

DAPstudio Reference Manual

*DAP Measurement Studio Manual
Software Description
and Reference Guide*

Version 3.00

Microstar Laboratories, Inc.

This manual contains proprietary information which is protected by copyright. All rights are reserved. No part of this manual may be photocopied, reproduced, or translated to another language without prior written consent of Microstar Laboratories, Inc.

Copyright © 2003 - 2006

Microstar Laboratories, Inc.
2265 116th Avenue N.E.
Bellevue, WA 98004
Tel: (425) 453-2345
Fax: (425) 453-3199
[http:// www.mstarlabs.com](http://www.mstarlabs.com)

Microstar Laboratories, DAPcell, Data Acquisition Processor, DAP, DAP 5400a, DAP 5200a, iDSC, iDSC 1816, DAPL, DAPL 2000, Channel List Clocking, Accel32, DAPtools, DAPview, DSCview, DAP Measurement Studio, and DAPstudio are trademarks of Microstar Laboratories, Inc.

Microstar Laboratories requires express written approval from its President if any Microstar Laboratories products are to be used in or with systems, devices, or applications in which failure can be expected to endanger human life.

Microsoft, MS, MS-DOS, Excel, and Windows are registered trademarks of Microsoft Corporation. IBM is a registered trademark of International Business Machines Corporation. Intel is a registered trademark of Intel Corporation. The term "Linux" is a registered trademark of Linus Torvalds, the original author of the Linux kernel. Other brand and product names are trademarks or registered trademarks of their respective holders.

Part Number MSDAPSTDIOM300

Contents

Section I. Introduction.....	1
Welcome	2
New Additions.....	4
Custom Design Window	4
Variable/Constant Display.....	4
Data File Window.....	4
Disk Logging Window	5
Table Configuration Dialog.....	5
Switching between boards.....	5
About This Document.....	7
System Requirements.....	8
Installation.....	8
Section II. User Interface.....	9
About The User Interface.....	11
Menus	13
File Menu Item	13
Start!/Stop! Menu Item.....	13
System Menu Item.....	14
Diagnostics Menu Item	17
Window Menu Item	18
Help Menu Item.....	20
Keyboard.....	22
Configuration Window for DAP boards.....	24
Input Tab.....	24
Output Tab.....	27
Processing Tab.....	31
DAPL Listing Tab	39
Interpreter Tab.....	39
Configuration Window for iDSC Boards.....	41
Multiple Boards Configure Menu Item – iDSC Boards.....	41
Input Tab.....	44
Filter Design Tab.....	45
SCS Module Tab.....	48
Graph Window	50
Table Window	57
Alarm Window	60
Bar Window	69
Waterfall Window.....	77
Digital Volt Meter Window.....	85
Variable/Constant Display.....	88
Custom Design Window	91
Disk Log Window.....	95
Server Disk Log Window.....	98
Data File Window.....	103

Section III. Sample Applications	105
About the Sample Applications	107
Summary of the Sample Applications	108
List of Sample Applications	111
App01 Getting Started.....	115
App0101 Sample and Graph One Channel	116
App0102 Sample, Graph, and Log Two Channels to a Disk File.....	118
App0103 Detect a DAP Board.....	120
App0104 Run Your Application	121
App0105 View the Memory Used.....	122
App0106 Lock a Configuration	124
App0107 View Error Messages	126
App0108 Read a Logged Data File	128
App0109 Use Icons in Tab Labels	130
App0110 Clone a Display Window.....	132
App02 Configure an Input Procedure.....	134
App0201 Select a Sample Rate.....	135
App0202 Sample and Graph Eight Differential Channels	136
App0203 Sample 128 Channels with Input Expansion.....	138
App0204 Select a Contiguous Range of Input Channel Pipes.....	140
App0205 Select an Even/Odd Range of Input Channel Pipes.....	142
App0206 Select a Rectangular Range of Input Channel Pipes.....	144
App0207 Configure All Input Channel Pipes to Sample the Same Pin.....	146
App0208 Configure All Input Channel Pipes to Sample an Incremented Pin	148
App0209 Configure All Input Channel Pipes to Sample at the Same Gain.....	150
App0210 Configure Input Channel Pipes to Sample Differential Inputs and Ground.....	152
App0211 Configure an Input Procedure for Simultaneous Sampling.....	154
App03 Configure an Output Procedure	157
App0301 Select an Update Rate	158
App0302 Produce a Sine Wave on DAC0	159
App0303 Produce a Sine Wave on DAC0 and a Square Wave on DAC1.....	161
App0304 Configure an Output Pipe to Update DAC0.....	163
App04 Write a Processing Procedure.....	165
App0401 Automatically Declare Pipes, Variables and Constants	166
App0402 Get DAPL Help	168
App0403 Use the Alphabetized or Categorized Command List.....	169
App0404 Use the FIRFILTER command	170
App0405 Use the FFT command	171
App0406 Duplicate Commands With Auto-Increment Parameters.....	172
App0407 Process Multiple Commands with Auto-Increment Parameters	174
App0408 Activate All Processing Tabs.....	177
App0409 Use the Sequencing Tab	179
App05 Using Graph Features.....	181
App0501 Add a Graph	182
App0502 Zoom Into a Specific Region	184
App0503 Use the Crosshairs.....	186
App0504 Display Data in FFT Blocks	188

App0505 Configure Data History	189
App0506 Configure Graph Axis and Titles	191
App0507 Configure Graph Colors and Fonts.....	193
App0508 Use 3D Graph Features	195
App06 Design Filters	198
App0601 Add a New Filter Design	199
App0602 Delete a Filter Design	200
App0603 Copy and Paste a Filter Design	201
App0604 Use the FIRFILTER Command	202
App0605 Change to Response Display	204
App0606 Adjust Number of Taps	206
App0607 Adjust Filter Phase Matching.....	207
App0608 Change Filter Vector Type	209
App0609 Filter Scaling and Zero Stripping	210
App0610 Change to Slope Approximation	212
App0611 Change Window Vector	213
App0612 Create a Bandpass Filter.....	215
App0613 Change Cutoff Slope.....	216
App0614 Use Crosshairs to Track Actual Filter Response	217
App0615 Export Filter Coefficients	219
App07 Design FFTs	220
App0701 Use the FFT Command	221
App0702 Graph FFT Magnitude.....	223
App0703 Display Data in FFT Blocks	226
App08 Create a Control Application	228
App0801 PID Tuning: Simple Direct Feedback Artificial System Under Test in Step Response Display	229
App09 Configure Multiple DAP Boards	231
App0901 Configure Two DAP Boards.....	232
App0902 Select a DAP Address	234
App0903 Browse for DAP Boards on a Network.....	236
App0904 Copy and Paste a DAP Board Configuration	238
App0905 Rename a DAP Board	240
App0906 Use a Shortcut to Switch Between DAP Boards	242
App10 Send Data to the PC	243
App1001 Use a Single Communication Pipe	244
App1002 Use Multiple Communication Pipes	245
App11 Server Disk Logging	247
App1101 Enable Server Disk Logging	248
App12 Use Diagnostic Features.....	250
App1201 Display Memory Used.....	251
App1202 Open the Interpreter Window	252
App1203 Use the Interpreter Commands.....	254
App13 Use Table Features	256
App1301 Copy/Paste Data from a Table to a Spreadsheet Program.....	257
App1302 Configure Column Widths and Row Heights.....	259
App1303 Configure the Data History.....	260
App14 Use Alarm Features	261

App1401 Create a Pass/Fail Application	262
App15 Use Digital Volt Meter (DVM) Features	265
App1501 Configure the DVM Display.....	266
App16 Use Bar Features.....	268
App1601 Configure the Bar Graph Display.....	269
App17 Use Waterfall Features.....	271
App1701 Configure the Waterfall Display	272
App1702 View FFT Data in Customized Waterfall Graphs.....	274
App18 Send Data to the DAP Board.....	276
App1801 Send a Data File with One Channel of Data to the DAP Board.....	277
App1802 Send a Data File with Three Channels of Data to the DAP Board.....	279
App1803 Send Multiple Data Files to the DAP Board	282
App19 Use iDSC Features.....	285
App1901 Configure an iDSC Board.....	286
App1902 Design iDSC Filters	288
App20 Use Custom Design Features.....	291
App2001 Configure the Custom Design Window	292
App2002 Add a Variable/Constant Control	295
App2003 Use Constant and Variable Controls.....	297
App2004 Use a Variable Control	299
Section IV. Hardware Configurations	301
About The Hardware Configurations	303
List of Hardware Configurations.....	303
HwCfg01 Basic Hardware Configuration.....	304
HwCfg02 Hardware Configuration with Input Expansion.....	306
HwCfg03 Two DAP Boards.....	312
HwCfg04 Hardware Configuration with Simultaneous Sampling.....	314
HwCfg05 Hardware Configuration with an iDSC Board.....	316
Index	319

Section I. Introduction

Welcome

Welcome to DAP Measurement Studio (DAPstudio) 3.00. We take great pleasure in providing you with this update of our Data Acquisition Processor application development environment.

DAPstudio lets you rapidly develop complete data acquisition applications. You can use it for proof-of-concept development or for your full application run-time environment. In either case, use it as your tool of choice for developing the onboard processing on your DAP board using DAPL. Just pick a sample application that comes close to what you want to do, and get down to work right away with DAPstudio.

Commands issued to DAPL determine exactly what low-level tasks the DAP will perform in an application. DAPstudio lets you create these commands by clicking on the appropriate tools as you design the system. At every step in the development process, the next step presents itself as both obvious and compelling.

DAPstudio 1.00 gave you useful tools for developing DAPL applications. The 1.50 release brought you extensions to those tools and the ability to review your experimental results rapidly without leaving DAPstudio. With the major version 2.00 release you gained new display types and configuration options, iDSC board/SCS system support, new diagnostic tools, and the ability to send data to the PC over multiple data channels (communication pipes) for mixed data rate applications. Version 2.50 provided the ability to send data from the PC to the DAP board and display live data. It included 3D display options, bar graphs, and waterfall graphs.

DAPstudio 3.00 extends the live data display capabilities to allow user input controls for run-time application configuration. Custom design windows allow you to embed different visual displays into a single window. Using multiple custom design windows, with user input controls when needed, you can create a complete user interface.

With 3.00, work with larger applications becomes easier. Use the new root path configuration option for `Disk Log` windows and rapidly re-direct all of the log files in your application. One `Data File` window now handles multiple files, simplifying configuration when viewing many data files within a single application.

In future releases we will develop new tools, based on what you see in DAPstudio 3.00, to support the rest of your data acquisition and control application development process.

Thank you for using Microstar Laboratories development products. We hope you enjoy using them.

New Additions

DAPstudio (Version 3.00) makes data display and analysis easier for you in several ways. Pick and choose from different displays to create the custom window that shows all of the data – in all of the ways – that you want it to. See instant changes in your application by making adjustments in real-time to the constants and variables you use.

Custom Design Window

- Select any combination of Graph, Table, Waterfall, Bar, Alarm, and Digital Volt Meter displays within a custom design window.
- Create a Custom Design window by selecting Window | New Custom Design.
- To include a display, select Custom Design Options | Add (display type).
- The top left buttons (T, B, <, >, C) allow for top, bottom, left, right, and client alignment. The CONFIG button allows specialized configuration for the display screen. Disable the design mode state using the top right button (D).

Variable/Constant Display

- Send and read variable and constant information from the DAP board with the Variable/Constant display. Access this display through the Custom Design window.
- To include the Variable/Constant display, select Custom Design Options | Add Variable/Constant.

Data File Window

- Open numerous data files using a single Data File window. This allows you to work with configuration of related files in one place. You can then configure multiple groups of files by using multiple Data File windows. In the previous release, each data file you read required a separate Data File window.
- Create a data file window by selecting Window | Open Data File...

- To add a data file, select the + button or Add label.
- To delete a data file, select the tab of the file you want to delete, followed by the - button or Delete label.

Disk Logging Window

- Use a base path and name to easily manage log files – especially for multiple log files for multiple DAP or iDSC boards.
- To use a base path and name, select Disk Log Options | Base Path and Name.
- The Disk Log window also now supports three logging options (overwrite confirm, overwrite, and append).
- To see these new features, select Window | DiskLog. The logging options are visible in window itself.

Table Configuration Dialog

- Select configuration information for a Table window in a new Table Configuration dialog.
- To access the Table Configuration dialog, select Window | Table, then Table Options | Display...

Switching between boards

- Switch between boards quickly – DAP boards, iDSC boards – using a new shortcut method.
- Select Window | Configuration and place the mouse over the board name (i.e. DAP0, DSC0, etc). The board name will highlight. Click on it to show all available boards in the system. Select the board to switch to it.

About This Document

DAPstudio provides immediate and easy access to one or more DAP boards. From DAPstudio, communication with a DAP board is initiated automatically and requires minimal programming. DAPstudio provides a graphical interface to:

- Save and load Input, Output, and Processing configurations.
- Select system options.
- Design and configure filters.
- Display data in a line graph, table, alarm, bar graph, waterfall graph, and/or digital volt meter window.
- Display data in a custom window that includes multiple visual displays selected by the user.
- Display variable and constant information.
- Disk log data to a text or binary file.
- Disk log data to a binary file at high speed by the server.
- Send data to a DAP board.
- View diagnostic data about the application.

This version of DAPstudio supports the DAPL 2000 operating system.

[Section II](#) describes the user interface, including various windows, menu items, and shortcut keys.

[Section III](#) describes sample applications ranging from simple input and output to complex signal processing and real-time process control.

[Section IV](#) describes hardware configurations for running the sample applications in [Section III](#).

The sample applications in [Section III](#) and hardware configurations in [Section IV](#) together serve as a good starting point for building complete data acquisition systems, including software and hardware.

System Requirements

DAPstudio supports all PCI DAP boards when they are installed under Windows 2003/XP/2000/NT/ME/9x operating systems with Accel32 or the DAPcell server.

Because DAPcell and DAPL 2000 hide most differences between PCI DAP boards and ISA DAP boards, DAPstudio will work with most ISA DAP boards.

Installation

Each DAPtools Basic, Standard, and Professional package on CD-ROM includes a version of DAPstudio. Place the CD-ROM into the CD-ROM drive. The Microstar Laboratories Setup Launcher (SETUP.EXE at the root of the CD) will run automatically. Select the DAP Measurement Studio link. You also can use Explorer or Run to browse for the DAPstudio folder. Find the SETUP.EXE program in this folder and run it.

The program will place the DAPstudio software into the folder listed below unless otherwise specified.

```
C:\Program Files\Microstar Laboratories\DAPstudio
```

Use DAPstudio right now and start creating systems to run on any DAP board. The DAPtools Professional CD includes DAPstudio with a license and software key. DAPtools Basic and DAPtools Standard include the evaluation version of DAPstudio. If you have DAPtools Basic or DAPtools Standard, contact Microstar Laboratories to purchase the full version of DAPstudio.

The evaluation DAPstudio version lets you use every feature in the product. Whenever you save a configuration or start acquisition, however, the software first displays a message that asks you to buy the product before you use it in your work.

You may use the software as often as you like to evaluate it, but each time you save a configuration or start acquisition you will see the same request. When you buy the product, we provide you with a license and with a software key to bypass this request.

Section II. User Interface

About The User Interface

DAPstudio provides immediate and easy access to one or more DAP boards. From DAPstudio, communication with the DAP board is initiated automatically and requires minimal programming. Various **menu** items and **shortcut keys** are available depending on the active window. DAPstudio provides the following types of windows:

Display Windows Configuration	Descriptions
Graph	Displays graphical representations of acquired and processed data from the DAP board.
Table	Displays text representations of acquired and processed data from the DAP board.
Alarm	Sets up an Alarm window for pass/fail testing, process level monitoring, and process range monitoring.
Bar	Displays acquired and processed data from the DAP board in a Bar graph window.
Waterfall	Sets up a Waterfall graph window to display and analyze large amounts of data over frequency and over time simultaneously.
Digital Volt Meter	Sets up a Digital Volt Meter window to display instantaneous values.
Variable/Constant	Displays variables and constants in the Custom Design window. Access through the Custom Design window.
Custom Design	Sets up a Custom Design interface to show multiple displays in a single window.

**Data Management
Windows**

Disk Log

Descriptions

Sets up logging data to a disk file and displays the logging information.

Server Disk Log

Sets up the server to log data to a disk file in the background and displays the logging information.

Data File

Accesses data from an existing binary file.

Menus

The following common menu items are accessible from all active windows. The individual window chapters in this manual cover the menu items that are unique to each window type.

File Menu Item

Contains options to save and load a workspace to a configuration file. When DAPstudio is started and acquiring data, this menu item is grayed out and not available for use.

- **New Menu Item:** Opens a new workspace. If changes have been made to the current workspace, DAPstudio uses a message box to prompt to save the changes.
- **Open... Menu Item:** Opens an existing workspace. If changes have been made to the current workspace, DAPstudio uses a message box to prompt to save the changes.
- **Close Menu Item:** Closes an existing workspace. If changes have been made to the current workspace, DAPstudio uses a message box to prompt to save the changes.
- **Save Menu Item:** Saves the current workspace to the specified filename. If a filename is not assigned, DAPstudio prompts for a filename. The shortcut is **Ctrl-S**.
- **Save As... Menu Item:** Saves the current workspace with a specified filename.
- **Save DAPL... Menu Item:** Saves the DAPL program listing as a .dap text file with a specified filename.
- **History Items:** Shows up to nine, numbered, recently opened files for quick repeat access.
- **Exit Menu Item:** Closes DAPstudio.

Start!/Stop! Menu Item

Initiates or terminates data acquisition.

- **Start!** Menu Item: Instructs the DAP board to start acquiring data. It appears when DAPstudio is not acquiring data. When **Start!** is selected, DAPstudio begins data acquisition and changes **Start!** to **Stop!**. The shortcut is **Alt-S**.
- **Stop!** Menu Item: Instructs the DAP board to stop acquiring data. It appears when DAPstudio is acquiring data. When **Stop!** is selected, DAPstudio terminates data acquisition and changes **Stop!** to **Start!**. The shortcut is **Alt-S**.

System Menu Item

Selects general options for DAPstudio. This controls how DAPstudio receives information from the DAP board and how the information is shared among the various windows of DAPstudio. When DAPstudio is started and acquiring data, this menu item is grayed out and not available for use.

- **Address Select...** Menu Item: Displays a **Dap Select** dialog for browsing for a DAP board.
 - **Server Configuration Tree View:** A display box shows all of the installed DAPcell servers and DAP boards attached to the selected machine or network. The installed servers and DAP boards are displayed by icons arranged in a graphical tree structure. Double-clicking on the selected icon in the display moves down one level in the search.
 - **Descriptions Group Box:** Displays the information about the selected server or DAP board.
 - **Refresh Button:** Refreshes the **Service Configuration Tree** using the transport selected in the **network transport combo box**. Toggles to **Abort** once it is clicked to start refreshing session and back to **Refresh** when the session is done. It aborts the refresh operation if one is on going.
 - **Network transport Combo Box:** Selects the network protocol to establish communication. Available options are **Local**, **All**, **NetBEUI**, **SPX/IPX**, **TCP/IP**, and **NamedPipe**. Selecting **Local** followed by the **Refresh** button will search DAP servers only over the local machine. Selecting one of the other network transports followed by the **Refresh** button will search over the network using that transport.

- Include cache Checkbox: Instructs the refresh operation whether to include cached servers or not. A server is cached once it is found.
- Select Button: Initiates a communication with the selected DAP board.
- Cancel Edit Box: Discards all changes and closes the Dap Select dialog box.
- Find server Edit Box: Selects a UNC server path and tries to find the remote DAPcell server over the network. If found, the server is shown in the display box. This is a faster way to search for a server if the path or the server is known.
- Multiple Boards Configure Menu Item: Displays a group interface for DAP and iDSC boards on the left hand side of the Configuration window. A check mark in the menu signifies the Configuration window is set up for group interface. Applications that use more than one DAP or iDSC board must enable this menu item to gain initial access to multiple boards. You may also activate it by clicking on the teal and red DAP icon on the top of the Configuration Window.

After multiple boards have been added to the application, you may continue to access them through the Multiple Boards Configure menu item. Or, to quickly move between boards, place the mouse over the DAPx or DSCx text at the top of the Configuration window. The text color will change to maroon. Click on the maroon link to show a selectable list of the DAP and iDSC boards already added to the application. Select a board from the drop-down box for configuration.

The group interface includes the following options.

- Add DAP Button: Adds a DAP board to the configuration.
- Add DSC Button: Adds an iDSC board to the configuration.
- Delete Button: Deletes a selected DAP or iDSC board from the configuration.
- Configuration Tree View: Each board is indicated by an icon arranged in the graphical tree structure. Double clicking on the selected icon in the display moves down one level in the search. If the DAP board does not have a valid address assigned an error message will appear.

- **Address Edit Box:** Selects the machine name and DAP board name. It is visible when the DAP address is selected in the configuration tree. The address is in UNC format. Using `\\.\Dap0` as an example, `\\.` denotes the local machine and `\Dap0` is the name of the DAP board. If DAPstudio connects through DAPcell to a remote machine named PC45, that contains Dap0, the address is `\\.\PC45`.
- **. . . Button:** This button appears when the Address Edit Box is visible. It is a shortcut connection to the DAP Select interface, also accessible by the menu items `System | Address Select...`
- **Mode Drop-Down Box:** Selects the mode for an iDSC board. See the [iDSC board Configuration section](#) for more information.
- **Press the right mouse button on the configuration tree to bring up a pop-up menu.** If you are over an iDSC board, see the [iDSC board Configuration section](#) for more information. If you are over a DAP board in the Configuration tree, the pop-up menu provides the following options.
 - ◆ **Delete Menu Item:** Deletes the selected DAP board.
 - ◆ **Copy Menu Item:** Copies the entire configuration of the selected DAP board to the clipboard.
 - ◆ **Paste Menu Item:** Pastes the copied configuration from the clipboard to another DAP board.
- **Board Detect and Update Menu Item:** Initiates communication with the DAP or iDSC board. It queries the model of the DAP or iDSC board and displays the model in the title bar of the Configuration window. It provides a confirmation of whether or not the board is responding. The shortcut is **F5**.
- **Configuration Lock Menu Item:** Locks the configuration of the DAP or iDSC board. A check mark signifies the Configuration window is for display only. There is also a yellow lock icon on the top right corner of the Configuration window. None of the parameters can be changed until the configuration is unlocked.
- **Hints Visible Menu Item:** Displays stoplight in the first bottom border of DAPstudio to show whether the system is acquiring data (green) or not

(red). On the right side of this border, hints are shown that explain menu items as they are selected.

- `Tab Reduce Menu Item`: If checked, tabs for all open windows are shown with icons only at the bottom border of DAPstudio. Rolling the mouse over a tab displays a floating text description. If unchecked, the tabs expand and show both the icons and text captions for the windows. Drag the tabs with your mouse to change the order of the tabs.
- `Memory Used Visible Menu Item`: Displays a progress bar in the second bottom border of DAPstudio to show the memory used on the DAP board. This information is useful in determining whether or not the DAP board will be able to sustain a particular sample rate without overflowing.

Diagnostics Menu Item

Offers diagnostic and trouble-shooting assistance.

- `Memory Used... Menu Item`: Brings up a window showing the memory used for each DAP or iDSC board in the current Configuration and the input and output counts for each.
- `Interpreter... Menu Item`: Brings up a separate window for the Interpreter Tab. In a multiple DAP system, when you select `System|Interpreter`, it will create the Interpreter window for the selected DAP. For instance, if you have DAP0, DAP1, and DAP2 with DAP1 selected, then selecting `System|Interpreter` will open the DAP1 Interpreter window. If you then change your selection to DAP2, then the DAP2 Interpreter window will open. The main text box displays the code run, any text data, or messages, including warnings and errors, if any, returned by the DAP board. Not available when iDSC boards selected.
 - `CLEAR ALL Button`: Clears all text from the main text box and the Errors text box.
 - `HIDE/SHOW Button`: Hides/Displays the Command drop-down list and the Errors text box at the bottom of the window.
 - ◆ `Command Drop-Down List`: Offers a choice of commands to send to the DAP board and accepts user-typed commands.
 - ◇ `display memory` prints the number of bytes currently in use and the total memory available.

- ◇ The `statistics` command displays information about CPU utilization of the system and processing tasks. To initiate collection of the measurements, issue the `statistics` command with the `on` command line option.
- ◇ After `statistics` collection is `on`, pause for a few seconds, then issue a `statistics` command to see the collected information.
- ◇ `status` displays information about the current status of the system – memory usage, active system tasks, interrupt status variables, etc. In most cases, this information is of interest to system implementers only. The `status` command should not be used while an input or output configuration is active.
- ◇ In addition, the user may type any command in this drop-down list, such as `hello`, `display tmem`, etc, to get an interactive response from the DAP board. If the command typed is an error, a error message is displayed.
- ◆ **SEND Button:** Sends the selected or typed command to the DAP board, with the result displayed in the main text box following any text already there. Hitting `Enter` after a typed command will also send the command to the DAP board.
- ◆ **CLR+SEND Button:** Removes all commands and error messages in the main text box and the `Errors` text box. Then sends the command to the DAP board and displays the result in the main text box.
- ◆ **Errors Text Box:** Displays error messages returned by the DAP board. This information is useful in determining whether or not the DAP board has encountered a failure.
- **Handles Close Menu Item:** Flushes the memory and closes the handles of all DAP or iDSC boards in the DAPstudio system.

Window Menu Item

Manipulates binary data files and output windows in DAPstudio.

- **New Graph Menu Item:** Adds a new `Graph` window to DAPstudio. To open a new graph to view acquired data, use the `Data Acquisition`

option. If binary data files have been opened, choose the graph option with the name of the data file to open a graph showing the saved data.

- **New Table Menu Item:** Adds a new Table window to DAPstudio. To open a new table to view acquired data, use the Data Acquisition option. If binary data files have been opened, choose the table option with the name of the data file to open a table showing the saved data.
- **New Alarm Menu Item:** Adds a new Alarm window to DAPstudio. To open a new alarm to view acquired data, use the Data Acquisition option. If binary data files have been opened, choose the Alarm option with the name of the data file to open a graph showing the saved data.
- **New Bar Menu Item:** Adds a new Bar graph window to DAPstudio. To open a new bar graph to view acquired data, use the Data Acquisition option. If binary data files have been opened, choose the Bar option with the name of the data file to open a graph showing the saved data.
- **New Waterfall Menu Item:** Adds a new Waterfall graph window to DAPstudio. To open a new waterfall graph to view acquired data, use the Data Acquisition option. If binary data files have been opened, choose the Waterfall option with the name of the data file to open a graph showing the saved data.
- **New Digital Volt Meter Menu Item:** Adds a new Digital Volt Meter window to DAPstudio. You can only display acquired data.
- **Custom Design Menu Item:** Adds a new Custom Design window to DAPstudio. This allows you to select any combination of other displays and configure them within a single Custom Design window.
- **Clone Active Window Menu Item:** Creates an additional window exactly duplicating the active window. All attributes, except the window name but including any custom display options like titles, colors, and axes, are copied. Only Graph, Table, Alarm, Bar, Waterfall, and Digital Volt Meter display windows may be cloned.
- **New Disk Log Menu Item:** Adds a new Disk Log window to DAPstudio. You can only log acquired data. When DAPstudio is started and acquiring data, this menu item is grayed out and not available for use.
- **New Server Disk Log Menu Item:** Adds a new Server Disk Log window to DAPstudio. You can only log acquired data. When DAPstudio is

started and acquiring data, this menu item is grayed out and not available for use.

- **Open Data File...** Menu Item: This menu item opens an interface to choose a binary data file for display. If the binary data file was logged using DAPstudio, a file with extension .dsd was automatically created. This .dsd file is a configuration file for the binary data file that stores the number of channels, display rate, channel names, and channel types. If the binary data file was logged using another program, a .dsd file is not available, but can be made using the **Save** button. Before saving a new .dsd file, update the number of channels, display rate, channel names, and channel types.
- **Cascade** Menu Item: Arranges all non-minimized windows in DAPstudio diagonally down the screen so that they overlap one another. The active window is on top.
- **Tile Horizontally** Menu Item: Arranges all non-minimized windows in DAPstudio as non-overlapping tiles across the screen horizontally.
- **Tile Vertically** Menu Item: Arranges all non-minimized windows in DAPstudio as non-overlapping tiles across the screen vertically.
- **Arrange Icons** Menu Item: Arranges all minimized windows in DAPstudio in an orderly fashion at the bottom of the workspace.
- **Minimize All** Menu Item: Resizes all windows in DAPstudio so only their title bars are visible and lines up the title bars at the bottom of the workspace.
- **Window Tabs**: Choose to bring a window to the front by either selecting its name in the **Window Menu** or by selecting the named tab shown in the bottom border of DAPstudio.

Help Menu Item

Displays help and copyright information.

- **Contents** Menu Item: Displays the DAPstudio Help document and finds the main table of contents.
- **Search** Menu Item: Displays a search dialog box for the DAPstudio help document.

- DAPstudio Online **Menu Item:** Displays the online Welcome to DAP Measurement Studio! **Web site.**
- Serial Number/Security Key... **Menu Item:** Displays a dialog box for entering the serial number and security key for using DAPstudio.
- About... **Menu Item:** Displays version and copyright information for DAPstudio and links to the Microstar Laboratories, Inc. Web site.

Keyboard

Shortcut keys provide a quick and easy way to navigate DAPstudio. Access them by using the Alt, Ctrl, and/or Shift keys in conjunction with a single letter key on the keyboard. The shortcut is listed as a modifier key followed by a single character key. For example, Ctrl-C means to press the Ctrl key and, while continuing to hold the Ctrl key, press the C key to perform the shortcut.

Shortcut Keys	Descriptions	Sample Application
F1	Opens DAPL 2000 documentation if DAPL is being edited.	App0402
F4	When F4 is used in the Configuration window Processing tab Procedures tab DAPL Listing edit box, DAPstudio displays a combo box for a list of variables and pipes.	
F4	When F4 is used in the combo boxes in Configuration window Input or Output tab Pipes tab, DAPstudio displays a drop-down list of available options for a given command.	
F5	Accesses the System Board Detect and Update menu item.	App0103
Ctrl-A	Selects all text in the Configuration window Processing tab Procedures tab DAPL Listing edit box.	
Ctrl-C	Copies the selected item to a clipboard.	App0406
Ctrl-D	Copies the selected filter design to a clipboard.	App0603
Ctrl-E	Increments the parameter name ending with a number in the copied item, pastes the incremented item to the current location and copies the already pasted item to a clipboard.	App0406
Ctrl-F	When Ctrl-F is used in the Configuration window Processing tab Procedures tab DAPL Listing edit box, DAPstudio opens a Find box and searches for the input text.	
Ctrl-F	When Ctrl-F is used in the Configuration window Processing tab Filter tab, DAPstudio copies the coefficients of the selected filter to the clipboard.	App0615
Ctrl-G	Pastes the copied filter design from a clipboard to the	App0603

	current location.
Ctrl-S	Saves the current configuration by accessing the File Save menu item.
Ctrl-V	Pastes the copied item from a clipboard to the current location.
Ctrl-Y	Redoes the previous action.
Ctrl-Z	Undoes the last action.
Alt-S	Starts or stops data acquisition by accessing the Start!/Stop! menu item.

The following shortcut keys are available only in the Graph, Alarm, Bar, and Waterfall display windows.

Shortcut Keys	Descriptions
Left Arrow	Scrolls with small steps toward the left of the graph.
Right Arrow	Scrolls with small steps toward the right of the graph.
Ctrl-Left Arrow	Scrolls with large steps toward the left of the graph.
Ctrl-Right Arrow	Scrolls with large steps toward the right of the graph.
Up Arrow	Scrolls with small steps toward the top of the graph.
Down Arrow	Scrolls with small steps toward the bottom of the graph.
Ctrl-Up Arrow	Scrolls with large steps toward the top of the graph.
Ctrl-Down Arrow	Scrolls with large steps toward the bottom of the graph.
End	Scrolls to the end (far right) of the graph.
Home	Scrolls to the beginning (far left) of the graph.
Ctrl-End	Scrolls to the bottom of the graph.
Ctrl-Home	Scrolls to the top of the graph.

Configuration Window for DAP boards

The Configuration window is designed to simplify the DAP board input, processing, and output configurations and filter design process. It provides the following types of tabs:

Tabs	Descriptions
Input	Sets up the input procedure.
Output	Sets up the output procedure.
Processing	Sets up the processing procedure.
DAPL Listing	Displays the DAPL commands that summarize all of the selections made on the Input, Output, and Processing tabs. It is for display only and is not editable. When the Start! menu item is selected, the contents of the DAPL Listing edit box are sent to the DAP board.
# Interpreter	Displays any text data or message, including warnings and errors, if any, returned by the DAP board. It is for display only and is not editable.

Input Tab

Sets up the input procedure.

- Pipes Tab: Selects input pins. When DAPstudio is started and acquiring data, all controls on this tab are grayed out and not available for use.
 - Enabled Checkbox: Enables/disables input sampling on selected channels. A check mark signifies that input sampling is enabled. If there is no check mark, and DAPstudio is started, no input pin is sampled.
 - Channels/Groups Combo Box: Selects the number of channels/groups of channels to sample. Changes to Groups when connecting to a DAP board that supports software-configurable channel groups.
 - Time, $\mu\text{s}/\text{ch}$ Edit Box: Accepts a requested time interval in microseconds between consecutive samples on any channel. DAPstudio generates DAPL commands that provide the closest match and adjusts the requested time interval appropriately. DAPstudio also converts this adjusted time interval into a sampling rate, and displays this rate in the Rate edit box. See below.

- Rate, s/s/ch Edit Box: Accepts a requested sampling rate for any channel. DAPstudio generates DAPL commands that provide the closest match and adjusts the requested sampling rate appropriately. DAPstudio also converts this adjusted sampling rate into a time interval in microseconds between consecutive samples on any channel, and displays this time in the Time edit box. See above.
- Pin Combo Box: Selects a pin for the input channel pipe shown in Pipe. Each pin has a prefix followed by a number. The following table summarizes the available options for the prefix and their representation.

Prefix	Represents
S	Single-Ended Input
D	Differential Input
B	Digital Input
G	Ground Input
SPG	Single-Ended Pin Group
S496	Track Mode
D248	Track Mode
CTL	Counter Timer Load
CT	Counter Timer Input
Custom	Custom Input

- Gain Combo Box: Selects the gain value for the programmable gain amplifier. Depending on the DAP board selected, available options are 1, 10, 100, and 500 or 1, 4, 10, and 40.
- Pipe Edit Selection Grid: Selects a subset of channel pipes to work with.
- Press the right mouse button on the Pipe Edit Selection Grid to bring up a pop-up menu that provides the following options to configure the subset of channel pipes selected in the Pipe Edit Selection grid.
 - ◆ Selected Channels Menu Item: Configures a subset of pipes selected in the Pipe Edit Selection grid. The following options apply to the subset of pipes displayed in the display box on the right hand side of the window.

- ◇ Pin Increment From First Menu Item: Configures the selected pipes to sample from the incremented pin from the first pipe.
- ◇ Pin Same As First Menu Item: Configures the selected pipes to sample from the same pin as the first pipe.
- ◇ Gain Same As First Menu Item: Sets the gain of the selected pipes equal to the gain of the first pipe.
- ◆ All Channels Menu Item: Configures all pipes. The following options apply to all pipes.
 - ◇ Pin Increment From First Menu Item: Configures all pipes to sample from the incremented pin from the first pipe.
 - ◇ Pin Same As First Menu Item: Configures all pipes to sample from the same pin as the first pipe.
 - ◇ Gain Same As First Menu Item: Sets the gain of all pipes equal to the gain of the first pipe.
- ◆ Select All Menu Item: Selects all pipes in the Pipe Edit Selection grid.
- ◆ Clear All Menu Item: Clears all selections in the Pipe Edit Selection grid.
- Settings Tab: Selects the options for input sampling. When DAPstudio is started and acquiring data, all controls on this tab are grayed out and not available for use.
 - Clclocking Checkbox: Selects the channel list clocking mode of the input configuration. A check mark signifies that channel list clocking is on. Otherwise, it is off.
 - Clock Group Box: Selects the source of the input configuration sample clock. Available options are Internal or External.
 - HTrigger Group Box: Selects the operating mode of the hardware trigger. Available options are Off, Gated, or Oneshot.

- Update Group Box: Selects burst mode for an input configuration. Available options are Continuous or Burst.
- Synchronization Group Box: Selects the operating mode for systems with multiple DAP boards. Available options are Normal, Master, or Slave.
- Count/ch Edit Box: Sets the number of input samples per channel. After the specified number of input samples on each active channel, the input configuration suspends operation. The default zero causes sampling to continue indefinitely until DAPstudio is stopped.
- AInExpand Checkbox: Selects the analog input expansion mode. A check mark signifies the analog input expansion mode is on. When analog input expansion mode is on, DAPL remaps input pins on an expansion board to match the pinout of an analog connector on the DAP board. This option is used for the Analog Input Expansion Board, part number MSXB 018, only. See the MSXB 018 documentation for more details about input pin mapping
- Input Range Group Box: Sets up the input voltage range for the input configuration. Available options are +/-5V and +/-10V. Visible for DAP boards that have a programmable input voltage range.
- Group Size Group Box: Sets up the number of channels in a programmable input channel group. Available options are 8 and 4. Visible for DAP boards that support software-configurable channel groups.
- DAPL Listing Edit Box: Displays the input procedure that summarizes all of the selections made on the [Input](#) tab. It is for display only and is not editable.

Output Tab

Sets up the output procedure. Visible for DAP boards that support output.

- Pipes Tab: Selects output pins. When DAPstudio is started and acquiring data, all controls on this tab are grayed out and not available for use.
 - Enabled Checkbox: Enables/disables output updating on selected channels. A check mark signifies that output sampling is enabled. If there is no check mark and DAPstudio is started, no output pin is updated.

- Channels Combo Box: Selects the number of channels to update.
- Time, $\mu\text{s}/\text{ch}$ Edit Box: Accepts a requested time interval in microseconds between consecutive updates on any channel. DAPstudio generates DAPL commands that provide the closest match and adjusts the requested time interval appropriately. DAPstudio also converts this adjusted time interval into an update rate, and displays this rate in the Rate edit box. See below.
- Rate, $\text{s}/\text{s}/\text{ch}$ Edit Box: Accepts a requested update rate for any channel. DAPstudio generates DAPL commands that provide the closest match and adjusts the requested update rate appropriately. DAPstudio also converts this adjusted update rate into a time interval in microseconds between consecutive updates on any channel, and displays this time in the Time edit box. See above.
- Pin Combo Box: Selects a pin for the output channel pipe shown in Pipe. Each pin has a prefix followed by a number. The following table summarizes the available options for the prefix and what each one represents.

Prefix	Represents
A0	Analog Output 0
A1	Analog Output 1
B	Digital Output

- Signal Combo Box: Selects the data source of Pin. Available options are Sinewave, Cosinewave, Squarewave, Triangle, Sawtooth, and Processing. If Signal is set to Sinewave, Cosinewave, Squarewave, Triangle, or Sawtooth, the DAP board samples values from an ideal sine, cosine, square, triangle, or sawtooth waveform with amplitude and period as set in the Ampl and Period edit boxes respectively. It then sends the values to Pin. If Signal is set to Processing, the analog output pipe will be available for update in the DAPL listing edit box under the [Processing](#) Procedure tab.
- Ampl Edit Box: Selects the amplitude of Signal when it is not set to Processing.
- Period Edit Box: Selects the period of Signal when it is not set to Processing.

- Pipe Edit Selection Grid: Selects a subset of channel pipes to work with.
- Press the right mouse button on the Pipe Edit Selection Grid to bring up a pop-up menu that provides the following options to configure a subset of channel pipes.
 - ◆ Selected Channels Menu Item: Configures a subset of pipes selected in the Pipe Edit Selection grid. The following options apply to the subset of pipes displayed in the display box on the right hand side of the window.
 - ◇ Pin Increment From First Menu Item: Configures the selected pipes to update the incremented pin from the first pipe.
 - ◇ Pin Same As First Menu Item: Configures the selected pipes to update the same pin as the first pipe.
 - ◇ Signal Source Same As First Menu Item: Configures the selected pipes to sample the same signal as the first pipe.
 - ◇ Amplitude Same As First Menu Item: Configures the selected pipes to use the same amplitude as the first pipe.
 - ◇ Period Same As First Menu Item: Configures the selected pipes to use the same period as the first pipe.
 - ◆ All Channels Menu Item: Configures all pipes. The following options apply to all pipes.
 - ◇ Pin Increment From First Menu Item: Configures all pipes to update the incremented pin from the first pipe.
 - ◇ Pin Same As First Menu Item: Configures all pipes to update the same pin as the first pipe.
 - ◇ Signal Source Same As First Menu Item: Configures all pipes to sample the same signal as the first pipe.
 - ◇ Amplitude Same As First Menu Item: Configures all pipes to use the same amplitude as the first pipe.
 - ◇ Period Same As First Menu Item: Configures all pipes to use the same period as the first pipe.

- ◆ Select All Menu Item: Selects all pipes in the Pipe Edit Selection grid.
 - ◆ Clear All Menu Item: Clears all selections in the Pipe Edit Selection grid.
- Settings Tab: Selects the options for output updating. When DAPstudio is started and acquiring data, all controls on this tab are grayed out and not available for use.
 - Clclocking Checkbox: Selects the channel list clocking mode of the output configuration. A check mark signifies that channel list clocking mode is on. Otherwise, it is off.
 - Clock Group Box: Selects the source of the output configuration sample clock. Available options are Internal or External.
 - HTrigger Group Box: Selects the operating mode of the hardware trigger. Available options are Off, Gated, or Oneshot.
 - Update Group Box: Selects burst mode for an output configuration. Available options are Continuous or Burst.
 - Synchronization Group Box: Selects the operating mode for systems with multiple DAP boards. Available options are Normal, Master, or Slave.
 - Count/ch Edit Box: Sets the number of output updates per channel. After the specified number of output updates on each active channel, the output procedure suspends operation. The default zero causes updating to continue indefinitely until DAPstudio is stopped.
 - Cycle/ch Edit Box: Sets the number of output values sent to each output channel pipe before repeating. After the specified number of output updates on each active channel, the output procedure repeats the operation.
 - Outputwait/ch Edit Box: Sets the output delay in number of output updates per channel. The output configuration waits until the specified number of samples is available before updating begins. This parameter applies to noncyclical output configurations only and defaults to 100 milliseconds of output data when set to zero. For most applications, the default value should not be overridden.

- DAPL Listing Edit Box: Displays the output procedure that summarizes all of the selections made on the **Output** tab. If the Signal of any Pin is not set to Processing, this edit box displays the processing and output procedures that summarize all of the selections made on the **Output** tab. It is for display only and is not editable.

Processing Tab

Sets up the processing procedure. To access options for processing, right-click over the processing sub-tabs and choose Options...

- Tabs Visible Group Box: Selects the sub-tabs visible for the Processing tab. All but the Send to DAP and Sequencing tabs appear in the default configuration.
- Procedure Group Box: Selects options for the Processing|Procedure tab.
 - Popup List Delay Edit Box: Sets up the time interval, in milliseconds, to display the pop-up list in the Configuration window|Processing tab|Procedure tab|DAPL listing edit box.
- Send To PC Group Box: Selects options for the Processing|Send To PC tab.
 - Column Width Edit Box: Sets up the width in pixels of the columns displaying the checkboxes in the Configuration window|Processing tab|Send To PC tab|Channel pipes box.
- Declarations Tab: Declares new, or modifies existing, elements. When DAPstudio is started and acquiring data, some controls on this tab are grayed out and not available for use.
 - New Element Group Box
 - ◆ Type Group Box: Selects the type of a new element. Available options are constants, pipes, string, triggers, variables, and vector.
 - ◆ Size Group Box: Selects the size of a new element. Available options are word, float, long, and double.

- ◆ **Edit Box:** Sets up a name for a new element.
- ◆ **New Button:** Declares a new element with the name as shown in the edit box next to the **New** button. The new element has properties specified by the **Type** and **Size** group boxes.
- **Rename Element Group Box**
 - ◆ **Combo Box:** Selects the element for renaming.
 - ◆ **Edit Box:** Sets up a new name for the element.
 - ◆ **Rename Button:** Replaces the name of the element selected in the combo box with the name in the edit box.
- **Declarations Edit Box:** Sets up DAPL commands for declarations of elements. It operates like a text editor. Use the mouse or the keyboard to move the insertion point to new locations. Characters typed in the window are inserted at the current insertion point. The **New Element** and **Rename Element** group boxes on the left hand side of the window provide a simple and quick way to create and rename elements.
- **Automatic Select Button:** For automatic declarations, the display and creation of pipes, triggers, constants, etc. are handled by DAPstudio. The user can still type declarations, or use the **New** button, but the display is sorted alphabetically. Comments on the same line as the declaration are fine but any comments typed on a different line are deleted.
- **Manual Select Button:** For manual declarations, the user has complete control and can type anything in any order – no error checking takes place. All comments, anywhere, are retained.
- **HIDE/SHOW Button:** Hides/Displays the **New Element** and **Rename Element** group boxes on the left hand side of the window.
- **Procedure Tab:** Sets up DAPL commands. When DAPstudio is started and acquiring data, all controls on this tab are grayed out and not available for use.
 - **Alphabetized/Categorized Label:** Sorts DAPL commands in the **Commands** list box alphabetically or by category. Change by clicking on the link.

- Commands List Box: Displays all DAPL commands in the order specified by the Alphabetized/Categorized label.
- DAPL Listing Edit Box: Sets up DAPL commands for processing procedures. It operates like a text editor. Use the mouse or the keyboard to move the insertion point to new locations. Characters typed in the window are inserted at the current insertion point. Various **shortcut** keys are available in this edit box. For example, press **F1** to bring up the DAPL 2000 Help file, press **F4** to bring up a list of commands and press **Ctrl-F** to open a Find box and search for the input text. Please see [Application 0401](#) for step-by-step instructions on adding a DAPL command.
- Display Box: Provides quick reference to the functionality and parameter lists for the selected command in the Commands list box.
- HIDE/SHOW Button: Hides/Displays the Commands list box on the left and the description of the selected command below the DAPL Listing edit box.
- Send To PC Tab: Sets up the options for data transfer between the DAP board and the PC. When DAPstudio is started and acquiring data, all controls on this tab are grayed out and not available for use.
 - Channel Pipes Checkboxes: Selects channel pipes for transmission to the host PC. Data from pipes with check marks are merged to the default binary communication pipe, \$BinOut. Data arrival rates in all selected pipes through the same binary communication pipe should be equal. If data volumes are different in different pipes, data will be backlogged in the pipes with higher volumes, causing processing to terminate when the capacity is exhausted.
 - \$BinOut Link: Clicking on the link displays the Comm Pipes Selection Box at the left side of the tab. The channels number next to the link tells how many channels have been selected to go to the selected communication pipe.
 - Comm Pipes Selection Box: Clicking the Hide/Show button from the default configuration, or clicking on the \$BinOut link, makes the Comm Pipes Selection Box appear in the left side of the tab. Use multiple communication pipes to send data with differing rates to the PC at the same time. For example, send really fast and really slow data at the same time, several fast channels with differing rates, or one continuous

channel and a trigger controlled channel, either slow or fast. Up to 30 different communication pipes may be used. Select the communication pipes using the checkboxes at the bottom of the selection box. The names of the checked pipes appear in the top of the selection box. Click on a pipe name, then configure the channels for the pipe using the channel checkboxes and the DAPL Listing Rate option, if applicable. Most times the default works. A Merge or Copy command will be defined for each communication pipe with selected channels.

- SELECT ALL Button: Selects all pipes by checking all checkboxes in the Send To PC edit box.
- CLEAR ALL Button: Clears all pipes selected in the Send To PC edit box. No checkbox is checked.
- HIDE/SHOW Button: Hides/Displays the DAPL Listing edit box at the bottom and/or the Comm Pipes selection boxes on the left side.
- DAPL Listing Edit Box: Displays a processing procedure that merges data from all selected pipes and sends it through the selected communication pipe to the PC. A different listing will be displayed for each communication pipe selected. It is for display only and is not editable.
- Rate Edit Box: Displays the transfer rate between the DAP board and the PC. It is updated whenever the Rate edit box in the Input|Pipes tab is changed. This rate affects the rate data is sent to the PC. It is reflected in the displayed time base of the Graph window when the Graph window displays the x-axis in seconds or milliseconds. For example, if the data rate to the PC is reduced by 10 (by averaging 10 samples for instance), then the data rate should be reduced by 10 so that the displayed time base is correct.
- DEFAULT Button: Sets the transfer rate to the default value, which is equal to the sample rate specified by the Rate edit box in the Input|Pipes tab.
- CHANGE Button: Changes the transfer rate between the DAP board and the PC.
- Send to DAP Tab: Sends data to the DAP board for further processing. The data may also be used as analog or digital outputs on the DAP. This tab sets up the options for data transfer from the PC to the DAP board. When DAPstudio is started and acquiring data, all controls on this tab are grayed

out and not available for use. To view this tab, right-click anywhere on the second level of tabs under the Processing tab, choose Options..., and check the Send to DAP box in the Tabs Visible group box.

- Data Files Checkboxes: Shows the data files available for transfer to the DAP board. The default is None. To make files available, open a data file with Window|Open Data File.... You can open any number of data files by either adding additional Data File tabs to an open Data File window or by invoking Window|Open Data File... multiple times. Adding Data File tabs is the recommended method, keeping the number of open windows lower. Only one data file may be selected for each communication pipe.
- No Comm Pipes Link: This link opens and closes the communication (Comm) pipes selection area. The link name changes depending on the communication pipe selected. A separate communication pipe must be selected for each data file transferred to the DAP board.
- Comm Pipes Section: This section shows all communication pipes available for selection. Use the checkboxes to select a communication pipe. The checked pipes are then shown in the selection tree above the checkboxes and in the Summary box. Highlighting one of the pipes in the tree puts that pipe name in the link text and enables the selection of one of the available data files, using the Data Files checkboxes.
- Summary Section: This section shows information for all input communication pipes that have been selected. It includes the amount of data in each file Transferred to the DAP board in bytes and the File Size in bytes. The transferred total will remain 0 until the system is started.
- Rate, bytes/second Edit Box: This box shows the transfer rate to be used for sending the selected file to the DAP board over the selected communication pipe. If not initially visible, it can be seen by clicking the HIDE/SHOW button.
- HIDE/SHOW Button: This button hides or shows the Comm pipes selection area and the Rate, bytes/second edit box.
- Filter Tab: Selects parameters of a filter design. Most parameters are configured by entering a number in an edit box or by moving a slider. Entering a number in the edit box must be followed by either pressing the Enter key on the keyboard or exiting the edit box for the change in the

parameter to be registered. When DAPstudio is started and acquiring data, some controls on this tab are grayed out and not available for use.

- `vecFilter0_` Tab: Displays the name of the active filter design.
 - ◆ Name Edit Box: Selects a unique name for the filter design. If an already existing filter name is assigned, the existing filter name will not change. A filter name is limited to 63 characters. Changing this field automatically updates the filter name displayed at the top of the tab.
 - ◆ Type Combo Box: Selects the type of the filter. Available options are Lowpass, Highpass, Bandpass, and Bandstop.
 - ◆ Taps Edit Box and Slider: Selects the number of taps of an ideal filter in the final filter stage. The number of taps determines the sharpness of the corner frequency response. Available values are in the range 3 to 511.
 - ◆ Low Cutoff Edit Box and Slider: Selects the ideal cutoff frequency that a filter is designed to approximate. The Low Cutoff frequency of an ideal filter is the filter's first transition band. It is specified as a percentage of the Nyquist frequency. Available values are in the range 1 to 95. For a lowpass filter, the first transition band is the transition from passband to stopband. For a bandpass filter, the first transition band is the transition from stopband to passband.
 - ◆ Low Width Edit Box: Selects the ideal cutoff response that a filter is designed to approximate. The Low Width of an ideal filter is the width of the filter's first transition band. It is specified as a percentage of the Nyquist frequency. Available values are in the range 0 to 80.
 - ◆ High Cutoff Edit Box and Slider: Selects the ideal cutoff frequency that a filter is designed to approximate. The High Cutoff frequency of an ideal filter is the filter's second transition band. It is specified as a percentage of the Nyquist frequency. Available values are in the range 2 to 95. For a bandpass filter, the second transition band is the transition from passband to stopband.
 - ◆ High Width Edit Box: Selects the ideal cutoff response that a filter is designed to approximate. The High Width of an ideal filter

is the width of the filter's second transition band. It is specified as a percentage of the Nyquist frequency. Available values are in the range 0 to 80.

- ◆ Window Combo Box: Selects the Window of the filter response. Available options are Blackman, Hamming, von Hann, Kaiser, and Rectangular.
- ◆ Alpha Edit Box and Slider: Selects the main lobe width, which determines the shape of the window. For $a=0$, the window is rectangular. The Alpha edit box and slider are available for use when Kaiser is selected for window. Available values are in the range 0 to 12.
- ◆ Graph Area: Displays a filter design graphically. The filter response is plotted in attenuation (dB) against % of Nyquist Frequency.
 - ◇ A pair of crosshairs: Holding the left mouse button down and dragging the mouse over the graph area displays a pair of crosshairs with the x and y coordinates of a particular point. The coordinates of the point are displayed at the bottom left hand corner of the graph area. If the Crosshair Track menu item, in the pop-up menu from the right mouse button click, is checked, the crosshair will track the filter response curve.
 - ◇ Press the right mouse button on the graph area to bring up a pop-up menu that provides the following options to configure the filter design.
 - New Filter Menu Item: Adds a new filter design. Any number of filter designs is allowed.
 - Delete Filter Menu Item: Deletes the active filter design. The minimum number of filter designs is one.
 - Crosshair Track Menu Item: A check mark signifies the crosshair will track the filter response curve. To track the filter response curve, click and hold down the left mouse button over the plotting area, and the corresponding data values will be shown at the bottom left corner of the Graph window.

- **View Coefficients Menu Item:** A check mark signifies that the coefficients of the filter response will display below the graph area.
- **Y Axis Menu Item:** Selects the unit of the amplitude response display. The default amplitude response is displayed graphically by Log method. Available options are Linear, Linear Zoom, Log, Log Zoom, and Unit Step. A unit step display shows the amplitude response of the filter in relation to a change in the input from zero to positive full scale. A dot beside the Y Axis option indicates the unit of amplitude response display selected.
- **Options Menu Item:** Selects options for a filter design.
 - **Normalize DC Menu Item:** Available options are on and off. A check mark beside Normalize DC signifies on, which means gain at DC is exactly one, and there is no attenuation at DC. If Normalize DC is off, then at DC the gain is less than one and there is some attenuation. To see the gain value, turn on the View Coefficient option and see Sum.
 - **Scaled Menu Item:** Selects scaling property. Available options are on and off. A check mark beside Scaled signifies on, and the coefficients are scaled up to reduce round-off error.
 - **Strip Zeros Menu Item:** Removes end point terms that are less than the precision of the representation. Available options are on and off. A check mark beside Strip Zeros signifies on, and no leading or trailing zeros are added. These zeros are used for phase calculations.
- **Precision Menu Item:** Selects the data width of filter coefficients, determining the calculation accuracy. Available options are 16 bit, 32 bit, Float and Double. Default is 16 bit. A dot beside the precision option indicates the data width of the filter coefficients.
- **Slope Approximation Menu Item:** Selects the method to approximate between the points along the cutoff slope

of an ideal cutoff response. Available options are `Linear` and `Cubic`. Default is `Cubic`.

- `Copy Coefficients Menu Item`: Copies the coefficients of a filter design to the clipboard.
 - `Copy Design Menu Item`: Copies the filter design parameters from a filter design to the clipboard.
 - `Paste Design Menu Item`: Pastes the copied filter design parameters from a clipboard to the active filter design.
- `Sequencing Tab`: Handles the startup and shutdown processes on the DAP. To view this tab, right-click on the Processing tabs, choose `Options`, and check the `Sequencing` box in the `Tabs Visible` group box.
 - `Startup Select Button`: Handles startup conditions, always including a `START` command. Additional manipulation is for advanced users interested in sequencing commands after `START`. As an example, this could include a `PAUSE` command followed by changing a variable value in advanced applications.
 - `Shutdown Select Button`: Handles shutdown conditions, always including a `STOP` command. Additional manipulation is for advanced users interested in sequencing commands after `STOP`. As an example, this could include a `PAUSE` command followed by a `STATISTICS` command.

DAPL Listing Tab

Displays the DAPL commands that summarize all of the selections made on the `Input`, `Output`, and `Processing` tabs. It is for display only and is not editable. When the `Start!` menu item is selected, the contents of the `DAPL Listing` edit box is sent to the DAP board.

Interpreter Tab

Displays any text data or message, including warnings and errors, if any, returned by the DAP board. DAPstudio switches focus to this tab when an error message is received. Additional [Interpreter Windows](#) may be opened for each DAP board in a configuration.

- CLEAR ALL Button: Removes all error messages and commands in the Errors text box.
- HIDE/SHOW Button: Hides/Displays the Errors list box at the bottom of the window and the Command Drop-down list.
- Command Drop-Down List: Offers a choice of 4 diagnostic commands to send to the DAP board for more information.
 - `display memory` prints the number of bytes currently in use and the total memory available.
 - The `statistics` command displays information about CPU utilization of the system and processing tasks. To initiate collection of the measurements, issue the `statistics` command with the `on` command line option.
 - After `statistics` collection is on, pause for a few seconds, then issue a `statistics` command to see the collected information.
 - `status` displays information about the current status of the system — memory usage, active system tasks, interrupt status variables, etc. In most cases, this information is of interest to system implementers only. The `status` command should not be used while an input or output configuration is active.
- SEND Button: Sends the selected diagnostic command to the DAP board, with the result displayed in the main text window following any text already there.
- CLR+SEND Button: Removes all error messages and commands in the main text window and the Errors text box. Then sends the diagnostic command to the DAP board and displays the result in the main text window.
- Errors Text Box: Displays error messages returned by the DAP board. This information is useful in determining whether or not the DAP board has encountered a failure.

Configuration Window for iDSC Boards

The Configuration window is designed to simplify the input, processing, and output configurations and filter design process. There are two different versions, depending on whether an iDSC board or DAP board is selected for Configuration. The default Configuration is set up for a DAP board. The Configuration for iDSC boards provides the following types of tabs:

Tabs	Descriptions
Input	Sets up the input procedure.
Filter Design	Sets up the filter design.

Multiple Boards Configure Menu Item – iDSC Boards

To initially configure one or more iDSC 1816 boards, check the menu item System|Multiple Boards Configure. Once multiple boards are added to the application, access them by clicking on the maroon DAPx or DSCx link at the top of the Configuration Window. Select the iDSC board to configure from the drop-down box. Enabling the Multiple Boards Configure Menu Item is optional.

- Multiple Boards Configure Menu Item: Displays a group interface for DAP and iDSC boards on the left hand side of the Configuration window. A check mark in the menu signifies the Configuration window is set up for group interface. Applications that use more than one DAP or iDSC board must enable this menu item to gain initial access to multiple boards. You may also activate it by clicking on the icon on the top of the Configuration window.

After multiple boards have been added to the application, you may continue to access them through the Multiple Boards Configure menu item. Or, to quickly move between boards, place the mouse over the DAPx or DSCx text at the top of the Configuration window. The text color will change to maroon. Click on the maroon link to show a selectable list of the DAP and iDSC boards already added to the application. Select a board from the drop-down box for configuration.

- Add DAP Button: Adds a DAP board to the configuration.
- Add DSC Button: Adds an iDSC board to the configuration.
- Delete Button: Deletes a selected board from the configuration.

- **Configuration Tree View:** A display box on the left side of the Configuration window shows the number of DAP or iDSC boards in the configuration. Each board is indicated by an icon arranged in the graphical tree structure. Double clicking on the selected icon in the display moves down one level in the search. If the iDSC board does not have an address assigned, an error will appear.
- **Address Edit Box:** Selects the machine name and iDSC board name. It is visible when the iDSC address is selected in the configuration tree. The address is in UNC format. Using `\\.\Dap0` as an example, `\\.` denotes the local machine and `\Dap0` is the name of the iDSC board. If DAPstudio connects through DAPcell to a remote machine named PC45, that contains Dap0, the address is `\\.\PC45`.
- **... Button:** This button appears when the Address Edit Box is visible. It is a shortcut connection to the DAP Select interface, also accessible by the menu items `System|Address Select`.
- **Mode Drop-Down Box:** Selects the mode for an iDSC board. It is visible when the Mode icon under an iDSC address is selected in the configuration tree. There are three possible modes.
 - ◆ **Independent:** Each new iDSC board added to the Configuration tree starts as an Independent board. If only one iDSC is available in the Configuration tree, this is the only option selectable. Independent boards may be made Masters only if there are other Independent boards available to become their Slaves. The icon for an independent iDSC board is teal.
 - ◆ **Master:** Makes the iDSC board the Master of any other Independent iDSC boards in the Configuration tree. If only one iDSC board is available in the Configuration tree, this option is visible, but not selectable. If more than one is available, the Master option is selectable. When Master is selected, the mode for all other independent iDSC boards in the configuration tree automatically change to Slave of the Master board. If all of their Slave boards become Independent or Slaves of other Masters, the Master mode automatically changes to Independent. The icon for a Master iDSC board is red.
 - ◆ **Slave of DSCx:** Makes the iDSC board the Slave of DSCx where x indicates the number of the Master iDSC board. This option is only available if more than one iDSC board is in the Configuration

tree. There are Slave of DSCx options for each of the other iDSC boards in the Configuration tree. If a board is put in Slave mode, then the numbered iDSC board automatically is changed to Master. Slaves cannot be made Master if no other Independent boards are available to become their Slaves. They can, however, be made Independent. The icon for a Slave iDSC board is yellow.

- Press the right mouse button on the configuration tree to bring up a pop-up menu. If you are over a DAP board in the Configuration tree, see the [System Menu item](#) for DAP Board Configuration for more information on the options given.
- ◆ Press the right mouse button on the configuration tree to bring up a pop-up menu. If you are over an iDSC board in the Configuration tree, the pop-up menu provides the following options.
 - ◇ Delete Menu Item: Deletes the selected iDSC board.
 - ◇ Calibrate menu item: Calibrates the selected iDSC board and any associated Slave boards. iDSC board calibration automatically is performed each time a program is run.
 - ◇ Commands Load menu item: Downloads the configuration commands to the iDSC board and performs the necessary configuration for filtering. Configures the iDSC board with the appropriate programs and coefficients. The filter designs are used internally to calculate and download the appropriate commands.
 - ◇ Raw Data menu item: Selects raw data rather than filtered data from the iDSC board. When Raw Data is enabled, all filters configured from the [Filter Design Tab](#) are ignored.
 - ◇ Remote Master menu item: Configures a Master iDSC board as a remote master.
 - ◇ SCS Module Calibrate menu item: Calibrates the Signal Conditioning System (SCS) Module if the SCS Module is enabled. The module calibration is not automatic, and has to be invoked explicitly. It is a slow process and should be performed only if necessary.

- ◇ SCS Module Enable menu item: Enables the SCS Module. Before any communication with the SCS Module is performed, for example calibration, the module must first be enabled.
- ◇ Timing Channels Visible menu item: Makes visible the three available timing channels in the Input tab.
- ◇ Copy Menu Item: Copies the entire configuration of the selected iDSC board to the clipboard.
- ◇ Paste Menu Item: Pastes the copied configuration from the clipboard to another iDSC board.

Input Tab

Sets up the input procedure. The following parameters are accessible from the Input tab.

- Sample Rate Drop-Down Box: The Sample Rate parameter sets the sample rate on each channel, in units of samples per second (s/s). The table below displays the valid sample rates arranged in octaves.

			153600		
102400			76800		
51200			38400		
25600			19200		15360
12800		10240	9600		7680
6400		5120	4800		3840
3200	3072	2560	2400	2048	1920
1600	1536	1280	1200	1024	960
800	768	640	600	512	480
400	384	320	300	256	240
200	192	160	150	128	120
100	96	80	75	64	60
50	48	40		32	30
25	24	20		16	15
	12	10		8	

- Channel Count Text Box: Indicates the number of channels enabled on the selected iDSC board. The channel count is read-only.
- Group Delay Text Box: The Group Delay parameter is the amount of time it takes for a reading to pass through the digital filters. All signal

frequency components that are present in the passband of the filter are delayed by group delay. The Group Delay property is read-only and is expressed in units of seconds. The Group Delay is calculated using the selected **Sample Rate** and filter designs. The Group Delay does not include the filter designs of disabled input pins.

- **Input Range Combo Box:** Configures the input range to either +/- 5 V or +/- 10 V.
- **Input Pin Text Boxes:** Identifies each of the available input pins on the selected iDSC board. The pins are read-only and grayed out if the pin is not enabled.
- **Filter Name Combo Boxes:** Maps an input pin to a named filter design. The same filter design may be applied to several input pins. An input pin is mapped to a filter design regardless of whether the input pin is disabled. The filter name can be changed in the **Filter Design** tab. When the filter name is changed, the filter name drop-down list is updated to reflect the new filter name. The default filter names are FD0, FD1, FD2, FD3, FD4, FD5, FD6, and FD7.
- **Cutoff Frequency Text boxes:** Shows the cutoff frequency for each pin as determined by the sampling rate and the filter design characteristics mapped for each pin.
- **Enabled Checkboxes:** Enables or disables each input pin. At run-time, the iDSC board returns data to the PC only from enabled input pins.
- **Timing Channels Checkboxes:** If **Timing Channels Visible** has been checked for the selected iDSC board, the three timing channels Tc0, Tc1, and TcWidth32 are visible and may be enabled and disabled by using the checkboxes. Tc0 enables Timing Channel 0 and Tc1 enables Timing Channel 1. TcWidth32 forces the timing channel width to be 4 bytes (32-bits) regardless of the sample rate. If TcWidth32 is not enabled, the timing channel width can be either 2 bytes or 4 bytes depending on the sample rate.

Filter Design Tab

The following parameters are accessible from the **Filter Design** tab. Each iDSC board may have up to eight different filters configured.

Each Filter Design parameter is configured by either entering a number or moving a slider. If you choose to enter a number, you must press 'Enter,' or exit the edit box when finished configuring the parameter.

- Filter Name Text box: Assigns a unique filter name to each filter design. If an already existing filter name is assigned, the existing filter name will not change. A filter name is limited to 63 characters. The filter name parameter is displayed on the tab at the top of the Filter Design tab. Changing the filter name parameter automatically updates this tab, and also updates the filter name in the Input tab.
- Filter Type Combo box: Assigns a filter type to each filter design. The filter type is either Lowpass or Bandpass.
- Sharpness Text box and Slider: Determines the sharpness of the corner frequency response. The sharpness of an ideal filter is the number of taps in the final filter stage. Valid sharpness values are odd numbers in the range 37 to 255, depending on the sample rate.
- Low Cutoff Frequency Text box and Slider: Determines the ideal cutoff frequency that a filter is designed to approximate. The low cutoff frequency of an ideal filter is the filter's first transition band. The low cutoff frequency for a filter is specified in Hertz (Hz). Valid low cutoff frequency values are in the range 2% to 80% of the Nyquist frequency. The Nyquist frequency is half the **Sample Rate**. For a lowpass filter the first transition band is the transition from passband to stopband. For a bandpass filter the first transition band is the transition from stopband to passband.
- Low Cutoff Slope Text box: Determines the ideal cutoff response that a filter is designed to approximate. The low cutoff slope of an ideal filter is the width of the filter's first transition band. The low cutoff slope of a filter is defined as a percentage of the Nyquist frequency. Valid low cutoff slope values are in the range 0% to 80% of the Nyquist frequency. The Nyquist frequency is half the **Sample Rate**.
- High Cutoff Frequency Text box and Slider: Determines the ideal cutoff frequency that a filter is designed to approximate. The high cutoff frequency of an ideal filter is the filter's second transition band. The high cutoff frequency for a filter is specified in Hertz (Hz). Valid high cutoff frequency values are in the range 2% to 80% of the Nyquist frequency. The Nyquist frequency is half the **Sample Rate**. For a bandpass filter the second transition band is the transition from passband to stopband.

- High Cutoff Slope Text box: Determines the ideal cutoff response that a filter is designed to approximate. The high cutoff slope of an ideal filter is the width of the filter's second transition band. The high cutoff slope of a filter is defined as a percentage of the Nyquist frequency. Valid high cutoff slope values are in the range 0% to 80% of the Nyquist frequency. The Nyquist frequency is half the **Sample Rate**.
- Attenuation Text box: Determines the response in the stopband of a filter. Valid attenuation values are in the range 6.0 to 12.0.
- Filter Response Display: Displays a filter's amplitude response based on selected filter parameters. There are several more options when you click the right mouse button over the filter window. These options include:
 - Crosshair Track Menu Item: Holding the left mouse button down and dragging the mouse over the graph will display a crosshair with the x and y coordinates of a particular point. If the Crosshair Track menu item is checked, the crosshair will track the filter response curve. This feature is useful in determining the exact cutoff frequency, cutoff slope, or attenuation at a particular point.
 - Y Display Menu Item: The filter response may be displayed graphically by one of the following methods: Linear Display, Linear Zoom Display, Log Display, Log Zoom Display, or Unit Step Display. The default amplitude response is a Log Display. The linear, linear zoom, log, and log zoom graphs display the amplitude response at frequencies from zero to the Nyquist frequency. At all frequencies above the Nyquist frequency, the iDSC board has attenuation of more than 96 dB. A unit step display shows the amplitude response of the filter in relation to a change in the input from zero to positive full scale.
 - ◆ Linear Display Menu Item: Shows the linear amplitude response in the frequency domain. A linear display graph plots the linear attenuation from 0 to 110%, with frequencies from zero to the Nyquist frequency. The Nyquist frequency is half the sample rate. The filters used in the iDSC board have linear phase, so the phase response is specified by the Group Delay.
 - ◆ Linear Zoom Display Menu Item: Shows the linear amplitude response in the frequency domain, with focus on the passband performance of the filter. A linear zoom display graph plots the linear attenuation, in 16-bit counts, from -16 counts to +16 counts,

with frequencies from zero to the Nyquist frequency. The Nyquist frequency is half the **Sample Rate**.

- ◆ **Log Display Menu Item:** Shows the logarithmic amplitude response in the frequency domain. A logarithmic display graph plots the logarithmic attenuation, in decibels, from -120 dB to 10 dB, with frequencies from zero to the Nyquist frequency. The Nyquist frequency is half the **Sample Rate**.
- ◆ **Log Zoom Display Menu Item:** Shows the logarithmic amplitude response in the frequency domain, with focus on the passband performance of the filter. A logarithmic zoom display graph plots the logarithmic attenuation, in decibels, from -4 dB to +1 dB, with frequencies from zero to the Nyquist frequency. The Nyquist frequency is half the **Sample Rate**.
- ◆ **Unit Step Display Menu Item:** Shows the amplitude response of the filter in relation to a change in the input from zero to positive full scale. Note that the response to a unit step change in the input is spread out over many samples. This is a necessary consequence of the very sharp cutoff in the frequency domain. It is possible to sharpen the unit step input response by increasing the cutoff slope parameter and decreasing the sharpness parameter.
- **Defaults Load Menu Item:** Loads the default filter response graphs for a particular sample rate. The default filter response graphs always have very flat passband characteristics and stop band attenuation of more than 96 dB.
- **Copy Menu Item:** Copies the filter design parameters from the filter design to the clipboard.
- **Paste Menu Item:** Pastes the copied filter design parameters from the clipboard to another filter design.

SCS Module Tab

The following Signal Conditioning System Module Parameters are accessible from the SCS Module tab.

- **Input Pin Text box:** Shows the names of the input pins. This field is read-only.

- **Input Type Combo box:** Configures the type of input signal. Valid input types are DC coupling, AC coupling, and Excitation.
- **Input Range Combo box:** Configures the input range. Please note that this input range is different from the iDSC Input Range, and only works if the iDSC input range is set to +/- 5V. Valid input ranges are:
 +/- 10 mV, +/- 20 mV, +/- 50 mV,
 +/- 100 mV, +/- 200 mV, +/- 500 mV,
 +/- 1 V, +/- 2 V, +/- 5 V, +/- 10 V
- **Input Offset (V) Text box:** Configures the input offset. The specified input offset must be in the Input Offset Range.
- **Input Offset Range Text box:** Displays the valid input offset range. The input offset range is determined by the selected Input Range and is read-only. For example, if the input range is +/- 500 mV then the input offset range is +/- 2.5 V, if the input range is +/- 2 V then the input offset range is +/- 1V. This is a read-only parameter that is dependent on the input range and cannot be specified. Valid input offset ranges are:

+/- 0.5 V	when the input range is +/- 10 mV
+/- 1.0 V	when the input range is +/- 20 mV
+/- 2.5 V	when the input range is +/- 50 mV
+/- 0.5 V	when the input range is +/- 100 mV
+/- 1.0 V	when the input range is +/- 200 mV
+/- 2.5 V	when the input range is +/- 500 mV
+/- 1.0 V	when the input range is +/- 1 V
+/- 1.0 V	when the input range is +/- 2 V
+/- 5.0 V	when the input range is +/- 5 V
+/- 5.0 V	when the input range is +/- 10 V
- **Output Excitation Combo box:** Configures the output excitation. Valid output excitation voltages are 0 V, 1 V, 2 V, 5 V, 10 V.

Graph Window

The Graph window displays graphical representations of data acquired and processed by the DAP board. The Graph window has these features.

- Any number of Graph windows is allowed. To add a new Graph window, select Window|New Graph. Or choose Window|Clone Active Window when a Graph Window is active.
- In addition to the common menu items described before, the following main menu items are available when the Graph window is active.
 - Channels...: Sets up the data source of a Graph window. Only data from the selected channel pipes are displayed. Selecting this menu item brings up a Channels Selection for Graph dialog as described below.
 - ◆ Button Grid: Displays the list of channel pipes. A channel pipe is selected when the button is down and deselected when the button is up. Although there is no upper limit on the number of channels selected, it is recommended to show at most sixteen channels per graph for good visualization.
 - ◆ OK Button: Saves all changes and closes the Channels Selection for Graph dialog box.
 - ◆ Cancel Button: Discards all changes and closes the Channels Selection for Graph dialog box.
 - ◆ Text Box: Displays the channel pipes selected from the Button grid. It is for display only and is not editable.
 - Graph Options: Sets up how the Graph window displays data.
 - ◆ Enabled: Enables or disables the Graph window. A check mark beside Enabled signifies that the Graph window is enabled. If the Graph window is enabled and DAPstudio is started, the Graph window displays data from the channels selected from Channels... If the Graph window is disabled and DAPstudio is started, no data are plotted.
 - ◆ Caption...: Allows a custom name for the Graph window.

- ◆ Connect To: Selects the source of the data shown in the graph. The default option is Data Acquisition – the open configuration. If a Data File has been opened, you may choose the Data File as the source of the graphed data.
- ◆ Display...: Selects options for the Graph window. The Graph Display options are also accessible by double-clicking on the Graph window. There are four tabs of options that include Titles/Axis, Colors/Legend, 3D, and General.
 - ◇ OK Button: Saves all changes and closes the Graph Display dialog box.
 - ◇ Cancel Button: Discards all changes, except those already Applied, and closes the Graph Display dialog box.
 - ◇ Apply Button: Saves and applies all changes without closing the Graph Display dialog box.
 - ◇ Title/Axis Tab: Configures the titles and axes for the display. Each F (Font) button opens a Font selection interface for the associated label. Define the Font, Font Style, Size, Effects, Color, and Script and see a sample.
 - Titles Group Box: Selects titles for the main graphical display. The following titles are available for edit.
 - Top Edit Box: Sets up the title to appear above the graphing area. Default is Data.
 - Left Edit Box: Sets up the title to appear on the left side of the graphing area. Default is Volts.
 - Bottom Edit Box: Sets up the title to appear below the graphing area. Default is Sample.
 - Left Axis Group Box: Selects the units and properties of the left axis. Available unit options are Voltage, Digital, or Custom.
 - Full Scale Combo Box: Using Voltage units, Full Scale is either 5 or 10 because the input voltage range is either -5 to +5 volts or -10 to +10 volts. The scale

factor is (5 / 32768) or (10 / 32768). Using Digital units, the integer range is -2^{31} to $+2^{31}$. Using Custom units, Full Scale is a number, x , that corresponds to a 5 or 10 volt reading. The scale factor is ($x / 32768$).

- Min Edit Box: Selects the lower limit for graphically displaying the data.
- Max Edit Box: Selects the upper limit for graphically displaying the data.
- Inc Edit Box: Selects the spacing between the left axis ticks in the Min and Max range. DAPstudio will automatically adjust Inc if Inc is too small to fit all of the ticks on the display.
- Bottom Axis Group Box: Selects unit and properties of the bottom axis. Available unit options are Samples, Seconds, and Milliseconds. The following items, except for Fixed Limits, are grayed out and not available for use when DAPstudio is started and acquiring data.
 - View Points Edit Box: Selects the number of data points per graph displayed in the Graph window. Available values are in the range 100 to 1024.
 - Block Scroll Edit Box: Selects the increments for scrolling from left to right. This is extremely useful for FFT data. See [App 0703](#).
 - Fixed Limits Checkbox: If selected, fixes the x-axis limits for the data displayed in the Graph Window.
 - ◆ Min Edit Box: Selects the lower fixed value for graphically displaying the data.
 - ◆ Max Edit Box: Selects the upper fixed value for graphically displaying the data.
 - ◆ Inc Edit Box: Selects the spacing between the left axis ticks in the Min and Max range.

DAPstudio will automatically adjust Inc if Inc is too small to fit all of the ticks on the display.

◇ Colors/Legend Tab

- **Colors Group Box:** Selects the colors for each channel selected for display. The legend on the right side of the Graph window displays the selected channels and their corresponding colors.
 - **Channels Combo Box:** Selects an available channel and the color assigned to it.
 - **Channels Color Selection Box:** Opens a color selection interface, by clicking the box, for the selected channel. Select a new color, followed by OK, to change the color of the selected channel.
 - **Channels Color Grid:** Shows the sixteen default colors. Click on a grid to change the color of the selected channel.
 - **All Channels: All Channels Same Button:** Assigns all channels the same color as the selected channel. To apply to the Graph, hit the Apply Button.
 - **All Channels: Use Grid Colors Button:** Assigns all channels the default colors. To apply to the Graph, hit the Apply Button.
 - **Background Color Selection Box:** Opens a color selection interface, by clicking the box, for the Graph background.
 - **Border Color Selection Box:** Opens a color selection interface, by clicking the box, for the border area around the Graph.
- **Legend Group Box:** Selects color and font appearance for the Graph Legend.
 - **Legend Visible Checkbox:** If checked, the channel names and color lines are shown in a legend box next to the graph. Also controlled through the small L

button on the Graph display, if General Tab | Display Tools Visible is selected.

- Legend Color Selection Box: Opens a color selection interface, by clicking the box, for the legend background.
- Legend F (Font) Selection Button: Opens a font definition interface for the legend font.

◇ 3D Tab

- 3D Enabled Checkbox: Enables or disables the three-dimensional display option. Also controlled through the small 3d button on the Graph display, if General Tab | Display Tools Visible is selected.
- Angle Text Box: Changes the angle of the 3D display and the depth of the display. It is shown in a percentage between 1 and 100, where 1 is close to flat and 100 compresses the display along the vertical. The default is 15%. Also controlled through the small Arrow buttons on the Graph display, if General Tab | Display Tools Visible is selected.
- Left Wall Color Selection Box: Opens a color selection interface, by clicking the box, for the left-side wall of a 3D display.
- Floor Color Selection Box: Opens a color selection interface, by clicking the box, for the floor of a 3D display.
- Background Color Selection Box: Opens a color selection interface, by clicking the box, for the background of the Graph display. Changing the background color for the 3D display also changes it for the flat display.
- Grid Visible Checkbox: Displays or hides the grid lines in a 3D display. Also controlled through the small G button on the Graph display, if General Tab | Display Tools Visible is selected.

- **Labels Visible Checkbox:** Displays or hides the depth labels in a 3D display. Also controlled through the small **D** button on the Graph display, if **General Tab | Display Tools Visible** is selected.
- **Grid Color Selection Box:** Opens a color selection interface, by clicking the box, for gridlines in a 3D display.

◇ **General Tab**

- **Caption Text Box:** Allows a custom name for the Graph window.
- **History Text Box:** Selects the number of data points to store in the Graph window. Available values are in the range 1 to 20000. When DAPstudio is started and acquiring data, this menu item is grayed out and not available for use.
- **Display Tools Visible Checkbox:** Shows shortcut buttons for display changes in the upper left corner of the Graph window display. When **Display Tools Visible** is checked, the following small buttons implement the following display changes.
 - **3d Button:** Changes the display from flat and two-dimensional to three-dimensional.
 - **G Button:** Displays or hides the grid lines. Only available when 3D display has been turned on. Otherwise the button is grayed out and not available for use.
 - **D Button:** Displays or hides the depth labels. Only available when 3D display has been turned on. Otherwise the button is grayed out and not available for use.
 - **Left Arrow Button:** Changes the angle of the display, moving it closer to a compressed, flat display. Only available when 3D display has been turned on. Otherwise the button is grayed out and not available for use.

- Right Arrow Button: Changes the angle of the display, increasing the depth of the display. Only available when 3D display has been turned on. Otherwise the button is grayed out and not available for use.
 - L Button: Displays or hides the Legend on the right side.
- **Zooming:** The Graph window has zooming in features. To zoom in, place the cursor over the points of interest and use the left mouse button to create a rectangular box. When the left mouse button is released, the area inside the rectangular box is enlarged. You can zoom in indefinitely, but the Graph window only keeps a history of the five most recent zoomed in levels. There is also a minimum zoom in of 20 samples for the left axis and 20 counts for the bottom axis. To access the saved zoomed-in levels, press the right mouse button to bring up a pop-up menu.
 - Zoom Level menu item: Displays the saved zoom levels. The underlined (depending on your operating system) zoom level is the current level.
 - Zoom Next menu item: Goes to a higher level of zooming.
 - Zoom Back menu item: Goes to a lower level zooming.
 - Zoom Clear menu item: Clears and resets the zooming.
- **A Pair of Crosshairs:** The Graph window has channel data tracking features. To track the data of a channel, click and hold down the left mouse button over the channel of interest from the legend located on the right side of the Graph window. Then drag the cursor over the plotting area, and the corresponding data values will be located at the bottom left corner of the Graph window.

Table Window

The Table window displays text representations of data acquired and processed by the DAP board. Only data from the selected channels are displayed. The Table window has these features.

- Any number of Table windows is allowed. To add a new Table window, select Window|New Table. Or choose Window|Clone Active Window when a Table window is active.
- In addition to the common menu items described before, the following main menu items are available when the Table window is active.
 - Channels...: Sets up the data source of a Table window. Only data from the selected channel pipes are displayed. Selecting this menu item brings up a Channels Selection for Table dialog as described below.
 - ◆ Button Grid: Displays the list of channel pipes. A channel pipe is selected when the button is down and deselected when the button is up.
 - ◆ OK Button: Saves all changes and closes the Channels Selection for Table dialog box.
 - ◆ Cancel Button: Discards all changes and closes the Channels Selection for Table dialog box.
 - ◆ Text Box: Displays the channel pipes selected from the Button grid. It is for display only and is not editable.
 - Table Options: Sets up how the Table window displays data.
 - ◆ Enabled: Enables or disables the Table window. A check mark beside Enabled signifies that the Table window is enabled. If the Table window is enabled and DAPstudio is started, the Table window displays data from the channels selected from Channels... If the Table window is disabled and DAPstudio is started, no data are displayed.
 - ◆ Caption...: Allows a custom name for the Table window.

- ◆ **Connect To:** Selects the source of the data shown in the table. The default option is `Data Acquisition` – the open configuration. If a `Data File` has been opened, you may choose the `Data File` as the source of the data.
- ◆ **Display...:** Selects options for the `Table` window. The `Table Display` options are also accessible by double-clicking on the `Table` window. There are two tabs of options: `Columns/Rows` and `General`.
 - ◇ **OK Button:** Saves all changes and closes the `Table Display` dialog box.
 - ◇ **Cancel Button:** Discards all changes, except those already Applied, and closes the `Table Display` dialog box.
 - ◇ **Apply Button:** Saves and applies all changes without closing the `Table Display` dialog box.
 - ◇ **Columns/Rows Tab:** Selects options for the `Table` window. It includes column and row properties.
 - **Column Width edit box:** Displays an input dialog box for specifying the width for all columns. Available values are in the range 10 to 200.
 - **Row Heights edit box:** Displays an input dialog box for specifying the height for all rows. Available values are in the range 10 to 200.
 - **Sample Column Visible checkbox:** If checked, the first column in the table is the sample count index of the data.
 - **Copy:** Copies the selected data to the clipboard. The short-cut is `Ctrl-C`.
 - **Select All:** Selects all data displayed in the `Table` window. The short-cut is `Ctrl-A`.
 - ◇ **General Tab:** Selects general options for the `Table` window.
 - **Caption...:** Allows a custom name for the `Table` window.

- **History...:** Determines the number of data points to store in the `Table` window. Available values are in the range 1 to 20000. When DAPstudio is started and acquiring data, this menu item is grayed out and not available for use.

Alarm Window

The Alarm window displays graphical representations of data acquired and processed by the DAP board. Use the Alarm window for pass/fail testing, process level monitoring, and process range monitoring.

- **Pass/fail example:** On a production line, simultaneously test 32 microphones for proper response to a test tone. In the alarm window set a pass level that shows green, a fail level high that shows red, and a fail level low that shows yellow. With this test, all passing microphones will display green, each microphone that drives too high a level in response to the test tone will show red, and each microphone that does not respond sufficiently to the tone will show yellow. This allows an operator to rapidly determine which, if any, of the 32 microphones fails and in what way the microphone fails.
- **Process level monitoring example (Alarm as display indicator):** In an oil refinery with 100 pressure sense points, set up four Alarm windows to display the current pressure in each of the 100 locations (25 locations per window each with a distinct color to allow easy identification of location). An operator can look at the single display to rapidly determine pressure levels in all 100 locations. To have DAPstudio check for proper pressure levels, set up alarm colors for out of bound conditions (over pressure/under pressure).
- **Process range monitoring example:** In a chemical etching plant with 10 vats of chemicals with temperature under PID control from a DAP board, set up an alarm window to monitor the state of the vats. Set a startup temperature threshold, below which all alarm bars show yellow, a green operating range, and a red over temperature range. An operator can then rapidly tell when all 10 vats are ready for operation. During operations, a spot check for any color other than green will show whether all vats remain under proper control.

The Alarm window has these features.

- Any number of Alarm windows is allowed. To add a new Alarm window, select `Window|New Alarm`. Or choose `Window|Clone Active Window` when an Alarm Window is active.
- In addition to the common menu items described before, the following main menu items are available when the Alarm window is active.

- Channels...: Sets up the data source of a Alarm window. Only data from the selected channel pipes are displayed. Selecting this menu item brings up a Channels Selection for Alarm dialog as described below.
 - ◆ Button Grid: Displays the list of channel pipes. A channel pipe is selected when the button is down and deselected when the button is up. Although there is no upper limit on the number of channels selected, it is recommended to show at most 64 channels per alarm window for good visualization.
 - ◆ OK Button: Saves all changes and closes the Channels Selection for Alarm dialog box.
 - ◆ Cancel Button: Discards all changes and closes the Channels Selection for Alarm dialog box.
 - ◆ Text Box: Displays the channel pipes selected from the Button grid. It is for display only and is not editable.
- Alarm Options: Sets up how the Alarm window displays data.
 - ◆ Enabled: Enables or disables the Alarm window. A check mark beside Enabled signifies that the Alarm window is enabled. If the Alarm window is enabled and DAPstudio is started, the Alarm window displays data from the channels selected from Channels... If the Alarm window is disabled and DAPstudio is started, no data are plotted.
 - ◆ Caption...: Allows a custom name for the Alarm window.
 - ◆ Connect To: Selects the source of the data shown. The default option is Data Acquisition – the open configuration. If a Data File has been opened, you may choose the Data File as the source of the data.
 - ◆ Display...: Selects options for the Alarm window. The Alarm Display options are also accessible by double-clicking on the Alarm window. There are five tabs of options that include Titles/Axis, Colors/Legend, 3D, Alarm, and General.
 - ◇ OK Button: Saves all changes and closes the Alarm Display dialog box.

- ◇ **Cancel Button:** Discards all changes, unless already applied, and closes the Alarm Display dialog box.
- ◇ **Apply Button:** Saves and applies all changes without closing the Alarm Display dialog box.
- ◇ **Title/Axis Tab:** Configures the titles and axes for the display. Each F (Font) button opens a Font configuration window for the associated label. Define the Font, Font Style, Size, Effects, Color, and Script and see a sample.
 - **Titles Group Box:** Selects titles for the main alarm display. The following titles are available for edit.
 - **Top Edit Box:** Sets up the title to appear above the alarm area. Default is Data.
 - **Left Edit Box:** Sets up the title to appear on the left side of the alarm area. Default is Volts.
 - **Bottom Edit Box:** Sets up the title to appear below the alarm area. Default is Sample.
 - **Left Axis Group Box:** Selects the units and properties of the left axis. Available unit options are Voltage, Digital, or Custom.
 - **Full Scale Combo Box:** Using Voltage units, Full Scale is either 5 or 10 because the input voltage range is either -5 to +5 volts or -10 to +10 volts. The scale factor is $(5 / 32768)$ or $(10 / 32768)$. Using Digital units, the integer range is -2^{31} to $+2^{31}$. Using Custom units, Full Scale is a number, x , that corresponds to a 5 or 10 volt reading. The scale factor is $(x / 32768)$.
 - **Min Edit Box:** Selects the lower limit for displaying the data.
 - **Max Edit Box:** Selects the upper limit for displaying the data.

- Inc Edit Box: Selects the spacing between the left axis ticks in the Min and Max range. DAPstudio will automatically adjust Inc if Inc is too small to fit all of the ticks on the display.
- Bottom Axis Group Box: Selects unit and properties of the bottom axis. Available unit options are Samples, Seconds, and Milliseconds. The following items, except for Fixed Limits, are grayed out and not available for use when DAPstudio is started and acquiring data.
 - View Points Edit Box: This item is unavailable for the Alarm Window.
 - Block Scroll Edit Box: This item is unavailable for the Alarm Window.
 - Fixed Limits Checkbox: If selected, fixes the x-axis limits for the data displayed in the Alarm Window.
 - ◆ Min Edit Box: Selects the lower fixed value for graphically displaying the data.
 - ◆ Max Edit Box: This item is unavailable for the Alarm Window.
 - ◆ Inc Edit Box: This item is unavailable for the Alarm Window.

◇ Colors/Legend Tab

- Colors Group Box: Selects the colors for each channel selected for display. The legend on the right side of the Alarm window displays the selected channels and their corresponding colors.
 - Channels Combo Box: Selects an available channel and the color assigned to it.
 - Channels Color Selection Box: Opens a color selection window, by clicking the box, for the selected

channel. Select a new color, followed by OK, to change the color of the selected channel.

- Channels Color Grid: Shows the sixteen default colors. Click on a grid square to change the color of the selected channel.
- All Channels: All Channels Same Button: Assigns all channels the same color as the selected channel. To apply to the Alarm, hit the Apply Button.
- All Channels: Use Grid Colors Button: Assigns all channels the default colors. To apply to the Alarm, hit the Apply Button.
- Background Color Selection Box: Opens a color selection window, by clicking the box, for the Alarm background.
- Border Color Selection Box: Opens a color selection window, by clicking the box, for the border area around the Alarm.
- Legend Group Box: Selects color and font appearance for the Alarm Legend.
 - Legend Visible Checkbox: If checked, the channel names and color lines are shown in a legend box next to the alarm display. Also controlled through the small L button on the Alarm display, if General Tab | Display Tools Visible is selected.
 - Legend Color Selection Box: Opens a color selection window, by clicking the box, for the legend background.
 - Legend F (Font) Selection Button: Opens a font definition window for the legend font.

◇ 3D Tab

- 3D Enabled Checkbox: Enables or disables the three-dimensional display option. Also controlled through the

small 3d button on the Alarm display, if General Tab | Display Tools Visible is selected.

- Angle Text Box: Changes the angle of the 3D display and the depth of the display. It is shown in a percentage between 1 and 100, where 1 is close to flat and 100 creates a deep display. The default is 15%. Also controlled through the small Arrow buttons on the Alarm display, if General Tab | Display Tools Visible is selected.
- Left Wall Color Selection Box: Opens a color selection interface, by clicking the box, for the left-side wall of a 3D display.
- Floor Color Selection Box: Opens a color selection interface, by clicking the box, for the floor of a 3D display.
- Background Color Selection Box: Opens a color selection interface, by clicking the box, for the background of the Alarm display. Changing the background color for the 3D display also changes it for the flat display.
- Grid Visible Checkbox: Displays or hides the grid lines in a 3D display. Also controlled through the small G button on the Alarm display, if General Tab | Display Tools Visible is selected.
- Labels Visible Checkbox: Displays or hides the depth labels in a 3D display. Also controlled through the small D button on the Alarm display, if General Tab | Display Tools Visible is selected.
- Grid Color Selection Box: Opens a color selection interface, by clicking the box, for gridlines in a 3D display.

◇ Alarm Tab

- Channels Combo Box: Selects an available channel.
 - Type Combo Box: Selects the Type of Alarm for the selected channel. Available options are None, Min & Max, Min only, or Max only.

- All Types Same Button: Assigns all channels the same type of alarm as the selected channel. To apply to the Alarm Window, hit the Apply Button.
- Min Edit Box: Selects the minimum level for an alarm to be triggered.
- All Min Same Button: Assigns all channels the same minimum level as the selected channel. To apply to the Alarm Window, hit the Apply Button.
- Max Edit Box: Selects the maximum level for an alarm to be triggered.
- All Max Same Button: Assigns all channels the same maximum level as the selected channel. To apply to the Alarm Window, hit the Apply Button.
- Min Color Selection Box: Selects the minimum alarm color for the selected channel. Click on the color box to open a color selection window.
- All Min Color Same Button: Assigns all channels the same minimum alarm color as the selected channel. To apply to the Alarm Window, hit the Apply Button.
- Max Color Selection Box: Selects the maximum alarm color for the selected channel. Click on the color box to open a color selection window.
- All Max Color Same Button: Assigns all channels the same maximum alarm color as the selected channel. To apply to the Alarm Window, hit the Apply Button.

◇ General Tab

- Caption Text Box: Allows a custom name for the Alarm window.
- History Text Box: Selects the number of data points to store in the Alarm window. Available values are in the range 1 to 20000. When DAPstudio is started and

acquiring data, this menu item is grayed out and not available for use.

- **Display Tools Visible Checkbox:** Shows shortcut buttons for display changes in the upper left corner of the Alarm window display. When Display Tools Visible is checked, the following small buttons implement the following display changes.
 - **3d Button:** Changes the display from flat and two-dimensional to three-dimensional.
 - **G Button:** Displays or hides the grid lines. Only available when 3D display has been turned on. Otherwise the button is grayed out and not available for use.
 - **D Button:** Displays or hides the depth labels. Only available when 3D display has been turned on. Otherwise the button is grayed out and not available for use. Not relevant for the Alarm display, so turned off by default.
 - **Left Arrow Button:** Changes the angle of the display, moving it closer to a compressed, flat display. Only available when 3D display has been turned on. Otherwise the button is grayed out and not available for use.
 - **Right Arrow Button:** Changes the angle of the display, increasing the depth of the display. Only available when 3D display has been turned on. Otherwise the button is grayed out and not available for use.
 - **L Button:** Displays or hides the Legend on the right side.
- **Zooming:** The Alarm window has zooming in features. To zoom in, place the cursor over the points of interest and use the left mouse button to create a rectangular box. When the left mouse button is released, the area inside the rectangular box is enlarged. You can zoom in indefinitely, but the Alarm window only keeps a history of the five most recent zoomed in levels. There is also a minimum zoom in of 20 samples for the left axis and 20 counts for

the bottom axis. To access the saved zoomed-in levels, press the right mouse button to bring up a pop-up menu.

- Zoom Level menu item: Displays the saved zoom levels. The underlined (depending on your operating system) zoom level is the current level.
 - Zoom Next menu item: Goes to a higher level of zooming.
 - Zoom Back menu item: Goes to a lower level zooming.
 - Zoom Clear menu item: Clears and resets the zooming.
- A Pair of Crosshairs: The Alarm window has channel data tracking features. To track the data of a channel, click and hold down the left mouse button over the channel of interest from the legend located on the right side of the Alarm window. Then drag the cursor over the plotting area, and the corresponding data values will be located at the bottom left corner of the Alarm window.

Bar Window

The Bar window displays graphical representations of data acquired and processed by the DAP board. The vertical bars provide an additional way to look at the data other than in the line graph format of the Graph window. You may prefer a bar graph to a line graph if the graph displays lower resolution spectra.

The Bar window has these features.

- Any number of Bar windows is allowed. To add a new Bar window, select Window|New Bar. Or choose Window|Clone Active Window when a Bar Window is active.
- In addition to the common menu items described before, the following main menu items are available when the Bar window is active.
 - Channels...: Sets up the data source of a Bar window. Only data from the selected channel pipes are displayed. Selecting this menu item brings up a Channels Selection for Bar dialog as described below.
 - ◆ Button Grid: Displays the list of channel pipes. A channel pipe is selected when the button is down and deselected when the button is up. Although there is no upper limit on the number of channels selected, it is recommended to show at most 64 channels per alarm window for good visualization.
 - ◆ OK Button: Saves all changes and closes the Channels Selection for Bar dialog box.
 - ◆ Cancel Button: Discards all changes and closes the Channels Selection for Bar dialog box.
 - ◆ Text Box: Displays the channel pipes selected from the Button grid. It is for display only and is not editable.
 - Bar Options: Sets up how the Bar window displays data.
 - ◆ Enabled: Enables or disables the Bar window. A check mark beside Enabled signifies that the Bar window is enabled. If the Bar window is enabled and DAPstudio is started, the Bar window displays data from the channels selected from Channels.... If the

Bar window is disabled and DAPstudio is started, no data are plotted.

- ◆ **Caption...:** Allows a custom name for the Bar window.
- ◆ **Connect To:** Selects the source of the data shown. The default option is Data Acquisition – the open configuration. If a Data File has been opened, you may choose the Data File as the source of the data.
- ◆ **Display...:** Selects options for the Bar window. The Bar Display options are also accessible by double-clicking on the Bar window. There are five tabs of options that include Title/Axis, Colors/Legend, 3D, Bar, and General.
 - ◇ **OK Button:** Saves all changes and closes the Bar Display dialog box.
 - ◇ **Cancel Button:** Discards all changes, unless already applied, and closes the Bar Display dialog box.
 - ◇ **Apply Button:** Saves and applies all changes without closing the Bar Display dialog box.
 - ◇ **Title/Axis Tab:** Configures the titles and axes for the display. Each F (Font) button opens a Font configuration window for the associated label. Define the Font, Font Style, Size, Effects, Color, and Script and see a sample.
 - **Titles Group Box:** Selects titles for the main alarm display. The following titles are available for edit.
 - **Top Edit Box:** Sets up the title to appear above the graph area. Default is Data.
 - **Left Edit Box:** Sets up the title to appear on the left side of the graph area. Default is Volts.
 - **Bottom Edit Box:** Sets up the title to appear below the graph area. Default is Sample.

- **Left Axis Group Box:** Selects the units and properties of the left axis. Available unit options are Voltage, Digital, or Custom.
 - **Full Scale Combo Box:** Using Voltage units, Full Scale is either 5 or 10 because the input voltage range is either -5 to +5 volts or -10 to +10 volts. The scale factor is (5 / 32768) or (10 / 32768). Using Digital units, the integer range is -2³¹ to +2³¹. Using Custom units, Full Scale is a number, x, that corresponds to a 5 or 10 volt reading. The scale factor is (x / 32768).
 - **Min Edit Box:** Selects the lower limit for displaying the data.
 - **Max Edit Box:** Selects the upper limit for displaying the data.
 - **Inc Edit Box:** Selects the spacing between the left axis ticks in the Min and Max range. DAPstudio will automatically adjust Inc if Inc is too small to fit all of the ticks on the display.

- **Bottom Axis Group Box:** Selects unit and properties of the bottom axis. Available unit options are Samples, Seconds, and Milliseconds. The following items, except for Fixed Limits, are grayed out and not available for use when DAPstudio is started and acquiring data.
 - **View Points Edit Box:** Selects the number of data points per graph displayed in the Bar window. Available values are in the range 100 to 1024.
 - **Block Scroll Edit Box:** Selects the increments for scrolling from left to right. This is extremely useful for FFT data. See [App 0703](#).
 - **Fixed Limits Checkbox:** If selected, fixes the x-axis limits for the data displayed in the Bar Window.

- ◆ **Min Edit Box:** Selects the lower fixed value for displaying the data.
- ◆ **Max Edit Box:** Selects the upper fixed value for displaying the data.
- ◆ **Inc Edit Box:** Selects the spacing between the left axis ticks in the Min and Max range. DAPstudio will automatically adjust Inc if Inc is too small to fit all of the ticks on the display.

◇ **Colors/Legend Tab**

- **Colors Group Box:** Selects the colors for each channel selected for display. The legend on the right side of the Bar window displays the selected channels and their corresponding colors.
 - **Channels Combo Box:** Selects an available channel and the color assigned to it.
 - **Channels Color Selection Box:** Opens a color selection window, by clicking the box, for the selected channel. Select a new color, followed by OK, to change the color of the selected channel.
 - **Channels Color Grid:** Shows the sixteen default colors. Click on a grid square to change the color of the selected channel.
 - **All Channels: All Channels Same Button:** Assigns all channels the same color as the selected channel. To apply to the Bar, hit the Apply Button.
 - **All Channels: Use Grid Colors Button:** Assigns all channels the default colors. To apply to the Bar, hit the Apply Button.
 - **Background Color Selection Box:** Opens a color selection window, by clicking the box, for the Bar background.

- Border Color Selection Box: Opens a color selection window, by clicking the box, for the border area around the Bar.
- Legend Group Box: Selects color and font appearance for the Bar Legend.
 - Legend Visible Checkbox: If checked, the channel names and color lines are shown in a legend box next to the alarm display. Also controlled through the small L button on the Bar display, if General Tab | Display Tools Visible is selected.
 - Legend Color Selection Box: Opens a color selection window, by clicking the box, for the legend background.
 - Legend F (Font) Selection Button: Opens a font definition window for the legend font.

◇ 3D Tab

- 3D Enabled Checkbox: Enables or disables the three-dimensional display option. Also controlled through the small 3d button on the Bar display, if General Tab | Display Tools Visible is selected.
- Angle Text Box: Changes the angle of the 3D display and the depth of the display. It is shown in a percentage between 1 and 100, where 1 is close to flat and 100 creates a deep display. The default is 15%. Also controlled through the small Arrow buttons on the Bar display, if General Tab | Display Tools Visible is selected.
- Left Wall Color Selection Box: Opens a color selection interface, by clicking the box, for the left-side wall of a 3D display.
- Floor Color Selection Box: Opens a color selection interface, by clicking the box, for the floor of a 3D display.
- Background Color Selection Box: Opens a color selection interface, by clicking the box, for the background

of the Bar display. Changing the background color for the 3D display also changes it for the flat display.

- **Grid Visible Checkbox:** Displays or hides the grid lines in a 3D display. Also controlled through the small G button on the Bar display, if General Tab | Display Tools Visible is selected.
- **Labels Visible Checkbox:** Displays or hides the depth labels in a 3D display. Also controlled through the small D button on the Bar display, if General Tab | Display Tools Visible is selected.
- **Grid Color Selection Box:** Opens a color selection interface, by clicking the box, for gridlines in a 3D display.

◇ Bar Tab

- **Border Color Combo Box:** Selects an available channel and the border color assigned to it.
- **Border Color Selection Box:** Opens a color selection window, by clicking the box, for the selected channel. Select a new color, followed by OK, to change the color of the selected channel. To change the color of the bar itself, not just the border, use the Colors/Legend tab.
- **All Border Same Button:** Assigns all channels the same border color as the selected channel. To apply to the Bar Window, hit the Apply Button.
- **Use Channel Colors Button:** Assigns each channel a border color the same as their Channel color defined on the Colors/Legend tab. To apply to the Bar Window, hit the Apply Button.
- **Width (pixels) Edit Box:** Defines the width, in pixels, of the bars for all channels. The maximum bar width is 500 pixels. Typing in this box automatically unselects Use Automatic Width.
- **Overlap (%) Edit Box:** Defines how much the bars in the display overlap and occupy the same space for each

sample. The possible values are from 0, where each bar is lined up beside the others and fully visible, to 200, where the order of the bars is reversed. At 100, the last channel displayed covers all others. The default is 20%.

- Use Automatic Width Checkbox: If checked, the Width (pixels) edit box is filled in with the optimal value to fill the display environment, with no spaces between samples.

◇ General Tab

- Caption Text Box: Allows a custom name for the Bar window.
- History Text Box: Selects the number of data points to store in the Bar window. Available values are in the range 1 to 20000. When DAPstudio is started and acquiring data, this menu item is grayed out and not available for use.
- Display Tools Visible Checkbox: Shows shortcut buttons for display changes in the upper left corner of the Bar window display. When Display Tools Visible is checked, the following small buttons implement the following display changes.
 - 3d Button: Changes the display from flat and two-dimensional to three-dimensional.
 - G Button: Displays or hides the grid lines. Only available when 3D display has been turned on. Otherwise the button is grayed out and not available for use.
 - D Button: Displays or hides the depth labels. Only available when 3D display has been turned on. Otherwise the button is grayed out and not available for use. Not relevant for the Bar display, so turned off by default.
 - Left Arrow Button: Changes the angle of the display, moving it closer to a compressed, flat display.

Only available when 3D display has been turned on. Otherwise the button is grayed out and not available for use.

- Right Arrow Button: Changes the angle of the display, increasing the depth of the display. Only available when 3D display has been turned on. Otherwise the button is grayed out and not available for use.
- L Button: Displays or hides the Legend on the right side.
- Zooming: The Bar window has zooming in features. To zoom in, place the cursor over the points of interest and use the left mouse button to create a rectangular box. When the left mouse button is released, the area inside the rectangular box is enlarged. You can zoom in indefinitely, but the Bar window only keeps a history of the five most recent zoomed in levels. There is also a minimum zoom in of 20 samples for the left axis and 20 counts for the bottom axis. To access the saved zoomed-in levels, press the right mouse button to bring up a pop-up menu.
 - Zoom Level menu item: Displays the saved zoom levels. The underlined (depending on your operating system) zoom level is the current level.
 - Zoom Next menu item: Goes to a higher level of zooming.
 - Zoom Back menu item: Goes to a lower level zooming.
 - Zoom Clear menu item: Clears and resets the zooming.
- A Pair of Crosshairs: The Bar window has channel data tracking features. To track the data of a channel, click and hold down the left mouse button over the channel of interest from the legend located on the right side of the Bar window. Then drag the cursor over the plotting area, and the corresponding data values will be located at the bottom left corner of the Bar window.

Waterfall Window

The Waterfall window displays graphical representations of data acquired and processed by the DAP board. Use the Waterfall window to display a time history of blocked data – to look at very large amounts of data quickly, looking for trends and behaviors, not detail. This allows you to look at spectra over frequency and over time simultaneously, giving the big picture.

All the traces in this display correspond to data from a single channel. The trace at the front represents the most recent View Points block of data. Each following trace represents the data sequence immediately prior to the trace in front of it.

So, in an example with a waterfall depth of 8 and view points of 1024, and looking at a data set from the beginning, the back most trace represents the samples 0 to 1023, the next trace forward represents data from 1024 to 2047, all the way forward to the most recent trace at the front, representing data from 7168 to 8091. The front label marks out the axis locations for the front-most trace.

If you then scroll forward in time into your data set, old data fall off the back most trace and the waveforms move backwards through the traces. Scroll forward a single block and the trace that was previously at offset 1 from the back steps back to offset 0. That is, the back most trace now represents 1024 to 2047 and the next trace forward represents 2048 to 3172. The front trace at this point shows a new scan for the samples 8192 to 9215.

The visual effect of all of this is that the traces appear to scroll back in time and then fall off the back of the display. So, rather than scrolling by samples, you are scrolling by blocks. Each point you scroll is an entire spectral result and you can see a history of the spectra not just a history of points.

The Waterfall window has these features.

- Any number of Waterfall windows is allowed. To add a new Waterfall window, select Window|New Waterfall. Or choose Window|Clone Active Window when a Waterfall Window is active.
- In addition to the common menu items described before, the following main menu items are available when the Waterfall window is active.

- Channels...: Sets up the data source of a Waterfall window. Only one channel may be selected for each Waterfall window. Only data from the selected channel is displayed. Selecting this menu item brings up a Channels Selection for Waterfall dialog as described below.
 - ◆ Button Grid: Displays the list of channel pipes. A channel pipe is selected when the button is down and deselected when the button is up. Only one channel may be selected for each Waterfall window.
 - ◆ OK Button: Saves all changes and closes the Channels Selection for Waterfall dialog box.
 - ◆ Cancel Button: Discards all changes and closes the Channels Selection for Waterfall dialog box.
 - ◆ Text Box: Displays the channel pipes selected from the Button grid. It is for display only and is not editable.
- Waterfall Options: Sets up how the Waterfall window displays data.
 - ◆ Enabled: Enables or disables the Waterfall window. A check mark beside Enabled signifies that the Waterfall window is enabled. If the Waterfall window is enabled and DAPstudio is started, the Waterfall window displays data from the channel selected from Channels... If the Waterfall window is disabled and DAPstudio is started, no data are plotted.
 - ◆ Caption...: Allows a custom name for the Waterfall window.
 - ◆ Connect To: Selects the source of the data shown. The default option is Data Acquisition – the open configuration. If a Data File has been opened, you may choose the Data File as the source of the data.
 - ◆ Display...: Selects options for the Waterfall window. The Waterfall Display options are also accessible by double-clicking on the Waterfall window. There are five tabs of options that include Title/Axis, Colors/Legend, 3D, Waterfall, and General.

- ◇ OK Button: Saves all changes and closes the Waterfall Display dialog box.
- ◇ Cancel Button: Discards all changes, unless already applied, and closes the Waterfall Display dialog box.
- ◇ Apply Button: Saves and applies all changes without closing the Waterfall Display dialog box.
- ◇ Title/Axis Tab: Configures the titles and axes for the display. Each F (Font) button opens a Font configuration window for the associated label. Define the Font, Font Style, Size, Effects, Color, and Script and see a sample.
 - Titles Group Box: Selects titles for the main alarm display. The following titles are available for edit.
 - Top Edit Box: Sets up the title to appear above the graph area. Default is Data.
 - Left Edit Box: Sets up the title to appear on the left side of the graph area. Default is Volts.
 - Bottom Edit Box: Sets up the title to appear below the graph area. Default is Sample.
 - Left Axis Group Box: Selects the units and properties of the left axis. Available unit options are Voltage, Digital, or Custom.
 - Full Scale Combo Box: Using Voltage units, Full Scale is either 5 or 10 because the input voltage range is either -5 to +5 volts or -10 to +10 volts. The scale factor is (5 / 32768) or (10 / 32768). Using Digital units, the integer range is -2³¹ to +2³¹. Using Custom units, Full Scale is a number, x, that corresponds to a 5 or 10 volt reading. The scale factor is (x / 32768).
 - Min Edit Box: Selects the lower limit for displaying the data.

- Max Edit Box: Selects the upper limit for displaying the data.
- Inc Edit Box: Selects the spacing between the left axis ticks in the Min and Max range. DAPstudio will automatically adjust Inc if Inc is too small to fit all of the ticks on the display.
- Bottom Axis Group Box: Selects unit and properties of the bottom axis. Available unit options are Sample, Seconds, and Milliseconds. The following items, except for Fixed Limits, are grayed out and not available for use when DAPstudio is started and acquiring data.
 - View Points Edit Box: Selects the number of data points per graph displayed in the Waterfall window. Available values are in the range 100 to 1024. The value of History must be greater than the value of View Points multiplied by the Depth. Set the History value on the General tab. Set the Depth value on the Waterfall tab.
 - Block Scroll Edit Box: Selects the increments for scrolling from left to right.
 - Fixed Limits Checkbox: If selected, fixes the x-axis limits for the data displayed in the Waterfall Window. Fixed Limits may be useful for looking at FFTs or other blocked data.
 - ◆ Min Edit Box: Selects the lower fixed value for displaying the data.
 - ◆ Max Edit Box: Selects the upper fixed value for displaying the data.
 - ◆ Inc Edit Box: Selects the spacing between the left axis ticks in the Min and Max range. DAPstudio will automatically adjust Inc if Inc is too small to fit all of the ticks on the display.
- ◇ Colors/Legend Tab

- **Colors Group Box:** Selects the colors for each channel selected for display. The legend on the right side of the Waterfall window displays the selected channels and their corresponding colors.
 - **Channels Combo Box:** Selects an available channel and the color assigned to it.
 - **Channels Color Selection Box:** Opens a color selection window, by clicking the box, for the selected channel. Select a new color, followed by OK, to change the color of the selected channel.
 - **Channels Color Grid:** Shows the sixteen default colors. Click on a grid square to change the color of the selected channel.
 - **All Channels: All Channels Same Button:** Assigns all channels the same color as the selected channel. To apply to the Waterfall, hit the Apply Button.
 - **All Channels: Use Grid Colors Button:** Assigns all channels the default colors. To apply to the Waterfall, hit the Apply Button.
 - **Background Color Selection Box:** Opens a color selection window, by clicking the box, for the Waterfall background.
 - **Border Color Selection Box:** Opens a color selection window, by clicking the box, for the border area around the Waterfall.
- **Legend Group Box:** Selects color and font appearance for the Waterfall Legend.
 - **Legend Visible Checkbox:** If checked, the channel names and color lines are shown in a legend box next to the alarm display. Also controlled through the small L button on the Waterfall display, if General Tab | Display Tools Visible is selected.

- Legend Color Selection Box: Opens a color selection window, by clicking the box, for the legend background.
- Legend F (Font) Selection Button: Opens a font definition window for the legend font.

◇ 3D Tab

- 3D Enabled Checkbox: Enables or disables the three-dimensional display option. Also controlled through the small 3d button on the Waterfall display, if General Tab | Display Tools Visible is selected.
- Angle Text Box: Changes the angle of the 3D display and the depth of the display. It is shown in a percentage between 1 and 100, where 1 is close to flat and 100 creates a deep display. The default is 15%. Also controlled through the small Arrow buttons on the Waterfall display, if General Tab | Display Tools Visible is selected.
- Left Wall Color Selection Box: Opens a color selection interface, by clicking the box, for the left-side wall of a 3D display.
- Floor Color Selection Box: Opens a color selection interface, by clicking the box, for the floor of a 3D display.
- Background Color Selection Box: Opens a color selection interface, by clicking the box, for the background of the Waterfall display. Changing the background color for the 3D display also changes it for the flat display.
- Grid Visible Checkbox: Displays or hides the grid lines in a 3D display. Also controlled through the small G button on the Waterfall display, if General Tab | Display Tools Visible is selected.
- Labels Visible Checkbox: Displays or hides the depth labels in a 3D display. Also controlled through the small D button on the Waterfall display, if General Tab | Display Tools Visible is selected.

- Grid Color Selection Box: Opens a color selection interface, by clicking the box, for gridlines in a 3D display.

◇ Waterfall Tab

- Depth Number Text Box: Changes the number of traces displayed and thus how far back the graph goes. The Depth * View Points (from the Titles/Axis tab) must be less than General tab | History.
- Rotate Colors Checkbox: If checked, the color of a given trace stays with that trace as it moves back in the depth of the Waterfall graph. On the Titles/Axis tab, the View Points and Block Scroll values must be equal for the colors to rotate.

◇ General Tab

- Caption Text Box: Allows a custom name for the Waterfall window.
- History Text Box: Selects the number of data points to store in the Waterfall window. Available values are in the range 1 to 20000. It must be a multiple of the Block Scroll from the Titles/Axis tab, if Block Scroll is enabled. Block Scroll is enabled if the value is greater than 1. When DAPstudio is started and acquiring data, this menu item is grayed out and not available for use.
- Display Tools Visible Checkbox: Shows shortcut buttons for display changes in the upper left corner of the Waterfall window display. When Display Tools Visible is checked, the following small buttons implement the following display changes.
 - 3d Button: Changes the display from flat and two-dimensional to three-dimensional.
 - G Button: Displays or hides the grid lines. Only available when 3D display has been turned on. Otherwise the button is grayed out and not available for use.

- D Button: Displays or hides the depth labels. Only available when 3D display has been turned on. Otherwise the button is grayed out and not available for use.
 - Left Arrow Button: Changes the angle of the display, moving it closer to a compressed, flat display. Only available when 3D display has been turned on. Otherwise the button is grayed out and not available for use.
 - Right Arrow Button: Changes the angle of the display, increasing the depth of the display. Only available when 3D display has been turned on. Otherwise the button is grayed out and not available for use.
 - L Button: Displays or hides the Legend on the right side.
- Zooming: The Waterfall window does not support zooming.
- A Pair of Crosshairs: The Waterfall window has channel data tracking features. To track the data of a channel, click and hold down the left mouse button over the channel of interest from the legend located on the right side of the Waterfall window. Then drag the cursor over the plotting area, and the corresponding data values will be located at the bottom left corner of the Waterfall window.

Digital Volt Meter Window

Use the Digital Volt Meter Window to display instantaneous values for data acquired and processed by the DAP board. For example, display the current temperature of a furnace or the current pressure in a control line.

The Digital Volt Meter window has these features.

- Any number of Digital Volt Meter windows is allowed. To add a new Digital Volt Meter window, select Window|New Digital Volt Meter. Or choose Window|Clone Active Window when a Digital Volt Meter Window is active.
- In addition to the common menu items described before, the following main menu items are available when the Digital Volt Meter window is active.
 - Channels...: Sets up the data source of a Digital Volt Meter window. Only data from the selected channel pipes are displayed. Selecting this menu item brings up a Channels Selection for DVM dialog as described below.
 - ◆ Button Grid: Displays the list of channel pipes. A channel pipe is selected when the button is down and deselected when the button is up.
 - ◆ OK Button: Saves all changes and closes the Channels Selection for DVM dialog box.
 - ◆ Cancel Button: Discards all changes and closes the Channels Selection for DVM dialog box.
 - ◆ Text Box: Displays the channel pipes selected from the Button grid. It is for display only and is not editable.
 - DVM Options: Sets up how the Digital Volt Meter window displays data.
 - ◆ Enabled: Enables or disables the Digital Volt Meter window. A check mark beside Enabled signifies that the Digital Volt Meter window is enabled. If the Digital Volt Meter window is enabled and DAPstudio is started, the Digital Volt Meter

window displays data from the channels selected from Channels.... If the Digital Volt Meter window is disabled and DAPstudio is started, no data are shown.

- ◆ **Caption...:** Allows a custom name for the Digital Volt Meter window.
- ◆ **Display...:** Selects options for the Digital Volt Meter window. The DVM Display options are also accessible by double-clicking on the Digital Volt Meter window. There are two tabs of options: Titles/Colors and General.
 - ◇ **OK Button:** Saves all changes and closes the DVM Display dialog box.
 - ◇ **Cancel Button:** Discards all changes, unless already applied, and closes the DVM Display dialog box.
 - ◇ **Apply Button:** Saves and applies all changes without closing the DVM Display dialog box.
 - ◇ **Title/Colors Tab:** Configures the titles and colors for the display.
 - **Number of Columns Edit Box:** Configures the number of columns of Digital Volt Meters displayed in the window.
 - **Colors Group Box:** Selects titles and colors for the main display. The following titles are available for edit.
 - **Channels Combo Box:** Selects the channel whose display is to be configured.
 - **Title Edit Box:** Configures the title for the selected channel's Digital Volt Meter. The default is Channels.
 - **All Titles Button:** Configures all active Digital Volt Meters with the selected channel's title.

- **Units Edit Box:** Configures the unit description for the selected channel's Digital Volt Meter. The default is Counts.
- **All Units Button:** Configures all active Digital Volt Meters with the selected channel's unit description.
- **Background Color Selection Box:** Opens a color selection window, by clicking the box, for the individual DVM's background color.
- **All Backgrounds Button:** Configures all active Digital Volt Meters with the selected channel's background color.
- **Border Color Selection Box:** Opens a color selection window, by clicking the box, for the border color around an individual DVM.
- **All Borders Button:** Configures all active Digital Volt Meters with the selected channel's border color.

◇ **General Tab**

- **Caption Text Box:** Allows a custom name for the Digital Volt Meter window.

Variable/Constant Display

The Variable/Constant display allows you to send and read variable and constant information from the DAP board, even during run-time. The Variable/Constant display only supports variables and constants created automatically, not those created manually. The display is only accessible through the [Custom Design](#) window.

The Variable/Constant display has different options, depending on whether the Design Mode is On or Off. When the Design Mode is On, the following features are shown in the display.

- **Select DAP (DAPx) Button:** Selects the DAP where the variable or constant information will be sent to or updated from. Click the button to display a drop-down list of the available DAP boards in the application. Select the DAP from the list.
- **Item Drop-Down Box:** Shows all automatically declared variables and constants on the selected DAP board. Use the Item drop-down boxes to select the variable or constant to want to display on the screen. Only displayed variables and constants may be manipulated.
- **Variable/Constant Edit Box:** Sets the value for the selected variable or constant. Also updates the value from the DAP if the Read value checkbox is checked in the Variable/Constant dialog box.
- **Scroll bar:** Scroll to change the value in the Variable/Constant edit box. Configure the options for the Scroll bar through the Variable/Constant dialog box.
- **Control bar:** For information on the Control bar options, see the [Custom Design](#) window section.

To access the Variable/Constant dialog box, either double-click on the display or click the Config button and select the Display... option. A Variable/Constant Display dialog box appears with two tabs.

- **Configuration Tab**
 - **Variable/Constant Group Box**
 - ◆ **Number of Items Edit Box:** Sets the number of variables and constants available for configuration in the display. If the Number

of Items is changed, press the Apply button before selecting the Scroll Bar Range tab. If the Apply button is not pressed, the number of items in the Scroll Bar Range tab will be incorrect.

- ◆ Number of Columns Edit Box: Sets the number of columns used to display the variables and constants.
- Read Interval Group Box
 - ◆ Read Value Checkbox: Determines if the variable or constant value should be read from the DAP and updated continuously while running.
 - ◆ Read Interval (ms) Edit Box: Determines the read interval for reading from the DAP and updating continuously, if the Read Value checkbox is checked.
- Send to DAP Options Group Box
 - ◆ Update declarations (variables and constants) Checkbox: Determines if the automatic variable/constant declaration in the Configuration window | Processing | Declarations | Automatic tab is updated when the Variable/Constant edit box values are sent to the DAP using the Send to DAPx Button.
 - ◆ Send variables after startup Checkbox: Determines if the variable values are sent to the selected DAP immediately after the DAP starts running. Constant values are never sent to the DAP while the DAP is running.
 - ◆ Always send variables (even if unchanged) Checkbox: Determines if the variable are always sent to the DAP board when the Send to DAPx button is pressed, whether or not they have been changed from the Configuration window.
- Scroll Bar Range Tab: This tab controls the appearance and behavior of the scroll bar for each item in the Variables display.
 - Name Drop-Down Box: The number of items available were determined in the Number of Items edit box on the Configuration tab. If the Apply button was not pressed after a change was made to the Number

of Items, the number of items in the Scroll Bar Range tab will be incorrect. Select a number to configure the scroll bar for that item.

- Minimum Edit Box: Sets the minimum range for the scroll bar for the selected item.
- Maximum Edit Box: Sets the maximum range for the scroll bar for the selected item.
- Small Increment Edit Box: Sets the increment change when scrolling left or right using the arrow buttons on the scroll bar.
- Large Increment Edit Box: : Sets the increment change when scrolling left or right by clicking on the scroll bar itself.

When the Variable/Constant display Design Mode is Off, the following changes are shown in the display.

- Send to DAPx Button: Click the button to send the configured variables and constant values to the DAP board. If the Update declarations (variables and constants) checkbox in the Variable/Constant dialog box is checked, then the automatic variable/constant declaration in the Configuration window | Processing | Declarations tab will be updated when this button is pressed.
- Cancel Button: Click the button to cancel any changes made to the variable and constant values and reset them to the last value sent to the DAP board.
- The Control Bar alignment items are not available, but the display options are available by double-clicking on the display.

Custom Design Window

The Custom Design window displays graphical representations of data acquired and processed by the DAP board. Use the Custom Design window to show multiple displays – such as Graphs, Tables, Alarms, Digital Volt Meters – in a single window. Select any number or combination of display options. View data in different ways, simultaneously, and make adjustments to variables, while your application is running.

The Custom Design window has these features.

- Any number of Custom Design windows is allowed. To add a new Custom Design window, select Window|New Custom Design.
- In addition to the common menu items described before, the Custom Design Options main menu item is available when the Custom Design window is active. The Custom Design Options main menu item includes the following items.
 - Add Graph: Adds a Graph display within the Custom Design window. For more information on using a Graph display, see the [Graph window](#) section.
 - Add Table: Adds a Table display within the Custom Design window. For more information on using a Table display, see the [Table window](#) section.
 - Add Alarm: Adds an Alarm display within the Custom Design window. For more information on using an Alarm display, see the [Alarm window](#) section.
 - Add Bar: Adds a Bar display within the Custom Design window. For more information on using a Bar display, see the [Bar window](#) section.
 - Add Waterfall: Adds a Waterfall display within the Custom Design window. For more information on using a Waterfall display, see the [Waterfall window](#) section.
 - Add Digital Volt Meter: Adds a Digital Volt Meter display within the Custom Design window. For more information on using a Digital Volt Meter display, see the [Digital Volt Meter window](#) section.

- Add Variable/Constant: Adds a Variable/Constant display within the Custom Design window. For more information on using a Variable/Constant display, see the [Variable/Constant display section](#).
- Caption...: Allows a custom name for the Custom Design window.
- Design Mode: This menu item has two options. You may turn the Design Mode On or Off for all displays in the Custom Design window. When Design Mode is On, you can design and configure the displays. This includes alignment (left, top, right, etc), configuration dialogs, etc. Turn design mode off – to go to run mode – after every display is designed and placed as planned, just before running the application
 - ◆ On: When On, the Custom Design window is in design mode.
 - ◆ Off: When Off, the Custom Design window is in run mode.

Each display that is added to the Custom Design has certain options to control how it appears. At the top of each display is a control bar. For each of the alignment buttons (T, B, <, >, C) when the button is selected, the display will continue to be aligned as selected and fill that space. When the alignment button is not selected, the alignment option is removed and the display may be moved or realigned.

The control bar includes the following Custom Design options.

- T Button: Aligns the display with the top of the Custom Design window, or a display already aligned with the top, and expands the display to fill the width of the window.
- B Button: Aligns the display with the bottom of the Custom Design window, or a display already aligned with the bottom, and expands the display to fill the width of the window.
- Left Arrow Button: Aligns the display with the left side of the Custom Design window, or a display already aligned with the left side, and expands the display to fill the height of the window.
- Right Arrow Button: Aligns the display with the right side of the Custom Design window, or a display already aligned with the right side, and expands the display to fill the height of the window.

- **C Button:** Aligns the display with the other set displays, to take up any remaining space.
- **Config Button:** Provides options for the selected display
 - **Channels...:** Sets up the data source of the selected display. Only data from selected channels are displayed. Selecting this menu item brings up a Channels Selection for the selected display. This option is not available for the Variables display.
 - ◆ **Button Grid:** Displays the list of channel pipes. A channel pipe is selected when the button is down and deselected when the button is up.
 - ◆ **OK Button:** Saves all changes and closes the Channels Selection for CustomDesign Window dialog box.
 - ◆ **Cancel Button:** Discards all changes and closes the Channels Selection for CustomDesign Window dialog box.
 - ◆ **Text Box:** Displays the channel pipes selected from the Button grid. It is for display only and is not editable.
 - **Display...:** Select this option, or double-click on the display, to configure specific options for the selected display. For more information on using the Display Options, see the relevant sections for each display type: [Graph](#), [Table](#), [Alarm](#), [Bar](#), [Waterfall](#), [Digital Volt Meter](#), or [Variable/Constant](#).
 - **Connect To:** Selects the source of the data shown in the display. The default option is Data Acquisition. If a Data File has been opened, you may choose the Data File as the source of the graphed data.
 - **Clone...:** Creates additional displays exactly duplicating the selected display. All attributes, except the name but including any custom display options like titles, colors, and axes, are copied. When selected, a text box appears with the option to create as few as one or as many as twenty clones.
 - **Design Mode:** Removing the check mark turns Design Mode Off for the selected display.

- Design Mode Caption...: Allows a custom name for the display title text, but only during Design Mode. If Design Mode is off, there is no control bar or display title.
- Order: This option controls the layering of the displays. There are two options: Send to Back and Bring to Front.
- Enabled: If checked, the display is enabled. If not checked, the display is not enabled and will not show data when the application is run.
- Design Mode Title Text: Displays the title of the embedded display. Note that the display title is only available in design mode.
- Design Mode Control Bar: Placing your mouse over the blue bar at the top of each display shows a four-way arrow and allows you to control the placement of the display.
- D Button: Turns Display Mode Off for only the selected display.
- X Button: Closes the selected display.

Disk Log Window

The Disk Log window logs data acquired from the DAP board to a disk file in binary or text format and displays the logging information, such as samples logged, the output file name, and input sources. Once a file has been selected, data logging to the file begins as soon as the application is started with the Start! menu item and stops when Stop! is selected. To disable disk logging, select Disk Log Options|Close File.

The window includes the following items.

- Output File Edit Box: Shows the name of the opened file.
- ... Button: Opens a new or stored file for logging data to disk as done in the Open File menu item.
- Open Button: Opens a file after the name has been typed in the File Name edit box. If the File Name edit box is blank, the button is grayed out and not available for use.
- Data Logged: Samples/channel Text: Shows the samples per channel logged to the selected file and is not editable.
- Data Logged: Total Bytes Text: Shows the total number of bytes logged to the selected file and is not editable.
- Format: Selects the format, Binary or Text, for logging data to disk as done in the Format menu item.
- Logging Options: Selects how new data is logged to the file.
 - Overwrite Confirm: Overwrites data already in the existing file, but asks you to confirm that data will be deleted, before it acts.
 - Overwrite: Overwrites any data already in the existing file.
 - Append: Adds the data to the end of the existing file.
- Input Sources Text: Shows the input channels logging to the selected file and is not editable.

The Disk Log window has these features:

- Any number of Disk Log windows is allowed. To add a new Disk Log window, select Window|New Disk Log.
- In addition to the common menu items described before, the following main menu items are available when the Disk Log window is active.
 - Channels...: Sets up the data source of a Disk Log window. Only data from the selected channel pipes are displayed. Selecting this menu item brings up a Channels Selection for DiskLog dialog as described below. For the Disk Log window, the selected channels must come from a single data source – a single output communication pipe – of the same DAP or iDSC board. For example, if there are data sources DAP0:\$BinOut and DAP1:Cp2Out, the Disk Log window can only log from either DAP0:\$BinOut or DAP1:Cp2Out, but not both.
 - ◆ Button Grid: Displays the list of channel pipes. A channel pipe is selected when the button is down and deselected when the button is up. The selected channels must come from a single data source – a single communication pipe – of the same DAP or iDSC board.
 - ◆ OK Button: Saves all changes and closes the Channels Selection for DiskLog dialog box.
 - ◆ Cancel Button: Discards all changes and closes the Channels Selection for DiskLog dialog box.
 - ◆ Text Box: Displays the channel pipes selected from the Button grid. It is for display only and is not editable.
 - Disk Log Options: Sets up how the DiskLog window logs data. When DAPstudio is started and acquiring data, this menu item is grayed out and not available for use.
 - ◆ Open File: Opens a new file for logging data to disk. When a file is opened, the filename is displayed under the Output File label. You can also choose to open a new file using the ‘...’ button in the Disk Log window screen. Selecting either the .bin or .txt extension from the Files of Type list automatically marks the Disk Log Options|Format as Binary or Text. You can also choose the file format in the Disk Log window screen.
 - ◆ Close File: Closes the opened data file. To view the data file in an editor or environment other than DAPstudio, it is important to

first close the data file in DAPstudio before switching to the other environment.

- ◆ **Base Path and Name:** Opens a dialog box for a base path and name for the file's location. This base path applies to all disk log windows in an application where the file name is specified using a relative path. By setting a base path, you can change where all files in your application are logged by changing a single parameter.

For example, if your root path were `c:\data\log1\` and you had two disk log windows, one with file name `d0.bin` and another with file name `d1.bin`, then when you start logging, the files you create would be `c:\data\log1\d0.bin` and `c:\data\log1\d1.bin`. By changing the root path from `c:\data\log1\` to `c:\data\log2\` you would move both your output files. The new files you create on your next run after changing the Base Path and Name to `c:\data\log2\` would be `c:\data\log2\d0.bin` and `c:\data\log2\d1.bin`.

In this example, we have shown a root path only, by the final path separator (`\`). However, you also can have a root file name. For example, a root name of `c:\data\log1\Run1`, with the same configuration described above for the log files, would give you files called `c:\data\log1\Run1d0.bin` and `c:\data\log1\Run1d1.bin`.

Server Disk Log Window

The Server Disk Log window enables and sets up server disk logging. It also displays the logging information when the server is logging data to a disk log file in the background. To use server disk logging you must use DAPcell Local Server or DAPcell Server, available in the optional DAPtools Standard and DAPtools Professional packages, respectively. DAPcell Local Server supports server disk logging on the local machine. DAPcell Server supports server disk logging both on the local machine and on any number of remote machines.

Enable server disk logging by opening a new Server Disk Log window using the menu item Window|New Server Disk Log and clicking the Enabled checkbox for one of the available data sources (output communication pipes). If enabled, this window will update the Total Bytes Logged when DAPstudio is acquiring data. Only one Server Disk Log window is available in a DAPstudio system as it covers all available data sources in the system.

The server logs acquired data from the DAP board to a disk file. Server disk logging occurs in the background without any PC interruption. DAPstudio can only perform server disk logging when appropriate permission and a valid default path are set through the Data Acquisition Processor Control Panel application. To update the permissions, go to Control Panel|Data Acquisition Processor, select the Disk I/O tab and under the Server Disk I/O Options group box, select a Disk Logging|Default Path and Disk Logging|Permission. Note that with server disk logging, you cannot choose which channels to log within a data source (output communication pipe). All channels in the Processing|Send To PC tab for a particular communication pipe are logged.

The Server Disk Log window has these features.

- One Server Disk Log window is allowed.
- In addition to the common menu items described before, the following main menu items are available when the Server Disk Log window is active.
 - Server Disk Log Options: Sets up how the Server Disk Log window displays data.

- ◆ **Caption...:** Allows a custom name for the Server Disk Log window.
- ◆ **All Configurations Same as First:** Copies the configuration of the first shown data source to any other shown data sources.
- **Output File Edit Box:** Selects an output file name for the server to log data to. When using server side disk logging, this file name is relative to the drives of the server machine, not to the local machine where you are running DAPstudio. Typically, you would set up a root logging path on the server, and in this dialog you just would enter a file name with no path or you would enter just a relative path. You can enter an absolute path, but remember that the absolute path is relative to the server machine.

For example, suppose you have two PCs in a system, PC1 and PC2. DAPcell Server runs on PC1 and has a DAP board installed in it. PC2 is a portable PC with no DAP board installed and you run DAPstudio on PC2. PC1 is connected to PC2 through a network. You intend to use server side disk logging at PC1 for maximum performance and to avoid network loading. You control your application from PC2. If you enter `c:\data\d1.bin` as the file name for server side disk logging in this configuration, that does not designate `c:\data\d1.bin` on your PC2 where you are running DAPstudio. It designates `c:\data\d1.bin` on PC1 where DAPcell Server runs and where you have the DAP board installed.

When you use DAPcell Server to log locally on a single PC, both server side and client side paths designate your local machine. So, in a single PC configuration you need not worry about server side vs. client side logging paths.

- **... Button:** Opens a new file for logging data to disk. When a file is opened, the filename is displayed in the `Output File` edit box. When DAPstudio is started and acquiring data, this menu item is grayed out and not available for use.
- **Enabled Checkbox:** Enables or disables server disk logging. A check mark beside `Enabled` signifies that server disk logging is enabled.
- **Configure Button:** Opens Server Disk Log dialog box for the given channel and data file.

- **Flags Group Box:** Selects various logging options. A check mark beside any of the following options signifies that option is enabled. Allows selecting more than one property.
 - ◆ **Server side Checkbox:** Logging is to take place on the same side of the network connection as the DAP board. If not specified, logging will take place on the application (client) side of the network connection.
 - ◆ **Flush before Checkbox:** Flushes the input data pipe before beginning the logging session. If not checked, the pipe is not flushed before logging.
 - ◆ **Flush after Checkbox:** Flushes the input pipe after the logging session has terminated. Default action is to NOT flush the pipes after logging. To ensure proper operation, an application should issue a STOP command to the DAP board before closing the disk logging session or the input pipe may fill up, causing flushing to fail.
 - ◆ **Mirror Log Checkbox:** Enables mirror logging. Mirror logging creates a copy of the logged data in another file. Requires configuration of a mirror logging path on the DAPcell Server.
 - ◆ **Append data Checkbox:** Allows new data to be appended to an existing file. This option will only be used when Open always or Open existing is chosen in the Open flags group box.
 - ◆ **Block transfer Checkbox:** Instructs DAPstudio to open the file with no intermediate buffering or caching and to access the file in a special way that is highly dependent on the target disk attributes to improve performance. This transfer mode, however, adds overhead to slow rate transfer with small buffers. It should only be used when necessary and with a very large Block Size value (such as 1048576 and above).
- **File share Group Box:** Selects the file share properties of the disk log file. Only one property is allowed. Use these settings to allow a program separate from DAPstudio to access the logged data at the same time DAPcell is logging the data to disk.
 - ◆ **None Radio Button:** Does not allow other processes to access the disk log file.

- ◆ Read Radio Button: Allows other processes to read from the disk log file.
- ◆ Write Radio Button: Allows other processes to write to the disk log file.
- ◆ Read/Write Radio Button: Allows other processes to read from and write to the disk log file.
- Open flags Group Box: Sets up how to handle file opening. Only one property is allowed.
 - ◆ Create new Radio Button: Creates a new file. Creation fails if the file already exists.
 - ◆ Create always Radio Button: Creates a new file. If the file already exists, it is overwritten.
 - ◆ Open always Radio Button: Opens an existing file. If the file does not exist, it will be created.
 - ◆ Open existing Radio Button: Opens an existing file without resetting permissions. Opening fails if the file does not exist.
- File flags attribute Group Box: Selects additional file attributes. A check mark beside any of the following options signifies that option is enabled. Allows selecting more than one property.
 - ◆ Attribute normal Checkbox: No special attributes.
 - ◆ Attribute encrypted Checkbox: The data in the file is encrypted.
 - ◆ Flag write through Checkbox: Writes through any intermediate caching and goes directly to disk.
 - ◆ Flag sequential scan Checkbox: Optimizes the transfer by using large blocks of data. Most applications will not need this flag.
- Max Count Edit Box: Selects the maximum number of bytes to log. The default zero causes logging to continue indefinitely until DAPstudio is stopped or closed.

- **Block Size Edit Box:** Selects the minimum number of bytes to write to the disk log file at one time. It is provided for disk transfer optimization. Default is 8192 bytes.
- **OK Button:** Saves all changes and closes the Server Disk Log dialog box.
- **Cancel Button:** Discards all changes and closes the Server Disk Log dialog box.

Data File Window

You may want to open one or more existing data files to display the data or to send the data to your DAP board. To open a data file, use the `Windows|Open Data File...` Menu Item. This menu item opens an interface to choose a binary data file. If the binary data file was logged using DAPstudio, a file with extension `.dsd` was automatically created. This `.dsd` file is a configuration file for the binary data file that stores the number of channels, display rate, channel names, and channel types. If the binary data file was logged using another program, a `.dsd` file is not available, but can be made using the `Save` button. Before saving a new `.dsd` file, update the number of channels, display rate, channel names, and channel types.

For a binary data file with an existing `.dsd` file, you can still change the number of channels, display rate, channel names, and channel types by selecting the `Change` button followed by the `Save` button. Note that once you select the `Save` button, the `.dsd` file is overwritten. There is a note above the channel name that states if the `.dsd` file is found or not.

Once you open a binary data file, the following items are updated if a `.dsd` file is found. If a `.dsd` file does not exist, update the number of channels, display rate, channel names, and channel types and choose `Save`.

You may use one `Data File` window to open multiple data files. A separate tab for each file will be added to the `Data File` window.

- `+ Add Button`: Opens an interface to find and select additional data files. When a file has been selected, a new labeled tab is added to the window. If no file is found, a default tab is created with a `No File` label.
- `- Delete Button`: Deletes the selected data file.

Each data file tab has the following features.

- `File Name Edit Box`: Shows the name and location of the binary data file opened for viewing. Or you can type in a file name and then hit the `Enter` key or the `Open` button.
- `...` `Button`: Opens an existing binary data file from disk for viewing. When a file is opened, the filename is displayed in the `File Name` edit box.

- **Open Button:** Opens a file after the name has been typed in the File Name edit box. If the File Name edit box is blank, the button is grayed out and not available for use.
- **Channels Edit Box:** Displays the number of channels of data stored in the binary data file. This number comes from the .dsd file. If the .dsd file does not exist, it defaults to 16. You can save a new .dsd file by selecting the Save button.
- **Display Rate Edit Box:** Displays the logged data rate in samples per second per channel. This option is only effective if you connect to a Graph display and select Seconds or Milliseconds for the Bottom Axis.
- **Channel Count Text Box:** Displays the number of logged samples per channel. This box is not available to edit.
- **Total Bytes Text Box:** Displays the size of the binary file in bytes. This box is not available to edit.
- **Save/Change Button:** If a .dsd file exists, this button shows Change. If Change is selected, then the Channels edit box, Display Rate edit box, Channel Name edit boxes, and Channel Type radio buttons become editable. If Save is then selected, the .dsd file is overwritten with the new configuration information. If a .dsd file does not exist, this button shows Save. Once the Channels edit box, Display Rate edit box, Channel Name edit boxes, and Channel Type radio buttons are updated, a new .dsd file can be created by selecting Save.
- **Configuration File Note:** This text shows whether or not a .dsd file is found.
- **Channel Name Edit Boxes:** Displays the name of each channel logged to disk.
- **Channel Type Radio Buttons:** Displays the type (word, long, float, or double) of each channel logged to disk.
- **Scroll Bar:** Allows viewing of all channels.

Section III. Sample Applications

About the Sample Applications

Sample applications serve as a good starting point to build a new application. You easily can modify them to meet your specific requirements. Each sample application consists of the following sections:

Create the Application

This section shows step-by-step instructions on how to build the application in DAP Measurement Studio (DAPstudio).

Sample Hardware Configuration

This section provides a hardware configuration to meet the requirements of the given example. It consists of a list of hardware, step-by-step instructions on how to connect the hardware, and a 3-D line drawing illustrating the channel architecture and overall signal configuration.

The chosen hardware provides quick and secure connections of discrete wires to a DAP board and better signal quality due to the shielding. Contact Microstar Laboratories for more information about available options.

Illustration

This section captures screen shots of DAPstudio at various steps.

Download the Application

This section provides a downloadable configuration file for DAPstudio.

Summary of the Sample Applications

App01 – Getting Started

Use these applications to get an introduction to the DAPstudio interface. Learn how to sample, graph, and log data obtained from simple configurations. View the memory used and any error messages, then control the DAPstudio environment by cloning windows or locking the configuration.

App02 – Configure an Input Procedure

These applications walk you through setting up an input procedure by configuring your sample rate, channels, gain, and other requirements.

App03 – Configure an Output Procedure

These applications walk you through setting up an output procedure by configuring your update rate, waveforms, and other output options.

App04 – Write a Processing Procedure

Learn how easy it is to work with processing in DAPstudio, with its automatic declaration of necessary pipes, variables, and constants. The applications introduce the command list and the processing procedure interface, with its auto-fill and auto-increment features. [App0406](#) and [App0407](#) provide particularly useful introductions to the auto-increment features that you will use regularly in your own applications.

App05 – Using Graph Features

Learn to use – and customize – the line Graph display window. Configure windows to your own preferences and application requirements. Change background colors, titles, history length displayed, axis units, and more.

App06 – Design Filters

Learn to create – and customize – filters for your data. Create new filters, copy existing ones, and export data. Create different types of filters and change slope, taps, scaling, and more.

App07 – Design FFTs

Learn how to use the built-in DAPL FFT command and how to graph and display the FFT in the most useful way.

App08 – Create a Control Application

This application uses a previously created configuration – “PID Tuning: Simple Direct Feedback Artificial System Under Test in Step Response Display” – to demonstrate what a useful tool DAPstudio can be for creating your control application.

App09 – Configure Multiple DAP boards

These applications show how to find, identify, and configure DAP boards when multiple boards are used in a single system.

App10 – Send Data to the PC

Set up one or more communication pipes for data to be sent from your DAP board to the PC.

App11 – Server Disk Logging

Enable and use server disk logging.

App12 – Use Diagnostic Features

These applications demonstrate how to use the diagnostic features of DAPstudio – Memory Used and the DAPL Interpreter – to troubleshoot and optimize your DAPL development.

App13 – Use Table Features

Learn to use – and customize – the Table display window. Copy data from DAPstudio to another table-based application like Microsoft Excel. Configure each window to your own preferences and application requirements. Change column widths and history length displayed.

App14 – Use Alarm Features

This application introduces you to using the Alarm window by presenting a sample pass/fail application.

App15 – Use Digital Volt Meter Features

Learn to use – and customize – the Digital Volt Meter (DVM) display window. Configure windows to your own preferences and application requirements. Change background colors, titles, and more.

App16 – Use Bar Graph Features

Learn to use – and customize – the Bar graph display window. Configure windows to your own preferences and application requirements. Change background colors, bar colors, border colors, titles, history length displayed, axis units, and more.

App17 – Use Waterfall Features

Learn to use – and customize – the Waterfall line graph display window. Use this window to display tens of thousands of samples of data from a single channel. Typically you use this kind of display for blocked data – such as FFT or other spectra – to allow you to see a time-history of the data blocks rather than just a time history of points. However, you can also use this window to view massive amounts of data from a single channel of time domain data rapidly.

App18 – Send Data to the DAP Board

Send data from your PC, in one or more files, to your DAP board.

App19 – Use iDSC Features

Learn to configure an iDSC board, design filters, and display the filtered data.

App20 – Use Custom Design Features

Learn to configure a custom window to include the display options you need. Add variable and constant controls to your custom design to make adjustments as you run your application.

List of Sample Applications

Category	Name	Descriptions
App01 Getting Started	App0101	Sample and Graph One Channel
	App0102	Sample, Graph, and Log Two Channels to a Disk File
	App0103	Detect a DAP Board
	App0104	Run Your Application
	App0105	View the Memory Used
	App0106	Lock a Configuration
	App0107	View Error Messages
	App0108	Read a Logged Data File
	App0109	Use Icons in Tab Labels
	App0110	Clone a Display Window
App02 Configure an Input Procedure	App0201	Select a Sample Rate
	App0202	Sample and Graph Eight Differential Channels
	App0203	Sample 128 Channels with Input Expansion
	App0204	Select a Contiguous Range of Input Channel Pipes
	App0205	Select an Even\Odd Range of Input Channel Pipes
	App0206	Select a Rectangular Range of Input Channel Pipes
	App0207	Configure All Input Channel Pipes to Sample the Same Pin
	App0208	Configure All Input Channel Pipes to Sample an Incremented Pin
	App0209	Configure All Input Channel Pipes to Sample at the Same Gain
	App0210	Configure Input Channel Pipes to Sample Differential Inputs and Ground
App0211	Configure an Input Procedure for Simultaneous Sampling	
App03 Configure an Output Procedure	App0301	Select an Update Rate
	App0302	Produce a Sine Wave on DAC0
	App0303	Produce a Sine Wave of DAP0 and a Square Wave on DAC1
	App0304	Configure an Output Pipe to Update DAC0

App04 Write a Processing Procedure	App0401	Automatically Declare Pipes, Variables, and Constants
	App0402	Get DAPL Help
	App0403	Use the Categorized and Alphabetized Command List
	App0404	Use the FIRFILTER Command
	App0405	Use the FFT Command
	App0406	Duplicate Commands with Auto-Increment Parameters
	App0407	Process Multiple Commands with Auto-Increment Parameters
	App0408	Activate All Processing Tabs
	App0409	Use the Sequencing Tab
App05 Using Graph Features	App0501	Add a Graph
	App0502	Zoom Into a Specific Region
	App0503	Use the Crosshairs
	App0504	Display Data in FFT Blocks
	App0505	Configure Data History
	App0506	Configure Graph Axis and Titles
	App0507	Configure Graph Colors and Fonts
	App0508	Use 3D Graph Features
App06 Design Filters	App0601	Add a New Filter Design
	App0602	Delete a New Filter Design
	App0603	Copy and Paste a Filter Design
	App0604	Use the FIRFILTER Command
	App0605	Change Response Display
	App0606	Adjust Number of Taps
	App0607	Adjust Filter Phase Matching
	App0608	Change Filter Vector Type
	App0609	Filter Scaling and Zero Stripping
	App0610	Change Slope Approximation
	App0611	Change Window Vector
	App0612	Create a Bandpass Filter
	App0613	Change Cutoff Slope
	App0614	Use Crosshair to Track Actual Filter Response
	App0615	Export Filter Coefficients
App07 Design FFTs	App0701	Use the FFT Command
	App0702	Graph FFT Magnitude
	App0703	Display Data in FFT Blocks

App08 Create a Control Application	App0801	PID Tuning: Simple Direct Feedback Artificial System Under Test in Step Response Display
App09 Configure Multiple DAP Boards	App0901 App0902 App0903 App0904 App0905 App0906	Configure Two DAP Boards Select a DAP Address Browse for DAP Boards on a Network Copy and Paste a DAP Board Configuration Rename a DAP Board Use a Shortcut to Switch Between DAP Boards
App10 Send Data to the PC	App1001 App1002	Use a Single Communication Pipe Use Multiple Communication Pipes
App11 Server Disk Logging	App1101	Enable Server Disk Logging
App12 Use Diagnostic Features	App1201 App1202 App1203	Display Memory Used Open the Interpreter Window Use the Interpreter Commands
App13 Use Table Features	App1301 App1302 App1303	Copy/Paste Data from a Table to a Spreadsheet Program Configure Column Widths and Row Heights Configure the Data History
App14 Use Alarm Features	App1401	Create a Pass/Fail Application
App15 Use Digital Volt Meter Features	App1501	Configure the DVM Display
App16 Use Bar Graph Features	App1601	Configure the Bar Display

App17 Use Waterfall Features	App1701	Configure the Waterfall Display
	App1702	View FFT Data in Customized Waterfall Graphs
App18 Send Data to the DAP Board	App1801	Send a Single Data File with One Channel of Data to the DAP Board
	App1802	Send a Single Data File with Three Channels of Data to the DAP Board
	App1803	Send Multiple Data Files to the DAP Board
App19 Use iDSC Features	App1901	Configure a Filter
	App1902	Design iDSC Filters
App20 Use Custom Design Features	App2001	Configure the Custom Design Window
	App2002	Add a Variable/Constant Control
	App2003	Use Constant and Variable Controls
	App2004	Use a Variable Control

App01 Getting Started

Use these applications to get an introduction to the DAPstudio interface. Learn how to sample, graph, and log data obtained from simple configurations. View the memory used and any error messages, then control the DAPstudio environment by cloning windows or locking the configuration.

App0101 Sample and Graph One Channel

This application shows a basic input configuration. It provides access to the DAP configuration options and the resulting data. The DAP board samples one input signal and sends the digitized values directly to the host PC. The host PC then displays the data in a graph.

Create the application

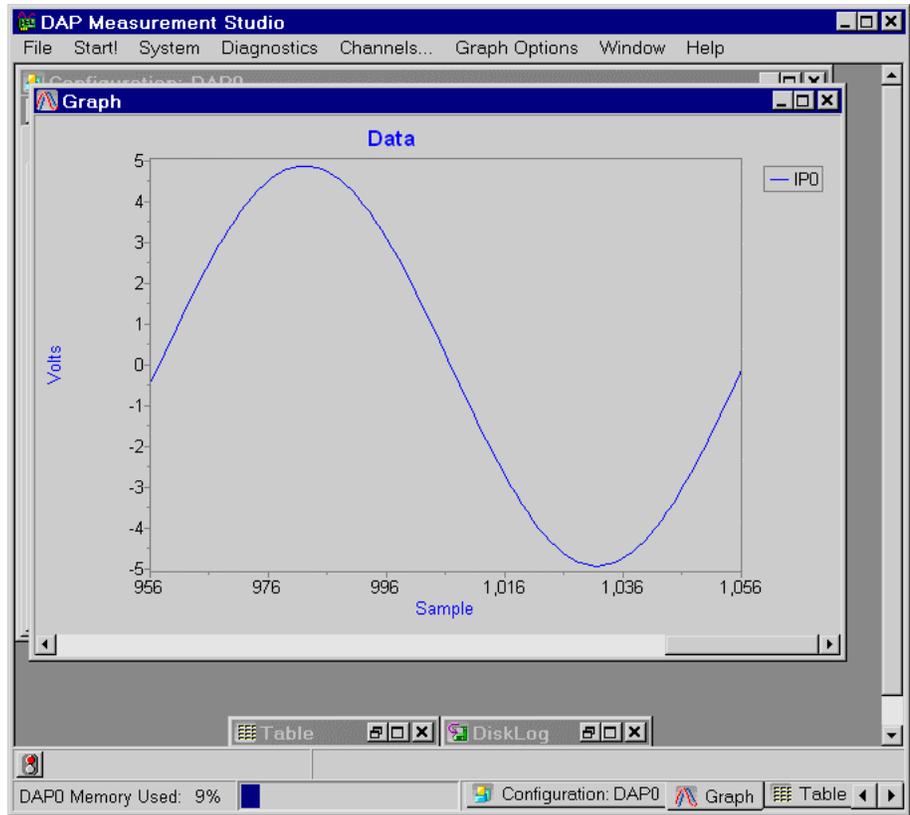
1. Select `File|New`.
2. Press the down arrow button next to the `Channels` combo box and select `1-32 -> 1` from the list. The `Channels` combo box is set to 1.
3. Open `Window|Graph`.
4. Select `Start!` or press `Alt-S` on the keyboard.

Sample Hardware Configuration

[HwCfg01 Basic Hardware Configuration](#)

Illustration

The following figure shows what DAPstudio looks like after starting acquisition.



App0102 Sample, Graph, and Log Two Channels to a Disk File

This application shows a basic input configuration with logging capability. It provides access to the DAP configuration options, the resulting data, and logging options. The DAP board samples two input signals and sends the digitized values directly to the host PC. The host PC then displays the data in a graph while logging to a disk file. Select the disk file before starting the DAP board. After stopping the DAP board, close the disk log file before accessing it through other applications. Only data from the selected channels are logged.

Create the application

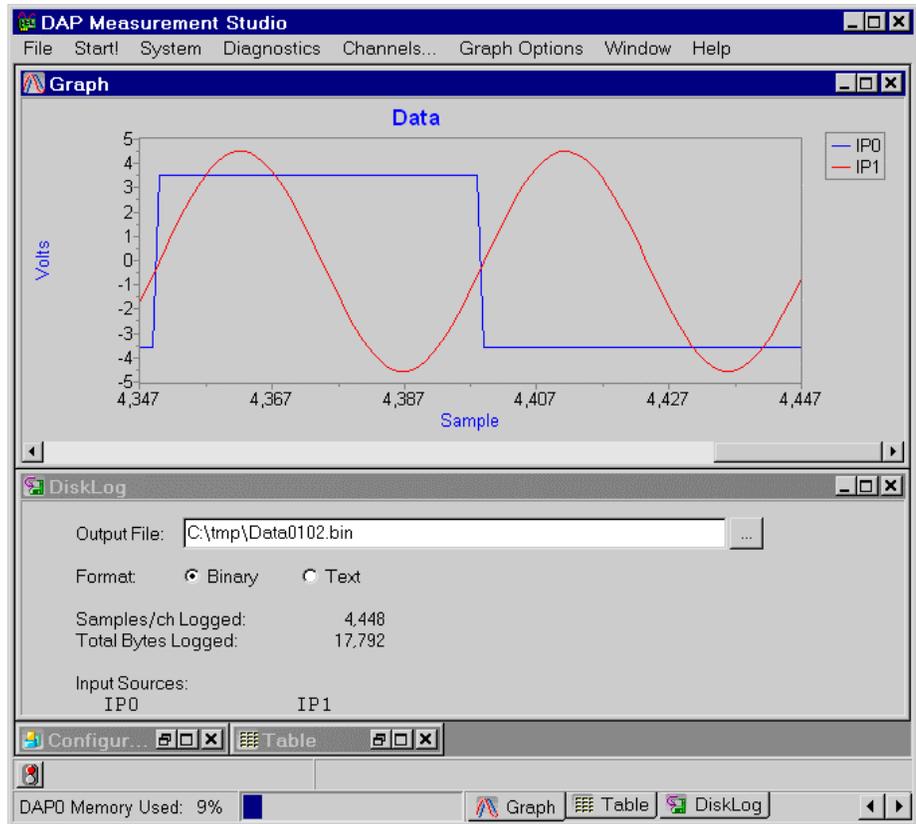
1. Select **File|New**.
2. Press the down arrow button next to the **Channels** combo box and select 1-32 -> 2 from the list. The **Channels** combo box is set to 2.
3. Open **Window|DiskLog**.
4. In the **Output File** edit box, type a file name "Data0102.bin".
5. Select the **output file** **Format as Binary or Text**.
6. Select the **output file** **Logging Options as Overwrite Confirm, Overwrite, or Append**.
7. Click the **...** button, choose the directory where the file will be saved, and click **Open**.
8. Open **Window|Graph**.
9. Select **Start!**, followed by **Stop!** when the experiment is complete.
10. Open **Window|DiskLog** and select **Disk Log Options|Close File**.
11. To read the saved data, follow [App0108](#).

Sample Hardware Configuration

[HwCfg01 Basic Hardware Configuration](#)

Illustration

The following figure shows the **Graph** and the **DiskLog** windows with two input channels.



Download the Application

Use the configuration file App0102.dms in the Apps sub-directory of the installation path to run this application in DAPstudio.

App0103 Detect a DAP Board

This application shows how to initiate communication with a DAP board. It queries the DAP board and displays the model in the title bar of the Configuration window. It provides confirmation that the DAP board is responding.

Create the application

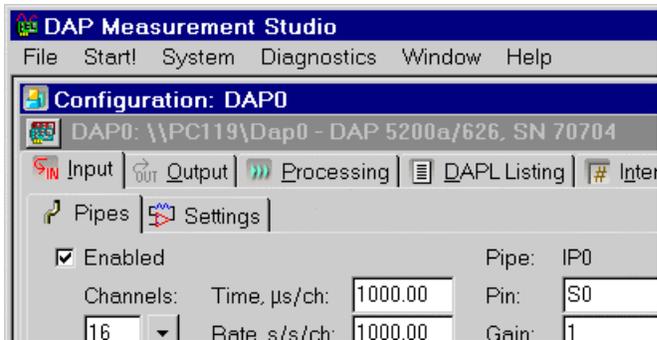
1. Select System|Board Detect and Update or press the **F5** key on the keyboard.
2. The model number of the DAP board is displayed below the title bar of the Configuration window.

Sample Hardware Configuration

[HwCfg01 Basic Hardware Configuration](#)

Illustration

The following figure displays the address and model of the DAP board below the title bar of the Configuration window.



App0104 Run Your Application

This example shows how to load a configuration from a file previously saved by DAPstudio.

Create the application

1. Select a recently opened file from the numbered items in the File menu. Or follow the following steps.
2. Select File|New.
3. Select File|Open.
4. Type a .dms file name in the File Name edit box, or choose it from the browser, then click the OK button.
5. Select Start! or press **Alt-S** on the keyboard.

Sample Hardware Configuration

[HwCfg01 Basic Hardware Configuration](#)

App0105 View the Memory Used

In the bottom border, DAPstudio can display the memory used. This information is useful in determining whether or not the DAP board can sustain a particular sample rate without overflowing.

Create the application

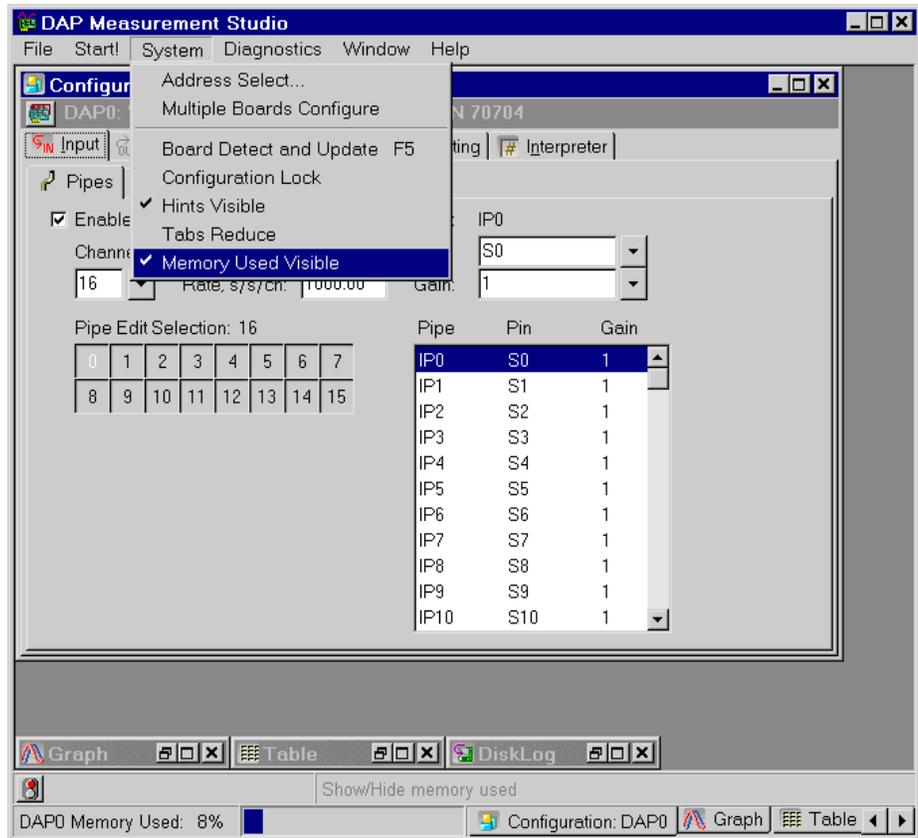
1. Select `System|Memory Used Visible` so that a check is next to it.

Sample Hardware Configuration

[HwCfg01 Basic Hardware Configuration](#)

Illustration

The following figure displays the memory usage at the bottom of DAPstudio.



App0106 Lock a Configuration

DAPstudio allows locking a configuration for a DAP board. When the configuration is locked, most controls, such as Channels, Time, and Rate edit boxes, are grayed out and not available for use. This keeps any user from accidentally changing the configuration.

Create the application

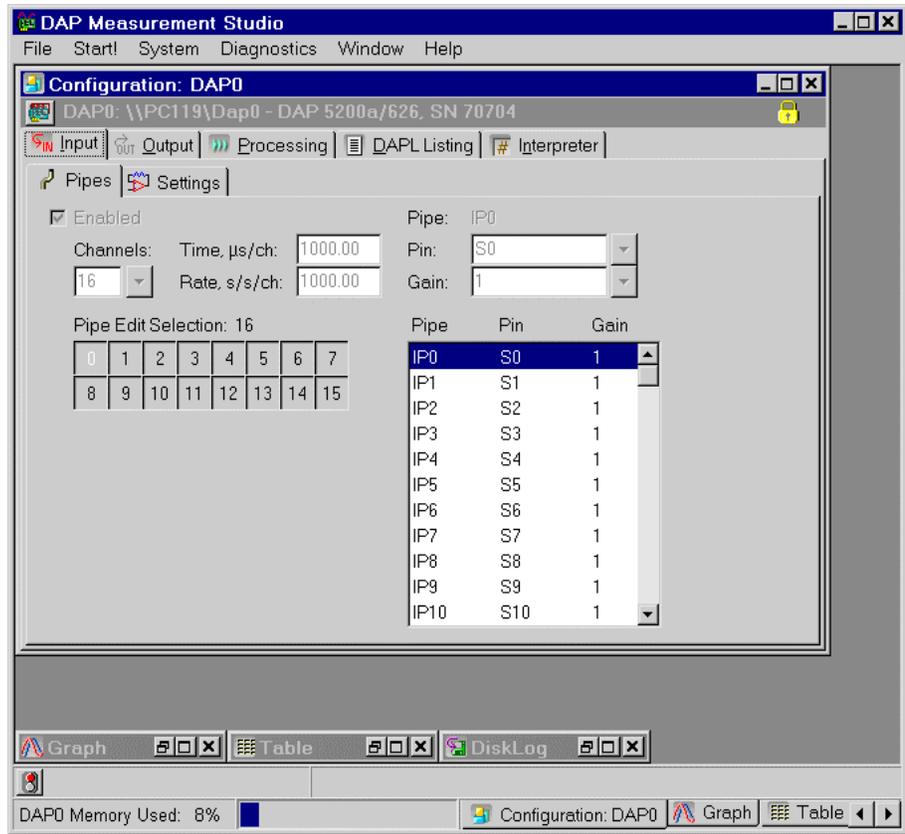
1. Select System|Configuration Lock.

Sample Hardware Configuration

[HwCfg01 Basic Hardware Configuration](#)

Illustration

The following figure shows a locked **Configuration** window. Most controls are grayed out and not available for use.



App0107 View Error Messages

The `# Interpreter` displays the error messages, if any, returned by a DAP board. This information is useful in determining whether or not the DAP board has encountered a failure. To show the error message, this application generates an incomplete DAPL command.

Create the application

1. Select `File|New`.
2. Press the down arrow button next to the `Channels` combo box and select `1-32 -> 1` from the list. The `Channels` combo box is set to `1`.
3. Select `Processing|Procedure`.
4. In the `DAPL Listing` edit box, type “A” between “`pdefine Ms1Proc`” and “`end`”. A drop-down list containing all DAPL commands starting with A will appear.
5. Press the down arrow key to select `Abs`, then press the `Enter` key. The `Abs` command is inserted in the `DAPL Listing` edit box.
6. Type “`(`” and press the down arrow key to select `IP0`, then press the `Enter` key. The `IP0` input pipe is inserted in `Abs` command.
7. Select `Start!` or press `Alt-S` on the keyboard. DAPstudio will switch to the `# Interpreter` tab with the error message shown in red.

Sample Hardware Configuration

[HwCfg01 Basic Hardware Configuration](#)

Illustration

The following figure shows the error messages in the `# Interpreter` tab.

```
Configuration: DAP0
DAP0: \\PC119\Dap0 - DAP 5200a/626, SN 70704
Input | Output | Processing | QAPL Listing | Interpreter
CLEAR ALL HIDE/SHOW
> channels 1
> set IPO s0
> time 1000.00 // 1000 us / 1 ch
>end
#
#pdefine MslProc
> Abs(IPO
*** Error 2269: bad command syntax near ''
>
> // Merge pipes to PC.
> merge(IP(0), $BinOut)
>end
#
#start
#
#
Errors:
*** Error 2269: bad command syntax near ''
```

App0108 Read a Logged Data File

This application shows how to open two logged files of data and view the data in graphs.

Create the application

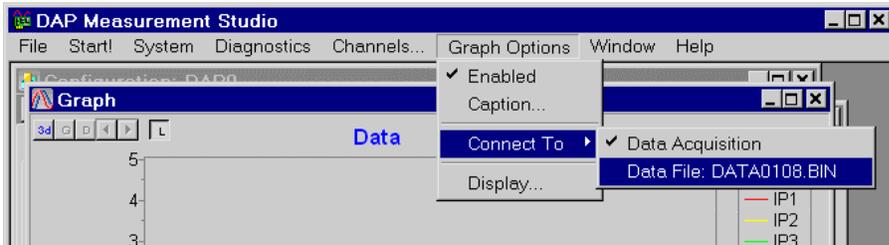
1. Select File|New.
2. Select Window|Open Data File...
3. Choose an existing data file, such as the existing example file DATA0108.BIN in the Apps sub-directory of the DAPstudio installation path, and select Open.
4. Open Window|New Graph and choose the new Data File: DATA0108.BIN option.
5. Or open Window|Graph, select Graph Options|Connect To and choose the new Data File: DATA0108.BIN option.
6. To open additional files for display, click the + Add button and choose an additional example file, such as DATA1802.BIN in the Apps sub-directory of the DAPstudio installation path, and select Open. Display by following step 4 or 5 for DATA1802.BIN using any display type window.

Sample Hardware Configuration

No hardware necessary.

Illustration

The following figure shows connecting the data to the graph, as described in step 5.



Download the Application

Use the configuration file App0108.dms in the Apps sub-directory of the installation path to run this application in DAPstudio.

App0109 Use Icons in Tab Labels

DAPstudio displays tabs with labels for each open window. The tabs appear along the bottom of DAPstudio and include the window caption and an icon. When the caption is included, it may be impossible to view all of the tabs on a single screen; scrolling may be required. You may find it more convenient to view only the icons for each window, especially if you have many windows opened.

You may drag-and-drop the tabs to put them in the order you prefer. Placing the mouse over any icon-only tab will reveal the floating caption for the window.

Create the application

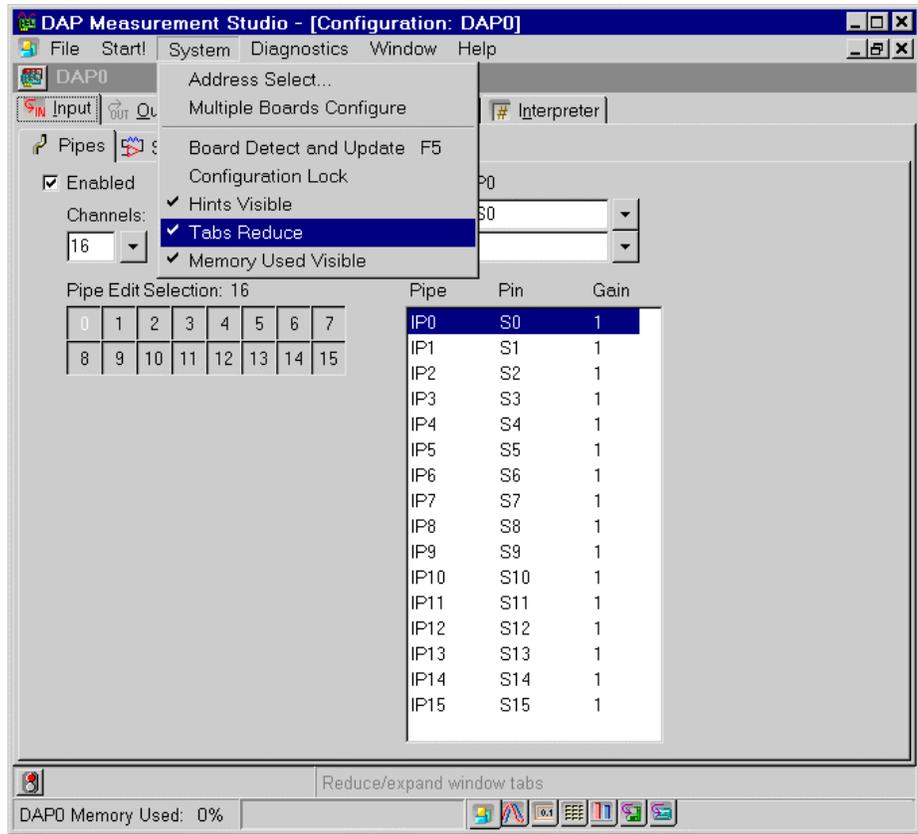
1. Select `System|Tabs Reduce`.

Sample Hardware Configuration

[HwCfg01 Basic Hardware Configuration](#)

Illustration

The following figure shows the tabs already configured to show only the icons, not the captions, for each open window.



App0110 Clone a Display Window

Cloning may be used on any of the display windows: [Graph](#), [Table](#), [Alarm](#), [Bar](#), [Waterfall](#), and [Digital Volt Meter](#). This application shows how to clone a customized Graph window.

This application shows a basic input configuration. It provides access to the DAP configuration options and the resulting data. The DAP board samples two input signals and sends the digitized values directly to the host PC. The host PC then displays the data from each channel in separate graphs.

Create the application

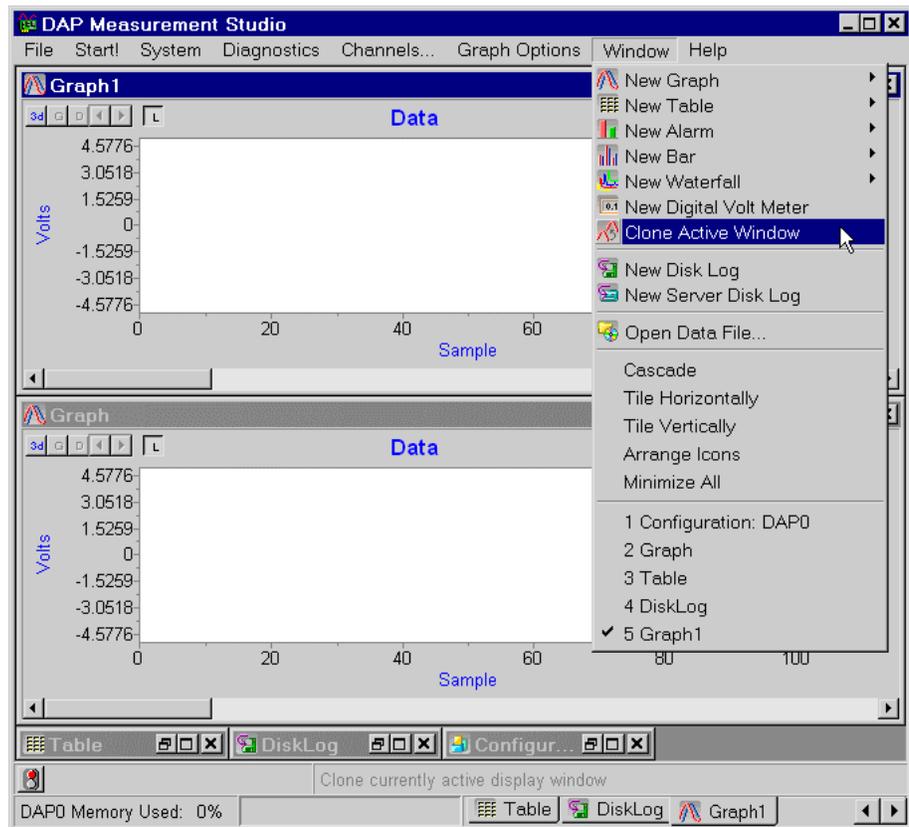
1. Select `File|New`.
2. Press the down arrow button next to the Channels combo box and select 1-32 -> 2 from the list. The Channels combo box is set to 2.
3. Select `Window|Minimize All`.
4. Open `Window|Graph`.
5. Select `Channels...` and click the IP1 button so only IP0 remains selected. Click OK.
6. Double-click the Graph window and select the Colors/Legend tab. (For more on working with Graph windows, see [App05](#).)
7. Click on the Background Color color selection box and choose white or another color. Click OK.
8. Click OK to exit the Graph Display dialog.
9. Select `Window|Clone Active Window`. A new Graph1 window is created with the exact parameters of the original Graph window: same background color, channels selected, titles, axis, etc.
10. Select `Channels...` and click the IP0 button and then the IP1 button so only IP1 remains selected.
11. Select `Window|Tile Horizontally`.
12. Select `Start!` or press `Alt-S` on the keyboard.

Sample Hardware Configuration

[HwCfg01 Basic Hardware Configuration](#)

Illustration

The following figure shows what DAPstudio looks like before starting acquisition.



App02 Configure an Input Procedure

These applications walk you through setting up an input procedure by configuring your sample rate, channels, gain, and other requirements.

App0201 Select a Sample Rate

This application shows how to select a sample rate for a DAP board. The DAP board samples two input signals and sends the digitized values directly to the host PC. The host PC then displays the data in a graph. The DAP board samples S0 and S1 at an aggregated rate of 4K samples per second. Each channel is sampling at 2K samples per second.

Create the application

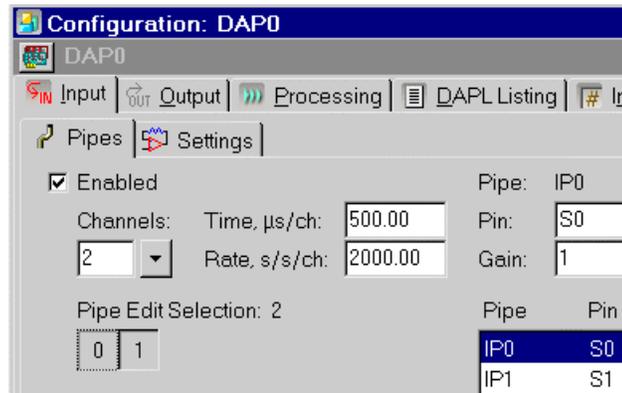
1. Select File|New.
2. Select 2 from the Channels combo box.
3. Type “2000” in the Rate, s/s/ch edit box.
4. Open Window|Graph.
5. Select Start! or press **Alt-S** on the keyboard.

Sample Hardware Configuration

[HwCfg01 Basic Hardware Configuration](#)

Illustration

The following figure shows the sample rate edit box.



App0202 Sample and Graph Eight Differential Channels

This application shows a basic input configuration for differential input signals. It provides access to the DAP configuration options and the resulting data. The DAP board samples eight differential input signals and sends the digitized values directly to the host PC. The host PC then displays the data in a graph.

Create the application

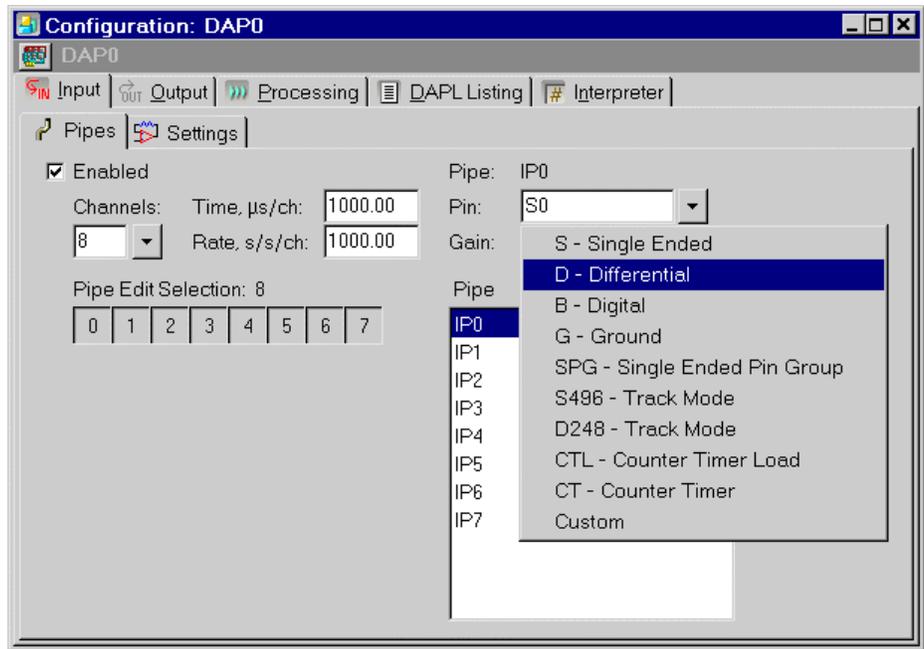
1. Select `File|New`.
2. Select 8 from the `Channels` combo box.
3. Press the down arrow button next to the `Pin` combo box and select `Differential` from the list. `D0` will be displayed in the `Pin` combo box.
4. Move the mouse cursor over the `Pipe Edit Selection` grid or the `Pipes Selected` listing, press the right mouse button to bring up a pop-up menu, and select `All Channels|Pin Increment From First`.
5. Open `Window|Graph`.
6. Select `Start!` or press `Alt-S` on the keyboard.

Sample Hardware Configuration

[HwCfg01 Basic Hardware Configuration](#)

Illustration

The following figure shows selecting a differential input.



Download the Application

Use the configuration file App0202.dms in the Apps sub-directory of the installation path to run this application in DAPstudio.

App0203 Sample 128 Channels with Input Expansion

This application utilizes the input capability. The DAP board samples 128 input signals by using Analog Input Expansion boards and sends the digitized values directly to the host PC. The host PC then displays the data in a graph. Although DAPstudio can display up to 128 traces in a single **Graph** window, for best visualization display no more than 16 channels. This sample application sends the digitized values of channels 17 to 32 to the host PC, and the host PC displays the data in a graph.

Create the application

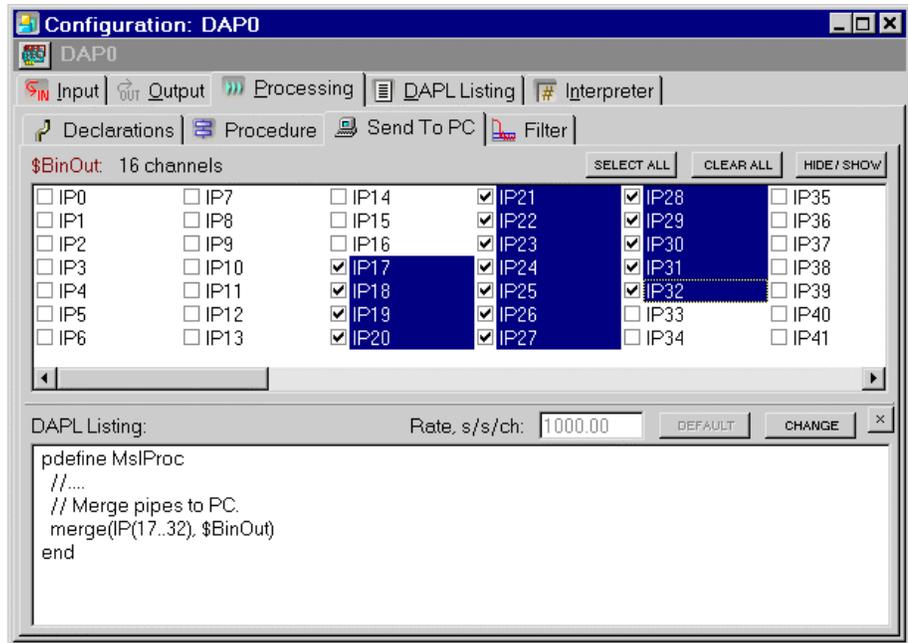
1. Select **File|New**.
2. Select **128** from the **Channels** combo box.
3. Select the **Processing|Send To PC** tab and press the **Clear All** button.
4. Highlight **IP17 to IP32** with the mouse or keyboard (**Shift + arrow keys**), then press the space bar or click any of the highlighted checkboxes. All of the checkboxes from **IP17 to IP32** are now checked.
5. Open **Window|Graph**.
6. Select **Start!** or press **Alt-S** on the keyboard.

Sample Hardware Configuration

[HwCfg02 Hardware Configuration with Analog Expansion](#)

Illustration

The following shows step 4 as described in the Create the Application section.



App0204 Select a Contiguous Range of Input Channel Pipes

DAPstudio makes working with a group of input channel pipes easy. This application shows how to select a contiguous range of input channel pipes.

By default, DAPstudio configures 16 contiguous input channel pipes to sample 16 contiguous input pins. Specifically, the input channel pipe IP0 samples from S0, IP1 samples from S1, etc. To provide interesting results, this application configures the second group of eight input channel pipes, namely IP8 through IP15, to sample input pins S0 through S7. The digitized values in all 16 channels are sent to the host PC. The host PC then displays the data in a graph.

Create the application

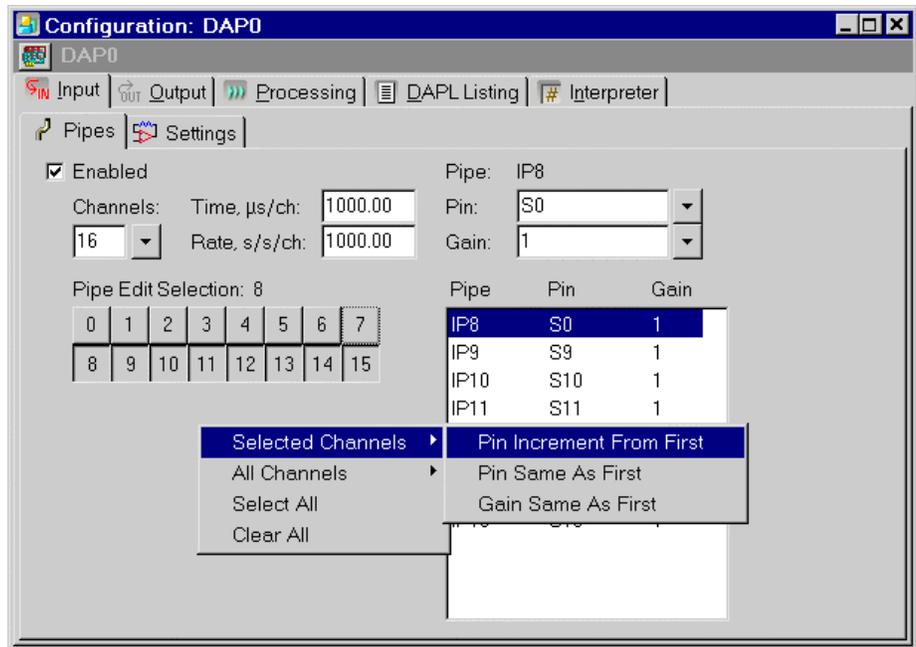
1. Select File|New.
2. Click the 0 button and drag the mouse to deselect all items through to the 7 button.
3. Type “S0” in the Pin combo box.
4. Move the mouse cursor over the Pipe Edit Selection grid or the Pipes Selected listing, press the right mouse button to bring up a pop-up menu, and select Selected Channels|Pin Increment From First.
5. Open Window|Graph.
6. Select Start! or press **Alt-S** on the keyboard.

Sample Hardware Configuration

HwCfg01 Basic Hardware Configuration

Illustration

The following shows step 4 as described in the Create the Application section.



App0205 Select an Even/Odd Range of Input Channel Pipes

DAPstudio makes working with a group of input channel pipes easy. This application shows how to select an even/odd range of input channel pipes.

By default, DAPstudio configures 16 contiguous input channel pipes to sample 16 contiguous input pins. Specifically, the input channel pipe IP_0 samples from S_0 , IP_1 samples from S_1 , etc. To provide interesting results, this application configures all even input channel pipes to sample the same input pin and all odd input channel pipes to sample the incremented input pin. Specifically, even input channel pipes IP_0 , IP_2 , IP_4 , IP_6 , IP_8 , IP_{10} , IP_{12} , and IP_{14} sample the input pin S_0 and odd input channel pipes IP_1 , IP_3 , IP_5 , IP_7 , IP_9 , IP_{11} , IP_{13} , and IP_{15} sample the input pins from S_1 to S_8 . The digitized values in all 16 channels are sent to the host PC. The host PC then displays the data in a graph.

This application demonstrates how to sample signals at different data rates. Setting a sequence of channels to a single pin reads that pin at a regular interval but faster than any of the other pins. This application samples the first input pin S_0 , eight times more than input pins S_1 to S_8 .

Create the application

1. Select `File|New`.
2. Select the `Input|Pipes` tab, move the mouse cursor to the `Pipe Edit Selection` grid, and press the right mouse button to bring up a pop-up menu. Select `Clear All`.
3. Press and hold the `Alt` key on the keyboard.
4. Click the `0` button and drag the mouse vertically to select both the `0` and `8` buttons.
5. Click the `2` button and drag the mouse vertically to select both the `2` and `10` buttons.
6. Click the `4` button and drag the mouse vertically to select both the `4` and `12` buttons.
7. Click the `6` button and drag the mouse vertically to select both the `6` and `14` buttons.
8. Release the `Alt` key.

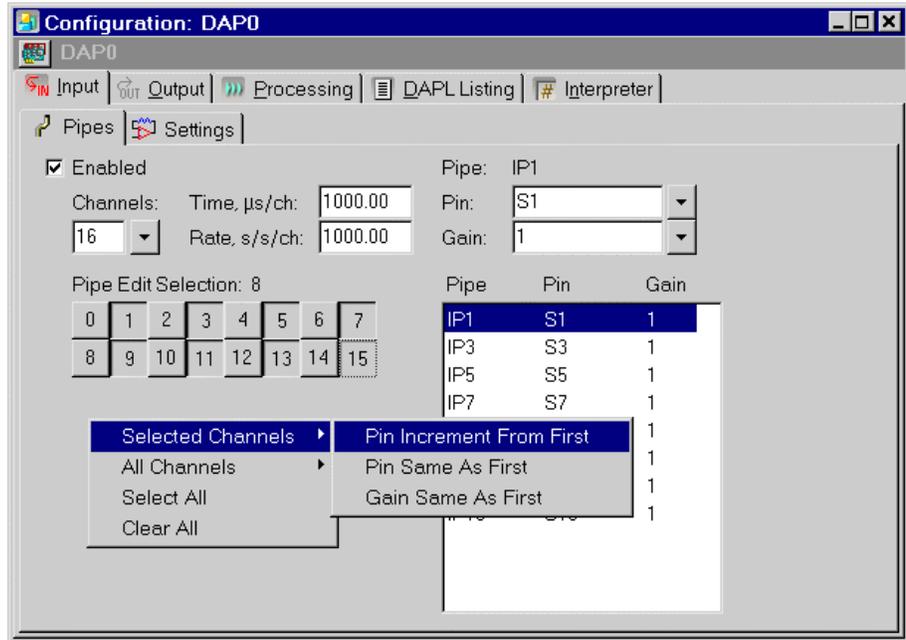
9. Move the mouse cursor over the Pipe Edit Selection grid or the Pipes Selected listing, press the right mouse button to bring up a pop-up menu, and select Selected Channels|Pin Same As First.
10. Click the 0 button and drag the mouse diagonally to select all buttons. Instead of even pipes, all buttons for odd pipes are now selected.
11. Move the mouse cursor over the Pipe Edit Selection grid or the Pipes Selected listing, press the right mouse button to bring up a pop-up menu, and select Selected Channels|Pin Incremented From First.
12. Open Window|Graph.
13. Select Start! or press **Alt-S** on the keyboard.

Sample Hardware Configuration

HwCfg01 Basic Hardware Configuration

Illustration

The following shows step 11 as described in the Create the Application section.



App0206 Select a Rectangular Range of Input Channel Pipes

DAPstudio makes working with a group of input channel pipes easy. This application shows how to select a rectangular range of input channel pipes.

By default, DAPstudio configures 16 contiguous input channel pipes to sample 16 contiguous input pins. Specifically, the input channel pipe IP0 samples from S0, IP1 samples from S1, etc. To provide interesting results, this application configures a rectangular range of input channel pipes to sample an incremented pin. That means the input channel pipes IP0, IP1, IP8, IP9 sample from the same input pin S0. The digitized values in all 16 channels are sent to the host PC. The host PC then displays the data in a graph.

Create the application

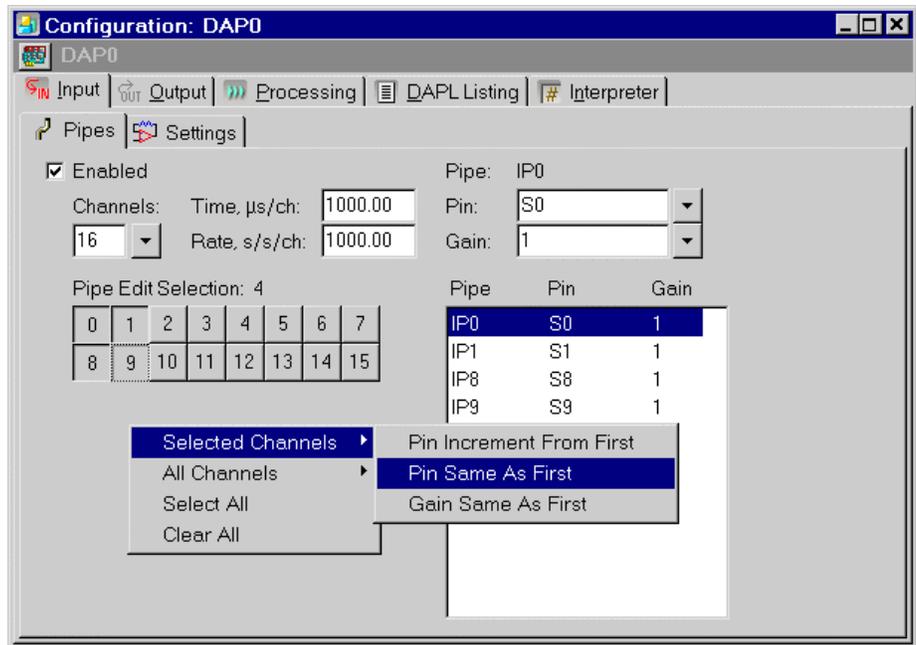
1. Select `File|New`.
2. Select the `Input|Pipes` tab, move the mouse cursor over the `Pipe Edit Selection grid` or the `Pipes Selected` listing, and press the right mouse button to bring up a pop-up menu. Select `Clear All`.
3. Press and hold the `Alt` key on the keyboard.
4. Click the `0` button and drag the mouse to select the `0, 1, 8, and 9` buttons.
5. Release the `Alt` key.
6. Move the mouse cursor over the `Pipe Edit Selection grid` or the `Pipes Selected` listing, press the right mouse button to bring up a pop-up menu, and select `Selected Channels|Pin Same As First`.
7. Open `Window|Graph`.
8. Select `Start!` or press `Alt-S` on the keyboard.

Sample Hardware Configuration

[HwCfg01 Basic Hardware Configuration](#)

Illustration

The following shows step 6 as described in the `Create the Application` section.



App0207 Configure All Input Channel Pipes to Sample the Same Pin

DAPstudio makes working with all input channel pipes easy. This application shows how to configure all input channel pipes to sample the same input pin $S0$ in one easy step.

By default, DAPstudio configures 16 contiguous input channel pipes to sample 16 contiguous input pins. Specifically, the input channel pipe $IP0$ samples from $S0$, $IP1$ samples from $S1$, etc. To provide interesting results, this application configures all 16 input channel pipes to sample input pin $S0$. The digitized values in all 16 channels are sent to the host PC. The host PC then displays the data in a graph.

Create the application

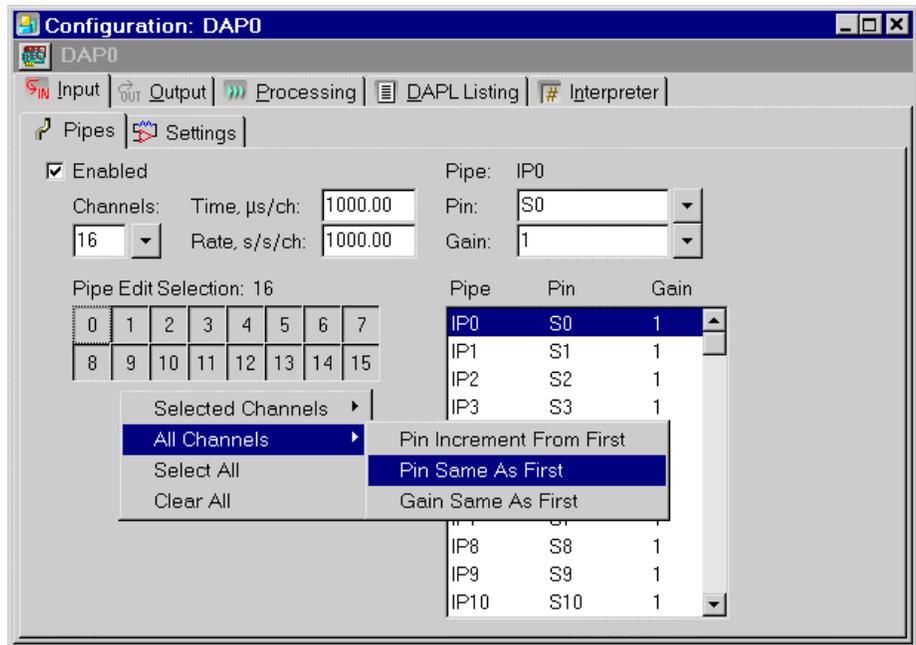
1. Select `File|New`.
2. Move the mouse cursor over the `Pipe Edit Selection` grid or the `Pipes Selected` listing, press the right mouse button to bring up a pop-up menu, and select `All Channels|Pin Same As First`.
3. Open `Window|Graph`.
4. Select `Start!` or press `Alt-S` on the keyboard.

Sample Hardware Configuration

[HwCfg01 Basic Hardware Configuration](#)

Illustration

The following shows the selection in the pop-up menu as described in step 2 in the Create the Application section.



App0208 Configure All Input Channel Pipes to Sample an Incremented Pin

DAPstudio makes working with all input channel pipes easy. This application shows how to configure all input channel pipes to sample an incremented pin in one easy step.

This application configures 16 contiguous input channel pipes to sample 16 contiguous input pins. Specifically, the input channel pipe `IP0` samples from `S0`, `IP1` samples from `S1`, etc. The digitized values in all 16 channels are sent to the host PC. The host PC then displays the data in a graph.

Create the application

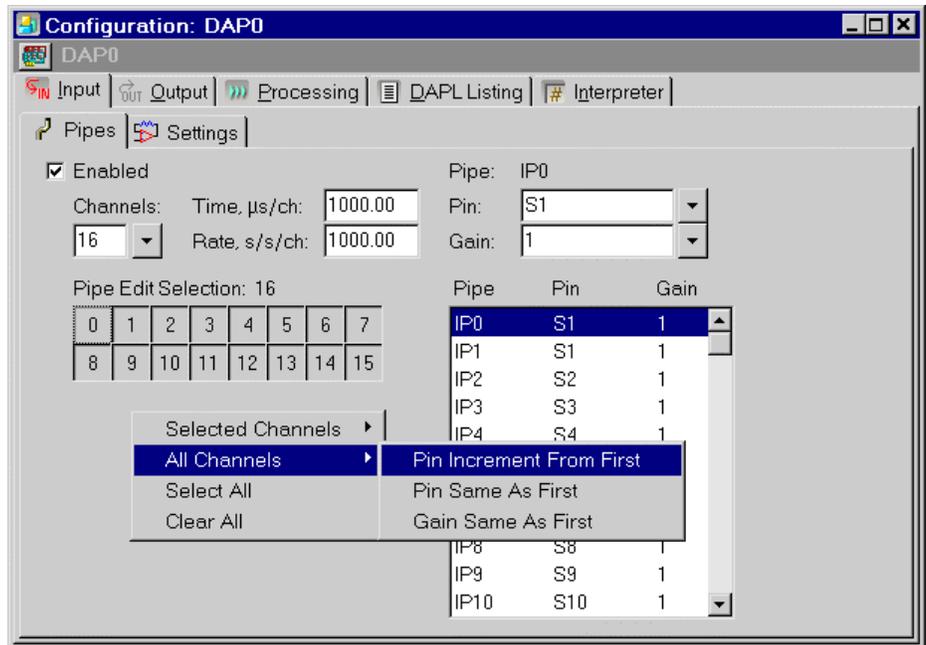
1. Select `File|New`.
2. Type `S1` in the `Pin` combo box.
3. Move the mouse cursor over the `Pipe Edit Selection` grid or the `Pipes Selected` listing, press the right mouse button to bring up a pop-up menu, and select `All Channels|Pin Increment From First`.
4. Open `Window|Graph`.
5. Select `Start!` or press `Alt-S` on the keyboard.

Sample Hardware Configuration

[HwCfg01 Basic Hardware Configuration](#)

Illustration

The following shows the selection in the pop-up menu.



App0209 Configure All Input Channel Pipes to Sample at the Same Gain

DAPstudio makes working with all input channel pipes easy. This application shows how to configure all input channel pipes to sample at the same gain in one easy step.

By default, DAPstudio configures 16 contiguous input channel pipes to sample 16 contiguous input pins at the gain of 1. Specifically, the input channel pipe IP0 samples from S0, IP1 samples from S1, etc. To provide interesting results, this application configures all 16 input channel pipes to sample at the same gain of 10. The digitized values in all 16 channels are sent to the host PC. The host PC then displays the data in a graph.

Create the application

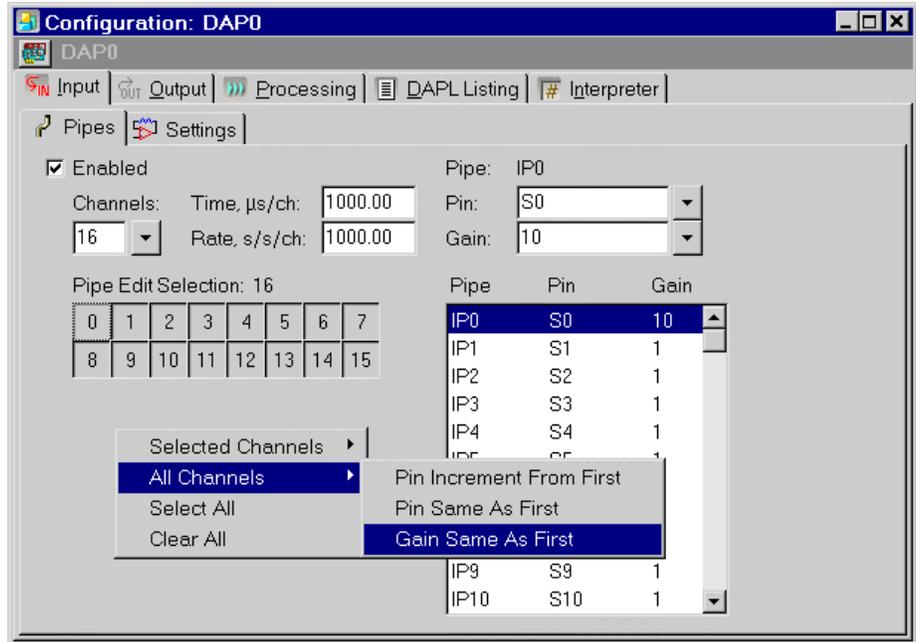
1. Select `File|New`.
2. Select 10 in the `Gain` combo box.
3. Move the mouse cursor over the `Pipe Edit Selection` grid or the `Pipes Selected` listing, press the right mouse button to bring up a pop-up menu, and select `All Channels|Gain Same As First`.
4. Open `Window|Graph`.
5. Select `Start!` or press `Alt-S` on the keyboard.

Sample Hardware Configuration

HwCfg01 Basic Hardware Configuration

Illustration

The following shows the selection in the pop-up menu.



App0210 Configure Input Channel Pipes to Sample Differential Inputs and Ground

DAPstudio makes working with input channel pipes easy. This application shows how to configure 32 input pipes to sample 16 differential inputs while sampling ground on every other channel.

For applications with well-driven inputs there is seldom any gain to sampling ground between signal channels. However, in applications with very low-level signals or poorly-driven signals, bringing the analog section to a known state between signal samples can reduce channel-to-channel cross talk.

In this application, the input channel pipe IP0 samples from D0, IP1 samples from G, IP2 samples from D1, IP3 samples from G, etc. The digitized values in all 32 channels are sent to the host PC. The host PC then displays the data in a graph.

Create the application

1. Select `File|New`.
2. Select 32 from the `Channels` combo box.
3. Deselect all of the odd numbered channels by holding down the `Alt` key and dragging the mouse pointer down each odd column in the `Pipe Edit Selection` grid.
4. Select `Differential` from the `Pin` combo box.
5. Move the mouse cursor over the `Pipe Edit Selection` grid or the `Pipes Selected` listing, press the right mouse button to bring up a pop-up menu, and select `Selected Channels|Pin Increment From First`.
6. Click the `0` button and drag the mouse diagonally to select all buttons. Instead of even pipes, all buttons for odd pipes are now selected.
7. Select `Ground` from the `Pin` combo box.
8. Move the mouse cursor over the `Pipe Edit Selection` grid or the `Pipes Selected` listing, press the right mouse button to bring up a pop-up menu, and select `Selected Channels|Pin Same As First`.
9. Select the `Processing|Send to PC` tab.
10. Uncheck the boxes for all odd channels.
11. Open `Window|Graph`.

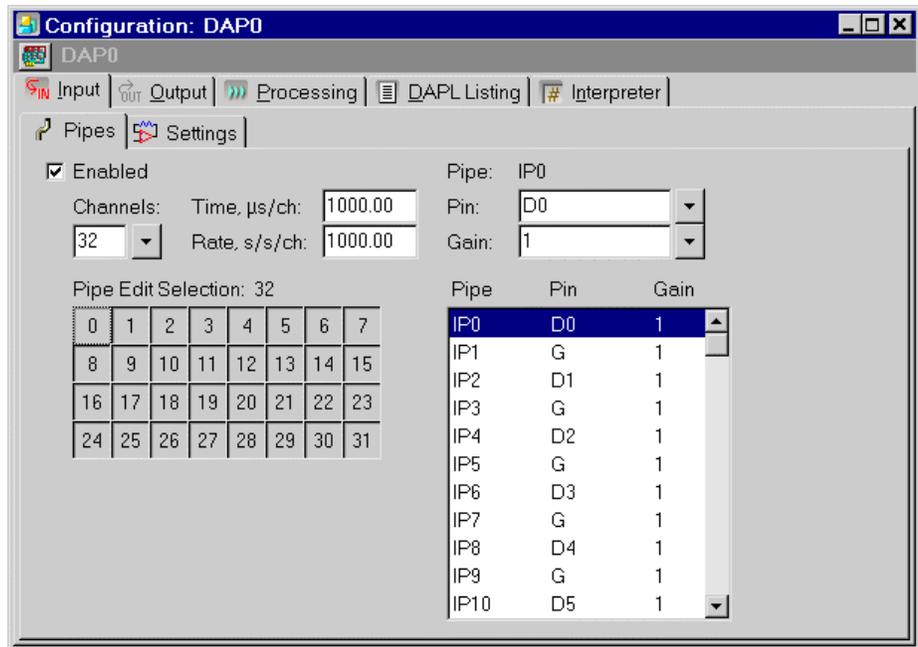
12. Select the Channels... menu item.
13. Drag the mouse over buttons IP16 through IP30 so that all channels are selected. Then click the OK button.
14. Double-click the Graph window to open the Graph Display interface.
15. On the Colors/Legend tab, click the Use Grid Colors button. Click OK.
16. Select Start! or press **Alt-S** on the keyboard.

Sample Hardware Configuration

HwCfg02 Hardware Configuration with Analog Expansion

Illustration

The following shows the [Configuration](#) window after all channels have been configured.



Download the Application

Use the configuration file App0210.dms in the Apps sub-directory of the installation path to run this application in DAPstudio.

App0211 Configure an Input Procedure for Simultaneous Sampling

DAPstudio makes working with input channel pipes easy. This application shows how to configure a simultaneous sampling application.

This application configures 20 input channel pipes to sample 16 contiguous input pins. The first input pipe IP0 is configured to sample a tracking channel. This places the Simultaneous Sampling Board into track mode single-ended inputs. Input channel pipe IP1 samples from S0, IP2 samples from S1, etc. The three extra channels sample ground.

These extra channels allow a sampling scan rate of exactly 1000 s/s or other multiple of 20 * the DAP time base resolution. Only 17 channels are required. With 17 channels, however, it is not possible to get an exact 1000 s/s sampling rate. The closest sampling rate available from a DAP with 0.05µs time-base resolution is 999.6µs or 1000.40016 s/s.

The additional channels also can be used to allow more track time on the MSXB 028 simultaneous sampling board. Since this allows faster conversion on the held channels, this may even improve overall system throughput.

The digitized values in all 20 channels are sent to the host PC. The host PC then displays the data in a graph.

Create the application

1. Select File|New.
2. Select 20 from the Channels combo box.
3. Move the mouse cursor over the Pipe Edit Selection grid or the Pipes Selected listing, press the right mouse button to bring up a pop-up menu, and select Clear All.
4. Select channel 0.
5. Select S496 -Track Mode in the Pin combo box.
6. Deselect channel 0 and select channels 1 through 16.
7. Type S0 in the Pin combo box or select S - Single Ended.

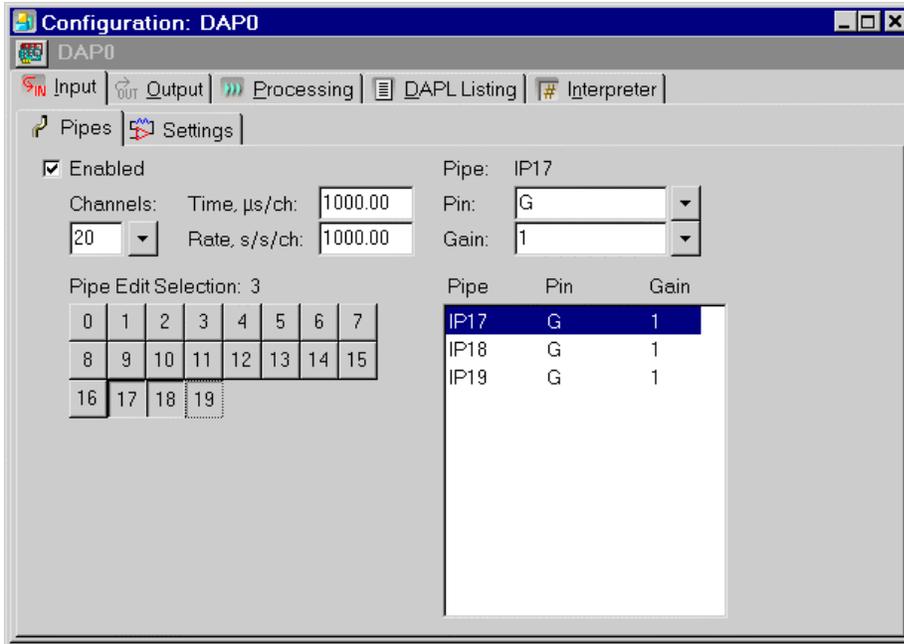
8. Move the mouse cursor over the Pipe Edit Selection grid or the Pipes Selected listing, press the right mouse button to bring up a pop-up menu, and select Selected Channels|Pin Increment From First.
9. Click the 1 button and drag the mouse diagonally to deselect channels 1 through 16 and select channels 17 through 19.
10. Select G - Ground from the Pin combo box.
11. Move the mouse cursor over the Pipe Edit Selection grid or the Pipes Selected listing, press the right mouse button to bring up a pop-up menu, and select Selected Channels|Pin Same As First.
12. Select the Processing|Send to PC tab.
13. Uncheck the boxes for IP0, IP17, IP18, and IP19.
14. Open Window|Graph.
15. Select the Channels... menu item.
16. Click the IP16 button to select it. Then click the OK button.
17. Select Start! or press **Alt-S** on the keyboard.

Sample Hardware Configuration

[HwCfg04 Hardware Configuration with Simultaneous Sampling](#)

Illustration

The following shows the configuration after step 11 of the application.



Download the Application

Use the configuration file App0211.dms in the Apps sub-directory of the installation path to run this application in DAPstudio.

App03 Configure an Output Procedure

These applications walk you through setting up an output procedure by configuring your update rate, waveforms, and other output options.

App0301 Select an Update Rate

This application shows how to select an update rate for a DAP board. The DAP board samples values from an ideal Sinewave with an amplitude of 32000 and a period of 100 samples and sends the values to A0. Because of sampling effects, the output values range from approximately -32000 to approximately +32000. The result is a 5Hz sine wave, because the output A0 reads 500 data values per second.

Create the application

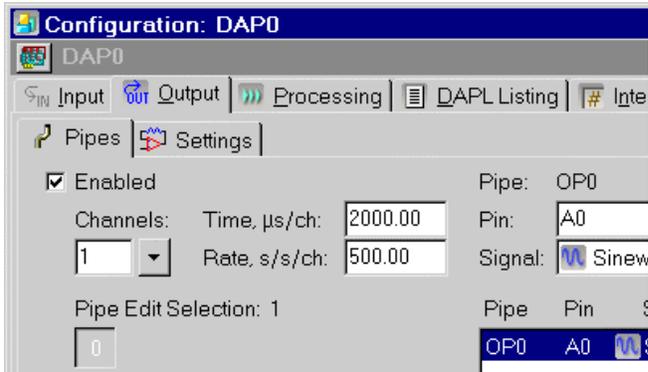
1. Select File|New.
2. Select the Input|Pipes tab and uncheck the Enabled checkbox.
3. Select the Output|Pipes tab and check the Enabled checkbox.
4. Select 1 from the Channels combo box and type “500” in the Rate, s/s/ch edit box.
5. Select Start! or press **Alt-S** on the keyboard.

Sample Hardware Configuration

[HwCfg01 Basic Hardware Configuration](#)

Illustration

The following figure shows the update rate edit box.



App0302 Produce a Sine Wave on DAC0

A DAP board can generate periodic output data. This application configures a DAP board to generate a sine wave and send data to its analog output DAC0.

The application performs the following operations.

1. The `Time` edit box specifies how often to update the output pin. This application updates the output pin every 4000 microseconds, which is 250 updates per second per channel.
2. The `Pin` combo box specifies A0 for output on analog output pin 0, which is DAC0 on an MSTB009-09-A2C-B.
3. The `Signal` edit box specifies a `Sinewave` output.
4. The `Ampl` edit box specifies the amplitude of 32000.
5. The `Period` edit box specifies the period of the waveform as 50 samples.

The DAP samples values from an ideal `Sinewave` with an amplitude of 32000 and a period of 50 samples and sends the values to A0. Because of sampling effects, the output values range from approximately -32000 to approximately +32000. The result is a 5Hz sine wave, because the output A0 updates 250 data values per second.

Create the application

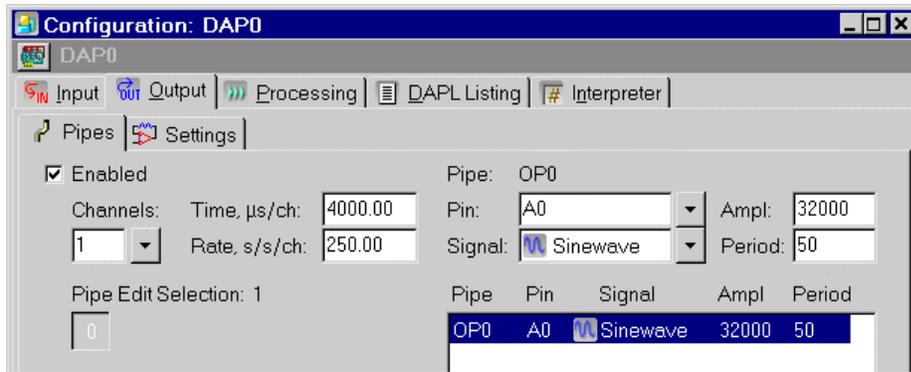
1. Select `File|New`.
2. Select the `Output|Pipes` tab and check the `Enabled` checkbox.
3. Select 1 from the `Channels` combo box, type “4000” in the `Time` edit box, and “50” in the `Period` edit box.
4. Select `Start!` or press **Alt-S** on the keyboard.

Sample Hardware Configuration

[HwCfg01 Basic Hardware Configuration](#)

Illustration

The following figure shows the output configuration as described in step 3.



App0303 Produce a Sine Wave on DAC0 and a Square Wave on DAC1

A DAP board can generate periodic output data. This application configures a DAP board to generate two waveforms and send data to its analog outputs DAC0 and DAC1.

The application performs the following operations.

1. The `Time` edit box specifies how often to update the output pin. This application updates the output pin every 4000 microseconds, which is 250 updates per second per channel.
2. The `Pin` combo box specifies A0 and A1 for output on analog output pins 0 and 1, which are DAC0 and DAC1 on an MSTB009-09-A2C-B.
3. The `Signal` edit box specifies a `Sinewave` output and a `Squarewave` output.
4. The `Ampl` edit box specifies the amplitude of the waveforms.
5. The `Period` edit box specifies the period of the waveforms.

The DAP samples values from an ideal `Sinewave` with an amplitude of 32000 and a period of 50 samples and sends the values to A0. Because of sampling effects, the output values range from approximately -32000 to approximately +32000. The result is a 5Hz sine wave, because the output A0 updates 250 data values per second per channel.

The DAP also samples values from an ideal `Squarewave` with an amplitude of 25000 and a period of 100 samples and sends the values to A1. Because of sampling effects, the output values range from approximately -25000 to approximately +25000. The result is a 2.5Hz square wave, because the output A1 updates 250 data values per second per channel.

Create the application

1. Select `File|New`.
2. Select the `Output|Pipes` tab and check the `Enabled` checkbox.
3. Type “4000” in the `Time` edit box and “50” in the `Period` edit box.
4. Click `OP1` to highlight it in the edit box on the right-hand side.
5. Select `Squarewave` from the `Signal` combo box.

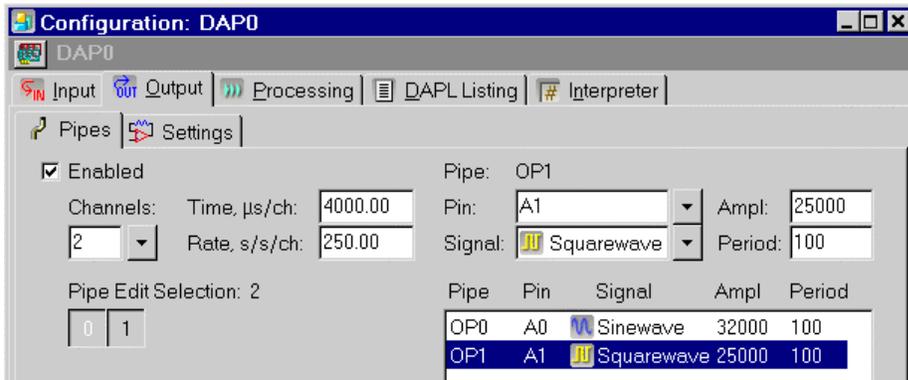
6. Type “25000” in the Ampl edit box.
7. Select Start! or press **Alt-S** on the keyboard.

Sample Hardware Configuration

HwCfg01 Basic Hardware Configuration

Illustration

The following figure shows the output configuration as described in step 6.



App0304 Configure an Output Pipe to Update DAC0

DAPstudio allows processing of input data before sending the result to analog outputs. This application configures a DAP board to average groups of 10 data values from an analog input and send the averages to an onboard digital-to-analog converter DAC0.

Create the application

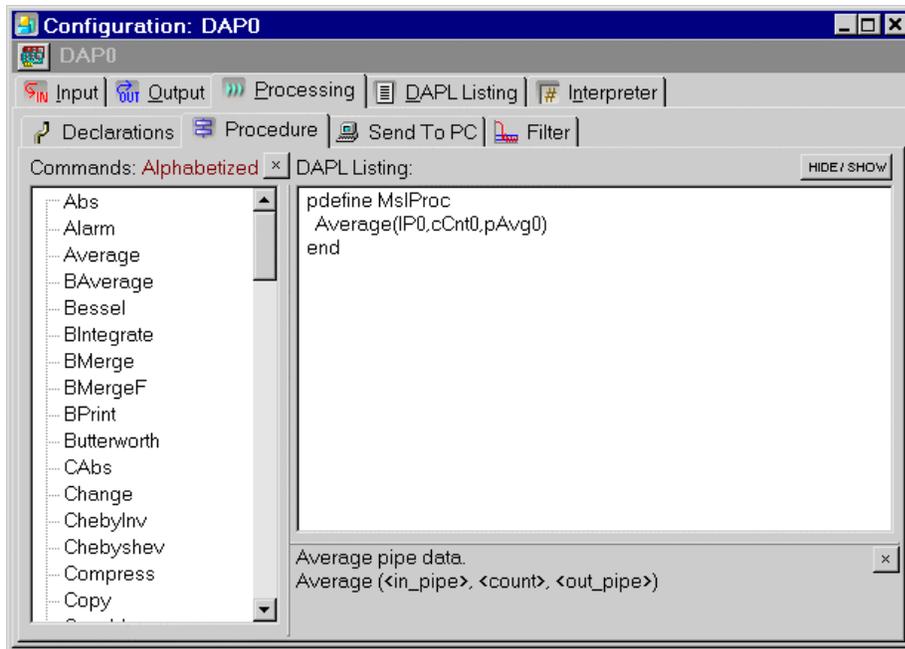
1. Select File|New.
2. Select 1 from the Channels combo box.
3. Select the Output|Pipes tab and check the Enabled checkbox.
4. Select 1 from the Channels combo box and type “100” in the Rate, s/s/ch edit box.
5. Select Processing from the Signal combo box.
6. Select the Processing|Procedure tab.
7. In the DAPL Listing edit box, type “Average(IP0, cCnt0, OP0)”.
8. Select Start! or press **Alt-S** on the keyboard.

Sample Hardware Configuration

[HwCfg01 Basic Hardware Configuration](#)

Illustration

The following figure shows the processing configuration as described in step 7.



App04 Write a Processing Procedure

Learn how easy it is to work with processing in DAPstudio, with its automatic declaration of necessary pipes, variables, and constants. The applications introduce the command list and the processing procedure interface, with its auto-fill and auto-increment features. [App0406](#) and [App0407](#) provide particularly useful introductions to the auto-increment features that you will use regularly in your own applications.

App0401 Automatically Declare Pipes, Variables and Constants

This application writes a DAPL command in a processing procedure, which applies real-time processing on the acquired data. In this application, the DAP board samples one input signal and compresses the data by applying the `Average` command. This command computes the arithmetic mean of a block of 100 samples. The resulting data are sent to the host PC. The host PC then displays the data in a graph.

Averaging not only reduces the data output rate but also improves the accuracy of the output by reducing the effect of noise in the input signal. In applications where averaging is not desirable, the `Skip` command can be used to reduce the output rate.

Another useful DAPstudio feature is the automatic declaration of pipes, variables, and constants in the building of a processing configuration. The `Average` command requires three parameters: an input pipe, a constant to specify the block size, and an output pipe. The input and output pipes are defined in the `input` and `output` tabs. DAPstudio declares the constant when building the `Average` command as shown in below.

Create the application

1. Select `File|New`.
2. Select `1` from the `Channels` combo box.
3. Select the `Processing|Procedure` tab.
4. In the `DAPL Listing` edit box, type “A” between “`pdefine Ms1Proc`” and “`end`”. A drop-down list containing all DAPL commands starting with A will appear automatically. Or press `F4` on the keyboard to bring up the drop-down list.
5. Press the down arrow key to select `AVERAGE`, then press the `Enter` key. The `Average` command is inserted in the `DAPL Listing` edit box.
6. Type “`(`” and press the `Enter` key. The `IP0` input pipe is inserted in the `Average` command.
7. Type “`,`” and press the `Enter` key. The new constant `cCnt0` is declared and inserted in the `Average` command.
8. Type “`,`” and press the `Enter` key. The new pipe `pAvg0` is declared and inserted in the `Average` command.

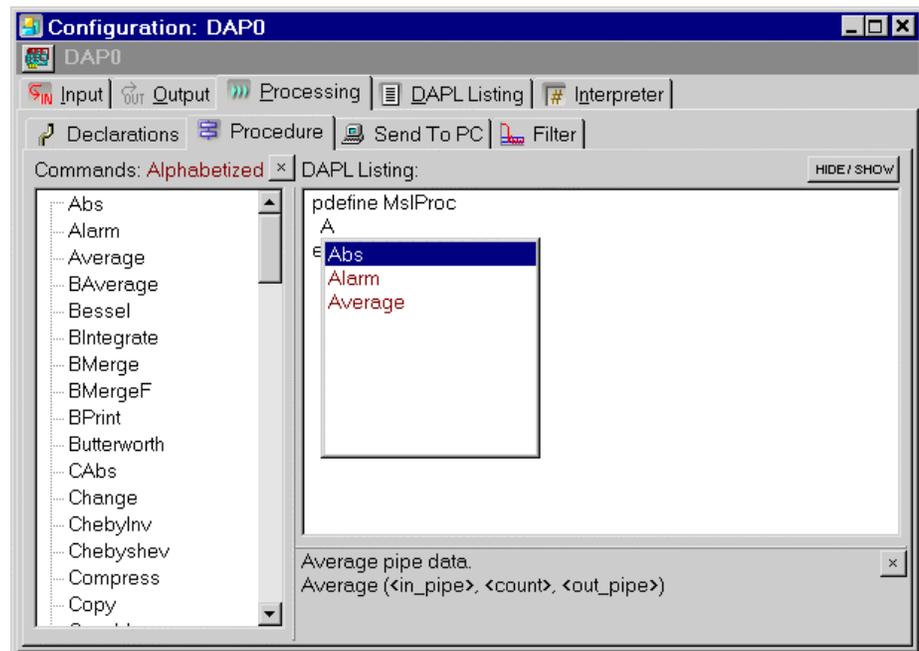
9. Type “)” and select the Processing|Declarations tab.
10. In the Processing|Declarations edit box, change the value of cCnt0 from 10 to 100.
11. Select the Processing|Send To PC tab.
12. Highlight all channels with the mouse or change focus to the checkbox area and select **Ctrl-A**. Then press the space bar. The IP0 checkbox is now unchecked, and instead the pAvg0 checkbox is now checked.
13. Open Window|Graph.
14. Select Start! or press **Alt-S** on the keyboard.

Sample Hardware Configuration

HwCfg01 Basic Hardware Configuration

Illustration

The following figure shows the drop-down command list as described in step 4.



App0402 Get DAPL Help

Getting help with DAPL commands is easy in DAPstudio. This application contains two sections: Quick Help and Complete Documentation. The Quick Help section demonstrates a quick reference to the selected DAPL command. A brief description and parameter list for the selected DAPL command are displayed. The Complete Documentation section shows how to access the full version of the DAPL 2000 manual in Windows Help format.

Quick Help

1. Select the `Processing|Procedure` tab.
2. Select a DAPL command in the `Commands` list box. A brief description of the selected DAPL command is displayed below the `DAPL Listing` edit box.

Complete Documentation

1. Select `Help` or press the `F1` key on the keyboard.

App0403 Use the Alphabetized or Categorized Command List

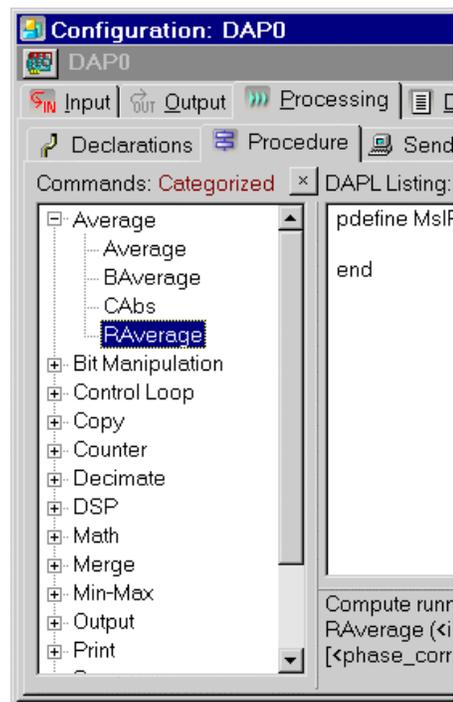
DAPL makes data processing easy by providing over 100 easy-to-use commands optimized for data acquisition. DAPstudio sorts the DAPL commands list in alphabetical order by default. This application shows how to organize commands by category.

Create the application

1. Select the Processing|Procedure tab.
2. Above the Commands edit box, click Alphabetized to sort the command list by category.

Illustration

The following figure shows the command lists sorted by category.



App0404 Use the FIRFILTER command

See App0604.

App0405 Use the FFT command

See App0701.

App0406 Duplicate Commands With Auto-Increment Parameters

DAPstudio provides an easy way to reproduce a command with auto-increment parameters. It is helpful when configuring a large number of channels. This application samples four channels at 1000 samples per second per channel and decimates the data rate by a factor of 100 by applying the `AVERAGE` command on each input channel pipe.

While in this application you only duplicate one command, the increment/paste/copy command works just as well for [multiple commands](#).

Create the application

1. Select `File|New`.
2. Select 4 from the `Channels` combo box.
3. Type “Average(IP0, cCnt0_, pAvg0)” in the `Processing|Procedures|DAPL Listing` edit box. Please see [App0401](#) for step-by-step instructions on adding a DAPL command. Using the underscore ensures that the constant `cCnt0_` will not be incremented.
4. Highlight the line for the `Average` command and its parameters.
5. Press `Ctrl-C` on the keyboard to copy the highlighted items to the clipboard.
6. Go to the next line, before end, and press `Ctrl-E` to increment/paste/copy the items from the clipboard. Where a parameter has a number at the end, the number automatically is incremented when it is pasted to the new line. The new command line reads `Average(IP1, cCnt0_, pAvg1)`.
7. Repeat step 6 twice to insert two additional `Average` commands.
8. Select the `Processing|Declarations` tab and change the value of constant `cCnt0_` from 10 to 100.
9. Select the `Processing|Send To PC` tab.
10. Highlight all channels with the mouse or change focus to the checkbox area and select `Ctrl-A`. Then press the space bar. The `IP0` through `IP3` checkboxes are now unchecked, and instead the `pAvg0` through `pAvg3` checkboxes are now checked.
11. Open `Window|Graph`.

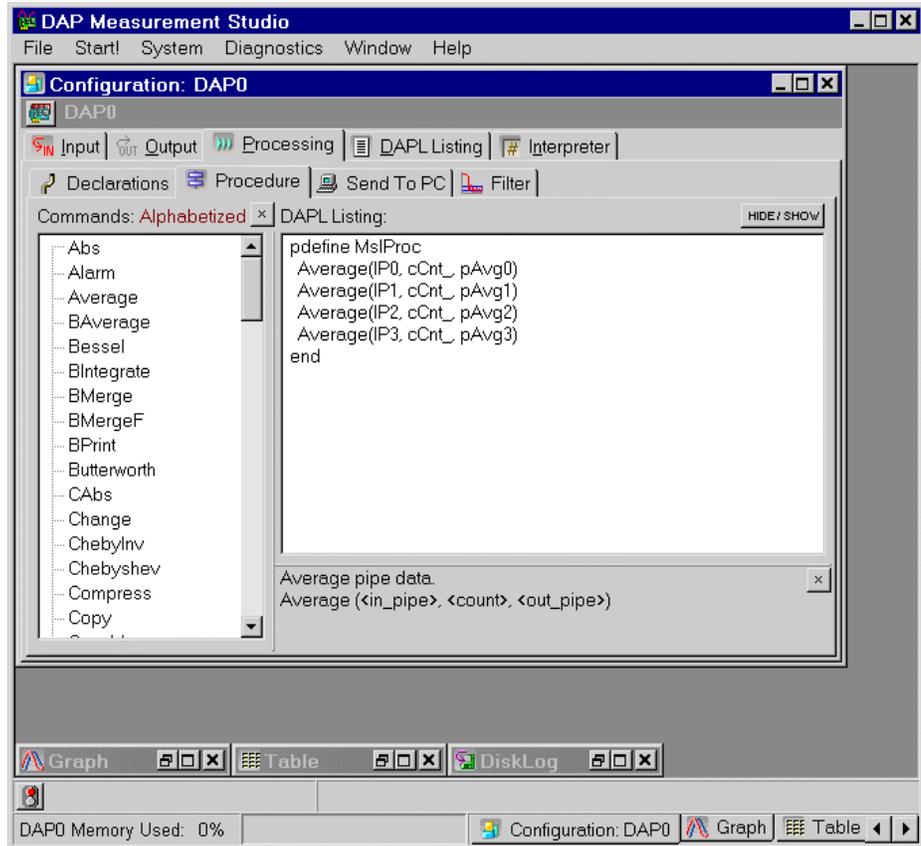
12. Select Start! or press **Alt-S** on the keyboard.

Sample Hardware Configuration

HwCfg01 Basic Hardware Configuration

Illustration

The following figure shows the process configuration as described in step 7.



App0407 Process Multiple Commands with Auto-Increment Parameters

DAPstudio provides an easy way to reproduce a command with auto-increment parameters. It is helpful when configuring a large number of channels and can be used for multiple commands in a single application.

This application samples four channels at 1000 samples per second per channel, decimates the data rate by a factor of 100 by applying the `AVERAGE` command on each input channel pipe, finds the high and low points, and gives the difference between the high and low points.

Create the application

1. Select `File|New`.
2. Select 4 from the `Channels` combo box.
3. Type `Average(IP0, cCnt0_, pAvg0)` in the `Processing|Procedure|DAPL Listing` edit box. Please see [App0401](#) for step-by-step instructions on adding a DAPL command. Using the underscore ensures that the constant `cCnt0_` will not be incremented.
4. Type `High(IP0, cCnt0_, pHigh0)` on the next line.
5. Type `Low(IP0, cCnt0_, pLow0)` on the next line.
6. Type `=` on the next line. A new pipe name will be suggested, used in this case for the difference. Complete the DAPL expression with the suggested terms. The line will read `pExps0 = pHigh0 - pLow0`.
7. Put an empty line after the DAPL expression.
8. Highlight the 5 lines for the `Average`, `High`, and `Low` commands and their parameters, plus the DAPL expression line and empty line.
9. Press `Ctrl-C` on the keyboard to copy the highlighted items to the clipboard.
10. Go to the next line, before `end`, and press `Ctrl-E` to increment/paste the items to the `DAPL Listing` edit box and recopy the items to the clipboard. Where a parameter has a number at the end, the number automatically is incremented when it is pasted to the new line. The new command lines read as follows.

```
Average(IP1, cCnt0_, pAvg1)
High(IP1, cCnt0_, pHigh1)
```

```
Low(IP1, cCnt0_, pLow1)
pExps1 = pHigh1 - pLow1
```

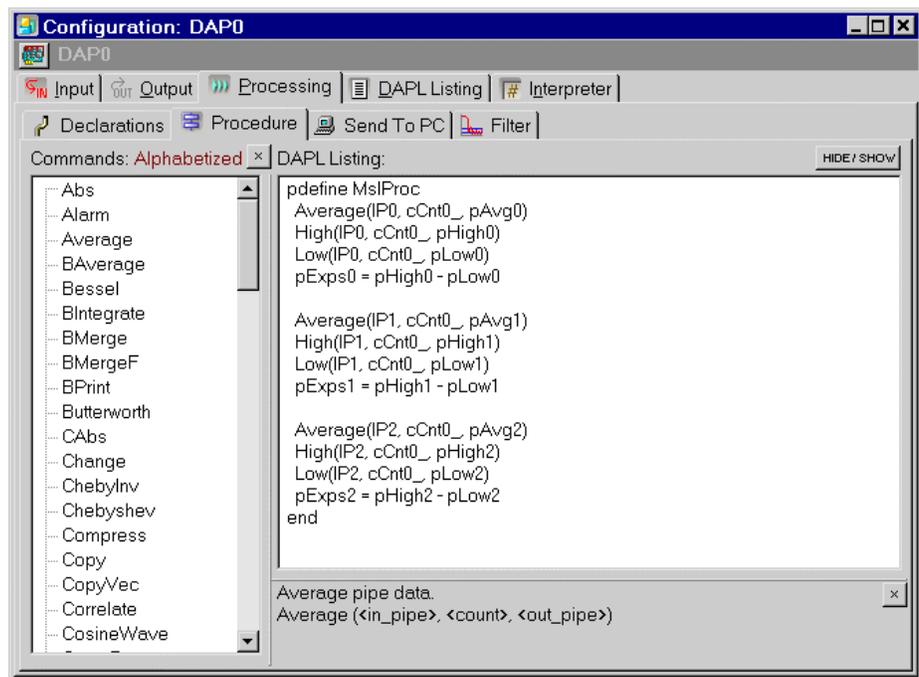
11. Repeat step 9 twice to insert two additional sets of commands.
12. Select the Processing|Send To PC tab.
13. Highlight all channels with the mouse or change focus to the checkbox area and select **Ctrl-A**. Then press the space bar. The IP0 through IP3 checkboxes are now unchecked, and all other channels are now checked.
14. Open Window|Graph.
15. Select Start! or press **Alt-S** on the keyboard.

Sample Hardware Configuration

HwCfg01 Basic Hardware Configuration

Illustration

The following figure shows the process configuration as midway through step 10.



Download the Application

Use the configuration file App0407.dms in the Apps sub-directory of the installation path to run this application in DAPstudio.

App0408 Activate All Processing Tabs

DAPstudio allows you to display only the Processing tabs that you need. This application shows how to activate all available Processing tabs and access other options.

Create the application

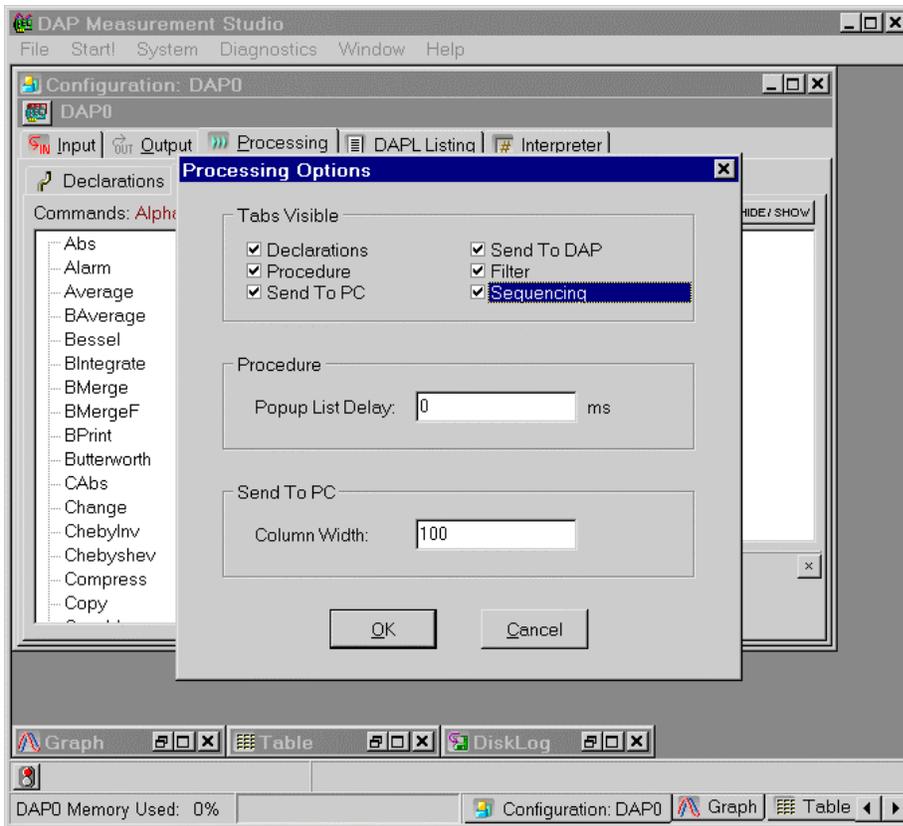
1. Select `File|New`.
2. Select the Processing tab and right-click at the sub-tab level.
3. Choose `Options...` and put check marks next to each of the `Tabs Visible` checkboxes. All are checked by default, except for `Send to DAP` and `Sequencing`.
4. See [App0409](#) for how to use the `Sequencing` tab. See [App18](#) for how to use the `Send to DAP` tab.

Sample Hardware Configuration

[HwCfg01 Basic Hardware Configuration](#)

Illustration

The following figure shows adding the `Send to DAP` and `Sequencing` tabs to the visible configuration, as in step 3 of the application.



App0409 Use the Sequencing Tab

DAPstudio provides an easy way to set up configuration items to run when an application is started or stopped. This application automatically checks on and reports the statistics each time an application stops.

Create the application

1. Select File|New.
2. Select 1 from the Channels combo box.
3. Select the Processing tab and activate the Sequencing tab, as described in [App0408](#).
4. Select the Processing|Sequencing tab.
5. Before the start line, type “statistics on”.
6. After the start line add the following lines.

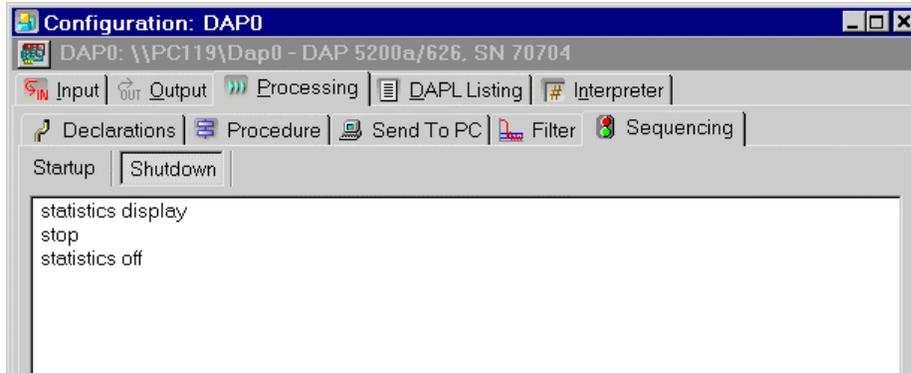
```
pause 100 // allow the system to stabilize
statistics clear
```
7. Click the Shutdown button.
8. Before the stop line, type “statistics display”.
9. After the stop line, type “statistics off”.
10. Select the Interpreter tab to view the statistics.
11. Select Start! followed by Stop! when the experiment is complete.

Sample Hardware Configuration

[HwCfg01 Basic Hardware Configuration](#)

Illustration

The following figure shows the shutdown procedure as described in steps 7-9.



App05 Using Graph Features

Learn to use – and customize – the line [Graph](#) display window. Configure windows to your own preferences and application requirements. Change background colors, titles, history length displayed, axis units, and more.

App0501 Add a Graph

Showing fewer channels in a graph helps visualization. In this application, the DAP board samples eight input signals and sends the digitized values directly to the host PC. The host PC then displays the data in two graphs, four input signals per graph.

Create the application

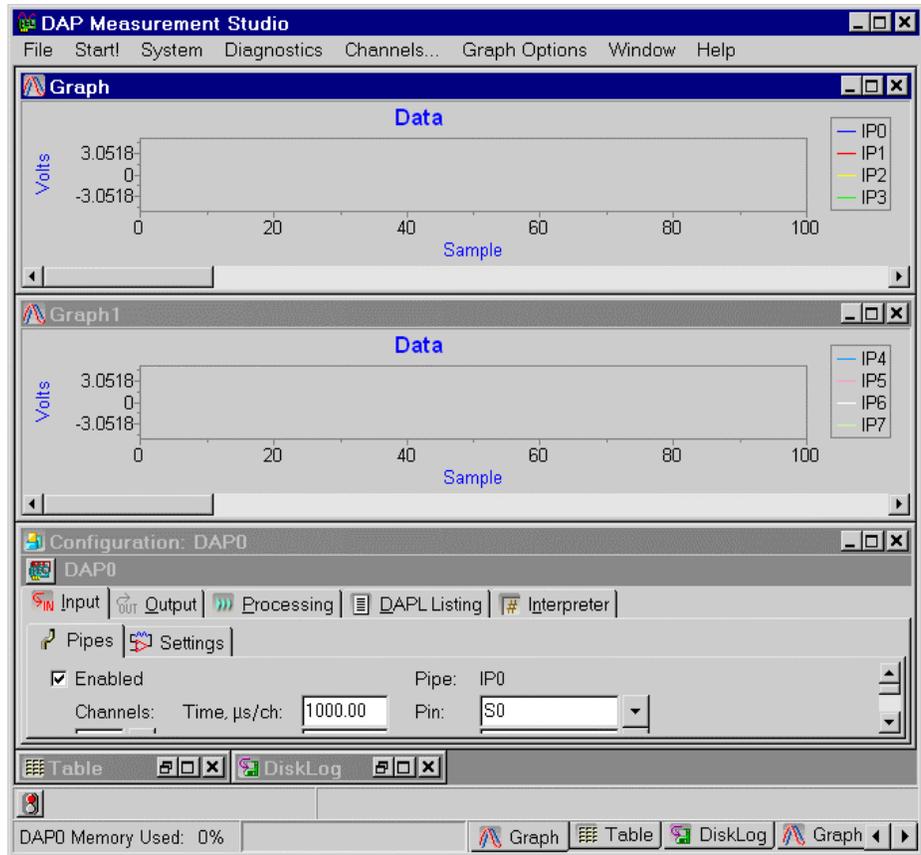
1. Select `File|New`.
2. Select 8 from the `Channels` combo box.
3. Open `Window|Graph`.
4. Select the `Channels...` menu item.
5. Click the button `IP4` and drag the mouse to deselect all items through to the `IP7` button. Then click the `OK` button. Only buttons `IP0` through `IP3` are now selected.
6. Select `Window|New Graph|Data Acquisition`.
7. Select the `Channels...` menu item.
8. Click the first button `IP0` and drag the mouse to deselect all items through to the `IP3` button. Then click the `OK` button. Only buttons `IP4` through `IP7` are now selected.
9. Select `Window|Tile Horizontally`.
10. Select `Start!` or press `Alt-S` on the keyboard.

Sample Hardware Configuration

[HwCfg01 Basic Hardware Configuration](#)

Illustration

The following figure shows the `Configuration` and two `Graph` windows titled horizontally.



Download the Application

Use the configuration file App0501.dms in the Apps sub-directory of the installation path to run this application in DAPstudio.

App0502 Zoom Into a Specific Region

DAPstudio has zooming features. This application shows how to enlarge a point of interest in a graph. The DAP board samples one input signal and sends the digitized values directly to the host PC. The host PC then displays the data in a graph.

Create the application

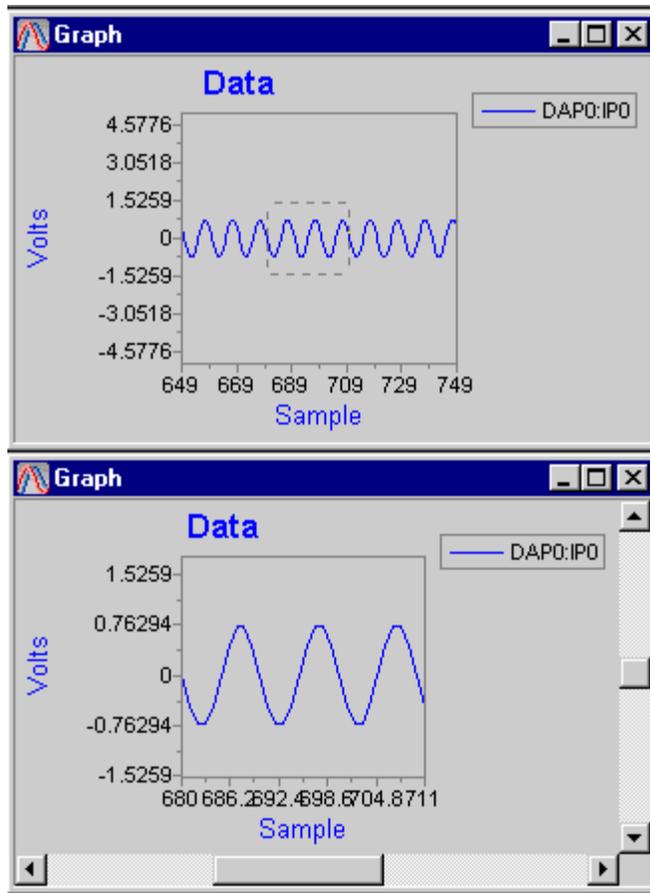
1. Select `File|New`.
2. Select 1 from the `Channels` combo box.
3. Open `Window|Graph`.
4. Select `Start!` followed by `Stop!` when the experiment is complete.
5. Press the left mouse button and drag the mouse to select a region of interest in the plotting area.
6. To restore the original graph setting, press the right mouse button to bring up a pop-up menu and select `Zoom Clear`.

Sample Hardware Configuration

[HwCfg01 Basic Hardware Configuration](#)

Illustration

The following figure shows two `Graph` windows. The top `Graph` window has the original setting, with the full-scale range of ± 5 Volts. The bottom `Graph` window zooms into the region selected by the rectangular box in the top `Graph` window.



App0503 Use the Crosshairs

It is helpful to know the exact numbers associated with a point on a graph. DAPstudio provides a pair of crosshairs to track the data of a single channel. The numerical data below the graph area displays the coordinates at the crosshairs. To provide the data for this application, the DAP board samples two input signals and sends the digitized values directly to the host PC. The host PC then displays the data from both channels in a graph.

Create the application

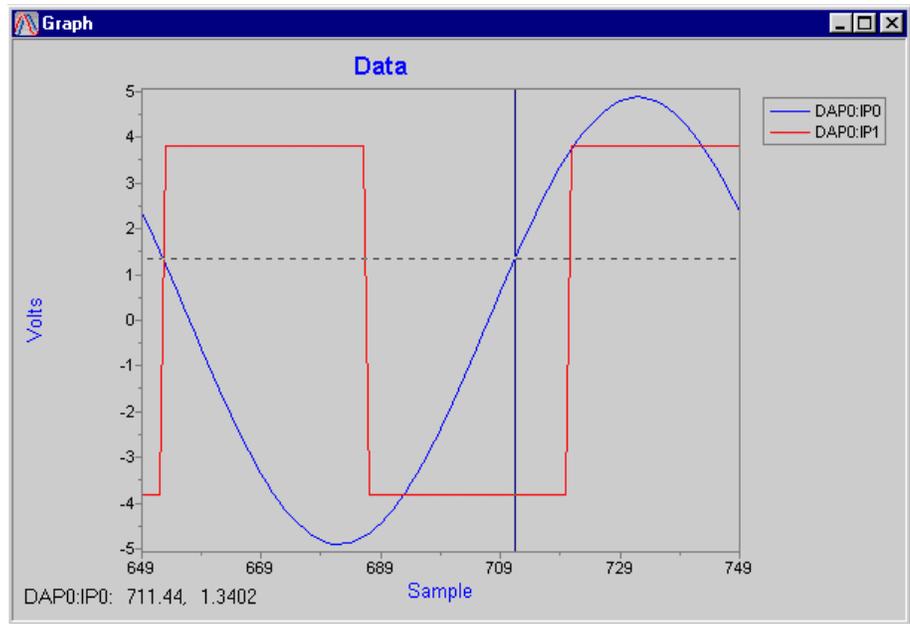
1. Select `File|New`.
2. Select `2` from the `Channels` combo box.
3. Open `Window|Graph`.
4. Select `Start!` followed by `Stop!` when the experiment is complete.
5. Move the cursor over `IP0` in the legend on the right side of the graph. Press and hold the left mouse button and drag the mouse back to the plotting area.

Sample Hardware Configuration

[HwCfg01 Basic Hardware Configuration](#)

Illustration

The following figure shows a pair of crosshairs tracking the first input channel pipe `IP0`. The coordinates are displayed at the bottom left hand corner of the [Graph](#) window.



App0504 Display Data in FFT Blocks

See App0703.

App0505 Configure Data History

Increase the number of data history points to display more data in a graph and give an overall picture of the signals. This application increases the history data points from 500 (by default) to 10,000. To provide the data for this application, the DAP board samples two input signals and sends the digitized values directly to the host PC. The host PC then displays the data from both channels in a graph.

Create the application

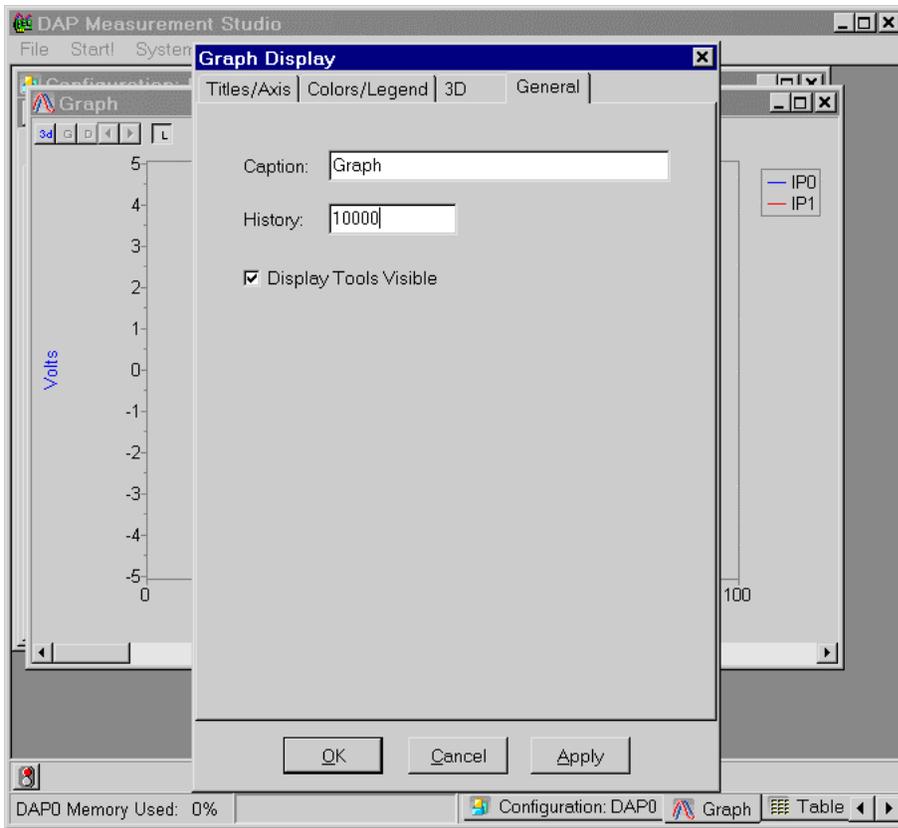
1. Select **File|New**.
2. Select **2** from the **Channels** combo box.
3. Open **Window|Graph**.
4. Select **Graph Options|Display...** and choose the **General** tab. Type **"10000"** in the **History** edit box.
5. Select **Start!** or press **Alt-S** on the keyboard.

Sample Hardware Configuration

[HwCfg01 Basic Hardware Configuration](#)

Illustration

The following figure shows the **Graph Options|Display...|General** tab, as described in the **Create the Application** section.



App0506 Configure Graph Axis and Titles

Customize your graph to display the data clearly and correctly. This application changes the default graphing of voltage level (left axis) for samples (bottom axis) to digital readings (left axis) per second (bottom axis).

If seconds or milliseconds are selected for the x-axis, the data rate between the DAP board and PC is important. If the data rate is unchanged (input pipes, FIRfilter, Merge, etc.), then the data rate is already correct. However, if there is a reduction in data rate (Average, High, Low, etc.) then the data rate can be reduced in the Processing|Procedure|Send To PC tab, under the Rate, s/s/ch edit box. For more information, please refer to the [Processing Tab](#) in the DAPstudio Help or PDF file.

Create the application

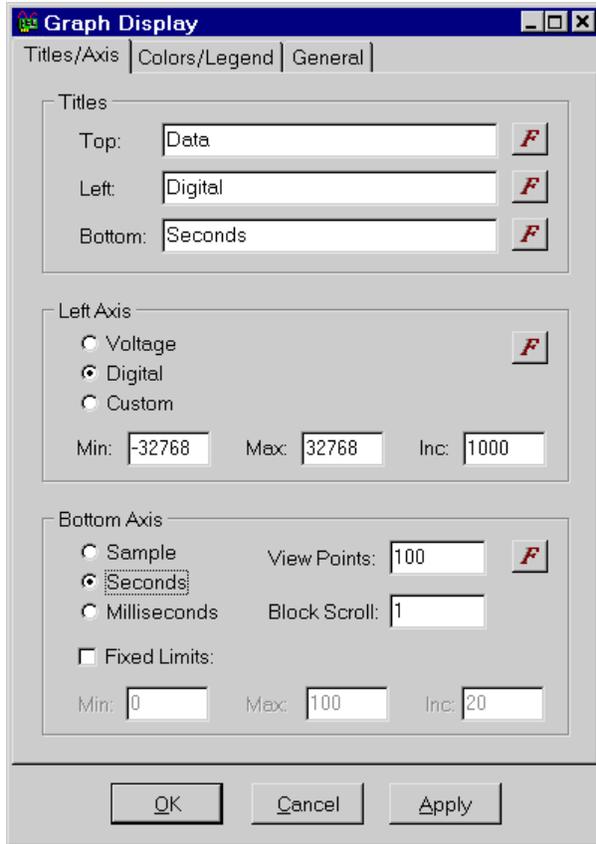
1. Select File|New.
2. Select Window|Graph.
3. Select Graph Options|Display... or double-click on the Graph window to open the Graph Display interface. Choose the Titles/Axis tab.
4. In the Titles group box, type "Digital" in the Left edit box.
5. In the Left Axis group box, select Digital.
6. In the Bottom Axis group box, select Seconds. This automatically changes the Bottom title to Seconds as well.
7. Click OK.
8. Select Start! or press **Alt-S** on the keyboard.

Sample Hardware Configuration

[HwCfg01 Basic Hardware Configuration](#)

Illustration

The following figure shows the Graph Options|Display...|Titles/Axis tab, as described in step 6.



App0507 Configure Graph Colors and Fonts

Customize your graph to display the data in a way that is clear and visually pleasing to you. This application changes the colors in the graph display and the name and font of the top title.

To provide the data for this application, the DAP board samples two input signals and sends the digitized values directly to the host PC. The host PC then displays the data from both channels in a graph.

Create the application

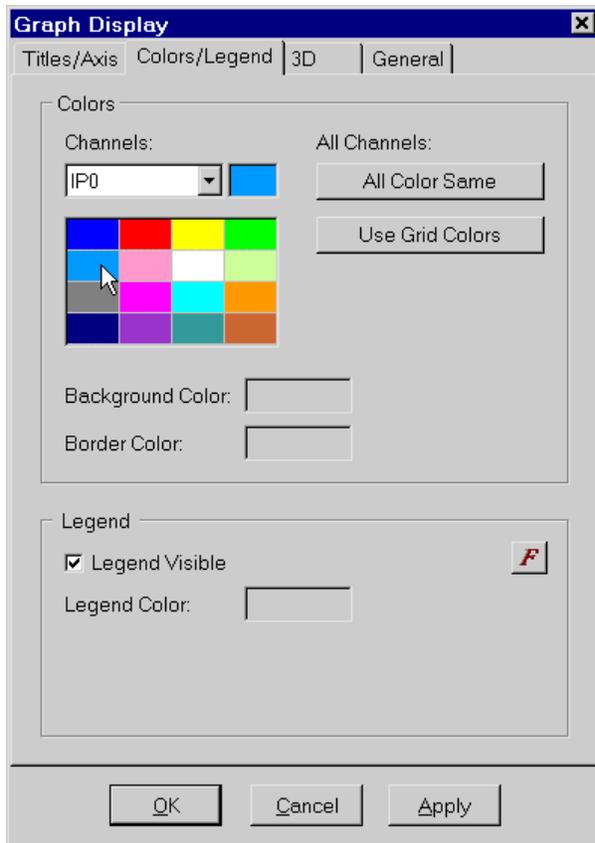
1. Select **File|New**.
2. Select **2** from the **Channels** combo box.
3. Open **Window|Graph**.
4. Select **Graph Options|Display...** or double-click on the Graph window. Choose the **Colors/Legend** tab.
5. Choose a color in the default color grid, or click on the **IP0** color selection box and select a new color.
6. Click on the **Background Color** color selection box and select an appropriate background color. Click on the **Apply** button.
7. Choose the **Titles/Axis** tab.
8. In the **Titles** group box, change the **Top** edit box to something appropriate.
9. Click the **F** button for the **Top** edit box and adjust the font size and style as desired.
10. Click **OK**.
11. Select **Start!** or press **Alt-S** on the keyboard.

Sample Hardware Configuration

[HwCfg01 Basic Hardware Configuration](#)

Illustration

The following figure shows the **Graph Options|Display...|Colors/Legend** tab, as described in the **Create the Application** section.



App0508 Use 3D Graph Features

Customize your graph to display the data in a 3D format. Compare the 3D graph with a flat line graph.

To provide the data for this application, use the stored application [App0108](#) or read the logged data file that was used in [App0108](#). This data file includes waveforms that overlap, providing a demonstration of how useful the 3D features can be. Observe the way the channels overlap in step 9 but are isolated and distinct in step 10. Use the 3d button to toggle between the 2D and 3D displays.

The 3D option is also available in [Alarm](#), [Bar](#), and [Waterfall](#) display windows.

Create the application

1. Select **File|Open...** and choose `App0108.dms`. Or open data file `Data0108.bin` as described in [App0108](#).
2. Select **Window|New Graph** and choose the **Data File: Data0108.bin** option. Or select **Window|Graph**, select **Graph Options|Connect To** and choose the **Data File: Data0108.bin** option
3. Select **Channels...** and click on channels **Rose** and **Violet** to deselect them. Click **OK**.
4. Double-click on the **Graph** window to open the **Graph Display** dialog. Or select **Graph Options|Display...**
5. Select the **3D** tab.
6. Check the **3D Enabled** checkbox.
7. Change the **Angle (%)** edit box to `20`.
8. Click **OK**.
9. In the upper left corner of the **Graph**, click the **3d** button to deselect it and turn it off.
10. Click the **3d** button again to turn it on.
11. Experiment with the upper left **Arrow** buttons, increasing and decreasing the **Angle (%)** amount that previously was adjusted in step 7.
12. Select **Window|Clone Active Window**.
13. In the new **Graph1** window, double-click the window to open the **Graph Display** dialog.

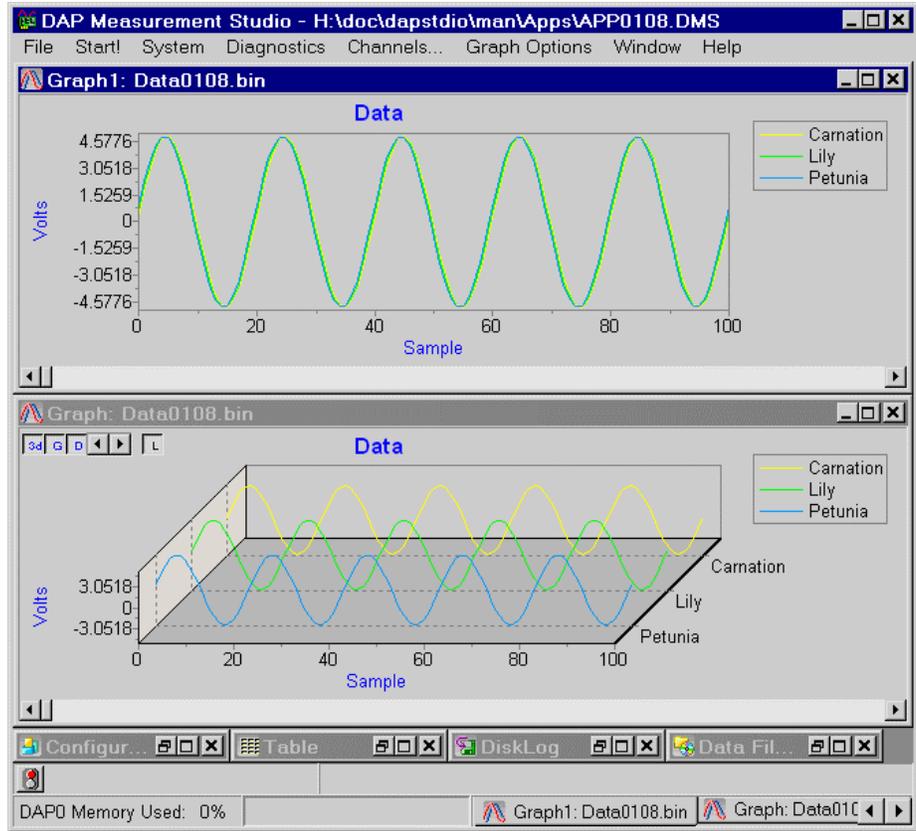
14. Select the 3D tab.
15. Click to remove the checkmark in the 3D Enabled checkbox.
16. Select the General tab.
17. Click to remove the checkmark in the Display Tools Visible checkbox. Click OK.
18. Select Window|Tile Horizontally.

Sample Hardware Configuration

[HwCfg01 Basic Hardware Configuration](#)

Illustration

The following figure shows the flat and 3D Graph windows from step 16 of the Create the Application section.



App06 Design Filters

Learn to create – and customize – filters for your data. Create new filters, copy existing ones, and export data. Create different types of filters and change slope, taps, scaling, and more.

App0601 Add a New Filter Design

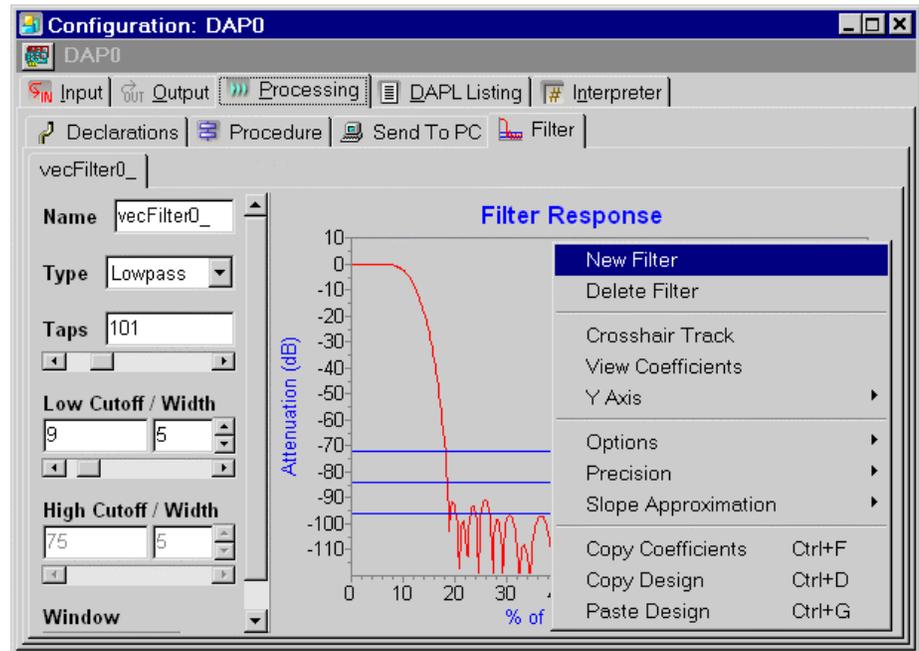
DAPstudio offers a simple and easy graphical user interface for designing digital filters. It encourages you to experiment with multiple filter designs to see how each responds to different effects. DAPstudio shows one filter design by default. This application shows how to add a new filter design then the following application deletes the original filter. Multiple filter designs are useful when different filter characteristics are needed for a multi-channel system.

Create the application

1. Select the Processing|Filter|vecFilter0_ tab.
2. Press the right mouse button to bring up a pop-up menu and select New Filter.

Illustration

The following figure shows a filter design and the pop-up menu.



App0602 Delete a Filter Design

To avoid confusion, filter designs no longer used should be removed. DAPstudio shows at least one filter design. To demonstrate how to delete a filter design, use [App0601](#) to add a second filter design, then follow these steps delete the original filter. Please remove all references to the filter design before deleting it.

Create the application

1. Select the Processing|Filter|vecFilter0_ tab.
2. Press the right mouse button to bring up a pop-up menu and select Delete Filter.

App0603 Copy and Paste a Filter Design

DAPstudio provides an easy way to reproduce a filter design. It is helpful when a backup copy of the filter design is needed, or as a starting point for designing a new filter. This application implements the original filter design as a highpass filter, then copies and pastes it to a new filter design.

Create the application

1. Select the Processing|Filter|vecFilter0_ tab.
2. Select Highpass from the Type combo box.
3. Press **Ctrl-D** on the keyboard or the right mouse button to bring up a pop-up menu and select Copy Design.
4. Press the right mouse button to bring up a pop-up menu and select New Filter.
5. Select the Processing|Filter|vecFilter1_ tab.
6. Press **Ctrl-G** on the keyboard or the right mouse button to bring up a pop-up menu and select Paste Design.

App0604 Use the FIRFILTER Command

DAPstudio provides a graphical interface to make choosing a digital filter easy. This application implements a lowpass finite impulse response (FIR) digital filter. It applies the filter to the DAP board's analog inputs by the `FIRFILTER` command, a task that applies the highpass FIR digital filter to the input data. The DAP board samples one input signal at 1000 samples per second per channel, removing the frequency component below the highpass filter on the input data, and sends the resulting data to the host PC.

Create the application

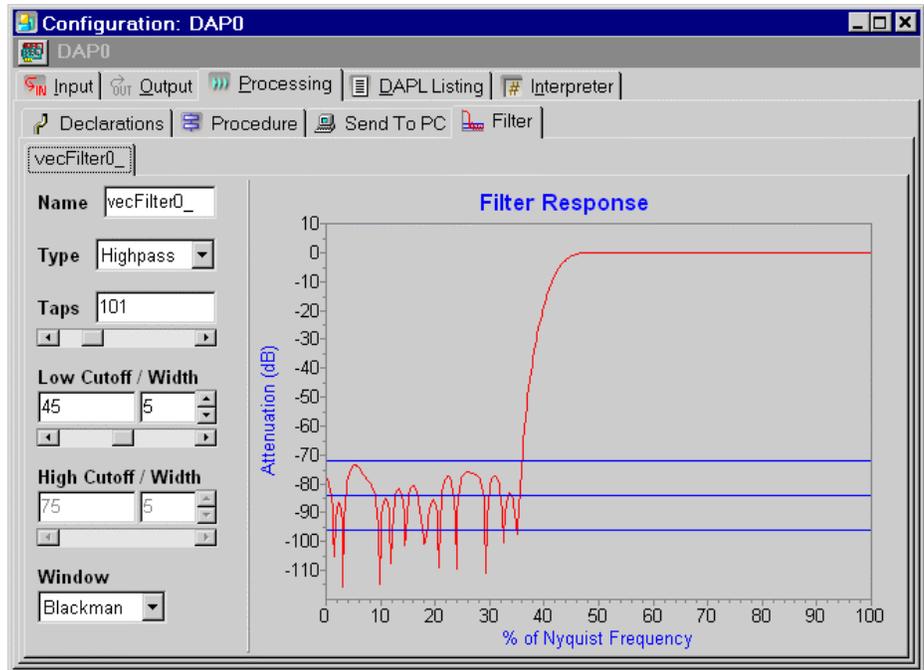
1. Select `File|New`.
2. Select `1` from the `Channels` combo box.
3. Select the `Processing|Filter|vecFilter0_` tab.
4. Select `Highpass` from the `Type` combo box.
5. Type `"45"` in the left hand side edit box below `Low Cutoff/Width`.
6. Select the `Processing|Procedure` tab.
7. In the `DAPL Listing` edit box, type `"FIRFilter(IP0, vecFilter0_, 89, 1, 1, -1, pFirF0)"` between `"pdefine MslProc"` and `"end"`. Please see [App0401](#) for step-by-step instructions on adding a DAPL command.
8. Select the `Processing|Send To PC` tab.
9. Highlight all channels with the mouse or change focus to the checkbox area and select `Ctrl-A`. Then press the space bar. The `IP0` checkbox is now unchecked, and instead the `pFirf0` checkbox is now checked.
10. Open `Window|Graph`.
11. Select `Start!` or press `Alt-S` on the keyboard.

Sample Hardware Configuration

[HwCfg01 Basic Hardware Configuration](#)

Illustration

The following figure shows the filter design as described in step 5 in the `Create the Application` section.



Download the Application

Use the configuration file App0604.dms in the Apps sub-directory of the installation path to run this application in DAPstudio.

App0605 Change to Response Display

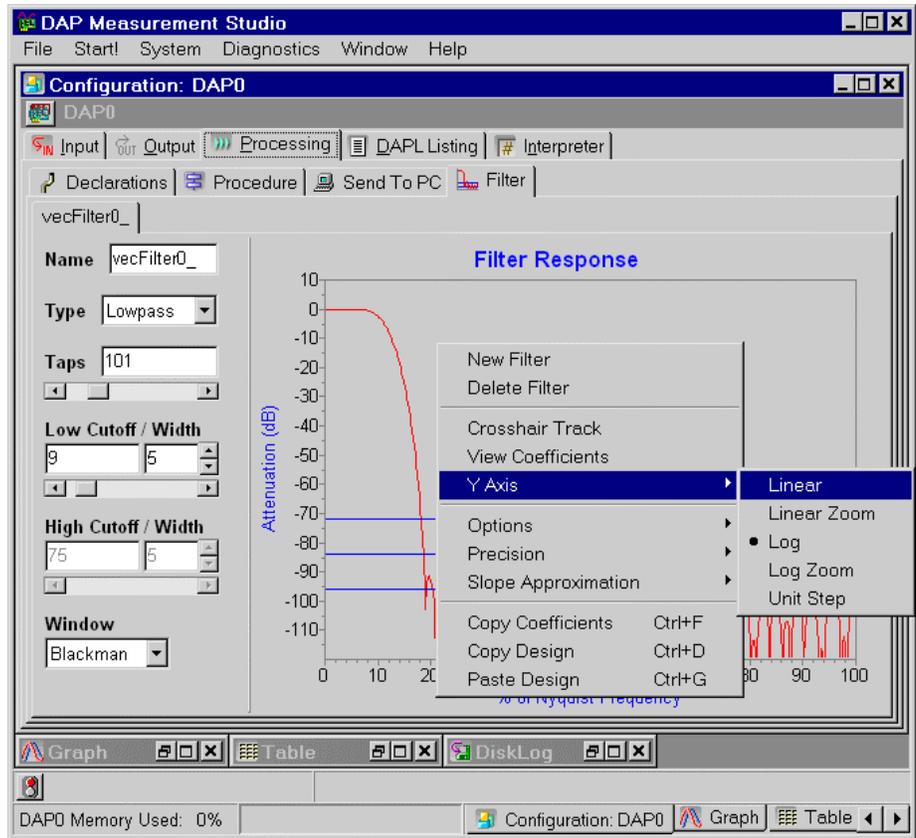
DAPstudio displays the amplitude response in various methods: linear, linear zoom, log, log zoom, and unit step units. This sample application displays the amplitude responses in linear units.

Create the application

1. Select the `Processing|Filter|vecFilter0_` tab.
2. Press the right mouse button to bring up a pop-up menu and select `Y Axis|Linear`.

Illustration

The following figure shows the pop-up menu.



App0606 Adjust Number of Taps

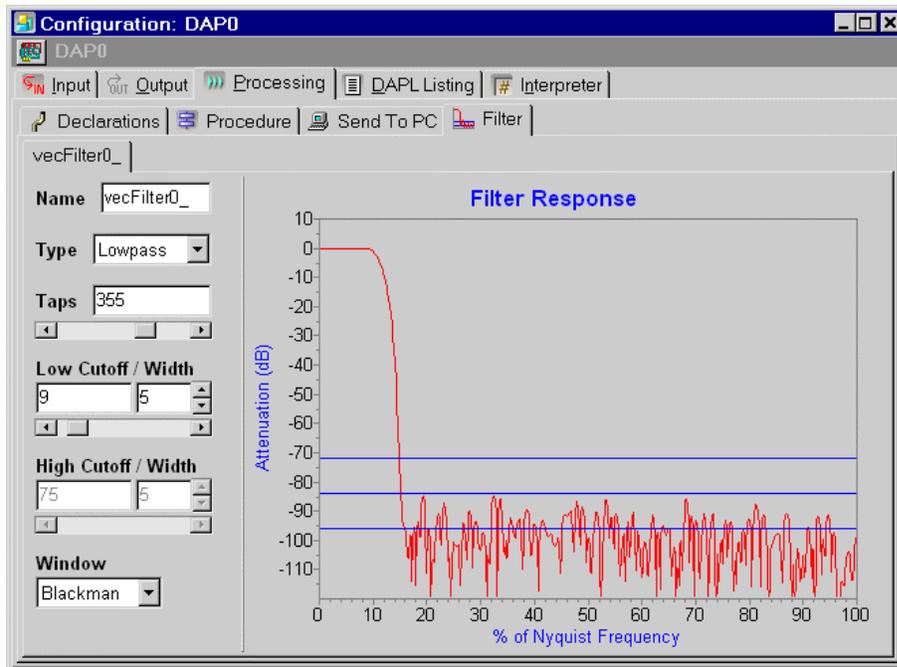
The number of taps determines the sharpness of the corner of the frequency response. By increasing the number of taps, this sample application increases the sharpness of the frequency response.

Create the application

1. Select the Processing | Filter | vecFilter0_ tab.
2. Adjust the number of taps by typing “355” in the Taps edit box or click and drag the slider until the Taps edit box displays 355.

Illustration

The following figure shows the filter design as described in step 2 in the Create the Application section.



App0607 Adjust Filter Phase Matching

The `FIRFilter` command applies software compensation to correct for the time and phase shifts introduced by the sampling process. This application applies a symmetric filter with 95 taps. The first output value calculated by the filter corresponds to the 48th input sample, sample number 47. To maintain sample count synchronization, this application replicates the first computed filter value an additional 47 times prior to applying decimation. It accomplishes this by setting the phase parameter in `FIRFilter` to 47.

Create the application

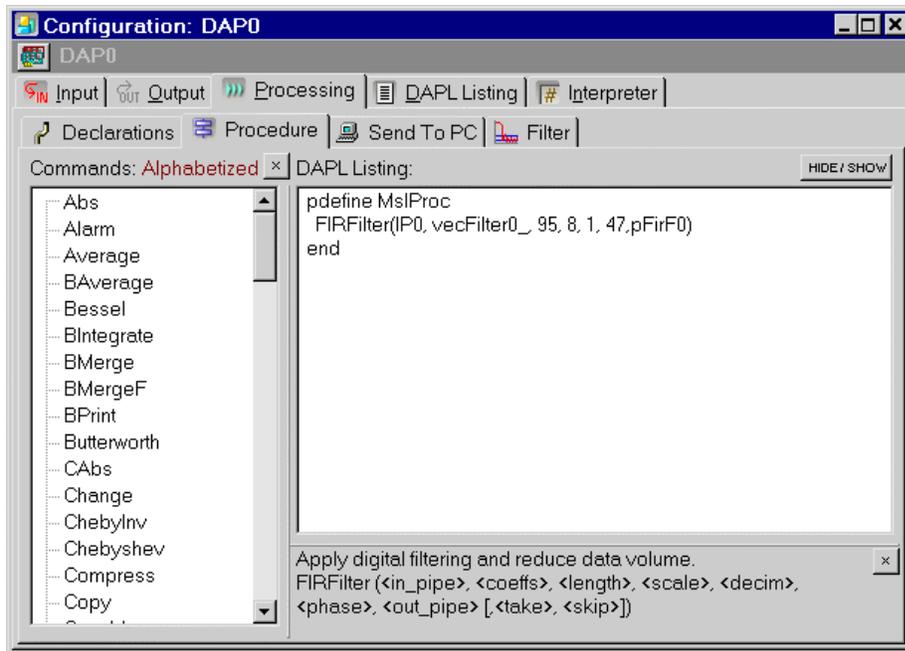
1. Select `File|New`.
2. Select 1 from the `Channels` combo box.
3. Select the `Processing|Procedure` tab.
4. In the `DAPL Listing edit` box, type “`FIRFilter(IP0, vecFilter0_, 95, 8, 1, -1, pFirf0)`” between “`pdefine MslProc`” and “`end`”. Please see [App0401](#) for step-by-step instructions on adding a DAPL command.
5. Change the value of the sixth parameter of `FIRFilter` from -1 to 47.
6. Select the `Processing|Send To PC` tab.
7. Highlight all channels with the mouse or change focus to the checkbox area and select `Ctrl-A`. Then press the space bar. The `IP0` checkbox is now unchecked, and instead the `pFirf0` checkbox is now checked
8. Open `Window|Graph`.
9. Select `Start!` or press `Alt-S` on the keyboard.

Sample Hardware Configuration

[HwCfg01 Basic Hardware Configuration](#)

Illustration

The following figure shows the DAPL listing as described in step 5 in the Create the Application section.



App0608 Change Filter Vector Type

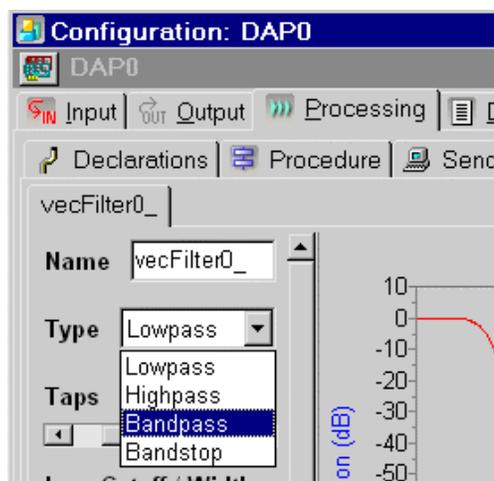
DAPstudio provides four types of filter response: lowpass, highpass, bandpass, and bandstop. The default type is lowpass. To remove the frequency components below low-cutoff and above high-cutoff limits, this application implements a digital bandpass filter.

Create the application

1. Select the Processing|Filter|vecFilter0_ tab.
2. Select Bandpass from the Type combo box.

Illustration

The following figure shows the drop-down list for the different types of filter designs.



App0609 Filter Scaling and Zero Stripping

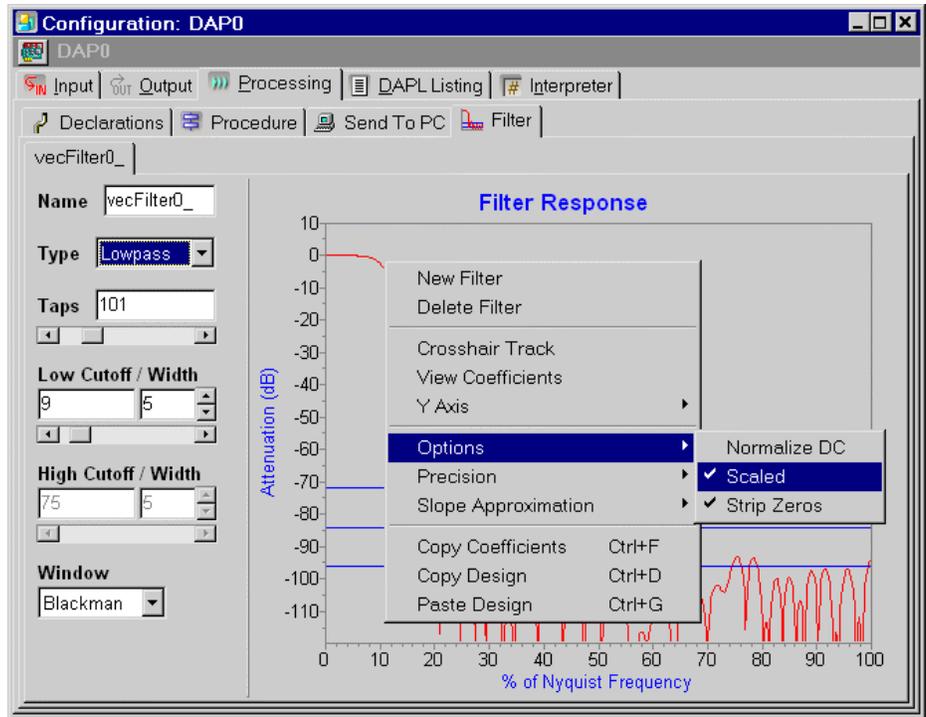
DAPstudio allows scaling the coefficients of a FIR filter. The scaling and zero stripping properties are on by default. This sample application turns off these properties. Therefore, zeros will be added at the beginning and end of the filter vector.

Create the application

1. Select the `Processing|Filter|vecFilter0_` tab.
2. Press the right mouse button to bring up a pop-up menu, then select `Options|Scaled` to turn on/off scaling.
3. Press the right mouse button to bring up a pop-up menu, then select `Options|Strip Zeros` to turn on/off zero stripping.

Illustration

The following figure shows the pop-up menu for selecting different options for the filter response display.



App0610 Change to Slope Approximation

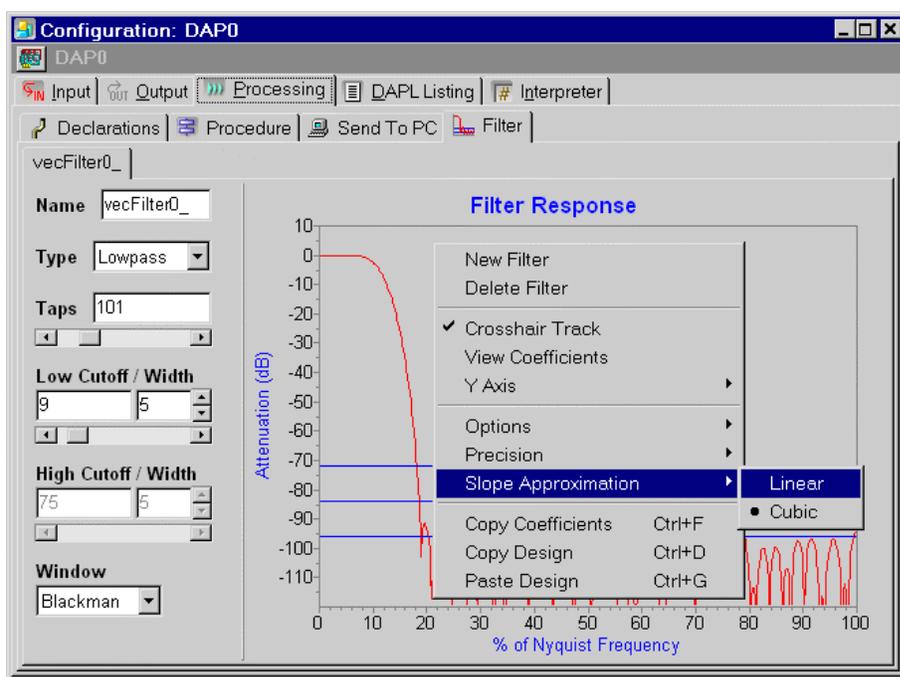
DAPstudio provides slope approximation with a linear or a cubic function. This application applies a linear slope approximation on a filter design.

Create the application

1. Select the Processing|Filter|vecFilter0_ tab.
2. Press the right mouse button to bring up a pop-up menu, then select Slope Approximation|Linear.

Illustration

The following figure shows the pop-up menu for the slope approximation options.



App0611 Change Window Vector

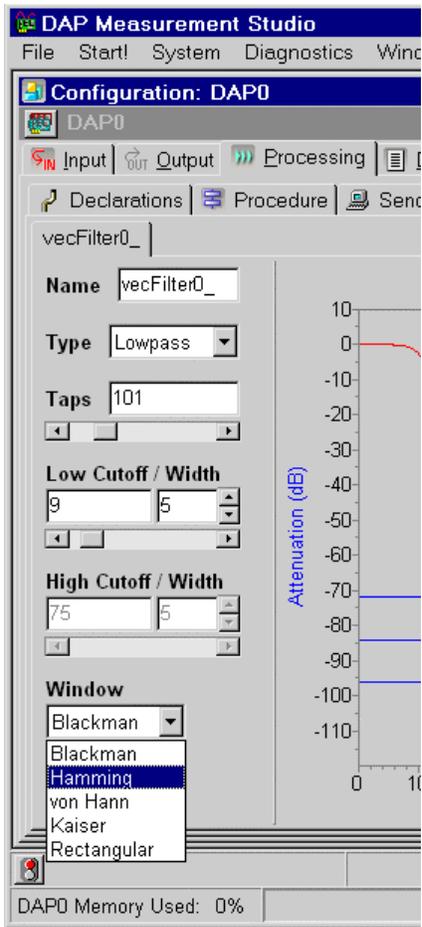
DAPstudio can produce several Window vector types: Blackman, Hamming, von Hann, Kaiser, and Rectangular. This application displays the filter in a Hamming window.

Create the application

1. Select the Processing|Filter|vecFilter0_ tab.
2. Select Hamming from the Window combo box.

Illustration

The following figure shows the drop-down list for different types of windows.



App0612 Create a Bandpass Filter

See App0608.

App0613 Change Cutoff Slope

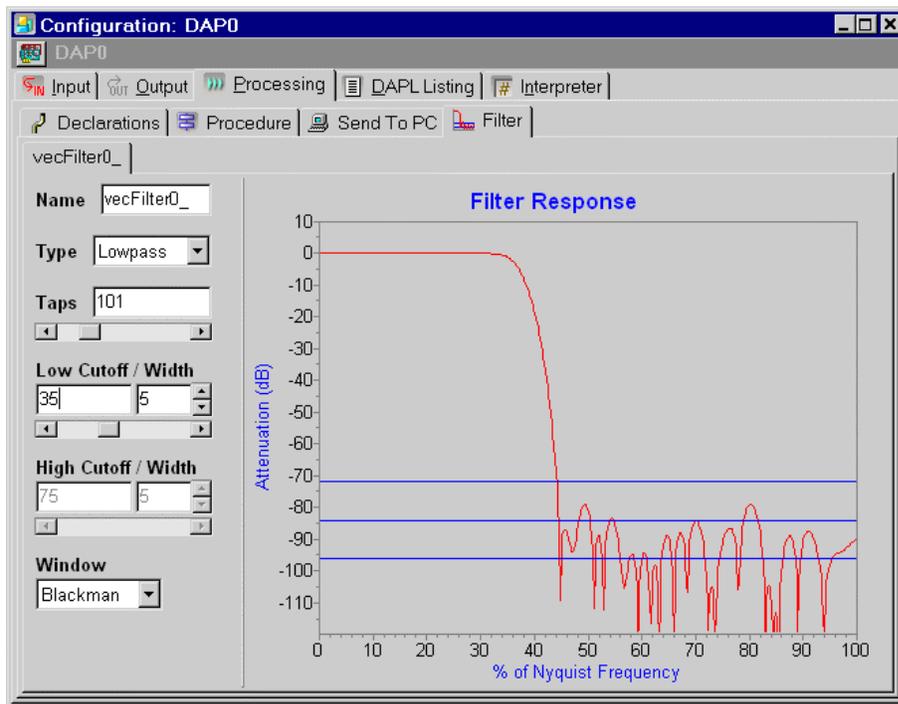
This application designs a filter with a cutoff frequency at 35% of the Nyquist Frequency.

Create the application

1. Select the Processing|Filter|vecFilter0_ tab.
2. Type “35” in the left hand side edit box below Low Cutoff/Width.

Illustration

The following figure shows the filter design as described in step 2.



App0614 Use Crosshairs to Track Actual Filter Response

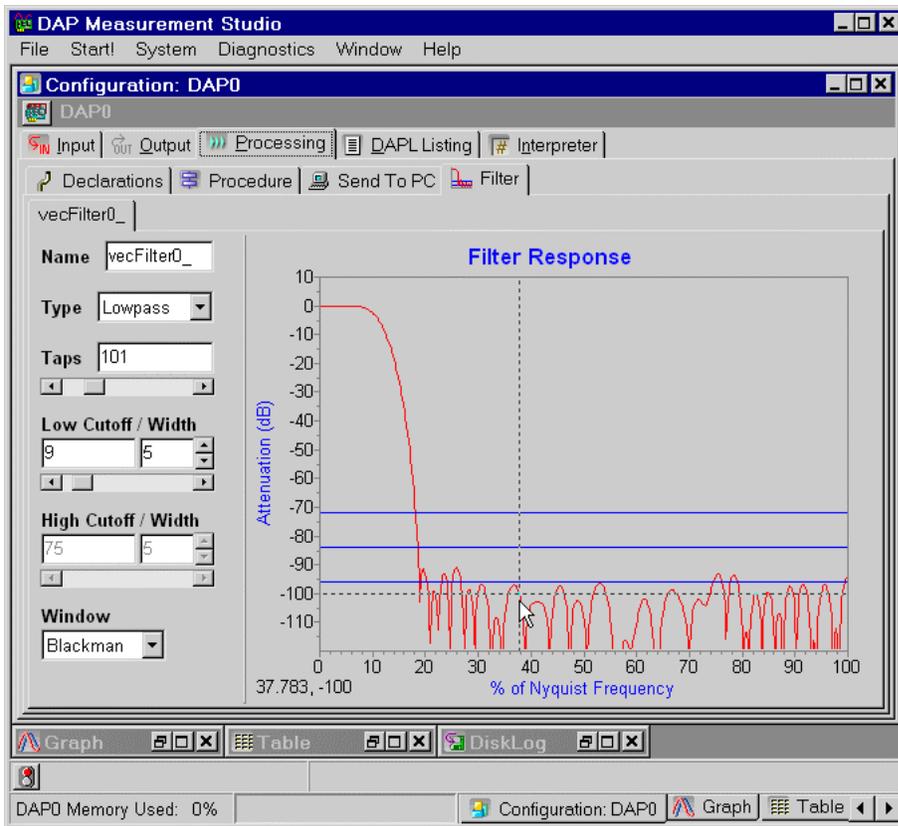
It is helpful to know the exact numbers associated with a point on a graph. DAPstudio provides a pair of crosshairs to track the actual filter response. The numerical data below the Filter Response graph display the filter response at the crosshairs.

Create the application

1. Select the Processing|Filter|vecFilter0_ tab.
2. Press the right mouse button to bring up a pop-up menu and select Crosshair Track.
3. Move the mouse cursor over the graph area, press the left mouse button, and drag it to display a pair of crosshairs.

Illustration

The following figure shows a pair of crosshair tracking the filter response. The coordinates are displayed at the bottom left hand corner.



App0615 Export Filter Coefficients

Sometimes it is handy to import the filter coefficients into a text editor for further processing. DAPstudio provides a utility to export filter coefficients. They are saved in a text file suitable for input into another text editor, such as Notepad.

Create the application

1. Select the `Processing|Filter|vecFilter0_` tab.
2. Press **Ctrl-F** on the keyboard or the right mouse button to bring up a pop-up menu and select `Copy Coefficients`.
3. Paste the filter coefficients into another text editor, such as Notepad.

App07 Design FFTs

Learn how to use the built-in DAPL FFT command and how to graph and display the FFT in the most useful way.

App0701 Use the FFT Command

This application shows how to use the FFT command, a task that calculates fast Fourier transforms of blocks of data. The DAP board samples one input signal, applies FFT to input data and sends the results to the host PC. The host PC then displays the data in a graph.

This application calculates a forward transform on real input data and outputs complex data. It uses 32-bit arithmetic for accumulating intermediate results.

Create the application

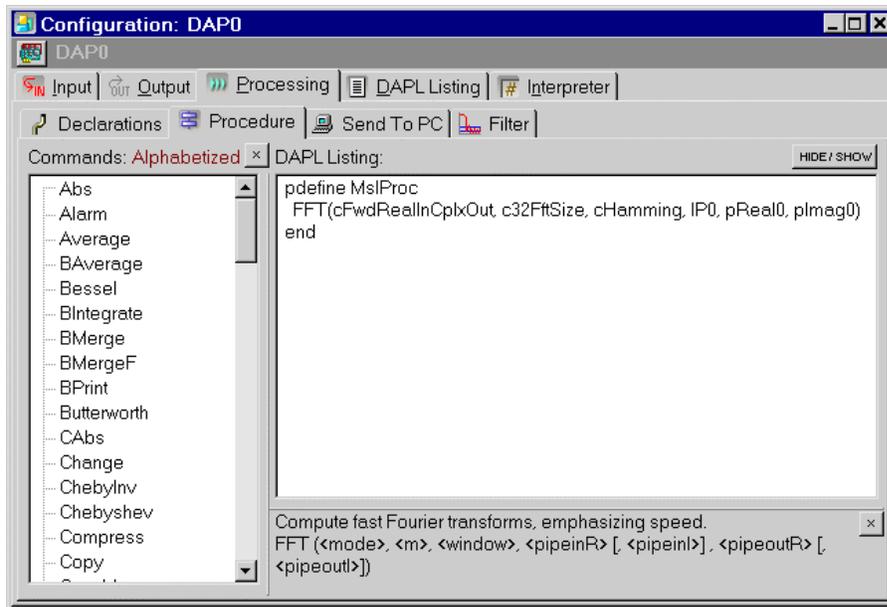
1. Select File|New.
2. Select 1 from the Channels combo box.
3. Select the Processing|Procedure tab.
4. In the DAPL Listing edit box, type “FFT(cFwdRealInCplxOut, c32FftSize, cHamming, IP0, pReal0, pImag0)”. Please see [App0401](#) for step-by-step instructions on adding a DAPL command.
5. Select the Processing|Send To PC tab.
6. Highlight all channels with the mouse or change focus to the checkbox area and select **Ctrl-A**. Then press the space bar. The IP0 checkbox is now unchecked, and instead the pImag0 and pReal0 checkboxes are now checked.
7. Open Window|Graph. Both channels pReal0 and pImag0 are selected for graphing.
8. Select Start! or press **Alt-S** on the keyboard.

Sample Hardware Configuration

[HwCfg01 Basic Hardware Configuration](#)

Illustration

The following figure shows the DAPL listing as described in step 4.



Download the Application

Use the configuration file App0701.dms in the Apps sub-directory of the installation path to run this application in DAPstudio.

App0702 Graph FFT Magnitude

This application graphs the FFT magnitude. It generates sawtooth and sine waves for interesting FFT Data.

The application shows the raw data in one graph and the FFT in another.

Create the application

1. Select File|New.
2. Either open file \Apps\App0702.dms and run it or follow these instructions to create the application.
3. In the Input|Pipes tab, uncheck the Enabled checkbox.
4. Select the Processing|Procedure tab.
5. In the DAPL Listing edit box, type “Sawtooth(cAmpl0, cPeriod0, pSawtth0)”. Please see [App0401](#) for step-by-step instructions on adding a DAPL command.
6. Type “SineWave(cAmpl1, cPeriod1, pSine0)”.
7. Use Ctrl-C/Ctrl-E to copy/paste/increment the SineWave command line. Please see [App0406](#) for step-by-step instructions on reproducing a command with auto-increment parameters.
8. Type the DAPL expression “pData0 = pSawtth0 - pSine0 + pSine1” in the following line.
9. Type the FFT command “FFT(cFwdRealInMagOut, clkFftSize, cBlackman, pData0, pFftMag0)”.
10. Select the Processing|Declarations tab.
11. Change the values for the variables to the following
constants cAmpl0 word = 15000
constants cAmpl1 word = 9000
constants cAmpl2 word = 7000

constants cPeriod0 word = 128
constants cPeriod1 word = 100
constants cPeriod2 word = 32000
12. Select the Processing|Send to PC tab.
13. Click the pData0 checkbox for \$BinOut.

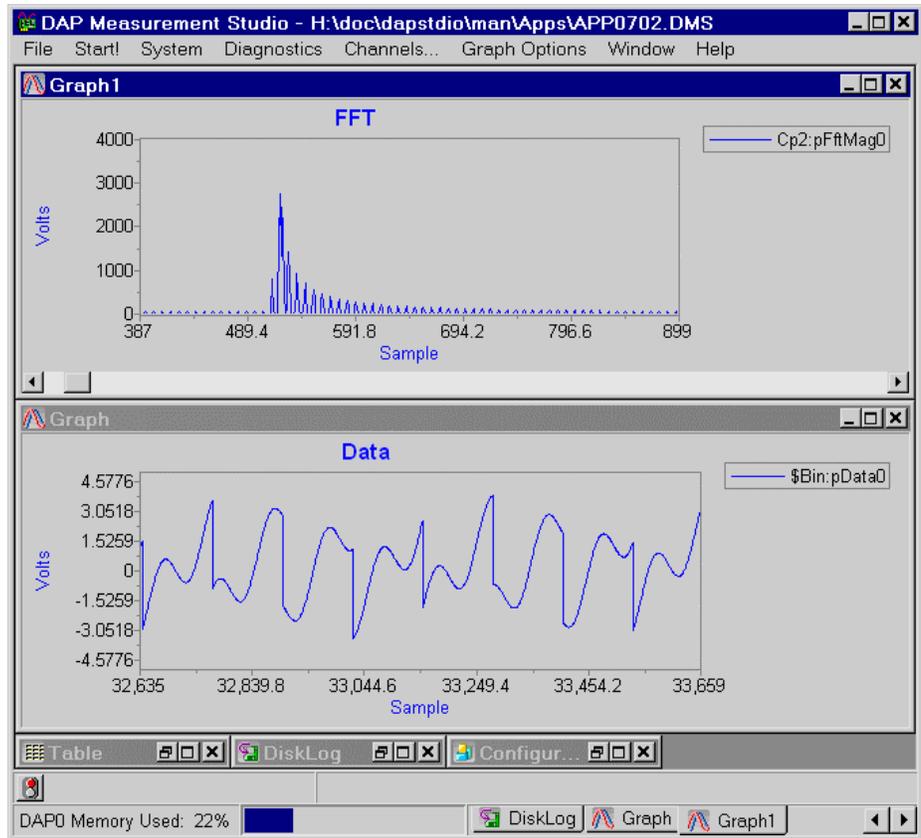
14. Click the **Change** button for the **DAPL Listing** edit box and enter **100000.00** in the **Rate, s/s/ch** edit box.
15. Click the **\$BinOut** link to access additional communication pipes.
16. Click the checkbox next to the **Cp20out** communication pipe to select it and click the **pFftMag0** checkbox to create the **MERGE** command.
17. Minimize the **Configuration Window**.
18. Select **Window|Graph**.
19. Select **Window|New Graph|Data Acquisition**.
20. Select the **Channels...** menu item and move the mouse across the channel buttons so that **\$Bin:pData0** is unselected and **Cp2:pFft2Mag** is selected. Click **OK**.
21. Select **Window|Tile Horizontally**.
22. Double-click on the **Graph** window so that the **Graph Display** interface appears.
23. Select the **Titles/Axis** tab. In the **View Points** edit box enter **1024**. For more step-by-step instructions to configure a **Graph Display**, see applications [App0506](#) and [App0507](#). Click **OK**.
24. Double-click on the **Graph1** window so that the **Graph Display** interface appears. Select the **General** tab and change the **History** to **16384**.
25. Select the **Title/Axis** tab. Change the **Top title** to **FFT** and the **Left title** to **Digital**. Change the **Left Axis** to **Digital** with a **Min** of **0** and a **Max** of **4000**. In the **View Points** edit box enter **512**.
26. Click **OK**.
27. Select **Start!** or press **Alt-S** on the keyboard.

Sample Hardware Configuration

[HwCfg01 Basic Hardware Configuration](#)

Illustration

The following figure shows the application after running.



Download the Application

Use the configuration file App0702.dms in the Apps sub-directory of the installation path to run this application in DAPstudio.

App0703 Display Data in FFT Blocks

This application shows how to take the data generated in the previous application and display the data in FFT blocks. The top graph shows the FFT of the bottom graph's raw data.

Block Scroll is useful in this application for FFTs, so that the data can be displayed in each FFT block. The fixed limits are used for the x-axis that the x-axis does not increment by the FFT block size. Run [App0702](#) and then this application to see the benefits provided by the display changes made in this application.

Create the application

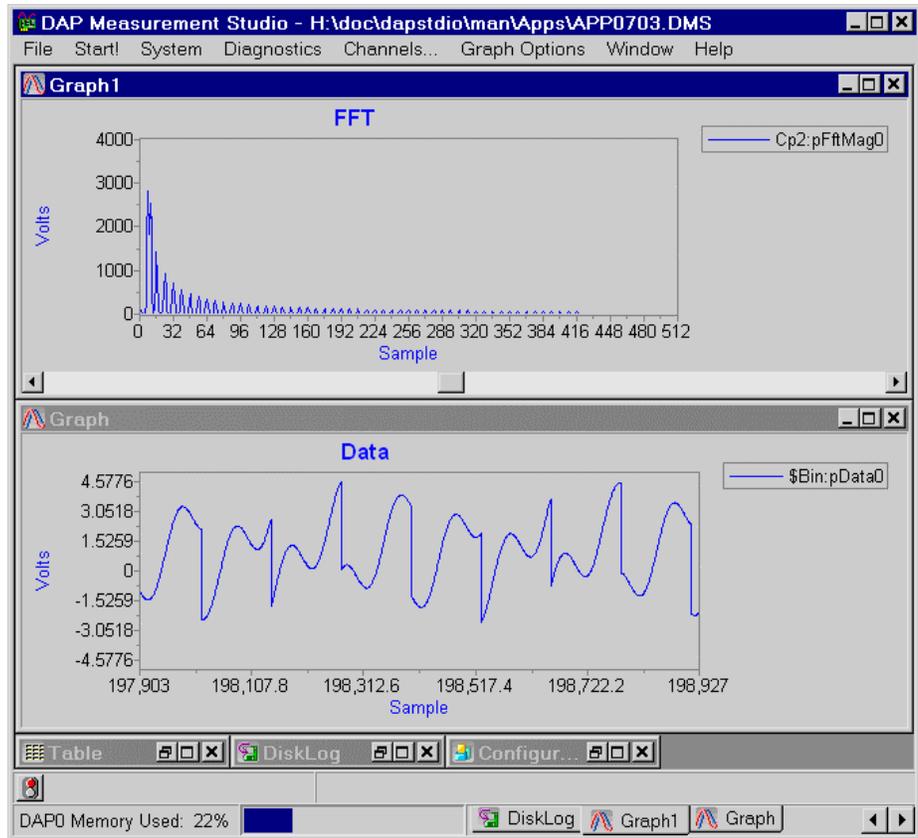
1. Start with the steps in [App0702](#) select file `\Apps\App0702.dms` and run it. Then follow these instructions to create the application. Or select file `\Apps\App0703.dms` and run it.
2. Double-click on the Graph1 window so that the Graph Display interface appears. For more step-by-step instructions to configure a Graph Display, see applications [App0506](#) and [App0507](#).
3. Enter 512 in the Block Scroll edit box.
4. Click the Fixed Limits checkbox in the Bottom Axis group box and enter a Min value of 0, a Max value of 512, and an Inc (increment) value of 32. Click OK.
5. Select Start! or press **Alt-S** on the keyboard.

Sample Hardware Configuration

[HwCfg01 Basic Hardware Configuration](#)

Illustration

The following figure shows the application after it was run.



Download the Application

Use the configuration file App0703.dms in the Apps sub-directory of the installation path to run this application in DAPstudio.

App08 Create a Control Application

This application uses a previously created configuration – “PID Tuning: Simple Direct Feedback Artificial System Under Test in Step Response Display” – to demonstrate what a useful tool DAPstudio can be for creating your control application.

App0801 PID Tuning: Simple Direct Feedback Artificial System Under Test in Step Response Display

This application runs a PID loop tuning demo for the `PID1` command. This simulation is very much like a real world PID application, except that simulated values are substituted for the actual measurements as they are captured in real time.

The simulated system is unusually hard to control because it is slow to change its operating level, but pushing hard excites a potentially damaging wobble. The goal of the simulation is to select P, I, and D gains to move the system to a new operating level quickly, while not over-stimulating that wobble.

In the plot, the green curve (`pSetpt`) shows the desired new operating level, the blue curve (`pPIDin`) shows the system response, and the red curve shows the drive signal applied by the PID controls (`pPIDout`). In general, the PV gain makes the controller push harder, the IV gain makes the controller correct persistent offsets, and the DV gain opposes oscillations.

For more information on tuning PID control by simulation, see Technical Note 031 at <http://www.mstarlabs.com/docs/tn031.html>.

Create the application

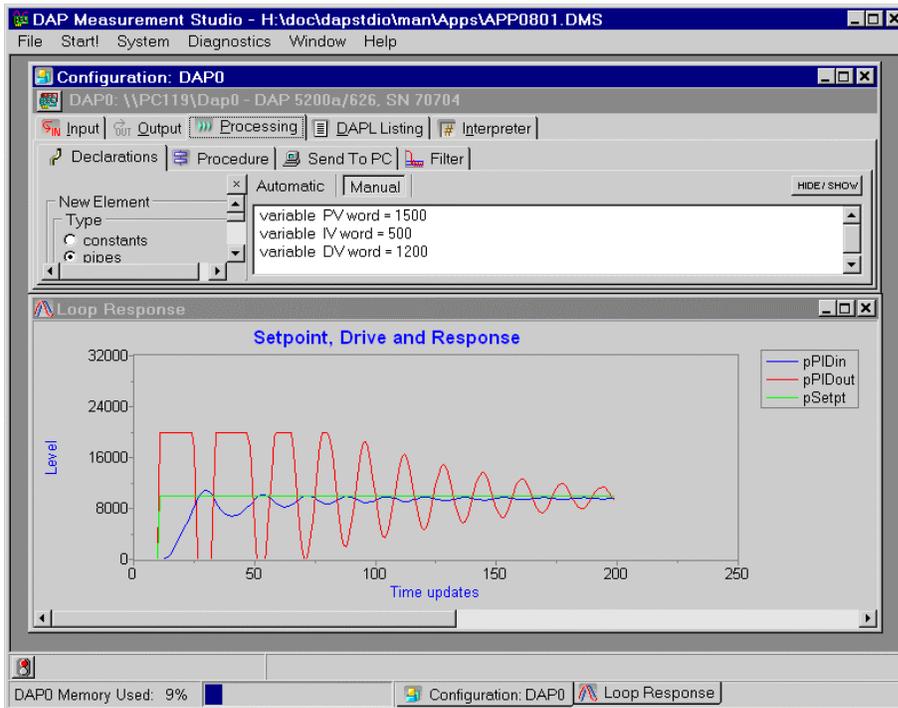
1. Select `File|Open`.
2. Select file `\Apps\App0801.dms`.
3. Select `Processing|Declarations` tab in the Configuration window and select the `Manual` button to see the gain variables that may be adjusted.
4. Select `Start!` or press `Alt-S` on the keyboard.
5. Observe the effects of the default gain variables.
6. Select `Stop!` or press `Alt-S` on the keyboard to end the simulation run.
7. In the `Configuration|Processing|Declarations` tab, adjust the declared values for the manual variables. The values of the three gain variables can be adjusted up or down.
8. After you have made an adjustment, use steps 4 through 6 to run the simulation again.
9. Make as many adjustments to the variables and run the simulation as many times as you wish, remembering the goal: a smooth, rapid transition to the new operating level.

Sample Hardware Configuration

HwCfg01 Basic Hardware Configuration

Illustration

The following figure shows the loaded configuration after the program has been run the first time.



Download the Application

Use the configuration file App0801.dms in the Apps sub-directory of the installation path to run this application in DAPstudio.

App09 Configure Multiple DAP Boards

These applications show how to find, identify, and configure DAP boards when multiple boards are used in a single system.

App0901 Configure Two DAP Boards

DAPstudio can configure more than one DAP board. This application configures two DAP boards. The first DAP board samples two input signals and sends the digitized values directly to the host PC. The second DAP board samples four input signals and sends the digitized values directly to the host PC. The host PC then displays all six input signals in a graph. This application requires two DAP boards installed in the same PC.

Create the application

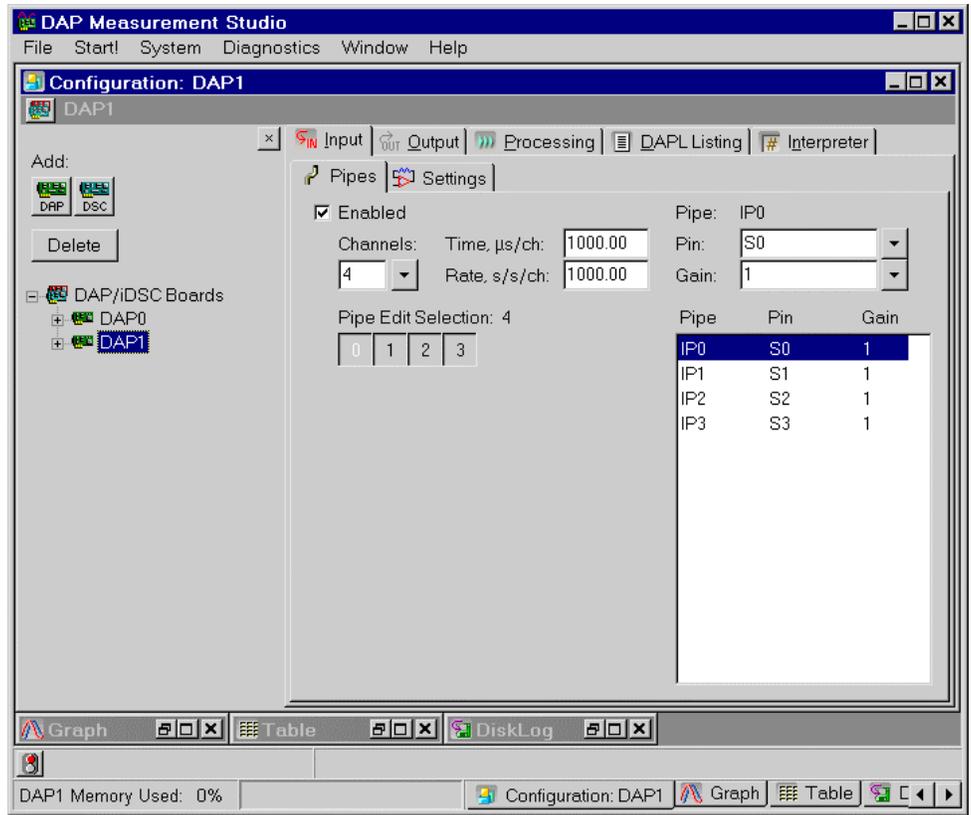
1. Select `File|New`.
2. Select `System|Multiple Boards Configure` or click the teal and red DAP icon at the top left of the Configuration window.
3. Select 2 from Channels combo box.
4. Click the Add DAP Button once.
5. Click DAP1 to highlight it.
6. Select 4 from the Channels combo box.
7. Open `Window|Graph` and select the Channels... menu item.
8. Click the button `DAP1:IP0` and drag the mouse to select all items through to the `DAP1:IP3` button. Then press the OK button. All six channels are now selected for graphing.
9. Select `Start!` or press `Alt-S` on the keyboard.

Sample Hardware Configuration

HwCfg03 Two DAP Boards

Illustration

The following figure shows the configuration as described in step 6.



App0902 Select a DAP Address

DAPstudio can search for and display all of the installed DAP boards and servers installed in a local machine. This application searches for and displays all of the installed DAP boards and servers attached to the local machine. This application requires two or more DAP boards to run.

Create the application

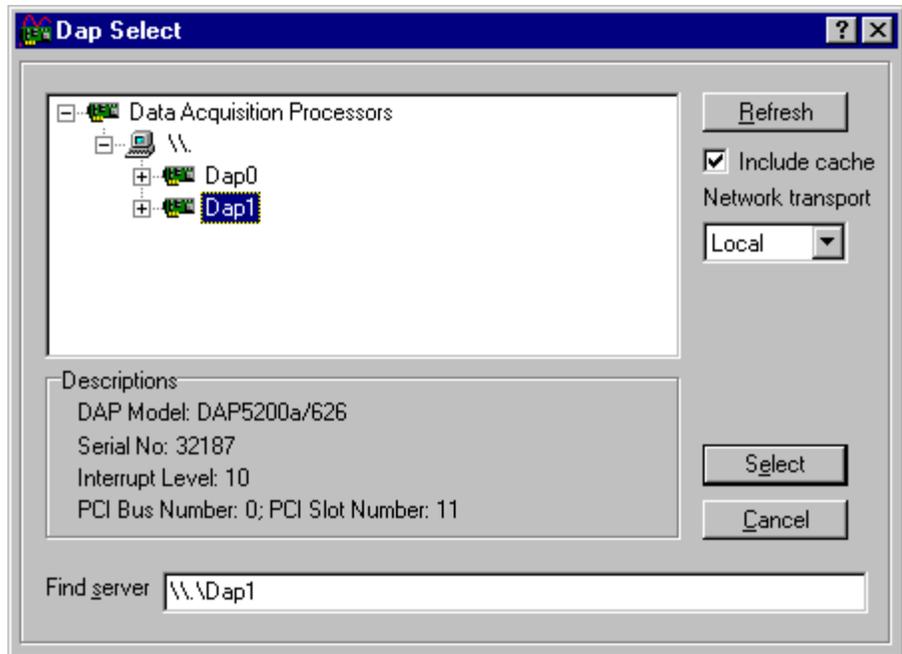
1. Select `File|New`.
2. Select `System|Address Select...`
3. Select `\\.` to move down one level in the search and display the DAP boards or servers on a PC.
4. Click on `DAP1` to highlight it and press the `Select` button.
5. Open `Window|Graph`.
6. Select `Start!` or press `Alt-S` on the keyboard.

Sample Hardware Configuration

[HwCfg03 Two DAP Boards](#)

Illustration

The following figure shows the address selection as described in step 4.



App0903 Browse for DAP Boards on a Network

DAPstudio allows access to DAP boards from a remote PC. Using DAPcell Server software, DAPstudio searches for and displays all of the DAP boards and servers installed in any machine on the same network. It allows you to access a DAP board remotely. The application requires at least two PCs, each with at least one DAP board installed, to run.

Create the application

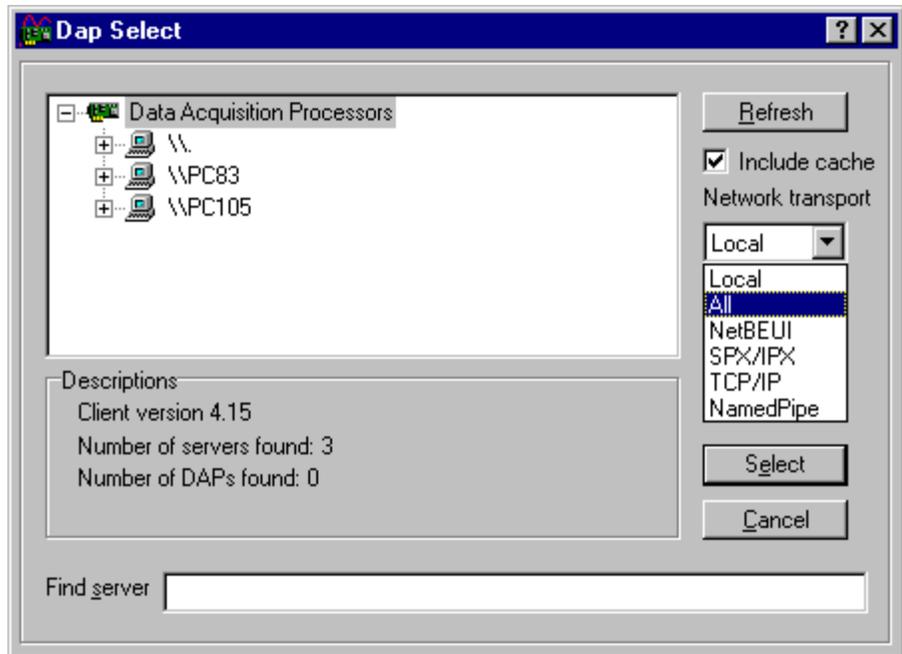
1. Select `File|New`.
2. Select `System|Address Select...`
3. Select `All from the Network transport` combo box and press the `Refresh` button.
4. Select the remote PC, `\\PC83` in the example illustration, to move down one level in the search.
5. Click on `DAP0` to highlight it and press the `Select` button.
6. Open `Window|Graph`.
7. Select `Start!` or press `Alt-S` on the keyboard.

Sample Hardware Configuration

[HwCfg03 Two DAP Boards](#)

Illustration

The following figure shows the selection from the Network Transport combo box on the right hand side. It also shows all available PCs on the network after performing step 3.



App0904 Copy and Paste a DAP Board Configuration

DAPstudio allows copying and pasting of configurations. It provides a fast and easy way to duplicate setup configurations for multi-DAP board systems. It also could minimize mistakes made manually. In this application, both DAP boards sample four input signals and send the digitized values directly to the host PC. The host PC then displays eight input signals in a graph. Instead of configuring each DAP board individually, this application minimizes the number of steps by copying the entire setup configuration from one to another. This application requires two or more DAP boards to run.

Create the application

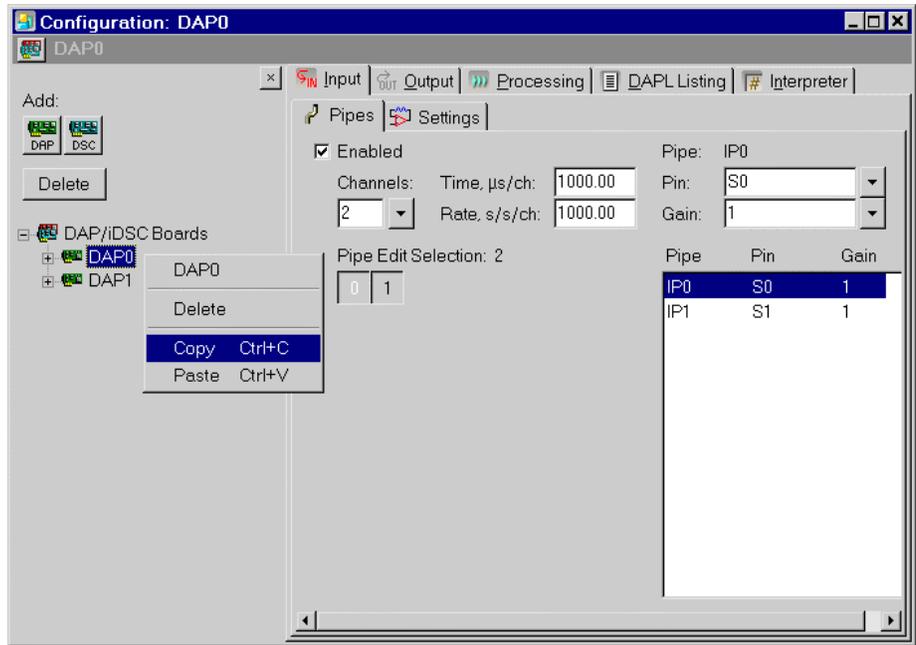
1. Select `File|New`.
2. Select `System|Multiple Boards Configure` or click the teal and red DAP icon at the top left of the Configuration window.
3. Select 2 from the Channels combo box.
4. Click the Add DAP button once.
5. Move the mouse cursor over DAP0 on the left hand side of the Configuration window, press the right mouse button to bring up a pop-up menu, and select Copy.
6. Move the mouse cursor over DAP1 on the left hand side of the Configuration window, press the right mouse button to bring up a pop-up menu, and select Paste.
7. Open `Window|Graph` and select the Channels... menu item.
8. Click the button DAP1:IP0 and drag the mouse to select all items through to the DAP1:IP1 button. Then press the OK button. All four channels are now selected for graphing.
9. Select `Start!` or press `Alt-S` on the keyboard.

Sample Hardware Configuration

HwCfg03 Two DAP Boards

Illustration

The following figure shows the pop-up menu as described in step 5.



App0905 Rename a DAP Board

DAPstudio can configure more than one DAP board. When working with multiple DAP boards, a more descriptive name than DAP0 or DAP1 may be helpful.

Create the application

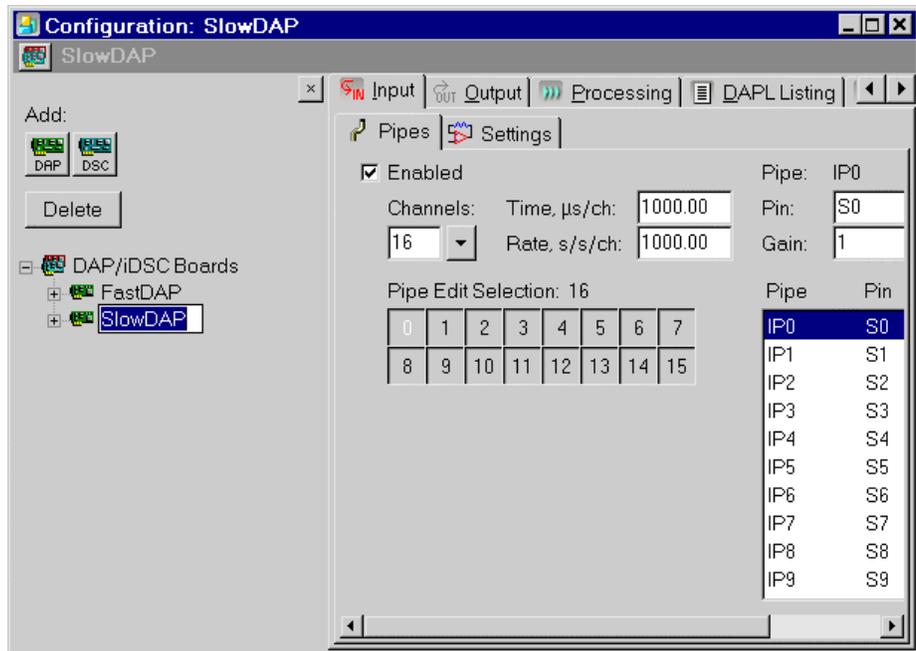
1. Select **File|New**.
2. Select **System|Multiple Boards Configure** or click the teal and red DAP icon at the top of the Configuration window.
3. Click the **Add DAP** button.
4. Click **DAP0** to highlight it. Click it again to make the text editable.
5. Enter the name **FastDAP** and hit **Enter**.
6. On the **Input|Pipes** tab, select **1** in the **Channels** combo box.
7. Click **DAP1** to highlight it. Click it again to make the text editable.
8. Enter the name **SlowDAP** and hit the **Enter** key.
9. On the **Input|Pipes** tab, select **1** from the **Channels** combo box and type **500** in the **Rate, s/s/ch** edit box.
10. Open **Window|Graph** and select the **Channels...** menu item.
11. Click the button **SlowDAP:IP0**. Then press the **OK** button. Both channels are now selected for graphing.
12. Double-click the **Graph** window to open the **Graph Display** interface.
13. On the **Colors/Legend** tab, click the **Use Grid Colors** button.
14. On the **General** tab, enter **10000** in the **History** edit box. Click **OK**.
15. Select **Start!** or press **Alt-S** on the keyboard.

Sample Hardware Configuration

[HwCfg03 Two DAP Boards](#)

Illustration

The following figure shows the configuration as described in step 8.



App0906 Use a Shortcut to Switch Between DAP Boards

A shortcut allows you to easily switch between multiple boards – DAP and iDSC boards – to configure them for your application.

Create the application

1. Select File|New.
2. Select System|Multiple Boards Configure or click the teal and red DAP icon at the top left of the Configuration window.
3. Click the Add DAP button twice.
4. Click the teal and red DAP icon at the top left of the Configuration window.
5. Put your mouse over the DAP name, DAP0, at the top of the Configuration window.
6. Click the DAP0 link and select DAP1 or DAP2.
7. Continue to configure each DAP for your application.

App10 Send Data to the PC

Set up one or more communication pipes for data to be sent from your DAP board to the PC.

App1001 Use a Single Communication Pipe

Using a single communication pipe to send data to the PC requires that the data rate for all channels be the same. This application samples data from sixteen channels. It then merges the data to the PC through a single communication pipe.

The data rate for all sixteen channels is the same, so a single communication pipe may be used. But if a data rate were different, like that for an additional Average command, an overflow error would be generated. How long it would take depends on the DAP board model used. Both streams of data go through until the system backs up and one channel or another fills completely, after which everything fails.

To transfer data of different rates, use multiple communication pipes rather than a single pipe. Each communication pipe can take data at any rate and send them through to the PC independent of the rate on any other communication pipe. See [App1002](#) for instructions on setting up multiple communication pipes.

Create the application

1. Select `File|New`.
2. Select `Processing|Send to PC` to see the input pipes sent to the PC through the default `$BinOut` communication pipe.
3. Open `Window|Graph`.
4. Select `Start!` or press `Alt-S` on the keyboard.

Sample Hardware Configuration

[HwCfg01 Basic Hardware Configuration](#)

App1002 Use Multiple Communication Pipes

DAPstudio allows you to send data to the PC using multiple communication pipes. This application samples data from sixteen channels. It averages the data from the first channel and then sends both the original data and the averaged data to the PC through two different communication pipes.

Create the application

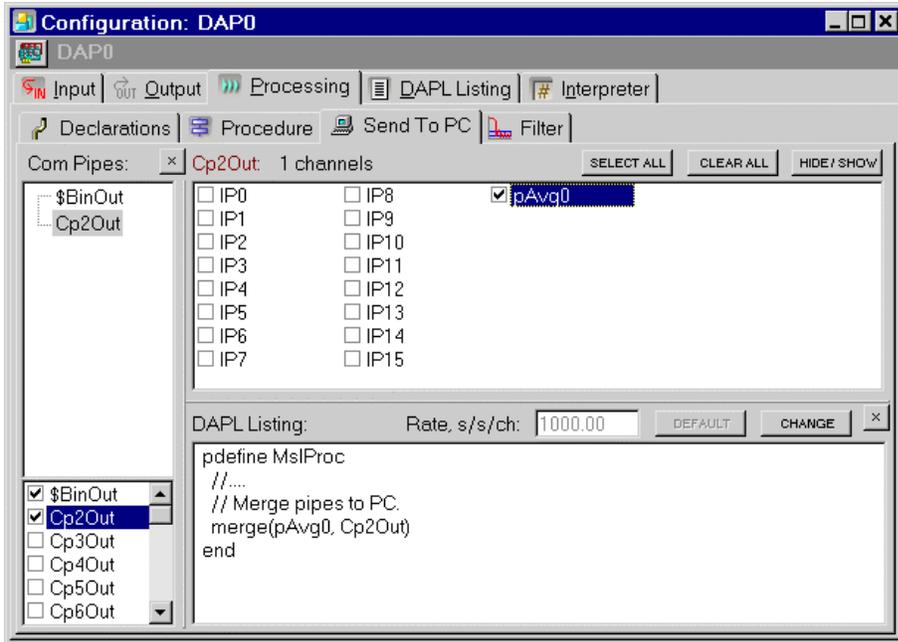
1. Select File|New.
2. Select Processing|Procedure.
3. In the DAPL Listing edit box, type “Average” and complete the command parameters with the default values. Please see [App0401](#) for step-by-step instructions on adding a DAPL command.
4. Select Processing|Declarations.
5. Change the constant value to 1000.
6. Select Processing|Send to PC.
7. Click the \$BinOut link to access additional communication pipes.
8. Click the Cp20out checkbox to add the Cp20out communication pipe.
9. In the Cp20out list box, click the pAvg0 checkbox to select it.
10. Select Window|New Graph|Data Acquisition.
11. Select Channels... and slide the mouse over the channel buttons. Only the Cp2:pAvg0 button is now selected. Click OK.
12. Select Window|Configuration and minimize the window.
13. Select Window|Graph.
14. Select Window|Tile Horizontally.
15. Select Start! or press Alt-S on the keyboard.

Sample Hardware Configuration

[HwCfg01 Basic Hardware Configuration](#)

Illustration

The following figure shows step 9 in the application.



App11 Server Disk Logging

Enable and use server disk logging.

App1101 Enable Server Disk Logging

This application shows how to enable server disk logging. Server disk logging is only supported with DAPcell or DAPcell Server for network logging, and is not supported by Accel32. Before enabling server disk logging in DAPstudio, please make sure that the appropriate permission and a valid default path are set through the Data Acquisition Processor Control Panel application. Please refer to the DAPcell Help or PDF file for detailed information.

Create the application

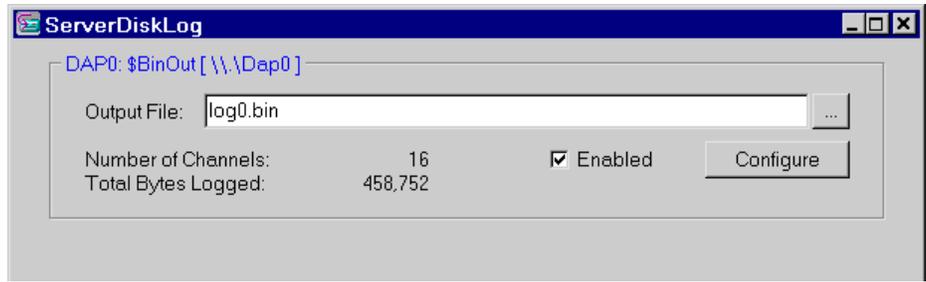
1. Select `File|New`.
2. Select `Window|New Server Disk Log`.
3. In the `ServerDiskLog` window, check the `Enabled` checkbox; this enables server disk logging.
4. In the `Output File` edit box, select a file using the `...` button, type a file name, or use the default file name.
5. Press the `Configure` button for specific [server disk log](#) configuration options.
6. Select `Start!` or press `Alt-S` on the keyboard.
7. The `Total Bytes Logged` label will show the number of bytes logged by the server.

Sample Hardware Configuration

[HwCfg01 Basic Hardware Configuration](#)

Illustration

The following figure shows the `ServerDiskLog` window with the `Total Bytes Logged` by the server.



App12 Use Diagnostic Features

These applications demonstrate how to use the diagnostic features of DAPstudio – Memory Used and the DAPL Interpreter – to troubleshoot and optimize your DAPL development.

App1201 Display Memory Used

DAPstudio gives you an easy way to see the memory used by all the DAP or iDSC boards in a system. The memory updates as the application runs.

Create the application

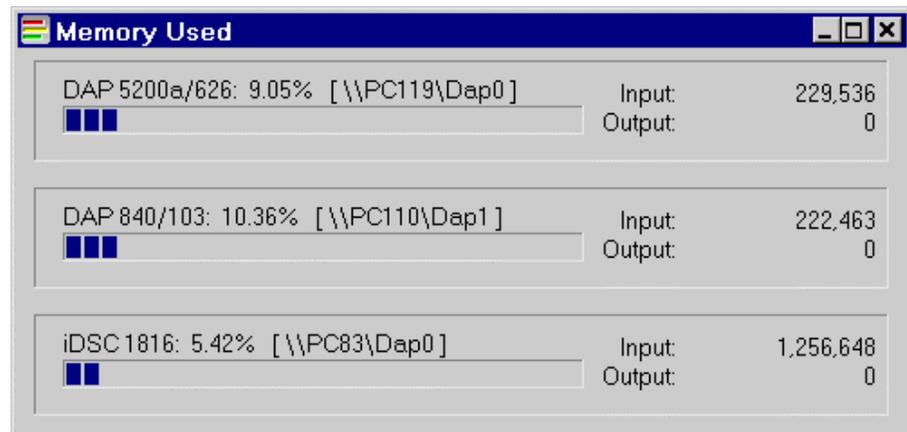
1. Select File|New.
2. Click on the teal and red DAP icon at the top of the Configuration window.
3. Click on the Add DAP button. For more information on configuring multiple DAP boards in a single application see section [App09](#).
4. Either double-click on the Memory Used bar at the bottom of the DAPstudio window or select Diagnostics|Memory Used... to open the Memory Used window.
5. Select Start! or press **Alt-S** on the keyboard.

Sample Hardware Configuration

[HwCfg03 Two DAP Board Configuration](#)

Illustration

The following figure shows the Memory Used window.



App1202 Open the Interpreter Window

DAPstudio gives you an easy way to see the DAPL code running on a DAP board. This application opens a separate Interpreter window for each DAP board in the configuration.

While code may be running on different boards, each Interpreter window will show only the information for one board. An Interpreter window may be opened for each DAP board but does not support iDSC boards. Each Interpreter window is in addition to the Interpreter tab; the window displays the same information as the tab if both reference the same DAP board.

Running this application requires connections to two DAP boards.

Create the application

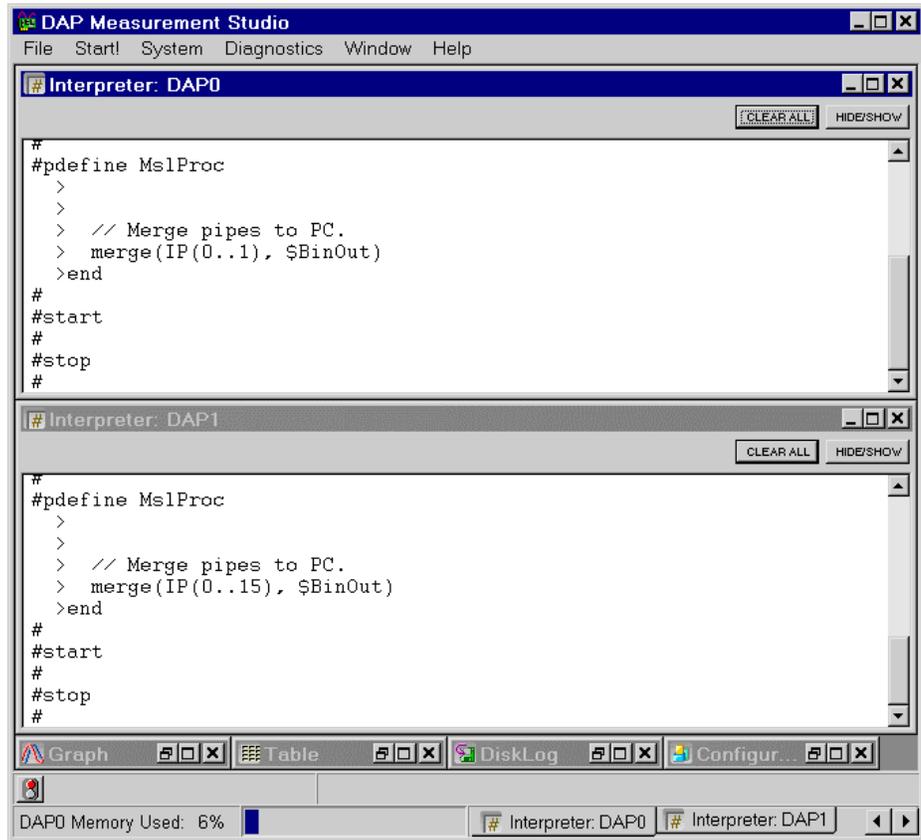
1. Select **File|New**.
2. Click on the teal and red DAP icon at the top of the Configuration window.
3. Click on the **Add DAP** button. For more information on configuring multiple DAP boards in a single application see section [App09](#).
4. Select **DAP0** from the **DAP/iDSC Boards** tree and change the **Channels** on the **Input|Pipes** tab to 2.
5. Select **Diagnostics|Interpreter...** to open the Interpreter window for DAP0.
6. Select **DAP1** from the **DAP/iDSC Boards** tree and then select **Diagnostics|Interpreter...** to open the Interpreter window for DAP1.
7. Minimize the Configuration window.
8. Select **Window|Tile Horizontally**.
9. Select **Start!** or press **Alt-S** on the keyboard.

Sample Hardware Configuration

[HwCfg03 Two DAP Board Configuration](#)

Illustration

The following figure shows the Interpreter windows after the application has run.



App1203 Use the Interpreter Commands

Interpreter windows and Interpreter tabs allow you to run commands on a DAP board, either by selecting from a list of options or typing a command into that list. This application shows how to obtain diagnostic information.

Use caution when entering commands while an application is running. Entering some commands, such as reset, will interfere with any active application.

Using `Ctrl+Send` or `Clear All` in the Interpreter window clears the window, but the Interpreter tab is not cleared, and vice versa.

Create the application

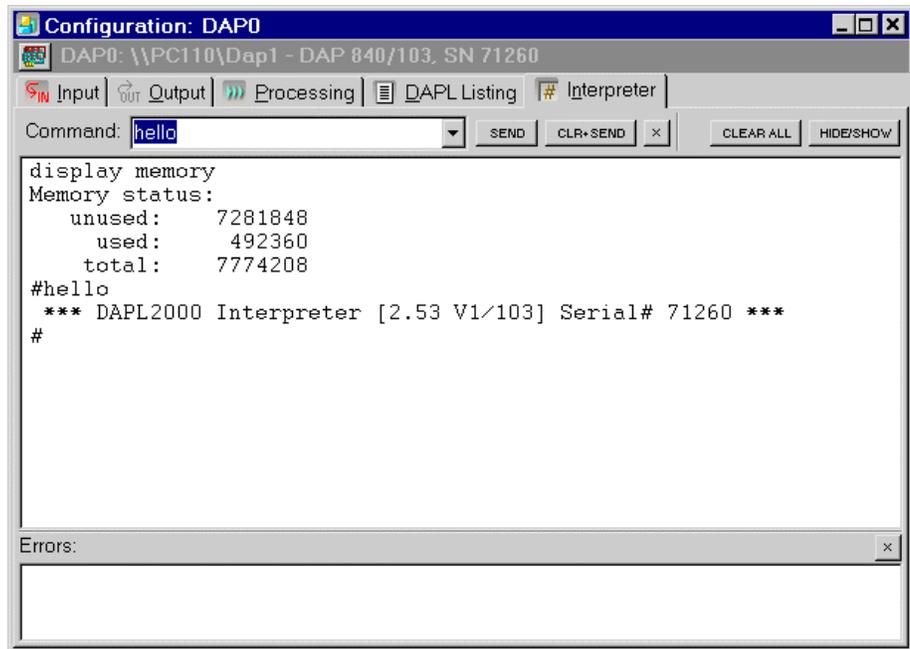
1. Select `File|New`.
2. Select `Diagnostics|Interpreter...` to open the Interpreter window or select the Interpreter tab.
3. Click the Hide/Show button to open the Command section.
4. Select `display memory` from the Command combo box.
5. Type “hello” in the Command combo box and hit the Enter key or click the SEND button.
6. Type “error” in the combo box followed by the `CLR+SEND` button. `CLR+SEND` clears the screen before sending the command to the DAP. error is not a valid command, so an error message is displayed.

Sample Hardware Configuration

[HwCfg01 Basic Hardware Configuration](#)

Illustration

The following figure shows the application after step 5.



App13 Use Table Features

Learn to use – and customize – the Table display window. Copy data from DAPstudio to another table-based application like Microsoft Excel. Configure each window to your own preferences and application requirements. Change column widths and history length displayed.

App1301 Copy/Paste Data from a Table to a Spreadsheet Program

DAPstudio makes it easy to transfer tables of data from DAPstudio to a preferred spreadsheet program. This application copies the data displayed in the table history and pastes it into another spreadsheet program. Selected rows or columns of data also may be copied and pasted separately.

Create the application

1. Select **File|New**.
2. Select 4 from the **Channels** combo box.
3. Open **Window|Table**.
4. Select **Start!** followed by **Stop!** when the experiment is complete.
5. Double-click on the table window or select **Table Options|Display...** and select the **Columns/Rows** tab.
6. Click the **Select All** button.
7. Click the **Copy** button and then the **OK** button.
8. Or instead of steps 5-7, press **Ctrl-A** on the keyboard to select all data displayed in the history. Then press **Ctrl-C** on the keyboard to copy the data to the clipboard.
9. Open a spreadsheet program, such as Microsoft Excel.
10. Paste the data into the spreadsheet program.

Sample Hardware Configuration

[HwCfg01 Basic Hardware Configuration](#)

Illustration

The following figure shows the configuration with 5 rows of data selected to copy.

Sample	IP0	IP1	IP2	IP3
1,158	30936	30256	30380	30380
1,159	30936	30272	30376	30380
1,160	30940	30268	30384	30376
1,161	30936	30260	30380	30380
1,162	30940	30248	30380	30376
1,163	30936	30240	30384	30380
1,164	30936	30248	30376	30376
1,165	30936	30232	30376	30376
1,166	30940	30236	30376	30380
1,167	30940	30224	30380	30372

App1302 Configure Column Widths and Row Heights

This application shows how to customize the column widths and row heights in a table.

Create the application

1. Select `File|New`.
2. Select 4 from the `Channels` combo box.
3. Open `Window|Table`.
4. Double-click on the table window or select `Table Options|Display...` and select the `Columns/Rows` tab.
5. Change the default 74 to 100 in the `Column Width` edit box.
6. Change the default 24 to 35 in the `Row Height` edit box. Click `OK`.
7. Select `Start!` or press `Alt-S` on the keyboard.

Sample Hardware Configuration

[HwCfg01 Basic Hardware Configuration](#)

App1303 Configure the Data History

This application shows how to change the number of data points saved in the table history. You may need more or less data than the default history of 500.

Create the application

1. Select `File|New`.
2. Select 4 from the `Channels` combo box.
3. Open `Window|Table`.
4. Select `Table Options|Display...`
5. Select the `General` tab.
6. Change the default 500 to 1000 in the `History` edit box. Click `OK`.
7. Select `Start!` or press `Alt-S` on the keyboard.

Sample Hardware Configuration

[HwCfg01 Basic Hardware Configuration](#)

App14 Use Alarm Features

This application introduces you to using the Alarm window by presenting a sample pass/fail application.

App1401 Create a Pass/Fail Application

DAPstudio makes it easy to indicate when a signal exceeds given limits for a pass/fail application. For interesting results, this application samples data from generated waveforms and reports data run to eight pipes. In the example, red is upper failure, yellow is lower failure, and green is pass.

Create the application

1. Select `File|New`.
2. Either open file `\Apps\App1401.dms` and run it or follow these instructions to create the application.
3. Select 4 from the `Channels` combo box.
4. Type `5.00` in the `Rate, s/s/ch` edit box.
5. Select the `Processing|Procedure` tab.
6. In the `DAPL Listing` edit box enter a `SineWave`, `Triangle`, `SquareWave`, and `Sawtooth` command lines with the three default parameters (amplitude, period, and output pipe). Please see [App0401](#) for step-by-step instructions on adding a DAPL command.
7. Add the following DAPL expression lines to create the eight pipes that will be read in the Alarm window.

```
p0 = pSine0 + (IP0 * 0)
p1 = pTriangle0 + (IP1 * 0)
p2 = pSquare0 + (IP2 * 0)
p3 = pSawtth0 + (IP3 * 0)
p4 = (pSine0 * 2) + (IP0 * 0)
p5 = (pTriangle0 * 2) + (IP1 * 0)
p6 = (pSquare0 * 2) + (IP2 * 0)
p7 = (pSawtth0 * 2) + (IP3 * 0)
```
8. Select `Processing|Declarations`.
9. Change the default constant definitions in the `Automatic` edit box to the following.

```
constants cAmpl0 word = 16000
constants cAmpl1 word = 30000
constants cAmpl2 word = 12000
constants cAmpl3 word = 8000
constants cPeriod0 word = 100
constants cPeriod1 word = 20
```

```
constants cPeriod2 word = 60
constants cPeriod3 word = 200
```

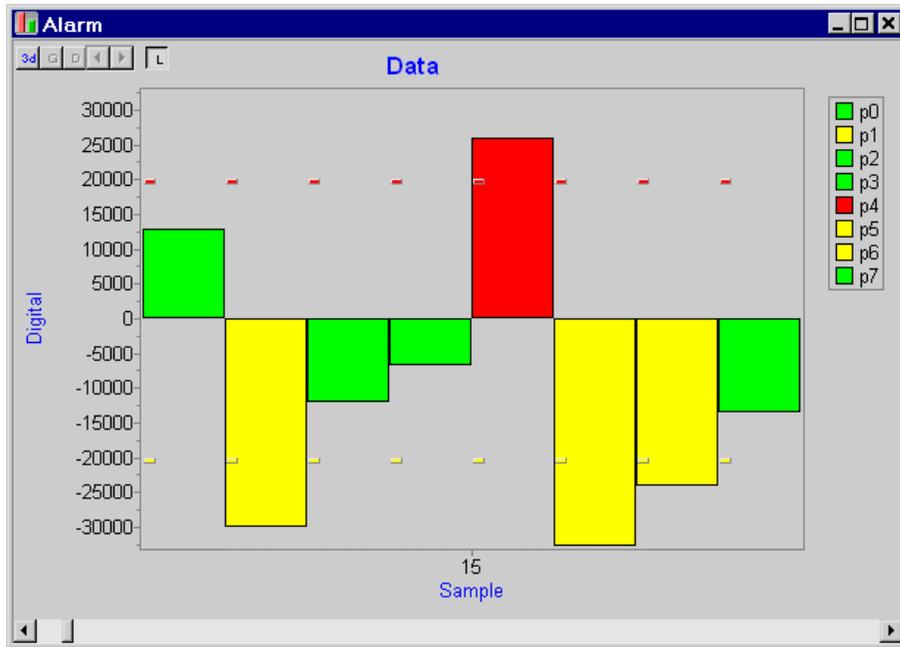
10. Select Processing|Send to PC.
11. Click the Clear All button.
12. Highlight p0 through p7 using the mouse and either hit the spacebar or click one of the boxes – all eight checkboxes will be selected.
13. Select Window|New Alarm|Data Acquisition.
14. Select Alarm Options|Display... or double-click on the Alarm window to open the Alarm Display interface.
15. In the Left Axis group box on the Titles/Axis tab, change from Voltage to Digital. In the Title group box, type “Digital” in the Left edit box.
16. Select the Colors/Legend tab and select green from the default color grid.
17. Click the All Color Same button.
18. Select the Alarm tab.
19. From the Type combo box, choose Min & Max. Click the All Type Same button.
20. Type -20000 in the Min edit box. Click the All Min Same button.
21. Type 20000 in the Max edit box. Click the All Max Same button.
22. Click the Min Color selection box and select yellow. Click OK.
23. Click the All Min Color Same button and the All Max Color Same button. Click OK.
24. Select Start! or press **Alt-S** on the keyboard.

Sample Hardware Configuration

[HwCfg01 Basic Hardware Configuration](#)

Illustration

The following figure shows the Alarm window after the program has been run.



Download the Application

Use the configuration file App1401.dms in the Apps sub-directory of the installation path to run this application in DAPstudio.

App15 Use Digital Volt Meter (DVM) Features

Learn to use – and customize – the Digital Volt Meter (DVM) display window. Configure windows to your own preferences and application requirements. Change background colors, titles, and more.

App1501 Configure the DVM Display

This application configures a Digital Volt Meter window so that several channels appear visually different from the others. You may also choose to make each channel the same using one of the All Channels Same buttons in the DVM Display interface.

Create the application

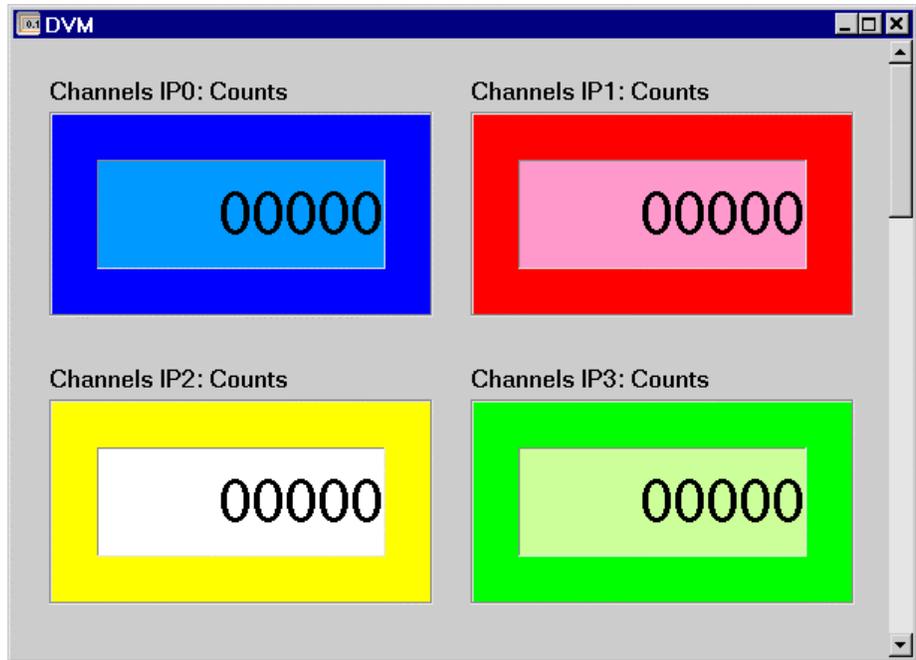
1. Select File|New.
2. Select Window|New Digital Volt Meter.
3. Select DVM Options|Display... or double-click on the DVM window.
4. Click on the Background color edit box and select the first custom color blue or your preferred color. Click the OK button.
5. Click on the Border color edit box and select the brighter custom color blue or your preferred color. Click the OK button.
6. Click the Apply button.
7. Select IP1 from the Channels drop-down box.
8. Click on the Background color edit box and select the first custom color rose or your preferred color. Click the OK button.
9. Click on the Border color edit box and select the brighter custom color red or your preferred color. Click the OK button.
10. Customize DVM displays for additional channels. Click the OK button.
11. Select Start! or press **Alt-S** on the keyboard.

Sample Hardware Configuration

[HwCfg01 Basic Hardware Configuration](#)

Illustration

The following figure shows the loaded configuration before the program runs.



Download the Application

Use the configuration file App1501.dms in the Apps sub-directory of the installation path to run this application in DAPstudio.

App16 Use Bar Features

Learn to use – and customize – the Bar graph display window. Configure windows to your own preferences and application requirements. Change background colors, bar colors, border colors, titles, history length displayed, axis units, and more.

App1601 Configure the Bar Graph Display

This application customizes a Bar graph window. For more information on configuring or using Bar graph displays, follow steps used for line graphs in [App05: Using Graph Features](#).

Create the application

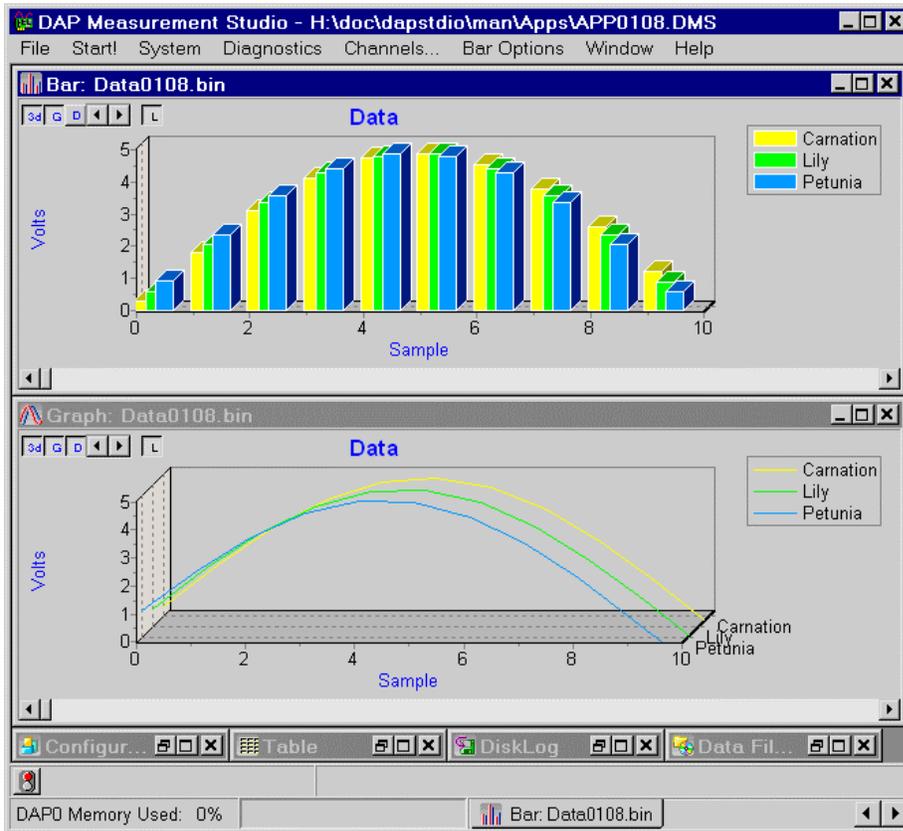
1. Select **File|Open...** and choose **App0108.dms**. Or open data file **Data0108.bin** as described in [App0108](#).
2. Select **Window|New Bar** and choose the **Data File: Data0108.bin** option.
3. Select **Channels...**. Press the left mouse button and drag the mouse across the channel grid. This deselects channels **Rose** and **Violet** and selects the other three channels. Click **OK**.
4. Double-click on the Bar window to open the **Bar Display** dialog. Or select **Bar Options|Display...**
5. Select the **Titles/Axis** tab. In the **Left Axis** group box, change **Min** to 0 and **View Points** to 10.
6. Select the **3D** tab. Check the **3D Enabled** checkbox.
7. Select the **Bar** tab. Click on the **Border Color** selection box and select white or your preferred color. Click the **OK** button.
8. Click the **All Border Same** button. Enter 40 in the **Overlap (%)** edit box. Click the **OK** button.
9. Click the **3d** button in the upper left of the Bar window and toggle back and forth to compare the flat and 3D Bar options.
10. Customize other **Bar Display** options as you prefer.
11. Select **Window|Tile Horizontally** to display both the original line Graph and the customized Bar graph window.

Sample Hardware Configuration

[HwCfg01 Basic Hardware Configuration](#)

Illustration

The following figure shows the Bar and Graph windows from step 11 of the Create the Application section.



App17 Use Waterfall Features

Learn to use – and customize – the `Waterfall` line graph display window. Use this window to display tens of thousands of samples of data from a single channel. Typically you use this kind of display for blocked data – such as FFT or other spectra – to allow you to see a time-history of the data blocks rather than just a time history of points. However, you can also use this window to view massive amounts of data from a single channel of time domain data rapidly.

App1701 Configure the Waterfall Display

This application introduces the Waterfall line graph display. For interesting results, it loads a data file from and configures one channel to be viewed over time in a Waterfall graph. For more on using the 3D features of the Waterfall graph, see App0508.

Create the application

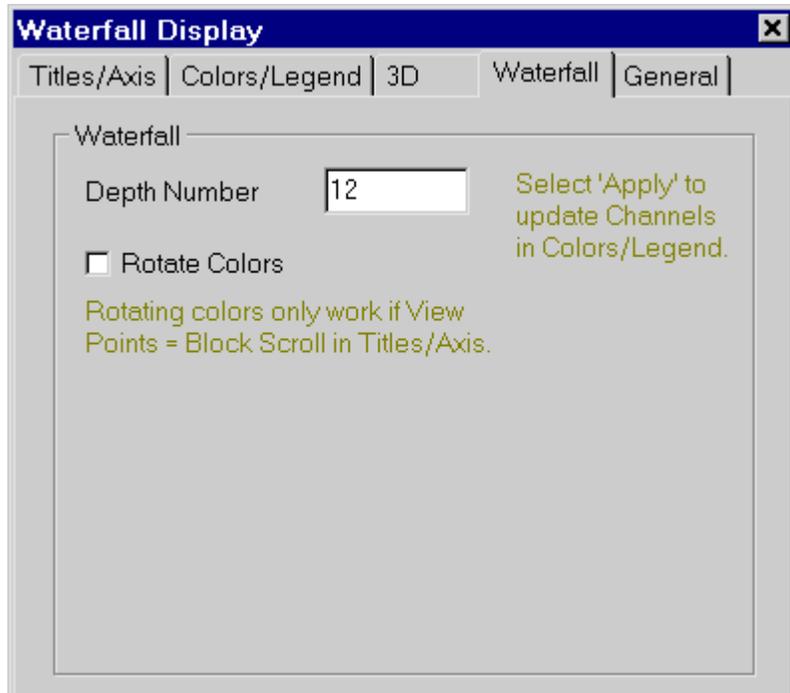
1. Select File|New.
2. Select Window|Open Data File and select DATA1701.BIN.
3. Select Window|New Waterfall|Data File: DATA1701.BIN.
4. Select Waterfall Options|Display... or double-click on the Waterfall window to open the Waterfall Display dialog.
5. Select the Titles/Axis tab. In the Bottom Axis group box, enter 256 in the View Points edit box and the Block Scroll edit box.
6. Select the Waterfall tab. Enter 12 in the Depth Number edit box and click the OK button.
7. Scroll from left to right to view the data over time.

Sample Hardware Configuration

[HwCfg01 Basic Hardware Configuration](#)

Illustration

The following figure shows changing the Depth Number in the Waterfall Display dialog, as described in step 6 of the Create the Application section.



App1702 View FFT Data in Customized Waterfall Graphs

This application configures two Waterfall graph windows, changing the axes, trace colors, depth, and other display options. For interesting results, this application loads a preexisting data file to display FFT data.

Create the application

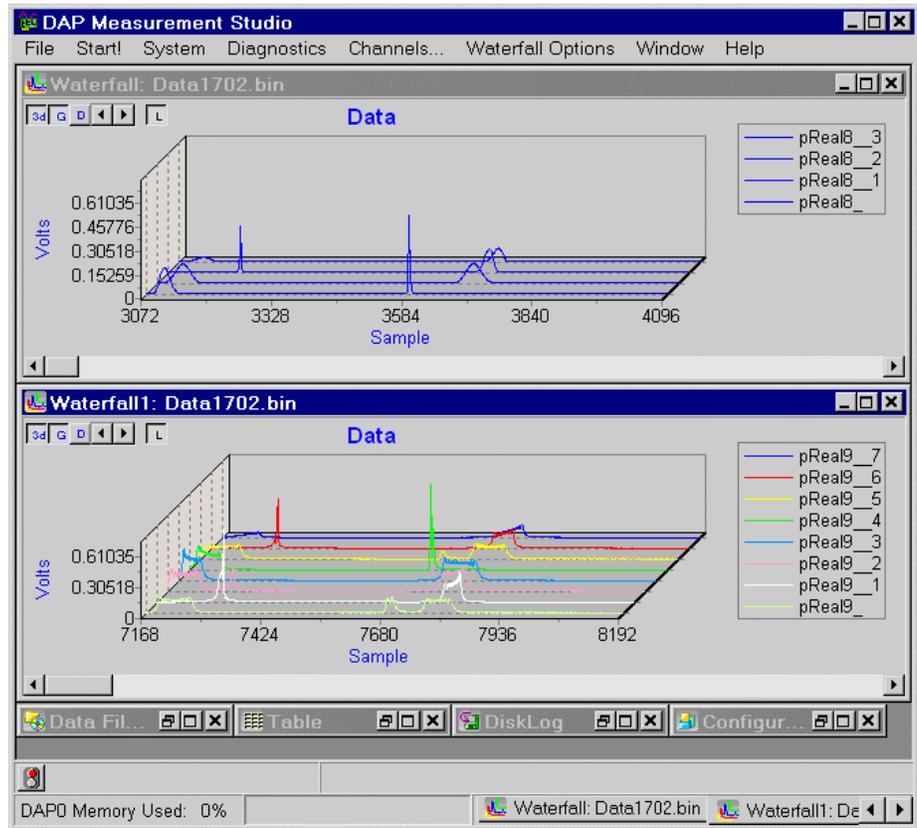
1. Select File|New. Minimize the Configuration window.
2. Select Window|Open Data File and select DATA1702.BIN. Minimize the Data File window.
3. Select Window|New Waterfall|Data File: DATA1702.BIN.
4. Select Waterfall Options|Display... or double-click on the Waterfall window to open the Waterfall Display dialog.
5. Select the Titles/Axis tab.
6. In the Left Axis group box, change Min to 0 and Max to 0.75.
7. In the Bottom Axis group box, enter 1024 in the View Points edit box and the Block Scroll edit box.
8. Select the 3D tab and click the Labels Visible checkbox to uncheck it.
9. Click the OK button.
10. Select Window|Clone Active Window.
11. Select Channels... and click on buttons pReal8_ and pReal9_ so that pReal9_ is the only channel selected. Click the OK button.
12. Select Waterfall Options|Display... or double-click on the Waterfall window to open the Waterfall Display dialog.
13. Select the Waterfall tab. Enter 8 in the Depth Number edit box, click the Rotate Colors checkbox to select it, and click the Apply button to save the changes.
14. Select the Colors/Legend tab and click the Use Grid Colors button. Click the OK button to return to the Waterfall window.
15. Select Window|Tile Horizontally.

Sample Hardware Configuration

HwCfg01 Basic Hardware Configuration

Illustration

The following figure shows the final configuration as described in step 15 of the Create the Application section.



Download the Application

Use the configuration file App1702.dms in the Apps sub-directory of the installation path to run this application in DAPstudio.

App18 Send Data to the DAP Board

Send data from your PC, in one or more files, to your DAP board.

App1801 Send a Data File with One Channel of Data to the DAP Board

This application introduces the `Processing|Send to DAP` tab. You may use this tab to send data to the DAP board to process it further. The data may also be used as analog or digital outputs on the DAP.

This application shows how to send a data file with one channel of data to the DAP board and then return the data to the PC. We provide this sample to illustrate how to send data to the DAP board. Returning the data to the PC allows us to graph the data, but you would not typically include this in a real application. Instead you would process the data on the DAP board and perhaps send those data to analog or digital outputs there.

Create the application

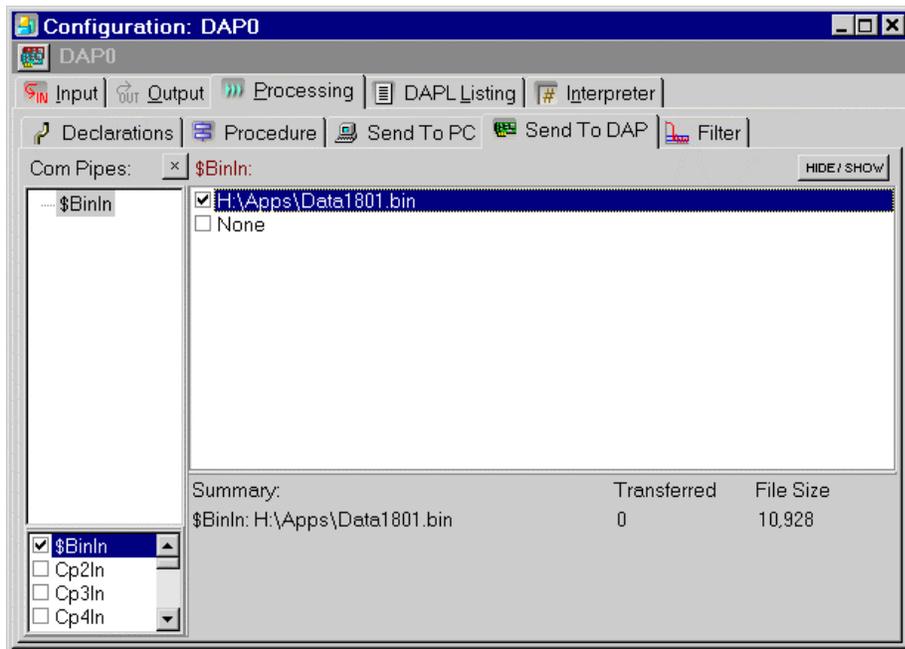
1. Select `File|New`.
2. Select the `Configuration|Processing` tab. Right-click on the second level of `Processing` tabs and select `Options...` from the pop-up menu.
3. Click to select the `Send to DAP` checkbox so that it is checked. Click the `OK` button.
4. Select the `Processing|Send to DAP` tab.
5. In the `Comm Pipes` selection checkboxes, check `$BinIn`. The information for the pipe displays in the file selection and summary sections of the `Send to DAP` tab. No data files are available, so `None` is shown.
6. Select `Window|Open Data File...` and select `DATA1801.BIN` and click `OK`. Minimize the `Data File` window.
7. The data file now is available for selection in the `Processing|Send to DAP` tab. Check the box next to the `DATA1801.BIN` file in the `$BinIn` checkboxes. The file size appears in the `Summary` section below.
8. Select the `Processing|Send to PC` tab.
9. Click the `Clear All` button then check the `$BinIn` checkbox to send the data to the PC for display.
10. Select the `Processing|Send to DAP` tab.
11. Select `Window|Graph` and then select `Window|Tile Horizontally`.
12. Select `Start!` or press `Alt-S` on the keyboard.

Sample Hardware Configuration

HwCfg01 Basic Hardware Configuration

Illustration

The following figure shows the Processing|Send to DAP tab after step 7 of the Create the Application section.



App1802 Send a Data File with Three Channels of Data to the DAP Board

This application shows how to send a data file with three channels of data to the DAP board, process those data, and return the results to the PC. We provide this sample to illustrate how to send data to the DAP board. Returning the data to the PC allows us to graph the result, but you would not typically include this in a real application. Instead you would process the data on the DAP board, and perhaps send those data to analog or digital outputs there.

Since the data file has three channels of interleaved data, the individual data channels must be separated on the DAP before processing any individual channel. For this, a `Separate` command is used to separate the three channels. The three channels are then sent back to the PC for display in a `Graph` window. To increase the display speed in the `Graph` window, you can increase the `Rate, s/s/ch` in the `Send to PC` tab.

For simplification, in this application no processing occurs. However, in real applications, usually the data is sent to the DAP for further processing or for DAC outputs.

Create the application

1. Select `File|New`.
2. Select the `Configuration|Processing` tab. Right-click on the second level of `Processing` tabs and select `Options...` from the pop-up menu.
3. Click to select the `Send to DAP` checkbox so that it is checked. Click the `OK` button and then select the `Processing|Send to DAP` tab.
4. In the `Comm Pipes` selection checkboxes, check `Cp2In`. The information for the pipe displays in the file selection and summary sections of the `Send to DAP` tab. No data files are available, so `None` is shown.
5. Select `Window|Open Data File...` and select `DATA1802.BIN` and click `OK`. Note that the data file has three channels: `Triangle`, `Combo`, and `Sawtooth`. Minimize the `Data File` window.
6. The data file now is available for selection in the `Processing|Send to DAP` tab. Check the box next to the `DATA1802.BIN` file in the `Cp2In` checkboxes. The file size appears in the `Summary` section below.
7. Select the `Processing|Procedure` tab.

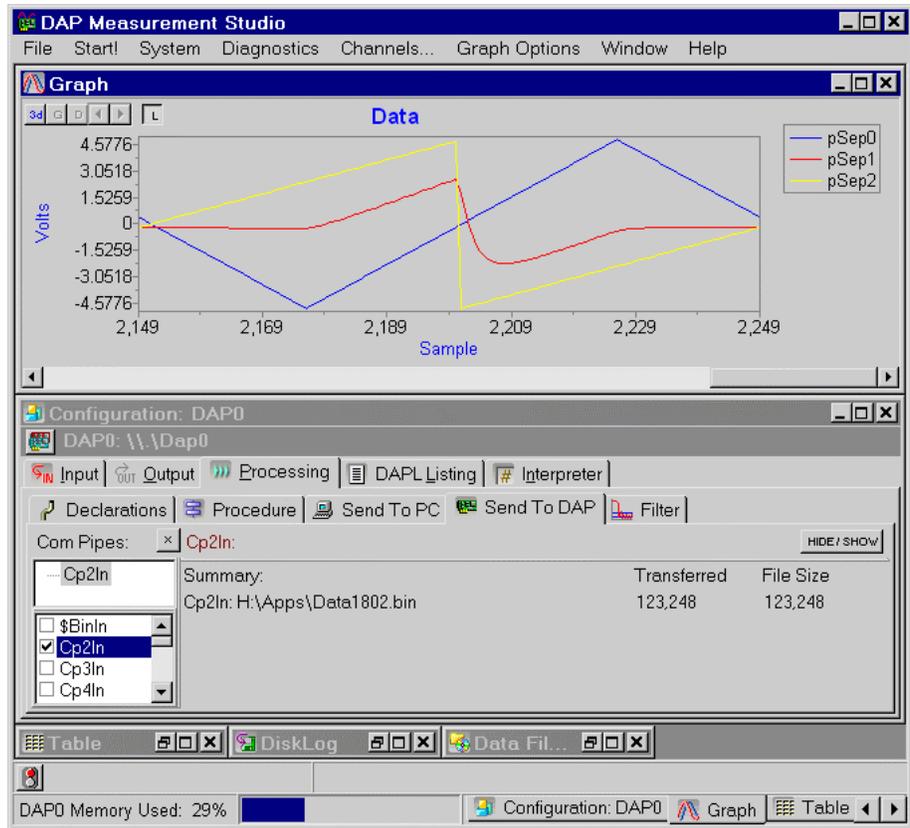
8. In the DAPL Listing edit box, enter the following command line. Please see [App0401](#) for step-by-step instructions on adding a DAPL command.
`Separate(Cp2In, pSep0, pSep1, pSep2)`
9. Select the **Processing|Send to PC** tab.
10. Click the **Clear All** button then check the `pSep0`, `pSep1`, and `pSep2` checkboxes to send the data to the PC for display. Select only one channel if you prefer to display only one.
11. Select the **Processing|Send to DAP** tab.
12. Select **Window|Graph** and then **Channels....** Click the buttons for `pSep1` and `pSep0` so that all three channels are selected. Click the **OK** button.
13. Select **Window|Tile Horizontally**.
14. Select **Start!** or press **Alt-S** on the keyboard.

Sample Hardware Configuration

[HwCfg01 Basic Hardware Configuration](#)

Illustration

The following figure shows DAPstudio after the application has run.



App1803 Send Multiple Data Files to the DAP Board

This application combines [App1801](#) and [App1802](#). It sends data from two different data files to a single DAP board, simultaneously displaying the data from the files in Graph windows on the PC. The channels must be separated before going to the DAP board and, due to different amounts of data, the files must be sent separately to the PC.

Create the application

1. Select **File|New**.
2. Select the **Configuration|Processing** tab. Right-click on the second level of **Processing** tabs and select **Options...** from the pop-up menu.
3. Click to select the **Send to DAP** checkbox so that it is checked. Click the **OK** button and then select the **Processing|Send to DAP** tab.
4. In the **Comm Pipes** selection checkboxes, check **\$BinIn** and check **Cp2In**. The information for the last selected pipe displays in the file selection area and both pipes are included in the summary section. No data files are available, so **None** is shown.
5. Select **Window|Open Data File...** and select **DATA1801.BIN** and click **OK**. **Minimize** the **Data File** window.
6. Select **Window|Open Data File...** and select **DATA1802.BIN** and click **OK**. **Minimize** the **Data File** window.
7. Both data files now are available for selection in the **Processing|Send to DAP** tab. Highlight **\$BinIn** in the **Comm pipes** tree and check the box next to the **DATA1801.BIN** file in the **\$BinIn** checkboxes. Highlight **Cp2In** in the **Comm pipes** tree and check the box next to the **DATA1802.BIN** file in the **Cp2In** checkboxes.
8. Select the **Processing|Procedure** tab.
9. **DATA1802.BIN** is sent to the DAP through **Cp2In**, and since **DATA1802.BIN** has three data channels, **Cp2In** must be separated on the DAP board. This then allows custom processing on individual channels. In the **DAPL Listing** edit box, enter the following command line. Please see [App0401](#) for step-by-step instructions on adding a DAPL command.
`Separate(Cp2In, pSep0, pSep1, pSep2)`
10. Select the **Processing|Send to PC** tab.

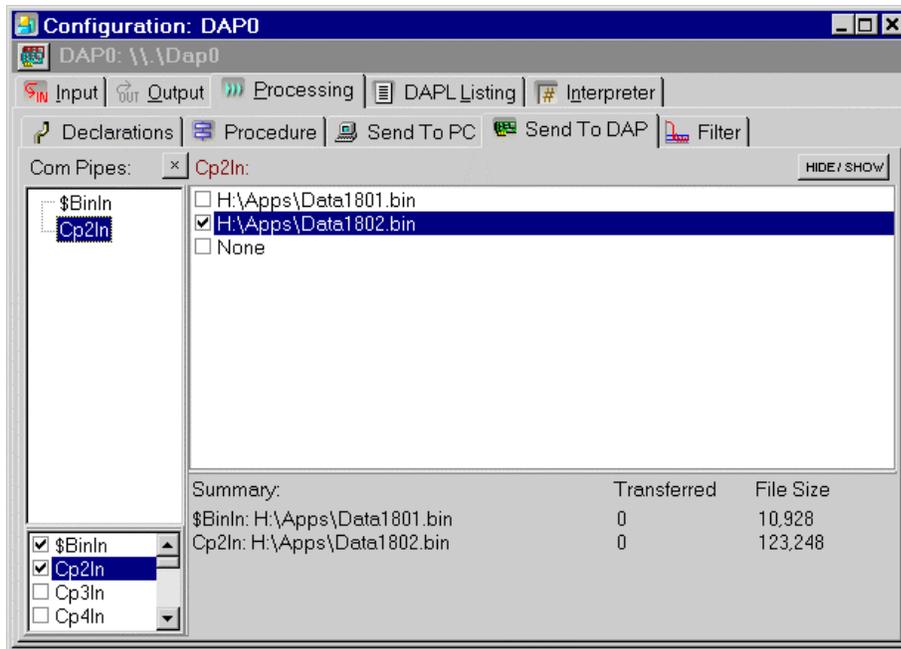
11. Click the `Clear All` button then check the `$BinIn` checkbox to send the first file of data to the PC for display.
12. To open a second output communication pipe, click on the `$BinOut` link and then check the `Cp2Out Comm Pipe` checkbox to select it.
13. Check the `pSep1` checkbox to send only one channel of data from the `App1802.bin` file for display.
14. Minimize the Configuration window.
15. Select `Window|New Graph|Data Acquisition`.
16. Select `Channels...` and click the `$Bin:$BinIn` button to deselect it and `Cp2:pSep1` button to select it. Click `OK`.
17. Select the `Window|Graph` and then select `Window|Tile Horizontally`.
18. Select `Start!` or press `Alt-S` on the keyboard.

Sample Hardware Configuration

[HwCfg01 Basic Hardware Configuration](#)

Illustration

The following figure shows the `Processing|Send to DAP` tab after step 7 of the `Create the Application` section.



App19 Use iDSC Features

Learn to configure an iDSC board, design filters, and display the filtered data.

App1901 Configure an iDSC Board

Configure an iDSC board for use in your application. This application samples the eight inputs available on an iDSC board, uses the default filters, and displays the data in a line Graph window.

For information on configuring the Graph window, or using another display window – all can be used with iDSC boards as well as DAP boards – see the relevant application chapters.

Create the application

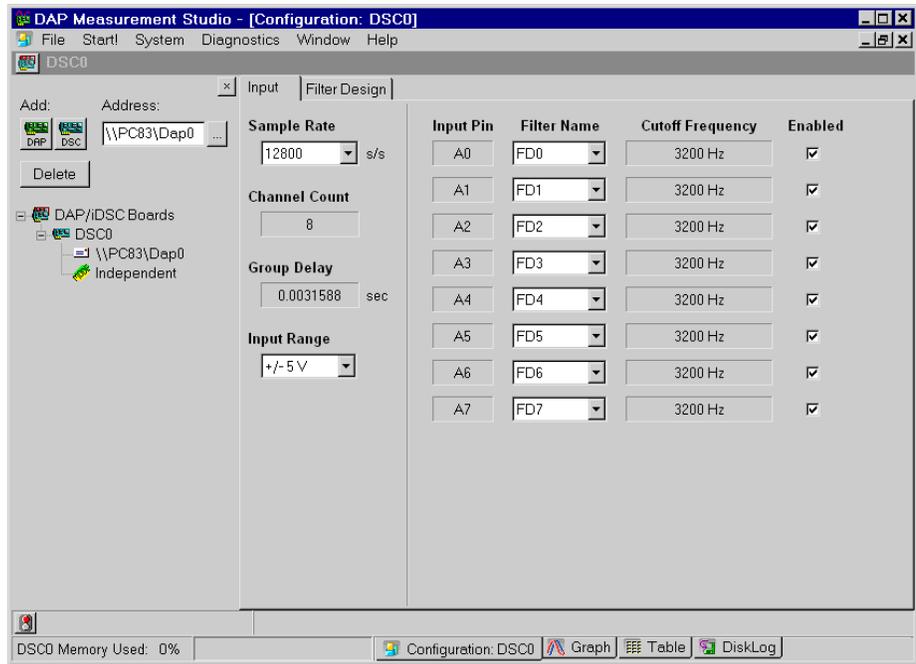
1. Select `File|New`.
2. Select `System|Multiple Boards Configure`.
3. Click the `Add DSC` button.
4. Click the `DAP0` icon, then click the `Delete` button or right-click and select `Delete` from the pop-up menu.
5. Click the plus sign next to the `DSC0` icon. Click the address location line. An `Address edit box` will appear.
6. Click the `...` button, choose `System|Address Select`, or type in the `Address edit box` directly.
7. Follow the steps in [App0902](#) or [App0903](#) and select an iDSC board.
8. Select `Window|Graph`.
9. Select `Start!` or press `Alt-S` on the keyboard.

Sample Hardware Configuration

[HwCfg05 Hardware Configuration with an iDSC Board](#)

Illustration

The following figure shows the DSC configuration interface.



App1902 Design iDSC Filters

This application samples inputs at 51200 samples per second. Three filters are used for the inputs: the default design, a custom lowpass filter, and a custom bandpass filter. The filters are applied to the signals on four inputs and the filtered data is displayed in a graph.

When you make changes in the fields of the Filter Design tabs, you either need to press the Enter key or click in another field in the same tab to register the change. If you make a change and move directly to another tab, the change will not be saved.

Create the application

1. Select File|New.
2. Follow the steps 2-7 in [App1901](#) to configure an iDSC board.
3. Select System|Multiple Boards Configure to uncheck the item and hide that part of the Configuration window. Or click the x in the top right of the DAP/iDSC selection tree or the teal and red icon in the top left.
4. Select the Input tab in the DSC0 Configuration window.
5. Select Sample Rate 51200 from the Sample Rate drop-down box. The filter characteristics will adjust depending on the sample rate.
6. Select the Filter Design tab in the DSC0 Configuration window.
7. Type Default in the Name edit box and press the Enter key.
8. Select Filter Design|FD1 and rename it Lowpass.
9. Change the Sharpness to about 225 by either moving the Sharpness slider or entering the new number in the Sharpness edit box.
10. Change the Low Cutoff to 5000 and the Slope to 2.8. Press the Enter key.
11. Select Filter Design|FD2 and rename it to Bandpass.
12. Select Bandpass from the Type drop-down box.
13. Adjust the Sharpness, Low Cutoff, High Cutoff, Attenuation, and Slope until you have a filter you like.
14. Select the Input tab in the DSC0 Configuration window.

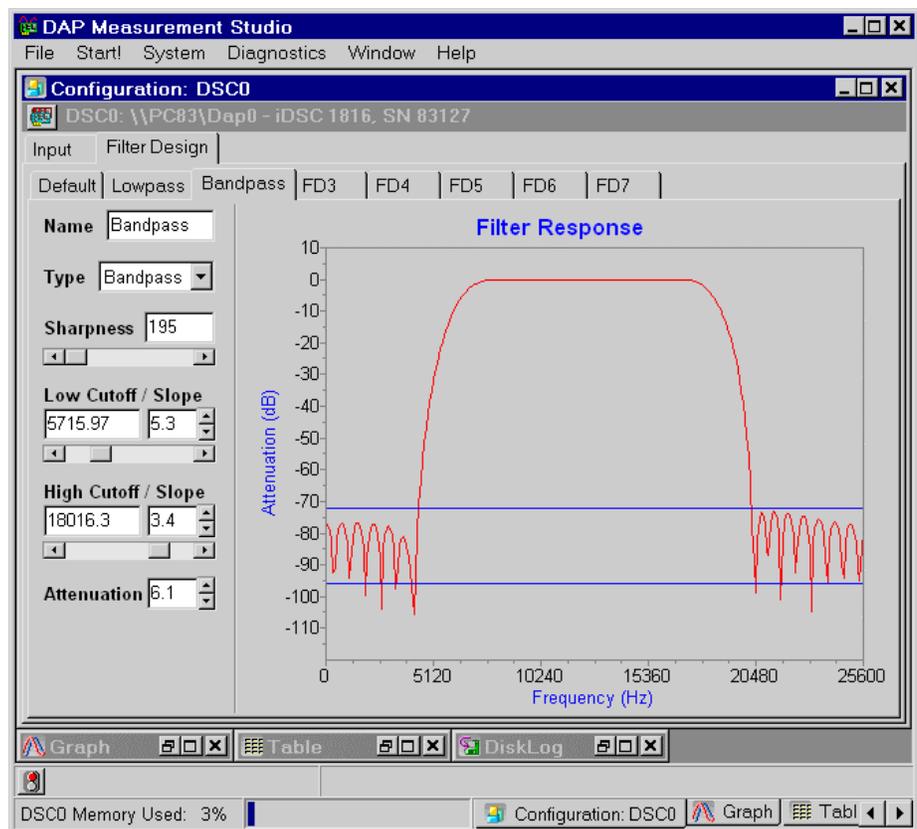
15. The Default, Lowpass, and Bandpass filters have been automatically assigned to the first three inputs.
16. Uncheck the boxes next to input pins A3, A4, A5, A6, and A7.
17. Select Window | Graph or select the Graph tab from the bottom of the window.
18. Select Start! or press **Alt-S** on the keyboard.

Sample Hardware Configuration

HwCfg05 Hardware Configuration with an iDSC Board

Illustration

The following figure shows the Bandpass filter design.



App20 Use Custom Design Features

Learn to configure a custom window to include the display options you need. Add variable and constant controls to your custom design to make adjustments as you run your application.

App2001 Configure the Custom Design Window

This application introduces the Custom Design window. It includes the data from App0108 and displays the data three different ways in a single, easy-to-view window.

For information on configuring the options dialog for the different display types, – the Graph, Table, Bar displays or others – see the relevant application chapters.

Create the application

1. Select File|New. Minimize the Configuration window.
2. Select Window|Open Data File and select DATA0108.BIN. Minimize the Data File window.
3. Select Window|New Custom Design.
4. Select Custom Design Options|Add Graph.
5. Click the Config button and select Connect To|Data File: DATA0108.BIN.
6. Select Custom Design Options|Add Table.
7. Click the Config button and select Connect To|Data File: DATA0108.BIN.
8. Select Custom Design Options|Add Bar.
9. Click the Config button and select Connect To|Data File: DATA0108.BIN.
10. To configure the Bar display to select different channels, click the Config button and select Channels....
11. Click on the first two channels to deselect them. Then click on the Carnation, Lily, and Petunia channels to select them. Click OK.
12. To adjust the Bar display, double-click on the Bar display to open the Bar Options dialog. Or click on the Config button and select Display....
13. Select the Bar tab and click the Use Channel Colors button. Click OK.
14. Click the 3D button to turn the feature on for the Bar display.
15. Click on the Display0 name to bring the Graph display to the front.
16. Click the < arrow button to align the Graph display to the left. Then click the < button again to remove the lock.

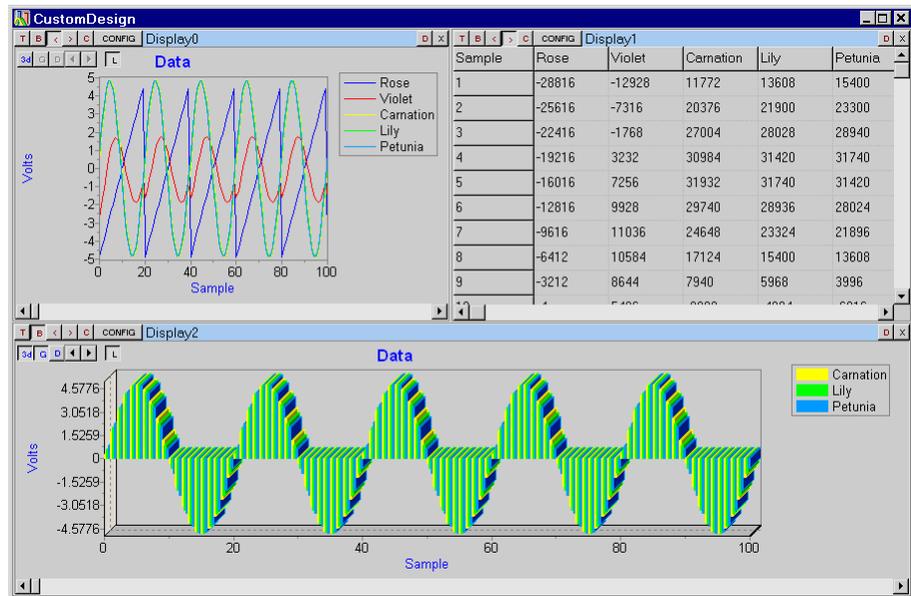
17. Click Display1 to bring the Table display to the front.
18. Click the > arrow button to align the Table display to the right side of the window.
19. Click Display2 to bring the Bar display to the front.
20. Click the B button to align the Bar display to the bottom of the window.
21. Maximize DAPstudio and resize the Control Design window to view all displays.
22. Resize the displays to the preferred balance. By putting the mouse pointer at the line between two displays, an up/down or left/right icon should appear.
23. Click the mouse button and then roll the mouse to make one display larger and the others smaller.

Sample Hardware Configuration

No hardware necessary.

Illustration

The following figure shows the Custom Design window configured as described in the application, with Design Mode On.



Download the Application

Use the configuration file App2001.dms in the Apps sub-directory of the installation path to run this application in DAPstudio.

App2002 Add a Variable/Constant Control

This application creates a sine wave using constant values for the period and amplitude. It displays the wave in a graph within the Custom Design window. Controls for the constants are used to adjust the values. Constants are only sent to the DAP when the application is started, but variables can be sent while the application continues to run. See [App2004](#) for an example. Start and stop the application to make additional adjustments to the constant values.

Create the application

1. Select File|New.
2. Select the Processing|Procedure tab.
3. In the DAPL Listing edit box enter a SineWave command.
`SineWave(cAmpl0, cPeriod0, pSine0)`
4. Select the Processing|Send to PC tab.
5. Check the pSine0 box and uncheck all other boxes.
6. Select Window|New Custom Design.
7. Select Custom Design Options|Add Graph and click the T button to align it to the top of the Custom Design window.
8. Select Custom Design Options|Add Variable/Constant.
9. In the drop-down box, select available constant cAmpl0.
10. Click the B button to align the display to the bottom of the Custom Design window. Rebalance the displays as described in steps 22 and 23 of [App2001](#).
11. In the Variable/Constant display click the Config button and select Display...
12. Select the Configuration tab. Change the Number of Items from the default 1 to 2. Click Apply.
13. Select the Scroll Bar Range tab. Change the Minimum to 0 and the Maximum to 30000.
14. Select number 2 from the Name drop-down box and change that Minimum to 0.
15. Click OK.
16. In the new drop-down box select the other available constant: cPeriod0.

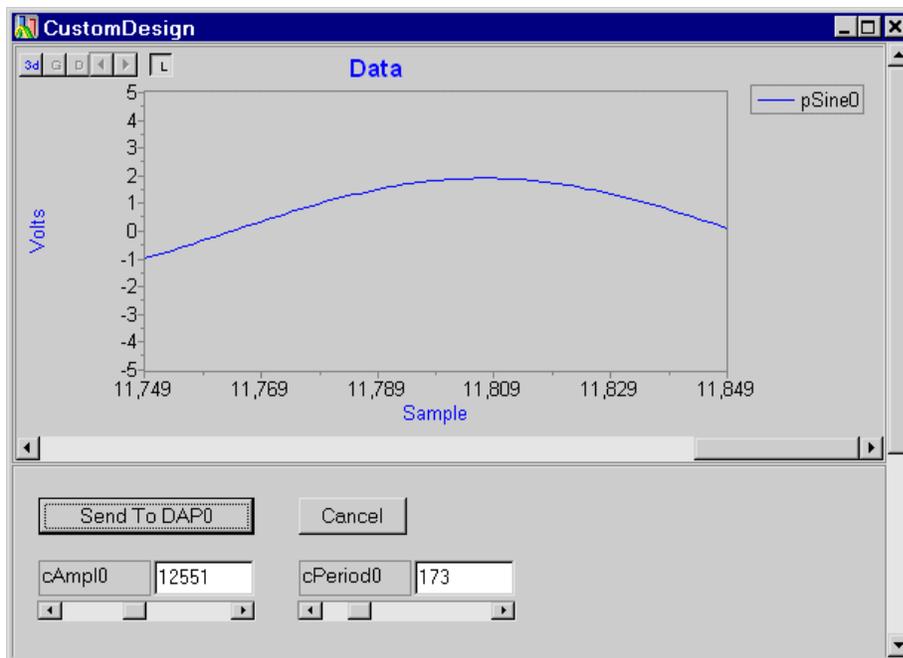
17. Select Custom Design Options|Design Mode|Off.
18. Select Start! or press **Alt-S** on the keyboard.
19. Select Stop! or press **Alt-S** on the keyboard.
20. Use the scroll bars to adjust the amplitude and period of the wave.
21. Click the Send to DAP0 button.
22. Select Start! and Stop! again to see changes in the wave.

Sample Hardware Configuration

HwCfg01 Basic Hardware Configuration

Illustration

The following figure shows the Custom Design window in run mode.



Download the Application

Use the configuration file App2002.dms in the Apps sub-directory of the installation path to run this application in DAPstudio.

App2003 Use Constant and Variable Controls

This application generates a sawtooth wave with configurable constant controls for the amplitude and period and a variable offset control. Adjust the constant values to make changes and watch the DAPL declarations change as you send the new values to the DAP board. Adjust the variable value and watch as the new information is sent to the DAP board as the application runs.

Create the application

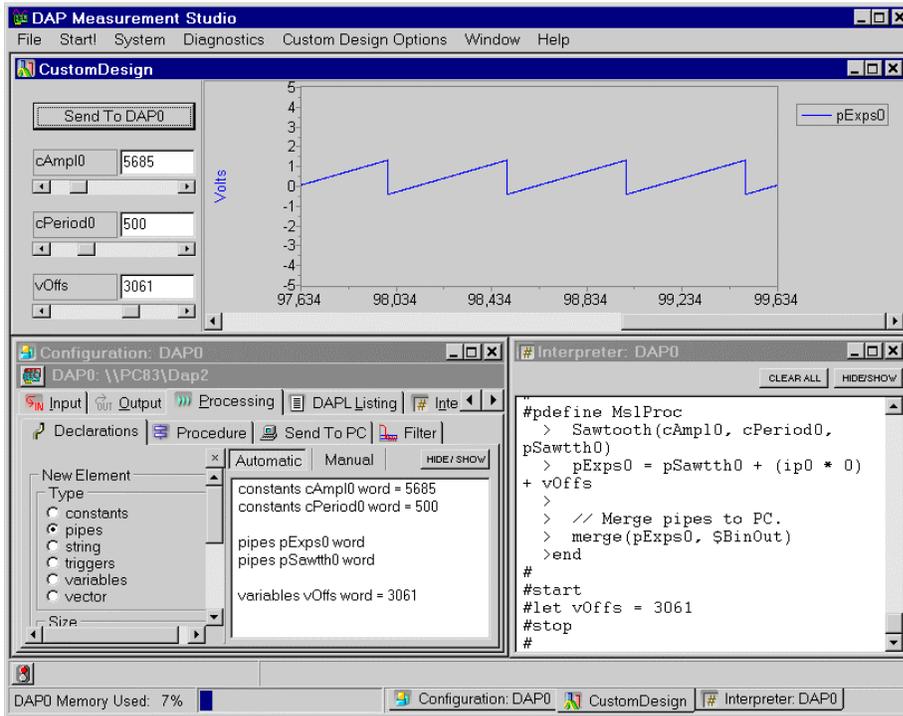
1. Select File|New.
2. Select file \Apps\App2003.dms.
3. Select Start! or press **Alt-S** on the keyboard.
4. Select Stop! or press **Alt-S** on the keyboard.
5. Change the amplitude and period using the constant controls for `cAmp10` and `cPeriod0`. Click the Send to DAP0 button.
6. Observe that the values in the Configuration|Processing|Declarations edit box immediately reflect the changes made.
7. Select Start!
8. Select Diagnostics|Interpreter and resize as preferred.
9. In the Custom Design window, change the offset using the variable control for `vOffs`. Click the Send to DAP0 button.
10. Observe that not only does the value in the Configuration|Processing|Declarations edit box immediately reflect the changes, but a LET command updates the variable in the DAPL code running in the Interpreter window.
11. Select Stop!.
12. Scroll up in the Interpreter window to view the DAPL code sent to the DAP board and observe the changes made in the Automatic Declarations.

Sample Hardware Configuration

[HwCfg01 Basic Hardware Configuration](#)

Illustration

The following figure shows DAPstudio in run mode for the application.



Download the Application

Use the configuration file App2003.dms in the Apps sub-directory of the installation path to run this application in DAPstudio.

App2004 Use a Variable Control

This application loads an application similar to [App0801](#), but configured through the Custom Design window. Adjust the variable value to make real-time changes, without stopping the application.

Create the application

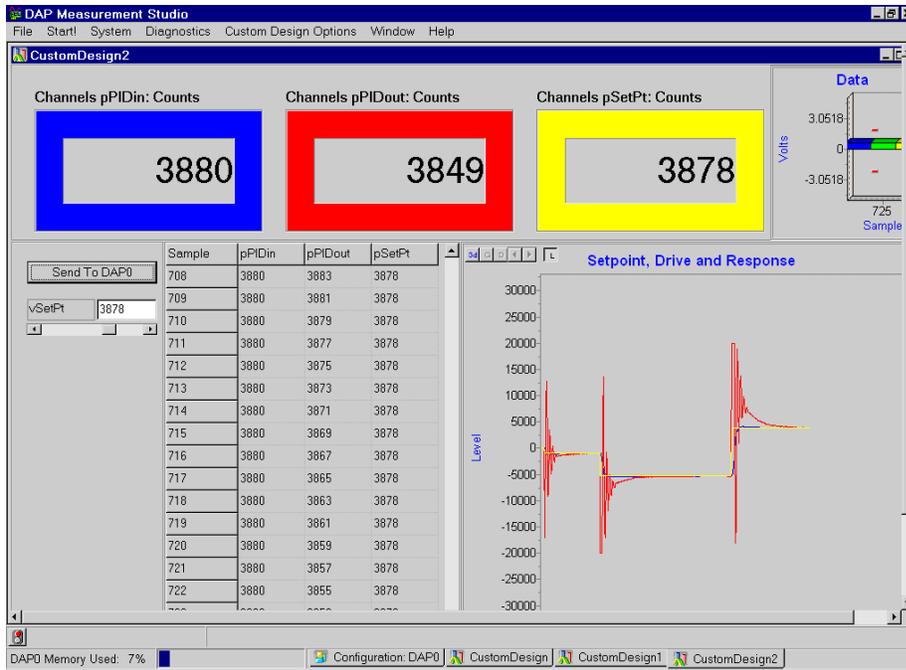
1. Select `File|New`.
2. Select file `\Apps\App2004.dms`.
3. Select `Start!` or press `Alt-S` on the keyboard.
4. Observe the effects of the default gain variables.
5. Use the scroll bar to change the value of the `vSetPt` variable, while the application continues to run.
6. Click the `Send to DAP0` button.
7. Observe the changes and make as many adjustments to the variable as you wish.
8. Select `Stop!` or press `Alt-S` on the keyboard to end the simulation run.

Sample Hardware Configuration

[HwCfg01 Basic Hardware Configuration](#)

Illustration

The following figure shows the sample application after two changes have been made to the `vSetPt` variable.



Download the Application

Use the configuration file App2004.dms in the Apps sub-directory of the installation path to run this application in DAPstudio.

Section IV. Hardware Configurations

About The Hardware Configurations

These hardware configurations serve as a good starting point to build a new application. You easily can modify them to meet your specific requirements. Each hardware configuration consists of the following sections.

Parts List

Lists all components required to build the application.

Connections

This section shows step-by-step instructions on how to connect the hardware shown in the Parts List section.

Line Drawing

This section provides a line drawing of the hardware configuration described in the Connections section to help visualization.

List of Hardware Configurations

Name	Descriptions
HwCfg01	Basic Hardware Configuration
HwCfg02	Hardware Configuration with Input Expansion
HwCfg03	Two DAP Boards
HwCfg04	Hardware Configuration with Simultaneous Sampling
HwCfg05	Hardware Configuration with an iDSC 1816 Board

HwCfg01 Basic Hardware Configuration

This hardware configuration shows a basic option for up to 16 single-ended analog inputs, or eight differential analog inputs, and two analog outputs. It provides quick connections for analog signals by means of an Analog Termination Board, part number MSTB009. An Analog Termination board provides 16 single-ended, or eight differential, analog inputs and two analog outputs with onboard termination points. Most hardware parts have more than one model available. The following models are chosen to provide a better signal quality because of shielding.

Parts List

Part Number	Description	Quantity
DAP 5200a	Data Acquisition Processor	1
MSTB009-09-A2C-B	Analog Termination Board in a Single Board Enclosure	1
MSCBL040-01-L36	68-line round, shielded cable	1

Connections

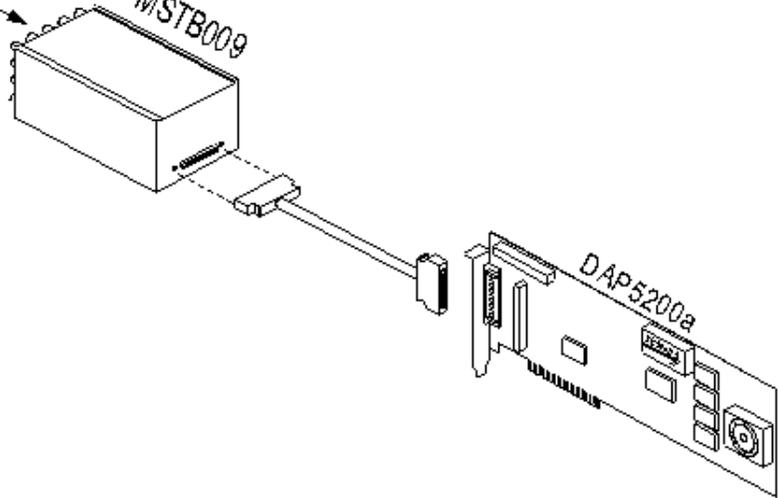
1. Install the DAP 5200a board as described in the DAP 5200a manual.
2. Connect the MSTB009-09-A2C-B enclosure to the DAP5200a with the MSCBL040-01-L36 cable.
3. Connect signals to the BNC connectors labeled S0 through S15 on the MSTB009-09-A2C-B enclosure. For differential inputs, refer to the MSTB009 manual for the input mapping.
4. Analog signals are output from DAC0 and DAC1 of the MSTB009-09-A2C-B enclosure.

Line Drawing

20 BNC
Terminations

MSTB009

DAP5200a



HwCfg02 Hardware Configuration with Input Expansion

This section shows two input configurations for up to 128 single-ended inputs or 64 differential inputs. The configurations each use a different standard end panel: BNC or DB-37 connectors. Both configurations provide quick connections for analog signals by means of an Analog Input Expansion Board, part number MSXB037. Each Analog Input Expansion board provides 16 single-ended or eight differential analog inputs with onboard termination points. Most hardware parts have more than one model available. The following models are chosen to provide a better signal quality because of shielding.

Configuration A

The DB37 end panel provides a DB-37 connector for mass input termination. Input signals are connected to the header by means of a DB-37 connector on the front panel. For more information, please see MSXB 037 hardware manual.

Parts List

Part Number	Description	Quantity
DAP 5200a	Data Acquisition Processor	1
MSIE001-01	Industrial Enclosure	1
MSXB037-02-E2K	Analog Input Expansion Board, 1 slot	8
MSCBL040-01-L36	68-line round, shielded cable	1

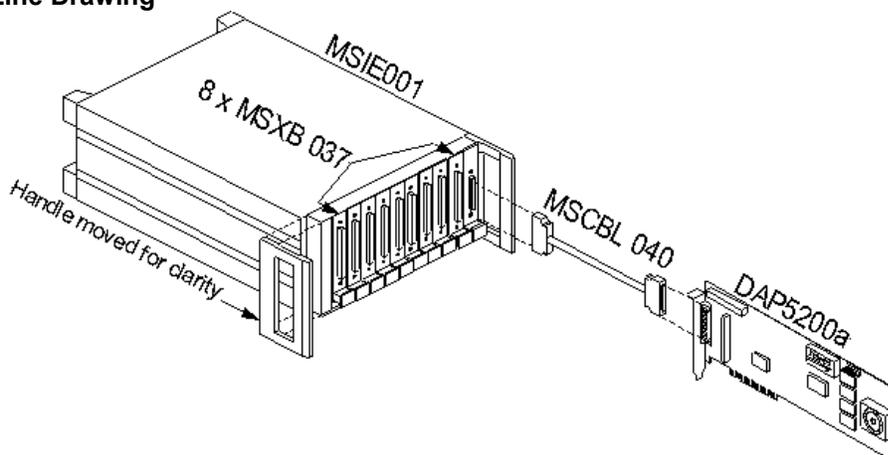
Connections

1. Install the DAP 5200a as shown in the DAP 5200a manual.
2. Set up the MSIE001-01 enclosure as shown below.
 - a. Install jumpers on Pin 1, 2, 3, 4, and 5 on connector J5 of the first MSXB037-02-E2K board and install the board next to the MSXB 029 board.
 - b. Install jumpers on Pin 1, 2, 3, and 4 on connector J5 of the second MSXB037-02-E2K board and install the board next to the first MSXB037-02-E2K board.

- c. Install jumpers on Pin 1, 2, 3, and 5 on connector J5 of the third MSXB037-02-E2K board and install the board next to the second MSXB037-02-E2K board.
 - d. Install jumpers on Pin 1, 2, and 3 on connector J5 of the fourth MSXB037-02-E2K board and install the board next to the third MSXB037-02-E2K board.
 - e. Install jumpers on Pin 1, 2, 4, and 5 on connector J5 of the fifth MSXB037-02-E2K board and install the board next to the fourth MSXB037-02-E2K board.
 - f. Install jumpers on Pin 1, 2, and 4 on connector J5 of the sixth MSXB037-02-E2K board and install the board next to the fifth MSXB037-02-E2K board.
 - g. Install jumpers on Pin 1, 2, and 5 on connector J5 of the seventh MSXB037-02-E2K board and install the board next to the sixth MSXB037-02-E2K board.
 - h. Install jumpers on Pin 1 and 2 on connector J5 of the eighth MSXB037-02-E2K board and install the board next to the seventh MSXB037-02-E2K board.
3. Connect the DAP 5200a board to the MSXB 029 interface face board in the MSIE001 enclosure with the MSCBL040-01 cable.
 4. Connect signals to the MSXB037 boards through the DB-37 connectors.

Note: When installing the MSXB037-01 board, push it firmly into the slot and make sure it is connected securely to the Analog Backplane. Always fully secure the MSXB028 board to the enclosure by tightening the screws at the top and the bottom of the front panel. These screws close the electrical chassis shield giving better measurements and guarantee that the board is fully seated into the backplane

Line Drawing



Configuration B

A BNC end panel provides individual signal connections. Each signal is connected to the MSXB 037 through a BNC connector on the end panel. When MSXB037-03-E2C-B is shipped, its input signal terminals are not connected to the BNC connectors on the BNC panel. Please see the BNC End-Panel Connections section below for the standard configuration.

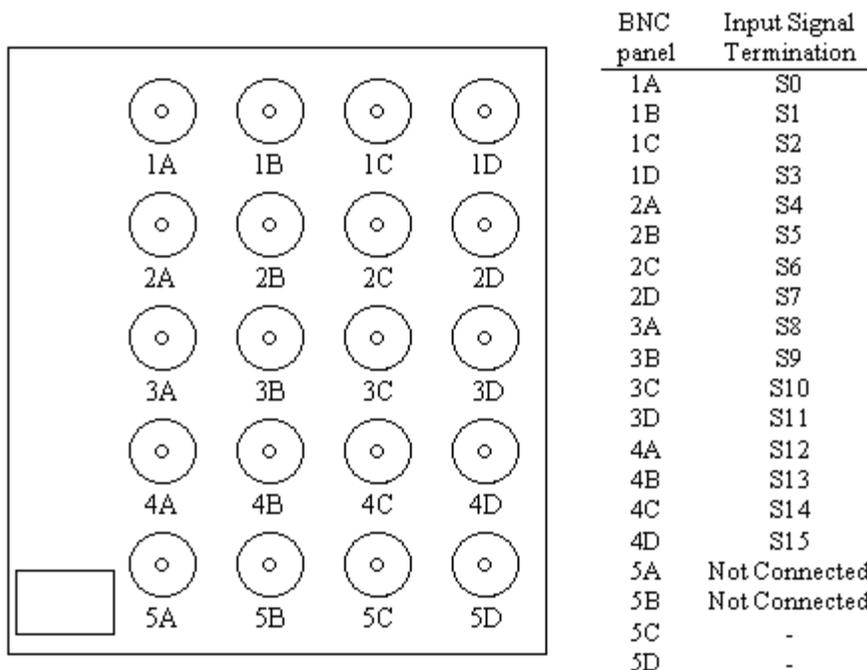
Parts List

Part Number	Descriptions	Quantity
DAP 5200a	Data Acquisition Processor	1
MSIE002-06-P	Industrial Enclosure	2
MSXB037-03-E2C-B	Analog Input Expansion Board, 5 slots	7
MSXB037-01-E2Y	Analog Input Expansion Board, 1 slot	1
FPANEL004-02	Front Panel with 4 Isolated BNC, 1 slot	4
MSCBL040-01-L36	68-line round, shielded cable, 36"	1
MSCBL040-01-L18	68-line round, shielded cable, 18"	1
MSCBL063-01-L4.5	68-line ribbon cable, 4.5"	1

Note: One MSXB037-01-E2Y and four FPANEL004-02 are used instead of the eighth MSXB037-01-E2C-B because the second MSIE only has 19 slots available.

BNC End-Panel Connections

The following figure shows a BNC panel with labels, and the table shows the standard configuration for mapping the BNC connectors to the input signal terminations on the MSXB 037 board.



Each BNC panel occupies five slots in an industrial enclosure and it provides 20 isolated BNC connectors. Each BNC input connector has a black wire and a red wire. The red wire is connected to S_x, where x represents the input signal termination, whereas the black wire is connected to G_x. For example, the red and black wires of 1A should connect to S0 and G0 on the MSXB 037 board.

All input signals should be within ± 10 volts of this reference ground.

Connections

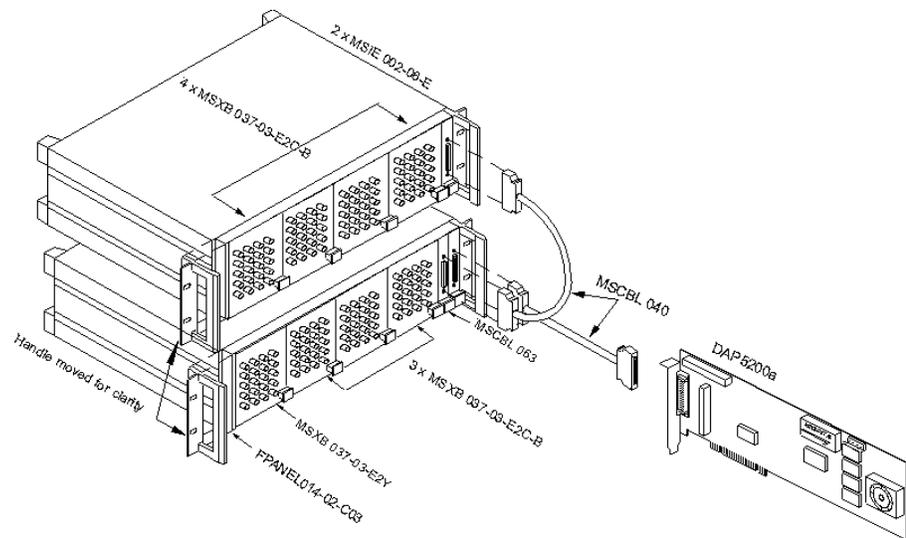
1. Install the DAP 5200a board as described in the DAP 5200a manual.
2. Connect four BNC panels to four MSXB037-01-E2C-B boards.

3. Set up the first MSIE002 enclosure as shown below.
 - a. Install jumpers on Pin 1, 2, 3, 4, and 5 on connector J5 of the first MSXB037-01-E2C-B board and install the board next to the MSXB 029 board, Analog Backplane Interface board.
 - b. Install jumpers on Pin 1, 2, 3, and 4 on connector J5 of the second MSXB037-01-E2C-B board and install the board next to the first MSXB037-01-E2C-B board.
 - c. Install jumpers on Pin 1, 2, 3, and 5 on connector J5 of the third MSXB037-01-E2C-B board and install the board next to the second MSXB037-01-E2C-B board.
 - d. Install jumpers on Pin 1, 2, and 3 on connector J5 of the fourth MSXB037-01-E2C-B board and install the board next to the third MSXB037-01-E2C-B board.
4. Connect the remaining three BNC panels to the three remaining MSXB037-01-E2C-B boards.
5. Replace the front panel on the MSXB037-01-E2Y board with FPANEL004-02 and connect the BNC wires on the remaining three FPANEL004-02 to the MSXB037-01-E2Y.
6. Set up the second MSIE002 enclosure as shown below.
 - a. Connect the short ribbon cable MSCBL063 to connector J3 of the MSXB 029 board.
 - b. Install jumpers on Pin 1, 2, 4, and 5 on connector J5 of the fifth MSXB037-01-E2C-B board and install the board next to the MSCBL063 cable.
 - c. Install jumpers on Pin 1, 2, and 4 on connector J5 of the sixth MSXB037-01-E2C-B board and install the board next to the fifth MSXB037-01-E2C-B board.
 - d. Install jumpers on Pin 1, 2, and 5 on connector J5 of the seventh MSXB037-01-E2C-B board and install the board next to the sixth MSXB037-01-E2C-B board.
 - e. Install jumpers on Pin 1 and 2 on connector J5 of the MSXB037-01-E2Y board with FPANEL004-02 and install the board next to the seventh MSXB037-01-E2C-B board.

- f. Install three FPANEL004-02 to cover the remaining open slots on the MSIE 002.
7. Connect the MSXB 029 interface board in the first MSIE002 enclosure to the MSCBL063 cable in the second MSIE002 enclosure with the MSCBL040-01-L18 cable.
8. Connect the DAP5200a board to the MSXB 029 board in the second MSIE002 enclosure with the MSCBL040-01-L36 cable.
9. Connect signals to the corresponding BNC connectors.

Note: When installing the MSXB037-01 board, push it firmly into the slot and make sure it is connected securely to the Analog Backplane. Always fully secure the MSXB037 board to the enclosure by tightening the screws at the top and the bottom of the front panel. These screws close the electrical chassis shield giving better measurements and guarantee that the board is fully seated into the backplane

Line Drawing



HwCfg03 Two DAP Boards

This hardware configuration shows an option for up to 32 single-ended analog inputs, or 16 differential analog inputs, and 4 analog outputs. It provides quick connections for analog signals by means of an Analog Termination Board, part number MSTB009. Each Analog Termination board provides 16 single-ended, or eight differential, analog inputs and two analog outputs with onboard termination points. Most hardware parts have more than one model available. The following models are chosen to provide a better signal quality because of shielding.

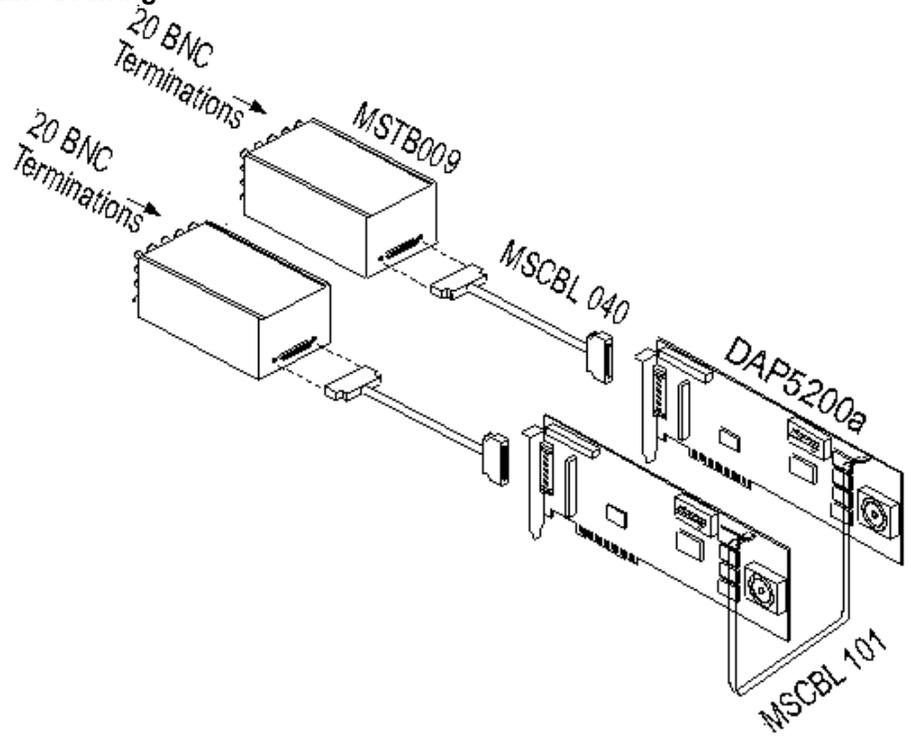
Parts List

Part Number	Descriptions	Quantity
DAP 5200a	Data Acquisition Processor	2
MSTB009-09-A2C-B	Analog Termination Board	2
MSCBL040-01-L36	68-line round, shielded cable	2
MSCBL101-01 (Optional)	Synchronization cable	1

Connections

1. Install both DAP5200a boards as shown in the DAP5200a manual.
2. Connect each of the MSTB009-09-A2C-B boards to each of the DAP5200a boards with the MSCBL040-01-L36 cable.
3. Connect the two DAP5200a boards with the MSCBL101-01 for synchronization.
4. For single-ended inputs, connect signals to S0 through S15 of the MSTB009-09-A2C-B board.
5. For differential inputs, connect signals to D0 through D7 of the MSTB009-09-A2C-B board.
6. Analog signals are output from DAC0 and DAC1 of the MSTB009-09-A2C-B board.

Line Drawing



HwCfg04 Hardware Configuration with Simultaneous Sampling

This hardware configuration shows a basic option for up to 16 single-ended simultaneous analog inputs. It provides quick connections for simultaneous analog signals by means of a Simultaneous Sampling Board, part number MSXB028. Simultaneous Sampling Boards are used in multichannel spectral analysis and other applications that require simultaneous acquisition of several channels. The MSXB028 provides 16 single-ended analog inputs. Most hardware parts have more than one model available. The following models are chosen to provide a better signal quality because of shielding.

Parts List

Part Number	Descriptions	Quantity
DAP 5200a	Data Acquisition Processor	1
MSIE002-06-P	Industrial Enclosure	1
MSXB028-05-E2C	Simultaneous Sampling Board, 5 slot	1
MSCBL040-01-L36	68-line round, shielded cable	1

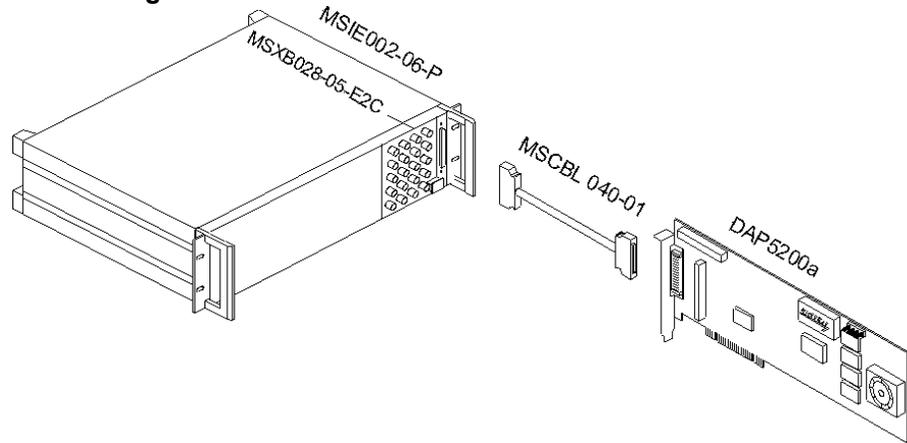
Connections

1. Install the DAP 5200a as shown in the DAP 5200a manual.
2. Connect the wires from the BNC connectors to the quick connect points on the MSXB028-05-E2C PCB.
3. Set up the MSIE002-06-P enclosure as shown below.
 - a. Make sure jumpers are installed on Pin 1, 2, 3, 4, and 5 on connector J5 of the MSXB028-05-E2C board. This is the factory default, so for a new system they should all be installed.
 - b. Install the MSXB028-05-E2C board next to the MSXB 029 Analog Backplane Interface board.
4. Connect the DAP 5200a board to the MSXB029 interface board in the MSIE002 enclosure with the MSCBL040-01-L36 cable.

5. Connect signals to the BNC connectors labeled S0 through S15 on the MSXB028-05-E2C.

Note: Always fully secure the MSXB028 board to the enclosure by tightening the screws at the top and the bottom of the front panel. These screws close the electrical chassis shield giving better measurements and guarantee that the board is fully seated into the backplane.

Line Drawing



HwCfg05 Hardware Configuration with an iDSC Board

The iDSC 1816 board combines 16-bit resolution on eight simultaneous channels of data acquisition with brick-wall anti-alias filters on each channel. This hardware configuration shows a basic option for up to eight single-ended analog inputs with optically isolated reference ground. Since the reference ground floats relative to the PC ground, the single-ended sense provides high accuracy measurements relative to any sense point.

This configuration provides quick connections for analog signals by means of an Analog Termination Board, part number MSXB042. This Analog Termination board provides eight single-ended analog inputs with onboard termination points. Most hardware parts have more than one model available. The following models are chosen to provide a better signal quality because of shielding.

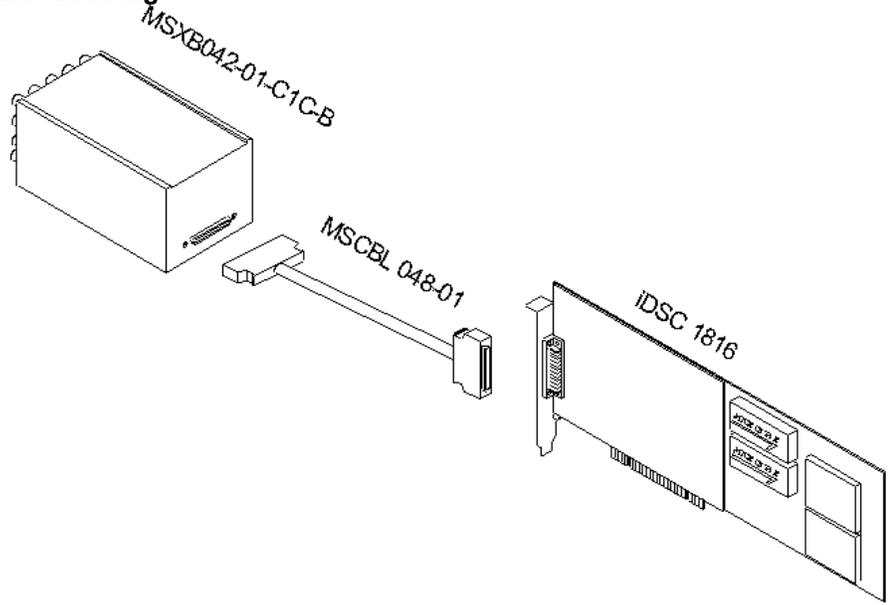
Parts List

Part Number	Descriptions	Quantity
iDSC 1816	Specialized Data Acquisition Processor Board with Anti-Alias Filters	1
MSCBL048-01-L36	50-line round, shielded cable	1
MSXB042-01-C1C-B	Analog Termination Board in a Single Board Enclosure	1

Connections

1. Install the iDSC 1816 board as described in the iDSC 1816 manual.
2. Connect the wires from the BNC connectors to the quick connect points on the MSXB042-01-C1C-B PCB.
3. Connect the MSXB042-01-C1C-B enclosure to the iDSC 1816 with the MSCBL048-01-L36 cable.
4. Connect signals to the BNC connectors labeled *S0* through *S7* on the MSXB042-01-C1C-B enclosure.

Line Drawing



Index

3D	195
3D Alarm	195
3D Bar.....	195
3D Graph Features	195
3D Waterfall.....	195
About The Hardware Configurations	303
About The Sample Applications	107
About The User Interface	11
About This Document	7
Add a Graph	182
Add a New Filter Design.....	199
Add a Variable/Constant Control.....	295
Address Select.....	14
Adjust Filter Phase Matching	207
Adjust Number of Taps.....	206
Alarm Application	262
Alarm Features	261
Alarm Options	61
Alarm Window	60
Alphabetized Command List	169
Alt-S	23
App01 Getting Started.....	115
App0101 Sample and Graph One Channel	116
App0102 Sample, Graph, and Log Two Channels to a Disk File.....	118
App0103 Detect a DAP Board.....	120
App0104 Run Your Application	121
App0105 View the Memory Used.....	122
App0106 Lock a Configuration	124
App0107 View Error Messages	126
App0108 Read a Logged Data File	128
App0109 Use Tab Icons	130
App0110 Clone a Display Window.....	132
App02 Configure an Input Procedure.....	134
App0201 Select a Sample Rate.....	135
App0202 Sample and Graph Eight Differential Channels	136
App0203 Sample 128 Channels with Input Expansion.....	138
App0204 Select a Contiguous Range of Input Channel Pipes.....	140
App0205 Select an Even/Odd Range of Input Channel Pipes.....	142
App0206 Select a Rectangular Range of Input Channel Pipes.....	144
App0207 Configure All Input Channel Pipes to Sample the Same Pin.....	146
App0208 Configure All Input Channel Pipes to Sample an Incremented Pin	148
App0209 Configure All Input Channel Pipes to Sample at the Same Gain.....	150
App0210 Configure Input Channel Pipes to Sample Differential Inputs and Ground.....	152
App0211 Configure an Input Procedure for Simultaneous Sampling.....	154

App03 Configure an Output Procedure	157
App0301 Select an Update Rate	158
App0302 Produce a Sine Wave on DAC0	159
App0303 Produce a Sine Wave on DAC0 and a Square Wave on DAC1	161
App0304 Configure an Output Pipe to Update DAC0	163
App04 Write a Processing Procedure	165
App0401 Automatically Declare Pipes, Variables, and Constants	166
App0402 Get DAPL Help	168
App0403 Use the Alphabetized or Categorized Command List	169
App0404	170
App0405	171
App0406 Duplicate Commands With Auto-Increment Parameters	172
App0407 Process Multiple Commands with Auto-Increment Parameters	174
App0408 Activate all Processing Tabs	177
App0409 Use the Sequencing Tab	179
App05 Using Graph Features	181
App0501 Add a Graph	182
App0502 Zoom Into a Specific Region	184
App0503 Use the Crosshairs	186
App0504	188
App0505 Configure Data History	189
App0506 Configure Graph Axis and Labels	191
App0507 Configure Graph Colors and Fonts	193
App0508 Use 3D Graph Features	195
App06 Design Filters	198
App0601 Add a New Filter Design	199
App0602 Delete a Filter Design	200
App0603 Copy and Paste a Filter Design	201
App0604 Use the FIRFILTER Command	202
App0605 Change to Response Display	204
App0606 Adjust Number of Taps	206
App0607 Adjust Filter Phase Matching	207
App0608 Change Filter Vector Type	209
App0609 Filter Scaling and Zero Stripping	210
App0610 Change to Slope Approximation	212
App0611 Change Window Vector	213
App0612 Create a Bandpass Filter	215
App0613 Change Cutoff Slope	216
App0614 Use Crosshairs to Track Actual Filter Response	217
App0615 Export Filter Coefficients	219
App07 Design FFTs	220
App0701 Use the FFT command	221
App0702 Graph FFT Magnitude	223
App0703 Display Data in FFT Blocks	226
App08 Create a Control Application	228
App0801 PID Tuning	229
App09 Configure Multiple DAP Boards	231
App0901 Configure Two DAP Boards	232

App0902 Select a DAP Address	234
App0903 Browse for DAP Boards on a Network.....	236
App0904 Copy and Paste a DAP Board Configuration	238
App0905 Rename a DAP Board	240
App0906 Use a Shortcut to Switch Between DAP Boards	242
App10 Send Data to the PC.....	243
App1001 Use a Single Communication Pipe	244
App1002 Use Multiple Communication Pipes.....	245
App11 Server Disk Logging.....	247
App1101 Enable Server Disk Logging.....	248
App12 Use Diagnostic Features.....	250
App1201 Display Memory Used.....	251
App1202 Open the Interpreter Window	252
App1203 Use the Interpreter Commands.....	254
App13 Use Table Features	256
App1301 Copy/Paste Data from a Table	257
App1302 Configure Column Widths and Row Heights.....	259
App1303 Configure the Data History.....	260
App14 Use Alarm Features	261
App1401 Create a Pass/Fail Application	262
App15 Use Digital Volt Meter Features	265
App1501 Configure the DVM Display.....	266
App16 Use Bar Graph Features	268
App1601 Configure the Bar Display	269
App17 Use Waterfall Features.....	271
App1701 Configure the Waterfall Display	272
App1702 View FFT Data in Customized Waterfall Graphs.....	274
App18 Send Data to the DAP Board.....	276
App1801.....	282
App1801 Send a Single Data File with One Channel.....	277
App1802.....	282
App1802 Send a Single Data File with Three Channels of Data to the DAP Board.....	279
App1803 Send Multiple Data Files to the DAP Board.....	282
App19 Use iDSC Features.....	285
App1901 Configure an iDSC Board.....	286
App1902 Design iDSC Filters	288
App20 Use Custom Design Features.....	291
App2001 Configure the Custom Design Window	292
App2002 Add a Variable/Constant Control	295
App2003 Use Constant and Variable Controls.....	297
App2004 Use a Variable Control	299
Auto-Increment.....	172, 174
Automatically Declare Pipes, Variables, and Constants	166
Bandpass Filter	215
Bar Display.....	269
Bar Graph Display	269
Bar Graph Features	268
Bar Options	69

Bar Window	69
Basic Hardware Configuration.....	304
Browse for DAP Boards on a Network	236
Categorized Command List	169
Change Cutoff Slope.....	216
Change Filter Vector Type	209
Change to Response Display	204
Change to Slope Approximation.....	212
Change Window Vector	213
Clone a Display Window.....	132
Close.....	13
Comm Pipes	245
Communication Pipe.....	244
Configuration Window for DAP Boards	24
Configuration Window for iDSC Boards.....	41
Configure All Input Channel Pipes to Sample an Incremented Pin	148, 152
Configure All Input Channel Pipes to Sample at the Same Gain.....	150
Configure All Input Channel Pipes to Sample the Same Pin.....	146
Configure an iDSC Board	286
Configure an Input Procedure.....	134
Configure an Output Pipe to Update DAC0.....	163
Configure an Output Procedure	157
Configure Data History	189
Configure Multiple DAP Boards	231
Configure the Custom Design Window.....	292
Configure the Waterfall Display.....	272
Configure Two DAP Boards.....	232
Constant Control.....	295
Constant Controls	297
Constants.....	88, 166
Control Application	228
Copy and Paste a DAP Board Configuration	238
Copy and Paste a Filter Design.....	201
Copy Data	257
Copyrights and Trademarks.....	i
Crosshairs.....	186, 217
Ctrl-A.....	22
Ctrl-C.....	22
Ctrl-D.....	22
Ctrl-DownArrow.....	23
Ctrl-E.....	22
Ctrl-EndKey	23
Ctrl-F	22
Ctrl-G.....	22
Ctrl-LeftArrow	23
Ctrl-S	23
Ctrl-UpArrow	23
Ctrl-V.....	23

Ctrl-Y	23
Ctrl-Z	23
Custom Design	292
Custom Design Features	291
Custom Design Window	91
Cutoff Slope	216
DAP Address	234
DAP Board Configuration	238
DAP Boards on a Network	236
DAPL Help	168
DAPL Listing Tab	39
Data File	277
Data File Window	103
Declarations Tab	31
Declare Pipes, Variables, and Constants	166
Delete a Filter Design	200
Design FFTs	220
Design Filters	198
Design iDSC Filters	288
Detect a DAP Board	120
Diagnostic Features	250
Diagnostics Menu Item	17
Digital Volt Meter Display	266
Digital Volt Meter Options	85
Digital Volt Meter Window	85
Disk Log Options	96
Disk Log Window	95
DownArrow	23
Duplicate Commands With Auto-Increment Parameters	172
DVM Display	266
DVM Features	265
DVM Options	85
EndKey	23
Error Messages	126
Exit	13
Export Filter Coefficients	219
F1	22
F4	22
F5	22
FFT Blocks	226
FFT Command	221
FFT Magnitude	223
FFTs	220
File Menu Item	13
Filter Coefficients	219
Filter Phase Matching	207
Filter Scaling	210
Filter Tab	36

Filter Vector Type.....	209
Filters.....	198
Find a DAP Board.....	120
FIRFILTER Command.....	202, 207
Get DAPL Help.....	168
Getting Started.....	115
Graph Axis.....	191
Graph Colors.....	193
Graph Eight Differential Channels.....	136
Graph Features.....	181
Graph Fonts.....	193
Graph Labels.....	191
Graph One Channel.....	116
Graph Options.....	50
Graph Two Channels.....	118
Graph Window.....	50
Hardware Configuration for Two DAP Boards.....	312
Hardware Configuration with Input Expansion.....	306
Hardware Configurations.....	301
Help Menu Item.....	20
Hidden Processing Tabs.....	177
HomeKey.....	23
HwCfg01 Basic Hardware Configuration.....	304
HwCfg02 Hardware Configuration with Input Expansion.....	306
HwCfg03 Two DAP Boards.....	312
HwCfg04 Hardware Configuration with Simultaneous Sampling.....	314
HwCfg05 Hardware Configuration with an iDSC Board.....	316
Icons in Tabs.....	130
iDSC Board.....	316
iDSC Board Configuration.....	41, 286
iDSC Filter Design.....	288
iDSC Filter Design Parameters.....	45
iDSC Filter Design Tab.....	45
iDSC Input Pipes Tab.....	44
iDSC Input Tab.....	44
Input Expansion.....	306
Input Pipes Tab.....	24
Input Settings Tab.....	26
Input Tab.....	24
Installation.....	8
Interpreter Commands.....	254
Interpreter Tab.....	39
Interpreter Window.....	252
Keyboard.....	22
LeftArrow.....	23
List of Hardware Configurations.....	303
List of Sample Applications.....	111
Lock a Configuration.....	124

Log to a Disk File	118
Logged Data	128
Memory Used	122, 251
Menu	13
Multiple DAP Boards	231
Multiple Data Files	282
New	13
New Additions	4
New Filter Design	199
Nyquist frequency	46
Open	13
Open Data File	18
Output Pipes Tab	27
Output Settings Tab	30
Output Tab	27
Pass/Fail Application	262
PID Tuning	229
Pipes	166
Procedure Tab	31, 32
Processing Procedure	165
Processing Procedure Tab	31
Processing Tab	31
Processing Tabs	177
Produce a Sine Wave on DAC0	159
Produce a Sine Wave on DAC0 and a Square Wave on DAC1	161
Read a Logged Data File	128
Rename a DAP Board	240
RightArrow	23
Run Your Application	121
Sample 128 Channels with Input Expansion	138
Sample an Incremented Pin	148
Sample and Graph Eight Differential Channels	136
Sample and Graph One Channel	116
Sample at the Same Gain	150
Sample Differential Inputs	152
Sample Ground	152
Sample Rate	44, 135
Sample the Same Pin	146
Sample Two Channels	118
Sample, Graph, and Log Two Channels to a Disk File	118
Save	13
Save As	13
Save DAPL	13
SCS Module Parameters	48
Section I. Introduction	1
Section II. User Interface	9
Section III. Sample Applications	105
Section IV. Hardware Configurations	301

Select a Contiguous Range of Input Channel Pipes.....	140
Select a DAP Address.....	234
Select a Rectangular Range of Input Channel Pipes.....	144
Select a Sample Rate.....	135
Select an Even/Odd Range of Input Channel Pipes.....	142
Select an Update Rate.....	158
Send Data to the DAP Board.....	276
Send Multiple Data Files to the DAP Board.....	282
Send Three Channels to the DAP Board.....	279
Send to DAP Tab.....	35
Send To PC Tab.....	33
Sequencing.....	179
Sequencing Tab.....	39
Server Disk Log Options.....	98
Server Disk Log Window.....	98
Server Disk Logging.....	248
Simultaneous Sampling.....	154, 314
Sine Wave.....	159, 161
Slope Approximation.....	212
Spreadsheet Programs.....	257
Square Wave.....	161
Start!/Stop! Menu Item.....	13
Summary of the Sample Applications.....	108
Switch Between DAP Boards.....	242
System Menu Item.....	14
System Requirements.....	8
Tab Icons.....	130
Table Columns.....	259
Table Data Point.....	260
Table Features.....	256
Table History.....	260
Table Options.....	57
Table Rows.....	259
Table Window.....	57
Taps.....	206
Track Actual Filter Response.....	217
Transfer Data to the DAP Board.....	279
Two DAP Boards.....	232
UpArrow.....	23
Update Rate.....	158
Use a Shortcut to Switch Between DAP Boards.....	242
Use a Variable Control.....	299
Use Constant Controls.....	297
Use Crosshairs to Track Actual Filter Response.....	217
Use the Alphabetized or Categorized Command List.....	169
Use the Crosshairs.....	186
Use the FFT Command.....	221
Use the FIRFILTER Command.....	202

Using Graph Features.....	181
Variable Control	295, 299
Variable Controls.....	297
Variable/Constant Display.....	88
Variables	88, 166
View Error Messages	126
View FFT Data	274
View the Memory Used	122
Waterfall Display.....	272, 274
Waterfall Graph Features	271
Waterfall Options.....	78
Waterfall Window.....	77
Welcome	2
Window Menu Item	18
Window Vector	213
Write a Processing Procedure	165
Zero Stripping.....	210
Zoom Into a Specific Region	184