VTB – Visual Tool Basic

IDE User Manual

1 INTRODUCTION

VTB is an integrated development environment for OBJECT oriented programming on PROMAX platforms. This environment contains inside all tools needed to development of application in simple and intuitive way. The VTB philosophy is based on latest technologies R.A.D. (RAPID APPLICATION DEVELOPMENT) which allow a fast development of application writing a reduced amount of source code. A large library of OBJECTS and TECNHOLOGIC FUNCTIONS allow to create applications for all sector area of industrial automation. VTB integrates a high level language like enhanced BASIC MOTION. It's also possible to manage in clear and simple way FIELD BUS such as:

CAN OPEN

ETHERCAT

MODBUS

Powerful functions of AXIS MOVING allow to manage any type of machine using LINEAR, CIRCULAR, FAST LINEAR INTERPOLATION or ELECTRIC GEAR, CAM PROFILES, etc.

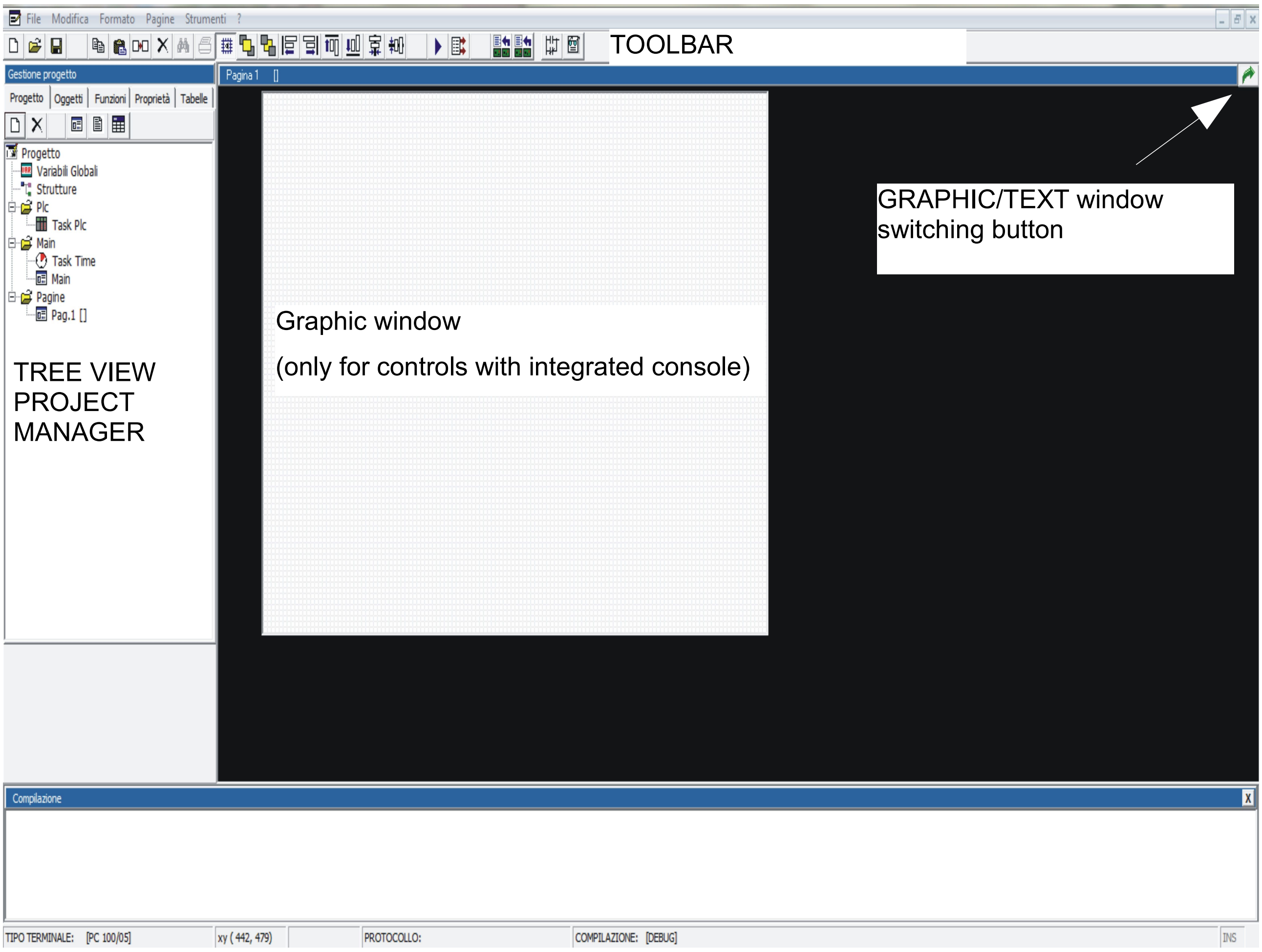
VTB is predisposed for MULTI-LANGUAGE APPLICATIONS simply selecting the USING LANGUAGE.

2 NOTES ON PROGRAMMING LANGUAGE

VTB programming language is defined as **BASIC MOTION**.
Its syntax is very similar as enhanced BASIC with some terminologies derived from **C** language.
Management of the functions is very similar as **VISUAL BASIC** also for **DATA STRUCTURES**.
Some **INSTRUCTIONS** are **VTB PROPRIETARY** but following the same philosophy.
VTB is a language **CASE INSENSITIVE** that is it make no differences between **UPPER CASE** and **LOWER CASE** regarding instructions, functions, variables etc. **VTB** converts internally all characters in **UPPER CASE**. The only one exception is the management of **DEFINE** where characters are not converted in upper case but they remain so in all compilation passes.
Because VTB is a language addressed to MOTION, some features, considered of secondary importance, remained at PRIMITIVE level. For example the STRING management is made like C language using function such as STRCPY, STRCAT, STRCMP etc.

3 DEVELOPMENT ENVIRONMENT

The development environment of VTB has an common intuitive interface like all Windows applications. It isn't necessary to have a great experience of programming. In the environment is included an EDITOR optimized for VTB programming.



TOOLBAR

GRAPHIC/TEXT window switching button

Graphic window

(only for controls with integrated console)

TREE VIEW PROJECT MANAGER

3.1 Toolbar

New Project - From menu ***File*** → ***New project***

It creates a new application. The previous one is closed requesting a confirm for saving.

Open Project - From menu ***File*** → ***Open project***

It opens an existing project.

Save Project - From menu ***File*** → ***Save project***

It saves the current project

Copy Selected Object/s - From menu ***Edit*** → ***Copy (Ctrl+C)***

The selected objects are copied in the clipboard. All property are copied, also the object position inside the page. The name of the new object will be automatically set with the first name avalaible for that class. It works as common copy/paste of Windows applications. **The source code added to the object events isn't copied.**

Paste Copied Object/s - From menu ***Edit* → *Paste (Ctrl+V)***

The objects copied in the clipboard are pase. All property of original objects are unchanged, also the position. The function Cpy/Paste is very useful to create pages with the same objects.

Duplicate Selected Object/s - From menu ***Edit* → *Duplicate (Ctrl+D)***

This works exactly the same as **Copy/Paste** but on one command. All property are copied, also the object position inside the page. The name of the new object will be automatically set with the first name avalaible for that class. It works as common copy/paste of Windows applications. **The source code added to the object events isn't copied.**

Delete Selected Object/s - From menu ***Edit* → *Delete***

The selected objects is deleted. Also the source code included in the object events is removed.

Find - From menu ***Edit* → *Find***

Searching for a text string in the project source code.

Print

It prints the text code in the current window.

Snap to Grid

If this button is activated the OBJECTS position is hooked to GRID step. It is useful to align the object quick and easy. The GRID STEP can be changed in PIXEL units from menu ***Options -> Grid Step***.

Foreground

The selected objects is brought to the foreground of the page making it completely visible.

Background

The selected objects is brought to the background of the page. It can be covered by other objects making it invisible.

Align left

The selected objects are aligned to left margin. The reference object will be the last selected.

Align right

The selected objects are aligned to right margin. The reference object will be the last selected.

Align top

The selected objects are aligned to top margin. The reference object will be the last selected.

Align bottom

The selected objects are aligned to bottom margin. The reference object will be the last selected.

Align horizontal

The selected objects are aligned at the horizontal center of the last selected object.

Align vertical

The selected objects are aligned at the vertical center of the last selected object.

Program compiling

The entire application is compiled to create the binary file in the format of the platform selected. The compiling results are showed in the MESSAGE WINDOW and if there are some compiling errors the binary file will not be created.

Transfer Program

The binary file created by compiler is transferred to the control by RS232 or ETHERNET line. The program will be saved in the permanent memory of the control and then it will be executed.

CanOpen Configurator

It launches the CanOpen configuration tool (see chapter CANOPEN CONFIGURATOR).

EtherCAT Configurator

It launches the EtherCAT configuration tool (see chapter ETHERCAT CONFIGURATOR).

DEBUG

It launches the DEBUG tool (see chapter DEBUG APPLICATION).

3.2 Project Manager

The PROJECT MANAGER allows a fast selection and navigation in all the PAGES of the PROJECT. From this AREA we have the entire control of the application: viewing pages, managing of variables, writing code, etc.

New Page - From menu ***Pages* → *New***

It adds a new page to the project. The page is automatically numbered. A page can contain GRAPHIC OBJECTS and source code. Both will work only when the page will be loaded and only a page at time can be loaded. To switch from a page to another can be used the system function:

Pagina(NrPag)

Delete Page - From menu ***Pages* → *Delete***

It deletes the showed PAGE. The entire content will be lost and all the page after this will be renumbered. **<u>Attention: all reference to these pages (button of function) will have to be modified.</u>**

View Graphic of the Page

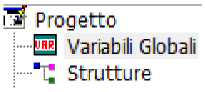
It shows the graphic window of the page.

View Code of the Page

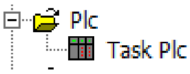
It shows the source code editor window of the page.

View Variables of the Page

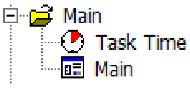
It shows the table of private variable of the page.



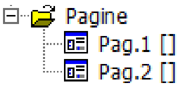
View GLOBAL Variables and STRUCTURE definitions



View source code editor of TASK PLC



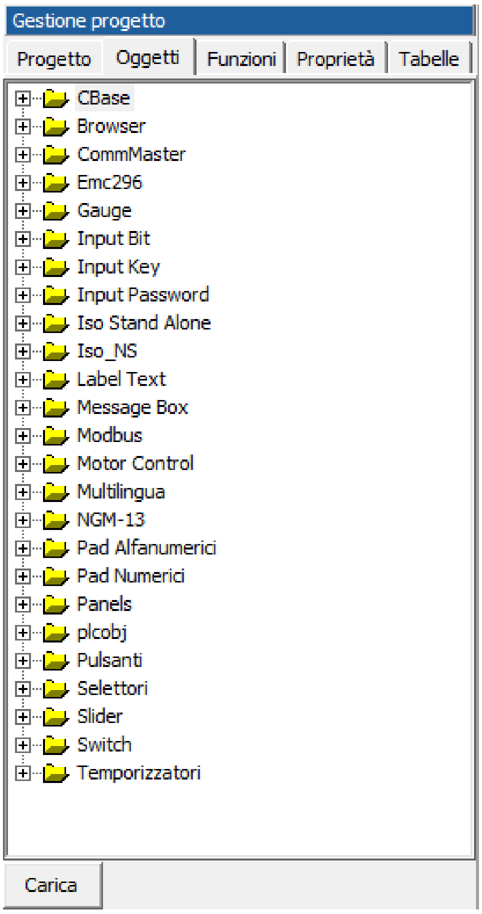
View source code editor of TASK MAIN or TASK TIME



View source code editor of a page

3.3 Objects manager

The OBJECTS MANAGER allows a fast selection of the objects to insert in the current page.
Inside it there are both base-objects and enhanced-objects. For a detailed description of a single object there is a separated user manual.
To insert an object it have to be selected and then dragged to the desired position.



The CARICA button allows to browse the CUSTOM OBJECT which are not included in the standard library.

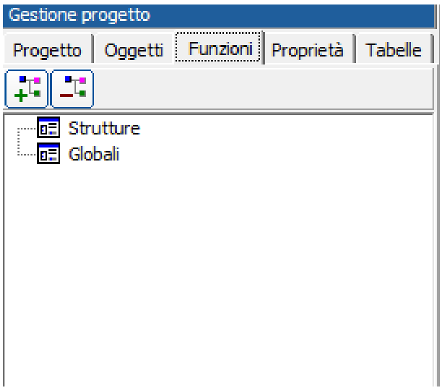
3.4 Functions Manager

In this Tree View are showed all the STRUCTURE and FUNCTIONS grouped per page. Just open the nodes to view informations.

In STRUCTURE section there is the possibility to add a new one by add-element button, it is also possible to remove the selected structure by delete-element button.

Opening an existent structure the fields of it are showed. By a click on the single field it is possible to modify its type, while the buttons add-element and remove-element can be used to add o remove a field from the structure.

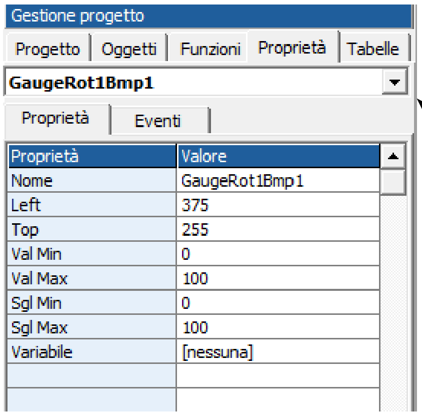
The section FUNCTIONS groups the functions per page, selecting a single function the editor window is opened showing the relative source code.



3.5 Objects Property

In the area OBJECTS PROPERTY it's possible to set all the working properties of an OBJECT. Properties are proprietary of the single object, refer to relative user manual for details.

To set a property click with the left button of the mouse on the desired item and put the new value. **To show the properties the object has to be selected before**.



Proprietà	Valore
Nome	GaugeRot1Bmp1
Left	375
Top	255
Val Min	0
Val Max	100
Sgl Min	0
Sgl Max	100
Variabile	[nessuna]

LIST OF THE PAGE'S OBJECTS

To simplify the selection of the OBJECT INCLUDED IN THE PAGE can be useful the COMBO-MENU clicking on the name of the desired object.

3.6 Text Table Manager

This section is described in detail in the section ***Text Tables*** of the chapter ***VARIABLES TYPE.***

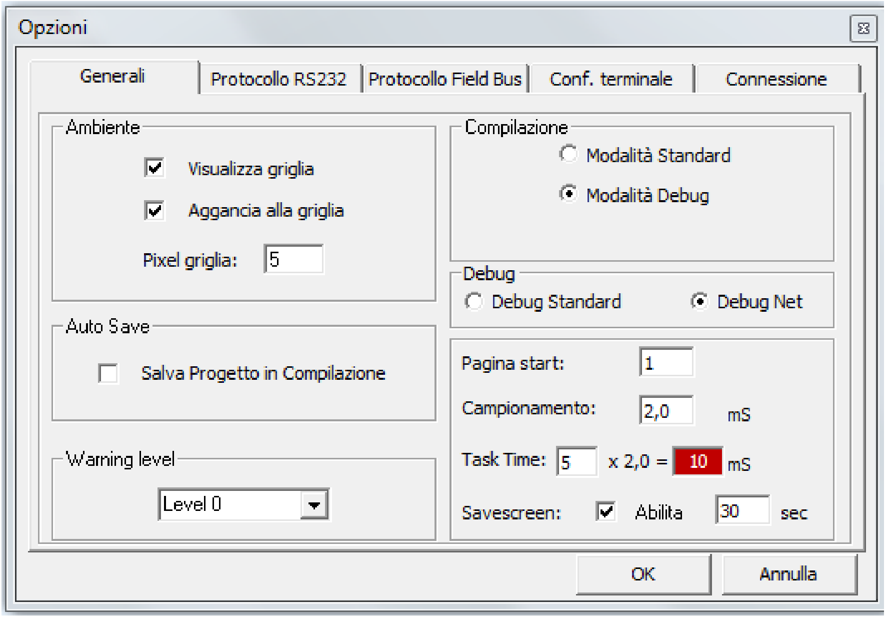
4 CONFIGURATION OF VTB

From Menu ***Strumenti→ Opzioni***

This command is used to configure some options of the VTB environment and the target hardware.

4.1 General Options

This table contains the general options of VTB



Ambiente

☑ Visualizza griglia

☑ Aggancia alla griglia

Pixel griglia: 5

Auto Save

□ Salva Progetto in Compilazione

Warning level

Level 0

Compilazione

○ Modalità Standard

● Modalità Debug

Debug

○ Debug Standard ● Debug Net

Pagina start: 1

Campionamento: 2,0 mS

Task Time: 5 x 2,0 = 10 mS

Savescreen: ☑ Abilita 30 sec

View Grid
When this check-box is activated the grid on the page windows is displayed. The grid is useful as referenc to position the graphic objects.

Snap to Grid
Activating this check-box the snap to grid is enabled. The objects will be positioned to the grid simplifying the manual alignment of them.

Grid Step
It sets the number of pixel of the grid step.

Pagina Start
It selects the number of the first page to be loaded at start-up.

Sampling
It selects the scan time of the TASK PLC (see chapter 5) in milliseconds. It can be changed with the resolution of 0.1 millisecond being careful at low value because they can cause crash of the program.
Always examine the elapsed time of TASK PLC by the DEBUG.

Task time
It is the scan time of the TASK TIME in multiples of TASK PLC scans, the resultant time (in milliseconds) is displayed on the right. Changing the time of TASK PLC this time changes too.

Savescreen
Time in seconds for the activation of display light reducing. Only for target with this function implemented (ex. PEC70).

Standard Mode (OBSOLETE)
It excludes the debugging code in the binary file. **Only for compatibility with the older 16 bit target.**

Debug Mode (<u>OBSOLETE</u>)
It includes in the binary file the code for the use of DEBUG APPLICATION. In this case RS232 protocols on the first chanel can not be enabled. **<u>Only for compatibility with the older 16 bit target</u>.**

Debug Standard (<u>OBSOLETE</u>)
It forces the use of DEBUG STANDARD of VTB. **<u>Only for compatibility with the older versions</u>.**

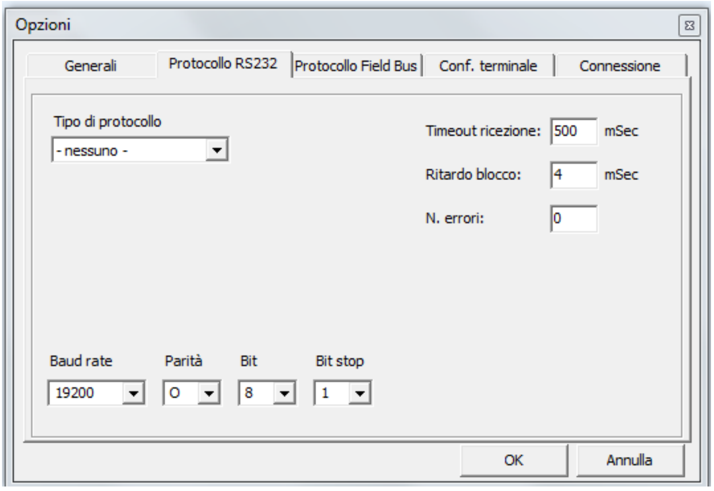
Debug.NET
It forces the use of the new DEBUG.NET application. On PC must be installed the Framework 2.0 or major. This is the debug option recommended.

Warning Level

Level 0	Compiler doesn't display any warning messages.
Level 1	Compiler displays warning messages when improper or dubious operations on variables are found. Anyway the binary file is created.

4.2 RS232 Protocol (<u>OBSOLETE</u>)

These options select the type of protocol on the first RS232 channel.



Tipo di protocollo: - nessuno -

Timeout ricezione: 500 mSec

Ritardo blocco: 4 mSec

N. errori: 0

Baud rate: 19200

Parità: O

Bit: 8

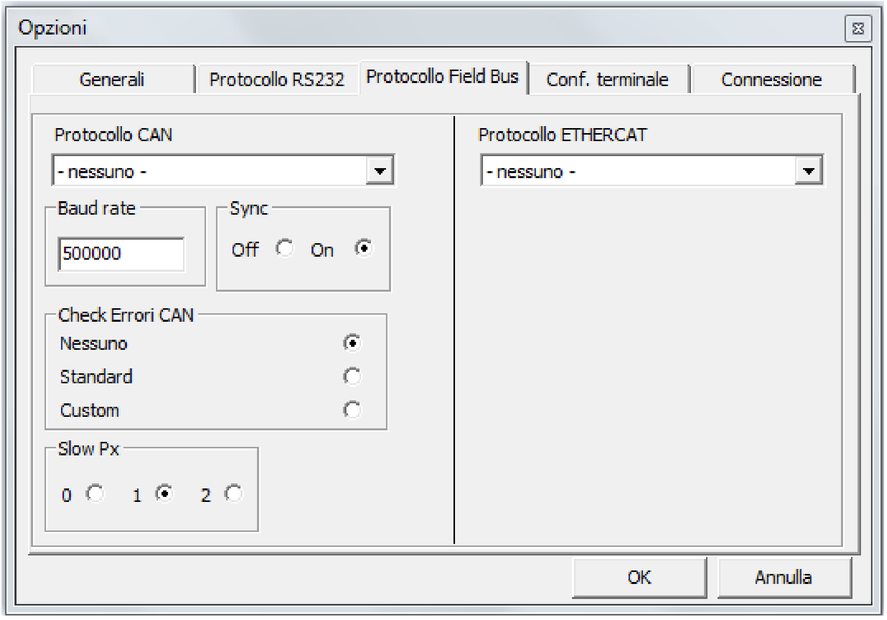
Bit stop: 1

<u>Only for compatibility with the older versions</u>

4.3 Field-Bus Protocol

These options allow to select the Field-Bus protocols used by the target hardware.
For the moment the protocols implemented are two:

CanOpen	***Standard DS301 DS4xxx***
Ethercat	***CoE (Can Over Ethercat)***



Protocollo CAN: - nessuno -

Baud rate: 500000

Sync: Off ○ On ●

Check Errori CAN: Nessuno ● Standard ○ Custom ○

Slow Px: 0 ○ 1 ● 2 ○

Protocollo ETHERCAT: - nessuno -

Protocol CanOpen
It enables the CanOpen protocol.

BaudRate
It selects the BaudRate of CanOpen line.

Sync
It enables or disables the SYNC message on CanOpen line.
The message Sync is sent cyclically at the time of TASK PLC (set in ***General Options).*** **<u>SYNC is essential for applications with AXIS INTERPOLATED</u>**

Chek Errori CAN
It selects the display mode of the eventual errors during the CanOpen **<u>configuration</u>** (see CanOpen configurator), there are three option:

None
On systems with display the result of configuration of each node is showed then the application continue indipendently there have been error or not.
On systemes without display there isn't any indication of eventual errors of CanOpen configuration.

Standard
<u>This option is valid only on systems with human interface</u>.
A specific object (CanErr) is added on MAIN page wich displays the list of node with the result of configuration. If there have been any errors program stops waiting for the press of a specific button to continue.

Custom
With this option the system doesn't perform any action but it calls some functions to allow the customization of the managing of CanOpen configuration errors.
The functions called by the system are three and they have to be defined by the application:

function open_cancfgerr(nodes as char) as void
nodes = Total number of nodes in the CanOpen configuration.
This function is called by the system before starting the CanOpen configuration. The

total number of the nodes in the configuration is written in the parameter ***nodes***.

function cancfgerr(nodo as int, err as uchar) as void
nodo=Number of configured node.
err=Result of configuration.
0 = Node correctly configured.
<>0 = Error code. See relative chapter of CanOpen functions.
This is called at the end of configuration of each node writing the result in the parameter ***err***.

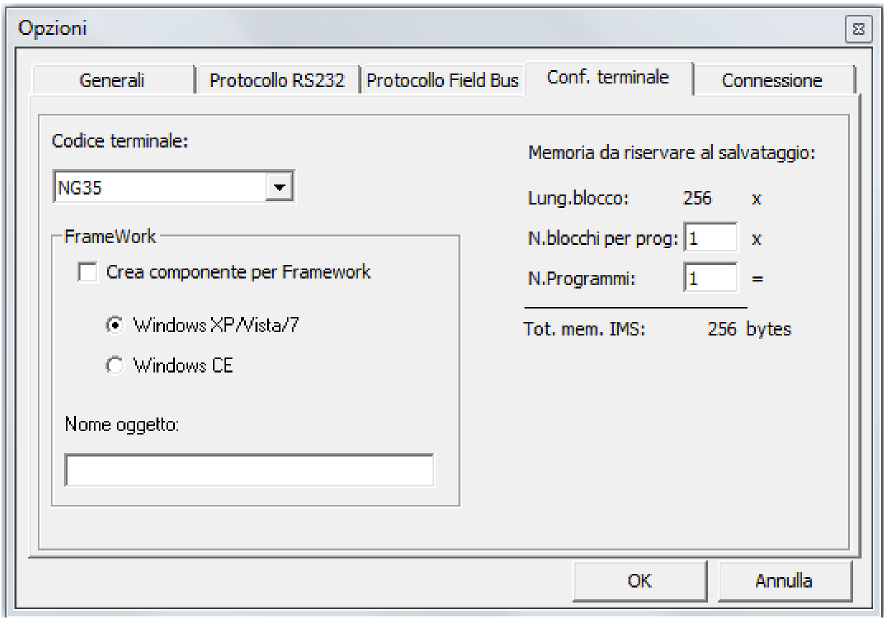
function close_cancfgerr() as void
This function is called after the end of the last node configured.

Slow Px
By default this option is set to one but for compatibility with all systems we recommend to keep it always at ZERO. It will be used for future expansions.

Ethercat Protocol
It enables the the Ethercat protocol in system which can manage it.
Ethercat can work also with CanOpen protocol enabled.

4.4 Configuring the target hardware

An application must always refer to the target hardware. That allows VTB to preconfigure for the selected hardware so it can use the relative function-call, use the appropriate memory addresses, signal the specific errors, use the correct debug, etc.
Normally it is set before starting the application but we can change it ever after to adapt the same application at another hardware.



Codice terminale: NG35

FrameWork
□ Crea componente per Framework
● Windows XP/Vista/7
○ Windows CE
Nome oggetto:

Memoria da riservare al salvataggio:
Lung.blocco: 256 x
N.blocchi per prog: 1 x
N.Programmi: 1 =
Tot. mem. IMS: 256 bytes

Target Hardware
This Combo allows to choose the code of target hardware. To facilitate the programming, in the list, beyond the single products, are also some preconfigured combinations such as:
NGM13/LPC20 – NG35/LPC40 etc.
They refer to a combination of a NGM13 or NG35 CPU coupled with a Promax serial terminal LPC20, LPC40.

Saving memory reserved area
This option selects the amount of internal memory reserved (called IMS) to the application data saving (ex. Parameters, recipes, etc.). This memory is organized in blocks of 256 bytes therefore it must select the number of blocks to reserve for each recipes and the max number of recipes. For example if the memory needed for one recipe is 300 byte, we must set 2 blocks (512 byte). Normally the IMS memory is removed from the flash memory reserved to the application, keep in mind that when you set this option. **This option**

isn't valid for the hardware in which the CODE FLASH isn't shared with the data saving memory (ex. NGM13).

Create framework component

VTB can create a DLL Component Model to integrate in a Framework .NET application.

That allows a direct control of the Hardware resource from external Host such as PC equipped with operative system like Windows XP, Vista, 7, CE or other supporting Framework (see Framework Component chapter).

If create framework component is checked the component type must be choose (Windows Xp or Windows CE) and also the DLL component name. A component framework file will be create in the same directory of VTB project.

5 TASKS MANAGED BY VTB

VTB provides the programmer for TASKS wich can be combined to create an application. Two of these are ***interrupt tasks***, that means they are executed, interrupting the other tasks, at fixed and constant time; the other two task in ***cooperative*** mode: they are executed one after another. The **TASK PLC** is the ***DETERMINISTIC*** task at highest level witch interrupts all the other tasks, the **TASK TIME** works like TASK PLC but with a lower level, finally the **PAGE TASK** and **MAIN TASK** run in cooperative mode between them and can be interrupted by the other two.

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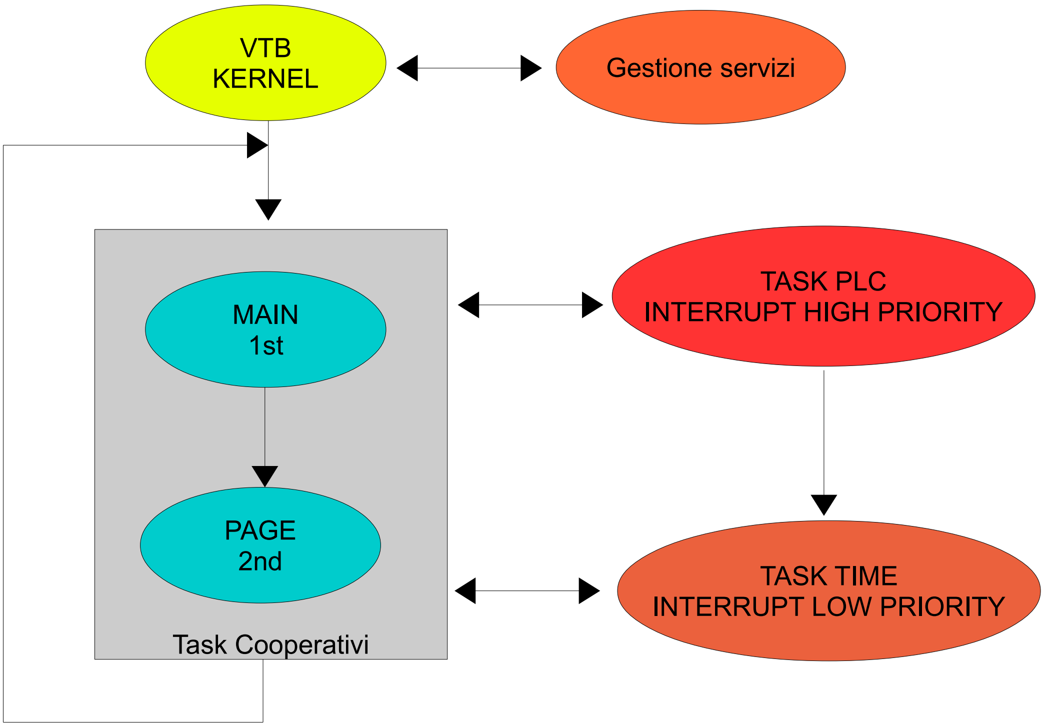
VTB KERNEL
Gestione servizi
MAIN 1st
PAGE 2nd
Task Cooperativi
TASK PLC INTERRUPT HIGH PRIORITY
TASK TIME INTERRUPT LOW PRIORITY

5.1 Task Plc

This task is the higest priority one: it is deterministic and run at fixed time making it suitable to manage situation that need a fast and precise response time. This task can not be interrupted by no other tasks but it can instead interrupt any other. Normally it is used by AXIS CONTROL OBJECTS or fast PLC cycles, but it can contain every type of code sequence exluding some IFS functions like:

GRAPHICS FUNCTIONS
AXIS INTERPOLATION (xxx.MOVETO, xxx.LINE_TO)
MANAGE OF CANOPEN SDO.
STATIC CYCLES

(see the single functions for details)

The typical sample time is 2 milliseconds wich is an enough time to manage a lot of application (for example 6 AXIS interpolation), however it can go down also under 1 millisecond when the charge of work is less stressful and for CPU with high computing power. In this task is also managed the CAN OPEN and ETHERCAT protocol in DETERMINISTIC mode. However it is advisable that its elapsed time doesn't exceed 60% of sample time, else we risk to slow or even to stop the other tasks. The **TASK PLC HASN'T A SECTION TO INSERT ANY OBJECT**, therefore if there is some code wich have to run inside, it must be written at the moment of object design. **IF THE CODE INSIDE TASK PLC BLOCKS IT ALL SYSTEM GO IN CRASH**.

To verify the elapsed time of TASK PLC there are two field in DEBUG.NET application:

PLC TP and **PLC TM** never must exceed the sample time.

VTB defines some

5.1.1 NOTE ON CONCURRENT PROGRAMMING

The use of CONCURRENT programming requires particular attention as in all MULTITASK systems. To avoid unexpected operation it's recommended do not call the same function from INTERRUPT TASKS and COOPERATIVE TASK in the same application. In other words the functions managed by MAIN TASK can be called without problems from PAGE TASK, but NOT ALSO from TASK TIME e TASK PLC and vice versa.
That is because if an INTERRUPT TASK using a function occurs exactly while a COOPERATIVE TASK is running in the same function, that could lead to abnormal operations in the application.

SHARING OF VARIABLES

Again in CONCURRENT programming can also occur some problem when variables are shared between INTERRUPT TASKS and COOPERATIVE TASK. Practically if managing of the variable don't provide an ATOMIC ASSEMBLER INSTRUCTION, this can cause false reading value when it is written by a TASK and read by another. According to the CPU type of the system these problems can occur in the following type of variables:

Sistem	**Variable type**
16 bit	LONG, FLOAT
32 bit	FLOAT

To overcome this problem VTB offers the possibility of a SECURE SHARING OF VARIABLES. Indeed in the variables declaration dialog there is an apposite field to enable the secure sharing. However, because a lot of use of this facility can generate jitter problem we recommend to ***use the enable of secure sharing of variables only when ABSOLUTELY NECESSARY.***

The same problem could also occur when using data array shared by more process. A simple example can be the use of array to data exchange in MODBUS protocol. These problems can arise when, for example, the writing process of data and the reading one are asynchronous. It can happen indeed that a reading process starts when the writing one has filled the array only partially. In this case the reading process will read a lot of new data and some from the old scan. It's evident in this situation false value readings can occur. System isn't able to understand these situations therefore to solve it there is the needs of ***semaphores*** at application level.
Task plc has also an INIT section. All code insert here will run only one time at system reset.

5.2 Task Time

TASK TIME, like TASK PLC, works at fixed time. It deffers from that for two features:
a) it has a lower priprity and it can be INTERRUPTED by TASK PLC;
b) it hasn't limit to managing of the IFS functions of VTB.
The scan time of this task is programmable at multiple of the sampling time of TASK PLC. TASK TIME is useful for the managing of timed cycles and with medium response time, furthermore the possibility of calling all IFS functions makes it of great utility, ensuring constant time to software. Typical sample time can be about 5 or 10 milliseconds, with witch it's possible to manage a complex PLC cycle with a lot of I/O channels. If the elapsed time of this task overcomes its sample time the system will continue to work stopping the cooperative tasks but task plc will continue to run.
TASK TIME HAS A SECTION TO INSERT THE OBJECT, therefore all the object inserted inside will run in this task at the programmed SAMPLING TIME.

5.3 Task Main

TASK MAIN is called continuously by VTB cycle running in COOPERATIVE mode with PAGE TASK. Therefore a static cycle on TASK MAIN will stop the PAGE TASK and vice versa. Its scanning time depends by the code contained in all the other TASKS. Usually this TASK manages repetitive cycles as control of emergency or alarm states, graphic control etc. where there isn't the need for constant time. However its scanning time can be very fast, also in the order of few ***microseconds,*** when the code inside the task is very short.
TASK MAIN HAS A SECTION TO INSERT THE OBJECTS, therefore all the object inserted inside will run in COOPERATIVE mode and regardless of which page is displayed.

TASK MAIN provides three sections to insert the CODE:

INIT PAGE

MASTER CYCLE

PAGE FUNCTIONS

Also there is a section **MASTER EVENT** but it has been left only for compatibility with older versions and therefore **it must not be used**.

INIT PAGE
The code in this section runs only one time at the start of the program and usually it handles the initialization of the global variables in the application. In this section we can write any type of code as long as it isn't STATIC CODE which can block the program.

MASTER CYCLE
This is the cyclic section called by system in cooperative mode with PAGE TASK.

PAGE FUNCTIONS
This section is the container for all the functions used by the application. They will be visible GLOBALLY from all TASKS

5.4 Page Task

PAGE TASK works like TASK MAIN, with which shares the scanning time in COOPERATIVE mode. The peculiarity of this task is its code will be loaded only when the page is running. The IFS function ***pagina(n)*** allows to run the page, written before with VTB environment, destroying the previous one. PAGES have to be seen as a set of code-graphics managed at convenience. Commonly PAGE TASKS are useful in systems equipped with HMI pages where they are both graphics part and associated code. In systems without HMI, pages are only part of code which runs when commended by ***pagina(n)*** function. As for TASK MAIN the scan time depends by the length of code inside all the other tasks. Usually the PAGE TASK manages cycles of setting, preparing and display of data application, with control of the graphics and data input.
PAGE TASK HAS A SECTION TO INSERT THE OBJECTS, therefore all the object inserted inside will run in COOPERATIVE mode and regardless of which page is displayed.
PAGE TASK provides three sections to insert the CODE:

INIT PAGE

MASTER CYCLE

PAGE FUNCTIONS

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INIT PAGE
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MASTER CYCLE
This is the cyclic section called by system in cooperative mode with PAGE TASK.

PAGE FUNCTIONS
This section is the container for all the functions used by the application. **They will not be visible from all TASKS**.

6 VARIABLES TYPE

VTB can manage several types of variables which can be used in programming phase.
Commonly all VARIABLES will be allocated in the VOLATILE MEMORY (RAM) of the system and they are zeroed at reset. In systems equipped with NON-VOLATILE RAM (as NG35 or PEC70) it's also possible to allocate them in this area, they are defined as STATIC VAR and they will retain its value also after turn-off.
VARIABLES follow the STANDARD terminology similar to common programming languages.
Furthermore it can be declared VARIABLES referred to external component like CANOPEN or ETHERCAT configurator. These are managed automatically from the system in transparent mode.

6.1 Numeric Values

VTB manages numeric values in conventional mode as other compilators. A numeric value can be written in **DECIMAL NOTATION** as well as in **HEXADECIMAL NOTATION** by preceding the number with the prefix ***0x*** (ZERO X). For example the decimal number 65535 is transalated with the hexadecimal 0xFFFF.
FLOATING-POINT values must be written with decimal point and it can not written in hexadecimal format.

Example:

```
A=1236       ‘ assigning 1236 to variable A
A=0x4d       ‘ assigning hexadecimal value 0x4d to variable A
             ‘ corresponding at decimal value 77
B=1.236      ‘assigning floating-point value 1.236 to variable B
```

6.2 Internal Variable

These variables are allocated in the VOLATILE MEMORY (RAM) of the system and are zeroed at reset.
The possible types managed by VTB reflects the main types defined in a lot of programming languages and they are the following:

TYPE	**DIMENSION**	**RANGE**
BIT	1 bit	From 0 to 1
CHAR	8 bit signed	From –128 to +127
UCHAR	8 bit unsigned	From 0 to 255
INT	16 bit signed	From –32.768 to +32.767
UINT	16 bit unsigned	From 0 to 65.535
LONG	32 bit signed	From –2.147.483.648 to +2.147.483.647
FLOAT (16 bit systems)	48 bit (proprietary format)	29 bit mantissa 15 bit exponent
FLOAT (32 bit systems)	64 bit (standard DOUBLE format IEEE 75)	From -1,79769313486232e308 to +1,79769313486232e308
STRING	Supported only as constant	
VETTORE	Single dimension for all variable types except BIT type	
STRUCTURE	Standard declaration	
POINTER	Char, Uchar, Int, Uint, Long, Float 32 bit	
DELEGATE	Pointer to FUNCTIONS 32 bit	

It's appropriate using variables according to the minimum an maximum value they have to contain choosing the best appropriate. INTERNAL VARIABLES can be declared **PAGE LOCAL** or **GLOBAL.**

PAGE LOCAL VARIABLES   declared inside the PAGE TASK and visible only to it

GLOBAL VARIABLES   declare in MAIN TASK and visible to all the others

<u>VTB doesn't make any control on dimension of the variables and on its assigned value.</u>

6.3 Pointers

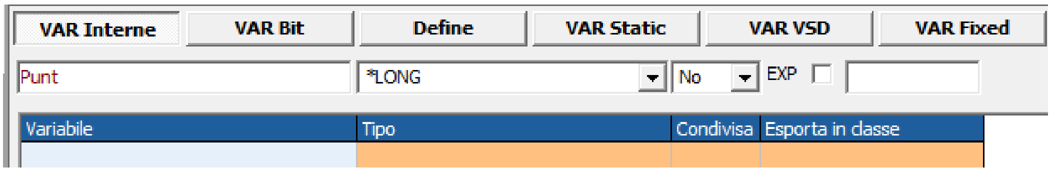
VTB is able to manage the pointers to variables too. Pointers defines the address of allocation memory of the variables, not its content. Some VTB functions need of pointers as parameter particularly when the function manage arrays or strings. To define the address of a variable it's enough insert the postfix ***()*** except for the funcions.

Example:
var as long
array(20) as uint

var()   ***refers to the address of variable var***
array()   ***refers to the address of the first element of array***

Pointers can be declared only to following types:
Char, Uchar, Int, Uint, Long, Float, Functions

Declaring of a pointer



Punt   *LONG   No   EXP □

To assign an address to the pointer it's need:
refer to the name of pointer (without brakes)
assign the desired address to pointer

To assign the value to a pointed field it's need:
refer to the pointer with square brackets
put the right index inside the brackets
assign the value

Examples
Used variables:
pnt as *long
val as long
pointer as *uint
array(10) as uint
var as long

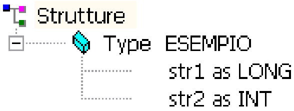
Writing/reading variables by pointer:
pnt=val()   ***'assign to pnt the address of variable val***
pnt[0]=2000   ***´pnt[0] points to variable val which will take the value 2000***
var=punt[0]   ***'assign to var the content of val by the pointer pnt***

Writing/reading array by pointer:
pointer=array()   ***´assign to pointer the address of array***
pointer[0]=13
pointer[1]=27
pointer[9]=55   ***´assign to array some value by pointer***
var=pointer[7]   ***´assign to var the content of array[7]***

It's also possible to declare pointers to data STRUCTURES.

Example

This structure is been declared



Strutture
Type ESEMPIO
str1 as LONG
str2 as INT

Used variables:

```
pointer as *Example     ´pointer to structure Example
struct as Example       ´struct is a structure type variable

pointer=struct()        ´pointer points to structure
pointer->str1=300       ´writing of both fields of structure by pointer
pointer->str2=200
```

As we have seen, to use pointer with the structures we need the token →

ATTENTION: VTB doesn't make any control on the index of pointer therefore **with pointers it's possible to write anywhere in memory with consequent risks to crash the system**.

Example:

```
pnt as *long
value as long

pnt=value()
pnt[10]=1234
```

The inscrution punt[10] = 1234 doesn't generate any compiling or run-time error, but it can cause unexpected operations. The correct use is:

```
pnt[0]=1234
```

To get the address of a function to assign to a variable we have to refer at the function simply with its name (without brackets):

Example
VarPnt=MyFunction
Where MyFunction is a declared function

6.4 Bits

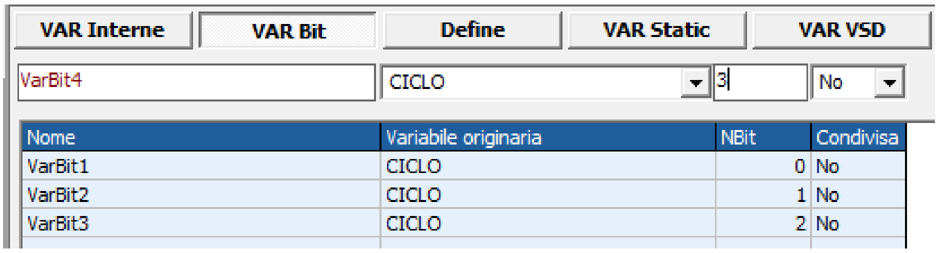
This type of variable can have only two values: 0 or 1, normally associated to a state OFF/ON or FALSE/TRUE. The variable BIT must always refer to an original variable which will can contain more bits.
This variables are very useful to manage FLAGS, digital I/O lines and in all cases where we need to read or write a single bit directly.
The bit variables can be both GLOBAL or PAGE LOCAL and they can be used like normal variables.
For example declaring an INTERNAL variable named STATE of type INT (16 bit) it's possible to associate it up to 16 bit variables.

VARBIT1	**STATE.0**	**(first bit of STATE)**
VARBIT2	**STATE.1**	**(second bit of STATE)**
.		
VARBIT16	**STATE.15**	**(16th bit of STATE)**

```
If VARBIT1 = 1     'test if first bit of STATE is set
      VARBIT2=1    'set second bit of STATE
      VARBIT3=0    'reset third bit of STATE
endif
```

A common use of these variables is the manage of the digital **INPUT** and **OUTPUT** lines of the system, as they are equipped inside system (ex. NGIO) or they are remote channels in a **CANOPEN** or **ETHERCAT** net. In the first case the bits will be associated to internal normal variables, while in the second one they will be contained in variables of type **VCB**. That means declaring the bit variables we shell control physically the state of these I/O lines simply reading or writing the relative bit variable.

DECLARING a BIT VARIABLE



VarBit4 | CICLO | 3 | No

Nome	Variabile originaria	NBit	Condivisa
VarBit1	CICLO	0	No
VarBit2	CICLO	1	No
VarBit3	CICLO	2	No

FIELDS OF BIT VARIABLE

Name It identify the UNIVOCAL name of the bit variable

Original Variable Name of the variable associated to the bit one. It must be of type CHAR, UCHAR, INT, UINT, LONG (also ARRAYS)

Nbit Number of the bit in the associated original variable
ATTENTION: the first bit is always the number 0 (zero)

The maximum number of bits depends by the type of the original variable:

CHAR/UCHAR	**0-7** (8 bits)
INT/UINT	**0-15** (16 bits)
LONG	**0-31** (32 bits)

6.5 Arrays

The arrays can be declared in the INTERNAL or STATIC variables and they can be defined as any type except the BIT one. The arrays managed by VTB are SINGLE-DIMENSION and the maximum limit depends on the free memory available. To declare an array we have to do as for a normal variable putting after the name, between parenthesis, the desired dimension.
If there was the need to use a TWO-DIMENSION array (matrix) we have to work with STRUCTURES. Simply we have to declare a structure with a field of type array then to declare an array of type structure.

ARRAY(10) Array of 10 elements

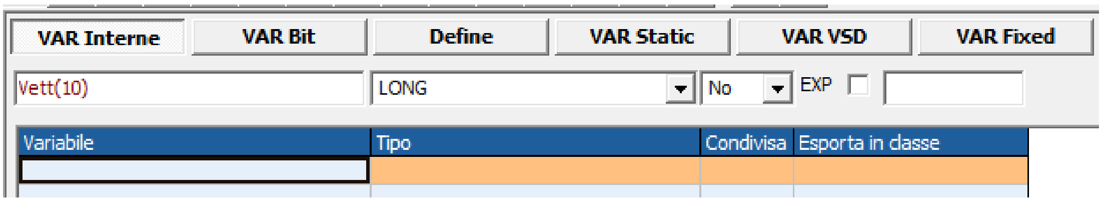
The first element of the array always start from 0 (zero) then:

ARRAY(0) first element
ARRAY(9) last element

Some VTB functions need the address of the array, that is specified writing the name of array followed by parenthesis with no index inside (see also pointer).

ARRAY() ***refers to the memory address of ARRAY***

DECLARING AN ARRAY



Vett(10) | LONG | No | EXP □

Variabile	Tipo	Condivisa	Esporta in classe

ATTENTION: VTB doesn't make any control on the index of array therefore **with it's possible to write over the array's dimension with consequent risks of unexpected operations**.

6.6 VCB Variables (CanOpen or EtherCAT)

The variables of type VCB are common variables which reflect the state of variables allocated in remote device connected at the central unit by field-bus like CANOPEN or ETHERCAT. These variables aren't defined directly by VTB environment but come from an external configurator which defines the field-bus typology and the connected devices. Practically the declaration is made automatically by the configurator and compiler application making them available to OBJECT or to WRITTEN SOURCE CODE. Refer to the chapters ***CANOPEN CONFIGURATOR and ETHERCAT CONFIGURATOR***.

In other words variables VCB are the shared resources of an external device connected by field-bus. For example a brushless motor driver will make available a lot of variables referred to MOTION, while an I/O device will make available variables referred to management of INPUT and OUTPUT channels.

Unlike other types of variables, the VCB ones are ever GLOBAL and then visible from all the page and all the tasks.

Variables VCB declared by configurator can be used in the SOURCE CODE as well in the property of the OBJECTS that make use.

There isn't a list of these variables, to use them we have to refer simply writing its name.

USE OF A VARIABLE VCB IN THE SOURCE CODE

To use a variable VCD we have to refer simply writing its name.

```
If encoderx >=10000      ' encoderx is a variable VCB

..............

endif
```

6.7 System Variables

Variables of type System are variables already defined by operative system, therefore we must not to declare them but they can be used as commen variables. This is the list of the SYSTEM VARIABLES available. There are more system variables but reserved to the system.

NAME	TYPE	R/W	DESCRIPTION
_SYSTEM_PXC	LONG	R/W	They are used in systems with NGM13 and contain . Contengono the double value of the number of steps generated by the four axis step controller.
_SYSTEM_PYC	LONG	R/W	
_SYSTEM_PZC	LONG	R/W	
_SYSTEM_PAC	LONG	R/W	
_SYSTEM_ACT_PAGE	INT	R	It contains the page number currently loaded/displayed.
_SYSTEM_OLD_PAGE	INT	R	It contains the page number previously loaded/displayed.
_SYSTEM_STRING(128)	CHAR	R	Array of 128 elements containing the string read by the function ***Get_TabStr(.....)***
_SYSTEM_LINGUA	CHAR	R/W	It contains the number of LANGUAGE currently used by application. It is a number from 0 to 127 which select the messages from the relative table.
_SYSTEM_EMCY(8)	CHAR	R	It contains the data frame of Emergency Object of CanOpen. It is updated calling the function ***read_emcy()***.
_SYSTEM_SDOAC0	LONG	R	These variables form the 8 byte of the eventual SDO ABORT CODE sended by a slave CANOPEN as a result of a call to the functions ***pxco_sdodl(...)*** or ***pxco_sdoul(...)***. If the retur value is 2, the variables _SYSTEM_SDOAC0 and _SYSTEM_SDOAC1 represent the error code.
_SYSTEM_SDOAC1	LONG	R	
_SYSTEM_TLUCE	LONG	R/W	It contains the response time in milliseconds of the automatic turn off of the background light in devices with HMI.
_SYSTEM_PLC_ACT_TIME	UINT	R	It is the actual elapsed time of TASK PLC in CPU units. DEBUG application displays it in milliseconds. It useful for test to understand the stress of CPUin TASK PLC. This time should be less than 30% of the sample time (set in general options) to avoid the other tasks run slowly.
_SYSTEM_PLC_MAX_TIME	UINT	R	It's similar to the previous but it contains the maximum value latched.
_SYSTEM_CARD_TYPE	INT	R	If there is present an internal SSD this variable contains its dimension in Mbyte (8, 16, 32, 64, 128, etc.).
_SYSTEM_VER	INT	R	It is the firmware version. Ex. 10317 → Vers. 1.03.17
_SYSTEM_CANERR_CNT0	LONG	R/W	Error counter of the Canopen channel 1. It is updated each sample of TASK PLC testing the hardware interface.
_SYSTEM_CANERR_CNT1	LONG	R/W	It's tha same as the previous one but it refers to channel 2.

_SYSTEM_ECERR_CNT	LONG	R/W	Error counter of the ETHERCAT line.
_SYSTEM_STDINP_DN	INT	R	It contains the code of a key when it is pressed.
_SYSTEM_STDINP_UP	INT	R	It contains the code of a key when it is released.

6.8 Static Variables

The variables of type STATIC are declared in NON-VOLATILE RAM: they aren't zeroed at reset and maintain their value also after turn off. They are very useful to retain data which change frequently (as encoders, counters, etc.), and which could not be saved in flash memory (IMS). Besides they are common variables.
STATIC variables are always GLOBAL that is visible in all page and in all tasks.

TYPE	**DIMENSION**	**RANGE**
BIT	1 bit	From 0 to 1
CHAR	8 bit signed	From –128 to +127
UCHAR	8 bit unsigned	From 0 to 255
INT	16 bit signed	From –32.768 to +32.767
UINT	16 bit unsigned	From 0 to 65.535
LONG	32 bit signed	From –2.147.483.648 to +2.147.483.647
FLOAT (16 bit systems)	48 bit (proprietary format)	29 bit mantissa 15 bit exponent
FLOAT (32 bit systems)	64 bit (standard DOUBLE format IEEE 75)	From -1,79769313486232e308 to +1,79769313486232e308
ARRAY	Single dimension for all variable types except BIT type	
DELEGATE	Pointer to FUNCTIONS 32 bit	

ATTENZIONE: Not all systems support the STATIC variables, then refer to hardware manual.

6.9 Fixed Variables

The variables of type FIXED are allocated at a fixed address in the internal memory of the device which, unlike common variables, doesn't change modifying the program. This type of variable simplifies the use of systems connected to an external HOST (ex. PC). In fact using FIXED variables there will be no need to recompile the HOST application at each change in VTB program.
FIXED variables are always GLOBAL that is visible in all page and in all tasks.

TIPO	**DIMENSIONE**	**RANGE**
BIT	1 bit	From 0 to 1
CHAR	8 bit signed	From –128 to +127
UCHAR	8 bit unsigned	From 0 to 255
INT	16 bit signed	From –32.768 to +32.767
UINT	16 bit unsigned	From 0 to 65.535
LONG	32 bit signed	From –2.147.483.648 to +2.147.483.647
FLOAT (16 bit systems)	48 bit (proprietary format)	29 bit mantissa 15 bit exponent
FLOAT (32 bit systems)	64 bit (standard DOUBLE format IEEE 75)	From -1,79769313486232e308 to +1,79769313486232e308

The START address of FIXED area is:

```
NGM13       Addr= 536874496
NG35        Addr= 1051648
```

6.10 Delegates

This type of variables is used to call a function by a variable. First of all the address of the function to call must be written in the DELEGATE variable. Then we can use this variable to call the function with the instruction ***call_delegate***. It can also be created an array of DELEGATE variables and then call a function according to the index of the delegate.
Using of DELEGATES is very powerful because it allows the access to the functions in the fastest way without writing a long series of conditional cycles.

ATTENTION: The function called by CALL_DELEGATE must be VOID both for arguments and return parameter.
VTB doesn't make any control to the initialization of the DELEGATE. **Calling a delegate not initialized can go the system in CRASH**

Example:
Used variables:
var(2) as delegate

Page Init of Main task (delegates initialization):

```
Var(0)=fun1     ´assign to var(0) the address of function fun1
Var(1)=fun2     ´assign to var(1) the address of function fun2
```

Page Function of Main task (functions declaration):

```
Function fun1() as void
.
Endfunction

Function fun2() as void
.
Endfunction
```

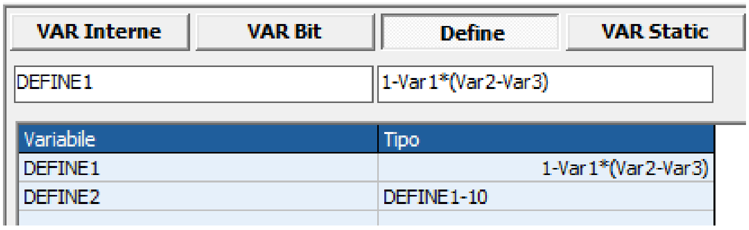
Master Ciclo of Main task (calling of functions by delegates):

```
Call_delegate var(0)    ‘ fun1 will run
Call_delegate var(1)    ‘ fun2 will run
```

6.11 Define

DEFINES are complex equivalences. They are composed by the NAME and the VALUE. The name identifies the DEFINE, the VALUE can contain any alfa-numeric expression. The compiler each time a NAME of DEFINE is found, replaces it with its VALUE. They are very useful to simplify the use of complex expressions or to Parametersze part of code. Also they can be combined between self.

Declaring of a DEFINE



DEFINE1 | 1-Var1*(Var2-Var3)

Variabile	Tipo
DEFINE1	1-Var1*(Var2-Var3)
DEFINE2	DEFINE1-10

Using of a DEFINE in the code

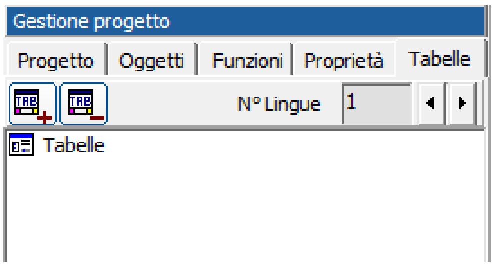
To use a DEFINE in text code just we have to write the NAME. DEFINES can be used in a lot of situations making the program more flexible because it's sufficient to change the VALUE of a DEFINE to obtain an immediate variation on all the project.

Example:

```
If Define1>=10000
        ...............
        ...............
endif
```

6.12 Text Tables

The TEXT TABLES are essentials to realize MULTILANGUAGE applications and to use the OBJECT of the class CBROWSER. TEXT TABLES are container of text lists divided in languages. Obviously it's necessary to use text objects which refer to TEXT TABLES. For example the object TabText of the CLASS CLABEL uses tables to display text, therefore it is predisposed for MULTILANGUAGE applications. Instead the simple object TEXT of the CLASS BASE OBJECT doesn't use TABLES making it not suitable to manage multilanguage applications. Before using a TEXT TABLE must be created. An apposite browser allows the writing of the text in the tables. To start the browser there is an apposite section in ***Project Manager.***
The tables will be automatically numbered with an INDEX to which refer for their use.

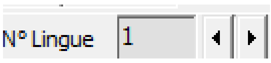


N° Lingue 1

Add a new table

Delete selected table

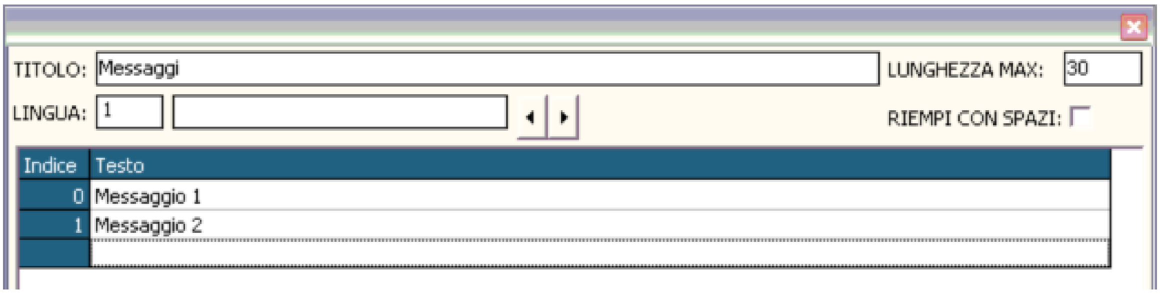
Near these buttons there is a spin-box to select the total number of languages in the project. **The number of languages is unique in all the project and it is associated at all the tables.**



N° Lingue 1

In the tree-view it's possible to see all the tables of the project, doing the double-click on a table we can enter to the modify window.

Browser of TEXT TABLES



TITOLO: Messaggi
LUNGHEZZA MAX: 30
LINGUA: 1
RIEMPI CON SPAZI: □

Indice	Testo
0	Messaggio 1
1	Messaggio 2

TITLE
It's a description of the table only as a comment. It isn't a reference for the table.

LANGUAGE
For each table there is a page for each language. With the two buttons at the right allow to scroll between these pages. The number indicates the index of the language currently displayed. We can also write a

message associated to each language for better understanding.

LENGHT MAX

It's the dimension of each single message in the table. All strings of a table will have the same dimension.

FILL WITH SPACES

If enabled, the text of length less than LENGTH MAX will be filled with space in order to reach that length.

INDEX

Index of the text in the table. This value together the index of the table are the reference to print the text with ***get_tabstr(...)***.

TEXT

It's the message contained in a row of the table.

DELETE ROW

Delete the selected row.

USE OF THE TABLE IN TEXT CODE

To manage the rows of the tables there is a single function: **Get_TabStr**

Example:

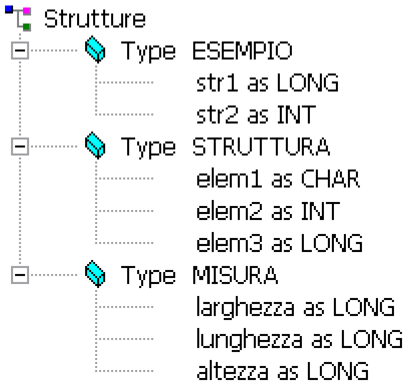
Print a message indexed with NMES of the table indexed with TAB

```
function draw_message(tab as int, nmes as int) as void
  get_tabstr(tab, nmes, _SYSTEM_LINGUA)
  draw_str(_system_string())
endfunction
```

6.13 Structures

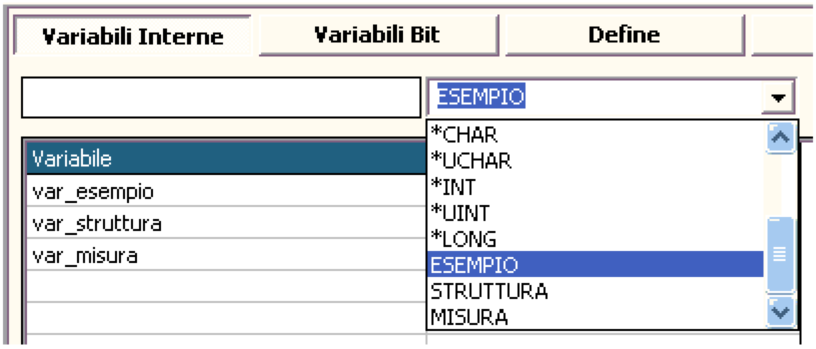
The STRUCTURES can be declared only as INTERNAL variables. The fields of a structure can be of any type except BIT and pointer.

To declare a STRUCTURE open the STRUCTURE TABLES and define the NAME of the structure and all single elements we need.



```
Strutture
  Type  ESEMPIO
        str1 as LONG
        str2 as INT
  Type  STRUTTURA
        elem1 as CHAR
        elem2 as INT
        elem3 as LONG
  Type  MISURA
        larghezza as LONG
        lunghezza as LONG
        altezza as LONG
```

When a structure is declared, in the list of the variable types the NAME of the STRUCTURE will be showed, allowing to define a new variable of all types declared as structure.



ESEMPIO

Variabile
var_esempio
var_struttura
var_misura

To use the elements of the structure it's necessary to write the NAME of the STRUCTURE followed by **dot** character (**.**) and by the name of the field at which we want to refer.

It's also possible manage the structures with pointers (see POINTERS chapter).

Example:

Used Variables:

```
val1 as long
val2 as long
val3 as long
Tool as ToolSTRUCT     ' declaration of a structure variable

Tool.wide=13
val1=Tool.wide
Tool.length=23
Tool.high=54
val2=Tool.length
val3=Tool.high
```

7 OPERATORS

The operators of VTB are common to other compilers.

7.1 Logic and Mathematical Operators

These are all the logic and mathematical operators available in VTB:

OPERATOR	DESCRIPTION	EXAMPLE
(	Parenthesis	It identifies the begin of a group of calculation or function ***a=(c+b)/(x+y) fun(10,20)***
+	Addition	Mathematical addition ***a=b+c***
-	Subtraction	Mathematical subtraction ***a=b-c***
*****	Multiplication	Mathematical multiplication ***a=b*c***
/	Division	Mathematical division ***a=b/c***
)	Parenthesis	It identifies the end of a group of calculation or function ***a=(c+b)/(x+y) fun(10,20)***
>	Greater	Greater than condition ***if a>b***
<	Less	Less than condition ***if a<b***
>=	Greater Equal	Greater or equal than condition ***if a>=b***
<=	Less Equal	Less or equal than condition ***if a<=b***
<>	Not equal	Not equal condition ***if a<>b***
=	Equal	Equal condition ***if a=b*** or assignment ***a=b***
||	Logic OR	OR logic condition ***if (a=b) || (b=c)*** condition it's true if at least one expression is true
&&	Logic AND	AND logic condition ***if (a=b) && (b=c)*** condition it's true if both expressions are true
|	OR bit	Execute the OR between two value ***a=a|3*** Bits 1 and 2 of variable ***a*** are set leaving unchanged the others
&	AND bit	Execute the AND between two value ***a=a&3*** All bit of variable ***a*** are reset except the bits 1 and 2
!	Logic NOT	Negation of an expression **if !(a<>b)** The expression is true if ***a*** is equal to ***b***
~	NOT bit	Execute a not on all the bits of a value, all bits will change its state **a=85 a=~a** After NOT instruction the variable ***a*** will take the value 170 **85 → 01010101** **170 → 10101010**
>>	Shift to right	The bits of the variable are shifted to left n times **a=8 a=a>>3** After shift the variable ***a*** will take the value 1
<<	Shift to left	The bits of the variable are shifted to right n times **a=1 a=a<<3** After shift the variable ***a*** will take the value 8

7.2 Notes on Expressions

VTB manages the mathematical expressions completely. Anyway we have to make attention when in the expression there are INTEGER variables together FLOAT variables. We have to remind these rules:

1) If in the expression there is at least one variable of type FLOAT all the expression is calculated in FLOAT;

2) If the result of an expression must be FLOAT at least one variable in the expression must be FLOAT;

Look at this example:

A=10
B=4
R=A/B

According to the type of the variables VTB calculates the following results:

A	B	R	
LONG	LONG	FLOAT	2
FLOAT	LONG	FLOAT	2,5
FLOAT	FLOAT	LONG	2

Enabling the Warning level of the compiler, some messages will be displayed in coincidence with the possibility of data truncation.

8 MATH FUNCTIONS

VTB manages a wide SET of mathematical functions.

8.1 SIN

Return the **sinus** of an angle in a FLOAT value.
Hardware ***NG35,NGM13,PEC70***

Syntax

Sin (***angle***) as float

The argument ***angle*** can be a FLOAT value or any numeric expression which represents the **angle in radians**.

Example:

```
Used variables:
angle float
Cosec float
angle = 1.3             ' Define the angle in radians.
cosec = 1 / Sin (angle) ' Calculate the cosecant.
```

8.2 COS

Return the **cosinus** of an angle in a FLOAT value.
Hardware ***NG35,NGM13,PEC70***

Syntax

Cos (***angle***) as float

The argument ***angle*** can be a FLOAT value or any numeric expression which represents the **angle in radians**.

Example:

```
Used variables:
angle float
sec float
angle = 1.3             ' Define the angle in radians.
sec = 1 / Cos (angle)   ' Calculate the secant.
```

8.3 SQR

Return the **square root** of a number.
Hardware ***NG35,NGM13,PEC70***

Syntax

Sqr (***number***) as float

The argument ***number*** can be a FLOAT value or any numeric expression greater or equal than zero.

Example

Used variables:

```
vsqr float
vsqr = sqr (4)     ‘ return the value 2
```

8.4 TAN

Return the **tangent** of an angle in a FLOAT value.

Hardware ***NG35,NGM13,PEC70***

Syntax

Tan (***angle***) as float

The argument ***angle*** can be a FLOAT value or any numeric expression which represents the **angle in radiant**.

Example:

```
Used variables:
angle float
ctan float

angle = 1.3              ' Define the angle in radians.
ctan = 1 / Tan (angle)   ' Calculate the cotangent.
```

8.5 ATAN

Return the **arctangent** of a number in a FLOAT value between -π/2 and +π/2.

Hardware ***NG35,NGM13,PEC70***

Syntax

Atan (***number***) as float

The argument ***number*** can be a FLOAT value or any numeric expression.

8.6 ASIN

Return the **arcsin** of a number in a FLOAT value.

Hardware ***NG35,NGM13,PEC70***

Syntax

Asin (***number***) as float

The argument ***number*** can be a FLOAT value or any numeric expression between 1 and -1.

Example

```
Used variables:
angle float
var float

angle = 1.3
var = asin (angle)
```

8.7 ACOS

Return the **arccos** of a number in a FLOAT value.

Hardware ***NG35,NGM13,PEC70***

Syntax

Acos (***number***) as float

The argument ***number*** can be a FLOAT value or any numeric expression between 1 and -1.

Example

Used variables:

```
angle float
var float

angle = 1.3
var = acos (angle)
```

8.8 ATAN2

It's similar to atan but it returns a value from -π and +π .

Hardware ***NG35,NGM13,PEC70***

Syntax

Atan2 (***y, x***) as float

The arguments **y** and **x** are of type FLOAT.

Return Value

The return value coincides with the angle whose tangent is **y / x.**

Example

Used variables:

```
x float
y float
angle float
radians float
result float
PI float

PI= 3.141592
x=1.0
y=2.0
angle = 30
radians = angle * (PI/180)
result = Tan(radians)    ' Calculate the tangent of 30 degree
radians = Atan(result)   ' Calculate the Arctangent of the result
angle = radians * (180/PI)
radians = Atan2(y, x)    ' Calculate the Atan2
angle = radians * (180/PI);
```

8.9 ABS

Return the absolute INTEGER value

Hardware ***NG35,NGM13,PEC70***

Syntax

Abs (***number***) as long

The argument ***number*** can be a LONG value or any numeric expression.

Example

Used variables:

```
Num long

Num = -3250
Num = Abs(Num)     ' return the value 3250
```

8.10 FABS

Return the absolute FLOAT value

Hardware ***NG35,NGM13,PEC70***

Syntax

FAbs (***numero***) as float

The argument ***number*** can be a FLOAT value or any numeric expression.

Example

Used variables:

```
Num float

Num = -3.250
Num = Abs(Num)     ' return the value 3.250
```

9 INSTRUCTIONS TO CONTROL THE PROGRAM FLOW

In VTB there are a lot of instruction to control the program flow. They are similar to other compiler and **THEY ARE AVAILABLE IN ALL THE HARDWARE TYPES.**

9.1 IF-ELSE-ENDIF

Allow the conditional execution of a group of instruction according to the result of an expression.

Syntax

```
        If condition
                [instruction]
        Else
                [instructionelse]
        endif
```

The syntax of instruction **if... else** is composed by the following elements:

condition Mandatory. Any expression with the result True (value not zero) or False (value zero).
instruction List of the instruction to execute if the condition **IF** is TRUE.
instructionelse Optional. List of the instruction to execute if the condition **IF** is FALSE.
endif End of cycle **IF ELSE**

Notes

The instruction **Select Case** can be more useful when there are a lot of continuous cycles IF because it creates a source code more readable.

Example

Used variables:

```
var1 int
var2 int
if var1*var2 > 120
        var1=0
else
        var1=120
endif
```

9.2 LABEL

Identifies a reference point for the **GOSUB** or **GOTO** jumps.

Syntax

```
        Label   labelname
```

labelname name of the reference of the LABEL.
In each PAGE or MAIN task it can not exist more LABEL with the same name.

ATTENTION: The LABEL instruction is OBSOLETE. It is preferred to use the FUNCTIONS.

Example

```
if condiition
        goto label1
else
        goto label2
endif
.
Label Label1
.
Label Label2
```

9.3 GOSUB-RETURN

Allow to pass the control to a SOUBRUTINE and to return at the next program instruction.

Syntax

```
        GoSub labelname
```

The argument ***labelname*** can be any LABEL inside the current PAGE or inside the MAIN task.

Notes

GoSub and **Return** can be used everywhere in the code, but they must be both included in the same PAGE or in MAIN task. A subroutine can be composed by more than one **Return** instructions, but the first **Return** founded by the program flow will act the return of the program to the first instruction after the last **GoSub.**.

ATTENTION: The LABEL instruction is OBSOLETE. It is preferred to use the FUNCTIONS.

Example

```
if condition
        gosub label1
else
        gosub label2
endif

Label Label1
.
Return
Label Label2
.
Return
```

9.4 GOTO

Allows to jump to a LABEL.

Syntax

```
        Goto labelname
```

The argument ***labelname*** can be any LABEL inside the current PAGE or inside the MAIN task.

Notes

Goto passes the control to a point of the program referenced by a LABEL. Unlike GOSUB the instruction **RETURN** isn't necessary.

ATTENTION: The LABEL instruction is OBSOLETE. It is preferred to use the FUNCTIONS.

Example

```
if condition
        goto label1
else
        goto label2
endif

Label Label1
.
Label Label2
.
```

9.5 INC

Increments a variable of any type.

Syntax

Inc *varname*

The argument ***varname*** can be any variable declared in the program.

Description

Inc is the same as **VAR=VAR+1** but it is executed more quickly.

Example

```
INC var1    'var1 is incremented by 1
```

9.6 DEC

Decrements a variable of any type.

Syntax

Dec *varname*

The argument ***varname*** può essere una qualsiasi variabile dichiarata nel programma.

Description

Dec is the same as **VAR=VAR-1** but it is executed more quickly.

Example

```
DEC var1    'var1 is incremented by 1
```

9.7 SELECT-CASE-ENDSELECT

Allow to execute blocks of instructions according the result of an expression.

Syntax

```
        Select expression
                [Case condition_1
                        [instruction_1]] ...
                [Case condition_2
                        [instruction_n]] …
                …
                [Case Else
                        [instructionelse]]
        EndSelect
```

The syntax of the instruction **Select Case** is composed by the following elements:

expression	Mandatory. Any expression.
condition_n	Mandatory. It can be in two forms: **expression**, **expression To expression**. The keyword **To** specifies a range of value.
instruction_n	Optional. Instructions executed if the **expression** matches the **condition_n.**
instructionelse	Optional. Instructions executed if no **condition_n** is matched.

Notes

If the result of **expression** equals a **condition_n**, the following instructions will be executed until the next instruction **Case** or **Case Else** or **EndSelect**.
If more than one **condition_n** is matched, only the first encountered will be execute. **Case Else** is used to execute a block of instruction if no condition are verified. Although it isn't mandatory, it is recommended the use of **Case Else** statement in each **Select** to manage also unexpected value of **expression.**
More instruction **Select Case** can be nested. At each instruction **Select Case** there must be an associated **EndSelect**.

Example

Used variables:

```
var1 int
```

```
var2 int
var3 int

Select var1
      case 10             ‘ if var1=10
            ...
      case var2+var3      ‘ if var1=var2+var3
            ...
      case 5 TO 20        ‘ if var1 is between 5 and 20
            ...
      case 1,6,8          ‘ if var1=1 or var1=6 or var1=8
            ...
      case else           ‘ all other value of var1
            ...
Endselect
```

9.8 FOR-NEXT-STEP-EXITFOR

Allow the iteration of a block of instructions for a number of times according to a variable. It is a mix between BASIC and C languages.

Syntax

```
      For counter = init To condition [Step increment]
            [intructions]
            ...
            ExitFor
            ...
      Next [counter]
```

The syntax of the instruction **For...Next** is composed by the following elements:

counter	Mandatory. Numeric variable used as counter of iteration. It can be a BIT variable.
init	Mandatory. Initial value of the counter.
condition	Mandatory. Iteration will continue until condition is true.
increment	Optional. Value added to the counter at the end of each iteration. If it isn't specified it will assume the value 1. It can be any numeric expression and can assume any value positive as well as negative.
instructions	Optional. Block of instructions to execute during the iteration.
ExitFor	It is used to force the stop of the iterations, the program will continue from the line immediately after the instruction **Next**.

Notes

It is possible to nest more cycles **For...Next** Assigning to each cycle a different counter:

Examples

```
For I = 1 To I<10
      For J = 1 To J<10
            For K = 1 To K<10
                  ...
            Next K
      Next J
Next I

For var1=0 to var1<8      ' Repeat 8 times
      ...
Next var1

For var1=1 to var1<var4 step var3
      ...
Next var1
```

```
For var2=1 to var2<=10
      ...
Next var2

For var1=10 to var1<var3*var4 step -1
      ...
Next var1
```

9.9 WHILE-LOOP-EXITWHILE

Allow the execution of a block of instructions until a condition is true.

Syntax

```
      While condition
            [instructions]
            …
            ExitWhile
            …
      Loop
```

The syntax of the instruction **While...loop** is composed by the following elements:

condition Mandatory. Any expression with the result True (value not zero) or False (value zero).
instructions Optional. Block of instructions executed until condition is true.

ExitWhile It is used to force the stop of the cycle, the program will continue from the line immediately after the instruction **Loop**.

Notes

If the condition is True, the block of instruction will be executed then yhe cycle will be repeated.
More cycles **While...loop** can be nested at any level. Each instruction **loop** will correspond to the more recent instruction **While.**

Example

Used variables:

```
Var1 int

while var1<10
...
loop
```

10 FUNZIONI

VTB manages functions with the same syntax as VISUAL BASIC. It exist a limitation in the declaration of internal variables: **they can not be ARRAYS, STRUCTURES or BITS.**

10.1 Declaration of a function

Syntax

```
        function function_name(par_1 as int, par_2 as char, ….., par_n as *long) as function_type
                dim var as int  'local variables
                ....
                ....            'body of the function
                ....
                function_name = return_value
        endfunction
```

The syntax of a **function** is composed by the following elements:

function Mandatory. Keyword identifying the begin of a function.
function_name Mandatory. Unambiguous name of the function chosen by programmer.
par_1...par_n Optional. They are the parameter passed to the function. If no parameter have to be passed (VOID) there must be nothing inside the parenthesis.
function_type Mandatory. It defines the data type returned from the function. If no data have to be returned write **as void.**
local variables Optional. Local variables are allocate at the moment when function is called and then destroyed when it returns.
They can be of any types **except ARRAYS, STRUCTURES or BITS.**
body of the function Optional. Block of instruction execute by the function.
function_name=… Optional. It assigns the value returned from the function.
endfunction Mandatory. Keyword to identifying the end of the function.

Notes

A function can be called simply writing its name passing to it the eventual parameters declared.
To return from the function in any moment it can be used the instruction **return**.
The assignment **nome_funzione = ….** doesn't cause the return from the function but only the assignment of the return value.

Example:
Used variables:
result as int
number_a as int
number_b as int

Page Function of Main task (functions declaration):

```
function int_average(number_1 as int, number_2 as int) as int
        dim temp as int
        temp=(number_1+number_2)/2
        int_average=temp
endfunction
```

Anywhere in the source code (function calling):

```
number_a=13
number_b=33
result=int_average(number_a, number_b)
```

10.2 Declaration of the function internal variables

Syntax

```
        Dim varname as type
```

The syntax of instruction **dim** is composed by the following elements:

varname Mandatory. Name of the variable.

type Mandatory. Type of the variable. It can be of any types **except ARRAYS, STRUCTURES or BITS.**

Example

```
dim var as long
dim var1 as uint
dim var2 as float
```

11 SYSTEM FUNCTIONS

VTB provides a wide LIBRERY to a complete management of the hardware devices. Some function can be available only for some type of hardware

.

11.1 FUNCTION FOR THE GRAPHIC CONTROL

This group of function are available in systems equipped with an HMI.

11.1.1 CLEAR_LCD

Clears display with a background color.

Hardware ***PEC70,NG35+...,NGM13+....***

Syntax

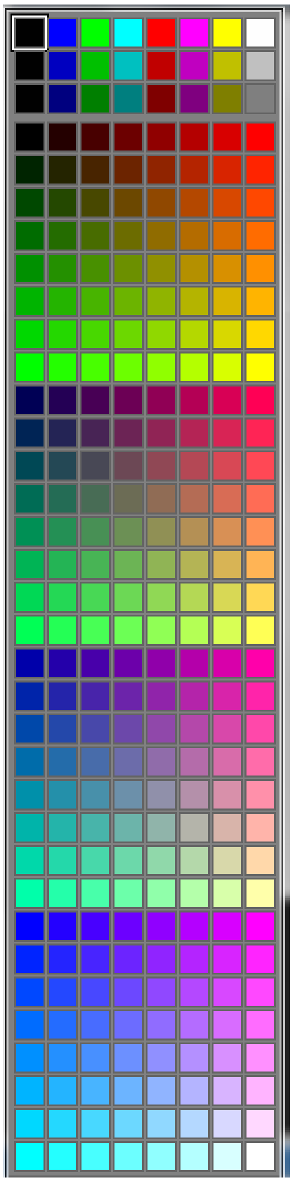
```
        CLEAR_LCD(int Background)
```

Parameters

Background Any number or expression in the range of the colours supported by the hardware.

Example:

```
clear_lcd(7)        ' clear display with the white color
```



11.1.2 SETBRIGHT

Sets the DISPLAY backligth.

Hardware ***PEC70***

Syntax

```
SetBright (char fun, long val)
```

Parameters

fun=0

val Cambia momentaneamente la luminosità del display (da 0 a 100)

fun=1

val Imposta la luminosità bassa (da 0 a 100, default 40) attivata dal save-screen

fun=2

val Imposta la luminosità alta (da 0 a 100, default 100) attivata dal save-screen

11.1.3 DRAW_HLINE

Draws an horizontal line. The colour has to be set with ***setcolor***.

Hardware ***PEC70,NG35+...,NGM13+....***

Syntax

```
DRAW_HLINE(int X0, int Y0, int Len)
```

Parameters

X0 Any number or expression corresponding to the coordinate X of starting point

Y0 Any number or expression corresponding to the coordinate Y of starting point

Len Any number or expression corresponding to the length of the line

Example

```
draw_hline(0,100,50)      ‘ draw an horizontal line of 50 pixel
```

11.1.4 DRAW_VLINE

Draws a vertical line. The colour has to be set with ***setcolor***.

Hardware ***PEC70,NG35+...,NGM13+....***

Syntax

```
DRAW_VLINE(int X0, int Y0, int Len)
```

Parameters

X0 Any number or expression corresponding to the coordinate X of starting point

Y0 Any number or expression corresponding to the coordinate Y of starting point

Len Any number or expression corresponding to the high of the line

Example

```
draw_vline(0,100,50)     ‘draw a vertical line of 50 pixel
```

11.1.5 DRAW_LINE

Draws a generic line. The colour has to be set with ***setcolor***.

Hardware ***PEC70,NG35+...,NGM13+....***

Syntax

```
DRAW_LINE(int X0, int Y0, int X1, int Y1)
```

Parameters

X0 Any number or expression corresponding to the coordinate X of starting point

Y0 Any number or expression corresponding to the coordinate Y of starting point

X1 Any number or expression corresponding to the coordinate X of ending point

Y1 Any number or expression corresponding to the coordinate Y of ending point

Example

```
draw_line(0,150,100,250)       ' draw a generic line
```

11.1.6 DRAW_BOX

Draws the outline of a box (rectangle). The colour has to be set with ***setcolor***.

Hardware ***PEC70,NG35+...,NGM13+....***

Syntax

```
    DRAW_BOX(int X0, int Y0, int X1, int Y1)
```

Parameters

X0	Any number or expression corresponding to the coordinate X of the upper left angle
Y0	Any number or expression corresponding to the coordinate Y of the upper left angle
X1	Any number or expression corresponding to the coordinate X of the lower right angle
Y1	Any number or expression corresponding to the coordinate Y of the lower right angle

Example

```
draw_box(0,150,100,250)        ' draw a box
```

11.1.7 DRAW_FBOX

Draws a filled box. The colour has to be set with ***setcolor***.

Hardware ***PEC70,NG35+...,NGM13+....***

Syntax

```
    DRAW_FBOX(int X0, int Y0, int X1, int Y1)
```

Parameters

X0	Any number or expression corresponding to the coordinate X of the upper left angle
Y0	Any number or expression corresponding to the coordinate Y of the upper left angle
X1	Any number or expression corresponding to the coordinate X of the lower right angle
Y1	Any number or expression corresponding to the coordinate Y of the lower right angle

Example

```
draw_fbox(0,150,100,250)       ' draw a filled box
```

11.1.8 DRAW_PIXEL

Draws a single pixel. The colour has to be set with ***setcolor***.

Hardware ***PEC70,NG35+...,NGM13+....***

Syntax

```
    DRAW_PIXEL(int X0, int Y0)
```

Parameters

X0	Any number or expression corresponding to the coordinate X
Y0	Any number or expression corresponding to the coordinate Y

Example

```
draw_pixel(100,150)       ' draw a pixel
```

11.1.9 SETFONT

Sets the current font to use in the drawing text functions. The font reference is a number which is declared by VTB when a new font is loaded. It is formed as: **FT_font_name**. Only fonts loaded in a graphics page can be used except the default one (FT_DEFAULT).

Hardware ***PEC70,NG35+...,NGM13+....***

Syntax

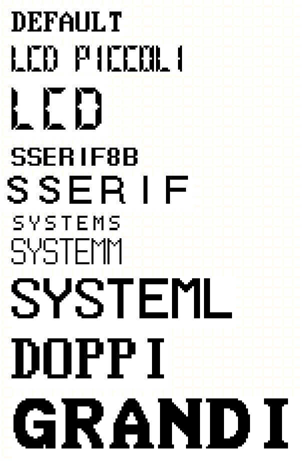
```
    SETFONT(char font)
```

Parameters

font	Any number or expression corresponding to the font type.

Example

```
setfont(FT_DEFAULT)       ' select the font DEFAULT
setfont(FT_LCD)          ' select the font LCD
```



DEFAULT
LCD PICCOLI
LCD
SSERIF8B
SSERIF
SYSTEMS
SYSTEMM
SYSTEML
DOPPI
GRANDI

11.1.10 SETCOLOR

This function sets the current colour using in all graphics functions.
Hardware ***PEC70,NG35+...,NGM13+....***

Syntax

```
SETCOLOR(int Pen, int Background)
```

Parameters

Pen Any number or expression corresponding to the pen colour

Background Any number or expression corresponding to the background colour

11.1.11 POS_TEXT

This function sets the cursor position X, Y used by the text drawing functions.
Hardware ***PEC70,NG35+...,NGM13+....***

Syntax

```
POS_TEXT(int X, int Y)
```

Parameters

X Any number or expression corresponding to the coordinate X

Y Any number or expression corresponding to the coordinate Y

11.1.12 PUTCHAR

Printing of a character. Position, colour and font have to be set respectively by ***pos_text***, ***setfont*** and ***setcolor***.
Hardware ***PEC70,NG35+...,NGM13+....***

Syntax

```
Putchar(char Chr)
```

Parameters

Chr ASCII code of the character to be printed

11.1.13 DRAW_STR

Printing of a string. Position, colour and font have to be set respectively by ***pos_text***, ***setfont*** and ***setcolor***.
Hardware ***PEC70,NG35+...,NGM13+....***

Syntax

```
Draw_str(char *str)
```

Parameters

***str** Pointer to the string to be printed

Example:
Used variables:
vect(20) as char

```
draw_str("Message1")          'print the string Message1
Strcpy(Vect(),"Message2")
draw_str(Vect())              'print the string Message2
```

11.1.14 DRAW_NSTR

Printing of a string limiting the lenght. Position, colour and font have to be set respectively by ***pos_text***, ***setfont*** and ***setcolor***.
Hardware ***PEC70,NG35+...,NGM13+....***

Syntax

```
        Draw_nstr(char *str, int Ncar)
```

Parameters
***str** Pointer to the string to be printed
Ncar Maximum number of characters to be printed

Example

```
draw_nstr(_system_string(),10)      ' print the first 10 characters contained in
                                     ' _system_string
```

11.1.15 DRAW_BITMAP

Drawing of a bitmap at desired position. VTB can import file in bmp format. The BITMAP reference is a number which is declared by VTB when a new bitmap is loaded. It is formed as: **BM_bitmap_name**. Only bitmaps loaded in a graphics page can be used.
Hardware ***PEC70***
Syntax

```
        Draw_bitmap(int Bmp, int X, int Y)
```

Parameters
Bmp Reference number of the BIT MAP: **BM_bitmap_name**
X Any number or expression corresponding to the coordinate X
Y Any number or expression corresponding to the coordinate Y

Example

```
draw_bitmap(BM_MYBITMAP,100,100)' draw the BITMAP named MYBITMAP
```

11.1.16 DRAW_SBITMAP

It is the same as ***draw_bitmap*** but STRECHING the image to adapt it in the set rectangle.
Hardware ***PEC70***

Syntax

```
        Draw_sbitmap(int Bmp, int X, int Y, int X1, int Y1)
```

Parameters
Bmp Reference number of the BIT MAP: **BM_bitmap_name**
X Any number or expression corresponding to the coordinate X of the upper left angle
Y Any number or expression corresponding to the coordinate Y of the upper left angle
X1 Any number or expression corresponding to the coordinate X of the lower right angle
Y1 Any number or expression corresponding to the coordinate Y of the lower right angle

11.1.17 SAVE_AREA

Saving of an area of display identified by the rectangle (X0,Y0,X1,Y1). The saved area can be restored by the function ***restore_area***.
Hardware ***PEC70***

Syntax

Save_area(int X0, int Y0, int X1, int Y1)

Parameters

X0	Any number or expression corresponding to the coordinate X of the upper left angle
Y0	Any number or expression corresponding to the coordinate Y of the upper left angle
X1	Any number or expression corresponding to the coordinate X of the lower right angle
Y1	Any number or expression corresponding to the coordinate Y of the lower right angle

Example

```
Save_area(10,10,100,100)      ' Save the display area contained in the square
                              '10,10 100,100
```

11.1.18 RESTORE_AREA

Restoring of the area previously saved with ***save_area***.

Hardware ***PEC70***

Syntax

Restore_area(,int X0,int Y0,int X1,int Y1)

Parameters

X0	Any number or expression corresponding to the coordinate X of the upper left angle
Y0	Any number or expression corresponding to the coordinate Y of the upper left angle
X1	Any number or expression corresponding to the coordinate X of the lower right angle
Y1	Any number or expression corresponding to the coordinate Y of the lower right angle

11.1.19 PRINT

Formatting print of an INTEGER value.

Hardware ***PEC70,NG35+...,NGM13+....***

Syntax

PRINT (const char *format, long val)

Parameters

Format	String corresponding to the format to be printed
Val	Any integer value or expression

Avalaible formats

######	Print a fixed number of characters	23456
###.###	Force the print of decimal point	123.456
+####	Force the print of the sign	+1234
#0.##	Force the print of a ZERO	0.12
X####	Print in HEXADECIMAL format	F1A3
B####	Print in BINARY format	1011

Example

```
var=12345
Print("###.##",var) ' It will be printed: "123.45"
var=2
Print("###.##",var) ' It will be printed: "   . 2"
Print("###.00",var) ' It will be printed: "   .02"
Print("##0.00",var) ' It will be printed: "  0.02"
```

11.1.20 PRINTFF

Formatting print of a FLOAT value. It is the same as ***printf***.

Hardware ***PEC70,NG35+...,NGM13+....***

Syntax

PRINTFF (const char *format, float val)

Parameters

Format	String corresponding to the format to be printed
Val	Any integer value or expression

11.1.21 PAGINA

Sets the page to be loaded and displayed. Pages are numbered starting from 1. The new page will be loaded not immediately but at the next cycle of the cooperative task.
Hardware ***PEC70,NG35+...,NGM13+....,NG35,NGM13***

Syntax

PAGINA (int Page)

Parameters

Page	Number of the page to be loaded

11.1.22 DRAW_ELLIPSE

Draws the outline of an ellipse. If Rx=Ry it will be drawn a circle. The colour has to be set with ***setcolor***.
Hardware ***PEC70,NG35+...,NGM13+....***

Syntax

DRAW_ELLIPSE (int Cx, int Cy, int Rx, int Ry)

Parameters

Cx	Coordinate X of the center
Cy	Coordinate Y of the center
RX	Radius X
RY	Radius Y

11.1.23 DRAW_FELLIPSE

Draws a filled ellipse. If Rx=Ry it will be drawn a circle. The colour has to be set with ***setcolor***.
Hardware ***PEC70,NG35+...,NGM13+....***

Syntax

DRAW_FELLIPSE (int Cx, int Cy, int Rx, int Ry)

Parameters

Cx	Coordinate X of the center
Cy	Coordinate Y of the center
RX	Radius X
RY	Radius Y

11.1.24 DRAW_FRAME

Draws a rectangle with the shadow effect.
Hardware ***PEC70***

Syntax

DRAW_FRAME (int X0, int Y0, int X1, int Y1, int tck, int col_up, int col_down)

Parameters

X0	Any number or expression corresponding to the coordinate X of the upper left angle
Y0	Any number or expression corresponding to the coordinate Y of the upper left angle
X1	Any number or expression corresponding to the coordinate X of the lower right angle
Y1	Any number or expression corresponding to the coordinate Y of the lower right angle
tck	Any number or expression corresponding to the thickness of the shadow
col_up	Any number or expression corresponding to the colour of the upper shadow
col_down	Any number or expression corresponding to the colour of the lower shadow

11.2 FUNCTIONS FOR THE SERIAL PORT CONTROL

All Promax hardware devices have 1 or 2 serial channel available to the application.
In VTB there are some object to manage the common serial protocol, for example MODBUS protocol both MASTER and SLAVE. However it's possible to use one serial channel to customize the protocol.
To do that there are some API function **which always refer to the SECOND SERIAL PORT of the hardware.**

11.2.1 SER_SETBAUD

Programming the BaudRate of the second SERIALE PORT.
Hardware ***PEC70,NG35+...,NGM13+....,NG35,NGM13***

Syntax

```
SER_SETBAUD (long Baud)
```

Parameters

Baud Value of Baud Rate. The standard value are:
1200-2400-4800-9600-19200-38400-57600-115200

11.2.2 SER_MODE

Programming the mode of the second SERIAL PORT. If this function is never called, by default the port is programmed with: No parity, 8 bits per character, 1 stop bit.
Hardware ***PEC70,NG35+...,NGM13+....,NG35,NGM13***

Syntax

```
SER_MODE(char par, char nbit, char nstop)
```

Parameters

par	Parity (0=no parity, 1=odd parity, 2=even parity)
nbit	Number of bits per character (7 or 8)
nstop	Number of stop bits (1 or 2)

Example

```
ser_mode(1,8,2)    ‘Program the 2nd serial port with:
                   ‘ODD-PARITY, 8 BIT/CHAR 2 STOP-BIT
```

11.2.3 SER_GETCHAR

Reads the receive buffer of the serial port. It doesn't wait for the presence of a character.
Hardware ***PEC70,NG35+...,NGM13+....,NG35,NGM13***

Syntax

```
SER_GETCHAR () as int
```

Return value:

-1	***No character is in the buffer***
>=0	***Code of the character read from the buffer***

11.2.4 SER_PUTCHAR

Sends a character to the serial port.
Hardware ***PEC70,NG35+...,NGM13+....,NG35,NGM13***

Syntax

```
SER_PUTCHAR (int Car)
```

Parameters

Car Code of the character to send

11.2.5 SER_PUTS

Sends a string of characters to the serial port. The string must be ended with the character 0 (NULL).
Hardware ***PEC70,NG35+...,NGM13+....,NG35,NGM13***

ATTENTION: **<u>This function can not be used in a BINARY transmision but only with ASCII transmision</u>.**

<u>Syntax</u>

SER_PUTS (char *str)

Parameters

***str**	Pointer to the string

Example

```
Ser_puts("TEXT MESSAGE")          ' Send the string TEXT MESSAGE
Strcpy(Vect(),"MESSAGE1")         ' Copy the string MESSAGE1 to Vect
Ser_puts(Vect())                  ' Send again the string TEXT MESSAGE
```

11.2.6 SER_PRINTL

Formatting print of an INTEGER value.

Hardware ***PEC70,NG35+...,NGM13+....***

<u>Syntax</u>

SER_PRINT (const char *format, long val)

Parameters

Format	String corresponding to the format to be printed
Val	Any integer value or expression

Avalaible formats

######	Print a fixed number of characters	23456
###.###	Force the print of decimal point	123.456
+####	Force the print of the sign	+1234
#0.##	Force the print of a ZERO	0.12
X####	Print in HEXADECIMAL format	F1A3
B####	Print in BINARY format	1011

Example

var=12345

```
ser_printl("###.##",var) ' It will be printed: "123.45"
```

var=2

```
ser_printl("###.##",var) ' It will be printed: "   . 2"
ser_printl("###.00",var) ' It will be printed: "   .02"
ser_printl("##0.00",var) ' It will be printed: "  0.02"
```

11.2.7 SER_PRINTFF

Formatting print of a FLOAT value. It is the same as ***ser_printf***.

Hardware ***PEC70,NG35+...,NGM13+....***

<u>Syntax</u>

SER_PRINTF (const char *format, float val)

Parameters

Format	String corresponding to the format to be printed
Val	Any integer value or expression

11.2.8 SER_PUTBLK

Sends a precise number of characters to the serial port. Unlike the function ***ser_puts*** it allows to send also the character with 0 code enabling the managing of binary protocols, furthermore it starts the background transmission setting in appropriate mode the RTS signal useful to work with RS485 lines.

Hardware ***PEC70,NG35+...,NGM13+....,NG35,NGM13***

ATTENTION: **<u>This function allows to manage BINARY and RS485 protocols</u>.**

<u>Syntax</u>

SER_PUTBLK (char *Buffer, int Len)

Parameters

***Buffer**	Pointer to the data buffer to send
Len	Number of bytes to send

Example

```
Ser_putblk(Vect(),11)         ‘ Send 11 bytes of array vect
```

11.2.9 SER_PUTST

Reads the state of background transmission started by ***ser_putblk.***

Hardware ***PEC70,NG35+...,NGM13+....,NG35,NGM13***

Syntax

SER_PUTST () as uint

Return value:

-1	***Transmit error***
>=0	***Number of characters to be transmitted***

Example

```
Ser_putblk(Vect(),11)    ' Send 11 bytes
while Ser_putst()        ' Wait for the complete transmission
loop
```

11.3 FUNCTION FOR TOUCH AND KEYBOARD CONTROL

In this chapter the primitive function for the management of data input are described, for both the control of TOUCH SCREEN and KEYBOARD.

11.3.1 KEY INPUT

To control the input of KEYS (TOUCH or KEYBOARD keys), two system variables are made available.
Hardware ***PEC70,NG35+...,NGM13+....,***

Int *_key_stdinp_dn* It contains the code of the pressed key
Int *_key_stdinp_dn* It contains the code of the realised key

Working with TOUCH systems the code is defined by the ***set_key*** function. For systems with KEYBOARD the code corresponds to the physical one of the key (refer to HARDWARE manual).

Example

```
if _key_stdinp_dn = keycode
       .... ' key pressed
endif
if _key_stdinp_up = keycode
       ...' key released
endif
```

11.3.2 SET_KEY

Draws a touch-key at the specified coordinate making it operative to the use. Usually the touch-keys are drawn in VISUAL MODE by IDE environment.
Hardware ***PEC70***

Syntax

```
      SET_KEY (int X0, int Y0, int X1, int Y1, int Cod, int form)
```

Parameters

X0 Any number or expression corresponding to the coordinate X of the upper left angle
Y0 Any number or expression corresponding to the coordinate Y of the upper left angle
X1 Any number or expression corresponding to the coordinate X of the upper right angle
Y1 Any number or expression corresponding to the coordinate Y of the upper right angle
Cod Any number or expression corresponding to code assigned to the key (from 1 to 255)
Form Any number or expression corresponding to the form of the key:
Form = 0 Enable the press effect
Form = 1 Disable the press effect

Example

```
Set_key(10,10,30,30,1,0) ' Draw a key at 10,10,30,30, Code 1
```

11.3.3 CLEAR_KEY

Disables the touch-key with the specified code. It isn't deleted from the screen but remaining displayed .
Hardware ***PEC70***

Syntax

```
      CLEAR_KEY (int Code)
```

Parameters

Code Code of the key to be disabled

11.4 MISCELLANEOUS API FUNCTIONS

11.4.1 GET_TIMER

Reads the system timer in units of TASK PLC (scan time).
Hardware ***All***

Syntax

Long GET_TIMER ()

Return value:
Value of the system timer in sampling units

Some defines are automatically generated by VTB to adapt the application at the scan time:
TAU Scan time of TASK PLC in milliseconds (INTEGER value)

TAUFLOAT Scan time of TASK PLC in milliseconds (FLOAT value)

TAUMICRO Scan time of TASK PLC in 0.1 milliseconds

Example

```
Used variables:
Tick long
Var char
Tick=Get_timer()                      ‘ Get initial value of timer
while Test_timer(Tick,1000/TAU)       ‘ Waiting for 1 second
Loop
```

11.4.2 TEST_TIMER

Compares the system timer with a value. It is used together the function ***get_timer*** to make timing.
Hardware ***All***

Syntax

char TEST_TIMER (long Timer, long Tempo)

Parameters
Timer Initial value of system timer
Tempo Time to compare

Return value:
1= time elapsed
0=time not elapsed

Example

```
Used variables:
Tick long
Var char
Tick=Get_timer()                      ‘ Get initial value of timer
while Test_timer(Tick,1000/TAU)       ‘ Waiting for 1 second
Loop
```

11.4.3 ALLOC

Dynamic allocating of memory area.
Hardware ***PEC70,NG35+...,NG35***

Syntax

ALLOC (Long Mem) as long

Parameters
Mem Total amount of memory to be allacated

Return value:
<>0 Pointer to the allocated memory

0	Allocation error

Example
Pnt As *Char
N as Long

```
Pnt=Alloc(3000)          'Alloc 3000 byte of memory
FOR N=0 to N<3000
      PUNT[N]=N
NEXT N
```

11.4.4 FREE

Frees the a memory area previously allocated with ***alloc***.
Hardware ***PEC70,NG35+...,NG35***

Syntax

```
      Free (Char *Punt)
```

Parameters

Pnt	Pointer to the memory to free

Example
Pnt As *Char

```
Pnt=Alloc(3000)   'Alloc 3000 byte of memory
....
....
Free(pnt)         'Free the memory
```

11.4.5 SYSTEM_RESET

Executes a software RESET on the hardware.
Hardware ***All***

Syntax

```
      SYSTEM_RESET (Char mode)
```

Parameters

mode	**=0**	Executes a normal RESET running the application
	=1	Executes a RESET putting device in BOOT state

11.5 API FUNCTIONS FOR MANAGING OF STRINGS

VTB doesn't use STRING variables, to manage them there are some apposite functions similar to the **“C”** language.

11.5.1 GET_TABSTR

Gets a string from a text table and put it in the system variable ***_SYSTEM_STRING.***

Hardware ***All***

Syntax

GET_TABSTR (Char Table, Char Msg, Char Lng)

Parameters

Table Index of the table

Msg Index of the string inside the table

Lng Index of the language to be used

Example

```
Get_tabstr(0,1,_SYSTEM_LINGUA)      ‘Read the second message (idx 1) from the
                                    ‘first (odx 0) table using the current
                                    ‘language
Draw_str(_system_string())     ‘ Print _system_string
```

11.5.2 STRCPY

Copies the string pointed by SOURCE into the array pointed by DEST. The string must terminate with the character 0 (NULL).

Hardware ***All***

Syntax

STRCPY (Char *Dest, Char *Source)

Parameters

Dest Pointer to destination

Source Pointer to source

Example

```
Used variables:
Dest(10) char
Dest1(10) char
strcpy(Dest(),”prova testo”)  ‘ copy the string “prova testo” in dest
strcpy(Dest1(),Dest())        `copy the string “prova testo” in dest1
```

11.5.3 STRLEN

Returns the length of a string.

Hardware ***All***

Syntax

STRLEN(Char *Str) as int

Parameters

Str Pointer to the string

Return value:

Length of the string.

Example

```
Used variables:
Len int
Len=StrLen(”prova testo”)     ‘ritorna il value 11
```

11.5.4 STRCMP

Comparing of two strings.

Hardware ***All***

Syntax

```
STRCMP(Char *Str1, Char *Str2) as char
```

Parameters

Str1	Pointer to the first string
Str2	Pointer to the second string

Return value:

0	***Equal strings***
<	***String Str1 less than Str2***
>*0*	***String Str1 greater than Str2***

11.5.5 STRCAT

Appends a copy of the source string to the destination string.

Hardware ***All***

Syntax

```
STRCMP(Char *Dest, Char *Source)
```

Parameters

Dest	Pointer to destination
Source	Pointer to source

Example

```
Used variables:
Str(30) Char
Strcpy(Str(),"PROVA ")
StrCat(Str(),"TESTO")   ' str1 will contain "PROVA TESTO"
```

11.5.6 STR_PRINTL

Converts an INTEGER variable to a characters STRING.

Hardware ***All***

Syntax

```
STR_PRINTL(Char *Dest, Char *Format, Long Var)
```

Parameters

Dest	Pointer to the destination string
Format	String corresponding to the format to be printed
Val	Any integer value or expression

Avalaible formats

######	Print a fixed number of characters	23456
###.###	Force the print of decimal point	123.456
+####	Force the print of the sign	+1234
#0.##	Force the print of a ZERO	0.12
X####	Print in HEXADECIMAL format	F1A3
B####	Print in BINARY format	1011

For the example see the function ***print.***

11.5.7 STR_PRINTF

Converts a FLOAT variable to a characters STRING.

Hardware ***All***

Syntax

```
STR_PRINTF(Char *Dest, Char *Format, Float Var)
```

Parameters

Dest	Pointer to the destination string
Format	String corresponding to the format to be printed
Val	Any float value or expression

Avalaible formats

######	Print a fixed number of characters	23456
###.###	Force the print of decimal point	123.456
+####	Force the print of the sign	+1234
#0.##	Force the print of a ZERO	0.12
X####	Print in HEXADECIMAL format	F1A3
B####	Print in BINARY format	1011

For the example see the function ***print***.

11.6 FUNCTIONS FOR AXIS INTERPOLATION

The axis interpolation functions are contained in an OBJECT in the CLASS COBJINTERPOLA. In this chapter are descriped this function with the primitive name. Remember to put the prefix of the OBJECT NAME. If, for example the object is named ***obj*** the function ***moveto*** will must be called as ***obj.moveto.***

11.6.1 PROPERTY

This is the list of the common properties of the OBJECT COBJINTERPOLA.

N.assi Number of axis to be interpolate. It can be changed only at VTB environment.
N.assi Number of elements in the movement buffer. It can be changed only at VTB environment and **must have a value as power of 2 (4, 8, 16, etc.)**. A DEFINE named ***NASSI*** is automatically generated with this value.
.vper Value for the changing of the speed “on-fly”. Together ***Div.vper*** form a ratio: when it is 1 the speed corresponds to the set one.
Div.vper Divisor of ***vper***. It can be changed only at VTB environment.
Abilita arcto Usually it is set to 1, if 0 the circular interpolation functions will be not avalaible. It is used to short the code size. It can be changed only at VTB environment.
.acc Acceleration and deceleration. During the execution of ramps, at each sample (TASK PLC) the speed, as unit/sample is incremented (o decremented) of this value. Default value 10.
.sglr Threshold of the radius error. Default value 10.
.sglp Threshold edge 2D as tenth of degree. It is used by moveto and lineto to calculate the presence of an edge on the working plane. Default value 10.(20 degrees).
.sgl3d(NASSI) Threshold edge 3D. Default value 0.2 (for all axis).
.pc(NASSI) Actual calculated value of the axis position.
.cmd Output of virtual axis managed by ***setcmd***.

11.6.2 MOVETO

Movement with linear interpolation. The interpolation is executed at speed **vel**. The parameter **mode** defines if the axis have to stop in the position or continue with the next movement. To do that there is a apposite BUFFER where movement are latched.

Hardware ***All***

Syntax

```
.MOVETO(Long Vel, Char mode, Long *PntAx) as char
```

Parameters

Vel Velocity of interpolation as unit/sample
mode Flag to control the stop before the next movement
mode=0 never stop
mode=1 always stop at the end of movement
mode=2 stop only on edge 3D (***sgl3d***)
mode=3 stop only on edge 3D (***sglp***)
PntAx Pointer to the array of the axis position as unit

Return value

Char ***0*** Command not written in the buffer (buffer full)
1 Command written in the buffer

Notes

Moveto is usually used to interpolate more than 2 axis. The speed vector is distributed on all axis to be interpolated. When **mode=2** it is calculated the presence of a multidimensional edge according to the values in ***sgl3d.*** When ***mode=2*** the test of edge is made only on the axis of the working plane and according to the value in ***sglp***. If the comand isn't written in the BUFFER, we have to wait and repeat otherwise it will be lost.

Approximative reference values of parameter SGL3D

THRESHOLD in DEGREE	VALUE OF SGL3D (min-max)
5	60-90

10	125-175
20	250-350
30	300-500
45	400-700

Example (object name = OBJ)
Used variables:

```
VectAssi(4) long
Vel long
Test char
'********************************************************************************
'Fast interpolation of several segments on axis X,Y holding Z and A stopped
'********************************************************************************
vel=1000
VectAssi(0)=1000 'X
VectAssi(1)=2000 'Y
VectAssi(2)=OBJ.pc(2) 'Z remain stopped
VectAssi(3)=OBJ.pc(3) 'A remain stopped
muovi()
VectAssi(0)=4000 'X
VectAssi(1)=6000 'Y
VectAssi(2)=OBJ.pc(2) 'Z remain stopped
VectAssi(3)=OBJ.pc(3) 'A remain stopped
muovi()
VectAssi(0)=5000 'X
VectAssi(1)=2000 'Y
VectAssi(2)=OBJ.pc(2) 'Z remain stopped
VectAssi(3)=OBJ.pc(3) 'A remain stopped
muovi()
.
.
‘ *********************************************************
‘Movement function waiting if the buffer is full
‘ *********************************************************
Function muovi() as Void
Dim test as Char
Label Move
test=Obj.moveto(vel,3,VectAssi())
if test=0
      goto Move
endif
EndFunction
```

11.6.3 LINETO

Lineto interpolates the axis distributing the vector speed ONLY ON THE AXIS OF THE CURRENT WORKING PLANE. The other axis will be TRANSPORTED.

The function is useful to manage TANGENTIAL AXIS such as cutting machine, where the blade have to be transported to increasing the fluidity of the movement. The eventual stop of axis is calculated according to the threshold value in ***sglp***. If the resultant edge is less or equal than this threshold axis don't stop in the position but continue filleting the two segments.

Hardware ***All***

Syntax

.LINETO(Long Vel, Long *PntAx) as char

Parameters

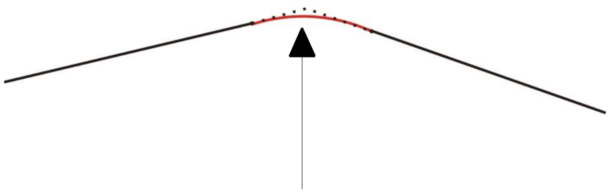
Vel	Velocity of interpolation as unit/sample
PntAx	Pointer to the array of the axis position as unit

Return value

Char	***0***	Command not written in the buffer (buffer full)
	1	Command written in the buffer

Notes

Lineto, unlike Moveto, doesn't distribute the velocity on all enables axis, but only on the working plane making this function not able to tridimensional interpolation.



If the edge is less or equal than SGLP axis don't stop

Example (object name = OBJ)

Used variables:

```
VectAssi(4) long
Vel long
Test char
‘ Fast interpolation with tansported third axis
vel=1000
VectAssi(0)=1000 'X
VectAssi(1)=2000 'Y
VectAssi(2)=100 'Z transported
VectAssi(3)=OBJ.pc(3) 'A remain stopped
muovi()
VectAssi(0)=4000 'X
VectAssi(1)=6000 'Y
VectAssi(2)=200 'Z transported
VectAssi(3)=OBJ.pc(3) 'A remain stopped
muovi()
VectAssi(0)=5000 'X
VectAssi(1)=2000 'Y
VectAssi(2)=300 'Z transported
VectAssi(3)=OBJ.pc(3) 'A remain stopped
muovi()

‘ ************************************************************
‘ Movement function waiting if the buffer is full
‘ ************************************************************
Function muovi() as Void
Dim test as Char
Label Move
```

```
test=Obj.lineto(vel,VectAssi())
if test=0
        goto Move
endif
EndFunction
```

11.6.4 ARCTO

Movement with CIRCULAR interpolation on the axis of the current WORKING PLANE. Two axis execute a CIRCULAR interpolation while the others are interpolated in LINEAR mode. As function LINETO, the property ***sglp*** defines the edge threshold for axis stopping. The direction of rotation is determined by the parameter **mode**.

Hardware ***All***

Syntax

.ARCTO(Long Vel, Char mode, Long *PntAx, Long CX, Long CY) as char

Parameters

Vel	Velocity of interpolation as unit/sample
mode	Direction of rotation
	mode=2 CW interpolation
	mode=3 CCW interpolation
PntAx	Pointer to the array of the axis position as unit
Cx,CY	Coordinate X,Y (axis of the working plane) of the CENTER

Return value

Char	***0***	Command not written in the buffer (buffer full)
	1	Command written in the buffer
	-1	Radius error (dipends by ***sglr***)

Note

Arcto executes a CIRCULAR interpolation ON WORKING PLANE while the other axis are interpolated in LINEAR MODE.

Example (object name = OBJ)

Used variables:

```
VectAssi(4) long
Cx long
Cy long
Vel long
'**********************************************************
'Circular interpolation CW on X,Y Z and A
'to realize the programmed arc the axis X and Y must be
'in precise positions, for Example at 0,2000
‘**********************************************************
vel=1000
VectAssi(4) long
VectAssi(0)=1000  ‘ final position X
VectAssi(1)=2000  ‘ final position Y
VectAssi(2)=5000  ‘ final position Z
VectAssi(3)=1000  ‘ final position A
Cx=500      ‘center X
Cy=500      ‘center Y
muovi()
.
.
Function muovi() as Void
Dim test as Char
Label Move
test=px_arcto(vel,2,VectAssi(),Cx, Cy)
if test = 0
        goto Move
endif
EndFunction
```

11.6.5 SETCMD

This function allows the synchronization of commands with the axis movement. In fact because of BUFFER OF AXIS MOVEMENT the interpolation functions don't wait the execution of the command but write it in the buffer. This implies the impossibility to command, for example, the digital output in a precise point of the path if axis don't stop in each position. This function enables the writing of a command value in the buffer when a interpolation function is called (***moveto, lineto, arcto***), it will be written in ***cmd*** at the instant the movement starts.

Hardware ***All***

Syntax

```
.SETCMD(Long CMD)
```

Parameters

CMD Value of the command

Example

```
muovi()
OBJ.setcmd(10)
muovi()
OBJ.setcmd (20)
```

Nel TASK PLC

```
if OBJ.CMD=10
        …
endif
if OBJ.CMD=20
        …
endif
```

11.6.6 SETPIANO

Selects the current working plane on desired axis. By default the plane is set on the first two axis X, Y (ax1=0, ax2=1). Ax1 can not be equal to ax2.

Hardware ***All***

Syntax

```
.SETPIANO(Char Ax1, Char Ax2)
```

Parameters

Ax1 Index of the first axis of the plane

Ax2 Index of the second axis of the plane

Note

The WORKING PLANE selects the axis for the CIRCULAR interpolation, for calculation of the edge 2D (***sglp***) and for calculation of the SPEED VECTOR in the function LINETO.

Example

```
Obj.setpiano(0,1) 'select the plane on axis X and Y
Obj.setpiano(1,2) 'select the plane on axis Y and Z
```

11.6.7 STOP

Stops axis with the programmed deceleration (***acc***) waiting for the complete execution (axis stopped). STOP is used to stop the axis before the TARGET point, programmed with MOVETO, LINETO or ARCTO, is reached. **The movement buffer will be emptied**.

Hardware ***All***

Syntax

```
.STOP()
```

Notes
STOP, unlike FSTOP, waits the axis are stopped, for this **IT MUST NOT BE CALLED IN TASK PLC.**

11.6.8 FSTOP

Stops axis with the programmed deceleration (***acc***) without waiting for the complete execution (axis stopped).
FSTOP is used to stop the axis before the TARGET point, programmed with MOVETO, LINETO or ARCTO, is reached. **The movement buffer will be emptied**.

Hardware ***All***

Syntax

```
FSTOP()
```

Note
FSTOP, unlike STOP, doesn't wait the axis are stopped, for this **IT CAN BE CALLED IN TASK PLC.**

11.6.9 MOVE

Riturns the state of the interpolation.
Hardware ***All***

Syntax

```
.MOVE() as char
```

Return value

char	**0**	No interpolation is running
	1	Interpolation is running

Note
MOVE retunrs 0 only the axis are stopped and the movement buffer is empty.
ATTENZIONE: MOVE tests only the DEMAND POSITION of AXIS.

Example

```
Muovi()             'start interpolation
while Obj.move()    'wait for complete execution
endif
```

11.6.10 PRESET

Presets the AXIS position without move them. Axis will assume the position as passed by parameters.
Hardware ***All***

Syntax

```
.PRESET(long *Pos)
```

Parameters

Pos Pointer to the array of the position value to preset

Note
Keep in mind these rules:

- **AXIS MUST BE STOPPED**
- **CHANGING INSTANTLY THE POSITION IT OCCURS A PARTICULAR SEQUENCE TO AVOID THE PHISICAL AXIS MOVES ROUGHLY**

For example WHEN USING THE CANOPEN AXIS IT NEEDS:

- **REMOVING THE CANOPEN FROM THE INTERPOLATION MODE**
- **PRESETTING THE CANOPEN AXIS BY METHOD .HOME**
- **PRESETTIN THE INTERPOLATOR WITH FUNCTION PRESET(pos())**
- **SETTING AGAIN THE CANOPEN AXIS IN INTERPOLATION MODE**

Example with the axis X as CanOpen

Used variables:
Quote(3) as long

```
ASSECAN.start=0          ' remove the start condition
ASSECAN.modo=0           ' set the position mode (remove from interpolation mode)
ASSECAN.home=1000        ' preset of axis at 1000
Quote(0)=1000            ' set the preset value in the position array for X
Quote(1)=OBJ.pc(1)       ' value to not modify the Y position
Quote(2)=OBJ.pc(2)       ' value to not modify the Z position
OBJ.PRESET(Quote())      ' preset of the interpolator
ASSECAN.modo=2           ' set the Interpolation Mode
ASSECAN.start=1          ' start
```

In similar way the same problem can occur using the STEP/DIR axis. **Refer to the chapter of STEP/DIR channels for a correct preset of them**.

11.7 CANOPEN FUNCTIONS

This group of functions allow the management of CANOPEN line at application level. A lot of library OBJECTS use these functions to make it more simple but in some cases it is necessary using the primitive functions directly.

11.7.1 PXCO_SDODL

This function allows to send data to a node of the canopen net using the protocol SDO. It is supported only the SDO EXPEDITED mode allowing to send up to 4byte of data length.

Hardware ***All***

Syntax

PXCO_SDODL(char node, unsigned index,unsigned char subidx,long len,char *data) as char

Parameters

Node	Node ID of the SLAVE to whch send data
Index, subindex	Address in the Object-Dictionary of the data to be written
Len	Number of bytes to send
***data**	Pointer to the data to send

Return value

char	**0**	No error
	<>0	Communication error
	=2	The node responded with a SDO ABORT CODE, calling the function ***read_sdoac*** in the system variables _SYSTEM_SDOAC0 e _SYSTEM_SDOAC0 will be available the relative error code.

ATTENTION: Cause the different allocation of bytes inside variables be careful to set the length corresponding to the variable type passed by pointer.

Example

Used variables:

```
value int
Ret char
value=100
Ret=pxco_sdodl(1,2000,0,2,value())  'node=1, index=2000, subidx=0,
                                    'len=2 byte, value=100
if Ret<>0                   'test if error occurs
      if Ret=2
            read_sdoac()'read eventual SDO ABORT CODE
            ...
      endif
      ...
endif
```

11.7.2 PXCO_SDOUL

This function allows to read data from a node of the canopen net using the protocol SDO. It is supported only the SDO EXPEDITED mode allowing to read up to 4byte of data length.

Hardware ***All***

Syntax

PXCO_SDOUL(char node, unsigned index,unsigned char subidx,char *dati) as char

Parameters

Node	Node ID of the SLAVE to whch send data
Index, subindex	Address in the Object-Dictionary of the data to be written
***data**	Pointer to the data to send

Return value

char	**0**	No error
	<>0	Communication error
	=2	The node responded with a SDO ABORT CODE, calling the function ***read_sdoac*** int the system variables _SYSTEM_SDOAC0 e _SYSTEM_SDOAC0 will be available the relative error code.

ATTENTION: Cause the different allocation of bytes inside variables be careful to use the variable passed by pointer of the type corresponding to the length of the data to be read.

Example

Used variables:

```
value int
Ret char
Ret=pxco_sdoul(1,2000,0,value())    'node=1, index=2000, subidx=0,
                                    'value=data read
if Ret<>0                'test if error occurs
      if Ret=2
            read_sdoac()'read eventual SDO ABORT CODE
            ...
      endif
      ...
endif
```

11.7.3 READ_SDOAC

Reading of the SDO ABORT CODE sended by a node in the canopen net as answer to a request done with the function PXCO_SDODL or PXCO_SDOUL. The read code will be written in the system variables _SYSTEM_SDOAC0 e _SYSTEM_SDOAC1.

Refer to the DS301 specific of the CAN OPEN for the code error values.

Hardware ***All***

Syntax

READ_SDOAC()

11.7.4 PXCO_SEND

Sending of a CAN frame at low level. This function allows to send in the net a CAN frame with a desired COB-ID and DATS. For example it's possible to send manually PDO frames, HEART-BEAT frames, etc. Should be specified the manage of PDO is managed AUTOMATICALLY by the CANOPEN CONFIGURATOR.

Hardware ***All***

Syntax

PXCO_SEND(int id, char Len,char Dati) as char

Parameters

Id	COB-ID value
Len	Number of data to send
***Dati**	Pointer to the data buffer

Return value

char	**0**	No error
	<>0	Communication error

Example

Used variables:

```
value int
Ret char
value=100
Ret=pxco_send(0x201,2,value)  'Send a PDO (cob-id=0x201) with 2 byte
if Ret<>0   'test if error occurs
            ...
endif
```

11.7.5 PXCO_NMT

Sending of a NMT frame of the CAN OPEN. NMT protocol allows to set the state of the nodes in the net. Remind that all the nodes correctly configured (canopen configurator) are automatically set in START state.

Hardware ***All***

Syntax

PXCO_NMT(char state, char node) as char

Parameters

state	State to set: 1 = START NODE 2 = STOP NODE 128 = PRE-OPERATIONAL 129 = RESET NODE 130 = RESET COMUNICATION
node	Number of the node

Return value

char	**0**	No error
	<>0	Communication error

Example

Used variables:

```
pxco_nmt(2,1)      'Set in STOP the node 1
```

11.7.6 READ_EMCY

Reads the last EMERGENCY OBJECT frame sended by a CAN OPEN node.

The emergency code is written in the system array _SYSTEM_EMCY(8) and it will contain all the 8 bytes of the EMERGENCY OBJECT frame as from the DS301 specific of the CAN OPEN. Usually it is called cyclically. The emergency code depends by type of connected device, therefore refer to its manual.

Hardware ***All***

Syntax

READ_EMCY() as char

Return value

char	**0**	No error
	<>0	Node that generated the emergency object.

_SYSTEM_EMCY							
0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Emergency Error Code		Error Register	Manufacturer specific Error Code				

ATTENZIONE

The system doesn't buffer more than one message, then <u>if more EMERGENCY OBJECT are sended along a single task plc, only the last will be read</u>.

An EMERGENCY OBJECT non significa che effettivamente ci sia un nodo in emergenza. The DS301 specific provide that an EMERGENCY OBJECT are send also on alarm reset. Furthermore some devices can be send this frame at start up.

Example

Used variables:

```
Err Long
NodeErr Char
```

```
function Alarm() as void
      NodeErr=read_emcy()
      if NodeErr=0                    ' no error
            return
      endif
      err=(_SYSTEM_EMCY(7)&0xff)      ' Read 4 byte of Manufactured specific
      err=err<<8                      ' field masking eventual bit not
      err=err|(_SYSTEM_EMCY(6)&0xff)' interested
      err=err<<8
      err=err|(_SYSTEM_EMCY(5)&0xff)
      err=err<<8
      err=err|(_SYSTEM_EMCY(4)&0xff)
endfunction
```

11.8 DATA SAVING FUNCTIONS

All hardware are equipped with several type of memory usable for DATA SAVING. According to the type of memory (Fash, Fram, etc.) some rules are to be implemented.
For example a FLASH memory has a ***maximum number of writing, block erase, etc.***

11.8.1 IMS_WRITE

Writes in the internal FLASH at the address contained in ADDR, the data pointed by PNT for a total of NBYTE of data.
The FLASH memory is managed in BLOCKS of 256 bytes, for this it's recommended to write multiple of 256 bytes. That because also writing less than 256 bytes the entire BLOCK is erased, therefore to avoid the loss of data it needs at beginning to read all the block, save the interested data and overwrite again all the block.
The systems NG35 or PEC70 have enough FLASH memory to be used without problems in blocks of 256 bytes also there is the need of less data.
Using the NGM13, this function works on a FRAM memory which can be managed at single BYTE.
Hardware ***All***

Syntax

IMS_WRITE(char *Pnt, long Addr, long Nbyte) as char

Parameters

Pnt	Pointer to data buffer to be written
Addr	Start address in the reserved area of the device
Nbyte	Number of bytes to be written

Return value:

Char	**0**	No error
	<>0	Writing error

Example
Used variables:

```
Vett(10) long
Ims_Write(Vett(),0,40) ' write 40 bytes (10 long * 4) to ADDR 0
```

ATTENTION: In this case the entire block of 256 byte is written if we are working with FLASH (NG35, PEC70).

11.8.2 IMS_READ

Reads from the internal memory at address ADDR a number of byte as in NBYTE and writes them in the array pointed by PNT.
Hardware ***All***

Syntax

IMS_READ(char *Punt, long Addr, long Nbyte) as char

Parameters

Pnt	Pointer to data buffer where read data will be saved
Addr	Start address in the reserved area of the device
Nbyte	Number of bytes to be read

Return value:

Char	**0**	No error
	<>0	Writing error

Example

```
Used variables:
Vett(10) long
Ims_Read(Vett(),0,40) ' read 40 bytes (10 Long) from Addr 0
```

11.9 ETHERNET FUNCTIONS

Systems equipped with ETHERNET manage AUTOMATICALLY the STACK TCP/IP. To work with protocols at upper level than TCP/IP it must be written some source code in the application. For example to process the MODBUS-TCP protocol there is a specific object in library which uses the functions of this group. In the same way it's possible to create customized protocols.

11.9.1 SET_IP

Sets the parameters of TCP/IP protocol.
Hardware ***PEC70,NG35+....,NG35***

Syntax

SET_IP(ip as *char, sm as *char, gw as *char)

Parameters

ip IP address of the device
sm subnet mask
gw gateway

Example

```
Set_ip("10,0,0,15","255,255,255,0",0)      'IP = 10,0,0,15
                                           'SUBNET = 255,255,255,0
                                           'GATEWAY = nothing
```

ATTENTION: This function must be called in the INIT section of the MAIN or PLC TASK.

11.9.2 PXETH_ADD_PROT

Adds a custom protocol to a specific port of TCP/IP. A custom function to process the new protocol must be written and its pointer must be pass to this function.
Hardware ***PEC70,NG35+....,NG35***

Syntax

PXETH_ADD_PROT(port as long, fun as delegate)

Parameters

port TCP port on which the new protocol is added
fun Pointer to the custom process function

Example

```
Used variables:
fun delegate

Init section of main:
Set_ip("10,0,0,15",0,0) 'set IP = 10,0,0,15
fun=my_protocol
pxeth_add_prot(502,fun) 'Add the protocol my_protocol on port 502

'protocol process function
function my_protocol(len as long, buftx as *char) as long
...
endfunction
```

11.9.3 PROTOCOL PROCESS FUNCTION

This function isn't defined by system but it must be written in the application. The system will call this function, by the pointer passed with ***pxeth_add_prot,*** each time a data packet is received from the port associated to this protocol. To read the received data the function **pxeth_rx** have to be call while to send the response data they must be written in the transmit buffer (buftx) and return from the function the number of bytes we want to send.
Hardware ***PEC70,NG35+....,NG35***

Syntax

PROCESS_MY_PROTOCOL(len as long, buftx as *char) as long

Parameters

len Length of data packet received
buftx Pointer to the transmit buffer

Return value

long Number of bytes to be send

Example

```
Used variables:
bufrx(100) char

'protocol process function
function my_protocol(len as long, buftx as *char) as long
dim i as int

for i=0 to i<len          'Read all received data
      bufrx(i)=pxeth_rx()
next i
...                       'Process the data
buftx(0)=12
buftx(1)=34
my_protocol=2             '2 will be sent as response
endfunction
```

11.9.4 PXETH_RX

Read a single byte from the TCP/IP receive buffer. It is called by the protocol process function to read the received data.

Hardware ***PEC70,NG35+....,NG35***

Syntax

PXETH_RX() as char

Return value

Char Data read from the receive buffer

11.10 DISK DRIVER FUNCTIONS

Some devices, such as NG35 and PEC70, can manage files by the standard fyle system FAT16 (or FAT32) on optional memory as FLASH DISK or USB KEY. The library functions are contained in the object FATLIB which will be loaded before using. In this chapter are described all the GENERIC function of the object. Remember to put the prefix of the OBJECT NAME. If, for example the object is named ***disk*** the function ***OpenRead*** will must be called as ***disk.OpenRead.***

Hardware ***NG35,PEC70***

11.10.1 PROPERTY

Numero files Maximum number of opened files. The HANDLE of the files will must be a number from 0 to this value minus one. It can be changed only at VTB environment.

FAT Monitor Enables the command monitor on the second serial port. It can be changed only at VTB environment.

11.10.2 DRIVER

The system can manage mor drivers if they are equipped on hardware. The reference in the path is in the standard mode (A:, B:, etc.) but for some functions it needs to pass the index of the driver. According to used hardware these are the reference of the driver:

	A:	**B:**
NG35	Optional internal disk	Not present
PEC70	Optional internal disk	USB Key

11.10.3 ERROR CODE

All function of this object, except **TestDrv**, **RTC.Read** and **RTC.Write**, return a value representing the error code.

Return value

Char	**0**	OK No error
	1	DISK ERROR
	2	INTERNAL ERROR
	3	NOT READY
	4	NO FILE
	5	NO PATH
	6	INVALID NAME
	7	ACCESS DENIED
	8	FILE/DIR EXIST
	9	INVALID OBJECT
	10	WRITE PROTECTED
	11	INVALID DRIVE
	12	NOT ENABLED
	13	NO FILESYSTEM
	14	FORMAT ERROR
	15	TIMEOUT
	100	HANDLE OVERFLOW

11.10.4 OPENREAD, OPENWRITE, OPENCREATE

These function open a file assigning an HANDLE to use as reference for the next functions.

Syntax

.OpenRead(handle as int, path as *char) as char
Opens a file in read mode and return error if it doesn't exist.

.OpenWrite(handle as int, path as *char) as char
Opens a file in write mode and return error if it doesn't exist.

.OpenCreate(handle as int, path as *char) as char

Creates a new file opening it in write mode, if it already exists it is overwritten.

Parameters

handle	Number to assign to file for any reference
path	Name of the file, it can contain also the complete path

Example

```
Used variables:
err char

err=disk.OpenRead(1,"\data\table.dat")  ' open table.dat in the directory data
if err
      ...
endif
```

11.10.5 CLOSE

Closes the file with the selected HANDLE freeing it to successive use.

Syntax

.Close(handle as int) as char

Parameters

handle	Reference number of the file

Example

```
Used variables:
err char

err=disk.OpenRead(1,"\data\table.dat")  ' open table.dat in the directory data
if err
      ...
endif
      ...
disk.Close(1)  ' close the file
```

11.10.6 READ

Reads data from the file with the selected HANDLE. LEN bytes will be read but if the end of file will be found before reading will be stopped. In NB will be written the effective number of bytes read.

Syntax

.Read(handle as int, dati as *char, len as long, nb as *long) as char

Parameters

handle	Reference number of the file
dati	Pointer to buffer in which data will be written
len	Number of bytes to read
nb	Pointer to the variable in which the effective number of bytes read will be written

Example

```
Used variables:
err char
dati(100) char
nbyte long

err=disk.OpenRead(1,"\data\table.dat")  ' open table.dat in the directory data
if err
      ...
endif
while 1
      err=disk.Read(1,dati(),10,nbyte())  'read blocks of 10 bytes ...
```

```
        if err
                ...
        endif
        if nbyte<10                         ' .. to the end of file
                exitwhile
        endif
loop
disk.Close(1)  ' close the file
```

11.10.7 WRITE

Writes LEN bytes in the file with the HANDLE reference.

Syntax

.Write(handle as int, dati as *char, len as long, nb as *long) as char

Parameters

handle Reference number of the file
dati Pointer to data buffer to be written in the file
len Number of bytes to be written
nb Pointer to the variable in which the effective number of bytes written will be saved

Example

```
Used variables:
err char
dati(100) char
nbyte long

err=disk.OpenCreate(1,"\data\table.dat")  'create table.dat in the directory data
if err
        ...
endif
        ...                             'prepare data to be written
err=disk.Write(1,dati(),50,nbyte())'write 50 bytes
if err
        ...
endif
disk.Close(1)  ' close the file
```

11.10.8 SEEK, SEEKEOF, SEEKREL

Sets the current pointer in the file.

Syntax

.Seek(handle as int, offset as long) as char
Sets the offset from the beginning of the file.

.SeekEof(handle as int, offset as long) as char
Sets the offset from the end of the file.

.SeekRel(handle as int, offs as long) as char
Sets the offset from the current position of the file.

Parameters

handle Reference number of the file
offset Value of the offset in number of bytes

Example

```
err=disk.OpenRead(1,"\data\table.dat")  ' open the file
...
err=disk.Seek(1,200)     ' set current position at 200 bytes
```

11.10.9 CHDIR

Changing of current directory. All successive functions without a complete path will refer to the current one.

Syntax

.Chdir(path as *char) as char

Parameters

path Name of the directory, it can contain also the complete path

Example

```
err=disk.Chdir("programs")
err=disk.OpenCreate(1,"file.txt")   ' create the file file.txt in the directory
                                    ' programs
```

11.10.10 MKDIR

Creates a new directory and returns error if it already exists.

Syntax

.Mkdir(path as *char) as char

Parameters

path Name of the directory, it can contain also the complete path

Example

```
err=disk.Mkdir("\test\text")  ' create the directory text in \test
```

11.10.11 DELETE, ERASE, KILL

Delete a file or a directory. The same function can be called with three different names.

Syntax

.Delete(path as *char) as char
.Erase(path as *char) as char
.Kill(path as *char) as char

Parameters

path Name of the directory, it can contain also the complete path

Example

```
err=disk.kill("\test\text")   ' delete the directory/file text in \test
```

11.10.12 RENAME

Renames a file or a directory. It returns error if the new name already exists.

Syntax

.Rename(oldpath as *char, newpath as *char) as char

Parameters

oldpath Name of file/directory to be renamed
newpath Name of the new file/directory to be renamed

Example

```
err=disk.Rename("text.txt","data.dat")    ' rename the file text.txt with
                                          ' data.dat in the current directory
```

11.10.13 COPY

Duplicates a file. If a file with the destination name exists this is overwritten.

Syntax

.Copy(srcpath as *char, dstpath as *char) as char

Parameters

srcpath Name of the file to be duplicated, it can contain also the complete path
dstpath Name of the duplicated file, it can contain also the complete path

ATTENTION: The destination path must contain the name of the file. It can not refer only to the directory.

Example

```
err=disk.Copy(″text.txt″,″B:data.dat″)    ' copy the file text.txt in driver B:
...
err=disk.Copy(″text.txt″,″\test\data.dat″)      ' copy the file text.txt in the
...                                             ' directory test
```

11.10.14 OPENDIR

Apre una cartella. E' il punto di partenza per una ricerca dei file presenti nel disco. Usata insieme a ***ReadDir***.

Syntax

.OpenDir(path as *char) as char

Parameters

path Nome della cartella. Se la stringa è vuota viene presa la cartella corrente.

11.10.15 READDIR

Reads the informations of the first file/directory found in the FAT. The informations are saved in the structure ***ObjectName_finfo***.

Syntax

.ReadDir() as char

Structure ObjectName_finfo

.size	File dimension	
.date	File date	bit 0-4 day (1-31) bit 5-8 month (1-12) bit 9-15 year (0-99)
.time	File time	bit 5-10 minutes (0-59) bit 11-15 hour (0-23)
.attrib	Attribute	bit 0 read-only bit 1 hidden bit 2 system bit 3 volume bit 4 directory bit 5 arch.
.name(13)	Short name ex. “nomefile.ext”	
.lname	Pointer to long name (max 255 characters)	

Example

```
' Function to print on the serial port of the file list in the current
' directory
function list_dir() as void
dim res as char
dim pname as *char
dim flbyte as long

res=disk.OpenDir("″)
if res
      ser_puts("No file")
      ser_putchar(10)
      ser_putchar(13)
```

```
        return
endif
while 1
        res = disk.ReadDir()
        if res || disk_finfo.name(0)=0
                return
        endif
        ser_printl("00",disk_finfo.date & 31)
        ser_printl("/00",(disk_finfo.date >> 5) & 15)
        ser_printl("/####",(disk_finfo.date >> 9) + 1980)
        ser_printl(" 00",disk_finfo.time >> 11)
        ser_printl(":00",(disk_finfo.time >> 5) & 63)
        if disk_finfo.attrib & ?p1?.ATTR_DIR
                ser_puts("  <DIR>  ")
        else
                ser_printl(" ######### bytes ",disk_finfo.size)
        endif
        ser_puts(" - ")
        ser_puts(disk_finfo.name())
        ser_puts(" - ")
        ser_puts(disk_finfo.lname)
        ser_putchar(10)
        ser_putchar(13)
loop
endfunction
```

11.10.16 GETFREE

Reads the property of a driver: total dimension and number of free bytes. The informations are written in the structure ***ObjectName_dinfo***

Syntax

.GetFree(drv as char) as char

Parameters

drv Index of the driver:
0 = A:
1 = B:

Structure ObjectName_dinfo

.btot	Disk dimension in bytes
.bfree	Number of available bytes

Example

```
err=disk.GetFree(0)
ser_puts("bytes free: ")
ser_printl("#.###.###.### ",disk_dinfo.bfree)
ser_puts("su ")
ser_printl("#.###.###.### ",disk_dinfo.btot)
```

11.10.17 CHDRV

Sets the current driver. All successive functions without the name of driver in the path will refer to the current one.

Syntax

.ChDrv(drv as char) as char

Parameters

drv Index of the driver:
0 = A:
1 = B:

Example

```
err=disk.ChDrv("B:")
err=disk.OpenCreate(1,"file.txt")   ' create file.txt in driver B:
```

11.10.18 TESTDRV

Tests the presence of a driver. This is the only function wich **doesn't return the code error as the others**.

Syntax

.TestDrv(drv as char) as char

Parameters

drv	Index of the driver: 0 = A: 1 = B:

Return value

Char	**0**	No driver found
	1	Driver found

ATTENTION: This function tests only the presence of the disk but not the presence of a FAT.

11.10.19 REAL TIME CLOCK (RTC)

When files are created in the relative fields of the FAT the actual date and time are written. For this in the same object there are the reading and writing functions of the real time clock. All the information pass in a defined structure names **RTC**.

Syntax

RTC.Read() as void
Read the Real Time Clock

RTC.Write() as void
Write in the Real Time Clock

Structure RTC

RTC.year	Year (0-99)
RTC.month	Month (1-12)
RTC.day	Day (1-31)
RTC.dweek	Day of week (0-6)
RTC.hour	Hour (0-23)
RTC.min	Minute (0-59)
RTC.sec	Second (0-59)

11.11 INTERFACE FUNCTIONS FOR NG35

This group of functions allows the interfacing to the hardware resource of NG35 systems.
Hardware ***NG35***

11.11.1 NG_DI - DIGITAL INPUTS

This function allows to read the digital input of the expansion cards of NG35: **NG-IO** and **NG-PP**.
The expansion cards are identified with a progressive number starting from 0. The first card near the NG35 has the index 0.

Syntax

Uint NG_DI(Char Card)

Parameters
Card Index of the expansion card (from 0 to 7)

Return value:
Uint Value of 16 BITS of the input, if Bit is 1 the input is ACTIVE

Input	**16**	**15**	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**
Bit	**15**	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**

Example
Used variables:
input UINT

input = ng_di(0) ***' read the digital inputs from the first card***
input = ng_di(2) ***' read the digital inputs from the second card***

11.11.2 NG_DO – DIGITAL OUTPUTS

This function allows to updates the digital output of the expansion cards of NG35: **NGIO** and **NGPP**.
The expansion cards are identified with a progressive number starting from 0. The first card near the NG35 has the index 0.

Syntax

NG_DO(Char Card, Uint Out)

Parameters
Card Index of the expansion card (from 0 to 7)
Out State of the outputs, if Bit is 1 the output is ACTIVE

Output		**14**	**13**	**12**	**11**	**10**	**9**		**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**
Bit	**15**	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**

Example
ng_Do(0,0x7) ***' Activate the outputs 1, 2 and 3 of the Card 0***
ng_Do(1,0x31) ***' Activate the outputs 1, 9 and 10 of the Card 1***

ATTENTION: **Bits 8 and 15 aren't used**.

11.11.3 NOTES FOR PROGRAMMING WITH DIGITAL I/O

To obtain an application program more clear and stable we suggest to call the I/O function only from TASK PLC. Therefore, in this task, read the inputs writing them in a GLOBAL variable (ex. Input) and write the outputs reading them from another GLOBAL variable (ex. Output). On these variables can be defined the single bits associated to the digital channels and then using them at occurrence.

Example
Used variables:

```
Input1 UINT
Input2 UINT
Output1 UINT
Output2 UINT
StartButton BIT Input1.3
StopButton BIT Input1.6
WaterPump BIT Output2.12
```

In TASK PLC:

```
Input1=Ng_Di(0)
Input2=Ng_Di(1)
Ng_Do(0,Out1)
Ng_Do(1,Out2)
```

EVERYWHERE:

```
if  StartButton
        WaterPump=1
endif
if  StopButton
        WaterPump=0
endif
```

11.11.4 NG_ADC – ANALOG INPUTS

The NG35 is equipped with 8 analog input channels at 10 Bit, these can be read by the function ***ng_adc***.

Syntax

Uint NG_ADC(Char Chan)

Parameters

Chan Number of the channel (from 0 to 7)

Return value:

Returns the analog value (from 0 to 1023).

11.11.5 NG_DAC – ANALOG OUTPUTS

This function allows to update the analog outputs of each channel equipped in the NG35 expansions **NG-IO** and **NG-PP** (as option).

These expansions have a digital to analog converter at 12 bit, with a range of +/-10V. Therefore a value of +2047 corresponds to 10V in output, a value of -2047 corresponds to -10V.

The selection of the channel is made by an index from 0 to 7, each expansion manages two channels:

Channel Index	Expansion
0	Card 0 (nearest NG35)
1	
2	Card 1
3	
4	Card 2
5	
6	Card 3
7	

Syntax

NG_DAC(Char Chan, Long Val)

Parameters

Chan Number of channel (from 0 to 7)

val Value of the output

Example

Used variables:

```
val LONG
channel CHAR

channel = 0
val = 1024
ng_Dac(channel, val)  ' write 1024 (~5V) to analog channel 0
ng_Dac(1,512)         ‘ write 512 (~2,5V ) to analog channel 1
```

11.11.6 NG_DAC_CAL – CALIBRATION OF THE ANALOG OUTPUT OFFSET

This function allows to calibrate the OFFSET of the analog outputs. Usually it can be occur that the analog output has a little value of voltage (OFFSET) in the order of mV also if zero has been set. With ***ng_dac_cal*** we can null this voltage setting a value opposite to the offset one. Remind that for each unit the output value will be about 4mV.

Syntax

```
        NG_DAC_CAL(Char Ch,Long Offset)
```

Parameters

Chan Number of channel (from 0 to 7)

Offset OFFSET value

ATTENTION: THE OFFSET VALUE ISN'T SAVED AND IT MUST BE SET AT EACH TURN-ON.

11.11.7 NG_ENC - ENCODER INPUTS

This function allows to read the quadrature encoder input of each channel equipped on the expansion card **NG-IO.** The resolution is 32 bits. This function read only the increment which will be added to a variable passed by its pointer. Therefore the real encoder counter will be contained in a variable defined in the application and it will can be zeroed in any time. For a correct processing of the encoders we recommend to use this function only in TASK PLC and then use it at the occurrence.

The selection of the channel is made by an index from 0 to 15, each expansion manages two channels:

Channel Index	Expansion
0	**Card 0 (nearest NG35)**
1	
2	**Card 1**
3	
...	**...**
...	
14	**Card 7**
15	

Syntax

```
        NG_ENC(Char Chan, Long *Quota)
```

Parameters

Chan Number of channel (from 0 to 15)

val Pointer to a long variable where will be contained the counter

Example

Used variables:

```
posx LONG             ' Counter encoder channel 0
posy LONG             ' Counter encoder channel 1
```

In TASK PLC:

```
ng_enc(0,posx)
ng_enc(1,posy)
```

EVERYWHERE:

```
if  posx>25000          ' Read encoder channel 0
        . . .
        posx=0          ' Reset counter channel 0
endif
if  posy>200000         ' Read encoder channel 1
        . . .
        posy=1000       ' Preset counter channel 1
endif
```

11.11.8 NG_T0 – ZERO INDEX OF ENCODER

This function allows to read the state of the zero index input of each encoder channel equipped in the expansion card **NG-IO**. The channel selection is made as for the reading of encoders.

Syntax

```
        NG_T0(Char Chan) as char
```

Parameters

Chan Number of channel (from 0 to 15)

Return value:

State of the index input:

0 OFF

1 ON

ATTENTION: THE INDEX INPUT IS DIFFERENZIAL, THE ON STATE ON OCCURS WHEN ON CH+ THERE IS A VOLTAGE GREATER THAN THE VOLTAGE ON CH- .

Example

```
if ng_t0(0)
        . . .
endif
```

11.11.9 NG_RELE

This function allows to update the two RELAIS equipped in each expansion card **NG-IO**.
Usually these RELAIS are connected to the input ENABLE of the SERVO DRIVER but they can be managed for any applications. The channel selection is made as for the reading of encoders.

Syntax

NG_RELE(Char Chan, char State)

Parameters

Chan Number of channel (from 0 to 15)
Stato State of the relay:
0 OFF (contact opened)
1 ON (contact closed)

Example

Used variables:
channel UINT
stato UINT

```
channel = 1
stato = 1
ng_rele(channel,stato)          'active the relay of  the second channel
channel = 2
stato = 0
ng_rele(channel,stato)          ‘disactive the relay of the third channel
ng_rele(0,1)                    ‘active the relay of  the first channel
```

11.11.10 TEMPERATURE READING ON NG35

The **NG35** is equipped with a TEMPERATURE SENSOR which can be useful to monitor the internal temperature. The sensor is connected to the **Nr. 9** internal ANALOG CHANNEL and it can be read with the system function **ng_adc** as for the other analog inputs. To convert the value in degrees Celsius we have to do a calculation (see example).

Example

```
Function Read_Temp() as Long
Dim Degrees as Long

Degrees=NG_ADC(8)               ' Read the temperature sensor
Degree= Degrees*3300/1024-600 ' Convert the value in 0.1 degrees
Read_Temp= Degrees
EndFunction
```

11.12 INTERFACE FUNCTIONS FOR NGM13

This group of functions allows the interfacing to the hardware resource of NGM13 systems. When this target is selected the OBJECT **NGM13_INIT** is automatically loaded. It defines the hardware configuration of the device.

Hardware ***NGM13***

11.12.1 NGM13_INIT PROPERTY

The object provides a complete vision of all the software option to be set for the correct use of **NGM13**.
In detali it allows to set:

- Enabling of the communication protocol RPC (PROMAX proprietary), with relative baudrate
- Which and how many analog inputs are configured
- The step/dir axis to be used and which are in interpolation mode
- Number of expansion cards

Obviously, for each single project there will be only an object NGM init.

Property

Link RPC port Serial port RS232 on which enable the RPC protocol to manage an HOST PC connection. These are the available options:
0 No RPC Link
1 RPC on serial port SER1/PROG (the DEBUG facilities will be disable and the application download must be done by manual keys BOOT/RESET of the NGM13.
2 RPC on serial port SER2

Link RPC baud Baud rate to be used for RPC communication

ADC enable mask Enabling mask of analog inputs. It is processed at bit.
Bit 0 Enables analog input 1 (digital input 9 is disabled)
Bit 1 Enables analog input 2 (digital input 10 is disabled)
. . .
Bit 7 Enables analog input 8 (digital input 16 is disabled)

P-P enable mask Enabling mask of step/dir channels. It is processed at bit.
Bit 0 Enables channel 0
Bit 1 Enables channel 1 (digital outputs 9 and 12 are disabled)
Bit 2 Enables channel 2 (digital outputs 10 and 13 are disabled)
Bit 3 Enables channel 3 (digital outputs 11 and 14 are disabled)

P-P Interp. Mask Enabling mask of step/dir channel in interpolation mode. It is processed at bit.
Bit 0 Channel 0 in interpolation mode
Bit 1 Channel 1 in interpolation mode
Bit 2 Channel 2 in interpolation mode
Bit 3 Channel 3 in interpolation mode

Num. NGM-IO Number of expansion cards NGM-IO or NGM-PS. Remember that 16 inputs and 14 output are available with the NGM13 without any expansion. It must not be considered.

L-Sync enable mask Enabling mask of L-SYNC channels
Bit 0 Enables channel 0 (digital output 1 is disabled)
Bit 1 Enables channel 1 (digital output 2 is disabled)
Bit 2 Enables channel 2 (digital output 3 is disabled)
Bit 3 Enables channel 3 (digital output 4 is disabled)

L-Sync Prescaler Prescaler Value of L-SYNC channels

11.12.2 NG_DI - DIGITAL INPUTS

This function allows to read the digital input of the **NGM13** and its expansion cards: **NGM-IO** and **NGM-PS**.
The expansion cards are identified with a progressive number starting from 0. The first card is to consider the NGM13 (index 0), the nearest expansion at that will have the index 1, and to follow the others.

Syntax

NG_DI(Char Card) as uint

Parameters

Card Index of the expansion card (from 0 to 7)

Return value:

Uint Value of 16 BITS of the input, if Bit is 1 the input is ACTIVE

Input	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Example
Used variables:
input UINT

```
input = ng_di(0)        ‘ read the digital inputs from the first card
input = ng_di(2)        ‘ read the digital inputs from the second card
```

11.12.3 NG_DO – DIGITAL OUTPUTS

This function updates the digital output of the **NGM13** and its expansion cards: **NGM-IO** and **NGM-PS**. The expansion cards are identified with a progressive number starting from 0. The first card is to consider the NGM13 (index 0), the nearest expansion at that will have the index 1, and to follow the others.

Syntax

NG_DO(Char Card, Uint Out)

Parameters
Card Index of the expansion card (from 0 to 7)
Out State of the outputs, if Bit is 1 the output is ACTIVE

Output			14	13	12	11	10	9	8	7	6	5	4	3	2	1
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Example

```
ng_Do(0,0x7)            ‘ Activate the outputs 1, 2 and 3 of the NGM13
ng_Do(1,0x31)           ‘ Activate the outputs 1, 8 and 9 of the first expansion card
```

ATTENTION: **Bits 8 and 15 aren't used.**
Outputs from 9 to 14 of the NGM13 are shared with the STEP/DIR channels 1, 2 and 3.

11.12.4 NOTES FOR PROGRAMMING WITH DIGITAL I/O

To obtain an application program more clear and stable we suggest to call the I/O function only from TASK PLC. Therefore, in this task, read the inputs writing them in a GLOBAL variable (ex. Input) and write the outputs reading them from another GLOBAL variable (ex. Output). On these variables can be defined the single bits associated to the digital channels and then using them at occurrence.

Example
Used variables:
Input1 UINT
Input2 UINT
Output1 UINT
Output2 UINT
StartButton BIT Input1.3
StopButton BIT Input1.6
WaterPump BIT Output2.12

In TASK PLC:

```
Input1=Ng_Di(0)
Input2=Ng_Di(1)
Ng_Do(0,Out1)
Ng_Do(1,Out2)
```

EVERYWHERE:

```
if  StartButton
```

```
        WaterPump=1
endif
if  StopButton
        WaterPump=0
endif
```

11.12.5 NG_ADC – ANALOG INPUTS

The NGM13 is equipped with 8 analog input channels at **12 Bit**. These inputs are shared with the digital inputs. The NGM13 must be hardware and software configured for the enable of the analog input channels, **each activated channel excludes a correspondent digital input**.
This is the relationship (first input is the number 1):

Analog input	Digital input
1	9
2	10
3	11
4	12
5	13
6	14
7	15
8	16

Syntax

```
        NG_ADC(Char Ch) as uint
```

Parameters

Chan Number of the channel (from 0 to 7)

Return value:

Returns the analog value (from 0 to 1023).

11.13 STEP/DIR CHANNELS

The system **NGM13** and the expansion card **NG-PP** for the system NG35 are equipped with 4 STEP/DIR channels which allows to work with axis with linear, circular or helical interpolation.

Normally for their use it is associated to a library object according to the type of application. For example we can use them with INTERPOLATOR, POSITIONER, CAM, GEAR, etc.

In this chapter will be described the need functions to interface these objects to the STEP/DIR output. At last there are some example to better clear how to create an application using this hardware resource.

11.13.1 PP_STEP – STEP/DIR SIGNAL GENERATION

The function **PP_STEP** allows the STEP signal generation on the selected channel. It is the function to connect a general object for motion application to a STEP/DIR channel.

Hardware ***NGM13,NG35+NG-PP***

Syntax

PP_STEP(Char Chan, Long Pos)

Parameters

Chan Number of the STEP/DIR channel (NGM13 from 0 to 3, NG-PP form 0 to 15)

Pos Absolute value of the position of the step/dir axis

ATTENTION: THE FUNCTION PP_STEP MUST BE CALLED IN TASK PLC.

11.13.2 PP_PRESET – PRESET OF STEP/DIR POSITION

This function updates the current position of a step/dir channel.

Hardware ***NGM13,NG35+NG-PP***

Syntax

PP_PRESET(Char Chan, Long Pos)

Parameters

Chan Number of the STEP/DIR channel (NGM13 from 0 to 3, NG-PP form 0 to 15)

Pos Value of the preset position

ATTENTION: TO A CORRECT PRESET OF THE AXIS FOLLOW THE INSTRUCTION DESCRIBED FARTHER ON

11.13.3 PP_GETPOS – READING OF ACTUAL POSITION (ONLY FOR NG-PP)

This function reads the actual position of a step/dir channel. **The value will correspond to the DOUBLE of the real position**. This function isn't present in NGM13 where to read the actual positions there are 4 system variables.

Hardware ***NG35+NG-PP***

Syntax

PP_GETPOS(Char Chan) as long

Parameters

Chan Number of the STEP/DIR channel (from 0 to 15)

Return value

Long Actual position x 2

11.13.4 READING OF ACTUAL POSITION

There are 4 system variables containing the actual position of the first 4 step/dir channels. **The value will correspond to the DOUBLE of the real position**. To read the position of the other channels of NG-PP we have to use ***pp_getpos***.

Hardware ***NGM13,NG35+NG-PP***

_SYSTEM_PXC as long Actual position channel 0

_SYSTEM_PYC as long	Actual position channel 1
_SYSTEM_PZC as long	Actual position channel 2
_SYSTEM_PAC as long	Actual position channel 3

11.13.5 EXAMPLE OF USING WITH THE OBJECT MONOAX

The object MONOAX is a SINGLE AXIS POSITIONER very sophisticated able to generate ACCELERATION and DECELERATION ramps, to control the axis position and velocity, etc.
To make the object independent of the using hardware it acts on a generic VARIABLE which finally will contain the axis position.
It will be required to write some row of code to interface the object to the hardware we want use redirecting the above variable to a **PID** filter to works with analog axis, a **PDO** to manage **CANOPEN** axis, or to function ***pp_step*** to interface a **STEP/DIR** axis.

Step to execute:

1) In the object **NGM13_INIT** enable the interpolation mode on the step/dir channel used

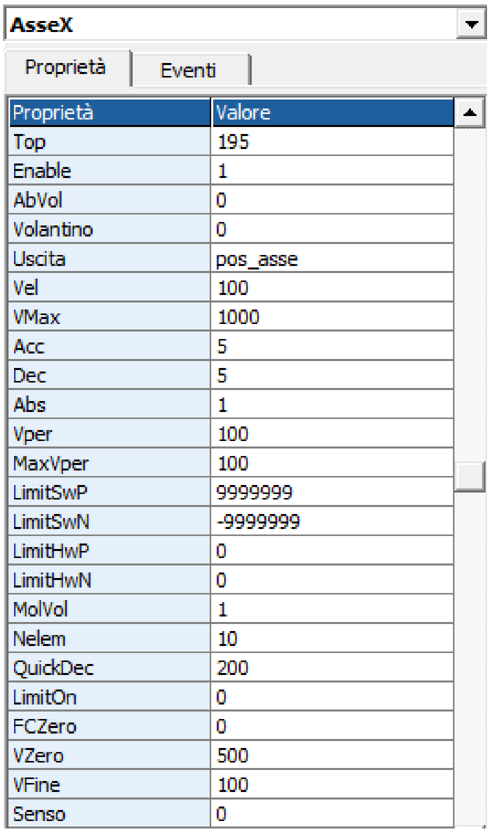
2) Load an object **MONOAX** from **MOTORCONTROL** → **CINTERPPOS** in the **MAIN PAGE**

3) Name it for example **ASSEX**

4) Declare the following GLOBAL VARIABLES:
Pos_Asse Long – position of the axis
RappX Float – ratio between generated steps and effective movement

5) Initialize in the section INIT of the MAIN task the variable RAPPX at the desired value (however not equal to 0). A negative value will be able to change the direction of the axis.

6) Set the following PROPERTY of the OBJECT MONAX (example):



Proprietà	Valore
Top	195
Enable	1
AbVol	0
Volantino	0
Uscita	pos_asse
Vel	100
VMax	1000
Acc	5
Dec	5
Abs	1
Vper	100
MaxVper	100
LimitSwP	9999999
LimitSwN	-9999999
LimitHwP	0
LimitHwN	0
MolVol	1
Nelem	10
QuickDec	200
LimitOn	0
FCZero	0
VZero	500
VFine	100
Senso	0

7) Write in TASK PLC the following CODE:
pp_step(0, pos_asse * RappX)

8) Write in MAIN TASK the test code to execute a movement (example):

```
if START_CONDITION
        AsseX.Vel=1000
        AsseX.quota=100000
        AsseX.start=true
        START_CONDITION=false      ' To avoid recursive starts
endif
```

With this example the variable pos_asse will reach the value 100000 following the programmed RAMP in the object. In TASK PLC the value is sent by the function PP_STEP to the STEP/DIR channal 0 obtaining a movement of the axis controlled in position and velocity. The function ***pp_step*** generate the STEPS by the value difference of the position variable between two sample. Then, according to the sampling time of TASK PLC, we have different speed. A typical sampling time for the STEP/DIR axis can be from 2 milliseconds to 5 milliseconds.

11.13.6 EXAMPLE OF USING WITH THE OBJECT INTERPOLATOR

The object INTERPOLATOR generates trajectories on more AXIS at the same time according to the type of interpolation executed. Similarly to the object MONAX, it works with a support variable which, opportunely sent to function ***pp_step,*** will be able to execute interpolation on STEP/DIR axis.

Step to execute:

1) In the object **NGM13_INIT** enable the interpolation mode on the step/dir channel used

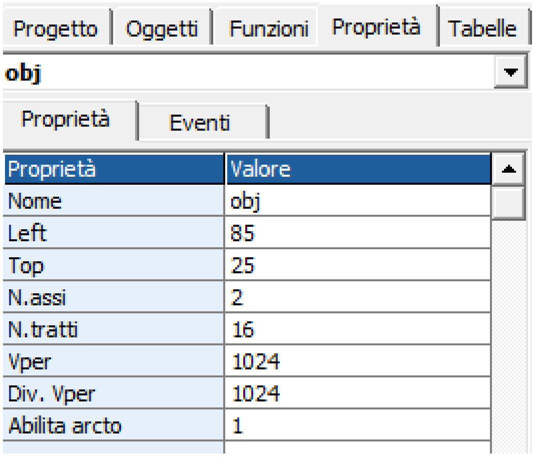
2) Load an object ***INTERPOLATORE*** from ***MOTORCONTROL--> COBJINTERPOLA*** in the **MAIN**

3) Name it for example **INTERPOLA1**

4) Declare the following GLOBAL VARIABLES:
PosAssi(2) long - position of the axis
Rapp(2) Float - ratio between generated steps and effective movement

5) Initialize in the section INIT of the MAIN task the variable RAPP(0) and RAPP(1) at the desired value (however not equal to 0). A negative value will be able to change the direction of the axis.

6) Set the following PROPERTY of the OBJECT INTERPOLA1 (example)



Proprietà	Valore
Nome	obj
Left	85
Top	25
N.assi	2
N.tratti	16
Vper	1024
Div. Vper	1024
Abilita arcto	1

7) Write in TASK PLC the following CODE:

```
pp_step(0, Interpola1.pc(0) * Rapp(0))          ' Asse X
pp_step(1, Interpola1.pc(1) * Rapp(1))          ' Axxe Y
```

8) Write in MAIN TASK the test code to execute a movement (example):

```
function MuoviAssi(Qx as Long, Qy as Long, Vel as Long)
PosAssi(0)=Qx
PosAssi(1)=Qy
Interpola1.moveto(Vel, 1, PosAssi())
endfunction
```

9) Call the declared function with desired parameters.

11.13.7 NOTES FOR A CORRECT PRESET OF STEP/DIR CHANNELS

Be careful when working with STEP/DIR or CAN OPEN axis in interpolation mode. In the chapter on interpolation functions it is already described an eample to manage the preset with CAN OPEN axis. Below will be treated the problem connected to the STEP/DIR axis.

The function PP_STEP works asynchronously to the function generating the trajectories as MONOAX or INTERPOLATOR. It is necessary that the positions of these objects are in agreement with the internal position of the steps generator. The number of generated steps by the function PP_STEP will correspond to the value difference of the position variable between two sample (TASK PLC). Resetting immediately the value of this variable, the function PP_STEP will generate a number of steps equal to the old value of the variable, and all in a single sample.

For example assuming the variable has a value of 10000, in the instant it is zeroed will be generate 10000 STEPS in a sample. Considering a sample of 2 mSec we have a frequency of 5MHz !

To avoid that happen it needs at each PRESET of the axis (changing of the support variable) to stop the generator of STEPS and re-enable it when the position will agree.

Then it is always better put under condition the calling of step generating function PP_STEP in the following mode:

```
if DisableStep=false
      pp_step(0,Iterpola1.pc(0) * Rapp(0))      ' ASSE X
      pp_step(1,Iterpola1.pc(1) * Rapp(1))      ' ASSE Y
endif
```

The flag DisableStep allows the stop of steps generation. Then at the moment we need to execute an axis preset, referring to the previous examples, call this code:

PRESET AXIS WITH INTERPOLATOR:

```
DisableStep=true
pos_vect(0)=qpresetX           ' preset position X
pos_vect(1)=qpresetY           ' preset position Y
obj.preset(pos_vect())         ' preset interpolator
pp_preset(0,qpresetX*Rapp(0)) ' preset step/dir channel 0
pp_preset(1,qpresetY*Rapp(1)) ' preset step/dir channel 1
DisableStep=false
```

PRESET ASSE WITH MONOAX:

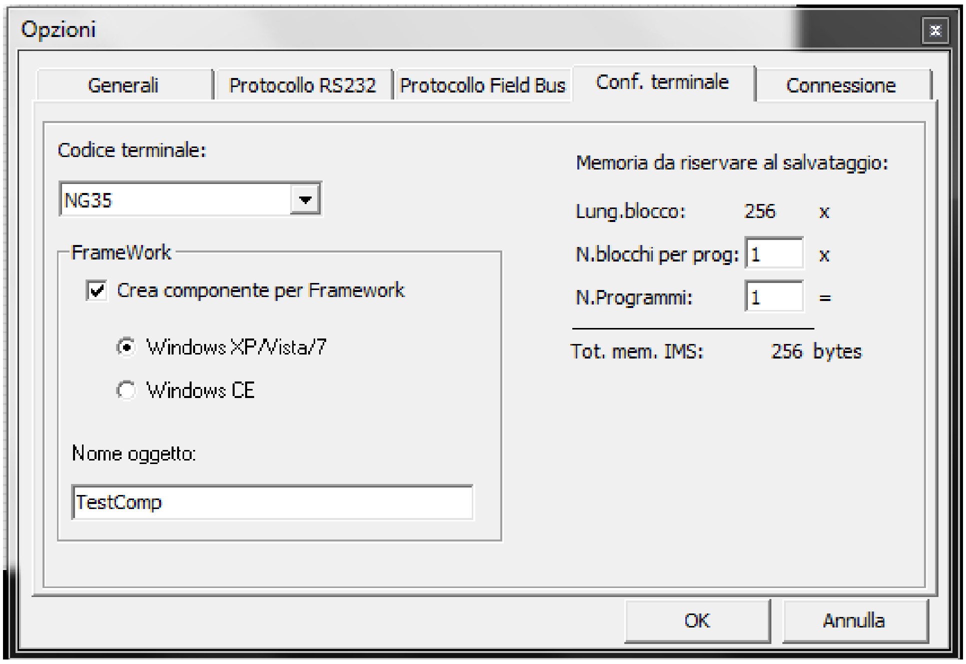
```
DisableStep=true
MONOAX.HOME= qpresetX          ' preset position
pp_preset(0,qpresetX*RappX)    ' preset step/dir channel 0
DisableStep=false
```

12 COMPONENT FOR FRAMEWORK

VTB compiler can create a DLL COMPONENT MODEL which can be imported in .NET (dot net) projects. That allows the full control of hardware resource directly by a PC: READ/WRITE VARIABLES, CALL FUNCTION IN REMOTE PROCEDURE CALL.
For details refer to the NG Framework manual.

12.1 Enabling the creation of the COMPONENT NGFRAMEWORK

To use the component we must enable from the VTB Options the compiling of the .NET DLL.



Codice terminale: NG35

FrameWork

☑ Crea componente per Framework

● Windows XP/Vista/7

○ Windows CE

Nome oggetto: TestComp

Memoria da riservare al salvataggio:

Lung.blocco: 256 x

N.blocchi per prog: 1 x

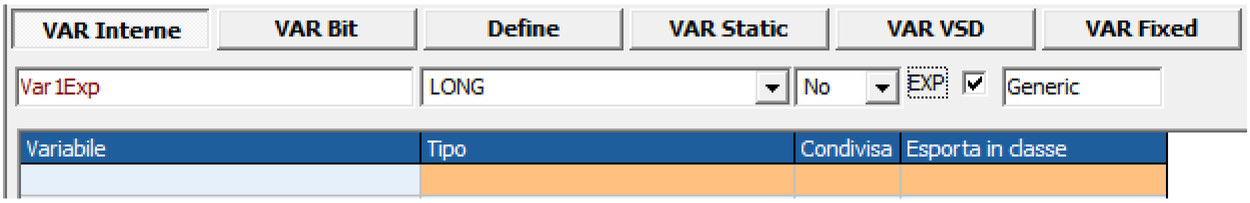
N.Programmi: 1 =

Tot. mem. IMS: 256 bytes

The component can be created for system with Windows XP/VISTA,/7 or with Windows CE.
The name of the created DLL must be indicated in the object name.
So, after the end of compiling it will be created the DLL OBJECTNAME:DLL which can be imported as a component in the .NET project.

12.2 Exporting VARIABLES

We can export the desired variable to FRAMEWORK and then, on PC, write or read them as normal variables of the project.



Var1Exp | LONG | No | EXP ☑ | Generic

Variabile	Tipo	Condivisa	Esporta in classe

To export a variable, when we declare it, enable the CHECK EXP and write the name of the exporting class (default Generic). The class serves only to group the exporting variables so to make more simple the research of them in the PC application.
In the example the variables will be contained in Generic.VAR1EXP and it can be read or written on the PC project as a common variable.
We remember the time of execute th READ or WRITE operation depends by the enabled LINK: serial port RS232 or ETHERNET. Obviously the second one will be more fast.
Only the INTERNAL VARIABLES can be exported, also if the it is refer to a structure.
In the last case (structures) exporting class isn't considered, but we can get it by the name of the variable (because a structure is similar to a class).

12.3 Exporting FUNCTIONS

In a similar way as for variables it can be exported also functions.
That must be declared with a specific POSTFIX :

```
function FunctionName(...Parameters...) as Type  $_EXPORT_$ CLASS
. . .
endfunction
```

$_EXPORT_$ Keyword to enable function exporting
CLASSE Name of the exporting class where the function will be found

Example:

```
function MyFunction(Val1 As Long,Val2 As Long) as Long  $_EXPORT_$ FunzSistem
. . .
endfunction
```

13 APPLICATION DEBUG

The DEBUG utility allows to control, both read and write, of all the application variables, to insert BREAK POINT and to execute the code STEP by STEP. That makes more simple the development of the application. The application DEBUG can be execute by RS232 port as well as ETHERNET.

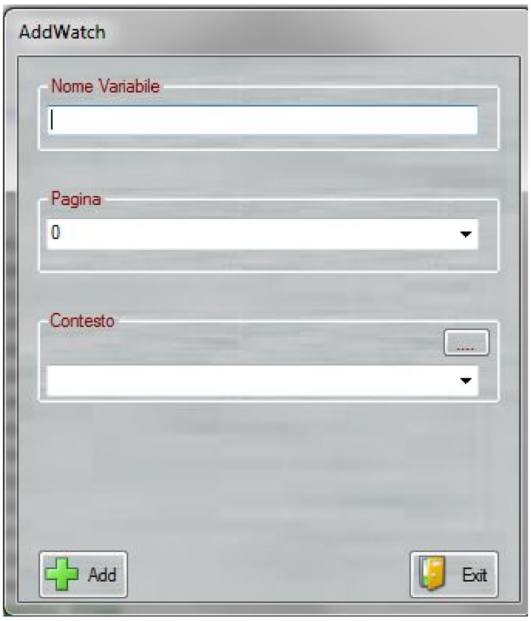
When the serial port is used, the PC must be connected to the first port of the target hardware (**SER-1/ PROG**).

ATTENTION: <u>If application uses the first serial port, (ex. MODBUS, etc.) DEBUG will not work</u>.

13.1 Button bar

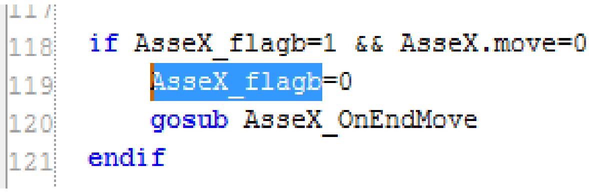
Add a variable to the WATCH window.

It allow to insert a variable which will be update in REAL time and it will be also written.



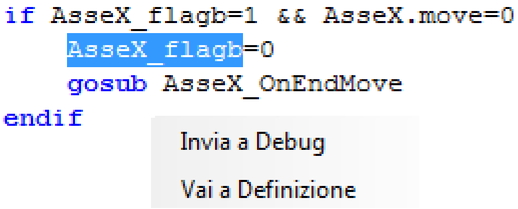
Writing in the field Nome VARIABILE the alphabetical list of the variables of the project will appear making the searching very simple. Variables can be added also in the following ways:

Drag&Drop. Select the desired variable in the code window and drag it in the WATCH window.



```
if AsseX_flagb=1 && AsseX.move=0
    AsseX_flagb=0
    gosub AsseX_OnEndMove
endif
```

Right button. Click with the right button on the selected variable and then ***Send to Debug***.



```
if AsseX_flagb=1 && AsseX.move=0
    AsseX_flagb=0
    gosub AsseX_OnEndMove
endif
```

Pagina

It selects the page of the VARIABLE (if it is a local variable of a page), PAGINA 0 refer to the GLOBAL variables.

Contesto

If the watching VARIABLE is local of a FUNCTION (defined with ***dim***) we can select the contest (function) of this variable.

These types of variables are visible only if a BREAK POINT in the relative contest is reached.

Remove the selected variable.

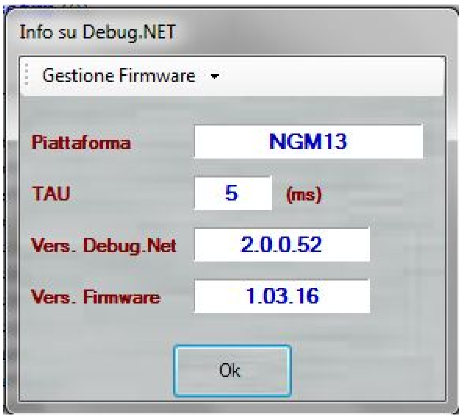
The selected variable will be removed from the WATCH window.

Remove all variables from the WATCH window.

Remove all Break-Points in the project.

Information about DEBUG.NET

With this button we can display some informations about DEBUG.NET and the target hardware. Also it is possible to update the FIRMWARE of the target. (See section Firmware Update).



Info su Debug.NET

Piattaforma	NGM13
TAU	5 (ms)
Vers. Debug.Net	2.0.0.52
Vers. Firmware	1.03.16

Stop array reading.

When arrays of BIG DIMENSION are read can happen a TIME OUT of the system, with this button we can stop the read.

Reset

It simulates a RESET of the HARDWARE.

ATTENTION: The application will be restarted.

Save the list of variables on file

It is possible to create a file with the list of the variables in the WATCH windows to reload it afterword.

Load a variables list file

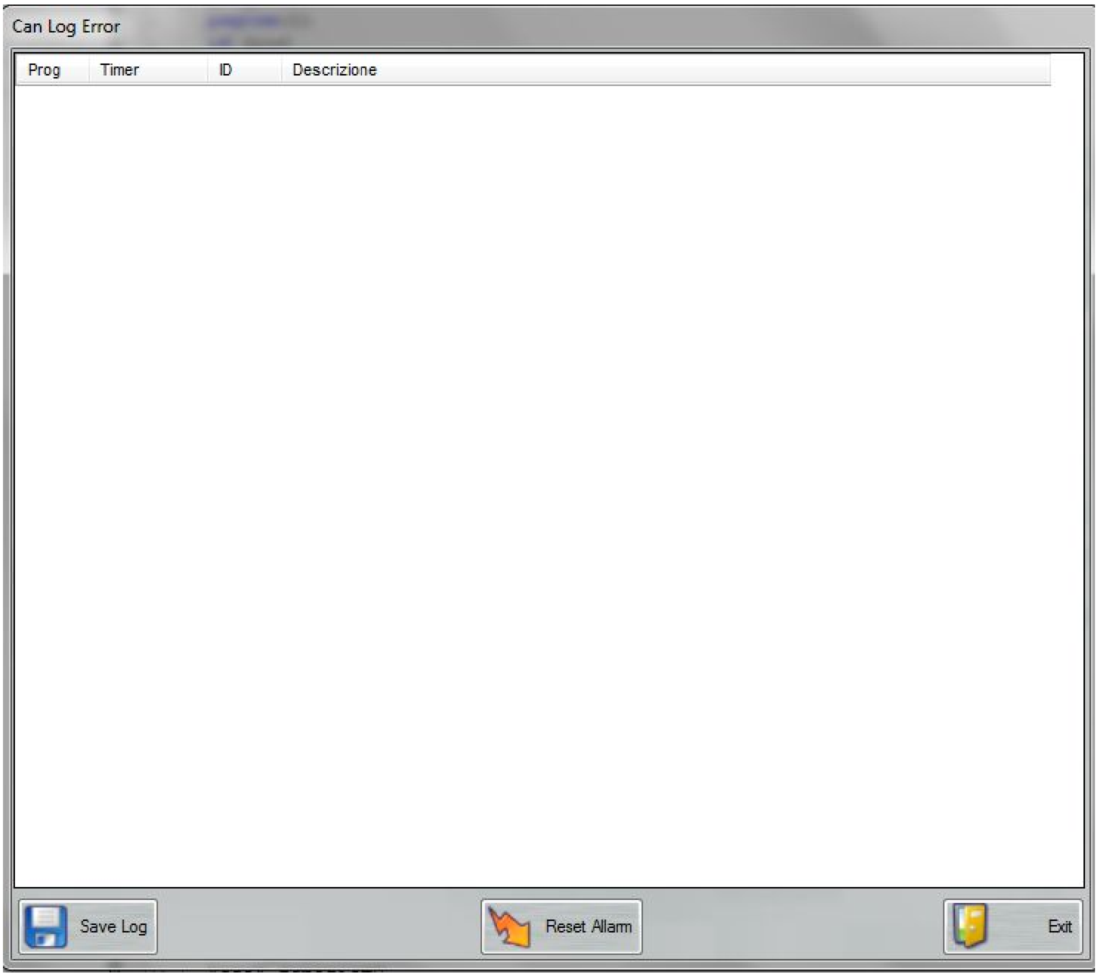
It allow to reload a list of variables previously saved.

The content of the variables WILL NOT BE INIZIALIZED.

Load a variables list file with value
It allow to reload a list of variables previously saved.
The content of the variables WILL BE INIZIALIZED with the saved value.

Load the last variables list
DEBUG.NET always saves the list when it is closed. With this button we can reload the last variables.

Display the LOG of HARDWARE ERRORS
All run-time errors are saved in this list. It is very useful particularly with CanOpen applications to test if in the CANBUS net there are some errors or it works correctly.



Errors are sampled by directly by the target hardware in REAL TIME and they are displaied in TEMPORAL order. It is also possible to save the logging list in a file to analyse them afterword.

Scope
Enable the digital scope (see relative section)

....

DEBUG.NET options
It allows to set some DEBUG options.

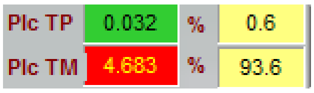
> ***Block Read Delay (Ms)***
> If this option is greater than ZERO a delay is added after the read of a block. If DEBUG uses the serial port RS232 IT ISN'T NECESSARY.
> It can be useful in ETHERNET because the high speed of the protocol could create some problem to the VTB application (slowdowns).
> We recommend to set the delay, when using ETHERNET to debug the application, with a value of at least one Ms.

□ VIS HEX

HEXADECIMAL/DECIMAL display
If activated the numeric value of the variables will be displayed in HEXADECIMAL format.

□ VIS ASCII

ASCII display
If activated, the ASCII character corresponding to the value of the variable will be displayed (it is useful for array of alphanumeric STRINGS).



Plc TP	0.032	%	0.6
Plc TM	4.683	%	93.6

It shows the elapsed time (in Milliseconds) of the TASK PLC and the relative percentage of CPU using. If the system read a value near the CRITICAL one it will be signal by RED BLINKS af the value.

Run after BreakPoint (or F5 key)
When a Break-Point is reached, it allow to resume the normal running of the program.

Execute Intruction/Routine (or F10 key)
When a Break-Point is reached, with this button it is possible to execute a single line of source code. Eventual functions will be execute completely **without enter inside them.**

Execute Intruction (or F11 key)
When a Break-Point is reached, with this button it is possible to execute a single line of source code.
If a function is encountered, program will stop inside it.

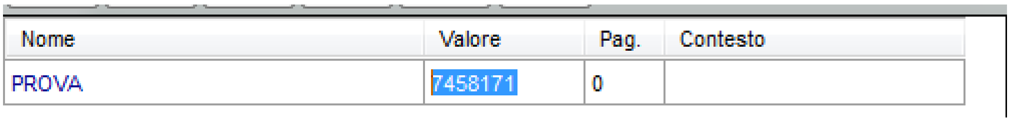
Find text
Find a text in the source code windows.

Task Plc

Display the content of TASK PLC
ATTENTION: in TASK PLC it isn't possible to set a Break-Point.

13.2 Writing of a variable

It is possible to change the value of all the variables in the WATCH list. Double click on the value and then write the desired value.



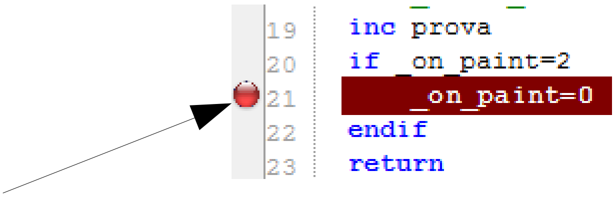
Nome	Valore	Pag.	Contesto
PROVA	7458171	0	

If the variable is a type BIT the double click switches from TRUE to FALSE and vice versa.

13.3 Insert/Remove a Break-Point

The insert of a Break-Point allows to break the program in a specified point. When a Break-Point is reached it is possible to execute STEP by STEP the program checking the correctness.
ATTENTION: **<u>Break-Points can not be inserted in the hardware NGM13.</u>**

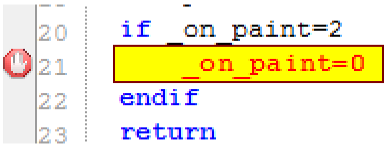
By Select File select the desired page of code.
Click with the left button of the mouse on the left of the source code window.



```
inc prova
if _on_paint=2
   _on_paint=0
endif
return
```

Click here

When the program passes from that line, the bar, from BROWN, will turn YELLOW and the execution will be BROKEN. At this point it will be possible re-run the program with ***Run after BreakPoint (F5)*** or execute it Step by Step***.***



```
if _on_paint=2
   _on_paint=0
endif
return
```

To remove a Break-Point click again on the Break-Point

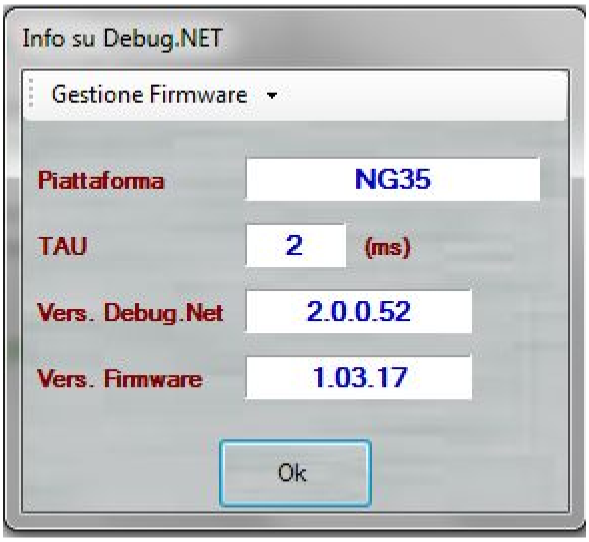
ATTENTION: When a Break-Point is reached and the program is stopped, the TASK PLC continues to run. Anyway breaking the program in CRITICAL points <u>we can create unsafe situation operating on machine. BE CAREFUL</u> !

13.4 Firmware update

With DEBUG application it is possible to update the FIRMWARE of the hardware in use.

ATTENTION: <u>FIRMWARE update can be executed only by serial port RS232</u>.

With the INFO button this window is showed:



Info su Debug.NET

Piattaforma: NG35

TAU: 2 (ms)

Vers. Debug.Net: 2.0.0.52

Vers. Firmware: 1.03.17

From Menu Gestione Firmware we can chose between two options:

Update from Server

In this case an INTERNET connection is necessary. The application checks if on SERVER PROMAX there is a newer version of the FIRMWARE proposing the updating.

Update from file

It allows to update the hardware FIRMWARE with a file .SREC.

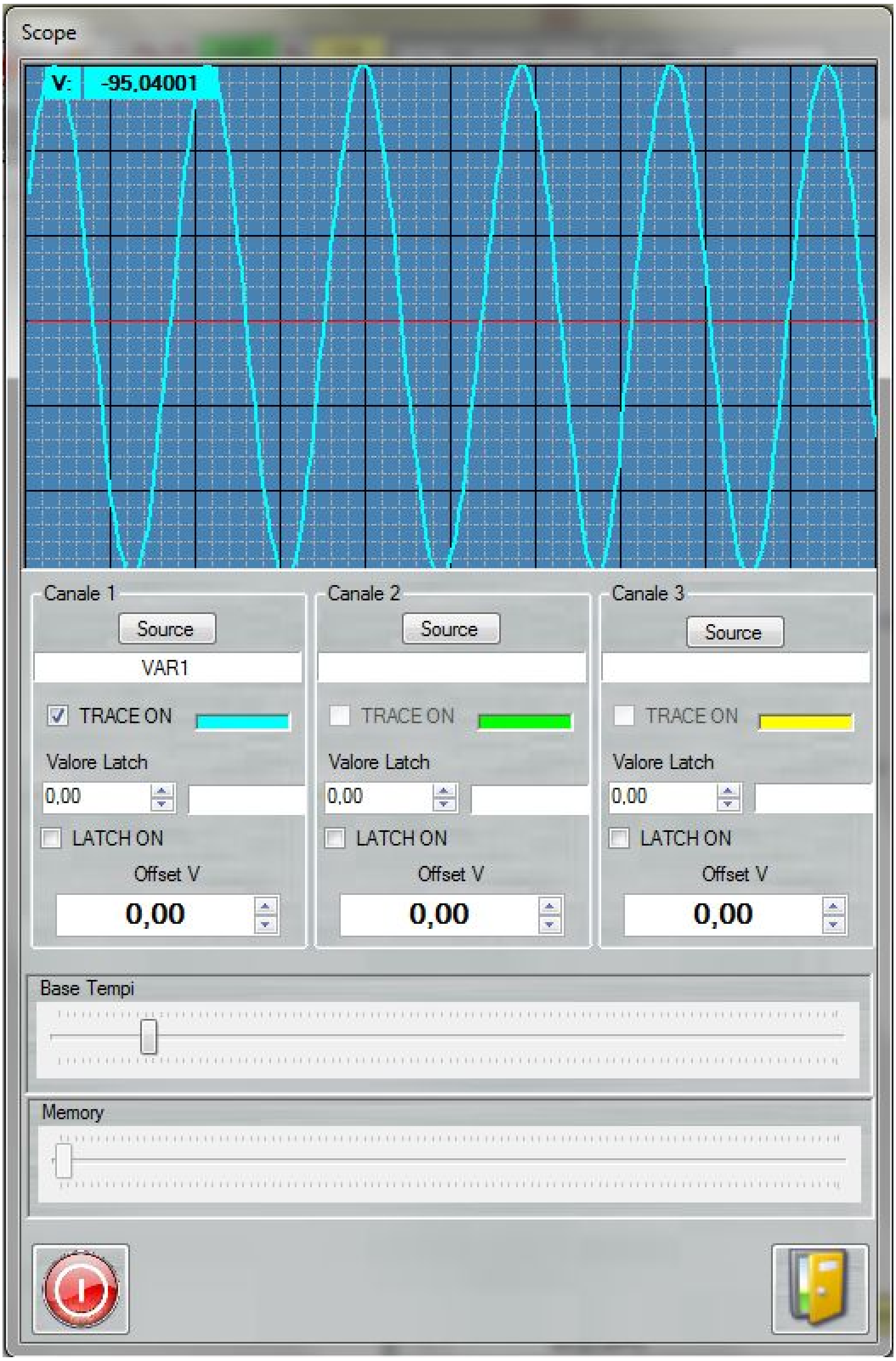
ATTENTION: <u>Updating from file, no control of the firmware revision and compatibility with the hardware is made</u>.

ATTENTION: <u>During the phase of updating the application are stopped but it WILL NOT BE LOST</u>.

13.5 Digital Scope

DEBUG.NET provides a SCOPE application to further support of debugging. DIGITAL SCOPE is able to monitor the variables in the **WATCH** window.

The scope can display up to 3 CHANNEL.



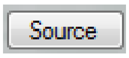
VAR1

☑ TRACE ON □ TRACE ON □ TRACE ON

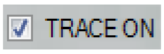
Valore Latch 0,00 | Valore Latch 0,00 | Valore Latch 0,00

□ LATCH ON □ LATCH ON □ LATCH ON

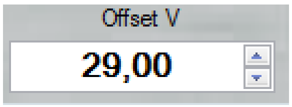
Offset V 0,00 | Offset V 0,00 | Offset V 0,00



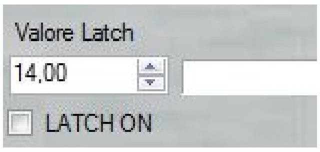
Selects the variable to connect to a channel.
The variable must be in the WATCH window.


☑ TRACE ON

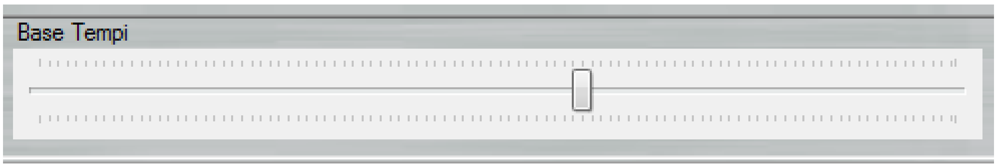
Enables or disables the TRACK of a channel.


Offset V
29,00

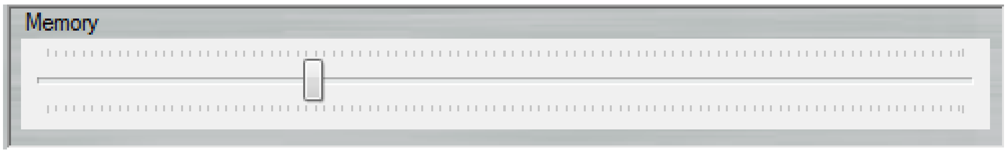
Sets an OFFSET on the TRACK.


Valore Latch
14,00
□ LATCH ON

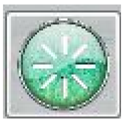
Enabling LATCH, when the variable overcomes the Latch value, the TRACK will be FROZEN.



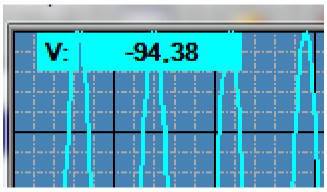
Set the BASE-TIME for all the tracks.



When scope is in OFF state, it aloows to scroll the track in the sampled memory.



Scope ON/OFF.


V: -94,38

Positioning the mouse on a point of the track, the value of the variable will be showed.

Indice generale