dSpace Solutions for Control Tutorial

Introduction

The dSpace systems used for Motor/Control labs are a data acquisition system combined with an independent processing system to implement digital control models. An overview of the pertinent system specification includes:

- 8-input analog to digital converter (ADC) and 8-outputs digital to analog converter (DAC) with 12 or 16 bit resolutions.
- 2 incremental Encoders
- Onboard independent 64-bit floating point processor
- Onboard Slave DSP
- Onboard memory
- Other I/O capabilities

The system includes three main components:

- PCI development Board
- I/O breakout box
- ControlDesk software and software protection dongle

The first thing to understand about the dSpace system is that is an "embedded system" or self contained system. The PCI board installed in the lab computers is its own entity. None of the processing for a system implemented on the board is done by the host PC. As a result the board requires that software be created and downloaded to the board for the system to function.

The ControlDesk software is used to design the system implementation and interface for the DS1104 PCI dSpace board. It is used to download software to the board, start and stop the function of the DS1104 as well as create a layout for interfacing with global variables in dSpace programs.

Hardware Setup

Make sure the computer is OFF prior to installation of Hardware. An I/O breakout box must be connected the header of the DS1104 PCI card located on the back of the computers (see Figure 2). Connections to the breakout box can now be made based on the requirements of the lab.

Figure 2 - I/O Breakout box

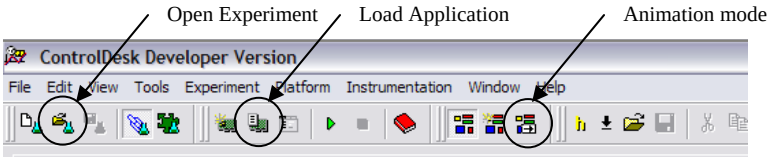
Software Setup

The Control desk icon should be located on the desktop of the lab computers and can be used to start the application once the hardware is installed and the computer is booted. The basic structure in ControlDesk is called an Experiment. An Experiment includes all the C/C++ code files that comprise the software for the DS1104 board, Layout windows that provide a graphical user interface (GUI) to the system variables, and support files that connect the global variables of the software to items in a layout.

To perform an experiment the following steps must be taken:

- Start ContolDesk

Figure 3 – ControlDesk Menu / Toolbar Interface



- Select from the “File” menu “Open Experiment…” or use the “Open Experiment” button on the Experiment Manager toolbar. Use the dialog box to find the desired experiment file and open it.

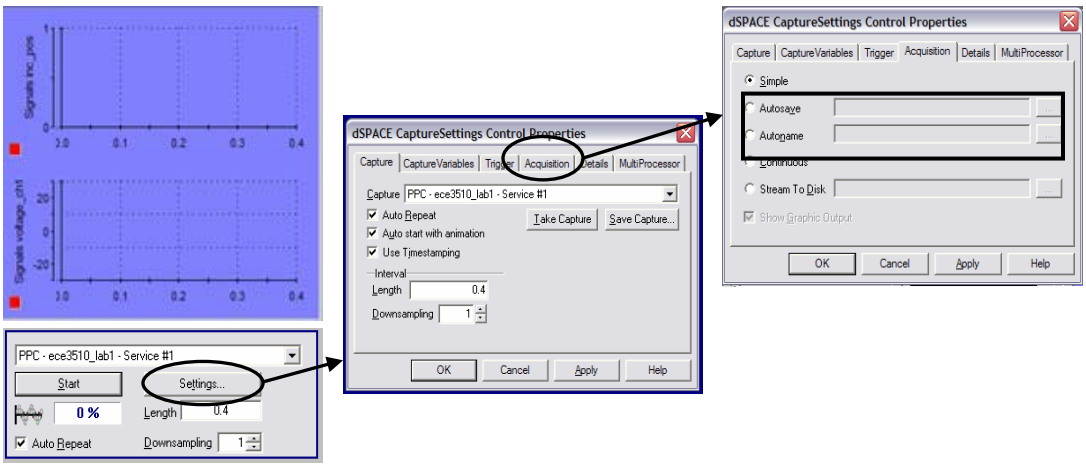
- Now the software for the system must be downloaded to the DS1104 PCI board. Use the “Load Application” button to download the software to the board. The dialog window should open up to the folder of the experiment and display a file with an .sdf extension. Select the .sdf file to load the board. Click yes to any following dialog boxes.

- Last, the animation mode must be started. This mode allows the interaction between layout window items such as buttons, plot windows, and sliders with the system variables available on the board.

Working with data

There are many way to get data from the dSpace system but the most straight forward way is to capture data that has been linked to a plot window in a layout. A plot window has an associated capture setting window that controls the saving of data. A plot window and the capture settings are presented in the first picture of Figure 4.

Figure 4 – Capture settings dialog progression



To save data outside dSpace the dialog progression for Figure 4 should be followed. The ultimate goal is to store the data graphed in the plot window to a .mat file for analysis in Matlab.

The two methods that will apply in the labs are Autosave and Autoname. Autosave creates a file that is overwritten each time the plot window is redrawn. With Autoname a file is created for each refresh of the plot window using a base name like “vars” and then added a suffix with each capture starting from 001 (ie… vars001, vars002, …. , vars999 is max).