

# **GX Developer FX**

Programming and  
Documentation System

## **Beginner's Manual**

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## About this Manual

The texts, illustrations and examples in this manual only explain the installation, operation and use of the *GX Developer FX* programming package.

If you have questions about the programming and operation of the programmable logic controllers mentioned in this manual please contact your dealer or one of our distributors (see back cover). Up-to-date information and answers to frequently-asked questions can be found on the Mitsubishi website at [www.mitsubishi-automation.com](http://www.mitsubishi-automation.com).

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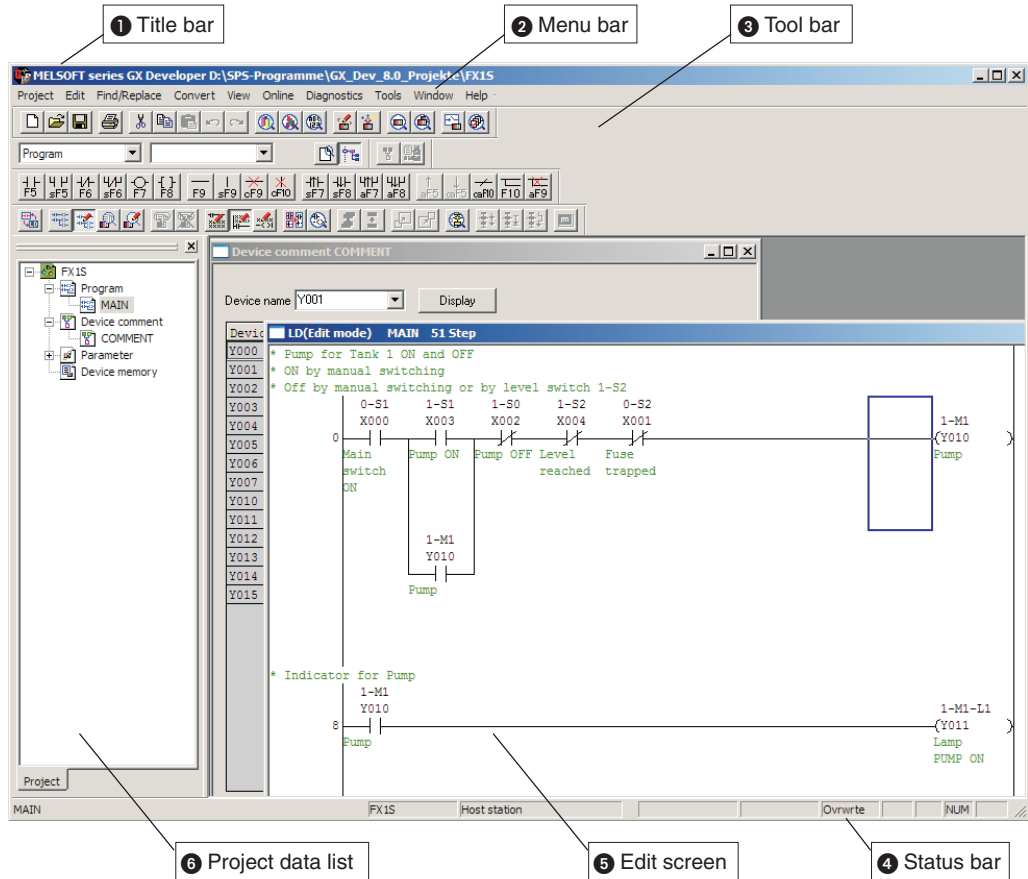


# 2 Programming

## 2.1 Starting GX Developer / The program workspace

After installing GX Developer on your PC you can start the program by selecting its entry **Start > Programs > MELSEC Application > GX Developer**.

This displays the main program window\*:



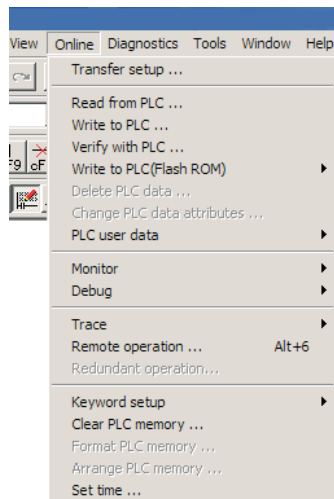
\* For more clarity this illustration shows the program with a project already opened. GX Developer does not actually open a project automatically when you start it – you must manually open an existing project or create a new one.

### 1 Title bar

The title bar of the GX Developer FX program window shows the path and name of the current project. The usual buttons for minimizing and resizing the program window and exiting the program are located at the right hand end of the title bar.

### 2 Menu bar

The menu bar contains the menus that provide access to GX Developer's functions. Clicking on a menu title displays a drop-down menu with a list of options that you can then select.



Menu options followed by a ► symbol on the right have sub-menus, which are displayed when you click on the menu option.

Menu options followed by three dots (...) display a dialog box when you select them.

Many of the more frequently-used options in the menus can be selected directly with icons in the toolbars.

### 3 Toolbars

Many of the most frequently-used program functions can be accessed directly with the tools (icons) in the toolbars.



You can activate and deactivate the individual toolbars with the options in the **View** menu.

### 4 Status bar

The status bar displays some useful information, including the current PLC type and editing mode (Insert/Overwrite). You can also activate and deactivate the status bar in the **View** menu.

### 5 Editing screen

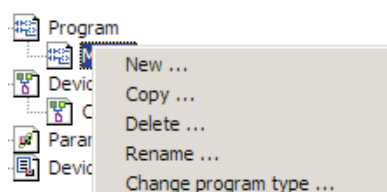
The editing screen is where you do your programming and documentation work. You can have multiple editing and dialog windows open at the same time.

### 6 Project data list

The program, its documentation and the parameters for the FX controller are stored together in a “project”. The project data list shows the directories in which the components of the current project are stored. You can open the project files, programs, documentation and parameters by double-clicking on their items in the data list.

#### Program

Controllers in the MELSEC FX family can only process one program at a time. The default name assigned to this program is MAIN.



You can rename MAIN if you want. To do this select the MAIN entry and then right-click on it to display the context menu and select *Rename...*

**Device comment**

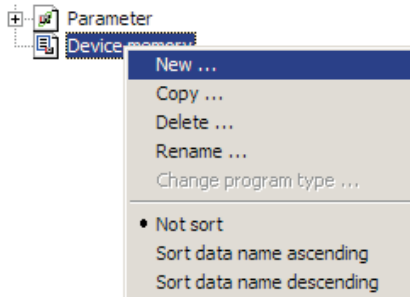
You can assign a comment to every PLC device (inputs, outputs, relays etc.). These comments can then be displayed in the program. You can enter and edit these comments by opening the **Device comment** file in the project data list. In addition to this you can also enter device comments directly in the program itself. For details see the **Documentation** chapter in this manual.

**Parameter**

Double-clicking on **PLC parameter** in the project data list opens a dialog in which you can enter and adjust all the settings necessary for the operation of the PLC. The PLC parameters are transferred to the CPU together with the program.

**Device memory**

The file stored in the **Device memory** directory can be used to enter default values for each of the CPU's data registers (D) while you are programming. When this file is transferred to the CPU together with the program the defaults are loaded automatically when the program is started for the first time. You can create a device memory file when you are creating a new project (see chapter 2.2) or at a later time.



To create a device memory file select **Device memory** in the project data list and right-click with the mouse to display the context menu. Then select **New...** and enter the name of the file you want to create.

Note that the CPU's device memory includes both volatile and latched memory ranges. If you want your values to be retained when the PLC is powered down and restarted you must use the latched memory ranges. See the manual of the PLC you are using for details on its device memory ranges.

To open the file containing the device memory values just double-click on its name in the project data list. You can choose between a variety of data display formats and you can also switch between hexadecimal and decimal modes. However, note that changing the display and numerical formats only affects the display on the computer screen, it doesn't change the content of the registers!

Device name	0	1	2	3	4	5	6	7	Character string
D0	12345	-6789	9876	-5432	4528	28429	5142		
D8	0	0	0	0	0	0	0	0	
D16	0	0	0	0	0	0	0	0	

Display as 16-bit integer value

Device name	0	2	4	6	Character string
D0	-444911559	-355981676	1863127472		
D8	0	0	0	0	
D16	0	0	0	0	

Display as 32-bit integer values (2 data words are combined for each value)



Device Label: D0 | Display: Floating Decimal Point | DEC | D0-D255

Device name	0	2	4	6	Character string
D0	-7.413772e+022	-1.209837e+026	4.365877e+028	-1.795501e+038	90(â€œâ€š”...o...y
D8	0.000000e+000	0.000000e+000	0.000000e+000		
D16	0.000000e+000	0.000000e+000	0.000000e+000		

Display as 32-bit floating point values

To enter a numerical value click once in the device field you want to change. To enter an ASCII string value double-click in the device field – the characters you enter will then be stored sequentially across multiple devices and the resulting string will be displayed in the **Character string** column (see below).

Device Label: D0 | Display: 16-bit integer | HEX | D0-D255

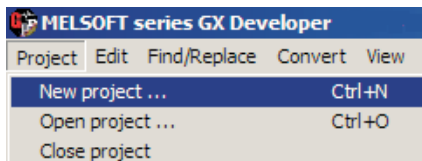
Device name	0	1	2	3	4	5	6	7	Character string
D0	454D	534C	4345	4620	2058	6553	6972	7365	MELSEC FX Series
D8	4C50	2043	0000	0000	0000	0000	0000	0000	PLC .....
D16	0000	0000	0000	0000	0000	0000	0000	0000	
D24	0000	0000	0000	0000	0000	0000	0000	0000	
D32	0000	0000	0000	0000	0000	0000	0000	0000	

Direct entry of ASCII strings

Character string input dialog: [PLC] [OK] [Cancel] [Read]

## 2.2 Creating a new project

To create a new project:



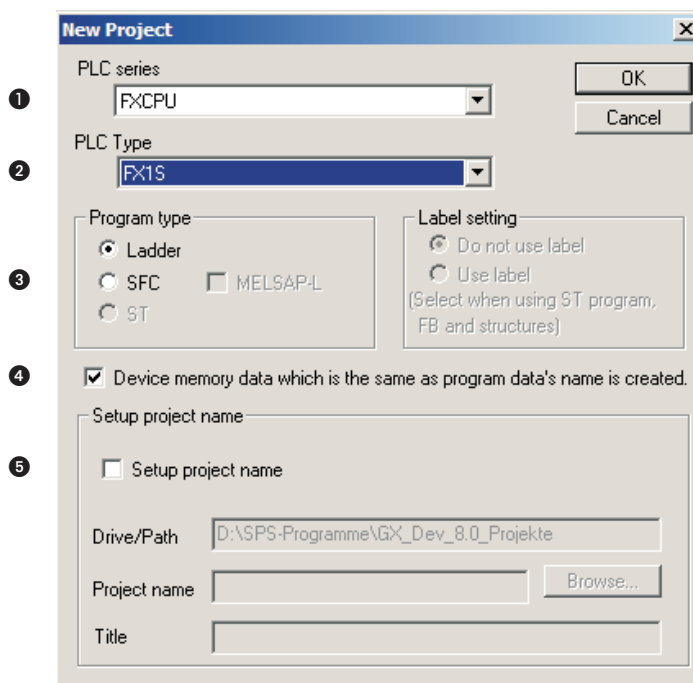
Select **New project...** in the Project menu

OR

Click on the New Project tool in the toolbar:

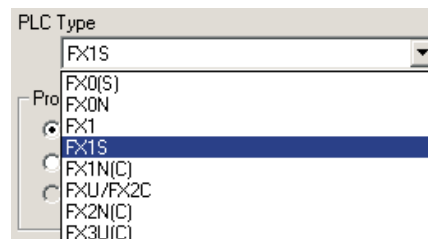


This opens the following dialog:



In GX Developer FX the field **PLC Series** (1) is preset to the default value of **FXCPU** because this software package can only be used for programming the MELSEC FX family of PLCs.

You can select the model of PLC you are using in the **PLC Type** (2) field. Just click on the arrow to the right of the field and then select the appropriate FX model from the drop-down list.



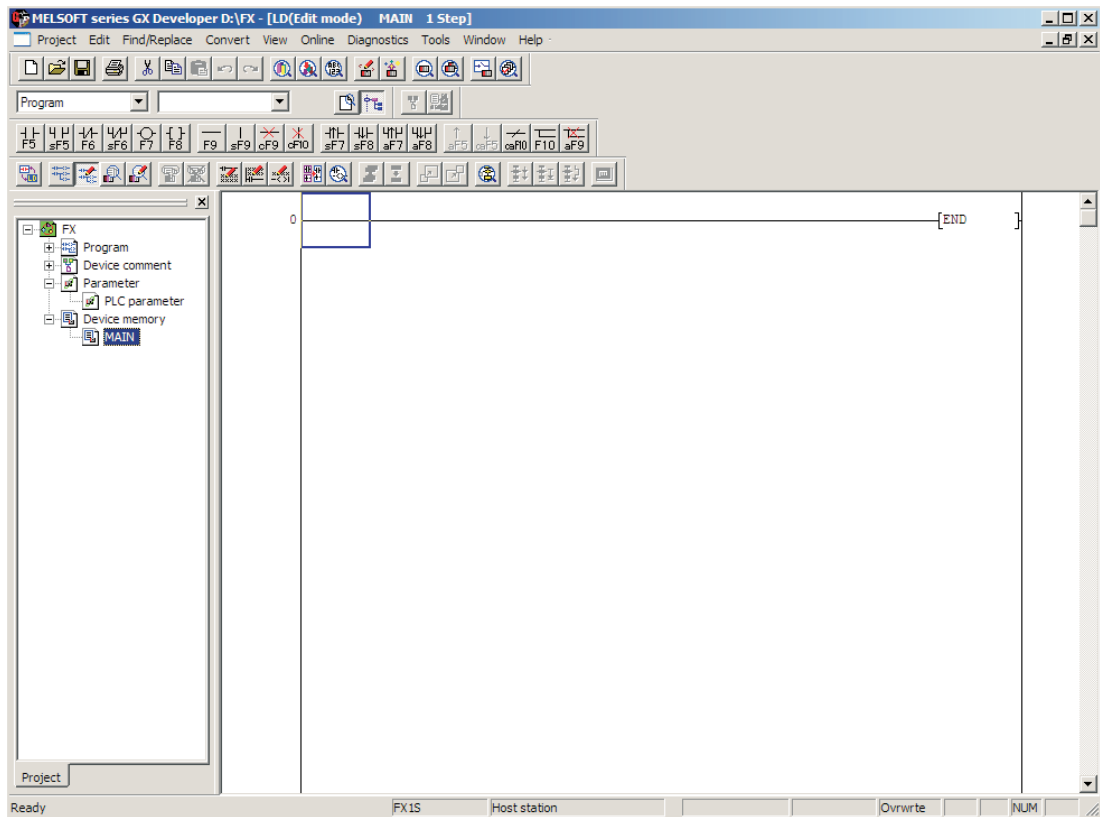
The **Program Type** (3) specifies whether you want to create a Ladder Diagram (**Ladder**) or a Sequential Function Chart (**SFC**) program. We have set this to **Ladder** for the examples in this manual.

If you activate the **Device memory data which is the same as...** checkbox (4) a file with the same name as the program will be created for the data register values (D) in the **Device Mem-**

**ory** directory in the project data list. If this file is not generated when you create the project you can also create it later (see chapter 2.1).

You can use the settings in the **Setup Project Name** section (5) to specify the name and path of the project before you start programming. Just activate the checkbox at the top of this section and enter the path, project name and title details. If you want to choose the project name later leave the checkbox unselected here and then use the **Save as...** option in the **Project** menu.

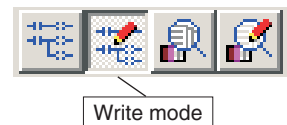
When you click on **OK** a new empty MAIN program will be displayed in the GX Developer editing window:



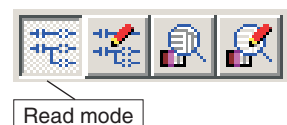
## 2.3 Entering a Ladder Diagram program

**Write mode** must be activated before you can enter or edit instructions.

You can activate this mode with the tool in the toolbar shown on the right or by selecting **Write mode** in the **Edit** menu.



**Read mode** is used for viewing or searching for devices in your program. Note that you cannot make any editing changes when you are in Read mode.









The LD symbol toolbar provides quick access to all tools needed for entering and editing Ladder Diagram programs:



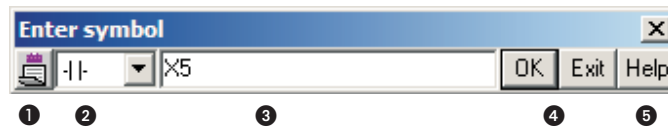
The tools in the toolbar are labelled with symbols representing their functions and abbreviations for the corresponding function keys or key combinations. The following abbreviations are used on the tool buttons:

- s: SHIFT key. Example: **sF5** = SHIFT + F5
- c: CTRL key. Example: **cF9** = CTRL + F9
- a: ALT key. Example: **aF7** = ALT + F7
- ca: CTRL + ALT. Example: **caF10** = CTRL + ALT + F10

Symbol	Bedeutung
	Normally open contact, the contact is closed when the device is ON ("1")
	Normally open in parallel to another instruction
	Normally open contact, the contact is closed when the device is OFF ("0")
	Normally open contact in parallel to another instruction
	Output instruction (coil)
	Application instruction ( instructions not included in the basic instruction set)
	Insert horizontal connecting line
	Insert vertical connecting line
	Delete horizontal connecting line
	Delete vertical connecting line
	Rising edge (contact is only on when signal changes from 0 to 1)
	Falling edge (contact is only on when signal changes from 1 to 0)
	Rising edge in parallel to another instruction
	Falling edge in parallel to another instruction
	Invert result
	Draw vertical and horizontal connecting lines with the mouse
	Delete vertical and horizontal connecting lines with the mouse

Clicking on one of the tools in the toolbar or selecting the corresponding keyboard shortcut opens a dialog box in which you can then enter the instruction details.

## 2.3.1 Entering functions



- 1 This button can be used to keep the entry dialog open so that you can enter multiple instructions without having to re-open the dialog every time. Clicking on the button switches it between the following two states:



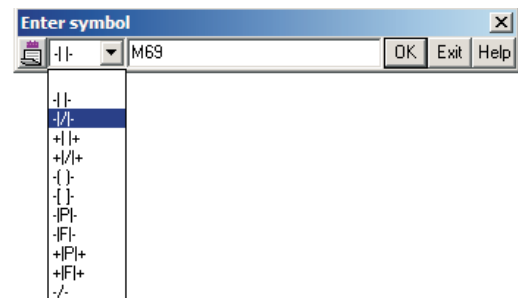
When this icon is displayed the **Enter Symbol** dialog box is closed when you click on the **OK** button.



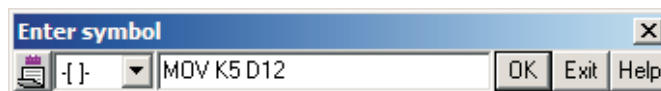
When this icon is displayed the **Enter Symbol** dialog box remains open when you click on the **OK** button, allowing you to enter additional instructions.

- 2 The instruction that will be added to the program when you click on **OK** is displayed in this field.

Initially the field shows the instruction selected on the toolbar but you can also select the instruction yourself here. Clicking on the  $\nabla$  icon displays a drop-down list from which you can select a different instruction.



- 3 This is a text entry field. When you are using instructions from the standard instruction set this is where you enter the device name. For other instructions this is where you enter the instruction code and one or more device names. Entries must be separated by spaces. All numerical characters must be preceded by a letter that identifies either the device type or (in the case of constants) the number format. K identifies decimal constants and H identifies hexadecimal constants.

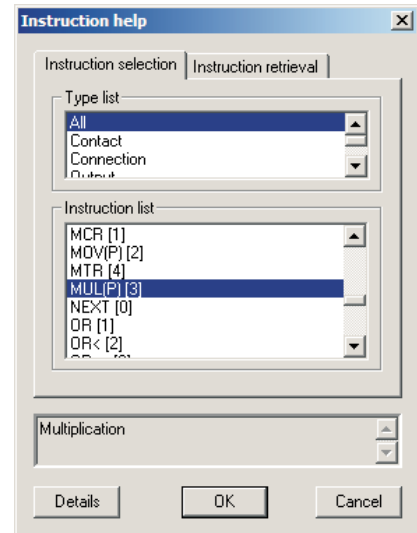


This example writes the value "5" to data register D12.

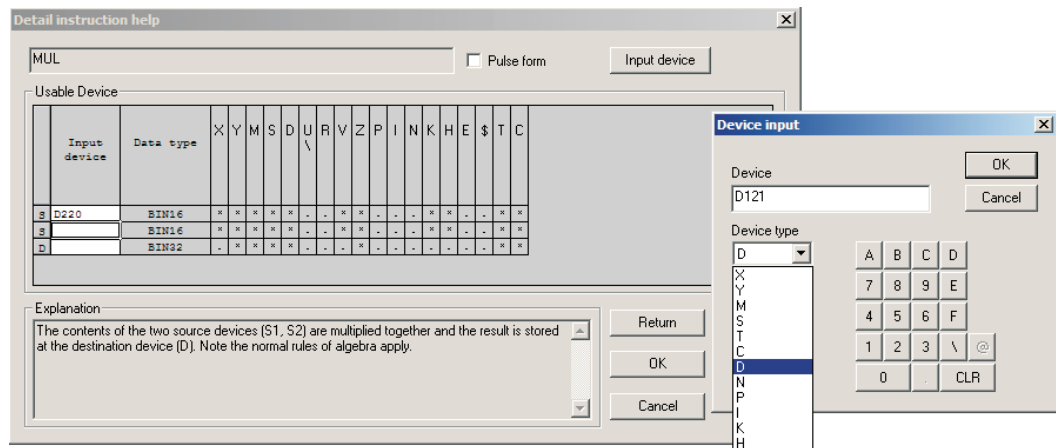
- 4 Clicking on **OK** inserts the function in the program, **Exit** cancels. You can also insert the instruction by pressing the ENTER key.
- 5 You can enter the instructions of the standard instruction set directly with the toolbar. However you don't need to memorise the other instructions and symbols. Clicking on **Help** opens a dialog in which you can search for an instruction that performs the function you need, and you can also display information on how the instruction works and the devices it supports. The Instruction Help dialog has two different tabs with different methods for locating instructions and displaying information about them: **Instruction Selection** and **Instruction Retrieval**.

The **Instruction Selection** tab contains two boxes. In the **Type List** box at the top you can select the type of instruction you are trying to locate (comparison operations, arithmetic operations etc.). All the instructions of the selected type are then displayed in the **Instruction List** box.

You can display detailed information about an instruction by selecting it in the **Instruction List** box and then clicking on the **Details** button.

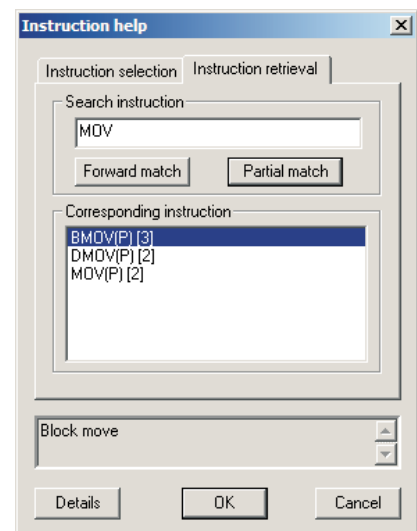


The information displayed when you click on **Details** includes a brief description of the instruction and a list of the supported devices. In addition to this the information dialog also contains entry fields in which you can enter the devices you want to use directly. Clicking on **OK** then transfers your entries to the instruction input dialog.



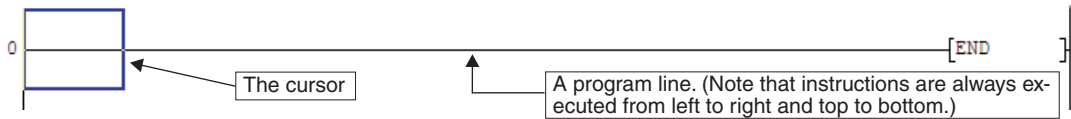
You can use the **Instruction Retrieval** tab if you already know the instruction code or a part of it. The search function in this tab can locate and display all the available instructions containing the character combination you enter.

Here too you can display the detailed help for a selected instruction by clicking on the **Details** button.

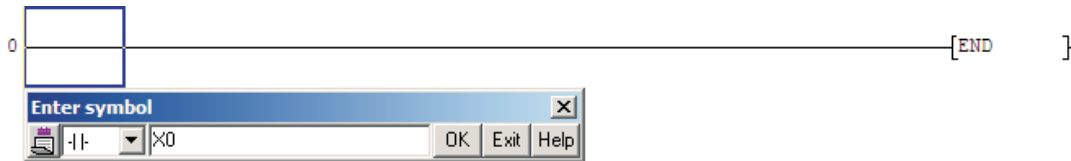


### 2.3.2 Inserting instructions

Click in the program line (rung) where you want to insert the instruction. A rectangular selection highlight (the cursor) will be shown in the place where you click. (The END instruction marks the end of the program and is inserted automatically by GX Developer.)



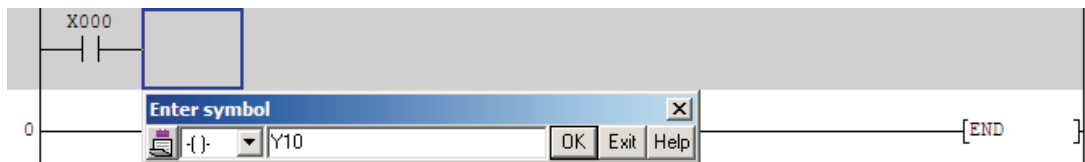
Now select an instruction in the toolbar or press the keyboard shortcut corresponding to the instruction you want to enter.




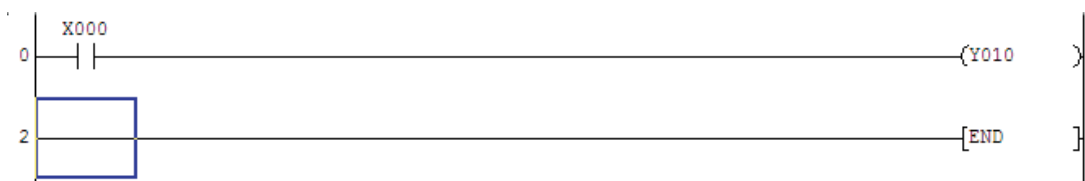
Enter the codes of the devices for the instruction and then click on **OK** (or press ENTER). The instruction will be inserted in the selected position and the cursor will move along to the next position in the program line. The instruction is displayed with a grey background to indicate that this part of the program has not yet been translated (converted) into machine code that the controller CPU can understand. Programs must always be converted before being transferred to the CPU.



Now you can enter additional instructions. If you enter an output instruction or an extended instruction when the cursor is in the position shown the instruction will automatically be positioned at the end of the program line.

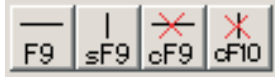



Selecting the  tool in the toolbar or pressing F4 converts the new section of the program into machine language. You don't have to do this every time you enter a new program line; you can also convert the program when you have finished making all your entries. When the translation is complete the grey shading disappears, indicating that the program can be transferred to the PLC.

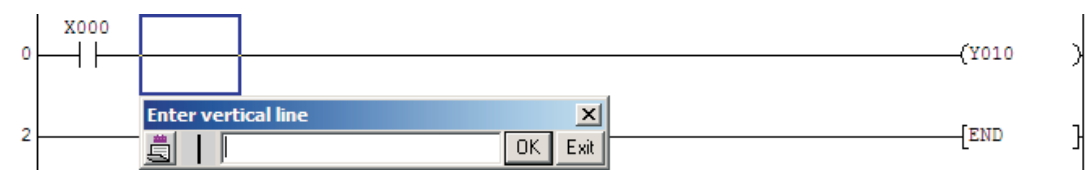


### 2.3.3 Inserting connecting lines

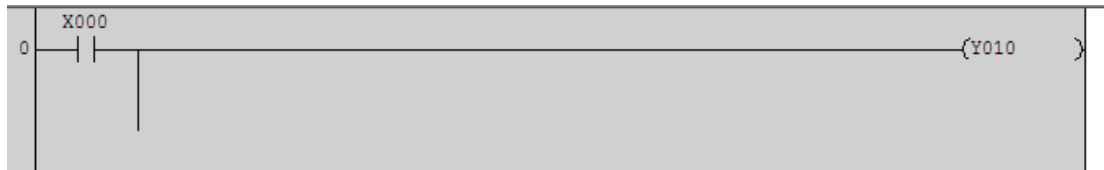
The graphical representation of logical connections is one of the main benefits of Ladder Diagram programming. There are a number of different methods for creating the connecting lines (also known as interconnects) for these connections:

Using the line insert/erase tools: 


Let's assume you want to insert a vertical connecting line. Click in the position in the program ladder where you want to insert the line to display the cursor, then click on the  tool.

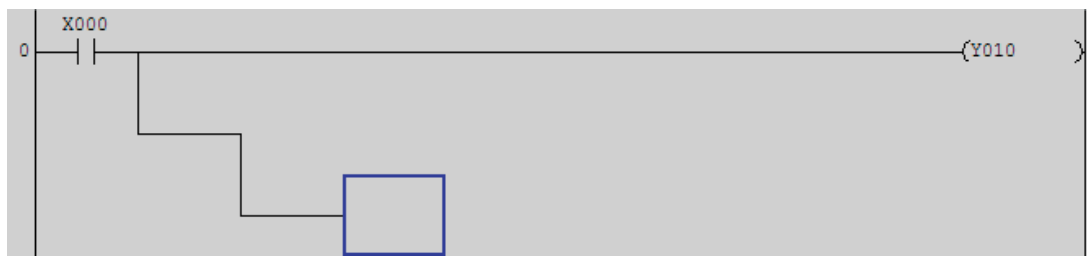



A dialog is displayed in which you can now enter the number of vertical connecting lines you want to insert. If you do not enter any value one line will be inserted by default. (The length of the line corresponds to the height of the cursor.) Then click on **OK** to insert the line.



Using the line draw/erase tools: 

When the  tool is active you can draw horizontal and vertical lines quickly and easily with the mouse. First position the cursor at the point where you want the line to start. Then press and hold the left mouse button and drag the mouse to draw the line. Release the left button at the point where you want the line to end.

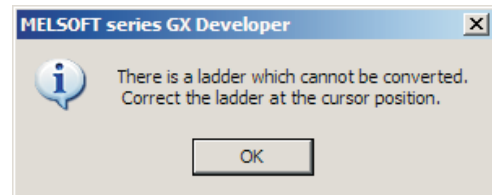


You can erase lines in the same way with the  tool. Hold down the left button and drag across the line you want to erase. The line will be erased when you release the mouse button.

**Important:** Note that these are toggle functions. They remain active until you turn them off by clicking on the corresponding tool again.

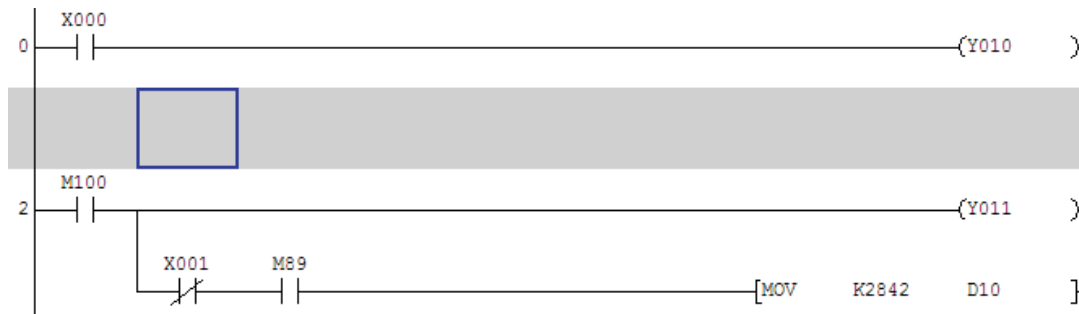


If your connecting lines contain errors the message shown on the right will be displayed when you try to convert the program. You must correct the error at the cursor position before you can complete the conversion.



### 2.3.4 Inserting and deleting program lines and elements

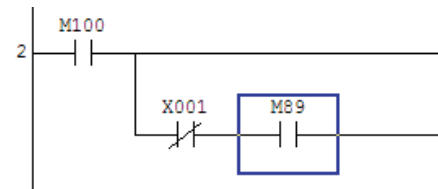
To insert a new line (rung) in the program ladder click to place the cursor on the line you want to move down and select **Insert Line** in the **Edit** menu.



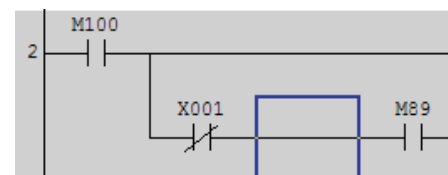
Note that you don't need to insert a new program line manually when you add program elements directly before the last line of the program (the rung in the ladder containing the END instruction). When you position the cursor in the last line and enter program elements the line containing the END instruction is pushed down and a new line is inserted automatically.

To delete an instruction in a program row position the cursor on the element you want to delete and select **Delete row** in the **Edit** menu.

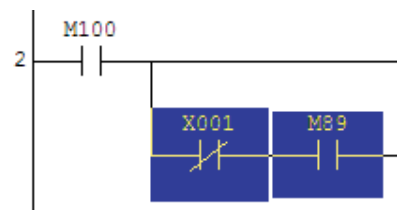
To insert an instruction between two elements on a program line first click on the second instruction (the one that will come after the new instruction) to select it with the cursor.



Then select **Insert row** in the **Edit** menu.



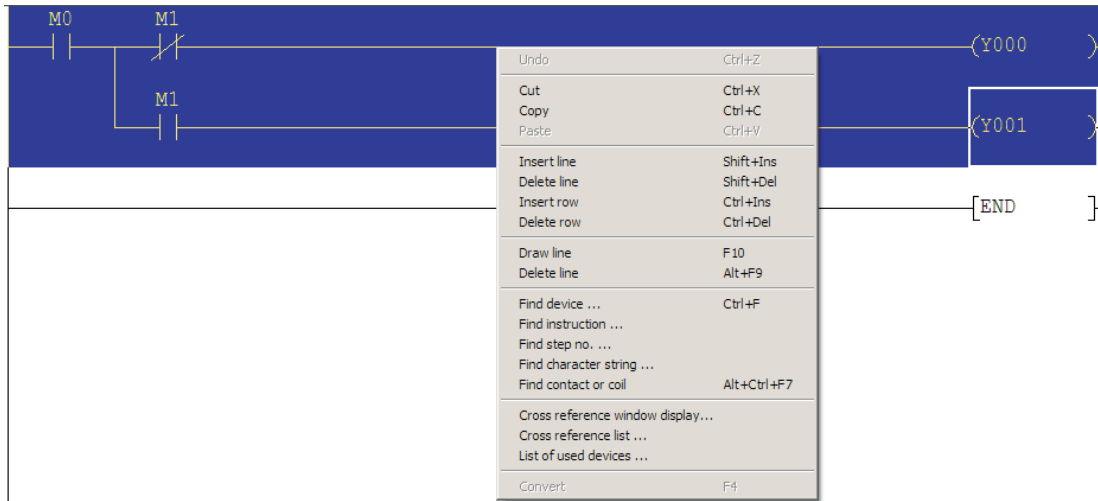
To delete an instruction in a program row position the cursor on the element you want to delete and select **Delete row** in the **Edit** menu.



Alternatively you can also select one or more elements and delete them by pressing the DEL key. To select multiple elements hold down the left mouse button and drag.

You can also insert and delete program lines and elements with the context menu that is displayed when you click with the right mouse button. This menu also includes options with which you can cut or copy individual program elements or even entire program rows and then paste them into other positions in the program.

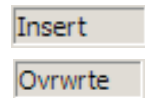
To select a single instruction just click on it with the left mouse button. To select an entire program line click and drag with the mouse. After selecting release the left mouse button and then right-click in the selected (highlighted) area to display the context menu.



### 2.3.5 Insert mode and Overwrite mode

You can switch between Insert and Overwrite mode by pressing the INSERT (INS) key on your keyboard. In GX Developer Overwrite mode is used to change existing instructions or devices, while Insert mode adds new ones.

The current mode is shown in the status bar of the GX Developer program window. (See the diagram in section 2.1 to confirm the on screen location of the status bar.)



The current mode is also indicated by the colour of the cursor. With the default settings the border of the cursor is violet in Insert mode and blue in Overwrite mode.

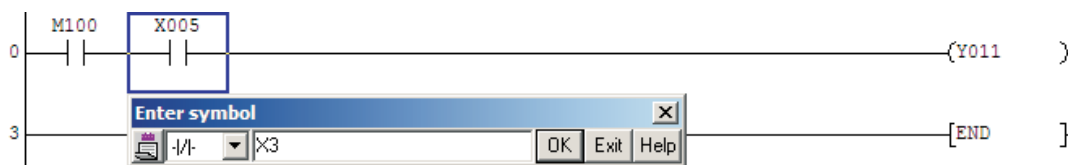
#### Example of working in Overwrite mode

Let's assume that you decide you want to replace input X5 (a normally open contact) with input X3.

1. Make sure that Overwrite mode is active, then click on the element in the program you want to replace to select it.



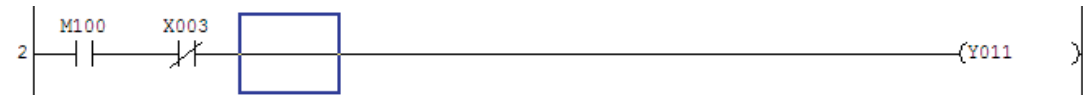
2. Select the new instruction in the toolbar or double-click on the cursor to display the input dialog box. Then just insert the new instruction or device.



3. Convert the program



4. Finished!



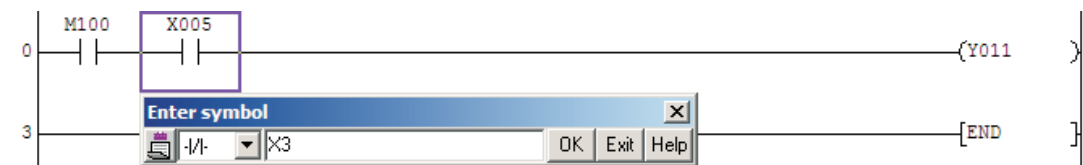
**Example of working in Insert mode**

You decide you want to insert a normally closed contact using input X3 before the normally open contact using input X5.

1. Make sure Insert mode is activated, then select the element in the program before which you want to insert the new contact.



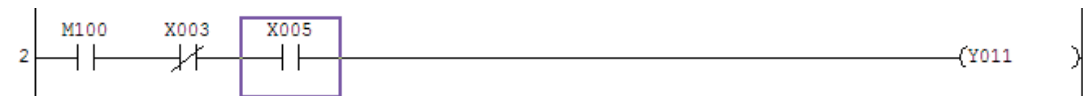
2. Select the new instruction in the toolbar or double-click on the cursor to display the input dialog box. Then just insert the new instruction or device.



3. Convert the program



4. Finished!



### 2.3.6 Programming timers

You can implement a switching delay by programming the conditions for starting the timer in a program line and then terminating the line with an output instruction that activates the “coil” of the timer.

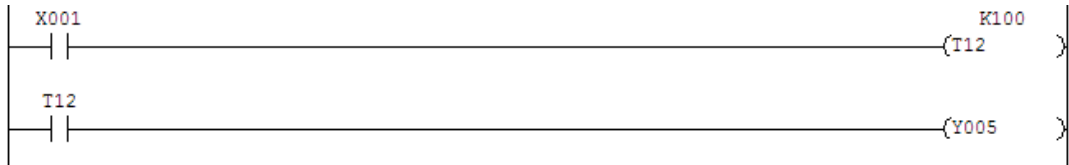


You can also use the  tool in the toolbar for this.



You must enter the value for the delay time together with the address of the timer.

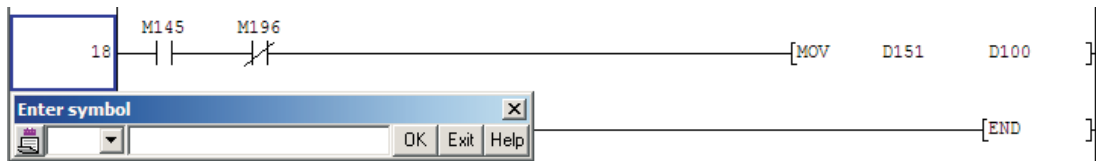
Once you have programmed a line like this you can then use the switching state of the defined timer as often as you want as a normally open or normally closed contact. In the following example for an FX1N series controller output Y005 is switched on 10 seconds after input X1 has been switched on. (T12 is a 100ms timer so K100 = 10s.)



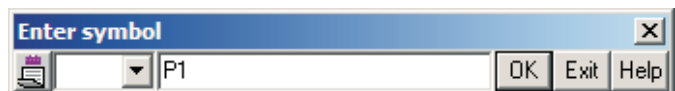
### 2.3.7 Labels for jump targets and interrupt programs

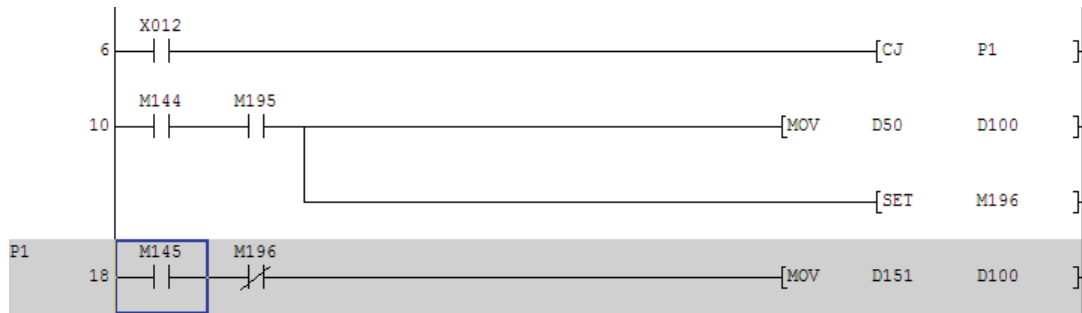
You can use jump statements in your programs to execute subroutines or to skip program lines. A jump statement consists of the jump instruction (conditional or unconditional jump) and the jump label (the target), which consists of the letter “P” followed by a unique number. You can define up to 128 jump labels in programs for controllers in the MELSEC FX family. If you use the FX3U, you can even define up to 4096 jump labels!

Jump labels are entered to the left of the program line (rung). To enter a label click to the left of the rung where you want to position the cursor, then double-click with the left mouse button to open the input dialog box.



Then enter the jump label name (“P1” in this example) and click on **OK**.





In the sample program above a conditional jump to label P1 is executed and line 10 is skipped if input X12 is on.

**Interrupt programs** are program sequences that are independent of the main program. They can be called by a change in the state of inputs or by timers or counters. When an interrupt program is called the main program is interrupted (hence the name) and then resumed automatically after the interrupt program has been executed. The advantage of interrupt programs is that they are executed immediately, making it possible to respond more quickly to states in the controlled system or internal events in the PLC. Interrupt programs are identified by labels consisting of the letter I and a unique sequential number. These labels are entered in the same way as the labels used for jump targets (see above).



For more details on interrupt programming please see the Programming Manual for the MELSEC FX family (Art.-no. 048261).

# 3 Documenting Your Programs

Good documentation is just as important as good programming. If you just enter instructions, devices and their addresses in your programs you will very quickly lose track of what you are doing. Programs with hundreds of rows of code and no comments are completely incomprehensible to anyone except the programmers, and even they can only understand them while they are actually working on the project.

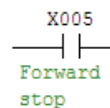
GX Developer has three different functions with which you can add documentation to your programs:

- Device comments
- Statements
- Notes

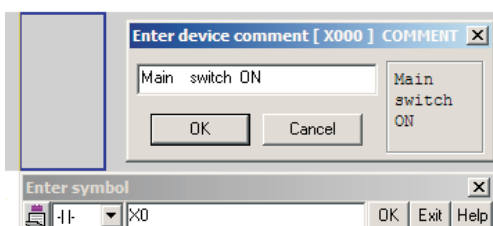
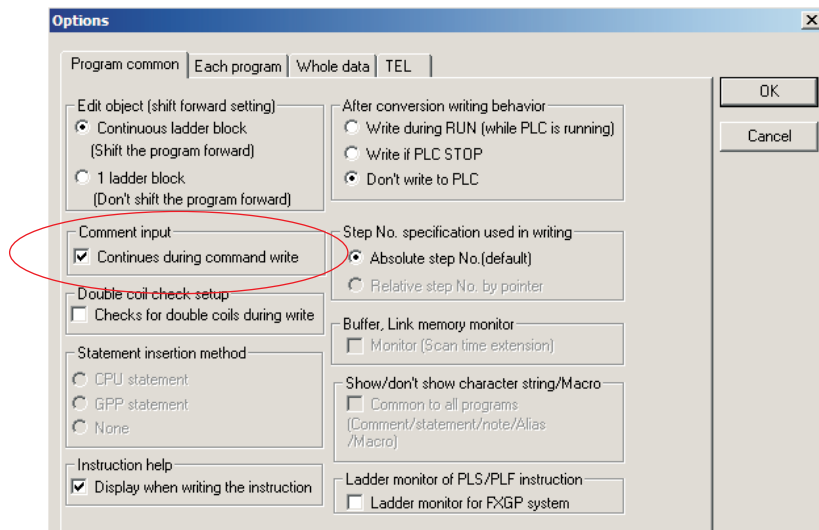
## 3.1 Device comments

A device comment is a brief description of the device. Each comment is directly associated with the device for which it is entered.

The comment can be displayed everywhere where the device is used in your program (This display can also be switched off, see next page.)

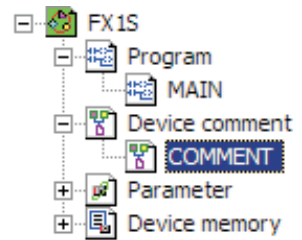


You can enter device comments separately in a file or add them while you are programming, together with the device with which they are associated. When you enter a comment with the device the entry in the comment file is updated automatically. To activate comment entry during programming select **Options** in the **Tools** menu and activate the **Continuous during write** option in the **Program Common** tab.



When this option is enabled you can enter and edit device comments while you are entering devices during the programming process.

Usually, however, you will know the functions of your inputs and outputs before you start with the actual programming work. It is then easier to enter all your descriptive comments in the comment file while you are setting up your project. To do this just double-click on the **COMMENT** entry in the **Device Comment** section of the project data list.



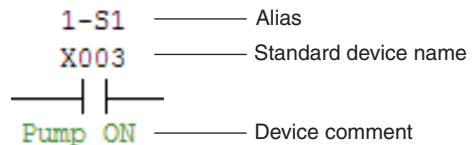
Select the device type and address here and then click on **Display**.

Device name X000 Display

Device name	Comment	Alias
X000	Main switch ON	0-S1
X001	Fuse trapped	0-S2
X002	Pump OFF	1-S0
X003	Pump ON	1-S1
X004	Level reached	1-S2

You can enter both a **Comment** and an **Alias** for each device. Comments can be up to 32 characters long, aliases up to 8 characters long.

An alias is an alternative name for a device that can be displayed together with or instead of the standard device name. You can enter the names of system components as aliases to make inputs and outputs easier to identify.



You can use the options in the **View** menu to enable or disable the display of device comments and/or aliases.

There are two options for the alias display mode:

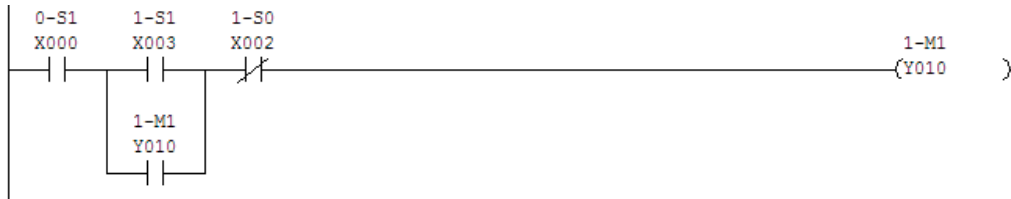
– **Replace device name and display**

This displays the alias instead of the standard device name. Example:



– **Arrange with device and display**

The alias is displayed in addition to the standard device name and address. Example:



### 3.1.1 Transferring device comments to the PLC

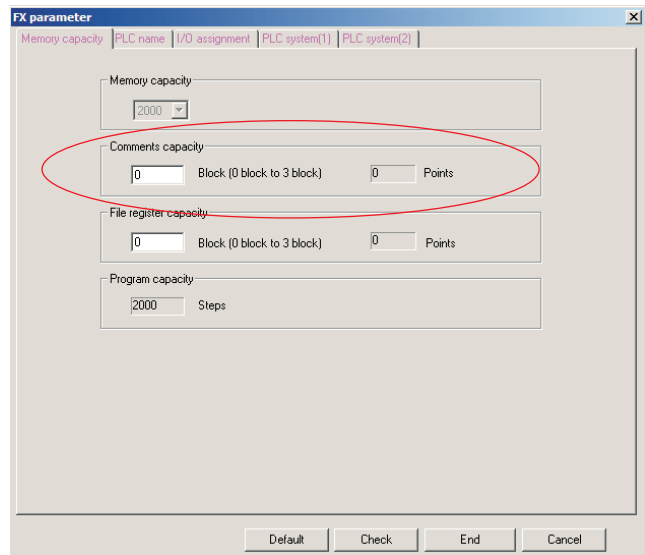
If you transfer the device comments to the PLC the program can be displayed with comments on a PC on which GX Developer is installed, even if the program itself is not stored on the PC. This feature can make maintenance and debugging a lot easier.

Comments are not transferred to the PLC automatically. This function must be activated manually in the **Online** menu (see chapter 4).



In addition to activating comment transfer you must also reserve memory for comments in your MELSEC FX controller before you can store comments in the PLC. This reserved memory is then no longer available for program code.

For example, controllers of the FX1S series can store up to 2,000 program steps. If you configure 1 block for comments as shown in the illustration on the right you can store up 50 device comments in this PLC.



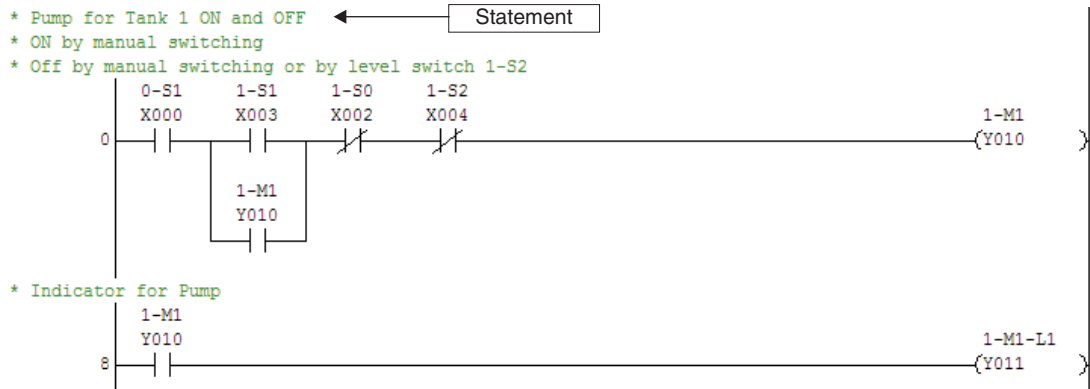
Each block of 50 comments reduces the program memory capacity by 500 program steps. In the FX1S you can reserve up to 3 comment blocks for a total of 150 device comments, which then reduces the number of program steps you can store to a maximum of 500.

You can reduce the size of the device comments file by executing the **Delete unused comments** function in the **Tools** menu.



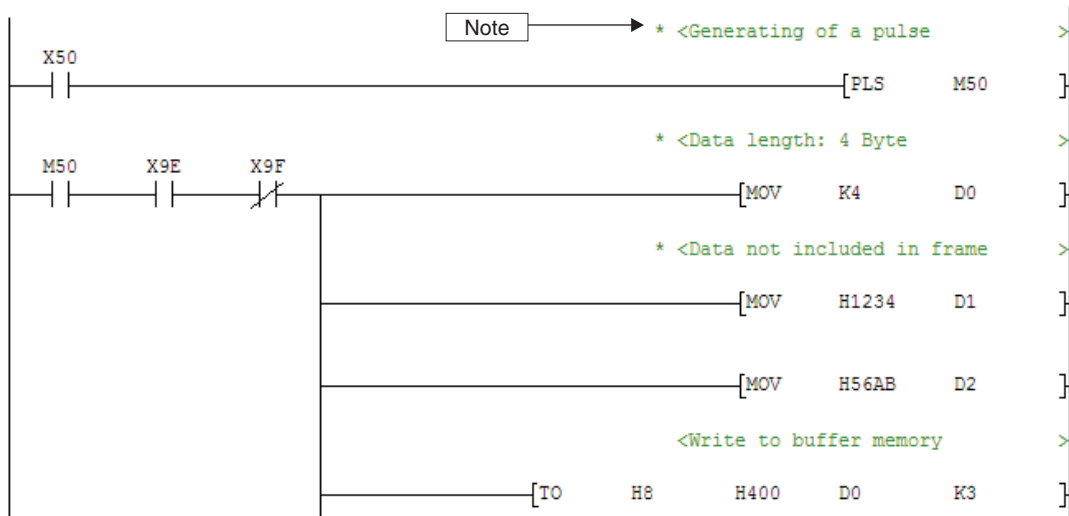
### 3.2 Program line titles (statements) and notes

Program line titles (referred to a **Statements** in GX Developer) help to document and organise your programs. Used well, they make it much easier to understand the program when you return to it again later.



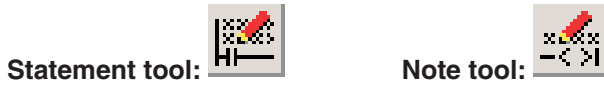
Each statement can be up to 64 characters long and is displayed above the program line in a separate line. You can enter up to 15 lines of statements for each program line in the ladder.

**Notes** can be entered for output and application instructions at the end of program lines. They can contain up to 32 characters.

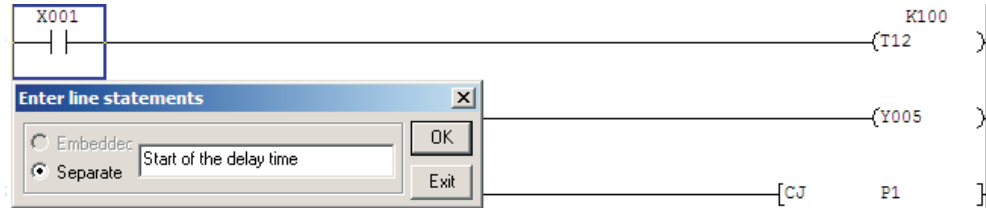


### 3.2.1 Entering statements and notes

To use statements and notes first elect the **Documentation – Statement** or **Documentation – Note** option in the **Edit** menu or activate the **Statement** or **Note** tool in the toolbar:



To enter a statement double-click on an object in a program line and then enter your text. To enter a note double-click on the last object in the program line and enter your text.



When you click on **OK** to confirm the program line will be displayed with a grey background.



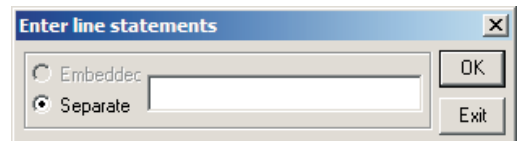
The statement or note is finalized when you convert the program – for example by pressing **F4** on the keyboard.



To enter additional statement lines just double-click on an object in the line again. To edit statements and notes double-click on the specific text that you want to change.

After entering your text you must switch off the statement or note editor before you can continue programming and enter or edit instructions.

Note that you cannot store statements and notes in the PLCs of the MELSEC FX family. This is why the **Embedded** option is always disabled when you are working with these PLCs.



**Separate** means that statements and notes are stored in the project directory. When you download a program from the PLC this information will only be displayed if there is a corresponding project containing this data on the PC.

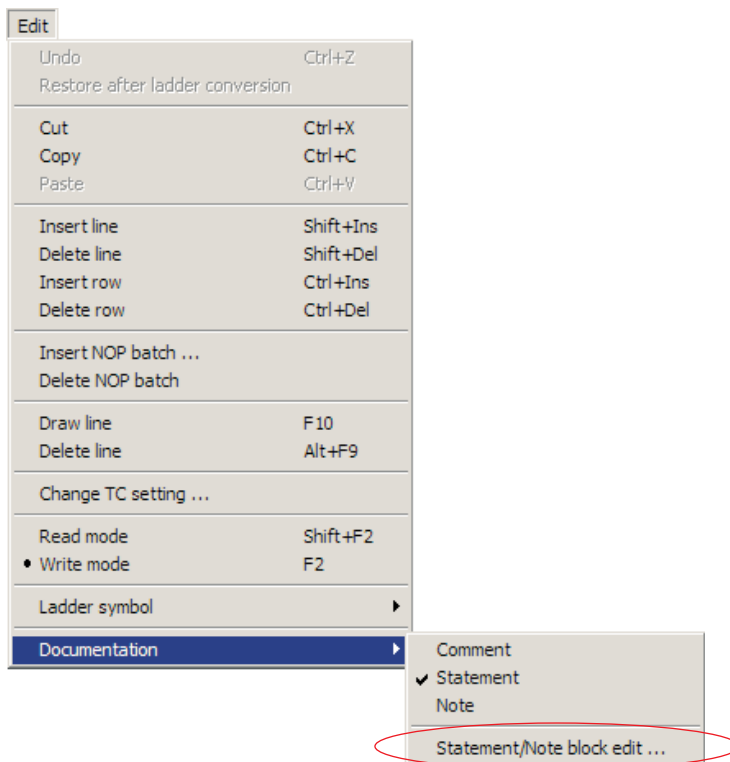
### 3.2.2 Displaying program line statements and notes

You can enable the display of statements and notes by activating the corresponding options in the **View** menu.

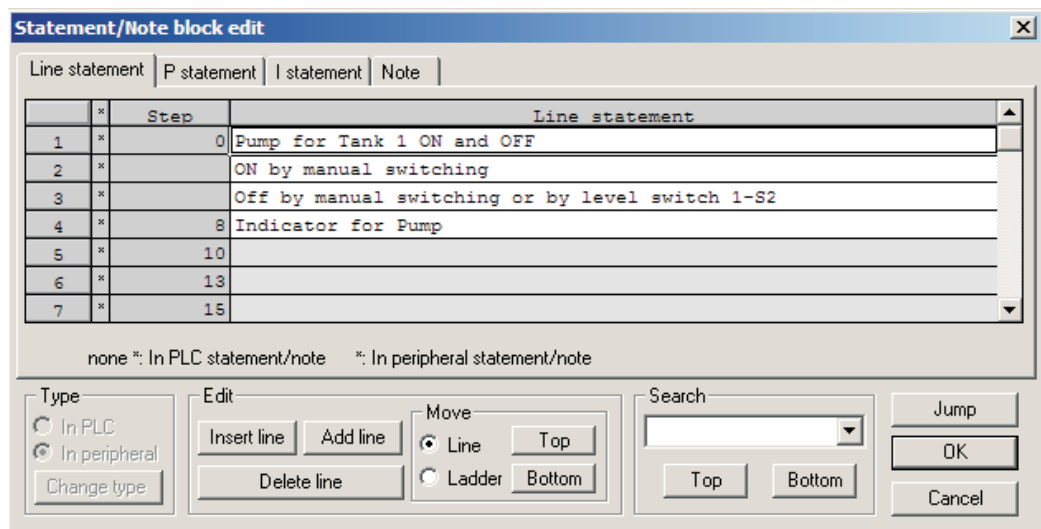


### 3.2.3 Editing statements and notes as a list

You can also enter all the statements and notes associated with your program together as a list. To do this select **Statement/Note block edit...** in the **Edit** menu.

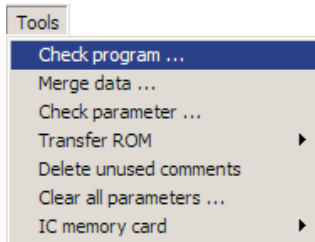


This opens the dialog shown below, listing all your statements and notes in order by program line. You can then edit and delete existing texts and add new lines.

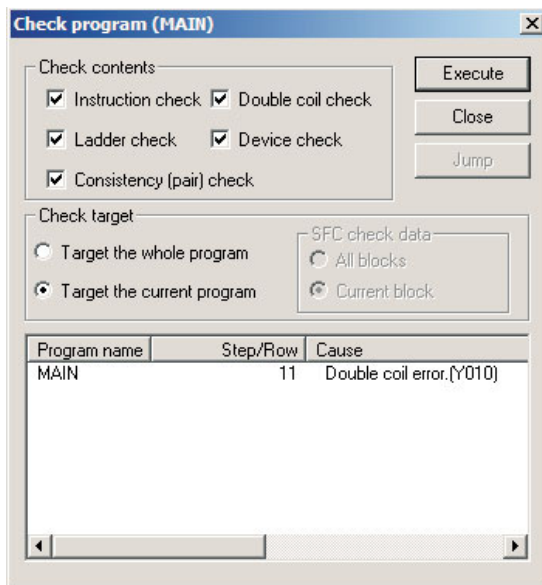


## 4 Transferring Programs to the PLC

Before you transfer your program to the PLC you must first check it for errors.



To do this select the **Check program...** option in the **Tools** menu.



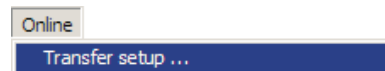
This displays a dialog in which you can choose the options for checking the program. When you click on **Execute** the check is performed and the results are displayed in the window at the bottom of the dialog box.

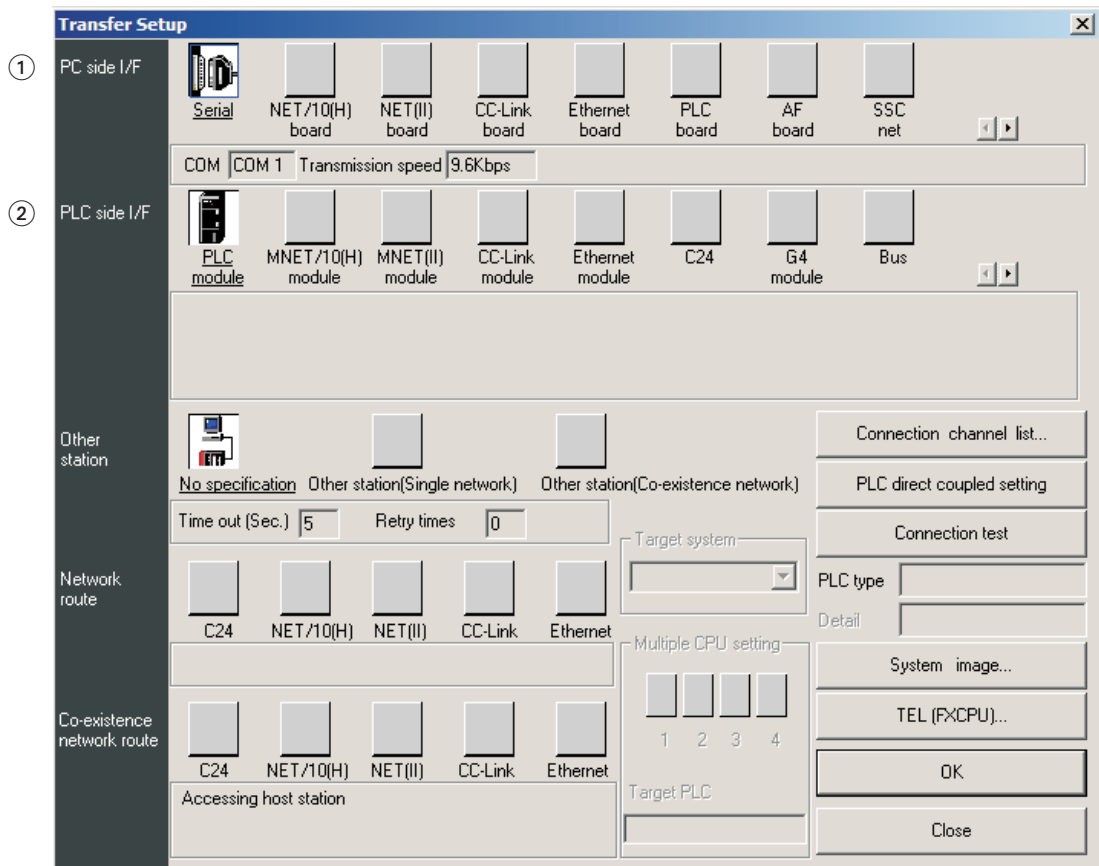
If errors are found you can jump to the program line containing the error by double-clicking on the error in the results list. Alternatively you can also select the error and then click on the **Jump** button.

In this example the programmer has accidentally used the same output twice as the target device for an output instruction.

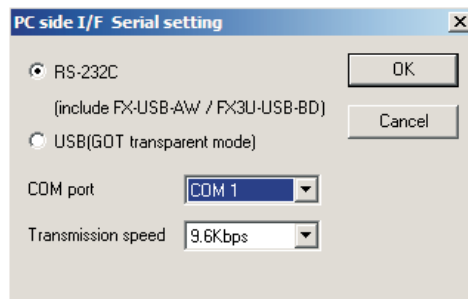
Before you can transfer your program to the PLC the PLC must be connected to the programming device and the controller's power supply must be switched on.

Next you need to select the method you want to use for communication between the programming device and the PLC. Click on **Transfer setup...** in the **Online** menu.





① Select the PC connection interface by double-clicking on **Serial** in the **PC Side I/F** line.

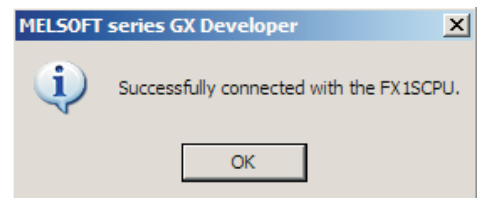


This opens the dialog for configuring the RS-232C interface. Select the COM port you are using and transmission speed (the default rate is 9.6Kbps).

Then click on **OK** to store your settings.

② Then select **PLC Module** in the **PLC Side I/F** line. (PLCs of the MELSEC FX family can only be connected to the programming device directly.)

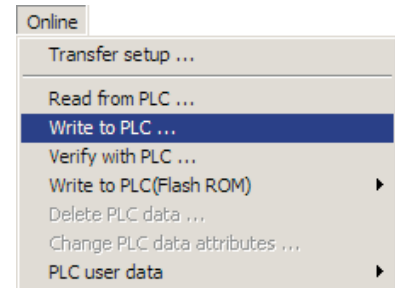
To test the connection click on the **Connection Test** button. If devices are able to communicate properly with these settings the message shown on the right will be displayed.



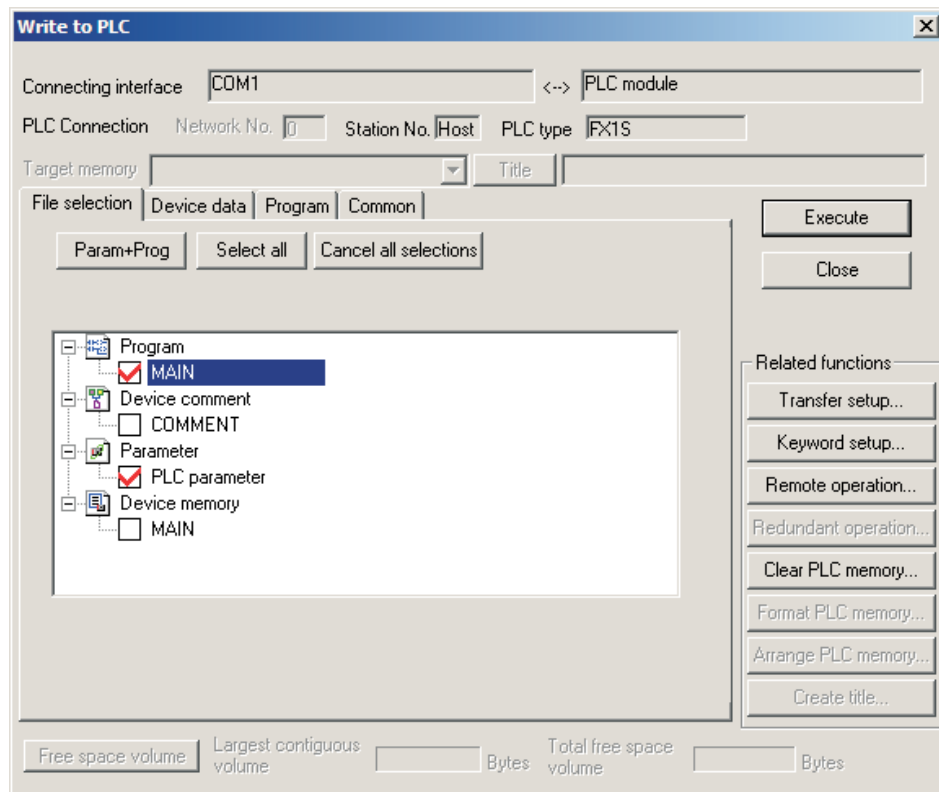
Then click on **OK** in the Transfer Setup dialog to save your settings and close the dialog.

To transfer a program to the PLC click on the  tool in the toolbar

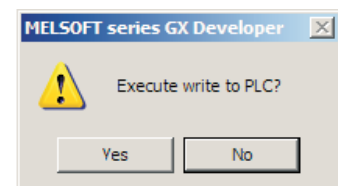
or select **Write to PLC...** in the **Online** menu.



This displays the Write to PLC dialog, in which you can select the project components that you want to transfer to the PLC. When you are setting up the controller for the first time you need to transfer both the program and PLC parameters. Later on (for example after program changes) you only need to transfer the program.



To start the program click on **Execute**. The prompt shown on the right will be displayed asking you to confirm.



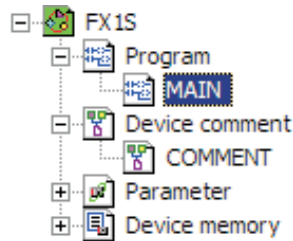
What happens if the CPU is in RUN mode depends on the CPU type. If the PLC supports it GX Developer will automatically stop the CPU and restart it when the transfer is completed. Otherwise you will be prompted to stop the CPU manually. When the transfer has been completed a confirmation message is displayed.

# 5 Testing and Diagnostics Functions

The ability to monitor the execution of your program in the PLC makes testing, optimising and debugging much easier. GX Developer has many functions for displaying the status of programs and devices while you are working.

## 5.1 Monitor mode


In Monitor mode the current statuses of the PLC devices are displayed in the program. The PLC must be switched on and connected to the programming device to use this mode, of course.



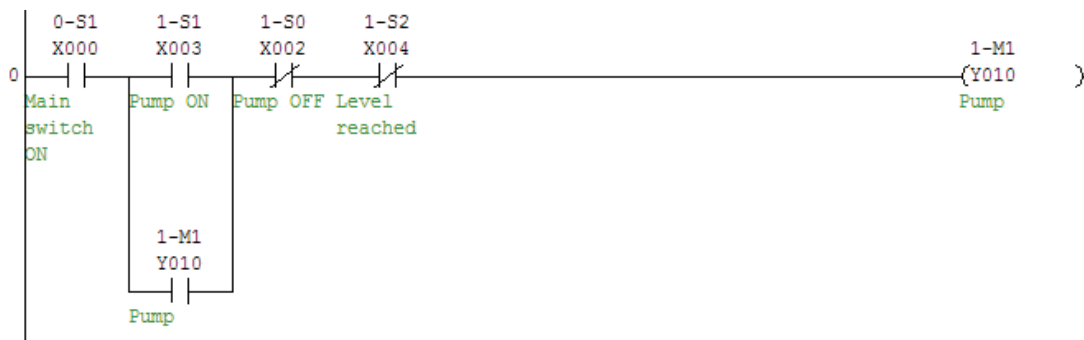
Open the project for the program that is stored in the PLC and double-click on the program file (MAIN in the example on the left) to display the program in the editing window.


If the program stored in the PLC is different from the version on the PC you can also load the current program from the PLC to the programming device.

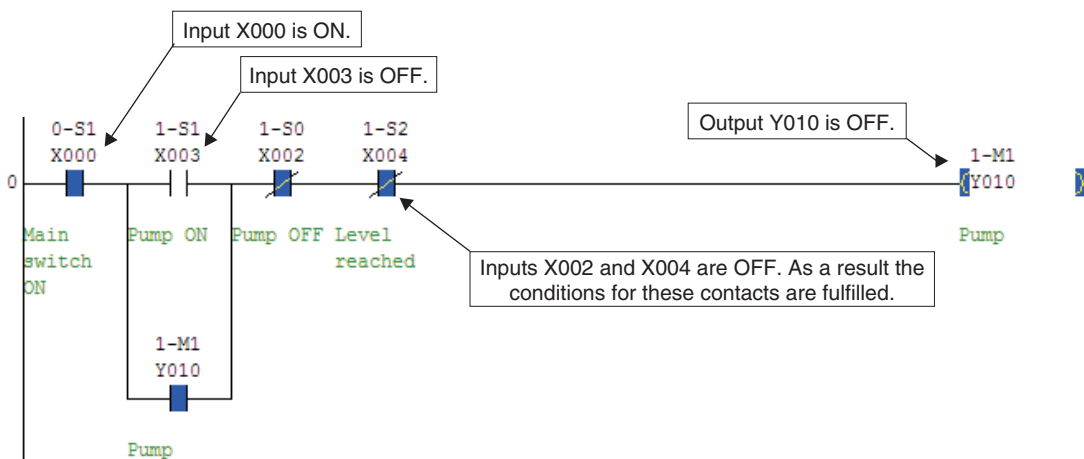


To do this click on the  tool in the toolbar or select **Read from PLC** in the **Online** menu.

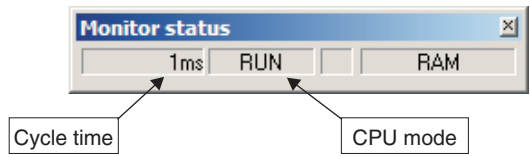
The program is then displayed in Read or Write mode.



Click on the  tool in the toolbar to activate Monitor mode. Contacts in the program whose conditions are fulfilled are then displayed as follows:



The current status of the PLC is also displayed in Monitor mode:

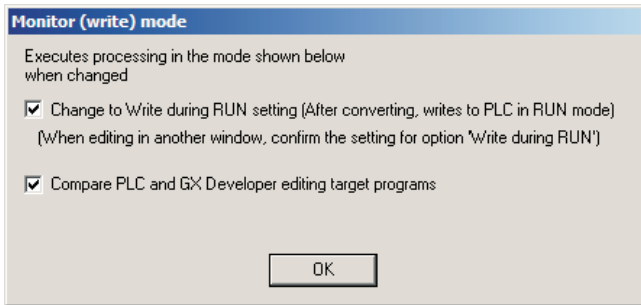


### 5.1.1 Monitor mode (write)

The passive Monitor mode described in the last section is useful for watching device status and program execution. There is also an active mode called **Monitor (write)** that you can use if you need to make changes to the program while you are monitoring

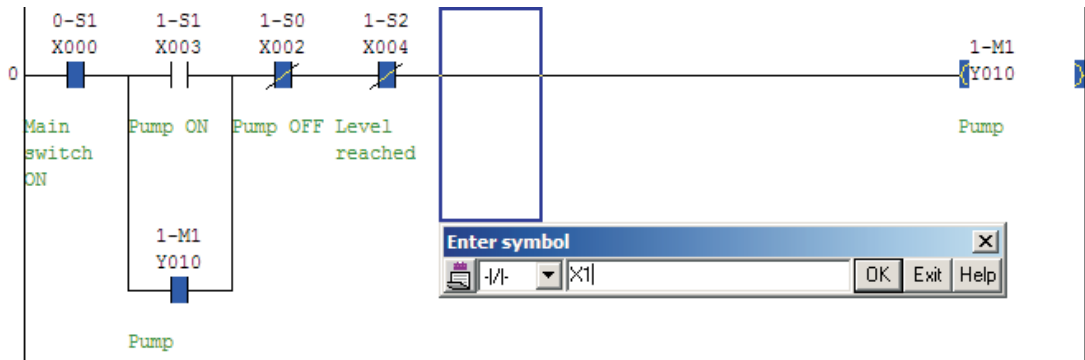


Click on the  tool in the toolbar to activate this mode. The following dialog is displayed:

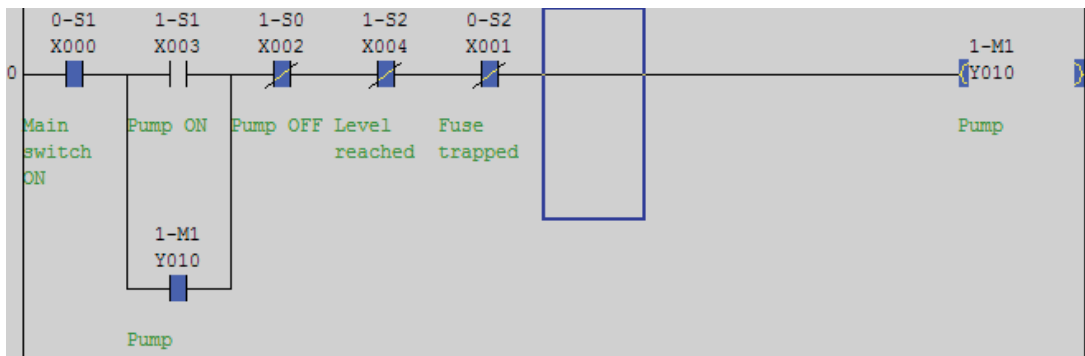


Select the first option if you want to be able to change the program while the PLC is in RUN mode.

The program and device status display work in the same way as in the passive Monitor mode described in the previous section. To make changes, corrections or additions to the program proceed in exactly the same way as you would when editing the program normally in offline mode (see chapter 2.3).

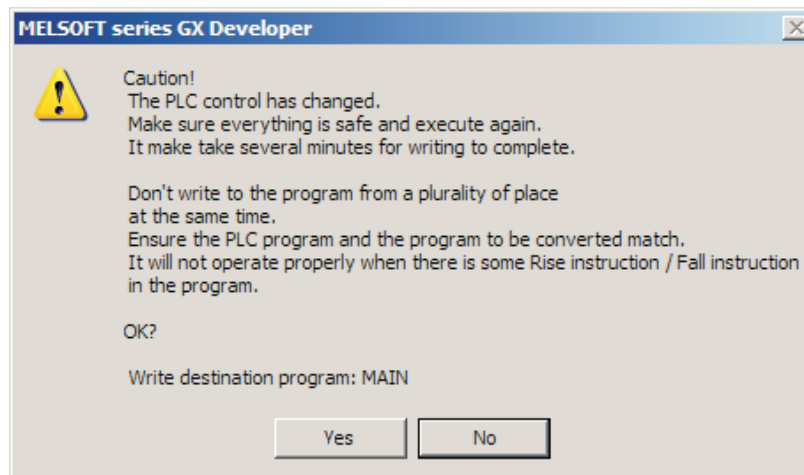


When you enter a change with **OK** the statuses are displayed but the changes have not yet been applied (indicated by the grey background).

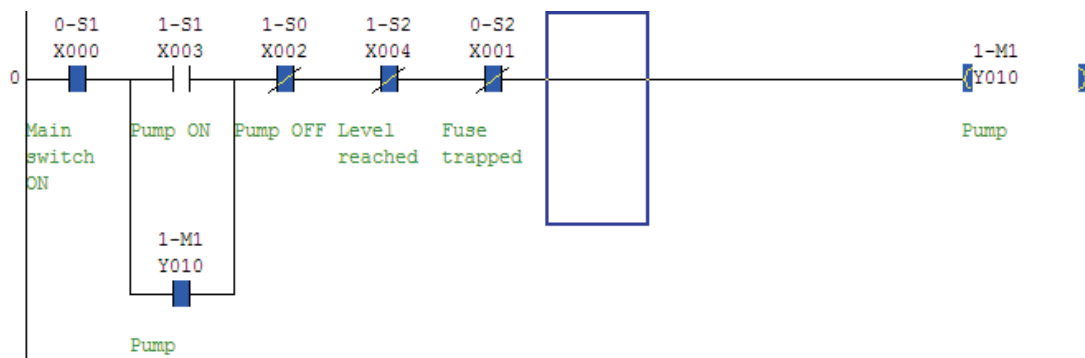




After you press **F4** to convert the program the following message and warning is displayed:



To apply and write the changes click on **Yes**. Once the program has been converted and updated Monitor mode will be continued.



## 5.2 Device Test function

You can also use the programming device (in this case the PC) change the values of devices directly from while you are testing your program. For example, if you need the input signal from a certain switch to initiate a process you can activate the switch from the PC and continue to watch the resulting program execution.



### CAUTION:

***Be extremely careful when using this function! Changing the states of devices independently of the program can cause potentially dangerous situations for both personnel and equipment!***

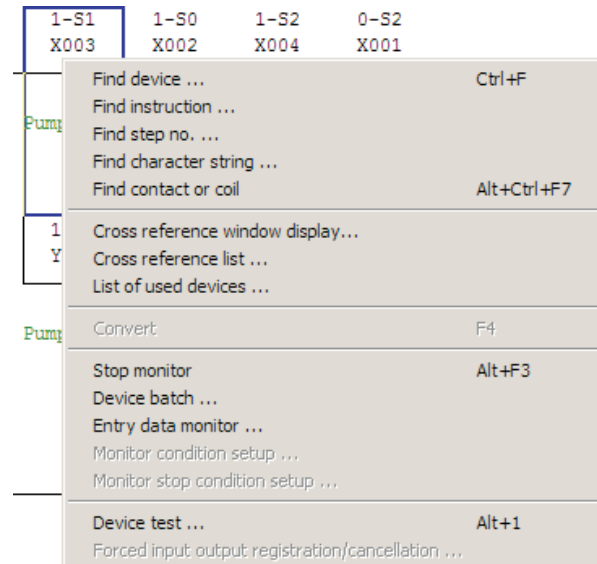
Execution by the program has higher priority for the control of devices used by output instructions, such as outputs. The Device Test function only changes these devices very briefly for the test, after which they are returned to the status assigned to them by the program.



Click on the  tool in the toolbar to open the Device Test dialog.

In **Monitor** and **Monitor (write)** modes you can activate the Device Test function by selecting a device in the editor and then right-clicking on it.

With some other test functions the Device test can be selected in the dialog box of the function. (see below).

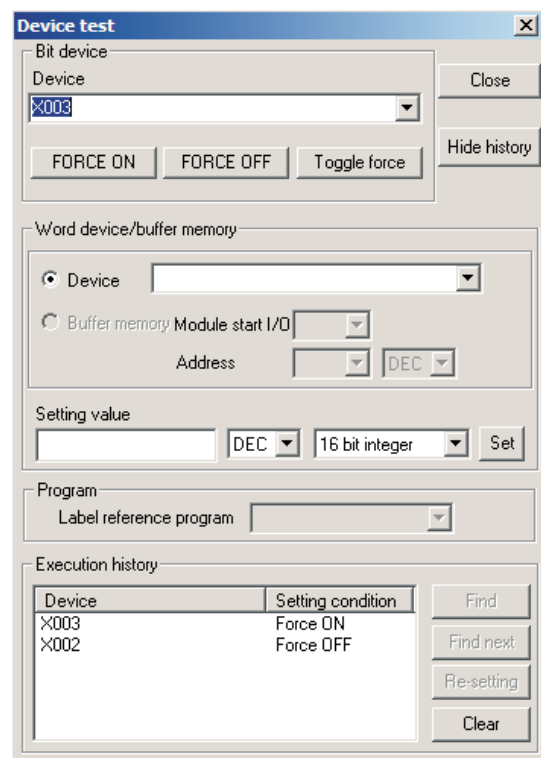


Bit devices (inputs, outputs, relays etc):  
Set (**Force ON**), reset (**Force OFF**)  
or change state (**Toggle Force**).

Select word devices: On some PLCs you can  
alter the contents of the buffer memory in  
special function modules. To do this you must  
specify the both the start I/O address of the  
module and the memory buffer address.

Value to be written to the word device.  
Click on **Set** to write the value.


History of device tests performed. You can  
search for selected devices with the buttons on  
the right. **Clear** removes all the current entries  
from the history list.

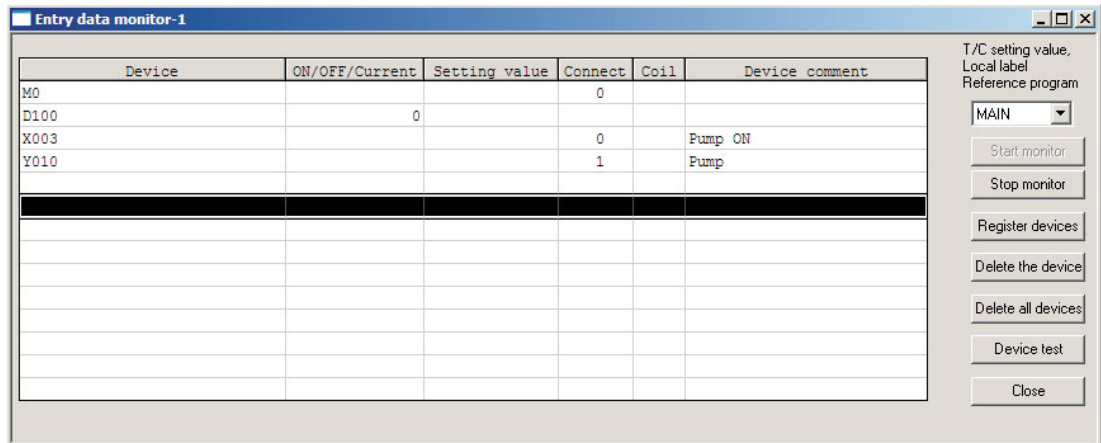


## 5.3 Entry data monitor

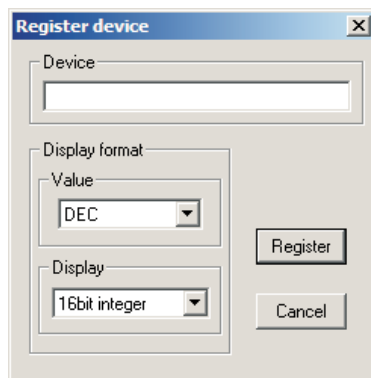
The Entry Data Monitor allows you to monitor data from different parts of the program at the same time. You can make your own list of the devices you want to monitor.



To start this function click on the  tool in the toolbar or select **Entry data monitor** in the **Online** menu.



Before you can start monitoring the status of devices you must first add devices to the Entry Data Monitor list. To do this double-click in an empty line in the list or click once in an empty line to select it and then click on **Register Devices**.



This displays the Register Device dialog. Select the device you want to monitor and the display format (for word devices). Then click on **Register** to insert the device in the list.


Once you have added all the devices you want to monitor to the list you can start monitoring with the **Start Monitor** button.

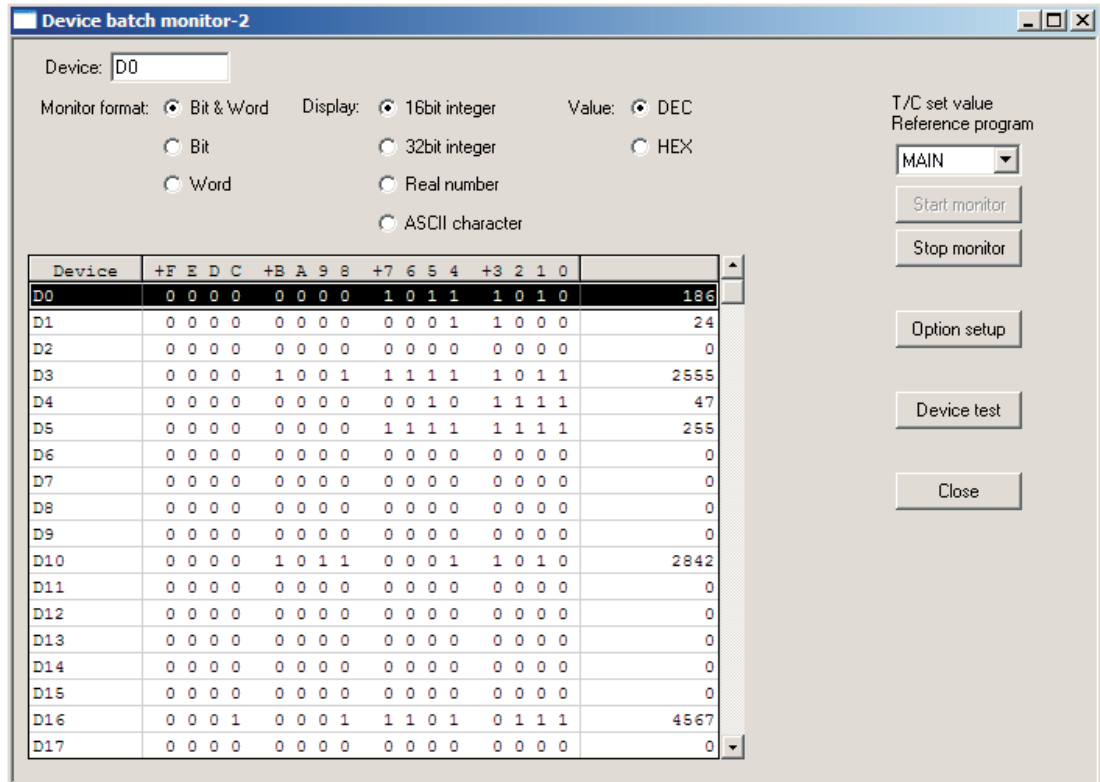
The other buttons in the Entry Data Monitor dialog are used to delete individual devices or all devices in the list and to perform a device test (see chapter 5.2 above). This test can also be started directly by double-clicking on a device in the list.

## 5.4 Device Batch Monitor

The Device Batch Monitor function is used for monitoring the status of consecutive groups of devices in a range.



To start this test function click on the  tool in the toolbar or select **Device batch ...** in the **Online** menu.



Enter the name of the first device in the range you want to monitor in the **Device** field. Then click on **Start Monitor** or press the ENTER key. GX Developer will then show the selected device and the following devices, displaying their current values in the selected format.

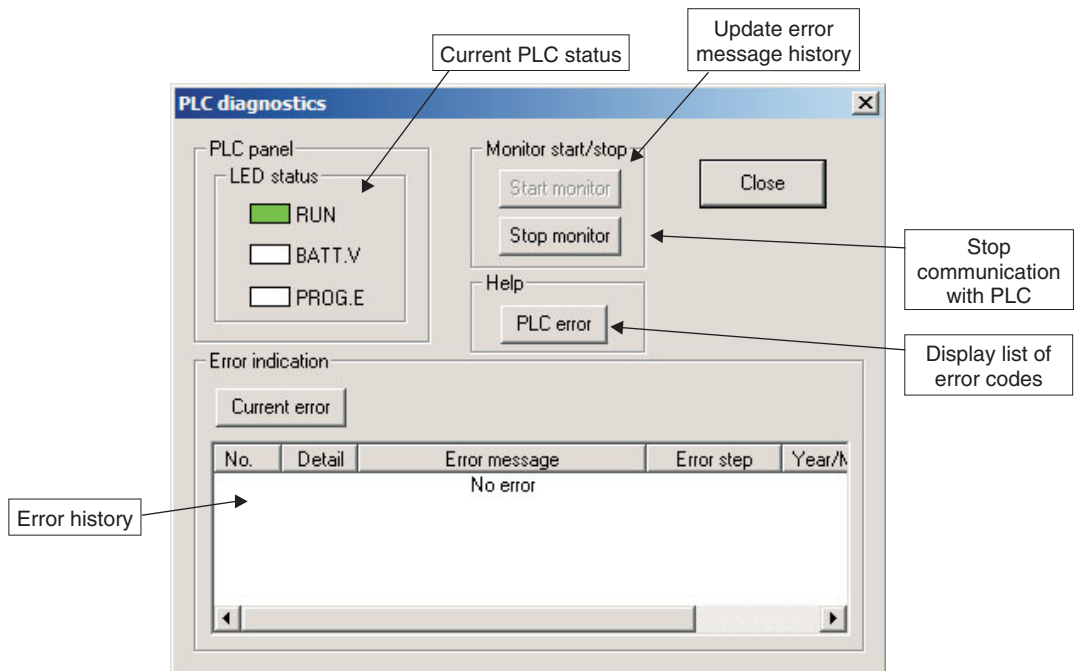
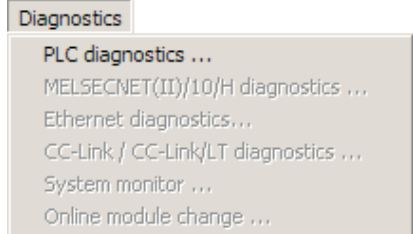
You can choose any display format you like. In addition to the options available directly in the dialog you can also click on **Option Setup** button for more settings.

You can shift the device display “window” across the entire device range supported by the connected PLC model.

If you change device values and want to enter setpoint values click on the **Device Test** button (see chapter 5.2 above).

## 5.5 PLC Diagnostics

To check the current status of the PLC and view error messages select the **PLC diagnostics** option in the **Diagnostics** menu.

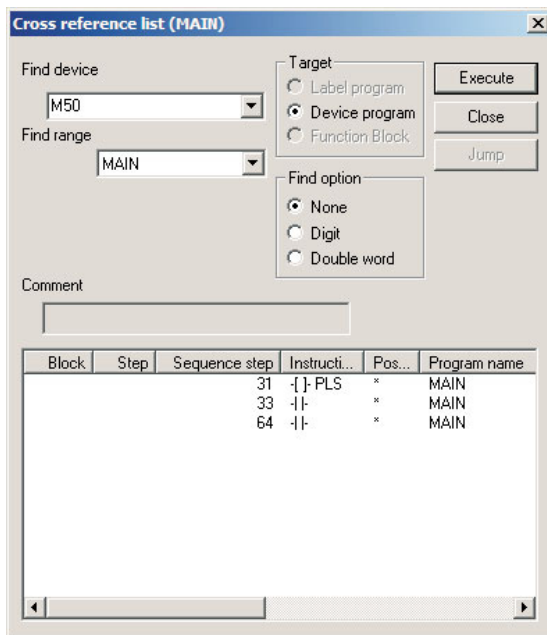
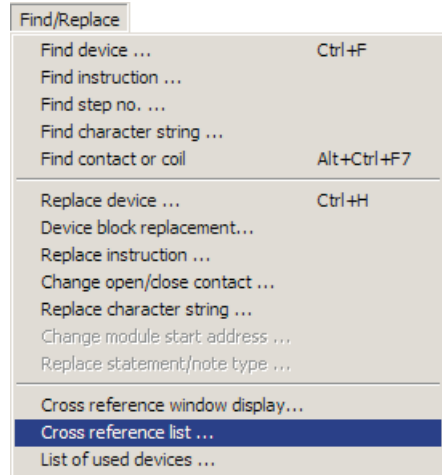


# 6 Other Functions

## 6.1 Cross Reference List

A cross reference list shows all the places where a device is used in the program.

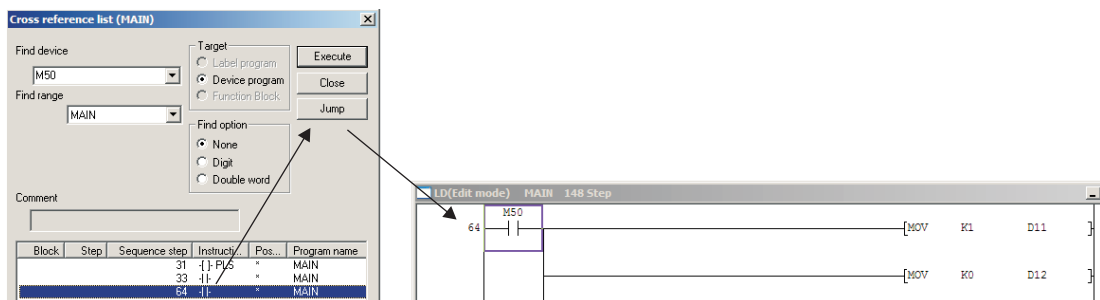
To activate this function select **Cross reference list** in the **Find/Replace** menu.



To display the cross references enter the name of a device in the **Find Device** field and click on **Execute**.

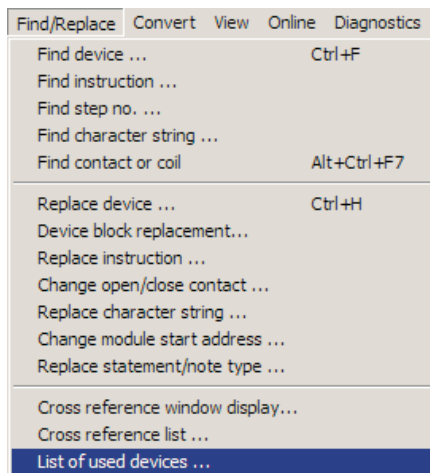
The list of instructions using the device is then shown in the window at the bottom of the dialog.

To display the corresponding program line click in the row in the cross reference list and then select **Jump**.

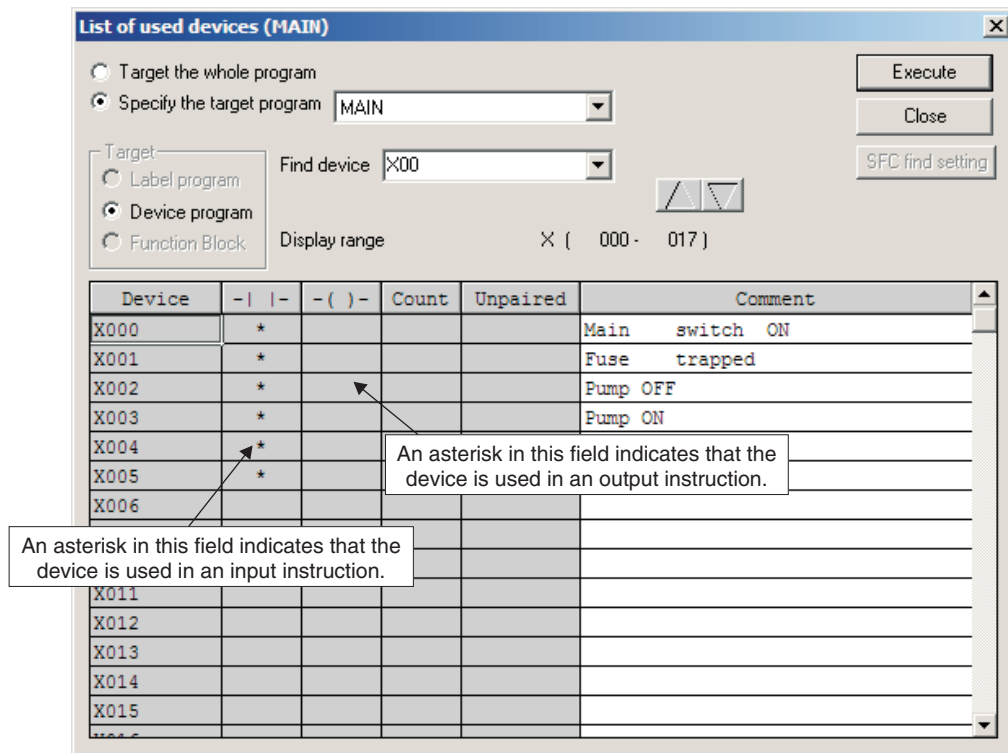


## 6.2 List of Used Devices

You can use this function to display a list of devices used in the current program to help you find free devices to use while you are programming.



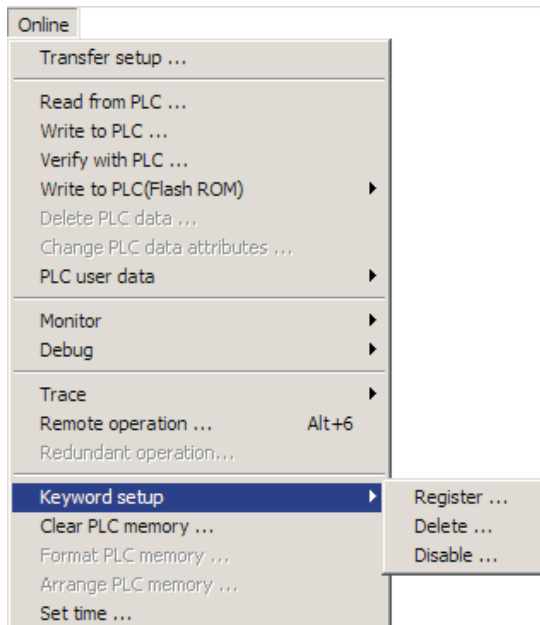
To activate this function select **List of used devices...** in the **Find/Replace** menu.



Enter the name of the first device you want to find in the **Find Device** field, then click on **Execute**.

## 6.3 Protecting programs with passwords

You can protect the program in the PLC with a password to prevent unauthorised reading and editing.



To display the dialog for registering, deleting or disabling a password click on the **Keyword setup...** option in the **Online** menu and then select the function from the submenu.

The password is stored in the PLC so the PLC must be connected to the programming device and switched on before you can use this function.

The input dialogs displayed will vary slightly depending on the connected PLC. However, on all PLCs the password must be exactly 8 characters long (no more and no less). Only the numbers 0-9 and the characters A-F are supported.

You must also enter the correct password to disable or delete a password. It is thus very important to make a note of the password and store it in a safe place, otherwise you risk locking yourself out of your own program!

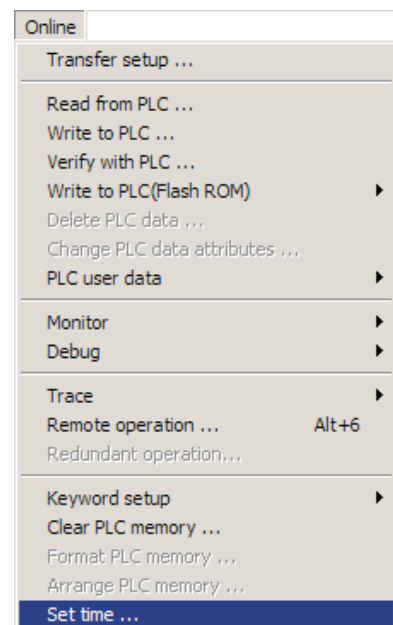
## 6.4 Setting the PLC clock

You can also use GX Developer to set the integrated clocks in the controllers of the MELSEC FX families.

You should always make sure that the PLC clock is set correctly, even you don't actually use the time and date in your program. For example, the PLC diagnostics functions use the CPU's internal clock to specify the time at which an error occurred (see chapter 5.5).

To set the clock the controller must be connected to the programming device and switched on

Select **Set time...** in the **Online** menu.



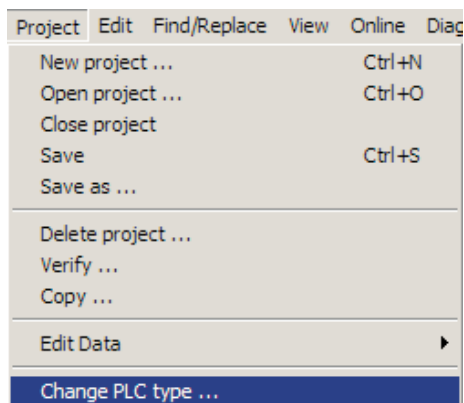


This opens the **Set Time** dialog box. The section at the top of the dialog shows how the PC and the PLC are connected.

Enter the date and the time in the fields in the **Clock Setup** section. If there are not enough input fields to enter the year as a four-digit number enter the last two digits only. The weekday will be displayed automatically as soon as you have entered the date. When you are finished click on **Setup** to set the new date and time in the PLC.

## 6.5 Changing the PLC type

When you create a new project you must specify the specific FX PLC type for the program and parameters of your project. You can also change these settings in an existing program – for example so that you can use the program for a different PLC.



Select **Change PLC type...** in the **Project** menu.

Then select the new PLC type in the dialog displayed and click on **OK**.

# 7 Macro Programming

You will often find that you reuse sequences of program lines with the same instructions but different devices, particularly in larger projects. For example, you will often use the same instructions over and over again to control an electric motor. GX Developer allows you to define “macros” to make it easier to reuse these repetitive blocks of program lines and instructions.

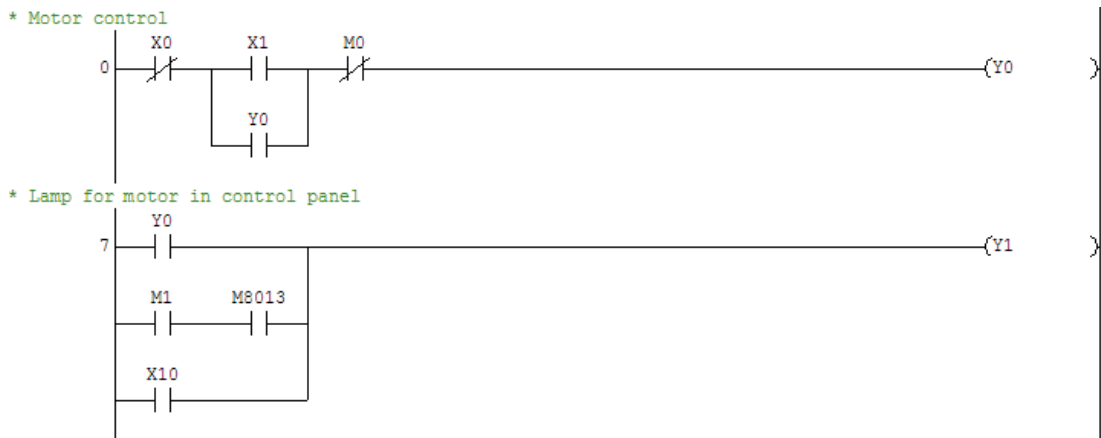
A macro is a “mini program” that GX Developer stores in a library that is accessible for use in all your projects. There’s nothing to prevent you from copying and pasting program lines within your project (see chapter 2.3.4), but named macros with comments are much easier to use and more efficient.

It’s important to understand that macros are **not** subprograms – subprograms are routines that only exist once within your main program and are accessed and executed by performing a jump. In contrast, macros are simply “reused code” that become part of the main program. They don’t reduce the number of steps in a program, they just make programming easier.

The following example illustrates the use of macros in a program that controls a motor.

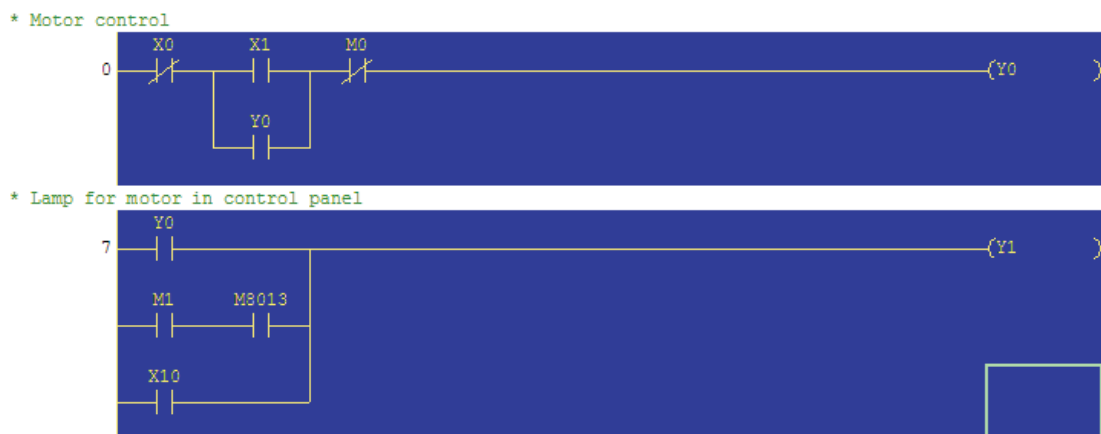
## 1. Enter your normal program code

First just program the function you want to turn into a macro normally. (You can also create macros from existing sequences of program code, of course.)



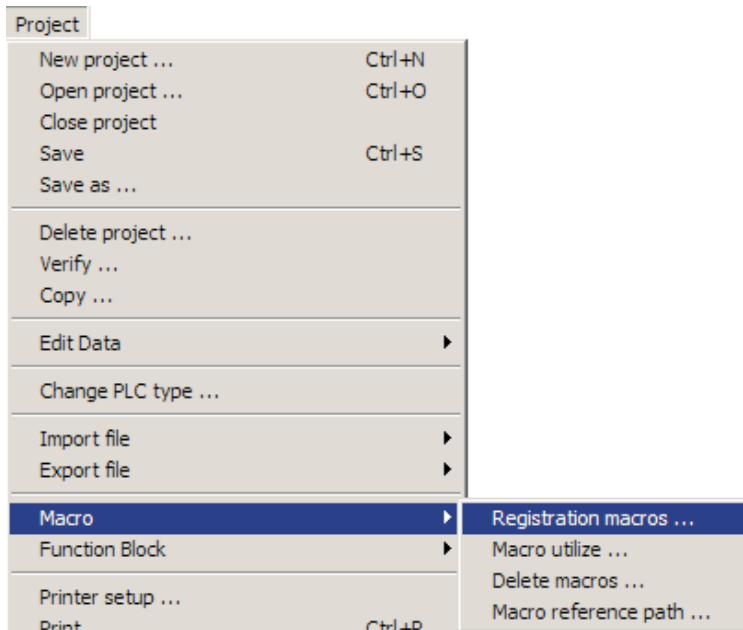
## 2. Select the program lines for the macro

To select the lines click at the top left with the left mouse button on the first contact you want to select. Then hold down the mouse button and drag downwards and to the right until all the instructions you want to include are selected.



### 3. Save the selection as a macro

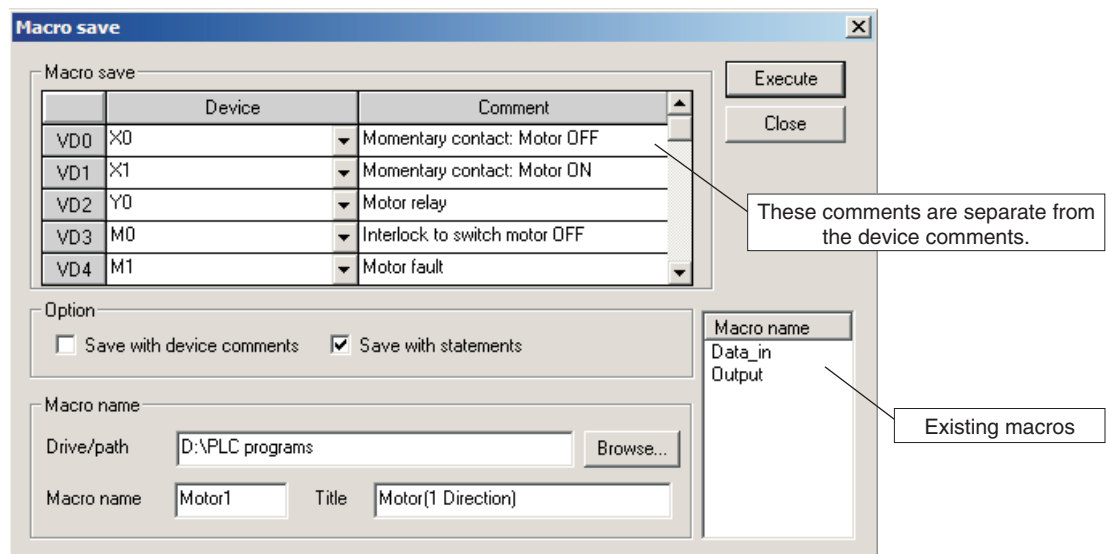
To save the selected program lines as a macro select **Macro** in the **Project** menu and then select **Registration macros...** in the submenu.



This opens a dialog box in which you can assign the devices in the selected program code to general variables (VD0, VD1 etc.) so that they can be replaced when you insert the macro in your program code.

In this example the special relay M8013 is used as a blinker signal. This relay can be used without change every time you use the macro and so it does not need to be assigned to a general variable. All other devices in the code must be assigned to variables.

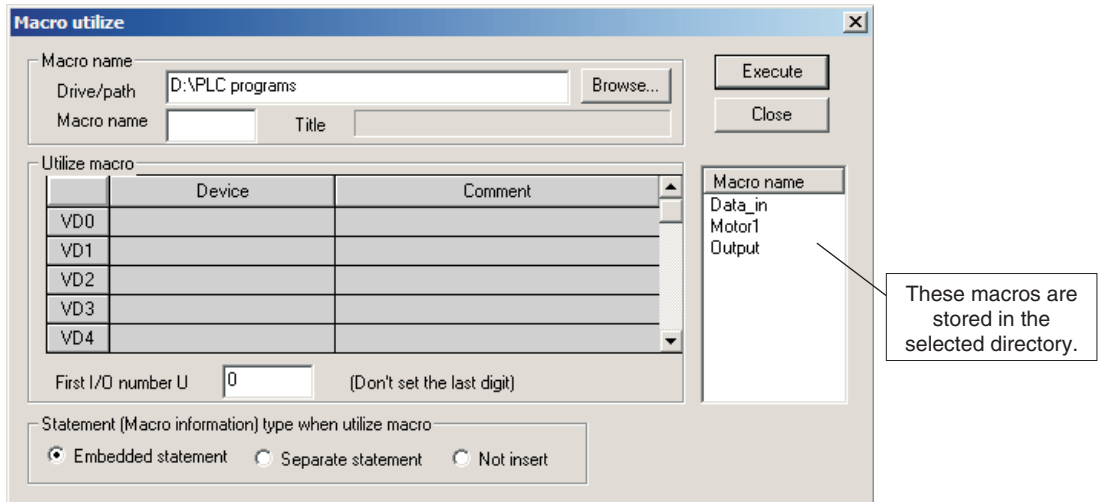
To select a device click on the ▼ symbol next to the device entry field to display a drop-down list of devices. It's also a good idea to enter a comment for every device – this will make the macro much easier to understand when you use it.



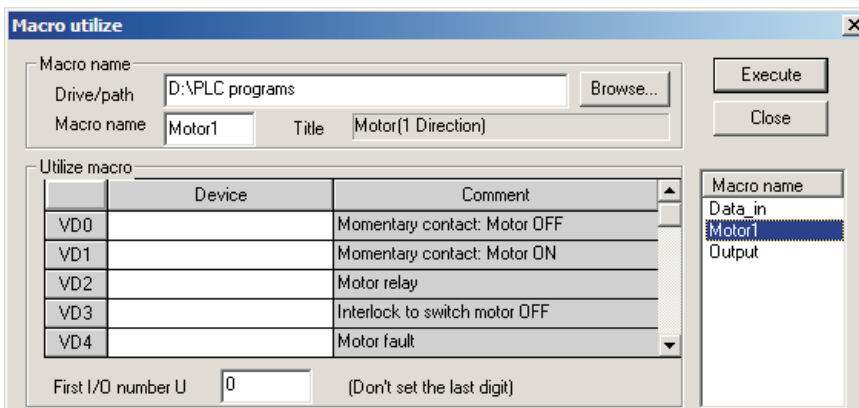
Enter the path to the directory where you want to store the macro in the **Drive/path** field. Then enter a name for the macro in the **Macro name** field and click on **Execute** to save it.

#### 4. Insert the macro in the program

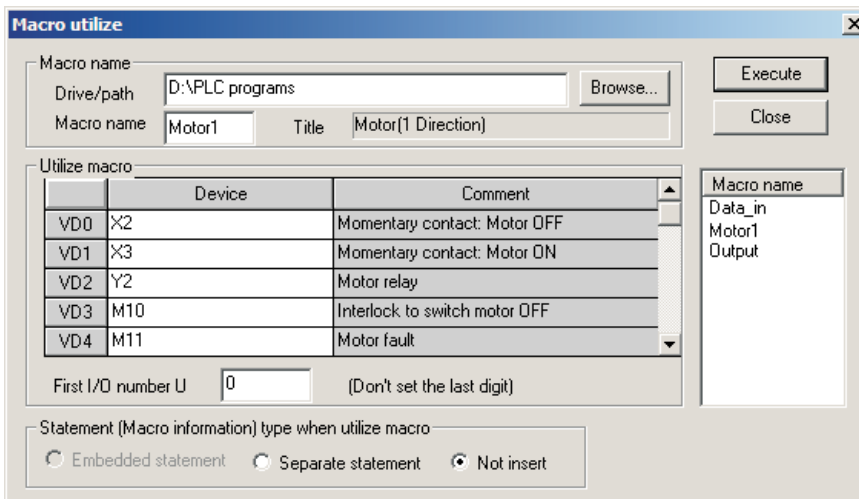
To insert a macro in your program first position the cursor in the position where you want to insert the macro. Then select **Macro > Macro utilize** in the **Project** menu. This displays a dialog in which you can select the macro from the path where you stored it in the last step.



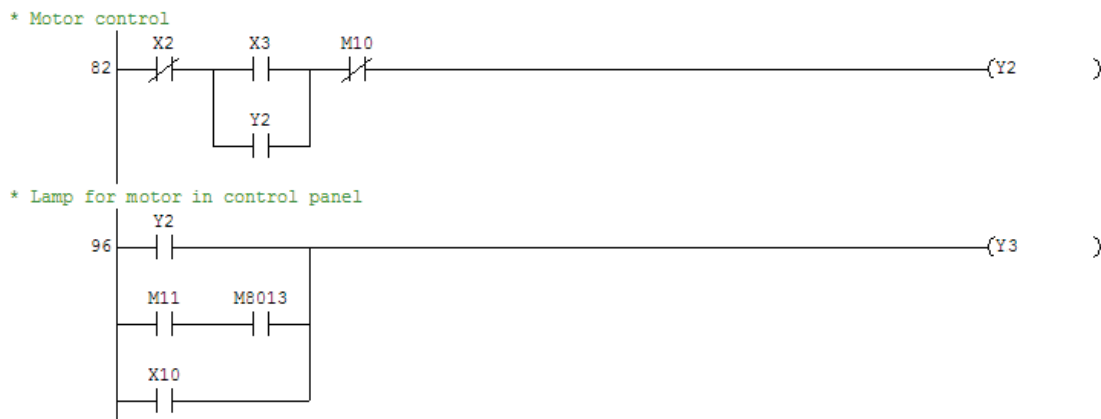
Double-click on the name of a macro in the list to display its variables and their associated comments.



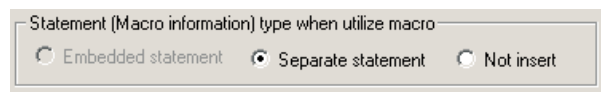
Then enter the devices you want to use in the new block of code that will be inserted by the macro.



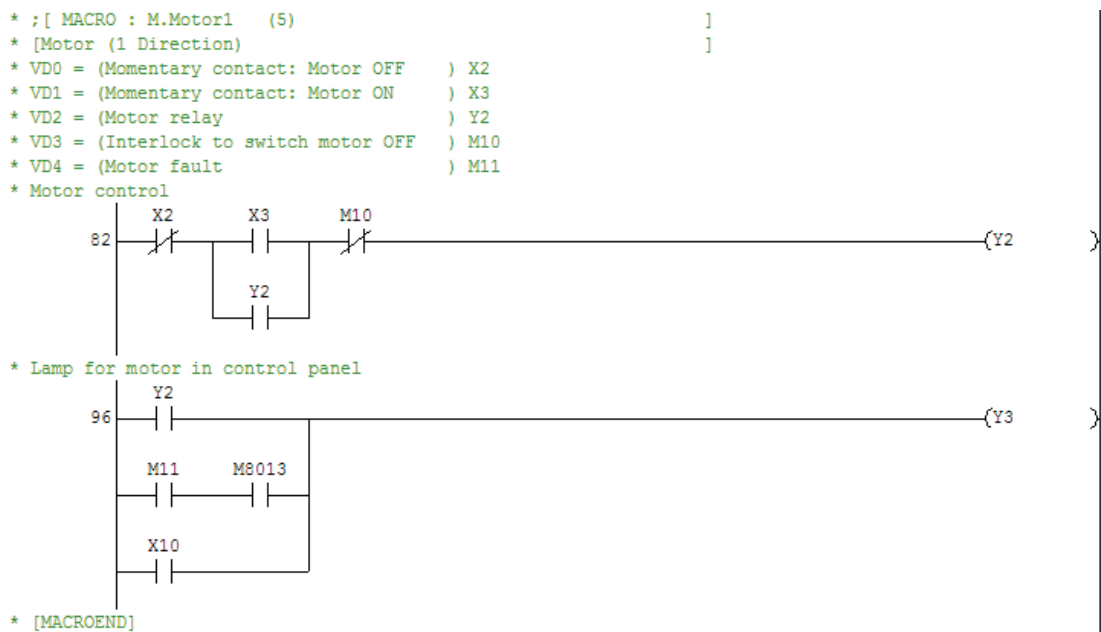
Finally, click on **Execute** to insert the macro in your program with the new devices:



In the lower part of the **Macro Utilize** dialog you can specify whether you want to insert information about the as program line titles (statements).



If you select **Separate statement** the information will be inserted in the program together with the code as additional statements, like this:



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