XtraWare™

User's Manual

Catalog No. 8U0109 Rev. B

YASKAWA ESHED TECHNOLOGY LTD.

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XtraWare User's Manual

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1. Introduction

The XtraWare software constitutes the user interface and tool of operation for the XtraDrive. It enables parameter settings, control loops tuning, fault status reporting as well as facilitating programming of the driver both for professional programmers and novices.

Topics described in this manual include:

- Software installation (including system requirements and setup instructions).
- Description of user menus and toolbars.
- Operation of the XtraDrive driver using the XtraWare software (including communication, parameters and program handling).
- Quick Start Procedure describing the initial settings required for operating the XtraDrive.
- Parameter Reference providing information on all the parameters available in the XtraWare software.
- Command Reference which lists alphabetically the commands used in the XtraWare software.
- Error Messages
- System Variables

Related documents:

Title	**Catalog No.**
XtraDrive Series Servo System User’s Manual	8U0108
AC SERVO MOTOR INSTRUCTIONS	TOE-C231-2 for ∑-II servomotors or other compatible motors
XtraDrive (XD-) SERIES AC SERVO DRIVER Short Form Installation Guide	8U0107

2. System Requirements and Software Installation

For optimum performance, XtraWare requires:

- Computer: Pentium 166 MHz (Pentium II 350 Mhz recommended)
- At least 32 MB of RAM (64 MB recommended).
- A hard drive with at least 100 MB of free disk space.
- Operating System:
    - Windows 95 OSR2 or later (IE4.01 Service Pack 2 or later)
    - Windows 98
    - Windows NT4.0 Service Pack 3 or later (IE4.01 Service Pack 2 or later)
    - Windows 2000
    - Windows Me
    - Windows XP
- Super VGA or better graphics display, minimum 256 colors (65536 colors recommended).
- One node or more RS-232C or RS-422A I/F.
- CD-ROM drive (for installation only).

The XtraWare software is supplied on a CD. Before proceeding with the installation procedure, close any applications that are open. During the procedure, XtraWare and its related files are installed on your hard disk. If a previous version of XtraWare is already installed, the existing program is overwritten.

To install XtraWare:

- Insert the CD into the CD-ROM drive.
- If the procedure does not start automatically (i.e., autoplay is not enabled) either:
    - Click Start | Run and type `"D:\Install\SETUP"` (where D: is your CD drive)

or

- Using Windows Explorer, load the CD-ROM contents, and double click `D:\Install\SETUP.EXE`

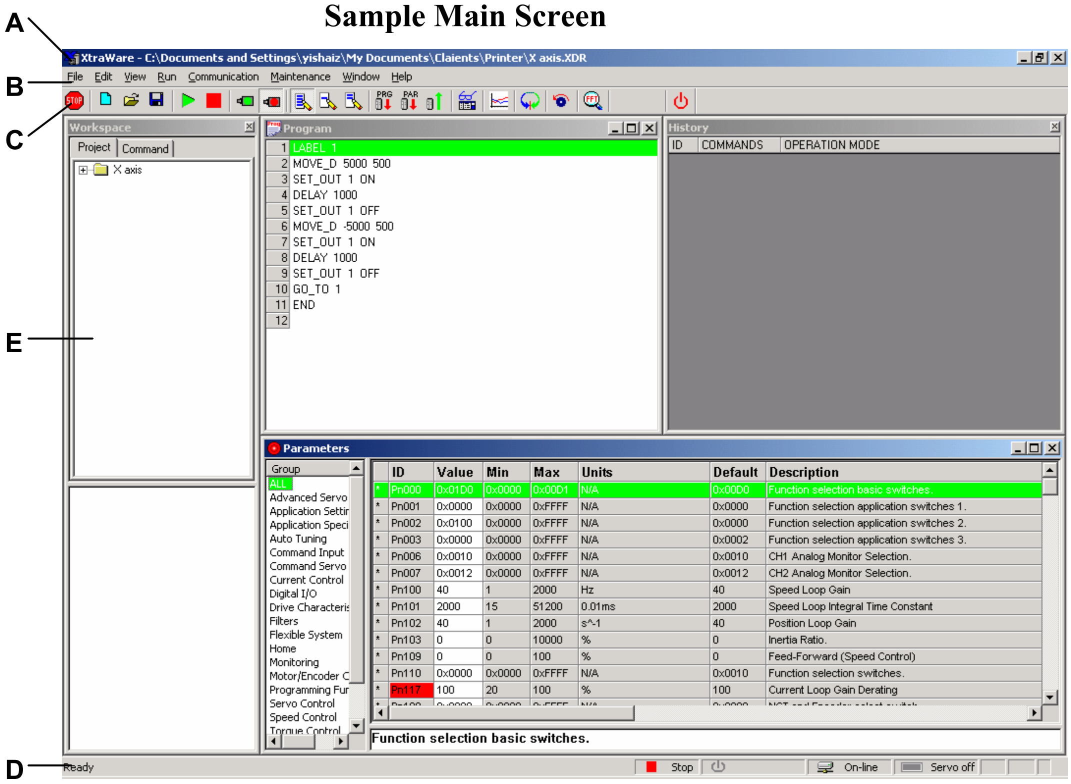
- The installation screen appears, the installation procedure commences and a message welcoming you to XtraWare appears.
- Click Next to continue.
- Follow the onscreen instructions to choose a destination folder for the XtraWare files.
- Click Next to continue.
- Select the program group to create the XtraWare icon. `c:\Program Files\YET\XtraWare` is the default setting.
- After selecting the program group or folder, click Next to continue.
- The PC files are copied from the CD-ROM. During the procedure, the progress of the copying is shown as a percentage.

Note: If new versions of the PC support files are needed to install XtraWare, a window will appear asking whether to overwrite the current version or to cancel the installation. XtraWare may not run correctly if the new versions of the support files are not installed.

3. The Main Screen Interface

This chapter describes the XtraWare main screen, which comprises a main toolbar, menus and several windows. A sample main screen is shown below. For clarity, the screen has been divided into separate elements.

Sample Main Screen



```
LABEL 1
MOVE_D 5000 500
SET_OUT 1 ON
DELAY 1000
SET_OUT 1 OFF
MOVE_D -5000 500
SET_OUT 1 ON
DELAY 1000
SET_OUT 1 OFF
GO_TO 1
END
```

	ID	Value	Min	Max	Units	Default	Description
*	Pn000	0x01D0	0x0000	0x00D1	N/A	0x00D0	Function selection basic switches.
*	Pn001	0x0000	0x0000	0xFFFF	N/A	0x0000	Function selection application switches 1.
*	Pn002	0x0100	0x0000	0xFFFF	N/A	0x0000	Function selection application switches 2.
*	Pn003	0x0000	0x0000	0xFFFF	N/A	0x0002	Function selection application switches 3.
*	Pn006	0x0010	0x0000	0xFFFF	N/A	0x0010	CH1 Analog Monitor Selection.
*	Pn007	0x0012	0x0000	0xFFFF	N/A	0x0012	CH2 Analog Monitor Selection.
*	Pn100	40	1	2000	Hz	40	Speed Loop Gain
*	Pn101	2000	15	51200	0.01ms	2000	Speed Loop Integral Time Constant
*	Pn102	40	1	2000	s^-1	40	Position Loop Gain
*	Pn103	0	0	10000	%	0	Inertia Ratio.
*	Pn109	0	0	100	%	0	Feed-Forward (Speed Control)
*	Pn110	0x0000	0x0000	0xFFFF	N/A	0x0010	Function selection switches.
*	Pn117	100	20	100	%	100	Current Loop Gain Derating

Function selection basic switches.

3.1 Title Bar (A)

The XtraWare title bar displays the name of the currently opened project file.

3.2 Menu Bar (B)/Toolbar (C)

The XtraWare menu bar provides access to the XtraWare menus: File, Edit, View, Run, Communication, Maintenance, Window and Help.

The toolbar is located immediately beneath the menu bar. It comprises shortcut icons to the most commonly used options in XtraWare. In the following descriptions of the menu options, the icons (where applicable) are listed next to the options.

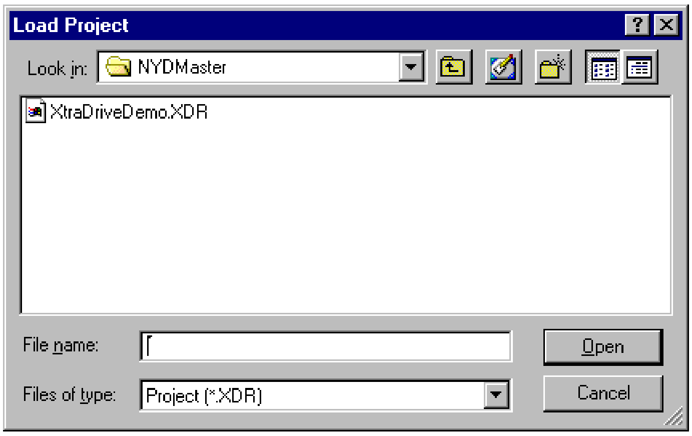
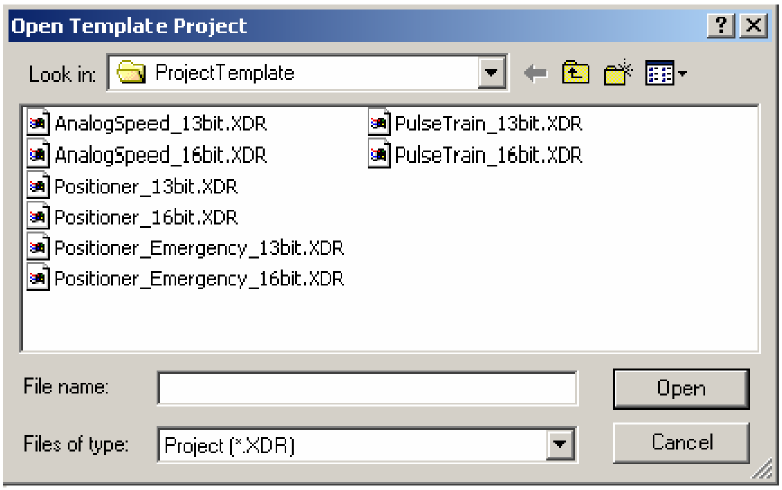
Note: In the different modes, some of the menu options are disabled (grayed) and cannot be accessed. Similarly, disabled icons indicate that communication is offline.

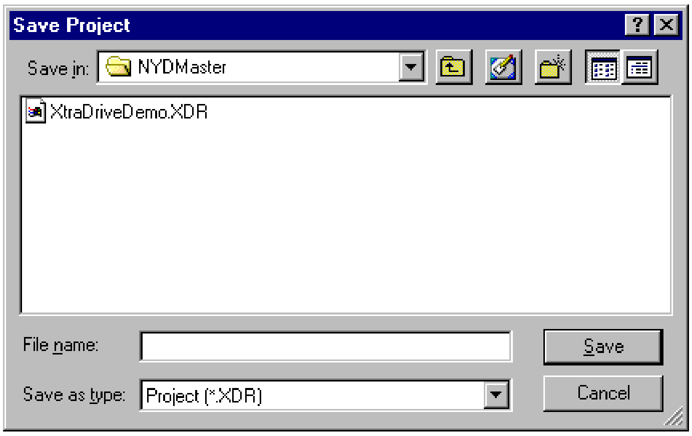
3.2.1 File Menu

A project contains all the data currently active in the XtraWare, such as the user program, parameter settings, and definitions. The File Menu options are used to create new XtraWare projects, open existing projects and save changes to projects. Project files, which are handled like any other file, are automatically assigned an extension of XDR, for example, project1.XDR.

In addition, the File Menu options are used to download, upload and print programs and parameters.

File Menu Options

Option	Icon	Description
New Project (Ctrl+N)	📄	Creates a new XtraWare project. When this option is selected, the Workspace, Program, History and Parameters windows are opened with their default contents.
Open Project (Ctrl+O)	📂	Opens an existing XtraWare project. When this option is selected, the Load Project window is opened:  Look in: NYDMaster XtraDriveDemo.XDR File name: Files of type: Project (*.XDR)
Open Project Template		Opens a project template containing a sample program for the type of motor encoder selected. Each template uses parameters suitable for the specific encoder. User units in a project template are: • Position: encoder counts • Speed: rpm • Acceleration: rad/sec^2  Look in: ProjectTemplate AnalogSpeed_13bit.XDR AnalogSpeed_16bit.XDR Positioner_13bit.XDR Positioner_16bit.XDR Positioner_Emergency_13bit.XDR Positioner_Emergency_16bit.XDR PulseTrain_13bit.XDR PulseTrain_16bit.XDR File name: Files of type: Project (*.XDR)

Option	Icon	Description
Save Project	💾	Saves the current project under its existing name. If the project has not yet been named, the Save Project window is opened:  Save Project Save in: NYDMaster XtraDriveDemo.XDR File name: Save as type: Project (*.XDR) In the File name field, type in a name for the project and click Save.
Save Project as		Saves the current project under a new name. When this option is selected, the Save Project window is opened.
Close Project		Closes the current project. If the project has not been saved, the following message is displayed: `Save changes to <project-name>?` Click Save to save the project.
Download Program	PRG	Downloads a program to the XtraDrive driver.
Download Parameters	PAR	Downloads a set of parameters to the XtraDrive driver.
Upload	↑	Uploads new data from the XtraDrive driver.
Print Program		Prints the current program on the printer.
Print Parameters		Prints the parameter list and their values on the printer. The parameters are printed in tabular format.
Print Charts		Prints the currently displayed charts.
Exit		Exits from XtraWare.

3.2.2 Edit Menu

Edit Menu options are used to edit the command order of a program in the Program window.

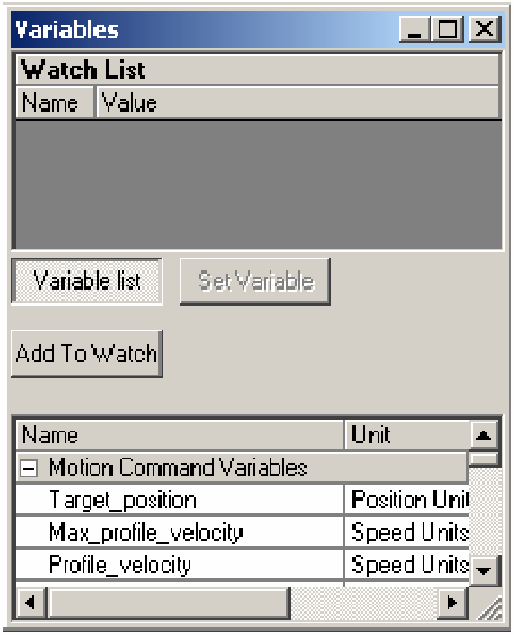
Edit Menu Options

Option	Description
Cut (Ctrl+X)	Deletes selected text or lines from the program, and places it on the Windows and XtraWare clipboards.
Copy (Ctrl+C)	Places a copy of selected text or lines from the program on the Windows and XtraWare clipboard.
Paste (Ctrl+V)	Inserts the contents of the XtraWare clipboard into the program.

3.2.3 View Menu

The View Menu options show/hide the windows you want displayed on the XtraWare screen.

View Menu Options

Option	Icon	Description
Program		Displays/hides the Program window.
Parameters		Displays/hides the Parameters window.
Workspace		Displays/hides the Workspace window.
History		Displays/hides the History window.
Charts	📈	Opens the Charts window.
Variable		Opens the Variables window.  Variables Watch List Name Value Variable list Set Variable Add To Watch Name Unit ⊟ Motion Command Variables Target_position Position Unit Max_profile_velocity Speed Units Profile_velocity Speed Units
FFT	FFT	Open the FFT window. FFT is a mechanical analysis utility.
Toolbar		Displays/hides the toolbar.
Status bar		Displays/hides the status bar.

3.2.4 Run Menu

The Run Menu options allow you to control the program running on the XtraDrive driver.

Run Menu Options

Option	Icon	Description
Run Program	▶	Runs the program immediately.
Stop Program	🟥	Stops the program immediately.
Servo ON	🟩	Switches the XtraDrive driver ON, i.e., in control. In this mode, the driver holds the motor in position under various load conditions, even when no motion is required.
Servo OFF	🟥	Switches the XtraDrive driver OFF, i.e., not in control.
Immediate Mode	✎	Switches to Immediate mode. In Immediate mode, commands are downloaded immediately to the driver’s memory. For details of all the available modes, see Section 4.4, Program Modes.
Program Mode	✎	Switches to Program mode. In Program mode, a list of commands is prepared in the program editor, to be downloaded to the driver at a later stage. For details of all the available modes, see Section 4.4, Program Modes.
Sequential Mode	✎	Switches to Sequential mode. In Sequential mode, each command is downloaded individually to the driver and then processed. For details of all the available modes, see Section 4.4, Program Modes.
Home		Defines the Home position for the motor. When this option is selected, the current position of the motor is defined as the Home position. From this point onward, when the motor is requested to move Home, it will move to this position.
Jog	↻	Runs the motor at a constant predefined speed.
Stop	STOP	Immediately stops the motor motion. You can also click the Stop icon on the toolbar or press F9. For further details, refer to the STOP command in Chapter 6, Command Reference.

3.2.5 Communication Menu

The Communication Menu options are used to switch on/off the communication between the XtraWare and the XtraDrive, and to customize the communication parameters.

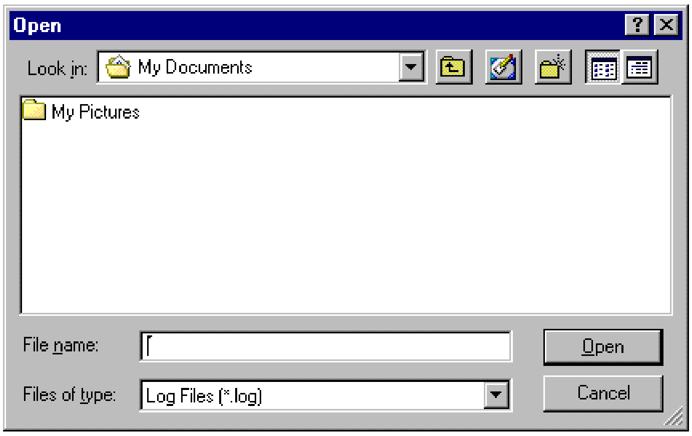
Communication Menu Options

Option	Description
Online	Switches to working in online mode.
Offline	Switches to working in offline mode.
Settings	Opens the Communication Settings window. See Section 4.1.1, Communication Settings, for details on this option.

3.2.6 Maintenance Menu

The Maintenance Menu options allow you to automatically or manually tune the control loops, to open/close a log file and to send a command to the XtraWare device.

Maintenance Menu Options

Option	Icon	Description
Autotuning	🔄	Automatically detects control loop gains based on actual system measurements and tunes the XtraDrive driver accordingly. See Section 4.5, Tuning the Control Loops for full details.
Open Log File		Starts a new log file and inserts all the commands sent via communication into the log file. The log file is used mainly for debugging purposes. When this option is selected, the Open dialog box is displayed. **Open Log File Dialog Box**  Open Look in: My Documents My Pictures File name: Files of type: Log Files (*.log) Open Cancel Select a directory and select the name of an existing file or type in a name to create a new log file. When XtraWare is in Online mode, all the commands sent via communication to the XtraDrive are stored in the selected log file. To close the log file, select the Close Log File option. See Section 4.5, Log Files for a sample log file.
Close Log File		Stops storing commands in the log file and closes the currently open log file.
Reset to Default Parameters		Discards user modifications to the parameters, and reverts to the factory default parameters. Note that some parameters are updated at power-up only and you must therefore restart the XtraDrive after using this option.
Password		Enables the modification of certain parameters (displayed in red in the Parameters window) which can only be modified by authorized users, who are required to enter a password using this option.
Send Command		
Reset	⏻	After certain parameters are edited, the main circuit and control power supply need to be cycled in order to enable the new settings. To do so, press Reset. The Need Reset indicator appears in the status line when this action is necessary.

3.2.7 Window Menu

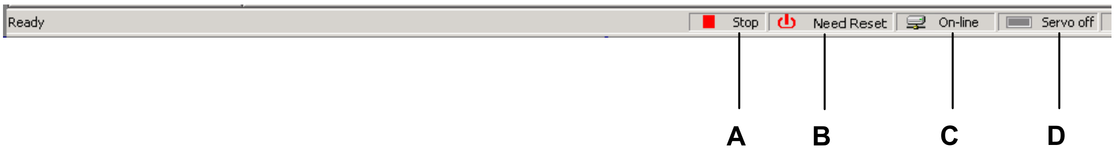
The Window menu is used to switch between different views in the XtraWare system, and to save a customized screen for future use.

Window Menu Options

Option	Description
Project Screen	Displays the default XtraWare Main Screen interface, which includes the Workspace, Program, History and Parameters windows.
Program Edit Screen	Enlarges the Program window to facilitate program editing. The History and Parameters windows are hidden.
User Screen	Displays the current user customized screen saved under the Save User Screen option.
Save User Screen	The size of the Workspace, Program, History and Parameters windows can be customized to facilitate your work session. This option enables you to save your customized screen for future work sessions. Each time you save a new customized screen, the previous user screen is overwritten.

3.3 Status Bar (D)

The Status Bar, located at the bottom of the XtraWare screen, indicates the status of the current driver and of the Servo.



The indicators on the right of the status bar are as follows:

A indicates whether or not a program is running on the controller (Run/Stop).

B – Need Reset indicator. After certain parameters are edited, the main circuit and control power supply need to be cycled in order to enable the new settings. When this indicator appears, press Reset.

C indicates the status of the connection to the XtraDrive driver – Offline or Online.

D indicates the current status of the XtraDrive driver – ON or OFF.

3.4 Work Area (E)

The Work Area comprises the following windows:

3.4.1 Workspace Window

The Workspace window includes:

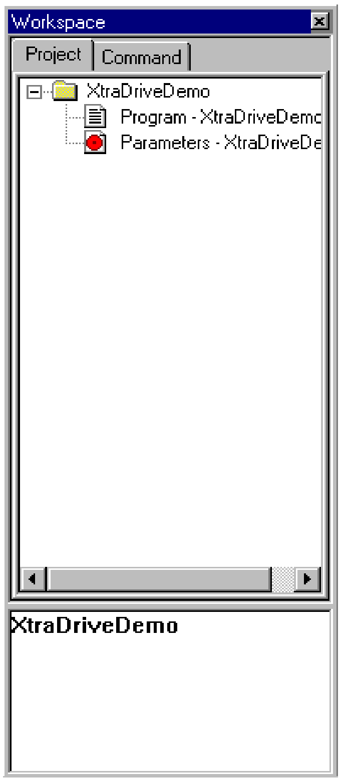
- **Project Tab:** the subsections of the current project.
- **Command Tab:** a list of the XtraWare commands divided into six groups.
- **Description Pane:** a description of the currently selected item.

3.4.1.1 Project Tab

The Project tab presents the subsections (program and parameters) of the current project.

To view the project subsections, click on the + sign next to the project name in the Workspace window.

Workspace Window – Project Tab

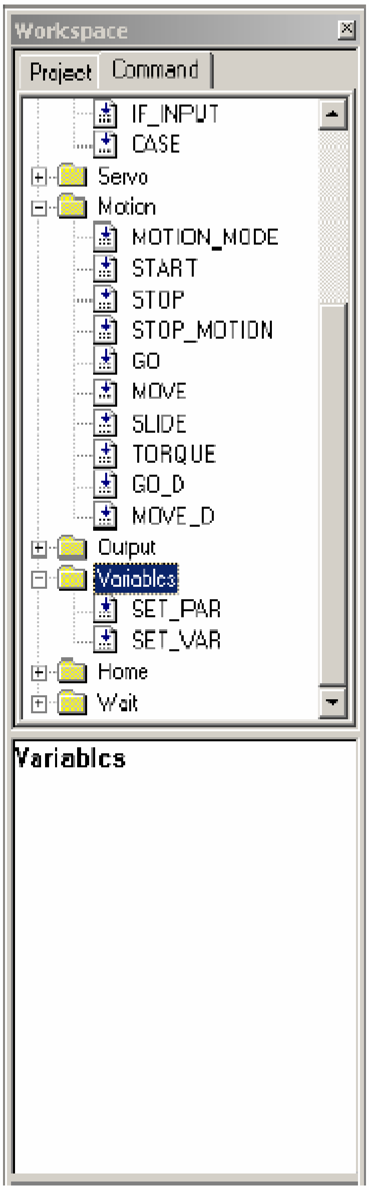


3.4.1.2 Command Tab

The Command tab presents the commands that can be used to write the program. The commands are divided into six groups. A full description of each command is provided in Chapter 6, Command Reference.

To view the commands under a command group, click on the + sign next to the group name in the Command tab.

Workspace Window – Command Tab



The icon next to each command indicates its current status. The availability or unavailability of a command depends on the current working mode.

Icon	Description
▯	Available command. This command can be inserted into the program.
■	Currently selected command. When a command is selected its description is displayed in the Description area under the command list.
☒	Currently unavailable command.

To select a command, double click on the command name. The appropriate command dialog box opens.

See Section 4.3.1, Writing a Program, for details on how to insert commands into the program.

Click on a command name to see a short description of the command in the Description pane or see Chapter 7, Command Reference for a more detailed description.

Command Groups

The Command Groups are:

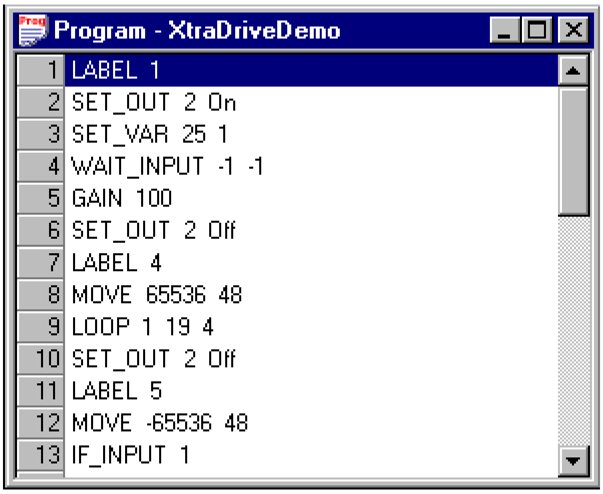
Group	Description	Included Commands
Profile	Changes the speed at which the motor moves.	ACCELERATION, JERK_TIME, SPEED
Program Flow Control	Program flow handling.	CALL, CASE, END, GO_TO, LOOP, RETURN, RUN, LABEL, IF, IF_INPUT, INPUT_CASE
Servo	Enables and disables SERVO control in the program. Sets gain and torque limits.	CONTROL, GAIN, TORQUE_LIMITS
Motion	Motion of the motor connected to the XtraDrive driver.	START, STOP, STOP_MOTION, GO, MOVE, SLIDE, TORQUE, TORQUE_ANALOG, GO_D, GO_H, MOVE_D, MOVE_H, MOVE_R, PT_FOLLOWER, SLIDE_ANALOG, SPEED_CONTROL
Output	Sets output ON/OFF.	SET_OUT
Variable	Setting of variables in the program.	SET_VAR
Home	Moves the motor to search for the (system) home position.	HARD_HOME, HOME_SW, HOME_SW_C, HOME_C SET_ZERO_POSITION
Wait	Stopping of the motor connected to the XtraDrive driver for a specified period of time.	DELAY, WAIT_EXACT, WAIT_FOR_START, WAIT_INPUT, WAIT_STOP, WAIT_VARIABLE_GT, WAIT_VARIABLE_LT

3.4.2 Program Window

The Program Window presents the entire program. The program is written by selecting commands from the Command tab, and entering values for the commands' parameters. See Section 4.3.1, Writing a Program, for details on how to write a program.

To change the value of a command's parameter after it has been added to the program, double click on the command line to open its window, and enter a new value(s).

Program Window



```
LABEL 1
SET_OUT 2 On
SET_VAR 25 1
WAIT_INPUT -1 -1
GAIN 100
SET_OUT 2 Off
LABEL 4
MOVE 65536 48
LOOP 1 19 4
SET_OUT 2 Off
LABEL 5
MOVE -65536 48
IF_INPUT 1
```

3.4.3 History Window

The History window presents a list of all the commands that have been downloaded or sent (in Immediate mode) to the XtraDrive driver.

For each command, the following information is displayed:

Name	Description
ID	A sequential number assigned to the command.
Command	The name of the command executed.
Operation Mode	The operation mode (Program, Immediate, Sequential) active when the command was issued.

3.4.4 Parameters Window

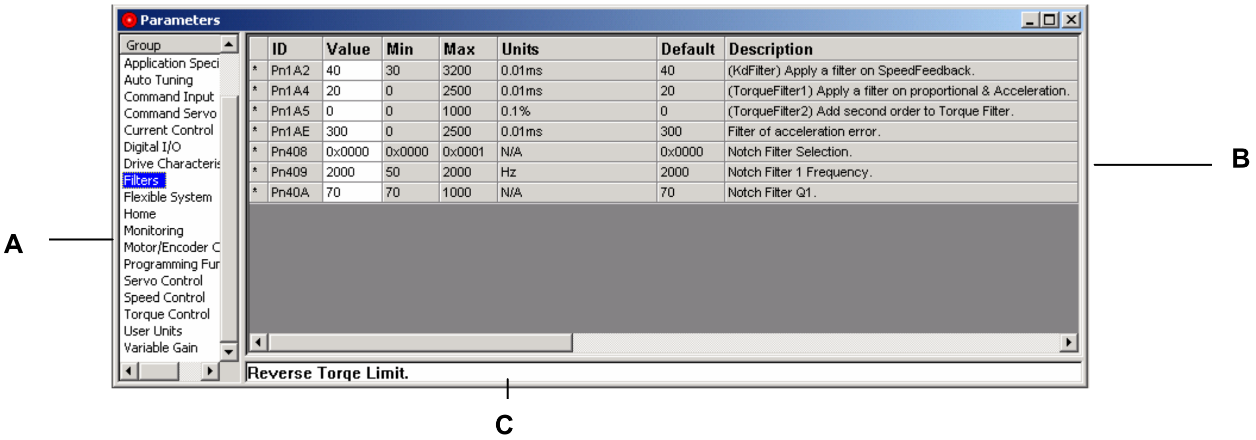
Each project in the XtraWare system comprises a program and parameters. How to write an XtraWare program is described in detail in Section 4.3.1, Writing a Program.

The XtraWare parameters are divided into different parameter groups, and are displayed in the Parameters window.

A full list of all the parameters available in the XtraWare system and their values is provided in Chapter 5, Parameter Reference.

The Parameters window is divided into three panes as shown below:

Parameters Window



	ID	Value	Min	Max	Units	Default	Description
*	Pn1A2	40	30	3200	0.01ms	40	(KdFilter) Apply a filter on SpeedFeedback.
*	Pn1A4	20	0	2500	0.01ms	20	(TorqueFilter1) Apply a filter on proportional & Acceleration.
*	Pn1A5	0	0	1000	0.1%	0	(TorqueFilter2) Add second order to Torque Filter.
*	Pn1AE	300	0	2500	0.01ms	300	Filter of acceleration error.
*	Pn408	0x0000	0x0000	0x0001	N/A	0x0000	Notch Filter Selection.
*	Pn409	2000	50	2000	Hz	2000	Notch Filter 1 Frequency.
*	Pn40A	70	70	1000	N/A	70	Notch Filter Q1.

Reverse Torqe Limit.

- Group pane (A) presents the list of parameter groups. For each parameter group, the parameters are displayed in the Parameters pane.
- The Value pane (B) displays the details of each parameter. Initially, the values displayed for the parameters are the default values.
- The Description pane (C) displays a short description of the currently selected parameter.

4. Operating the XtraDrive using XtraWare

This chapter provides detailed instructions on how to operate the XtraDrive servo driver using the XtraWare software.

4.1 Connecting the Driver to the PC

The communication connection between the PC and the driver is serial.

1. Connect a communication cable to an available COM port of your PC. Note that only COM 1 through 4 are supported by XtraWare.
2. Connect the other end to the CN3 connector on the XtraDrive.

4.1.1 Communication Settings

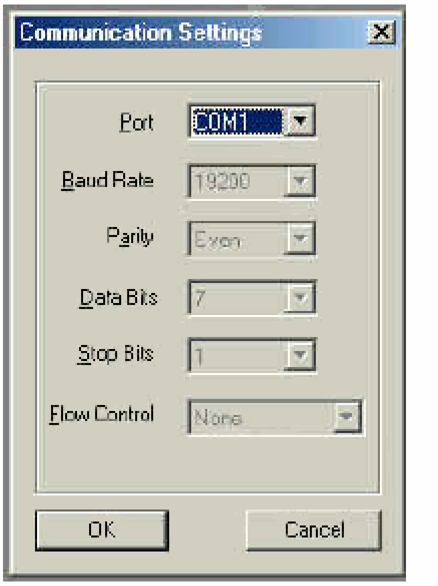
Run the XtraWare software. The default location is: Start > Programs > XtraWare.

In order to establish communication, select the Online option from the Communication menu. The communication indicator on the status line indicates whether communication is offline or online.

If you set the communication to Online and the communication indicator in the status line changes to online for a few seconds and then reverts to Offline, this indicates that communication between XtraWare and the XtraDrive has not been established.

In such cases, check the following:

- The driver is powered on.
- The communication cable is connected both to the PC and to the XtraDrive.
- Select the Setting option from the Communication menu and make sure that the Port is set to the correct COM port of your PC (the default is COM1 on most computers).



Communication Settings

Port: COM1

Baud Rate: 19200

Parity: Even

Data Bits: 7

Stop Bits: 1

Flow Control: None

All other communication parameters are predefined and are for display purposes only:

- Baud Rate – 19200
- Parity – Even
- Data Bits – 7
- Stop bits – 1
- Flow Control – None

4.2 Parameter Control

In order to control the motor and the peripheral system (such as I/O lines), the XtraDrive requires setting of certain parameters in its memory. Some parameters are automatically set by the system based on the automatic motor identification (when applicable), and some must be set by the user. The parameters define data such as current limits, encoder type and I/O configuration, as well as data related to specific user application (such as the ratio between the encoder resolution and the user units).

4.2.1 Uploading and Downloading Parameters

Parameters can be sent from the PC to the XtraDrive (Downloading) or read from the XtraDrive to the PC (Uploading). Note too that the Upload function reads not only the parameters from the XtraDrive, it also reads the program and all other data currently active in the XtraDrive. Therefore, it is advisable to save your program prior to using the Upload function.

To download the parameters, click the download icon PAR↓ on the toolbar.

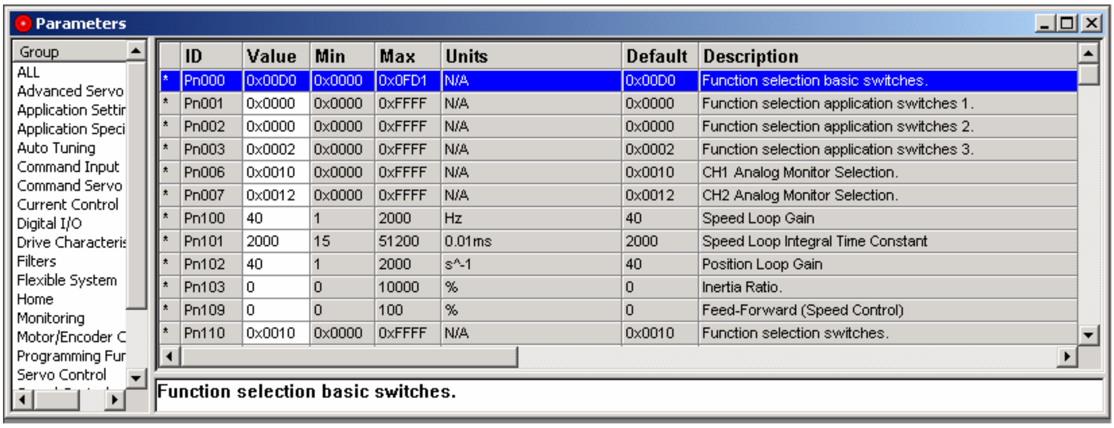
Similarly, to upload the parameters, click the upload icon ↑ on the toolbar.

4.2.2 Setting Parameters

Parameters are set in the Parameters window. This window displays the current value of the parameters in the project. Note that parameter values in the project do *not* necessarily match the values currently active in the XtraDrive.

In order to provide easy access to certain parameters, the parameters can be viewed in groups. The default group setting of the Parameters window is ALL, i.e., all available parameters in the system are shown. To display only parameter belonging to a specific group in the Value pane, select one of the predefined groups (e.g., Digital I/O, Servo Control) listed in the Group pane.

Parameters Window



Group
ALL
Advanced Servo
Application Settir
Application Speci
Auto Tuning
Command Input
Command Servo
Current Control
Digital I/O
Drive Characteris
Filters
Flexible System
Home
Monitoring
Motor/Encoder C
Programming Fur
Servo Control

	ID	Value	Min	Max	Units	Default	Description
*	Pn000	0x00D0	0x0000	0x0FD1	N/A	0x00D0	Function selection basic switches.
*	Pn001	0x0000	0x0000	0xFFFF	N/A	0x0000	Function selection application switches 1.
*	Pn002	0x0000	0x0000	0xFFFF	N/A	0x0000	Function selection application switches 2.
*	Pn003	0x0002	0x0000	0xFFFF	N/A	0x0002	Function selection application switches 3.
*	Pn006	0x0010	0x0000	0xFFFF	N/A	0x0010	CH1 Analog Monitor Selection.
*	Pn007	0x0012	0x0000	0xFFFF	N/A	0x0012	CH2 Analog Monitor Selection.
*	Pn100	40	1	2000	Hz	40	Speed Loop Gain
*	Pn101	2000	15	51200	0.01ms	2000	Speed Loop Integral Time Constant
*	Pn102	40	1	2000	s^-1	40	Position Loop Gain
*	Pn103	0	0	10000	%	0	Inertia Ratio.
*	Pn109	0	0	100	%	0	Feed-Forward (Speed Control)
*	Pn110	0x0010	0x0000	0xFFFF	N/A	0x0010	Function selection switches.

Function selection basic switches.

These are the fields in the panes of the Parameters window (from left to right):

- **Group:** Parameter group selection.
- **Parameter status indication:** An asterisk in this column indicates that the value of the parameter has been changed in the PC, but has *not* been downloaded to the XtraDrive.
- **Parameter ID:** The parameter number.
- **Value:** Current parameter value (0x indicates hexadecimal values)
- **Min:** Minimum value allowed for the parameter.
- **Max:** Maximum value allowed for the parameter.
- **Units:** The units used for the parameter.
- **Default:** The default value for the parameter.
- **Description:** A short description of the parameter functionality.

Use either of the following methods to set parameter values:

- Right click on the row of the parameter you wish to change. A pop-up window appears, displaying the current value of the parameter. Use the +/- buttons below this value to change the value of the parameter. Note that the changed value is sent on-line to the XtraDrive. Some values take effect immediately; others are sent to the driver but take effect only after the power is cycled. The Need Reset indicator appears in the status line when this action is necessary.
- Double click on the value field of the desired parameter, and write the desired value. The new value is *not* sent to the driver (an asterisk appears in the Parameter status indication column). Use the Download function to send the changed values to the driver.

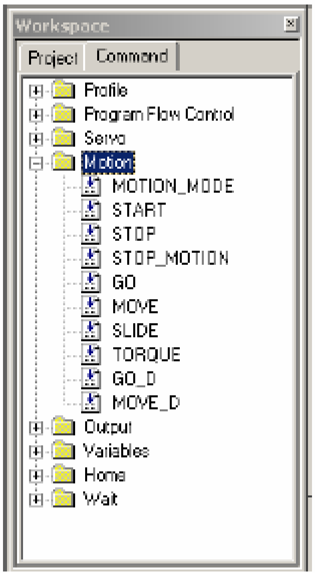
4.3 Programming the XtraDrive

XtraDrive has built-in programming capabilities. The user can write a program that will be executed by the XtraDrive without the need for an external positioning controller.

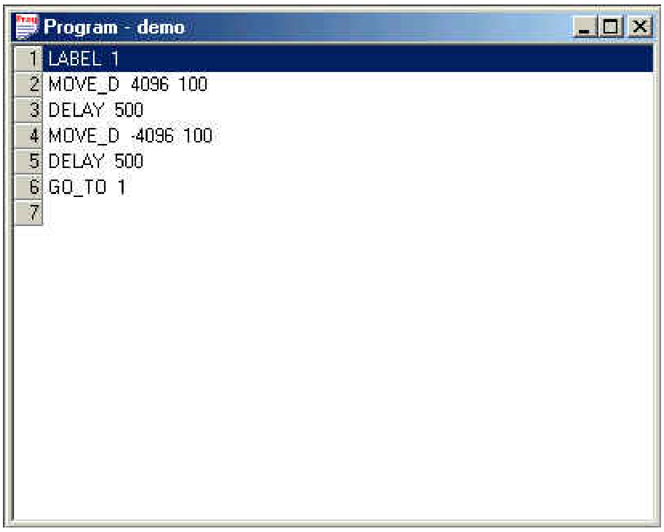
4.3.1 Writing a Program

A program is written by selecting a command from the command list in the Workspace window, and adding it to the Program window. For a detailed description of the command, see Chapter 7, Command Reference. You must be in Program mode to write a program (click the Program icon in the toolbar, or select the Program Mode option from the Run menu). The maximum length of a program is 50 command lines.

Workspace Window



Program Window



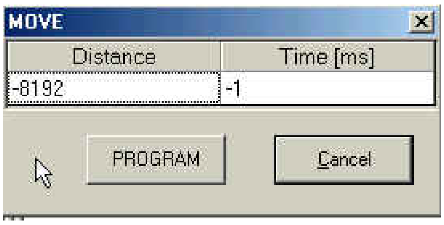
```
LABEL 1
MOVE_D 4096 100
DELAY 500
MOVE_D -4096 100
DELAY 500
GO_TO 1
```

The commands in the Workspace window are divided to groups.

To add a command to a program:

- Open the relevant command group.
- Double click on the requested command to open a pop-up dialog box relating to the command.

Sample Command Pop-up Dialog Box



Distance	Time [ms]
-8192	-1

- Set the parameters required for the command.
- Click Program to add the command to the program in the Program window.

It is possible to edit the parameters of commands already listed in the Program window:

- Double click on a command in the Program window to open the command's pop-up window.
- Edit the parameters as desired and click Program.

To edit the order of the commands listed in the Program window, use the standard Windows operations (Ctrl+X - cut, Ctrl+C - copy, and Ctrl+V - paste).

When you have completed the program, it must be downloaded to the XtraDrive (click the Download Program icon PRG).

4.3.2 Running a Program

When a program has been completed and downloaded, it can be run using either of the following methods:

- Click the RUN icon ▶ on the toolbar to run the program from the first line.
- In Immediate and Sequential modes, select the RUN command from the Program Flow Control commands in the Workspace window. In the pop-up window, type in the label number from which you want the program to run. If you want the program to run from the first line, enter 0 as the label number.

4.4 Program Modes

XtraDrive has three programming modes:

- Program
- Immediate
- Sequential

Each mode utilizes an individual buffer for commands and program processing and execution, dedicated for specific need. Note that not all of the commands are available in all the buffers. A full explanation on the use of the buffers is provided in the introductory section of Chapter 7, Command Reference.

4.4.1 Program Mode

Use this mode when writing a program that is to be executed after the entire program has been written (see Section 4.3.1, Writing a Program). This mode stores the program in the User Program Buffer (UPB). Program execution is activated by the Run command (see Section 4.3.2, Running a Program).

4.4.2 Immediate Mode

Use this mode in order to issue a single command for immediate execution, or when sending a single command from a host PC (e.g., changing the state of an output while a program is running, lower the gain while the motor is enabled and not in motion and no program is running). Commands sent in Immediate Mode are stored in the Immediate Command Buffer (ICB) and are executed within 2 msec (or less).

4.4.3 Sequential Mode

Use this mode when using a host PC, which sends a command stream that should be executed as a program (e.g., move the motor and wait for motion completion; wait for input; make another move, etc.). Immediate mode cannot be used in such cases since commands like MOVE_D (move the motor and wait for motion completion) are not available in Immediate mode.

4.5 Tuning the Control Loops

The mathematical coefficients of the control loop, an advanced control algorithm, must be tuned in order to ensure good system behavior. The Autotuning function automatically moves the motor back and forth for a few moments, measures the system behavior, and sets the proper gains of the control loops.

Using encoder feedback, XtraDrive constantly:

- checks the current motor position.
- compares this position to the desired one.
- corrects the motor position if it is found to be different than the desired position.

This correction is automatically performed within the XtraDrive according to the tuned control loops.

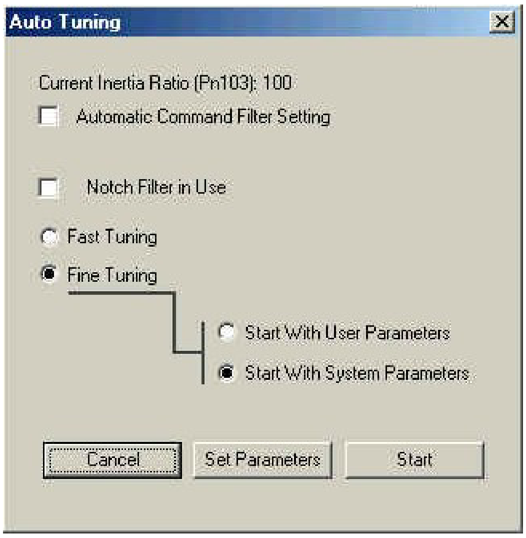
4.5.1 Manual Tuning

Not applicable in this version.

4.5.2 Autotuning

Autotuning is applicable in sequential command mode only. To change the XtraDrive to this mode, set the parameter Pn000.2 = D. Note that this setting becomes active only after the power is recycled.

When you select the Autotuning option from the Maintenance menu, this pop-up window opens:



Current Inertia Ratio (Pn103): 100

□ Automatic Command Filter Setting

□ Notch Filter in Use

○ Fast Tuning

● Fine Tuning

○ Start With User Parameters

● Start With System Parameters

Automatic Command Filter Setting: enables the command filter function. The value of the command filter is calculated automatically and stored in parameter Pn216.

Notch Filter: enables the use of notch filter (as set in parameters Pn408, Pn409).

Fast Tuning: the driver loads a group of parameters from predefined tuning groups, based on the motor and driver type and the load inertia.

Fine Tuning (default): the driver moves the motor back and forth and searches for the parameters that allow the best system performance.

Select Start with System Parameters to perform Autotuning using the system (default) parameters.

Otherwise, select Start with User Parameters and then click Set Parameters to open the Parameters pane of the Parameters window (see Section 4.2.2, Setting Parameters) to set your own parameters manually.

Click Start to commence the tuning procedure. When the procedure ends, the parameters are automatically stored in the controller memory.

5. Quick Start Procedure

5.1 Wiring

For full wiring information, see Chapter 3 in the XtraDrive User Manual.

5.2 Setting Initial Parameters

5.2.1 Motor Selection

5.2.1.1 Yaskawa Motor with Serial Encoder – Load Project Template

- Connect the PC to XtraDrive.
- Select File | Open Project Template
- Select Proper Template.
- Select Motor from the list.
  You can then select either:
  - Programmable mode: with or without emergency switch wired. If you select "without emergency," XtraDrive can be operated with no connection to CN1 to allow for rapid first operation.
    or:
  - Un-programmable mode: Analog speed control or Pulse Train command input.
  - Additional modes not listed in Templates include: analog torque, speeds by digital inputs, as well as a combination of modes.

5.2.1.2 Yaskawa Motor with AB Encoder

- Load any project and select Maintenance | Reset to Default Parameters.
- Set parameter Pn190.2 = 1
- For motor SGM, set Pn190.0 = 0
  For motor SGMP, set Pn190.0 = 1
- Reset controller.
- The error message "Wrong default profile values" appears (Error 26, see Chapter 8, Error Messages) until the default working speed and acceleration are set (see Section 5.2.5, Default Speed, Acceleration and Jerk).

5.2.2 Digital Input

Each input can be assigned to a predefined function, or can be configured as a general purpose input signal.

The table below lists the predefined functions, their associated parameters and default values. Listed in the two right-hand columns are the Input Pins and Numbers. The parameters below (with the exception of Home Switch) are configured in the Digital I/O group of the Parameters window (see Section 4.2.2, Setting Parameters). For example, to set Input SI0 (CN1-40) as emergency input, configure Pn2D1.0 = 0; similarly to set Input SI1 (CN1-41) as programmable input, configure Pn2D0.1 = 1.

Event	Parameter	Def		Input Pin	Num
Servo On (only if Pn000.1≠D)	Pn50A.1	8		SI0 (CN1-40)	0
P-Control	Pn50A.2	8		SI1 (CN1-41)	1
P-OT (Positive Over Travel)	Pn50A.3	8		SI2 (CN1-42)	2
N-OT(Negative Over Travel)	Pn50B.0	8		SI3 (CN1-43)	3
ALM-RST	Pn50B.1	4		SI4 (CN1-44)	4
P-CL	Pn50B.2	8		SI5 (CN1-45)	5
N-CL	Pn50B.3	8		SI6 (CN1-46)	6
SPD-D	Pn50C.0	8		Always ON	7
SPD-A	Pn50C.1	8		Always OFF	8
SPD-B	Pn50C.2	8		Reverse signal of SI0	9
C-SEL	Pn50C.3	8		Reverse signal of SI1	A
ZCLAMP	Pn50D.0	8		Reverse signal of SI2	B
INHIBIT	Pn50D.1	8		Reverse signal of SI3	C
G-SEL	Pn50D.2	8		Reverse signal of SI4	D
Input -1	Pn2D0.0	1		Reverse signal of SI5	E
Input -2	Pn2D0.1	5		Reverse signal of SI6	F
Input -3	Pn2D0.2	6			
Input -4	Pn2D0.3	8			
Input-5	Pn2D1.2	8			
Input-6	Pn2D1.3	8			
Emergency	Pn2D1.0	7			
Fast Input (125 usec)	Pn2D1.1	8			
Home Switch	Pn2C7.0	0			

5.2.3 Digital Output

Like inputs, each output can be assigned to a predefined function or can be configured as a general purpose output signal. The parameters below are configured in the Digital I/O group of the Parameters window (see Section 4.2.2, Setting Parameters). For example, to set output SO2 (CN1-27,28) as a programmable output, set Pn2D2.1 = 2.

Event	**Parameter**	**Def**		**Output Pin**	**Num**
COIN	Pn50E.0=0	0		Disabled	0
V-CMP	Pn50E.1=0	0			
T-GON	Pn50E.2=0	0			
S-RDY	Pn50E.3=0	3			
CLT	Pn50F.0=0	0		SO1 (CN1-25,26)	1
VLT	Pn50F.1=0	0			
BK	Pn50F.2=0	0			
WARN	Pn50F.3=0	0			
NEAR	Pn510.0=0	0		**SO2 (CN1-27,28)**	**2**
Reserved	Pn510.1=0	0			
Not used	Pn510.2=0	0			
Not used	Pn510.3=0	0			
COIN(serial command)	Pn2D2.0=0	1		SO3 (CN1-29,30)	3
ProgrammOutput1	Pn2D2.1=2	2			
ProgrammOutput2	Pn2D2.2=0	0			
ProgrammOutput3	Pn2D2.3=0	0			

5.2.4 User Units

5.2.4.1 Position Units

The parameters below are configured in the User Units group of the Parameters window (see Section 4.2.2, Setting Parameters). They are used to convert position units from [encoder count] to [user units].

Parameter	**Setting Range**	**Default**	**Signal**
Pn2B0	1 - 65535	1	Position units ratio numerator
Pn2B1	1 - 16383	0	Position units ratio numerator (high bits)
Pn2B2	1 - 65535	1	Position units ratio denominator
Pn2B3	1 - 16383	0	Position units ratio denominator (high bits)

Position user units are calculated according to the formula:

$$1\left[User\ \ Position\ \ Unit\right]=U\left[counts\right]=\frac{Position\ \ units\ \ ratio\ \ numerator}{Position\ \ units\, ratio\ \ deno\min ator}\left[counts\right]$$

where U is the number of encoder counts in each user position unit. The number need not be an integer.

The maximum value of numerator (Pn2B0) or denominator (Pn2B2) is 65535. In cases where greater values are required, it is possible to use parameters Pn2B1 and Pn2B3 for storing the high bits of numerator and denominator, respectively, according to the following formula:

$$\boxed{\begin{array}{l} High\ Bits = HB = Integer\ \ part\ \ of\ \ \dfrac{N}{65536} \\ Low\ Bits = N - HB \cdot 65536 \end{array}}$$

where N is the required value.

Example

A rotary motion system uses a motor with a 17-bit encoder. The user wants to program the system in units of 0.1 degree:

17-bit encoder produces 131072 [counts] per revolution.

360 [degree] = 3600 [0.1 degree]

$$1\ [0.1\ \deg ree] = \frac{131072}{3600}\ [counts] = \frac{Position\ \ units\ \ ratio\ \ numerator}{Position\ \ units\ ratio\ \ deno\min ator}\ \ [counts]$$

First option

It is possible to reduce the fraction so that both the numerator and denominator are smaller than 65536:

131072 / 3600 = 32768 / 900 → Reduction

Pn2B0 = 32768
Pn2B1 = 0
Pn2B2 = 900
Pn2B3 = 0

Second option

Without reduction of the fraction:

High Bits = HB = Integer part of N/65536 = Integer part of 131072 / 65536 = 2

Low Bits = N – HB*65536 = 131072 – 2 * 65536 = 0

Pn2B0 = 0
Pn2B1 = 2
Pn2B2 = 3600
Pn2B3 = 0

Both options are equivalent.

5.2.4.2 Speed Units

The parameters below are configured in the User Units group of the Parameters window (see Section 4.2.2, Setting Parameters). They are used to convert speed units from [encoder count/msec] to [user speed units].

Parameter	Setting Range	Default	Signal
Pn2B4	1 - 65535	1	Speed units ratio numerator
Pn2B5	1 - 16383	0	Speed units ratio numerator (high bits)
Pn2B6	1 - 65535	1	Speed units ratio denominator
Pn2B7	1 - 16383	0	Speed units ratio denominator (high bits)

Speed user units are calculated according to the formula:

$$\boxed{1\,[User\ Speed\ Unit] = \frac{U[counts]}{T[ms]} = \frac{Speed\ units\ ratio\ numerator}{Speed\ units\ ratio\ deno\min ator}}$$

where U is the number of encoder counts in one speed unit,
T is the time of speed unit in msec.

The maximum value of numerator (Pn2B4) or denominator (Pn2B6) is 65535. In cases where greater values are required, it is possible to use parameters Pn2B5 and Pn2B7 for storing the high bits of numerator and denominator, respectively, according to the following formula:

$$\boxed{\begin{array}{l} High\ Bits = HB = Integer\ \ part\ \ of\ \ \dfrac{N}{65536} \\ Low\ Bits = N - HB \cdot 65536 \end{array}}$$

where N is the required value.

Example

A rotary motion system uses a motor with a 17-bit encoder. The user wants to program the system in speed units of rpm:

17-bit encoder produces 131072 [counts] per revolution.

U = 131072

1 [minute] = 60000 [ms]

T = 60000

$$1\,[rpm] = \frac{U[counts]}{T[ms]} = \frac{131072[counts]}{60000[ms]} = \frac{Speed\ units\ ratio\ numerator}{Speed\ units\ ratio\ deno\min ator}$$

First option

It is possible to reduce the fraction so that both the numerator and denominator are smaller than 65536:

131072 / 60000 = 32768 / 15000

Pn2B4 = 32768
Pn2B5 = 0
Pn2B6 = 15000
Pn2B7 = 0

Second option

Without reduction of the fraction:

High Bits = HB = Integer part of N/65536 = Integer part of 131072 / 65536 = 2

Low Bits = N – HB*65536 = 131072 – 2 * 65536 = 0

Pn2B4 = 0
Pn2B5 = 2
Pn2B6 = 60000
Pn2B7 = 0

Both options are equivalent.

5.2.4.3 Acceleration Units

The parameters below are configured in the User Units group of the Parameters window (see Section 4.2.2, Setting Parameters). They are used to convert acceleration units from [encoder count / (10msec)^2] to [user acceleration units].

Parameter	Setting Range	Default	Signal
Pn2B8	1 - 65535	1	Acceleration units ratio numerator
Pn2B9	1 - 16383	0	Acceleration units ratio numerator (high bits)
Pn2BA	1 - 65535	1	Acceleration units ratio denominator
Pn2BB	1 - 16383	0	Acceleration units ratio denominator (high bits)

Acceleration user units are calculated according to the formula:

$$1\,[User\ Acceleration\ Unit]=\frac{U[counts]}{T^2\left[(10\cdot ms)^2\right]}=\frac{Acceleration\ units\ ratio\ numerator}{Acceleration\ units\,ratio\ deno\min ator}$$

where U is the number of encoder counts in one acceleration unit,
T is the time of acceleration unit in (10*ms)^2.

The maximum value of numerator (Pn2B8) or denominator (Pn2BA) is 65535. In cases where greater values are required, it is possible to use parameters Pn2B9 and Pn2BB for storing the high bits of numerator and denominator, respectively, according to the following formula:

$$High\ Bits=HB=Integer\ part\ of\ \frac{N}{65536}$$
$$Low\ Bits=N-HB\cdot 65536$$

where N is the required value.

Example

A rotary motion system uses a motor with a 17-bit encoder. The user wants to program the system in acceleration units of rad/s^2:

17-bit encoder produces 131072 [counts] per revolution.

One revolution = 2π [rad]

U = 131072 / 2π

1 [s^2] = 1000000[ms^2] = 10000 [10*ms]^2

T^2 = 10000

$$1\left[\frac{rad}{s^2}\right]=\frac{U[counts]}{T^2[ms]}=\frac{131072}{2\pi\cdot 10000}=\frac{131072}{62832}=\frac{Speed\ units\ ratio\ numerator}{Speed\ units\,ratio\ denomi\min ator}$$

High Bits = HB = Integer part of N/65536 = Integer part of 131072 / 65536 = 2

Low Bits = N – HB*65536 = 131072 – 2 * 65536 = 0

Pn2B8 = 0
Pn2B9 = 2
Pn2BA = 62832
Pn2BB = 0

5.2.5 Default Speed, Acceleration and Jerk

Default movement profile values for Speed, Acceleration and Jerk are configured in the Application Setting group of the Parameters window (see Section 4.2.2, Setting Parameters). Their values can also be changed in the XtraWare program using the PROFILE commands.

Since these setting are in user units, it is important to update them after each change in user units.

In cases where greater values than 65536 are required, it is possible to define the values by two parameters (high and low bits) according to the following formula:

$$\begin{array}{l} High\ Bits = HB = Integer\ \ part\ of\ \dfrac{N}{65536} \\ Low\ Bits = N - HB \cdot 65536 \end{array}$$

where N is the required value.

- Default Speed Setting

  Pn2A2 – Speed (Low bits) = (Default Speed) modulo 65536

  Pn2A3– Speed (High bits) = integer part of (Default speed) / 65536

  Example: Setting default speed of 500000 micron/second.

  Set Pn2A3=500000/65536=7

  Set Pn2A2=500000 - 7*65536=41248

- Default Acceleration Setting

  Pn2A4 – Acceleration (Low bits) =(Default Acceleration) modulo 65536

  Pn2A5– Acceleration (High bits) =integer part of (Default Acceleration) / 65536

  Example: Setting default acceleration of 30000 rad/s^2.

  Set Pn2A5 = 0

  Set Pn2A4=30000

- Default Jerk Setting

  Pn2A6 defines (in msecs) the duration of time needed for the profile to reach maximum acceleration or minimum deceleration.

5.2.6 Motion End Window

There are two options for defining the motion end window:

- For program uses – Set parameter Pn2C0 (motion end window). This parameter defines the default value of a window for position error to finish a motion. In case of a MOVE_D or GO_D command, the next command in the buffer will be executed after the command is finished and the position error (in user units) will be smaller than the value of this variable. This parameter can be changed in the program by the SET_VAR command.
- For I/O uses – Set parameter Pn500 (positioning completed width) to define the COIN output signal. The signal indicates that the servomotor operation is completed.

5.2.7 Load Of Inertia

In order to use values of Loop Gains that are closely related to the characteristics of your system, loop gains are normalized in Hertz. This normalization of parameters is performed according to the assumed inertia of the system.

Roughly calculate an estimation of the inertia of the load for your system and input its value in the Load Inertia Ratio parameter (Pn103).

Set Pn103 to the following value.

$$\boxed{Pn103 = \frac{Load\ Inertia\ (J_L)}{Motor\ Rotor\ Inertia\ (J_M)} \cdot 100\%}$$

Motor rotor inertia can be found in parameter PnF0C.

For further information, see Section 6.2.6 of the XtraDrive User Manual.

5.2.8 Homing Parameters

These parameters can be configured in the Home group of the Parameters window (see Section 4.2.2, Setting Parameters). There are several methods of finding Home:

- Home switch and C - phase (HOME_SW_C)
- C - phase only (HOME_C)
- Home switch only (HOME_SW)
- By encountering an obstacle (HARD_HOME)

Note: After finding home, the motor is not necessarily in the zero position. Use the GO command to move to the zero position. Alternatively, you can set the current position as zero (HOME) using the SET_ZERO_POSITION command.

Set the following parameters according to the homing procedure being used. For further information, see the section on home commands in Chapter 7, Command Reference.

Pn2C5 – Defines the stop speed when searching for hard home.

Pn2C7.0 – Sets home switch input attribution.

Pn2C7.1 – Sets home switch input polarity (NO or NC). This parameter must to be set in order to use the home switch.

5.3 Run Autotuning

Autotuning is a predefined trapezoid movement which is cyclically executed during the Autotuning session.

The range and speed of this motion is defined by the following parameters which should be set as closely as possible to the required movement in the application:

- Pn2C8: Delay between two moves
- Pn2C9: Plateau Speed as % of the maximum speed
- Pn2CA: Acceleration time in msec
- Pn2CB: Plateau length, in msec

Before commencing Autotuning, check the values of these parameters to ensure that the acceleration and speed of the Autotuning movement are in the allowed range.

For further information, see Section 5.9.5 in the XtraDrive User Manual.

5.3.1 Autotuning Options

The available Autotuning options are:

- Fast Autotuning – Values are set to the control parameters according to the load mounted on the motor.
- Start with user parameters – Initial Autotuning values are the control parameters currently loaded in the drivers.
- Start with system parameters – Initial Autotuning values are the default values of the control parameters.
- Automatic Command Filter Setting – Autotuning sets the command filter (Pn216).
- Notch filter in use – The notch filter value (if a notch filter has been defined) is taken into consideration.

For further information, see Section 4.5.2, Autotuning.

5.3.2 Autotuning Operation

1. In the Autotuning window, select Fast Tuning.
2. Press Start.
3. After the process finishes press OK.
4. Set parameter Pn1A0 = 30
5. Check the stability of control after turning Servo On. If vibrations occur, reduce global gain Pn1A0 until stable control is observed.
6. In the Autotuning window, select Fine tuning.
7. Select Start with user parameters.
8. Select Automatic command filter setting.
9. Press Start. Important Note: **The motor is about to move**.

The procedure takes a few minutes. When finished, press OK to accept the new parameters.

The system is now ready for operation.

6. Parameter Reference

This chapter provides information on all the parameters available in XtraWare.

Table 6-1 lists all the parameters according to their ID number. For each parameter this information is provided:

- The group to which the parameter belongs
- A short description
- Units
- Range
- Default value
- Reference to the section in the XtraDrive User’s Manual which provides a full description of the parameter.

Table 6-2 lists the switches and their default settings. Table 6-3 lists input signal selections and their default settings. Table 6-4 lists output signal selections and their default settings.

Table 6-1: Parameters

Category	Parameter Number	Name	Unit	Setting Range	Default Setting	Reference
Function Selection Parameters	**Pn000***	Function Selection Basic Switches	—	—	0x00C0	5.1.1, 5.3.5
	Pn001*	Function Selection Application Switches 1**	—	—	0000	5.1.2, 5.4.2, 5.5.7
	Pn002*	Function Selection Application Switches	—	—	0000	5.2.8, 5.2.9, 5.7.2
	Pn003	Function Selection Application Switches 3	—	—	0002	6.4
	Pn006	Function Selection Application Switches 3	—	—	0000	6.4
	Pn007	Function Selection Application Switches 3	—	—	0000	6.4
Gain Parameters	Pn100	Speed Loop Gain	Hz	1 to 2000	40	6.2.2, 6.2.7, 6.2.10
	Pn101	Speed Loop Integral Time Constant	0.01ms	15 to 51200	2000	
	Pn102	Position Loop Gain	s^{-1}	1 to 2000	40	6.2.10
	Pn103	Inertia Ratio	%	0 to 10000	300	6.2.6, 6.3.1, 6.3.5
	Pn109	Feed-Forward (Speed control)	%	0 to 100	0	6.2.2
	Pn110*	Online Autotuning Switches	—	—	0010	6.3.4
	Pn119	Reserved parameters (do not change)	s-1	1 to 2000	50	—
	Pn11A		0.1%	1 to 2000	1000	—
	Pn11B		Hz	1 to 250	50	—
	Pn11C		Hz	1 to 250	70	—

Category	Parameter Number	Name	Unit	Setting Range	Default Setting	Reference
	Pn11D		0.1%	1 to 10000	100	—
	Pn11E		0.1%	1 to 10000	100	—
	Pn140		0.1Hz	10-2500	200	--
	Pn141		0.1Hz	10-2500	800	--
	Pn142		0.1%	0-2000	0	--
	Pn143		0.01ms	0-65535	0	--
	Pn144		0.1%	0-10000	1000	--
	Pn145		0.1%	0-10000	0	--
Motor parameters	**Pn190***	Motor selection switch	--	--	0000	5.8
	Pn191*	Motor selection switch	--	--	0000	5.8
	Pn192*	Pulses number of A quad B encoder	pulse/rev	500-8000	2048	5.8
	Pn193*	Difference between C-pulse and original (U phase)	0.1deg	0-3599	0	5.8
	Pn194	Reserved parameters (do not change)				
	Pn195					
	Pn196					
Gain parameters	Pn1A0	Global gain factor (tightness)	%	0-500	60	6.3.3
	Pn1A2	Speed feedback filter	0.01ms	30-3200	40	6.3.5
	Pn1A4	Torque filter (low pass)	0.01ms	0-2500	20	6.3.5
	Pn1A5	Torque filter (second order)	0.1%	0-1000	0	6.3.5
	Pn1A7	Integral mode switch	--	--	1121	6.3.5
	Pn1A9	Integral feedback gain	Hz	0-500	40	6.3.5
	Pn1AA	Proportional feedback gain	Hz	0-500	40	6.3.3
	Pn1AB	Supplementary proportional feedback gain	Hz	0-500	30	6.3.3
	Pn1AC	Speed feedback gain	Hz	0-2000	30	6.3.3
	Pn1AD	Acceleration feedback gain	%	0-500	0	6.3.3
	Pn1AE	Acceleration feedback filter	0.01ms	0-2500	300	6.3.9
	Pn1AF	Feed forward gain	%	0-200	0	6.3.3
	Pn1B5	Maximum variable gain	%	100-1000	160	6.3.7
	Pn1B6- Pn1BA	Reserved parameters (do not change)	--	--		
	Pn1BB	Feed forward compensation	Hz	10-2000	2000	6.3.4
	Pn1BC	Filter on command acceleration	0.01ms	0-2500	300	6.3.4
	Pn1BD	Reduction of vibrations due to system flexibility.	Hz	10-2000	2000	6.3.4
	Pn1BF	Integral switch advance	--	1-15	3	6.3.8
	Pn1C0	Integral offset averaging time	ms	0-25	0	6.3.7
	Pn1C2	Reserved parameters (do not change)	--	--		

Category	Parameter Number	Name	Unit	Setting Range	Default Setting	Reference
Position Parameters	**Pn200***	Position Control Reference Selection Switches	—	—	0000	5.2.2
	Pn201*	PG Divider	p/rev	16 to 16384	16384	5.2.3
	Pn202*	Electronic Gear Ratio (Numerator)	—	1 to 65535	4	5.2.5
	Pn203*	Electronic Gear Ratio (Denominator) (see note 3).	—	1 to 65535	1	5.2.5
	Pn205*	Multi-Turn Limit Setting**	rev	0 to 65535	65535	5.7.2
	Pn206	Reserved parameter (do not change)	p/rev	513 to 65535	16384	—
	Pn216	Command smoothing	0.1ms	0-65535	0	6.3.4
Serial communication command	**Pn2A2***	Work speed default (low)	Speed units	0-65535	0	5.9.1.2
	Pn2A3*	Work speed default (high)	Speed units* 65536	0-256	0	5.9.1.2
	Pn2A4*	Work acceleration default (low)	accel. units	0-65535	0	5.9.1.2
	Pn2A5*	Work acceleration default (high)	accel. units* 65536	0-256	0	5.9.1.2
	Pn2A6*	Work jerk smoothing time default	µs	0-65535	0	5.9.1.2
	Pn2A8*	Quick stop deceleration (low)	accel. units	0-65535	65535	5.9.1.2
	Pn2A9*	Quick stop deceleration (high)	accel. units* 65536	0-256	256	5.9.1.2
	Pn2B0*	Position units ratio numerator (low)	--	1-65535	1	5.9.1.1
	Pn2B1*	Position units ratio numerator (high)	--	0-16383	0	5.9.1.1
	Pn2B2*	Position units ratio denominator (low)	--	1-65535	1	5.9.1.1
	Pn2B3*	Position units ratio denominator (high)	--	0-16383	0	5.9.1.1
	Pn2B4*	Speed units ratio numerator (low)	--	1-65535	1	5.9.1.1
	Pn2B5*	Speed units ratio numerator (high)	--	0-16383	0	5.9.1.1
	Pn2B6*	Speed units ratio denominator (low)	--	1-65535	1	5.9.1.1
	Pn2B7*	Speed units ratio denominator (high)	--	0-16383	0	5.9.1.1
	Pn2B8*	Acceleration units ratio numerator (low)	--	1-65535	1	5.9.1.1
	Pn2B9*	Acceleration units ratio numerator (high)	--	0-16383	0	5.9.1.1
	Pn2BA*	Acceleration units ratio denominator (low)	--	1-65535	1	5.9.1.1

Category	**Parameter Number**	**Name**	**Unit**	**Setting Range**	**Default Setting**	**Reference**
	Pn2BB*	Acceleration units ratio denominator (high)	--	0-16383	0	5.9.1.1
	Pn2C0	Motion end window	user position units	0-250	10	5.9.1.2
	Pn2C1	Torque slope	0.1% of rated torque/ ms	1-8000	8000	5.9.2
	Pn2C4	Synchronize window for pulse train	user position units	0-250	7	
	Pn2C5	Zero speed when find hard home	speed units	0-32000	2	5.9.3
	Pn2C6	Communication switch selection	null	0-1	1	Appendix E
	Pn2C7*	Home switch selection	--	--	0020	5.9.3
	Pn2C8	Autotuning – time between movements	ms	200-2000	400	5.9.5
	Pn2C9	Autotuning – speed of movement	% of maximum speed	0-100	50	5.9.5
	Pn2CA	Autotuning – acceleration time	ms	1-125	50	5.9.5
	Pn2CB	Autotuning – plateau time of movement	ms	0-1000	50	5.9.5
	Pn2CC*	Auto start user program	--	0-99	0	5.10
	Pn2D0*	Expand input signal selection 1	--	--	8651	5.9.4
	Pn2D1*	Expand input signal selection 2	--	--	8887	5.9.4
	Pn2D2*	Expand output signal selection 1	--	--	0021	5.9.4
Speed Parameters	Pn300	Speed Reference Input Gain	0.01V/ rated speed	150 to 3000	600	5.2.1
	Pn301	Speed 1	rpm	0 to 10000	100	5.2.6
	Pn302	Speed 2	rpm	0 to 10000	200	5.2.6
	Pn303	Speed 3	rpm	0 to 10000	300	5.2.6
	Pn304	Jog Speed	rpm	0 to 10000	500	5.3.2
	Pn305	Soft Start Acceleration Time	ms	0 to 10000	0	6.2.2
	Pn306	Soft Start Deceleration Time	ms	0 to 10000	0	6.2.2
	Pn307	Speed Reference Filter Time Constant	0.01ms	0 to 65535	40	—
	Pn308	Speed Feedback Filter Time Constant	0.01ms	0 to 65535	0	—

Category	Parameter Number	Name	Unit	Setting Range	Default Setting	Reference
Torque Parameters	Pn400	Torque Reference Input Gain	0.1V/ rated torque	10 to 100	30	5.2.7
	Pn401	Torque Reference Filter Time Constant	0.01ms	0 to 65535	100	6.2.2
	Pn402	Forward Torque Limit	%	0 to 800	800	5.1.3
	Pn403	Reverse Torque Limit	%	0 to 800	800	5.1.3
	Pn404	Forward External Torque Limit	%	0 to 800	100	5.1.3
	Pn405	Reverse External Torque Limit	%	0 to 800	100	5.1.3
	Pn406	Emergency Stop Torque	%	0 to 800	800	5.1.2
	Pn407	Speed Limit during Torque Control	rpm	0 to 10000	10000	5.2.7
	Pn408	Torque Function Switches	—	—	0000	6.2.9
	Pn409	Notch Filter Frequency	Hz	50 to 2000	2000	6.2.9
	Pn40A	Notch Filter width	Hz	70 to 1000	70	6.2.9
Sequence Parameters	Pn500	Positioning Completed Width	ref. units	0 to 250	7	5.5.3
	Pn501	Zero Clamp Level	rpm	0 to 10000	10	5.4.3
	Pn502	Rotation Detection Level	rpm	1 to 10000	20	5.5.5
	Pn503	Speed Coincidence Signal Output Width	rpm	0 to 100	10	5.5.4
	Pn504	NEAR Signal Width	ref. units	1 to 250	7	5.5.8
	Pn505	Overflow Level	256 ref. units	1 to 32767	1024	6.2.1
	Pn506	Brake Reference Servo OFF Delay Time	10ms	0 to 50	0	5.4.4
	Pn507	Brake Reference Output Speed Level	rpm	0 to 10000	100	5.4.4
Sequence Parameters	Pn508	Timing for Brake Reference Output during Motor Operation	10ms	10 to 100	50	5.4.4
	Pn509	Momentary Hold Time	ms	20 to 1000	20	5.5.9
	Pn50A*	Input Signal Selections 1	—	—	8881	5.3.3
	Pn50B*	Input Signal Selections 2	—	—	8848	5.3.3
	Pn50C*	Input Signal Selections 3	—	—	8888	5.3.3
	Pn50D*	Input Signal Selections 4	—	—	8888	5.3.3
	Pn50E*	Output Signal Selections 1	—	—	3000	5.3.4
	Pn50F*	Output Signal Selections 2	—	—	0000	5.3.4
	Pn510*	Output Signal Selections 3	—	—	0000	5.3.4
	Pn511	Reserved parameter (do not change)	—	—	8888	—
	Pn512*	Output Signal Reversal Settings	—	—	0000	5.3.4
Other Parameters	Pn600	Regenerative Resistor Capacity **	10W	0 to capacity	0	5.6.1
	Pn601	Reserved parameter (do not change)	—	0 to capacity	0	—

* After changing this parameter, cycle the main circuit and control power supplies to enable the new settings.
** The multi-turn limit is valid only when parameter Pn002.2 Absolute Encoder Usage is set to "2". The value will be processed in the range of "+32767 to -32768" for other settings even if the value is changed. There is no need to change the multi-turn limit except in special cases. It is recommended not to change the setting unless necessary.

Table 6-2: Switches

Parameter	Digit Place	Name	Setting	Description	Default Setting
Pn000 Function Selection Basic Switches	0	Direction Selection	0	Sets CCW as forward direction	0
			1	Sets CW as forward direction (reverse rotation mode)	
	1	Control Method Selection	0	Speed control (analog reference)	0
			1	Position control (pulse train reference)	
			3	Internal set speed control (contact reference)	
			4	Internal set speed control (contact reference)/Speed control (analog reference)	
			5	Internal set speed control (contact reference)/Position control (pulse train reference)	
			6	Internal set speed control (contact reference)/Torque control (analog reference)	
			7	Position control (pulse train reference)/Speed control (analog reference)	
			8	Position control (pulse train reference)/Torque control (analog reference)	
			9	Torque control (analog reference)/Speed control (analog reference)	
			A	Speed control (analog reference)/Zero clamp	
			B	Position control (pulse train reference)/Position control (Inhibit)	
			C	Position control (pulse train)	
			D	Serial communication command	
	2	Axis Address	0 to F	Sets servo amplifier axis address	0
	3	Reserved		—	0
Pn001 Function Selection Application Switches	0	Servo OFF or Alarm Stop Mode	0	Stops the motor by applying dynamic brake (DB)	0
			1	Stops the motor by applying dynamic brake (DB) and then releases DB	
			2	Makes the motor coast to a stop state without using the dynamic brake (DB)	
	1	Overtravel Stop Mode	0	Same setting as Pn001.0 (stops the motor by applying DB or by coasting)	0
			1	Sets the torque of Pn406 to the maximum value, decelerates the motor to a stop, and then sets it to servo lock state	
			2	Sets the torque of Pn406 to the maximum value, decelerates the motor to a stop, and then sets it to coasting state	

Parameter	Digit Place	Name	Setting	Description	Default Setting
	2	AC/DC Power Input Selection	0	Not applicable to DC power input: Input AC power supply through L1, L2, and (L3) terminals	0
			1	Applicable to DC power input: Input DC power supply through (+)1 and (-) terminals	
	3	Warning Code Output Selection	0	ALO1, ALO2, and ALO3 output only alarm codes	0
			1	ALO1, ALO2, and ALO3 output both alarm codes and warning codes. While warning codes are output, ALM signal output remains ON (normal state)	
Pn002 Function Selection Application Switches	0	Speed Control Option (T-REF Terminal Allocation)	0	None	0
			1	Uses T-REF as an external torque limit input	
			2	Uses T-REF as a torque feed-forward input	
			3	Uses T-REF as an external torque limit input when P-CL and N-CL are ON	
	1	Torque Control Option (V-REF Terminal Allocation)	0	None	0
			1	Uses V-REF as an external speed limit input	
	2	Absolute Encoder Usage	0	Uses absolute encoder as an absolute encoder	0
			1	Uses absolute encoder as an incremental encoder	
			2	Uses absolute encoder as an absolute encoder. Uses multi-turn limit	
	3	Not used	0	—	0
Pn003 Function Selection Application Switches	0	Analog Monitor 1 Torque Reference Monitor	0	Motor speed: 1V/1000rpm.	2
			1	Speed reference: 1V/1000rpm	0
			2	Torque reference: 1V/100%	
			3	Position error: 0.05V/1 reference units	
			4	Position error 0.05V/100 reference units	
			5	Reference pulse frequency (converted to rpm): 1V/1000rpm	
			6	Motor speed x 4: 1V/250rpm	
			7	Motor speed x 8: 1V/125rpm	
	1	Analog Monitor 2 Speed Reference Monitor	8	Reserved parameter (do not change)	
			9		
			A		
			B		
			C		
			D		
			E		
			F		
	2	Not used	—	—	0

Parameter	Digit Place	Name	Setting	Description	Default Setting
	3	Not used	—	—	0
Pn006 Gain Application Switches	0	Analog monitor 1	0	Servo position error: 1V/10 encoder counts	0
			1	Servo position error: 1V/5 user units	
			2	Target speed 1V/500 rpm	
			3	Target speed after applying command smoothing: 1V/500 rpm	
			4	Torque reference: 10V/max torque	
			5	Target acceleration after applying command smoothing: 10V/max acceleration allowed	
	1	Analog monitor 1 - selection of source parameter	0	Pn003.0 used for analog monitor 1	0
			1	Pn006.0 used for analog monitor 1	
	2	Analog monitor 1 – magnification of signal	0-4	0: x1, 1: x10, 2: x100 3: x1/10, 4: x1/100	0
	3	Not used	0	--	0
Pn007 Gain Application Switches	0	Analog monitor 2	0	Servo position error: 1V/10 encoder counts	0
			1	Servo position error: 1V/5 user units	
			2	Target speed 1V/500 rpm	
			3	Target speed after applying command smoothing: 1V/500 rpm	
			4	Torque reference: 10V/max torque	
			5	Target acceleration after applying command smoothing: 10V/max acceleration allowed	
	1	Analog monitor 2 - selection of source parameter	0	Pn003.1 used for analog monitor 2	0
			1	Pn007.0 used for analog monitor 2	
	2	Analog monitor 2 – magnification of signal	0-4	0: x1, 1: x10, 2: x100 3: x1/10, 4: x1/100	0
	3	Not used	0	--	0
Pn110 Online Autotuning Switches	0	Online Autotuning Method	0	Tunes only at the beginning of operation	0
			1	Always tunes	
			2	Does not perform autotuning	
	1	Speed Feed-back Compensation Selection	0	Enabled	1
			1	Disabled	
	2	Friction Compensation Selection	0	Friction compensation: Disabled	0
			1	Friction compensation: Small	
			2	Friction compensation: Large	
	3	Reserved	0 - 3	Reserved parameter (do not change)	0

Parameter	Digit Place	Name	Setting	Description	Default Setting
Pn190 Motor selection switches	0	Model of motor	0	Yaskawa A quad B model SGM	0
			1	Yaskawa A quad B model SGMP	
			2	Other A quad B motor	
	1	Encoder type	0	Incremental A quad B encoder	0
			1	Yaskawa absolute A quad B encoder	
	2	Encoder selection	0	Yaskawa serial encoder	0
			1	A quad B encoder	
	3	C- phase mask	0	C phase signal used	0
			1	C phase signal mask	
Pn191 Motor selection switches	0	Motor phase order	0	Not defined	0
			1	UVW	
			2	UWV	
	1-3	Not used	0	--	0
Pn1A7 Motor selection Switches	0	Integral mode	0	No special treatment of integral	1
			1	Value of integral is modified at end of a movement command to avoid overshoot	
	1-3	Not used	0	--	0
Pn200 Position Control References Selection Switches	0	Reference Pulse Form	0	Sign + pulse, positive logic	0
			1	CW + CCW, positive logic	
			2	A phase + B phase (x1), positive logic	
			3	A phase + B phase (x2), positive logic	
			4	A phase + B phase (x4), positive logic	
			5	Sign + pulse, negative logic	
			6	CW + CCW, negative logic	
	1	Error Counter Clear Signal Form	0	Clears error counter when the signal goes high	0
			1	Clears error counter at the rising edge of the signal	
			2	Clears error counter when the signal goes low	
			3	Clears error counter at the falling edge of the signal	
	2	Clear Operation	0	Clears error counter at the base block	0
			1	Does not clear error counter which can only be cleared with CLR signal	
			2	Clears error counter when an alarm occurs	
			3	Clear signal ignore	
	3	Filter Selection	0	Reference input filter for line driver signals	0
			1	Reference input filter for open collector signals	

Parameter	Digit Place	Name	Setting	Description	Default Setting
Pn2C6 Communica-tion switch	0	Check Sum	0	Does not use check sum	1
			1	Uses check sum	
	1	Not used	---	---	
	2				
	3				
Pn2C7 Home Switches	0	Home limit switch input	0	SI0 (CN1-40)	0
			1	SI1 (CN1-41)	
			2	SI2 (CN1-42)	
			3	SI3 (CN1-43)	
			4	SI4 (CN1-44)	
			5	SI5 (CN1-45)	
			6	SI6 (CN1-46)	
			7-F	Home failure	
	1	Limit switch polarity	0	Normally closed (0 Volt logic)	2
			1	Normally open	
			2	Home failure	
Pn408 Torque Control Function Switches	0	Notch filter selection	0	Disabled	0
			1	Uses a notch filter for torque reference	
	1	Not used	—	—	
	2				
	3				

Table 6-3: Input Signal Selections

Parameter	Digit Place	Name	Setting	Description	Default Setting
Pn50A	0	Input Signal Allocation Mode	0	Sets the input signal allocation for the sequence to the same one as for the Yaskawa special servo amplifier	0
			1	Possible to freely allocate the input signals	
	1	/S-ON Signal Mapping (Servo ON when low)	0	Inputs from the SI0 (CN1-40) input terminal	0: SI0
			1	Inputs from the SI1 (CN1-41) input terminal	
			2	Inputs from the SI2 (CN1-42) input terminal	
			3	Inputs from the SI3 (CN1-43) input terminal	
			4	Inputs from the SI4 (CN1-44) input terminal	
			5	Inputs from the SI5 (CN1-45) input terminal	
			6	Inputs from the SI6 (CN1-46) input terminal	
			7	Sets signal ON	
			8	Sets signal OFF	
			9	Inputs the reverse signal from the SI0 (CN1-40) input terminal	
			A	Inputs the reverse signal from the SI1 (CN1-41) input terminal	
			B	Inputs the reverse signal from the SI2 (CN1-42) input terminal	
			C	Inputs the reverse signal from the SI3 (CN1-43) input terminal	
			D	Input the reverse signals from the SI4 (CN1-44) input terminal	
			E	Inputs the reverse signal from the SI5 (CN1-45) input terminal	
			F	Inputs the reverse signal from the SI6 (CN1-46) input terminal	
	2	/P-CON Signal Mapping (Pcontrol when low)	0 to F	Same as above	1: SI1
	3	P-OT Signal Mapping (overtravel when high)	0 to F	Same as above	2: SI2
Pn50B	0	N-OT Signal Mapping (overtravel when high)	0 to F	Same as above	3: SI3
	1	/ALM-RST Signal Mapping (alarm reset when low)	0 to F	Same as above	4: SI4
	2	/P-CL Signal Mapping (Torque control when low)	0 to F	Same as above	5: SI5

Parameter	Digit Place	Name	Setting	Description	Default Setting
	3	/N-CL Signal Mapping (Torque control when low)	0 to 8	Same as above	6: SI6
Pn50C	0	/SPD-D Signal Mapping (Internal Set Speed Selection)	0 to F	Same as above	8: OFF
	1	/SPD-A Signal Mapping (Internal Set Speed Selection)	0 to F	Same as above	8: OFF
	2	/SPD-B Signal Mapping (Internal Set Speed Selection)	0 to F	Same as above	8: OFF
	3	/C-SEL Signal Mapping (Control Mode Switching)	0 to F	Same as above	8: OFF
Pn50D	0	/ZCLAMP Signal Mapping (Zero Clamping)	0 to F	Same as above	8: OFF
	1	/INHIBIT Signal Mapping (Disabling Reference Pulse)	0 to F	Same as above	8: OFF
	2	/G-SEL Signal Mapping (Gain Switching)	0 to F	Same as above	8: OFF
	3	(Reserved)	0 to F	Same as above	8: OFF

When Pn50A.0 is set to 0 for the XtraDrive servo amplifier, only the following modes are compatible: Pn50A.1=7, Pn50A.3=8, and Pn50B.0=8.

Extended input signal selection: the following inputs are used in the user program:

Parameter	Digit Place	Name	Setting	Description	Default Setting
Pn2D0	0	Input 1	0 to 8	Same as above	8: OFF
	1	Input 2	0 to 8	Same as above	8: OFF
	2	Input 3	0 to 8	Same as above	8: OFF
	3	Input 4	0 to 8	Same as above	8: OFF
Pn2D1	0	Emergency input	0	Inputs from the SI0 (CN1-40) input terminal	8: ON
			1	Inputs from the SI1 (CN1-41) input terminal	
			2	Inputs from the SI2 (CN1-42) input terminal	
			3	Inputs from the SI3 (CN1-43) input terminal	
			4	Inputs from the SI4 (CN1-44) input terminal	
			5	Inputs from the SI5 (CN1-45) input terminal	
			6	Inputs from the SI6 (CN1-46) input terminal	
			7	Sets emergency signal OFF	
			8	Sets emergency signal ON	
	1	Fast Input	0 to 8		8: OFF
	2	Input 5	0 to 8	Same as Pn50A.1	8: OFF
	3	Input 6	0 to 8		8: OFF

Table 6-4: Output Signal Selections

Parameter	Digit Place	Name	Setting	Description	Default Setting
Pn50E	0	/COIN Signal Mapping	0	Disabled	1: SO1
			1	Outputs from the SO1 (CN1-25, 26) output terminal	
			2	Outputs from the SO2 (CN1-27, 28) output terminal	
			3	Outputs from the SO3 (CN1-29, 30) output terminal	
	1	/V-CMP Signal Mapping	0 to 3	Same as above	1: SO1
	2	/TGON Signal Mapping	0 to 3	Same as above	2: SO2
	3	/S-RDY Signal Mapping	0 to 3	Same as above	3: SO3
Pn50F	0	/CLT Signal Mapping	0 to 3	Same as above	0: Not used
	1	/VLT Signal Mapping	0 to 3	Same as above	
	2	/BK Signal Mapping	0 to 3	Same as above	
	3	/WARN Signal Mapping	0 to 3	Same as above	
Pn510	0	/NEAR Signal Mapping	0 to 3	Same as above	
	1	Reserved	0 to 3	Same as above	
	2	Not used	0	—	0
	3	Not used	0	—	0
Pn512	0	Output Signal Reversal for SO1 (CN-25 and 26)	0	Output signal is not reversed	0: Not reversed
			1	Output signal is reversed	

Parameter	Digit Place	Name	Setting	Description	Default Setting
	1	Output Signal Reversal for SO2 (CN-25 and 26)	0	Output signal is not reversed	
			1	Output signal is reversed	
	2	Output Signal Reversal for SO3 (CN-25 and 26)	0	Output signal is not reversed	
			1	Output signal is reversed	
	3	Not used	—	—	0

Extended output signal selection: the following outputs are used in the user program:

Parameter	Digit Place	Name	Setting	Description	Default Setting
Pn2D2	0	/COIN Signal Mapping	0	Disabled.	0:disable
			1	Outputs from the SO1 (CN1-25, 26) output terminal	
			2	Outputs from the SO2 (CN1-27, 28) output terminal	
			3	Outputs from the SO3 (CN1-29, 30) output terminal	
	1	Output 1	0 to 3	Same as above	0:disable
	2	Output 2	0 to 3	Same as above	0:disable
	3	Output 3	0 to 3	Same as above	0:disable

Note: **1.** When more than one signal is allocated to the same output circuit, data is output using OR logic.
2. Depending on the control mode, undetected signals are treated as OFF. For example, in the speed control mode, the /COIN signal is treated as OFF.
3. Types of /WARN signals: Overload and regenerative overload.

7. Command Reference

This chapter contains an alphabetical list of all the commands available for writing a program in the XtraWare system.

The following information is presented for the commands:

- **Command Name:** The name of the command.
- **Command Group:** The group to which the command belongs.
- **Syntax:** The format in which the command should be written.
- **Units:** The units of the command value (if applicable).
- **Range:** The range of the command value (if applicable). All command values are limited to 2^31 (2e9) except where another value is specified in the command description.
- **Description:** A detailed description of the command.
- **Syntax Parameters:** A description of the parameters used in the command syntax.
- **Example:** An example that shows the use of the command.
- **Example Explanation:** A concise explanation of the example.
- **Modes:** Modes in which the command is available. For details of the available modes, see Section 4.4, Program Modes. Information on how commands are executed in the different modes is provided below.
- **Notes:** Additional information that is useful to know for using this command.
- **See Also:** A list of additional commands and/or parameters that are related to this command.

Command Reference Conventions: The generic term uu, found in this section, refers to user units. The user defines the units by setting the wanted gear ratio. For further information, see Chapter 5 in the XtraDrive User Manual.

User Program Buffer (UPB)
1
2
.
.
.
100

Immediate Command Buffer (ICB)
1
2
3
4
5

Sequential Command Buffer (SCB)
1
2
.
.
.
101

Motion Command Buffer (MCB)
1
2
3
4
5

Program Mode (User Program Buffer UPB)

In this mode, a program (a group of commands) is downloaded into the UPB of the driver. Program commands have the highest priority.

Program execution is activated by the RUN command or by clicking the RUN icon on the toolbar.

Motion commands in program mode are first calculated and then inserted into the motion command buffer (MCB). This enables the setting of an output or insertion of a certain term immediately after the motion begins until it ends. Commands with the suffix _D are fetched to the MCB and only after their completion (i.e., the MCB is empty) is the next command fetched.

Sequential Mode (Sequential Command Buffer SCB)

In this mode, each command is placed in the SCB and processed sequentially. If no program is running, a command in the SCB is executed immediately after a previous command in the SCB has been executed.

In sequential mode, motion commands which are executed through the MCB are handled as follows: A motion command fetched from the SCB is moved into the MCB. The MCB will then execute the motion command after a previously sent motion command has been completed. **Note:** When the user issues a motion command (MOVE, MOVE_D, GO, GO_D, SLIDE), the motion is calculated internally by the controller and then placed in a “motion queue” inside the motion command buffer (MCB). Therefore, changes made in profile commands (ACCELERATION, SPEED, JERK) in Immediate mode do not affect motions that are already in the MCB.

Immediate Mode (Immediate Command Buffer ICB)

In immediate mode, commands are placed in the ICB and executed immediately. If a program is running or sequential commands are being executed, an immediate command is fetched only when a delay in the program or the sequential commands occurs. For example, when a MOVE_D command is executed, it pauses the execution of subsequent commands. During that pause, commands from the immediate command buffer can be fetched and executed. An exception is the immediate stop command, which is executed immediately.

SCB and UPB Motion Command Flushing

Motion command flushing from the SCB or UPB depends on the command type:

Motion commands with _D suffix

These commands are flushed from the SCB or UPB only when the corresponding movement is terminated according to the precision requirement setting, i.e., subsequent commands in the buffer are executed immediately following movement termination of the _D command. For example, setting of an output will occur at the end of the movement.

Motion commands without _D suffix

These commands are transferred to the MCB, and are flushed from SCB or UPB immediately following execution. This enables the user to enter a number of motion commands, and while they are being executed by the driver other commands can be executed sequentially.

Motion Command Buffer (MCB)

All motion commands are executed through the MCB.

There are five motion modes:

- *Position*: Motion commands (MOVE, GO, MOVE_D, GO_D) are calculated, and a trajectory movement speed and duration are determined.
- *Velocity*: The velocity command (SLIDE) can be sent and changed at any time, while keeping acceleration and jerk in the limits defined by the relevant variables.
- *Torque*: The TORQUE command is immediately applied to the motor, the torque changing rate being limited by the *Torque_slope* variable.
- *Homing*: Homing commands (HARD_HOME, HOME_SW, HOME_SW_C, HOME_C), start an automatic search for the home position, according to the homing parameter values.
- *Hunting*: A target position value can be changed at any time (not necessarily at the end of a motion), according to the SPEED and ACCELERATION defined by the parameters and variables. The hunting algorithm causes the motor position to hunt the moving target.

The motion buffer can contain commands from only one motion mode at a time. For example, if the user sends GO and MOVE commands followed by a SLIDE command, the buffer will first flush the motion commands before executing the SLIDE command.

ACCELERATION Profile

Syntax `ACCELERATION <n>`

Units Acceleration units (defined by the user; see Chapter 5 in the XtraDrive User Manual).

Description Predefined value. Sets the acceleration value for the motion profile (see introductory section of this chapter). The command changes the default acceleration value set by parameters Pn2A4, Pn2A5 and remains in effect until the next controller reset.

Syntax Parameters `n` Profile acceleration in acceleration units (can be defined by the user).

Example

```
LABEL 1
ACCELERATION 720
SLIDE 200
DELAY 1000
ACCELERATION 360
SLIDE 1000
DELAY 1000
SLIDE 0
END
```

Example Explanation The acceleration value is defined as 720, which is used by the SLIDE command. The next slide motions (SLIDE 1000 and SLIDE 0) will use the new acceleration value, i.e., 360.

The SLIDE 0 command stops the motor.

Modes Program, Immediate, Sequential

See Also MOVE, MOVE_D, GO, GO_D, SLIDE
Variables: Profile_acceleration, Max_Profile_acceleration.
Parameters Pn2A4, Pn2A5.

CALL Program Flow Control

Syntax

```
CALL <n>
```

Description

Calls a subroutine. The program flow is transferred to the subroutine. The called subroutine must begin with a LABEL command and end with a RETURN command.

Syntax Parameters

`n` The label number at which the subroutine begins.

Example

```
LABEL 1
IF_INPUT 1
CALL 2
END
LABEL 2
SLIDE 1000
DELAY 1000
SLIDE 0
RETURN
```

Example Explanation

The program checks if a certain event has occurred (represented by input 1). If the event has occurred, it will call the subroutine LABEL 2. A SLIDE motion will occur for 1000 msec. Otherwise the CALL 2 code line is skipped. End of program.

Modes

Program

See Also

`LABEL, RETURN`

CONTROL Servo

Syntax `CONTROL <switch>`

Description Enables/disables the motor.

If the servomotor is disabled while a motion is in progress, a quick_stop is first made using the maximum deceleration, before the motor disable command is executed.

Syntax Parameters `switch` ON – enables the motor

OFF – disables the motor

Example

```
LABEL 1
CONTROL ON
DELAY 1000
MOVE_D  3600 -1
CONTROL OFF
END
```

Example Explanation The CONTROL ON command enables the servo. The MOVE_D command is executed; the servo is disabled. End of program.

Modes Program, Immediate, Sequential

Notes After the CONTROL_ON command is issued, an internal delay may occur (especially the first time after power cycling or controller reset with AB motors during the phase finding process).

See Also Parameter Pn200.2, Clear options

DELAY Wait

Syntax `DELAY <n>`

Units msec

Description Waits for the specified period of time before executing the next command. The actual delay is ±2 msec in addition to the delay specified by the user.

Syntax Parameters `n` The time in msec to wait before executing the next command.

Modes Program, Sequential

Notes If this command is used after a MOVE command, and the motion time set by the user is shorter than the delay time, the program will not wait until the motion has completed before continuing. Therefore, in order to synchronize the program with completion of the motion, use the MOVE_D or GO_D command.

END Program Flow Control

Syntax `END`

Description Terminates the user program currently being executed.

Parameters None.

Example

```
LABEL 1
WAIT_INPUT 1 -1
CALL 2
END

LABEL 2
SET_OUT 1 ON
RETURN
```

Example Explanation Waits for Input 1 to be ON and then calls subroutine that sets output 1 to ON. Returns to the program, end of program.

Modes Program, Immediate

Notes The END command must be used at the end of all programs.

GAIN Servo

Syntax `GAIN <n>`

Units %

Range 0-1000

Description Sets a user factor for the control loop gains. This command can be used to momentarily decrease system bandwidth, i.e., when the motor is not in motion but holding its position, or to increase system bandwidth for short and stiff motion.

Syntax Parameters

`n`	User gain in %. Default gain is 100%.

Modes Program, Immediate, Sequential

GO Motion

Syntax `GO <target> <time>`

Units User Units (defined by the user; see Chapter 5 in the XtraDrive User Manual).

Description Moves the motor to a specified target (absolute coordinates) in the specified time.

This command automatically changes Motion mode to Position mode.

The controller calculates the speed of the motor based on the default values acceleration and jerk. The maximum permitted speed is the maximum motor speed (Variable Max_Profile_Velocity).

If the user specifies the value -1 for <time>, the motion profile is based on the default speed as set in parameters Pn2A2 and Pn2A3 or by the predefined SPEED.

Syntax Parameters

`target`	The specified target in absolute coordinates.
`time`	The time allowed for the motion in msec.

Example

```
GO 10000 -1
SET_OUT 1 ON
GO 0 300
END
```

Modes Program, Sequential

Example Explanation Motion will start towards destination 10000 uu at the specified speed and acceleration default values. Output 1 is then immediately set to ON. The second GO command to destination 0 uu starts only after the demand value is equal to 10000 uu and the program ends.

See Also ACCELERATION, JERK_TIME, GO_D, MOVE, SPEED

Variables: Max_Profile_Velocity, Profile_Velocity, Max_Profile_Acceleration, Profile_Acceleration

Parameters: Pn2A2, Pn2A3, Pn2A4, Pn2A5

GO_D Motion

Syntax `GO_D <target> <time>`

Units target: User Units (defined by the user; see Chapter 5 in the XtraDrive User Manual).

time: msec

Description Moves the motor to a specified target (absolute coordinates) in the specified time. This command is identical to the GO command in motion execution, but it delays the execution of the next program command until the command (theoretical motion) generated by the GO_D command is completed.

This command automatically changes Motion mode to Position mode.

The controller calculates the speed of the motor based on the default values of acceleration and jerk. The maximum permitted speed is maximum motor speed (Variable Max_Profile_Velocity).

If the user specifies the value -1 for <time>, the motion profile is based on the default speed as set in parameters Pn2A2 and Pn2A3 or by the SPEED command.

Syntax Parameters

`target`	The specified target in absolute coordinates.
`time`	The time allowed for the motion in msec.

Example

```
LABEL 1
GO_D 10000 -1
SET_OUT 1 ON
GO_D 0 300
END
```

Example Explanation Movement commences to destination 10000 uu. –1 indicates that the movement time will be determined by the Motion Profile, i.e., the predefined speed, acceleration and jerk time. Unlike the GO Example in which the output was set at the beginning of the command, output 1 is set to ON only after the movement has completed. Motor moves to point 0 (zero position) in 300msec;

end of program.

Modes Program, Sequential

See Also GO, MOVE, MOVE_D, SPEED, ACCELERATION, JERK_TIME

Variables: Max_Profile_Velocity, Profile_Velocity, Max_Profile_Acceleration, Profile_Acceleration.

Parameters: Pn2A2, Pn2A3, Pn2A4, Pn2A5

GO_H Motion

Syntax

```
GO_H <target>
```

Units

User Units (defined by the user; see Chapter 5 in the XtraDrive User Manual).

Description

Enables change of the target position while the motor is still in motion. This is unlike the GO and GO_D commands where every command is executed only after the previous one has ended. (After the GO and GO_D commands the motor comes to a full stop).

The motion profile is calculated according to the Command profiles set by the user, i.e., Speed, Acceleration and Jerk time.

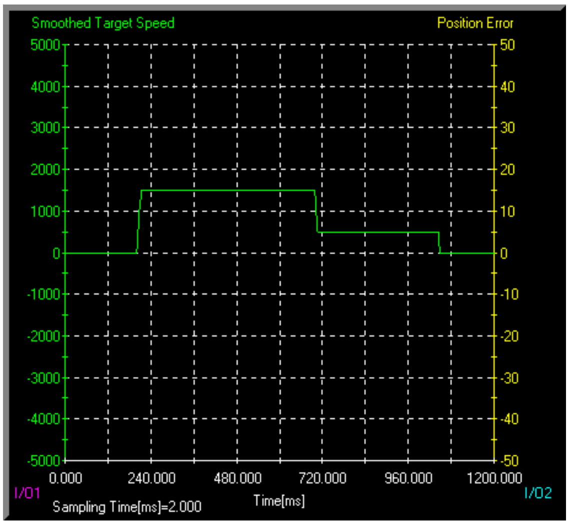
Automatically changes Motion mode to Hunting Position mode (-1).

Syntax Parameters

`target`	The specified target in absolute coordinates.

Example

```
SET_ZERO_POSITION
SPEED 1500
GO_H 60000
GO_H 1000000
WAIT_VARIABLE_GT Position_actual_value 800000
SPEED 500
END
```



Example Explanation

The speed is set to 1500 rpm and movement commences to a destination of 600,000 user units. While in motion, the destination is changed to 1,000,000 user units. When the Actual position equals 800,000 user units, the speed changes to 500 rpm.

Modes

Program, Sequential

See Also

MOVE_H
Variables: Max_Profile_Velocity, Profile_Velocity, Max_Profile_Acceleration, Profile_Acceleration.
Parameters: Pn2A2, Pn2A3, Pn2A4, Pn2A5

GO_TO Program Flow Control

Syntax `GO_TO <n>`

Description Changes the flow of the program by specifying a label to jump to.

Parameters `n` The number of the label number to jump to.

Example 1

```
LABEL 1
MOVE 3600 500
MOVE -3600 500
GO_TO 1
```

Example 1 Explanation An endless loop application.

A movement in the positive direction occurs followed by a negative direction movement. The GO_TO 1 command returns to the beginning of the program (LABEL 1).

Example 2

```
LABEL 1
IF_INPUT 1
GO_TO 2
IF_INPUT 2
GO_TO 3
END
LABEL 2
MOVE 3600 500
MOVE -3600 500
GO_TO 2
LABEL 3
MOVE 7200 500
MOVE -7200 500
GO_TO 3
```

Example 2 Explanation The program checks: if input 1 is True, then calls the LABEL 2 subroutine. If input 2 is True and input 1 is false (If input 1 is true the IF_INPUT 2 code line will never be reached), the program calls the LABEL 3 subroutine.

In the LABEL 2 and 3 subroutines, first a movement to the positive direction occurs then to the negative direction in an endless loop.

If both inputs are False, the program does not call any of the subroutines, End of program.

Modes Program

See Also `LABEL, LOOP`

HOME Commands

- The home switch is a digital input, which defines the start point to search for the C-pulse. Do not define the over travel switch as the home switch.
- The accuracy of Home position in A quad B encoder by C-pulse is +/- 1 count if the motor searches in the same direction. If the motor searches in both directions the accuracy is the C-pulse width +/- 1 count.

HARD_HOME Home

Syntax `HARD_HOME <torque> <speed>`

Description Sets the home position using the machine hard stop. The motor moves at <speed> to the machine hard stop. There are two indications that identify a machine hard stop:

a. The speed is reduced to a value lower than that specified in the Pn2C5 parameter.

b. The torque to the motor exceeds the value of <torque>.

When a hard stop is identified by both of the conditions, the encoder counter is zeroed and the motor decelerates to stop. Use the GO or GO_D command to set the motor at the zero position.

Syntax Parameters `speed` The speed and direction of searching for the Hard stop [speed user units].

Modes Program, Sequential

See Also HOME_SW, HOME_SW_C, HOME_C

Related Parameters Pn2C5 – Defines the stop speed when searching for hard home.

HOME_C Home

Syntax `HOME_C <speed1>`

Description Sets the home position using the encoder C-pulse. The motor moves at speed1 to the C-pulse and only then does the encoder counter zero and the motor decelerate to stop. The motor stops after the C-pulse. Use the GO or GO_D commands to set the motor at the zero position.

Syntax Parameters `speed1` The speed and direction of searching for the C-pulse [speed user units**].**

Modes Program, Sequential

See Also HOME_SW, HOME_SW_C, HARD_HOME

HOME_SW Home

Syntax `HOME_SW <speed1> <speed2>`

Description Sets the home position using the home switch. The motor moves at speed1 to the home switch and then changes direction and moves at speed2 until it is no longer located on the home switch. Only then does the encoder counter zero and the motor decelerates to stop. The motor does not stop at the zero position. Use the GO or GO_D command to set the motor at the zero position.

speed1 and speed2 must have opposite signs, i.e., the movement is in opposite directions.

Syntax Parameters

`speed1` The speed and direction of searching for the home switch [speed user units**].** Must have an opposite sign to that of speed2.

`speed2` The speed and direction of searching for the home switch [speed user units**].** Must have an opposite sign to that of speed1

Modes Program, Sequential

See Also HOME_C, HOME_SW_C, HARD_HOME

Related Parameters

Pn2C7.0 – Sets home switch input attribution.

Pn2C7.1 – Sets home switch input polarity (NO or NC). This parameter must to be set in order to use the home switch.

HOME_SW_C Home

Syntax `HOME_SW_C <speed1> <speed2>`

Description Finds the encoder C-pulse only after the home switch is found. The motor moves at speed1 to the home switch and then changes direction and moves at speed2 towards the C-pulse. Only then does the encoder counter zero and the motor decelerates to stop. The motor stops after the C-pulse. Use the GO or GO_D command to set the motor at the zero position.

speed1 and speed2 must have opposite signs, i.e., the movement is in opposite directions.

Syntax Parameters

`speed1`	The speed and direction of searching for the home switch [speed user units**]. **Must have an opposite sign to that of speed2.
`speed2`	The speed and direction of searching for the C-pulse [speed user units]. Must have an opposite sign to that of speed1.

Modes Program, Sequential

See Also HOME_C, HOME_SW, HARD_HOME

Related Parameters Pn2C7.0 – Sets home switch input attribution.

Pn2C7.1 – Sets home switch input polarity (NO or NC). This parameter must to be set in order to use the home switch

IF Program Flow Control

Syntax `IF <variable> <condition> <value> <then> <label>`

Description Defines the different types of conditions/terms that control the flow of the program. If the IF condition is true the next program line is performed. Otherwise the next program line is skipped.

Syntax Parameters

`variable`	System variable (see Chapter 9, List of System Variables).
`value`	Set a value with the same units as <variable>.
`condition`	>, <, >=, <=, =, != mathematical operator
`then`	CALL or GO_TO CALL: call subroutine with specified <label>; when finished, return. GO_TO: continue from the specified <label>.
`label`	Label to jump to as required by the operation specified in <then>.

Example

```
SET_ZERO_POSITION
SET_OUT 1 Off
DELAY 1000
LABEL 1
SLIDE 100
DEALY 100
IF Position_actual_value > 550000 THEN GO_TO 2
GO_TO 1
END
LABEL 2
SET_OUT 1 ON
SLIDE 0
END
```

Example Explanation

Position is set to zero, output 1 is set to off.

The motor starts moving at a constant speed. After a short delay the term is checked (motor is still running). If true (i.e., the position value is greater than 550000) go to label 2, output 1 is set to ON, motion stops, end of program.

If false the subroutine labeled 1 starts again, until the term becomes true.

Modes Program

See Also IF_INPUT, CASE, CALL, GO_TO, WAIT_VARIABLE_GT, WAIT_VARIABLE_LT

IF_INPUT Program Flow Control

Syntax `IF_INPUT <n>`

Description Checks the state of an event. If the event is True, execute the next command. If the event is False, skip the next command.

There are six events that can be checked. Each event corresponds to the physical input connected to the system.

The parameter Pn2D0 must be used to define the relation between the physical input and a logical event. Thus a change in a pin input simply requires a new definition of the logical connection in the Pn2D0 parameter (not a change in the program).

Syntax Parameters `n` Event number. A negative event number represents a logical NOT.

Example

```
LABEL 1
IF_INPUT 1
MOVE_D 4096 -1
IF_INPUT -2
GO_TO 1
END
```

Example Explanation If input 1 is true, a movement will occur; if input 1 is false, skip the MOVE_D command.

If input 2 is false, the GO_TO 1 command will be executed (negative Event No.), if input 2 is true, program ends.

Modes Program

See Also IF, WAIT_INPUT, INPUT_CASE

Parameters Pn2D0, Pn2D1

INPUT_CASE Program Flow Control

Syntax

```
INPUT_CASE <mask> <state>
```

Range

mask – 0 to 63

state – 0 to 191

Description

Checks the state of an event representing a combination of inputs. If the event is True, execute the next command. If the event is False, skips the next command.

The command has two syntax parameters: Input Mask and Input State. Input Mask is used to define which inputs are detected and which are ignored (1-check 0-ignore). For example, if mask is set to 5 (in binary: 0101) only inputs 1+3 are checked; the rest are ignored.

Mask					
0	0	0	1	0	1
Prg In 5	Prg In 5	Prg In 4	Prg In 3	Prg In 2	Prg In 1

The Input State defines the logical combination to be detected as True. For example, if State is set to 4 (in binary: 0100), True means input 1 off, input 2 off, input 3 on and input 4 off.

State					
0	0	0	1	0	1
Prg In 5	Prg In 5	Prg In 4	Prg In 3	Prg In 2	Prg In 1

If the user decides that all other combinations except the chosen one are true, 128 should be added to the decimal number, i.e., in the above example 4+128=132.

Parameter Pn2D0 or Pn2D1 must be used to define the relation between the physical input and a logical event. A change in a pin input requires a new definition of the parameters (not a change in the program).

Syntax Parameters

`mask` Input Mask (decimal value). Define which inputs are detected and which are ignored (1-check, 0-ignore)

`state` Input State (decimal value). A logical NOT can be applied to the event by adding 128 (decimal) to the required event number.

Example

```
LABEL 1
INPUT_CASE 3 2
MOVE 4096 -1
GO_TO 1
END
```

Example Explanation Input Mask is 3 (in binary is 0011), i.e., check inputs 1+2, ignore 3+4+5+6.

Input State is 2 (in binary is 0010), i.e., true means input 2 is ON and inputs 1 is OFF.

Because of the mask, only input 1+2 is checked. Thus, if input 1 is OFF and input 2 is ON, the condition is true, i.e., proceed to the MOVE command.

Otherwise, skip the next command..

Modes Program

See Also IF_INPUT, Parameter Pn2D0

JERK_TIME Profile

Syntax `JERK_TIME <n>`

Range 0-62,000 msec

Description Defines the time duration for the changing of acceleration and deceleration.

The default jerk time is stored in the Pn2A6 parameter.

Parameters `n` Jerk time in microseconds.

Used by `MOVE, MOVE_D, MOVE_R, MOVE_H, GO, GO_D, SLIDE`

Example `JERK_TIME 2000`

Modes Program, Immediate, Sequential

Note The JERK_TIME value has priority over the Low Pass Command Filter (Pn216) variable. However, if the JERK_TIME is smaller than 250, the JERK_TIME is ignored and only the Low Pass Command Filter value is used even if the JERK_TIME is subsequently changed.

See Also Parameters Pn2A6, Pn216

LABEL Program Flow Control

Syntax

```
LABEL <n>
```

Description

Defines the beginning of a program or subroutine. May be used to mark the beginning of a code line in order to use the GO_TO or LOOP commands.

Parameters

`n`	The label number.

Example

```
LABEL 1
CONTROL ON
DELAY 1000
GO_D 10000 -1
IF_INPUT 1
CALL 2
CONTROL OFF
END
LABEL 2
SET_OUT 1 ON
RETURN
```

Example Explanation

Servo enabled, motor moves to position 10000, if input 1 is true, calls LABEL 2 subroutine. The subroutine sets output 1 as true.

If input 1 is false, CALL 2 code line is ignored, servo is disabled, program ends.

Modes

Program

See Also

`GO_TO, LOOP, END, CALL, RUN`

LOOP Program Flow Control

Syntax `LOOP <n> <v> <l>`

Description Repeats a portion of code beginning at a label, for a specified number of times. Up to four loops may be nested within one another but may not cross one another.

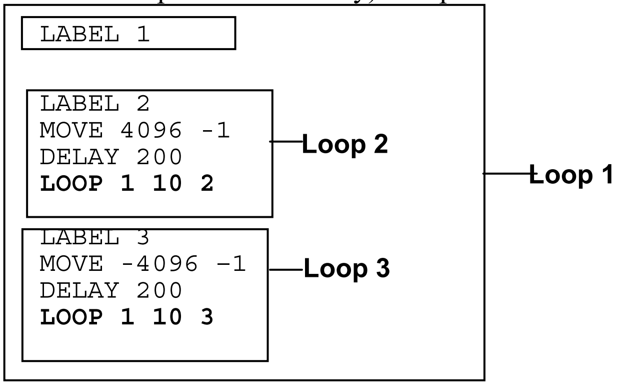
Syntax Parameters

`n` The levels of nesting within this loop (up to 4).

`v` The number of cycles of this loop to perform.

`l` The label to which this loop belongs.

Example Three loops with two nesting levels is shown below (the command lines have been separated for clarity). Loops 2 and 3 are nested in Loop 1.



```
LABEL 1

LABEL 2
MOVE 4096 -1
DELAY 200
LOOP 1 10 2
LABEL 3
MOVE -4096 -1
DELAY 200
LOOP 1 10 3
```

```
LOOP 2 5 1

END
```

Example Explanation The program has two nesting levels:
First level: Loop_2 and Loop_3

Second level: Loop1

Ten movements to the positive side will occur (first loop marked by label 2), then ten to the negative side (second loop marked by label 3). The two sets of movements will be repeated 5 times (2nd nesting level that contains the two 1st nesting level loops).

Modes Program

See Also `LABEL`

MOVE Motion

Syntax `MOVE <target> <time>`

Units target: user units (defined by the user; see Chapter 5 in the XtraDrive User Manual).

time: msec

Description Moves the motor to a specified target (relative coordinates) in the specified time.

This command automatically changes Motion mode to Position mode.

The controller calculates the speed of the motor based on the default values of acceleration and jerk. The maximum permitted speed is the maximum motor speed (Variable Max_Profile_Velocity).

If the user specifies the value -1 for <time>, the motion profile is based on the default speed as set in Parameters Pn2A2 and Pn2A3 or by the SPEED command.

Syntax Parameters

`target`	The next point in user units.
`time`	The time allowed for the motion in msec.

Example

```
LABEL 1
MOVE 4096 1000
DELAY 2000
MOVE -4096 -1
END
```

Example Explanation The motor moves 4096 user units in the positive direction, 2000 msec after the motion begins. The next MOVE command is executed, this time in the opposite direction. The time of the movement is determined internally according to the Motion Profile specified by the user. The program ends.

Modes Program, Sequential

See Also MOVE_D, MOVE_H, MOVE_R, GO, GO_D, ACCELERATION, JERK_TIME, SPEED

Variables: Max_Profile_Velocity, Profile_Velocity, Max_Profile_Acceleration, Profile_Acceleration.

Parameters: Pn2A2, Pn2A3, Pn2A4, Pn2A5

MOVE_D Motion

Syntax `MOVE_D <target> <time>`

Units target: user units (defined by the user; see Chapter 5 in the XtraDrive User Manual).

time: msec

Description Moves the motor to a specified target (relative coordinates) in the specified time. This command is identical to the MOVE command in motion execution, but it delays the execution of the next program command till the command (theoretical motion) generated by the MOVE_D command is completed.

This command automatically changes Motion mode to Position mode.

The controller calculates the speed of the motor based on the default values of acceleration and jerk. The maximum permitted speed is the maximum motor speed (Variable Max_Profile_Velocity).

If the user specifies the value -1 for <time>, the motion profile is based on the default speed as set in parameters Pn2A2 and Pn2A3 or by the SPEED command.

Syntax Parameters

`target`	The next point in user units.
`time`	The time allowed for the motion in msec.

Example

```
LABEL 1
MOVE_D 4096 1000
MOVE_D -4096 -1
END
```

Example Explanation The motor moves 4096 user units in the positive direction. Execution of the next MOVE command commences as soon as the previous motion ends (after 1000 msec), this time in the opposite direction. The time of the movement is determined internally according to the Motion Profile specified by the user. The program ends.

Modes Program, Sequential

See Also MOVE, MOVE_H, MOVE_R, GO, GO_D, ACCELERATION, JERK_TIME, SPEED

Variables: Max_Profile_Velocity, Profile_Velocity, Max_Profile_Acceleration, Profile_Acceleration.

Parameters: Pn2A2, Pn2A3, Pn2A4, Pn2A5

MOVE_H Motion

Syntax `MOVE_H <distance>`

Units User Units (defined by the user; see Chapter 5 in the XtraDrive User Manual).

Description While the motor is still in motion, enables addition of a distance to the wanted motion. This is unlike the MOVE and MOVE_D commands where every command is executed only after the previous one has ended. (After the MOVE and MOVE_D commands the motor comes to a full stop).

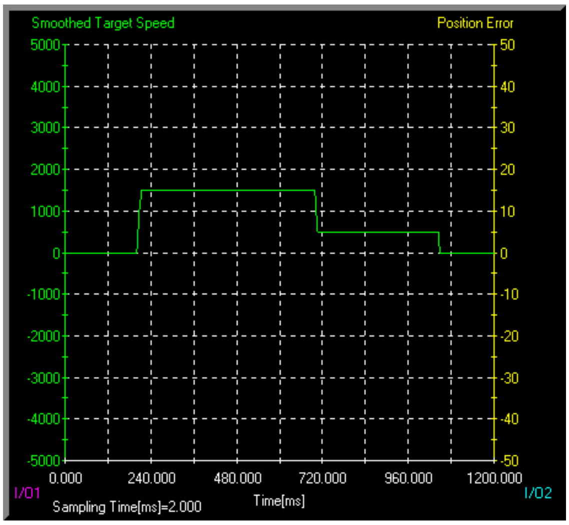
The motion profile is calculated according to the Command profiles set by the user, i.e., Speed, Acceleration and Jerk time.

Automatically changes Motion mode to Hunting Position mode (-1).

Syntax Parameters `distance` The movement distance (in user units).

Example

```
SET_ZERO_POSITION
SPEED 1500
MOVE_H 600000
MOVE_H 400000
WAIT_VARIABLE_GT Position_actual_value 800000
SPEED 500
END
```



Example Explanation The speed is set to 1500 rpm and movement commences to a distance of 600,000 user units. While in motion, another 400,000 user units is added so the total movement distance is 1,000,000 user units. When the Actual position equals 800,000 user units, the speed changes to 500 rpm.

Modes Program, Sequential

See Also GO_H

MOVE_R Motion

Syntax `MOVE_R <distance>`

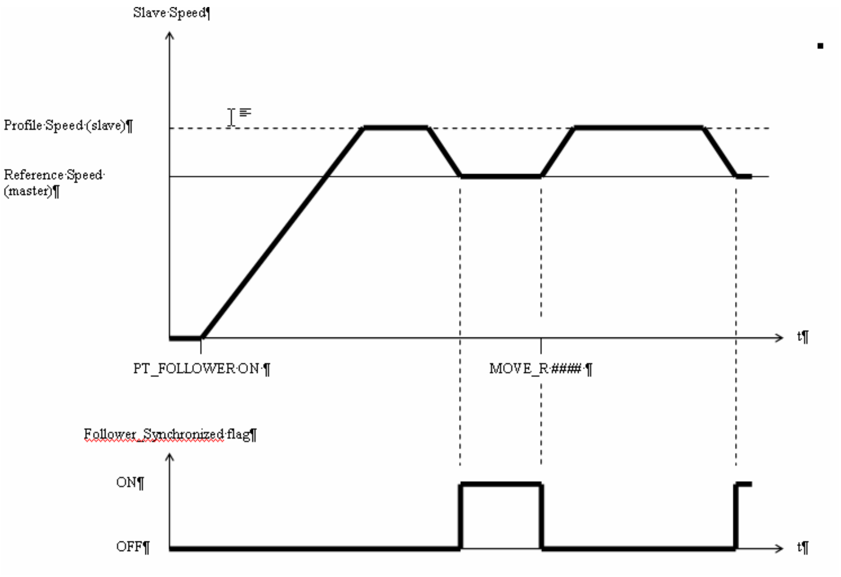
Units User Units (defined by the user; see Chapter 5 in the XtraDrive User Manual.

Description Creates a movement that is not time oriented but synchronized to an External Pulse source. The command adds <distance> user units to the Target_position (see diagram below).

Movement profiles are according to the Command profile set by the user. For example, if the Speed Profile is set to 900 rpm and the driver moves the motor at a speed of 500 rpm (caused by external pulses), MOVE_R causes the overall speed of the movement (the pulse train speed plus MOVE_R speed) to be 900 rpm for the next <distance>, and the relative speed of the MOVE_R command over the pulse train speed is 400 rpm.

MOVE_R (0) is equivalent to PT_FOLLOWER (ON).

The command mode automatically changes to Pulse Train Input mode (-3).



Syntax Parameters `distance` The movement distance (in user units).

Example

```
LABEL 1
PT_FOLLOWER ON
DELAY 10000
MOVE_R 10000
DELAY 10000
PT_FOLLOWER OFF
END
```

Example Explanation PT_FOLLOWER - Motor starts responding to an input pulse train. After a 10-second delay, the motor executes the MOVE_R command and moves 10000 user units, at a speed defined in the speed profile.

Modes Program, Sequential

See Also PT_FOLLOWER

Variables: Follower_synchronized, Follower_position_offset

Parameters: Pn200 – Determines the reference pulse form.

Pn202, Pn203 – The number of received pulses is multiplied by the electronic gear ration defined by the user.

Pn2C4 – Synchronizes window for pulse train. Defines the difference between the Target_position and actual_demand_value where the Follower_synchronized flag is set to True.

PT_FOLLOWER Motion

Syntax `PT_FOLLOWER <switch>`

Description Starts driver synchronization with external pulses input (see the diagram in the MOVE_R command above).

The command mode automatically changes to Pulse Train Input mode (-3).

Syntax Parameters `switch` ON – Enables pulse train follower.

Off – Disables pulse train follower.

Modes Program, Immediate, Sequential

See Also MOVE_R

Variables Follower_synchronized (flag, set to 1 when pulse train is synchronized with motion), Follower_position_offset.

Related Parameters Pn200 – Determines the reference pulse form.

Pn202, Pn203 – The number of received pulses is multiplied by the electronic gear ration defined by the user.

Pn2C4 – Synchronizes window for pulse train. Defines the difference between the Target_position and actual_demand_value where the Follower_synchronized flag is set to True.

RETURN Program Flow Control

Syntax `RETURN`

Description Returns from a subroutine to the command following the CALL that called this subroutine.

Parameters None

Example

```
LABEL 1
CONTROL ON
DELAY 1000
JERK_TIME 700
MOVE_D 7200 1
CALL 2
SET_OUT 2 OFF
CONTROL OFF
END
LABEL 2
SET_OUT 2 ON
JERK_TIME 350
MOVE_D -7200 -1
RETURN
```

Example Explanation Servo enabled, jerk time is set to 700uu, MOVE command executes, subroutine LABEL 2 is called.

Within the subroutine: output 2 gets true value; jerk time is set to 350uu; movement in the negative direction; return to the main program; command that follows the CALL code line is executed: output 2 is false, servo disabled, end of program.

Modes Program

See Also LABEL, CALL

RUN Program Flow Control

Syntax `RUN <n>`

Description Runs a program or a subroutine from the specified label.

If 0 is assigned, the program runs from the first line.

Syntax Parameters `n` The label number.

Modes Immediate, Sequential

See Also `LABEL`

Parameter Pn2CC

SET_OUT Output

Syntax

```
SET_OUT <n> <switch>
```

Description

Sets a physical output pin to ON or OFF.

There are three logical outputs that can be set corresponding to the three output pins on the processor.

The parameter Pn2D2 must be used to define the relation between the physical output pin and a logical event. Thus a change in an output pin simply requires a new definition of the logical connection in the Pn2D2 parameter (not a change in the program).

Syntax Parameters

`n`	Program output number (1 – 3)

Example

```
LABEL 1
SET_ZERO_POSITION
SLIDE 200
WAIT_VARIABLE_GT Position_actual_value 10000
SLIDE 0
SET_OUT 2 ON
END
```

Example Explanation

Current Position is set to zero; slide motion takes place until the position value exceeds 10000uu (the WAIT_VARIABLE_GT command stalls the execution of the next command). When the position value exceeds 10000uu, the SLIDE 0 command “stops” (tells the motor to move at 0 speed); the motor output 2 is True; End of program.

Modes

Program, Immediate, Sequential

See Also

Parameter Pn2D2

SET_VAR **Variable**

Syntax

```
SET_VAR <variable> <value>
```

Description

Sets the contents of a writeable user variable. The following three variables are writeable:

Exact_mode - a flag (0/1) which defines the behavior of the motion buffer, i.e., the timing of the next motion in relation to the current one. If Exact_mode is set, *all* motion in the motion buffer waits until the Motion_end_window is reached. The default value of the Motion_end_window is set by the Pn2C0 parameter in user position units.

Motion_end_window – A predefined window that determines the end of movement, i.e., when Position error is smaller than the motion_end_window value.

Clock – System clock in ms.

Speed_reference – Defines reference speed in speed user units for the SPEED_CONTROL command when <switch> = variable.

Syntax Parameters

`variable`	Exact_mode / motion_end_window / clock / speed_reference
`value`	The value of the user variable.

Example

```
LABEL 1
SPEED CONTROL VARIABLE
IF_INPUT 1
SET_VAR Speed_reference 500
IF_INPUT -1
SET_VAR Speed_reference 200
GO_TO 1
END
```

Example Explanation

The SPEED_CONTROL command enables speed control according to the Speed_reference value which changes according to program input 1 level (True or False).

Modes

Program, Immediate, Sequential.

See Also

SPEED_CONTROL, WAIT_EXACT

Variables: Speed_reference, Motion_end_window, Exact_mode, Clock

SET_ZERO_POSITION Home

Syntax `SET_ZERO_POSITION`

Description Sets the current encoder value to zero. This command is used to define the current position. All other positions are redefined internally in relation to the new current position.

This command should only be used when the motor is not in motion.

Example

```
LABEL 1
HOME_C 200
GO_D 7800 1000
WAIT_EXACT -1
SET_ZERO_POSITION
END
```

Example Explanation This example shifts the home position (Zero position) from the C pulse location to a different location. After searching the C pulse with HOME_C command the motor moves to position 7800 uu. There is a waiting period for the motor to arrive at the exact position and only then is the encoder counter reset.

Notes The motor must be in full stop when the SET_ZERO_POSITION command is used so that Actual_position_value = 0.

Modes Program, Immediate, Sequential

See Also HARD_HOME, HOME_SW, HOME_SW_C, HOME_C

SLIDE Motion

Syntax `SLIDE <n>`

Units User units (defined by the user; see Chapter 5 in the XtraDrive User Manual).

Description Moves the motor at the specified speed. Acceleration to a speed of <n> is according to the profile acceleration and jerk_time parameters.

This command automatically changes the motion mode to velocity mode.

Syntax Parameters

n	Speed of movement. A negative number moves the motor in the negative direction. Zero stops the movement.

Example

```
LABEL 1
SLIDE 10000
DELAY 1000
SLIDE 2000
DELAY 1000
SLIDE -2000
DELAY 1500
SLIDE 0
DELAY 1000
END
```

Example Explanation

Motor accelerates to 10000uu, decelerates to 2000uu decelerates to -2000uu and accelerates (in the positive direction) to 0, i.e., motion ends, end of program.

The DELAY commands after each SLIDE command determine the length of movement by stalling the next command.

Modes Program, Sequential

Notes The SLIDE command sets unlimited travel jog motion. In order to stop the motion the user must enter a SLIDE 0 command, since the END command stops the program but does not stop the SLIDE motion.

See Also ACCELERATION, JERK_TIME

SLIDE_ANALOG Motion

Syntax `SLIDE_ANALOG`

Description Enables use of a potentiometer as an analog means of changing motor speed.

The speed generated by the driver is proportional to the voltage that the potentiometer creates.

Parameter Pn300 determines the voltage level (in 0.01V) that is equivalent to the motor rated speed; the higher the voltage, the higher the speed.

Speed calculation:
Motor Rated Speed * [Input Voltage (0.01V)] / Pn300 = Demand Speed
Motor Rated Speed – Parameter of motor (PnF05 low bite)

For example, the rated speed is 3000 rpm, Pn300 is set to 600 (6V), if the voltage generated is 3V, the speed will be 1500 rpm.

Note: Movement acceleration is according to the Acceleration and Jerk Time profiles set by the user.

The command mode changes to Analog Speed mode (-4).

Modes Program, Sequential

See Also TORQUE_ANALOG, SPEED_CONTROL, ANALOG_INPUT

SPEED Profile

Syntax `SPEED <n>`

Units User units (defined by the user; see Chapter 5 in the XtraDrive User Manual).

Description Sets the profile speed value.

Syntax Parameters `n` Default speed in speed units (can be defined by the user).

Used by MOVE, MOVE_D, GO, GO_D *only* if command time is set to -1

Example

```
LABEL 1
CONTROL ON
DELAY 500
SPEED 50
MOVE 3600 -1
SPEED 200
MOVE_D -3600 -1
CONTROL OFF
END
```

Example Explanation Servo enabled; speed profile is set to 50uu; first movement occurs; speed profile is set to 200uu; second movement, which uses the new speed profile, is faster and in the opposite direction (the target value is negative); servo disabled; end of program.

Modes Program, Immediate, Sequential

Notes Not used in SLIDE motion or when using motion commands with time (the speed is calculated internally and can be greater than the default speed).

See Also MOVE, MOVE_D, MOVE_H, MOVE_R, GO, GO_D, GO_H

SPEED_CONTROL Motion

Syntax `SPEED_CONTROL <switch>`

Description Changes control from NCT position control to NCT speed control. The type of speed command is determined according to the <switch> setting.

The command mode changes to Speed Control mode (-6).

Syntax Parameters `switch`

ANALOG_INPUT – Analog speed command (similar to the SLIDE_ANALOG command, except that a speed control loop is closed on the command).

PULSE_TRAIN_INPUT – Pulse train speed command.

VARIABLE - Speed command set by a variable. Use the SET_VAR command to change the variable Speed_reference which changes the motor speed.

Modes Program, Sequential

See Also SLIDE_ANALOG, PT_FOLLOWER, SET_VAR

Variable: Speed_reference

Parameters: Pn200, Pn202, Pn203, Pn300

START Motion

Syntax `START`

Description Triggers the execution of a previously defined motion that is held by a WAIT_FOR_START command.

The START command reaches all the drivers (provided that several drives are connected via serial communication) at the same time as a broadcast message.

The START command clears the WAIT_FOR_START flag. Therefore the WAIT_FOR_START command *must* be set per motion.

Modes Immediate

See Also WAIT_FOR_START

STOP Motion

Syntax `STOP <switch>`

Description Immediately stops the motor motion using the quick_stop deceleration as defined in parameters Pn2A8 and Pn2A9, and stops the program and clears the immediate, sequential and motion buffers.

Syntax Parameters `switch` This parameter defines system behavior after the motion actually stops:

ON - keeps the motor enabled

OFF - disables the motor

Note When using this command, the deceleration parameters Pn2A8 and Pn2A9 cannot be defined as zero. The default rate of this deceleration is automatically calculated by the XtraDrive according to the motor torque. *If the user changes this value, it is the user's responsibility to set a value which is appropriate for an emergency stop.*

Modes Program, Immediate, Sequential

See Also STOP_MOTION

Parameters Pn2A8, Pn2A9

STOP_MOTION Motion

Syntax `STOP_MOTION`

Description Immediately stops the motor motion (not the program) using the quick_stop deceleration, as defined in parameters Pn2A8 and Pn2A9, and clears the motion buffer.

Example

```
LABEL 1
MOVE 3600 -1
DELAY 100
MOVE -3600 -1
DELAY 100
IF_INPUT 1
CALL 2
GO_TO 1
LABEL 2
STOP_MOTION
WAIT_INPUT -1 -1
GO_D 0
RETURN
```

Example Explanation

There are two motions (one in the positive direction, the other in the opposite direction), which are continuously executed as long as Input 1 is false. When input 1 is set to true, subroutine LABEL 2 is called and the motion stops.

By setting Input 1 to false, the motor returns to its zero position and the two move motions are executed again and again in an endless loop.

The user can stop the program simply by using the stop command in immediate mode.

Modes

Program, Immediate, Sequential

Note

When using this command, the deceleration parameters Pn2A8 and Pn2A9 cannot be defined as zero. The default rate of this deceleration is automatically calculated by the XtraDrive according to the motor torque. *If the user changes this value, it is the user's responsibility to set a value which is appropriate for an emergency stop.*

See Also

STOP

Parameters Pn2A8, Pn2A9

TORQUE Motion

Syntax

```
TORQUE <n>
```

Units

0.1% of rated motor torque

Range

-1000 to 1000

Description

Defines the torque that the motor generates.

The slope of the torque increase / decrease is defined in parameter Pn2C1.

This command automatically changes the mode to Torque.

Syntax Parameters

n	The torque value. The torque units are 0.1% of the rated motor torque.

Example

```
LABEL 1
TORQUE 100
DELAY 1000
TORQUE 200
DELAY 1000
TORQUE -200
DELAY 1500
TORQUE 0
DELAY 1000
END
```

Example Explanation

The Torque Profile value is changed four times, each time for a period of time determined by the subsequent DELAY command.

The final TORQUE command sets the profile value to zero (see Notes below).

Modes Program, Sequential

Notes A TORQUE 0 command must be entered when it is no longer necessary to apply torque. The program END command stops the program but does not set the torque to zero.

See Also Variable: Target torque

Parameter: Pn2C1

TORQUE_ANALOG Motion

Syntax `TORQUE_ANALOG`

Description Enables use of a potentiometer as an analog input of required motor torque.

The torque generated by the driver is proportional to the voltage that the potentiometer creates.

Parameter Pn400 determines the voltage level (in 0.01V) that is equivalent to the motor rated torque; the higher the voltage, the greater the torque.

Torque calculation:
[Motor Rated Torque] * [Input Voltage (0.01V)] / Pn400 = [Generated Torque].
For example, the rated torque is 500 [Nm], Pn400 is set to 60 (6V), if the voltage generated is 3V, the torque will be 250[Nm].

The command mode changes to Analog Torque mode (-5).

Modes Program, Sequential

See Also SPEED_ANALOG

Variable: Analog torque

Parameter: Pn400

TORQUE_LIMITS Servo

Syntax `TORQUE_LIMITS <CW> <CCW>`

Units 0.1% of peak motor torque

Range 0 to 1000

Description Sets torque limits in the CCW and CW directions in a single command.

The torque value is specified as 0.1% of the maximum motor torque.

Syntax Parameters `CW, CCW` Torque limits.

Modes Program, Immediate, Sequential

See Also Parameters: Pn402, Pn403

WAIT_EXACT Wait

Syntax `WAIT_EXACT <n>`

Units msec

Description Waits until the position error is smaller than the motion_end_window and theoretical motion is over (velocity_demand_value is equal to zero) **or** the time limit is exceeded before proceeding to the next command.

Motion_end_window is set by the Pn2C0 parameter in user position units.

Unlike the Exact_mode flag the WAIT_EXACT command wait only once.

Syntax Parameters `n` The time period to wait. If this value is –1, waits for an infinite period of time, i.e., until the motion ends.

Example

```
LABEL 1
MOVE 10800 3000
SET_OUT 2 ON
WAIT_EXACT -1
SET_OUT 1 ON
END
```

Example Explanation Motor starts to move; output 2 is set to True; motion continues; when motion ends output 1 is set to True. (The WAIT ... command pauses execution of the following lines of the program.)

Modes Program, Sequential

See Also Variables: Exact_mode, Motion_end_window, Position_error

Parameter: Pn2C0

WAIT_FOR_START Wait

Syntax `WAIT_FOR_START`

Description This command pauses the execution of motion commands until a sequential START command is applied.

The main purpose of this command is to enable the user to send a group of (up to 10) sequential commands, so that execution of the commands waits for the START command.

This command is used to coordinate axes.

The START command clears the WAIT_FOR_START command. Therefore the WAIT_FOR_START command *must* be set per motion.

Example System with X and Y axes. Send in serial a WAIT_FOR_START command to each of the axes and then send in serial a MOVE command to each of the axes. The axes will not move until a START command arrives. The START command arrives simultaneously at both of the axes but the MOVE command arrives individually at each axis.

Modes Program, Sequential

See Also START

WAIT_INPUT Wait

Syntax `WAIT_INPUT <n> <t>`

Description Waits until the digital input is set *or* the time limit is exceeded before proceeding to the next command.

Syntax Parameters

`n`	The number of the input to be set (positive or negative. A negative input number represents a logical NOT).
`t`	The time in msec to wait until the input is set. If t is -1, waits indefinitely.

Example

```
LABEL 1
WAIT_INPUT 2 -1
MOVE 10800 -1
WAIT_INPUT -2 10000
MOVE -10800 -1
END
```

Example Explanation Only when Input 2 is set to ON does the first movement commence.

The second WAIT command pauses the next movement for 10000msec (10 sec) or until the input is set to OFF (negative argument).

Modes Program, Sequential

See Also INPUT_CASE, IF_INPUT

WAIT_STOP Wait

Syntax `WAIT_STOP <n>`

Description Halts program execution until the theoretical motion is over or until the time limit is exceeded before proceeding to the next command.

Syntax Parameters

`n`	The time period in msec to wait. If this value is set to -1 waits for an infinite period of time, i.e., until the motion ends.

Example

```
LABEL 1
MOVE 4096 -800
SET_OUT 1 ON
WAIT_STOP
SET_OUT 1 OFF
END
```

Example Explanation Motor moves 4096uu in the positive direction; immediately after the motion begins output 1 is set to ON. The WAIT_STOP command pauses execution of the next command until the theoretical motion is over (800 msec). Then output1 is set to OFF.

Note The MOVE command followed by WAIT_STOP performs the same operation as the MOVE_D command, but enables the execution of commands while the motion is in progress.

Modes Program, Sequential

See Also MOVE

WAIT_VARIABLE_GT Wait

Syntax

```
WAIT_VARIABLE_GT <switch> <n>
```

Description Waits until <switch> has a value greater than <n>.

Example

```
LABEL 1
SET_ZERO_POSITION
SLIDE 50
WAIT_VARIABLE_GT Position_actual_value 20000
SLIDE 0
DELAY 1000
END
```

Example Explanation Current position is set to zero; motor starts moving at a constant speed (50uu); as soon as the motor reaches position 20000 the next command is executed; motor stops; end of program.

Modes Program, Sequential

See Also WAIT_VARIABLE_LT

WAIT_VARIABLE_LT Wait

Syntax

```
WAIT_VARIABLE_LT <switch> <n>
```

Description Waits until the <switch> has a value less than <n>.

Example

```
LABEL 1
SET_ZERO_POSITION
SLIDE -50
WAIT_VARIABLE_LT Position_actual_value -20000
SLIDE 0
DELAY 1000
END
```

Example Explanation Current position is set to zero; motor starts moving at a constant speed (50uu in the negative direction); as soon as the motor reaches position -20000 the next command is executed; motor stops; end of program.

Modes Program, Sequential

See Also WAIT_VARIABLE_GT

8. Error Messages

Error messages that may be generated by XtraWare are listed below together with a short description of each.

Code	Message	Description
1	Sequential buffer full	Serial commands were sent to the Sequential buffer at a rate faster than the execution rate.
2	Immediate buffer full	Serial commands were sent to the Immediate buffer at a rate faster than the execution rate.
3	Motion buffer full	Serial commands were sent to the Motion buffer at a rate faster than the execution rate.
4	Invalid program line number	The program line number is either zero or greater than 50.
5	Message transmission error	An incorrect checksum indicates that an error occurred during message transmission.
6	Invalid SET_VAR index	An invalid variable index has been used in the SET_VAR command.
7	Variable is read-only	The position cannot be set to zero while the motor is moving.
8	Unknown command	This command does not exist in the command list.
9	SET_ZERO_POSITION cannot be performed when motion in progress	This command cannot be performed if the Motion Command buffer is not empty, or if a motion is in progress.
10	Send buffer full	The send buffer is full because the command GET_VAR is used in very high rate.
11	Message receive time exceeded	The time limit for the message to be sent to XtraDrive via serial communication has been exceeded.
12	Message receive buffer full	The size of a message sent to XtraDrive via serial communication is limited to 64 characters.
13	Home sensor not found	In the HOME_SW, HOME_SW_C commands the driver moves the motor and looks for the home sensor as defined by the user. XtraDrive has detected that although the motion has reached its mechanical end, no sensor has been found.
14	Invalid input setting	A digital input is configured for more than one function.
15	Invalid output setting	A digital output is configured for more than one function.
16	Selected I/O not in use	The digital I/O selected is not defined as an event.
17	Serial command prohibited	Incorrect operation mode for serial command (refer to parameter Pn000.2 in this manual.
18	Parameter storing fault	Contact your distributor or YET representative.
19	Parameter storing failed	Contact your distributor or YET representative.

Code	Message	Description
20	Motor should be stationary during first CONTROL_ON after power up	XtraDrive has detected that the motor is moving while performing the first CONTROL_ON after power up.
21	Phase finding error	An error has been detected during the phase finding (commutation) process. Verify that motor and encoder parameters are set correctly.
22	Autotuning available in Serial Command mode only (Pn000.1 = D)	Autotuning is available in Serial Command mode only. Change the working mode by setting [Pn000.1 = D].
23	Program being run	The requested program cannot be run since another program is already running.
24	Variable does not exist	
25	Wrong gear setting	
26	Wrong default profile values	
31	Both speeds are in the same direction	
64	A.02: parameter breakdown	
65	A03: Main circuit encoder error	
66	A04: Parameter setting error	
67	A05: Servomotor and amplifier combination error	
68	A10L Overcurrent or heat sink overheated	
69	A30: Regeneration error detected	
70	A32: Regenerative overload	
71	A40: Overvoltage	
72	A41:Undervoltage	
73	A51: Overspeed	
74	A71: Overload: high load	
75	A72: Overload: low load	
76	A73: Dynamic brake overload	
77	A74: Overload of surge current limit resistor	
78	A7A: Heat sink overheated	

Code	Message	Description
79	A81: Absolute encoder backup error	
80	A82: Encoder checksum error	
81	A83: Absolute encoder battery error	
82	A84: Absolute encoder data error	
83	A85: Absolute encoder overspeed	
84	A86: Encoder overheated	
85	AB1: Reference speed input read error	
86	AB2: Reference torque input read error	
87	ABF: System alarm	
88	AC1: Servo overrun detected	
89	AC2: Phase finding error	
90	AC8: Absolute encoder clear error and multi-turn limit setting error	
91	AC9: Encoder communications error	
92	ACA: Encoder parameter error	
93	ACB: Encoder echoback error	
94	ACC: Multi-turn limit disagreement	
95	AD0: Position error overflow	
96	AE7: Option unit detection error	
97	AF1: Power line open phase	
112	A91: Overload (warning)	
113	A92: Regenerative overload (warning)	
128	Line number error in program run	Program flow has been directed to a non-existent label.
129	Command not applicable in this mode	Not all commands are applicable in all programming modes (Program/Sequential/Immediate). The specified command is not applicable in this mode.

Code	Message	Description
130	Acceleration too low for this motion	The requested motion cannot be performed. The specified motion time is too short for the specified acceleration.
131	Required speed for this motion greater than maximum motor speed	The required speed for this motion is greater than the maximum motor speed. Set a lower motion speed.
132	Value out of range	Acceleration time is limited to a maximum of 128 msec. Set an acceleration rate that results in an acceleration time of less than 128 msec.
133	Distance to target too great	The requested motion requires more than the maximum of 128 motor revolutions.
134	Motion time too long	The motion time should not exceed 4 seconds.
135	Variable value in command SET_VAR out of range	The variable value in command SET_VAR is out of range.
136	Program flow error	Program flow error: RETURN without CALL or CALL nesting too deep.
137	Jerk time too long	The specified jerk time exceeds the maximum of 64000 msec.
138	Home sensor already active	The home sensor was found to be active when the HOME_SW/HOME_SW_C procedure was requested.
139	Home sensor not defined	The Home sensor is not defined. Refer to the HOME_SW and HOME_SW_C commands in this manual.
140	Motion cannot be executed while motor disabled	The motion cannot be executed while the motor is disabled. Make sure the motor is enabled (CONTROL_ON) before issuing the motion command.
141	Invalid torque limits	The maximum torque limit is smaller than the minimum torque limit.
142	Invalid label number	The label number is either zero or greater than the maximum line number.
143	Invalid input index	The input referred to in the command is not defined as an event.
144	Invalid output index	Invalid output index in the SET_OUT command.
145	Excessive vibrations detected during Autotuning	Excessive vibrations were detected during the Autotuning process. Check for faults in the mechanical system.
146	Autotuning already in progress	The Autotuning process is already in progress. It cannot be restarted till the process ends.
147	Parameter autosave failed	Contact your distributor or YET representative.
149	Unable to switch Servo Control	
255	Fault buffer full	Contact your distributor or YET representative.

Code	Message	Description
260	Data reference data error	Invalid value in data field.
264	Data reference address error	Invalid value in data field.
277	Data setting data error	Invalid value in data field.
281	Data setting address error	Invalid value in data field.
294	Data string reference num transmitted	Contact your distributor or YET representative.
298	Data string reference head address error	Contact your distributor or YET representative.
311	Data string setting num transmitted data error	Contact your distributor or YET representative.
315	Data string setting head address error	Contact your distributor or YET representative.
330	Fixed cycle trace mode error	Contact your distributor or YET representative.
333	Fixed cycle trace cycle error	Contact your distributor or YET representative.
342	Data string binary reference num transmitted data error	Contact your distributor or YET representative.
346	Data string binary reference head address error	Contact your distributor or YET representative.

9. List of System Variables

Name	Unit	Read Only	Min	Max	Description	Group
Analog_Speed	0.1 % of max	Yes	-2147483648	2147483647	Motor speed when an analog input is used as a reference speed.	Others
Analog_Torque	0.1 % of max	Yes	-2147483648	2147483647	Motor torque when an analog input is used as a reference torque.	Others
Application_gain	%	Yes	0	1000	Gain factor. Can be changed during application running.	Others
CCW_Torque_limit	0.1% of max	Yes	-1000	1000	Maximum torque to be applied, in CCW direction.	Torque Mode and Torque Related
Clock	ms	No	-2147483648	2147483647	System clock.	Others
Command_mode		Yes	1	2	Mode of execution of command (1 - Sequential, 2 - Program).	Others
CW_Torque_limit	0.1% of max	Yes	-1000	1000	Maximum torque to be applied, in CW direction.	Torque Mode and Torque Related
Exact_mode		No	0	1	Defines the ending mode of motion commands.	Others
Follower_position_offset	Position Units	Yes	-2147483648	2147483647	(Pulse_train_position - Position_demand_value).	Others
Follower_synchronized		Yes	0	1	Flag, 1- Synchronized, 0- Not synchronized.	Others
Following_error_actual_value	Position Units	Yes	-2147483648	2147483647	(Position_demand_value - Position_actual_value).	Motion Command Variables
Inputs_State		Yes	-2147483648	2147483647	Input ports state (Decimal representation of a Binary number: 1-ON, 0-OFF).	Others
Jerk_smoothing_time	us	Yes	-2147483648	2147483647	Time constant of filter on acceleration.	Motion Command Variables
Max_profile_acceleration	Acceleration Units	Yes	-2147483648	2147483647	Maximum absolute acceleration value during Motion Commands.	Motion Command Variables
Max_profile_velocity	Speed Units	Yes	-2147483648	2147483647	Maximum absolute speed value during Motion Commands.	Motion Command Variables
Modes_of_operation		Yes	-5	7	Motion mode (POSITION=1, VELOCITY=3,TORQUE=4, HOMING=6, HUNTING=-1, PULSE_TRAIN=-3, ANALOG_SPEED=-4, ANALOG_TORQUE=-5, SPEED_CONTROL=-6)	XD Control
Motion_end_window	Position Units	No	0	255	Window for Following_error_actual_value.	Others
Motion_go		Yes	0	1	Flag to trigger the execution command in Motion buffer (used with WAIT_FOR_START, START).	XD Control

Name	Unit	Read Only	Min	Max	Description	Group
Outputs_State		Yes	-2147483648	2147483647	Output ports state (Decimal representation of a Binary number: 1-ON, 0-OFF).	Others
Position_actual_value	Position Units	Yes	-2147483648	2147483647	Motor position in User Units, as read from encoder.	Motion Command Variables
Position_demand_value	Position Units	Yes	-2147483648	2147483647	Present target position. It is updated every servo cycle.	Motion Command Variables
Profile_acceleration	Acceleration Units	Yes	-2147483648	2147483647	Absolute acceleration value during Motion Commands.	Motion Command Variables
Profile_velocity	Speed Units	Yes	-2147483648	2147483647	Absolute speed value during Motion Commands.	Motion Command Variables
Program_line		Yes	-2147483648	2147483647	Holds the last Program line.	Others
Servo_cycle_time	0.1 us	Yes	-2147483648	2147483647	Servo cycle time.	Others
Speed_reference	Velocity Units	No	-2147483648	2147483647	Defines reference speed for speed control command.	Others
Target_position	Position Units	Yes	-2147483648	2147483647	Final destination of Motion Commands.	Motion Command Variables
Target_torque	0.1% of rated	Yes	-1000	1000	Torque Command.	Torque Mode and Torque Related
Target_velocity	Velocity Units	Yes	-2147483648	2147483647	User velocity command.	Speed Control Variables
Torque_demand_value	0.1% of rated	Yes	-1000	1000	Actual value for torque.	Torque Mode and Torque Related
User_encoder	Encoder Units	Yes	-2147483648	2147483647	Motor position in Encoder Units, as read from encoder.	Motion Command Variables
Velocity_actual_value	Velocity Units	Yes	-2147483648	2147483647	Motor speed in User Units, as derived from encoder.	Speed Control Variables
Velocity_demand_value	Velocity Units	Yes	-2147483648	2147483647	Present target speed. It is updated every servo cycle.	Speed Control Variables

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Specifications are subject to change without notice due to ongoing product modifications and improvements.

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