Panasonic®

Control FPWIN Pro V5.2 Reference Manual

Panasonic Electric Works Europe AG

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Panasonic®

Programming Software

Control FPWIN Pro V5.2 Reference Manual

BEFORE BEGINNING

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Important Symbols

One or more of the following symbols may be used in this manual:

Warning.
The warning triangle indicates especially important safety instructions. If they are not adhered to, the results could be:

- **fatal or critical injury and/or**
- **significant damage to instruments or their contents, e.g. data**

◆ NOTE

Contains important additional information.

◆ EXAMPLE

Contains an illustrative example of the previous text section.

◆ PROCEDURE

Indicates that a step-by-step procedure follows.

◆ REFERENCE

Indicates where you can find additional information on the subject at hand.

◆ CAUTION

Indicates that you should proceed with caution.

◆ KEYPOINTS

Summarizes key points in a concise manner.

◆ SHORTCUTS

Provides helpful keyboard shortcuts.

◆ EXPLANATION

Provides brief explanation of a function, e.g. why or when you should use it.

☛ next page

Indicates that the text will be continued on the next page.

The manual uses the following conventions to indicate elements from the user interface or the keyboard:

"Data Field"	Data field entries and option names are rendered in quotation marks.
[Button]	Buttons are indicated by square brackets.
<Key>	Keys are indicated by pointed brackets

Table of Contents

Chapter 1

Installation and First Steps

1.1 Installing and Starting

Before installing Control FPWIN Pro, check whether your PC meets the following requirements:

- Pentium processor or compatible
- 128 MB RAM or more
- CD-ROM drive
- Hard disk with at least 100 MB free disk space
- VGA monitor or compatible monitor
- Mouse
- Serial COM interface to connect your PLC

Furthermore, Windows 95, 98, NT V4.0, 2000, ME or XP should be in place before you start installing FPWIN Pro.

◆ NOTES

- **To install under Windows 2000 or XP, you need administrator rights on your computer.**
- **We assume that you are an experienced user of Microsoft Windows.**

◆ PROCEDURE

1. **Start Windows**
2. **Insert the Control FPWIN Pro CD into the CD-ROM drive**

   A browser showing the contents of the CD is automatically started.
3. **Select a language**
4. **Choose “Install software”**

   Carefully read the information displayed on the screen and follow the instructions. To start Control FPWIN Pro:
5. **Programs → Panasonic MEW Control → FPWIN Pro 5 → FPWIN Pro 5**

1.2 First Steps and Helpful Files

A “First Steps” PowerPoint tutorial of Control FPWIN Pro is included on the CD. You can run the tutorial or install it. If you installed it, activate the First Steps program via the Programs → Panasonic MEW Control → FPWIN Pro 5 → FPWIN Pro 5 submenu.

For your convenience, the following files are also included on the CD and found under “Helpful Files”:

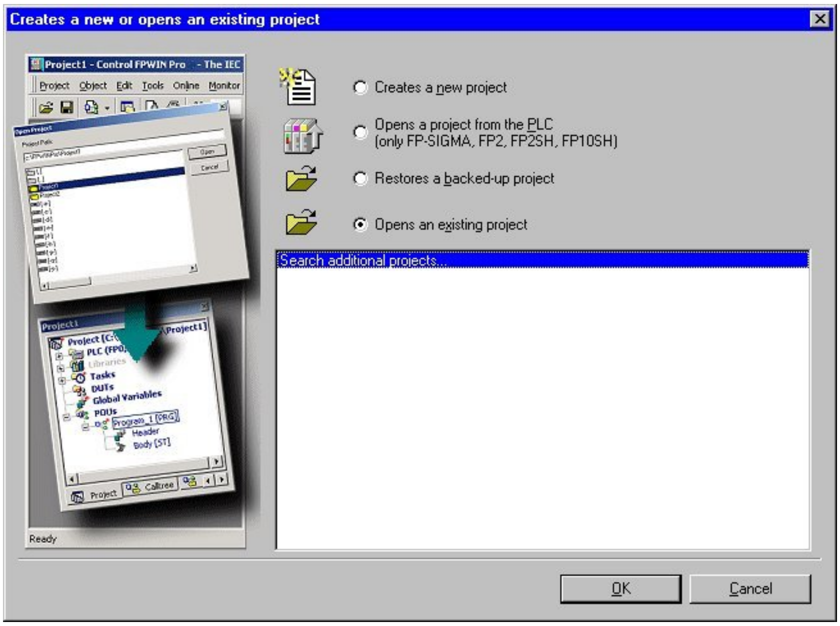
- IEC61131_3_basics.pdf, for an introduction to the IEC61131–3 standard.
- PDF file of the First Steps tutorial for easy printing. For best results, select “Print as image” when printing.
- A link to our website to download manuals.

Chapter 2

User Interface

2.1 Start Dialog

When you open FPWIN Pro, the following window appears:



Creates a new or opens an existing project

○ Creates a new project

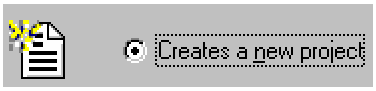
○ Opens a project from the PLC (only FP-SIGMA, FP2, FP2SH, FP10SH)

○ Restores a backed-up project

● Opens an existing project

Search additional projects...

In the Start dialog you can perform the following actions:

Select  ● Creates a new project to create a new project in which you can enter programs, functions and function blocks. You may also create an empty project.

Select ● Opens a project from the PLC to open a project that has been saved in the comment memory of the PLC.

Select ● Restores a backed-up project to open a project that has been packed.

Select ● Opens an existing project if you wish to open a project on your computer or network. To open a project recently opened, double-click on the name desired in the project list.

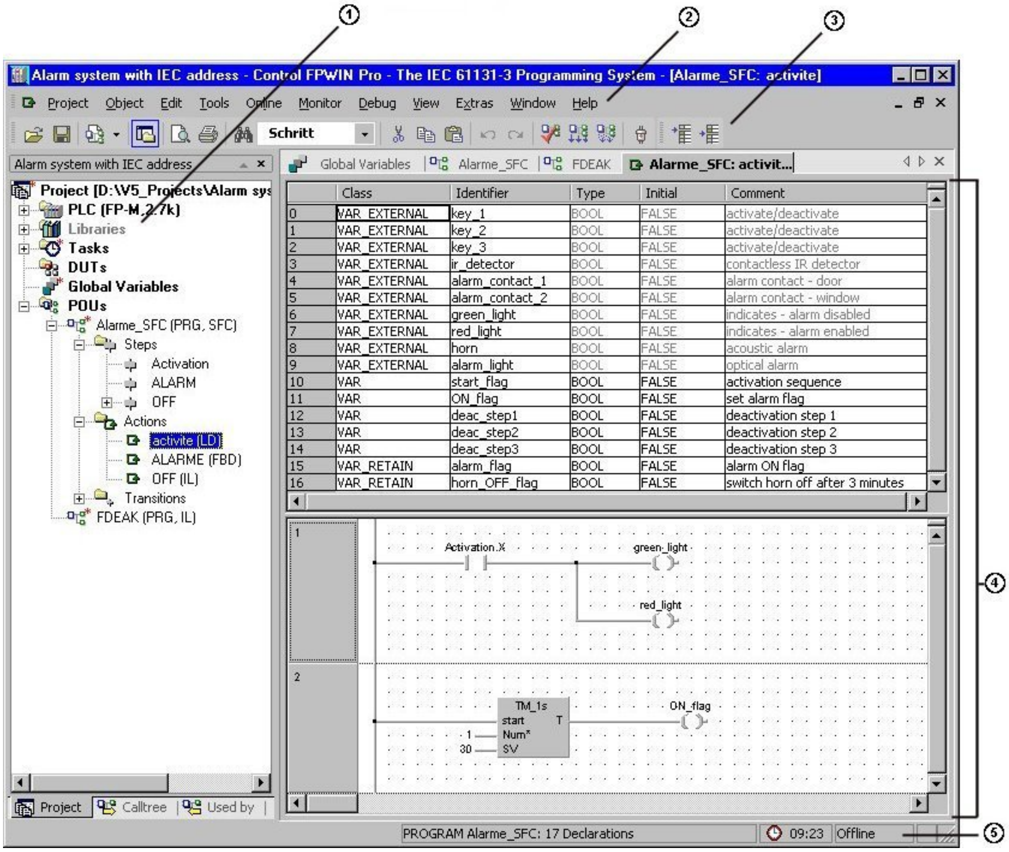
To open a project not listed here, double-click on **Search additional projects**.

◆ **NOTE**

You can change the number of projects listed under Extras → Options → Program Options → General.

2.2 Main Window

To facilitate programming, the graphical user interface of FPWIN Pro consists of the following components:



	Class	Identifier	Type	Initial	Comment
0	VAR_EXTERNAL	key_1	BOOL	FALSE	activate/deactivate
1	VAR_EXTERNAL	key_2	BOOL	FALSE	activate/deactivate
2	VAR_EXTERNAL	key_3	BOOL	FALSE	activate/deactivate
3	VAR_EXTERNAL	ir_detector	BOOL	FALSE	contactless IR detector
4	VAR_EXTERNAL	alarm_contact_1	BOOL	FALSE	alarm contact - door
5	VAR_EXTERNAL	alarm_contact_2	BOOL	FALSE	alarm contact - window
6	VAR_EXTERNAL	green_light	BOOL	FALSE	indicates - alarm disabled
7	VAR_EXTERNAL	red_light	BOOL	FALSE	indicates - alarm enabled
8	VAR_EXTERNAL	horn	BOOL	FALSE	acoustic alarm
9	VAR_EXTERNAL	alarm_light	BOOL	FALSE	optical alarm
10	VAR	start_flag	BOOL	FALSE	activation sequence
11	VAR	ON_flag	BOOL	FALSE	set alarm flag
12	VAR	deac_step1	BOOL	FALSE	deactivation step 1
13	VAR	deac_step2	BOOL	FALSE	deactivation step 2
14	VAR	deac_step3	BOOL	FALSE	deactivation step 3
15	VAR_RETAIN	alarm_flag	BOOL	FALSE	alarm ON flag
16	VAR_RETAIN	horn_OFF_flag	BOOL	FALSE	switch horn off after 3 minutes

Components of the user interface

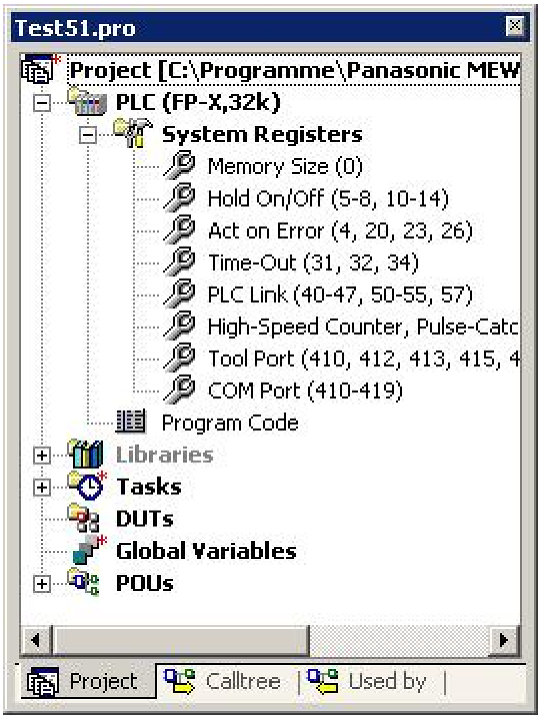
①	Project Navigator
②	Menu Bar
③	Tool Bar
④	Programming Window including header and body within one frame
⑤	Status Bar

You can position the components anywhere on your screen. To move a component, drag its title bar.

Many commands from the tool bar and the menus are also available in pop-up menus, which open when you click on the right mouse button. Pop-up menus are available in the project navigator, in the programming editors (except SFC), in the sampling trace window, and in the recipe editor.

2.3 Project Navigator

The clear graphic representation of the project hierarchy in the navigator provides an overview even for very complex projects. All objects of the project can be easily accessed by double-clicking on the respective object. Use **Window** → **Navigator on or off** or click to show/hide the navigator window.



Test51.pro

Project [C:\Programme\Panasonic MEW
PLC (FP-X,32k)
System Registers
Memory Size (0)
Hold On/Off (5-8, 10-14)
Act on Error (4, 20, 23, 26)
Time-Out (31, 32, 34)
PLC Link (40-47, 50-55, 57)
High-Speed Counter, Pulse-Catc
Tool Port (410, 412, 413, 415, 4
COM Port (410-419)
Program Code
Libraries
Tasks
DUTs
Global Variables
POUs

Project navigator

There are three different tabs at your disposal:

- Project
- Calltree (see page 29)
- Used by (see page 30)

You can configure each of the tabs by using the pop-up menu (right mouse button within the navigator) and select **display** to display additional information in the project navigator on the respective objects.

Displaying the declaration of a symbol or reference of an object

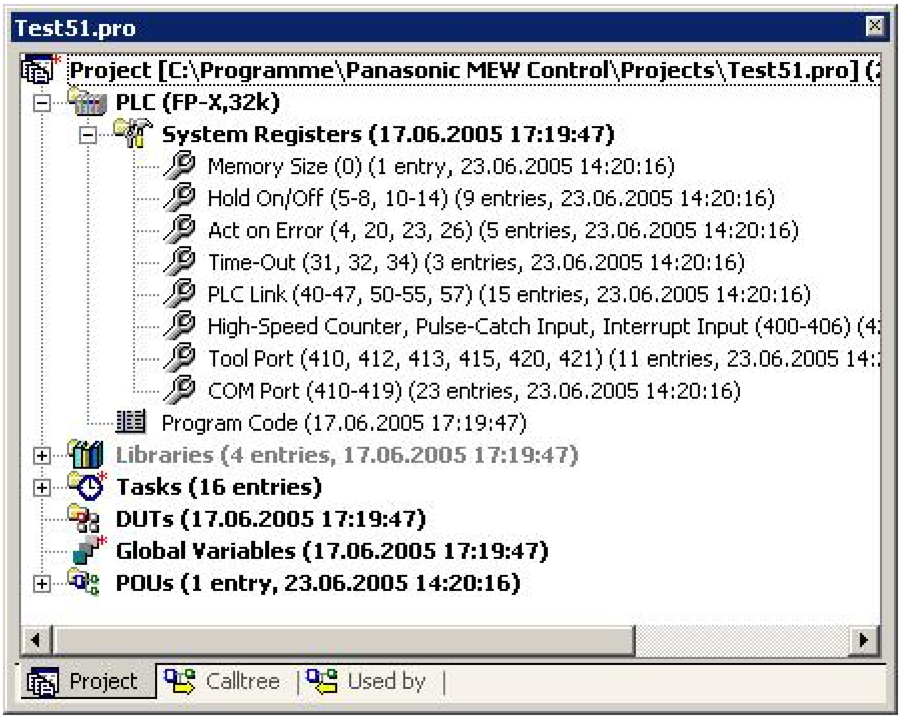
Using the pop-up menu from the navigator or the programming editors, you can quickly display the declaration of a variable or the reference of a POU. FPWIN Pro opens the editor containing the declaration or reference and highlights the symbol.

PROCEDURE

1. **Select the variable/POU in the navigator or in the programming editor and click the right mouse button**
2. **Select either** Go To Definition **or** Go To Reference **from the pop-up menu**
3. **Press <F3> if desired to go to the next reference**

See the online help (keyword “Navigator”) for further information on these options.

Select **Sorting Criteria** if you want to define the order in which objects are displayed in the project navigator. Sorting takes place from top to bottom.



Test51.pro

Project [C:\Programme\Panasonic MEW Control\Projects\Test51.pro] (2

PLC (FP-X,32k)

System Registers (17.06.2005 17:19:47)

Memory Size (0) (1 entry, 23.06.2005 14:20:16)

Hold On/Off (5-8, 10-14) (9 entries, 23.06.2005 14:20:16)

Act on Error (4, 20, 23, 26) (5 entries, 23.06.2005 14:20:16)

Time-Out (31, 32, 34) (3 entries, 23.06.2005 14:20:16)

PLC Link (40-47, 50-55, 57) (15 entries, 23.06.2005 14:20:16)

High-Speed Counter, Pulse-Catch Input, Interrupt Input (400-406) (4

Tool Port (410, 412, 413, 415, 420, 421) (11 entries, 23.06.2005 14:

COM Port (410-419) (23 entries, 23.06.2005 14:20:16)

Program Code (17.06.2005 17:19:47)

Libraries (4 entries, 17.06.2005 17:19:47)

Tasks (16 entries)

DUTs (17.06.2005 17:19:47)

Global Variables (17.06.2005 17:19:47)

POUs (1 entry, 23.06.2005 14:20:16)

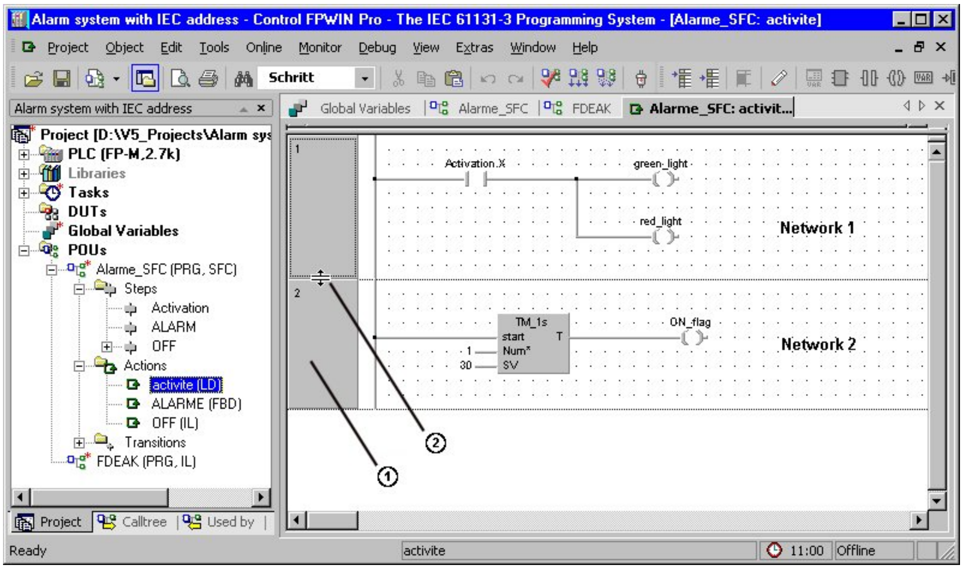
Project navigator with extended information

2.4 Programming Window

In the programming window you enter your programs in the selected programming editor. The programming window is divided into individual networks. Each network contains one program step.

The programming window is displayed when you open the program with a double-click.

A network information area is next to each network on the left side of the programming window.



Programming window

①	Network Info Area
②	Set Network Height

In the network info area you can adjust the network height using the mouse:

PROCEDURE

1. **Position the cursor on the horizontal line**

   The cursor turns into a double arrow.

2. **Hold mouse button down and move the cursor to the desired position**

3. **Release mouse button**

   The position at which you release the mouse button defines the new network height.

Optimize the height of a network:

1. **Select the network by clicking into the network info area**

   Use <ctrl> and/or <shift> for multiple selection.

2. **Tools → Optimize Network Height**

The network will be adapted to the height that is needed.

To enter a network before or after the current network, activate the following icons:

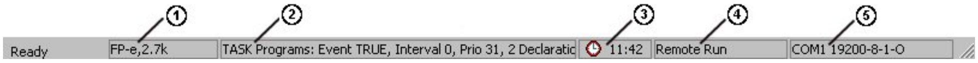
Network before

Network after

You can also insert a new network at the top or bottom of the program or before or after the current network via **Edit** → **New Network** → **Top/Before/After/Bottom**.

2.5 Status Bar

The status line is found at the bottom of your screen. In the status line you will find information about your PLC type, communication parameters, the time, and other status reports.



Ready | FP-e,2.7k | TASK Programs: Event TRUE, Interval 0, Prio 31, 2 Declaratic | 11:42 | Remote Run | COM1 19200-8-1-O

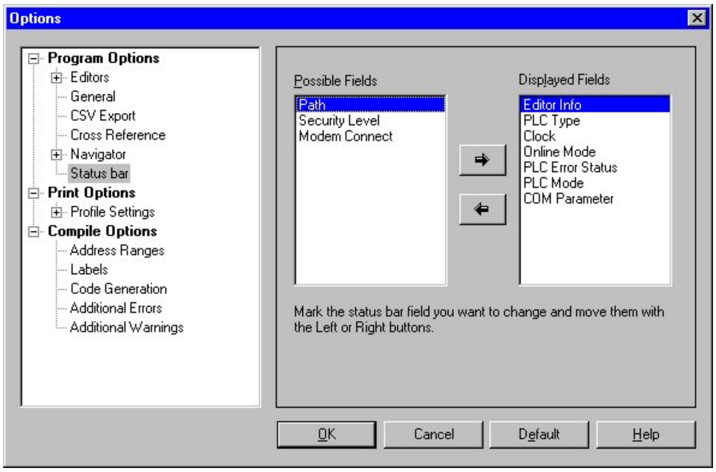
Status line

①	PLC Type
②	Editor Info
③	Clock
④	Online Mode
⑤	Communication Parameters

You can customize the status line in the "Status bar" dialog box.

PROCEDURE

1. **Double-click the status line not within an active field**



Possible Fields: Path, Security Level, Modem Connect

Displayed Fields: Editor Info, PLC Type, Clock, Online Mode, PLC Error Status, PLC Mode, COM Parameter

Mark the status bar field you want to change and move them with the Left or Right buttons.

2. **Select the item to be added beneath “Possible Fields”**
3. **Click** ➡
4. **Select the item to be removed beneath “Displayed Fields”**
5. **Click** ⬅
6. **Click [OK]**

After you have set up the status bar, watch the tool tips for the double-click functions within active fields.

◆ NOTE

It is also possible to reset the status bar to the default settings by selecting [Defaults].

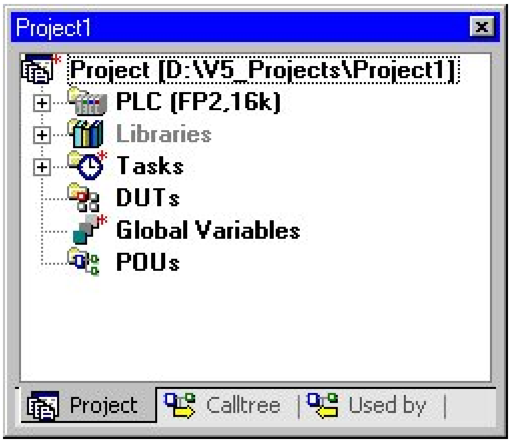
Chapter 3

Control FPWIN Pro Projects

3.1 What Does a Project Consist of?

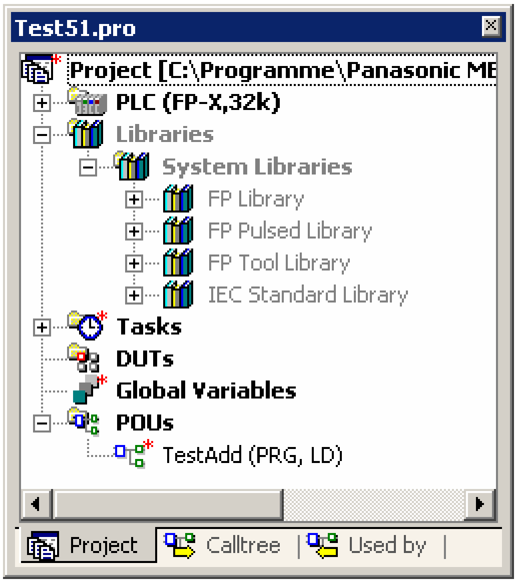
In Control FPWIN Pro a control task is referred to as a project. A project consists of all the objects which are listed in the project navigator.

When you set up a project, the following objects will first appear:



Navigator with objects

Objects with sub-points or pools are marked by a plus sign (⊞). By double-clicking on the name of the object, you can open a pool, e.g. the Library pool:



Open Library pool

A minus sign (⊟) means that the respective sub-points are already displayed.

3.1.1 PLC

Under **PLC** you can set system registers as well as configure inputs/outputs and decentralized inputs/outputs of the PLC.

3.1.1.1 Setting System Registers

System registers are memory areas reserved for setting hold and non-hold areas for timers, counters, flags and data registers.

In the system registers you can also define parameters for PLC interfaces as to how they should react when errors occur.

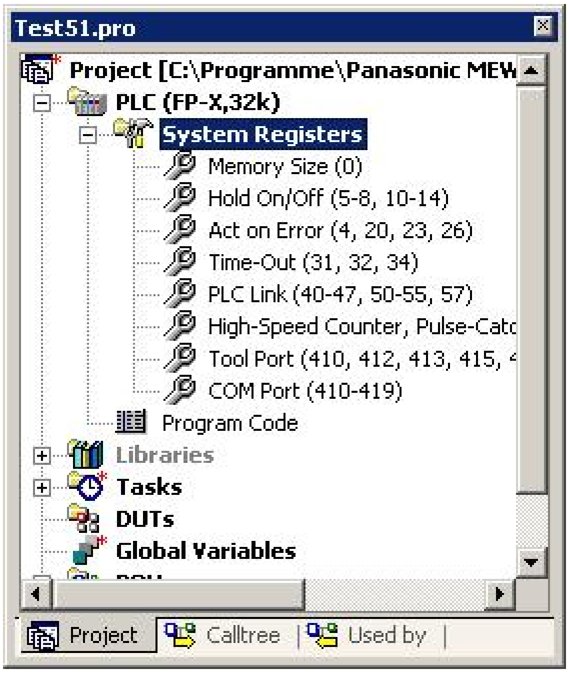
◆ NOTES

- **The size of the memory depends on the PLC type used. The sum of all memory sizes for system registers, user program and machine program may not be larger than the entire PLC memory.**
- **The 2 highest data registers (4 in PLCs with a second task (see page 66)) are at the user’s disposal, since they are always in the hold area and used by the compiler.**

◆ PROCEDURE

1. **Double-click "PLC"**
2. **Double-click "System Registers"**

A list with all system registers will be displayed. The number indicated in parentheses is identical to the system register number. In "Memory Size (0-3)", you define the memory sizes for machine programs, for example. You will find a list with all system registers and the memory size of your PLC in your hardware description.



3. **Double-click desired set of system registers**
4. **Enter your settings**

3.1.1.2 Configuring Inputs/Outputs for Modular PLCs

Each module on the backplane has to be configured, i.e. entered into the address list.

There are two options available:

- Loading configuration in online mode from the PLC
- Entering I/O maps for each slot manually

Loading configuration in online mode from the PLC

PROCEDURE

1. **Online → Online Mode or**

   The PLC must be installed for this procedure.
2. **Online → PLC Configuration**
3. **Select the configuration to be uploaded**
4. **Click [Upload from PLC]**

The Configuration saved in the PLC is transferred to Control FPWIN Pro. Modules inserted in the meantime are not recognized automatically.

or:

Click on [Register I/0 Maps]

If the PLC is in RUN mode, the question appears if the PLC should be switched into PROG mode. If the PLC is in PROG mode, the PLC reconfigures the hardware configuration and stores it in Control FPWIN Pro, i.e. modules inserted in the meantime are recognized.

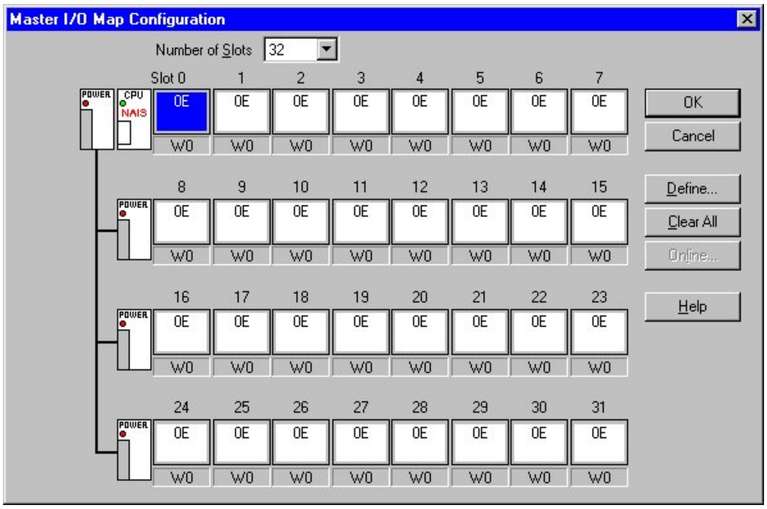
Entering I/O Maps for Each Slot Manually

PROCEDURE

1. **Double-click "PLC" in the project navigator**
2. **Double-click "I/O Maps"**

   A dialog box appears with a schematic of the backplane with the slots on which the modules can be mounted.
3. **Define the complete number of slots in "Number of Slots"**

   Vacant slots are indicated with 3 asterisks (***) and are displayed gray.

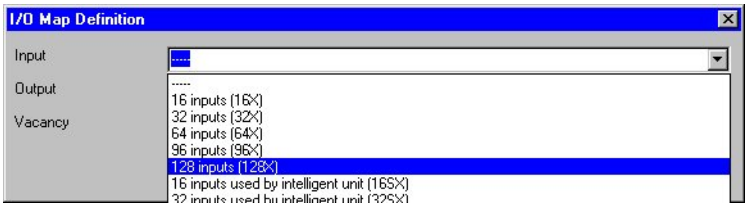


Master I/O Map Configuration

Number of Slots: 32

Slot 0	1	2	3	4	5	6	7
0E	0E	0E	0E	0E	0E	0E	0E
W0	W0	W0	W0	W0	W0	W0	W0
8	9	10	11	12	13	14	15
0E	0E	0E	0E	0E	0E	0E	0E
W0	W0	W0	W0	W0	W0	W0	W0
16	17	18	19	20	21	22	23
0E	0E	0E	0E	0E	0E	0E	0E
W0	W0	W0	W0	W0	W0	W0	W0
24	25	26	27	28	29	30	31
0E	0E	0E	0E	0E	0E	0E	0E
W0	W0	W0	W0	W0	W0	W0	W0

4. **[Define]**



I/O Map Definition

Input: -----

Output

Vacancy

-----
16 inputs (16X)
32 inputs (32X)
64 inputs (64X)
96 inputs (96X)
128 inputs (128X)
16 inputs used by intelligent unit (16SX)
32 inputs used by intelligent unit (32SX)

5. **Select desired module type**
6. **[OK]**

7. **Proceed until all modules are entered**
8. **Click [OK] in the "Master I/O Map Configuration" window**

You can save the I/O configuration with the project, compile it and transfer it into the PLC or, if you are in online mode, transfer the I/O configuration directly into the PLC with **Online** → **PLC Configuration** (see page 117).

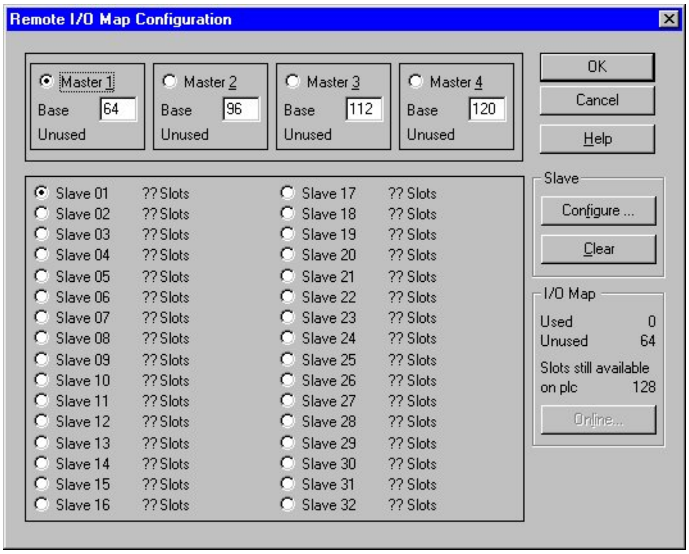
3.1.1.3 Configuring Remote I/Os for Modular PLCs

Each slave must be configured, i.e. entered in the address list. There are two options for all other PLCs:

- Loading configuration in online mode from the PLC (see page 20)
- Entering I/O maps in the master I/O map configurating list, described here:

PROCEDURE

1. **Double-click "PLC Config" in the project navigator**
2. **Double-click "Remote I/O Map"**



Remote I/O Map Configuration

● Master 1	○ Master 2	○ Master 3	○ Master 4
Base 64	Base 96	Base 112	Base 120
Unused	Unused	Unused	Unused

● Slave 01	?? Slots	○ Slave 17	?? Slots
○ Slave 02	?? Slots	○ Slave 18	?? Slots
○ Slave 03	?? Slots	○ Slave 19	?? Slots
○ Slave 04	?? Slots	○ Slave 20	?? Slots
○ Slave 05	?? Slots	○ Slave 21	?? Slots
○ Slave 06	?? Slots	○ Slave 22	?? Slots
○ Slave 07	?? Slots	○ Slave 23	?? Slots
○ Slave 08	?? Slots	○ Slave 24	?? Slots
○ Slave 09	?? Slots	○ Slave 25	?? Slots
○ Slave 10	?? Slots	○ Slave 26	?? Slots
○ Slave 11	?? Slots	○ Slave 27	?? Slots
○ Slave 12	?? Slots	○ Slave 28	?? Slots
○ Slave 13	?? Slots	○ Slave 29	?? Slots
○ Slave 14	?? Slots	○ Slave 30	?? Slots
○ Slave 15	?? Slots	○ Slave 31	?? Slots
○ Slave 16	?? Slots	○ Slave 32	?? Slots

I/O Map
Used 0
Unused 64
Slots still available on plc 128

3. **Click Master (Master 1, Master 2 ...)**

   The number of slots is displayed for each slave. If there is a slave, the text "Used" is displayed under "Base".

4. **Enter "Base" in number of words (0 to 127)**
5. **Click desired slave**
6. **[Configure]**

   A dialog box appears with a schematic of the backplane with the slots on which the modules can be mounted.

7. **Set the total number of slots under "Number of Slots"**

Free slots are marked with three asterisks ("***") and are gray in color.

8. **[Define]**
9. **Select desired module type**
10. **[OK]**
11. **Repeat steps 8. to 10. until all modules are entered**
12. **Click [OK] in the "Slave I/O Map Configuration" window**
13. **[OK]**

You can save the I/O configuration with the project, compile it and transfer it into the PLC or, if you are in online mode, transfer the I/O configuration directly into the PLC with **Online** → **PLC Configuration** (see page 117).

3.1.1.4 Program Code

By double-clicking on **Program Code** in the project navigator, your program will be shown in basic code. The code is entered as soon as you download your program to the PLC or upload a program from the PLC (see page 116).

3.1.2 Libraries

By double-clicking **Libraries**, you can open the list containing all of the libraries available. In the libraries, you will find functions and function blocks that will save you a lot of programming work.

Detailed information on how to use libraries and how to create your own library is provided in the online help.

3.1.3 Tasks

Each program is assigned to a task (see page 62). In a task, you specify how the program is to be executed, e.g. cyclically, event triggered or time triggered.

Only PRG-type POUs can be assigned to a task. The tasks are located under **Tasks** (Task pool) in the project navigator.

3.1.4 DUTs

With a **D**ata **U**nit **T**ype (DUT) you can define a data unit type that is composed of other data types. A DUT is first defined under **DUTs** in the navigator and then processed like the standard data types (BOOL, INT, etc.) in the list of global variables or the POU header.

☞ ◆ NOTE

A DUT cannot be used as a variable of another DUT; ARRAYs of DUTs are not possible.

3.1.5 Global Variables

Global variables are symbolic names which are assigned to the inputs and outputs. They are global in the sense that they can be accessed by all POUs (PRG, FB).

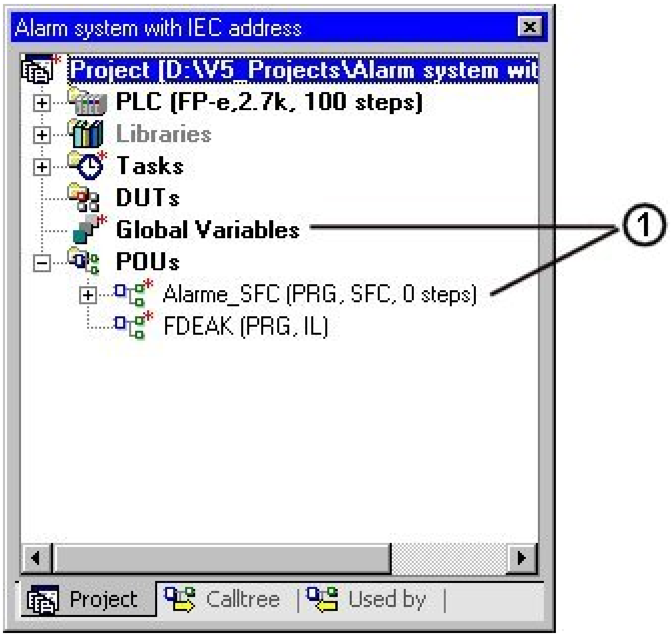
For further information, see Global Variables (see page 43)

3.1.6 POUs

The object **POUs** (POU pool) is a list containing all of the Program Organisation Units (see page 36) you program.

◆ NOTE

Objects which have not yet been compiled or have been changed since last being compiled are marked by an asterisk (*) in the project navigator.


Alarm system with IEC address
Project [D:\V5_Projects\Alarm system wit
PLC [FP-e,2.7k, 100 steps]
Libraries
Tasks
DUTs
Global Variables
POUs
Alarme_SFC [PRG, SFC, 0 steps]
FDEAK [PRG, IL]
1
Project
Calltree
Used by

Open POU pool

1	Objects not yet compiled

3.2 Projects Created in FPWIN Pro

3.2.1 Create New Project

With the help of the Wizard, you can create a new project using Control FPWIN Pro. You may enter any project path and provide the project with a name of your choice. See also the Power Point presentation "First Steps".

The wizard appears immediately upon starting Control FPWIN Pro, or with **Project** → **New ...** The wizard offers you a second possibility for creating projects. When you activate the Advanced Dialog box in the lower, left-hand corner, you can define several programs, functions or function blocks. These are automatically entered in the program when it is created.

See the online help (keyword “Wizard”) for further information on using the wizard.

3.2.2 Open Project from the PLC

You can upload a project that has been stored (e.g. via **Online** → **Save Project in the PLC**) in a PLC to Control FPWIN Pro, and then open it. If you select **Project** → **Open Project from the PLC** or select this option in the project wizard (see page 6), an empty project will be created in the path chosen. Then an attempt will be made to establish a connection to the PLC. If this is successful, the program code and project information will be uploaded, if present. Project information includes: the contents of all editors, the PLC configuration, compiler options, and the contents of user libraries. If user libraries are present, they will likewise appear in the project directory.

◆ NOTE

You can only open a project in the PLC if it has a configuration memory (see hardware manual). The following PLCs can support a configuration memory option:

PLC	Card necessary?	Type of card:
FP-X	no	
FP-Sigma	no	
FP2	yes	Expansion Memory Unit: FP2-EM1, FP2-EM2 or FP2-EM3
FP2SH	no	
FP10SH	yes	ROM Operation Board: AFP6208

If you are using a different PLC type, the program code instead of the project information will be uploaded to your PC. Then the program code will be converted to a ladder diagram (compare with the import of FPWIN-GR files).

PROCEDURE

1. **Project → Open Project from the PLC**

   or select this option in the project wizard.

   The New Project window appears.

2. **Enter or select path**

3. **Click [Select]**

   If you receive a message that the program code and the code in the PLC are different, confirm with [OK]. This error message appears when the project in the PLC was compiled incrementally.

3.2.3 Restore a Backed-up Project

Using this option of the wizard, you can open a project you saved with **Extras → Backup Project** (see page 25). Select the data base format you used for the backup, locate the path and select the file name. Click [Open] to restore the selected project.

3.2.4 Open an Existing Project

You can open an existing project via **Project** → Open, or select a project from the list of recently opened projects.

This list of recently opened projects appears when you start Control FPWIN Pro, but also appears at the bottom of the menu item “Project”.

If you open a project that was created with a previous version of Control FPWIN Pro, you will receive a message about converting the project (for further information, see online help, “Upgrade information”).

NOTE

You can change the number of recently opened projects listed under Extras → Options → Program Options → General**, “Number of recent projects on project menu”.**

3.3 Processing Projects

When you have set up a project, you can work on this project, i.e. you can do the following:

- Open
- Close
- Save or Save as
- Create backup
- Restore saved data

When you use open, close, save or save as, the procedure is similar to standard Windows commands.

3.3.1 Backup Project

Extras → **Backup Project** projects enables you to create a backup for your project in two different compressed formats. In the PCD format (packed data base format) the entire data base of the project is saved. In the PCE format (packed export format) only the project data without libraries are saved.

☞ ◆ NOTES

- **The project data is packed while the backup is created.**
- **Backups created with Extras → Backup Project can only be reopened with Extras → Restore Project.**

3.3.2 Restore Project

Extras → **Restore Project** enables you to unpack and restore a project that was saved before with Extras → Backup Project in the packed data base format (*.PCD) or in the packed export format (*.PCE).

3.4 Edit Objects

All of the objects contained in the project navigator can be edited using the “Object” and “Edit” sub-menus.

With the “Object” menu, you can influence the external features of an object, i.e. you can do the following, for example:

- Open
- Rename
- Add a comment
- Check for syntax errors
- Print out and
- Import and export

You can also display:

- Object properties
- Object calltrees and “Used by” lists

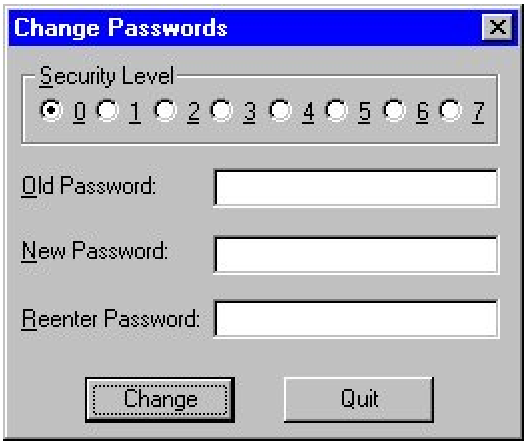
With the “Edit” menu, you can edit the contents of an object as well as create new objects.

3.5 Passwords and Security Levels

In order to control access to individual objects in your project, you can assign a security level to each object. Define a password for each security level beforehand. Only those who know the password to the respective security level can change the object in question.

◆ **PROCEDURE**

1. **Project → Change Passwords**



Change Passwords

Security Level: ● 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7

Old Password:

New Password:

Reenter Password:

2. **Compose a password for each security level**

   When you define a password for the first time, you enter your passwords one after another for each security level under "New Password" and "Reenter Password", and click [Change] each time. The system will confirm the change of a password.

3. **Select the object in the navigator you wish to protect access to**

4. **Object → Properties**

   Only security levels which have already been defined may be entered in the Properties dialog.

5. **Click the desired security level and activate "Allow Read Access for Lower Levels" if necessary**

   Access control is activated after rebooting the computer.

3.5.1 Access to Protected Objects

Project → Change Security Level allows you to access an object protected by a password.

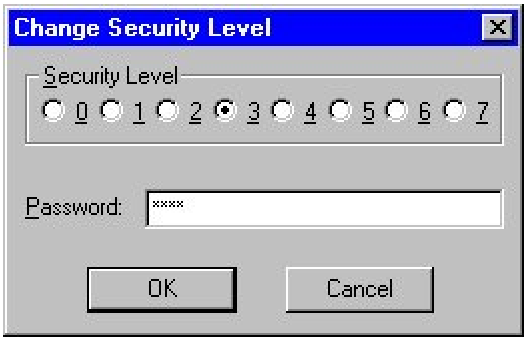
◆ **NOTES**

- **For objects with higher security levels than that of the project, you may not change the security level.**

- **If you only have access to the lower security level of the project, you may read objects with higher security levels if "Allow Read Access for Lower Levels" has been defined under Object → Properties for each respective object.**

PROCEDURE

1. **Click the object in the project navigator**
2. **Project → Change Security Level**



Change Security Level

Security Level

○ 0 ○ 1 ○ 2 ● 3 ○ 4 ○ 5 ○ 6 ○ 7

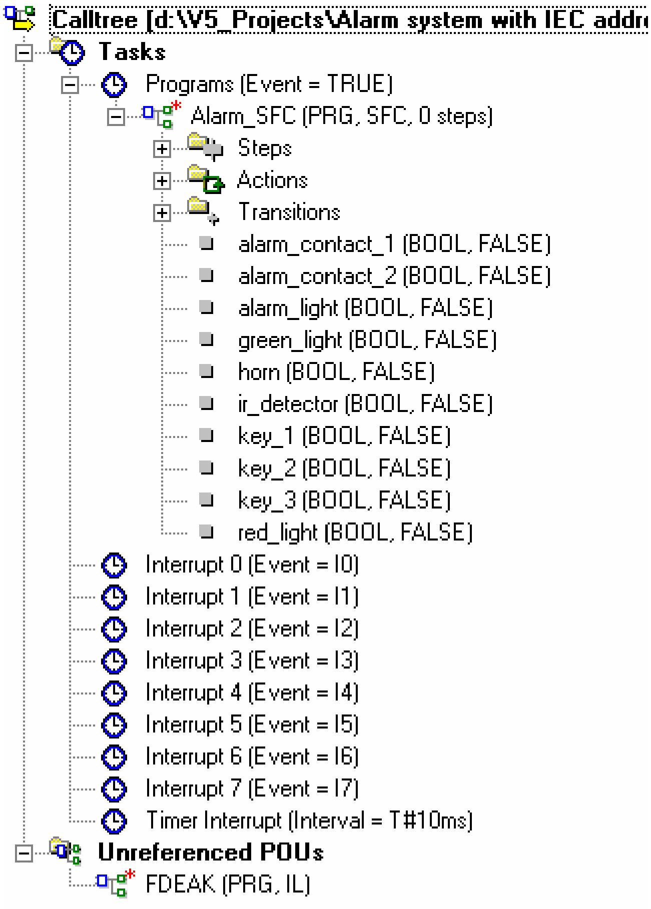
Password: ****

3. **Click security level and enter the password**
4. **[OK]**

   You have now regained access to the object and can change it if necessary. Access control remains even after the change has been made. You do not need to redefine it.

3.6 Calltree Tab

This tab only displays the root entries, tasks or POUs that are not assigned to a task. The called POUs and the used global variables are displayed hierarchically in a tree structure. The Calltree shows you whether functions or function blocks were used in a program and how dependent they are on each other:



```
Calltree [d:\V5_Projects\Alarm system with IEC addr
⊟ Tasks
   ⊟ Programs (Event = TRUE)
      ⊟ Alarm_SFC (PRG, SFC, 0 steps)
         ⊞ Steps
         ⊞ Actions
         ⊞ Transitions
           alarm_contact_1 (BOOL, FALSE)
           alarm_contact_2 (BOOL, FALSE)
           alarm_light (BOOL, FALSE)
           green_light (BOOL, FALSE)
           horn (BOOL, FALSE)
           ir_detector (BOOL, FALSE)
           key_1 (BOOL, FALSE)
           key_2 (BOOL, FALSE)
           key_3 (BOOL, FALSE)
           red_light (BOOL, FALSE)
     Interrupt 0 (Event = I0)
     Interrupt 1 (Event = I1)
     Interrupt 2 (Event = I2)
     Interrupt 3 (Event = I3)
     Interrupt 4 (Event = I4)
     Interrupt 5 (Event = I5)
     Interrupt 6 (Event = I6)
     Interrupt 7 (Event = I7)
     Timer Interrupt (Interval = T#10ms)
⊟ Unreferenced POUs
     FDEAK (PRG, IL)
```

Calltree

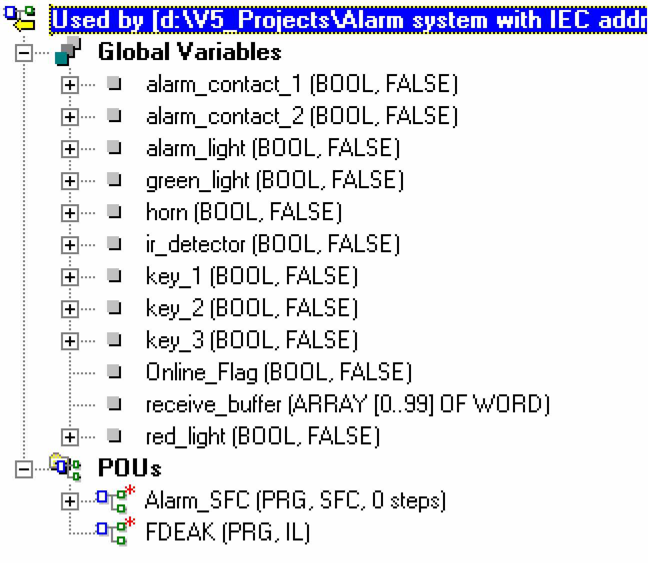
◆ **NOTES**

- **The calltree is only displayed if you have placed a check mark in the "Display objects in the Project view" dialog box.**
- **For further information on the calltree settings such as displaying the** global variables**, see "Display objects in the calltree".**

3.7 Used by Tab

This tab has exactly two root entries:

- POU pool with its POUs as nodes
- the Global Variable List with its global variables as nodes.



Used by [d:\V5_Projects\Alarm system with IEC addr

Global Variables

- alarm_contact_1 (BOOL, FALSE)
- alarm_contact_2 (BOOL, FALSE)
- alarm_light (BOOL, FALSE)
- green_light (BOOL, FALSE)
- horn (BOOL, FALSE)
- ir_detector (BOOL, FALSE)
- key_1 (BOOL, FALSE)
- key_2 (BOOL, FALSE)
- key_3 (BOOL, FALSE)
- Online_Flag (BOOL, FALSE)
- receive_buffer (ARRAY [0..99] OF WORD)
- red_light (BOOL, FALSE)

POUs

- Alarm_SFC (PRG, SFC, 0 steps)
- FDEAK (PRG, IL)

"Used by" list

POUs that use global variables or that invoke other POUs, e.g. FBs, are arranged hierarchically in a tree structure.

3.8 Check Objekt

You should have programs and variable lists checked by Control FPWIN Pro before you compile them. We recommend checking each individual component once it is finished.

◆ **PROCEDURE**

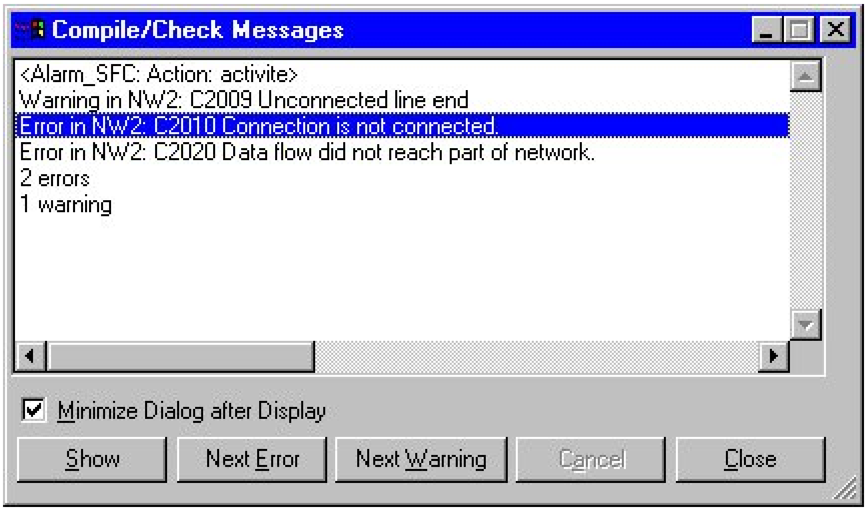
Check Object

1. **Click object to be checked**

2. **Object → Check or** ✓ **or**
   pop-up menu (within the navigator) → Check

Find error

1. **Click error message/warning in the window**



```
<Alarm_SFC: Action: activite>
Warning in NW2: C2009 Unconnected line end
Error in NW2: C2010 Connection is not connected.
Error in NW2: C2020 Data flow did not reach part of network.
2 errors
1 warning
```

2. **Click [Show] or**

   Double-click the error message.

   Control FPWIN Pro automatically opens the part of the program with the error and highlights it.

◆ **NOTE**

If several errors occur, correct the first error listed in the Compile/Check messages first and repeat Object → Check**. All other errors might be sequential errors. Click [Next Error] to jump to the next error.**

Chapter 4

Program Organisation Units

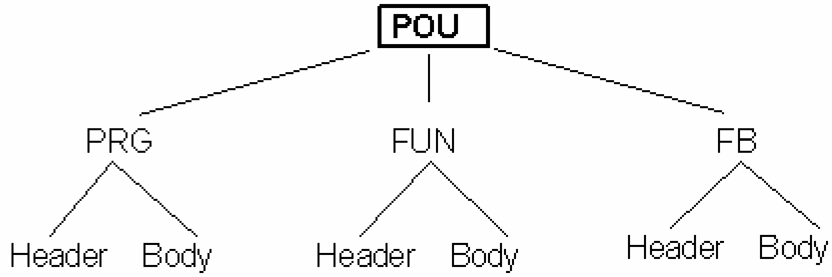
4.1 Program Organisation Units (POUs)

Program **O**rganisation **U**nits, or POUs for short, are components of a Control FPWIN Pro program. They contain the PLC control program. In comparison to conventional programming, a Control FPWIN Pro program is not a program that loads sub–programs, but consists itself of several sub-programs. Each sub-program is complete in itself and performs a specific task. Depending on which task is concerned, the corresponding type of POU is selected.

We differentiate between three different types of POUs (program classes):

- Program (see page 36) (PRG)
- Function (see page 36) (FUN)
- Function Block (see page 37) (FB)

Each POU, regardless of what type it is, is divided into a POU header and a POU body, both appear in the common programming window.



The two parts (header and body) come from the IEC philosophy which maintains that variables should be declared in a list, whereby these declarations (symbolic names) are used in the program instead of physical addresses.

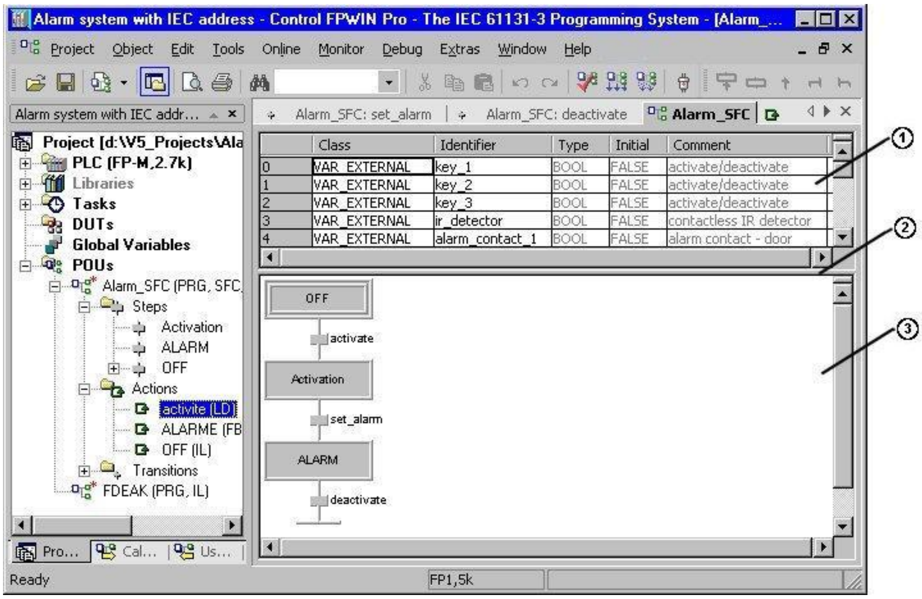
The advantage of this is that the compiler takes care of address administration and that you only have to make address changes in the POU header once (as long as you have defined a variable which is assigned to an address). The programs remain unchanged.

While all variables with an input/output address or a PLC address can be entered in the list of global variables and can be used in the entire project (all POUs), only local variables are declared in the POU header. Local variables are variables which are only used in the accompanying POU body.

The body contains the program logic which can be written in several programming languages:

- ladder diagram (LD) or function block diagram (FBD) (see page 76)
- structured text (ST) (see page 82)
- instruction list (IL) (see page 91)
- sequential function chart (SFC) (see page 93)

The local variables are entered in the POU header, i.e. the connection to the inputs/outputs and the internal memories is defined. The program logic is contained in the POU body. Both, the header and the body appear in one common programming window that can be splitted.

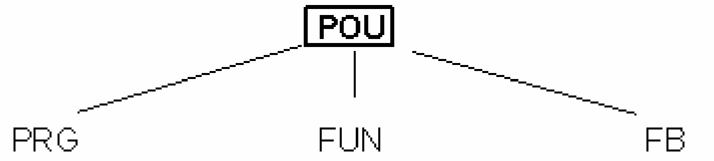


	Class	Identifier	Type	Initial	Comment
0	VAR_EXTERNAL	key_1	BOOL	FALSE	activate/deactivate
1	VAR_EXTERNAL	key_2	BOOL	FALSE	activate/deactivate
2	VAR_EXTERNAL	key_3	BOOL	FALSE	activate/deactivate
3	VAR_EXTERNAL	ir_detector	BOOL	FALSE	contactless IR detector
4	VAR_EXTERNAL	alarm_contact_1	BOOL	FALSE	alarm contact - door

POU components

①	Header of the POU
②	Drag this bar with the mouse (pointer ÷) to adjust the height of the window.
③	Body of the POU

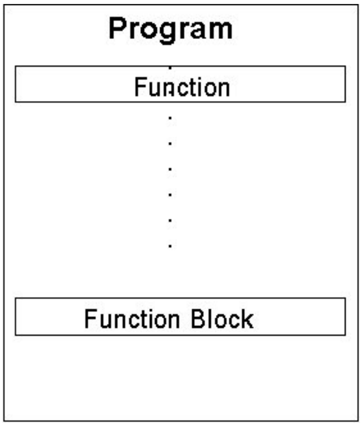
4.2 Types of POUs



4.2.1 Programs

The control task can, for example, concern measuring a temperature, processing it (e.g. comparing it with a set value) and issuing corresponding output data in order to control peripheral equipment such as a heating system.

A program is the highest level in the POU hierarchy. Functions and function blocks can be called from a program.



◆ NOTE

A program can only be loaded by a task (see page 62). On the other hand, functions and function blocks can call functions (FUN) and function blocks (FB), but not programs.

4.2.2 Functions

Functions (FUN) are Program Organisation Units (POUs) that upon execution deliver a data element as a result and any number of output values of the classes VAR_OUTPUT and VAR_IN_OUT. By specifying the result type **VOID** the function has no result.

They can also access global variables via VAR_EXTERNAL, VAR_EXTERNAL_RETAIN or VAR_EXTERNAL_CONSTANT.

Functions do not contain any internal status information, i.e. calling a function with the same input values for the classes VAR_INPUT and VAR_IN_OUT will always yield the same result and the same output values for the classes VAR_OUTPUT and VAR_IN_OUT.

FPWINPro provides two types of functions:

1. Functions of the system libraries

   - FP Library
   - FP Pulsed Library
   - FP Tool Library
   - IEC Standard Library

2. User functions (see page 123)
   You can also write your own user functions and insert them into your own User Library. Then you can use these functions in all projects in which this user library is installed. Functions can be written in four programming languages:

   - ladder diagram (LD) or function block diagram (FBD) (see page 76)
   - structured text (see page 82) (ST)
   - instruction list (see page 91) (IL)

◆ **NOTES**

- **Functions** cannot **be assigned to a task as they can only be loaded by a program or function block.**
- **A function cannot be called recursively.**
- **The maximum of 5 nested function calls, e.g.**
  Fun1 (Fun2 (Fun3 (Fun4 (Fun5 (x))))) may not be exceeded.
- **User functions do not require a variable to store the result of the function or at the outputs.**
  Exception:
  In the program editors ST and IL when calling a function without formal parameters.
- **When calling a function with formal parameters in the ST editor, the following conditions apply:**

  - The order of the parameters is not important.
  - With user functions with EN / ENO, the EN input can be omitted; in this case the input will be initialized with TRUE.

4.2.3 Function Blocks

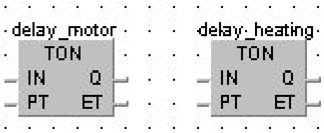
Function **B**locks (FB) are small programs. In contrast to Functions, Function blocks have their own memory area in which values can be stored. Depending on the value stored, which can be added to, subtracted from, etc., the same input values provide different results. You can use the same FB as often as you like in your PRG. For this reason, each time you load a FB, a copy is created. Give this copy (instance) a name so its values are neither overwritten nor processed by a FB of the same type.

FPWINPro provides two types of function blocks:

1. Function blocks of the system libraries
   - Standard Function Blocks
   - Basic FP Function Blocks
2. User Function Blocks (see page 124)
3. These FBs can be written in four programming languages:
   - ladder diagram (LD) or function block diagram (FBD) (see page 76)
   - structured text (see page 82) (ST)
   - instruction list (see page 91) (IL)

◆ EXAMPLE

If you call up the FB "E_TON" (timer with input delay) of the IEC Standard Library for the first time, e.g. to switch on a motor with delay, this FB could have the name "E_Del_Motor". The next time you call up this FB you give it a different name, e.g. "E_Del_Heater", etc.



◆ NOTES

- **Do NOT assign a FB to a task, for a FB can be called up by a program or a function only.**
- **A function block cannot be called recursively.**
- **The maximum of 5 nested function calls, e.g.**
  Fun1 (Fun2 (Fun3 (Fun4 (Fun5 (x))))) may not be exceeded.
- **Altogether you may define up to 40 input and output variables per FB.**

4.3 Create a New POU

The procedure for creating a POU for a PRG, FUN or FB is similar but not the same.

◆ PROCEDURE

1. **Edit → New → POU or**

   The dialog box "New POU (Project)" is displayed. When creating a POU with the wizard (advanced dialog), the dialog's name is "NEW POU [Insert]" or "NEW POU [Change]".

2. **Select "Program", "Function" or "Function Block"**

3. **Proceed carefully, selecting the choices offered by the successive dialogs**

Chapter 5

Variables

5.1 Variables

Variables are symbolic names for inputs, outputs and memory areas within the PLC. These symbolic names are used in the program instead of physical addresses.

A distinction is made between global (see page 43) and local (see page 46) variables:

- Global variables are a direct connection to the outside world, i.e. they represent inputs and outputs for the process. Other variables are used for IOP or visualization. Global variables are declared in the Global Variable List.
- Local variables are place holders for intermediate results that the system saves in a location of your choice. They are declared in the POU header of the respective POU.

Variables which have been declared once can be changed, assigned directly in the program to the input/output etc. or assign them to groups of variables, e.g. ARRAYs or data unit types. For complex control procedures, you can also create recipes.

To help you maintain on overview, the cross–reference list enables you to list all variable declarations and their constraints.

5.2 Global Variables

Global variables are symbolic names. They are declared in the **Global Variable List** which can be accessed from the project navigator. Via the global variables, the PLC sets up the connection to the outside world. The following variables must be declared in the global variable list:

- Variables which are assigned to inputs and outputs, e.g. X0, Y0 of the PLC
- Variables which need to be assigned to a certain address, e.g. DT0 to enable communication with an operator device, for example
- Variables which nee to be accessible from other POUs (via VAR_EXTERNAL)

◆ NOTE

Do not assign addresses to global variables unless you have to! The compiler automatically assigns addresses after the power has been turned on. This prevents errors caused by duplicate outputs and ensures that the addresses are automatically updatd ahen the PLC type is changed.

For further information, we would like to familiarize you with address formats in the online help under the keyword "addresses".

Three classes of global variables are available**:**

- **VAR_GLOBAL**

  - The value of the global variable can be changed by the PLC program whereever it is used. It is initialized with the value defined in the global variable list when the PLC is re-booted, after a power failure, or after switching the PLC from PROG to RUN mode.

- **VAR_GLOBAL_RETAIN**

  - Variables of this type are **holding** variables, which keep their current buffered value when the PLC is re-booted, after a power failure, or after switching the PLC from PROG to RUN mode. The value of a holding variable is only initialized with the value defined in the global variable list after a cold start, i.e. when a program is downloaded to the PLC or when the INITIALIZE switch is activated in PROG mode.

  Note:
  If under Extras → Options → Compile Options → Code Generation, you activated "Retain variables in the user area are not initialized**", holding variables for which the user assigned addresses are not reinitialized.**

- **VAR_GLOBAL_CONSTANT**

  - The value of the global variable **cannot** be changed by the PLC program. These variables do not occupy an address in the PLC and are inserted in the program code as constant numbers.

5.2.1 Addresses

Addresses enable you to specify which input ("I") or internal memory area ("M") should be read and which output ("Q") should be controlled. Both word and bit addresses are used for addressing Panasonic controllers.

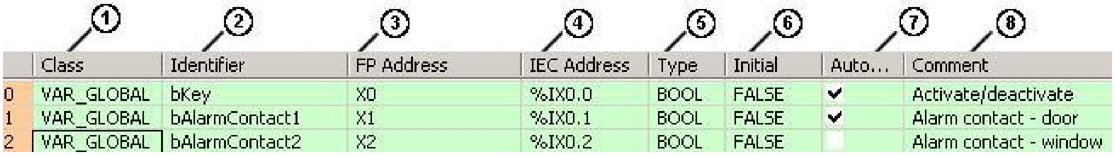
Under Control FPWIN Pro you can enter addresses in FP format (i.e. the hardware address) or in IEC format. For details, refer to the online help (keyword "Address Definition") or programming manuals.

5.2.2 Global Variable List (Field Descriptions)

Before you begin declaring global variables, we would like to provide a brief explanation of the fields in the list of global variables.

An example for a declaration of the global variables can be found in the online help (keyword "Global Variables Declaration").

The fields in the global variable list have the following meaning:



	Class	Identifier	FP Address	IEC Address	Type	Initial	Auto...	Comment
0	VAR_GLOBAL	bKey	X0	%IX0.0	BOOL	FALSE	✓	Activate/deactivate
1	VAR_GLOBAL	bAlarmContact1	X1	%IX0.1	BOOL	FALSE	✓	Alarm contact - door
2	VAR_GLOBAL	bAlarmContact2	X2	%IX0.2	BOOL	FALSE		Alarm contact - window

①	**Class** is the variable class, e.g. VAR_GLOBAL, VAR_GLOBAL_CONSTANT, etc., for details see Global Variables (see page 43)
②	**Identifier** is the symbolic name that is used in the program. Identifiers may not start with a number!
③ ④	**FP Address and IEC Address** is the physical address which is assigned to the variable. • Enter an address only for the inputs and outputs of the PLC or when a specific data register is necessary. Otherwise, do not enter an address. • It does not matter whether you enter the FP address or IEC address first – the second one is automatically displayed when you jump to the next field. If you do not enter an address, the compiler will assign one. Detailed information on these address formats can be found under IEC ⇔ FP addresses.
⑤	**Type** When you have entered an address, a preselected data type (e.g. "BOOL” for inputs/outputs) will appear. You can select another type from the list of data types.
⑥	**Initial** is the starting value which is assigned to the variable whenever your PLC is started. You can change these values when necessary.
⑦	**Autoextern** inserts the global variable automatically into the headers of all POUs to be created later. Activate the checkbox ☑ Copy declaration to POUs after marking auto extern under **Extras → Options → Program Options → Editors → Declaration Editors**, the variable is also inserted automatically in all POUs currently displayed in the project navigator.
⑧	**Comment** Fill in for a more detailed description of the variables.

☞ ◆ **NOTES**

- **Identifiers may not start with a number.**
- **FP addresses (X0, Y1, etc.) are fixed terms and may not be used as identifiers.**

5.3 Local Variables (VAR)

Local variables are declared in the POU header and can only be used in the accompanying POU body. Local variables do not permit an exchange with other POUs. In the POU header a distinction is made between those variables which are adopted from the global variable list in the POU header and those which you declare specially for a certain POU body in the accompanying POU header.

The variable type that can be declared in the POU header depends on the POU type.

◆ NOTE

Extras → Options → Compile Options → Address Ranges **(see page 102) enables you to specify the address area which the compiler reserves for local variables. The remaining address area is used for global variables.**

5.3.1 Adopting Global Variables in the POU Header

If when declaring global variables you have checked the “Autoextern” field, all global variables are automatically adopted in each new POU in the POU header.

If you did not check the field, you can adopt all or only certain global variables at a later stage by using **Extras → Declare External Variables**.

◆ PROCEDURE

1. **Double-click “Global Variables” in the project navigator**

   The list of global variables is opened.

2. **Select desired variables**

3. **Extras → Declare External Variables**

   A request to confirm is displayed.

4. **Click [OK]**

   The selected global variables are inserted in the headers of all current PRG and FB-type POUs available in the POU pool as VAR_EXTERNAL.

◆ NOTE

Edit → Undo is not **possible for Extras → Declare External Variables. You can only remove externally declared variables from the POU headers with Extras → Delete Unused Variables (see page 47).**

Variables which you adopt from the list of global variables in a POU header have three different classes:

- **VAR_EXTERNAL**
  A VAR_GLOBAL type variable which has been adopted from the list of global variables. A VAR_EXTERNAL type variable can only be adopted in the header of a PRG or FB type POU. The value of this variable is initialized with the value defined in the POU header when the PLC is re-booted, after a power failure, or after switching the PLC from Prog to RUN mode.
- **VAR_EXTERNAL_RETAIN**
  A VAR_GLOBAL_RETAIN type variable which has been adopted from the list of global variables. VAR_EXTERNAL type variables are **holding** variables, which keep their current buffered value when the PLC is re-booted, after a power failure, or after switching the PLC from PROG to RUN mode. The value of a holding variable is only initialized with the value defined in the global variable list after a cold start, i.e. when a program is downloaded to the PLC or when the INITIALIZE switch is activated in PROG mode.
  Note:
  If under **Extras** → **Options** → **Compile Options** → **Code Generation**, you activated “Retain variables in the user area are not initialized”, variables for which the user assigned addresses are not reinitialized.
- **VAR_EXTERNAL_CONSTANT**
  A VAR_GLOBAL_CONSTANT type variable which has been adopted from the list of global variables. VAR_EXTERNAL_CONSTANT type variables can only be adopted in the header of a PRG or FB type POU. They do not occupy an address in the PLC and are inserted in the program code as constant numbers.

If you have adopted superfluous variables from the list of global variables, you can delete them again from the POU header.

5.3.2 Delete Unused Variables

With **Extras** → **Delete Unused Variables** you can remove unused variables from the POU headers listed in the POU pool and/or from the global variable list. However, you can only delete unused variables in the POU headers and/or in the global variable list if they have not been used in the respective POU bodies.

You can choose the following options:

Delete	Explanation
local variables	All local variables of the POU headers will be deleted if they are not used in the respective POU bodies.
external variables	All variables that are declared as external variables of the POU headers will be deleted if they are not used in the respective POU bodies.
global variables	All variables from the global variable list will be deleted if they are not used in any POU headers.

◆ NOTE

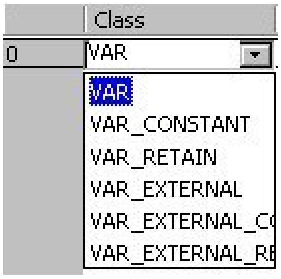
POUs in user libraries are not taken into consideration.

Default setting:

Deletion of all variables in all POUs.

5.3.3 Declaring Local Variables

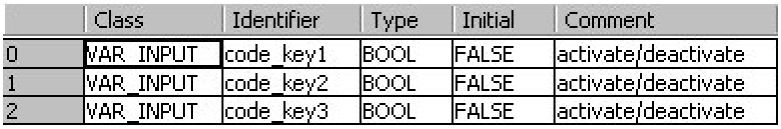
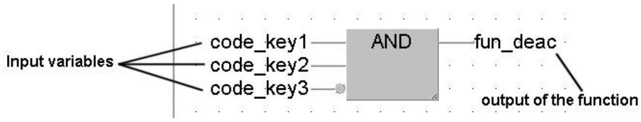
Local variables are declared in a similar way to global variables, but in the POU header:



	Class
0	VAR

VAR
VAR_CONSTANT
VAR_RETAIN
VAR_EXTERNAL
VAR_EXTERNAL_C
VAR_EXTERNAL_R

Addresses for local variables are always automatically provided by the system. In the case of local variables, seven different classes are provided. The class you can select depends on the POU type.

Type of Variable	Explanation
VAR	Variable which you can declare for each POU type, e.g. to save intermediate results. The values of VAR remain from one invocation to the next. VAR is only placed at the initial value once you have switched the PLC from PROG mode into RUN mode or after a power failure.
VAR_CONSTANT	Like VAR but contains a constant. VAR_CONSTANT does not occupy any addresses, but the constant is inserted in the program code.
VAR_RETAIN	Like VAR but holding, i.e. the value of the variable remains even in the event of a power failure. VAR_RETAIN is only set at the initial value after a PLC cold boot, provided you downloaded a program into the controller beforehand and switched the PLC from PROG mode to RUN mode. If under **Extras** → **Options** → **Compile Options** → **Code Generation**, you activated “Retain variables in the user area are not initialized”, variables for which the user assigned addresses are not reinitialized.
VAR_INPUT	Input variable used for transferring parameters. The POU invocated transfers a value to a function or a function block (not a PRG). Input variables must be declared in the accompanying header of the function/function block. You can read the value of an input variable but you cannot set it (exception: “Forcing”, see online help).  | Class | Identifier | Type | Initial | Comment 0 | VAR_INPUT | code_key1 | BOOL | FALSE | activate/deactivate 1 | VAR_INPUT | code_key2 | BOOL | FALSE | activate/deactivate 2 | VAR_INPUT | code_key3 | BOOL | FALSE | activate/deactivate The output is implicitly part of the function and is not declared in the header. **Program Code in the POU Body of the function "fun_deac"**  Input variables code_key1 code_key2 code_key3 AND fun_deac output of the function

Type of Variable	Explanation
VAR_OUTPUT	Output variable which you can only use in function blocks. VAR_OUTPUT are only set at the initial value once you have switched the PLC from PROG mode to RUN mode or after a power failure. Please note the following: • - It can be placed in the function block in which the output variable has been declared; other POUs can only read the output variables. • - Compared to function blocks, functions always have only one output which has the exact same name as the function itself, e.g. fun_deac. The data type is determined when the function is created or via **Object** → **Properties**.
VAR_OUTPUT_ RETAIN	Like VAR_OUTPUT but holding, i.e. the value of the variable is retained even after a power failure. VAR_OUTPUT_RETAIN is only set as the initial value after a PLC cold boot, provided you have downloaded a program to the controller beforehand and switched the PLC from PROG mode to RUN mode. If under **Extras** → **Options** → **Compile Options** → **Code Generation**, you activated “Retain variables in the user area are not initialized”, variables for which the user assigned addresses are not reinitialized.
VAR_IN_OUT	With Input/Output variables (VAR_IN_OUT), the current parameters are copied to the formal parameters before the jump into the function program; after the return jump they are copied from the formal parameters back to the current parameters. In the function program formal parameters can be read and written.

Declare local variables in the POU header as follows.

◆ NOTES

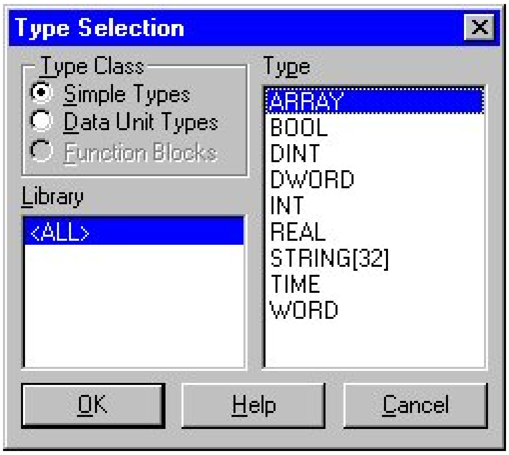
- **Identifiers may not begin with a number.**
- **FP addresses (X0, Y1 etc.) are fixed terms and may not be used as identifiers for global or local variables.**

◆ PROCEDURE

1. **Double-click POU name in the project navigator**
2. **Click “Class” field in header**
3. **Click variable class <Tab>**
4. **Enter identifier <Tab>**

   When you declare an FB entity, select the desired function block here.

5. **Click ▾ in the “Type” field**



6. **Select desired data type under “Type Class”**

7. **Select library**

8. **Click desired data type under “Type”**

   When you declare an FB entity, select the desired function block here.

9. **Click [OK] <Tab>**

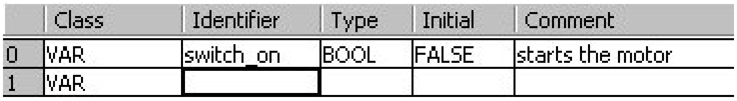
   The default initial value for the selected data type is displayed automatically. You can overwrite it if required.

10. **<Tab>**

11. **Enter comment <Enter>**

12. **<Shift> + <Enter>**

    A new declaration line is created after the current line if it is the last line in the POU header.



	Class	Identifier	Type	Initial	Comment
0	VAR	switch_on	BOOL	FALSE	starts the motor
1	VAR				

Tip:

In the FBD and LD editor you can also declare local variables directly in the POU body if you have activated the check box "Declare new identifiers" under **Extras** → **Options** → **Program Options** → **Editors** → **LD/FBD Editors**. In this case, the "Variable Selection (Mode NewVar)" dialog box is automatically opened as soon as you enter the name of a variable not yet declared in the POU header in the POU body and press <Enter>. You can then declare the variable immediately.

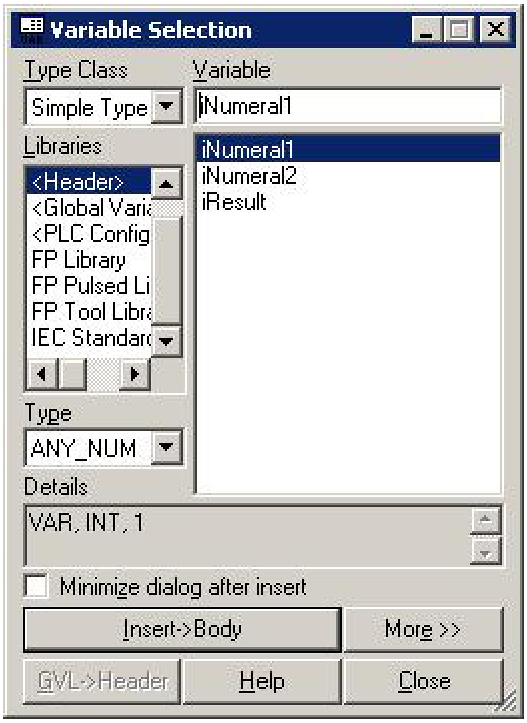
5.3.4 Assigning Variables in the Program

After declaring variables in the list of global variables or in the POU header, you can assign them in the PLC program with the aid of the “Variable Selection” dialog box. In the following procedure, it is assumed that the POU body is already displayed in the programming window.

◆ **PROCEDURE**

1. **LD and FB: Click name box**
   IL: Position cursor in the operand column

2. **Click , press <F2>, or click "Variable Selection" from the pop-up menu**



Variable Selection

Type Class: Simple Type

Variable: iNumeral1

Libraries: <Header>, <Global Vari, <PLC Config, FP Library, FP Pulsed Li, FP Tool Libr, IEC Standar

iNumeral1
iNumeral2
iResult

Type: ANY_NUM

Details: VAR, INT, 1

□ Minimize dialog after insert

3. **Click declaration location under “Library”**

   The variable can be declared in the header of the current POU “<Header>”, in the global variable list “<Global Variables>” or in a user library (if available). By clicking “<ALL>”, all of these declaration locations are searched through.

4. **Select type class**

   Here you can classify the data types which are then displayed in the “Type” selection field: Simple Types (INT, WORD etc.), Data Unit Types or Function Blocks.

5. **Select data type**

   In the “Type” selection field, specify the data type for which the available variables are displayed. If under “Library” “<Global Variables>”, for example, you have selected “Simple Types” as type class and “Array” as type, all variables of data type array will be displayed under “Variable” that are declared in the global variable list.

6. **Click desired variable**

   The parameters of the selected variables are displayed under “Details”.

7. **Double-click selected variable or [Insert -> Body]**

   The selected variable is inserted at the current position in the POU body. If you have selected a global variable, it will automatically be copied into the header of the current POU if it is not already there.

Tip:

When inserting variables into the PLC program you can also use global variables that are not yet in the POU header.

PROCEDURE

1. **In the Variable Selection dialog box, select "Global Variables" under "Library"**
2. **In the right column, select the global variable you wish to insert**
3. **Click [Insert -> Body]**

   The selected variable is also automatically copied into the header of the current POU.

   [More >>] enables you to extend the "Variable Selection" dialog box so that you can change variables and declare new ones.

5.4 Changing Variables

Variable parameters such as name, type, etc. are changed for global variables in the list of global variables and in the respective POU headers for local variables. You can specify that all changes to variables are adopted in the POU header and body for the current project. Or accept the changes via **Extras** → **Update Variables**, in which you can accept or reject the update for each POU header and body individually.

From the POU body, you can change certain parameters of global and local variables directly via the “Variable Selection” window.

For detailed information on updating variables, refer to the online help (keyword "Update all POE headers and bodies").

5.5 Export Variables

Using **Extras** → **Export CSV File** you create a text file in the CSV (**C**omma **S**eparated **V**alues) format. This means that the individual entries are separated by commas ‘,’ or semicolons ‘;’. You can choose the separator under **Extras** → **Options** → **Program Options** → **CSV Export**. With these text data, information about variables in external programs, e.g. process visualization, can later be imported.

◆PROCEDURE

1. **Extras → Export CSV-file**
2. **Select drive in which the CSV-file is to be saved**
3. **Enter file name**
4. **Select file type (CSV-Export Project or CSV-Export general)**
5. **[OK]**

If you chose **CSV-Export Project**, a text file is created that contains all variables in Control FPWin Pro with their name and address. In addition, general information about the project is exported, e.g. project name, compiler time and the Control FPWin Pro version.

Each variable includes the following entries in the text data: Class, Name, IEC Address, FP Address, Type, Initial, Comment.

If you select **CSV-Export general** the following options are available on the opening dialog:

[Assign]

By clicking on Assign, the highlighted entry from the left column will be assigned to the highlighted entry in the right column and be shown in parentheses. Several entries in the right column can be highlighted. If an entry is highlighted in the right column, it also appears in the field below. You can edit it there. In this way you can give Field x a meaningful name.

[Remove]

By clicking on Remove, the highlighted entry in the right column is removed. "Unassigned" appears in parentheses.

[Save export configuration]

Saves the export configuration to a file.

[Load export configuration]

Loads the export configuration from a file.

Export column title

If this box is checked, a header is written into the CSV file. Separated by the separator character, this header contains the entries Field 1, Field 2 or the names you assigned them.

Export array elements as single variables

Activate this checkbox to list all elements of the array in the export file.

[Export]

Starts the export process

[Cancel]

Closes the dialog without exporting.

◆ NOTE

In order to have access to data unit types or arrays, which are not supported directly, their individual elements are exported as variables to the CSV file.

5.6 Import Variables

Using **Extras** → **Import CSV File** you can import variables from a text file to the Global Variable List. The text data has to be in CSV (**C**omma **S**eparated **V**alues) format. This means that the individual entries are separated by commas ‘,’ or semicolons ‘;’. (The separator can be set under **Extras** → **Options** → **Program Options** → **CSV Export**).

PROCEDURE

1. **Extras → Import CSV-file**
2. **Select drive in which the CSV-file is stored**
3. **Enter file name**
4. **Select file type (CSV-Import Project or CSV-Import general)**
5. **[OK]**

If you have selected **CSV-Import Project,** the CSV file must have been created via **Extras** → **Export CSV File**. All global variables in the CSV file will be imported into the Global Variable List.

If you chose **CSV-Import general**, you can import any CSV files not created with Control FPWin Pro. The dialog "CSV Import general" appears and the following options are available:

Import from line

The import process is started, beginning with this line. The line chosen is shown in the list above.

[Assign]

By clicking on Assign, the highlighted entry from the left column will be assigned to the highlighted entry in the right column and be shown in parentheses. Several entries in the right column can be highlighted.

[Remove]

By clicking on Remove, the highlighted entry in the right column is removed. "Unassigned" appears in parentheses.

Separating character

From this group you select the separating character that will separate the individual columns of the CSV file to be imported.

[Save import configuration]

Saves the import configuration to a file.

[Load import configuration]

Loads the import configuration column from a file.

[Import]

Starts the import process from the line given in "Import from Line".

[Cancel]

Closes the dialog without importing.

5.7 ARRAY and Data Unit Type

ARRAYs

An array is a group of variables which all have the **same** elementary data type and that are grouped together, one after the other, in a continuous data block. This variable group itself is a variable and must hence be declared for this reason. In the program you can either use the whole array or individual array elements.

◆ NOTE

An array cannot be used as a variable by another array.

Data types valid for arrays are:

- BOOL
- INT
- DINT
- REAL
- WORD
- DWORD
- TIME
- STRING

Arrays can be 1, 2 or 3-dimensional. In each dimension, an array can have several fields.

Data Unit Type

A **D**ata **U**nit **T**ype (DUT) is a group of variables composed of several **different** elementary data types (BOOL, WORD etc.). These groups are used when tables are edited, such as for the bit sample edition in the F164_SPD0 command (FP1, FP-M) of the FP Library (see online help). You can use the bit sample edition of this command for regulating the speed of a motor via a speed governor, for example. Define a DUT in the DUT pool first. Then you can use the DUT in the “Type” field of the global variable list or of a POU header similarly to the integer, BOOL etc. data types. In the program you can then use either the whole DUT or individual variables of the DUT.

◆ NOTE

A DUT cannot be used as a variable by another DUT.

For details on working with ARRAYs or DUTs, please refer to the online help or programming manuals.

5.8 Cross-Reference Lists

In FPWIN Pro you can obtain a good overview of all variables used, their parameters, declarations, dependencies and references by using a cross-reference list. Via a dialog box with various search and filter criteria, you can specify the cross-references to be sought more accurately and have all declarations and POU bodies in which they appear directly displayed.

The cross-reference list is created from cross-reference objects (*.SCT)--which are first created separately for each POU tested--from the list of global variables (GVL) and from each data unit type (DUT). These cross-reference objects are then linked by the system to create a cross-reference file (*.SCX).

◆ NOTES

- **Cross-reference objects for the cross-reference list are only created if you have checked the objects (POU, GVL, DUT) or the whole project with** Object → Check **and activated the option to generate cross-reference objects during the check/compile process under** Extras → Options → Program Options → Cross-Reference**. During each check of an object, the accompanying cross-reference object is updated.**
- **By checking “Link cross-reference objects to cross-reference list”, you can have the cross-reference list created automatically while compiling the program. As this makes the compilation procedure longer, we do not recommend this procedure.**

For details on cross-reference lists, search criteria, wild cards etc., please refer to the online help (keyword "Cross-Reference").

5.9 Recipe Editor

If, for example, you wish to use your PLC program to control a reaction chamber for chemical substances that has supply and drain valves, heating elements and mixers, etc., it can be very helpful to summarize the control variables of these components for a certain substance in a recipe.

With **Monitor** → **Recipe Editor** → **Open Recipe Editor** you can compose a data record containing all variables necessary for a certain recipe. In other words, you can enter and change variables or assign new values to the variables. Then the recipe can be saved in a file (*.rez) and be transferred directly into the PLC with Monitor → Recipe Editor → Download Recipe if you are in online mode.
Monitor → **Recipe Editor** → □□□□□□□□□□□□ enables you to upload the current variable values of a recipe in online mode.

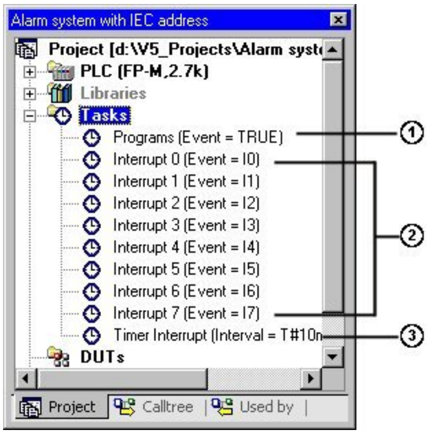
For details on working with recipes, please refer to the online help (keyword "Recipe Editor").

Chapter 6

Tasks

6.1 Introduction to Tasks

Tasks come first in the project hierarchy. They control all PRG-type (program) POUs. Tasks are located in the **Task pool** in the project navigator:



Alarm system with IEC address

Project [d:\V5_Projects\Alarm syst
- PLC (FP-M,2.7k)
- Libraries
- Tasks
  - Programs (Event = TRUE)
  - Interrupt 0 (Event = I0)
  - Interrupt 1 (Event = I1)
  - Interrupt 2 (Event = I2)
  - Interrupt 3 (Event = I3)
  - Interrupt 4 (Event = I4)
  - Interrupt 5 (Event = I5)
  - Interrupt 6 (Event = I6)
  - Interrupt 7 (Event = I7)
  - Timer Interrupt (Interval = T#10n
- DUTs

Open Task Pool

FPWIN Pro offers three kinds of execution control:

①	**cyclical (Programs)** means that the program will be always processed completely and then repeated, etc. Example: A liquid is continually pumped out of a container and the liquid's temperature is measured.
②	**event-driven (Interrupt)** means that the program will be called when a certain event occurs. Example: If the temperature in the container is lower than the minimum, the PRG "heating" is called.
③	**time-driven (Timer Interrupt)** means that the program is called in regular intervals. Example: The program "synchronize" is called every ten minutes.

◆ **NOTE**

Each POU of the type PRG has to be compiled and assigned to a task first, i.e. it has to be entered into Tasks of the navigator. Otherwise it will not be processed.

You may assign one or several POUs to a task. If you assign several POUs, they will be processed according to their input sequence. During compilation, the programs are treated as one single program and are downloaded into the PLC.

You can deactivate/activate a program within a task for code generation by highlighting the program and selecting **Deactivate/Activate** from the pop-up menu or via the menu Edit.

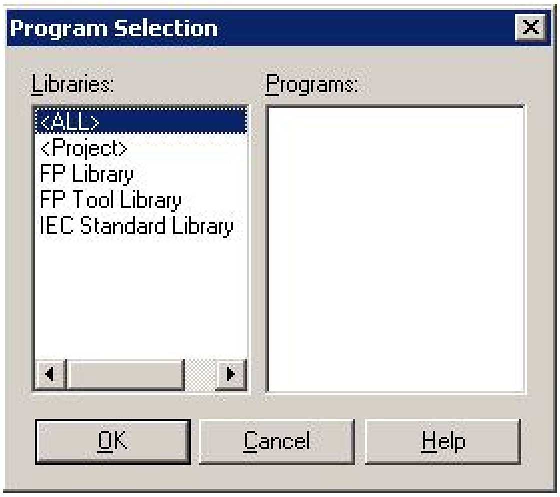
6.2 Assigning a Program to a Task

Programs are automatically assigned to a task when you create a project or afterwards via the task list, as illustrated below.

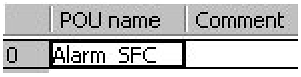
In this example, the program is to be controlled cyclically and is therefore assigned to the "program" task.

◆ PROCEDURE

1. **Double-click "Tasks" in the project navigator**
2. **Click into the field under "POU name"**
3. **Click ▾ to scroll for the selection**



4. **[OK]**



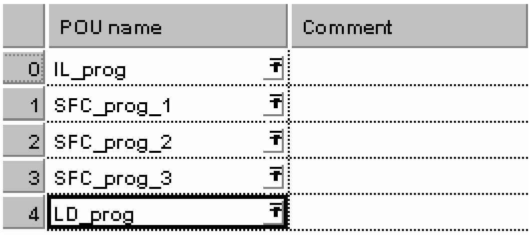
	POU name	Comment
0	Alarm_SFC	

If you have created several programs, it is possible to assign them to one task. All assigned programs will then be controlled by this single task.

5. **<Tab>**
6. **Enter comment <Enter>**
7. **Object → Save**
8. **Object → Close**

◆ NOTES

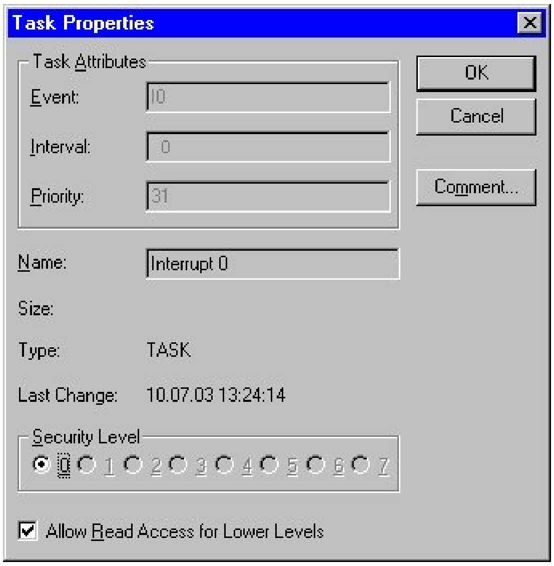
- **SFC programs (SFC POUs) must always be entered one after the other in the Task_Pool. No other POU types are allowed between them.**



	POU name	Comment
0	IL_prog	
1	SFC_prog_1	
2	SFC_prog_2	
3	SFC_prog_3	
4	LD_prog	

- **You can deactivate/activate a program within a task for code generation by highlighting the program (or click on the POU number) and selecting Deactivate/Activate from the pop-up menu or via the menu Edit.**

You can view each task definition with **Object** → **Properties** or <Alt>+<Enter>.



Task Attributes

Event: I0

Interval: 0

Priority: 31

Name: Interrupt 0

Size:

Type: TASK

Last Change: 10.07.03 13:24:14

Security Level

● 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7

☑ Allow Read Access for Lower Levels

Task information

Event

This field displays the assigned event or TRUE with cyclic processing. The event is directly linked to the task.

Interval

For time-driven tasks, this field displays the interval after which the POU is reloaded. You can change the interval by clicking the interval field and entering a time.

◆ **NOTE**

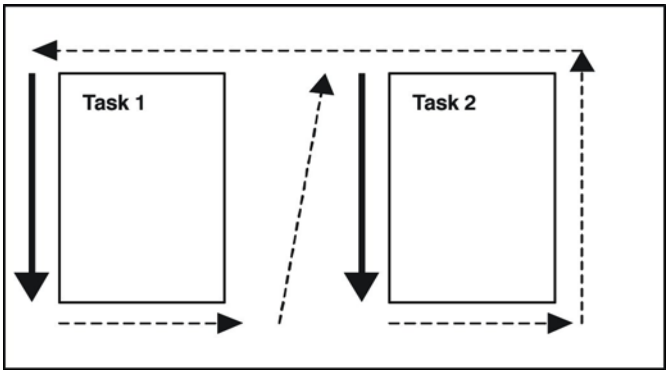
The interval must be entered in IEC format: e.g.: T#10s

Priority

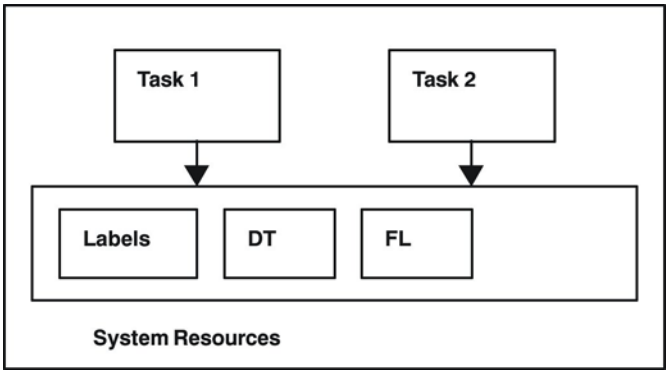
Under FPWIN Pro, the priority for all tasks is firmly set at the value 31 and cannot be changed. Interrupt tasks are processed in the order displayed in the Task pool, i.e. Interrupt 0 has a higher priority than Interrupt 1, etc.

6.3 Second task for FP10SH/120k and FP2SH 120k

For the FP2SH 120k and the FP10SH 120k the program memory is divided into two tasks. Each task can perform a maximum of 60K programming steps. If a POU is entered for the first task, the compiler enters the program code created into the first 60K of the program memory automatically. If a POU is entered for the second task, the compiler enters the program code created into the second 60K of the program memory automatically. There are two Program Code Editors, one for each program memory, in the project navigator ((Program Code and Program Code_2). The initialization of variables that are used in programs (POU) always takes place in the first task. The tasks are executed in turn by the PLC (Task 1, Task 2, Task 1, Task 2, ...).



The system resources, e.g. labels, data registers or file registers are used by both tasks and are administered centrally.



◆ NOTES

- **Programs that are entered under Tasks → Program 1 and the Interrupt routine (Interrupt 0 - 23 and Timer Interrupt) are assigned to the first task.**
- **Programs entered under Tasks → Program 2 are assigned to the second task.**
- **Programs written in Funtion Sequential Chart can only be used in the first task.**

- **If a function is used in various POUs and is not assigned to a task, the program code of the function is duplicated, i.e. the function's program code is assigned to both the first and second task.**
- **Even if under Extras → Options → Compile Options → Code generation the checkbox "Indicate User Function Blocks" is activated, the function block is duplicated if the function block is used by POUs in both tasks.**

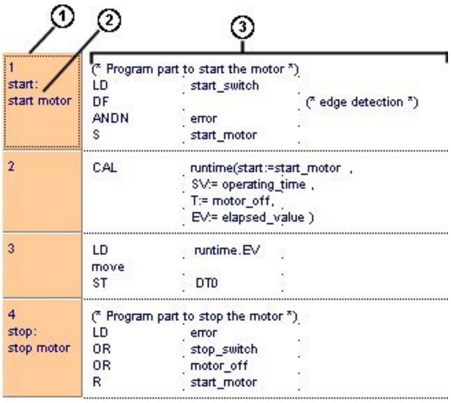
Chapter 7

Networks

7.1 Introduction to Networks

Networks are sections of programs containing a complete subtask. They are created in all editors in the same way. Networks consist of two columns. The left-hand column contains the network information area and the right-hand column contains the programming window. The network information area contains serial network numbers. You can enter a label here.

Enter the program in the programming window. The illustration shows two networks with the labels "start" and "stop".



```
1            (* Program part to start the motor *)
start:       LD       start_switch
start motor  DF                          (* edge detection *)
             ANDN     error
             S        start_motor
2            CAL      runtime(start:=start_motor ,
                      SV:= operating_time ,
                      T:= motor_off,
                      EV:= elapsed_value )
3            LD        runtime.EV
             move
             ST        DT0
4            (* Program part to stop the motor *)
stop:        LD       error
stop motor   OR       stop_switch
             OR       motor_off
             R        start_motor
```

Labels in an IL network

①	Network info area with consecutive network number
②	Label (e.g. start) and title (e.g. start motor)
③	Programming window

All networks together comprise one POU. In a POU, you can insert networks, delete them, deactivate or activate them, add labels and comments. After creating networks, you can have a list of them drawn up with **Tools** → **Network list** (see page 71).

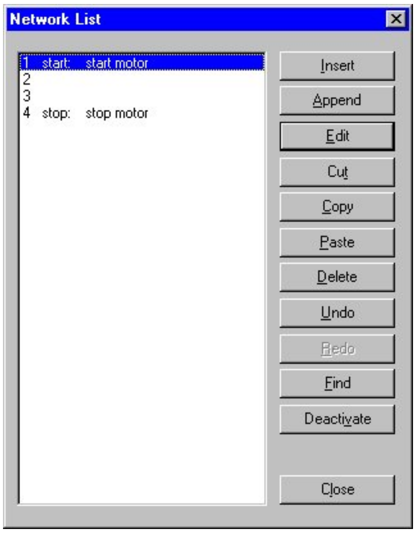
◆ **NOTES**

- **No labels may be defined in Sequential Function Chart in action networks.**
- **To avoid generating superfluous program code, do not assign labels if you do not require a jump destination.**

7.2 Network List

PROCEDURE

1. **Double-click the chosen POU in the Navigator**
2. **Tools → Network List**



1 start: start motor
2
3
4 stop: stop motor

In this example, 2 networks are listed with the **start** and **stop** labels and their titles (comments).

On the right side of the network list dialog box there are several keys used for editing the network in many different ways.

Always select the network prior to editing it. It is up to you to select one network or several consecutive or non-consecutive networks.

7.3 Defining Lables and Titles

You can define a label for a network (see page 70) in order to jump from one program point to a particular network, for example.

◆ NOTES

- **To avoid generating superfluous program code, do not assign labels if you do not require a jump destination.**
- **No labels may be defined in action networks of SFC editor nor in ST editors.**
- **Labels must always end with a colon, otherwise the compiler will register a programming error.**

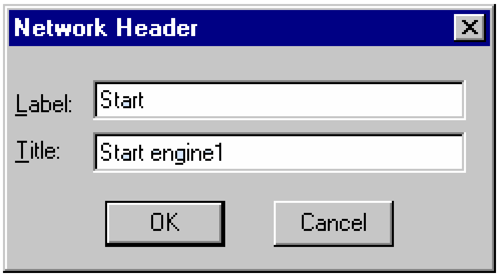
When defining a label you may also enter a title (comment) for the network at the same time. The following procedure also applies to the editing of network labels or titles.

◆ PROCEDURE

In the network list:

1. **Select the network**
2. **Click [Edit]**

   The following dialog box appears:



Network Header

Label: Start

Title: Start engine1

3. **Enter label and/or title**

   If no label is needed, you may enter a title only.
4. **Click [OK]**

In the network info area:

1. **Double-click the network info window**

   The dialog box "Network Header" appears:
2. **Enter name and/or title**
3. **Click [OK]**

7.4 Deactivate or Activate Network

For code generation, the network selected can be activated or deactivated. The network’s status is indicated in the network information area or network list by a "X" (crossed out).

Network list:

1. **Select network (multiple selection is possible)**
2. **[Deactivate]**

In the programming window:

1. **Select network (multiple selection is possible)**
2. **Edit → Deactivate/Activate or ☒ or Deactivate/Activate in the pop-up menu**

   Move mouse cursor in the network info area to use the pop-up menu.

Chapter 8

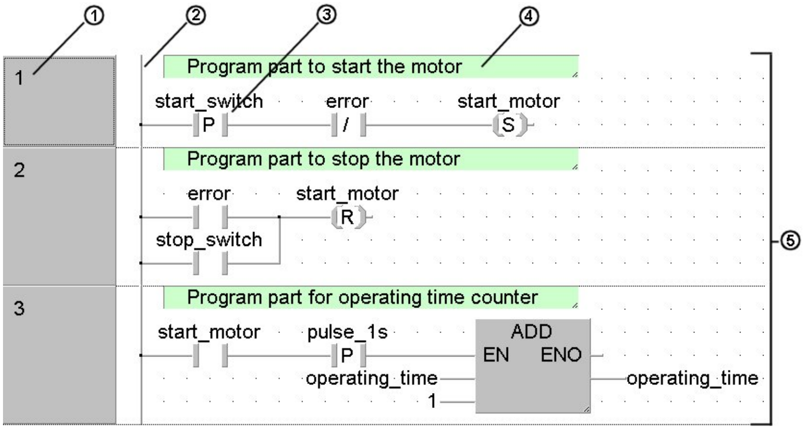
Programming Editors

8.1 LD and FBD Editors

In the Ladder Diagram (LD) and Function Block Diagram (FBD) editors, programs are presented graphically. The LD editor can portray everything the FBD can, but in addition the LD:

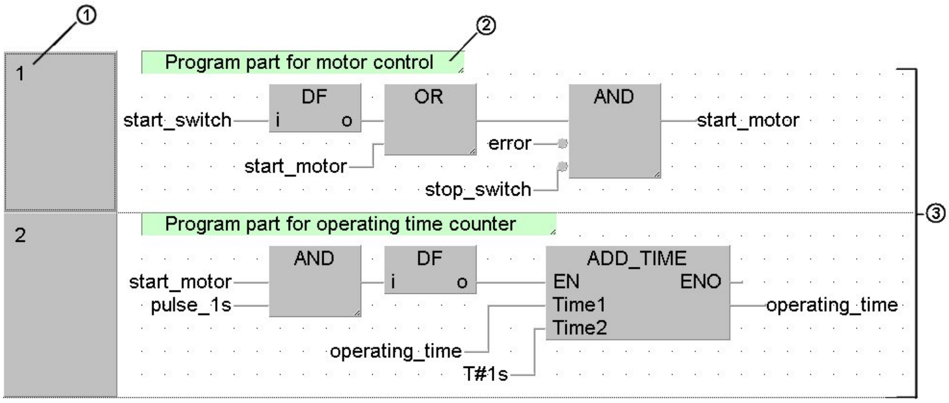
- can incorporate Boolean variables in the form of contacts and coils
- has a power rail that connects all networks and to which contacts, etc. are connected within networks.

LD symbols include: contacts, coils, input variables, output variables, jumps and backward jumps. An FBD program consists of blocks, jumps, input variables and output variables.



LD program, which includes a power rail and Boolean contac

①	Network info area with network number
②	Power rail
③	Network with Boolean contacts
④	Comment field
⑤	Programming window



FBD program

①	Network info area with network number

②	Comment field
③	Programming window

Each POU body consists of one or more networks. The network info area is displayed on the left. Here you can find the network number, labels and statuses, e.g. for breakpoints (debug), network selection and error messages. The program is displayed in the right of the programming window. Comments can be inserted using the 💬 symbol.

◆ NOTE

You may place up to 160 elements within a network. An element is anything that can be created on screen, including lines. For this reason, when creating lines, please draw them as long as possible using one stroke. If you compose lines from several pieces, each piece counts as an element.

8.1.1 Connecting Objects

The LD and FBD contain two editing modes: selection mode (cursor = arrow) and interconnect mode (cursor = pen). In selection mode, you can select programming symbols, e.g. contacts, and position or edit them in the programming window. In interconnect mode, you can draw the lines that connect the programming symbols to each other.

The selection mode is the default mode. You can change to the interconnect mode via:

- **Edit → Draw Line**, the "Draw Line" command is checked if active
- click ✏ in the tool bar, or
- select the "Draw Line" command in the pop-up menu (right mouse button)

Press <ESC> or double-click on an empty space within the programming window to leave the interconnect mode.

Programming symbols that do not have any connection points cannot be selected in interconnect mode. Logical elements, input and output variables, jumps and backward jumps can also be positioned in interconnect mode.

Time-saver features of the grafical editors:

- When inserting functions, function blocks and operators in the POU body, these programming symbols are automatically equipped with empty input/output variables and name boxes ("?") if "Add input/output variables automatically" is activated under **Extras → Options → Program Options → Editors → LD/FBD Editor**.
- Press and hold <Shift> while connecting programming symbols, the connecting line is automatically calculated.
- Press and hold <Shift> while moving elements that are already connected, e.g. a coil, the connection lines automatically shift when the element is moved.
- When copying programming symbols (contacts, functions etc.) with **Edit → Copy/Paste** or the corresponding command buttons, the accompanying connecting lines are also

copied. If you copy a programming symbol by selecting it and keeping <Ctrl> pressed while dragging it to the new position, the programming symbol and all of its accompanying connection lines is duplicated and automatically equipped with contacts.

8.1.1.1 Useful Hints

The following hints facilitate programming and save programming time:

◆ SHORTCUTS

- Press <Strg> + <a> to select all networks within one POE
- Use <Tab> to jump within one network from a editing field, e.g. variable name to another. Jump backwards with <Shift> + <Tab>.
- **Tools** → **Minimize Network** enables you to optimize the height of the network.
- Double-click on an empty space within the programming window to change from the interconnect mode to select mode and vice versa.
- Press <ESC> to leave the interconnect mode.

8.1.1.2 Command Buttons in the Tool Bar

When you open an LD or FBD body, the following buttons appear in the tool bar:

Icon	Description
+	Inserts a new network before the selected network.
+	Inserts a new network after the selected network.
☒	Deactivates/activates the selected network. Deactivated networks are treated like comments and are therefore not compiled.
✎	Switches between interconnect mode (Draw Line) and selection mode.
VAR	Opens the “Variable Selection” dialog box if a name box for an input/output variable is selected.
▯	Opens the “OP/FUN/FB Selection” dialog box from which you can select operators, functions or function blocks and insert them in the programming window with a left-click at the desired position.
VAR	Inserts a name box for an variable in the programming window. Left-click at the desired position.
L	Inserts a jump.
R	Inserts a backward jump (return).
💬	Inserts a comment.
↕	Changes the vertical distance.
↔	Changes the horizontal distance.
In addition, LD includes the following symbols in the tool bar:	
‑‖‑	Inserts a contact in the programming window. Left-click at the desired position.

Icon	Description
-( )-	Inserts a coil in the programming window. Left-click at the desired position.

8.1.1.3 Pop-up Menu

When you click the **right** mouse button anywhere in the programming window, a pop-up menu opens. This menu contains many useful commands.

A list of the last operators, functions or function blocks used appears in the bottom part of the pop-up menu.

◆ NOTE

For all of the functions, function blocks or operators inserted in the POU body, you can have the corresponding help page displayed by selecting the desired programming symbol and pressing <F1>.

8.1.1.4 Programming Example

For programming examples, please refer to the online help.

8.1.1.5 Enable Input and Enable Output

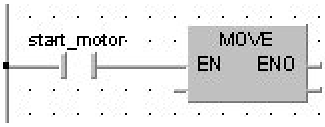
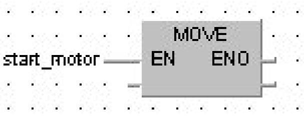
In FBD and LD you can program for conditions by using EN/ENO functions and function blocks. EN stands for enable input, ENO for enable output.

All IEC functions and function blocks are available both with and without EN and ENO. The E_MOVE function does and the MOVE function **does not** have an EN/ENO, for example.

If you require an enable input (EN) and an enable output (ENO):

Insert the EN/ENO instruction by selecting **[Insert with EN/ENO]** from the OP/FUN/FB selection in the LD, FBD and IL editors. To facilitate reusing the Enable (E_) instruction, it will then appear as such under "Recently used" in the pop-up menu.

EN and ENO are Boolean variables. When EN is set (TRUE), the function or function block is processed. When the function or function block has been successfully executed, the corresponding ENO is set to TRUE. At the ENO output of a FUN/FB, you can connect the EN input to the next POU, which is then only processed when the output ENO of the first POU is set to TRUE.

	
EN/ENO in a ladder diagram	*EN/ENO in a function block diagram*

User-defined functions (see page 123) and function blocks (see page 124) can be created with or without EN/ENO input and output. You can choose between the following possibilities:

- when creating a new POU (**Edit** → **New** → **POU** or) and selecting the option "With EN/ENO contacts"
- at a later time with **Object** → **Properties...**

The ENO output can be explicitly set in the body during programming:

- If you do not explicitly set the ENO output within the body of the user-defined function or function block, it will have the same value as the EN input.
- If you set the ENO output within the body of the user-defined function or function block to FALSE, the values of the output variables will not be transmitted to the outputs.

◆ NOTE

Set EN to TRUE prior to processing the POU. Once the POU has been successfully processed, the corresponding ENO is set to TRUE. If ENO is not set, an error might have occurred.

8.1.1.6 Editing Programming Symbols

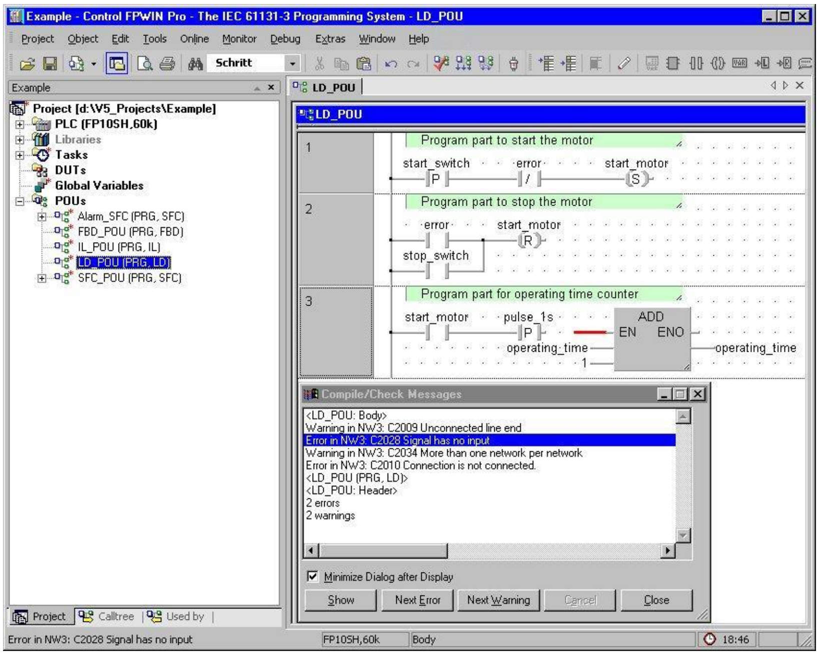
In the Ladder Diagram and Function Block Diagram editors you can edit the programming symbols in your program in selection mode as follows:

- select and deselect
- cut/copy and paste
- shift (with and without connection lines)
- change distance between programming symbols
- enter/change variable names
- extend functions and operators
- negate contacts, define edges, set and reset
- define graphic macros

For the description of these features and their use, please refer to the online help.

8.1.1.7 Check a LD or a FBD Program

You can check your program any time with **Object** → **Check** or . The entire program defined up to that point is checked for syntax errors as well as for declaration errors (e.g. whether a variable is used that has not yet been declared). Each error is listed individually in the error list. Selection of any error in the error list by double-clicking causes the error to be displayed in the POU body in the color defined for errors.



```
<LD_POU: Body>
Warning in NW3: C2009 Unconnected line end
Error in NW3: C2028 Signal has no input
Warning in NW3: C2034 More than one network per network
Error in NW3: C2010 Connection is not connected.
<LD_POU (PRG, LD)>
<LD_POU: Header>
2 errors
2 warnings
```

☑ Minimize Dialog after Display

Error in NW3: C2028 Signal has no input | FP10SH,60k | Body | 18:46

If applicable, please click on the displayed error and then [Show]. The program containing the error will be displayed on your screen and the error will be highlighted.

◆ **NOTE**

Always fix the first error first and then repeat Object → Check. Subsequent errors may be sequential errors.

8.2 Structured Text Editor (ST)

Structured Text is a text-based editor exempt from normal syntax. ST allows you to write complex programs and control structures using an optimized programming language. It is available for all PLCs and requires no more resources, e.g. steps, labels or calls, than other editors while doing comparable programming.

EXAMPLE

```
IF Send THEN
    (* Copy characters of the variable SendString to the SendBuffer[1]
*)
    (* SendBuffer[0] will be used by F144_TRNS. The number of bytes not
    yet transmitted is stored in SendBuffer[0] at each transmission *)
    F10_BKMV( s1_Start:= Adr_Of_VarOffs( SendString, StringHeaderSize),
             s2_End:= AdrLast_Of_Var( SendString), d_Start:=
SendBuffer[1]);

    (* Send the information of the SendBuffer *)
    F144_TRNS( s_Start:= SendBuffer[0], n_Control:= LEN(SendString));
END_IF;
```

8.2.1 Expressions

Expressions link the Operands (see page 83) of Operators (see page 83) based on their rank.

When their rank is the same, processing proceeds from left to right.

With the values A:=1.0; B:=2.0; C:=3.0; and D:=4.0; for

```
X:=A+B-C*SQRT(D);
```

the result is -3.

By inserting parentheses, the processing order can be changed, e.g. for

```
X:=A+(B-C)*SQRT(D);
```

the result is -1.

Boolean expressions are always fully processed:

```
IF a<100 AND UserFun1(a) THEN
     a:=a+1;
END_IF;
```

In this case, UserFun1 is also processed if a>=100.

When you wish to avoid processing UserFun1 for whatever reason, e.g. it's too time-consuming, or when a>=100 an operation error occurs, or because the memory area will be overwritten, you can write, for example:

```
IF a<100 THEN
     IF UserFun1(a) THEN
```

```
        a:=a+1;
    END_IF;
END_IF;
```

Expressions can also indicate elements of an array:

```
X:=Array1[i+2];
```

8.2.2 Operands

The operands you can use in the ST editor are:

Name	Type	Example
Literal	Numerical String Time	49 or 3,14159 'This is a text' T#8d_3h_23m
Variable	Individual variable Element of an Array (see page 58) Element of a DUT (see page 21) Element of an Array or a DUT	Var1 Array1[5] Dut1.Var1 Dut1.Array1[i+5]
Function	Call function	Fun1(a,b,c)

These operands can be linked via Operators (see page 83). The combination of Operators in connection with Operands are called Expressions (see page 82).

8.2.3 Operators

The operators you can use in the ST editor are:

Operator	Description	Precedence
( )	Parentheses, Call up function	highest
- NOT	Negation Complement	
** * / MOD	Raise to a power Multiplication Division Modulo (remainder)	
+ -	Addition Subtraction	
>,<,>=,<=	Comparison	
= <>	Equal Not equal	
&, AND	Boolean AND	
XOR	Boolean exclusive OR	
OR	Boolean OR	lowest

Operators can link Operands (see page 83). The combination of Operators in connection with Operands are called Expressions (see page 82).

8.2.4 Instructions

The ST editor’s instructions are:

- the assignment instruction :=
- the specification instructions IF, CASE
- the repeating instructions FOR, WHILE, REPEAT along with the quit instruction EXIT
- the return instruction RETURN

Keyword	Description	Example	Explanation
:=	Assignment	`a:=87;b:=b+1;c:=SIN(x);`	The value on the right is assigned to the identifier on the left

	Calling functions	`Y:=SIN(x);`
		`Y:=LIMIT(MN:=0,IN:=X,`
		`MX:=100);`
			Function’s argument in shorthand
			Function arguments **with** formal parameters
			Note:
			The order does not matter for arguments with formal parameters.
			With user functions, the EN input and output can be omitted.
			Omitted EN will be interpreted as TRUE.

		`Y:=LIMIT(0, X, 100);`	Function arguments **without** formal parameters **Note:** The order matters for arguments without formal parameters. The case of letters is not significant.

	Calling FBs	`TON1( IN:= Start1,`
		`PT:=T#300ms ,`
		`Q=> End1 ,`
		`EV=> EV_1 );`
			Function block arguments **with** formal parameters
			Note:
			The order does not matter for arguments with formal parameters.

		`Ton1(IN:=Start1,`
		`PT:=T#300ms);`
		`End1:=Ton1.Q;`
		`Ev1:=Ton1.EV;`
			Function block arguments **without** formal parameters
			Note:
			The order matters for arguments without formal parameters.
			The case of letters is not significant.

Keyword	Description	Example	Explanation

		Ton1.IN:=Start1;
		Ton1.PT:=T#300ms;
		Ton1();
		IF Ton1.Q THEN
		....
		END_IF;
			Unlimited use of formal parameters in program called

IF	Conditional divergence	IF a>=0 AND a<=10 THEN
		b:=0;
		ELSIF a>=100 THEN
		b:=1;
		ELSE
		b:=2;
		END_IF;
			Divergence depends upon the Boolean value of the expression

CASE	Multiple selection	CASE a OF
		0: b:=0;
		1,2: b:=1;
		3,4,10...20: b:=2;
		100..110: b:=3;
		ELSE b:=4;
		END_CASE;
			Multiple selection depending on the variable

FOR	Loop instruction	FOR i:=0 TO 100 DO
		SUM:=SUM + a[i]
		END_FOR;
		
		FOR i:=0 TO 100 BY 10 DO
		IF a[i]>=100 THEN
		EXIT;
		END_IF;
		END_FOR;
			Defined number of loops with preset step width 1
			
			or with user-defined step width
			
			Note:
			Do not use the value of the control variable (i in this example) after the loop is finished because different values have been assigned to it.

Keyword	Description	Example	Explanation

WHILE	Loop instruction	i:=0;
		WHILE i<=100 AND a[i]<100 DO
		    i:=i+10;
		END_WHILE;
			Loop processing while checking the loop condition **before** the loop

REPEAT	Loop instruction	i:=0;
		REPEAT
		    i:=i+10;
		UNTIL i>100 OR a[i]>=100
		END_REPEAT;
			Loop processing while checking the loop condition **after** the loop

EXIT	Quit instruction	EXIT;	Non-conditional exiting of the loop
RETURN	Return jump	RETURN;	The program returns to the called POU

8.2.5 Comments

You can enter comments anywhere you like in the ST editor. Comments are enclosed by parentheses with asterisks '(*' and '*)' and are not nested. They can extend over several lines.

```
(* this is a
      comment on two lines *)
```

Invalid comment because there is no ending *)

```
(* this is an invalid comment
```

Nested comments, e.g. (* Level 1 (* Level 2 .... *) *) are allowed but not usual according to IEC 1131-3. These comments cause an error depending on the compiler settings. See **Extras** → **Options** → **Compile Options** → **Additional Errors**.

8.2.6 Checking your Program

The procedure for checking the program is the same as that for LD/FBD. Therefore, please see check LD/FBD program (see page 81).

8.2.7 Insertion Shortcuts

The following insertion shortcuts will save you time programming:

◆ SHORTCUTS

Insertion template for OP/FUN/FB:

1. **Enter the instruction into the programming window, e.g. SHL**
2. **Press <Strg> + <F1>**

   With a function. e.g. SHL, the following could appear:

   ```
   SHL( IN:= ?ANY_BIT? , N:= ?ANY_BIT? );
   ```
3. **Highlight the data types between the questionsmarks, e.g. by double-clicking**
4. **Enter operands**

   For help, you can also place the cursor on the name of a function or a function block and then press <F1>.

Insertion template for specification or repeating instructions:

For the instructions IF, CASE, FOR, WHILE, REPEAT, EXIT, RETURN, an insertion template is at your disposal. This will ease your working with the ST editor.

1. **Place the cursor on or directly behind the instruction, e.g. IF**
2. **Press <Ctrl> + <F1>**

   With the instruction IF, the following could appear:

   ```
   IF ?BOOL? THEN
   ELSIF ?BOOL? THEN
   ELSE
   END_IF;
   ```
3. **Highlight the parameter between the questionmarks, e.g. by double-clicking**
4. **Enter the desired parameter**

8.2.7.1 OP/FUN/FB Selection

You can enter the name of an operator or a function (see Insert operand (see page 88)) directly in the editor. A function block is entered by the name of its instance in the dialog variable selection.

◆ PROCEDURE

1. **Click or**
   Tools → OP/FUN/FB Selection or

<Shift> + <F2>

The dialog box OP/FUN/FB Selection is opened.

2. **Choose OP, FUN or FB**
3. **Insert with [Insert -> Body] or by double-clicking in the editor**
4. **Create parameter list with the insertion template**

   or
   Enter parameters directly into the editor

8.2.7.2 Insert Operands

You can enter the name of the variable (see page 83) or instances of function blocks (see page 37) as text into the editor or use the Variable Selection dialog box.

◆ **PROCEDURE**

1. **Click in the programming window**
2. **Click on VAR or**
   Tools → Variable Selection or
   <F2>

   The dialog box Variable Selection opens.
3. **Select variable**
4. **Insert with [Insert -> Body] or by double-clicking in the editor**

For instances of function blocks:
Create parameter list with the insertion template or enter parameters directly into the editor.

8.2.8 Particularities of ST Editor

Please note the following when using the ST editor.

- There are no EN/ENO functions and function blocks from the IEC Standard Library within the ST editor.
- For Boolean constants, TRUE and FALSE as well as the Boolean zero (0) and one (1) can be used.
- The FP library’s F and the FP Pulsed Library's P instructions’ EN input contacts and ENO output contacts play no role. Rather, this functionality is determined by using a specification instruction.

Example:

```
IF start THEN
    F10_BKMV( s1_Start:= source_Array[1],
         s2_End:= source_Array[3],
         d_Start=> target_Array[0]);
END_IF;
```

- The address functions of the FP Tool Library do not distinguish between input and output functions, i.e. in the ST editor, only one of them exists.

Functions of the ST editor	Corresponding functions in the FP Tool Library	
Adr_Of_Var	Adr_Of_Var_I	Adr_Of_Var_O
AdrLast_Of_Var	AdrLast_Of_Var_I	AdrLast_Of_Var_O
Adr_Of_VarOffs	Adr_Of_VarOffs_I	Adr_Of_VarOffs_O
AdrDT_Of_Offs	AdrDT_Of_Offs_I	AdrDT_Of_Offs_O
AdrFL_Of_Offs	AdrFL_Of_Offs_I	AdrFL_Of_Offs_O

- When debugging an IF or CASE control structure, the program code within the control structure will run even if the control condition is not true. However, the individual commands will not be executed.
- Do not use the value of the control variable after the loop is finished because different values have been assigned to it.
- Programming loops with many steps may extend the scan time of the PLC. Increase the settings (system register 30) or try to divide the program into several cycles.
- The data type of a Boolean or numeric literal can be specified by adding a type prefix to the literal, consisting of the name of an elementary data type and the '#' sign. For example INT#2 or REAL-3.2.
  To identify literals, some competitor programming systems require typed literals. For this reason, FPWIN Pro also supports typed literals. Because internally the compiler of FPWIN Pro automatically assigns a the right type to literals, it is not required to explicitly type literals as described above.
- The case of letters is not significant in
  - identifiers (for instance, the identifiers abcd, ABCD, and aBCd are interpreted identically) and
  - keywords (for instance, the keywords "FOR" and "for" are syntactically equivalent).

◆ **NOTE**

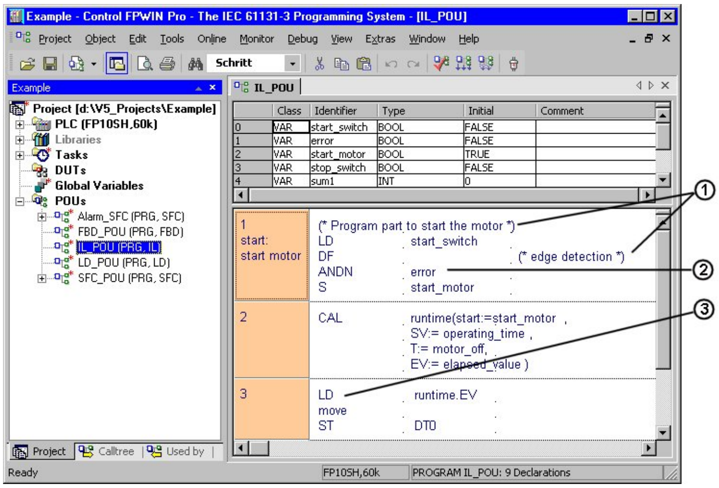
When compiling code with earlier versions of Control FPWIN Pro, please remember that these versions are case-sensitive.

8.2.9 Programming Example

For programming examples, please refer to the online help.

8.3 IL Editor

The instruction list editor is a text-based, non-syntaxed editor. Here you enter IL commands in accordance with the IEC-61131 standard, which are listed under "Standard Operators" in the online help, or in accordance with the basic instruction set.


Example - Control FPWIN Pro - The IEC 61131-3 Programming System - [IL_POU]
Project Object Edit Tools Online Monitor Debug View Extras Window Help
Schritt
Example
Project [d:\V5_Projects\Example]
PLC (FP10SH,60k)
Libraries
Tasks
DUTs
Global Variables
POUs
Alarm_SFC (PRG, SFC)
FBD_POU (PRG, FBD)
IL_POU (PRG, IL)
LD_POU (PRG, LD)
SFC_POU (PRG, SFC)
Project
Calltree
Used by
IL_POU
1
2
3
Ready
FP10SH,60k
PROGRAM IL_POU: 9 Declarations

	Class	Identifier	Type	Initial	Comment
0	VAR	start_switch	BOOL	FALSE	
1	VAR	error	BOOL	FALSE	
2	VAR	start_motor	BOOL	TRUE	
3	VAR	stop_switch	BOOL	FALSE	
4	VAR	sum1	INT	0	

```
1             (* Program part to start the motor *)
start:        LD      start_switch
start motor   DF                        (* edge detection *)
              ANDN    error
              S       start_motor

2             CAL     runtime(start:=start_motor ,
                      SV:= operating_time ,
                      T:= motor_off,
                      EV:= elapsed_value )

3             LD      runtime.EV
              move
              ST      DT0
```

Instruction list (IL) with three networks

①	Comments
②	Operands
③	Operators

Each POU body consists of one or more networks. In the left of the network info area, the labels (Start:, Stop:) and statuses, e.g. for breakpoints, network selection and error messages, are displayed.

The program is displayed on the right in the programming window. It is subdivided into three columns: **Operators**, **Operands** and **Comments**. The comments are restricted by brackets and asterisks (* *). Comments can be several lines long and positioned anywhere in the programming window. Empty lines in the body are permissible. Each body can contain 60kB maximum of ASCII source texts.

An IL network (see page 70) must always start with a load operation (LD). Linking results are filed in the bit memory. They are lost, however, when transferred from one network to another.

◆ NOTES

- **Each result which you require at a later stage should be buffered (variable) before another network is processed.**
- **Please do not create overly large networks as this makes searching for errors and following labels a very time-consuming task. Take advantage of structured programming.**

For additional information and examples on working with the IL editor, please refer to the online help (keyword "Instruction List Editor").

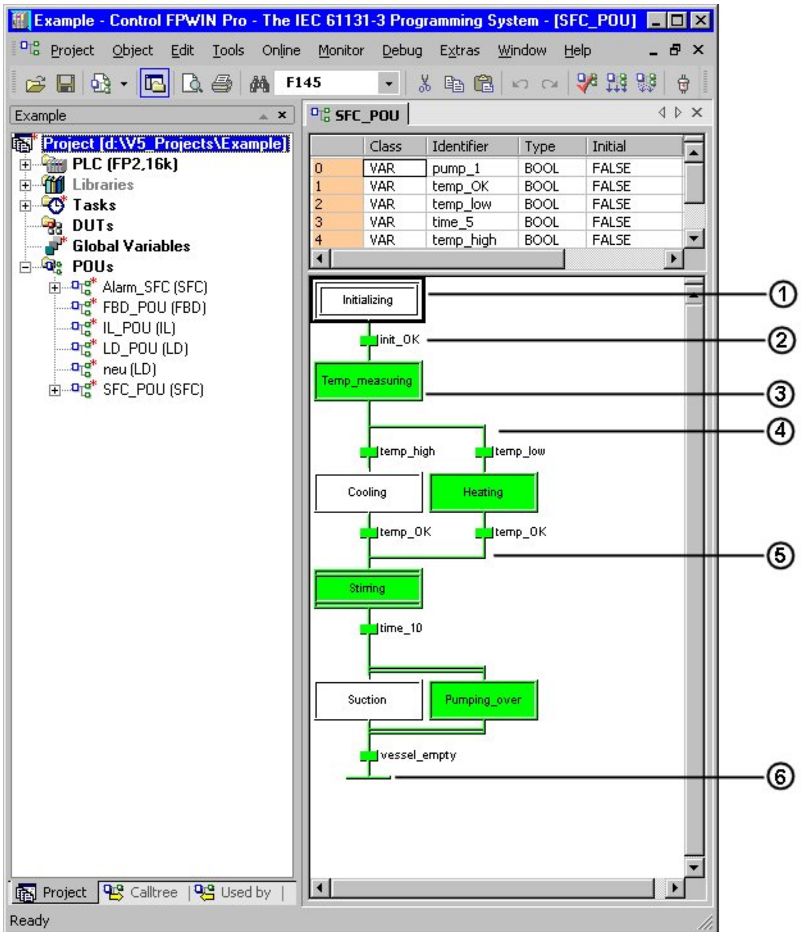
8.3.1 Checking your Program

The procedure for checking the program is the same as that for LD/FBD. Therefore, please see check LD/FBD program (see page 81).

8.4 Sequential Function Chart (SFC)

In the sequential function chart you can portray complex programs clearly. The entire task is subdivided into part-tasks and the sequence portrayed step by step.

Example:



	Class	Identifier	Type	Initial
0	VAR	pump_1	BOOL	FALSE
1	VAR	temp_OK	BOOL	FALSE
2	VAR	temp_low	BOOL	FALSE
3	VAR	time_5	BOOL	FALSE
4	VAR	temp_high	BOOL	FALSE

SFC program

①	Initial step
②	Transition
③	Step
④	Divergence
⑤	Convergence
⑥	Final step

The following symbols are used:

Step

A step is a part-task, e.g. switch on motor.

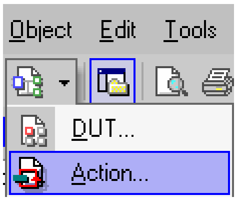
When you switch the PLC from PROG to RUN mode, the initial step is the first step to be activated. The steps are processed one after the other. Once the final step has been processed, the initial step is reactivated etc.

You can assign one or more actions to each step. If you do not assign an action to a step, the step has a wait function until the subsequent transition is fulfilled. Actions are entered under Actions in the project navigator and can be Boolean variables or programs in LD, ST, IL or FBD. They can be assigned to one or more steps. Whenever a step is active, the actions assigned to it are executed.

Action

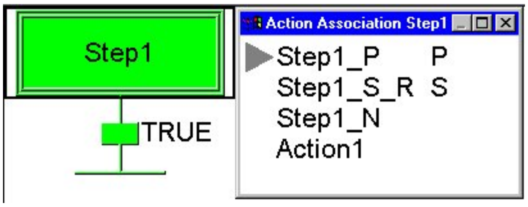
Create a new action in the navigator:

1. **Select the POE or the respective Action pool of the SFC program**



2. **Edit → New → Action or**
3. **Choose a name and the programming editor**
4. **[OK]**

Select the step you wish to associate with an action and click to open the respective window "Action Association".



Action Association Step1

```
Step1_P     P
Step1_S_R   S
Step1_N
Action1
```

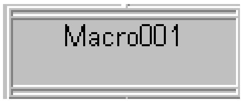
◆ **NOTE**

In action networks, no labels (see page 72) may be defined.

Monitor → **Monitor Header** or lets you monitor the status of a step flag. The name of this flag is composed of the name of the step plus the extension **.X**, e.g. **Step1.X**.

Macro step

Several steps can be summarized in a macro step. A macro step is marked by two extra horizontal lines. Behind the "Ventilation" macro step, for example, there are several steps which serve ventilation control.

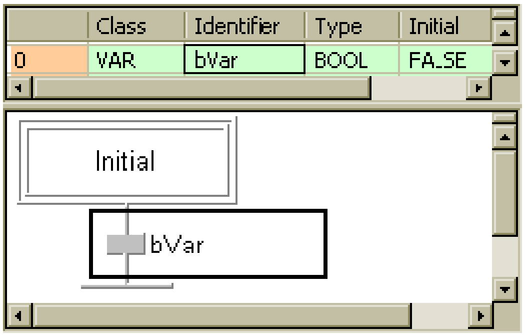


Transitions

A transition is a conditional jump. Once the transition is fulfilled, the next step becomes active.

A transition can be:

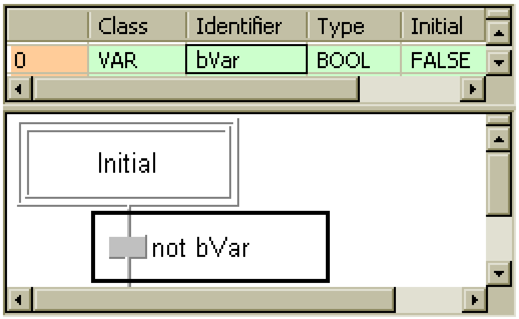
- A Boolean variable or address (e.g. bVar or R0)



	Class	Identifier	Type	Initial
0	VAR	bVar	BOOL	FALSE

The transition is regarded as fulfilled once the assigned variable or address is TRUE.

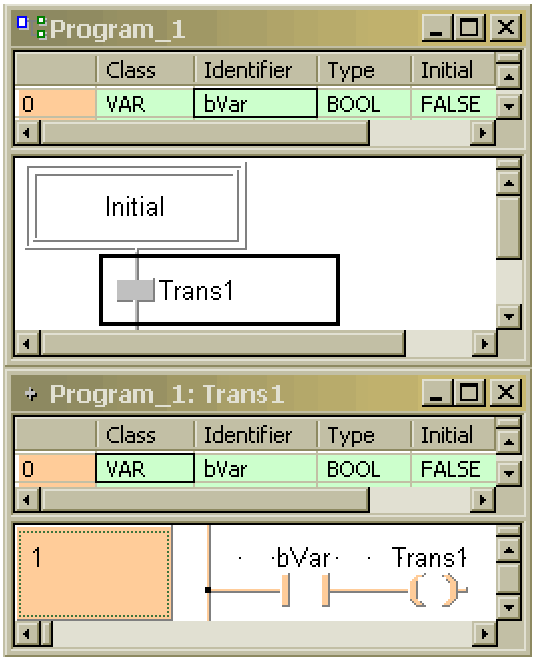
- A transition condition (e.g. "NOT bVar" or "bVar1 & bVar2")



	Class	Identifier	Type	Initial
0	VAR	bVar	BOOL	FALSE

The transition is regarded as fulfilled if the calculation result of the ST program code is TRUE.

- A program in IL, FBD, LD or ST programming language


Program_1

	Class	Identifier	Type	Initial
0	VAR	bVar	BOOL	FALSE

Program_1: Trans1

	Class	Identifier	Type	Initial
0	VAR	bVar	BOOL	FALSE

The transition is regarded as fulfilled once the variable with the name of the transition is TRUE. The variable with the transition name is automatically declared by Control FPWIN Pro.

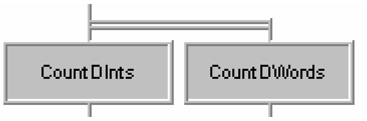
◆ **NOTE**

When you assign a program to a transition, the following restrictions apply:

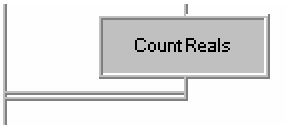
- **Only one network is permitted in the transition body.**
- **Functions with enable input may not be used.**

Parallel divergence

A parallel divergence is marked by a double horizontal line. When the transition is fulfilled before the parallel divergence, two or more steps are executed in parallel (simultaneously).



After execution, all of the steps are reunited in a transition by a parallel connection.

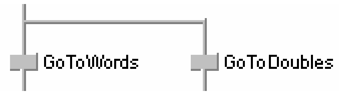


◆ **NOTE**

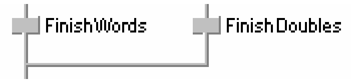
The transition after a parallel convergence only takes effect once all of the previous steps have been processed.

Alternative divergence

An alternative divergence is marked by a horizontal line. Depending on which transition is fulfilled (**GoToWords** or **GoToDoubles**), the accompanying divergence is executed. When both transitions are fulfilled at the same time, the execution priority of left to right applies, i.e. in the following divergence, only the step to **GoToWords** is executed.



No matter which step is executed, both steps are reunited with the following symbol:



When programming with the SFC editor, not only the POEs but all actions and transitions for entering an SFC program are displayed in the navigator under **Actions**.

For further information on the most important steps, see online help under keyword "Edit an SFC".

Chapter 9

Downloading Projects to the PLC

9.1 Before You Download Your Program to the PLC

Once you have programmed your PLC program, you can download it to the PLC in order to try it out. But before you download the program, do the following:

1. Set the PLC type
2. Set the compiler options, e.g. address ranges
3. Compile the project
4. Etc.

In this chapter, you will learn how to proceed step by step.

9.2 PLC Type

Online → **PLC Type** enables you to select the PLC type. Please note that you can only change the PLC type in offline Mode.

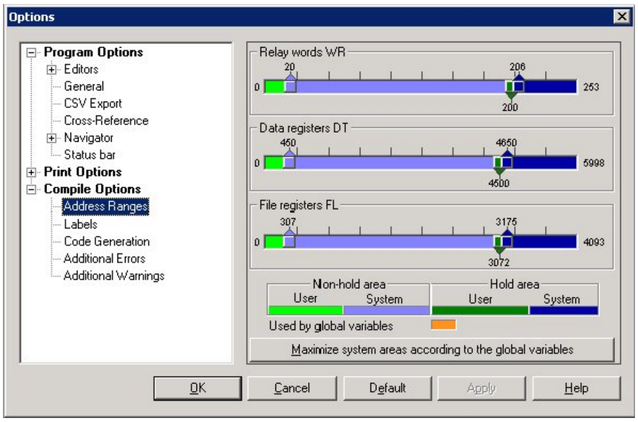
◆ NOTES

- **When you select [Default], the compile options are reset to the default values. Variables from the list of global variables that were in the hold area might now be in the non-hold area. For this reason, you should adapt the compiler options and hold/non-hold areas after changing the PLC. Under** Extras → Options → Compile Options → Code Generation**, you can set the compiler to retain these variables.**
- **Furthermore, all system registers are reinitialized and the default values are loaded when you change the PLC type.**

9.3 Address Ranges

The compiler must designate a memory area to each variable which has not been directly assigned to a physical address.

With Extras → Options → Compile Options → Address Ranges you can define the memory areas which are hold or non-hold and for these you can define the memory areas which are reserved for the system (compiler) and for the user. Adjust the memory areas by moving the sliders or by double-clicking on the sliders.



Relay words WR: 0, 20, 206, 200, 253

Data registers DT: 0, 450, 4650, 4500, 5998

File registers FL: 0, 307, 3175, 3072, 4093

The memory areas include:

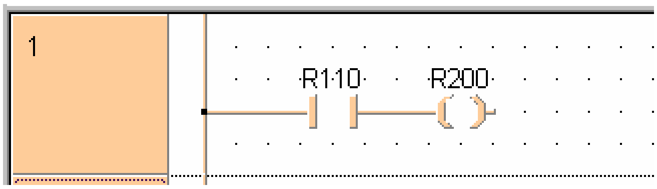
- Relay words (WR),
- Data registers (DT) and
- File (FL) registers (depending on the PLC type used).

With **[Maximize system areas according to the global variables]**, you provide maximum address areas to the system (compiler) automatically.The user area (area which is defined by variables entered by the user) is restricted to the areas which were allocated by global variables with explicit addresses.

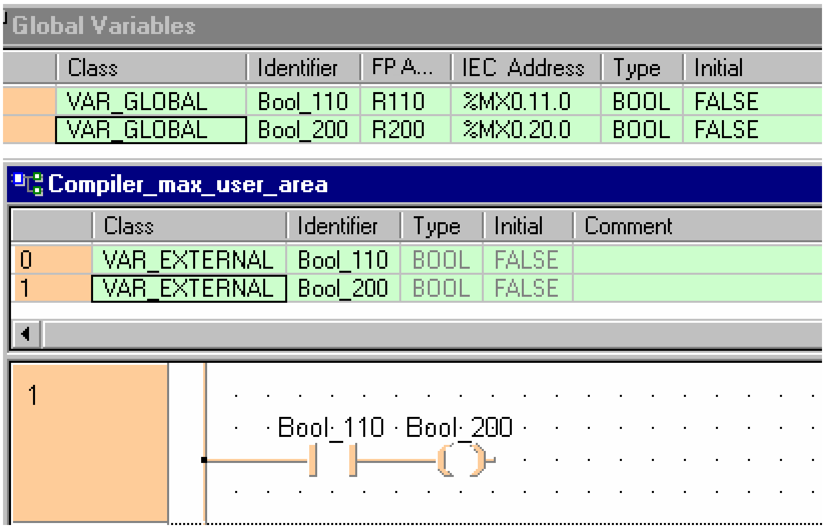
◆ **NOTE**

Do not use explicit addresses in the editor's bodies, because they will be unaccounted for if the you have pressed [Maximize system areas according to the global variables]**.**

For example, if you use R110 and R200 directly in the body, WR11 and WR20 would not be taken into consideration.



WR11 and WR20 are taken into consideration when you use global variables with explicit addresses as shown in the following example:



Global Variables

	Class	Identifier	FP A...	IEC Address	Type	Initial
	VAR_GLOBAL	Bool_110	R110	%MX0.11.0	BOOL	FALSE
	VAR_GLOBAL	Bool_200	R200	%MX0.20.0	BOOL	FALSE

Compiler_max_user_area

	Class	Identifier	Type	Initial	Comment
0	VAR_EXTERNAL	Bool_110	BOOL	FALSE	
1	VAR_EXTERNAL	Bool_200	BOOL	FALSE	

Values in the non-hold area are lost in the event of a power cut or when switching from RUN to PROG mode; values in the hold area are retained. They are not initialized until the program is downloaded to the PLC. The values in the user area are **not** initialized if you did not place a check mark in the "Retain variables in the user area are not initialized" check box in the "Options" dialog field under **Extras** → **Options** → **Compile Options** → **Code Generation**.

◆ **NOTES**

- **For FP2, FP3, FP-C and FP5 the size of the file register (FL) can be set in the Project Navigator under PLC → System Registers → Memory Size (0-3).**
- **The address from which the areas are self-holding can be set in the navigator under PLC → System Registers → Hold OnOff (5-18).**
- **When you change the compiler options, you must recompile the entire project.**
- **Each variable which did not receive an address in the global variable list is automatically assigned a memory area by the compiler.**
- **Not all memory areas apply for all PLC types (highlighted in light gray).**
- **In the global variable list addresses for all PLC inputs and outputs (X,Y) must be provided. For all internal data areas (DT, R, etc.) the addresses are automatically assigned by the compiler unless a hardware address is entered. It is recommended to have all addresses assigned by the compiler to ensure that all addresses are automatically updated when the PLC type is changed. Addresses should be designated only if it is absolutely necessary, e.g. to assign addresses for higher ranking devices (operator devices, terminals, etc.).**

The following table shows where the compiler allocates variables of a given class and data type:

Class	Data type	Memory Area
VAR, VAR_GLOBAL	BOOL	Relay words WR, non-hold
VAR_RETAIN, VAR_GLOBAL_RETAIN	BOOL	Relay words WR, hold
VAR, VAR_GLOBAL	INT, DINT, WORD, DWORD, TIME, REAL, STRING	Data register DT, File register FL, non-hold
VAR_RETAIN, VAR_GLOBAL_RETAIN	INT, DINT, WORD, DWORD, TIME, REAL, STRING	Data register DT, File register FL, hold

The compiler also automatically creates labels which are required for loops.

The number of labels for the system (compiler) can be specified using **Extras** → **Options** → **Compile Options** → **Labels**.

◆ NOTE

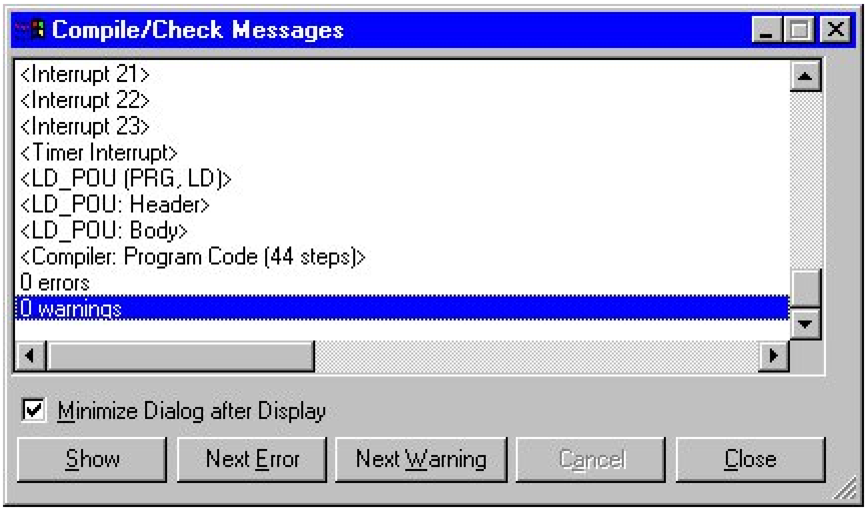
You can activate the standard settings for your compiler if you click on [Default].

9.4 Compiling a Project

Each program must be compiled before it can be downloaded. With **Project → Compile All** the entire project is compiled. During this process, each POU is once again checked for syntax errors and translated into the machine language.

◆ PROCEDURE

1. **Project → Compile All or or <Ctrl>+<Shift>+<A>**



```
<Interrupt 21>
<Interrupt 22>
<Interrupt 23>
<Timer Interrupt>
<LD_POU (PRG, LD)>
<LD_POU: Header>
<LD_POU: Body>
<Compiler: Program Code (44 steps)>
0 errors
0 warnings
```

If no errors arise while compiling, you can download the compiled project using **Online → Download Program Code and PLC Configuration**.

◆ NOTE

Only POUs of the type Program (PRG) that are entered under Tasks are compiled.

9.4.1 Compile Incrementally

All objects marked with an asterisk (*) in the project navigator have not been compiled since last being changed. **Project → Compile Incrementally** compiles these objects only.

◆ PROCEDURE

1. **Project → Compile Incrementally or or <Ctrl>+<Shift>+<I>**

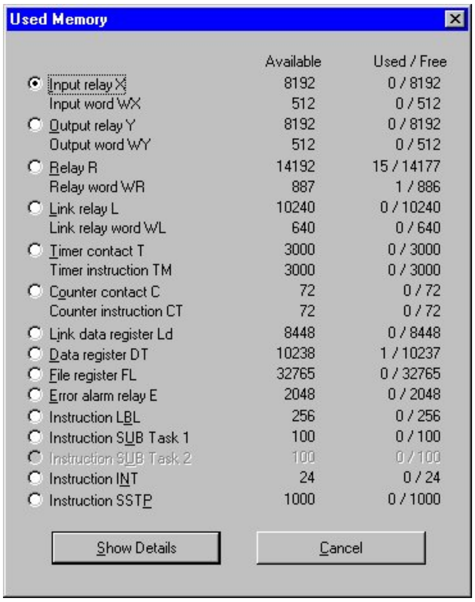
If no errors arise, you can download the compiled project using → Download Program Code and PLC Configuration.

◆ **NOTES**

- **If you use the function Compile Incrementally several times in a row the memory assignment of the PLC might be fragmented. We therefore recommend that you use the function Compile All (see page 105) in regular intervals. With Compile All any fragmented memory assignment will be restored.**
- **A POU is an incremental unit. When part of a POU is changed, the entire POU is recompiled. In order to keep the complexity of commissioning to a minimum, we would recommend distributing the whole program among as many POUs as possible (structured programming).**
- **Only the POUs of the type Program (PRG) which are entered under Tasks are compiled.**

9.5 Check Memory Area Assignment

Project → Used Memory enables you to display how much memory is available and how much of it is used.



	Available	Used / Free
● Input relay X	8192	0 / 8192
Input word WX	512	0 / 512
○ Output relay Y	8192	0 / 8192
Output word WY	512	0 / 512
○ Relay R	14192	15 / 14177
Relay word WR	887	1 / 886
○ Link relay L	10240	0 / 10240
Link relay word WL	640	0 / 640
○ Timer contact T	3000	0 / 3000
Timer instruction TM	3000	0 / 3000
○ Counter contact C	72	0 / 72
Counter instruction CT	72	0 / 72
○ Link data register Ld	8448	0 / 8448
○ Data register DT	10238	1 / 10237
○ File register FL	32765	0 / 32765
○ Error alarm relay E	2048	0 / 2048
○ Instruction LBL	256	0 / 256
○ Instruction SUB Task 1	100	0 / 100
○ Instruction SUB Task 2	100	0 / 100
○ Instruction INT	24	0 / 24
○ Instruction SSTP	1000	0 / 1000

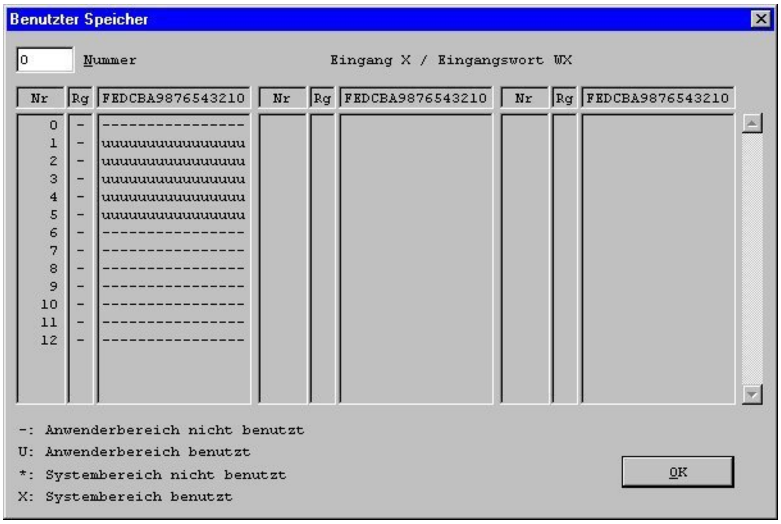
◆ **NOTES**

- **Sequential Steps (SSTP) are available in the Sequential Function Chart (SFC) only. You can obtain a display of available steps and those already used.**
- **Instruction SUB is the memory for user-defined function blocks (FB) and functions (FUN).**
- **The number of available relays and registers depends on your PLC type and PLC configuration.**

When you click **[Show Details]** you will receive a detailed description of the point you have clicked in the window shown above.

Inputs/Outputs, Relays, Link Relays, Timers, Counters, Registers, Instructions

In the top left you can enter the word address to be displayed. In the bottom part of the dialog box, the symbols are explained which show whether a relay is reserved for the user or the system and whether it is being used or not.



Benutzter Speicher

0 Nummer

Eingang X / Eingangswort WX

Nr	Rg	FEDCBA9876543210	Nr	Rg	FEDCBA9876543210	Nr	Rg	FEDCBA9876543210
0	-	----------------						
1	-	uuuuuuuuuuuuuuuu						
2	-	uuuuuuuuuuuuuuuu						
3	-	uuuuuuuuuuuuuuuu						
4	-	uuuuuuuuuuuuuuuu						
5	-	uuuuuuuuuuuuuuuu						
6	-	----------------						
7	-	----------------						
8	-	----------------						
9	-	----------------						
10	-	----------------						
11	-	----------------						
12	-	----------------						

-: Anwenderbereich nicht benutzt
U: Anwenderbereich benutzt
*: Systembereich nicht benutzt
X: Systembereich benutzt

Memory areas for inputs/outputs, relays and link relays

The display differs depending on which memory type you have clicked under “Used Memory”.

9.6 Communication Parameters

Check the communication parameters before downloading a program. FPWIN Pro can communicate with your PLC directly via:

- RS232C
- Modem
- Ethernet

You can also connect to a PLC network. The settings to be made depend on the PLC type and on the kind of connection. FPWIN Pro automatically searches for the suitable parameters, unless you have deactivated this feature. Please also refer to the corresponding hardware manuals.

Select **Online** → **Communication Parameters**, choose the network type and proceed logically.

Note the following when using a modem connection:

◆ NOTES

- **To connect directly to the modem from the "Communication Setting" dialog box, click [Connect]. Please note that in this case, the modem is** NOT **disconnected with Online → Online Mode or .**
  To disconnect the modem you must go offline and then click [Disconnect] in the "Communication Setting" dialog box.
- **Add "Modem connect" to the status bar (see page 12) of FPWIN Pro to monitor your modem connection.**

Note the following when using a Ethernet connection:

◆ REFERENCE

When using an ET-LAN unit, make sure you have read the "ET-LAN SYSTEM Technical Manual" before setting the communication parameters.

9.6.1 PLC Network Connection

The parameters for a connection to a PLC network such as MEWNET-H, MEWNET-P, MEWNET-W, or C-NET are set in the "Network Setting" dialog box. You need to specify which one of the PLCs on the network you want to access from the computer. You can also access a PLC on a multi-layer network.

Select **Online** → **Network Parameters** and proceed logically.

9.7 Online Mode

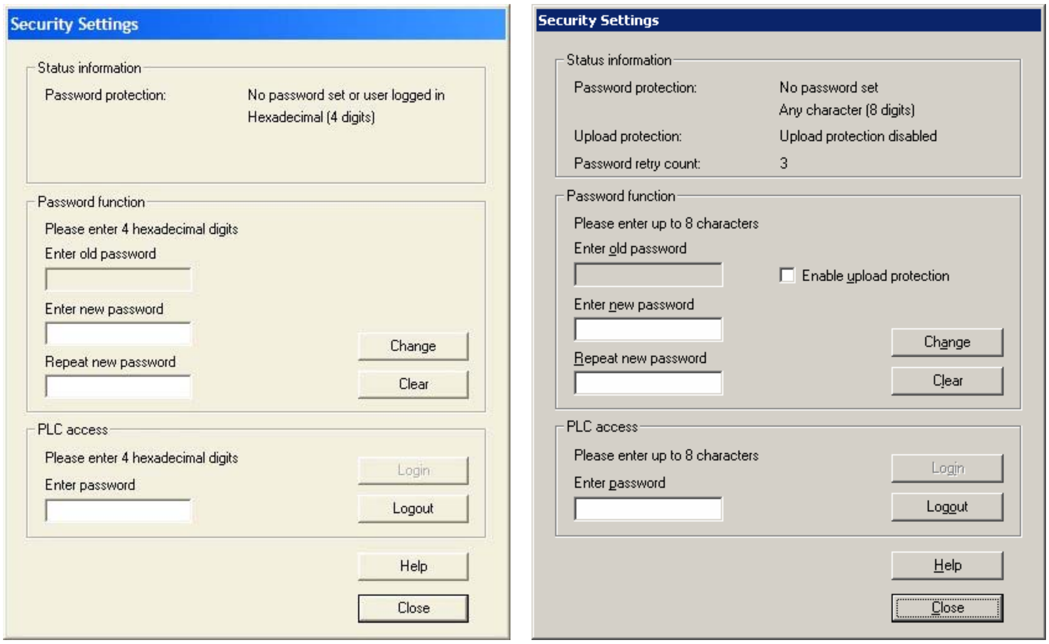
With **Online** → **Online Mode** or **<Shift>** + **<Esc>** or 🔌, you can switch between online and offline mode. The status line (see page 12) indicates whether online or offline mode is switched on (if status was set up correctly). The symbol 🔌 is highlighted if you are online.

As soon as you change from offline mode to online mode, the software checks whether the PLC type set in the project is the same as the PLC connected. If this is not the case, you will be requested to adopt the PLC type connected. If you cancel this procedure, Control FPWIN Pro remains in offline mode.

If you update the PLC, you also have to adjust the PLC configuration. Otherwise FPWIN Pro will not switch into online mode, but will rather ask you to configure your PLC accordingly.

9.8 Security Settings

Online → Security Settings displays the current security settings and enables you to protect the access to the PLC. Depending on the PLC type, password protection and PLC program upload protection can be set.



Security Settings

Status information

Password protection: No password set or user logged in
Hexadecimal (4 digits)

Password function

Please enter 4 hexadecimal digits

Enter old password

Enter new password

Repeat new password

PLC access

Please enter 4 hexadecimal digits

Enter password

Security Settings

Status information

Password protection: No password set
Any character (8 digits)

Upload protection: Upload protection disabled

Password retry count: 3

Password function

Please enter up to 8 characters

Enter old password

Enter new password

Repeat new password

□ Enable upload protection

PLC access

Please enter up to 8 characters

Enter password

Security settings dialogs for PLCs (upload protection dialog on the right, e.g. for FP-X)

Status information

The status information shows the accessibility condition of the PLC as either password protected or accessible.

Password retry count (for FP-X only)

The password retry count displays how many tries you have to enter the correct password. If you enter an incorrect password 3 times in a row, you have to switch the PLC power OFF and ON again. Then you get 3 new tries to enter the correct password.

Upload protection (for FP-X only)

If the current PLC type offers upload protection functionality (e.g. FP-X), the check box “Enable upload protection” enables or disables the upload protection. If activated, no uploads can be made from the PLC.

◆ **NOTE**

Once upload protection has been activated, the complete program code, comments and password settings will be erased if the function is turned off.

Password function

Here you can set a new password or change an existing one.

If you have forgotten the password and you are not logged in, when you press [Clear] not only the password is deleted but also the program and other parameters in the PLC.
ATTENTION! The procedure may take a very long time.

Set password

Enter a new password in the “Enter new password” field and again in the “Repeat new password” field. Click [Change] to set the password.

Change password

To change the password, enter a new password in the field “Enter new password” as described above. To change the existing password, the user must be logged onto the PLC (see below) or must specify the old password in the field “Enter old password”. Click [Change] to change the password.

Clear password

To delete the existing password, press [Clear] or change the password (see above) to an empty password.

PLC access

In this section you can log onto or log off the PLC.

Login

To log onto the PLC, enter the current password in the field “Enter password” and click [Login]. The section “Status” now shows the new password state.

Logout

If a password is set and the user is already logged onto the PLC, the PLC can be protected by clicking [Logout]. In this case, neither uploading nor downloading is possible.

9.9 Downloading a Project

Once you have created and compiled your program, you can download it.

PROCEDURE

1. **If RUN mode is active: Online → Change PLC Mode to PROG mode**

   Click RUN to switch between PROG mode and RUN mode.

2. **Online → Download Program Code and PLC Configuration or**

3. **Online → Change PLC Mode to RUN mode**

NOTE

If your PLC supports the configuration memory option (see hardware manual), you can download not only the program code, but the entire project via Online → Save Project in the PLC**. Project information includes the contents of all editors, the PLC configuration, the compiler options and the content of the user libraries.**

The following PLCs support this configuration memory option:

PLC	Card necessary?	Type of card
FP SIGMA	no	
FP2	yes	Expansion Memory Unit: FP2-EM1, FP2-EM2 or FP2-EM3
FP2SH	no	
FP10SH	yes	ROM Operation Board: AFP6208

9.9.1 Downloading Changes in Run Mode

Attention!

When downloading changes with connected periphery, programming errors may present a danger for both users and machinery.

You can download small program changes into the controller in the online mode without having to switch to PROG mode, with the following restrictions:

- The variables in the global variable list, the DUT and the POU Headers may not have been edited, added to, or deleted.
- Only a program or function may have been changed. Function blocks cannot be changed online.
- A program can be added, but not removed.
- The PLC configuration may not have been changed.
- If the PLC remains in RUN mode, only an instruction may be changed or inserted.

PROCEDURE

1. **Set offline mode**
2. **Make program change**
3. **Set online mode**
4. **Online → Download Program Code Changes or**

   The program is compiled and then downloaded. After a successful change, you will receive a message to this effect.

NOTES

- **In the case of FP1 and FP-M prior to Version 3.0, Online → Download Program Code Changes is only available in PROG mode; for all other PLC types, this command is available in both PROG and RUN mode.**
- **Make small changes or spread out the changes in small bits, since only small contiguous program packages can be downloaded to the PLC while in RUN mode (max. 128 steps compiled, contiguous code; for the FP-X: 512 steps).**
- **The FP-X offers the possibility to download the complete program code in run mode if the size of code changes exceeds 512 steps.**
- **The offline PLC configuration must be the same as the online configuration. If this is not the case, you will receive an error message.**

9.9.2 Program Changes in Run Mode while Online

Attention!

When downloading changes with connected periphery, programming errors may present a danger for both users and machinery.

With **Online** → **Online Edit Mode** or you change the mode so that you can make changes in the body of your PLC program. In order to do this, the correct project opened in the project Navigator has to be loaded on the PLC (**Online** → **Download Program Code and PLC Configuration**). After you have made the desired changes, select **Online** → **Download Program Code Changes** (see page 113) or click .

◆ NOTES

- **With the PLC types FP1 and FP-M, you can only make changes in Online programs while in PROG mode. With all other PLC types, you can do this in PROG or RUN mode.**
- **Make small changes or spread out the changes in small bits, since only small contiguous program packages can be downloaded to the PLC while in Online mode (max. 128 steps compiled contiguous code; for the FP-X: 512 steps).**
- **The FP-X offers the possibility to download the complete program code in run mode if the size of code changes exceeds 512 steps.**
- **New variables cannot be declared in Online mode. In this case, define a dummy variable while in Offline mode. You can use this to enter addresses directly into the body at any time.**

◆ PROCEDURE

1. **Online → Online Mode or**
2. **Open the body of the program you wish to change**

   The program has to already be loaded on the PLC.
3. **Online → Online Edit Mode or**
4. **Make changes in the body**
5. **Online → Download Program Code Changes or click**

   Changes are automatically compiled and downloaded to the PLC.

9.9.3 Upload Program Code and PLC Configuration

Use this option only in an emergency if you no longer have a source program available. The program is displayed on screen in the basic instruction set and not **in your IL, ST, LD, FBD or SFC program. The entire program's documentation (e.g. variable names) is lost when uploaded from the PLC.**

FPWIN Pro offers two options:

- upload the program code and the PLC configuration
- upload the program code and the PLC configuration and create an FPWIN Pro project.

Upload Program Code

You can upload your program from the PLC into a project, view it on the screen, or change it. However, only compiled Masushita code can be uploaded, which are then placed under "Program Code" in the project navigator. You can observe the uploaded program in monitor mode and check it for errors, if necessary.

In any case, save the program, e.g. on external disk, **before** changing it with **Object** → **Export Program Code**. In an emergency, you can fall back on the untouched program.

Upload Program Code and Create PLC Program

An FPWIN Pro project will be created and the program code will be uploaded and converted into an LD program (see also import of FPWIN GR files). So you can change programs that are not created with FPWIN Pro or that do not contain any project information.

Use these possibilities only in an emergency, e.g. in case the source program has been deleted by accident.

◆ NOTE

If you want to upload an entire project from the PLC to the PC, use the command Project → Open Project from the PLC. However, only certain PLCs can utilize this command.

◆ PROCEDURE

1. **Create or open project**
2. **Online → Online mode or**
3. **Online → Upload Program Code and PLC Configuration or**

4. **Double-click "Program Code" in the project navigator**

If you are familiar with the Program Code Editor (see page 21), you can monitor and debug the uploaded program. Then it can be compiled and downloaded to the PLC.

The modified program must be checked, compiled and transferred into the PLC using **Object** → **Download Program Code and PLC Configuration**.

◆ PROCEDURE

1. **Online → Online mode or**
2. **Open Program Code Editor (double-click on "Program Code" in the project navigator)**
3. **Object → Download Program Code and PLC Configuration or**

   Program code is downloaded to the PLC.

9.9.4 Clear Program and Reset System Registers

With **Online** → **Clear Program and Reset System Registers**, you erase the current program in the PLC and return the PLC's system registers to their original, factory default settings.

◆ NOTES

- **It is not necessary to erase an old program before writing a new program in the PLC.**
- **The factory settings of the PLC differ from the standard settings of the system registers in FPWIN Pro.**

The PLC's program and system register settings are overwritten by those of the FPWIN Pro Program.

9.9.5 Verify Program Code and Systemregister

Online → **Verify Program Code and Systemregisters** enables you to compare the project on your PC with the one in the PLC. The program is uploaded from the PLC to the PC and compared with the **compiled** project in the PC byte for byte. You receive notification of the result in a screen message.

9.9.6 PLC Configuration

With **Online** → **PLC Configuration** you can load the PLC configuration (system registers, I/O addresses, remote I/O addresses) from the PLC to your PC (upload I/O maps or system registers from PLC) or vice-versa (download I/O maps to the PLC). You can also reset the PLC configuration with FPWIN Pro to their default settings (**Defaults** –> **Project**).

◆ **NOTE**

In order to load the PLC configuration, you must be in online mode.

9.9.7 Change PLC Mode

Online → Change PLC Mode or RUN enables you to switch back and forth between the RUN and PROG PLC modes if the PLC operating type selection switch is at REMOTE. In PROG mode, you can download the program into the PLC memory; in RUN mode, the program is run in the PLC.

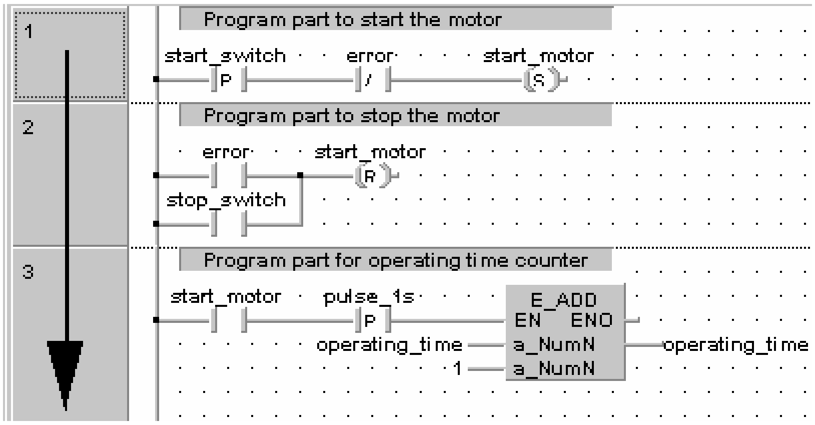
If you added the field "online mode" to the status bar (see page 12) you also can double-click this field to switch between the two modes.

9.10 How the Compiler Works

The following sections provide information as to the order in which the compiler processes networks and how program elements, jumps, variables and functions are dealt with. This information can help you to avoid programming errors.

9.10.1 Priority when Processing Networks in a POU

If you have programmed **several networks** in a POU (instruction list, ladder diagram, function block diagram), they will be processed one by one **from top to bottom** as illustrated below:



Network processing order

If the status of an input or output changes within a PLC cycle at a position which has already been executed, this status modification will only be detected during the following cycle.

The execution of commands within a network **from left to right** has 1st priority, **from the top to the bottom** 2nd priority.

The next section provides information as to the order in which the compiler evaluates and processes the elements within a network programmed with ladder diagram or function block diagram.

9.10.2 Processing Order in LD and FBD Networks

When processing networks in the LD or FBD editor, the following evaluation order applies:

1. The compiler starts at the top left at the power rail. If the elements are directly connected to the power rail, the current is conducted through all of these elements. If there are no directly connected elements, the compiler starts with all inputs. Control FPWIN Pro deals with inputs as though they were ready for processing.
2. Then the compiler looks for the element at the highest level which it can evaluate. If there are two elements on the same level (line), it processes the left element first. If the element is an output or the cue for a function or function block, the compiler creates the corresponding code. Temporary variables can be inserted from the compiler in order to buffer the signal or stack it.

3. In the case of the element from the second step (interim result), the compiler conducts the output current to all elements directly connected to it. Then it evaluates the next element. Finally, it returns to the second step until all elements are evaluated or no element is available for the evaluation.
4. The processing procedure is interrupted or ended.

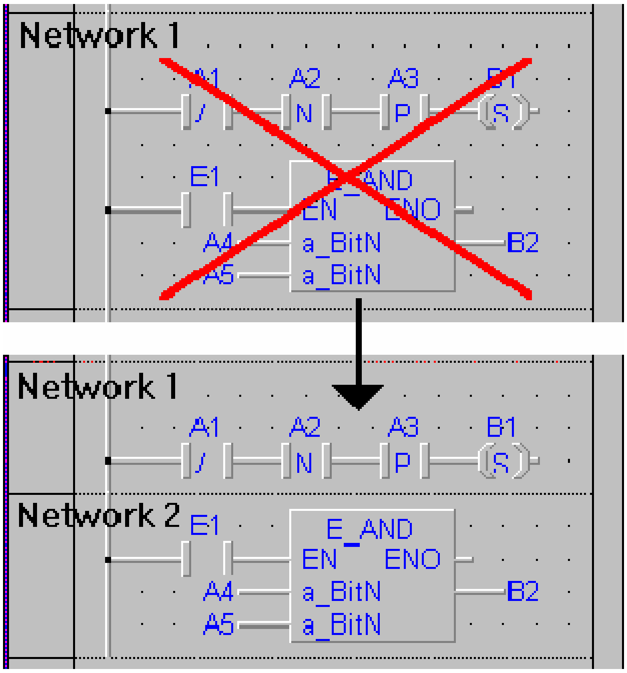
You will find program examples for the processing order in FPWIN Pro in the online help (keyword “Processing Order in LD and FBD Networks”).

9.10.3 Subdividing Networks

We recommend placing each program string in its own network. This has the following advantages:

- Networks are small and easy to see
- You can find errors faster, e.g. by deactivating networks (see page 73)
- Unintentional use of "late assignment (see page 121)" when accessing variables is avoided.

The top part of the illustration contains two strings in a network. When compiling or checking, you will receive a warning message in such a case.



Practical subdivision of networks

However FPWIN Pro deals with Network 1 the same way as the two strings arranged behind each other, as illustrated in the bottom part of the diagram.

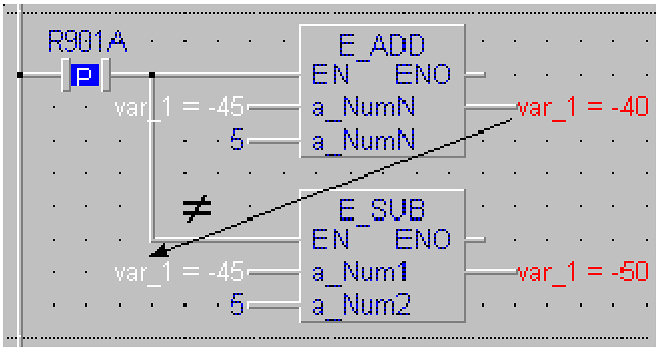
9.10.4 Managing Variables in the Compiler

If the value of a variable or address is read within a network, the compiler always uses the value which the variable or address had when the compiler started processing the network.

Please note that unintentional programming errors often arise when the value of a variable or an address is changed and then read.

Example 1:

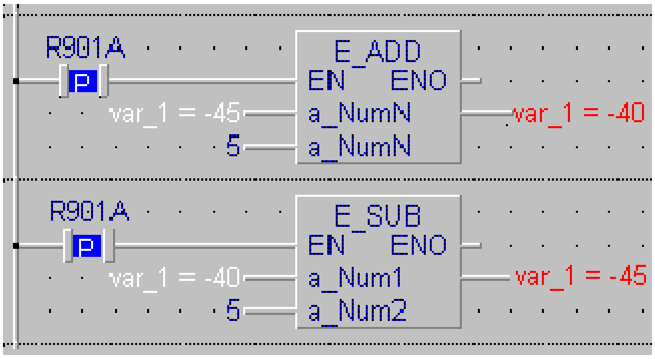
The value of **var_1** is changed from -45 to -40. But in the **var_1** variable of the E_SUB function, the value -45 is used which the variable had when the compiler entered the network This is termed a “late assignment”.



The result after processing the network: **var_1** = -50. This is as a result of temporary variables which are introduced internally in the Control FPWIN Pro program code. At the end of a network and before each jump, the variables are assigned the values of these temporary variables.

Example 2:

Here the program is divided among two networks. The result from network 1 for **var_1 = -40** is used by E_SUB in network 2. The value after processing in network 2 is **var_1** = -45



9.10.5 Managing Jumps in the Compiler

Regardless of where you position a jump in the network, it will only be executed at the end of the network.

9.10.6 Managing FUN/FB in the Compiler

In managing functions (FUN) and function blocks (FB), Control FPWIN Pro distinguishes between those which are already implemented (Basic FP and IEC) and those which are user-defined. For user-defined function blocks, you can activate the option “Indexed function block instances” under **Extras** → **Options** → **Compile Options** → **Code Generation** for some controllers and with which program code can be saved, particularly when these function blocks are used frequently, but which also increases the PLC cycle time.

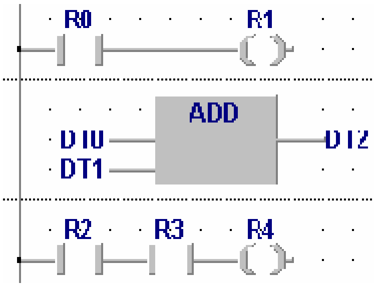
9.10.7 Implemented FUN/FB

The implemented functions (FUN) and function blocks (FB) include IEC operators, functions and function blocks from the **IEC Standard Library** and **FP Tool Library**, as well as the F and P commands from the **FP Library** and **FP Pulsed Library**. For these, the compiler creates an inline code, i.e. the instructions (assembler code) of the respective function are integrated and executed directly at the cue point.

In the following example, we have used FP addresses in order to facilitate verification of the assembler code created from them. As the program becomes more complicated when FP addresses are used, we recommend using variables with meaningful names.

◆ **EXAMPLE**

The IEC operator ADD is loaded in the ladder diagram:



The following assembler code is created for the PLC:

```
ST     R0

OT     R1

ST     R9010

F22          (*PLUS_S*)
```

```
      DT0
      DT1
      DT2                 if (TRUE) DT2=DT0+DT1
ST    R2
AND   R3
OT    R4
```

9.10.8 User-Defined Functions

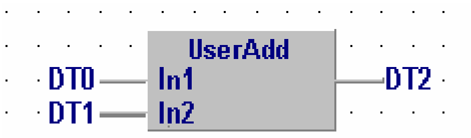
For the functions (see page 36) created by the user in the project or user library, a subprogram is created in the compiled program. Each time it is loaded, the input parameters of the classes VAR_INPUT and VAR_IN_OUT are transferred first. Then the corresponding subprogram is jumped into. Finally the output parameters of the classes VAR_OUTPUT and VAR_IN_OUT are read again. The number of subprograms or functions you may define depends on the type of controller.

For a user-defined function, only one subprogram is created. It can then be loaded from various points.

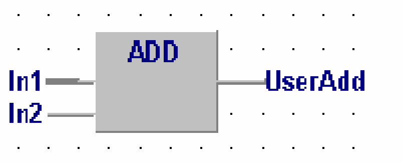
In the following example, we have used FP addresses in order to facilitate verification of the assembler code created from them. Because the program becomes more complicated when FP addresses are used, we recommend using variables with meaningful names for normal use.

◆ **EXAMPLE**

The user-defined function UserAdd is loaded in the ladder diagram:



It has the following contents:



For the PLC, the following assembler code is created:

```
ST          R9010                      Transfer input parameters
F0                     (*MV*)          R9010 always = TRUE
            DT0                        DT0 -> UserAdd.In1
```

```
           DT550
F0                   (*MV*)
           DT1                   DT1 -> UserAdd.In2
           DT551
CALL       0                     UserAdd subprogram cue
ST         R9010                 Reload output parameters
F0                   (*MV*)
           DT552
           DT2                   UserAdd -> DT2
...
ED                               End of the main program
SUB        0                     UserAdd subprogram
ST         R9010
F22                  (*PLUS_S*)
           DT550
           DT551
           DT552                 if (TRUE)
                                 UserAdd=UserAdd.In1 + UserAdd.In2
RET                              backward jump to main program
```

9.10.9 User-Defined Function Blocks, FB Indexing

For the functions created by the user in the project or user library, a subprogram is created in the compiled program. Each time it is loaded, the input parameters of the classes VAR_INPUT and VAR_IN_OUT are transferred first. Then the corresponding subprogram is jumped into. Finally the output parameters of the classes VAR_OUTPUT and VAR_IN_OUT are read again. The number of subprograms or function blocks you may define depends on the type of controller.

Function blocks are equipped with a “memory”, i.e. each entity of this function block is assigned a data area and a subprogram when loaded. With some controllers, you can activate the option “Indexed function block instances” under **Extras** → **Options** → **Compile Options** → **Code Generation**. All entities of a function block then use the same subprogram. Via the index register, the data area valid for the respective entity is accessed.

This implementation helps save a lot of useful space in the program memory, especially when the same user-defined function blocks are frequently used. However, accessing the data areas via index registers may prolong the cycle time.

◆ NOTE

- **With FB indexing, some basic functions do not work correctly when they are called up several times within a cycle. You will receive an error message with the following commands:**

  - Counters: F118, F166, F167, F168

  - Shift instructions: SR, F119

9.10.9.1 Function Block Instances in Holding Areas

Instances of function blocks can be assigned to holding areas, i.e. all conditions for the function block's variables remain intact after a power failure. In this case, the variables have to be entered under the class VAR_RETAIN or VAR_EXTERNAL_RETAIN in the POU header. For VAR_EXTERNAL_RETAIN, the FB instance must have been declared in the global variable list as VAR_GLOBAL_RETAIN.

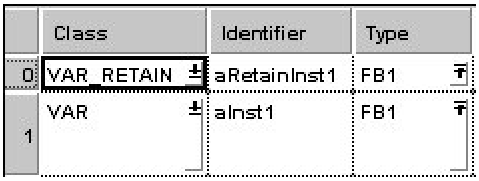
If the class VAR_RETAIN or VAR_EXTERNAL_RETAIN is used for the instance, the compiler assigns addresses from the holding area to the non-holding variables of the classes VAR, VAR_INPUT, VAR_OUTPUT or VAR_IN_OUT, which are only initialized after downloading the program. Sub-instances of the class VAR are treated like sub-instances of the class VAR_RETAIN. The adresses for other variables or sub-instances of the classes VAR_RETAIN, VAR_OUTPUT_RETAIN, VAR_EXTERNAL, or VAR_EXTERNAL_RETAIN are assigned as for instances of the class VAR or VAR_EXTERNAL. The values of the variables of the classes VAR_CONSTANT and VAR_EXTERNAL_CONSTANT are entered as constant values in the program code.

If the class VAR or VAR_EXTERNAL is used for an instance, the declaration of the variables or sub-instances in the function block determines whether they are holding (VAR_RETAIN) or not (VAR).

◆ EXAMPLE

POU Header for the Program 'Prog'

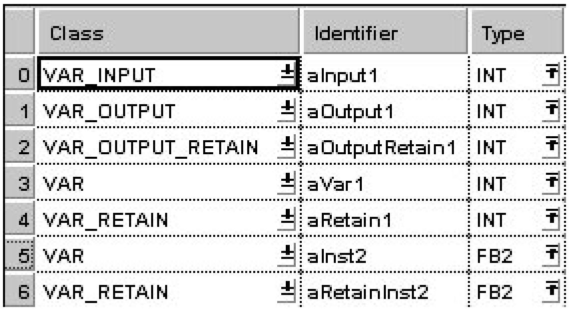
A program 'Prog' accesses the function block 'FB1' twice:



	Class	Identifier	Type
0	VAR_RETAIN	aRetainInst1	FB1
1	VAR	aInst1	FB1

POU Header of the function block 'FB1'

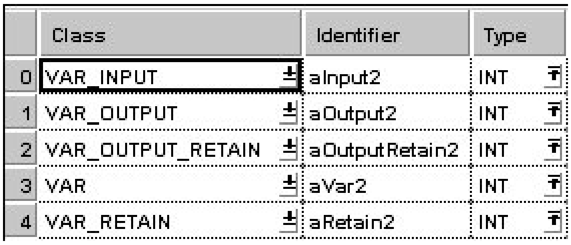
The POU Header of the function block 'FB1' has the following entries. Function block 'FB1' also draws upon two instances of function block 'FB2'.



	Class	Identifier	Type
0	VAR_INPUT	aInput1	INT
1	VAR_OUTPUT	aOutput1	INT
2	VAR_OUTPUT_RETAIN	aOutputRetain1	INT
3	VAR	aVar1	INT
4	VAR_RETAIN	aRetain1	INT
5	VAR	aInst2	FB2
6	VAR_RETAIN	aRetainInst2	FB2

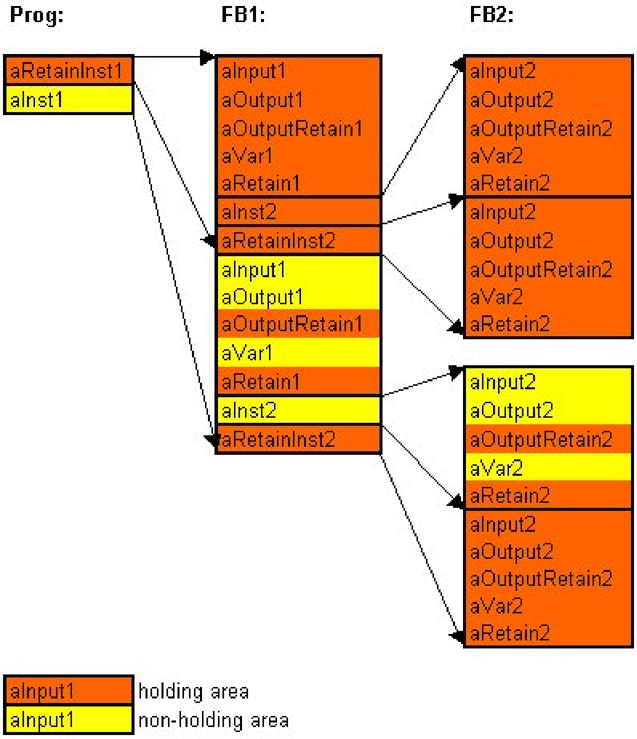
POU Header of the function block ‘FB2’

The POU Header of the function block ‘FB2’ has the following entries.



	Class	Identifier	Type
0	VAR_INPUT	aInput2	INT
1	VAR_OUTPUT	aOutput2	INT
2	VAR_OUTPUT_RETAIN	aOutputRetain2	INT
3	VAR	aVar2	INT
4	VAR_RETAIN	aRetain2	INT

Memory distribution for the Program 'Prog':



9.10.10 Processing Interrupt Programs

Interrupt programs interrupt the processing of the main program’s programs in the task list “Programs”.

◆ **NOTES**

- **If several interrupt requests occur simultaneously, they are executed in the order of priority from the lowest to the highest number.**
- **If further interrupt requests occur while an interrupt program is being processed, the interrupt program with the highest priority, i.e. with the smallest number, will be processed after the interrupt program being processed is finished. In other words, interrupt programs cannot interact with each other.**

9.10.10.1 Protecting the Index Registers in Interrupt Programs

The compiler's job is to ensure that index registers that are used in interrupt programs, functions or function blocks are not overwritten. For this reason the following code is generated for PLCs (index register in interrupt: program code, programmer's comments on the right):

PLCs with index register banks (FP2SH and FP10SH)

```
INT0
ST R9010
F411_CHGB K1      Index register bank set to 1

ST R9010
F0_MV DT458, I5   Actual program code
F0_MV K5, I5DT455

ST R9010
F412_POPB         Index register band reset
```

PLCs without index register banks

```
INT 0
ST R9010
F0_MV I5, DT461   Protecting the current content

ST R9010
F0_MV DT458, I5   Actual program code
F0_MV K5, I5DT455

ST R9010
F0_MV DT461, I5   Rewriting the current content
IRET
```

Chapter 10

Debugging

10.1 Introduction to Debugging

When you change your program and wish to download these changes with connected periphery, programming errors may present a danger for both users and machinery.

With Panasonic controllers (except FP-e, FP-Sigma, FP0, FP-X, FP1, and FP-M), you can process your program step by step in TEST mode. The controllers must be in test run mode. Switch your PLC's mode selection switch to TEST (see hardware description), the operating type selection switch to REMOTE and, if necessary, enter RUN mode using **Online** → **Change PLC Mode**.

When debugging, you can select between step mode and breakpoint mode. The next sections describe how to proceed.

◆ NOTE

When debugging, you can simulate the program flow (i.e. you have not connected any outputs) or you can activate the outputs using Debug → Test Flags → Output Enable**. The PLC must be in test prog mode for this.**

10.2 Step Mode

If you choose the step mode to test your program you can observe the effect of each individual step on the registers, and, if applicable, find possible errors. From a function block or a user-defined function you may branch to the subroutine and process it step by step.

Depending on the programming language, step mode is executed as follows:

IL: A command line is processed.

ST: A command line is processed.

LD: A network is processed.

FBD: A network is processed.

SFC: A selected program step is processed.

◆ **NOTE**

The POUs entered in the task are loaded automatically and processed in step mode.

In the procedure, we assume that you have already downloaded your project into the PLC.

◆ **PROCEDURE**

1. **Set PLC into PROG Mode**
2. **Debug → Test Flags → Step Mode**
3. **Switch mode selection switch to TEST**
4. **Online → Change PLC Mode (Test run mode) or** •RUN
5. **Debug → Step Into or <F11> or**

   If you diverge into the sub-program after reaching a function block or a user-defined function and wish to process it in steps. When the end of the FB/FUN is reached, the loaded program is continued.
6. **Debug → Step Over or <F10> or**

   If the PLC is to process the FB or FUN but not yet in step mode. Always use step mode when you are sure that the FB or FUN is okay.
7. **Continue step mode with <F11> or <F10>**

10.3 Breakpoint Mode

When you change your program and wish to download these changes with connected periphery, programming errors may present a danger for both users and machinery.

With Control FPWIN Pro you can set several breakpoints in your program and then process the program from one breakpoint to another. The PLC must be in test mode.

◆ NOTES

- **Specify the colors for set and active breakpoints using** Extras → Options → Program Options → Editors → Format**. Select an editor and open the "Format" menu. Choose a color for set and active breakpoints.**
- **The POUs entered in the task are loaded automatically and processed from breakpoint to breakpoint.**

In the procedure, we assume that you have already downloaded your project into the PLC.

Inserting a breakpoint and testing the program

◆ PROCEDURE

1. **Switch PLC to Prog mode**
2. **Debug → Test Flags → Break Valid**
3. **Select line in IL/ST or network in LD/FBD**
4. **Debug → Insert/Remove Breakpoint or** ✋

   The line at which the breakpoint was set is highlighted in the default breakpoint color.
5. **Repeat the last two steps until all of the breakpoints are set**
6. **Online → Change PLC Mode (RUN mode) or** RUN
7. **Debug → Continue or <F5>**

   <F5> enables you to process the program from one breakpoint to another.

Removing a breakpoint

1. **Switch PLC to Prog mode**
2. **Select breakpoint**

3. **Debug → Insert/Remove Breakpoint or** ✋

   The line is no longer highlighted.

With **Debug → Breakpoints** you can view the breakpoints set in the current project, insert or erase breakpoints.

Use **Debug → Test Flags → Output Enable** to send the results of the links to the outputs. Please ensure that the control for these settings must be in TEST PROG mode.

10.4 Breakpoints

With **Debug → Breakpoints or** ✋ you can view the breakpoints set in the current project, or insert or erase them.

The fields in the dialog box mean the following:

Task
no function

Call Path (POU)
Breakpoint in programs:
Enter program name

Breakpoint in functions:
Enter function name

Breakpoint in function blocks:
Program name, function block instance name
e.g. p**rogram name.FB instance name 1.FB instance name 2**
if a function block has to access another function block:

Editor Position
Enter Network number. The first network has the number 1.

Break condition
no function

Number of Passes
no function

Breakpoints
Shows the current breakpoints that are set.

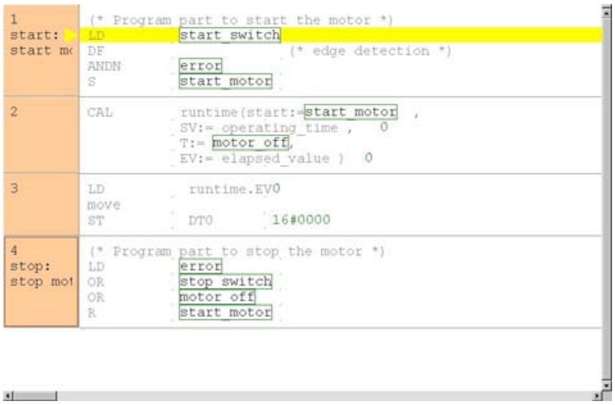
10.4.1 Breakpoints in the IL/ST Editor

You can set a breakpoint in any program line as long as your IL/ST program was correctly compiled and downloaded to the PLC.

☞ ◆ **NOTE**

Please note that due to the code optimization of the compilers, it is not possible to set breakpoints in some IL/ST lines.

In the following illustration, the breakpoint is in the first network, 2nd line.



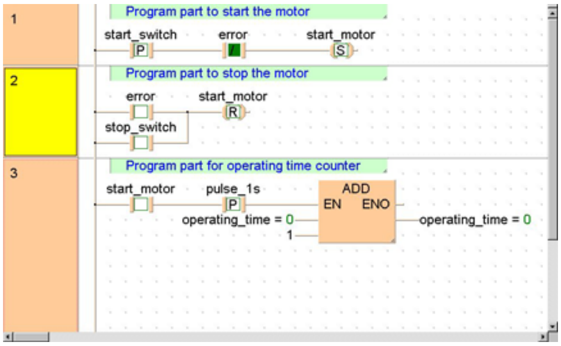
```
1          (* Program part to start the motor *)
start:     LD        start_switch
start mo   DF                   (* edge detection *)
           ANDN      error
           S         start_motor

2          CAL       runtime(start:=start_motor ,
                     SV:= operating_time ,   0
                     T:= motor_off,
                     EV:= elapsed_value )   0

3          LD         runtime.EV0
           move
           ST         DT0        16#0000

4          (* Program part to stop the motor *)
stop:      LD        error
stop mot   OR        stop_switch
           OR        motor_off
           R         start_motor
```

Breakpoint in an IL

10.4.2 Breakpoints in the LD Editor

You can insert as many breakpoints in the ladder diagram editor as you wish.

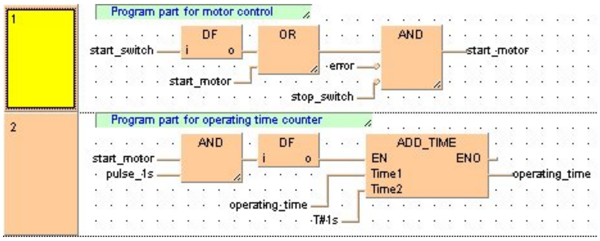
In the following illustration, the breakpoint was set in the second network and highlighted in the breakpoint color.



Breakpoint in a LD

10.4.3 Breakpoints in the FBD Editor

You can insert as many breakpoints in the function block diagram editor as you wish.

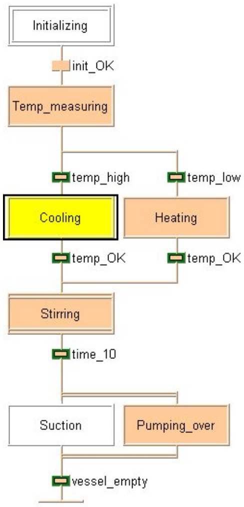


Breakpoint in a FBD

In the above illustration a breakpoint is set in the first network and is highlighted in the breakpoint color in the network info area.

10.4.4 Breakpoints in the SFC Editor

A breakpoint can be set on a step within an SFC program which has been successfully compiled and downloaded.



Breakpoint in a SFC

In the above illustration a breakpoint was set on the first step after the initializing step (color background).

In the SFC program, the breakpoint is only processed when the program has also reached this stage. If the program part in which the breakpoint was set is not processed, the breakpoint is not reached either.

Chapter 11

Monitoring

11.1 Monitoring while Online

Once you have downloaded your compiled program, there are several ways to monitor the program while it is running. In monitor mode, you can change the values of the variables, view the changes in values and even set some variable values (force).

For this purpose, you can monitor:

Item to be monitored	Icon
values	👓
the header	👓
entry values	👓
sampling traces	👓

You can also check the following statuses and assignments:

- PLC status
- link status
- network status
- statuses of special internal relays
- statuses of special data registers and the
- shared memory assignment

◆ NOTE

Monitoring can only be carried out in online mode (see page 110).

◆ REFERENCE

For details and procedures on these monitoring operations, please refer to the online help.

Chapter 12

Additional Memory

12.1 IC Card, EEPROM, EPROM

IC Card

IC Cards can be used for additional memory in several PLC types. With the IC Memory Card Manager you can format, write, read and clear IC Cards under FPWIN Pro.

FPWIN Pro supports IC Cards for SRAM and F-EEPROM. Depending of the type of IC card inserted into the PLC, certain functions (e.g. formatting) are locked out in the IC Card Manager dialog box.

EEPROM

A program can be exchanged directly between the RAM of a Matsushita PLC and an EEPROM (plug-in EEPROM or EEPROM card available as an option, depending on the PLC type used).

EPROM

A compiled program can be saved on a hard drive or a floppy disk in FP Hex format, in Motorola Hex format or in Intel Hex format and loaded in an EPROM using EPROM software.

Using EPROM software, the Motorola Hex and Intel Hex formats can be loaded in an EPROM which can be plugged into the PLC as a program memory facility.

With the exception of FP0 (10k), FP-Σ, FP-M (0.9k), FP1 C14 (0.9k) and FP10/FP10S, all Panasonic PLC types can use an EPROM for saving programs.

◆ NOTE

When plugging in an EPROM, ensure that the PLC write-protect switch is at “Access enabled” (see hardware description) and the EPROM card is not write-protected when writing.

Chapter 13

Exporting and Importing

13.1 Introduction to Exporting and Importing

Control FPWIN Pro enables you to export or import projects either completely or in part (e.g. list of global variables). When exporting, an ASCII file compatible with Control FPWIN Pro is created, which you can also use for importing at a later stage.

☞ ◆ NOTES

- **Exporting projects is a good way to save data, especially for saving space. The ASCII file can be saved on floppy disk.**
- **Before installing an Control FPWIN Pro upgrade/update, we recommend exporting all existing projects with the old version and importing them into the new version once it has been installed. This ensures that you are working with the current data base.**

13.2 Introduction to Reusability Level

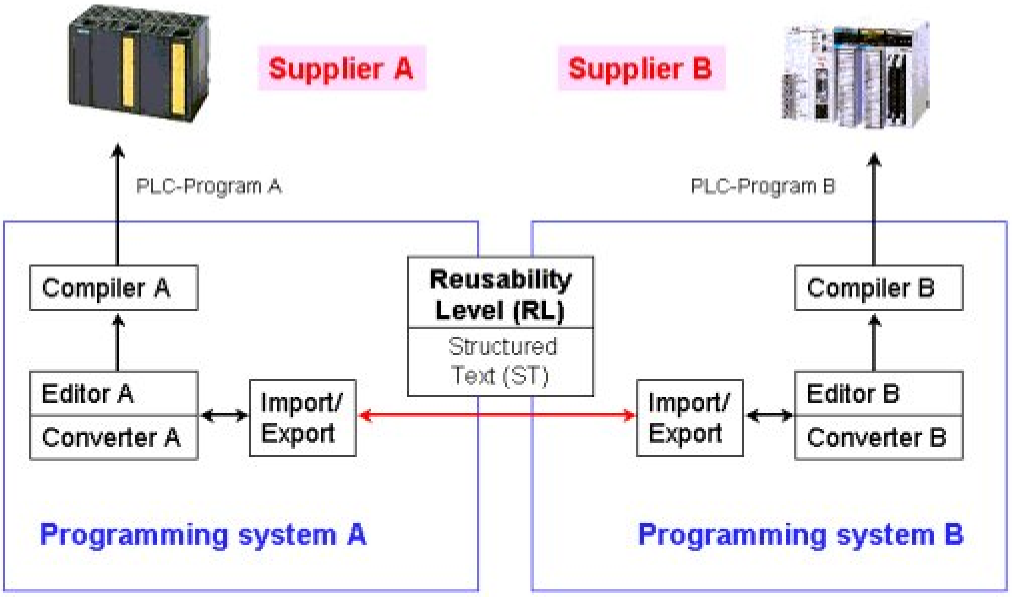
Reusability focusses on the reusability of user-derived Functions (see page 36) and Function Blocks (see page 37) across certified **P**rogram **S**upport **E**nvironments (PSE). This is guaranteed for commonly supported data types and the functionality as long as they are supported by both PSEs.

For supplier-dependent functions and function blocks, no equivalent is guaranteed on the receiving side, i.e. they will not work on the other system.

For example, on one supplier's system a Function Block is created in Structured Text (see page 82) (ST), which is intended to be used later on a **different system** from a **different supplier**. As a prerequisite, both systems must be certified for the PLCopen Reusability Level and the data types and commands used must be supported by both systems. Concerning data types, if one system supports TIME, for example, and the other does not, one cannot reuse the Function Block. In other words, the user has to check which data types are supported.

If these requirements are fulfilled, one can exchange Function Blocks between systems in ASCII format.

The following illustration shows the principle of exchanging function blocks, in which the neutral language Structured Text (ST) is the key.



The format of the import/export consits of two types of files:

- POU files (*.st)
  that contain one or more POUs of the ST editor. A POU can be specified as a function, as a function block or as program.
- Type files (*.typ)
  that contain declarations, e.g. DUT declarations.

13.3 Exporting/Importing Projects

You can export a complete project as an ASCII file, e.g. to back it up on a floppy disk.

Exporting a project:

PROCEDURE

1. **Project → Export Project**
2. **Select drive and directory into which the file is to be saved**
3. **Select the file type**

   Possible file types are:

   FPWIN Pro (*.asc), Reusability Level POU files or Type files (*.st, *.typ).
4. **Enter file name**
5. **Click [Save]**

   If the file name already exists, a question appears. Click [Yes] to overwrite the file name, [No] to discontinue export.

NOTES

- **The file type “Reusability Level: POU files (*.st)” is available for POUs only that are created with the ST editor.**
- **The file type “ Reusability Level: Type files (*.typ)” is available only if data unit types are created under "DUTs" in the project navigator.**

Importing a project:

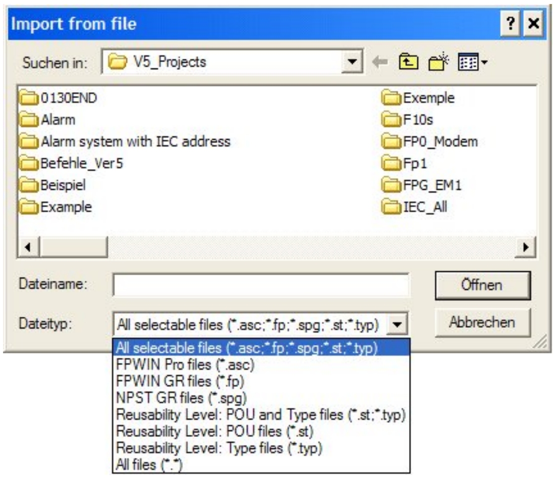
The following files can be imported with the function "Import Project":

- FPWIN Pro (*.asc)
- FPWIN GR project files (*.fp)
- NPST GR files (*.spg)
- Reusability Level POU files (*.st)
- Reusability Level Type files (*.typ)

PROCEDURE

1. **Project → Import Project**

Before using this function you have to create an empty project using **Project** → **New** or an existing project has to be opened with **Project** → **Open**.


Import from file

Suchen in: V5_Projects

Dateiname:

Dateityp: All selectable files (*.asc;*.fp;*.spg;*.st;*.typ)

0130END
Alarm
Alarm system with IEC address
Befehle_Ver5
Beispiel
Example
Exemple
F10s
FP0_Modem
Fp1
FPG_EM1
IEC_All
Öffnen
Abbrechen
All selectable files (*.asc;*.fp;*.spg;*.st;*.typ)
FPWIN Pro files (*.asc)
FPWIN GR files (*.fp)
NPST GR files (*.spg)
Reusability Level: POU and Type files (*.st;*.typ)
Reusability Level: POU files (*.st)
Reusability Level: Type files (*.typ)
All files (*.*)

2. **Select directory of file that is to be imported**
3. **Select file type you want to import**
4. **Click file name from the list**

   Use <Shift> or/and <Ctrl> for multi-selection of files.
5. **[Open]**

   The project of the selected file will be imported into the current project of FPWIN Pro. Clicking [Cancel] will cancel the import procedure.

◆ **REFERENCE**

For details on importing NPST GR or FPWIN GR projects see the online help (keyword “NPST GR file” or “FPWIN GR file”).

Examples of FPWIN GR file import

13.4 Exporting/Importing Objects

Objects such as POUs, global variable lists, tasks etc. can be exported. Thus, you can save certain program parts on a floppy disk/hard drive, for example, and continue using them in another project.

Exporting Objects:

PROCEDURE

1. **Click the object you wish to export in the project navigator**

   Use <Shift> or <Ctrl> for multi-selection of files.

   Do not open the object, or the menu "Export Object" will not be active.

2. **Object → Export Object**

3. **Select directory where the file is (files are) to be saved**

4. **Select the file type**

   Possible file types are FPWIN Pro (*.asc) files. When importing DUTs or global variables, also the file types *.st and *.type are available.

5. **Enter file names in which the components are to be saved**

6. **[Save]**

With **Object** → **Export Object** you can export any or all objects to a Control FPWIN Pro compatible file.

NOTES

- **The file type “Reusability Level: POU files (*.st)” is available for POUs only that are created with the ST editor.**
- **The file type “ Reusability Level: Type files (*.typ)” is available only if data unit types are created under "DUTs" in the project navigator.**

Importing objects:

Objects such as POUs, global variable lists, and tasks can be imported. You can save certain program parts on a floppy disk/hard drive to use later in a different project, for example. **Object** → **Import Object** enables you to import individual objects from a completely exported project.

The following files can be imported with the function "Import Object":

- FPWIN Pro files (*.asc)
- FPWIN GR project files (*.fp)
- NPST GR files (*.spg)
- Reusability Level POU files (*.st)

- Reusability Level Type files (*.typ)

PROCEDURE

1. **Select the object (objects) in the project navigator, e.g. POUs and/or Tasks**

   Only objects according to the selection in the project navigator are imported. Use <Shift> and/or <Ctrl> for multiple selection.

2. **Object → Import Object**

3. **Select drive and path of the file that is to be imported**

4. **Click file name**

   Use <Shift> and/or <Ctrl> for multiple selection.

5. **Click [OK]**

   The information from the file selected will be imported into the current project of FPWIN Pro and will be displayed within the project navigator under the respective objects.

A system message will be displayed as soon as you have successfully completed the import procedure.

13.5 Exporting/Importing Program Code

With **Object → Export Program Code** you can save the compiled program code in the Program Code Editor to a file.

PROCEDURE

1. **Double-click "Program Code" in the project navigator**
2. **Object → Export Program Code**
3. **Enter file name *.asc and select a drive/path**
4. **Click [Save] to save file**

With **Object → Import Program Code** you can upload a compiled program code of a file.

PROCEDURE

1. **Double-click on "Program Code" in the project navigator**
2. **Object → Import Program Code**
3. **Select file *.asc**
4. **Click [Open] to load file**

Chapter 14

Keyboard Assignment

14.1 Shortcuts

Key		**<Shift>**	**<Ctrl>**	**<Alt>**	**<Shift>+ <Ctrl>**
			<1>Navigator on/off **<a>**Select all **<c>**Copy **<f>Find** **<h>**Replace **<k>Edit breakpoints** **<n>**New project **<o>**Open project **<p>**Print **<q>Print preview** **<s>**Save **<v>**Insert **<x>**Cut **<y>Redo** **<z>**Undo	<underlined character> Activate menu **<0>** Activate navigator	
<Esc>	Discard changes in edit box and close field	Online mode			
<Tab>	Next field Next line Insert line at the end	Previous field Last field of previous line Insert line at the beginning	Change windows		
<Space>	Open field or text entry if field open			Open system menu	
<Return> or <Enter>	Close field IL: new line in same network	Next field of same column Next network	Insert carriage return in comment Close network	Object properties	Previous network
<Back-space>	Delete selected characters Delete character left of cursor		Redo	Undo	
<Ins>		Paste	Copy		
<Del>	Delete selected characters Delete character right of cursor	Cut selected characters			
<Pos 1>	Beginning of line	Select characters from cursor position to beginning of line	Beginning of text		Select characters from cursor position to beginning of text

Key		**<Shift>**	**<Ctrl>**	**<Alt>**	**<Shift>+ <Ctrl>**
<End>	End of line	Select characters from cursor position to end of line	End of text		Select characters from cursor position to end of text
<PgUp>	Page up		Page left		
<PgDn>	Page down		Page right		
<↑>	Line up				
<↓>	Line down Open Class/Type selection				
<←>	Character left Field left	Select character left of cursor position			
<→>	Character right Field right	Select character right of cursor position			
<->	Show sub-items				
<+>	Hide sub-items				
F1	Open help topic		IL: insert insertion template in operator column		
F2	Open variable/ function/ function block selection				
F4			Close current window in FPWIN Pro	Exit Control FPWIN Pro	
F5	Continue debugging				
F6			Change to next window in FPWIN Pro		Change to previous window in FPWIN Pro
F9	Insert/delete breakpoints				
F10	Step over (Debugging)				
F11	Step into (Debugging)				

Chapter 15

Glossary

Accumulator

The accumulator stores intermediate results of an IL instruction. The result of each operation is stored immediately after it is processed. Input conditions for subsequent operations are not necessary: further processing is based on the current value of the accumulator. The accumulator's content is lost when the following network is processed. Therefore, store its value in a variable if you require it later on in another network.

Action Assignment

An action combines one sequence (created with the SFC editor) with parts of the logic which are executed when a specific step is active. An action contains parts of the over-all logic. An action can be assigned to multiple steps and can be coded in FBD, LD, IL or ST.

Action Pool

The action pool appears below the POU in the project navigator when a program is created using SFC. All actions programmed for this POU are located here.

Array

An array is a number of variables all of which have the same data type. This combination represents a variable itself, and therefore it is declared.

Compile

When a project is compiled, Control FPWIN Pro translates it into machine language so that the PLC can read it.

Data Type

In Control FPWIN Pro a difference is made between elementary and user-defined data types. **Elementary data types** include: BOOL, INT, DINT, WORD, DWORD, REAL, TIME and STRING.

Declaration

A declaration is the definition of variables for global or local use.

DUT

With a Data Unit Type (DUT) you can define a data unit type that is composed of other data types. A DUT is first defined in the DUT pool and then processed like the standard data types (BOOL, INT, etc.) in the list of global variables or the POU header.

DUT Pool

The DUT pool is located in the project navigator and contains all Data Unit Types (DUTs). Data Unit Types are user-defined.

F-Instructions

F-Instructions are instructions from the basic Instruction Set. They are executed whenever the EN input has a value of TRUE.

Function

Functions are used within the definition of the user logic whenever a routine is needed, which, when executed, yields exactly one result. Since Functions do not access any internal memory, every invocation of one Function with identical input parameters always results in an identical value: the Function result. As soon as a Function has been declared it can be accessed from any other Program Organisation Unit of the User Logic.

Function Block

Function Blocks define both the algorithm and the data declaration of a part of the User Logic. Due to this definition the logic can be considered a class. Not the Function Block itself is invoked but several instances of this Function Block can be created, which then can be used separately. Each instance possesses its private copy of the data declaration memory, which provide the necessary data information for executing the Function Block's functionality.

The private data declaration memory of a Function Block Instance persists from one invocation of this instance to the next one. This internal memory allows for the implementation of incremental functionality by using Function Blocks.

As a consequence, several invocations of one Function Block Instance with the same input variables do not necessarily yield the same results.

In contrast to Functions, Function Blocks permit defining not only one but a set of output variables representing the Function Block results.

Instances of Function Blocks can be declared locally for use within one POU. Declaring the instance of a Function Block within a POU defines the scope of this instance at the same time.

Function Block Diagram (FBD)

FBD is a graphical language for programming connective logic. The individual Program Organisation Unit's Variables are connected with the inputs and outputs of function boxes. The connection represents a data flow between variables and inputs/outputs of function boxes.

A Function Block Diagram program is internally structured in Networks.

A Function Block Diagram network is defined by a connected graph of function boxes.

Function Block Instance

An object of the Function Block class owns its private copy of the Function Block's data declaration memory. This private data area is linked to the Function Block algorithm for this particular instance.

Global Variable

A global variable is assigned a physical address in the global variable list. From there it can be accessed by all POUs.

Identifier

The identifier is the symbolic name of a variable.

Input Variable

Input variables provide functions and function blocks with the values they need for calculation.

Instruction List (IL)

IL is a low level textual language which provides capabilities for effective PLC programming. It is based on individual instructions which define one operation per instruction. Besides the variables listed explicitly as arguments for an operation, the actual value of the accumulator is used as an additional implicit argument.

The result of an operation is also stored here after the execution of the appropriate instruction, thus providing a link between a preceding instruction and one that follows.

An Instruction List program is internally structured as an assembly of networks.

Ladder Diagram (LD)

LD a graphical language for programming connective logic. Similar to the Function Block Diagram's capabilities, the individual POU's variables are connected at the inputs and outputs of function boxes. In addition Boolean connections can be drawn by using coils and contacts. This connection represents a Boolean signal flow.

A Ladder Diagram program is internally structured in networks.

A Ladder Diagram network is defined by a connected graph of functions boxes linked with the left-hand power rail.

Library Pool

Four libraries come with Control FPWIN Pro. For more information, see online help.

Local Variable

A local variable is only valid for the POU in whose header it is declared.

Logic

The complete PLC program defined by the user for solving the automation problem. The user logic is structured in Program Organisation Units.

Machine Program

Machine programs can be used with the FP2, FP3 and FP5 only. One of these PLC types has to be selected with Online " PLC Type, otherwise the component Machine_Program will not be displayed in the Project Navigator.

Panasonic Electric Works Europe AG optionally offers machine programs which take over certain partial tasks which facilitate programming. At this point in time a PID controller is available.

Network

Networks belong to a POU body and contain the logic (program).

Network List

A network list provides you with a better overview of your program. Open the network list when the POU body is active via **Tools → Network List**.

Object

In Control FPWIN Pro, all components listed in the project navigator are objects.

Online

Online means that the PC and the PLC are communicating with each other. You can also program while online. **Caution! When online, you must program with extreme caution because programming errors/changes could injure men or damage machinery!**

Output Variable

Functions and function blocks write their results into output variables.

P-Instructions

P-Instructions are instructions from the Basic FP Instruction Set that work exactly like the F-Instructions except that they are only executed at a rising edge.

Program

A program is similar to a Function Block with one implicit Function Block Instance. The differences between Programs and Function Blocks are:

- Programs are only allowed on top of a POU invocation hierarchy (i.e. a program may not be invoked from another POU)
- Directly represented variables can be used for defining a Program

Program Organisation Unit (POU)

POUs are used for structuring the complete user logic. Individual Units may invoke other ones, however a recursive POU structure is not allowed.

POUs are either defined as standard by default or user specific depending on the specific automation problem to be solved by the User Logic.

Control FPWIN Pro differentiates between the POU **Header**, which contains the declared variables, and the **Body**, which contains the POU’s algorithm.

Due to different requirements for the solution of a sub-problem, different types of POUs are provided.

The different POU types are Functions, Function Blocks and Programs.

Project

The project occupies the highest level in the hierarchy of Control FPWIN Pro. It includes everything the PLC carry out what is required.

Project Navigator

The project navigator provides structure for the project and contains all objects belonging to the project: libraries, PLC configuration, the Task pool, POUs, etc.

Sequential Function Chart (SFC)

The SFC consists of the basic elements steps and transitions. While steps represent a specific state during the execution of a POU, a transition allows for the definition of the conditions for changing from one state to the next state.

Using either parallel or alternative branches you can complement several types of SFC sequences.

Specific connective logic program code can be associated to the steps via actions by using the appropriate languages FBD, LD and IL.

Task

defines the moment (and other execution parameters) of program execution. A POU of type program contains the logic, i.e. it defines what has to be done. The association of a program to a task defines the moment of the logic’s execution.

Structured Text

a text-based editor exempt from normal syntax. ST is a high-level language allowing you to write complex programs and control structures. It is available for all PLCs and requires no more resources, e.g. steps, labels or calls, than other editors while doing comparable programming.

Variable

A variable is a symbolic name that links an input or output to an internal memory area of the PLC. Variables can be either global or local.

Index

Record of Changes

Manual No.	Date	Description of Changes
ACGM0142END V1.0	JUNE 2000	
ACGM0142END V2.0	AUG. 2001	Update for release of Control FPWIN Pro V4.0. See the section "What is new" in the online help.
ACGM0142END V2.1	SEPT. 2001	Minor modifications and improvements integrated
ACGM0142V3.0EN	Dez. 2003	Update for release of Control FPWIN Pro V5. See the section "New in this version" in the online help.
ACGM0142V4.0END	July 2005	Update for release of Control FPWIN Pro V5.1 and new PLC type FP-X. Security settings new. See also the section "New in this version" in the online help.
ACGM0142V4.1END	January 2006	No changes in content.

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