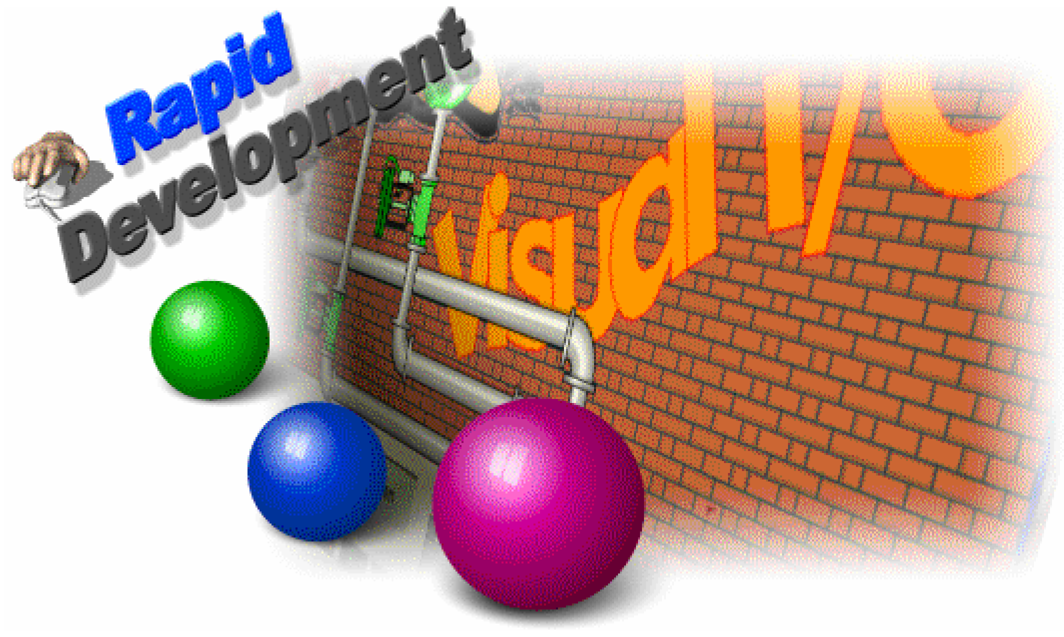
Visual PLC

Productivity tools

Programmer's Guide



- **Editor**
- **Language**
- **Instruction Set**

Ver 7.xx

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Structure of programs and datas **5**
VPU Files (Visual Pascal Unit) 5
MVARGLOB.VPU 5
Presentation of the editor **6**
First Step **7**
Project definition 7
Second Step **8**
Declare the process variables (Globals variables). 8
The Types of Variables available in Visual PLC 9
Third Step **10**
Writing a Program in Ladder 10
Loading the real time engine. 11
Loading the real time engine. 12
Mnemonics 13
Invert Input or output parameter of a functional module 13
Blocks of Programs (in line) 14
Possibility of testing if the input is true in the program block 14
Writing a program in Grafcet 15
Create a GRAFCET 15
Renum steps 16
Instructions and variables concerning a Grafcet 16
Grafcet variables can be used by other programs 17
Use of external functions in Grafcet. 18
Introduction to the Pascal Language **19**
Textual commentaries 19
Identifiers 20
Declarations 20
Boolean types : 21
Arrays 21
Character strings 21
The operators 22
The arithmetical operators 22
Character string operator 22
Logic operators 23
The boolean operators 23
Tips & tricks 23
The Relational Operators 24
Instructions 24
Simple Instructions 24
Affectations 24
Call of a procedure 24
Compound statements 25
IF THEN ELSE Statement 25
REPEAT UNTIL Statement 26
WHILE DO Statement 26
CASE OF Statement 26
FOR TO /DOWNTO Statement 27
Procedures and functions 28
Writing functional modules **29**
Philosophy of a functional module 29
Programming in a functional module 30
Test equation in Ladder validating the functional module 31
System Variables 31
To quit the functional module 31
Examples of functional modules 32
Tables transfer and typecast 33

Transfer a table in another table 34
Transfer of variables 35
Shift bits to left in consecutives words. 36
Call functions and procedure in a library VPU. 37
Compiling a functional module 37
Cross references 40
Statuts of the real time engine 41
Adding a program to the real time engine 42
Programs execution order of in the real time engine 43
Saving the configuration of the real time engine 43
Loading the configuration in the real time engine 43
Writing cyclical programs in Pascal language 44
The USES clause 44
Cyclical programs with interface 45
Writing VPU libraries 47
Initialization in a library 48
Passing parameters by values and address 48
Calling procedures and functions in a DLL 50
To redefine the name of the function contained in a DLL 50
Localization of a DLL 50
Example of Visual PLC variable allocated in an external DLL 51
Launching the real time engine automatically 52
Visualization of programs loaded 53
Profibus Configuration tool for DPC102 Profibus card 54
Setting the equipment parameters 55
Test of the Profibus card and ScanDP. 55
Testing the communication with connected Profibus equipment 56
Dangerous Interactions with Visual PLC 56
Maintenance of data 57
To add a password protecting the editor 59

Structure of programs and datas

With Arsoft's compiler included, Visual PLC works differently to most traditional programs.

All programs you write will be compiled at maximum speed, which means they are without external and additionnal programs.

Each program (Ladder, Grafcet, Language etc….) will be checked for syntax errors, and then will be compiled in a file extension (.VPU).

VPU Files (Visual Pascal Unit)

These files are the result of program compilations. Once compiled, they contain all the variables and procedures declarations to be operated by the real time kernel or with other VPUs. A VPU could be the declaration of the application's global variables in its simplest form. It could also be procedures or functions that you created for use in other programs. With the VPUs '*pre-compiled'*, programs using them do not need to have their source codes for running. It is impossible to know in what language a VPU has been written. We will see later on that VPUs have an Interface part and an Implementation part.

Interfacing is the declaration of the variables or procedures that can be accessed by other VPUs. The implementation is the real part of the code.

The 'Driver' programs communicating with the embedded cards in your PC are also VPUs allowing you to interface with physical elements (I/O) and the Input/Output image table that uses the program.

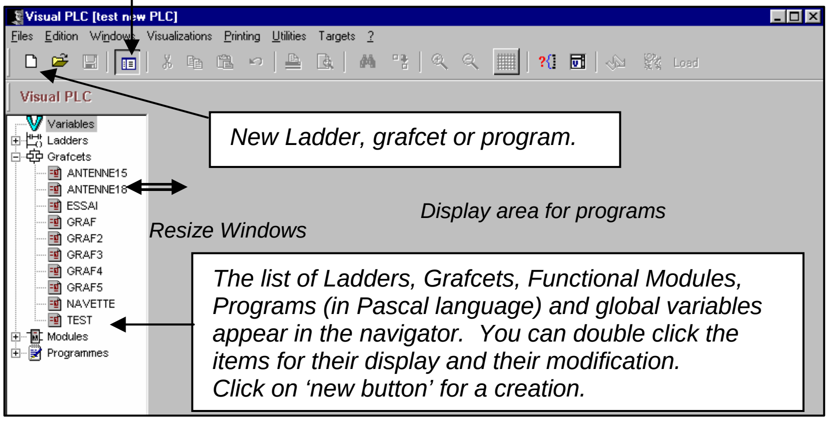
MVARGLOB.VPU

Within the Visual PLC package, Mvarglob.VPU is the basic file containing all the process variables, such as the input/output image table, internal variables, bits of the active steps and their activation time. Before starting to develop a program in Ladder, Grafcet or indeed any other packages, you need to declare the variables with the help of the Global Variable editor.

Models of variables (pre-definitions) are implemented.
With starting a new project, you can choose a model of variables (Schneider, Siemens, Allen Bradley Etc..).
You can also add your own variables to this model.

Presentation of the editor

Show or hide the navigator



New Ladder, grafcet or program.

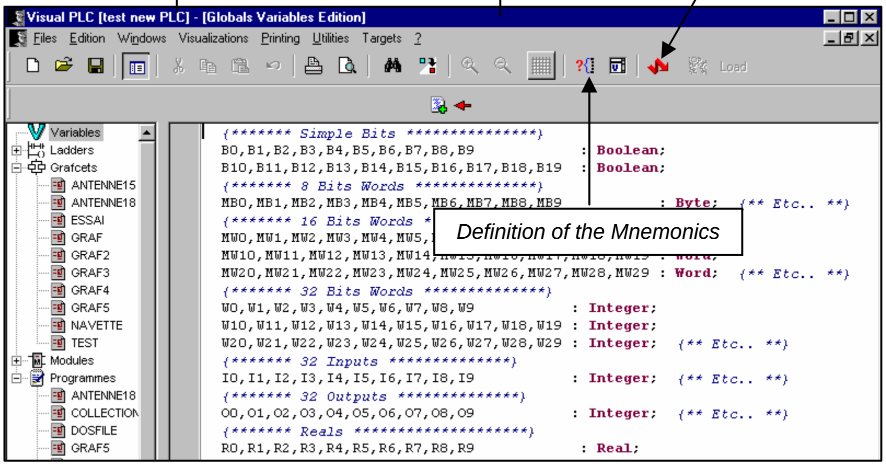
Display area for programs

Resize Windows

The list of Ladders, Grafcets, Functional Modules, Programs (in Pascal language) and global variables appear in the navigator. You can double click the items for their display and their modification.
Click on 'new button' for a creation.

Tools to copy, paste, undo, Find, Replace, Prints, Print preview and Zooms.

To compile the program in the current window



```
{******* Simple Bits ***************}
B0,B1,B2,B3,B4,B5,B6,B7,B8,B9             : Boolean;
B10,B11,B12,B13,B14,B15,B16,B17,B18,B19   : Boolean;
{******* 8 Bits Words **************}
MB0,MB1,MB2,MB3,MB4,MB5,MB6,MB7,MB8,MB9        : Byte;  {** Etc.. **}
{******* 16 Bits Words *
MW0,MW1,MW2,MW3,MW4,MW5,
MW10,MW11,MW12,MW13,MW14,
MW20,MW21,MW22,MW23,MW24,MW25,MW26,MW27,MW28,MW29 : Word;  {** Etc.. **}
{******* 32 Bits Words **************}
W0,W1,W2,W3,W4,W5,W6,W7,W8,W9           : Integer;
W10,W11,W12,W13,W14,W15,W16,W17,W18,W19 : Integer;
W20,W21,W22,W23,W24,W25,W26,W27,W28,W29 : Integer;  {** Etc.. **}
{******* 32 Inputs **************}
I0,I1,I2,I3,I4,I5,I6,I7,I8,I9           : Integer;  {** Etc.. **}
{******* 32 Outputs **************}
O0,O1,O2,O3,O4,O5,O6,O7,O8,O9           : Integer;  {** Etc.. **}
{******* Reals ********************}
R0,R1,R2,R3,R4,R5,R6,R7,R8,R9            : Real;
```

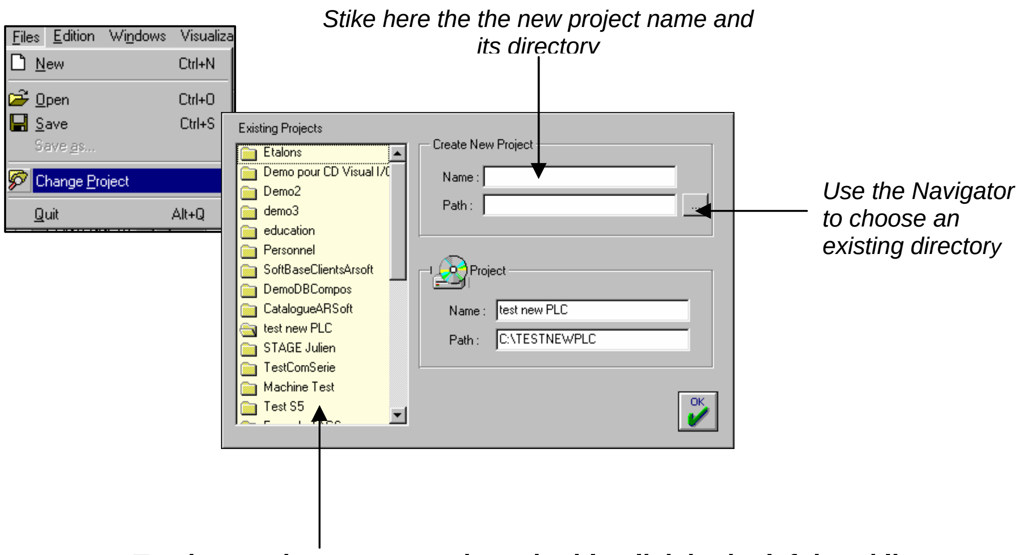
Definition of the Mnemonics

First Step

Project definition

Before programming, you must define a project. This project will contain a title and the physical path on your hard disk. If no project is defined in the launching of the editor, this window appears automatically.

Click on Project Change to change or define a new project



Existing Projects
- Etalons
- Demo pour CD Visual I/
- Demo2
- demo3
- education
- Personnel
- SoftBaseClientsArsoft
- DemoDBCompos
- CatalogueARSoft
- test new PLC
- STAGE Julien
- TestComSerie
- Machine Test
- Test S5

Project

Name : test new PLC

Path : C:\TESTNEWPLC

To change the current project, double-click in the left hand list (Existing Projects).

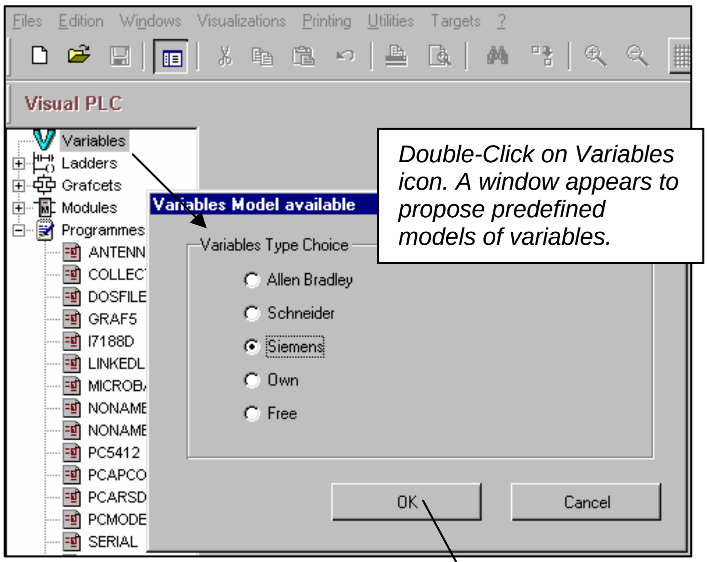
Note :
While clicking on a project in the left list and by striking **<Del >** key, the project and its contents are completely erased.

When creating a new project, the specified directory is created on the disc and all the files contained in the installation directory under ‘Modules’ sub-directory (ex:C:\api32\Modules) are copied in the new project directory.

It will contain all the functional Modules delivered.

Second Step

Declare the process variables (Globals variables).

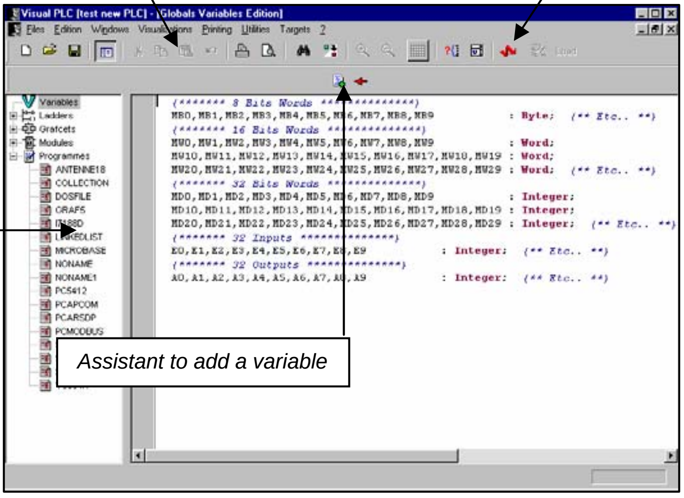


Variables Type Choice: Allen Bradley / Schneider / [✓ Siemens] / Own / Free

Double-Click on Variables icon. A window appears to propose predefined models of variables.

Compiling Variables. (Mvarglob.VPU is created)

The system creates a list of variables corresponding to the specific PLC. The user can constantly remove or add a variable of your choice and write the variable at the end of the list or use the help of the assistant.



```
(******* 8 Bits Words **************)
MB0,MB1,MB2,MB3,MB4,MB5,MB6,MB7,MB8,MB9           : Byte;   (** Etc.. **)
(******* 16 Bits Words **************)
MW0,MW1,MW2,MW3,MW4,MW5,MW6,MW7,MW8,MW9           : Word;
MW10,MW11,MW12,MW13,MW14,MW15,MW16,MW17,MW18,MW19 : Word;
MW20,MW21,MW22,MW23,MW24,MW25,MW26,MW27,MW28,MW29 : Word;   (** Etc.. **)
(******* 32 Bits Words **************)
MD0,MD1,MD2,MD3,MD4,MD5,MD6,MD7,MD8,MD9           : Integer;
MD10,MD11,MD12,MD13,MD14,MD15,MD16,MD17,MD18,MD19 : Integer;
MD20,MD21,MD22,MD23,MD24,MD25,MD26,MD27,MD28,MD29 : Integer;   (** Etc.. **)
(******* 32 Inputs **************)
E0,E1,E2,E3,E4,E5,E6,E7,E8,E9           : Integer;   (** Etc.. **)
(******* 32 Outputs **************)
A0,A1,A2,A3,A4,A5,A6,A7,A8,A9           : Integer;   (** Etc.. **)
```

Assistant to add a variable

Note : All Ladder Programs, and Grafcets refer to the globals variables.

A variable can be initialised.

Example : Consigne : Integer=1000 ;

<u>The Types of Variables available in Visual PLC</u>

Boolean	: Byte (True=1 False=0).
Byte	: Byte 8 bits. (Bits 0 to 7)
Word	: Word 16 bits. (Bits 0 to 15).
Integer	: Integer 32 Bits. (Bits 0 to 31). -2147483648 to 2147483647
Real	: Float. (10 bytes) $1{,}9\text{x}10^{-4951}$ to $1{,}1\text{x}10^{4932}$
Single	: Float 1.5e-45..3.4e38 (4 bytes)
String	: String of 255 characters. (1 to 255).
Array	: Array of variables define above. Example : Array [0..12] of Boolean;

Boolean

```
MBool  : Boolean;
MBool:=True; MBool:=False;    equivalent to Mbool:=1; Mbool:=0;
```

Byte

```
By     : Byte;         By:=12;
```

Word

```
Wd     : Word;         WD:=12000;    WD:=$F012;
```

Integer

```
It     : Integer       ;
It:=255; It:=$FF;              Numerical value allocation;
It.0:=True; It.4:=False;  Bit of Integer allocation;
```

Real, Single

```
RL     : Real;         RL:=-12.40;
SL     : Single ;              SL :=456.89 ;
```

String

```
ST     : String;       ST:='Visual PLC';     ST:='C:\WinNt';
```

Array

```
AMBOOL: Array [0..10] of Boolean;     AMBool[1]:=True;

ABY    : Array [1..50] of Byte;   ABY[2]:=34;

AWD    : Array [1..50] of Word;  AWD[2]:=12034;

AIT    : Array [1..30] of Integer;         AIT[4]:=-255;  AIT[5].0 :=True;

ARL    : Array [2..14] of Real;   ARL[2]:=-34.6789;

AST    : Array [0..6] of String;   AST[2]:='Bonjour';
```

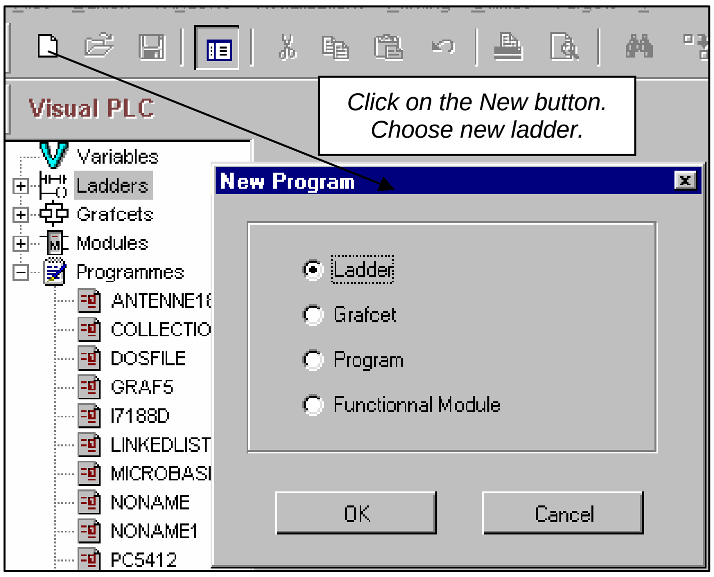
<u>Contrary to others Soflogic, Visual PLC is allowed address Bit in a word.</u>

<u>Example</u>: W10.0 (First bit of word « W10 ») .

<u>Third Step</u>

<u>Writing a Program in Ladder</u>

Having defined the global variables and internal variables in the Mvarglob.VPU, it is possible to write programs in Ladder (which will be also VPUs).

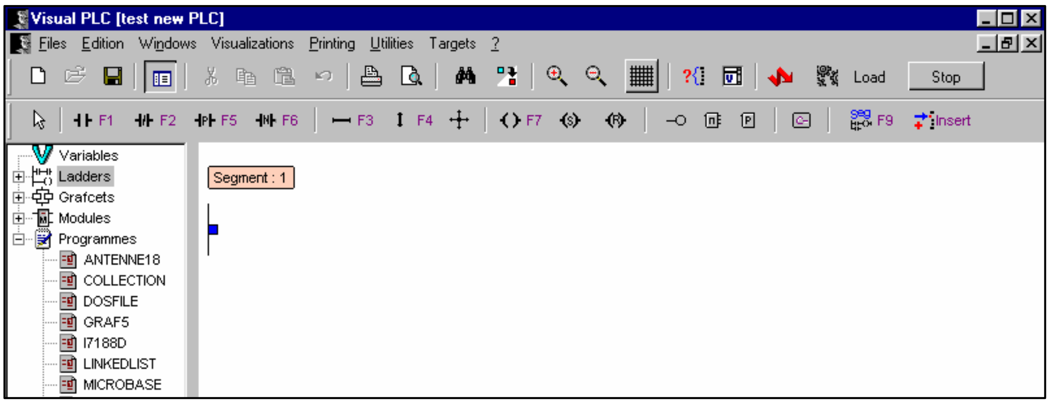


Click on the New button. Choose new ladder.

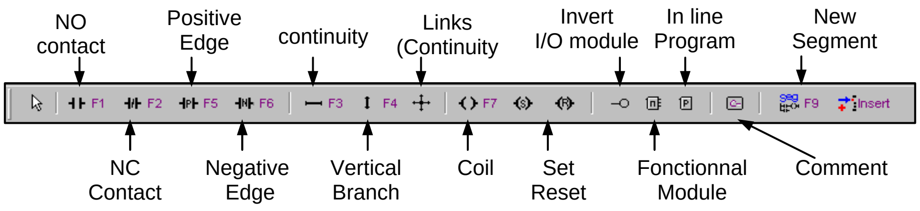
New Program

[✓ Ladder] Grafcet Program Functional Module

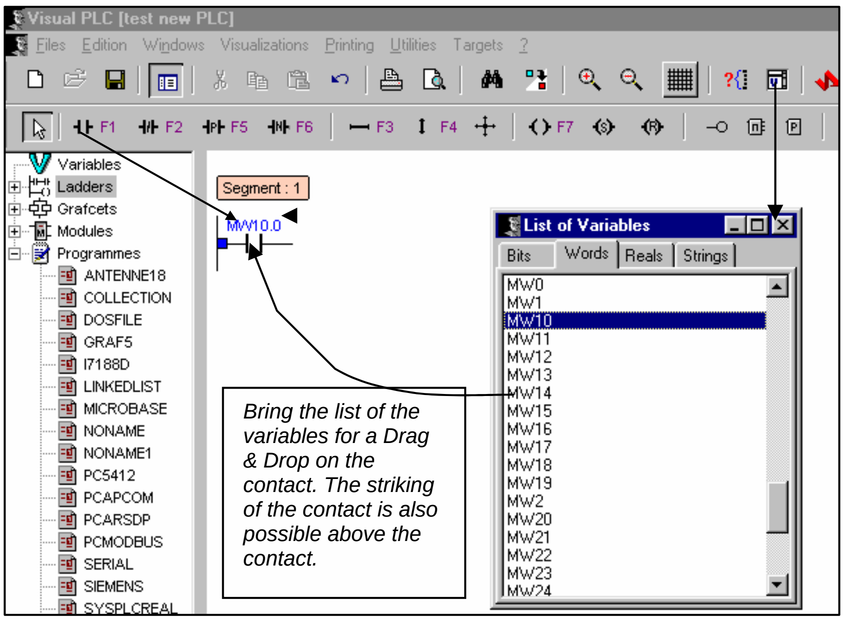
A window appears to be allowed to write a program in Ladder. A toolbar appears below the standard bar. The programs written in Ladder are organized in consecutives segments, allowing the constitution of cross references.



Visual PLC [test new PLC]
Files Edition Windows Visualizations Printing Utilities Targets ?
Load
Stop
F1 F2 F5 F6 F3 F4 F7 F9 Insert
Variables
Ladders
Grafcets
Modules
Programmes
ANTENNE18
COLLECTION
DOSFILE
GRAF5
I7188D
LINKEDLIST
MICROBASE
Segment : 1



Blinking Program

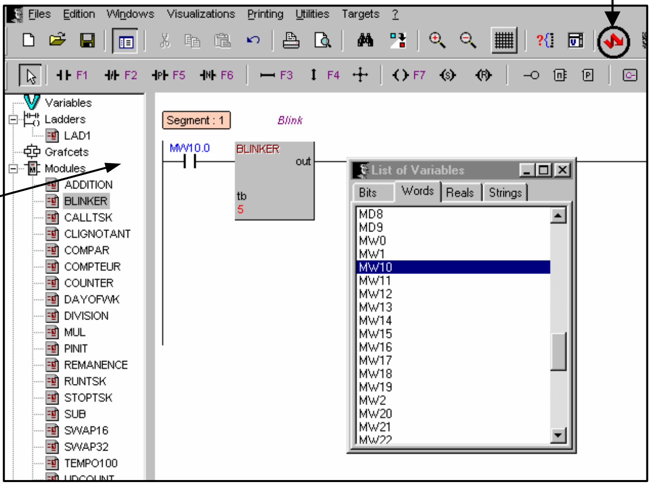


Bring the list of the variables for a Drag & Drop on the contact. The striking of the contact is also possible above the contact.

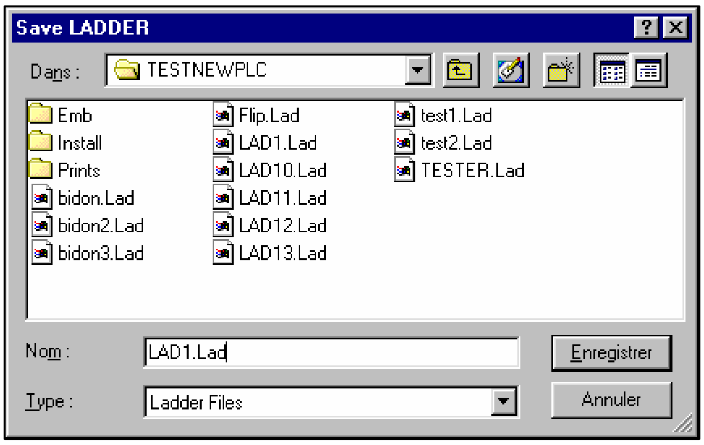
<u>Compilation</u> current Ladder (Visible).

Bring the functional module ***Blinker*** *by Drag & Drop. Place a coil to output by using bit 1 of MW10 word (MW10.0).*

Strike the value 'time Base' of the module (in 1/10 seconds). Here 5 (0.5 Seconds). Finally <u>compile</u> your Ladder by clicking on the 'Compile' button

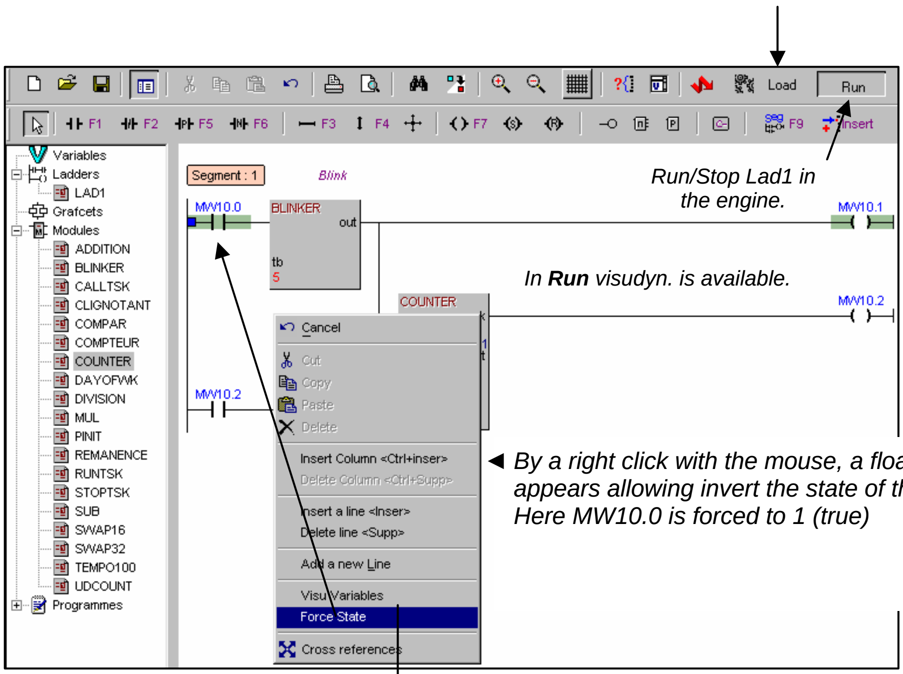


During the first compilation, the system requires a name for this program. So a dialog box appears. On each Compilation, the system saves the program then compiles it by creating a compiled file with a VPU extension.



Loading the real time engine.

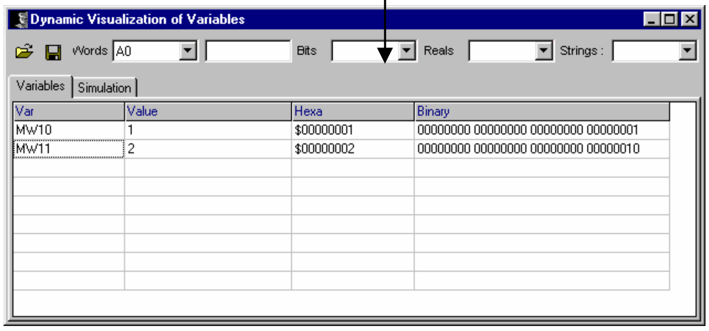
After compilation, click on the '*Load'* button, to load LAD1 in the real time engine.



Run/Stop Lad1 in the engine.

In ***Run*** *visudyn. is available.*

◄ *By a right click with the mouse, a floating menu appears allowing invert the state of the pointed bit. Here MW10.0 is forced to 1 (true)*



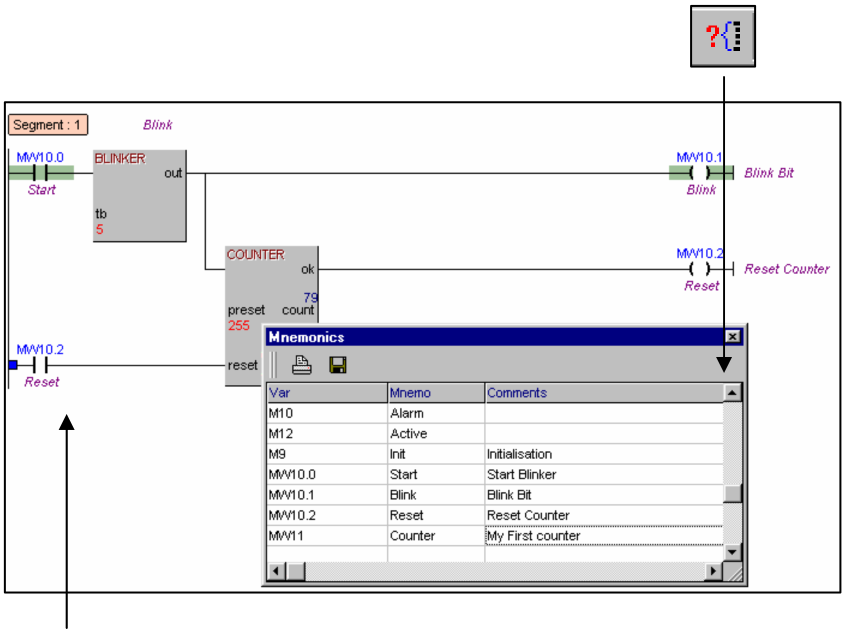
Var	Value	Hexa	Binary
MW10	1	$00000001	00000000 00000000 00000000 00000001
MW11	2	$00000002	00000000 00000000 00000000 00000010

◄ *A grid for visualisation & Forcing is also available by selecting 'Visu Variables' in the floating menu. These commands are also available in the main menu of Visual PLC*

Note : Save the lists of visualized variables (*Save button*).

Other :In our example 2 functional modules are in cascades. Visual PLC allows the cascade of modules without assignment of intermediate variables.
The functional modules require variables in parameters (Variables or constants).
If the programmer decides not to affect variables, the compiler creates automatically *ghost* variables making it possible that the module runs normally. These *ghost* variables will be visible in visu-dynamics but not exploitable by programs.

Mnemonics
MW10.0, MW10.1 and MW10.2 are not very significant names. Visual PLC allows assigning mnemonics to these variables or these bits of variables. While clicking on the button '*mnemonic',* a window appears:

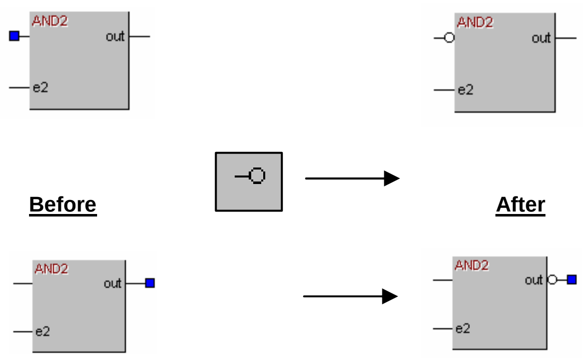


Var	Mnemo	Comments
M10	Alarm	
M12	Active	
M9	Init	Initialisation
MW10.0	Start	Start Blinker
MW10.1	Blink	Blink Bit
MW10.2	Reset	Reset Counter
MW11	Counter	My First counter

These mnemonics is usable in programming instead of the names of variables.

Invert Input or output parameter of a functional module

This command is allowed to invert the input or the output of a bit parameter in a functional module.
1 / place the cursor on the selected bit parameter of the module then click on this button

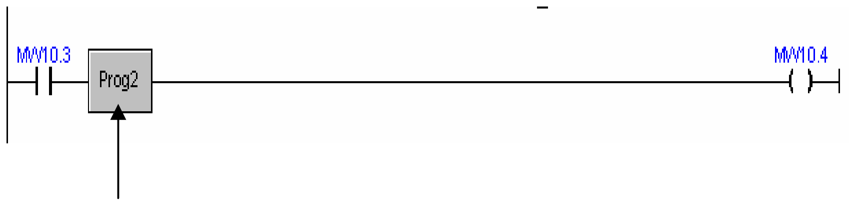


Example: Transforms an AND Bloc to a NAND Bloc.

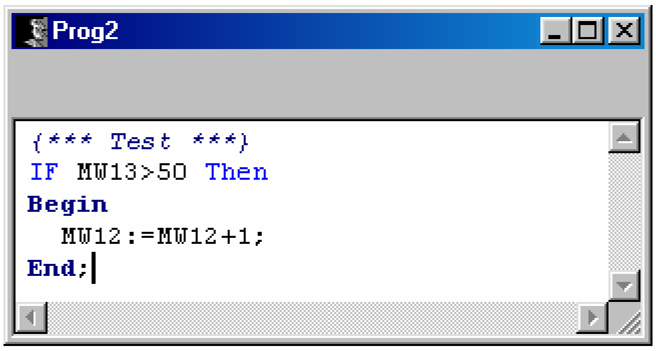
Blocks of Programs (in line)

It is possible to insert blocks of programs in a Ladder.

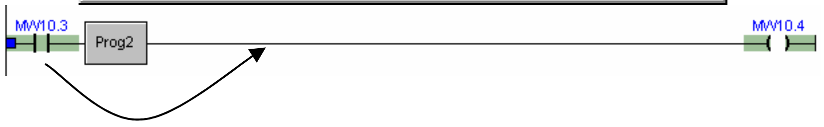
Click on the Bloc button Programs, then place this block (empty) in the current Ladder



Double-click on this block, a program editor appears:

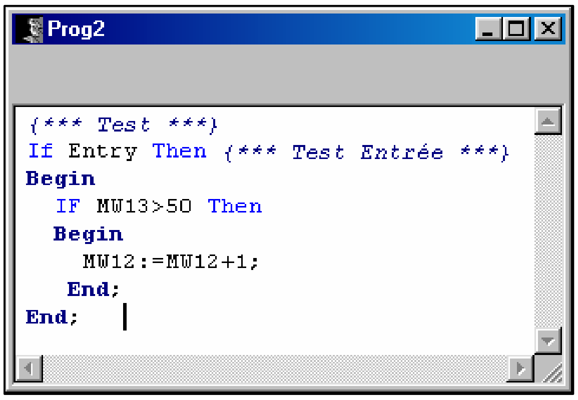


```
{*** Test ***}
IF MW13>50 Then
Begin
  MW12:=MW12+1;
End;
```



This program block always valid its output even if the input is False (0).

In this case, the result of the input is sent to the output.
Possibility of testing if the input is true in the program block.



```
{*** Test ***}
If Entry Then {*** Test Entrée ***}
Begin
   IF MW13>50 Then
   Begin
     MW12:=MW12+1;
    End;
End;
```

The reserved word ENTRY (Boolean) allows to test the input of the program block and to react consequently.

Here test MW13>50 is executed if the input of the program block is true.

Note :
You can affect the output of the program block by setting result to false or true. If nothing is done, the output (result) is always true.

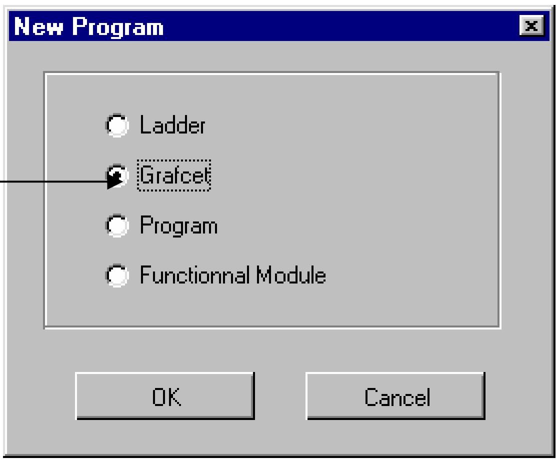
Example :
```
            If Entry Then Result :=True
                          Else Result :=False ;
```
Follow the input block program.

Fourth Step

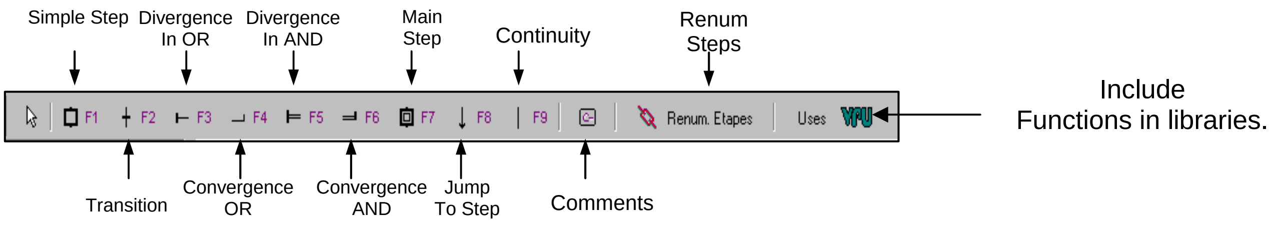
Writing a program in Grafcet

After having defined global variables and internal variables in MVarglob.VPU, it is possible to write programs in Grafcet (which will be also VPUs files).

Click on the new button in the main bar of commands.
A dialog box appears.
Select Grafcet then click on button OK

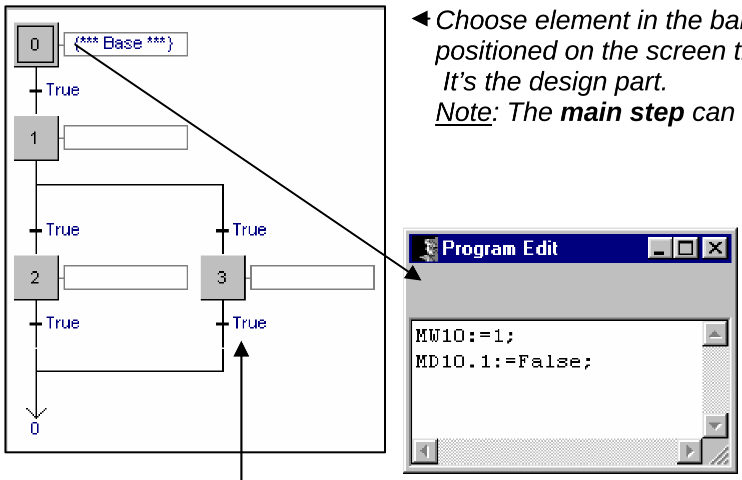


The Grafcet editor commands bar



Uses Vpu: Allow you to use external function & procedures in libraries

Create a GRAFCET



```
MW10:=1;
MD10.1:=False;
```

Choose element in the bar of commands, the element will be positioned on the screen then place the original onet.
It's the design part.
*Note: The **main step** can be positioned only at the **first line**.*

Double-Click on the selected element, a step and a transition.
An editor code appears. Proceed in the same way on all elements of Grafcet.

If the transitions do not contain code, the system initializes them to be True.

Important note:

The divergences of Grafcet can leave only the main stage and return aligned below the main step to the line.
Grafcet cannot be center on vertical symmetry axis.

Visual PLC allows the programming in Grafcet. It has something to do with the established Grafcet standards, but can treat all particulars cases which remain the responsibility for the programmer.

Grafcet contains transitions equations, which are programmed into literal language using instructions AND OR NOT. All advanced functions come from VPU's libraries.

One can have a simple equation like : I0.0 And I0.1 (Also possible I0.0 & I0.1)
A complex equation like : I0.0 and **MyFunction**(W0,12,Tab[1])

Myfunction is a function located in a VPU file.

Visual PLC will be a sequencer and find its complex equations in ladder diagram with contacts validating the transitions.
Visual PLC is allowed to receive a complete program using the same instructions in its steps as the instructions are accessible by the libraries.
For example, the complete instruction set of the PASCAL language. The programs written in Grafcet are compiled like all other programs and are stored with **VPU** format.

The real time engine loading the VPU cannot know if this program is written in Grafcet or Ladder or other language.

Renum steps

The editor renum the steps as well as the corresponding numbers.
The numbers of steps are fixed by the system by automatic renum (click on button Renum steps).

Attention this function is under the responsibility of the programmer.
Indeed as with each step Boolean (bit) reflecting the state, this bit can be well exploited in others programs. The renum does not modify these bits and their exploitations in the other programs.

Instructions and variables concerning a Grafcet

When you program in Grafcet, you can recover or affect certain information bits concerning it.

Detecting a step call

The **START_STEP** internal variable becomes true when the step is called.
Placed in a step, this program allows the user to detect the validation of whatever step.

Ex: If **Start_Step** Then Counter:=0;

{ At the rising edge of the step the counter is reset.}

The activation time for a Grafcet step

The activation time for a step is contained in:

A variable array of integer type: **TSTEP[X]**. This array is accessible only in the Grafcet program itself.

Ex : **If** Tstep[1]>=10 **Then** Alert:=True;
{ If the time of activation of step 1 is >= 1seconde then the bit 'Alert' is set}

Grafcet variables can be used by other programs

It is possible to test or affect the steps of a Grafcet. Visual PLC automatically creates an array of Booleans and Integers corresponding with the states of the steps in the Grafcet as well as their activation times.

Let's suppose that your Grafcet is called MyGraf, and has 10 steps.
These steps are numbered 0 to 9.
Visual PLC created automatically two arrays in Mvarglob.pas :

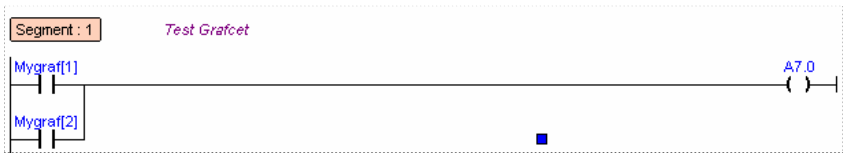
```
MyGraf      : Array [0..9] of Boolean; //** Steps States
TMyGraf     : Array [0..9] of Integer;   //** Time of activation of the
                                       current steps
```

MyGraf represents 10 steps' states of MyGraf program.
TMyGraf represents 10 steps' activation times of MyGraf program.

Ex: Reset a Grafcet :

For I:=0 **to** 9 **do** MyGraf[I]:=False;
*{** with the For instruction, the program force all steps of Grafcet to 0 (false) **}*

It is possible in a ladder to test if the Grafcet step is true.



Here a OR between 2 program steps of MyGraf is done.

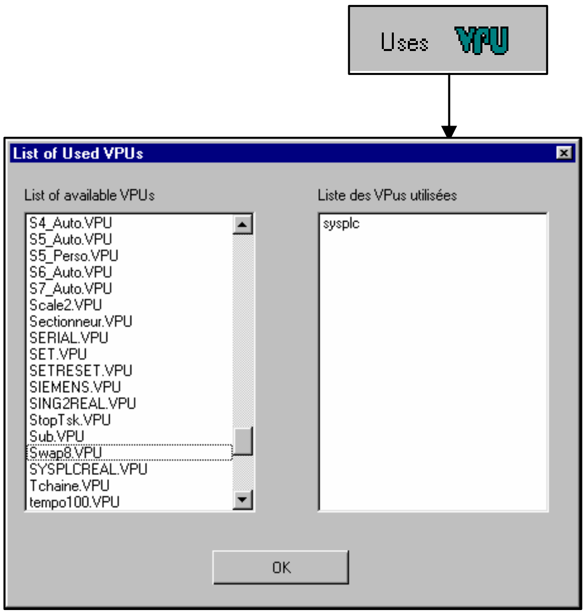
In a transition of Grafcet, one can have an equation testing the step activation time.

```
If TMyGraf[2]>100 Then Mygraf[3]:=True;
```

If the step 2 is active more 10 seconds, the next step 3 is forced. Putting automatically the step 2 to False if these 2 Steps are consecutives.

<u>Use of external functions in Grafcet.</u>

The grafcet can call external functions which you would have written in a library. You must specify the libraries which you want to use through the button ‘Uses VPU. Then the compiler can find these functions and procedures.



List of Used VPUs

List of available VPUs

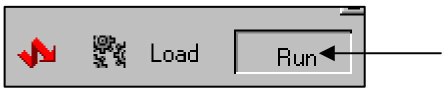
S4_Auto.VPU
S5_Auto.VPU
S5_Perso.VPU
S6_Auto.VPU
S7_Auto.VPU
Scale2.VPU
Sectionneur.VPU
SERIAL.VPU
SET.VPU
SETRESET.VPU
SIEMENS.VPU
SING2REAL.VPU
StopTsk.VPU
Sub.VPU
Swap8.VPU
SYSPLCREAL.VPU
Tchaine.VPU
tempo100.VPU

Liste des VPus utilisées

sysplc

Double click in the list in left on the library which you want to use. This library is placed in the list of right-hand side. Thus you will be able to use all the functions included in this library in yours equations, transitions or steps.

Compile and load your GRAFCET in the real time engine in the same way of LADDER.



Run/Stop all the programs in the real time engine.

Introduction to the Pascal Language

Background information

Completed with Visual I/O, the indispensable complementary tool for the Visual PLC package for all your Man/Machine interfaces, Arsoft can boast of an extensive experience with Pascal Language. The language set out in the IEC 1131 standard is close to the syntax used by Pascal, whose own language existed well before this standard came into being. To keep close to home, Arsoft chose this language to oppose to the definition laid out by the afore-mentioned standard. The Visual PLC user is able to transfer something which has booted the program up in Visual PLC to Visual I/O easily. What's more, inter-connecting with the Windows system is becoming increasingly sought after and necessitates the putting in place of mechanisms that go beyond those forecasts by standard IEC 1131. You will find both the basic instructions (affectations, Loop For, If/Then/Else, Case etc.) and the possibility of transtyping which have access to external DLLs and many other things.

Visual PLC's Pascal compiler was designed for solving your automation problems. It is not an office automation compiler! Arsoft's compiler uses powerful algorithms to minimise and optimise the time it takes for you to execute your programs.

Visual PLC's compiler enables the:

- Optimisation of the generated code.
- Compilation at fast speed.
- Incremental compilation.
- Direct compilation without transforming the source code.
- Single pass compilation.
- Compilation with debugging information.
- Segmentation of the program in the VPU module that can be performed directly by the real time engine.

Textual commentaries

The commentaries are texts ignored by the compiler. Their purpose is to help the user and inform him/her of certain matters which are focused on in greater details.

The commentaries are placed in brackets { and }

{This is a commentary} or with // characters before the comment.
// this is another comment

Identifiers

In order to write a program, one has to use identifiers that symbolise certain parts of its structure. A Pascal identifier must have a maximum of 63 characters and start with a letter of the alphabet. These characters are letters without accents, numbers and underlined characters. No distinction is made between upper case and lower case letters hence 'a' and 'A' are identical.

The List of accepted characters :

a à z	A à Z
0 à 9	et _

Here are some useful examples :

CallA   TwoNumber   ReadNextRecord   Call_2

Here are some bad examples:

August   { Letter with an accent } 1_Call   { Starts with a number }

Call-Sp   { The hyphen is forbidden }

Warning :   One must not use reserved words or names of procedures and functions defined by the language as identifiers.

Declarations

The declarations comprise 2 main elements:
the constants (CONST) and the variables (VAR) .
These 2 elements can be written in any order and repeated several times.

The declarations are grouped together under one of the 2 afore-mentioned elements, which play a lead role.
Each declaration ends with a semi-colon.

Example :

```
CONST
  MaxNum = 1235;
  Chaine   = 'Bonjour';
Var
      I,J   : Integer;    {*** not initialize variable **}
      K,L : Word=1;    {*** initialize variable**}
```

Boolean types :

In automation mode the byte denomination corresponds to a Boolean in Visual PLC.
However, the bit of a byte is also a part of Visual PLC's Booleans.
The Boolean types can only take 2 pre-defined values, FALSE and TRUE.
The ordinal values of FALSE and TRUE are 0 and 1 respectively.
Output: BOOLEAN

If I0 is an Integer, I0.4 is a Boolean in Visual PLC.

Arrays

An array is a structure that groups elements of the same type together. The example below shows the syntax of the arrays:

```
Cash            : Array [1..4] Of REAL
SEMESTRE        : Array [1..6] Of BOOLEAN
```

To access to an element of an array you pass via an indexation, for example, Cash[2]. In this case, you work with the second real number of the Cash array.

Character strings

A character string is a series of characters whose number can vary from 1 to 255. You can assimilate the string to an array of 256 elements. The first element, indice 0, contains the useful length of the string.

The example below of syntax of a typical string :

```
Chaine          : STRING
Ich             : STRING ='Automatic';  {** initialize string **}
```

The 0 index returns the length of the string which is an ASCII value..

A character string is written between two apostrophes. If an apostrophe appears in the component of the character string, a back up copy is taken.

Example :

```
Var
   Msg : STRING;
BEGIN
  Msg : = 'Bonjour';
  Msg := 'Today' :
END;
```

To guage the length of a string, Pascal Length (Msg) has come up with a pre-defined facility for just this purpose. In addition, you can also use the ordinal value of the 0 indice belonging to the Ord string (Msg[0]) which returns 7 in the 'Hello' example.

If you group a string of 200 characters and another of 100 together, the last 45 characters will be lost.

The operators

Below are listed all the keyboard operators :

Not, /, Mod, And, Shl, Shr +, -, Or, Xor, =, <>, >, <, <=, >=

Some of them will have the weighty task to carry out several sorts of different operations.

The arithmetical operators

The arithmetical operators carry out the 4 basic operations on numbers; addition, subtraction, multiplication and division, and are all represented by their usual symbols with the exception of the multiplication task which is represented by an asterisk *. Another operator is used for dividing: the MOD operator, which oversees the rest of the division operation. Visual PLC simplifies arithmetical calculations as far as possible. You can freely mix types. Similarly, the division of a 32-bit byte (Integer) by a Real is possible. The compiler automatically transforms the arithmetical expression when it finds different types in an equation.

Pay attention to rounding up in this case!
Dividing by 0 will not work in the system since it will just come back with the result 0.

Character string operator

The only operating symbol used by the character strings is the +, whose job it is to group strings, characters and compact chains together. In each case, the regrouping of strings is limited to a length of 255 characters.

Below is an example:

```
TS :='Visual PLC'+' Real Time';
```

The result in TS is: ‘Visual PLC Real Time’

To test or affect an element from a character string, use the following syntax.
String[X]

Example:

If TS[1]='v' **Then** Ts[1]:='V';

Logic operators

The logic operators display the complete results with full operands.

♦ And	binary AND
♦ Or	binary OR
♦ Xor	exclusive OR
♦ Shl	shiftof bits to the left
♦ Shr	shift of bits to the right

Here is the truth table for AND OR and XOR :

SHL and SHR carry out the shifting of bits to the right or left of the whole numbers.
Example, I: = 5 SHL 1 gives a result of 10.
The departure byte in binary is 0000 0101, after the shifting the byte becomes 0000 1010. The bit furthestmost to the left is lost.
On the other hand, if the shifting had been SHR 1, the result given would have been : 0000 0010. The bit furthestmost to the right is lost.

The boolean operators

Boolean operands are used in conjunction with boolean operators.

ARRAY OF BOOLEAN OPERATORS

♦ And &	and logic (This character & is valid as an logic operator)
♦ Or	logic or
♦ Xor	exclusive or
♦ Not	negative

Example :
State: = I0.0 and Cde & Not (W0.12);

Tips & tricks

Affecting the result of a boolean.
```
Var
     V       : Integer;
     Egal  : Boolean ;
Begin
   V :=12 ;
   Egal : = (V=12);     {*** Boolean Result affected to Egal **}
End ;
```

The Relational Operators

The number of relational operators on sets are 4.

Array of all the relational operators combined

- = equals.
- <> different to.
- <= less than or equal to.
- >= more than or equal to.

Instructions

The instructions are actions executed inside of the block in order of programming.

You can distinguish between simple instructions:

Affectations, procedure and function calls.

You can also distinguish between composed instructions:

IF, CASE, REPEAT, WHILE, FOR.

Simple Instructions

The simple instructions are one of the followings:

- Affectation instructions.
- Procedure and function instructions.

Affectations

The instruction of affectation:= is allowed to load a variable by a new value. The former is an expression of a compatible type with the variable.

Here is some examples:

```
TS :='Hello' ;
I :=12 ;
R :=12.3 ;
```

Call of a procedure

Such an instruction executes a procedure. The former is appointed by its identifier and, possibly, by a list of arguments (formal parameters).

Here is the syntax:
If Button Then **Initialize**;

The number and the type of parameters passed in arguments of procedure have to correspond to these describes called in the heading of the procedure.

Compound statements

Compound instructions are composed of conditional instructions (IF,CASE), of repetitious instructions (REPEAT, FOR, WHILE).

IF THEN ELSE Statement

In Visual PLC the instruction IF THEN ELSE is always used.
The expression between the **IF** and **THEN** keywords must have a Boolean return type. If the expression evaluates to True, the statement following then is executed.

First Case

```
If Counter=10 Then Counter:=0; // here the point comma must be placed
behind 0
```

If the variable Counter is equal to 10, Counter is reset.
In this case Else is not used, you must write the character ; behind the last instruction.

2nd Case

```
If Counter =10 Then Counter:=0    // not ; behind 0 because Else is present
               Else Counter:= Counter +1; // Last instruction Then ;
```

If the counter variable is equal to 10, Counter takes the value 0. Otherwise, counter increases.
In this case 'not' is at the end of the first line because Else is used in the second line.

Third Case :

```
If Counter =10 Then
Begin
  Counter:=0;
  Ok:=True;
End;  // *** Last instruction Then ; ***
```

If Counter is equal to 10, execution of a series of instructions is included in the **Begin End**; block
In this case the character is present behind End because no Else is used.

Forth case :

```
If Counter =10 Then
Begin             // First Block of instructions
   Counter:=0;
   Ok:=True;
End Else          // not ; behind End because Else is present
Begin             // Second Block of instructions
    Counter:= Counter +1;
    Ok:=False;
End;              // last instruction then  ;  ***
```

If Counter is equal to 10, execution of a series of instructions is included in the **Begin End**; block;
Else execution of another instructions block.

REPEAT UNTIL Statement

The repeat statement is used to execute a statement until a certain condition is reached.
The statement will be executed at least once.
The statements between repeat and until are executed until the Boolean expression is True.

Example:

```
Repeat
   Counter:= Counter+1;
   Ok:=False;
Until Counter =10;      // *** ; needed
```

The next syntax is correct but useless. The Begin and the End are useless.

```
Repeat
   Begin
      Counter:= Counter+1;
      Ok:=False;
    End;
Until Counter:=10;      // *** ; needed
```

The instruction Repeat Until is the neighbour of the instruction While Do.
However, in Repeat Until the block of instructions is executed at least once, because the test is at the end of the block.

WHILE DO Statement

A while statement contains an expression that controls the repeated execution of a singular or compound statement.
The syntax is **WHILE** Condition is True **DO** Something;
The expression is evaluated before the statement is executed, so if the expression is False at the beginning, the statement is not executed.

Example:

```
While Counter <10 Do
Begin
   Counter:= Counter +1;
   Ok:=False;
End;        // *** ; needed
```

CASE OF Statement

If one of the case constant values matches the value of the expression, the statement that follows this constant is executed
After that, the program continues after the final end. If none of the case constants match the expression value, the statement after the else keyword is executed

```
Example :
Begin
   Case Indice of
            1     : Order:=11;
            2     : Order:=22;
            3     : Order:=11;
            100   : Order:=100;
            Else Order:=0;    // *** Else is optional
      End;
End;
```

IF indice=1 then order receive the value 1.

FOR TO /DOWNTO Statement

A for loop is used in case one wants to calculate something a fixed number of times
Statement can be a compound statement. When this statement is encountered, the control variable is initialized with the initial value, and is compared with the final value. What happens next depends on whether to or downto is used
In the case To is used, if the initial value is larger than the final value, Statement will never be executed.
In the case DownTo is used, if the initial value is less than the final value, Statement will never be executed.
The syntax is :

For .. **To/Downto** … **Do**

Example:

```
For I :=1 to 10 do Somme:=Somme+Tablo[I];
```

This loop goes from 1 to 10.

Example:

```
For I :=10 DownTo 1 do Somme:=Somme+Tablo[I];
```

This loop goes from 10 to 1.

Procedures and functions

Procedure statements are called subroutines. There are different possibilities for procedure calls. They are necessary for the good comprehension of a program and to their maintenance. Procedures and functions can be declared in the VPU library part and can use other functions in other VPU

Structure

A procedure is a program part that performs a specific action, often based on a set of parameters.
A function is a program part that computes and returns a value.
Procedures and functions are constituted of a heading and a block.
The heading is constituted by reserved word **PROCEDURE** or **FUNCTION**, followed by an identifier, possibly of a list of arguments in parentheses, and for functions the type of the result returned.

Here is the syntax:

```
    Procedure MyProc1( Element : String) ;
    Procedure MyProc2( Var Element : String) ;
    Function    MyFunc ( Number : Real) : Boolean ;
```

In the case of the MyProc1 procedure, the variable Element is sent to the procedure. This Variable can be only read.
In the case of the MyProc2 procedure, the variable Element is sent to the procedure. This Variable can be read and written.
In the case of the MyFunc function, the variable Number is sent to the function. This variable can be read but not written.
This function returns a Boolean that can be tested or not by the instruction has called it.

Returns a result from a Function :

A function returns a typed result (Boolean, Real, Etc..).
This result is a variable created by the function itself. This result variable is a reserved word of the Pascal language named **RESULT**.

Example:

```
Function Addition ( V1,V2 : Real) : Real ;
Begin
   Result :=V1+V2 ;
End ;
```

Result: is the result variable of the function. In the case below Total will receive the result of the Addition function in return.
Total :=Addition(10,20) ;

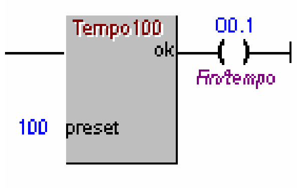
Writing functional modules

Thanks to a particular philosophy, the functional module editor allows you to write blocks of programs that can be assimilated to procedures with parameters. To write these functional modules you can use Pascal language's scope and power as well as call procedures and functions that you will have written or that come externally. From simple equations to complex overlaps, Visual PLC can boast of a language comparable to those which is used for development under the Windows environment. However, the Arsoft compiler in the Visual PLC version is very much orientated towards automation and optimising the boolean treatments and the type of variables that can be passed (eg: a bit in a byte).

Philosophy of a functional module

A functional module is a black box performing a particular function. The box receives either input and output parameters or nothing at all.
If the parameters are necessary, they can be put in the input or/and output of the module.

Let's take the 100ms temporization as an example:

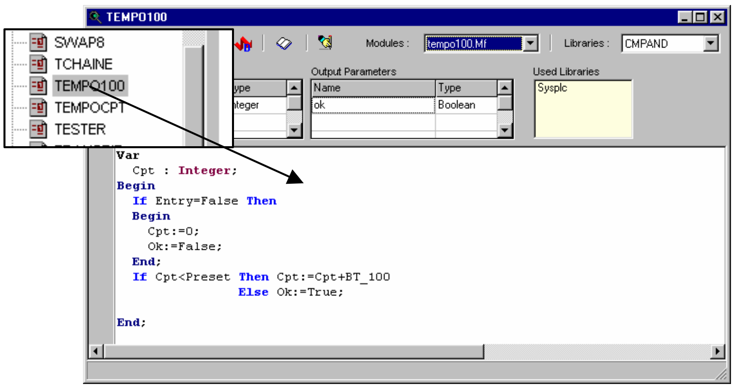


We notice that there are 2 parameters :

1 input parameter, **preset**, situated to the **left** of the module.
1 output parameter, **ok**, situated to the **right** of the module.

It appears that the input parameter is of a numerical nature and of a boolean type output.

Let's call up the functional module editor to display the source of this temporization.
Double-Click on Tempo100 in the module explorer:



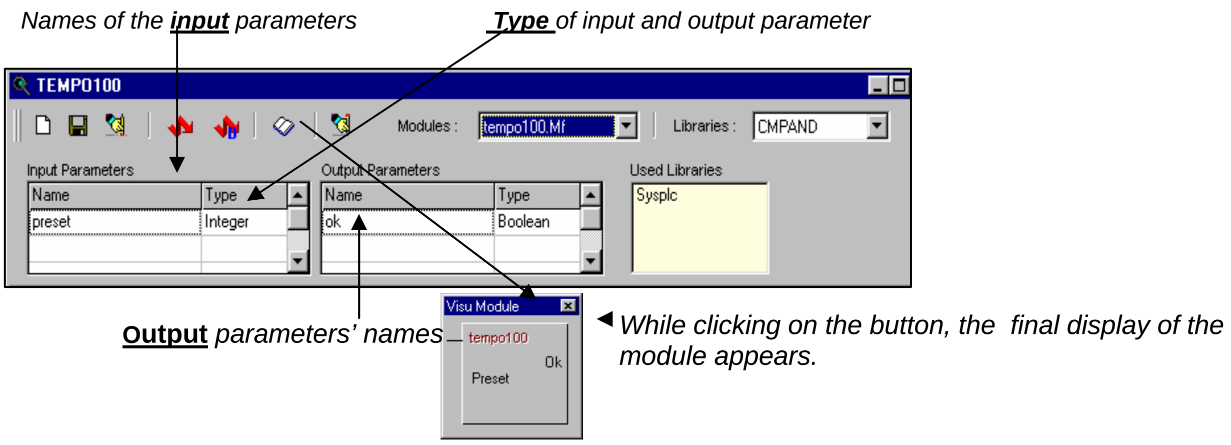
Name	Type
ok	Boolean

```
Var
  Cpt : Integer;
Begin
  If Entry=False Then
  Begin
    Cpt:=0;
    Ok:=False;
  End;
  If Cpt<Preset Then Cpt:=Cpt+BT_100
                Else Ok:=True;

End;
```

<u>Programming in a functional module</u>

Let's examine the source code of the 100 ms temporization module:

<u>The declaration of the parameters :</u>
<u>Type</u> *of input and output parameter*



Input Parameters

Name	Type
preset	Integer

Output Parameters

Name	Type
ok	Boolean

In the two grids, write the names of the input and output parameters.
In the example above, Preset is an input parameter in Integer type and Ok is an output parameter in Boolean type.

When you write a new input or output parameter, the Integer type will be displayed automatically. To change the type, double click on the cell, thereby scrolling through all the possible new types.

POSSIBLE INPUT TYPES: INTEGER, BOOLEAN, STRING AND REAL
Possible output types: Integer, Boolean, String, Real and ALL

<u>An Integer can receive</u> numerical variables and constants of an Integer, Word, Byte and eventually Real type.
If an input parameter is of an Integer type, and it receives a variable or constant of a real type, a rounding up is automatically done upon the receipt of this value.

<u>A Boolean can receive</u> boolean variables or bits of a Integer (Integer, Word).
Example: Cde or I0.0

<u>A String can receive</u> character string variables or constants.

<u>A Real can receive</u> all types of input numerical variables. These variables will be typecasted into float value.

<u>ALL</u> can receive all types of output variable. This variable will be typecasting by the module. The typecast will be viewed later.

Test equation in Ladder validating the functional module

It is useful to test the validating conditions of the functional module. In other words, it is to be able to know the result of the Ladder linked to the module.
The pre-defined variable ENTRY in Boolean type has the same state as the Ladder connected to the module.

If **ENTRY** is **True**, that means that the Ladder linked to the module is true.

Let's analyse the source code of the temporization

```
Var
  Cpt : Integer;
Begin
  If Entry=False Then      If ENTRY is false(0), the
  Begin                   output bit is reset as well as
    Cpt:=0;               the internal counter.
    OK:=FALSE;
  End;
  If Cpt<Preset Then Cpt:=Cpt+BT_100 If the internal counter is
                Else Ok:=True;         less than the parameter value,
 End;                              add the elapsed time.  If not, the output
                                     bit is True(1).
```

We can see that the module needs a saved internal variable. This variable is declared before the beginning of the program. In the case of a functional module, all variables declared in this way are saved when the program leaves the module.
We can declare all types of local variables (arrays, strings etc) in the module.

System Variables

ENTRY	(Boolean)	Has the same state of the Ladder linked to the module.
BT_100	(Integer)	Is true every **100ms** for **one cycle**.
START_PROG	(Boolean)	Shows the first program cycle.

Attentions: in a functional module, the local variables in the module are not initialized.
We initialize these variables with the **Start_Prog** variable.

Example: **If** Start_Prog **Then** Cpt: =0;

To quit the functional module

The EXIT instruction allows you to leave a module without executing the rest of the program module.

Example:

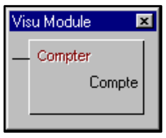
```
If Entry=False Then
Begin
    Cpt: =0;
    Ok: =False;
    Exit;        {exit the module here }
End;
```

Examples of functional modules

Simple counter:
Let's consider a module which has only one output Integer parameter named Compte and we want to count the pulses of the Ladder linked to this module.

If the program was written as follows:

```
Begin
 If Entry Then Compte: =Compte+1;
End;
```



The variable Compte will be increased for every cycle. You must insert a rising edge by declaring a Boolean used as a rising edge.

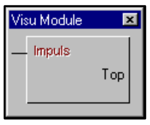
```
Var
 Edge: Boolean;                         {Internal rising edge bit saved}
Begin
  If Entry and Not(Edge) Then  {If the ENTRY variable is true and the Edg
  Begin                                 variable is false,  then the variable Compte increases.}
    Compte: =Compte+1;
    Edge: =True;
  End;
  If Not(Entry) Then Edge:=False;       { If the ENTRY variable is false, the Edge variable is
                                   false.}
End;
```

Impulse:
Consider a module named '*Top*' in parameter in output in Boolean type and we wanted to send pulses every 100ms if the ladder is true.

```
Begin
 If Entry Then              If the ladder is true, then execute the following block
 Begin
   If BT_100=1          Then Top: =True                { If Bt_100=1 then Top is True (1)}
                  Else  Top: =False;        { else top is False (0).}

  End Else Top: =False;
End;
```

Variant / Optimization:

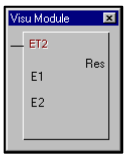
```
Begin
  If Entry Then Top: =(BT_100=1)
            Else Top: =False;
End;
```



It is necessary to understand:
'*Top*' is a Boolean, we assign the result of the test (BT_100=1) which is true or false to this Boolean.

AND Block with 2 inputs:
Let us consider a module having 2 named parameters of input E1 and E2 and 1 parameter of output named RES
All the parameters are Boolean type.

```
Begin
 If Entry Then  Res: =E1 and E2
         Else    Res: =False;
End;
```



<u>Tables transfer and typecast</u>

Often in a functional module it is necessary to transfer one consecutive bytes into other consecutive bytes. Or simply put an entire table back to zero.

Let's take the transfer of a constant into an array of bytes (Integer) as an example.

Let's consider that you have declared an array of integers in the global variables. This array is displayed as follows:

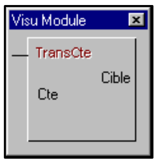
TWords: Array [0..12] of Integer

<u>Construct a functional module to transfer a constant in this array.</u>

Declare an input parameter called **Cte** of type **Integer** receiving the constant to transfer.
Declare an output parameter called **Cible** receiving the array. The problem is to choose a type for this array. This is not a simple Integer since it is an array.
So we intervene the type **ALL**. This declaration allows you to pass all type of variable to this functional module.

The program can be as follows:

```
Var
 I : Integer;
Begin
  If Entry Then
  Begin
      For I:=0 to 12 do Cible[I]:=Cte;
   End;
End;
```



<u>Explanations :</u>
For intruction scan all the array passed. As Cible is a type ALL parameter, it can be addressed by all manners (Array of Boolean, Real, string etc.). To the compilation of the module, the compiler does not know what its type is; the compiler guesses it by the employed syntax and by the affectation that it receives.

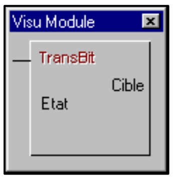
Here since there are hooks ([I]) the compiler guesses that it is a table. Yes, but of what?
The compiler looks the type of variable that receives this array, it sees that it is an Integer, it deduces that it is an array of Integer. This operation is called a simplified typecast.

<u>Transfer a state in a array</u>
We declare an array of Boolean in Global variables:
Tbits: Array [0..12] of Boolean;

The program is very similar to what have been described above. Simply the parameter of entry is an Boolean and the array of exit is an array of Boolean. The typecast by the compiler is here the type Boolean.

The program can be as follows:

```
Var
 I : Integer;
Begin
  If Entry Then
  Begin
      For I: =0 to 12 do Cible[I]: =Etat;
   End;
End;
```



Transfer a table in another table

Consider that in global variable the arrays hereafter are declared:

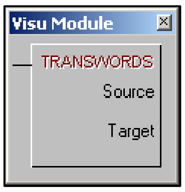
```
TabSour     : Array [1..20] of Integer;
TABTARGET   : ARRAY [0..19] OF INTEGER;
```

2 arrays have the same dimension but do not begin to the same index.

A functional module allowed to transfer a table in another has to have 2 parameters of output in ALL type.
Declare source and target as output parameters in ALL type.

The parameters of the fonctional module will be able to be this type by passing the first element of TabSource and TabTarget.

The program in the fonctional module is :



```
Var
  i : Integer;

Begin
  IF ENTRY=FALSE THEN EXIT;
  For I: =1 To 4 Do
   TArrayInt(Target)[I]: =TArrayInt(Source)[I];
End;
```

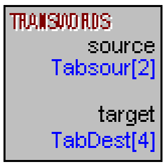
As Target and Source are both of typical ALL, the compiler needs to know the types to compute.
TArrayInt **(Source[I])** indicates to the compiler that Source is an array of Integer and thereby that Target is the same type.
Here the program transfer 4 Integers from Source to Target.
This is a classic typecast of variables.

Already declared in Sysplc.pas used for typecasting

```
Type
  TArrayInt       = Array [1..10] Of Integer;
  TArrayWord      = Array [1..10] Of Word;
  TArrayByte      = Array [1..10] Of Byte;
  TArrayBool      = Array [1..10] Of Boolean;
  TArrayReal      = Array [1..10] Of Real;
```

Other type of specification in ladder

Here the functional module will transfer 4 consecutive elements starting to TabSour[2] into 4 consecutives elements starting to TabDest[4].



Other high speed transfer possibility the instruction MOVE :
The program of our functional module can be written like this

```
Begin
    If Entry Then  MOVE(Source,Target,16);
End;
```

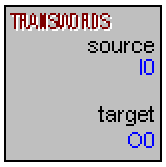
Transfers the content of the Source variable into the Target variable with a number of bytes. Here 4 integers=16 bytes.

The instruction **Move** copy a specified number of contiguous bytes (Count) from a source range to a destination range. **No range-checking is performed**.

Transfer of variables

Consider the existing array in global variables
```
I0,I1,I2,I3       : Integer;
O0,O1,O2,O3       : Integer;
```

The functional module described before being allowed to transfer values of an array into another array. However as an array is composed by contiguous values, thanks to this functional module we can transfer others contiguous values not belonging to the array.



In this case the specification in the ladder can also be as follows.
Since I0,I1,I2,I3 are declared consecutively,
it is possible for the functional module to take them as an array so as to transfer them into other contiguous variables as O0,O1,O2,O3.

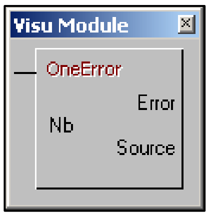
Test bits in contiguous variables

Consider a module allowing testing if one of the inputs of the process is to 1. Physical inputs of the process are contained in variables I0,I1,I2,I3 of Integer type;

The module will be able to be as follows:

Input the number of words to test (Integer Type).
Output a bit is setting if one of the bits of source is detected to 1 (Boolean Type).
Output the first word to test (ALL Type).

```
Var
  I : INTEGER;
Begin
   ERROR:=FALSE;
     FOR I:=0 TO NB DO
     IF TARRAYINT(SOURCE)[I]<>0 THEN ERROR:=TRUE;
 End;
```



<u>Shift bits to left in consecutives words.</u>

Consider a module allowed to shift to the left all the bits of contiguous words.
The program could be as follows:

```
Var
 I    : Integer;
 Edge : Boolean;
Begin
  If Entry and Not(Edge) Then
  Begin
    For i:=3 Downto 0 do
    Begin
      TArrayInt(Source)[I]:=TArrayInt(Source)[I] Shl 1;
       If I>0 Then
         If Source[I-1].31 Then Source[I].0:=True;
    End;
    Edge:=True;
  End;
  If Entry=False Then Edge:=False;
End;
```

<u>Explanations :</u>

```
If Entry and Not(Edge) Then
```
Allow you to do an edge when the connected Ladder is true.

```
For i: =3 Downto 0 do
```
Loop starting from 3 downto 0. Start on the last Integer to goto the first integer.

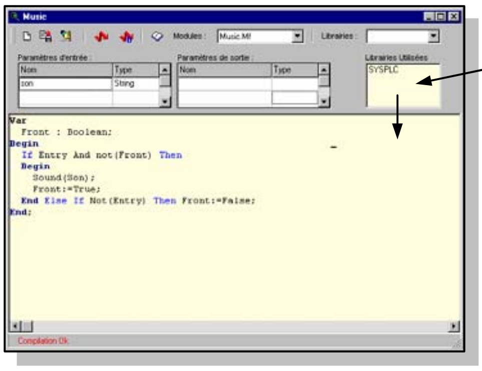
```
TArrayInt(Source)[I]:=TArrayInt(Source)[I] Shl 1;
```
All the bits of the word in progress are shift of one position to the left.

```
If I>0 Then
         If Source[I-1].31 Then Source[I].0:=True;
```
If the pointer is not on the first word, we take the last bit of the preceding word; that report in the first bit of the word in progress.

Here one processes words of 32 bits.

Call functions and procedure in a library VPU.

We will see thereafter that it is possible to create its own functions and procedures in VPU library.
In a functional module it is possible to use procedures and functions localized in VPU libraries.
The **Sound** function allowing you to play a music by the sound card of your PC is programmed in the library **SysPLC**.
In order that a functional module could use this procedure, it is necessary to indicate the name of the VPU library containing the procedure.



```
Var
  Front : Boolean;
Begin
  If Entry And not(Front) Then
  Begin
    Sound(Son);
    Front:=True;
  End Else If Not(Entry) Then Front:=False;
End;
```

Compilation Ok

To indicate compiler in the functional module to include procedures and functions of a library, bring by drag & drop the library name wished in the list.
Here the procedure Sound of Sysplc library is used and accepted by the compiler.

Compiling a functional module

Compiling is done by clicking on the '*zig zag button*'. The result of this compilation is written in red in the status zone at the bottom of the screen.

If an error is detected, an inverted video indicates where the compiler stops.
If no error is detected, the text '*Compilation Ok*' is displayed at the bottom of the page and the module with VPU extension file name is created and stored on the disc.

Instruction set of the Pascal language for Visual PLC

The instructions set incorporates the compound statements described previously:
IF/THEN/ELSE   REPEAT/UNTIL   FOR/TO/DOWNTO CASE

Basic instructions

Arithmetic operations + - * /

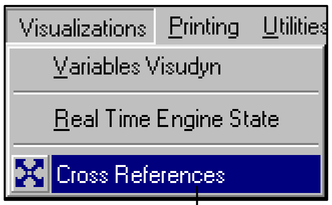
Logical operations   OR AND XOR

Shl	To shift to left of X bits	*I:=J SHL 3;*
Shr	To shift to right of X bits	*I:=J SHR 3;*
Not	To invert a boolean	*I0.0:=Not(I0.1);*
IntToStr	To convert an Integer into Sting	*TS:=IntToStr(12);*
StrToInt	To convert a String into Integer	*I:=StrToInt('12');*
FloatToStr	To convert a Real into String	*TS:=FloatToStr(12.45);*
IntToHex	To convert an Integer into String representing a hexadecimal number	*TS:=IntToHex(I,Digits);*
Move	To transfer a series of consecutive bytes into another series	*MOVE(Source,Destination,Number);*
Copy	Copy part of a String into another String.	*TS:=Copy('Arsoft',3,4); {*** TS:='soft' ***}*
Val	To convert String into numerical value.	*Val(TS,I,Ok); {** I=Real OK=Integer); Si OK=0 I=correct value }*
Pos	Return the position of a text in a String.	*I:=Pos(TS,'soft'); {** I=3 si Ts='Arsoft' **}*
Delete	Erase a portion of the specified String	*Delete(TS,3,4); {** TS=Arsoft → TS=Ar **}*
EditInsert	Insert String into another String	*EditInsert(TS,'Visual Plc ',1); {** TS='Arsoft' -→ TS='Visual PLC Arsoft' **}*
Length	Return the length of a String	*I:=Length('Arsoft'); {** I=6 **}*
Addr,@	retrieves the address in memory of a variable	*A:=Addr(Counter); ou A:=@(Counter);*
Chr	Return character associated with the ASCII code.	*TS:=Chr(65); {*** TS='A' ***}*
Ord	Return the ASCII code of the specified character.	*I:=Ord('A'); {*** I=65 ***}*
FillChar	To fill a zone of the specified value.	*FillChar(Tablo,16,0); {*** Tablo : array [1..4] of integer The first 4 Elements of the table are put at 0 ***}*
Cos	Return cosine of the argument passed in radians	*R := Cos(Pi);*
Sin	Return sine of the argument passed in radians	*R := Sin(Pi);*
Exp	Return the exponential value of X.	*E := Exp(1.0);*
Int	Return the integer part of a real number.	*R := Int(123.456); { 123.0 }*
Frac	Return the decimal part of a Real.	*R := Frac(123.456); { 0.456 }*
Trunc	Truncate a Real in integer.	

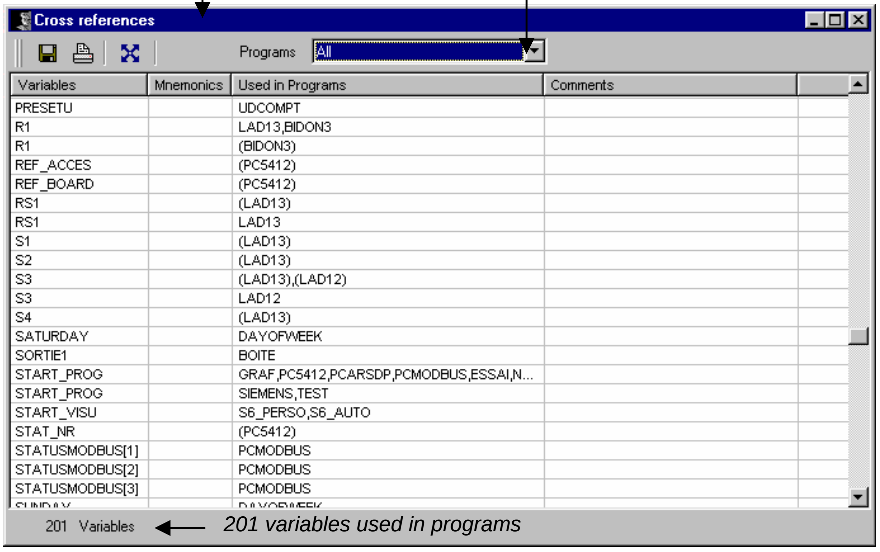
DegToRad	To convert degrees into radians	*R:=Cos(DegToRad(60));*
Abs	Return an absolute value.	*r := Abs(-2.3); { 2.3 }*
ArcTan	To calculate the arc-tangent of the value given.	*R := ArcTan(Pi);*
Ln	Return the natural logarithm of a real expression.	*E := Exp(1.0);*
Sqr	Return the square of a number.	
Sqrt	Return the square root of a number.	
LoWord	Return the low part 16 bits of an integer.	*W: =Loword(I);*
HiWord	Return the high part 16 bits of an integer.	*W: =Hiword(I);*
Lo	Return the low part 8 bits of an integer.	*W: =Lo(I); {0..255}*
Hi	Return the high part 8 bits of an integer.	*W: =Hi(I); {0..255}*
Port	When reading return the value of a physical port of I/O *V:=Port($2F8);* When writing affect a physical port of I/O by a value *Port($2F8):=0;*	
Mem	When reading return the value of an address memory *V:=Mem($C800,0); {** reading of one byte **}* When writing affect an address memory by a value *Mem($C800,0):=255; {** writing of one byte **}*	

Cross references

You can get the list of the bits, constants and functional modules used in all the compiled programs (Ladders, Grafcets, programs etc.). Click on the main menu Visualizations/Cross References



You can ask for the entire cross references (the system scans all the compiled programs in the current project directory.
You can also select only one program to scan.



Variables	Mnemonics	Used in Programs	Comments
PRESETU		UDCOMPT	
R1		LAD13,BIDON3	
R1		(BIDON3)	
REF_ACCES		(PC5412)	
REF_BOARD		(PC5412)	
RS1		(LAD13)	
RS1		LAD13	
S1		(LAD13)	
S2		(LAD13)	
S3		(LAD13),(LAD12)	
S3		LAD12	
S4		(LAD13)	
SATURDAY		DAYOFWEEK	
SORTIE1		BOITE	
START_PROG		GRAF,PC5412,PCARSDP,PCMODBUS,ESSAI,N...	
START_PROG		SIEMENS,TEST	
START_VISU		S6_PERSO,S6_AUTO	
STAT_NR		(PC5412)	
STATUSMODBUS[1]		PCMODBUS	
STATUSMODBUS[2]		PCMODBUS	
STATUSMODBUS[3]		PCMODBUS	

201 Variables

201 variables used in programs

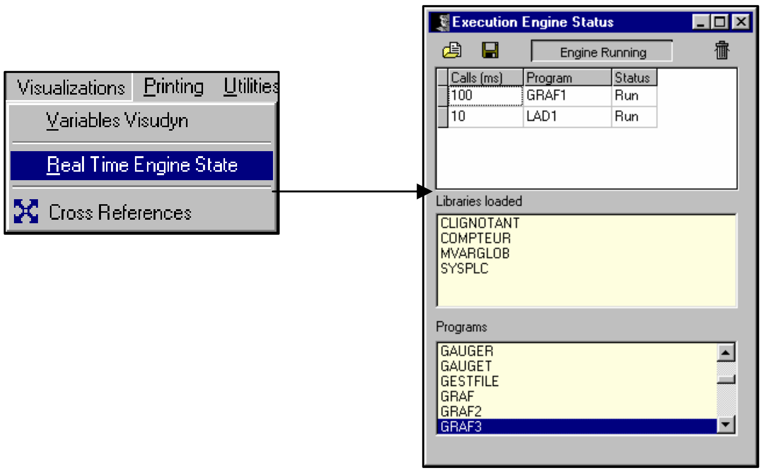
Explanations:

(LAD1**)** : Coil or activation by program.
LAD1 : Used like a ladder or in an expression.

Note: The cross references are done by the compiler (during the programs compilation phase).

Statuts of the real time engine

Programs are loaded up in the real time engine by the '*load'* buttons in different editors (Ladder, Grafcet).
However it is possible to load up the real time engine manually, particularly in the case of programs written in high level language by the 'Vpu libraries' editor.



Calls (ms)	Program	Status
100	GRAF1	Run
10	LAD1	Run

Libraries loaded

CLIGNOTANT
COMPTEUR
MVARGLOB
SYSPLC

Programs

GAUGER
GAUGET
GESTFILE
GRAF
GRAF2
GRAF3

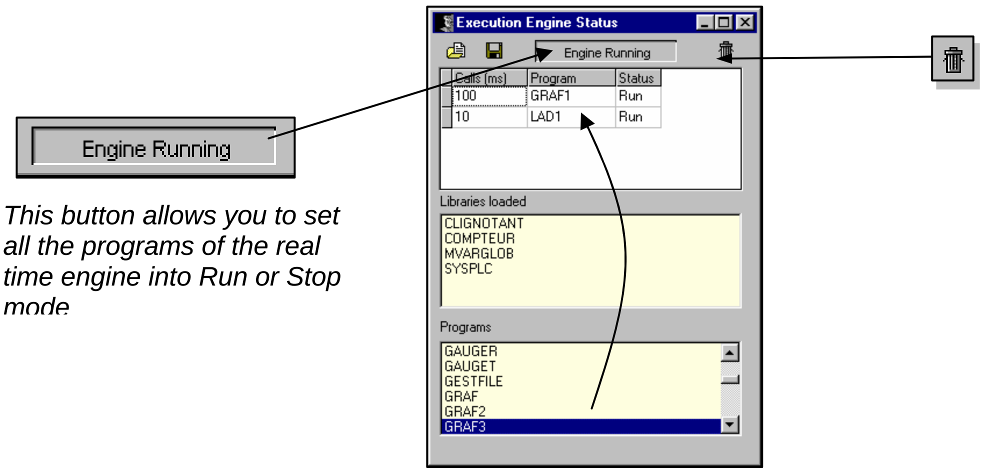
In the top grid, the list of programs present in the real time engine appears. To the left, in the main column, the time bases concerning each program are displayed. In this example, the LAD1 program is running every 10 ms and Graf 1 every 100ms. The 2 programs are in Run and are in maximum priority in your PC.
It is possible to stop the program by striking '*Stop*' in the statuts column and in the requisite cell.
You can delete a program in the real time engine by clicking on the name of the program and then striking the **<Del>** key

To change the time base for one of the programs, click on the cell to the left of the name of the concerned program and type in the new desired time base. This time base has to be a multiple of 10ms or 2,4,6,8 ms.

Adding a program to the real time engine

To add any program to the real time engine, use the Drag & Drop method to bring on screen the name of the program concerned from the bottom list and put it in the top grid.

By clicking on this button, all the programs present in the real time engine will be deleted.



Calls (ms)	Program	Status
100	GRAF1	Run
10	LAD1	Run

Libraries loaded:
CLIGNOTANT
COMPTEUR
MVARGLOB
SYSPLC

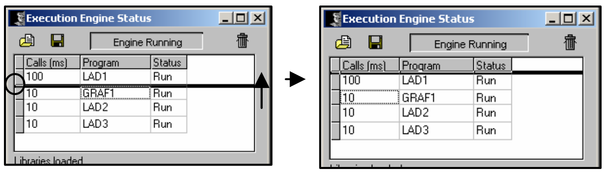
Programs:
GAUGER
GAUGET
GESTFILE
GRAF
GRAF2
GRAF3

This button allows you to set all the programs of the real time engine into Run or Stop mode

Programs execution order of in the real time engine

It is possible to organize the order in which programs are performed in the real time engine. In order to do so, move the concerned program from the top list to the desired spot.

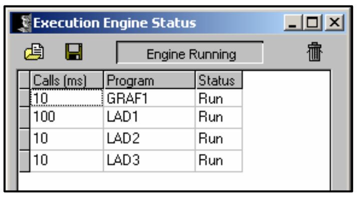
Click on the grey cell to the left of the name of the program concerned. Then move it to the necessary position. A dark bar will appear.



Calls (ms)	Program	Status
100	LAD1	Run
10	GRAF1	Run
10	LAD2	Run
10	LAD3	Run

Calls (ms)	Program	Status
100	LAD1	Run
10	GRAF1	Run
10	LAD2	Run
10	LAD3	Run

When you click the left button of the mouse, an inversion of the source programs and target is performed. However at this step the real time engine was still not affected. It is necessary to save the list of these programs, then reload it in the engine through the 2 buttons in the superior part.



Calls (ms)	Program	Status
10	GRAF1	Run
100	LAD1	Run
10	LAD2	Run
10	LAD3	Run

Saving the configuration of the real time engine

TO SAVE THE LIST OF THE PROGRAMS DISPLAYED IN THE WINDOW, CLICK ON THE 'SAVE CURRENT CONFIGURATION' BUTTON

The list of the programs is saved in the textual file **PROG.PLC**. This file will allow an automation to load the engine at the Bootstrap of Windows. You can also save the list under another file name.

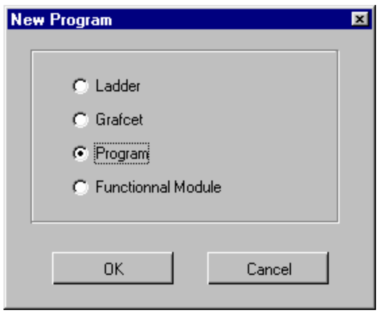
Loading the configuration in the real time engine

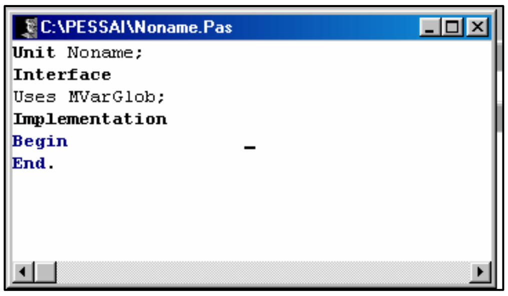
To load the last configuration in the real time engine, click on this button. It allows you to load the engine with programs listed in the file 'PROG.PLC' or to choose in a list of files.

Writing cyclical programs in Pascal language

With Visual PLC, it is possible to write a cyclical program (VPU) to be loaded in the real time engine with the same way as a program written in Ladder or Grafcet.

YOU CAN CALL THE PROGRAM EDITOR BY CLICKING ON THE NEW BUTTON AND SELECT PROGRAM.





```
Unit Noname;
Interface
Uses MVarGlob;
Implementation
Begin
End.
```

The programs and libraries editor appears. A mask of library is proposed.

This editor is allowed to write libraries or cyclic programs, such as a program **Clear** the first line containing the reserved word **UNIT** as well as the line containing the word **INTERFACE**.

A simple program can be:

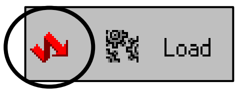
```
Uses MVarglob;       {** Use the global variables Mvarglob.Vpu **}
Begin                {*** Beginning body of program ***}
  D0:=D0+1;
End.                 {*** End of body ***}
```

The USES clause

Each identifier in a uses clause is named as a unit used by the current program.
Example **USE Mvarglob, Calcul, Personal**; Indicate to the program that it can use all that is provided by the libraries Mvarglob, Calcul and Personal.VPU.

The body of program
The body of program contains the instructions which must be called recurringly by the real time engine. This body starts with a **BEGIN** and finishes with an **END**. (Followed by a **point** but not a semicolon).

Compile the program with the help of the compiler button located in the tool bar :



Cyclical programs with interface

Normally, a program cannot exchange variables or procedures since it uses these procedures, functions or variables in the unit itself (private).
However Visual PLC allows you to mix programs and libraries.

Let’s consider that a program increased a word, and we wanted that it belonged to the program and it is also accessible to other externals programs.

Let’s examine the code:

```
Interface
Var
  ID0 : Integer;        {** variable accessible to external programs **}
Implementation
{*** Internal program function***}
Function Inc( Value : Integer) : Integer;
Begin
  Result:=Value+1;
End;
{** Body of program ***}
Begin
  ID0:=Inc(ID0);
End.
```

We can see that the Uses clause has disappeared because we are not using neither any global variables nor any functions contained in other VPUs.

The **INTERFACE** clause has appeared. This clause allows us to indicate to the compiler that we want to put variables, procedures or functions at the disposal of other programs. In our example, we simply want to put an Integer type variable at the disposal of externals programs.
The interface section of a unit is a public part. It determines what is visible and accessible to any program (or other unit) using that unit.
The interface section starts at the reserved word interface, which appears after the unit header, and ends with the reserved word implementation.
In the unit interface, you declare constants, data types, variables, procedures, and functions.
The "bodies" of public procedures and functions are in the implementation section.

The **IMPLEMENTATION** clause allows you to determine the end of the interface and when to start up the code and variables exclusive to the program but not accessible to the others (programs).

The implementation part of the unit is where you find the bodies of the procedures and functions that are declared in the interface part of the unit.

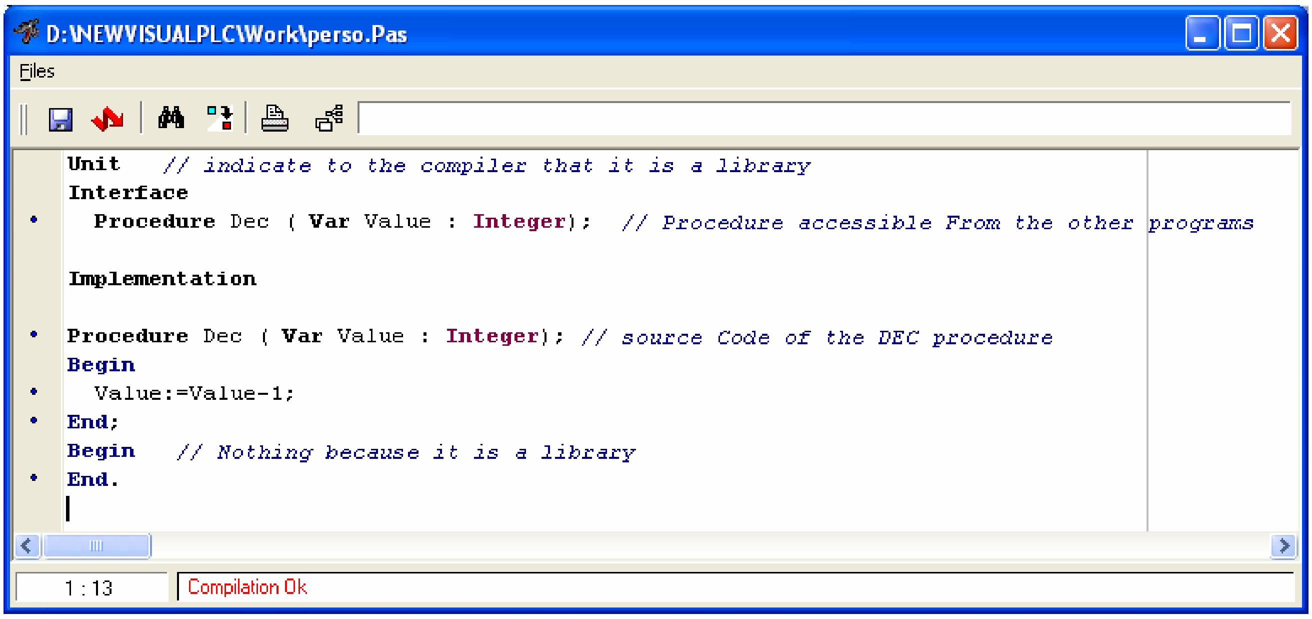
The implementation part of the unit is a private part. Declarations made here can be used only within this section of the unit.

The **Inc** function allows you to increase a variable. This function can only be used in the program itself because it is contained in the implementation part.
Finally, we get to the main part of the program which increased the IDO variable in running program.
Only when the noname3 program is loaded up in the real time engine, the IDO variable can now be accessible under the same way as all Mvarglob VPU’s global variables.
That is the proof of the mixing of program and library.
Normally, a library does not contain a program, or it would not act as library.
This case can be useful to control the internal progress since it offers an IDO interface that can be a command according to its state.
If you want to allow other programs to have access to the INC function, the program would be written as follows:

```
Interface
Var
  ID0 : Integer;                   {** accessible variable to any program
**}
Function Inc( Value : Integer) : Integer;      {** This function is now
accessible  **}
Implementation
{*** Internal program function ***}
Function Inc( Value : Integer) : Integer;
```

Writing VPU libraries

The principle seen before remains the same, but the only difference is that a library do not contain cyclic program. A library is passive and export variables, procedures and functions.



```
Unit    // indicate to the compiler that it is a library
Interface
  Procedure Dec ( Var Value : Integer);  // Procedure accessible From the other programs

Implementation

Procedure Dec ( Var Value : Integer); // source Code of the DEC procedure
Begin
  Value:=Value-1;
End;
Begin   // Nothing because it is a library
End.
```

1 : 13   Compilation Ok

.

Let us examine this code:

```
UNIT  // indicate to the compiler that it is a library
Interface
 Procedure Dec ( Var Value : Integer);    // Procedure accessible to the other programs

Implementation

Procedure Dec ( Var Value : Integer);   // source Code of the DEC procedure
Begin
  Value:=Value-1;
End;
Begin // Nothing because it is a library
End.
```

The UNIT clause
The unit header starts with the reserved word unit indicating to the compiler. It is a **library**, not a program.
Nothing is executed cyclically in the main between BEGIN and END.

In **IMPLEMENTATION**
The implementation section of a unit is the section that contains the actual code for the unit. The implementation can have additional declarations of its own, although these declarations are not accessible to any other application or unit.
In **INTERFACE**
In the unit interface section, we can declare global constants, data types, variables, procedures and functions.

The DEC procedure : We can see this Value is passed in parameter with the word **VAR** in before.
When a parameter is preceded by the VAR clause, it means that the program in the procedure or the function receiving it can modify it.
In fact, the parameter received by the procedure is not the contents of Value but its address.
Program DEC decreases contents of the variable to the given address.

Initialization in a library

If we want to initialize any data the unit uses, you can add an initialization code to the **BEGIN END** Section of the unit (Main). When an application uses a unit, the code within the unit's initialization part is called before any other application code runs.

Let us examine this code:

```
UNIT          // indicate to the compiler that it is a library
Interface
  Procedure Dec ( Var Value : Integer);   // Procedure  exportable to other programs

Implementation

Procedure Dec ( Var Value : Integer);      //  source Code of the DEC procedure
Begin
  Value:=Value-1;
End;

Procedure Initial;    // Internal procedure in the library
Begin
   …..
 End;

Begin         // Initialization of the library (unit) at the start-up time of the application
  Initial;  // Call initial is done only one time
End.
```

Passing parameters by values and address

When you create procedures and functions, you will have to pass parameters to these procedures and functions. Two solutions are possible.

Passing by value

```
Ex: Procedure Test (Value: Integer);
Begin
End;

Begin
  I:=10;
  Test(I); // ** sent by value to TEST procedure
           // here I is always equal to 10 whatever the action in Test
End.
```

In this procedure, 'I' cannot be modified by the procedure.

We are able to write: If Value = 10 Then … or Counter:=Value;

The expression Value:=100 will not have any effect on the variable 'I'. Affecting Value in the procedure modifies the local value but not the original value. A local copy of I is made in the Test procedure.

Passing by address

```
Ex : Procedure Test( Var Value : Integer);
Begin
   Value:=Value*2;   // *** Modify the value of i *
End;
Begin
  I:=10;
  Test(I);   // ** passing to the procedure Test by address *
            // here I is not equal to 10 it depends on the Test procedure
End
```

When passing data to a routine (function or procedure), you can prefix the parameter definition with Var if the variable itself is to be updated by the routine. This allows a caller to pass data to a routine that will be enriched by the routine.
Let us take the example of the procedure Inc that allows increasing a variable again.

We could write:

```
Procedure INC ( Var Value : Integer);
Begin
  Value:=Value+1;
End;
Begin
  Inc(I); // ** Increase I by 1
End.
```

Or writing a function that will do the action:

```
Function INC (Value : Integer) : Integer;
Begin
  Result:=Value+1;
End;
Begin
  I:=inc(I);
End.
```

Other example:

```
Function Inc(Value : Integer) : Integer;
Begin
  Result:=Value+1;
End;
Begin
  R:=1.2;
  R:=Inc(R);   // ** send a real to the function and retrieve result in a
real
End.
```

The INC Function is normally designed to receive and return an Integer. In this case, the compiler transforms R (a real) into an Integer to adapt to the function and transforms the result returned in integer into real.

Passing a variable with no type

We can also write:

```
Procedure Inc ( Var Value);
Begin
   Integer(Value):=Integer(Value)+1;
End;
```

Here the INC procedure receives a non-typed variable and this by address.
It is necessary that the procedure typecasts the variable to exploit it. The INC procedure decides in the example that value is an integer type.

Calling procedures and functions in a DLL

Visual PLC allows calling procedures and functions located in a dynamic link library DLL. This interface is interesting in the case where you have libraries for scientific cards, or if you decide to enlarge Visual I/O functionalities written under another language (for example in Visual Pascal, C++, Delphi).
To use these procedures and functions in a DLL, it is necessary to declare the structure of the function or the procedure in the INTERFACES part of a unit (vpu). The library is used as a link between Visual I/O and the DLL.
When you import a routine from a DLL, the procedure or function is imported explicitly by its name.

Let us examine the following declaration:

```
Unit
Interface
   Function MessageBeep(Utype : Integer) : Integer; StdCall 'user32.dll';
Implementation
Begin
End.
```

This VPU library allows getting a new function named MessageBeep.
This function is not implemented in the VPU itself but in a DLL named User32.dll.
It is necessary to pass a parameter named Utype (Integer type)to the function.
StdCall allows specifying to the compiler that it must respect the standard mode for passage of parameters predefined by Microsoft for the 32Bits applications.

In case of MessageBeep, the function in User32.dll is also named MessageBeep.

Attention: respect scrupulously the case sensitive in the declarations

The following declaration is not correct:
Function MESSAGEBEEP(Utype : Integer) : Integer ; **StdCall** 'user32.dll';

To redefine the name of the function contained in a DLL
You can redefine the interface name of the procedure in the DLL. The following declaration allows it:

```
Unit
Interface
  Function Beep (Utype : Integer) : Integer; StdCall 'user32.dll' name 'MessageBeep';
Implementation
```

You define a new exploitable function in Visual I/O whch is Beep and corresponds to MessageBeep in user32.dll.

Localization of a DLL
It is possible that Visual I/O does not find the called DLL. Then you can copy your DLL into a Windows directory. For example, you can copy your DLL into C:\Windows. The Visual I/O runtime will locate this DLL.

You can also specify the complete path for the DLL (not recommended).
Function **Go**(Utype : Integer) : Integer ; **StdCall** 'C:\Proj1\Test.dll' name 'Start';

Visual I/O places many data types at the disposal so that the interface with DLL is the most compatible. However, the generally encountered problem is related to the character strings. In C language, for example, the type always used is PChar (Pointer on char, ended by the Null character 0). In Pascal, the character strings are different, and the first character is the length. To typecast (change the type for compatibility) you can use the PChar function from the Windows.pas library (source is included in Visual I/O).

Example to pass a text to a procedure in a DLL.
Example: **ExternFunc**(PChar('Hello')); PChar('Hello') returns the address of the first character in the string 'Hello'. The PChar function also ADD (if it is not the case) a Null character to the end of the text string.

Example of Visual PLC variable allocated in an external DLL

Let's consider the Pascal program implemented in a DLL named MyDLL.
This program is allowed to force to 1, 10 Integers in Visual PLC.

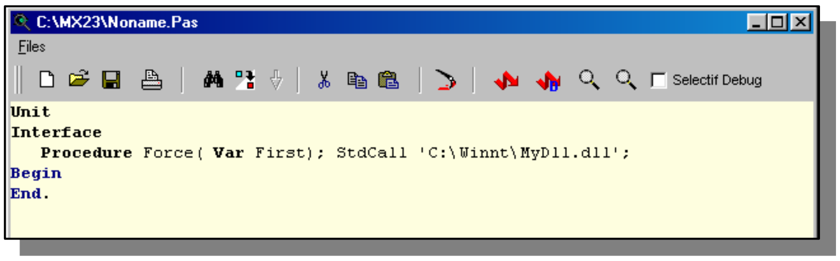
Example in Delphi or Visual Pascal :

```
Library Mydll;
{$C PRELOAD MOVEABLE DISCARDABLE}

 {******** Force to 1 all Integers in Visual I/O or PLC ***********}
Procedure Force( P : Pointer); StdCall;
Var
   I        : Integer;
   PTInt    : ^Integer;   //*** Pointer on Integer
Begin
  PTInt:=P;  //**** transfer the Pointer received
  For I:=1 To 10 do
  Begin
     PTInt^:=1;   //*** Force the word Visual I/O or Visual PLC to 1
     Inc(PTInt);  //*** Pass to the next word
  End;
End;

{******* Exports **************}
 Exports
    Force Index 1;
{******** Your Initialisation ***********}
Begin
End.
```

To call the procedure Forces in this DLL, it is necessary to declare the prototype in a Visual PLC library VPU.

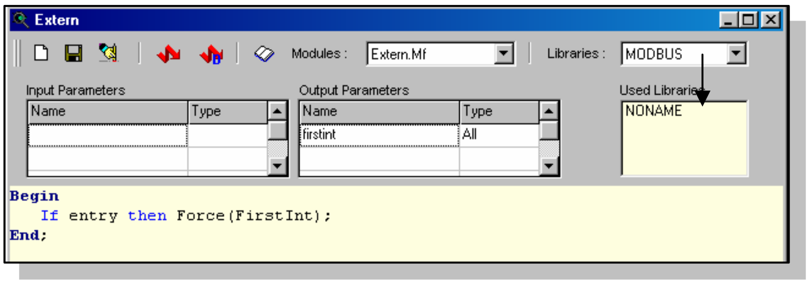
Example :

The library Noname.pas allows the interface with the procedure localized in MyDll.com.



```
Unit
Interface
   Procedure Force( Var First); StdCall 'C:\Winnt\MyDll.dll';
Begin
End.
```

Let's now create a functional module calling this procedure (Force).



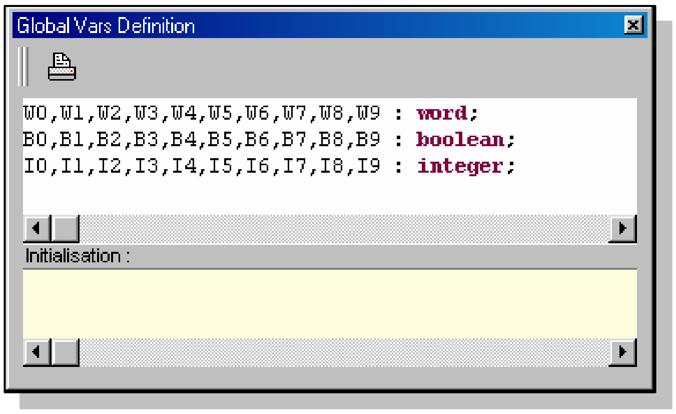
Name	Type
firstint	All

NONAME

```
Begin
    If entry then Force(FirstInt);
End;
```

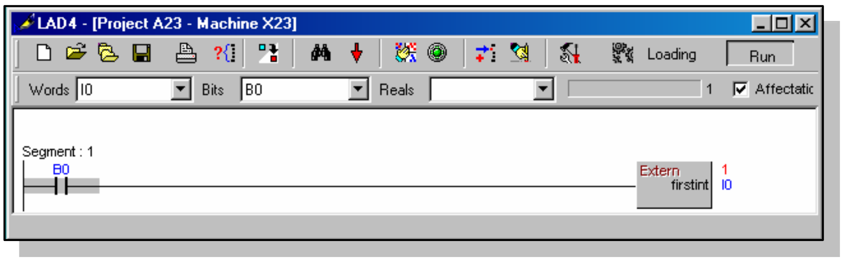
The All Type allows you to receive an address (checker) in the functional module. This address is retransmitted to the Force procedure of our DLL.

Let's declare at least 10 integers (I0 to I10) allowing us to carry out the test.



```
W0,W1,W2,W3,W4,W5,W6,W7,W8,W9 : word;
B0,B1,B2,B3,B4,B5,B6,B7,B8,B9 : boolean;
I0,I1,I2,I3,I4,I5,I6,I7,I8,I9 : integer;
```

Let's place the functional module in a Ladder.



By affecting the B0 bit the functional module is internally valid and call the procedure '*force*' to pass to it the adress of the first word (I0)
It is possible to do the same work with any Visual PLC variable. This variable can be an array element.

Launching the real time engine automatically

After development with Visual PLC, programs are saved in an file named PROG.PLC (or other files) by clicking on the button 'Save Current Configuration ' (to see chapter ' Status of the real time engine').

This text file contains the list of all programs that will be loaded by the engine. This file does not contain library used by these programs.
If you must change machine, you must transport:

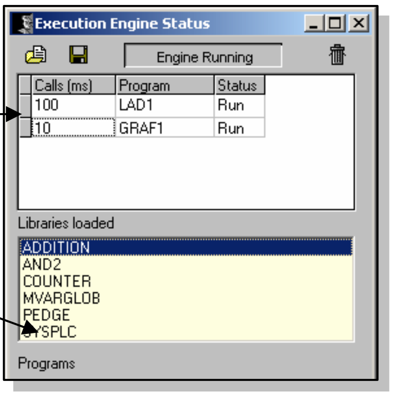
The programs files (.VPU)
The library files used (.VPU).

Example :

The engine use the programs :

LAD1.VPU and **GRAF1**.VPU

And the libraries
ADDITION.VPU,
AND2.VPU,
COUNTER.VPU
PEDGE.VPU
SYSPLC.VPU



Calls (ms)	Program	Status
100	LAD1	Run
10	GRAF1	Run

Libraries loaded

ADDITION
AND2
COUNTER
MVARGLOB
PEDGE
SYSPLC

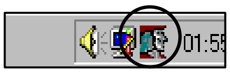
You must carry these 7 files on the target machine.

To start the real time engine, run the program PLCRUN.EXE found in the directory API32 or PLCRUN Configuration*Name.PLC*

This program searchs the current directory for the file PROG.PLC.
If the file is not present at PlcRun.Exe, search it in the current project.

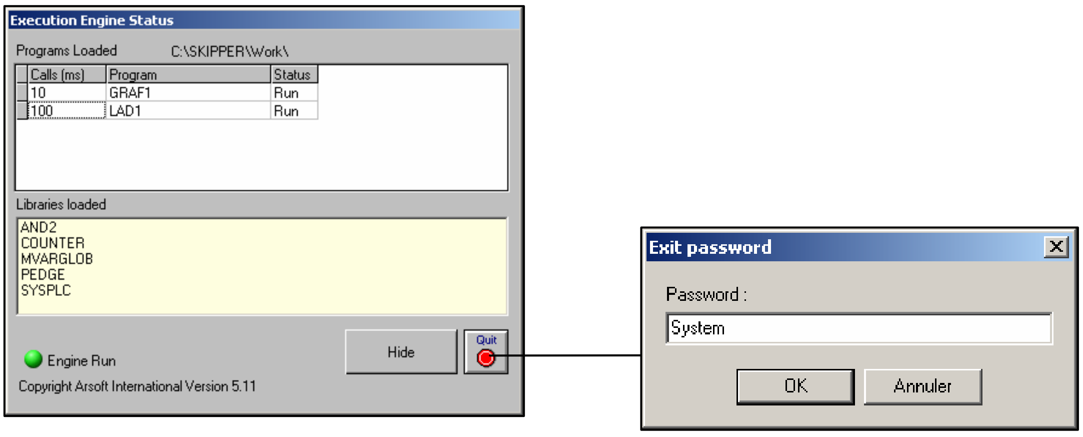
The PLCRUN.EXE program can be executed automatically in the « Start Group » of Windows.
After the launching, an icon places in the task bar of Windows.

By clicking on this icon a window appears with the list of all programs loaded by the real time engine.



Visualization of programs loaded

By clicking on the icon in the task bar of Windows a window appears:



Programs Loaded C:\SKIPPER\Work\

Calls (ms)	Program	Status
10	GRAF1	Run
100	LAD1	Run

Libraries loaded

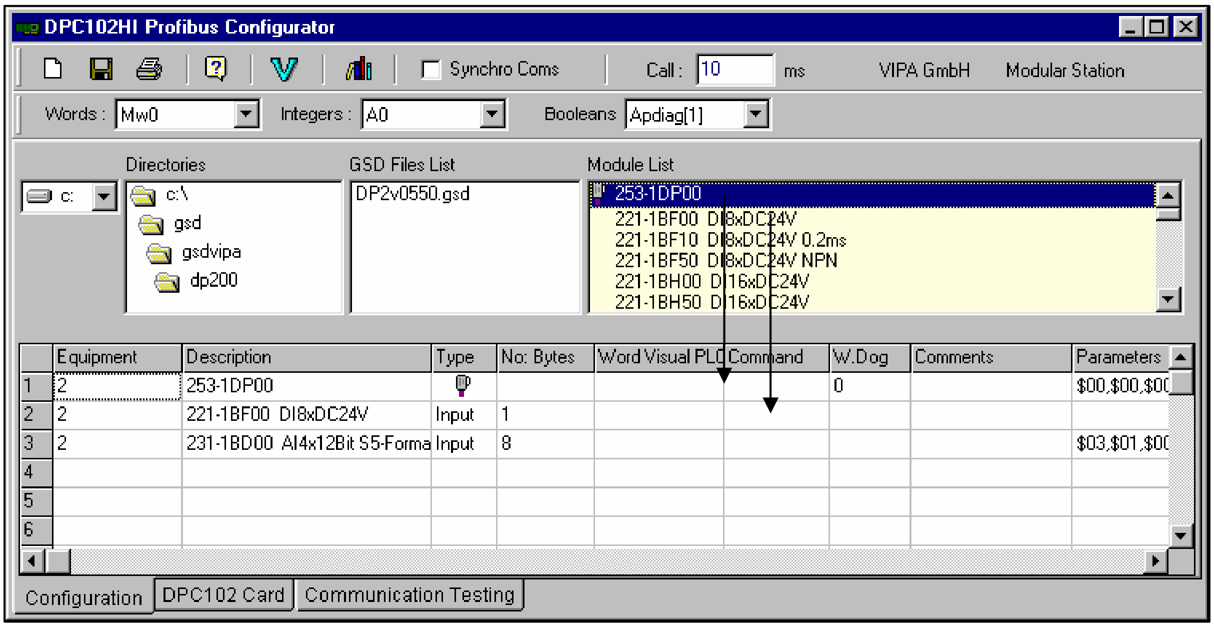
AND2
COUNTER
MVARGLOB
PEDGE
SYSPLC

Engine Run
Copyright Arsoft International Version 5.11

Password : System

By clicking on the *'Quit'* button, it is possible to stop the real Time engine by striking the password '**System**'.

Profibus Configuration tool for DPC102 Profibus card


DPC102HI Profibus Configurator

Synchro Coms   Call : 10 ms   VIPA GmbH   Modular Station

Words : Mw0   Integers : A0   Booleans Apdiag[1]

Directories: c: — c:\ — gsd — gsdvipa — dp200

GSD Files List: DP2v0550.gsd

Module List:
- 253-1DP00
- 221-1BF00 DI8xDC24V
- 221-1BF10 DI8xDC24V 0.2ms
- 221-1BF50 DI8xDC24V NPN
- 221-1BH00 DI16xDC24V
- 221-1BH50 DI16xDC24V

	Equipment	Description	Type	No: Bytes	Word Visual PLC	Command	W.Dog	Comments	Parameters
1	2	253-1DP00					0		$00,$00,$0
2	2	221-1BF00 DI8xDC24V	Input	1					
3	2	231-1BD00 AI4x12Bit S5-Forma	Input	8					$03,$01,$0
4									
5									
6									

Configuration | DPC102 Card | Communication Testing

According to the chosen module type, the number of bytes in input and output is displayed. You can inform the user of the choice of the visual I/O variable (Or Visual PLC) to register in the column Word Visual PLC.

Word Visual PLC (or Visual I/O): First word receiving bytes read or written from the profibus equipment.

Command : If no bit is specified, the interrogation of the equipment is made regularly by the card. If a Visual I/O bit is specified, the interrogation of the concerned equipment is provided when this bit (Boolean) is set. When the frame has been read (the equipment replied without error), this bit is set to 0 (False) by the card which returns a reception acknowledgement.

W.Dog : WatchDog. If no value is specified, Profibus outputs remains in the state when any frame is sent by the card. If a value is specified (x100ms), a frame has to be sent regularly by the card before reaching this value.
If it is not the case, the outputs are reset and the station passes in Bus Fail State.

Comments : Your comments.

Parameters : Enables to display or to modify the initialisation parameters of the station (doubleclick on cell).

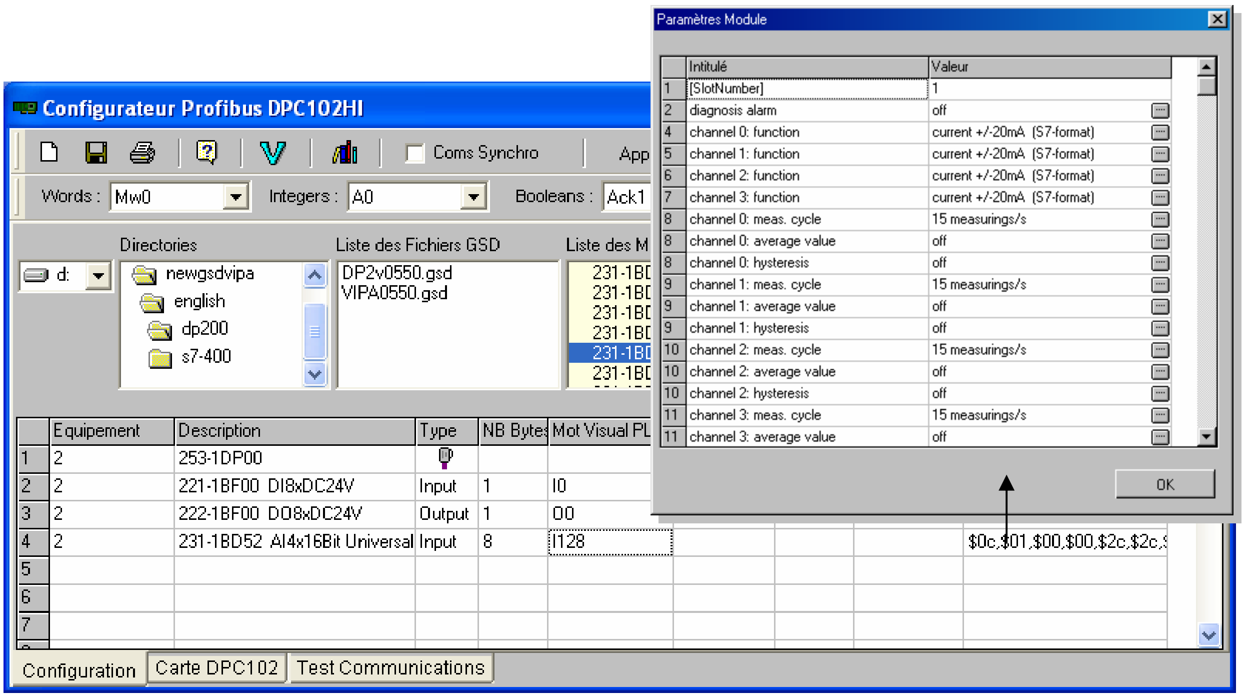
Coms Synchro : If this checkbox is checked, the 'PCARSDP.VPU' driver is different, allowing to **chain** all profibus equipment every 10 ms systematically. If Coms Synchro is not checked, each equipment is scanned one by one every 10 ms (or 2ms mini).

Save, the configuration tool compiles a driver according to your configuration. You must put the VPU **PCARSDP.VPU** in the real time engine of Visual PLC if you want to start the communication.

For Visual I/O put **PCARSDP** in Constitution Application/Tasks priority.
.

Setting the equipment parameters

Double-click on the **parameter column** to set each parameter of the concerned module. Below a module of
4 analog inputs where you must set each canal (4/20ma, 0/10V, PT100 etc..)



Configurateur Profibus DPC102HI

Coms Synchro

Words : Mw0 | Integers : A0 | Booleans : Ack1

Directories	Liste des Fichiers GSD	Liste des M
newgsdvipa	DP2v0550.gsd	231-1BD
english	VIPA0550.gsd	231-1BD
dp200		231-1BD
s7-400		231-1BD

	Equipement	Description	Type	NB Bytes	Mot Visual PL				
1	2	253-1DP00							
2	2	221-1BF00 DI8xDC24V	Input	1	I0				
3	2	222-1BF00 DO8xDC24V	Output	1	O0				
4	2	231-1BD52 AI4x16Bit Universal	Input	8	I128				$0c,$01,$00,$00,$2c,$2c,$
5									
6									
7									

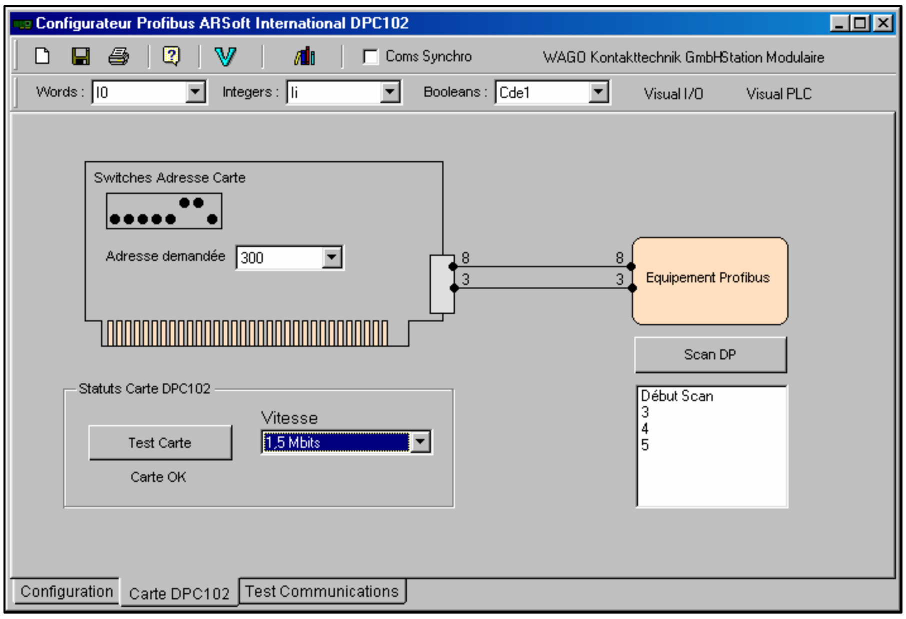
Configuration | Carte DPC102 | Test Communications

Paramètres Module

	Intitulé	Valeur
1	[SlotNumber]	1
2	diagnosis alarm	off
4	channel 0: function	current +/-20mA (S7-format)
5	channel 1: function	current +/-20mA (S7-format)
6	channel 2: function	current +/-20mA (S7-format)
7	channel 3: function	current +/-20mA (S7-format)
8	channel 0: meas. cycle	15 measurings/s
8	channel 0: average value	off
8	channel 0: hysteresis	off
9	channel 1: meas. cycle	15 measurings/s
9	channel 1: average value	off
9	channel 1: hysteresis	off
10	channel 2: meas. cycle	15 measurings/s
10	channel 2: average value	off
10	channel 2: hysteresis	off
11	channel 3: meas. cycle	15 measurings/s
11	channel 3: average value	off

OK

Test of the Profibus card and ScanDP.



Configurateur Profibus ARSoft International DPC102

Coms Synchro   WAGO Kontakttechnik GmbHStation Modulaire

Words : I0 | Integers : Ii | Booleans : Cde1 | Visual I/O | Visual PLC

Switches Adresse Carte

Adresse demandée: 300

Equipement Profibus

Scan DP

Début Scan
3
4
5

Statuts Carte DPC102

Test Carte

Carte OK

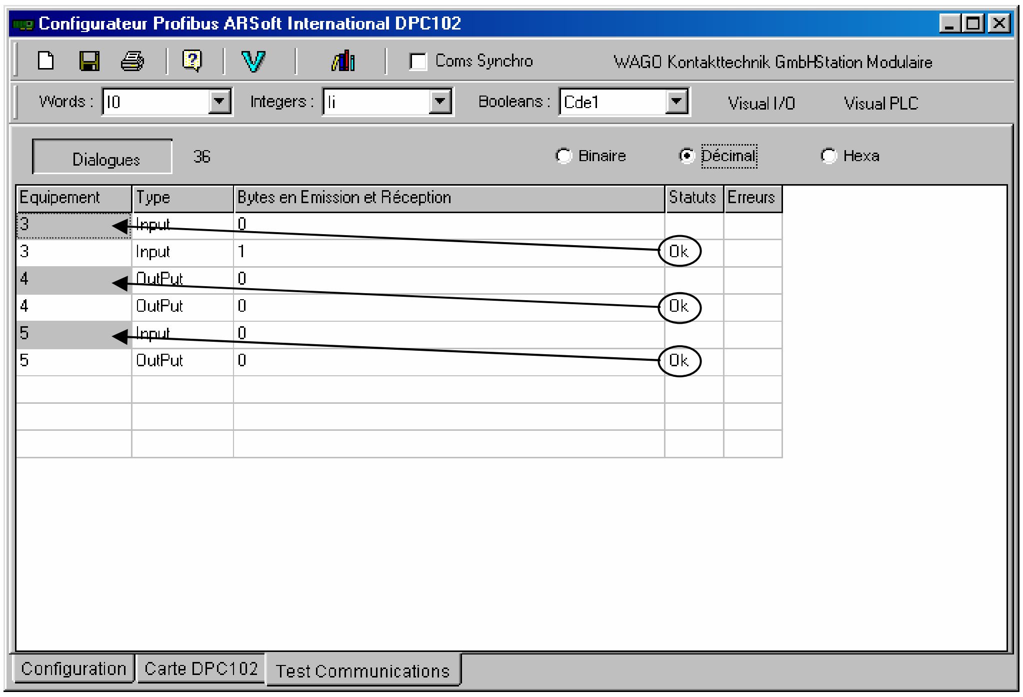
Vitesse: 1,5 Mbits

Configuration | Carte DPC102 | Test Communications

Click on the button Test Card to test the profibus card ('loop Back' Mode) completely.
This command shows the position of Switches on the card. If the card is not detected, it is probable that the card is in address conflict with other card on the bus or the driver is not installed. Choose an address in the Combo to search for an adress', the system indicates you the new position of Switches.

Scan DP: Allows to scan connected equipments on the Profibus bus. Because of the speed self-adaptation, slaves do not reply immediately.
This command must be done several times if necessary.
Some slaves memorize the last speed. It is necessary to shutdown power supply to change it

Testing the communication with connected Profibus equipment


Configurateur Profibus ARSoft International DPC102

☐ Coms Synchro   WAGO Kontakttechnik GmbHStation Modulaire

Words : I0   Integers : Ii   Booleans : Cde1   Visual I/O   Visual PLC

Dialogues   36   ○ Binaire   [✓ Décimal]   ○ Hexa

Equipement	Type	Bytes en Emission et Réception	Statuts	Erreurs
3	Input	0		
3	Input	1	Ok	
4	OutPut	0		
4	OutPut	0	Ok	
5	Input	0		
5	OutPut	0	Ok	

Configuration   Carte DPC102   Test Communications

Click on the button Dialogs, a grid appears displaying the value of the bytes read and written in the equipments. You can force some bytes by writing a new value in the concerned cell.
Cells with a grey background in the Equipment column indicate the first byte of the equipment.

It is evident that you can only force the bytes with 'OutPut' statement.
If the equipment replies normally, the text Ok appears, otherwise the number of detected errors appears in the error column.

Here the first text OK starting to the top corresponds to the equipment #3
Dangerous Interactions with Visual PLC
The PROFIBUS configurator is an external program that generates and compiles a VPU that is the Profibus driver. This driver **PCARSDP.VPU** is usable by the real time engine of Visual PLC and by Visual I/O. In the case you use Visual PLC and Visual I/O together, it is necessary to have only one PCARDSP.VPU active on your PC.

It is necessary that PCARSDP.VPU is in the priority tasks of Visual I/O or in the real time engine of Visual PLC BUT NOT IN BOTH.
Generally, the Profibus driver concerns the automation in Visual PLC.

Necessary files to use the Profibus card.

DPConf.DP :	The configuration file (contents of the grid) in the application directory.
ARSBT.SYS:	The Windows driver. It is in the directory Windows/drivers32
Arsdp.dll :	The DLL interface with the configuration file in the directory Windows.

☞ **Note**: In the case of Arsoft panel PC file, DPCONF.DP is not necessary in run any more. The parameters are included in the Profibus driver.

Coms synchro: You have the possibility of changing the frequency of driver's activation and passing to 1 ms and multiples. However, considering that Profibus equipment reacts into 1 ms, it is impossible to scan more than one Profibus slave within 1 ms.

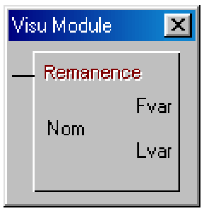
It is necessary if you want to read Profibus slaves quickly which are set the driver to 1 or 2 ms and do not set Coms synchro.

Maintenance of data

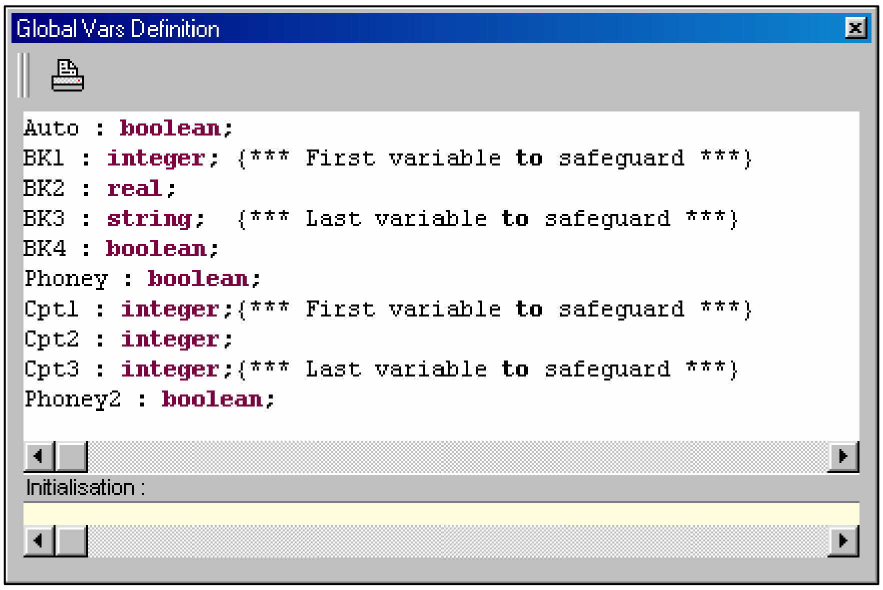
Visual PLC allows the total or partial maintenance of data. In other words, you can get back the context after a power supply shutdown of the PC. For example in your application, the program counts a number of parts. If the maintenance of some variables is not done, after a shutdown, the application will not restart the machine correctly if values of variables are not those that are presented before the shutdown.

For choosing a series of maintenance variables, the Functional module maintenance has to be used.

This module has 3 parameters to set.
Name : Name of the block of data to safeguard and to reload at the launching of the engine Visual PLC.
Fvar : Name of the first variable to safeguard.
Lvar : Name of the consecutive variable to the last variable to safeguard.



Let's consider the next declaration, where BK1 to BK4 and Cpt1 to Cpt3 have to be safeguarded:



```
Auto : boolean;
BK1 : integer; {*** First variable to safeguard ***}
BK2 : real;
BK3 : string;  {*** Last variable to safeguard ***}
BK4 : boolean;
Phoney : boolean;
Cpt1 : integer;{*** First variable to safeguard ***}
Cpt2 : integer;
Cpt3 : integer;{*** Last variable to safeguard ***}
Phoney2 : boolean;
```

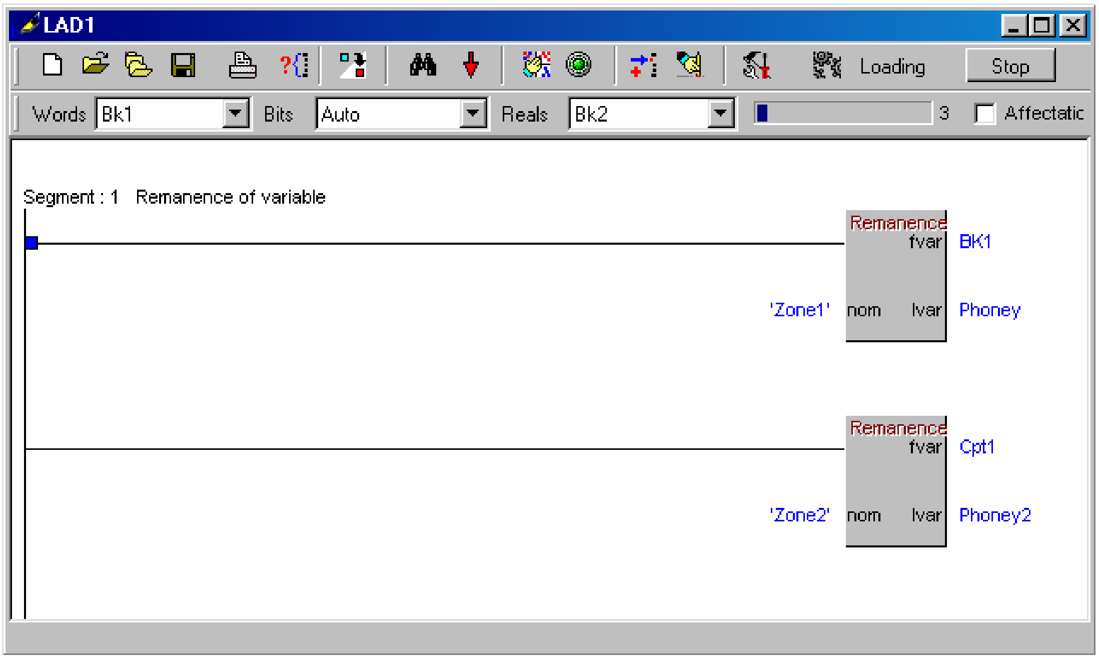
So as to undertake this operation, 2 functional modules are placed in the ladder.

The first functional module saves in an appointed block 'Zone1', the variables BK1 to BK4.
The second functional module saves in an appointed block 'Zone2', the variables CPT1 to CPT3.
Explanations :

The parameter **fvar** has to be informed of the name of the first variable to safeguard. The parameter **Lvar** has to be informed of the name of the consecutive variable to the last variable to safeguard. In other terms the block safeguards variables specified from the first variable to the last variable -1.

You must declare variables consecutively in the global variable editor in order that the functional module safeguards them by block. If the last variable to safeguard is the last one to be declared, declare a phoney variable (not used in programs) to create a heel (case in our example of Cpt1 to Cpt3).

This block uses a complex internal mechanism, allowed to safeguard regularly the variable specified without disturbing the functioning of the real time engine.



Words: Bk1 Bits: Auto Reals: Bk2 3

Segment : 1 Remanence of variable

Remanence: fvar BK1, nom 'Zone1', lvar Phoney

Remanence: fvar Cpt1, nom 'Zone2', lvar Phoney2

To add a password protecting the editor

It is possible to lock access to the editor when you launch it. One dialog box will ask you to strike a password you have preset.

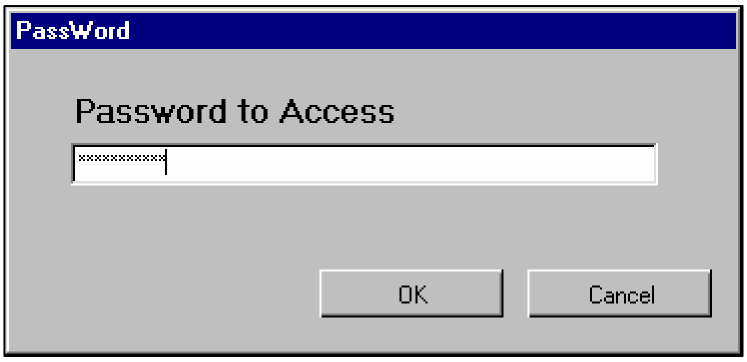
Add a textual file (for example, with Notepad.exe) containing on a line the password that the operator must enter to the lunching of the editor.

The text file is **MP** (without extension).

- It must be localized in the installation directory (basic in **C:\API32**).
- The first line contains the password to be tested.

Example:
  First line = My Password.

With the launching this window appears:


PassWord

Password to Access

****

The programmer must then strike **exactly** the text « My Password », to reach the editor.