CDHD2

ServoStudio 2

Reference Manual

CDHD2 Servo Drive

DDHD Dual Drive

Revision: 1.1

Software Version 2.15.x

Firmware Version 2.15.x

SERVOTRONIX

always in motion™

Revision History

Doc. Rev.	Date	Remarks
1.1	Oct. 2018	Software version 2.15.x
1.0 STX	Apr. 2018	Software version 2.15.2.xx: for CDHD2 Release 1.5 Beta 1

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Contents

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 Manual Format

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

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

For detailed information on setting and using drive 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 an EtherCAT or CANopen network.

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

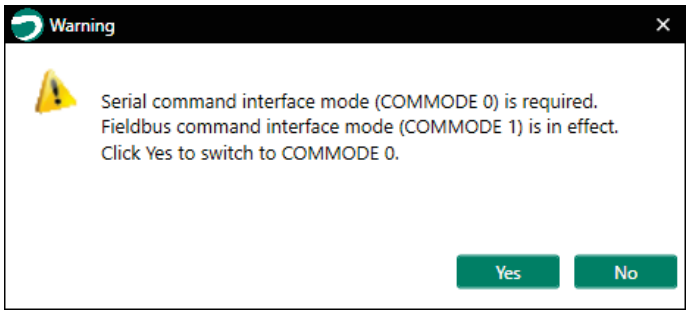


Figure 2-1. Command Interface Mode

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 shut down 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:

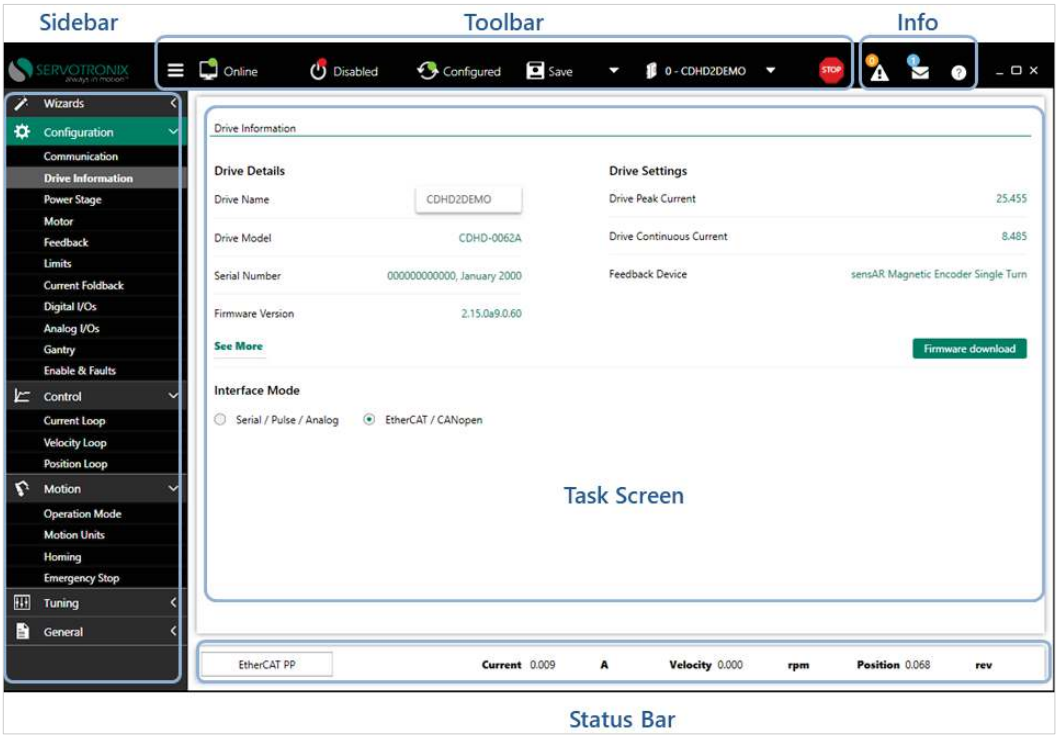
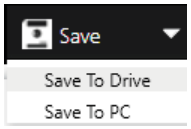


Figure 3-1. ServoStudio 2 Software Interface

	Toolbar	Contains quick access buttons for frequently used functions.
	**Sidebar Show/Hide**	Opens/closes the sidebar, which contains the navigation menu.
	**Offline | Online**	Toggles ServoStudio 2 communication with the drive off and on, and indicates the state of the connection. • **Offline** mode: ServoStudio 2 does not attempt to communicate with the drive. Red icon. • **Online** mode: 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. **Note**: It is recommended to switch to Offline mode before physically disconnecting the drive or powering off the drive.

	**Enabled | Disabled**	Enables and disables the drive, and indicates the state of the drive. Icon is **green** when the drive is enabled (active); it is **red** when the drive is disabled (inactive).
	**Configured**	Triggers the internal drive configuration. VarCom CONFIG. The CONFIG command is required after certain parameters are modified.
	**Save to Drive | Save to PC**	Use **Save** after configuring parameters to keep values in non-volatile memory. • **Save to Drive** 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 SAVE. • **Save to PC** saves the parameter values to a backup file on the host computer.
	**Drive in Use**	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.
	**Stop**	Emergency stop.
	Info	
	**Faults/Warnings**	Indicates faults and warnings currently in effect. Click the icon to view the fault messages. Click **Clear Fault** to send a clear faults command (CLEARFAULTS) to the drive.
	**Messages**	Notifications from ServoStudio 2 that do not require immediate attention. Click the icon to view messages. Click **Clear All** to delete all messages in the log.
	**Help**	Online help for drive software and hardware. In addition, use **F1** or the right-click shortcut menu to activate Help for the currently selected field.
	About	Software version information.
	Sidebar	Contains a navigation menu to the various ServoStudio 2 screens.
	Task Screen	Displays various interactive screens for viewing, setting and testing parameters and drive configurations.
	Status Bar	Displays the status of the drive.
	Operation Mode	Indicates the currently defined operation mode.
	Current	Motor current. VarCom I. Shows the equivalent motor current.

	Velocity	Motor velocity. VarCom V. Shows the velocity value measured by the feedback device (on motor or load), as defined by the secondary feedback mode.
	Position	Motor position. VarCom PFB. 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.

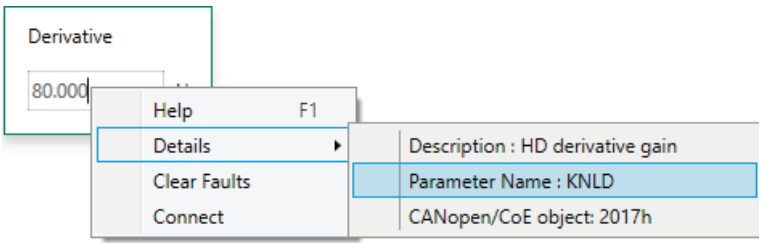


Figure 3-2. Right-Click Help Shortcuts

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

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.

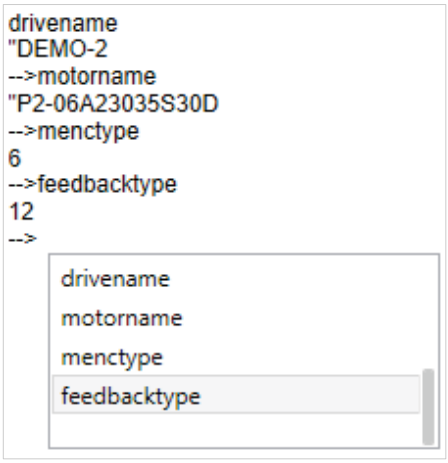


Figure 3-3. History

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

- Press **Enter** to sends 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 mnemonic.

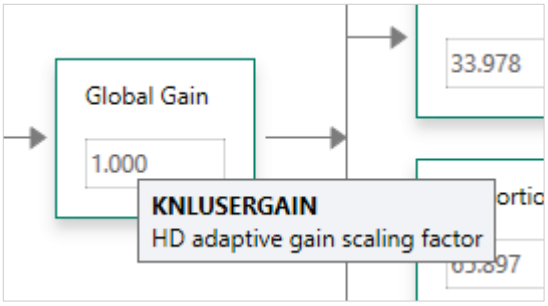


Figure 3-4. Schematic Tooltip

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 appears in various ServoStudio 2 screens, such as Scope and Motor. It displays and allows you to modify parameters relevant to the operation mode in effect.

For each parameter (variable), the Parameter Table presents the following information:

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

Hover over the parameter name to view the VarCom mnemonic.

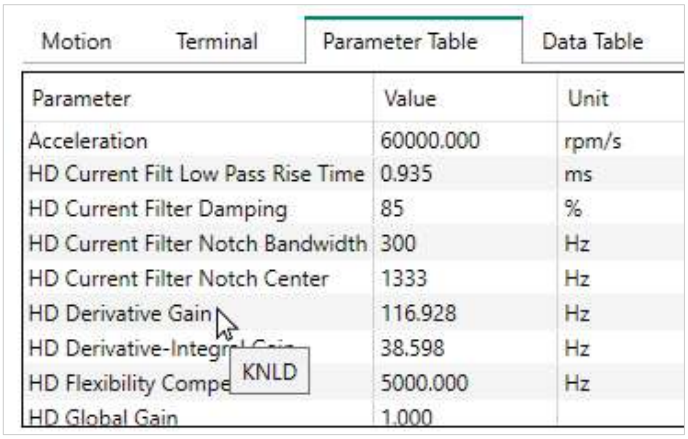


Figure 3-5. Parameter Table Tooltip

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

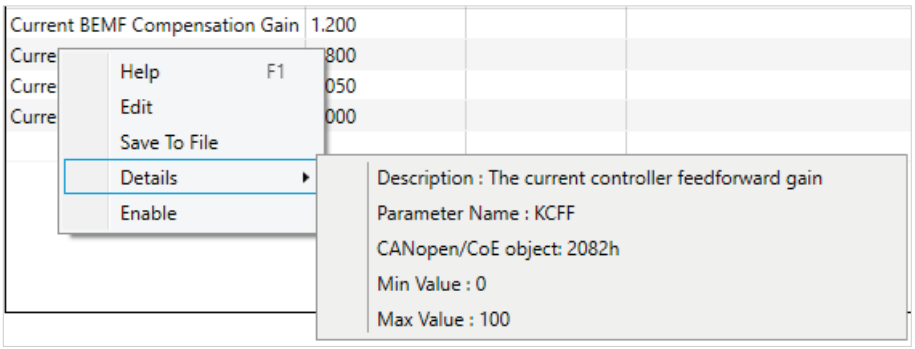


Figure 3-6. Parameter Table – Right-Click Info

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 mnemonic. ServoStudio 2 automatically displays the descriptive name, 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.

Help	**F1**. Activates online help for the currently selected screen element.
Edit	Opens an Edit Parameter dialog box that contains the essential functions provided in the Scope screen to facilitate tuning of motion parameters. Options enable automatic and consistent intervals for adjusting parameter values.
Save to File	Saves the entire parameter table to a text file, for reference purposes only. Default location is: \<*My Documents*>\ServoStudio 2
Enable | Kill	Toggles the Enable/Disable state of the drive. VarCom EN and K. This option is displayed when modification of the parameter value requires the drive to be in the disabled state.
Details	**Description**. A brief description of the parameter. **Command Name**. The VarCom equivalent. **Min/Max Value**. The minimum and maximum values allowed for the parameter. **CANopen Index**. Where applicable, the equivalent CANopen object code.

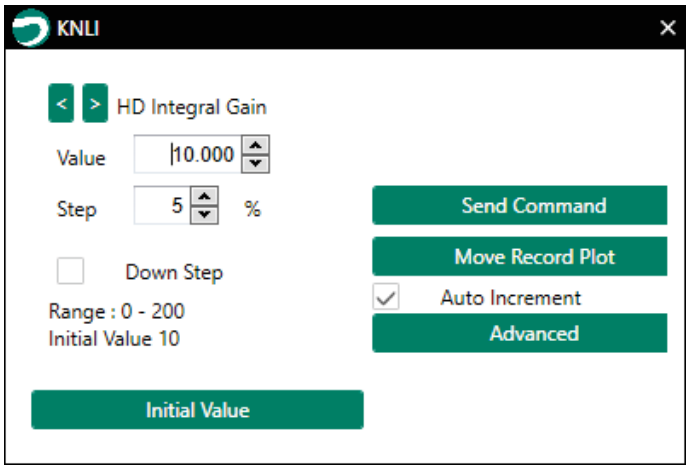


Figure 3-7. Parameter Table – Edit Parameter Dialog Box

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

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

The Parameter Table in the Motor screen does not allow modification of parameter values, except for motors defined as User Motors.

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 drive user manual
1	**Connection**	*Communication*	Communication
2	**Drive Information**	*Drive Information*	Drive Identification
3	**Motor Selection**	*Motor*	Motor Identification | Motor Initialization
4	**Limits**	*Limits*	Current Limits | Velocity Limits | Position Limits
5	**Motor Direction**		Motor Direction
6	**Save**	*Backup & Restore*	

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 on 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.

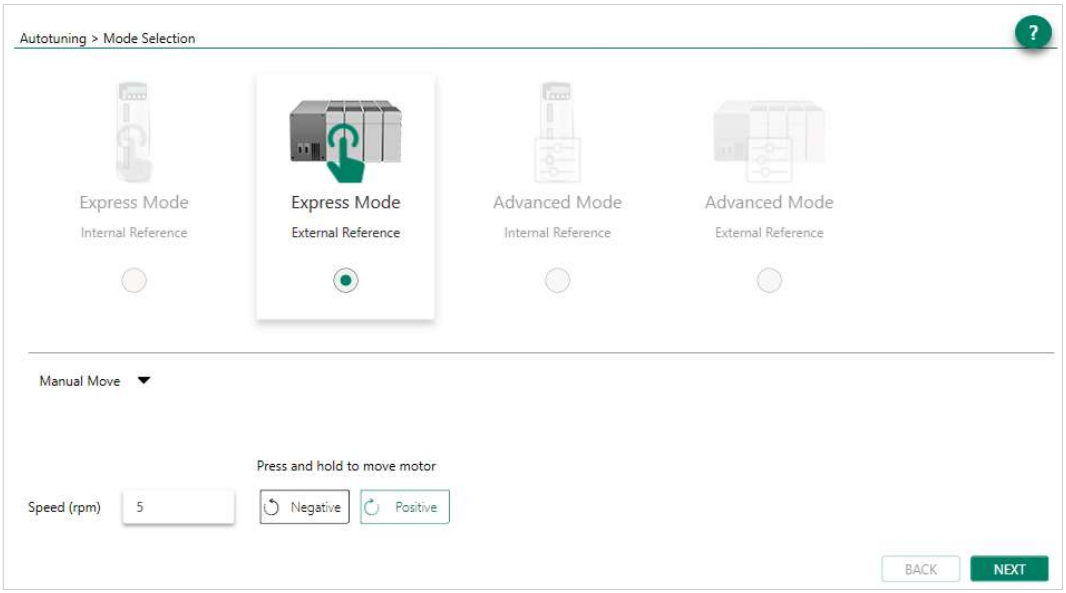


Figure 5-1. ServoStudio 2 – Autotuning Wizard – Drive-Based

Table 5-1. Steps in Autotuning Process – Drive-Based

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

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.

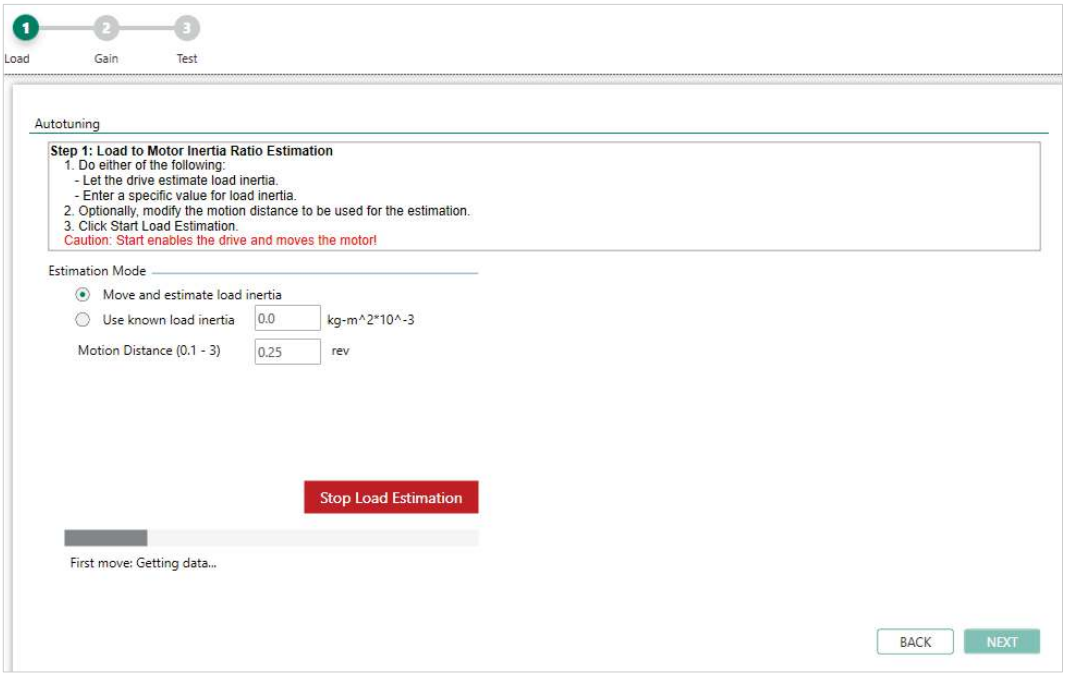


Figure 5-2. ServoStudio 2 – Autotuning Wizard – PC-Based

Table 5-2. Steps in Autotuning Process – PC-Based

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

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 offline, all Interface Modes are displayed.
When the software is communicating with the drive, only the relevant modes are shown.

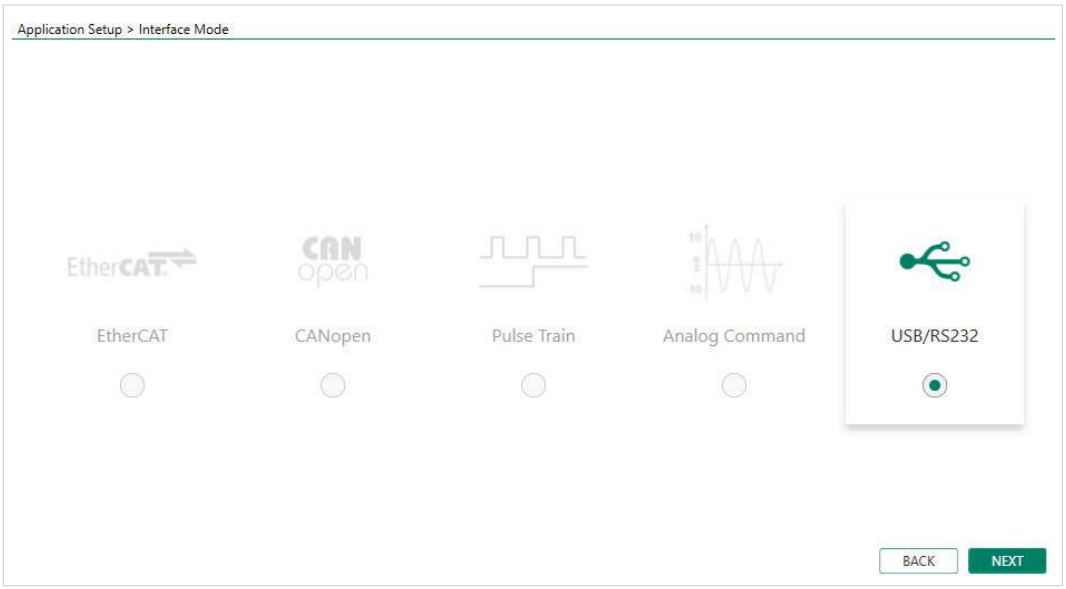


Figure 6-1. ServoStudio 2 – Application Setup Wizard – Interface Mode

Table 6-1. Steps in EtherCAT Application Setup

	Step	Refer to the instructions in the drive user manual
1	Operation Mode	Application Setup - Operation Mode
2	PDO Mapping	Application Setup - PDO Mapping
3	Position Units	Application Setup - Position Units
4	Inputs/Outputs	Application Setup - Inputs/Outputs
5	Homing	Application Setup - Homing
6	Save	Application Setup - Save

Table 6-2. Steps in CANopen Application Setup

	Step	Refer to the instructions in the drive user manual
1	Communication	Application Setup - Communication
2	PDO Mapping	Application Setup - PDO Mapping
3	Position Units	Application Setup - Position Units
4	Inputs/Outputs	Application Setup - Inputs/Outputs
5	Homing	Application Setup - Homing
6	Save	Application Setup - Save

Table 6-3. Steps in Pulse Train Application Setup

	Step	Refer to the instructions in the drive user manual
1	Pulse Train	Application Setup - Pulse Train
2	Resolution	Application Setup - Resolution
3	Filters	Application Setup - Filters
4	Limits	Application Setup - Limits
5	Inputs/Outputs	Application Setup - Inputs/Outputs
6	Homing	Application Setup - Homing
7	Save	Application Setup - Save

Table 6-4. Steps in Analog Command Application Setup

	Step	Refer to the instructions in the drive user manual
1	Resolution	Application Setup - Resolution
2	Filters	Application Setup - Filters
3	Limits	Application Setup - Limits
4	Inputs/Outputs	Application Setup - Inputs/Outputs
5	Homing	Application Setup - Homing
6	Save	Application Setup - Save

Table 6-5. Steps in USB/RS232Application Setup

	Step	Refer to the instructions in the drive user manual
1	Inputs/Outputs	Application Setup - Inputs/Outputs
2	Homing	Application Setup - Homing
3	Save	Application Setup - Save

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 COMMODE 0.

To transmit commands to the drive over EtherCAT or CANopen networks, the drive must be set to COMMODE 1. While COMMODE 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.

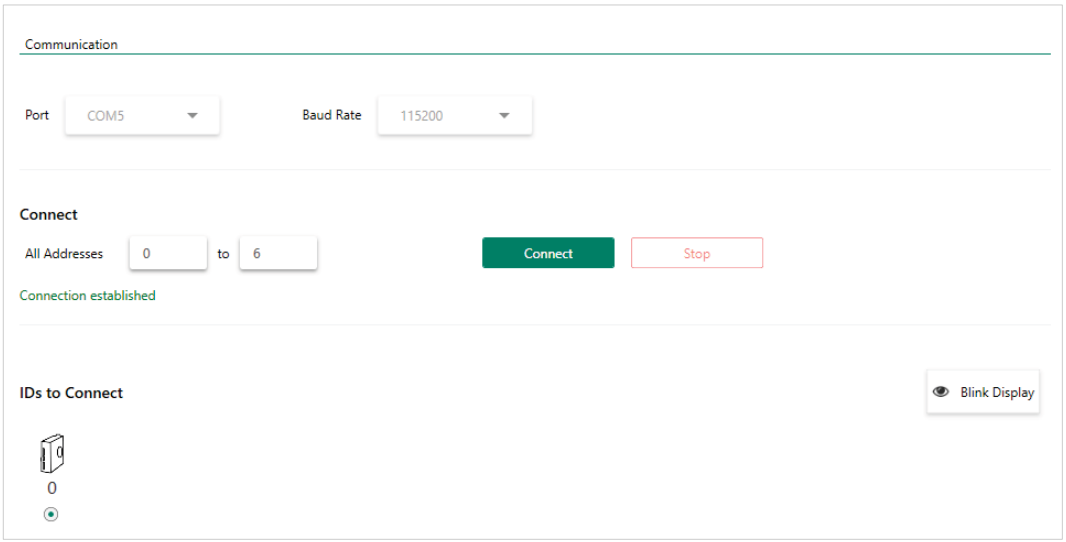


Figure 7-1. ServoStudio 2 – Communication Screen – Serial

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	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. To modify baud rate settings, the change must be made **both** in the drive and in ServoStudio 2 software. VarCom BAUDRATE.
Connect	
All Addresses	Defines the drive addresses to be searched, from 0-99 (CDHD2) or 1-15 (DDHD). The default limit is 10 addresses. 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. If an address is not selected, ServoStudio 2 will establish and maintain communication with all drives on the port.
Connect	Attempts to connect to drive/s according to the address setting/s. The software searches all COM ports on the host computer to locate the port to which a drive is connected. Once the software identifies the port, it searches for all drives that may be daisy-chained to the port.
Stop	Halts the attempt to connect to drive/s.
Connection Status	A progress bar reflects the search and connect process. When completed, message indicates either **Connected established** or **Connection failed**.
Blink Display	To test communication between ServoStudio 2 and the drive, press **Blink Display**, and observe the 7-segment display on the drive. If communication is established, the display will flash **8 8 8 8 8** several times.
IDs to Connect	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..

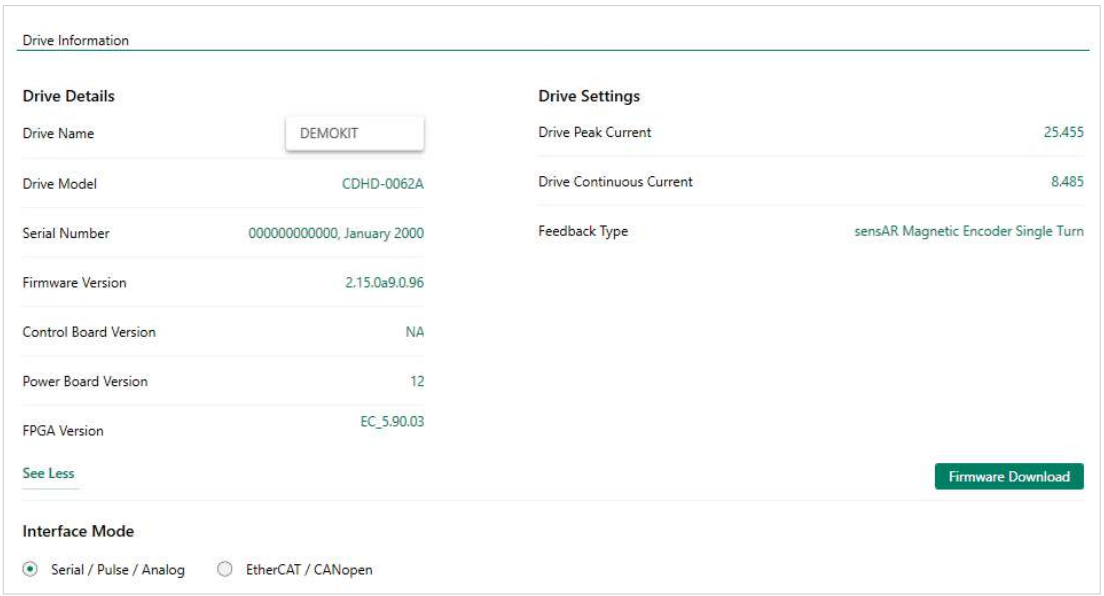


Figure 8-1. ServoStudio 2 – Drive Information Screen

Drive Details		
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
Additional drive info	Hardware-defined. Read only. Shows the drive model and serial number, and version numbers of firmware, control board, power board and FPGA.	INFO
Drive Settings		
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
Interface Mode		
Serial/Pulse/Analog	Servo ON status (ACTIVE) and motion commands are transmitted via a serial, pulse or analog interface..	COMMODE 0
EtherCAT/CANopen	Servo ON status (ACTIVE) and motion commands are transmitted via an EtherCAT/CANopen interface. **Note**: Not applicable for **AP** models	COMMODE 1
Download Firmware	Opens a dialog box for installing new versions of drive firmware. Refer to Firmware Update in the drive user manual.	

9 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

9.1 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.

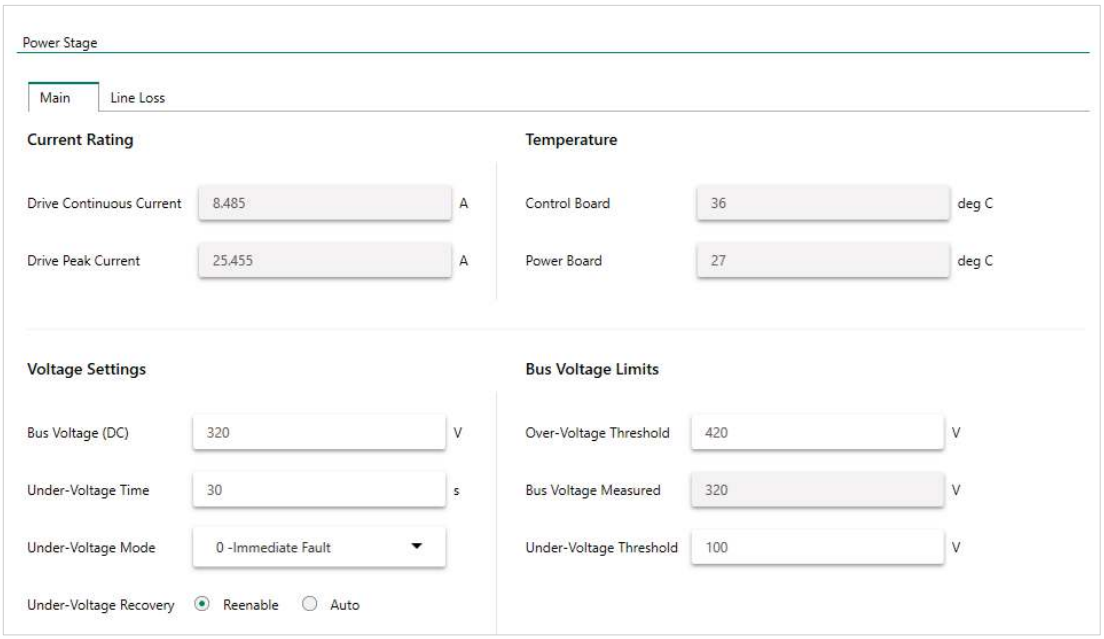


Figure 9-1. ServoStudio 2 – Power Rating Screen – Main

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

Voltage Settings		
Bus Voltage (DC)	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. **Note:** 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.	VBUS
Under-Voltage Time	Specifies the amount of time an under-voltage condition will exist before latching a fault, when working in Delayed Fault Under-Voltage mode.	UVTIME
Under-Voltage Mode	Defines how the drive will respond to an under-voltage fault.	UVMODE
Under-Voltage Recovery	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.	UVRECOVER
Bus Voltage Limits		
Over-Voltage Threshold	Shows the level for detection of bus over-voltage. Defined in hardware. Read only.	OVTHRESH
Bus Voltage Measured	Shows the actual bus voltage of the drive. Read only. Defined in hardware. Read only.	VBUSREADOUT
Under-Voltage Threshold	Defines the level for detection of bus under-voltage condition.	UVTHRESH

9.2 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.

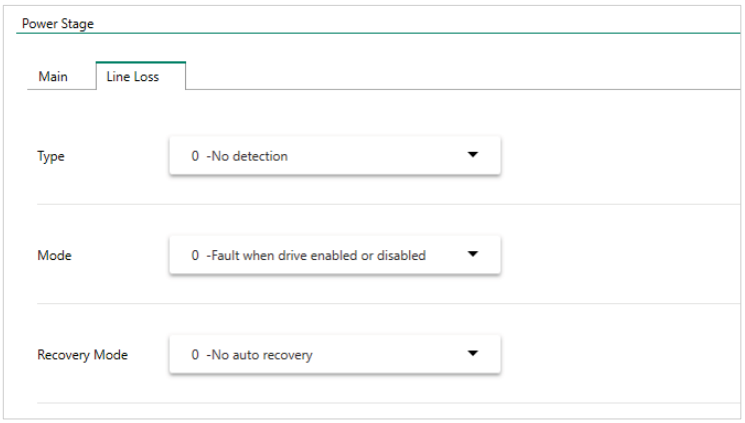


Figure 9-2. ServoStudio 2 – Power Rating Screen – Line Loss

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

10 Motor

Refer to Motor Setup in the drive user manual.

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.

10.1 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.

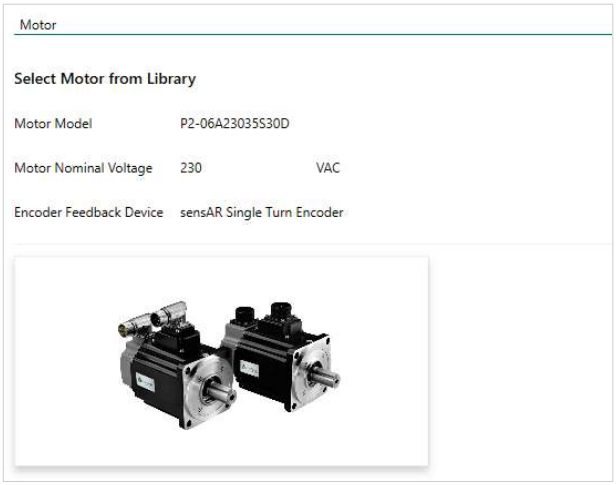


Figure 10-1. ServoStudio 2 – Motor Data from Electronic Motor Nameplate

10.2 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.

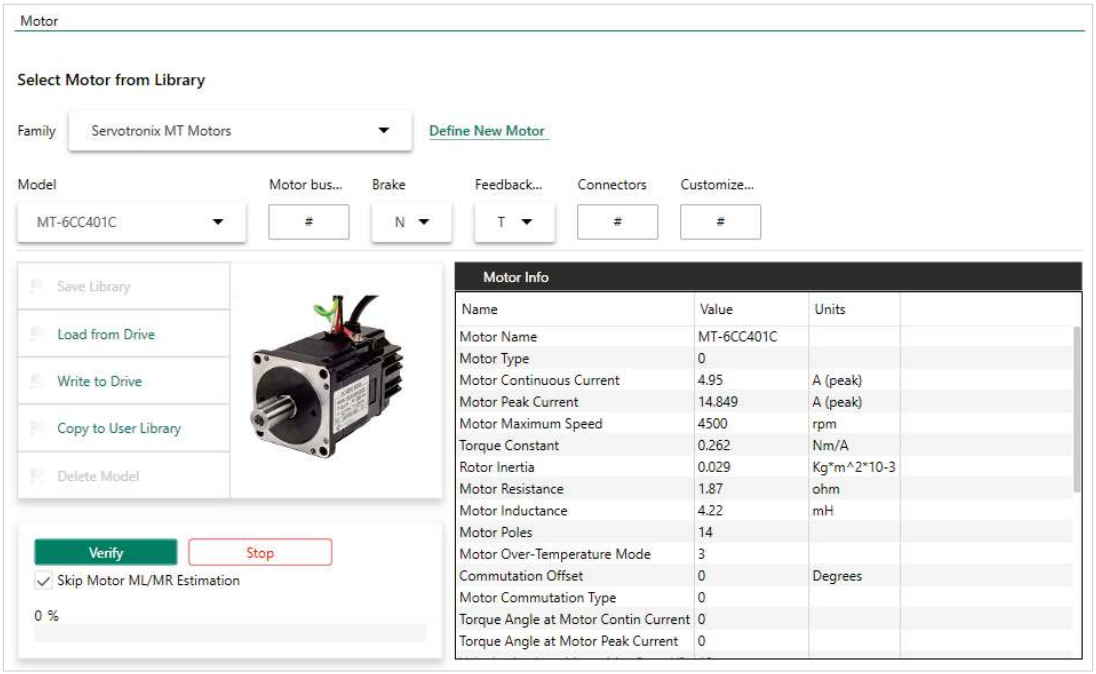


Figure 10-2. ServoStudio 2 – Motor Screen

Motor Family	ServoStudio 2 has several databases containing predefined sets of parameters for motors. **User Motors** 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. To add a motor to this list, select Motor Family>User Motors, and then Motor Type>New. The Parameters Table then displays a list of motor properties that need to be defined.
Motor Model	A list of all models in the selected Motor Family that have a predefined set of parameters in ServoStudio 2. 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. 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. Different fields represent certain functions or capabilities of the motor, which can be seen in the tooltip for each field. Depending on your selections, you may be prompted to define the output that releases the motor brake. After selecting the motor press **Write To Drive** to write this parameter to the drive.
New Motor	Refer to *New Motor Wizard*.

10.3 Motor Parameters

Save Library	Saves the entire contents of the User Motors library to a file.
Delete Model	Deletes the currently displayed motor from the User Motors library.
Load from Drive	Displays the values of the drive's motor parameters.
Write to Drive	Writes all displayed parameters to the drive. You can also modify a parameter value and press **Enter** to send the new value to the drive.
Copy to User Library	Copies the parameter values currently displayed to the User Motors library, to enable modification.
Verify	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. The drive's 7-segment display flashes the character **A t 1** during this procedure. When the procedure finishes successfully, the display returns to its normal state. If the procedure fails, the display shows **-5**. Refer to VarCom MOTORSETUP and the section *Motor Setup Wizard*.
Skip ML/MR Estimation	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.
Stop	Aborts the Verify process.
Progress bar	Shows the progress of the Verify process (which takes about 30 seconds).
Click for Details	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.

10.4 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.

11 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

11.1 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.

11.1.1 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.

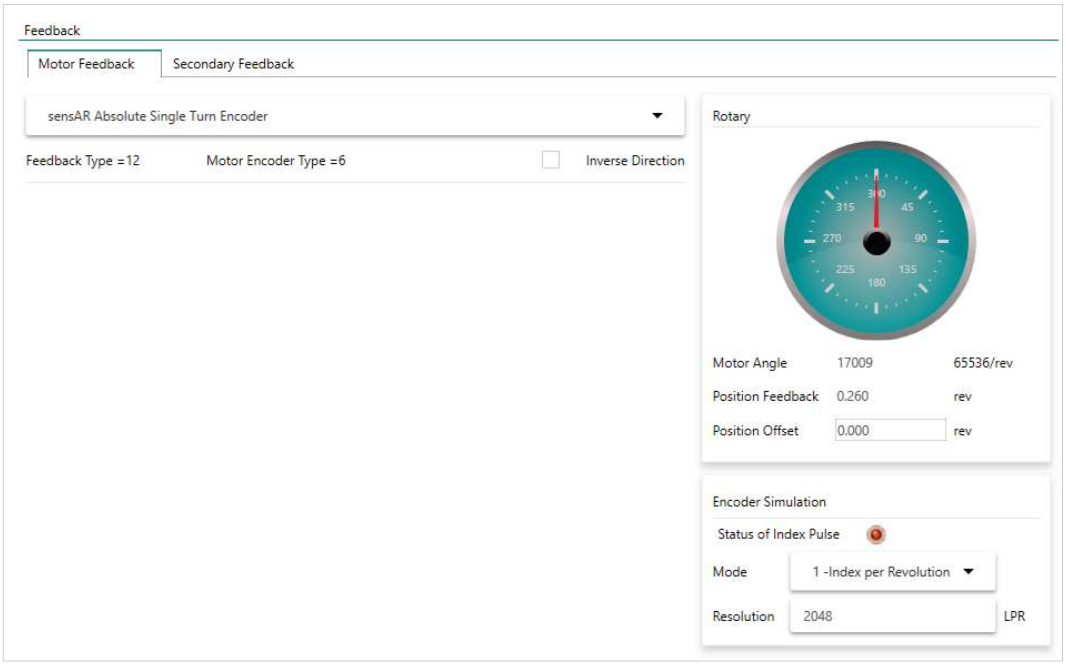


Figure 11-1. ServoStudio 2 – Feedback Screen – Motor Feedback Tab – sensAR Encoder

11.1.2 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.

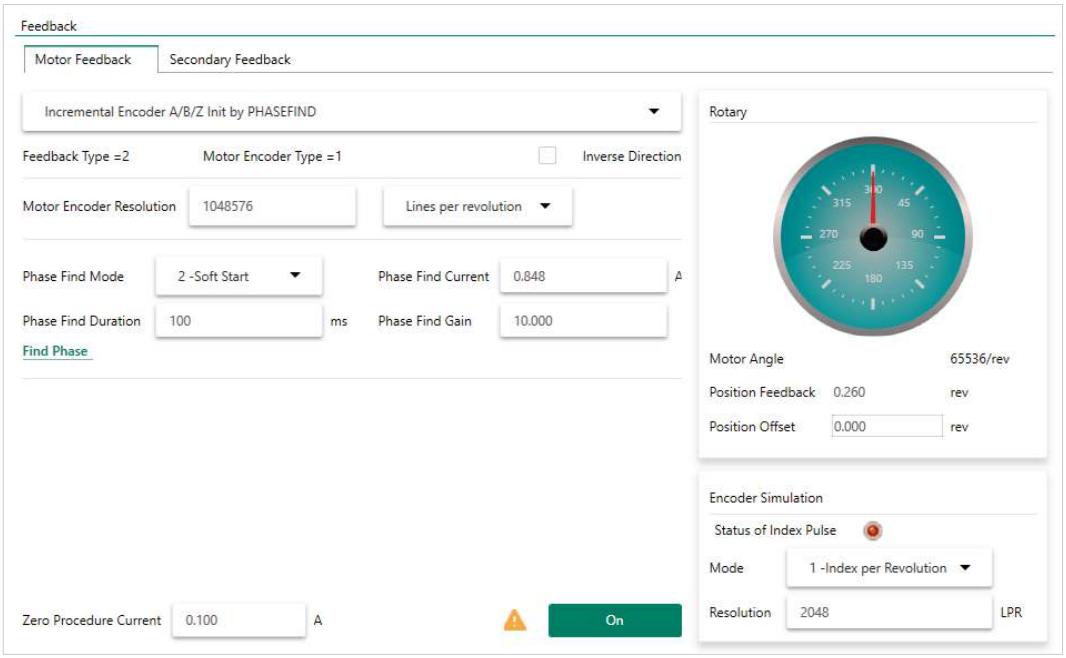


Figure 11-2. ServoStudio 2 – Feedback Screen – Example – Incremental Encoder

Motor Feedback		
Feedback Device	From the dropdown list, select the motor feedback device being used in the application: Incremental Encoder A/B/Z + Halls Incremental Encoder A/B/Z Init by PHASEFIND Incremental Encoder A/B/Z Init by first Enable or PHASEFIND Incremental Encoder A/B Init by PHASEFIND Incremental Encoder A/B Init by first Enable or PHASEFIND Incremental Encoder A/B + Halls Halls Only Sine Encoder A/B/Z/ + Halls Sine Encoder A/B/Z Init by PHASEFIND Sine Encoder A/B/Z Init by first Enable or PHASEFIND Sine Encoder A/B Init by PHASEFIND Sine Encoder A/B Init by first Enable or PHASEFIND Sine Encoder A/B + Halls Endat 2.x Protocol Endat 2.x Protocol with Sine Signals HIPERFACE with Sine Signals Nikon Encoder: 17/20-bit Absolute Single Turn Nikon Encoder: 17/20-bit Absolute Multi Turn Tamagawa Incremental Encoder (8 wires) Tamagawa Absolute Encoder: 17/15-bit Single Turn Tamagawa Absolute Encoder: 17/23-bit Multi-turn sensAR Absolute Single Turn Encoder sensAR Absolute Multi-turn Encoder Resolver BiSS-C Interface Encoder The selection automatically sets both the Feedback type and the Encoder type, as indicated on screen.	

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
Rotary	The graphic represents the value of MECHANGLE. 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	A offset value that is added to the internal cumulative position counter, to give the position feedback value.	PFBOFFSET
Zero		
Zero Procedure Current	The current used for the Zero procedure.	IZERO
On	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.	ZERO
Encoder Simulation	Enables the equivalent encoder output, and sets the resolution.	
Status of Index Pulse	An icon represents the state of the encoder index signal: **Red**. The encoder index signal is inactive, indicating the position is not within the index. **Green**. The encoder index signal is active, indicating the position is within the index.	
Mode	The state of the encoder simulation. **0** Off. Encoder simulation not enabled. **1** Index per revolution. Encoder simulation enabled, with an index signal (zero pulse) on each turn (or pitch, for linear motor). **2** Index per feedback. 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.	ENCOUTMODE
Resolution	The resolution, in number of lines, of the encoder equivalent output	ENCOUTRES

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

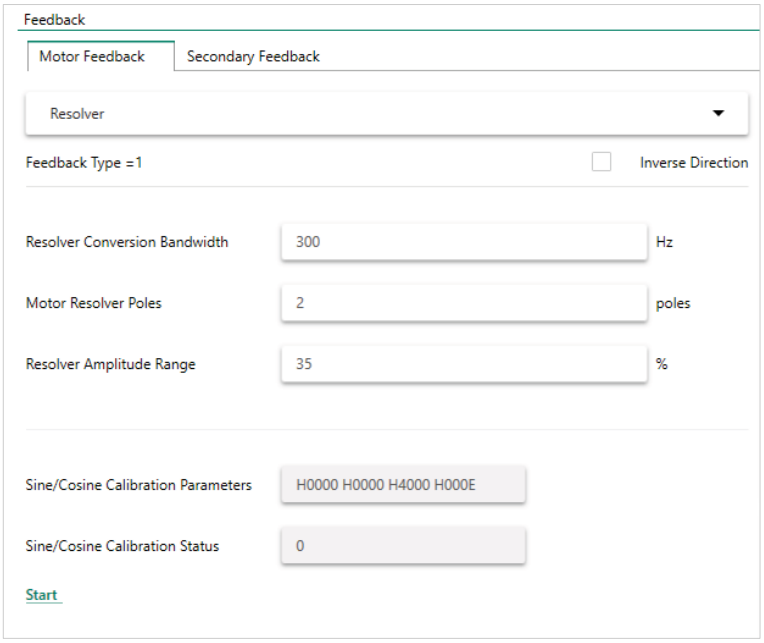


Figure 11-3. ServoStudio 2 – Feedback Screen – Example – Resolver

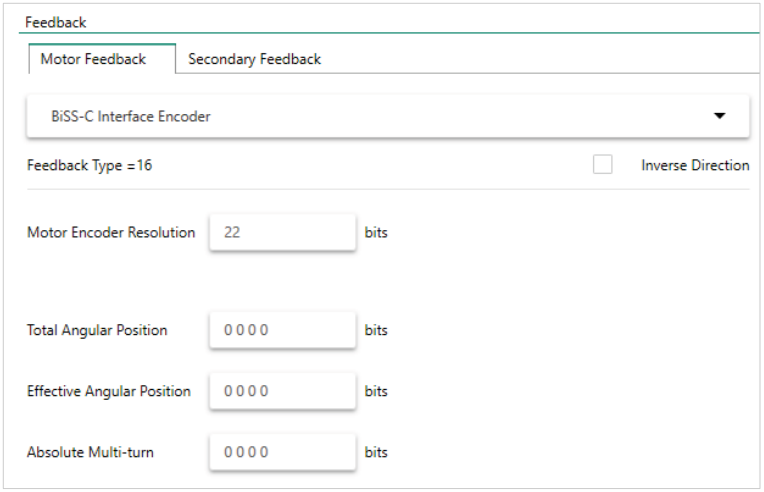


Figure 11-4. ServoStudio 2 – Feedback Screen – Example – BiSS-C Protocol

Motor Encoder Resolution	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.	MENCRES
Halls		
Hall Signals Type	The source and method used for Hall sensors.	HALLSTYPE
Halls	The current state of the Hall commutation sensors. Read only.	HALLS

Inversion	Inverts the polarity of individual Hall signals associated with motor phases UVW, thereby providing correction for crossed wiring.	HALLSINV
Phase Find		
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
Find Phase	Activates the automatic motor phasing routine.	PHASEFIND
Resolver		
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
Calibration		
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
Start	Activates a procedure that calibrates the resolver sine/cosine signals. The calibration serves to reduce Harmonic errors in the resolver reading.	SININIT
Multi-turn		
Reset Multi-turn	Resets the position counter of an absolute multi-turn encoder.	MTTURNRESET
BiSS-C		
Total Angular Position	**Single Turn Data** (bits). The number of bits allocated for transmission of single turn (or linear) position data within a BiSS-C packet.	BISSCFIELDS (argument 3)
Effective Angular Position	**Effective Single Turn Data** (bits).The number of effective bits in transmission of single turn (or linear) position data.	BISSCFIELDS (argument 4)

Absolute Multi-turn	**Multi-turn Data** (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.	BISSCFIELDS (argument 1)

11.2 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.

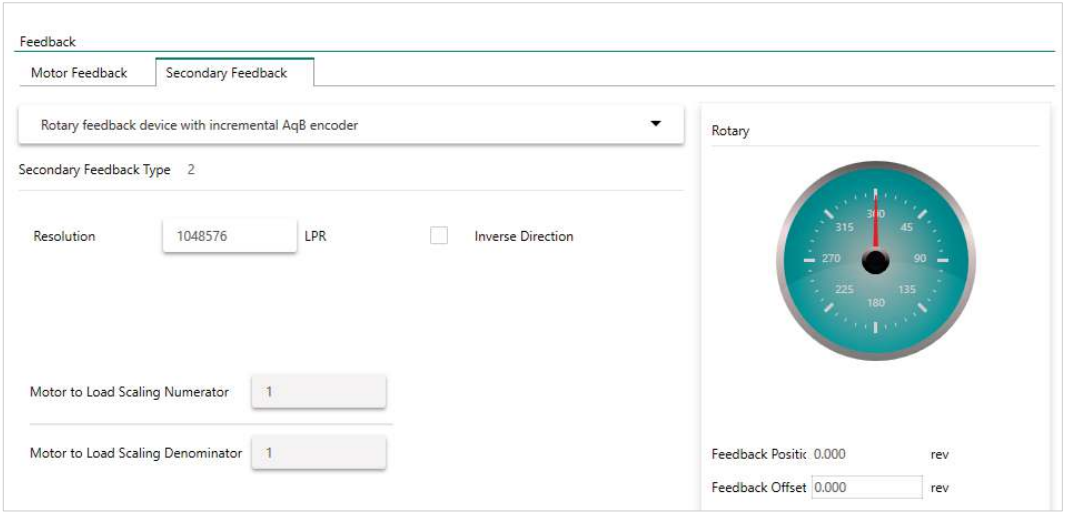


Figure 11-5. ServoStudio 2 – Feedback Screen – Secondary Feedback Tab

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.

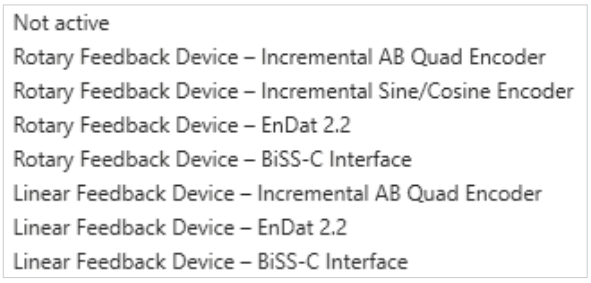


Figure 11-6. ServoStudio 2 – Feedback Screen – Secondary Feedback Options

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*.

12 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

12.1 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.

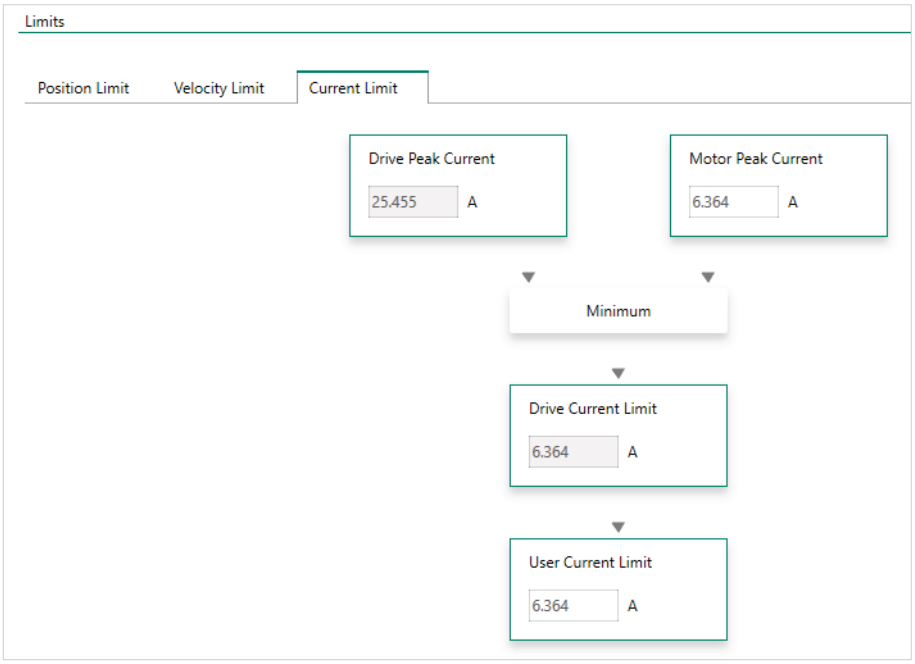


Figure 12-1. ServoStudio 2 – Current Limit Screen

Drive Peak Current	The peak rated current of the drive. Defined in hardware. Read only.	DIPEAK
Motor Peak Current	The peak current of the motor. This value is obtained from the motor datasheet/electronic nameplate.	MIPEAK
Drive Current Limit	The maximum current for the drive and motor combination. This value is calculated by the software. Read only.	IMAX
User Current Limit	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

12.2 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.

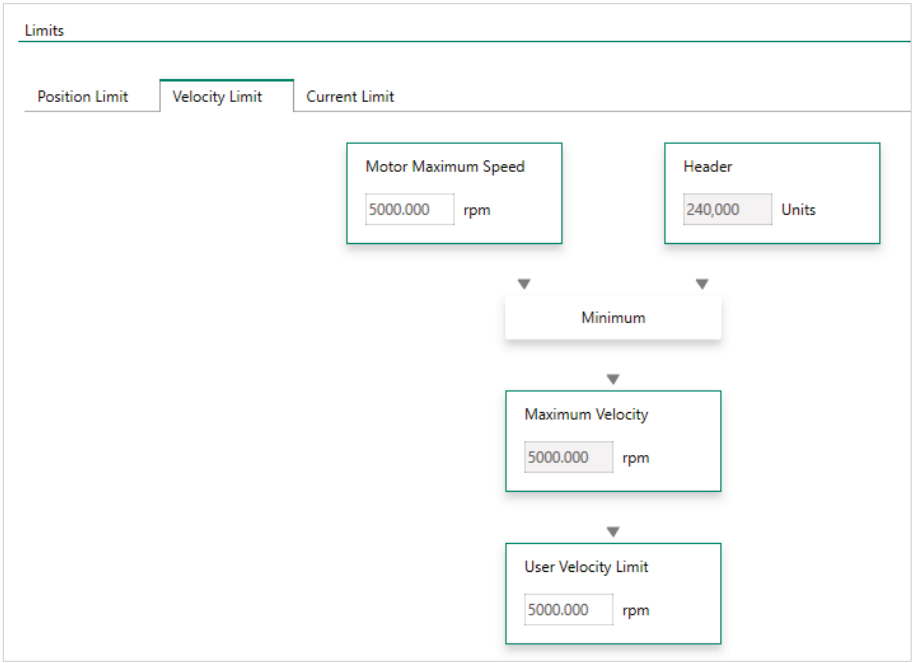


Figure 12-2. ServoStudio 2 – Velocity Limit Screen

Motor Maximum Speed	The maximum motor speed. This value is obtained from the motor datasheet/electronic nameplate.	MSPEED
Maximum Value	The maximum speed that the drive can compute. Defined in hardware. Read only.	
Maximum Velocity	The maximum allowed motor velocity is computed according to the values of the two preceding parameters. Read only.	VMAX

User Velocity Limit	A user-definable maximum velocity for the application. You set a value up to the value defined by VMAX.	VLIM

12.3 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.

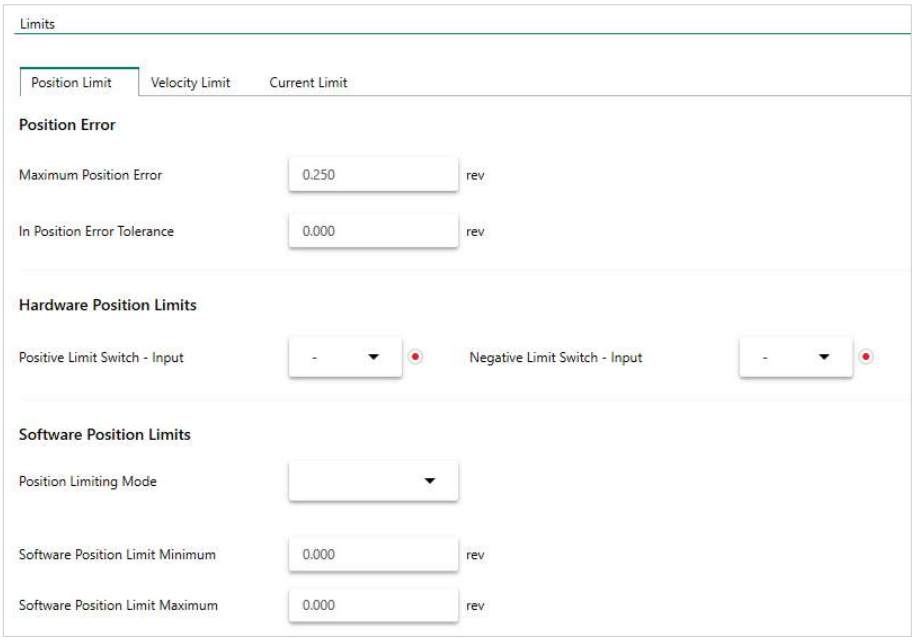


Figure 12-3. ServoStudio 2 – Position Limit Screen

Position Error		
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
Hardware Position Limits		
Positive Limit Switch - Input	Defines the digital input (*n*) that indicates whether the positive limit has been reached.	INMODE *n* 5
Negative Limit Switch - Input	Defines the digital input (*n*) that indicates whether the negative limit has been reached.	INMODE *n* 6

Software Position Limits		
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

13 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

13.1 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.

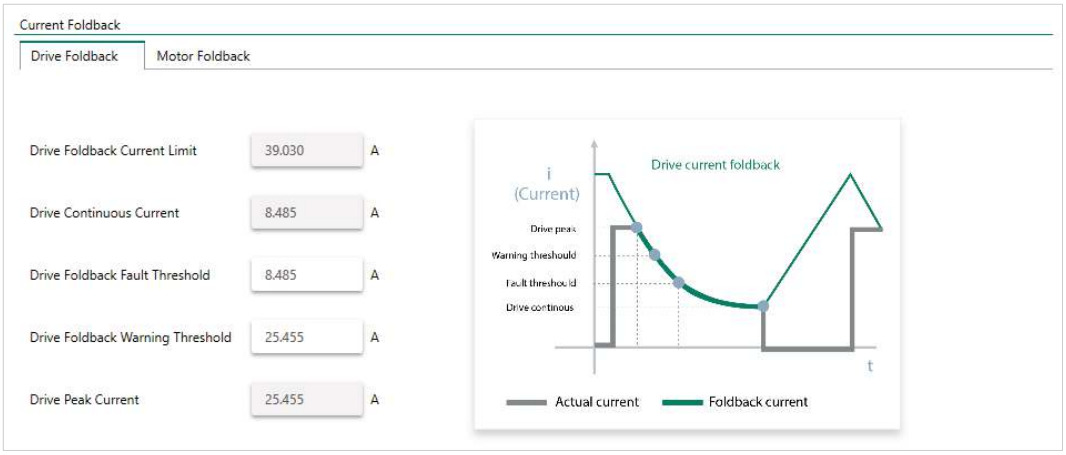


Figure 13-1. ServoStudio 2 – Current Foldback Screen – Drive

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

13.2 Motor Foldback

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

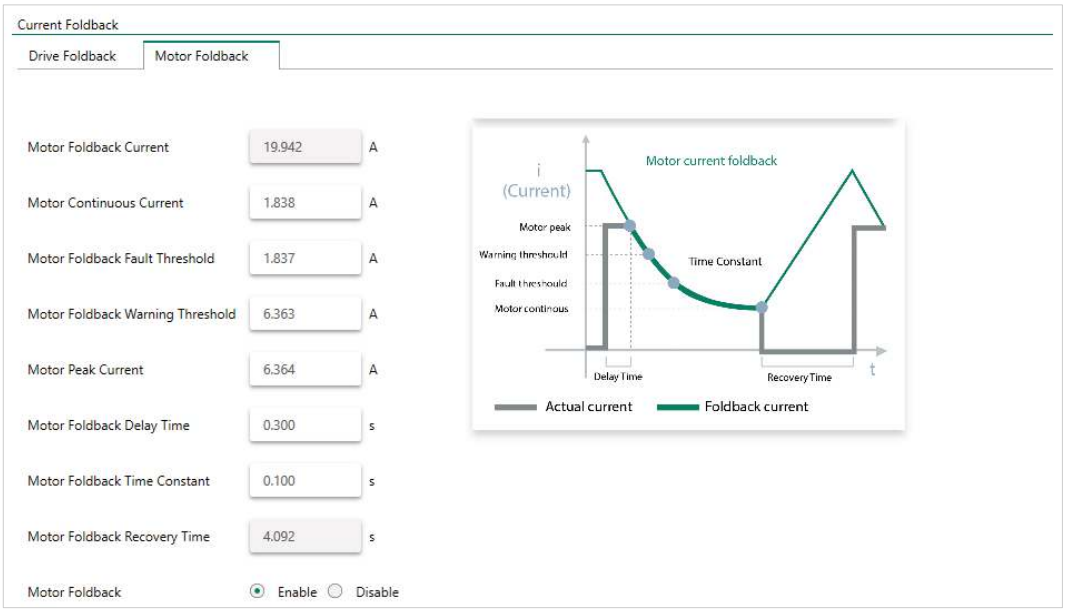


Figure 13-2. ServoStudio 2 – Current Foldback Screen – Motor

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

14 Digital IOs

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

14.1 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.

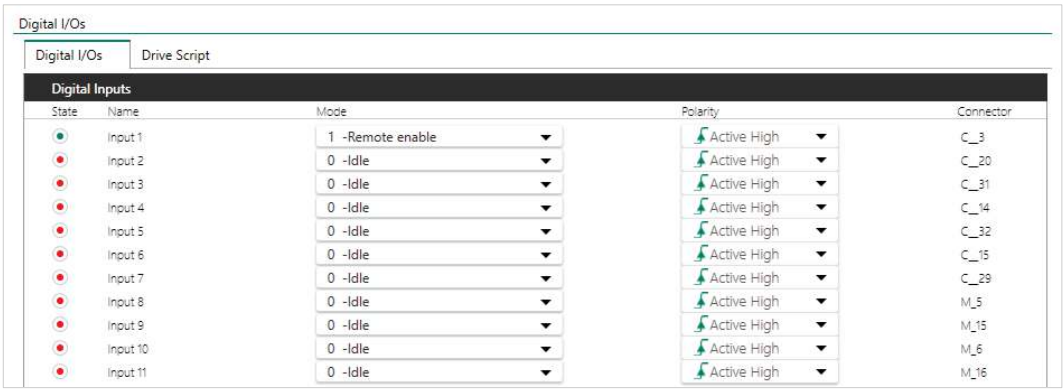


Figure 14-1. ServoStudio 2 – Digital Inputs Pane

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

Mode	Defines the functionality of the digital input. 0 -Idle 1 -Remote Enable 2 -Clear Faults 3 -PLL Synchronization 4 -Emergency Stop 5 -Positive Limit Switch 6 -Negative Limit Switch 8 -Home Switch 9 -Script Trigger 10 -Script bit 0 11 -Script bit 1 12 -Script bit 2 13 -Script bit 3 14 -Script bit 4 26 -Homing Command 27 -Touch Probe 1 28 -Touch Probe 2 30 -Hold and Resume Motion 32 -Operation mode change while drive enabled 33 -Explicitly sets OPMODE 4 and ENCFOLLOWER 1+ 34 -Explicitly sets OPMODE 4 and ENCFOLLOWER 2+ 35 -Explicitly sets OPMODE 4 and ENCFOLLOWER 3+ 36 -Explicitly sets OPMODE 4 and ENCFOLLOWER 4+ 37 -Explicitly sets OPMODE 4 and ENCFOLLOWER 5+ 38 -Jog motor in positive direction at speed JOGSPD1 39 -Jog motor in negative direction at speed -JOGSPD1 40 -Jog motor in positive direction at speed JOGSPD2 41 -Jog motor in negative direction at speed -JOGSPD2 Digital input 5 includes INMODE 17-Pulse signal. Digital input 6 includes INMODE 18-Direction signal. **Note**: Some INMODE values are not supported in ServoStudio 2.	INMODE
Polarity	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.	ININV
Connector	Indicates the pin number of the input on either the Controller (C) interface or the Machine (M) interface.	

14.2 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 panel 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** panel.

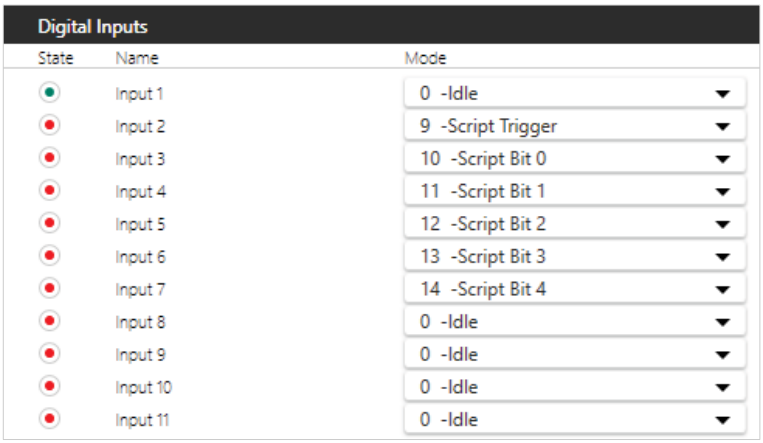


Figure 14-2. ServoStudio 2 – Digital Inputs for Scripts

- 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.

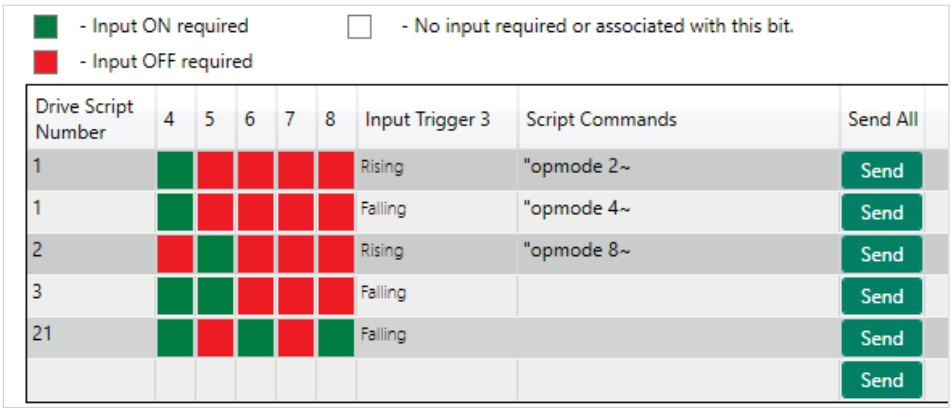
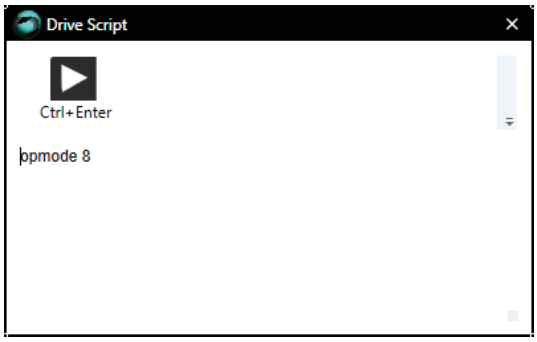


Figure 14-3. ServoStudio 2 – Digital I/Os Screen – Drive Scripts

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

Drive Script Number	The **Script ID** number is generated by the system according to the states defined for the physical inputs associated with the logical bits. For example (refer to Figure 14-2 and Figure 14-3): 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). 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). 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 (2^0=1). 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: $2^0+2^2+2^4$ = 1+4+16=21
[Bit Input state]	The color of the cell represents the state of the physical input/logical bit (IN). • **Red** cell: input must be **off** for script to run. • **Green** cell: input must be **on** for script to run. • **Gray (light or dark)** cell: the input is **not defined** as a Script ID bit. Click on a Bit Input cell to toggle the states on/off.

Input Trigger	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. Only one drive script is triggered and executed at a time. A drive script is executed when **both** of the following conditions exist: ● The inputs associated with the bits are either on or off, as defined for the specific script. ● The trigger signal rises or falls, as defined for the specific script.
Script Command	Double-click in the **Script Commands** cell. A Drive Script dialog box opens.  Enter a command or a set of commands. Use **Ctrl+Enter** to write to the table and close the dialog box.
Send All	Sends all scripts currently displayed on the screen to the drive.
Delete All	Deletes all scripts from the drive.
Clear Screen	Clears all drive scripts from the screen.
Load Script	Loads all scripts from the drive to the screen.

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

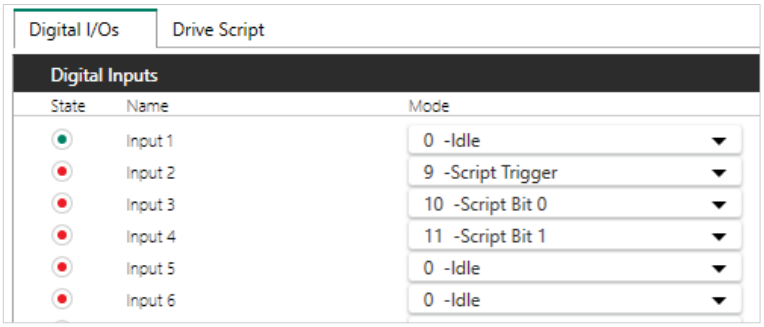


Figure 14-4. ServoStudio 2 – Drive Scripts Example (1)

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

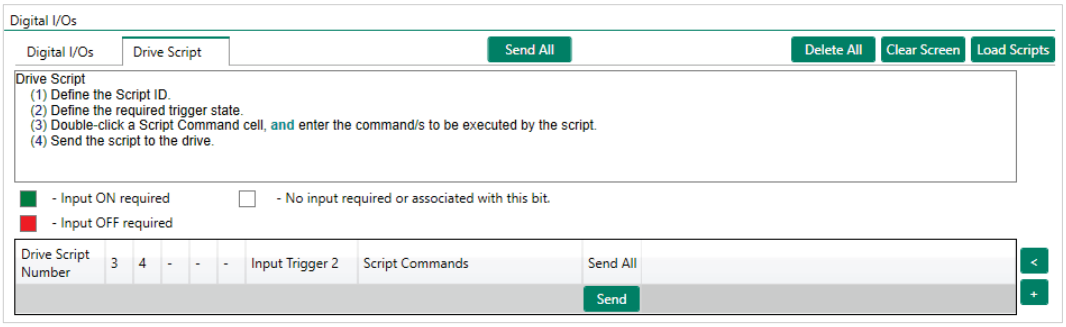


Figure 14-5. ServoStudio 2 – Drive Scripts Example (2)

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	$2^0 + 2^1 = 3$

4. 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**.

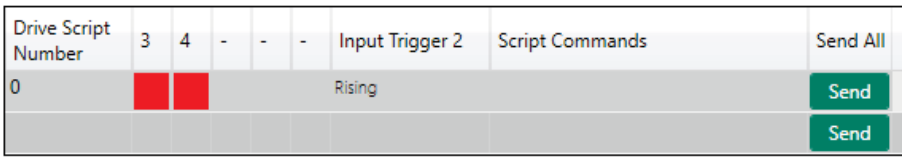


Figure 14-6. ServoStudio 2 – Drive Scripts Example (3)

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

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

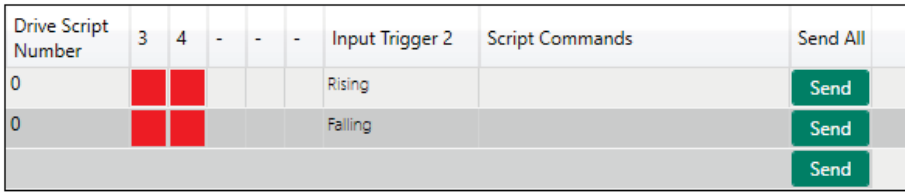


Figure 14-7. ServoStudio 2 – Drive Scripts Example (4)

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.

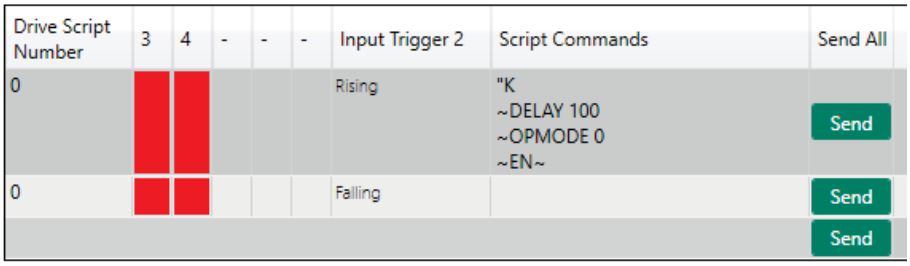


Figure 14-8. ServoStudio 2 – Drive Scripts Example (5)

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.

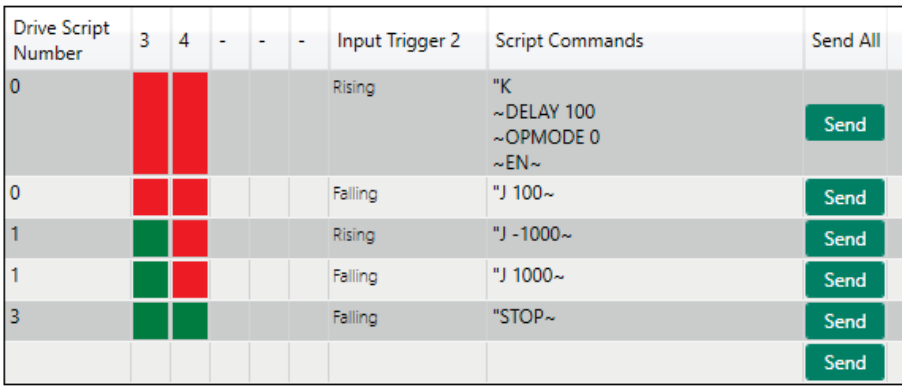


Figure 14-9. ServoStudio 2 – Drive Scripts Example (6)

14.3 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.

Figure 14-10. ServoStudio 2 – Digital Outputs Pane

State	A graphic element that toggles between green and red to reflect the on or off state of the actual output.	OUT OUTPUTS
Name	Identifies the specific output.	

Mode	Defines the condition that will activate a specified digital output. 0 -Idle **1 -Active** 2 -Brake Release Signal 3 -Alarm Any Fault 4 -In-Position 5 -Stopped 6 -Foldback 7 -Current Level 8 -Current Range 9 -Velocity Level 10 -Velocity Range 11 -Position Level 12 -Position Range 13 -Battery Low V Fault 14 -Warning On 15 -Faults or Disabled 16 -Battery Low V Warning or Fault 17 -Phase Find Succeeded 18 -Over-Current Fault 19 -Over-Voltage Fault 20 -Under-Voltage Fault 21 -Phase Find Required 22 -Alarm Excl. Phase Find Failure 23 -Homing Complete 24 -Encoder Simulation Index 25 -Zero Position After Homing	OUTMODE
Connector	Indicates the pin number of the input on either the Controller (C) interface or the Machine (M) interface.	

15 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

15.1 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.

To set the functionality mode of analog input 2 (ANIN2MODE), use the Terminal.

Note Some drives do not have a second analog input.

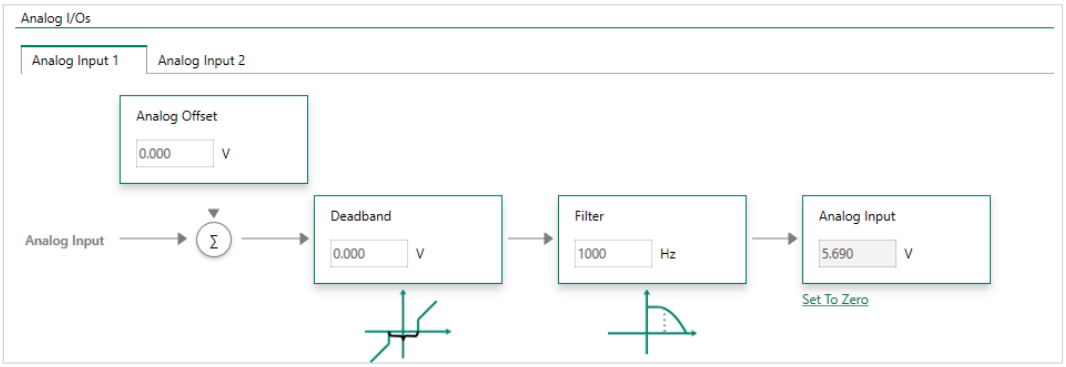


Figure 15-1. ServoStudio 2 – Analog I/Os Screen

		Analog Input 1	Analog Input 2
Analog Offset	The DC voltage offset on the analog input.	ANIN1OFFSET	ANIN2OFFSET
Deadband	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
Filter	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
Analog Input	The voltage at the analog input. Read only.	ANIN1	ANIN2

		Analog Input 1	Analog Input 2
Set to Zero	Causes the value of the analog input signal to become 0 by modifying the analog offset value.	ANIN1ZERO	ANIN2ZERO

15.2 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.

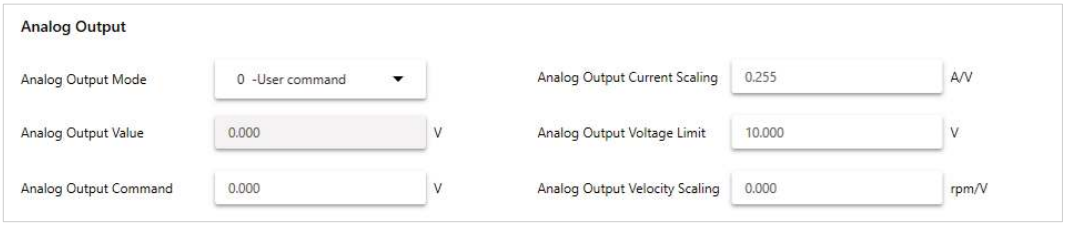


Figure 15-2. ServoStudio 2 – Analog I/Os Screen – Analog Output

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

Analog Output Mode	Defines the function of the analog output. **0 -User command** 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)	ANOUTMODE
Analog Output Value	Displays the analog output value (in volts), as set by ANOUTMODE. Read only.	ANOUT
Analog Output Command	The analog output command (in volts) set by user in ANOUTMODE 0.	ANOUTCMD
Analog Output Current Scaling	The scaling of the analog output voltage that represents the motor current (I) or the current command (ICMD).	ANOUTISCALE
Analog Output Voltage Limit	The analog output command voltage limit for all modes.	ANOUTLIM
Analog Output Velocity Scaling	The scaling of the analog output voltage that represents velocity (V).	ANOUTVSCALE

16 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.

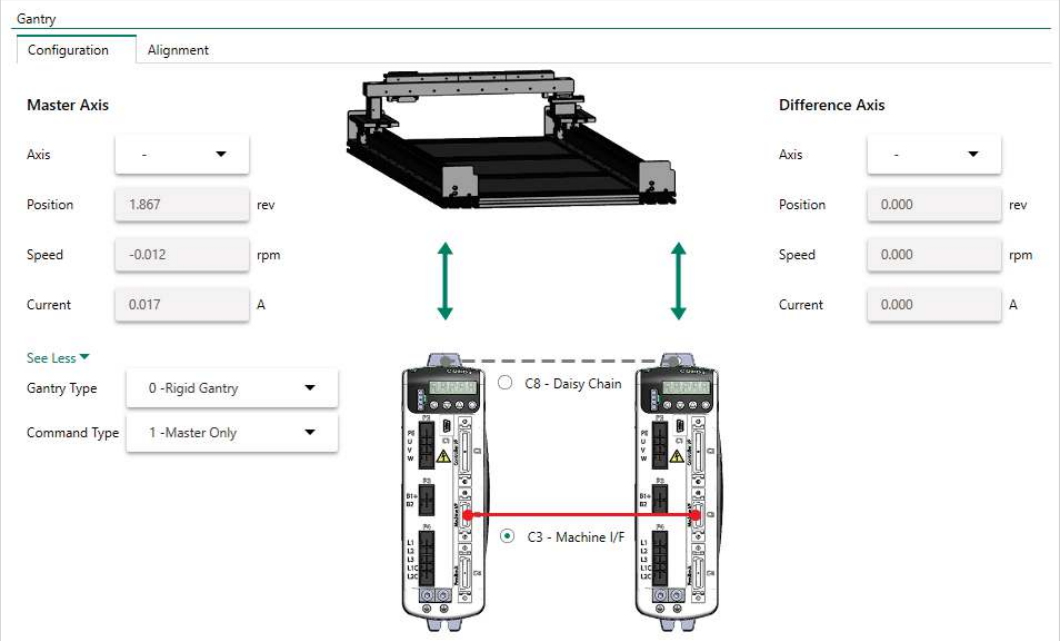


Figure 16-1. ServoStudio 2 – Gantry - Configuration

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

Gantry Type	Defines whether the gantry structure is rigid or flexible.	GANTRYTYPE
Command Type	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.	GANTRYCMDTYPE
C8/C3	Defines which controller interface is used for connecting the communication cable between gantry drives.	GANTRYINTERFACE

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.

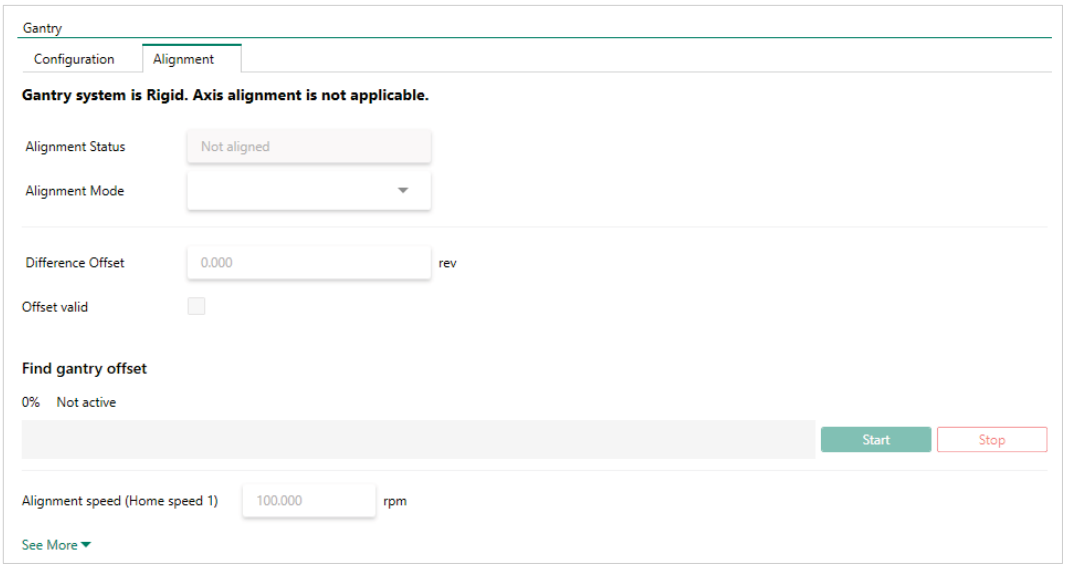


Figure 16-2. ServoStudio 2 – Gantry - Alignment

Alignment Status	Indicates whether the gantry Y axes are aligned.	GANTRYALIGNED
Alignment Mode	Defines the alignment method for a flexible gantry system.	GANTRYALIGNMODE
Difference Offset	The difference in distance between the Y1 and Y2 reference points. Value required for flexible gantry system.	GANTRYOFFSET
Offset Valid	Indicates whether the stored GANTRYOFFSET value is valid and can be used for alignment procedure	GANTRYOFFSETST
Find Gantry Offset	**Start/Stop**. Initiates/aborts the procedure for finding the value of the difference (in distance) between reference points on the Y1 and Y2 gantry axes.	GANTRYFINDOFF
Alignment Speed	The initial velocity used in the homing process during the search for limit switches, home switches, and hard stops.	HOMESPEED1
See More ...		
In Position Error Tolerance	The error tolerance for declaring an “in position” state.	PEINPOS
In Position Time	The duration of the “in position” state for the motor to be considered settled.	PEINPOSTIME

17 Error Correction

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

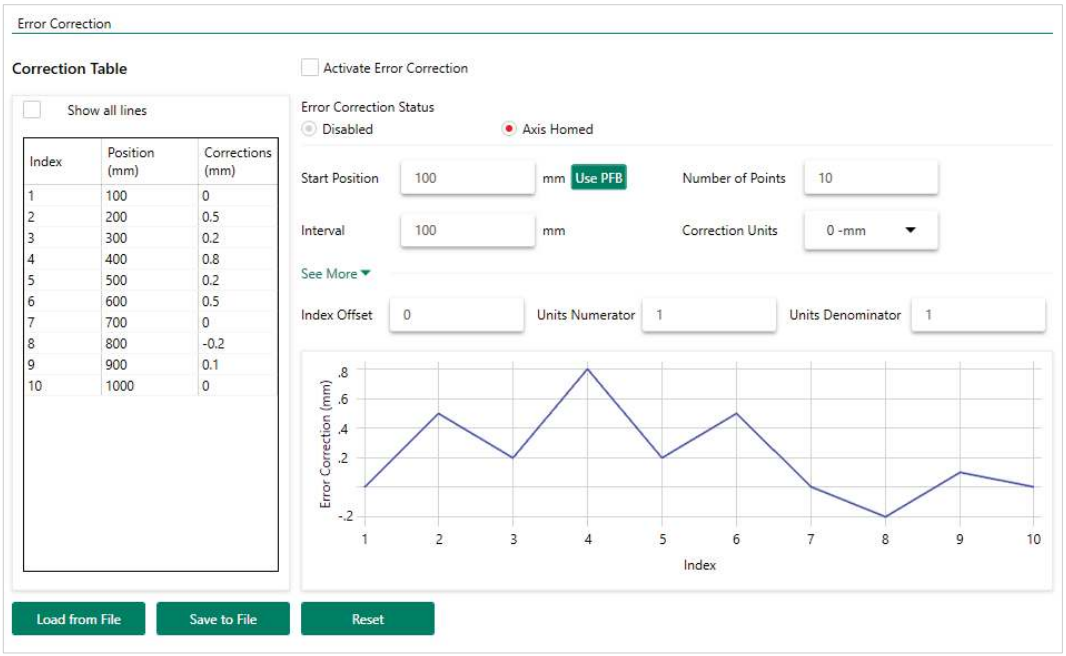


Figure 17-1. ServoStudio 2 – Error Correction Screen

Activate Error Correction	Defines a user request to activate the error correction function.	ERRCOREN
Error Correction Status	Indicates the state of the error correction function after a user request (ERRCOREN 1) has been issued.	ERRCORST
Start Position	Defines the position corresponding to the first active entry of the error correction table; defined according to Correction Units. **Use PFB** (current motor position) as the first active entry of the error correction table.	ERRCORSTARTPOS
Number of Points	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.	ERRCORACTIVENUM
Interval	Defines the distance between the positions at which the errors are measured and added to the correction table. Defined in LOAD units.	ERRCORINTERVAL

Correction Units	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.	ERRCORUNITS
Index Offset	Defines the offset to the first active entry in the error correction table.	ERRCORSTARTOFF
Units Numerator	The denominator of the motor feedback to load feedback scaling ratio.	LMUNITSNUM
Units Denominator	The numerator of the motor feedback to load feedback scaling ratio.	LMUNITSDEN
Load from File	Loads error correction data file from the host computer. Can be in either *.SSV or *.RTL format.	
Save to File	Saves all parameters from the drive to the host computer, including all error correction entries. In *.SSV format.	
Reset	Used to reset all error correction parameters and table entries to their default values. Reset occurs when ERRCORRESET is set to 1.	ERRCORRESET
line highlighted yellow	Indicates the index of the error correction table entry whose value is currently added to PFB.	ERRCORINDEX
Corrections *value*	Defines a correction value for a specific entry in the correction table.	ERRCORSETINDEX
line highlighted red	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).	ERRCORFAILINDEX

18 Enable | Faults

18.1 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.

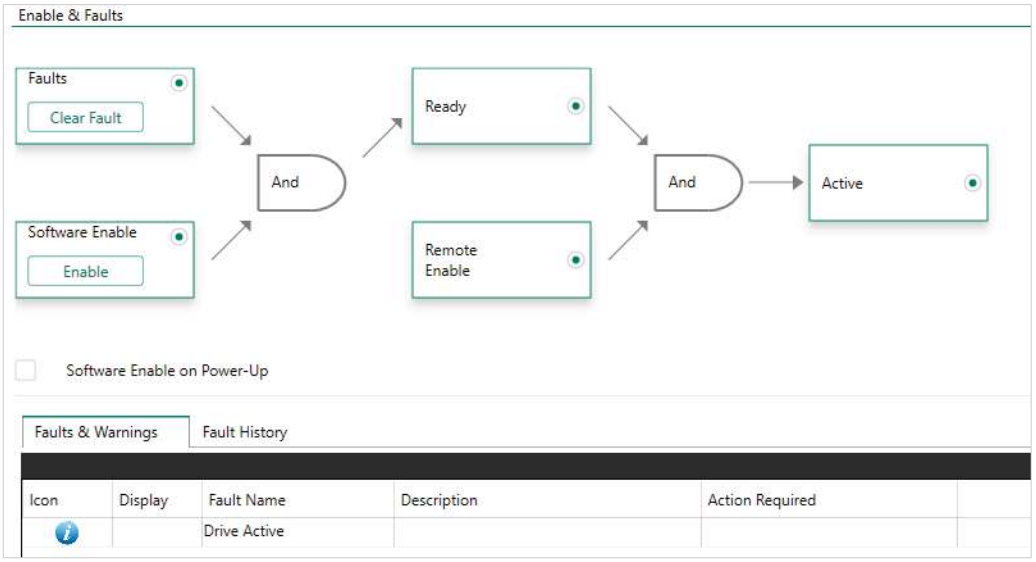


Figure 18-1. ServoStudio 2 – Enable & Faults Screen

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.

18.2 Faults

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

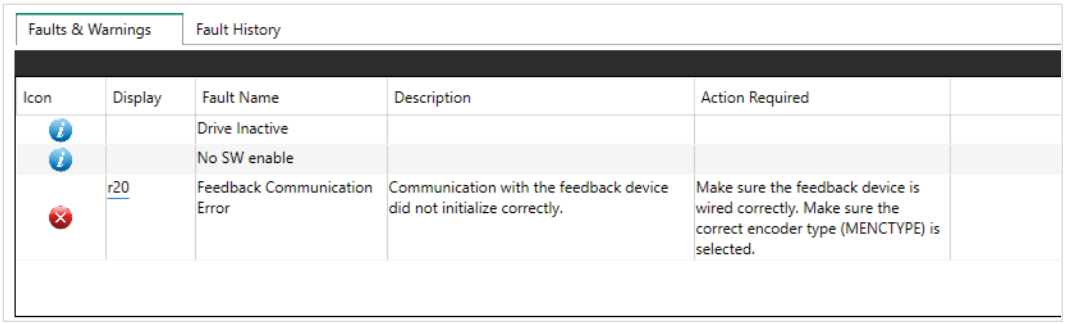


Figure 18-2. ServoStudio 2 – Fault History

The Faults pane has two tabs:

- Faults & Warnings
- Faults History

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

19 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.

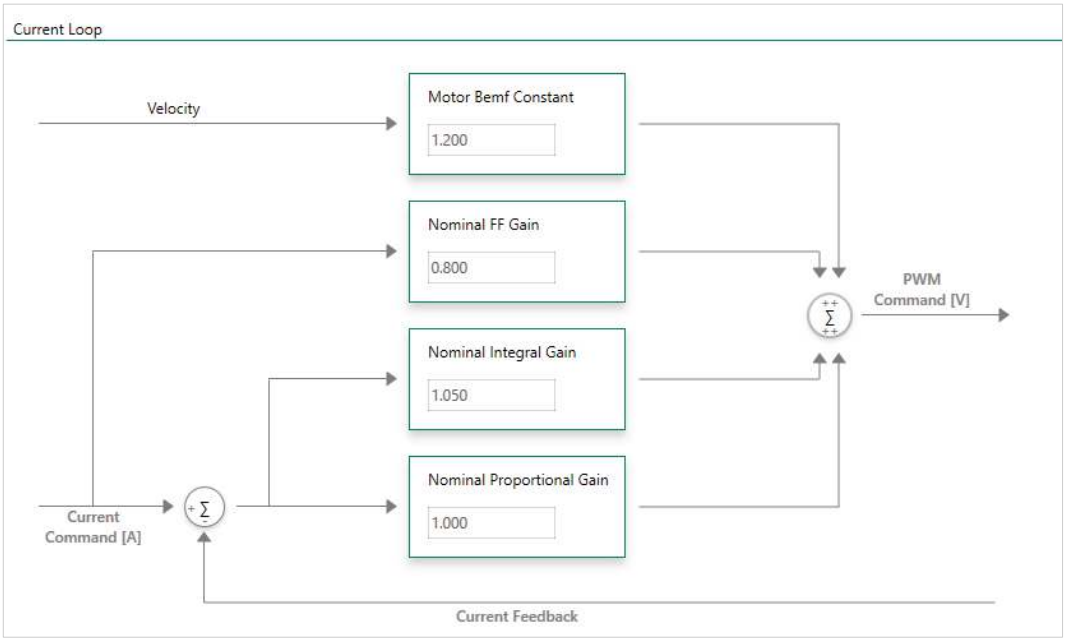


Figure 19-1. ServoStudio 2 – Current Loop Screen

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

20 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)

20.1 HD Velocity Controller with Integrator

Refer to VarCom VELCONTROLMODE 7.

Refer to Velocity Control in the drive user manual.

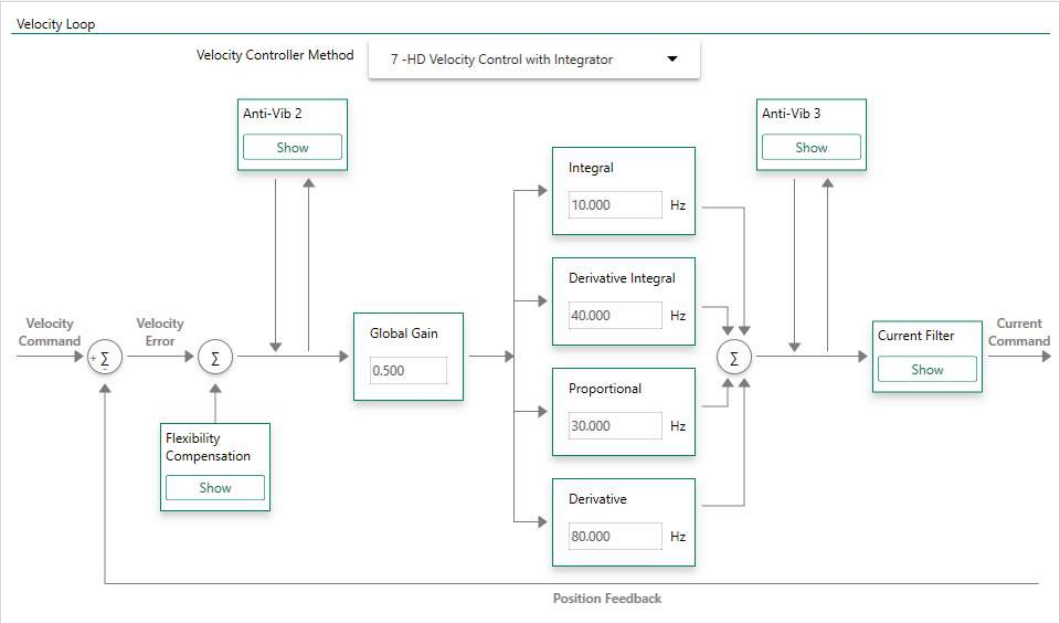


Figure 20-1. ServoStudio 2 – Velocity Control Loop – HD Velocity Control with Integrator

20.2 PI Velocity Controller

Refer to VarCom VELCONTROLMODE 0.

Refer to Velocity Control in the drive user manual.

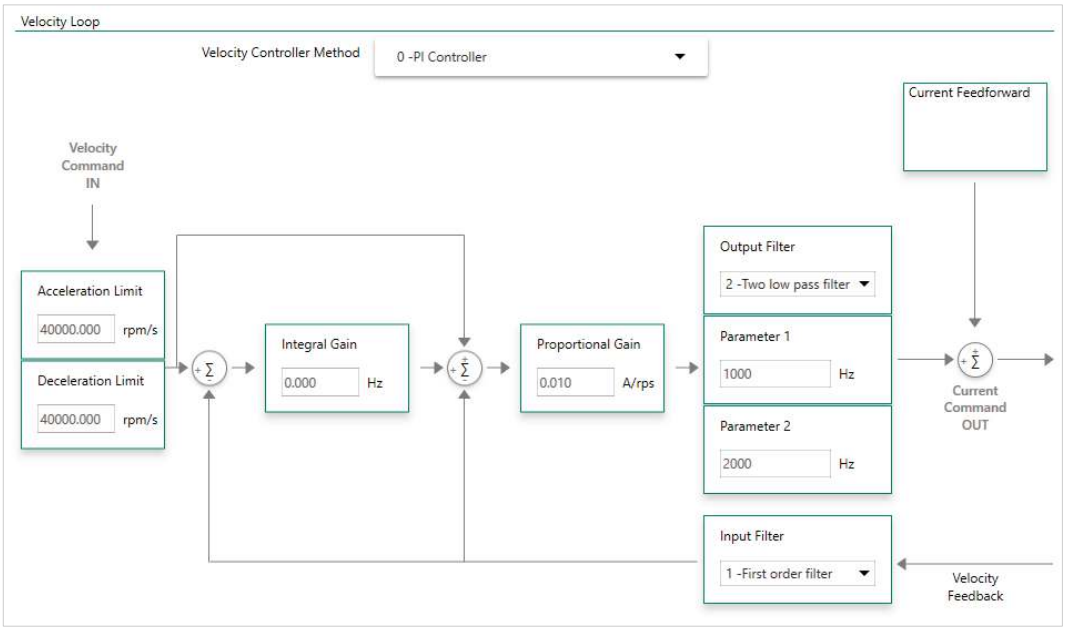


Figure 20-2. ServoStudio 2 – Velocity Control Loop – PI Controller

20.3 PDFF Velocity Controller

Refer to VarCom VELCONTROLMODE 1.

Refer to Velocity Control in the drive user manual.

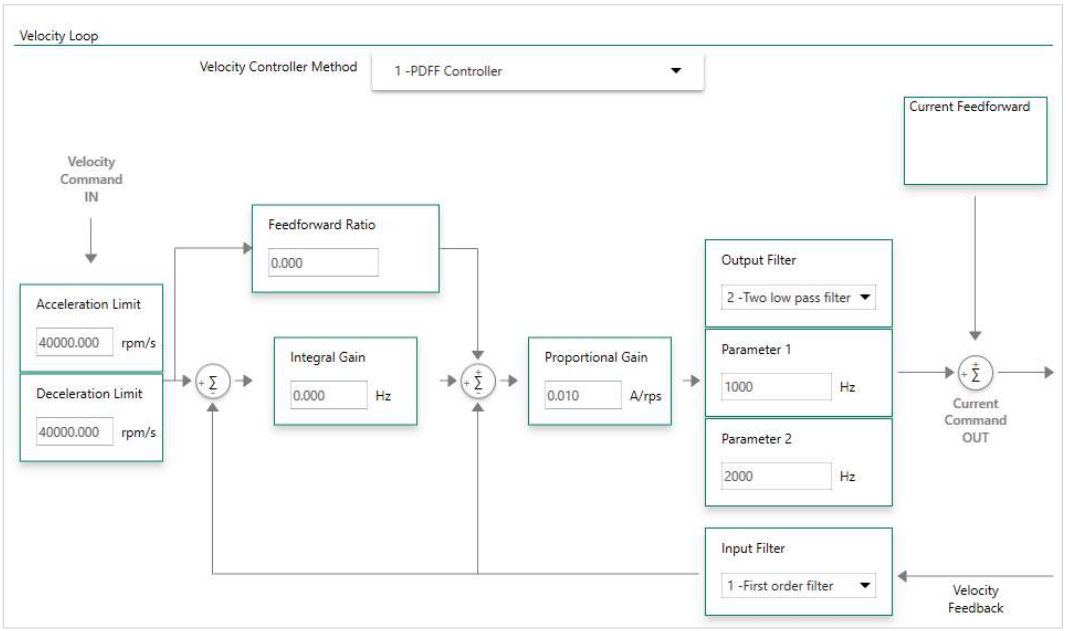


Figure 20-3. ServoStudio 2 – Velocity Control Loop – PDFF Controller

20.4 Standard Pole Placement Velocity Controller

Refer to VarCom VELCONTROLMODE 2.

Refer to Velocity Control in the drive user manual.

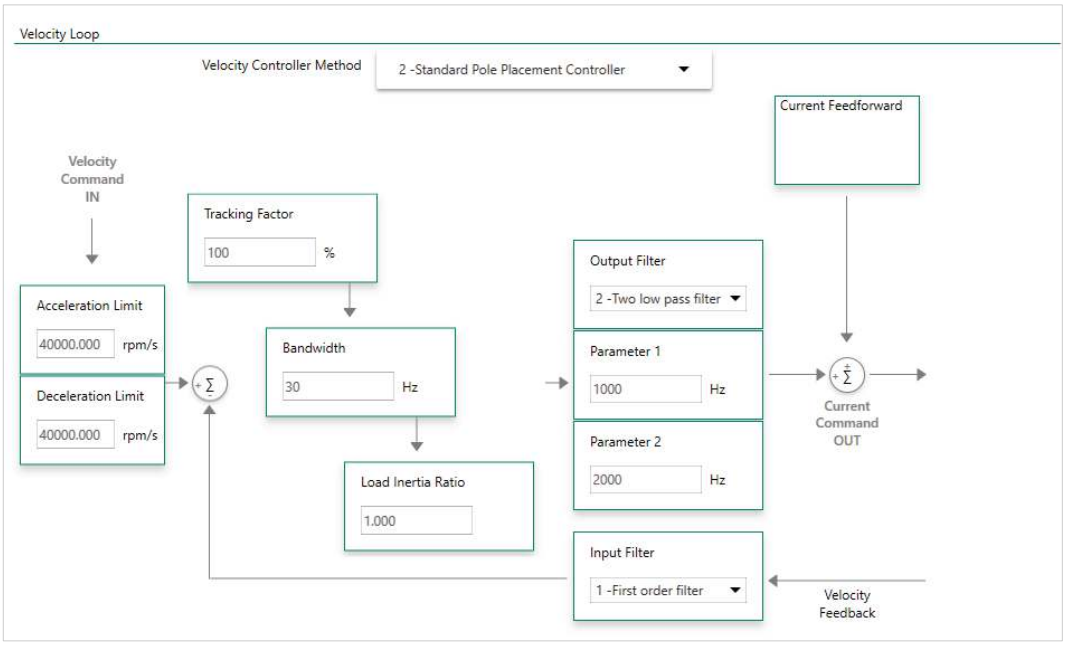


Figure 20-4. ServoStudio 2 – Velocity Control Loop - Standard Pole Placement Controller

21 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.

21.1 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.

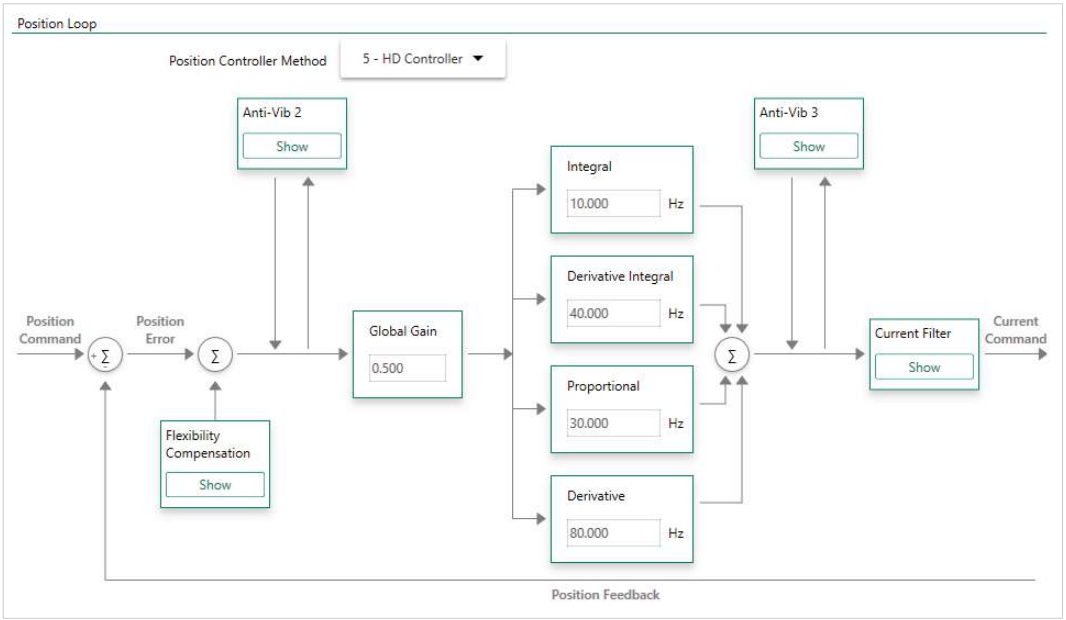


Figure 21-1. ServoStudio 2 – Position Loop – HD Controller Screen

21.2 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).

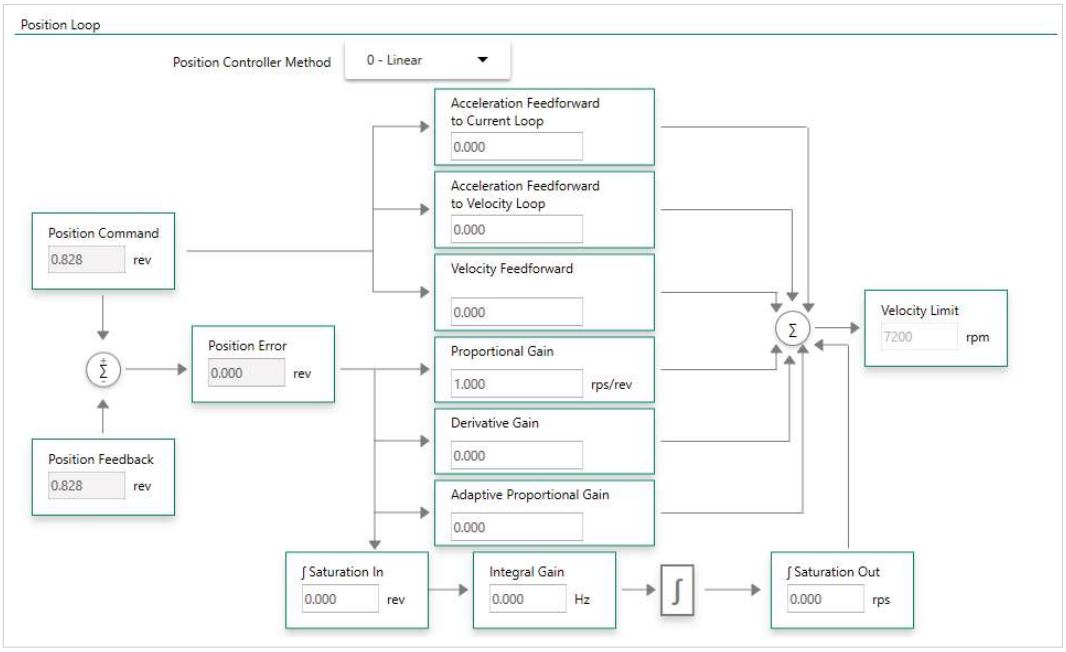


Figure 21-2. ServoStudio 2 – Position Loop – Linear Screen

22 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 the type of operation mode:

- When a serial operation mode is selected, ServoStudio sets COMMODE=0.
- When a fieldbus operation mode is selected, ServoStudio sets COMMODE=1.

When the operation mode includes the **Dual Feedback** option, there is no change in the software interface. The values simply reflect the feedback and functionality of the dual control loop.

22.1 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.

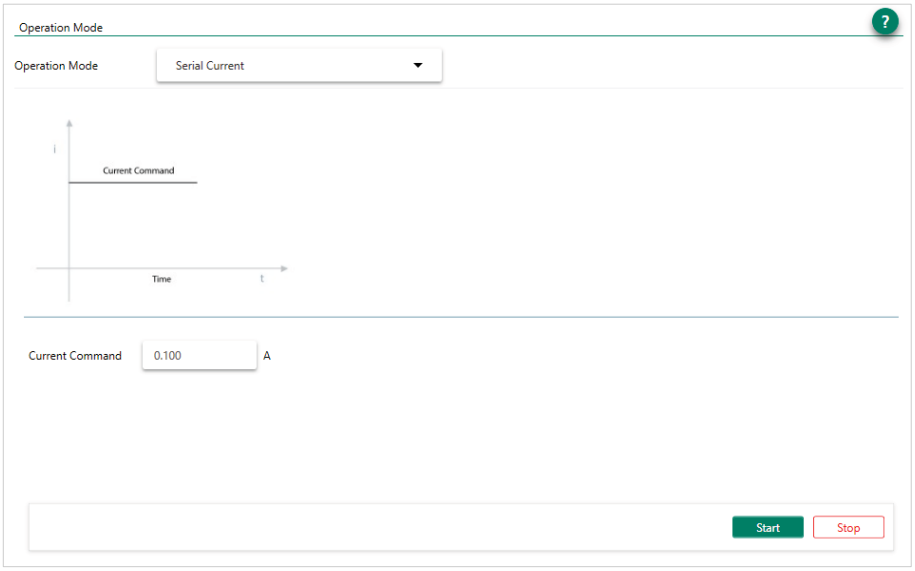


Figure 22-1. ServoStudio 2 – Motion Screen – Serial Current Mode

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

22.2 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.

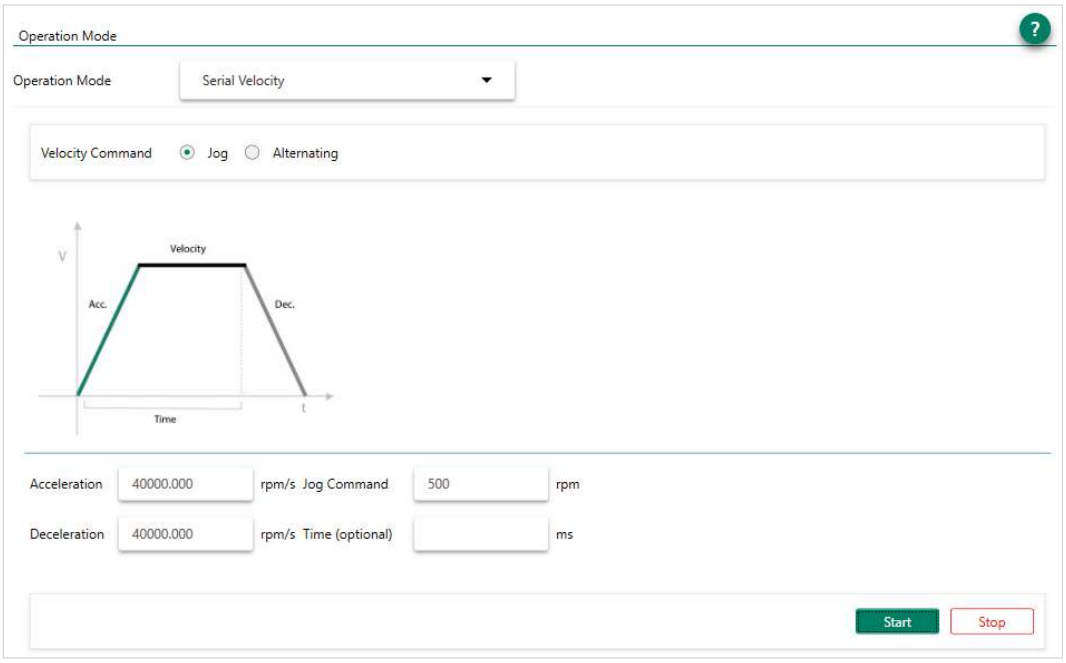


Figure 22-2. ServoStudio 2 – Motion Screen – Serial Velocity Mode

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

22.3 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 – Dual Feedback**) to display the schematic and parameters for this operation mode.

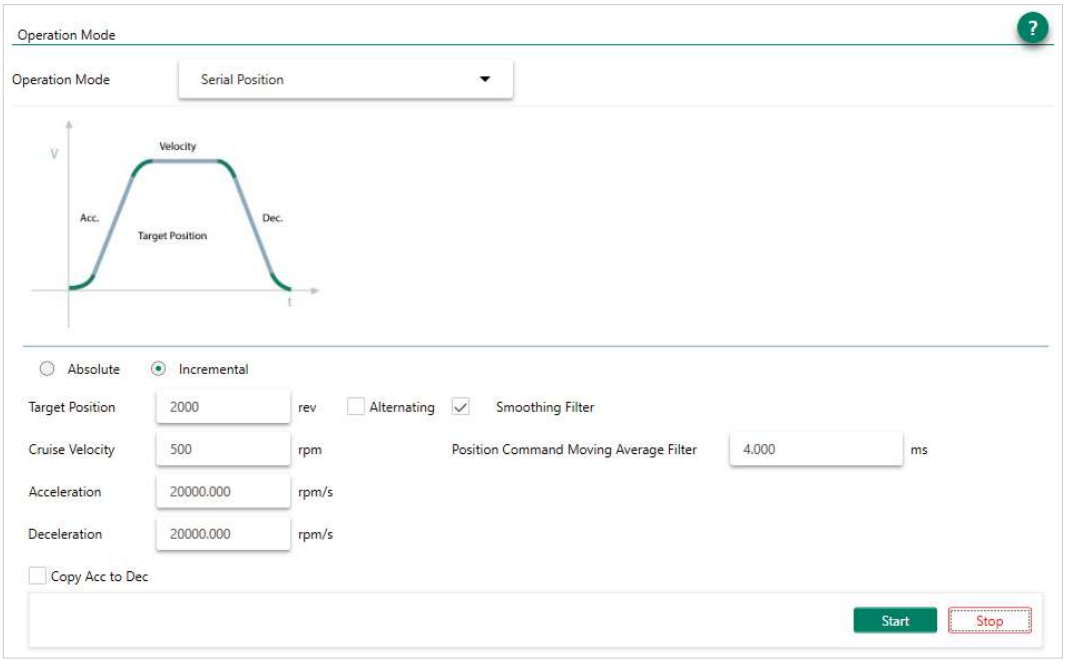


Figure 22-3. ServoStudio 2 – Motion Screen – Serial Position Mode

Motion Command		
Absolute	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
Incremental	Moves the motor the specified number of counts from its current location. Executes an incremental position movement according to the acceleration/deceleration settings.	MOVEINC
Alternating	Automatically reverses the direction of motion each time **Start** is pressed.	
Motion Profile		
Target Position	The destination of the movement command.	
Cruise Velocity	The velocity of the movement command.	
Acceleration	Acceleration value.	ACC
Deceleration	Deceleration value.	DEC
Copy Acc to Dec	Copies the acceleration value to the deceleration value field.	
Smoothing		
Smoothing Filter	When selected, activates an S-curve smoothing filter to a position reference command.	MOVESMOOTHMODE
Position Command Moving Average	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.	MOVESMOOTHAVG
Start	Sends the movement command to the drive.	
Stop	Stops the movement.	

22.4 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.

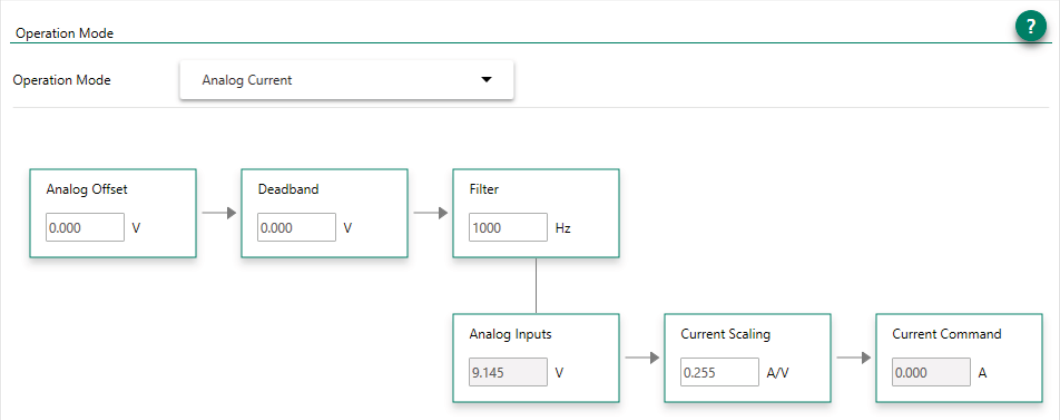


Figure 22-4. ServoStudio 2 – Motion Screen – Analog Current Mode

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

22.5 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.

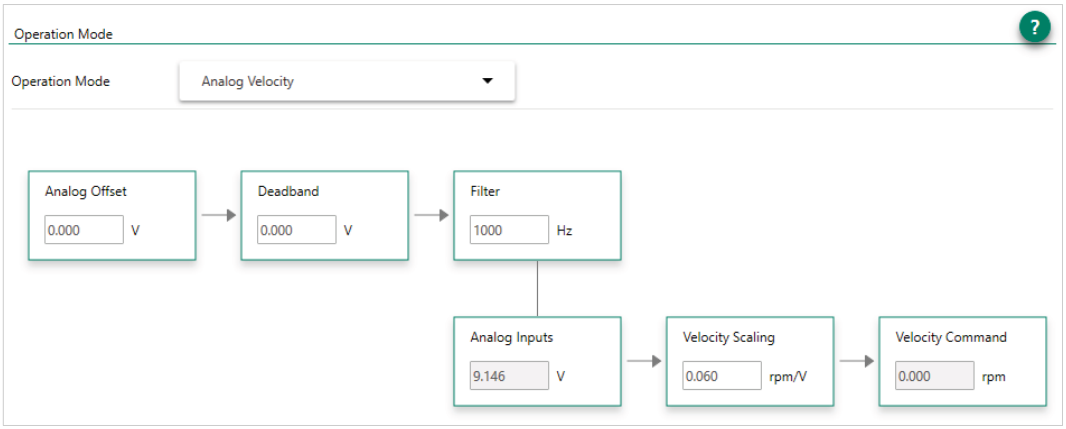


Figure 22-5. ServoStudio 2 – Motion Screen – Analog Velocity Mode

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

22.6 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 – Dual Feedback**) to display the schematic and parameters for the gearing operation mode.

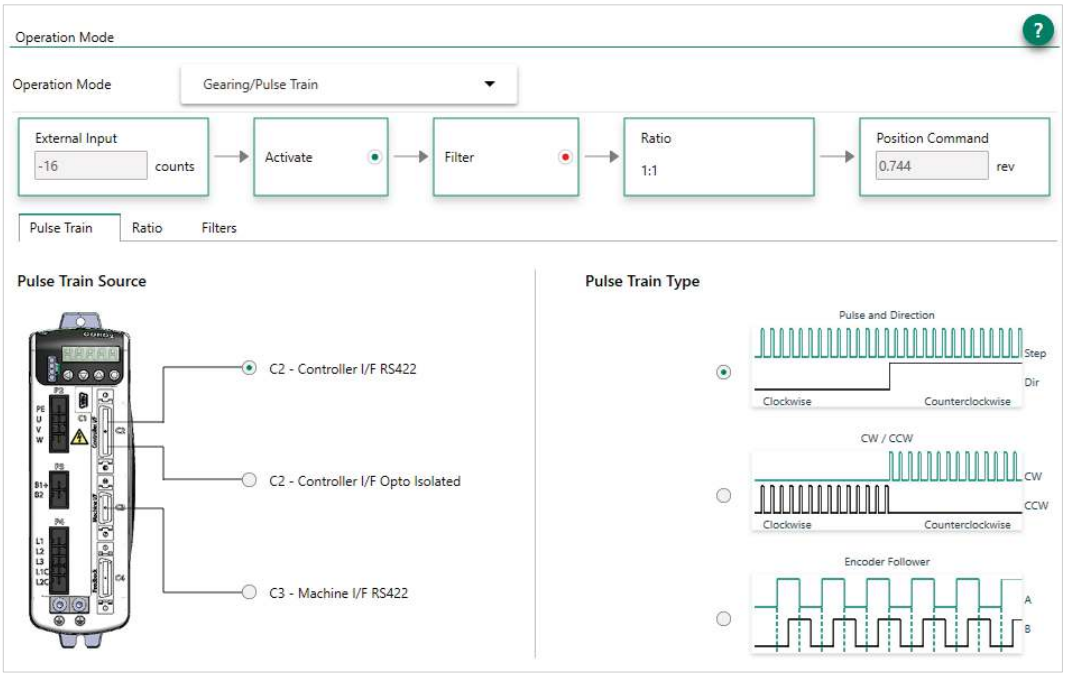


Figure 22-6. ServoStudio 2 – Motion Screen – Gearing/Pulse Train Mode

The drive supports a number of gearing modes.

Refer to Gearing/Pulse Train Operation Mode in the drive user manual.

External Input	The position as measured by an external feedback device.	HWPEXT
Activated	Indicates whether the gearing/pulse train function is activated.	GEAR
Filter	Indicates whether the gearing filter is activated, as defined in the **Filter** tab.	GEARFILTMODE
Ratio	Indicates the ratio defined, as defined in the **Ratio** tab.	GEARIN GEAROUT
Position Command	Indicates the position command.	PCMD
Pulse Train		
Pulse Train Source	**Pulse Train Type**	**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
Ratio		
Input Resolution	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
Filters		
Command Smoothing Filter		
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
Gear Command Noise Filter		
Gear Noise Filter	Activates the gearing filter.	GEARFILTMODE
Stiff>Soft slider	Increasing the filter value smooths the input command, but adds a delay.	GEARFILTDEPTH

22.7 Fieldbus (EtherCAT/CANopen) Operation Modes

Note

When the software is offline, **Fieldbus** is displayed.
When the software is communicating with the drive, either **CANopen** or **EtherCAT** is displayed, according to the actual type of drive in use.

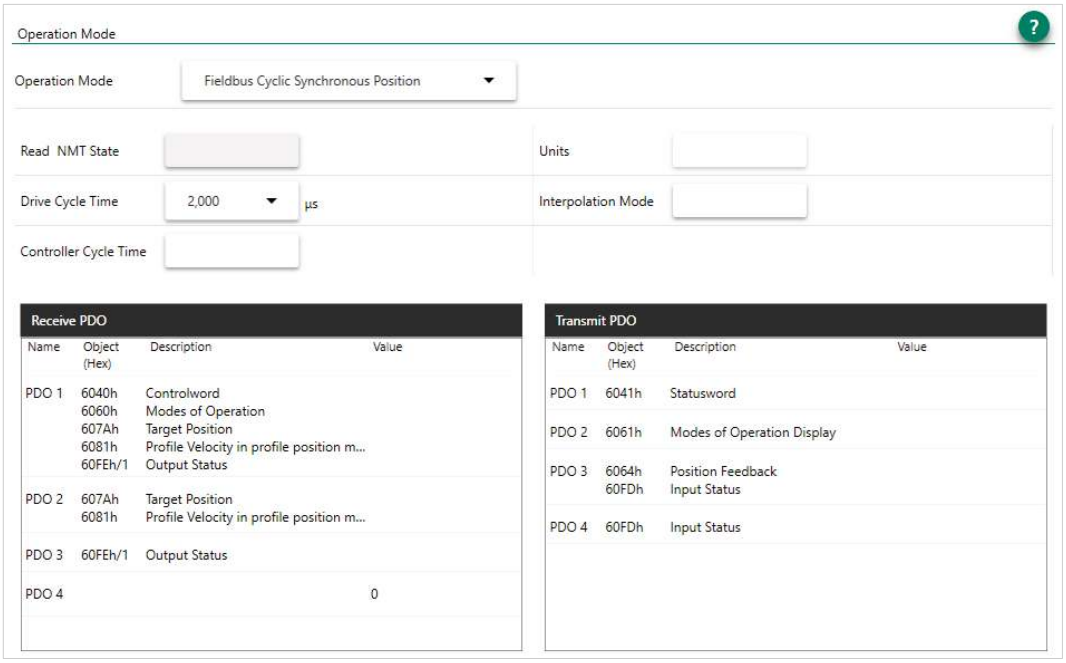


Figure 22-7. ServoStudio 2 – Operation Mode Screen – Fieldbus - Example

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

22.7.1 Fieldbus Cyclic Synchronous Position

Object 6060h is set to 8 | COMMODE=1

Dual Feedback option.

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.

22.7.2 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.

22.7.3 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.

22.7.4 Fieldbus Profile Position

Object 6060h is set to 1 | COMMODE=1

Dual Feedback option.

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.

22.7.5 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.

22.7.6 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.

23 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.

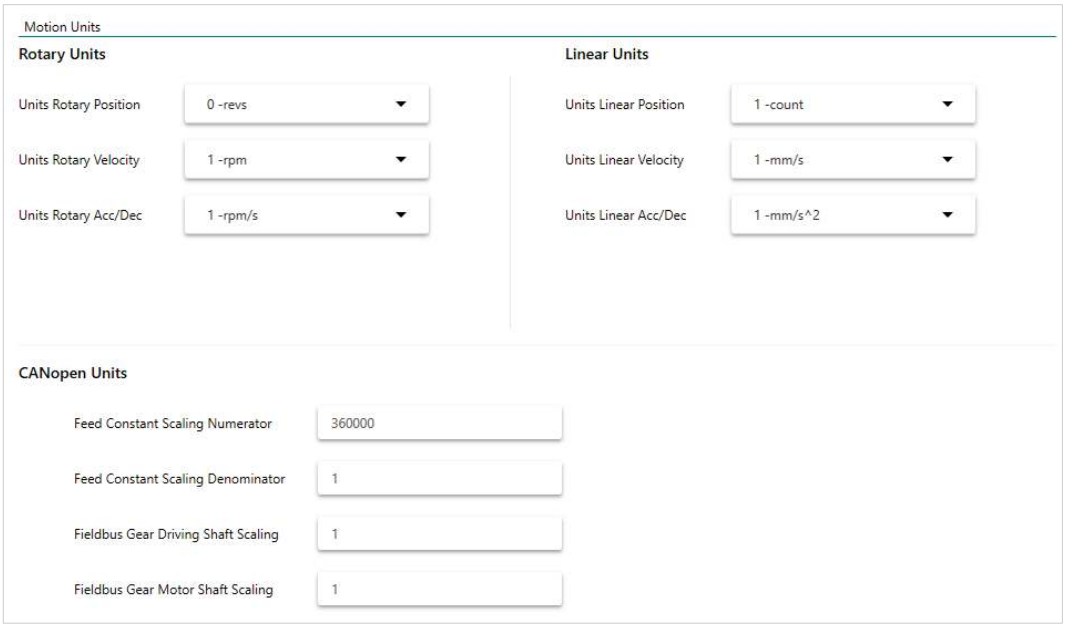


Figure 23-1. ServoStudio 2 – Motion Units Screen

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

CANopen Units	CANopen has two objects, each with two sub-indices, for setting the gear ratio and the feed constant values. 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 network. The relationship is as follows: $\frac{PNUM}{PDEN} \times \frac{FBGMS}{FBGDS} = \text{Resolution}$ **Note**: ServoStudio 2 uses standard CANopen units of motion, as selected by the user. However, in instances of CANopen units, the ServoStudio 2 screens display only the values, and do not include the type of unit.	
Feed Constant Scaling Numerator and Feed Constant Scaling Denominator	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
Fieldbus Gear Driving Shaft Scaling	The conversion factor of the fieldbus device's **drive** shaft revolution.	FBGDS
Fieldbus Gear Motor Shaft Scaling	The conversion factor of the fieldbus device's **gear** shaft revolution.	FBGMS

24 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.

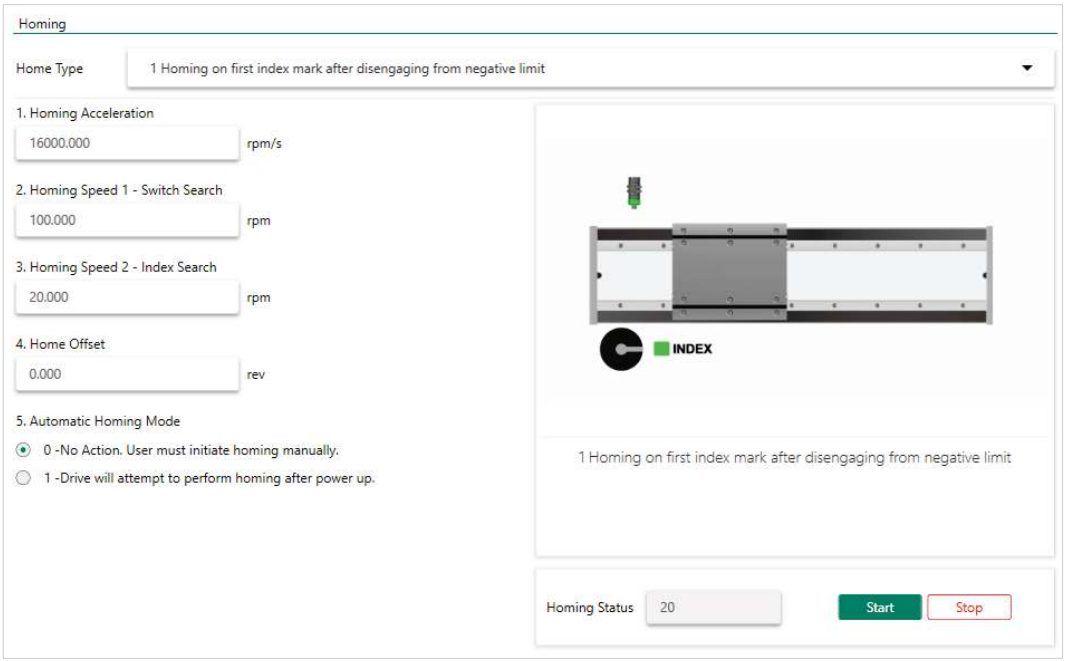


Figure 24-1. ServoStudio 2 – Homing Screen

Home Type	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 HOMETYPE 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.	HOMETYPE
[graphic]	A graphic display representing the method selected for the homing process.	
[description]	A description of the selected homing method.	
Homing Acceleration	The value of acceleration and deceleration during the homing process.	HOMEACC
Homing Speed 1 – Switch Search	The initial velocity used in the homing process during the search for limit switches, home switches, and hard stops.	HOMESPEED1

Homing Speed 2 – Index Search	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 HOMETYPE).	HOMESPEED2
Home Offset	Sets an offset, in counts, for the Home position.	HOMEOFFSET
Home	**Start.** Starts the homing process. **Stop.** Stops the homing process.	HOMECMD HOMECMD 0
Homing Status	Displays the current state of system homing. **0** = Homing idle **19** = Homing completed **20** = Homing failed *All other values* = homing in progress, or stalled	HOMESTATE
Automatic Homing Mode	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).	AUTOHOME

25 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.

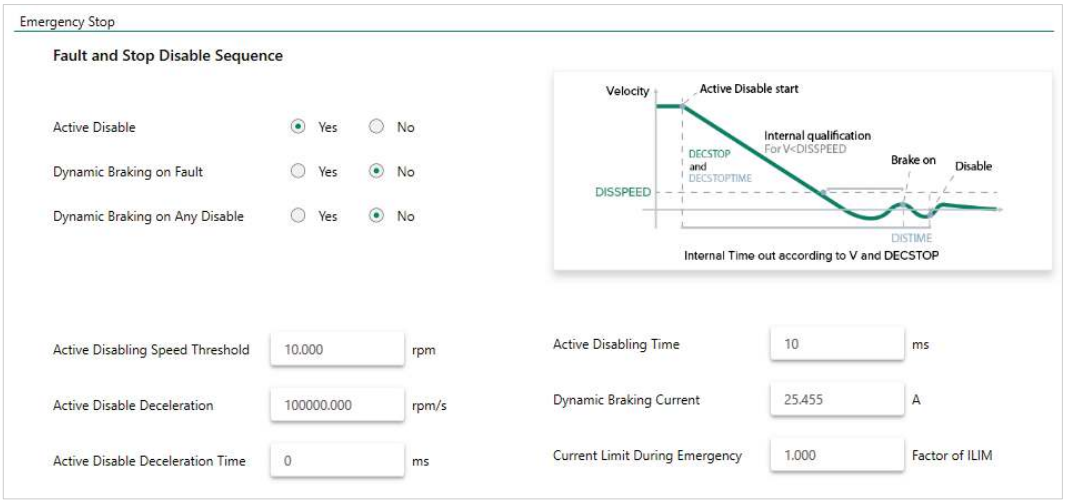


Figure 25-1. ServoStudio 2 – Disable Stop

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

Fault and Stop Disable Sequence				
Yes	Yes	Yes	Active disabling on fault*; dynamic braking on any disable.	DISMODE 5

Active Disable Speed Threshold	The speed threshold for the Active Disable function.	DISSPEED
Active Disable Deceleration	The deceleration speed value for the Active Disable function.	DECSTOP
Active Disable Deceleration Time	The deceleration time for the Active Disable function. This value is ignored if it exceeds the deceleration speed value.	DECSTOPTIME
Active Disable Time	The time to wait after motor speed goes below the threshold (DISSPEED) until the drive is disabled by the Active Disable function.	DISTIME
Dynamic Brake Current	The maximum current allowed during the dynamic braking process.	ISTOP
Current Limit During Emergency	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.	ESTOPILIM

26 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.

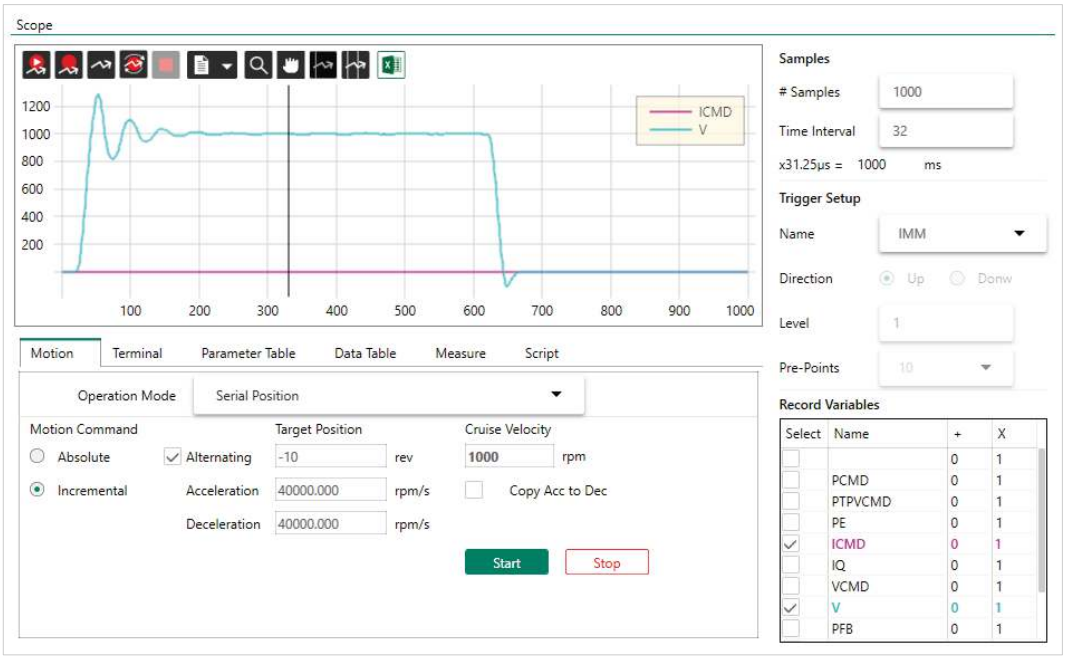


Figure 26-1. ServoStudio 2 – Scope Dashboard

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** panel.

26.1 Recording Setup

The **Recorder Setup** panel, 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

# Samples	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.
Time Interval	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 µs. 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 µs (4×31.25=125); therefore 2000 data points are recorded in 250 milliseconds.

Trigger Setup

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

Record Variables

Name	Name of a variable that can be recorded (VarCom RECORD). Any of the variables returned by the VarCom command RECLIST 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 **Enter**. 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.
+	**Offset**. 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.
X	**Multiply**. 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.

26.2 Scope Toolbar

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

26.3 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.

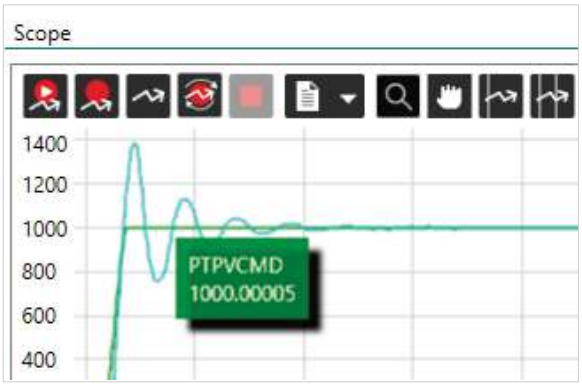


Figure 26-2. ServoStudio 2 – Scope Trace Value

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

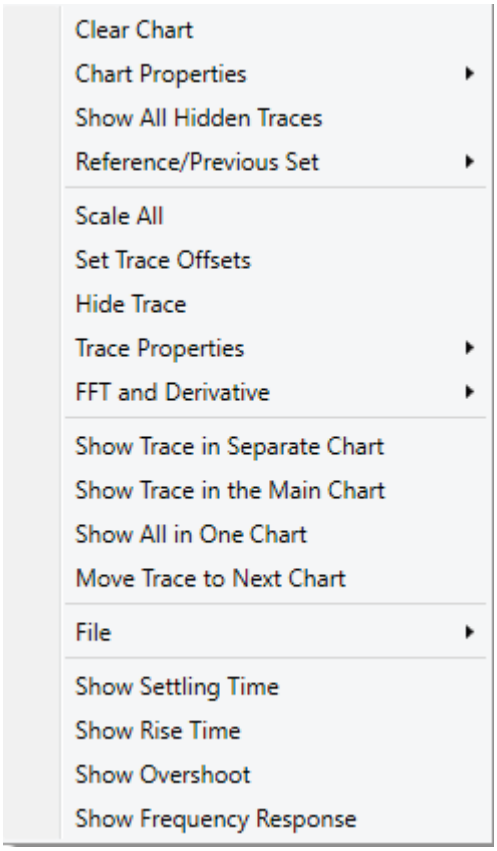


Figure 26-3. ServoStudio 2 – Chart Options menu

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

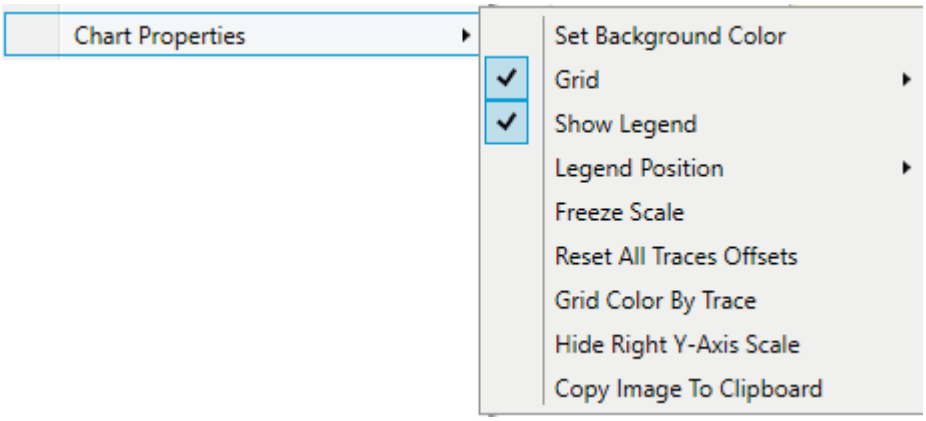


Figure 26-4. ServoStudio 2 – Chart Options > Properties menu

Set Background Color	Opens the Colors dialog box, and allows you to modify the background color of the chart.
Grid	Toggles the grid display on and off. Also allows you to modify the grid: **X Axis**. Toggles the X-axis grid line on/off. **Y Axis**. Toggles the Y-axis grid line on/off. **Dot | Line**. Uses either dotted lines or solid lines for the grid.
Show Legend	Toggles the legend display on and off.
Legend Position	Top right or bottom left.
Freeze Scale	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.
Reset All Trace Offsets	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.
Grid Color by Trace	If two grids are used (right and left axis), different colors can be defined to improve the readability of the chart.
Hide Right Y Scale	Hides the Y-axis scale on the right side of the chart, if displayed.
Copy Image to Clipboard	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

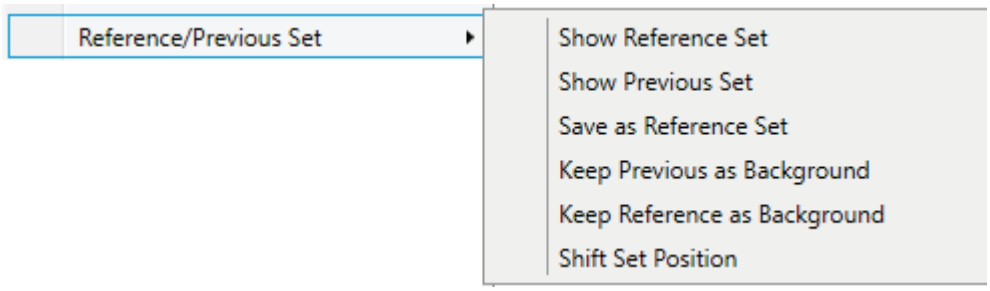


Figure 26-5. ServoStudio 2 – Chart Options > Reference/Previous Set

Show Reference Set	Displays the trace previously saved as a reference.
Show Previous Set	Displays the previously displayed trace in addition to the currently displayed trace.
Save as Reference Set	Saves the trace currently displayed on screen as a reference.
Keep Previous as Background	Displays the previously recorded trace as a background.
Keep Reference as Background	Keeps the reference trace displayed on screen as a background.
Shift Set Position	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 adjusts 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.

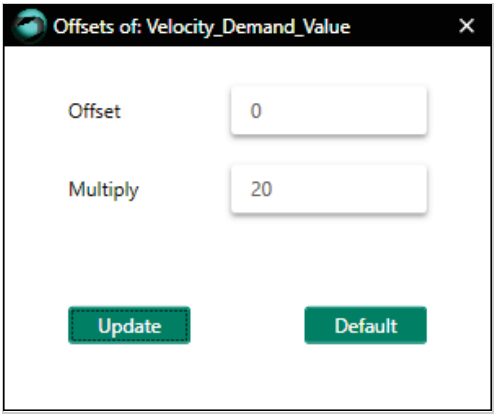


Figure 26-6. Set Trace Offsets Dialog Box

Hide Trace

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

Trace Properties

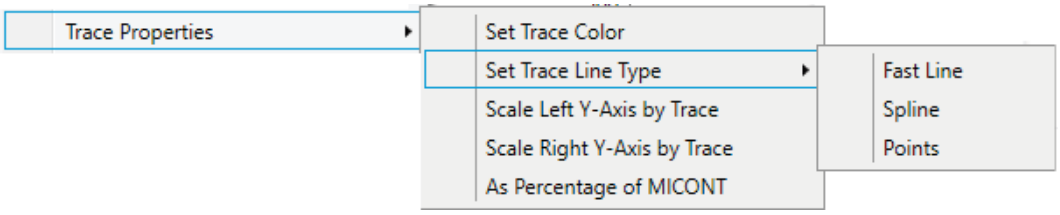


Figure 26-7. ServoStudio 2 – Chart Options > Trace Properties

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

FFT and Derivative

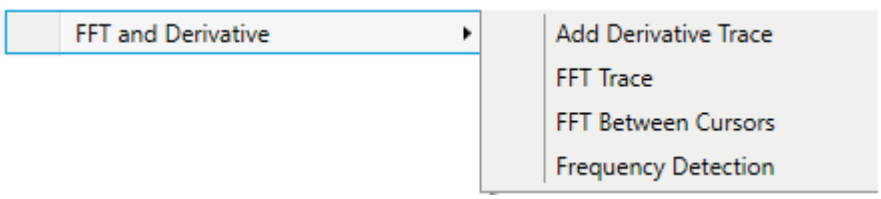
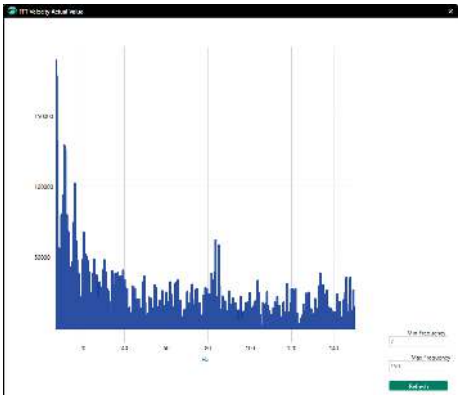
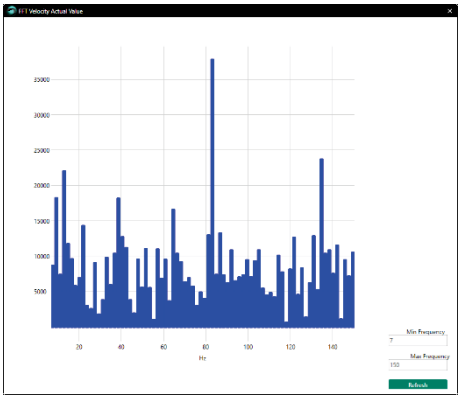


Figure 26-8. ServoStudio 2 – Chart Options > Add Manipulated Trace

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

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

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 panel.

Figure 26-9. 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 panel.

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).

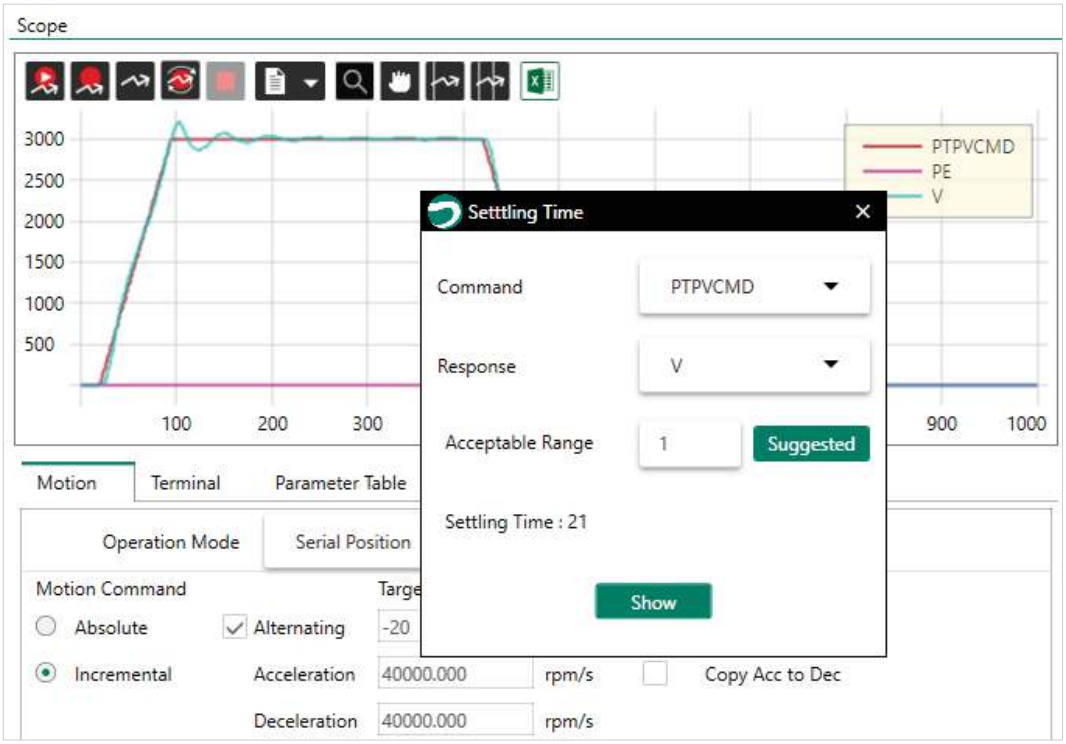


Figure 26-10. Show Settling Time

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).

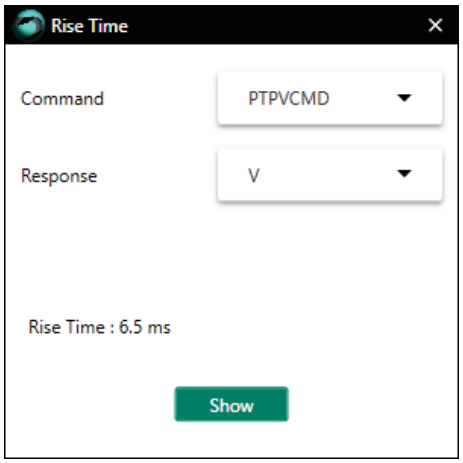


Figure 26-11. Show Rise Time

Show Overshoot

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

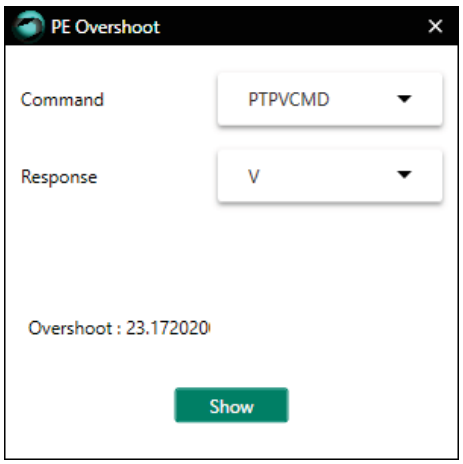


Figure 26-12. Show Overshoot

Show Frequency Response

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

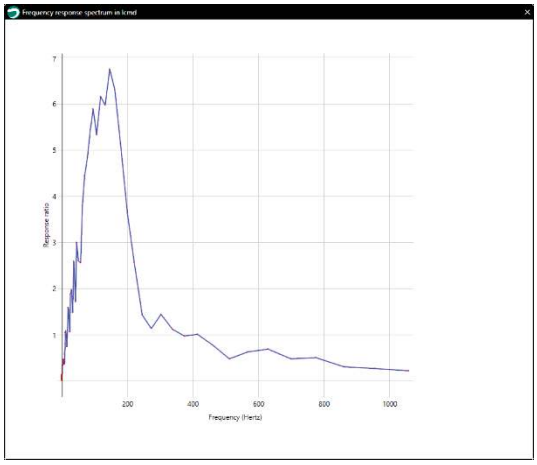


Figure 26-13. Show Frequency Response

26.4 Scope Tabs/Panels

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

Data Table

A tabular view of the data generated by the recording.

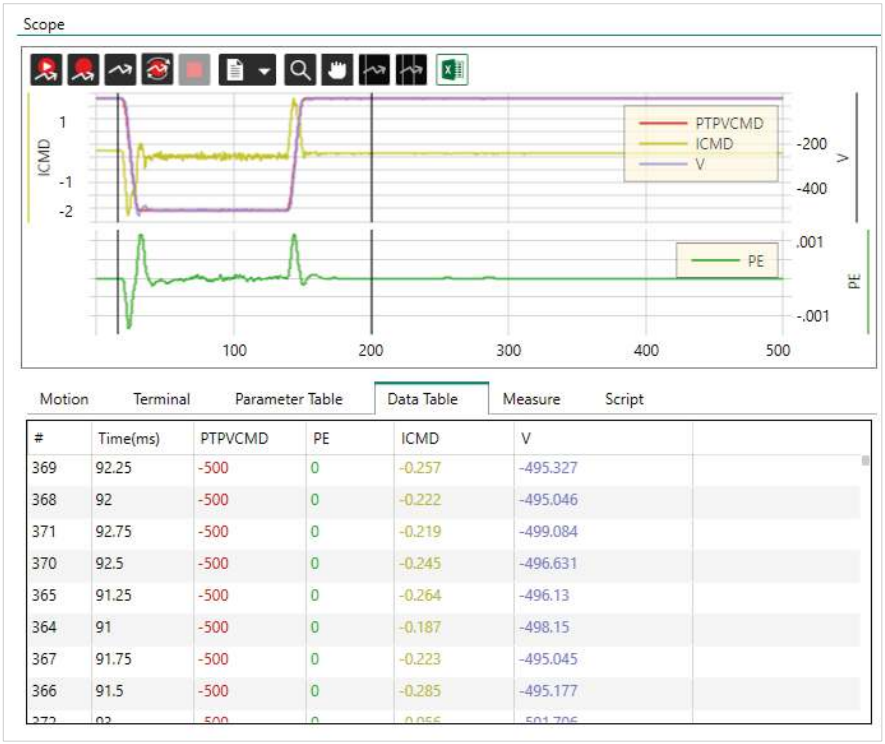


Figure 26-14. ServoStudio 2 – Scope Data Table

#	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.

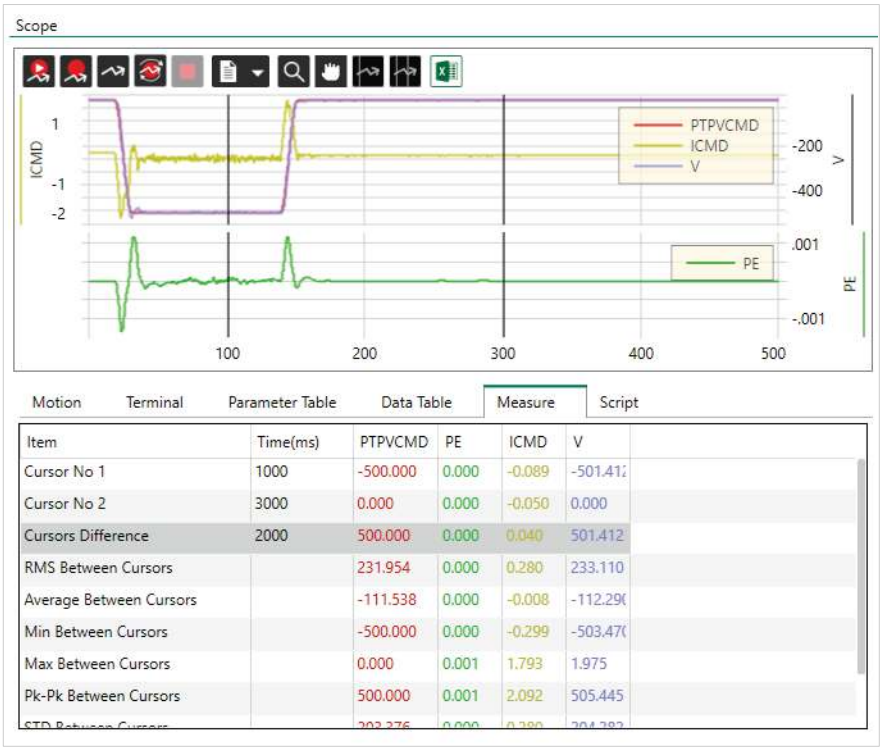


Figure 26-15. ServoStudio 2 – Scope Measurement Tab

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

27 Expert

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

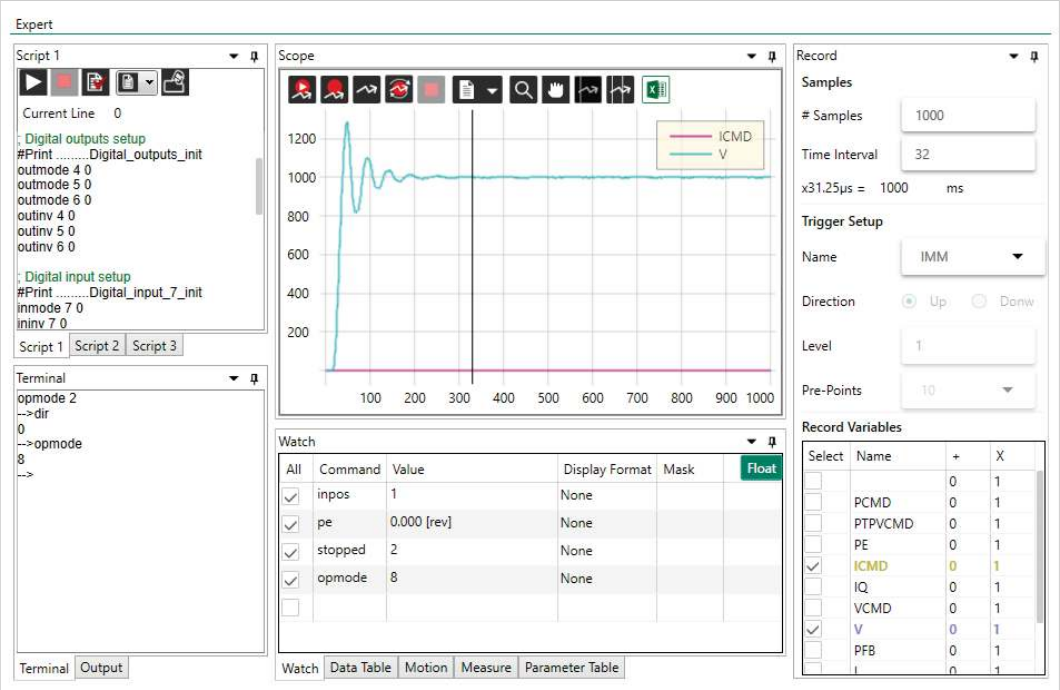


Figure 27-1. ServoStudio 2 – Expert Dashboard

27.1 Expert Screen Layout

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

	Press the pin button to hide the panel. A small tab remains visible on the size of the screen. Press the tab to reopen the panel. Right-click the pin button to access the option to **Restore Layout**.
	Click the arrow to access the options to **Float** and **Dock** the panels.

27.2 Expert Tabs/Panels

The Expert screen contains the following panels and tabs:

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

28 Terminal

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

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

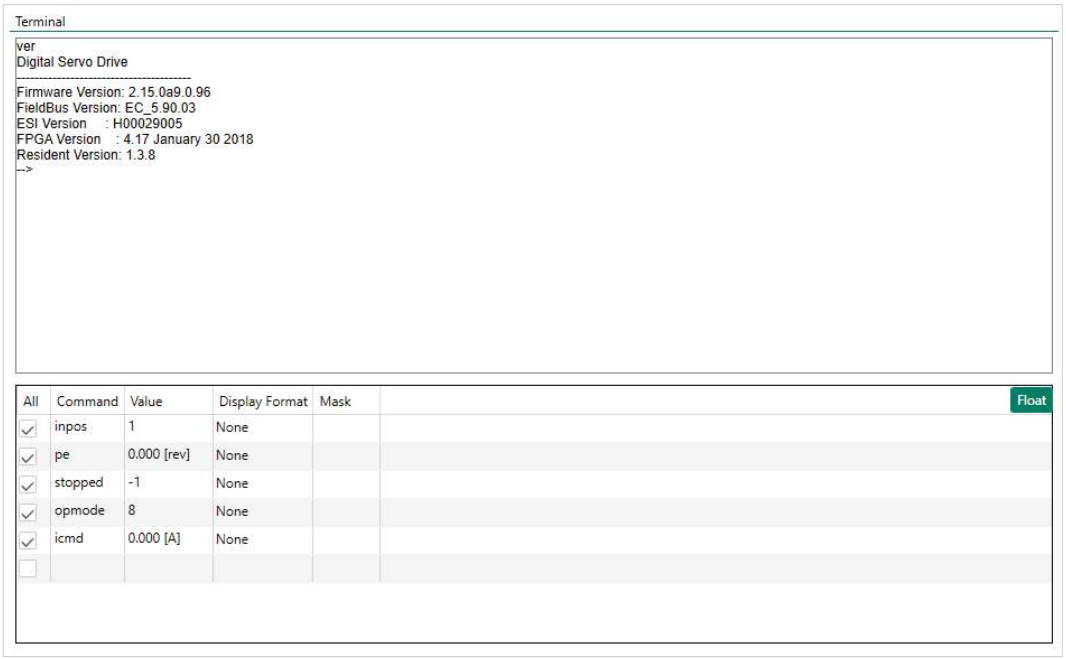


Figure 28-1. ServoStudio 2 – Terminal Dashboard

28.1 Terminal Editing Functions

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

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

28.2 Watch Variables

The **Watch** panel 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.

All	Select or clear an individual checkbox to start or stop monitoring a specific variable. Click the header **All** to select or clear all variables listed.
Command	Use this field to enter the name of the drive variable whose value you want to monitor. Click the header **Command** to sort the list alphabetically. Once alphabetized, press the header to reverse ascending/ descending order.
Value	The value of the watched variable is displayed in this field.
Display Format	Select the format that is used for displaying the value: default, Binary Decimal or Hexadecimal.
Mask	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 panel is closed. Therefore, do not select more variables than necessary, and clear the watched variable selections when no longer needed.

29 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**.

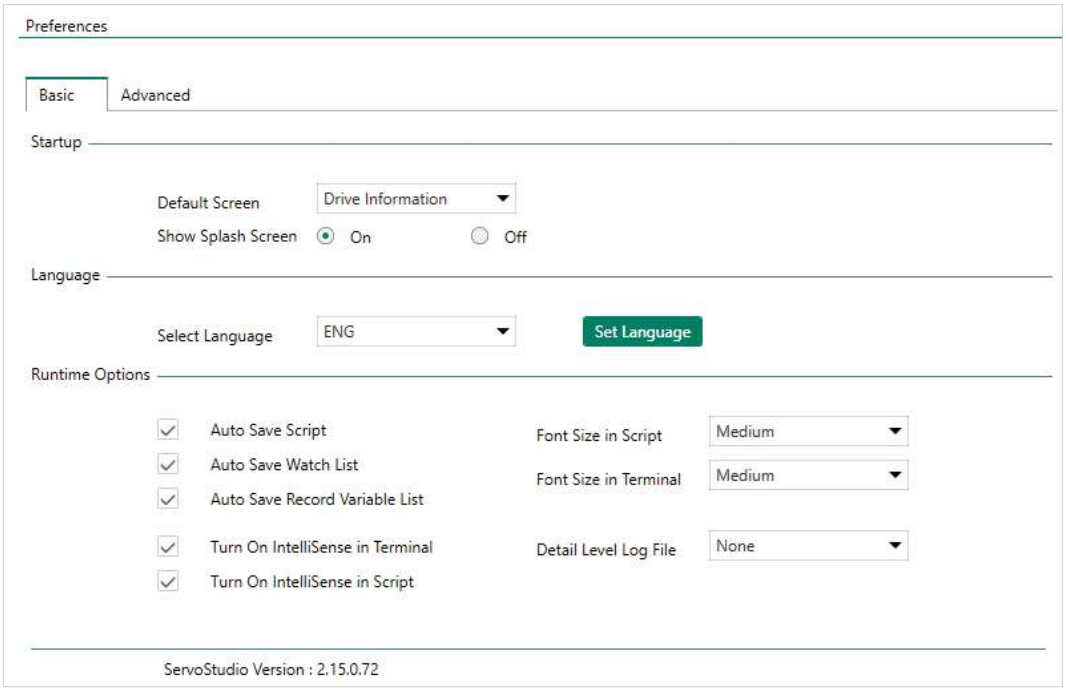


Figure 29-1. ServoStudio 2 – Preferences Screen – Basic Settings

Startup	
Default Screen	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.
Show Splash Screen	Defines whether the ServoStudio 2 splash screen is displayed when ServoStudio 2 is activated.
Language	
Select Language	Defines the interface language (options: English, Chinese Simplified/Traditional, Korean).
Set Language	Activates the interface in the selected language.
Runtime Options	
Auto Save options	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.
IntelliSense options	Activates auto-selection and auto-complete when working in Terminal and/or Script panel. Opens and displays list of available drive commands that can be selected based on the characters entered.

Font options	Defines the size of the text displayed in the in Terminal and/or Script panel.
Detail Level Log File	Determines the type and amount of information to be included in log files.
ServoStudio 2 Version	The version of the ServoStudio 2 software.

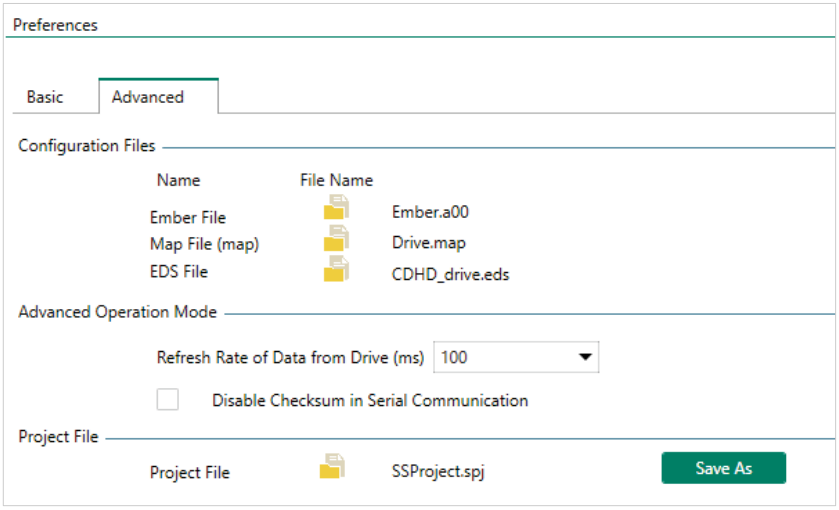


Figure 29-2. ServoStudio 2 – Preferences Screen – Advanced Settings

Configuration Files	The names and locations of files used by ServoStudio 2. For Expert users only.
Advanced Operation Mode	
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.
Tuning Setting File	Not in use.
Project File	A project file contains all settings currently defined in ServoStudio 2, and any autosaved data.

30 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.

30.1 Save and Restore

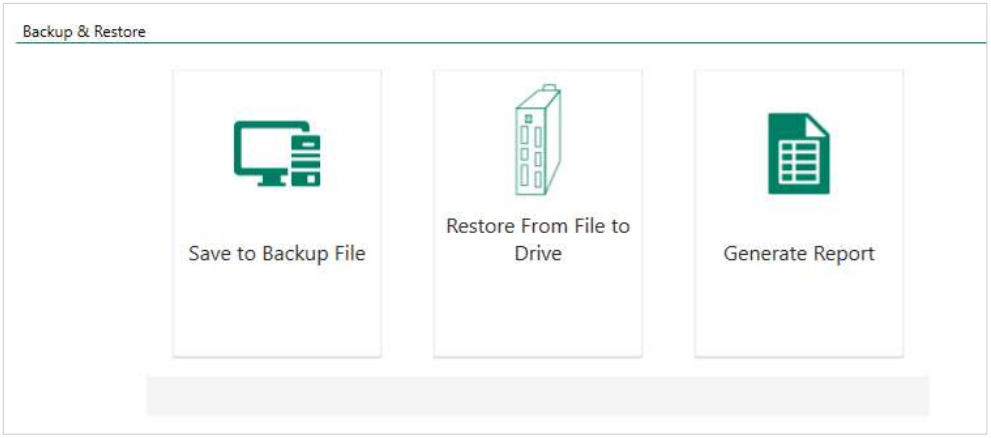


Figure 30-1. ServoStudio 2 – Backup & Restore Screen

Save to Backup File	Opens a **Save as** dialog box. 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.
Restore from File to Drive	Opens an **Open** dialog box. Loads parameters and values from a file on the host computer to the drive RAM.
Generate Report	Opens the *Report Generator* dialog box. Creates a set of CSV and TXT files within a zip file. The file can be attached to an email that is automatically addressed to Technical Support. You can change the address and send to a different recipient.
All Drives	If ServoStudio 2 detects more than one drive, it will display parameter backup and restore options for multiple drives. Backup file names are automatically created according to the name of each drive.

30.2 Report Generator

The **Report Generator** is a ServoStudio 2 utility that allows you to save a copy of all system settings. 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.

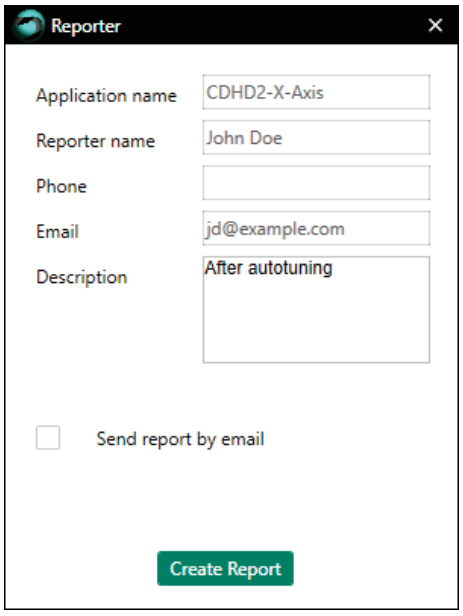


Figure 30-2. ServoStudio 2 – Report Generator

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

Send report by email	Attaches the report zip file to an email that is automatically addressed to Technical Support. You can change the address and send to a different recipient.

31 Software Scripts

31.1 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** panels.

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.

31.2 Software Script Panel

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

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:

	**Run**. Validates and then runs a script.
	**Stop**. Halts a running script.
	**Validate**. 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.

	Script file options can also be accessed by right-clicking anywhere in a Script tab. **File**. Click the arrow to access the file options: **Open**. Opens a saved script file. Also Ctrl+O **Save**. Saves the script to a file. Also Ctrl+S **Save As**. Saves the script under a different filename. **Dump**. 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 DUMP. **Copy.** Ctrl+C **Paste**. Same as Ctrl+V **Clean Script**. Selects and deletes all contents of script tab. **Close Script**. Closes script without saving contents. **Font Size**. Gives you a choice of four sizes for displaying the script text. **IntelliSense**. Toggles the autocompletion system. **Run Selection**. Executes only the lines currently selected in the script. **Firmware Upgrade**. Refer to the user manual.
	**New Script**. Opens a new tab for a new script.

31.3 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.
+ - * /	**Operators**. add, subtract, multiply, divide.
< > == !=	**Condition operators**. 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 (*drive*.map)

31.4 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**

31.5 Software Script Commands

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

31.5.1 Software Script Program Flow

Label

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

Goto

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

If

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

While

Syntax	`#While <Condition>`
	…
	`#End_While`

Variables	<*Condition*> = can be < > == !=
Operation	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.

Delay

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

31.5.2 Software Script Data

Var

Syntax	`#Var $<VarName>` `#Var $<VarName> = <Value>`
Variables	$<*VarName*> = variable name <*Value*> = number or drive parameter name
Operation	Declares the variable. Declares the variable and sets its initial value.

Print

Syntax	`#Print <Var_1> [<Var_2>]`
Variables	<*Var_1*> <*Var_2*> = can be a script variable, drive command or text string
Operation	Prints the value of the variable/s to the Output panel.

Print Parameters

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

ClearOutput

Syntax	`#ClearOutput`
Operation	Clears the contents of the Output panel

Message

Syntax	`#Message <VarName_1> [<VarName _2>]`
Variables	*<VarName _1>* *<VarName _2>* = can be a script variable, drive command or text string
Operation	Opens message box to display the value of the variables, and pauses execution of the script until user presses OK.

Round

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

SysValue

Syntax	`# SysValue`
Variables	$<*VarName*> = a script variable

Operation	Gets ServoStudio 2 internal values.
	A script can get a value from any of the following:
	● Any cell in the Measurement table in the Scope screen, such as Min, Max, Pk-Pk of each of the recorded variables.
	● Any cell in the Motor parameter table in the motor screen.
	● A value calculated from data in the Scope chart.
	Settling time (SLT)
	Overshoot (OS)
	Rise time (RT)
	Examples:
	`#SysValue $var MT 2 3`
	Gets value from Measurement table, column 2 row 3 and assigns to variable **var**.
	`#SysValue $st SLT PTPVCMD PE`
	Gets the settling time value and assigns to variable **st**.
	`#SysValue $var OV VCMD V`
	Gets overshoot and assigns to variable **var**.
	`#SysValue $var RT VCMD V`
	Gets rise time and assigns to variable **var**.

31.5.3 Software Script Operation

Plot

Syntax	`#Plot`
Operation	Plots a graph using recorded data from the drive. This is the same as pressing the **Plot** button on Scope screen toolbar.

SavePlotFile

Syntax	`#SavePlotFile [<Filename>]` `#SavePlotFile [$<Name>]`
Variables	<*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
Operation	Saves data from the currently displayed Scope screen to a CVS file.

DownloadFirmware

Syntax	`#DownloadFirmware`
Operation	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 downloaded to more than one drive from a single script.

BroadcastingOn | BroadcastingOff

Syntax	`#BroadcastingOn	#BroadcastingOff`
Operation	Starts and ends the broadcasting session.

Connect

Syntax	`#Connect <ComPortNum> <DriveID>`
Variables	<*ComPortNum*> = ID number of communication port <*Drive ID*> = ID number of drive
Operation	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

ScaleYTrace

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

31.6 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
ininv 7 0
ininv 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
```

ServoStudio 2 Reference Manual
for CDHD2 and DDHD