APPLICATION NOTE: Determining Signal Delay between Analog Data Channels and WFT

APN-1017

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SUMMARY

The signal input to a Titan Digital Pod (internal or external versions) will be slightly delayed with respect to the analog input. This delay is the result of differences in processing time and filtering between the Digital and Analog sections. This delay will be consistent with the same test configuration and thus can be calculated. By determining the delay values in the system, users will then be able to correctly configure the TCS Exporter for the delay value(s). The method described below uses an impulse to measure and determine the delay for a given test configuration that uses Wheel Force Transducers (WFT's).

SETUP

To measure the delay, begin by instrumenting the wheel with the WFT that you will be using for the test. Connect the WFT output to the Digital Pod input.

Mount an Accelerometer to the wheel on the Z axis. Wire the sensor to channel 1 of the Titan Input Module. Connect the Titan device to a computer or a Titan CPU connected to your network.

MEASURING THE DELAY

Delay values will vary based on the scan rate of the test system; this means that in order to determine delay value for the system, this procedure should be performed using the same scan rate planned for the actual test.

Launch TCS and connect [F1] to the Titan Device. In the 'Configuration' screen, set the Scan Rate to the appropriate rate for the test that you will be running:
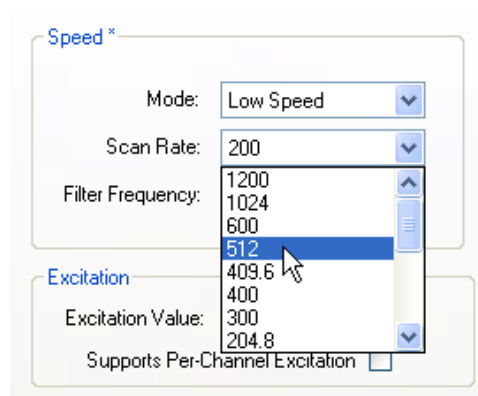
Clicking on the 'Digital Pod Configuration' button opens the "Configure Digital Pod" window. Configure the Wheel Force Transducer on the appropriate CAN port.
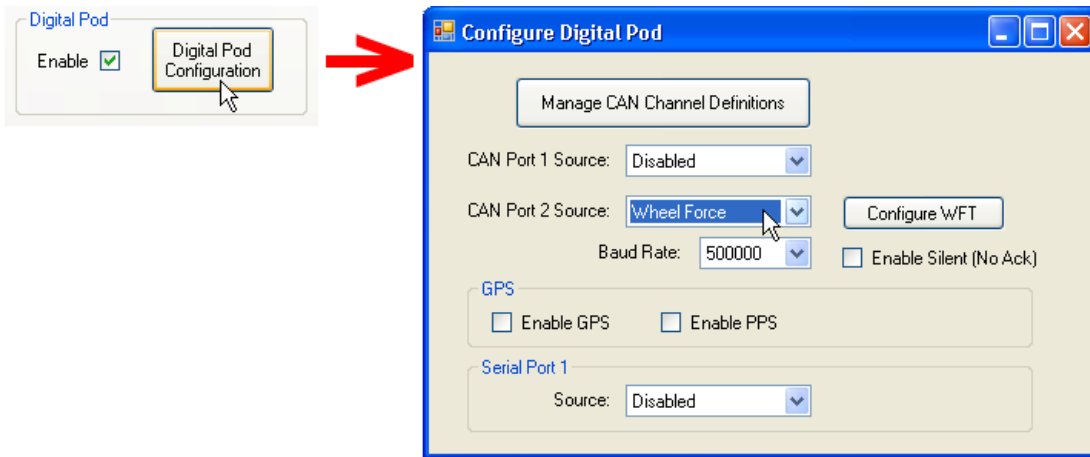

Click on the 'Manage CAN Channel Definitions' button. Browse and select the correct DBC file for the WFT, and then click on the 'Load' button to load the file into TCS:
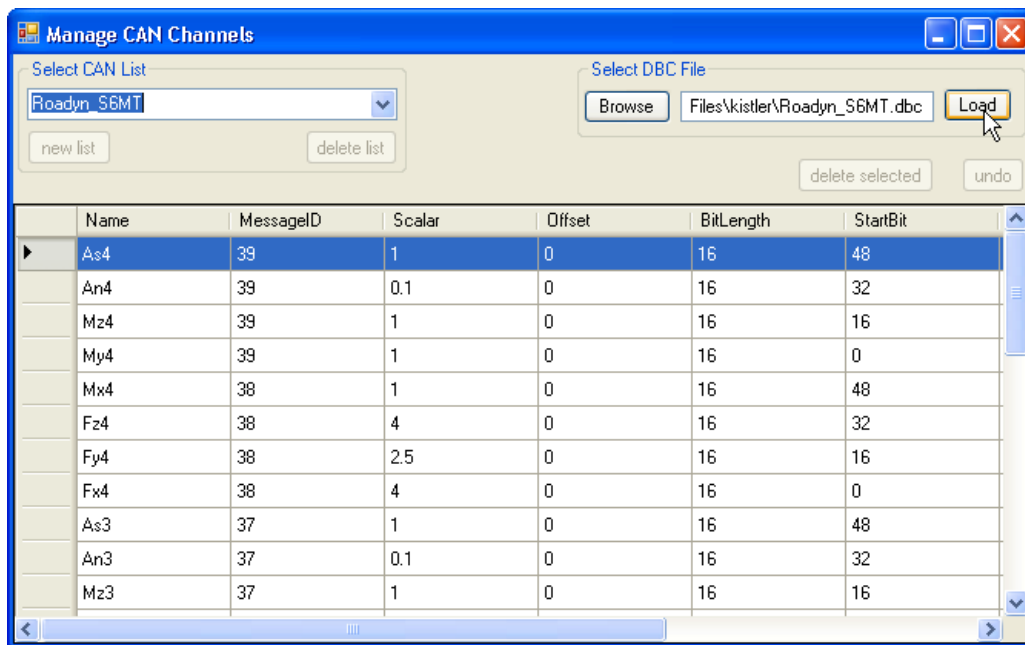

Exit out of the 'Manage CAN Channels' window and return to the 'Configure Digital Pod' window

Click on the 'Configure WFT' button to get the 'Configure CAN Port' screen. Select the appropriate DBC file from the CAN List dropdown (upper right). If the channel names in the DBC file match the field labels in TCS, clicking on the 'Auto Assign Channels' button will automatically map the proper channels to all wheels, eliminating the need to make individual assignments:
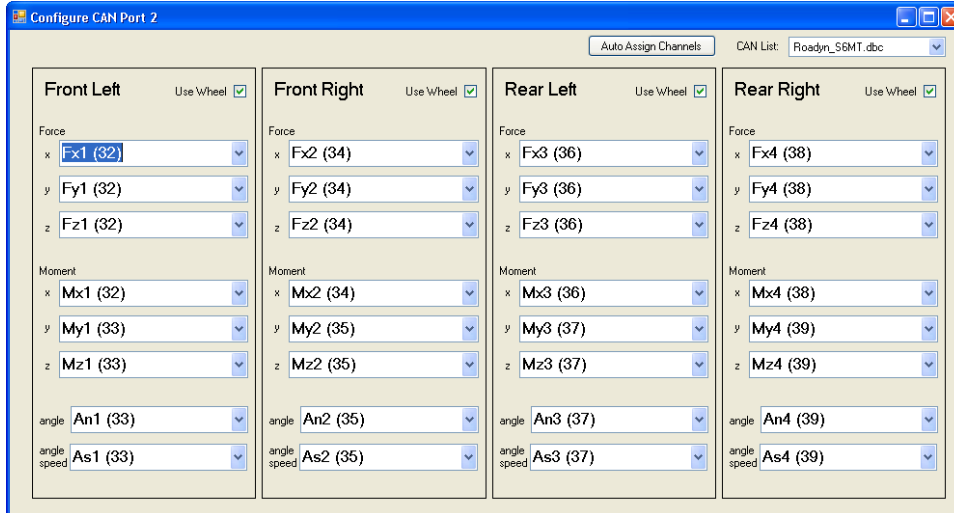

Click on the close box to enter the channel assignments into TCS.

Switch to the Sensors screen and select an Accelerometer sensor. Configure the Engineering Units for the Accelerometer sensor to Newtons ("N"). The reason for selecting Newtons is so that the Accelerometer will plot on the same display as the WFT. The scaling factor for the sensor should be changed so that the WFT and Accelerometer show the same amplitude for the impulse, this means that the user may have to scale up the Accelerometer by adjusting the Sensitivity parameter. The easiest way to do this is through trial and error.
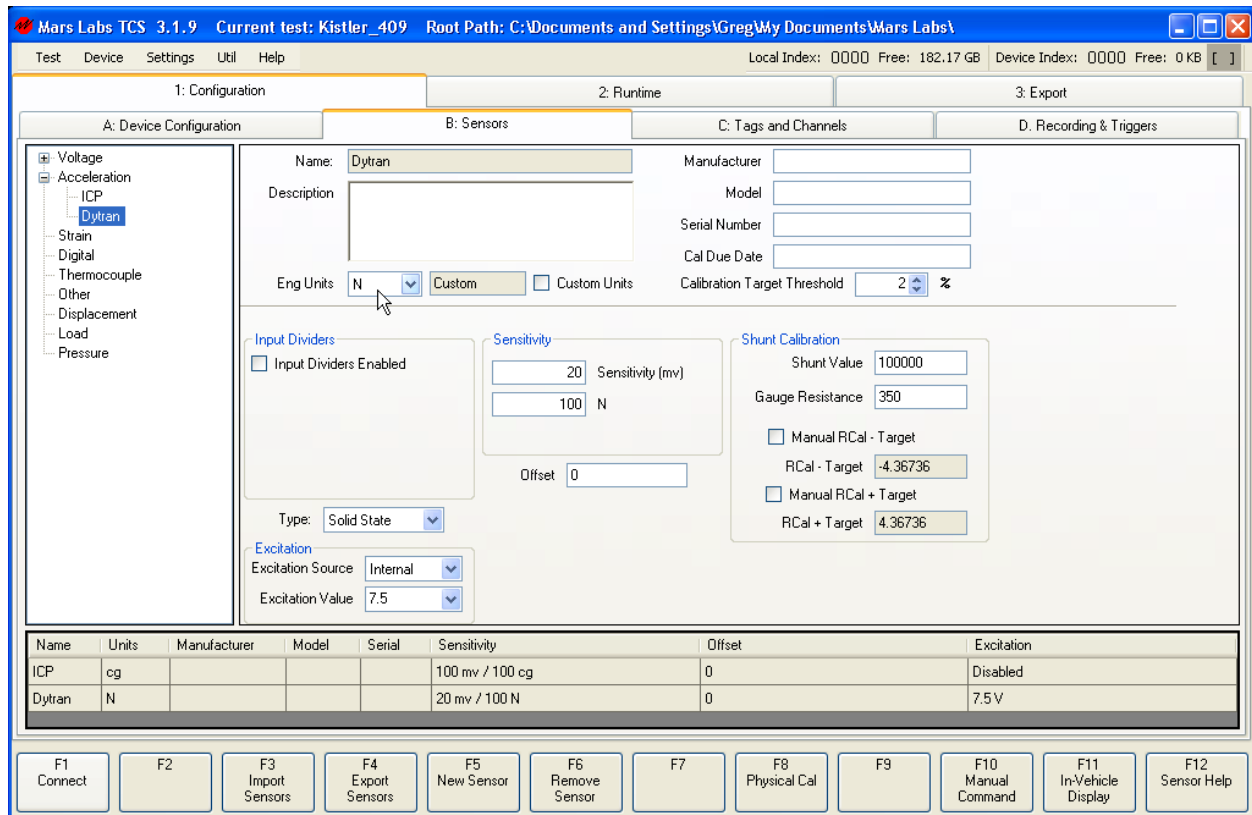
Configure all of the other Sensor parameters as normal.

After configuring the sensor, switch to the Tags and Channels page and apply the Accel sensor to the appropriate sensor:
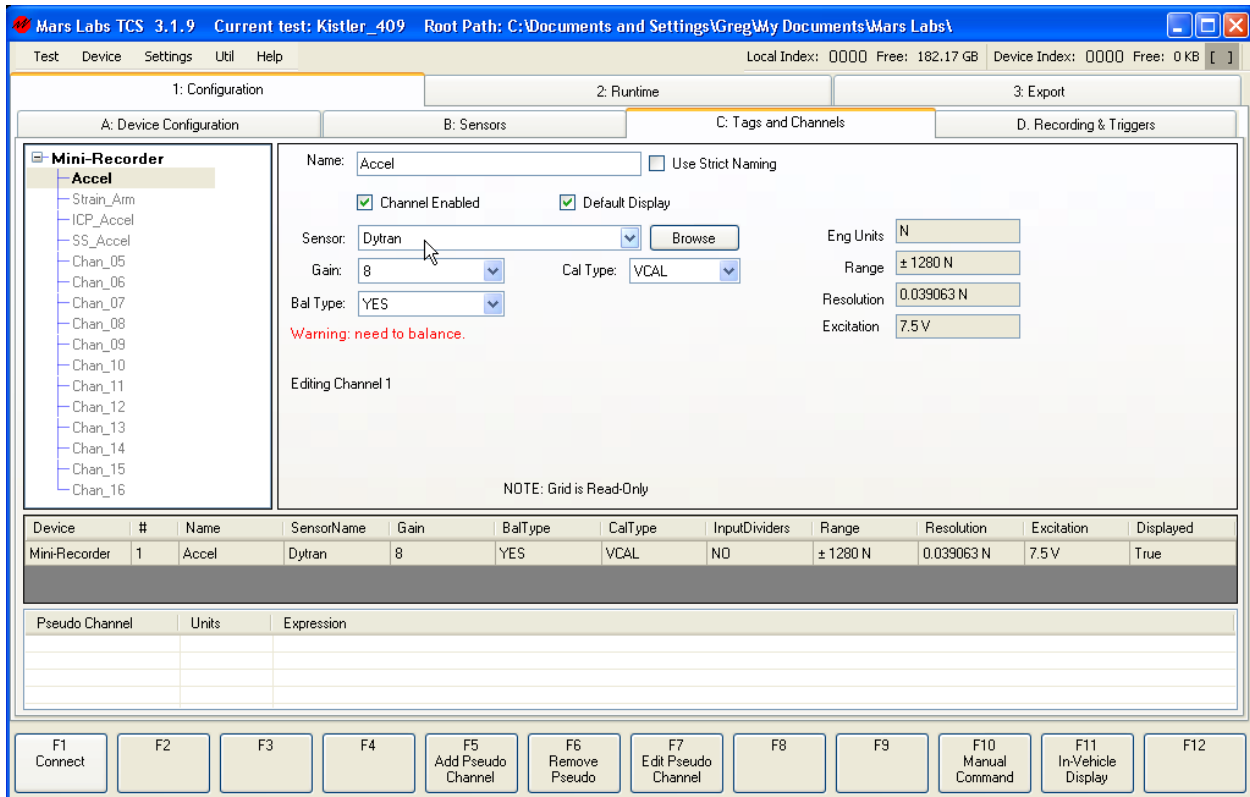
Switch to the Runtime screen and begin scanning [F3]. Start recording a data set. Using a rubber mallet, strike the wheel 3 times to provide an impulse to the instrumented wheel. Stop recording and scanning and then switch to the Export screen. Select the recently recorded file and double click on it to export it.

In the resulting display, select the Accel channel (accelerometer input) and the WFT channel (Fz1) that show the impulse. Using the cursor, select and drag across an impulse to obtain a magnified view of the data.

Select the 'Show Points' check box and count the number of points between the impulse on the analog channel (Accel) and the impulse (Fz1) on the WFT channel:
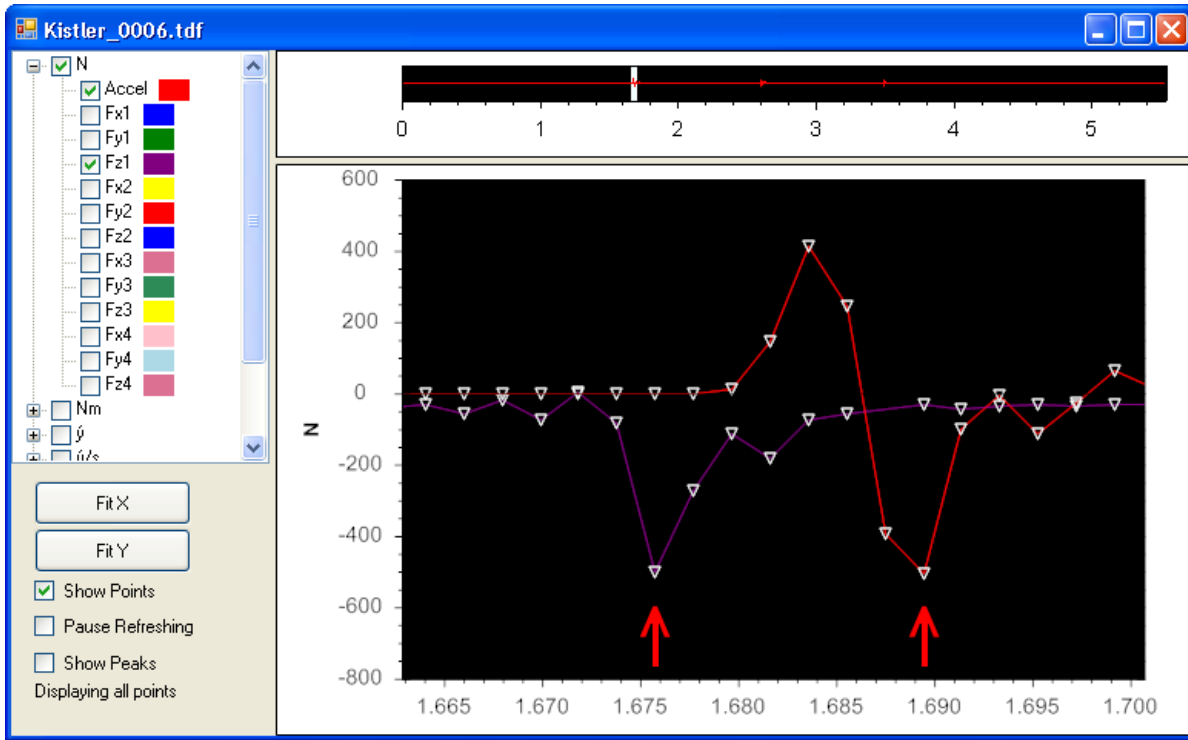
The number of points <u>between</u> the two impulses is the delay value in scans, which can be converted to seconds by dividing by the scan rate. For the plot shown above, there are 6 scans between the impulses. For a scan rate of 512, the resulting calculated delay value is 11.7 ms:

Test Number	Filter	CAN BAUD Rate	Sample Rate	Delay Scans	Delay time WFT to Titan Analog in mS
006	150	500K	512	6	**11.7**

FACTORING IN THE DELAY

The TCS Exporter includes a tool to offset the delay between individual digital and analog channels by a known constant. From the Export screen, select "Export Options" then "Edit Delay Values". Enter the calculated delay value in milliseconds as shown at right:

When all delay values are entered, click 'Done'. Before leaving the 'Export Options' window, check the 'Use Delay Values' checkbox. The entered delay values will apply a correction to the digital data during export: