



# **ServoStudio 2**

# **Reference Manual**

## **CDHD2 Servo Drive**

## **DDHD Dual Drive**

ORIGINAL DOCUMENT  
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# 1 Introduction

## 1.1 ServoStudio 2 Overview

ServoStudio 2 is a graphical user interface (GUI) supplied with the drive to enable setup, configuration and tuning of the servo drive. ServoStudio 2 allows you to configure parameters for the motor to which the drive is connected and for the particular operation the drive will perform in the machine.

ServoStudio 2 is the recommended tool for commissioning the drive. It provides several methods for setting up the drive servo drive.

- **Wizards:** Several wizards guide you through a sequence of steps to configure and optimize parameters for your specific motor, drive and application.
- **Task screens:** Individual screens allow you to access and define specific parameters and functions.
- **Terminal screen:** A command line interface that allows you to send instructions to the drive, and read the drive's responses.

## 1.2 ServoStudio 2 Product Support

The CDHD servo family version of ServoStudio 2 is compatible with the following products:

- **CDHD:** all models, firmware version 1.41.xx and later
- **CDHD2:** all models, firmware version 2.15.x and later
- **DDHD:** AF, AP models, firmware version 1.41.xx and later
- **DDHD:** EtherCAT model, firmware version 2.15.x and later

## 1.3 Documentation Format

This documentation describes the user interface menus and options in ServoStudio 2.

**Note** Options displayed in the software may differ from those shown in this documentation, depending on the state of communication (online/offline) or the type of drive detected by the software (e.g., DDHD, EtherCAT, CANopen).

**Note** When the software is communicating with the drive, either CANopen or EtherCAT is displayed, according to the actual type of drive in use.  
When offline, the type of drive displayed has no effect on software behavior.

For detailed instructions on operating and tuning the drive, refer to the drive's user manual.

For detailed information on setting and using drive ASCII parameters, refer to the drive's VarCom documentation.

For detailed information on configuring and operating the drive in EtherCAT or CANopen networks, refer to the drive's EtherCAT/CANopen documentation.

## 2. Software Setup

Refer to [Host Computer System](#) in the drive user manual.

### 2.1 Computer Requirements

Computer requirements for ServoStudio 2 are specified in [Host Computer System](#) in the drive user manual.

### 2.2 Software Installation

#### 2.2.1 ServoStudio 2 Installation

ServoStudio 2 software installation instructions are detailed in [Host Computer System](#) in the drive user manual.

#### 2.2.2 USB Driver Installation

The first time the CDHD2 is connected to the host computer's USB port, Windows may display a **Found New Hardware** wizard and prompt you to select the **Drivers** folder.

USB driver installation instructions are detailed in [Host Computer System](#) in the drive user manual.

### 2.3 Serial Connection

A serial RS232 or USB connection is required for commissioning the drive through ServoStudio 2. Once the drive is configured, you can then connect it to a PLC or controller over a CANopen or EtherCAT network.

After drive factory settings are restored (Motor Setup screen), ServoStudio 2 may prompt you to confirm or change the command interface mode.

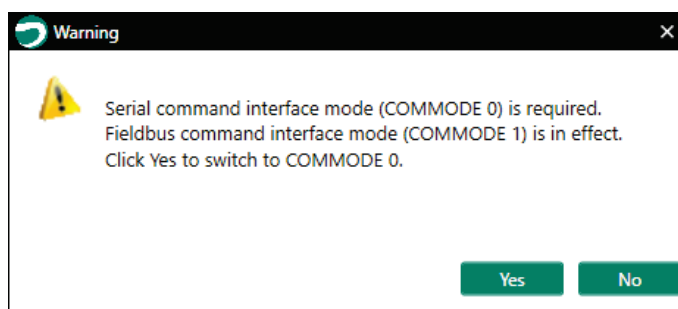


Figure 2-1. Command Interface Mode

**Note**

- **COMMODE 0.** Serial RS232/USB communication enabled.
- **COMMODE 1.** CANopen/EtherCAT (fieldbus) communication is enabled.

To switch to **serial** command interface mode (COMMODE 0), press **Yes**.

## 2.4 Drive Selection

ServoStudio 2 software supports several types of Servotronix drives.

If your system uses a **DDHD** drive (firmware version 2.15.x and later), select the CDHD2 option.

The selected drive can be changed through the **Drive in Use** at the top of screen. Switching the drive will cause the software to close and restart with the new drive type.

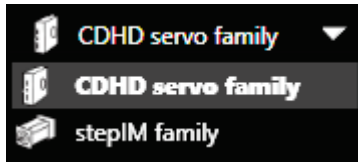


Figure 2-2. Drive in Use Option (in top menu)

**Note** Options displayed in the software may differ from those shown in this documentation, depending on the type of drive detected by the software (e.g., **DDHD**, EtherCAT, CANopen).

### 3. Software Interface Elements

#### 3.1 ServoStudio 2 Screen Components

The ServoStudio 2 software window has five main function areas:

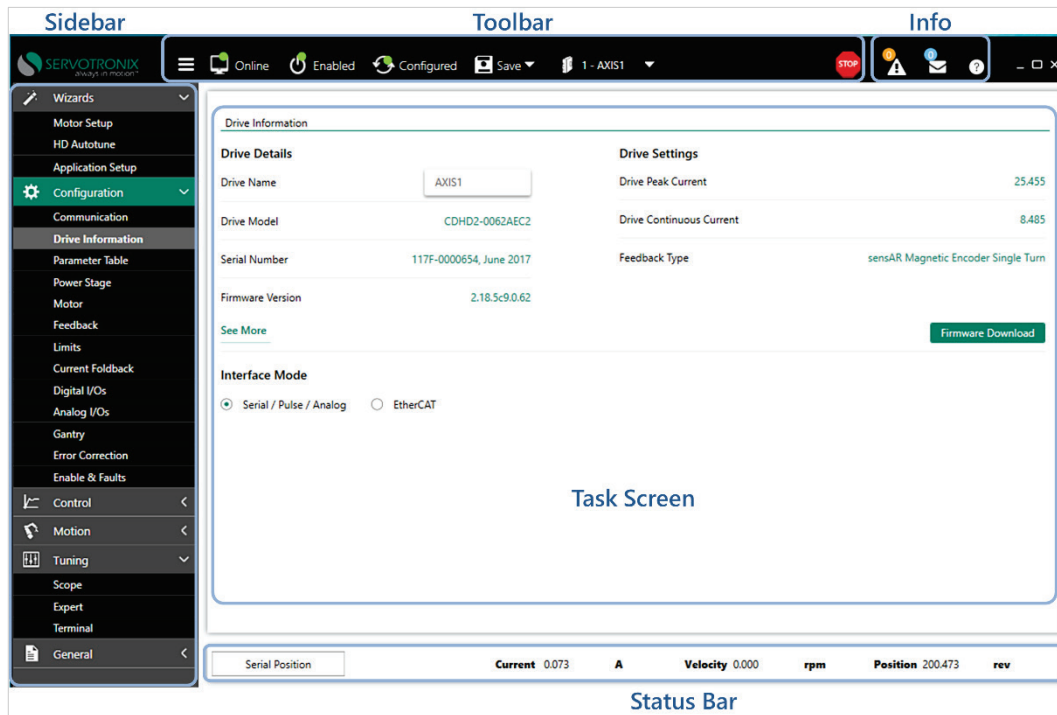


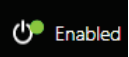
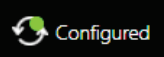
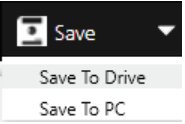
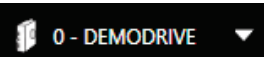






Figure 3-1. ServoStudio 2 Software Interface

	<b>Toolbar</b>	Contains quick access buttons for frequently used functions.
	<b>Sidebar Show/Hide</b>	Opens/closes the sidebar, which contains the navigation menu.
	<b>Offline   Online</b>	Toggles ServoStudio 2 communication with the drive off and on, and indicates the state of the connection. <ul style="list-style-type: none"> <li>• <b>Offline mode:</b> ServoStudio 2 does not attempt to communicate with the drive. Red icon.</li> <li>• <b>Online mode:</b> ServoStudio 2 continually communicates with the drive to read parameters and status. Green icon. Online status is also indicated by the display of the connected drive’s name (if defined) and address.</li> </ul> <p><b>Note:</b> It is recommended to switch to Offline mode before physically disconnecting the drive or powering off the drive.</p>

	<b>Enabled   Disabled</b>	Enables and disables the drive, and indicates the state of the drive. Icon is <b>green</b> when the drive is enabled (active); it is <b>red</b> when the drive is disabled (inactive).
	<b>Configured</b>	Triggers the internal drive configuration. VarCom <b>CONFIG</b> . The CONFIG command is required after certain parameters are modified.
	<b>Save to Drive   Save to PC</b>	Use <b>Save</b> after configuring parameters to keep values in non-volatile memory. <ul style="list-style-type: none"> <li>• <b>Save to Drive</b> saves the parameter values currently in the drive RAM to the drive's non-volatile memory. These values will be loaded to drive RAM at power-up. VarCom <b>SAVE</b>.</li> <li>• <b>Save to PC</b> saves the parameter values to a backup file on the host computer.</li> </ul>
	<b>Drive in Use</b>	Shows the drive selected for use or detected. To switch to another drive, press the down arrow, and select another drive from the displayed list. If more than one drive is connected on a serial Daisy chain, those drives all appear in the list.
	<b>Stop</b>	Emergency stop.
	<b>Info</b>	
	<b>Faults/Warnings</b>	Indicates faults and warnings currently in effect. Click the icon to view the fault messages. Click <b>Clear Fault</b> to send a clear faults command (CLEARFAULTS) to the drive.
	<b>Messages</b>	Notifications from ServoStudio 2 that do not require immediate attention. Click the icon to view messages. Click <b>Clear All</b> to delete all messages in the log.
	<b>Help</b>	Online help for drive software and hardware. In addition, use <b>F1</b> or the right-click shortcut menu to activate Help for the currently selected field.
	<b>About</b>	Software version information.
	<b>Sidebar</b>	Contains a navigation menu to the various ServoStudio 2 screens.
	<b>Task Screen</b>	Displays various interactive screens for viewing, setting and testing parameters and drive configurations.
	<b>Status Bar</b>	Displays the status of the drive.
	<b>Operation Mode</b>	Indicates the currently defined operation mode.
	<b>Current</b>	Motor current. VarCom <b>I</b> . Shows the equivalent motor current.

	<b>Velocity</b>	Motor velocity. VarCom <b>V</b> . Shows the velocity value measured by the feedback device (on motor or load), as defined by the secondary feedback mode.
	<b>Position</b>	Motor position. VarCom <b>PFB</b> . Shows the position value of the feedback device (on motor or load) as defined by the secondary feedback mode, and includes any offsets and error corrections that may have been added.

### 3.2 Help

Right-click on any field, button or menu item in ServoStudio 2 to open a Help shortcut menu. The shortcut menu provides access to the most common functions associated with the selected element, depending on context.

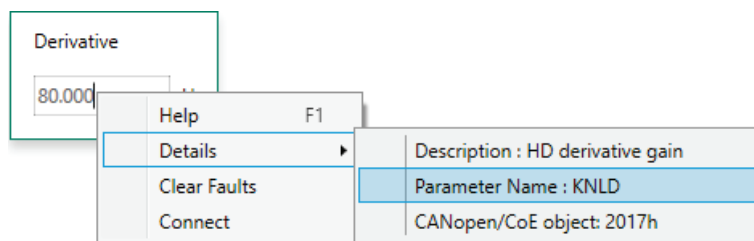


Figure 3-2. Right-Click Help Shortcuts

<b>Help</b>	F1. Activates online help for the currently selected screen element.
<b>Details</b>	<b>Description.</b> A brief description of the parameter. <b>Command Name.</b> The VarCom equivalent. <b>CANopen Index.</b> The comparable CANopen object.
<b>Clear Faults</b>	Displayed when faults exist. Sends a clear faults command ( <b>CLEARFAULTS</b> ) to the drive.
<b>Enable   Kill</b>	Toggles the Enable/Disable state of the drive. VarCom <b>EN</b> and <b>K</b> .

### 3.3 Command Entry

ServoStudio 2 provides two methods that reduce the need for command memorization and keyboard input:

- **Autocompletion.** An autocompletion system (IntelliSense) allows you to access variable and commands, and descriptions of their functions. IntelliSense can be disabled in the Preferences screen or in the Terminal shortcut menu.

When you begin typing a command, a list of available drive parameters is displayed based on the characters typed.

- **History.** Use the **Up** arrow key to show a list of all command strings that have been sent to drive in the current working session; that is, since ServoStudio 2 was last opened.

```

drivename
"DEMO-2
-->motorname
"P2-06A23035S30D
-->menctype
6
-->feedbacktype
12
-->

```

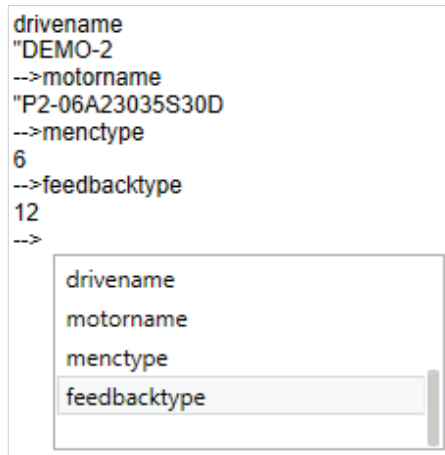


Figure 3-3. History

When a command in the autocomplete or history list is highlighted:

- Press **Enter** to send the command to drive.
- Press **spacebar** to edit the command.

### 3.4 Parameters

Refer to the chapter [Parameters](#) in the drive user manual.



**Disable the drive before manipulating motor and feedback parameters.**

Many parameters can be modified while the drive is enabled.

Exercise caution, however, as motor behavior will change.

If a parameter cannot be modified while the drive is enabled, ServoStudio 2 will prompt you to disable the drive.

### 3.5 Data Entry

Throughout ServoStudio 2, you will work with fields containing configurable (read/write) drive parameters.

Whenever you begin entering a parameter value, the field turns blue.

After entering or modifying a value, press **Enter** to send the value to the drive RAM.

- If the value entered is valid, the field reverts to white.
  - The displayed format of the value might be slightly different than what you entered; for example, if you enter 10, the drive might return 10.00.
- If the value entered is invalid, the last valid value is displayed.

Gray fields are read-only; the displayed values cannot be modified.

Drive parameters may be saved to the drive's non-volatile memory at any time by pressing the **Save** button on the toolbar. If not saved, modified parameter values are lost upon power cycle.

### 3.5.1 Schematics

ServoStudio 2 uses schematic diagrams to help you visualize and correctly set values for required parameters.

Hover over a parameter field to view its description and VarCom name.

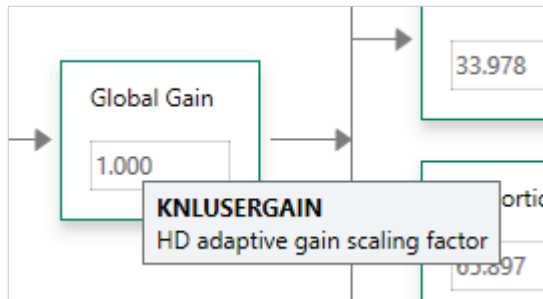


Figure 3-4. Schematic Tooltip

Some of the fields in these screens are read-only. Their values are entered automatically according to the motor defined in the Motor screen and/or settings defined elsewhere in the software.

Other fields in these schematic screens are configurable (read/write).

After entering or modifying a value, press **Enter** to send the value to the drive RAM.

### 3.5.2 Parameter Tables

A parameter table **tab** appears in various ServoStudio 2 screens, such as Scope, Expert, and Motor. It displays and allows you to modify parameters relevant to the operation mode in effect. The parameter table in the Motor screen does not allow modification of parameter values, except for motors defined as User Motors. This section describes the use and behavior of these parameter table tabs/panes.

ServoStudio 2 also includes a **screen** called Parameter Table, which provides access to most of the drive parameters. Its use and behavior differ from the parameter table tab/panes. For details, refer to the chapter *Parameter Table*.

For each parameter (variable), the parameter table tabs present the following information:

<b>Parameter</b>	Definition of the parameter (variable).
<b>Value</b>	The value currently in the drive working memory. You can modify a parameter value and press <b>Enter</b> to send the new value to the drive RAM. Alternately, use <b>Write to Drive</b> to send all displayed parameters to the drive RAM.
<b>Unit</b>	Unit of the variable.

Hover over the parameter definition to view the VarCom (ASCII) name.

Parameter	Value	Unit
Acceleration	60000.000	rpm/s
HD Current Filt Low Pass Rise Time	0.935	ms
HD Current Filter Damping	85	%
HD Current Filter Notch Bandwidth	300	Hz
HD Current Filter Notch Center	1333	Hz
HD Derivative Gain	116.928	Hz
HD Derivative-Integral Gain	38.598	Hz
HD Flexibility Compensation Gain	5000.000	Hz
HD Global Gain	1.000	

Figure 3-5. Parameter Table Tooltip

Right-click on a parameter line to view more information and options.

Current BEMF Compensation Gain	1.200		
Current BEMF Compensation Gain	0.800		
Current BEMF Compensation Gain	0.050		
Current BEMF Compensation Gain	0.000		

- Help F1
- Edit
- Save To File
- Details
- Enable

Description : The current controller feedforward gain

Parameter Name : KCFF

CANopen/CoE object: 2082h

Min Value : 0

Max Value : 100

Figure 3-6. Parameter Table – Right-Click Info

ServoStudio 2 provides a blank line at the bottom of the table that lets you add any configurable parameter defined in the firmware (VarCom) and assign a value to it.

To add a parameter to the table, enter the VarCom (ASCII) name. ServoStudio 2 automatically displays the definition, and adds a new blank line at the end of the table.

Depending on the context and changes already made in the parameter value, some or all of the following options will be displayed.

<b>Help</b>	<b>F1.</b> Activates online help for the currently selected screen element.
<b>Edit</b>	Opens an Edit Parameter dialog box that contains the essential functions provided in the Scope and Expert screens to facilitate tuning of motion parameters. Options enable automatic and consistent intervals for adjusting parameter values.
<b>Save to File</b>	Saves the parameter table of the specific screen to a text file, for reference purposes only. Default location is: \<My Documents>\ServoStudio 2
<b>Enable   Kill</b>	Toggles the Enable/Disable state of the drive. VarCom <b>EN</b> and <b>K</b> . This option is displayed when modification of the parameter value requires the drive to be in the disabled state.
<b>Details</b>	<b>Description.</b> A short description of the parameter. <b>Parameter Name.</b> The VarCom (ASCII) parameter name. <b>CANopen/CoE object.</b> Where applicable, the index of the equivalent CANopen/EtherCAT object. <b>HMI Number.</b> The code used to display and modify the parameter on the HMI panel of the CDHD2. <b>Min/Max Value.</b> The minimum and maximum values allowed for the parameter.

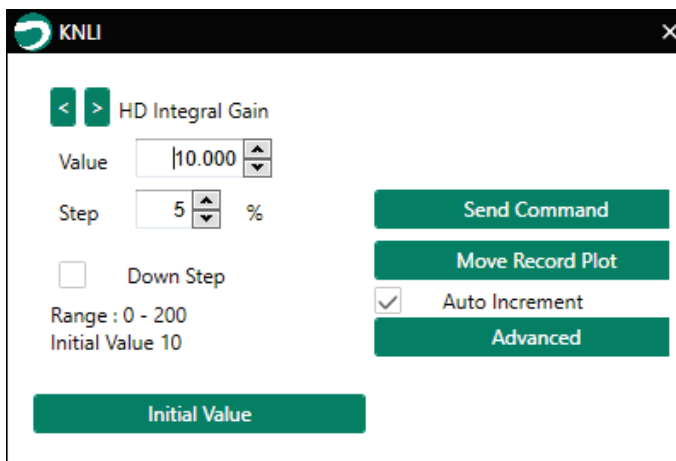


Figure 3-7. Parameter Table – Edit Parameter Dialog Box (only in Scope/Expert screen tabs)

<b>&lt; &gt;</b>	Click the left and right arrows to scroll to and access the values for each of the parameters in the table.
<b>Value</b>	The value of the parameter currently in the drive. Click the arrows to increase or decrease the value, according to the define Step percentage.
<b>Step</b>	Defines the percentage for incrementing or decrementing the parameter value.
<b>Down Step</b>	Defines whether the parameter is incremented or decremented in each step.
<b>Initial Value</b>	Restores the value of the parameter that was in effect before the Edit function was activated.

<b>Send Command</b>	Sends the currently displayed value to the drive.
<b>Move Record Plot</b>	Moves, records and plots the motion according to the newly entered value.
<b>Auto Increment</b>	If selected, the value is incremented according to the Step value.
<b>Advanced</b>	Displays two additional options: <b>Show Previous.</b> Displays the previously displayed trace in addition to the currently displayed trace. <b>Show Reference.</b> Displays the trace previously saved as a reference.

## 3.6 Wizards

ServoStudio 2 includes wizards, or interactive utilities, that guide you through complex tasks.

- **Motor Setup** wizard guides you through a procedure that results in the basic configuration of parameters for a motor without load. Refer to *Motor Setup Wizard*.
- **Autotuning** wizard guides you through a procedure that will automatically tune a position control loop and optimize drive parameters for a motor with load, based on the source of the motion command. Refer to *Autotuning Wizard*.
- **Application Setup** wizard guides you through a procedure that will set drive parameters for your specific application, based on the type of interface used for transmitting motion commands, Refer to *Application Setup Wizard*.
- **New Motor** wizard is a series of dialog boxes that allow you to define a motor and its set of parameters. Refer to *New Motor Wizard*.

## 4. Motor Setup Wizard

Refer to the [Motor Setup](#) in the drive user manual.

It is recommended that you use the ServoStudio 2 **Motor Setup Wizard** when connecting the drive for the first time.

The **Motor Setup Wizard** provides the quickest and easiest method for getting the drive up and running. It configures the essential parameters and the current control loop.

If the drive system includes an electronic motor nameplate (e.g., PRO2 motor with sensAR magnetic encoder), certain motor and feedback parameters are transferred directly to the drive after power-up, and cannot be manipulated.

Also refer to the following sources:

	Step	Refer to the screen descriptions in the ServoStudio 2 manual	Refer to the instructions in the CDHD2 user manual
1	<b>Connection</b>	<i>Communication</i>	<a href="#">Communication</a>
2	<b>Drive Information</b>	<i>Drive Information</i>	<a href="#">Drive Identification</a>
3	<b>Motor Selection</b>	<i>Motor</i>	<a href="#">Motor Identification</a>   <a href="#">Motor Initialization</a>
4	<b>Limits</b>	<i>Limits</i>	<a href="#">Current Limits</a>   <a href="#">Velocity Limits</a>   <a href="#">Position Limits</a>
5	<b>Motor Direction</b>		<a href="#">Motor Direction</a>
6	<b>Save</b>	<i>Backup &amp; Restore</i>	

### 1. Motor Setup – Connection

If ServoStudio 2 is already communicating with the drive, this step is not included in the Motor Setup procedure.

### 2. Motor Setup – Drive Information

This step includes an option to reset drive parameters to the original factory settings: Restore Factory Default.

### 3. Motor Setup – Motor Selection

If the drive detects an electronic motor nameplate, the parameters in this screen are set automatically and cannot be manipulated. Press **Next** to continue to the next step.

If the drive does not detect an electronic nameplate, or if the software is not communicating with the drive, you can select a motor from the ServoStudio 2 database (library), or use the option **Define New Motor** to set parameters for any other motor.

### 4. Motor Setup – Limits

The wizard suggests Low, Medium or High limit values for current and velocity, which are equivalent to 25%, 50% and 100%, respectively, of the maximum range. It also allows you to set the maximum value that will not produce a position error fault. You can select one column, or set your own values.

#### 5. Motor Setup – **Motor Direction**

If the drive detects an electronic motor nameplate, this step is not included in the Motor Setup procedure.

If the drive does not detect an electronic nameplate, or if the software is not communicating with the drive, this step defines the rotational direction for a movement command.

#### 6. Motor Setup – **Save**

When the Motor Setup is completed, it is recommended that you save parameters to the drive's non-volatile memory and to a file on the host computer for backup. It is also recommended that you create a report.

## 5. Autotuning Wizard

The drive design includes a proprietary (HD) nonlinear position control algorithm that is designed to minimize position error during motion and to minimize settling time at the end of motion. The ServoStudio 2 Autotuning wizard is used to set HD control parameters for a motor with load.

The setting and optimization of parameters by the Autotuning wizard may be either drive-based or PC-based:

- If an electronic motor nameplate (e.g., PRO2 and PRHD2 motors with sensAR magnetic encoder) is detected, or if the software is operating offline, ServoStudio 2 will activate the **drive-based** autotuning wizard.
- If an electronic motor nameplate is not detected, ServoStudio 2 will activate the **PC-based** autotuning wizard.

### 5.1 Drive-Based Autotuning

Refer to [Drive-Based Autotuning](#) in the drive user manual.

Drive-based autotuning has four possible routines: **Express/Internal**, **Express/External**, **Advanced/Internal** and **Advanced/External**.

- **Express** autotuning requires no user input except to activate each step.
- **Advanced** autotuning requires user input.
- **Internal Reference** – the motion command used for tuning is generated by the drive.
- **External Reference** – the motion command used for tuning is generated by an external controller, such as a PLC.

The Autotuning **Mode Selection** screen also provides an option that allows you to manually move the axis to a suitable starting position.

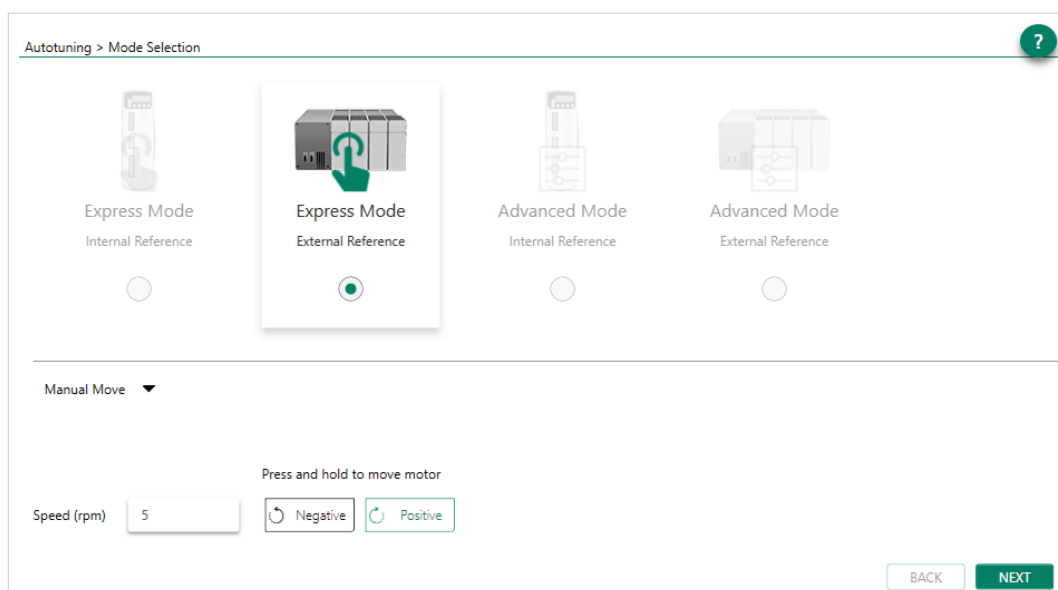


Figure 5-1. ServoStudio 2 – Autotuning Wizard – Drive-Based

### Steps in Autotuning Process – Drive-Based

Internal Reference Command		External Reference Command		Description	Refer to the instructions in the CDHD2 user manual
Advanced	Express	Advanced	Express		
Mode	Mode	Mode	Mode	Set the motion generator: Internal (Drive) or External (PLC/Controller).	<a href="#">Drive-Based Autotuning – Autotuning Mode</a>
Inertia				Run the load to motor inertia ratio estimation.	<a href="#">Drive-Based Autotuning – Load/Motor Inertia Ratio (LMJR) Estimation</a>
Movement				Set the motion profile values.	<a href="#">Drive-Based Autotuning – Movement</a>
Options		Options		Set the options for parameter optimization.	<a href="#">Drive-Based Autotuning – Options</a>
Start	Start	Start	Start	Run Autotuning	<a href="#">Drive-Based Autotuning – Start</a>
Test	Test	Test	Test	Test the result	<a href="#">Drive-Based Autotuning – Test</a>
Save	Save	Save	Save	Save the modified parameters	<a href="#">Drive-Based Autotuning – Save</a>

## 5.2 PC-Based Autotuning

Refer to [PC-Based Autotuning](#) in the drive user manual.

If an electronic motor nameplate is not detected at power up, ServoStudio 2 will activate the PC-based autotuning wizard.

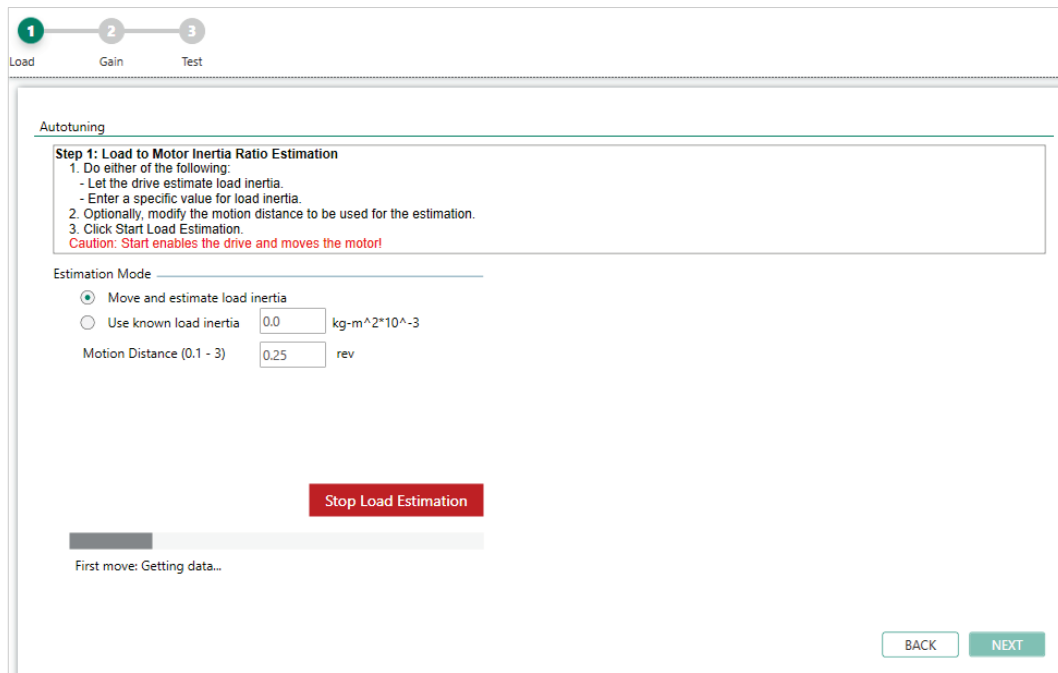


Figure 5-2. ServoStudio 2 – Autotuning Wizard – PC-Based

### Steps in Autotuning Process – PC-Based

Step	Description	Refer to the instructions in the CDHD2 user manual
Inertia (Load)	Run the load to motor inertia ratio estimation	<a href="#">PC-Based Autotuning – LMJR Estimation</a>
Gain	Run gain optimization tuning	<a href="#">PC-Based Autotuning – Gain Optimization</a>
Test	Record a motion to test the result of autotuning	<a href="#">PC-Based Autotuning – Test Quality of Motion</a>
Save	Save the modified parameters	<a href="#">PC-Based Autotuning – Save</a>

## 6. Application Setup Wizard

Refer to [Application Setup Wizard](#) in the drive user manual.

The Application Setup wizard guides you through a procedure that will set drive parameters for your particular application.

The specific Application Setup procedure is determined by the Interface Mode selected in the first step. Subsequent steps may include PDO mapping, definition of position units, gearing ratios, limits, homing, and functionality of inputs and outputs.

**Note** When the software is communicating with the drive, only the relevant modes are shown.

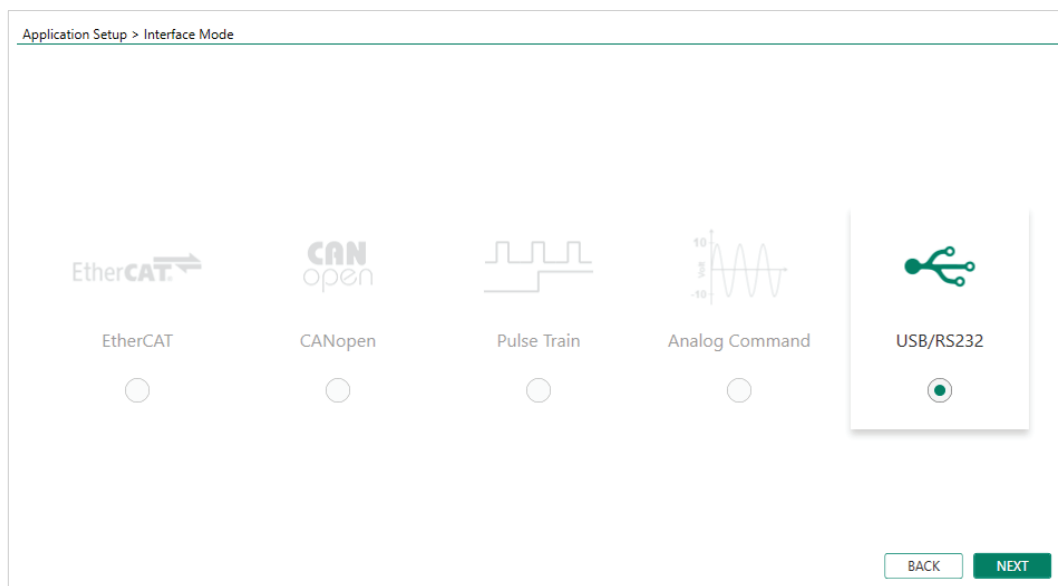


Figure 6-1. ServoStudio 2 – Application Setup Wizard – Interface Mode

### Steps in EtherCAT Application Setup

	Step	Refer to the instructions in the CDHD2 user manual
1	Operation Mode	<a href="#">Application Setup - Operation Mode</a>
2	PDO Mapping	<a href="#">Application Setup - PDO Mapping</a>
3	Position Units	<a href="#">Application Setup - Position Units</a>
4	Inputs/Outputs	<a href="#">Application Setup - Inputs/Outputs</a>
5	Homing	<a href="#">Application Setup - Homing</a>
6	Save	<a href="#">Application Setup - Save</a>

### Steps in CANopen Application Setup

	Step	Refer to the instructions in the CDHD2 user manual
1	Communication	<a href="#">Application Setup - Communication</a>
2	PDO Mapping	<a href="#">Application Setup - PDO Mapping</a>

	Step	Refer to the instructions in the CDHD2 user manual
3	Position Units	<a href="#">Application Setup - Position Units</a>
4	Inputs/Outputs	<a href="#">Application Setup - Inputs/Outputs</a>
5	Homing	<a href="#">Application Setup - Homing</a>
6	Save	<a href="#">Application Setup - Save</a>

### Steps in Pulse Train Application Setup

	Step	Refer to the instructions in the CDHD2 user manual
1	Pulse Train	<a href="#">Application Setup - Pulse Train</a>
2	Resolution	<a href="#">Application Setup - Resolution</a>
3	Filters	<a href="#">Application Setup - Filters</a>
4	Limits	<a href="#">Application Setup - Limits</a>
5	Inputs/Outputs	<a href="#">Application Setup - Inputs/Outputs</a>
6	Homing	<a href="#">Application Setup - Homing</a>
7	Save	<a href="#">Application Setup - Save</a>

### Steps in Analog Command Application Setup

	Step	Refer to the instructions in the CDHD2 user manual
1	Resolution	<a href="#">Application Setup - Resolution</a>
2	Filters	<a href="#">Application Setup - Filters</a>
3	Limits	<a href="#">Application Setup - Limits</a>
4	Inputs/Outputs	<a href="#">Application Setup - Inputs/Outputs</a>
5	Homing	<a href="#">Application Setup - Homing</a>
6	Save	<a href="#">Application Setup - Save</a>

### Steps in USB/RS232 Application Setup

	Step	Refer to the instructions in the CDHD2 user manual
1	Inputs/Outputs	<a href="#">Application Setup - Inputs/Outputs</a>
2	Homing	<a href="#">Application Setup - Homing</a>
3	Save	<a href="#">Application Setup - Save</a>

## 7. Communication

Refer to [Communication](#) in the drive user manual.

Commissioning the drive through ServoStudio 2 requires a serial RS232 or USB connection. Once the drive is configured, you can then connect it to a PLC or controller over an EtherCAT, or CANopen network.

- Notes**
- To transmit commands to the drive through serial RS232/USB connections and pulse/analog interfaces, the drive must be set to COMM MODE 0.
  - To transmit commands to the drive over EtherCAT or CANopen networks, the drive must be set to COMM MODE 1. While COMM MODE 1 is in effect, the drive cannot be enabled and the motor cannot be moved through ServoStudio 2.
  - The Application Setup wizard switches the Communication mode according to the selected Interface mode.

The ServoStudio 2 **Communication** screen allows you to establish communication between the host computer and the drive over a serial connection.

Multiple drives can be accessed through the same instance of ServoStudio 2 provided they are all daisy-chained to the RS232 port.

To access two drives on different networks (ports), two instances of ServoStudio 2 can and should be used.

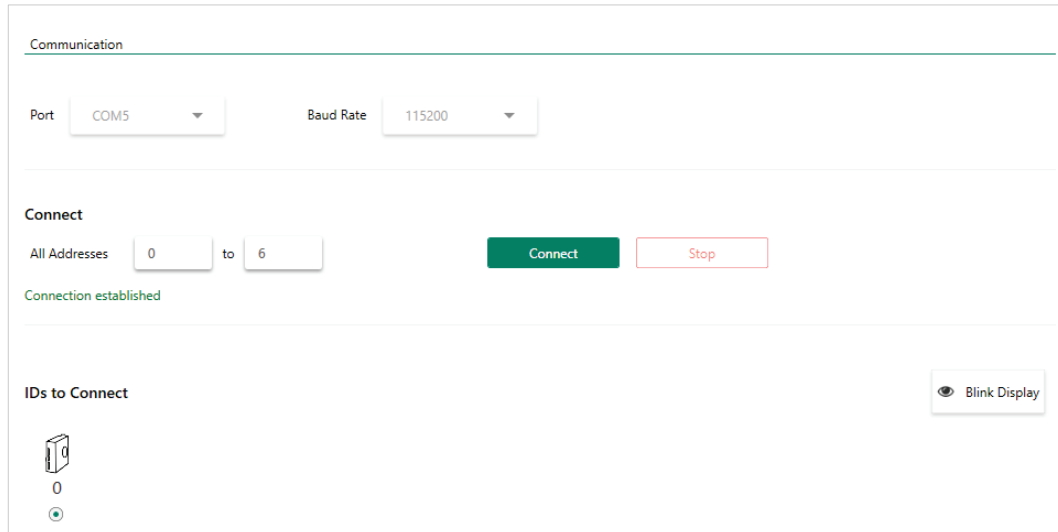


Figure 7-1. ServoStudio 2 – Communication Screen – Serial

Communication	
Port	The COM ports on the host computer to which a drive, or daisy-chain of drives, is connected. Select either a specific COM port or Search All.

Baud Rate	<p>By default, the baud rate is 115200. If the setting is changed and saved in the drive's non-volatile RAM memory, the drive will use the saved baud rate at power up.</p> <p>To modify baud rate settings, the change must be made <b>both</b> in the drive and in ServoStudio 2 software.</p> <p>VarCom <a href="#">BAUDRATE</a>.</p>
<b>Connect</b>	
All Addresses	<p>Defines the drive addresses to be searched, from 0-99 (CDHD2) or 1-15 (<b>DDHD</b>). The default limit is 10 addresses.</p> <p>The values you enter must match the drive address defined in the drive, either the factory default setting or the setting made during the drive setup.</p> <p>If an address is not selected, ServoStudio 2 will establish and maintain communication with all drives on the port.</p>
<b>Connect</b>	<p>Attempts to connect to drive/s according to the address setting/s.</p> <p>The software searches all COM ports on the host computer to locate the port to which a drive is connected.</p> <p>Once the software identifies the port, it searches for all drives that may be daisy-chained to the port.</p>
<b>Stop</b>	Halts the attempt to connect to drive/s.
<i>Connection Status</i>	A progress bar reflects the search and connect process. When completed, message indicates either <b>Connected established</b> or <b>Connection failed</b> .
<b>Blink Display</b>	<p>To test communication between ServoStudio 2 and the drive, press <b>Blink Display</b>, and observe the 7-segment display on the drive.</p> <p>If communication is established, the display will flash <b>88888</b> several times.</p>
<b>IDs to Connect</b>	A list of the names and addresses of all drives found.

## 8. Drive Information

Refer to [Drive Identification](#) in the drive user manual.

The **Drive Information** screen displays basic information about the drive, such as current rating, hardware version and firmware version. It is important to provide this information to Technical Support when asking for assistance.

It also allows you to select the **Interface Mode**, the type of interface used for transmitting motion commands and servo active status.

The **Drive Information** screen also provides access to the Firmware Download utility..

Drive Information	
<b>Drive Details</b>	
Drive Name	AXIS1
Drive Model	CDHD2-0062AEC2
Serial Number	117F-0000654, June 2017
Firmware Version	2.18.5c9.0.62
Control Board Version	03
Power Board Version	01
FPGA Version	4.27
<a href="#">See Less</a>	<a href="#">Firmware Download</a>
<b>Interface Mode</b>	
<input checked="" type="radio"/> Serial / Pulse / Analog <input type="radio"/> EtherCAT	
<b>Drive Settings</b>	
Drive Peak Current	25.455
Drive Continuous Current	8.485
Feedback Type	sensAR Magnetic Encoder Single Turn

Figure 8-1. ServoStudio 2 – Drive Information Screen

<b>Drive Details</b>		
Drive Name	Allows you to assign a name to the drive. The name may contain up to 15 alphanumeric characters. Other valid characters are ( ) / - . : This field is optional, but is useful when an application has more than one drive. It is recommended that you provide a name for the drive that reflects the function it performs, such as Axis-1.	DRIVENAME
<i>Additional drive info</i>	Hardware-defined. Read only. Shows the drive model and serial number, and version numbers of firmware, control board, power board and FPGA.	INFO
<b>Drive Settings</b>		
Drive Peak Current	Hardware-defined. Read from drive.	DIPEAK
Drive Continuous Current	Hardware-defined. Read from drive.	DICONT
Feedback Type	Factory-defined default, or user-defined setting. Alternately, shows feedback device detected from electronic motor nameplate (MTP).	FEEDBACKTYPE MENCTYPE

<b>Interface Mode</b>		*
Serial/Pulse/Analog	Servo ON status ( <b>ACTIVE</b> ) and motion commands are transmitted via a serial, pulse or analog interface..	<b>COMMODE 0</b>
EtherCAT/CANopen	Servo ON status ( <b>ACTIVE</b> ) and motion commands are transmitted via an EtherCAT/CANopen interface. <b>Note:</b> Not applicable for <b>AP</b> models	<b>COMMODE 1</b>
<b>Download Firmware</b>	Opens a dialog box for installing new versions of drive firmware. Refer to <a href="#">Firmware Update</a> in the drive user manual.	

## 9. Parameter Table



The **Parameter Table** screen allows you to monitor, and modify most of the drive parameters. The Parameter Table serves to provide easy access to parameters by category.





The screen has two panes:

- **Navigation tree.** A categorical list of parameter functions.
- **Parameter list.** An alphabetical list of all parameters associated with the currently selected function group. When possible, you can manipulate the value of parameters displayed in this pane.

ASCII Name	Description	Value	Units	HMI Code	CANopen EtherCAT
FEEDBACKTYPE	Feedback Type	12		P2000	0x204D/0
MENCRES	Motor Encoder Resolution	1048576	LPR	P2002	0x608F/1
PFB	Position Feedback	0.320	rev		0x6064/0
PFB OFFSET	Position Offset	0.000	rev	P0021	0x2095/0
MENC TYPE	Motor Encoder Type	0		P2001	0x2029/0
HALLSINV	Hall Signals Inversion	0 0 0		P2009	0x2057/1
HALLS TYPE	Hall Signals Type	0		P2010	0x2058/0
MENCAQBFILT	Motor Encoder AB Quadrature Filter	1		P2024	
MFBMODE	Motor Feedback Mode	1			0x202D/0
AQBFILT	Motor Encoder AB Quad Filter Count	8			
IGNOREINDEXLB	Ignore Index Line Break (STX)			P7316	
HALLS	Hall Signals	Hu Hv Hw 1 1 1			0x2056/1

Figure 9-1. ServoStudio 2 – Parameter Table Screen

	<b>Refresh from Drive</b>	Reads data from the drive and updates the displayed values.
	<b>Save to File</b>	<p>Saves the contents of the Parameter Table to a file (*.prm). The saved parameter file can then be viewed by technical support and/or kept for reference. The file includes certain read-only parameter values (such as I, V and PFB) that may be useful for troubleshooting. This file is not suitable for use in restoring a drive configuration.</p> <p>This Save option is different from the <b>Save to PC</b> or the <b>Save to Backup File</b> options used elsewhere in ServoStudio 2. Those options save the entire set of parameter values currently in the drive RAM to a file, and can be used to restore a drive configuration.</p> <p>To backup and restore the entire contents of the drive, it is recommended that you use the Backup and Restore screen. Like all parameter values set in ServoStudio 2, when values are</p>

		<p>changed in the Parameter Table screen, they are also modified in the drive's volatile memory. To save parameter values so that they remain in effect after a power reset, use the <b>Save to drive</b> option in ServoStudio 2 tool bar.</p>
	<b>Load File</b>	<p>Loads the contents of the *.prm file to the Parameter Table in ServoStudio 2.</p> <p>When ServoStudio 2 connects the drive, the system compares the values in the Parameter Table to the values in the drive. If a conflict is detected, ServoStudio 2 prompts whether to read from the drive or from the Parameter Table.</p>
	<b>Restore Factory Defaults</b>	<p>Restores all parameters to their factory default settings.</p> <p>If the drive system includes an encoder with an electronic motor plate (MTP), the drive will restore all configuration variables from the MTP.</p>
  8 / 14	<b>Find Parameter</b>	<p>Enter one or more characters, and press Enter or the search icon.</p> <p>ServoStudio 2 opens the first parameter group in the table that contains ASCII Names and Descriptions that match the search string. Rows with matching strings are highlighted.</p> <p>Use the arrows to scroll through all matching strings in the table. ServoStudio 2 automatically moves to the next group containing a match.</p> <p>Numbers indicate the currently selected match, and the total number of matching Names and Descriptions.</p>

## 10. Power Stage

The **Power Stage** screen allows you to monitor the drive's power rating parameters and internal temperature, and to modify certain bus voltage parameters.

The **Power Stage** screen has two panes:

- Main (Drive Power)
- Line Loss

### 10.1 Drive Power (Main)

The **Main** tab in the **Power Stage** screen displays the drive's current ratings and internal temperature. In addition, it displays and allows you to modify bus voltage parameters.

The screenshot shows the 'Power Stage' screen with the 'Main' tab selected. The interface is organized into four main sections:

- Current Rating:** Contains two input fields: 'Drive Continuous Current' (8.485 A) and 'Drive Peak Current' (25.455 A).
- Temperature:** Contains two input fields: 'Control Board' (36 deg C) and 'Power Board' (27 deg C).
- Voltage Settings:** Contains three input fields: 'Bus Voltage (DC)' (320 V), 'Under-Voltage Time' (30 s), and 'Under-Voltage Mode' (0 - Immediate Fault). Below these is a radio button for 'Under-Voltage Recovery' with 'Reenable' selected and 'Auto' unselected.
- Bus Voltage Limits:** Contains three input fields: 'Over-Voltage Threshold' (420 V), 'Bus Voltage Measured' (320 V), and 'Under-Voltage Threshold' (100 V).

Figure 10-1. ServoStudio 2 – Power Rating Screen – Main

Current Rating		
Drive Continuous Current	Defined in hardware. Read only.	DICONT
Drive Peak Current	Defined in hardware. Read only.	DIPEAK
Temperature		
Control Board	The temperature of the control board in the drive. Read only.	DRIVETEMP
Power Board	The temperature of the power board in the drive. Read only.	DRIVETEMP

<b>Voltage Settings</b>		
<b>Bus Voltage (DC)</b>	This setting is required for basic current loop tuning. Although the drive monitors the bus voltage, you must enter the nominal bus voltage here. Enter 320 for a drive powered by 220 VAC per phase. Enter 160 for a drive powered by 110 VAC per phase. <b>Note:</b> The Motor Setup wizard assumes the Bus Voltage setting is 320V. If the drive is powered by 220 VAC per phase, you do not need to modify this setting before initiating the Motor Setup procedure. If the drive is powered by 110 VAC per phase, you must change the Bus Voltage setting to 160V.	<a href="#">VBUS</a>
<b>Under-Voltage Time</b>	Specifies the amount of time an under-voltage condition will exist before latching a fault, when working in Delayed Fault Under-Voltage mode.	<a href="#">UVTIME</a>
<b>Under-Voltage Mode</b>	Defines how the drive will respond to an under-voltage fault.	<a href="#">UVMODE</a>
<b>Under-Voltage Recovery</b>	Defines how the drive will recover from an under-voltage fault: by toggling the drive from disable to enable, or by automatically recovering, after the under-voltage condition clears.	<a href="#">UVRECOVER</a>
<b>Bus Voltage Limits</b>		
<b>Over-Voltage Threshold</b>	Shows the level for detection of bus over-voltage. Defined in hardware. Read only.	<a href="#">OVTHRESH</a>
<b>Bus Voltage Measured</b>	Shows the actual bus voltage of the drive. Read only. Defined in hardware. Read only.	<a href="#">VBUSREADOUT</a>
<b>Under-Voltage Threshold</b>	Defines the level for detection of bus under-voltage condition.	<a href="#">UVTHRESH</a>

### Bus AC Power Line Loss

The **Line Loss** tab in the **Power Rating** screen allows you to define drive behavior related to a disconnection of the bus AC supply line.

**Note** | Applicable only to STO-certified CDHD2 drives (-ST models) and to **DDHD** drives.

Figure 10-2. ServoStudio 2 – Power Rating Screen – Line Loss

<b>Type</b>	Defines the types of bus AC supply line disconnect fault. Programmable only if supported by hardware.	<a href="#">LINELOSSTYPE</a>
<b>Mode</b>	Defines how the drive will respond if phase loss is detected on the bus AC supply line.	<a href="#">LINELOSSMODE</a>
<b>Recovery Mode</b>	Defines how the drive will recover from a bus AC supply line disconnect fault.	<a href="#">LINELOSSRECOVER</a>

# 11. Motor

At power-up, the CDHD2 attempts to detect an electronic motor nameplate (MTP), which is a set of motor parameters that are embedded in the non-volatile memory of the motor feedback device. If detected, certain motor and feedback parameters are loaded directly to the drive after power-up and cannot be manipulated.

If an electronic motor nameplate is not detected, the **Motor** screen allows you to define the motor and its parameters.

Refer to [Motor Setup](#) in the drive user manual.

## 11.1 Motor Properties from Electronic Nameplate

When the CDHD2 drive system includes an electronic motor nameplate, certain motor and feedback parameters are transferred directly to the drive after power-up, and cannot be manipulated. For example, the PRO2 and PRHD2 motors are typically equipped with a sensAR encoder, which has an electronic motor nameplate.

For systems such as these, the Motor screen simply reflects the motor and feedback device connected to the drive.

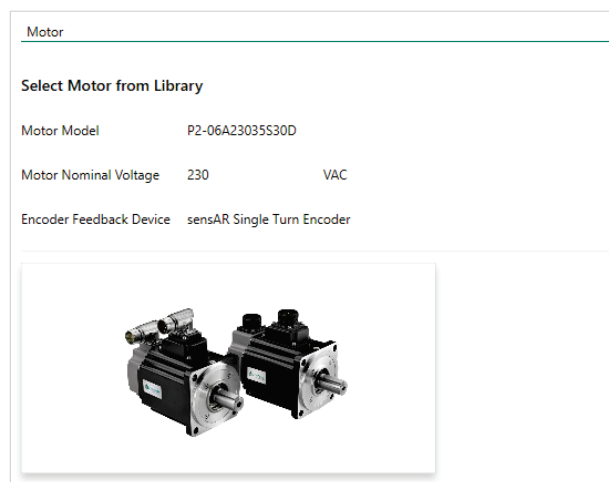


Figure 11-1. ServoStudio 2 – Motor Data from Electronic Motor Nameplate

## 11.2 Motor Selection

If an electronic motor nameplate is not detected at power-up, the **Motor** screen allows you to select a motor from the ServoStudio 2 databases (motor libraries). You can simply select the motor family and motor part number, and ServoStudio 2 will prepare the appropriate motor and feedback parameters. The screen allows you to modify and send parameters to the drive, read parameters from the drive, and save parameters.

The Motor screen also includes a wizard for defining a motor whose parameters are not available in the default sets of motor libraries.

**Note** In addition to motor parameters, the motor libraries also contain the motor feedback and thermal protection parameters.

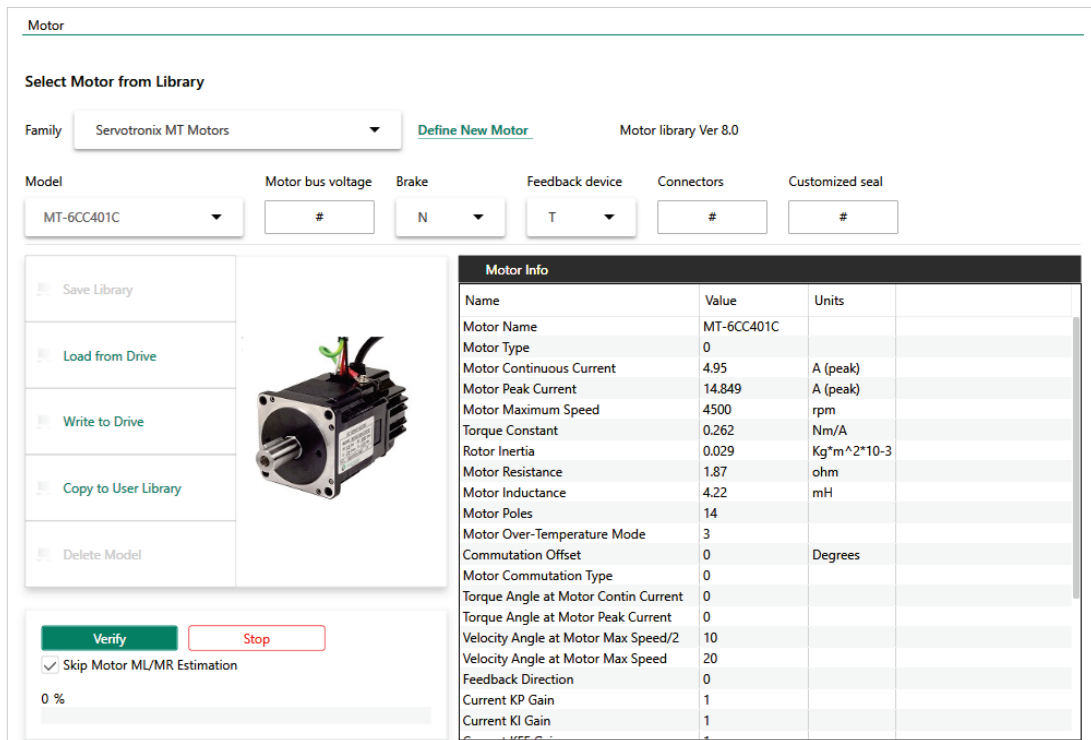


Figure 11-2. ServoStudio 2 – Motor Screen

<p><b>Motor Family</b></p>	<p>ServoStudio 2 has several databases containing predefined sets of parameters for motors.</p> <p><b>User Motors</b> contains a list of motors whose parameter sets have been created by the user, either by modifying a predefined set, or by defining an entirely new set of parameters for a motor.</p> <p>To add a motor to this list, select <b>Motor Family&gt;User Motors</b>, and then <b>Motor Type&gt;New</b>. The Parameter Table then displays a list of motor properties that need to be defined.</p>
<p><b>Motor Model</b></p>	<p>A list of all models in the selected Motor Family that have a predefined set of parameters in ServoStudio 2.</p> <p>For most motors, the motor catalog number is followed by a series of fields, each of which represents a segment in the motor’s complete ID number, as shown on the motor’s label.</p> <p>In each field select the option that matches the information on the motor label. If a field contains a # sign, you do not need to select an option, as the field is not relevant to motion.</p> <p>Different fields represent certain functions or capabilities of the motor, which can be seen in the tooltip for each field.</p> <p>Depending on your selections, you may be prompted to define the output that releases the motor brake.</p> <p>After selecting the motor press <b>Write To Drive</b> to write this parameter to the drive.</p>
<p><b>New Motor</b></p>	<p>Refer to <i>New Motor Wizard</i>.</p>

## 11.3 Motor Parameters

<b>Save Library</b>	Saves the entire contents of the User Motors library to a file.
<b>Delete Model</b>	Deletes the currently displayed motor from the User Motors library.
<b>Load from Drive</b>	Displays the values of the drive's motor parameters.
<b>Write to Drive</b>	Writes all displayed parameters to the drive. You can also modify a parameter value and press <b>Enter</b> to send the new value to the drive.
<b>Copy to User Library</b>	Copies the parameter values currently displayed to the User Motors library, to enable modification.
<b>Verify</b>	<p>Activates an automatic procedure for setting commutation related variables. The procedure involves finding the electrical phase and detecting the direction of motor movement, Hall switches and index crossing.</p> <p>The drive's 7-segment display flashes the character <b>A t 1</b> during this procedure. When the procedure finishes successfully, the display returns to its normal state.</p> <p>If the procedure fails, the display shows <b>-5</b>.</p> <p>Refer to VarCom <a href="#">MOTORSETUP</a> and the section <i>Motor Setup Wizard</i>.</p>
<b>Skip ML/MR Estimation</b>	The verification procedure can include estimation of motor inductance (ML) and motor resistance (MR). The estimation may take some time and may be noisy; therefore, the option to skip is selected by default.
<b>Stop</b>	Aborts the Verify process.
<i>Progress bar</i>	Shows the progress of the Verify process (which takes about 30 seconds).
<b>Click for Details</b>	Shows more information about the Verify process.

The **Parameter Table** displays the parameters of the selected motor as currently defined in the database, or as read from the drive. As soon as you change any Motor Model field, the values in the Parameter Table change accordingly.

## 11.4 New Motor Wizard

Refer to [New Motor Wizard](#) in the drive user manual.

The **New Motor** wizard allows you to define a motor whose parameters are not available in the default sets of motor libraries in ServoStudio 2.

Once defined, these parameters can be saved to the drive, and the motor can be saved to the User Motors library.

To activate the wizard, press **Define New Motor** either in the Motor screen, or during the Motor Selection step in the Motor Setup wizard. A series of dialog boxes prompts you to provide motor parameters, which you should be able to extract from the motor datasheet.

---

**Note** | It is recommended that you activate the New Motor wizard from the Motor screen, because parameters cannot be saved to the User Motor library when the wizard is activated from Motor Setup.

## 12. Feedback

Refer to [Feedback](#) in the drive user manual.

The **Feedback** screen displays and allows you to define the properties of feedback devices. Some feedback parameters may be read only, depending on the motor and CDHD2 drive system in use.

The **Feedback** screen has two tabs:

- Motor Feedback
- Secondary Feedback

### 12.1 Motor Feedback Settings

The **Motor Feedback** tab allows you to define the motor feedback. It also allows you to monitor the motor position, and to activate the encoder simulation output and set its resolution.

#### 12.1.1 Feedback Defined by Electronic Motor Nameplate (MTP)

An electronic motor nameplate (MTP) is a set of motor parameters that are embedded in the non-volatile memory of the motor feedback device.

As of firmware version 1.40.0, the drive attempts to detect an electronic motor nameplate at power-up. If detected, certain motor and feedback parameters are transferred directly to the drive, and cannot be manipulated by the user.

PRO2 and PRHD2 motors are typically equipped with a sensAR encoder, which has an electronic motor nameplate.

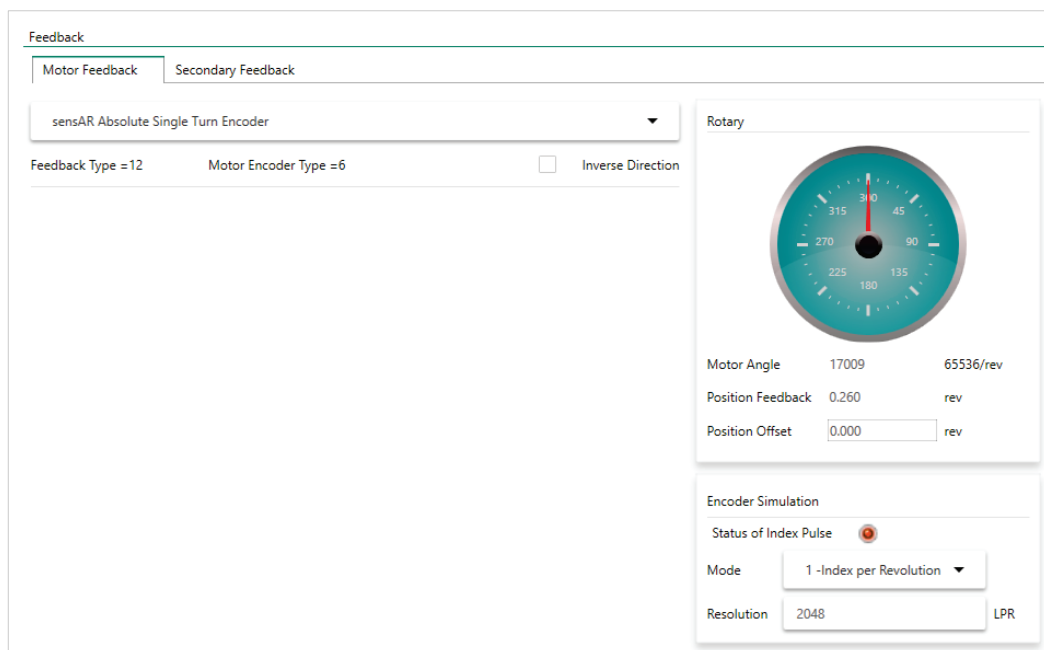


Figure 12-1. ServoStudio 2 – Feedback Screen – Motor Feedback Tab – sensAR Encoder

## 12.1.2 Feedback Defined by User

If an electronic motor nameplate is not detected at power-up, the **Feedback** screen allows you to configure the properties of the motor's feedback device. Select the feedback device from the Motor Feedback tab. The screen will change accordingly, enabling you to set the relevant feedback properties.

### Note

Many motors have a predefined feedback device. When the motor is selected from the ServoStudio 2 Motor Library, some feedback parameters are pre-set and written to the drive during the Motor Setup procedure. These parameters are manufacturer-defined and should not be manipulated unless instructed to do so by Technical Support

### Note

The Motor Setup wizard assumes that the motor model number indicates a particular type of feedback. If this is not true for your motor, you must define the motor feedback before starting the Motor Setup wizard.

Figure 12-2. ServoStudio 2 – Feedback Screen – Example – Incremental Encoder

<b>Motor Feedback</b>		
Feedback Device	<p>From the dropdown list, select the motor feedback device being used in the application:</p> <div style="border: 1px solid gray; padding: 5px; margin: 5px 0;"> <p><b>No feedback</b></p> <p>Incremental Encoder A/B/Z + Halls</p> <p>Incremental Encoder A/B/Z Init by PHASEFIND</p> <p>Incremental Encoder A/B/Z Init by first Enable or PHASEFIND</p> <p>Incremental Encoder A/B Init by PHASEFIND</p> <p>Incremental Encoder A/B Init by first Enable or PHASEFIND</p> <p>Incremental Encoder A/B + Halls</p> <p>Halls Only</p> <p>Sine Encoder A/B/Z/ + Halls</p> <p>Sine Encoder A/B/Z Init by PHASEFIND</p> <p>Sine Encoder A/B/Z Init by first Enable or PHASEFIND</p> <p>Sine Encoder A/B Init by PHASEFIND</p> <p>Sine Encoder A/B Init by first Enable or PHASEFIND</p> <p>Sine Encoder A/B + Halls</p> <p>Endat 2.x Protocol</p> <p>Endat 2.x Protocol with Sine Signals</p> <p>HIPERFACE with Sine Signals</p> <p>Nikon Absolute Encoder: Single Turn</p> <p>Nikon Absolute Encoder: Multi Turn</p> <p>Tamagawa Incremental Encoder (8 wires)</p> <p>Tamagawa Absolute Encoder: 17/23-bit Single Turn</p> <p>Tamagawa Absolute Encoder: 17/23-bit Multi Turn</p> <p>Tamagawa Incremental Encoder 17/23-bit</p> <p>sensAR Absolute Single Turn Encoder</p> <p>sensAR Absolute Multi-turn Encoder</p> <p>Resolver</p> <p>BiSS-C Interface Encoder</p> </div> <p>The selection automatically sets both the Feedback type and the Encoder type, as indicated on screen.</p>	
Feedback Type	Indicates the selected feedback type.	FEEDBACKTYPE
Motor Encoder Type	Indicates the selected encoder type.	MENCTYPE
Inverse Direction	When enabled, inverts the values of the motor velocity and actual position determined by the motor feedback. Motor rotation and position do not change.	DIR
<b>Rotary</b>	The graphic represents the value of <b>MECHANGLE</b> . You can turn the motor by hand one revolution and use the graphic to verify a complete revolution as well as motor direction.	
Motor Angle	The actual position of the motor within one revolution.	MECHANGLE
Position Feedback	The position feedback value. Read only.	PFB
Position Offset	An offset value that is added to the internal cumulative position counter, to give the position feedback value.	PFBOFFSET

<b>Zero</b>		
Zero Procedure Current	The current used for the Zero procedure.	<a href="#">IZERO</a>
<b>On</b>	Activates the Zero procedure, which locks the rotor in place by passing current through two phases. This is useful for determining the commutation offset (MPHASE) on motors that have a resolver or absolute encoder.	<a href="#">ZERO</a>
<b>Encoder Simulation</b>	Enables the equivalent encoder output, and sets the resolution.	
Status of Index Pulse	An icon represents the state of the encoder index signal: <b>Red.</b> The encoder index signal is inactive, indicating the position is not within the index. <b>Green.</b> The encoder index signal is active, indicating the position is within the index.	
Mode	The state of the encoder simulation. <b>0 Off.</b> Encoder simulation not enabled. <b>1 Index per revolution.</b> Encoder simulation enabled, with an index signal (zero pulse) on each turn (or pitch, for linear motor). <b>2 Index per feedback.</b> Encoder simulation enabled, with the index signal routed directly from the motor feedback device (by the FPGA) to the drive, regardless of the value of ENCOUTRES. This mode is intended primarily for linear motors, whose index is once per stroke.	<a href="#">ENCOUTMODE</a>
Resolution	The resolution, in number of lines, of the encoder equivalent output	<a href="#">ENCOUTRES</a>

The other options in this screen will change according to the selected **Feedback** type:

Figure 12-3. ServoStudio 2 – Feedback Screen – Example – Resolver

Figure 12-4. ServoStudio 2 – Feedback Screen – Example – BiSS-C Protocol

<b>Motor Encoder Resolution</b>	The resolution of the motor encoder, defined in lines per revolution. If Counts per Revolution is selected and a value is entered in the Motor Encoder Resolution field, ServoStudio 2 will divide the value by 4 to produce the MENCRES setting, and the displayed unit will revert to Lines per Revolution.	<a href="#">MENCRES</a>
<b>Halls</b>		
Hall Signals Type	The source and method used for Hall sensors.	<a href="#">HALLSTYPE</a>
Halls	The current state of the Hall commutation sensors. Read only.	<a href="#">HALLS</a>

Inversion	Inverts the polarity of individual Hall signals associated with motor phases UVW, thereby providing correction for crossed wiring.	HALLSINV
<b>Phase Find</b>		
Phase Find Mode	Defines the method to be used for the commutation phase finding.	PHASEFINDMODE
Phase Find Duration	Defines the duration of the phase finding mechanism in a soft start.	PHASEFINDTIME
Phase Find Current	Adjusts the current of the phase finding mechanism.	PHASEFINDI
Phase Find Gain	Adjusts the gain of the phase finding mechanism.	PHASEFINDGAIN
<b>Find Phase</b>	Activates the automatic motor phasing routine.	PHASEFIND
<b>Resolver</b>		
Resolver Conversion Bandwidth	The resolver conversion bandwidth. High bandwidth produces better dynamic tracking and less phase lag in high frequencies. Lower bandwidth results in better noise reduction.	RESBW
Motor Resolver Poles	The number of individual poles (not pairs) in the resolver feedback device.	MRESPOLES
Resolver Amplitude Range	The acceptable range of resolver sine/cosine signals, expressed as a percentage, around their nominal value.	RESAMPLRANGE
<b>Calibration</b>		
Sine/Cosine Calibration Parameters	The parameters that are used for calibration of the resolver sine and cosine signals, in hexadecimal representation. Read only.	SINPARAM
Sine/Cosine Calibration Status	The status of the resolver calibration procedure. Read only.	SININITST
<b>Start</b>	Activates a procedure that calibrates the resolver sine/cosine signals. The calibration serves to reduce Harmonic errors in the resolver reading.	SININIT
<b>Multi-turn</b>		
Reset Multi-turn	Resets the position counter of an absolute multi-turn encoder.	MTTURNRESET
<b>BiSS-C</b>		
Total Angular Position	<b>Single Turn Data</b> (bits). The number of bits allocated for transmission of single turn (or linear) position data within a BiSS-C packet.	BISSFIELDS (argument 3)
Effective Angular Position	<b>Effective Single Turn Data</b> (bits).The number of effective bits in transmission of single turn (or linear) position data.	BISSFIELDS (argument 4)

Absolute Multi-turn	<b>Multi-turn Data</b> (bits). The number of bits allocated for transmission of multi-turn position data within a BiSS-C packet. If using a single turn encoder, or a linear encoder, or if it is not specified in the encoder data sheet, enter value 00.	<a href="#">BISSFIELDS (argument 1)</a>
---------------------	---	---

## 12.2 Secondary Feedback Device Settings

The **Secondary Feedback** tab allows you to configure a feedback device for dual loop control.

Refer to [Secondary Feedback](#) in the drive user manual.

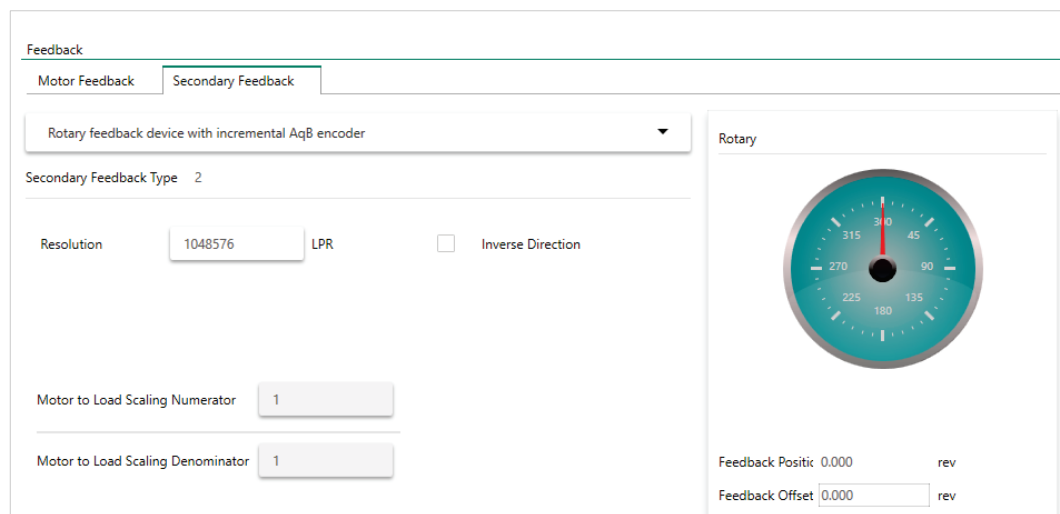


Figure 12-5. ServoStudio 2 – Feedback Screen – Secondary Feedback Tab

CDHD2 dual loop control can be implemented with either rotary motors or linear motors. In addition, it can be configured with AB quadrature, BiSS-C interface, or EnDat 2.2 feedback devices.

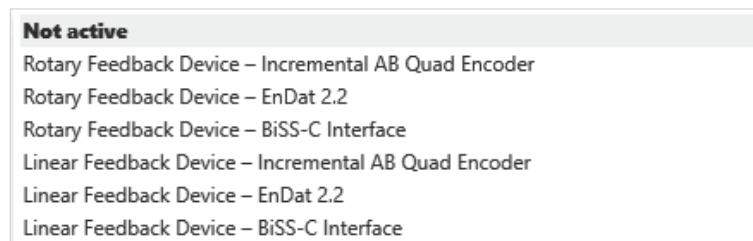


Figure 12-6. ServoStudio 2 – Feedback Screen – Secondary Feedback Options

The other options in the screen will change according to the selected **Secondary Feedback** type. For descriptions of these options, refer to *Motor Feedback Settings*.

## 13. Limits

The **Limits** screen allows you to view and set parameters for position limits, velocity limits and your application current limit.

The **Limits** screen has three tabs:

- Position Limit
- Velocity Limit
- Current Limit

### 13.1 Current Limit

Refer to [Current Limits](#) in the drive user manual.

The **Current Limit** screen contains a diagram that shows how the maximum current for the system is determined, and enables you to set the current limit for your application.

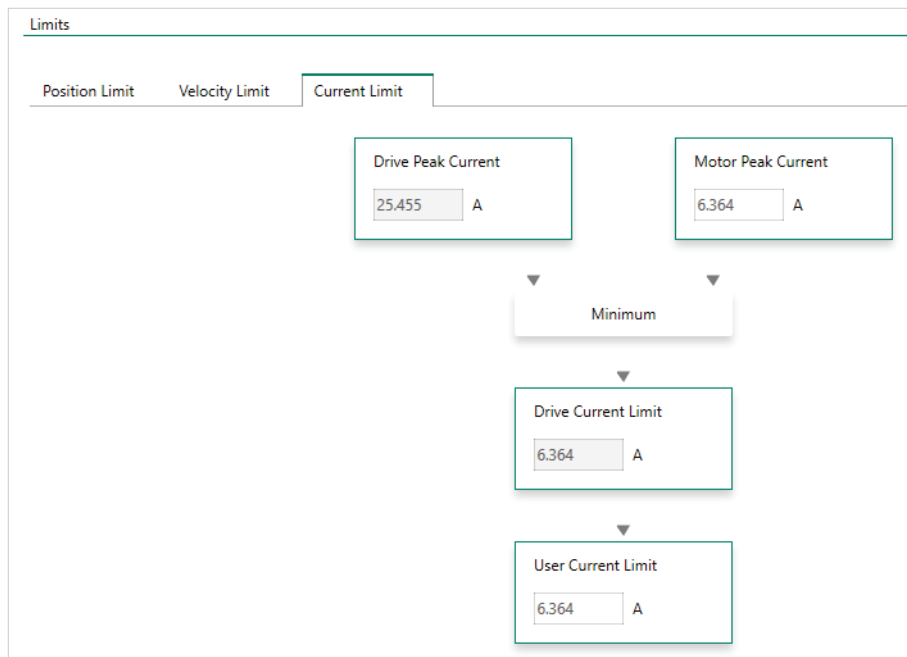


Figure 13-1. ServoStudio 2 – Current Limit Screen

<b>Drive Peak Current</b>	The peak rated current of the drive. Defined in hardware. Read only.	DIPEAK
<b>Motor Peak Current</b>	The peak current of the motor. This value is obtained from the motor datasheet/electronic nameplate.	MIPEAK
<b>Drive Current Limit</b>	The maximum current for the drive and motor combination. This value is calculated by the software. Read only.	IMAX
<b>User Current Limit</b>	A user-definable maximum current for the application. You can set a value that is lower than Drive Current Limit and Motor Peak Current.	ILIM

## 13.2 Velocity Limit

Refer to [Velocity Limits](#) in the drive user manual.

The **Velocity Limit** screen contains a diagram that shows how the maximum velocity for the system is determined, and enables you to set the velocity limit for your system accordingly.

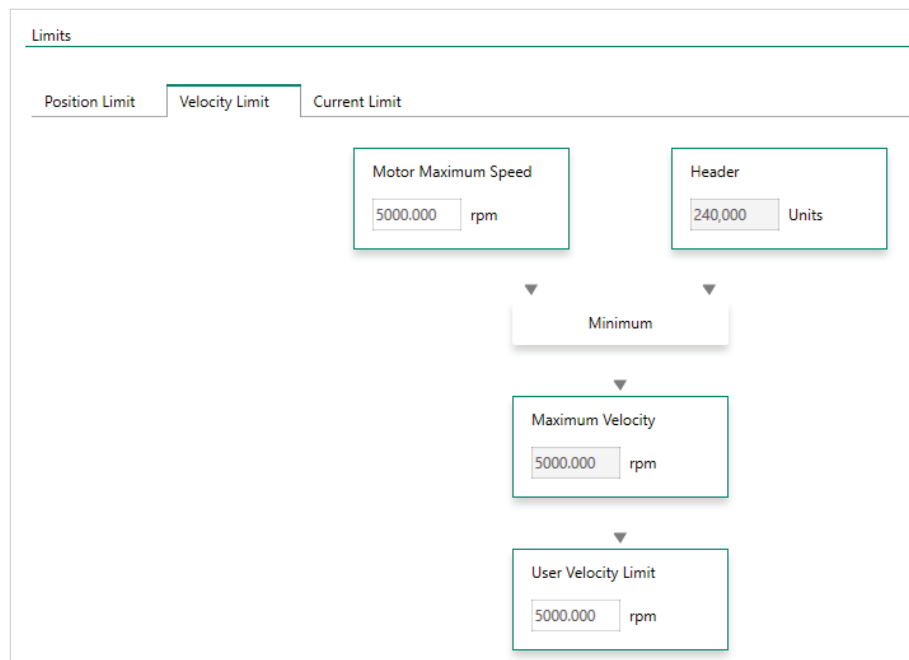


Figure 13-2. ServoStudio 2 – Velocity Limit Screen

<b>Motor Maximum Speed</b>	The maximum motor speed. This value is obtained from the motor datasheet/electronic nameplate.	MSPEED
<b>Maximum Value</b>	The maximum speed that the drive can compute. Defined in hardware. Read only.	
<b>Maximum Velocity</b>	The maximum allowed motor velocity is computed according to the values of the two preceding parameters. Read only.	VMAX
<b>User Velocity Limit</b>	A user-definable maximum velocity for the application. You set a value up to the value defined by VMAX.	VLIM

## 13.3 Position Limit

Refer to [Position Limits](#) in the drive user manual.

The **Position Limit** screen contains elements that indicate the status of limit switches, and define if and how software position switches are used as motion limit switches.

Figure 13-3. ServoStudio 2 – Position Limit Screen

<b>Position Error</b>		
Maximum Position Error	The maximum position error allowed without producing a fault; according to defined motion units.	PEMAX
In Position Error Tolerance	The error tolerance for declaring an “in position” state; according to defined motion units.	PEINPOS
<b>Hardware Position Limits</b>		
Positive Limit Switch - Input	Defines the digital input ( <i>n</i> ) that indicates whether the positive limit has been reached.	INMODE n 5
Negative Limit Switch - Input	Defines the digital input ( <i>n</i> ) that indicates whether the negative limit has been reached.	INMODE n 6
<b>Software Position Limits</b>		
Position Limiting Mode	Enables and disables the use of software position limits. 0 = Software position limits disabled. 1 = Software position limits enabled.	POSLIMMODE bit 0
Software Position Limit Minimum	The minimum value for the software position limits; according to defined motion units.	POSLIMNEG

## 14. Current Foldback

Refer to [Current Foldback](#) in the drive user manual.

The **Current Foldback** screen allows you to set the parameters used by CDHD2 to protect the drive and motor from overheating due to excessive current. Current foldback is set separately for the drive and for the motor.

Some motor foldback parameters may be read only, depending on the motor currently in use.

The screen has two tabs:

- Drive Foldback
- Motor Foldback

### 14.1 Drive Foldback

The **Drive Foldback** screen is used mostly to monitor the foldback values for the drive, and to set foldback warning and fault limits.

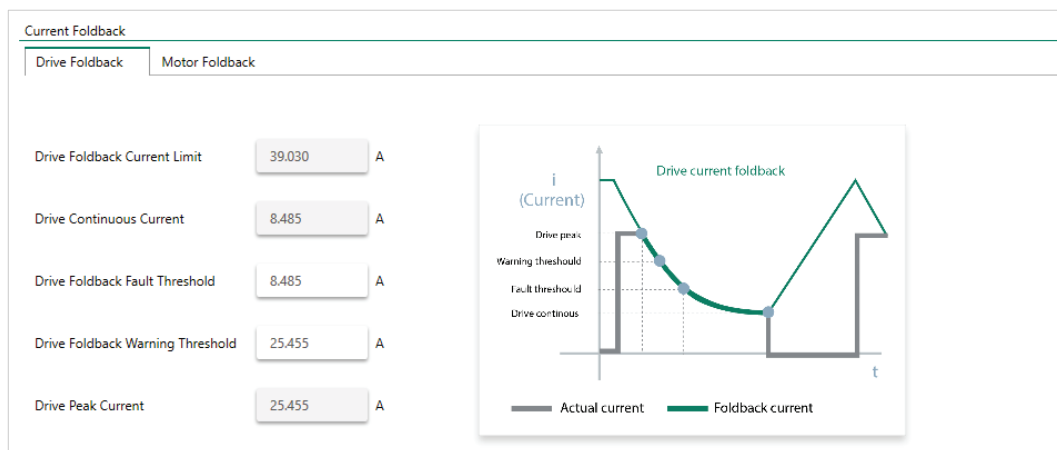


Figure 14-1. ServoStudio 2 – Current Foldback Screen – Drive

Drive Foldback	
Drive Foldback Current	IFOLD
Drive Continuous Current	DICONT
Drive Foldback Fault Threshold	IFOLDFTHRESH
Drive Foldback Warning Threshold	IFOLDWTHRESH
Drive Peak Current	DIPEAK

### 14.2 Motor Foldback

The **Motor Foldback** screen is used to view and set the values of the parameters required by the drive to apply motor foldback protection.

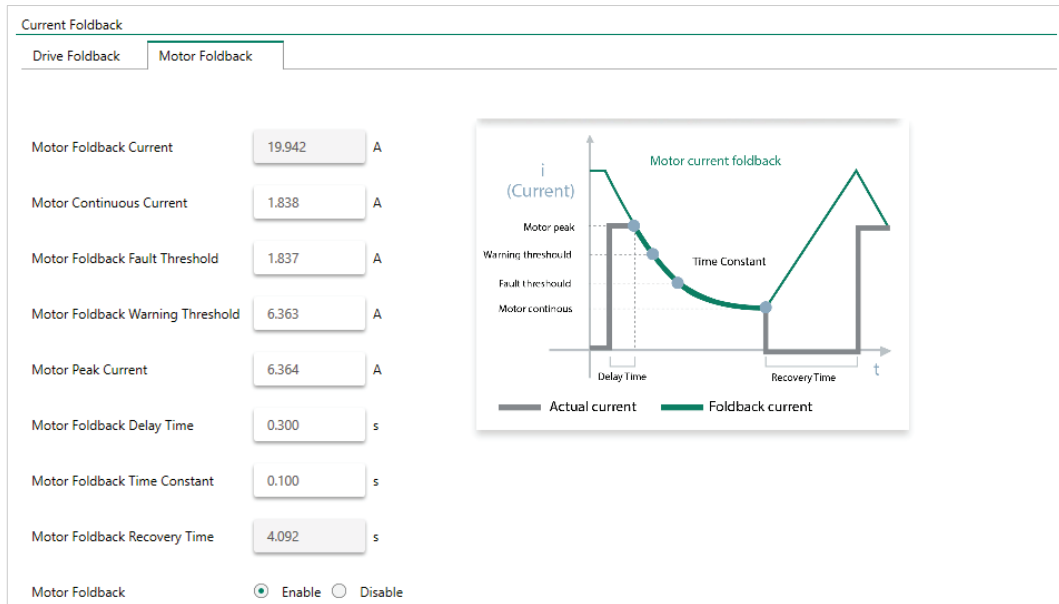


Figure 14-2. ServoStudio 2 – Current Foldback Screen – Motor

Motor Foldback	
Motor Foldback Current	MIFOLD
Motor Continuous Current	MICONT
Motor Foldback Fault Threshold	MIFOLDFTHRESH
Motor Foldback Warning Threshold	MIFOLDWTHRESH
Motor Peak Current	MIPEAK
Motor Foldback Delay Time	MFOLDD
Motor Foldback Time Constant	MFOLDT
Motor Foldback Recovery Time	MFOLDR
Motor Foldback – Enable or Disable	MFOLDDIS

# 15. Digital I/Os

The **Digital I/Os** screen enables you to configure functionality and polarity of the digital I/Os, and to monitor the state of all digital I/Os.

The **Digital I/Os** screen has two panes:

- Digital I/Os
- Drive Script

## 15.1 Digital Inputs

Refer to [Digital Inputs](#) in the drive user manual.

The **Digital Inputs** pane in the **Digital I/Os** screen enables you to configure functionality and polarity of the digital inputs, and to monitor the state of all digital inputs.

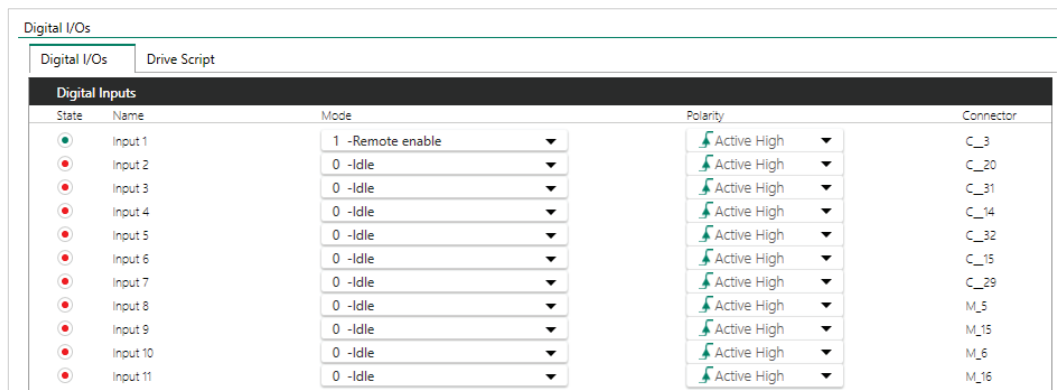


Figure 15-1. ServoStudio 2 – Digital Inputs Pane

<b>State</b>	A graphic element that toggles between green and red to reflect the on or off state of the actual input.	<b>IN INPUTS</b>
<b>Name</b>	Identifies the specific input.	

<b>Mode</b>	<p>Defines the functionality of the digital input.</p> <div style="border: 1px solid black; padding: 5px;"> <ul style="list-style-type: none"> <li>0 -Idle</li> <li>1 -Remote Enable</li> <li>2 -Clear Faults</li> <li>3 -PLL Synchronization</li> <li>4 -Emergency Stop</li> <li>5 -Positive Limit Switch</li> <li>6 -Negative Limit Switch</li> <li>8 -Home Switch</li> <li>9 -Script Trigger</li> <li>10 -Script bit 0</li> <li>11 -Script bit 1</li> <li>12 -Script bit 2</li> <li>13 -Script bit 3</li> <li>14 -Script bit 4</li> <li>26 -Homing Command</li> <li>27 -Touch Probe 1</li> <li>28 -Touch Probe 2</li> <li>30 -Hold and Resume Motion</li> <li>32 -Operation mode change while drive enabled</li> <li>33 -Explicitly sets OPMODE 4 and ENCFOLLOWER 1+</li> <li>34 -Explicitly sets OPMODE 4 and ENCFOLLOWER 2+</li> <li>35 -Explicitly sets OPMODE 4 and ENCFOLLOWER 3+</li> <li>36 -Explicitly sets OPMODE 4 and ENCFOLLOWER 4+</li> <li>37 -Explicitly sets OPMODE 4 and ENCFOLLOWER 5+</li> <li>38 -Jog motor in positive direction at speed JOGSPD1</li> <li>39 -Jog motor in negative direction at speed -JOGSPD1</li> <li>40 -Jog motor in positive direction at speed JOGSPD2</li> <li>41 -Jog motor in negative direction at speed -JOGSPD2</li> </ul> </div> <p>Digital input 5 includes INMODE 17-Pulse signal.  Digital input 6 includes INMODE 18-Direction signal.  <b>Note:</b> Some INMODE values are not supported in ServoStudio 2.</p>	INMODE
<b>Polarity</b>	<p>Defines the polarity of a digital input. Switch between Active High and Active Low option to invert polarity. As a result of inversion, the LED graphic in the software immediately changes color.</p>	ININV
<b>Connector</b>	<p>Indicates the pin number of the input on either the Controller (C) interface or the Machine (M) interface.</p>	

## 15.2 Digital Input Activation of Drive Scripts

### Note

Drive (internal) scripts are not to be confused with software (external) scripts that can be written and executed in ServoStudio 2. Refer to *Software Scripts*.

ServoStudio 2 includes a **Drive Script** tool for programming instructions for digital inputs. These scripts can modify drive behavior while a machine is in operation, such as increasing or

reducing acceleration, initiating a movement, setting a variable, or switching operation modes.

The Drive Script pane in the ServoStudio Digital I/Os screen is used to define these runtime instructions.

The drive scripts are controlled by up to five digital inputs that are defined for this purpose. Up to 32 drive scripts can be defined.

Any VarCom variable or command can be used in a drive script. A drive script is limited to 128 characters.

Drive scripts are saved in the drive, and can be viewed by means of the VarCom command DUMP.

**Note**

ServoStudio 2 software script commands – which start with #, such as #if, #while, #delay – cannot be used in a drive script.

### Drive Script Inputs

To use drive scripts, set the functionality (INMODE) of the required inputs in the Digital I/Os screen > **Digital I/Os** pane.

Digital Inputs		
State	Name	Mode
<input checked="" type="radio"/>	Input 1	0 -Idle
<input type="radio"/>	Input 2	9 -Script Trigger
<input type="radio"/>	Input 3	10 -Script Bit 0
<input type="radio"/>	Input 4	11 -Script Bit 1
<input type="radio"/>	Input 5	12 -Script Bit 2
<input type="radio"/>	Input 6	13 -Script Bit 3
<input type="radio"/>	Input 7	14 -Script Bit 4
<input type="radio"/>	Input 8	0 -Idle
<input type="radio"/>	Input 9	0 -Idle
<input type="radio"/>	Input 10	0 -Idle
<input type="radio"/>	Input 11	0 -Idle

Figure 15-2. ServoStudio 2 – Digital Inputs for Scripts

- Select one input as the trigger that activates drive scripts: INMODE 9-Script trigger
- Select up to 5 inputs that will be used to define and activate various drive scripts:
  - INMODE 10-Script Bit 0
  - INMODE 11-Script Bit 1
  - INMODE 12-Script Bit 2
  - INMODE 13-Script Bit 3
  - INMODE 14-Script Bit 4

Each input and state has a binary bit value, which is used to generate the drive script ID number.

## Drive Script Settings

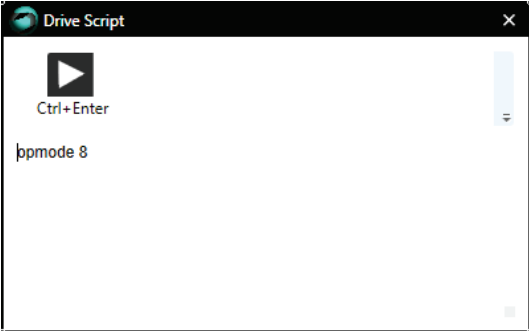
Use the Digital I/Os screen > **Drive Scripts** tab to define the bits whose values determine which script will run when trigger occurs.

Drive Script Number	4	5	6	7	8	Input Trigger 3	Script Commands	Send All
1	■	■	■	■	■	Rising	"opmode 2~	Send
1	■	■	■	■	■	Falling	"opmode 4~	Send
2	■	■	■	■	■	Rising	"opmode 8~	Send
3	■	■	■	■	■	Falling		Send
21	■	■	■	■	■	Falling		Send
								Send

Figure 15-3. ServoStudio 2 – Digital I/Os Screen – Drive Scripts

The Drive Scripts pane opens with only one row displayed. Once data is entered in the last row, a new row is added to the table.

<b>Drive Script Number</b>	<p>The <b>Script ID</b> number is generated by the system according to the states defined for the physical inputs associated with the logical bits.</p> <p>For example (refer to Figure 15-2 and Figure 15-3): when input 3 (script trigger) changes status from 0 to 1 (rises), AND input 4 is on and inputs 5, 6, 7 and 8 are off, the drive will switch to serial current mode (OPMODE 2).</p> <p>Similarly, when the bit inputs remain as defined, but input 3 changes status from 1 to 0 (falls), the drive will switch to position gear mode (OPMODE 4).</p> <p>Script ID "1" is generated by the binary value of the bits. In this example, input 4 represents bit 0, which is on and thus has a value of 1 (<math>2^0=1</math>).</p> <p>Script ID "21" is generated by the binary value of bit 0 (input 4), bit 2 (input 6) and bit 4 (input 8); in other words: <math>2^0+2^2+2^4 = 1+4+16=21</math></p>
<b>[Bit Input state]</b>	<p>The color of the cell represents the state of the physical input/logical bit (IN).</p> <ul style="list-style-type: none"> <li>• <b>Red</b> cell: input must be <b>off</b> for script to run.</li> <li>• <b>Green</b> cell: input must be <b>on</b> for script to run.</li> <li>• <b>Gray (light or dark)</b> cell: the input is <b>not defined</b> as a Script ID bit. Click on a Bit Input cell to toggle the states on/off.</li> </ul>

<p><b>Input Trigger</b></p>	<p>Each Script ID can have one or two associated scripts. One script is executed when the trigger signal rises (input state changes from off to on); the other is executed when the trigger signals falls (input state changes from on to off). Thus, up to 64 drive scripts can be defined and executed.</p> <p>Only one drive script is triggered and executed at a time. A drive script is executed when <b>both</b> of the following conditions exist:</p> <ul style="list-style-type: none"> <li>• The inputs associated with the bits are either on or off, as defined for the specific script.</li> <li>• The trigger signal rises or falls, as defined for the specific script.</li> </ul>
<p><b>Script Command</b></p>	<p>Double-click in the <b>Script Commands</b> cell.</p> <p>A Drive Script dialog box opens.</p>  <p>Enter a command or a set of commands.</p> <p>Use <b>Ctrl+Enter</b> to write to the table and close the dialog box.</p>
<p><b>Send All</b></p>	<p>Sends all scripts currently displayed on the screen to the drive.</p>
<p><b>Delete All</b></p>	<p>Deletes all scripts from the drive.</p>
<p><b>Clear Screen</b></p>	<p>Clears all drive scripts from the screen.</p>
<p><b>Load Script</b></p>	<p>Loads all scripts from the drive to the screen.</p>

**Creating Drive Scripts – Example**

1. In the **Digital I/O** screen select the **Digital I/O** tab.
2. Define the inputs to be used for the drive script functionality:
  - Input 2 as the trigger
  - Input 3 as bit 0
  - Input 4 as bit 1

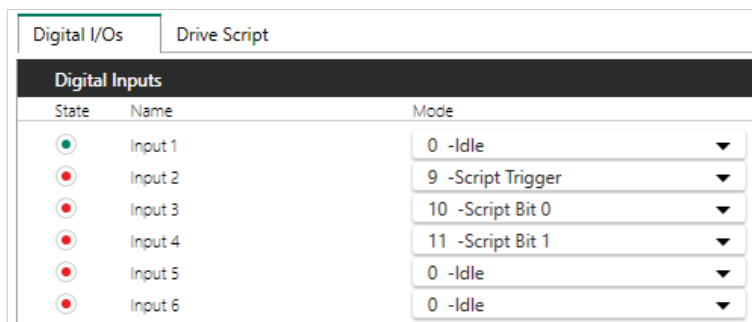


Figure 15-4. ServoStudio 2 – Drive Scripts Example (1)

- In the **Digital I/O** screen select the **Drive Script** tab.

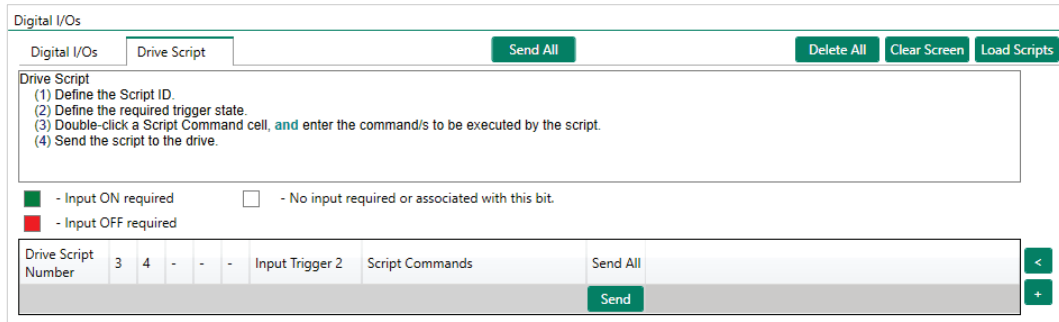


Figure 15-5. ServoStudio 2 – Drive Scripts Example (2)

The **Drive Script Number** (Script ID) is defined by the state of the physical inputs associated with the logical bits.

Since you defined two inputs as bit 0 and bit 1, four scripts are possible:

Bit 0	Bit 1	
0	0	$0 + 0 = 0$
1	0	$2^0 + 0 = 1$
0	1	$0 + 2^1 = 2$
1	1	$2^0 + 2^1 = 3$

- In the first row of the table, press in the Drive Script Number cell. Enter the value **0**, and press **Enter**.

The bit values will be updated, and a new row will be displayed.

In the second row, enter **0**, and press **Enter**.

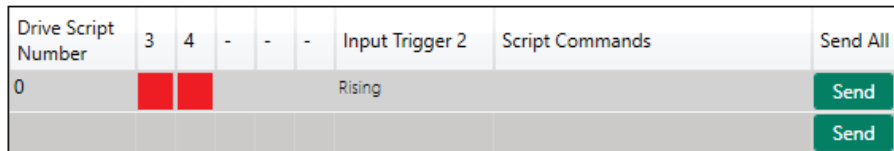


Figure 15-6. ServoStudio 2 – Drive Scripts Example (3)

The **Input Trigger** defines when a specific script will be activated. The specified change in the trigger signal (rising/falling) will activate the script.

Since you defined one input as a trigger and two inputs as bit 0 and bit 1, eight possible scripts can be activated:

Script number	Trigger	
0	Rising	Falling
1	Rising	Falling
2	Rising	Falling
3	Rising	Falling

- In the first row, double-click in the Input Trigger cell, and set the trigger to **Rising**.

Drive Script Number	3	4	-	-	-	Input Trigger 2	Script Commands	Send All
0						Rising		Send
0						Falling		Send
								Send

Figure 15-7. ServoStudio 2 – Drive Scripts Example (4)

6. In the first row, double-click in the Script Commands cell.  
A Drive Script window opens.
7. In the Drive Script window, enter the commands that will be executed by the script:
 

```
K
DELAY 100
OPMODE 0
EN
```
8. When finished, press **Ctrl+Enter**. The Drive Script windows closes.
9. Click **Send** to send the script to the drive.

Drive Script Number	3	4	-	-	-	Input Trigger 2	Script Commands	Send All
0						Rising	"K ~DELAY 100 ~OPMODE 0 ~EN~	Send
0						Falling		Send
								Send

Figure 15-8. ServoStudio 2 – Drive Scripts Example (5)

**Note** Alternately, you can define all the scripts for all bit combinations, and then press **Send All** to send all scripts to the drive.

10. Continue adding drive scripts for the following actions:
  - Drive script **0** when trigger is **rising**: disable the drive (K), wait 100 [ms] (DELAY 100), change the operation mode to 0-serial velocity (OPMODE 0) and enable the drive (EN).
  - Drive script **0** when trigger is **falling**: motor will jog in positive direction at 100 [rpm] (J 100).
  - Drive script **1** when trigger is **rising**: motor will jog in negative direction at 1000 [rpm] (J -1000).
  - Drive script **1** when trigger is **falling**: motor will jog in positive direction at 1000 [rpm] (J 1000).
  - Drive script **3** when trigger is **falling**: motor will stop (STOP), drive will remain enabled.

Drive Script Number	3	4	-	-	-	Input Trigger 2	Script Commands	Send All
0						Rising	"K ~DELAY 100 ~OPMODE 0 ~EN~	<input type="button" value="Send"/>
0						Falling	"J 100~	<input type="button" value="Send"/>
1						Rising	"J -1000~	<input type="button" value="Send"/>
1						Falling	"J 1000~	<input type="button" value="Send"/>
3						Falling	"STOP~	<input type="button" value="Send"/>
								<input type="button" value="Send"/>

Figure 15-9. ServoStudio 2 – Drive Scripts Example (6)

### 15.3 Digital Outputs

Refer to [Digital Outputs](#) in the drive user manual.

The **Digital Outputs** pane in the **Digital I/Os** screen enables you to configure functionality and polarity of the digital outputs, and to monitor the state of all digital outputs.

Digital Outputs				
State	Name	Mode	Polarity	Connector
	Output 1	0 -Idle	Active High	C_2
	Output 2	0 -Idle	Active High	C_33
	Output 3	0 -Idle	Active High	C_16
	Output 4	0 -Idle	Active High	M_17
	Output 5	0 -Idle	Active High	M_8
	Output 6	0 -Idle	Active High	M_18
	Output 7	0 -Idle	Active High	C_34
	Output 8	0 -Idle	Active High	C_12
	Fault Relay Mode	0 -Close when no faults		

Figure 15-10. ServoStudio 2 – Digital Outputs Pane

<b>State</b>	A graphic element that toggles between green and red to reflect the on or off state of the actual output.	<a href="#">OUT OUTPUTS</a>
<b>Name</b>	Identifies the specific output.	

<b>Mode</b>	Defines the condition that will activate a specified digital output. <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <ul style="list-style-type: none"> <li>0 -Idle</li> <li>1 -Active</li> <li>2 -Brake Release Signal</li> <li>3 -Alarm Any Fault</li> <li>4 -In-Position</li> <li>5 -Stopped</li> <li>6 -Foldback</li> <li>7 -Current Level</li> <li>8 -Current Range</li> <li>9 -Velocity Level</li> <li>10 -Velocity Range</li> <li>11 -Position Level</li> <li>12 -Position Range</li> <li>13 -Battery Low V Fault</li> <li>14 -Warning On</li> <li>15 -Faults or Disabled</li> <li>16 -Battery Low V Warning or Fault</li> <li>17 -Phase Find Succeeded</li> <li>18 -Over-Current Fault</li> <li>19 -Over-Voltage Fault</li> <li>20 -Under-Voltage Fault</li> <li>21 -Phase Find Required</li> <li>22 -Alarm Excl. Phase Find Failure</li> <li>23 -Homing Complete</li> <li>25 -Zero Position After Homing</li> <li>30 -Force Control in Position</li> <li>31 -Force Control Active</li> </ul> </div>	OUTMODE
<b>Connector</b>	Indicates the pin number of the input on either the Controller (C) interface or the Machine (M) interface.	

## 16. Analog I/Os

The **Analog I/Os** screen enables you to define properties and monitor the state of two analog inputs and one analog output.

The **Analog I/Os** screen has two panes:

- Analog Inputs
- Analog Output

### 16.1 Analog Inputs

Refer to [Analog Inputs](#) in the drive user manual.

The **Analog Input 1** and **Input 2** tabs in the **Analog I/Os** screen allows you to set the analog input properties and to monitor the input state.

**Note** Some drives do not have a second analog input.

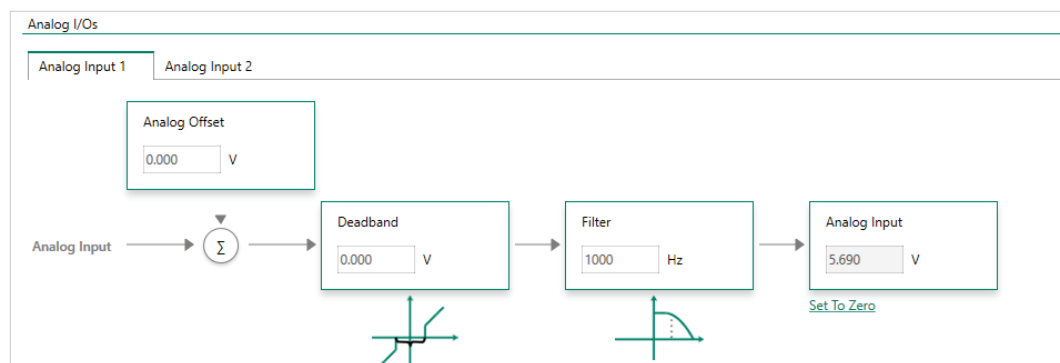


Figure 16-1. ServoStudio 2 – Analog I/Os Screen

		Analog Input 1	Analog Input 2
<b>Analog Offset</b>	The DC voltage offset on the analog input.	ANIN1OFFSET	ANIN2OFFSET
<b>Deadband</b>	The deadband range of the analog input. Useful for preventing the drive from responding to voltage noise near the zero point of the analog input.	ANIN1DB	ANIN2DB
<b>Filter</b>	A low-pass filter applied to the analog input. Useful for filtering high frequency noise from the input, or for limiting the rate of change of that signal.	ANIN1LPFHZ	ANIN2LPFHZ
<b>Analog Input</b>	The voltage at the analog input. Read only.	ANIN1	ANIN2
<b>Set to Zero</b>	Causes the value of the analog input signal to become 0 by modifying the analog offset value.	ANIN1ZERO	ANIN2ZERO

## 16.2 Analog Output

Refer to [Analog Output](#) in the drive user manual.

The **Analog Output** pane in the **Analog I/Os** screen enables you to configure the analog output.



Figure 16-2. ServoStudio 2 – Analog I/Os Screen – Analog Output

The drive's analog output can be set to output a voltage equivalent to the value of certain parameters.

<b>Analog Output Mode</b>	Defines the function of the analog output. <b>0 -User command</b> 1 -Tachometer mode 2 -Equivalent current monitoring 3 -Velocity error monitoring 4 -Current command monitoring 5 -Triangle wave at low frequency 6 -Current in-phase (IQ) monitoring 11 -Triangle wave (10 Hz) 12 -Rectangular wave (10 Hz) 13 -Velocity command (VCMD)	<a href="#">ANOUTMODE</a>
<b>Analog Output Value</b>	Displays the analog output value (in volts), as set by ANOUTMODE. Read only.	<a href="#">ANOUT</a>
<b>Analog Output Command</b>	The analog output command (in volts) set by user in ANOUTMODE 0.	<a href="#">ANOUTCMD</a>
<b>Analog Output Current Scaling</b>	The scaling of the analog output voltage that represents the motor current (I) or the current command (ICMD).	<a href="#">ANOUTISCALE</a>
<b>Analog Output Voltage Limit</b>	The analog output command voltage limit for all modes.	<a href="#">ANOUTLIM</a>
<b>Analog Output Velocity Scaling</b>	The scaling of the analog output voltage that represents velocity (V).	<a href="#">ANOUTVSCALE</a>

## 17. Force Control

The **Force Control** screen is used to configure, test, and monitor the force control function.

Force control is used to maintain a constant force on the tool endpoint.

The force control mode can be set only when position control mode (serial OPMODE 8) is in effect and the motor is stopped.

Figure 17-1. ServoStudio 2 – Force Control

Configuration		
<b>Force Control Mode</b>	Force can be set by means of an analog input, a serial command, or an EtherCAT object.	FCMODE
<b>Force Setpoint</b>	Defines the target value for the force control function.	FCSETPOINT
<b>Force Slope</b>	Defines the rate of change in acceleration/deceleration when the force control function is in use. Limits the rate of change of the force setpoint.	FCSLOPE
<b>Force Proportional Gain</b>	Defines the proportional gain for the force control command.	FCKP
<b>Force Tolerance</b>	Force control voltage tolerance. Defines the voltage tolerance at which the force is considered to be at the setpoint (target value).	FCEINSET
<b>Force Duration</b>	Force control tolerance duration. Defines the period of time for which the force must be at the setpoint (target value).	FCEINSETTIME

<b>Force Low Pass Filter</b>	Defines the low pass filter value that is used in the force control command before the proportional gain is applied.	<a href="#">FCLPF</a>
<b>Monitor (Read only)</b>		
<b>Force Control Command</b>	The actual value of voltage applied to the proportional (P) gain when the force control function is in use.	<a href="#">FCCMD</a>
<b>Force Control Error</b>	The difference between the force control command voltage value (FCCMD) and the actual voltage input on the force control sensor (ANIN2).	<a href="#">FCE</a>
<b>Analog Input 1 Value</b>	Indicates the voltage value of analog input 1.	<a href="#">ANIN1</a>
<b>Analog Input 2 Value</b>	Indicates the voltage value of analog input 2. Normally used for the force control sensor.	<a href="#">ANIN2</a>
<b>Digital Outputs</b>		
<b>Force Control at Setpoint</b>	Defines the digital output that indicates when the force control setpoint is reached.	<a href="#">OUTMODE 30</a>
<b>Force Control Active</b>	Defines the digital output that indicates when the force control is active	<a href="#">OUTMODE 31</a>
<b>Record</b>	Defines the recording parameters. For details on use, see <a href="#">Recording Setup</a> .	
<b>Test</b>		
<b>Start</b>	Activates force control according to the defined configuration, and triggers recording. Motion will be executed according to the analog input.	
<b>Stop</b>	Aborts the motion and disables force control.	

## 18. Gantry

Refer to [Gantry System](#) in the drive user manual.

The **Gantry** screen has two tabs:

- Gantry Configuration
- Gantry Alignment

The Gantry screen **Configuration** tab is primarily used to monitor the state of the gantry axes.

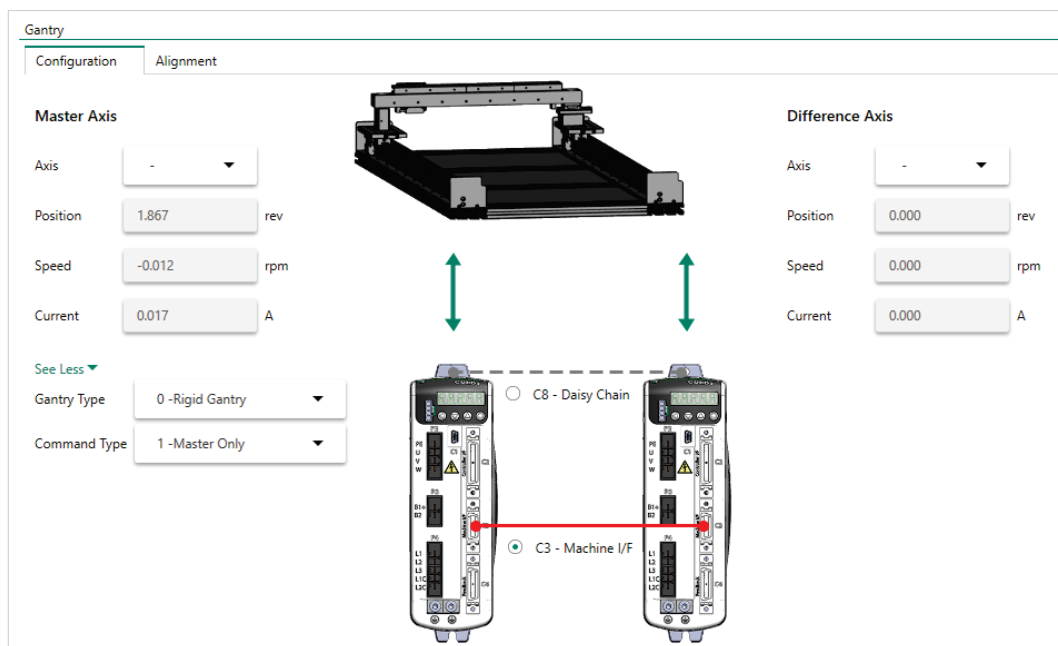


Figure 18-1. ServoStudio 2 – Gantry - Configuration

<b>Axis</b>	Defines whether the position loop is applied to the average value or the difference in value of the two gantry motor positions.	<a href="#">GANTRYMODE</a>
<b>Master Axis</b>		
<b>Position</b>	The position of the motor, including any offsets that have been added.	<a href="#">MFB</a>
<b>Speed</b>	The velocity of the motor.	<a href="#">V</a>
<b>Current</b>	The current command to the motor.	<a href="#">ICMD</a>
<b>Difference Axis</b>		
<b>Position</b>	The MFB value of the other (partner) gantry motor.	<a href="#">GANTRYPRTNRMFB</a>
<b>Speed</b>	The ICMD value of the other (gantry partner) drive.	<a href="#">GANTRYPRTNRICMD</a>
<b>Current</b>	The V value of the other (gantry partner) drive.	<a href="#">GANTRYPRTNRVFB</a>

<b>Gantry Type</b>	Defines whether the gantry structure is rigid or flexible.	<a href="#">GANTRYTYPE</a>
<b>Command Type</b>	Defines how a gantry drive responds to reference commands. Defines which position feedback value the drive will report through EtherCAT/CANopen objects and encoder simulation.	<a href="#">GANTRYCMDTYPE</a>
<b>C8/C3</b>	Defines which controller interface is used for connecting the communication cable between gantry drives.	<a href="#">GANTRYINTERFACE</a>

The Gantry screen **Alignment** tab is used mainly to set the gantry properties and align the axes. If the gantry system is defined as **rigid**, the alignment functions are not applicable.

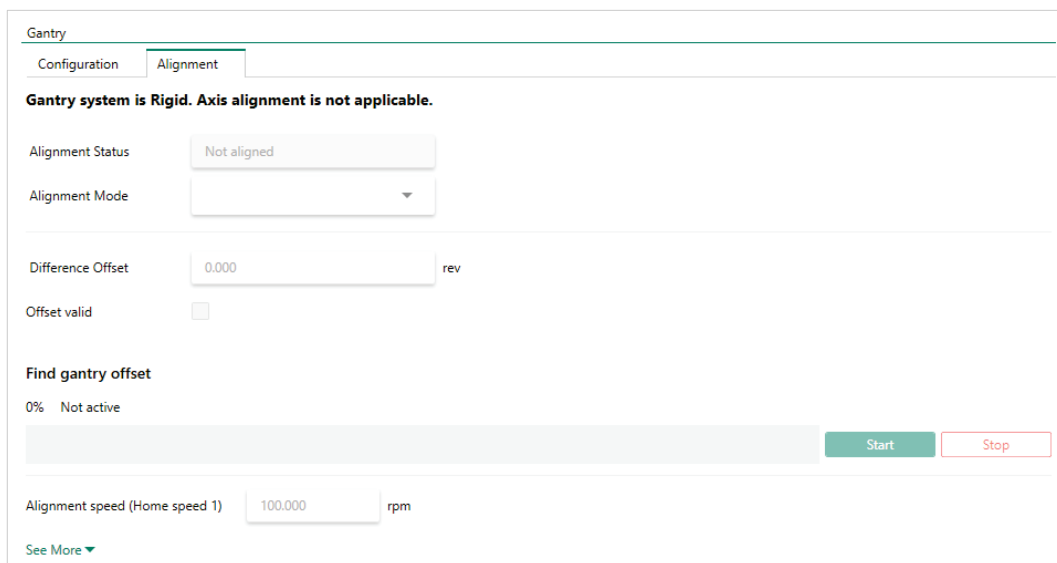


Figure 18-2. ServoStudio 2 – Gantry - Alignment

<b>Alignment Status</b>	Indicates whether the gantry Y axes are aligned.	<a href="#">GANTRYALIGNED</a>
<b>Alignment Mode</b>	Defines the alignment method for a flexible gantry system.	<a href="#">GANTRYALIGNMODE</a>
<b>Difference Offset</b>	The difference in distance between the Y1 and Y2 reference points. Value required for flexible gantry system.	<a href="#">GANTRYOFFSET</a>
<b>Offset Valid</b>	Indicates whether the stored GANTRYOFFSET value is valid and can be used for alignment procedure	<a href="#">GANTRYOFFSETST</a>
<b>Find Gantry Offset</b>	<b>Start/Stop.</b> Initiates/aborts the procedure for finding the value of the difference (in distance) between reference points on the Y1 and Y2 gantry axes.	<a href="#">GANTRYFINDOFF</a>
<b>Alignment Speed</b>	The initial velocity used in the homing process during the search for limit switches, home switches, and hard stops.	<a href="#">HOMESPEED1</a>

<b>See More ...</b>		
<b>In Position Error Tolerance</b>	The error tolerance for declaring an "in position" state.	<a href="#">PEINPOS</a>
<b>In Position Time</b>	The duration of the "in position" state for the motor to be considered settled.	<a href="#">PEINPOSTIME</a>

# 19. Error Correction

The Error Correction screen is used to configure and apply the error correction function.

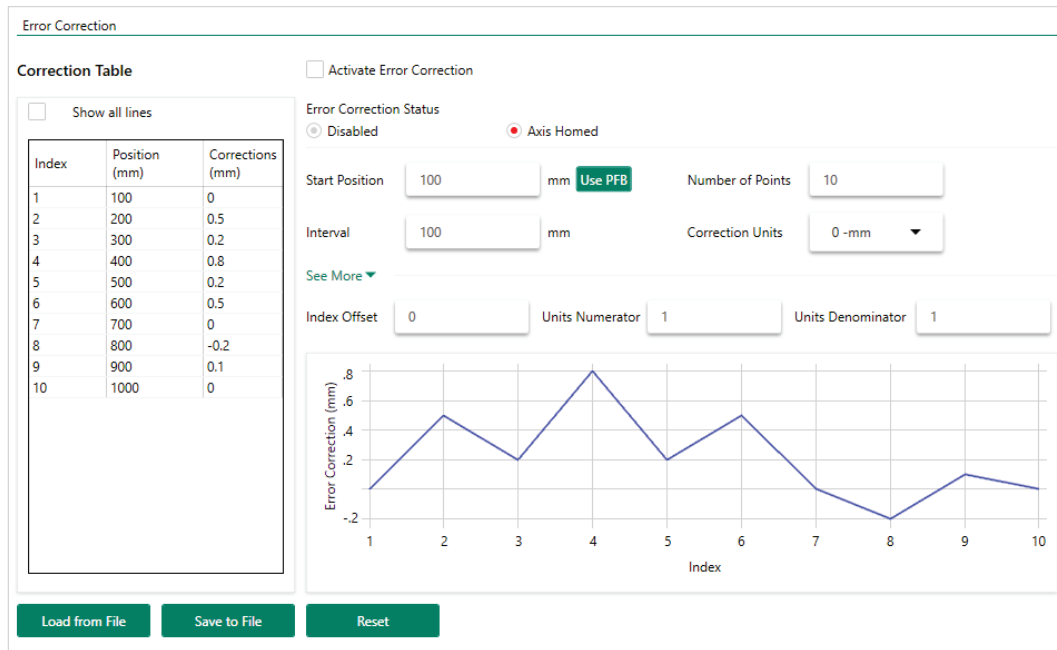


Figure 19-1. ServoStudio 2 – Error Correction Screen

<b>Activate Error Correction</b>	Defines a user request to activate the error correction function.	<a href="#">ERRCOREN</a>
<b>Error Correction Status</b>	Indicates the state of the error correction function after a user request (ERRCOREN 1) has been issued.	<a href="#">ERRCORST</a>
<b>Start Position</b>	Defines the position corresponding to the first active entry of the error correction table; defined according to Correction Units. <b>Use PFB</b> (current motor position) as the first active entry of the error correction table.	<a href="#">ERRCORSTARTPOS</a>
<b>Number of Points</b>	Defines the number of active entries in the error correction table. Up to 1000 entries can be defined (and active) in the error correction table.	<a href="#">ERRCORACTIVENUM</a>
<b>Interval</b>	Defines the distance between the positions at which the errors are measured and added to the correction table. Defined in LOAD units.	<a href="#">ERRCORINTERVAL</a>
<b>Correction Units</b>	Defines the units of the error position data delivered by the error correction table. Applies to the values of Start Position, Interval and Corrections in the table.	<a href="#">ERRCORUNITS</a>

<b>Index Offset</b>	Defines the offset to the first active entry in the error correction table.	<a href="#">ERRCORSTARTOFF</a>
<b>Units Numerator</b>	The denominator of the motor feedback to load feedback scaling ratio.	<a href="#">LMUNITSNUM</a>
<b>Units Denominator</b>	The numerator of the motor feedback to load feedback scaling ratio.	<a href="#">LMUNITSDEN</a>
<b>Load from File</b>	Loads error correction data file from the host computer. Can be in either *.SSV or *.RTL format.	
<b>Save to File</b>	Saves all parameters from the drive to the host computer, including all error correction entries. In *.SSV format.	
<b>Reset</b>	Used to reset all error correction parameters and table entries to their default values. Reset occurs when ERRCORRESET is set to 1.	<a href="#">ERRCORRESET</a>
<i>line highlighted yellow</i>	Indicates the index of the error correction table entry whose value is currently added to PFB.	<a href="#">ERRCORINDEX</a>
<b>Corrections value</b>	Defines a correction value for a specific entry in the correction table.	<a href="#">ERRCORSETINDEX</a>
<i>line highlighted red</i>	Indicates the index of the error correction table entry that failed due to an invalid error size. Error size must not exceed a maximum value of 1 (degree for rotary units/ millimeters for linear units).	<a href="#">ERRCORFAILINDEX</a>

## 20. Enable | Faults

### 20.1 Drive Enable

Refer to [Drive Enable](#) in the drive user manual.



**Caution:** Enabling the drive might cause the motor to move.

The **Enable & Faults** screen graphically shows the conditions required for the drive to be enabled. It allows you to clear faults and to activate the Software Enable switch.

As long as any light in the diagram is red, the drive remains disabled. When all lights are green, the drive is enabled.

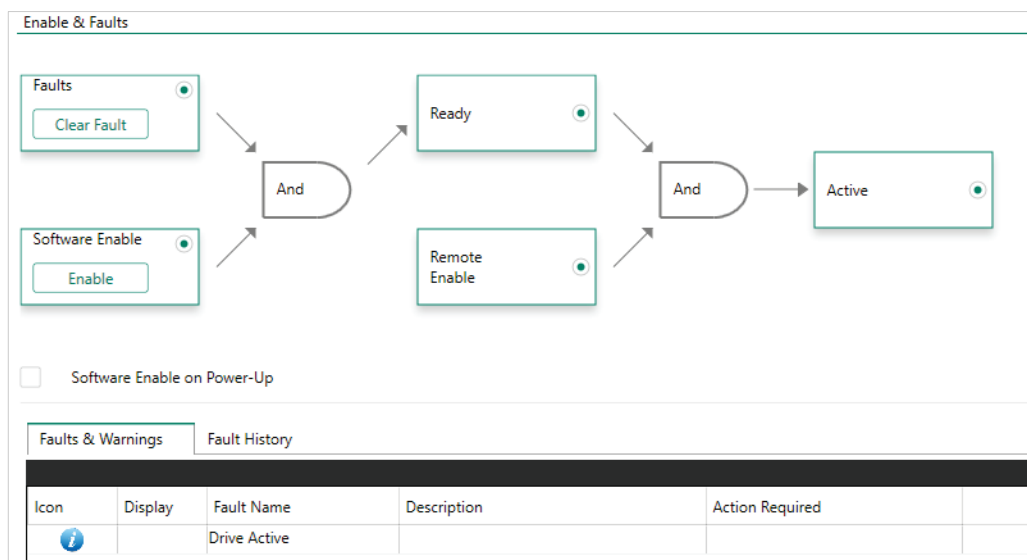


Figure 20-1. ServoStudio 2 – Enable & Faults Screen

#### Software Enable on Power-up

This option is available only in serial command interface mode (COMMODE=0).

The Software Enable at Power-Up switch determines whether the drive powers up in a Disabled or Enabled state.

- By default, the Software Enable switch is **off** (SWENMODE=0), and the drive powers up in the Disabled state.
- If the Software Enable switch is **on** (SWENMODE=1), the drive powers up in the Enabled state, provided there are no faults and the Remote Enable signal is on.

Three conditions are required for enabling the drive:

1. **No Faults.**

The drive can be enabled only when no faults exist. Once all faults are cleared, the drive is ready for activation (READY).

2. **Software Enable switch must be ON.**

The Software Enable switch can be controlled in two ways:

- VarCom commands **EN** (Enable) and **K** (Disable) toggle the switch.
- ServoStudio 2 **Enable|Disable** button toggles the switch.

By default, the drive powers up with the Software Enable switch **off** (SWENMODE=0), meaning the drive powers up in the Disabled state.

If the drive powers up with the Software Enable switch **on** (SWENMODE=1), the drive will power up in the Enabled state, provided the other two conditions are met.

### 3. Remote Enable switch must be ON.

**Input 1** is factory-defined as a Remote Enable switch (INMODE 1 = 1).

Remote Enable is a signal in the range of 12—24 VDC that is applied to one of the opto-isolated digital inputs in the Controller I/F connector.

By default the drive powers up with the Remote Enable signal **on** (REMOTE=1) even if no input is configured for this function.

## 20.2 Faults

The **Faults** pane displays a list of all faults and warnings currently in effect.

Faults & Warnings		Fault History			
Icon	Display	Fault Name	Description	Action Required	
		Drive Inactive			
		No SW enable			
	r20	Feedback Communication Error	Communication with the feedback device did not initialize correctly.	Make sure the feedback device is wired correctly. Make sure the correct encoder type (MENCTYPE) is selected.	

Figure 20-2. ServoStudio 2 – Fault History

The Faults pane has two tabs:

- Faults & Warnings
- Faults History

<b>Icon</b>	A graphic image that indicates the type of fault: Warning, Fault, Fatal Fault.
<b>Display</b>	In <b>Faults &amp; Warnings</b> tab only. A graphic replica of the code that appears on the drive's 7-segment display.
<b>Time</b>	In <b>Fault History</b> tab only. The internal runtime at which the fault occurred.
<b>Fault Name</b>	The system name of the fault.
<b>Description</b>	Describes the status or fault indicated by the code.
<b>Action Required</b>	Describes the recommended steps for correcting the fault.

### Faults & Warnings

The **Faults and Warnings** tab displays a list of all faults and warnings currently in effect.

- Displays a list of **warnings** (VarCom [ST](#)).
- Displays a list of **faults** that are preventing the drive from being enabled (VarCom [FLT](#)).

Warnings remain displayed until cleared by **Clear Faults** button or [CLEARFAULTS](#) command, provided the condition that caused the warning has been removed.

After a fault condition is removed, the fault remains latched until cleared by any of the following methods:

- **Clear Faults** button or [CLEARFAULTS](#) command.
- **Software Enable** button or [EN](#) command.

Once all faults are cleared, the drive is ready for activation (VarCom [READY](#)).

### **Fault History**

The **Fault History** tab displays a list of faults that have occurred since the fault buffer was last cleared. (VarCom [FLTHIST](#))

The drive stores a log of the 40 most recent faults.

## 21. Current Control Loop

Current control loop tuning is derived from the motor properties and the bus voltage. The ServoStudio 2 Motor Setup wizard tunes the current control loop.

**Note** There is no need to manipulate values in the Current Loop screen, unless instructed to do so by Technical Support.

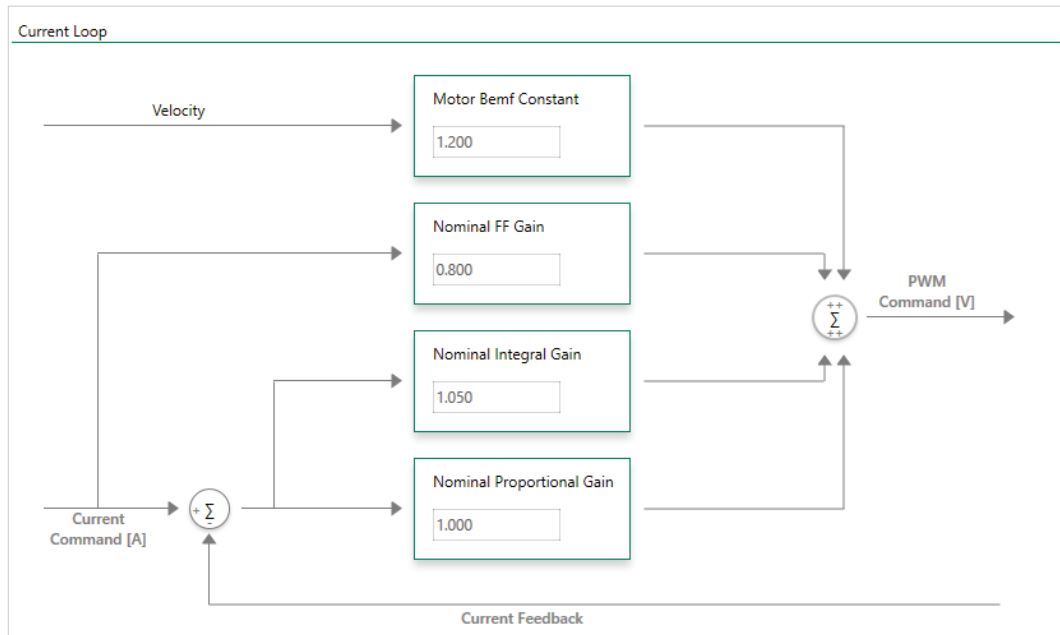


Figure 21-1. ServoStudio 2 – Current Loop Screen

<b>Motor BEMF Constant</b>	The feedforward BEMF compensation ratio for the current control.	KCBEMF
<b>Nominal FF Gain</b>	The current controller feedforward gain.	KCFF
<b>Nominal Integral Gain</b>	The current controller integrator gain.	KCI
<b>Nominal Proportional Gain</b>	The current controller proportional gain.	KCP

## 22. Velocity Control Loop

Refer to [Velocity Control](#) in the drive user manual.

The **Velocity Loop** screen provides four options for velocity tuning.

Select the controller method from the list at the top of the screen:

0 – PI controller

1 – PDFF controller

2 – Standard pole placement controller

7 – HD velocity controller with integrator (recommended)

### 22.1 HD Velocity Controller with Integrator

Refer to VarCom [VELCONTROLMODE 7](#).

Refer to [Velocity Control](#) in the drive user manual.

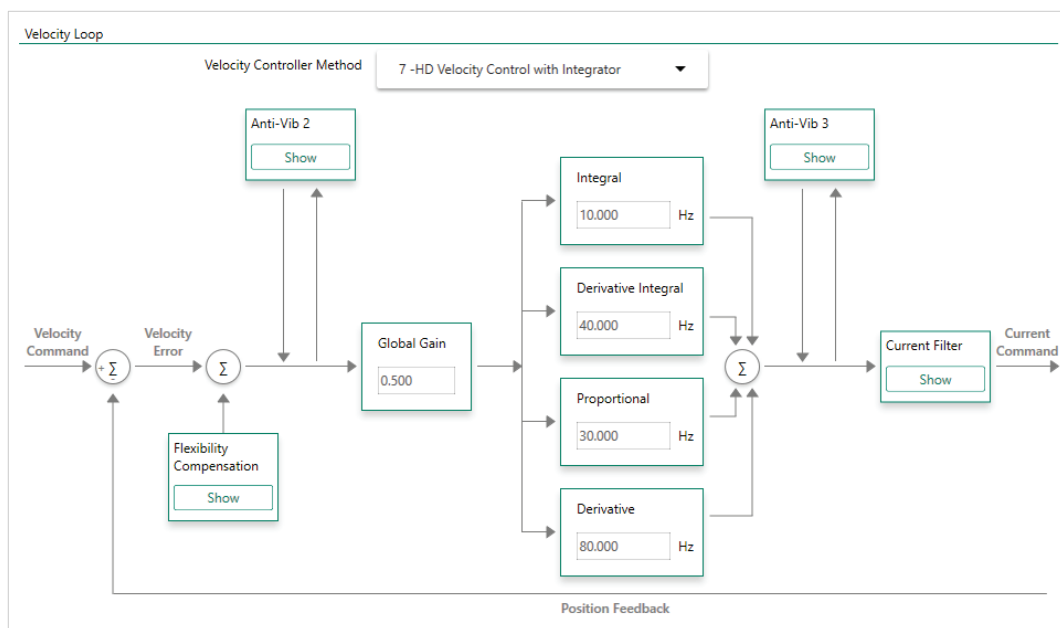


Figure 22-1. ServoStudio 2 – Velocity Control Loop – HD Velocity Control with Integrator

### 22.2 PI Velocity Controller

Refer to VarCom [VELCONTROLMODE 0](#).

Refer to [Velocity Control](#) in the drive user manual.

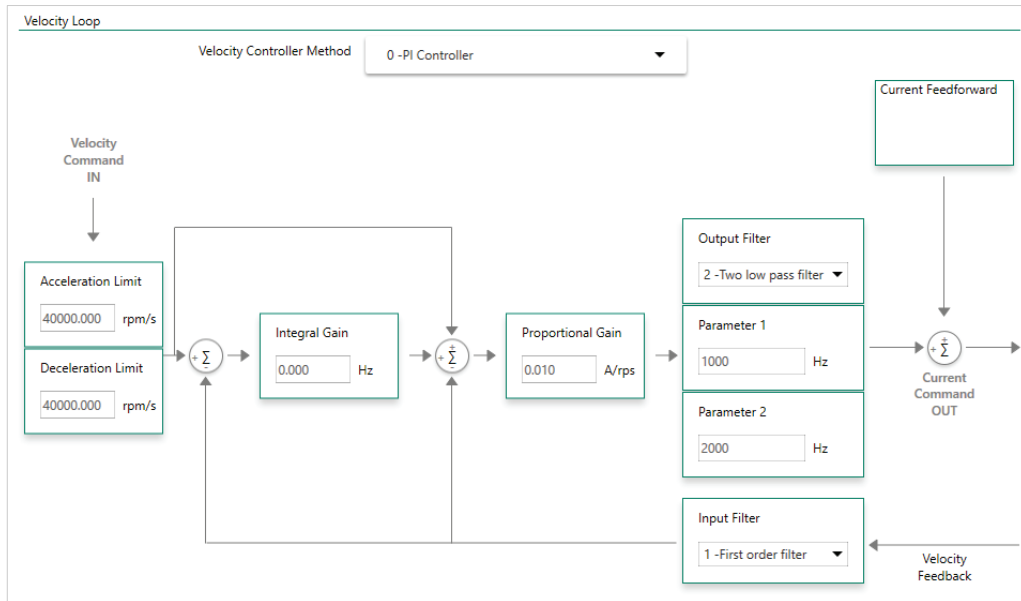


Figure 22-2. ServoStudio 2 – Velocity Control Loop – PI Controller

### 22.3 PDFF Velocity Controller

Refer to VarCom [VELCONTROLMODE 1](#).

Refer to [Velocity Control](#) in the drive user manual.

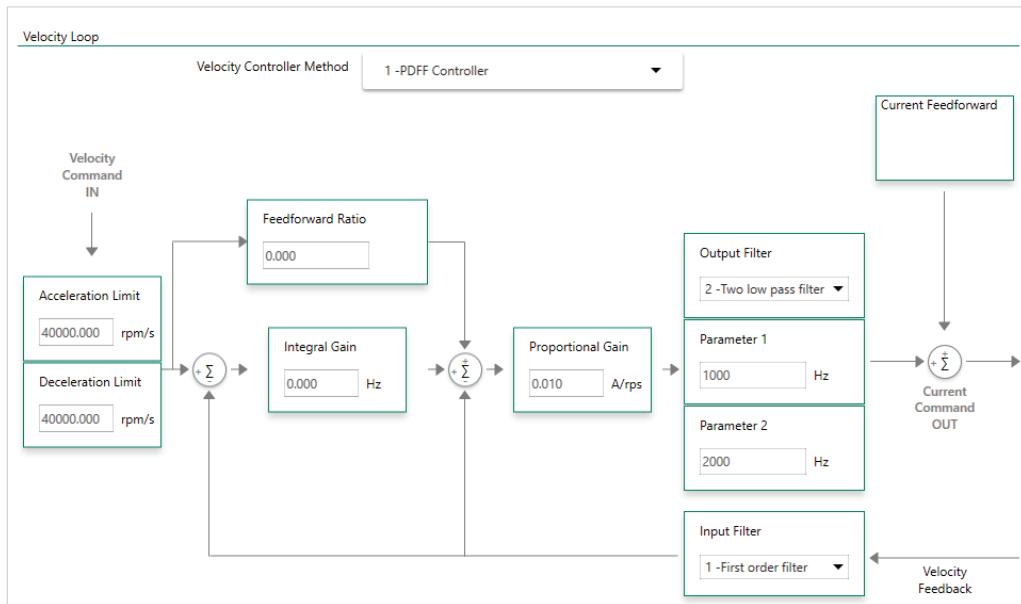


Figure 22-3. ServoStudio 2 – Velocity Control Loop – PDFF Controller

### 22.4 Standard Pole Placement Velocity Controller

Refer to VarCom [VELCONTROLMODE 2](#).

Refer to [Velocity Control](#) in the drive user manual.

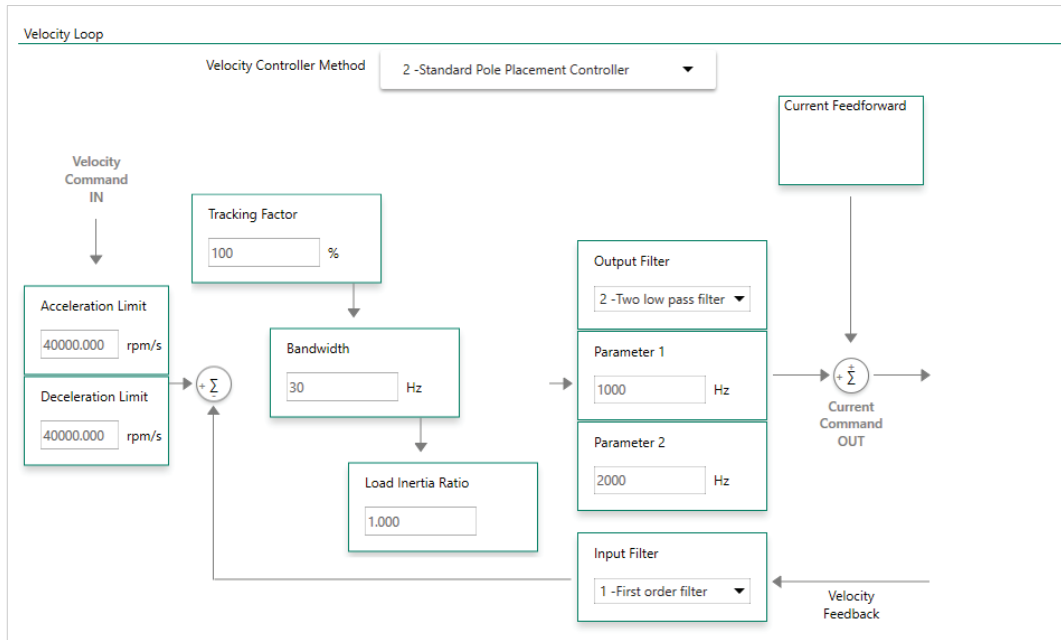


Figure 22-4. ServoStudio 2 – Velocity Control Loop - Standard Pole Placement Controller

## 23. Position Control Loop

Refer to [Position Control](#) in the drive user manual.

Two position control loop options are available for the drive – linear and HD control.

In the **Position Loop** screen, select the controller method from the list at the top of the screen.

### 23.1 HD (Nonlinear) Position Controller

Refer to [Position Control](#) in the drive user manual.

The HD (nonlinear) position control algorithm is designed to minimize position error during motion and to minimize settling time at the end of motion.

The HD controller parameters are initially set using the Autotuning wizard. The parameters are shown in the Position Loop – **HD Controller** screen, and can be modified as required by the application.

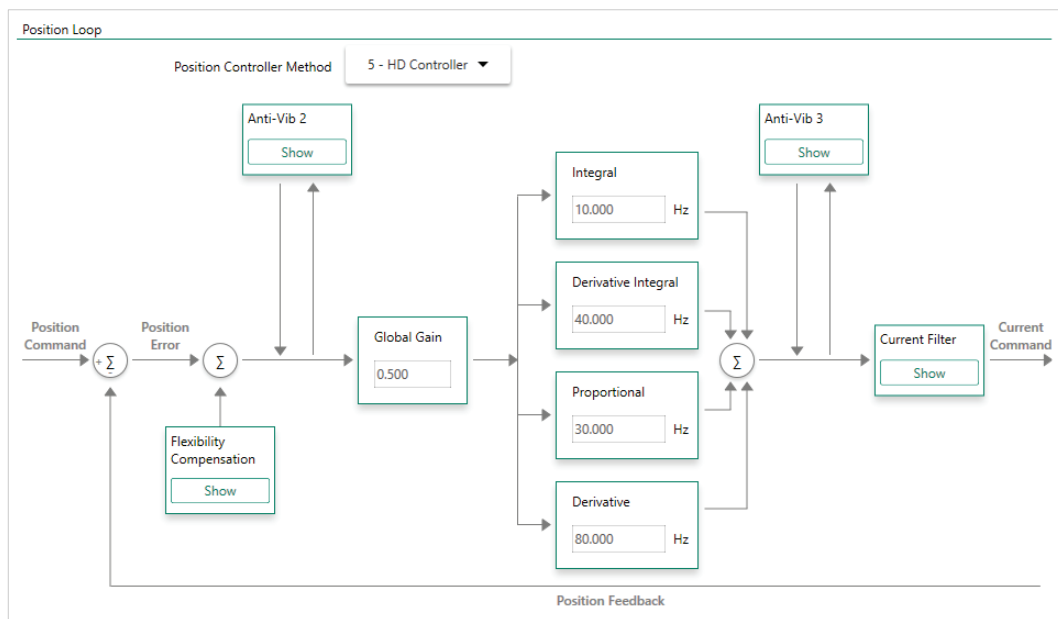


Figure 23-1. ServoStudio 2 – Position Loop – HD Controller Screen

### 23.2 Linear Position Controller

Refer to [Position Control](#) in the drive user manual.

The Linear Position controller is a PID controller with feedforward and an option to limit the integral saturation (anti-windup).

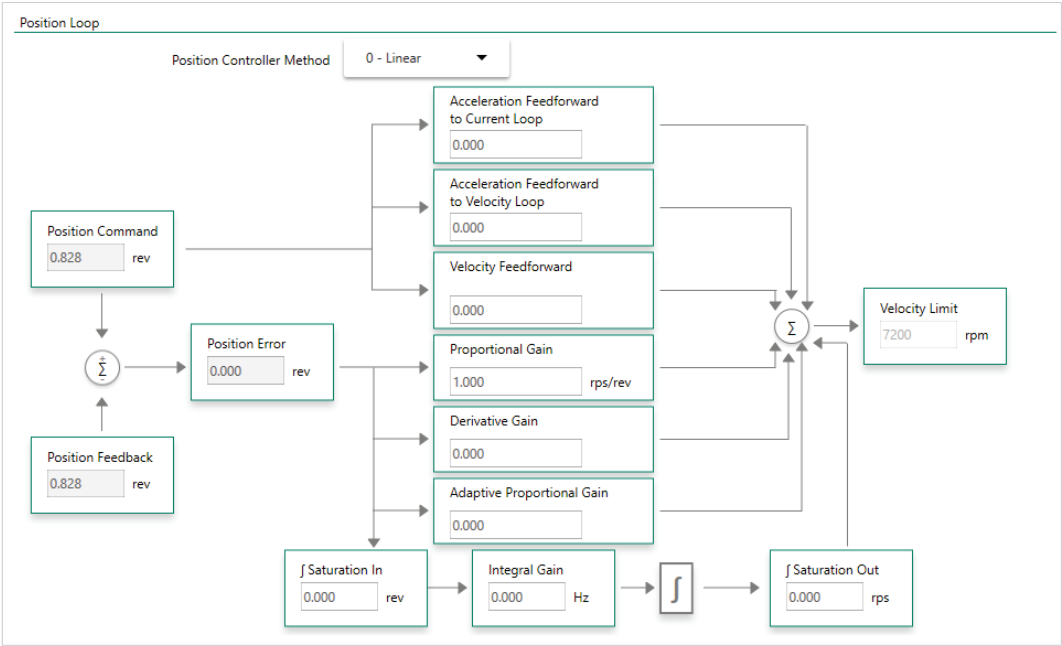


Figure 23-2. ServoStudio 2 – Position Loop – Linear Screen

## 24. Operation Mode

The **Motion** screen allows you to select the operation mode and define motion settings. The schematic diagram and data displayed in the Motion screen varies according to the selected operation mode.

When using VarCom instructions, the operation modes are set by the value of **OPMODE**.

When using CANopen or CANopen over EtherCAT (CoE) communication, the operation modes are set by object **6060h**, and reported by object 6061h.

In addition, ServoStudio 2 sets the communication interface mode (COMMODE) according to the type of operation mode:

- When a serial operation mode is selected, ServoStudio sets COMMODE=0.
- When a fieldbus (CANopen/EtherCAT) operation mode is selected, ServoStudio 2 sets COMMODE=1.

### 24.1 Secondary Feedback (Dual Control) Operation Mode

When a secondary feedback device has been configured, several operation modes in the selection menu include **Secondary Feedback** options.

Serial Velocity
Serial Position
Serial Position - Secondary Feedback
Fieldbus Cyclic Synchronous Position
Fieldbus Cyclic Synchronous Position - Secondary Feedback
Fieldbus Cyclic Synchronous Velocity
Fieldbus Cyclic Synchronous Torque
Fieldbus Profile Position
Fieldbus Profile Position - Secondary Feedback
Fieldbus Profile Velocity
Fieldbus Profile Torque
Analog Current
Analog Velocity
Gearing/Pulse Train
Gearing/Pulse Train - Secondary Feedback

Figure 24-1. ServoStudio 2 – Motion Screen – Operation Mode Selection

When an operation mode for a secondary feedback device is selected, the software interface does not change. The settings and values simply reflect the functionality and feedback of the secondary device defined for the dual control loop.

Refer to the section *Secondary Feedback Device Settings*.

Refer also to [Secondary Feedback](#) in the drive user manual.

### 24.2 Serial Current Operation Mode

Refer to [Serial Current Operation](#) in the drive user manual.

**OPMODE=2 | COMMODE=0**

In the Motion screen select Operation Mode – **Serial Current** to display the schematic and variables that affect the Serial Current command.

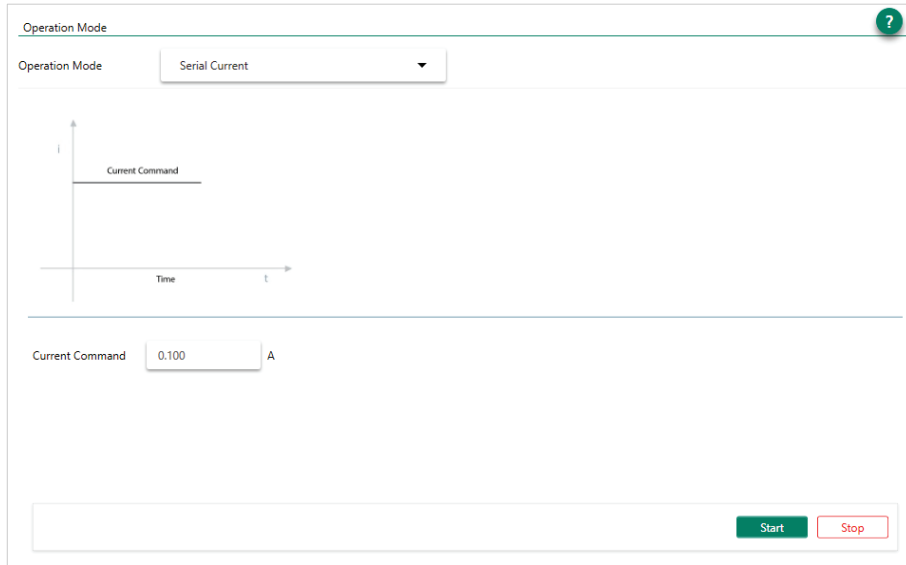


Figure 24-2. ServoStudio 2 – Motion Screen – Serial Current Mode

<b>Current Command</b>	Sets the value of the current.	T
<b>Start</b>	Sends the current command to the motor.	
<b>Stop</b>	Stops the current command.	

### 24.3 Serial Velocity Operation Mode

Refer to [Serial Velocity Operation](#) in the drive user manual.

`OPMODE=0` | `COMMODE=0`

In the Motion screen, select Operation Mode – **Serial Velocity** to display the schematic and variables that affect the Serial Velocity command.

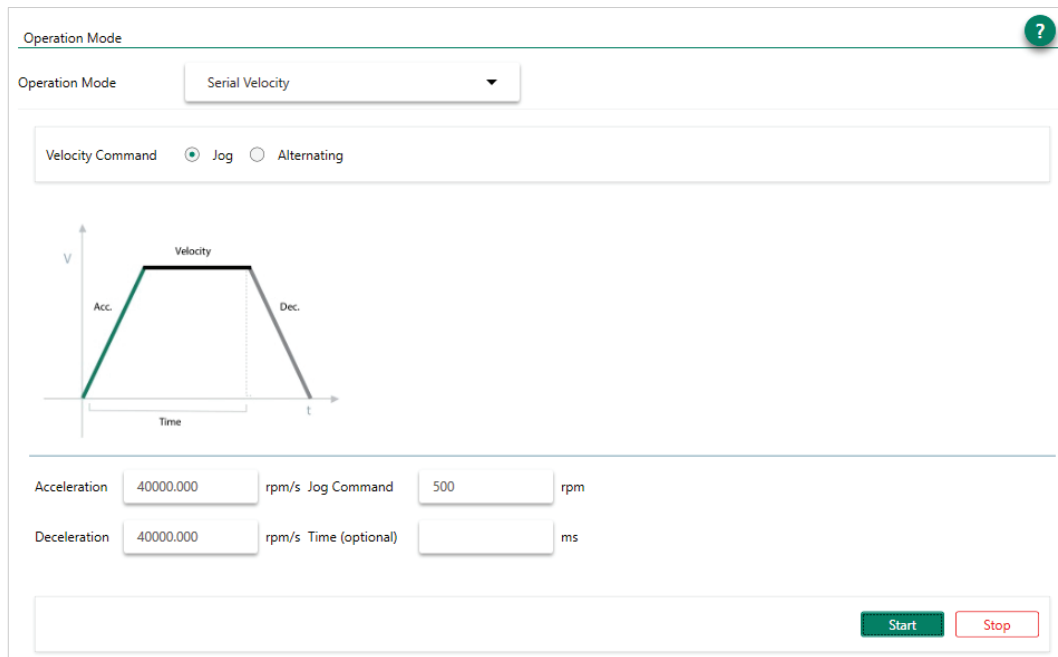


Figure 24-3. ServoStudio 2 – Motion Screen – Serial Velocity Mode

<b>Velocity Command</b>		
<b>Jog</b>	Moves the motor at a constant velocity, for a specified time, or endlessly until <b>Stop</b> is pressed.	J
<b>Alternating</b>	Moves the motor at two alternating velocities by repeatedly issuing two independent velocity command values, with each running for a specified time.	STEP
<b>Motion Profile</b>		
<b>Acceleration</b>	Acceleration value.	ACC
<b>Deceleration</b>	Deceleration value.	DEC
<b>Jog Command</b>	If <b>Jog</b> is selected, the velocity of the motion.	
<b>Time (optional)</b>	If <b>Jog</b> is selected, the duration of the motion.	
<b>Velocity/1/2</b>	If <b>Alternating</b> is selected, the command requires values for two velocity variables.	
<b>Time/1/2</b>	If <b>Alternating</b> is selected, the command requires values for two time variables.	
<b>Start</b>	Sends the velocity command to the drive.	
<b>Stop</b>	Stops the velocity command.	

## 24.4 Serial Position Operation Mode

Refer to [Serial Position Operation](#) in the drive user manual.

OPMODE=8 | COMMODE=0

In the Motion screen, select Operation Mode – **Serial Position** (or **Serial Position – Secondary Feedback**) to display the schematic and parameters for this operation mode.

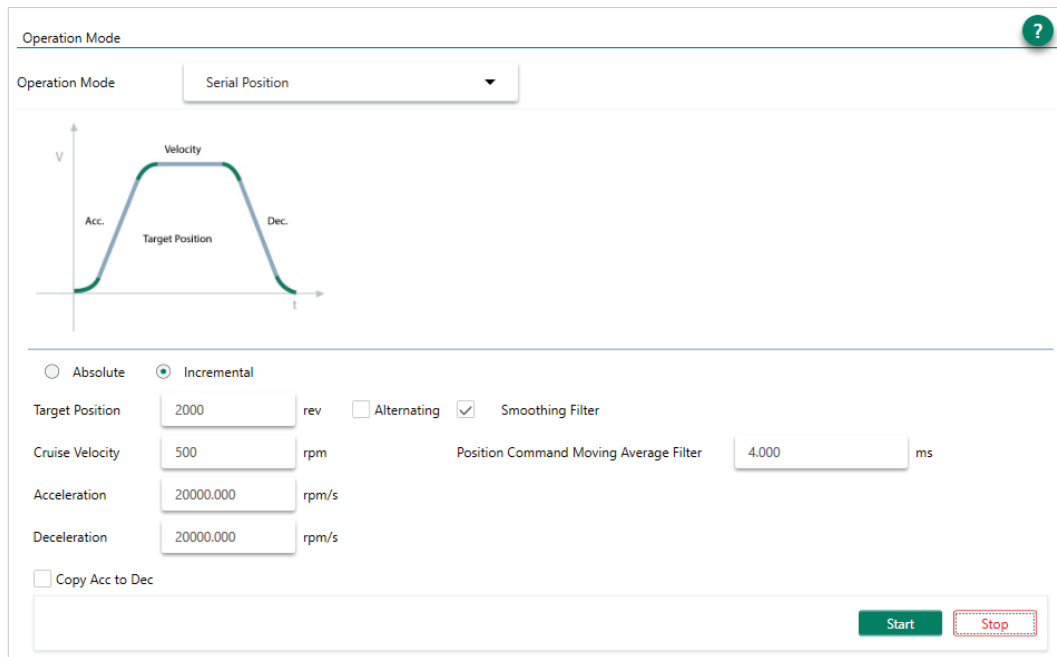


Figure 24-4. ServoStudio 2 – Motion Screen – Serial Position Mode

<b>Motion Command</b>		
<b>Absolute</b>	Moves the motor the specified number of counts from the encoder 0 position. Executes an absolute position movement according to the acceleration/deceleration settings.	MOVEABS
<b>Incremental</b>	Moves the motor the specified number of counts from its current location. Executes an incremental position movement according to the acceleration/deceleration settings.	MOVEINC
<b>Alternating</b>	Automatically reverses the direction of motion each time <b>Start</b> is pressed.	
<b>Motion Profile</b>		
<b>Target Position</b>	The destination of the movement command.	
<b>Cruise Velocity</b>	The velocity of the movement command.	
<b>Acceleration</b>	Acceleration value.	ACC
<b>Deceleration</b>	Deceleration value.	DEC
<b>Copy Acc to Dec</b>	Copies the acceleration value to the deceleration value field.	

<b>Smoothing</b>		
<b>Smoothing Filter</b>	When selected, activates an S-curve smoothing filter to a position reference command.	<a href="#">MOVESMOOTHMODE</a>
<b>Position Command Moving Average</b>	When Smoothing Filter is selected, this value defines the moving average filter to be applied to the reference command in order to smooth the movement.	<a href="#">MOVESMOOTHAVG</a>
<b>Start</b>	Sends the movement command to the drive.	
<b>Stop</b>	Stops the movement.	

## 24.5 Analog Current Operation Mode

Refer to [Analog Current Operation](#) in the drive user manual.

`OPMODE=3` | `COMMODE=0`

In the Motion screen select Operation Mode – **Analog Current** to display the schematic and variables for this operation mode.

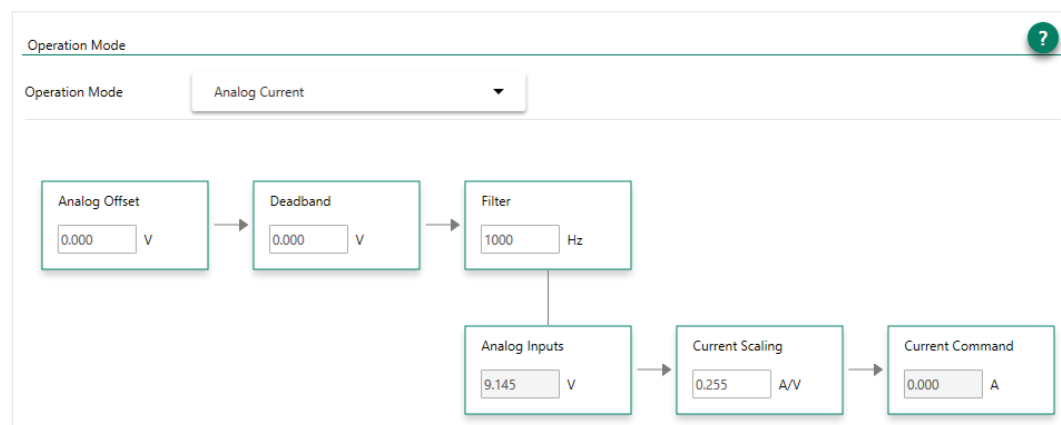


Figure 24-5. ServoStudio 2 – Motion Screen – Analog Current Mode

<b>Analog Offset</b>	The DC voltage offset on the analog input.	<a href="#">ANIN1OFFSET</a>
<b>Deadband</b>	The deadband range of analog input 1.	<a href="#">ANIN1DB</a>
<b>Filter</b>	A low-pass filter applied to the analog input.	<a href="#">ANIN1LPFHZ</a>
<b>Analog Input</b>	The voltage at the analog input. Read only.	<a href="#">ANIN1</a>
<b>Current Scaling</b>	Current scaling affects how the current command varies relative to any change in voltage at the analog input.	<a href="#">ANIN1ISCALE</a>
<b>Current Command</b>	The resulting Current command. Read only.	<a href="#">ICMD</a>

## 24.6 Analog Velocity Operation Mode

Refer to [Analog Velocity Operation](#) in the drive user manual.

OPMODE=1 | COMMODE=0

In the Motion screen select Operation Mode – **Analog Velocity** to display the schematic and variables for this operation mode.

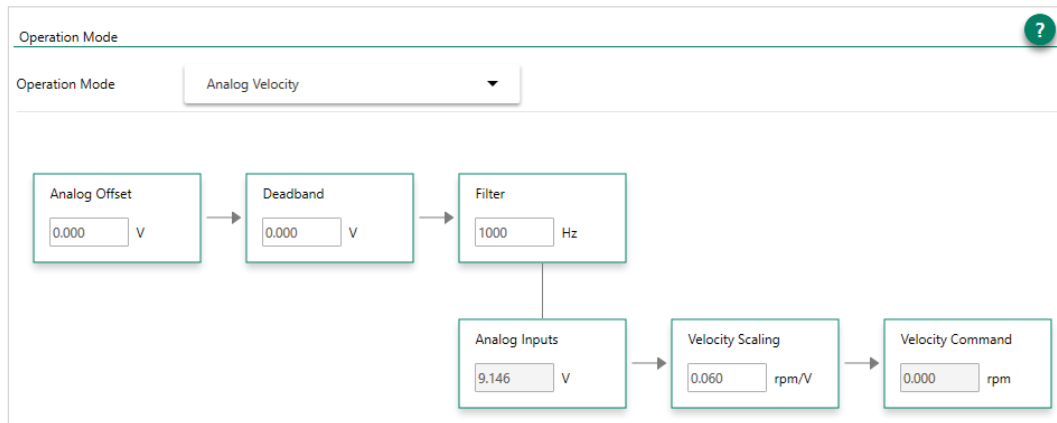


Figure 24-6. ServoStudio 2 – Motion Screen – Analog Velocity Mode

<b>Analog Offset</b>	The DC voltage offset on the analog input.	<a href="#">ANIN1OFFSET</a>
<b>Deadband</b>	The deadband range of analog input 1.	<a href="#">ANIN1DB</a>
<b>Filter</b>	A low-pass filter applied to the analog input.	<a href="#">ANIN1LPFHZ</a>
<b>Analog Input</b>	The voltage at the analog input. Read only.	<a href="#">ANIN1</a>
<b>Velocity Scaling</b>	Velocity scaling affects how the motor speed will vary as a result of any change in voltage at the analog velocity command.	<a href="#">ANIN1VSCALE</a>
<b>Velocity Command</b>	The velocity command.	<a href="#">VCMD</a>

## 24.7 Gearing/Pulse Train Operation Mode

Refer to [Gearing/Pulse Train Operation](#) in the drive user manual.

OPMODE=4 | COMMODE=0

In the Motion screen, select Operation Mode – **Pulse Train** (or **Pulse Train – Secondary Feedback**) to display the schematic and parameters for the gearing operation mode.

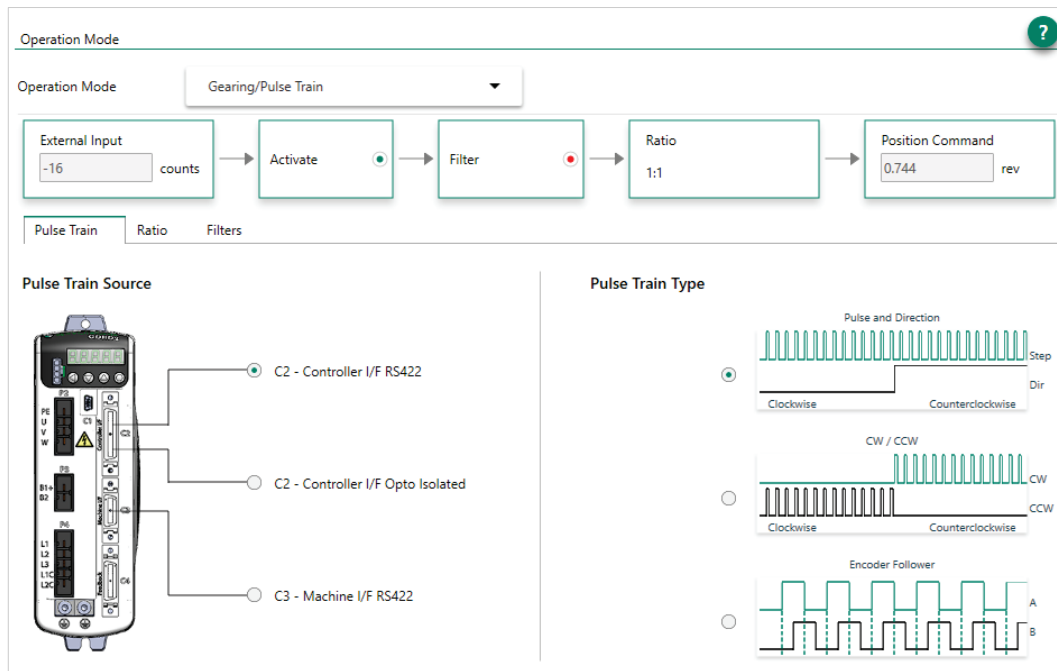


Figure 24-7. ServoStudio 2 – Motion Screen – Gearing/Pulse Train Mode

The drive supports a number of gearing modes.

Refer to [Gearing/Pulse Train Operation Mode](#) in the drive user manual.

<b>External Input</b>	The position as measured by an external feedback device.	HWPEXT
<b>Activated</b>	Indicates whether the gearing/pulse train function is activated.	GEAR
<b>Filter</b>	Indicates whether the gearing filter is activated, as defined in the <b>Filter</b> tab.	GEARFILTMODE
<b>Ratio</b>	Indicates the ratio defined, as defined in the <b>Ratio</b> tab.	GEARIN GEAROUT
<b>Position Command</b>	Indicates the position command.	PCMD
<b>Pulse Train</b>		
<b>Pulse Train Source</b>	<b>Pulse Train Type</b>	VarCom
Controller interface (C2) RS422 /Opto-isolated	Encoder Follower	GEARMODE 0
Controller interface (C2) RS422 /Opto-isolated	Pulse and Direction	GEARMODE 1
Controller interface (C2) RS422 /Opto-isolated	CW/CCW (Up/Down)	GEARMODE 2
Machine interface (C3)	Encoder Follower	GEARMODE 3
Machine interface (C3)	Pulse and Direction	GEARMODE 4
<b>Ratio</b>		
<b>Input Resolution</b>	The resolution of the external encoder, in number of pulses (or sine cycles) per motor revolution.	XENCRES

Gear Ratio Numerator	The numerator of the gearing ratio.	GEARIN
Gear Ratio Denominator	The denominator of the gearing ratio.	GEAROUT
<b>Filters</b>		
<b>Command Smoothing Filter</b>		
Smoothing Filter	Activates the moving average filter.	MOVESMOOTHMODE
Stiff>Soft	Increasing the filter value smooths the input command, and shapes it into an S-curve profile.	MOVESMOOTHAVG
<b>Gear Command Noise Filter</b>		
Gear Noise Filter	Activates the gearing filter.	GEARFILTMODE
Stiff>Soft slider	Increasing the filter value smooths the input command, but adds a delay.	GEARFILTDEPTH

## 24.8 Fieldbus (EtherCAT/CANopen) Operation Modes

**Note** When the software is communicating with the drive, either CANopen or EtherCAT is displayed, according to the actual type of drive in use. When offline, the type of drive displayed has no affect on software behavior.

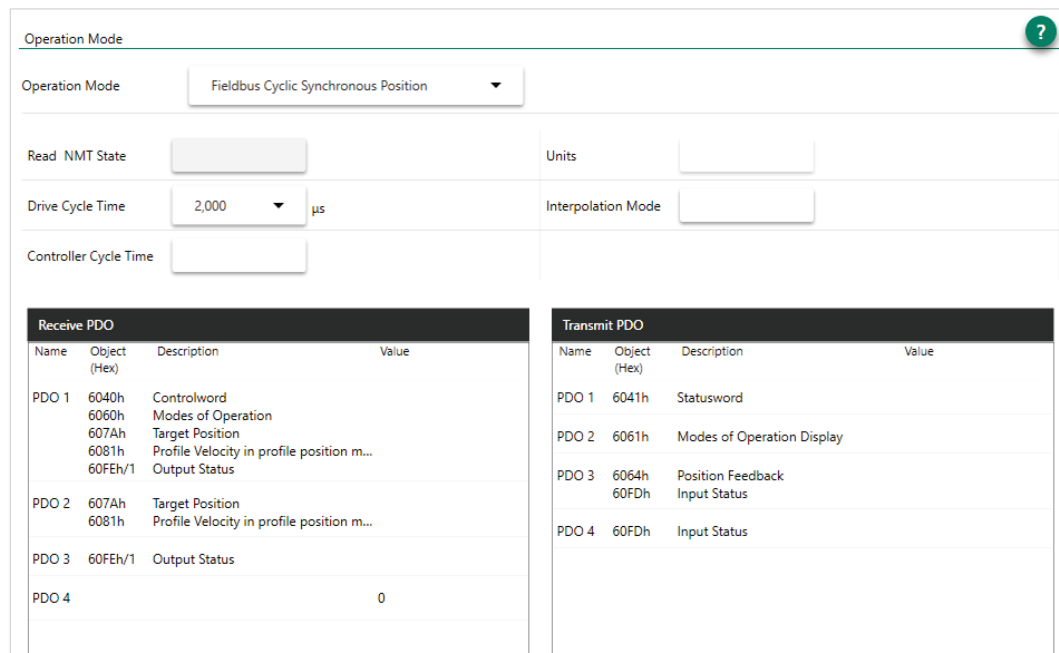


Figure 24-8. ServoStudio 2 – Operation Mode Screen – Fieldbus – Example

<b>Read NMT State</b>	Gets the NMT state through serial communication. (Read only.) Possible values: 0 = UNKNOWN 1 = INIT 2 = PREOP 3 = BOOTSTRAP 4 = SAFEOP 8 = OP	<a href="#">ECREADCOMMSTATE</a>
<b>Drive Cycle Time</b>	in microseconds ( $\mu$ s).	
<b>Controller Cycle Time</b>	Gets/sets the interpolation time period for fieldbus cycle time calculation.	<a href="#">FBITPRD</a>
<b>Units</b>	(Read only.)	
<b>Interpolation Mode</b>	Gets/sets an SDO object, in hexadecimal format, through serial communication.	<a href="#">ECSENDSDO</a>

### 24.8.1 Fieldbus Cyclic Synchronous Position

Object 6060h is set to 8 | [COMMODE=1](#)

In the Cyclic Synchronous Position operating mode, the master controller provides a target position to the drive at each EtherCAT/CAN cycle, and the drive performs position control, velocity control and torque control.

In the Motion screen, select Operation Mode – **Cyclic Synchronous Position** (or **Cyclic Synchronous Position – Secondary Feedback**) to display the schematic and parameters for this operation mode.

### 24.8.2 Fieldbus Cyclic Synchronous Velocity

Object 6060h is set to 9 | [COMMODE=1](#)

In the Cyclic Synchronous Velocity operating mode, the master controller provides a target velocity to the drive at each EtherCAT/CAN cycle, and the drive performs velocity control and torque control.

In the Motion screen, select Operation Mode – **Cyclic Synchronous Velocity** to display the schematic and parameters for this operation mode.

### 24.8.3 Fieldbus Cyclic Synchronous Torque

Object 6060h is set to 10.

In the Cyclic Synchronous Torque operating mode, the master controller provides a target torque to the drive at each EtherCAT/CAN cycle, and the drive performs torque control.

In the Motion screen, select Operation Mode – **Cyclic Synchronous Torque** to display the schematic and parameters for this operation mode.

#### 24.8.4 Fieldbus Profile Position

Object 6060h is set to 1 | [COMMODE=1](#)

In the Profile Position operating mode, the motor executes a movement according to a target position, acceleration and velocity values sent from the master controller.

In the Motion screen, select Operation Mode – **Profile Position** (or **Profile Position – Secondary Feedback**) to display the schematic and parameters for this operation mode.

#### 24.8.5 Fieldbus Profile Velocity

Object 6060h is set to 3 | [COMMODE=1](#)

In the Profile Velocity operating mode, the motor executes a movement according to a target velocity and acceleration values sent from the master controller.

In the Motion screen, select Operation Mode – **Profile Velocity** to display the schematic and parameters for this operation mode.

#### 24.8.6 Fieldbus Profile Torque

Object 6060h is set to 4 | [COMMODE=1](#)

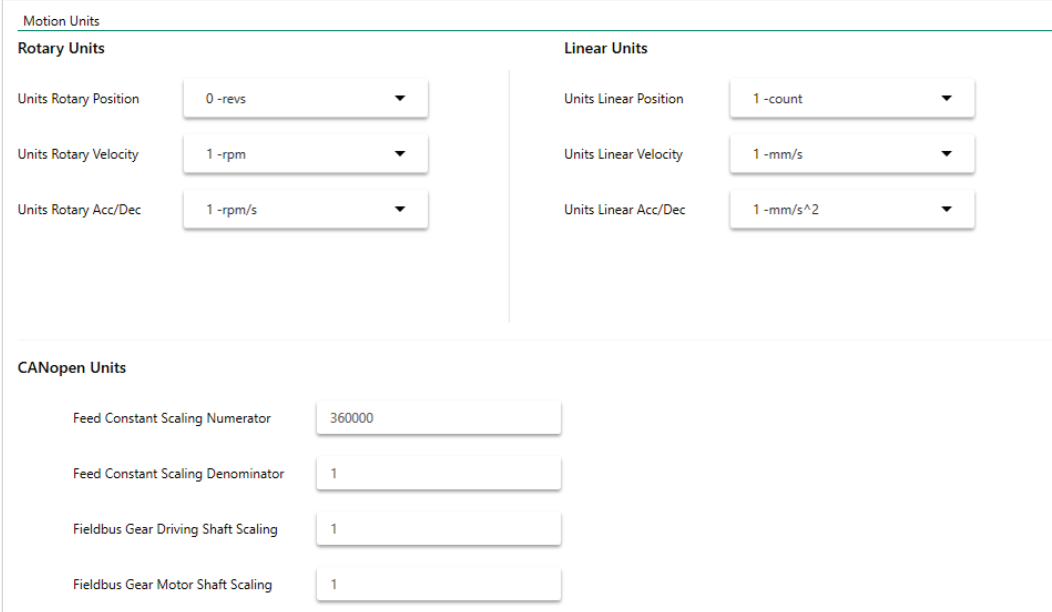
In the Profile Torque operating mode, the motor executes a movement according to a target torque value sent from the master controller.

In the Motion screen, select Operation Mode – **Profile Torque** to display the schematic and parameters for this operation mode.

## 25. Motion Units

Refer to [Motion Units](#) in the drive user manual.

The **Motion Units** screen lets you select the unit definitions for specifying position, velocity, and acceleration/deceleration.



The screenshot shows the 'Motion Units' configuration screen. It is organized into three main sections:

- Rotary Units:** Contains three dropdown menus: 'Units Rotary Position' set to '0 -revs', 'Units Rotary Velocity' set to '1 -rpm', and 'Units Rotary Acc/Dec' set to '1 -rpm/s'.
- Linear Units:** Contains three dropdown menus: 'Units Linear Position' set to '1 -count', 'Units Linear Velocity' set to '1 -mm/s', and 'Units Linear Acc/Dec' set to '1 -mm/s<sup>2</sup>'.
- CANopen Units:** Contains four input fields: 'Feed Constant Scaling Numerator' (360000), 'Feed Constant Scaling Denominator' (1), 'Fieldbus Gear Driving Shaft Scaling' (1), and 'Fieldbus Gear Motor Shaft Scaling' (1).

Figure 25-1. ServoStudio 2 – Motion Units Screen

<b>Rotary Units</b>		
<b>Position</b>	Defines the units of position variables in a rotary system.	<a href="#">UNITSROTPOS</a>
<b>Velocity</b>	Defines the units of velocity variables in a rotary system.	<a href="#">UNITSROTVEL</a>
<b>Acc/Dec</b>	Defines the units of acceleration and deceleration variables in a rotary system.	<a href="#">UNITSROTACC</a>
<b>Linear Units</b>		
<b>Position</b>	Defines the units of position variables in a linear system	<a href="#">UNITSLINPOS</a>
<b>Velocity</b>	Defines the units of velocity variables in a linear system.	<a href="#">UNITSLINVEL</a>
<b>Acc/Dec</b>	Defines the units of acceleration and deceleration variables in a linear system.	<a href="#">UNITSLINACC</a>

<b>CANopen Units / EtherCAT Units</b>	<p>CiA and ETG standards provide two objects, each with two sub-indices, for setting the gear ratio and the feed constant conversion factors</p> <p>These objects have four equivalent drive parameters, which appear in this pane. By defining the gear ratio and feed constant values in ServoStudio 2, they will be converted into values correctly recognized by a drive operating in a CANopen/EtherCAT network.</p> <p>The relationship is as follows:</p> $\frac{PNUM}{PDEN} \times \frac{FBGMS}{FBGDS} = \text{Resolution}$ <p><b>Note:</b> ServoStudio 2 uses standard CANopen/ EtherCAT units of motion, as selected by the user. However, in instances of CANopen/ EtherCAT units, the ServoStudio 2 screens display only the values, and do not include the type of unit.</p>	
<b>Feed Constant Scaling Numerator and Feed Constant Scaling Denominator</b>	Conversion factors of the user-defined unit. They are used to multiply the motor revolution (rotary motors) or the motor pitch (linear motors), according to the type of motor (MOTORTYPE).	PNUM PDEN
<b>Fieldbus Gear Driving Shaft Scaling</b>	The conversion factor of the fieldbus device's <b>drive</b> shaft revolution.	FBGDS
<b>Fieldbus Gear Motor Shaft Scaling</b>	The conversion factor of the fieldbus device's <b>gear</b> shaft revolution.	FBGMS

## 26. Homing

Refer to [Homing](#) in the drive user manual.

The **Homing** screen allows you to select the methods and parameters to be used for homing the motor, and to initiate and monitor the homing process.

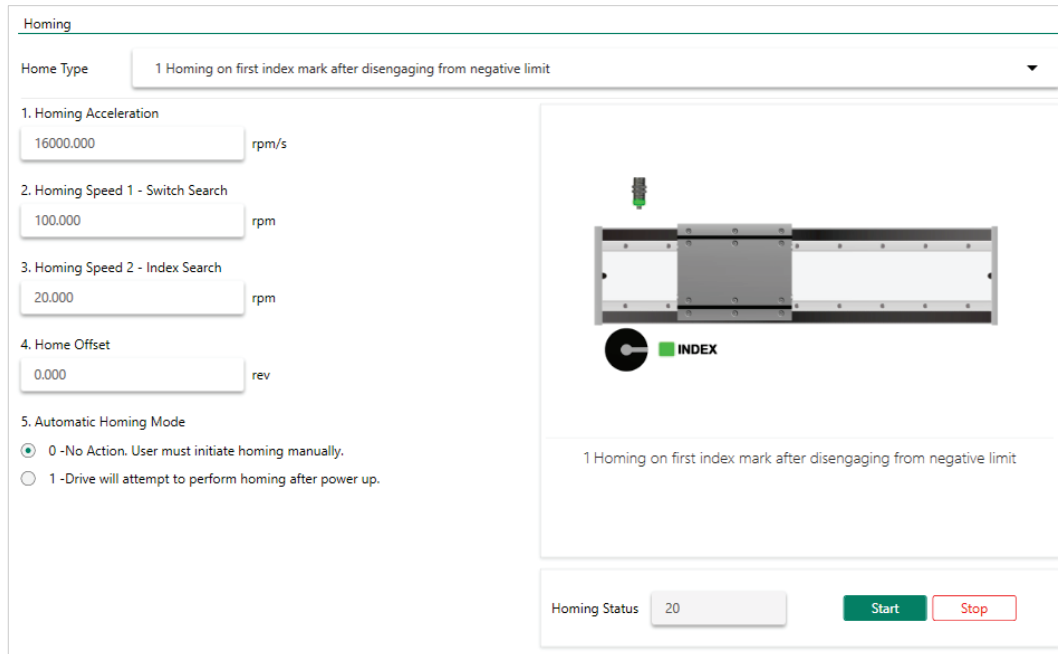


Figure 26-1. ServoStudio 2 – Homing Screen

<b>Home Type</b>	Allows you to select any one of 35 homing methods. Homing types 1 through 14, 17 through 30, and 33 through 35 are according to CiA 402. Additional homing types have been defined per customer requests, and can be selected through VarCom <a href="#">HOMETYPE</a> in the Terminal screen. Home Type defines when direction of motion is reversed during homing, the homing trigger (e.g., switch, index), and other conditions.	<a href="#">HOMETYPE</a>
<i>[graphic]</i>	A graphic display representing the method selected for the homing process.	
<i>[description]</i>	A description of the selected homing method.	
<b>Homing Acceleration</b>	The value of acceleration and deceleration during the homing process.	<a href="#">HOMEACC</a>
<b>Homing Speed 1 – Switch Search</b>	The initial velocity used in the homing process during the search for limit switches, home switches, and hard stops.	<a href="#">HOMESPEED1</a>

<b>Homing Speed 2 – Index Search</b>	The velocity used in the homing process during the search for the homing trigger, which may be an index mark, a limit switch transition, a home switch transition, or another source (as defined by <a href="#">HOMETYPE</a> ).	<a href="#">HOMESPEED2</a>
<b>Home Offset</b>	Sets an offset, in counts, for the Home position.	<a href="#">HOMEOFFSET</a>
<b>Home</b>	<b>Start.</b> Starts the homing process. <b>Stop.</b> Stops the homing process.	<a href="#">HOMECMD</a> <a href="#">HOMECMD 0</a>
<b>Homing Status</b>	Displays the current state of system homing. 0 = Homing idle 19 = Homing completed 20 = Homing failed <i>All other values = homing in progress, or stalled</i>	<a href="#">HOMESTATE</a>
<b>Automatic Homing Mode</b>	The type of automatic homing to be performed at power-up. 0 = No Action. User must initiate homing manually. Default. 1 = Homing to be attempted after power up if conditions allow (that is, drive is enabled by means of a serial or hardware command, and no faults exist).	<a href="#">AUTOHOME</a>

## 27. Emergency Stop

Refer to [Disable Mode](#) in the drive user manual.

The Emergency Stop screen allows you to select the methods and parameters to be used for stopping the motor when the drive becomes disabled. The disabling of the drive may be the result of an explicit command from the motion controller or the drive’s own response to a fault condition.

When the drive becomes disabled, the **Disable Mode** function can be used in certain cases to bring the motor to a fast stop before power to the motor is shut off. This reduces the amount of motor coasting.

Disable mode consists of two mechanisms: **Active Disable** and **Dynamic Brake**.

**Note** Faults that require immediate disable (to prevent drive damage) and feedback faults that might cause a commutation fault (motor runaway) cannot issue Active Disable.

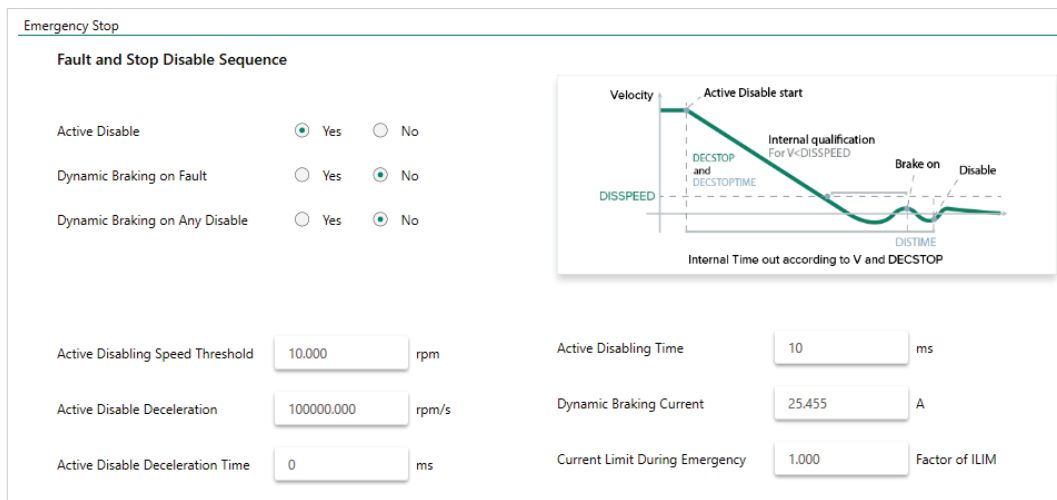


Figure 27-1. ServoStudio 2 – Disable Stop

Fault and Stop Disable Sequence				
Active Disable	Dynamic Brake on Fault	Dynamic Brake on Any Disable		
No	No	No	No active disabling; no dynamic braking.	DISMODE 0
No	Yes	No	No active disabling; dynamic braking on fault only.	DISMODE 1
No	Yes	Yes	No active disabling; dynamic braking on any disable.	DISMODE 2
Yes	No	No	Active disabling on fault*; no dynamic braking.	DISMODE 3
Yes	Yes	No	Active disabling on fault*; dynamic braking on fault only.	DISMODE 4
Yes	Yes	Yes	Active disabling on fault*; dynamic braking on any disable.	DISMODE 5

<b>Active Disable Speed Threshold</b>	The speed threshold for the Active Disable function.	DISSPEED
<b>Active Disable Deceleration</b>	The deceleration speed value for the Active Disable function.	DECSTOP
<b>Active Disable Deceleration Time</b>	The deceleration time for the Active Disable function. This value is ignored if it exceeds the deceleration speed value.	DECSTOPTIME
<b>Active Disable Time</b>	The time to wait after motor speed goes below the threshold (DISSPEED) until the drive is disabled by the Active Disable function.	DISTIME
<b>Dynamic Brake Current</b>	The maximum current allowed during the dynamic braking process.	ISTOP
<b>Current Limit During Emergency</b>	The current limit used during the Active Disable process. Defined as a value from 0 to 1, as a factor of the application current limit.	ESTOPI LIM

## 28. Scope

ServoStudio 2 provides extensive recording and data graphing capabilities. Recording is done by the drive in real-time, and sent to the host computer for display.

Recording can be set up to be triggered when a specified event or condition occurs. In addition, ServoStudio 2 enables continuous data recording or a one-time recording. ServoStudio 2 also allows execution of a motion command during recording, which is sometime useful for tuning.

The ServoStudio 2 **Scope** screen is a dashboard for data recording and plotting.

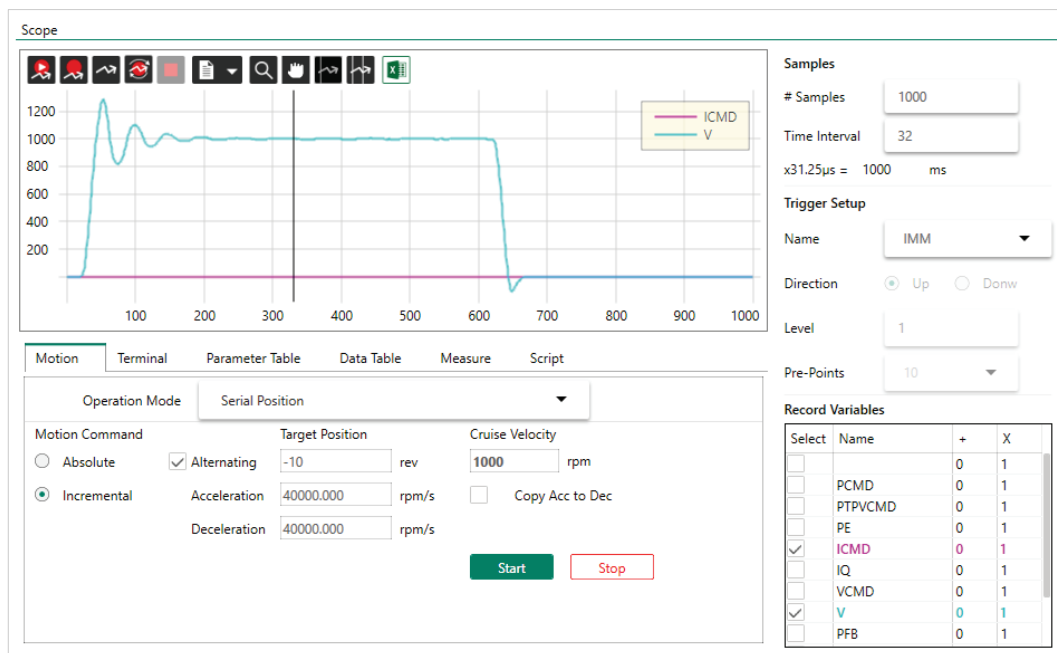


Figure 28-1. ServoStudio 2 – Scope Dashboard

The **Scope** screen allows you to perform the following tasks:

- Configure recording settings, record data from the drive, and display the data according to your preferences.
- Generate motion in order to record data related to that specific motion. Commands can be sent to the drive via the **Move Record and Plot** buttons in the Scope toolbar, or via the **Motion** or **Terminal** tabs.
- Program and run scripts using the **Script** pane.

### 28.1 Recording Setup

The **Recorder Setup** pane, on the right side of the Scope screen, allows you to define the variables and conditions for the data recording.

To clear all settings in the Record Variables pane, right-click on any variable cell, and select the option **Reset Variable List**.

**Samples**

<b># Samples</b>	The total number of points to be recorded. Up to 2048 data points for up to six 32-bit (non-position) variables, or three 64-bit (position) variables, can be recorded simultaneously.
<b>Time Interval</b>	The rate at which data is recorded. The interval value is specified in multiples of the drive's basic sampling rate, which is 31.25 $\mu$ s. The calculated total recording time is also indicated, in milliseconds (ms). For example, an interval of 4 means data is recorded once every 4 samples, or once per 125 $\mu$ s ( $4 \times 31.25 = 125$ ); therefore 2000 data points are recorded in 250 milliseconds.












**Trigger Setup**

<b>Name</b>	Name of a variable that will trigger the recording (VarCom <a href="#">RECTRIG</a> ). Any of the variables returned by the VarCom command <a href="#">RECTRIGLIST</a> can be used to trigger a recording. In addition, the following variables can trigger a recording: <b>IMM</b> . Starts the recording immediately <b>CMD</b> . Starts the recording as soon as the next command is sent to the drive
<b>Direction</b>	Defines whether the trigger occurs when value of the variable goes above the threshold ( <b>Up</b> ) or below the threshold ( <b>Down</b> ).
<b>Level</b>	The threshold value for the trigger.
<b>Pre-Points</b>	The number of points to be recorded prior to the trigger point.

**Record Variables**

<b>Name</b>	Name of a variable that can be recorded (VarCom <a href="#">RECORD</a> ). Any of the variables returned by the VarCom command <a href="#">RECLIST</a> can be recorded. To add a variable to the list, type the name of the variable in the blank cell in the first row, and press <b>Enter</b> . To define the variables that will actually be recorded, select or clear the checkboxes. Up to six 32-bit (non-position) variables, or three 64-bit (position) variables, can be recorded simultaneously.
<b>+</b>	<b>Offset</b> . An offset value on the X-axis that serves to separate overlapping traces on the plot, or to move traces closer together for easier viewing and comparison. Whenever an offset is in effect, a plus sign + is displayed next to the variable name in the legend.
<b>X</b>	<b>Multiply</b> . Enlarges a trace that may be too small to view properly because the plot is scaled to the largest value of another variable. Whenever an enlarged trace is in effect, an asterisk * is displayed next to the variable name in the legend.

## 28.2 Scope Toolbar

	<b>Move Record and Plot</b>	Executes the command defined in the Motion screen, triggers (and stops) the recording, plots the response and stops the motion.
	<b>Record and Plot</b>	Triggers the recording and plots the response. Does not start or stop the drive.
	<b>Plot</b>	Reads the data last recorded (in the drive), and displays a trace on screen.
	<b>Continuous Record and Plot</b>	Continuously records and displays a trace of the currently defined record data. Does not have a trigger.
	<b>Stop Recording</b>	Stops a recording. Aborts the command.
	<b>Chart Options</b>	Refer to <i>Chart Options</i> .
	<b>Zoom</b>	Click on the plot and drag to select an area for magnification. Double-click on the plot or Zoom button to restore the original display.
	<b>Pan</b>	Click on the plot and drag to pan.
	<b>Cursor Line</b>	Displays a cursor line on the plot. Click and drag the cursor line. Use the <b>Measure</b> tab to view additional variable values at the point marked by the cursor.
	<b>Second Cursor Line</b>	Displays/hides a second cursor line. Click and drag the cursor line. The <b>Measure</b> tab will show values for the segment of the plot delimited by the two cursor lines.
	<b>View in Excel</b>	Copies recorded data to a temporary CSV file and opens Microsoft Excel to display it.

## 28.3 Chart Options

To see the recorded value of a variable at any given point, simply hover over the trace in the chart. The value is displayed in a floating box.

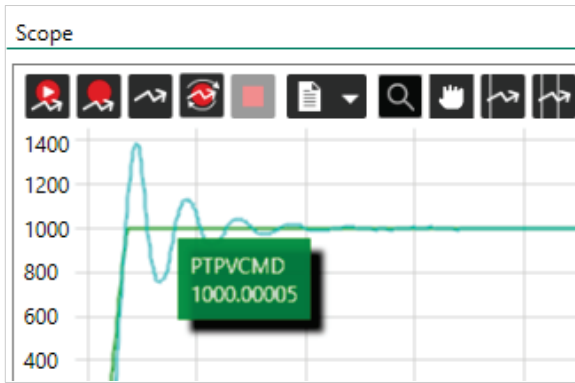


Figure 28-2. ServoStudio 2 – Scope Trace Value

Right-click anywhere on the chart to access the Chart Options menu.

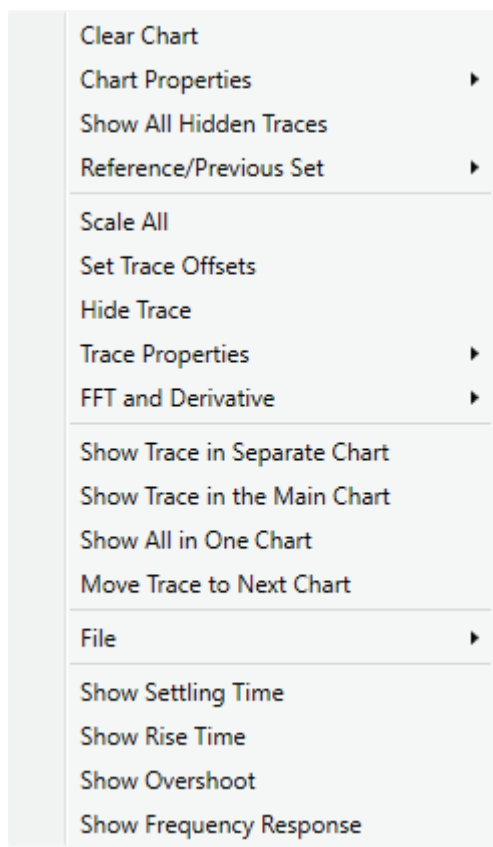


Figure 28-3. ServoStudio 2 – Chart Options menu

Some of these options, along with additional trace options, are accessed by right-clicking anywhere in the Record Variables pane.

**Clear Chart**

Clears the displayed chart.

## Chart Properties

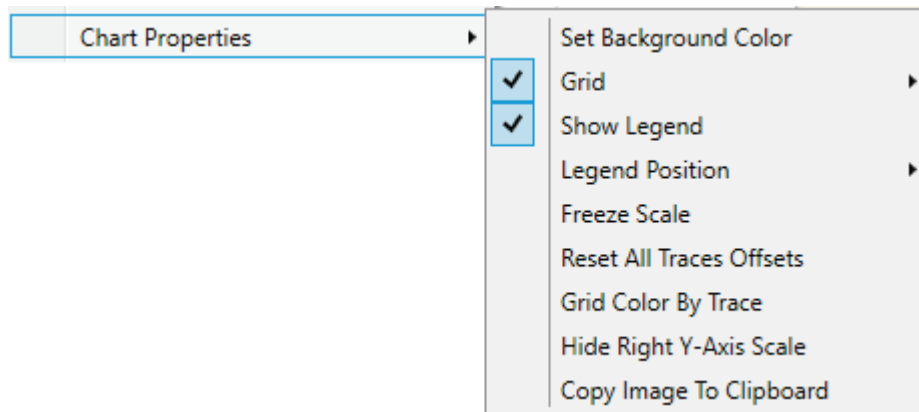


Figure 28-4. ServoStudio 2 – Chart Options > Properties menu

<b>Set Background Color</b>	Opens the Colors dialog box, and allows you to modify the background color of the chart.
<b>Grid</b>	Toggles the grid display on and off. Also allows you to modify the grid: <b>X Axis.</b> Toggles the X-axis grid line on/off. <b>Y Axis.</b> Toggles the Y-axis grid line on/off. <b>Dot   Line.</b> Uses either dotted lines or solid lines for the grid.
<b>Show Legend</b>	Toggles the legend display on and off.
<b>Legend Position</b>	Top right or bottom left.
<b>Freeze Scale</b>	Sets the Y-axis to a fixed scale. Normally the Y-axis is scaled dynamically as the amplitude of the signals changes. When Scale is frozen, the letter F is displayed next to the Chart Options button on the toolbar. When Scale is frozen, the letter O is also displayed if part of the trace is out of view.
<b>Reset All Trace Offsets</b>	Resets the value of all offset (+) values in the Record Variables list to 1. Whenever an offset is in effect, a plus sign + is displayed next to the variable name in the legend.
<b>Grid Color by Trace</b>	If two grids are used (right and left axis), different colors can be defined to improve the readability of the chart.
<b>Hide Right Y Scale</b>	Hides the Y-axis scale on the right side of the chart, if displayed.
<b>Copy Image to Clipboard</b>	Copies the chart to a graphic image, which can be pasted into other application.

### Show All (Hidden) Traces

Displays all traces on the chart that were hidden by the **Hide Trace** option.

The Show/Hide status of a trace can be toggled by right-clicking on the variable in the Record Variables pane.

## Reference/Previous Set

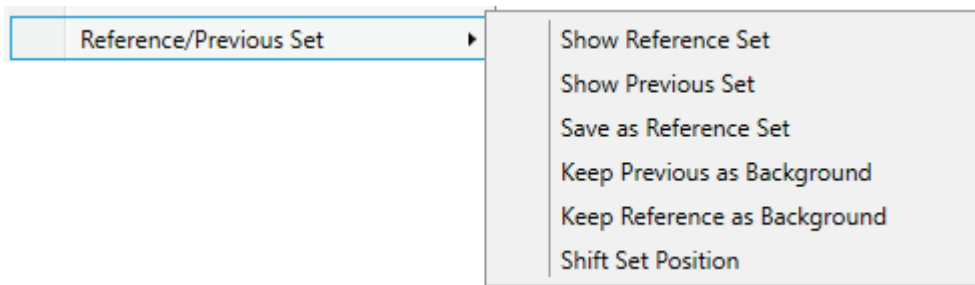


Figure 28-5. ServoStudio 2 – Chart Options > Reference/Previous Set

<b>Show Reference Set</b>	Displays the trace previously saved as a reference.
<b>Show Previous Set</b>	Displays the previously displayed trace in addition to the currently displayed trace.
<b>Save as Reference Set</b>	Saves the trace currently displayed on screen as a reference.
<b>Keep Previous as Background</b>	Displays the previously recorded trace as a background.
<b>Keep Reference as Background</b>	Keeps the reference trace displayed on screen as a background.
<b>Shift Set Position</b>	Allows you to move a set of traces along the X-axis, to separate overlapping traces on the chart, or to align the trigger points on different traces.

### Scale All

This option is used to adjust and display all traces on a scale of 0—100%, for better viewing.

### Set Trace Offsets

This option is used to separate overlapping traces, and improve the readability of the chart.

**Note** This option is maintained for compatibility purposes. For best viewing of traces, it is recommended that you use the option **Show Trace in Separate Chart**.

Right-click on a specific trace, and enter offset values.

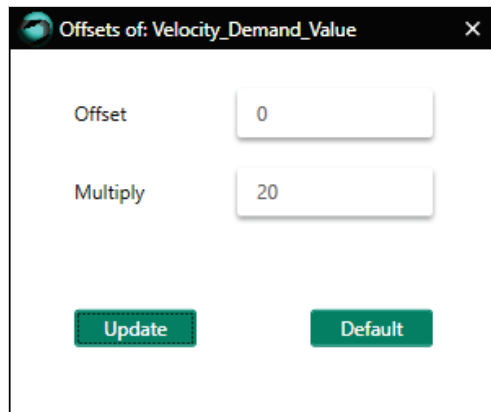


Figure 28-6. Set Trace Offsets Dialog Box

### Hide Trace

Right-click on a specific trace, and select **Hide Trace** to hide just one trace.

### Trace Properties

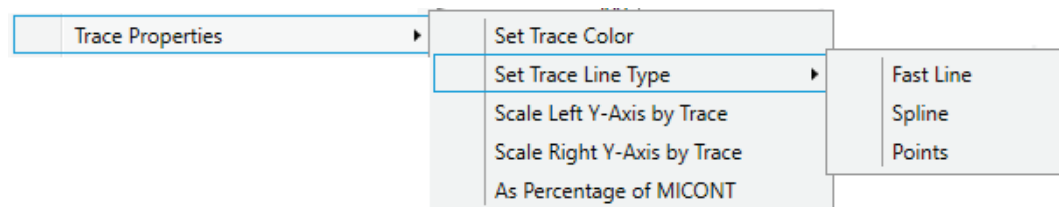


Figure 28-7. ServoStudio 2 – Chart Options &gt; Trace Properties

<b>Set Trace Color</b>	Allows you to define the color of the trace.
<b>Set Trace Line Type</b>	Allows you to define how the trace line is displayed: <b>Line</b> , <b>Spline</b> or <b>Points</b> .
<b>Scale Left Y-Axis by Trace</b>	Displays a Y-axis on the left side of the chart, scaled to the values of the selected variable.
<b>Scale Right Y-Axis by Trace</b>	Displays a Y-axis on the right side of the chart, scaled to the values of the selected variable.
<b>As Percentage of MICONT</b>	Displays current as a percentage of motor continuous current, rather than amperage.

### FFT and Derivative

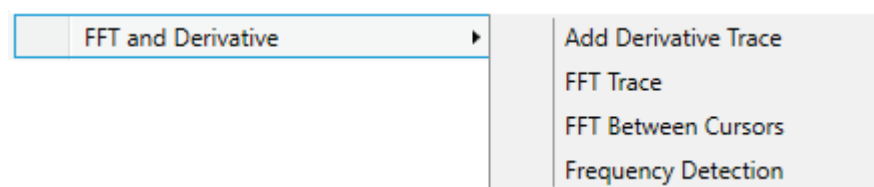
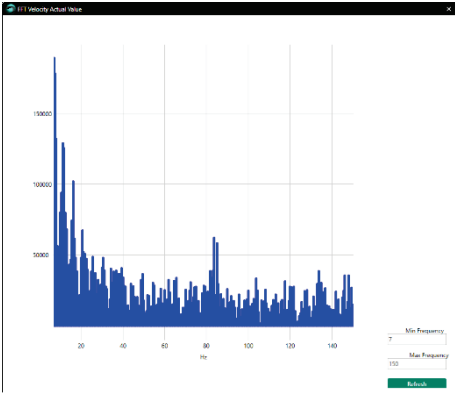
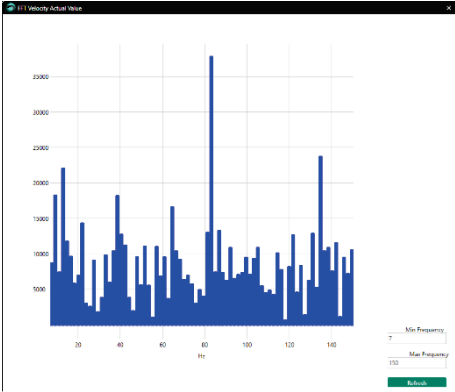


Figure 28-8. ServoStudio 2 – Chart Options &gt; Add Manipulated Trace

These options define how a fast Fourier transform (FFT) algorithm is performed on the selected trace.

<p><b>Add Derivative Trace</b></p>	<p>Calculates and displays the derivative of the function.</p>
<p><b>FFT Trace</b></p>	<p>The FFT is performed on the selected trace, and displays a graph that represents the frequency domain.</p> 
<p><b>FFT Between Cursors</b></p>	<p>The FFT is performed on the selected trace between the two cursors, and ignores the data outside the cursors.</p> 
<p><b>Frequency Detection</b></p>	

**Show Trace in Separate Chart**

Opens a dialog box that allows you to select the trace of one of the recorded variables. The selected trace is displayed in a new graph at the bottom of pane.

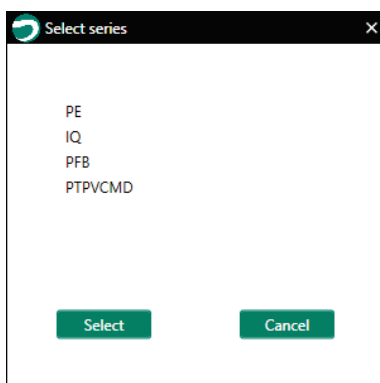


Figure 28-9. Set Trace Offsets Dialog Box

**Show Trace in Main Chart**

Moves the trace of the selected variable to the main graph, at the top of pane.

### Show All in One Chartf

All traces are displayed in one chart.

### Move Trace to Next Chart

Moves the trace of the selected variable from the current graph to the graph directly below it.

### File

Save As	Exports a recording to a CSV file, so that it can be viewed and analyzed in Microsoft Excel.
Load From	Loads recorded data that was saved in a CSV file.

### Show Settling Time

Settling time is the time elapsed from the application of a step command (e.g., PTPVCMD) to the time at which the output has entered and remained within a specified error window (e.g., PE less than a specified value).

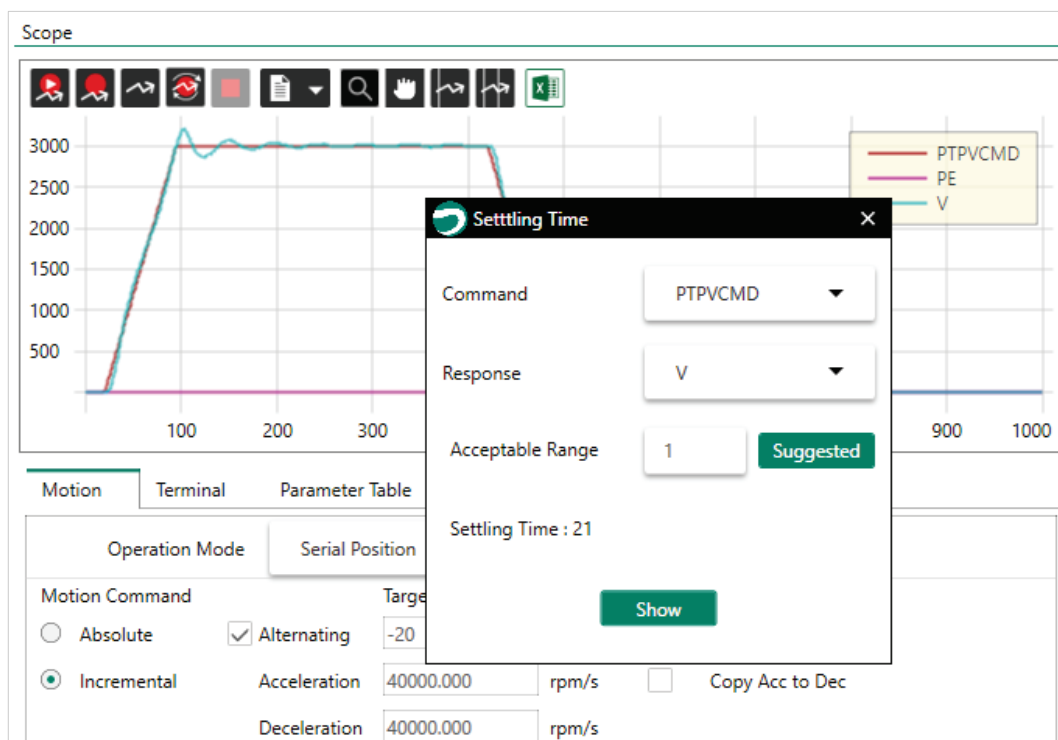


Figure 28-10. Show Settling Time

### Show Rise Time

Rise time is the time required for a signal to change from a specified low value to a specified high value. Typically, these values are 10% and 90% of the step command (e.g., PTPVCMD as input, and V as OUTPUT).

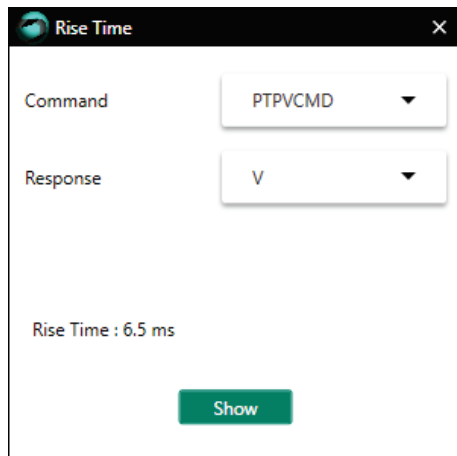


Figure 28-11. Show Rise Time

### Show Overshoot

Overshoot is when a signal exceeds its target, as for example, the maximum value of V when it exceeds PTPVCMD.

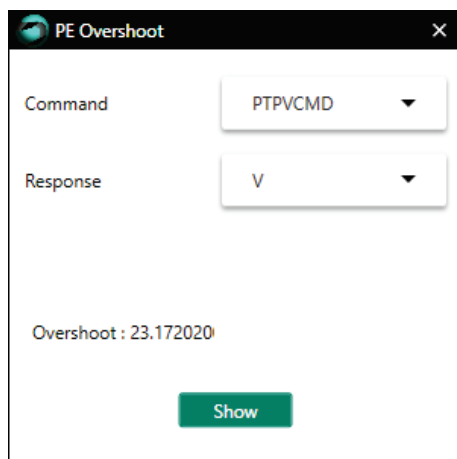


Figure 28-12. Show Overshoot

### Show Frequency Response

This graph shows the frequency response of the current command (ICMD).

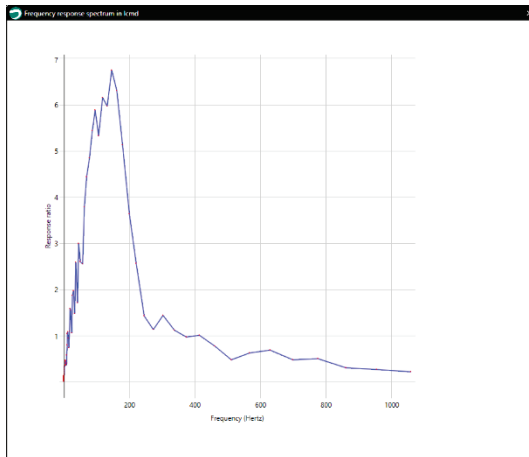


Figure 28-13. Show Frequency Response

## 28.4 Scope Tabs/Panes

The Scope screen contains the following tabs and panes:

<b>Motion</b>	Change operation mode and initiate motion. Motion is triggered by pressing <b>Start</b> (without recording) or <b>Move Record and Plot</b> . Refer to <i>Operation Mode</i> .
<b>Terminal</b>	Send commands to the drive. Refer to <i>Terminal</i> .
<b>Parameter Table</b>	View and manipulate parameter values. Refer to <i>Parameter Tables</i> .
<b>Data Table</b>	A tabular view of the data generated by the recording. Refer to <i>Data Table</i>
<b>Measure</b>	View measurements from the plot of a recording. Refer to <i>Measurements</i> .
<b>Script</b>	Program and run scripts. Refer to <i>Software Scripts</i> .

### Data Table

A tabular view of the data generated by the recording.

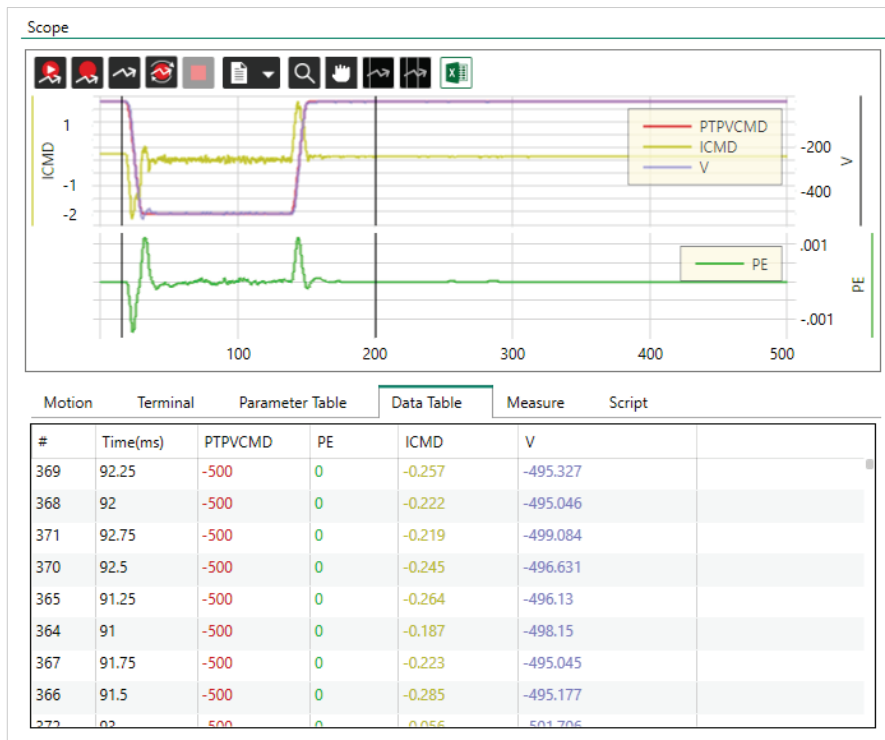


Figure 28-14. ServoStudio 2 – Scope Data Table

#	A sequential number for identifying the recorded sample.
Time (ms)	The time of the recorded sample.
Recorded Variable	Columns show the names and values of the variables selected for recording.

### Measurements

The **Measure** tab in the Scope screen presents several measurements from the data currently displayed in the chart.

The values displayed change as you drag the cursors to different locations on the chart.

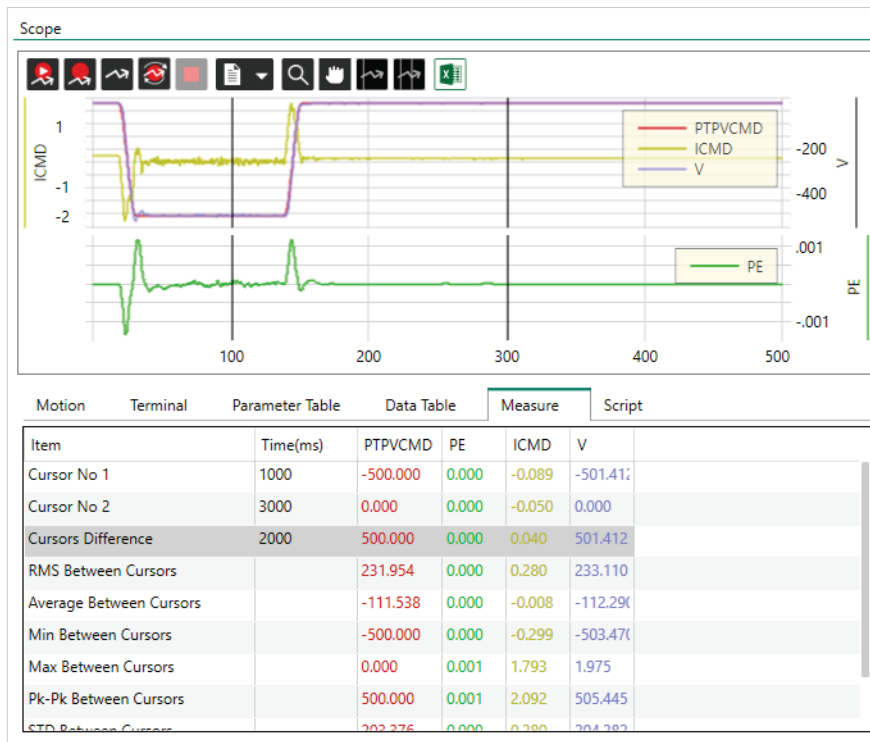


Figure 28-15. ServoStudio 2 – Scope Measurement Tab

<b>Cursor No.1</b>	X-axis = time (in ms); value of trace at the point crossed by cursor.
<b>Cursor No.2</b>	X-axis = time (in ms); value of trace at the point crossed by cursor.
<b>Cursors Difference</b>	Time difference between the two cursors. (Cursor 2 – Cursor 1)
<b>RMS   RMS Between Cursors</b>	The root mean square for the entire recording, or only between the two cursors.
<b>Average   Average Between Cursors</b>	The average value for the entire recording, or only between the two cursors.
<b>Min   Min Between Cursors</b>	Lowest recorded value in the entire recording, or in the trace between the two cursors.
<b>Max   Max Between Cursors</b>	Highest recorded value in the entire recording, or in the trace between the two cursors.
<b>Pk-Pk   Pk Between Cursors</b>	The span between the highest and lowest recorded values in the entire recording, or in the trace between the two cursors.
<b>STD   STD Between Cursors</b>	The standard deviation of the entire recording, or for the trace between the two cursors.

## 29. Frequency Analysis

For availability and details, contact your product vendor.

## 30. Expert

The **Expert** dashboard allows experienced users to perform a number of tasks from one screen.

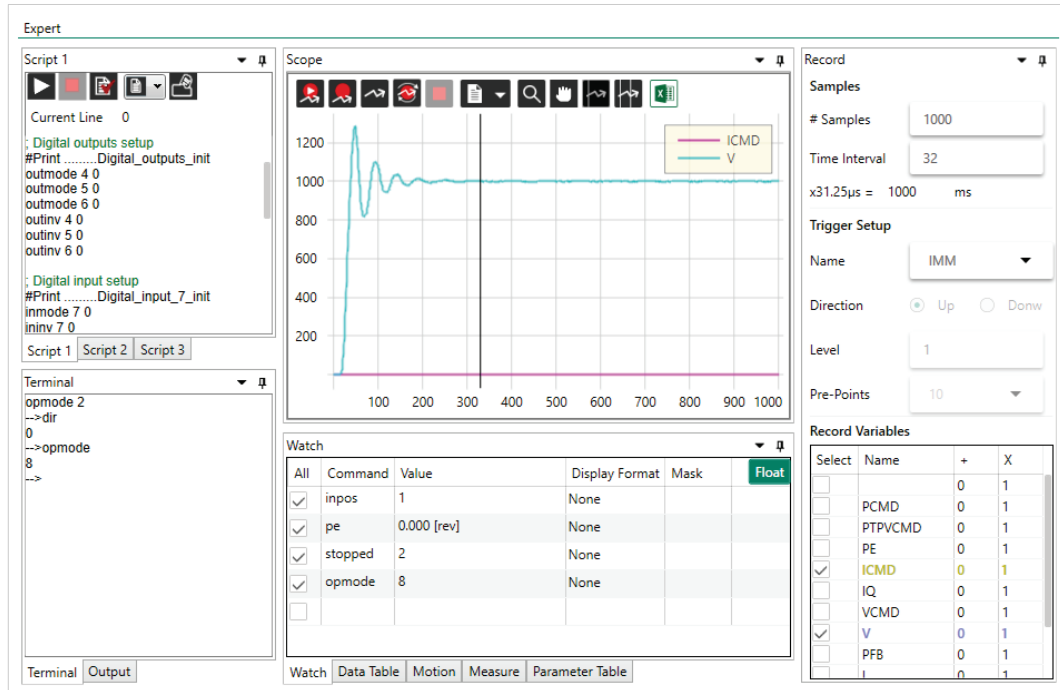




Figure 30-1. ServoStudio 2 – Expert Dashboard

### 30.1 Expert Screen Layout

The Expert screen has dockable panes, which can be visible, hidden or floating.

	<p>Press the pin button to hide the pane. A small tab remains visible on the size of the screen. Press the tab to reopen the pane.</p> <p>Right-click the pin button to access the option to <b>Restore Layout</b>.</p>
	<p>Click the arrow to access the options to <b>Float</b> and <b>Dock</b> the panes.</p>

### 30.2 Expert Tabs/Panes

The Expert screen contains the following tabs and panes:

---

<b>Script</b>	Program and run scripts. Refer to <i>Software Scripts</i> .
<b>Terminal</b>	Send commands to the drive. Refer to <i>Terminal</i> .
<b>Output</b>	View data generated by the #Print command in a script.
<b>Watch</b>	Monitor changes in variable values. Refer to <i>Watch Variables</i> .
<b>Data Table</b>	A tabular view of the data generated by the recording.
<b>Motion</b>	Change operation mode and initiate motion. Refer to <i>Operation Mode</i> .
<b>Measure</b>	View measurements from the plot of a recording. Refer to <i>Measurements</i> .
<b>Parameter Table</b>	View and manipulate parameter values. Refer to <i>Parameter Tables</i> .
<b>Scope</b>	View the plot of a recording. Refer to <i>Scope</i> .
<b>Record</b>	Opens the Recording Setup pane. Refer to <i>Recording Setup</i> .

# 31. Terminal

The **Terminal** screen allows you to send VarCom instructions to the drive, and read the drive's responses.

It also includes a **Watch** pane that allows experienced users to monitor parameters.

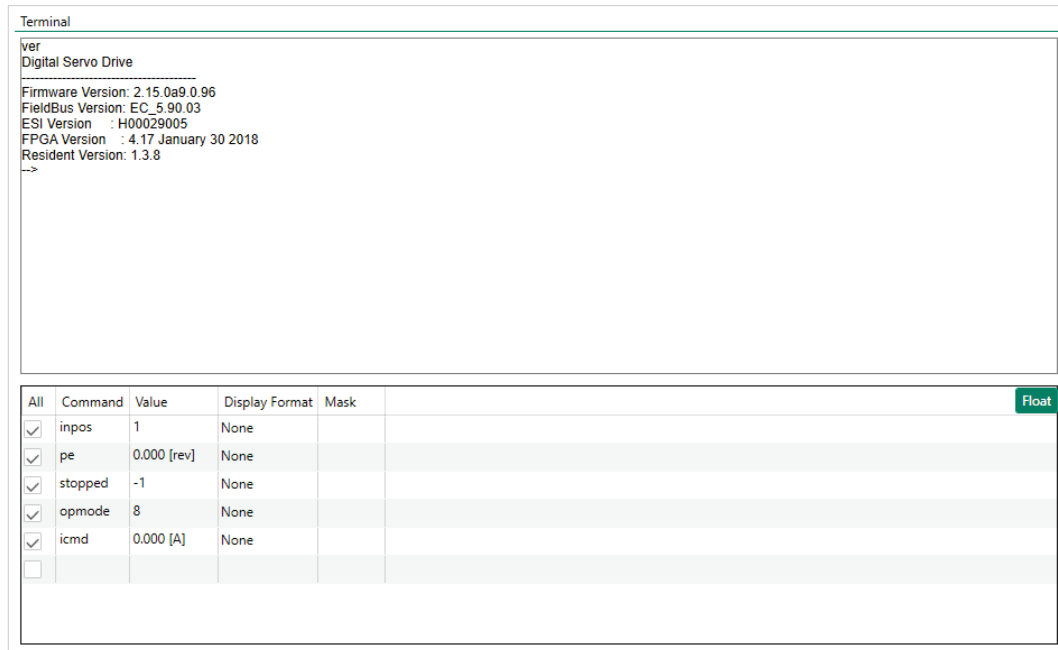


Figure 31-1. ServoStudio 2 – Terminal Dashboard

## 31.1 Terminal Editing Functions

Right-click anywhere in the Terminal pane to access additional functions:

<b>Copy/Paste</b>	Standard Windows editing functions: Ctrl+C, Ctrl+V
<b>Undo</b>	Standard Windows editing functions: Ctrl+Z
<b>Clear Terminal</b>	Deletes the contents of the Terminal.
<b>Clear History</b>	Deletes from memory all the commands that have been entered in the Terminal in the current working session.
<b>Save to File</b>	Prompts you to save the contents of the Terminal as a text file.
<b>Font Size</b>	Defines the size of the text displayed in the Terminal screen or pane.
<b>Find</b>	Standard Windows search function: Ctrl+F
<b>IntelliSense</b>	Enable/disables autocompletion (IntelliSense) function.
<b>Copy History to Script</b>	In <b>Expert</b> screen. Copies the entire list of commands in the Terminal history to the currently active script.

## 31.2 Watch Variables

The **Watch** pane is used to monitor drive variables. The rate at which variables are updated is dependent on the load on the serial communications link and on the Refresh Rate of Data From Drive setting in the Preferences screen.

<b>All</b>	Select or clear an individual checkbox to start or stop monitoring a specific variable. Click the header <b>All</b> to select or clear all variables listed.
<b>Command</b>	Use this field to enter the name of the drive variable whose value you want to monitor. Click the header <b>Command</b> to sort the list alphabetically. Once alphabetized, press the header to reverse ascending/ descending order.
<b>Value</b>	The value of the watched variable is displayed in this field.
<b>Display Format</b>	Select the format that is used for displaying the value: default, Binary Decimal or Hexadecimal.
<b>Mask</b>	Use this field to enter a value that will be logically ANDed with the parameter value.

**Note** ServoStudio 2 continues to continuously query the value of each watched variable, even when the Watch pane is closed. Therefore, do not select more variables than necessary, and clear the watched variable selections when no longer needed.

## 32. Preferences

The Preferences screen allows you to modify file names and locations, runtime options, and other ServoStudio 2 default settings.

The Preferences screen has two tabs: **Basic** and **Advanced**.

The screenshot shows the 'Basic' tab of the 'Preferences' dialog. It features three main sections: 'Startup', 'Language', and 'Runtime Options'. The 'Startup' section has a 'Default Screen' dropdown set to 'Drive Information', a 'Show Splash Screen' section with 'On' selected, and a 'Language' section with 'ENG' selected and a 'Set Language' button. The 'Runtime Options' section contains several checkboxes, all of which are checked, and four dropdown menus for font sizes and log file details. The version number '2.18.5.53' is visible at the bottom.

Figure 32-1. ServoStudio 2 – Preferences Screen – Basic Settings

<b>Startup</b>	
<b>Default Screen</b>	The task screen that is displayed when ServoStudio 2 is activated. It can be any of the screens listed in the sidebar. By default, Drive Information is the default screen.
<b>Show Splash Screen</b>	Defines whether the ServoStudio 2 splash screen is displayed when ServoStudio 2 is activated.
<b>Language</b>	
Select Language	Defines the interface language (options: English, Chinese).
Set Language	Activates the interface in the selected language.
<b>Runtime Options</b>	
<b>Auto Save options</b>	For Expert users. Selected elements will be automatically saved and restored the next time ServoStudio 2 is opened, even if they were not explicitly saved before closing ServoStudio 2.
<b>IntelliSense options</b>	Activates auto-selection and auto-complete when working in Terminal and/or Script pane. Opens and displays list of available drive commands that can be selected based on the characters entered.
<b>Font options</b>	Defines the size of the text displayed in the in Terminal and/or Script pane.

<b>Detail Level Log File</b>	Determines the type and amount of information to be included in log files.
<b>Drive Type in Offline</b>	Do not use unless instructed by Technical Support.
<b>ServoStudio 2 Version</b>	The version of the ServoStudio 2 software.

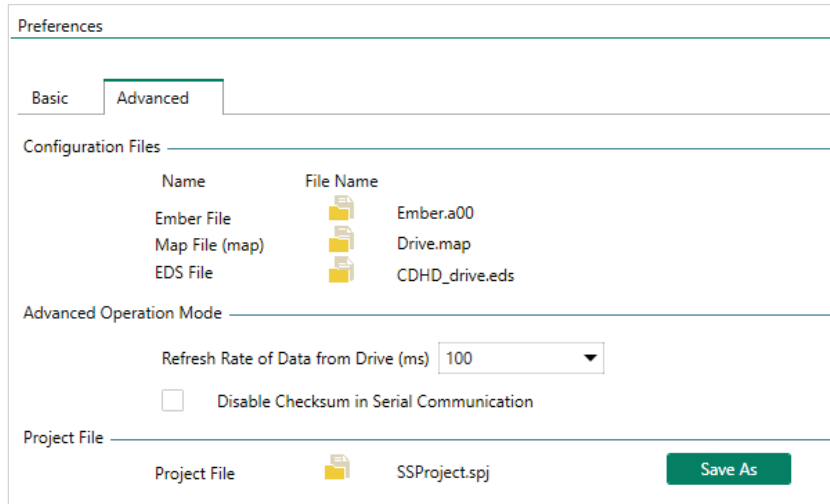


Figure 32-2. ServoStudio 2 – Preferences Screen – Advanced Settings

<b>Configuration Files</b>	The names and locations of files used by ServoStudio 2. For Expert users only.
<b>Advanced Operation Mode</b>	
Refresh Rate of Data from Drive	Sets the rate at which variable values are refreshed on screen. This includes both user-defined watched variables and system-defined variables which may trigger warnings or faults. Defined in milliseconds.
Disable Checksum in Serial Communication	ServoStudio 2 functions properly with or without CHECKSUM enabled in the drive. By default, ServoStudio 2 enables checksum.
<b>Project File</b>	A project file contains all settings currently defined in ServoStudio 2, and any autosaved data.

## 33. Backup & Restore

Refer to [Parameters](#) in the drive user manual.

The **Backup & Restore** screen allows you to save and load parameters to and from files on the host computer.

### 33.1 Save and Restore

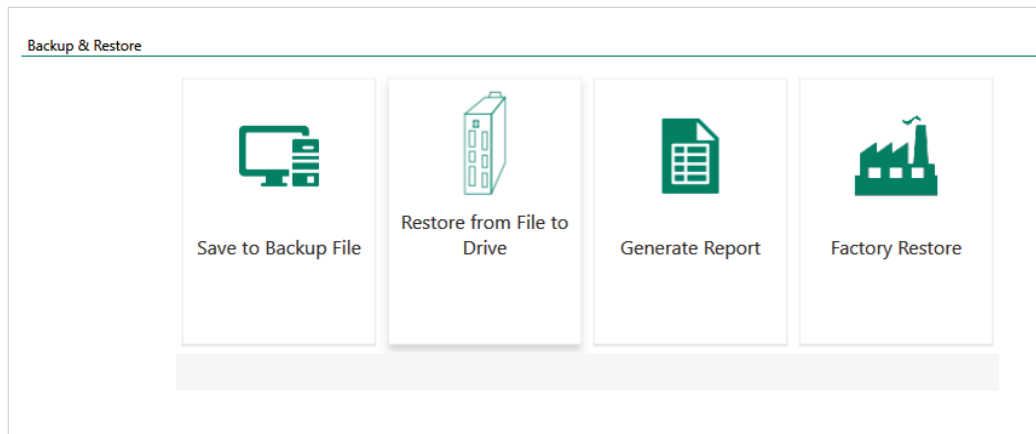


Figure 33-1. ServoStudio 2 – Backup & Restore Screen

<b>Save to Backup File</b>	<p>Opens a <b>Save as</b> dialog box.</p> <p>Saves the parameters and values currently in the drive RAM to a file on the host computer. The parameters are saved in a text file with either TXT or SSV extension. The text file can be edited using Notepad or any other text editor.</p>
<b>Restore from File to Drive</b>	<p>Opens an <b>Open</b> dialog box.</p> <p>Loads parameters and values from a file on the host computer to the drive RAM.</p>
<b>Generate Report</b>	<p>Opens the <i>Application Report</i> Generator dialog box.</p> <p>Creates a set of CSV and TXT files within a zip file. The file can be attached to an email and sent to Technical Support.</p>
<b>Factory Restore</b>	<p>Restores all drive parameters to their factory default settings.</p> <p>If the drive system includes an encoder with an electronic motor plate (MTP), the drive will restore all configuration variables from the MTP.</p> <p>Factory Restore does not clear the fault log.</p>
<b>All Drives</b>	<p>If ServoStudio 2 detects more than one drive, it will display parameter backup and restore options for multiple drives.</p> <p>Backup file names are automatically created according to the name of each drive.</p>

## 33.2 Application Report Generator

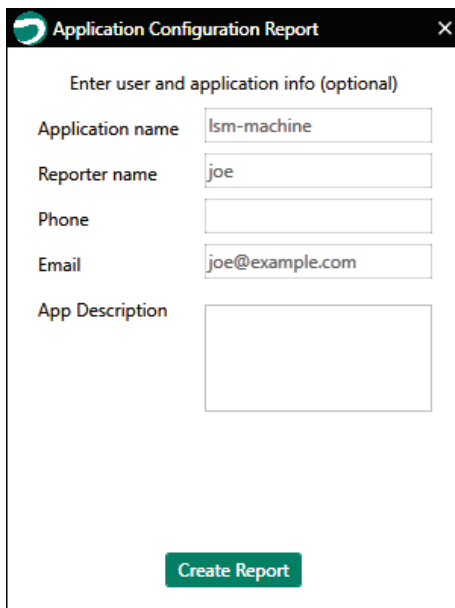
The **Report Generator** is a ServoStudio 2 utility that allows you to save a copy of all system settings and log files. It creates a set of files which can be sent to technical support and/or kept for reference.

It is strongly recommended that you create a report whenever you complete configuration of your application, even when the system is functioning properly.

The Report Generator option appears in the Backup and Restore screen and in the Save dialog box at the end of Autotuning Wizards.

When activated, the Report Generator opens a dialog box that allows you to enter application and user information.

All fields are optional, but it is recommended that you enter all relevant information.



The screenshot shows a dialog box titled "Application Configuration Report" with a close button (X) in the top right corner. The dialog contains the following fields and values:

- Application name: lsm-machine
- Reporter name: joe
- Phone: (empty)
- Email: joe@example.com
- App Description: (empty text area)

A green "Create Report" button is located at the bottom center of the dialog.

Figure 33-2. ServoStudio 2 – Application Report Generator

The Report Generator creates a set of CSV and TXT files within a zip file and saves it in the default path: C:\users\owner\Documents\ServoStudio 2\Reports\History

## 34. Software Scripts

### 34.1 Software Scripts Overview

**Note**

Software (external) scripts are not to be confused with drive (internal) scripts, which are controlled by digital inputs. Refer to *Digital Input Activation of Drive Scripts*.

ServoStudio 2 includes a **scripting language** for programming logical and control tasks that can run independently and simultaneously, such as:

- Sending commands to the drive.
- Reading and setting values in the drive.
- Defining variables and performing simple operations on their values.
- Issuing commands according to status or conditions.
- Controlling program flow.
- Plotting recorded data
- Saving and restoring drive parameters.

ServoStudio 2 **scripts** may contain any number of commands. A command may be either a VarCom instruction or any of the script commands described in this chapter.

Scripts are executed and controlled in the ServoStudio 2 **Script** panes.

Multiple scripts can be executed concurrently. Each script is executed in its own thread, so that other program functions, such as Terminal, Scope and Watch, can be simultaneously active for any number of scripts.




Script files are **saved on the host computer** as text files, which can also be edited in Notepad or any other text editor.



### 34.2 Software Script Pane

Each script opens in its own tab within the Script pane.

Any number of scripts can be open and in use, although typically no more than two scripts are needed for a task. Running numerous scripts simultaneously may slow down ServoStudio 2 and affect PC performance.

The Script tab includes a toolbar with a number of buttons:

	<b>Run.</b> Validates and then runs a script.
	<b>Stop.</b> Halts a running script.
	<b>Validate.</b> Checks the syntax of a script to make sure all script commands are valid. Highlights any errors. It does not check the validity of VarCom instructions.

	<p>Script file options can also be accessed by right-clicking anywhere in a Script tab.</p> <p><b>File.</b> Click the arrow to access the file options:</p> <p><b>Open.</b> Opens a saved script file. Also Ctrl+O</p> <p><b>Save.</b> Saves the script to a file. Also Ctrl+S</p> <p><b>Save As.</b> Saves the script under a different filename.</p> <p><b>Dump.</b> Retrieves all parameters from drive memory. Can be used for viewing and modifying parameter values, followed by Run to send new values to drive. Refer to VarCom <a href="#">DUMP</a>.</p> <p><b>Copy.</b> Ctrl+C</p> <p><b>Paste.</b> Same as Ctrl+V</p> <p><b>Clean Script.</b> Selects and deletes all contents of script tab.</p> <p><b>Close Script.</b> Closes script without saving contents.</p> <p><b>Font Size.</b> Gives you a choice of four sizes for displaying the script text.</p> <p><b>IntelliSense.</b> Toggles the autocompletion system.</p> <p><b>Run Selection.</b> Executes only the lines currently selected in the script.</p> <p><b>Firmware Upgrade.</b> Refer to the user manual.</p>
	<p><b>New Script.</b> Opens a new tab for a new script.</p>

### 34.3 Software Script Syntax and Special Characters

#	Defines the start of a script command.
\$	Prefix for all variable names. A variable name begins with the character \$ followed by any combination of letters and digits.
+ - * /	<b>Operators.</b> add, subtract, multiply, divide.
< > == !=	<b>Condition operators.</b> less than, greater than, equal to, not equal to.
=	Assigns a value to a variable; for example: #Var \$Pos = 3 \$Pos = \$Pos + 1
;	Marks the beginning of a comment. Can be inserted anywhere in the line. All text after the ; until the end of the line is ignored. Comment text is displayed in green.
{ }	Brackets delineate a string of two or more arguments (tokens), which are thus sent to the drive as a single entity. The script engine can handle only 3 variables.
@	Replaces name of a variable with an address from a map file ( <i>drive.map</i> )

### 34.4 Software Script Variables

A variable is defined by an **assignment statement**:

```
<VarName> = <Value> <Operator> <Value>
```

Where *<Value>* is a variable name, drive command, or decimal number.

Variable values can be the output of drive command or the result of a calculation. These values can be compared in a **condition statement**:

*<Condition>* = *<Value>* *<Condition Operator>* *<Value>*

Where *<Condition>* is **if** or **while**

Script variables can be either **local** – used by a specific script, or **global** – shared by all scripts. Local variable names have the prefix **\$** and global variable names have the prefix **\$G\_**. The scope of a local variable is a script Run command. The scope of a global variable is a ServoStudio 2 session. Global variables are useful in synchronizing the execution of two or more scripts running concurrently. Refer to *Var*.

**Note** In rare instances, global variables may cause undefined behavior; since the scheduling of scripts is managed by Windows, and shared variables are not semaphore, values may change between test and set commands.

## 34.5 Software Script Commands

The following commands, listed alphabetically, are recognized by the ServoStudio 2 script engine.

### BroadcastingOn | BroadcastingOff

<b>Syntax</b>	#BroadcastingOn   #BroadcastingOff
<b>Operation</b>	Starts and ends the broadcasting session.

### Connect

<b>Syntax</b>	#Connect <ComPortNum> <DriveID>
<b>Variables</b>	<ComPortNum> = ID number of communication port <Drive ID> = ID number of drive
<b>Operation</b>	Establishes communication, switches from offline to online, and connects ServoStudio 2 to the specified drive through a specified communication port. Example: #Connect 33 1 Connects to drive ID 1 through port COM33

### ClearOutput

<b>Syntax</b>	#ClearOutput
<b>Operation</b>	Clears the contents of the Output pane

### Delay

<b>Syntax</b>	#Delay \$<VarName>
<b>Variables</b>	\$<VarName> = a number or a variable
<b>Operation</b>	Pauses execution of the script for the specified number of milliseconds.

**DownloadFirmware**

<b>Syntax</b>	#DownloadFirmware
<b>Operation</b>	Starts the firmware upgrade. The command can get the path of the firmware or use the default path, if one exists. When used with #Connect, firmware can be downloaded to more than one drive from a single script.

**Label**

<b>Syntax</b>	#Label <LabelName>
<b>Variables</b>	<LabelName> = the label name <b>Note:</b> The name of a drive command or variable (that is, any ASCII name returned by the VarCom command LIST) cannot be used as a script label.
<b>Operation</b>	Sets a label to be referred to by #If and #Goto commands.

**Goto**

<b>Syntax</b>	#Goto <LabelName>
<b>Variables</b>	<LabelName> = the name of the label for the #Goto
<b>Operation</b>	Jumps to the label name

**If**

<b>Syntax</b>	#If <Condition> <LabelName>
<b>Variables</b>	<Condition> = can be < > == != <LabelName> = the name of the label for the #Goto
<b>Operation</b>	Evaluates a condition; if true, jumps to the label name.

**Include**

<b>Syntax</b>	#Include <ScriptFileName>
<b>Variables</b>	<ScriptFileName> = a script file name
<b>Operation</b>	Adds the specified script file to the main script, as if it were copy-pasted into the script at that line. The inclusion (addition of the script) occurs after Start Script is activated and before the first line is executed. The included script is not displayed. If an included script is open in its own window with unsaved changes, the changes will not be part of the Include. <b>Notes:</b> Only one #Include can be used in a script. An included script cannot contain #Include or #Run. A script must not include itself. ServoStudio 2 does not detect or notify about Include errors.

**Message**

<b>Syntax</b>	<code>#Message &lt;VarName_1&gt; [&lt;VarName_2&gt;]</code>
<b>Variables</b>	<code>&lt;VarName_1&gt; &lt;VarName_2&gt;</code> = can be a script variable, drive command or text string
<b>Operation</b>	Opens message box to display the value of the variables, and pauses execution of the script until user presses OK.

**Parse**

<b>Syntax</b>	<code>#Parse</code>
<b>Variables</b>	<code>&lt;Var1&gt; &lt;Var2&gt; [&lt;index&gt;]</code>
<b>Operation</b>	Extracts a number from a string and assigns it to a variable. Example: <code>--&gt;drivetemp</code> <code>Control: 52 [deg C] Power: 42 [deg C] IGBT: 43 [deg C]</code>  <code>\$Var2 = drivetemp</code> <code>#Parse \$Var1 \$Var2 ; \$Var1 contains 52</code> <code>#Parse \$Var1 \$Var2 2 ; \$Var1 contains 42</code> <code>#Parse \$Var1 \$Var2 3 ; \$Var1 contains 43</code>

**Plot**

<b>Syntax</b>	<code>#Plot</code>
<b>Operation</b>	Plots a graph using recorded data from the drive. This is the same as pressing the <b>Plot</b> button on Scope screen toolbar.

**Print**

<b>Syntax</b>	<code>#Print &lt;Var_1&gt; [&lt;Var_2&gt;]</code>
<b>Variables</b>	<code>&lt;Var_1&gt; &lt;Var_2&gt;</code> = can be a script variable, drive command or text string
<b>Operation</b>	Prints the value of the variable/s to the Output pane.

**Print Parameters**

<b>Syntax</b>	<code>#PrintParameters &lt;CommandName_prefix&gt;</code>
<b>Variables</b>	<code>&lt;CommandName_prefix&gt;</code> = first few characters of a VarCom name
<b>Operation</b>	Outputs all VarCom commands that start with the specified prefix. Useful for saving a partial list of VarCom parameters. Example: <code>#PrintParameters kc*</code> Outputs all current loop parameters

**Round**

<b>Syntax</b>	#Round \$<VarName>
<b>Variables</b>	\$<VarName> = a script variable
<b>Operation</b>	Gets the variable and the number of digits after the point. For example: #Round \$var 0

**Run**

<b>Syntax</b>	#Run <ScriptFileName>
<b>Variables</b>	<ScriptFileName> = a script file name
<b>Operation</b>	Open a new Script window, loads the specified script file into it, and runs the script. The calling script continues to run. Whenever this line is executed, a new script is created and starts execution. The invoked script is not displayed. If an invoked script is open in its own window with unsaved changes, the changes will not be part of the Run. Use right-click "Stop All Scripts" command to stop the Run. <b>Note:</b> Global variables should be used to synchronize scripts running concurrently.

**SavePlotFile**

<b>Syntax</b>	#SavePlotFile [<Filename>] #SavePlotFile [\$<Name>]
<b>Variables</b>	<Filename> = name of a file; if not specified, a default name is used \$<VarName> = a script variable; enables saving multiple files in the same script
<b>Operation</b>	Saves data from the currently displayed Scope screen to a CVS file.

**ScaleYTrace**

<b>Syntax</b>	#ScaleYTrace <Name>
<b>Variables</b>	<TraceName> = name of a trace
<b>Operation</b>	Sets the units of axis Y in the scope chart to the units of the specified trace.

**SysValue**

<b>Syntax</b>	#SysValue
<b>Variables</b>	\$<VarName> = a script variable
<b>Operation</b>	<p>Gets ServoStudio 2 internal values.</p> <p>A script can get a value from any of the following:</p> <ul style="list-style-type: none"> <li>• Any cell in the Measurement table in the Scope screen, such as Min, Max, Pk-Pk of each of the recorded variables.</li> <li>• Any cell in the Motor parameter table in the motor screen.</li> <li>• A value calculated from data in the Scope chart. Settling time (SLT) Overshoot (OS) Rise time (RT)</li> </ul> <p>Examples:</p> <pre>#SysValue \$var MT 2 3</pre> <p>Gets value from Measurement table, column 2 row 3 and assigns to variable <b>var</b>.</p> <pre>#SysValue \$st SLT PTPVCMD PE</pre> <p>Gets the settling time value and assigns to variable <b>st</b>.</p> <pre>#SysValue \$var OV VCMD V</pre> <p>Gets overshoot and assigns to variable <b>var</b>.</p> <pre>#SysValue \$var RT VCMD V</pre> <p>Gets rise time and assigns to variable <b>var</b>.</p>

**Var**

<b>Syntax</b>	<pre>#Var \$&lt;VarName&gt;</pre> <pre>#Var \$G_&lt;VarName&gt;</pre> <pre>#Var \$&lt;VarName&gt; = &lt;Value&gt;</pre>
<b>Variables</b>	<pre>\$&lt;VarName&gt; = local variable name</pre> <pre>\$G_&lt;VarName&gt; = global variable name</pre> <pre>&lt;Value&gt; = number or drive parameter name</pre>
<b>Operation</b>	<p>Declares the variable.</p> <p>Declares the global variable.</p> <p>Declares the local variable and sets its initial value.</p> <p>A global needs to be declared in each script that uses it.</p> <p>A global variable should be declared and initialized in separate statements; for example, use:</p> <pre>#VAR \$G_IDX</pre> <pre>\$G_IDX = 1</pre> <p>Do not use:</p> <pre>#VAR \$G_IDX = 1</pre>

**While**

<b>Syntax</b>	#While <Condition> ... #End_While
<b>Variables</b>	<Condition> = can be < > == !=
<b>Operation</b>	Repeats all commands between #While and #End_While, as long as the condition is true. The #While block may include any script commands, including any number of nested #While blocks.

## 34.6 Software Script Examples

### Software Script Example – Record a Motion

```

k
opmode 0
velcontrolmode 7
acc 2000
dec 2000
kvp 1
kvi 0
en
record 16 1000 "vcmd "v "iq
rectrig "imm
j 500
#Delay 200
j 0
#Delay 200
k
#Plot

```

### Software Script Example – Set Outputs According to Input

```

; Toggle_out.txt script
; First, the script checks state of digital input 7
; if digital input 7 equal to 1 then
; the script will toggle one by one
; digital outputs from output 4 to 6

; Digital outputs setup
#Print .....Digital_outputs_init
outmode 4 0
outmode 5 0
outmode 6 0
outinv 4 0
outinv 5 0
outinv 6 0

; Digital input setup
#Print .....Digital_input_7_init
inmode 7 0
ininv 7 0

; Initialize output number counter
#Var $out_n
$out_n=4

```

```

; Infinite loop
#While 1>0

#If {in 7} <1 end_loop
out $out_n 1
#Print outputs
#Delay 500
out $out_n 0

$out_n= $out_n + 1
#round $out_n 0
#If $out_n> 6 reset_out_n

#Goto end_loop

#Label reset_out_n
$out_n = 4

#Label end_loop
#End_While

```

### Software Script Example – Set Speed According to Inputs

```

; Toggle_velocity.txt script
;
; The script checks state of digital inputs 7,8
; and sets drive speed accordingly
; IN 7 | IN 8 | V
; 0 | 0 | 0
; 1 | 0 | 200
; 0 | 1 | -200
; 1 | 1 | 0

; Digital input setup
#Print .....Digital_Inputs_Setup
inmode 7 0
inmode 8 0
inin 7 0
inin 8 0

; Variable for digital input 7,8 state
#var $in_state
#var $in_7
#var $in_8

; Put the drive in serial velocity loop
k
opmode 0
en

; Infinite loop
#While 1>0

; Read state of in 7 and in 8
$in_7 = {in 7}
$in_8 = {in 8}*2
$in_state = $in_7+$in_8

#If $in_state == 0 jog_zero
#If $in_state == 1 jog_positive

```

```
#If $in_state == 2 jog_negative

#Label jog_zero
#Print JOG_zero
j 0
#Goto end_loop

#Label jog_positive
#Print JOG_plus_200
j 200
#Goto end_loop

#Label jog_negative
#Print JOG_minus_200
j -200

#Label end_loop
#Delay 500
#End_While
```

### **Software Script Example – Set Position Feedback to Zero (Forced Homing)**

```
pfboffset 0 ;Clear position offset
#Print pfboffset ;Print position offset
pfboffset = -pfb ;Assign the inverse value of actual position (PFB) to the position offset
#Print pfboffset ;Print the new value of position offset
```