

# VTB Visual Tool Basic

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## User Guide



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## 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**.

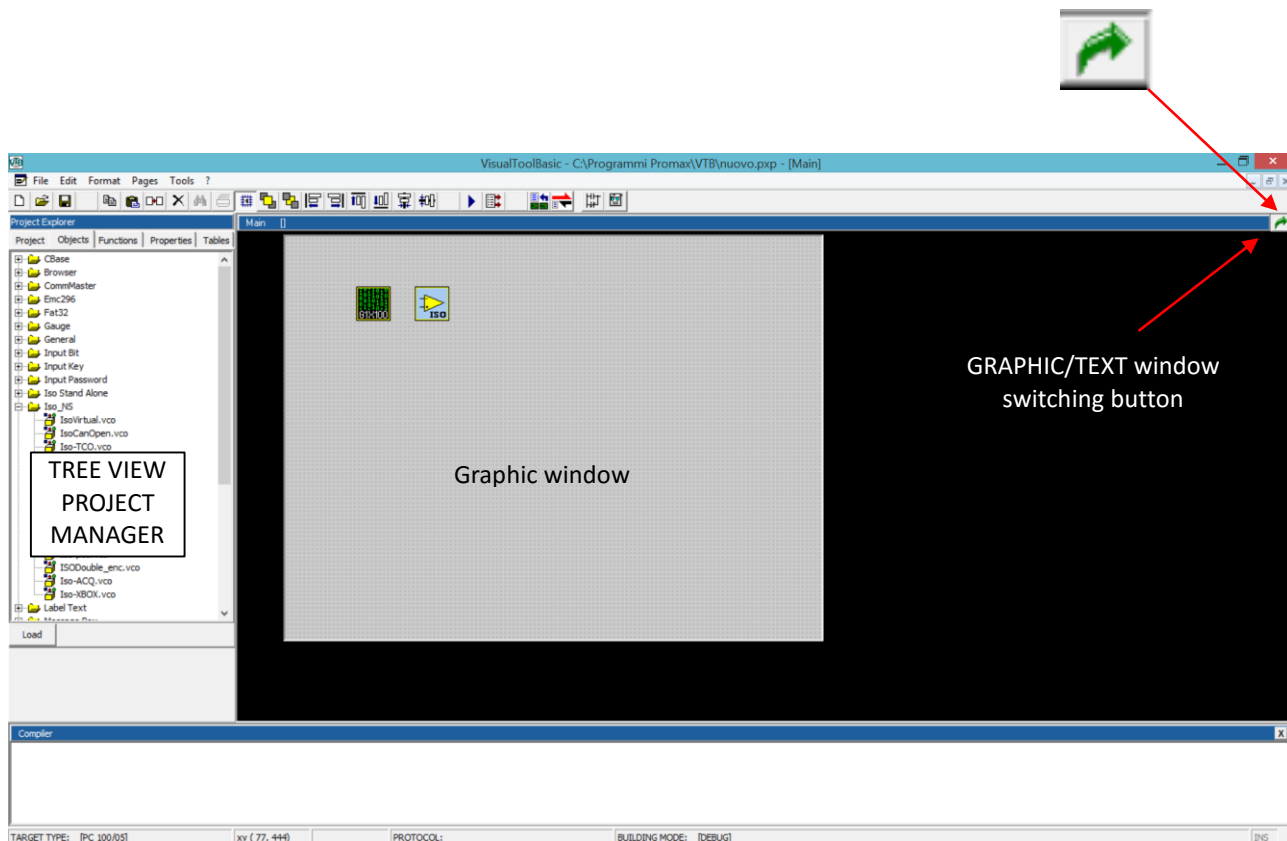
Some **INSTRUCTIONS** are **VTB PROPRIETARY** but following the same philosophy.

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

### 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 available 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 paste. 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 available 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.

**Attention: all reference to these pages (button of function) will have to be modified.**

**View Graphic of the Page**



It shows the graphic window of the page.

**View Code of the Page**

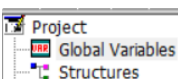


It shows the source code editor window of the page.

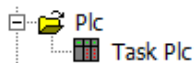
**View Variables of the Page**



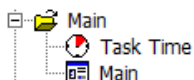
It shows the table of private variable of the page.



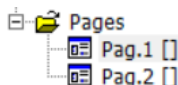
**View GLOBAL Variables and STRUCTURE definitions**



**View source code editor of TASK PLC**



**View source code editor of TASK MAIN or TASK TIME**



**View source code editor of a page**

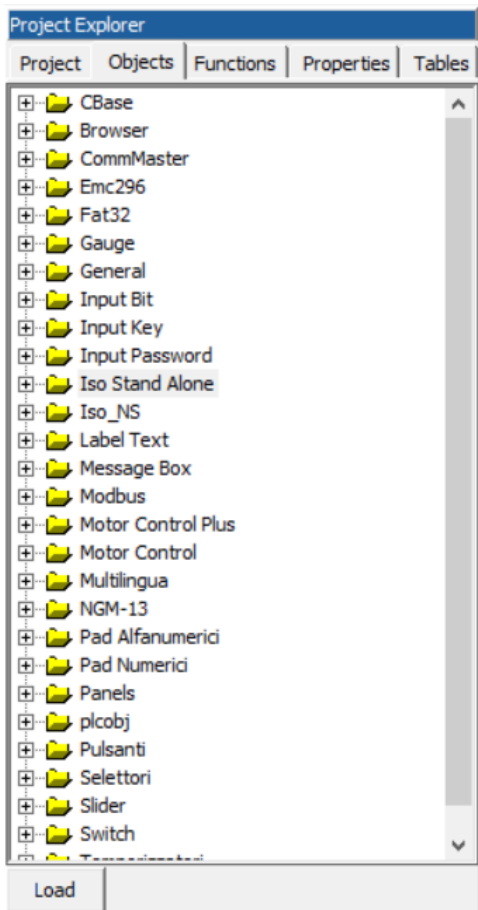


### 3.3 Objects manager

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 **LOAD** button allows to browse the CUSTOM OBJECT which are not included in the standard library.

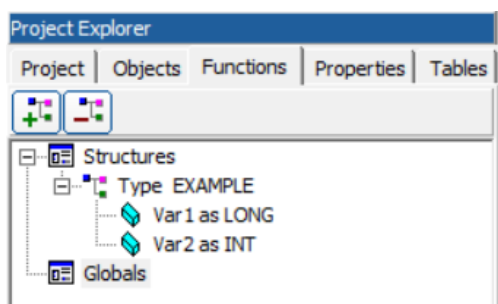
### 3.4 Functions Manager

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.

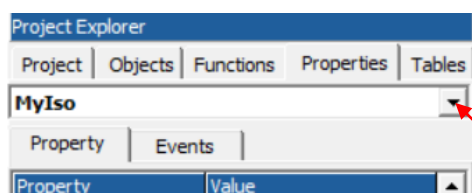
The section FUNCTIONS groups the functions per page, selecting a single function the editor window is opened showing the relative source code.



### 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.**



#### 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

OBSOLETE SECTION

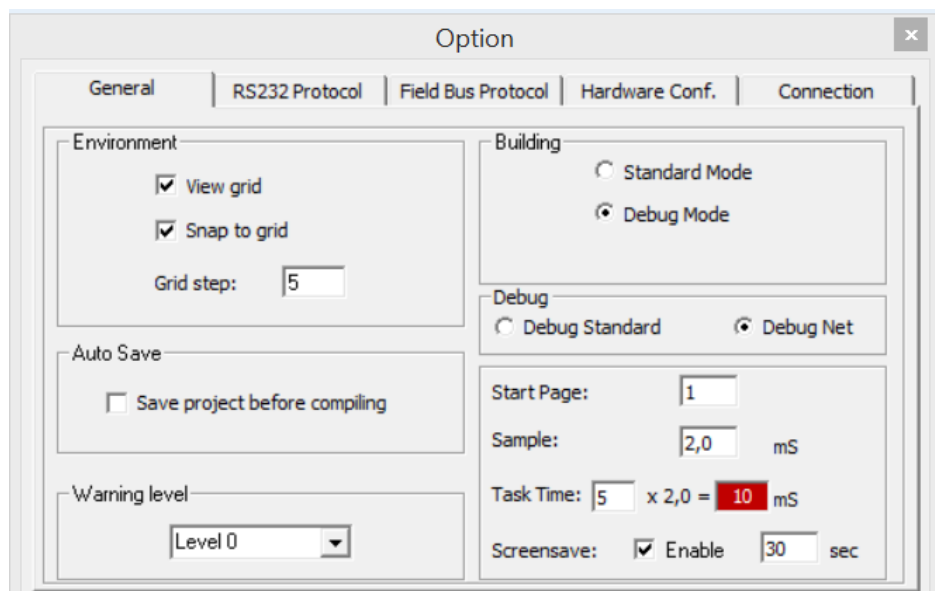
## 4 CONFIGURATION OF VTB

From Menu **Tools** → **Options**

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



#### 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.

#### Start Page

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

#### Sample

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

OBSOLETE

**Standard Mode**

OBSOLETE

**Debug Mode**

OBSOLETE

**Debug Standard**

OBSOLETE

**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.

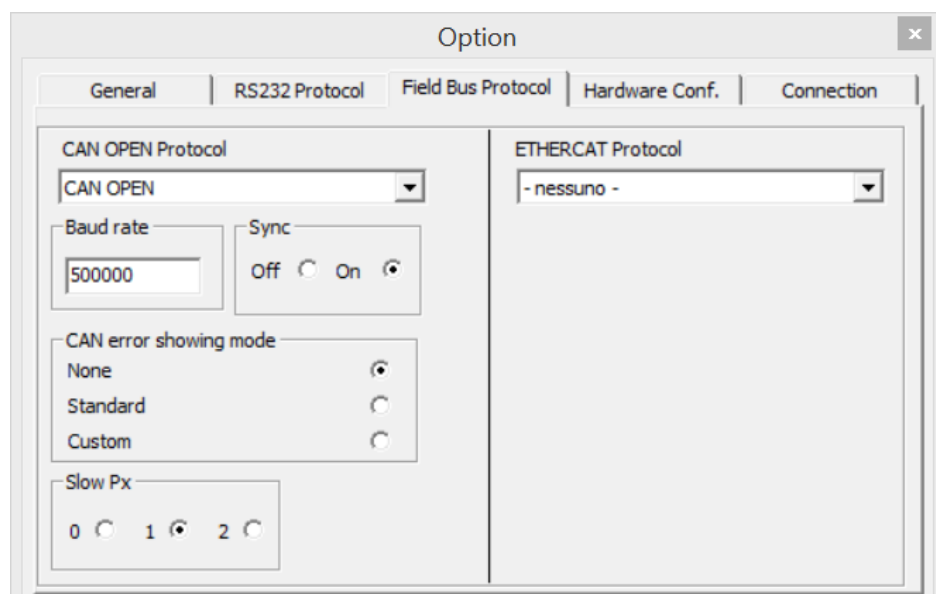
**Level 1** Compiler displays warning messages when improper or dubious operations on variables are found. Anyway the binary file is created.

**4.2 RS232 Protocol****(OBSOLETE)**

### 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)**



#### CanOpen Protocol

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**). **SYNC is essential for applications with AXIS INTERPOLATED**

#### Check Error Showing mode

It selects the display mode of the eventual errors during the CanOpen **configuration** (see CanOpen configurator), there are three options:

- |                 |   |
|-----------------|---|
| <b>None</b>     | On systems with display the result of configuration of each node is showed then the application continue independently there have been error or not.<br>On systems without display there isn't any indication of eventual errors of CanOpen configuration.  |
| <b>Standard</b> | <b><u>This option is valid only on systems with human interface.</u></b><br>A specific object (CanErr) is added on MAIN page with 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. |
| <b>Custom</b>   | 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.<br>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**

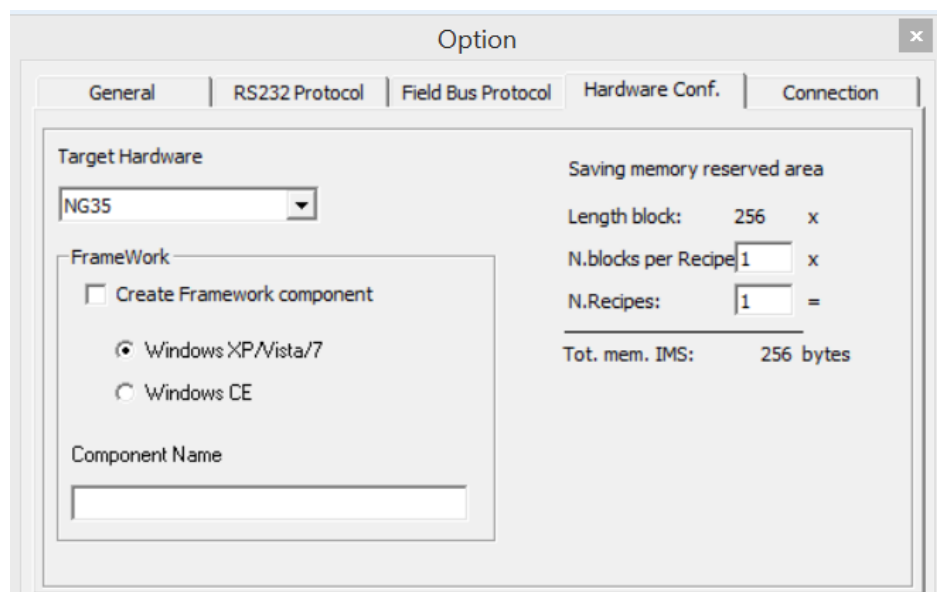
It enables the the Ethercat protocol in system which can manage it.

Ethercat can work also with CanOpen protocol enabled.

## 4.4 Target Hardware Configuration

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.



### 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

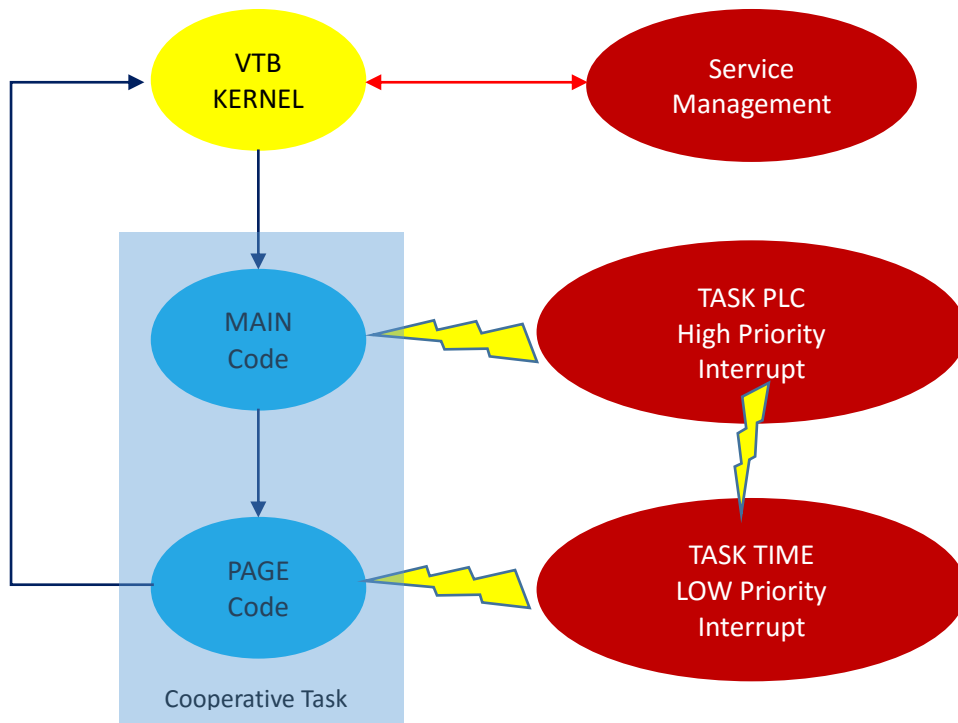
VTB can create a DLL Component Model to integrate in a Framework .NET application.

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 which 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 tasks in **cooperative** mode: they are executed one after another. The **TASK PLC** is the **DETERMINISTIC** task at highest level which 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.





## 5.1 Task Plc

This task is the highest 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 excluding 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 which 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 which 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 WARNING 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
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 differs from that for two features:

- a) it has a lower priority and it can be INTERRUPTED by TASK PLC;
- b) it has no 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 which 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 commanded 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**

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**

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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 compilers. 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 translated 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	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 and 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

**VTB doesn't make any control on dimension of the variables and on its assigned value.**

## 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 functions.

**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**

Internal VAR	Bit VAR	Define	Static VAR	VSD VAR	Fixed VAR
Punt		*LONG	No	EXP	
Variable	Type	Shared	Export in Class		

**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=pnt[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**

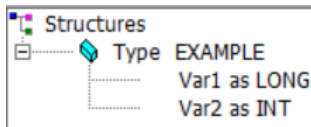
**pointer[9]=55** *' assign to array some value by pointer*

**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*



**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->Var1=300**      *' writing of both fields of structure by pointer*  
**pointer->Var2=200**

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

**WARNING:** 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 inscription `pnt[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 Bit

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.

**VARBIT1STATE.0 (first bit of STATE)**

**VARBIT2STATE.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

Internal VAR	Bit VAR	Define	Static VAR	VSD VAR
VARBIT4		CYCLE	4	No
Name	Main Variable	NBit	Shared	
VARBIT 1	CYCLE	0	No	
VARBIT2	CYCLE	1	No	
VARBIT3	CYCLE	2	No	

### FIELDS OF BIT VARIABLE

<b>Name</b>	It identify the UNIVOCAL name of the bit variable
<b>Original Variable</b>	Name of the variable associated to the bit one. It must be of type CHAR, UCHAR, INT, UINT, LONG (also ARRAYS)
<b>Nbit</b>	Number of the bit in the associated original variable <b><u>WARNING: the first bit is always the number 0 (zero)</u></b>

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

<b>CHAR/UCHAR</b>	<b>0-7</b> (8 bits)
<b>INT/UINT</b>	<b>0-15</b> (16 bits)
<b>LONG</b>	<b>0-31</b> (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

Internal VAR	Bit VAR	Define	Static VAR	VSD VAR	Fixed VAR
Vect(10)		LONG	No	EXP <input type="checkbox"/>	
Variable	Type	Shared	Export in Class		

**WARNING:** 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 common 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 <b>Get_TabStr(.....)</b>
_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 <b>read_emcy()</b> .
_SYSTEM_SDOAC0	LONG	R	These variables form the 8 byte of the eventual SDO ABORT CODE send by a slave CANOPEN as a result of a call to the functions <b>pxco_sdodl(...)</b> or <b>pxco_sdoal(...)</b> . If the return 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 is useful for test to understand the stress of CPU in 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 the 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
<code>BIT</code>	1 bit	From 0 to 1
<code>CHAR</code>	8 bit signed	From -128 to +127
<code>UCHAR</code>	8 bit unsigned	From 0 to 255
<code>INT</code>	16 bit signed	From -32.768 to +32.767
<code>UINT</code>	16 bit unsigned	From 0 to 65.535
<code>LONG</code>	32 bit signed	From -2.147.483.648 to +2.147.483.647
<code>FLOAT</code>	64 bit (standard <code>DOUBLE</code> format IEEE 75)	From -1,79769313486232e308 to +1,79769313486232e308
<code>ARRAY</code>	Single dimension for all variable types except <code>BIT</code> type	
<code>DELEGATE</code>	Pointer to <code>FUNCTIONS</code> 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.

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	64 bit (standard DOUBLE format IEEE 75)	From -1,79769313486232e308 to +1,79769313486232e308

*The START address of FIXED area is:*

**NGM13 - NGMEVO**      **Addr= 536874496**  
**NG35**                    **Addr= 1051648**  
**NGQ - NGQx**            **Addr = 8389632**

## 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.

**WARNING: 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

Internal VAR	Bit VAR	Define	Static VAR
DEFINE4		DEFINE2-10	
Variable	Type		
DEFINE1	MyVect(4)		
DEFINE2	10		
DEFINE3	Var1*var2+(Var4/Var5)		

### 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***

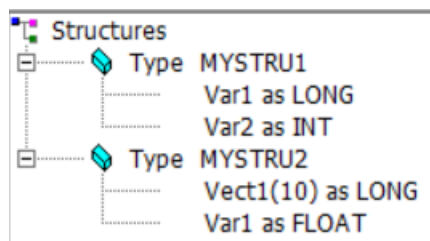
## 6.12 Text Tables

### OBSOLETE

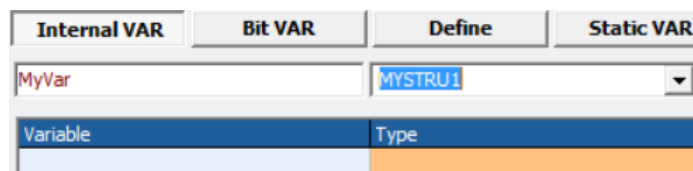
## 6.13 Structures

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.



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.



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 $a=(c+b)/(x+y)$ <i>fun(10,20)</i>
+	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 $a=(c+b)/(x+y)$ <i>fun(10,20)</i>
>	Greater	Greater than condition <i>if a&gt;b</i>
<	Less	Less than condition <i>if a&lt;b</i>
>=	Greater Equal	Greater or equal than condition <i>if a&gt;=b</i>
<=	Less Equal	Less or equal than condition <i>if a&lt;=b</i>
<>	Not equal	Not equal condition <i>if a&lt;&gt;b</i>
=	Equal	Equal condition <i>if a=b</i> or assignment $a=b$
	Logic OR	OR logic condition <i>if (a=b)    (b=c)</i> condition it's true if at least one expression is true
&&	Logic AND	AND logic condition <i>if (a=b) &amp;&amp; (b=c)</i> 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 <i>if !(a&lt;&gt;b)</i> 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 <b>85 → 01010101</b> <b>170 → 10101010</b>
>>	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 WARNING 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** *All*

#### 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

**cosec** = 1 / **Sin** (*angle*)      *' Define the angle in radians.*

*' Calculate the cosecant.*

### 8.2 COS

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

**Hardware** *All*

#### 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

**sec** = 1 / **Cos** (*angle*)      *' Define the angle in radians.*

*' Calculate the secant.*

### 8.3 SQR

Return the **square root** of a number.

**Hardware** *All*

#### 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** *All*

#### 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******ctan = 1 / Tan (angle)******' Define the angle in radians.******' Calculate the cotangent.*****8.5 ATAN**Return the **arctangent** of a number in a FLOAT value between  $-\pi/2$  and  $+\pi/2$ .**Hardware** **All****Syntax****Atan** (*number*) as floatThe 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** **All****Syntax****Asin** (*number*) as floatThe 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** **All****Syntax****Acos** (*number*) as floatThe 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  $-\pi$  and  $+\pi$ .

**Hardware** All

### 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** All

### 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**     *All*

### 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.

**WARNING: 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**

### 9.3 GOSUB-RETURN

Allow to pass the control to a SOUBROUTINE 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**..

**WARNING: 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.

**WARNING: 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:

<b>expression</b>	Mandatory. Any expression.
<b>condition_n</b>	Mandatory. It can be in two forms: <b>expression</b> , <b>expression To expression</b> . The keyword <b>To</b> specifies a range of value.
<b>instruction_n</b>	Optional. Instructions executed if the <b>expression</b> matches the <b>condition_n</b> .
<b>instructionelse</b>	Optional. Instructions executed if no <b>condition_n</b> 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]
    [instructions]
...
ExitFor
...
Next [counter]

```

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

<b>counter</b>	Mandatory. Numeric variable used as counter of iteration. It can be a BIT variable.
<b>init</b>	Mandatory. Initial value of the counter.
<b>condition</b>	Mandatory. Iteration will continue until condition is true.
<b>increment</b>	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.
<b>instructions</b>	Optional. Block of instructions to execute during the iteration.
<b>ExitFor</b>	It is used to force the stop of the iterations, the program will continue from the line immediately after the instruction <b>Next</b> .

**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:

<b>condition</b>	Mandatory. Any expression with the result True (value not zero) or False (value zero).
<b>instructions</b>	Optional. Block of instructions executed until condition is true.
<b>ExitWhile</b>	It is used to force the stop of the cycle, the program will continue from the line immediately after the instruction <b>Loop</b> .

### 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:

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

### 11.1 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.**

#### 11.1.1 SER\_SETBAUD

Programming the BaudRate of the second SERIAL PORT.

**Hardware**      *All*

##### Syntax

`SER_SETBAUD` (long Baud)

##### **Parameters**

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

#### 11.1.2 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**      *All*

##### 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*

#### 11.1.3 SER\_GETCHAR

Reads the receive buffer of the serial port. It doesn't wait for the presence of a character.

**Hardware**      *All*

##### Syntax

`SER_GETCHAR` () as int

##### **Return value:**

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

### 11.1.4 SER\_PUTCHAR

Sends a character to the serial port.

**Hardware** All

#### Syntax

`SER_PUTCHAR` (int CodeChar)

#### Parameters

**CodeChar** Code of the character to send

### 11.1.5 SER\_PUTS

Sends a string of characters to the serial port. The string must be ended with the character 0 (NULL).

**Hardware** All

**WARNING: This function can not be used in a BINARY transmission but only with ASCII transmission.**

#### Syntax

`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
```

### 11.1.6 SER\_PRINTL

Formatting print of an INTEGER value.

**Hardware** All

#### Syntax

`SER_PRINTL` (const char \*Format, long Val)

#### Parameters

**Format** String corresponding to the format to be printed

**Val** Any integer value or expression

#### Available formats

<code>#####</code>	Print a fixed number of characters	23456
<code>###.###</code>	Force the print of decimal point	123.456
<code>+#####</code>	Force the print of the sign	+1234
<code>#0.##</code>	Force the print of a ZERO	0.12
<code>X#####</code>	Print in HEXADECIMAL format	F1A3
<code>B#####</code>	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"`

### 11.1.7 SER\_PRINTF

Formatting print of a FLOAT value. It is the same as *ser\_printf* but use a float value

**Hardware**      *All*

#### **Syntax**

`SER_PRINTF` (const char \*Format, float Val)

#### **Parameters**

**Format**            String corresponding to the format to be printed

**Val**                Any integer value or expression

### 11.1.8 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**      *All*

**WARNING:** This function allows to manage BINARY and RS485 protocols.

#### **Syntax**

`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*

### 11.1.9 SER\_PUTST

Reads the state of background transmission started by *ser\_putblk*.

**Hardware**      *All*

#### **Syntax**

`SER_PUTST` () as int

#### **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`



## 11.2 MISCELLANEOUS API FUNCTIONS

### 11.2.1 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:

<b>TAU</b>	Scan time of TASK PLC in milliseconds (INTEGER value)
<b>TAUFLOAT</b>	Scan time of TASK PLC in milliseconds (FLOAT value)
<b>TAUMICRO</b>	Scan time of TASK PLC in 0.1 milliseconds

#### Example

Used variables:

**Tick long**

**Tick=Get\_timer()** *' Get initial value of timer*

**while Test\_timer(Tick,1000/TAU)** *' Waiting for 1 second*

**Loop**

### 11.2.2 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** All

#### Syntax

PAGINA (int Page)

#### Parameters

**Page** Number of the page to be loaded

### 11.2.3 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 Time)

#### Parameters

**Timer** Initial value of system timer

**Time** Time to compare

**Return value:**

**1= time elapsed**

**0=time not elapsed**

#### Example

Used variables:

**Tick long**

**Tick=Get\_timer()** *' Get initial value of timer*

**while Test\_timer(Tick,1000/TAU)** *' Waiting for 1 second*

**Loop**

### 11.2.4 ALLOC

Dynamic allocating of memory area.

**Hardware** *NG35*

#### Syntax

`ALLOC` (Long Mem) as long

#### Parameters

**Mem** Total amount of memory to be allocated

#### 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`

### 11.2.5 FREE

Frees the a memory area previously allocated with *alloc*.

**Hardware** *NG35*

#### Syntax

`Free` (Char \*Pnt)

#### Parameters

**Pnt** Pointer to the memory to free

#### Example

**Pnt As \*Char**

`Pnt=Alloc(3000)` ' Alloc 3000 bytes of memory

....

....

`Free(pnt)` ' Free the memory

### 11.2.6 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

## 11.3 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.

### 11.3.1 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(),"My Text")**    *' copy the string "My Text" in dest*

**strcpy(Dest1(),Dest())**      *'copy the string "My Text" in dest1*

### 11.3.2 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("My Text")**    *' return value 7*

### 11.3.3 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**

### 11.3.4 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(), "My ")`

`StrCat(Str(), "Text")` *'str will contain "My Text"'*

### 11.3.5 STR\_PRINTL

Converts an INTEGER variable to a characters STRING.

**Hardware** All

#### Syntax

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

#### Parameters

**Dest** Pointer to the destination string

**Format** String corresponding to the format to be printed

**Val** Any integer value or expression

#### Available formats

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

#### Example

`var=12345`

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

`var=2`

`STR_Printl("###.##", var)` *'It will be printed: ". 2"'*

`STR_Printl("###.00", var)` *'It will be printed: ".02"'*

`STR_Printl("##0.00", var)` *'It will be printed: "0.02"'*

### 11.3.6 STR\_PRINTF

Converts a FLOAT variable to a characters STRING.

**Hardware** All

#### Syntax

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

#### Parameters

**Dest** Pointer to the destination string

**Format** String corresponding to the format to be printed

**Val** Any float value or expression

**Available formats**

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

**11.4 FUNCTIONS FOR AXES INTERPOLATION**

The axis interpolation functions are contained in an OBJECT in the CLASS COBJINTERPOLA. In this chapter are described 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**.

**11.4.1 PROPERTY**

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

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

**11.4.2 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**

<b>Vel</b>	Velocity of interpolation as unit/sample
<b>mode</b>	Flag to control the stop before the next movement
	<b>mode=0</b> never stop
	<b>mode=1</b> always stop at the end of movement
	<b>mode=2</b> stop only on edge 3D ( <b>sgl3d</b> )
	<b>mode=3</b> stop only on edge 3D ( <b>sglp</b> )
<b>PntAx</b>	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 axes. The speed vector is distributed on all axes 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**

### 11.4.3 LINETO

**Lineto** interpolates the axis distributing the vector speed ONLY ON THE AXES 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

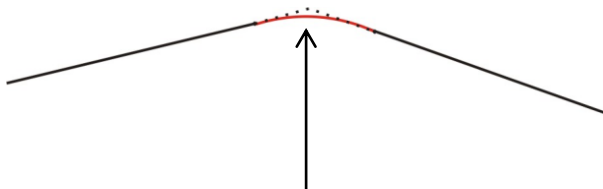
**Vel**                      Velocity of interpolation as unit/sample  
**PntAx**                    Pointer to the array of the axis position as unit

#### 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 transported 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

#### 11.4.4 ARCTO

Movement with CIRCULAR interpolation on the axes of the current WORKING PLANE. Two axes 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 (depends 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

```

#### 11.4.5 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)

```

**'Insert the following code in the TASK PLC**

```

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

```

#### 11.4.6 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

```

### 11.4.7 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.**

### 11.4.8 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.**

### 11.4.9 MOVE

Returns the state of the interpolation.

**Hardware**      *All*

**Syntax**

`.MOVE()` as char

**Return value**

<b>char</b>	<b>0</b>	No interpolation is running
	<b>1</b>	Interpolation is running

**Note**

MOVE returns 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
```

### 11.4.10 PRESET

Preset 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 PHYSICAL 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
- PRESETTING THE INTERPOLATOR WITH FUNCTION PRESET(pos())
- SETTING AGAIN THE CANOPEN AXIS IN INTERPOLATION MODE

Example with the axis X as CanOpen (object name *AxisCan*)

Used variables:

*PresetValue(3)* as long

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

## 11.5 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.

### 11.5.1 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

<b>Node</b>	Node ID of the SLAVE to which send data
<b>Index, subindex</b>	Address in the Object-Dictionary of the data to be written
<b>Len</b>	Number of bytes to send
<b>*data</b>	Pointer to the data to send

#### Return value

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

**WARNING:** 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
```

### 11.5.2 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 which 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.

**WARNING: 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
```

### 11.5.3 READ\_SDOAC

Reading of the SDO ABORT CODE sent 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()`

### 11.5.4 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 *Data)` as char

#### **Parameters**

**Id** COB-ID value  
**Len** Number of data to send  
**\*Data** 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**

### 11.5.5 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 COMMUNICATION  
**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'***11.5.6 READ\_EMICY**

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

The emergency code is written in the system array `_SYSTEM_EMICY(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_EMICY()` as char**Return value**

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

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

**WARNING**

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

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

**11.6 DATA SAVING FUNCTIONS**

All hardware are equipped with several type of memory usable for DATA SAVING. According to the type of memory (Flash, Fram, etc.) some rules are to be implemented.

For example a FLASH memory has a *maximum number of writing, block erase, etc.*

### 11.6.1 IMS\_WRITE

Writes in the internal FLASH at the address contained in ADDR, the data pointed by Punt 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,NGMEVO,NGQ,NGQx**, this function works on a FRAM memory which can be managed at single BYTE.

**Hardware** All

#### Syntax

**IMS\_WRITE**(char \*Punt, long Addr, long Nbyte) as char

#### Parameters

**Punt** 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

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

### 11.6.2 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 Punt.

**Hardware** All

#### Syntax

**IMS\_READ**(char \*Punt, long Addr, long Nbyte) as char

#### Parameters

**Punt** 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

## 11.7 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.

### 11.7.1 SET\_IP

Sets the parameters of TCP/IP protocol.

**Hardware**      **NG35,NGMEVO**

#### 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
```

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

### 11.7.2 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**      **NG35,NGMEVO**

#### 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**



### 11.7.3 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**      *NG35,NGMEVO*

#### 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
```

### 11.7.4 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**      *NG35,NGMEVO*

#### Syntax

`PXETH_RX`() as char

#### Return value

Char      Data read from the receive buffer

## 11.8 DISK DRIVER FUNCTIONS

Some devices, such as NG35, can manage files by the standard file 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 with DISK FLASH EXPANSION**

### 11.8.1 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.

### 11.8.2 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:
<b>NG35</b>	Optional internal disk	Not present

### 11.8.3 ERROR CODE

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

#### Return value

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

### 11.8.4 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
```

**11.8.5 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
```

**11.8.6 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

```

### 11.8.7 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

<b>handle</b>	Reference number of the file
<b>dati</b>	Pointer to data buffer to be written in the file
<b>len</b>	Number of bytes to be written
<b>nb</b>	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

```

### 11.8.8 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
```

**11.8.9 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
```

**11.8.10 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
```

**11.8.11 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
```

**11.8.12 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
```

**11.8.13 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

**WARNING:** 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
```

**11.8.14 OPENDIR**

Apre una cartella. È 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.

**11.8.15 READDIR**

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

**Syntax**

`.ReadDir`() as char

**Structure ObjectName\_info**

<b>.size</b>	File dimension
<b>.date</b>	File date bit 0-4 day (1-31) bit 5-8 month (1-12) bit 9-15 year (0-99)
<b>.time</b>	File time bit 5-10 minutes (0-59) bit 11-15 hour (0-23)
<b>.attrib</b>	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\_printf("00",disk\_finfo.date & 31)

    ser\_printf("/00", (disk\_finfo.date >> 5) & 15)

    ser\_printf("/####", (disk\_finfo.date >> 9) + 1980)

    ser\_printf(" 00", disk\_finfo.time >> 11)

    ser\_printf(":00", (disk\_finfo.time >> 5) & 63)

**if** disk\_finfo.attrib & ?p1?.ATTR\_DIR

        ser\_puts(" <DIR> ")

**else**

        ser\_printf(" ##### 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**

### 11.8.16 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_printf("#.###.###.### ",disk_dinfo.bfree)
ser_puts("su ")
ser_printf("#.###.###.### ",disk_dinfo.btot)
```

### 11.8.17 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:
```

### 11.8.18 TESTDRV

Tests the presence of a driver. This is the only function with **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

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



### 11.8.19 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)

## 11.9 INTERFACE FUNCTIONS FOR NG35

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

**Hardware**      **NG35**

### 11.9.1 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

<b>Input</b>	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
<b>Bit</b>	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

### 11.9.2 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

<b>Output</b>		14	13	12	11	10	9		8	7	6	5	4	3	2	1
<b>Bit</b>	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

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

### 11.9.3 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**

### 11.9.4 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).

### 11.9.5 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*

### 11.9.6 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

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

### 11.9.7 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 number
0	Card 0 (nearest NG35)
1	
2	Card 1
3	
...	...
...	
14	Card 7
15	

#### Syntax

`NG_ENC(Char Chan, Long *Val)`

#### 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`

### 11.9.8 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

**WARNING: THE INDEX INPUT IS DIFFERENTIAL, THE ON STATE ON OCCURS WHEN ON CH+ THERE IS A VOLTAGE GREATER THAN THE VOLTAGE ON CH- .**

#### Example

```
if ng_t0(0)
```

```
    ...
```

```
endif
```

### 11.9.9 NG\_RELE RELE' on NGIO

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)

**State** State of the relay:

0 OFF (contact opened)

1 ON (contact closed)

#### Example

Used variables:

**channel** UINT

**state** UINT

```
channel = 1
```

```
state = 1
```

```
ng_rele(channel,state) 'active the relay of the second channel
```

```
channel = 2
```

```
state = 0
```

```
ng_rele(channel,state) 'disactive the relay of the third channel
```

```
ng_rele(0,1) 'active the relay of the first channel
```

### 11.9.10 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= Degree

EndFunction

## 11.10 Functions for NGMsX - NGMEVO

Functions for NGMsX expansion board for NGMEVO

**Hardware**      **NGMEVO**

### 11.10.1      **NG\_DAC – Analog Outputs NGMsX**

This function allows to update the analog outputs of each channel equipped in the NGMsx

This 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 5, each expansion manages two channels:

Channel Index	Expansion number
0	Board 0 (nearest NGMEVO)
1	
2	Board 1
3	
4	Board 2
5	

#### 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*

### 11.10.2      **NG\_DAC\_CAL - CALIBRATION OF THE ANALOG OUTPUT OFFSET NGMsX**

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 5)

**Offset**    OFFSET value

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



### 11.10.3 NG\_ENC - ENCODER INPUTS

This function allows to read the quadrature encoder input of each channel equipped on the expansion card **NGMsX**. 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 5, each expansion manages two channels:

Channel Index	Expansion Number
0	Board 0 ( nearest NGMEVO)
1	
2	Board 1
3	
4	Board 2
5	

#### Syntax

**NG\_ENC**(Char Chan, Long \*Val)

#### Parameters

**Chan** Number of channel (from 0 to 5)

**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**

### 11.10.4 NG-T0 - ZERO INDEX OF ENCODER NGMsX

This function allows to read the state of the zero index input of each encoder channel equipped in the expansion card **NGMsX**. 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 5)

#### Return value:

State of the index input:

0 OFF  
1 ON

**WARNING: THE INDEX INPUT IS DIFFERENTIAL, THE ON STATE ON OCCURS WHEN ON CH+ THERE IS A VOLTAGE GREATER THAN THE VOLTAGE ON CH-.**

**Example**

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

### 11.10.5 NG\_RELE – RELE' NGMsX

This function allows to update the two RELAIS equipped in each expansion card **NGMsX**.

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 5)  
**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 Functions for Analog Outputs on NGQ

Functions for NGQ Analog Outputs

**Hardware**      **NGQ**

### 11.11.1      **NG\_DAC – Analog Outputs NGQ**

This function allows to update the analog outputs of each channel equipped in the NGQ

This expansions have 2 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 1.

**WARNING: For enable the analog outputs on NGQ, is necessary set the following property**

**ENCODER ENABLE=true** on **NGQ INIT** Object

**Syntax**

`NG_DAC(Char Chan, Long Val)`

**Parameters**

**Chan**    Number of channel (from 0 to 1)

**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*

### 11.11.2      **NG\_DAC\_CAL - CALIBRATION OF THE ANALOG OUTPUT OFFSET NGQ**

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 1)

**Offset**    OFFSET value

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

## 11.12 Functions for NGQx Analog Outputs and encoder inputs

Functions for NGQx Analog Outputs and encoder inputs

**Hardware**      **NGQx**

### 11.12.1      **NG\_DAC – Analog Outputs NGQx**

This function allows to update the analog outputs of each channel equipped in the NGQx This expansions have 2 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 1.

**WARNING: For enable the analog outputs on NGQx, is necessary set the following property**  
**ENCODER ENABLE=true** on **NGQ INIT** Object

#### Syntax

`NG_DAC(Char Chan, Long Val)`

#### Parameters

**Chan**    Number of channel (from 0 to 1)  
**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*

### 11.12.2      **NG\_DAC\_CAL - CALIBRATION OF THE ANALOG OUTPUT OFFSET NGQx**

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 1)  
**Offset**    OFFSET value

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

### 11.12.3      **NG\_ENC - ENCODER INPUTS**

This function allows to read the quadrature encoder input of each channel equipped on the expansion card **NGQx** 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 1

**WARNING: For enable the encoder inputs on NGQx, is necessary set the following property**

**ENCODER ENABLE=true on NGQ INIT Object****Syntax**

`NG_ENC(Char Chan, Long *Val)`

**Parameters**

**Chan** Number of channel (from 0 to 1)

**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`

**11.12.4 NG-T0 - ZERO INDEX OF ENCODER NGQx**

This function allows to read the state of the zero index input of each encoder channel equipped in the expansion card **NGQx**. 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 1)

**Return value:**

State of the index input:

0 OFF

1 ON

**WARNING: THE INDEX INPUT IS DIFFERENTIAL, THE ON STATE ON OCCURS WHEN ON CH+ THERE IS A VOLTAGE GREATER THAN THE VOLTAGE ON CH-.**

**Example**

`if ng_t0(0)`

...

`endif`

**11.12.5 NG\_RELE – RELE' on NGQx**

This function allows to update the two RELAIS equipped in each expansion card **NGQx**.

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 1)**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*

### 11.13 INTERFACE FUNCTIONS FOR NGM13-NGMEVO-NGQ-NGQx

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

**Hardware**            **NGM13-NGMEVO**

#### 11.13.1            **NGM13\_INIT PROPERTY-NGMEVO\_INIT PROPERTY**

The object provides a complete vision of all the software option to be set for the correct use of **NGM13-NGMEVO**.

In detail 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

<b>Link RPC port</b>	Serial port RS232 on which enable the RPC protocol to manage an HOST PC connection. These are the available options: <b>0 No RPC Link</b> <b>1 RPC on serial port SER1/PROG</b> (the DEBUG facilities will be disable and the application download must be done by manual keys BOOT/RESET of the NGM13. <b>2 RPC on serial port SER2</b> <b>The NGMEVO Board has the link RPC always activated on ETHERNET</b>
<b>Link RPC baud</b>	Baud rate to be used for RPC communication
<b>ADC enable mask</b>	Enabling mask of analog inputs. It is processed at bit. <b>Bit 0</b> Enables analog input 1 (digital input 9 is disabled) <b>Bit 1</b> Enables analog input 2 (digital input 10 is disabled) ... <b>Bit 7</b> Enables analog input 8 (digital input 16 is disabled)
<b>P-P enable mask</b>	Enabling mask of step/dir channels. It is processed at bit. <b>Bit 0</b> Enables channel 0 <b>Bit 1</b> Enables channel 1 (digital outputs 9 and 12 are disabled) <b>Bit 2</b> Enables channel 2 (digital outputs 10 and 13 are disabled) <b>Bit 3</b> Enables channel 3 (digital outputs 11 and 14 are disabled)
<b>P-P Interp. Mask</b>	Enabling mask of step/dir channel in interpolation mode. It is processed at bit. <b>Bit 0</b> Channel 0 in interpolation mode <b>Bit 1</b> Channel 1 in interpolation mode <b>Bit 2</b> Channel 2 in interpolation mode <b>Bit 3</b> Channel 3 in interpolation mode
<b>Num. NGM-IO</b>	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.
<b>L-Sync enable mask</b>	Enabling mask of L-SYNC channels <b>Bit 0</b> Enables channel 0 (digital output 1 is disabled) <b>Bit 1</b> Enables channel 1 (digital output 2 is disabled) <b>Bit 2</b> Enables channel 2 (digital output 3 is disabled) <b>Bit 3</b> Enables channel 3 (digital output 4 is disabled)
<b>L-Sync Prescaler</b>	Prescaler Value of L-SYNC channels

### 11.13.2 NGQ\_INIT PROPERTY-NGQ and NGQx

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

- Enabling of the communication protocol RPC (PROMAX proprietary), with relative baudrate
- The step/dir axes to be used in interpolation mode

#### Property

<b>Link RPC port</b>	Serial port RS232 on which enable the RPC protocol to manage an HOST PC connection. These are the available options: <b>0 No RPC Link</b> <b>1 RPC on serial port SER1/PROG</b> (the DEBUG facilities will be disable and the application download must be done by manual keys BOOT/RESET of the NGM13. <b>2 RPC on serial port SER2</b>
<b>Link RPC baud</b>	Baud rate to be used for RPC communication
<b>P-P Interp. Mask</b>	Enabling mask of step/dir channel in interpolation mode. It is processed at bit. <b>Bit 0</b> Channel 0 in interpolation mode <b>Bit 1</b> Channel 1 in interpolation mode <b>Bit 2</b> Channel 2 in interpolation mode <b>Bit 3</b> Channel 3 in interpolation mode
<b>STEP Level</b>	If value=1 the clock pulse is inverted for have more delay for pulse and dir signals Some drives STEP have a high delay time from pulse and dir commutation
<b>ENCODER Enable</b>	if Value=1 is enabled the Encoder Read in the NGQx and the analog outputs +/- 10V in the NGQ

### 11.13.3 NG\_DI - DIGITAL INPUTS NGM13 NGMEVO

This function allows to read the digital input of the **NGM13-NGMEVO** 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-NGMEVO** (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

<b>Input</b>	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
<b>Bit</b>	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



### 11.13.4 NG\_DI - DIGITAL INPUTS NGQ NGQx

This function allows to read the digital input of the **NGQ-NGQx**  
The card Index must be 0

#### Syntax

`NG_DI(Char Card)` as uint

#### Parameters

**Card** Index of the expansion card (fmust be 0)

#### Return value:

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

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

### 11.13.5 NG\_DO – DIGITAL OUTPUTS NGM13-NGMEVO

This function updates the digital output of the **NGM13-NGMEVO** 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

<b>Output</b>			14	13	12	11	10	9	8	7	6	5	4	3	2	1
<b>Bit</b>	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*

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

**Outputs from 9 to 14 of the NGM13 (NOT THE OUTPUTS OF NGMEVO) are shared with the STEP/DIR channels 1, 2 and 3.**

### 11.13.6 NG\_DO – DIGITAL OUTPUTS NGQ-NGQx

This function updates the digital output of the **NGQ-NGQx** The card Index must be 0

#### Syntax

`NG_DO(Char Card, Uint Out)`

#### Parameters

**Card** Index of the expansion card (Must be 0)

**Out** State of the outputs, if Bit is 1 the output is ACTIVE

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

### 11.13.7 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**

### 11.13.8 NGM13 NGMEVO – ANALOG INPUTS

The NGM13 is equipped with 8 analog input channels at **12 Bit**. These inputs are shared with the digital inputs. The **NGM13-NGMEVO** 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 4095).

### 11.13.9 NGQ NGQx – ANALOG INPUTS

The NGQ and NGQx, have up to 4 Analog Inputs (only ONE for NGQx). **12 Bit.**

**In THE NGQ if are ENABLED the STEP/DIR channels, only ONE analog input is available**

#### 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 4095).

### 11.14 STEP/DIR CHANNELS-NGM13-NGMEVO-NGQ-NGPP

The system **NGM13,NGMEVO,NGQ e NG-PP** 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.

The NGMEVO board can use the expansion board NGMsX with two additional channels STEP/DIR

#### WARNING

**THE STEP/DIR CHANNELS, IN THE NGPP and NGMsX CAN BE USED ONLY IN INTERPOLATION MODE**

#### 11.14.1 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 channels on board  
**NGQ** from 0 to 3 channels on board  
**NGMEVO** from 0 to 3 channels on board  
**NGMEVO** from 4 to 5 channels on First NGMsX expansion  
**NGMEVO** from 6 to 7 channels on Second NGMsX expansion  
**NGMEVO** from 8 to 9 channels on Third NGMsX expansion  
**NGPP** from 0 to 3 channels on First NGPP expansion  
**NGPP** from 4 to 7 channels on Second NGPP expansion  
 .  
 .  
**NGPP** from 28 to 31 channels on Last NGPP expansion

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

**WARNING: THE FUNCTION PP\_STEP MUST BE CALLED IN TASK PLC.**

#### 11.14.2 PP\_PRESET – PRESET OF STEP/DIR POSITION

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

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

#### Syntax

**PP\_PRESET**(Char Chan, Long Pos)

#### Parameters

**Chan** Number of the STEP/DIR channel (See PP\_STEP for channels reference)  
**Pos** Value of the preset position

#### WARNING

**TO A CORRECT PRESET OF THE AXIS FOLLOW THE INSTRUCTION DESCRIBED**

### 11.14.3 PP\_GETPOS – READING OF ACTUAL POSITION NGPP-NGMEVO

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,NGQ where to read the actual positions there are 4 system variables.

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

#### Syntax

PP\_GETPOS(Char Chan) as long

#### Parameters

**Chan** Number of the STEP/DIR channel (See PP\_STEP for channels reference)

#### Return value

**Long** Actual position x 2

### 11.14.4 READING OF ACTUAL POSITION NGM13-NGQ

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.**

**Hardware** NGM13,NGQ

\_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

### 11.14.5 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 AxisX
- 4) Declare the following GLOBAL VARIABLES:
 

<b>PosAxis</b>	Long – position of the axis
<b>RappX</b>	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):

Project Explorer	
AxisX	
Property	Value
Left	125
Top	100
Enable	1
AbVol	1
Volantino	0
Uscita	PosAxis
Vel	5000
VMax	10000
Acc	100
Dec	100
Abs	1
Vper	100
MaxVper	100
LimitSwP	9999999
LimitSwN	-9999999
LimitHwP	0
LimitHwN	0
MolVol	1
Nelem	10
QuickDec	200
LimitOn	1
FCZero	0
VZero	500
VFine	100
Senso	0

- 7) Write in TASK PLC the following CODE:  
**`pp_step(0, PosAxis * RappX)`**
- 8) Write in MAIN TASK the test code to execute a movement (example):  
**`if START_CONDITION`**  
**`AxisX.Vel=1000`**  
**`AxisX.quota=100000`**  
**`AxisX.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 channel 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.

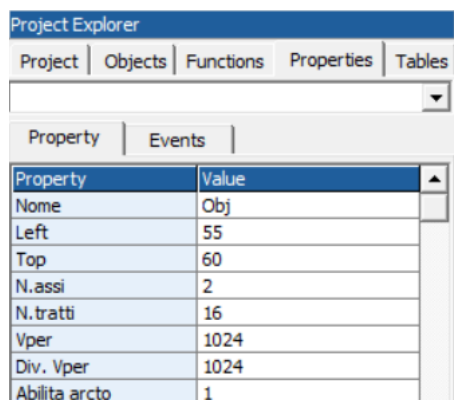
#### 11.14.6 EXAMPLE OF USING WITH THE OBJECT INTERPOLATOR

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:  
**PosAxes(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.
- 7) Set the following PROPERTY of the OBJECT INTERPOLA1 (example)



Property	Value
Nome	Obj
Left	55
Top	60
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, Obj.pc(0) * Rapp(0)) 'Asse X
pp_step(1, Obj.pc(1) * Rapp(1)) 'Axse Y
```
- 8) Write in MAIN TASK the test code to execute a movement (example):  

```
function MoveAxes(Qx as Long, Qy as Long, Vel as Long)
PosAxes (0)=Qx
PosAxes (1)=Qy
Obj.moveto(Vel, 1, PosAxes ())
endfunction
```
- 9) Call the declared function with desired parameters.

#### 11.14.7 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 example 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, Obj.pc(0) * Rapp(0)) 'AXES X
pp_step(1, Obj.pc(1) * Rapp(1)) 'AXES 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
```

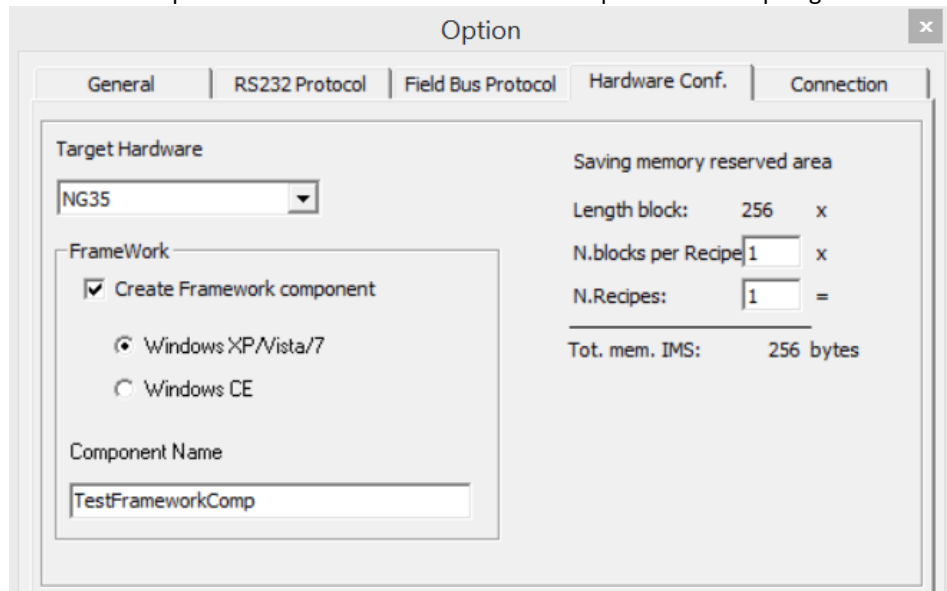
## 12 COMPONENT FOR FRAMEWORK

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.



The component can be created for system with Windows XP/VISTA,/7,8 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.

Internal VAR	Bit VAR	Define	Static VAR	VSD VAR	Fixed V
PosAxis		LONG	No	EXP <input checked="" type="checkbox"/>	Generic
Variable	Type	Shared	Export in Class		

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 the 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**).

**WARNING: If application uses the first serial port, (ex. MODBUS, etc. ) DEBUG will not work.**

### 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 VARIABLE* 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.

```

117 /
118  if AsseX_flagb=1 && AsseX.move=0
119      AsseX_flagb=0
120      gosub AsseX_OnEndMove
121  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

```

Invia a Debug

Vai a Definizione

### 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.**

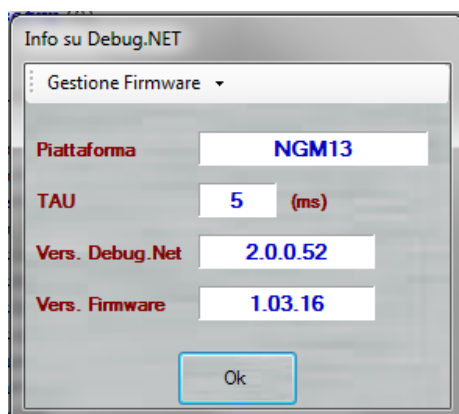


**Remove all Break-Points in the project.**



**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).



**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.*

**WARNING: 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 afterward.*

**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.*

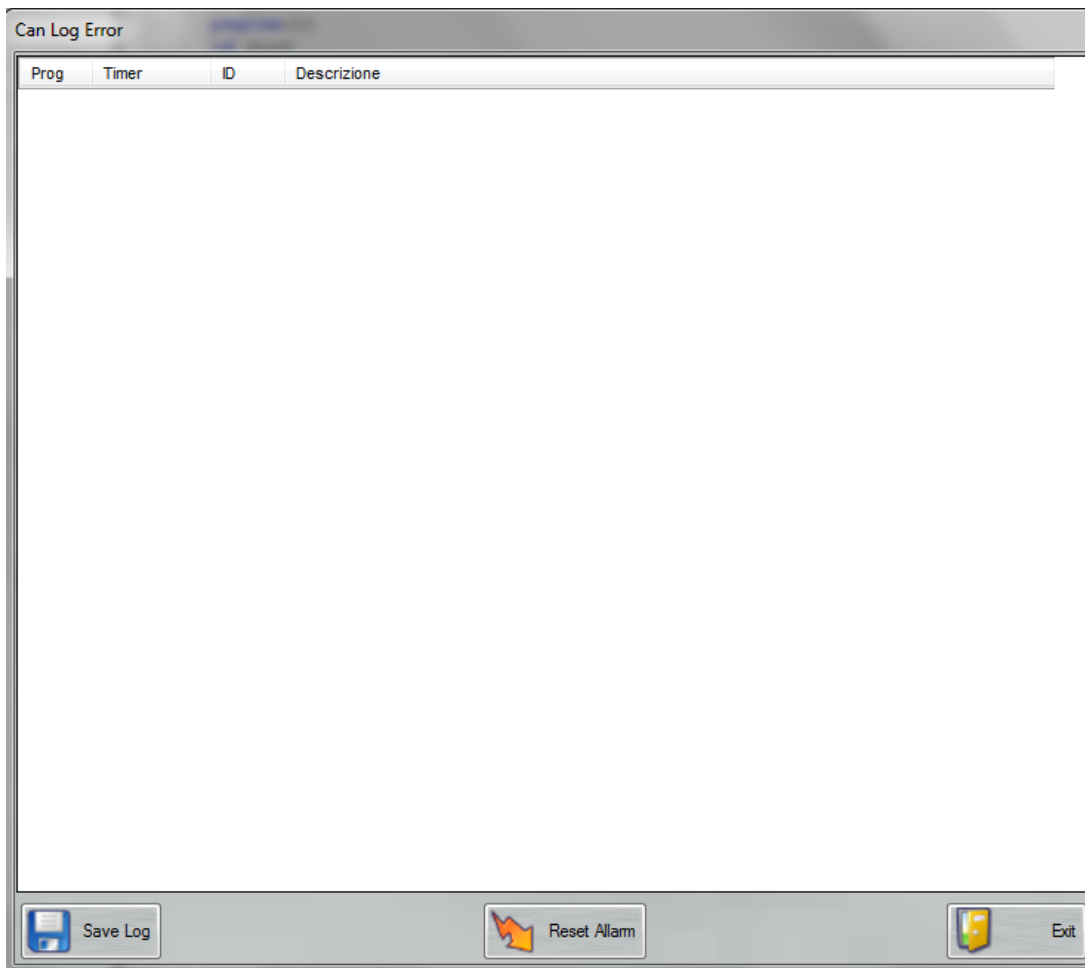
*The content of the variables WILL BE INIZIALIZED with the saved value.*

**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 displayed 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.

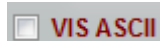
It can be useful in ETHERNET because the high speed of the protocol could create some problem to the VTB application (slowdowns).

We recommend to set the delay, when using ETHERNET to debug the application, with a value of at least one Ms.



### HEXADECIMAL/DECIMAL display

If activated the numeric value of the variables will be displayed in HEXADECIMAL format.



### 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 of 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

**WARNING:** 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.

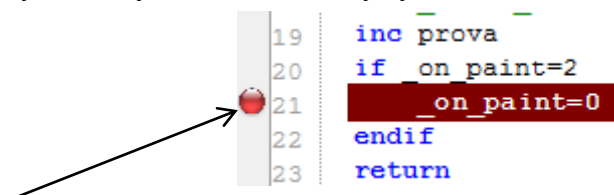
### 13.3 Insert/Remove a Break-Point

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.

**WARNING:** Break-Points can not be inserted in the hardware NGM13.

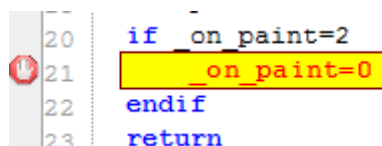
By Select File select the desired page of code.

Click with the left button of the mouse on the left of the source code window.



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.



To remove a Break-Point click again on the Break-Point

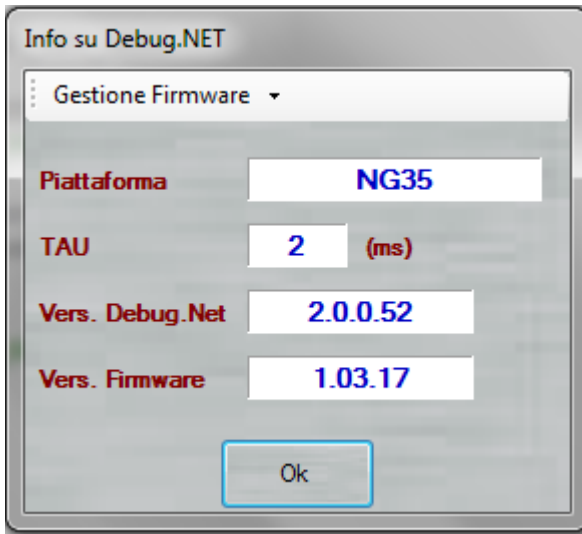
**WARNING:** When a Break-Point is reached and the program is stopped, the TASK PLC continues to run. Anyway breaking the program in CRITICAL points we can create unsafe situation operating on machine. BE CAREFUL !

### 13.4 Firmware update

With **DEBUG** application it is possible to update the **FIRMWARE** of the hardware in use.

**WARNING: FIRMWARE update can be executed only by serial port RS232.**

With the **INFO** button this window is showed:



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**.

**WARNING: Updating from file, no control of the firmware revision and compatibility with the hardware is made.**

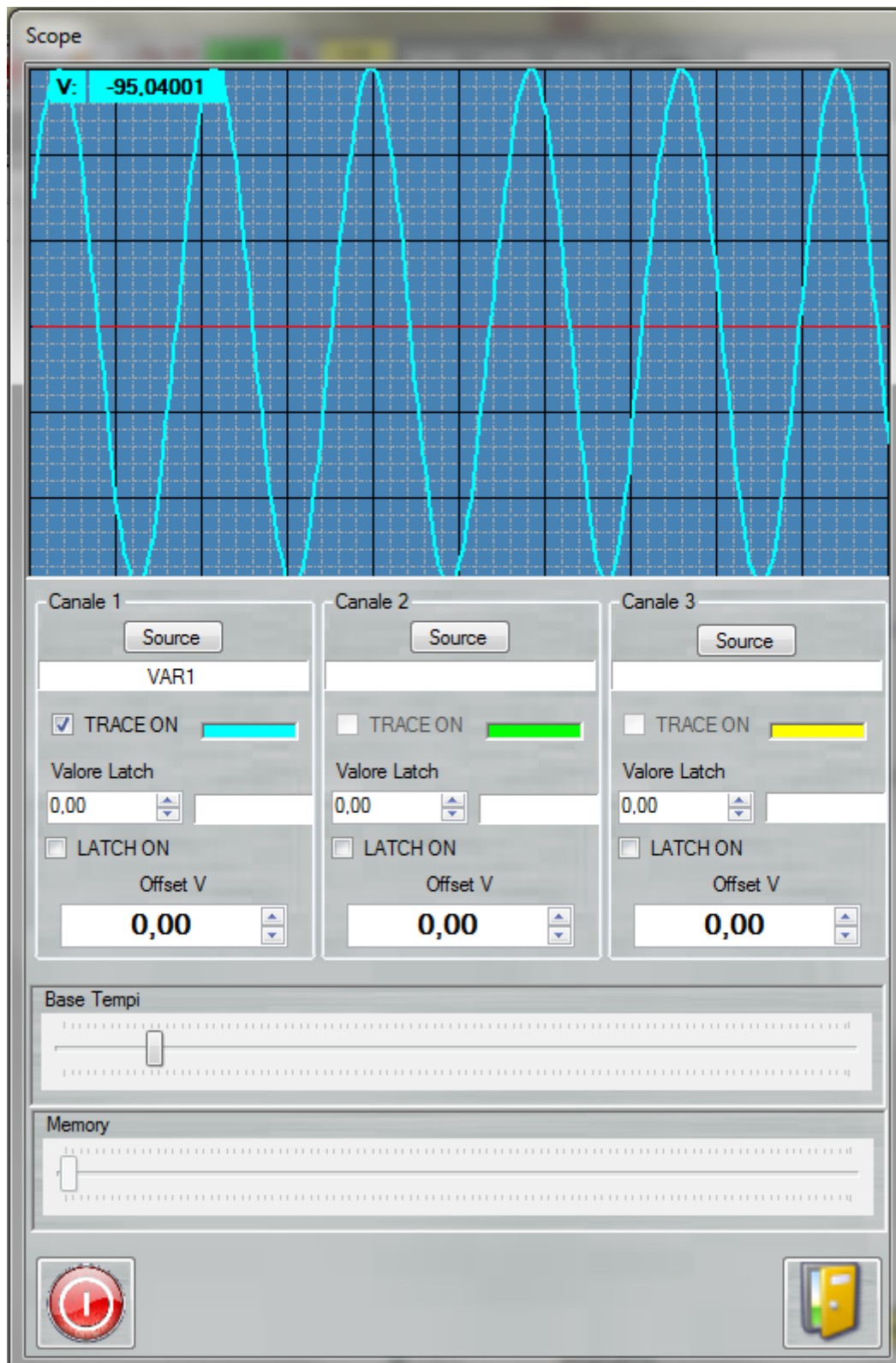
**WARNING: During the phase of updating the application are stopped but it WILL NOT BE LOST.**



### 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.





**Selects the variable to connect to a channel.**  
The variable must be in the WATCH window.

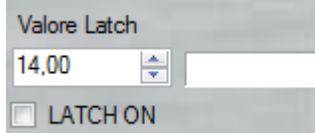
 TRACE ON

**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.**



Base Tempi

**Set the BASE-TIME for all the tracks.**

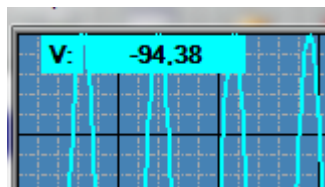


Memory

**When scope is in OFF state, it allows to scroll the track in the sampled memory.**



**Scope ON/OFF.**



**Positioning the mouse on a point of the track, the value of the variable will be showed.**

## 14 CANOPEN CONFIGURATOR

The CanOpen Configurator software, is a tool that is included in the VTB IDE package and allow to describe the CanOpen net that a Promax CNC will use.

With this software, the developer can easily describe the number of slave nodes and the various PDOs that the net will exchange.

### ***14.1 Note on the devices using***

This software can work with Promax CanOpen slaves (Old CanIo and CanAx or newer NG series) and also with third companies slaves.

The only needed is to have a standard EDS file of the device, to understand which are the properties or the objects that can be used.

For third company EDS files, ask to the producer to provide it.

### ***14.2 Note on the CanOpen configuration meaning***

CanOpen configuration initialize every slave node inside the net, with the needed synchronous PDOs (Process Data Object).

It also informs the CanOpen master on which data it will exchange with the slaves that are in the net, using the PDO communication.

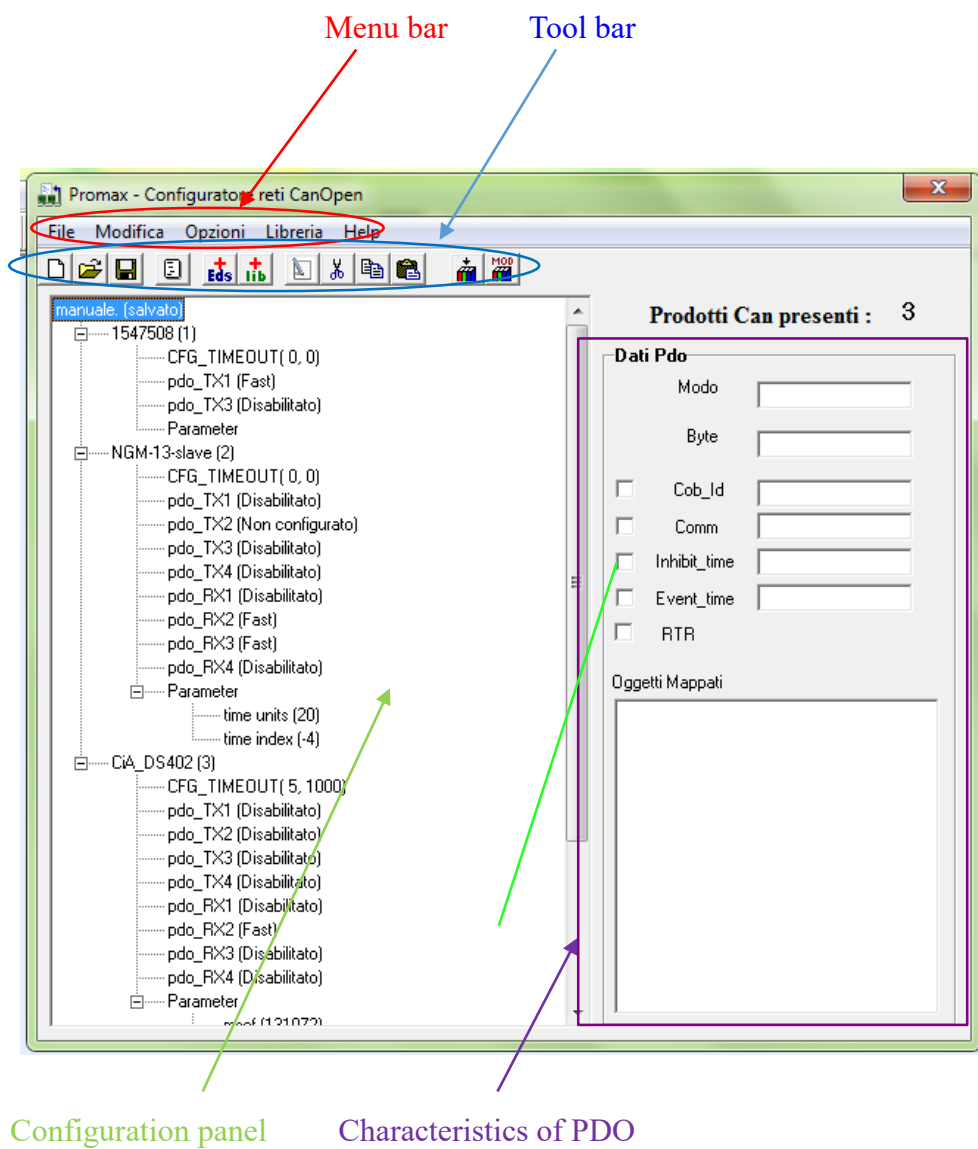
At the end of the procedure, it also makes the slaves in the “operational” state, as defined in the DS301 draft.

Data and the structures that can be configured inside every slave, depends on the device firmware, not from the CanOpen configurator software and are described in the EDS file of the device.

The net Configuration isn't linked to the master that will use it, but only on the slave devices present in the net.

An unknown slave can be also simulated with EDS file of a similar device, not supplied from the manufacturer and already present in the library, but without any guaranties of success.













### 14.3 Main interface



Can Open Configurator interface, appear as a standard Windows style application, with classic menu and tool bar. Then there is a configuration panel, that shows the actual configuration with the name of the file and the various nodes included.

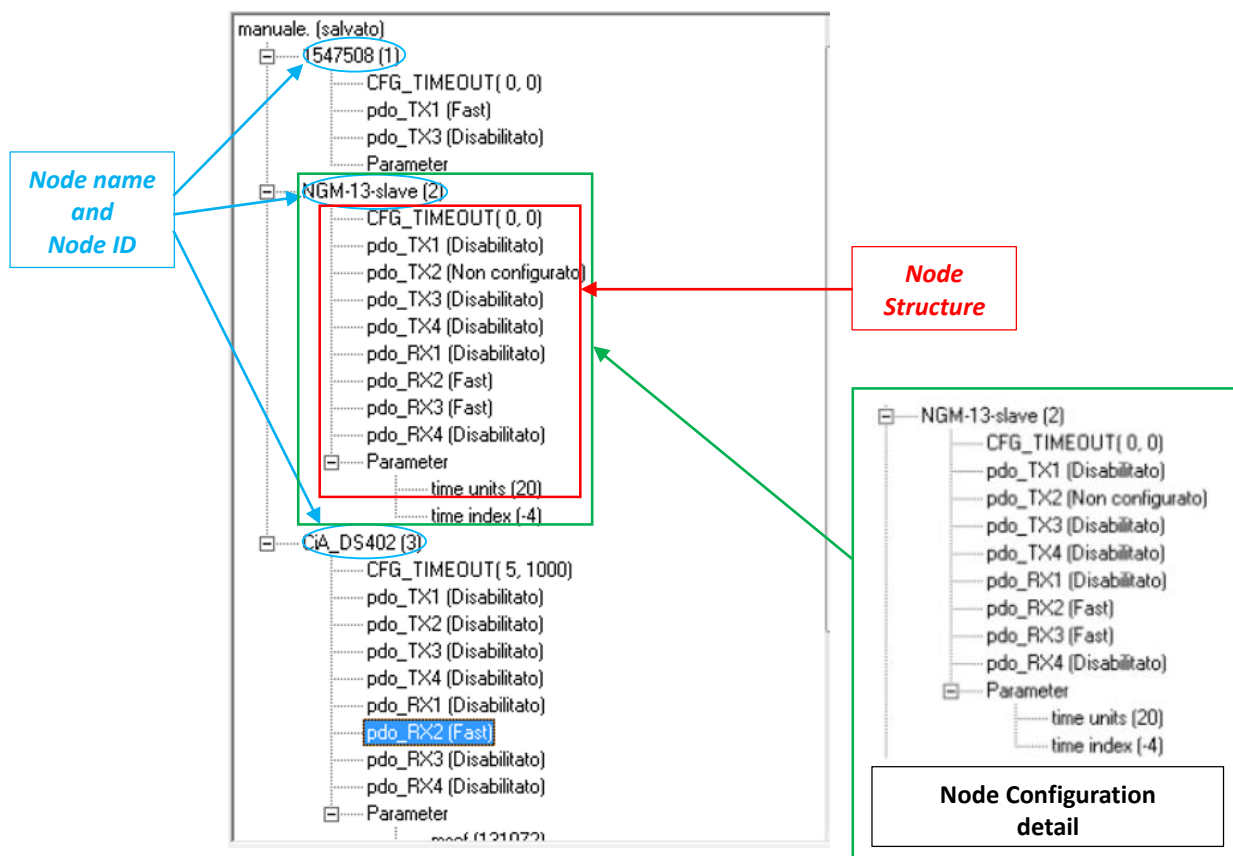
The other section can show a summary of the characteristics of the selected PDO.

### 14.3.1 Tool bar

	<b>New Configuration</b> - From menu <b>File</b> → <b>New</b> It creates a new configuration file. The previous one is closed requesting a confirm for saving.
	<b>Open Configuration</b> - From menu <b>File</b> → <b>Open</b> It opens an existing configuration.
	<b>Save Configuration</b> - From menu <b>File</b> → <b>Save</b> It saves the current project. Also create the VTB - linkable file and makes an analysis on the number of PDOs and the transmission time needed to manage them.
	<b>View File</b> – From menu <b>Opzioni</b> → <b>View File</b> Allow to see the real configuration file that will be linked in the VTB project
	<b>Add Node from EDS</b> – From menu <b>Modify</b> → <b>Add Node</b> Adds a CanOpen node, taking the basic configuration from an EDS file.
	<b>Add Node from Library</b> – From menu <b>Library</b> → <b>Add from Library</b> Adds a CanOpen node, using a ready made configuration, saved in the library.
	<b>Modify Node</b> – From menu <b>Modify</b> → <b>Modify Node</b> Allow to edit/change the node id.
	<b>Delete Node</b> – From menu <b>Modify</b> → <b>Delete Node</b> Cut out the selected node from the configuration.
	<b>Copy Node</b> – From menu <b>Modify</b> → <b>Copy Node</b> Copy the selected node to the clipboard, with all its characteristics, ready to be pasted as a new node
	<b>Paste Node</b> – From menu <b>Modify</b> → <b>Paste Node</b> Add the selected and copied node into the configuration, allowing to set a new node id.
	<b>Export in Library</b> – From menu <b>Library</b> → <b>Export in Library</b> Exports the selected node to the library, making it usable for other similar projects.
	<b>Modify Library</b> – From menu <b>Library</b> → <b>Modify Library</b> Opens the library in edit mode, for modify some of the saved node.

### 14.3.2 Configuration panel

The Configuration panel it's the real work area of the application. It shows the actual net configuration and makes possible to modify it. Every work that we must do in our file, can be made here, selecting various informations and using the tool bar or menu command.



The tree structure displays the composition of the configured CanOpen net.  
The root it's the project name and every branch represents a node.

In example, taken from a real configuration, we have:

- NGM13 it's the slave/node type;
- node id it's 2;

After, there is a very useful function: configuration time-out (see 111).

Then we can see the defined structure of the device we are using, taken from its EDS file.

Here we have a device that have four TX (transmit) and four RX (receive) PDO.

The direction of the communication is define from the slave point of view, means that TX goes from slave to master while RX from master to slave.

Every PDO is showed with its active mode (see 112).

The last information we can see, are parameters that the function will set after making the slave configuration.

### 14.3.3 Configuration Time-out

In normal situations, when the machine starts, it's usual to have the master CNC that makes initialization functions in a very short time, like the NG35 for ex., while one or more slaves starts in a longer time, like drives.

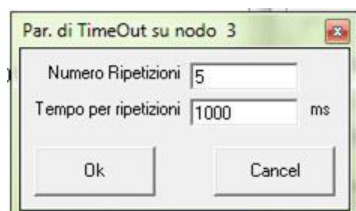
Promax system makes the net configuration as the first initialization operation, then in this case could be possible that a device will be not configured, cause it's not ready to accept master instructions. Therefore the device will not be able to exchange PDO informations, like interpolated target quotas for ex.

How can we avoid this situation?

With the Configuration time-out. Using this strategy, when the master try to set the slave and the slave doesn't answer, it will try once again after a little while, then can try again and again...

How many times the master must try to reach the slave and how many time have to wait from one and another try?

These are the data that are closed inside the round parenthesis: making a double-click, will open a form, where can be setted in the right way.



**“Numero Ripetizioni”** Repeat Number, are the times that the master will try to reach the slave.

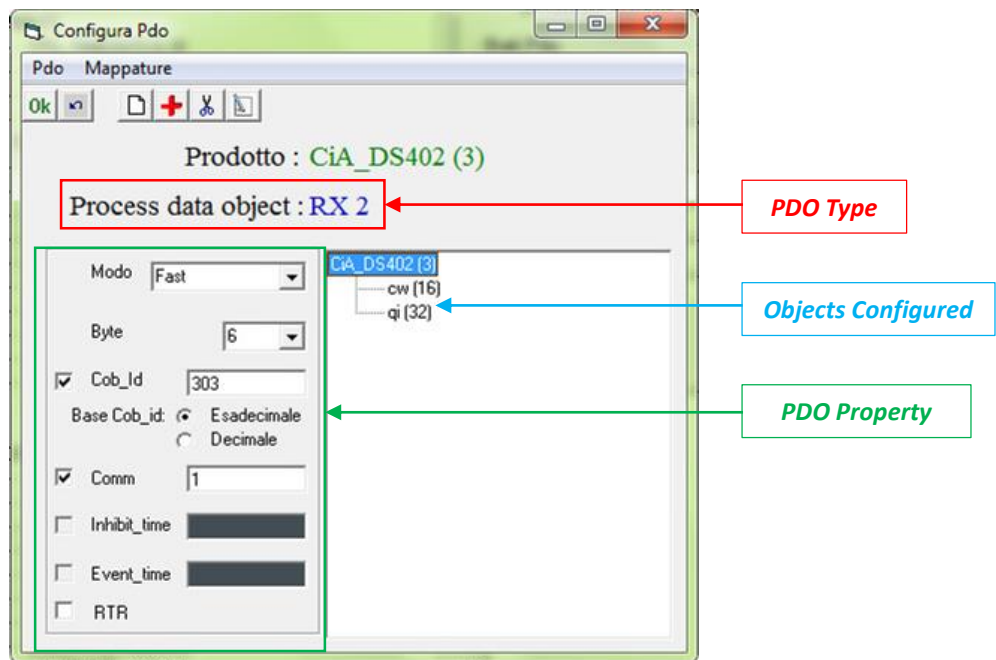
**“Tempo per ripetizioni”** Time for repeat, expressed in ms, is the time between two repetitions.

In the example showed, the master will try to reach the slave (node 3) 5 times, wait 1000ms (1sec) every time. It means that the slave must have a start time, less then 5 sec.

### 14.3.4 Change PDO configuration

Now, let's see how we can change or add a PDO configuration in a slave device.

To change the PDO configuration, we can make a double-click on the required PDO, or select “Modify → PDO Configure”

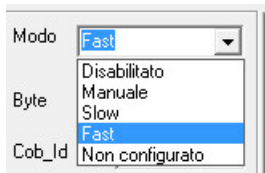


In the first row of the form that will appear, we can read the device name, then the PDO type-id.

The first property that can be setted, is the “modo”, mode, that define the PDO mode of work.

Working as “fast” the PDO will be send or received on every sample time.

Working as “slow”, can be useful to discharge the net traffic. When there is more then one slow PDO, on every sample time will be send, from master to slave or vice versa, only one of this. Means that if we have 3 slow PDO, we'll have all data updated only after 3 sample times. Clearly, this mode can be used only with low rate changing data.



*PDOs mode*

“Disabilitato”, disabled, means that the PDO will be disabled. It is useful to cut out some ready configured PDO in a device, but the possibility to do that, must be verified on the device manual.

“Non configurato”, not configured, leave the standard device PDO

configuration active. No change on this PDO, will be made by configuration function.

Last possibility is “Manuale” manual, means that the PDO declaration will be from another node, don't create a new PDO. In this case, the Cob-id of the PDO, will be the same as the node that have the right configuration. This type of work, will be explained better later (see 117)

Then, there is the possibility to set the number of byte that will be exchanged in this PDO, with a maximum of 8 as standard, the Cob-id that is the index of the PDO in the net and will be created automatically by the software. As mentioned talking about the mode, there are some cases where we have to set manually the Cob-id, but we will turn back later on it.

In the right side of the form, we can see the data that are configured to be exchanged in the actual PDO and the dimension in bits.

Here we have an object named cw 16 bits long and another object named qi 32 bits long.



With a double-click on one of it, will open a form where we can see and set the object that we want to manage. It shows the name of the object, that we can change to easy remember it, the Can Open object dictionary index and sub-index and the length, expressed as bit.

*Object details*

be 8 bytes, 64 bits, we can't exceed this length. We can use less of it, but not more than this. Second, activating a PDO, normally the application will show a configuration taken directly on the EDS file.

We can try to change it, but we have to verify if the device we are setting, have freely configurable PDOs or not.

Otherwise, our operation will be ignored, in the best case, or generate an error during the operation, in the worst one.

### 14.3.5 Parameters

In the lower part of a node-branch, there are parameters.

Parameters are device-objects that we want to write during the node initialization.

It can be useful, for ex, to set the output state when the device loses the communication with the master, or to initialize some particular function inside the slave device.

Making a double-click on the parameters branch, it's possible to add a new parameter in a form similar to the PDO configuration while making the same on a parameter, it's possible to open and change its characteristics.

The only main difference between a PDO and a parameter property, is that we have to set a value that will be written into the device.

*Parameter details*

## 14.4 PDO characteristics panel

This panel make a summary of PDO properties.

On the upper edge, it shows the number of devices that the project contains.

Then, selecting a PDO of one device, it will show all the information about it, like Mode, Cob-id, length and so on. It's only a visualization, it isn't possible to change any property on it.

The screenshot shows the VTB software interface. On the left, a tree view lists project components. Under the 'CiA\_DS402 (3)' device, the 'pdo\_RX2 (Fast)' item is selected. On the right, the 'Prodotti Can presenti : 3' panel displays the 'Dati Pdo' configuration for the selected PDO. The configuration includes: Modo (Fast), Byte (6), Cob\_Id (checked, 303), Comm (checked, 1), Inhibit\_time (unchecked, 0), Event\_time (unchecked, 0), and RTR (unchecked). Below this, the 'Oggetti Mappati' section lists 'cw [6040.0]' and 'qi [60C1.1]'.

*PDO properties summary*

## 14.5 Project management

### 14.5.1 How to add a node

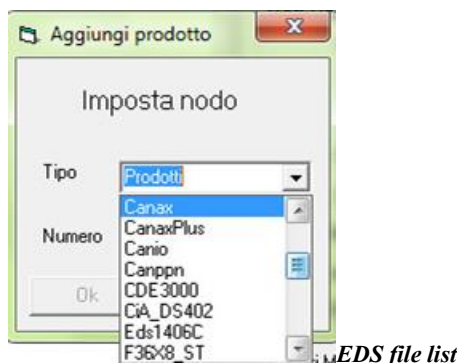
To add a node in a project, we have two main possibility:

- add a node using a EDS file, “+EDS” button;
- add a node from library;

About the using the library, we can talk about later (see 116).

Using the EDS file, we can see a list of the devices that are present in the system, where it's possible to choose the required one. To add a new device, third parties or a new Promax one as the same, just add the EDS file in the `\eds` directory inside the installation directory of Configuratore.

After, the new device will appear in the list as the filename.



After selected the device, set the node of it and confirm the operation. If there is another device on the same node, the system will show an error message.

When the new node appears in the configuration panel, it can be possible to make any type of changes, allowed from the EDS file.

### 14.5.2 Saving and verify a project

Pushing the save button, the system will save the project, giving the same name as the VTB project name, only using a specific file type.

Moreover, after saving, it'll show a form where can be found some information about the project.



*Project analysis*

It's very useful, because it shows the total number of TX and RX PDO configured in fast mode, the slow mode ones and the total time that will be taken by the communication management, depending on the baud rate.

Here we have to make a little note: in Promax system CNC, the max PDO number that can be managed by a master is 10, mixed RX and TX. Only NG35 can manage a higher number of PDO in particular cases. Refer to the VTB and NG35 to know how.

Therefore, if we have setted more then 10 PDO, the system will show a warning message and we'll must make some optimization in the project.

Also, selecting the baud rate that we have to use in the VTB application, it'll show the total time taken by the communication management, that can be compared with the sample time of the application.

If the total time exceed the sample time, the application will

not be able to manage any other instruction.

To ensure that the communication can't cause some problem on other sides of the VTB project, the communication time must not exceed the 60% of the sample time.

Choosing “salva con nome, the only difference is that the system gives the possibility to set a different name to save it.

### 14.5.3 Opening a project

Starting the Configuratore inside VTB IDE, it will automatically open the configuration related to the VTB project.

Also there is the possibility to open a different project, using the commands described above (see 109).

## 14.6 Library using

Configuratore gives the possibility to save a ready made and tested configuration, that could be used inside any other project that have to use the same particular device.

It will be created a list of ready made configurations, named library, that can be modified, selected and so on.

### 14.6.1 Save a configuration

Using the “Esporta in libreria”, export to library, button (see 109), it is possible to save a device configuration.

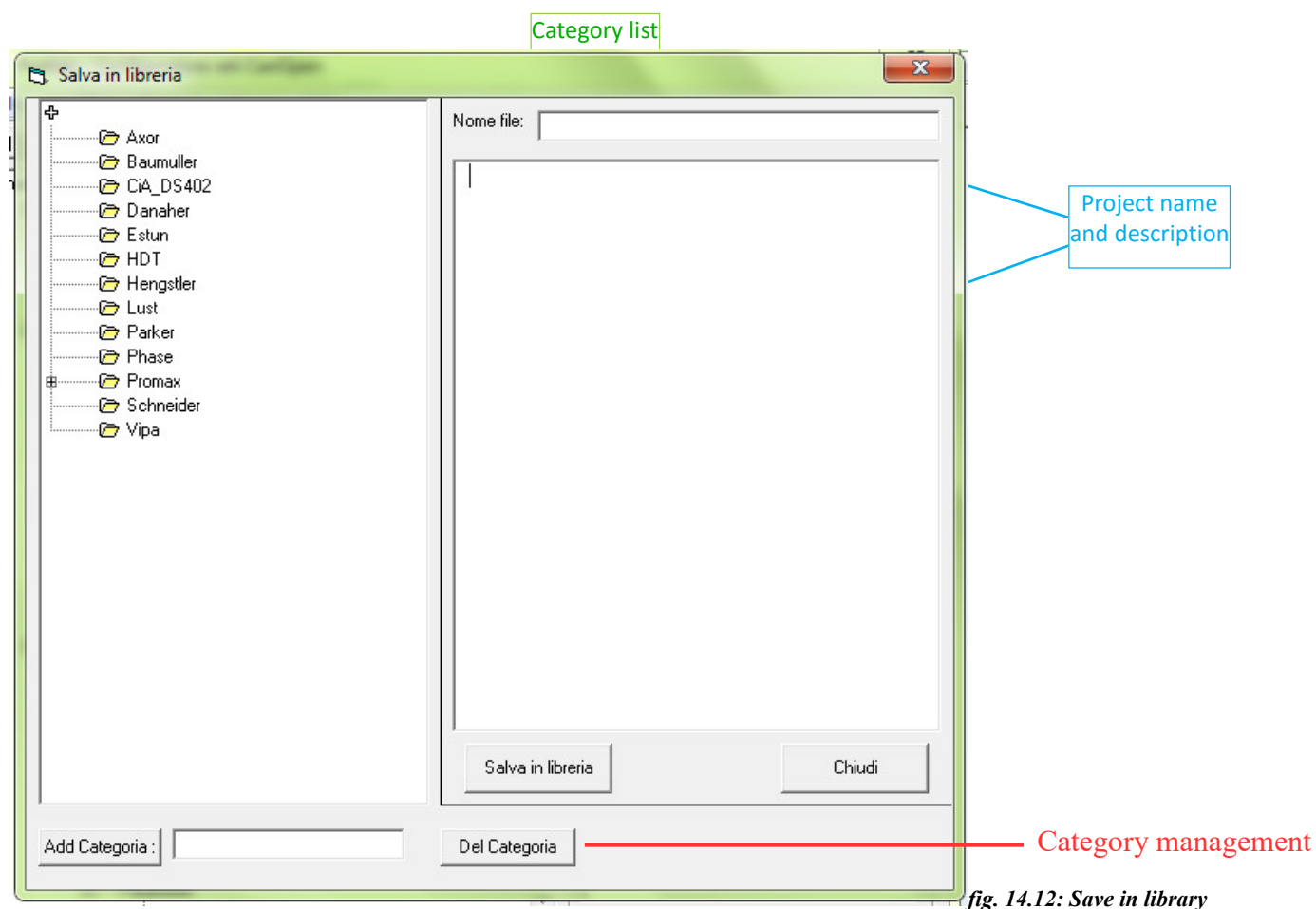


fig. 14.12: Save in library

form

The library as organized with a categories list, normally the producer name, and also sub categories, normally the device name, inside every category there are some ready made configurations.

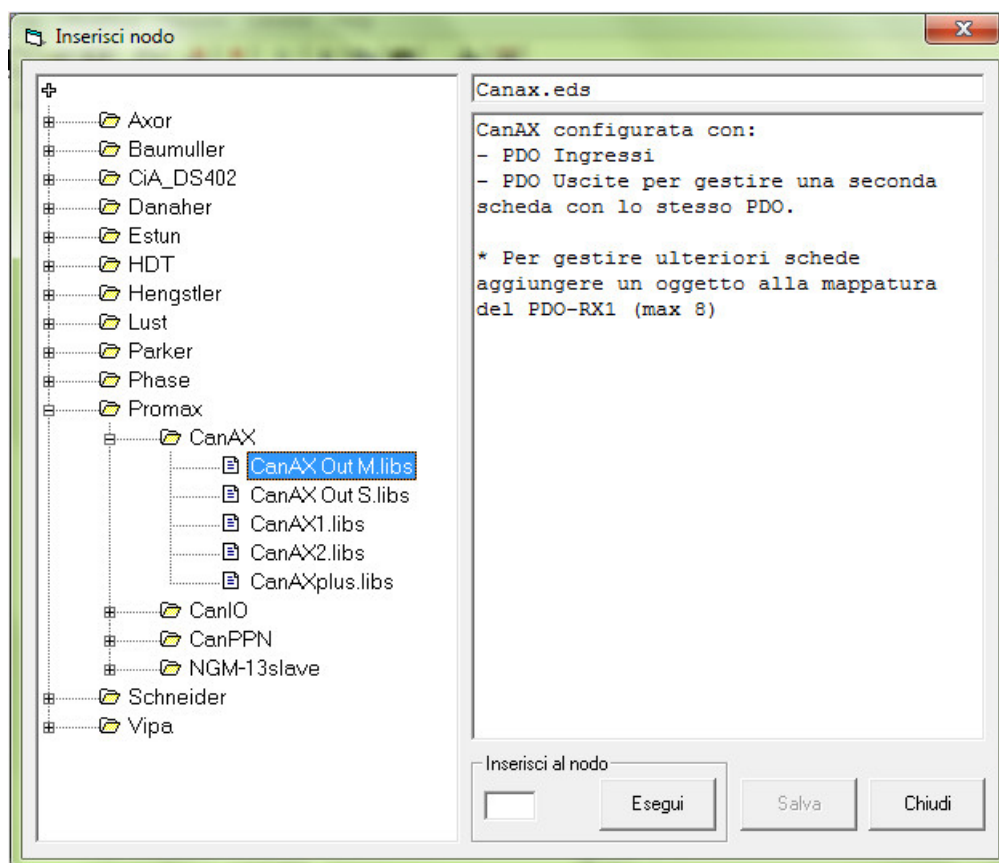
Using the “Add categoria”, add category, button and writing a new name in the text box, it's possible to create new categories.

Then the configuration can be saved with a name and a description that can be inserted in the appropriated space. “Salva in libreria”, save in library, button complete the saving operation.

### 14.6.2 Open a configuration

The “+lib” button (see 109), gives the access to the library, where a particular configuration can be selected. Every configuration will be displayed with its description, allowing to see the already configured objects or properties, for ex.

After the configuration as been inserted in the project, it can be modified as required in the normal manner.



*library form*

*fig. 14.13: Insert from*

### 14.7 Note on “packed” PDOs

A particular case of PDOs are “packed” PDO.

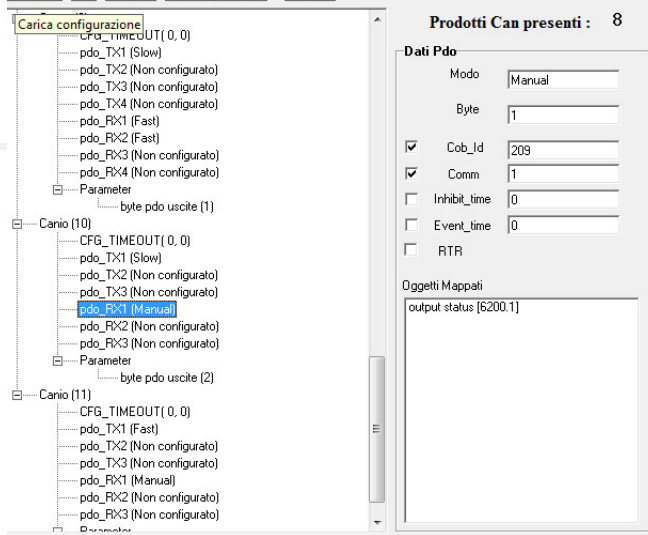
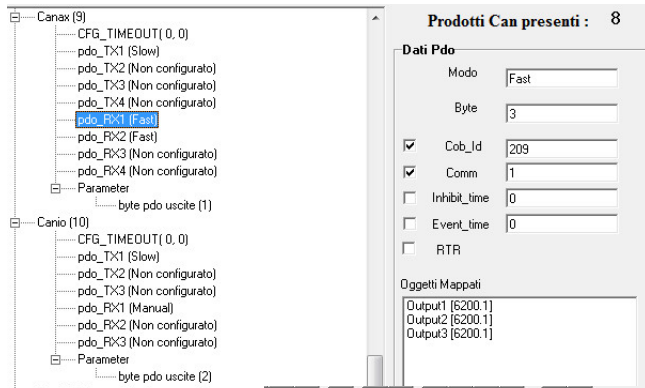
This is a useful manner to manage data useful for more than one node, interpolated quotas or output state for ex, as a single PDO. It can be used only with RX PDOs (from master to slave).

As we know, the length of the PDOs data is 8 byte, but the various objects that can be exchanged inside it, have less length, for ex interpolated quotas have 4 byte length, or Promax slaves output state is 1-byte long.

How can we fully use the entire PDO length, without any “hole” in it?

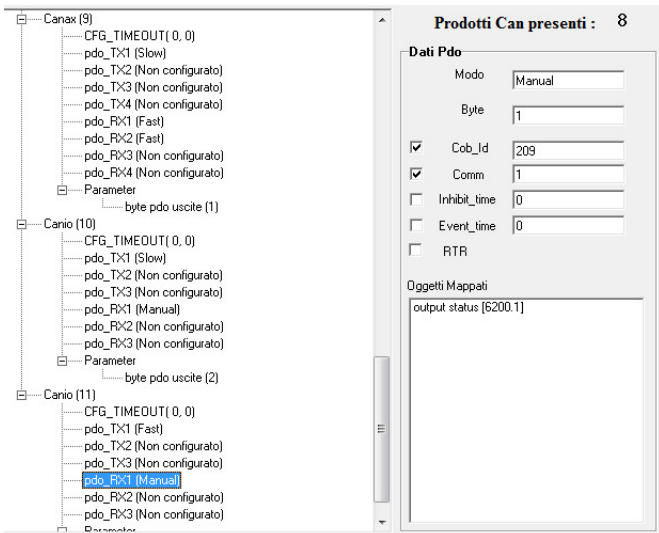
Using the packed PDO.

What does it mean? Consider the three images below,



*Declaration*

*Second node PDO declaration*



*Third node PDO declaration*

There are displayed three I/O slaves, old Promax devices named Canio and CanAx, that have the RX1 PDO configured. As we can see the first slave (CanAx, node 9) have the PDO setted to “Fast”, while the two others have the same one as “Manual”.

But have a look on the summary on the right of each image. All three PDOs have the same Cob-id, but the first have three objects configured, while the others have only an objects.

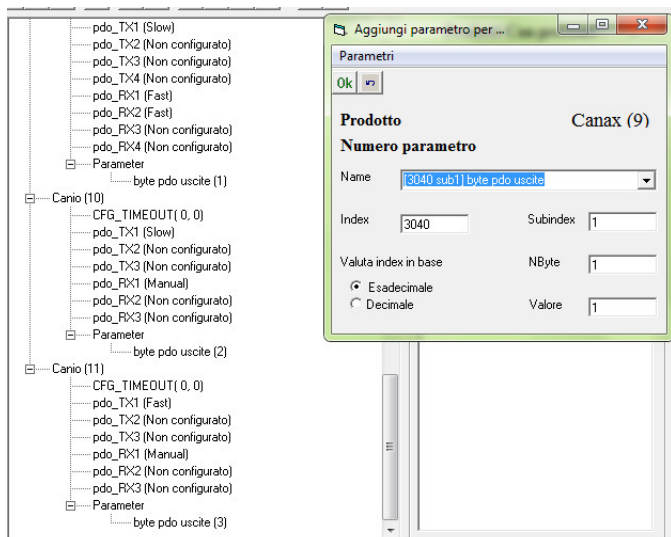
The first one is the “packed” PDO, this PDO will be read from all three slaves for the output state. But how can they split its own data from the others?

On every slave there is a parameter that specify this information.

As it is displayed in the figures above and showed in fig. 14.17, on every slave there is a parameter (“byte PDO uscite”) that specify to the devices, where in the PDO data, starts the byte that it have to use. As showed, the first slave, will have his own data starting from the first byte, the second slave starting from the second byte and so on.

Using this PDO management, we can have only a PDO for 8-byte output block, also on 8 different slaves and not 8 different PDOs, one for each one. It means low net charging.

The real PDO is defined in the first slave, where is the “Fast” mode. In the others, the “Manual” mode, tells to the



*Output byte selection parameter*

device that the PDO where will be the data, is already defined

somewhere, no new PDO have to be defined. The Cob-id have to be inserted manually as the same as “fast” PDO. The parameter tells to the device, what are its data within the PDO.

Therefore the master will send all data in one PDO, that every slaves will

read it and select his own data.

The same thing can be made with the interpolated target quotas. This data is 4-bytes long, then we can have one PDO with at least 2-devices data inside.

Not all devices supports “packed” PDOs, refer to the devices user manual to verify it.

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