Measuring S200 Current Loop Performance User Tutorial



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Kollmorgen S200 Series Servo Drive



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Because Motion Matters™

Record of Document Revisions

Revision	Remarks
1.0	Preliminary edition

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1 INTRODUCTION

This is a teaching document that shows how to measure the current loop performance of Danaher Motion S200 Servo Drive. We will develop a custom MechaWare control loop that allows Bode Tool to analyze the behavior of Actual Current / Command Current in the frequency domain

1.1 Prerequisites

The following MEI Training Courses are recommended in order to fully understand the concepts introduced in this exercise.

Courses:	MEI 101: MEI Boot Camp
	MEI 203: Advanced Servo Tuning and Motion System Analysis
	MEI 301: Develop Advanced Control Algorithms with MechaWare

The following software and hardware are used in this exercise.

Software	MPI 03.04.12
	MechaWare 03.02.03
	Matlab 7.3.0 (R2006b)
	Bode Tool 1.06.18
	Custom ZMP firmware for MechaWare (Z20P635XX)
Hardware	ZMP controller
	1 S200 with firmware 3.2j

Procedure and screenshots in this document are in reference to what's listed above.

1.2 Checklist

1. Drive is setup properly to work with your motor.

1 AKM motor any feedback

- a. Check drive firmware version, upgrade to 3.2j if necessary
- b. Drive parameter configuration
- 2. Run a plant measurement with Bode Tool and tune your axis.
- 3. Command motion on axis 0 through Motion Console.
- 4. Download custom ZMP firmware for MechaWare
- 5. Configure controller
 - a. 8kHz controller sample rate. This is mandatory to get an accurate measurement of the S200 default bandwidth of 2kHz. Use 16Hz if S200 bandwidth is 5kHz.
 - b. Map axis, Disable hardware limits, Increase position error limit in Motion Consol
 - c. Drive Monitor A is mapped to drive actual current by default Map Drive Monitor B to drive commanded current address 0x9f9e

🔤 MEI Utilities - so	drivemonitor -poll		_ 🗆 ×
c:\mei\xmp\bin\ Monitor B chango c:\mei\xmp\bin\ Node Ø Drive Ø	winnt>sqdrivemon ed to memory 0x9 winnt>sqdrivemon	itor -monitorB -memory 0x9f9e F9E itor -poll	
Monitor A address Øx4544 ØxfffØ	Monitor B address 0x9f9e 0x0000	Monitor C address 0x3938 0x050f	

Now we are ready to proceed!

2 MECHAWARE MODEL

This section provides information on using MechaWare to measure the S200 current loop.

2.1 Block Definition

We are going to implement a custom control loop to measure the S200 current loop performance with MechaWare. We will be using the following MechaWare blocks.

Block	Description User Specifies a Controller Memory Address and a Data type. The Output is the value of the memory address in the specified data type.		
Polance Memory			
Memory User Buller	Same as the Memory block, but the user only specifies a User Buffer number. The Output is the specified User Buffer with the specified data type.		
Main and PD with Reset	Standard PID filter in a single block. User specifies Proportional, Integral and Differential Gains. Has optional smoothing parameter, Ksm, set to 0 for no smoothing.		
Error Enor	Outputs the Position Error of an Axis		
Okput Feedback	Outputs Primary OR Secondary Encoder values from an Axis		
Sum (2 Input)	This block is available with 2 – 6 Inputs The Output is the Sum of all the inputs		

The complete control loop is shown below.



2.2 Mapping Address Blocks

We will use command line utility vm3.exe to locate the memory locations of Drive Monitor A and B on the controller. If you are using the same MPI version and custom firmware used in this example, you will find the Drive Monitor values in the location shown below.

🛤 Motion Engineering, Inc FWO Ver. 6.35B7 Op	t. 20 Memory (Hex)		- 🗆 ×
RinconBufferInternal			
Rx_0.Status.Motor[0].Monitor[0]	0×01000170:	0×FFFD0020	
Rx_0.Status.Motor[0].Monitor[1]	0x01000174:	0x3938050C	
Rx_0.Feedback.Header	0×01000178:	0×40000080	
Rx_0.Feedback.FPGATimer	0x0100017C:	0x551950A2	
Rx_0.Feedback.Motor[0].Encoder	0×01000180:	0×01B81598	
Rx_0.Feedback.Motor[0].CptCmpStatus	0x01000184:	0×00000000	
Feedback.Motor[0].CaptureData[0]	0×01000188:	0×00000000	
Rx_0.Feedback.Motor[0].ProbeStatus	0×0100018C:	0×00000000	-
•			

Monitor A is mapped to Ifbx, actual current, by default. We previously mapped Icmd, internal command current, to monitor B. Each monitor address is a 16bit value. The lower 16 bits of memory Rx_0.Status.Motor[0].Monitor[0] contains the value for Monitor A while the upper contains Monitor B.

The ZMP uses byte addressing. Each memory location in Vm3 is one byte. Rx_0.Status.Motor[0].Monitor[0] is a 32 bits (4 bytes) that spans from 0x1000170 to 0x1000173.

Icmd is located at 0x1000170 and Ifbx is located at 0x1000172.

2.3 Monitoring UserBuffer Blocks

User buffers are memory locations on the controller allocated for the use of external applications. In our MechaWare model, we mapped 5 different output points to different user buffers. We can monitor these memory locations in vm3.exe or Motion Scope. This is a great way to debug our MechaWare model if it is not working as expected.

📧 Motion Engineering, Inc FWO Ver. 6.35B7 Opt	t. 20 Memory (Hex)		- 🗆 🗙
MEIXmpBufferData.UserBuffer			A
MEIXmpBufferData.UserBuffer.Data[0]	0x000ECDD4:	0x41400000	
MEIXmpBufferData.UserBuffer.Data[1]	0×000ECDD8:	0×C2000000	
MEIXmpBufferData.UserBuffer.Data[2]	0×000ECDDC:	0×00000000	
MEIXmpBufferData.UserBuffer.Data[3]	0×000ECDE0:	0xC20870A4	
MEIXmpBufferData.UserBuffer.Data[4]	0x000ECDE4:	0xC20870A4	
MEIXmpBufferData.UserBuffer.Data[5]	0×000ECDE8:	0×00000000	
MEIXmpBufferData.UserBuffer.Data[6]	0×000ECDEC:	0×00000000	
MEIXmpBufferData.UserBuffer.Data[7]	0×000ECDF0:	0×00000000	-
↓			▶ <i> </i> /,

2.4 Block Parameters

Block	Parameter Name	Value	Description
Noise	Axis Number	0	
	Kn1	1	
	Kn2	1	
Error	Axis Number	0	
PID	Kp	0.01	
	Ki	0	
	Kd	0.3	
	Imax	5000	Output limit
_			
Sum	K1	-1	
	K2	1	
Output	Motor	0	
Address Icmd	Memory Address	0x1000170	Motor 0 Drive Monitor B
	Data Type	2	16 bit integer
Address Ifbk	Memory Address	0x1000172	Motor 0 Drive Monitor A
	Data Type	2	16 bit integer
			-
Puffor b0	Puffor Numbor	0	Icmd, internal current
Duller DU	Duller Nulliber	0	command
Buffer b1	Buffer Number	1	Ifbk, torque producing current
Buffer b2	Buffer Number	2	Noise block output
			Total command, noise block +
Buffer b3	Buffer Number	3	PID
Buffer b4	Buffer Number	4	PID output

Parameters not displayed below have a value of 0.

2.5 Downloading Our Model

Use mwload.m Matlab file provided in MechaWare Install.

MATLAB 7.3.0 (R20	06b)		
File Edit Debug Desktop	Window H	elp	
	> > d	C:\MEI\MechaWare\Matlab\v14	E
Shortcuts 💽 How to Add 🛛	What's New		
Current Directory	b\v14 *	x Command Window	x r
🖻 📽 🔊 🐼 ·		Type = MEMOUT_USER	1
Al Files Analysis Utilities mwblocks.mdl slblocks.m SystemParameters FPIDBIQ.txt FPIDBIQ.txt IFBfbk.m JowpassParams.txt	File Type Folder Folder Model M-file M-file TXT File TXT File TXT File	DataType = 0 Subsample Code = 0 User Data 0 = 0 User Data 1 = 0 MechaWare Buffer Size: 65536 (0x10000) bytes. Avaiable memory: 65536 (0x10000) bytes. Memory used for model 0 is 1120 bytes Program size (all models, including margin) is 1248 (0x4e0) bytes.	
Current Directory Workspan Command History	ce 7 6 PM% lechaVare 'BXRevb.mu	ans = x 0 >> mwload s200IFBXRevb.mdl	
start	1.51		OVR

Or use mdl2mw.exe command line utility

📼 MEI Utilities	_ 🗆 🗙
c:\mei\xmp\bin\winnt>mdl2mw.exe s200IFBXRevb.md1_	
	_
•	

3 BODE TOOLS ANALYSIS

This chapter provides start up information for the Panel PAC.

3.1 Configuration

Measurement type	FFT Noise	checked
	Advanced	checked
User Buffer	Input	0, drive internal command current
	Output	1, drive actual current
Number Samples	81920	
Number FFT Points	1024	
Overlap	50%	
Amplitude	2000	

🔞 Bode Tool 📃 🗆 🔀				
File	Measurement	Filter Help		
	Fourier 🕨	Server Port	Controller Number	
	FFT)	V Noise	0	
<u> </u>	Advanced I	Save Raw Data	10	
	0 🗸	First Motor Number	1 First Motor Coefficient	
	1 💌	Second Motor Number	1 Second Motor Coefficient	
	User Buffer	▼ In O	Out 1	
	81920	Number Samples	Display	
	1024	Number FFT Points	Bode Test	
	50	▲ Overlap (%)		
	2000	Amplitude (DAC counts)	Auto Tune	

Start Test



Note: If your axis faults during the test, it is most likely due to Position Error Limit. By default, the limit value is set to 1000. You will need to increase this to a reasonable number due to the high resolution of the S200 drive.

The second end of each wire is prepared as required for the connection to the DC-power supply.

3.2 Measured Current Loop Performance

Bode tool displays data up to half of the controller sample rate, 4 kHz in this case. This is sufficient to measure the default S200 bandwidth of 2 kHz. If you want to measure up to 5 kHz, please increase controller sample rate to 16 kHz.



The measured closed loop (red) trace is shown below.

4 CONCLUSION

The power of MechaWare and Bode Tool made it possible to determine the S200 current loop performance. Procedure covered in this exercise can also be applied to other Danaher Motion SynqNet servo drives as long as we can map the internal command and actual currents to our model.

Please feel free to contact us for MEI Training information and schedule if you are having trouble following this document or simply would like to learn more about our products!

http://support.motioneng.com

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