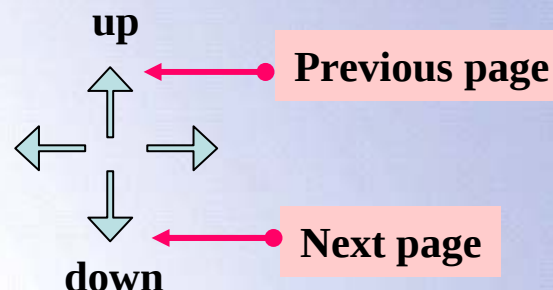


Short explanation about using this tutorial

1. Your PC must be hooked up to a PLC, and Control FPDWIN Pro must be running.

2. Press <Alt> + <Tab> to switch back and forth between this presentation and Control FPDWIN Pro!

3. Change pages using pagination keys:



4. Press ESC to return to the presentation at any time.

5. A PDF file of the presentation is included on the CD, e.g. to print.

This tutorial provides an overview of:

- handling and programming with Control FPWIN Pro**
- conventional programming with FP addresses**
- programming according to the IEC 61131-3 standard**

**Please spend about two hours to take your first, easy steps into
Control FPWIN Pro.**



**Please stop!
And spend a little while
to learn your
first programming steps.**



Why IEC 61131-3?

IEC 61131-3

An internationally accepted standard

- **Unified rules in systems worldwide,
reduces misunderstandings and shortens training**
- **Reuse of ready-made Functions and Function Blocks,
saves time for programming and debugging**
- **Better overview through structure and modularity**
- **Fewer errors through defined data types and encapsulation**
- **Safe investment due to standardisation**

**If you want to know more about IEC 61131-3, please refer to the
other presentation on your CD-ROM: IEC61131_3_basics.pdf**

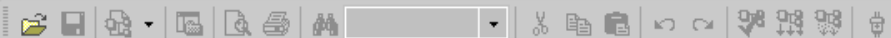


Start Control FPWIN Pro

The screenshot shows a Windows XP Professional desktop. The Start menu is open, displaying a list of installed programs. The path to 'FPWIN Pro 5' is highlighted: Start > Programme > FPWIN Pro 5. The desktop background is blue, and various application icons are visible on the left side, including 'Eigene Dateien', 'Arbeitsplatz', 'Internet Explorer', 'Papierkorb', 'Microsoft Outlook', 'Acrobat Reader 4.0', 'Adobe Acrobat 5.0', 'Alchemy Catalyst', 'Arbeitsspeicher defragmentieren.vbs', 'Speicher freiräumen.vbs', 'Translator's Workbench', and 'Verknüpfung mit AITAdmin.exe'. A taskbar at the bottom shows the Start button and several open applications. A green text box on the right side of the screen contains the text 'Start Control FPWIN Pro unter Windows/Programs.'.

Start Control FPWIN Pro
unter Windows/Programs.





Create a new project
with the start-up wizard.

Creates a new or opens an existing project



☒ Creates a new project



☐ Opens a project from the PLC



☐ Restores a backed-up project



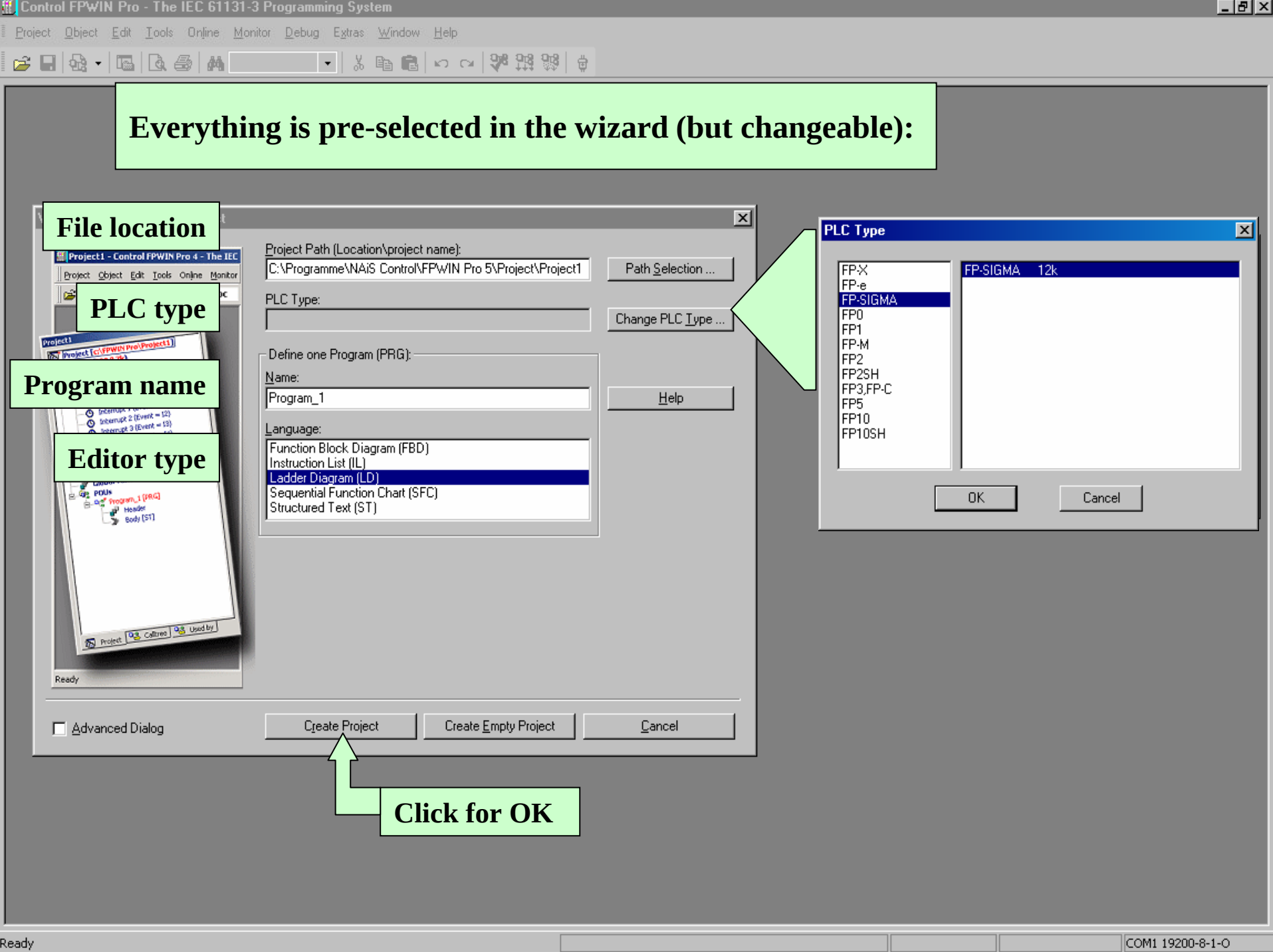
☐ Opens an existing project

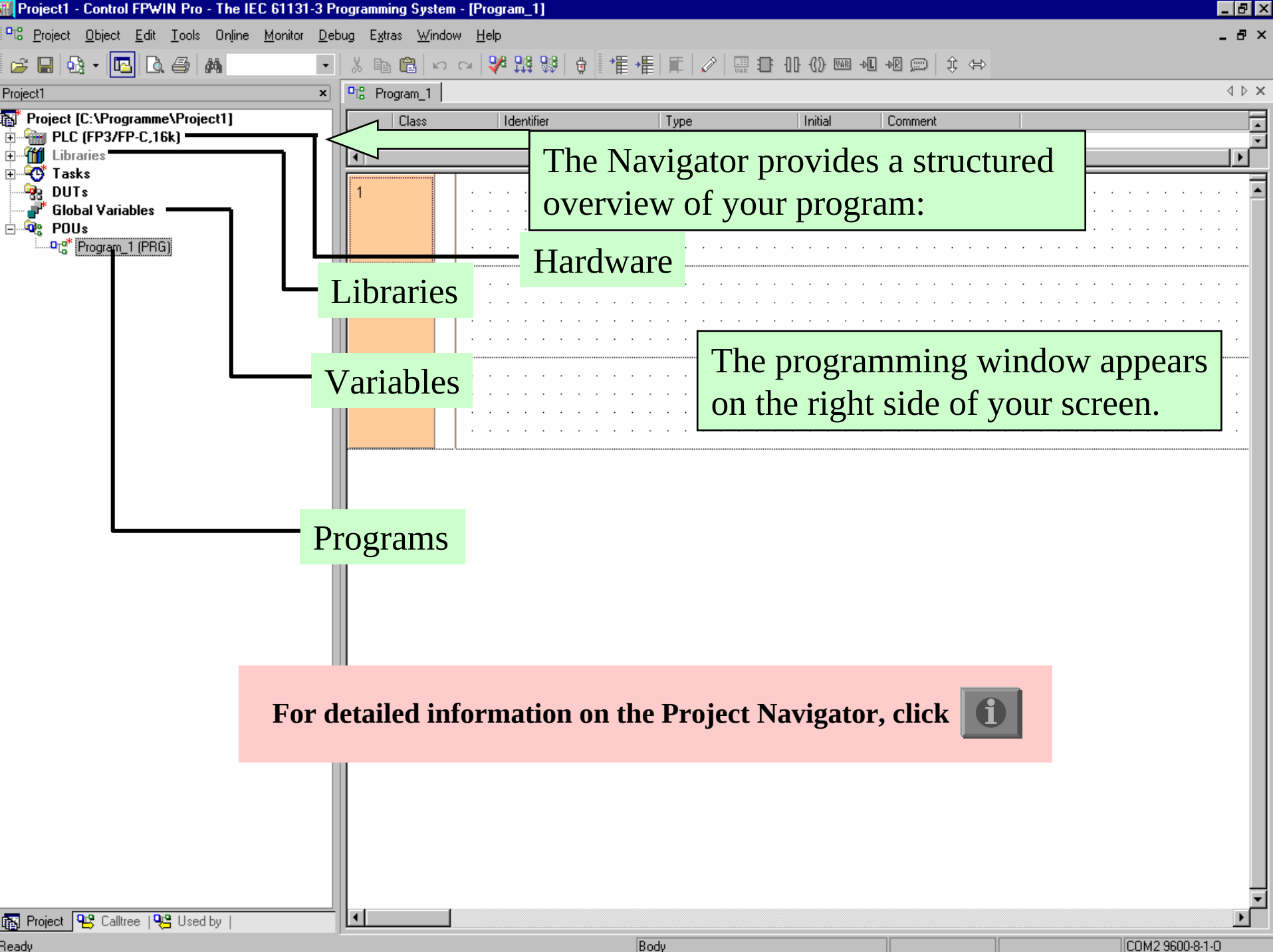
Search additional projects...

OK

Cancel







The Navigator provides a structured overview of your program:

Hardware

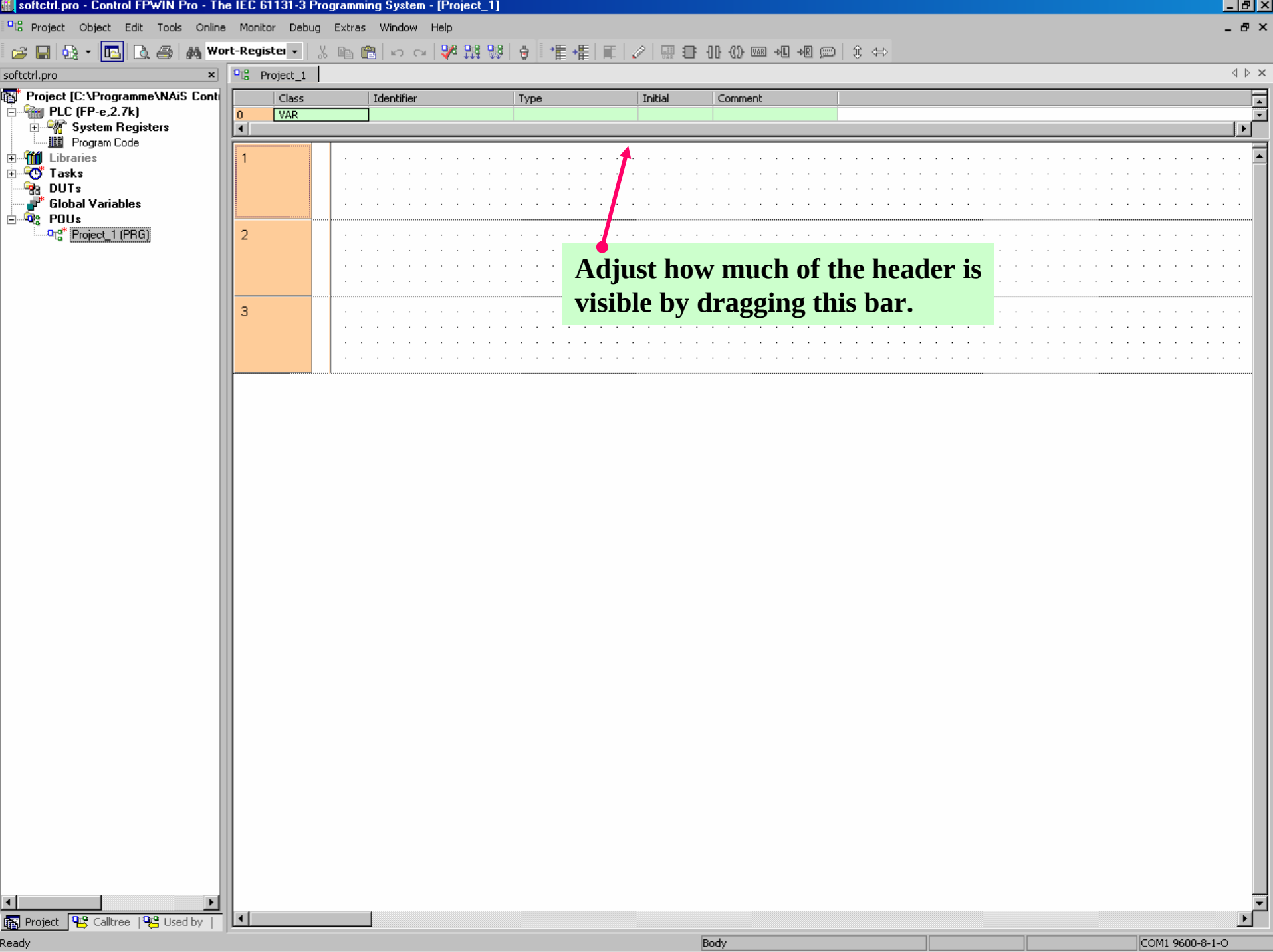
Libraries

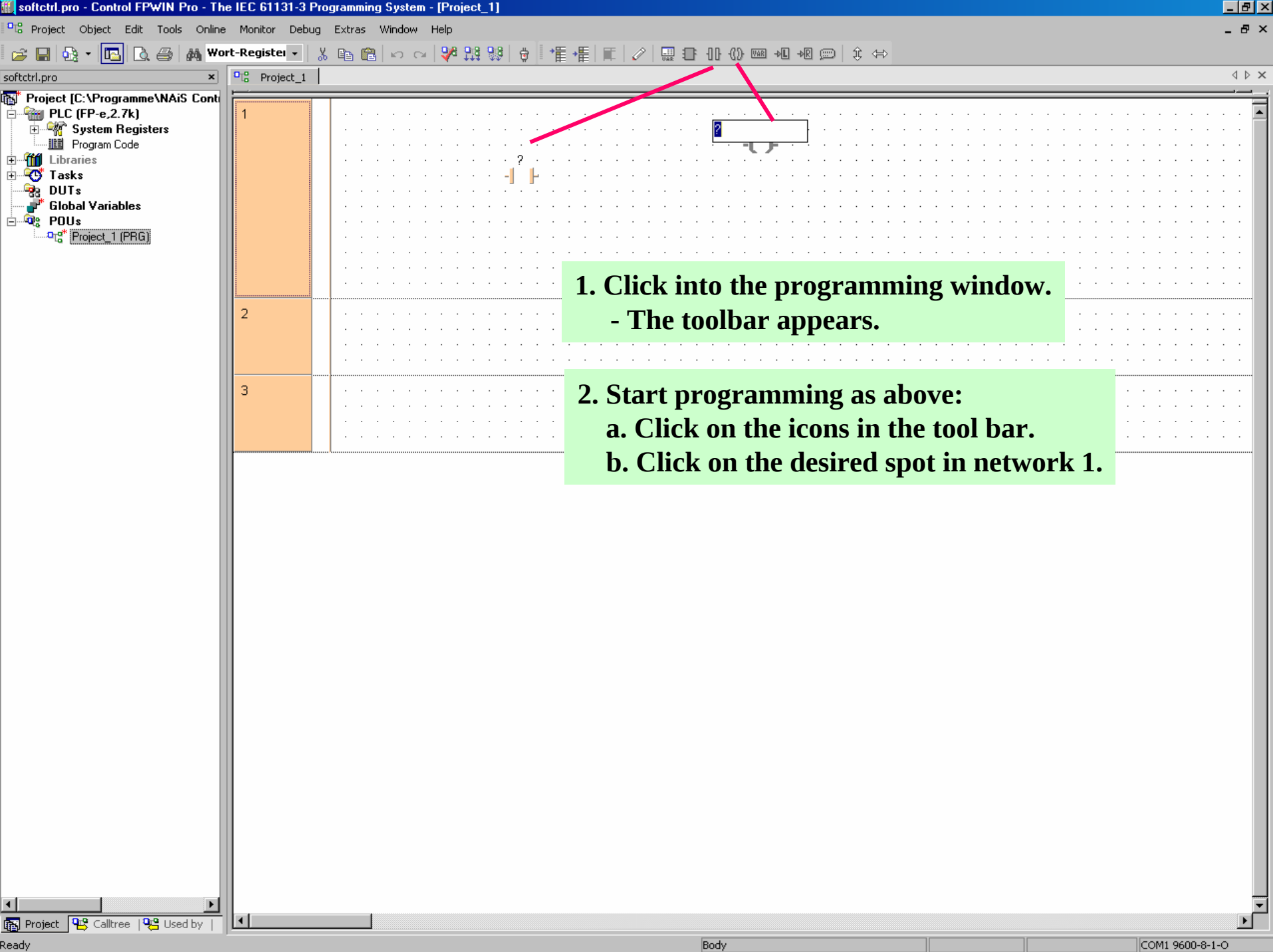
Variables

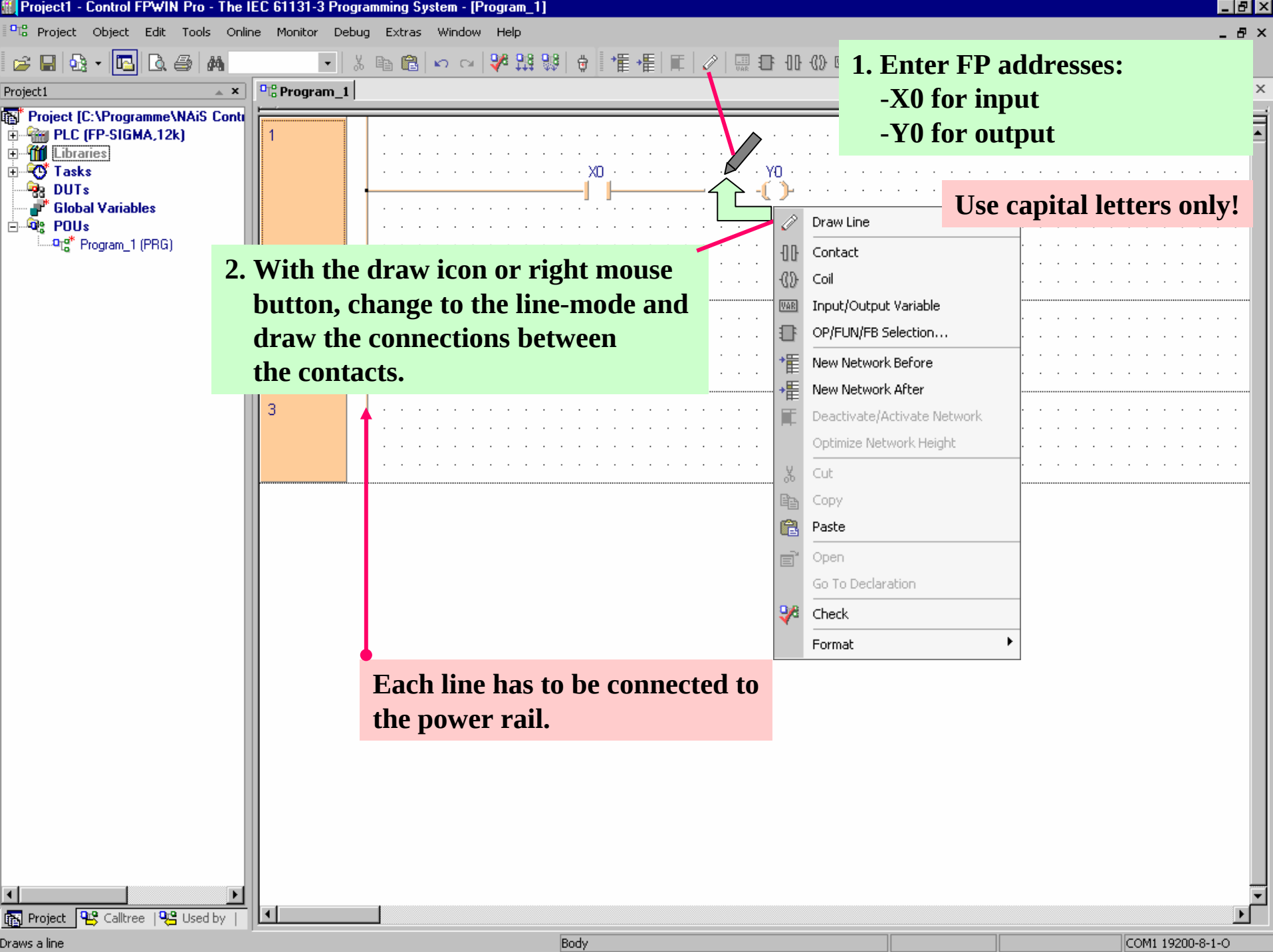
Programs

The programming window appears on the right side of your screen.

For detailed information on the Project Navigator, click 





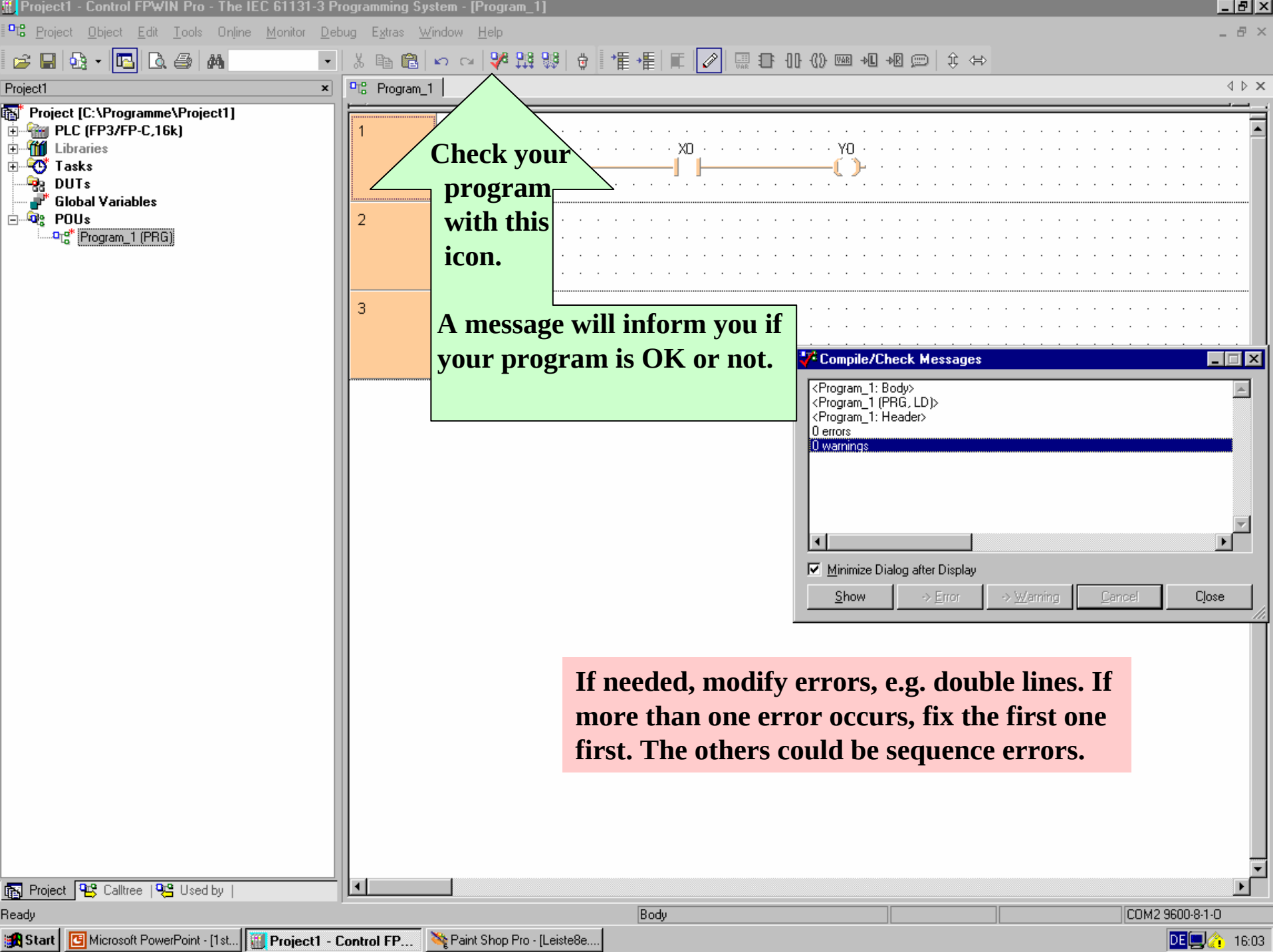


1. Enter FP addresses:
-X0 for input
-Y0 for output

Use capital letters only!

2. With the draw icon or right mouse button, change to the line-mode and draw the connections between the contacts.

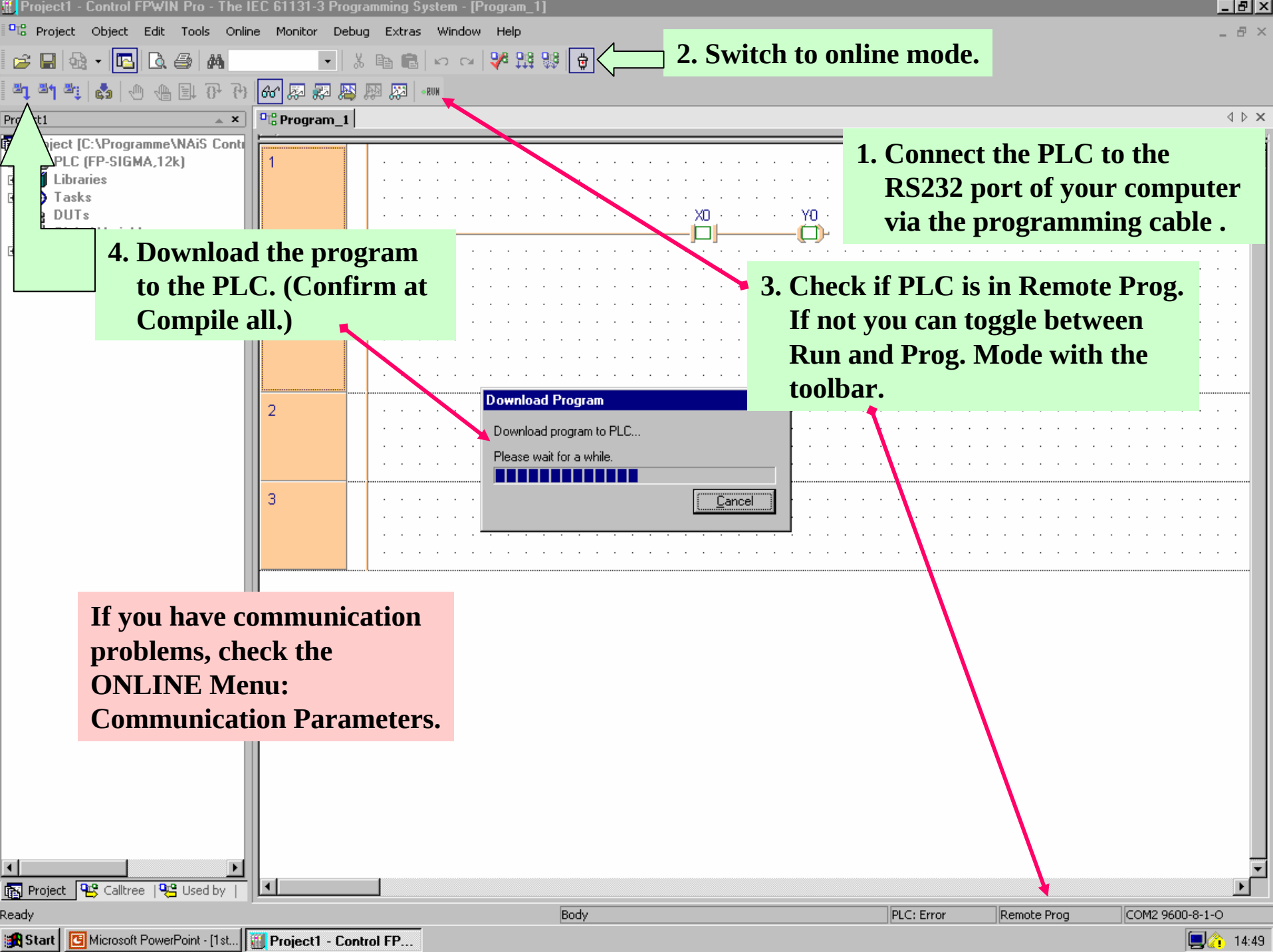
Each line has to be connected to the power rail.



Check your
program
with this
icon.

A message will inform you if
your program is OK or not.

If needed, modify errors, e.g. double lines. If
more than one error occurs, fix the first one
first. The others could be sequence errors.



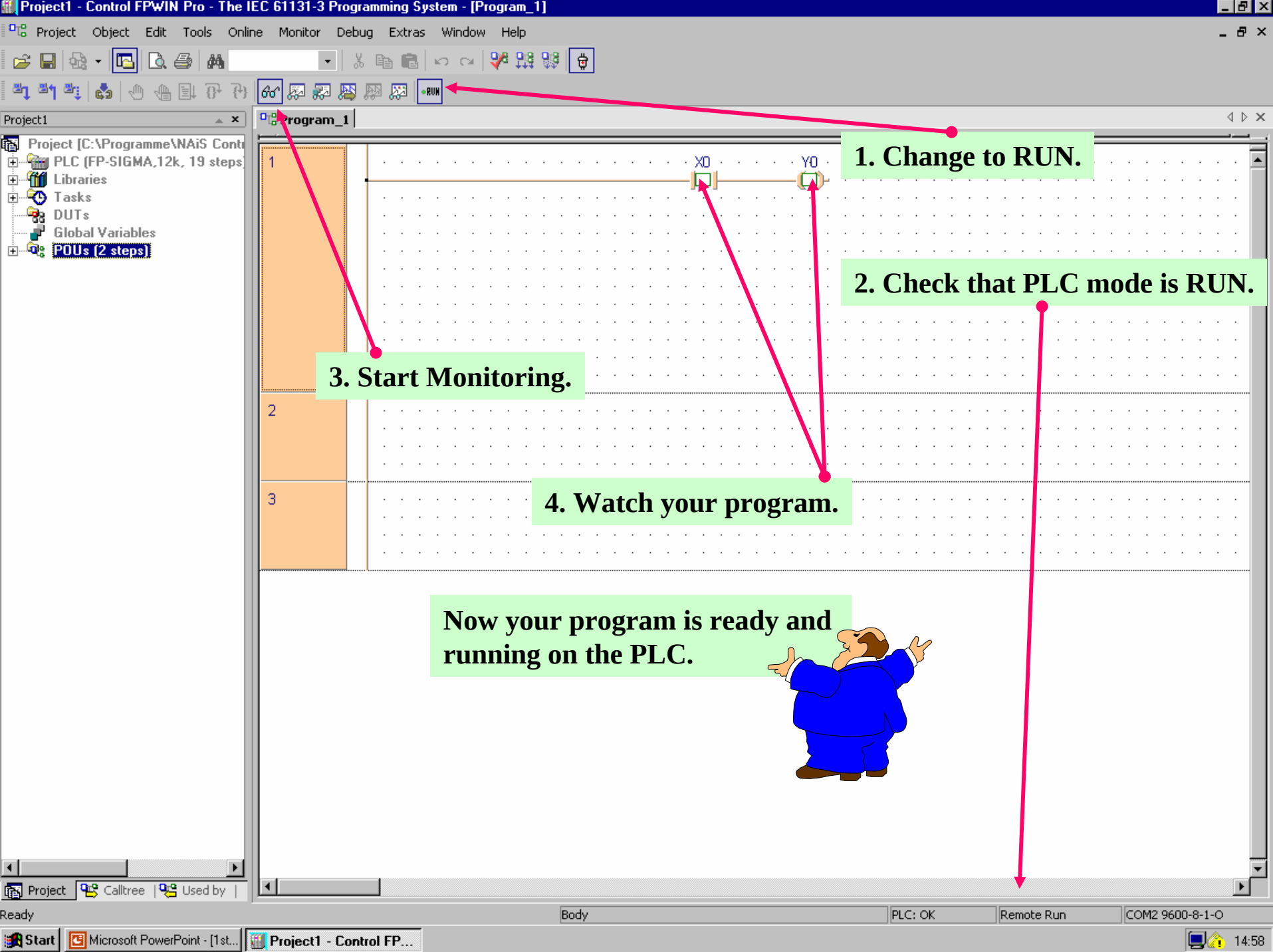
2. Switch to online mode.

1. Connect the PLC to the RS232 port of your computer via the programming cable .

3. Check if PLC is in Remote Prog. If not you can toggle between Run and Prog. Mode with the toolbar.

4. Download the program to the PLC. (Confirm at Compile all.)

If you have communication problems, check the ONLINE Menu: Communication Parameters.



The screenshot shows the IEC 61131-3 Programming System interface. The 'Project' menu is open, and the 'Close' option is highlighted. A green arrow points to the 'Close' option. A green box with the text 'Close and Save the project.' is overlaid on the ladder logic diagram. The ladder logic diagram shows a network with two inputs, X1 and Y1, connected by a line. The background is a grid of dots.

Project Menu Options:

- New... (Ctrl+N)
- Open... (Ctrl+O)
- Open Project from the PLC...
- Close**
- Save (Ctrl+S)
- Save As...
- Compile All...
- Compile Incrementally...
- Used Memory...
- Printer Setup...
- Print Preview (Ctrl+Q)
- Print... (Ctrl+P)
- Open Cross-Reference List...
- Import Project...
- Export Project...
- Change Security Level...
- Change Passwords...
- 1 C:\Programme\Projet1
- 2 C:\Programme\Projet5
- 3 C:\Programme\Progetto7
- 4 C:\Programme\Progetto3
- 5 C:\Programme\Progetto2
- 6 C:\Programme\Progetto6
- 7 C:\Programme\Progetto5
- 8 C:\Programme\Progetto4
- 9 C:\Programme\Progetto1
- 0 C:\Programme\Progetto6
- 1 C:\Programme\Progetto5
- 2 C:\Programme\Progetto4
- 3 C:\Programme\Progetto3
- 4 C:\Programme\Progetto2
- Exit (Alt+F4)

Close and Save the project.

Closes the Project

Body

PLC: OK

Remote Run

COM2 9600-8-1-0

1. A small program

Next is a small program.

We will use conventional programming style with FP addresses.

Description:

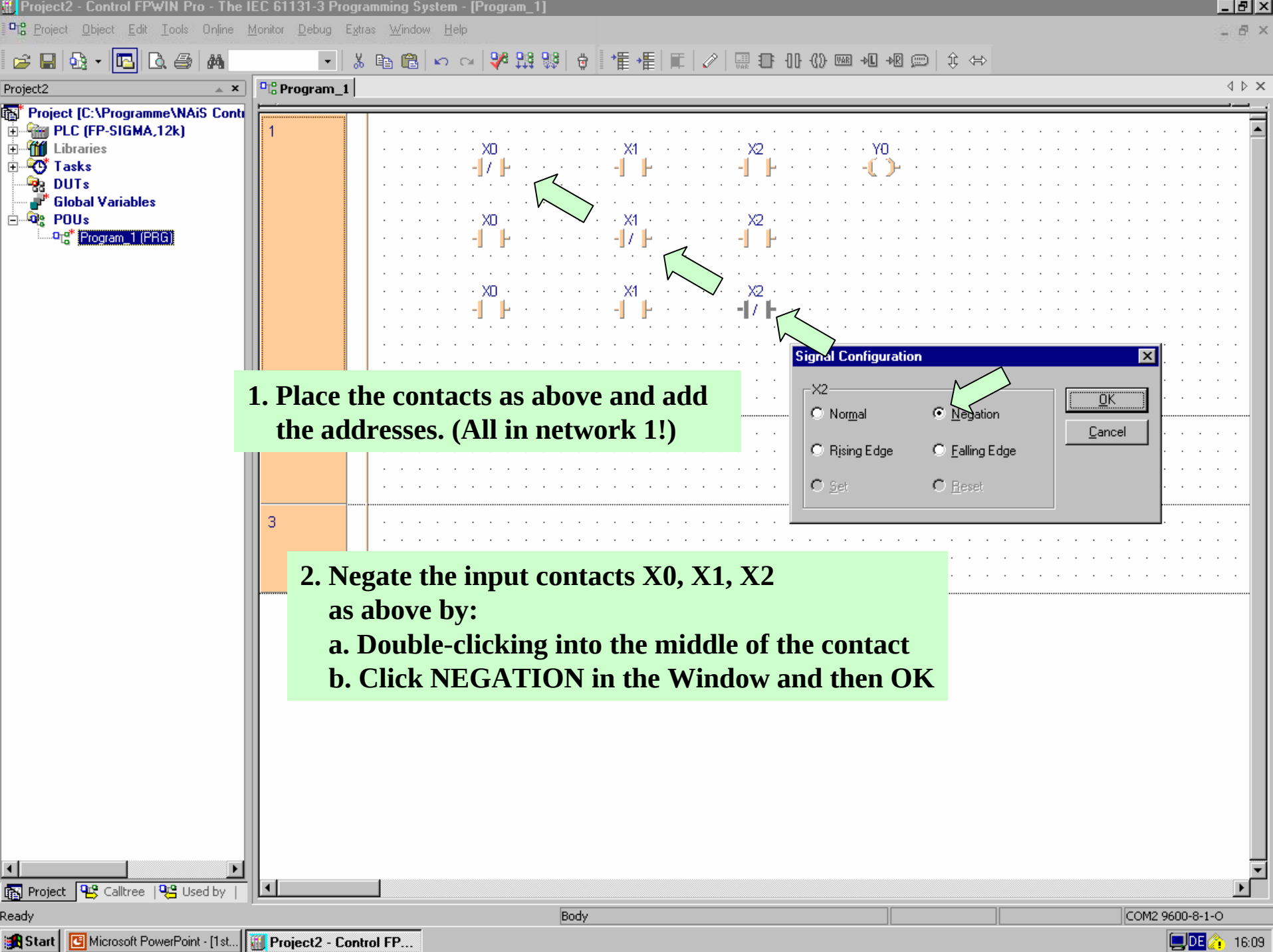
If 2 of 3 inputs are ON, the output will be switched ON

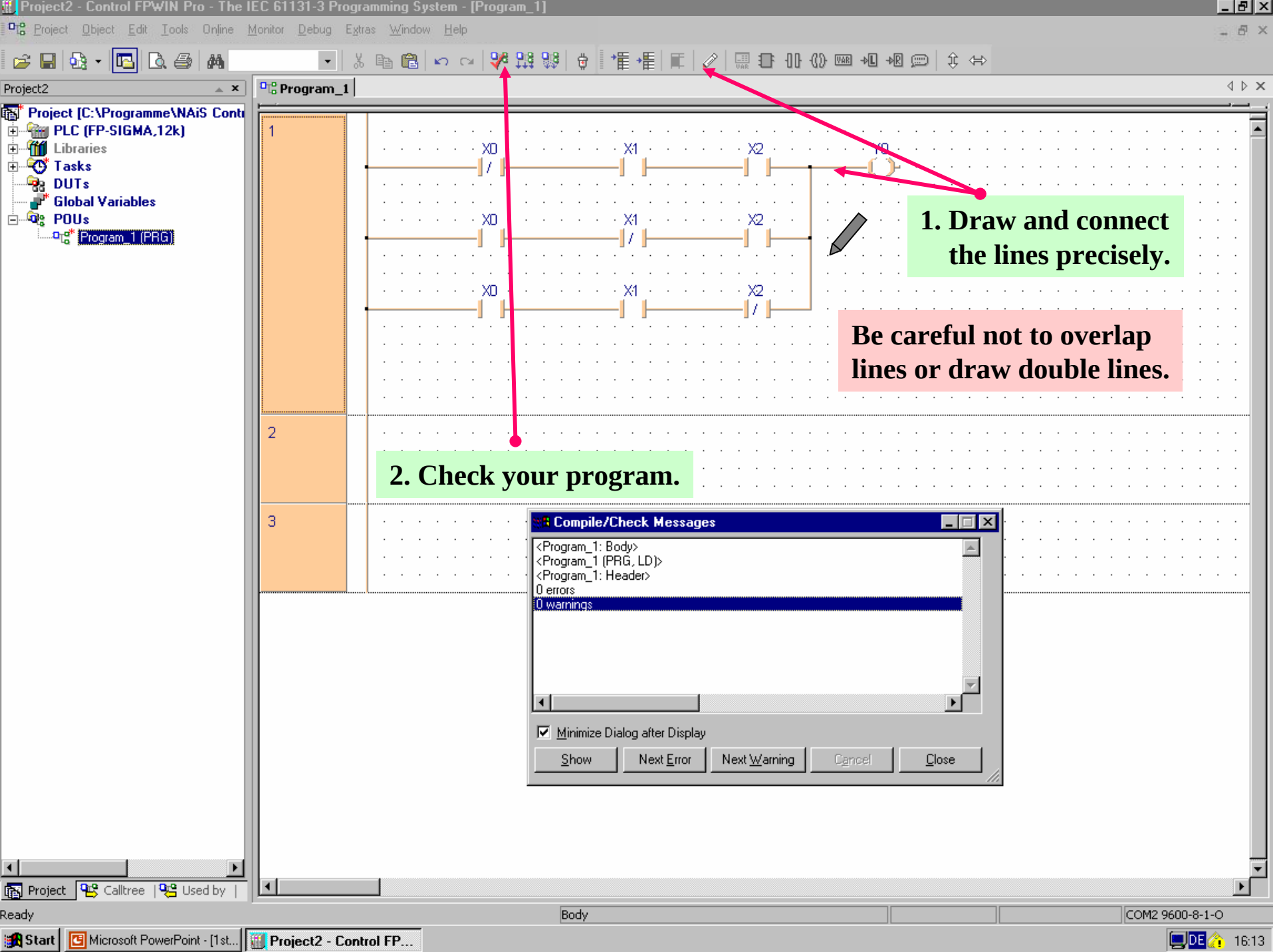
Please remember the introduction!

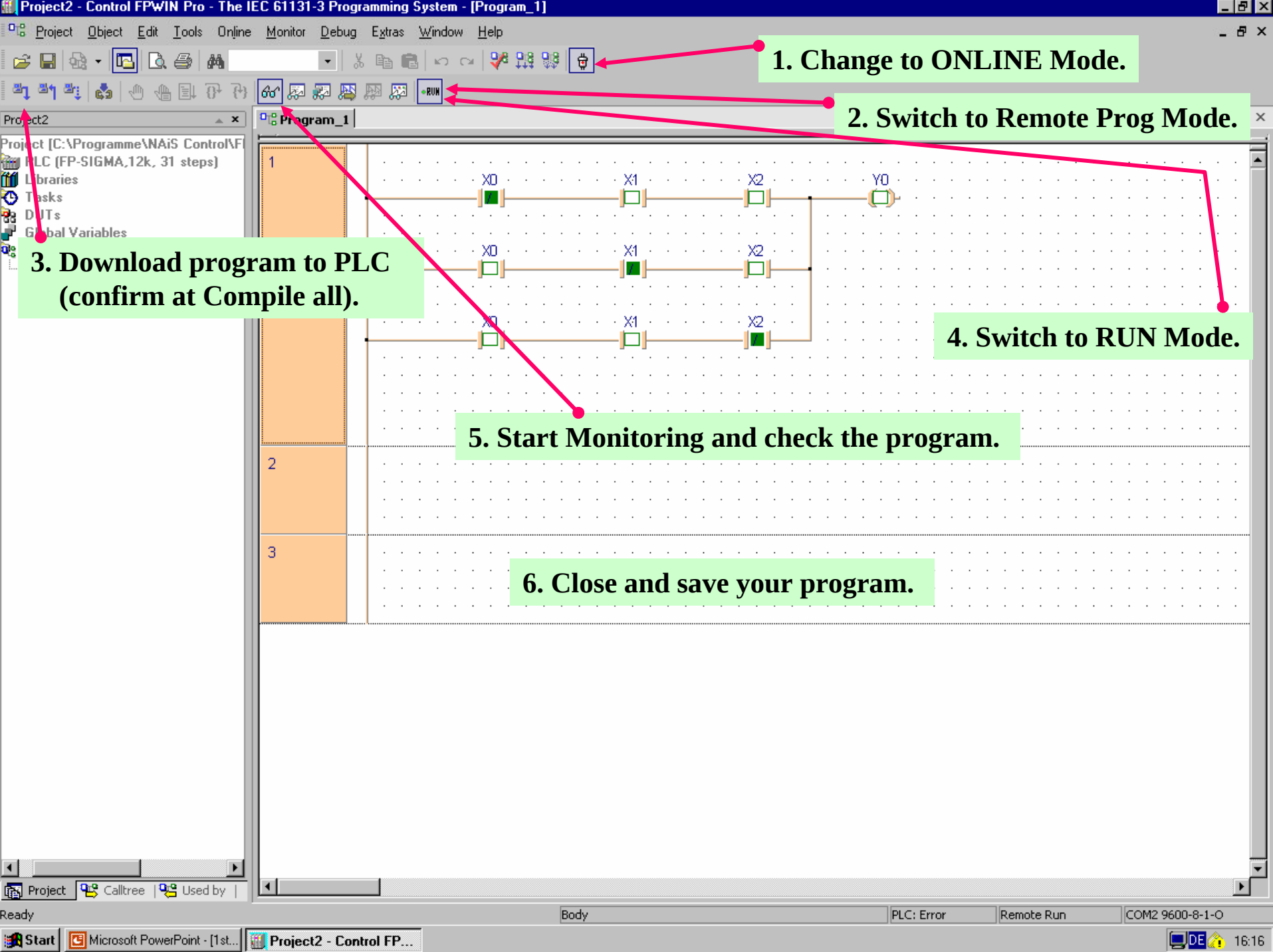
Create a new project/program

The screenshot shows the 'softctrl.pro - Control FFWIN Pro - The IEC 61131-3 Programming System' window. The 'Project' menu is open, showing options like 'New...', 'Open...', 'Close', 'Save', 'Compile All...', 'Used Memory...', 'Printer Setup...', 'Print Preview', 'Print...', 'Open Cross-Reference List...', 'Import Project...', 'Export Project...', 'Change Security Level...', and 'Change Passwords...'. A green callout box with the text '1. Create a new project with the start-up wizard' points to the 'New...' menu item.

The 'Wizard - Create a new project' dialog box is open, showing the 'Project Path (Location\project name)' field with the value 'C:\Programme\NAIS Control FFWIN Pro 5\Project\Project3'. The 'PLC Type' field is empty. The 'Define one Program (PRG):' section shows the 'Name' field with the value 'Program_1' and the 'Language' dropdown set to 'Ladder Diagram (LD)'. The 'Advanced Dialog' checkbox is unchecked. The 'Create Project' button is highlighted with a green arrow and a green callout box with the text '2. Click for OK.'.







1. Change to ONLINE Mode.

2. Switch to Remote Prog Mode.

3. Download program to PLC
(confirm at Compile all).

4. Switch to RUN Mode.

5. Start Monitoring and check the program.

6. Close and save your program.

2. Program with IEC 61131-3 addresses

In the next sample program you will use addresses according to the IEC 61131-3 standard.

We will write the same 2-of-3-inputs program.

With IEC 61131-3 addresses you can see the names of your contacts in the editor field.

Create a new project/program

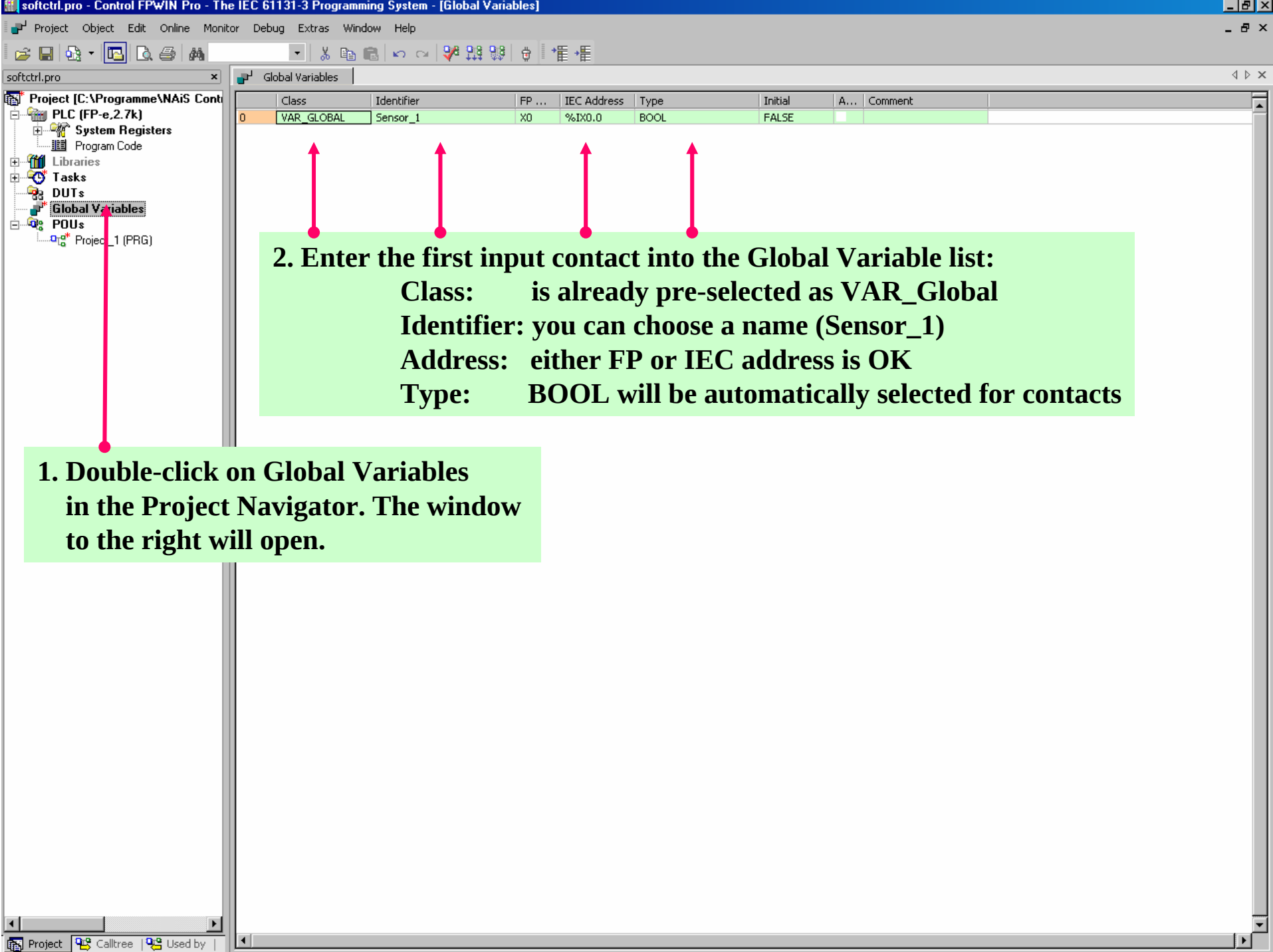
1. Create a new project with the start-up wizard

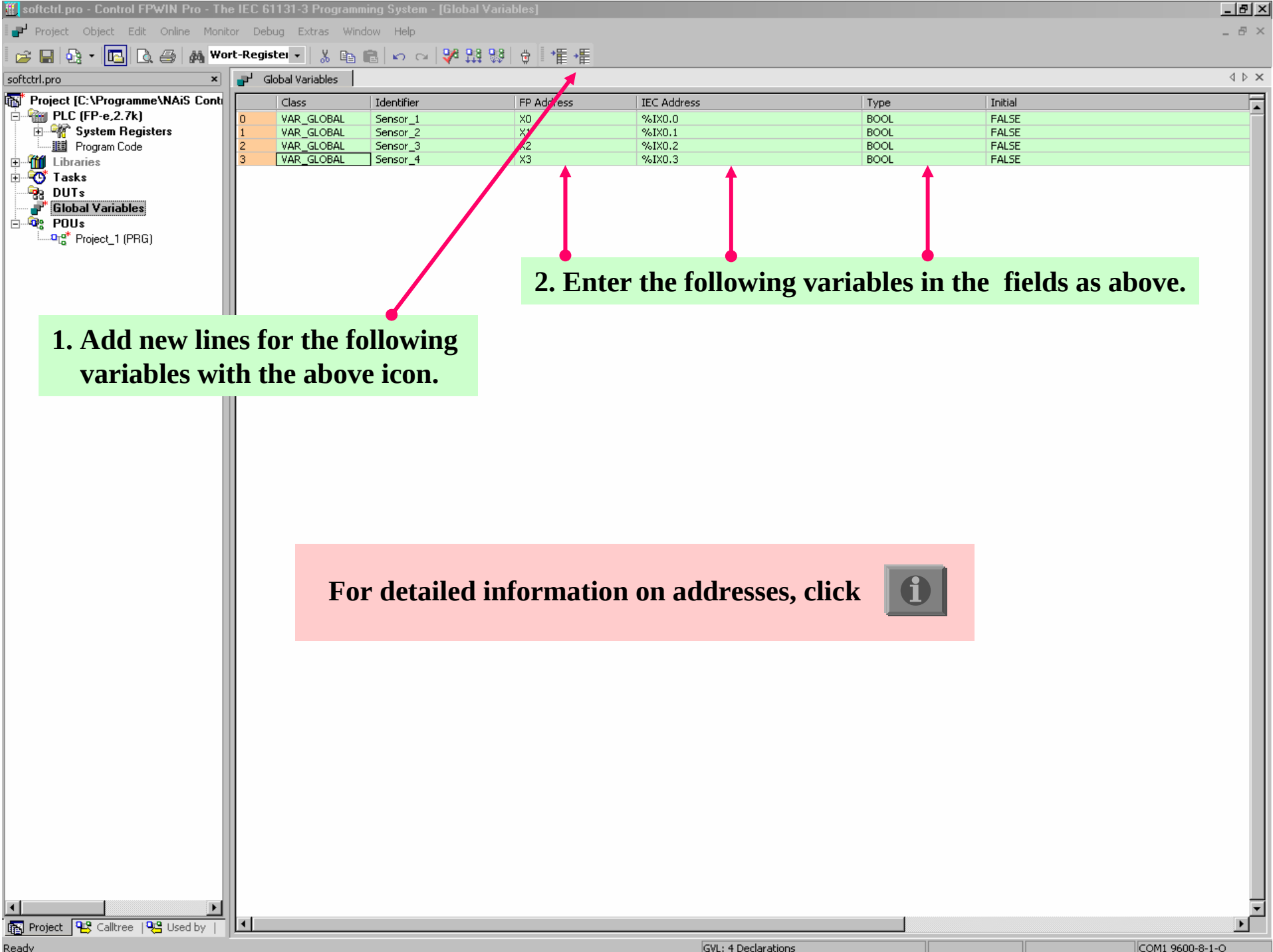
2. Click for OK.

The screenshot shows the 'Control FFWIN Pro - The IEC 61131-3 Programming System' window. The 'Project' menu is open, and the 'Wizard - Create a new project' dialog box is displayed. The dialog box contains the following information:

- Project Path (Location/project name):** C:\Programme\NAIS Control\FPWIN Pro 5\Project\Project3
- PLC Type:** (Empty field)
- Define one Program (PRG):**
 - Name:** Program_1
 - Language:** Ladder Diagram (LD) (Selected)
 - Other options: Function Block Diagram (FBD), Instruction List (IL), Sequential Function Chart (SFC), Structured Text (ST)
- Buttons:** Path Selection..., Change PLC Type..., Help, Create Project, Create Empty Project, Cancel

A green arrow points to the 'Create Project' button, and a green box contains the text '2. Click for OK.'



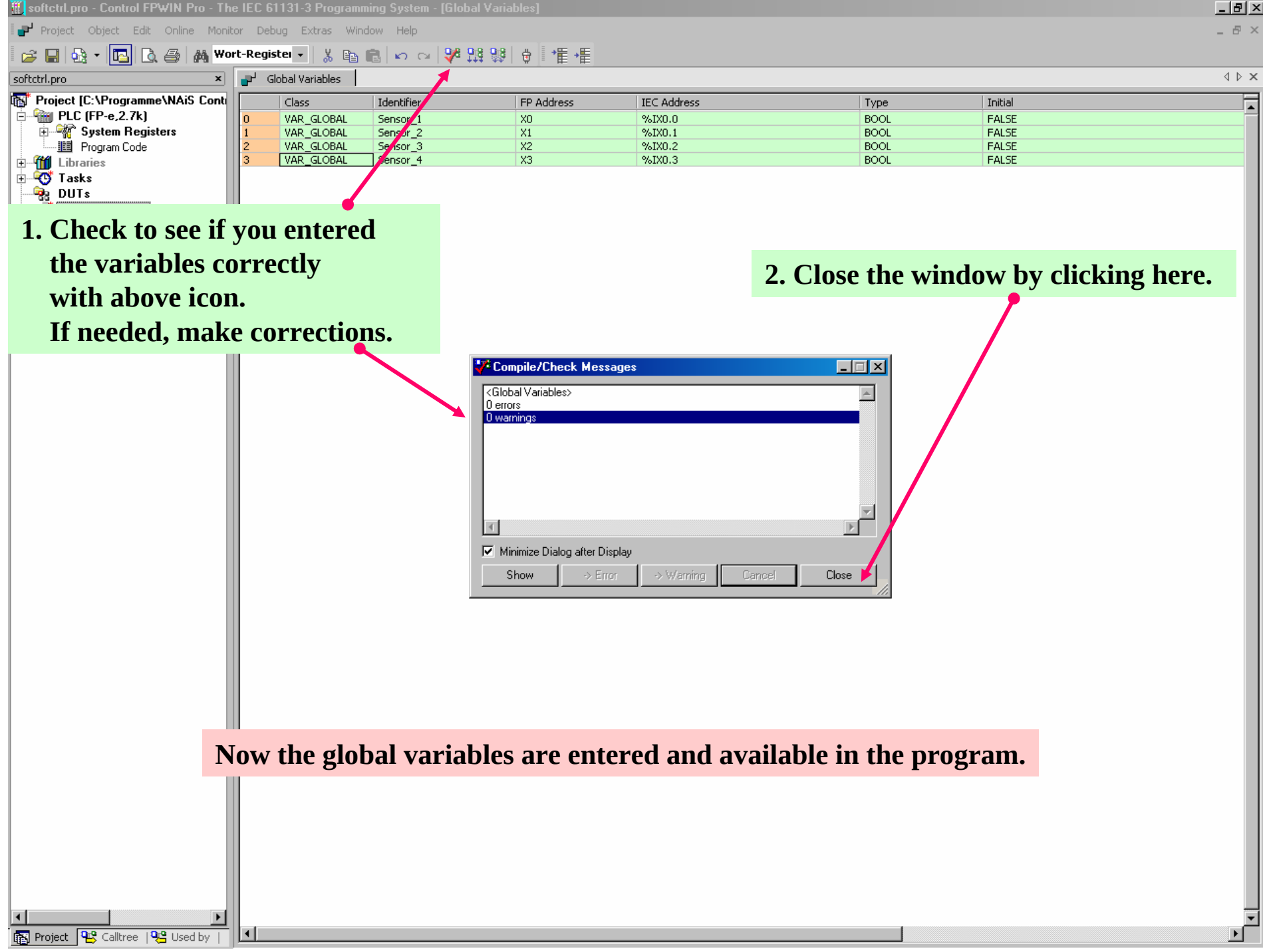


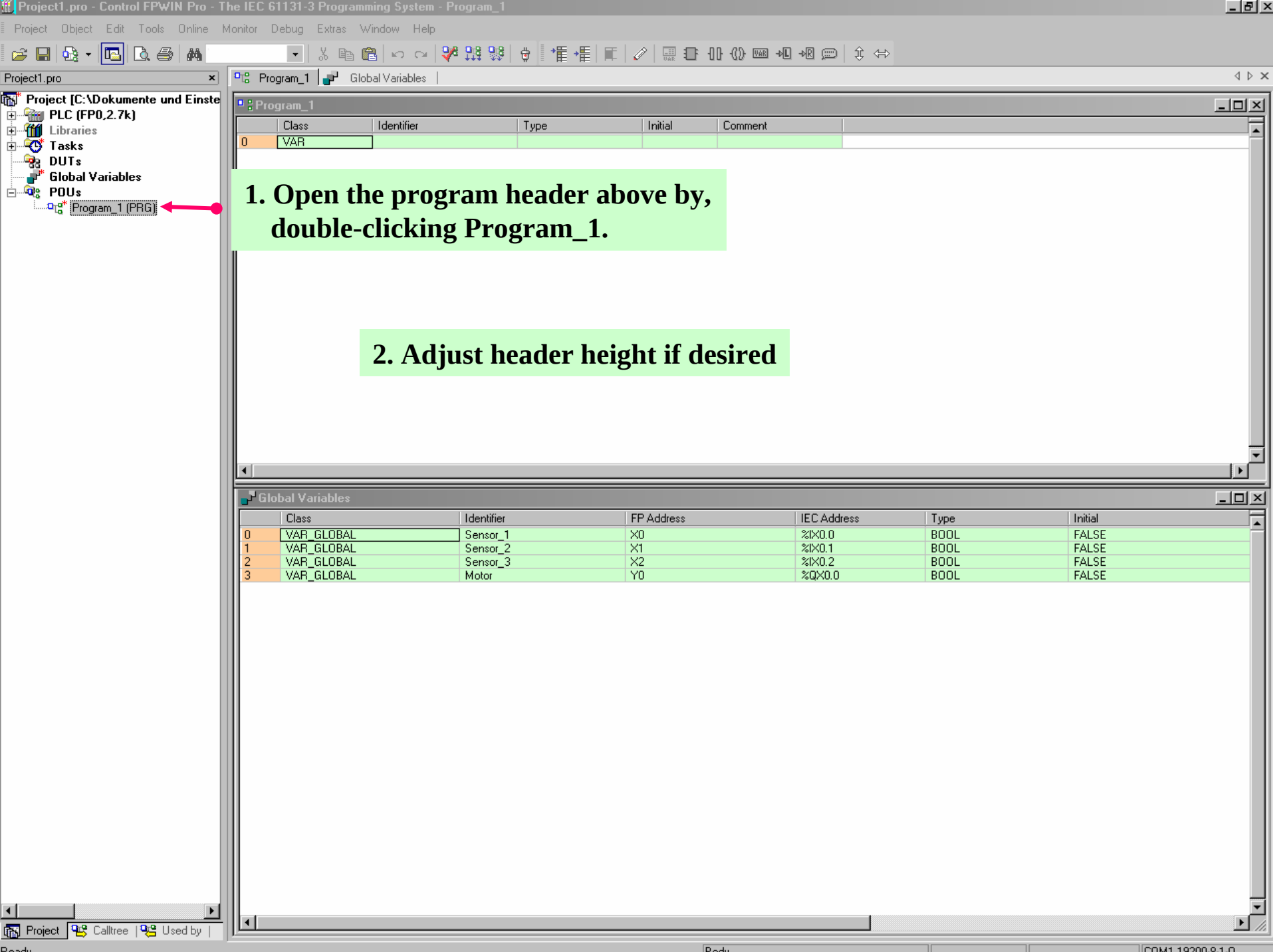
1. Add new lines for the following variables with the above icon.

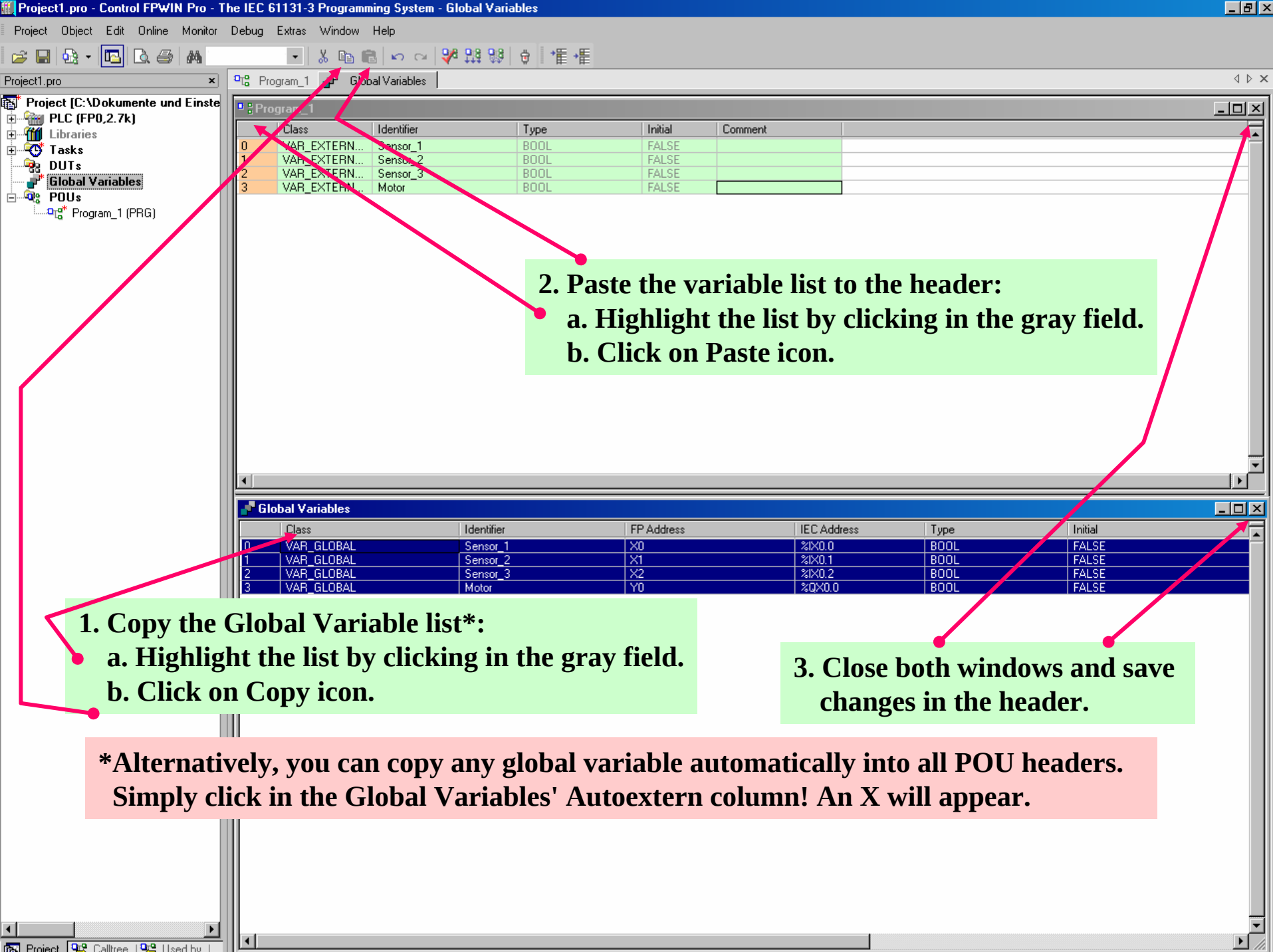
2. Enter the following variables in the fields as above.

For detailed information on addresses, click







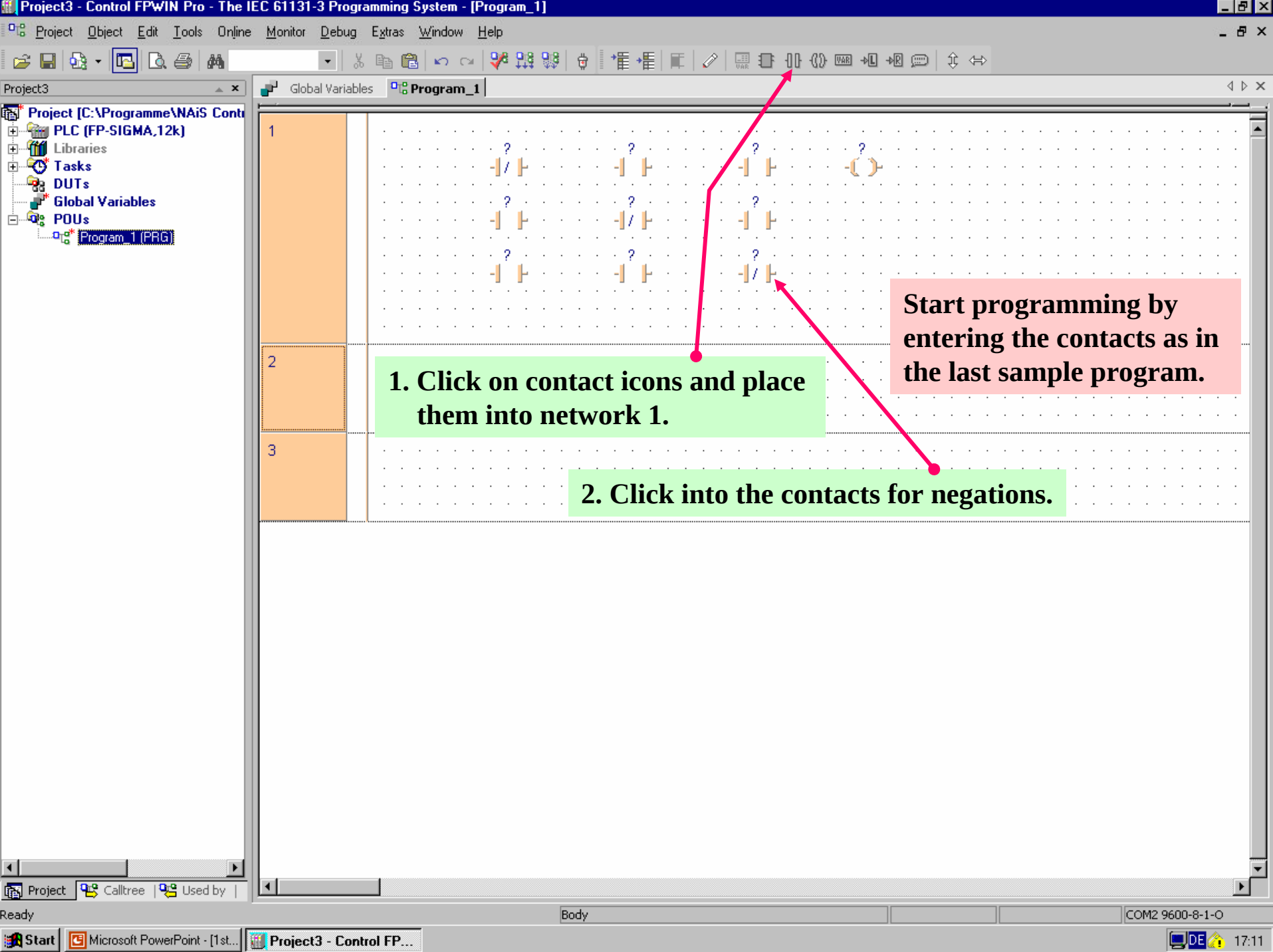


2. Paste the variable list to the header:
a. Highlight the list by clicking in the gray field.
b. Click on Paste icon.

1. Copy the Global Variable list*:
a. Highlight the list by clicking in the gray field.
b. Click on Copy icon.

3. Close both windows and save changes in the header.

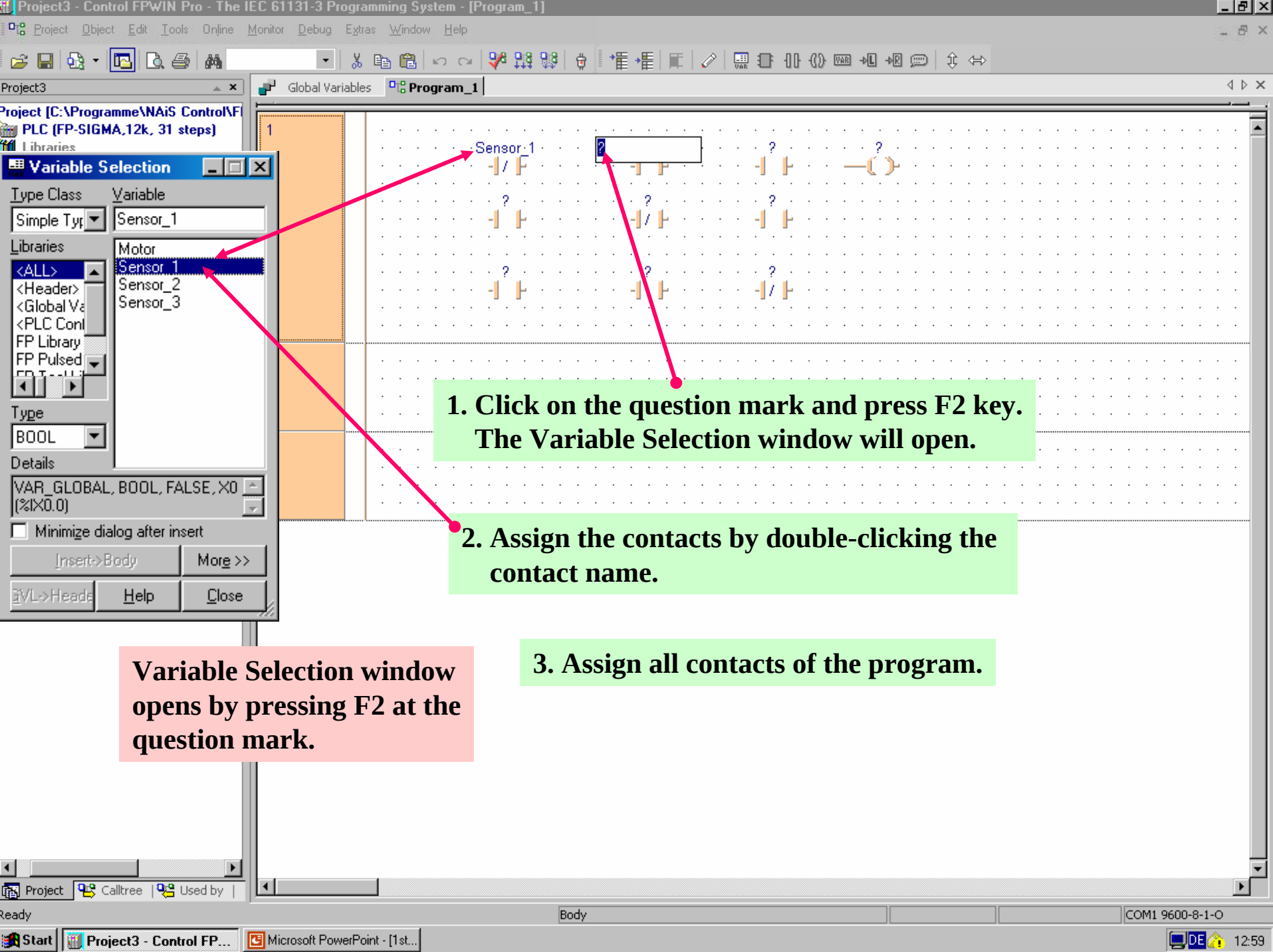
***Alternatively, you can copy any global variable automatically into all POU headers. Simply click in the Global Variables' Autoextern column! An X will appear.**



Start programming by entering the contacts as in the last sample program.

1. Click on contact icons and place them into network 1.

2. Click into the contacts for negations.

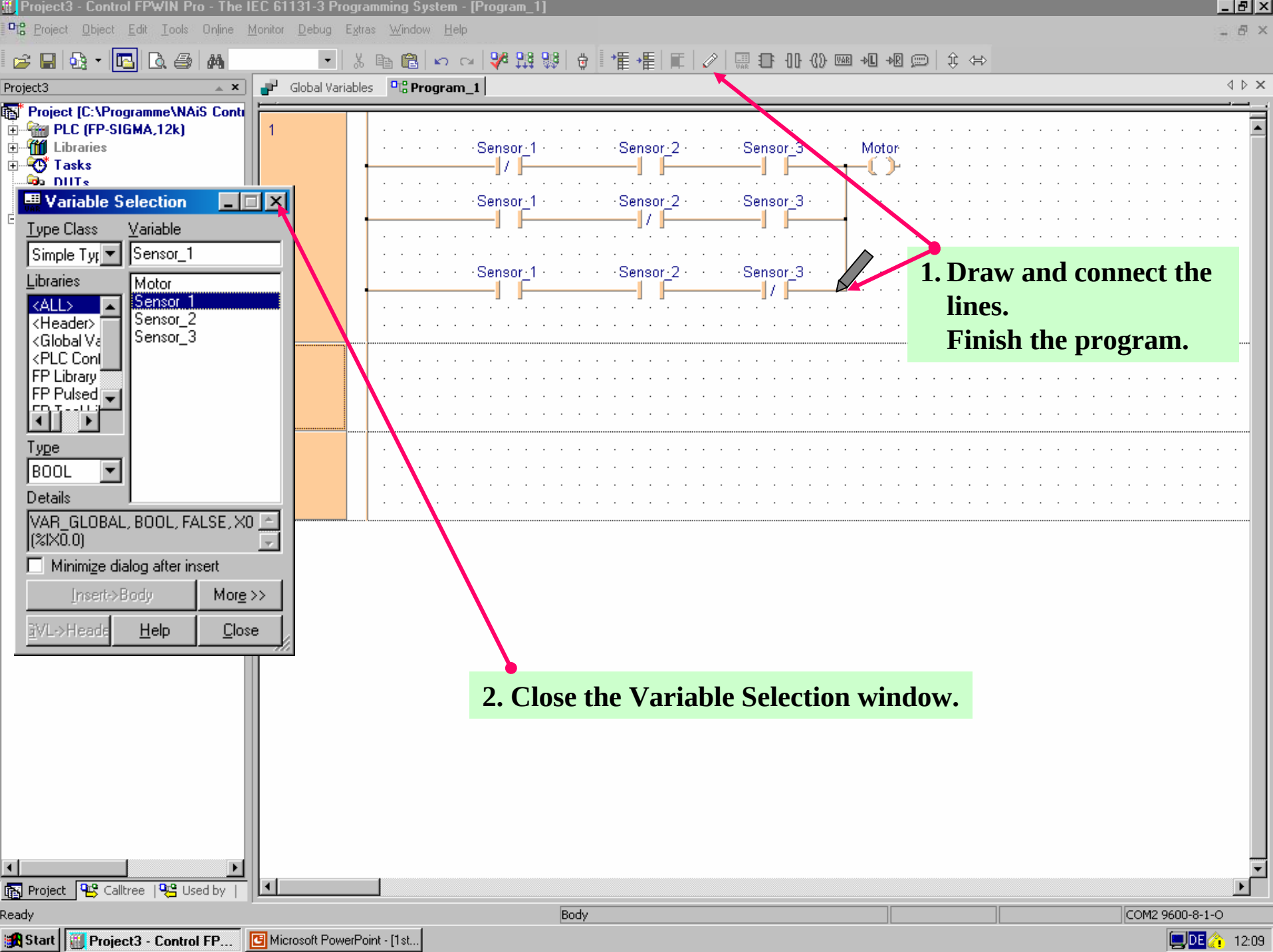


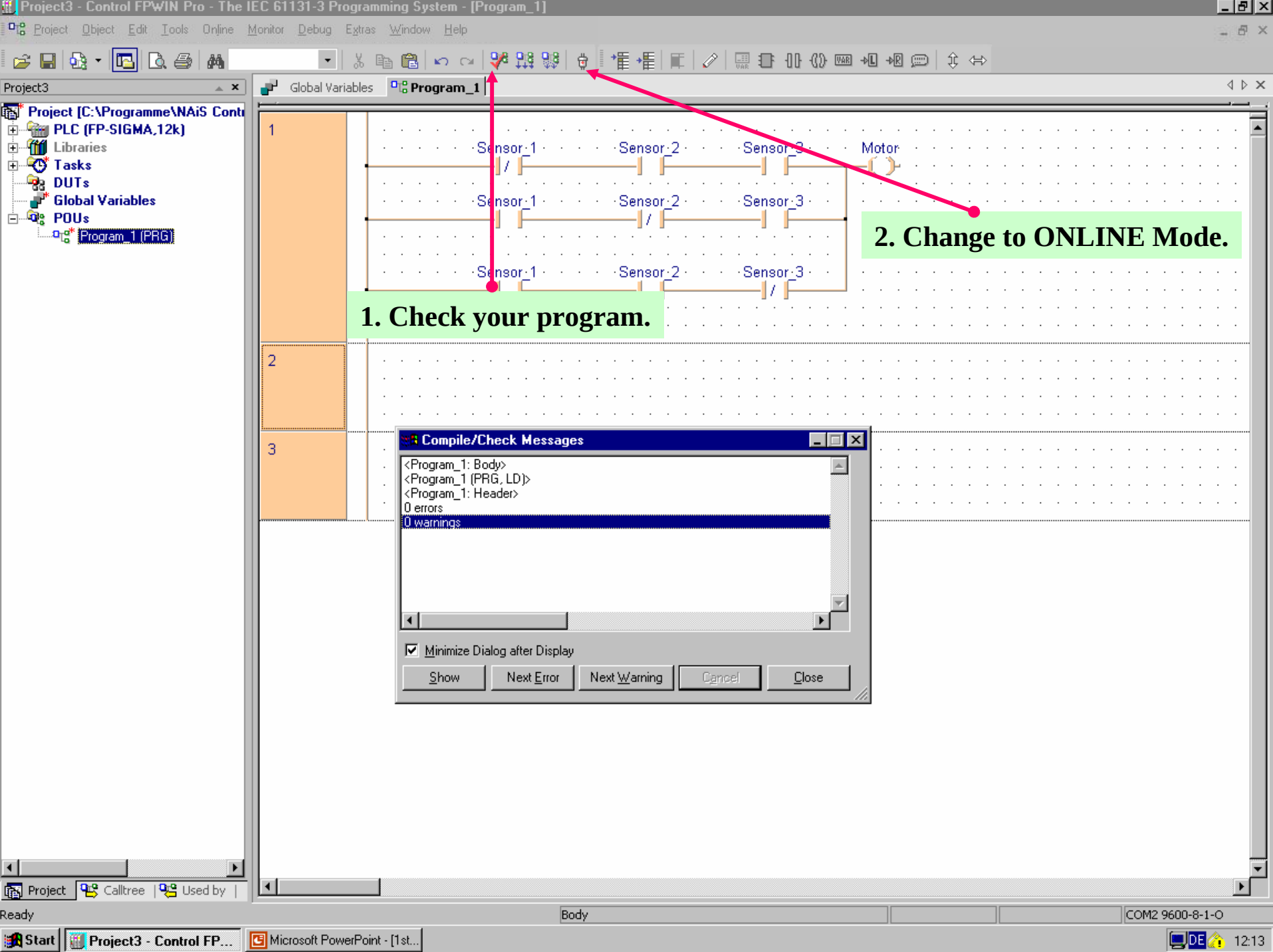
**1. Click on the question mark and press F2 key.
The Variable Selection window will open.**

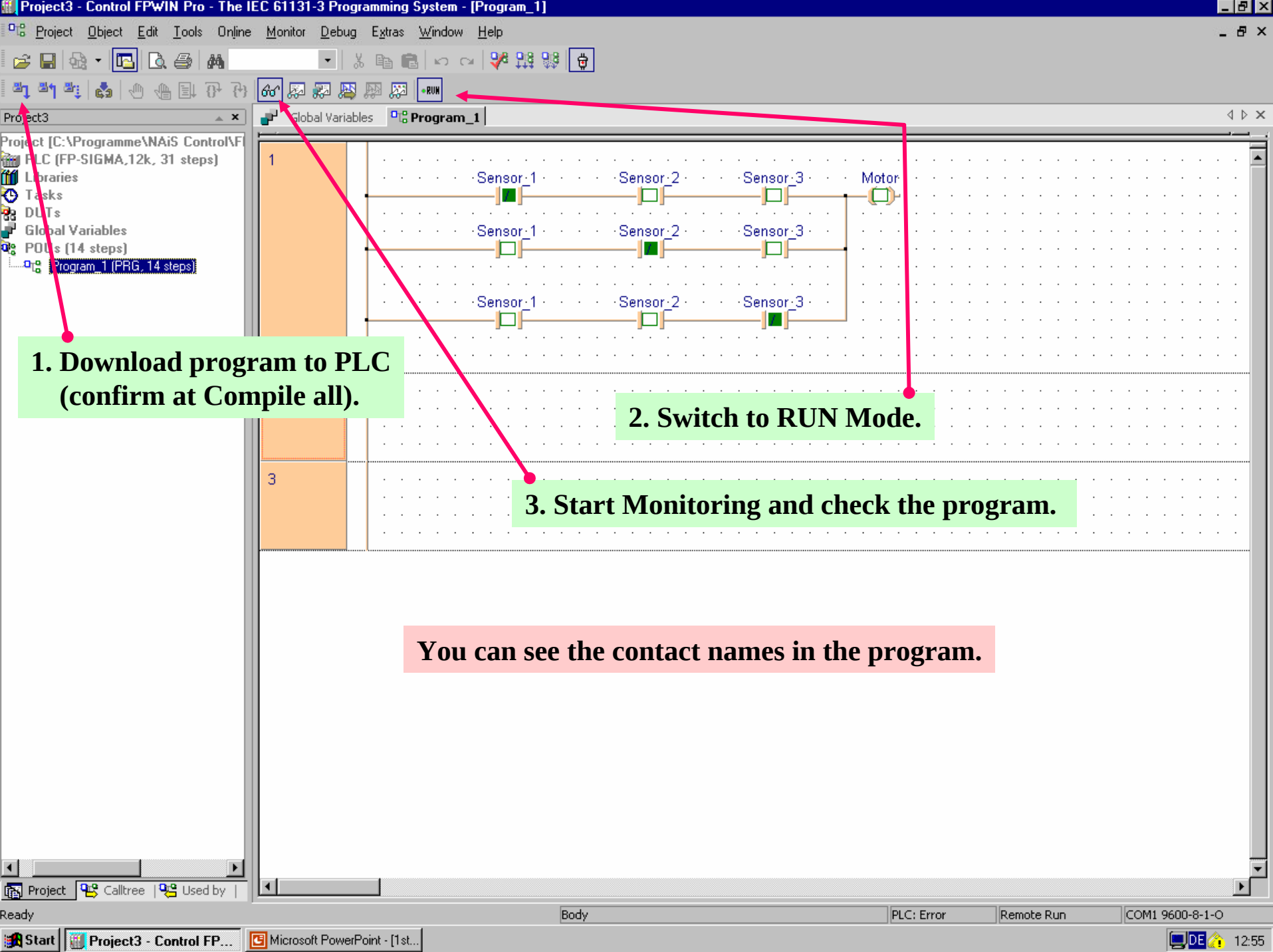
**2. Assign the contacts by double-clicking the
contact name.**

3. Assign all contacts of the program.

**Variable Selection window
opens by pressing F2 at the
question mark.**







**1. Download program to PLC
(confirm at Compile all).**

2. Switch to RUN Mode.

3. Start Monitoring and check the program.

You can see the contact names in the program.

3. Program with Timer and Add Functions

In the next sample program you will use FP addresses.

We will write a program which has a timer and an add function.

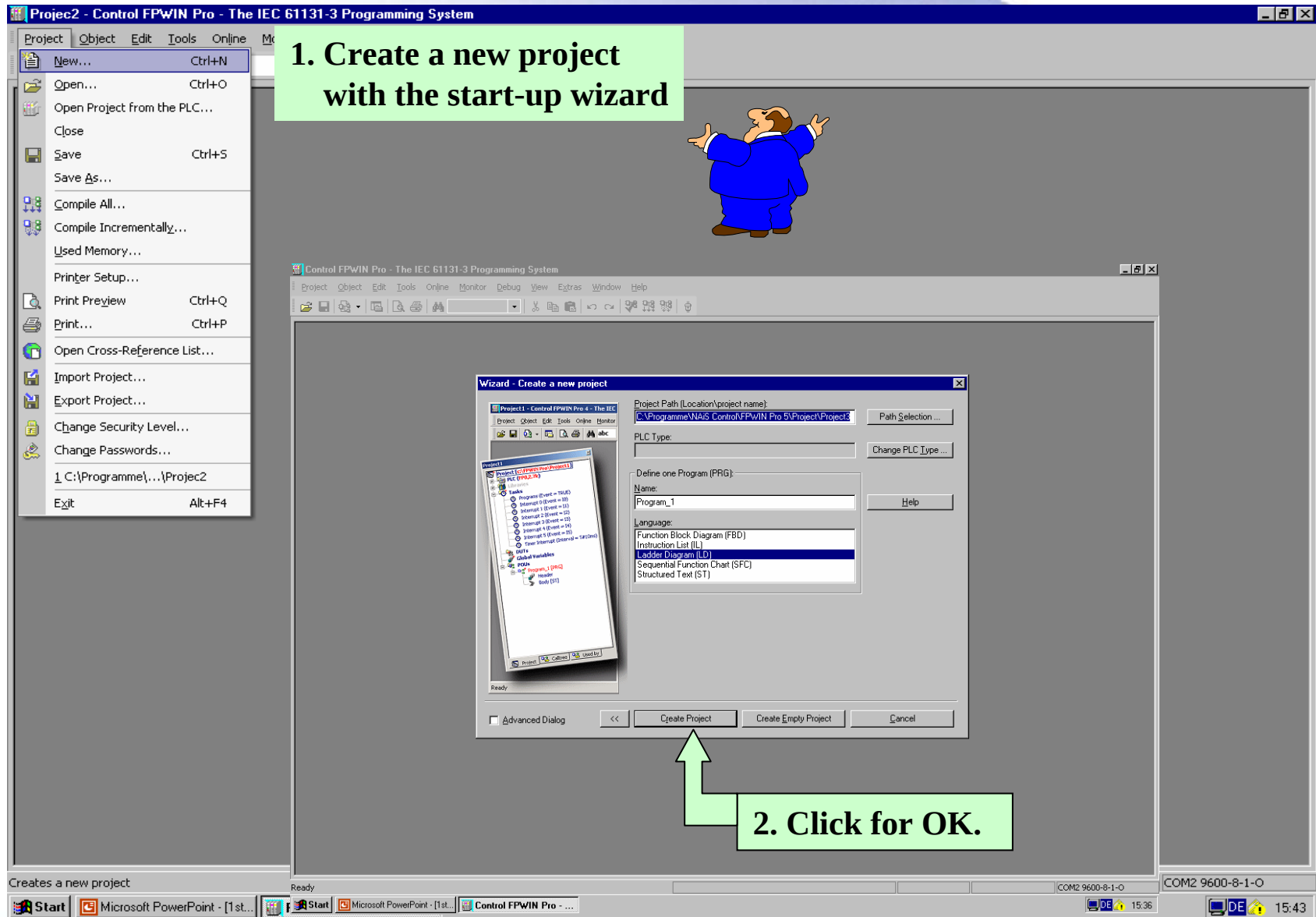
This exercise demonstrates how to utilize functions in the libraries which are pre-installed.

Create a new project/program

1. Create a new project with the start-up wizard



2. Click for OK.



**OP/FUN/FB Selection**

Libraries: <ALL>

Recently used: TM_100ms_FB, @ADD-2

Types:
☐ All Types
☒ Operators
☐ Functions
☐ Function Blocks

Number of pins: 2

OP/FUN/FB:
ADD
AND
DIV
EQ
GE
GT
LE
LT
MUL
NE
OD

☐ Minimize dialog

Insert

Insert with EN/END

Close Help

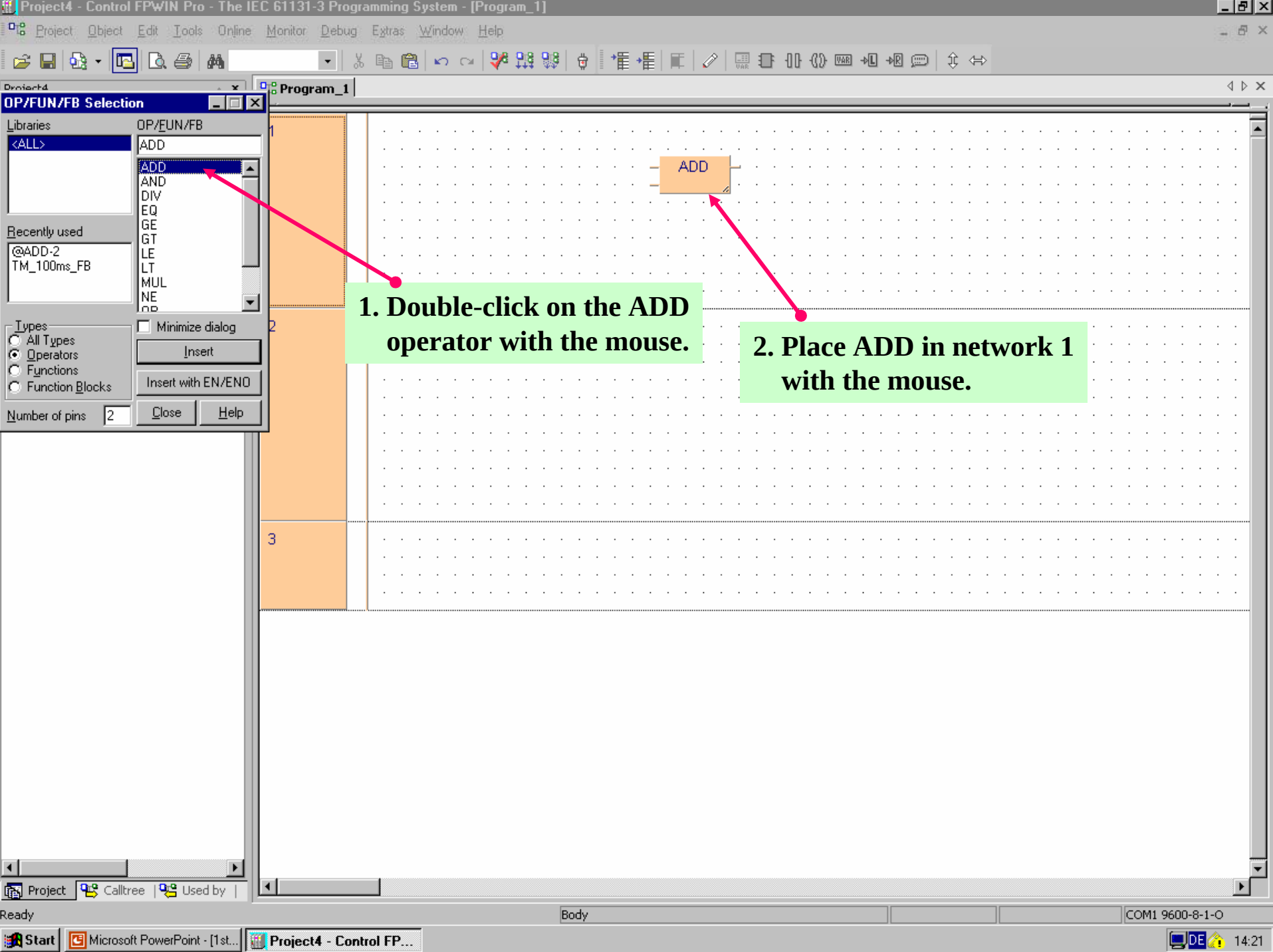
**1. Click on the IC icon (software IC).
The OP/FUN/FB Selection window will open.**

From this window you can access all

- Operators (ADD, SUB, MUL, AND...)
- Functions
- Function Blocks

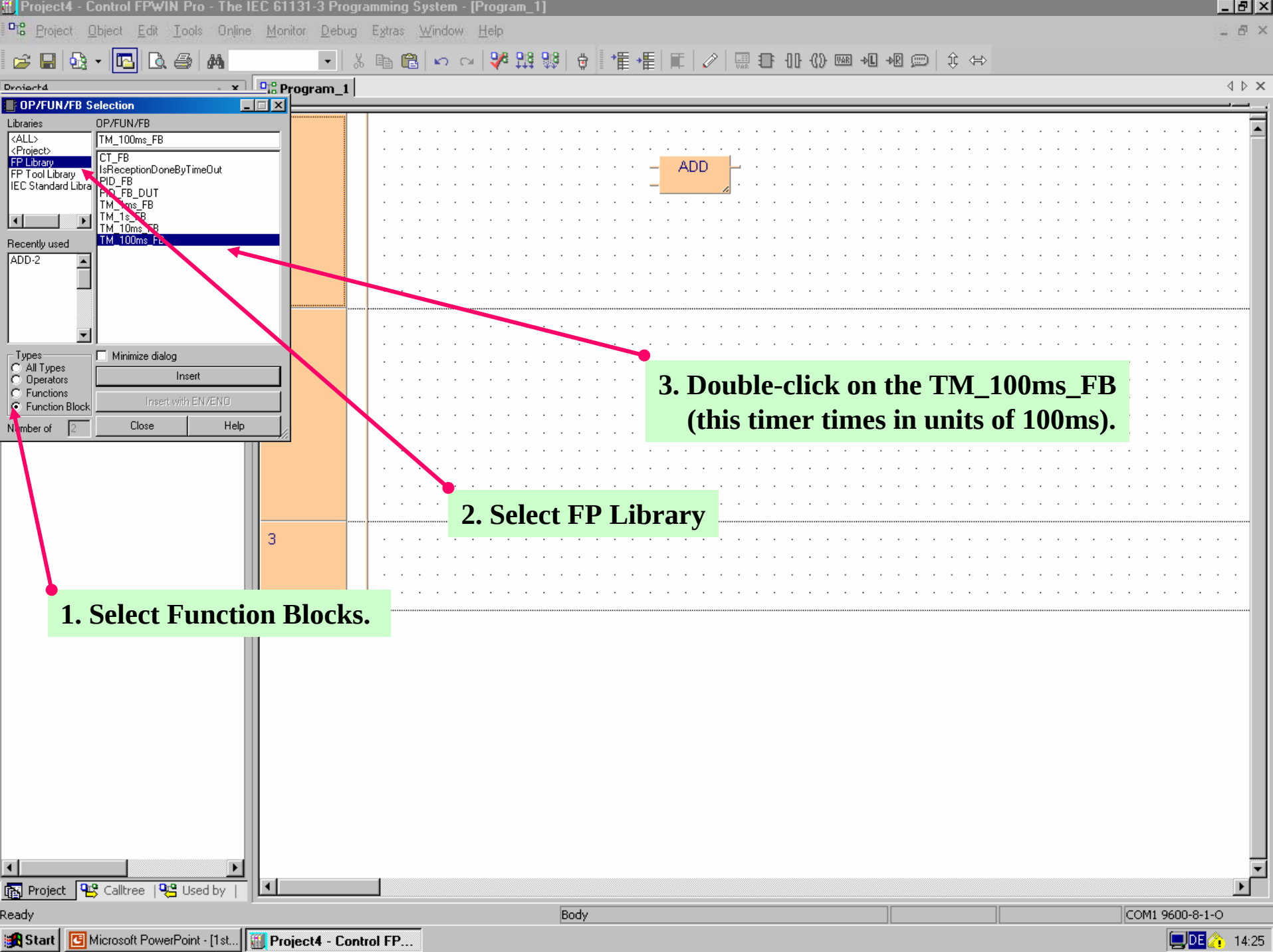
which are available in Control FPWIN Pro.

Later you can also add your own Functions and Function Blocks.



1. Double-click on the ADD operator with the mouse.

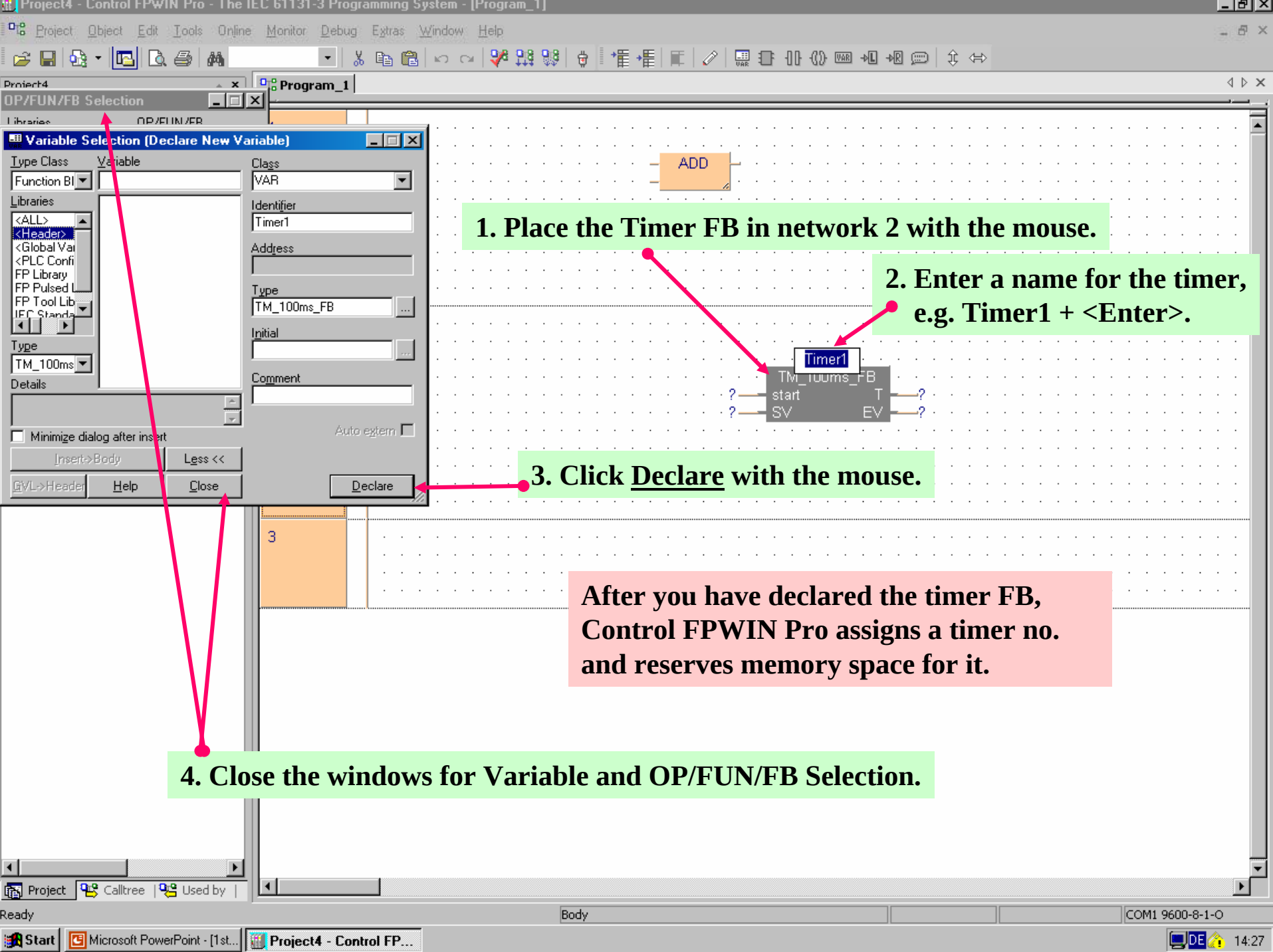
2. Place ADD in network 1 with the mouse.

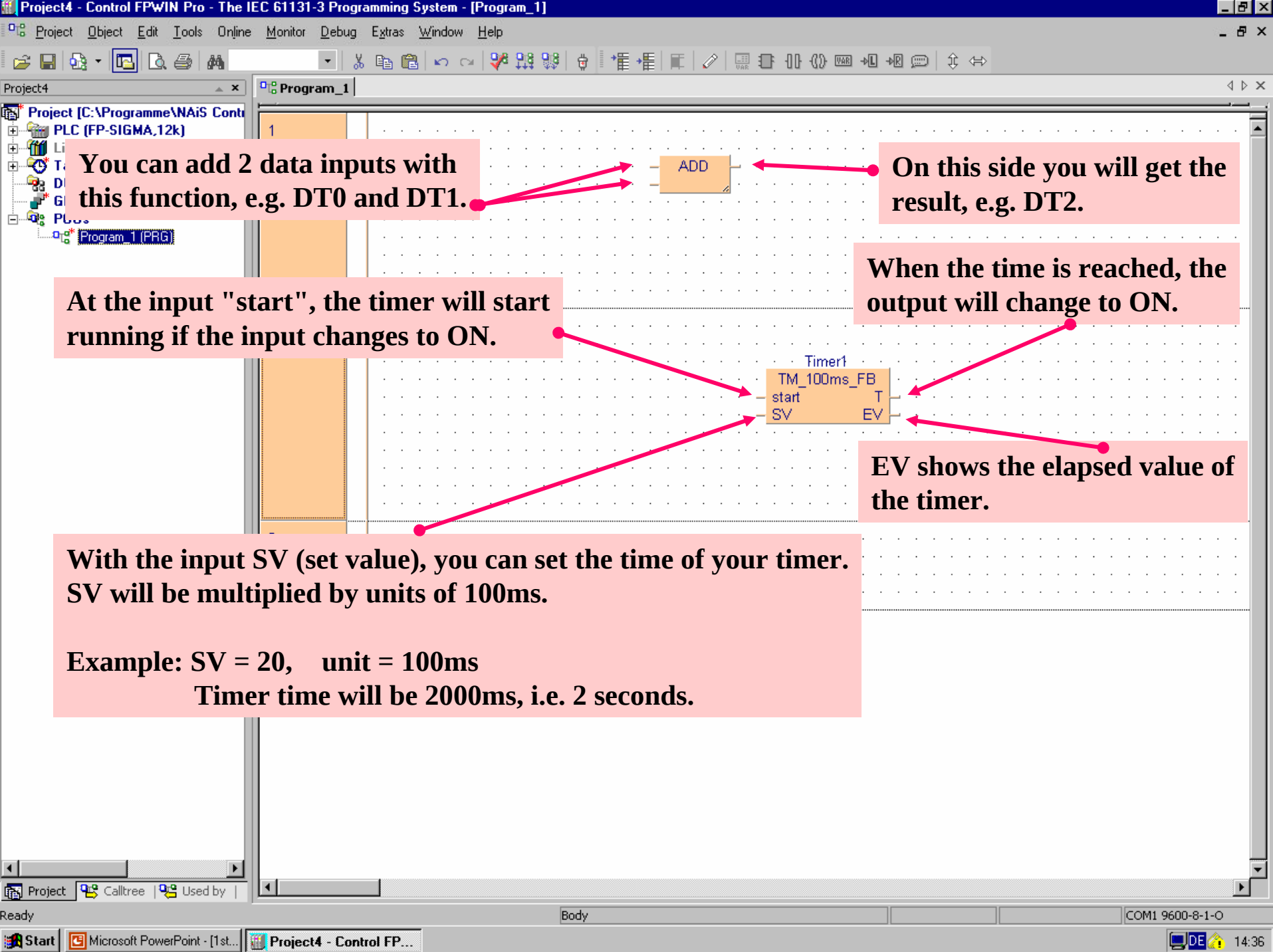


1. Select Function Blocks.

2. Select FP Library

3. Double-click on the TM_100ms_FB
(this timer times in units of 100ms).





You can add 2 data inputs with this function, e.g. DT0 and DT1.

On this side you will get the result, e.g. DT2.

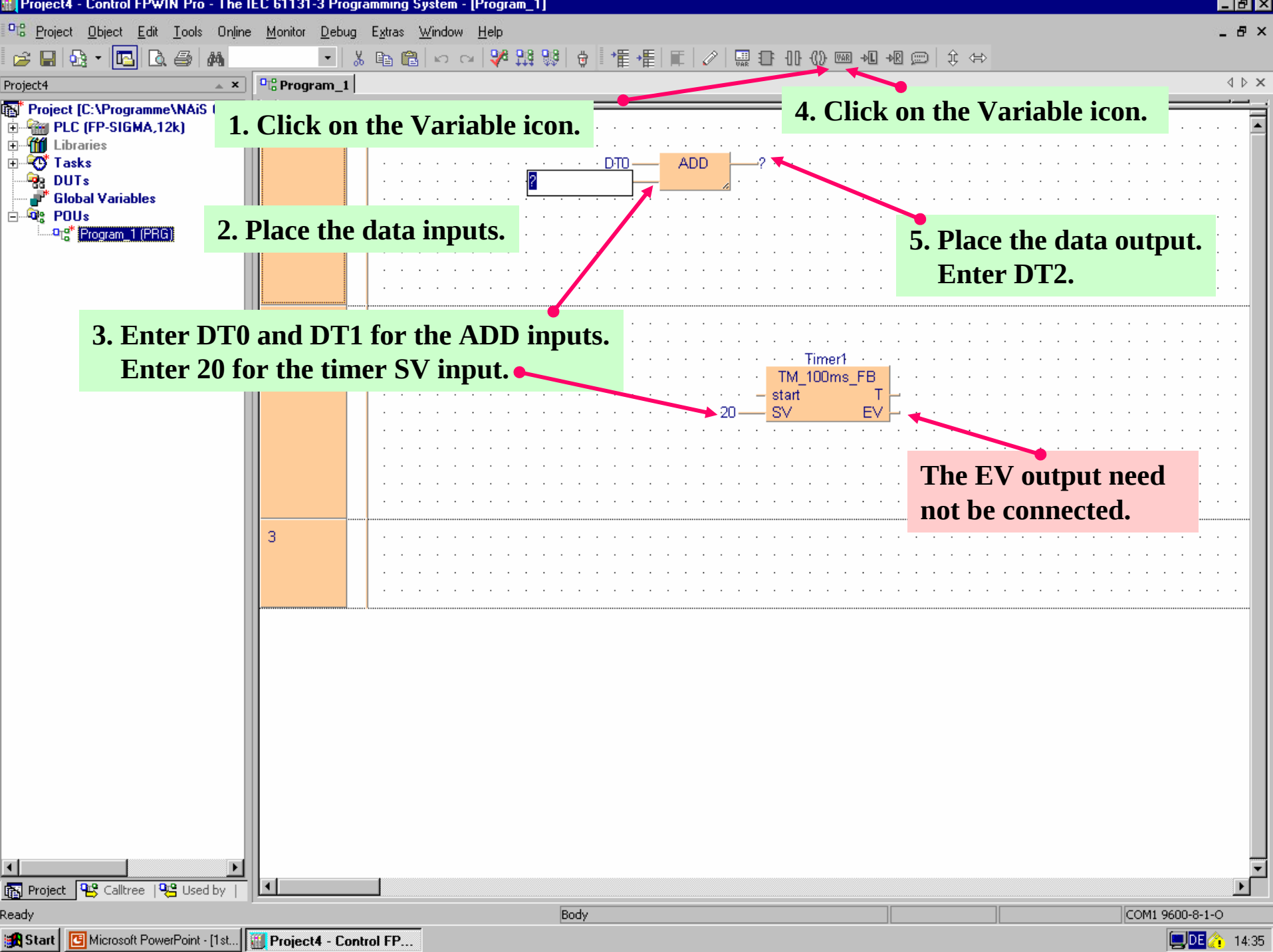
At the input "start", the timer will start running if the input changes to ON.

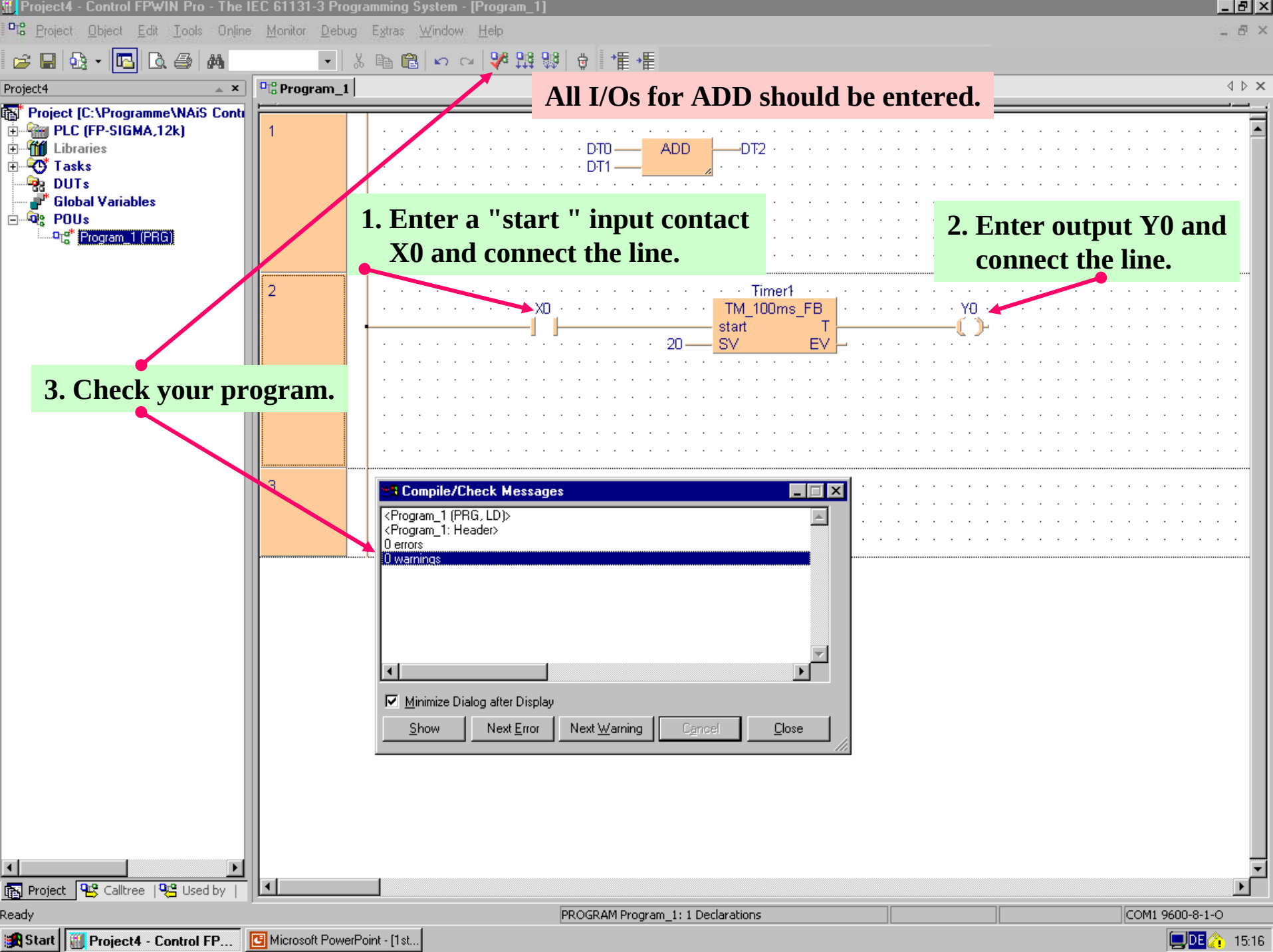
When the time is reached, the output will change to ON.

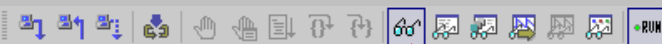
With the input SV (set value), you can set the time of your timer. SV will be multiplied by units of 100ms.

**Example: SV = 20, unit = 100ms
Timer time will be 2000ms, i.e. 2 seconds.**

EV shows the elapsed value of the timer.







Projekt4

Project [C:\Programme\Projekt4]
PLC (FP-e,2.7k)
Libraries
Tasks
DUTs
Global Variables
POUs (14 steps)
 Programm_1 (PRG, 14 steps)

Programm_1

1. Switch to Online mode.

2. Download the program to PLC.

4. Start Monitoring and watch the program.

5. You can enter the input data online and see the result. Double-click into the data area.

3. Switch to RUN Mode.

2s after X0 switches to ON, Y0 will switch to ON.

6. Close and Save the program.

DT0 = 16#000A ADD DT2 = 16#001E
DT1 = 16#0014

2

3

X0

20

Timer1

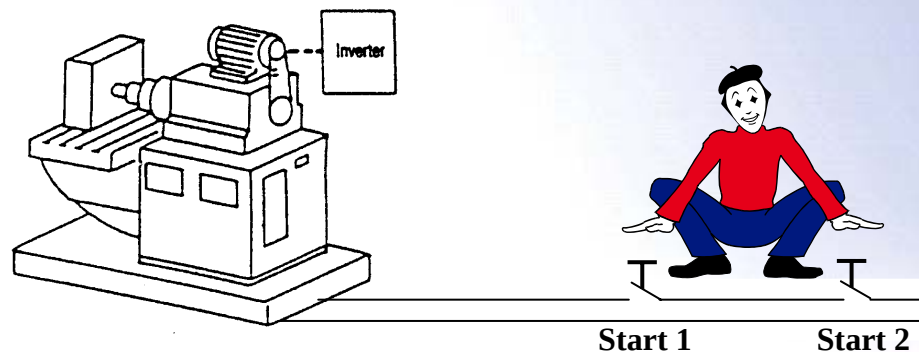
TM 100ms_FB
start SV EV

Y0

4. Two-Hand Trip Guard

In the next sample program you will use addresses according to the IEC 61131-3 standard. You will write a two-hand trip guard program.

With dangerous machines, two buttons must be pushed to ensure the user's safety. Both buttons have to be pressed within 0.5s of each other.

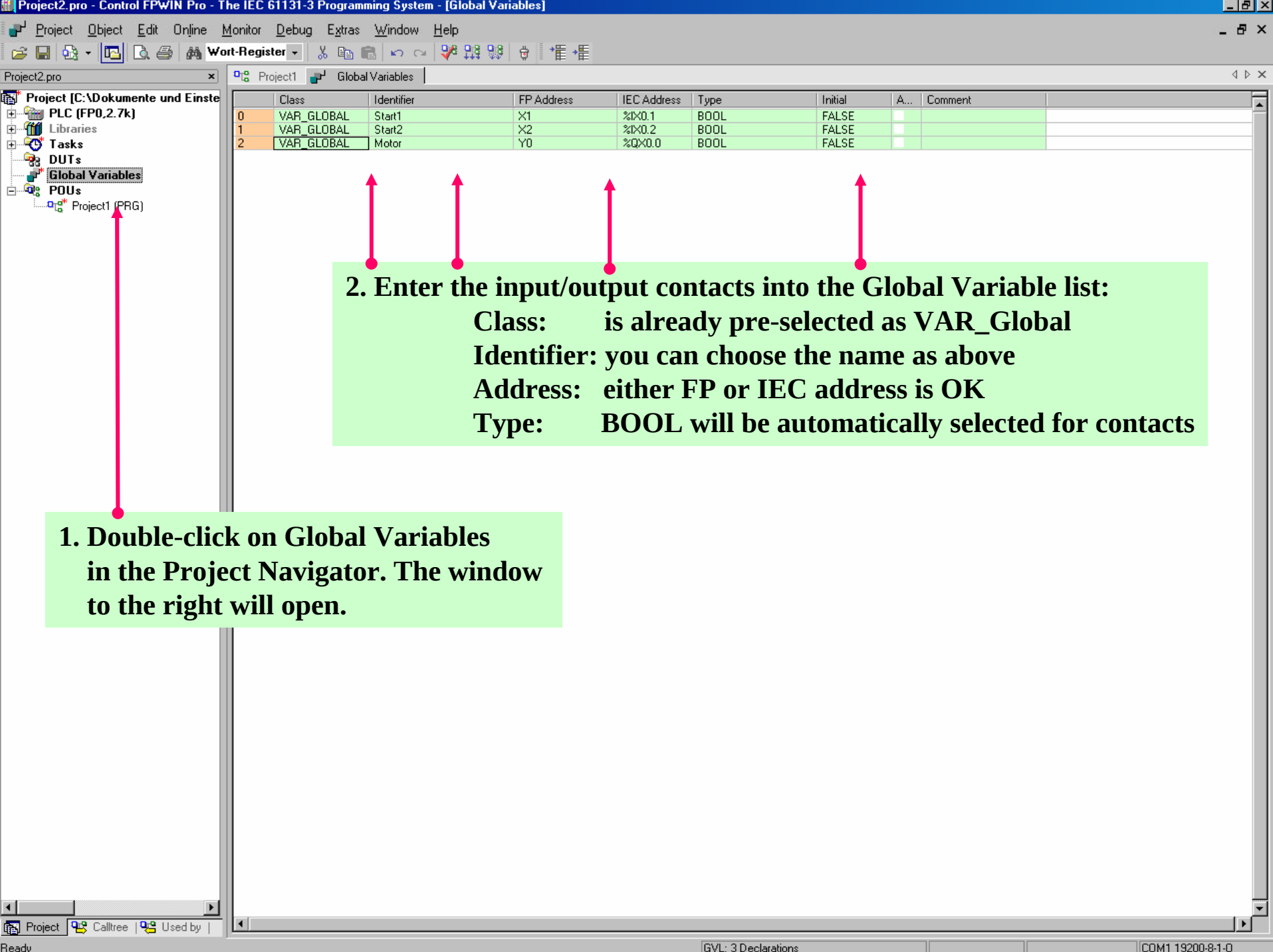


Create a new project/program

1. Create a new project with the start-up wizard

2. Click for OK.

The screenshot shows the 'Control FFWIN Pro - The IEC 61131-3 Programming System' window. The 'Project' menu is open, showing options like 'New...', 'Open...', 'Save', etc. The 'Wizard - Create a new project' dialog box is displayed, showing the 'Project Path' as 'C:\Programme\NAIS Control\FFWIN Pro 5\Project\Project2'. The 'PLC Type' is set to 'S7-300'. The 'Define one Program (PRG)' section shows 'Name: Program_1' and 'Language: Function Block Diagram (FBD)'. The 'Create Project' button is highlighted with a green arrow.



1. Double-click on Global Variables in the Project Navigator. The window to the right will open.

2. Enter the input/output contacts into the Global Variable list:
Class: is already pre-selected as VAR_Global
Identifier: you can choose the name as above
Address: either FP or IEC address is OK
Type: BOOL will be automatically selected for contacts

1. Open program body by double-clicking Program_1

2. Click on the IC icon (software IC). The OP/FUN/FB Selection window will open.

3. Select the Function Blocks.

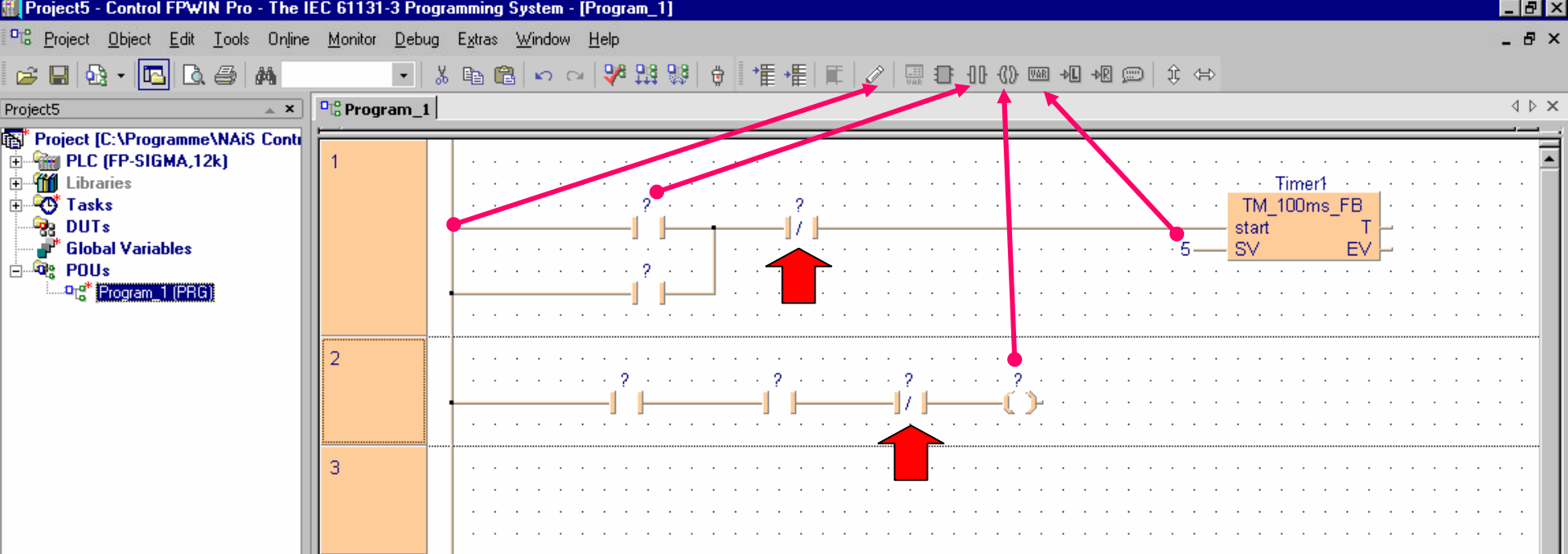
4. Select FP Library.

5. Double-click TM_100ms_FB (this timer times in units of 100ms).

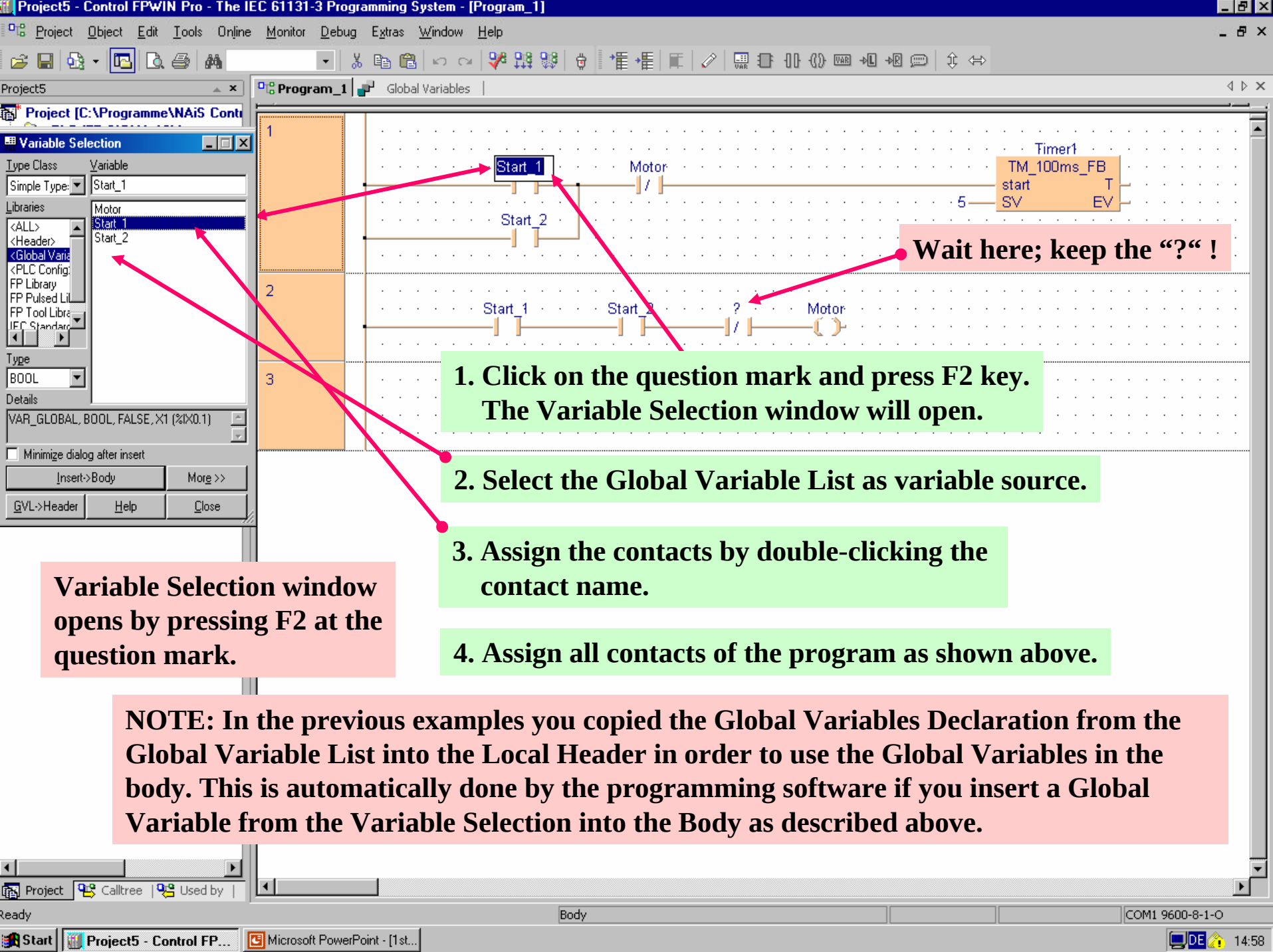
6. Place the timer.

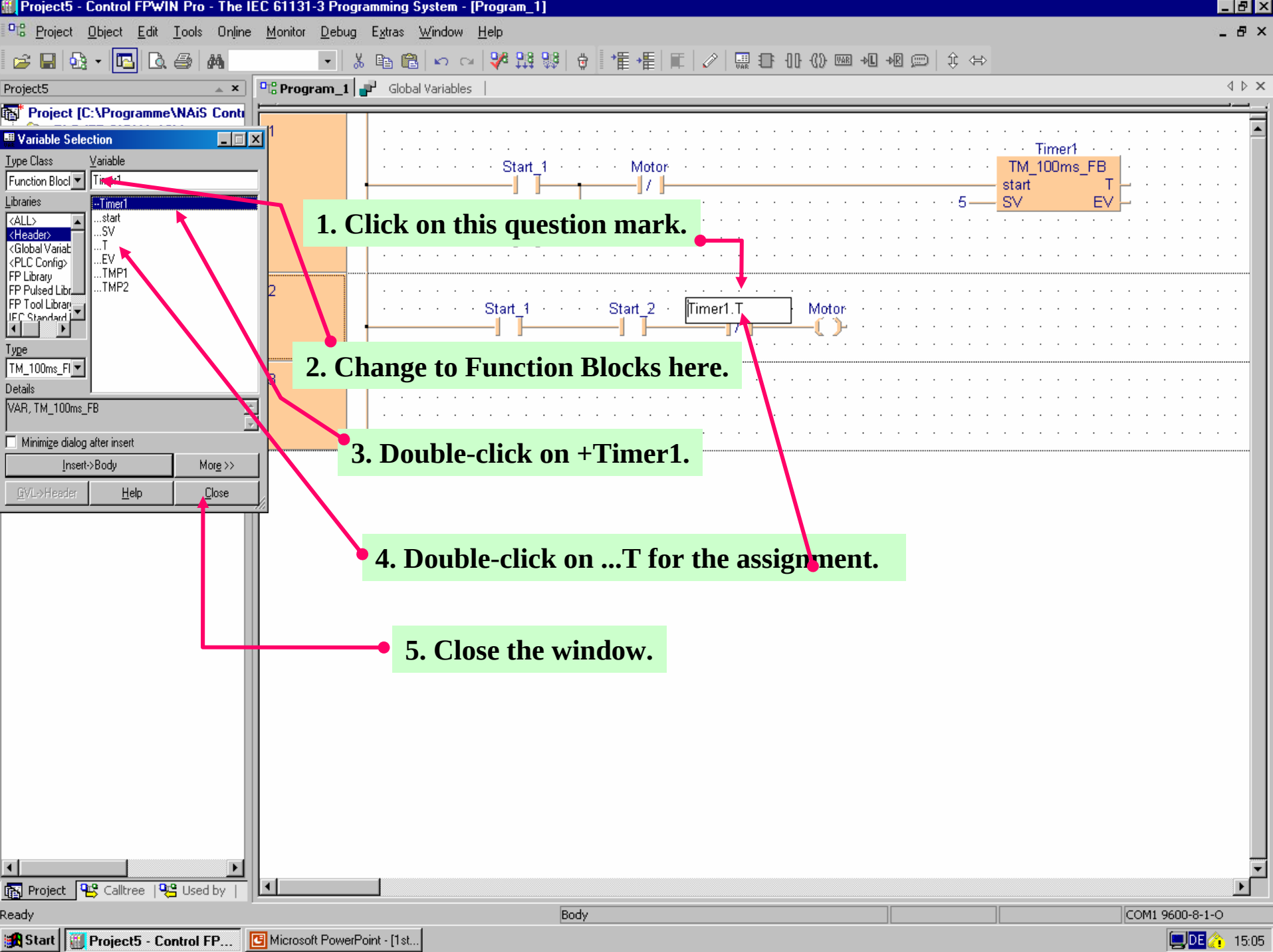
7. Enter Instance: Timer1 and Declare as before.

The screenshot shows the 'OP/FUN/FB Selection' dialog with the 'FP Library' selected. The 'Recently used' list shows 'TM_100ms_FB' selected. The main editor shows the 'Timer1' block being placed on the ladder logic rungs. The block is labeled 'Timer1' and 'TM_100ms_FB' with inputs 'start' and 'SV' and outputs 'T' and 'EV'.



1. Enter the contacts and draw the lines using the toolbar above.
Do not forget about the 2 negations.





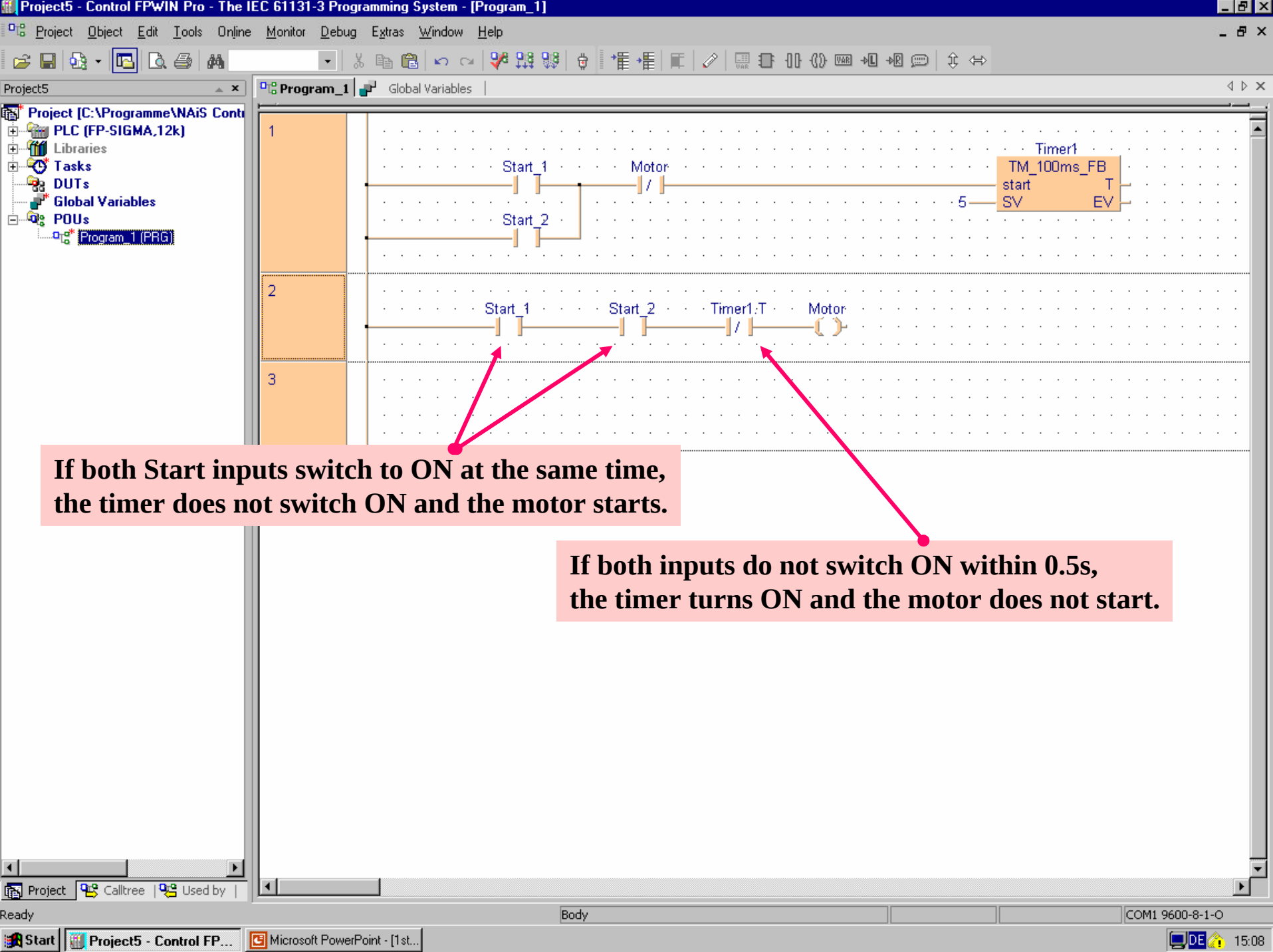
1. Click on this question mark.

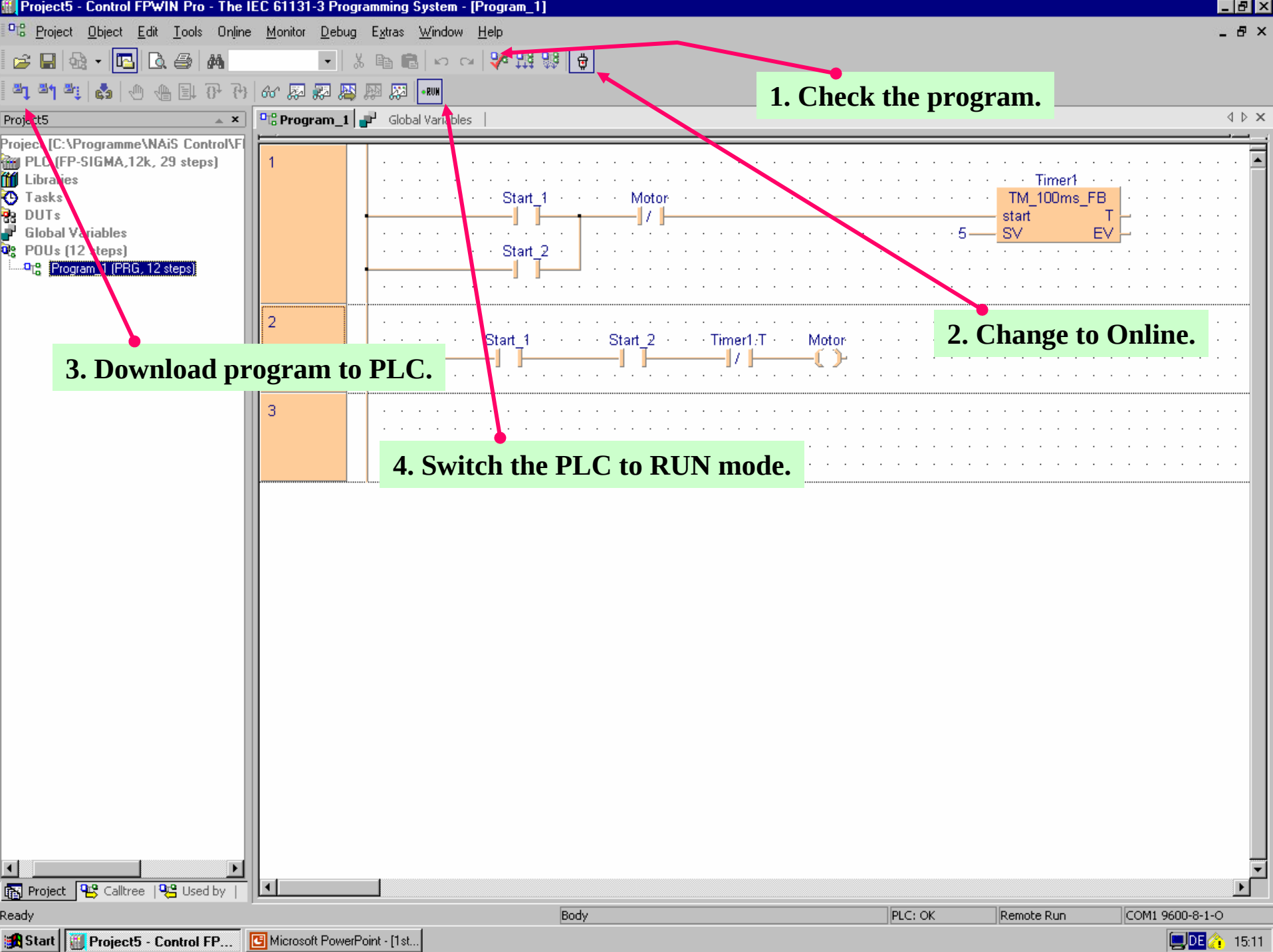
2. Change to Function Blocks here.

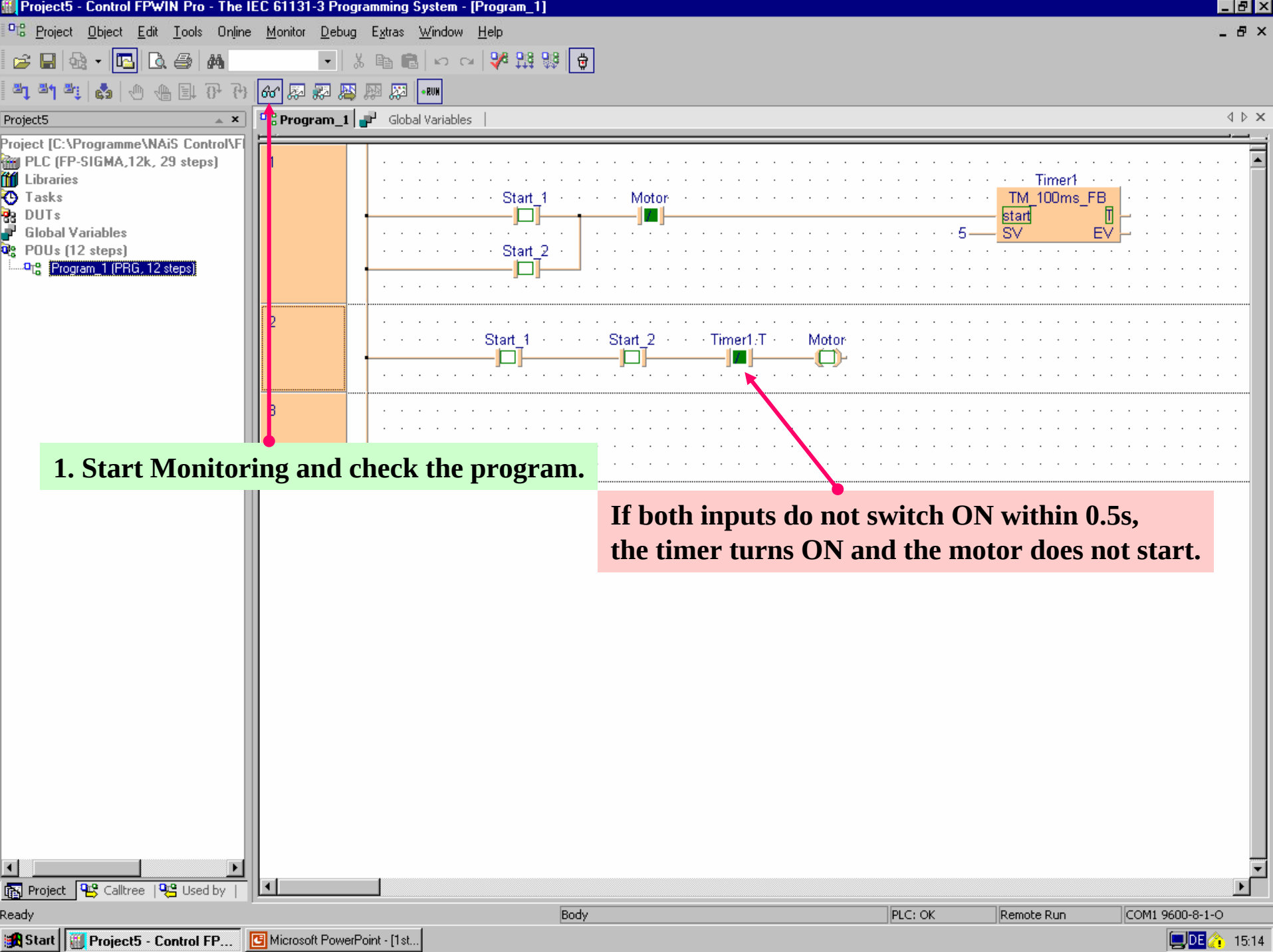
3. Double-click on +Timer1.

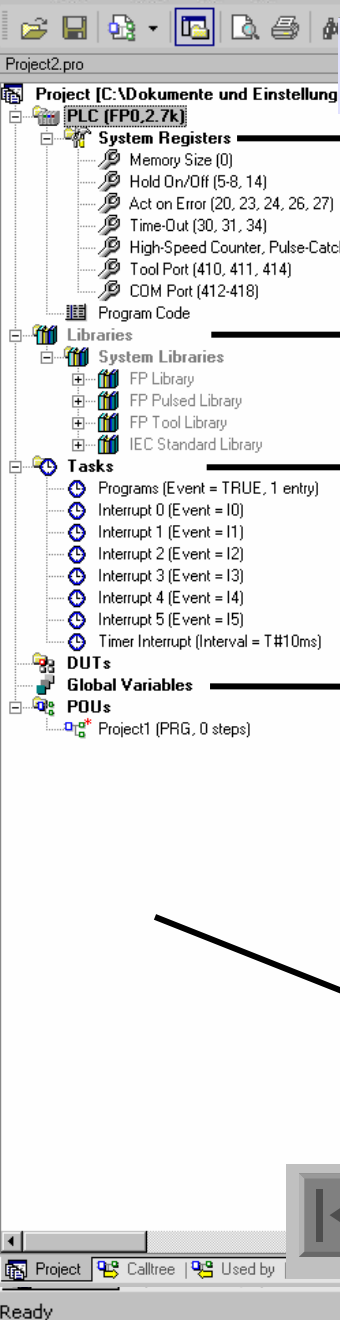
4. Double-click on ...T for the assignment.

5. Close the window.









Navigator explanation:

Hardware

With the sytem registers it is possible to change hardware characteristics (e.g. no. of Timers/Counters)

Libraries

In the Library Pool all instructions, functions and function blocks which are available are stored.

Task pool

The programs of the POU pool have to be entered into the Task pool as program or interrupt. This will be done automatically with the start wizard.

Variables

If IEC 61131-3 programming style is used, the global variables have to be entered here.

**POU pool
Programs**

The programs are stored in the POU pool. Several programs are allowed. Each program has a header (variables) and a body (program code).

The header is only used for IEC 61131-3 style. The start wizard installs 1 program; more programs can be added with the menu: EDIT -> New -> POU.

Return to presentation

IEC 61131-3 Address Format

This table enables you to compile the respective IEC address at any time.

IEC address			Explanation
%			IEC address identifier
	I		Input location
	Q		Output location
	M		Memory location
	X		Data type BOOL (1 bit)
	W		Data type WORD (16 bits)
	D		Data type DOUBLE WORD (32 bits)
	No_1		a.) For I and Q: No_1 = word number b.) For M: No_1 = reference for the internal memory Relay, special internal relay R/WR/DWR ⇒ 0 Timer T ⇒ 1 Counter C ⇒ 2 Set value counter/timer SV/DSV ⇒ 3 Elapsed value counter/timer EV/DEV ⇒ 4 Data register, special data register DT/DDT ⇒ 5 Index register IX,IY ⇒ 6 Link relay L/WL/DWL ⇒ 7 Link data register Ld/DLd ⇒ 8 File register FL/DFL ⇒ 9 Alarm relay E ⇒ 10 Impulse relay P ⇒ 11
	.		Separator
	No_2		a.) For I and Q: No_2 ⇒ bit position in the word b.) For M: When No_1 = 0..9, or 11 ⇒ No_2 = word number (D) When No_1 = 10 ⇒ No_2 = relay number
	.		Separator
	No_3		Used when No_1 = 0, 7 or 11 (R, L, P) ⇒ No_3 = bit position in word

Examples:

X0 **%IX 0.0**

X2F **%IX 2.15**

Y0 **%QX 0.0**

Y30 **%QX 3.0**

R0 **%MX 0.0.0**

R5 **%MX 0.0.5**

R200 **%MX 0.20.0**

DT0 **%MW 5.0**

DT200 **%MW 5.200**

T1 **%MX 1.1**



Return to presentation

Supported IEC 61131-3 Data Types

Elementary data types

Data Type	Abbreviation	Value Range	Data Width
BOOL	BOOL	0 (FALSE) or 1 (TRUE)	1 bit
INTEGER	INT	-32,768 to 32,768	16 bit
DOUBLE INTEGER	DINT	-2,147,483,648 to 2,147,483,647	32 bit
WORD	WORD	16#0000...16#FFFF	16 bit
DOUBLE WORD	DWORD	16#00000000...16#FFFFFFFF	32 bit
STRING	STRING	1 to 255 bytes (ASCII)	8 bits per byte
TIME 32 bit	TIME	T#0,00s to T#21 474 836,47s	32 bit
REAL	REAL	-1,175494 x 10E-38 to -3,402823 x 10E-38 and 1,175494 x 10E-38 to 3,402823 x 10E-38	32 bit

Others

Type	Meaning	Size	Comment
ARRAY[...] OF ...	Array of elements of the same data type	1-255 bytes	Max. three dimensions
FB Name	Used for creation of function block instances	variable	Local or global function block instance
DUT Name	instance of a Data Unit Type	variable	Global DUT instance

Supported IEC 61131-3 Classes

Class field in POU headers and the list of global variables:

Class	Usage In	Usage of definition of
VAR_GLOBAL	GVL	non-holding global variable
VAR_GLOBAL_RETAIN	GVL	holding global variable
VAR_GLOBAL_CONSTANT	GVL	constant global variable
VAR_EXTERNAL	Header of PRG, FB	non-holding global variable
VAR_EXTERNAL_RETAIN	Header of PRG, FB	holding global variable
VAR_EXTERNAL_CONSTANT	Header of PRG, FB	constant global variable
VAR	Header of PRG, FUN, FB	non-holding local variable
VAR_RETAIN	Header of PRG, FB	holding local variable
VAR_CONSTANT	Header of PRG, FUN, FB	constant local variable
VAR_INPUT	Header of FUN, FB	input variable
VAR_OUTPUT	Header of FB	output variable
VAR_OUTPUT_RETAIN	Header of FB	output holding variable
VAR_IN_OUT	Header of FB	input and output variable

GVL = Global Variable List

POU = Program Organization Unit

PRG = Program

FUN = Function

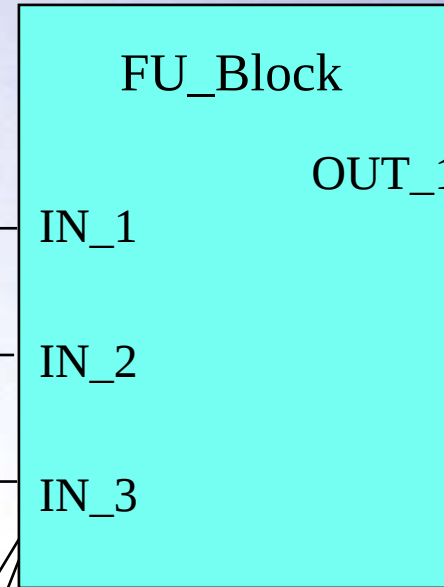
FB = Function Block

DUT = Data Unit Type

- **five IEC 61131-3 languages combined in one software:**
 - **Instruction List**
 - **Structured Text**
 - **Ladder Diagram**
 - **Function Block Diagram**
 - **Sequential Function Chart**
- **all available Panasonic PLC types are programmable without limitations**
- **easy reuse of programs and program parts with self-made Functions and Function Blocks which can be stored in self-defined libraries**
- **a wide range of test and debug functions shorten installation and troubleshooting time**
- **user-friendly comment and documentation features**
- **modem functions for remote programming and testing**
- **the PLCopen Base Level IL certificate**
- **PLCopen Conformity Level ST and Reusability Level ST certificate**

Function Blocks can be easily reused

1. Function Block Body



2. Variable Interface

FU-Block Header			
	Class	Identifier	Type
0	VAR_INPUT	IN_1	BOOL
1	VAR_INPUT	IN_2	BOOL
2	VAR_INPUT	IN_3	BOOL
3	VAR_OUPUT	OUT_1	BOOL

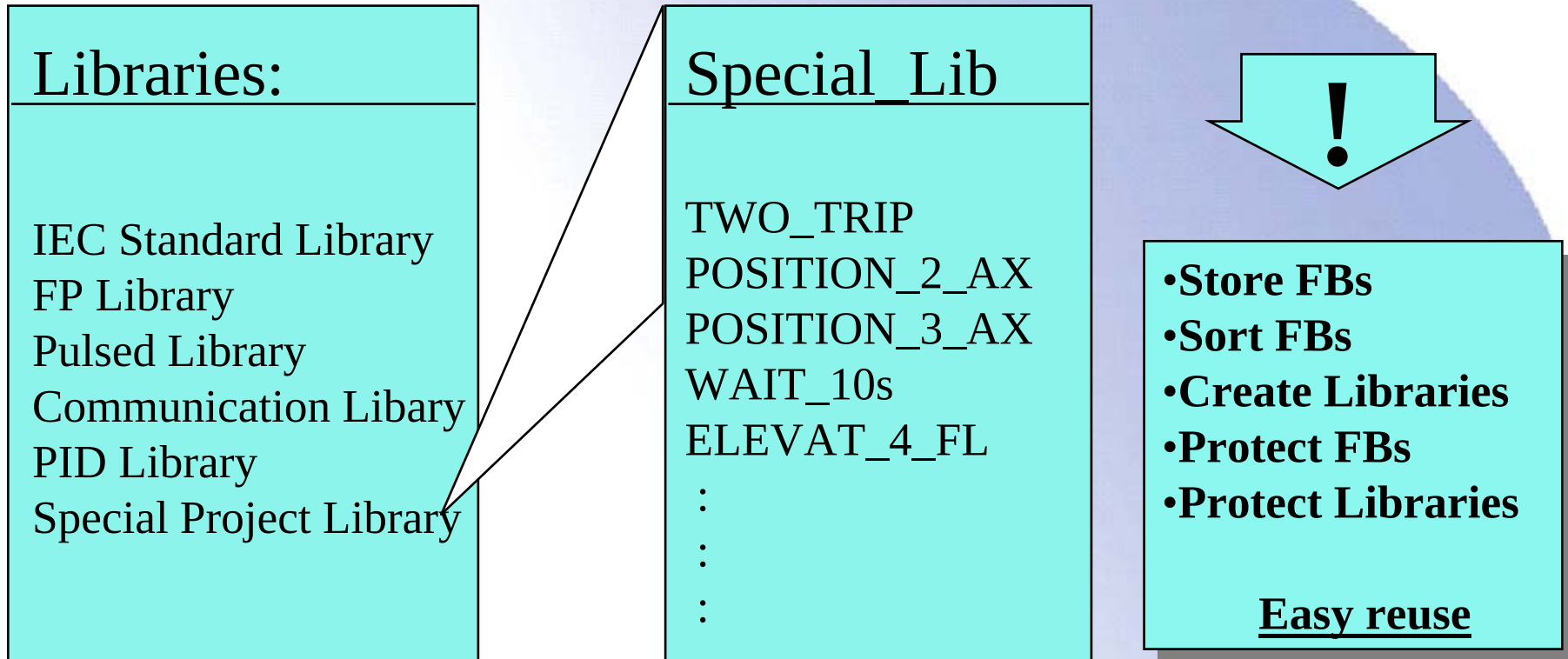
3. Program

```

LD    IN_1
AND   IN_2
OR    OUT_1
AND   IN_3
:
:
:
:
ST    OUT_1
  
```

Panasonic's Library Concept

Additional Panasonic feature

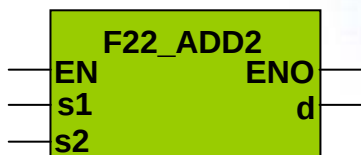


- **Self-created Function Blocks (FBs) can be stored in libraries.**
- **Comfortable structuring and sorting in the libraries.**
- **Know-how protection of FBs and libraries.**
- **Easy reuse of tested software --> saves time.**

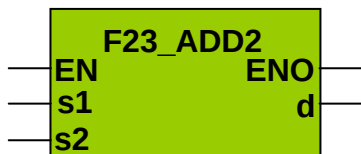
IEC 61131-3 Functions

Conventional programming requires different functions for e.g.:

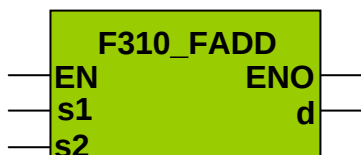
16-bit



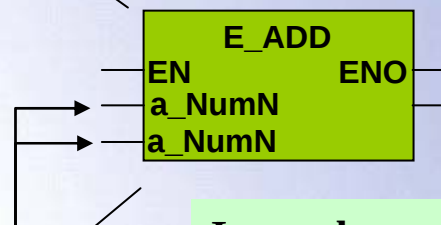
32-bit



Floating point data

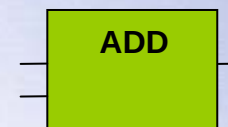


Flexible IEC instructions:
1 function instead of several

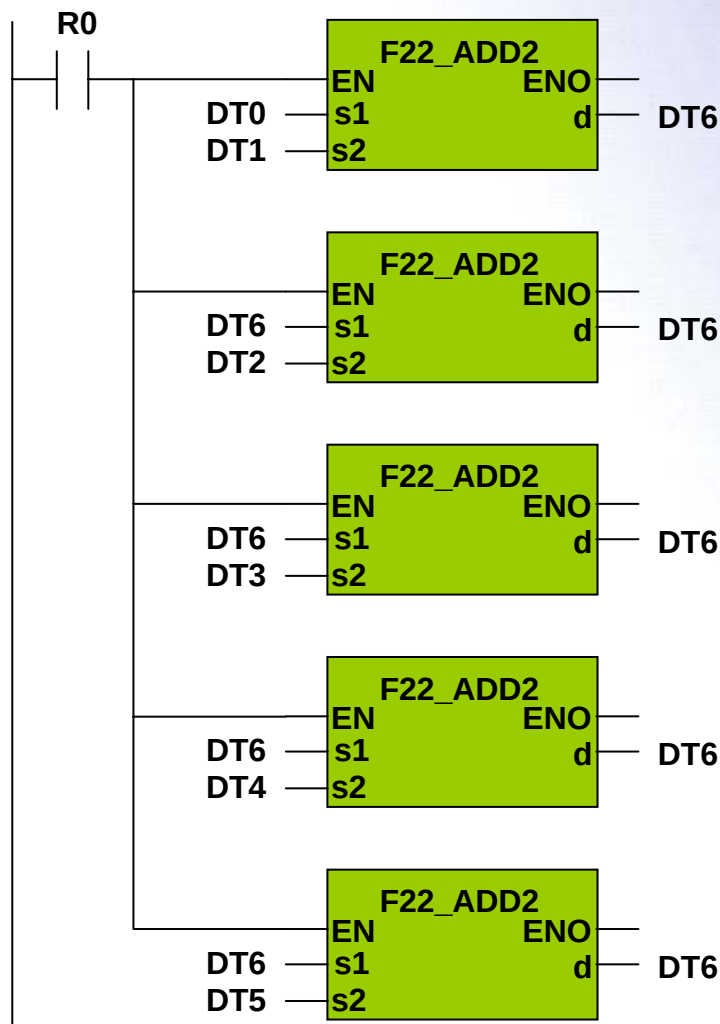


Input data must be of the same type!

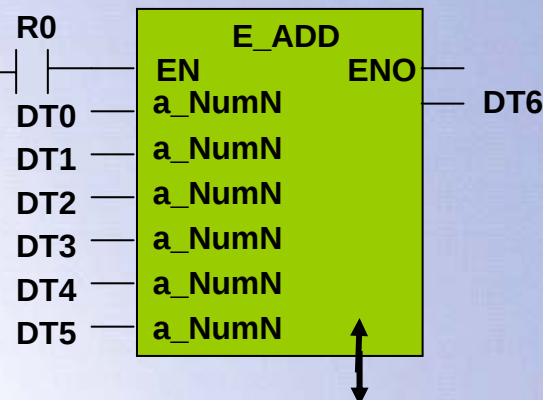
Or execution in every PLC cycle (R9010) with:



IEC 61131-3 Functions

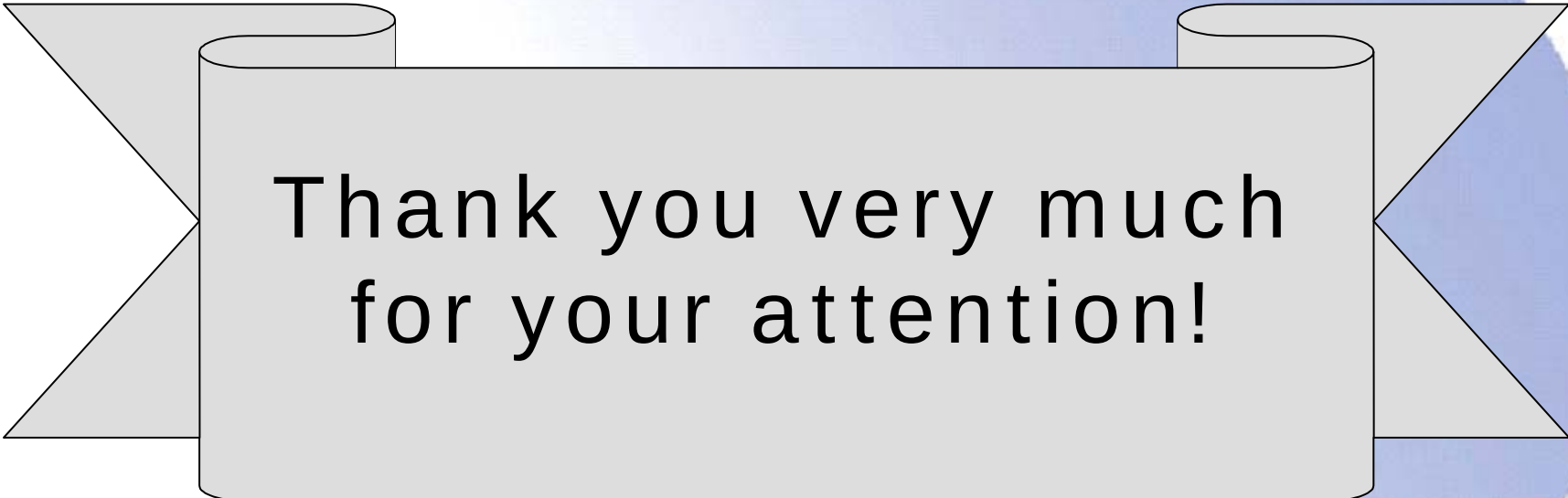


Extensible Instructions:
1 Function instead of several



To extend the function:
1. Place cursor on the bottom edge.
 -The cursor has an arrow on each end.
2. Pull to desired length.

Good luck!



**Thank you very much
for your attention!**