XtraWare™

User's Manual

XtraWare Version 2.6 for
XtraDrive Version 2.9

Catalog No. 8U0109 Rev. C

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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).
- 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
    - the commands available in the serial communication protocol
- Description of the XtraDrive serial communication protocol.
- Error Messages
- System Variables
- Status Word Bits
- Operation Codes

Related documents:

Title	**Catalog No.**
XtraDrive Series Servo System User 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`

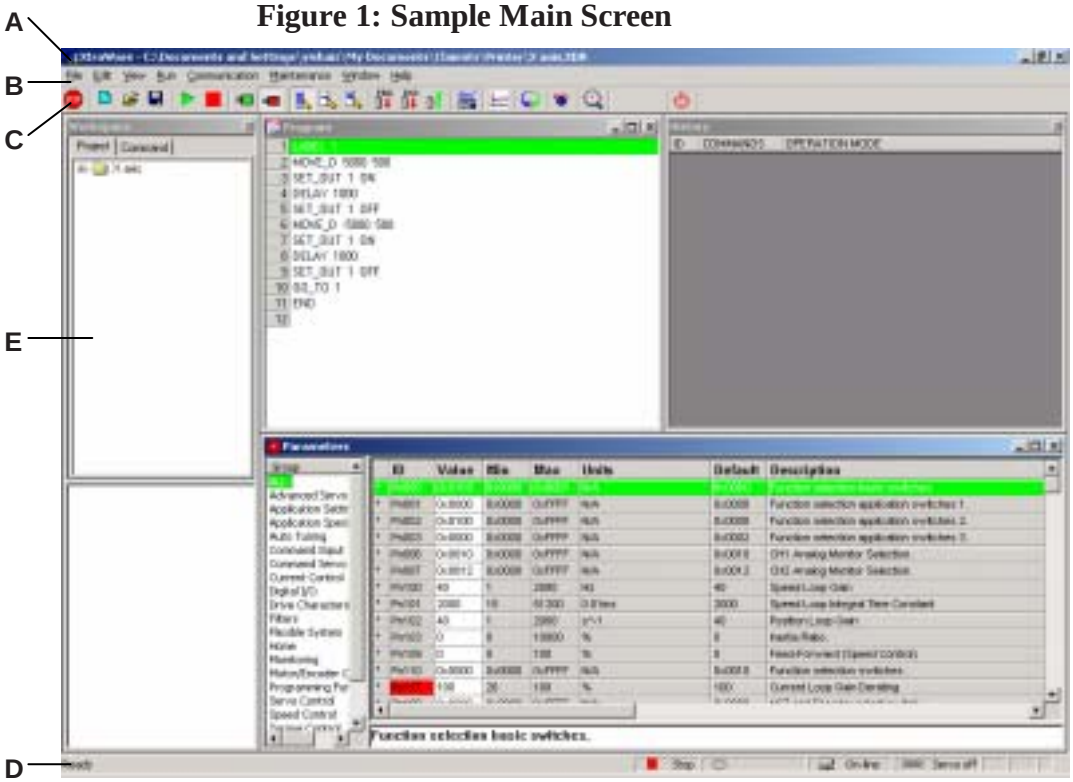
- The installation screen appears, the installation procedure commences and a message welcoming you to XtraWare appears.
- Click Next to continue.
- Follow the onscreen instructions to choose a destination folder for the XtraWare files.
- Click Next to continue.
- Select the program group to create the 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 in Figure 1 below. For clarity, the screen has been divided into separate elements.

Figure 1: Sample Main Screen



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.

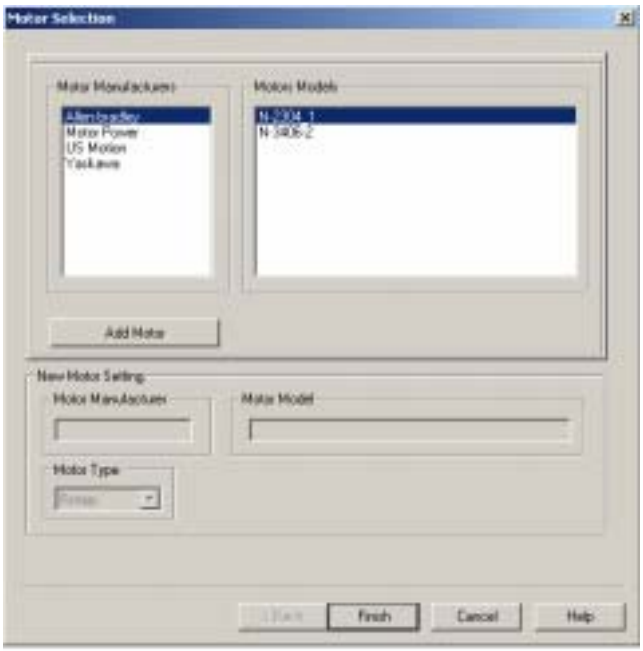
Note: In the different modes, some of the menu options are disabled (grayed) and cannot be accessed. Similarly, disabled icons indicate that communication is offline.

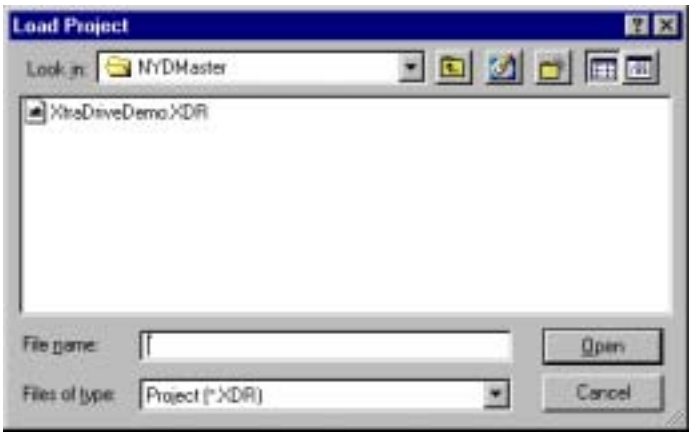
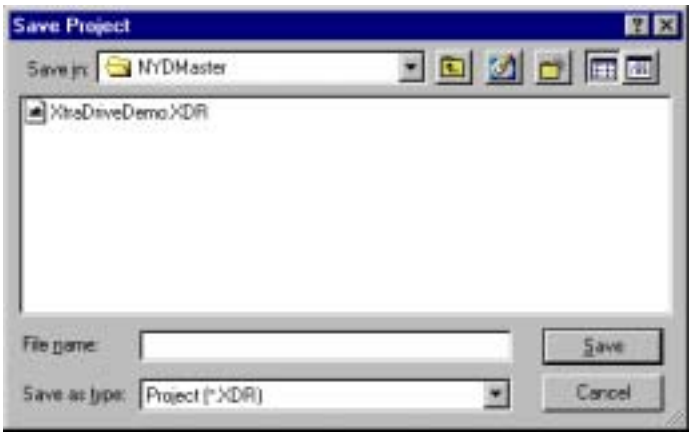
3.2.1 File Menu

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 Motor Selection window opens where you select the motor which will be used for this project. **Figure 2: Motor Selection Window**  Select the appropriate manufacturer and then one of the listed models. If you are using a model which is not listed, click Add Motor. Enter the name of the model in the Motor Model field and select the Motor Type (either Rotary or Linear). Click Finish to proceed; the Workspace, Program, History and Parameters windows are opened with their default contents.

Option	Icon	Description
Open Project (Ctrl+O)		Opens an existing XtraWare project. When this option is selected, the Load Project window (Figure 3) is opened: **Figure 3: Load Project Window** 
Save Project		Saves the current project under its existing name. If the project has not yet been named, the Save Project window (Figure 4) is opened: **Figure 4: Save Project Window**  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		Downloads a program to the XtraDrive driver.
Download Parameters		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.

Option	Icon	Description
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 chart and its corresponding data. See Section 4.6.4, Printing a Chart, for further information.
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

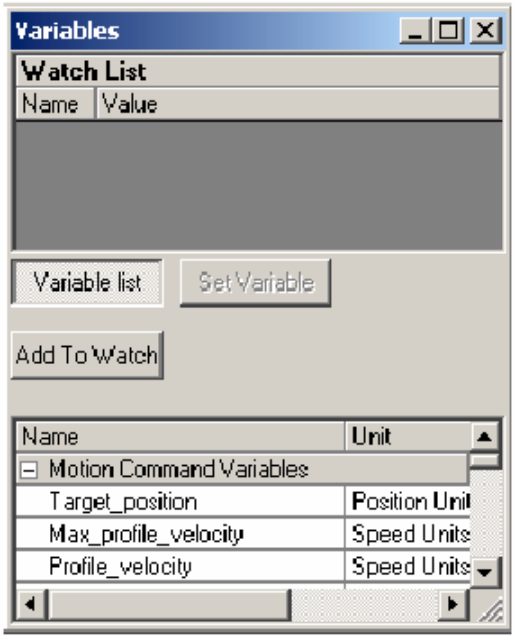
Option	Description
Cut (Ctrl+X)	Deletes selected text or lines from the program, and places it on the Windows and XtraWare clipboards.
Copy (Ctrl+C)	Places a copy of selected text or lines from the program on the Windows and XtraWare clipboard.
Paste (Ctrl+V)	Inserts the contents of the XtraWare clipboard 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. See Section 4.6, Charts, for a description of this window's operation.

Option	Icon	Description
Variable		Opens the Variables window (Figure 5). **Figure 5: Variables Window** 
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.

Option	Icon	Description
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.
Jog		Runs the motor at a constant predefined speed.
Stop		Immediately stops the motor motion. You can also click the Stop icon on the toolbar or press F9. For further details, see 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

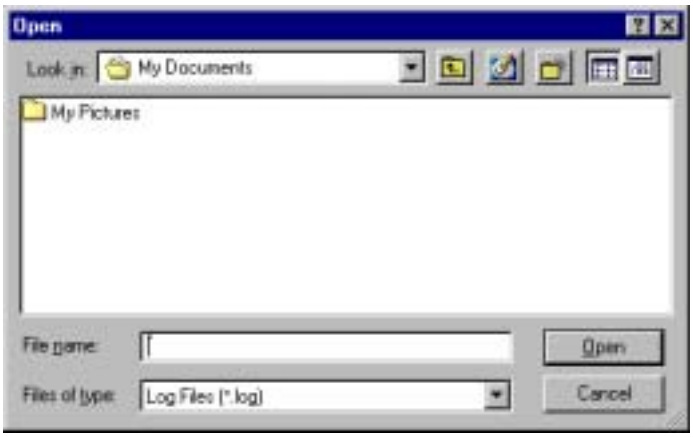
Option	Description
Online	Switches to working in online mode.
Offline	Switches to working in offline mode.
Settings	Opens the Communication Settings window. See Section 4.1.1, Communication Settings, for details on this option.

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.
Mechanical Analysis		The mechanical analysis (FFT) option samples and analyzes 2000 points to produce the speed response to sinusoidal torque frequencies command in the frequency domain. This is displayed as a graph of the gain (dB) and phase angle (degree) versus frequency (Hz in log scale). According to the graph, the relevant parameters can then be adjusted in order to reduce the effect of the mechanical restrictions. See Section 4.7, Mechanical Analysis, for full details.

Option	Icon	Description
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 Log File dialog box is displayed (Figure 6). **Figure 6: Open Log File Dialog Box**  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.
Close Log File		Stops storing commands in the log file and closes the currently open log file.
Reset Driver		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.
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		For internal use only.

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.

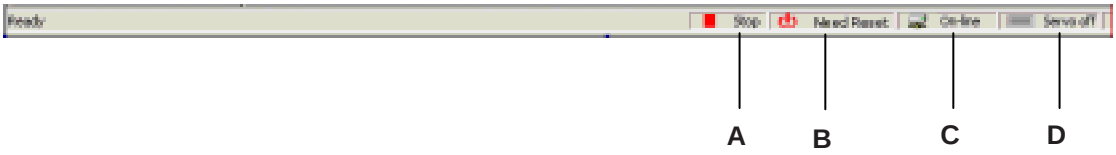
Window Menu Options

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 (Figure 7), located at the bottom of the XtraWare screen, indicates the status of the current driver and of the Servo.

Figure 7: Status Bar



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 (Figure 8) 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.

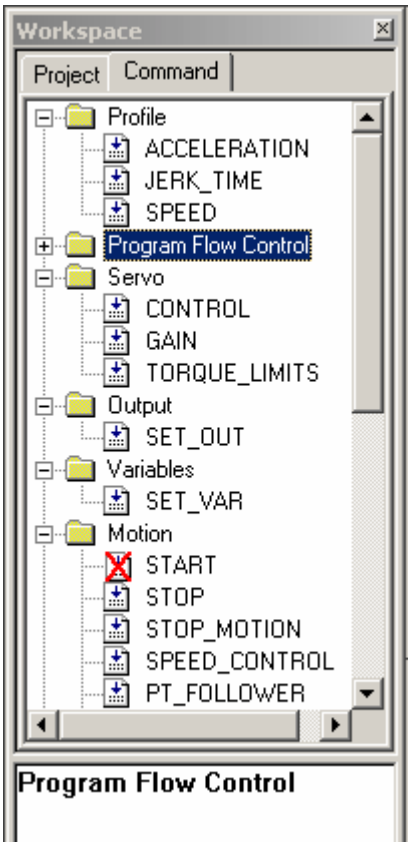
Figure 8: Workspace Window – Project Tab

3.4.1.2 Command Tab

The Command tab (Figure 9) presents the commands that can be used to write the program. The commands are divided into 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.

Figure 9: 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 6, Command Reference for a more detailed description.

Command Groups

The Command Groups are:

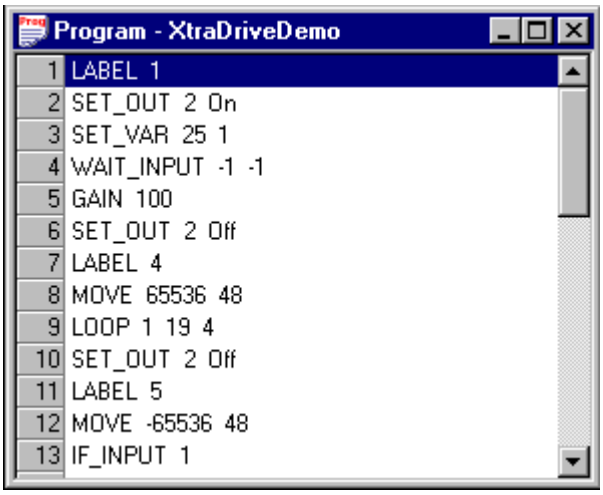
Group	Description	Included Commands
Profile	Changes the speed at which the motor moves.	ACCELERATION, JERK_TIME, SPEED
Program Flow Control	Program flow handling.	CALL, END, GO_TO, LOOP, RETURN, RUN, LABEL, IF, IF_INPUT, INPUT_CASE
Servo	Enables and disables SERVO control in the program. Sets gain and 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_VAR

3.4.2 Program Window

The Program Window (Figure 10) 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).

Figure 10: Program Window



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

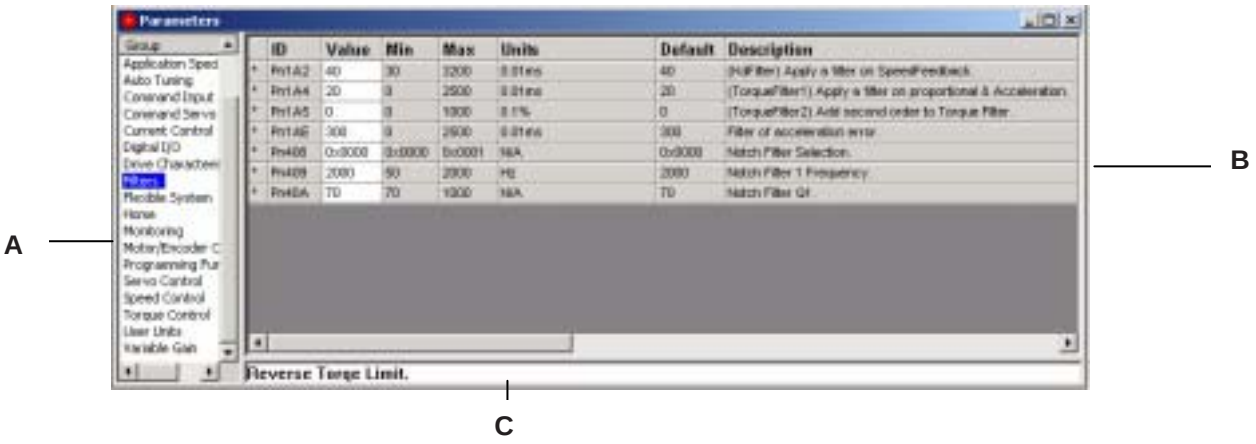
Each project in the XtraWare system comprises a program and parameters. How to write an XtraWare program is described in detail in Section 4.3.1, Writing a Program.

The XtraWare parameters are divided into different parameter groups, and are displayed in the Parameters window (Figure 11). For details on how to set parameters, see Section 4.2.3, Setting Parameters Online and Section 4.2.4, Setting Parameters Offline.

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

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

Figure 11: Parameters Window



- 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.

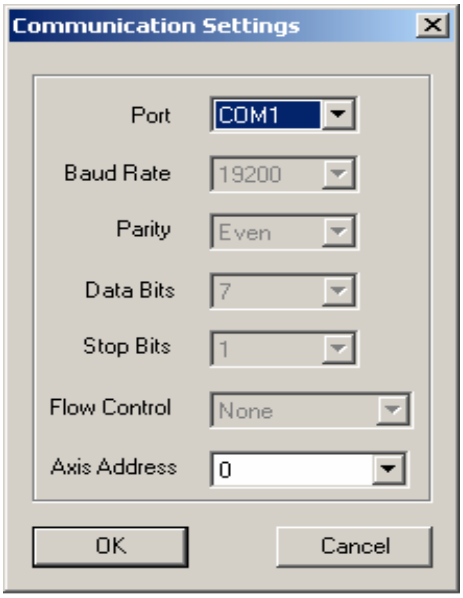
1. Connect a communication cable to an available COM port of your PC. Note that only COM 1 through 4 are supported by XtraWare.
2. Connect the other end to the CN3 connector on the XtraDrive.

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.

Figure 12: Communication Settings Window



1. Select the Setting option from the Communication menu. The Communication Settings window (Figure 12) opens.
2. Set the Port to the correct COM port of your PC (the default is COM1 on most computers).
3. Set the Axis Address.
4. 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

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).

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 

on the toolbar.

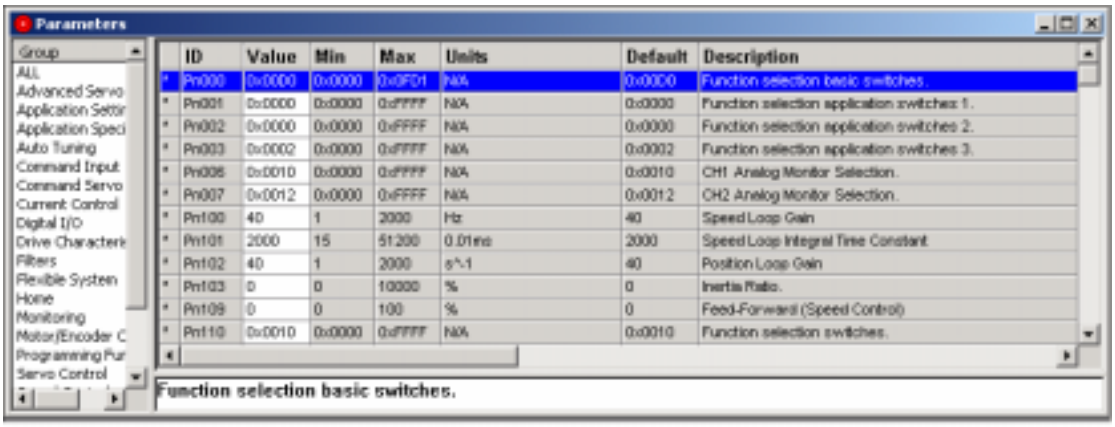
Similarly, to upload the parameters, click the upload icon  on the toolbar.

4.2.2 Viewing Parameter Settings

Parameters are set in the Parameters window (Figure 13). 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.

Figure 13: Parameters Window



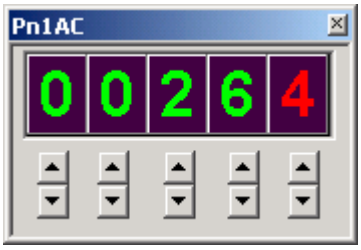
These are the fields in the panes of the Parameters window (from left to right):

- **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.

4.2.3 Setting Parameters Online

Right click on the row of the parameter you wish to change. A pop-up window appears (Figure 14), displaying the current value of the parameter.

Figure 14: Parameter Setting Window



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.

4.2.4 Setting Parameters Offline

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 (Figure 15), and adding it to the Program window (Figure 16). For a detailed description of the command, see Chapter 6, 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 100 command lines.

Figure 15: Workspace Window

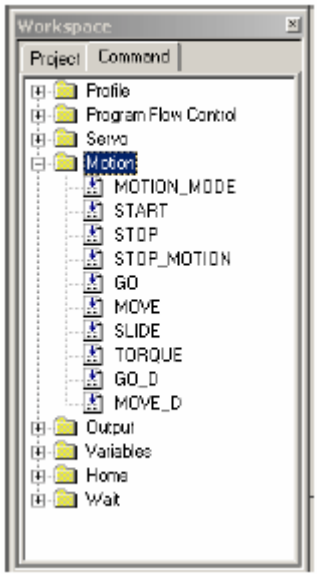
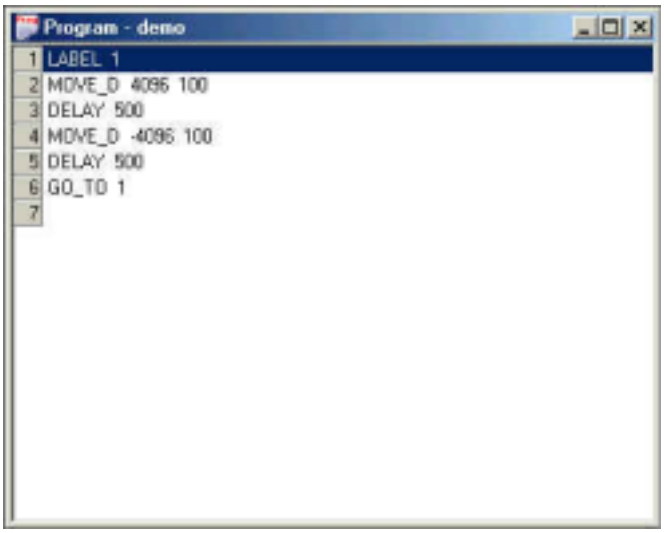


Figure 16: Program Window

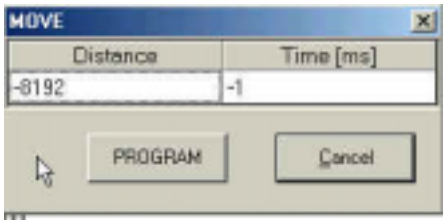


The commands in the Workspace window are divided to groups. For further details, see Section 3.4.2, Program Window.

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 (Figure 17) relating to the command.

Figure 17: Sample Command Pop-up Dialog Box



- 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 

).

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.
- After downloading a user program to the driver, it is possible to run it automatically every time the driver turns ON, by setting the parameter Pn2CC to 1. For further information, see Section 5.10 of the XtraDrive User Manual.

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 6, 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

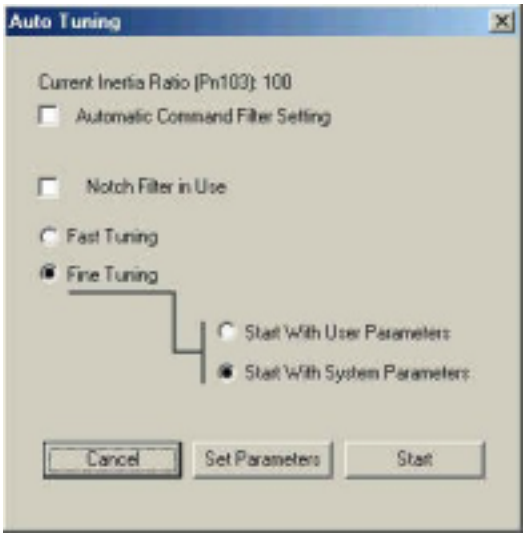
Manual tuning can be performed according to the instructions in the XtraDrive User Manual.

4.5.2 Autotuning

Autotuning is applicable in sequential command mode only. To change the XtraDrive to this mode, set the parameter Pn000.1 = D. Note that this setting becomes active only after the power is recycled.

When you select the Autotuning option from the Maintenance menu, the Autotuning window (Figure 18) opens:

Figure 18: Autotuning Window



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, Parameter Control) and set your own parameters manually.

Click Start to commence the tuning procedure. Note that **the motor is about to move**. When the procedure ends, click OK to accept the new parameters which are automatically stored in the controller memory.

If you selected Fast Tuning, when the procedure ends, set parameter Pn1A0 = 30. Then check the stability of control after turning Servo On. If vibrations occur, reduce global gain Pn1A0 until stable control is observed.

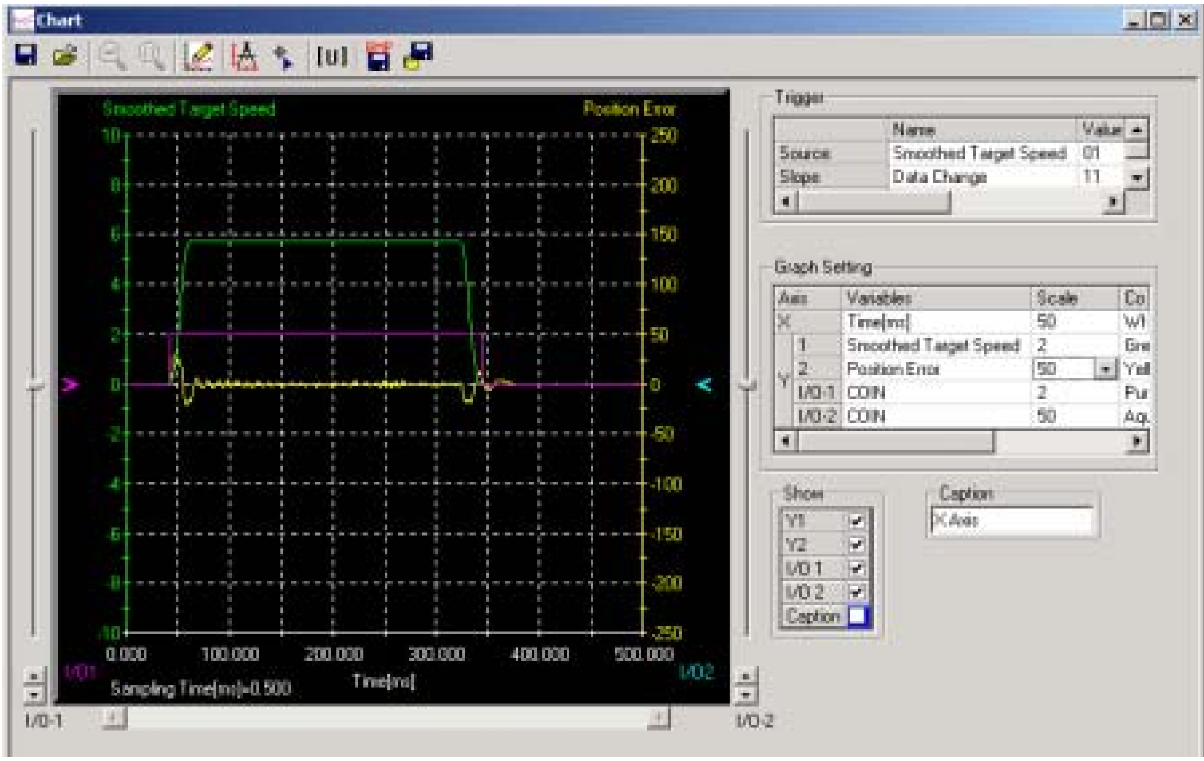
4.6 Charts

The Charts option provides a graphical display of signals over a specified time period. Two analog signals and two digital I/O can be displayed.

4.6.1 The Chart Main Window

Select the Charts option from the View menu to display the Chart Main window (Figure 19).

Figure 19: Chart Main Window



Trigger

A trigger is a device for designating the timing of data access. For example, it is possible to set conditions such as "After /COIN signal goes ON" or "After the speed feedback exceeds 100 rpm", and thereby make detailed reference of the servo operation at the time these conditions occur.

Trigger conditions are designated as any one of the following four items:

Source - Trigger object selection

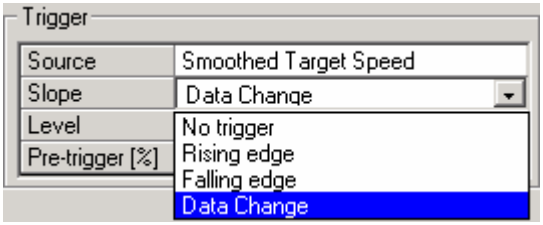
Specify the object to which the trigger is applied. The selected objects can either be from the designated in **Y1** and **Y2**, and **I/O 1** and **I/O 2**.

Figure 20: Trigger Selection (1)

Slope - Edge Type

Specify the direction of change when a trigger is applied.

Figure 21: Trigger Selection (2)



As the type of edge, select:

- Rising Edge - The trigger is detected when the trigger object data rises from below the trigger **Level** to above the trigger **Level**, i.e., .when the change is from LO to HI in I/O.
- Falling Edge - The trigger is detected when the trigger object data falls from above the trigger **Level** to below the trigger **Level**, i.e., **w**hen the change is from HI to LO in I/O.
- Data Change - The trigger is detected if the trigger object crosses the trigger **Level** in any way, i.e., when the signal level changes in I/O.
- No Trigger - The trigger will be applied at the same time as the START TRACE button is pressed. All other trigger settings are irrelevant.

Level - Trigger Level

Specify the standard for determining when the trigger starts. The units for the setting are the same as those of the trigger object selected in **Source**. The trigger level cannot be set if the trigger object is I/O 1 or I/O 2.

Pre-Trigger (0% to 99%)

Specify to what degree data is displayed in the graph before a trigger is applied.

4.6.2 Graph Settings

For all of the graph settings described below, you can select the scale (available values are 1, 2, 5, 10, 25, 50, 100, 500, 1000) and the color in which the results will be displayed..

X – Sampling Time Interval

Specify the time interval for obtaining trace data (default: 25 ms). The total trace time for which results are obtained is the sampling time interval multiplied by 10.

Y1 / Y2 – Sampled Channel

Available values are:

- Target Speed
- Smoothed Target Speed
- Acceleration

- Motor Speed
- Position Error
- Torque Reference

I/O 1 / I/O 2 – Sampled Digital I/O

Select the sampled output and input signals.

Show

Select the objects that will be displayed in the graph.

Caption

Enter the caption to be displayed in the graph.

Chart Toolbar

Figure 22: Chart Toolbar

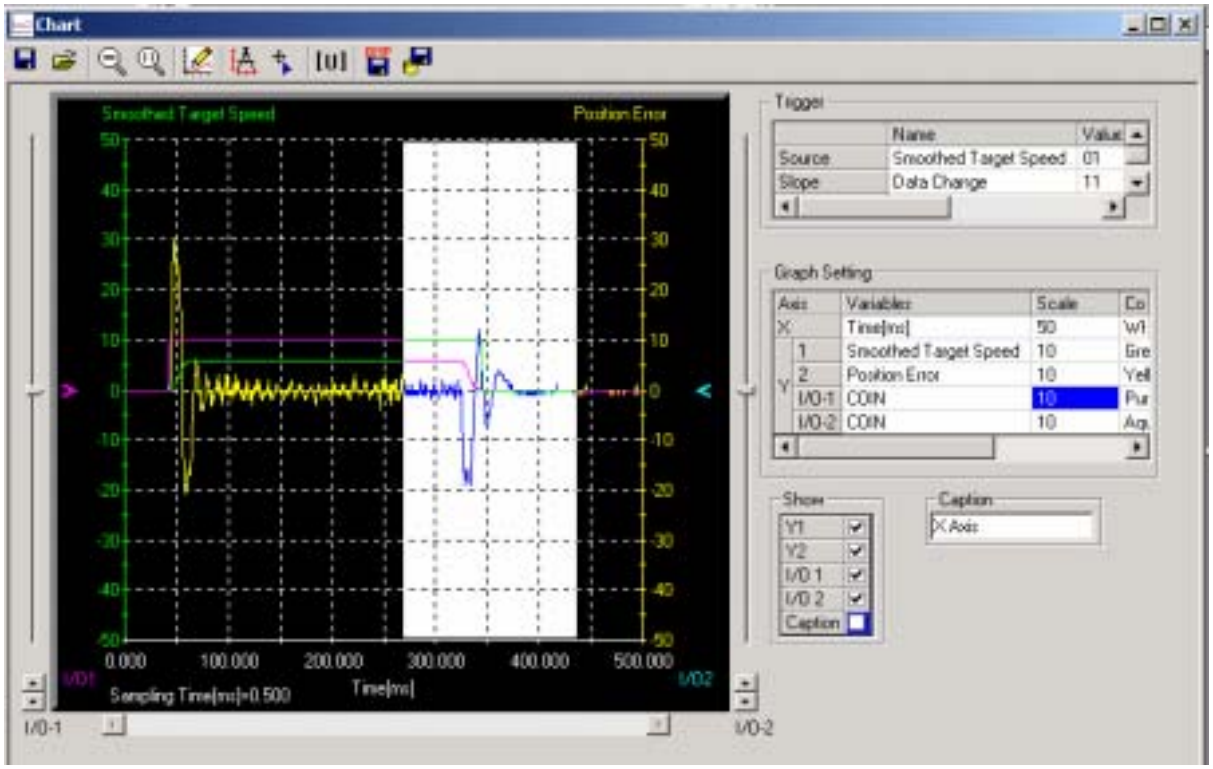
Option	Icon	Description
Save Chart		Saves a copy of the on-screen trace graph to a specified file.
Open		Loads a trace data file.
Up one zoom level		Restores the previous zoom level.
Reset zoom		Restores the area shown in the window to its normal size.
Start Trace		Starts the trigger searching. Click the icon again to cancel the search.
Enable Measure		Measures the delta values of X Y1 and Y2 by right-clicking and dragging the mouse. The values are displayed on the respective axes.
Show markers		Displays information on current cursor location.
Driver Units		Toggles graph units between user units and encoder counts.
Save graph as picture		Saves graph in bmp format enabling you to view the graph without the need for the XtraWare software.
Save		Saves graph data in Excel format (*.csv).

Zoom

A view of an area selected by the mouse can be magnified. Zoom in on an area using the following procedure.

1. Position the mouse at one corner of the area you want to select, and drag while left clicking to the opposite corner. A white area will appear around the selected area.
2. Release the left mouse button. The selected area of the graph is enlarged.
3. Click  to view the original graph.
4. Click  to view the previous zoom level.

Figure 23: Chart Zoom Feature



4.6.3 Starting the Trace

In the Chart main window, click the Start Trace icon  .

An illustration showing XtraWare waiting for the trigger appears. This illustration is displayed until the set trigger conditions are met. Click Start Trace again to stop waiting for the trigger.

When the conditions are met and the trigger is applied, a pop up message appears.

Press Cancel if you want to halt the data sampling process. The Chart main window is displayed when the specified data are obtained.

Notes

1. Sometimes the trigger cannot be detected in under 2ms due to the relationship of the detection period.
2. If the sampling time is increased, XtraWare may continue to wait for the trigger even after the trigger has been applied. XtraWare waits because data for the sampling time is saved in the XtraDrive after the trigger has been applied.

4.6.4 Printing a Chart

The chart and data of the Chart main window can be printed. To do so, select the Print Chart option from the File menu while the chart is open.

4.7 Mechanical Analysis

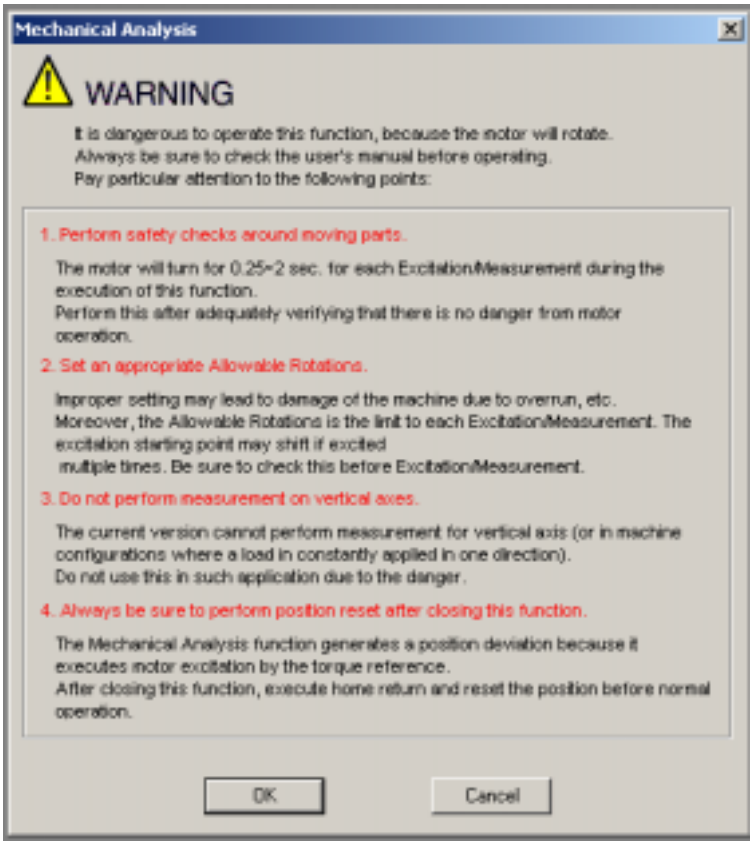
Controlling a system (amplifier, motor and load) requires knowing its mechanical restrictions, such as resonance and anti-resonance frequencies.

The Mechanical Analysis (FFT) option samples and analyzes 2000 points to produce the speed response to sinusoidal torque frequencies command in the frequency domain. This is displayed as a graph of the gain (dB) and phase angle (degree) versus frequency (Hz in log scale). According to the graph, the relevant parameters can then be adjusted in order to reduce the effect of the mechanical restrictions.

Note: The process uses the predefined parameters of Notch Filter (Pn408.0, Pn409, Pn40A) and does not take control gains into consideration.

When you select this option, this Warning message appears (Figure 24):

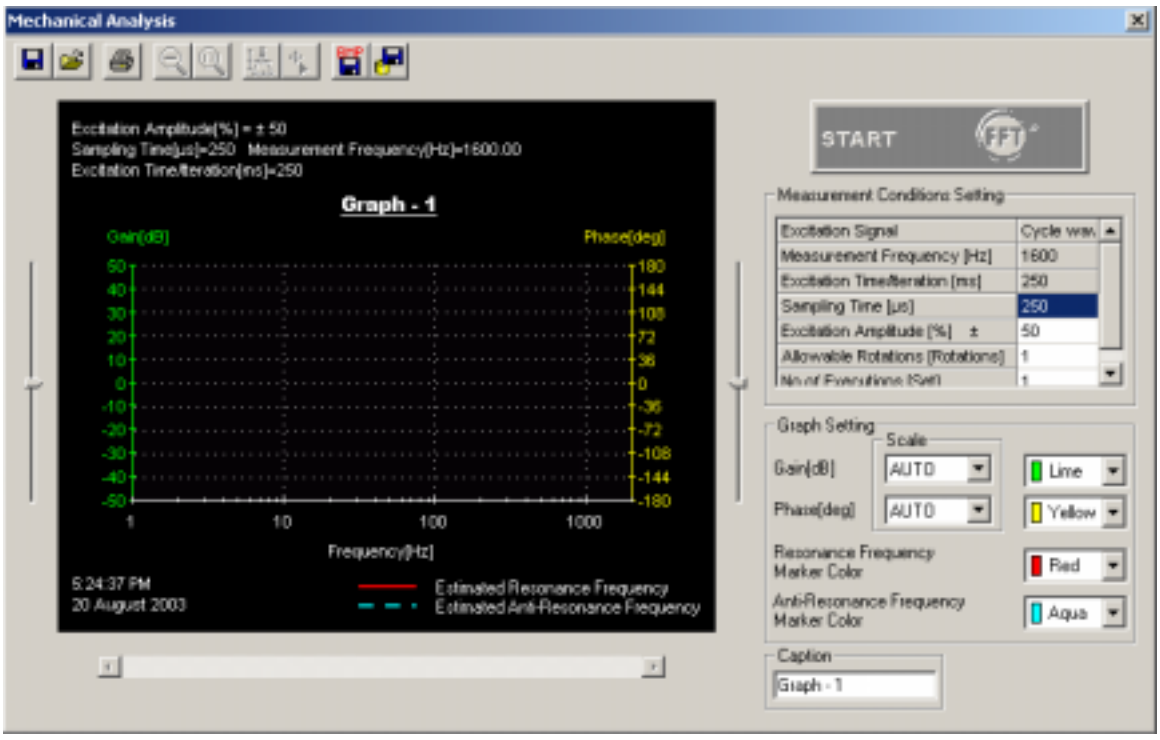
Figure 24: Warning Message



Click OK to open the Mechanical Analysis window (Figure 25).

4.7.1 Mechanical Analysis Window

Figure 25: Mechanical Analysis Window



Accurate measurement of the frequency characteristics depends on the settings of the following parameters:

- **Sampling Time** [µsec] (Measurement Frequency [Hz], Excitation Time [ms])
  If the sampling time is shortened, a higher frequency can be measured and the shorter the excitation time becomes. However, frequency resolution deteriorates and measurement accuracy is reduced at low measuring frequency. The measuring frequency and excitation time depend on the sampling time. To begin with, set the sampling time to a small value. Then reset it to a more appropriate value in accordance with the results produced.
- **Excitation Amplitude** [±%/Rated torque] Range: 1 to 300%
  Must be set to a value below the Torque Limit.
  Select the size of the reference amplitude applying excitation to the machine as a percentage of the ratio of size to rated torque.
  A larger excitation amplitude tends to give more correct measurements, but an excessively large amplitude can cause overspeed (A.51) and overcurrent (A.10) alarms. Problems with the load inertia and the balance would cause alarms, and accurate measurements would be impossible.
  Note: Accurate measurement is not possible if the torque is restricted during excitation.
  Refer to the XtraDrive User Manual for details on the Torque Limit function.
- **Allowable Rotations [Rotation] Range: ±1 to 1000 rotations** The number of Allowable Rotations must be set so the measurements can be taken safely. Set the motor revolutions so the setting is within the operable range. Select the limit of motor rotations during measurement. If the allowable number of rotations is exceeded, the zero clamp function will cause the motor to stop and measurements will be halted. Consider the deceleration rations for the pulley radius, ball screws, and so on, and then select a number of motor rotations. When reducing the number of motor rotations, also reduce the excitation amplitude and the sampling time.
    - The allowable rotations are a restriction for each excitation period. In multiple excitation applications, the excitation start position might shift. Check the range of motion each time excitation is applied.
    - Detection of the allowable rotation in the XtraDrive may be delayed by a maximum of 2 ms. If so, operation may exceed the settings due to factors such as inertia size and interference from speed. Include a margin when setting the allowable number of rotations.
- **No. of Executions [Set] Range: 1 to 5** Select the number of times that the measurements should be taken for an average measurement to be calculated. A set is a back-and-forth operation that starts excitation or measurement from the forward side and excitation/measurement from the reverse side. More measurement iterations tend to yield more accurate measurements, but the time required for measurement increases.
- **Excitation Signal** (fixed): Excites the machine with cycle wave.

- **Graph Setting:** Select the graph scale or leave the default setting of AUTO for automatic scale setting.
  Select the colors of the lines used in the graph of the measurement results.
- **Caption:** Enter the caption to be displayed in the graph.

Analysis Toolbar

Figure 26: Analysis Toolbar

Option	Icon	Description
Save Chart		Saves the current analysis include the settings and the graph.
Open		Opens a previously saved analysis.
Print		Prints the currently displayed chart and its corresponding data
Up one zoom level		Restores the previous zoom level.
Reset zoom		Restores the area shown in the window to its normal size.
Enable Measure		Dragging the cursor by left-clicking the mouse enables the measurement of the difference (delta) between the endings of the line. The delta values are displayed in each axis label. Left-clicking in a new location starts a new measurement.
Show markers		Shows exact value of a point. A yellow cross reflects the movement of the mouse and the exact value can be seen in each axis label.
Save graph as picture		Saves graph in bmp format enabling you to view the graph without the need for the XtraWare software.
Export graph data		Saves graph data in Excel format (*.csv).

4.7.2 Running the Mechanical Analysis

- Run the motor to excite the machine and measure the frequency characteristics.
- Run the process by pressing the **START** button.
  Note: The motor will start moving.
- When the process is completed, a graph is displayed; in the bottom right corner the values of resonance and anti resonance frequency values (if any) are displayed.

5. Parameter Reference

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

Table 5-1: Parameters

This table 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 Manual which provides a full description of the parameter.

Category	Parameter Number	Name	Unit	Setting Range	Default Setting	Reference
Function Selection Parameters	**Pn000***	Function Selection Basic Switches	-	-	0x00D0	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
Motor parameters	**Pn190***	Motor selection switch	-	-	0000	5.8
	Pn191*	Motor selection switch	-	-	0000	5.8
	Pn192*	Pulses number of A quad B encoder	pulses/ rev	0-9999	2048	5.8

Category	Parameter Number	Name	Unit	Setting Range	Default Setting	Reference
	Pn193*	Pulses number of A quad B encoder (High)	pulse* 10000/ rev	0-419	0	5.8
	Pn199	Encoder counts per Scale Pitch of linear motor	counts/ scale pitch	1-256	1	
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
	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
	Pn1C1	Integral switch advance	125µs	0-8		
Position Parameters	**Pn200***	Position Control Reference Selection Switches	-	-	0000	5.2.2
	Pn201*	PG Divider (rotary motor)	p/r	0 to 65635	2048	5.2.3
	Pn202*	Electronic Gear Ratio (Numerator)	-	1 to 65535	4	5.2.5
	Pn203*	Electronic Gear Ratio (Denominator) ***	-	1 to 65535	1	5.2.5
	Pn205*	Multi-Turn Limit Setting**	rev	0 to 65535	65535	5.7.2
	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)	accelera-tion units	0-65535	0	5.9.1.2
	Pn2A5*	Work acceleration default (high)	accelera-tion units* 65536	0-256	0	5.9.1.2
	Pn2A6*	Work jerk smoothing time default	µs	0-63999	0	5.9.1.2

Category	Parameter Number	Name	Unit	Setting Range	Default Setting	Reference
	Pn2A8*	Quick stop deceleration (low)	accelera-tion units	0-65535	65535	5.9.1.2
	Pn2A9*	Quick stop deceleration (high)	accelera-tion 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
	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	1-24000	24000	5.9.2
	Pn2C4	Synchronize window for pulse train	user position units	0-250	7	Chapter 6, Command Reference
	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	-	-	0008	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	1-1000	50	5.9.5
	Pn2CB	Autotuning – plateau time of movement	ms	0-1000	50	5.9.5

Category	Parameter Number	Name	Unit	Setting Range	Default Setting	Reference
	Pn2CC*	Auto start user program	-	0-99	0	5.10
	Pn2D0*	Reserved	-	-	-	-
	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	
Linear Motor Speed Parameters	Pn380	Speed1	mm/s	0-5000	10	
	Pn381	Speed2	mm/s	0-5000	20	
	Pn382	Speed3	mm/s	0-5000	30	
	Pn383	Jog Speed	mm/s	0-5000	40	
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

Category	Parameter Number	Name	Unit	Setting Range	Default Setting	Reference
	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
Linear Motor Sequence Parameters	Pn580	Zero clamp level	mm/s	0-5000	10	
	Pn581	Motion detection level	mm/s	1-5000	20	
	Pn582	Speed coincidence signal output width	mm/s	0-5000	10	
	Pn583	Brake reference output speed level	mm/s	0-5000	100	
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. Be careful not to change the setting unless necessary.
*** The setting of parameter Pn111 is valid only when parameter Pn110.1 is set to 0.
**** Normally set to "0". When using an external regenerative resistor, set the capacity (W) of the regenerative resistor.
***** The upper limit is the maximum output capacity (W) of the servo amplifier.

Table 5-2: 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)	D
			1	Torque control (analog reference)	
			3	Internal set speed control (contact reference)	
			4	Internal set speed control (contact reference)/Speed control (analog reference)	
			6	Internal set speed control (contact reference)/Torque 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	
	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	

Parameter	Digit Place	Name	Setting	Description	Default Setting
	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)	
			2	Uses absolute encoder as an absolute encoder. Uses multi-turn limit.	
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	0-7	Same as Pn003.0 (see above)	
	2	Not used	-	-	0
	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	Motor speed: 1V/500 rpm	

Parameter	Digit Place	Name	Setting	Description	Default Setting
			6	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	Motor speed: 1V/500 rpm	
			6	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
Pn080 Linear Motor Commutation Switch	0	Communica-tion sensor switch	0	With commutation sensors	1
			1	Without commutation sensors	
	1	Communica-tion sensor order	0	UVW	
			1	UVW	
	2	Reserved	-	-	1
	3	Reserved	-	-	
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	Motor model	0	Yaskawa A quad B model SGM	0
			1	Yaskawa A quad B model SGMP	
			2	Non Yaskawa rotary motor	
			3	Non Yaskawa linear 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	
			2	A quad B encoder with commutation sensors (U,V,W)	
			3	A quad B encoder with commutation sensors (/U,/V,/W)	
	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	Disable clear integral function (refer to 6.3.8)	1
			1	Enable clear integral function (refer to 6.3.8)	
	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	
			7	A phase + B phase (x1), negative logic	
			8	A phase + B phase (x2), negative logic	
			9	A phase + B phase (x4), 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	

Parameter	Digit Place	Name	Setting	Description	Default Setting
	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	
Pn2C6 Communica-tion switch	0	Check Sum	0	Does not use check sum	1
			1	Uses check sum	
	1	Not used	-	-	0
	2				
	3				
			1	Normally open	
			2	Home failure	
Pn2D4 Oscillation Canceling Mode Switch	0	Oscillation Canceling Mode	0	OCA is not activated	0
			1	OCA is active	
	1	Not used	-	-	
	2				
	3				
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 5-3: 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	

Parameter	Digit Place	Name	Setting	Description	Default Setting
			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
	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

Parameter	Digit Place	Name	Setting	Description	Default Setting
	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

Note: 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.

Table 5-4: Home Switches

Parameter	Digit Place	Name	Setting	Description	Default Setting
Pn2C7	0	Home switch input	-	Same as Pn50A.1	8
	1	Reserved	-	-	0
	2	Reserved	-	-	0
	3	Reserved			0

Table 5-5: Extended Input Signal Selection

These inputs are used in the user program.

Parameter	Digit Place	Name	Setting	Description	Default Setting
Pn2D1	0	Emergency input	0	Same as Pn50A.1	8: ON
	1	New Move Enable	0-F	Same as Pn50A.1	7
	2	Reserved	-	-	0
	3	Reserved	-	-	0

Table 5-6: 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	
	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

Table 5-7: 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	Not used	-	-	0
	2	Not used	-	-	0
	3	Not used	-	-	0

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.

Table 5-8: Auxiliary Functions

The following list shows the available auxiliary functions.

Parameter	Function
Fn000	Alarm traceback data display.
Fn001	Rigidity setting for online autotuning.
Fn002	JOG mode operation.
Fn003	Zero-point search mode.
Fn004	(Reserved parameter).
Fn005	Parameter settings initialization.
Fn006	Alarm traceback data clear.
Fn007	Writing to EEPROM inertia ratio data obtained from online autotuning.
Fn008	Absolute encoder multi-turn reset and encoder alarm reset.
Fn009	Automatic tuning of analog (speed, torque) reference offset.
Fn00A	Manual adjustment of speed reference offset.
Fn00B	Manual adjustment of torque reference offset.
Fn00C	Manual zero-adjustment of analog monitor output.
Fn00D	Manual adjustment of analog monitor output gain.
Fn00E	Automatic adjustment of motor current detection signal offset.
Fn00F	Manual adjustment of motor current detection signal offset.
Fn010	Write protect setting (protects parameters from being changed).
Fn011	Motor model display.
Fn012	Software version display.
Fn013	Multi-turn Limit Setting: Change when a multi-turn limit disagreement alarm (A.CC) occurs.
Fn014	Clear option unit detection alarm (A.E7).

Table 5-9: Monitor Modes

The following list shows monitor modes available

Parameter	Content of Display	Unit	Remarks
Un000	Actual motor speed	rpm	-
Un001	Input speed reference	rpm	-
Un002	Internal torque reference	%	Value for rated torque
Un003	Rotation angle 1	pulse	Number of pulses from the origin
Un004	Rotation angle 2	degree	Angle from the origin (electrical angle)
Un005	Input signal monitor	-	-
Un006	Output signal monitor	-	-
Un007	Input reference pulse speed	rpm	-
Un008*	Error counter value	Reference-units	Amount of position error
Un009	Accumulated load rate	%	Value for the rated torque as 100%. Displays effective torque in 10sec cycle.
Un00A	Regenerative load rate	%	Value for the processable regenerative power as 100%. Displays effective torque in 10sec cycle.
Un00B	Power consumed by DB resistance	%	Value for the processable power when dynamic brake is applied as 100%. Displays effective torque in 10sec cycle.
Un00C	Input reference pulse counter	-	Displayed in hexadecimal.
Un00D	Feedback pulse counter	-	Displayed in hexadecimal.

*Not used in serial communication command.

6. Command Reference

This chapter contains an alphabetical list of:

- the commands available for writing a program in the XtraWare system.
- the commands available in the serial communication protocol

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 modes

The motion commands are divided into Motion modes as described below. The current motion mode can be read from the Modes_of_operation variable.

- *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 within 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.

- *Speed Control* – A speed control loop is closed on the reference command instead of the position control loop that is normally used (SPEED_CONTROL).
- *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.
- *Pulse Train* – A reference position command is given by pulse-train from an external source (MOVE_R, PT_FOLLOWER).
- *Analog Speed* – A reference speed command is given by analog input from an external source and the position control loop is closed on the reference value (SLIDE_ANALOG).
- *Analog Torque* – A reference torque command is given by analog input from an external source and the position control loop is closed on the reference value (TORQUE_ANALOG).

Motion mode name	Modes_of_operation value
POSITION	1
VELOCITY	3
TORQUE	4
HOMING	6
SPEED_CONTROL	0
HUNTING	-1
PULSE_TRAIN	-3
ANALOG_SPEED	-4
ANALOG_TORQUE	-5

Motion Command Buffer (MCB)

All motion commands are executed through the MCB.

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.

6.1 XtraWare Commands

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
INPUT_CASE 3 2
CALL 2
END
LABEL 2
SLIDE 1000
DELAY 500
SLIDE 0
RETURN
```

Example Explanation

The program checks if a certain input combination has occurred. If the combination exists, it will call the subroutine `LABEL 2`. A SLIDE motion will occur for 500 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

`CONTROL ON` 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 -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>` 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.

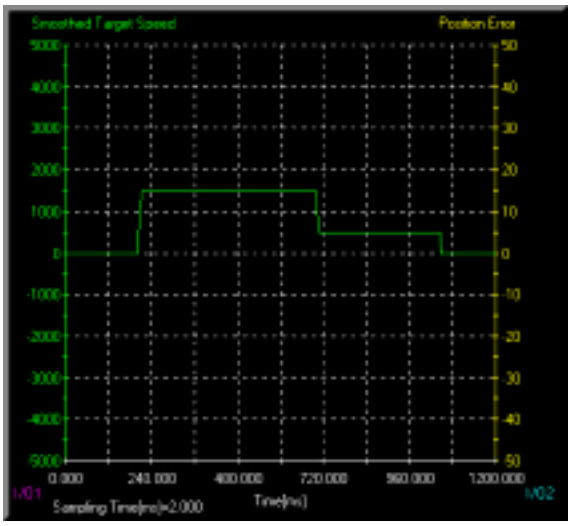
Automatically changes Motion mode to Hunting Position mode (-1).

Syntax Parameters

`target`	The specified target in absolute coordinates.

Example

```
SET_ZERO_POSITION
SPEED 1500
GO_H 60000
GO_H 1000000
WAIT_VAR 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
MOVE_D 3600 500
MOVE_D -3600 500
GO_TO 2
END
```

Example 2 Explanation Axis moves 3600 UU forward and returns 3600 UU backwards. Then the program jumps to LABEL 1 and starts again. This creates an endless loop.

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 profile acceleration and `<speed>` until the `<torque>` is reached for 2 seconds and the Maximum Encoder Position does not change during that time.

If the torque exceeds the torque limit parameters (Pn402 Pn403), this alarm is output: "Torque exceeded Torque Limits" (err: 33).

The Home Position is defined as the actual position when the torque reaches the defined `<torque>` for 2 seconds.

The torque will not exceed the defined `<torque>` during this procedure.

It is recommended to first set a low `<torque>` value. If the machine hard stop is not found, gradually increase the `<torque>` value.

Syntax Parameters		
	`torque`	The torque limit and torque indication for finding the Home position [0.1% of rated].
	`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

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.

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.

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 action specified by `<then>` is performed. Otherwise the next program line is performed.

Syntax Parameters

`variable`	System variable (see Chapter 9, List of System Variables).
`condition`	>, <, >=, <=, =, != mathematical operator
`value`	Set a value with the same units as `<variable>`.
`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
DELAY 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_VAR

IF_INPUT — Program Flow Control

Syntax

```
IF_INPUT <input number> <input condition> <input state> <then> <label>
```

Range

Input number – 0 to 7 and 8 to 24 (depending on Option board type, if any)

Description

The program flow is conditional on the state of digital input. If the condition is True, the action specified by `<then>` will occur. Otherwise, the next program line is executed.

Syntax Parameters

`Input number`	Digital input number according to the pin on CN1. Pin 40 is related to `<input number>`, 0 and 41 to 1, etc.
`Input condition`	= Constant setting equal sign.
`Input state`	0 OR 1
`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

```
LABEL 1
IF_INPUT 1 = 0 THEN GO_TO 2
SET_OUT 2 ON
LABEL 2
MOVE_D -4096 –1
END
```

Example Explanation

If `INPUT 1` is false (the condition is true) jump to `LABEL 2` and move forward, else, set `OUTPUT 2` to `ON` and move forward.

Modes

Program

See Also

IF, WAIT_INPUT, INPUT_CASE

INPUT_CASE — Program Flow Control

Syntax `INPUT_CASE <input mask> <input state>`

Range `<input mask>` – 1 to 0x00FFFFFF

`<input state>` – 0 to 0x00FFFFFF

Description The program flow is conditional on the state of a combination of digital inputs. If the condition is True, the next program line is executed. Otherwise, the next program line is skipped.

`<input mask>` is used to define which inputs are detected and which are ignored (1 - detected, 0 - ignore). For example, if `<input mask>` is set to 5 (in binary: 0101) only inputs 0+2 are checked; the rest are ignored.

Input Mask					
0	0	0	1	0	1

`<input state>` defines the logical combination to be detected as True. For example, if `<input state>` is set to 4 (in binary: 0100), True means input 0 OFF, input 1 OFF, input 2 ON and input 3 OFF.

Input State					
0	0	0	1	0	1

Syntax Parameters

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

`Input state` — Input State (decimal value). A bit string represents the digital input state. The leftmost is input 0 related to pin 40 on CN1, etc. The eighth bit is not in use.

Example

```
LABEL 1
INPUT_CASE 7 2
MOVE 4096 –1
GO_TO 1
END
```

Example Explanation `<input mask>` is 7 (in binary is 0011), i.e., check inputs 0, 1, 2 and ignore the rest.

`<input state>` is 2 (in binary is 0010).

True means input 0 is OFF, input 1 is ON and input 2 is OFF.

If the condition is true, proceed to the MOVE command. Otherwise skip the next command and jump to GO_TO command.

Modes Program

See Also IF_INPUT

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 = 1 THEN 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, servo is disabled, program ends.

Modes Program

See Also `GO_TO, LOOP, END, CALL, RUN`

LOOP — Program Flow Control

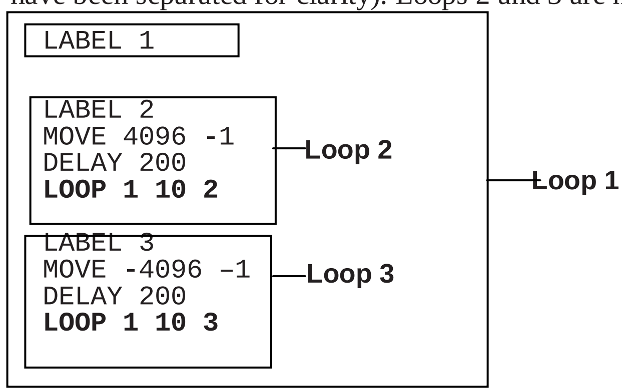
Syntax `LOOP <n> <v> <l>`

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.




```
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 <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 <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.

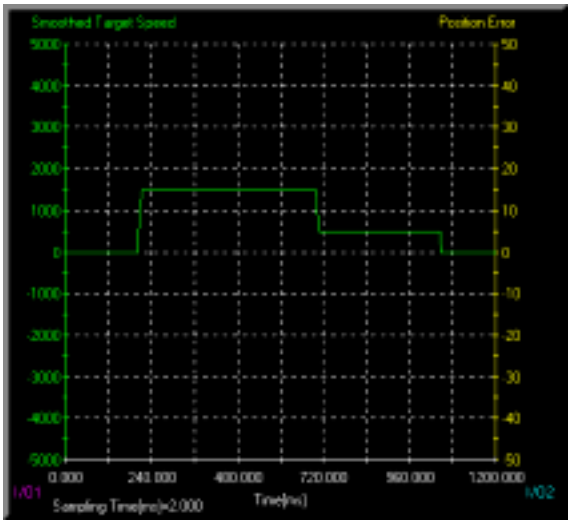
Automatically changes Motion mode to Hunting Position mode (-1).

Syntax Parameters

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

Example

```
SET_ZERO_POSITION
SPEED 1500
MOVE_H 600000
MOVE_H 400000
WAIT_VAR 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>`

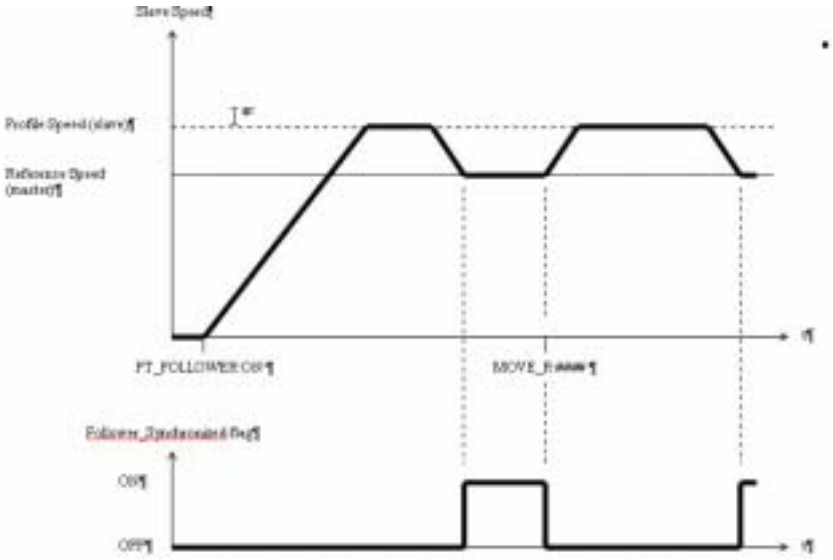
Units User Units (defined by the user; see Chapter 5 in the XtraDrive User Manual.

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 acceleration is set by the default acceleration value, and speed is limited by the default speed value. The default speed must be set to a higher value than the master speed.

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, Max_Profile_Velocity, Profile_Velocity, Max_Profile_Acceleration, Profile_Acceleration.

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.

Pn2A2, Pn2A3, Pn2A4, Pn2A5 – Motion profile defaults

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.

Syntax Parameters

`n`	The label number.

Modes Immediate, Sequential

See Also LABEL, CALL

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.

Syntax Parameters

n	Program output number (1 – 3)

Example

```
LABEL 1
SET_ZERO_POSITION
SLIDE 200
WAIT_VAR 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 equals or exceeds 10000uu (the WAIT_VAR command stalls the execution of the next command). When the position value equals or 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

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

```
SPEED_CONTROL VARIABLE
LABEL 1

IF_INPUT 1 = 0 THEN GO_TO 2
SET_VAR Speed_reference 500

GO_TO 3

LABEL 2
SET_VAR Speed_reference 200

LABEL 3

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.

If error 9 occurs, insert a STOP_MOTION command before the SET_ZERO_POSITION command.

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 = 1 THEN CALL 2
GO_TO 1
LABEL 2
STOP_MOTION
WAIT_INPUT 1 = 0 –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 <input number> <input condition <input state> <time>`

Range Input number – 0 to 7 and 8 to 24 (depending on Option board type, if any)

Description Pauses execution of program until the condition on digital input is true *or* until the time specified by `<time>` has passed.

Syntax Parameters

`Input number`	Digital input number according to the pin on CN1. Pin 40 is related to `<input number>`, 0 and 41 to 1, etc.
`Input condition`	(=) OR (!=) Equal to or not equal to
`Input state`	0 or 1
`time`	The time in msec to wait until the input is set. If `<time>` is -1, waits indefinitely.

Example

```
LABEL 1
WAIT_INPUT 2 = 1 –1
MOVE 10800 –1
WAIT_INPUT 2 = 0 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.

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_VAR — Wait

Syntax `WAIT_VAR <variable> <condition> <value>`

Description Pauses execution of program until the condition on `<variable>` value is true.

Syntax Parameters

`variable`	System variable (see Chapter 9, List of System Variables).
`condition`	>, <, >=, <=, =, != mathematical operator
`value`	Set a value with the same units as `<variable>`.

Example

```
LABEL 1
SET_ZERO_POSITION
SLIDE 50
WAIT_VAR Position_actual_value = 20000
SLIDE 0
END
```

Example Explanation Position_actual_value 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 and motor stops; end of program.

Modes Program, Sequential

See Also IF, WAIT_INPUT

6.2 Serial Communication Commands

The commands described in this section are available only in the serial communication protocol; they are not available in XtraWare. Detailed information about the serial communication protocol can be found in Chapter 8.

GET_PAR

Syntax	`GET_PAR <parameter number>`	
Description	Reads the contents of XtraDrive parameter.	
Syntax Parameters	`Parameter number`	XtraDrive parameter (see Chapter 5, Parameter Reference).
Modes	Immediate, Sequential	
See Also	SET_PAR	

GET_VAR

Syntax	`GET_VAR <variable>`	
Description	Reads the contents of the variable.	
Syntax Parameters	`variable`	System variable (see Chapter 9, List of System Variables).
Modes	Immediate, Sequential	
See Also	POLLING, SET_VAR	

GET_VERSION

Syntax	`GET_VERSION`
Description	Reads XtraDrive version number.
Modes	Immediate

POLLING

Syntax `POLLING`

Description Reads XtraDrive status. For details, see Chapter 10, List of Status Word Bits.

Modes Immediate

SET_PAR

Syntax `SET_PAR <parameter number> <value>`

Description Sets XtraDrive parameter. The driver must be reset before the change takes effect.

Syntax Parameters		
	`parameter number`	XtraDrive parameter (see Chapter 5, Parameter Reference).
	`value`	Sets value to specified parameter. For setting range see Chapter 5, Parameter Reference.

Modes Immediate, Sequential.

See Also SET_PAR

7. Serial Interface Protocol

This chapter describes the XtraDrive serial communication protocol. XtraDrive can work with XtraWare or with any other software that confirms with this protocol. Up to 15 XtraDrive units can be connected on a bus. Broadcast commands can be sent to all axes (XtraDrive units).

7.1 Basic Communication Specifications

Half duplex communication using the following:

Baud rate:	19200	Auto-detect
Bit Structure:	Start	1 bit
	Data	7 bit (ASCII code)
	Stop	1 bit
	Even-number parity	1 bit
Synchronization:	Start / Stop synchronization	1 bit

7.2 Protocol Specifications

In this master/slave protocol, a PC (or other device) is the master and the XtraDrive is the slave. The master sends a request or a polling message, and the XtraDrive answers with a response message. The master can only send a new message after receiving an answer or ACK (acknowledge) message or after timeout has expired.

The master can control up to 15 XtraDrive units by using addresses. When broadcast messages are sent, the master does not wait for an ACK.

When there is no command to send, the master can continue sending polling messages; the XtraDrive responds with an ACK.

The diagram below illustrates the communication protocol between a PC (master) and a single XtraDrive.

PC Master				**XtraDrive Slave**
	1st Message	→		
		←	Response	
	2nd Message	→		
	:			
	:			
	:			
Timeout	3rd message	→		
		←	Response	

7.2.1 Message Data Structure

- A message consists of bytes where each byte holds one digit of hexadecimal data in ASCII code representation.
- The data can be signed or unsigned according to the Command Operational Code argument type (see Chapter 11, List of Operation Codes). For signed data the leftmost bit (msb) determines the sign.
- Negative number representation is according to standard hexadecimal representation and to size of data.
- The messages are a string of bytes according to the formats specified below.
- Every message in this protocol starts with "N" and terminates with CR (Carriage Return).

Note: 0x## represents a hexadecimal number.

7.2.2 Master Message

Format:

N	A	m	Id1	Id2	C1	C2	P1	P2	. . .	Pn	S1	S2	CR

N:

Description: XtraDrive message start symbol. Constant value.

Range: N

A:

Description: Axis address

Range: 0x0 – 0xF

Notes:
Use Pn000.2 to set Axis address (see XtraDrive User Manual, Appendix D, List of Parameters).

For a broadcast message and when only one driver is used, address 0x0 is written.

m:

Description: Operation mode

Range: 0 – broadcast message

1 – polling message

2 – Immediate mode

3 – Sequential mode

4 – Program download

5 – Program upload

Id1 and Id2:

Description: Message Identification (two bytes for two digits). Since the range is greater than 0xF, two bytes are required for holding the number. Message Identification is needed to bind a fault condition to a specific command and to enable download (new or replace) of XtraDrive program lines.

Range: 0x0 – 0xFF. 0x0 – 0xF each

Message Identification Number	Description
0x00	To ignore message identification
0x01 – 0xB4	Program line number (Program mode)
0xB5 – 0xC8	Message Identification (Immediate and Sequential modes)
0xC9 – 0xFF	For future use

Notes: Message ID enables rewriting of lines in XtraDrive program. The program must be stopped prior to line rewriting.
Message ID enables synchronization between status received from XtraDrive and a specific message.
Message ID may be ignored and set as 0x00.

C1 and C2:

Description: Command Operational Code (two bytes for two digits). Since the range is greater than 0xF, two bytes are required for holding the number.

Range: 0x0 – 0xFF. 0x0 – 0xF each (see Chapter 11, List of Operation Codes).

P1 P2 …Pn:

Description: Command Parameter. Each Pn is one byte for one digit. The number of parameters (arguments) and size (number of digits), if relevant, depend on the Command Operational Code (see Chapter 11, List of Operation Codes).

Range: 0x0 – 0xF for each Pn.

S1 and S2:

Description: Message checksum (two bytes for two digits). The checksum is calculated by summing all bytes (excluding N and CR) in a message body . (See 7.2.2.1, Checksum Calculation.)

Range: 0x0 – 0xFF. 0x0 – 0xF each

CR:

Description: Carriage Return. Used as a message response termination symbol. Constant value.

Range: CR (0x0D in ASCII code)

7.2.2.1 Checksum Calculation

Checksum is calculated for a binary message. Each factor in the equation (excluding N and CR) is two digits of a hexadecimal number and consists of two adjacent bytes.

The checksum of the message: N a m id1 id2 C1 C2 P1 P2 P3 P4 S1S2 CR is:

S1S2 = 0x100 – (am + id1id2 + P1P2 + P3P4)

Only the two digits on the right are considered.

Note: It is possible to work without checksum by setting Pn2C6 = 0. When working without checksum, set 00 instead of checksum (S1S2).

7.2.2.2 Master Message Format Example

CONTROL ON command

Example of CONTROL_ON command to axis 0 in Immediate mode:

Format:

N	A	m	Id1	Id2	C1	C2	P1	P2	S1	S2	CR
N	0	2	0	0	4	5	0	1	B	8	CR

where:

A=0 – axis number 0

m=2 – Immediate mode

Id1=0; Id2 =0 – ignore message ID

C1=4; C2 =5 – command operational code = 0x45

P1=0; P2=1 – one command parameter (two digits).

S1=B; S2=8 – 0x100–(0x02+0x00+0x45+0x01)= 0xB8

MOVE Command

Example of MOVE command (600uu in 1000 msec), of axis 2 in Sequential mode:

Format:

N	a	m	Id1	Id2	C1	C2	P1	P2	P3	P4	P5	P6	P7	P8
N	2	3	0	0	7	1	0	0	0	0	0	2	5	8

P9	P10	P11	P12	P13	P14	P15	P16	S1	S2	CR
0	0	0	0	0	3	E	8	2	7	CR

where:

a=2 – axis number 2.

m=3 – Sequential mode.

Id1=0; id2 =0 – ignore message ID

C1=7; C2 =1 – command operational code = 0x71

P1 P2 …P16=00000258000003E8 – 600 = 0x258 and 1000=0x3E8. Each command parameter has 8 digits.

S1=2; S2=7

0x100–(0x23+00+0x71+00+00+0x02+0x58+00+00+0x03+0xE8)=

0xFFFFFFFFFFFFFF27

Since only the last two digits are considered, S1S2 = 0x27.

7.2.3 Response Message

All master messages - except broadcast messages - are responded to by an XtraDrive response message.

Format:

N	A	m	Id1	Id2	Answer	S1	S2	CR

N:

Description: XtraDrive response message start symbol. Constant value.

Range: N

A:

Description: Axis address. The response message holds the same axis address as the original message.

Range: 0x0 – 0xF

m:

Description: Response type.

Range: 0 – Acknowledge (without Fault)

1 – Acknowledge (with Fault)

2 – Response for data request command

3 – Acknowledge with watch variables field

5 – Program upload

Id1 and Id2:

Description: Message Identification in case of Fault (Response type, m = 1). Otherwise (no fault) the Message Identification is set to 0x00 (two bytes for two digits). If a fault is related to a specific command / message, Id1 and Id2 contain the Message Identification as sent by the master.

Since the range is greater than 0xF, two bytes are required for holding the number.

Range: 0x0 – 0xFF. 0x0 – 0xF each

Answer:

Description: XtraDrive response. Can hold acknowledge (ACK) or value as response to Data Request Commands such as GET_VAR. The format of ACK and Data Request Commands are described below.

S1 and S2:

Description: Message checksum (two bytes for two digits). The checksum is calculated by summing all bytes (excluding N and CR) in a message body (see 7.2.2.1, Checksum Calculation).

Range: 0x0 – 0xFF. 0x0 – 0xF each

CR:

Description: Carriage Return. Used as a message response termination symbol. Constant value.

Range: CR (0x0D in ASCII code)

7.2.3.1 Answer Field for Acknowledge (ACK)

A response message is sent either in response to a Data Request command or as a response to the other commands such as ACK. ACK accepts only when Response type m=0,1,3.

ACK format:

F1	F2	SW1	SW2	SW3	SW4

where:

F1 and F2:

Description: Fault Code. Only in cases where Response type m=1. In case of no fault F1 and F2 equal 0x00.

Range: 0x00 – No fault

SW1, SW2, SW3 and SW4:

Description: Status word. 16-bit of bit string holding XtraDrive statuses (see Chapter 10, List of Status Word Bits).

Range: 0x00 – 0xFFFF

7.2.3.2 Answer Field for Data Request Command

A response message is sent either in response to a Data Request command or as a response to the other commands such as ACK. Answer to Data Request command accepts only when Response type m=2. The Answer format depends on the exact command. General format is:

C1	C2	D1	D2	….	Dn

where:

C1 and C2:

Description: Response message Operational Code. C1 and C2 hold the same Operational Code as the original message.

Range: 0x0 – 0xFF. 0x0 – 0xF each (see Chapter 10, List of Operation Codes).

D1 - Dn:

Description: Data field. Number of bytes in data field depends on command type.

Answer Field for GET_VAR Command

C1	C2	Inx_1	Inx_2	V1	V2	V3	V4	V5	V6	V7	V8

C1 and C2:

Description: Response message Operational Code. C1 and C2 hold the same Operational Code as the original message.

Inx_1 – Inx_2n:

Description: variable ID.

Range: See Chapter 9, List of System Variables.

V1 – V8:

Description: variable value.

Answer Field for GET_PAR Command

C1	C2	Inx_1	Inx_2	Inx_3	Inx_4	V1	V2	V3	V4

C1 and C2:

Description: Response message Operational Code. C1 and C2 hold the same Operational Code as the original message.

Inx_1 – Inx_4:

Description: Parameter number reference list in Chapter 5.

V1 – V4:

Description: Parameter value.

Answer field for GET_VERSION Command

C1	C2	V1	V2	V3	V4

C1 and C2:

Description: Response message Operational Code. C1 and C2 hold the same Operational Code as the original message.

V1-V4:

Description: XtraDrive version number with the following format:

V1 . V2 V3 _ V4

Note: V4 can be set only as A or B

For example, XtraDrive with version number 2.80 A will respond with:

C1	C2	2	8	0	A

7.2.3.3 Response Message Format Example

CONTROL ON command

Example of response message to CONTROL_ON command to axis 0 in Immediate mode with message identification of 0x7F.

Format:

N	A	m	Id1	Id2	C1	C2	P1	P2	S1	S2	CR
N	0	2	7	F	4	5	0	1	3	9	CR

Format in cases of no fault:

N	A	m	Id1	Id2	F1	F2	SW1	SW2	SW3	SW4	S1	S2	CR
N	0	0	0	0	0	0	0	4	3	7	C	5	CR

where:

A=0 – axis number 0

m=0 - Response type is acknowledge without Fault

Id1=0; id2 =0 – No fault, so message identification is 0x00.

F1=0; F2 =0 – No fault, so fault code is 0x00

SW1=0; SW2=4; SW3=3; SW4=7 – Shows XtraDrive status. No emergency, no fault, control on and in position (see Chapter 10, List of Status Word Bits).

S1=C; S2=5

0x100–(00+00+00+0x04+0x37)= 0xC5

MOVE Command

Example of response message to MOVE <600> <1000> command (600uu in 1000 msec), of axis 0 in Sequential mode, with message identification of 0x96 when control is off. Since a motion cannot be executed when CONTROL_OFF, fault 0x8C occurs.

Master Message Format:

N	a	M	Id1	Id2	C1	C2	P1	P2	P3	P4	P5	P6	P7	P8
N	0	3	9	6	7	1	0	0	0	0	0	2	5	8

P9	P10	P11	P12	P13	P14	P15	P16	S1	S2	CR
0	0	0	0	0	3	E	8	B	1	CR

Response Message Format in case of fault:

N	a	m	Id1	Id2	F1	F2	SW1	SW2	SW3	SW4	S1	S2	CR
N	0	1	9	6	8	C	0	4	3	3	A	6	CR

where:

a=0 - axis number 0.

m=1 - Response type is Acknowledge with Fault.

Id1=9; Id2 =6 – Because of fault message identification, Id1 and Id2 contain the same value as master message identification.

F1=8; F2 =C – Fault code.

SW1=0; SW2=4; SW3=3; SW4=3 – Shows XtraDrive status. No emergency, no fault (Status word fault only represents XtraDrive hardware faults marked as A.##), control off and in position (see Chapter 10, List of Status Word Bits).

S1=A; S2=6

0x100–(0x01+0x96+0x8C+0x04+0x33)= 0xA6

Response message format in case of no fault:

N	a	m	Id1	Id2	F1	F2	SW1	SW2	SW3	SW4	S1	S2	CR
N	0	0	0	0	0	0	0	4	3	7	C	5	CR

GET_VAR command

Example of response message to GET_VAR command to variable Position_Actual_value (0x09) to axis 0 in Immediate mode with message identification of 0x7F.

Master Message Format:

N	A	m	Id1	Id2	C1	C2	P1	P2	S1	S2	CR
N	0	2	6	5	4	8	0	9	4	8	CR

Response Message Format in cases of no fault:

N	a	m	Id1	Id2	C1	C2	Inx_1	Inx_2	V1	V2	V3	V4	V5	V6	V7	V8	S1	S2	CR
N	0	2	6	5	4	8	0	9	F	F	F	F	F	0	6	0	F	A	CR

where:

a=0 - axis number 0.

m=2 - Response type is Answer for data request command.

Id1=6; id2 =5 – Message identification contains the same value as master message identification.

C1=4; C2=8 - Response message Operational Code.

Inx_1=0; Inx_2=9 - Variable Position_Actual_value ID.

V1-V8 = FFFFF060 - Variable value. Since Position_Actual_value is signed and the leftmost bit is 1, the number is negative and equals (–4000) decimal.

S1=3; S2=D

0x100–(0x02+0x65+0x48+0x09+0xFF+0xFF+0xF0+0x60)= 0xFA

7.3 Troubleshooting

Problem	Possible Cause	Solution
Unable to establish communication with XtraDrive	Communication cable does not match XtraDrive requirements	See cable schema in XtraDrive User Manual, Appendix C.11
	Communication setting is different than XtraDrive requirements.	See Section 4.1.1, Communication Settings
	XtraDrive axis address is different than the one referred to by the master.	Match axis address (**a** – second byte) to XtraDrive axis address (Pn000.2)
	XtraWare (or any other program that communicates with the COM port) is on-line.	Close all programs that communicate with COM port
The response message format or value is different than expected.	The response message which accepts Data Request Commands response does not necessarily match the master command. Data Request Command response will match the master command unless a fault was occur and then fault acknowledgment will accepted before.	To accept a specific response message, write a loop with POLLING command (Command Operational Code 0x00) until the appropriate response message is accepted.
	After a variable has been watched in the XtraWare variable watch-window (even if XtraWare is no longer open), message response type is changed to 3 (m=3) and the message format holds the variable value as well.	To delete a variable from the watch list, set XtraWare to On-line mode. Delete the desired variable(s) and return to Off-Line mode. If XtraWare is closed, rerun the program and go On-Line and then Off-Line.
No checksum value accepted on the response message.	Pn2C6 setting is different than 0x0001.	Set Pn2C6=0001 and reset XtraDrive.

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.
4	Too many program lines or invalid program line number	The program line number is either zero or greater than 100.
5	Message checksum error	An incorrect checksum indicates that an error occurred during message transmission.
6	SET_VAR: Invalid variable 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	Wrong op code	This command does not exist in the command list.
9	Wrong motion mode for SET_ZERO_POSITION command. Set STOP_MOTION command before	This command cannot be performed if the Motion Command buffer is not empty, or if a motion is in progress.
10	Reply buffer full	The reply buffer is full because the command GET_VAR is used in very high rate.
11	Incomplete message received	The time limit for the message to be sent to XtraDrive via serial communication has been exceeded.
12	Message too long	The size of a message sent to XtraDrive via serial communication is limited to 64 characters.
13	C-phase parameter not set	C-phase is not defined by Pn190.
14	Invalid input assignment	A digital input is configured for more than one function.
15	Invalid output assignment	A digital output is configured for more than one function.
16	Selected traced I/O not in use	The digital I/O selected is not defined as an event.
17	Command prohibited in present control method	Incorrect operation mode for serial command. Set parameter

Code	Message	Description
		Pn000.1=D.
18	Parameter storing fault during autotuning	Contact your distributor or YET representative.
19	Parameter storing fault	Contact your distributor or YET representative.
20	Motor moving during CONTROL_ON	XtraDrive has detected that the motor is moving while performing the first CONTROL_ON after power up.
22	Autotuning available in Programming Command mode only	Autotuning is available in Serial Command mode only. Change the working mode by setting [Pn000.1 = D].
23	Program already running	The requested program cannot be run since another program is already running.
24	Variable does not exist	
25	Wrong user units setting	
26	Wrong setting profile Speed Acceleration or Jerk	
27	Invalid parameter	
28	EEPROM read buffer full	
31	Home Command: Both speeds are in the same direction	
33	HARD_HOME: Torque exceeded torque limits	
34	Unable to download/delete program	
64	A.02: parameter breakdown	
65	A03: Main circuit encoder error	
66	A04: Parameter setting error	
67	A05: Servomotor and amplifier combination error	
68	A10: 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	

Code	Message	Description
77	A74: Overload of surge current limit resistor	
78	A7A: Heat sink overheated	
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	Reference to invalid label or END command is missing	Program flow has been directed to a non-existent label.
129	Command not applicable in this programming mode (Program/Immediate/Sequential)	Not all commands are applicable in all programming modes (Program/Sequential/Immediate). The specified command is not applicable in this mode.
130	Cannot perform this motion with present profile acceleration	The requested motion cannot be performed. The specified motion time is too short for the specified acceleration.
131	Cannot perform this motion with present profile speed	The required speed for this motion is greater than the maximum motor speed. Set a lower motion speed.
134	Too low speed	The speed is too low for specified motion.

Code	Message	Description
135	SET_VAR: Variable value 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	Moving time is too short with present profile Jerk time	The specified jerk time exceeds the maximum of 64000 msec.
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 CONTROL_OFF	The motion cannot be executed while the motor is disabled. Make sure the motor is enabled (CONTROL_ON) before issuing the motion command.
141	TORQUE LIMITS: Invalid torque limits	The maximum torque limit is smaller than the minimum torque limit.
142	Invalid or duplicated label	The label number is either zero or greater than the maximum line number.
143	Invalid input number	The input referred to in the command is not defined as an event.
144	Invalid output number	Invalid output index in the SET_OUT command.
146	Autotuning already in progress	The Autotuning process is already in progress. It cannot be restarted till the process ends.
149	Unable to switch CONTROL_ON	
151	Positive Over Travel	
152	Negative Over Travel	
	Can't perform motion. Reconfigure New move enable digital input (Pn2D1.1)	
255	Fault buffer full	Contact your distributor or YET representative.

9. List of System Variables

Name	Variable ID (Dec)	Unit	Read Only	Min	Max	Description	Group
Analog_Speed	42	0.1 % of max	Yes	-2147483648	2147483647	Motor speed when an analog input is used as a reference speed	Others
Analog_Torque	41	0.1 % of max	Yes	-2147483648	2147483647	Motor torque when an analog input is used as a reference torque	Others
Application_gain	27	%	Yes	0	1000	Gain factor. Can be changed during application running	Others
CCW_Torque_limit	20	0.1 % of max	Yes	-1000	1000	Maximum torque to be applied, in CCW direction as % of the torque limit set by Pn403	Torque Mode and Torque Related
Clock	37	ms	No	-2147483648	2147483647	System clock	Others
Command_mode	26		Yes	1	2	Mode of execution of command (1 - Sequential, 2 - Program)	Others
CW_Torque_limit	19	0.1% of max	Yes	-1000	1000	Maximum torque to be applied, in CW direction as % of the torque limit set by Pn402	Torque Mode and Torque Related
Exact_mode	25		No	0	1	Defines the ending mode of motion commands	Others
Follower_position_offset	39	Position Units	Yes	-2147483648	2147483647	(Pulse_train_position - Position_demand_value)	Others
Follower_synchronized	39		Yes	0	1	Flag, 1- Synchronized, 0- Not synchronized	Others
Following_error_actual_value	10	Position Units	Yes	-2147483648	2147483647	(Position_demand_value - Position_actual_value)	Motion Command Variables
Inputs_State	33		Yes	-2147483648	2147483647	Input ports state (Decimal representation of a Binary number: 1-ON, 0-OFF)	Others
Jerk_smoothing_time	7	us	Yes	-2147483648	2147483647	Time constant of filter on acceleration.	Motion Command Variables
Max_profile_acceleration	4	Acceleration Units	Yes	-2147483648	2147483647	Maximum absolute acceleration value during Motion Commands	Motion Command Variables
Max_profile_velocity	2	Speed Units	Yes	-2147483648	2147483647	Maximum absolute speed value during Motion Commands	Motion Command Variables
Modes_of_operation	23		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	30	Position Units	No	0	255	Window for Following_error_actual_value	Others
Motion_go	24		Yes	0	1	Flag to trigger the execution command in Motion buffer (used with WAIT_FOR_START, START)	XD Control
Outputs_State	34		Yes	-2147483648	2147483647	Output ports state (Decimal representation of a Binary number: 1-ON, 0-OFF).	Others

Name	Variable ID (Dec)	Unit	Read Only	Min	Max	Description	Group
Override New Move Enable	58		No	0	1	Specifies the functioning of New Move Enable digital input (Pn2D1.1). 0 - Input functions as setup; 1 - Input ignored	
Position_actual_value	9	Position Units	Yes	-2147483648	2147483647	Motor position in User Units, as read from encoder	Motion Command Variables
Position_demand_value	8	Position Units	Yes	-2147483648	2147483647	Present target position. It is updated every servo cycle	Motion Command Variables
Profile_acceleration	5	Acceler ation Units	Yes	-2147483648	2147483647	Absolute acceleration value during Motion Commands	Motion Command Variables
Profile_velocity	3	Speed Units	Yes	-2147483648	2147483647	Absolute speed value during Motion Commands	Motion Command Variables
Program_line	45		Yes	-2147483648	2147483647	Holds the last Program line	Motion Command Variables
Resonance_frequency	56	Hz	Yes	0	65535	System resonance frequency. Works only when OCA is activated (Pn2D4.0)	Others
Sensor_WVU	21		Yes	0	111	Hall sensors inputs (when motor on hall sensor W, variable equals 100; on V, 010; on U 001)	Digital I/O
Servo_cycle_time	29	0.1 us	Yes	-2147483648	2147483647	Servo cycle time	Others
Speed_reference	43	Velocity Units	No	-2147483648	2147483647	Defines reference speed for speed control command	Others
Target_position	1	Position Units	Yes	-2147483648	2147483647	Final destination of Motion Commands	Motion Command Variables
Target_torque	16	0.1% of rated	Yes	-1000	1000	Torque Command	Torque Mode and Torque Related
Target_velocity	13	Velocity Units	Yes	-2147483648	2147483647	User velocity command	Speed Control Variables
Torque_demand_value	17	0.1% of rated	Yes	-1000	1000	Actual value for torque	Torque Mode and Torque Related
User_encoder	31	Encoder Units	Yes	-2147483648	2147483647	Motor position in Encoder Units, as read from encoder	Motion Command Variables
Velocity_actual_value	12	Velocity Units	Yes	-2147483648	2147483647	Motor speed in User Units, as derived from encoder	Speed Control Variables
Velocity_demand_value	11	Velocity Units	Yes	-2147483648	2147483647	Present target speed; updated every servo cycle	Speed Control Variables

10. List of Status Word Bits

A status word is a 16-bit string containing the current XtraDrive status. Use the POLLING command to get a status word. An acknowledge (ACK) message also contains a status word.

Bit	Term	Comment
0	Ready to Switch On	Always 1
1	Switched On	0 Emergency ON; 1 Emergency OFF
2	Operation Enabled	0 Control OFF; 1 Control ON
3	Fault	0 No Fault; 1 Fault A.##
4	Voltage disabled	Always 1
5	Quick Stop	1 only while stopping
6	Switch On Disabled	Always 0
7	Warning	0 No warning; 1 Warning (Over torque...)
8	Manufacturer specific. (Ready for start)	1 only while waiting to START command
9	Remote	Always 0
10	Target Reached	Profile position mode: 1 only while Velocity_demand_value =0 AND Position error < Pn500 Profile velocity mode – 1 when Target speed reached Profile torque mode – 1 when Target torque reached
11	Internal Limit Active	1 motor on Over Travel switch
12	Operation Mode Specific	On homing mode: 0 while homing; 1 After homing. On speed mode (SLIDE): 0 speed != 0; 1 speed = 0
13	Operation Mode Specific	On homing mode: 0 No homing error; 1 Homing error.
14	Manufacturer specific (program run)	0 No program running; 1 Program running
15	Manufacturer specific (need restart)	1 Need restart

11. List of Operation Codes

Op-Code	Name	Mode of Operation[1]	Arg 1[2]	Arg 2[2]	Arg 3[2]	Arg 4[2]	Arg 5[2]
64	ACCELERATION	2;3;4	4 U	-	-	-	-
66	CALL	4	1 U	-	-	-	-
69	CONTROL	2;3;4	1 U	-	-	-	-
144	DELAY	3;4	4 U	-	-	-	-
70	END	2;4	-	-	-	-	-
71	GAIN	2;3;4	2 U	-	-	-	-
106	GET_DRIVER_INFO	2	-	-	-	-	-
85	GET_PAR	2;3;4	2 U	-	-	-	-
72	GET_VAR	2;3;4	1 U	-	-	-	-
63	GET_VERSION	2	-	-	-	-	-
112	GO	3;4	4	4	-	-	-
128	GO_D	3;4	4	4	-	-	-
117	GO_H	3;4	4	-	-	-	-
73	GO_TO	4	1 U	-	-	-	-
131	HARD_HOME	3;4	2	4	-	-	-
133	HOME_C	3;4	4	-	-	-	-
132	HOME_SW	3;4	4	4	-	-	-
130	HOME_SW_C	3;4	4	4	-	-	-
105	IF	4	1 U	1 U[3]	4	1 U	1 U
108	IF_INPUT	4	1 U	1 U[3]	1 U	1 U	1 U
97	INPUT_CASE	4	4 U	4 U	-	-	-
74	JERK_TIME	2;3;4	4 U	-	-	-	-
88	LABEL	4	1 U	-	-	-	-
75	LOOP	4	2 U	4 U	1 U	-	-
113	MOVE	3;4	4	4	-	-	-
129	MOVE_D	3;4	4	4	-	-	-
118	MOVE_H	3;4	4	-	-	-	-
119	MOVE_R	3;4	4	-	-	-	-
0	POLLING		-	-	-	-	-
101	PT_FOLLOWER	3;4	1 U	-	-	-	-
77	RETURN	4	-	-	-	-	-
78	RUN	2;3	1 U	-	-	-	-
79	SET_OUT	2;3;4	1 U	1 U	-	-	-
80	SET_PAR	2;3	2 U	2 U	-	-	-
81	SET_VAR	2;3;4	1 U	4	-	-	-
95	SET_ZERO_POSITION	2;3;4	-	-	-	-	-
115	SLIDE	3;4	4	-	-	-	-
102	SLIDE_ANALOG	3;4	-	-	-	-	-
83	SPEED	2;3;4	4 U	-	-	-	-
100	SPEED_CONTROL	3;4	1 U	-	-	-	-
82	START	4	-	-	-	-	-
84	STOP	2;3;4	1 U	-	-	-	-
99	STOP_MOTION	2;3;4	-	-	-	-	-
116	TORQUE	3;4	2	-	-	-	-
103	TORQUE_ANALOG	3;4	-	-	-	-	-
87	TORQUE_LIMITS	2;3;4	2	2	-	-	-
145	WAIT_EXACT	3;4	4	-	-	-	-

Op-Code	Name	Mode of Operation[1]	Arg 1[2]	Arg 2[2]	Arg 3[2]	Arg 4[2]	Arg 5[2]
146	WAIT_FOR_START	3;4	-	-	-	-	-
109	WAIT_INPUT	3;4	1 U	1 U[3]	1 U	4	-
148	WAIT_STOP	3;4	4	-	-	-	-
110	WAIT_VAR	3;4	1 U	1 U[3]	4	-	-

(1) Mode of operation: 2 Immediate; 3 Sequential; 4 Program; U Unsigned integer.

(2) Argument size. Number of data bytes of each argument. Each byte is 2 hexadecimal digits, e.g. 01011111 = 5Fx0

(3) Condition codes:

Sign	Condition	Setting
=	Equal to	0
>	Greater than	1
<	Smaller than	2
>=	Greater than or equal to	3
<=	Smaller than or equal to	4
!=	Not equal to	5

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