

SPiiPlus MMI Application Studio

User Guide

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SPiiPlus MMI Application Studio

Release Date: September 2020

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Revision History

Date	Revision	Description
September 2020	3.02	Corrections to SinCos Encoder Compensation section
July 2020	3.01	Bug fixes, ADK Update
June 2020	3.00	Changed to WPF
April 2019	2.70	Layout corrections
July 2018	2.60	Added Current Loop Auto Tuning Added Open Loop Verification Added XRMSD, XRMSM, XRMSTD, XRMSTM, CERRK, KDEC
December 2017	2.50	Updated Adjuster Wizard and Scope.
July 2017	2.40	Added PdoIndex to the #ETHERCAT command Removed the obsolete description of basic and advanced SPiiPlusMMI Application Studio Packages Added a description of the Backup Machine and Duplicate Machine to Upgrade and Recovery Wizard feature Updated Windows Platform Support Removed UDPPORT
August 2016	2.30	 Added optional groups to System Setup Added to Safety and Faults Configurator and Safety and Faults Monitor STO Hardware Emergency Stop Removed "Component Failure" inversion checkbox from Safety and Faults Configurator Added Component Failure to Safety and Faults Monitor Renamed "Drive Fault" to "Drive Fault/ Laser Fault" Clarified the default response for a hardware emergency stop Added note stating that to save any work in a buffer window that it must be compiled first. Added new scope features

Date	Revision	Description	
		> Save MMI data as Excel CSV	
		> Quadrature grid for XY-CH# display	
		 Setting Y-axis limits per channel 	
March 2015	2.29	Upgrade and Recovery Wizard Updated	

Conventions Used in this Guide

Text Formats

Format	Description
Bold	Names of GUI objects or commands
BOLD + UPPERCASE	ACSPL+ variables and commands
Monospace + grey background	Code example
Italic	Names of other documents
Blue	Hyperlink
[]	In commands indicates optional item(s)
	In commands indicates either/or items

Flagged Text

Note - includes additional information or programming tips.



Caution - describes a condition that may result in damage to equipment.



Warning - describes a condition that may result in serious bodily injury or death.



Model - highlights a specification, procedure, condition, or statement that depends on the product model



Advanced - indicates a topic for advanced users.

Related Documents

Documents listed in the following table provide additional information related to this document.

The most updated version of the documents can be downloaded by authorized users from www.acsmotioncontrol.com/downloads.

Online versions for all ACS software manuals are available to authorized users at <u>ACS Motion Control</u> <u>Knowledge Center</u>.

Document	Description
SPiiPlus Setup Guide	A complete guide for setting up the SPiiPlus system.
SPiiPlus Utilities User Guide	A guide for using the SPiiPlus User Mode Driver (UMD) for setting up communication with the SPiiPlus motion controller.
SPiiPlus Command & Variable Reference Guide	Complete description of all variables and commands in the ACSPL+ programming language.
SPiiPlus C Library Reference	C/C++ library for host PC applications. This guide is applicable for all the SPiiPlus motion control products
SPiiPlus .NET Library Reference	.NET Methods, Properties, and Events for communication with the controller.
SPiiPlus Programmer's Guide	Guide for using the ACSPL+ high level programming language.
SPiiPlus NTM Network Manager Hardware Guide	Technical description of the SPiiPlus NTM Network Manager that provides complete communication control between the ACS Motion Control products on an EtherCAT network

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1. SPiiPlus MMI Application Studio Overview

SPiiPlus MMI Application Studio is a comprehensive environment for setting up and managing ACS Motion Control SPiiPlus motion controllers as well as control modules such as the MC4U product line.

1.1 System Requirements

The SPiiPlus MMI Application Studio can be run in any of the following Microsoft Windows[®] operating systems:

- > Windows[®] 7 (32-bit and 64-bit)
- > Windows[®] Server 2003 (32-bit and 64-bit)
- > Windows[®] Server 2008 (32-bit and 64-bit)
- > Windows[®] Server 2008 R2 (64-bit)
- > Windows[®] 8.1 (32 bit and 64 bit)
- > Windows Server 2012[®] (32 bit and 64 bit)
- > Windows 10[®] (32 bit and 64 bit)

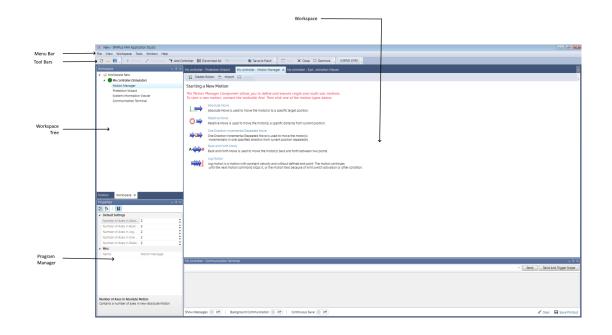
1.1.1 SPiiPlus MMI Application Studio

The SPiiPlus MMI Application Studio consists of the following:

- > Adjuster Wizard
- > Safety and Faults Configurator
- > Application Wizard
- > Program Manager
- > Protection Wizard
- > Motion Manager
- > FRF Analyzer
- > HSSI Manager
- > Inputs/Outputs Manager
- > Safety and Faults Monitor
- > Scope
- > Variables Manager and Watch
- > Communication Terminal
- > System Information Viewer
- > Upgrade and Recovery Wizard

1.2 SPiiPlus MMI Application Startup Window

The SPiiPlus MMI Application Studio startup window:



Workspace

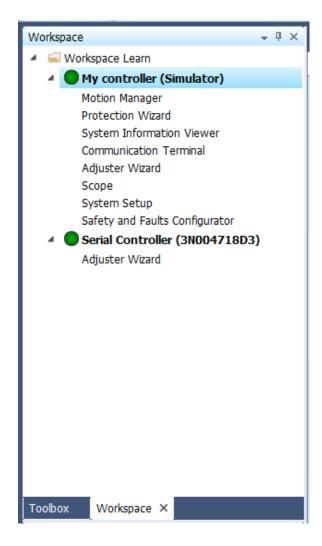
The Workspace is where all data is entered. The contents of the Workspace depend on the MMI option that is currently being used.

Workspace Tree

The Workspace Tree displays all MMI components associated with the Workspace that you have activated.

The pod in which the Workspace Tree is displayed has two tabs:

- > Workspace Tree Tab clicking this tab displays the Workspace Tree.
- > Toolbox Tab clicking this tab displays the SPiiPlus MMI Application Studio tools.



Status Bar

This displays messages of the MMI status and the status of any component action you have executed.

1.3 Menu Bar

The SPiiPlus MMI Application Studio Menu Bar has the following options:

File	New	Create a new Workspace file.
	Open	Open an existing Workspace file.
	Close Workspace	Close the currently displayed Workspace.
	Save Workspace	Save the Workspace data.
	Save Workspace As	Save the Workspace data to a different filename.
	Print	Access Print Manager for printing Workspace data.
	Recent	Display list of Workspace data files to enable selecting a specific Workspace.
	Exit	Close SPiiPlus MMI Application Studio.
	Toolbox Window	Toggle Toolbox display on and off.
View	Properties Window	Toggle Properties display on and off.
	Workspace Window	Toggle Workspace Tree display on and off.
	Add Controller	Add a new controller to the Workspace.
Workspace	Add File	Add an external file to the Workspace Tree - when selected, this file will open in the appropriate application.
	Set as Default	Sets the current Workspace as the default - it is displayed on the next time SPiiPlus MMI Application Studio is initiated.

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1. SPiiPlus MMI Application Studio Overview

	Language	Select language used by MMI. Default: US English
	Style	Change the look of the MMI to suit your tastes.
Tools	Settings	 Select log settings, your options are: Off - Turns logging off. Errors - only errors are logged. Warnings - Errors & warnings are included in the log. Info - Errors, warnings and messages are included in the log. Verbose - Everything is included in the log. In addition you can set the display time for ToolTips in seconds.
	Close All	Closes the display of all component windows in the Workspace.
Window	Tile Horizontal	If the Floating option is selected, each component window is displayed horizontally in the Workspace.
WINDOW	Tile Vertical	If the Floating option is selected, each component window is displayed vertically in the Workspace.
	Cascade	If the Floating option is selected, each component window is displayed cascaded (one behind the other) in the Workspace.
	Contents	Displays the Help topics for the function in the active Workspace.
Help	Index	Displays a list of keywords from which you can perform a search for a particular help.
	Knowledge Center	Open the Knowledge Center in the web browser.
	About	Displays SPiiPlus MMI Application Studio version information.



When you press **Alt + the Underlined Letter**, the selections for the Menu option are displayed.

1.4 Toolbars

The SPiiPlus MMI Application Studio contains four built-in toolbars:

> Workspace



This toolbar contains Workspace handling function buttons. They are:

- > Open a new Workspace
- > Load a Workspace from a file on the computer
- > Save the Workspace data to computer
- > Controller

🗉 🍈 Connect 🌾 Disconnect 🍈 Add Controller 🕋 Disconnect All 💮 Connect All 🔞 Save to Flash

This toolbar contains controller handling function buttons. They are:

- > Connect connects the selected controller
- > Disconnect disconnects the selected controller
- > Add Controller adds a new controller to Workspace
- > Disconnect All disconnects all controllers in Workspace
- > Connect All connects all controllers in Workspace
- > Component

🗔 Open 🗙 <u>C</u>lose 🛅 <u>R</u>emove

This toolbar contains function buttons for components in the Workspace tree. They are:

- > Open Displays the selected component in the Workspace
- > Close Closes the selected component in the Workspace
- > Remove Removes the selected component from the Workspace

> Style

	*	Default
Style Image: Style	•	Derault DevExpress Style DevExpress Dark Style VS2010 Seven Classic Office 2010 Blue Office 2010 Black Office 2010 Black Office 2010 Silver Office 2013 Dark Gray Office 2013 Dark Gray Office 2013 Light Gray Visual Studio 2013 Blue Visual Studio 2013 Blue Visual Studio 2013 Light Visual Studio 2013 Dark Coffee Liquid Sky London Liquid Sky Glass Oceans

This button opens a menu offering style options:

- > Flat
- > Ultra Flat
- > Style 3D
- > Office 2003
- > Windows XP
- > Skin (Opens sub-menu with various options)
- > Useful Links

🛛 <u>U</u>seful Links 🔻

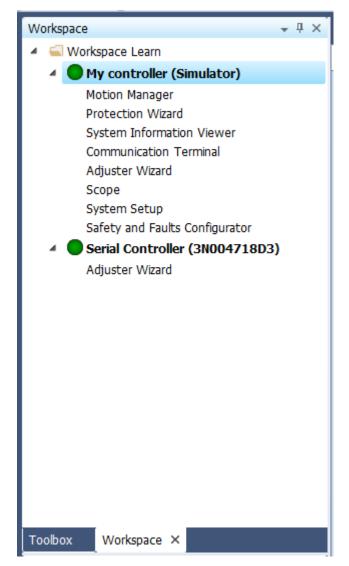
This toolbar opens a menu offering shortcuts to the following functions.

- > Setup New System
- > Tune an Axis
- > Create Watch
- > Save Application to PC

> Load Application to Controller

1.5 Workspace Tree Tab

The Workspace Tree displays all MMI functions that you have used for a particular session.



When you initiate SPiiPlus MMI Application Studio, the following functions are loaded by default:

- > Program Manager
- > Motion Manager
- > Communication Terminal

As you work within the MMI, each function that you employ is added to the list.

For details on the Workspace Tree operations, see Working with Workspace Tree.

1.6 Toolbox Tab

SPiiPlus MMI Application Studio Toolbox provides the following tools:

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1.	SPiiPlus	MMI	Appli	cation	Studio	Over\	/ie
1.	SPIIPlus	MMI	Appli	cation	Studio	0ver\	/

Foolbox		Ψ×
Setup		
Adjuster	Wizard	
Safety a	nd Faults Configurator	
System S	Setup	
Cable		
Setup		
	Development	
	Development	
Application [Utilities		
Application [Utilities	Development and Monitoring	
Application [Utilities		>

> Setup

The Setup set of tools enables you to configure your SPiiPlus Motion Controller

Application Development >

The Application Development set of tools enables you to program your SPiiPlus Motion Controller.

Utilities >

The Utilities enable you to upgrade the SPiiPlus Motion Control firmware and software.

Utilities also is your access point to Communication Terminal which enables you to send commands directly to the SPiiPlus Motion Controller.

Diagnostics and Monitoring >

The Diagnostics and Monitoring set of tools enables you to monitor, graphically through the Scope and the FRF Analyzer, and analyze the motion as well as keep abreast the values of critical variables.

1.7 Program Manager

Program Manager is the principal tool for programming your SPiiPlus Motion Controller.

The Program Manager window displays information for the controller selected in the Workspace Tree.

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Buffer	Select	Open	Lines	Status		
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1			0	empty]
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3			0	empty]
4			0	empty		
5			0	empty	 	
6			0	empty	 	
7			0	empty]
8			0	empty	 	
9			0	empty	 	
D-E	Buffer		0	compiled		

1.8 Properties Window

The Properties window enables you to set certain attributes for the object, such as color, numeric value, identifying name, and the like.

General Plot Settings							
Cursors Color	#FFFFFFF						
Grid Color	#FF808000						
Grid Visible							
Plot Area Color	#FF000000						
4 Plot Settings							
Channel	CH1						
Line Style	Solid						
Line Width	3						
Plot Color	#FFFFFF00						
Point Style	None						
View Settings							
Numbers Precision	3						
Cursors Color (No description)							

For details of the Properties window see Working with Workspace Tree.

1.9 Communication Terminal

The utility enables you to enter commands directly to the controller.

My cor	ontroller - Communication Terminal			+ += ×
1	✓ See	nd Se	end And Tr	rigger Scope
Show I	w Messages 💿 Off) 🔋 Background Communication 💿 Off) 🔋 Continuous Save 💿 Off	10	kar 🖪	Save Printout

There are two types of commands that you can enter:

- 1. Terminal commands these are commands specific to the Terminal and are not part of the ACSPL+, SPiiPlus C Library, or SPiiPlus COM Library command sets.
- 2. Certain ACSPL+ commands.

1.10 Emergency Stop Button

When you enter SPiiPlus MMI Application Studio, it connects to the SPiiPlus motion controller via the **SPiiPlus User Mode Driver** (UMD). The UMD displays the Emergency Stop button in the lower right side of the screen.



Clicking this button immediately stops all Program Buffers along with halting all motors and sets all axis offsets to 0.



By default, the button is always overlaid on top of the display. To change this, rightclick the button and uncheck **Always On Top**.

1.11 Wizards

Wizards are special tools where your operations have been bundled into a single tool. For each option of a wizard there is a logical sequence of actions that need to be taken, and the wizard leads through them step-by-step. The SPiiPlus MMI Application Studio has the following wizards:

> Adjuster Wizard

The **Adjuster Wizard**, one of the Setup tools, enables you to improve the system and modify its behavior. The **Adjuster Wizard** provides tuning in terms of high-level parameters, namely parameters that have a clear meaning for you. Once you have assigned values to the high-level parameters, the **Adjuster Wizard** automatically transforms them into values for the low-level parameters, that is, controller parameters.

> Application Wizard

The **Application Wizard**, one of the Application Development tools, enables you to manage the controller program files, such as loading applications, saving applications, copying files to the controller, as well as loading/saving system and axis parameters.

> Upgrade and Recovery Wizard

The **Upgrade and Recovery Wizard**, one of the Utilities tools, enables you to upgrade your controller's firmware as well as to recover the firmware data should you need to reinstall the controller.

> Protection Wizard

The **Protection Wizard**, one of the Application Development tools, enables you to define the controller program Protection mode parameters, modify the Protection mode parameters, and view the Protection status. By applying Protection, you assure that your ACSPL+ programs are protected from unauthorized changes to system and axis parameters.

1.12 Graphic Monitors

SPiiPlus MMI Application Studio provides you with three graphic monitors to enable you to view and analyze the motion. These monitors are:

> FRF Analyzer

Frequency Response Function (FRF) is the steady-state transfer function of a dynamic system describing the relation between an input and an output as a function of frequency in terms of gain and phase. You have the option of displaying the data as either a Nyquist Diagram or a Bode Diagram.

> Scope

Scope presents a real time display of the values of selected motion variables. Signal values are tracked through various program variables, such as ACSPL+ variables, SP variables, user-defined variables, and the like. You can set the Scope to display any motion parameters you like.

> Sin Cos Encoder Compensation and Monitoring

The **Sin Cos Encoder Compensation** displays a Sin-Cos Lissajous curve graph of the wave form which enables you to read a controller's gain, phase and offsets compensation parameters (**SCGAIN**, **SCPHASE**, **SCSOFFS**, and **SCCOFFS**) and make adjustments where necessary to improve the encoder's response.

1.13 Variables Monitoring Tools

In addition to the graphic monitors, SPiiPlus MMI Application Studio provides you with a number of tools for viewing the values and status of various variables to aid you in diagnosing the motion. These tools are:

> Inputs/Outputs Manager

The Inputs/Outputs Manager displays the status of the input and output variables of the SPiiPlus controller as well as those of the HSSI if defined.

> Safety and Faults Monitor

The Safety and Faults Monitor displays the status of the SPiiPlus controller faults as defined through the Safety and Faults Configurator.

> Variables Manager and Watch

The Variables Manager displays the values currently stored in a program that is running. This includes ACSPL+, global and local variables.

> HSSI Manager

The HSSI Manager is used for monitoring the status of HSSI channels. The manager displays the number and states of the HSSI channels.

1.14 Motion Manager

The Motion Manager is used control the axes' motion. It also displays when the motion is in progress, accelerating, slowing, and so forth. It enables you to operate each axis independently.

There are five types of motion available:

- > **Absolute Move** Moves the motor(s) to a specific target.
- > **Relative Move** Moves the motor(s) a specific distance from current position.
- > **One Direction Incremental Repeated Move** Repeatedly moves the motor(s) incrementally in one specified direction from current position.
- > Back and Forth Move Moves the motor(s) back and forth between two specified points.
- Jog Motion Moves the motor(s) with constant velocity and without a defined end point. The motion continues until the next motion command stops it, or the limit switch has been activated, or some other condition.

SPiiPlus MMI Application Studio User Guide 2. MMI Basics

2. MMI Basics

This chapter presents the procedures used in performing the basic functions in the SPiiPlus MMI Application Studio Workspace.

The basic functions covered by this chapter include:

- > Workspace Operations
- > Handling Controllers
- > Handling Workspace Components
- > Working with Workspace Tree
- > Working with Wizards

2.1 Workspace Operations

Workspace operations include:

- > Creating a New Workspace
- > Saving a New Workspace
- > Loading a New Workspace
- > Closing the Workspace
- > Handling Controllers
- > Handling Workspace Components
- > Working with Workspace Tree

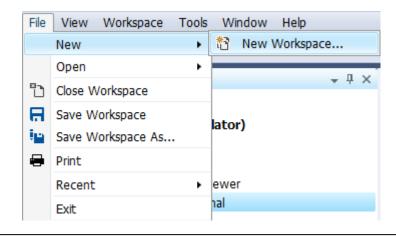
2.1.1 Creating a New Workspace

You may create as many Workspaces as you want. Some reasons for creating Workspaces are:

- > Retaining certain setups
- > Maintaining separate Workspaces for each controller

To create a new Workspace:

- 1. Click **File** in the Main Menu.
- 2. Select New.
- 3. Click **New Workspace**.



You can also create a new Workspace by pressing **Ctrl+N**, or by clicking in the top bar.

4. You are prompted with:

			×
<u>^</u>	The workspace ha	s been changed. I	Do you want to save it?
	Yes	No	Cancel

5. If you want to save the current Workspace, click **Yes**; otherwise click **No**. The new Workspace is loaded.

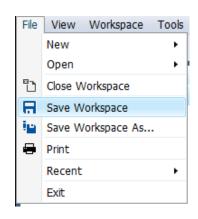
Workspace		,	- 4 ×
🛋 Work	space New		
Toolbox	Workspace ×		

6. To rename the **Workspace** click the Workspace folder and type in the new name.

2.1.2 Saving a New Workspace

Once created, you save the new Workspace by:

- 1. Click **File** in the Main Menu.
- 2. Select Save Workspace.





You can also save the new Workspace by pressing **CTRL+S**, or by clicking 🛃 in the toolbar.

3. You are prompted with:

-> · · 🛧 📙 « ACS Me	otion Control > SPiiPlus ADK Suite v2.70 > SPi	iPlus MMI Application Studio	v ♂ Searc	h SPiiPlus MMI Applicati
ganize 👻 New folder				8== -
Personal	^ Name ^	Date modified	Туре	Size
Translations	en	24/07/2019 12:51	File folder	
Troubleshooting	Help	24/07/2019 12:51	File folder	
Website	default.acsw	12/06/2019 8:39	ACSW File	8 KB
This PC				
🗊 3D Objects				
Desktop				
🗄 Documents				
🖶 Downloads				
Music				
Pictures				
📲 Videos				
OS (C:)	~			
File name: Default 22	2			
Save as type: Workspace	files (* aceu)			

4. Type in the filename and click **Save**.



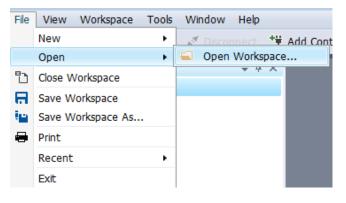
The Workspace configuration is stored in files having **.acsw** file extension.

2.1.3 Loading a New Workspace

To load a new Workspace:

- 1. Click **File** in the Main Menu.
- 2. Select Open.

SPiiPlus MMI Application Studio User Guide 2. MMI Basics



You can also open the new Workspace by pressing Ctrl+O , or by clicking ⊄ toolbar.

3. You are prompted with:

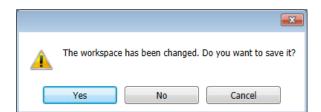
→ ~ ↑ 📙 « AC	S Motion Control > SPiiPlus AD	Suite v3.00 → SPiiPlus MMI Applicatio	n Studio ⇒	ע ט Searc	h SPiiPlus MMI A	pplicati 🔎
ganize 🔻 New folde	r				=== -	
Knowledge Cent ^	Name	Date modified	Туре	Size		
Personal	- Help	26/01/2020 14:24	File folder			
Translations	default.acsw	05/01/2020 17:23	ACSW File	6 KB	1	
Troubleshooting						
This PC						
🕽 3D Objects						
Desktop						
Documents						
🕹 Downloads						
👌 Music						
Pictures						
🚆 Videos						
OS (C:)						
— Data (D:) 💙						
File <u>n</u> a	ame:			~ Wor	kspace files (*.acs	w) \

4. Use the Open window to browse for the location of the file, select the file and click **Open**.



The Workspace configuration is stored in files having **.acsw** file extensions.

5. You are prompted with:



6. If you want to save the current Workspace, click **Yes**; otherwise click **No**. The new Workspace is loaded.

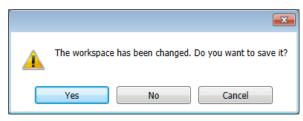
2.1.4 Closing the Workspace

To close the Workspace:

- 1. Click **File** in the Main Menu.
- 2. Select Close Workspace.

File	View We	orkspace	Tools
	New		•
	Open		•
b	Close Work	space	
Ħ	Save Works	space	
i -	Save Works	space As	
-	Print		
	Recent		•
	Exit		

3. You are prompted with:



4. If you want to save the current Workspace, click **Yes**; otherwise click **No**.

2.2 Handling Controllers

The Workspace controller handling functions are:

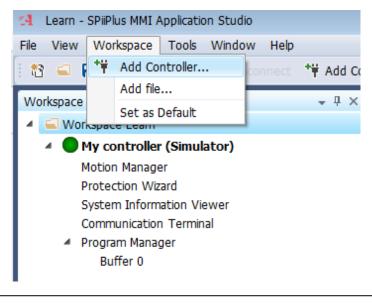
- > Adding a Controller
- > Disconnecting a Controller
- > Connecting a Controller
- > Setting Controller Properties
- > Saving to Flash
- > Controller Reboot

- > Setting Factory Defaults
- > Removing a Controller

2.2.1 Adding a Controller

To add a controller:

1. Click Workspace on Menu bar, and select Add Controller.



	_	_	2	_	_
1					1
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		=	=	=	
	-	-	-	-	1
				-	7
1				ν	۴

You can also click ADD CONTROLLER on the toolbar or press ALT+A.

The Connect to Controller dialog is displayed:

Connect To Controller				×
Recent Connections	Interface settings			
	Controller Alias Name:	Simulator]
	Connection Timeout (ms):	2000		
	Compilation Timeout (ms):	3600000]
	Connection Type:	Ethernet Serial	Simulator	
	Remote Connection	Remote Address: Connection Status:	o	
Device Information				
Model: Unknown Serial Number:				
Vendor Name: ACS Motion Control				
Connect Disconnect Connection Status: 🕢				
			Close	

- 2. Enter an identifying name in the **Controller Alias Name** field.
- **3**. Enter the connection timeout value, in milliseconds, in the **Connection Timeout** field.
- 4. If your computer is connected directly to the controller, select **Serial**, and
 - > Select the communication port from the **Port** dropdown list. If not all the ports are displayed, press the **Refresh** button.
 - > Select the baud rate from the **Rate** dropdown list:

Connect To Controller			×
Recent Connections	nterface settings		
	Controller Alias Name:		
	Connection Timeout (ms): Compilation Timeout (ms):	3600000	
	compliation timeout (ms):		
	Connection Type:	Ethernet Serial Simulator	
	Remote Connection	Remote Address:	Ø
	Kemole Connection	Connection Status:	
Device Information	COM Port:	▼ (@	Refresh
Model: Unknown	Baud Rate:	Auto	-
Serial Number: Vendor Name: ACS Motion Control		Auto 115200	43
		857600	
		B19200	
		B9600	
		B4800 B1200	
		B1200 B300	
Connect Disconnect			
Connection Status: 🥑			
		•	Close

- > Click **Connect**.
- 5. If your computer is connected to the controller through a LAN, select **Ethernet**.

Connect To Controller			×
Recent Connections	Interface settings		
20/04/2020 06:06	Controller Alias Name:	My Controller	
🕎 My Controller 🔗	Connection Timeout (ms):	2000	
	Compilation Timeout (ms):	3600000	
	Connection Type:	Ethernet Serial	Simulator
	Remote Connection	Remote Address: Connection Status:	0
Device Information	Hostname / IP Address:	Port	: 701 🛞 Refresh
Model: Unknown	IP Address	192.168.43.154 V	endor Name
Serial Number: Vendor Name: ACS Motion Control	172.30.16.84	A	CS Motion Control
Vendor Name: ACS Motion Control	192.168.43.154	A	CS Motion Control
Connect Disconnect Connection Status:			
			Close

> Select the IP Address from the **Controller IP Address** dropdown list.



The factory default TCP/IP address is 10.0.0.100.

> Click **Connect**.

6. If the controller is connected to a different computer, you have the option of establishing a remote connection by selecting the **Remote Connection** checkbox.

Connect To Controller	×	
Recent Connections	Interface settings	
20/04/2020 06:06	Controller Alias Name: My Controller	
🖫 My Controller 🖉	Connection Timeout (ms): 2000	
	Compilation Timeout (ms): 3600000	
	Connection Type: Ethernet Serial Simulator	
	Remote Connection Remote Address: Connection Status: Image: Connection Status:	
Device Information	Remote Address: Port: 9999	
Model: Unknown	Login Details	
Serial Number: Vendor Name: ACS Motion Control	Domain:	
	Password:	
	Connect Disconnect	
Connect Disconnect	Hostname / IP Address: Port: 701 Refresh	
Connection Status: 🕑	IP Address Product Name Vendor Name	
	Close	

- > Enter the IP of the remote computer in the **Remote Address** field.
- > Enter the port number of the remote computer in the **Remote Port** field.
- > If the remote computer has login requirements, enter the Domain name, Username and Password in the **Login Details**.

Remote Address:		
Connection Status:	0	\circ
	Port: 999	9
Connect	Discon	nect
	Connection Status:	Connection Status: Port: 999

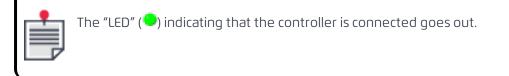
> Click **Connect**. The controller is automatically stored in the Workspace folder and appears in the Workspace Tree.

2.2.2 Disconnecting a Controller

To disconnect a controller:

- 1. In the Workspace Tree select the controller you want to disconnect.
- 2. Click **Disconnect** (______) or press **Alt+D**.

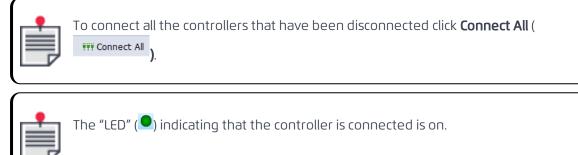




2.2.3 Connecting a Controller

To connect a controller that has been disconnected:

- 1. In the Workspace Tree select the controller you want to connect.
- 2. Click **Connect** (^{# Connect}) or press **Alt+C**.



2.2.4 Setting Controller Properties

This option enables you to set various communication properties for your controller.

To set controller properties: click the controller, the SPiiPlus Communication Parameters window is displayed:

Communication Parameters	
(TCPIP2), TCP/IP Port (TCPP	Rate (BAUD), TCP/IP Address (TCPIP), TCP/IP2 ORT) and UDP Port (UDPPORT) will be active only er the controller restart.
Message Flags (COMM	FL) 00000010 🕥
Serial Baud Rate (BAUD)	115200
TCP/IP Address (TCPIP)	10 .0 .0 .94
Subnet Mask (SUBNET)	255 255 0
Gateway (GATEWAY)	0.0.0.0
TCP/IP Address 2 (TCPIP2)	192 168 0 100
TCP/IP Port (TCPPORT)	701
UDP Port (UDPPORT)	700
	S Factory Defaults Discard Changes
	Save to Flash Close

This window allows you to set the following communication parameters:

- > COMMFL
- > DISPCH
- > BAUD
- > TCPIP
- > SUBNET
- > GATEWAY
- > TCPIP2
- > TCPPORT
- > UDPPORT

2.2.4.1 COMMFL

COMMFL is a scalar variable containing a set of 9 bits that affect controller communication. To set the bits:

1. Click Message Flags (COMMFL) 00000010 (the Message Flags Form is displayed:

Message Flags (COMMFL)	0000001	0	\bigcirc
Message Flags (COMMFL) 0000	00010		
Verbose	(Bit 0)		
Enable Motor Messages	(Bit 1)		
Enable Axis Messages	(Bit 2)		
Enable Program Messages	(Bit 3)		
Unsolicited Messages in SAFE Fo	rmat (Bit 4)	\checkmark	
Unsolicited Messages with Check	sum (Bit 6)		
Disable # Commands	(Bit 7)		
Disable ? Commands	(Bit 8)		
		(Default

2. You can either type the number in the **Message Flags (COMMFL)** field, or select the bits you want to enable by clicking the appropriate checkbox. The meanings of the bits are:

Bit No.	Description
0	1 = Controller includes an extended explanation with error code messages.
1	1 = Enables motor messages.
2	1 = Enables Axis messages.
3	1 = Enables Program messages.
4	1 = Controller sends unsolicited messages in Safe communication format.
6	1 = A checksum is included in unsolicited messages. Normally you do not need to enable this bit.
7	1 = The controller ignores any command received via communication channels except the queries that start with the '?' character. The bit is not effective if the controller is in the Configuration mode. The default value is 0.
8	1 = The controller ignores any query received via communication channels. The bit is not effective if the controller is in Configuration mode. The default value is 0.

3. Click **Close** to save the settings. Or you can click **Default** to enter the default settings.

2.2.4.2 DISPCH

DISPCH is a scalar integer variable that defines the communication channel between the controller and a host application, MMI or any device connected to the controller's communication ports.

DISPCH is relevant only to messages sent with **DISP** and **SEND** (referred to as "Unsolicited Messages"). In order to view unsolicited messages in the window, select the check box in the lower right corner of the Terminal window to enable **Show Unsolicited Messages**.

If **DISPCH** specifies a valid communication channel, all unsolicited messages (messages that are sent with **DISP** and **SEND** from the program buffers) are sent to this channel irrespective of the channel used for immediate commands.

To set **DISPCH**: Type the required number in the **Default Channel (DISPCH)** field. Your choices are:

Channel Number	Description
-1	No default channel is specified, the command uses the last channel activated by the host.
-2	All channels (default)
1	Serial port 1
2	Serial port 2
6	Ethernet network (TCP)
7	Ethernet network (TCP)
8	Ethernet network (TCP)
9	Ethernet network (TCP)
10	Ethernet Point-to-Point (UDP)
12	PCI bus

2.2.4.3 BAUD

BAUD is an integer variable that defines the serial communication rate, given in bits per second.

Enter the required Baud rate from the dropdown menu by clicking the down arrow of the **Serial Baud Rate (BAUD)** field. The options are:

- > 300
- > 1200
- > 4800
- > 9600

SPiiPlus MMI Application Studio User Guide 2. MMI Basics

- > 19200
- > 57600
- > 115200 (default)

2.2.4.4 TCPIP

TCPIP sets IP Address for the 1st Ethernet Port. If **TCPIP** has a non-zero value, the controller uses the value as its TCP/IP address.

The default address is 10.0.0.100.

To set the IP Address enter the address in the **TCP/IP Address (TCPIP)** field.

If you set the **TCPIP** to: **0.0.0.0**, the controller uses the DHCP protocol to retrieve the network configuration from the DHCP server. The network configuration received from the DHCP server includes the following parameters:

- > Controller's TCP/IP address
- > Subnet mask
- > Gateway address

2.2.4.5 SUBNET

SUBNET is used to determine to what subnet an IP address belongs.

The **SUBNET** value consists of four individual bytes, each being a decimal number between 0 and 255, separated by dot. The right most value is the least significant byte.

The default is 255.255.255.0.

To set the Subnet Mask enter the values in the **Subnet Mask (SUBNET)** fields.

If controller is configured to get network settings from DHCP server, that is, **TCP/IP** is set to **0.0.0.0**, **SUBNET** receives its value from the DHCP server subnet mask.

2.2.4.6 GATEWAY

GATEWAY is the address of a network router that serves accessing another network segments.

The **GATEWAY** value consists of four individual bytes, each being a decimal number between 0 and 255, separated by dot. The right most value is the least significant byte.

The default is 0.0.0.0.

To set the Gateway address enter the values in the Gateway (GATEWAY) fields.

If controller is configured to get network settings from DHCP server, that is, **TCP/IP** is set to **0.0.0.0**, **GATEWAY** receives its value from the DHCP server gateway address.

2.2.4.7 TCPIP2

TCPIP2 sets IP Address for the 2nd Ethernet Port. If **TCPIP2** is zero, the address will be automatically obtained at the controller start-up through the DHCP protocol.

The default address for second Ethernet port is 192.168.0.100.

To change the IP Address enter the address in the TCP/IP Address2 (TCPIP2) field.

2.2.4.8 TCPPORT

TCPPORT defines Ethernet ports in the controller for TCP. The value that can be set in **TCPPORT** ranges between 0 and 65536. By default, this variable is set to 701.

In order to establish communication with the controller through a port different from default port numbers, do the following:

1. Set **TCPPORT** to a value other than 701 (you can use the up and down arrows of the **TCP/IP Port (TCPPORT)** field to increment/decrement the value).



Some of the ports are used by the controller OS and cannot be used. It's recommended to use ports starting from 1024.

- 2. Save system parameters to the flash (see Saving to Flash).
- **3**. Restart the controller.
- 4. Try to establish communication using new ports by providing them in the client user application. If communication is not established, try to set other values.

2.2.4.9 Controller Parameters Function Buttons

The Controller Parameters tab has the following function buttons:

S Factory Defaults	Loads factory default values into the fields.
Discard Changes	Removes any values you have entered and restores the previous values.

2.2.5 Saving to Flash

You use this function to save your program and configuration data to the selected controller's flash memory.

To save to flash:

- 1. In the Workspace Tree select the controller to whose flash memory you want to save the data.
- 2. Click **Save to Flash** (Save to Flash). The Save to Flash window is displayed:

User:				
Application:				
Remarks:				
Serial Controller	Save Ontions - "Check" / "L	Jncheck All" option is available	e by clicking on checkbox, at	the column's header
	ACSPL+ Programs		met 🔲 SP Programs	User Arrays
	Buffer 0	▲ System	SP#0	▲ 🔲 I
	Buffer 1	Axis 0	SP#1	V
	Buffer 2	Axis 1	SP#2	
	Buffer 3	Axis 2	SP#3	
	Buffer 4	Axis 3	SP#4	
	Buffer 5	Axis 4	SP#5	=
	Buffer 6	Axis 5	SP#6	
	Buffer 7	Axis 6	SP#7	
	Buffer 8	Axis 7	SP#8	
	Buffer 9	Axis 8	E SP#9	
	Buffer 10	Axis 9	SP#10	
	Buffer 11	Axis 10	SP#11	
	Buffer 12	Axis 11	SP#12	
	Buffer 13	Axis 12	SP#13	
	Buffer 14	* Axis 13	* SP#14	v
	Show Preview			6

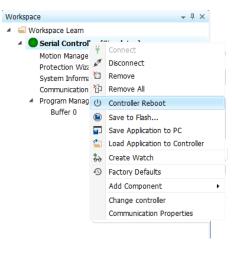
- 3. Enter your user name in the **User** field.
- 4. Enter the application name in the **Application** field.
- 5. You can, if you desire, enter free text remarks in the **Remarks** field.
- 6. By default all data is selected. Select the data you want to load into the controller by clicking (thereby deselecting) the checkbox of the data you do not want to be saved.
- 7. Click Save.

2.2.6 Controller Reboot

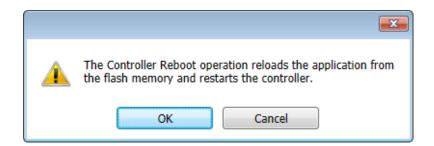
You use this function whenever you've made changes to the memory of the SPiiPlus Motion Controller. You have to reboot the controller in order to activate these changes.

To reboot the controller:

1. Right-click the controller in the Workspace Tree and select **Controller Reboot** from the menu.



2. The following prompt appears:



3. Click **OK**. The rebooting operation begins.



4. Wait until you are notified of a successful reboot:



5. Click **OK**.

2.2.7 Setting Factory Defaults

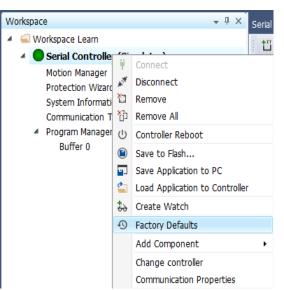
You use this function to set factory default values into the controller.



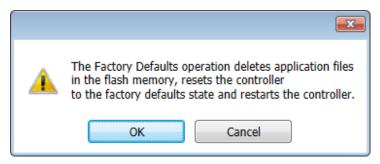
While this option exists, it should be used with some care in that the factory defaults may be inconsistent with your system, and may cause you to lose communication with the controller.

To set the factory defaults into the controller:

1. Right-click the controller in the Workspace Tree and select **Factory Defaults** from the menu.



2. The following prompt appears:



3. Click **OK**. The rebooting operation begins.



4. Wait until you are notified of a successful reboot:

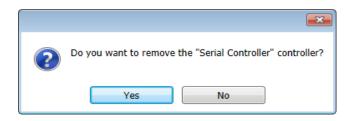


5. Click OK.

2.2.8 Removing a Controller

To remove a controller:

- 1. In the Workspace Tree select the controller you want to remove.
- 2. Click **Remove** (^{D Remove}) on the toolbar or press **Alt+R**. You are asked:



3. Click Yes.

2.3 Handling Workspace Components

Workspace components consist of all the various SPiiPlus MMI Application Studio functions and utilities that can be applied to the controller, such as the Program Manager, Safety and Faults Configurator, Motion Manager, Scope, and the like.

The Workspace component handling functions are:

- > Opening a Component
- > Closing a Component
- > Removing a Component

These functions are activated by clicking the appropriate button on the Toolbars.

2.3.1 Opening a Component

To activate a component in the Workspace Tree:

- 1. Select the component.
- 2. Click **Open** on the toolbar or press **Alt+O**. The component is displayed in the Workspace.

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2.3.2 Closing a Component

To close a component:

- 1. Select the component.
- 2. Click **Close** (Cose) on the toolbar or press **Alt+C**. The component is no longer displayed in the Workspace.

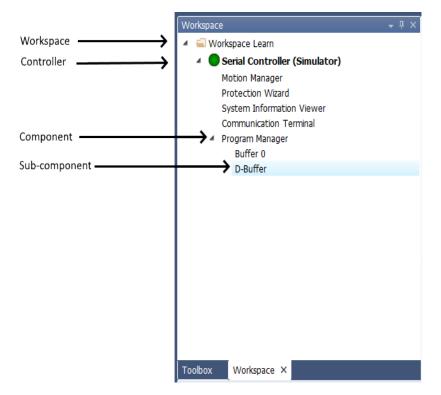
2.3.3 Removing a Component

To remove a component:

- 1. Select the component.
- 2. Click **Remove** (Bemove) on the toolbar or press **Alt+R**. The component is no longer displayed in the Workspace and it has been removed from the Workspace Tree.

2.4 Working with Workspace Tree

The Workspace Tree is constructed as follows:



- > Workspace Top level
- > Controller Level Two
- > Components Level Three
- > Sub Component Level Four

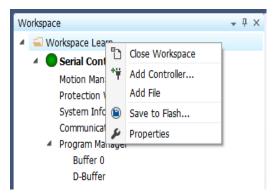
Each level has functions associated only with that level that are activated by right-clicking the element in the level.



Only Program Manager and Variables Manager and Watch have sub-components, but their right-click options are the same as level three components.

2.4.1 Workspace Right-Click Options

Right-clicking the Workspace top level displays the following list of options:



The options that are available are:

- > Close Workspace see Closing the Workspace
- > Add Controller see Adding a Controller
- > Save to Flash see Save to Flash
- > Add File enables you to add a shortcut to any file in your system, for example:



When you click the file, it is opened in the appropriate application. When you save the Workspace, the shortcut is saved as part of the Workspace.



This function can also be selected from list in the **Workspace** option of the Main Menu.

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l	

A good use for this capability is to link ACS Motion Control documentation, such as the *SPiiPlus Command & Variable Reference Guide* and the *SPiiPlus ACSPL+ Programmer's Guide* for looking up information while working in the SPiiPlus MMI Application Studio.

> **Properties** - this activates the Workspace **Properties** window.

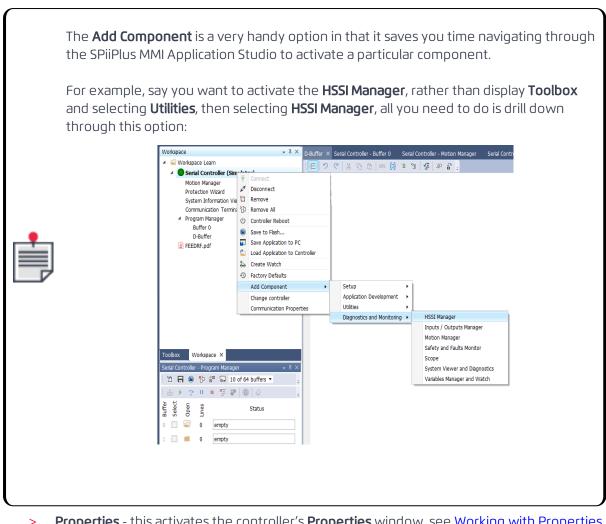
2.4.2 Controller Right-Click Options

Right-clicking the controller displays the following list of options:

Workspace		- ₽ ×
🔺 🛋 Workspace Learn		
 Serial Controlle Motion Manager Protection Wizard System Informat Communication 1 Program Manage Buffer 0 D-Buffer FEEDRF.pdf 	■ * * * で	Connect Disconnect Remove Remove All Controller Reboot Save to Flash Save Application to PC Load Application to Controller Create Watch Factory Defaults Add Component Change controller Communication Properties

The options that are available are:

- > **Connect** this is the same as Connecting a Controller.
- > **Disconnect** this is the same as **Disconnecting a Controller**.
- > **Remove** this is the same as Removing a Controller
- > **Remove All** this removes all components under the selected controller.
- > Controller Reboot this reboots the selected controller, generally used when you have saved new data to the controller's flash and you want it to take effect.
- > Save to Flash this is the same as Save to Flash.
- Factory Defaults this restores the factory-set default values of the selected controller, see Setting Factory Defaults.
- > Add Component this enables you add a component to the Controller branch.



 Properties - this activates the controller's Properties window, see Working with Properties Window.

2.4.3 Component Right-Click Options

Right-clicking the component displays the following list of options:

Workspace 👻 🕂 🗙								
🔺 🛋 Workspace Learn	 Workspace Learn 							
🔺 🔵 Serial Controll	er (S	imulator)						
Motion Manager	r i							
Protection Wiza								
System Informa								
Communication		ninal						
 Program Manage Buffer 0 	ei							
D-Buffer								
Inputs / Output	s Mai	nader	_					
EEDRF.pdf	Open							
	×	Close						
	2	Remove						
	۲	Save to Flash						
			_					
					_			
Toolbox Workspace	×							

The options that are available are:

> **Open** - this is the same as Opening a Component.

- > **Close** this is the same as **Closing a Component**.
- > **Remove** this is the same as Removing a Component.
- > Save to Flash this is the same as Save to Flash.
- Properties this activates the component's Properties window, see Working with Properties Window.

2.5 Working with Properties Window

All SPiiPlus MMI Application Studio components have an associated **Properties** window. The properties often determine how a component is displayed or how it is communicated with, and just as often it merely determines the name of the component.

To display a component's Properties window:

- 1. Select the component in the Workspace Tree.
- 2. Press **Ctrl+Alt+P** (or select **Properties Window** from **View** in the Main Menu, or use the Workspace right-click option see Working with Workspace Tree).

The Properties pane is displayed, for example:

4	Communication	
	ConnectionType	Simulator
	Remote Connection	
	Timeout	2000
4	Misc	
	Connect at Startup	
	Error	No errors
	Firmware	2.79.17.00
	Is protected	
	Model	Automatic Setup Configuratio
	Name	Serial Controller
	Part Number	N/A
	Serial Number	Simulator
	ConnectionType No description)	

Properties that are highlighted in **bold** can be changed in the pod by clicking the field to inputfocus it. Those properties that are grayed-out are for information only and cannot be changed through the Properties pod.

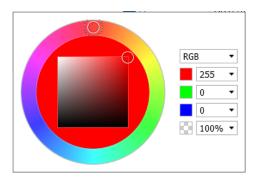
There are three action buttons associated with the Properties window:

Categorize - displays the Properties according to various categories.

	bottom of the pod	, for example	iption of the selected property	
		Properties	- 4 ×	
		₽ 24 ?		
		Communication		
		ConnectionType	Simulator	
		Remote Connection		
		Timeout	2000	
		▲ Misc		
		Connect at Startup		
		Error	No errors	
?		Firmware	2.79.17.00	
		Is protected Model	Automatic Setup Configuration	
		Name	Serial Controller	
		Part Number	N/A	
		Serial Number	Simulator	
		Schurndunger	Sindacor	
		Remote Connection Indicates whether conn established via remote c	ection to controller should be omputer.	

Setting Color Properties

The Color property is very common to most of the Property windows. You set the Color property by clicking 📩 in the color field which displays the color options from which you can choose.



The Custom tab presents gradations of the most common colors. You select the color by clicking the required box.

2.6 Workspace Tab Options

When you add a component, SPiiPlus MMI Application Studio opens its data window in a separate tab in the Workspace. You navigate from window to window by clicking its tab.

Right-clicking the tab displays the following menu:

D-B	Close	Seria
) I	Close Others	
, A=4	Close Tab Group	
,a=4 12,1	Close All Documents	2,193
,v2,	Float	92,V9
	Dock	
	Pin Tab	
	New Horizontal Tab Group	
	New Vertical Tab Group	

Your options are:

- Close closes the window (you can reopen it by clicking the component in the Workspace Tree).
- Close Others closes the other windows in the tab group (you can reopen them by clicking the component in the Workspace Tree).
- Close Tab Group closes all windows and removed the pod containing the tab group (you can restore windows by clicking the component in the Workspace Tree).
- > **Close All Documents** closes the window (you can reopen it by clicking the component in the Workspace Tree).
- > **Float** the window is displayed separately apart from the rest of the windows and you can resize it or move it to any place on the screen.
- > **Dock** the window is arranged in a line together with the rest of the windows (default).
- > **Pin Tab** the window is pinned to the left side of the tab group

- > New Horizontal Tab Group the area of the tab group is split in half horizontally and the tabbed window is moved to the lower area
- > New Vertical Tab Group the area of the tab group is split in half vertically and the tabbed window is moved to the area on the right

2.7 Panel Controls

To expand the view of the Workspace, you have the following available controls:

Clicking Places the panel on the side of the window:



The panel display can be restored by placing the mouse cursor over it. Then when you move the mouse cursor outside the pod, it slides back to the side.

If you want to restore its display permanently, click $\stackrel{\textcircled{}_{==}}{=}$.

You can cancel its display by clicking \bowtie .

2.8 Tool Tips

In addition to the instructions that appear at the bottom of the Workspace window, if you allow the mouse cursor to linger on any field in the window, a popup Tool Tip is displayed to aid you in

connection with the data in the field. For example:

Compone > <u>A</u> Moto	Topology	
🔥 Drive	Type	1
Feedba	Components: Motor	
Moto	Type: Drive Type is not defined yet	1. I
Calculat	Nominal Current [A]:	plitud€
Safety ar	The value "NaN" is out of range.	
Miscellan	Minimum Value: 0.01. Maximum Value: 100.	
Verificatio	Feak Current [A] (Sine Amplitude).	
Axis Setu	The value "NaN" is out of range. Minimum Value: 0.01.	
Save to F		
Axis Dupl	Maximum Velocity:	
Final Pag	The value "NaN" is out of range. Minimum Value: 1. Maximum Value: 100000.	^2]
	Holding Torque Constant	1 -1

You can set the length of time, in secon selecting Tools→Settings from the Main Settings Log Level ToolTip Show Time	ds, that the Tool Tip remains displayed by Menu. This displays a dialog window:
Enter the display time (the default is 30	ok Cancel seconds) and click OK .

2.9 Printing Component Data

SPiiPlus MMI Application Studio provides you with a wide variety of Workspace printing options. To print component data in the Workspace:

1. Select **Print** from the Main Menu **File** option. This displays the Print Manager:

Print Manager		x
Simulator	General	
System Information Viewer	General Information	
Remarks		
		•
		Print Cancel

The Print Manager lists all components currently in the Workspace.

- 2. Select the data you want to print. By default Print Manger selects all checkboxes. If there is data you do not want to print, unselect the appropriate checkbox.
- 3. Click **Print**. The Print Report Preview window is displayed.

2.9.1 Print Report Preview Window

In addition to displaying the data that will be printed, the Print Report Preview window provides you with complete functionality for printing.

/ - print report p	review		
	. # 2 🗉 🖬 🏜 🗸		
	-		
	Report Date	1/21/2020	I
	MMI version	2.92.0.31018	- 1
	Library version	6.68.2.0	
	UMD version	6.68.2.0	
	.NET library version	1.0.0.0	
	Controll	er Information	
	Controller Model	Automatic Setup Configuration	- 1
	Controller is protected	True	I
	Serial Number	Simulator	I
	Part Number	N/A	
	Firmware	2.79.17.00	
	-	m Information Viewer	
	User		I
	User Name	ACSMC\aharonm	
	Machine Name	AHARON-PC	
	Current Directory	C:\Program Files (x86)\ACS Motion Control\SPiiPlus ADK Suite	- 1
		v3.00\SPiiPlus MMI Application Studio	

Toolbar

The Print Report Preview Toolbar contains the following buttons:

4	Print - displays a Print window so set printer and printing preferences.
	Copy - copies selected text
۲	Expand - expand report in preview window
$\Theta_{\rm s}$	Contract - contract report in preview window
+	100% - resize report to fit page in preview window
E	Resize Page Width - resize report to fit page width to window

	Resize Whole Page - resize report to fit page width to window
	Resize Two Pages - resize report to fit two pages in display window
٩	 Export Document - export report to one of the following formats: PDF RTF XLS XLSX CSV Text file Image file

2.10 Working with Wizards

Wizards are groups of procedures. The procedures are broken down by tasks, and once you have selected a particular task, the wizard leads you through each task step-by-step.

The following wizards are available:

- > Adjuster Wizard
- > Protection Wizard
- > Upgrade and Recovery Wizard
- > Application Wizard

2.10.1 Starting a Wizard

To start a wizard:

1. From the Toolbox select the tool of which the wizard is a component, for example:

Toolbox	•	џ	×
Setup			
Adjuster Wizard			
Safety and Faults Configurator			
System Setup			
Setup			
Application Development			
Utilities			
Diagnostics and Monitoring			
Toolbox × Workspace			

2. Click the required wizard in the list. The **Select a Task** window for the selected wizard is displayed in the workspace, for example:

	Serial Controller - Adjuster	r Wizard 🗙 D-Buffer Seri	al Controller - Motion Manager Serial ControllerOutputs Manager		
	You are working with Axi	is: Axis 0			
eps	→ Select Task <	Axis Architecture			
	Initialization	Axis Structure			
	 Axis Architecture Components 	Motor-Load Topology	Rotary Motor and Rotary Load - Direct Drive		
	Safety and Protecti	Gear Ratio*	1		
	Miscellaneous Defini	Feedback Topology	Single, on motor		
	Verification	Unav Unite	Tandad an anna		
	Axis Setup and Tun Save to Flash	User Units Applied To	Motor		
	Axis Duplication	Rotary Units	harron		
	Final Page	Rotary Units	Count - Encoder Count		
	Avic prohitocture provideo		will be used during current Adjuster session.		
	Axis architecture provides		we be used during current Adjuster session.		<< Back Next >>
Help & Instructions					
				Wizard Progress Buttons	
				These arroy cos baccoro	
				licking the controller and sel	

The wizard can also be selected directly by right-clicking the controller and selecting **Add component-><Tool>-><Wizard>**, from the dropdown menu, for example:

Hal Final Comment Connect Disconnect Disconnect Connect Controler Reboot Disconnect Remove All Controler Reboot Save Application to PC Controler Reboot Disconnect Save Application to PC Controler Reboot Controler Reboot Controler Reboot Controler Reboot Save Application to PC Controler Controler Craste Watch Adjuster Wtard Safety and Faults Configurator Safety and Faults Configurator System Setup Dignostics and Monitoring +
--

3. Select the Task by clicking the associated button and then click **Next**.

2.10.2 Wizard Window Elements

The Wizard Window elements are:

[Serial Controller - Adjuster	Wizard × D-Buffer Serial Cor	troler - Motion Manager Serial ControllerOutputs Manager	
	You are working with Axis:	Axis 0		•
ask Steps	→ Select Task 〈	Axis Architecture		
	Initialization	Axis Structure		
	 Axis Architecture Components 	Motor-Load Topology	Rotary Motor and Rotary Load - Direct Drive	Ŧ
	Safety and Protection	Gear Ratio*	Ĩ	
	Miscellaneous Definit Verification	Feedback Topology	Single, on motor	٣
	Axis Setup and Tuni	User Units		
	Save to Flash	User Units Applied To	Motor	Ŧ
	Axis Duplication	Rotary Units		
	Final Page	Rotary Units	Count - Encoder Count	٣
(
	Axis architecture provides of	options to set User units that will I	be used during current Adjuster session.	<< Back Next >>
		Ī		
Help & Instructions				
			Wizard Progress Buttons	
			-	

> Task Steps

This lists the steps that are performed during the course of working through the wizard. When the step is highlighted, indicates on what step you are on.

- Task Workspace
 This is the area in which you enter the data required by the task step.
- Help & Instructions
 This area provides quick instructions and tips of what you are to do in the current step.
- > Wizard Progress Buttons You use these buttons to navigate from one task to another. The buttons are:

Next >>	
<< Back	

Displays the next task in the Task Workspace. It should be noted that this button is not available until you have entered all of the data required by the task step.

Displays the previous task in the Task Workspace.

	Aborts the wizard. When you click this button, you are prompted with, for
	example:
Cancel	Are you sure you want to cancel the Adjuster Wizard?
	Yes No
	Click Yes to cancel.
Finish	Appears in the final task of the wizard - exits the wizard.

There are other action buttons that are specific to particular tasks, such as **Restart** (Restart) which, when clicked, reboots the SPiiPlus Motion Controller.

3. Setup

Setup contains the following tools for setting up your controller and system:

- > Adjuster Wizard for setting up your motion parameters and adjust them to maximize your system's motion performance.
- > Safety and Faults Configurator for selecting specific faults that you want monitored during a program run.
- > Automatic System Setup for performing a manual or automatic system configuration.

3.1 Accessing Setup Tools

To access the Setup tools:

- 1. Open the **TOOLBOX**.
- 2. Click SYSTEM SETUP.
- 3. Click the required tool.

3.2 Adjuster Wizard



Only personnel having a good background in servo parameters, stability, frequency response, bandwidth, etc., and are capable of analysis and diagnostics in time domain and of setting parameters of pre-defined control filters/algorithms should use the **Adjuster Wizard**. For details on the algorithms and control filters, see the *SPiiPlus Setup Guide*.

The **Adjuster Wizard** is used to setup the system and tune the control loops. You use the **Adjuster Wizard** to set the parameters for the:

- > Axis architecture
- > Drive
- > Motor
- > Feedback

The **Adjuster Wizard** provides tuning in terms of high-level parameters, namely parameters that have a clear meaning for you. Once you have assigned high-level parameters, the **Adjuster Wizard** automatically translates them into low-level parameters, that is, controller parameters.

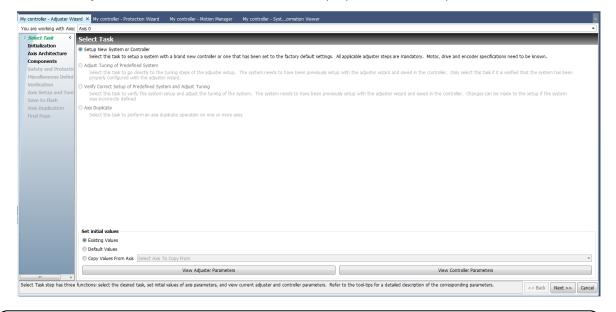
Since the **Adjuster Wizard** works together with the **Scope**, the Adjuster provides interactive tuning. The **Adjuster Wizard** sends a trial signal to the motor and automatically selects suitable **Scope** settings and sends the low-level parameter values. The **Scope** displays the motor response and you can immediately view the results. Some operations during the adjustment process may cause the motor to begin moving unexpectedly. Some of the limits and safety features may be temporarily disabled. To avoid personal injury or damage to the equipment, check the following before starting the adjustment process:



- > Verify that NOTHING (people, electrical cables, or other obstacles) is in the path of the motor or objects connected to the motor.
- > Verify that the motor is securely anchored and that proper safety barriers, stops, and/or limits are installed.

3.2.1 Starting Adjuster Wizard

- 1. In the Toolbox click **Setup** to display the Setup list of tools.
- 2. Click **Adjuster Wizard** in the list of tools. The Adjuster Wizard **Select Task** window is displayed in the workspace.





You can also activate the **Adjuster Wizard** using the right-click **Add Component** option of the Workspace Tree - see **Controller Right-Click Options**.

3.2.2 Adjuster Wizard Select Task Window

The **AdjusterWizardSelect Task** window consists of the following elements:

ask K	Axis 0	
	Select Task	
tion hitecture	Betup New System or Controler Select this task to setup a system with a brand new controler or one that has been set to the factory default settings. All applicable adjuster steps are mandatory. Notor, drive and encoder specifications need to be known.	
ents nd Protectio veous Defini		
ion up and Tuni Flash	() Verfy Connect Setup of Prodefined System and Adjust Tuning Select the task to verify the neutrino setup and adjust the tuning of the system. The system needs to have been previously setup with the adjuster wazed in the controller. Changes can be made to the system was incomety of Index	
dication	Axe Duplicite Select this task to perform an axis duplicate operation on one or more axes	
	Set initial values	
	Set interviews	Si
	© Default Values	v
	Contraction to model Copy Values From Axes Select Axis To Copy From v	
		- v
,	View Adjuster Parameters View Controller Parameters	

Selecting a task is done in the following sequence:

1. Select Axis

The Adjuster Wizard is applied on an axis-by-axis basis. That is, you have to perform it for each axis individually. When you activate the wizard, the first thing you have to do before selecting a Task is select the axis to which the data is to be applied.

You select the axis by clicking the Axis Selector field and then select the axis from the dropdown list:

You are working with Axis:	Axis 6	
Select Task <	Axis 0	
nitialization	Axis 1	
Axis Architecture	Axis 2	
Components	Axis 3	
afety and Protection	Axis 4 Axis 5	
liscellaneous Definition	Axis 6	
	Axis 7	
/erification	Axis 8	
xis Setup and Tuning	Axis 9	
Save to Flash	Axis 10	
Axis Duplication	Axis 11	
inal Page	Axis 12	
	Axis 13	
	Axis 14	
	Axis 15	
	Axis 16	
	Axis 17 Axis 10	
	Axis 18 Axis 19	
	AXD 19	

2. Set Initial Values

Your choices of initial values to be used by the Adjuster are:

- > **Existing Values** using the values that have been built into the Adjuster database.
- > **Default Values** using factory default values that have been set in the controller.

When you select this option, a prompt window is displayed:

My controller - Adjuster Wizard	
Do you want to load Adjuster and Controller parameters default values?	
View Adjuster Parameters View Controller Parameters Yes	No

To view the Adjuster database default values click **View Adjuster Parameters**, the View Adjuster Parameters window is displayed with the values for the selected axis.

To view the controller parameter values click **View Controller Parameters**, the View Controller Parameters window is displayed with the values for the selected axis.

Parameter	Description	Current Value	New Value	Modified
ACC	Acceleration	100000	100000	No
BOFFTIME	Brake Deactivation Time	50	50	No
BONTIME	Brake Activation Time	50	50	No
CERRA	Critical Error (Acceleration)	1000	1000	No
CERRI	Critical Error (Idle)	1000	1000	No
CERRK	StandardVariable_CERRK	1000	1000	No
CERRV	Critical Error (Velocity)	1000	1000	No
CTIME	Control Cycle Time	1	1	No
DCOM	Drive Command	0	0	No
DEC	Deceleration	100000	100000	No
DELI	Delay on Transition to Idle State	50	50	No
DELK	Delay on Transition to Idle State (on Kill)	50	50	No
DELV	Delay on Transition to Velocity State	50	50	No
E_FREQ	Encoder Frequency	20	20	No
E_SCMUL	Encoder Sin-Cos Multiplier	10	10	No
E_TYPE	Encoder Type	3	3	No
50.0000	Secondary Encoder Sin-Cos		10	

Modify parameters as needed for the controller and application as appropriate and then click **Yes**.

> **Copy Values From Axis** - using values that have previously been set for another axis.

When you select this option, you choose the axis whose values are to be used from the **Select Axis To Copy From** (which becomes active when you select this option) dropdown list:

	Axis 0	×
	Axis 1	
	Axis 2	
	Axis 3	1
	Axis 4	
	Axis 5	
	Axis 6	
	Axis 7	
	Axis 8	
	Axis 9	
	Axis 10	
	Axis 11 Axis 12	
	Axis 12 Axis 13	
	Axis 13 Axis 14	
	Axis 14 Axis 15	
Set initial values	Axis 16	
	Axis 17	
Existing Values	Axis 18	
Oefault Values	Axis 19	*
Copy Values From Axis	Select Axis To Copy From	
	View Adjuster Parameters	View Controller Parameters

A prompt window is displayed:

Do you	u want to copy parameters from	m Axis 15 to Axis 0?	

You can view the Adjuster and Controller parameters values that will be copied. If these are the values you want to copy, click **Yes**.

3. Select Task

There are four tasks that can be performed using the Adjuster **Wizard**:

> Setup New System or Controller

You perform this task when setting up a new controller, or if the controller has been set to the factory default values.

When performing the task you not only set the control loop values, but you also set system hardware values, that is, values for the Drive and Motor.

> Adjust Tuning of Predefined System

You perform this task to fine-tune the control loop values. When you select this task, you are taken directly to the Axis Setup and Tuning step.

> Verify Correct Setup of Predefined System and Adjuster Tuning

You perform this task to verify the setup that was saved to the controller from the **Setup New System of Controller** task.

When you select this task, you are taken directly to the Verification step and then to the Axis Setup and Tuning step. Both of these steps are available only if you have first setup the system.

> Axis Duplication

You perform this task to copy an axis set of parameters to any other axis in the controller.

When you select this task, a window appears in which you can select the source axis and the destination axis.

3.2.3 Adjuster Wizard Task Steps

In all, the **AdjusterWizard** consists of nine task steps:

> Initialization

In this step you provide information that serves to identify the database containing the high-level parameter values.

> Axis Architecture

In this step you define the electro-mechanical structure of the controller's working application as well as the units for measuring feedback.

> Components

In this step you define the parameters governing the:

- > Drive
- > Motor
- > Feedback

Once you have defined these, you trigger the Adjuster to calculate the optimal values for the high-level parameters and you load them into the system.

> Safety and Protection

In this step you define the parameters for:

- > Motion limits
- > Current limits
- > Position errors
- > Position limits

> Miscellaneous Definitions

In this step you define the parameters for such things as:

- > Motion completion
- > Enable/Disable/Brake
- > Dynamic brake
- > Home switch

> Verification

In this step the **AdjusterWizard** runs various verification tests for such things as:

- > Feedback
- > Motor
- > Switches
- > Stop, Alarm and Brake

This enables you to see where you need to adjust the values of the parameters.

> Axis Setup and Tuning

In this step you are given the opportunity to refine your values and fine tune your system.

> Save to Flash

Once your high-level values are correct for your system, in this step you save the low-level values to the controller flash.

> Final Page

This step is your exit point from the **AdjusterWizard**.

	-	
	_	
1	<u> </u>	
l		

Many of task options are dependent on the nature of the three basic components you have defined. That is, the type of motor, drive and required feedback signal defined in the **Axis Architecture** and **Components** steps determine what you can define in the subsequent steps.

3.2.4 Component Database

The adjustment procedure affects both the volatile and non-volatile memory of the controller. The Adjuster keeps the controller memory in-sync with the application database.

The **AdjusterWizard** maintains the high-level adjusted values for each component separately on your computer. Upon selecting **Apply changes**, the **AdjusterWizard** saves the values into low-level parameters, that is the parameters that the controller recognizes. Only after you have selected **Save to Flash**, does the wizard save the low-level parameter values into the flash, i.e., non-volatile, memory of the controller.



If the controller is shut off during an adjustment session and the data has not been saved to the controller's flash memory, synchronization is lost and the adjustment session must be repeated.

Incompatibility Symbol

The Incompatibility Symbol⁴ indicates that the value in the component field is incompatible with what you have defined in previous windows.

You should return to a previous window and change the value with which it is in conflict, or, if possible, change the value in the field in the current window. In any case you should resolve all conflicts before continuing.



This symbol can be ignored when an element is not yet defined. For example, a Drive has been defined but not the Motor.

3.2.5 Working in Adjuster Wizard Task Windows

There are several elements that are common to most of the **Adjuster Wizard** task windows. These are:

Data Action Buttons

There are five data action buttons:



Add an item to the field.

_	
	Edit the data fields.
	Deletes the item from the database.
3	<image/>
	<text></text>

Adding Data to Component Database

When you define the values for the Motor, Drive and Feedback components, the following action buttons are available:

SPiiPlus MMI Application Studio	User	Guide
	З.	Setup

Ħ	Add to database	Active if you have entered a component name that is not in the database. Clicking this button adds the data to the Component database under the component name.
FI	Update in database	Active if you have made changes to the data that exists in the database. Clicking this button puts changes into the Component database.
0	Discard changes	Deletes all changes you have made to the data fields.

3.2.6 Setup New System or Controller

You must perform this task for any new system or a controller whose data has been reset to factory defaults.

The steps involved in setting up a new controller are:

- > Axis Architecture
- > Components
- > Safety and Protection
- > Miscellaneous Definitions
- > Axis Setup and Tuning

3.2.6.1 Initialization

Initialization serves only for tracking purposes.

N	ly controller - Adjuster Wizard 🗙	My controller - Systor	mation Viewer			
1	ou are working with Axis: Axis 0					•
	Select Task <	Initialization				_
	> Initialization	User Information				
	Axis Architecture Components	User Name	Aharon			
	Safety and Protection	Application/Machine	Learn1			
	Miscellaneous Definitions Verification	Controller FW version	2.79.17.00			
	Axis Setup and Tuning	Controller S/N	#New Board			
	Save to Flash	Controller P/N	N/A			
	Axis Duplication					
	Final Page	Date	1/21/2020			•
		Remarks				
		Remarks				
I	nitialization step has one function:	track user information.	Refer to the tool-tips for a detailed description of the corresponding parameters.	<< Back	Next >>	Cancel

- 1. Enter your name in the **User Name** field (optional this field may be skipped).
- 2. Enter the name of your application or the ID of the machine for which the controller is being employed in the **Application/Machine** field (optional this field may be skipped).



You will note that Adjuster has extracted the controller's firmware version, S/N and P/N from the controller and filled in these fields.

3. Enter the date in the **Date** field - its format is: mm/dd/yyyy. Or you can click the down arrow and select the date from the calendar.

1/21/2020							
<	< January 2020 >						
SUN	MON	TUE	WED	THU	FRI	SAT	
29	30	31	1	2	3	4	
5	6	7	8	9	10	11	
12	13	14	15	16	17	18	
19	20	21	22	23	24	25	
26	27	28	29	30	31	1	
2	3	4	5	6	7	8	
П	oday: 1/	23/2020					

- 4. Enter any remarks you want in the **Remarks** field (optional this field may be skipped).
- 5. Click Next.

3.2.6.2 Axis Architecture

In this step you are to define the general parameters of the feedback mechanism to include the electro-mechanical characteristics of the motion and how feedback is to be measured and from what.

Data must be entered in all the fields. The data is entered by selecting the appropriate value from the dropdown list of each field.

Feedback Topology

The feedback topology choices are:

Controller Drive Interface	Options
ACS PWM drive	All current options
PDICL	 Verification, on motor Verification, on load None
PDMNT	None

My controller - Adjuster Wizard ×	Wy controller - Systormation	1 Viewer			
You are working with Axis: Axis 0					•
Select Task <	Axis Architecture				
Initialization	Axis Structure				
 Axis Architecture Components 	Motor-Load Topology	Rotary Motor and Rotary Load - Direct Drive			٠
Safety and Protection	Gear Ratio*	1			
Miscellaneous Definitions	Feedback Topology	Sinde, on motor			
Verification	User Units	unge, un noor			
Axis Setup and Tuning Save to Flash		Notor			
Axis Duplication	User Units Appled To Rotary Units	Notor			•
Final Page	Rotary Units	Count - Encoder Count			
Axis architecture provides options	to set User units that will be us	sed during current Adjuster session.	<< Back	Next >>	Cancel

Once you have entered all the values, click **Next** to go on to the next step.

User Units

Of particular import in this step is the setting of User Units to be used by Adjuster in measuring feedback. The User Unit can be millimeters, microns, nanometers, degrees or any other unit that defines a distance for a linear axis or an angle for a rotary axis.

The User Unit is defined per axis. By default, the User Unit is the Encoder Count. For example, for a quadrature encoder with resolution of 500 lines per millimeter, each default User Unit equals 2mm/4 = 0.5mm.

The User Unit is applied to the **EFAC** variable. **EFAC** is a 64 bits member (one for each possible axis) real array used for defining a factor between the raw feedback in encoder counts and the **FPOS** value calculated by the controller. See *SPiiPlus Command & Variable Reference Guide* for complete details.

Advanced Parameters

Advanced Parameters enables you define your own feedback units.

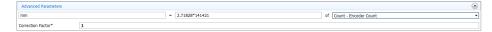


The **Advanced Parameters** option should be used with caution. Badly defined units may cause serious problems with measuring the actual feedback.

To access **Advanced Parameters** click 🖳 in Units field and select **User defined**, for example:

My controller - Adjuster Wizard X	My controller - Systormation Vie	ener			1
You are working with Axis: Axis 0					•
Select Task <	Axis Architecture				
Initialization	Axis Structure				
Axis Architecture	Motor-Load Topology	Rotary Motor and Rotary Load - Direct Drive			-
Components	Gear Ratio*				_
Safety and Protection Miscellaneous Definitions	Gear kabo -	1			_
Verification	Feedback Topology	Single, on motor			•
Axis Setup and Tuning	User Units				
Save to Flash	User Units Applied To	Mator			•
Axis Duplication	Rotary Units				
Final Page	Rotary Units	Count - Encoder Count			
		Count - Brooder Count			
		Revolution			
		Degree Radan			
		kadan Arcminute			
		Arcsecond			
		User defined			
					_
Axis architecture provides options t	o set User units that will be used	during current Adjuster session.	<< Back	Next >>	Cancel

The Advanced Parameters panel is displayed:



- 1. Enter a unique parameter name in User Defined Unit Name.
- 2. Enter a mathematical expression in **Function**, you can use the standard arithmetical operations:
 - > + (Add)
 - > (Subtract)
 - > * (Multiply)
 - > / (Divide)

The function is used as a conversion factor applied to the selected standard unit. For example: 2.71828*1.41421 (*e* times the square root of 2).

3. Select a standard unit from the dropdown list in the **of** field.

4. Enter a correction factor (if different than 1) in **Correction Factor**. The correction factor is used to correct the difference between actual movement (as measured by a laser interferometer) and the software commanded move (indicated in the user units).

3.2.6.3 Components

The Components step consists of defining the values for:

- > Motor
- > Drive
- > Feedback

At the end of the step the Adjuster calculates the parameters that are to be used and inserts them into the appropriate program variables.



3.2.6.3.1 Motor

The first component for which you need to enter values is the Motor.

My controller - Adjuster	Wizard ×				-
You are working with A	xis: Axis 0				•
Select Task	Components: Motor				
Initialization					
Axis Architecture	List of Motors Learn1 Motor				• + 🖍 - 🖻 🛍
Components	Topology	Rotary			
Drive	Туре	DC Brush			
Feedback Motor	Nominal Current [A]*	5			
Calculate Paramet	Peak Current [A] (Sine Amplitude)*	6			
Safety and Protec		RPM * 3600			
Miscellaneous Defi Verification		V/(kRPM) * 0.1			
Axis Setup and Tu	ning Phase Resistance [Q]	1			
Save to Flash Axis Duplication	Total Moving Inertia [Kg*m^2]				
Final Page	Holding Torque Constant	N*m/A 👻			
	Serial Number	12345			
	Remarks				
		Update in database		Discard changes	
Components: Motor ste	p provides the interface to define the motor par	ameters for the motor being used in the current Adjuster sessi	on. If certain motor parameters are not known refer to the to	ol-tips for guidance on how to approximate the	
values. It is highly reco	mmended to specify the motor parameters befor	e adjusting the drive and feedback parameters.			<< Back Next >> Cancel

Data must be entered in all the fields. The data is entered by selecting the appropriate value from the dropdown list of each field or entering the values taken from the motor's technical data sheet.

In entering the values the incompatibility icon (¹) may appear. Check the tool-tip. If it states that there is incompatibility between components that have not been set yet, ignore it. Continue to set component values.

However, do not forget to go back after all the components have been set up and ensure that it no longer appears. If it still appears, then resolve it by changing the component's values or changing the **Axis Setup** values.

Once you have entered all the values, click **Next** to define the Drive component.

3.2.6.3.2 Drive

The second component for which you need to enter values is the Drive.

The relevant drive parameters are:

> Step Motor

My controller - Adjuster Wizard ×								-
You are working with Axis: Axis	0							•
Select Task <	Components: Drive							
Initialization								
Axis Architecture	List of Drives Learn2					- +		2
Components	Controller-Drive Interface	PWM, Digital Current Control						*
✓ Motor								
> ✓ Drive	Type	ACS Universal Digital Drive						*
Feedback Motor	Nominal Current [A]*	3						
Calculate Parameters	Peak Current [A]*	3						
Safety and Protection	Supply Input Voltage Type	DC Voltage						Ŧ
Miscellaneous Definitions Verification	Supply Input Voltage [V]							
Axis Setup and Tuning	Serial Number	SDM00000						
Save to Flash	John Humber	3040000						
Final Page	Remarks							
1								
l								
	E	Update in database		\otimes	Discard changes			
Components: Drive step provides	the interface to define the driv	e parameters for the drive being used in the curre ed in the Components: Motor step.	ent Adjuster session. If certain drive paramete	rs are not known refer to th	e tool-tips for guidance on how to approximate the values. Be	<< Back	Next >>	Cancel

Data must be entered in all the fields. The data is entered by selecting the appropriate value from the drop-down list of each field or entering the values taken from the drive's technical data sheet.



In entering the values the incompatibility icon (¹) may appear. Check the tool-tip. If it states that there is incompatibility between components that have not been set yet, ignore it. Continue to set component values.

However, do not forget to go back after all the components have been set up and ensure that it no longer appears. If it still appears, then resolve it by changing the component's values or changing the **Axis Setup** values.

Controller Drive Interface	Feedback topology	Window Behaviour
ACS PWM	Verification, on motor Verification, on load None	Available - as Stepper Motor
ACS PWM	Any option not listed above	Unavailable
PDIcl PDMnt	Any	Availble - as Pulse Direction Setup

Step Motor

Once you have entered all the values, click **Next** to define the Feedback component.

3.2.6.3.3 Feedback



The **Feedback** component can be either the Motor, the Load, or both depending on what you defined in **Feedback Topology** in the Axis Architecture step.

Data must be entered in all the fields that are active (many, you will note, have already been selected by Adjuster from data that you have previously entered for the Drive and Motor components). The data is entered by selecting the appropriate value from the dropdown list of each field or entering the values directly in the fields.



In entering the values the incompatibility icon (^A) may appear. Check the tool-tip to see what is causing the incompatibility. If it is a value of a previously set up component, then return to the component and either change the component's value, or make changes in the **Axis Setup**.

Make sure that all component incompatibilities are resolved before continuing.

are working with Axis: Axi	is 0				
beleet room	Components: Feedb	ack: Motor			
Initialization					
Axis Architecture	Feedback Devices Learn1Fee	edback			• + 🖊 – 🖻
Components V Motor	Topology	Rotary			
✓ Motor ✓ Drive	Туре	Incremental Quadrature Encoder			
Feedback				1000	
> 🗸 Motor	Resolution*	lines/revolution	¥	1000	
Calculate Parameters	External Multiplier*	1			
fety and Protection	Internal Multiplier	4			
iscellaneous Definitions	Encoder Count Value	counts/revolution	*	4000	
erification		Counts/revolution		4000	
ds Setup and Tuning	Hall Sensors				
ve to Flash	Serial Number				
xis Duplication					
inal Page	Remarks				
	a	Update in database	0	Discard changes	

The feedback choices are:

Controller Drive Interface	Feedback topology	Window behavior
ACS PWM	Single, on motor Single, on load Verification, on motor Verification, on load	Available
ACS PWM	None	Unavailable – the entire step is skipped
PDICL	Verification, on motor Verification, on load	Available
PDICL	None	Unavailable – the entire step is skipped
PDMNT	None	Unavailable – the entire step is skipped

Click **Next** to advance to calculate and apply the feedback parameters.

3.2.6.3.4 Calculate Parameters

At this stage, the Adjuster verifies that the Axis Architecture, Motor, Drive and Feedback definitions are all compatible with each other.

If an inconsistency is detected, a prompt is displayed about it with recommended solutions.

. The

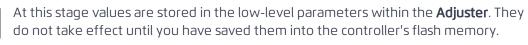
If there are no inconsistencies, click: 🚨

Adjuster calculates the values for the controller parameters and displays a table with each parameter name, its old and its new value, for example:

Calculate Parameters

isk ^c Components: Calcula	te Parameters		
nitecture	Calculate Parameters	Apply Changes	
ents	Existing Value	Calculated Value	
re EFAC	1	0.000003	
VELBRK	2E+006	5.202617	
Motor	2E+006	6.243141	
te Parameters XRMSD	50	100	
nd Protection XVEL	200000	0.624314	
eous Definitions			
on			
on up and Tuning			
Flash			
Flash Jication			
Flash			
Flash Jication			

Click: Apply Changes and click **Next** to advance to the next step.



3.2.6.4 Safety and Protection

The Safety and Protection step enables you to set certain safety and protection variables. There are a total of four possible types of Safety and Protection parameters that you can set.



The actual number of parameter types and parameters available to you depends on what you defined in the Axis Architecture and Components steps.

The Adjuster displays values it has calculated in the window of each type. You have the option of changing these within the limits of valid values.



A complete explanation of each parameter is given in the Tool Tips associated with the parameter.



For the meanings of the variables see the *SPiiPlus Command & Variable Reference Guide*.

3.2.6.4.1 Motion Parameters Limits

My controller - Adjuster Wizard	v .				
You are working with Axis: Ax					Ť
					•
Select Task	Safety and Protection: Motion	Parameters Limits			_
Initialization	Motion Parameters Limits				
Axis Architecture	Maximum Velocity [mm/sec]*	0.624314			
Components		0.024514			
Safety and Protection	Maximum Acceleration [mm/sec^2]*	6.243141			
> ✓ Motion Parameters Li	KILL (Emergency) Deceleration [mm/sec^2]*	0.5			
Current Limits	inter (anne jene)/ second second (in these si				
Position Errors					
Position Limits					
Miscellaneous Definitions					
Verification					
Axis Setup and Tuning					
Save to Flash					
Final Page					
1					
Safety and Protection: Motion I	Parameter Limits step provides the ability to define	the maximum velocity and maximum acceleration limits. Default values are determined using user input in previous Adjuster steps. Refer to the tool-tips for more	<< Back	Next >>	Cancel

This window is used for entering the Maximum Velocity and Maximum Acceleration Limits values.

- MAXIMUM VELOCITY (XVEL) [UNITS/SEC] The maximum allowed value is automatically calculated based on motor parameters that were defined in Components step. Letting the mouse cursor linger on the field displays a tool-tip guiding you in permissible values.
- MAXIMUM ACCELERATION (XACC) [UNITS/SEC²] The Adjuster puts in a value based on motor parameters that were defined in Components step. Letting the mouse cursor linger on the field displays a tool-tip guiding you in permissible values.
- > KILL (Emergency Deceleration KDEC)[deg/sec²]

3.2.6.4.2 Current Limits

My controller - Adjuster Wizard ×					
You are working with Axis: Axis 0					-
Select Task <	Safety and Protection: Curr	ent Limits			
Initialization	Limits on Current Commands				
Axis Architecture	Maximum Current In Idle State* 1.5	Amps 50			%
Components Safety and Protection	Maximum Current In Moving State* 3	Arros 100			%
 Motion Parameters Limits 	Overcurrent Fault Detection	Junita Tana			
> ✓ Current Limits	-				0
Position Errors	Drive				۲
Position Limits	RMS Current Limit* 1.5	Amps 50			%
Miscellaneous Definitions Verification	Advanced				\odot
Axis Setup and Tuning	RMS Time Constant* 3230				ms
Save to Flash					
Axis Duplication	7				
Final Page	7000				
	2 7000 -				
	9				
	0				
	50 60 70 current	80 90 100			
		(4)			
	Motor				
	RMS Current Limit* 2.85	Amps 95			%
	Advanced				\odot
	RMS Time Constant* 20000				ms
	140000				
	70000 Temperature (
	dia dia				
	5				
	0				_
	95 96 97	98 99 100			
	current	[%]			
Safety and Protection: Current Limit specific parameter.	ts step provides the ability to define the cu	irrent protection for the motor and drive. Default values are determined using user input in previous Adjuster steps. Refer to the tool-tips for more information regarding the	<< Back	Next >>	Cancel

This window is used for defining motor and drive protection parameters:

Maximum Current In Idle State (XCURI) - The Adjuster automatically calculates the value from the maximum torque/force required during standstill to overcome gravitation, friction, etc.

If the value cannot be automatically calculated, that is, you have not specified gravitation, friction, etc., the parameter XCURI is set to default.

If you want to set values other than the value displayed, letting the mouse cursor linger on the field displays a tool-tip guiding you in permissible values.

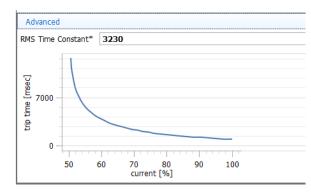
Maximum Current In Moving State (XCURV) - The value is automatically calculated according to minimum of either maximal acceleration (XACC) or motor peak current that you have specified.

If you want to set values other than the calculated one, letting the mouse cursor linger on the field displays a tool-tip providing guidance in changing maximal acceleration or motor peak values.

- > Overcurrent Fault detection The following numeric controls defines Overcurrent Fault detection criterion:
 - RMS CURRENT LIMIT (XRMSD, XRMSM) The value is automatically calculated based on motor/drive parameters that were defined in the Components step. If you want to set values other than the calculated ones, letting the mouse cursor linger on the field displays a tool-tip guiding you in permissible values for the motor and/or drive current limits.
 - RMS CURRENT TIME CONSTANT (XRMSTD, XRMSTM) This is the time interval for checking whether an overcurrent fault has occurred (meaning that XRMSM or XRMSD has been exceeded). The overcurrent fault activation time is according to the following formula:

- Motor: fault activation = -ln(1-(XRMSM/DCOM)²)*XRMSTM For example: if XRMSM=50, DCOM = 100 and XRMSTM = 3300 msec, then fault activation = -ln (0.75)*3300 = 950msec.
- > Drive: fault activation = -ln(1-(XRMSD/DCOM)²)*XRMSTD

If you click the **Advanced** down arrow, the Adjuster displays a graph of the Overcurrent Fault Detection:



When you change parameter values, you can see the effect on the graph.

3.2.6.4.3 Position Errors

My controller - Adjuster Wizard ×			
You are working with Axis: Axis 0			•
Select Task <	Safety and Protection: Position Errors		
Initialization	Critical Position Error Fault Detection		
Axis Architecture		[
Components	Critical Position Error While Idle [mm]*	1000	
Safety and Protection	Critical Position Error While In Constant Velocity [mm]*	1000	
 Motion Parameters Limits 	Critical Position Error While Accelerating [mm]*	1000	
✓ Current Limits	Critical Position Error during KILL (Emergency Deceleration) [mm]*		
→ Position Errors	Critical Position Error during Kall (Emergency Deceleration) [mm]	1000	
Position Limits Miscellaneous Definitions	Advanced Parameters		۲
Verification			
Axis Setup and Tuning			
Save to Flash			
Final Page			
Safety and Protection: Position Erro	In step provides the ability to define the criteria for the critical and no	n-ortical position error detection. Refer to the tool-tips for more information regarding the specific parameter. A time diagram is provided in the elerating-to-Moving Transition Delay.	
Advanced Parameters section to sh	ow the practical usage of the Moving-to-Idle Transition Delay and Acc	elerating-to-Moving Transition Delay.	<< Back Next >> Cancel

This window is used for defining Critical Position Errors criteria:

- > Critical Position Error While Idle (CERRI)
- > Critical Position Error While In Constant Velocity (CERRV)
- > Critical Position Error While Accelerating (CERRA)
- > Maximum Critical Position Error during kill (CERRK)

If you click the **Advanced** down arrow, the Adjuster displays the following:

u are working with Axis:	Axis 0		
	Safety and Protection: Position Errors		
Initialization	Critical Position Error Fault Detection		_
Axis Architecture	Critical Position Error While Idle [mm]*	1	
Components Safety and Protectic	Critical Position Error While In Constant, Velocity [mm]*	1	
 Motion Parameter 			
✓ Current Limits	Critical Position Error While Accelerating [mm]*	1	
→ ✓ Position Errors	Critical Position Error during KILL (Emergency Deceleration) [mm]*	1	
✓ Position Limits			
Miscellaneous Definit	Advanced Parameters Non-critical Position Error Fault Detection		
Verification	Allow Position Error Fault Detection		
Axis Setup and Tuni			
Save to Flash	Position Error While Idle [mm]	1	
Axis Duplication Final Page	Position Error While in Constant Velocity [mm]	1	
rinai Page	Position Error While Accelerating [mm]	1	
	Motion Phase Transition Delay		
	Moving-to-Idle Transition Delay [ms]	50	
	Accelerating-to-Moving Transition Delay [ms]	50	
	Kil-to-Idle Transition Delay [ms]		
	Kil-to-Idle Transition Delay [ms]	50	
	v		
	↑ PE > ERRI PE > EI	RRA PE > ERRV PE > ERRA PE > ERRI	
	or or	or or or	
	(PE > CERRI) (PE > CE	ERRA) (PE > CERRV) (PE > CERRA) (PE > CERRI)	
		DELV	
		t	

This enables you to set values for Non-critical Position Errors whereby excessive errors that might affect the application are flagged:

- > Non-critical Position Error Fault Detection
 - > Position Error In Idle (ERRI)
 - > Position Error While In Constant Velocity (ERRV)
 - > Position Error While Accelerating (ERRA)
- > Motion Phase Transition Delay
 - > Moving-to-Idle Transition Delay (DELI)
 - > Accelerating-to-Moving Transition Delay (DELV)
 - > Kill-to-Idle Transition Delay (DELK)

•	A diagram illustrating the meaning of the delay is included.
---	--

3.2.6.4.4 Position Limits

My controller - Adjuster Wizard X			
You are working with Axis: Axis 0			•
Select Task <	Safety and Protection: Position Limits		
Initialization	Position Limits		
Axis Architecture	Alow Soft Upper Position Limit Fault Detection		
Components			
Safety and Protection	Soft-Upper Position Limit [mm] 2E+014		
 Motion Parameters Limits 	Allow Soft Lower Postion Limit Pault Detection		
✓ Current Limits	Soft Lower Position Limit [mm] -2E+014		
✓ Position Errors			
> V Position Limits			
Miscellaneous Definitions			
Verification			
Axis Setup and Tuning			
Save to Flash			
Final Page			
Cafety and Distortion Desition Line	is step provides the ability to define software position limits. Refer to the tool-tips for more information regarding the specific parameter.		
Sarety and Protection: Position Lim	is step provides the ability to define sortware position minis. Refer to the took-tps for more mormation regarding the SpECIC parameter.	<< Back Next >>	Cancel
3			

This window defines Software Position Limits and enables you to select:

- ALLOW SOFT UPPER POSITION DETECTION (SRLIMIT) If Software Right Limit Mask is selected, then the controller examines the fault and kills the motion that is beyond the defined limit.
- ALLOW SOFT LOWER POSITION DETECTION (SLLIMIT) If Software Left Limit Mask is selected, then the controller examines the fault and kills the motion that is beyond the defined limit.

3.2.6.5 Miscellaneous Definitions

The Miscellaneous Definitions step enables you to set values of sets of variables of up to four possible types, depending on the system configuration.

	-	
	<u> </u>	

The actual number of parameter types and parameters available to you depends on what you defined in the Axis Architecture and Components steps.

The Adjuster displays values it has calculated in the window of each type. You have the option of changing these within the limits of valid values.



A complete explanation of each parameter is given in the **Tool Tips** associated with the parameter.



For the meanings of the variables see the *SPiiPlus Command & Variable Reference Guide*.

3.2.6.5.1 Motion Completion

Motion is considered completed once the position is within a window of TARGRAD user units and has not exited this window for a period of SETTLE ms.

My controller - Adjuster Wizard ×	
You are working with Axis: Axis (
Select Task <	Miscellaneous Definitions: Motion Completion
Initialization	End of Motion Criterions
Axis Architecture	
Components	Target Radus [rm] 1
Safety and Protection	Setting Window Time [ms] 0
Miscellaneous Definitions	
> V Motion Completion	Shown in detail in
Enable / Disable / Brake	next figure
Dynamic Brake	
Home Switch	
Verification	TO subar your
Axis Setup and Tuning	Boosition Position
Save to Flash	L south for
Axis Duplication	Bosition and the standard st
Final Page	Bostific Participation of the state of the s
	Motion Motion Time Motion
	Start Complete
	Event Event
1	Motion
	Complete
1	Event
	position v t (user units)
	Feedback variable Position (msc)
	1_ Motion Time Time
	Motion Motion
	Start Complete
	Event Event
Miscellaneous Definitions: Motion O	Completion step provides the ability to define the criteria for when a motion is considered complete. Refer to the tool-tips for more information regarding the specific parameter. A time diagram is provided to show how <
the Motion Completion calculation	s done in the controller.

There are two variables, both optional, for which you can enter values:

- > Target Radius (TARGRAD)
- > Settling Time (SETTLE)

To aid your understanding a diagram is included showing the meaning of the two variables.

3.2.6.5.2 Enable/Disable/Brake

This window is used for defining the Enable operation and Mechanical Brake timing.

< Mise	cellaneous Definitions: Enable / Disable / Brake			
	mand Delay			
tuno	rotracted Enable			
Totection				
	hanical Brake			
/ Disable / Brake	se Mechanical Brake			
Brake Brake	Release Time [ms] 50			
	Engagement Time [ms] 50			
	Output None		 No available bits 	
nd Tuning				
	Enable Timing with negative BOFFTIME		with positive BONTIME	Disable Timing with negative BONTIME
on	Enable Timing with positive BOFFTIME (commutated	controller)	Enable Timing with po	sitive BOFFTIME (not commutated controller)
		Preliminary Operation 200 ms	Brake output signal Servo is ON Enable output signal to drive ns ENTIME BOFFTIME 50 ms 50 ms	
ENTI Enab Servo	troller was commutated before EHABLE command IME-50; BOFFTIME-50 de output signal to drive (blue ine) – based on measurement phase current or 50 (ir (ed ine) – based on measurement DSP vanable MPU X_CONTROL e output signal (vole ine) – based on orbake current measurement			

The variables you can define are:

- PROTRACTED ENABLE This is optional, but if you select it, you must put a value in Enable Delay (ENTIME). The controller delays the Enable Command by ENTIME mSec.
- > **USE MECHANICAL BRAKE** You need to select this only if the application has a mechanical brake; otherwise leave it unselected. If you select it, you have to enter values for:
 - > **BRAKE RELEASE TIME (BOFFTIME)** This value can be positive or negative and sets when the brake is released.
 - BRAKE ACTIVATION TIME (BONTIME) This value can be positive or negative and sets when the brake is applied.



You are also informed of the Digital Output variable (**OUTx.x**) that will contain the state of brake. Make sure that you include it in your program to test the brake status.

To aid you in determining the values of **BOFFTIME** and **BONTIME** you can see diagrams of the effect these values have by clicking the appropriate tab.

3.2.6.5.3 Dynamic Brake

This window enables you to activate (or deactivate) the dynamic brake.

1	

This option is active only for those axes having a built-in drive.

My controller - Adjuster Wizard ×		
You are working with Axis: Axis (•
Select Task <	Miscellaneous Definitions: Dynamic Brake	
Initialization	Priane Brake	
Axis Architecture		
Components	Use Dynamic Brake	
Safety and Protection	Threshold Velocity [mm/sec] 5.202617	
Miscellaneous Definitions		
Motion Completion		
✓ Enable / Disable / Brake		
> 🗸 Dynamic Brake		
Home Switch		
Verification		
Axis Setup and Tuning		
Save to Flash		
Axis Duplication		
Final Page		
1		
1		
Miscellaneous Definitions: Dynamic	II Brake step provides the ability to activate or deactivate the dynamic brake. The threshold velocity can also be specified. This feature is only available for an axis with a built-in drive.	
		<< Back Next >> Cancel

You activate a dynamic brake by:

- 1. Selecting **Use Dynamic Brake** (this sets the **MFLAGS#DBRAKE** bit for the axis), and then
- 2. Entering a Threshold Velocity (VFLBRK) value.

Braking will occur when both of the following two conditions are met:

- > The motor is disabled.
- > The feedback velocity (FVEL) is less than VFLBRK.

3.2.6.5.4 Home Switch

This window enables you to specify a digital input (**IN**) to signal when the motor is in its home position.

In a SPiiPlus motion controller there is no dedicated Home Switch. You use this **Adjuster** option to check a value that you want to be the Home Switch. Once you have completed the **Adjuster**, and tested the value (adjusting it as needed), you then have to incorporate the value into your motion program.

My controller - Adjuster Wizard ×				
You are working with Axis: Axis 0				•
Select Task <				
Initialization	Moseswith			
Axis Architecture				
Components	Home Switch Input [1910]			•
Safety and Protection	Default Homing Method Homing on the current position			
Miscellaneous Definitions				
 Motion Completion 				
✓ Enable / Disable / Brake				
✓ Dynamic Brake				
> ✓ Home Switch				
Verification				
Axis Setup and Tuning				
Save to Flash Axis Duplication				
Final Page				
rinai rage				
Miscellaneous Definitions: Home Sv	itch step provides the ability to specify a digital input as the Home Switch input.	<< Back	Next >>	Cancel

The Home Switch can be **None** or you can select the digital input variable from the **Home Switch** dropdown list:

Home Switch Input	None	-
	None	
Default Homing Meth	INO	
	IN1	- 1
	IN2	- 1
	IN3	- 1
	IN4	- 1
	IN5	- 1
	IN6	- 1
	IN7	- 1
	IN9	- 1
	IN10	- 1
	IN11	- 1
	IN14	- 1
	IN15	- 1
	IN16	- 1
	IN17	- 1
	IN18	- 1

In addition, the user can chose the default homing method from the list shown below.

		_
Default Homing Method	Homing on the current position	•
	Not in use	
	Negative limit switch and index pulse	
	Positive limit switch and index pulse	
	Negative Limit Switch	
	Positive Limit Switch	
	Negative Index pulse	
	Positive Index pulse	
	Homing on the current position	
	Negative Hard Stop and Index pulse (ACS Specific)	
	Positive Hard Stop and index pulse (ACS Specific)	

3.2.6.6 Verification

The Verification step examines the values you have entered and verifies that they are valid.

Verification is performed on the following:

- > Feedback devices
 - > Limit switches

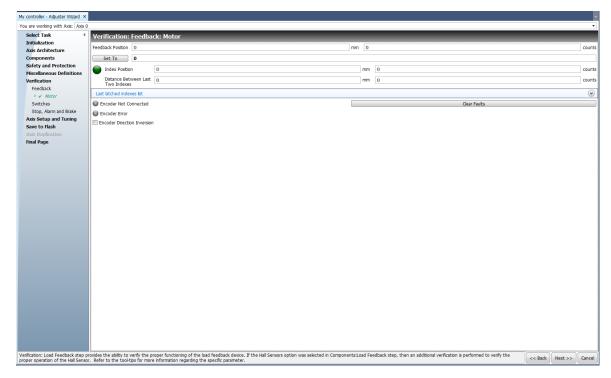
- > Hardware Emergency Stop
- > Mechanical Brake

There are three "LED" indicators used throughout the Verification windows:

•	Indicates that the item passed verification
•	Indicates that the item failed verification
•	Indicates that the item is not active

3.2.6.6.1 Feedback

This window verifies that the feedback values are valid.



Depending on what you defined in Components, the window displays the values for:

- > Load
- > Motor



If you have defined both Load and Motor as feedback components, there is one page for Load and one page for Motor.

On this page:

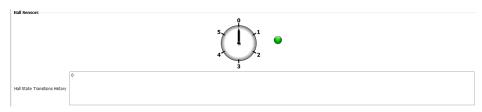
- > Check that there are no encoder faults.
- > Check that encoder counts in the right direction. If it does not, click the **Encoder Direction Inversion** check box to reverse the direction
- > Check that the index is working properly by manually moving the motor. The motor should be moved slowly to ensure that each index is latched and displayed.
- > Check that calculated distance between indexes is correct.

You can view a list of the last latched indexes by clicking the down arrow of the **Last latched indexes list**. To clear this list click **Clear List**.

There are two LEDs in this window relevant to the encoder:

- Encoder Not Connected Fault (FAULT.#ENCNC) green indicates that this fault was not detected.
- > Encoder Error Fault (FAULT.#ENC) green indicates that no encoder fault was detected.

If you selected **Hall Sensors** in **Components:** Feedback, the following is displayed:



The connection sequence of the three Hall Sensors is not important. You only have to verify that the three Hall sensors are connected and the Hall counter counts 0,1,2,3,4,5 or vice versa. It does not matter if the Hall counters count opposite to the encoder. This will be identified and taken care of during Axis Setup and Tuning.

The diagram shows:

- > Feedback Position (FPOS) the position in user units.
- > Hall State the Hall State transitions: $0^{a_1a_2a_3a_4a_5}$ or $5^{a_4a_3a_2a_1a_0}$.

The history of the Hall State transitions is displayed under the diagram.

To test the Hall Sensors:

- 1. Rotate the motor by hand in one direction. The diagram should show the expected Hall state transitions.
- 2. Rotate the motor by hand in opposite direction. The diagram should show the expected Hall state transitions.

Correcting Feedback Values that Fail Verification

Where feedback values fail verification:

- 1. Return to the **Components:**Feedback step by clicking **Components** in the Task List, then click **Feedback**. The **Components:Feedback** window is displayed.
- 2. Click **Edit** () and enter a new value or values.



Those values that can be changed are displayed in bold face. Values that cannot be changed are grayed out.

3. Click **Update in Database** and click **Next**. The **Components:Calculate Parameters** window is displayed.

t Task Components: Calculat	a Paramotore	
lization	e rataliteters	
Architecture	Calculate Parameters	Apply Changes
Motor Name	Existing Value	Calculated Value
Drive	Looding vinos	
edback		
✓ Notor		
Calculate Parameters		
y and Protection		
daneous Definitions cation		
Setup and Tuning		
to Flash		
Duplication		
Page		

- Click Calculate Parameters then click Apply changes.
 Adjuster recalculates the values of the low-level controller parameters and applies them to the appropriate variables.
- 5. Click **Verification** in the Task List to return to **Verification** and check if the new value(s) pass verification.

3.2.6.6.2 Switches

This window is used for verifying the that actual limit switches are properly connected.

You ze words with Xee Xee Seket Taki Verifications Asis Achiterue Imit Switch Position Seket Taki Verifications Verifications Verifications Sex toriseit	My controller - Adjuster Wizard $ imes $								-
Initialization Axis Architecture Components Init Switche Safety and Protection Verification Verification Verification Seeback	You are working with Axis: Axis 0				_				•
Axis Architecture Components Immersion Nover Fault Limit Switch Position Safety and Protection Hiscolaneous Definitions Lover Position Immersion Mescalaneous Definitions Upper Position Immersion Verification Immersion Immersion Feedback Feedback Position Immersion Verification Immersion Immersion Systechers Set To Immersion Verification Immersion Immersion Systechers Set To Immersion Axis Stoppation Immersion Immersion			witche	: S					
Components Introgic Detection Fault Limit Switch Position Safety and Protection Lover Positon Image: Detection Image: Detection Miscellenous Definitions Uper Positon Image: Detection Image: Detection Verification Image: Detection Image: Detection Image: Detection Verification Image: Detection <tdi< th=""><th></th><th>Limit Switches</th><th>c 1</th><th></th><th></th><th></th><th></th><th></th><th></th></tdi<>		Limit Switches	c 1						
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Miscellaneous Definitions Upper Poston Feedback Upper Poston Feedback Image: Constraint of the second of the secon		Lower Position				0			mm
Vertradult Feedback Feedback Feedback Poston V Motor Feedback Poston Swtches Set To Mone Switches Mone Switches Save to Flash Mone Switch Input	Miscellaneous Definitions					a			mm
· Motor Feedback Poston 0 · ✓ Stor, Alemand Brake Set To 0 Axis Setup and Tuning Set To 0 Save to Flash Home Switch Bruy 0		Opper Position		×	•	0			m
V Stock Set To 0 V Stock Set To 0 Axis Duplication Imme Switch Input 0		Feedback Position	0						mm
✓ Stop, Alim and Bake Axis Setup and Tuning Save to Flash Home Switch Input									mm
Axis Secup and rump Save to Fash Axis Duplication									
Axis Duplication	Axis Setup and Tuning								
		Home Switch Input	0						mm
	Final Page								
Verification: Switches provides the ability to define the parameters for the Linkt and Home switches. Refer to the tool-tops for more information regarding the specific parameter.	Verification: Switches provides the	ability to define the pa	rameters f	for the Limit	and Ho	e switches. Refer to the tool-tips for more information regarding the specific parameter.	<< Back	Next >>	Cancel

Verification of Switch Operability

The LEDs indicate if the switches are properly connected or not. The switches are:

- > Upper Position Limit (SAFINI.#RL)
- > Lower Position Limit (SAFIN.#LL)

that you set in Safety and Protection: Position Limits.



If you have selected a digital input variable in **MISCELLANEOUS DEFINITIONS** Home Switch, its value is also displayed.

To verify that the switches are properly connected manually move the motor into the switch and check if the Fault LED turns red.

If it does not turn red, this means that there is something wrong with the switch. Check its connection and if it is operational.

Fault Detection Settings

You have the options of:

> Enable/disable fault detection (FMASK.#RL for upper limit, FMASK.#LL for lower limit) by selecting the appropriate check box.

	If the bit is empty, the controller does not detect the fault.
>	Inverting the detection logic (SAFINI.#RL for upper limit and SAFINI.#LL for lower limit) by selecting the appropriate check box.

Feedback Setting

- 1. To set the feedback (FPOS) to a particular value:
- 2. Enter the value in the **Set To** field.

Click Set To

- this resets the position and the Adjuster starts counting from this position.

3.2.6.6.3 Stop, Alarm and Brake

This window verifies the status of Hardware Emergency Stop and Mechanical Brake.

Select Task < Initialization						
Initialization	Verification: Stop, I	Alarm and	l Brake			
	Hardware Emergency Sto				 	
Axis Architecture		Inverse A	Allow Fau	de-		
Components		Logic Det		nt		
Safety and Protection	Hardware Emergency Stop					
Miscellaneous Definitions	Drive Fault					
Verification	Diwe Fault	1000				
Feedback	Mechanical Brake					
✓ Motor	Mechanical Brake Output					
✓ Switches						
✓ Stop, Alarm and Brake						
xis Setup and Tuning ave to Flash						
ds Duplication						
nal Page						
iai raye						

The window shows the status of the:

- > Hardware Emergency Stop (S_SAFIN.#ES)
- > Drive Fault / Laser Fault (SAFIN.#DRIVE)

You have the options of:

Enable/disable fault detection (S_FMASK.#ES for Hardware Emergency Stop and S_ FMASK.#DRIVE for Drive Fault / Laser Fault) by selecting the appropriate checkbox.

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	<u> </u>

If the bit is empty, the controller does not detect the fault.

Inverting the detection logic (S_SAFINI.#ES for Hardware Emergency Stop and SAFINI.#DRIVE for Drive Fault / Laser Fault) by selecting the appropriate checkbox.

3.2.6.7 Axis Setup and Tuning

The Axis Setup and Tuning step enables you to fine tune your system. There are a total of six possible options:

- 1. Current Loop
- 2. Current Phase Offset
- 3. Commutation
- 4. Open Loop Verification
- 5. Position and Velocity Loops
- 6. Position Verification



The options that are available to you depend on the definitions you entered in Components.

3.2.6.7.1 Current Loop

Current Loop enables you to adjust the current loop.

 Current Loop adjustment applies only to:

 PWM, Digital Current Control, controller-drive interface with:

 DC brushless/AC servo motor (two or three phase)

 Step motor (with feedback, close loop)

 DC brush or single phase motor

 AC induction motor

 Analog (±10V), Digital Current Control, controller-drive interface with

 Three phase DC brushless/AC servo motor

 DC brush or single phase

Two current loop tuning methods are available:

> Auto tuning - The auto tuning process calculates the current loop parameters from values measured by the frequency response.

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> Manual tuning - The manual tuning process calculates the current loop parameters from a step response with parameters you set. Manual tuning is optional.

Auto tuning

The calculated current loop parameters are:

- > The Proportional Gain (SLIKP)
- > The Integrator Gain (SLIKI)
- 1. To start the auto tuning process, click **Start Auto Tuning**.

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langes to
0.1902.12

- > When the auto tuning process is complete, the LED returns to "gray" and **Done** shows to the right of it.
- 2. When the auto tuning is complete, click **Next** to go to the next adjustment.

During current loop tuning, the motor is enabled and no position or velocity control is executed. To remove the risk of motor motion due to gravity, do the following:

For motors with mechanical brake, it is necessary to:

- 1. Set MFLAGS.23 = 0
- 2. Tune the current loop.
- 3. When the current loop tuning is complete,set MFLAGS.23=1 to activate the mechanical brake.

For products that do not have a dedicated mechanical brake output, it is necessary to:

- 1. Send setconf(29, 0, AANNOO) with an appropriate AANNOO value
- 2. Tune the current loop.
- 3. Send setconf(29, 0, AANNOO) with an appropriate AANNOO value.

Auto tuning with Use Initial Parameters During Measurement (Optional)

If necessary, the current loop auto tuning can be done from initial parameters that you set. The parameters are:

- > Motor resistance phase-to-phase
- > The rectified bus voltage
- > Initial excitation current

To start the Auto Tuning process with the optional **Use Initial Parameters During Measurement**:

- 1. Click Use Initial Parameters During Measurement (Optional) check box.
- 2. Enter the values in the applicable field.
- 3. Select Start Auto Tuning.

Axis Setup and Tu	ining: Current Loop	
Auto Tuning		٢
📝 Use Initial Parameters D	During Measurement (Optional)	
R p-p [Ohm]		
Vbus [V] DC		
Excitation current [%] Ip	2	
	Start Auto Tuning	
Fine Tuning		٢
Tuning Level	Normal	Ŧ
	Fine Tune	

4. When the auto tuning is complete, click **Next** to go to the next adjustment.

Fine Tuning

When Auto tuning is complete, a **Fine Tuning** process can be done. Auto fine tuning is only for PWM drives with good linear properties. You can do fine tuning for three different types of drives :

- > Weak (PWM drives with poor linear properties)
- > Normal (PWM drives with good linear properties)

- > Strong (PWM drives with good linear properties)
- 1. To start fine tuning, click **Fine Tuning** drop down icon to show the different tuning levels.
- 2. Select the applicable drive.
- **3**. Click **Fine Tune**.

Variables Manager and Wat	tch Adjuster Wizard X					Ŧ
You are working with Axis:	Axis 0					•
Select Task <	Axis Setup and Tuning: Current Loop					
Initialization	-					\bigcirc
Axis Architecture	Auto Tuning					
Components	Use Initial Parameters D	uring Measurement (Optional)				
Safety and Protectic		Start Auto T	uning 📄 🔘 Done			
Miscellaneous Definit	Fine Tuning					\bigcirc
Verification	Tuning Level	Normal				
Axis Setup and Tuni	runing Lever	Weak				
> ✓ Current Loop		Normal				
Current Phase Offse	Control Parameters	Strong				
 Commutation 	P (Proporcional Gain)	141.085083				
Open Loop Verificat	I (Integrator Gain)	10790.441064				
Position and Velocit	1 (Integrator Gain)	10790.441004				
Settings and Ide Basic Tuning	Manual Tuning (Optional	al)				
Bandwidth and S	Step Response					•
Advanced Tuning						0
Position Verification						
Save to Flash						
Axis Duplication						
Final Page						
r nar r uge						
0						
Axis Setup and Tuning: Cur control modules with intern	rrent Loop step provides the nal drives. Refer to the tool-	ability to adjust the current loop to optimize the performance of tips for more information regarding the specific parameter.	of the internal drive. This step is only applicable for	< Back	Next >>	Cancel

4. When the fine tuning is complete, click **Next** to go to the next adjustment.

Manual Tuning (Optional)

If you select manual tuning, you can set the proportional gain (SLIKP) and the integrator gain (SLIKI).

- 1. Click the **Manual Tuning** check box.
- 2. Enter the values in the applicable field.

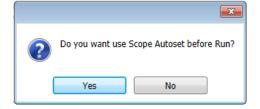
Variables Manager and Wa	tch Adjuster Wizard	×					
You are working with Axis:	Axis 0			+			
Select Task <	Axis Setup and T	uning: Current Lo	00p				
Initialization	Auto Tuning	<u> </u>					
Axis Architecture	Use Initial Parameters	During Measurement (On	ntional)				
Components Safety and Protectic		builing Housardmone (op					
Miscellaneous Definit		Start Auto Tuning O Done					
Verification	Fine Tuning			•			
Axis Setup and Tuni	Control Parameters						
> ✓ Current Loop	P (Proportional Gain)	141.085683					
Current Phase Offse	I (Integrator Gain)	10790.441064					
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Open Loop Verificat Position and Velocit	Step Response	,		$\overline{\mathbf{v}}$			
Settings and Ide							
Basic Tuning							
Bandwidth and S							
Advanced Tuning							
Position Verification							
Save to Flash Axis Duplication							
Final Page							
r nur ruge							
Axis Setup and Tuning: Cu control modules with interr	rrent Loop step provides the nal drives. Refer to the too	ne ability to adjust the cu pl-tips for more information	Irrent loop to optimize the performance of the internal drive. This step is only applicable for n regarding the specific parameter.	incel			

3. Click **Next** to go to the next adjustment.

Step Response

Use step response to verify the proportional gain and integrator gain. The required parameters to do a step response are:

- > Current level
- > Pulse width
- 1. To start the step response, click the **Step Response** drop down box to show the parameter fields available.
- 2. Enter the parameter values.
- 3. Click **Check Step Response**. A dialog box opens and shows the message.



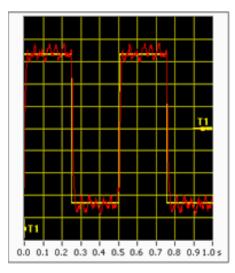
4. Select the applicable condition.



When the step response starts, the **Check Step Respnse** button changes to **Stop** and the LED next to it flashes "green".

5. To make adjustments on the signal:

> Increase the Proportional Gain (SLIKP) until the response waveform approximates a square and a small overshoot appears, for example:



- > Increase the Integrator Gain (SLIKI) by hundreds, until you get a narrow overshoot of 10% to 20%.
- 6. When you achieve the optimal values, click **Stop**. Close the Scope.
- 7. Click **Next** to go to the next adjustment.

3.2.6.7.2 Current Phase Offset

The Current Phase Offset window enables you to verify, and, if needed, adjust the values of the current phase offset.

Current Phase Offset applies to Analog (±10V) controller-drive interfaces with two or three phase DC brushless (AC servo) motor connected to an external drive with two drive command inputs (also known as a UV drive).

Theoretically, the drive should produce zero voltage in the three phases when the controller drive commands are zero. If, however, the drive outputs have a bias voltage when the controller commands are zero, this can be corrected with the SLBIASA and SLBIASB variables.

If the external drive is a current drive, it must be connected to the motor while doing the bias adjustment. If it is a voltage drive, it doesn't have to be connected.

#New Board - Adjuster Wizard								×
You are working with Axis:				Axis 0 (X)				
Select Task Initialization	Axis Set	up and Tuning	j: Current Ph	ase Offset				
Axis Architecture Components				Enable Motor				
Safety and Protection	Current Phase Offset							
Miscellaneous Definitions Verification	Phase R Offset	0.192749					(%)	nax current)
Axis Setup and Tuning	Phase S Offset	-0.191406					(%)	nax current)
Axis Setup and Tuning: Current Phase Offs drive analog inputs. The procedure should	et step provides th be repeated when	e ability to adjust the bia ever a drive or controller i	s voltages that may e: is replaced. The proce	xist in the controller DAC o dure assumes that a brush	utputs or the hless motor is	A Sack	Next >>	Cancel

There are two current phase offset variables:

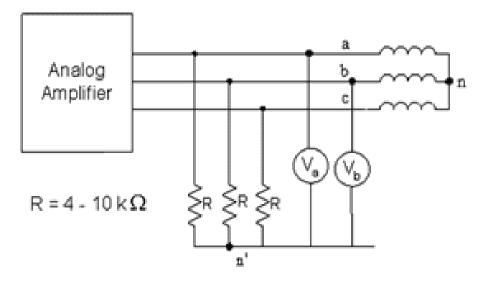
- Phase R Offset (SLBIASA) which contains the maximum controller voltage output (expressed as a percentage).
 - > For integrated models: SLBIASA specifies the measured value of the current input bias of Phase R.
 - > For nonintegrated models: SLBIASA specifies the bias of the drive output. The controller uses the value only for brushless motors commutated by the controller.
- Phase S Offset (SLBIASB) which is used for defining the maximum controller current (expressed as a percentage).
 - For integrated models: SLBIASB specifies the measured value of the current input bias of Phase S.
 - > For nonintegrated models: SLBIASB specifies the bias of the drive output. The controller uses the value only for brushless motors commutated by the controller.

Click **Enable Motor** and check that the LED turns green.

If the LED turns red, this means that one or both values need to be adjusted, in which case, the variables **SLBIASA**, **SLBIASB** have to be adjusted to bring both readings as close to zero as possible. This can be done by a single voltmeter (or multimeter) as follows:

- 1. Make sure that the value of the **DOUT** variable is zero (you can query it from the **Communication Terminal**, for example: **?X_DOUT**).
- Connect the voltmeter between phase "R" and the motor neutral point, and adjust SLBIASA to make the reading as close to zero as possible. A typical range is ±10%. The value can be either positive or negative.
- 3. Connect the voltmeter between phase "S" and the motor neutral point, and adjust **SLBIASB** to make the reading as close to zero as possible.

If the neutral point is not accessible, or the motor is connected in delta, you may create an "artificial" neutral point by connecting three-phase resistors in parallel to the motor. The 3 resistors should be identical, in the range of 4-10 k Ω . Then you should measure relative to the artificial neutral as shown in the following drawing:



When you are done, click **Next** to go to the next window.

3.2.6.7.3 Commutation

The Commutation window enables you to adjust motor commutation and generate a commutation startup program.



Commutation applies only for DC brushless (AC Servo) motors. It will appear in the Adjuster tasks only if motors of this type have been defined as part of the system.

Adjuster and Commutation

In a DC brush motor, a fixed magnetic field created by permanent magnets in the stator interacts with the armature current flowing in the rotor winding. The interaction of the current-carrying conductors with the magnetic field produces a torque (or force in the case of a linear motor). This torque/force is at its maximum value when the magnetic field vector is perpendicular to the resultant current vector.

The mechanical commutator of a DC brush motor distributes the motor current among the windings such that the resultant current vector remains perpendicular to the magnetic field vector at any position and speed. This process is referred to as commutation.

In a DC brushless/AC servo motor, on the other hand, an electronic drive takes the place of the mechanical commutator, keeping the resultant current vector perpendicular to the magnetic field vector by controlling the phase currents.

The **Adjuster** Commutation process creates a startup program that is loaded into the controller which enables the controller to commutate the drive correctly based on the motor and encoder electrical properties.



For this reason the **Adjuster** Commutation has to be performed for every new system. Once it has been performed, whenever a new motor or encoder is introduced into your system so long as you do not change the type of motor or encoder, you do not have to perform it again.

SPiiPlus motion controllers support three types of drives for 3-phase DC brushless/AC servo motors:

- > **Universal Internal Drive** (such as SPiiPlus CM and MC4U drives). Commutation is performed by the controller as part of its Field-Oriented Control algorithm.
- Two-Input Drive (such as SPiiPlus SA controller or SPiiPlus PCI card with a Sine Wave Brushless Amplifier). The drive receives two current commands from the controller, reflecting required current for two of the motor phases. In this case <u>the controller is</u> <u>responsible for commutation</u>.
- One-Input External Drive (such as a SPiiPlus SA controller with an Analog Input Brushless Amplifier). This drive receives a single current command from the controller (±10V), reflecting the required current amplitude, and takes care of the commutation by itself.



Commutation needs to be done only for types 1 and 2.

Motor commutation requires an initial setup process in which an initial current vector is generated and the magnetic field of the motor aligns with it (at what is called a *detent point*). Once the magnetic field is aligned with the current vector, it is shifted 90° thereby achieving maximum torque/current ratio.

Since the commutation angle depends on the motor position, the commutation process has to be done only once for an absolute encoder but after every power-up for incremental quadrature and Sin/Cos encoders – since the motor position is not known.

Therefore, when working with an incremental encoder and a DC brushless motor, commutation setup must be executed after every powerup. For this reason you can use **Adjuster** to generate and store a **Commutation Startup Program**.

The **Adjuster** executes a program that performs Commutation Adjustment setup. The program supports several commutation schemes (procedures). You select the most appropriate scheme for your application. In most cases, the commutation scheme will include the following steps:

- 1. Find a detent point.
- 2. Identify the phase sequence both of the motor and the encoder.

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- 3. (Optional): Verify variables (number of poles or magnetic pitch, encoder resolution) by moving the motor several magnetic pitches and comparing the encoder feedback with the expected results.
- 4. (Optional): Move to the index and save the commutation phase at that point to the controller flash memory.

The **Commutation Startup Program** is an ACSPL+ program that is used to retrieve commutation. It can be executed upon every powerup (once the system has been setup). The startup program can be based either on bringing the motor to a detent point (usually involves movement) or on **automatic commutation (COMMUT** command), which is fast commutation retrieval using a closed-loop algorithm (and involving almost no motor movement).



When the current vector is aligned with the magnetic field during commutation, the motor can jump. The maximum jump is one magnetic pitch (180 electrical degrees) of the motor in either direction. If the motor bumps into an obstacle, the commutation setup algorithm will attempt recovery. The recovery may involve additional abrupt moves.

To prevent possible damage or injury, it is recommended that the motor be initially positioned at least one magnetic pitch away from any obstacles.

Variables Manager and Wa	itch Adjuster Wizard 🗙						
You are working with Axis	Axis 0		•				
Select Task <	Axis Setup and Tuning: Commutation						
Initialization	Commutation Program St	ndard Run in Buffer 0	▼ Default				
Axis Architecture Components	Preferences		<u> </u>				
Safety and Protectic							
Miscellaneous Definit	Excitation Current 2		% of maximum				
Verification	Search Velocity 1	0000	count(s)/sec				
Axis Setup and Tuni	Settling Window Time 1	00	ms				
✓ Current Loop Current Phase Offse	Retrieve Commutation A						
> ✓ Commutation	Advanced Parameters		\odot				
Open Loop Verificat Position and Velocit	Initial Commutation Offset	0	degrees				
Settings and Ide	Maximum Search Distance	Two Rotations	•				
Basic Tuning Bandwidth and S	Verify Control and Feedback Parameters						
Advanced Tuning Position Verification	Display Detailed Commutation Results						
Save to Flash Axis Duplication	Number of Magnetic Pitches to Measure	4					
Final Page	Make sure that the unsolicited messages are not shown in Communication Terminal, otherwise the commutation program output will be partially shown in Communication Terminal and partially in commutation program output window.						
		Start Commutation Program					
		Generate Startup Program					
		Run Startup Program					
	Commutation Program	Dutput					
			1				
Axis Setup and Tuning: Co commutation performed b	mmutation step provides the y the controller. Refer to th	ability to perform a motor commutation and generate a start-up program. This step only applies tool-tips for more information regarding the specific parameter.					



When the page is first displayed, **Preferences** and **Advanced Parameters** are not displayed. It is strongly recommended that you expand both and view all the options available to you.

Your options are:

Preferences



When initially setting **Preferences**, you should first use the default values (by clicking Default). This will set the commutation parameters in accordance with the settings you have entered in previous steps of the Adjuster.

Excitation Current	Determines the amplitude of the current vector that is used for commutation setup. The value should not exceed the nominal current ratings of the drive and the motor. The default value is: 0.95 × XRMS .					
	Things you should consider:					
	Due to friction and load, a low excitation current may result in poor alignment between the current vector and the magnetic field, resulting in unsatisfactory commutation.					
	 On the other hand, too high an excitation current with a low friction system (inadequate damping) may result in excessive oscillation and even in mechanical damage. 					
	It is recommended starting the commutation process with an excitation current of 0.4 x XRMS . If the results are not successful, repeat this task with higher excitation current values.					
Search Velocity	Determines the velocity of the current vector during the commutation process. During this process the motor position follows the current vector in order to align the magnetic axes. It is recommended to set a velocity lower than one magnetic pitch per second and higher than one fifth of a magnetic pitch per second.					
Settling Window Time	Determines the time assigned to the motor for settling at detent points.					
	In all the schemes except the powerup position scheme, the following steps are performed:					
	> Settle at a first detent point.					
	 Move the current vector to identify the phase sequence. Automatically correct for wrong polarity. 					
Retrieve	If the feedback indicates that the motor has moved less than 50% of the expected distance, it is assumed to have run into an obstacle and the program tries to recover in the opposite direction.					
Commutation Phase at	 Retrieve the commutation phase according to the selected scheme. 					
	Considerations when selecting a Commutation Scheme:					
	 Based on detent point: If the feedback device has no index, this is the only scheme that can be used. If the feedback device does have an index it is recommended to use one of the "index" schemes so that the index can be used as an absolute reference point for commutation phase retrieval at subsequent powerups. 					
	2. Based on index: Saves the value of the commutation phase at the index position. This value can be used at subsequent system					

powerups to achieve the same commutation result. Six variations of this scheme are available:

- > First Index in Positive Direction
- > First Index Next to Right Hard Stop
- > First Index Next to Right Limit Switch
- > First Index in Negative Direction
- > First Index Next to Left Hard Stop
- > First Index Next to Left Limit Switch
- 3. Other
- > Powerup Position
- > Hall Signals Transition
- > Current Absolute Position

Advanced Parameters

	Determines the initial value of the commutation phase, and, thereby, the initial orientation of the current vector and the initial detent point.
Initial Commutation Offset	By properly setting this offset, you can avoid an initial jump in a system with a predefined startup position. For other systems it can be used to determine a specific target position for the initial jump.
	If no information is known about the relationship between the current vector and the motor position, it should be set to 0 (the default).
Maximum Search Distance	Sets the maximum allowed distance for searching for targets (index or limits). It is recommended to set the variable according to the operational distance.
Verify Control and Feedback Parameters	Causes the system verify the encoder and motor variables during the initial commutation process. If the variables seem to be configured wrong, a general message will be displayed stating that improperly configured variables are a possible reason for failure. Once corrected, you will be able to continue. In a case of more than 20% deviation between the defined and measured pitch, the commutation process reports failure.
Display Detailed Commutation Results	Displays commutation phase data (in electrical degrees).

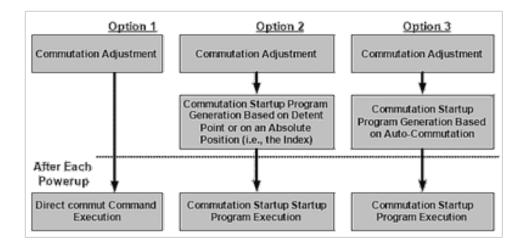
Use Hall SIgnals for Continuous Commutation*	This option resolves a commutation loss due to improper incremental encoder-to-motor rotation counts. When this option is selected, the commutation angle is adjusted at each hall transition. In between hall transitions, a sinusoidal commutation is calculated based on incremental feedback.
Calculated Hall Alignment Offset*	Compensates for Improper hall alignment and optimizes torque/force production.
Number of Magnetic Pitches to Measure	A word of caution: Deviation between defined and measured pitch does not necessarily indicate poor commutation quality. For example, incorrect definitions of feedback variables may be compensated for by high friction, thus the deviation may be low but the commutation will be poor.

*Only available when Hall Signals Transition is the selected option for "Retrieve Commutation Phase at". This is the default condition if Hall sensors were selected.

	Axis Setup an Commutation Program Sta	d Tuning: Commutation andard Run in Buffer 0 V	Default
Components			
Safety and Protection	Preferences		
Miscellaneous Definitio Verification	Excitation Current	47.5	% of maximum
Axis Setup and Tuning	Search Velocity	2000	count(s)/sec
✓ Current Loop ✓ Current Phase Offset	Setting Window Time	1000	ms
 Commutation Open Loop Verification 	Retrieve Commutation Phase at	Hall Signals Transition	
Position and Velocity	Advanced Parameters	\$	
Settings and Ider Basic Tuning	Initial Commutation Offse	et 0	degrees
Bandwidth and St	Maximum Search Distance	Two Rotations	1001
Advanced Tuning Position Verification	Verify Control and Feedback Parameters		
Save to Flash Axis Duplication	Display Detailed Commutation Results	•	-
Final Page	Use Hall Signals for Continuous Commutation		
	Calculate Hall Alignment Offset	a	
	Number of Magnetic Pitches to Measure	4	

Commutation Startup Program

The options that you have when setting the Commutation Startup program are illustrated in the following diagram:



To set the Commutation Startup program:

- 1. Select one of the two Commutation Program options from the **Commutation Program** dropdown list:
 - > **Standard**: Uses a built-in default commutation scheme that is incorporated in **Adjuster**.
 - > User Defined: For selecting a commutation program that was previously saved in a file (in this case you need to have prepared the Commutation Startup program through Program Manager). A browser is displayed enabling you to search for and load your program:

> -> 🛧 📙 « Trai	ining > Training Examples > Programming		✓ Ö Searc	h Programming
organize 🔻 New folde	r			
This PC	Name	Date modified	Туре	Size
3D Objects	Programming 02 - ProgEnvironment.prg	23/03/2020 14:07	PRG File	1 KB
C on AHARONL	Programming 03 - ProgStructure.prg	23/03/2020 14:07	PRG File	4 KB
Desktop	Programming 04 - VariableMGMT.prg	23/03/2020 14:07	PRG File	4 KB
Documents	Programming 05 - ProgramFlow.prg	23/03/2020 14:07	PRG File	2 KB
_	Programming 06 - SetMotionParam.prg	23/03/2020 14:07	PRG File	2 KB
Downloads	Programming 07 - Single Axis Motion.prg	23/03/2020 14:07	PRG File	9 KB
Music	Programming 08 - AnalogFiltering.prg	23/03/2020 14:07	PRG File	2 KB
Pictures	Programming 08 - DIODebouncing.prg	23/03/2020 14:07	PRG File	2 KB
🚪 Videos	Programming 08 - XYRotation.prg	23/03/2020 14:07	PRG File	2 KB
S (C:)	Programming 09 - Safety and faults.prg	23/03/2020 14:07	PRG File	6 KB
Data (D:)	📄 Programming 12 - Multi-axis motion.prg	23/03/2020 14:07	PRG File	1 KB
Marketing (\\ma	Programming 13(optional) - Stepper Mot	23/03/2020 14:07	PRG File	2 KB
net POs (\\main_ser ↓				
File na	ime:		~ Prog	ıram (*.prg)

- Select the required buffer for storing the Commutation Startup program from the Run in Buffer dropdown list (the controller supports up to 9 simultaneously executing program buffers). Usually, you will want to select an empty buffer to avoid overwriting an existing program.
- 3. Set your preferences (see Preferences and Advanced Parameters), or click **Default** which will enter default values in the preferences.
- 4. At this point you have two choices:

Start Commutation Program

- causes the **Adjuster** to automatically generate the Commutation program taking the **Retrieve Commutation Phase at** parameter as its starting point. It compiles the program and runs it.

b.

a.

Generate Startup Program - causes the Adjuster to generate the

Commutation Startup program. You are prompted with:

Generate S	tartup Program		
Save Startu	p Program in:		
Buffer	0		-
🔲 File			
	Generate	Cance	

The **Buffer** checkbox should be selected and the buffer number that you entered in Step 2 should appear. If the program is to be generated from a

user file, select the **File** checkbox and click is to browse for the file. If you want to use automatic commutation, select the **Use Auto-commutation** checkbox.



Automatic commutation is a way to retrieve the commutation offset automatically, using closed-loop control.

Commutation setup (without using automatic commutation) is required once: during Commutation Adjustment. Once this has been done, automatic commutation is recommended at every controller powerup.

- 5. Click **Generate**. In the **Program Manager** pod, note that program appears in the specified buffer, and a notification that the program was successfully generated is displayed.
- 6. Click **Start Startup Program** to run the Commutation Startup program.
- Observe the motion of the motor and the messages that appear in the Commutation Program Output panel. If errors appear or the motor does not respond as it should, make adjustments to the parameters and run again - refer to Troubleshooting Commutation.

Commutation Program Output Panel

There are two buttons associated with the **Commutation Program Output** panel:

> Clear Output - clears the messages in panel.

- enables you to save all the messages to a text file.

Troubleshooting Commutation

If the motor does not move during **Start Commutation Program** or **Start Startup Program** execution, consider the following:

- > Check the connections between the controller and the drive and motor.
- > If a high friction or active load is applied, increase the **Excitation Current** and try again.

If **Start Commutation Program** or **Start Startup Program** execution displays a message about wrong motor variables, return to **Components** and verify the following:

- > Number of Poles or Magnetic Pitch are specified correctly.
- > Encoder variables are specified correctly.

If the motion failed during Commutation Adjustment or Commutation Startup program execution, probable causes are:

- > The required **Excitation Current** is greater than the minimum of **XRMSM** value and **XRMSD** value. If the motor and drive rating allow it, try to increase this value.
- > There is an obstacle in the path of the motion.

Another problem that can arise is the case where **Verify Control & Feedback Parameters** is not selected in the **Advance Preferences**. Inaccurate variables can cause the commutation process to report successful completion even though the commutation is actually wrong. Therefore it is recommended to select this field.

Possible reasons for failure of the commutation process:

- > Hard stop: motor has bumped into a hard stop or an obstacle and is unable to move.
- > Excitation current too low: results in poor field alignment.
- > Inaccurate motor and feedback variables.
- > Hardware problems, such as encoder or drive fault, wiring error, or bad grounding.
- 8. When you are done, click **Next** to go to the next window.

3.2.6.7.4 Open Loop Verification

The Open Loop Verification window enables you to check if the motor responds correctly to the drive command, that is, the motor velocity should be in the same direction as drive command.

Enabling the motor may cause it to jump. To avoid personal injury or damage to the equipment, check the following before enabling the motor:



- Ensure that nothing (people, cables, or other obstacles) is in the path of the motor or objects connected to the motor.
- > Ensure that the motor is securely anchored and that proper safety barriers, stops, and limits are installed.

Be ready to engage the Emergency Stop switch.

My con	ntroller - Adjuster Wa	ard ×						
You ar	re working with Axis:	Axis 0						-
Se	lect Task <	Axis Setup an	d Tuning: Open Loop Verification					_
Ini	itialization		r may cause the motor to take off. Be very carefu	if the range of motion is limited				
	ds Architecture	chability the moto	a may cause the motor to take on. be very carefu	in the range of motion is innited.				
	mponents				Enable Motor			
	fety and Protectic	Open Loop Param	ieters					
	scellaneous Definit rification	Percents				Enable/Disable Motor Enable Motor		•
	is Setup and Tuni	Drive Output Range	10					• %
	✓ Current Loop							- 70
	Current Phase Offse	DAC Offset	0					
		Drive Output	0 0					%
>	✓ Open Loop Veril	1						
	Position and Velocit				and the second second second	e e e e <u>e</u> e e e e e		
	✓ Settings and	-10	-5		0 Drive Output (%)	5		10
	 Basic Tuning Bandwidth and S 				bine output (10)			
	 Advanced Tu 	Lower Limit					U	Jpper Limit
	Position Verification	-100	-10		0	10	100	
	ve to Flash							
		-						-
Fin	nal Page	Velocity	0				% of ma	ax. velocity
7			0					count(s)
1		Invert Drive Com	mand					
	etun and Turning: O	an Loop Verification of	ten provides the options to verify that the motor and d	rive polarity are in the same directions. If	the controller is doing the commutation for a brus	shless motor, the standard commutation algorithm in the		
previo	us step wil guarante	e that the polarities ar	e correct. Refer to the tool-tips for more information re	garding the specific parameter.	che controller is doing che commutation for a brus	siness motor, the standard commutation algorithm in the	<< Back Next >>	Cancel

Values can be expressed either as:

- > % Percentages
- > Amps Amperes

which you select from the dropdown list.

The parameters on this window are:

- Drive Output Range Percentage (or amperage) relative to the maximum voltage as defined in Components see Drive.
- DAC Offset Offset to be added to the results of the current loop control. This value is stored in the SLIOFFS variable.

The offset can be used to compensate for an active component of the motor load. For example, in a vertical axis the weight of the carriage can be compensated.

- 1. Click **Enable** to enable the drive.
- 2. If an encoder is active in the system, click **Zero** to reset the encoder.
- 3. Drag the Drive Output slider slowly to the right until the motor moves. If the motor does not move (due to friction), increase the **Drive Output Range** (with the slider or by entering a value) until the motor moves.

													-														
-10							5						0							5						10	
												Driv	e Out	out (%)												
Lowe	r Limit	_																							Upp	er Limit	
		-100					-1	0					0						10					10	° (

4. Verify that the velocity gauge indicator moves to the right (same direction you moved the slider). If the velocity arrow moves in the opposite direction, select **Invert Drive Command**.



If the direction of the velocity gauge is opposite to that of the Drive Output slider, it is an indication of positive feedback. This is likely to cause a motor run away. If the direction of the velocity gauge is opposite to that of the Drive Output slider, it is an indication of positive feedback. This is likely to cause a motor run away.

- For DC brush motor only: If there is bias (an offset) in the drive (motor moves while the controller command is zero), then with **Driver Output Range** set to zero, use the **DAC Offset** (SLIOFFFS) field to compensate.
- 6. When you are done, click **Next** to go to the next window.

3.2.6.7.5 Position and Velocity Loops

The Position and Velocity Loops window enables you to tune the position and velocity loops in order to optimize the servo system performance.

To tune the Position and Velocity Loops we recommend using One Parameter Based Tuning as described below. One Parameter Based Tuning has been tested on several demanding applications and achieved excellent results.

Experienced control engineers can make use of Manual Tuning or Advanced Tuning.

One Parameter Based Tuning

This feature enables you to tune the system based on a single parameter - the required bandwidth of the Position loop.

The Adjuster Wizard measures and identifies the characteristics of the electro-mechanical system. Once identified, you specify the required bandwidth and the Adjuster determines the relevant servo parameters and gains required to achieve the specified bandwidth.

You can now verify that the system performs as required and is stable by activating a motion and monitoring the response with the scope. You can modify the bandwidth parameter accordingly and repeat the process until an optimal time response is achieved.

Afterwards, you can use the FRF to verify that the required bandwidth is achieved and that the stability margins are adequate.

To perform one parameter tuning:

- 1. In the **Settings and Identification** window, select the characteristics of the system in the **System Characteristics** section. If unknown, use the defaults.
- 2. Define start and end motion limits position in the Motion Limits section either by entering values or by clicking the **Read** buttons. Ensure that the values are adequately distanced from the actual travel limits.

My controller - Adjuster Wi	izard ×		
You are working with Axis:	s: Axis 0		-
Select Task <	Axis Setup and Tuning: Position and Velocity Loops: Settings and Identification		
Initialization	Instructions		•
Axis Architecture	asouccus System Characteristics		•
Components			-
Safety and Protectic Miscellaneous Definit			
Verification	Fiction Level Low		•
Axis Setup and Tuni	Motion Limits		
✓ Current Loop	Start Position 0	Rea	d
Current Phase Offse	End Postion 10000	Rea	d
			_
✓ Open Loop Verif			
Position and Velocit			
→ ✓ Settings and			
✓ Basic Tuning Bandwidth and S	FRF Analyzer Measurement (Unavailable: Not supported for Simulator)		
✓ Advanced Tu	Calculations Based On Motor Data (Unavalable: Total Moving Inertia value missing)		
	_ FRF Analyzer Settings		
Save to Flash	☑ FRF Analyzer Autoset		
	Minimal Frequency 15 Excitation Current (% of max) 5		
Final Page	Naximal Frequency 3000		
	Restore Defaults		
i.			
	Start Identification Stop Identification		
	System Identification Results		
)	1		Ŧ
Settings and Identification:	n: Determine the settings for the tuning process and identify the system	< Back Next >>	Cancel



In case of an encoder fault, the motion limits will be zeroed by default. After the fault is cleared, entering new values may be required.

- 3. Under System Identification, select **FRF Analyzer Measurement**.
 - > The values in the **FRF Analyzer Settings** are initially calculated according to the system characteristics.
 - > If you select the **FRF Analyzer Autoset** option, the optimal excitation current is measured at the beginning of the system identification measurement (in this case the frequency range is disabled for changes).
- 4. Click Start Identification.

The FRF Analyzer is displayed showing graphs of the movement.

Screen shot - Adjuster Wizard			×	Screen shot - FRF Analyzer *	P 🗙
You are working with Axis		Axis 1		100	Axis 1
Select Task Initialization	Axis Setup and Tuni	ng: Position and Velocity Loops: Settings	and Identification		Graph Bode Diagram Mode Measure
Axis Architecture Components	Instructions			Amplitude (dB)	Servo Loop Open
Safety and Protection	System Characteristics			- The second sec	Measure set contains data
Miscellaneous Definitio Verification	System Type Med	dium Load/ Mildly Stiff System	.		Save to Baseline
Axis Setup and Tuning	Friction Level Low		.		Overwrite Min Frequency (Hz) 15
✓ Current Loop Current Phase Offset	Motion Limits			60 - 200	Max Frequency (Hz) 15 Max Frequency (Hz) 90
✓ Commutation	Start Position 0		Read	150 -	Points per Decade 30
 Open Loop Verificatic Position and Velocty 	End Position 72	3	Read	100 -	Excitation Current 2.5 (% of max.)
Position and velocity Settings and Ider	Feedback Position	4.48995E+006		(c) 50 - co	Start Default
Basic Tuning	System Identification		(69) 0	Vew	
Bandwidth and St Advanced Tuning	System Identification Method		-100 −	Tools	
Position Verification	FRF Analyzer Measurement (Re	ecommended)	-150 - 150		
Save to Flash Axis Duplication	Calculations Based On Motor D	ata (Unavailable: Total Moving Inertia value missing)		-200 -	
Final Page	FRF Analyzer Settings			14.7 Freq.(Hz) 🌑	92.6 Zoom
	FRF Analyzer Autoset			-	
	Minimal Frequency 1	5 Excitation Current (% of max) 5		Signals Cursors Servo Param	Design Baseline
	Maximal Frequency 34	000		Closed	Design Design
	Restore Defaults			Open Controller	CARGO
	Start Identification Stop Identifi	cation		Plant	
	System Identification Results			Line Width 2.0	1.0 1.0
	System identification succeeded.		1	Firmware NT 2.30.03 Servo Loop Open	
				Dual Loop No	
			2		
Settings and Identification: Det	rmine the settings for the tuning pro	cess and identify the system			
		< Back	Next >> Cancel	<((

5. When the system identification is successful, click Next to continue to the next step. If the system identification is not successful, follow the recommendations under System Identification Results. If you were not able to identify the system, only Manual Tuning is available in the Basic Tuning window.

-	Axis 0		
Select Task <	Axis Setup and Tuning: Position and	Velocity Loops: Basic Tuning	
Initialization	Instructions		
Axis Architecture	One Parameter Based Tuning		
Components			
Safety and Protecti			
Miscellaneous Defin Verification	System Response Monitoring		
Axis Setup and Tun	Servo Loop Mode		Motion Manager Auto
✓ Current Loop	Position and Velocity Loop		Scope Autoset
Current Phase Offs	Manual Tuning		
Commutation			
✓ Open Loop Ver		Value	Units
Position and Veloci		100	Controller
 Settings and 	Integrator Gain	100	Controller
> ✓ Basic Tuning	Position Proportional Gain	10	Controller
		700	Controller
✓ Advanced Tu	Acceleration Feed-Forward	0	Controller
Position Verification			
Save to Flash Axis Duplication			
Final Page			

6. In the **Basic Tuning** window, click **Motion Manager Autoset**. The Motion Manager is displayed.

ቅ Back and	Forth Move		
xis	Axis 0	~ ×	
oint A	Read +/-	0	
oint B	Read +/-	100	
well		500	
eedback	0	0.0000	
osition Error		0.0000	
loving			
ccelerating			
n Position			
lotor State		Enable	
arameters			
elocity/		20000	
cceleration		200000	
eceleration		200000	
ill Deceleratio	n	1E+006	
erk		2E+006	
ager Scope	on Motion	22+000	
able Motor(s		tion	

- 7. Click Enable Motor(s) and then Start Motion.
- 8. Click **Scope Autoset** and monitor the scope:

Increase the **Bandwidth** parameter as long as position error improves and stability is maintained.

Decrease the bandwidth to improve stability.

The ideal Scope display is a square wave indicating that the Position and Velocity Loops are well adjusted.

Screen shot - Adjuster Wizard		Sc	reen shot	- Scope				
You are working with Axis	Axis 1						Horizontal	•
Select Task Initialization	Axis Setup and Tuning: Position and Velocity Loops: Basic Tuning						Length (sec) Sampling 1.00	1000 1
Axis Architecture Components	Instructions						(ms) S	cale
Safety and Protection Miscellaneous Definitio	One Parameter Based Tuning			_			0.1	sec/
Verification Axis Setup and Tuning	Bandwidth [ftz] 5		\wedge	$ \land$	$\Lambda \Lambda$	∕\"	Trigger	¥
✓ Current Loop	System Response Monitoring			/	\sim \vee	* V	Reference	
Current Phase Offset	Servo Loop Mode Motion Manager Autoset						FFT Setup	
 Open Loop Verification Position and Velocity 	Position and Velocity Loop						Tools	¥
 ✓ Settings and Ider Ø Sasic Yunkg ✓ Bandwidth and Si Advanced Tuning Position Verification Save to Flash Axis Duplication Final Page 	Marual Tuning		0.0 0.1	0.2 0.3	3 0.4 0.5 0.6 0.7 Stop Autofit Riders Statistics Display YT	0.8 0.9 1.0 s		
			Channel	State	Variable	Axis / Index	Scale / Limits	Shift
			CH1	On	Reference Velocity	(1)	5E+002 units/div	
			CH2 CH3	On On	Feedback Velocity Position Error	(1) (1)	SE+002 units/div 2E+000 units/div	
			014	Off	Feedback Position	(1)	1E+002 units/div	
Basic Tuning: Perform a basic tu manipulating the relevant servo	ning by manipulating the Bandwidth parameter's value (One Parameter Based Tuning) or by arameters' values (Manual Tuning). If a system was not identified in the "Settings and Identification" 😴 << Back Next >> Cancel							

9. When you achieve a satisfactory bandwidth, click **Next** to continue to the next step.

Screen shot - Adjuster Wizard					×					
You are working with Axis	:		Axis 1						Horizontal	•
Select Task Initialization	Axis Setup and Tu	ining:	Position and Velocity Loops: Ban	dwidth and Stability Verificatio	n				Length (sec) 5.00 Sampling 1.00	100
Axis Architecture Components	Instructions								(ms) S	icale sec/
Safety and Protection Miscellaneous Definitio	Motion Manager Settings		Verification Results				للككك		. 0.31	HEC1
Verification	Use Jog Motion Type (Rec	ommended)		4	9		دككك	T1	Trigger	
Axis Setup and Tuning	FRF Analyzer Settigs						الالالالال		Reference	
✓ Current Loop Current Phase Offset	Minimal Frequency (Hz)	15								
✓ Commutation	Maximal Frequency (Hz)	3000							FFT Setup	~
 Open Loop Verification Position and Velocity 	Excitation Current (% of max	5							Tools	٣
 Settings and Ider 	Restore Defaults									
✓ Basic Tuning ✓ Bandwidth and S	Start Verification					π1				
Advanced Tuning Position Verification	Stop Verification					0.0 0.5 1.0 1	.5 2.0 2.5 3.0 3.5 4	4.0 4.5 5.0 s		
Save to Flash Axis Duplication						Normal	Stop @ Autofit	🕘 🥥 Zoom		
Final Page						Signals Cursors	Riders Statistics	- Lund		
						Number 4	Display YT	~	l	
						Channel State	Variable	Axis / Index	Scale / Limits	Shift
						CH1 On	Reference Velocity	(1)		
						CH2 On	Feedback Velocity	(1)		
						CH3 On	Position Error	(1)	2E+000 units/div	
						OH4 Off	Feedback Position	(1)	1E+002 units/div	5.000 div
Bandwidth and Stability Verifica	tion: Perform Bandwidth and Stab	ility verifica	ation using FRF Analyzer	< Back Next >> Cancel						

- 10. In the Bandwidth and Stability Verification window, click Start Verification.
- 11. Click **Yes** to the following warning messages.

New - S	PiiPlus MMI Application Studio
0	It is recommended to move the motor during the measurement. Continue anyway?
Adjuster W	fizard
	During the measurement process the motor will be enabled in Closed Loop and the Excitation Current will be applied. Make sure that Motor Nominal Current and Drive Peak Current values are correct. Make sure that the Excitation Current level is appropriate for the system. Excessive Excitation Current may cause physical damage, saturation and unreliable measurement results. In case of unreasonable / excessive oscillations disable the motor immediately and reduce the Excitation Current. Continue?
	Yes No

The Bandwidth and stability verification is based on FRF closed loop measurement and comparing the measured stability gains to the predefined thresholds. The measured bandwidth is also compared to the required one.

Screen shot - Adjuster Wizard				So	reen shot - FRF Analyzer *	
You are working with Axis:			Axis 1	16	40	Axis 1
Select Task Initialization	Axis Setup and Tu	ining: P	osition and Velocity Loops: Bandwidth and Stability Verification	١.	20. 0.	Graph Bode Diagram 💌 Mode Measure 💌
Axis Architecture Components	Instructions				(B) -20 -	Servo Loop Position and
Safety and Protection Miscellaneous Definitio Verification Axis Setup and Tuning	Motion Manager Settings Use Jog Motion Type (Reco	ommended)	Verification Results Bandwidth [tt] = 76.12. Positive Gain Margin (dB) = 18.37 Negative Gain Margin (dB) = Not available Phase Margin (dB) = 35.70		-100	Measure set contains data Save to Baseline Overwrite Min Frequency (Hz) 15
 Current Loop Current Phase Offset Commutation Open Loop Verification Position and Velocity ✓ Settings and Ider ✓ Basic Tuning ✓ Bandwidth and S Advanced Tuning Position Verification Save to Flash Axis: Duplication Final Page 	Minimal Frequency (Hz) Maximal Frequency (Hz) Excitation Current (% of max) Restore Defaults Start Verification Stop Verification	15 3000 5	Verification succeeded.		200	Max Frequency (Hz) 3000 Points per Decade 50 Excitation Current 5.
Bandwidth and Stability Verificat	on: Perform Bandwidth and Stab	lity verificati	n usno RFP Analyzer		Signals Cursors Servo Parameters Measurement An Weasure Design Controller Vent	alysis Boselne 1.0
banumber and stability verificat	un, ne iom banuwion and Stab	ety vernicat	on using Hor Analyzer Cancel	s	creen shot - Scope * Screen shot - FRF Analyzer *	

> If the verification is unsuccessful, follow the recommendations under the **Verification Results** section.

You may need to return to the **Basic Tuning** window and repeat the process described in **Step 6**.

> If the verification is successful, you can click **Next** to Advanced Tuning. Advanced tuning is optional and requires experience in Control field.

Manual Tuning

Manual tuning involves tuning controller parameters in the **Basic Tuning** window. You can modify each parameter during a motion in both Velocity Loop mode and Position and Velocity Loop mode. Available parameters are:

- > Velocity loop Proportional gain (SLVKP) in both servo loop modes
- > Velocity loop Integrator gain (SLVKI) in both servo loop modes
- > Position loop Proportional gain (SLPKP) only in Position and Velocity Loop
- > Low pass filter bandwidth (SLVSOF) in both servo loop modes
- > Acceleration Feed-Forward (SLAFF) only in Position and Velocity Loop

To perform manual tuning:

- 1. In the **Basic Tuning** page, click **Motion Manager Autoset**. The Motion Manager is displayed.
- 2. Click Enable Motor(s) and then Start Motion.
- Click Scope Autoset and monitor the scope: Change the relevant controller parameters values as long as position error improves and stability is maintained.

The ideal Scope display is a square wave indicating that the Position and Velocity Loop is well adjusted.

- 4. When you achieve a satisfactory bandwidth, click **Next** to continue to the next step.
- In the Bandwidth and Stability Verification page, click Start Verification.
 The Bandwidth and stability verification is based on FRF closed loop measurement and comparing the measured stability gains to the predefined thresholds.
 - If the verification is unsuccessful, follow the recommendations under the Verification Results section.
 You may need to return to the Basic Tuning page and repeat the process described in

Step 3.

If the verification is successful, you can click Next to Advanced Tuning.
 Advanced tuning is optional and requires experience in Control field.

Advanced Tuning

Use the Advanced controller parameters tuning for further improvements.

- To tune the filters (Notch, BiQuad or Low-Pass) select **Filters**. If the verification measurement was successfully completed then the FRF component will be opened with already existing measurement. Otherwise, measure the FRF of the Position and Velocity loop; We recommend to move the motor slowly in constant velocity during the measurement (1 revolution/sec for rotary motor, or a few mm/sec for linear motor). By default, **Open Motion Manager** is selected for that purpose.
 Click **Design** to epop the design mode and tupe the filters.
- Click **Design** to open the design mode and tune the filters. When the Design FRF is satisfactory, click **Finish** and choose **yes** in the message asking to save the design parameters to the controller. Then, measure the FRF again to verify it is close to the design.
- **3**. To tune other controller parameters, select **Algorithms**, then open the required servo variables group and click **Motion Manager & Scope** to open the Motion Manager and Scope.
- 4. In the Motion Manager, apply a required motion, monitor the Scope and modify the controller parameters as needed.
- 5. When you achieve satisfactory results, the tuning is finished. Click **Next** to continue to the next step to finish the adjustment.

3.2.6.7.6 Position Verification

The Position Verification window is relevant only for open loop modes for step motors and enables you to verify that the actual move corresponds to a commanded one, and make changes where necessary.

You are working with Axi	81	Axis 0 (X)	<u></u>
Select Task Initialization	Axis Setup and	d Tuning: Position Verification	
Axis Architecture	Position Verification		
Components Safety and Protection	Motion Manager Autoset		
Miscellaneous Definition Verification			
Axis Setup and Tuning			
Current Loop			
Current Phase Offset			
Commutation			
Open Loop Verification			
Position and Velocity L			
Position Venification			
Save to flash			
Final Page			

To tune position verification:

1. Click **Motion Manager Autoset**. The Motion Manager panel is displayed.

		e X
My Controller - Motio	n Manager	- □ ×
Create Motion	👏 Import 🔲 Exp	ort
A Back and For	th Move	$\odot \otimes$
Axis	📝 Axis 0 (X) 🛛 🗙	
Point A	Read +/- 0	
Point B	Read +/- 10000	
Dwell	500	
Feedback	0 3.0000	
Position Error	0.0000	
Moving	•	
Accelerating	•	
In Position		
Motor State	Enable	
▲ Parameters		
Velocity	66666.666667	
Acceleration	666666.666667	
Deceleration	666666.666667	
Kill Deceleration	3.333333E+006	
Jerk	6.666667E+006	
Trigger Scope on	Motion	
Enable Motor(s)	Start Motion	
Select Axis(Axes) 🔻	1	
)	
My Controller - Motion	n Manager 🗙 🛛 Workspac	e Toolbox

The **Motion Type** dropdown list gives you the option of defining the type of motion, the options are:

- > One Direction Repeated Move
- > Back and Forth Move (Default)

If you select One Direction Repeated Move, you specify how much movement by entering a value in **Move By**.

If you select Back and Forth Move, the position is measured between two points:

- > Point A
- > Point B

Point A is the start position and **Point B** is the end position. The motion is then measured from Point A to Point B.



You can set these points by manually moving the motor to Point A and clicking ^{Read} , and repeating this for Point B.

You can change the sign of the value by clicking ${}^{{
m triangle}}$

The **Dwell** value is Dwell time between moves.

The Motion Parameters that you can manipulate are:

- > Velocity (VEL)
- > Acceleration (ACC)
- > Deceleration (DEC)
- > Kill Deceleration (KDEC)
- > Jerk (JERK)

To start the measurement:

- 1. Click Enable Motor(s), this enables the motor of the axis you are working on.
- Click Start Motion, this starts the motion.
 Visually check the motion. If there is a positional error, exit Adjuster and correct the value in your program, then run Adjuster again.
- 3. When you are done, click **Next** to go to the next window.

3.2.6.8 Save to Flash

The Save to Flash step enables you to save all the **Adjuster** data to the controller's flash. When you enter this step, the Save to Flash prompt is displayed.

Save To Fla	sh				
User: Application:	Aharon Learn1				
Remarks:					
My con	troller	Save Options - "Check" / "Uncl	heck All" option is available by cli	-	umn's header
		Buffer 0	System	SP#0	
		Buffer 1	Axis 0	SP#1	v
		Buffer 2	Axis 1	SP#2	FRFLib_CLr
		Buffer 3	Axis 2	SP#3	FRFLib_CLi
		Buffer 4	Axis 3	SP#4	OLr
		Buffer 5	Axis 4	SP#5	E OLi
		Buffer 6	Axis 5	SP#6	FRFLib_frequencies
		Buffer 7	Axis 6	SP#7	
		Buffer 8	Axis 7	SP#8	
		Buffer 9	Axis 8	SP#9	
		Buffer 10	Axis 9	SP#10	
		Buffer 11	Axis 10	SP#11	
		Buffer 12	Axis 11	SP#12	
		Buffer 13	Axis 12	SP#13	
		Buffer 14	Axis 13	SP#14	*
		Show Preview			٢
					Save Cancel

For saving to the controller's flash see Saving to Flash.



If you do not save the data to the controller's flash, all of the data will be lost.

Once you have saved the data, the Final Page is displayed. This marks the completion of the **Adjuster**. Click **Finish** to exit.

3.2.7 Adjust Tuning of Predefined System

The **Adjust Tuning of Predefined System** task of the Adjuster enables you to fine tune your system in order to optimize performance.



Although you can perform this task before performing Setup New System or Controller, it is not recommended.

1. In the Adjuster **Select Task** window, select **Adjust Tuning of Predefined System**.

My Controller - Adjuster Wizard $ imes$	
You are working with Axis: Axis 0 (X)	•
> Select Task <	Select Task
Initialization Axis Architecture Components Safety and Protection Miscellaneous Definitions Verification Axis Setup and Tuning Save to Flash Axis Duplication Final Page	 Setup New System or Controller Select this task to setup a system with a brand new controller or one that has been set to the factory default settings. All applicable adjuster steps are mandatory. Motor, drive and encoder specifications need to be known. Adjust Tuning of Predefined System Select this task to go directly to the tuning steps of the adjuster setup. The system needs to have been previously setup with the adjuster wizard and saved in the controller. Only select this task if it is verified that the system has been properly configured with the adjuster wizard. Verify Correct Setup of Predefined System and Adjust Tuning Select this task to verify the system setup and adjust the tuning of the system. The system needs to have been previously setup with the adjuster wizard and saved in the controller. Changes can be made to the setup if the system was incorrectly defined Axis Duplicate Select this task to perform an axis duplicate operation on one or more axes
	Set initial values
	Existing Values
	O Default Values
	Copy Values From Axis Select Axis To Copy From
	View Adjuster Parameters View Controller Parameters
	the desired task, set initial values of axis parameters, and view current adjuster and controller <pre></pre> <pre>Cancel</pre> Cancel

You have a choice of selecting:

- > Existing Values (default), or
- > Copy Values From Axis
- 2. Click **Next**, you jump to the **Axis Setup and Tuning** task page:

My Controller - Adjuster Wizard ×					
You are working with Axis: Axis 0 (X)					•
Select Task <	Axis Setup and T	uning: Current Loop			
Initialization	Auto Tuning	· ·			\bigcirc
Axis Architecture	-				\odot
Components	Use Initial Parameters	During Measurement (Optional)			
Safety and Protection		Start Auto Tuning			
Miscellaneous Definitions	Fine Tuning				\checkmark
Verification	Control Parameters				
Axis Setup and Tuning		100			
> ✓ Current Loop	P (Proportional Gain)	100			
Current Phase Offset	I (Integrator Gain)	1000			
Commutation		-0			
Open Loop Verification	Manual Tuning (Option	ai)			
Position and Velocity Loops	Step Response				$\overline{\mathbf{v}}$
Settings and Identification					
Basic Tuning					
Bandwidth and Stability Verification					
Advanced Tuning					
Save to Flash					
Final Page					
Axis Setup and Tuning: Current Loop step p drive. This step is only applicable for contro	provides the ability to adjust I modules with internal drive	the current loop to optimize the performance of the internal .s. Refer to the tool-tips for more information regarding the	<< Back	Next >>	Cancel

The Axis Setup and Tuning step enables you to fine tune your system. There are a total of six possible options:

- 1. Current Loop
- 2. Current Phase Offset
- 3. Commutation
- 4. Open Loop Verification
- 5. Position and Velocity Loops
- 6. Position Verification



The options that are available to you depend on the definitions that were entered in Components during the performance of Setup New System or Controller

Axis Architecture Components Safety and Protection Miscellaneous Definition Verification Axis Setup and Tuning Current Loop Current Loop Current Phase Offset Commutation Commutation Commutation Commutation Sistion Verification Save to Flash Final Page
 Current Phase Offset Commutation Open Loop Verification Position and Velocity L Sition Verification Save to Flash

- 7. Once you have tuned your values to your satisfaction, you move to Save to Flash.
- 8. After saving the values to the controller's flash, click **Finish** to exit the **Adjuster Wizard**.

3.2.8 Verify Correct Setup of Predefined System and Adjuster Tuning

You use the **Verify Correct Setup of Predefined System and Adjuster Tuning** task of the Adjuster to verify the setup recorded in the performance of the Setup New System or Controller task, and, where needed, fine tune your system in order to optimize performance.

1. From the Adjuster Select Task window select Verify Correct Setup of Predefined System and Adjuster Tuning.

My Controller - Adjuster Wizard $ imes$	
You are working with Axis: Axis 0 (X)	•
> Select Task <	Select Task
 Select Task Initialization Axis Architecture Components Safety and Protection Miscellaneous Definitions Verification Axis Setup and Tuning Save to Flash Axis Duplication Final Page 	 Select Task Setup New System or Controller Select this task to setup a system with a brand new controller or one that has been set to the factory default settings. All applicable adjuster steps are mandatory. Motor, drive and encoder specifications need to be known. Adjust Tuning of Predefined System Select this task to go directly to the tuning steps of the adjuster setup. The system needs to have been previously setup with the adjuster wizard and saved in the controller. Only select this task if it is verified that the system has been properly configured with the adjuster wizard. Verify Correct Setup of Predefined System and Adjust Tuning Select this task to verify the system setup and adjust the tuning of the system. The system needs to have been previously setup with the adjuster wizard and saved in the controller. Changes can be made to the setup if the system was incorrectly defined Axis Duplicate Select this task to perform an axis duplicate operation on one or more axes
	Set initial values Existing Values Default Values Copy Values From Axis Select Axis To Copy From View Adjuster Parameters View Adjuster Parameters
	tt the desired task, set initial values of axis parameters, and view current adjuster and controller (<< Back Next >>) Cancel tailed description of the corresponding parameters.

You have a choice of selecting:

- > Existing Values (default), or
- > Copy Values From Axis
- 2. Click **Next**, you jump to the **Safety and Protection** task window:

My Controller - Adjuster Wizard $ imes$								
You are working with Axis: Axis 0 (X)								•
Select Task	<	Safety and Protection: Motion Para	meters Limi	its				
Initialization		Motion Parameters Limits						
Axis Architecture		Maximum Velocity [count(s)/sec]*	2E+006					
Components								
Safety and Protection		Maximum Acceleration [count(s)/sec^2]*	1E+007					
 ✓ Motion Parameters Limits Current Limits 		KILL (Emergency) Deceleration [count(s)/sec^2]*	100000					
Position Errors								
Position Limits								
Miscellaneous Definitions								
Verification								
Axis Setup and Tuning								
Save to Flash								
Final Page								
				N				
				23				
Safety and Protection: Motion Parameter Default values are determined using user	r Limi r inpu	its step provides the ability to define the maximum v it in previous Adjuster steps. Refer to the tool-tips	elocity and maxim for more informati	num acceleration limits. ion regarding the	•	<< Back	Next >>	Cancel

In this task you verify that the settings are correct for:

- > Motion Parameters Limits
- > Current Limits
- > Position Errors
- > Position Limits

In the event that you find an incompatibility, this task provides you with the ability to make changes.

	You can skip steps either by clicking Next , or by clicking the step in the Task Steps list that you want to activate:
	My Controller - Adjuster Wizard ×
	You are working with Axis: Axis 0 (X
	Select Task <
	Initialization
	Axis Architecture
	Components Sofatu and Protection
	Safety and Protection V Motion Parameters Limits
	✓ Current Limits
	✓ Position Errors
	> V Position Limits
	Miscellaneous Definitions
	Verification
	Axis Setur
	Save to FI Verification
	Axis Duplication
	Final Page
	In the same manner you can return to previous task steps by clicking Back , or clicking
	the required step in the Task Steps list.

- 3. The next task is Miscellaneous Definitions. In this task you check the values for:
 - > Motion Completion
 - > Enable/Disable/Brake
 - > Dynamic Brake
 - > Home Switch
- 4. The next task is Verification. In this task you check the values for:
 - > Feedback
 - > Switches
 - > Stop, Alarm and Brake
- 5. The next task is Axis Setup and Tuning. In this task you check the values for:
 - > Current Loop
 - > Current Phase Offset
 - > Commutation
 - > Open Loop Verification
 - > Position and Velocity Loops
 - > Position Verification

_

The options that are available to you depend on the definitions that were entered in Components when running Setup New System or Controller.

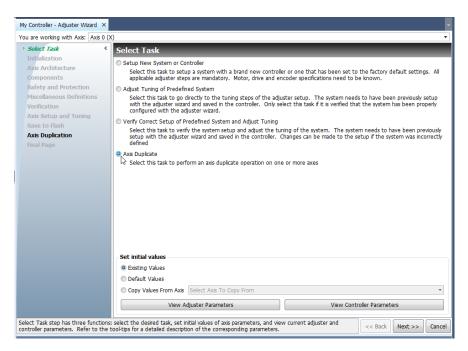
- 6. Once you have checked the values, and tuned them, if needed, you move to Save to Flash.
- 7. After saving the values to the controller's flash, click **Finish** to exit the **Adjuster Wizard**.

3.2.9 Axis Duplication

This option allows you to copy adjuster and controller parameters from one axis to another axis, typically the one you currently adjusting.

To duplicate an axis:

1. Select Axis Duplication in the Select Task step and click Next.



The Axis Duplication: Selection window substep appears.

My Controller - Adjuster Wizard $ imes$			
You are working with Axis: Axis 0 ()	<)		•
Select Task <	Axis Duplication: Selection		
Initialization	Select Source Axis	Select Target Axes	
Axis Architecture	Auto 0 (00)	(Check All)	
Components	Axis 0 (X)	Axis 0 (X)	
Safety and Protection		Axis 1 (Y)	
Miscellaneous Definitions		Axis 2 (Z)	
Verification		Axis 3 (T)	
Axis Setup and Tuning		Axis 4 (A)	
Save to Flash		Axis 5 (B)	
Axis Duplication		Axis 6 (C)	
> Selection		Axis 7 (D)	
Final Page			
Allows to select a source and target	axes		<< Back Next >> Cancel

2. Select the Source Axis. By default the source axis is the working axis.

3. Select the Target Axis and click **Next**.

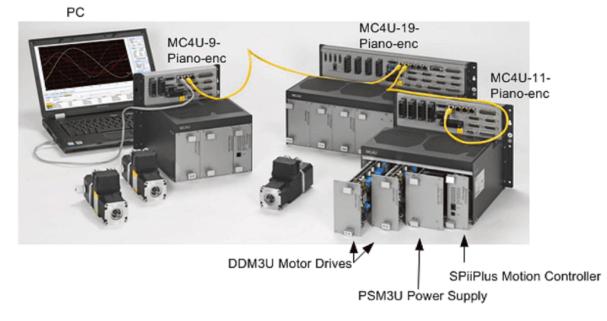
The Wizard prompts you to Save to Flash the source axis (the Wizard copies only data that is saved to the controller flash). When the duplication is completed, the Wizard presents the results in the Progress and Results substep.

Select Task			
	Axis Duplication: Progress and Results		
Initialization	Axis Duplication Process Report		
Axis Architecture	Axis 0 was successfully duplicated on axis 1		
Components	Axis duplication process was successfully completed!		
Safety and Protection			
Miscellaneous Definitions			
Verification			
Axis Setup and Tuning			
Save to Flash			
Axis Duplication			
Selection			
> Progress and Results			

4. Click **Next** to complete the Adjuster Wizard and then click **Finish** to close the wizard.

3.3 System Setup

ACS Motion Control's NT technology allows several units to be chained together using EtherCAT. **System Setup** enables you to configure a single or multiple Unit Control Module along with standalone NT modules and non-ACS units as a network, as shown in the following figure:



Use System Setup to:

- > Define the system configuration
- > Update the system configuration

You can setup the system either automatically or manually.



You should run the automatic system setup on initialization and whenever the system is changed.

3.3.1 Automatic System Setup

To activate System Setup:

- 1. In the Workspace right-click the controller.
- Select Add component > Setup> System Setup. The System Configuration window opens.
- 3. In the Automatic Setup tab, press **Execute**.

CT000007A - Syste	m Setup 🗙		
Automatic Setup	Manual Setup	Burn EEPROM	
Execute	tion		
System Configura	tion		

- 4. Approve the message about the controller being rebooted. The system is setup automatically. This may take several minutes to complete.
- 5. When the setup is complete, click **OK**.

🖪 Automatic Setup Task	-		×
✓ Taking backup of existing configuration.			
✓ Initializing.			
✓ Scanning network.			
✓ Initializing.			
✓ Identifying network units.			
✓ Scanning network.			
✓ Identifying network units.			
Saving configuration to controller.			
✓ Initializing.			
Reading configuration from controller.			
Completed			
Completed		ОК	

The screen shown shows representative output of the automatic system configuration process:

itic Setup Manual Setup Burn EEP	ROM		
xecute			
n Configuration			
12	Product Information System I	nformation	
	Ordering Part Number	12	
	Serial Number	12	
	Revision	A2	
	Vendor Name	ACS Motion Control	
	DIP	0	
	4 Drive Characteristics		
	Maximum RMS Protection T	n 3476	
	Voltage [V]	320	
	Peak Current [A]	15	
	Nominal Current [A]	7.5	
	4 I/O Connectors		
	DigitalInputsConnectors0	13-I/O(IN0),13-I/O(IN1),13-I/O(IN1),13-I/O(IN3),13-I/O(IN4),13-I/O(IN5),13-I/O(IN7),N/A,N/A	
		13-I/O(0UT1),13-I/O(0UT1),13-I/O(0UT2),13-I/O(0UT3),13-I/O(0UT4),13-I/O(0UT5),13-I/O(0UT6),13-I/O(0UT7),N/A,N/A	
		J3-I/O(AIN0),J3-I/O(AIN1),J11-6P(AIN2),J11-6P(AIN3)	
		13-I/O(AOUT0),13-I/O(AOUT1)	
	HSSIChannelsConnectors0		
	4 Advanced		
	Controller I2C Address	0x0007	
	Controller Part Number	00122001	
	Controller Serial Number		
	Controller Revision	A2	
		Wednesday, November 8, 2017	
	Number of Servo Processor		
	DigitalInputs0Mask	0x000300FF	
	DigitalOutputs0Mask	0x00003FF	
	AnalogInputs0Mask	xx000000F	
	AnalogOutputs0Mask	0x0000003	
	HSSIChannels0Mask	1	
	Drive Type	PWM drive (5)	
	Drive I2C Address	- vin une (J) (x0003	
	Drive Part Number	PWR-2-220V-7.5/15A	

3.3.2 Manual System Setup

The following tasks can be done using manual setup:

- > Modifying a system configuration
- > Modifying a configuration from a database
- > Loading a configuration from a database

3.3.2.1 Modifying a system configuration

- 1. In the Workspace, right-click the controller.
- 2. Select Add component > Setup > System Setup.
- 3. In the System Configuration window, click **Manual Setup**.
- 4. Click **Modify System Configuration**. The system will load the configuration and may take several minutes.

🛃 Modify System Configuration Task	-		\times
✓ Reading configuration from controller.			
< Scanning network.			
Identifying network units.			
Completed			
Completed		ОК	

5. When the **Configuration Design Pad** window appears, you can modify settings such as the axes and I/O allocations:

🛃 Configuration Design Pad: Modify System C	onfiguration Task		-	[<
Design Configuration						-
Þ 🚮 12	roduct Information				ave	
	⊿ General	A			to Control	ier
	Ordering Part Number	12		Save t	o File	
	Serial Number	12				
	Revision	A2				
	Vendor Name	ACS Motion Control				
	DIP	0				
	4 Drive Characteristics					
	Maximum RMS Protection Tim	1 3476				
	Voltage [V]	320				
	Peak Current [A]	15				
	Nominal Current [A]	7.5				
	✓ Options					
	Number of allowed SIN-COS	e 2				
	Number of allowed SIN-COS	e 2				
	Allowed Absolute Encoder Typ					
	Number of allowed Absolute I	2				
	I/O Connectors					
	DigitalInputsConnectors0	J3-I/O(IN0),J3-I/O(IN1),J3-I/O(IN2),J3-I/O(IN3),J3-I/O(IN4),J3-I/O(IN5),J3-I/O(IN6),J3-I/O(IN7),N/A,N/A				
		J3-I/O(OUT0),J3-I/O(OUT1),J3-I/O(OUT2),J3-I/O(OUT3),J3-I/O(OUT4),J3-I/O(OUT5),J3-I/O(OUT6),J3-I/O(OL				
		J3-I/O(AIN0),J3-I/O(AIN1),J11-GP(AIN2),J11-GP(AIN3)				
		J3-I/O(AOUT0),J3-I/O(AOUT1)				
	HSSIChannelsConnectors0	J12-HSSI				
	4 Advanced					
	Controller I2C Address	0x0007 *		D	one	

6. Modify axes allocation in the following window:

nfiguration Axi	es and I/O		Save
EtherCAT Master	Axes		Save to Contr
EtherCAT Slave 0	Network Axes	0,1	Save to File
Axes and I/O	Network Axes Range Begin	0	
Axis 1	Network Axes Range Fini	1	
	I/O		
Þ	AnalogInputs0	AIN(0),AIN(1),AIN(2),AIN(3)	
⊳	AnalogOutputs0	AOUT(0),AOUT(1)	
⊳	DigitalInputs0	IN(0)	
⊳	DigitalOutputs0	OUT(0)	
Þ	HSSIChannels0	EXTIN(03)/EXTOUT(03)	

7. Modify I/O allocation in the following window:

Lateroxi Master Axes	0,1 gin 0 iii. 1 AIN(0),AIN(1),AIN(2),AIN(3) 0 1 2 3 AOUT(0),AOUT(1) III(0) 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0	Axes and I/O		Save
• Axis 0 • Axis 1 • Network Axes 8 0,1 • Network Axes Range Begin 0 • Noto • Noto	0,1 0 0 i 1 AIN(0),AIN(1),AIN(2),AIN(3) 0 1 2 3 AOUT(0),AOUT(1) IN(0) OUT(0) 0 () () () () () () () () () ()	▲ Axes		
• Axis 0 Network Axes Range Egin 0 • Axis 1 Network Axes Range Egin 0 • I/O I • AnalogInputs0 AIN(0),AIN(1),AIN(2),AIN(3) [0] 0 [1] 1 [2] 2 [3] 3 • AnalogInputs0 AOUT(0),AOUT(1) • DigitalInputs0 IN(0) • DigitalInputs0 OUT(0)	i 1 AIN(0),AIN(1),AIN(2),AIN(3) 0 1 2 3 AOUT(0),AOUT(1) IN(0) OUT(0)	 Network Axes 	0,1	Save to File
Network Axes Range Fini I 4 1/0 4 AnalogInputs0 ANIN(),AIN(1),AIN(2),AIN(3) [0] 0 [1] 1 [2] 2 [3] 3 P AnalogOvtputs0 AU(0),AOUT(1) P DigitalDupts0 IN(0) P DigitalDupts0 OUT(0)	AIN(0),AIN(1),AIN(2),AIN(3) 0 1 1 2 3 AOUT(0),AOUT(1) IN(0) OUT(0)	Network Axes Range Be	gin 0	
▲ Analoginputs0 AIN(0),AIN(1),AIN(2),AIN(3) [0] 0 [1] 1 [2] 2 [3] 3 ▷ AnalogOutputs0 AOUT(0),AOUT(1) ▷ DigitalOutputs0 IN(0) ▷ DigitalOutputs0 OUT(0)	0 1 2 3 AOUT(0),AOUT(1) IN(0) OUT(0)	Network Axes Range Fin	i 1	
[0] 0 [1] 1 [2] 2 [3] 3 > AnalogOutputs0 AOUT(0),AOUT(1) > Digitalinguts0 IN(0) > Digitalioutputs0 OUT(0)	0 1 2 3 AOUT(0),AOUT(1) IN(0) OUT(0)	⊿ I/O		
[1] 1 [2] 2 [3] 3 ▷ AnalogOutputs0 AOUT(0),AOUT(1) ▷ DigitalInputs0 IN(0) ▷ DigitalOutputs0 OUT(0)	1 2 3 AOUT(0),AOUT(1) IN(0) OUT(0)	AnalogInputs0	AIN(0),AIN(1),AIN(2),AIN(3)	
[2] 2 [3] 3 > AnalogOuts0 AOUT(0),AOUT(1) > DigitalInputs0 IN(0) ⇒ DigitalOutputs0 OUT(0)	2 3 AOUT(0),AOUT(1) IN(0) OUT(0)	[0]	0	
[3] 3 ▷ AnalogOutputs0 AOUT(0),AOUT(1) ▷ DigitalDutputs0 IN(0) ▷ DigitalOutputs0 OUT(0)	3 AOUT(0),AOUT(1) IN(0) OUT(0)	[1]	1	
b AnalogOutputs0 AOUT(0),AOUT(1) b DigitaIInputs0 IN(0) b DigitaIOutputs0 OUT(0)	AOUT(0),AOUT(1) IN(0) OUT(0)	[2]	2	
DigitalInputs0 IN(0) DigitalOutputs0 OUT(0)	IN(0) OUT(0)	[3]	3	
DigitalOutputs0 OUT(0)	OUT(0)	AnalogOutputs0	AOUT(0),AOUT(1)	
		DigitalInputs0	IN(0)	
HSSIChannels0 EXTIN(03)/EXTOUT(03)	EXTIN(03)/EXTOUT(03)	DigitalOutputs0	OUT(0)	
		HSSIChannels0	EXTIN(03)/EXTOUT(03)	
				Done

8. Modify PDO configuration in the following window:

AT Master AT Slave 0 df /0 10 /0 11 /0 /0 11 /0 /0 /0 /0 /0 /0 /0 /0 /0 /0 /0 /0 /0 /0 /0 /0 /0 /0	Save to Controller
nd 1/0 EtherCAT Slave Name SPiPlus CMmt-2-xx-t-1xx/SPiPlus UDMpm-2-xxx-t-xx-x-1-x s 0 EtherCAT Slave Index 0	Save to File
EtherCAT Slave Index 0	
Vendor Name ACS Motion Control	
Vendor ID 0x0000540	
Product ID 0x06010000	
Revision 0x00000001	
Previous EtherCAT Slave Master	
4 Advanced	
DC Operation Mode DcSync	
Sync 0 Unit Cycle (ns) 50000	
Sync 5 Onic Cycle (ns) 50000 Sync 1 Unit Cycle (ns) 1000000	
Telegram Data Presented PDO Group 😰 <all></all>	
PDO Name Type Size Address Transmit / Receive	
← Command response1 DINT 4 72.0 Transmit ▲	
← Command response2 DINT 4 76.0 Transmit	
← Command response3 DINT 4 80.0 Transmit	
Command response4 DINT 4 84.0 Transmit	
Command response5 DINT 4 88.0 Transmit	
← Command response5 DINT 4 88.0 Transmit ← Command response6 DINT 4 92.0 Transmit	
Command response5 DINT 4 88.0 Transmit Command response6 DINT 4 92.0 Transmit Command response7 DINT 4 96.0 Transmit	
← Command response5 DINT 4 88.0 Transmit ← Command response6 DINT 4 92.0 Transmit	

- 9. To save the configuration to the controller or to the database, select the required option under **Save** and click **Save**.
- 10. In the **Configuration Details** window, enter a name for the configuration and optionally enter additional information.

🛃 Configuration Design Pad: Modify System	m Configuration Task	– 🗆 ×
Design Configuration		Court
	Configuration blake Configuration blake Configuration blake Configuration blake Configuration blake Configuration blake Configuration Configur	Save to controller
	* Mandatory fields Cancel OK	Done

11. Click **OK**.

3.3.2.2 Modifying a Configuration from the Database

A configuration that has been saved to a database can be edited.

- 1. In the Workspace right-click the controller.
- 2. Select **Add component > Setup**> **System Setup**. The System Configuration window opens.
- 3. Press the **Modify Configuration from Database** button. A window displaying the configurations saved in the database appears.

🖪 Select Configuration from Database		-		×
Click to Enter Value				p
Configuration name All time				
Configuration Name	Comment			
Learn1				
			Select	t

- 4. Select the saved configuration to use.
- 5. Edit the configuration as required.
- 6. To save the configuration to the controller or to the database, select the required option under **SAVE** and click **Save**.

🛃 Configuration Design Pa	ad: Modify System Configuration Task —	ο×
Design Configuration		6
Þ 🚮 12	Product Information	Save
	4 General	ave to Controller
	Ordering Part Number 12	ave to File
	Serial Number 12	
	Revision A2	
	Vendor Name ACS Motion Control	
	DIP 0	
	Drive Characteristics	
	Maximum RMS Protection Tim 3476	
	Voltage [V] 320	
	Peak Current [A] 15	
	Nominal Current [A] 7.5	
	▲ Options	
	Number of allowed SIN-COS e 2	
	Number of allowed SIN-COS e 2	
	Allowed Absolute Encoder Typ Any	
	Number of allowed Absolute E 2	
	4 I/O Connectors	
	▷ DigitalInputsConnectors0 J3-I/O(IN0),J3-I/O(IN1),J3-I/O(IN2),J3-I/O(IN3),J3-I/O(IN4),J3-I/O(IN5),J3-I/O(IN6),J3-I/O(IN7),N/A,N/A	
	DigitalOutputsConnectors0 J3-I/O(OUT0),J3-I/O(OUT1),J3-I/O(OUT2),J3-I/O(OUT3),J3-I/O(OUT4),J3-I/O(OUT5),J3-I/O(OUT6),J3-I/O(OU	
	AnalogInputsConnectors0 33-I/O(AIN0),J3-I/O(AIN1),J11-GP(AIN2),J11-GP(AIN3)	
	AnalogOutputsConnectors0 33-I/O(AOUT0),33-I/O(AOUT1)	
	HSSIChannelsConnectors0 J12-HSSI	
	A Advanced	
	Controller I2C Address 0x0007	Done

7. In the **CONFIGURATION DETAILS** window, enter a name for the configuration and optionally enter additional information.

	System Configuration Task	- 0 :
gn Configuration		Save
M 12	Configuration Details	Save to Contro
EtherCAT Master EtherCAT Slave 0	Configuration Name *	Save to File
A C Axes and I/O		Save to File
Axis 0	Application name Customer name	
Axis 1		
	Operator name	
	Comment	
	• Nadary Mda	

8. Click OK.

3.3.2.3 Loading a Configuration from the Data Base

A configuration that has been saved to a database can be loaded and edited.

- 1. In the Workspace right-click the controller.
- 2. Select Add component > Setup > System Setup. The System Configuration window opens.

Simulator - System Setup 🗙	
Automatic Setup Manual Setup	Burn EEPROM
Modify System Configuration	dify Configuration from Database Configuration

- 3. Press the Load Configuration from Database button.
- 4. A message stating that the controller will be rebooted will appear, click **Yes**.
- 5. A window displaying the configurations saved in the database appears.

🛃 Select Configuration from Database		-		×
Click to Enter Value				4
Configuration name 🔹 All time 🔹 🚺				
Configuration Name	Comment			
Learn1				
			Selec	t

- 6. Press **Select** to load the desired configuration.
- 7. Enter the **Serial number** and **Revision** for the relevant products.

8. Click Save to Controller.

🖪 Configuration Design Pad: Load Configuration from Da	atabase Task - Learn1			- 0		Х
Design Configuration				C	o	
A CMnt-2-x-x-1 Product Info	ormation			Save to (Controlle	3 r
EtherCAT Master General	al		1			
EtherCAT Slave 0 Ordering	g Part Number					
Axes and I/O Serial No	lumber	CMNT2502N0Y1600GNNNN				
Revision	n	123				
Vendor	Name /	ACS Motion Control				
DIP						
✓ Drive C	Characteristics					
Maximu	Im RMS Protection Tim	3476				
Voltage	[V]	320				
Peak Cu	urrent [A]	15				
Nominal	l Current [A]	7.5				
⊿ I/O Co	onnectors					
▷ DigitalIn	nputsConnectors0	J3-I/O(IN0),J3-I/O(IN1),J3-I/O(IN2),J3-I/O(IN3),J3-I/O(IN4),J3-I/O(IN5),J3-I/O(IN6),J3-I/O(IN7),N/A,N/A				
DigitalO	OutputsConnectors0	J3-I/O(OUT0),J3-I/O(OUT1),J3-I/O(OUT2),J3-I/O(OUT3),J3-I/O(OUT4),J3-I/O(OUT5),J3-I/O(OUT6),J3-I/O(O				
AnalogIu	InputsConnectors0	J3-I/O(AIN0),J3-I/O(AIN1),J11-GP(AIN2),J11-GP(AIN3)				
▷ AnalogC	OutputsConnectors0	J3-I/O(AOUT0),J3-I/O(AOUT1)				
▷ HSSICha	annelsConnectors0	112-HSSI				
⊿ Advanc	ced					
Controll	ler I2C Address	0x0007				
Controll	ler Part Number	CMnt-2-x-x-1				
Controlle	ler Serial Number					
Controlle	ler Revision					
Number	r of Servo Processors	1				
DigitalIn	nputs0Mask (0x000300FF -		Dr	one	

9. When the configuration has been saved to the controller, click **OK** to close the progress report window.

🛃 Configuration Design Pad: Load Configu	ration from Database Task - Learn1a	>	×
Design Configuration	Red of Television	Save to Controller	er
 12 EtherCAT Master EtherCAT Slave 0 Axes and I/O 	Boulductinfiguration Scanning network. Identifying network units. Saving configuration to controller. Initializing. Verification: Scanning network. Ve		
	Completed OK	Done	

10. Click on **Done** to close the configuration design pad.

3.3.2.4 MC4U Configuration Codes

The following are the standard codes used for indicating the configuration of the MC4U unit. The general format is:

MC4U [MMM] AA-B#-CC-DD-[E]-[F]-[G]-[H]

Where:

MMM – Motherboard type

Depending on the **MC4U** model, motherboard codes can be:

- > Z MB5U-Z Motherboard
- > ZZ MB5U-ZZ Motherboard

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- > 2 MB5U-2 Motherboard
- > 90A MB5U-2-90A Motherboard
- > 4 MB5U-4 Motherboard
- > YYYY MB5U-YYYY Motherboard
- > ZZW MB5U-ZZW Motherboard
- > ZZZ MB5U-ZZZ Motherboard
- > PS MB5U-CON-PS Motherboard
- > PS2 MB5U-CON-PS2 Motherboard
- **AA** MC4U Configuration Type, which can be:
 - > CS Customization Solution
 - > CM Control Module
- **B#** SPiiPlus Controller Type and number of axes, the controller can be:
 - > P SPiiPlus 3U-HP
 - > T SPiiPlus 3U-LT
 - > NTP SPiiPlus NT-HP
 - > DCP SPiiPlus DC-HP
 - > NTT SPiiPlus NT-LT
 - > DCT SPiiPlus DC-LT

The number (#) of axes can be:

- > 4 Four axes
- > 6 Six axes
- > 8 Eight axes
- > 4E Four axes and eight feedback interfaces

CC – Power Supply Type (there can be more than one), which can be:

- > 00 None
- > A PSM3U-28V-0.5kW
- > H PSM3U-320V-8kW
- > L PSM3U-48V-0.7kW
- > V PSM3U-560V-8kW
- > HH PSMU3U-320V-11Kw
- > LL PSMU3U-48V-1.4Kw
- > HL PSMU3U-320/48V-0.7/8Kw
- > HM PSMU3U-320/48V-0.7/8kW
- > VL PSMU3U-560/48V-0.7/8kW

DD – Drive Type (there can be more than one), which can be:

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- > A DDM3U-2-60V-2A
- > B DDM3U-1-320V-5A
- > C DDM3U-1-320V-10A
- > D DDM3U-1-320V-20A
- > E DDM3U-1-560V-2A
- > F DDM3U-1-560V-5A
- > G DDM3U-1-560V-10A
- > H DDM3U-1-560V-15A
- > K DDM3U-1-320V-45
- > M DDM3U-1-320V-30
- > S DDM3U-2-680V-2A
- > T DDM3U-2-680V-5A
- > U DDM3U-2-680V-10A
- > V DDM3U-2-680V-15A
- > W DDM3U-4-60V-2A
- > Wa DDM3U-4-60V-4A
- > W1 DDM3U-4-320-1A
- > W2 DDM3U-4-320-2A
- > W3 DDM3U-4-320-3A
- > X DDM3U-2-320V-5A
- > Y DDM3U-2-320V-10A
- > Z DDM3U-2-320V-20A
- > Pa LDM3U-55V-8A (Analog)
- > Pd LDM3U-55V-8A (Digital)
- > Ps LDM3U-55V-8A (Space Vector Modulation)
- > Ra LDM3U-55V-16A (Analog)
- > Rd LDM3U-55V-16A (Digital)
- > Rs LDM3U-55V-16A (Space Vector Modulation)

E – Total number of Sin-Cos multipliers (optional), which can be:

- > 1
- > 2
- > 3
- > 4
- > 5
- > 6

- > 7
- > 8

F – Number of 2.5 MHz Sin-Cos multipliers (optional), which can be:

- > 1
- > 2
- > 3
- > 4

When included, **E** must also be included as **F** represents the number of 2.5 MHz Sin-Cos multipliers out of the total number of Sin-Cos multipliers, for example, 63 which means there is a total of 6 Sin-Cos multipliers, of which 3 are 2.5 MHz Sin-Cos multipliers.

F cannot be greater than E.

G - Input Shaping (optional), its code is:

- > I Convolve Input Shaping® algorithm enabled
- H PLC and axis and I/O extension network (optional), its code is:
 - > C PLC and axis extension enabled



The code string consists of a maximum of 15 characters, beginning with: MC4U. In the event that the string exceeds 15 characters, the leading MC4U can be shortened or omitted completely.

3.3.3 Optional Groups Setup

The System Setup component now includes the capability to define optional groups to support flexible configuration. Flexible configuration provides the ability to work with a subset of an initial configured system without requiring reconfiguration of the system. Using flexible configuration enables an optional group of EtherCAT slaves to be disconnected from the system without a need to reconfiguration, for details see *AN Flexible Configuration Application Note*.

The following operations on optional groups are now supported in System Setup:

- > Define optional group
- > Discard optional group
- > Discard all optional groups
- > View optional groups

3.3.3.1 Head of optional group

Product Name Prefix

The presentation name of the product which is defined as head of optional group in the tree will start with prefix "[HG<*group ID*>]" ("HG" = Head of Group).

Properties

On the product property panel of each head of optional group, the following information is presented:

Optional group section	Values
Head of group [R/O]	<group id=""></group>
Number of members in the group [R/O]	<[N]>
Included in group(s) [R/O]	<i, j,="" k,=""> where i, j, k are including groups' IDs, i є j є k</i,>

MC4U-NT	Product Information			Save
EK1100 EtherCAT Coupler (2A E-Bus) EtherCAT Slave 2) 🔺 General			Save to Contro
Ellercal Slave 2 Ellercal Slave 2 Ellercal Slave 2 Ellercal Slave 2	Ordering Part Number	SP+DCLT-8		Save to File
ELGOBO EtherCAT Memory Termin EtherCAT Slave 3	Serial Number	MC4U000000		
EL3008 8Ch. Ana. Input +/-10V	Revision	A		
 EL1809 16Ch. Dig. Input 24V, 3m 	e Vendor Name	ACS Motion Control		
EtherCAT Slave 5	DIP	0		
 EL1809 16Ch. Dig. Input 24V, 3m 	s 4 Options			
EtherCAT Slave 6	Number of allowed SIN-	COS e 8		
EK1122 2 port EtherCAT junction	Number of allowed SIN-	COS e 8		
Port D	Allowed Absolute Encode	er Typ BISS	=	
Port B	Number of allowed Abso	lute E 8		
➡ EtherCAT Slave 7	▲ I/O Connectors			
4 🛃 [HG1] IOMnt-32-32-00-00	DigitalInputsConnectors(J8(IN0), J8(IN1), J8(IN2), J8(IN3), J8(IN4), J8(IN5)		
EtherCAT Slave 8	DigitalInputsConnectors1	J8(IN6),J8(IN7),N/A,N/A,N/A,N/A		
Axes and I/O	DigitalOutputsConnector	s0 J8(OUT0),J8(OUT1),J8(OUT2),J8(OUT3)		
MC4U-DC	DigitalOutputsConnector	s1 J8(OUT4),J8(OUT5),J8(OUT6),J8(OUT7)		
EtherCAT Slave 9	AnalogInputsConnectors	0 J8(AIN10),J8(AIN11)		
EtherCAT Slave 10	AnalogInputsConnectors	1 J8(AIN14), J8(AIN15)		
Axes and I/O	AnalogOutputsConnector	rs0 J8(AOUT10),J8(AOUT11)		
Plug-in Components	AnalogOutputsConnector	s1 J8(AOUT14), J8(AOUT15)		
	HSSIChannelsConnectors	50 J4_HSSI0,J5_HSSI1		
	HSSIChannelsConnectors	s1 J6_HSSI2,N/A		
	▲ Optional Groups			
	Head of group	2		
	Number of members in t	he gr 1		
	Included in group(s)	2		
	4 Advanced			
	Controller I2C Address	0x0307		
	Controller Part Number	SPiiPlus DC-LT-8 (v.2)	*	Done

3.3.3.2 Member of optional group

Product Name Prefix

The presentation name of the product which is defined as a member of optional group in the tree will start with [G<group ID>] prefix ("G" = Group). If this product is also a head of nested optional group then the member of group prefix will be preceded by head of group prefix: [HG<group i ID>] G<group j ID>].

Properties

On the product property panel of each member of optional group the following information is presented:

Included in group(s) [F	/0] <i, j,="" k,=""> where i, j, k are ir</i,>	ncluding groups' IDs, i e j e k
🛃 Configuration Design Pad: Modify System Configurati	n Task	>
Design Configuration	Product Information	Save
 IH61] EK1100 EtherCAT Coupler (2A E-Bu EtherCAT Slave 2 [G1] ELG090 EtherCAT Memory Termin EtherCAT Slave 3 [G1] ELG090 EtherCAT Memory Termin EtherCAT Slave 3 [G1] ELG090 EtherCAT Memory Termin EtherCAT Slave 5 [G1] EL1809 16Ch. Dig. Input 24V, 3m EtherCAT Slave 5 [G1] EL1809 16Ch. Dig. Input 24V, 3m EtherCAT Slave 5 [G1] EL1809 16Ch. Dig. Input 24V, 3m EtherCAT Slave 5 [G1] EL1809 16Ch. Dig. Input 24V, 3m EtherCAT Slave 5 [G1] EthErCAT Slave 5 [G1] EthErCAT Slave 5 [G1] EtherCAT Slave 5 [G2] EtherCAT Slave 5 [G3] IG1] MC4U-DC [EtherCAT Slave 9 [EtherCAT Slave 10 [I] Are and I/O [I] Churdier [I] Power Supply [I] Drive Component 	General Vendor Name Beckhoff Automation GmbH & Co. KG Optional Groups Head of group 1 Number of members in the gr 8 Included in group(s) 1	Save to Contro Save to File

3.3.3.3 Highlighting optional group

To observe the whole optional group with all its members user can highlight the group by selecting the related option from right click menu of head of group product.

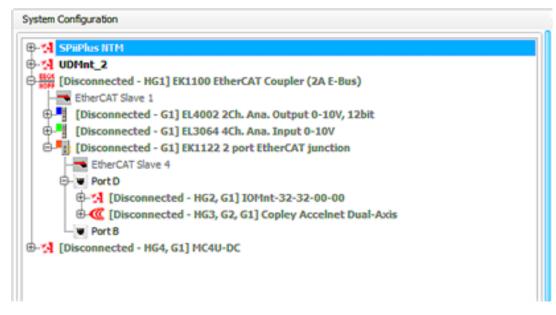
A Configuration Design Pad: Modify System Configuration	n Task	– 🗆 ×
Design Configuration		Caut
🕨 🚮 MC4U-NT	Product Information	
	Product Information 4 General Vendor Name Beckhoff Automation GmbH & Co. KG 4 Optional Groups Head of group 1 Number of members in the gr. 8 Included in group(s) Included in group(s) 1	Save to Controller
		Done

To stop highlighting the optional group user selects either "Undo highlighting optional group" from the right click menu, or highlights another optional group. Only one optional group can be highlighted at the same time.

3.3.3.4 View optional groups

The maximal configuration is presented (including all optional groups). If a partial system is connected (one or more optional groups are disconnected) then all disconnected products are grayed and marked as disconnected by adding the "Disconnected – "word to the prefix of product name.

- > Available from tasks
 - > System Viewer and Diagnostics



3.3.4 Activating Ring Topology in the Controller

The **Enhanced Network Failure Detection and Recovery** option in the controller affects both automatic and manual setup as follows:

If Enhanced Network Failure Detection and Recovery is enabled in the controller:

- Automatic Setup If the master secondary port is connected, ring topology is activated in the controller; otherwise it is deactivated.
 If a configuration file does not support ring topology, the setup process cannot continue and an appropriate message appears.
- > Manual Setup in the Configuration Design Pad, the relevant check box can be set for activation or deactivation.

If the check box is selected but the configuration file does not support ring topology, the setup process cannot continue and an appropriate message appears.

The initial state of the check box depends on the task you are performing:

- > **Modify Configuration Stored on Controller** the check box will be according to the controller current activation state.
- Modify Configuration from Database and Load Configuration from Database to Controller - the check box will be according to EtherCAT configuration file of the selected configuration.

If Enhanced Network Failure Detection and Recovery is not enabled in the controller:

- > Automatic Setup the ring topology connection is deactivated in controller.
- > Manual Setup in the Configuration Design Pad, the relevant check box is not selected and cannot be changed.

3.4 Safety and Faults Configurator

The Safety and Faults Configurator enables you to select specific faults that you want monitored during a program run. There are two types of faults:

- > Axis Faults These faults relate to motor motion.
- > System Faults These faults relate to the controller program that is running.

3.4.1 Activating Safety and Faults Configurator

To activate Safety and Faults Configurator:

- 1. In the Toolbox click **Setup** (Setup (Setup) to display the Setup list of tools.
- 2. Click **Safety and Faults Configurator** in the Setup list of tools.

You can also activate the **Safety and Faults Configurator** using the right-click **Add Component** option of the Workspace Tree - see **Controller Right-Click Options** .

3. The Safety and Faults Configurator window is displayed:

ixis Faults				
xis: 0				
Axis Faults				
Invers	ion (SAFINI)	Inspection (FMASK)	Response (FDEF)	Indication (FAULT)
Hardware Right Limit			✓	
Hardware Left Limit			✓	
Network Error			✓	
Motor Overheat			✓	
Software Right Limit			×	
Software Left Limit			V	
Encoder 1 Not Connected			×	
Encoder 2 Not Connected			✓	
Drive Fault / Laser Fault			✓	
Encoder 1 Error			✓	
Encoder 2 Error			✓	Ŏ
Non-Critical Position Error		✓	✓	
Critical Position Error		1	V	ě
Velocity Limit			V	
Acceleration Limit			V	
Overcurrent		v	V	
Servo Processor Alarm			V	
Safe Torque Off			✓	
HSSI Not Connected			✓	
Hardware Emergency Stop				
System Faults				
System Faults				
Invers	ion (S_SAFINI)	Inspection (S_FMASK)	Response (S_FDEF)	Indication (S_FAULT)
MPU Overheat				
ACSPL+ Program Error				
Memory Overflow				
MPU Overuse				
Hardware Emergency Stop				
Servo Interrupt				
File Integrity				
Component Failure			✓	

The System and Faults Configurator window is divided into two sections:

Axis Faults

xis Faults				
is: 0				
Axis Faults				
Invers	ion (SAFINI)	Inspection (FMASK)	Response (FDEF)	Indication (FAULT)
Hardware Right Limit			×	
lardware Left Limit			\checkmark	
letwork Error			\checkmark	
lotor Overheat			\checkmark	
oftware Right Limit			\checkmark	
oftware Left Limit			\checkmark	
ncoder 1 Not Connected			\checkmark	
ncoder 2 Not Connected			\checkmark	
rive Fault / Laser Fault			\checkmark	
ncoder 1 Error			\checkmark	
ncoder 2 Error			\checkmark	
on-Critical Position Error		\checkmark	\checkmark	
ritical Position Error		×	\checkmark	
elocity Limit			\checkmark	
cceleration Limit			\checkmark	
vercurrent		\checkmark	\checkmark	
ervo Processor Alarm			×	
fe Torque Off			×	
SSI Not Connected			×	
ardware Emergency Stop				

System Faults

System Faults				
System Faults				
	Inversion (S_SAFINI)	Inspection (S_FMASK)	Response (S_FDEF)	Indication (S_FAULT)
MPU Overheat				
ACSPL+ Program Error				
Memory Overflow				
MPU Overuse				
Hardware Emergency Stop				
Servo Interrupt				
File Integrity				
Component Failure			\checkmark	

3.4.2 ACSPL+ Fault Variables

There are two sets of ACSPL+ Fault variables, one for axis faults and one for system faults.

For details of all ACSPL+ variables see the *SPiiPlus Command & Variable Reference Guide*.

3.4.2.1 Axis Fault Variables

The axis fault variables are:

- > SAFINI
- > FMASK
- > FDEF
- > FAULT

3.4.2.1.1 SAFINI

SAFINI is a 64 member (one for each axis) integer array with a set of bits defining the active state of the axis safety input variable (**SAFIN**) specifying inversion of the signal input logic, if required.

When a **SAFINI** bit=0, the corresponding signal is not inverted and the high voltage state is considered active.

When a **SAFINI** bit=1, the bit is inverted and the low voltage state is considered active.

The **SAFINI** bits that can be inverted are:

Bit	Bit Name	Description
0	#RL	Hardware Right Limit

Bit	Bit Name	Description
1	#LL	Hardware Left Limit
4	#HOT	Motor Overheat
9	#DRIVE	Drive Fault / Laser Fault
28	#ES	Hardware Emergency Stop Changing this bit will automatically change the corresponding bit of all axes belonging to the same device.

3.4.2.1.2 FMASK

FMASK is an integer array with a set of bits (one set for each axis) used for enabling or disabling each axis fault bit.

The default value of each bit is 1 and causes the controller to check for the fault associated with that bit, as follows:

0 = the corresponding **FAULT** bit is disabled.

1 = the corresponding FAULT is enabled and examined each MPU cycle.

The **FMASK** bits are:

Bit	Fault	Fault Description
0	#RL	Hardware Right Limit 1 = Right limit switch is activated.
1	#LL	Hardware Left Limit 1 = Left limit switch is activated.
2	#NT	Network Error 1 = Network error is activated. This applies on to SPiiPlus NT Motion Controllers.
4	#HOT	Motor Overheat 1 = Motor's temperature sensor indicates overheat.

Bit	Fault	Fault Description
5	#SRL	Software Right Limit 1 = Axis reference position (RPOS) is greater than the software right limit margin (SRLIMIT).
6	#SLL	Software Left Limit 1 = Axis reference position (RPOS) is less than the software left limit margin (SLLIMIT).
7	#ENCNC	Encoder Not Connected 1 = Primary encoder (for digital encoder type only) is not connected.
8	#ENC2NC	Encoder 2 Not Connected 1 = Secondary encoder (for digital encoder type only) is not connected.
9	#DRIVE	Drive Fault / Laser Fault 1 = Signal from the drive reports a failure.
10	#ENC	Encoder Error 1 = Primary encoder miscounts.
11	#ENC2	Encoder 2 Error 1 = Secondary encoder miscounts.
12	#PE	 Non-Critical Position Error 1 = Non-critical position error has occurred. PE is defined by the following variables: ERRI - Maximum position error while the axis is idle ERRV - Maximum position error while the axis is moving with constant velocity ERRA - Maximum position error while the axis is accelerating or decelerating DELI - Delay on transition from ERRA to ERRI DELV - Delay on transition from ERRRA to ERRV

Bit	Fault	Fault Description
13	#CPE	 Critical Position Error 1 = Position error exceeds the value of the critical limit. #CPE errors occur outside normal range of operation and #CPE > #PE. The critical limit depends on the axis state and is defined by the following variables: CERRI if the axis is idle (not moving) CERRV if the axis is moving with constant velocity CERRA if the axis is accelerating or decelerating DELI - Delay on transition from ERRA to ERRV
14	#VL	Velocity Limit 1 = Absolute value of the reference velocity (RVEL) exceeds the limit defined by the XVEL parameter.
15	#AL	Acceleration Limit 1 = Absolute value of the reference acceleration (RACC) exceeds the limit defined by the XACC parameter.
16	#CL	Current Limit 1 = RMS current calculated in the Servo Processor exceeds the limit value defined by the XRMSD or XRMSM parameter.
17	#SP	Servo Processor Alarm 1 = Axis Servo Processor loses its synchronization with the MPU. The fault indicates a fatal problem in the controller.
18	#STO	Safe Torque Off 1 =STO is activated.
20	#HSSINC	HSSI Not Connected 1 = HSSI module is not connected.

3.4.2.1.3 FDEF

FDEF is a 64 member (one for each axis) integer array with a set of bits used for setting default responses to an axis faults.

The **FDEF** bits are:

Bit	Fault	Fault Description	Default Response
0	#RL	Hardware Right LimitThe controller kills the violating axis.1 = Right limit switch is activated.As long as the fault is active, the controller kills any motion that tries to move the axis in the direction of the limit; however, motion within the permissible range is allowed.	
1	#LL	Hardware Left Limit 1 = Left limit switch is activated.	Same as for #RL.
2	#NT	Network Error 1 = Network error is activated.	Disable all. Valid only for SPiiPlus NT Motion Controllers.
4	#HOT	Motor Overheat 1 = Motor's temperature sensor indicates overheat.	None.
5	#SRL	Software Right Limit 1 = Axis reference position (RPOS) is greater than the software right limit margin (SRLIMIT). The controller kills the violating axis. As long as the fault is active, the controller kills any motion that tries to move the a in the direction of the limit. Motion in the direction out of the limit is allowed.	
6	#SLL	Software Left Limit 1 = Axis reference position (RPOS) is less than the software left limit margin (SLLIMIT).	Same as #SRL.
7	#ENCNC	Encoder Not Connected 1 = Primary encoder (for digital encoder type only) is not connected.	The controller disables the violating axis.
8	#ENC2NC	Encoder 2 Not Connected	No default response.

Bit	Fault	Fault Description	Default Response
		1 = Secondary encoder (for digital encoder type only) is not connected.	
9	#DRIVE	Drive Fault / Laser Fault 1 = Signal from the drive reports a failure.	The controller disables the violating axis. This fault is only detected when the axis is enabled. To catch this fault in an ACSPL+ program, write an autoroutine.
10	#ENC	Encoder Error 1 = Primary encoder miscounts.	The controller disables the violating axis. The faults remain active until the user resolves the problems and enables the axis again or executes FCLEAR .
11	#ENC2	Encoder 2 Error 1 = Secondary encoder miscounts.	Same as #ENC.
12	#PE	 Non-Critical Position Error 1 = Non-critical position error has occurred. PE is defined by the following variables: ERRI - Maximum position error while the axis is idle ERRV - Maximum position error while the axis is moving with constant velocity ERRA - Maximum position error while the axis is accelerating or decelerating DELI - Delay on transition from ERRA to ERRI 	None.

Bit	Fault	Fault Description	Default Response
		DELV - Delay on transition from ERRA to ERRV	
13	#CPE	Critical Position Error 1 = Position error exceeds the value of the critical limit. #CPE errors occur outside normal range of operation and #CPE > #PE. The critical limit depends on the axis state and is defined by the following variables: CERRI if the axis is idle (not moving) CERRV if the axis is moving with constant velocity CERRA if the axis is accelerating or decelerating DELI - Delay on transition from ERRA to ERRI	The controller disables the violating axis.
14	#VL	Velocity Limit 1 = Absolute value of the reference velocity (RVEL) exceeds the limit defined by the XVEL parameter.	The controller kills the violating axis.

Bit	Fault	Fault Description	Default Response
15	#AL	Acceleration Limit 1 = Absolute value of the reference acceleration (RACC) exceeds the limit defined by the XACC parameter.	The controller kills the violating axis.
16	#CL	Current Limit 1 = RMS current calculated in the Servo Processor exceeds the limit value defined by the XRMSD or XRMSM parameter.	
17	#SP	Servo Processor Alarm 1 = Axis Servo Processor loses its synchronization with the MPU. The fault indicates a fatal problem in the controller.	The controller disables the violating axis and kills the motion that involves the axis.
18	#STO	Safe Torque Off 1 = STO is activated.	Blocks the PWM signals to the power stage of the drive.
20	#HSSINC	HSSI Not Connected 1 = HSSI module is not connected.	None.

3.4.2.1.4 FAULT

FAULT is a 64 member (one for each axis) integer array with a set of bits that stores axis-related fault bits.

FAULT indicates axis-related fault bits as detected by the safety mechanism. When each of the faults is active (such as Left Limit), the corresponding fault bit becomes = 1 while the fault is active, and automatically reverts to 0 when the fault is no longer active.

Each fault can be masked by FMASK.

The logic of some faults can be inverted by SAFINI.

The default response of each fault can be disabled by FDEF. In this case, any customized default response can be implemented by autoroutines.

The **FAULT** bits are:

Bit	Fault	Fault Description	
0	#RL	Hardware Right Limit. 1 = Right limit switch is activated.	
1	#LL	Hardware Left Limit. 1 = Left limit switch is activated.	
2	#NT	Network Error 1 = Network error is activated. Valid only for SPiiPlus NT Motion Controllers.	
4	#HOT	Motor Overheat 1 = Motor's temperature sensor indicates overheat.	
5	#SRL	Software Right Limit 1 = Axis reference position (RPOS) is greater than the software right limit margin (SRLIMIT).	
6	#SLL	Software Left Limit 1 = Axis reference position (RPOS) is less than the software left limit margin (SLLIMIT).	
7	#ENCNC	Encoder Not Connected 1 = Primary encoder (for digital encoder type only) is not connected.	
8	#ENC2NC	Encoder 2 Not Connected 1 = Secondary encoder (for digital encoder type only) is not connected.	
9	#DRIVE	Drive Fault / Laser Fault 1 = Signal from the drive reports a failure.	
10	#ENC	Encoder Error 1 = Primary encoder miscounts.	
11	#ENC2	Encoder 2 Error 1 = Secondary encoder miscounts.	
12	#PE	Non-Critical Position Error 1 = Non-critical position error has occurred.	

Bit	Fault	Fault Description
		PE is defined by the following variables:
		ERRI - Maximum position error while the axis is idle
		ERRV - Maximum position error while the axis is moving with constant velocity
		ERRA - Maximum position error while the axis is accelerating or decelerating
		DELI - Delay on transition from ERRA to ERRI
		DELV - Delay on transition from ERRA to ERRV
		Critical Position Error
		1 = Position error exceeds the value of the critical limit.
		#CPE errors occur outside normal range of operation and #CPE > #PE.
13	#CPE	The critical limit depends on the axis state and is defined by the following variables:
12	in cr c	CERRI if the axis is idle (not moving)
		CERRV if the axis is moving with constant velocity
		CERRA if the axis is accelerating or decelerating
		DELI - Delay on transition from ERRA to ERRI
		DELV - Delay on transition from ERRA to ERRV
		Velocity Limit
14	#VL	1 = Absolute value of the reference velocity (RVEL) exceeds the limit defined by the XVEL parameter.
		Acceleration Limit
15	#AL	1 = Absolute value of the reference acceleration (RACC) exceeds the
		limit defined by the XACC parameter.
16	#CI	Current Limit
16	#CL	1 = RMS current calculated in the Servo Processor exceeds the limit value defined by the XRMSD or XRMSM parameter.
		Servo Processor Alarm
17	#SP	1 = Axis Servo Processor loses its synchronization with the MPU. The fault indicates a fatal problem in the controller.

Bit	Fault	Fault Description	
18	#STO	Safe Torque Off 1 = STO is active.	
20	#HSSINC	HSSI Not Connected 1 = HSSI module is not connected.	

3.4.2.2 System Fault Variables

The system fault variables are:

- > S_SAFINI
- > S_FMASK
- > S_FDEF
- > S_FAULT

3.4.2.2.1 S_SAFINI

S_SAFINI is a scalar integer variable used for defining the active state of the system safety input variable (**S_SAFIN**) specifying inversion of the signal input logic, if required.

When an **S_SAFINI** bit=0, the corresponding signal is not inverted and the high voltage state is considered active.

When an **S_SAFINI** bit=1, the bit is inverted and the low voltage state is considered active.

There is only one **S_SAFINI** bit that can be inverted:

Bit	Fault	Fault Description	
28	#ES	Hardware Emergency Stop 1 = ES signal is activated.	

3.4.2.2.2 S_FMASK

S_FMASK is scalar integer variable consisting of a set of bits for enabling or disabling the system faults contained in S_FAULT. **S_FMASK** is connected to **S_FAULT** in the same way that FMASK is connected withFAULT.

The **S_FMASK** bit default values are 1 which cause the controller to check for the fault associated with that bit, as follows:

- > 0: The corresponding **S_FAULT** bit is disabled
- > 1: The corresponding **S_FAULT** is enabled and examined each MPU cycle.

The **S_FMASK** bits are:

Bit	Fault	Fault Description	
25	#PROG	Program Fault 1 = Run time error occurs in one of the executing ACSPL+ programs.	
26	#MEM	Memory Overflow 1 = User application requires too much memory.	
27	#TIME	MPU Overuse 1 = User application consumes too much time in the controller cycle.	
28	#ES	Hardware Emergency Stop 1 = ES signal is activated.	
29	#INT	Servo Interrupt 1 = The servo interrupt that defines the controller cycle is not generated. The fault indicates a fatal controller problem.	
30	#INTGR	File Integrity 1 = The integrity of the user application in controller RAM is checked by the controller at power-up and whenever an #IR command is issued.	
31	#FAILURE	Component Failure 1 = An MC4U hardware component other than the drive, such as the Power Supply, I/O card, or encoder card, has failed.	

3.4.2.2.3 S_FDEF

S_FDEF is a scalar integer variable consisting of a set of bits for defining the default response for the system faults contained in S_FAULT. **S_FDEF** is connected to **S_FAULT** in the same way that FDEF is connected with FAULT.

The default value for all **S_FDEF** bits is 1, which enables the default response. If an **S_FDEF** bit = 0, the default response is disabled.

The **S_FDEF** bits are:

Bit	Fault	Fault Description	Default Response
25	#PROG	Program Fault 1 = Run time error occurs in one of the executing ACSPL+ programs.	The controller kills all axes.
26	#MEM	Memory Fault 1 = User application requires too much memory.	The controller kills all axes.

Bit	Fault	Fault Description	Default Response
27	#TIME	MPU Overuse 1 = User application consumes too much time in the controller cycle.	No default response.
28	#ES	Hardware Emergency Stop 1 = ES signal is activated.	The controller disables all axes. It does not stop the program buffers.
29	#INT	Servo Interrupt 1 = The servo interrupt that defines the controller cycle is not generated. The fault indicates a fatal controller problem.	The controller disables all axes.
30	#INTGR	File Integrity 1 = The integrity of the user application in controller RAM is checked by the controller at power-up and whenever an #IR command is issued.	No default response
31	#FAILURE	Component Failure 1 = An MC4U hardware component other than the drive, such as the Power Supply, I/O card, or encoder card, has failed.	No default response You are responsible for incorporating a user- defined response into your program.

3.4.2.2.4 S_FAULT

S_FAULT is a scalar integer variable consisting of a set of bits equating to the occurrence of System Faults (faults that are not related to any specific axis).

The **S_FAULT** bits are:

	•
1	-
L	

The **S_FAULT** variable contains bits related to Axis Faults, but only the System Fault bits are relevant to the Safety and Faults Configurator.

Bit	Fault	Fault Description
25	#PROG	Program Fault 1 = Run time error occurs in one of the executing ACSPL+ programs.
26	#MEM	Memory Fault 1 = User application requires too much memory.
27	#TIME	MPU Overuse 1 = User application consumes too much time in the controller cycle.
28	#ES	Hardware Emergency Stop 1 = ES signal is activated.
29	#INT	Servo Interrupt 1 = The servo interrupt that defines the controller cycle is not generated. The fault indicates a fatal controller problem.
30	#INTGR	File Integrity 1 = The integrity of the user application in controller RAM is checked by the controller at power-up and whenever an #IR command is issued.
31	#FAILURE	Component Failure 1 = An MC4U hardware component other than the drive, such as the Power Supply, I/O card, or encoder card, has failed.

3.4.3 Working with Safety and Faults Configurator

Select Axis

You can select as many axes as you have or are interested in tracking. To select an axis:

1. Click the **Axis** down arrow to display the list of axes.

Axis:	1 (Y)			
Axis	0 (X)			
- AND	1 (Y)			
_	2 (Z)			
Hardy	Hardy 3 (T)			
Hardy	Hardware Left Limit			

2. Click the axis that you want to configure.

Enabling/Disabling Fault Bits

Only those fault variable bits with a checkbox in the column are available for selection. To enable a bit you click it.

The bit selection symbols are:

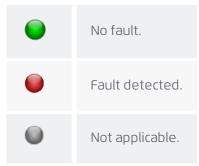
Bit has not been selected.
Bit has been selected.
Bit is not available for selection



Some bit selections are dependent on your selecting other bits. For example, there is a connection between FMASK and FDEF, when you select a bit in **FMASK**, this makes the corresponding bit in **FDEF** available for selection.

Indication

The symbols in the **Indication** column act like LEDs and indicate:



Action Buttons

The Safety and Faults Configurator has the following action buttons:

S Factory Default	Sets all parameters to factory defaults.
O Discard Changes	Removes changes and restores previous selections.
Save to Flash	Saves the data to the controller's flash memory.
Save and Close	Saves the data to the controller's flash memory and closes the window.
× Close	Closes the window without saving the data.

4. Application Development

Application Development contains the following tools for use in programming your SPiiPlus Motion Controller:

- Application Wizard enables you to manage the controller program files, such as loading applications parameters, saving the parameters, copying files to the controller, and the like.
- > Program Manager your principal tool for programming your SPiiPlus Motion Controller.
- Protection Wizard enables you to define the controller protection mode parameters, modify the protection mode parameters, and view the protection status.

4.1 Accessing Application Development Tools

To access the Application Development tools:

- 1. If the Toolbox is not displayed, click **Toolbox**.
- 2. Click **Application Development**. The Application Development list of tools appears:

Toolbox	•	џ	×
Application Development			
Application Wizard			
Program Manager			
Protection Wizard			
Setup			
Application Development			
Utilities			
Diagnostics and Monitoring			
Toolbox × Workspace			

3. Click the required tool in the list to open it.

4.2 Application Wizard

The **Application Wizard** is a tool for loading or saving system and axis parameters from or to the disk files, changing settings, managing the user files, exporting/importing arrays, copying any files to the controller's flash and deleting any files from the controller's flash.

Application Wizard leads you through the performance of the following tasks:

- > Application Loader
- > Application Saver
- > User File Manager
- > Import Data to Controller
- > Export Data from Controller
- > Copy File to Controller
- > Delete File from Controller

4.2.1 Activating Application Wizard

- 1. From the Toolbox click **Application Development**.
- 2. Click **Application Wizard**.

•	

You can also activate the **Application Wizard** using the right-click **Add Component** option of the Workspace Tree - see **Controller Right-Click Options**.

The Application Wizard Task window appears.

My controller - Application	Vaard ×			
	Select a Task			
Configure Loading Loading Configure Saving	Application Loader / Saver			
Import Array Export Array	Coad Application to Controller Loads application from a file on computer to the controller's fash.			
User files Manager Copy File	Save Application to PC Saves application from the controller's flash to a file on computer.			
Delete File	Import / Export Arrays			
	Import Data to Controler Imports data from selected file on computer to controller array or file.			
	Export Data from Controler Exports data from controler's array or file to selected file on computer.			
	Files Manager			
	Manage User Files in Controler Alows the user to manage user files on controler's flash.			
	Copy File to Controller Copies selected files from computer to controller's flash.			
	Delete File from Controller Deletes selected file from controller's flash.			
The Application Wizard has	2 different options to choose from: Load Application to Controler, Save Application from Controler, Import Data to Controler, Export Data from Controler, Manage User Fles in Controler, Copy Fle to Controler, and	Produ		(and)
Delete File from Controller.		<< Back	Next >>	Cancel

3. Select the required task, then click **Next**.

4.2.2 Application Loader

Application Loader is used:

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- > To load an application from the disk file
- > To change settings of the loaded application.
- To load an application from a disk file:
- 1. Select Load Application to the Controller under Application Saver/Loader in Select a Task.

My controller - Application V	Vizard ×		
	Select a Task		
Configure Loading Loading Configure Saving	Application Loader / Saver		
Import Array Export Array	Load Application to Controller Loads application from a file on computer to the controller's flash		
User files Manager Copy File	Save Application to PC Saves application from the controller's flash to a file on computer.		
Delete File	Import / Export Arrays		
	Import Data to Controller Imports data from selected file on computer to controller array or file.		
	Export Data from Controler Exports data from controler's array or file to selected file on computer.		
	Files Manager		
	Manage User Fles in Controler Alows the user to manage user fles on controler's flash.		
	Copy File to Controller Copies selected files from computer to controlle's flash.		
	Delete Fle from Controller Deletes selected fle from controller's flash.		
The Application Wizard has Delete File from Controller.	7 different options to choose from: Load Application to Controler, Save Application from Controler, Import Data to Controler, Export Data from Controler, Manage User Files in Controler, Copy File to Controler, and	< Back Ne	xt >> Cancel

2. Click Next. The Configure Loading window appears.

CT000007A - Application V	Vizard ×					
Select a Task <	Configure Loading					
> Configure Loading	-					
Loading Configure Saving	File:			Browse		
Import Array	User:					
Export Array	Machine:					
User files Manager	Date:	Saving took				
Copy File Delete File	Firmware:	Controller s/n:				
Delete File						
	Remarks:					
	ACSP	+ Programs Configuration Parameters SP Programs User parameters				
		view of selected term		<u> </u>		
Configure Loading step pro application file has been se	wides the fu lected. Only	nctionality to browse for an application file to load to the controller. Al components of the application file (Saved ACSPL+ programs, configuration parameters, SP programs, and user files) are displayed once the r checked components will be loaded to the controller. A preview of a selected component can be displayed. Refer to the tool-tips for a detailed description of the corresponding parameters.	<< Back Ne	xt >> Cancel		

3. Click **Browse** to select the application file to be loaded.

A Select file to load				×
← → ✓ ↑ 🔤 « SPiiPlus ADK Suite v3.00 > SPiiPlus MMI Application	Studio	マ ひ Search SPi	iPlus MMI Applicati	P
Organize 🔻 New folder			III 🔹 🔲	?
Translations ^ Name	Date modified	Туре	Size	
Troubleshooting	26/01/2020 14:24	File folder		
Website				
This PC				
Desktop				
Documents				
+ Downloads				
b Music				
E Pictures				
• OS (C:)				
Data (D:)				
File <u>n</u> ame:		 ✓ Spi files (' 	*.spi)	~
		<u>O</u> per	n Cancel	



Application files have an **.spi** extension.

4. Select the file and click **Open**.

The common information about the application appears and the option grid is filled with the values from the file. You can choose the setting to be loaded.

ACSPL+ Programs	Configuration Parameters	SP Programs	User parameters
Buffer 0	System		
Buffer 1	Axis 0 To 0	di seconda	
Buffer 2	Axis 1 To 1	/	
Buffer 3	Axis 2 To 2	/	
V Buffer 4	Axis 3 To 3	/	
✓ Buffer 5	Axis 4 To 4	1	
✓ Buffer 6	Axis 5 To 5	1	
V Buffer 7	Axis 6 To 6	1	
✓ Buffer 8	Axis 7 To 7	/	
V Buffer 9	Axis 8 To 8	/	
Buffer 10	Axis 9 To 9		
Buffer 11	Axis 10 To 10		
✓ Buffer 12	Axis 11 To 11	/	
Buffer 13	Axis 12 To 12	/	
✓ Buffer 14	Axis 13 To 13	/	
✓ Buffer 15	Axis 14 To 14	/	
✓ Buffer 16	Axis 15 To 15	/	
Buffer 17	Axis 16 To 16	1	
Buffer 18	Axis 17 To 17	1	
✓ Buffer 19	Axis 18 To 18	/	
Buffer 20	Axis 19 To 19	/	
Puffor 21	Axis 20 To 20		

In the **Configuration Parameters** column you can see default axis assignment (which axis in the loaded application is assigned each axis in the controller).

5. To change the default assignment, click 🖉 next to the required axis or axes and clear the destination axis.

This lets you assign the destination axis with a different source axis.

Axis 2(Z)	*
0	
1	
2	
3	

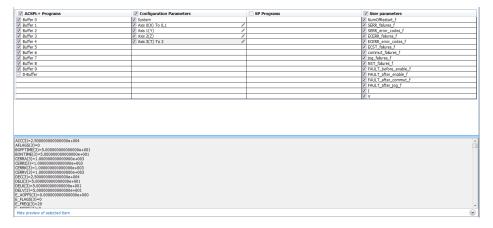
6. Click OK.

7. Click 📝 next to any axis and assign the axis that you unassigned in the previous step.

Axis 3(T) To 2	*
0	
1	
2	
3	

In this way, you can assign any axis from the loaded application to any **axis or axes** in the controller.

8. You can preview the data loading from the file. Select **Show preview of selected item**.



9. To check or uncheck all options in the grid column, click the checkbox 🗹 in the column header.



SP Programs will appear only if they have been previously saved.

Click Next to start loading process.
 The Loading window is displayed listing the process steps that are performed:

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<mark>k <</mark> Loading	
ACSPL+ programs from buffer 32 - were not loaded	
ACSPL+ programs from buffer 32 - were not loaded ACSPL+ programs from buffer 33 - were not loaded	
ACSPL+ programs from buffer 33 - were not loaded	
ACCRL + programs from huffer 25 - wore not loaded	
ACSPL+ programs from buffer 35 - were not loaded	
ACSPL+ programs from buffer 37 - were not loaded	
ACCOL - and and from huffer 20 - ward and landed	
ACSPL+ programs from buffer 39 - were not loaded	
ACSPL+ programs from buffer 40 - were not loaded	
ACSPL+ programs from buffer 41 - were not loaded	
ACSPL+ programs from buffer 42 - were not loaded	
ACSPL+ programs from buffer 43 - were not loaded	
ACSPL+ programs from buffer 44 - were not loaded	
ACSPL+ programs from buffer 45 - were not loaded ACSPL+ programs from buffer 46 - were not loaded	
ACSPL+ programs from buffer 40 - were not loaded ACSPL+ programs from buffer 47 - were not loaded	
ACSPL+ programs from buffer 48 - were not loaded	
ACSPL+ programs from buffer 49 - were not loaded	
ACSPL+ programs from buffer 50 - were not loaded	
ACSPL+ programs from buffer 51 - were not loaded	
ACSPL+ programs from buffer 52 - were not loaded	
ACSPL+ programs from buffer 53 - were not loaded	
ACSPL+ programs from buffer 54 - were not loaded	
ACSPL+ programs from buffer 55 - were not loaded	
ACSPL+ programs from buffer 56 - were not loaded	
ACSPL+ programs from buffer 57 - were not loaded	
ACSPL+ programs from buffer 58 - were not loaded ACSPL+ programs from buffer 59 - were not loaded	
ACSPL+ programs from buffer 60 - were not loaded	
ACSPL+ programs from buffer 61 - were not loaded	
ACSPL+ programs from buffer 62 - were not loaded	
ACSPL+ programs from buffer 63 - were not loaded	
ACSPL+ programs from D-Buffer - were successfully loaded	
System parameters - were successfully loaded	
Parameters of Axis 0 - were successfully loaded To Axis 6	
Parameters of Axis 1 - were successfully loaded To Axis 1	
Parameters of Axis 2 - were successfully loaded To Axis 2	
Parameters of Axis 3 - were successfully loaded To Axis 3 Parameters of Axis 4 - were successfully loaded To Axis 4	
Parameters of Axis 4 - were successfully loaded To Axis 4 Parameters of Axis 7 - were successfully loaded To Axis 7	
Parameters of Axis 7 - were successfully loaded To Axis 7 Parameters of Axis 8 - were successfully loaded To Axis 8	
Parameters of Axis 9 - were successfully loaded To Axis 9	
Parameters of Axis 10 - were successfully loaded To Axis 10	
Parameters of Axis 11 - were successfully loaded To Axis 11	
Save Report	
Save Report	

The controller is rebooted:



11. Click **OK**.

12. Wait for notification of a successful reboot:



- 13. Click **OK**. You are returned to the Loading window.
- 14. To save the report click **Save Report**. The browser window is displayed:

🛃 Save log					×
$\leftarrow \rightarrow \ \cdot \ \uparrow$ \blacksquare « ACS Motion Control	→ SPiiPlus ADK Suite v3.00 → SPiiPlus MM	l Application Studio	√ Ū	Search SPiiPlus MMI Ap	oplicati 🔎
Organize 🔻 New folder					- ?
This PC	Name	Date modified	Туре	Size	
3D Objects	Help	17/11/2019 16:59	File folder		
E Desktop					
Documents					
🖶 Downloads					
👌 Music					
Pictures					
Videos					
🟪 OS (C:)					
👝 Data (D:)					
🛖 Marketing (\\main_server\Main_Ser					
🛫 Users (\\storage-01\Main_Server\0)					
🛖 POs (\\main_server\Main_Server\Pr 🗸					
File name:					~
Save as type: *.log					~
 Hide Folders 				Save	Cancel

15. Select a directory and enter a filename. Click **Save**.

The file extension for all reports is .log .

- **16**. To print the report click **Print Report**.
- 17. Click **Finish** to exit the Application Wizard.

4.2.3 Application Saver

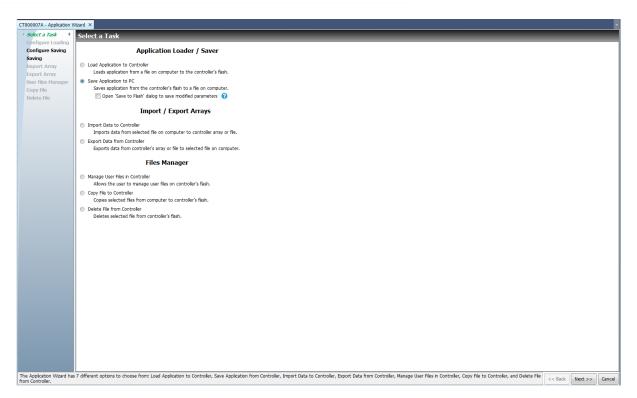
Application Saver is used:

- > To save the application from the controller to the disk file.
- > To view and, where needed, change the settings of the axes, system parameters and variables in the controller application.

To save an application from the controller to a disk file:

1. Select Save Application from Controller from SELECT A TASK.

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2. Click **Next**. The Save to Flash window is displayed:

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ne:			
1/28/2020		Saving tool: Application Wizard (SPiPlus M	MI Application Studio)
			na rippication occupy
are: 2.79.17.00		Controller s/n: CT000007A	
rks:			
ACSPL+ Programs	Configuration Parameters	SP Programs	User parameters
uffer 0	System	SP#0	NumOfRestart_f
iffer 1	Axis 0(X)		SERR_failures_f
iffer 2	Axis 1(Y)		SERR_error_codes_f
iffer 3	Axis 2(Z)		ECERR_failures_f
iffer 4	Axis 3(T)		<pre>ECERR_error_codes_f</pre>
iffer 5			ECST failures f
iffer 6			commut failures f
iffer 7			✓ jog_falures_f
iffer 8			NST failures f
iffer 9			✓ FAULT_before_enable_f
Buffer			FAULT after enable f
			FAULT_after_commut_f
			✓ FAULT_after_jog_f
			V I

The save to file process is as follows:

- > The wizard first saves the configuration data to the controller's flash.
- > It then saves the data from the controller's flash to the selected file.



You have the option of saving some or all of the application data by selecting or deselecting the checkbox (🗹) in the column header.

3. Click **Save**. The Configure Saving window is displayed:

Configure Savin			
File:			
User:			
Machine:			
Date: 11/18/2019		Saving tool: Application Wizard	I (SPIPlus MMI Application Studio)
Firmware: 2.79.12.00		Controller s/n: #New Board	
Remarks:			
ACSPL+ Program	S Configuration Parame	eters SP Programs	✓ User parameters
Buffer 0	System	SP#0	
Buffer 1	Axis 0	SP#1	
Buffer 2	Axis 1	SP#2	
Buffer 3	Axis 2	SP#3	
V Buffer 4	Axis 3	SP#4	
V Buffer 5	Axis 4	SP#5	
Buffer 6	Axis 5	SP#6	
Buffer 7	Axis 6	E SP#7	
Buffer 8	Axis 7	SP#8	
Buffer 9	Axis 8	SP#9	
Buffer 10	Axis 9	SP#10	
Buffer 11	Axis 10	SP#11	
Buffer 12	Axis 11	SP#12	
Buffer 13	Axis 12	SP#13	
Buffer 14	Axis 13	SP#14	
Buffer 15	Axis 14	SP#15	
Buffer 16	Axis 15	SP#16	
Buffer 17	Axis 16	SP#17	
Buffer 18	Axis 17	SP#18	
Buffer 19	Axis 18	SP#19	
Buffer 20	Axis 19	SP#20	
	Z Avic 70		
Ruffer 21			

4. Click **Browse** to select where the application data is to be saved. A browse window is displayed:

🛃 Save to file				\times
← → · ↑ 📙 « SPiiP	lus ADK Suite v3.00 > SPiiPlus MMI Application Studio	✓ [™] Searce	h SPiiPlus MMI Applic	ati 🔎
Organize 🔻 New folder				?
Website	^ Name ^	Date modified	Туре	Size
💻 This PC	Help	26/01/2020 14:24	File folder	
🧊 3D Objects				
E Desktop				
Documents				
🖶 Downloads				
👌 Music				
Pictures				
📑 Videos				
🟪 OS (C:)				
🔜 Data (D:)				
a	✓ <			>
File <u>n</u> ame:				~
Save as type: Spi files	(*.spi)			~
∧ Hide Folders			<u>S</u> ave Car	nceli



Application files have an **.spi** extension.

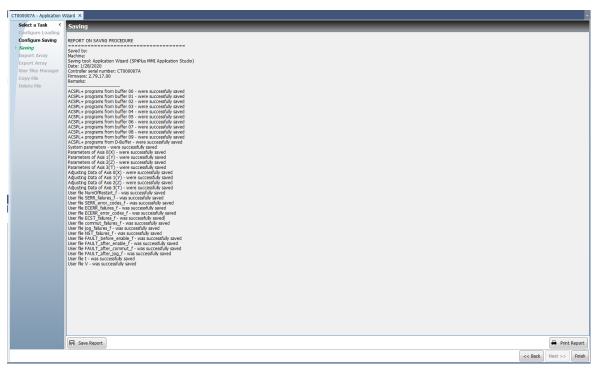
- 5. Select the directory, and enter a file name in the **File name** field. Click **Open**. You are returned to the Configure Saving window.
- 6. You can determine what data to be saved by selecting or deselecting the checkbox (♥) in the column header.

By default the SP column is not selected. If you want to save the SP data as well, select
the column. You are advised:
New - SPiiPlus MMI Application Studio
Check only if customized SP programs are used. Do you still want to check ?
Normally you will want to save SP data only if the SP programs have been customized; however, you can save it in any case by clicking Yes .

7. You can view any data in the controller application by selecting the item and clicking **Show preview of selected item**, for example:



8. Click **Next**. The Saving window is displayed.



9. To save the report click **Save Report**. The browser window is displayed:

🛃 Save log				×
$\leftarrow \ ightarrow \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \$	Plus ADK Suite v3.00 > SPiiPlus MMI A	Application Studio 🗸 ひ	Search SPiiPlus M	MI Applicati 🔎
Organize 👻 New folder				III - III
💻 This PC	^ Name	^ Date modified	Туре	Size
3D Objects	Help	26/01/2020 14:24	File folde	2r
📃 Desktop				
Documents				
👆 Downloads				
b Music				
E Pictures				
📑 Videos				
🟪 OS (C:)				
🔜 Data (D:)				
👝 Kindle (F:)				
	~ <			>
File <u>n</u> ame:				~
Save as type: *.log				~
 Hide Folders 			<u>S</u> ave	Cancel

10. Select a directory and enter a filename. Click **Save**.



The file extension for all reports is **.log**.

- 11. To print the report click **Print Report**.
- 12. Click **Finish** to exit the Application Wizard.

4.2.4 Import Data to Controller

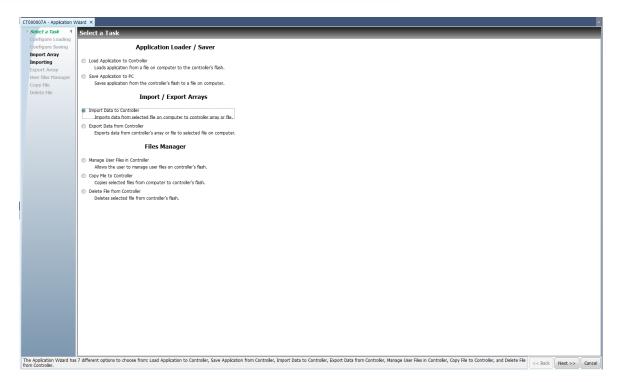
Import Data to Controller is used:

- > To import arrays and user files to the controller.
- > To preview the contents of the array or the user file .

The imported data must be in tabular form (an array of rows and columns), with the columns separated by either a tab or space.

If you are importing data from an Excel file:

- 1. Ensure the data is organized in tabular form (rows and columns).
- 2. Depending on the Excel version you have, click **FILE** >**SAVE AS**.
- 3. Select the folder **PROGRAM ARRAYS**, and in the **FILE NAME** box, type a name for the file.
- 4. In the SAVE AS TYPE list, click either TEXT (TAB DELIMITED) (*.TXT) or FORMATTED TEXT (SPACE DELIMITED) (*.PRN).
- 5. Click SAVE.
- 1. Select Import Data to Controller from Select a Task.



2. Click **Next**. The Import Array window is displayed.

Import Arr		
Import Arr	ay	
File:	Select fle	
Data Type		
Show Preview	N	🔲 Trar
O Array in Conti	roler	
Select Scope	Giobal	
Select Name	1	
Data Type		
Row Range f	from 0 \$ to 0 \$	
Column Range f	from 0 \$ to 0 \$	
File in Control	ler	
Select File	NumORestart_f	ŭ v

3. Click **Browse** and select the file for importing from the list that is displayed. Then click **Open**.

🖪 Import array from file					х
← → × 📙 « SPiiPlu	IS ADK Suite v3.00 → SPiiPlus MMI Application	Studio	✓ ່ບ Search SPi	Plus MMI Appl	licati ,0
Organize 🔻 New folder					
Translations	Name	Date modified	Туре	Size	
Troubleshooting	Help	26/01/2020 14:24	File folder		
This PC 3D Objects					
Desktop Documents Downloads 					
Music					
Videos					
Data (D:)					
File <u>n</u> ame	s		✓ Text files (<u>Oper</u>	-	~ ancel

4. You may preview the data of the selected array file by selecting **Show preview**.

< Export Ar	,	
ring File:	C:\Program Files (x86) ACS Motion Control SPIPlus ADK Suite v3.00 SPIPlus MMI Application Studio\Learn1.txt	
Array in Cor	ntroler	
Select Scope	Gobal	
ager Select Name	I	
Data Type	int(100)	
Row Range	from 0 \$ to 99 \$	
Column Range	from 1 \$\opprox 1\$ \$\opprox 0\$ -1 \$\opprox -1\$	
Format	12345	(# Ch
Transpose	Data	
File in Cont	roler	
Select File	NumORestart, f	
Transpose	Data	
Show Previe		0
		0
		0
0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0
0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0
0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0
0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0
•	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	



You can transpose the array by clicking **Transpose**.

You have two options:

- > Importing into an ASCPL+ array (or matrix) variable
- > Importing into a user-defined array (or matrix) variable
- 1. For importing into an ASCPL+ array:

> Select Array in Controller.

> You can select from Global variables, or narrow the selection of variables to a particular buffer by selecting the buffer from the **Select Scope** dropdown list:

Array in Control	y in Controller		
Select Scope	Giobal		
	Global		
	Buffer 0		
Data Type	Buffer 1		
	Buffer 2		
Row Range fro	Buffer 3		
	Buffer 4		
Column Range fro	Buffer 5		
Format	Buffer 6		
	Buffer 7		
Transpose Data	Buffer 8		
	Buffer 9		
Controller			

> Select the variable name from the dropdown list.

Array in Control	A Array in Controller				
Select Scope	Global				
	1				
	1 10 10				
Row Range fro	n				
Column Range fro					
F	14				
	15				
File in Controller	18 79				
	190				
Transpose Data	191 192				
	193				
	194 195				
	196				
	197				

Once you have entered the variable name, the data type is automatically displayed.

You have the option of selecting only a portion of the array by entering the range using **Row Range** and **ColumnRange**, as appropriate.

@ Array in Controller					
Select Scope	Global	.			
Select Name	DCA				
Data Type	real(3)(1000)				
Row Range	from 0 0 to 2 0				
Column Rang	e from 00 to 9990				
Format	l.23451e+4	Change Format			
E Transpose Da	ка				

- > Click **Next** to start the exporting process.
- 2. For importing into a file in the controller's flash:
 - > Select File in Controller.
 - > Either type in a name or select the required file from the dropdown list.

	U R
NumOfRestart_f	
SERR_falures_f	
SERR_error_codes_f	
ECERR_failures_f	
ECERR_error_codes_f	
ECST_falures_f	
commut_failures_f	
jog_falures_f	
NST_falures_f	
FAULT_before_enable_f	
FAULT_after_enable_f	
FAULT_after_commut_f	
FAULT_after_jog_f	
I	

> Click **Next** to start the exporting process.

The Importing window is displayed with a running log of the process:

CT000007A - Application	- ward ×
Select a Task 《	
Configure Loading	
Configure Saving	REPORT ON LOADING PROCEDURE START
Import Array Importing	Report time: 2/3/2020 10:21:33 AM
Export Array	Firmware version: 2.79.17.00 Controller s/n: C100007A
User files Manager	Task: Import data from the local file to the user file on the controller. File twee: int100
Copy File	The type: int(100) user file location: <cupre numorestart_f<="" th=""></cupre>
Delete File	> Loading data from file "C:\Program Files (x86)\ACS Motion Control\SPIPUs ADK Suite v3.00\SPIPUs MMI Application Studio\Learn1.bt" to local file "NumORestart_f" - successfully loaded.
	LOADING PROCEDURE FINISHED
•	
	Save Report
	<< Back Next >> Finish

3. You have the option of saving the log to a file by clicking **Save Report** which opens a dialog window:

🗧 🔿 🕐 🕇 📴 « SPiiPl	us ADK Suite v3.00 > SPiiPlus MMI Application S	tudio 🗸 🖉 Sea	rch SPiiPlus MMI Applicati
Organize 👻 New folder			8:: -
💻 This PC	^ Name ^	Date modified	Type S
3D Objects	Help	26/01/2020 14:24	File folder
Desktop			
Documents			
👆 Downloads			
👌 Music			
E Pictures			
Videos			
💁 OS (C:)			
👝 Data (D:)			
Kindle (F:)			
	~ <		
File name:			
Save as type: *.log			

4. Select a directory and enter a filename. Click **Save**.

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	•
	<u> </u>

The file extension for all reports is **.log**

- 5. To print the report click **Print Report**.
- 6. Click **Finish** to exit the Application Wizard.

4.2.5 Export Data from Controller

Export Data from Controller is used:

- > To export arrays and user files from the controller flash to files on the disk
- > To preview the content of the array or the user file from the controller
- 1. Select **Export Data from Controller** from Select a Task.

CT000007A - Application V							
> Select a Task <	Select a Task						
Configure Loading							
Configure Saving	Application Loader / Saver						
Import Array							
Export Array	Load Application to Controller						
Exporting	Loads application from a file on computer to the controller's flash.						
User files Manager	Save Application to PC						
Copy File	Saves application from the controller's flash to a file on computer.						
Delete File							
	Import / Export Arrays						
	Import Data to Controller						
	Imports data from selected file on computer to controller array or file.						
	Export Data from Controller						
	Exports data from controller's array or file to selected file on computer.						
	Files Manager						
	Пез манаден						
	O Manage User Fles in Controller						
	Allows the user to manage user files on controller's flash.						
	Copy File to Controller						
	Copies selected files from computer to controller's flash.						
	Delete File from Controller						
	Delete as microardoard						
The Application Wizard has	7 different options to choose from: Load Application to Controller, Save Application from Controller, Import Data to Controller, Export Data from Controller, Manage User Files in Controller, Copy File to Controller, and Delete File	<< Back	Next >>	Cancel			
from Controller.		S BdCK	Mext >>	Carlcer			

- 2. Click **Next**. The Export Array to the File window is displayed.
- 3. Click **Browse** in the **Select File** field, the browse window is displayed:

	Select a Task <	Export Arra		
0	onfigure Saving	File:	Select file	Browse
> 1	mport Array Export Array	Array in Control	ц	
	xporting Jser files Manager	Select Scope	Global	

4. Use the browse window to select the directory, and, if applicable, a file name.

Export array to file			×
	ADK Suite v3.00 > SPiiPlus MMI Application Studio	o > ∨ Č Sear	ch SPiiPlus MMI Applicati 🔎
Organize 👻 New folder			BII - ()
Translations	^ Name	Date modified	Type Size
Troubleshooting	Help	26/01/2020 14:24	File folder
	Repository Data	29/01/2020 7:37	File folder
💻 This PC			
3D Objects			
Desktop			
Documents			
Downloads			
👌 Music			
E Pictures			
📑 Videos			
L OS (C:)	v <		
File <u>n</u> ame: Learn1.txt			`
			· · · · · · · · · · · · · · · · · · ·

5. Click Save.



You can type a name in the **File name** field to create a new file.

The Export Array to the File window is displayed:

Sixt Lake Configure Lake Configure Lake (d8)/LCS Motion Control(SPP/Lis MML Application Studio).Lam2.bt Function	CT000007A - Application	Waad ×	-
File: C\Program Files (x86)\ACS Motion ControlSPP/Ms ADK Suite V3.00(SPP/Ms MMI. Application Studio)Leam2.bt Browsee Proor A rary A ray in Controler Select Scope Gobal Select Name I I		Export Array	
Array Coord Array Excorting Wer files Runado Delete File Aray in Controller Select Scope Delete File Select Scope Select Select Scope Select Scope Select Scope Select		Ein- ChPromam Eins (V961)/4CS Motion Control Spiblus ADX Suita v3 00(SDB)/us MMI Application Structure)	Browse
Arry n Controler Sect Stope Gobal Sect Gobal			
Uper files Hanage Select Name I Cotyp File Select Name I I Delete File Select Name I I I Row Range from 0 to 99 0 I I I Column Range from 0 to 99 0 I <t< th=""><th></th><th>Array in Controller</th><th></th></t<>		Array in Controller	
Select Name I Deta Type int(100) Box Range from 0 to 10 to 99 to Column Range from 1 to 10 to 10 Formet 12345 Transpose Data O Fle n Controler Select File NumORRestart f Transpose Data		Select Scope Global	•
Delete File Dela Type Int(100) Row Range from 0 0 to 99 0 Colum Range from 1 0 0 - 1 0 Formet 12345 # Change Formatc. Intranspose Data # Change Formatc. Select File NumORestant. f • To Refresh Intranspose Data • To Refresh		Select Name I	
Column Range from 1 + to 1 + t		Data Type int(100)	
Column Range from 1 + to 1 + t		Row Range from 0 ¢ to 99 ¢	
Format 12245 ff: Diange Format. Transpose Data * O File in Controler * Select: File NumORestart. f. * Transpose Data *			
Fle n Controler Select Fle Iumo/Restart_f Refresh Refresh Refresh			# Change Format
Fle n Controler Select Fle Iumo/Restart_f Refresh Refresh Refresh		Transpose Data	
Select Fie NumORestart_f Refresh Refresh			
Transpose Data			
		Select Fie NumORestart, f	▼ 🕑 Refresh
Show Preview		Transpose Data	
		Show Preview	()
Export Array step provides the functionality to save an ACSPL+ array or Fash file in the controler to a deta file in a local file directory. The data file can be written with integer or floating-point data. The data file is written with the columns being single-	Export Array step provide	be functionality to save an ACSPL+ array or Fash file in the controller to a data file in a local file directory. The data file can be written with integer or floating-point data. The data file is written with the columns being snolls-	

You have two options:

- > Exporting an ASCPL+ array (or matrix) variable
- > Exporting a user-defined array (or matrix) variable
- 1. For exporting an ASCPL+ array:

> Select Array in Controller.

> You can select from Global variables, or narrow the selection of variables to a particular buffer by selecting the buffer from the **Select Scope** dropdown list:

Array in Control	ler	
Select Scope	Global	•
	Global	
Select Name	Buffer 0	
Data Type	Buffer 1	
	Buffer 2	
Row Range fro	Buffer 3	
	Buffer 4	
Column Range fro	Buffer 5	
Format	Buffer 0 Buffer 7	
	Buffer 7	
Transpose Data	Buffer 8	
	Buffer 9	
C City in Combroller		

> Select the variable name from the dropdown list.

Array in Control	Aer	
Select Scope	Giobal	,
Select Name	I	•
Data Type	1 3	ľ
Row Range fro	, 11	
Column Range fro		ļ
	H 15	
📃 Transpose Data	- 16 7	
File in Controller		
Select File	190	
Transpose Data	191 92	
	93 94	
	195	
	196 197	

Once you have entered the variable name, the data type is automatically displayed.	
--	--

> You have the option of selecting only a portion of the array by entering the range using **Row Range** and **ColumnRange**, as appropriate.

@ Array in Controller	
Select Scope Global	•
Select Name I	•
Data Type int(100)	
Row Range from 0 C to 99 C	
Column Range from 1 0 to 1 0	
Format 12345	# Change Format
Transpose Data	

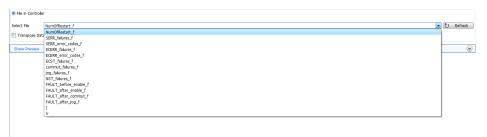
> The current format of the output data is displayed in the Format field. You have the option to change output format by clicking **Change Format**.

🛃 Change F	×	
Format	Decimal	•
Width	12 🛊	
Example	12345	
Apply	7	Cancel

> Select the required notational format from the **Format** dropdown list. Where needed, change the **Width** and/or **Precision**. Click **Apply**.

You can transpose the array elements by selecting Transpose , for example, if a matrix has m rows and n columns, selecting Transpose causes it to be saved as a matrix having n rows and m columns.
You also have the option of viewing the current values of the array elements by clicking Show Preview .
Stour Preview © 0 <

- > Click **Next** to start the exporting process.
- 2. For exporting a file in the controller's flash:
 - > Select File in Controller.
 - > Select the required file from the dropdown list.





You can transpose the array by clicking **Transpose.** You can preview the data by clicking **Show Preview.**

> Click **Next** to start the exporting process.

The Exporting window is displayed with a running log of the process:

#New Board - Application Wizard	
Select a Task Configure Loading	Exporting Page
Configure Saving Import array ♥ Eqort array User files Manager Copy file Delete file Delete file	REPORT ON SAVING PROCEDURE START Remove version: 6:00 Controller s/n: #Hew Board Task: Export data from twistable on the controller to the local file Versible toston: global > Saving data from variable "1" to local file "C:\SPIPLus MMI Application Studio - 2010-01-21 (PROTECTED)(Database)New Data.txt" - successfully saved. SAVING PROCEDURE FINISHED
	Save Report
	<< Back Next >>> Finish

3. You have the option of saving the log to a file by clicking **Save Report** which opens a dialog window:

Save log			>
> 🗠 🛧 📙 « SPiiPlu	us ADK Suite v3.00	Studio v Ö Se	arch SPiiPlus MMI Applicati 🔎
Organize 👻 New folder			ii • 🔞
This PC	^ Name ^	Date modified	Type Size
3D Objects	Help	26/01/2020 14:24	File folder
Cesktop			
Documents			
🕹 Downloads			
Music			
E Pictures			
🚰 Videos			
OS (C:)			
👝 Data (D:)			
Kindle (F:)			
	~ <		
File game:			
Save as type: ".log			
		_	Save Cancel

4. Select a directory and enter a filename. Click **Save**.



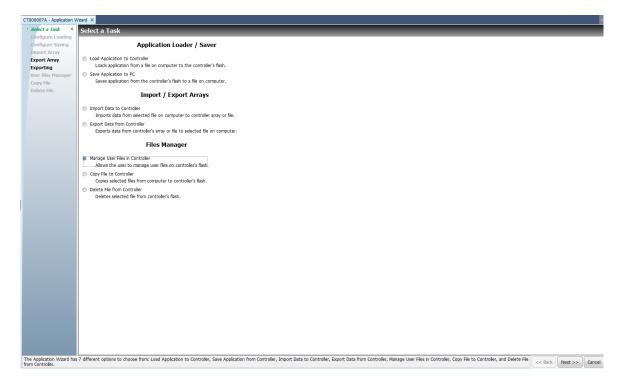
The file extension for all reports is **.log**.

- 5. To print the report click **Print Report**.
- 6. Click **Finish** to exit the Application Wizard.

4.2.6 User File Manager

User File Manager is used:

- > To view the list of the user files stored in the controller flash
- > To preview the contents of the user file
- > To delete some or all user files
- 1. Select Manage User Files in Controller from Select a Task.



2. Click **Next**. The Manage User Files in Controller window is displayed:

Name			
	Туре	File Size [bytes]	
NumOfRestart_f	int(100)	416	
SERR_failures_f	int(1)	20	
SERR_error_codes_f	int(3)(1000)	12016	
ECERR_failures_f	int(1)	20	
ECERR_error_codes_f	int(3)(1000)	12016	
ECST_failures_f	int(7)	44	
commut_failures_f	int(16)	80	
jog_fallures_f	int(16)	80	
NST_falures_f	int(20)	96	
FAULT_before_enable_f	real(16)(32)	4112	
FAULT_after_enable_f	real(16)(32)	4112	
FAULT_after_commut_f	real(16)(32)	4112	
FAULT_after_jog_f	real(16)(32)	4112	
I	int(100)	416	
v	real(100)	816	
Free space: 111 Mb			
Free Space: 111 Mb V Refresh 🏠 Delete Selected File 💕 Delete Al			
🕐 Refresh 🎽 Delete Selected File 🍯 Delete Al			

3. You select the required file(s) either by pressing **Ctrl** and clicking the files for selecting individual files, or select a file and press **Shift** to select a range of files.

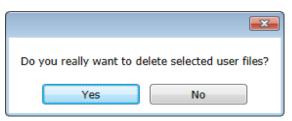


You can view the contents of a file by selecting the file and then clicking **Show Preview**.

4. To delete selected files, click **Delete Selected**. Or click **Delete All** to remove all of the files in the controller flash.

You can also delete a file by clicking × under the delete column in the file's row.	V.
---	----

5. You are prompted by:



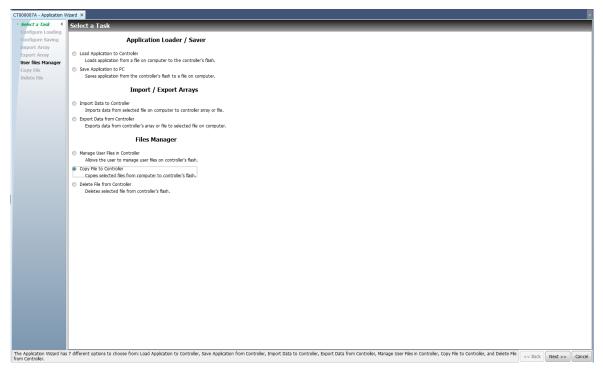
Click **Yes** to delete the file.

6. Click **Finish** to exit the Application Wizard.

4.2.7 Copy File to Controller

Copy File to Controller is used for copying files from the hard disk to the controller.

1. Select **Copy File to Controller** from Select a Task.

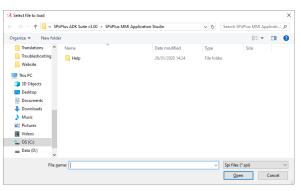


2. Click **Next**. The Copy File to Controller window is displayed.

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CT000007A - Application V	/izard ×				-
Select a Task 《	Copy File				
Configure Loading Configure Saving Import Array	Select file for copying	Select file		Br	owse
Export Array User files Manager	Destination Path	[C]			
 Copy File Copying 					
Delete File					
Copy File step provides the	functionality to copy a	fie to the controller's flash memory. Refer to the tool-tips for a detailed description of the corresponding parameters.	<< Back	Next >>	Cancel

3. Click Browse and select the file for copying from the list that is displayed. Then click Open.



4. Select the controller's path from the Destination Path dropdown list.



5. Click **Next** to start the copying process. You are prompted by:

?	File copying into the controller can take long time. Are you sure that you want to continue?
	OK Cancel

6. Click **OK** to start the copying process and wait for the conclusion of the process as indicated in the Copying window:

a Task 🛛 <	Copying		
ure Loading			_
ure Saving	REPORT ON COPYING PROCEDURE START		
t Array	Report time: 2/3/2020 1:08:55 PM		
t Array les Manager	Firmware version: 2.7.9.17.00 Controler s/n: CT00007A		
ies Manager F ile	Controller s/n: CT00007A Task: Copy file to controller.		
-ne 1 <i>g</i>	Copying C\Program Files (x86)\ACS Motion Control\SPiPlus ADK Suite v3.00\SPiPlus MMI Application Studio\Learn1.txt to C\Learn1.txt to C\Learn1.txt - successfully copied.		
File			
	COPYING PROCEDURE FINISHED		
	R Save Report	🖶 Print	it Re

7. You have the option of saving the log to a file by clicking **Save Report** which opens a dialog window:

A Save log					>
	« SPiiPlus ADK Suite v3	00 > SPiiPlus MMI Application Studio	∨ Ö Searc	h SPiiPlus MMI Appli	cati 🔎
Organize 👻 Ne	w folder			8== •	- 0
This PC	^	Name	Date modified	Туре	Size
3D Objects		Help	26/01/2020 14:24	File folder	
E Desktop					
🗎 Documents					
🖊 Downloads					
👌 Music					
Pictures					
📕 Videos					
骗 OS (C:)					
👝 Data (D:)					
🕳 Kindle (F:)	~	,			
	-	`			
File name:					
Save as <u>t</u> ype:	*.log				
N Hide Folders				<u>S</u> ave Ca	incel

8. Select a directory and enter a filename. Click **Save**.



9. To print the report click **Print Report**.

10. Click **Finish** to exit the Application Wizard.

4.2.8 Delete File from Controller

Delete File from Controller is used for deleting a file from the controller.

1. Select **Delete File** from Controller from Select a Task.

CT000007A - Application V	veza ×			-
Select a Task Configure Loading	Select a Task			_
Configure Saving	Application Loader / Saver			
Import Array Export Array	Load Application to Controller			
User files Manager	Loads application from a file on computer to the controller's flash.			
Copy File	Save Application to PC Saves application from the controller's flash to a file on computer.			
Copying Delete File				
	Import / Export Arrays			
	Import Data to Controller Imports data from selected file on computer to controller array or file.			
	Export Data from Controller Exports data from controller's array or file to selected file on computer.			
	Files Manager			
	O Hanage User Files in Controller Allows the user to manage user files on controller's flash.			
	Copy Fie to Controller Copies selected files from computer to controller's flash.			
	Delete File from Controller Deletes selected file from controller's flash.			
The Application Wizard has from Controller.	7 different options to choose from: Load Application to Controller, Save Application from Controller, Import Data to Controller, Export Data from Controller, Manage User Files in Controller, Copy File to Controller, and Delete File	<< Back	Next >>	Cancel

2. Click **Next**. The Delete File from Controller window is displayed.

CT000007A - Application Wiza	nd ×			1
Select a Task 🤸 🛽	Delete File			
Configure Loading Configure Saving	Pestination Path CCI			v
Import Array	seruismi .ser.			
Export Array				
User files Manager				
Copy File				
> Delete File				
Deleting				
Delete File step provides the I	functionality to delete a file from the controller's flash memory. Refer to the tool-tips for a detailed description of the corresponding parameters.	<< Back	Next >>	Cancel

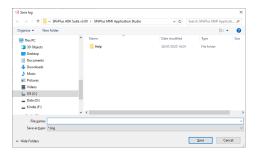
3. Select the **Destination Path** of the file you want to delete from the dropdown list.



- 4. Type the name of the file.
- 5. Click **Next** to start the deleting process. When the process is complete, the deleting log is displayed.

CT000007A - Application V	vizad ×	
Select a Task <	Deleting	
Configure Loading		
Configure Saving	REPORT ON DELETING PROCEDURE START	
Import Array Export Array	Report time: 2/5/2020 2:25947 PM F Firmwa'e version: 2.794.17.00	
User files Manager	Controler s/n: CT000007A Task Delete file from controler.	
Copy File		
Delete File	Deleting C:V/C.1g - successfully deleted.	
> Deleting	DELETING PROCEDURE FINISHED	
	R Save Report	🖶 Print Report
	<	ack Next >> Finish

6. You have the option of saving the log to a file by clicking **Save Report** which opens a dialog window:



7. Select a directory and enter a filename. Click **Save**.



The file extension for all reports is **.log**.

- 8. To print the report click **Print Report**.
- 9. Click **Finish** to exit the Application Wizard.

4.3 Program Manager

Program Manager is your principal tool for programming your SPiiPlus Motion Controller. Using **Program Manager** you can:

- > Load your programs into the controller's buffers.
- > Edit the programs in the buffers.
- > Run the programs.
- > Debug the programs.



Once your programs are running properly, it is highly recommended that you save the contents of the buffers to the controller's flash memory (see Saving to Flash). In the event of a loss of electricity, your programs will be restored to the controller's buffers upon restart. Not doing this will result in the loss of your programs.

4.3.1 Activating Program Manager

By default, when you initially enter SPiiPlus MMI Application Studio, **Program Manager** is automatically displayed. If you have closed it, you can reactivate it by either clicking it in the Workspace Tree or by:

- 1. From the Toolbox click **Application Development** (**Incolution Development** (**Incolution Development**) to display the Application Development tools.
- 2. Click **Program Manager** in the Application Development list of tools.



You can also activate the **Program Manager** using the right-click **Add Component** option of the Workspace Tree - see **Controller Right-Click Options** .

The Program Manager window is displayed.

_			_	im Manager
1	0 F	8	わ	8 5- 10 of 10 buffers •
Ē.		9	н	■ 또 ♥ @ ⊘
Buffer	Select	Open	Lines	Status
0			0	empty
			0	empty
			0	empty
з		۰.	0	empty
4		۰.	0	empty
5			0	empty
6			0	empty
			0	empty
8			0	empty
9			0	empty
D-I	Buffer		4	compiled
СТ	00000	7A - P	rogra	m Manager × Properties

4.3.2 Program Manager Window Overview

The **Program Manager** window has 5 columns:

- > Buffer the number of the buffer
- > Select indicates if the buffer has been selected
- > Open indicates if the buffer has been opened
- > Lines gives the number of program lines in the buffer
- > Status provides the status of the buffer

There are also two toolbars:

	СТ	000	007	A - P	rogra	am M	anag	er	-	Д	×
Buffer Functions	1	2	Ħ	۲	ť	ê	-	10 of 10 buffers 💌			Ŧ
Buffer Program Functions	E	ŵ	►	a	н			🌮 💿 🖉			Ŧ
	Buffer	Select		Open	Lines			Status			
	0				0	e	mpty	(
	1				0	e	mpty	1]
	2				0	e	mpty	1			

- > Buffer Functions these functions are associated with various buffer actions.
- > Buffer Program Functions these functions are associated with various buffer program actions.

4.3.2.1 Select

The **Select** column indicates:



You select a buffer by clicking the icon. You can select any and all buffers with the exception of Unused buffers.

4.3.2.2 Open

The icons in the **Open** column indicate if a buffer is open or not:

Buffer is open.
Buffer is closed.

They also indicate if the buffer is in the Protected mode, for example:

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🗄 🕨 🤅	п	• 🖫 🌮 💿 🖉
Buffer Select Open	Lines	Status
0 🔲 🚄	4	compiled
1 🔲 💼	0	empty
2	0	empty
3 🔲 💼	0	empty
4 🔲 💼	0	empty
5 🔲 💼	0	empty
6 🔲 💼	0	empty
7 🔲 💼	0	empty
8 🔲 💼	0	empty
9 🔲 💼	0	empty
D-Buffer 💼	4	compiled

There are two icons associated with the Protected mode.

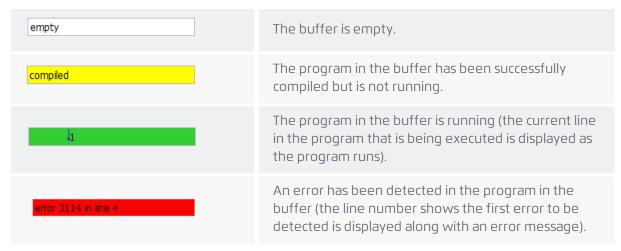


Hidden - the program in the buffer cannot be viewed.

Read-Only - the program in the buffer can be viewed, but cannot be changed.

4.3.2.3 Status

The Buffer Status column displays the current status of the buffer. There are four indications associated with the Status:



Status Right-Click Menu

Right-clicking the Status displays the following menu:

	Open Buffer 0
*	Compile Buffer 0
	Run Buffer 0
?	Step Buffer 0
ш	Pause Buffer 0
	Stop Buffer 0
6	Copy Buffer 0
ĥ	Paste Buffer 0
\Diamond	Clear Buffer 0
Α	Disable Autoroutine in Buffer 0

Clicking one of the options activates it. Your options are:

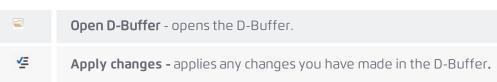
	Open Buffer - opens the buffer.
*	Compile Buffer - compiles the program in the buffer.
	Run Buffer - runs the program in the selected buffer.
Þ	 When you click this option, the motors start to move. Also, some of the limits and safety features may be temporarily disabled. To avoid personal injury or damage to the equipment, check the following before clicking the button: Ensure that nothing (people, cables, or other obstacles) is in the path of the motor or objects connected to the motor. Ensure that the motor is securely anchored and that proper safety barriers, stops, and limits are installed.
?	Step Buffer - executes the command where the cursor is currently sitting. Once executed, the cursor moves down one line.
н	Pause Buffer - temporarily halts program running in the buffer. The program can be restarted by Run Buffer.
•	Stop Buffer - halts the program running in the buffer. The program can be rerun by Run Buffer.
	Copy Buffer - puts contents of the buffer into the clipboard so they can be copied into another buffer.
岱	Paste Buffer - copies contents in the clipboard into the buffer.
\Diamond	Clear Buffer - removes the contents from the buffer
А	Disable Autorountine - disables any autoroutine that is in the buffer. When selected it changes to Enable Autoroutine in Buffer , which you can select to reenable the autoroutine in the buffer.

The D-Buffer has a different right-click menu:

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	Open D-Buffer
1 2	Apply Changes

Your options are:



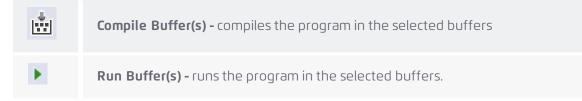
4.3.2.4 Buffer Functions Toolbar

The Buffer Functions toolbar contains:

2	Load from File - loads the contents of a program file that has been previously saved into the buffer.
H	Save to File - saves the contents of a buffer to a file on the computer.
* 57	Clear Buffer - deletes the contents of a buffer.
	Copy Buffer - copies the contents of a buffer to another buffer.
<u>.</u>	Program Buffer Parameters - sets the PRATE and ONRATE buffer parameters.
10 of 10 buffers 💌	Number of Buffers Selector - select the number of buffers to be displayed: Image: Selector - select the number of buffers to be displayed: Image: Selector - select the number of buffers to be displayed: Image: Selector - select the number of buffers to be displayed: Image: Selector - select the number of buffers to be displayed: Image: Selector - select the number of buffers that you can select depends on the controller. Once you have selected the number, it is stored as part of the Workspace data.

4.3.2.5 Buffer Program Functions Toolbar

The Buffer Program Functions toolbar contains:



	When you click this button, the motors start to move. Also, some of the limits and safety features may be temporarily disabled. To avoid personal injury or damage to the equipment, check the following before clicking the button:
	 Ensure that nothing (people, cables, or other obstacles) is in the path of the motor or objects connected to the motor.
	 Ensure that the motor is securely anchored and that proper safety barriers, stops, and limits are installed.
?	Step Buffer(s) - executes the command where the cursor is currently sitting for the selected buffers. Once executed, the cursor moves down one line.
н	Pause Buffer(s) - temporarily halts programs running in selected buffers. The program(s) can be restarted by clicking Run Buffer.
•	Stop Buffer(s) - halts program(s) running in the selected buffers. The program(s) can be rerun by clicking Run Buffer(s).
	Stop All Buffer(s) - halts all running programs. The programs can be rerun by clicking Run Buffer(s).
*	Remove All Breakpoints in Buffer(s) - removes all breakpoints that have been set in the selected buffers.
	Trigger Scope - triggers the display of the signals from the running program.
\bigcirc	Clear Buffer(s) - removes the contents from the selected buffers.

4.3.3 Programming a Buffer

Clicking **Open Buffer** (•) opens the Buffer Editor window in the Workspace which enables you to:

- > Enter a program into the buffer manually.
- > Edit an existing program (if it is not Protected).
- > View a program in the buffer (if it is not Hidden).
- > Run the program and watch the progress and status of each program command.
- > Debug the program (steps, breakpoints, start from line).

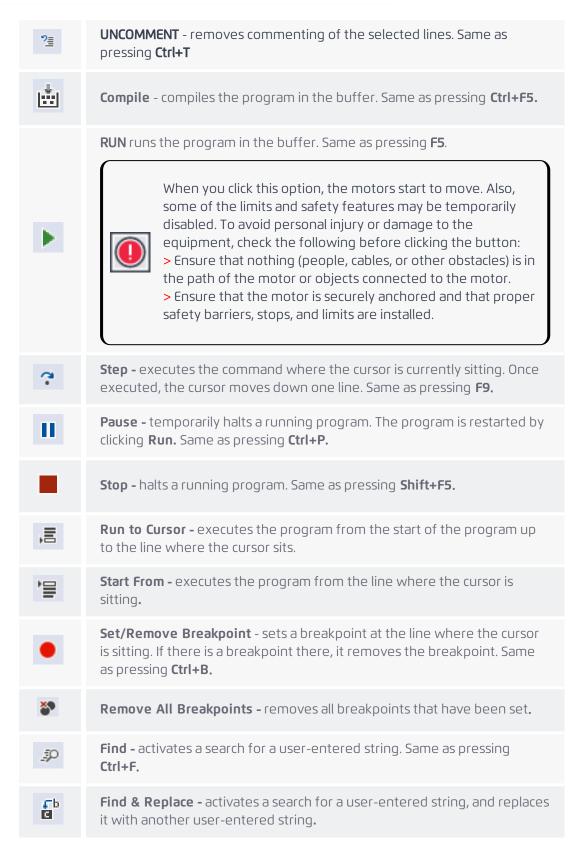
Buffer Editor Window

		0 × Buffer 2 Buffer 1	
Toolbar		2 (米 氏 缶 回 録 3 河 山 ▶ ? Ⅱ ■ 居 宮 ● 夢 〃 ♀ 。	
		105 Akt/ 2015 Akt/ 2015 Akt/ 2017 Akt/ 2	Î
Workspace			
	11 12 14 14 15 14 15 16 16 16 16 16 16 16 16 16 16	<pre>rectrop full if reg_1_dist(), 1, -1000, -1000, 5, 21 136 puints reg_1_dist(), 1, -100, -1000, -100,</pre>	8
Buffer Status		· · · · · · · · · · · · · · · · · · ·	۳
builer status	com	u 37, 045 3	-
		Cursor Position	

Toolbar

The Buffer Editor toolbar contains the following:

	Line Numbers - toggles the display of line numbers on and off.
9	Undo - undoes any changes made and restores the previous contents. Same as pressing Ctrl+Z .
۲.	Redo - reverses preceding undo actions. Same as pressing Ctrl+Z .
Ж	Cut - deletes the selected contents and places it in the clipboard. Same as pressing Ctrl+X .
	Copy - places the selected contents into the clipboard. Same as pressing Ctrl+C .
ß	Paste - pastes the contents of the clipboard into the buffer at the cursor position. Same as pressing Ctrl+V.
[@]	PARAMETER INFO - displays function parameter info. Same as pressing Ctrl+Shift+Space
[]	FORMAT - formats the contents of the buffer. Same as pressing Ctrl+I
2	COMMENT - formats the contents of the selected lines. Same as pressing Ctrl+R



Workspace

Used for typing in the program commands.

Status Line

The Status Line provides the status of the program in the buffer. There are four colors associated with the Status:

- > White the buffer is empty.
- > Yellow the program in the buffer has been successfully compiled but is not running.
- > Green the program in the buffer is running (the current line in the program that is being executed is displayed as the program runs).
- > Red an error has been detected in the program in the buffer (the error number, line number, and a brief description of the error of the first error to be detected is displayed).

Cursor Position

Informs you of exactly where in the program the cursor sits.

4.3.3.1 Entering a Program

To enter a new program into a Buffer or modify an existing program:

1. In **Program Manager** click **Open Buffer** (•) of the buffer (or click its Status Line). This opens the Buffer Editor Window.

	Buffer 1	
	affer 2 × laffer 1 目 クマ X & ② ② 即 詩 エ 注 山 ▶ ク Ⅱ ■ 思 智 ● ₽ 의 ₽ ;	
	1	
I		
Ì		
1		
I	e complete c	Ln 1, Col 1
1		2.2.2

2. Type in your program.

You can view the value of a variable in the program by letting the mouse pointer linger on the variable. Variables of any type - ACSPL+, user-defined, scalar, arrays (the first 30 elements) - can be viewed. The current value is displayed in popup window by the mouse pointer.

3. Click **Compile** () or press **Ctrl+F5**. Check the Status Line that the program compiled successfully.



Any work made within a buffer window is stored locally within the MMI workspace. It is only written to the controller upon compilation (even if compilation fails).



If there is an error in your program, the Status Line provides the error number, the line number in which the error is detected, and a brief description of the error. Refer to Chapter 6 of the *SPiiPlus Command & Variable Reference Guide* for details of errors.

4.3.3.2 Programming the D-Buffer

The D-Buffer is an additional special buffer that provides a place for the definitions of axis names and global variables. At start-up, the controller loads the D-Buffer before any other buffers.



Executing programs and autoroutines is not supported in D-Buffer.

Axes and global variables defined in D-Buffer are not required to be defined in other buffers before use. However, such redefinition is not an error, if all the attributes of the definitions are identical.

To program D-Buffer:

1. In **Program Manager** click **Open Buffer** (=) of D-Buffer (or click its Status Line). The D-Buffer is displayed:

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	D-Buffer × Buffer 0	8.dfer 2 - Belfer 1
	1 !axisdef) 2 !axisdef s 3 global int	د (مر) بردی بردی (مر) مرا می (مر) مر) مر) مر) مر) مر) مر) مر) مر) مر)
	∢ compiled	, Ln 4, col 52
-	are e	ffer differs from other buffers in that it contains default contents. Other buffers mpty, by default, but the default contents of D-Buffer contain a set of definitions provides compatibility with previous Firmware versions.
2.		our variable definitions. ve the following functions on the D-Buffer editor toolbar:
	1— 2— 3—	Line Numbers - toggles the display of line numbers on and off.
	ゥ	Undo - undoes any changes made and restores the previous contents. Same as pressing Ctrl+Z .
	۲	Redo - reverses preceding undo actions. Same as pressing Ctrl+Z .
	¥	Cut - deletes the selected contents and places it in the clipboard. Same as pressing Ctrl+X .
		Copy - places the selected contents into the clipboard. Same as pressing

Paste - pastes the contents of the clipboard into the buffer at the cursor position. Same as pressing **Ctrl+V**.

PARAMETER INFO - displays function parameter info. Same as pressing Ctrl+Shift+Space

凸

Ctrl+C

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{]	FORMAT - formats the contents of the buffer. Same as pressing Ctrl+I
2	COMMENT - formats the contents of the selected lines. Same as pressing Ctrl+R
2	UNCOMMENT - removes commenting of the selected lines. Same as pressing Ctrl+T
₹ <u></u>	APPLY CHANGES - writes changes to the current buffer.
P	Find - activates a search for a user-entered string. Same as pressing Ctrl+F.
C b	Find & Replace - activates a search for a user-entered string, and replaces it with another user-entered string.

3. Click **Apply changes** (🖆) and close the window.

4.3.3.3 Loading Programs from a PC File

To load programs from a PC file:

1. In **Program Manager** click **Load from File** (¹⁰), the Load Program dialog window is displayed:

Load Program	n	>
Application		
Information	Brow	se
Information		
		*
oad the progra	ms to the following buffers:	
Programs	Buffers	
Program 0	v	4
Program 1	· ·	
Program 2	~	
Program 3	v	
Program 4	v	
Program 5	~	
Program 6	v	
Program 7	v	
Program 8	· ·	
Program 9	v	
Program 10	· ·	
Program 11	· ·	
Program 12	v	
Program 13	· ·	
Program 14	· · ·	

2. Click **Browse** to search for the file (when found, select the file).

	-
	•
1	_
1	
. *	

Program files have a **prg** file extension.

3. Click **OK**, the Load Program dialog window displays the default buffer location of each program contained in the selected file, for example:

Load Program	1	>		
pplication –				
C:\Program Files (x86)\ACS Motion Control\SPiiPlus ADK Suite v3.				
information				
	sion = 2.79.17.00 020 10:15 AM =	÷		
	contains 1 program.			
Programs	Buffers			
D- Program	D-Buffer •	-1		
Program 1	· ·	_		
Program 2	· · ·	_		
Program 3	·			
Program 4	v			
Program 5	· ·			
Program 6	v			
Program 7	· · ·	_		
Program 8	· ·	_		
Program 9	· ·	_		
Program 10	·			
Program 11	· ·	_		
Program 12	· ·	-		
Program 13	·	-		
	v	-		
Program 14				

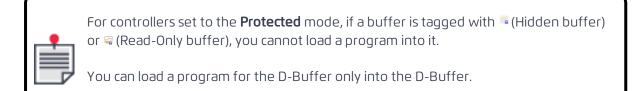
You can reassign the buffer location by clicking the **Buffers** field of the program and selecting the buffer from the list:

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Load Progran	n			
C:\Program Files (x86)\ACS Motion Control\SPiiPlus ADK Suite v3.(Browse				
Information				
Controller vers Date = 2/6/2 User remarks				
ile 'Learn2.prg'	contains 2 programs.			
Programs	Buffers			
Program 0	Buffer 0 🗸			
D- Program	Select All			
Program 2	Buffer 0			
Program 3	Buffer 2			
	Buffer 3			
Program 4	Buffer 5			
Program 5	Buffer 6			
Program 6	Buffer 7 Buffer 8			
Program 7	Buffer 9			
Program 8	- Buffer 10			
-	Buffer 12			
Program 9	Buffer 13			
Program 10	Buffer 14			
Program 11	Buffer 16			
Program 12	Buffer 17			
Program 13	Buffer 18 Buffer 19			
Program 14	Buffer 20			
Program 14	OK Cancel			

_

You can load the same program into more than one buffer.



4. Click OK.

4.3.3.4 Saving Programs to PC File



To save programs from the buffers to a PC file:

1. In **Program Manager** click **Save to File** (**I**), the Save Buffers dialog window is displayed:

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A Save Buffers	>
Save As	
	Browse
Remarks	
	-
Buffers	=
Buffer 0	
Buffer 1	
Buffer 2	
Buffer 3	
Buffer 4	
Buffer 5	
Buffer 6	
Buffer 7	
Buffer 8	
	*
Save	Cancel

2. Click **Browse** to open the browser.

🚮 Save to file					×
	« SPiiPlus ADK Suite v	100 > SPiiPlus MMI Application Stu	dio v Ö	Search SPiiPlus MN	ll Applicati 🔎
Organize • Ne	w folder):: • ()
Website	^	Name	Date modified	Туре	Size
💷 This PC		Help	26/01/2020 14:24	File folder	
3D Objects					
Desktop					
Documents					
🕹 Downloads					
Music					
Pictures					
🔚 Videos					
💶 OS (C:)					
Data (D:)					
• · · · ·		<			
File game:	1				~
Save as type:	Spi files (*.spi)				~
∧ Hide Folders				Save	Cancel

- Drill down to the directory into within which you want to save your program files, and either select an existing file (for overwriting), or enter a new file in File name and click Save. You return to the Save Buffers dialog window.
- 4. Select the buffers you want to save in Buffer Tree.



For controllers set to the **Protected** mode, if a buffer is tagged with (Hidden buffer), you cannot save it to a file.

5. Click Save.

4.3.4 Saving Programs to Flash Memory

1. In the **Program Manager**, click **Save to Flash** (**•**); the Save to Flash dialog window will open.

Save To Flash				
User:				
Application:				
Application:				
Remarks:				
Simulator	Save Options - "Check" / "Unch	neck All" option is available by cl	icking on checkbox at the c	olumn's header
	ACSPL+ Programs	Configuration Paramet	-	User Arrays
	Buffer 0	System	SP#0	
	Buffer 1	Axis 0	SP#1	V
	Buffer 2	Axis 1	SP#2	
	Buffer 3	Axis 2	SP#3	
	Buffer 4	Axis 3	SP#4	
	Buffer 5	Axis 4	SP#5	
	Buffer 6	Axis 5	SP#6	
	Buffer 7	Axis 6	SP#7	
	Buffer 8	Axis 7	SP#8	
	Buffer 9	Axis 8	SP#9	
	Buffer 10	Axis 9	SP#10	
	Buffer 11	Axis 10	SP#11	
	Buffer 12	Axis 11	SP#12	
	Buffer 13	Axis 12	SP#13	
	Buffer 14	Axis 13	SP#14	
	Show Preview			٢
			(Save Cancel

- 2. Fill in User, Application, and Remark text boxes as appropriate.
- 3. Click Save.

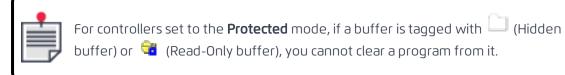
4.3.4.1 Clearing Buffers

You can clear the contents of any or all buffers by:

1. In **Program Manager** click **Clear buffers** (12), the Clear Buffers dialog window is displayed:

🛃 Clear Buffer(s) Dialog	×
Clear selected buffers:	
▲ Buffers	
Buffer 0	
Buffer 2	
D-Buffer	
Clear	Cancel

2. Select buffer(s) to be cleared.



3. Click Clear.

•

You can also make use of the popup menu that appears when you right-click the buffer Status Line (see Status Right-Click Menu).

4.3.4.2 Copying Buffers

To copy programs from some buffer to others:

1. In **Program Manager** click **Copy buffers** (), the Copy Buffers dialog window is displayed:

Copy Buffer(s) Di	Destination Buffer(s):	
Buffer 0	Option name	
Buffer 2	▲ ■ Buffers	
	Buffer 0	E
	Buffer 1	
	Buffer 2	
	Buffer 3	
	Buffer 4	
	Buffer 5	
	Buffer 6	
	Buffer 7	
	Buffer 8	
	Buffer 9	
	Buffer 10)
	Buffer 11	
	Buffer 12	
	Buffer 13	
Copy Bu	fer(s) Can	cel

Note that a buffer cannot be copied into itself.

Select the buffer from which to copy.

For controllers set to the Protected mode, if a buffer is tagged with (Hidden buffer), you cannot copy the file. However if the buffer is tagged with a (Read-Only buffer), it can be copied into another buffer so long as the destination buffer is not Read-Only.

- 2. Select the buffer(s) into which to copy.
- 3. Click **Copy**.



You can also make use of the popup menu that appears when you right-click the buffer Status Line (see Status Right-Click Menu).

4.3.5 Stepping Buffer Program

To aid you in debugging your program or programs you can use the **Program ManagerStep** function to run programs step-by-step. You have the option of using this function on a single buffer or a number of buffers.

4.3.5.1 Stepping Single Program

To run a single buffer program step-by-step:

- If the buffer is not open, click **Open Buffer** (=) of the required buffer in the **Program** Manager.
- In the Buffer Editor Window click Step Buffer (a) or press F9.
 Note that the Status Line in the Program Manager turns green (indicating that the program is running) and the line number of the command being executed is displayed.
 In addition an arrow appears indicating the line being executed:



The Status Line in the **Buffer Editor Window** indicates **Suspend**. If an error is detected, it turns red.

3. Continue clicking **Step Buffer** until you have reached the end of the program.



You can stop the program at any point and reset it by clicking **Stop** (_) or pressing **Shift+F5**.

4.3.5.2 Stepping Multiple Programs

To run several buffer programs step-by-step simultaneously:

- 1. In **Program Manager** select the buffers in the **Select** column.
- 2. Click Step Buffer(s) (?).



You can also make use of the popup menu that appears when you right-click the buffer Status Line (see Status Right-Click Menu).



The Status for each selected buffer turns green (indicating that the program is running in them) and the line number of the next command is displayed.

Му со	ntrol	ler - I	Progr	am M	lanag	jer				•	ņ	×
2	Ħ	۲	ť	6	۵.	10	of 64	buffers	٠			
		?	н			* ?		\diamond				
Buffer select		Open	Lines					Status				
0 🔽			47	4	2							
1		-	0	e	mpty]
2 🗸			47	4	2							
3			0	e	mpty]

If an error is detected in any of the buffers, the buffer's status turns red and the program line number of the error is displayed.

3. Continue clicking **Step Buffer(s)** until you have reached the end of the programs.



You can stop the programs at any point and reset them by clicking **Stop Buffer(s)** (두)

4.3.6 Setting/Removing Breakpoints

A breakpoint is an intentional stopping or pausing place in your program, put in place for debugging purposes. More generally, a breakpoint is a means of acquiring knowledge about the buffer program during its execution. During the interruption, you can inspect the test environment (logs, memory, files, etc.) to find out if the program functions as expected.

Setting Breakpoints

To set a breakpoint:

- 1. In Program Manager click Open Buffer (=).
- 2. Scroll down to the line at which you want to set the breakpoint.
- 3. Click **Set Breakpoint** (•). A red ball is displayed to the left of the line indicating that a breakpoint has been set.

```
    5 SET FPOS (Axis+1)=1000
    6 SET FPOS (Axis+2)=1000
    7
    9 !setconf (205, AXIS, 0b100000000)
    10 assignmark Axis, 1, 0
    11 assignmark Axis+2, 1, 0
    12 assignmark Axis+2, 1, 0
    13 assignpeg Axis, 0b100, 0b11
    14 ASSIGNPOUTS Axis, 0, 0b0
    15 ASSIGNPOUTS Axis+2, 2, 0b1
    16 ASSIGNPOUTS Axis+2, 2, 0b1
    17 enable (Axis)
    18
```

You can set as many breakpoints as you want. Once you have set the breakpoints, you can run the program (see Running/Stopping Buffer Programs). It will run up to the line containing the breakpoint, and then pause. When you execute it again, it will run from this line to the next breakpoint.

Removing Breakpoints

To remove breakpoint:

4. In **Program Manager** click **Open Buffer** (=).

5. Scroll down to the line where the breakpoint is set (indicated by the red ball).

Click **Remove Breakpoint** (•). The red ball indicated that a breakpoint has been set for line is no longer displayed.

You can remove all of the breakpoints by clicking **Remove All Breakpoints in Buffer** (**P**).

4.3.7 Disable/Enable Autoroutines

Autoroutines are similar to hardware interrupts. In distinction to routines that must be explicitly executed (by way of the ACSPL+ **CALL** command), the autoroutine is automatically executed when a specific condition is satisfied. The routine interrupts the currently executing program, executes the commands specified in the autoroutine body, and then returns control to the interrupted program.

To disable autoroutines in single buffer:

- 1. Right-click the buffer.
- 2. Select **Disable Autoroutines in Buffer** (A) from the popup-menu.



Note that the option changes to **Enable Autoroutines in Buffer A**.

To reenable the autoroutines in the buffer:

- 1. Right-click the buffer.
- 2. Select **Enable Autoroutines in Buffer** from the popup-menu.

4.3.8 Setting Program Buffer Parameters

There are two program buffer parameters:

- > PRATE defines the program execution rate in buffer. The execution rate is PRATE lines per each MPU cycle. Its value ranges between 1 (default) and 10 (maximum).
- > ONRATE When an autoroutine executes in the program buffer, the execution rate is ONRATE lines per each MPU cycle. Its value ranges between 1 (default) and 10 (maximum).

PRATE is used only if no autoroutine is activated in the buffer. While an autoroutine is executed, **ONRATE** defines execution rate.

•
T

For example, if **PRATE** is set to 1 for a buffer, but **ONRATE** is set to 4, the program in the buffer will be executed one line per one controller cycle, and any autoroutine specified in buffer that interrupts the program will be executed four lines per one controller cycle. When the **RET** command that terminates the autoroutine is executed, the controller switches back to the rate of one line per one cycle.

To set the program buffer parameters:

1. In **Program Manager** click **Program Buffer Parameters** (a). The Program Buffer Parameters window is displayed:

Buffer Number	Program Rate (PRATE)	Autoroutine Rate (ONRATE)
0	1	
1	1	
2	1	
3	1	
4	1	
5	1	
6	1	
7	1	
8	1	
9	1	
10	1	
11	-1	
12	-1	
13	-1	
14	-1	

2. For each buffer enter the required **PRATE** and **ONRATE** values, as appropriate, and click **Close**.

	To set the value to the default, click Default .
f you hav	ve changed any of the values, the following prompt appears:

You changed one or more configuration parameters. Do you want to save changes in the flash memory?
Yes No

If you want to save the changes to the SPiiPlus Motion Controller flash (recommended), click **Yes**. The Save to Flash window is displayed (note that **System** is selected):

ave To Flash				_ 0
plication:				
presson				
marks:				
My controller			ailable by clicking on checkbox at	
	ACSPL+ Programs Buffer 0		Paramet SP Programs	User Arrays
		▲ System	* SP#0	
	Buffer 1 Buffer 2		* SP#1	V
	Buffer 3	Axis 2 Axis 3	SP#3	
	Buffer 4		SP#4	
	Buffer 5	Axis 4		6
	Buffer 6	Axis 5	E SP#6	
	Buffer 7	Axis 6	SP#7	
	Buffer 8	Axis 7	E SP#8	
	Buffer 9	Axis 8	E SP#9	
	Buffer 10	Axis 9	E SP#10	
	Buffer 11	Axis 10	SP#11	
	Buffer 12	Axis 11	E SP#12	
	Buffer 13	Axis 12	SP#13	
	Buffer 14	+ Axis 13	. SP#14	*
	Show Preview			(

- 3. Enter:
- > Your name in the **Name** field (optional).
- > Application name in the **Application** field (optional).
- > Appropriate remarks in the **Remarks** field (optional).
- 4. Click Save.

4.3.9 Running/Stopping Buffer Programs

Running Buffer Programs

To run the buffer program(s):

1. In **Program Manager** select the buffer (or buffers) in the **Select** column.

2. Click **Run Buffer(s)** (**•**).

Run Buffer(s) causes the motors to move. Also, some of the limits and safety features may be temporarily disabled. To avoid personal injury or damage to the equipment, check the following before running the program:



Ensure that nothing (people, cables, or other obstacles) is in the path of the motor or objects connected to the motor.

Ensure that the motor is securely anchored and that proper safety barriers, stops, and or limits are installed.



If you are working in the Buffer Editor, you can use **Run or pressF5to run the program.**

Pausing/Stopping Buffer Programs

To pause programs while running:

In **Program Manager** select the buffers in the **Select** column.

Click Pause Buffer(s) (III).



You can restart the programs by clicking Run Buffer(s) 🚩

To stop programs:

- 1. In **Program Manager** select the buffer in the **Select** column
- 2. Click Stop Buffer(s) (



For **Pause Buffer** and **Stop** you can also make use of the popup menu that appears when you right-click the buffer Status Line (see Status Right-Click Menu).

To stop all programs that are running click **Stop All Buffer(s)** (E).

_	_

If you are working in the Buffer Editor, you can use **Pause** or press**Ctrl+P** to pause the program, and **Stop** or press **Shift+F5** to stop the program.

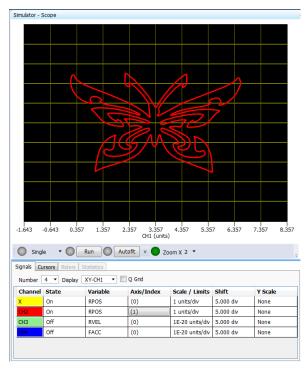
4.3.10 Trigger Scope

Once the programs are running, you can analyze the motion using the scope.

To make use of the Scope when running your programs:

- 1. Activate the Scope (see Activating the Scope).
- 2. Set the Scope display to **Single** and **Autofit**.

- 3. In **Program Manager** click **Trigger Scope** (
- 4. In the **Select** column select the buffer you want to run and click **Run Buffer(s)** (**>**). You get a display like this:



4.4 Protection Wizard

The controller can be in one of two modes:

- > **Protected Mode** certain restrictions are placed on the programs in the controller's Program buffers. Usually this mode is used to ensure that the programs cannot be edited.
- > Not Protected Mode no restrictions are placed on the Program buffers.

The **Protection Wizard** is used for setting and unsetting the Protection Mode of the controller. It leads you through the performance of the following tasks:

- > Define Protection
- > Update Protection
- > Remove Protection
- > View Protection

4.4.1 Starting Protection Wizard

- 1. From the Toolbox click **Application Development** (Application Development (Application Development tools.
- 2. Click **Protection Wizard** in the Application Development list of tools.



You can also activate the **Protection Wizard** using the right-click **Add Component** option of the Workspace Tree - see **Controller Right-Click Options**.

The **Protection Wizard** Task window is displayed in the workspace.



3. Select the task you want to perform by clicking the appropriate button and then click **Next**.



If the controller is in the **Not Protected** mode, the only task available is **Define Protection**.

If the controller is in the **Protected** mode, the tasks available are: **Update Protection**, **Remove Protection**, and **View Protection Status**.

4.4.2 Define Protection

The Define Protection task enables you to put the controller into the Protected Mode and to set certain restrictions on the programs stored in the controller's buffers.

To define Protection:



This task, and this task only, is available if the controller is in the **Not Protected** mode.

1. Since this is the only task available, click **Next**. The Set Protection Level window is displayed.



There are three tasks that can be performed from the Select Protection Level window:

> Application Protection

- > You perform this task to set the program in the specified buffers to Read Only, that is, it can be viewed but cannot be modified.
- > Intellectual Property Protection
- > You perform this task to set the program in the specified buffers such that its contents cannot be modified and cannot be seen.
- > Custom Protection
- > There are three tasks that can be performed from the Custom Protection window:
 - > You can set the program in the specified buffers such that its contents cannot be modified and/or cannot be seen.
 - > You can set specified variables to Read Only, that is, it can be viewed but cannot be modified.
 - > You allow the system to be reconfigured.

4.4.2.1 Setting Application Protection

1. To set Application Protection, select the button next to **Application Protection**. Then click **Next**. The Buffers Protection task is displayed.

Sin	nulator - Protection Wiza	rd ×		
	Select a Task <	Buffers	Protection	
>	Select Protection Le Buffers Protection	Mode: Not Protected		
	Variables Protection	Buffers	No edit	
	Advanced Protection	Buffer 0		
	Preview Changes	Buffer 1		
	-	Buffer 2		
	Set Password	Buffer 3		
	Task's report	Buffer 4		
		Buffer 5		
		Buffer 6		
		Buffer 7		
		Buffer 8		
		Buffer 9		
		Buffer 10		
		Buffer 11		



By selecting the **Prevent from editing** checkbox you set the program in the buffer to Read Only, that is, it can be viewed but cannot be modified.

2. Click **Next**. The Preview Changes window is displayed:

Sir	mulator - Protection Wiza	rd ×			
	Select a Task <	Preview Changes			
	Select Protection Le Buffers Protection	Mode: <u>No</u>	ot Protected		
	Variables Protection	Buffers	No Edit Before	No Edit After	
	Advanced Protection	Buffer 0			
)	Preview Changes	Buffer 1			
	Set Password	Buffer 2			
		Buffer 3			
	Task's report	Buffer 4		V	
		Buffer 5			
		Buffer 6			

3. Check that the proper Protections are set. If they are, select **Accept Changes**. Click **Next**. The Set Password window is displayed.

Simulator - Protection Wizar	d ×
Select a Task <	Set Password
Select Protection Le	Made: Net Destanted
Buffers Protection	Mode: Not Protected
Variables Protection	
Advanced Protection	Only English letters, digits, and symbols are allowed
Preview Changes	New password
> Set Password	
Task's report	Confirm password

4. If you want to set a user password to prevent unauthorized personnel from removing Protection, type it into the **Enter password** and **Confirm password** fields.

A password is not required.

5. Click **Next**. The controller is rebooted. Wait for the notification of a successful restart.





The controller must be restarted, otherwise the protected programs can become corrupted.

6. Click **OK**.

The Report window is displayed.

ct a Task 🛛 <	Task's report	
ct Protection Le ers Protection	Node: Protected	
ables Protection	Protection From Viewing - OFF	
anced Protection	Buffer 47 set to:	
	Protection From Editing - OFF Protection From Viewing - OFF	
riew Changes	Buffer 48 set to:	
Password	Protection From Editing - OFF	
's report	Protection From Viewing - OFF	
	Buffer 49 set to:	
	Protection From Editing - OFF Protection From Viewing - OFF	
	Buffer So set to:	
	Protection From Editing - OFF	
	Protection From Viewing - OFF	
	Buffer 51 set to:	
	Protection From Editing - OFF	
	Protection From Viewing - OFF	
	Buffer 52 set to: Protection From Editing - OFF	
	Protection From Educing - OFF	
	Buffer 35 set to:	
	Protection From Editing - OFF	
	Protection From Viewing - OFF	
	Buffer 54 set to:	
	Protection From Editing - OFF	
	Protection From Viewing - OFF Buffer 55 set to:	
	Protection From Editing - OFF	
	Protection From Usering - OFF	
	Buffer 56 set to:	
	Protection From Editing - OFF	
	Protection From Viewing - OFF	
	Buffer 57 set to: Protection From Editing - OFF	
	Protection From Educing - OFF	
	Buffer Start to:	
	Protection From Editing - OFF	
	Protection From Viewing - OFF	
	Buffer 59 set to:	
	Protection From Editing - OFF Protection From Viewing - OFF	
	Protection From Viewing - UFF Buffer 60 set to:	
	Protection From Editing - OFF	
	Protection From Usering - OFF	
	Buffer 61 set to:	
	Bave report	🖶 Print
	tailed log of the protection status applied to the controller.	

7. To save the report click **Save report**. The browser window is displayed:

🐴 Save As								×
$\leftrightarrow \rightarrow \cdot \uparrow$	→ This PC → Data (D:)	> Projects > MI	MI_Learn		5 ~	Search MMI_Lea	rn	Q
Organize 🔻 Ne	w folder							?
Website	^	Name	^		Date modified	Туре		Size
This PC				No items m	atch your search.			
🧊 3D Objects 📃 Desktop								
Documents								
👆 Downloads								
👌 Music								
Pictures								
Videos								
🏪 OS (C:)								
🔜 Data (D:)								
a	~	<						>
File <u>n</u> ame:								~
Save as <u>t</u> ype:	*.txt							~
∧ Hide Folders						<u>S</u> ave	Can	cel

8. Select a directory and enter a filename. Click **Save**.



- 9. To print the report click **Print report**.
- 10. Click **Finish** to exit the Protection Wizard.

4.4.2.2 Setting Intellectual Property Protection

 To set Intellectual Property Protection, select the button next to Intellectual Property Protection. Then click Next. The Buffers Protection task is displayed.

Simulator - Protection Wiza	'd ×		•
Select a Task <	Buffers	Protection	
Select Protection Le Buffers Protection	Mode: <u>Pr</u>	otected	
Variables Protection	Buffers	📃 No edit no view	
Advanced Protection	Buffer 0		A
Preview Changes	Buffer 1		
Set Password	Buffer 2 Buffer 3		
Task's report	Buffer 4		
	Buffer 5		
	Buffer 6		
	Buffer 7		
	Buffer 8		
	Buffer 9		

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<u> </u>

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By selecting the **Prevent from editing and viewing** checkbox, you set the program in the specified buffers such that its contents cannot be modified and cannot be seen.

2. Click **Next** to preview changes and follow step 3 through step 10 in Setting Application Protection to complete setting protection and to exit the Protection Wizard.

4.4.2.3 Setting Custom Protection

4.4.2.3.1 Custom buffer protection

1. To set Custom Protection, select the button next to **Custom Protection**. Then click **Next**. The Buffers Protection task is displayed.

Sin	nulator - Protection Wiza	rd ×			•
	Select a Task <	Buffers	Protectio	on	
>	Select Protection Le Buffers Protection	Mode: Pre	otected]
	Variables Protection	Buffers	🔳 No edit	📃 No view	
	Advanced Protection	Buffer 0			 •
	Preview Changes	Buffer 1			
	Set Password	Buffer 2			
	Task's report	Buffer 3 Buffer 4	 Image: A start of the start of		
		Buffer 5			
		Buffer 6			
		Buffer 7			
		Buffer 8			
		Buffer 9			

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1	_	
Ļ		

By selecting the **Custom Protection** checkbox, you set the program in the specified buffers such that its contents cannot be modified and/or cannot be seen.

2. Click **Next**. The Variables Protection Task is displayed.

4.4.2.3.2 Custom variable protection

SPiiPlus MMI Application Studio User Guide 4. Application Development

Simulator - Protection Wize Select a Task (Select Protection Durables Protection Advanced Protection Preview Changes Set Password Task's report	Variables Protection Mode: Protected SE 94
You can click 🔳 to sort t	he variables by groups, or to sort alphabetically.

1. Select the appropriate **Read only** box to prevent the variables from being edited.

You can either set all the variables in a group by selecting the **Read only** box, or expand the groups by clicking the tree expansion button:
and marking individual variables for read only.

Variables Protection

Variables	Protected (Read only)
P-Motion	
ACC	
- DEC	
- JERK	
- KDEC	
- NVEL	Image: A start and a start
- TPOS	
- VEL	
VELBRK	
B- Safety_Control	
Program_Execution_Control	
B- System_Configuration	
Axis_Configuration	
Organization	
Đ- Commutation	
B- Servo_Loop	
9- Miscellaneous	
E- Obsolete	

2. Click **Next**. The Advanced Protection Task is displayed.

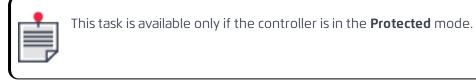
4.4.2.3.3 Advanced protection options

Cin	ulator - Protection Wiza	rd X
	Select a Task <	Advanced Protection
	Select Protection Le Buffers Protection	Mode: Protected
	Variables Protection	
>	Advanced Protection Preview Changes	
	Set Password	
	Task's report	

- 1. To allow system configuration, select the checkbox.
- 2. Click **Next** to preview changes and follow step 3 through step 10 in Setting Application Protection to complete setting protection and to exit the Protection Wizard.

4.4.3 Update Protection

The Update Protection task enables you to make changes in Protection settings.



To update Protection data:

1. Select **Update Protection** in the Select a Task window.



2. Click **Next**. The Set Protection Level window is displayed.



- 3. You have the option of changing the Protection by selecting the appropriate buttons:
- To change Application Protection settings, select the button next to Application
 Protection. Then click Next and follow the procedure described in Setting Application
 Protection.
- > To change Intellectual Property Protection settings, select the button next to Intellectual Property Protection. Then click Next and follow the procedure described in Setting Intellectual Property Protection.
- > To change Custom Protection settings, select the button next to **Custom Protection**. Then click **Next** and follow the procedure described in Setting Custom Protection.

•
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In the selected protection task, you enable protection or cancel an existing Protection by clicking the selected checkbox (💌) to toggle it on or off.

4.4.4 Remove Protection

The Remove Protection task enables you to disable the **Protection** mode.



This task is available only if the controller is in the **Protected** mode.

To remove Protection:

1. Select **Remove Protection** in the Select a Task window.



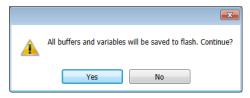
2. Click **Next**. The following notification appears:



3. The Enter Password dialog is presented.

Sir	nulator - Protection Wiza	d ×
	Select a Task <	Remove Protection
	Select Protection Le	Mode: Protected
	Buffers Protection	Mode: Protected
	Variables Protection	Enter password
	Advanced Protection	
	Preview Changes	
	Set Password	
>	Remove Protection	
	Task's report	

4. Enter the password and click Next. The following dialog appears



5. Click **Yes**. Another confirmation dialog appears.



- 6. Click OK
- 7. Wait for the appearance of a successful restart message:



8. Click **OK**. The Report window is displayed:

		•
Select a Task <	Task's report	
Select Protection Le	Mode: Not Protected	
Buffers Protection	Mode. <u>Not Protected</u>	
Variables Protection	REPORT ON PROTECTION REMOVING PROCEDURE	
Advanced Protection	Report time: 2/11/2020 9:40:44 AM	
Preview Changes	Firmware version: 2.79.18.00	
Set Password Remove Protection	Controller s/n: Simulator Task: Remove	
> Task's report	PROTECTION REMOVING PROCEDURE COMPLETE	
	Save report	Print report.
	etailed log of the protection status applied to the controller.	
The cask report shows a de	stalled log of the protection status applied to the Controller.	CC Back Next >> Finish

9. To save the report click **Save report**. The browser window is displayed:

$ ightarrow \uparrow$ 📙 « SPiPlu	as ADK Suite v3.00 → SPiiPlus MMI Application S	itudio 🗸 Ö Sea	rch SPiiPlus MMI App	licati 🔎
rganize 👻 New folder			100	- 0
This PC	^ Name ^	Date modified	Туре	Size
3D Objects	Help	26/01/2020 14:24	File folder	
Cesktop				
Documents				
🕹 Downloads				
Music				
No. Pictures				
📱 Videos				
OS (C:)				
🕳 Data (D:)				
— Kindle (F:)				
	v (
File game:				~
Save as type: 1.log				~

Select a directory and enter a filename. Click **Save**.

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The file extension for all reports is **.log**.

- 10. To print the report click **Print log**.
- 11. Click **Finish** to exit the Protection Wizard.

4.4.5 View Protection

The View Protection task enables you to view the Protection mode settings of the controller.



This task is available only if the controller is in the **Protected** mode.

To view the Protection mode settings:

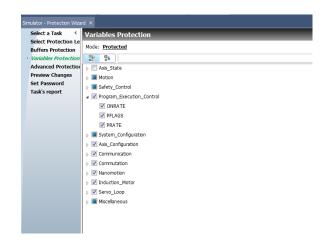
1. Select **View Projection** in the Select a Task window.



2. Click **Next**. The Buffers Protection task is displayed.

elect a Task < elect Protection Le	Buffers	Protec	ion	
uffers Protection	Mode: Pr	otected		
ariables Protection	Buffers	No edit	No view	
	Buffer 0			
review Changes	Buffer 1			
at Deserves a	Buffer 2			
	Buffer 3			
	Buffer 4			
	Buffer 5			
	Buffer 6			
	Buffer 7			
	Buffer 8			
	Buffer 9			

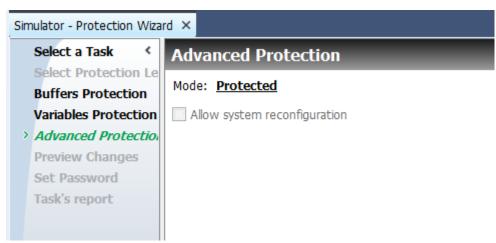
3. Click **Next**. The Variables Protection is displayed.





You can view the settings of the individual variables by clicking the tree expansion button: \blacksquare of the groups.

4. Click **Next**. The Advanced Protection is displayed.



5. Click **Finish** to exit the Protection Wizard.

4.4.6 Entering Incorrect Password

If the password that you enter is incorrect, the **Protection Wizard** displays the following message:



1. Acknowledge the message by clicking **Continue**. The task report informs the user that the task has failed, for example:

ect a Task 🛛 <	Task's report	
lect Protection Le	Mode: Protected	
ffers Protection	Mode: Protected	
riables Protection	REPORT ON PROTECTION APPLYING PROCEDURE	
lvanced Protectio eview Changes	Report time: 2/11/2020 10:21:30 AM	
eview Changes t Password	Firmware version: 2.79.18.00	
sk's report	Controller s/n: Simulator Task: Update	
on o report	Error. Wrong password.	
	chor, mong passion.	
	Save report	🖶 Print re

- 2. Your options are:
 - > Click **Back** to return to the window with the password field and enter the correct password, or
 - > Click **Finish** to exit the wizard.

5. Utilities

Utilities include the following tools:

- > Upgrade and Recovery Wizard upgrades your SPiiPlus Motion Controller software and firmware.
- > System Information Viewer consolidates all the pertinent data about your system and displays it in a single window.
- Communication Terminal enables you to enter commands directly to your controller. These commands are executed as soon as they are received through one of the communication channels. The results of the command, once executed, appear in the Communication Terminal window Output panel.

5.1 Accessing Utilities

To access Utilities:

- 1. If the Toolbox is not displayed, click **Toolbox**.
- 2. To display the Utilities list click **Utilities**.

Toolbox	•	џ	×
Utilities			
Upgrade and Recovery Wizard			
System Information Viewer			
Communication Terminal			
	_		
Setup			
Application Development			
Utilities			
Diagnostics and Monitoring			

3. Click the required utility.

5.2 Upgrade and Recovery Wizard

You use the **Upgrade and Recovery Wizard** to:

- > Upgrade the SPiiPlus Motion Controller firmware and user applications or downgrade to revert to an earlier firmware version.
- > Recover a SPiiPlus Motion Controller that has totally stopped functioning.
- > Provides the option to set a shortcut for automatically installing updates.

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- > Backup specific controller (machine) information to a location that you specify and create MMC file for Smarter Motion Tools.
- > Duplicate by copying the contents in the source directory created by the "Backup Machine" feature to a SPiiPlus Motion controller.

5.2.1 Starting Upgrade and Recovery Wizard

To start the Upgrade and Recovery Wizard:

- 1. From the Toolbox click **Utilities**.
- 2. Click Upgrade and Recovery Wizard.

You can also activate the **Upgrade and Recovery Wizard** using the right-click **Add Component** option of the Workspace Tree - see **Controller Right-Click Options**.

The Upgrade and Recovery Wizard Task window appears.

lect Task <	Select Task		
ect User Applicati			
ating Shortcut	© Recovery Recovery controller firmulare		
	© Create shortcut for automatic upgrade Creates a shortcut for automatic controller firmware and / or application upgrade / downgrade		
	Backup Machine and MCC File Creation Greates the complete backup of the controller (including the creation of MCC - Motion Controller Configuration' file for Smarters Motion Tools)		
	Duplcate Machine Restores the complete backup of the controller to the target machine		
		ACS.EStop	
		STO	

Available tasks are:

- > Upgrade Controller Task
- > Recovery Task (available only if the controller is disconnected)
- > Create Shortcut for Automatic Upgrade Task
- > Backup Machine
- > Duplicate Machine

5.2.2 Upgrade Controller Task



Upgrading the controller firmware is a dangerous operation that may destroy the controller if executed improperly. It is strongly recommended that you adhere strictly to the directions presented by the wizard.



Upgrading from SPiiPlus NT v1.0 to SPiiPlus NT v2.0 is done through the Recovery Task and not the Upgrade Controller Task.

To upgrade the controller firmware and user applications:

1. Select **Upgrade/Downgrade** and click **Next**. The Select Upgrade Options window is displayed.

Select Upgrade Options	
✓ Upgrade Firmware	
Source Firmware Directory	
Select directory that contains the firmware files to be loaded to the controller	
C:\Program Files (x86)\ACS Motion Control\SPIiPlus ADK Suite v3.00\Firmware	Browse
Backup Firmware Directory Select Backup directory if you want to be able to restore the previous firmware version	
Select backup directory	Browse
V No Backup	
Command Line Utility File Path	$\overline{\mathbf{v}}$

2. Enter the pathname of the directory in which the firmware files are located if different from what the Upgrade and Recovery has automatically entered, or click **Browse** and search for the directory:

Browse For Folder	Х
🛄 Desktop	
> 📓 acsmotioncontrol.com	
> 👩 Creative Cloud Files	
> 🤝 OneDrive - acsmotioncontrol.com	
> 🚴 โกล่าวสายหุ้อไฟโลยโก	
> 💻 This PC	
> 🐂 Libraries	
> 💣 Network	
> 🔝 Control Panel	
🛐 Recycle Bin	
> 🛃 Adobe Acrobat XI	
PDK	
OK Cancel	

3. Click OK.



Normally when you install the firmware on the computer from the ACS Motion Control Installation CD, by default, it is copied into the **Firmware** subdirectory of the same directory in which the SPiiPlus MMI Application Studio is located. However, it may be stored anywhere.

4. You can select to backup the old firmware by deselecting the **No backup** checkbox and entering the pathname of the directory into which the data is to be saved in the **Backup**

directory field (or use **Browse** to find it). The default is not to backup the old firmware.

5. Enter the path to the **Upgrader.exe** utility if different from what the Upgrade and Recovery has automatically entered, or use **Browse** to find it.

→ ↑ ↑ → This PC → Data (D:) → Project	ts → MMI_Learn	∨ Ö Se	arch MMI_Learn	م ا
ganize 👻 New folder			-	
- Translations ^ Name ^	Date modified	Type	Size	
	No items match you			
🛃 Website	No items match you	ir search.		
This PC				
3D Objects				
Desktop				
1 Documents				
United Street St				
Downloads Music				
· · · · · · · · · · · · · · · · · · ·				
Music				
Music				
Music Pictures Videos				

6. Click OK.

7. Click **Next**. The Select User Application Options window is displayed:

Select Task < Select Upgrade Opti	Select User Applic	ation Options							
> Select User Applicati									
Preview									
Upgrading Firmware	File Name:								Browse
	User Name:								
	Machine:								
	Date:			Saving					
	Date.								
	Firmware:			Contro	ler S/N:				
	Remarks:								
	ACSPL+ Programs		Configuration Parameters		SP Programs		User Arrays		
									۲
	Show Preview								0
Select User Application Opt programs, and user files) ar	tions step provides the funct re displayed once the application	ionality to browse for an application tion file has been selected. Only ch	file to load to the controller after the u ecked components will be loaded to the	pgrade. All components of ti e controller. A preview of a s	ne application file (Saved Al elected component can be	CSPL+ programs, configuration displayed. Refer to the tool	n parameters, SP tips for a detailed	Seck N	ext >> Cancel

8. You can either skip this task by clicking **Next** and go to Step 8, or, if you have saved your application to the computer (see Application Saver), you can load it by selecting the **Load User Application checkbox.**

Doc94 - Upgrade and Rec	covery Wizard × My Controller - Varinager and Watch	My Controller - Production Wizard	
Select Task <	Select User Application Options		
Select Upgrade Opti Select User Applicat			
Preview	File Name:		Browse
Upgrading Firmware	User Name:		
	Machine:		
	Date:	Saving tool:	
	Firmware:	Controler S/N:	

	Remarks:		
	ACSPL+ Programs	Configuration Parameters SP Programs User Arrays	
0	Show Preview		<u> </u>
Select User Application Op	otions step provides the functionality to browse for an applic	ation file to load to the controller after the upgrade. All components of the application file (Saved ACSPL+ programs, configuration parameters, SP	Cancel

9. Use the **Browse** button to locate and select the application data file:

A Select file to load					×
$\leftarrow \rightarrow \checkmark \uparrow$ \blacksquare « SPiiPlus ADK Suite v3.00 »	SPiiPlus MMI Application Stud	v oib	ප Search SPiil	Plus MMI Appl	icati 🔎
Organize 👻 New folder				== -	
Translations ^ Name	Da	te modified Typ	e	Size	
Troubleshooting Help	26,	/01/2020 14:24 File	folder		
💻 This PC 🧊 3D Objects					
🗾 Desktop 😭 Documents					
Downloads Music					
E Pictures					
Videos					
CS (C:)					
File <u>n</u> ame:			✓ Spi files (*. <u>Open</u>		∼ ancel



Application data is saved in files having an **spi** extension.

10. Click **Load**. The application data is loaded into the window.

Select Upgrade Options Select User Application O Preview	Select User Application Options							
Upgrading Firmware Start Recovery Download Recovery Moni	File: User: Mashine:	C:\Program Files\A	rogram Files)ACS Motion Control(ACS MMI New Generation 1.0 (IR2)(second_box.spi					
Select Upgrade Options Preview	Date:	09/16/2009 09:42		Application Saver of SPiPlus	MMI ver. 6.49.02			
Upgrading Firmware Finish Recovery Select Batch File Name fo	Firmware: Remarks:							
Select Upgrade Options Select User Application 0		L+ Programs		onfiguration Parameters	SP Programs	User parameters		
Preview	> Buffer		√ Sy		SP#0			
Creating Shortcut	✓ Buffer		_	is 0(X)	SP#1			
	Buffer		_	is 1(Y) is 2(Z)	SP#2			
	✓ Duffer		_	is 3(T)	- Jack 1			
	Duffer			is 4(A)				
	Buffer			is 5(B)				
	Buffer	7	✓ A)	is 6(C)				
	✓ Buffer	8	🗸 A.)	is 7(D)				
	Duffer	9						
	🖌 D-Buff	er						

You can see the contents of any buffer program or variable by selecting it and clicking **Show preview of selected item** checkbox. For example:

	ACSPL+ Programs	 Configuration Parameters 	SP Programs	User parameters
	Buffer 0	System	SP#0	
>	Buffer 1	Axis 0(X)	SP#1	
	Buffer 2	Axis 1(Y)	SP#2	
	Buffer 3	Axis 2(Z)	SP#3	
	Buffer 4	Axis 3(T)		
	Buffer 5	Axis 4(A)		
	Buffer 6	Axis S(B)		
	Buffer 7	Axis 6(C)		
	Buffer 8	Axis 7(D)		
	Buffer 9			
	✓ D-Buffer			
 Image: Construction 	Show preview of selected item			
AF BC BC CE	C(0)=1.00000000000000000000000000000000000			

You can control what is loaded from the application data by unselecting the checkbox of those items you do not want loaded.

11. Click **Next**. The Preview task window is displayed.

Deally Hermite and Deal	and the second second	troller - Varlnager and Watch My Controller - Production Wizard			
		luuvet - valkunaget anu vvaluti - My Controllet - Mououcon viluaru			
Select Task < Select Upgrade Opti	Preview				
Select User Applicati		de the firmware in the controller with the following gotions:			
> Preview					
Upgrading Firmware	Communication:	ETHERNET(TCP/IP Address: 10.0.094)			
	Upgrade Firmware				
	Firmware Directory:	C:\Program Files (x86)\ACS Motion Control\SPIPlus ADK Suite v3.00\Firmware			
	Command Line Utility:	C\Program Files (x86))ACS Motion Control/SPIPlus ADK Suite v3.00/SPIPlus MMI Application Studio/Upgrader.exe			
	No Backup				
	E no bucup				
	Load User Applicatio	n			
	Application filename:				
	Application filename:				
0					
Preview step provides one and/or Recovery process	ast chance to verify all o	If the selected options. All options are read-only and if changes need to be made press Back to go back to the appropriate step. If all options are correct press Next to begin the Upgrade a detailed determinity of the correspondence optimistic and the second statement of the second statement o	<< Back	Next >>	Cancel

12. Review the Preview window contents, and if it is what you want to load, click Next.



The **Preview** window is for information only. In order to make any changes, you have to use the **Back** button to return to previous windows and make your changes there.

The Upgrade Firmware window is displayed while the wizard loads the data.

A New - SPiPlus MMI Application Studio		
File View Workspace Tools Window Help		
📋 🏠 🛋 拱 💡 Connect 💉 Disconnect 👎 Add Co	ontroller 👯 Disconnect All 👯 Connect a	Al 🕲 Save to Flash 🖕 🗄 🕞 Open 🗙 Close 🖆 Remove 🖕 🕴 Useful Links 🖕
Workspace 👻 🕂 🛪	My Controller - UpgrRecovery Wizard	× .
 Workspace New 	Select Task <	Upgrading Firmware
	Select Upgrade Options Select User Application Options Preview > Upgrading Firmware	Displaying a Do you commit (Yn) a Displaying b Display
		Old firmware version: 2.99.60.00 New firmware version: 2.99.60.00
Description Upgrade and Recovery Wizard Name Upgrade and Recovery Wizard		The controller was successfully upgraded
		Press Finish to end upgrade proccess
		Copy Report
	Upgrading Firmware step shows the statu and Save Report options become usable.	us of the firmware upgrade. Once the upgrade is complete or fails the Print Report If the upgrade was successful press Finish to end the Upgrade and Recovery
	My Controller - Communication Terminal	- 4 ×
	Write command	Send And Trigger Scope
Description (No description)		
	Show Messages Off Backgrou	nd Communication 🔘 Off) 🕴 Continuous Save 🔘 Off) 🧯 🗹 Clear 🛛 🗖 Save Printout

- 13. When the upgrading is complete, you have the options of:
 - Saving the Upgrade Report to a log file by clicking Copy Report. A browser window is displayed:

🖪 Save log					×
	« SPiiPlus ADK Suite v3	00 > SPiiPlus MMI Application Studio	ٽ ~	Search SPiiPlus MMI Ap	plicati ,0
Organize 🔻 Ne	w folder			80	• 🕐
This PC	^	Name	Date modified	Туре	Size
3D Objects		Help	26/01/2020 14:24	File folder	
E Desktop					
Documents					
🕹 Downloads					
👌 Music					
Pictures					
Videos					
🟪 OS (C:)					
👝 Data (D:)					
👝 Kindle (F:)					
	~	<			>
File <u>n</u> ame:					~
Save as <u>t</u> ype:	*.log				~
∧ Hide Folders				Save	Cancel

Drill down to the directory in which you want to save the report and enter a name in the **Filename** field.

14. Click Save.



All log files have the **log** file extension.

- Print the Upgrade Report by clicking **PRINT REPORT**, a Print Preview window is displayed seePrint Report Preview Window.
- **15.** Click **Finish** to exit the Upgrade and Recovery wizard.

5.2.3 Recovery Task

The Recovery task is a routine to restore a SPiiPlus motion controller that has totally stopped functioning.

To run the Recovery task:

1. Select the controller in the Workspace Tree, and click **Disconnect** or press **Alt+D**.



The controller has to be disconnected before the **Recovery** task can be run.

- 2. Activate the Upgrade and Recovery wizard (see Starting Upgrade and Recovery Wizard).
- 3. Click **Next**. The Start Recovery window is displayed:

Doc94 - Upgrade and Rec	ecovery Wizard 🗙 My Controller - Varinager and Watch My Controller - Production Wizard			-
Select Task <	Start Recovery			
 Start Recovery Select Recovery Opt Preview Recovering 	Select controller type: SPIP/w/EC .			
Finish Recovery	To start the recovery procedure do the following steps:			
	 Connect a serial (RS-232) cable to the controler's COM1 port and to any available COM port of the host computer. 			
	2. Select the corresponding COM port of the host computer: COMI -			
	3. Switch the controller off.			
	4. Connect a serial (RS-232) loopback plug* to controller's COM2 port:			
	5. Switch the controller on. 6. Click "Next" button to continue,			
	 To main the looplock (b) the following initiated to consider do potentia: Data Caine Bocks, Data Set Review (Data Terminal Review) (Prist, 6. & 4). Review Data and Transmit Data (Prist 2. & 3). Review Data Caine Data (Prist 7. & 4.). 			
	0			
Start Recovery step provid	dies the functionality to define the controller type to recover. Once a controller has been selected instructions are provided to prepare the controller to be recovered.	<< Ba	k Next >>	Cancel

4. Select the SPiiPlus motion controller type from the dropdown list, for example:

SPiiPlus MMI Application Studio User Guide 5. Utilities



The window display changes depending on the type of controller you have selected:

Start Recovery
Select controller type: SPiPlus NT-LT/NT-HP
To start the recovery procedure do the following steps:
 Connect a serial (RS-232) cable to the controller's COM1 port and to any available COM port of the host computer.
2. Select the corresponding COM port of the host computer: COM1
3. Select current firmware version: Select 💌
4. Switch the controller off.
5. Connect a serial (RS-232) loopback connector to controller's COM2 port:
6. Switch the cost offer on.
7. Click "Next" button to continue.

Perform the following steps appearing in the window:



It is extremely important for the success of this task that you adhere to the instructions and perform each step in its proper sequence.

- > Connect a serial (RS-232) communication cable to the controller's COM1 port and to any available COM port on the host computer.
- > Select the host's COM port from the dropdown list.
- > Select the current firmware version from the dropdown list.
- > Switch the controller off.
- Connect a serial (RS-232) port loop-back adapter to the controller's COM2 port (as shown in the picture in the window).

With the serial port loop-back adapter installed in COM2, you then install the loop back plug (shown below) on the adapter. Pin 1 Pin 4 Pin 6 To make the loop back plug, the following pins need to be connected together: Data Carrier Detect, Data Set Ready and Data Terminal Ready (Pins 1, 6 & 4) Receive Data and Transmit Data (Pins 2 & 3) Request To Send and Clear To Send (Pins 7 & 8) as follows:

> Turn the controller back on.

Perform the following steps appearing in the window:



It is extremely important for the success of this task that you adhere to the instructions and perform each step in its proper sequence.

- 1. Connect a serial (RS-232) communication cable to the controller's COM1 port and to any available COM port on the host computer.
- 2. Select host's COM port from the dropdown list.
- 3. Turn the power off.



Power must be turned off to prevent the possibility of electric shock to personnel or damage to the controller card when extracting the controller to install the jumper.

- Extract the controller and install the jumper. Then reinstall the controller. Note that the picture showing the jumper location has changed to match the controller that you have selected.
- 5. Turn the power on.
- 6. Click **Next**. The controller is restarted:



Wait until the controller has finished rebooting.

7. If you are using SPiiPlus v2.0 or earlier, the Download Recovery Monitor appears. Otherwise, skip to The Select Upgrade Options window appears:.

Select a Task Download Recovery Monitor Select User Application 0 Preview Upgrading Firmware Select Recovery Monitor file path Select Recovery Monitor File path Select Recovery Monitor file path Select Recovery Monitor File path Select Recovery Monitor File path C:/Program Files/ACS Motion Control/ACS MMI New Generation 1.0 (IR2)/jrunemb.exe Brow	•
Preview Upgrading Firmware Start Recovery Monitor File path C:Program Files/ACS Motion Control/ACS MMI New Generation 1.0 (IR2)/runemb.exe Download Recovery Monitor	
Upgrading Firmware Select Recovery Monitor Fie path Start Recovery Orchard	
Start Recovery C:\Program Files\ACS Motion Control\ACS MMI New Generation 1.0 (IR2)\runemb.exe Brow	
Download Recovery Moni-	_
Select Upgrade Options Download Recovery monitor Preview Recovery task needs to download the Recovery Monitor to the controller.	_
Preview Recovery task needs to download the Recovery Monitor to the controller. Downlo	ad
Finish Recovery	18
Select Batch File Name fo	
Select Upgrade Options Select User Application 0	
Preview	
Creating Shortcut	
	2
Press Next Car	cel

The default path and filename (**RUNEMB.exe**) of the Recovery Monitor is in the same directory as the SPiiPlus MMI Application Studio.

8. If for some reason it is somewhere else, click **Browse** and in the browser window look for the file: **RUNEMB.exe**.

Select Recovery	Monitor Utility	? ×
Look jn:	CS MMI New Generation 1.0 (IR2) 💿 🔇 🎓 🔛 -	
My Flecent Documents Desktop My Documents My Documents	Configuration Wizard ADK Configuration Wizard PDK en Logs Repository Data Sope & FRF Test Files ACS.Estop.exe ACS.StogWewer.exe ACS.LogWewer.exe CS.CSW.exe ENDEMPERSE Sobile.exe Upgrader.exe	
My Network Places	File pame: Files of type: Exe files Car	

and click **Open**.

9. Click **Download** (Download), the Recovery Monitor is downloaded to the controller.



Wait for the completion of the downloading.

10. The **Select Upgrade Options** window appears:

Doc94 - Upgrade and Recovery Wizard $ imes$	My Controller - Varinager and Watch My Controller - Production Wizard	•
Select Task <	Select Recovery Options	
> Start Recovery > Select Recovery Options	Upgrade Firmware	
Preview	Source Firmware Directory	
Recovering	Select directory that contains the firmware files to be loaded to the controller	
Finish Recovery	C:\Program Files (x86)\ACS Motion Control\SPiPlus ADK Suite v3.00\Frmware	Browse
	Backup Firmware Directory	
	Select Backup directory if you want to be able to restore the previous firmware version	
	Select backup directory	Browse
	V No Backup	
	Command Line Utility File Path	$\overline{\mathbf{v}}$
	Factory Defaults	
	Select if want to reset the controller to Factory defaults	
	Restore Factory Defaults	
	Copy File to Controller	
	Select file for copying	
	Select file for copying	Browse
	Select Destination path	
	(C)	*
	Delete File from Controller	
	Select Destination path	
	Select directory	~
Select Recovery Options step provides the the factory defaults, copy specified file to	Initiality to specify the firmware source directory, firmware backup directory, and command line utility used to recovery the controler. There are the additional options to load << Back N	ext >> Cancel

You can select one or more operations from the following list:

- > Upgrade Firmware (with option to save the existing Firmware files in the backup folder)
- > Restore Factory Defaults
- > Copy File to Controller
- > Delete File from Controller
- 11. Normally, the firmware files reside in the **Firmware** subdirectory under the same directory as the SPiiPlus MMI Application Studio.

If for some reason they are somewhere else, click **Browse** and search for the directory:

📃 D	esktop	٦
> 1	acsmotioncontrol.com	
> 6	Creative Cloud Files	
> 🥑	OneDrive - acsmotioncontrol.com	
> 8	L anoar Malviarin	
> 🗖	This PC	
>	Libraries	
> 💣	Network	
> 🗵	Control Panel	
0	Recycle Bin	
>	Adobe Acrobat XI	
	PDK	
	aa	

and click **OK**.

12. You can select to backup the old firmware by deselecting the **No backup** checkbox and entering the pathname of the directory into which the data is to be saved in the **Backup directory** field (or use **Browse** to find it).

The default is not to backup the old firmware.

13. Enter the path to the **Upgrader.exe** utility or use **Browse** to find it.

Select Upgrader	Utility	<u>?×</u>
Look jn:	🔁 ADS MMI. New Recession 2.0.002	
My Recent Documents Desktop My Documents My Computer	Configuration Wizard ADK Configuration Wizard ADK Onfiguration Wizard PDK On Sope & Configuration Wizard PDK Sope & FRF Test Files ACS-Framework.exe ACS-LogViewer.exe ACS-CSRV.exe ACS-LogViewer.exe ACS-LogViewe	
My Network Places	File pare: Upgrader.exe Files of type: Exe files	<u>O</u> pen Cancel

and click **OK**.

(
L	•
L	_
L	
L	
L	

You also have the option of loading the factory default values by selecting the **Restore Factory Defaults** checkbox.

14. The Preview window is displayed:

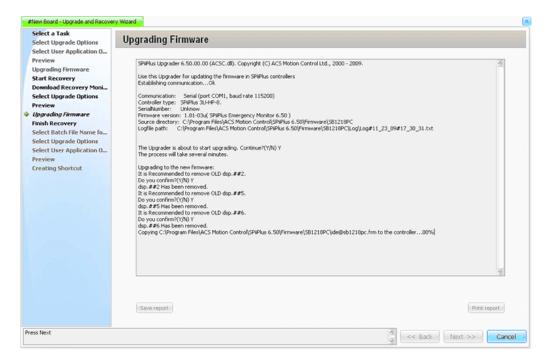
Doc94 - Upgrade and Recovery Wizard	K My Controller - Varin	ager and Watch Ny Controller - Production Wizard		1	
Select Task <	Preview				
Start Recovery Select Recovery Options	You are going to upgr	ade the firmware in the controller with the following options:			
> Preview	Communication:	SERIAL(Port: COM1, Rate(bps): 115200)			
Recovering	Upgrade Firmware				
Finish Recovery	Firmware Directory:	C:\Program Files (x86)\ACS Motion Control\SPIPlus ADK Suite v3.00\Firmware			
	Command Line Utility:	C:\Program Files (x86)\ACS Motion Control\SPiPlus ADK Suite v3.00\SPiPlus MMI Application Studio\Upgrader.exe			
	No Backup				
	Restore Factory De	faults			
	Copy File to Contro	ler			
	Delete File from Co	ntroller			
Preview step provides one last chance to begin the lingrade and/or Recovery proce	verify all of the selected o	ptions. All options are read-only and if changes need to be made press Back to go back to the appropriate step. If all options are correct press Next to for a detailed description of the corresponding parameters.	<< Back	Next >>	Cancel

Review the contents of the Preview window, and if it is what you want to load to the controller, click **Next**.



The **Preview** window is for information only. In order to make any changes, you have to use the **Back** button to return to previous windows and make your changes there.

15. The Upgrading Firmware window is displayed showing the progress of the Recovery.



- **16**. Wait for the completion of the process. On completion you have two options.
 - Saving the Upload Firmware Report to a log file by clicking Save report. A browser window is displayed:

Save log			
ightarrow 🛧 📙 « SPiiPlus	ADK Suite v3.00 > SPiiPlus MMI Application Stud	io v Ö Se	arch SPiiPlus MMI Applicati ,
Organize 👻 New folder			8:: •
This PC	^ Name	Date modified	Type Si
3D Objects	Help	26/01/2020 14:24	File folder
Desktop			
Documents			
🖶 Downloads			
Music			
E Pictures			
Videos			
🛀 OS (C:)			
👝 Data (D:)			
👝 Kindle (F:)			
	~ <		
File name:			

Drill down to the directory in which you want to save the report and enter a name in the **Filename** field. Then click **Save**.



All log files have the **log** file extension.

- Printing the Upload Firmware Report by clicking PRINT REPORT. A PRINT PREVIEW window is displayed. See Print Report Preview Window
- 17. Click Finish.



In order for the changes to take effect you have to reboot the controller - see Controller Reboot.

5.2.4 Create Shortcut for Automatic Upgrade Task

This task enables you to create a batch file that can be used to automatically upgrade your SPiiPlus Motion Controller.

To create the automatic upgrade shortcut:

1. Select **Create shortcut for automatic upgrade** and click **Next**. The Select Batch File Name for Automatic Upgrade window is displayed.

Select Task <	overy Wizard × My Controller - Varinager and Watch My Controller - Production Wizard Select Batch File Name for Automatic Upgrade	_	-	
Select Batch File National Select Upgrade Option	Shortcut File Name			
Select User Applicati Preview Creating Shortcut	Select batch file name		Br	owse
creating shortcut				
0				
elect Batch File Name for	Automatic Upgrade step provides the functionality to define the file name of the batch file to allow for an automatic upgrade.	<< Back Ne	xt >>	Cancel

2. Click **Browse** to enter a path and filename where the upgrade routine will be saved.

A Save As				
	Data (D:) > Projects > MMI_Learn	✓ ♂ S	sarch MMI_Learn	P
Organize 👻 New folder			800 -	6
This PC	^ Name ^	Date modified	Туре	Siz
3D Objects		No items match your search.		
E Desktop		*		
Documents				
🕹 Downloads				
👌 Music				
Not the second s				
🚼 Videos				
骗 OS (C:)				
Data (D:)				
📥 Kindle (F:)				
	v <			
File name:				_
Save as type: Text Document	is (*.txt)			
		r	Save Cancel	
Hide Folders		L	Save Cancel	

Drill down to the directory in which you want to save the batch file, and enter a name in the **Filename** field. Then click **Save**.

3. Click **Next**. The Select Upgrade Options window is displayed.

Doc94 - Upgrade and Reco	very Wizard X My Controller - Varinager and Watch My Controller - Production Wizard	•
	Select Upgrade Options	
Select Batch File Nan Select Upgrade Opti	Operation: Upgrade Firmware and Load Application	•
Select User Applicati	Source Firmware Directory	
Preview Creating Shortcut	Select directory that contains the firmware files to be loaded to the controller	
Creating Shortcut	Browse	
	Backup Firmware Directory	
	Select Backup directory if you want to be able to restore the previous firmware version	
	Select backup directory	Browse
	V No Backup	
	Command Line Utility File Path	\odot
Select Upgrade Options ste	p provides the functionality to specify the firmware source directory, firmware backup directory, and command line utility used to upgrade the	
controller. Refer to the too	I-tips for a detailed description of the corresponding parameters.	<< Back Next >> Cancel

4. Enter the pathname of the directory in which the firmware files are located, or click **Browse** and search for the directory:

Browse For Folder	×
🔜 Desktop	
> 📓 acsmotioncontrol.com	
> 👩 Creative Cloud Files	
> 📀 OneDrive - acsmotioncontrol.com	
> 🤱 ្ត្រឹងចែន សង្កែរបានកំព័	
> 💻 This PC	
> 🐂 Libraries	
> 💣 Network	
> 🖭 Control Panel	
🔯 Recycle Bin	
> 🔄 Adobe Acrobat XI	
PDK	
ок	Cancel
0.1	

and click **OK**.



Normally when you install the firmware on the computer from the ACS Motion Control Installation CD, by default it is copied into the **Firmware** subdirectory of the SPiiPlus <version number> directory as shown above. However, it may be stored anywhere.

- 5. You can select to backup the old firmware by deselecting the No backup checkbox and entering the pathname of the directory into which the data is to be saved in the Backup directory field (or use Browse to find it). The default is not to backup the old firmware.
- 6. Enter the path to the **Upgrader.exe** utility or use **Browse** to find it.

Select upgrader utility				>
→ ↑ ↑ → This PC → Data (D:) → Projects → MI	MI_Learn	✓ Ö Sear	ch MMI_Learn	م
rganize 👻 New folder				
Translations ^ Name	Date modified	Туре	Size	
5 Troubleshooting	No items wetch server	h		
😞 Website	No items match your :	search.		
This PC				
3D Objects				
Desktop				
Documents				
🕹 Downloads				
J Music				
E Pictures				
🚰 Videos				
🟪 OS (C:)				
Data (D:)				
File name:		✓ Exe	files (*.exe)	~
			<u>O</u> pen C	ancel

and click **OK**.

7. Click **Next**. The Select User Application Options window is displayed:

Doc94 - Upgrade and Rec	overy Wizard X	My Controller - Varinager ar	id Watch My Co	ontroller - Production Wi	ard		•
Select Task <		er Application Options	;				
Select Batch File Nan Select Upgrade Opti	The section of the se	Application					
> Select User Applicati							Browse
Preview	User Name:						
Creating Shortcut	Machine:						
	Date:				Saving tool:		
	Firmware:				Controler S/N:		
	Filliwale.						
	Remarks:						
	ACSPL+	Programs	Configuration	Parameters	SP Programs	User Arrays	
	Show Previev	N					٢
Colort Have Application On				he local de dise anatorilles	- A	fathe and leasting	
file (Saved ACSPL+ progra	tions step provid ms, configuration	des the functionality to browse f n parameters, SP programs, and	or an application file user files) are display	to load to the controller ed once the application	after the upgrade. All components o file has been selected. Only checked	f the application components will	Next >> Cancel

8. You can either skip this task by clicking **Next** and go to Step 10, or, if you have saved your application to the computer (see Application Saver), you can load it by selecting the **LOAD USER APPLICATION** checkbox.

Select Task <	Select User Application	Ontions		
Select Batch File Nan		options		
Select Upgrade Opti				
Select User Applicati	File Name:			Browse
Preview Creating Shortcut	User Name:			
2	Machine:			
	Date:		Saving tool:	
	Firmware:		Controller S/N:	
	Remarks:	Configuration P	rameters SP Programs	User Arrays
	Show Preview			

9. Use the **Browse** button to locate and select the application data file:

🛃 Select file to load					×
← → · · ↑ 📙 « SPiiPlu:	IS ADK Suite v3.00 > SPiiPlus MMI Application S	Studio	マ Ö Search SP	iPlus MMI App	licati ,0
Organize 🔻 New folder				8:: •	•
Translations ^ N	Name	Date modified	Туре	Size	
Troubleshooting	Help	26/01/2020 14:24	File folder		
💻 This PC					
🧊 3D Objects					
E Desktop					
Documents					
🖶 Downloads					
👌 Music					
Notures Pictures					
🚼 Videos					
🟪 OS (C:)					
Data (D:)					
File name:	:		 ✓ Spi files ('.spi)	~
			Qpe	n C	ancel

Application data is saved in files having an spi extension.

Select Task <	Select I	Jser Applicati	on Options						
Select Batch File Name for Automatic Upgrad Select Upgrade Options	Load Us	er Application							
Select User Application Options			1. 1. 1				_		
Preview	File Name:	C:\Users\dmitryl\D	esktop\tmp\MyProgram.spi				Brow		
Creating Shortcut	User Name	User Name:							
cating biorceat	Machine:								
	Machine.								
	Date:	4/23/2020		Saving tool:	Application Wizar	d (SPiiPlus MMI Applicati	on Stud		
	Firmware:	2.99.60.00		Controller S/N:	: CT000816C				
	Remarks:								
	✓ Buffer	PL+ Programs	Configuration Paramet	. SP Prog	rams 🛛 🗹 User Array		ys		
			System	SP#0		V I			
	Buffer 1		Axis 0(X)			V 🔽			
	Buffer		Axis 1(Y)			NumOfRestart_f			
	Buffer		Axis 2(Z)			SERR_failures_f			
	Buffer		Axis 3(T)			SERR_error_code	s_f		
	Buffer		Axis 4(A)			ECERR_failures_f			
	Buffer		Axis 5(B)			ECERR_error_cod	es_f		
	Buffer		Axis 6(C)			ECST_failures_f			
	Buffer		Axis 7(D)			commut_failures_	f		
	Buffer					jog_failures_f			
	D-Buff	er				NST_failures_f			
						FAULT_before_e			
						FAULT_after_ena			
						FAULT_after_con			
				_		FAULT_after_jog	f		
						ABS_E_f			
				-		Points			
						 States 			
						X_FILE			
						PMAP			
						ONE			
				-		TW0			
	Show Prev	riew							

Click **Load**. The application data is loaded into the window.

	ACSPL+ Programs	Configuration Parameters	SP Programs	User parameters
	Buffer 0	System	SP#0	
>	Buffer 1	Axis 0(X)	SP#1	
	Buffer 2	Axis 1(Y)	SP#2	
	Buffer 3	Axis 2(Z)	SP#3	
	Buffer 4	Axis 3(T)		
	Buffer 5	Axis 4(A)		
	Buffer 6	Axis 5(B)		
	Buffer 7	Axis 6(C)		
	Buffer 8	Axis 7(D)		
	Buffer 9			
	D-Buffer			
	Show preview of selected item		1724	
AF BC BC	CC(0)=1.00000000000000000000000000000000000			

You can control what is loaded from the application data by unselecting the checkbox of those items you do not want loaded. Click **Next**. The Preview task window is displayed.

Doc94 - Upgrade and Recov	very Wizard × My Cor	ntroller - Varinager and Watch My Controller - Production Wizard			-
	Preview				
Select Batch File Nan Select Upgrade Optic	You are going to upgra	ade the firmware in the controller with the following options:			
Select User Applicati Preview	Communication:	ETHERNET(TCP/IP Address: 10.0.0.94)			
Creating Shortcut	Command Line Utility File Name	D:\Projects\MMI_Learn\Shortcut.bat			
	🗹 Upgrade Firmware				
	Firmware Directory:	C:\Program Files (x86)\ACS Motion Control\SPiPlus ADK Suite v3.00\Training\Training Examples			
	Command Line Utility:	C:\Program Files (x86)\ACS Motion Control\SPiPlus ADK Suite v3.00\SPiPlus MMI Application Studio\Upgrader.exe			
	Vo Backup				
	Load User Applicati	20			
	Application filename:				
	Application mename.				
0					
		f the selected options. All options are read-only and if changes need to be made press Back to go back to the appropriate the Upgrade and/or Recovery process. Refer to the tool-tips for a detailed description of the corresponding parameters.	<< Back	Next >>	Cancel

10. Review the contents of the Preview window, and if it is what you want to load, click **Next**.



The **Preview** window is for information only. In order to make any changes, you have to use the **Back** button to return to previous windows and make your changes there.

The Creating Shortcut is displayed while the wizard creates the batch file.

Doc94 - Upgrade and Reco	very Wizard X My Controller - Varinager and Watch My Controller - Production Wizard			-
	Creating Shortcut			
Select Batch File Nan Select Upgrade Optic	The batch file "D:\Projects\MMI_Leam\Shortcut.bat" for automatic upgrade has been successfully created. The shortcut has been successfully created on your Desktop.			
Select User Applicati	The shortcut has been succession created on your besktop.			
Preview				
> Creating Shortcut				
0	R Save report		🖨 Print	report
Creating Shortcut step disp	lays the results of the Create Shortcut for Automatic Upgrade task.	<< Back	Next >>	Finish

- 11. When the creation of the batch job is complete, you have the options of:
 - Saving the Shortcut Creation Report to a log file by clicking Save report (Save report). A browser window is displayed:

→ · · ↑ 📙 « SPiiPlus A	DK Suite v3.00 > SPiiPlus MMI Application Studio	∨ Ö Sea	rch SPiiPlus MMI Applicati
Organize 🔻 New folder			800 -
💶 This PC	^ Name ^	Date modified	Туре
	Help	26/01/2020 14:24	File folder
Desktop			
Documents			
🕹 Downloads			
👌 Music			
E Pictures			
🚆 Videos			
🟪 OS (C:)			
👝 Data (D:)			
👝 Kindle (F:)			
	~ <		
File name:			
Save as type: *.log			

Drill down to the directory in which you want to save the report and enter a name in the **Filename** field. Then click **Save**.



All log files have the **log** file extension.

- > Clicking PRINT REPORT. A PRINT PREVIEW window is displayed. See Print Report Preview Window
- 12. Click Finish.

5.2.5 Backup Machine

The Backup Machine function allows the user to store all application level information (axes, system parameters, user defined parameters) as well as system configuration (Firmware, DSPs). The backup location is selected by the user on the host computer. This information can later be used as input for "duplicate machine" functionality.

 Select Backup Machine and click Next. The Select Backup Machine Options window is displayed.

Select Task <	wery Wizard × My Controller - Varinager and Watch My Controller - Production Wizard Select Backup Machine Options	_		
Select Backup Mach	Backup Directory Path			
Preview Creating Backup	Select target directory			
5 .	Select directory		P	Browse
	Command Line Utility File Path			6
	Select command line utility file path			
	C:\Program Files (x86)\ACS Motion Control\SPiiPlus ADK Suite v3.00\SPiiPlus MMI Application Studio\Upgrader.exe		B	Browse
0	tions step provides the functionality to specify the backup directory and command line utility used to backup the machine			

2. Enter the backup directory path to save the backup machine files, or click **Browse** and search for the directory.

- 3. Enter the path to the **Upgrader.exe** utility if different from what the Upgrade and Recovery has automatically entered, or click **Browse** and search for the directory.
- 4. Click **Next**. The Preview window is displayed.

Doc9	4 - Upgrade and Reco	overy Wizard 🗙 My Co	ntroller - Varinager and Watch	My Controller - Production Wizard				
Se	elect Task <	Preview						
Se	elect Backup Machi							
	review	You are going to create a backup with the following options:						
Cr	eating Backup	Communication:	ommunication: ETHERNET(TCP/IP Address: 10.0.0.94)					
		Backup Directory:	C:\Program Files (x86)\ACS Motion C	Control/SPiiPlus ADK Suite v3.00/Training/Backup				
		Command Line Utility:	C:\Program Files (x86)\ACS Motion C	Control/SPiiPlus ADK Suite v3.00/SPiiPlus MMI Application Studio/Upgrader.exe				
Previe step.	Preview step provides one last chance to verify all of the selected options. All options are read-only and if changes need to be made press Back to go back to the appropriate step. If all options are correct press Next to begin the Upgrade and/or Recovery process. Refer to the tool-tips for a detailed description of the corresponding parameters.							
-								

5. Veryify the Backup Directory and Upgrader Utility locations and make any necessary changes, then Click **Next**. A warning message is displayed.

Controller is goin	g to be disconnected now.
ОК	Cancel

6. Click **OK**. The Creating Backup window is displayed.

Doc94 - Upgrade and Recov	very Wizard 🗙 My Controller - Varinager and Watch My Controller - Production Wizard			
	Creating Backup			
Preview > Creating Backup	Swing dog, ##1 to the hostOK Swing dog, ##2 to the hostOK Swing dog, ##3 to the hostOK Swing dog, ##4 to the hostOK Swing dog, ##5 to the hostOK Swing dog, ##8 to the hostOK Swing dog, ##9 to the hostOK Swing dog, #10 to the hostOK Swing dog, #11 to the hostOK Swing dog, #12 to the hostOK Swing dog, #15 to the hostOK Swing Backup.spi to the hostOK			
	Press Finish to end backup proccess			
0	R Save report		Print	report
elect Backup Machine Optio	ons step provides the functionality to specify the backup directory and command line utility used to backup the machine	<< Back	lext >>	Finish

- 7. If desired, click **Save Report** or **Print Report**.
- 8. Click **Finish**.

5.2.6 Duplicate Machine

This functionality is based on "Backup Machine" feature output. User selects the source directory which was created by "Backup Machine" feature. The contents of the selected folder are copied to the controller.

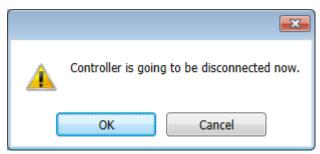
1. Select **Duplicate Machine** and click **Next**. The Select Duplicate Machine Options window is displayed.

Select Task <	Select Duplicate Machine Options	
Select Duplicate Machine Options Preview Duplicating	Duplicate Directory Path Select source directory	
	Select directory	Browse
	Command Line Utility File Path	6
	Select command line utility file path C:\Program Files (x86)\ACS Motion Contro\SPIPlus ADK Suite v3.00\SPIPlus MMI Application Studio\Upgrader.exe	Browse
ect Duplicate Machine Options step pro	vides the functionality to specify the source directory and command line utility used to duplicate the machine	>> Cance

- 2. Enter the pathname of the source directory in which to save the duplicate machine files, or click **Browse** and search for the directory.
- 3. Enter the path to the **Upgrader.exe** utility if different from what the Upgrade and Recovery has automatically entered, or click **Browse** and search for the file path.
- 4. Click **Next**. The Preview window is displayed.

Doc94 - Upgrade and Recovery Wizard $ imes$	My Controller - Varir	ager and Watch My Controller - Production Wizard				
Select Task <	Preview					
Select Duplicate Machine Options						
> Preview	You are going to dupli	are going to duplicate machine with the following options:				
Duplicating	Communication:	ETHERNET(TCP/IP Address: 10.0.0.94)				
	Source Directory:	C:\Users\aharonm\Documents\ACS\Backup\sb1218pc				
	Command Line Utility:	C:\Program Files (x86)\ACS Motion Control\SPIPlus ADK Suite v3.00\SPIPlus MMI Application Studio\Upgrader.exe				
Preview step provides one last chance to v step. If all options are correct press Next	verify all of the selected of to begin the Upgrade an	ptions. All options are read-only and if changes need to be made press Back to go back to the appropriate d/or Recovery process. Refer to the tool-tips for a detailed description of the corresponding parameters.	< Back Next >>	Cancel		

5. Verify the Source Directory and Upgrader Utility locations and make any necessary changes, then Click **Next**. A warning message is displayed.



6. Click **OK**. The Duplicating Machine window is displayed.

Select Task Select Ugrade Options Select User Application Options Preview Upgrading Firmware Start Recovery Download Recovery Monitor Select Recovery Options Preview Recovering Finish Recovery Select Batch File Name for Auto Select Ugrade Options Select Ugrade Options Select Ugrade Options Preview Creating Shortcut Select Backup Machine Options Preview Creating Backup Select Duplicate Machine Options Preview Opticating Preview Opticating Machine Options
Select User Application Options Select User Application Options Preview Upgrading Firmware Start Recovery Download Recovery Monitor Select Recovery Options Preview Recovering Finish Recovery Select Batch File Name for Auto Select Upgrade Options Select User Application Options Preview Creating Shortcut Select Backup Machine Options Preview Creating Backup Select Backup Select Duplicate Machine Options Preview
Preview Upgrading Firmware Start Recovery Download Recovery Monitor Select Recovery Options Preview Recovering Finish Recovery Select Batch File Name for Auto Select Upgrade Options Select Upgrade Options Preview Creating Shortcut Select Backup Machine Options Preview Creating Backup Select Duplicate Machine Options
Ugrading Firmware Start Recovery Download Recovery Monitor Select Recovery Options Preview Recovering Finish Recovery Select Batch File Name for Auto Select Upgrade Options Select Upgrade Options Select User Application Options Preview Creating Shortcut Select Backup Machine Options Preview Creating Backup Select Duplicate Machine Options Preview
Start Recovery Download Recovery Monitor Select Recovery Options Preview Recovering Finish Recovery Select Batch File Name for Auto Select Batch File Name for Auto Select Upgrade Options Select User Application Options Preview Creating Shortcut Select Backup Machine Options Preview Creating Backup Select Duplicate Machine Options Preview Creating Backup Select Duplicate Machine Options Preview
Download Recovery Monitor Select Recovery Options Preview Recovering Finish Recovery Select Batch File Name for Auto Select Upgrade Options Select Upgrade Options Select User Application Options Preview Creating Shortcut Select Backup Machine Options Preview Creating Backup Select Duplicate Machine Options Preview
Select Recovery Options Preview Recovering Finish Recovery Select Batch File Name for Auto Select Upgrade Options Select User Application Options Preview Creating Shortcut Select Backup Machine Options Preview Creating Backup Select Duplicate Machine Options Preview
Preview Recovering Finish Recovery Select Batch File Name for Auto Select Upgrade Options Select Upgrade Options Select User Application Options Preview Creating Shortcut Select Backup Machine Options Preview Creating Backup Select Duplicate Machine Options Preview Preview Preview Select Duplicate Machine Options
Recovering Finish Recovery Select Batch File Name for Auto Select Upgrade Options Select Upgrade Options Select User Application Options Preview Creating Shortcut Select Backup Machine Options Preview Creating Backup Select Duplicate Machine Options Preview Creating Backup Select Duplicate Machine Options
Finish Recovery Select Batch File Name for Auto Select Upgrade Options Select User Application Options Preview Creating Shortcut Select Backup Machine Options Preview Creating Backup Select Duplicate Machine Options Preview Creating Backup Select Duplicate Machine Options Preview
Select Batch File Name for Auto Select Upgrade Options Select User Application Options Preview Creating Shortcut Select Backup Machine Options Preview Creating Backup Select Duplicate Machine Options Preview
Select Upgrade Options Select User Application Options Preview Creating Shortcut Select Backup Machine Options Preview Creating Backup Select Duplicate Machine Options Preview
Select User Application Options Preview Creating Shortcut Select Backup Machine Options Preview Creating Backup Select Duplicate Machine Options Preview
Preview Creating Shortcut Select Backup Machine Options Preview Creating Backup Select Duplicate Machine Options Preview
Creating Shortcut Select Backup Machine Options Preview Creating Backup Select Duplicate Machine Options Preview
Select Backup Machine Options Preview Creating Backup Select Duplicate Machine Options Preview
Preview Creating Backup Select Duplicate Machine Options Preview
Creating Backup Select Duplicate Machine Options Preview
Select Duplicate Machine Options Preview
Preview
⇒ Duplicating
Save report Print report
Select Duplicate Machine Options step provides the functionality to specify the source directory and upgrader utility used to
duplicate the machine.

- 7. If desired, click Save Report or Print Report.
- 8. Click Finish.

5.3 System Information Viewer

The **System Information Viewer** consolidates all of the system information and enables you to view it in one place. It is extremely convenient in that it relieves you of having to activate numerous SPiiPlus MMI Application Studio tools to get the same information.

5.3.1 Activating the System Information Viewer

To activate the System Information Viewer:

- 1. From the Toolbox click **Utilities** to display the list of utilities.
- 2. Click System Information Viewer in the list of utilities.

•

You can also activate the **System Information Viewer** using the right-click **Add Component** option of the Workspace Tree.

The System Information Viewer window is displayed in the workspace.

My Controller - Syst...ormation Viewer $\, imes \,$ 🍆 🖰 Refresh 🛛 🛱 Save 🖄 Load Function Buttons -4 Computer Envir Item Value User User Processor Memory User Name DESKTOP-HNUS92U\noame System Information Tree -Machine Name DESKTOP-HNUS92U Operating System Current Directory System Directory C:\Program Files (x86)\ACS Motion Contro. C:\WINDOWS\system32 ACS Motion Control Software C / .NET Library MMI Application Studio Components Processor Name Intel(R) Core(TM) i7-4600U CPU @ 2.10G. 4 Host-Controller Communication Intel64 Family 6 Model 69 Stepping 1 Description General Communication Channels Manufacturer GenuineIntel Max Clock Speed 2701 Mhz Active Communication Channel Memory Total Physical Memory Available Physical Memory 8.00 Gb 2.88 Gb Total Virtual Memory 9.16 Gb General Hardware 3.30 Gb 1.25 Gb Available Virtual Memory Total Page File Space Axes Operating System Network Units Name Microsoft Windows 10 Pro A Safety & Fault Response 10.0.18363 Build 18363 Version Axes Faults EtherCAT Configuration Nodes Network Variables System Information Panel

5.3.2 System Information Viewer Window

The components of the System Information Viewer window are:

Functions

The System Information Viewer has the following function buttons:

	Causes the System Information Viewer to re-read your system and update, if necessary, the information that is displayed.
	There are two cases when you use this:
Refresh	A change has been made to one or more of the components during operation and you want an updated version of the information.
	You have loaded a previously saved snapshot of the System Information and you want to restore the correct information.
Save	Enables you to save a snapshot of the System Information to a file on the computer.
Load	Enables you to load the System Information snapshot that has been previously saved on your computer into the System Information Viewer.

System Information Tree

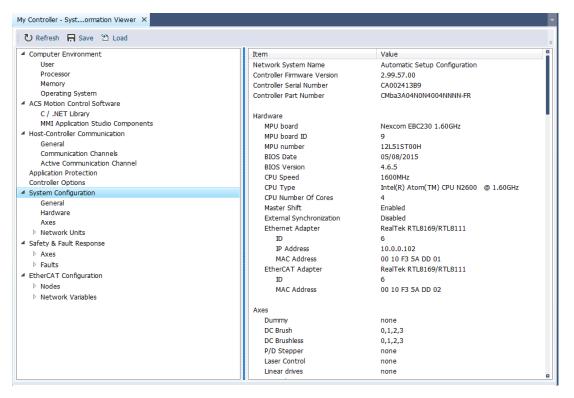
There are two different structures of the System Information Tree:

- > EtherCAT Network System Information Tree reflects a system that consists network elements.
- > Non-EtherCAT Network System Information Tree This structure reflects a system that is not network-based.

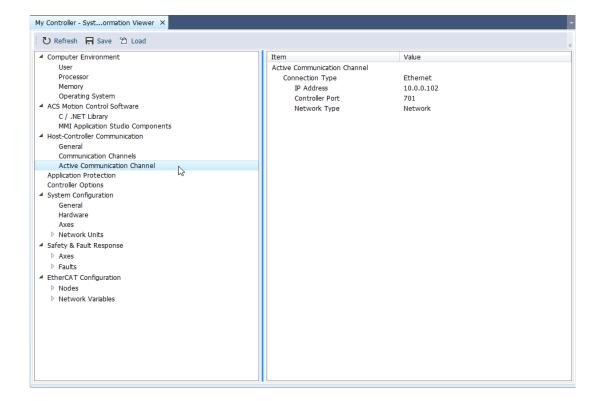
System Information Panel

The System Information Panel displays the information for the selected item in the System Information Tree.

When you select a main branch of the System Information Tree, the System Information Viewer displays all the information for the branch, for example:



When you select a sub-branch, the System Information Viewer displays only the information for the sub-branch, for example:



5.3.3 EtherCAT Network System Information Tree

An EtherCAT network-based System Information Tree has the following items:

- > Computer Environment
- > ACS Motion Control Software
- > Host-Control Communication
- > Application Protection
- > Controller Options
- > System Configuration

Version 3.02

- > Safety & Fault Response
- > EtherCAT Configuration

5.3.3.1 Computer Environment

Computer Environment displays the host computer data, including:

- > User Name of the user currently logged into the system
- > Processor Displays the technical information of the host computer's processor
- > Memory Displays the amount used and amount available of the physical and virtual memories.
- > Operating System Displays the name of the operating system and version number

5.3.3.2 ACS Motion Control Software

ACS Motion Control Software displays:

- > C/.NET Library the most current versions of the C and .NETLibraries.
- MMI Application Studio Components each tool and application making up the SPiiPlus MMI Application Studio.

5.3.3.3 Host-Control Communication

Host-Control Communication includes:

- > General displays the timeout setting and remote connection status
- > Communication Channels displays all of the available communication channels by channel number, type and mode
- > Active Communication Channel displays the currently active communication channel, including connection type, IP address, controller port number and network type

5.3.3.4 Application Protection

An application can have one of two states: Protected, that is, some variables have been protected from change, or Unprotected. See Protection Wizard for details.

5.3.3.5 Controller Options

Controller Options displays the status of various controller options that may exist, such as total number of axes, number of SIN-COS encoders, whether or not Input Shaping is on, number of non-ACS drivers are connected, and for each node that is connected, it displays the Unit ID and DIP switch settings (if exists).

5.3.3.6 System Configuration

System Configuration includes:

- > General Displays the name of the network, firmware version of the controller, serial and part number of the controller
- > Hardware Displays data of the hardware, including such things as the MPU, Ethernet adapter, and EtherCAT adapter.

- > Axes Displays a consolidated listing of all the axes that have been defined in the system, including their numbers, types of drives, operating current (continuous and peak), etc.
- > Network Units

For each unit in the network the following is provided:

- General Displays the unit's ID and DIP switch settings (if exists), part number, vendor ID, controller part number, vendor ID, network system name ID, revision, controller serial number, hardware ID, FPGA ID
- > Axes Assignments Displays the axes numbers as assigned to the unit
- Inputs/Outputs Assignments Displays the values of the IN and OUT (Digital I/O), AIN and AOUT (Analog I/O), and EXTIN and EXTOUT (External I/O) variables along with the number of HSSI channels
- > Integrated Components



This appears only if the unit is one of the **MC4U** products.

- > Lists all the components that make up the unit, such as power supply(s), controller(s), and drivers, and displays the information for each component
- > Servo Processors Displays the Servo Processors (SP) contained in the unit

5.3.3.7 Safety & Fault Response

This displays the following for each axis:

- > The FAULT value for the selected axis.
- > A list of the faults and the value of the selected fault for each axis.

5.3.3.8 EtherCAT Configuration

This provides the same information as running **#ETHERCAT** in the System Commands command in the **Communication Terminal**. It divides the information between the Node and the Input/Output Network Variables.

5.3.4 Non-EtherCAT Network System Information Tree

A non-EtherCAT network-based System Information Tree has the following items:

- > Computer Environment
- > ACS Motion Control Software
- > Host-Control Communication
- > Application Protection
- > Controller Options
- > System Configuration
- > Safety & Fault Response

5.3.4.1 Computer Environment

Computer Environment displays the host computer data, including:

- > User Name of the user currently logged into the system
- > Processor Displays the technical information of the host computer's processor
- Memory Displays the amount used and amount available of the physical and virtual memories.
- > Operating System Displays the name of the operating system and version number

5.3.4.2 ACS Motion Control Software

ACS Motion Control Software displays:

- > C/.NET Library the most current versions of the C and .NET Libraries.
- MMI Application Studio Components each tool and application making up the SPiiPlus MMI Application Studio.

5.3.4.3 Host-Control Communication

Host-Control Communication includes:

- > General Displays the timeout setting and remote connection status
- > Communication Channels Displays all of the available communication channels by channel number, type and mode
- > Active Communication Channel Displays the currently active communication channel, including connection type, IP address, controller port number and network type

5.3.4.4 Application Protection

An application can have one of two states: Protected, that is, some variables have been protected from change, or Unprotected. See Protection Wizard for details.

5.3.4.5 Controller Options

Controller Options displays the status of various controller options that may exist, such as, number of SIN-COS encoders, whether or not Input Shaping is on, Servo Features mask, etc.

5.3.4.6 System Configuration

System Configuration includes:

- > General Displays the name of the network if the controller is connected through a LAN, firmware version of the controller, serial and part number of the controller
- > Hardware Displays data of the hardware, including such things as the MPU, Ethernet adapter(s), controller card revision and number of Servo Processors.
- > Axes Displays the list of axes controlled by the controller, the type of drives that those axes can control, the operating current (continuous and peak) for integrated axes, and the PEG status that have been defined for the axes.
- Inputs/Outputs Displays what axes have been defined for the IN and OUT (Digital I/O), and AIN and AOUT (Analog I/O) variables along with the number of HSSI channels

Integrated Modules - Lists all the components that make up the unit, such as power supply (s), controller, and drivers, and displays the information for each component, including such things as type, axes associated with the component, voltage and amperage values, etc.

-	-	
=	=	1
_	=	
	IF.	7
	D	7

This appears only if the unit is one of the **MC4U** products.

> Servo Processors - Displays the Servo Processors (SP) contained in the unit with a brief description of the functionality of each SP.

5.3.4.7 Safety & Fault Response

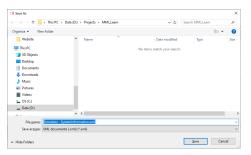
This displays the following for each axis:

- > The FAULT value for the selected axis
- > A list of the faults and the value of the selected fault for each axis

5.3.5 Saving System Information

To save the System Information to a file on your computer:

1. Click **Save** (_{Rse}). The browser is displayed.



2. Browse to the location where you want to save the information and click **Save**.



The System Information data is saved in a file having an **.ini** file extension.

5.3.6 Loading System Information

To load System Information that has been previously saved on your computer:

1. Click **Load**. The browser is displayed.

→	> MM_Learn	~ O	Search MM_Learn	
Irganize - New folder)II •	
Translations ^ Name	Date modified	Type	Size	
Troubleshooting	No items match your	search.		
This PC				
3D Objects Desktop				
Documents				
🕹 Downloads				
Music				
Fictures				
S (C)				
Data (D:)				
			XML documents (an	

2. Browse to the location where you saved the information and click **Open**. The System Information stored in the file is then displayed in the System Information Viewer.

5.4 Communication Terminal

Communication Terminal enables you to enter commands directly to the controller.

There are two types of commands that can be entered through Communication Terminal:

> ASCPL+ Commands - valid ASCPL+ command or a string of ASCPL+ commands.



Only certain ACSPL+ commands may be strung together. The commands that you can enter in this way must be fairly simple. You cannot, for example, enter ACSPL+ loops or conditional commands.

> Terminal Commands - commands that are specific to the Communication Terminal and are not part of the ACSPL+ commands and variables set.

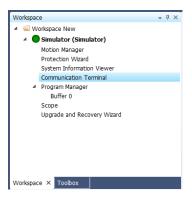
5.4.1 Accessing Communication Terminal

By default Communication Terminal is loaded when SPiiPlus MMI Application Studio is first activated. However, if you have closed the Communication Terminal window, or removed Terminal from the Workspace Tree, you can activate it again by:

- > Access Communication Terminal from Workspace Tree
- > Access Communication Terminal from Utilities

5.4.1.1 Access Communication Terminal from Workspace Tree

1. Display Workspace.



2. Click Communication Terminal.

5.4.1.2 Access Communication Terminal from Utilities

Since the Communication Terminal is one of the SPiiPlus MMI Application Studio Utilities, it can be accessed by:

- 1. From the Toolbox click **Utilities**.
- 2. Click Communication Terminal.

Toolbox	-	џ	×			
Utilities						
Upgrade and Recovery Wizard						
System Information Viewer						
Communication Terminal						
Setup						
Application Development						
Utilities						
Diagnostics and Monitoring						
Workspace Toolbox ×						



You can also activate **Communication Terminal** using the right-click options of the Workspace Tree (see Controller Right-Click Options).

5.4.2 The Communication Terminal Window

The Communication Terminal window consists of:

	Simulator - Communication Terminal	* 9 ×
Command Line	enable 1	Send Send And Trigger Scope
Output Window	enable 0 enable 1	
Communications Toolbar	Show Messages (0 0F) Background Communication (0 0F) Continuous Save (0 0F)	✓ Clear
	Printout Toolbar	

Command Line

The Command Line is used for entering the commands. You can enter ASCPL+ commands or Communication Terminal Commands.

Certain ACSPL+ commands may be strung together using the semicolon (;) as a delimiter, for example:

SET FPOSO = 0;ENABLE X;PTP X, 10000



In the example, the initial position of the X axis is set to 0, then the axis is enabled, and a point-to-point command is executed. If you were to enter the Communication Terminal query command, **?FPOSO** after sending the string, you would get a response of **10000**.

The commands that you can enter in this way must be fairly simple. You cannot, for example, use loops or conditionals.

Communication Terminal commands, however, cannot be strung together; they must be entered individually.

Once you have typed in the command(s), press **Enter** to send the command, or click **Send**.

You also have the option of sending the command(s) and seeing the system reaction on the by clicking **Send And Trigger Scope**.

Output Window

The Output Window displays what you have sent and reactions to Communication Terminal commands. For example;

APOS								 Send Send And Trigger Scop
т етдале								, <u> </u>
2VEL(1)								
15000								
: 20000								
PAPOS								
0	0	0	0	0	0	0	0	
ő	ő	ő	ŏ	ő	ŏ	ő	ő	
0	0	0	0	0	0	0	0	
0							0	
0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	

Communications Tools Bar

You have the following Communication options available to you.

- Show Messages a program that is running in the controller may have display commands (such as DISP) that you might want to see, in which case you click this and the messages are displayed.
- > **Background Communication** selecting this option causes the display of the ongoing communication checks that Communication Terminal conducts with the controller.



Currently **Exclusive Communication** is not supported.

Printout Tools Bar

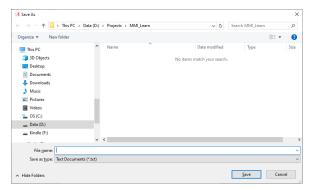
You have the following Printout options available to you.

- > **Clear** selecting this clears the Output Window.
- Save Printout selecting this enables you to save the contents of the Output Window to a text file.
- Continuous Save selecting this enables you to open a text file and Communication Terminal will save the running contents of the Output Window until you close Communication Terminal.

5.4.3 Saving Communication Terminal Command Output to File

To save the output of a Communication Terminal command:

- 1. Run the Communication Terminal command.
- 2. Click **Save Printout**, a browser window is displayed:



 Use the browser to select where you want to store the file, enter a File Name and click Save.



If you select **Continuous Save** instead of **Save**, Communication Terminal displays the same browser. Once you have designated a file to which Terminal is to write the command output, Communication Terminal appends the output of each command you enter to the file. When you close Communication Terminal, the file is closed.

5.4.4 Communication Terminal Commands

Communication Terminal commands are divided into:

- > Query Commands
- > Program Management Commands
- > System Commands

5.4.4.1 Query Commands

Query commands are designated by the question mark (?).

Command & Syntax	Description
? [ACSPL+ variable name]	Returns the current value of a ACSPL+ variable. The ACSPL+ variable name must be entered in all CAPs.
? [ACSPL+ variable name], [ACSPL+ variable name]	Returns the current value of listed standard variables. The ACSPL+ variable name must be entered in all CAPs.
?? [ACSPL+ variable name]	Returns a brief description of the ACSPL+ variable. The ACSPL+ variable name must be entered in all CAPs.
? [buffer number]: [local user- defined variable]	Returns the current values of a local user variable or array defined in a program buffer. The variable name must be entered exactly as it appears in the program.
? [array_variable (index)]	Returns the current value of a specific element in the given array. The brackets enclosing the index are optional. If it is an ACSPL+ array variable, it must be entered in all CAPs.
? [global user array_variable [(index)]]	Returns the current values of a global user variable or array. Or the value of an element in the array if index is included.
? [matrix_variable (row_index) (col_ index)]	Returns the current value(s) of an element in a two dimensional matrix. The indices may be entered as a range, e.g., (0,4) is the first through fifth, inclusively.
? [buffer number]	Returns the current status and information about a program buffer
?#	Returns the current status of all program buffers.
?\$	Returns the current status of all motors.
?VR	Returns the firmware version
?SN	Returns the controller serial number and hardware version - indicated by a letter.
?? [error code]	Returns the error code number. If the error code is included in the query, returns error description.

By adding tags you can determine the format of the response to the Query.

Format	Description
?D/	Decimal format. This format is identical to the default format for integer variables. When applied to a state variable, the format displays the decimal presentation of the variable.
?X/	Hexadecimal format. When applied to an integer variable, this format displays the hexadecimal presentation of the variable.
?B/	Binary format. This format is identical to the default format for the IN and OUT variables. When applied to an integer variable, the format displays the binary presentation of the variable.
?E/	Extended format. This format is useful for very large or small real values, when the default format produces ambiguous results because the default does not provide enough positions to display very large or very small numbers. When applied to a real variable, the format displays each value in 20 positions.

You also have the option specifying a format using C notation. The specification is placed just before the variable name in curly brackets. The specification applies only to the value of the name that is included in the command. If an array is queried, the specification applies to each element of the array.

C notation provides an unlimited number of possible formats. Some examples are:

Format	Description
? {%12.3f}FPOS	The motor feedback values for all axes are displayed in 12 digits, fixed decimal point, 3 digits after the point. The same format applies to all 8 values.
?{%8.0f}X_ FPOS	8 digits, no decimal point, no fraction digits.
?{XFPOS = %8.0f}X_ FPOS	The response will look like XFPOS = 1234.
?{%08X} X_ MST	8 digits, hexadecimal format with leading zeros

5.4.4.2 Program Management Commands

Program Management commands are used for:

> Buffer Handling

- > Program Variables Handling
- > Program Handling
- > Debug Handling

The Program Management commands are designated by the pound (#) character.

In those commands including a line designation, the line designation can appear in one of the following forms:

- > Single number Specifies only one line.
- > Two numbers separated by comma Specifies a range of lines. If the second number is larger than a total number of lines in the program, the list range spans the last program line.
- > Label preceded by a slash (/) character Specifies the line containing the designated label.
- > Label preceded by a slash (/) character, then a comma and number -Specifies a range of lines starting from the line with the designated label.



Items enclosed in square brackets, for example, [buffer_no], are optional.

5.4.4.2.1 Buffer Handling

These commands enable you to open buffers for entering program commands, searching the buffer contents, deleting contents from the buffer, and the like. The buffer commands are:



All Terminal commands are case-sensitive and must be entered as listed.

- > # Open/Close buffer
- > D Delete
- > F Find
- > FI Case-sensitive Find

Command	Syntax	Description
		The # (Open/Close Buffer) command is used to open and close a buffer for the purpose of entering code. Where:
		 buffer_no - Specifies the buffer, a number between 0 and 10.
#	#buffer_no [I][line_no]	 I - Optional, if included, opens the buffer for insertion of code. If omitted, the command closes the buffer.
		line_no - Optional, if included, the command opens the buffer specified by buffer_no and sets the insert line before the line specified by line_no.
		The D (Delete) command deletes the specified lines in the buffer. Where:
	#buffer_ noDline_no [,line_no]	buffer_no - Specifies the buffer, a number between 0 and 10.
D		line_no - Specifies the line to delete. If a second line_no (separated by a comma) is included, it specifies a range of lines. If the second number is larger than the total number of lines in the program, the delete range includes the last program line.
		If a buffer is open, the D command that addresses the buffer shifts the insert line to before the first undeleted line.

Command	Syntax	Description
F Fl	<pre>#buffer_ noF/search_ string [,line_ no] #buffer_ noFl/search_ string [,line_ no]</pre>	 The F and FI (Find/Find Case-sensitive) commands are used to search for specific text in a specified buffer or in all buffers. Where: buffer_no - Specifies the buffer, a number between 0 and 10. If # is used, the search is conducted throughout all buffers. search_string - The text being sought. line_no - Optional, if included, line_no defines the start line for the search. Otherwise, the search starts from the first line. search_string in search commands can be a label or a label and number separated by comma. The label in the search_string is not, however, limited to labels in the program, any name may be specified. Therefore, the command can be used to search for any variable, constant, label or keyword. The search terminates when the first entry of the specified text is found, or the buffer end is reached. The command reports the line that contains the text, or an error message if the text was not found. To find the next entry, you have to execute the command again, specifying the new start line number of the reported line plus one.

5.4.4.2.2 Program Variables Handling

There are three types of variables:

- > ACSPL+ Standard Variables variables built into ACSPL+
- > SP Variables variables built into the controller
- > User-Defined Variables variables that you have declared in your program

These commands enable you to list variables. The commands are:



All Communication Terminal commands are case-sensitive and must be entered as listed.

- > VS Display ACSPL+ variable names
- > VSG Display ACSPL+ variable names within ACSPL+ variable name categories
- > VSF Display of ACSPL+ variable names and attributes
- > VSGF Display of ACSPL+ variable names and attributes
- > VSP Display SP variables

- > VGR Display categories within which ACSPL+ variables are grouped
- > VSD Display brief description of ACSPL+ variables
- > VG Display list of all global variables
- > VGF Display all global variables and attributes
- > VL Display local variables
- > VLF Display local variables and attributes
- > V Display user-defined global and local variables
- > VF Display of user-defined global and local variables and attributes
- L List program
- > VST Display ACSPL+ variables which can be protected using the Protection Wizard
- VSGT Display ACSPL+ variables for ACSPL+ variable categories which can be protected using the Protection Wizard
- VSTF Display ACSPL+ variables which can be protected using the Protection Wizard and their attributes
- VSGTF Display ACSPL+ variables for ACSPL+ variable categories which can be protected using the Protection Wizard and their attributes
- VSDT Display ACSPL+ variables for ACSPL+ variable categories which can be protected using the Protection Wizard and their attributes
- > **RESET** Reset program variables to factory defaults
- > VGV Remove global variables set through Terminal

Command	Syntax	Description
		Both the VS and VSG commands display the names of the ACSPL+ standard variables.
VS VSG	#VS #VSG [group_ name]	<pre>group_name is the name of the category within which ACSPL+ variables are grouped (for the categories see VGR). When group_name is added to the VSG command, the names of the ACSPL+ standard variables within the specified category are listed. group_name is case-sensitive and must be entered exactly as given in the list displayed by VGR, for example, #VSG Axis_State.</pre>
VSF VSGF	#VSF #VSGF [group_ name]	Both the VSF and VSGF commands, in addition to the variable names, display the variable type, the number of elements (for arrays only), address of the variable in the controller memory and the step between array elements (for arrays only).

Command	Syntax	Description	
		group_name is the name of the category within which ACSPL+ variables are grouped (for the categories see <u>#VGR</u> . When group_name is included in the VSGF command, the names of the ACSPL+ standard variables within the specified category and their details are listed. group_name is case- sensitive and must be entered exactly as given in the list displayed by VGR , for example, #VSGF Axis_State .	
VSP	#VSPservo_ number	 The VSP (List Servo Processor Variables) provides a list of SP variables that are defined in the program in the specified SP. servo_number is an integer number, 0, 1, 2, or 3, specifying the SP. Each variable name in the list is accompanied by an SP address of the variable. 	
VGR	#VGR [group_ name]	Each variable name in the list is accompanied by an SP	

Command	Syntax	Description
VSD	#VSD [group_ name]	The VSD command, without group_name , lists all ACSPL+ variables with a short description. group_name is the name of the category within which ACSPL+ variables are grouped (for the categories see VGR). When group_name is added to the VSD command, the ACSPL+ variables within the specified category and a brief description of each variable is listed. group_name is case- sensitive and must be entered exactly as given in the list displayed by VGR , for example, #VSD Axis_State
VG VGF	#[buffer_ no]VG #[buffer_ no]VGF [variable_ name]	 The VG command lists all global variable names in the system. If buffer_no (a number between 0 and 10) is included, VG lists all the global variables in the specified buffer. The VGF command, in addition to the global variable names, lists the variable type, the number of elements (for arrays only), address of the variable in the controller memory and the step between array elements (for arrays only). If buffer_no (a number between 0 and 10) is included, VGF lists the details for all the global variables in the specified buffer. If variable_name specifying one of the global variables is included, VGF lists the details just for the specified variable.
VL VLF	#[buffer_ no]VL #[buffer_ no]VLF [variable_ name]	 The VL command lists all local variable names in the system. If buffer_no (a number between 0 and 10) is included, VL lists all the local variable names in the specified buffer. The VLF command, in addition to the local variable names, lists the variable type, the number of elements (for arrays only), address of the variable in the controller memory and the step between array elements (for arrays only). If buffer_no (a number between 0 and 10) is included, VLF lists the details for all the local variables in the specified buffer. If variable_name specifying one of the local variables is included, VLF lists the details just for the specified variable.
V VF	#[buffer_ no]V #[buffer_ no]VF	The V command lists all user-defined variable names in the system. If buffer_no (a number between 0 and 10) is included, V lists all the user-defined variables in the specified buffer.

Command	Syntax	Description
		The VF command, in addition to the variable names, lists the variable type, the number of elements (for arrays only), address of the variable in the controller memory and the step between array elements (for arrays only). If buffer_no is included, VF lists the details of all the user- defined variables in the specified buffer.
L	#buffer_ noL[line_ no]	 The L (List) command is used for displaying a program listing. The listing contains all program lines preceded by line numbers. Each line appears exactly as it was inserted. No automatic formatting is provided. To address all buffers the # character is used instead of the buffer number, for example, the command ##L provides a listing of all programs in all buffers. If line_no is included, L lists the contents of the specified line. If a buffer number is listed. If the buffer is empty, the list includes the buffer designation followed by the first line (0) which is blank.
VST VSGT	#VST #VSGT [group_ name]	Both the VST and VSGT commands display a list of ACSPL+ variables to which Program Variables Handling can be applied. However, when group_name , the name of the category within which ACSPL+ variables are grouped (for the categories see VGR), is included with the VSGT command, the ACSPL+ variables within the specified category are listed. group_name is case-sensitive and must be entered exactly as given in the list displayed by VGR , for example, #VSGT Axis_ State .

Command	Syntax	Description
VSTF VSGTF VSDT	#VSTF #VSGTF [group_ name] #VSDT [group_ name]	The VSTF, VSGTF, and VSDT commands all list the variable names, the variable type, the number of elements (for arrays only), address of the variable in the controller memory and the step between array elements (for arrays only) of those ACSPL+ variables to which Program Variables Handling can be applied. However, when group_name , the name of the category within which ACSPL+ variables are grouped (for the categories see VGR), is included with the VSGTF or VSDT command, the ACSPL+ variables within the specified category are listed. group_name is case-sensitive and must be entered exactly as given in the list displayed by VGR , for example, #VSGTF Axis_State .
RESET	#RESET	The RESET command is used to reset the controller to factory default state. The RESET command can be issued even if the application is in the Protected mode (see Program Variables Handling), in which case the password, if included, is not needed.
VGV	#VGV [global_var]	The VGV command is used to remove global variables that have been set via Terminal . If global_var (the name of the variable) is included, it removes only this variable; otherwise it removes all of them.

5.4.4.2.3 Program Handling

These commands are used for compiling, executing, pausing and halting the program. The commands are:



All Communication Terminal commands are case-sensitive and must be entered as listed.

- > C Compile program
- > X Execute program
- > S Stop program
- > SR Stop and reset program
- > P Pause program

Command	Syntax	Description
		The C (Compile) command compiles a program in the buffer or all programs in all buffers, depending on the buffer qualifier. Where:
		buffer_no - Specifies the buffer, a number between 0 and 10.
		The C command must not include a line qualifier and is prohibited when the buffer is in the Run or Suspended states.
		The C command is not obligatory in order to execute a program. When the X (Execute) command is issued, the controller automatically compiles the program if it was not previously compiled. However, a separate compilation step is required in the following cases:
С	# [buffer_ no]C	 To check the program correctness without executing it.
		 The program is not intended for direct starting, but contains autoroutines. The autoroutines are ready for execution only after compilation.
		The program is intended for starting from another program by the START command. The program started by the START command must be compiled before the START command can be executed.
		If the program is successfully compiled, the Terminal displays a short report of how many lines were compiled. If an error was encountered, Terminal reports the error code and the line number in which the error was found.

X#buffer_ noX [line_no]The X (Execute) command starts a program in a specific bur and can be executed in any program state except the Run Where:>buffer_no - Specifies the buffer, a number betwee and 10. It must specify one buffer only.>line_no - Can be a line number or a label. Execution starts from the specified line. If included, line_no defines a specific line to be listed. Otherwise the program starts from the first line.If the state of the program is Not Compiled, the controller to compiles the program and then starts it. If an error was encountered during compilation, the program does not start If the state of the program is Suspended, the X command resumes the program was suspended.The S (Stop) command terminates program execution in a or execution of all programs in all buffers. The SR (Stop and Reset) command terminates program execution in a buffer or execution of all programs in all buffers.	umber between 0 ly. abel. Execution ded, line_no herwise the ne controller first error was
[IIIne_no]If the state of the program is Not Compiled, the controller to compiles the program and then starts it. If an error was encountered during compilation, the program does not state If the state of the program is Suspended, the X command resumes the program execution. In this case the command not contain line_no because execution resumes from the p where the program was suspended.The S (Stop) command terminates program execution in a or execution of all programs in all buffers.The SR (Stop and Reset) command terminates program execution in a buffer or execution of all programs in all buffers to the Not Compiled state	error was
or execution of all programs in all buffers. The SR (Stop and Reset) command terminates program execution in a buffer or execution of all programs in all buf and resets the buffer or all buffers to the Not Compiled sta	X command the command must
# if the program contains autoroutines that are ready to star when the buffer is in Compiled state. Where: S no]S SR # [buffer_no]SR If buffer_no is omitted, this will stop, or stop and reset all programs in all buffers, or the # character may be used as the buffer_no, for example, ##S, which will do the same. Program termination commands must not include line quate the sector of the SR command effectively prevents	s program rams in all buffers, t Compiled state. on, which is useful e ready to start umber between 0 ly. and reset all y be used as the e same.

Command	Syntax	Description
		The P (Pause) command suspends program execution in a buffer. Where:
		buffer_no - Specifies the buffer, a number between 0 and 10. It must specify one buffer only.
Р	#buffer_	The # character may be used instead of a buffer number, for example, ##P , in which case the execution of all programs in all buffers is suspended.
Р	noP	The P command must not include a line qualifier.
		P commands are allowed in any program state, but in all states, other than Run, the command has no effect.
		If the program is in the Suspended state, the X command resumes execution. The S command transfers the buffer to the Compiled state. The SR command transfers the buffer to the Not Compiled state.

5.4.4.2.4 Debug Handling

The Debug commands enable you to run your program in the Debug Mode, set breakpoints and to run sections of the program. The commands are:



All Communication Terminal commands are case-sensitive and must be entered as listed.

- > XS Execute one step
- > XD Execute program in Debug mode
- > BS Set breakpoint
- > BR Reset breakpoint

Command	Syntax	Description
XS	#buffer_ noXSline_ no	 The XS (Execute One Step) command executes one program line. Where: buffer_no - Specifies the buffer, a number between 0 and 10. It must specify one buffer only. line_no - Can be a line number or a label. Indicates what line to run. After executing the specified line_no, the buffer automatically enters the Suspended state.
XD	#buffer_ noXD	 The XD (Execute in Debug Mode) command executes the program up to the next breakpoint. Where: buffer_no - Specifies the buffer, a number between 0 and 10. It must specify one buffer only.
XD (CONTINUED)		The command is similar to the X command. The difference is that the X command ignores breakpoints in the program. If the program is started by the XD command, it will stop when it reaches a breakpoint. At the breakpoint the program transfers to the Suspended state and can be started again by the X , XS or XD commands.
BS	#buffer_ noBS [line_no]	 The BS (Set Breakpoint) command sets a breakpoint at the specified line. Where: buffer_no - Specifies the buffer, a number between 0 and 10. It must specify one buffer only. line_no - Can be a line number or a label. Indicates in what line to set the breakpoint. You can set any number of breakpoints in your program; however, for breakpoints to be active, you have to start the program with the XD command.

Command	Syntax	Description	
BR	#buffer_ noBR [line_no]	 The BR (Reset Breakpoint) command resets the breakpoint at the specified line or all breakpoints. Where: buffer_no - Specifies the buffer, a number between 0 and 10. It must specify one buffer only. line_no - Can be a line number or a label. Indicates in what line to reset the breakpoint. If it is omitted, the command resets all breakpoints in the buffer. If the buffer qualifier is specified as #, for example, ##BR, and 	
		line_no is omitted, the command resets all breakpoints in all buffers.	

5.4.4.3 System Commands

The System commands provide you with information contained in the system. The commands are:



All Communication Terminal commands are case-sensitive and must be entered as listed.

- > IR Integrity Report
- > U System Usage Report
- > TD User-defined Variables in System
- > SC Safety Control Report
- > SI System Information
- > SIR System Information Report
- > ETHERCAT Network Information

Command	Syntax	Description
IR	#IR	The IR (Integrity Report) command activates integrity validation and provides a report of current integrity state. The report displays a list of files. Each list entry displays a file name, expected file size and checksum of the file and actual file size and checksum. If any integrity problem is detected, the command sets S_FAULT.#INTGR fault bit. You can view this by using the Query Commands .

Command	Syntax	Description
U	#U	The U (Usage) command is used for monitoring MPU usage. It returns the maximum, average, and minimum values as a percent. The controller continuously measures the time taken by real-time tasks. When the U command is received, the controller analyzes the measured times during the last 50 controller cycles and calculates minimal, maximal
		and average time. The results are reported as a percentage.
TD	#TD	The TD command returns the names of all user-defined variables and arrays that are in the controller flash memory.
SC	#SC	The SC (Safety Control) command reports the current safety system configuration. The controller response includes the following: Active safety groups The configuration of each fault for each motor
SI	#SI	The SI (System Information) command returns system information about the SPiiPlus controller including serial number, firmware version, configuration, name and SP programs.

Command	Syntax	Description
SIR	#SIR/section/key/	 The SIR (System Information Report) command is an expanded version of the SI command and returns system information broken down into various categories (section) and subjects (key) within the categories. section: Hardware - This section contains information about the controller's hardware Options - This section contains information about the controller's options, such as, total number of axes, encoder support, number of non-ACS unit servo axes, etc. Network - This section contains information about the controller's EtherCAT channels. Axes_support - This section contains information about the controller's EtherCAT channels. Munt# - There is a UNIT section for each unit in the system, they are numbered from 0 up to the number of units minus 1, for example, UNIT0 is the first unit in the system. Each UNIT section contains information specifically about the unit. key depends on the category. The format of the return is: [Section] Key = value To see all sections and keys enter: #SIR/ALL/ALL/
ETHERCAT	#ETHERCAT	The ETHERCAT command is used for obtaining complete information about the devices connected in the network. The information it displays is: Slave number Vendor ID Product ID Revision

Command	Syntax	Description
		 > Serial number > EtherCAT physical address > DC support > Mailbox support
		This is followed by a list of network variables associated with the device. Each variable is described with:
		 Name (as in XML) Offset inside the telegram (magic number that is used for mapping)
		> IN or OUT description> Data size
		> PdoIndex

6. Diagnostics and Monitoring

Diagnostics and Monitoring tools enable you to view the status of various elements in the controller's program and aid you in analyzing the motion.

You can use the following tools for viewing the values and status of critical variables:

- Inputs/Outputs Manager The Inputs/Outputs Manager tool displays the status of the digital input and output variables of the SPiiPlus controller as well as those of the HSSI, if defined.
- > Safety and Faults Monitor displays the status of the SPiiPlus controller faults as defined through the Safety and Faults Configurator.
- > Variables Manager and Watch displays the values currently stored in variables of a program that is running.
- > HSSI Manager used for monitoring the status of HSSI channels. The manager displays the quantity and state of the HSSI channels.

The following windows provide graphic representations:

- Scope presents a real time display of the selected motion or variable. You can set the Scope to display any parameters you like.
- FRF Analyzer is the steady-state transfer function of a dynamic system describing the relation between an input and an output as a function of frequency in terms of gain and phase. You have the option of displaying the data as either a Nyquist Diagram or a Bode Diagram.
- Sin Cos Encoder Compensation and Monitoring displays a Sin-Cos Lissajous curve graph of the wave form and enables you to make adjustments to controller's gain, phase and offsets compensation parameters (SCGAIN, SCPHASE, SCSOFFS, and SCCOFFS). Sin Cos Encoder Compensation automatically calculates best fits for the parameters.

Diagnostics and Monitoring also provides you with Motion Manager to setup the motion for each axis and monitor motion status.

6.1 Accessing Diagnostics and Monitoring Tools

To access the Diagnostics and Monitoring tools:

- 1. If the Toolbox is not displayed, click **Toolbox**.
- 2. Click Diagnostic and Monitoring.

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6. Diagnostics and Monitoring

Toobox	+ ₽ ×
Diagnostics and Monitoring	
FRF Analyzer	
HSSI Manager	
Inputs / Outputs Manager	
Motion Manager	
Safety and Faults Monitor	
Scope	
System Viewer and Diagnostics	
Variables Manager and Watch	
Setup	
Secup	
Application Development	
Application Development	

3. Click the required tool.

6.2 FRF Analyzer

The **FRF** (Frequency Response Function) **Analyzer** provides you with a powerful tool for servo analysis of the ACS Motion Control SPiiPlus motion controllers. It allows mechanical characterization of the machine, and is a valuable aid in tuning your machine.

- > With this tool you can:
- > Obtain the mechanical signatures of the machine.
- > Identify and compensate for mechanical resonances.
- > Expand machine bandwidth and improve performance.
- > Improve machine stability.
- > Compare between different machines.

FRF measurements can be made under the following conditions:

- > Brushless motor should be commutated. The FRF Analyzer does not allow FRF measurement for non-commutated brushless motor or stepper motors.
- > Axis must be enabled. In the axis is disabled it will be automatically enabled when FRF measurement begins.
- Axis is not in open loop. You should not be confused with the fact that Open-Loop FRF and Plant FRF are measured as well. All FRF measurements are performed in a closed loop. For this purpose the axis must be adjusted before performing the measurement.



It is recommended using the Adjuster Wizard to make preliminarily adjustments to the axis with a relatively low bandwidth. After the FRF measurements are taken, you can more knowledgeably set the servo parameters and adjust the filters to maximize the performance and the bandwidth, while remaining within adequate stability margins.



Do not perform FRF Measurement when the servo loop is not stable or with very marginal tuning!

Sometimes it is preferable to do the measurement while the axis is moving. This is typically the case, when it is required to overcome the non-linear effect of coulomb friction. In this case it is recommended to write an ACSPL+ program in one of the buffers that takes care of the required motion. The following types of motion can be used during FRF measurement:

- > Axis is idle, no motion is executed
- > Jog motion when the travel is not limited
- > PTP motion when the travel is limited (i.e., linear motor)

In case of PTP or JOG, it is recommended moving at very low velocity, which is enough to overcome the coulomb friction.



A disturbance in the FRFs may appear if PTP is used while the axis is changing its direction. To minimize this effect, it is recommended performing cyclic motion between two points without any dwell time between motions.

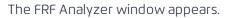
6.2.1 Activating FRF Analyzer

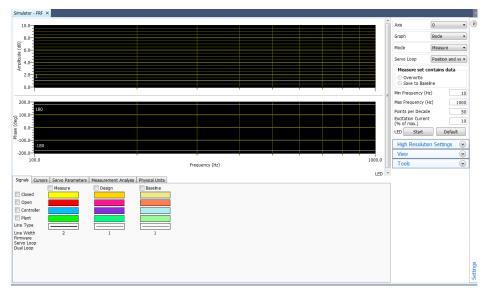
To activate the FRF Analyzer:

- 1. From the Toolbox click **Diagnostics and Monitoring** to display the Diagnostics and Monitoring tools list.
- 2. Click FRF Analyzer.



You may use **Add Component** from the right-click menu of the controller in the Workspace Tree (Controller Right-Click Options) to activate the **FRF Analyzer**.





6.2.2 Working with FRF Analyzer

The right side of the window contains the following option controls:

Axis 0 •	Used for selecting the axis to be measured. See Selecting Axis.
Graph Bode -	Used for selecting the FRF Analyzer display format. See Selecting Graph Format .
Mode Measure -	Used for setting the FRF Analyzer mode. The FRF Analyzer has two modes: Measure (see Measure Mode) Design (see Design Mode)
Servo Loop Position and ve	Used for setting the Servo Loop to: > Position & Velocity > Current > Velocity > Position > Open
High Resolution Settings	
View	Used for selecting: Arkers (see Markers) Phase Modulo Amplitude for display. See Setting View Options.
Tools	Used for: > Saving FRF data to a file > Retrieving FRF data from a file > Clearing FRF data from the display See Tools.

Underneath the FRF graph there is a section for selecting what is displayed and for viewing the measured values. This section is divided into the following tabs:

Signals	This tab enables the user to select the signals you want displayed. See Signals Tab .
Cursors	This tab enables the user to set cursors in the graph in order to view the values at points of your choosing. See Cursors Tab .

Servo Parameters	This tab enables the user to view the values of servo parameters. In the Design mode change the user can set the values of Servo Parameters. See Servo Parameters Tab .
Measurement Analysis	This tab enables the user to perform measurement analysis. See Measurement Analysis.
Physical Units	This tab enables the user to set the physical measurements used in the analysis. See FRF Physical Units.

High Resolution Settings

This section allows the user to control the display resolution. Checking the "Enable" checkbox activates the parameter input controls. The start frequency can be set using the text box or the slider. Text boxes also control the number of points per decade and the excitation current. The "Default" button resets all parameters to their default values.

Selecting Axis

You select the axis to be measured from the **Axis** dropdown list. The list of axes is extracted from the controller.

To display the list click 💌 .

Selecting Graph Format

There are two graphic formats from available to you:

- > Bode Diagram
- > Nyquist Diagram

You select the graphic format from the **Graph** dropdown list which you display by clicking 😬 .

6.2.3 Signals Tab

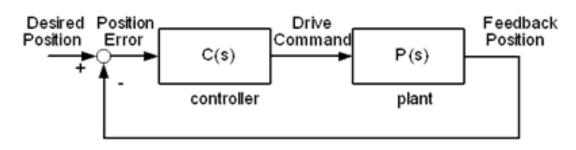
The Signals tab is used for setting what FRFs are to be measured.

If the Signals tab is not displayed, click Signals.



FRF Signals

The FRF signals are based on the following diagram:



- Closed the relation between the required position and the feedback position, when the loop is closed, CL(s)= C(s)*P(s)/(1+C(s)*P(s)).
- Open this is the loop transfer function, OL(s) = C(s)*P(s). This function has a major role in a stability analysis of a system.
- > **Controller** the relation between the position error and the drive command, C(s). This is the control algorithm that is implemented in the SPiiPlus controller.
- > **Plant** the relation between the drive command and the feedback position, P(s). The plant constitutes of the mechanical stage, the motor, the feedback device and the drive.

The FRF gain is shown in absolute units or decibels (dB). A value in dB corresponds to 20log10 (value). The phase is typically shown in degrees.

Display Options

You can select which FRF signals (Closed, Open, Controller, Plant) to display by clicking the relevant check boxes 💌 .

You can also select which graph sets (Measure, Design, Baseline) to display by clicking the relevant check boxes.

To set the line color, type and width for each graph, see Setting FRF Analyzer Properties.

Controller Information

The following information is displayed for reference:

- > **Firmware** controller software version.
- > **Servo Loop** servo loop setting used during analysis.
- Dual Loop state (yes/no) of DUALLOOP CONTROL variable for each axis. If state is yes, the Position and Velocity option cannot be selected for Servo Loop.

6.2.4 Cursors Tab

The FRF Analyzer provides cursors that you can use to see the exact values at any point in the graphs.

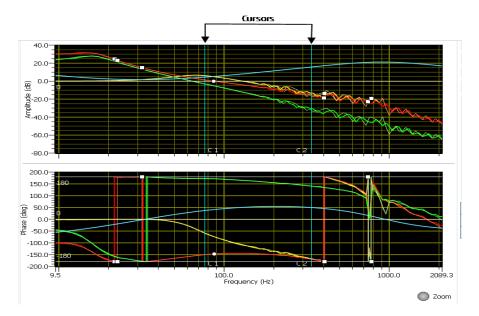
To display the Cursors tab click

The cursor options depend on what graph format you are using:

- > Bode Diagram Cursors
- > Nyquist Diagram Cursors

6.2.4.1 Bode Diagram Cursors

In the Bode diagram there are two cursors, as shown, giving you the ability to compare values at two different positions.



You move the cursors by dragging them left or right. At each point you will notice that the values of the graph at the cursor point are displayed in table in the tab.

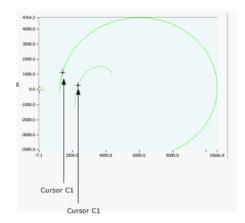
Bignals Cu	irsors Serv	/o Paramet	ters Measure	ment Analysis	Physical U	Units			
Mode	Graph	Freq1	Amp1	Phase1	Freq2	Amp2	Phase2	Amp2 - Amp1	Phase2 - Phase1
Closed	Measure	76.19	6.14593	-58.36	337.41	-13.22436	-167.35	-19.37030	-108.98
Closed	Baseline		6.05966	-57.90		-15.23343	-167.29	-21.29309	-109.39
Open	Measure		1.37944	-150.52		-14.90698	-169.60	-16.28642	-19.08
Open	Baseline		1.42466	-150.20		-16.61265	-169.19	-18.03732	-18.99
Controller	Measure		4.42427	36.98		15.71786	49.82	11.29359	12.84
Controller	Baseline		4.42427	36.98		15.71786	49.82	11.29359	12.84
Plant	Measure		-3.02662	172.50		-30.62503	140.58	-27.59841	-31.93
Plant	Baseline		-2.98473	172.83		-32.34220	140.99	-29.35747	-31.84



Freq1, Amp1, and Phase1 are the values of C1.Freq2, Amp2, and Phase2 are the values of C2.Their units depend on your selections made in View (see Setting View Options).

6.2.4.2 Nyquist Diagram Cursors

In the Nyquist diagram due to the nature of the graph there is only one cursor, **CI**. It is distributed along the points of the graph.



You move the cursor either by dragging it to a new point on the graph, or just click the point you are interested in and the cursor moves to the point. The values are displayed in the fields of the tab.

Signals	Cursors	Serv	o Parame	ters Meas	urement Analysis	Physical U	Jnits			
Mode	Grap	h	Freq1	Amp1	Phase1	Freq2	Amp2	Phase2	Amp2 - Amp1	Phase2 - Phase1
Closed	Mea:	sure	76.19	6.14593	-58.36	337.41	-13.22436	-167.35	-19.37030	-108.98
Closed	Base	line		6.05966	-57.90		-15.23343	-167.29	-21.29309	-109.39
Open	Mea:	sure		1.37944	-150.52		-14.90698	-169.60	-16.28642	-19.08
Open	Base	line		1.42466	-150.20		-16.61265	-169.19	-18.03732	-18.99
Controlle	er Mea:	sure		4.42427	36.98		15.71786	49.82	11.29359	12.84
Controlle	er Base	line		4.42427	36.98		15.71786	49.82	11.29359	12.84
Plant	Mea:	sure		-3.02662	172.50		-30.62503	140.58	-27.59841	-31.93
Plant	Base	line		-2.98473	172.83		-32.34220	140.99	-29.35747	-31.84

For each signal the values displayed are:

- > **Freq** the frequency of the signal at the cursor point
- > Amplitude (abs) the absolute amplitude of the signal at the cursor point
- > **Phase** the phase of the signal at the cursor point
- > Real the value of the signal on the X axis
- > Imaginary the value of the signal on the Y axis

6.2.5 Servo Parameters Tab

The Servo Parameters tab serves primarily as a tool for Design. It enables you to fine-tune servo parameters and see the system reaction to your changes.

To display the Servo Parameters tab click Servo Parameters.

Signals Cursors Servo Parameters	Measurement Analysis Physical Unit	5			
Variables	Controller	Measure	Design	Baseline	-
▲ Position Loop					
Proportional Gain	10				
Integrator Gain	0				
Integrator Gain Target Factor	1				
Proportional Gain Target Fac					=
Integrator Limit	0				
Velocity Loop					
Gear Ratio	1				L
Maximum Velocity	2000000				

The tab is divided into five columns:

> Variables

This column lists all the servo-loop variables.



For the meanings of the variables refer to the *SPiiPlus Command & Variable Reference Guide*.

> Controller

This column displays the status of the servo-loop variable (ON/OFF) and its value(s) stored in the motion controller. It is for information only and the values cannot be changed.

> Measure

This column displays the status of the servo-loop variable (ON/OFF) and its value(s) stored in the Measure set. It is for information only and the values cannot be changed.

> Design

This column displays the status of the servo-loop variable (ON/OFF) and its value(s) stored in the Design set.

When in the **Design** mode, if a value in this column is not greyed-out, it can be changed.

> Baseline

This column displays the status of the servo-loop variable (ON/OFF) and its value(s) stored in the Baseline set. It is for information only and the values cannot be changed.



When working in the Design Mode, once you have found the proper values, you can then use the Adjuster Wizard to set the values into the motion controller.

Flag Variable Status

The status of the flag variable is indicated a checkbox.

-

This indicates that the flag variable is ON.

This indicates that the flag variable is OFF.

If you are in the **Design Mode**, you can change the status, for example, from ON to OFF, by clicking the button.

You can check the meaning of a flag variable by using and the ? command, for	
example:	
Smultor - Communication Terminal	
enable all ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' '	Send And Tripper S
10 OF 7 2 Phase Motors (#BRASE2) 11 OF T Dynamic Brake Mode (#BBRASE) Show Mesage () Off Bedgound Communication () Off Continuous Save () Off	🗸 Clear 🛛 Save
Sender - Commonition Termol	

6.2.6 Measurement Analysis Tab

Using Measurement Analysis to Adjust System Identification Parameters

To display the measurement analysis page click Measurement Analysis

Signals Cursors Servo	Parameters Measurement Analysis	Physical Units		
		Get	Results	
Set	Measure	•		
Bandwidth (Hz)	86.8		Phase Margin (deg)	32.8
Positive Gain Margin (dB)	18.5		Negative Gain Margin (dB)	-14.7
Acceleration Feedforward	77.98			

You can use Measurement Analysis to adjust system identification parameters through the Adjuster Wizard as follows:

- 1. Open the Adjuster Wizard.
- 2. Click Axis Setup and Tuning.
- 3. Click Position and Velocity Loops.
- 4. Under **System Identification**, click **Start Identification** and if it is safe to proceed, click **Yes** in the **Adjuster Wizard** dialog box.
- 5. Wait for the message "System identification succeeded" to appear in the System Identification results text box.
- By using the Measure and Design sets, you can use the information displayed on the Measurement Analysis tab to fine tune the Advanced Tuning parameters received during the Axis Tuning and Setup.

The following information is displayed:

- > Set click Measure, Design or Baseline to display the required set.
- > Bandwidth displays the system bandwidth.
- Positive Gain Margin how much the gain can be raised before instability results. The value is the amount by which the open loop gain is higher than 0dB at the phase crossover frequency.
- > **Acceleration Feedforward** reduces position errors during acceleration and deceleration.

- Phase Margin how much delay can be added to the loop before instability results. The value is the amount by which the open loop phase exceeds –180° at the gain crossover frequencies.
- > **Negative Gain Margin** how much the gain can be reduced before instability results. The value is the amount by which the open loop gain is lower than OdB at the phase crossover frequency.

6.2.7 FRF Analyzer Modes

The **FRF Analyzer** has two modes:

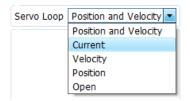
- > Measure Mode enables you to collect data for calculating the FRF signals of your system (Closed, Open, Controller and Plant see Signals Tab).
- Design Mode enables you to design a new Controller FRF and to view the effect on the Open Loop FRF and Closed Loop FRF, based on a previous system measurements. The Plant FRF does not change because of modifications by the controller FRF.

6.2.7.1 Measure Mode

The **Measure** mode enables you to perform FRF analysis on the actual motion of your system. You can save the analysis data to use for making comparisons in the **Design** mode.

Measure Mode Settings

Use the **Servo Loop** button to set the loop to be measured:



Your options are:

> **Position and Velocity** (default)

The controller FRF acts as a PID equivalent. A current sine-sweep excitation is injected to the drive command (% of max current), and the total closed position loop FRF is measured (measurement takes into account the velocity FRF).

> Current

This option measures the current loop closed and open loop FRF. During the measurement the position and velocity loops are open.

> Velocity

This option measures a separate velocity loop. During the measurement the **FRF Analyzer** disables the position loop.

> Position

A separate position loop FRF measurement is done. This measurement differs from all other measurements since the excitation is a velocity command rather than current. A velocity sweep excitation is injected to the velocity command (% of max velocity XVEL), and the total closed position loop is measured (without accounting for velocity FRF).

> Open

Measures transmission function from current to motor velocity. The measurement is done in an open loop.

You select **Measure** from the **Mode** dropdown list.

Your measurement data save options are:

Measure set contains data						
Save to Baseline						
Overwrite						
Min Frequency (Hz)	10					
Max Frequency (Hz)	2000					
Points per Decade	50					
Excitation Current (% of max.)	5					
Start	Default					

- > **Save to Baseline** When you start the measurement, if there is previous data in the Measure set, it is written to the Baseline prior to sampling new signals.
- > **Overwrite** When you start the measurement, whatever data was previously stored in the Measure set is overwritten with the new data. The previous data is not saved.

You can set the following parameters:

- > **Minimal Frequency (Hz)** and **Maximal Frequency (Hz)** These set the sine sweep, specified in Hz. These frequencies can range from 1 Hz to 5000 Hz. The FRF measurement itself is executed at 20 kHz. This provides a reliable measurement at the specified frequencies.
- Frequencies per Decade Adjacent frequency steps are uniformly distributed on a logarithmic scale. You can set the required amount of points per one decade of frequencies. Using a larger number of points results in finer resolution of the data, and a longer measurement results. A smaller number of points results in coarser resolution of that data, and a shorter measurement.

For each frequency, the FRF Analyzer waits 20 cycles for transients to decay and then measures for additional 20 cycles. As the frequency gets higher, the measurement time gets shorter.

Excitation Current - The excitation current determines the amplitude of the sine sweep as percentage of the maximum drive command. The excitation current should be appropriately determined. It should be sufficient to provoke the system. If the excitation current is too low, measurement results may be unreliable.

However, excessive excitation current is dangerous. If the current is too high, overcurrent may occur. In certain cases, high excitation current can cause saturation s and lead to unreliable measurement results.

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Clicking **Default** inserts the factory-set default values. These are:

	•	
	-	
1:		
18		
11		

Minimal Frequency (Hz): 10

Maximal Frequency (Hz): 1000

Frequencies per Decade: 50

Excitation Current (% of max): 10.00



The **FRF Analyzer** does not allow performing FRF measurements if the excitation current is higher than the overcurrent parameter XRMSD, or XRMSM, or if it is higher than 80% of the current limit parameters XCURI or XCURV. It also recommended setting the excitation current lower than the integrator limit parameter, **SLVLI**.



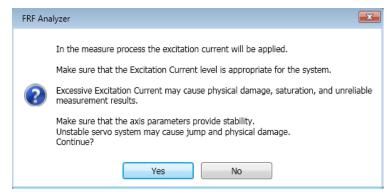
Prior to running the FRF measurements, you can set which signals you want to view from the Signals Tab.

Running in Measure Mode



If the excitation current is excessively high, mechanical damage may occur.

- 1. Once you have entered the Measure mode settings, click **Start** (**Start**) to initiate the FRF analysis.
- 2. The **FRF Analyzer** prompts you with:



3. Click Yes to start the analysis.



The **Start** button changes to **Stop**. Normally you do not need to click this button. The **FRF Analyzer** analyzes one cycle and then stops automatically. You use this button in the event you need to stop the motion before completion of the measurement.



To view particular values you can use the cursors (see Cursors Tab) and markers (see Markers).

6.2.7.2 Design Mode

The **Design** mode enables you to make changes to the values of the Servo Parameters (see Servo Parameters Tab) and run **the FRF Analyzer** to check the effect of these values.

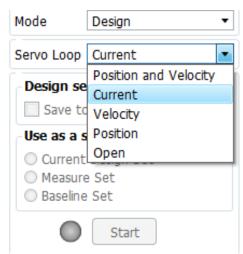


Prior to running the **FRF ANALYZER** in **DESIGN** mode, you must first have run the analyzer in Measure Mode so that the analyzer has data to compare your changes with. Once you have run the analyzer in the **DESIGN** mode, you can use the data from this mode for further designs.

Alternately, you can load the values from a previously saved file (see Tools).

Design Mode Settings

Use the **Servo Loop** button to set the loop to be measured:



Your options are:

> Position and Velocity (default)

The controller FRF acts as a PID equivalent. A current sine-sweep excitation is injected to the drive command (% of max current), and the total closed position loop FRF is measured (measurement takes into account the velocity FRF).

> Current

This option measures the current loop closed and open loop FRF. During the measurement the position and velocity loops are open.

In the Design mode the **FRF Analyzer** simulates changes in the current loop servo parameters: **SLIKP,SLIKI**. You should be aware that due to non-linearities, the results may differ for different excitation currents, depending on the motor parameters and used bus voltage.

> Velocity

This option measures a separate velocity loop. During the measurement the **FRF Analyzer**

disables the position loop.

In the Design mode the FRF simulates changes in velocity loop servo parameters: **SLVKP**, **SLVKI**, low-pass, Notch and BiQuad filters (BiQuad in single loop mode only). A separate velocity loop measurement is required in dual loop systems, but not necessarily required for single loop systems (all this information exists in the combined position & velocity FRFs).

> Position

A separate position loop FRF measurement is done. This measurement differs from all other measurements since the excitation is a velocity command rather than current. A velocity sweep excitation is injected to the velocity command (% of max velocity **XVEL**), and the total closed position loop is measured (without accounting for velocity FRF). In the Design mode, the **FRF Analyzer** simulates changes in position loop servo parameter **SLPKP** and position loop BiQuad filter parameters (dual loop only). A separate position loop measurement is required in dual loop systems, but not necessarily required for single loop systems (all this information exists in the combined position & velocity FRFs).

> Open

Measures transmission function from current to motor velocity. The measurement is done in an open loop.

Select **Design** from the **Mode** (Mode Design) dropdown list.

Your options for using the source data for your design are:



- Current Design Set Usually selected as a follow-on when making adjustments to the design.
- > Measure Set The most commonly selected source.
- > Baseline Set Normally selected if you have saved your design to the Baseline.



To save previously collected data to the Baseline select the **Save to Baseline** checkbox.

Running in Design Mode

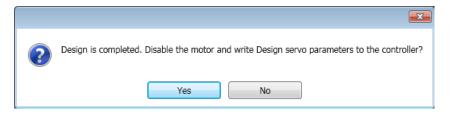
To run **FRF Analyzer** in the **Design** mode:

1. Click Start.



The **Start** button changes to **Finish** and the Servo Parameters Tab is displayed.

- Enter the required Servo Loop parameter values in the **Design** column and press **Enter**. Note that the graph changes to reflect the new values. To view particular values you can use the cursors (see Cursors Tab) and markers (see Markers). If the values did not meet your requirements, you can set other values in the Servo Parameters and press **Enter** again.
- 3. Once you are satisfied with the values, click the **Finish** button. Your are prompted with:



4. Click **Yes**. The new values are loaded into the controller.

6.2.8 Setting View Options

The **View** options enable you to set certain graph display options. To display the options click 💌 .

View		\diamond
✓ Markers ✓ Phase Modulo		
Amplitude	dB	•

Your options are:

- > Markers Displays the crossover markers (see Markers)
- > **Phase Modulo** Displays the phase wrapped back to 180^o at a point where it reaches -180^o.
- > **Amplitude** select displaying the amplitude:
 - > **Absolute** displays the amplitude in absolute units
 - > **dB** displays the amplitude in decibels



The **Phase Modulo** and **Amplitude** options are relevant only in Bode Diagrams.

6.2.9 Markers

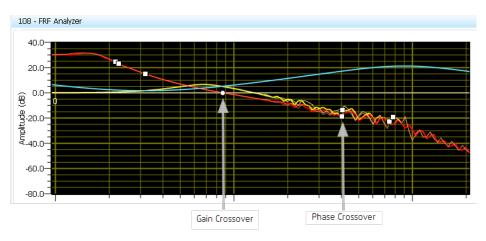
The level of stability is typically judged at certain frequencies, known as crossover frequencies:

- > Gain crossover frequency 0 dB crossing of the open-loop FRF gain.
- > Phase crossover frequency ±180^o crossing of the open-loop FRF phase.

In order to quantify the level of stability, two criteria have been introduced:

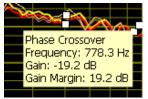
- Gain margin (GM) is a measure of how much the gain can be raised or reduced before instability results. It is the amount by which the open loop gain is lower (negative GM) or higher (positive GM) than 0dB at the phase cross over frequency.
- Phase margin (PM) is a measure of how much delay can be added to the loop before instability results. It is the amount by which the open loop phase exceeds –180° at the gain cross over frequencies.

When you select **Markers**, phase crossover frequencies are marked by white squares, and gain crossover frequencies are marked by white circles:



Clicking one of the markers shows details of the frequency, the gain, the phase and the stability margin at that point, for example:





The markers are displayed in both the Bode and Nyquist Diagrams.

6.2.10 Tools

The Tools options are:

- > SAVE for saving data to a file, see Saving FRF Data to File
- > LOAD for loading data from a file, see Loading FRF Data from File
- > **CLEAR** for clearing data from the display, see Clearing FRF Data from Display

To display the Tools options click 💌 .

Tools		\diamond
	Save	
	Load	
	Clear	

6.2.10.1 Saving FRF Data to File

To save the FRF data to a file:

1. Click **Save**, the Save Signals dialog window is displayed:

File Name:		Browse
User:		
Machine:		
Remarks:		•
FRF:	Measure	Closed
	Design	Open
	Design	Controller
	Baseline	Plant
		Save Cancel

- 2. Enter the file path and filename in **File Name** (or click **Browse** to search for a directory, and filename if required).
- 3. Enter your name in the **User** field.
- 4. Enter the controller ID in the **Machine** field.
- 5. You can add optional remarks in the **Remarks** field.
- 6. Select or deselect, as required, the FRF data you want to save by clicking the appropriate checkbox.
- 7. Click Save.

6.2.10.2 Loading FRF Data from File

To load FRF data that has been saved to a file:

1. Click **Load**, the Load FRF Data dialog window is displayed:

File Name:				Browse
User:				
Date:				
Machine:				
Saving tool:				
Controller s/n:				
Firmware:				
Remarks:				
				•
	The file contains		Load to:	
	the following FRF sets	Measure	Design	Baseline
	Measure			
	Design			
	Baseline			
	Load Measure Settings			
			Load	Cancel
			2004	

2. Enter the path and filename in the **File Name** field (or click **Browse** to search for the file). Once you have entered a filename, the contents of the saved file are displayed.



FRF Analyzer signal data is stored in files having an **.frf** file extensions. File data that has been stored using an old version of the **FRF Analyzer** can be loaded.

File Name:	C:\Users\haiml\Desktop\Exa	ample.frfx		Browse
User:				
Date:	22/04/2020 15:19			
Machine:				
Saving tool:	SPiiPlus MMI FRF Analyser	version: 2.91.0.146	37	
Controller s/n:	CA000003A			
Firmware:	2.99.60.00			
Remarks:				8
				•
	The file contains the following FRF sets		Load to:	Deselies
	Measure	Measure	Design	Baseline
	Design			
	Baseline			
	Load Measure Settings			
			Load	Cancel

- 3. You can change into what subset the data is loaded (for example, loading the Design data into Measure) by clicking the appropriate checkbox.
- 4. Click Load.

6.2.10.3 Clearing FRF Data from Display

To clear the current FRF data from the display:

1. Click **Clear**, you are prompted with:



2. Click **Yes**. All data in the display is removed.

6.2.11 Setting FRF Analyzer Properties

The FRF Analyzer plot properties, such as color, line width, line style, and the like, of each signal is set in the **FRF Analyzer Properties** window.

If the panel is not displayed, see Working with Properties Window for displaying the **FRF Analyzer Properties** panel.

Properties			+ □ ×
	?		
▲ FRF Sett	inas		
	Closed FRF Plot C	#FFF0E68C	•
	Controller FRF Plot	#FEAFEEE	•
	Open FRF Plot Color	#FFF7F50	•
	Plant FRF Plot Color	#FF98FB98	•
Desian C	losed FRF Plot Color	#FFFED700	•
	ontroller FRF Plot	#FF8A2BE2	•
_	pen FRF Plot Color	#FFFF1493	•
Design P	lant FRF Plot Color	#FF00FF7F	•
_	Closed FRF Plot C	#FFFFF00	•
Measure	Controller FRF Plo	#FF00BFFF	•
Measure	Open FRF Plot Col	#FFFF0000	•
Measure	Plant FRF Plot Color	#FF00FF00	•
⊿ General	Plot Settings		
Cursors C	Color	#FFOOFFFF	•
Grid Visib	ble		
Major Gri	d Color	#FF808000	•
Markers (Color	#FFFFFF	•
Minor Gri	d Color	#FF808000	•
Plot Area	a Color 🛛	#FF000000	•
Point sty	le I	None	•
🔺 Graph Lir	ne Settings		
Baseline	Line Style I	None	•
Baseline	Line Width	1	\$
Design Li	ine Style I	None	•
Design Li	ine Width	1	\$
		None	•
Measure	Line Width :	2	÷
Baseline Cle (No descript	osed FRF Plot Color tion)		

The properties are divided into four groups, as explained following.

6.2.11.1 FRF Settings

4	FDF Cottings	
1	FRF Settings	
	Baseline Closed FRF Plot	#FFF0E68C •
	Baseline Controller FRF	#FFAFEEEE •
	Baseline Open FRF Plot	#FFFF7F50 🔹
	Baseline Plant FRF Plot	#FF98FB98< ▼
	Design Closed FRF Plot	#FFFFD700 -
	Design Controller FRF Pl	#FF8A2BE2 -
	Design Open FRF Plot C	#FFFF1493 •
	Design Plant FRF Plot C	#FF00FF7F 🔹
	Measure Closed FRF Plo	#FFFFF00 T
	Measure Controller FRF	#FF00BFFF 🔹
	Measure Open FRF Plot	#FFFF0000 -
	Measure Plant FRF Plot	#FF00FF00 -

The FRF Settings are used to set the colors in which the four signals: Closed, Controller, Open and Plant are plotted for:

- > Baseline
- > Design
- > Measure

To select a color click the color box and select a color from the dropdown list.

6.2.11.2 General Plot Settings

4	General Plot Settings		
	Cursors Color	#FFOOFFFF	• I
	Grid Visible	\checkmark	
	Major Grid Color	#FF808000	-
	Markers Color	#FFFFFFF	•
	Minor Grid Color	#FF808000	•
	Plot Area Color	#FF000000	-
	Point style	None	•
	on the line of the sec		

General Plot Settings are used to set the properties of the graph against which the data is to be plotted. These include:

- > Cursors Color the color of the cursors when displayed
- Grid Visible toggles between displaying the grid (checkbox selected) or not (checkbox unselected)
- > Major Grid Color the color of the main grid, this marks the horizontal and vertical divisions of the graph
- > Markers Color the color of the markers when displayed

- > Minor Grid Color the color of the secondary grid, this marks the horizontal and vertical division is between the main grid points
- > Plot Area Color the background color of the graph
- > Point Style the style of the points being displayed

To select a color click the color box and select a color from the dropdown list.

6.2.11.3 Graph Settings

4	Graph Line Settings		
	Baseline Line Style	None	•
	Baseline Line Width	1	\$
	Design Line Style	None	•
	Design Line Width	1	\$
	Measure Line Style	None	•
	Measure Line Width	2	ŧ

Graph Settings are used to set the line width and style of graphic display for:

- > Baseline
- > Design
- > Measure

To set the width click the value and enter a number, then press **Enter**.

To set the style click the field and select from the dropdown list.

6.2.11.4 Nyquist Graph Settings

M-Circles Color	DodgerBlue
M-Circles Number	3
M-Circles Show	M
M-Circles Step (dB)	2
N_Circles Color	Magenta
N-Circles Show	M
N-Circles Step (degrees)	_30
Single Circle Color	LawnGreen
Single Circle Show	

Nyquist Graph Settings are used for the Nyquist graph when it is displayed.

The settings are for M-Circles, N-Circles, and Single Circle, which are:

- > M-Circles loci for constant gains of the total closed-loop FRF
- > N-Circles loci for constant phases of the total closed-loop FRF
- > Single Circle unity loop

The properties in this group are:

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- > M-Circles Color set the color of the M-Circles
- > M-Circles Number set the number of M-Circles to display
- M-Circles Show toggles between displaying the M-Circles (checkbox selected) or not (checkbox unselected)
- > M-Circles Step (dB) sets the steps, in dB, between each M-Circle
- > N-Circles Color set the color of the N-Circles
- N-Circles Show toggles between displaying the N-Circles (checkbox selected) or not (checkbox unselected)
- > N-Circles Step (degrees) sets the steps, in degrees, between each N-Circle
- > Single Circle Color set the color for the unity circle
- Single Circle Show toggles between displaying the Single Circle (checkbox selected) or not (checkbox unselected)

6.2.12 Troubleshooting

Because of non-linear effects in the system, for example, backlash, different results may be achieved for various scenarios:

- Problem: Different results when the axis is idle or moving.
 Solution: In case of static friction it is recommended to move the axis at low velocity during the measurement.
- > Problem: A disturbance in the FRFs may appear if PTP is used, while the axis is changing its direction.

Solution: To minimize this effect, it is recommended to perform cyclic motion between two points without any dwell time between motions.

- Problem: Different results for different excitation levels.
 Solution: Always verify that the excitation current level is appropriate.
- Problem: Non-linearities because of saturation s in the system, the drive or the control algorithm, such as, integrator windup, current limit, etc.
 Solution: Always verify that nothing in the control algorithm and the system saturates.
- Problem: Cross coupling between axes can affect the measurement results, for example, if one axis location affects the center of gravity of a second axis.
 Solution: Always record the axes state and position while taking a measurements.
- Problem: Dual loop topology usually has two encoders and the FRF of each loop has to be separately measured.
 Solution: This is not supported by the FRF Analyzer. Still, the total Close loop FRF will be measured correctly. Open-Loop and plant FRF will be only estimations.
- Problem: Resonances with very low attenuation (lower than 2%) may affect the coherence of the measurement and its reliability.
 Solution: After the resonance is identified, it is recommended to attenuate it using low-pass or Notch filter. Afterward you should re-measure the system.
- > Problem: Noise may effect the measurement results, especially at high frequencies when the signal to noise ratio is low.

Solution: Make sure that the system is properly grounded and shielded, that is, ground the controller, use twisted-pair shielded cables, etc.

6.3 HSSI Manager

The **HSSI Manager** is used for monitoring the status of the HSSI (High Speed Serial Interface) channels. The manager displays the quantity and state of the HSSI channels.



Some strings will be connected if the device occupies more than one register.

The HSSI Manager

- > Displays the status of the controller's HSSI channels.
- > Provides a "Reconnect/Refresh" function for reinitializing communication between the controller and connected HSSI modules.

6.3.1 Activating HSSI Manager

To activate HSSI Manager:

- 1. From the Toolbox click **Diagnostics and Monitoring**.
- 2. Click HSSI Manager.



You may use **Add Component** from the right-click menu of the controller in the Workspace Tree (Controller Right-Click Options) to activate the **HSSI Manager**.

You are prompted with:



3. Click **Yes**. The HSSI Manager window is displayed.

HSSI Manager			
🌠 Initialize			
Channel : Register	Index	ID	Communication stat

4. Click **Initialize** to establish communication with the controller. The HSSI Manager reads the HSSI Channel data and displays it.



Should you close the window and then reopen it, communication is cut off with the controller. To reestablish communication, click **Reconnect**.

6.3.2 HSSI Manager Window

Unit	Channel : Register	Index	ID	Communication status	
Unit0	0:0	0	HSSI-ED2(Id:2)	<u>e</u>	
	0:1	1	No device	😑 🗧	
	0:2	2	No device	<u></u>	
	0:3	3	HSSI-HES(Id:12)	<u>()</u>	
	1:0	4	No device		
	1:1	5	No device		
	1:2	6	No device		
	1:3	7	No device	<u></u>	
	2:0	8	No device		
	2:1	9	No device		
	2:2	10	No device		
	2:3	11	No device		
	3:0	12	No device		
	3:1	13	No device		
	3:2	14	No device	<u> </u>	
	3:3	15	No device		
Unit2	0:0	16	No device		
	0:1	17	No device		
	0:2	18	No device		
	0:3	19	No device	Θ	
	1:0	20	No device		
	1:1	21	No device)	
	1:2	22	No device	Θ	
	1:3	23	No device		
	2:0	24	No device		
	2:1	25	No device	<u>e</u>	
	2:2	26	No device	<u> </u>	
	2:3	27	No device		
	3:0	28	No device	<u> </u>	
	3:1	29	No device	<u> </u>	
	3:2	30	No device	<u> </u>	
	3:3	31	No device	<u> </u>	

The HSSI Manager Main Window has 5 columns:

> Unit

In an NT configuration, several motion controllers can be connected together, each motion controller is treated separately

> Channels:Register

This column displays the number of the channel and register number in the channel (separated by a colon).

> Index

This column displays number of SPii index.

> ID

This column displays the Device ID, if it exists.

> Communication status

This column displays the channel status: Green for normal, Red for error.

6.4 Inputs/Outputs Manager

The **Inputs/Outputs Manager** tool displays the status of the digital input and output variables of the SPiiPlus controller as well as those of the HSSI, if defined.

Status of digital input is measured against the value of the associated **IN** variable, and that of digital output against the value of the associated **OUT** variable.

The **IN** variable is a scalar 16-bit integer and stores the current state of the General Purpose digital inputs represented by bits 0..15 of **IN**. Each bit reports the state of one General Purpose input.

In a like manner **OUT** is a scalar 16-bit integer and stores the current state of the General Purpose digital outputs represented by bits 0..15 of **OUT**. Each bit reports the state of one General Purpose output.

HSSI input is reported through the **EXTIN** (Extended In) variable which is a 16 member integer array that reads the current state of the HSSI inputs. Each element of the array contains a 16 bit number, each bit of which representing the state of one input; therefore, up to 256 inputs can be read. The number of inputs depends on the HSSI module.

HSSI output is reported through the **EXTOUT** (Extended Out) variable which, like **EXTIN**, is a 16 member integer array that reads the current state of the HSSI outputs. Each element of the array contains a 16 bit number, each bit of which representing the state of one output; therefore, up to 256 outputs can be read. The number of outputs depends on the HSSI module.

6.4.1 Activating Inputs/Outputs Manager

To activate the Inputs/Outputs Manager:

- 1. From the Toolbox click **Diagnostics and Monitoring** (Depressus and Monitoring) to display the Diagnostics and Monitoring tools list.
- 2. Click Inputs/Outputs Manager.

•
_

You may use **Add Component** from the right-click menu of the controller in the Workspace Tree (Controller Right-Click Options) to activate the Inputs/Outputs Manager.

The Inputs/Outputs Manager window is displayed:

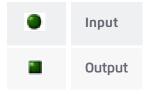


Some controllers have only 8 digital inputs and outputs instead of 16. In this case the symbols in columns 8 through 31 are greyed-out indicating that they are not available.

An NT configuration may contain several controllers linked together. The **Inputs/Outputs Manager** displays each controller - **Unit** - separately.

6.4.2 Inputs/Outputs Manager Operations

The Inputs/Outputs Manager window employs two icons to show input and output:



They can be displayed in one of three colors:

SPiiPlus MMI Application Studio User Guide 6. Diagnostics and Monitoring

Green - indicates that it has been activated.



Dark Grey - indicates that it has not been activated.

Light Grey - indicates that it is not supported by the controller (for example, an external device that has been included in the system).

not been connected to the HSSI channel).

The controller activates and deactivates the bits as it progresses through its program.



You can activate a bit manually by clicking it. To deactivate it manually you just click it again.



You can use the **Terminal t**o check the value or values of the bits, for example, if you enter **?IN(0)** in the Terminal command line, you will get the values for all 16 bits of the variable.

6.4.2.1 Display Options

You have the following display options:

- > Column Display
- > Cell Display
- > Selecting HSSI EXTIN/EXTOUT Variables

Column Display

If you right-click a column, you are given the following options:

₽J	Sort Columns Ascending
z↓	Sort Columns Descending

Using this menu you can sort the columns from left to right (ascending order, that is, 0 to 31), or from right to left (descending order - 31 to 0).

Cell Display

You hide the display of any cell by selecting it and clicking **Hide Cell**. To restore its display, select the hidden cell and click **Show Cell**.

As an aid in identifying the specific inputs and outputs, you can give cells names:

1. Right-click the cell and select **Properties**. The Properties panel for the cell is activated.

Pr	operties		₹ ₽ ×
0	2↓ ?		
4	Misc	_	
	Name	SD	

- 2. Enter the identifier you want in the **Name** field.
- 3. Select **Show Names** either from **Options**, or by right-clicking the cell. You can also activate this by pressing **Ctrl+C** and then pressing **N**. The name is displayed.

Properties	→ ₽ ×	My Controller 02	- IOutputs	Manage	r
A Misc		Hide Cell Opt	ions 🔹 Va	riables 🔻	ح
	SD	Unit (ID)	Variable	HSSI	0
			OUT(8)		
		Unit9 (ID:9)	IN(9)		SD

		t constrained a Jth by draggin		-				pand the
Ì	Variable IN	HSSI	Δ	0	1 SD	2 RD	kg 3 ●	
_	Once the P	roperties pane	el is displa	iyed, you	can select i	t for each	n cell by selec	ting the

cell, then entering its identifying name in the Properties **Name** field.

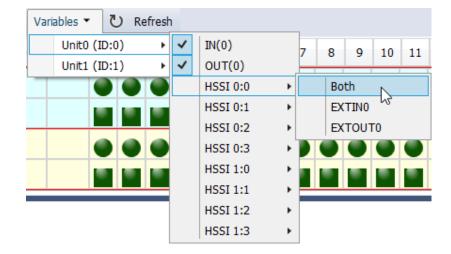
To hide the names select **Show Names** either from **Options**, or by right-clicking the cell. You can also toggle the display of names off by pressing **Ctrl+C** and then pressing **N**.

6.4.2.2 Selecting HSSI EXTIN/EXTOUT Variables

If you have EXTIN and EXTOUT signals that you want to monitor:

- Click Variables, and select the Unit from the dropdown list. A list of HSSI variables is displayed.
- 2. Select the HSSI variable, you have three choices:

- > **EXTIN** for the selected variable
- > **EXTOUT** for the selected variable
- > **Both** (display both EXTIN and EXTOUT)



Once you have made your choice, additional rows are added to the selected Unit's row showing the status of the variables.

6.5 Motion Manager

Motion Manager is used for the following:

- > Setting the motion parameters for each axes
- > Initiating the motion
- > Monitoring the progress of the motion
- > Stopping the motion

6.5.1 Activating Motion Manager

By default, when you initially enter SPiiPlus MMI Application Studio, **Motion Manager** is automatically displayed. If you have closed it, you can reactivate it by either clicking it in the Workspace Tree or by:

- 1. From the Toolbox click **Diagnostics and Monitoring** to display the Diagnostics and Monitoring tools.
- 2. Click Motion Manager in the Diagnostics and Monitoring list of tools.



You can also activate the **Motion Manager** using the right-click **Add Component** option of the Workspace Tree - see Controller Right-Click Options .

The Motion Manager main window appears:

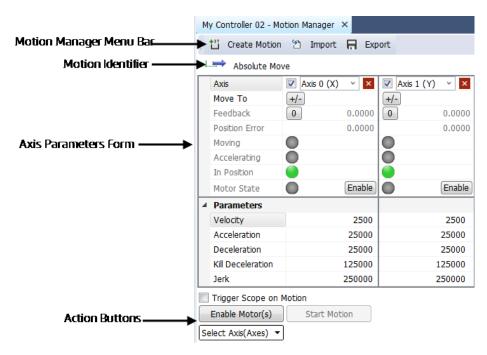
My Controller	- Motion Manager 🗙
ti Create	Motion 🖄 Import 📊 Export
Starting a l	New Motion
	Manager Component allows you to define and execute single and multi-axis motions. ew motion, connect the controller first. Then click one of the motion types below:
	Absolute Move Absolute Move is used to move the motor(s) to a specific target position.
⊘⇒	Relative Move Relative Move is used to move the motor(s) a specific distance from current position.
>	One Direction Incremental Repeated Move One Direction Incremental Repeated Move is used to move the motor(s) incrementally in one specified direction from current position repeatedly.
A	Back and Forth Move Back and Forth Move is used to move the motor(s) back and forth between two points.
	Jog Motion Jog motion is a motion with constant velocity and without defined end point. The motion continues until the next motion command stops it, or the motion fails because of limit switch activation or other condition.

There are five types of motion that can be set:

L⇒	Absolute Move	- Used for moving the motor(s) to a specific target.
0\$	Relative Move	- Used for moving the motor(s) a specific distance from current position.
	One Direction Incremental Repeated Move	- Used for repeatedly moving the motor(s) incrementally in one specified direction from current position.
A	Back and Forth Move	- Used for moving the motor(s) back and forth between two specified points.
	Jog Motion	- Used for moving the motor(s) with constant velocity and without a defined end point. The motion continues until the next motion command stops it, or the limit switch has been activated, or some other condition.

6.5.2 Motion Manager Window

The Motion Manager window components are:



The Motion Manager window enables you to set up and manage the motion of motors, both along individual axes and along all axes.

6.5.2.1 Motion Manager Menu Bar

The Motion Manager Menu bar has four options:

T Create Motion

This option enables you to create a new motion type. When you click the down arrow, a dropdown menu appears from which you can select the motion type:

XY	Create Motion 🎦 Import 🖪 Export
⇒	Absolute Move
⇔	Relative Move
**	One Direction Incremental Repeated Move
A#8	Back and Forth Move
⇔	Jog Motion

To select: click the required motion type, a new Axis Motion Parameters Form opens.

While the **Axis Motion Parameters Form** allows you to add as many axes as you need, their parameters will all be of the same motion type. You use this option in the event that the motion type of other axes is different.

👌 Import

This option enables you to import the parameter settings from a previously saved file. When you select the option, a browser window opens:

	MMI_Learn	~ Ū	Search MMI_Lea	m	
Organize 🔻 New folder				• =	
Translations ^ Name	Date modified	Туре	Size		
Troubleshooting	No items match your se				
👩 Website	No items match your se	arcn.			
This PC					
3D Objects					
Desktop					
Documents					
🕹 Downloads					
Music					
E Pictures					
📓 Videos					
L OS (C:)					
Los (C:)					

Select a directory and filename and click **OK**.



This option enables you to save the parameter settings to a file. When you select the option, a browser window opens:

A Save As			
← → ✓ ↑ → This P	C > Data (D:) > Projects > MMI_Learn	v ঊ Sear	ch MMI_Learn 🔎
Organize 👻 New folder			8== - (?
This PC	^ Name	Date modified	Type Size
3D Objects		No items match your search.	
E Desktop		*	
Documents			
🕹 Downloads			
👌 Music			
Pictures			
🚼 Videos			
S (C:)			
Data (D:)			
👝 Kindle (F:)			
	~ <		
File name:			
Save as type: Text Docu	iments (*.txt)		
Hide Folders			Save Cancel
 Hide Folders 			gave Cancer

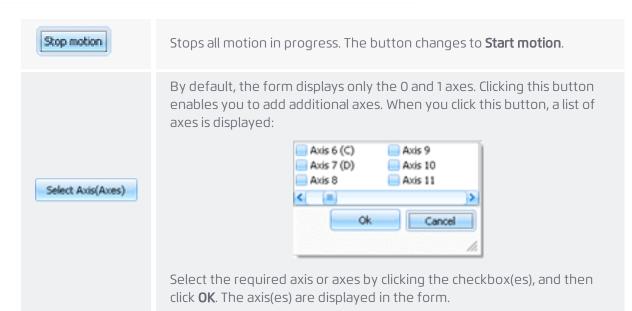
Select the directory into which you want to save the file and enter a filename. Then click OK.

6.5.2.2 Motion Manager Window Action Buttons

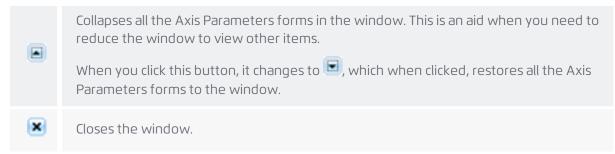
The Motion Manager window has the following action buttons:

Enable Motor(s)	When clicked, all motors are enabled. The button changes to Disable Motor(s).
Disable Motor(s)	When clicked, all motors are disabled. The button changes to Enable Motor(s).
Start motion	Initiates motion for all enabled motors. The button changes to Stop motion.

>



In the upper right corner of the window there are two buttons:



The window contains one checkbox, **Trigger Scope on Motion**. When this is selected, upon the start of motion, the is automatically displayed and set to the Single Trigger mode.

6.5.2.3 Axis Motion Parameters Form

The Axis Motion Parameters form is displayed when any type of motion is selected, for example:

	Axis	Axis 0	× ×	Axis 1	~ ×
	Move To	+/-	10000	+/-	
	Feedback	0	10000.0000	0	0.0000
	Position Error		0.0000		0.0000
	Moving				
	Accelerating				
	In Position	0			
	Motor State	•	Disable		Enable
4	Parameters				
	Velocity		10000		10000
	Acceleration		100000		100000
	Deceleration		100000		100000
	Kill Deceleration		100000		100000
	Jerk		2E+007		2E+007

Each form has the same layout, it is divided into two sections:

- > **Axis** motion type specific settings and common parameters (motor states, feedback position and position error). The section contains four motor status indicators:
 - > Moving the motor is in motion
 - > Accelerating the motor is accelerating
 - > **In Position** the motor is in initial position
 - > Motor State the motor is enabled



The indicators are gray (switched off) by default. When the motion is in progress, the indicator of the corresponding status turns green.

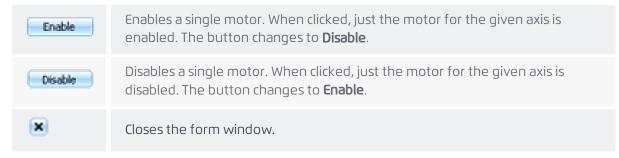
Motion Parameters - for viewing or setting values specifically applicable to the motor.



>

If one of these parameters is changed when a motion is in progress, the change affects the currently executing motions, or motions that were created before the substitution.

The form has one action button:



6.5.3 Working with Axis Motion Parameters Form

The following are general instructions applying to all Axis Motion Parameters forms:

Field Values

Values entered into the various fields are, when motion is initiated, inserted in the appropriate ACSPL+ variable. For example, the value in the **Feedback Position** field is supplied to the ACSPL+ **FPOS** axis state variable.



If you let the mouse cursor linger on the name of a field, a Tool Tip appears informing you of the name of the ACSPL+ variable with which the field is associated.

Changing Axis

When you first enter the Axis Motion Parameters Form, by default, the form displays fields for Axis 0 and Axis 1. You can change the axis designation by clicking the down arrow of the **Axis** field. A dropdown menu appears:

Select Axis(Axes)	•
Axis 0	
🗹 Axis 1	
Axis 2	
Axis 3	
Axis 4	
Axis 5	
Axis 6	
Axis 7	
Axis 8	•
	=
Clear All	

Select the required axis from the list by clicking it.

The Move By Field Value

You can toggle the value of the **Move By** field between positive and negative by clicking $\frac{+}{-}$.

Zeroing the Feedback Position Field

You can set the value of the **Feedback Position** field to zero (0) by clicking

Expanding/Collapsing the Parameters List

You can collapse the Parameters list display by clicking \checkmark . And you can expand its display by clicking \triangleright .

6.5.4 Absolute Move

Absolute Move represents the motion from the origin of coordinates to the initially given destination point - target position.

To set the parameters for Absolute Move:

- 1. Activate Motion Manager.
- 2. Click **Absolute Move** (). The Absolute Move form is displayed.

Axis	Axis 0	~	×	Axis 1	~ ×
Move To	+/-		+	/-	
Feedback	0	10000.0	000		0.0000
Position Error		0.0	000		0.0000
Moving)	
Accelerating)	
In Position					
Motor State		Ena	ble 🔵)	Enable
▲ Parameters					
Velocity		10	000		10000
Acceleration		100	000		100000
Deceleration		100	000		100000
Kill Deceleration		100	000		100000
Jerk		2E+(007		2E+007
Trigger Scope or	n Motion				
Enable Motor(s)	Start	Motion			

- 3. Set the motion parameters:
 - > Move To the destination point in accordance to the selected axis
 - > Feedback Position the current position
 - > **Position Error** the difference between current and required position coordinates
 - > Velocity defines the default velocity of the motion profile
 - > Acceleration how quickly the speed will reach the required limit
 - > Deceleration defines the speed reduction rate
 - > Kill Deceleration defines deceleration when a motion is killed or fails due to a fault
 - > **Jerk** stands for the jerk of the motion profile
- 4. If you need to define the motion parameters for axes other than X and Y, click Add Axis (Axes) and select the additional axis or axes.
- 5. Click Enable Motor(s).
- 6. To start the motion click **Start motion** .

6.5.5 Relative Move

Relative Move is used to move the axis a specific distance from current position.

To set the parameters for Relative Move:

- 1. Activate Motion Manager.
- 2. Click **Relative Move** (○↔). The Relative Move form is displayed.

○⇒ Relative Mo	/e			\odot
Axis	Axis 0	~ 🗙 📝 Axi	s 1 🗸 🗙	
Move By	+/-	+/-		
Feedback	0 1000	0.0000	0.0000	
Position Error	(0.0000	0.0000	
Moving	•			
Accelerating	0			
In Position				
Motor State	•	Enable	Enable	
▲ Parameters				
Velocity		10000	10000	
Acceleration	1	00000	100000	
Deceleration	1	00000	100000	
Kill Deceleration	1	00000	100000	
Jerk	2	E+007	2E+007	
Trigger Scope on	Motion			
Enable Motor(s)	Start Motio	-		

- **3**. Set the motion parameters:
 - > Move By the distance for the motor to move
 - > Feedback Position the current position
 - > **Position Error** the difference between the current and required position coordinates
 - > Velocity defines the default velocity of the motion profile
 - > Acceleration how quickly the speed will reach the required limit
 - > Deceleration defines the speed reduction rate
 - > Kill Deceleration defines deceleration when a motion is killed or fails due to a fault
 - > Jerk stands for the jerk of the motion profile
- 4. If you need to define the motion parameters for axes other than X and Y, click **Add Axis** (**Axes**) and select the additional axis or axes.
- 5. Click Enable Motor(s).
- 6. To start the motion click **Start motion**.

6.5.6 One Direction Incremental Repeated Move

One Direction Incremental Repeated Move is used to move the motor(s) incrementally and repeatedly in one specified direction from the current position.

To set the parameters for One Direction Incremental Repeated Move:

- 1. Activate Motion Manager.
- 2. Click **One Direction Incremental Repeated Move** (). The One Direction Incremental Repeated Move form is displayed.

M		Axis 0	✓ ×	Axis 1	~ ×	
M	love By	+/-		+/-		
D	well		0		0	
Fe	eedback	0	10000.0000	0	0.0000	
P	osition Error		0.0000		0.0000	
М	loving					
A	ccelerating	0				
In	Position	0				
М	lotor State		Enable		Enable	
⊿ P	arameters					
V	elocity		10000		10000	
Α	cceleration		100000		100000	
D	eceleration		100000		100000	
Ki	ill Deceleration		100000		100000	
Je	erk		2E+007		2E+007	

- **3**. Set the motion parameters:
 - > Move By the required distance
 - > Dwell the amount of time, in ms, to dwell in each point
 - > Feedback Position the current position
 - > **Position Error** the difference between current and required position coordinates
 - > Velocity defines the default velocity of the motion profile
 - > Acceleration how quickly the speed will reach the required limit
 - > Deceleration defines the speed reduction rate
 - > Kill Deceleration defines deceleration when a motion is killed or fails due to a fault
 - > Jerk stands for the jerk of the motion profile
- If you need to define the motion parameters for axes other than X and Y, click Add Axis (Axes) and select the additional axis or axes.
- 5. Click Enable Motor(s).
- 6. To start the motion click **Start motion**.

6.5.7 Back and Forth Move

Back and Forth Move is used to move the axis back and forth between two specific points.

To set the parameters for Back and Forth Move:

- 1. Activate Motion Manager.
- 2. Click **Back and Forth Move** (

Axis	🗹 Axis 0 🗸 🗙	🗹 Axis 1 🛛 🗸 🗙
Point A	Read +/-	Read +/-
Point B	Read +/-	Read +/-
Dwell	0	0
Feedback	0 10000.0000	0.0000
Position Error	0.0000	0.0000
Moving	•	
Accelerating	•	
In Position		
Motor State	Enable	Enable
Parameters		
Velocity	10000	10000
Acceleration	100000	100000
Deceleration	100000	100000
Kill Deceleration	100000	100000
Jerk	2E+007	2E+007

- 3. Set the motion parameters:
 - > **Point A** the starting point
 - > **Point B** the end point
 - > Dwell the amount of time, in ms, to dwell at the end point
 - > Feedback Position the current position

Select Axis(Axes) 🔻

- > **Position Error** the difference between current and required position coordinates
- > Velocity defines the default velocity of the motion profile
- > Acceleration how quickly the speed will reach the required limit
- > **Deceleration** defines the speed reduction rate
- > Kill Deceleration defines deceleration when a motion is killed or fails due to a fault
- > Jerk stands for the jerk of the motion profile
- If you need to define the motion parameters for axes other than X and Y, click Add Axis (Axes) and select the additional axis or axes.
- 5. Click Enable Motor(s).
- 6. To start the motion click **Start motion**.

6.5.8 Jog Motion

Jog Motion is a motion with constant velocity and without a defined end point. The motion continues until the next motion command stops it, or the motion fails because of limit switch activation or other condition.

To set the parameters for Jog Motion:

- 1. Activate Motion Manager.
- 2. Click **Jog Motion** (). The Jog Motion form is displayed.

X	💥 Jog Motion		\odot \otimes
	Axis	🗹 Axis 0 🛛 🖌 📈 Axis	s 1 🗸 🗙
	Direction	Positive Positive	•
	Feedback	0 10000.0000 0	0.0000
	Position Error	0.0000	0.0000
	Moving	0	
	Accelerating	0	
	In Position		
	Motor State	Enable	Enable
4	Parameters		
	Velocity	10000	10000
	Acceleration	100000	100000
	Deceleration	100000	100000
	Kill Deceleration	100000	100000
	Jerk	2E+007	2E+007
	Trigger Scope on I	lotion	
	Enable Motor(s)	Start Motion	
Se	elect Axis(Axes) 🔻		

- **3**. Set the motion parameters:
 - > Direction select between positive and negative directions in accordance to the axis
 - > Feedback Position the current position
 - > **Position Error** the difference between current and required position coordinates
 - > Velocity defines the default velocity of the motion profile
 - > Acceleration how quickly the speed will reach the required limit
 - > Deceleration defines the speed reduction rate
 - > Kill Deceleration defines deceleration when a motion is killed or fails due to a fault
 - > Jerk stands for the jerk of the motion profile
- 4. If you need to define the motion parameters for axes other than X and Y, click **Add Axis** (**Axes**) and select the additional axis or axes.
- 5. Click Enable Motor(s).
- 6. To start the motion click **Start motion**.

6.6 Safety and Faults Monitor

The Safety and Faults Monitor is, as it were, an expanded LED display enabling you to view the status of the variable faults that were set in *Section 3.4, Safety and Faults Configurator.*

6.6.1 Activating Safety and Faults Monitor

To activate the Safety and Faults Monitor:

- 1. From the Toolbox click **Diagnostics and Monitoring**.
- 2. Click Safety and Faults Monitor.

<u> </u>

You may use **Add Component** from the right-click menu of the controller in the Workspace Tree (see Controller Right-Click Options) to activate the Safety and Faults Monitor.

The Safety and Faults Monitor window is displayed:

		0	1	2	3	Aggregared Fault (S_FAULT)
Axis Faults (FAULT)						
Hardware Right Limit		0	0			
Hardware Left Limit		0	0			
Network Error		0	0			
Motor Overheat		0	0	0	0	0
Software Right Limit		0	0			
Software Left Limit			0			
Encoder 1 Not Connected		0	0	0	0	
Encoder 2 Not Connected		0	Õ	Õ	Ō	0
Drive Fault / Laser Fault		0	0	0	0	
Encoder 1 Error		0	0		0	
Encoder 2 Error			Ö	Õ	Ö	
Non-Critical Position Error						
Critical Position Error						
Velocity Limit						
Acceleration Limit		ŏ	Ŏ	Ŏ	ŏ	- Ö
Overcurrent		ĕ	ĕ		ĕ	
Servo Processor Alarm		ĕ	ĕ		ĕ	
Safe Torque Off		ě	Ŏ	<u> </u>	ě	
HSSI Not Connected			ŏ	<u> </u>		
Hardware Emergency Stop		ĕ	ĕ	ě	Ă	
nationale Energency Stop		•				
Safety Inputs (SAFIN)						
Hardware Right Limit		0	0			
Hardware Left Limit		0	0			
Motor Overheat		0	0			
Drive Fault / Laser Fault		0	-)		
Safe Torque Off 1		0	0			
Safe Torque Off 2		0	0			
Hardware Emergency Stop		0	0			
Component Failure		0	0			
System Safety Inputs (S_SAFIN)				System Faults	(S_FAULT)	
				MPU Overheat		0
				ACSPL + Progra	am Error	
				Memory Overflo		
				MPU Overuse		
Hardware Emergency Stop Input	0			Hardware Emer	gency Stop	
The Bauel areh whee				Servo Interrupt		
				File Integrity		
Component Failure Input				. no incogney	lure	

The fault status is distributed as follows:

> **Axis Faults** - These show the status of the axis motion as gathered by the ACSPL+ **FAULT** variable and reflect the following bits of the variable:

Bit	Fault	Fault Description
0	#RL	Hardware Right Limit. 1 = Right limit switch is activated.
1	#LL	Hardware Left Limit 1 = Left limit switch is activated.
2	#NT	Network Error 1 = Network error has occurred. Valid only for SPiiPlus NT Motion Controllers.
4	#HOT	Motor Overheat

Bit	Fault	Fault Description
		1 = Motor's temperature sensor indicates overheat.
5	#SRL	Software Right Limit 1 = Axis reference position (RPOS) is greater than the software right limit margin (SRLIMIT).
6	#SLL	Software Left Limit 1 = Axis reference position (RPOS) is less than the software left limit margin (SLLIMIT).
7	#ENCNC	Encoder Not Connected 1 = Primary encoder (for digital encoder type only) is not connected.
8	#ENC2NC	Encoder 2 Not Connected 1 = Secondary encoder (for digital encoder type only) is not connected.
9	#DRIVE	Drive Fault / Laser Fault 1 = Signal from the drive reports a failure.
10	#ENC	Encoder Error 1 = Primary encoder miscounts.
11	#ENC2	Encoder 2 Error 1 = Secondary encoder miscounts.
12	#PE	 Non-Critical Position Error 1 = Non-critical position error has occurred. PE is defined by the following variables: ERRI - Maximum position error while the axis is idle ERRV - Maximum position error while the axis is moving with constant velocity ERRA - Maximum position error while the axis is accelerating or decelerating DELI - Delay on transition from ERRA to ERRI DELV - Delay on transition from ERRA to ERRV

Bit	Fault	Fault Description
Bit 13	Fault #CPE	Fault DescriptionCritical Position Error1 = Position error exceeds the value of the critical limit.#CPE errors occur outside normal range of operation and#CPE > #PE.The critical limit depends on the axis state and is definedby the following variables:CERRI if the axis is idle (not moving)CERRV if the axis is moving with constant velocityCERRA if the axis is accelerating or decelerating
		DELI - Delay on transition from ERRA to ERRI DELV - Delay on transition from ERRA to ERRV
14	#VL	Velocity Limit 1 = Absolute value of the reference velocity (RVEL) exceeds the limit defined by the XVEL parameter.
15	#AL	Acceleration Limit 1 = Absolute value of the reference acceleration (RACC) exceeds the limit defined by the XACC parameter.
16	#CL	Current Limit 1 = RMS current calculated in the Servo Processor exceeds the limit value defined by the XRMSD or XRMSM parameter.
17	#SP	Servo Processor Alarm 1 = Axis Servo Processor loses its synchronization with the MPU. The fault indicates a fatal problem in the controller.
18	#STO	Safe Torque Off 1 = STO is activated.
20	#HSSINC	HSSI Not Connected 1 = HSSI module is not connected.
23	#ES	Hardware Emergency Stop 1 = ES signal is activated.

> **Aggregated Faults** - These show the status of the axis motion as gathered by the ACSPL+ S_FAULT variable and reflect the following bits of the variable:

Bit	Fault	Fault Description
0	#RL	Hardware Right Limit. 1 = Right limit switch is activated.
1	#LL	Hardware Left Limit. 1 = Left limit switch is activated.
2	#NT	Network Error 1 = Network error has occurred. Valid only for SPiiPlus NT Motion Controllers.
4	#HOT	Motor Overheat 1 = Motor's temperature sensor indicates overheat.
5	#SRL	Software Right Limit 1 = Axis reference position (RPOS) is greater than the software right limit margin (SRLIMIT).
6	#SLL	Software Left Limit 1 = Axis reference position (RPOS) is less than the software left limit margin (SLLIMIT).
7	#ENCNC	Encoder Not Connected 1 = Primary encoder (for digital encoder type only) is not connected.
8	#ENC2NC	Encoder 2 Not Connected 1 = Secondary encoder (for digital encoder type only) is not connected.
9	#DRIVE	Drive Fault / Laser Fault 1 = Signal from the drive reports a failure.
10	#ENC	Encoder Error 1 = Primary encoder miscounts.
11	#ENC2	Encoder 2 Error 1 = Secondary encoder miscounts.
12	#PE	Non-Critical Position Error 1 = Non-critical position error has occurred. PE is defined by the following variables: ERRI - Maximum position error while the axis is idle

Bit	Fault	Fault Description
		 ERRV - Maximum position error while the axis is moving with constant velocity ERRA - Maximum position error while the axis is accelerating or decelerating DELI - Delay on transition from ERRA to ERRI DELV - Delay on transition from ERRA to ERRV
13	#CPE	 Critical Position Error 1 = Position error exceeds the value of the critical limit. #CPE errors occur outside normal range of operation and #CPE > #PE. The critical limit depends on the axis state and is defined by the following variables: CERRI if the axis is idle (not moving) CERRV if the axis is moving with constant velocity CERRAif the axis is accelerating or decelerating DELI - Delay on transition from ERRA to ERRI DELV - Delay on transition from ERRA to ERRV
14	#VL	Velocity Limit 1 = Absolute value of the reference velocity (RVEL) exceeds the limit defined by the XVEL parameter.
15	#AL	Acceleration Limit 1 = Absolute value of the reference acceleration (RACC) exceeds the limit defined by the XACC parameter.
16	#CL	Current Limit 1 = RMS current calculated in the Servo Processor exceeds the limit value defined by the XRMSD or XRMSM parameter.
17	#SP	Servo Processor Alarm 1 = Axis Servo Processor loses its synchronization with the MPU. The fault indicates a fatal problem in the controller.
18	#STO	Safe Torque Off 1 = STO is activated.

Bit	Fault	Fault Description
20	#HSSINC	HSSI Not Connected 1 = HSSI module is not connected.
23	#ES	Hardware Emergency Stop 1 = ES signal is activated.

Safety Inputs - These show the status of the axis motion as gathered by the ACSPL+ SAFIN variable which indicates the raw state, before processing, of the axis safety inputs and reflect the following bits of the variable:

Bit	Bit Name	Description
0	#RL	Hardware Right Limit
1	#LL	Hardware Left Limit
4	#HOT	Motor Overheat
9	#DRIVE	Drive Fault / Laser Fault
17	#ST01	Safe Torque Off 1
18	#ST02	Safe Torque Off 2
28	#ES	Hardware Emergency Stop
31	#COMP	Component Failure

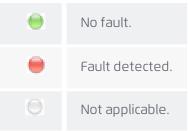
System Safety Inputs - These show the status of the controller program as gathered by the ACSPL+ S_SAFIN variable which indicates the raw state, before processing, of the inputs and reflect the following bits of the variable:

Bit	Fault	Fault Description
28	#ES	Hardware Emergency Stop 1 = ES signal is activated.
31	#FAILURE	Component Failure 1 = An MC4U hardware component other than the drive, such as Power Supply, I/O card, or encoder card, has failed.

System Faults - These show the status of the controller program as gathered by the ACSPL+ S_FAULT variable and represent the following bits of the variable:

Bit	Fault	Fault Description
25	#PROG	Program Fault 1 = Run time error occurs in one of the executing ACSPL+ programs.
26	#MEM	Memory Fault 1 = User application requires too much memory.
27	#TIME	MPU Overuse 1 = User application consumes too much time in the controller cycle.
28	#ES	Hardware Emergency Stop 1 = ES signal is activated.
29	#INT	Servo Interrupt 1 = The servo interrupt that defines the controller cycle is not generated. The fault indicates a fatal controller problem.
30	#INTGR	File Integrity 1 = The integrity of the user application in controller RAM is checked by the controller at power-up and whenever an #IR command is issued.
31	#FAILURE	Component Failure 1 = An MC4U hardware component other than the drive, such as the Power Supply, I/O card, or encoder card, has failed.

The "LED" indicators have the following meanings:



6.6.2 Working with Safety and Faults Monitor

You have the following actions that you can take when viewing the Safety and Faults Monitor:

For Axis Faults to get the action menu for any column, right-click the column number. The following popup menu appears:

₽J	Sort Axes Columns Ascending
z↓	Sort Axes Columns Descending

Your options are:

- > To sort a column by ascending order click Sort Axes Columns Ascending.
- > To sort a column by descending order click Sort Axes Columns Descending.



The **System Faults** is fixed and you cannot change it.

6.7 Scope

The SPiiPlus MMI Application Studio **Scope** enables you to view a real-time graphic display of the motion. It provides you with a wide diversity of display options that allow you to define the graph's display to meet your needs.

6.7.1 Activating the Scope

To activate the Scope:

- 1. From the Toolbox, click **Diagnostics and Monitoring** to display the Diagnostics and Monitoring tools list.
- 2. Click Scope.

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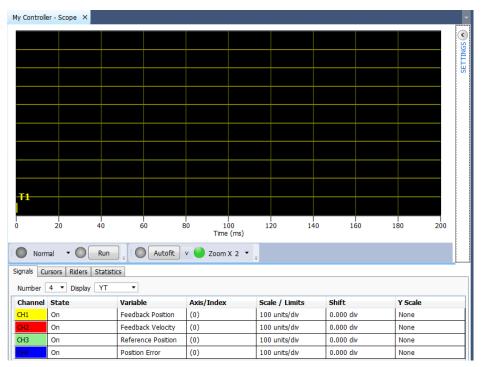
You can use **Add Component** from the right-click menu of the controller in the Workspace Tree (see Controller Right-Click Options) to activate the Scope.

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cl
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The Scope display can also be triggered from the Communication Terminal by the

clicking **Send and Trigger Scope**, and from the **Program Manager** by clicking **E** or pressing **Ctrl+Alt+T**, and from **Motion Manager** by selecting the **Trigger Scope on Motion** checkbox.

The **Scope** window is displayed:



You can set the graphic display parameters by clicking **(Settings)** on the right of the Scope display.

Horizontal	\diamond
Length(ms)	200.00
	mpling ms)
Auto	
Manual	1.00
s s s	cale 20.00 ms ▼
Trigger	\bigcirc
Reference	$\overline{\mathbf{v}}$
FFT Setup	$\overline{\mathbf{v}}$
Tools	$\overline{\mathbf{v}}$

Version 3.02

Used for setting the horizontal scale of the graph. See Horizontal \frown Setting Horizontal Scale. Used for setting the trigger parameters at which points \checkmark Trigger the motion is sampled. See Setting Triggers. Used for setting the reference points to assist in Reference * analyzing simple graphical signals of motion. See Setting Reference Axis Used for selecting an FFT (Fast Fourier Transform) \checkmark FFT Setup algorithm to be used in displaying the graph. See FFT Setup. Tools V) Save and load signal recordings.

There are four options for setting the graphic display parameters:

To expand an option click: 🖳 To reduce, click 🔼

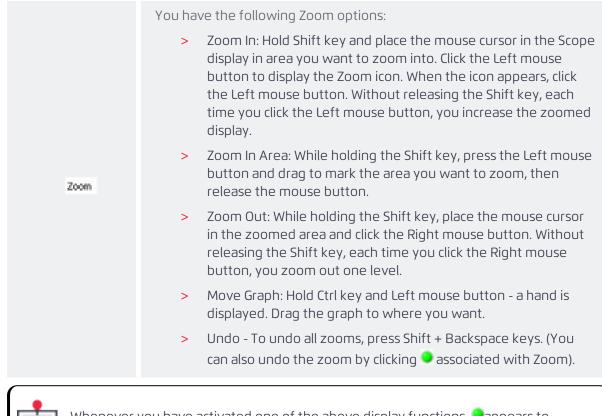
Underneath the Scope display there is a section for defining what channels are displayed and for viewing the measured values. This section is divided into four tabs:

Signals	This tab enables you to set the number of channels to be sampled, how they are to be sampled, and to set what is to be displayed. See Signals Tab .
Cursors	This tab enables you to set cursors on the graph to view the values between selected points on the graph. See Cursors Tab .
Riders	This tab enables you to see the specific values along the graph. You can move the Riders along the graph and view the values at the intersection of the Rider and the graph. See Riders Tab .
Statistics	This tab displays all the measured statistics for the channels being sampled. See Statistics Tab .

There are four display controls directly under the Scope. These are:

Single Normal - The graph is displayed. Your options are: Normal - The graph is displayed according to the Trigger setting, if a signal is outside of the Trigger setting, it is not displayed - only those signals within the Trigger. Normal Auto Auto - If the signals are all within the Trigger setting, this setting acts the same as Normal; however, if a signal is outside of the Trigger setting, after some delay it is also displayed. Single Single - The graph is displayed for a single frame, that is, the data is displayed for the length of the time set in the Horizontal scale and then stop. Each time you click Run, another frame is displayed. These options are connected to the definition of the Trigger. This appears if the data collection for the graph is not running. To start the data collection and the graph display, you click this button. Soo When you click Run to start the data collection, it changes to this button. You click this button to stop the data collection. Rucer In some cases the graph may exceed the boundaries of the Scope screen. Click for the Scope to resize the entire screen, thus each time you click Autofit, the data is refreshed and displayed in the Full Screen mode. Between Cursors - This option sets the Scope display to the area between the cursors. Permanent Full Screen - This option sets the Scope display to the area between the cursors. Permanent Full Screen - This option sets the Scope display permanently to the Autofit Between display mode.		
Image:	Normal Auto	 Normal - The graph is displayed according to the Trigger setting. If a signal is outside of the Trigger setting, it is not displayed - only those signals within the Trigger. Auto - If the signals are all within the Trigger setting, this setting acts the same as Normal; however, if a signal is outside of the Trigger setting, after some delay it is also displayed. Single - The graph is displayed for a single frame, that is, the data is displayed for the length of the time set in the Horizontal scale and then stop. Each time you click Run, another frame is displayed.
button . You click this button to stop the data collection. In some cases the graph may exceed the boundaries of the Scope screen. Click for the Scope to resize the display so that all data is displayed. You have four Autofit options: Full Screen - This option sets the Scope to resize the entire screen, thus each time you click Autofit , the data is refreshed and displayed in the Full Screen mode. Between Cursors - This option reduces the Scope display to the area between the cursors. Each time you click Autofit , the data is refreshed and displayed for the area between the cursors. Permanent Full Screen - This option sets the Scope display permanently to the Autofit Full Screen display mode. Permanent Between Cursors - This option sets the Scope display permanently to the Autofit Between the Cursors screen	Run	
Screen. Click for the Scope to resize the display so that all data is displayed. You have four Autofit options: > Full Screen - This option sets the Scope to resize the entire screen, thus each time you click Autofit, the data is refreshed and displayed in the Full Screen mode. > Between Cursors - This option reduces the Scope display to the area between the cursors. Each time you click Autofit, the data is refreshed and displayed for the area between the cursors. > Permanent Full Screen - This option sets the Scope display permanently to the Autofit Full Screen display mode. >	Stop	
	Autofit	 screen. Click for the Scope to resize the display so that all data is displayed. You have four Autofit options: Full Screen - This option sets the Scope to resize the entire screen, thus each time you click Autofit, the data is refreshed and displayed in the Full Screen mode. Between Cursors - This option reduces the Scope display to the area between the cursors. Each time you click Autofit, the data is refreshed and displayed for the area between the cursors. Permanent Full Screen - This option sets the Scope display permanently to the Autofit Full Screen display mode. Permanent Between Cursors - This option sets the Scope display permanently to the Autofit Between the Cursors screen

1 W



Whenever you have activated one of the above display functions, <a>appears to indicate that it is active.

6.7.2 Setting Horizontal Scale

You set the horizontal scale (the X axis) of the Scope graph using the Horizontal

options. If the options are not visible, click 😬 to expand.

Horizontal	\bigcirc
Length(ms)	200.00
Sa	mpling (ms)
Auto	
Manual	1.00
:	Scale
	20.00 ms 🔻

Your options are:

- > Length
- > The length of the Scope X axis is for information only. It reflects the Sampling rate and Scale that you establish.
- > Sampling
- > Sampling reflects the point in time at which Scope measures the values. It can be:
 - Automatic In which case Scope determines, based on the Scale, where the sampling points are.
 - > Manual Which enables you to enter your own value.



If you enter a value that not within range of the Scope algorithm, Scope will enter the closest minimum value to the one you have entered.

- > Scale
- Scale establishes the value of each division of the X axis. It ranges between 0.05 ms/division to 10 sec/division.



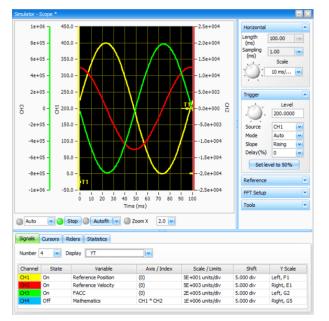
You can either select the value from the dropdown list, or use the dial button: 🗏

To use the dial button, place the mouse cursor over the button and drag it left or right.

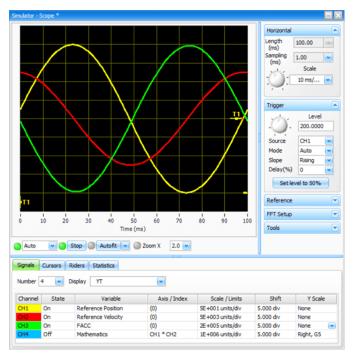
6.7.3 Ability to display Y-axis units

This feature includes three new properties for each Channel:

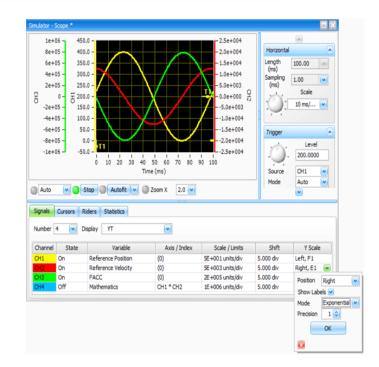
- > Scale Label Mode (General, Fixed Point, Exponential)
- > Scale Label Precision (digital number from 0 up to 99)
- > Scale Label Visible (true, false)
- > Scale Position (None, Left, Right)



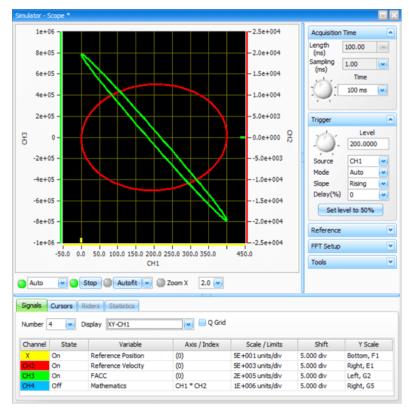
For YT or FFT modes the scales display as shown below.



If the scale position for all scales select as "None", the Scope display is:



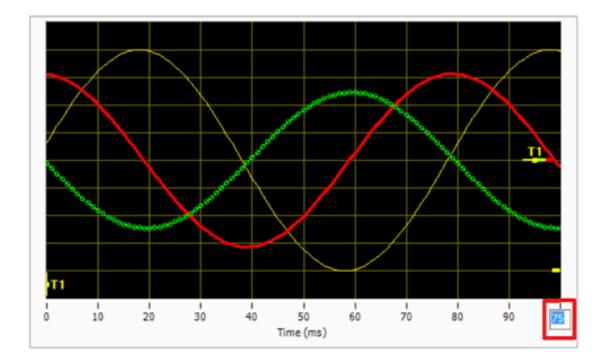
If the Scope display is set to the XY mode, then the Left/Right positions display as bottom position as shown.

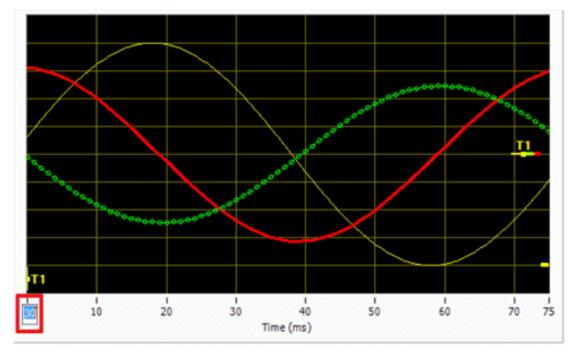


6.7.4 Setting X-axis zoom interval bounds

To select the X- Axis zoom interval bounds, click on Left/Right labels of the Time scale and enter the desired the value.

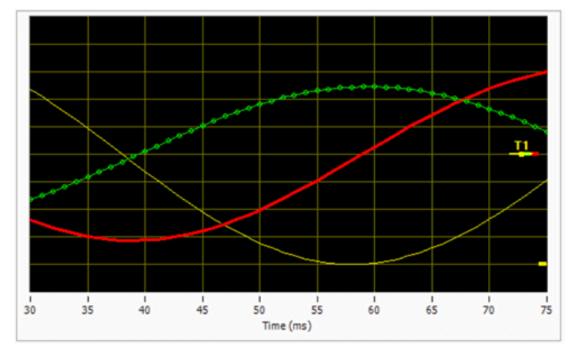
Example to change the maximum (upper) bound.





Example to change the minimum (lower) bound.

Result of after resetting the lower and upper bounds.

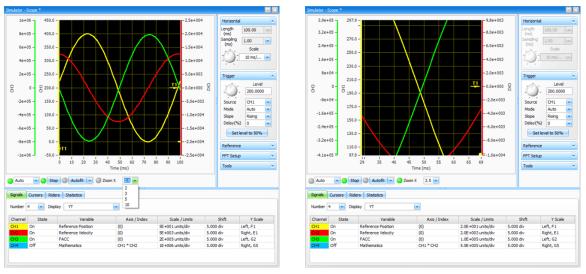


6.7.5 Zoom factor

The zoom factor provides the ability to specify a desired zoom level. The selectable range for the Zoom Factor is from 1 up to 10.

Example of Zoom Factor 2.5.

Scope display before setting the zoom factor Scope display after setting the zoom facor to 2.5.



6.7.6 Setting Triggers

You set the Triggers, that is, the points at which you want data collection to begin, of the Scope graph using the Trigger 🕥 options. If the options are not visible, click 💌 to expand.

Trigger	\bigcirc
Level	
	0.00
Source	CH1 •
Mode	Auto 🔻
Slope	Rising -
Delay(%)	0 •
Set	level to 50%

Your options are:

> Level

This is the threshold value of the signal for the start of data collection. When the signal reaches this value, data collection begins and the signal's graph is displayed.



It is recommended that you set the Trigger value broad enough to obtain a usable graph, then slowly fine tune the results.



You can either enter the value directly into the field, or use the dial button:

To use the dial button, place the mouse cursor over the dial and drag it left or right.

> Source

Select the triggering channel from the dropdown list.

> Mode

There are three possible modes (selected from the dropdown list):

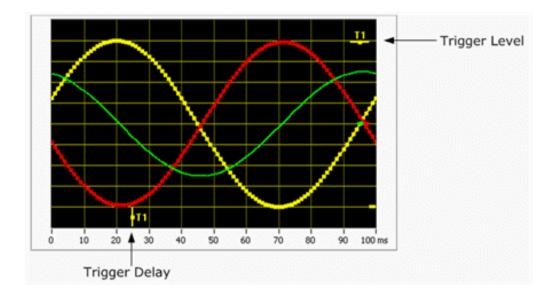
- > **Normal** Samples when the triggering signal is within the settings in the Trigger dialog box.
- Auto If the triggering signal is within the Trigger setting, this mode is the same as Normal. However, even if the triggering signal is outside the Trigger setting, after a short delay, it will be sampled. The sampling period is proportional to the Horizontal setting.
- > **Single** Samples the triggering signal only once over the length of the Horizontal setting and then stops. It repeats this for the next frame each time you click **Run**.
- > Slope

You can set the triggering to:

- > **Rising** Trigger on signal rising past trigger level.
- > **Falling** Trigger on signal falling past trigger level.
- > Delay

Delay polling for trigger until a percentage of the X axis, selected from the dropdown list, has passed.

The Triggers are displayed as follows:





6.7.7 Setting Reference Axis

You can use a References axis to assist you in analyzing simple graphical signals of motion. You set

the Reference axis using the Reference Interview options. If the options are not visible, click to expand.

Reference	\bigcirc
Axis	0 •
Signal Type	Sine 🔻
Period(ms)	100
Magnitude (units)	200
	Run

Your options are:

> Axis

Select the required axis from the dropdown list.

Reference		\diamond
Axis	0	•
Signal Type	0	
Signal Type	1	
Period(ms)	2	45
Magnitude	3	
(units)	4	
	5	
	6	

> Signal Type

Select the signal type from the dropdown list. The available signal types are:

- > PULSE
- > RAMP
- > SINE
- > Period

Enter the required period (in ms).

> Magnitude

Enter the required signal magnitude.

Once you have entered the your settings, click and the graph will be displayed reflecting your choices.



You may use the Riders (see Riders Tab) to view the exact values at points along the graph, like the maximum and minimum values.

Stop

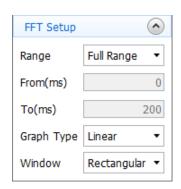
To stop the display and return to the regular Scope display click 📒

6.7.8 FFT Setup

The FFT option enables you to view the signals on the Scope in an FFT (Fast Fourier Transform) format. The MMI Scope has a wide variety of FFT algorithms that are available to you. The FFT format displays the Spectral Density against the Frequency

You set the FFT display using the FFT Setup options. If the options are not visible, click

💌 to expand.



Your options are:

> Range

The range can be:

- > Full Signal Covers the continuous run of the signal
- Window Covers a portion of the signal, which you set by entering values in From and To.

> Graph Type

The graph type can be:

- > Linear
- > dB (logarithmic)

> Window

You select the specific FFT format from this dropdown list.

Once you have set the parameters, in the **Signals** tab (see Signals Tab) select FFT from the Display dropdown to view the FFT display in the Scope.

Display YT YT XY-CH1	ble				
	Y .				
		Axis/Index	Scale / Limits	Shift	Y Scale
	ack Position	(0)	1E-06 units/div	5.000 div	None
XY-CH3	ack Velocity	(0)	1E-06 units/div	5.000 div	None
XY-CH4	ence Position	(0)	1E-06 units/div	5.000 div	None
FFT	n Error	(0)	1E-06 units/div	5.000 div	None
_	XY-CH4 FFT	XY-CH3 ack Velocity XY-CH4 ence Position	XY-CH3 ack Velocity (0) XY-CH3 ack Velocity (0) XY-CH4 ance Position (0)	XT-CH2 ack Velocity (0) 1E-06 units/div XY-CH3 ack Velocity (0) 1E-06 units/div XY-CH4 nce Position (0) 1E-06 units/div	XY-CH3 ack Velocity (0) 1E-06 units/div 5.000 div XY-CH4 ance Position (0) 1E-06 units/div 5.000 div

6.7.9 Tools

The Scope Tools option enables you to save your signal data to a file for later retrieval.

To save or load your data use the **Tools** Options. If the options are not visible, click

💌 to expand.

Tools		\bigcirc
	Save	
1	Load	

To Save Signal Data

1. Click **Save**. The Save Signals dialog is displayed:

Save S	Signals		x
File:			Browse
Signa	ls: Save In Format:	Mmi	
CH1	Feedback Position (0)	Mmi MatLab	45
CH2	Feedback Velocity (0)	Excel	
СНЗ	Reference Position (0)		
CH4	Position Error (0)		V
Rema	rks:		
	Save	Cancel	6

- 2. Select the file type desired. You have the options of:
- > MMI signal file with **.sgn** file extension.
- > Matlab data file with **.m** file extension.
- > Xcel CSV file with **.csv** file extension.
- **3**. Either enter a path and filename in the **File** field, or click **Browse** to find the path (and filename, if needed).
- 4. Click to unselect those signals whose data you do not want to save.
- 5. Click Save.

To Load Signal Data

1. Click **Load**.

Load Signals			x
File:		Brows	e
Signals:		Display i	n:
Remarks:			
			•
	Load	Cancel	۰
	LUGU	Cancer	

2. Either enter a path and filename in the **File** field, or click **Browse** to find the file.

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<u> </u>

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Scope signal data is stored in files having **.sgn** file extensions. Files saved on older versions of the MMI can be loaded.

The contents of the file are displayed, for example,

Load Signals	x
File: D:\Projects\MMI_Learn\scope.sgn	Browse
Signals:	Display in:
Feedback Position(0)	Ch1 🔹
Feedback Velocity(0)	Ch2 🔹
Reference Position(0)	Ch3 🔹
Position Error(0)	Ch4 🔹
Remarks:	
Date: 26/4/2020 14:20 SPiiPlus MMI Scope version: 2.91.0.220 Controller serial number: CA000003A Firmware version: 2.99.60.00	18
Load Cancel]

3. The Scope file contains the signal data that was collected in a previous session, arranged according the channels that were sampled. You have the option to change the assignment of these signals if you desire.

Click 💹 to view the channels to which the signal may be applied.

Load S	Signals	x
File:	D:\Projects\MMI_Learn\scope.sgn	Browse
Signa	ıls:	Display in:
Feed	lback Position(0)	Ch1 🔹
Feed	lback Velocity(0)	Off
Refe	rence Position(0)	Ch1
Posit	tion Error(0)	Ch2 Ch3
		Ch4
SPiiP Cont	rks: : 26/4/2020 14:20 /lus MMI Scope version: 2.91.0.220 roller serial number: CA000003A ware version: 2.99.60.00	18
	Load Cancel	J

You may select:

- > Off does not retrieve this particular data
- > **CH#** puts this data into the selected channel
- 4. Click Load



When the signals are loaded, they are loaded in the **Freeze** state. Once loaded, you can change the state to whatever you want. See **State**.

6.7.10 Signals Tab

The Signals tab is used for setting the channels that are to be graphed in the Scope.

Signals 🛛	Cursors Riders Statist	ics				
Number	4 • Display YT	•				
Channe	state	Variable	Axis/Index	Scale / Limits	Shift	Y Scale
CH1	On	Feedback Position	(0)	1E-06 units/div	5.000 div	None
CH2	On	Feedback Velocity	(0)	1E-06 units/div	5.000 div	None
CH3	On	Reference Position	(0)	1E-06 units/div	5.000 div	None
CH4	On	Position Error	(0)	1E-06 units/div	5.000 div	None

The following describes how you work with each field in the tab.

> Number

- > Display
- > State
- > Variable
- > Axis/Index
- > Scale/Limits
- > Shift

Number

You use the **Number** field to set the number of channels to be tracked.

- 1. Click 💌 to display the number of channels available. A list of numbers from 1 to 8 is displayed.
- 2. Click the last number to be displayed, for example, if you are measuring four channels, you would click **4**, if you are measuring eight channels (the maximum), you would click **8**.

The channels are displayed in the **Channel** column.

Display

You use the **Display** field to set the type of display you want on the Scope.

1. Click 💌 to display the options available.

Your display options are:

- > YT Channel(s) vs. Time. This is the most common display.
- > XY-CH# All signals measured against the selected channel.



If the XY-CH# display option is selected, then an option for a quadrature grid is available.

> To enable the quadrature grid, select the **Q grid** check box.

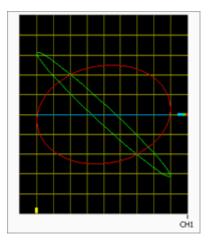
When **Q grid** is enabled, the ratio of the X axis scaling to the Y axis scaling remains constant as the display window is resized.

nulator - Scope				
			Acquisition Time	
			Length 100.00 (ms)	100
			Sampling (ms) 1.00	
			Time	
			100 ms	
			Trigger	
			Reference	
			FFT Setup	
			Tools	
			Save	
		CH1	Load	
Auto 💌	Run Autofit	🚽 🎯 Zoom		
Signals Curso	rs Riders Statistics		_	
Number 2	Display XY-CH1		Q Grid	
Channel	Variable	Axis / Index	Scale / Limits	
X F	eedback Position	(0)	SE+001 units/div	
CH2 R	eference Position	(0)	SE+001 units/div	

- > FFT Fast Fourier Transform display (also see FFT Setup)
- 2. Click the display option to activate it. For example:

Signals Cu	rsors Riders	Statistics	
Number	4 • Display	YT	-
Channel	State	YT XY-CH1	iable
CH1	On	XY-CH2	MFL
CH2	On	ХҮ-СНЗ	:axes[1
CH3	On	XY-CH4	erence
CH4	On	FFT	rosition Er

The Scope display changes to:



mapping the signals against the selected channel.

The Horizontal option of	hanges to Acquisition Time :
	Acquisition Time
	Length (ms) 200.00
	Sampling (ms) Auto Manual 1.00 Time 200.00 I V
	Trigger
	Reference 📀
	FFT Setup
	Tools 📀

This enables you to set the data collection time for measuring the value (in the same way as Setting Horizontal Scale).

State

A signal can have one of three states:

- > On the signal is active
- > Off the signal is inactive
- > Freeze the signal is frozen at its current value

To set the signal's state click the **State** field and select the state from the dropdown menu.

Variable

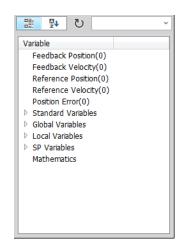
Signal values are tracked through various program variables, such as ACSPL+ variables, SP variables, user-defined variables, and the like. You use this field to track the signal via a specific variable.

To select the variable you want to track:

1. Click the **Variable** field, the Variables tree appears:

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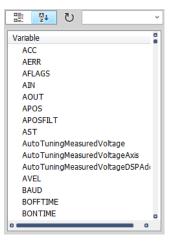




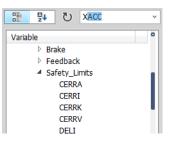
The list is accumulative, it maintains a history of all variables you have selected in the past.

2. Drill down to the variable you want by expanding the tree, where needed, and click the variable.

You can view the variables list sorted alphabetically by clicking ${}^{{\bf P}}$ Sorted.



You can type the variable name in the search bar:





The signal variable list items are:

ltem	Description	
Feedback Position	Motor position based on the FPOS variable.	
Feedback Velocity	Motor velocity based on the FVEL variable.	
Feedback Acceleration	Motor acceleration based on the FACC variable.	
Reference Position	Reference position based on the RPOS variable.	
Reference Velocity	Reference velocity based on the RVEL variable.	
Standard Variables	This branch lists the built-in ACSPL+ variables. These variables are broken down into: Axis_State Monitoring Motion Safety_Control Inputs_Outputs Program_Execution_Control System_Configuration Axis_Configuration Communication Commutation Data_Collection Servo_Loop Miscellaneous Obsolete	
Global Variables	Lists all global variables declared in any compiled buffer.	
Local Variables	Lists variables broken down by the buffers within which they are declared.	
SP Variables	Lists variables stored in the SPiiPlus controller RAM as part of the controller's firmware. The variables are broken down by controller.	
Mathematics	Signal is derived from an arithmetic operation performed on two channels. The operation is defined in the Axis/Index field.	

ſ	•

If a variable is an array or matrix, select an array element in the Axis/Index field.

•

Refer to the *SPiiPlus Command & Variable Reference Guide* and the *SPiiPlus ACSPL+ Programmer's Guide* for details on all the variables.

Axis/Index

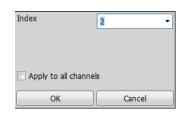
The **Axis/Index** field is used in three cases:

- > Selecting an index for an array variable
- Selecting a bit for a variable that can be bit-accessed (including elements of an array variable)
- > Defining a mathematical operation for two channels

Selecting a Real Array Index

To select an index for a real array variable:

1. Click the **Axis/Index** field for the array variable. A Select Index dialog box appears, for example:



	If the variable is a two-dimensional matrix, two Index fields appear.
2. (Enter the index number in the Index field

- 3. If you want it to apply the index to all of the channels being measured, select the **Apply to all channels** checkbox.
- 4. Click OK.

Selecting a Scalar Bit Number

To select a bit number for a bit-accessible scalar variable:

1. Click the **Axis/Index** field for the variable, the following dialog box appears:

Show Bit				
Apply to all channels				
ОК	Cancel			

2. Select the **Show Bit** checkbox. The dialog box expands to:

🗹 Show Bit	þ -			
Apply to all channels				
ОК	Cancel			

3. Enter the bit number and click **OK**.

	If array is a two-dimensional scalar matrix, the following appears:			
•	Ir	ndex	Ō	•
		Show Bit Apply to all channel	s	
		ОК	Cancel	
	In this case you have to	select both t	the array in	dex, and the bit number.

Defining a Mathematical Operation

To define a mathematical operation between two channels:

 Click the Axis/Index field for a variable defined as a Mathematics array variable. A dialog box appears:

Source1	CH2 •
Operation	Add 🔻
Source2	CH2 •
ОК	Cancel

- 2. Use the down arrow to select **Source1**
- 3. Use the down arrow to select the **Operation**. Your options are:
 - > Add
 - > Subtract
 - > Multiply
 - > Divide
- 4. Use the down arrow to select **Source2**. Click **OK**.

Scale/Limits

The **Scale/Limits** field is used in two cases:

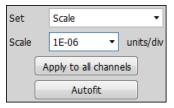
> To adjust the Y axis (vertical) units used for displaying of a selected signal in the graph

> To set the Y axis (vertical) limits used for displaying of a selected signal in the graph

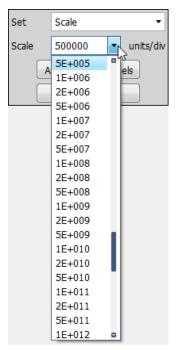
This is often useful for when the graph exceeds the borders of the Scope and you want to see the complete graph.

Adjusting the Y axis units

1. Click the **Scale/Limit** field for the desired signal. A dialog box appears:



- 2. Select **Scale** (default).
- 3. Use the dropdown list to adjust the scale:



٥г

Click **Autofit** to center the signal by altering the scale so that the entire graph is visible.

4. You can apply it to all channels by selecting the **Apply to all channels** checkbox.

Setting the Y axis limits

 Click the Scale/Limit field for the desired signal, and in the Set dropdown field select Limits.

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Set	Scale	-			
Scale	Scale				
Scale	Limits				
	Apply to all channels				
(Autofit				

2. Enter the maximum limit in the **Height** field, and the minimum limit in the **Low** field.





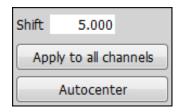
3. You can apply it to all channels by selecting the **Apply to all channels** checkbox.

Shift

You use the **Shift** field to move the graph of a selected signal along the Y axis (vertical).

This is often useful for when the graph is cluttered and you want to see a particular signal on the graph separated from the others.

1. Click the **Shift** field of the channel the display of which you want to move. A dialog box appears:



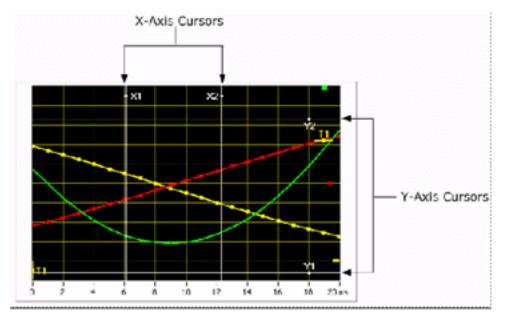
- 2. In the **Shift** field, enter the wanted adjusting of the scalel, or Click **Autocenter** to center the signal in the Scope display.
- 3. You can apply it to all channels by selecting the **Apply to all channels** checkbox.

6.7.11 Cursors Tab

The Cursors tab enables you to mark points on the Scope display where you are interested in seeing exactly what the values at the points are.

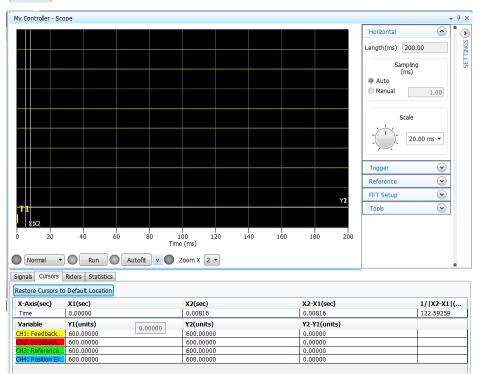
In addition, the cursors enable you to reduce the Scope display to a particular area of interest where you want to see the signal reactions within a given range.

There are four Cursors:



To set the Cursors:

1. Click Cursors The Cursors tab is displayed and the Cursors are displayed on the Scope.



- Set the X Cursors by placing the mouse cursor on them and dragging them left or right (depending on the cursor you are setting).
 As you move the X Cursors the values in the following change:
 - > X1(sec) the time on the X axis where the X1 Cursor is sitting.

- > X2(sec) the time on the X axis where the X2 Cursor is sitting.
- > X2-X1(sec) the time between the X2 Cursor and the X1 Cursor.
- > 1/(X2_X1)(Hz) the frequency of signal between the X2 Cursor and the X1 Cursor.
- 3. Set the Y Cursors by placing the mouse cursor on them and dragging them up or down (depending on the cursor you are setting).

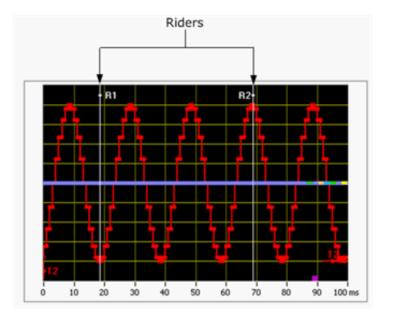
As you move the Y Cursors the values in the following change:>

- Y1(units) the amplitude of the signal at the time where the Y1 Cursor is sitting.
- > **Y2(units)** the amplitude of the signal at the time where the Y2 Cursor is sitting.
- > **Y2-Y1(units)** the difference in signal amplitude between the Y2 Cursor and the Y1 Cursor.
- 4. To view just the area of the Scope graph bounded by the Cursors select **Between Cursors** or **Permanent Between Cursors** from the **Autofit** dropdown list.
- 5. To reset the cursors to their original position, click Restore Cursors to Default Location.

6.7.12 Riders Tab

Riders are like Cursors (see Cursors Tab), but unlike Cursors they provide both the X and Y values at the same time.

There are two Riders:



To set the Riders:

1. Click Riders . The Riders tab is displayed and the Riders are displayed on the Scope.

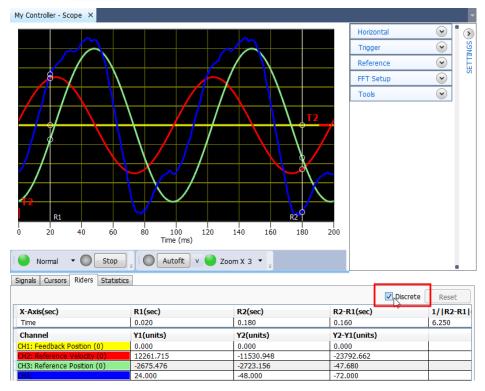
roller -	- Scope											
											Horizontal	
											Length(ms)	200.00
											Sa	mpling (ms)
											Auto	(ms)
											Manual	1
												Scale
												20.00 m
\dashv												20100 11
											Trigger	
											Reference	
											FFT Setup	
											Tools	
20)	40 6	i0 8	0 10 Time (0 12 (ms)	20 14	40 10	1 50	180	200		
mal	• 0	Run	Autofit	v 🔵 Zo	om X 2	•						
Curso	ors Ride	rs Statistics									·	
Riders	s to Defa	ult Location	Discrete									
(sec)		R1(sec)			R2(sec)				R2-R1(se	c)		1/
		0.00000			0.00000				0.00000			00
		M4 (MD(-1			VD V4 ((h - 1)		

0.00000	0.00000	0.00000	ω
Y1(units)	Y2(units)	Y2-Y1(units)	
0.00000	0.00000	0.00000	
0.00000	0.00000	0.00000	
0.00000	0.00000	0.00000	
0.00000	0.00000	0.00000	
	Y1(units) 0.00000 0.00000 0.00000	Y1(units) Y2(units) 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000	Y1(units) Y2(units) Y2-Y1(units) 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000

2. Set the Riders by placing the mouse cursor on them and dragging them left or right. As you move the Riders the values in the following change:

- > **R1(sec)** the time on the X axis where the R1 Rider is sitting.
- > **R2(sec)** the time on the X axis where the R2 Rider is sitting.
- > **R2-R1(sec)** the time between the R2 Rider and the R1 Rider.

- > 1/(R2_R1)(Hz) the frequency of signal between the R2 Rider and the R1 Rider.
- > Y1(units) the amplitude of the signal at the time where the R1 Rider is sitting.
- > Y2(units) the amplitude of the signal at the time where the R2 Rider is sitting.
- Y2-Y1(units) the difference in signal amplitude between the R2 Rider and the R1 Rider.
- 3. To reset the cursors to their original position, click Restore Riders to Default Location.
- Checking the Discrete checkbox causes TBD.



5. You can reset the values by clicking Reset Reset.



6.7.13 Statistics Tab

The Statistics tab provides you with various data connected with measurements of the signals displayed in the Scope.

Click Statistics to display the Statistics tab.

Signals Cursors Riders	Statistics						
Range Full Signal	▼ Fro	om(X1)		0.00 ms to(X2)	100000.00	ms Reset
Channel	Maximum	at(ms)	Minimum	at(ms)	Magnitude	Average	Std.Deviati
CH1: Feedback Position (0.000	0.000	0.000	0.000	0.000	0.000	0.000
CH2: Reference Velocity	12558.104	24.000	-12558.104	74.000	25116.208	0.591	8884.344
CH3: Reference Position.	2438.000	48.000	-2838.000	98.000	400.000	-2638.099	141.491
CH4:	52.000	1148.000	-52.000	178.000	104.000	-0.018	33.220

Using the **Range** dropdown list you can obtain statistics for:

- > Full Screen Displays the statistics for all signals that appear within the Scope boundaries.
- > Full Signal Displays the statistics for all signals whether they appear within the Scope or are beyond the Scope boundaries.
- > Between Cursors Displays the statistics for the signals within the boundaries of the X1 and X2 Cursors.



If you select **Between Cursors**, the X1 and X2 Cursors set using the appear. You can change the locations of the X1 and X2 Cursors using the **From(X1)** and **To(X2)** fields, or use the mouse to drag them to different positions. To reset values to default click**Reset**.

The signal statistics that are given are:

- > Maximum the maximum value a signal obtained, and the point on the X axis where it was obtained displayed in the at(ms) column.
- > Minimum the minimum value a signal obtained, and the point on the X axis where it was obtained displayed in the at(ms) column.
- > Magnitude the calculated maximum minus minimum signal values.
- > Average the average value, maximum plus minimum divided by 2.
- > Std. Deviation the standard deviation of the signal.

6.7.14 Setting Scope Plot Properties

The Scope's plot properties, such as color, line width, line style, and the like, of each signal is set in the Scope **Properties** window.

If the **Properties** window is not displayed, press **Ctrl+Alt+P**, or select **Properties Window** from **View** in the Main Menu (or use the Workspace right-click option - see **Working with Workspace Tree**).

General Plot Settin Cursors Color Grid Color Grid Visible Plot Area Color Plot Settings Channel Line Style Line Width Plot Color Point Style View Settings Numbers Precision		
Cursors Color Grid Color Grid Visible Plot Area Color Plot Settings Channel Line Style Line Width Plot Color Point Style View Settings		
Grid Color Grid Visible Plot Area Color Plot Settings Channel Line Style Line Width Plot Color Point Style View Settings	gs	
Grid Visible Plot Area Color Plot Settings Channel Line Style Line Width Plot Color Point Style View Settings	#FFFFFFFF	•
 Plot Area Color Plot Settings Channel Line Style Line Width Plot Color Point Style View Settings 	#FF808000	•
 Plot Settings Channel Line Style Line Width Plot Color Point Style View Settings 	\checkmark	
Channel Line Style Line Width Plot Color Point Style 4 View Settings	#FF000000	•
Line Style Line Width Plot Color Point Style 4 View Settings		
Line Width Plot Color Point Style View Settings	CH1	•
Plot Color Point Style View Settings	Solid	•
Point Style View Settings	3	\$
✓ View Settings	#FFFFFF00	-
-	None	•
Numbers Precision		
	3	÷
General Plot Settings	1	

The Scope properties are divided into three groups:

General Plot Settings

These properties relate to the Scope graphic display:

- > Cursors Color this sets the color of both the cursors and riders.
- > Grid Color this sets the color of the grid.
- > Grid Visible this checkbox toggles between displaying and not displaying the grid.
- > Plot Area Color this sets the color of the background of the graph.

Plot Settings

These properties relate to the plots of the signals:

> Channel - you use this dropdown list to select the signals to which the Plot Settings are to be applied:

4	Plot Settings	
	Channel	CH2 🔹
	Line Style	CH1
	Line Width	CH2 CH3
	Plot Color	CH3 LG CH4
	Point Style	CH5
4	View Settings	CH6 CH7
	Numbers Precision	CH8

> Line Style - this sets the line style of the plot of the selected channel, selected from a dropdown list:

4	Plot Settings		
	Channel	CH2	•
	Line Style	Solid	-
	Line Width	None	
	Plot Color	Solid	
		Dash	6
	Point Style	Dot	

- > Line Width this sets the width (in points) of the plot of the selected channel.
- Plot Color this sets the color of the plot of the selected channel which you select from a dropdown list (see Setting Color Properties).
- > Point Style you have the option of displaying the plot as a smooth curve, in which case there is no Point Style, or you can select the format that individual points on the plot are to be displayed from the dropdown list:

	Point Style	None	•
4	View Settings	None	
	Numbers Precision	Diamond K Rectangle Cross Plus	

View Settings

This property enables you to set the precision that the plot values are to be displayed.

6.8 Sin Cos Encoder Compensation and Monitoring

The Sin Cos Encoder Compensation tool enables you to:

- > Select axis for encoder measurements.
- > Display a Sin-Cos Lissajous curve graph of the wave form.
- Read a controller's gain, phase and offsets compensation parameters (SCGAIN, SCPHASE, SCSOFFS, and SCCOFFS).
- > Write new compensation parameters to the controller.
- > Examine the compensation effect of each parameter.

The **Sin Cos Encoder Compensation** can do the following:

- > Perform step-by-step calculations of the compensation parameters for Sin-Cos encoders based on user input.
- > Perform automatic calculations of the optimum compensation parameters set.
- > Perform monitoring for the calculated compensation parameters set.

6.8.1 Activating Sin Cos Encoder Compensation and Monitoring

To activate the Sin Cos Encoder Compensation tool:

- 1. From the Toolbox click **Diagnostics and Monitoring** to display the Diagnostics and Monitoring tools list.
- 2. Click Sin Cos Encoder Compensation.



You may use **Add Component** from the right-click menu of the controller in the Workspace Tree (see Controller Right-Click Options) to activate Sin Cos Encoder Compensation.

The **Sin Cos Encoder Compensation** window is displayed.

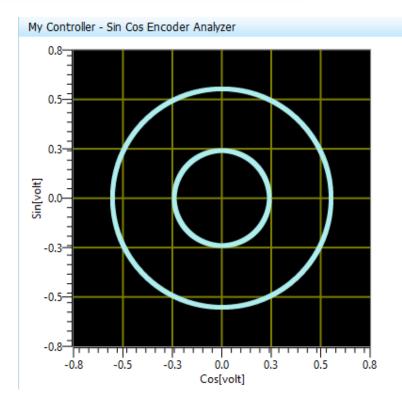
6.8.2 Sin Cos Encoder Compensation Window

The **Sin Cos Encoder Compensation** window consists of the following sections:

- > Measurement Curve Display
- > Compensation Execution Panel
- > Motion Operation Panel
- > Parameters Panel

6.8.2.1 Measurement Curve Display

The Measurement Curve is a Lissajous plot, an example of which is shown below, which displays the curve of the results of the measurements performed by **Sin Cos Encoder Compensation**.

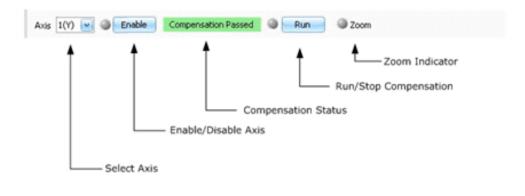


The Lissajous plot displays the aspect ratio of the phase shift between the input and output, with an aspect ratio of 1 (perfect circle) corresponding to a phase shift of \pm 90° as well as amplitude differences (ellipse).

As with the SPiiPlus MMI Application Studio , you can set cursors on the display through the Cursors tab of the Parameter Selection panel (see Setting Cursors).

6.8.2.2 Compensation Execution Panel

The Sin Cos Encoder Compensation Execution panel serves for executing the **Sin Cos Encoder Compensation** calculation routines:



The elements in this panel are:

Select Axis - used for selecting the axis from a dropdown list, the contents of which depend on the type of controller. There is a LED associated with the selected axis that can be:

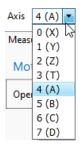
- > Grey the axis is not enabled
- > Green the axis is enabled.

If the axis is not enabled, you enable it by clicking the **Enable** button.



If you select an axis that is not connected to a Sin-Cos Encoder, it cannot be enabled.

Select the required axis from the dropdown list, for example:



- Compensation Status this field displays messages associated with the Sin Cos Encoder Compensation status. The messages that can be displayed are:
 - > **Compensation Off** the Sin Cos Encoder Compensation has not been activated. (You activate it by clicking the **Run** button).
 - > **Compensation in Progress** the Sin Cos Encoder Compensation is performing its measurements.
 - > **Compensation Passed** the Sin Cos Encoder Compensation has completed its measurements and the compensation is correct.
 - Compensation Failed the Sin Cos Encoder Compensation has completed its measurements and the compensation is not correct.
- Compensation Cancelled the Sin Cos Encoder Compensation has been stopped (when you click the Stop button) before the measurements have been completed. There is a LED associated with the status which can be:
 - Grey the Sin Cos Encoder Compensation has not been activated, or has completed its measurements.
 - > Green/blinking the Sin Cos Encoder Compensation has been activated and is working.
- Run/Stop button activates or halts the Sin Cos Encoder Compensation measurements, when clicked, the Run button changes to the Stop button for manually halting the measurements in progress.
- > **ZoomIndicator** you have the following Zoom options:



When the display has been zoomed, the Zoom LED (🏓) turns green.

- > Zoom In Hold Shift key and place the mouse cursor in the Scope display in area you want to zoom into. Click the Left mouse button to display the Zoom icon. When the icon appears, click the Left mouse button. Without releasing the Shift key, each time you click the Left mouse button, you increase the zoomed display.
- > Zoom In Area While holding the Shift key, press the Left mouse button and drag to mark the area you want to zoom, then release the mouse button.
- > Zoom Out While holding the Shift key, place the mouse cursor in the zoomed area and click the Right mouse button. Without releasing the Shift key, each time you click the Right mouse button, you zoom out one level.
- > Move Graph Hold Ctrl key and Left mouse button a hand is displayed. Drag the graph to where you want.
- > Undo To undo all zooms, press Shift + Backspace keys. (You can also undo the zoom by clicking the Zoom LED).

6.8.2.3 Motion Operation Panel

You use the Motion Operation panel to select the operation type for the Sin Cos Encoder: compensation or monitoring.

6.8.2.4 Parameters Panel

You use the Parameter panel to set up parameters and display options you want. The panel has three tabs:

- > Measurement Tab
- > Cursors Tab
- > Statistics Tab

6.8.2.4.1 Measurement Tab

The Measurement tab is used for defining the required input measurement parameters and to control the output results.

You can change the Target values in Monitoring and Compensation modes.

Once you are in compensation mode, pressing the run button will start the compensation algorithm. Based on the value in Mode (Automatic or Manual) - motion will be performed either by MMI commands or the user phsically moving the motor.

If Automatic mode is selected then the user may change the velocity of the stage commanded by the MMI from its default value, as determined by the algorithm.

If Manual mode is selected the user may either move the stage by hand or write a program that will execute a motion.

Measurement Cursors Statistics		
Motion	Compensation Criteria	Parameters 📀
Operation Compensation -	Target Result	SCGAIN 1.0000 Read
Mode Manual 💌	Iterations 20 0	SCPHASE 0.0000
	Asymmetries 0.02 0.00000 0	SCSOFFS 0.0000 Set
	X Offset 0.02 0.00000 0	SCCOFFS 0.0000
	Y Offset 0.02 0.00000 0	SLEBIASA 0.0000 Default
	Slope 0.05 0.00000 •	SLEBIASB 0.0000
	Max. Error 72.58766 0.00000 O	
	Default In Range O	

Alternatively, the user can choose automatic mode, and set the velocity, as illustrated below.

Measurement Cursors Statistics Motion	 Compensation 	ion Criteria		Parameters
Operation Compensation		Target	Result	SCGAIN 1.0000 Read
Mode Automatic -	Iterations	20	0 0	SCPHASE 0.0000
Velocity 25600.0000 🗘 Default	Asymmetries	0.02	0.00000	SCSOFFS 0.0000 Set
	X Offset	0.02	0.00000	SCCOFFS 0.0000
	Y Offset	0.02	0.00000	SLEBIASA 0.0000 Default
	Slope	0.05	0.00000	SLEBIASB 0.0000
	Max. Error	72.58766	0.00000	
		Default	In Range 🔘	

Measurement	Cursors	Statistics			
Motion			Compensation	ion Criteria	
Operation I	Monitoring	•		Target	Result
			Iterations	20	0
			Asymmetries	0.02	0.00000 •
			X Offset	0.02	0.00000 •
			Y Offset	0.02	0.00000 •
			Slope	0.05	0.00000 •
			Max. Error	72.58766	0.00000 •
				Default	In Range 🔘

Under monitoring operation a limited set of criteria can be set.

Motion

When Automatic mode is selected the velocity field appears and can be set.

lotion	Compensation Criteria	Parameters
Operation Compensation 🔻	Target Result	SCGAIN 1.0000 Read
Iode Automatic 🔻	Iterations 20	0 • SCPHASE 0.0000
/elocity 25600.0000 🗘 Default	Asymmetries 0.02 0.000	00 O SCSOFFS 0.0000 Set
	X Offset 0.02 0.000	00 SCCOFFS 0.0000
	Y Offset 0.02 0.000	00 O SLEBIASA 0.0000 Defaul
		SLEBIASB 0.0000
	Max. Error 72.58766 0.000	00 •
	Default In Rar	nge 🔍

Compensation Criteria

This section displays the target criteria used by the **Sin Cos Encoder Compensation** when making the calculations and current values of calculated parameters along with a set of LEDs. If the current value of any parameter is equal to or less than the target value, the associated LED is Green (otherwise it is Red if the value fails, or Grey if the parameter is not relevant).

The criteria are:

- > Iterations the number of iterations that the **Sin Cos Encoder Compensation** is to perform during the measurements.
- Asymmetries Max(dx,dy) Min(dx,dy), where dx is X_{final point} X_{start point}, and dy is Y_{final point} Y_{start point}. If this is zero, the graph is a perfect circle.
- > Shift X the offset on the X axis
- > Shift Y the offset on the Y axis
- > Slope dy/dx, where dx is X_{final point} X_{start point}, and dy is Y_{final point} Y_{start point}.

You can make changes to the values of the **Target** fields when fine-tuning the compensation.

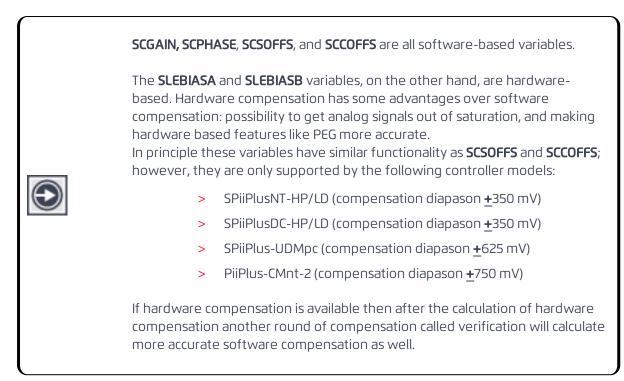


Clicking **Default** sets default values of the target calculated parameters.

Parameters

This section lists the ACSPL+ variables that are connected with managing Sin-Cos encoders. These are:

- SCGAIN Modify the amplitude of the COS signal, to compensate amplitude difference between the SIN/COS signals
- SCPHASE Modify the phase of the COS signal, to compensate phase difference between the SIN/COS signals (phase should be 90 degrees)
- > SCSOFFS Compensating SIN signal offset
- > SCCOFFS Compensating COS signal offset
- > SLEBIASA
- > SLEBIASB



You have the option of changing the values by inputting new values in the appropriate fields. Details of these variables are provided in the *SPiiPlus Command & Variable Reference Guide*.

There are three action buttons associated with this section:



6.8.2.4.2 Cursors Tab

The Cursors tab enables you to mark points on the display where you are interested in seeing exactly what the values at the points are.

There are two cursors, **X1** and **X2**, for delimiting the Cos voltage values, and two cursors, **Y1** and **Y2**, for delimiting the Sin voltage. As the **Sin Cos Encoder Compensation** performs its routines, the values at the cursor settings are displayed in the field below the graph. For setting the cursors see **Setting Cursors**.

6.8.2.4.3 Statistics Tab

For each run, the **Sin Cos Encoder Compensation** builds a statistics table consisting of compensation calculation measurements in the Statistics tab:

The rows are color-coded, Green for those values that passed the compensation measurements, and Red for those that failed.

At the bottom of the table the **Sin Cos Encoder Compensation** adds a line containing the average values of the variables. There is a separate line for each axis that was checked.

Right-clicking on any row displays a menu with the following options:

- Set Parameters selecting this option causes the Sin Cos Encoder Compensation to use these variable values for purposes of making the measurement.
- > Save to Flash selecting this option causes Sin Cos Encoder Compensation to save the values to the controller's flash memory.
- > **Delete** selecting this option deletes the row from the Statistics.
- > **Clear All** selecting this option removes all the values from the Statistics.

6.8.3 Running Sin Cos Encoder Compensation

To perform automatic encoder compensation:

- 1. From the Motion Operation panel, select **Compensation**.
- 2. From the Execution pane select axis from the **Axis** dropdown list.
- 3. Click Enable.
- 4. Click Run.

before encoder compens following is displayed: The easiest way to comm	with the encoder is a brushless motor, it has to be commutated sation. In the event that it has not been commutated, the nutate the motor at this point is to enter the COMMUT unication Terminal , for example:
	3N1234568 - Communication Terminal
Then click Run again.	Show Mescanes. Rackmound Communication

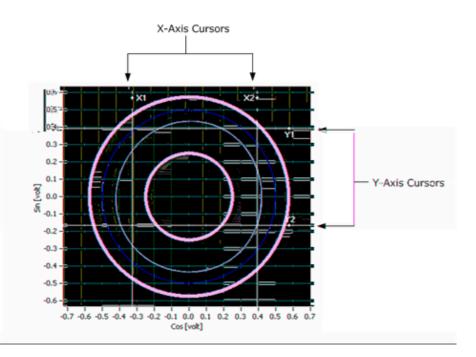
If the compensation is successful, go to the Measurement Tab of the Parameter Selection panel and save the values to the controller's flash memory by clicking **Set** in Measurement Tab.

6.8.4 Setting Cursors

You can use Cursors to mark points on the display where you are interested in seeing exactly what the values at the points are.

In addition, the cursors enable you to reduce the display to a particular area of interest where you want to see the signal reactions within a given range.

There are four Cursors:



To set the Cursors:

- 1. Click the Cursors tab of the Parameter Selection panel. The Cursors are displayed on the graph.
- 2. Set the X Cursors by placing the mouse cursor on them and dragging them left or right (depending on the cursor you are setting).
- 3. As you move the X Cursors the values in the following change:
 - > X1(volt) the cosine voltage on the X axis where the X1 Cursor is sitting.
 - > X2(volt) the cosine voltage on the X axis where the X2 Cursor is sitting.
 - X2-X1(volt) the difference of cosine voltages between the X2 Cursor and the X1 Cursor.
- 4. Set the Y Cursors by placing the mouse cursor on them and dragging them up or down (depending on the cursor you are setting).
- 5. As you move the Y Cursors the values in the following change:
 - > Y1(volt) the sine voltage on the Y axis where the Y1 Cursor is sitting.
 - > **Y2(volt)** the sine voltage on the Y axis where the Y2 Cursor is sitting.
 - > **Y2-Y1(volt)** the difference of sine voltages between the Y2 Cursor and the Y1 Cursor.

6.8.5 Setting Sin Cos Encoder Compensation Properties

The Lissajous Curve properties, such as line color, width, style, and the like, of each graph is set in the Sin Cos Encoder Compensation **Properties** window.

If the **Properties** window is not displayed, press **Ctrl+Alt+P**, or select **Properties Window** from **View** in the Main Menu (or use the Workspace right-click option - see **Working with Workspace Tree**).

	General Plot Settir	200	
-	Cursors Color	#FFFFFFF	
	Grid Color	#FF808000	•
	Grid Visible		
	Plot Area Color	#FF000000	•
⊿	Plot Settings		
	High Limit Diameter	1.15	¢
	Limits Line Width	5	÷
	Limits Plot Color	#FFAFEEEE	•
	Low Limit Diameter	0.5	÷
	Reference Line Wi	1	ŧ
	Reference Plot Color	#FF00FF00	•
G	eneral Plot Settings	;	

The Sin Cos Encoder Compensation properties are divided into two sections:

General_Plot_Settings

This section enables you to set the background properties of the graph:

- > Cursors Color for setting the color of the cursors.
- > Grid Color for setting the color of the background grid.
- > Grid Visible a checkbox for toggling between the display (default)/non-display of the grid.
- > Plot Area Color for setting the color of the background of the graph.

Plot Settings

This section enables you to set the properties of the graph:

Plot - there are four possible plots: Measure, Initial, Reference, Limits, each with its own set of properties. You select the plot for which you want to set the properties from the dropdown list:

Plot	Measured 😽
Plot Color	Measured
Point Style	Initial 13
Line Style	Reference

- > Once you have select the plot, you can set:
 - > Plot Color for setting the color of the selected plot.
 - Point Style for setting the style of the points used in displaying the graph of the selected plot.
 - > Line Style for setting the style of the line used in displaying the graph of the selected plot.

- > Line Width for setting the thickness of line used in displaying the graph of the selected plot.
- > High Limit Diameter for setting the diameter of the outside limit (maximum) that is displayed.
- > Low Limit Diameter for setting the diameter of the inside limit (minimum) that is displayed.

6.8.6 Running Sin Cos Encoder Monitoring

To perform encoder compensation monitoring:

- 1. From the Motion Operation panel, select **Monitoring**.
- 2. From the Execution pane select axis from the **Axis** dropdown list.
- 3. Click Enable.
- 4. Click Run.

6.9 Variables Manager and Watch

Variables Manager and Watch is used for viewing the values of ACSPL+ standard variables, user global and local variables, and SP variables.

It is useful during debugging sessions or when the value of a variable needs to be observed in realtime.

Variables Manager and Watch provides two types of display:

- > Quick Viewer for viewing the current values of selected variables.
- > Watch for viewing the values of selected variables as they change in real-time.

6.9.1 Activating Variables Manager and Watch

To activate Variables Manager and Watch:

- From the Toolbox click **Diagnostics and Monitoring** (to display the Diagnostics and Monitoring tools list.
- 2. Click Variables Manager and Watch.



You may use **Add Component** from the right-click menu of the controller in the Workspace Tree (see Controller Right-Click Options) to activate the **Variables Manager and Watch**.

Diagnostics and Monitoring

 No conside - Variables Ranger and Watch
 Image: Consid

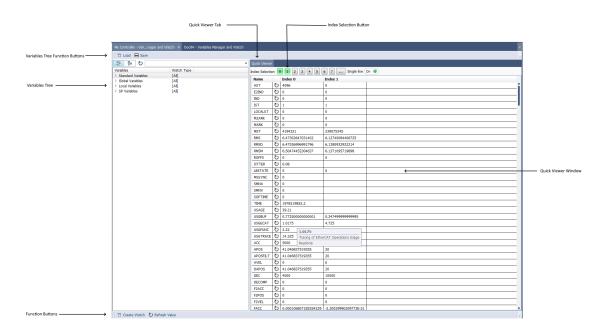
The Variables Manager and Watch main window is displayed.



When you first activate **Variables Manager and Watch**, it opens in the Quick View mode. As you add watches, these are displayed in their own tabs.

6.9.2 Quick Viewer

The **Quick Viewer** is used to view the current values of variables selected from the Variables Tree.



Quick Viewer consists of:

- > The Variables Tree for selecting the variable for display
- > Index Selector for selecting the index of the variable
- > Quick Viewer window displaying the values of the selected variable

6.9.2.1 The Variables Tree

The Variables Tree, which appears in both the **Quick Viewer Mode** and the **Watch Mode**, is used to select the variable for viewing. You can select a group of variables, a single variable, an array element, or a bit of an integer.

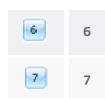
The following function buttons are associated with the Variables Tree:

	Group - displays the variables according to their groups.
₽	Sort - displays the variables in alphabetic order.
G	Refresh - refreshes the Variable Selector list.
	Search - Entering the name of the required variable in the field (or a partial name) displays the variables starting with the one you entered, for example:

6.9.2.2 Index Selector

You use the Index Selector to display the value of the variable for the selected Index. Each Index is associated with an axis:

0	0
1	1
2	2
3	3
4	4
5	5





If no Index Selection button has been selected, then all of the variable values are displayed in one column, labeled **Value**.

When you click an Index button, the value for that Index replaces whatever was previously displayed.

To cancel the display click the button again.

The Index Selector has an additional button: 🔤, which enables you to select multiple axes for display.

6.9.2.3 Selecting Multiple Axes

To select multiple axes:

1. Click . the Index Selection dialog is displayed:

Index Selection	×
 ✓ Index 0 ☐ Index 1 ☐ Index 2 ☐ Index 3 ☐ Index 4 	•
Index 5 Index 6 Index 7 Index 8	
Index 9 Index 10 Index 11 Index 12 Index 13	
 Index 14 Select all 	•

2. Select the required axes by clicking the checkbox associated with the Index (or select **Select All** for all of the axes) and close the dialog window.



To cancel the display of a particular Index click and deselect the Index checkbox.

6.9.2.4 Selecting Variables

You use the Variables Tree, which appears in both the **Quick Viewer Mode** and the **Watch Mode**, to select the variable. You can select a group of variables, a single variable, an array element, or a bit of an integer.

Doc94 - Variables Manager and Wat	ich ×	
🔁 Load 🛛 🗮 Save		
BOFFTIME		•
Variables	Watch Type	
Program_Execution_Control	[AII]	
System_Configuration	[AII]	
Axis_Configuration	[All]	
▲ Brake	[AII]	
BOFFTIME	real(4)	
BOFFTIME(0)	real	
BOFFTIME(1)	real	
BOFFTIME(2)	real	
BOFFTIME(3)	real	
BONTIME	real(4)	
VELBRK	real(4)	
Feedback	[All]	

The Variables Tree consists of the following columns:

- > Variable containing a tree of groups, variables, array element and bits (for integers)
- > Watch Type containing the variable type

Using the Variables Selector you can:

- > Select a Group
- > Select a Single Variable
- > Select an Array Element
- > Select a Bit of an Integer

6.9.2.4.1 Select a Group

To select a group click the variable name with **[All]** in the Variables Selector Watch Type column:

Doc94 - Variables Manager and Wat	tch ×
🔁 Load 🛛 🗮 Save	
BOFFTIME	-
Variables	Watch Type
Program_Execution_Control	[AII]
System_Configuration	[AII]
 Axis Configuration 	[AII]
🖉 Brake	
BOFETIME	real(4)
BOFFTIME(0)	real
BOFFTIME(1)	real
BOFFTIME(2)	real
BOFFTIME(3)	real
BONTIME	real(4)
VELBRK	real(4)
Feedback	[All]

6.9.2.4.2 Select a Single Variable

To select a single variable click its corresponding cell in Variables Selector.

						Colored and a	Autobal Manuary	
						Select mode	Quick Viewer	
🗟 😫 🔄 🍫			Index Selection	0 1 2 3 4 5 6	·]			
iables	Watch	4	Name	Value				
Standard Variables	[AI]		> APOS	(0, 0, 0, 0, 0, 0, 0, 0)				
- Axis_State	[AI]	11						
- APOS	array							
- APOS(0)	Realar	-						
- APOS(1)	scalar							
- APOS(2)	scalar							
- APOS(3)								
- APOS(4)	scalar							
- APOS(5)								
- APOS(6)								
APOS(7)	scalar							
B- AST	array							
⊕– AST(0)								
B- AST(1)								
⊕– AST(2)								
E- AST(3)								
⊕– AST(4)	scalar							
B- AST(5)								
⊕– AST(6)								
⊕- AST(7)								
- DAPOS	array							
E2IND	array							
⊕- F2POS	array							
F2VEL	array							
⊕- FACC	array							
B- FPOS	array							
⊕ FVEL	array	-						
d no.	aman I	20 U _						

6.9.2.4.3 Select an Array Element

All arrays have Watch Type = array. To expand the list of elements, click • . After you have expanded the list, click any of its elements.

¢ 🔛				Select mode	Quick Viewer	
🖴 iž 💈		Index Selection	0 1 2 3 4 5 6 7			
ariables	Watch	Name	Value			
	[AI]	> APOS(2)	Click here			
	[AI]					
	array					
- APOS(0)						
- APOS(1)						
- APO5(2)						
- APOS(3)						
- APOS(4)						
- APOS(5)						
- APOS(6)						
- APOS(7)	scalar					
	array					
AST(0)		-				
B- AST(1)						
⊕– AST(2)						
⊕- AST(3)						
⊕– AST(4)						
B- AST(5)						
⊕– AST(6)						
	scalar					
	array					
	array					
	array					
	array					
	array					
	array					
	array					
d no.						

6.9.2.4.4 Select a Bit of an Integer

If a single variable or an array element is an integer, then to the right of its name you see . Clicking this expands the integer to reveal the bits.

After you have expanded the list of bits, click of them.

Ø 🛃							Select mode	Quick Viewer	
👬 12	\$			Index Selec	tion 0 1 2 3	4 5 6 7			
ariables		WatchType	4	Name	Value				
⊕- IND	•	array		> SMNA(0)	.1 Click here				
⊕- IST		array							
⊕- M2/	ARK	array							
⊕- MA	RK	array							
⊕- MP(05	array							
⊕- MST	r	array							
⊕- PE		array							
E- RAG	cc	array							
⊕- RO	FFS	array							
⊕- RPC	DS	array							
⊕- RV8	ÐL.	array							
Monitor	ring	[AI]							
⊖- SM		array							
e-	SMNA(0)	scalar							
	- SMINA(0).0								
	SMNA(0).1								
	- SMINA(0).2								
	- SMINA(0).3								
	- SMNA(0).4								
	- SMNA(0).5								
	- SMINA(0).6								
	- SMINA(0).7								
	- SMINA(0).8								
	- SMINA(0).9								
	- SMINA(0).10								
	- SMNA(0).11								
	- SMNA(0).12		~						

6.9.2.5 Displaying a Variable's Value

In order to display the current value of a variable

- 1. Select the variable in the Variables Selector panel.
- 2. In the Quick Viewer window click its cell.

i 🖉					Select mode	Quick Viewer
🔛 12 🛛 🗢			Index Sele	ction 0 1 2 3 4 5 6 7 .		
riables	WatchType	1	Name	Value		
- Standard Variables	[AI]		> AST	Clickhere		
- Axis_State	[AI]			R€		
é- APOS	array	-				
- APOS(0)	scalar					
- APOS(1)	scalar					
- APOS(2)	scalar					
- APOS(3)	scalar					
- APOS(4)	scalar					
- APOS(5)	scalar					
- APOS(6)	scalar					
- APOS(7)	scalar					
B- AST	array					
⊕– AST(0)	scalar					
B- AST(1)	scalar					
⊕– AST(2)	scalar					
E- AST(3)	scalar					
⊕– AST(4)	scalar					
E- AST(5)	scalar					
E AST(6)	scalar					
	scalar					
E- DAPOS	array					
E2IND	array					
⊕- F2PO5	array					
F2VEL	array					
B- FACC	array					
E- FPOS	array					
PVEL	array	~				
d no.						

6.9.2.6 Update Variable Values

You should be aware that the Quick Viewer does not maintain a running display of the current values of the variables. From time to time you have to update the values. To do this click **Refresh Values**

6.9.2.7 Quick Viewer Properties

The Quick Viewer properties are:

Global	·
Name	Variables Manager
Max dimensions	
Max column dimensi	5
Max row dimension	5

- > Max column dimension width of column.
- > Max row dimension height of row.

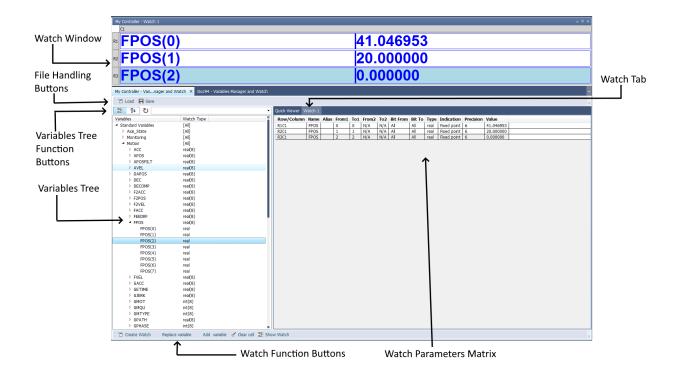
6.9.3 Watch

The Watch, unlike the Quick Viewer, is used for real-time monitoring of selected variables.

6.9.3.1 Creating a Watch

To create a Watch:

- 1. Select the variable from the Variables Tree (see Components).
- Click Create Watch (Create Watch). The Watch is displayed in a new tab.



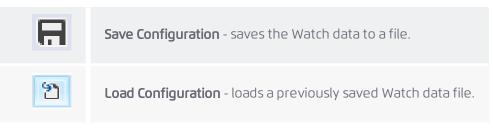
6.9.3.2 Watch Display

The Watch display has the following elements:

- > File Handling Functions
- > Watch Parameters Matrix
- > Modifying Watch Parameter Matrix Fields

6.9.3.2.1 File Handling Functions

The file handling functions enable you to save and retrieve Watch data.



6.9.3.2.2 Watch Parameters Matrix

The Watch Parameters Matrix shows the parameters of each cell displayed in the Watch window. The Matrix has the following columns:

- > Name The name of the variable
- > Alias Enables you to enter a more meaningful name of the variable
- > From1 Starting index of an array

Version 3.02

- > To1 Ending index of an array
- > From2 Starting index of a 2-dimensional array
- > To2 Ending index of a 2-dimensional array
- > Bit Bit number of the variable being monitored (or **All** if all the bits are being monitored)
- > Type The type of the variable (int, real, etc.)
- Indication Numerical representation of the value (Decimal, Hexadecimal, Binary, Fixed Point, etc.)
- > Precision For Real numbers this indicates the number of decimal points displayed
- > Value The detected value of the variable being monitored

6.9.3.2.3 Modifying Watch Parameter Matrix Fields

The Watch Parameter Matrix enables you to modify what is displayed in the Watch window. Depending on the variable, you can select what is displayed by clicking the field in the matrix and

click the down arrow ($\stackrel{{\scriptstyle \blacksquare}}{=}$) to select from the dropdown list.

For example, you may want to see a different variable momentarily. You click the **Name** field and select the required variable:

Row/Column	Name	Alias	From1	To1
R1C1	FPOS		0	0
R2C1	FPOS		1	1
R3C1	FPOS 🗡		2	2
	FPOS	•		
	FVEL			
	FVFIL			
	G_01WC	s		
	G_02WC	s		
	G_03WC	s		

This variable and its values are now displayed in the Watch window. To return to the original variable, you repeat this process and select the original variable.

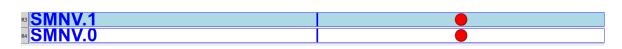
Another modification you can make is change the **To** or **From** indices of the variable by:

Fro	From1		
0		0	
1		1	
2	٢	2	
All		1	
0			
1			
2			
3			
4			
5			
6			
7			

If the variable that's being watched is a bit, you can select whether to show its numeric value, or as a Boolean display (True/False).

Туре	Indication
real	Fixed point
real	Fixed point
real	Fixed point
int	Decimal 🔻
	Decimal
	Boolean

When you select **Boolean**, instead of 0 or 1, you get a graphic display in the Watch window, for example:



6.9.3.3 Replace a Variable

To replace a variable in the Watch:

- 1. In the Watch Parameter Matrix select the row of the variable you want to replace.
- 2. In the Variables Tree select the variable you want it to be replace by.

37	12 0			Quick Viewer	Watch1										
/ariable	5	Watd	hType												
- Star	dard Variable	s (All)		Row/Column	Name	Alias	From1	To1	From2	To2	BR	Type	Indication	Precision	Value
₽-	Axis_State	[AI]	12	R1C1	ECERR		N/A	N/A	N/A	N/A	Al	int	Decimal		0
€-	Monitoring	[AI]		R2C1	MERR		0	0	N/A	N/A	All	int	Decimal		0
₽-	Notion	[AI]	_	land a second se	BOFFTIME		0	0	N/A	N/A	Al	real	Fixed point		50.000.
	Safety_Contro	ol [Al]		> ROLI	DOTTIONE		U.	U	nya.	NUA	A8	rea	Proced poinc	0 💌	50.000.
	- AERR	array	8												
	- ECERR	scalar													
	B- ECST	scalar													
	- FAULT	array													
	⊕-FAULT	(0) scalar													
	E-FAUL	nt) scalar													
	- FAULT														
		(2) scalar													
	B- FAULT	f(2) scalar f(3) scalar													
	⊕- FAULT ⊕- FAULT	(2) scalar (3) scalar (4) scalar													
	⊕- FAULT ⊕- FAULT ⊕- FAULT	((2) scalar ((3) scalar ((4) scalar ((5) scalar													
	⊕- FAULT ⊕- FAULT ⊕- FAULT ⊕- FAULT	(2) scalar (3) scalar (4) scalar (5) scalar (6) scalar													
	⊕- FAULT ⊕- FAULT ⊕- FAULT ⊕- FAULT ⊕- FAULT	(12) scalar (13) scalar (14) scalar (15) scalar (16) scalar (17) scalar													
	 ⊕- FAULT ⊕- FAULT ⊕- FAULT ⊕- FAULT ⊕- FAULT 	(2) scalar (3) scalar (4) scalar (5) scalar (6) scalar (7) scalar (7) scalar (8) scalar													
	E-FAULT E-FAULT E-FAULT E-FAULT E-FAULT E-FAULT E-FAULT	(2) scalar (13) scalar (14) scalar (15) scalar (16) scalar (17) scalar (17) scalar (17) scalar (18) scalar (19) scalar													
		((2) scalar ((3) scalar ((4) scalar ((5) scalar ((6) scalar ((7) scalar ((8) scalar ((9) scalar (10) scalar													
		(2) scalar (3) scalar (4) scalar (5) scalar (6) scalar (7) scalar (7) scalar (7) scalar (7) scalar (7) scalar (8) scalar (9) scalar (10) scalar (11) scalar													
		(2) scalar (3) scalar (4) scalar (5) scalar (6) scalar (7) scalar (8) scalar (9) scalar (10) scalar (11) scalar (12) scalar													
		(2) scalar (3) scalar (4) scalar (5) scalar (6) scalar (7) scalar (8) scalar (9) scalar (10) scalar (11) scalar (12) scalar (13) scalar													
		(2) scalar (3) scalar (4) scalar (5) scalar (6) scalar (7) scalar (8) scalar (9) scalar (10) scalar (11) scalar (12) scalar (13) scalar (14) scalar													

3. Click Replace variable (Replace variable).

6.9.3.4 Add a Variable

To add a variable to the Watch:

1. In the Variables Tree select the variable you want to add.

SPiiPlus MMI Application Studio User Guide 6. Diagnostics and Monitoring

- 2. Click Add variable (Add variable).
- 6.9.3.5 Remove a Variable

To remove a variable from the Watch:

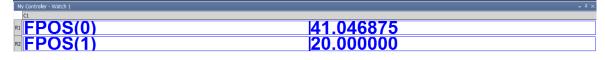
- 1. In the Watch Parameter Grid select the variable you want to remove.
- 2. Click **Clear cell** (< Clear cell).

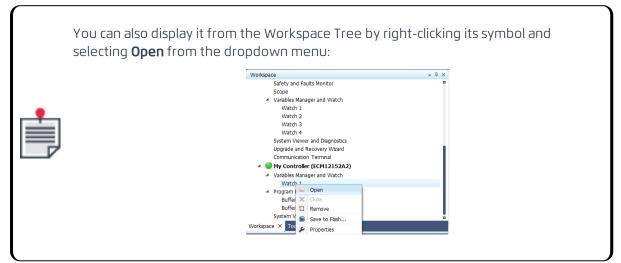
6.9.4 Watch Window

A Watch window consists of rows which can contain several columns. The display of each variable consists of the variable's name and its value. The value is constantly updated in the display.

6.9.4.1 View Watch

In the event that you have closed the Watch window, you can recall it by clicking **Show Watch** (**Show Watch**) in the Watch Parameters Matrix.





6.9.4.2 Removing a Watch

To remove a Watch:

- 1. If it is not displayed, switch to the **Workspace** panel.
- 2. Right-click the Watch you want to remove.
- 3. Select **Remove** from the dropdown menu.

						_	
Workspace				Ŧ	џ	×	
Safety and Faults Monitor						۰	
Scope	Scope						
 Variables Manage 	 Variables Manager and Watch 						
Watch 1	Watch 1						
Watch 2							
Watch 3							
Watch 4							
System Viewer a	and D	Diagnostics					
Upgrade and Red	Upgrade and Recovery Wizard						
Communication	Term	ninal				L	
🔺 🤍 My Controller ((ECM	112152A2)				L	
 Variables Manage 	er an	d Watch				L	
Watch 1		-				L	
 Program Manage 		Open				L	
Buffer 1	х	Close				L	
Buffer 2	×:	Remove					
System Viewer	۲	Save to Flash					
Workspace × Toolbox	۶	Properties					

6.9.4.3 Save/Load Watch

Save Watch Data

To save Watch data:

1. From the toolbar click **Save Configuration** (🕞 Save), the following prompt appears:

Save configuration to file	×
V Watch 1	
	Save Cancel

2. Click **Save**, a browser opens enabling you to save the data:

🛃 Save As									×
	> This PC > Data (I	D:) → Projects :	> MMI_Learn		~ Ö	Search	MMI_Learn		P
Organize 👻 Ne	w folder							8:: •	0
This PC		^ Name	^	D	ate modified		Туре		Size
🧊 3D Objects				No items mat	ch your search.				
Desktop					<i>.</i>				
Documents									
🕹 Downloads									
👌 Music									
Pictures									
🚼 Videos									
🏪 OS (C:)									
Data (D:)									
👝 Kindle (F:)									
		~ <							>
File name:	1								~
Save as type:	Text Documents (".txt)							~
						_			
∧ Hide Folders						2	ave	Cance	el

3. Enter a filename and click **Save**.



The data is saved with an **.ini** extension.

Load Watch Data

To load previously saved Watch data:

1. From the toolbar click **Load Configuration** (2), a browser opens enabling you to select the Watch you want to load:

14 Open				×
← → ✓ ↑ → This PC → Data (D:) → Projects → MMI_Learn		~ Ö	Search MMI_Learn	٩
Organize 👻 New folder			E • 🔲	?
o Translations ^ Name ^ o Troubleshooting o Website	Date modified No items match your search	Туре	Size	
This PC Destop Oursets Constraints Music Pittures Videos Videos This PC Destrop Destrop Destrop Destrop				
1 05 (C) Data (D) File game		~	Xml files (*xml) Qpen Cancel	~

2. Select the required Watch file and click **Open**.

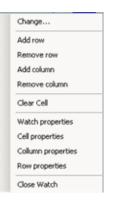
6.9.4.4 Watch Right-Click Options

There are three right-click options associated with the Watch:

- > Watch Window Right-Click Options
- > Watch Row Right-Click Options
- > Watch Column Right-Click Options

6.9.4.4.1 Watch Window Right-Click Options

When you right-click the Watch window, you are presented with the following menu:



This menu enables you to:

> **Change** - which enables you to make changes to the selected variable. When you select this option, the following prompt is displayed:

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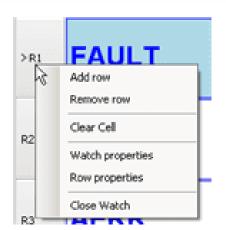
	Variable - FPC)S		
Name	FPOS			
Value	20.00000			
Alias				
Index				
From1	1	•	To1	1 •
From2		•	To2	•
Bit From		•	Bit To	•
Presenta	tion			
Туре	real			
Indication	Fixed point			•
Precision	6			•
Indication				

You can make any change and click **OK**.

- Add row which adds a blank row to the Watch window, then you use Add a Variable in the matrix to select the variable for the row.
- > **Remove row** which removes the selected row in the Watch window.
- Add column which adds a blank column to the Watch window, then you use Add a Variable in the matrix to select the variable or variables for the column.
- > **Remove column** which removes the selected column in the Watch window.
- > **Clear Cell** which removes the variable display from the selected cell.
- > Watch properties which displays the Watch window properties panel.
- > **Cell properties** which displays the Cell properties panel.
- > **Column properties** which displays the Column properties panel.
- > **Row properties** which displays the Row properties panel.
- > **Close Watch** which closes the Watch window.

6.9.4.4.2 Watch Row Right-Click Options

When you right-click a Row, you are presented with a number of options:

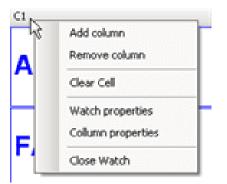


This menu enables you to:

- > Add row which adds a blank row to the Watch window, then you use Add a Variable in the matrix to select the variable for the row.
- > **Remove row** which removes the selected row in the Watch window.
- > **Clear Cell** which removes the variable display from the selected cell.
- > **Row properties** which displays the Row properties panel.
- > **Close Watch** which closes the Watch window.

6.9.4.4.3 Watch Column Right-Click Options

When you right-click a Column, you are presented with a number of options:



This menu enables you to:

- Add column which adds a blank column to the Watch window, then you use Add a Variable in the matrix to select the variable or variables for the column.
- > **Remove column** which removes the selected column in the Watch window.
- > **Clear Cell** which removes the variable display from the selected cell.
- > Watch properties which displays the Watch window properties panel.
- > Column properties which displays the Column properties panel.
- > **Close Watch** which closes the Watch window.

6.9.4.5 Watch Properties

The following properties panels are associated with the Watch window:

- > Watch Window Properties enable you to set certain general properties of the Watch window as a whole.
- > Watch Row Properties enable you to set properties for the Watch window rows.
- > Watch Column Properties enable you to set properties for the Watch window columns.
- > Watch Cell Properties enable you to set the properties of the selected cell in the Watch window.

6.9.4.5.1 Watch Window Properties

When you select a Watch window, you activate the Watch's Properties.

It can also be displayed by selecting **Watch properties** from any of the right-click menus.

Pr	operties		т ф	×
	24 2			
4	Circle Color			
	False Color	#FFFF0000	•	
	True Color	#FF008000	•	
4	Color			
	Background	#FFADD8E6	•	
	Foreground	#FFFFFFF	•	
4	Count			
	Number Of Columns	0		
	Number Of Rows	0		
4	Font			
	Auto Resizeable			
	Font Color	#FF0000FF	•	
	Font Family	Arial	•	L
	Font Size	45	\$	ш
	Font Style	Normal	•	
	Font Weight	Bold	•	ш
4	Misc			
	Name	Watch 1		
4	Show/hide			
-	Show Column Ishel			•
	alse Color Vo description)			
Му	Controller - Program Ma	My Controller - Program Ma	Properties	×

The options are:

> Circle Color

This applies only to the graphic display of bit values in the Watch window and enables you to select the colors in which the values are to be displayed.

- > FalseColor the color for a False value
- > TrueColor the color for a True value

> Color

This applies to the Watch window cells and enables you to select the colors in which the cells are to be displayed.

- > Background indicates selected cells
- > Foreground indicates non-selected cells
- > Count

This applies to the number of columns and rows to be displayed:

- > NumberOfColumns the number of columns to be displayed
- > NumberOfRows the number of rows to be displayed



If you enter a number greater than the number of variables being watched, empty rows/columns are inserted.

> Font

Font - for selecting the display font The font section allows the user to select the the required font, size, and attributes:

▲ Font		
Auto Resizeable		
Font Color	#FF0000FF	•
Font Family	Arial	•
Font Size	45	\$
Font Style	Normal	•
Font Weight	Bold	•

from which you can select the required font, size and attributes.

> Misc

By default, when you create a Watch, it is given the name **Watch#** (where # is the number of the Watch window). if you have several Watch windows running, you can use this field to give them each a unique identifying name.

Show/Hide

You can use these buttons to toggle between displaying or hiding the Row, Column and Variable labels.

6.9.4.5.2 Watch Row Properties

You can display the Row Properties panel either by selecting a Row, or from the right-click menu.

✓ General		
Alias		
Name	FPOS	
▲ Index		
From1	0	
From2	N/A	
To1	0	
To2	N/A	
Presentation		
Indication	Fixed point	
Precision	6	
✓ Value		
Value	41.046875	
Alias (No description)		

The options are:

> Names

This enables you to enter a unique identifying name for the Row.

> Type

This enables you to set display characteristics of the values.



6.9.4.5.3 Watch Column Properties

You can display the Column Properties panel either by selecting a Column, or from the right-click menu.

Properties		→ Ĥ
24		
▲ Names		
Column Label	C1	
Column Label		
(No description)		

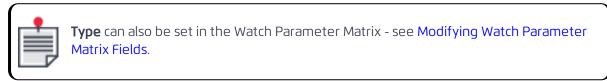
The options are:

> Names

This enables you to enter a unique identifying name for the Column.

> Type

This enables you to set display characteristics of the values.



6.9.4.5.4 Watch Cell Properties

You can display the Cell Properties panel either by selecting a Cell, or from the right-click menu.

P	roperties	→ ₽ ×
	24 ?	
⊿	General	
	Alias	
	Name	FPOS
⊿	Index	
	From1	2 •
	From2	N/A
	To1	2 •
	To2	N/A
⊿	Presentation	
	Indication	Fixed point 🔹
	Precision	6 •
⊿	Value	
	Value	0.000000
	lias	
	No description)	

The options are:

> Index

This enables you to change the Index of the variable displayed in the Cell.

> Names

This is for information only.

> Type

This enables you to set display characteristics of the values.

> Value

This is for information only.

> Visible elements

The number of elements - this appears for array and bit variables and indicates the total number of elements that can be visible.

6.10 System Viewer and Diagnostics

System Viewer and Diagnostics displays the system configuration stored on a controller. It also displays any inconsistency between the system configuration stored on the controller and the connected system.

To open System Viewer and Diagnostics:

- 1. From the Toolbox, click **Diagnostics and Monitoring** to display the Diagnostics and Monitoring tools list.
- 2. Click System Viewer and Diagnostics.



You can use **Add Component** from the right-click menu of the controller in the Workspace Tree (see Controller Right-Click Options) to open **System Viewer and Diagnostics**.

3. Click **Retrieve** :



4. The System configuration stored in the controller is displayed:

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Retreve					
m Configuration					
12	Product Information System Information				
	✓ General				
	Ordering Part Number	12			
	Serial Number	12			
	Revision	A2			
	Vendor Name	ACS Motion Control			
	DIP	0			
	Drive Characteristics				
	Maximum RMS Protection Time [-]	3476			
	Voltage [V]	320			
	Peak Current [A]	15			
	Nominal Current [A]	7.5			
	4 Options				
	Number of allowed SIN-COS encoders (up to 50				
	Number of allowed SIN-COS encoders (up to 10)				
	Allowed Absolute Encoder Type	Any			
	Number of allowed Absolute Encoders	2			
	I/O Connectors				
	DigitalInputsConnectors0	J3-I/O(IN0),J3-I/O(IN1),J3-I/O(IN2),J3-I/O(IN3),J3-I/O(IN4),J3-I/O(IN5),J3-I/O(IN6),J3-I/O(IN7),N/A,N/A			
	DigitalOutputsConnectors0	33-I/O(OUT0),J3-I/O(OUT1),J3-I/O(OUT2),J3-I/O(OUT3),J3-I/O(OUT4),J3-I/O(OUT5),J3-I/O(OUT6),J3-I/O(OUT7),N/A,N/A			
	AnalogInputsConnectors0 AnalogOutputsConnectors0	33-I/O(AIN0),33-I/O(AIN1),311-GP(AIN2),311-GP(AIN3)			
	AnalogOutputsConnectors0 HSSIChannekConnectors0	33-I/O(AOUT0),J3-I/O(AOUT1) 112-HSSI			
	Advanced	315-U201			
	 Advanced Controller I2C Address 	0x0007			
	Controller I2C Address Controller Part Number	0x0007 CMnt-2-x-x-1			
	Controller Part Number	UMnt-2-x-x-1 12			
	Controller Serial Number Controller Revision	12 A2			
	Controller Revision Controller Production Date	A2 Wednesday, November 8, 2017			
	Number of Servo Processors	1			
	DigitalInputs0Mask	1 0x000300FF			
	DigitalOutputs0Mask	0x00003FF			
	AnalogInputs0Mask	0x000003FP			
	AnalogOutputs0Mask	0x0000003			
	HSSIChannekoMask	1			
	Drive Type	PWM drive (5)			
	Drive 12C Address	0x0003			
	Drive Part Number	PWR-2-320V-7.5/15A			
	Drive Revision	A2			
	Drive Serial Number	DCM00005			
	Drive Production Date	Friday, September 16, 2011			
	Number of Drive Subsystems	2			

5. If the system contains inconsistent information, the following dialog box will be displayed:

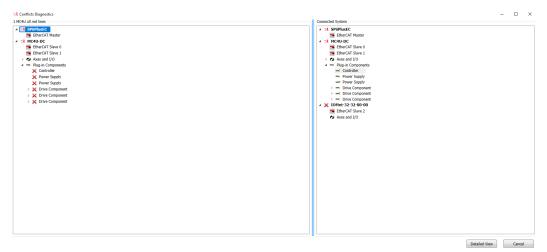
System Viewer and Diagnostics	_		>
Reading configuration from controller.			
Scanning network.			
Identifying network units.			
System Configuration is inconsistent with connected system			
Setup procedure that is not based on existing system configuration should be performed first			
Diag	nostics	Can	cel

6. Click **Diagnostics** to see additional information in the following window :

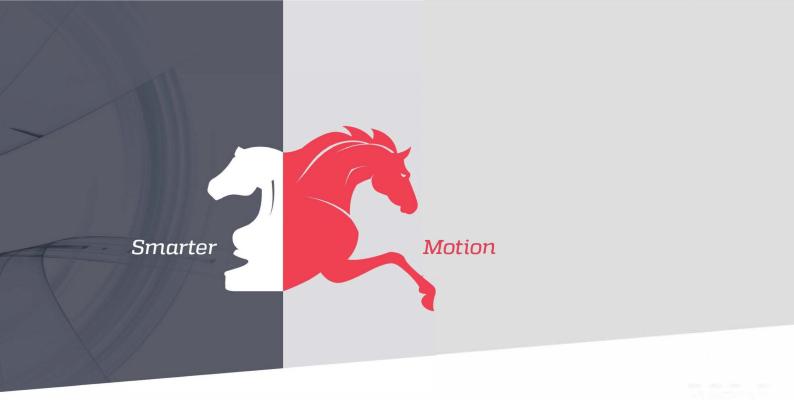
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A CA000003A	Product Information System Informatio	n
🔫 EtherCAT Master	⊿ General	
EtherCAT Slave 0	Ordering Part Number	CA000003A
Axes and I/O	Serial Number	12
4 PDMnt-4-00-00-00	Revision	A2
	Vendor Name	ACS Motion Control
	DIP	0
	A Drive Characteristics	
	Maximum RMS Protection Time [-]	3476
	Voltage [V]	320
	Peak Current [A]	20
	Nominal Current [A]	10
	▲ I/O Connectors	
	DigitalInputsConnectors0	J9-I/O(IN0), J9-I/O(IN1), J9-I/O(IN2), J9-I/O(IN
	DigitalOutputsConnectors0	J9-I/O(OUT0), J9-I/O(OUT1), J9-I/O(OUT2), J9
	AnalogInputsConnectors0	J9-I/O(AIN0), J9-I/O(AIN1), J9-I/O(AIN2), J9-I/
	AnalogOutputsConnectors0	J9-I/O(AOUT0),J9-I/O(AOUT1)
	▹ HSSIChannelsConnectors0	J1-HSSI0,J2-HSSI1
	▲ Advanced	
	Controller I2C Address	0x0007
	Controller Part Number	CMhp-3-x-x-4
	Controller Serial Number	12
	Controller Revision	A2
	Controller Production Date	Monday, March 23, 2020
	Number of Servo Processors	1
	DigitalInputs0Mask	0x000300FF
	DigitalOutputs0Mask	0x000007FF
	AnalogInputs0Mask	0x00000FF
	AnalogOutputs0Mask	0x0000003
	HSSIChannels0Mask	2
	Drive Type	PWM drive (5)
	Drive I2C Address	0x0003
	Drive Part Number	PWR-3-320V-10/20A
	Drive Revision	A
	Drive Serial Number	PCM06537
	Drive Production Date	Monday, March 23, 2020
	Number of Drive Subsystems	3

7. If the user clicks **Cancel** rather than **Diagnostics**, a window such as the following will be displayed:



Version 3.02



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