*Applied Mechanics and Materials* *Online: 2011-10-24*
*ISSN: 1662-7482, Vols. 121-126, pp 3819-3823*
*doi:10.4028/www.scientific.net/AMM.121-126.3819*


# Application of GX simulator software in PLC program development

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**Keywords:** GX simulation software. Sequential function chart. PLC program development

**Abstract.** Simulation software is used to PLC program development,Engineering and technical personnel can get rid of the shackles of PLC hardware conditions,They can be flexible and independent to design and debug program. Sequential function chart (SFC) is a programming method of efficient and simple in PLC program development,For complex procedures,The efficiency is very high,This paper introduces PLC program development and simulation with sequential function chart and simulation software,This method can greatly improve efficiency.

## Introduction

Programmable Logic Controller (PLC) is a application technology that the computer technology used in industrial control field. PLC changes control process by software, It has a small, Assembly and maintenance is easy, Simple programming, High reliability, Anti-interference ability is strong and other characteristics,It has been widely used in metallurgy, Chemical industry, Transportation, Electricity and other fields, It has become one of the three pillars of modern industrial control.

GX Simulator can do offline simulation and debugging.to the user program of Mitsubishi FX series, A series, Q series programmable controllers.After installed GX simulation in ordinary personal computer, No PLC hardware, Programmers can do design and debugging of program according to the need for control system, Using GX Simulator, Engineering and technical personnel of PLC-related professional can get rid of the shackles of PLC hardware conditions, Flexibility in the design and debugging,It can greatly improve the efficiency. After GX Developer is Installed in a computer and the additional installed GX Simulator, Offline program debugging of PLC will be able to achieve in a computer.

Sequential Function Chart is a method of PLC program development, It is favored gradually by the engineering staff for its simple, efficient and other advantages. But information on the application of drawing and simulation for SFC is relatively small, This article describes to use the method of sequential function chart to do the PLC program development and simulation.

## Sequential Function Chart Overview

There are the following common programming methods in Mitsubishi programmable controller, They are Ladder (LAD), Instruction List (LI), the state flow chart (SFC), Instruction List is very similar to assembly language of computer, Its simple, Good flexibility, We can do programming design without the computer, But the intuitive is bad, Ladder programming language is the most commonly used programming language, It comes from a description of the relay logic control system, It features an intuitive and correspondence, Thus, It has been welcomed by the electrical technician, However, the design of ladder program needs to consider the complex circuit interlock, Related part. The overall Intuitive nature of process is less, It’s relatively difficult to understand and check. State diagram, also known as state transition diagram, Sequential Function Chart [1].

To program with Status Flow Chart (SFC) has the following characteristics:

1) When the control system is designed, There is a corresponding system mode established according to the order of implementation of the action, After the state is allocated, By simply setting we can directly modify the programming on the basis of the model, So reducing the amount of design time.

2) procedures to function as the main line, Has clearly structured, Easy to division of design and inspection debugging for program, Run adjustment and inspectionis of failure is very intuitive, convenient, Without checking the long ladder.

3) The readability of the program is good, Users is easily to understand all the action process, Easy to equipment maintenance,

4) We needn't to consider too much complex interlocking action, Easier to design and maintain the system [2].

## GX Simulator software applications (sequential function chart method)

The following is a design methods of sequential function chart to control water light an example:

Questions asked after pressing the start button, Water lamp light one every 5 seconds, Light cycle, Only light one each time, When the button is released, Three lights all off.

1) Double-click the icon to open GX Developer programming software, Select the Project menu, Project / create a new project, Create New Project dialog box is popped. Select "PLC Series", "PLC type" and "program type", I have the FX2N PLC of FX series as an example, Select the "SFC" program, select the storage path, Such as: F: \ ZXM program, fill in project name, click "OK" to enter the block information window (Figure 1).

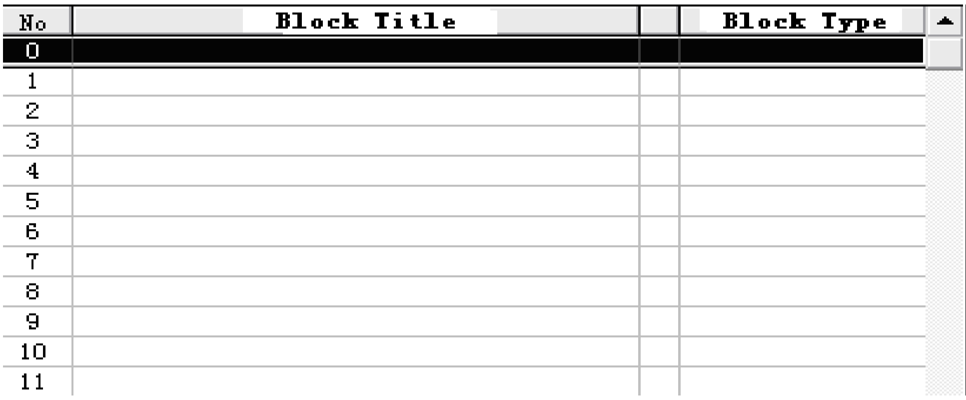


Figure 1. Block information window

2) Double-click No.0 block title, Pop-up block information setup dialog box.. Enter block title, Such as: the initial state, the block type "Ladder block", Click "Run" into the ladder diagram block editor window. The right side of the ladder deagram block editor window,we start input program, This program is used to set the program's initial state and setting conditions to turn the initial step (Figure 2)

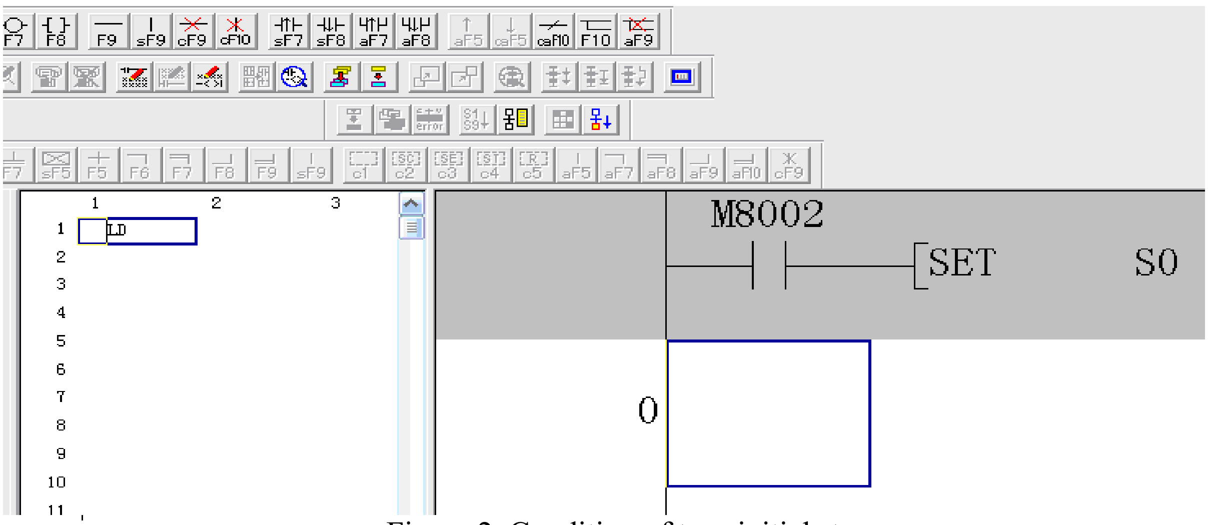


Figure 2. Condition of turn initial step

3) Select the "Window" menu "MAIN" main program window ,displays the block information window, Double-click the block number "No.1" in the "block information" dialog box, enter the block title. At this point, you should select "SFC block" block type, click "Run" into the SFC programming window, At this point the left side of the window the program will automatically generate an initial state of the SFC and state transition conditions (Figure 3).

4) we enter each state and state transition conditions in the status edit box of SFC according to the state transition diagram designed that control of the water lamp.

5) Double-click the transition condition 0 icon of left side of the window that is directly connected with the state 0, Pop-up "SFC symbol type" dialog box, In the options of "icon number"we select "TR" that is the transfer of a single process, The remaining default options, click "OK." Click the icon of transfer conditions 0, We enter the corresponding procedures with the conditions of transfer, In conditions program editor of the right of window, Press F4 to change, complete edit of the transfer conditions. Which "tran" statement is virtual output command, It used to connect the corresponding transfer output (Figure 3) [3].

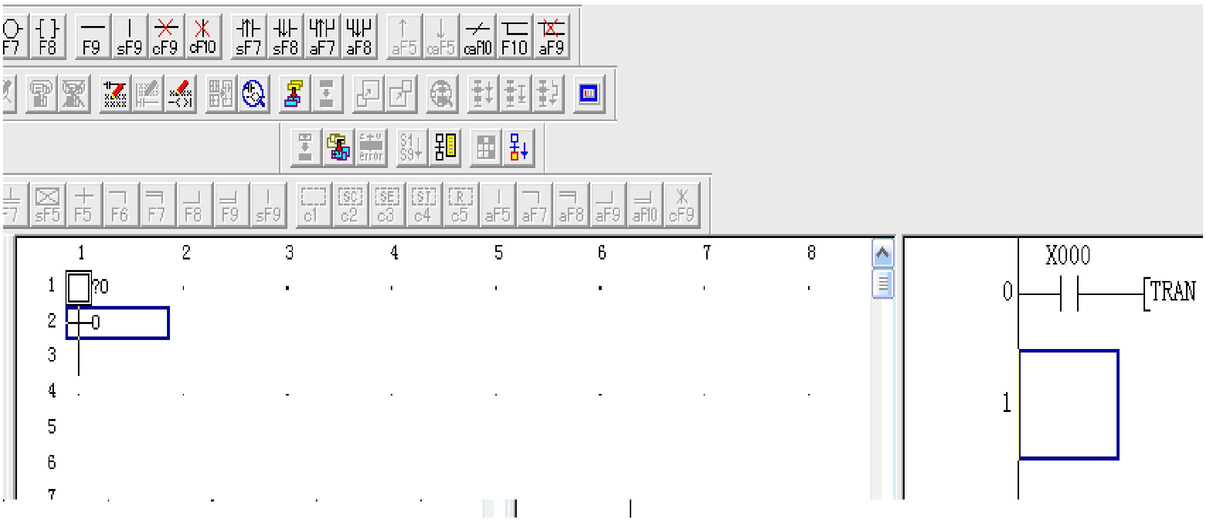


Figure 3. Conditions of transfer

6) Double-click the next status icon that directly connected with the transfer conditions 0, Pop-up "SFC symbol type" dialog box, in the "icon number" options "STEP", We enter the step number or the system default step number like "10"in the status bar, Click "OK", then click the status icon, Then to write the corresponding action program of state 10 (Figure 4).

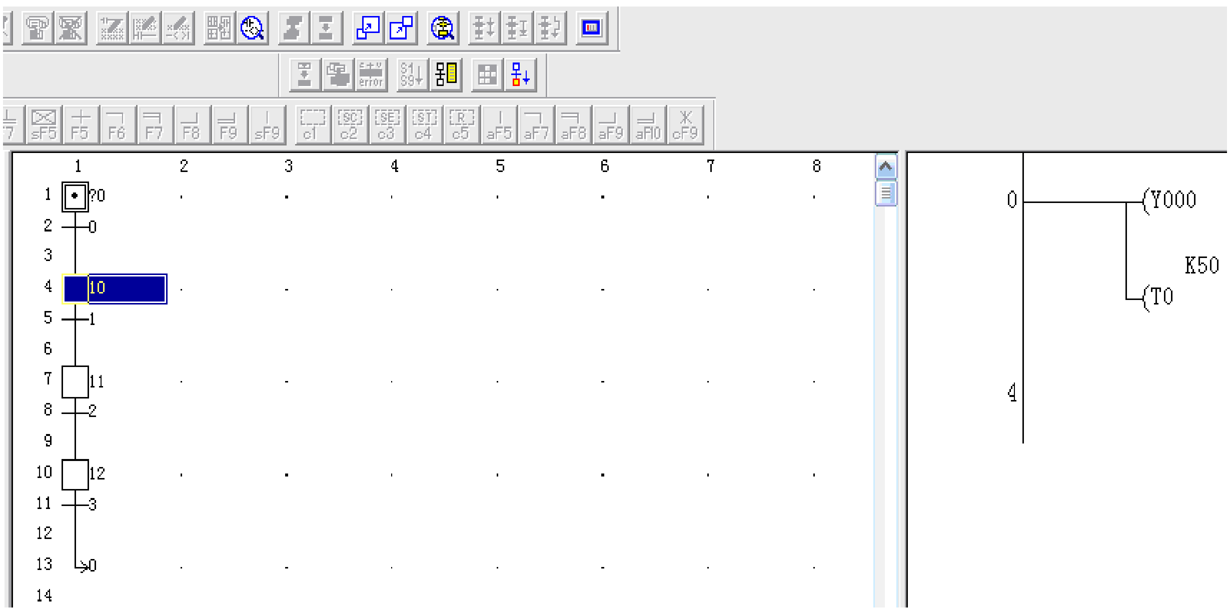


Figure 4. Action program of Status

7) Repeat the operation of steps 5) to 6) until all the edit of the flow chart is completed. When the last state is prepared, Double-click the status icon .In the status bar, we enter the number that need jump to the specific steps, such as "0", Returned to state 0 loop executes, (Figure 5).

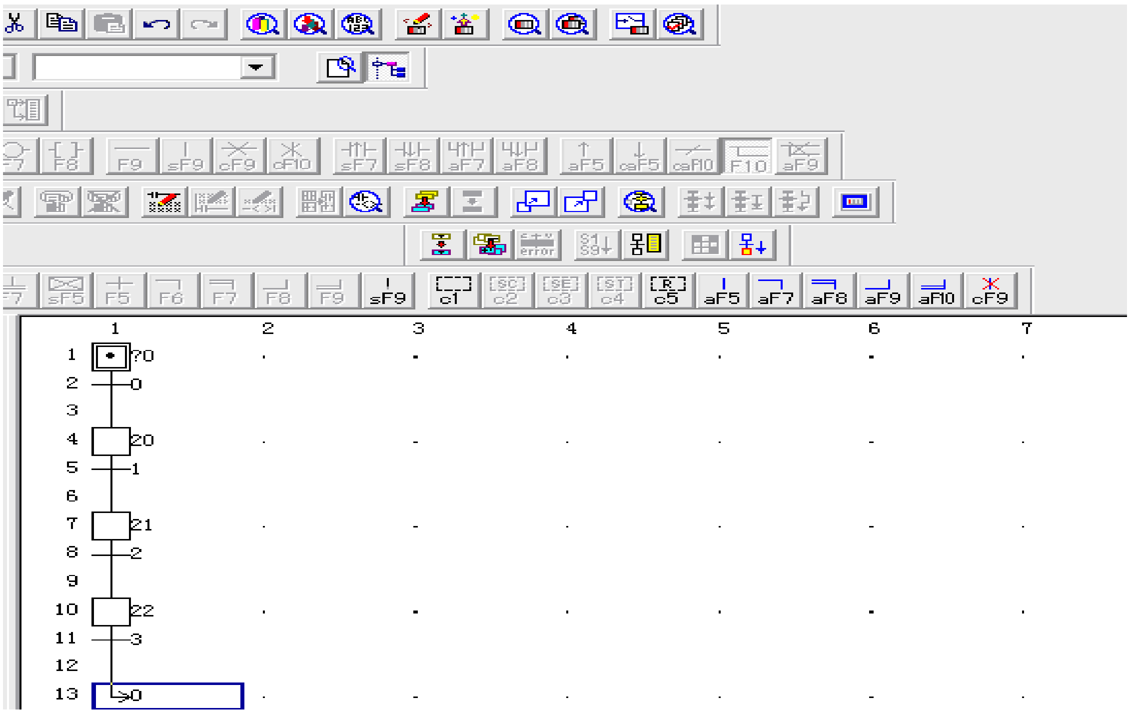

Figure 5. Jump set

8) After completion of the program input, We need to transform the SFC program content,of each block, Select the menu "transform" "/ transform (Edit All Programs)", If there are errors in the program at this time, the system automatically pop up error box.

9) Select the menu Project / edit data / change type, Sequential function chart programs can be transformed into a ladder program, transform a good ladder program (Figure 6).

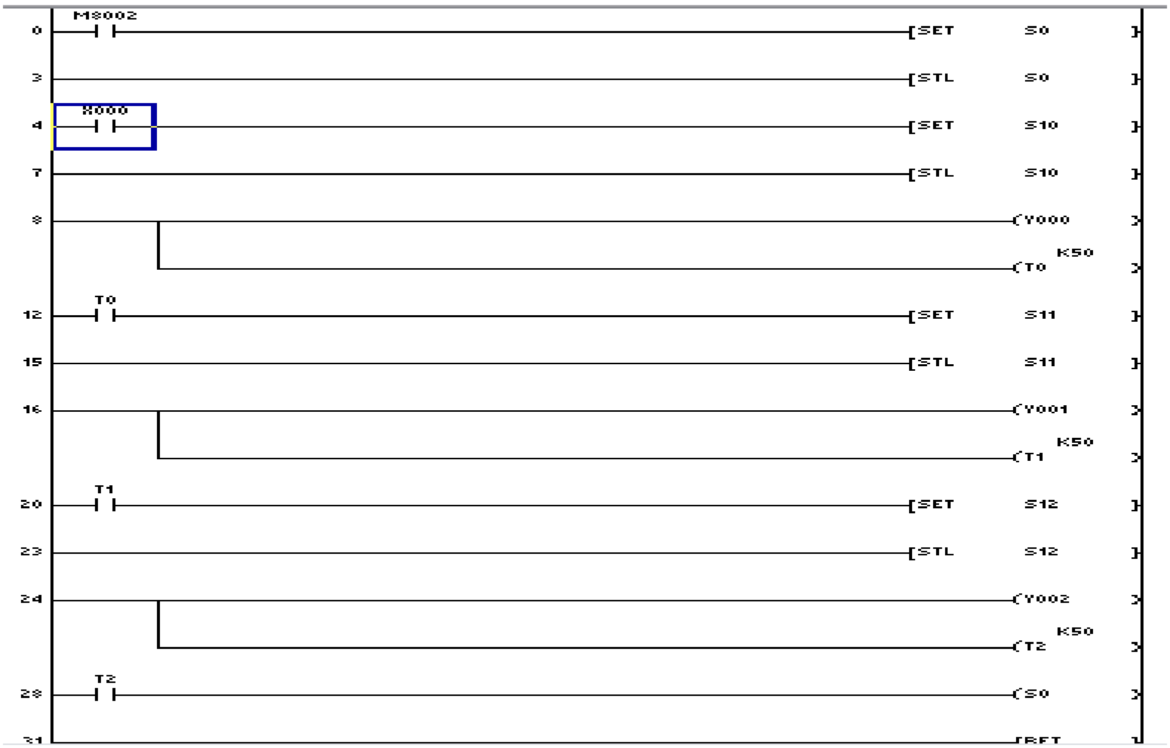

Figure 6. Ladder

10) Select the GX Developer Tools / ladder logic test start, start the GX Simulator, Simulation run after the program written to the PLC, Like the debugging step of ladder, At this point, we can clearly monitor the implementation to each state, That X0 switched on (yellow), Y0 immediately connected (yellow), 5 seconds later turned Y1 (yellow), Then, after 5 seconds turn Y2 (yellow), Disconnect X0, (double), Y0, Y1, Y2 all out (Figure 7). In the ladder, we can clearly see the case of on and off each step (Blue is connected) [4].

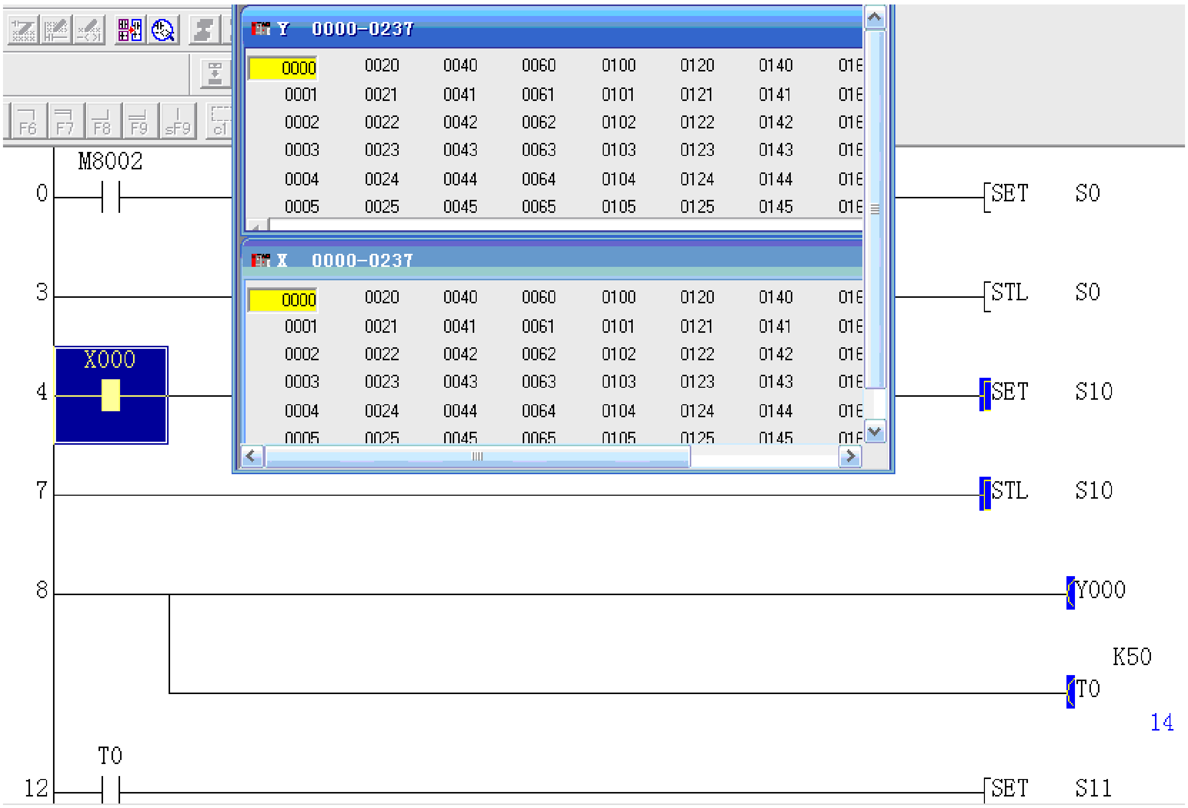


Figure 7. Simulation

**Acknowledgement**

It is a project supported by. Education Department of Henan Province Natural Science Project. Item Number: （2011C520005）

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