Run GCX File and Check Step Response Timeof a Lightning™ II Scan Head with TuneMaster II Support Module

1 Introduction

Step response time of a galvanometer-based scan head is generally considered a critical performance that characterizes the dynamics of this scanning system. This technical bulletin describes the procedure of how to check step response time of a Lightning™ II scan head with TuneMaster II support module.

2 Setup

2.1 Software installation

Install TuneMaster II Support Module on your computer. Please contact CambridgeTechnology on where to download TuneMaster II (TM2) Support Module.

Upon installation of TM2 software, the Lightning II driver should be automaticallyinstalled on your computer too.

2.2 Hardware connection

The Lightning II scan head used to demonstrate this test is a 2-axis scan head. The scan head is connected to the computer with a USB cable, with the other end of the USB cable connected to the X-board of the Lightning II board stack, as shown in Figure 1.

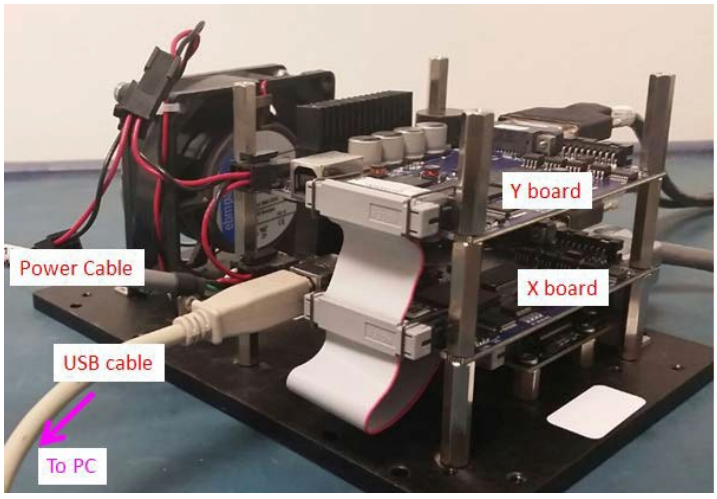

Figure 1 - USB Connected to the X-board

2.3 Settings in TM2 Support Module

Launch TM2 support module as shown in Figure 2.

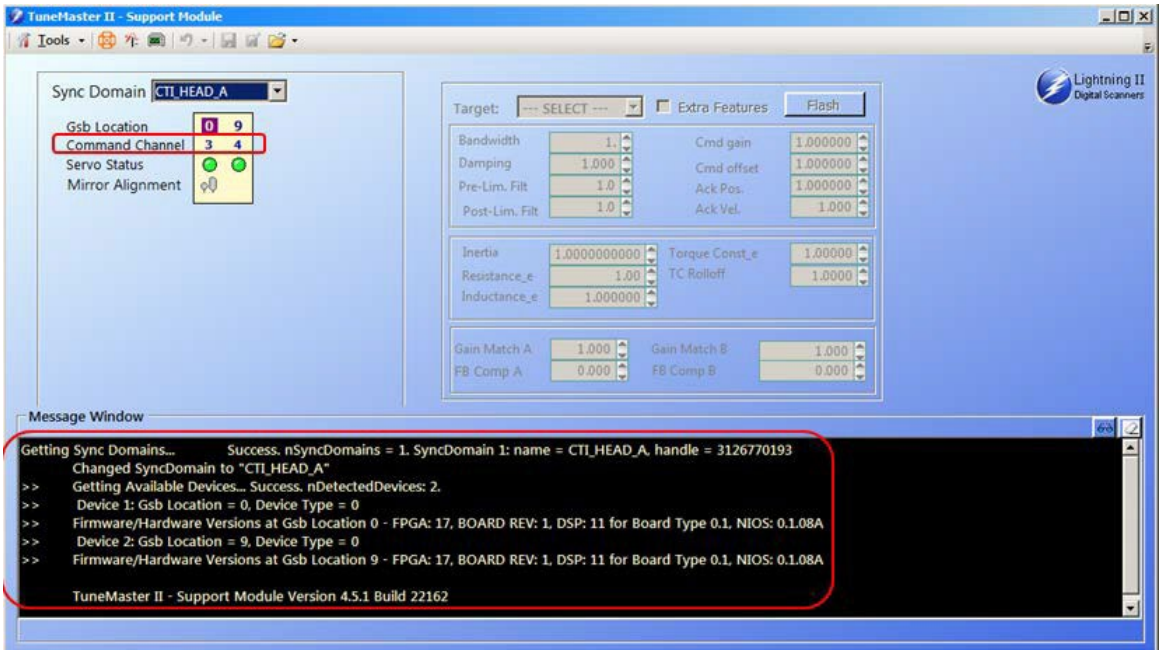

Figure 2 - TM2 Support Module

Under Gsb Location 0 and 9 (for 2-axis scan head), change Command Channel to 3 and 4. You can change the command channel by clicking on the number and choosing thecorrect value in the drop-down list.

In the top tool bar, there are three tools related to this test: **Function Generator**,**Probe Setup**, and **V-Scope**.

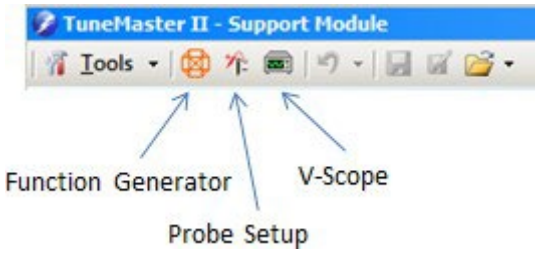

Figure 3 - Function Generator, Probe Setup and V-Scope

3 Check Step Response of the Lightning II Scan Head

3.1 Run GCX file with Function Generator

Open **Function Generator**. Load Multi_step_size_fast_hwtrig.gcx from directory shownas in Figure 4. Multi_step_size_fast_hwtrig.gcx is a job file that consists of pure-step square wave with multiple step sizes.

Figure 4 - Load Multi-step GCX Job File

Click the “Run” button to get the scan head to run this GCX job.

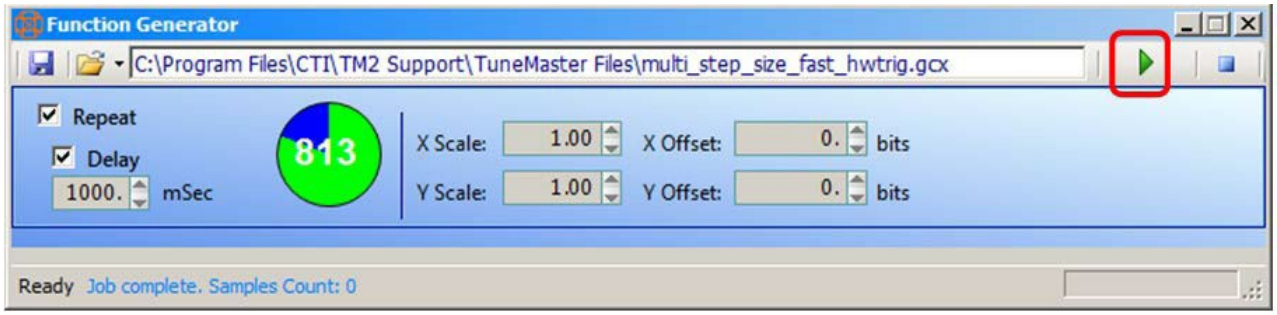

Figure 5 - Run GCX Job File

3.2 Probe Setup

Click the **Probe Setup** icon in the tool bar to open the Probe Setup Window, and thenfollow these steps (Figure 6):

1. Click on the probe to be set under the axis you want to characterize.
2. Select probe from the dropdown list. To check step response, choose CMD_RAW (rawcommand) and MOTOR_POSITION_ERROR.
3. Set scale for each probe. The scale will be the full range (in rad-mechanical unit forCMD_RAW and MOTOR_POSITION_ERROR) that the probe will use.
4. Click Set Probe
5. Select trigger mode to be 'Trigger in response to Command Flag in data'
6. Set sample size. Maximum sample size is 65536.
7. Click Set Trigger

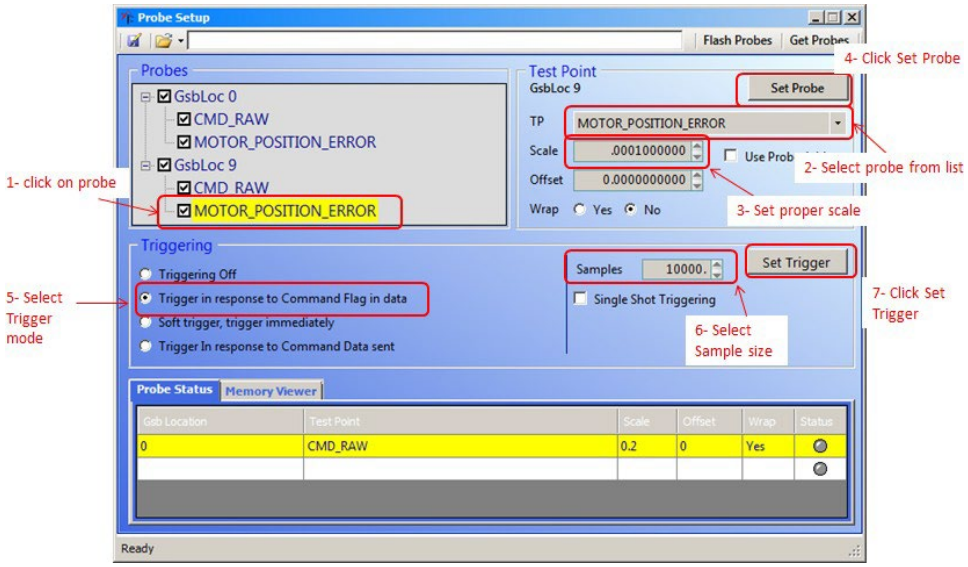

Figure 6 - Probe Setup

3.3 View step response in V-Scope

V-Scope is a virtual oscilloscope embedded in TM2 software that allows user to view theprobed signals from Lightning II scan head. To characterize step response, the probes set for this test is raw command and motor position error. Therefore these are the signals to be displayed in V-Scope.

Click the **V-Scope** icon in the tool bar to open V-Scope.

1. In the V-Scope window, turn on the scope channels by clicking on the circle beforethe channel name. In this example (shown in Figure 7), CH1 (channel 1) and CH2 (channel 2) are turned on.

2. Select a probed signal to display in each channel. In this example (shown in Figure 7), Gsb Location 0 (x-axis) CMD_RAW is selected to display in CH1 and Gsb Location0 (x-axis) MOTOR_POSITION_ERROR is selected to display in CH2.

   Click the Auto Zoom Out icon at the top (see Figure 8) to scale the signals so that their entire range is displayed in the V-Scope window. You will see the trigger counterrolling. You can freeze the data and turn on the measurement cursors if you are ready to measure.

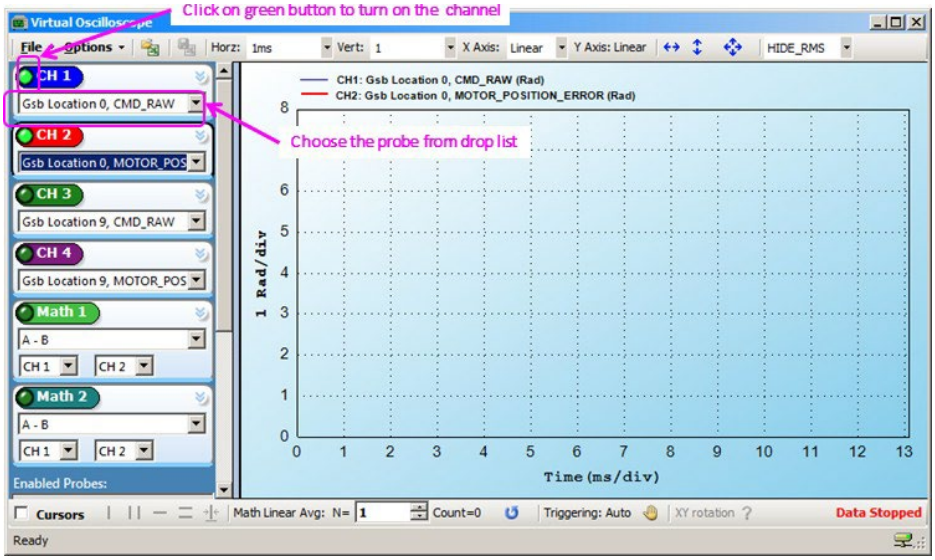

Figure 7 - Turn on Channels and Select Signals to Display

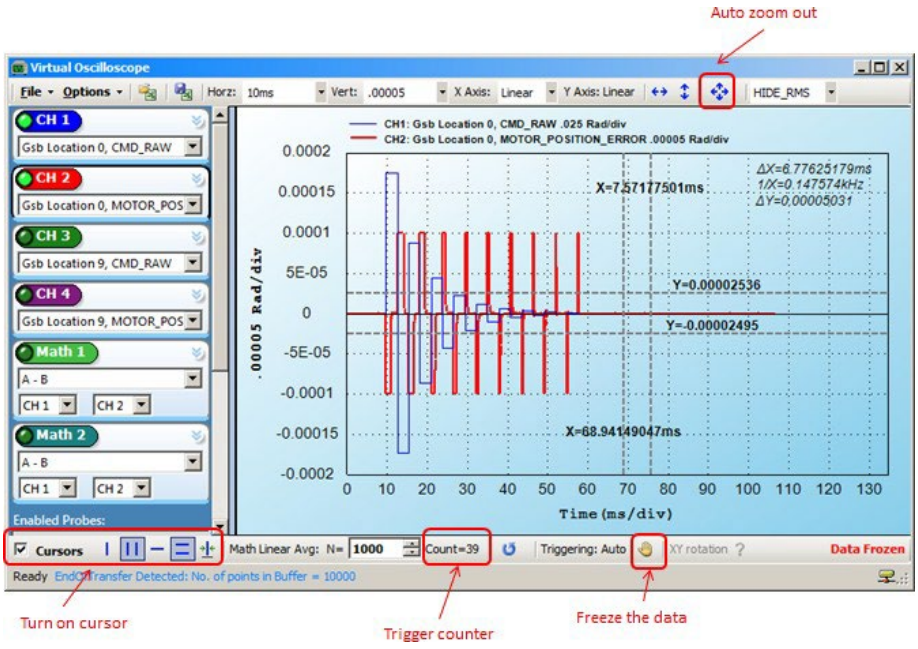

Figure 8 - Scale, Freeze and Measure Signals in V-Scope

3.4 Step response time measurement

3.4.1 Set and measure the jump size

As shown in Figure 9, highlight the RAW_CMD (blue curve) by clicking on “CH1” in the legend above the signal window. Window zoom into the portion of interest on the signalcurve. Measure the step size with the horizontal double cursors.

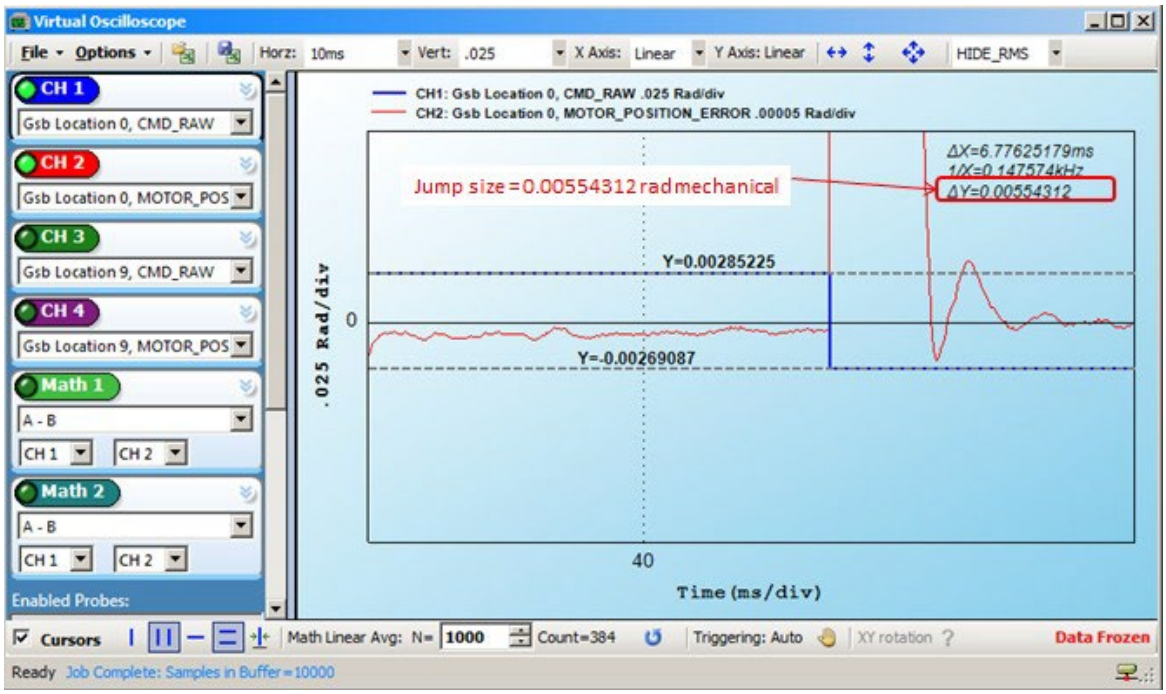

Figure 9 - Measure Step Size of a Particular Step

If the step size is not exactly what you want, you can change the command scale in theFunction Generator to scale the step size up and down.

Figure 10 - Scale Command in Function Generator

3.4.2 Measure step response time

Follow the steps below to measure the step response time of the step defined in 3.4.1

1. Click on “CH2” in the legend above the signal window to highlight MOTOR POSITIONERROR signal.
2. Window zoom in on the portion of MOTOR POSITION ERROR curve that correspondsto the correct step of the command signal curve.
3. Turn on the horizontal double cursors, and drag the cursors to define the error window (unit is rad mech) within which the scanner is considered to be ‘settled’ to thefinal position of the step. Refer to Figure 11.
4. Turn on the vertical double cursors, and drag the vertical cursor to measure the step response time. Place the 1st vertical cursor to when the step command is issued, or the motor position erorr starts to rise drastically. Place the 2nd vertical cursor to whenthe motor position error drops within the error window. Refer to Figure 11.
5. The time duration between 1st and 2nd vertical cursor is the step response time of thisLightning II scan head at this step size.

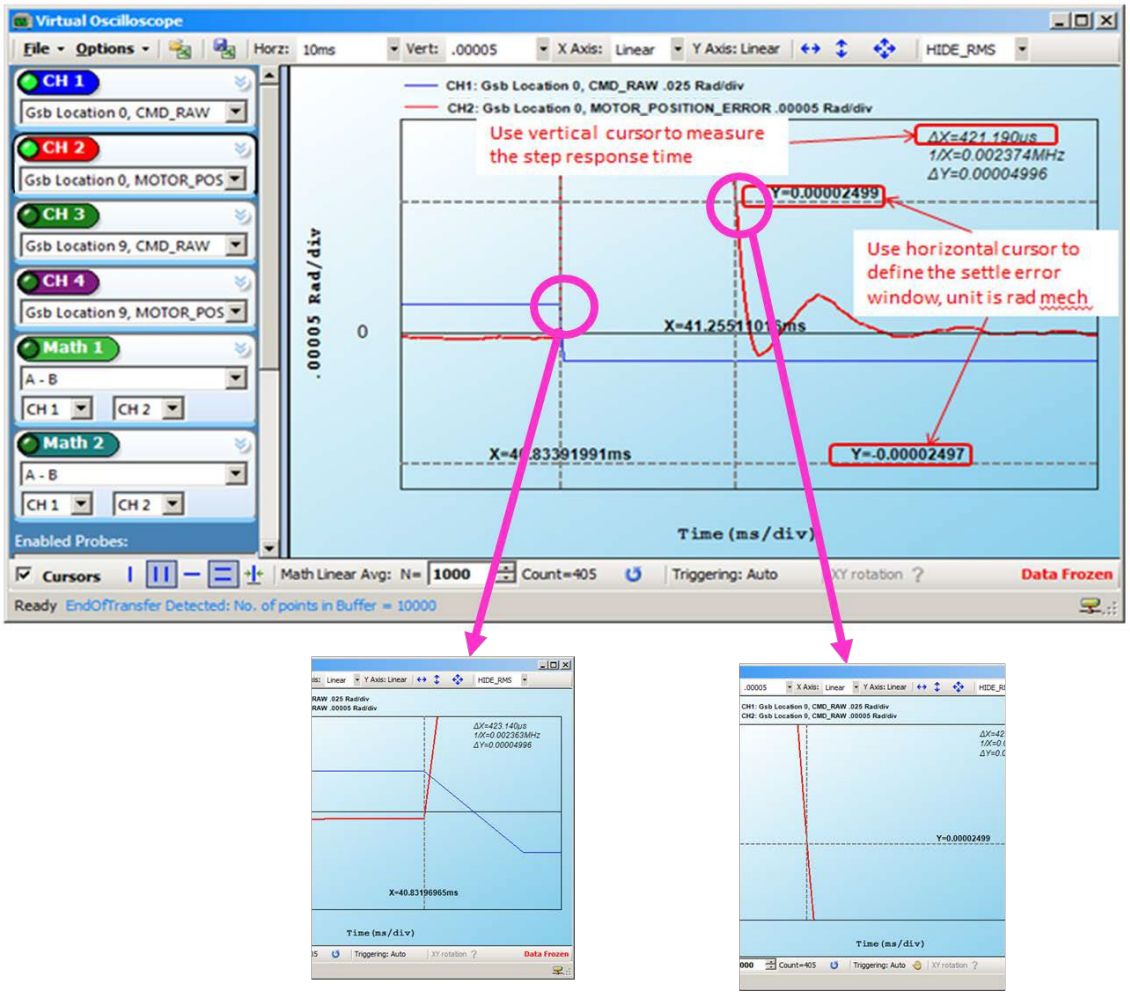

Figure 11 - Measure Step Response Time