Getting Started

Hardware and Software Guide

Version 6.50

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Changes in Version 6.50

Page	Change
	New Document - First Release

Table of Contents

1 Introduction

This manual serves as an introduction to the SPiiPlus MMI, (Motion Machine Interface) which is a comprehensive environment for setting up and managing SPiiPlus controllers. The manual provides you with basic steps for working with the SPiiPlus MMI together with short descriptions of each MMI tool. The Getting Started manual instructs you on how to perform the following:

- Connect to the simulator
- Copy, compile and execute a program using the **Program Manager**
- Initiate a point-to-point motion
- Diagnose motion using the MMI **Scope**
- Diagnose the I/O status using the **I/O Monitor**
- Querying parameters from the controller and modifying motion variables using the **Terminal**
- Save and load a program to the flash memory or to a file

Note	
	*Verify that the SPiiPlus ADK tools version 5.00 or higher is installed on your PC. For installation instructions, see Section 3.2 of the SPiiPlus Setup Guide.*

1.1 Related SPiiPlus Tools

Table 1 Related SPiiPlus Tools

Tool	Description
SPiiPlus MMI	A multipurpose user interface with the controller including: Program management, Motion management, Communication terminal, Four channel digital oscilloscope, Safety and I/O signals monitor, Signal tuning and adjustment, and a fully interactive simulator.

1.2 The SPiiPlus Documentation

Table 2 Collateral Documentation (page 1 of 2)

Document	Description
SPiiPlus PCI Series Hardware Guide	Installation and hardware connection with the SPiiPlus PCI 4 or 8 axes
SPiiPlus CM Hardware Guide	Installation and hardware connection with the SPiiPlus Control Module

Table 2 Collateral Documentation (page 2 of 2)

Document	Description
SPiiPlus Setup Guide	Communication, configuration and adjustment procedures for SPiiPlus motion control products.
SPiiPlus ACSPL+ Programmer's Guide	Command set and high level language for programming SPiiPlus controllers.
SPiiPlus Command & Variable Reference Guide	Complete description of all variables and commands in the ACSPL+ programming language.
SPiiPlus Library Reference	C++ and Visual Basic® libraries for host PC applications. This guide is applicable for all the SPiiPlus motion control products
SPiiPlus COM Library Reference Guide	COM Methods, Properties, and Events for Communication with the Controller
HSSI Expansion Modules Guide	High-Speed Synchronous Serial Interface (HSSI) for expanded I/O, distributed axes, and nonstandard devices.
SPiiPlus Utilities User's Guide	Firmware upgrade and recovery procedures.
SPiiPlus FRF Analyzer User's Guide	The SPiiPlus FRF (Frequency Response Function) Analyzer? is a powerful servo analysis GUI for ACS Motion Control SPiiPlus motion controllers.
SPiiPlus SA, SA-LT and SAR-LT Hardware Guide	Installation and hardware connection with the SPiiPlus SA, SA-LT and SAR-LT Controllers.
SPiiPlus 3U Hardware Guide	Installation and hardware connection with the SPiiPlus 3U controller.

1.3 Conventions Used in this Guide

Several text formats and fonts, illustrated in **Table 3**, are used in the text to convey information about the text.

Table 3 Text Conventions

Text	Description
BOLD CAPS	ACSPL+ elements (commands, functions, operators, standard variables, etc.) when mentioned in the text. Software tool menus, menu items, dialog box names and dialog box elements.
bold	Emphasis or an introduction to a key concept.
`Monospace`	Code examples.
`Italic monospace`	Information in code examples that the user provides.
ALL CAPS	(Keyboard) key names [example: SHIFT key].
Bold Blue Text	Links within this document, to web pages, and to e-mail addresses.

Table 3 Text Conventions

Text	Description
|	Used in command syntax to indicate input of one alternative *or* another.
→	Used in GUI descriptions to indicate nested menu items and dialog box options leading to a final action. For example, the sequence: **Debug → New Watch → Real-time** directs the user to open the Debug menu, choose the New Watch command, and select the Real-time option.

Note	*Notes include helpful information or tips.*

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

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

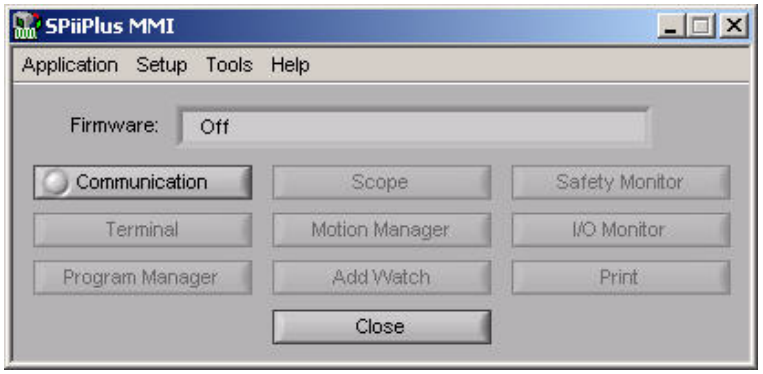
Advanced	*Indicates a topic for advanced users.*

Model	*Highlights a specification, procedure, condition, or statement that depends on the product model.*

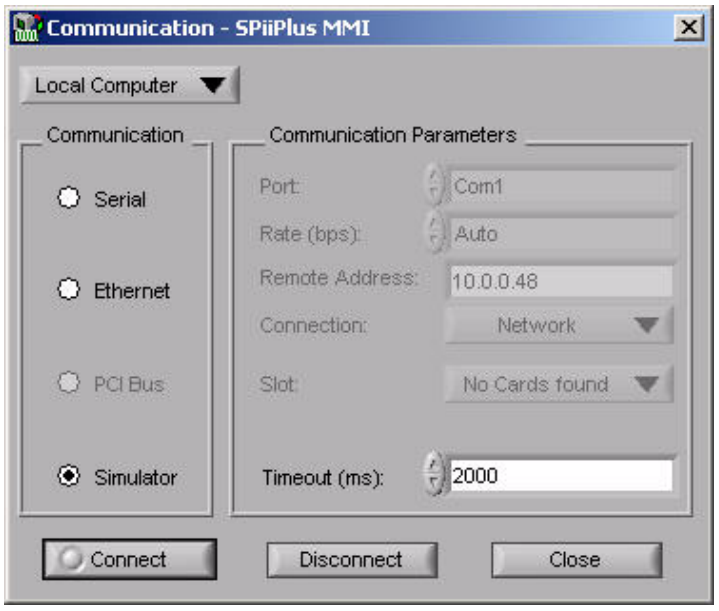
2 Communicating with Simulator

The SPiiPlus MMI includes an internal simulator which fully emulates the operation of the SPiiPlus controller. The simulator comes with all the capabilities of the controller and you can familiarize yourself with SPiiPlus MMI tools, initiate motion, develop programs and analyze motion before connecting to the hardware.

1. Select **Start→Program→SPiiPlus 6.50→SPiiPlus MMI**.
   The following window appears:



2. To allow you to select a communication channel with the controller, click **Communication**.
3. To establish communication with the simulator, select Simulator and click **Connect**.
   The Connect LED turns green once communication is established.



4. To close the window, click **Close**.

3 Copying and Compiling a Program

This chapter instructs you on how to copy an ACSPL+ program into Buffer 0 of the controller and to compile it using the **Program Manager** window. During the compilation, the program is uploaded to the controller's RAM.

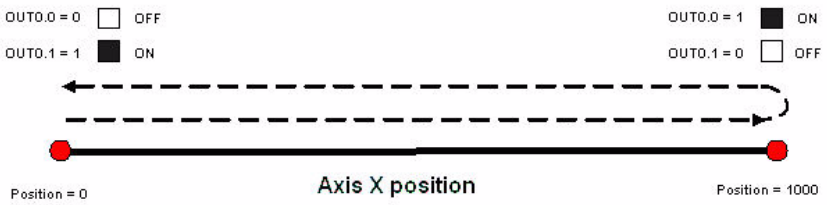
The ACSPL+ program initiates the following actions:

- A point-to-point reciprocating motion from 0 counts to 10000 counts and back to 0 counts.
- Loop - motion repeats for 30 times.
- Change the status of the digital outputs OUT0.0 and OUT0.1 as the following table lists

Table 4Output Number

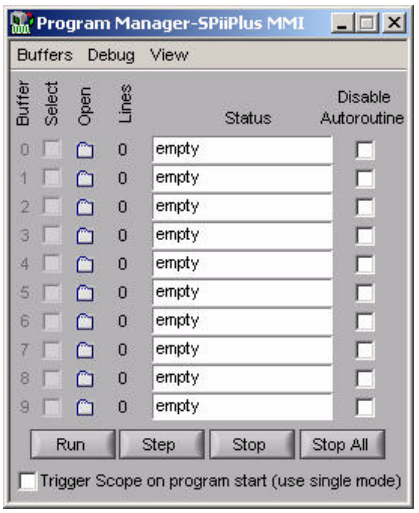
Position	OUT0.0	OUT0.1
10000	1 (ON)	0 (OFF)
0	0 (OFF)	1 (ON)

The following figure shows the motion and the status of the output:

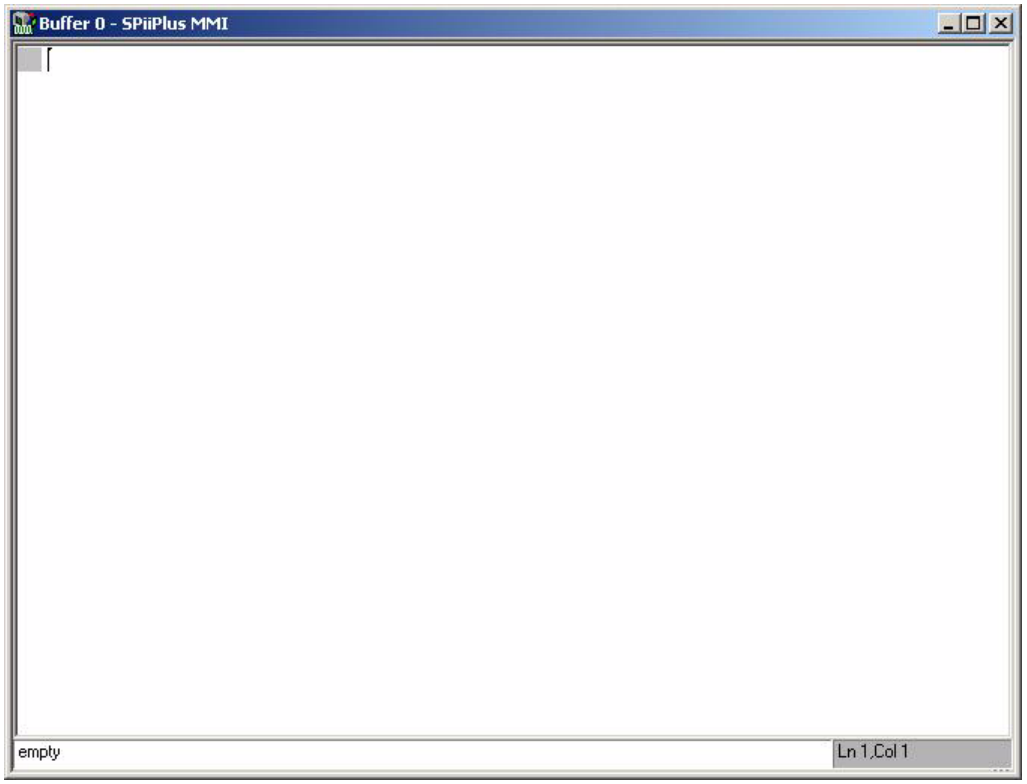


To copy and compile a program in Buffer 0

1. In the SPiiPlus MMI window, click **Program Manager**.
   The following window appears:



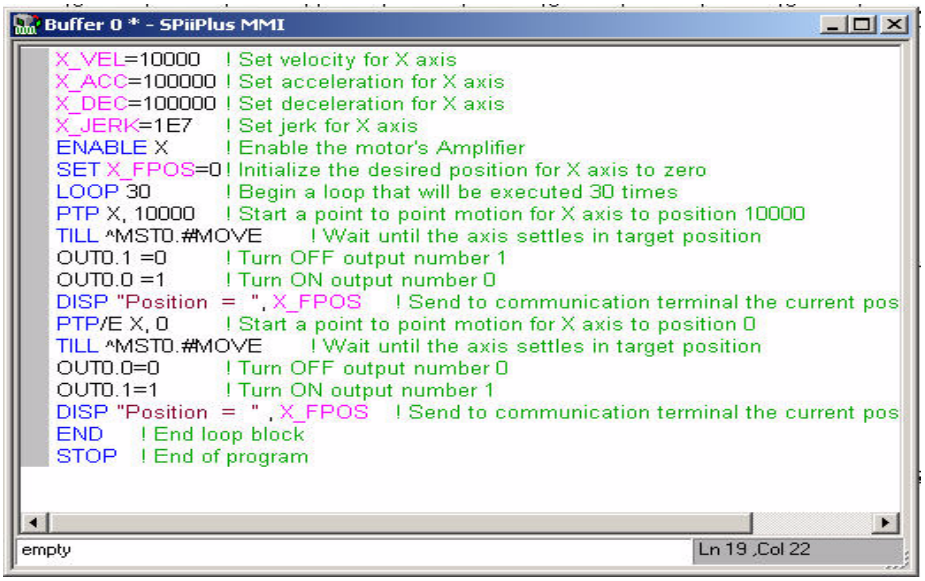
2. Double-click **Buffer 0 Status** field.
   The **Buffer 0 Edit** window appears.



3. Copy the following program and paste it in the **Buffer 0 Edit** window.

```
X_VEL=10000                    ! Set velocity for X axis
X_ACC=100000                   ! Set acceleration for X axis
X_DEC=100000                   ! Set deceleration for X axis
X_JERK=1E7                     ! Set jerk for X axis
ENABLE X                       ! Enable the motor's Amplifier
SET X_FPOS=0                   ! Initialize the desired position for X axis to zero
LOOP 30                        ! Begin a loop that will be executed 30 times
PTP X, 10000                   ! Start a point to point motion for X axis to position 10000
TILL ^MST0.#MOVE               ! Wait until the axis settles in target position
OUT0.1 =0                      ! Turn OFF output number 1
OUT0.0 =1                      ! Turn ON output number 0
DISP "Position  =  ", X_FPOS   ! Send to communication terminal the current position of X axis
PTP/E X, 0                     ! Start a point to point motion for X axis to position 0
TILL ^MST0.#MOVE               ! Wait until the axis settles in target position
OUT0.0=0                       ! Turn OFF output number 0
OUT0.1=1                       ! Turn ON output number 1
DISP "Position  =  " , X_FPOS  ! Send to communication terminal the current position of X axis
```

```
X_VEL=10000                    ! Set velocity for X axis
END                            ! End loop block
STOP                           ! End of program
```



4. To compile the program, right click any where in the **Buffer 0 Edit** window and select **Compile**.

   Once the program is compiled the status bar of the **Buffer 0 Edit** window turns yellow.

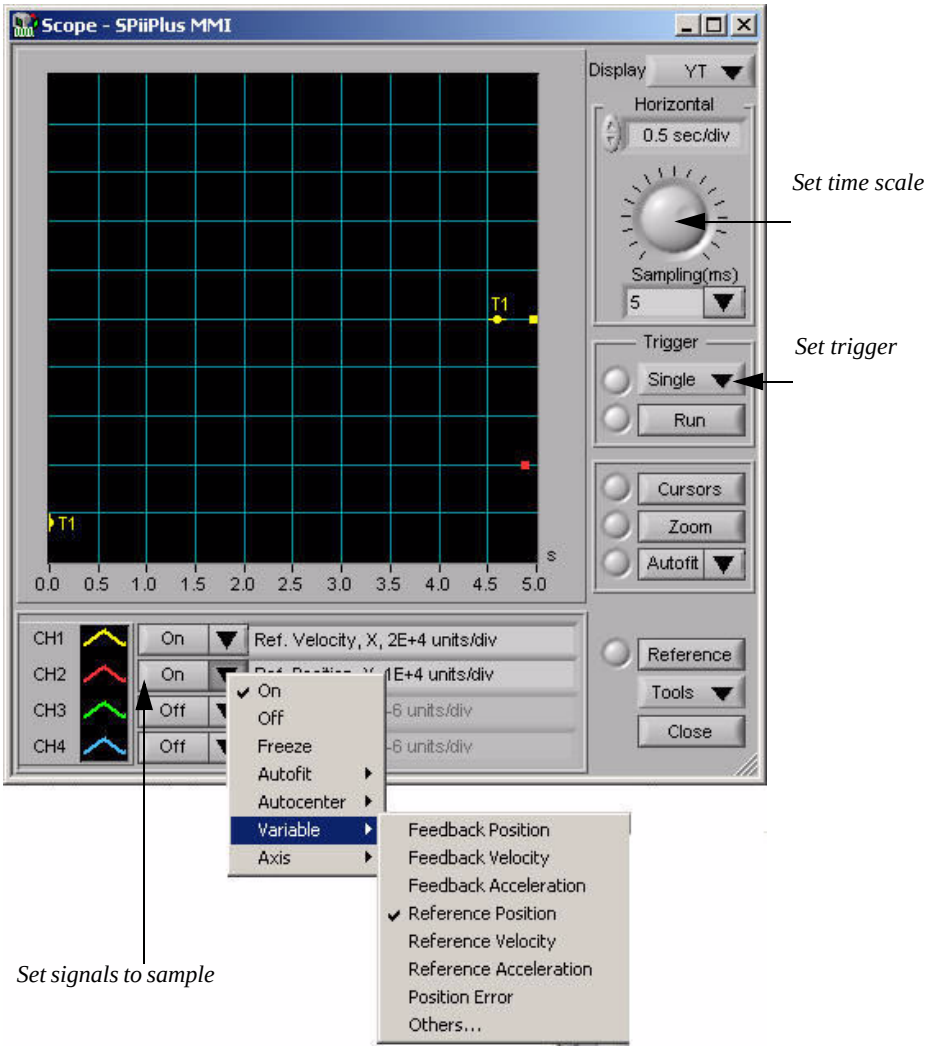
4 Analyzing the Motion

This chapter instructs you on how to diagnose the motion using the **SPiiPlus MMI Scope**. The **SPiiPlus MMI Scope** allows you to sample signals from the running program and monitor the motion. Currently, you will measure the following signals:

- Reference position of X axis
- Reference velocity of X axis

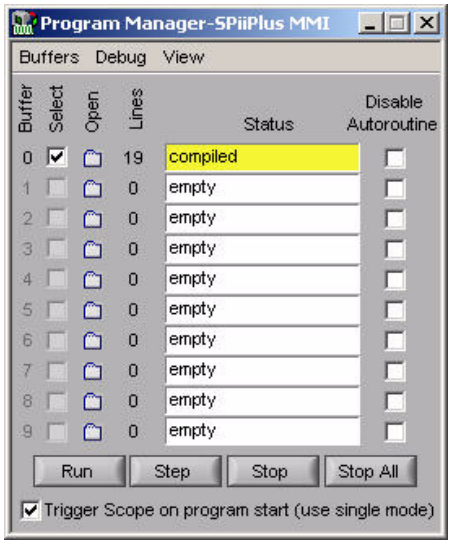
4.1 How to Diagnose the motion

1. In the MMI window, click **Scope**.
2. Set the scope as follows:
   - Set channel 1 to sample Reference Velocity for X axis
   - Set channel 2 to sample Reference Position for X axis.
   - Set the horizontal time scale dial to 0.5 sec/div
   - Verify that the trigger mode is set to **Single**.

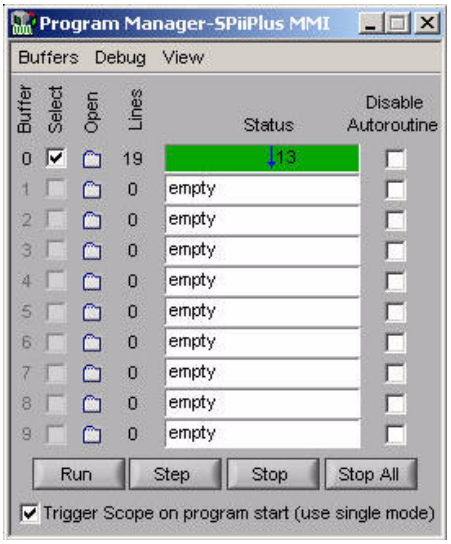


3. In the **Program Manager** window, do the following:
   - In the Select column, check buffer 0.
   - Select **Trigger Scope on Program Start**.
   - Click **Run**.

   As the program executes, the status bar turns green and the number of the executed line appears in the buffer status line.



Before execution

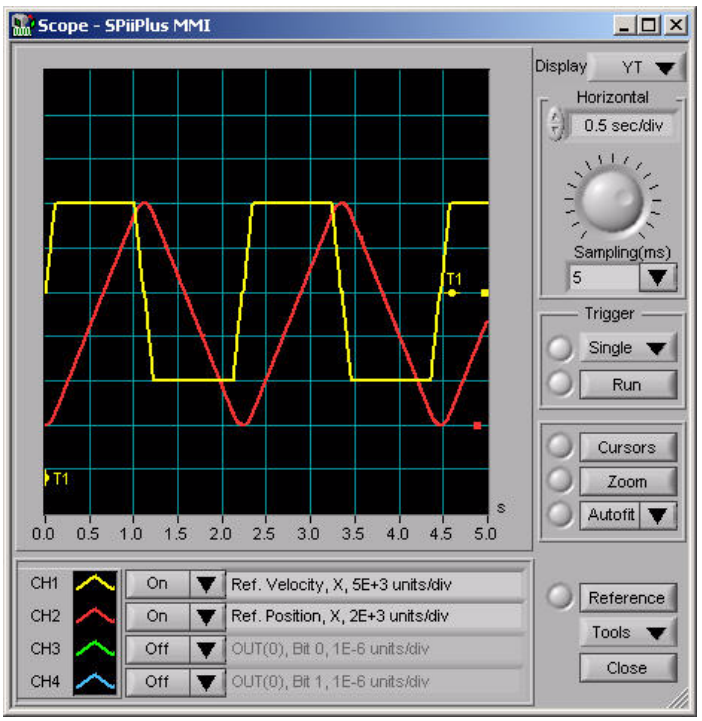


During execution

4. After the execution of the program, maximize the **Scope** window and wait for a few seconds to let the scope finish capturing the data.

   The scope displays both sampled channels; Reference Velocity of X axis (channel 1) and Reference Position of X axis (channel 2).

5. Click **Autofit**.



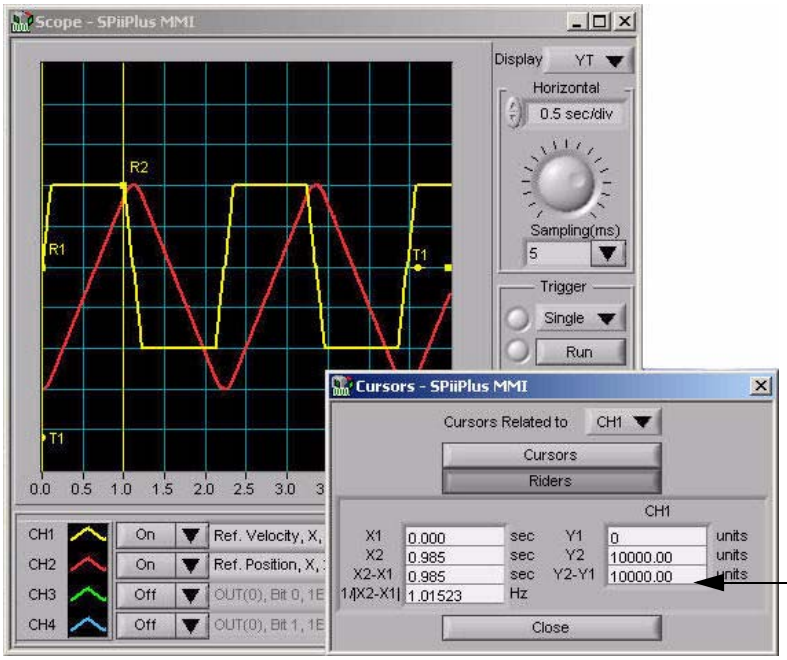
4.2 Measuring Sampled Signals

This section guides you on how to measure the following:

- The axis constant velocity. Once you measure it you can check whether it matches the program defined value; X_VEL=10000.
- The reference position value.

4.2.1 Measuring Reference Velocity

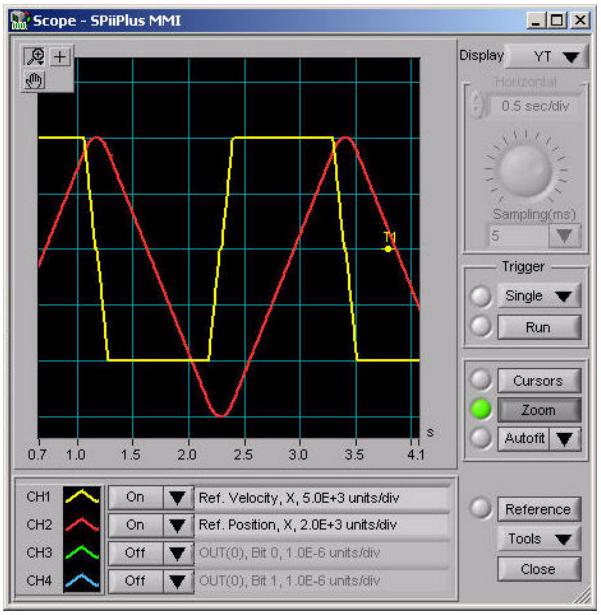
1. Click **Cursors**.
2. Open the **Cursors Related** list and select CH1.
3. Select **Riders**.
4. Drag the riders along the CH1 signal to place one rider pointer on the zero line and the other rider pointer place on the constant velocity.
5. Verify that the difference between the riders (Y2 - Y1) is exactly 10000.



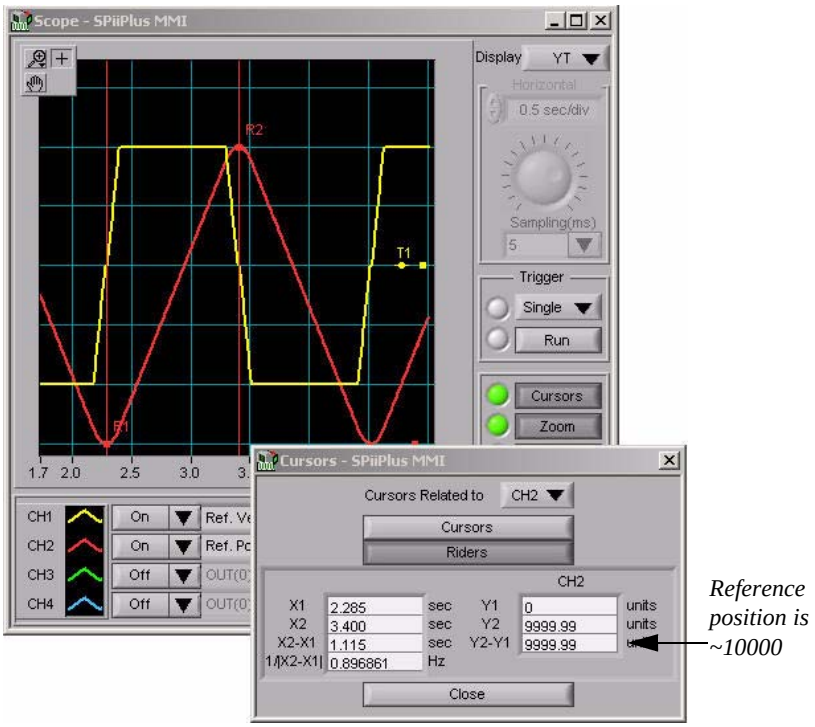
Reference Velocity is 100000

4.2.2 Measuring Reference Position

1. Click **Cursors**, to turn off the riders.
2. Click **Zoom**, to zoom in on one cycle of the reference position signal, CH2.
3. Click + at the top left corner of the Scope window, to drag the cursors in Zooming mode.



4. In the Scope window, click **Cursors**.
5. Open the **Cursors Related** list and select CH2.
6. Click **Riders**.
7. To measure the Reference Position signal, place one rider pointer on zero and the other rider on the target position.
8. Verify that the difference between the riders (Y2 - Y1) is 10000.



The axis moves to a target position of 10000counts with a velocity of 10000 count/sec and returns to 0 position with velocity of 10000 counts/sec.

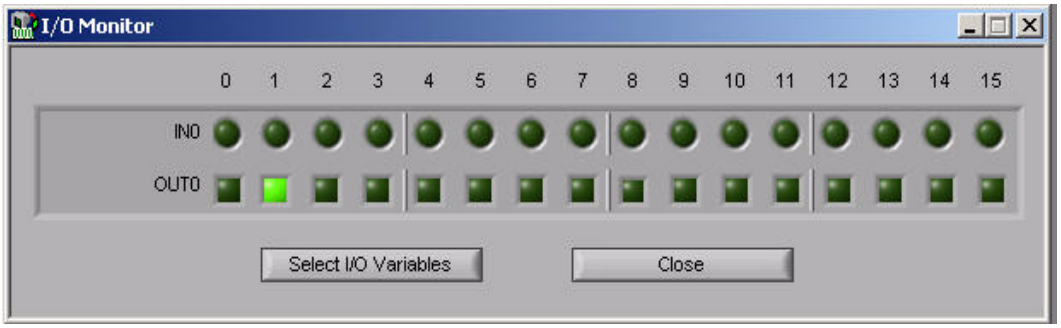
9. To turn off the cursors and the zoom in, click **Cursors** and **Zoom**.

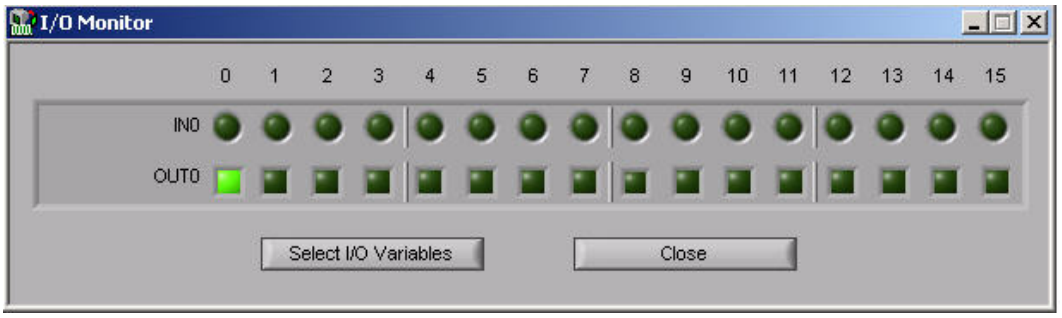
5 Analyzing the I/Os Status

This chapter instructs you on how to diagnose the I/Os status using the I/O Monitor. The I/O Monitor displays the logic state of the controller's digital inputs and outputs.

5.1 How to Diagnose the I/Os Status

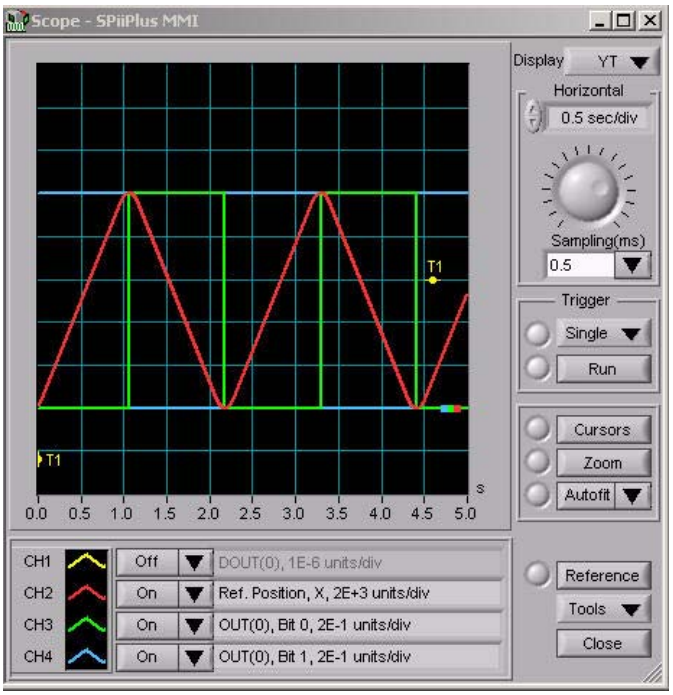
1. In the MMI window, click **I/O Monitor**.
2. In **Program Manager**, run the program in buffer 0.
3. In **I/O Monitor**, view the logic state of the digital inputs and outputs. Whenever the axis reaches its destination, the state of each output LED changes as the following pictures show:.





4. To verify that the outputs states changes exactly at the target points of 0 and 10000, do the following:
   1. Open the Scope.
   2. Set channel 3 to measure the signal of variable OUT0. For detailed instructions, see **"Setting Scope Channels to Diagnose I/O Status" on Page 15**.
   3. Set channel 4 to measure the signal of variable OUT1. For detailed instructions, see **"Setting Scope Channels to Diagnose I/O Status" on Page 15**.
   4. Click **Autofit**.

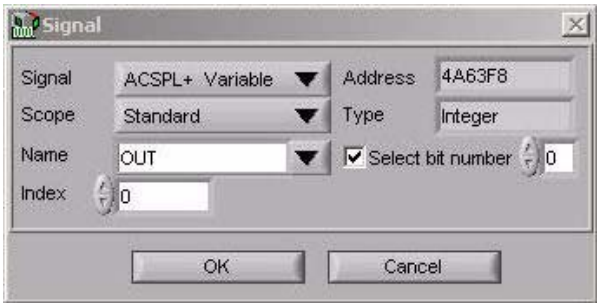
      In the scope you can see that output changes when reference position reaches the target points:



5.2 Setting Scope Channels to Diagnose I/O Status

The following instructions refer to setting the parameters of both channel 3 and 4.

1. Verify that channel 3, or 4 is on, if not click on off to turn on the channel.
2. Click the arrow head next to channel 3/4 | **Variables** | **Others**.
   The Signal dialog appears.
3. In Signal, select **ACSPL+ Variable**.
4. In Scope, select Standard.
5. In Name, select OUT.
6. Check the Bit Number box and set it for channel 3 to 0 and for channel 4 to 1.



7. Click **OK**.

6 Querying the Controller

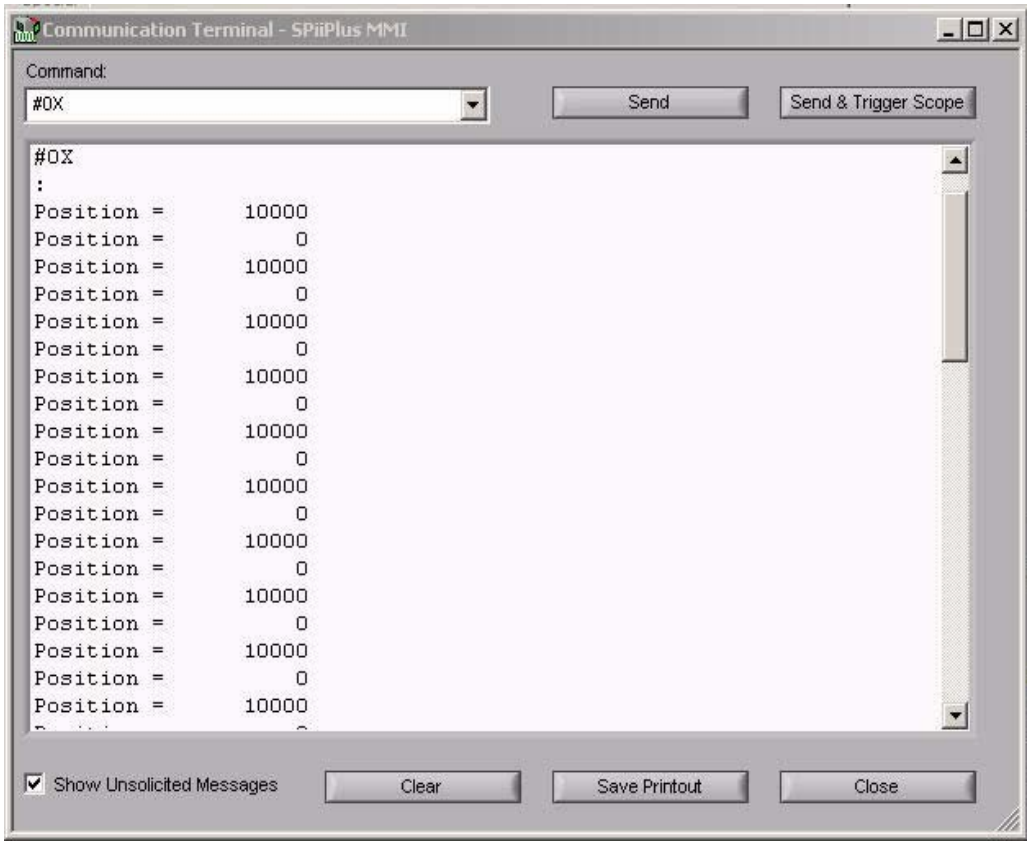
This chapter instructs you on how to query the controller and modify motion parameters using the **Terminal** window. The **Terminal** window is a direct communication channel with the controller. You may write commands and queries or modify the status of any system and user variables.

To query the controller and modify the motion parameters, execute the required program (in this case the program in buffer 0) using the Terminal window:

6.1 Executing the Program from the Terminal Window

1. In the MMI window click **Terminal**.
2. To allow communication between the terminal and the executed program, select the **Show Unsolicited Messages** box.
3. To run the program in buffer 0, type in the command line in capital letters **#0X** and click **Send**.

   At the end of each motion segment, an output appears in the Communication Terminal dialog.



4. To stop the program execution in all buffers and to disable all axes, click the Emergency Stop button.

6.2 How to Query the Controller

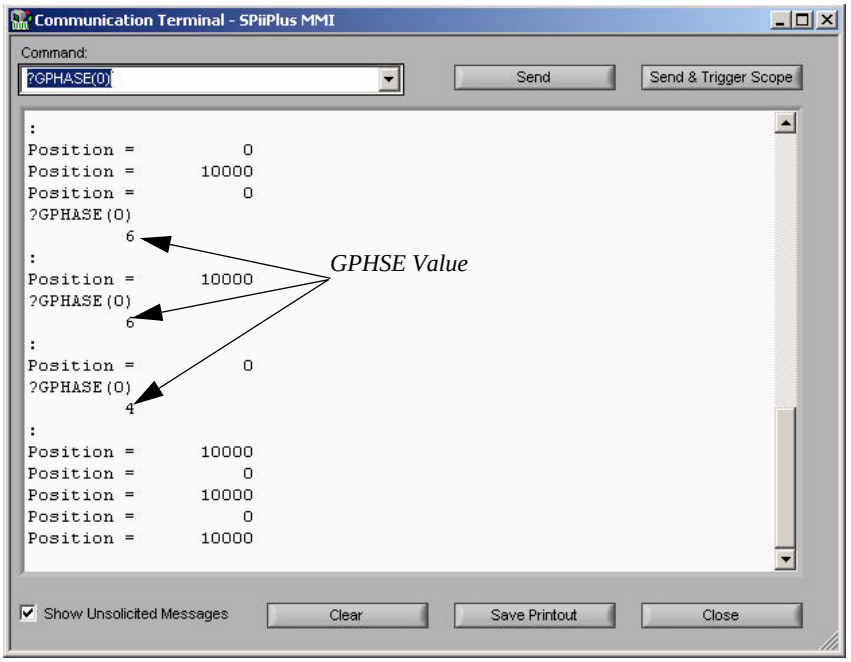
1. Re-run the program by typing in the command line in capital letters **#0X** and click **Send**.
2. To query the controller for the motion phase type **?GPHASE(0)** and click send.

   The variable **?GPHASE** displays the motion phase according to the following translation table.

Table 5 Translation table of ?GPHASE

GPHASE	Motion Phase
0	No motion - motor is idle
1	Increasing acceleration
2	Constant acceleration
3	Reducing acceleration
4	Constant velocity
5	Increasing deceleration
6	Constant deceleration
7	Decreasing deceleration
8	Kill deceleration

3. View the changes in motion phase by recurrently clicking **Send** along the execution.



4. Close the **Terminal** window.

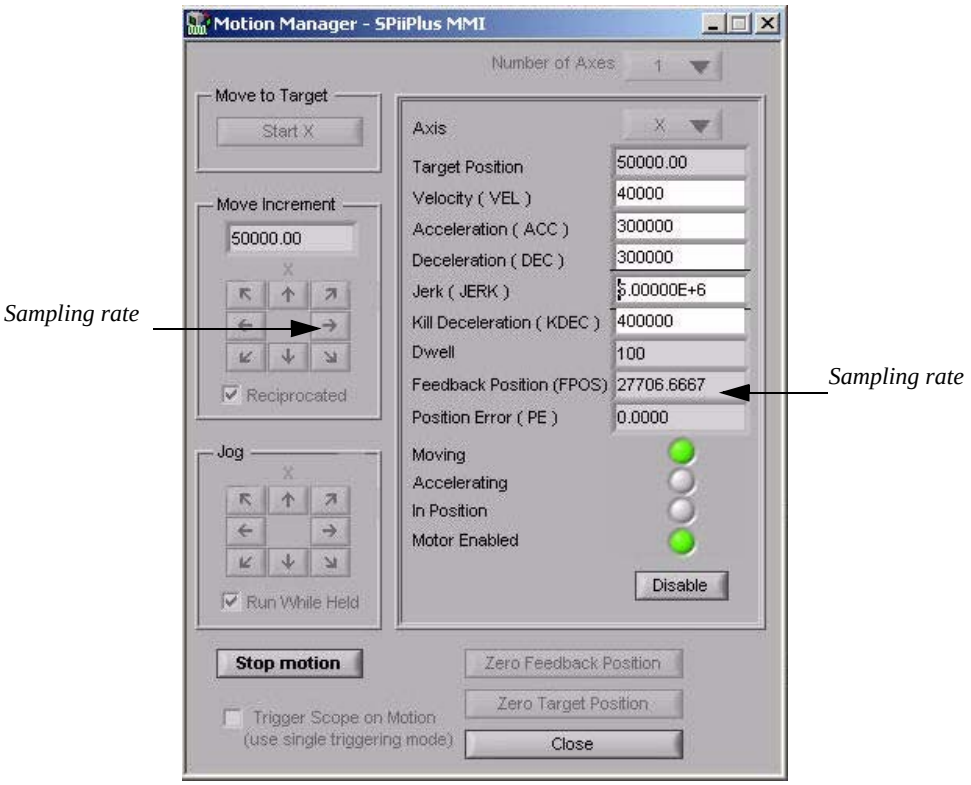
7 Initiating Motion with the Motion Manager

The Motion Manager allows you to execute simple point-to-point, reciprocating point-to-point motions and jog motion. In the following section, you will execute a reciprocated point-to-point motion.

1. In the MMI window, open the **Motion Manager** dialog.
2. Verify that the selected axis is X and set the following motion parameters:

Parameter	Definition	Value
VEL	Velocity	40000
ACC	Acceleration	300000
DEC	Deceleration	300,000
JERK	Acceleration derivative	5000000
KDEC	Kill Deceleation	400,000
Dwell	Delay time at target point	100

3. Under **Move Increment** type 50000 to set the target point.
4. Select **Reciprocated** box, to set a reciprocated motion (from 0 counts to 50000 and back).
5. Click **Zero Feedback Position**, to reset the encoder feedback.
   The Feedback Position (FPOS) is currently 0.
6. If the motor is not enabled, click **Enable** to enable it.
   Currently you are ready to start the motion.
7. Under Move Increment, click  .
   The motion is in progress. The Moving LED is green and the feedback position values continuously change.



8. To analyze motion, click **Scope** in the MMI main screen.
9. Under **Trigger** select **Auto**.
10. Under **Sampling**, select a rate of 10mSec (1 sec/dev).
11. Set the channels as follows:

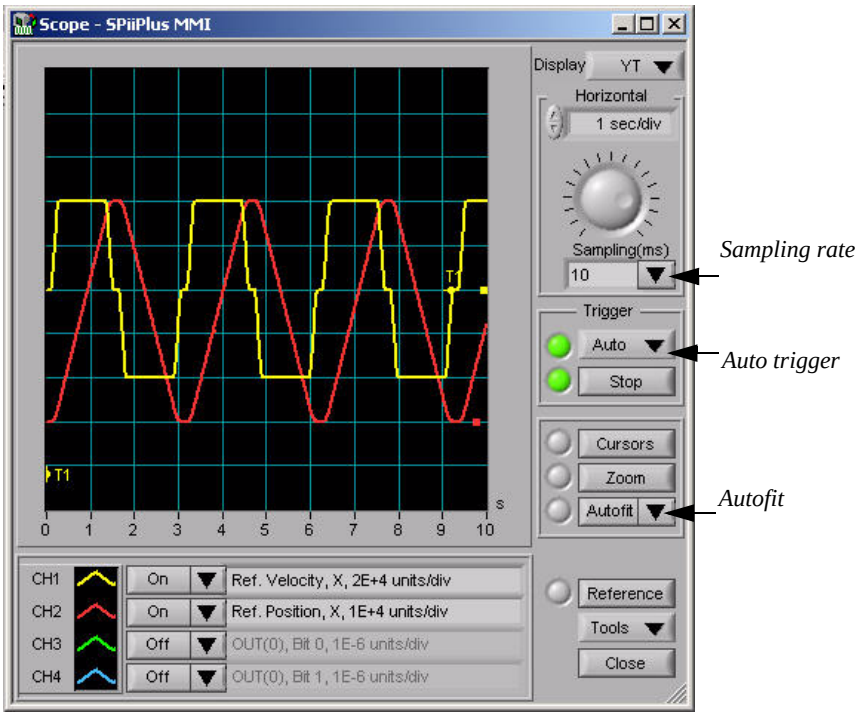
    Ch1 - captures reference velocity

    Ch2 - captures reference position

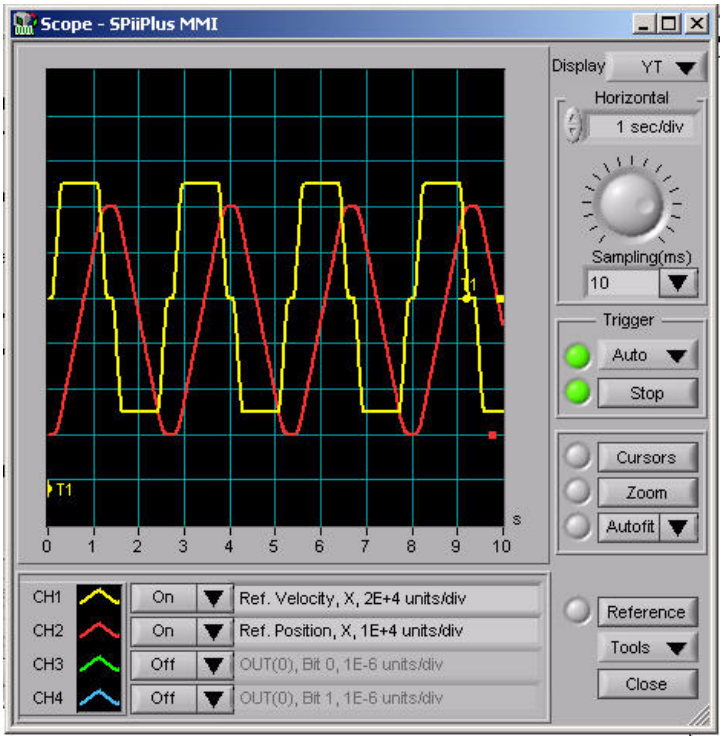
    Ch3 - turn off

    Ch4 - turn off

12. Click Autofit, to adjust the vertical scale to fit into the window of the scope.
13. Using the cursors, measure the values of both signals. For further information, see **"Analyzing the Motion" on Page 8**.



14. Change the velocity on the fly from 40000 to 50000 by doing the following:
    1. In the MMI main window, click **Terminal.**
    2. In the command line, type IMM X_VEL=50000.
    3. Click **Send**.
15. Open the scope and observe the change in the velocity signal.
16. Measure the new velocity signal and verify that the constant velocity value is 50000.



17. To stop the motion, open the **Motion Manger** window and click **Stop Motion**.
18. Close the **Scope** window.

8 Saving and Loading a Program

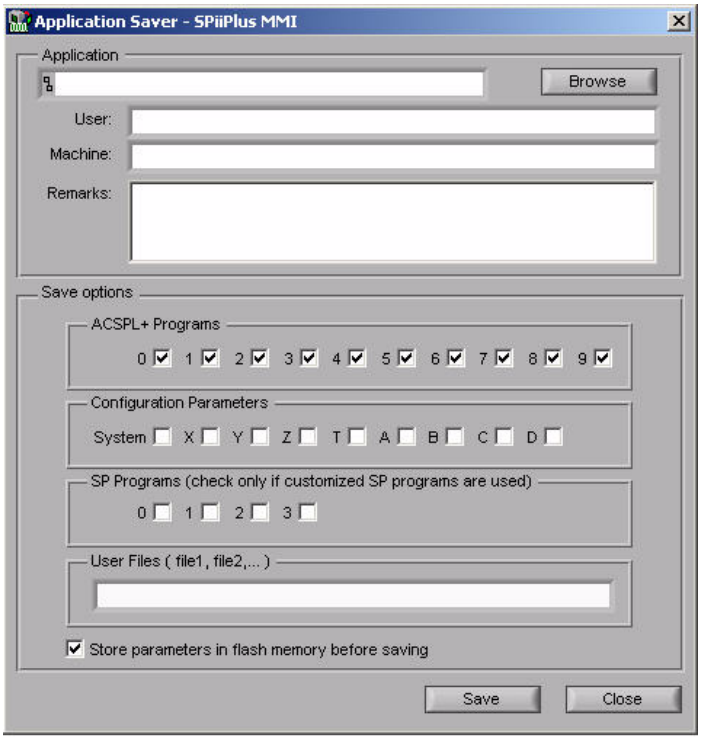
This chapter guides you on how to save the program in Buffer 0 into the non-volatile memory (flash) of the controller. Once you save a program to the flash memory of the controller, the program is not removed when the controller is shut down or is rebooted (**#HWRES** command). The program is removed from the memory when resetting the controller (**#RESET** command).

In addition, this section guides you on how to save a program to a file and to load it into a required buffer.

8.1 How to Save a Program to Flash

1. Open the **Program Manager** window.
2. Select **Buffer → Save to Flash**.

   The **Application Saver** window appears. It allows you to select the required buffer and to save to flash SP programs and axis configuration parameters:

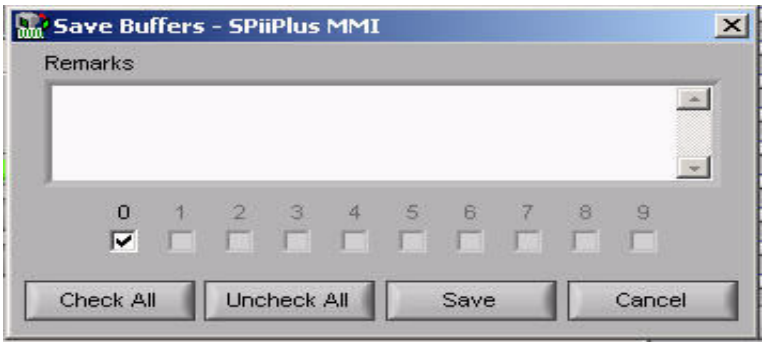


3. Under **ACSPL Programs**, select **Buffer 0**.
4. Click **Save**.

   The program is saved to the flash memory.

8.2 How to Save a Program to a File

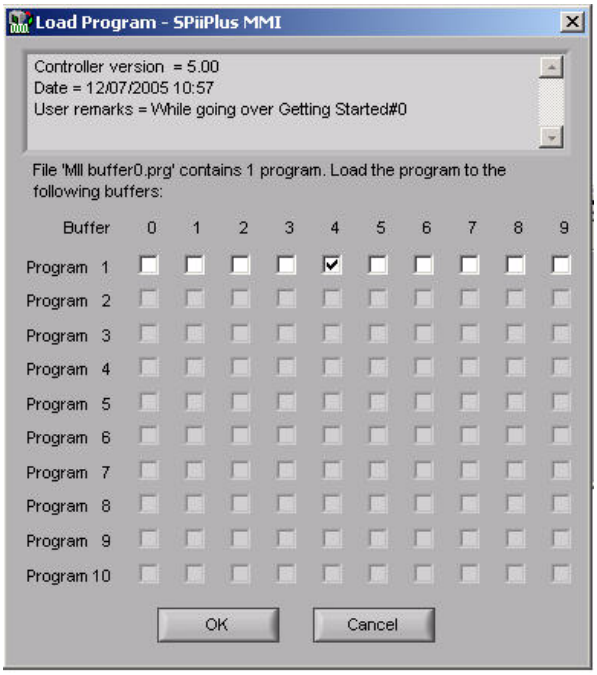
1. Open the **Program Manager** window.
2. Select **Buffer→Save to File**.
   The following window appears:



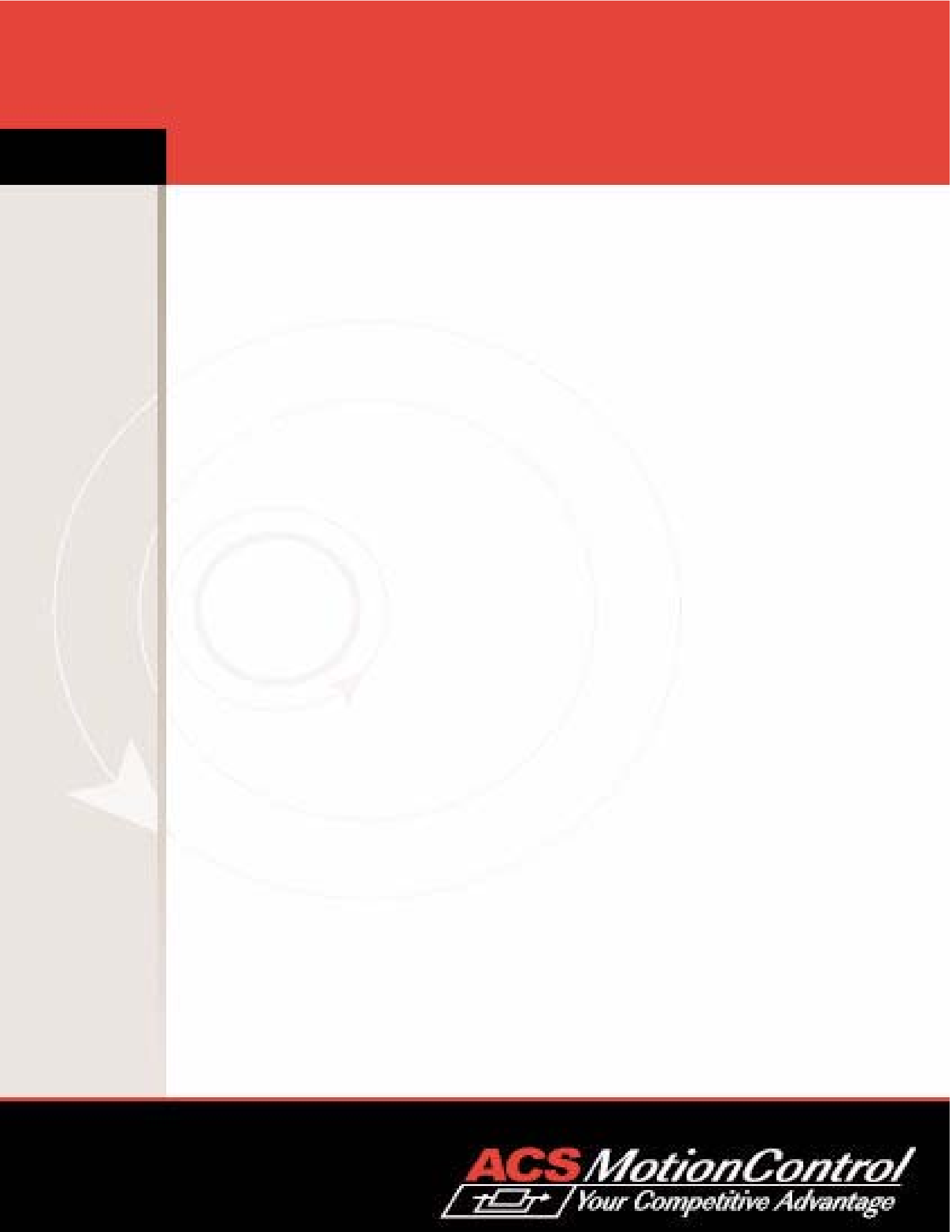
3. Select the required buffer, in this case buffer 0.
4. Click **Save**.
5. Browse to the required location and click **Ok**.

8.3 How to Load a Program

1. Open the **Program Manager** window.
2. Select **Buffer→ Load from File**.
3. In the window that appears navigate to C:\Program Files\ACS-Tech80|SPiiPlus 5.00\Training\Training Examples\Excercises with real system or simulator\Motion commands and select the file: PTP MOTION - making a circle.prg.
4. Click **Ok**.
   The following window appears:



5. Select the required buffer, in this case buffer 4.
6. Close the Program Manager.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