Measuring S200 Current Loop Performance

User Tutorial

Revision 1.0, August 2011

Kollmorgen S200 Series Servo Drive

Keep all manuals as a product component during the life span of the product.
Pass all manuals to future users / owners of the product.

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Record of Document Revisions

Revision	Remarks
1.0	Preliminary edition

IMPORTANT NOTICE

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August 2011

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.

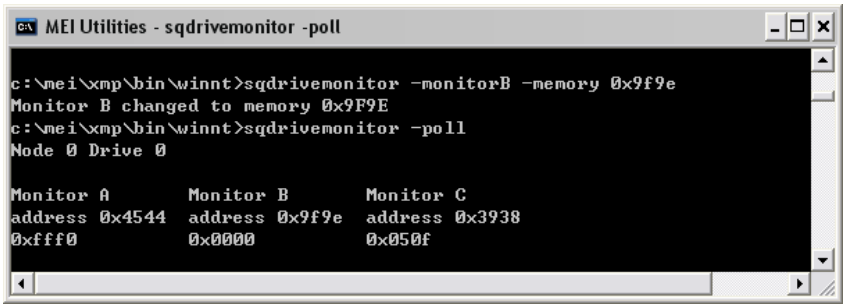
Software MPI 03.04.12
MechaWare 03.02.03
Matlab 7.3.0 (R2006b)
Bode Tool 1.06.18
Custom ZMP firmware for MechaWare (Z20P635XX)

Hardware ZMP controller
1 S200 with firmware 3.2j
1 AKM motor any feedback

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.
    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



Now we are ready to proceed!

2 MECHAWARE MODEL

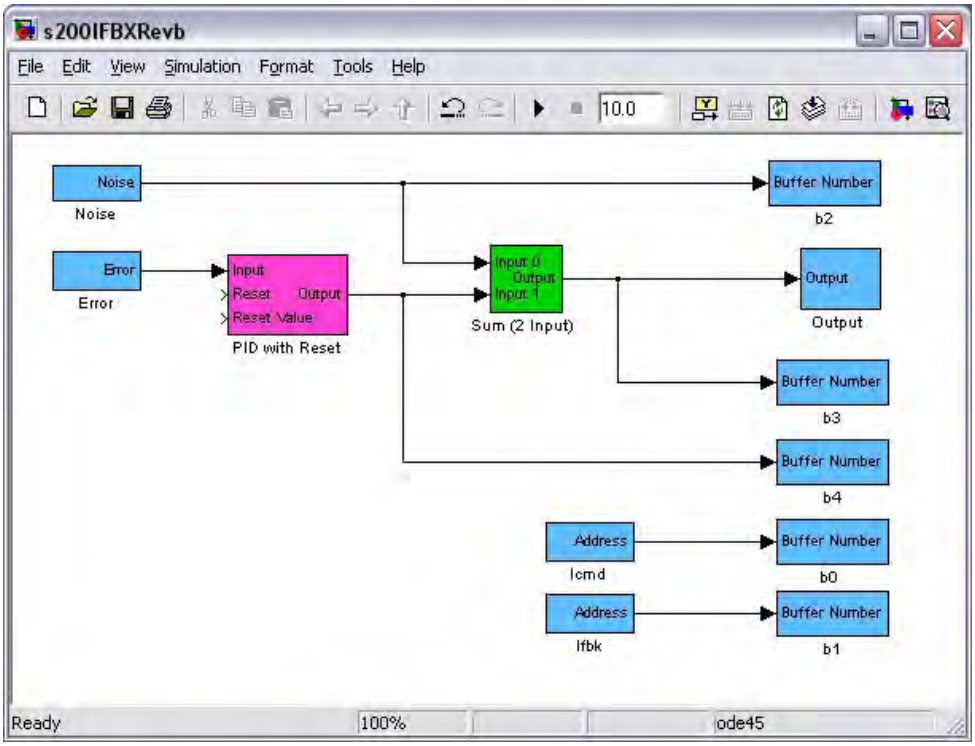
This section provides information on using MechaWare to measure the S200 current loop.

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.

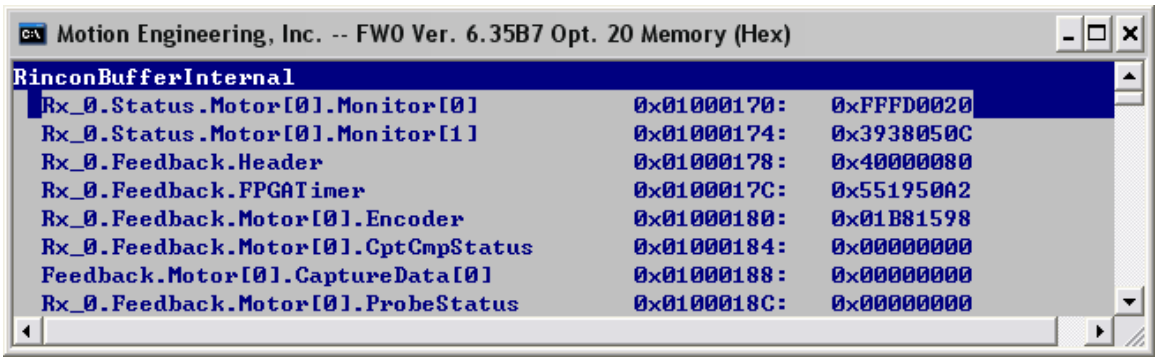
Block	Description
Memory	User Specifies a **Controller Memory Address** and a **Data type**. The Output is the value of the memory address in the specified data type.
Memory User Buffer	Same as the Memory block, but the user only specifies a User Buffer number. The Output is the specified User Buffer with the specified data type.
PID 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	Outputs the Position Error of an Axis
Feedback	Outputs Primary OR Secondary Encoder values from an Axis
Sum (2 Input)	This block is available with 2 – 8 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.



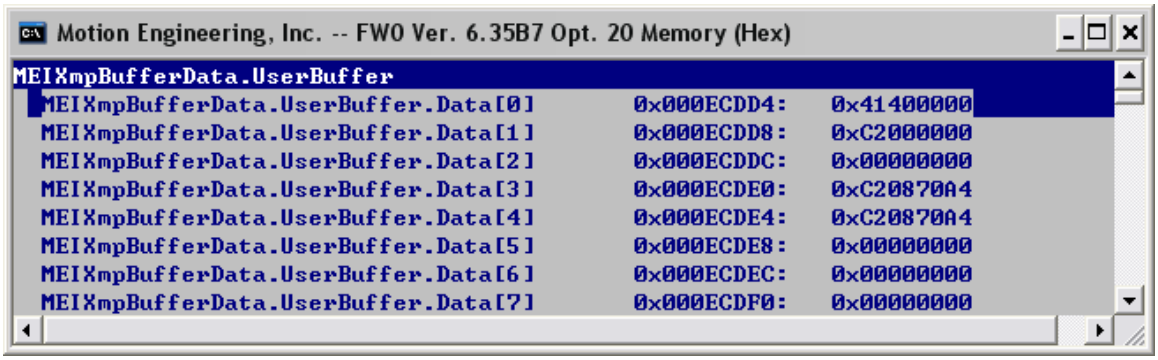
Monitor A is mapped to Ifbx, actual current, by default. We previously mapped Icmd, internal command current, to monitor B. Each monitor address is a 16bit value. The lower 16 bits of memory Rx_0.Status.Motor[0].Monitor[0] contains the value for Monitor A while the upper contains Monitor B.

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.



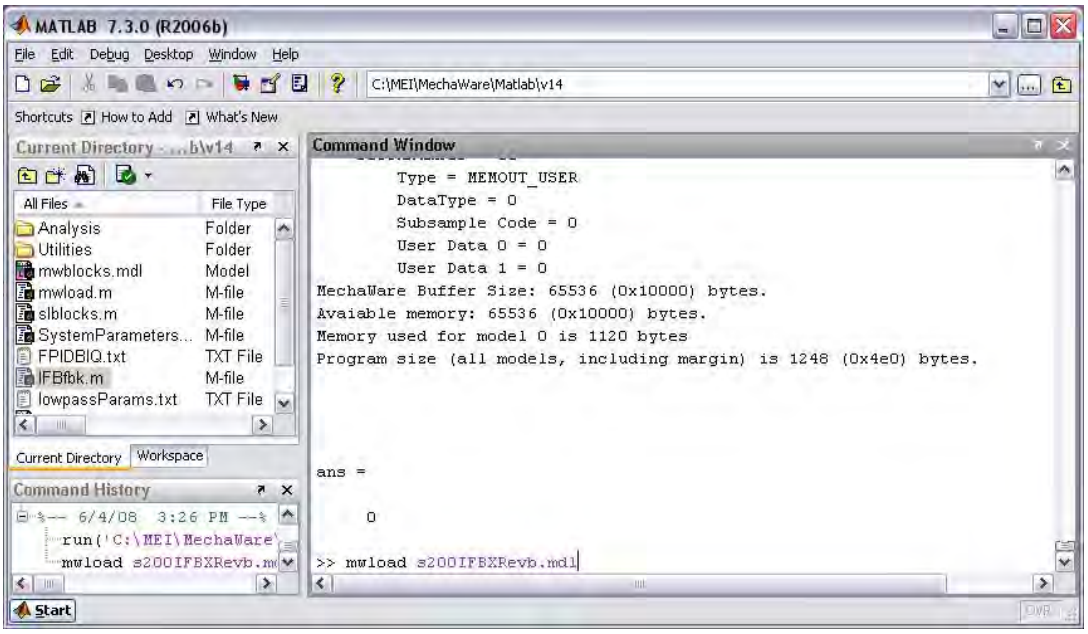
2.4 Block Parameters

Parameters not displayed below have a value of 0.

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
Buffer b0	Buffer Number	0	Icmd, internal current command
Buffer b1	Buffer Number	1	Ifbk, torque producing current
Buffer b2	Buffer Number	2	Noise block output
Buffer b3	Buffer Number	3	Total command, noise block + PID
Buffer b4	Buffer Number	4	PID output

2.5 Downloading Our Model

Use mwload.m Matlab file provided in MechaWare Install.



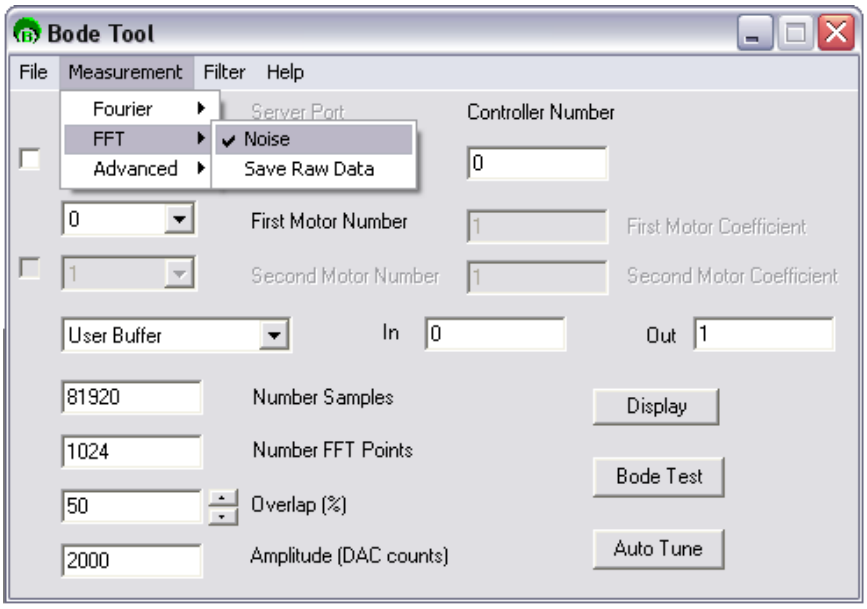
Or use mdl2mw.exe command line utility

3 BODE TOOLS ANALYSIS

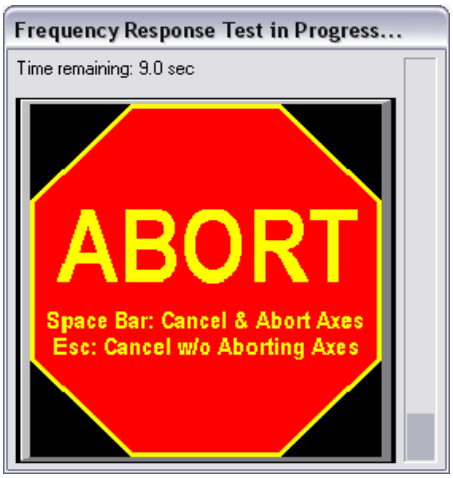
This chapter provides start up information for the Panel PAC.

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	



Start Test



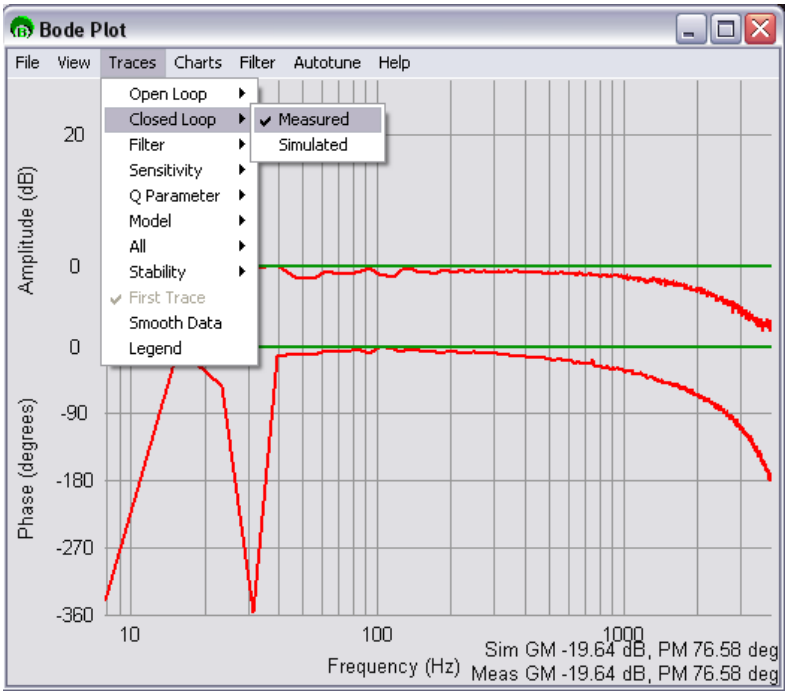
Note: If your axis faults during the test, it is most likely due to Position Error Limit. By default, the limit value is set to 1000. You will need to increase this to a reasonable number due to the high resolution of the S200 drive.

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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