Cat. No. I170E-EN-01A

# MX2/RX/LX Drive Programming

Model:
MX2 series inverter
RX series inverter
LX series inverter

# USER'S MANUAL

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## 1-Introduction

This Instruction Manual explains how to use the *Drive Programming* software for the Omron MX2/RX/LX Series Inverter. Be sure to read this Instruction Manual carefully before using *Drive Programming*, and keep it on hand for future reference.

### 1-1 Handling of this Instruction Manual

- The contents of this Instruction Manual are subject to change without prior notice.
- No part of this Instruction Manual may be reproduced in any form without the publisher's permission.
- If you find any incorrect description, missing description or have a question concerning the contents of this Instruction Manual, please contact the publisher.

### 1-2 Safety Instruction

Be sure to read this Instruction Manual, Inverter Instruction Manual, and appended documents thoroughly before using *Drive Programming* and the inverter.

Before creating user programs for the inverter, also refer to the Inverter Instruction Manual and configuration software (CX-Drive) Instruction Manual for the necessary related Knowledge, and ensure you understand and follow all safety information, precautions, and operating and handling instructions for the correct use of the inverter.

Always use the inverter strictly within the range of specifications described in the Inverter Instruction Manual and correctly implement maintenance and inspection to prevent fault from occurring.

When using the inverter together with optional products, also read the manuals for those products. Note that this Instruction Manual and the manual for each optional product to be used should be delivered to the end user of the inverter.

In this instruction manual you can find WARNINGS along the instructions

WARNING: Indicates that incorrect handling may cause hazardous situation, which may result in serious personal injury or death.



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**1-3 Preparation and System configuration**

To create user programs with Drive Programming function of the inverter, you must prepare the following devices and software:

(1) MX2, RX, LX inverter
(2) Personal computer (PC) (Windows System)
-32-bit PC: Windows XP SP3, Windows Vista (any service pack) and Windows 7.
-64-bit PC: Windows Vista (any service pack) and Windows 7.

(3) Optional programming software CX-Drive
· MX2 inverter: CX-Drive version 2.0x or higher.
· RX inverter: CX-Drive 2.3x or higher.
· LX inverter: CX-Drive 2.5x or higher.

(4) Optional PC-inverter connection cable. For MX2 it is a USB cable, For RX/LX, the converter cable USB to RJ-45 is required. Item codes:
- Item code name for MX2: **AX-CUSBM002-E**
- Item code name for RX/LX (2 option cables):
· **3G3AX-PCACN2**, or
· **USB CONVERTERCABLE**

LX:
· Inverter port: Operator-connection port RJ-45.
RX:
· Inverter port: Operator-connection port RJ-45.
MX2:
· Inverter port: USB connector.

The following figure shows the basic system configuration for programming.

| Optional programming software CX-Drive | Windows personal computer | Optional PC-Inverter cable | MX2, RX or LX Inverter |
|---|---|---|---|
| <br>MX2: CX-Drive 2.0x or higher<br>RX: CX-Drive 2.3x or higher<br>LX: CX-Drive 2.5x or higher | | - For MX2:<br>· **AX-CUSBM002-E**<br><br>- For RX/LX (2 options):<br>· **3G3AX-PCACN2**, or<br>· **USB-CONVERTERCABLE** | |

Install CX-Drive on your Windows personal computer, and connect the personal computer to the inverter (MX2, RX or LX) via the PC-inverter connection cable.

After completing these preparations, you can operate Drive Programming Editor to create a user program and download it to the inverter.

The table below lists the main functions of Drive Programming Editor.

| Function | Description |
|---|---|
| Programming Editor | Supports the input, editing, saving, reading, and printing of user programs |
| Compilation | Compile and edit a user program |
| Downloading and uploading | Downloads a user program to the inverter<br>Uploads a user program from the inverter |



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## 2- Specifications

The table below lists the programming-related specifications of the Drive Programming function.

| Item | | Specification | | |
|---|---|---|---|---|
| Language specification | Programming language | Flow Chart and Text language | | |
| | Input device | Windows personal computer (OS: Windows XP-SP3**,** Windows Vista, Windows 7) | | |
| | Max. program size | 1024steps (The internal storage capacity of the inverter is 1024 steps or 6 Kilobytes.) | | |
| | Programming support function (programming software) | -Editing (on Windows) / - Display (on Windows)<br>-Program syntax check (on Windows)<br>-Downloading, uploading, and full clearance of program | | |
| | Execution format | Execution by interpreter in an execution cycle of 2ms per instruction (possible subroutine call with nesting in up to 8 layers) | | |
| Input/output-related functions | External input | Contact Signal | Program run signal input | 24v open – collector input (using intelligent input terminals) |
| | | | | RX: Assign to the PRG terminal / Always run |
| | | | | MX2: Assign to the PRG terminal / Always run |
| | | | Multifunction terminals | RX: Up to 8 terminals (X(00) to X(07)) |
| | | | | MX2: Up to 8 terminals (X(00) to X(07)) |
| | | General-purpose analog input | | XA(0): 0 to 10V (O terminal) |
| | | | | XA(1): 4 to 20mA (OI terminal) |
| | | | | XA(2): 0 to 10V (O2 terminal) (Only RX) |
| | External Output | General-purpose output terminal | | RX: Up to 6 terminals (Y(00) to Y(05)) |
| | | | | MX2: Up to 3 terminals (Y(00) to Y(02)) |
| | | General-purpose analog output | | YA (0): Assignable to the **EO** terminal (FM terminal for RX) |
| | | | | YA (1): Assignable to the AM terminal |
| | | | | YA (2): Assignable to the AMI terminal (Only RX) |
| Reserved Words | Instructions | (1) Program control instructions<br>-Loop (For) / - Unconditional branching (Goto) / -Time control (Wait)<br>-Conditional branching (If Then, Ifs Then Else, Select Case, Until, and While)<br>-Subroutine (call, sub) / - Others (Entry, End, Sub, End Sub, Inc, and Dec)<br>(2) Arithmetic instructions<br>-Arithmetic operation (+,-,*,/) / - Remainder (Mod) / -Substitution (=)<br>-Absolute value (Abs) / - Logic operation (Or, And, Xor, and Not)<br>(3) Input/Output control<br>-General-purpose input/output (bit input, word input, bit output, and word output)<br>- Reading of inverter input terminal.<br>(4) Timer control: - Delay operation / -Timer control<br>(5) Parameter control: - Rewriting of parameters by reselecting code on the operator's display | | |
| | Number of variables | User-defined variable | | U (00) to U (31) (32 variables) |
| | | Internal user variable | | UL (00) to UL (07) (8 variables) |
| | | Set frequency | | SET-Freq |
| | | Acceleration time | | ACCEL |
| | | Deceleration time | | DECEL |
| | | Monitoring variable | | FM, Iout, Dir, PID-FB, F-CNV, Tmon, Vout, Power, RUN-Time, ON-Time, PlsCnt (Only RX), POS, STATUS, DCV, ERR CNT, ERR(1), ERR(2), ERR(3), ERR(4), ERR(5), and ERR(6) |
| | | Bit commands | | FW, RV, CF1, CF2,CF3,CF4,JG,DB,SET,TCH,FRS,EXT,USP,CS,SFT, AT, RS, STA, STP, F/R, PID, PIDC, UP, DWN, UDC, OPE, SF1, SF2, SF3, SF4, SF5, SF6, SF7, OLR, TL, TRQ1-2, BOK, LAC, PCLR, ADD, F-TM, ATR, KHC, AHD, CP1-3, ORL, ORG, SPD, RS485, HLD, ROK, DISP. |
| | | Output Functions | | RUN, FA1, FA2, OL, OD, AL, FA3, OTQ, UV, TRQ, RNT, ONT, THM, BRK, BER, ZS, DSE, POK, FA4, FA5, OL2, ODc, OIDc, FBV, NDc, LOG1, LOG2, LOG3, WAC, WAF, FR, OHF, LOC, IRDY, FWR, RVR, MJA, WCO, WCOI, FREF, REF, SETM, EDM. |
| | | General-purpose input contact | | LX : X(00) to X(06) (7 contacts) |
| | | | | RX : X (00) to X (07) (8 contacts) |
| | | | | MX2 : X(00) to X(07) (8 contacts) |
| | | Extended IO option input contact | | LX : X(07) to X(11) (3G3AX-EIO-E expansion card) |
| | | | | RX : ----- |
| | | | | MX2 : ----- |
| | | General-purpose output contact | | LX : Y(00) to Y(03) (4 contacts) |
| | | | | RX :Y(00) to Y(05) (6 contacts) |
| | | | | MX2 : Y(00) to Y(02) (3 contacts) |
| | | Extended output contact | | LX: Y(04) to Y(06) (3G3AX-EIO-E expansion card) |
| | | | | MX2 & RX : ----- |
| | | Internal user contact | | UB (00) to UB (7) (8 contacts) |
| | | Internal timer contact | | TD (0) to TD (7) (8 counter contacts) |
| | | Internal timer counter | | TC (0) to TC (7) (8 counters) |
| | | Inverter input/output | | Specification by code on the remote operator's display |
| | | User Monitor | | UMon(00) to UMon(02) (3 user monitors) |
| | | User trip | | Makes the inverter trip (10 trips) |



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### 3- Drive Programming Editor

Drive Programming Editor allows the user to design drive programs in an intuitive way. CX-Drive provides a way to create drive programs, compile them, transfer them to and from the drive, start and stop their execution, and other related tasks.
You can open this function by clicking on Drive Programming in the workspace of a drive which supports it, or selecting *Program* | *Program Editor* from the Drive menu, or with the CX-Drive toolbar button .

Please create a new CX-Drive File by clicking on the menu *File* | *New*. The New Drive window will appear (Image 1). Select the Drive Type and press OK button. Then it will appear on the Workspace (Image 2).

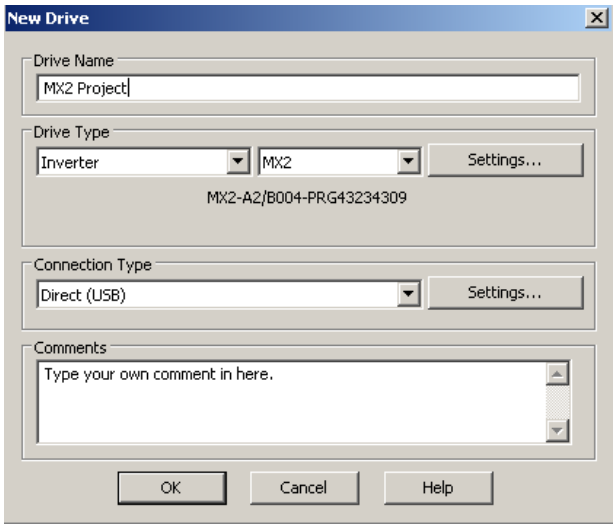



Image 1- New Drive window

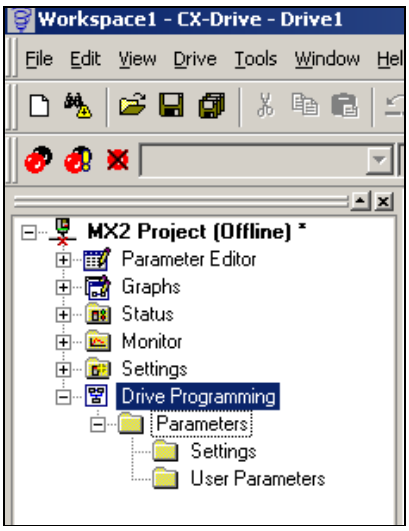
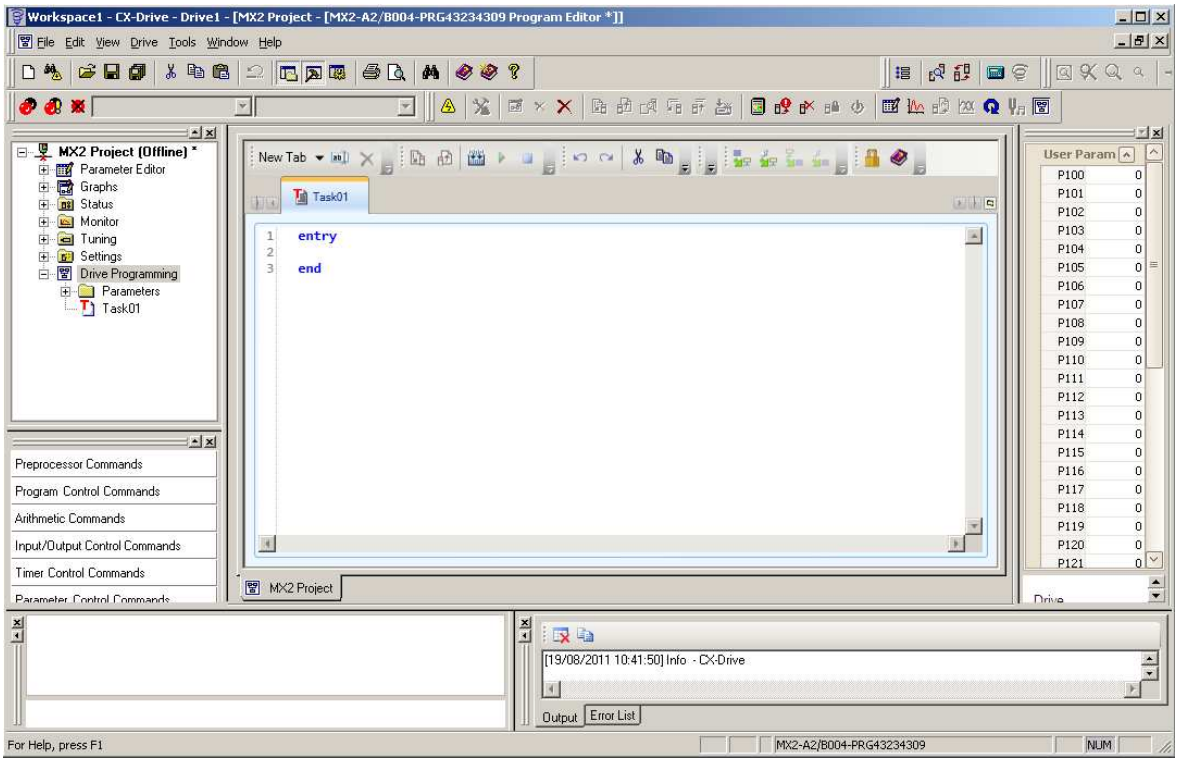



Image 2- CX-Drive Workspace

Making double-click to the Drive Programming option, the Drive Programming Editor will appear.



### 3-1 Saving and loading programs

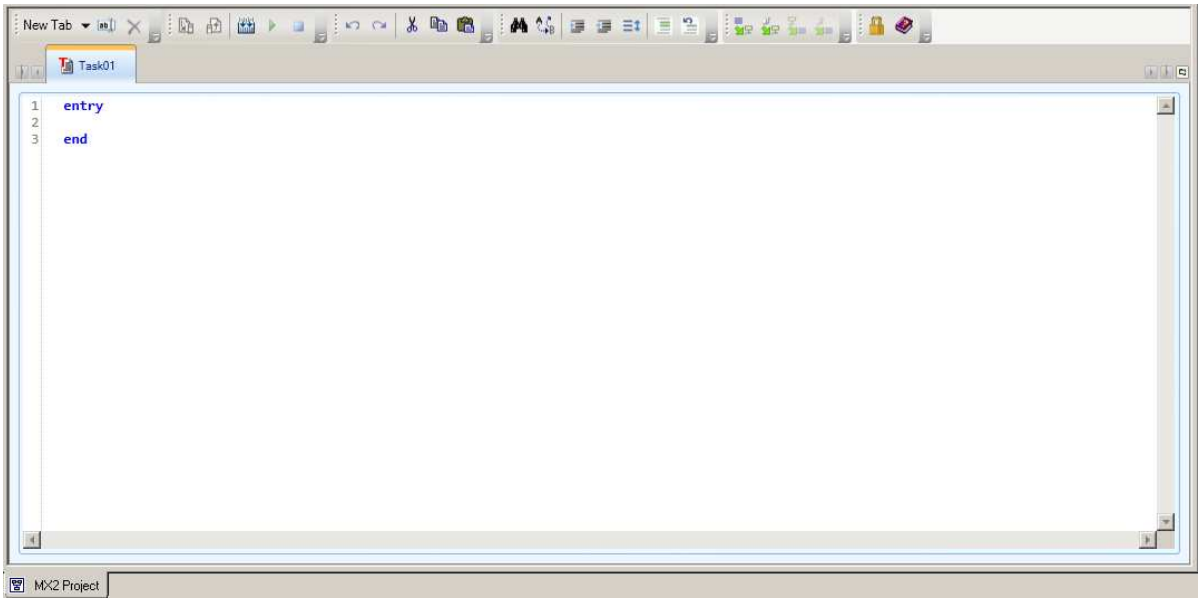
A drive program is automatically saved when the drive document which contains it is saved.
When a CX-Drive document is opened, the drive program which it contains, if any, is automatically loaded. You can display it by opening the Program Editor.

Alternatively, you can export a drive program, to save it independently of other drive information. To do so, use the *Program* | *Export Program* command in the Drive menu. Enter the name of the file to be used. The file will be saved with extension *driveprogram*.

A drive program can be imported with the *Program* | *Import Program* command in the Drive menu.

### 3-2 Editor

The Program Editor is the main window of the Drive Programming function.




The window area consists of a toolbar with common commands, and a designer area where the program is displayed as a text.

### 3-3 Toolbar

The Program Editor window contains the following commands:

#### 3-3-1 Common Commands

| Commands | Image | Description |
|---|---|---|
| | | |
| **New task (Flowchart)** | | It allows creating a new Flowchart task for the program, up to the maximum number of tasks allowed. Tasks are parts of the program which are executed independently of each other. |
| **New Task (Text)** | | It allows creating a new Text task for the program, up to the maximum number of tasks allowed. Tasks are parts of the program which are executed independently of each other. |
| **New Subroutine (Flowchart)** | | It allows creating a new Flowchart subroutine. A subroutine is a part of the program which is called from a task. |
| **New Subroutine (Text)** | | It allows creating a new Text subroutine. A subroutine is a part of the program which is called from a task. |
| **Rename Current Task/Subroutine** | | It allows to rename the current task/subroutine. |
| **Delete Current Tab** | | It deletes the current Task or Subroutine. |
| **Undo** | | It reverts the latest change. |
| **Redo** | | It recovers the most recently undone change. |
| **Transfer to Drive** | | It compiles the program and, if there are no errors, transfer it to the drive. |
| **Transfer from Drive** | | It transfers the program from the drive to the Program Editor. |
| **Start** | | It starts the program in the drive. CX-Drive will first compare it with the program currently being edited, to make sure that they are the same. If they differ, the program will not be started. |
| **Stop** | | It stops the program in the drive. This action is done regardless of whether the program in the drive is the same that in the program designer. |
| **Compile** | | It compiles the program which is currently being designed. Compile errors and warnings will be reported as tool tips in the blocks in the flowchart. |
| **Password** | | It allows you to set, change or remove the program password. |
| **Help** | | It displays the Drive Programming help. |



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### 3-3-2 Commands for the Flowchart Editor

| Commands | Image | Description |
|---|---|---|
| **Zoom in** | | It increases the zoom level. |
| **Zoom out** | | It decreases the zoom level. |
| **Zoom Reset** | | It restores the zoom to its initial value. |
| **Select Mode** | | It allows the user to select one or more elements of the program, by click-and-drag with the mouse cursor. This mode is active by default. |
| **Pan Mode** | | It allows the user to move the extent of the view.<br>in any direction while keeping the same scale, by click-and-drag. |
| **Horizontal Align Left** | | It aligns horizontally the left sides of the selected blocks. |
| **Horizontal Align Middle** | | It aligns horizontally the middles of the selected blocks. |
| **Horizontal Align Right** | | It aligns horizontally the right sides of the currently selected blocks. |
| **Vertical Align Top** | | It aligns vertically the top sides of the selected blocks. |
| **Vertical Align Middle** | | It aligns vertically the middles of the selected blocks. |
| **Vertical Align Bottom** |  | It aligns the bottom sides of the selected blocks. |
| **Orientation** | | It selects a preferred orientation for connecting the blocks. |
| **Auto-arrange** | | It arranges the elements of the flowchart automatically in the currently selected orientation. |
| **Show contacts** | | It toggles display/hide of the contacts of the blocks, which are placeholders for the beginning and ending of arrow connections |
| **Show** | | It allows you to select a display style of the program. (Text only, Icon Only, Icon and Text, or Name, Icon and Arguments). |

### 3-3-3 Commands for the Text Editor

| Commands | Image | Description |
|---|---|---|
| **Find** | | It finds a text on the program code. |
| **Replace** | | It replaces a text on the program code. |
| **Increment Indentation** | | It increases the indentation of the selected text. |
| **Decrement Indentation** | | It decreases the indentation of the selected text. |
| **Format Selected Text** | | It applies the automatic formatting to the selected text. |
| **Comment Selected Text** | | It transforms the selected rows of text to comments. |
| **Uncomment Selected Text** | | It uncomments the selected rows of text. |
| **Convert Text to Flowchart** | | It converts current text Task/Subroutine to Flowchart |
| **Convert whole program to Flowchart** | | It converts whole program to Flowchart. |
| **Convert Flowchart to Text** | | It converts current Flowchart Task/Subroutine to text. |
| **Convert whole Program to Text** | | It converts whole program to Text. |



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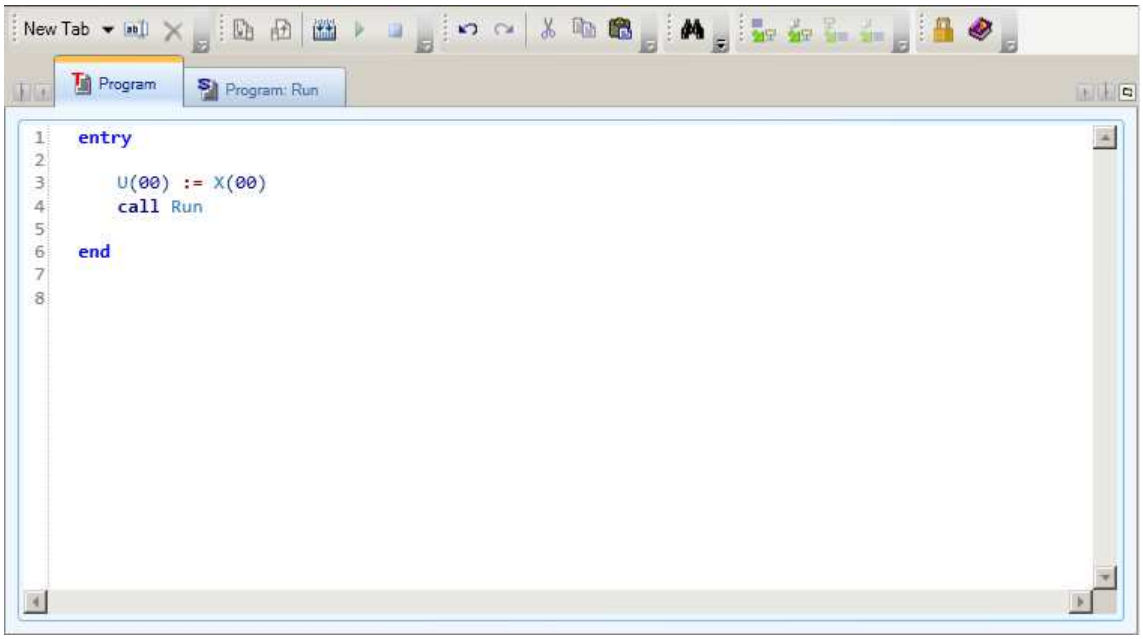
### 3-4 Shortcut Keys

The following Keyboard shortcuts can be applied to the designer area.

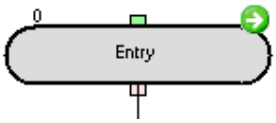
· Ctrl + X: Cut
· Ctrl + C: Copy
· Ctrl + V: Paste
· Ctrl + Z: Undo
· Ctrl + Y: Redo
· Ctrl + A: Select All
· Ctrl + F: Find function
· Ctrl + L: Lock
· Ctrl + P: Pin
· Ctrl + Space: Code Snippets
· Tab: Select Next
· Shift + Tab: Select Previous
· Arrow Keys: Move selected element
· Home, End, Page Up, Page Down: Navigate through the graph
· +: Zoom In
· -: Zoom Out

### 3-5 Designer Area

The designer area will display the current design of the program.




This area may have different pages, organized in tabs. Each tab is either a Task or a Subroutine in Flowchart or Text.
The designer is created with one default tab, which is a Text Task.
When a program is compiled without error, an icon with a circled green arrow highlights the starting point of each Flow chart task.

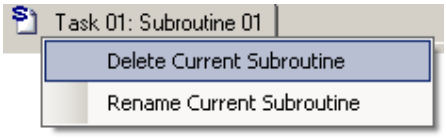



With text editor, the output window will indicate if the program is compiled successfully.

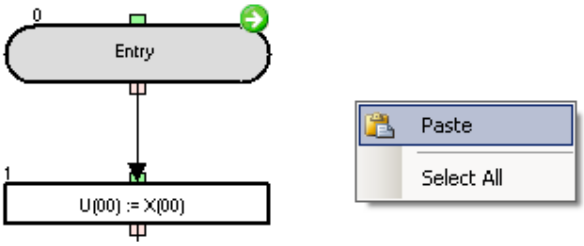
For programs compiled with errors, a red icon with an exclamation mark identifies the erroneous blocks with Flowchart Editor. Placing the mouse on the error icon displays the compile error, which can also be seen in the Error List.

With Text Editor, in the output window will appear the errors of the program. The error will be showed with a red underline.

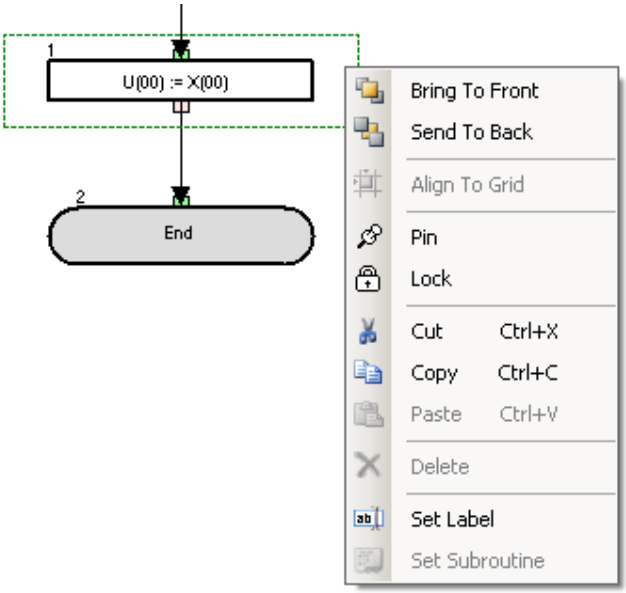
A Task or Subroutine may be deleted, or renamed, by right-clicking on the tab title.



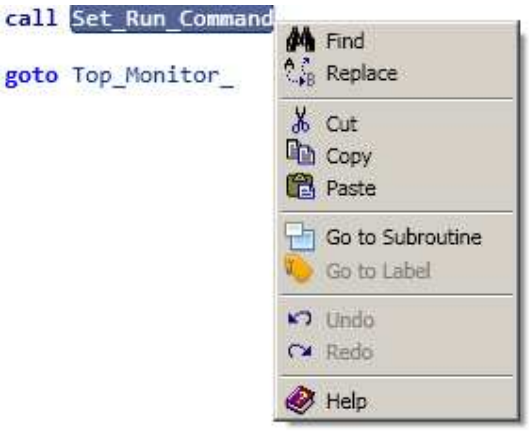

Right-clicking on an area which is not an element of the flowchart displays a popup menu which allows you to Paste elements that you have previously copied, or to select all the elements.




Right-clicking on a Flowchart block element it shows a popup menu with more options



Right-clicking on a selected Text it shows a popup menu with more options




The available menu commands with Flowchart editor are described below.

• *Bring To Front* places the element graphically in front of other elements.
• *Send To Back* places the element graphically in back of other elements.
• Pin fixes the element to its current position in the graph. It will not be moved in click-and-drag operations.
• Lock acts like Pin and, besides, sets the properties of the element as read-only.
• Cut deletes the element and saves it in the clipboard, for further pasting.
• Copy saves the element in the clipboard, for further pasting.
• Paste puts the contents previously copied in the clipboard into the design area. Note that after copying elements, you can also paste them to other contexts; for example, as images in a Microsoft Office application.

The available menu commands with Text editor are described below.

• *Find looks for* the selected text on the program code.
• *Replace* exchange the selected text on the program code.
• *Cut* deletes the element and saves it in the clipboard, for further pasting.
• *Copy* saves the element in the clipboard, for further pasting.
• *Paste* puts the contents previously copied in the clipboard into the design area. Note that after copying text elements, you can also paste them to other contexts; for example, as text in a Microsoft Office application.
• *Go to Subroutine* jumps to the selected text subroutine
• *Go to Label* jumps to the selected text label.
• *Undo* reverts the latest change.
• *Redo* recovers the most recently undone change.
• *Help* will show the CX-Drive help.



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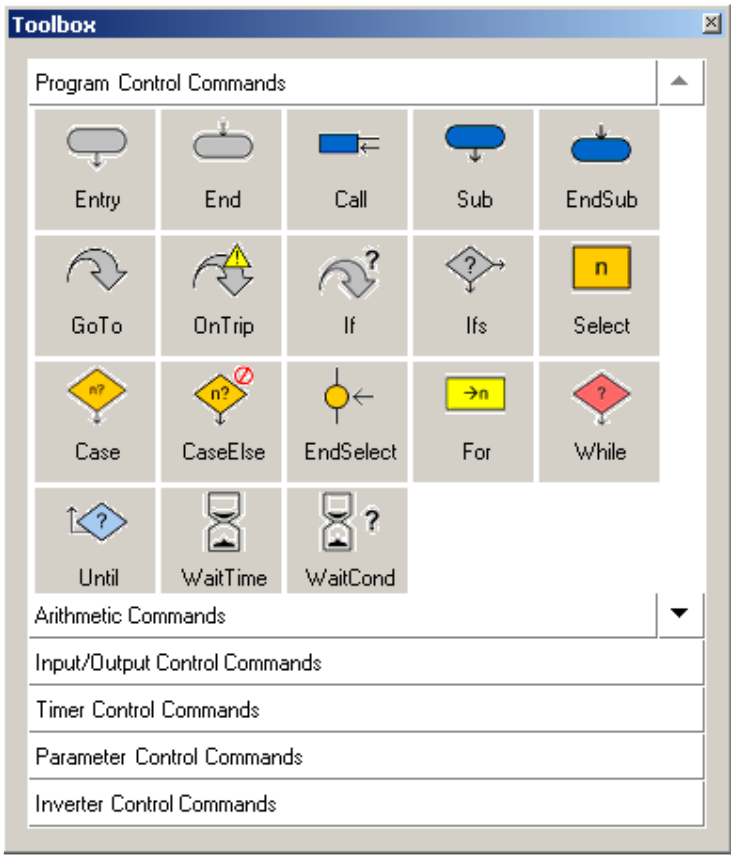
### 3-6 Toolbox window

The Toolbox window allows you to add blocks to the Program Designer by drag and drop. It displays the blocks supported for a particular drive, organized in categories.

The Toolbox is displayed when Drive Programming is entered. You can also show or hide it by clicking on *Drive Programming* | Toolbox in the View menu.

The Toolbox is displayed by default docked at the rightmost side of CX-Drive. You can resize it as needed to better display its elements. Also, you can toggle its docking by right clicking near the window's edges.




You can also choose its displays style by right-clicking on it with the mouse. Three styles are available: Large Icons, Small Icons, and List. In any style, placing the mouse cursor on a block will show a short help text for it.

Click on any category title to display the blocks which belong to that category.



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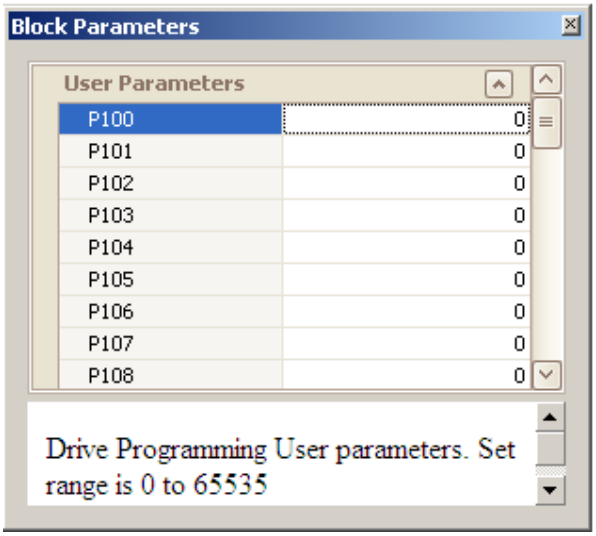
### 3-7 Block Parameters window

The Block Parameters window allows the user to edit drive program parameters which act as variables of the program. The parameters are organized in categories. Block parameters is displayed when Drive Programming is entered. You can also show or hide it by clicking on Drive Programming | Block Parameters in the View menu.

Block Parameters is displayed by default docked at the rightmost side of CX-Drive. You can resize it as needed to better display its elements. Also, you can toggle its docking by right clicking near the window's edges.



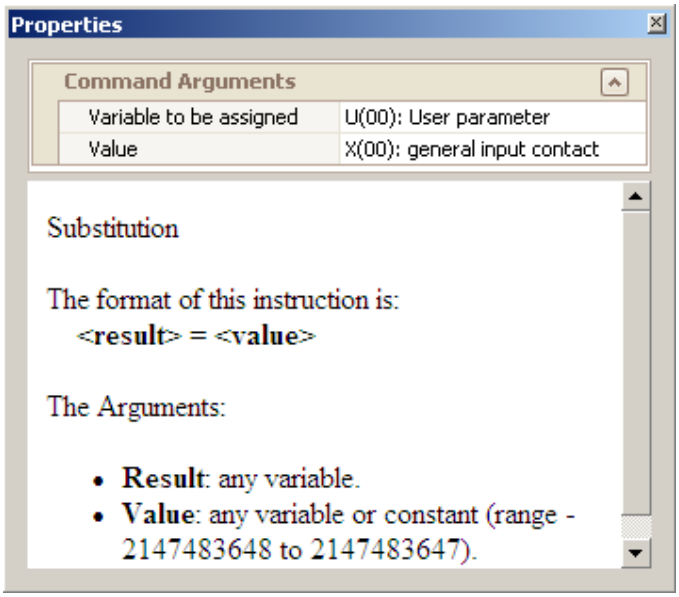

To change the value of a block parameter, place the cursor at its row and click on the edition box to the right of its name. Enter the new value. CX-Drive will warn you if the value exceeds the valid range. At the lower part of the window, a help text for the block parameters is displayed.

### 3-8 Properties window

The Properties window allows the user to edit the properties of the drive program block which is currently selected in the Flowchart Program Editor.

Properties are displayed when Drive Programming is entered. You can also show or hide it by clicking on Drive Programming | Properties in the View menu.

Properties are displayed by default docked at the rightmost side of CX-Drive. You can resize it as needed to better display its elements. Also, you can toggle its docking by right clicking near the window's edges.




To change one block command argument, place the cursor at its row and click on the edition box to the right of its name.

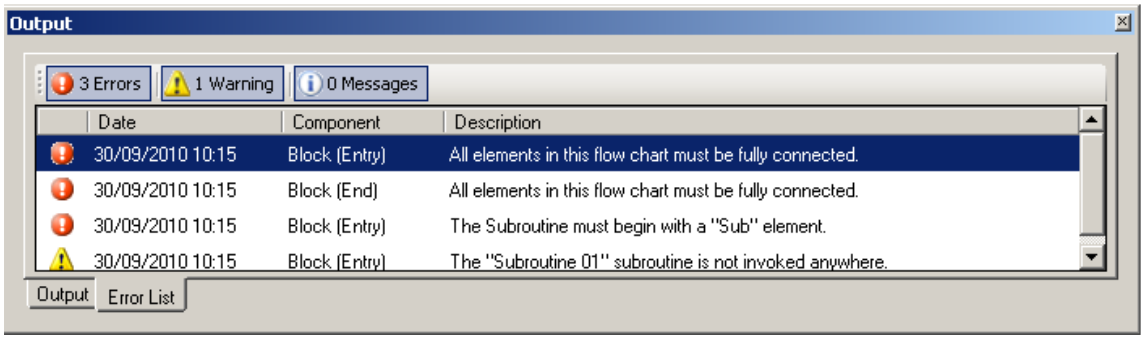
▪ If the block argument has options, a second click of the mouse will unfold the available options for you to select.

▪ If the block argument does not have options, clicking on its current value will enable you to change it by typing a new one. CX-Drive will warn you if the value exceeds the valid range.

If the block argument can have both an option and a custom value, clicking on the unfold sign at the right of the cell will unfold the available options, whereas clicking anywhere in the cell text, you will be able to edit it.

### 3-9 Output window

It shows the compilation errors and warnings of the currently edited drive program after it is compiled. Errors will prevent the program to be correctly compiled. Warnings will allow compilation, but advise customer of abnormal conditions.




· The

*Error(s)* button toggles displaying error in the list.

· The

*Warning(s)* button toggles displaying warnings in the list.

· The

*Message(s)* button toggles displaying informative message in the list.

Messages in the list show the following information:

· Date: The date and time when the error was generated.
· Component: Identifies the element with an error.
· Description: The text of the error or warning message.

The list is automatically cleared every time a Compile is done.

### 3-10 Creating a program with Flowchart Editor

Follow the steps described below to create a drive program.

1. Open the Program Editor. The Drive Programming auxiliary windows (Toolbox, Block Parameters, Properties and Error List) will be displayed automatically.
2. Select on the menu “New Tab”  New Task (flowchart) or New Subroutine(flowchart).
3. Drag each block of the program from the Toolbox window to the Flowchart Program Editor.
4. After dragging a block, edit its properties by clicking on it and edit the arguments in the Properties window.
5. Connect the blocks accordingly.
6. Edit the drive program variables in the Block Parameters window.
7. You may now compile the program, transfer it to the drive, export it, etc.

Alternatively, you can connect to a drive which has a program and transfer it, following the simple steps described below.

1. Open the Program Editor. The auxiliary Drive Programming windows (Toolbox, Block Parameters and Properties) will be displayed automatically.
2. Click the Transfer from Drive button in the program Editor Toolbar. The program will be transferred from the drive and automatically displayed in the Program Editor designer area.
3. You may now edit the program, compile it, transfer it to the drive, export it, etc.

When a drive program is present, you can also transfer it from and to the drive with the Transfer to Drive and Transfer from Drive buttons of the CX-Drive toolbar. In this case, a message dialog will ask you whether to transfer the parameters, the program or both.



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### 3-11 Creating a program with Text Editor

Follow the steps described below to create a drive program:

1. Open the program Editor. The Drive Programming auxiliary windows (Toolbox, Block Parameters, Properties and Error List) will be displayed automatically.
2. The three ways to edit the code are:
    a. Manual typing
    b. Calling code snippets (Ctrl+Space)
    c. Drag & Drop commands from Toolbox window (like Flowchart Editor)
3. You may now compile the program, transfer it to the drive, export it, etc.

Note 1: The Text editor is supported from CX-Drive version 2.50.

Note 2: Text and Flowchart Tasks/Subroutines can be used simultaneously within same program.

### 3-12 Run a program

After transferring the program to the device, you can run the program with the command or setting the next inverter parameters:

· MX2 and RX:

| Parameter | Value | Description |
|---|---|---|
| A017 – Drive Programming Selection | 0: Disabling | Drive Programming program will be stopped. |
| | 1: PRG terminal | Drive Programming program will run by digital input. Set terminal to PRG function. |
| | 2: Always | Drive Programming program will be always running. |

· LX:

| Parameter | Value | Description |
|---|---|---|
| F025 – Drive Programming function selection | 0: Disable | Drive Programming program will be disabled. |
| | 1: Enable | Drive Programming program will be Enabled. |
| F026 – Drive Programming RUN trigger selection | 0: TRM('PRG' terminal) | Drive Programming program will run by terminal. Set terminal to PRG function. |
| | 1: PARAM (setting F025=enable) | Drive Programming program will run if F025 = enable |

### 3-13 Comments – Text Editor

Only it is possible to add comments in a Text editor task or subroutine. To add a comment in a text line press the character "'" follow by the comment. The comment will be showed in a green color format.

· **Examples**

```
#alias global Time as U(10)              ' Timer time
#alias global AppTimer as TD(0)          ' Timer TD(0)
#alias global Temp as UL(05)             ' Internal use
```

Note: if you convert a Text task or subroutine to Flowchart, the comments will be lost.



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### 3-14 #Alias definition – Text Editor

Only it is possible to define an alias in a Text editor task and before the command '**entry**'. It's not possible to define an alias in a subroutine.

Alias definitions are user-friendly names given to parameters, variables, commands and numerical constants. There are two kinds of alias definition:

· **Local alias**: this alias definition only can be used in the current task and his subroutines, and not in the other tasks and subroutines that the program could have. This is the format for a local alias definition inside a task:

```
#alias local alias as replacement
```

· **Examples**

```
#alias local ON_ as 1
#alias local OFF_ as 0
#alias local Monitor_1 as UMon(0)
#alias local MaxFrequency as A004
#alias local Count as U(00)
#alias local Dummy_1 as UL(00)

entry
```

· **Global alias**: this alias definition can be used in all the tasks and subroutines. This is the format for a global alias definition:

```
#alias global alias as replacement
```

· **Examples**

```
#alias global const_100 as 100
#alias global Acceleration as F002
#alias global Deceleration as F003
#alias global Time as U(10)
#alias global AppTimer as TD(0)
#alias global Temp as UL(05)

entry
```

**Note 1:** The alias will be lost converting a text task/subroutine to flowchart. CX-Drive will show a message advising about this issue.
**Note 2**: reserved words cannot be used like an alias. A compilation error will appear.

### 3-15 #Region definition – Text Editor

A Region definition can be only defined in a text task or subroutine. It is useful to define code regions to clarify the program code.

**· Examples**

```
#region Alias

#alias global const_100 as 100
#alias global Acceleration as F002
#alias global Deceleration as F003
#alias global Time as U(10)
#alias global AppTimer as TD(0)
#alias global Temp as UL(05)

#endregion

entry

#region Start

    Acceleration := const_100
    Deceleration := const_100
    Time := 500
    Temp := 10000
    set-freq := 1000
    Fw := 1

#endregion

#region Stop...
```

### 3-16 Conversion from Flowchart to Text

There are two options to convert from Flowchart program to text:

| Command | Image | Description |
|---|---|---|
| **Convert Flowchart to text** | | It converts current Flowchart Task/Subroutine to text. |
| **Convert whole program to text** | | It converts whole program to text. |

### 3-17 Conversion from Text to Flowchart

There are two option to convert from Text to Flowchart:

| Command | Image | Description |
|---|---|---|
| **Convert Text to Flowchart** | | It converts current Flowchart Task/Subroutine to text. |
| **Convert whole program to Flowchart** | | It converts whole program to text. |



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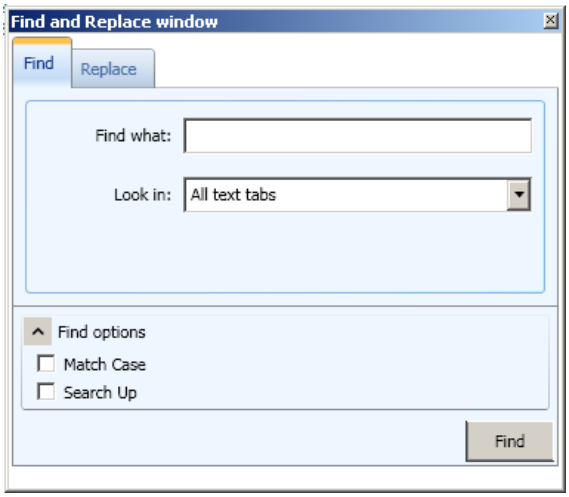
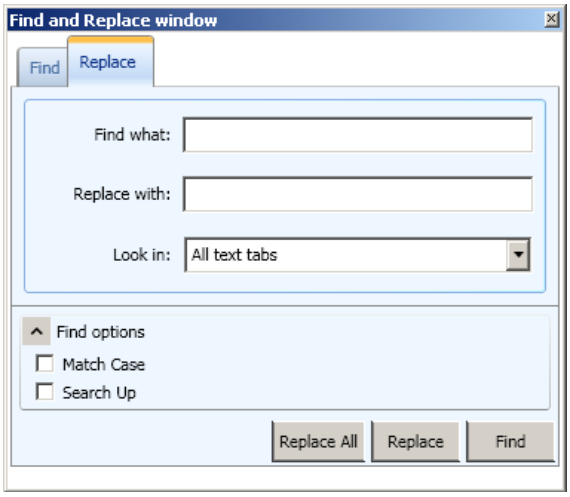
### 3-18 Find & Replace function

This Find and Replace function are only available in text mode. Find and Replace function allow look for an exchange code inside your text program.

To use Find function press the icon or the shortcut keys '**Ctrl + F**'.

To use Replace function press the icon or the shortcut keys '**Ctrl+F**'



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## 4- Drive Program structure

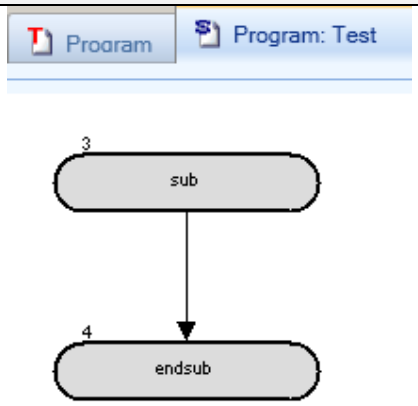
The programming language is a Flowchart/Text language.
The inverter can process five parallel tasks.
The processing is as following diagram.

| + | >>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>> **Command Execution** >>>>>>>>>>>>>>>>>>>>>>>>>>>> | | | | | | | | | | | - |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| V V V

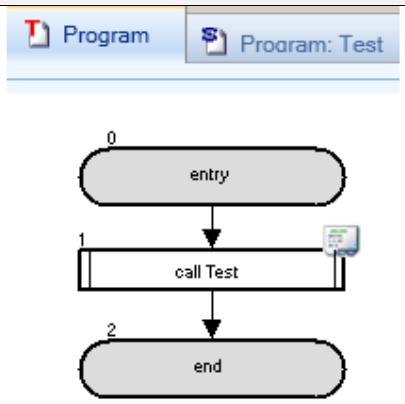
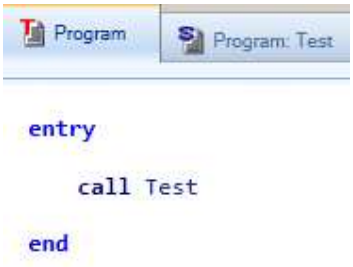
### 4-2 Subroutines

Subroutines are useful to organize your program into parts of code that you can reuse in other programs or in the same program. For insert a subroutine press the button or and a new subroutine will appear. Like on Tasks, you can delete or rename a subroutine.

Every subroutine must begin with the **Sub** block, and end with the **EndSub** *Control Command*.

| Flowchart | Text |
|---|---|
|   | |

The subroutine is executed via the call command with the subroutine name.

| Flowchart | Text |
|---|---|
|   |   |

It is only possible to call a subroutine that is associated with the task. To be used with other task, a copy of the subroutine is necessary on the task.

## 5- Drive Programming user variables

### 5-1 Initial Data

**U(00) to U(31) or User parameters**

| U(00) to U(31) | Description | Range of values | Default | Unit | Data size | Attribute |
|---|---|---|---|---|---|---|
| | User variable | 0 to 65535 | Data stored in P100 to P131 | - | Unsigned 1-word | R/W |

User variables are the general-purpose functions that can be used as unsigned 1-word. The data written from a drive program to the user-defined variables is not stored in the inverter's EEPROM. The variables will restore the initial settings when the inverter power is turned off. The user-defined variables correspond to inverter parameters "P100" to "P131". You can also change the settings of user-defined variables from the digital operator. The changes made from the digital operator will be stored in EEPROM. This is also possible to emulate from drive programming by using the EepWrt command.

The variables P129 to P131 (U(29) to U(31)) are saved at power down of the inverter automatically. This function may not work under heavy load (motor output current) or too small inverter (low capacity in DC bus). In case of trouble it is recommended to disable the inverter output to preserve the energy in the capacitors.

**UL(00) to UL(07) or Internal User parameters.**

| UL(00) – UL(07) | Description | Range of values | Default | Unit | Data size | Attribute |
|---|---|---|---|---|---|---|
| | Internal user variable | $-2^{31}$ to $2^{31}-1$ | 0 | - | Signed 2-word | R/W |

Internal user variables are the general-purpose functions that can be used as unsigned 2-word variables, for example, to temporarily store arithmetic operation results. The initial values can be set via the initial program data.

### 5-2 Setting Variables

| Set-Freq | Description | Range of values | Default | Unit | Data size | Attribute |
|---|---|---|---|---|---|---|
| | Output frequency setting | 0 to 40000 | 0 | 0.01 Hz | Unsigned 1-word | R/W |

When A001=7 (Freq. ref. from Drive Programming), it becomes the frequency set point of the inverter. Always reflects the reading of parameter F001, regardless the setting of A001. This variable is not stored in the inverter EEPROM. It will be restored to initial setting after power cycle.
When the inverter receives an operation command (FW=1 or RV=1), it accelerates the motor up to the frequency that was set last.

| ACCEL | Description | Range of values | Default | Unit | Data size | Attribute |
|---|---|---|---|---|---|---|
| | Acceleration time setting | 1 to 360000 | Note 1 | 0.01 sec | Unsigned 2-word | R/W |

This variable can be used to read and write the motor acceleration time in the inverter. It is enabled only when the setting of accel/decel time input selection (P031) is "03" (PRG). (Please note that it does not correspond to the setting of inverter parameter "F002"). The data written to this variable is not stored in the inverter's EEPROM. It restores initial value after power cycle.

**Note 1:** By default (when the inverter power is turned on), the acceleration time follows the setting of the inverter parameter "F002", "F202", or "F302". For details, refer to the Inverter Instruction Manual.
**Note 2**: When a program writes a value to this variable, the value is reflected in the inverter in a 40-ms cycle, which conforms to the standard inverter specifications.



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| DECEL | Description | Range of values | Default | Unit | Data size | Attribute |
|---|---|---|---|---|---|---|
| | Deceleration time setting | 1 to 360000 | Note 1 | 0.01 sec | Unsigned 2-word | R/W |

This variable can be used to read and write the motor deceleration time in the inverter. The deceleration time setting using this variable is enabled only when the setting of accel/decel time input selection (P031) is “03” (PRG). (The setting of this variable does not correspond to the setting of inverter parameter “F003”). The data written to this variable is not stored in the inverter’s EEPROM. This variable will restore the initial setting when the inverter power is turned off.

**Note 1**: By default (when the inverter power is turned on), the deceleration time follows the deceleration (1) time setting “F003”, “F203” or “F303”. For details, refer to the Inverter Instruction Manual.
**Note 2**: When a program writes a value to this variable, the value is reflected in the inverter in a 40-ms cycle, which conforms to the standard inverter specifications.

**5-3 Inverter Monitor Variables (This units does not always corresponds with the display units)**

| FM | Description | Range of values | Default | Unit | Data size | Attribute |
|---|---|---|---|---|---|---|
| (d001) | Output frequency monitor | 0 to 40000 | - | 0.01 Hz | Unsigned 1-word | R |

The data monitored with this variable corresponds to the data monitored by the output frequency monitor (d001). This variable is read-only.

| Iout | Description | Range of values | Default | Unit | Data size | Attribute |
|---|---|---|---|---|---|---|
| (d002) | Output current monitor | 0 to 9999 | - | 0.01 % | Unsigned 1-word | R |

The data monitored with this variable corresponds to the data monitored by the output current monitor (d002). The monitored data indicates the ratio of present output current to rated current of the inverter. This variable is read-only. For details, refer to the Inverter Instruction Manual.

| Dir | Description | Range of values | Default | Unit | Data size | Attribute |
|---|---|---|---|---|---|---|
| (d003) | Rotation direction monitor | 0: Stop<br>1: Normal rotation<br>2:Reverse rotation | - | - | Unsigned 1-word | R |

The data monitored with this variable corresponds to the data monitored by the rotation direction monitor (d003). This variable is read-only.

| PID-FB | Description | Range of values | Default | Unit | Data size | Attribute |
|---|---|---|---|---|---|---|
| (d004) | Process variable (PV), PID feedback monitoring | 0 to 9990000 | 0 | 0.01 % | Unsigned 2-word | R |

The data monitored with this variable corresponds to the data monitored by the process variable (PV), PID feedback monitor (d004). This variable is read-only.

| F-CNV | Description | Range of values | Default | Unit | Data size | Attribute |
|---|---|---|---|---|---|---|
| (d007) | Scaled output frequency monitor | 0 to 3996000 | - | 0.01 | Unsigned 2-word | R |

The data monitored with this variable corresponds to the data monitored by the scaled output frequency monitor (d007). This variable is read-only.



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| **Tmon** | Description | Range of values | Default | Unit | Data size | Attribute |
|---|---|---|---|---|---|---|
| (d012) | Torque monitor | -300 to 300 | - | % | Unsigned 1-word | R |

The data monitored with this variable corresponds to the data monitored by the torque monitor (d012). This variable is read-only.

| **Vout** | Description | Range of values | Default | Unit | Data size | Attribute |
|---|---|---|---|---|---|---|
| (d013) | Output Voltage monitor | 0 to 6000 | - | 0.1v | Unsigned 1-word | R |

The data monitored with this variable corresponds to the data monitored by the output voltage monitor function (d013). This variable is read only.

| **Power** | Description | Range of values | Default | Unit | Data size | Attribute |
|---|---|---|---|---|---|---|
| (d014) | Power monitor | 0 to 9999 | - | 0.1 Kw | Unsigned 1-word | R |

The data monitored whit this variable corresponds to the data monitored by the power monitor (d014). This variable is read only.

| **RUN-Time** | Description | Range of values | Default | Unit | Data size | Attribute |
|---|---|---|---|---|---|---|
| (d016) | Run Time monitor | 0 to 999999 | - | Hour | Unsigned 2-word | R |

The data monitored with this variable corresponds to the data monitored by the cumulative operation RUN time monitor (d016). This variable is read only.

| **On-Time** | Description | Range of values | Default | Unit | Data size | Attribute |
|---|---|---|---|---|---|---|
| (d017) | Power-on time monitor | 0 to 999999 | - | Hour | Unsigned 2-word | R |

The data monitored with this variable corresponds to the data monitored by the cumulative power-on time monitor (d017). This variable is read-only.

| **UMon(0) to Umon(2)** | Description | Range of values | Default | Unit | Data size | Attribute |
|---|---|---|---|---|---|---|
| (d025 to d027) | User Parameter monitor 0 to 2 | $-2^{31}$ to $2^{31}-1$ | 0 | - | Signed 2-word | R/W |

The data monitored with these variables corresponds to the data monitored on d025, d026 and d027. These are monitors available for the user Drive Programming application



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| **POS** | Description | Range of values | Default | Unit | Data size | Attribute |
|---|---|---|---|---|---|---|
| (d030) | Current Position monitor | $-(2^{28}-1)$ to $2^{28}-1$ *[*$-(2^{30}-1)$ to $2^{30}-1$*]* | - | 1 | Signed 2-word | R |

The data referenced with this variable corresponds to the data monitored by the current position monitor (d030).
With RX when "03" (high-resolution absolute position control) has been selected for control pulse setting (P012), the range in brackets "[]" applies.

| **ERR-CNT** | Description | Range of values | Default | Unit | Data size | Attribute |
|---|---|---|---|---|---|---|
| (d080) | Trip counter monitor | 0 to 65535 | - | Nº of times | Unsigned 1-word | R |

The data monitored with this variable corresponds to the data monitored by the trip counter monitor (d080).

| **ERR(1)-ERR(6)** | Description | Range of values | Default | Unit | Data size | Attribute |
|---|---|---|---|---|---|---|
| (d081-d086) | Trip monitor 1 to 6 | 0 to 127 | - | - | Unsigned 1-word | R |

The data monitored with these variables correspond to the data monitored by trip monitors 1 to 6 (d081 to d086).

| **DCV** | Description | Range of values | Default | Unit | Data size | Attribute |
|---|---|---|---|---|---|---|
| (d102) | DC voltage monitor | 0 to 9999 | - | 0.1 Vdc | Unsigned 1-word | R |

The data referenced with this variable corresponds to the data monitored by the DC voltage monitor (d102).

| **STATUS** | Description | Range of values | Default | Unit | Data size | Attribute |
|---|---|---|---|---|---|---|
| | Inverter status monitor | - | - | - | Unsigned 1-word | R |

This variable can be used to reference inverter status information.
The information is reflected with the following bit weights:

| Bit 9 to 15 | Bit 8 | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---|---|---|---|---|---|---|---|---|---|
| Reserve | Under voltage | Reset | Over voltage suppression | Over current suppression | Overload suppression | Retry | Reverse | Trip | Run |



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**5-4 Terminal Variables**

**Input/Output Control Instructions**

| X(00) - X(11) | Description | Range of Values | Data Size | Attribute |
|---|---|---|---|---|
| | Input terminal 0 to 11 | 0: Off<br>1: On | bit | R |

See table below for each inverter function number:

| Input | Inverter function number | | |
|---|---|---|---|
| | MX2 | RX | LX |
| X(00) – MI1 | 56 | 56 | 49 |
| X(01) – MI2 | 57 | 57 | 50 |
| X(02) – MI3 | 58 | 58 | 51 |
| X(03) – MI4 | 59 | 59 | 52 |
| X(04) – MI5 | 60 | 60 | 53 |
| X(05) – MI6 | 61 | 61 | 54 |
| X(06) – MI7 | 62 | 62 | 55 |
| X(07) – MI8 | 63 | 63 | 56 |
| X(08) – MI9 | -- | -- | 57 |
| X(09) – MI10 | -- | -- | 58 |
| X(10) – MI11 | -- | -- | 59 |
| X(11) – MI12 | -- | -- | 60 |

| Xw | Description | Range of Values | Data Size | Attribute |
|---|---|---|---|---|
| | Input terminal (word) | 0 to 65535 | Unsigned 1-word | R |

Instruction to access contact inputs by word. Each bit reflects one of the inputs.

| Y(00) - Y(06) | Description | Range of Values | Data Size | Attribute |
|---|---|---|---|---|
| | Output terminal 0 to 6 | 0: Off<br>1: On | bit | R/W |

See table below for each inverter function number:

| Output | Inverter function number | | |
|---|---|---|---|
| | MX2 | RX | LX |
| Y(00) – MO1 | 44 | 44 | 35 |
| Y(01) – MO2 | 45 | 45 | 36 |
| Y(02) – MO3 | 46 | 46 | 37 |
| Y(03) – MO4 | -- | 47 | 38 |
| Y(04) – MO5 | -- | 48 | 39 |
| Y(05) – MO6 | -- | 49 | 40 |
| Y(06) – MO7 | -- | -- | 41 |

| Yw | Description | Range of Values | Data Size | Attribute |
|---|---|---|---|---|
| | Output terminal (word) | 0 to 65535 | Unsigned 1-word | R/W |

This variable can be used to change the digital output terminals in units of word. Each output is one bit.



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| **XA(0) –XA(2)** | Description | Range of Values | Data Size | Attribute |
|---|---|---|---|---|
| XA(0) | General-purpose analog input (O terminal) | 0 to 10000 | Unsigned 1- word (0.01%) | R |
| XA(1) | General-purpose analog input (OI terminal) | | | |
| XA(2) | General-purpose analog input (O2 terminal) only for RX and LX | | | |

These variables can be used to monitor the analog input to the O and OI and O2 terminals. Terminals [O]-[L], [OI]-[L], [O2]-[L]. Associated parameters (A011 to A015, A101 to A105, A111 to A114). XA(2) is only available for Rx and LX.

| **YA(0) –YA(2)** | Description | Range of Values | Data Size | Attribute |
|---|---|---|---|---|
| YA(0) | General-purpose analog output (EO terminal for MX2) (FM terminal for RX and LX) | 0 to 10000 | Unsigned 1-word (0.01%) | R/W |
| YA(1) | General-purpose analog output (AM terminal) | | | |
| YA(2) | General-purpose analog output (AMI terminal) only for RX and LX | | | |

With this variables we can monitor the analog outputs (any multifunction assigned to them), or write analog output if YA(0) to YA(2) are assigned to analog multifunction parameters (C027, C028 and C029). Value is reflected as a data range from 0% to 100.00%. YA(2) is only available for RX and LX**.**

| **UB(00) – UB(07)** | Description | Range of Values | Data Size | Attribute |
|---|---|---|---|---|
| | Internal user contact (bit access) | 0: Off<br>1: On | bit | R/W |

These variables can be used as bit variable for the user.

| **UBw** | Description | Range of Values | Data Size | Attribute |
|---|---|---|---|---|
| | Internal user contact (word access) | 0 to 255 | Unsigned<br>1-word | R/W |

The bit variables reflected as single word.

| **TC(0) - TC(7)** | Description | Range of Values | Data Size | Attribute |
|---|---|---|---|---|
| | Timer counters (0 to 7)<br>(Unit: 10ms) | 0 to $2^{31}-1$ | Unsigned<br>2-word | R/W |

The timer counters “TC(0)” to “TC(7)” operate as 31-bit-free-running timer counters. They start with the user program startup and are incremented in a 10-ms cycle.

When a timer-start instruction (timer set) or delay operation instruction (delay on or delay off) is executed, the timer counter corresponding to the instruction operates as the counter for output to a specified timer contact. In this case, the counter is cleared to zero when the instruction is executed, start counting, and then stops counting upon reaching the specified count. When a timer-stop instruction (timer off) is executed, the timer counter corresponding to the instruction is cleared to zero and operates as a 31-bi-free-running timer counter that is incremented in a 10-ms cycle.

| **TD(0) - TD(7)** | Description | Range of Values | Unit | Attribute |
|---|---|---|---|---|
| | Timer contact output 0 – 7 (bit access) | 0: Off<br>1: On | Unsigned<br>1-word | R |

The data in timer contact output variables “TD(0)” to “TD(7)” change only when these variables are specified in the timer-start instruction (timer set) or delay operation instruction (delay on or delay off). A timer contact output variable is set to “0”(off) when the counter corresponding to the contact output is cleared to zero, the variable is set to “1”(on) when the counter stops counting (the timing action selected finish).
While a timer counter variable “TC(k)” is being used for a free-running timer counter, timer contact output variable “TD(k)” corresponding to the timer counter variable retains its status.

| **TDw** | Description | Range of Values | Unit | Attribute |
|---|---|---|---|---|
| | Timer contact output (word access) | 0 to 255 | Unsigned<br>1-word | R |

It access to the timer counter outputs as word.



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### 5-5 Digital input Functions

These variables correspond to the settings available for the digital multifunction input terminals. Setting the variable to 1 will simulate the function as if the terminal was closed in a digital input. It is interesting to note that the multifunction does not need to be configured in order to use the function.

E.g. FW := 1 will generate a RUN Forward command (as used in some examples).
Please refer to the inverter user manual for details about the individual functions.
Values: · 0: Off
· 1: On

| Function | Description | MX2 | RX | LX | Usage | Comment |
|---|---|---|---|---|---|---|
| FW | Forward | √ | x | x | R/W | C001-C009 = 00 |
| RV | Reverse | √ | √ | x | R/W | C001-C009 = 01 |
| CF1-CF4 | Multi-speed 1-4 | √ | √ | x | R/W | C001-C009 = 02-05 |
| JG | Jogging | √ | √ | x | R/W | C001-C009 = 06 |
| DB | External Brake | √ | √ | x | R/W | C001-C009 = 07 |
| SET | Second control | √ | √ | √ | R/W | C001-C009 = 08 |
| 2CH | 2nd acceleration/deceleration time | √ | √ | x | R/W | C001-C009 = 09 |
| FRS | Free run | √ | √ | √ | R/W | C001-C009 = 11 |
| EXT | External trip | √ | √ | √ | R/W | C001-C009 = 12 |
| USP | Unattended start protection | √ | √ | x | R/W | C001-C009 = 13 |
| CS | Change from commercial power | √ | √ | x | R/W | C001-C009 = 14 |
| SFT | Software lock | √ | √ | √ | R/W | C001-C009 = 15 |
| AT | Change of analog input | √ | √ | x | R/W | C001-C009 = 16 |
| SET3 | 3rd control | x | √ | x | R/W | C001-C009 = 17 |
| RS | System reset | √ | √ | √ | R/W | C001-C009 = 18 |
| STA | Start of 3 wires | √ | √ | x | R/W | C001-C009 = 20 |
| STP | Stop of 3 wires | √ | √ | x | R/W | C001-C009 = 21 |
| F/R | Forward/Reverse of 3 wires | √ | √ | x | R/W | C001-C009 = 22 |
| PID | Switch PID | √ | √ | x | R/W | C001-C009 = 23 |
| PIDC | Reset of PID integration | √ | √ | x | R/W | C001-C009 = 24 |
| CAS | Control gain switching | x | √ | x | R/W | C001-C009 = 26 |
| UP | Increasing speed from remote | √ | √ | x | R/W | C001-C009 = 27 |
| DWN | Decreasing speed from remote | √ | √ | x | R/W | C001-C009 = 28 |
| UDC | Clear data from remote operation | √ | √ | x | R/W | C001-C009 = 29 |
| OPE | Change to operator | √ | √ | x | R/W | C001-C009 = 31 |
| SF1-SF7 | Multi-speed bit 1-7 | √ | √ | x | R/W | C001-C009 = 32-38 |
| OLR | Overload protection switch | √ | √ | x | R/W | C001-C009 = 39 |
| TL | Torque Limit Enable | √ | √ | x | R/W | C001-C009 = 40 |
| TRQ1-2 | Torque Limit Selection 1-2 | √ | √ | x | R/W | C001-C009 = 41-42 |
| PPI | P/PI switching | x | √ | x | R/W | C001-C009 = 43 |
| BOK | Brake Confirmation | √ | √ | x | R/W | C001-C009 = 44 |
| ORT | Orientation | x | √ | x | R/W | C001-C009 = 45 |
| LAC | LAD Cancel | √ | √ | x | R/W | C001-C009 = 46 |
| PCLR | Clear Position Deviation | √ | √ | x | R/W | C001-C009 = 47 |
| STAT | Pulse train position command input permission | x | √ | x | R/W | C001-C009 = 48 |
| ADD | Add Setting Frequency | √ | √ | x | R/W | C001-C009 = 50 |
| F-TM | Forced Terminal Block | √ | √ | x | R/W | C001-C009 = 51 |
| ATR | Torque reference input permission | √ | √ | x | R/W | C001-C009 = 52 |
| KHC | Integrated power clear | √ | √ | x | R/W | C001-C009 = 53 |
| SON | Servo ON | x | √ | x | R/W | C001-C009 = 54 |
| FOC | Preliminary excitation | x | √ | x | R/W | C001-C009 = 55 |
| X(00) –X(07) | Drive Programming (MI1-MI8) | √ | √ | x | R/W | C001-C009 = 56-63 |
| AHD | Analog command on hold | √ | √ | x | R/W | C001-C009 = 65 |
| CP1-3 | Position command selection 1-3 | √ | √ | x | R/W | C001-C009 = 66-68 |
| ORL | Origin return limit signal | √ | √ | x | R/W | C001-C009 = 69 |
| ORG | Origin return start signal | √ | √ | x | R/W | C001-C009 = 70 |
| FOT | Forward driving stop | x | √ | x | R/W | C001-C009 = 71 |
| ROT | Reverse driving stop | x | √ | x | R/W | C001-C009 = 72 |
| SPD | Speed/Position switching | √ | √ | x | R/W | C001-C009 = 73 |
| PCNT | Pulse counter | x | √ | x | R/W | C001-C009 = 74 |
| PCC | Pulse counter clear | x | √ | x | R/W | C001-C009 = 75 |
| GS1 | GS1 input | √ | x | x | R/W | C001-C009 = 77 |



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| Function | Description | MX2 | RX | LX | Usage | Comment |
|---|---|---|---|---|---|---|
| GS2 | GS2 input | √ | x | x | R/W | C001-C009 = 78 |
| RS485 | Inverter communication start terminal | √ | x | x | R/W | C001-C009 = 81 |
| PRG | Executing Drive Program | √ | x | x | R/W | C001-C009 = 82 |
| HLD | HOLD Acceleration / deceleration stopping | √ | x | x | R/W | C001-C009 = 83 |
| ROK | Operation OK signal | √ | x | x | R/W | C001-C009 = 84 |
| DISP | Display limitation terminal | √ | x | x | R/W | C001-C009 = 86 |
| UP | Upward RUN | x | x | √ | R/W | C001-C009 = 00 |
| DOWN | Downward RUN | x | x | √ | R/W | C001-C009 = 01 |
| SPD1 | Multi-speed 1 setting | x | x | √ | R/W | C001-C009 = 02 |
| SPD2 | Multi-speed 2 setting | x | x | √ | R/W | C001-C009 = 03 |
| SPD3 | Multi-speed 3 setting | x | x | √ | R/W | C001-C009 = 04 |
| OLR | Change OL-level | x | x | √ | R/W | C001-C009 = 32 |
| TL | Torque Limit enable | x | x | √ | R/W | C001-C009 = 33 |
| TRQ1 | Change Torque Limit 1 | x | x | √ | R/W | C001-C009 = 34 |
| TRQ2 | Change Torque Limit 2 | x | x | √ | R/W | C001-C009 = 35 |
| PCLR | Clear the current position | x | x | √ | R/W | C001-C009 = 40 |
| KHC | Kwh clear | x | x | √ | R/W | C001-C009 = 46 |
| X(00)-X(11) | Drive Programming | x | x | √ | R/W | C001-C009 =49-60 |
| EMP | Em-Power Operation | x | x | √ | R/W | C001-C009 = 61 |
| INS1 | Inspection 1 | x | x | √ | R/W | C001-C009 = 62 |
| INS2 | Inspection 2 | x | x | √ | R/W | C001-C009 = 63 |
| COK | Contactor check signal | x | x | √ | R/W | C001-C009 = 64 |
| BOK | Brake check signal | x | x | √ | R/W | C001-C009 = 65 |
| FP1-FP6 | Floor position 1 to 6 | x | x | √ | R/W | C001-C009 = 66-71 |
| PAL | Auto learning data latch trigger | x | x | √ | R/W | C001-C009 = 72 |
| TCL | Torque bias latch trigger | x | x | √ | R/W | C001-C009 = 73 |
| LVS | Leveling signal | x | x | √ | R/W | C001-C009 = 74 |
| NFS | Near floor signal | x | x | √ | R/W | C001-C009 = 75 |
| PRG | Program run | x | x | √ | R/W | C001-C009 = 76 |
| CMC | Control Mode change | x | x | √ | R/W | C001-C009 = 77 |

Note:The LX inverter functions are available for the digital multifunction input terminals P140-P144 (Multi-Input [Ex.IN1-5] → 3G3AX-EIO-E: LX extra I/O board)



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### 5-6 Digital Output Functions

These variables correspond to the settings available for the digital multifunction output terminals. The variable can read and used as it would be for an external device connected to the digital output configured for the function.
It is interesting to note that digital outputs are not required to be assigned in order to use the function within the program (in other words, no waste of digital outputs required).

| Function | Description | MX2 | RX | LX | Usage | Comment |
|---|---|---|---|---|---|---|
| RUN | Running | √ | √ | √ | R | C021 - C026 = 00 |
| FA1 | Reaching constant speed | √ | √ | √ | R | C021 - C026 = 01 |
| FA2 | Greater than setting frequency | √ | √ | √ | R | C021 - C026 = 02 |
| OL | Overload preannounce | √ | √ | √ | R | C021 - C026 = 03 |
| OD | PID deviation overrate | √ | √ | x | R | C021 - C026 = 04 |
| AL | Trip signal | √ | √ | √ | R | C021 - C026 = 05 |
| FA3 | Only the setting frequency | √ | √ | √ | R | C021 - C026 = 06 |
| OTQ | Over torque/under torque | √ | √ | √ | R | C021 - C026 = 07 |
| IP | Signal during m. power interruption | x | √ | √ | R | C021 - C026 = 08 |
| UV | Under voltage signal | √ | √ | √ | R | C021 - C026 = 09 |
| TRQ | Torque limitation signal | √ | √ | √ | R | C021 - C026 = 10 |
| RNT | RUN time over | √ | √ | √ | R | C021 - C026 = 11 |
| ONT | ON time over | √ | √ | √ | R | C021 - C026 = 12 |
| THM | Thermal warning | √ | √ | √ | R | C021 - C026 = 13 |
| ZS | 0 Hz detection signal | x | x | √ | R | C021 - C026 = 14 |
| POK | Positioning complete | x | x | √ | R | C021 - C026 = 16 |
| FA4 | Set frequency overreached 2 | x | x | √ | R | C021 - C026 = 17 |
| FA5 | Set frequency reached 2 | x | x | √ | R | C021 - C026 = 18 |
| BRK | Brake open | √ | √ | x | R | C021 - C026 = 19 |
| BER | Brake error | √ | √ | x | R | C021 - C026 = 20 |
| ZS | Zero speed signal | √ | √ | x | R | C021 - C026 = 21 |
| DSE | Speed deviation overrate | √ | √ | x | R | C021 - C026 = 22 |
| POK | Positioning operation complete | √ | √ | x | R | C021 - C026 = 23 |
| FA4 | Greater than setting frequency 2 | √ | √ | x | R | C021 - C026 = 24 |
| FA5 | Only the setting frequency 2 | √ | √ | x | R | C021 - C026 = 25 |
| OL2 | Overload preannounce 2 | √ | √ | x | R | C021 - C026 = 26 |
| ODc | Analog O break detection | √ | √ | x | R | C021 - C026 = 27 |
| OIDc | Analog OI break detection | √ | √ | x | R | C021 - C026 = 28 |
| O2Dc | Analog 2 disconnection detection | x | √ | x | R | C021 - C026 = 29 |
| WAC | Capacitor life warning | x | X | √ | R | C021 - C026 = 30 |
| FBV | PID feedback comparison | √ | √ | x | R | C021 - C026 = 31 |
| NDc | Communication break detection | √ | √ | x | R | C021 - C026 = 32 |
| LOG1 | Result of logic operation 1 | √ | √ | x | R | C021 - C026 = 33 |
| LOG 2 | Result of logic operation 2 | √ | √ | x | R | C021 - C026 = 34 |
| LOG 3 | Result of logic operation 3 | √ | √ | x | R | C021 - C026 = 35 |
| LOG 4 | Result of logic operation 4 | x | √ | x | R | C021 - C026 = 36 |
| LOG 5 | Result of logic operation 5 | x | √ | x | R | C021 - C026 = 37 |
| LOG 6 | Result of logic operation 6 | x | √ | x | R | C021 - C026 = 38 |
| WAC | Condenser life-span preannounce | √ | √ | x | R | C021 - C026 = 39 |
| WAF | Fan life-span preannounce | √ | √ | x | R | C021 - C026 = 40 |
| FR | Start contact signal | √ | √ | x | R | C021 - C026 = 41 |
| OHF | Cooling fan over heat preannounce | √ | √ | x | R | C021 - C026 = 42 |
| LOC | Low electricity signal | √ | √ | x | R | C021 - C026 = 43 |
| Y(00) | Drive Programming (MO1) | √ | √ | x | R | C021 - C026 = 44 |
| Y(01) | Drive Programming (MO2) | √ | √ | x | R | C021 - C026 = 45 |
| Y(02) | Drive Programming (MO3) | √ | √ | x | R | C021 - C026 = 46 |
| Y(03) | Drive Programming (MO4) | x | √ | x | R | C021 - C026 = 47 |
| Y(04) | Drive Programming (MO5) | x | √ | x | R | C021 - C026 = 48 |
| Y(05) | Drive Programming (MO6) | x | √ | x | R | C021 - C026 = 49 |
| IRDY | Operation setup complete | √ | √ | x | R | C021 - C026 = 50 |
| FWR | Forward running signal | √ | √ | x | R | C021 - C026 = 51 |
| RVR | Reverse running signal | √ | √ | x | R | C021 - C026 = 52 |
| MJA | Serious failure signal | √ | √ | x | R | C021 - C026 = 53 |
| WCO | Window comparator O | √ | √ | x | R | C021 - C026 = 54 |
| WCOI | Window comparator OI | √ | √ | x | R | C021 - C026 = 55 |
| WCO2 | Window comparator O2 | x | √ | x | R | C021 - C026 = 56 |
| MPS | Magnet pole position search | x | x | √ | R | C021 - C026 = 57 |



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| Function | Description | MX2 | RX | LX | Usage | Comment |
|---|---|---|---|---|---|---|
| FREF | Command frequency sel. mode | √ | x | x | R | C021 - C026 = 58 |
| REF | Command operation mode | √ | x | x | R | C021 - C026 = 59 |
| SETM | Setting motor | √ | x | x | R | C021 - C026 = 60 |
| EDM | STO operation monitor signal | √ | x | x | R | C021 - C026 = 62 |
| IRDY | Inverter ready | x | x | √ | R | C021 - C026 = 44 |
| FWR | Forward rotation | x | x | √ | R | C021 - C026 = 45 |
| RVR | Reverse rotation | x | x | √ | R | C021 - C026 = 46 |
| MJA | Major failure | X | x | √ | R | C021 - C026 = 47 |
| OL2 | Overload advance signal 2 | x | x | √ | R | C021 - C026 = 19 |
| TH-C | Thermal warning (CTL) | x | x | √ | R | C021 - C026 = 20 |
| NDc | Network disconnection | x | x | √ | R | C021 - C026 = 23 |
| WAF | Cooling-fan speed drop | x | x | √ | R | C021 - C026 = 31 |
| FR | Starting contact signal | x | x | √ | R | C021 - C026 = 32 |
| OHF | Heat sink overheat warning | x | x | √ | R | C021 - C026 = 33 |
| LOC | Low-current indication signal | x | x | √ | R | C021 - C026 = 34 |
| Y(00) | Drive Programming (MO1) | x | x | √ | R | C021 - C026 = 35 |
| Y(01) | Drive Programming (MO2) | x | x | √ | R | C021 - C026 = 36 |
| Y(02) | Drive Programming (MO3) | x | x | √ | R | C021 - C026 = 37 |
| Y(03) | Drive Programming (MO4) | x | x | √ | R | C021 - C026 = 38 |
| Y(04) | Drive Programming (MO5) | x | x | √ | R | C021 - C026 = 39 |
| Y(05) | Drive Programming (MO6) | x | x | √ | R | C021 - C026 = 40 |
| Y(06) | Drive Programming (MO7) | x | x | √ | R | C021 - C026 = 41 |
| CON | Contactor control signal | x | x | √ | R | C021 - C026 = 51 |
| BRK | Brake Control signal | x | x | √ | R | C021 - C026 = 52 |
| UPS | UPS protect direction search status | x | x | √ | R | C021 - C026 = 54 |
| UPD | UPS protect direction | x | x | √ | R | C021 - C026 = 55 |
| GMON | Gate suppress monitor | x | x | √ | R | C021 - C026 = 56 |
| SEQ | SEQ error | x | x | √ | R | C021 - C026 = 58 |

Note:The LX inverter functions are available for the digital multifunction output terminals P145-P147 (Multi-Output [Ex.OUT1-3] → 3G3AX-EIO-E: LX extra I/O board)



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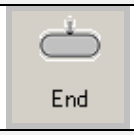
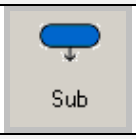
## 6- Drive Programming Instructions

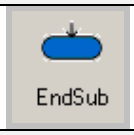
### 6-1 Control Commands

| Entry | | |
|---|---|---|
| **Command** | **Description** | **Arguments** |
| | It indicates the beginning of the task. | --- |
| **Format** | | |
| **---** | | |
| **Note**: It is compulsory to have Entry at the begging of each task. | | |

| End | | |
|---|---|---|
| **Command** | **Description** | **Arguments** |
|  | It indicates the end of the task. | --- |
| **Format** | | |
| --- | | |
| **Note**: It is compulsory to have End at the end of each task. | | |

| Call | | |
|---|---|---|
| **Command** | **Description** | **Arguments** |
| | It jumps to a subroutine | • **Subroutine**: Subroutines are identified by a name or alias defined by the user. |
| **Format** | | |
| call <subroutine> | | |
| **Note**: After the execution of the subroutine ends, the next instruction line after the call is executed. | | |

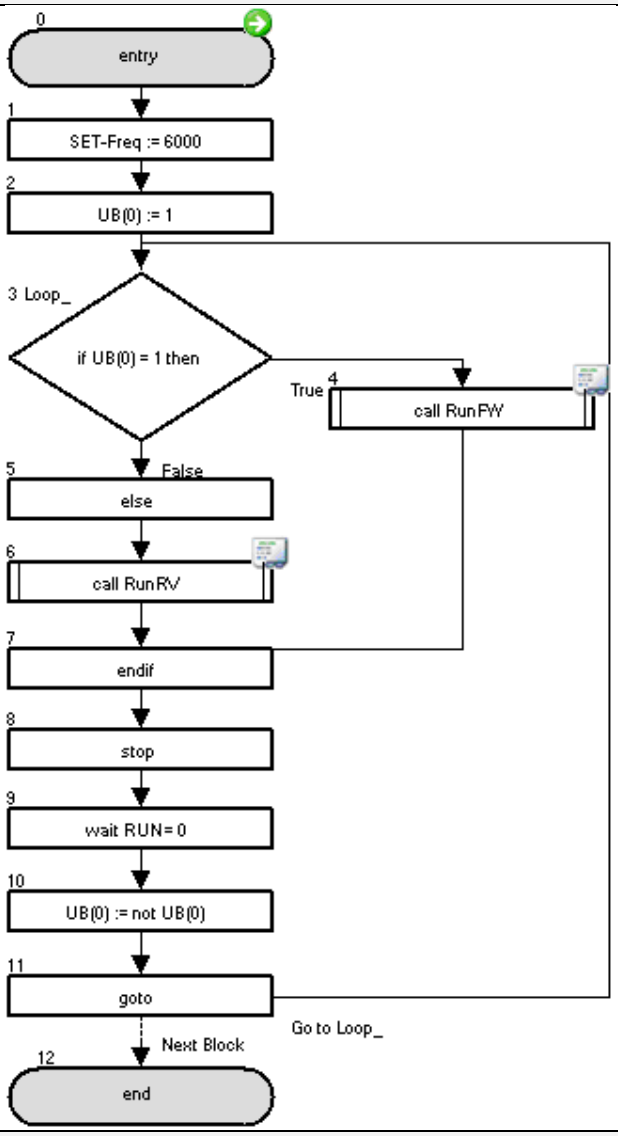
| Sub | | |
|---|---|---|
| **Command** | **Description** | **Arguments** |
|  | It indicates the beginning of the subroutine. | --- |
| **Format** | | |
| **---** | | |
| **Note**: It is compulsory to have **Sub** at the beginning of each subroutine. | | |

| End Sub | | |
|---|---|---|
| **Command** | **Description** | **Arguments** |
|  | It indicates the end of a subroutine. | --- |
| **Format** | | |
| **---** | | |
| **Note**: It is compulsory to have **End Sub** at the end of each subroutine. | | |

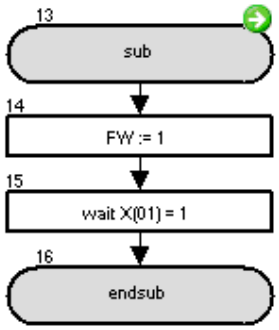
**Example**

**Flowchart**

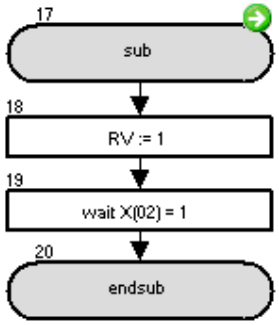
*Main*




*Main:RunFW*




*Main:RunRV*




**Text**

*Main*

```
entry
    set-freq := 6000
    UB(0) := 1
:Loop_
    if UB(0) = 1 then
        call RunFW
    else
        call RunRV
    endif
    stop
    wait RUN = 0
    UB(0) := not UB(0)
    goto Loop_
end
```

*Main:RunFW*

```
sub
    FW := 1
    wait X(01) = 1
endsub
```

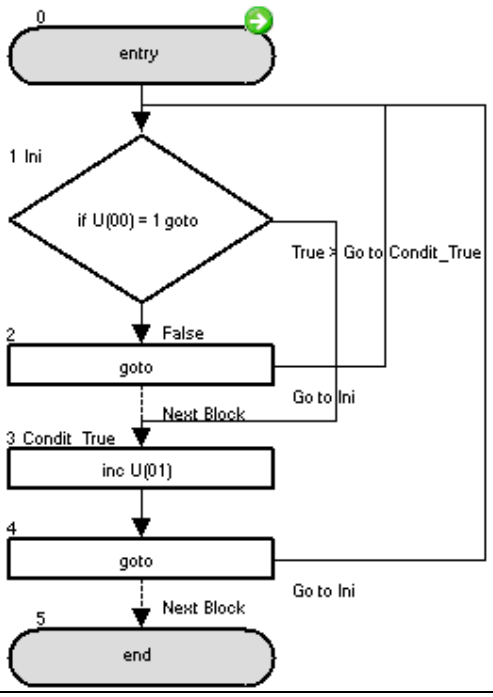
*Main:RunRV*

```
sub
    RV := 1
    wait X(02) = 1
endsub
```

*A forward and reverse run at 60Hz is repeated continuously between two limits X(01) and X(02).*

| Go To | | |
|---|---|---|
| **Command** | **Description** | **Arguments** |
| | Use this instruction to branch processing unconditionally to the step labeled with label name. | • **Label**: A name that is used to identify a particular function block in the task. |
| **Format** | | |
| GoTo <label> | | |
| **Note**: The instruction must also be connected to the next program block you want to be executed. This is necessary to make clear the flow of the program. | | |

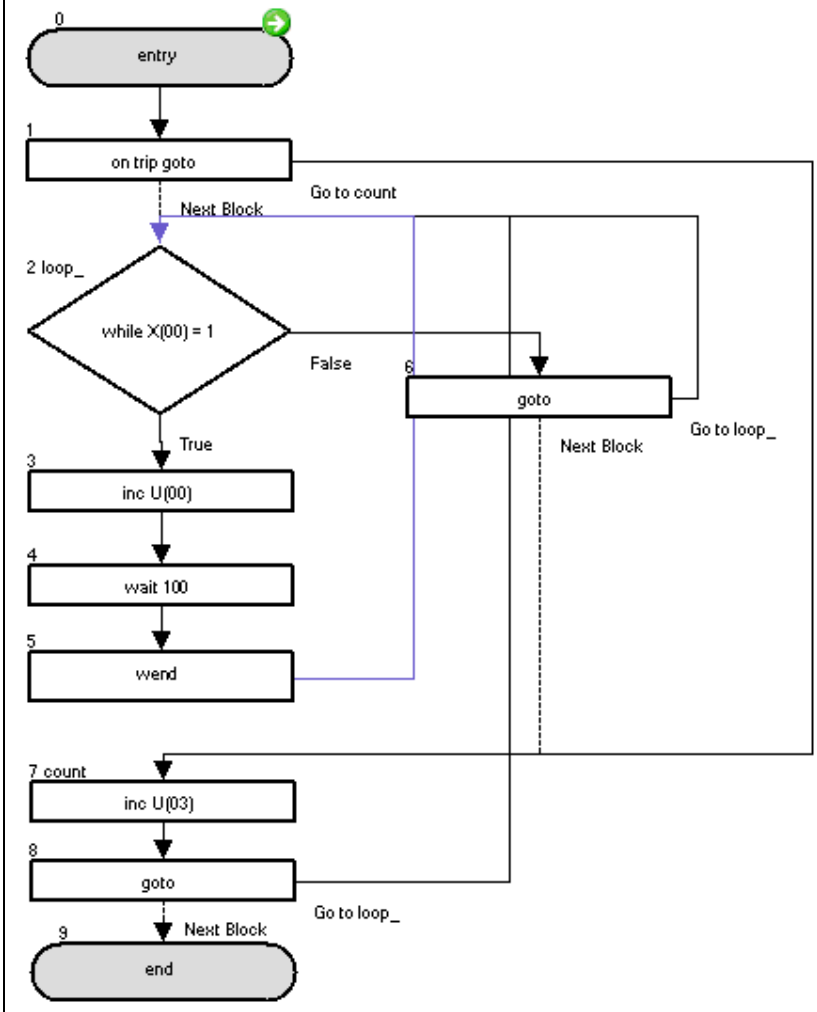
**Example**

| Flowchart | Text |
|---|---|
|   | entry<br><br>:Ini<br>if U(00) = 1 goto Condit_True<br>goto Ini<br>:Condit_True<br>inc U(01)<br>goto Ini<br><br>end |

*Change parameter P100 in order to test the **GoTo** function with this sample. When P100=1, P101 starts counting. When P100<>1 stops counting.*

| On Trip | | |
|---|---|---|
| **Command** | **Description** | **Arguments** |
| | This instruction makes conditional branching in case a trip in the inverter occurs. | • **Label**: A name that is used to identify a particular function block in the task. |
| **Format** | | |
| On Trip goto <label> | | |
| **Note**: The **On Trip** instruction works as a trigger arming. The instruction is executed once, if any trip occurs the program jumps immediately to the designated label, then the On trip trigger is disarmed. | | |

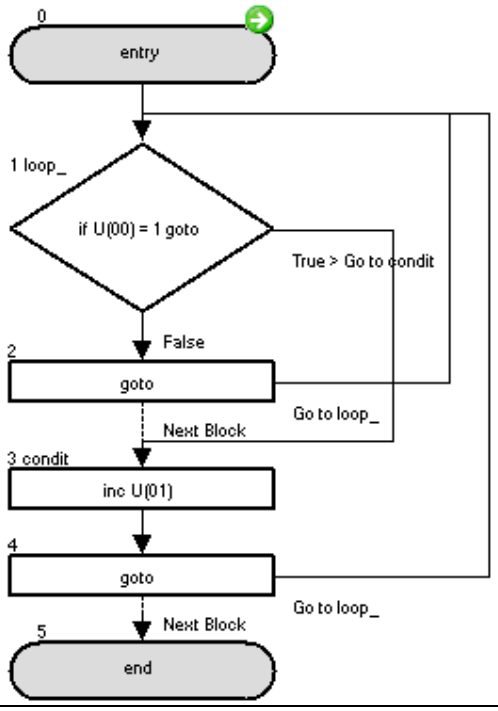
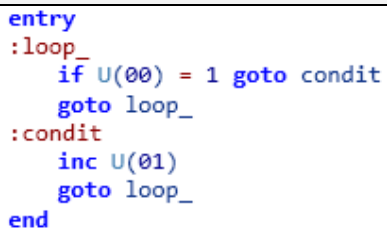
**Example**

| Flowchart | Text |
|---|---|
|   | ```<br>entry<br>on trip goto count<br>:loop_<br>while X(00) = 1<br>inc U(00)<br>wait 100<br>wend<br>goto loop_<br>:count<br>inc U(03)<br>goto loop_<br>end<br>``` |

*When the digital input is set to ON value, then P100 parameter is incrementing every second. If a trip is generated (like by external trip input) then P103 increments count. And then goes to the beginning of the task.*

| If | | |
|---|---|---|
| **Command** | **Description** | **Arguments** |
| | Jump to a label when a condition is satisfied. | • **Condition**: A comparison between two variables or constant with the format<Left hand value><Comparison><Right Hand Value><br>-Left hand value: any variable or constant(range -128 to 127)<br>-Comparison: =, <, >, <=, >=, <><br>-Right hand value: any variable or constant(range -128 to 127)<br>• **Label**: A name that is used to identify a particular function block in the task. |
| **Format** | | |
| If <condition> GoTo <label> | | |

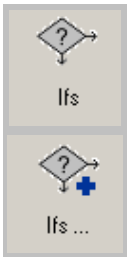
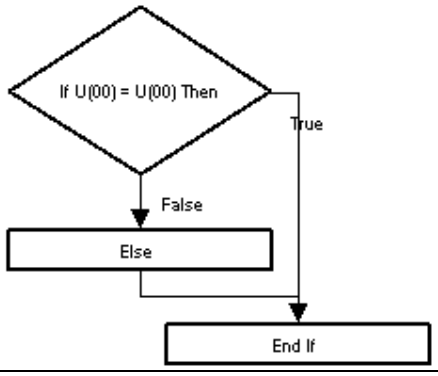
**Example**

| Flowchart | Text |
|---|---|
|  |  |

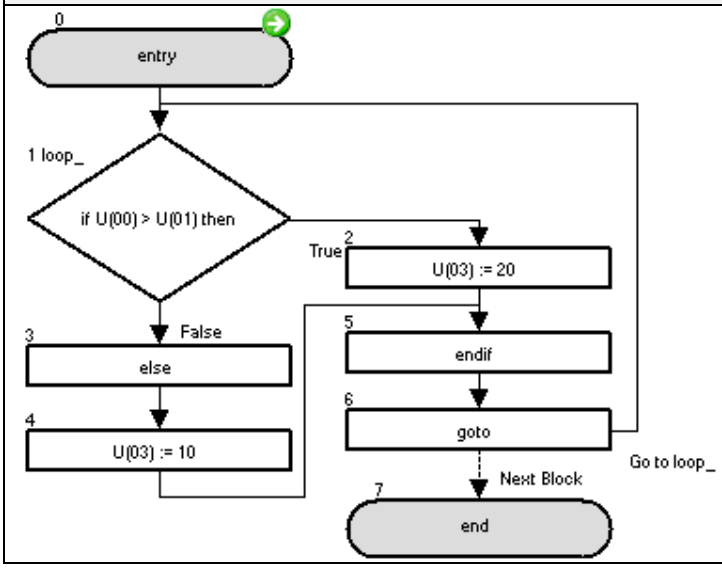


```
entry
:loop_
    if U(00) = 1 goto condit
    goto loop_
:condit
    inc U(01)
    goto loop_
end
```

*Change parameter P100 in order to test the **GoTo** function with this sample. When P100 = 1, P101 starts counting. When P100<>1 stops counting.*

| Ifs/ Else / End If | | |
|---|---|---|
| **Command** | **Description** | **Arguments** |
|  | This instruction executes different portion of code based on a condition.<br>When the condition is met, this instruction executes <instruction set 1>.<br>When the condition is not met, this instruction executes <instruction set 2>. | • **Condition**: A comparison between two variables or constant with the format <Left hand Value><Comparison><Right hand Value><br>-Left hand value: any variable or constant (range -128 to 127)<br>-Comparison: =, <, >, <=, >=, <><br>-Right hand value: any variable or constant (range -128 to 127)<br>• **Instruction set 1**: One or more instructions, until **Else** instruction. It can contain nested instructions (up to 8 levels)<br>• **Instruction set 2**: One or more instructions, until **End If** instruction. It can contain nested instructions (up to 8 levels) |
| **Format** | | |
| Ifs <condition> Then<br>  <instruction set 1><br>Else<br>  <instruction set 2><br>Endif | |  |

**Example**

| Flowchart | Text |
|---|---|
|  | `entry`<br>`:loop_`<br>`  if U(00) > U(01) then`<br>`  U(03) := 20`<br>`  else`<br>`  U(03) := 10`<br>`  endif`<br>`  goto loop_`<br>`end` |

*The example changes the value of P103 based on the value of parameter P100 and P101. If P100 is bigger than P101 then P103=10. If not P103=20.*



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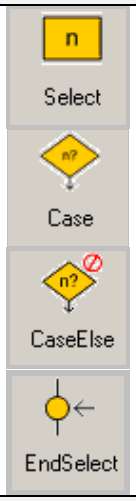
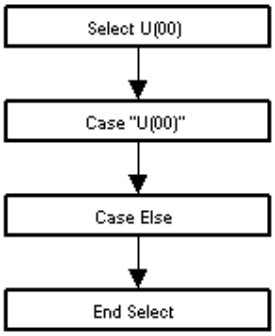
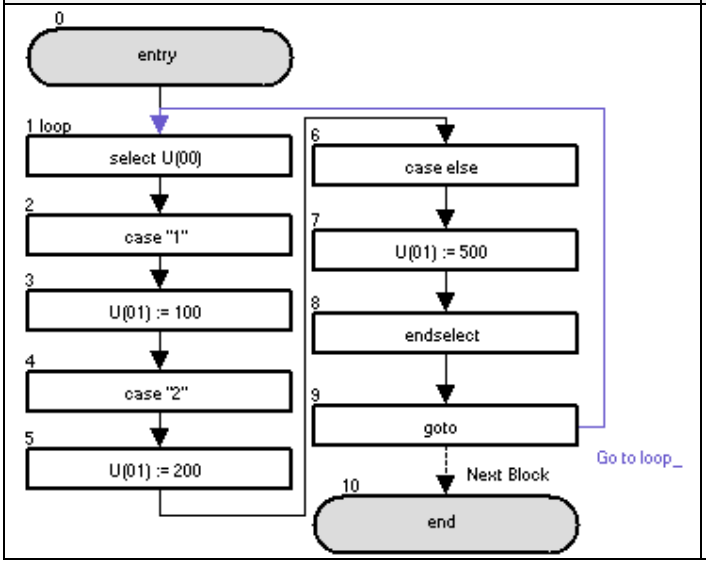
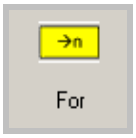
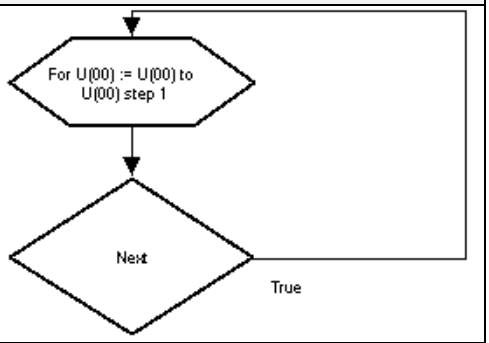
| Select / Case / End Select | | |
|---|---|---|
| **Command** | **Description** | **Arguments** |
|  | This instruction allows multiple program sections to be executed depending on a variable value. For a particular CASE section it Executes <instruction set n> when <conditional variable> matches <conditional value n><br>If <conditional variable> doesn't match any of the CASE section the <instruction set if no other> (Case Else) is executed.<br>This instruction is convenient when multiple choices have to be done from parameter value. It makes simple some if/then structures. This instruction is recommended to organize program by using subroutine calls as instruction set. | • **Conditional variable**: the instruction select variable.<br>• **Conditional value x**: variable value.<br>• **Instruction set x**: One or more instructions, until next **case** or **end select**. It can contain nested instructions (up to 8 levels). |
| **Format** | | |
| Select <conditional variable><br>Case <conditional value 1><br>  <instruction set 1><br>Case <conditional value 2><br>  <instruction set 2><br>…<br>Case Else<br>  <instruction set if no other><br>End select | |  |

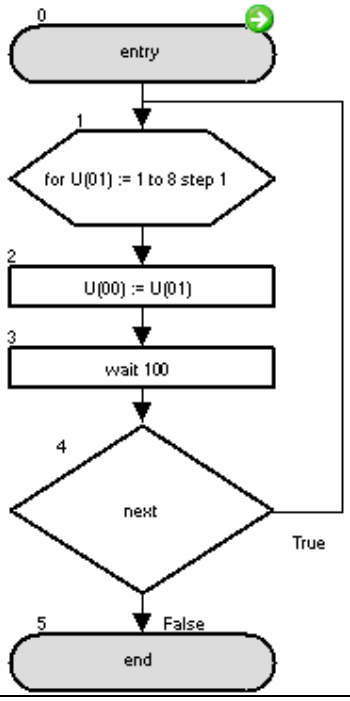
**Example**

| Flowchart | Text |
|---|---|
|  | ```<br>entry<br>:loop_<br>  select U(00)<br>  case "1"<br>  U(01) := 100<br>  case "2"<br>  U(01) := 200<br>  case else<br>  U(01) := 500<br>  endselect<br>  goto loop_<br>end<br>``` |

*The P101 parameter is set to 100, 200, 300 or 500 depending on the value of the P100 parameter (1, 2, 3 or any other, respectively).*

| For / Next | | |
|---|---|---|
| **Command** | **Description** | **Arguments** |
|  | Executes <instruction set> repeatedly until <variable> reaches <end value>. Each cycle <incremental value> is added to <variable>. | • **Variable**: any variable<br>• **Start value**: Initial value, it is the value assigned to the variable in the first loop.<br>• **End value**: Value that exits the loop.<br>• **Incremental value**: The variable will be incremented by this value each loop.<br>• **Instruction set**: One or more instructions, until **Next** instruction. It can contain nested instructions (up to 8 levels) |
| **Format** | | |
| For <variable><start value><end value><incremental value><br>  <instruction set><br>Next | |  |

**Example**

| Flowchart | Text |
|---|---|
|  | `entry`<br>`  for U(01) := 1 to 8 step 1`<br>`  U(00) := U(01)`<br>`  wait 100`<br>`  next`<br>`end` |

*This example make the variable U(00) P(100) count from 1 to 8 each second.*



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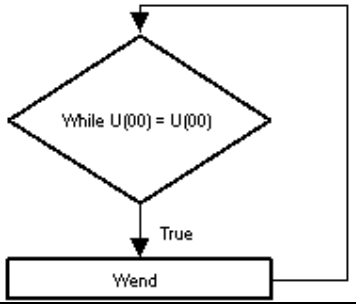
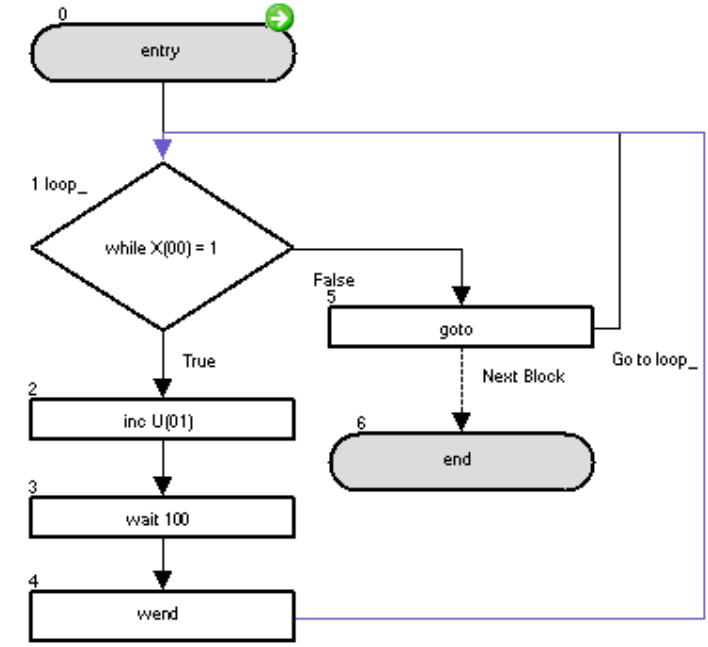
| While / Wend | | |
|---|---|---|
| **Command** | **Description** | **Arguments** |
| | Executes <instruction set> while a condition is met. | • **Condition**: A comparison between two variables or constants with the format <Left hand value><Comparison><Right Hand Value><br>- Left hand value: any variable or constant (range -128 to 127).<br>- Comparison: =, <, >, <=, >=, <><br>- Right hand value: any variable or constant (range -128 to 127).<br><br>• **Instruction set**: One or more instructions, until **Wend** instruction. It can contain nested instructions (up to 8 levels) |
| **Format** | | |
| While <condition><br>  <instruction set><br>Wend | |  |

**Example**

| Flowchart | Text |
|---|---|
|  | ```<br>entry<br>:loop_<br>  while X(00) = 1<br>  inc U(01)<br>  wait 100<br>  wend<br>  goto loop_<br>end<br>``` |

*The code will increment P101 parameter every second while the digital input X(00) is closed (**while-wend** loop). If it is open, P101 is not increased (**GoTo-label loop** loop; the **while** – **wend** portion is not executed). Digital input has to be configured in the multifunction input.*



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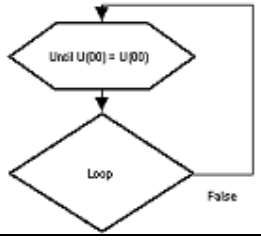
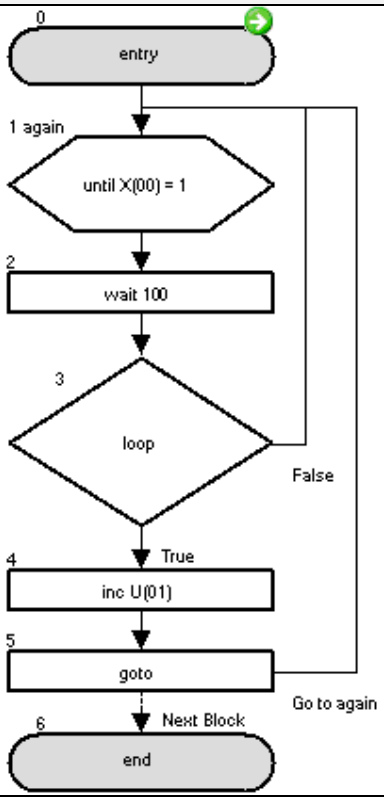
| Until / Loop | | |
|---|---|---|
| **Command** | **Description** | **Arguments** |
| | Executes <instruction set> until a <condition> is met. | • **Condition**: A comparison between two variables or constants with the format <Left hand value><Comparison><Right Hand Value><br><br>-Left hand value: any variable or constant (range -128 to 127)<br>-Comparison: =,<,>,<=,>=,<><br>-Right hand value: any variable or constant (range -128 to 127)<br><br>• **Instruction set**: One or more instructions, until **Loop** instruction. It can contain nested instructions (up to 8 levels) |
| **Format** | | |
| Until <condition><br>  <instruction set><br>Loop | |  |

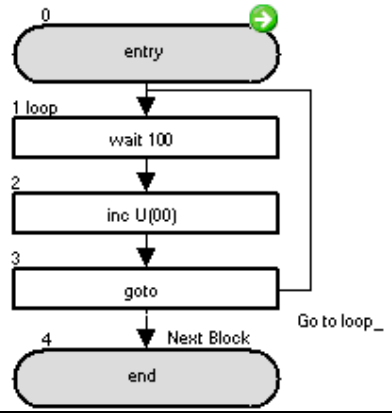
**Example**

| Flowchart | Text |
|---|---|
|  | entry<br>:again<br>  until X(00) = 1<br>  wait 100<br>  loop<br>  inc U(01)<br>  goto again<br>end |

*This code will increment while the digital input is closed. If it is open, then it will stay in the **until-loop** portion. The check of the input is every second because of this structure. Digital input has to be configured in the multifunction input.*

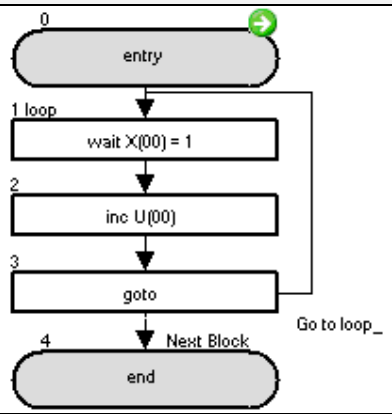
| Wait | | |
|---|---|---|
| **Command** | **Description** | **Arguments** |
| | This instruction makes the program wait for a number of seconds or until a condition is met. | • **Value**: any variable or constant (time in 10 x ms).<br>• **Condition**: A comparison between two variables or constant with the format <Left hand value><Comparison><Right Hand Value><br>-Wait Time value from 0 to 32767 * 10ms<br>-Left hand value: any variable or constant (range -128 to 127)<br>-Comparison: =, <, >, <=, >=, <>.<br>-Right hand value: any variable or constant (range -128 to 127) |
| **Format** | | |
| Wait <value> or <condition><br>**NOTE:** WaitTime is not accurate way to measure time, please use internal timers or external Real Time Clock in LCD for accurate time measurement. | | |

**Example Wait Time:** wait during a time period.

| Flowchart | Text |
|---|---|
|  | entry<br>:loop_<br>wait 100<br>inc U(00)<br>goto loop_<br>end |

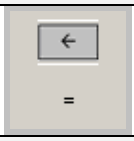
*The P100 parameter is increased every second.*

**Example Wait condition:** wait for condition.

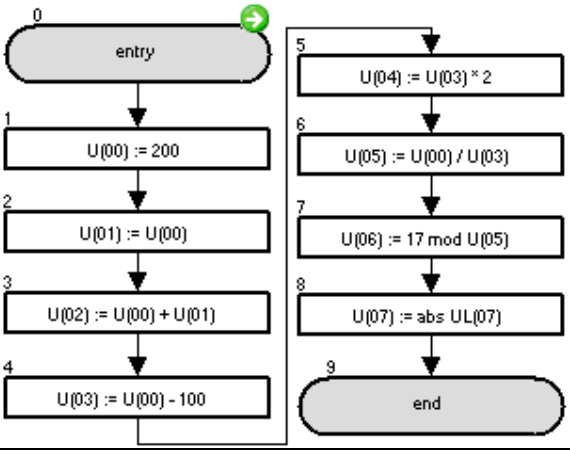
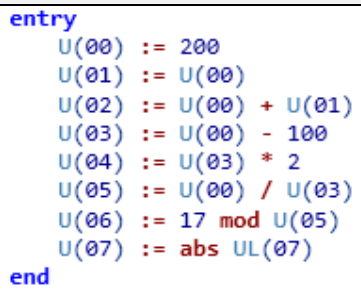
| Flowchart | Text |
|---|---|
|  | entry<br>:loop_<br>wait X(00) = 1<br>inc U(00)<br>goto loop_<br>end |

*The program waits until the digital input is closed (you need to set one of the multifunction inputs for this), and then P100 parameter is increased.*

### 6-2 Arithmetic and Logic Commands

| = (Substitution) | | |
|---|---|---|
| **Command** | **Description** | **Arguments** |
|  | Assigns <value> to <result>. | • **Result**: any variable.<br>• **Value**: any variable or constant (range -2147483648 to 2147483647). |
| **Format** | | |
| <result> = <value> | | |
| **Warning**: Drive programming does not control overflow/underflow. The application should take care. | | |

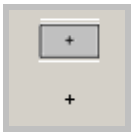
**Example**

| Flowchart | Text |
|---|---|
|  |  |

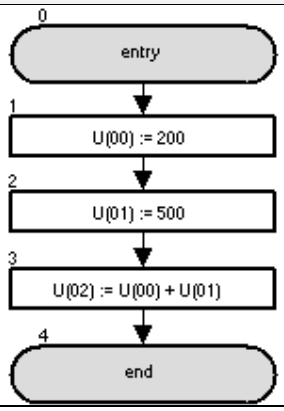
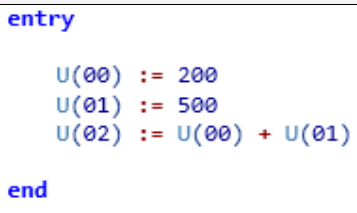


```
entry
    U(00) := 200
    U(01) := U(00)
    U(02) := U(00) + U(01)
    U(03) := U(00) - 100
    U(04) := U(03) * 2
    U(05) := U(00) / U(03)
    U(06) := 17 mod U(05)
    U(07) := abs UL(07)
end
```

*The P100 and P101 parameters are set to 200.*

| + (Addition) | | |
|---|---|---|
| **Command** | **Description** | **Arguments** |
|  | Adds <value 1> and <value 2>. | • **Result**: any variable.<br>• **Value 1**: any variable or constant (range -128 to 127)<br>• **Value 2**: any variable or constant (range -2147483648 to 2147483647). |
| **Format** | | |
| <result> = <value 1> + <value 2> | | |
| **Warning**: Drive Programming does not control overflow/underflow. The application should take care. | | |

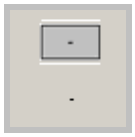
**Example**

| Flowchart | Text |
|---|---|
|  |  |

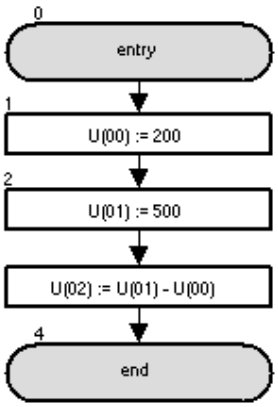


```
entry

    U(00) := 200
    U(01) := 500
    U(02) := U(00) + U(01)

end
```

*The P102 parameter calculation result is 700.*

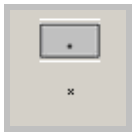
| - (Subtraction) | | |
|---|---|---|
| **Command** | **Description** | **Arguments** |
|  | Subtracts <value 2> from <value 1>. | • **Result**: any variable.<br>• **Value 1**: any variable or constant (range -128 to 127).<br>• **Value 2**: any variable or constant (range -2147483648 to 2147483647). |
| **Format** | | |
| <result>= <value 1> - <value 2> | | |
| **Warning**: Drive Programming does not control overflow/underflow. The application should take care. | | |

**Example**

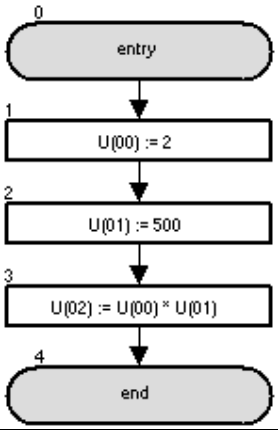
| Flowchart | Text |
|---|---|
|  | `entry`<br>`  U(00) := 200`<br>`  U(01) := 500`<br>`  U(02) := U(01) - U(00)`<br>`end` |



*The P102 parameter calculation result is 300.*

| *(Multiplication) | | |
|---|---|---|
| **Command** | **Description** | **Arguments** |
|  | Multiplies <value 1> by <value 2>. | • **Result**: any variable.<br>• **Value 1**: any variable or constant (range -128 to 127).<br>• **Value 2**: any variable or constant (range -2147483648 to 2147483647). |
| **Format** | | |
| <result> = <value 1> * <value 2> | | |
| **Warning**: Drive Programming does not control overflow/underflow. The application should take care. | | |

**Example**

| Flowchart | Text |
|---|---|
|  | `entry`<br>`  U(00) := 2`<br>`  U(01) := 500`<br>`  U(02) := U(00) * U(01)`<br>`end` |



*The P102 parameter is set to 1000.*



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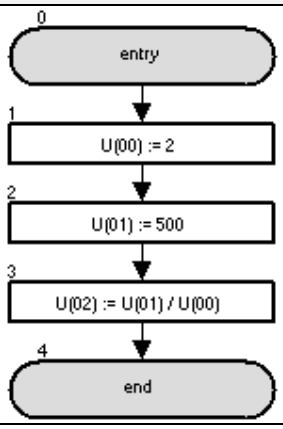
| /(Division) | | |
|---|---|---|
| **Command** | **Description** | **Arguments** |
| | Divides <value 1> by <value 2>. | • **Result**: any variable.<br>• **Value 1**: any variable or constant (range -128 to 127)<br>• **Value 2**: any variable or constant (range -2147483648 to 2147483647). |
| **Format** | | |
| <result> = <value 1> / <value 2> | | |
| **Warning**: Drive Programming does not control overflow/underflow. The application should take care. | | |

**Example**

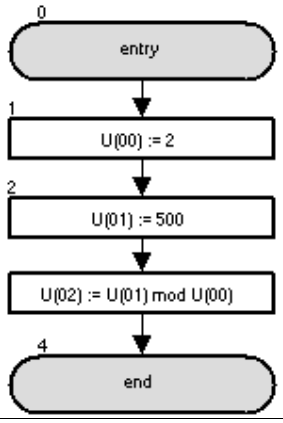
| Flowchart | Text |
|---|---|
|  | `entry`<br>`  U(00) := 2`<br>`  U(01) := 500`<br>`  U(02) := U(01) / U(00)`<br>`end` |



*The P102 parameter calculation result is 250.*

| % (Mod) | | |
|---|---|---|
| **Command** | **Description** | **Arguments** |
| | Remainder of division. | • **Result**: Any variable.<br>• **Value 1**: any variable or constant (range -128 to 127).<br>• **Value 2**: any variable or constant (range -2147483648 to 2147483647) |
| **Format** | | |
| <result> = <value 1> Mod <value 2> | | |
| **Warning**: Drive Programming does not control overflow/underflow. The application should take care. | | |

**Example**

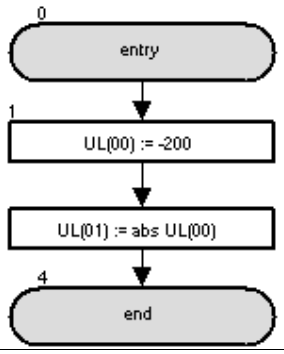
| Flowchart | Text |
|---|---|
|  | `entry`<br>`  U(00) := 2`<br>`  U(01) := 500`<br>`  U(02) := U(01) mod U(00)`<br>`end` |



*The P102 parameter calculation result is 0.*

| Abs | | |
|---|---|---|
| **Command** | **Description** | **Arguments** |
| | Absolute value. | • **Result**: any variable.<br>• **Value**: any variable or constant (range -2147483648 to 2147483647). |
| **Format** | | |
| <result> = Abs <value> | | |
| **Warning**: Drive Programming does not control overflow/underflow. The application should take care. | | |

**Example**

| Flowchart | Text |
|---|---|
|   | `entry`<br>`  UL(00) := -200`<br>`  UL(01) := abs UL(00)`<br>`end` |

*The UL(01) variable is set to 200.*



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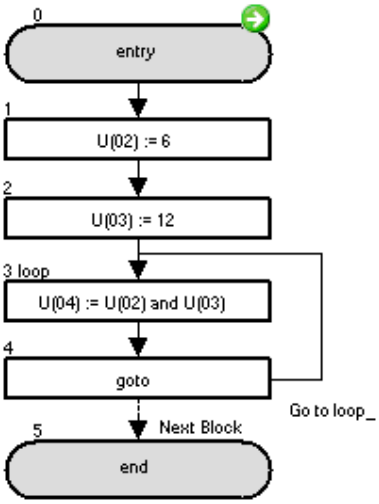
<table>
<tr><th colspan="3">And</th></tr>
<tr><th>Command</th><th>Description</th><th>Arguments</th></tr>
<tr>
<td>
</td>
<td>And (logical product).
<table>
<tr><th>Value 1</th><th>Value 2</th><th>Result</th></tr>
<tr><td>0</td><td>0</td><td>0</td></tr>
<tr><td>0</td><td>1</td><td>0</td></tr>
<tr><td>1</td><td>0</td><td>0</td></tr>
<tr><td>1</td><td>1</td><td>1</td></tr>
</table></td>
<td>• Result: any variable.<br>• Value 1: any variable or constant (range -128 to 127).<br>• Value 2: any variable or constant (range -2147483648 to 2147483647).</td>
</tr>
<tr><th colspan="3">Format</th></tr>
<tr><td colspan="3"><result> = <value 1> And <Value 2></td></tr>
<tr><td colspan="3">Warning: Drive Programming does not control overflow/underflow. The application should take care.</td></tr>
</table>

**Example**

<table>
<tr><th>Flowchart</th><th>Text</th></tr>
<tr>
<td> 
</td>
<td>

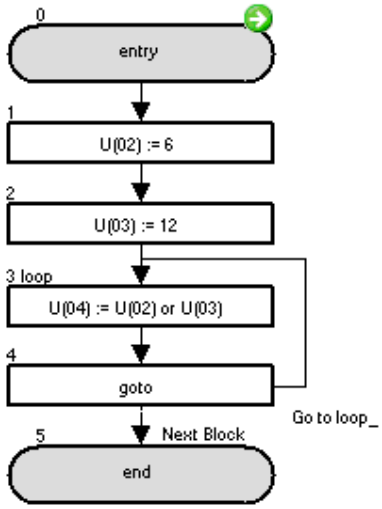
```
entry
    U(02) := 6
    U(03) := 12
:loop_
    U(04) := U(02) and U(03)
    goto loop_
end
```

</td>
</tr>
</table>

*The initial P104 parameter calculation result is 4, as 6 in binary format is 00000110 and 12 in binary format is 00001100, so the result of the **and** operation is 00000100 that is 4 in decimal format*
*If P102 and P103 are changed by the user, then P104 will recalculate accordingly.*

<table>
<tr><th colspan="3">Or</th></tr>
<tr><th>Command</th><th>Description</th><th>Arguments</th></tr>
<tr>
<td>
</td>
<td>Or (logical addition).
<table>
<tr><th>Value 1</th><th>Value 2</th><th>Result</th></tr>
<tr><td>0</td><td>0</td><td>0</td></tr>
<tr><td>0</td><td>1</td><td>1</td></tr>
<tr><td>1</td><td>0</td><td>1</td></tr>
<tr><td>1</td><td>1</td><td>1</td></tr>
</table></td>
<td>• Result: any variable.<br>• Value 1: any variable or constant (range -128 to 127).<br>• Value 2: any variable or constant (range -2147483648 to 2147483647).</td>
</tr>
<tr><th colspan="3">Format</th></tr>
<tr><td colspan="3"><result> = <value 1> Or <value 2></td></tr>
<tr><td colspan="3">Warning: Drive programming does not control overflow/underflow. The application should take care.</td></tr>
</table>

**Example**

<table>
<tr><th>Flowchart</th><th>Text</th></tr>
<tr>
<td> 
</td>
<td>

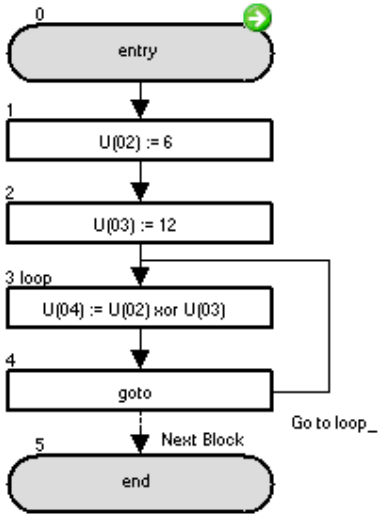
```
entry
    U(02) := 6
    U(03) := 12
:loop_
    U(04) := U(02) or U(03)
    goto loop_
end
```

</td>
</tr>
</table>

*The initial P104 parameter calculation result is 14, as 6 in binary format is 00000110 and 12 in binary format is 00001100, so the result of the operation is 00001110 that is 14 in decimal format. If P102 and P103 are changed by the user, then P104 will recalculate accordingly.*

<table>
<tr><th colspan="3">XOr</th></tr>
<tr><th>Command</th><th>Description</th><th>Arguments</th></tr>
<tr>
<td>
</td>
<td>XOr(exclusive-or)
<table>
<tr><th>Value 1</th><th>Value 2</th><th>Result</th></tr>
<tr><td>0</td><td>0</td><td>0</td></tr>
<tr><td>0</td><td>1</td><td>1</td></tr>
<tr><td>1</td><td>0</td><td>1</td></tr>
<tr><td>1</td><td>1</td><td>0</td></tr>
</table></td>
<td>• Result: any variable.<br>• Value 1: any variable or constant (range -128 to 127).<br>• Value 2: any variable or constant (range -2147483648 to 2147483647).</td>
</tr>
<tr><th colspan="3">Format</th></tr>
<tr><td colspan="3"><result>= <value 1> XOr <value 2></td></tr>
<tr><td colspan="3">Warning: Drive Programming does not control overflow/underflow. The application should take care.</td></tr>
</table>

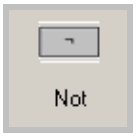
**Example**

<table>
<tr><th>Flowchart</th><th>Text</th></tr>
<tr>
<td> 
</td>
<td>

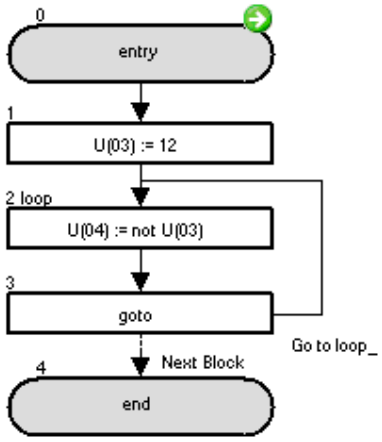
```
entry
    U(02) := 6
    U(03) := 12
:loop_
    U(04) := U(02) xor U(03)
    goto loop_
end
```

</td>
</tr>
</table>

*The initial P104 parameter calculation result is 10, as 6 in binary format is 00000110 and 12 in binary format is 00001100, so the result of the **XOr** operation is 00001010 that is 10 in decimal format. If P102 and P103 are changed by the user, then P104 will recalculate accordingly.*

<table>
<tr><th colspan="3">Not</th></tr>
<tr><th>Command</th><th>Description</th><th>Arguments</th></tr>
<tr><td> 
</td><td>Not (negation)<br><table><tr><th>Value 1</th><th>Result</th></tr><tr><td>0</td><td>1</td></tr><tr><td>1</td><td>0</td></tr></table></td><td>• Result: any variable, except variables with bit data size (Note 1)<br>• Value: any variable or constant, except variables with bit data size (Note 1) (range -2147483648 to 2147483647).</td></tr>
<tr><th colspan="3">Format</th></tr>
<tr><td colspan="3"><result> = Not<value></td></tr>
<tr><td colspan="3">Note: Unexpected result will be obtained with instructions like UB(1) = Not UB(0).<br>Please use XOr command to negate variables with bit data size in Drive Programming as shown on the next examples:<br>・Example 1: UB(1) = UB(0) Xor 1<br>・Example 2: UB(2) = X(00) Xor 1</td></tr>
<tr><td colspan="3">Warning: Drive Programming does not control overflow/underflow. The application should take care.</td></tr>
</table>

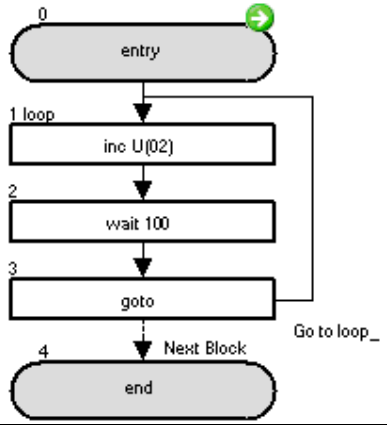
**Example**

<table>
<tr><th>Flowchart</th><th>Text</th></tr>
<tr><td> 
</td><td><pre>entry
    U(03) := 12
:loop_
    U(04) := not U(03)
    goto loop_
end</pre></td></tr>
</table>

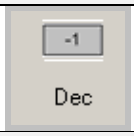
*The initial P104 parameter calculation result is 65523, as 12 in binary format is 0000000000001100, so the result of the **not** operation is 1111111111110011 that is 65523 in decimal format. If P103 is changed by the user, then P104 will recalculate accordingly.*

| Inc | | |
|---|---|---|
| **Command** | **Description** | **Arguments** |
| | Increments a value by 1. | • **Value**: any variable. |
| **Format** | | |
| Inc<value> | | |
| **Warning**: Drive Programming does not control overflow/underflow. The application should take care. | | |

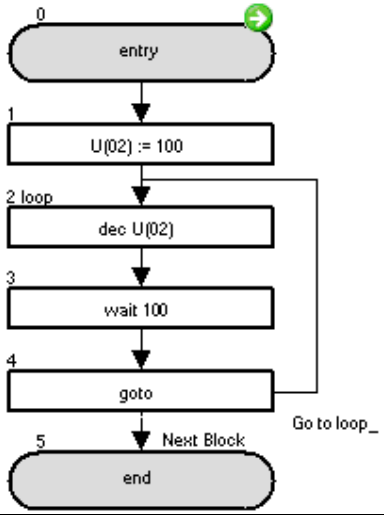
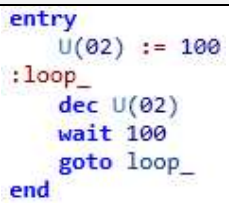
**Example**

| Flowchart | Text |
|---|---|
|  | entry<br>:loop_<br>inc U(02)<br>wait 100<br>goto loop_<br>end |

*The P102 parameter is incremented by 1 every second.*

| Dec | | |
|---|---|---|
| **Command** | **Description** | **Arguments** |
|   | Decrements a value by 1. | • **Value**: any variable. |
| **Format** | | |
| Dec<value> | | |
| **Warning**: Drive Programming does not control overflow/underflow. The application should take care. | | |

**Example**

| Flowchart | Text |
|---|---|
|   |   |

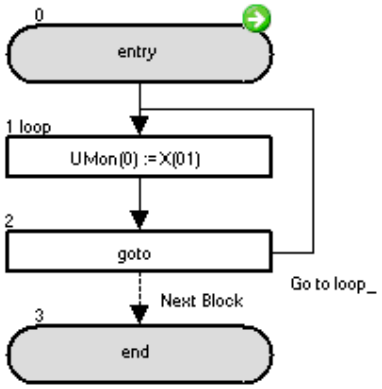
*The P102 parameter is decremented by 1 every second.*

### 6-3 Input/Output Control Commands

For memory optimization, use Input/Output Control Commands (4 bytes) instead of the Equal Arithmetic Command "=" (8 bytes).

| **Var = X(i)** | | |
|---|---|---|
| **Command** | **Description** | **Arguments** |
| | Instruction to access contact inputs.<br>Reflects the state of the input. | • **Variable**: any variable (the value of the variable will be 0 or 1).<br>• **i**: Number of the contact input (range 0 to 11). |
| **Format** | | |
| <variable>=X(i) | | |
| **Note**: The inputs have to be assigned to digital multifunction input (by the multifunction 56 to 63).<br>X(02) is not necessarily input 2 (depends where MF 58 is).<br><br>X(00) = MI1<br>X(01) = MI2<br>X(02) = MI3<br>X(03) = MI4<br>X(04) = MI5<br>X(05) = MI6<br>X(06) = MI7<br>X(07) = MI8<br>X(08) = MI9<br>X(09) = MI10<br>X(10) = MI11<br>X(11) = MI12<br>Note: more details in chapter *5-4 Terminal Variables*. | | |

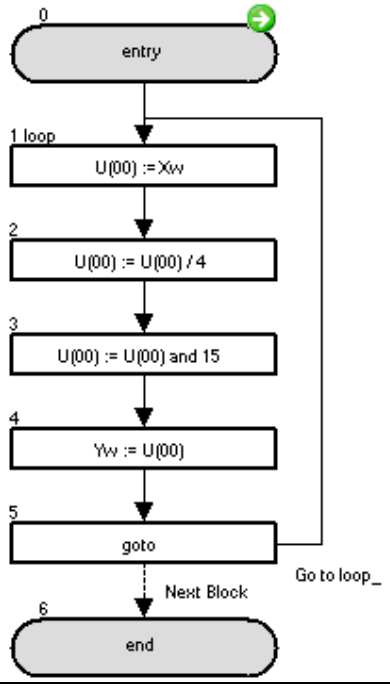
**Example**

| **Flowchart** | **Text** |
|---|---|
|  | `entry`<br>`:loop_`<br>`  UMon(0) := X(01)`<br>`  goto loop_`<br>`end` |

*The state of the input terminal X(01) is monitored on the d025 parameter.*

| Var = Xw | | |
|---|---|---|
| **Command** | **Description** | **Arguments** |
| | Instruction to access contact inputs by word.<br>Each bit reflects one of the inputs. | • **Variable**: any variable. |
| **Format** | | |
| <variable> = Xw | | |
| **Note**: The inputs have to be assigned to digital multifunction input (by the multifunction 56 to 63 for MX2 and RX or 49 to 60 on LX)<br><br>Xw = 1 → bit 0<br>Xw = 2 → bit 1<br>Xw = 4 → bit 2<br>Xw = 8 → bit 3<br>Xw = 16→ bit 4<br>Xw = 32→ bit 5<br>Xw = 64→ bit 6<br>Xw = 128 → bit 7 (only for RX and LX)<br>Xw = 256 → bit 8 (only for LX with extension I/O)<br>Xw = 512 → bit 9 (only for LX with extension I/O)<br>Xw = 1024 → bit 10 (only for LX with extension I/O)<br>Xw = 2048 → bit 11 (only for LX with extension I/O) | | |

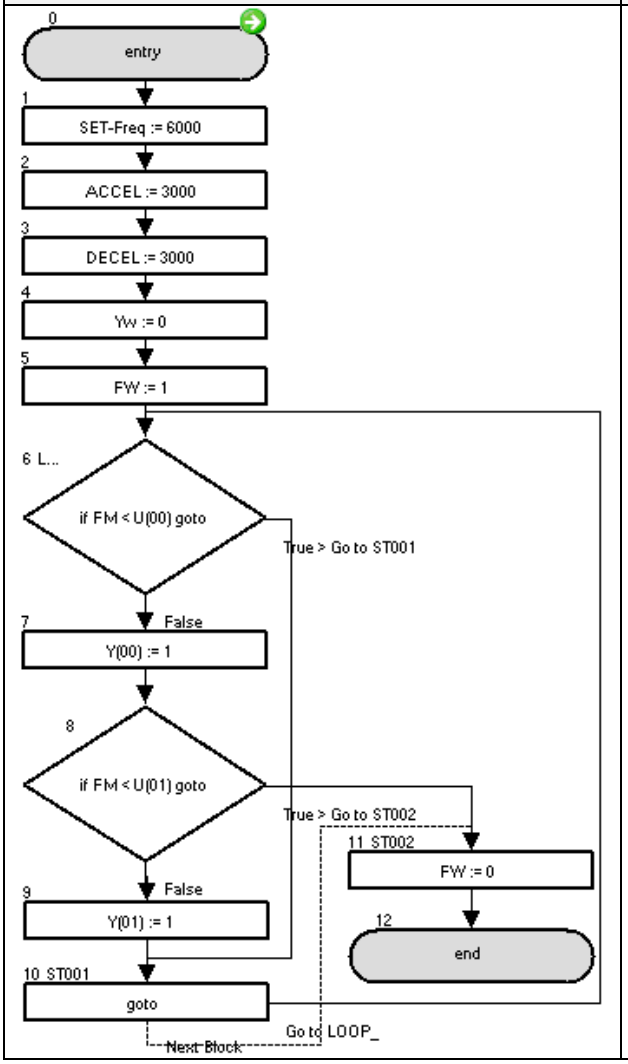
**Example**

| Flowchart | Text |
|---|---|
|   | `entry`<br>`:loop_`<br>`  U(00) := xw`<br>`  U(00) := U(00) / 4`<br>`  U(00) := U(00) and 15`<br>`  yw := U(00)`<br>`  goto loop_`<br>`end` |

*This example acquires the state of the X(02) - X(05) input terminals and outputs it to Y(00) -Y(03) output terminals. To cut X(00) - X(01), the U(00) value is divided by 4. To cut X(06) - X(07), the U(00) value is masked by 15.*

| Y(i) = value | | |
|---|---|---|
| **Command** | **Description** | **Arguments** |
| | Instruction to access digital outputs. | • **i**: Number of the contact output (range 0 to 6)<br>• **Value**: any variable or constant. |
| **Format** | | |
| Y(i)=<value> | | |
| **Note**: The inputs have to be assigned to digital multifunction output (by the multifunction 44 to 49 for MX2 and RX and 35 to 41 for LX).<br>Y(00) = MO1<br>Y(01) = MO2<br>Y(02) = MO3<br>Y(03) = MO4<br>Y(04) = MO5<br>Y(05) = MO6<br>Y(06) = MO7<br>Note: more details in chapter *5-4 Terminal Variables* | | |

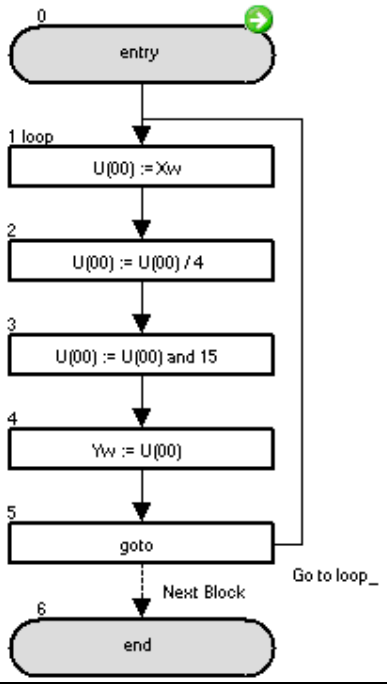
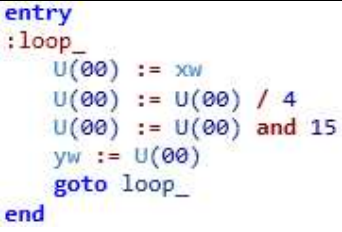
**Example**

| Flowchart | Text |
|---|---|
|  | ```<br>entry<br>    SET-Freq := 6000<br>    ACCEL := 3000<br>    DECEL := 3000<br>    yw := 0<br>    FW := 1<br>:LOOP_<br>    if FM < U(00) goto ST001<br>    Y(00) := 1<br>    if FM < U(01) goto ST002<br>    Y(01) := 1<br>:ST001<br>    goto LOOP_<br>:ST002<br>    FW := 0<br>end<br>``` |

*To test this example, initialize the user variables with the following value: U(00) = 1000, U(01) = 2000, U(02) = 3000. Y(00) – Y(01) are sequentially turned on every 10Hz step of the output frequency.*

| Yw = value | | |
|---|---|---|
| **Command** | **Description** | **Arguments** |
| Yw=value | Instruction to access digital outputs by word.<br>Each bit reflects one of the outputs. | • **Value**: any variable or constant |
| **Format** | | |
| Yw = <value> | | |
| **Note**: The inputs have to be assigned to digital multifunction input (by the multifunction 44 to 49 for MX2 and RX, 35 to 41 for LX).<br>Yw = 1 → bit 0<br>Yw = 2 → bit 1<br>Yw = 4 → bit 2<br>Yw = 8 → bit 3 (only if expanded I/O board used)<br>Yw = 16 → bit 4 (only if expanded I/O board used)<br>Yw = 32 → bit 5 (only if expanded I/O board used, and enough outputs)<br>Yw = 64 → bit 6 (only if expanded I/O board for LX is used) | | |

**Example**

| Flowchart | Text |
|---|---|
|  |  |

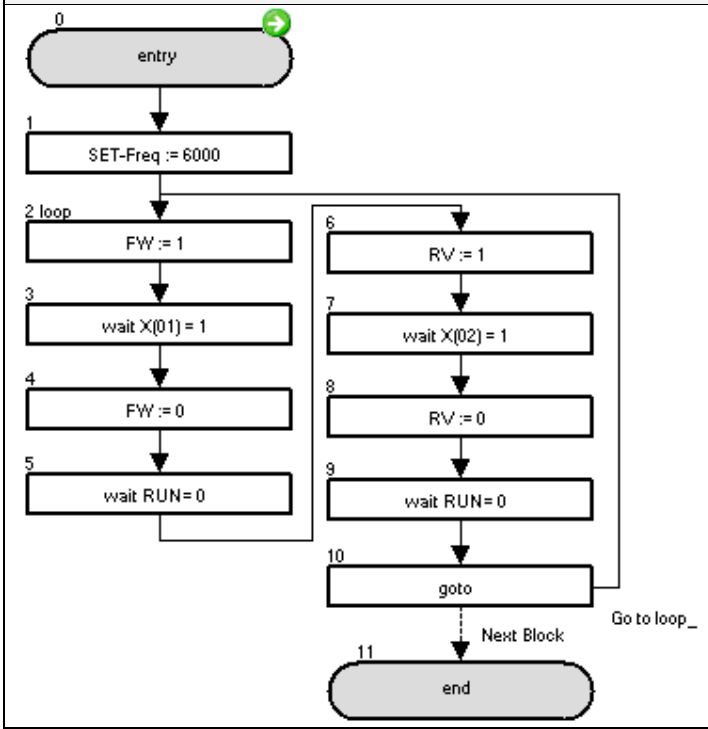


```
entry
:loop_
    U(00) := xw
    U(00) := U(00) / 4
    U(00) := U(00) and 15
    yw := U(00)
    goto loop_
end
```

*This example acquires the state of the X(02)-X(05) input terminals and outputs it to Y(00)-Y(03) output terminals.*
*To cut X(00) – X(01), the U(00) value is divided by 4. To cut X(06) – X(07), the U(00) value is masked by 15.*

| func = value | | |
|---|---|---|
| **Command** | **Description** | **Arguments** |
| | Assigns the value of a variable to a command of a terminal input. | • **Function**: any function of input terminal.<br>• **Value**: any variable or constant. |
| **Format** | | |
| <function> = <value> | | |

**Example**

| Flowchart | Text |
|---|---|
|   | `entry`<br>`  SET-Freq := 6000`<br>`:loop_`<br>`  FW := 1`<br>`  wait X(01) = 1`<br>`  FW := 0`<br>`  wait RUN = 0`<br>`  RV := 1`<br>`  wait X(02) = 1`<br>`  RV := 0`<br>`  wait RUN = 0`<br>`  goto loop_`<br>`end` |

*A forward and reverse run at 60Hz is repeated continuously.*



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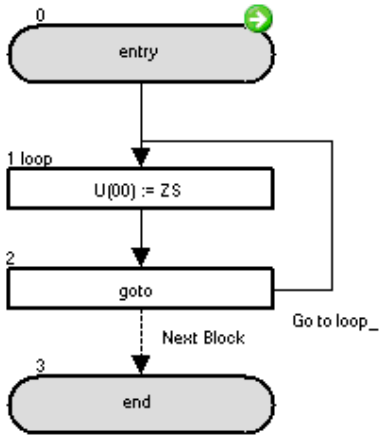
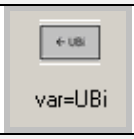
| Var = func | | |
|---|---|---|
| **Command** | **Description** | **Arguments** |
| | A terminal output status is assigned to a variable. | • **Variable**: any variable.<br>• **Function**: any function of output terminal. |
| **Format** | | |
| <variable>=<function> | | |

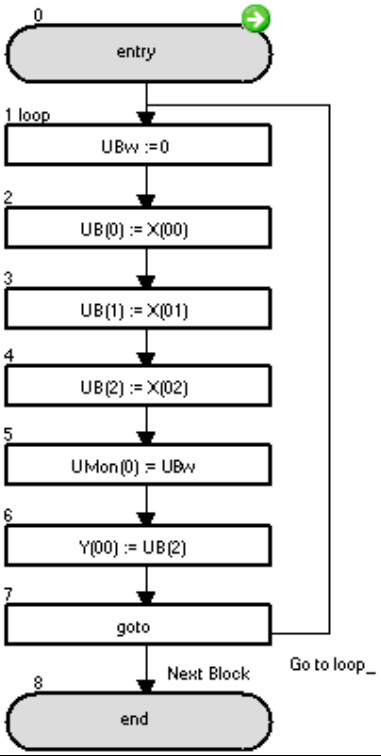
**Example**

| Flowchart | Text |
|---|---|
|  | entry<br>:loop_<br>U(00) := ZS<br>goto loop_<br>end |

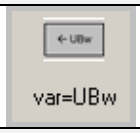
*The value of P100 is set to "1" if the ZS (zero speed signal) is on, otherwise is set to "0".*

| Var = UB(i) | | |
|---|---|---|
| **Command** | **Description** | **Arguments** |
|  | Assigns the value of an internal user contact to a variable. | • **Variable**: any variable (value of the variable will be 0 or 1).<br>• **i**: Number of the user contact (range 0 to 7) |
| **Format** | | |
| <variable> = UB(i) | | |

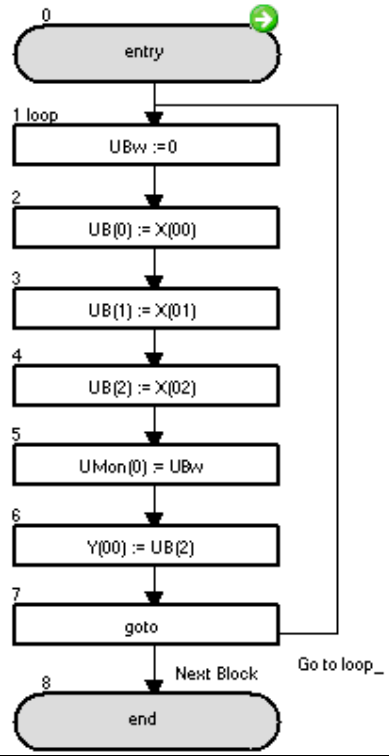
**Example**

| Flowchart | Text |
|---|---|
|  | entry<br>:loop_<br>ubw := 0<br>UB(0) := X(00)<br>UB(1) := X(01)<br>UB(2) := X(02)<br>UMon(0) := ubw<br>Y(00) := UB(2)<br>goto loop_<br>end |

*The internal user contacts are cleared on the loop's 1st instruction.*
*The status of the X(00) – X(02) input terminals are stored in the UB(0) – UB(2) internal user contacts and monitored on the d025 parameter.*
*Finally, the status of the X(02) input terminal is set tot the Y(00) output terminal.*

| Var = UBw | | |
|---|---|---|
| **Command** | **Description** | **Arguments** |
|  | Assigns the value of the internal user contact as word (all together) to a word variable.<br>. | • **Variable**: any variable. |
| **Format** | | |
| <variable> = UBw | | |
| **Note**:<br>UBw = 1 → bit 0<br>UBw = 2 → bit 1<br>UBw = 4 → bit 2<br>UBw = 8 → bit 3<br>UBw = 16 → bit 4<br>UBw = 32 → bit 5<br>UBw = 64 → bit 6<br>UBw = 128 → bit 7 | | |

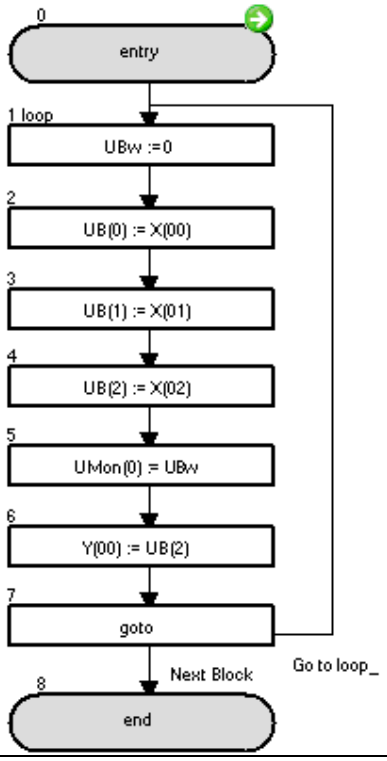
**Example**

| Flowchart | Text |
|---|---|
|  | entry<br>:loop_<br>ubw := 0<br>UB(0) := X(00)<br>UB(1) := X(01)<br>UB(2) := X(02)<br>UMon(0) := ubw<br>Y(00) := UB(2)<br>goto loop_<br>end |

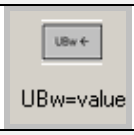
The internal user contacts are cleared on the loop's 1st instruction.
The status of the X(00) – X(02) input terminals are stored in the UB(0) – UB(2) internal user contacts and monitored on the d025 parameter.
Finally the status of the X(02) input terminal is set to the Y(00) output terminal.

| UB(i) = value | | |
|---|---|---|
| **Command** | **Description** | **Arguments** |
| | Assigns a value to an internal user contact control. | • **i**: Number of the user contact (range 0 to 7).<br>• **Value**: any variable or constant. |
| **Format** | | |
| UB(i) = <value> | | |

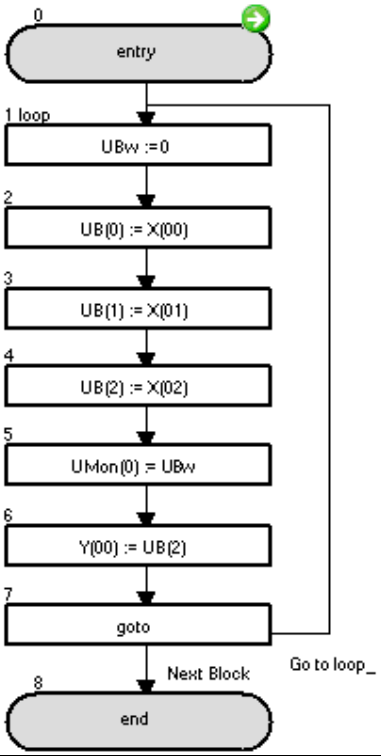
**Example**

| Flowchart | Text |
|---|---|
|  | entry<br>:loop_<br>ubw := 0<br>UB(0) := X(00)<br>UB(1) := X(01)<br>UB(2) := X(02)<br>UMon(0) := ubw<br>Y(00) := UB(2)<br>goto loop_<br>end |

*The internal user contacts are cleared on the loop's 1st instruction.*
*The status of the X(00)-X(02) input terminals are stored in the UB(0)-UB(2) internal user contacts and monitored on the d025 parameter. Finally, the status of the X(02) input terminal is set to the Y(00) output terminal.*

| UBw = value | | |
|---|---|---|
| **Command** | **Description** | **Arguments** |
|   | Assigns a value to the internal user contact controls.<br>Instruction to access internal user contact by word. | • **Value**: any variable or constant. |
| **Format** | | |
| UBw = <value> | | |
| **Note**:<br>UBw = 1 → bit 0<br>UBw = 2 → bit 1<br>UBw = 4 → bit 2<br>UBw = 8 → bit 3<br>UBw = 16 → bit 4<br>UBw = 32 → bit 5<br>UBw = 64 → bit 6<br>UBw = 128→ bit 7 | | |

**Example**

| Flowchart | Text |
|---|---|
|   | `entry`<br>`:loop_`<br>`  ubw := 0`<br>`  UB(0) := X(00)`<br>`  UB(1) := X(01)`<br>`  UB(2) := X(02)`<br>`  UMon(0) := ubw`<br>`  Y(00) := UB(2)`<br>`  goto loop_`<br>`end` |

*The internal user contacts are cleared on the loop's 1st instruction. The status of the X(00)-X(02) input terminals are stored in the UB(0)-UB(2) internal user contacts and monitored on the d025 parameter. Finally, the status of the X(02) input terminal is set to the Y(00) output terminal.*



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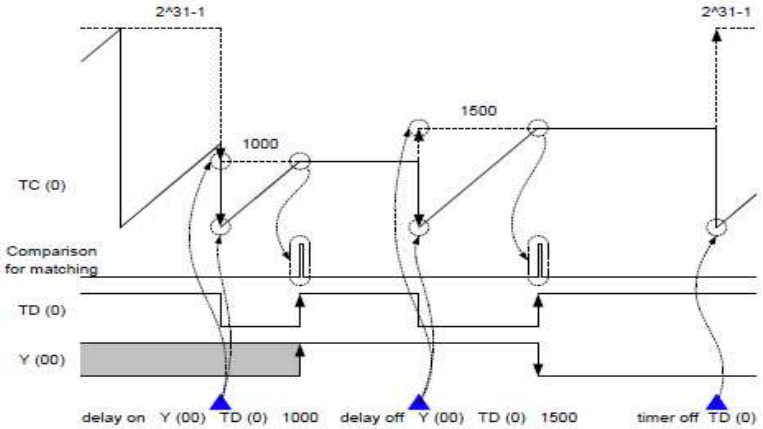
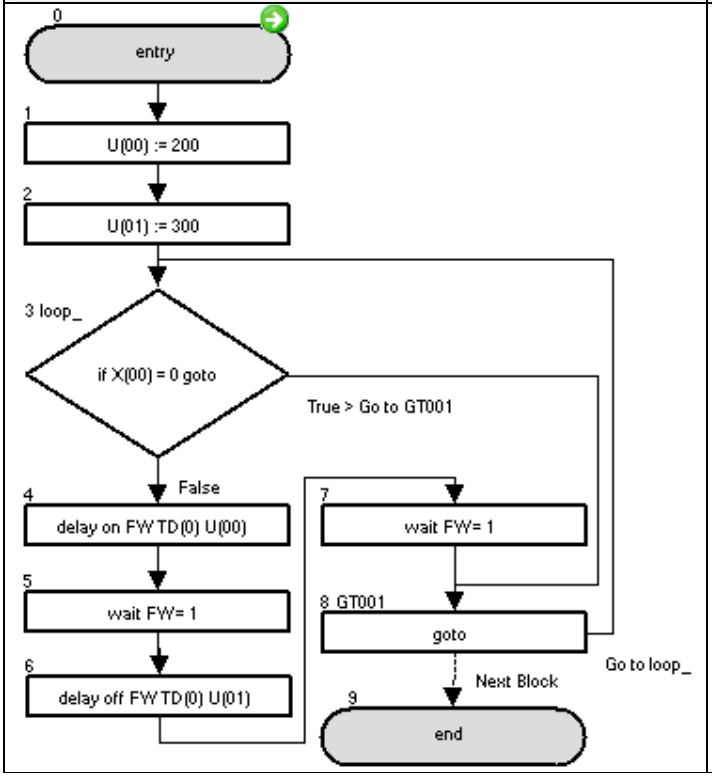
### 6-4 Timer Control Commands

| Delay | | |
|---|---|---|
| **Command** | **Description** | **Arguments** |
| | This instruction sets the count of the timer in <value 2> and starts the timer counter. When the timer output “TD (K)” is turned on/off, <value 1> is turned on/off. It is important to note, that meantime counting proceeds, the <value 1> remains unchanged from original value. | • **Value 1**: any variable.<br>• **Value 2**: any variable or constant (time in 10 x ms)<br>• **K**: number of timer. |
| **Format** | | |
| Delay on/off <value 1>TD(k)<value 2> | | |

**Timing chart**




**Example**

| Flowchart | Text |
|---|---|
|   | `entry`<br>`  U(00) := 200`<br>`  U(01) := 300`<br>`:loop_`<br>`  if X(00) = 0 goto GT001`<br>`  delay on FW TD(0) U(00)`<br>`  wait FW = 1`<br>`  delay off FW TD(0) U(01)`<br>`  wait FW = 1`<br>`:GT001`<br>`  goto loop_`<br>`end` |

*Sample program that activates/deactivates the FW instruction with Delay On/Delay Off instruction.*



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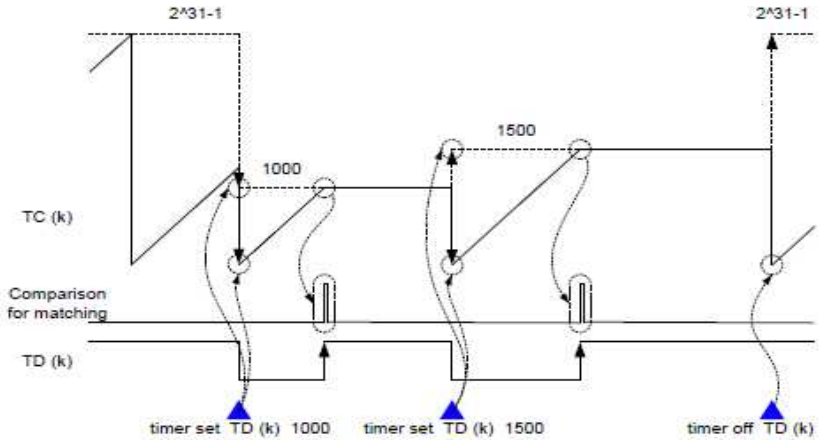
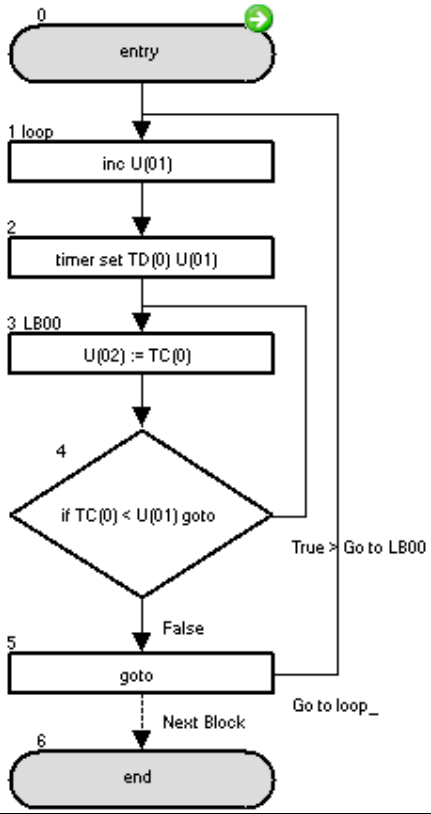
| Timer Set | | |
|---|---|---|
| **Command** | **Description** | **Arguments** |
| | Sets <value> in the timer and starts the counter. The timer starts from 0 and increments until <value>. Associated timer contact reflects status (“1” = finish timing) | • **Value**: any variable or constant (time in 10 x ms)<br>• **K**: number of timer (range 0 to 7) |
| **Format** | | |
| Timer set TD(k) <value> | | |
| **Note**: Timer value can be check in variable TC(k). Completion of timer can be checked in variable TD(k) (when it becomes “1”). | | |

**Timing chart**



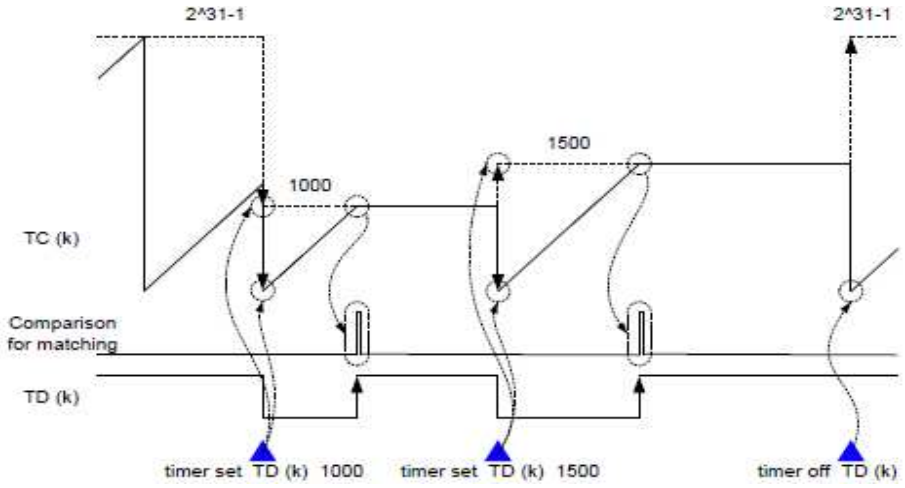

**Example**

| Flowchart | Text |
|---|---|
|  | ```<br>entry<br>:loop_<br>  inc U(01)<br>  timer set TD(0) U(01)<br>:LB00<br>  U(02) := TC(0)<br>  if TC(0) < U(01) goto LB00<br>  goto loop_<br>end<br>``` |

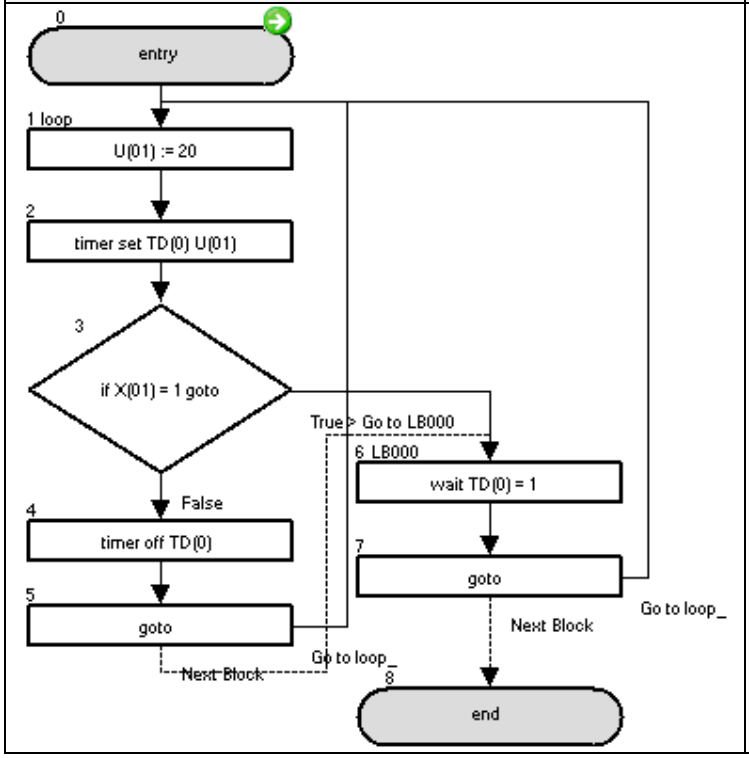
*This program will set the timer TD(0) to an increasing value each timer execution, taking longer time on each loop.*

| Timer Off | | |
|---|---|---|
| **Command** | **Description** | **Arguments** |
| | Clears the timer counter (up counter) to zero, and starts it in free-running mode. | • **k**: number of timer (range 0 to 7) |
| **Format** | | |
| Timer off TD(k) | | |

**Timing chart**




**Example**

| Flowchart | Text |
|---|---|
|  | `entry`<br>`:loop_`<br>`  U(01) := 20`<br>`  timer set TD(0) U(01)`<br>`  if X(01) = 1 goto LB000`<br>`  timer off TD(0)`<br>`  goto loop_`<br>`:LB000`<br>`  wait TD(0) = 1`<br>`  goto loop_`<br>`end` |



*This example uses a fixed timer execution. But it is cancelled when digital input X(01) is OFF.*



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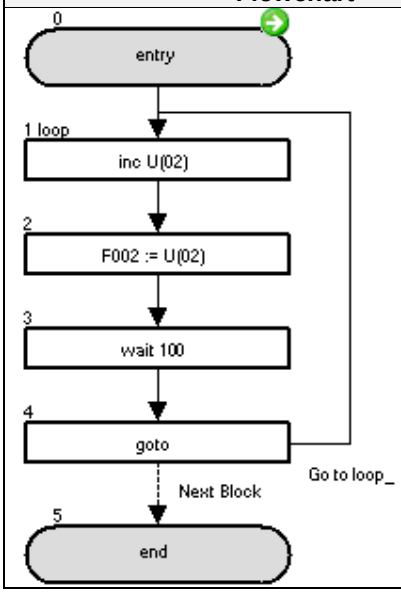
### 6-5 Parameter Control Commands

| ChgParam | | |
|---|---|---|
| **Command** | **Description** | **Arguments** |
| | Changes the parameter's inverter setting specified by display code to a value. Any inverter parameter can be changed. | • **Parameter**: parameter code (Fxxx, Axxx, bXXX, Cxxx, Hxxx, Pxxx)<br>• **Value**: any variable or constant. |
| **Format** | | |
| ChgParam <parameter><value> | | |
| **Note**: The same rules to parameter writing from operator panel or communications apply: Some parameters can not be written in certain mode of inverter (e.g. some parameters can not be changed during RUN condition). This instruction does not fix the parameter in EEPROM (EepWrt to be used for this purpose) | | |

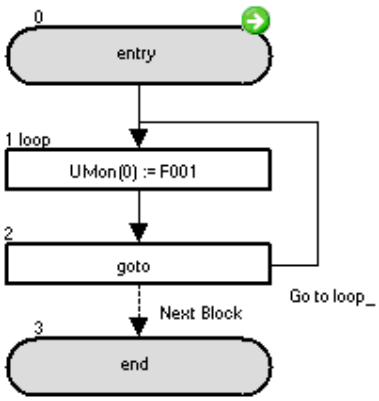
**Example**

| Flowchart | Text |
|---|---|
|  | `entry`<br>`:loop_`<br>`  inc U(02)`<br>`  F002 := U(02)`<br>`  wait 100`<br>`  goto loop_`<br>`end` |

*The F002 (acceleration time setting 1) value is increased by 1 every second.*

| MonParam | | |
|---|---|---|
| **Command** | **Description** | **Arguments** |
| | Assigns the inverter's parameter content specified by display code to a variable. | • **Parameter**: parameter code (Fxxx, Axxx, bxxx, Cxxx, dxxx, Hxxx, Pxxx).<br>• **Variable**: any variable |
| **Format** | | |
| MonParam<parameter><variable> | | |

**Example**

| Flowchart | Text |
|---|---|
|  | entry<br>:loop_<br>UMon(0) := F001<br>goto loop_<br>end |

*The value of the F001 parameter (output frequency setting) is monitored on the d025 parameter (user parameter monitor).*



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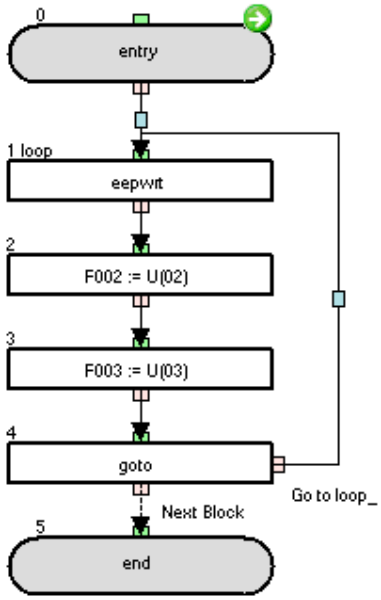
| EepWrt | | |
|---|---|---|
| **Command** | **Description** | **Arguments** |
| | The command allows write into EEPROM the next ***ChgParam*** executed just after this command. (if two ChgParam follows an EepWrt, only for the first one will be saved). | --- |
| **Format** | | |
| EepWrt | | |

**Note**: Limitation of ***EepWrt***:

-If this command is executed in more than one task, ***ChgParam*** is executed in the sequence it is detected. For the second invocation of the command, a waiting time of typically 10 ms will occur before each ***ChgParam*** is executed. For example, when ***ChgParam*** is detected in task 1,2 and 3 at the same time, and the one in task 1 is executed at first, is necessary to wait 10 ms for task 2 and 20 ms for task 3. But when ***Eepwrt*** is not executed, ***ChgParam*** doesn't need this waiting time.

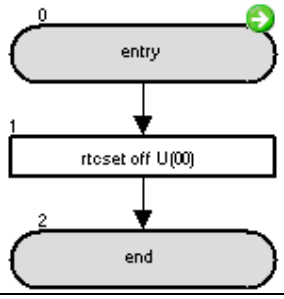
**Example:** (*only F002 is stored in EEPROM*)

| Flowchart | Text |
|---|---|
|   | `entry`<br>`:loop_`<br>`  eepwrt`<br>`  F002 := U(02)`<br>`  F003 := U(03)`<br>`  goto loop_`<br>`end` |

*On executing the program, only F002 parameter is saved permanently from U(02). After power off and on again, F003 will have the old value. The initial values of the U(02) and U(03) variables can be set on the program variables list or the P102, P103 parameters.*

| RtcSet | | |
|---|---|---|
| **Command** | **Description** | **Arguments** |
| | This statement sets 6 bytes data of time to a variable. This data corresponds with year, month, day, day of week, hour and minute.<br>The variable value in hexadecimal corresponds to the year, month, day, day of a week, hour and minute (in decimal).<br>**RtcSet on**: updates the 6 bytes data continuously.<br>**RtcSet off**: updates the 6 bytes data only once. | • **User variable**: any user or internal user variable (U(xx) or UL(xx)). |
| **Format** | | |
| RtcSet on/off <user variable> | | |
| **Note**:<br>• **RtcSet on U(<k>)**: It will set U(<k>) with 2 bytes for year and 2 bytes for month, U(<k+1>) with 2 bytes for Month's day and 2 bytes for week's day(00 for Sunday, 06 for Saturday), and U(<k+2>) with 2 bytes for hour and 2 bytes for minutes.<br>• **RtcSet on UL(<k>)**: It will set UL(<k>) with 2 bytes for year, 2 bytes for month, 2 bytes for month's day and 2 bytes for week's day (00 for Sunday, 06 for Saturday), and UL(<k+1>) with 2 bytes for hour, 2 bytes for minutes and 4 bytes of padding(0000).<br>• If the watch LCD operator is not attached, **RtcSet** instruction sets 000000000000h | | |

**Example**

| Flowchart | Text |
|---|---|
|  | entry<br>rtcset off U(00)<br>end |

*After executing the program (with the watch LCD operator attached), the hexadecimal value of the first 2 bytes of U(00) will correspond with the current year and the hexadecimal value of the last 2 bytes of U(00) will correspond to the current month.*

I.e. if the example program runs on July 5th (Monday) of 2010 at 02:29 P.M., then U(00), U(01) and U(02) will display the following values:

| Parameter… | …display in decimal format… | Which converted to hexadecimal format results in… | …which means |
|---|---|---|---|
| U(00) | 4103 | 1007 | '10' for 2010<br>'07' for July |
| U(01) | 1281 | 0501 | '05 for 5th day of month<br>'01' for Monday |
| U(02) | 5161 | 1429 | '14' for 2 p.m.<br>'29' for 29 minutes |

### 6-6 Inverter Control Commands

| Run FW | | |
|---|---|---|
| **Command** | **Description** | **Arguments** |
| | Makes the inverter run the motor in forward direction (starts the inverter output).<br>This command is a shortcut of the ***func* = *value*** command. | --- |
| **Format** | | |
| FW = 1 for RX and MX2 or UP =1 for LX | | |
| **Note**: The instruction is available since CX-Drive v2.10. | | |

| Run RV | | |
|---|---|---|
| **Command** | **Description** | **Arguments** |
| | Makes the inverter run the motor in reverse direction (starts the inverter output).<br>This command is a shortcut of the ***func* = *value*** command. | --- |
| **Format** | | |
| RV = 1 for RX and MX2 or DOWN=1 for LX | | |
| **Note**: This instruction is available since CX-Drive v2.10. | | |

| Stop | | |
|---|---|---|
| **Command** | **Description** | **Arguments** |
| | Makes the inverter decelerate and stop the motor (stop the inverter output). | --- |
| **Format** | | |
| Stop | | |

| Set Freq | | |
|---|---|---|
| **Command** | **Description** | **Arguments** |
| | It sets the frequency of the inverter.<br>This command is a shortcut of the '=' command.<br>Units: 0.01Hz. | • **Value**: any variable or constant (range from 0 to 40000). |
| **Format** | | |
| Set-Freq = <value> | | |
| **Note**: This instruction is available since CX-Drive v2.10. | | |



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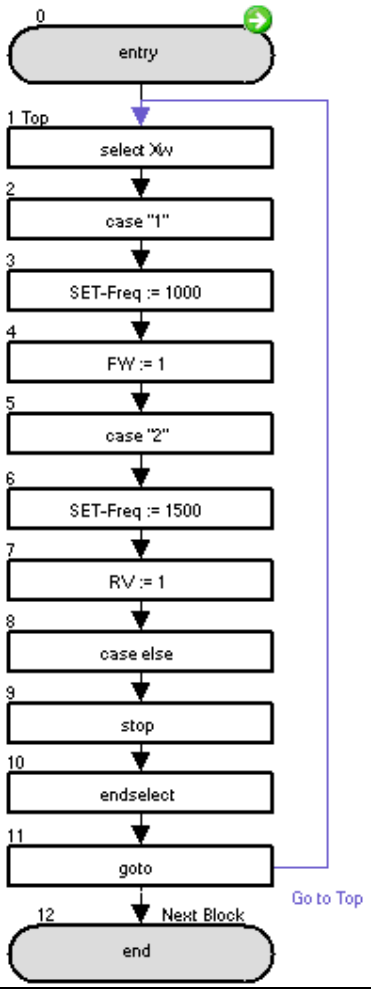
**Example**

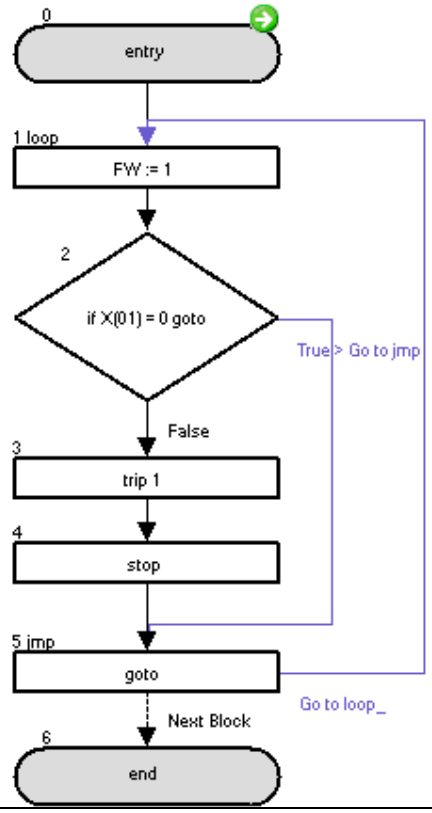
| Flowchart | Text |
|---|---|
|  | `entry`<br>`:Top`<br>`  select Xw`<br>`  case "1"`<br>`  set-freq := 1000`<br>`  fw := 1`<br>`  case "2"`<br>`  set-freq := 1500`<br>`  rv := 1`<br>`  case else`<br>`  stop`<br>`  endselect`<br>`  goto Top`<br>`end` |



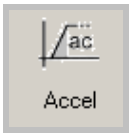
*This program will run the motor in forward direction at 10Hz if general input contact Xw is 1. If general input contact Xw is 2, it will run in reverse direction at 15Hz. For other values the motor will stop.*

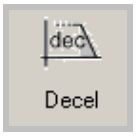
| Trip | | |
|---|---|---|
| **Command** | **Description** | **Arguments** |
| | This instruction makes inverter trip. | • **Value**: any variable or constant (range 0 to 9). |
| **Format** | | |
| Trip<value> | | |

**Example**

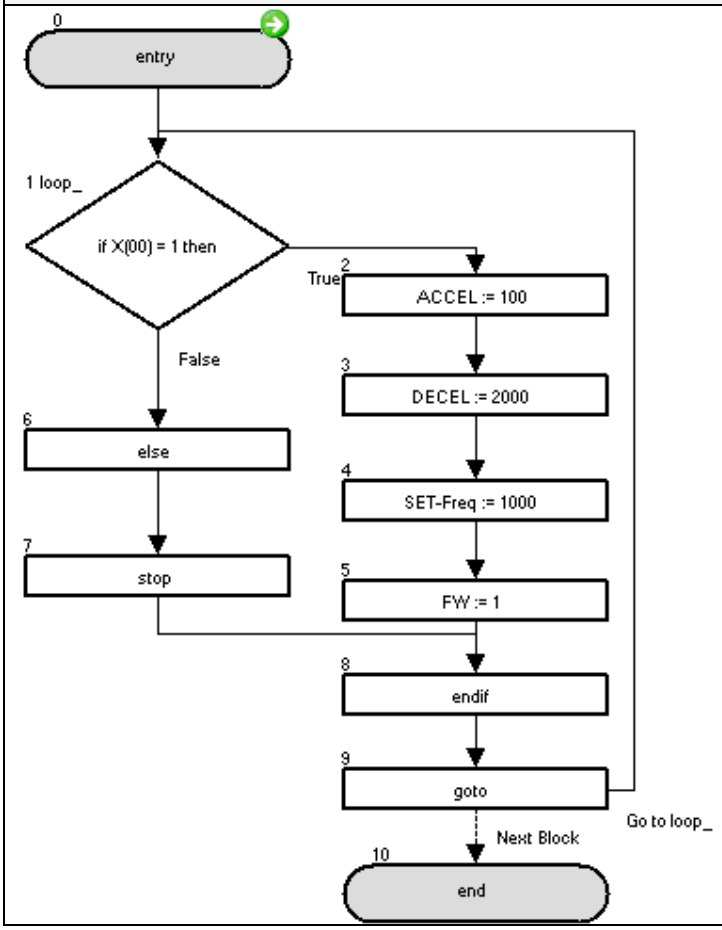
| Flowchart | Text |
|---|---|
|   | entry<br>:loop_<br>FW := 1<br>if X(01) = 0 goto jmp<br>trip 1<br>stop<br>:jmp<br>goto loop_<br>end |

*This sample program will throw a user trip on the inverter when digital input X(01) is set to ON.*

| Accel | | |
|---|---|---|
| **Command** | **Description** | **Arguments** |
|  | It sets the acceleration time of the inverter.<br>This command is a shortcut of the '=' command.<br>Units: 10 ms. | • **Value**: any variable or constant (range from 1 to 360000). |
| **Format** | | |
| Accel =<value> | | |
| **Note:** Parameters P031 for MX2 and RX or A053 on LX must be set to value 3 (Drive programming) for the command to become effective. | | |

| Decel | | |
|---|---|---|
| **Command** | **Description** | **Arguments** |
|  | It sets the deceleration time of the inverter.<br>This command is a shortcut of the '=' command.<br>Units: 10ms | • **Value**: any variable or constant (range from 1 to 360000). |
| **Format** | | |
| Decel = <value> | | |
| **Note**: Parameters P031 for MX2 and RX or A053 on LX must be set to value 3 (Drive programming) for the command to become effective | | |

**Example**

| Flowchart | Text |
|---|---|
|  | `entry`<br>`:loop_`<br>`  if X(00) = 1 then`<br>`  accel := 100`<br>`  decel := 2000`<br>`  set-freq := 1000`<br>`  fw := 1`<br>`  else`<br>`  stop`<br>`  endif`<br>`  goto loop_`<br>`end` |

*This sample program will set the Acceleration to 10 seconds and deceleration to 20 seconds if digital input X(00) is set to ON.*

### 7- Drive Programming specific trips and Troubleshooting

The table below shows how to handle the specific errors to Drive Programming function. For details on other errors in the inverter, refer to the inverter instruction manual.

| Factor code | Error (causing inverter trip) | Possible cause | Checking method | Corrective action |
|---|---|---|---|---|
| E43 | Invalid instruction | The PRG terminal was turned on without a program downloaded to the inverter. | By uploading the program, you can check if really a program is in the inverter or not. | Recreate the program, and then download it to the inverter |
| E44 | Nesting count error | Subroutines are nested in more than eight layers. | Read the program to check the number of nesting layers (some times difficult to recognize)… | Correct the program so that the number of layers will be eight or less. |
| | | For-Next loop statements are nested in more than eight layers. | | |
| | | If statements are nested in more than eight layers. | | |
| E45 | Instruction error 1 | The jump destination of a GoTo instruction is a next instruction to end a for or other loop. | Check whether each GoTo instruction jumps to an instruction that ends a loop. | Correct the jump destinations of GoTo instructions. As general recommendation, never jump a Goto out of the current level it is. |
| | | The variable “U(ii)” referenced via another variable is not found. | Check the numerical value specified in “U(ii)”. | Correct the value of variable “U(ii)” or limit the range of values of variable “U(ii)”. |
| | | An arithmetic instruction caused:<br>-Overflow,<br>-underflow, or<br>-division by zero | Check the program for the instruction causing overflow, underflow, or division by zero (not in early MX2 firmware). | Correct the program so that no arithmetic instruction causes overflow, underflow, or division by zero. |
| | | A ChgParam instruction caused:<br>- reference to a non existing parameter.<br>-writing of a value out of the setting range<br>-change of a parameter value (during inverter operation) that cannot be updated during inverter operation, or<br>Change of a parameter value of which updating is restricted by software lock (when software lock is enabled). | -Check the parameters and the values to be written.<br>-If the error has occurred during inverter operation, check whether the parameter in question can be updated during inverter operation.<br>-Check the setting of software lock selection (b031). | -Correct the parameters or the values to be written to parameters so that they will be within the setting range.<br>-Disable software lock.<br>-If the parameter to be updated is the one that cannot be updated during inverter operation, change the setting of software lock selection (b031) to “10” to switch to the mode enabling parameter updating during inverter operation. |
| E50 to E59 | User trip 0 to 9 | These trips are generated from the user application. The cause is determined by the Drive Programming logic | Check with the drive program documentation to recognize the trip conditions | Check the drive program documentation to recognize countermeasures |



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## 8- Drive Programming Parameters – General Precautions

### 8-1 Parameters list affected by setting order

| Parameter | Description |
|---|---|
| A003 | Base frequency setting |
| A004 | Maximum frequency setting |
| A203 | Base frequency setting, 2nd motor |
| A204 | Maximum frequency setting, 2nd motor |
| B015 | Free setting, electronic thermal frequency (1) |
| B017 | Free setting, electronic thermal frequency (2) |
| B019 | Free setting, electronic thermal frequency (3) |
| B049 | Dual Rating Selection |
| B050 | Controlled deceleration on power loss |
| B051 | DC bus voltage trigger level of control deceleration |
| B052 | Over-voltage threshold of control deceleration |
| B060 | Maximum-limit level of window comparators O |
| B061 | Minimum-limit level of window comparators O |
| B062 | Hysteresis width of windows comparators O |
| B063 | Maximum-limit level of window comparators OI |
| B064 | Minimum-limit level of window comparators OI |
| B065 | Hysteresis width of window comparator (OI) |
| B079 | Watt-hour display gain setting |
| B082 | Start frequency adjustment |
| B100 | Free setting V/f freq. (1) |
| B102 | Free setting V/f freq. (2) |
| B104 | Free setting V/f freq. (3) |
| B106 | Free setting V/f freq. (4) |
| B108 | Free setting V/f freq. (5) |
| B110 | Free setting V/f freq. (6) |
| B112 | Free setting V/f freq. (7) |
| P070 | Low-speed zero-return frequency |

Note: this parameter list only affect MX2 and RX.

### 8-2 Parameters list affected by Rated Current (%)

| Parameter | Description |
|---|---|
| B012 | Level of electronic thermal setting |
| B016 | Free setting, electronic thermal current (1) |
| B018 | Free setting, electronic thermal current (2) |
| B020 | Free setting, electronic thermal current (3) |
| B022 | Overload restriction level setting |
| B025 | Overload restriction level 2 setting |
| B028 | Current level of active freq. matching restart setting |
| B126 | Brake release current setting |
| B212 | Level of electronic thermal setting, 2nd motor |
| B222 | Overload restriction operation mode, 2nd motor |
| C030 | Digital current monitor reference value |
| C039 | Low load detection level |
| C041 | Overload level setting |
| C111 | Overload setting (2) |
| C241 | Overload level setting, 2nd motor |

Note: this parameter list affect MX2. RX and LX.



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**8-3 Parameters list affected by PID enabled/disabled**

| Parameter | Description |
|---|---|
| A011 | Pot./O-L input active range start frequency |
| A012 | Pot./O-L input active range end frequency |
| A020 | Multi-speed 0 setting |
| A021 | Multi-speed 1 setting |
| A022 | Multi-speed 2 setting |
| A023 | Multi-speed 3 setting |
| A024 | Multi-speed 4 setting |
| A025 | Multi-speed 5 setting |
| A026 | Multi-speed 6 setting |
| A027 | Multi-speed 7 setting |
| A028 | Multi-speed 8 setting |
| A029 | Multi-speed 9 setting |
| A030 | Multi-speed 10 setting |
| A031 | Multi-speed 11 setting |
| A032 | Multi-speed 12 setting |
| A033 | Multi-speed 13 setting |
| A034 | Multi-speed 14 setting |
| A035 | Multi-speed 15 setting |
| A101 | [OI] input active Range start frequency |
| A102 | [OI] input active Range end frequency |
| A145 | ADD frequency |
| A220 | Multi-speed 0 setting, 2nd motor |
| F001 | Output frequency setting |

These parameters are affected by A071 / A075.
Note: this parameter list only affect MX2 and RX.



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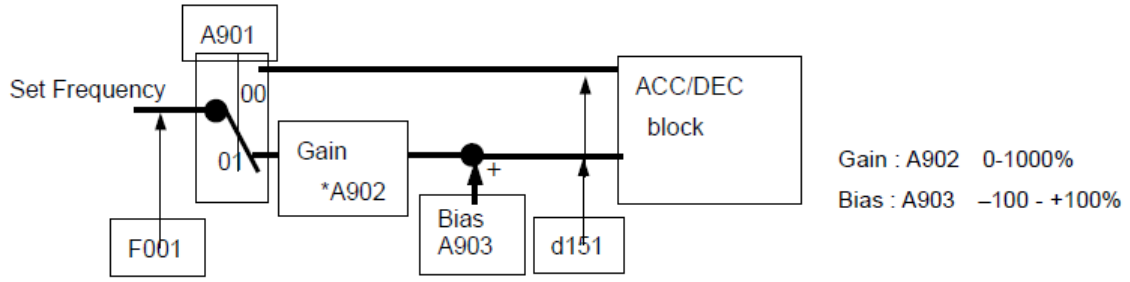
**9 Insertion Point ( MX2 & RX )**

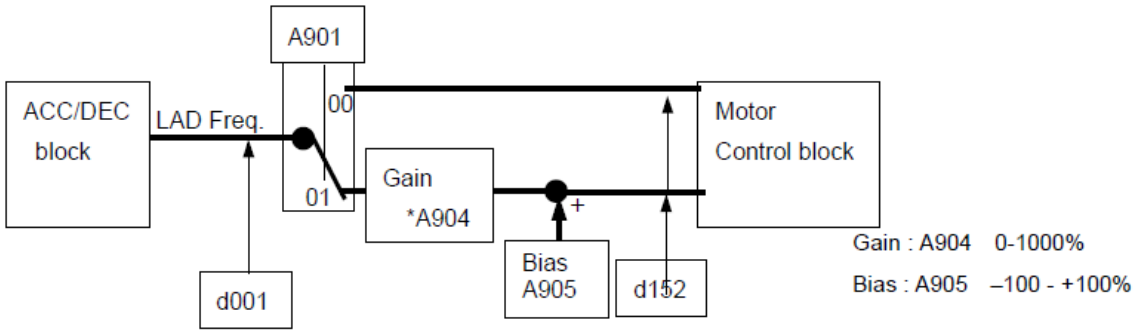
The Gain/Bias can be applied to any reference

**9-1 'Frequency' before ACC/DEC**



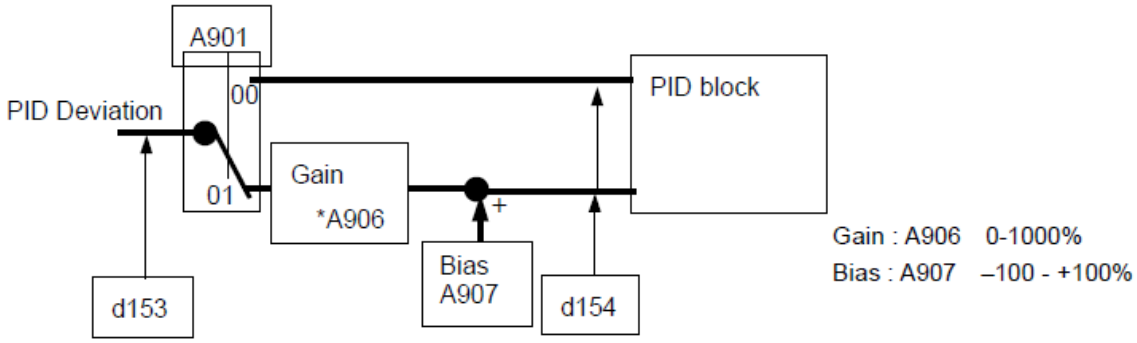

| Parameter | Description | Range |
|---|---|---|
| A901 | Insertion Point | 0: Disable; 1: Enable |
| A902 | Insertion Point 'Frequency' before ACC/Dec Gain | 0 to 1000% |
| A903 | Insertion Point 'Frequency' before ACC/DEC Bias | -100 to +100% |

**9-2 'Frequency' after ACC/DEC**




| Parameter | Description | Range |
|---|---|---|
| A901 | Insertion Point | 0: Disable; 1: Enable |
| A904 | Insertion Point 'Frequency' after ACC/Dec Gain | 0 to 1000% |
| A905 | Insertion Point 'Frequency' after ACC/DEC Bias | -100 to +100% |

**9-3 'Deviation' before PID block**




| Parameter | Description | Range |
|---|---|---|
| A901 | Insertion Point | 0: Disable; 1: Enable |
| A906 | Insertion Point 'Deviation' before PID block Gain | 0 to 1000% |
| A907 | Insertion Point 'Deviation' before PID block Bias | -100 to +100% |



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