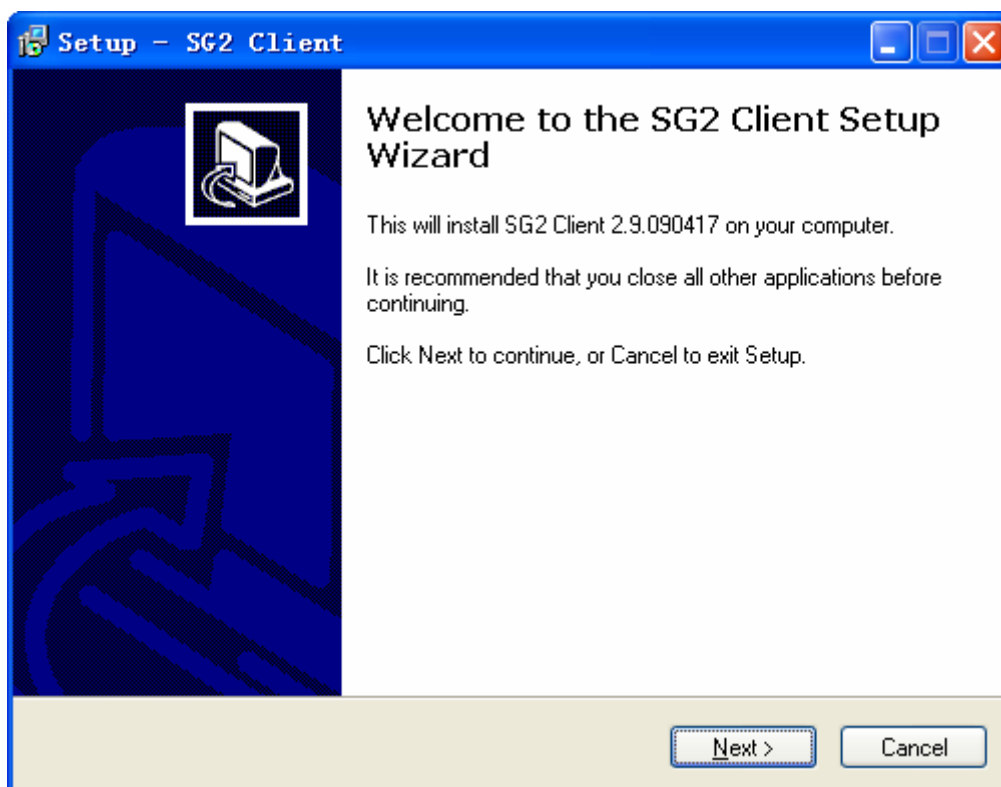
The SG2 Client programming software provides two edit modes, Ladder Logic and Function Block Diagram (FBD). The SG2 Client software includes the following features:

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

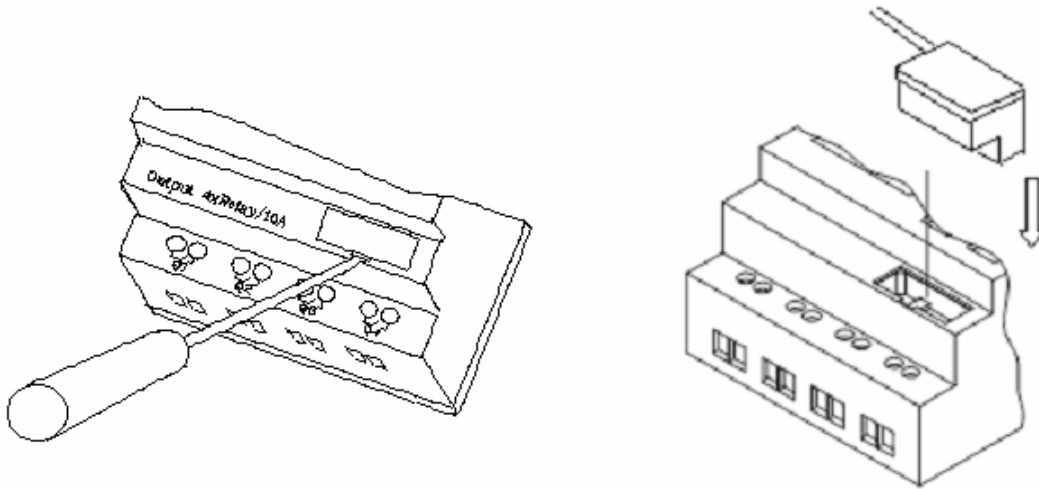
Install the SG2 Client Software from CD or from the free internet download at

www.taian-technology.com



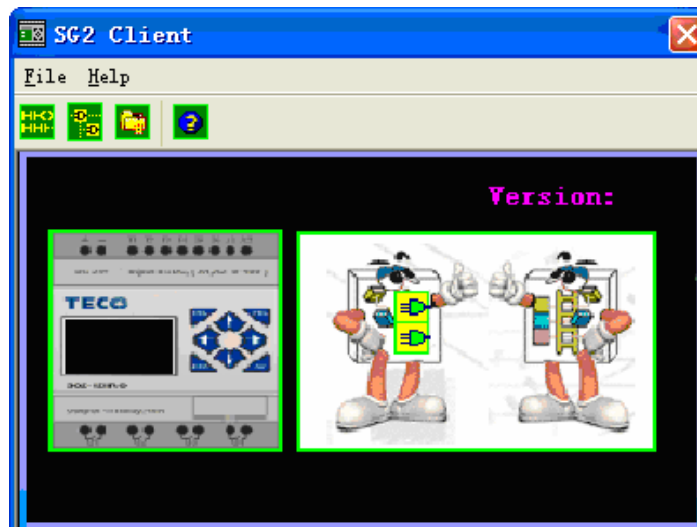
Connecting the Software

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.

