Model AC10

DAQ Director Software

User's Manual

Revision 2.00
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Table of Contents

Table of Figures

About This Manual

Organization

Chapter 1, ***Introduction***, gives you an overview of the DAQ Director application.

Chapter 2, ***Installation***,

- lists the minimum software and hardware requirements for DAQ Director,
- explains how to install the software needed to use this application, and
- explains how to install the Grand Interconnect or FOXI hardware used for communication between the host workstation and the VXI mainframe(s).

Chapter 3, ***Understanding the DAQ Director Application***, provides examples using DAQ Director to acquire continuous and transient data.

Chapter 4, ***DAQ Director Details***, provides a reference to the many features found in the DAQ Director application.

For additional information about DAQ Director, software updates and a users' forum visit **www.daqdirector.com** the World Wide Web.
For more information about KineticSystems and its products, visit www.kscorp.com**.**

Chapter 1: Introduction

Features

- Provides a prepackaged data acquisition system based on industry standards:
  - VXI hardware for data acquisition,
  - Windows® NT for the computer operating system,
  - LabVIEW® for the operator interface and for data analysis,
  - Visual Basic® for the system configuration,
  - Access® for the configuration database, and
  - A VISA library as the hardware/software "glue."
- Uses the Grand Interconnect™ or FOXI high-performance data highway for high I/O throughput.
- Recording to disk with transfer rates to 6.3 megabytes per second
- Allows the selection of high-performance VXI modules from KineticSystems. Modules from other manufacturers can be added.
- Self-configured to default values.
- Easy to set up and change the configuration.
- Excellent configuration control.
- An unlimited number of user-defined configuration databases.
- A suite of preconfigured displays included.
- *No* programming required to use the system as delivered.
- Easy to customize the displays and use powerful LabVIEW analysis tools.

System Hardware

A typical DAQ Director system includes the following hardware elements:

- A host computer with the Windows NT Operating system,
- A PCI Host Adapter (2962 for the Grand Interconnect or V122 for the FOXI interface).
- One or more VXI mainframes, each with a Slot-0 controller (V160 for the Grand Interconnect or V120 for FOXI).
- Fiber-optic highway cables to connect the host adapter to the Slot-0 controller(s).

Data acquisition and signal conditioning VXI modules. The system hardware is shown in the diagram on the following page.

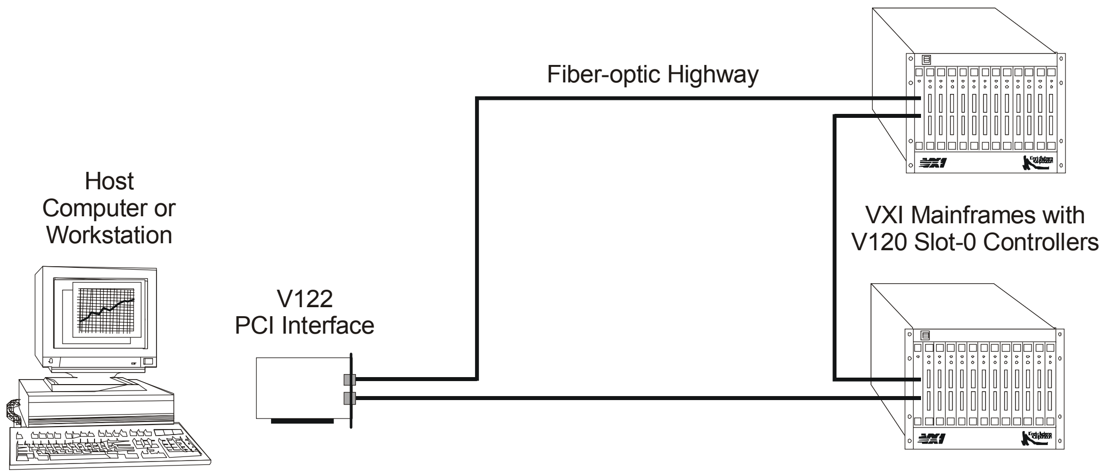


Figure 1-1. A typical hardware configuration using FOXI

The DAQ Director Main Window

Running the DAQ Director application opens its main window. DAQ Director features are accessed by using the 23 selection buttons found on the toolbar in this window.

Figure 1-2. The DAQ Director main window

Configuration Overview

The information necessary to initialize and operate the DAQ Director is held in two locations. These are the configuration file and the Access database.

Rudimentary information such as file paths and file names is held in a file, *kscsys.cfg*. You may specify the location of various system components by making entries in this file. This arrangement allows the central storage of information on the network. In this manner, multiple DAQ Director systems may access the same configuration information. The following example shows some of the configuration entries in a typical *kscsys.cfg* file.

```
SequenceDataPath=C:\DAQ_Director\Database
ResmanExePath = C:\Program Files\KineticSystems\Grand Interconnect\Resman
ResmanTblPath = C:\Program Files\KineticSystems\Grand
Interconnect\Resman\Resman.tbl
SuffixTblPath = C:\Program Files\KineticSystems\Grand
Interconnect\Resman\Suffix.tbl
*SuffixTblPath = C:\nivxi\win32\Suffix.tbl
*ResmanExePath =C:\nivxi\win32
*ResmanTblPath = C:\nivxi\tbl\Resman.tbl
```

Figure 1-3. Configuration information in the kscsys.cfg file

Detailed configuration information for the DAQ Director is held in an Access database. This Configuration Database contains the information required to initialize and operate all the modules in the VXI mainframe. In addition, the Configuration Database can contain application-specific parameters, such as engineering unit assignments, transducer identification, and calibration history.

Creating a New Configuration

The KSC Module Library is an Access database supplied with the system that contains the information necessary to build a Configuration Database. Following is a portion of the Module Library database records for the V208 ADC module. The first six fields are shown here:

DbProperty	Global	DefaultValue	PropertyType	Option_1	Option_2
AppendDataFile	Global	No	2	Yes	No
CalEU(1)	Channel	-10	0	unused	unused
CalEU(2)	Channel	10	0	unused	unused
CalRaw(1)	Channel	-10	0	unused	unused
CalRaw(2)	Channel	10	0	unused	unused
Channel_Enabled	Channel	Yes	2	Yes	No
Channel_Name	Channel	Spare#	1	unused	unused
Channel_Type	Channel	Analog_Input	0	unused	unused
ChannelCount	Global	4	1	unused	unused
ConfigAddrSpace	Global	A16	-1	unused	unused
Counts_Volt	Channel	3200	0	unused	unused
Data_Source	Global	No	2	Yes	No
Data_Type	Global	Unsigned_Integer	-1	Unsigned_Byte	Signed_Byte
DataFileName	Global	Default	-1	unused	unused

Figure 1-4. A portion of the KSC Module Library database table for the V208 ADC

Information from the Module Library supplies the data required for the Configuration Utility to create a new Configuration Database. The new Configuration Database initially contains default values as defined in the Module Library. The result is a Configuration Database that sets up the DAQ Director to operate on those default values. The following example shows a portion of the Configuration Database in Access containing default values.

Channel	Property	Value	PropertyType
Global	Module	V207 Slot3	0
Global	TTL Trigger Line	Line 1	2
Global	ModuleEnabled	Yes	2
Global	PostTriggerSamples	0	1
Global	Sample Clock Source	Internal	2
Global	Clock Setting	1000 Hz	2
Global	Enable Clock	Yes	2
Global	External Clock Rate	0	1
Global	SamplesPerChannel	100	1
Global	Number Of Buffers	1	1
Global	Data Source	0	1
Global	Enable Limit Checking	No	2
Global	ChannelCount	4	1
1	Channel Type	Analog Input	0
1	Transducer ID	Unknown	1
1	Channel Name	Slot3 Channel1	1

Figure 1-5. A Configuration Database with default values

The Operator's Interface to the Configuration Database

The DAQ Director includes a simplified interface to the Configuration Database. It is not *necessary to be an Access user or to have Access installed* on the host Computer. When you click the Resource Manager (*Resman*) from the DAQ Director window, your current module configuration is automatically determined. When you request a new Configuration Database, a pull-down menu includes only those modules that are currently in your system.

Data fields in the *Configuration Database Utility* window are either *read-only* or *editable.* The read-only fields are for information only and cannot be changed by the user. The editable fields either have an unlimited choice of valid entries, such as *Channel_ Name*, or a limited number of valid choices, such as *Clock_Setting*. If the number of choices is limited, you are presented with a *pull-down* selector, which contains all the valid choices. A typical *Mainframe Configuration Utility* window is shown on the following page.

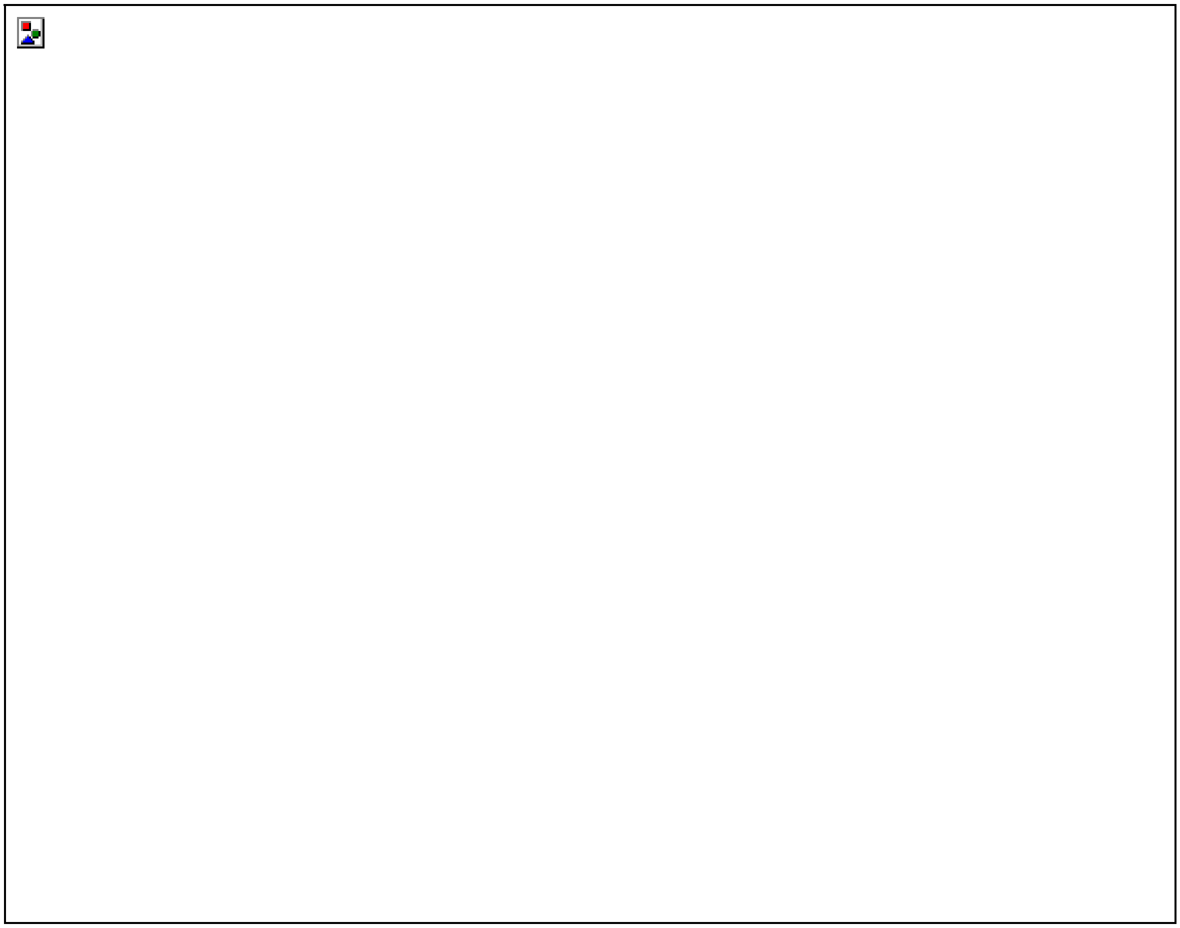


Figure 1-6. A typical Mainframe Configuration Utility window

Selection of the Configuration Database

There is no limit to the number of Configuration Databases that you can create. This allows the DAQ Director to have unique configurations for various test applications. This also aids in configuration control. The Configuration Database may be archived along with the test data to give a traceable record of the test setup. The *mainframe Configuration Utility* provides a method to easily create, edit, archive and activate a Configuration Database.

The Data Engine—the Heart of DAQ Director

Associated with each module in the mainframe is a DAQ Director *Data Engine*—an executable to control that module for data acquisition or control. When you click the *Start Data Engine* button on the DAQ Director main toolbar, a DAQ Director *Control Panel* window opens and starts the data engine. Once the data engine becomes active, the example on the following page shows *V208_Slot4 Running* and the indicator in the *V208_Slot4* button turns green. The data engine is now running. If more than one module were present, their data engines would be activated in sequence.

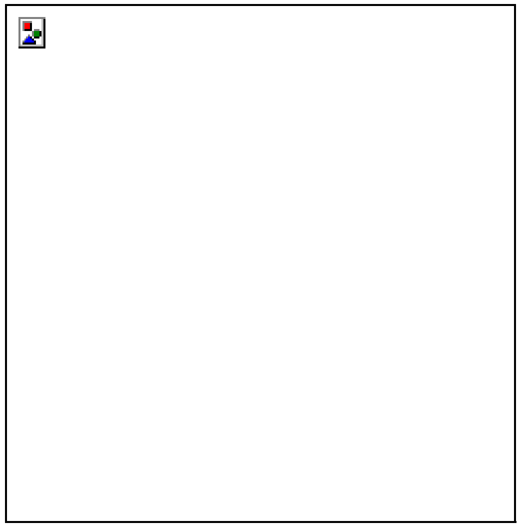


Figure 1-7. The DAQ Director Control Panel window

A typical Data Engine window is shown in the figure below. Data engine windows associated with analog-to-digital converter modules contain buttons to start and stop recording to disk as well as a button to display a quick graph to check on system operation..

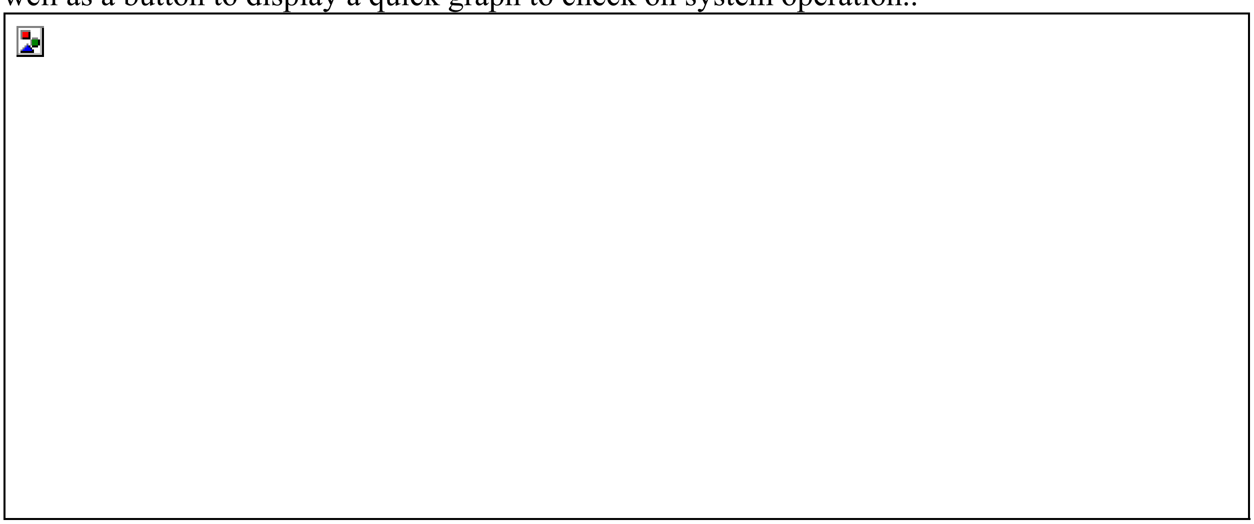


Figure 1-8. A typical Data Engine window extended to show a quick graph

Data Collection Options

DAQ Director supports two types of data collection when used with the V200, V207 or V208 data acquisition modules from KineticSystems, continuous and transient. With other modules that do not support transient capture, such as the V213, only continuous data acquisition is supported.

Continuous Data Acquisition

With continuous data acquisition, data is acquired as long as the data engine for that module is running. The data can be viewed in graphical or digital form. Clicking the *Record Data* button causes the data to also be recorded to disk. With the V200, disk recording throughput can be as high as 6.3 megabytes per second with a fast disk drive.

Transient Data Acquisition

It is often desirable to base the acquisition of data on an external event. With transient data capture, you can set the total number of samples to be captured and the number of samples to be captured after the event—thereby also setting the number of samples before the event. The memory on the module acts like a circular buffer, and data is being recorded to this on-board buffer. The event, such as a crash sled hitting a barrier, for example, causes the module to continue recording for the preset post-trigger samples, and recording stops. DAQ Director then transfers the data to disk. The primary advantages of transient recording are:

- Only the pre-trigger and post-trigger data of interest are transferred to disk, simplifying analysis, and minimizing the disk space used.
- The limiting data transfer bandwidth is from the module's A-to-D converter to its onboard memory, not the transfer to disk. This is particularly useful, for example, when using a number of V200 modules, with each module sampling at a high rate.

Calibration—the Key to Data Quality

Most KineticSystems VXI data acquisition modules include facilities for internal calibration of the entire signal conditioning and digitizing path. The Configuration Database for each of these modules can be set to automatically perform the internal calibration sequence when the data engine is run. Additionally, DAQ Director contains a rich set of routines to facilitate end-to-end calibration, including the sensor. This can be performed using live data and applying stimulus to a transducer, or it can be accomplished by text data entry, using calibration information from a sensor calibration certificate.

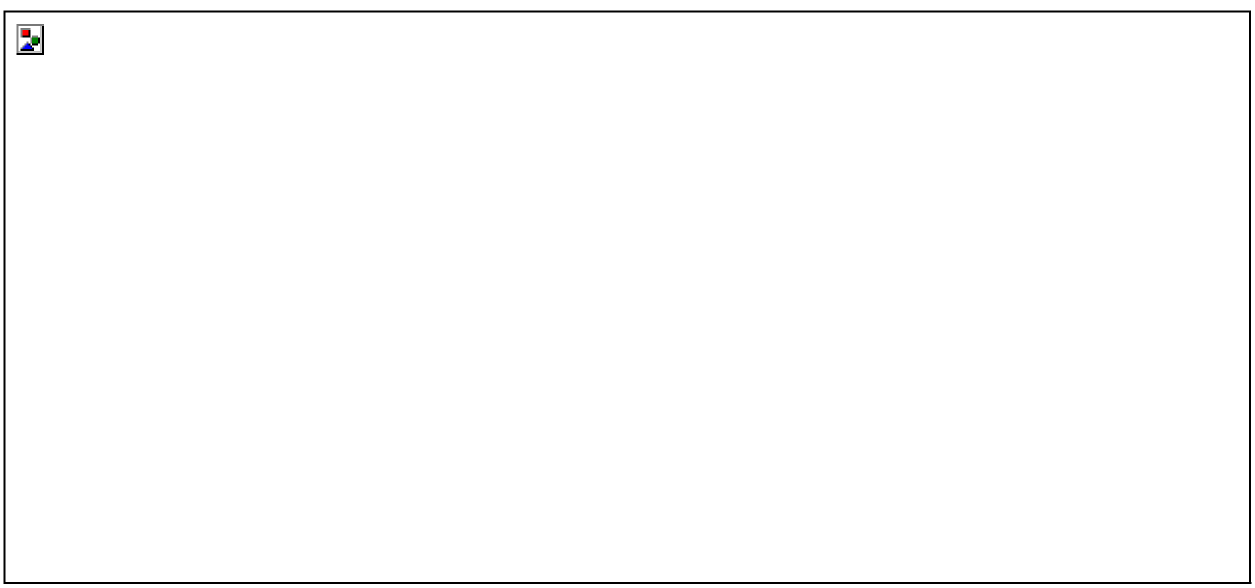


Figure 1-9. Accepting data from the Live Data Entry screen

Data Display—Information to the User

DAQ Director contains a variety of utilities to represent acquired data and present it ot you. As we saw in Figure 1-7, the Data Engine itself provides the instantaneous value of the raw data in counts as well as a quick-graph capability to provide you with a check on the results. Digital displays can be attached to the real-time data from a number of channels. These displays, as shown in the following figure, can represent ADC counts or engineering units, as set up in the Configuration Database. You can select the number of these displays that are active.

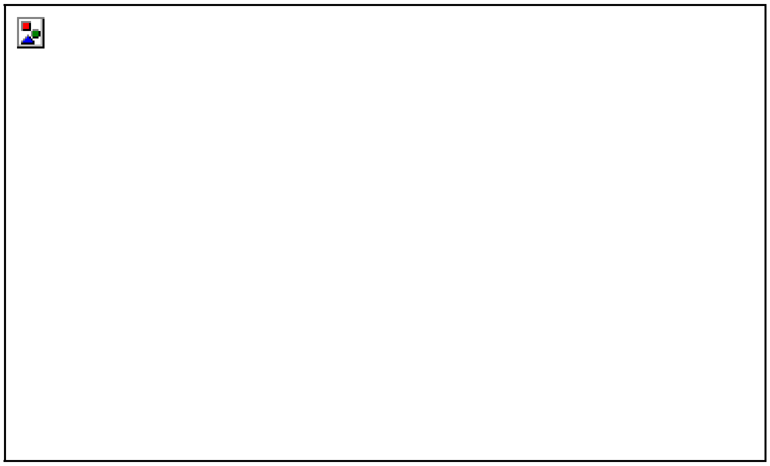


Figure 1-10. Four digital displays in a display window

Two types of meter displays are available. A single large meter can give the real-time display of data from any channel. This meter is shown in Figure 1-10. A multiple meter option is also available. A meter window with 16 meters is shown in Figure 1-11.

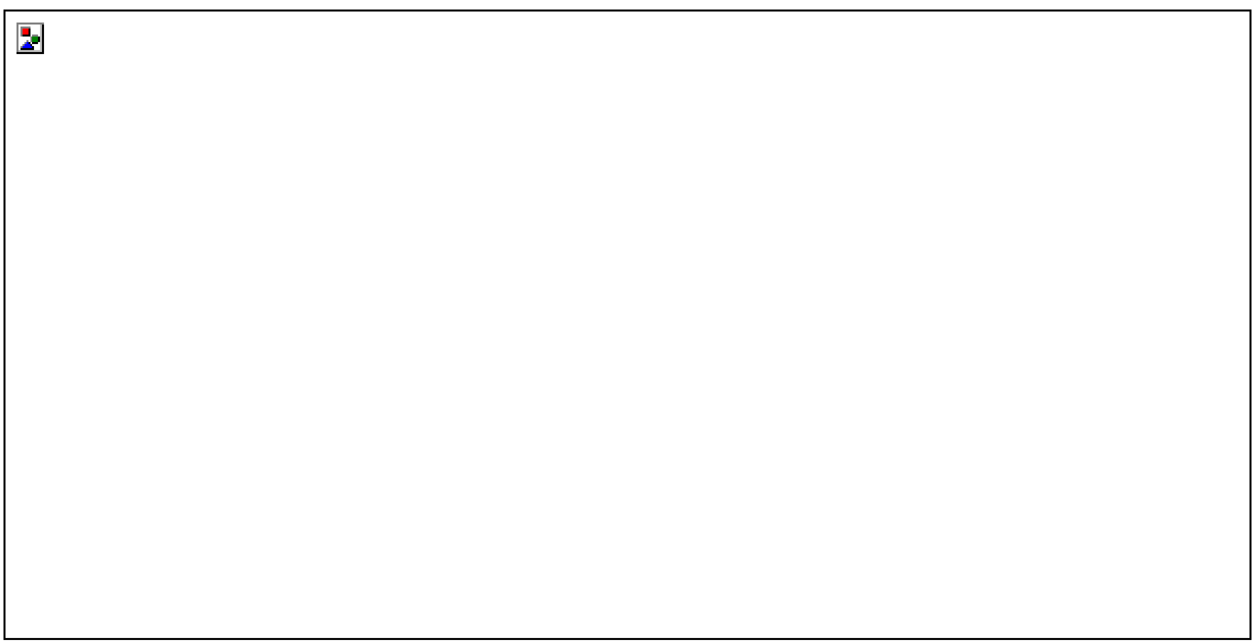


Figure 1-11. A display window containing one large meter

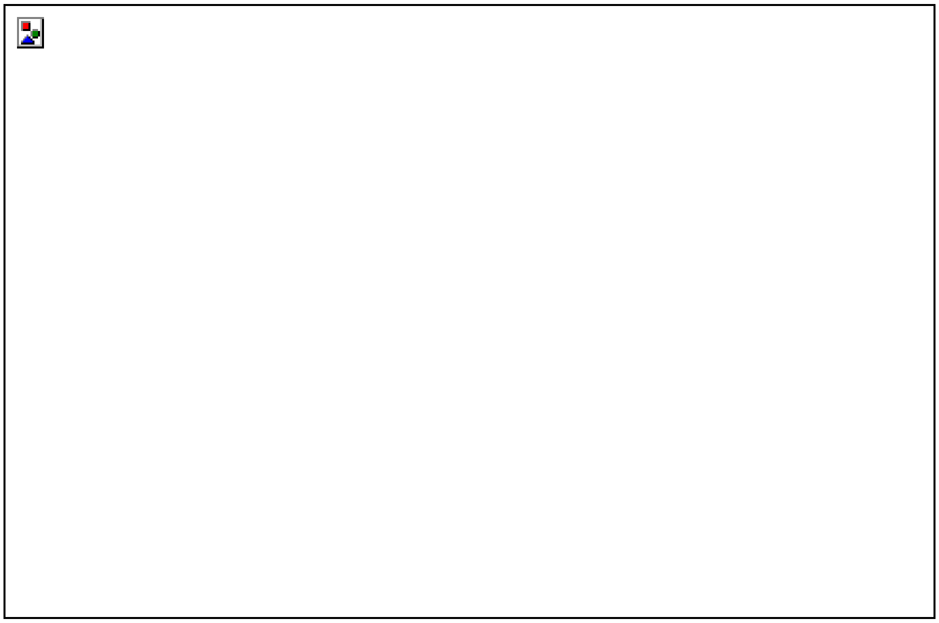


Figure 1-12. A display window containing 16 meters

The data can be displayed in graphical form as it is acquired. This graphical display includes a rich set of features, such as scaling in the x and y direction, a cursor for accurate timing measurements of the waveform, and the ability to create multiple graphs.

Figure 1-13 The DAQGraph window

Data Analysis

A key element in any test program is the analysis of the acquired data. We have just discussed the DAQGraph utility for viewing continuous data as it is being acquired and transient data after it is acquired. DAQ Director provides utilities to simplify the post-test analysis of the data stored on your hard disk. One utility demultiplexes the data and creates a tab-delimited file. This allows the resulting file to be imported into a variety of applications, including a Microsoft Excel spreadsheet. Other analysis tools, such as DADiSP and Mathmaticia can be used to provide post-test analysis. DAQ Director also includes a utility to convert a tab-delimited file to one using another delimiter character for increaced compatibility with third-party analysis tools.

If you are familiar with the LabVIEW programming environment, you can use LabVIEW to provide post-data analysis or to link LabVIEW to live incoming data.

Figure 1-14. DAQ Director acquired data imported into an Excel spreadsheet and graphed

Automating Your Test

We have shown test sequences that are activated by your selection of the various toolbar buttons. DAQ Director provides the facility to allow you to create and edit operation sequences. These can range from several steps to the automation of a complete test program. This information can be saved in a sequence file, which you can recall as needed. You can create user buttons, which can assert any DAQ Director function or execute a test sequence. The following figure shows a group of user-created buttons.

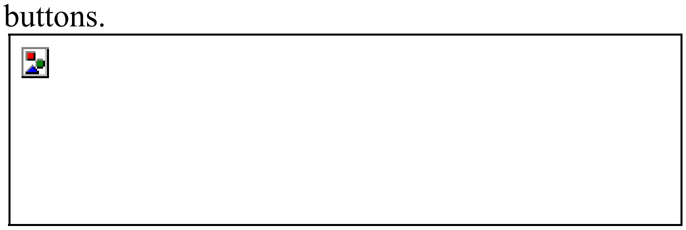


Figure 1-15. A typical set of user-created buttons

Some of the items that can be included in a test sequence are:

- Start and stop recording to disk.
- Set a value.

- Wait for a value (a conditional response).
- Execute a calibration routine.
- Read or write data.
- Perform mathematical operations.

There is no practical limit to the number of steps in a test sequence. The following figure shows the *Sequencer* window containing a test sequence to automatically perform shunt calibration on a number of bridge-type channels.

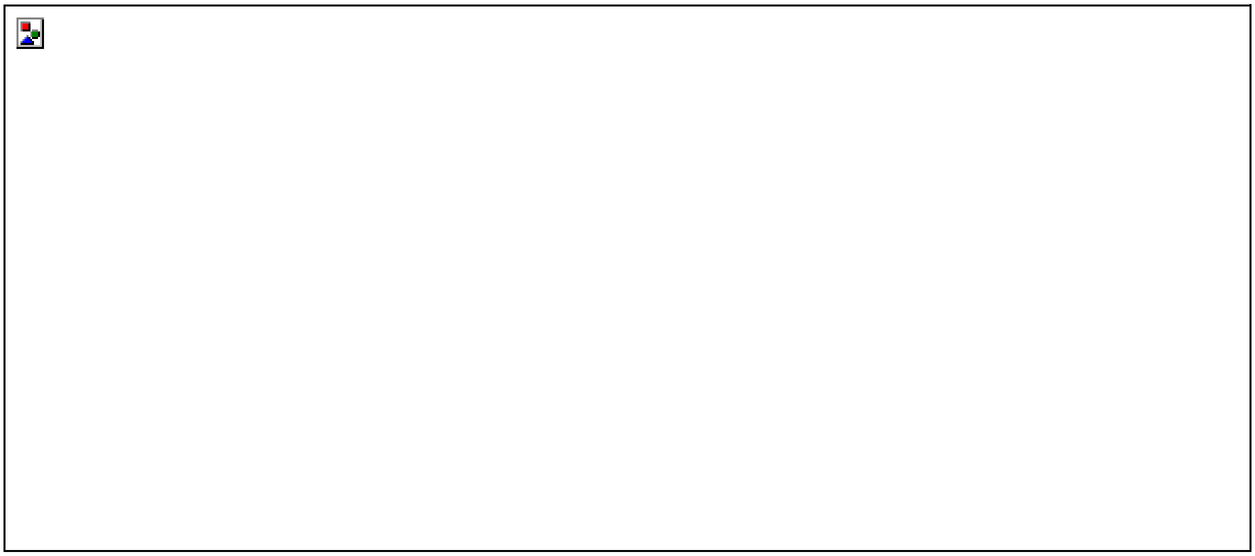


Figure 1-16. A Sequencer window containing a test sequence

Output Control

In addition to its data acquisition capabilities, DAQ Director provides a variety of control functions, using modules such as the V285 DAC/Arbitrary Waveform Generator and the V387 Digital I/O module. Control can be asserted via user-defined pushbuttons, such as those in the figure below. The action from these buttons can range from setting individual bits in a digital output module to executing elaborate test sequences. Similar to the buttons, you can create user-defined indicators to monitor digital input channels.

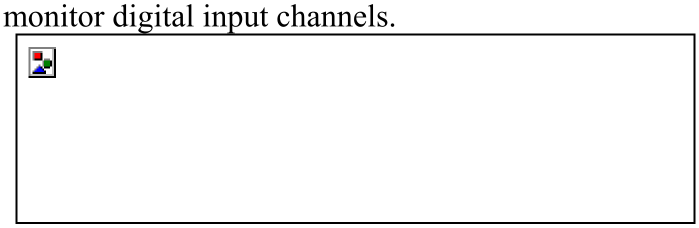


Figure 1-17. A Digital Control window containing a set of user-defined buttons or indicators

A data file can be used to generate an analog sequence when used with the V285 500,000 Sample/second DAC/Arbitrary Waveform Generator for applications such as the playback of vibration data from a test track. A *Pulse Train* utility allows the creation of precision pulse-type waveforms, which are then read by the V285. On command the V285 can repeat this pulse sequence, usually at TTL levels.

Figure 1-18. A Pulse Train window containing a precision pulse sequence for the V285

Chapter 2: Installation

System Requirements

For proper operation of a DAQ Director system the following system requirements must be met:

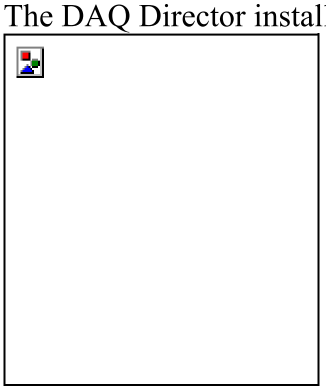
Minimum Requirement	**Recommended**
• Windows NT 4.0 or later with Service Pack 4	• Windows NT 4.0 or later with Service Pack 4
• 120 MHz Pentium processor	• 400 MHz Pentium II processor or greater
• 32 MB RAM	• 128 MB RAM or greater
• IDE or SCSI hard drive	• Fast/wide SCSI hard drive

Installing the Software

The software needed for this application is found on the DAQ Director CD-ROM. It consists of three separate installations using *InstallShield*. If your DAQ Director system has been integrated at the factory, this software would have already been installed. If you need to install the software, do the following:

- Place the DAQ Director CD-ROM in your CD-ROM drive and close the drawer.
- *Install the DAQ Director Application*—Select *Run* from the Windows Start menu. Browse the CD-ROM drive and open the *MDI_install* directory. Select *setup.exe* and run the setup file. Follow the *InstallShield* instructions. The DAQ Director application is now installed.
- *Install the LabVIEW Runtime Application*—Select *Run* from the Windows Start menu. Browse the CD-ROM drive and open the *LVruntime* directory. Select *setup.exe* and run the setup file. Follow the *InstallShield* instructions. The LabVIEW runtime application is now installed. DAQ Director uses this application to support certain graphical features.
- *Install the GI/FOXI Driver*—Select *Run* from the Windows Start menu. Browse the CD-ROM drive and open the *GrandInt* directory. Select *setup.exe* and run the setup file. Follow the *InstallShield* instructions. The kernel driver for the 2962 Grand Interconnect PCI Adapter or the V122 FOXI PCI Adapter, the VISA software and the VXI*plug&play* drivers for supported VXI modules are now installed.

The DAQ Director installation creates the following file structure:



- The *DAQ_Director* directory contains DAQ Director application files.
- The *Data* directory is used to store files associated with data acquisition.
- The *Database* directory is used to store Configuration databases.
- The *Inits* directory contains initialization (.ini) files.
- The *Library* directory contains Dynamic Link Library (.dll) files.
- The *Images* directory contains icons and other images,
- The *Logs* directory contains error logs.

Figure 2-1, The DAQ Director file structure

Once the software is installed, you will need to create an Environmental variable as well as an addition to the path. From the *Start Menu*, select *Settings*, select *Control Panel* and double click the *System* icon.

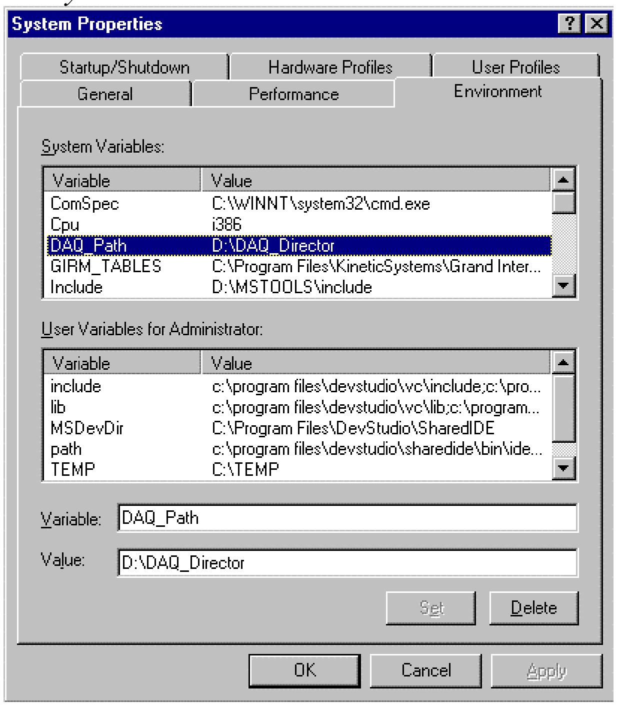


Figure 2-2. Entering the Environmental variable

The *System Properties* dialog opens.

- Select the *Environment* tab.
- In the *System Variables* window, click any variable.
- The variable will appear in the *Variable* text box at the bottom of the form.
- Highlight the text in *Variable* text box and enter `DAQ_Path` in the box. This will not harm the variable previously selected.
- Enter `C:\DAQ_Director` in the *Value* text box immediately below. If DAQ Director had been installed on a different drive, substitute the actual drive letter for *C:* (*D:* in this example).
- Press Set. This defines the new variable in the operating system. It now appears in the *System Variables* window.

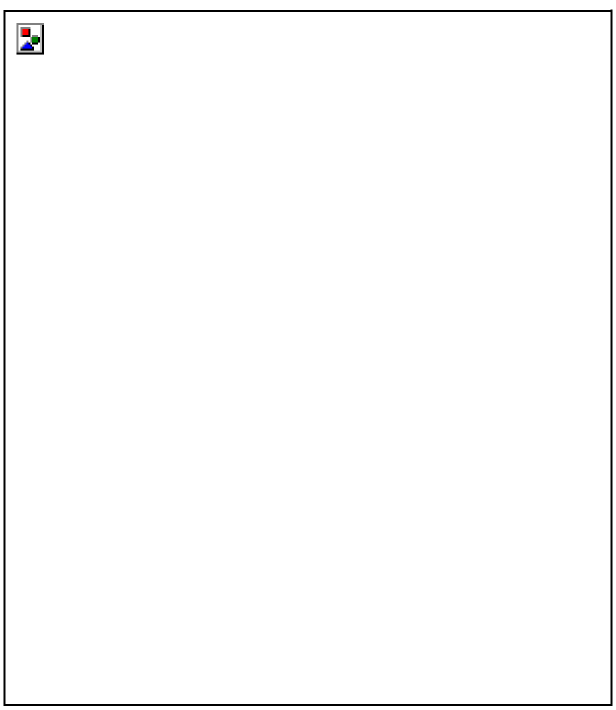


Figure 2-3. Entering the path

- Next find *Path* in the *System Variables* window. Click on it.
- *Path* will appear in the *Variable* text entry window at the bottom of the form
- Place the insertion point (cursor) in the *Value* text entry box.
- Press *End* on the keyboard. This moves the insertion point to the end of the string in *Value*.
- Enter `;C:\DAQ_Director\Library` to append this value to the semicolon-delimited string. If DAQ Director had been installed on a different drive, substitute the actual drive letter for *C*.
- Click *Set*.

Click *OK* to update the information and close the *System Properties* dialog.

Installing the Grand Interconnect or FOXI Hardware

A DAQ Director system uses the high-speed, deterministic Grand Interconnect or FOXI hardware to communicate between the Windows NT workstation and the VXI mainframe. These interfaces include the following:

- A PCI Host Adapter (Model 2962 for the Grand Interconnect or Model V122 for the FOXI interface) for the Windows NT workstation.
- A Slot-0 controller for the VXI mainframe (Model V160 for the Grand Interconnect or Model V120 for the FOXI interface).
- A pair of fiber-optic cables terminated with ST connectors (Model 5802-Lxyz or 5802-Nxyz).

Caution—Use appropriate handling precautions to avoid electrostatic discharge (ESD) damage to any of the electrical components.

1. - *PCI Host Adapter Installation*—The 2962 or V122 PCI Host Adapter can be installed in any full-size PCI expansion slot in your Windows NT workstation.
   - Before starting the installation, turn off the power to the workstation and remove the power cord.
   - Remove the workstation cover and locate an empty full-size PCI expansion slot.
   - Remove the blank plate from the mounting rail of the selected slot. Insert the 2962 or the V122 into the slot and secure the card with the screw that you removed from the blank plate.
   - Replace the workstation cover, and reinstall the power cord.
2. *Slot-0 Controller Installation*—The Slot-0 controller (Model V160 or V120) is configured at the factory for standard operation. Verify that the logical address switch is set to "0" as indicated by the top segments of all of the logical address switches pushed *in*.

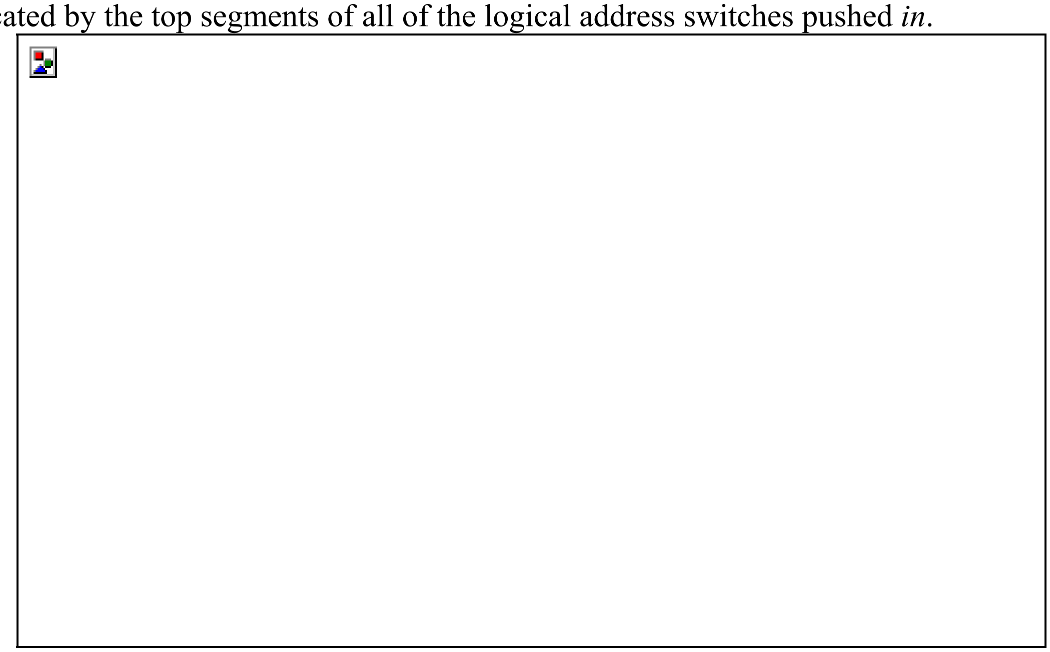


Figure 2-4, Slot-0 controller logical address switch settings

   - *Be sure that the power switch on the VXI mainframe is OFF.* Install the Slot-0 controller in Slot 0 (the left-most slot) of the mainframe. Press the front panel until the controller seats fully. Then tighten the top and bottom front-panel screws.

- Set the front panel *Node Address* switch to `01`. If your system contains more than one mainframe, each controller must be set to a different address in the range of 01 to 126.

3, *Connect the Fiber-optic Cables*—The PCI Host Adapter communicates with the Slot-0 control via a fiber-optic highway "loop." For systems with one VXI mainframe:

1. Connect a fiber-optic cable from the *Hwy Out* connector on the PCI Host Adapter to the *Hwy In* connector on the Slot-0 controller. To connect a fiber-optic cable connector, push it onto the panel connector until it is fully seated, then push and turn the spring-loaded barrel clockwise until it locks into place. *It is extremely important that the barrel be rotated. Otherwise, the fiber end may not be fully seated, with possible transmission errors.*
2. Connect a second fiber-optic cable from the *Hwy Out* connector on the Slot-0 controller to the *Hwy In* connector on the PCI Host Adapter. Be sure that the connectors are fully locked as indicated above.

- For systems with more than one mainframe, the fiber-optic cables are connected as follows:

1. Connect a fiber-optic cable from *Hwy Out* on the PCI Adapter to *Hwy In* on the first Slot-0 controller.
2. Connect a fiber-optic cable from *Hwy Out* on the first Slot-0 controller to *Hwy In* on the second Slot-0 controller.
3. Repeat Step 2 for all remaining Slot-0 controllers.
4. Connect a fiber-optic cable from *Hwy Out* on the last Slot-0 controller to *Hwy In* on the PCI Adapter, completing the "loop."

Figure 2-5. Fiber-optic cable connections with one VXI mainframe

Chapter 3: Understanding the DAQ Director Application

Overview

In order to obtain an better understanding of the DAQ Director application, we cover the following topics in this chapter:

- Most of the DAQ Director features are accessed by the main toolbar. Each of the 23 selection buttons is listed, and a summary is provided for each feature button.
- Several examples are described. All of the steps, from equipment setup through the viewing of recorded data, are given for each example. If you have the equipment available, you can perform these examples, or you can follow the examples on paper to gain insight into many of DAQ Director's features.

DAQ Director Main Window Toolbar Button Summary

The DAQ Director Main Window includes a toolbar that contains 23 selection buttons that perform a wide range of functions within the software application. The action performed by selecting each button is summarized below.

View/change Configuration Database—This selection opens the *Mainframe Configuration* dialog. From this dialog you can create a new database, open an existing database, view and make changes to module properties within a database, and save a new or changed database. It can also update the database to the latest revision level.

View Suffix Table—This selection opens a *Notepad* window that displays the contents of the Suffix table. This file contains the mainframe node address as well as the slot location, the model number and the model suffix of each of the I/O modules. The *GetSuffix* utility is run as part of the *Resman* selection.

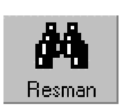
View/edit Setup File—This selection opens a *Notepad* window that displays the contents of the *kscsys.cfg* setup file. You can change, add or delete setup parameters. Saving a modified window will cause the changes to go into effect the next time DAQ Director is run.

View Resman Table—This selection opens a *Notepad* window that displays the contents of the *Resource Manager* table. Table entries include the model and manufacturer of the computer interface as well as the model, manufacturer and slot number of each I/O module.

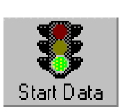
Select New Configuration—This selection displays an *Open File* dialog that allows you to select a *Configuration* database from the list of existing databases and make it the current database by clicking the *Open* button.

Open Sequence Editor—This selection displays the *Sequence Editor* dialog. This editor allows you to create a sequence of commands that will be automatically executed whenever you wish. You can create and save a sequencer file for each of your tests.

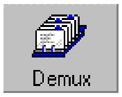
Open Pulse Train Editor—This selection displays a *Pulse Train* editor. It can display up to 16 channels of data. There are two timing modes, with the data represented by data points or milliseconds. This editor is useful for generating files with precision pulse trains for use with the Model V285 Waveform Generator.



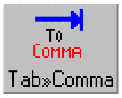
Run Resource Manager—This selection runs the VXI Resource Manager (*Resman*) and the *GetSuffix* utility. *Resman* interrogates the modules in the mainframe to determine the system configuration. It must be run before any data acquisition or control can take place.



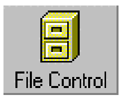
Start/stop Data Engine—This button has two states, *Start Data Engine* (green) and *Stop Data Engine* (red). When the data engine(s) are stopped, it is green. Selecting it then starts the data engine(s), turning it red. Selecting it again stops the data engine(s) and turns it green again.



Demultiplex Data—This selection causes data that is stored in interlaced form to be demultiplexed (Channel 1 data block, Channel 2 data block, …), converted to engineering units and stored in tab-delimited ASCII, allowing the data to be readily viewed in Excel or similar applications.

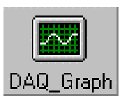


Convert Tab to Comma Delimited—This selection allows a data file that is formatted in tab-delimited form (as from *Demultiplex Data* above) to be converted to comma-delimited form in order to match the requirements of a particular data analysis application.



Open File Control—When the data engine(s) are running, this selection opens a *File Control* dialog. It allows you to select a data engine and create a data file name. If the *File Control* selection is made when the engine(s) are stopped, a runtime error occurs.

Start/stop Recording—This button has two states, *Record Start* (green) and *Record Stop* (red). When green, selecting it starts continuous data recording to disk, turning it red. Selecting it again stops the recording to disk.

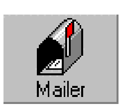


Display Graphical Data—This selection displays a viewer that presents the data in graphical form as it is acquired. This viewer can contain one or more graph windows with each graph containing one or more channels. You can select the channels to be graphed.

Display Digital Data—This selection displays a viewer that presents the current value of the data in digital format. This viewer opens with the number of channel monitor windows selected in the previous display. You can select the channels to be monitored, and you can add channel monitor windows.

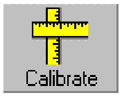
Control Digital Output—This selection displays a window that contains buttons for controlling digital output channels. Each button is a toggle to select the state of the associated output channel (OFF or ON). You configure each button, its association with an output data channel, and its color when OFF or ON in the *kscsys.cfg file*. Rectangular displays similar to the buttons can be created to monitor digital input channels.

Run Sequencer—This selection displays a dialog box that allows you to select, load and execute any of the command sequences that you created earlier with the sequence editor. This automates the execution of preconfigured test sequences.

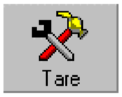


Mailer—This selection opens a dialog box that allows you to send mailbox messages and view received messages. This send/receive message utility is used primarily for diagnostic purposes.

Display User-defined Buttons—This selection displays a group of user-defined pushbuttons. The color, label text and action for each button would have been previously created in the *KscSys.cfg* file.

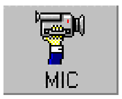


Open Calibration Utility—This selection displays a dialog box that allows you to set up, view and save multi-point calibration constants for desired channels. Calibration information can be acquired from live data or from manual text entry.



Set/clear Tare Values—This selection opens a dialog box that allows you to select one or more channels and arithmetically remove the tare offset based upon current transducer conditions. You can also clear the tare settings.

Reset Internal Calibration— This selection opens a dialog box that allows you to select one or more channels and reset the internal calibration constants for those channels.



Control the GI—This selection opens a dialog box that allows you to provide interactive control of the KineticSystems Grand Interconnect or FOXI computer interface.

A Continuous Data Example Using the V208 ADC

The V208 ADC module is usually used with one or more signal conditioning modules, such as the V243 Low-level Signal Conditioner or the V246 Bridge Signal Conditioner. For this simplified example, the V208 is used alone. It assumes that you have already installed the DAQ Director software, the Resource Manager (Resman) software for the Grand Interconnect (GI) or the FOXI computer interface, and the GI or FOXI PCI host adapter.

1. The following hardware and software are required for this example:
   - A Pentium-based computer with Windows NT, Version 4.0 (with Service Pack 4) or later
   - DAQ Director application software
   - Resource Manager (*Resman*) software for FOXI or the Grand Interconnect (found on the DAQ Director distribution CD-ROM)
   - A PCI host adapter (V122 for FOXI or 2962 for the Grand Interconnect)
   - A Slot-0 controller (V120 for FOXI or V160 for the Grand Interconnect)
   - Model 5802 fiber-optic cables (two required)
   - A V208 ADC module
   - A VXI mainframe (V194 or equivalent)
   - A function generator, set to produce a sine wave output.
   - A cable with a BNC connector on each end for use with function generator
   - A cable with an SMB connector on one end and a normally open momentary-contact switch on the other end (used for the transient test)
2. The VXI mainframe configuration is set up as shown below:

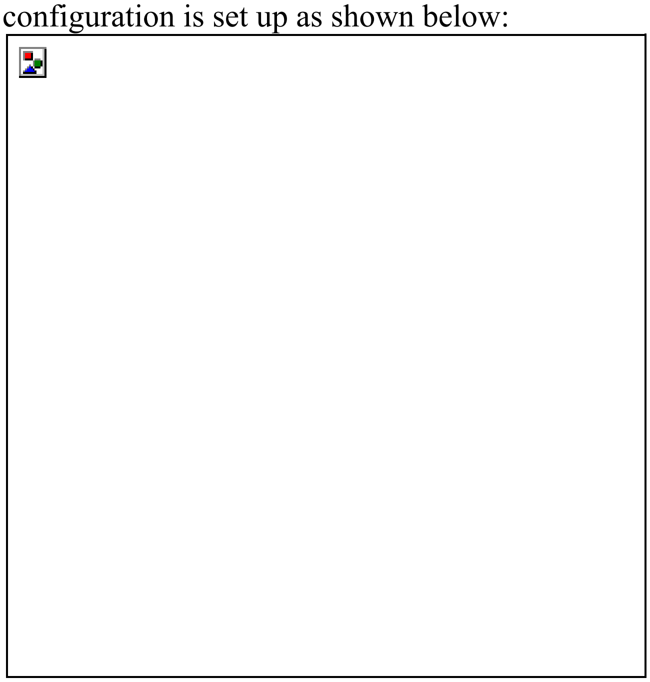


Figure 3-1. The VXI Configuration for the V208 Example

- *With the power switch on the mainframe OFF,* insert the V120 or V160 Slot-0 controller in the left-most slot (Slot 0) and the V208 ADC module in Slot 4 of the VXI mainframe.

- Connect one fiber-optic cable from *Hwy Out* on the PCI host adapter to *Hwy In* on the Slot-0 controller.
- Connect the other fiber-optic cable from *Hwy Out* on the Slot-0 controller to *Hwy In* on the PCI host adapter.
- Connect the BNC cable from the function generator output to the *Ch1* input of the V208. *Be sure that the shell of the function generator output is connected to ground. Otherwise, the differential input on the V208 will "float" and distort the monitored signal.*
- Connect the switch cable to the *Trig In* SMB connector on the V208. This will be used for transient capture mode.

3. Press the power switch on the mainframe to the ON position. After the power-up self test is completed in a few seconds, the only module LED that should be ON is *Sync* on the Slot-0 controller, indicating that synchronization has been established from the PCI host adapter.
4. Select *Programs | KineticSystems DAQ Director II | Control Panel* from the Windows Start Menu or double-click the DAQ Director shortcut on the Windows Desktop (if you had created one) to start DAQ Director. The DAQ Director Main Window opens as shown below.

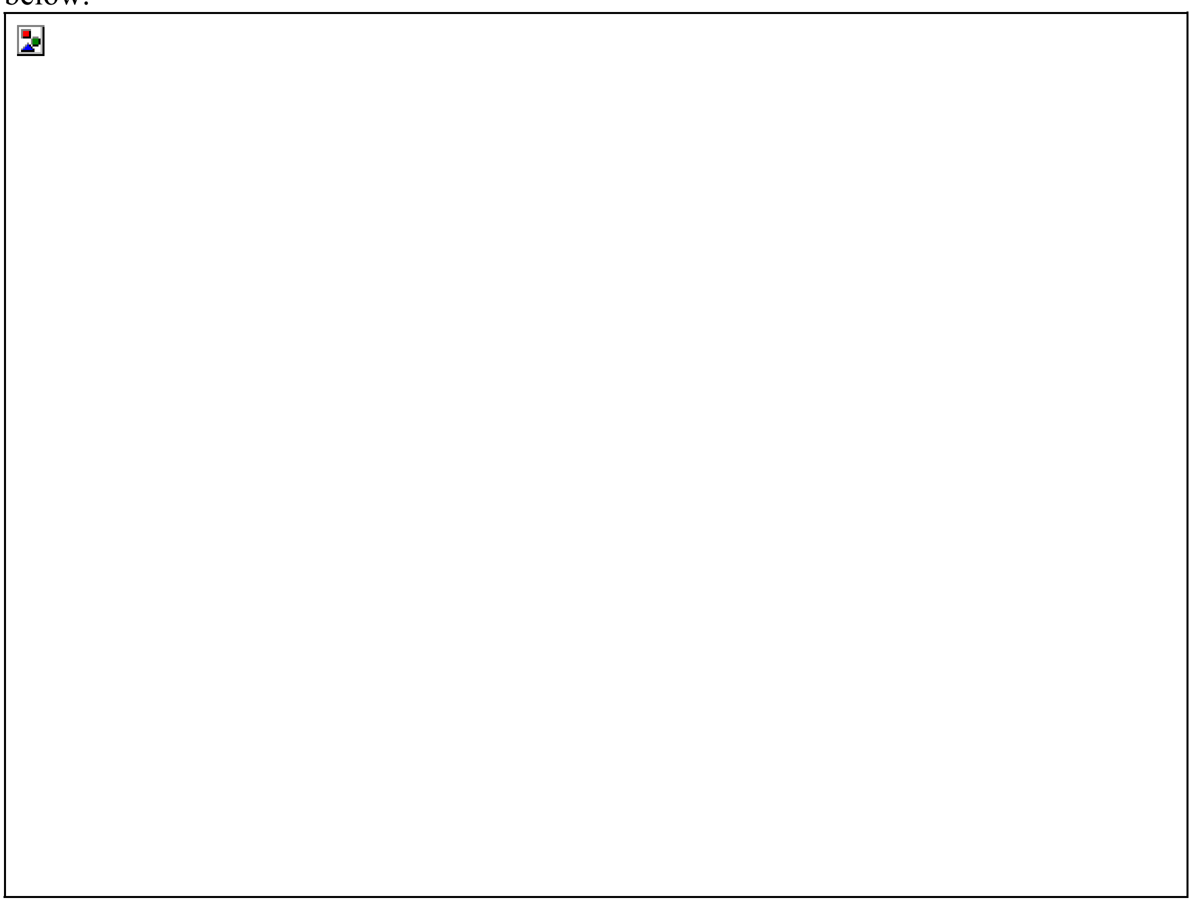
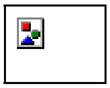


Figure 3-2. The DAQ Director Main Window

5. Click the *Resman* button on the toolbar to run the VXI Resource Manager (*Resman*). A

DOS window opens while *Resman* interrogates the modules in the VXI mainframe to create a *Resman table* of the configuration. The DOS window closes when *Resman* is complete. If *Resman* cannot complete (if the mainframe is OFF, for example), *Resman* halts, and the DOS window remains open. In that case, use the Window Close box to close it.



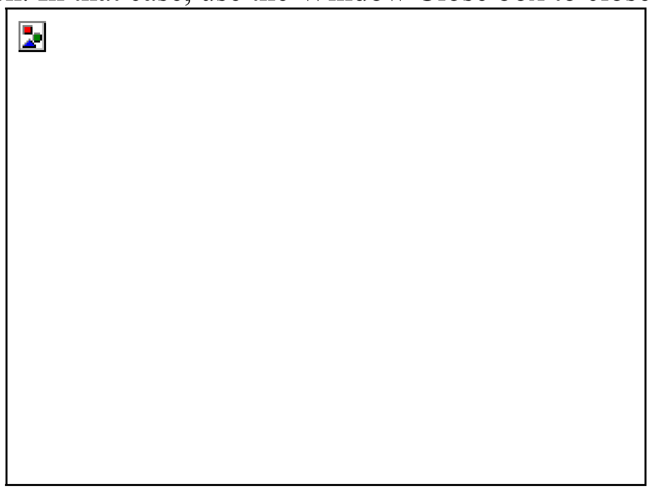
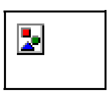


Figure 3-3. Resman executing in a DOS window.

6. Click the *ResMan* button on the toolbar to open a *Notepad* window to view the contents of the *Resman table*. This table contains the configuration information obtained by the execution of the Resource manager. *Resman* determined that a V160 was present in Slot 0, a V208 in Slot 4.and that the manufacturer of both products is KineticSystems (VXI manufacturer Code f29), along with other information. Close the *Notepad* window after you have viewed it.



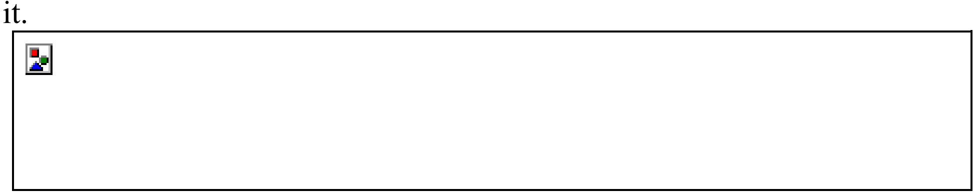


Figure 3-4. Viewing the Resman table

7. Click the *Suffix* button on the toolbar to open a *Notepad* window to view the contents of the *Suffix table* (V208-ZD22 in Slot 4 in this case). The module suffix in KineticSystems products indicates a particular set of ordering options (memory size, number of channels, etc.). This information is needed by DAQ Director. It can be read from the modules' *Suffix register*. The batch file that runs *Resman* also runs the *GetSuffix utility* that creates a *Suffix table*.

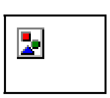
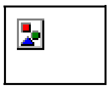


Figure 3-5. Viewing the Suffix table

8. Click the *Config* button on the toolbar to open the *Configuration Utility* dialog.. If no configuration database is present, the body of this dialog will be blank. If one or more databases are present, it will represent the currently active database.



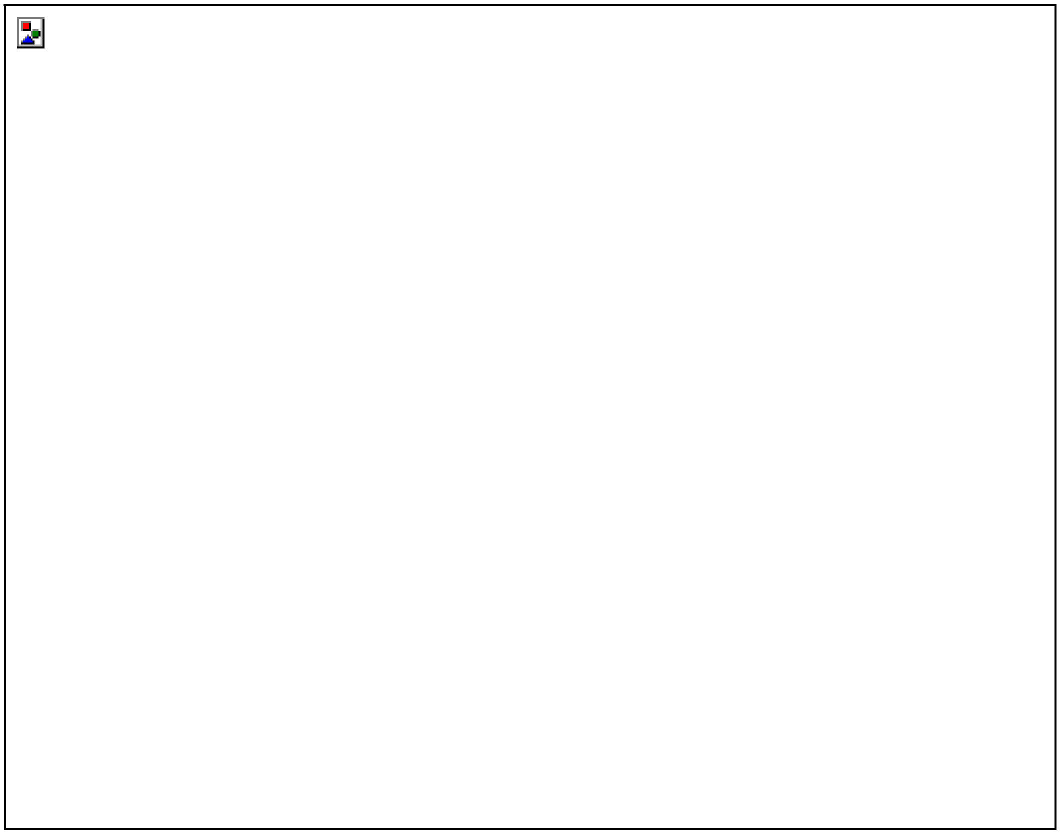
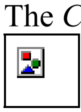


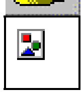
Figure 3-6. The Configuration Utility dialog box

The *Configuration Utility* dialog contains five toolbar buttons. They are described here:

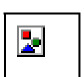


Create New Database—This selection is used to create a new configuration database. There is no practical limit to the number of databases that can be present on your local or network drive..

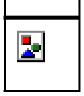
Select a Database for Editing—This selection opens a file dialog that allows you to select a database for editing from the list of existing databases.



Save Database—This selection saves any changes that you have made to the database that is open for editing. Note that this action *does not* make this the currently active database.



Select New Configuration—This selection opens a file dialog that allows you to select a database to be currently active from the list of existing databases



Update Configuration—This selection opens a file dialog that allows you to select a database and make that database compatible with a new release of the KSC library.

Select the *Create New Database* button in the *Configuration Utility* dialog box. A file dialog opens. Enter `demo1` in the *File Name* box and click *Open*. A new database, *demo1.mdb*, is created. Since *Resman* had previously determined the configuration, this database contains properties for the V208 in Slot 4. Click the *Channel* pull-down and select *V208_Slot4 Channel = Global*. This allows you to view the global parameters (those that are common to all channels).

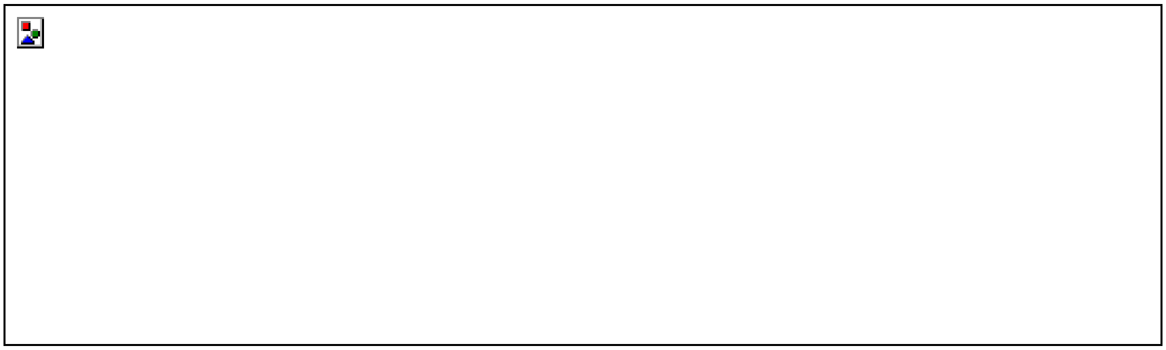


Figure 3-7. Selecting global parameters for viewing

You will now select a new *per-channel* clock setting property. The default value in the KSC library is *1000 Hz*. Click the pull-down for the value of the *Clock_Setting* property. This gives you a list of clock settings for the V208. Select 2*000 Hz* from the list. This will cause each of the four channels in the V208 to be sampled at 2000 Hz.

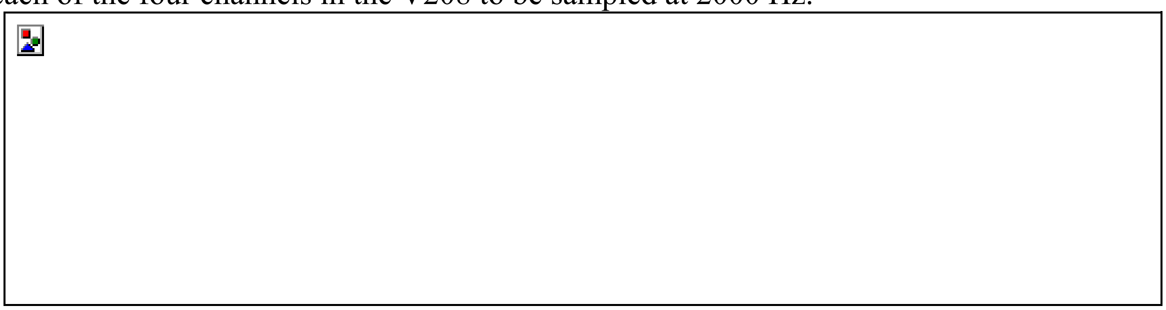
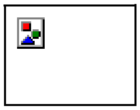


Figure 3-8. Selecting the clock rate for each channel

- Scroll down until you see the *SamplesPerChannel* property. This affects the update rate for graphical displays. This property generally should be set to 10% of the clock rate for continuous data acquisition. Note that the *Test_Mode* property immediately below the *SamplesPerChannel* property is set to *Continuous* for continuous data acquisition.
- Enter *200* for the *Samples per Channel* value.
- Click the *Save Database* button to save your changes.
- Click the *Select New Configuration* button to make *demo1.mdb* your currently active database.
- Click the *Close Box* in the upper right corner of the dialog to close it and return you to the main DAQ Director window. Note that the status line at the bottom of the window indicates: *Config Database Name: demo1.mdb*.

9. Now that you have a created, edited, saved and made current a configuration, you can run the data engine to begin to acquire data in continuous mode. Click the *Start Data Engine* button from the toolbar. This green button turns red, making it available to stop the data engine. For this example, we only have the V208 and its data engine. If more modules with their associated data engines were present, the *Start Data Engine* button would start all of them.



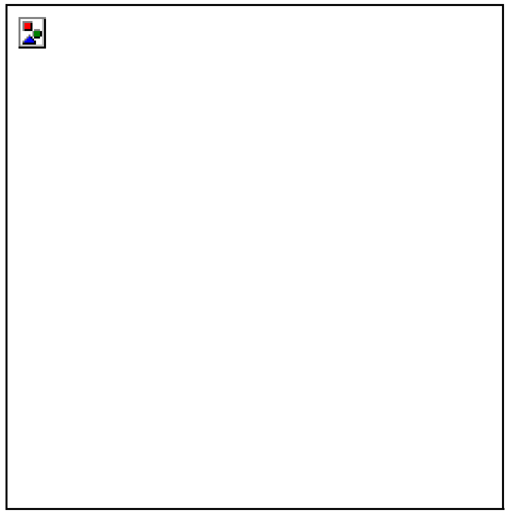


Figure 3-9. DAQ Director Control Panel

As shown in Figure 3-9, selecting *Start Data* opens the DAQ Director *Control Panel* window (if it is not already open) and starts the data engine. Once the data engine becomes active, the status indicates *V208_Slot4 Running* and the indicator in the *V208_Slot4* button turns green. The data engine is now running. If more than one module were present, their data engines would be activated in sequence.

10. When the data engine becomes active, it appears minimized in the Windows toolbar. Click the V208 icon in the Windows toolbar to bring it into the DAQ Director window as shown below.

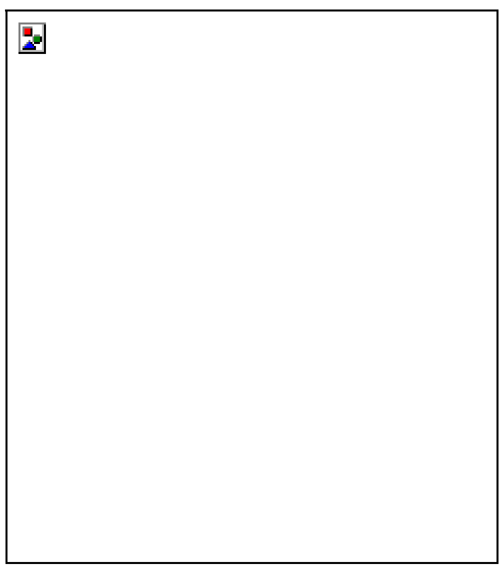


Figure 3-10. The V208 data engine dialog

The data engine dialog includes a text box at the top, which indicates the instantaneous value of the data being read from the selected channel. This is represented in raw counts (0 to 65536 from minus full scale to plus full scale for a 16-bit ADC). The box in the upper left-hand corner is normally white and turns red any time a data overrun condition exists. Click the *Plot* button to view a quick plot of the data as it is being acquired.

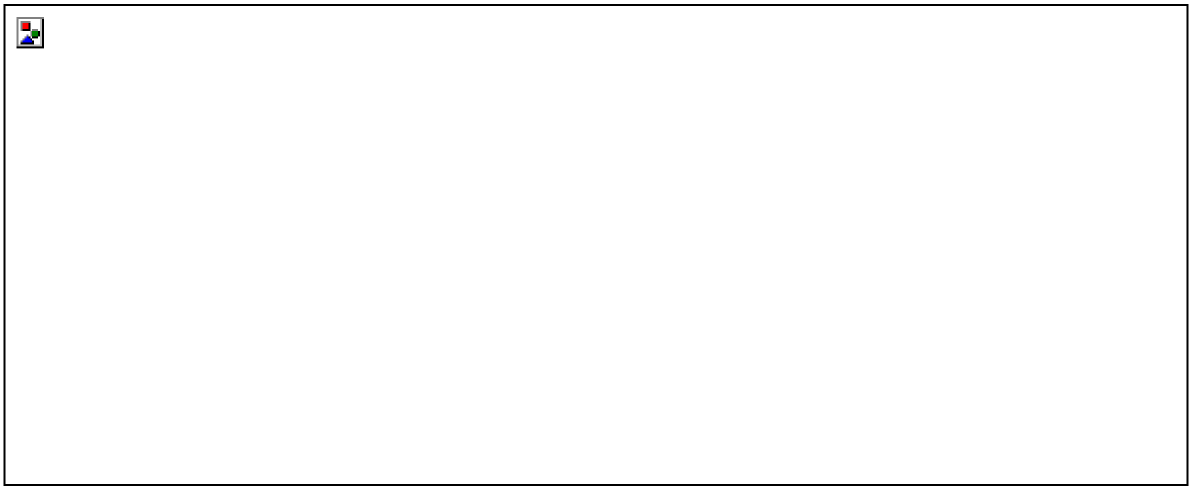


Figure 3-11. The V208 data engine dialog extended to view a quick plot of the data

- With the function generator connected to Channel 1 of the V208, set the frequency to 50 Hz
- Increase the signal amplitude to approximately ±7 volts (14 volts peak-to-peak). The graph, which is being updated 200 times per second (as set earlier by the *Samples per Channel* property in the Configuration Utility), should look similar to that shown above. The full-scale range is ±10.24 volts. Change the frequency to 100 Hz and note the change in the display.
- Select *Slot4_Ch2* from the pull-down. The result should be a straight line as seen below. The actual amplitude will vary, since the Channel 2 input is "floating."

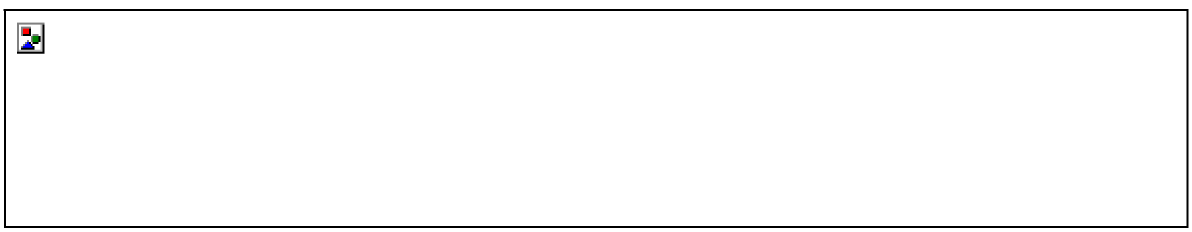
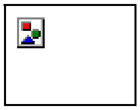


Figure 3-12. The V208 data engine dialog extended and viewing Channel 2

- Click the *Plot* button again to collapse the dialog. *This graphical display can adversely affect system performance, so it should be selected only to check operation of the data engine. The dialog should be collapsed or minimized during normal operation.*
- Click the *Minimize* box on the dialog to minimize the data engine.

The sequence of steps that you have just taken shows some of the power of DAQ Director to easily configure a system and make a quick check on the acquisition of data.

11. With the V208 data engine minimized but still running, select the *Display Graphical Data* button from the DAQ Director toolbar. This opens a *Select Channels* dialog. Since the V208 is the only data engine running, it is the only item listed in the *Digitizer* text box. Under *Channels Available* select *Slot4_Ch1*. Click the *OK* button to accept your selection.



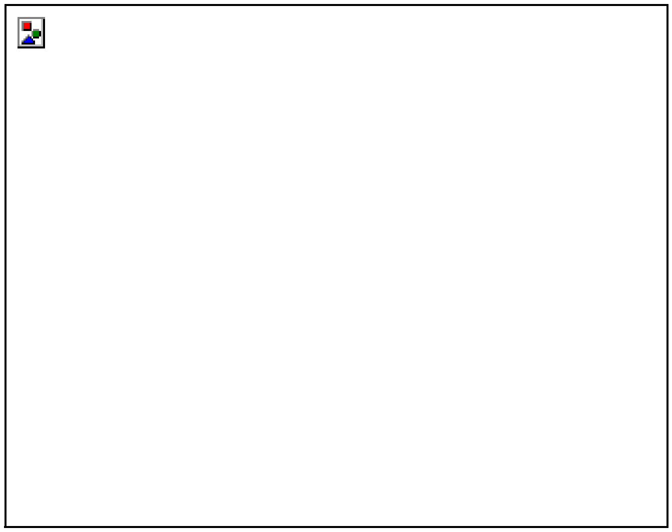


Figure 3.13. The channel selection dialog for the graphical display

The *DAQGraph* window opens. The display should be similar to that shown below.

Figure 3-14. The DAQGraph window

This graphical display includes a rich set of features, such as scaling in the x and y direction, a cursor for accurate timing measurements of the waveform, and the ability to create multiple graphs. The features of this utility will be described in detail in the next chapter. Click the *DAQGraph* window close box to close it.

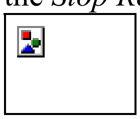
12. Up to this point you have:

- Set up a simple example using the V208 ADC,
- Run the DAQ Director application,
- Run the Resource Manager (*Resman*) to automatically determine the module configuration in the VXI mainframe,
- Viewed the *Resman* and *GetSuffix* tables,
- Created and edited a configuration database,
- Started the V208 data engine,
- Viewed a quick graph within the V208 data engine dialog, and
- Viewed the data in the *DAQGraph* display.

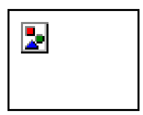
13. The next step is to record to disk the data that is being acquired by the V208. There are two ways to manually start recording.

    - One method is to click the *Record* button on the V208 data engine dialog. this would record only from the V208, even if other modules and their associated data engines were present and running, See Figure 3-11 for the location of the *Record* button.
    - Another method is to use the *Start Recording* button on the main toolbar. This will start recording from all running data engines that are related to ADC modules.

    With the V208 data engine still running and the signal source set to 50 Hz and about 14 volts peak-to-peak, click the green *Start Recording* button. It will turn red to become the *Stop Recording* button, and recording to disk will commence. After about 5 seconds, click the *Stop Recording* button to cease recording.



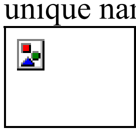
Click the green *Start Recording* button to start recording to disk.



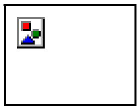
Click the red *Stop Recording* button to stop *recording* to disk.

This creates a binary data file *V208_Slot4.bin* in the *c:\DAQ_Director\Data* directory. This binary file stores the data in interleaved form (Channel 1, 2, 3, 4, 1, 2, …) as it was extracted from the V208. If, during a DAQ Director session, you performed the *Start/stop Recording* sequence one or more additional times, the new data would be appended to the file. You can use the time tags that are stored with the data points to determine the location of each recording segment.

At the start of a session, DAQ Director always creates a new binary data file or overwrites an existing file. Later in this document we will describe how to use *File Control* to provide unique names for the data files.



Click the *Demultiplex Data* button to create a new file that uses the binary data file in demultiplexed form (Channel 1 data block, channel 2 data block, …), converts the data to engineering units (if desired) and presents the data in tab-delimited format to make it compatible with other applications such as *Excel*.



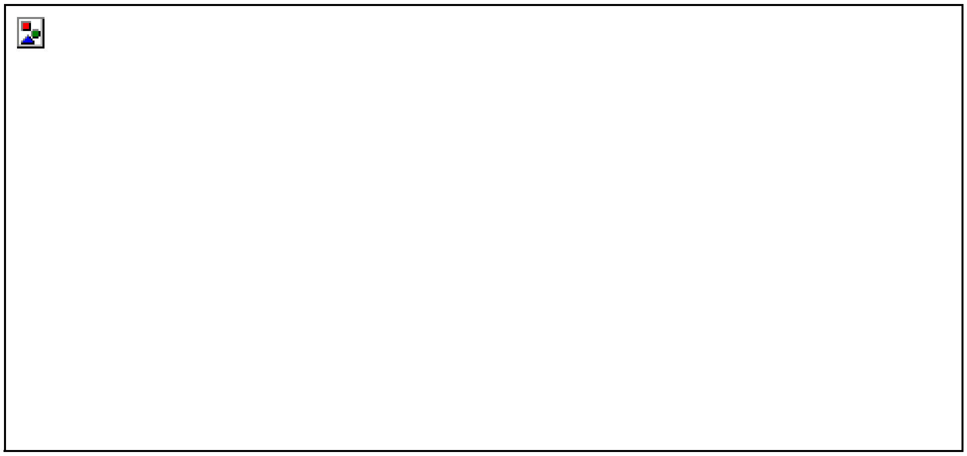


Figure 3-15. The Demultiplex_Data_Files dialog

Clicking the *Demux* button opens the *Demultiplex_Data_Files* dialog. To Demultiplex the *V208_Slot4* binary file, select it and click the *Go* button. File processing will commence, as indicated in the text box. When processing is complete, a beep will be heard and the status will change to *Finished processing files*. In this case a file *V208_Slot4.tda* is created in the *Data* subdirectory. If that file already existed, it will be overwritten. Click the *Exit* button to close this utility.

14. Open the *Windows NT Explorer* and double-click on the tab-delimited *V208_Slot4.tda* file. If files with a *tda* extension are not already arranged to open *Excel*, select *Excel* when *Windows NT* presents the *Open With* dialog. *Excel* should then open. If it presents you with the *Text Import Wizard*, select *Tab-delimited data.* The spreadsheet should be similar to that shown below.

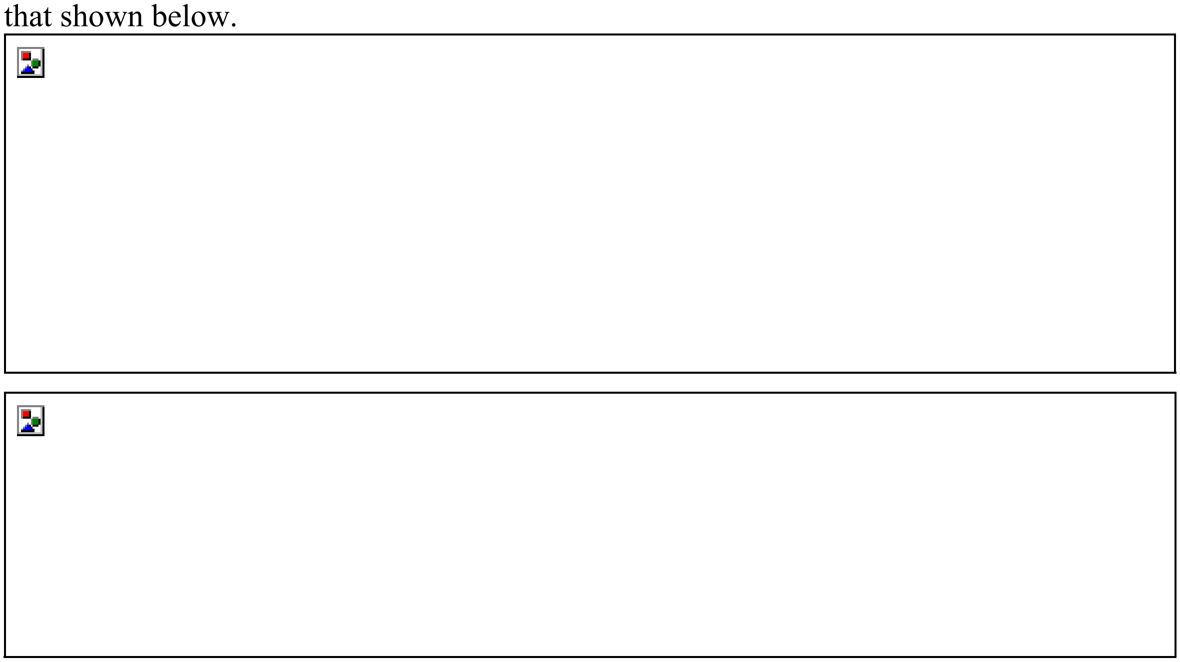
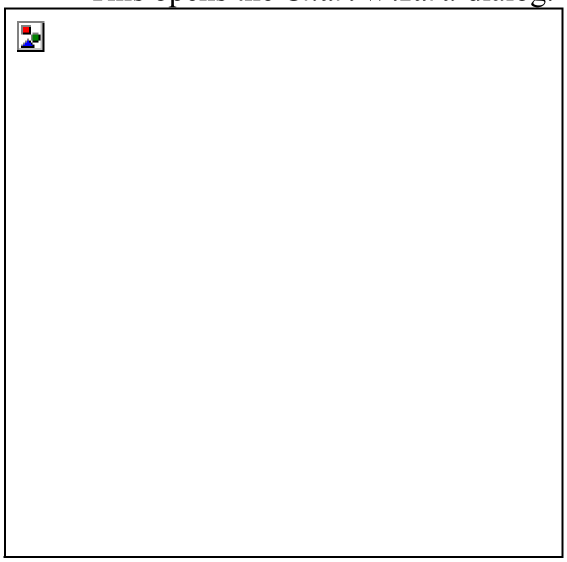


Figure 3-16. An Excel spreadsheet after importing tab-delimited ASCII file

Note that the first 37 rows represent header, calibration and EU (engineering unit) information. This will be discussed in detail later in this document. The actual data begins in Row 38.

- Starting at Row 38, columns A to E contain the time tag information in *IRIG* format.
- Place the insertion point in cell *F38* and press *Page Down* five times while holding *Shift* down to block-select about 116 cells.

Click the *Chart Wizard* button on the *Excel* tool bar to open the graphing utility. This opens the *Chart Wizard* dialog.



- Select *Chart type: Line,* as shown.
- Select *Chart sub-type* as shown (highlighted)..
- Click the *Finish* button.

Figure 3-17, The Excel Chart Wizard

The following graph is pasted by *Excel* onto the spreadsheet. After viewing the chart, close the *Excel* application.

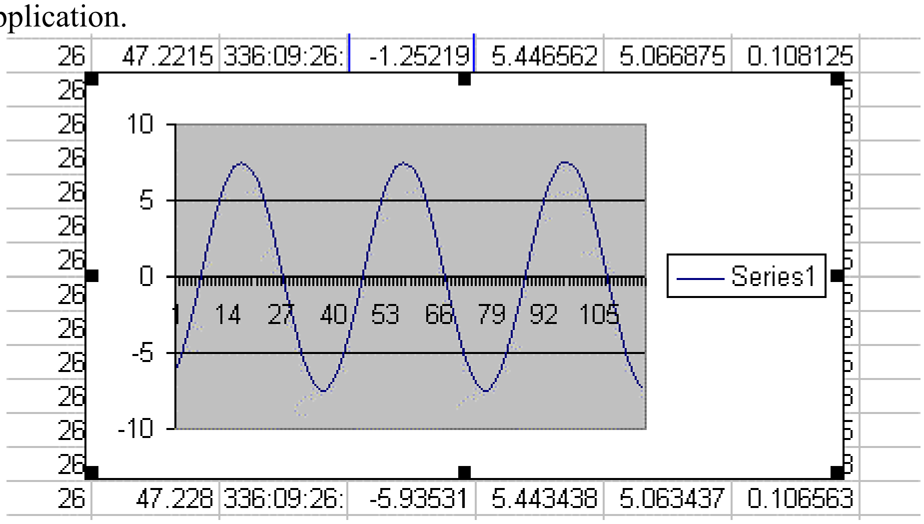
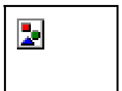


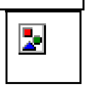
Figure 3-18, Some of the data points graphed in Excel

You have now recorded continuous data to disk, converted the file to tab-delimited format, imported the data in Engineering Units (±10.24 volts as set up within the *Configuration Utility*), and plotted some of the data for Channel 1. *Excel* auto-scaled the graph to ±10 volts.

A Transient Data Example Using the V208 ADC

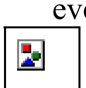
The previous example involved continuous data acquisition—data being acquired continuously as long as the data engine is running. In this example, you will record transient data. The V208 will be armed and triggered to record a preset number of pre-trigger and post-trigger samples. This example assumes that you have completed the continuous data example and have gained some familiarity with many of the DAQ Director functions.

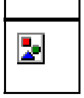
1. Perform the following preliminary steps:
   - Open the DAQ Director application from the Program menu if it is not already open.
   - Turn VXI mainframe power ON if it is not already ON.
   - Run *Resman* again if you have exited the DAQ Director application and/or turned power OFF on the VXI mainframe since you performed the continuous data example.
2.  Click the *Config* button on the main DAQ Director toolbar to open the *Configuration Utility* dialog.

    Click the *Create New Database* button on the *Configuration Database* dialog to create a new database. A file dialog opens. Enter `demo2` in the *File Name* box and click *Open*. A new database, demo2.mdb, is created.

   Set the *Channel* pull-down to *V208_Slot4 = Global* to view common properties for the entire module.
   - Set the *Clock Setting* property pull-down to *2000 Hz* for a sample rate of 2000 Hz per channel.
   - Enter `2000` for the *SamplesPerChannel* property. For the transient application, this provides a 2000-sample circular memory—one second of data acquired during transient capture.
   - Set the *Test Mode* property pull-down to *Transient.*
   - Enter `1000` for the *PostTriggerSamples* property. This provides for the acquisition of 1000 points of data after the trigger and 1000 points before the trigger.
   - Set both the *Transient_Start_Trigger* property pull-down and the *Module_Limits_Trigger_Line* pull-downs to *TTL_Trigger_Line 0.* This allows the V208 module limit detection to assert *VXI Trigger Line 0* and the V208 transient start circuitry to use that trigger. Note that another module that is capable of asserting TTL trigger lines could be configured to start transient acquisition.

   Change the *Channel* pull-down to *V208_Slot4 Channel = 1* to view properties for Channel 1.
   - Set the *Module_Limit_Enable* pull-down to *yes.* This allows module limit checking to be performed by the voltage level on Channel 1.
   - Enter `5` for the *Module_Limit_Level* property. This allows Channel 1 to cause a trigger event whenever the instantaneous voltage on that channel exceeds 5 volts.

    Click the *Save Database* button on the *Mainframe Configuration Utility* toolbar to save the changes that you have made to the *demo2* database.

    Click the *Select New Configuration* button. When the dialog opens, highlight the *demo2.mdb* database, then click the *Open* button. This makes *demo2* the current database.

Close the *Mainframe Configuration Utility* and return to the DAQ Director main window.

3. Set the function generator for sine wave output, and set its output voltage to zero.
4. Click the green *Start Data Engine* button on the main toolbar. The green button turns red, making it available to stop the data engine.

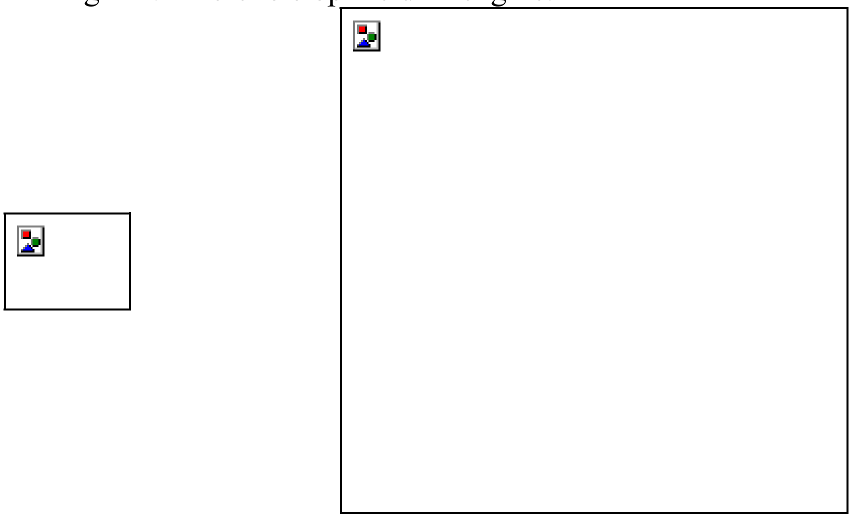


Figure 3-19. DAQ Director Control Panel showing Armed State

The *DAQ Director Control Panel* opens, similar to the action for the continuous data example, and the indicator turns green when the engine is running. However, in this case, an additional item appears in the text box, *Status, V208_Slot4, TransArmed*. This indicates that the V208 is armed and awaiting the trigger event.

5. Click the green *Start Recording* button on the main toolbar to start recording. For transient capture, recording is not to disk at this time. Instead, the V208 is now recording data to its multbuffer RAM, set up as a 2000-sample circular memory. It is still armed, awaiting a trigger. The *Control Panel* now indicates that the V208 is recording data.

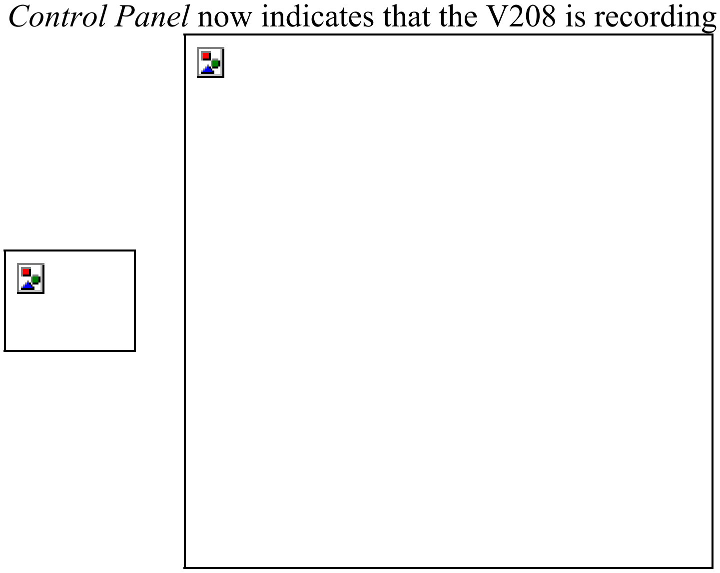


Figure 3-20. DAQ Director Control Panel showing the Recording state

6. Click the V208 data engine icon that is minimized in the Windows toolbar to bring it into the DAQ Director window as shown below.

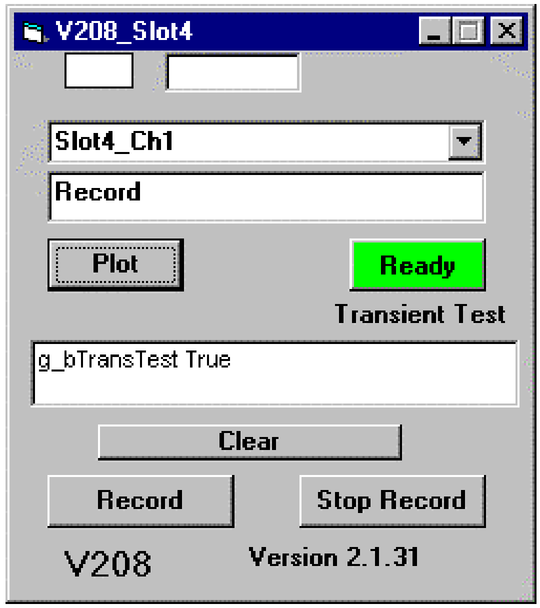


Figure 3-21. The V208 data engine dialog showing the transient ready state

This dialog is similar to what you had seen in Step 10 of the continuous data example, with the following exceptions:

- It is indicating the *Record* was the last message received by the data engine..
- A *transient Test* indicator/button is present. It is green and in the *Ready* state, awaiting trigger.

Click the *Plot* button to extend the dialog. It now takes form below: The plot area should be blank, with the V208 awaiting trigger.

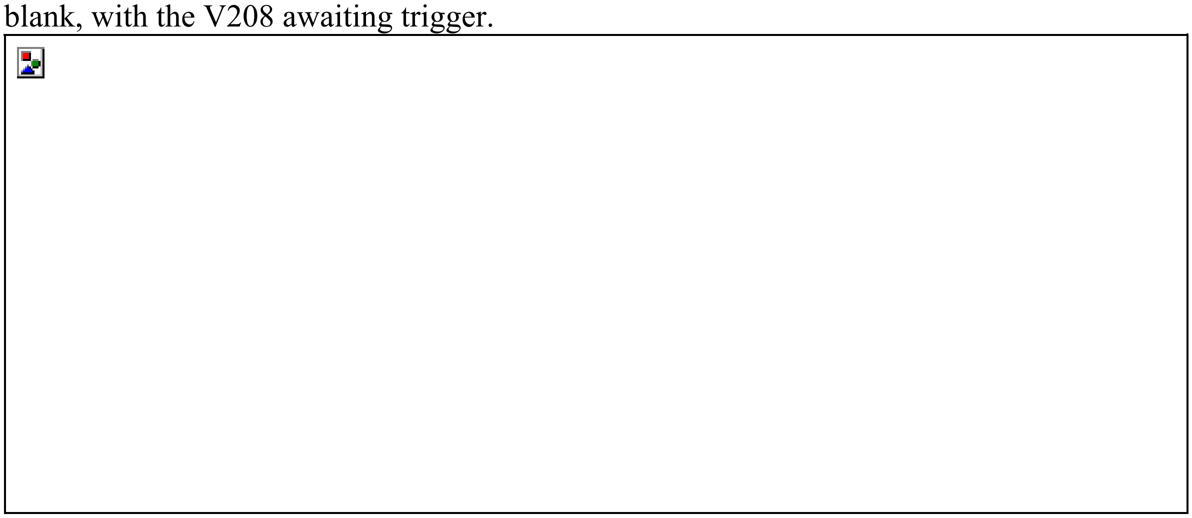


Figure 3-22. The V208 data engine dialog extended to show the quick-plot area

7. With the function generator set to produce a 5 Hz sine wave, increase the voltage until the V208 triggers when the signal level passes 5 volts. This will be indicated by the *Add Rec* LED on the V208 being solidly ON and the *Control Panel* showing *Status, V208_Slot4, TransCapture*, indicating that transient capture was initiated. Return the function generator voltage to zero. Once the data is acquired, it is automatically stored in the *V208_Slot4.bin* file.

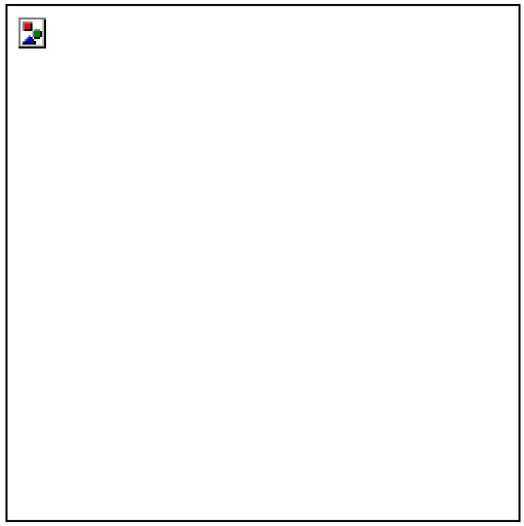


Figure 3-23, DAQ Director Control Panel showing the Transient Capture state

Once the transient capture is complete, the *Transient Test* button on the V208 data engine has turned red, indicating *ReArm*, and the quick-graph section shows the 2000 points of data, 1000 pre-trigger and 1000 post-trigger. Note that the trigger point, 5 volts, is in the center of the graph. With a 2000 Hz sample rate, the input frequency could be much higher that 5 Hz. We chose this frequency for the example since it displays well in a 2000-sample plot.

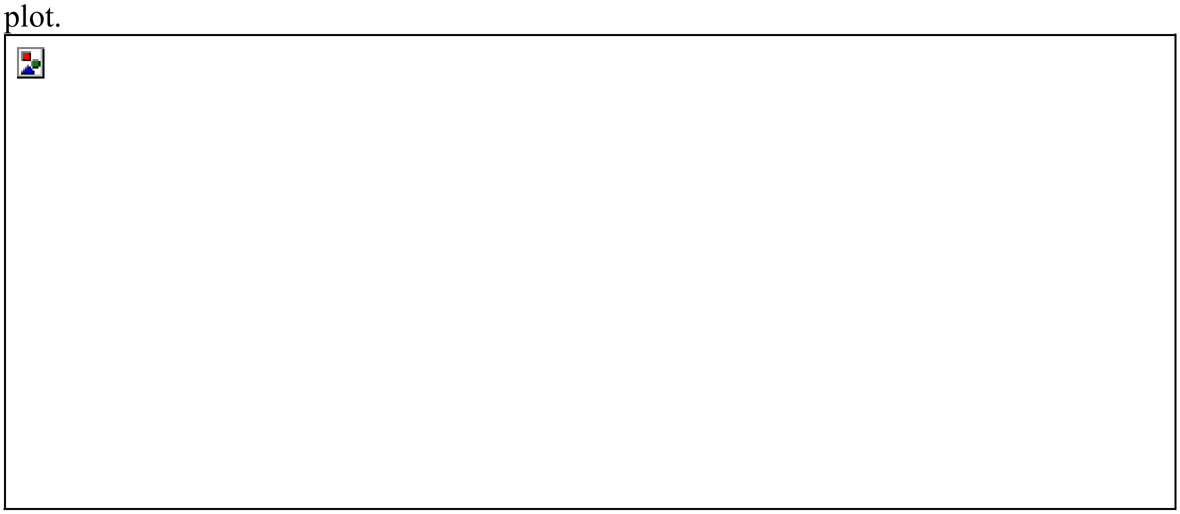
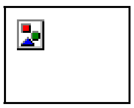


Figure 3-24. The V208 data engine dialog showing a graph of the acquired transient

If you click the *Transient Test button* on the V208 data engine, it will turn green again and indicate *Ready*. You can repeat Step 7 to record another transient. Any subsequent transient captures during this session will be appended to the *V208_Slot4.bin* binary file. Any recording from this module in a future session (continuous or transient) will overwrite this file.

8. Click the *DAQGraph* button to display a graph of the data. Note that x axis represents 1000 milliseconds, the total capture time for 2000 points with a 2000 Hz sample rate for each channel. The many features of this graphical utility will be described in the next chapter.



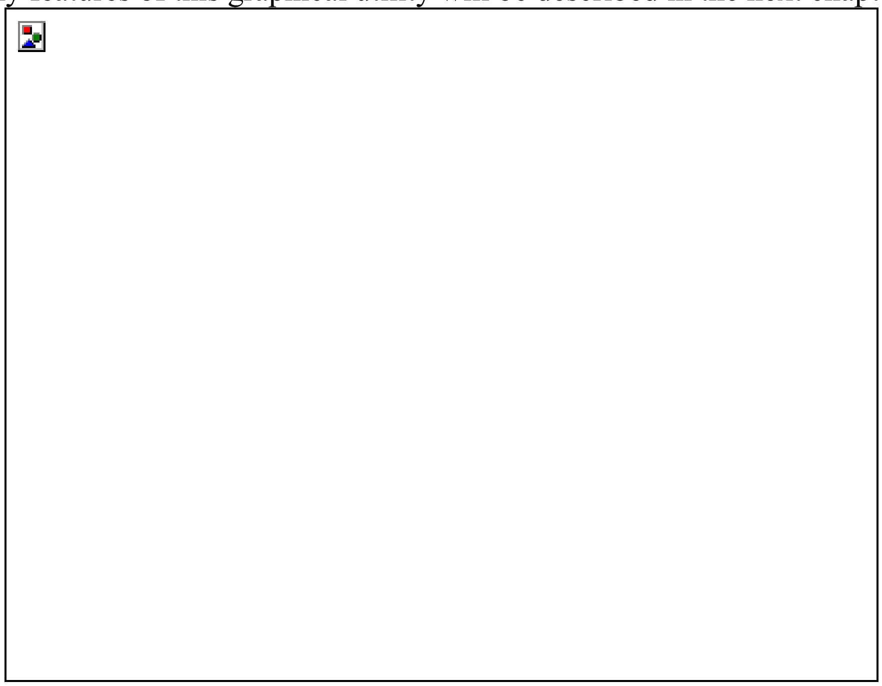


Figure 3-25. The DAQ Graph utility showing the transient waveform

9. The *Demultiplex Data* utility can be used (as in Step 13 of the V208 Continuous Data Example) to convert the *V208_Slot4.bin* file data to a form that can be imported into applications such as *Excel*. The *V208_Slot4.tda* file can then be used to import into *Excel*. The resulting graph for Channel 1 is shown below.

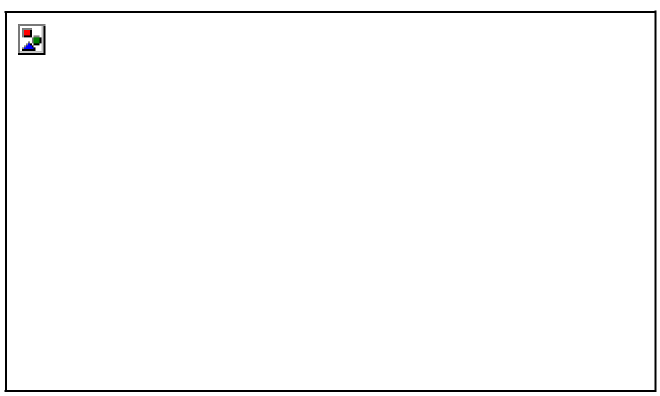
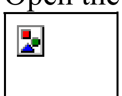


Figure 3-26, An Excel-created graph of the captured transient.

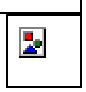
You have demonstrated DAQ Director acquiring transient data from a V208 ADC module based upon the limit checking contained within the V208. Recording was started, and then the input signal was increased until it instantaneously reached the level entered in the configuration database.

10. You will now demonstrate acquiring a block of transient data by the assertion of an external trigger signal.
    - Stop data recording and stop the data engine with the associated icons on the DAQ Director main toolbar.
    - Exit the DAQ Director application so that you will be starting in an initial state.
    - Connect a cable with an SMB connector on one end and a normally open momentary-contact switch on the other end to the V208 Trig In connector.
11. Open the *Windows NT Explorer*. Highlight the *demo2.mdb* file in the *c:\DAQ_Director\database* directory. Press *Control-C* followed by *Control-V* to copy the file and paste a copy of it in the same directory. Windows NT will name the new file *Copy of demo2.mdb*. Select and click the file name to rename this file *demo3.mdb*. This will be your configuration database for the external trigger example, using the *demo2* database as a starting point.

12 Open the DAQ Director application.



Click the *Config* button to open the *Mainframe Configuration* dialog.

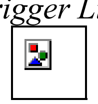
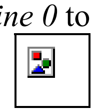


Click the *Select a Database for Editing* button and then select the *demo3.mdb* database file—a clone of the *demo2.mdb* file used for the transient example at this point.

Select.*V208_Slot4 = Global* and make the following changes:

- Change the *Module_Limits_Trigger_Line* property pull-down from *TTL_Trigger_Line 0* to *Disabled*.
- Change the *Front_Panel_Trig_In* property pull-down from *Disabled* to *TTL_Trigger_Line 0.*

This will cause a high-to-low signal on the front-panel trigger connector to use *TTL Trigger Line 0* to generate a *Transient Start Trigger* signal.

Click *Save Database* followed by *Select New Configuration*. Then select *demo3.mdb* to be the current active database.

13. Set the function generator for sine wave output, 5 Hz and approximately ±7 volts (14 volts, peak-to-peak).
14. Repeat Steps 4 through 9 with the following exception: In Step 7, instead of changing the function generator amplitude, momentarily press the switch connected to the V208 *Trig In* connector to start transient capture. The display will show a constant-level sine wave in this case.

You have now demonstrated the use of internal limit checking as well as external triggering to start transient capture.

Using the V208 with Signal Conditioner(s)

In the two previous examples, we have used a V208 ADC module, first in continuous mode, then in transient mode. However, one or more signal conditioning modules are generally used with the V208. The choices are:

- V241 High-level Multiplexer (24, 48, 72 or 96 channels).
- V243 Low-level Signal Conditioner (48 or 96 channels).
- V246 Bridge Signal Conditioner (8 channels).
- V252 8-Pole Analog Filter (8 or 16 channels).
- V253 Programmable Gain / Filter (16 channels).

The V208's addressing space supports 2,048 channels. With currently available modules, the maximum number of channels connected to a V208 is 1,056 (Eleven 96-channel V243 modules connected to a V208 using MUX-bus on the VXI backplane).

An ADC / signal conditioning combination is created with the signal conditioning module(s) immediately to the right of the V207 or V208 ADC module. The MUX-bus connection is automatically made via the Local Bus on the VXI backplane. Multiple ADC "clusters" can be present in the same mainframe as shown in the following figure.

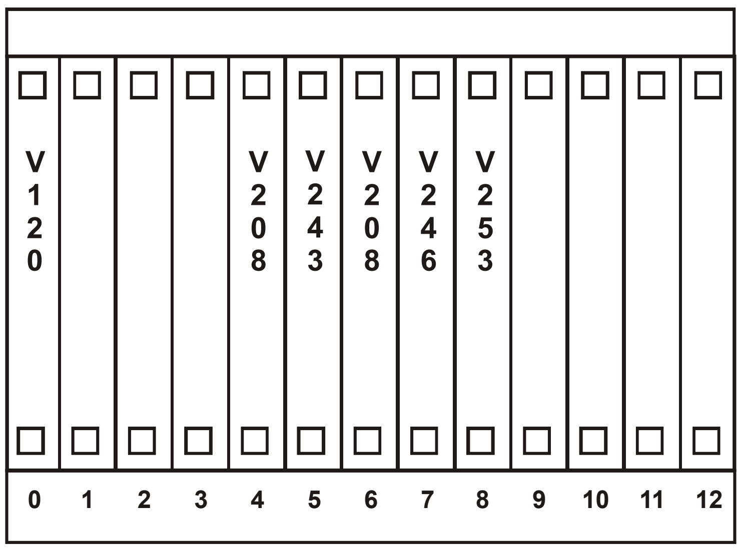


Figure 3-27. A VXI configuration showing two MUX-bus "clusters"

A MUX-bus "cluster" containing a V207 or V208 ADC and one or more signal conditioning modules is treated by DAQ Director as a single data engine. In the previous example, two data engines would be created, *V208_Slot4* and *V208_Slot6*.

The *V208_Slot4* data engine consists of a V208 in Slot 4 and a V243 in Slot 5. This DAQ Director connection is accomplished in the *Configuration Database* by setting the *Data_Source* property for the V208 to *Yes*, as shown in the following figure. The *V243_Slot5 Data_Source* property remains *No*, because there is not another signal conditioning module immediately to the right of the V243. For the second cluster, both the V208 in Slot 6 and the V246 in slot 7 would have their *Data Source* property set to *Yes*, while the V253 would have its *Data_Source* property set to *No*.

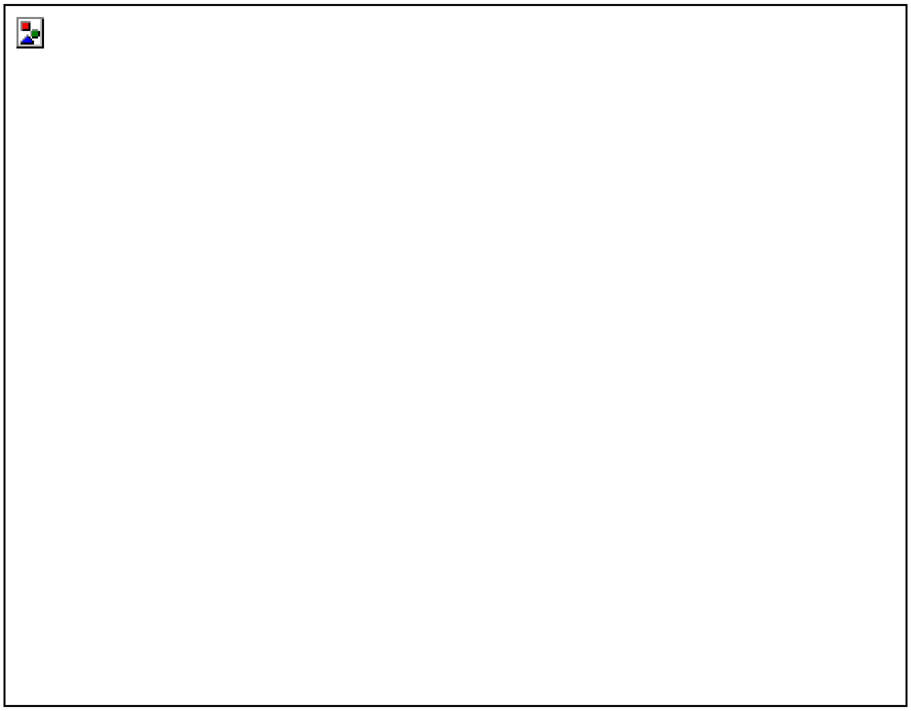


Figure 3-28. Setting the V208 Data_Source Property to Yes to accommodate a signal conditioner

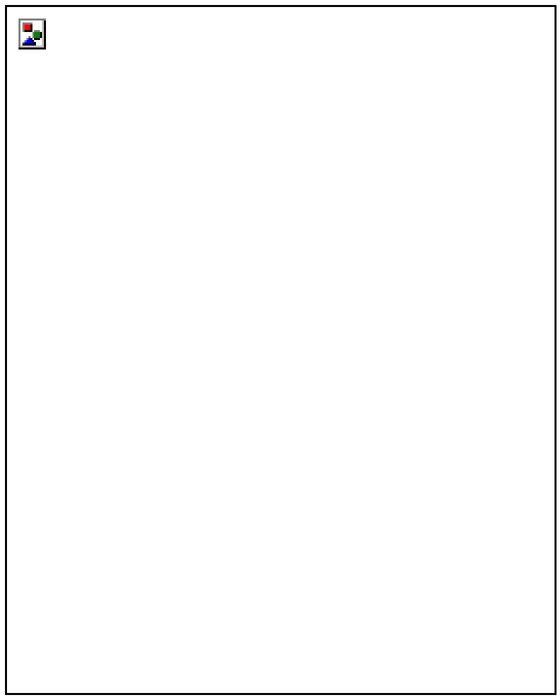
With the V243 data source, the four input channels on the V108 ADC are not used. Instead, the 96 channels on the V243 provide input to the V208. The following figure shows the setting of V243 channel properties.

Figure 3-29. Setting channel properties for the V243 signal conditioner

DAQ Director treats a V207 or V208 ADC and the signal conditioning module(s) associated with it as a single module. Therefore, the operation of one of these clusters follows very closely the continuous and transient examples that we have given earlier in this chapter.

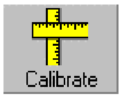
Chapter 4: Reference

- This chapter is intended primarily as a reference to DAQ Director features.
- Topics are arranged alphabetically.
- Most topics cover features that are activated by buttons on the DAQ Director main toolbar.
- Where appropriate, the button text is shown in parentheses, such as **Pulse Train Utility (P_Train)**.
- For convenience, each topic begins at the top of a page.
- Refer to the *Reference Topics* listing that follows for the topics covered in this chapter.



Reference Topics

Calibration (Calibrate)



This selection displays a utility that allows you to set up, view and save multi-point calibration constants for desired channels. Calibration information can be acquired from live data or from manual text entry.

There are two elements to the calibration of voltage-input channels, i*nternal calibration* and e*ngineering unit (E.U.) calibration*. The relationship between these elements is shown in the following figure.

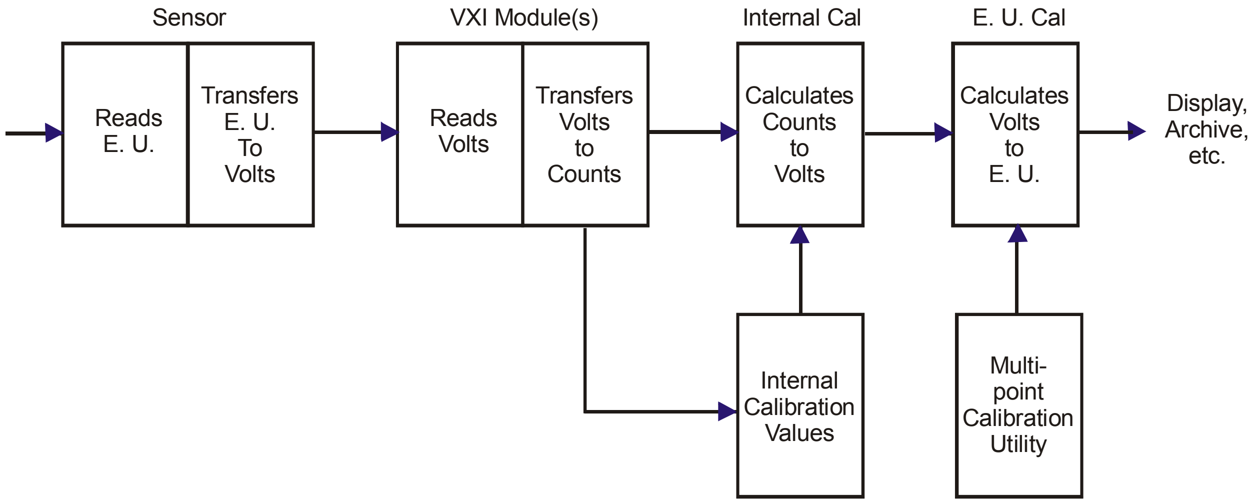


Figure 4-CAL1. The relationship between internal and engineering-unit calibration

Internal calibration (if selected in the *Configuration Utility*) is performed automatically, and it determines the actual gain and offset relationship for each channel. This is used to determine the real relationship between ADC counts and voltage input to a particular channel. E.U. calibration uses this *Calibration Utility* to determine the relationship between engineering units in the sensor (pressure, temperature, etc.) and the voltage produced by applying those engineering units to the sensor.

The default setting for the *InternalCalibrate* global property in the *Configuration Database* is *Yes*. This causes internal calibration to be automatically performed on all channels as the data engine is started. As this calibration occurs, it is displayed in the *Control Panel* window as shown in the following figure.

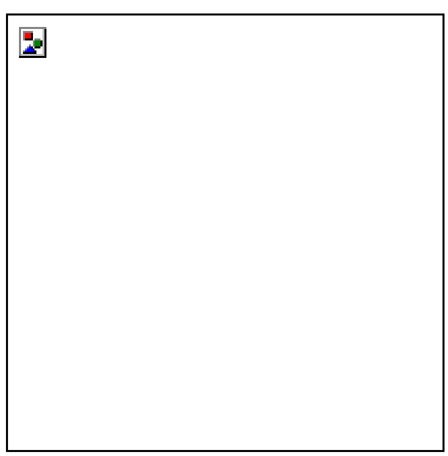


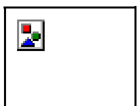
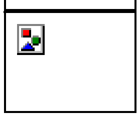
Figure 4_CAL2. The Control Panel showing that internal calibration is being performed

If you wish to use the last internal calibration values, you can set the *InternalCalibrate* property in the *Configuration Utility* to *No*. You can also set the counts-to-volts relationships to their theoretical values. This is done by using the *Reset Internal Calibration Values* utility. This topic is described later in this chapter. Click the *Reset Cal* button on the main toolbar to activate this utility. If you set internal calibration values for some or all channels to their theoretical values, then run the data engine with the *InternalCalibrate* property set to *No*, the data engine will use theoretical transfer-function values.

You can use the transfer function from engineering units to voltage that occurs within sensors in one of two ways:

- Apply engineering-unit values (force, pressure, etc.) to sensors in order to calibrate their transfer functions. This is called live calibration.
- Use transfer functions based upon the external calibration of sensors (calibration certificates). You enter calibration information as text in this calibration utility.

Follow the following sequence to create engineering unit calibration:

1.  Click the *Start Data* button on the main toolbar to start the data engine. Wait for the data engine to start and internal calibration, if enabled, to complete.
2.  Click the *Calibrate* button on the main toolbar to open the *Calibration Utility*. The *Multi_Point_Calibration_Utility* dialog window opens. Note that the calibration sequence can be automated by use of the *Sequencer*. Refer to later in this topic for more information on automating the sequence.

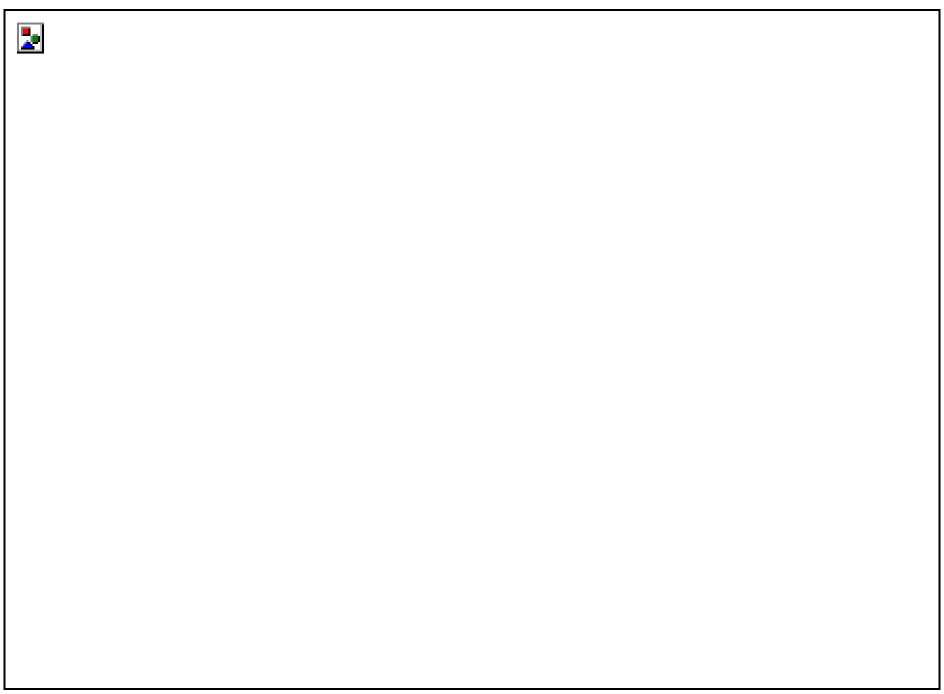


Figure 4-CAL3. The Multi_Point_Calibration_Utility dialog window

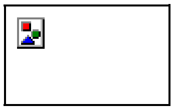
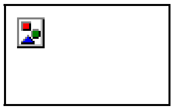
3.  Click the *Select Channels* button. The *Multi_Point_Calibration_Setup* dialog window opens.

Figure 4-CAL4. The Multi_Point_Calibration_Setup dialog window

4. You can provide E.U. calibration for any channels that are of the *Polynomial* or *Linear* (first-order polynomial) type. Only these types of channels are in the *Channel List.* Select the channels to calibrate from the *Channel List*.
   - Click *Add* to move these channels to the *Selected Channels* list. To remove any selected channels, select them from the *Selected Channels* list and click *Remove*.
   - The allowable combinations of selections for *Cal Reference Information* and *Cal Input Information* are:
     - *Cal Reference Information = Manual (Text) Entry*
       Cal Input Information = Live Calibration Data
       This is the default setting. After selecting *Acquire Data*, you enter the E.U. calibration
       points and use live data to acquire the calibration data.
     - *Cal Reference Information = Manual (Text) Entry*
       Cal Input Information = Manual (Text) Data Entry
       After selecting *Acquire Data*, you enter the E.U. calibration points and manually enter the calibration data (by using a calibration certificate, for example).
     - *Cal Reference Information = Data Channel*
       Cal Input Information = Live Calibration Data
       After selecting *Acquire Data*, you use a previously calibrated channel as a standard and use live data to acquire the calibration data. This standard channel is often called a *golden channel.* To use this feature you must be able to have all channels in this group receive the same E.U. input (by connecting all of the channels to a common manifold, for example).

4a. ***Live Calibration*****—**Calibration using text entry for the calibration points and live calibration data (the default setting):

- Highlight the channels to be calibrated and use *Add* to select them.
- Select *Cal Reference Information = Manual (Text) Entry*
- Select *Cal Input Information = Live Calibration Data*
- Select the number of E.U. calibration points.
- Enter your name or initials in the *User Identification* box.

5a.  Click the *Acquire Data* button. This opens a file dialog window. You can select a current calibration file to overwrite, or you can enter a new filename. Click *Open* to perform the operation. Click *Cancel* to save the data in the default file.

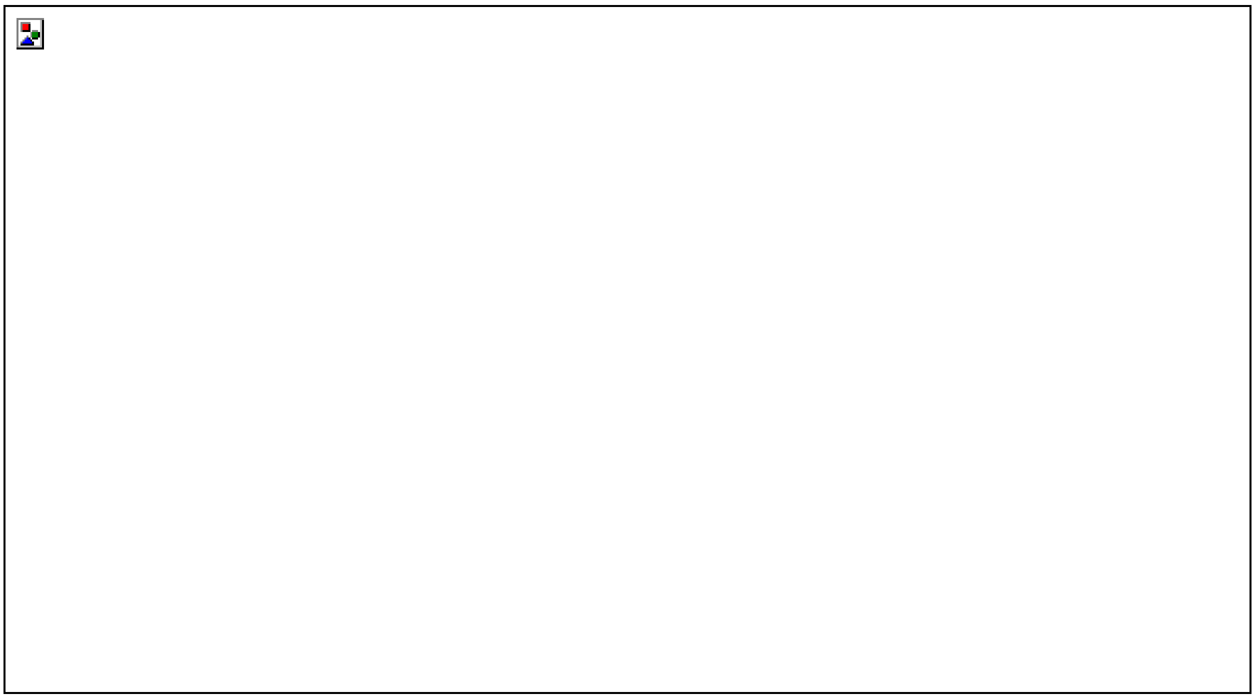


Figure 4-CAL5. Selecting a calibration file by clicking *Acquire Data*

6a. The *Acquire Calibration Data Live Data Entry* dialog window then opens.

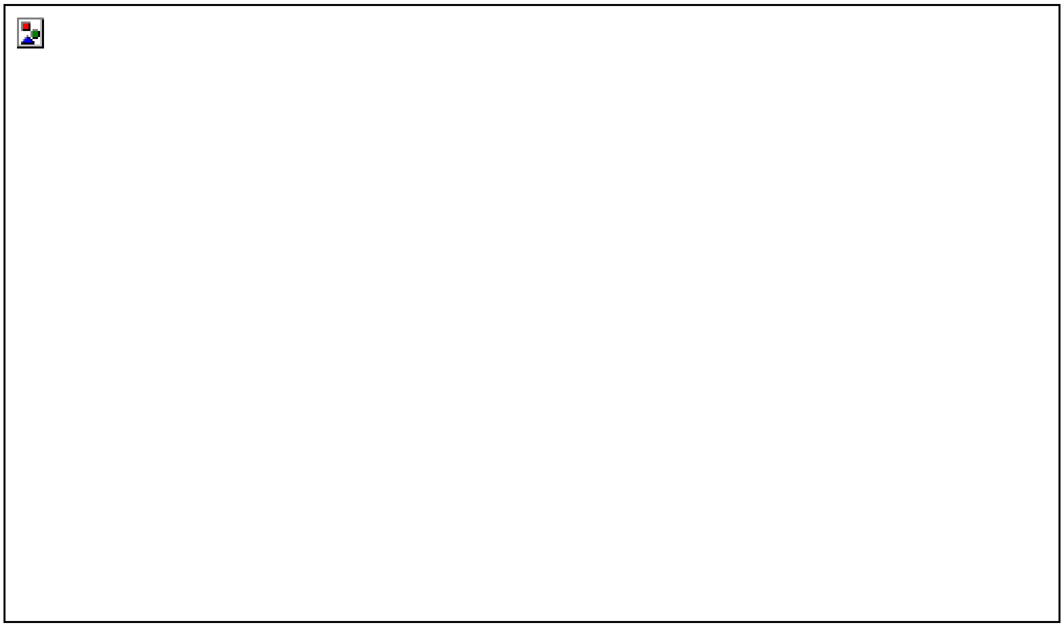


Figure 4-CAL6. The Acquire Calibration Data Live Data Entry dialog window

7a. Enter the Engineering Unit (E.U.) values for the points to be acquired (pressure, temperature, etc.).

8a. Set the transducer stimulus to the E.U. selected for Point 1 and Click the *Acquire Point 1* button. It is now active and data acquisition commences. Various parameters are tabulated, such as *Volts Avg, Volts Min, Volts Max, Delta Volts, Counts Avg, Counts Min, Counts Max* and *Delta Counts* as an aid in determining the quality of the calibration data.
If you wish to view the data distribution, click the *Plot* button to view a plot of the individual calibration points. This selection is for diagnostic purposes and can generally be eliminated.

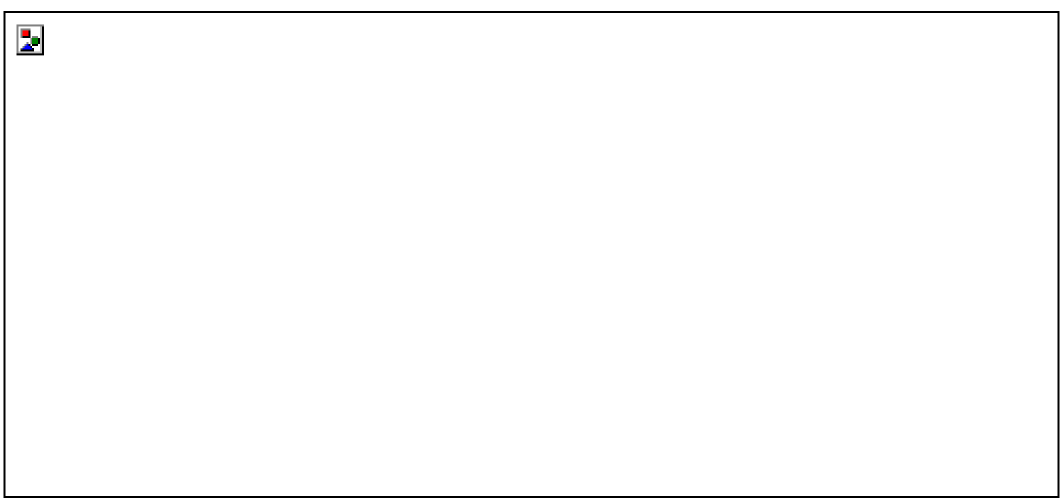


Figure 4-CAL7. Acquiring the data for Calibration Point 1

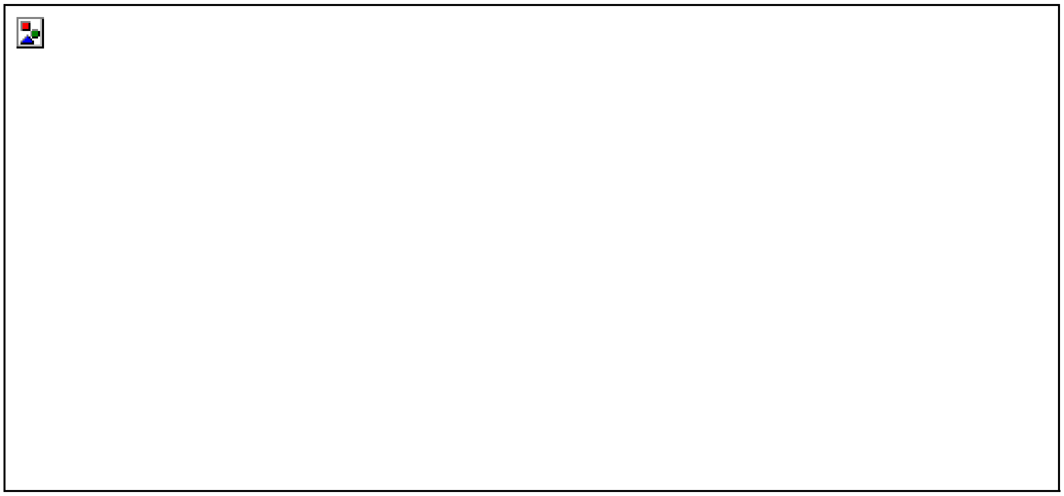


Figure 4-CAL8. Viewing the calibration data for Calibration Point 1

9a. Set the transducer stimulus to the E. U. selected for Point 2 and Click the *Acquire Point 2* button. It is now active and data acquisition commences. Various parameters are tabulated, such as *Volts Avg, Volts Min, Volts Max, Delta Volts, Counts Avg, Counts Min, Counts Max* and *Delta Counts* as an aid in determining the quality of the calibration data.
If you desire, click the *Plot* button to view a plot of the individual calibration points.
If more than two points had been selected earlier, this would be repeated for any additional data points

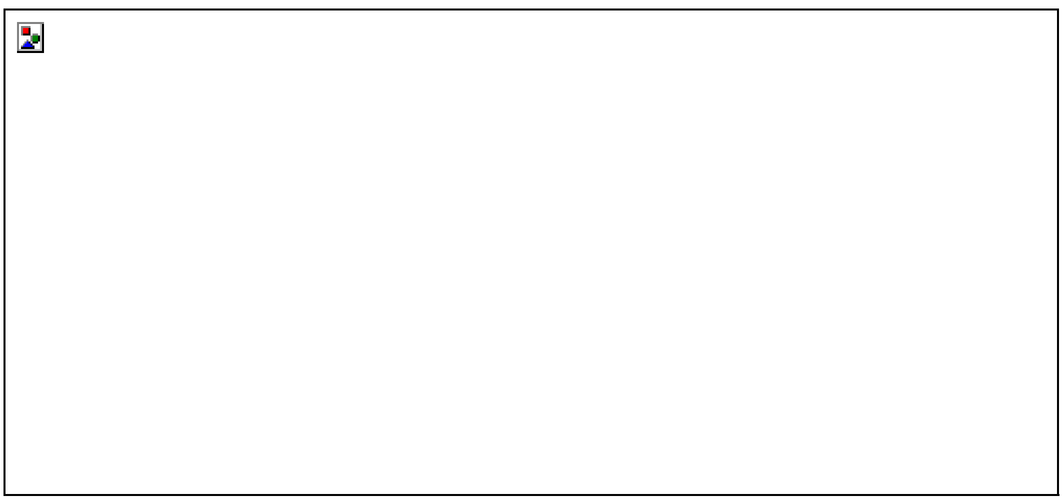
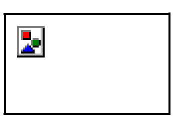


Figure 4-CAL9. Acquiring the data for Calibration Point 2

10a.  Click the *Solve Poly* button to display the resulting constants from the calibration just performed. The *Display Polynomials* dialog window contains a green button for each channel, labeled *Accept*. If any constants are not acceptable, click the associated button. It will turn red, and its label will change to *Reject.*

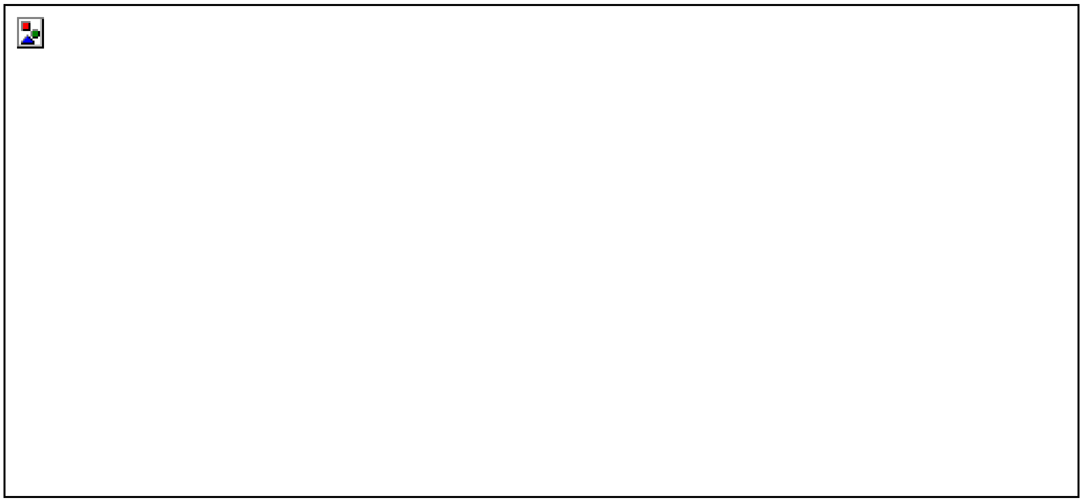
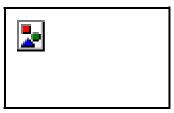


Figure 4-CAL10. Opening the *Display Polynomials* window

11a. 

If desired, you can click the *Test Poly* button to perform a reverse calculation for the Engineering-unit data points. The results should be the Engineering Units entered in Step 7a. This is used primarily for diagnostic purposes.

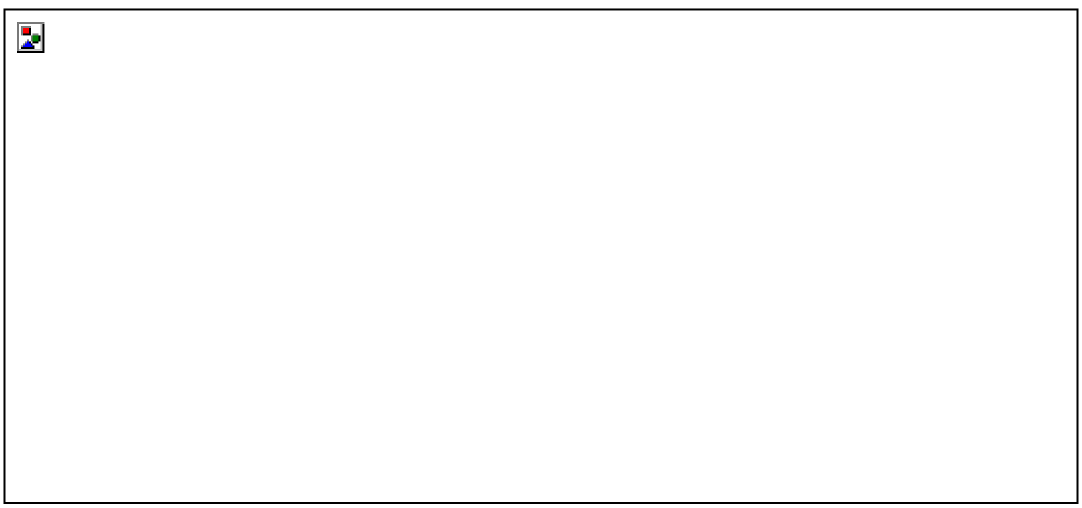
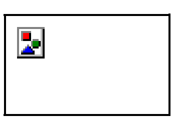


Figure 4-CAL11. Testing the polynomial constants

12 a. 

Click the *Save* button to save the calibration information with an appropriate number of data points for all channels that were selected and accepted. The E.U. calibration for any rejected channels can be re-taken with another calibration session.

4b. **Calibration Certificate**—Calibration using text entry for the calibration points and for the calibration:

- Highlight the channels to be calibrated and use *Add* to select them.
- Select *Cal Reference Information = Manual (Text) Entry*
- Select *Cal Input Information = Manual (Text) Data Entry*
- Select the number of E.U. calibration points.
- Enter your name or initials in the *User Identification* box.

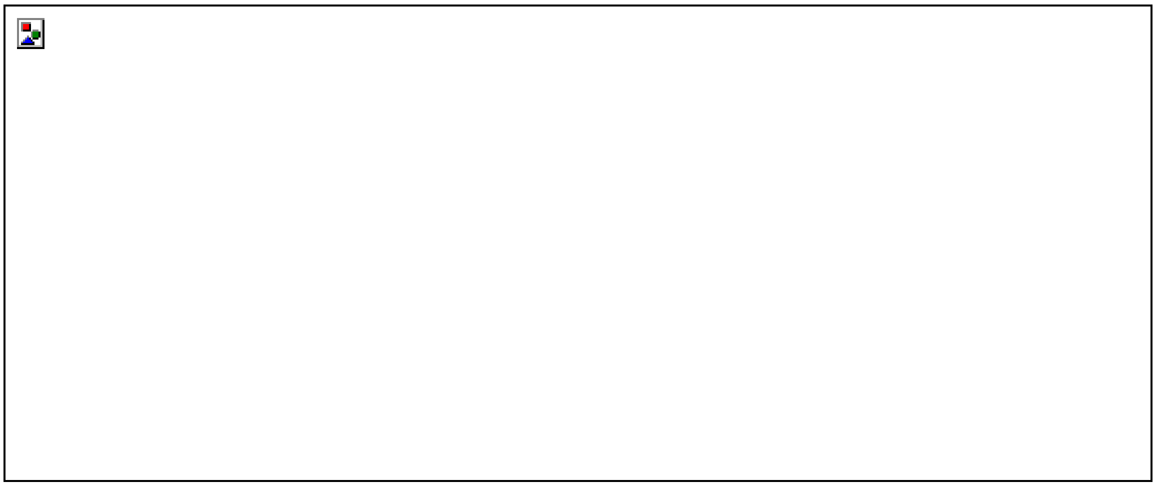
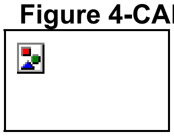


Figure 4-CAL12. The Multi Point Calibration Setup dialog for a Calibration Certificate

5b.  Click the *Acquire Data* button. The *Acquire Calibration Data Manual (Text) Data Entry* dialog window then opens.

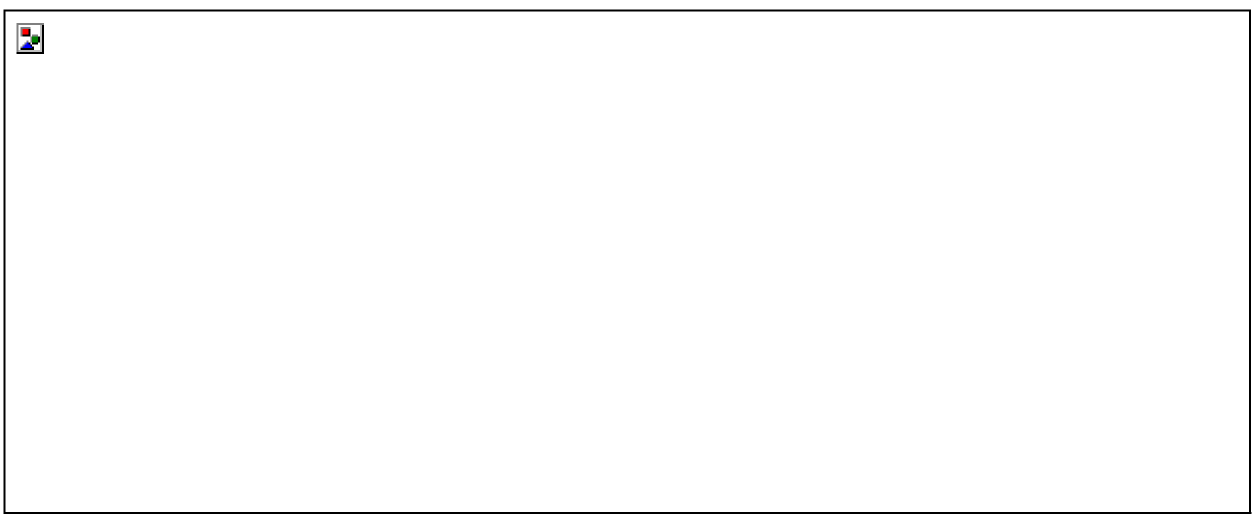
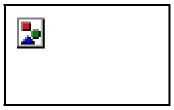
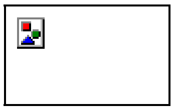


Figure 4-CAL13. The Acquire Calibration Data Manual (Text) Data Entry dialog window

6b. Enter the Engineering Unit (E.U.) values for the points to be acquired (pressure, temperature, etc.).
Enter the transfer voltages for the selected channels that relate to the first data point and click the *Acquire Point 1* button. The E.U./voltage relationship for the *Point 1* is stored.

Enter the transfer voltages for the selected channels that relate to the second data point and click the *Acquire Point 2* button. The E.U./voltage relationship for the *Point 2* is stored. If there are more than two data points, repeat the entry for these points.

7b.  Click the *Solve Poly* button to display the resulting constants from the calibration just performed. The *Display Polynomials* dialog window contains a green button for each channel, labeled *Accept*. If any constants are not acceptable, click the associated button. It will turn red, and its label will change to *Reject.*

8b.  Click the *Save* button to save the calibration information with an appropriate number of data points for all channels that were selected and accepted. The E.U. calibration for any rejected channels can be re-taken with another calibration session.

4c. **Golden-channel Calibration—**Calibration using text entry for the calibration points and a reference channel for the calibration:

- Highlight the channels to be calibrated, and use the *Add* button to select them.
- Select *Cal Reference Information = Data Channel*
- Select *Cal Input Information = Live Calibration Data*
- The *Select Channel* pull-down now appears. Select the channel that is to be the "golden channel" reference.
- Select the number of E.U. calibration points.
- Enter your name or initials in the *User Identification* box.

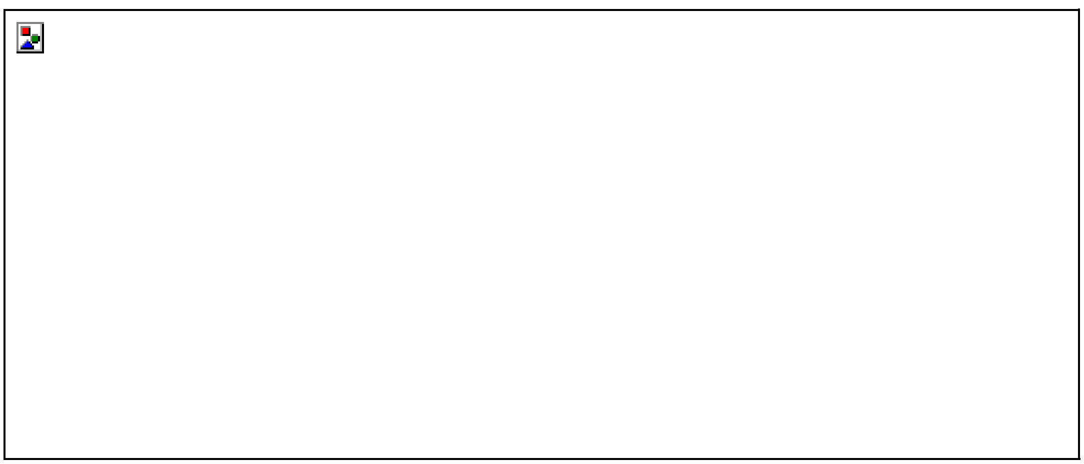
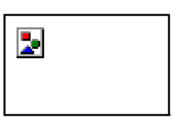


Figure 4-CAL14. Multi-Point Calibration Setup with "Golden Channel" calibration

5c. Follow Steps 5a through 12a found under *Live Data* calibration, skipping Step 7a.

Automating Calibration



Calibration can be automated by using the DAQ Director Sequencer. A previously created sequence can be loaded by clicking the *Load Sequence* button on the *Calibration Utility* toolbar. A file dialog window opens.

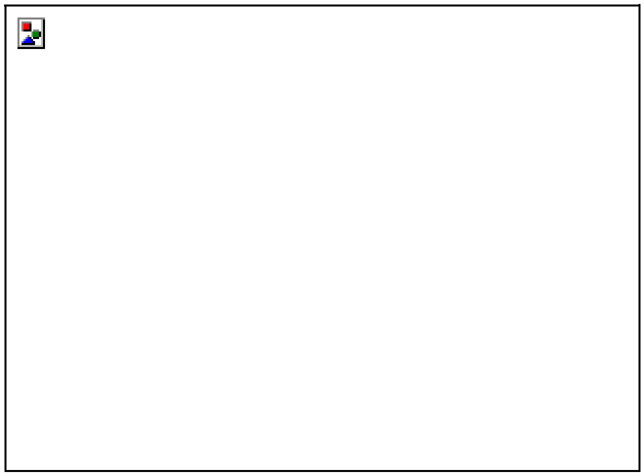


Figure 4-CAL15. A file dialog for selecting a sequence file

Select a sequence file, and click *Open* to open the *Sequencer.* This dialog window contains the selected sequence file, ready to run.

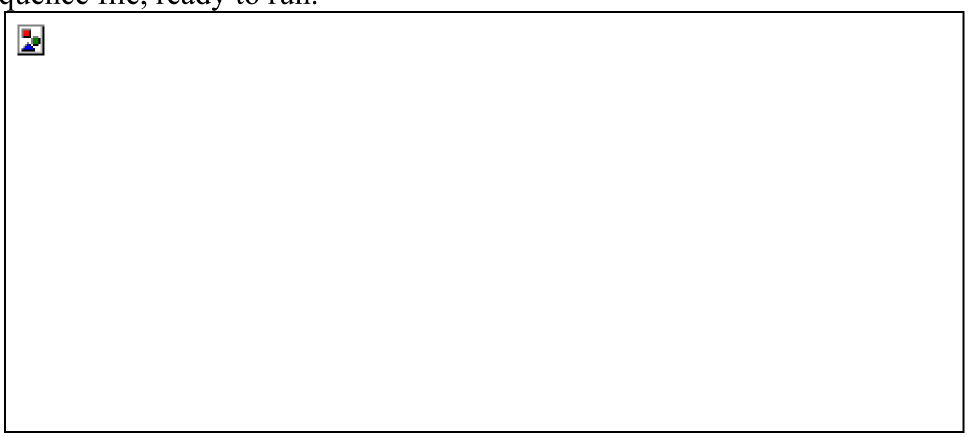
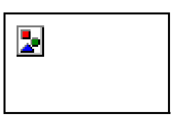


Figure 4-CAL16. The Sequencer dialog window with a sequence file loaded

Click *Start* to run the selected sequence file.
Refer to the *Sequence Editor* topic later in this chapter for use of this editor to create new sequence files and to *Appendix A* for the calibration sequence keywords.

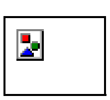


The *Start Sequence* button operates in the same manner as the *Load Sequence* button, with one exception. The sequence file that you select runs as soon as you click *Open* on the file dialog. Pressing the *Start* button is not required with this button.

Channel Enable/disable

See also: **Configuration Database (Config)**

Certain analog input modules allow channels to be disabled from the scan list. When a channel is disabled, its data is not included when the ADC module buffer is read.



Click the *Config* button to open the *Mainframe Configuration Utility* dialog window. Use a configuration that contains ADC(s) and/or signal conditioning module(s) that supports channel enable/disable. The *Channel Enable/disable* button should appear on the toolbar as shown in the following figure.

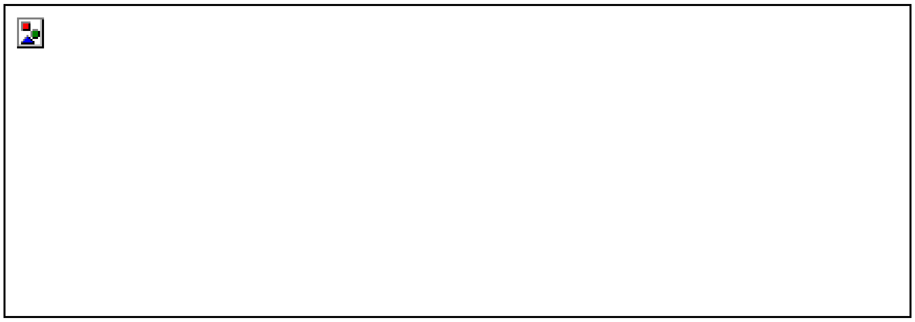
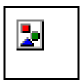


Figure 4-CHE1. A Mainframe Configuration Utility dialog with the Channel Enable/disable button



Channel Enable/disable—Click this button to selectively enable and disable channels. An *Enable Control* window opens.

A button appears at the top of the *Enable Control* window for each module that is part of the configuration and supports channel enable/disable. The active button is indicated as pressed and has a green background. Click the desired button to select the module for channel enable/disable.

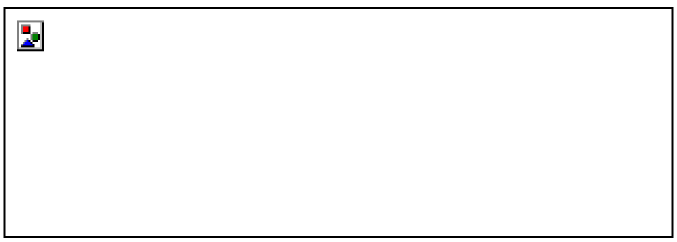


Figure 4-CHE2. An Enable Control dialog window showing the module selection buttons

The enabling and disabling of channels falls into two categories:

- The module allows the enabling and disabling of any channel (V200 or V213).
- The module allows the enabling and disabling of channels only by groups (V241, V243, V246, V252 or V253). This grouping is required because the MUX-bus uses four analog paths to provide the analog settling that is needed.

This is the *Enable Control* window for a V243 96-channel signal conditioner. As with other MUX-bus modules, the following channel enable rules apply:

- The first enabled channel must be from the *A group.*
- Enabled channels must progress in an *A, B, C, D* sequence. The enabled channels do not need to be adjacent in the list as long as they follow this sequence. A checked channel is enabled.
- The last enabled channel must be from the *D* group.

A yellow *ALL* bars toggles the associated group enabled or disabled. Click the *Save* button to save the selection.

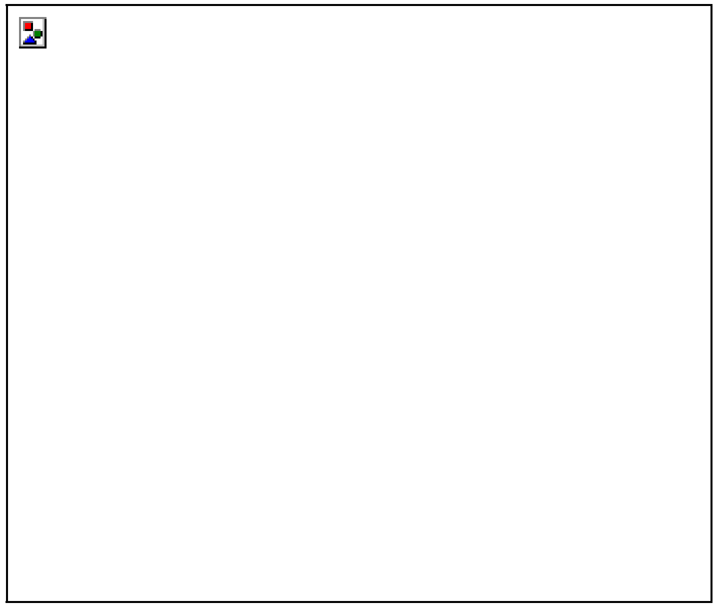


Figure 4-CHE3. An Enable Control dialog window

The *Enable Control* dialog window for MUX-bus modules includes a feature that tests the enabled/disabled channels against the *A, B, C, D* sequence requirement.

In this example the following sequence is set:

- Channel 56 (D) is enabled.
- Channel 57 (A) is disabled.
- Channel 58 (B) is enabled.

Channel 58 is the first channel in error (*D* followed by *B*, not *A*). All channels from 58 to the end are marked with a red background (a dark block in this photo).

The *Save* button is disabled until the pattern error is corrected.

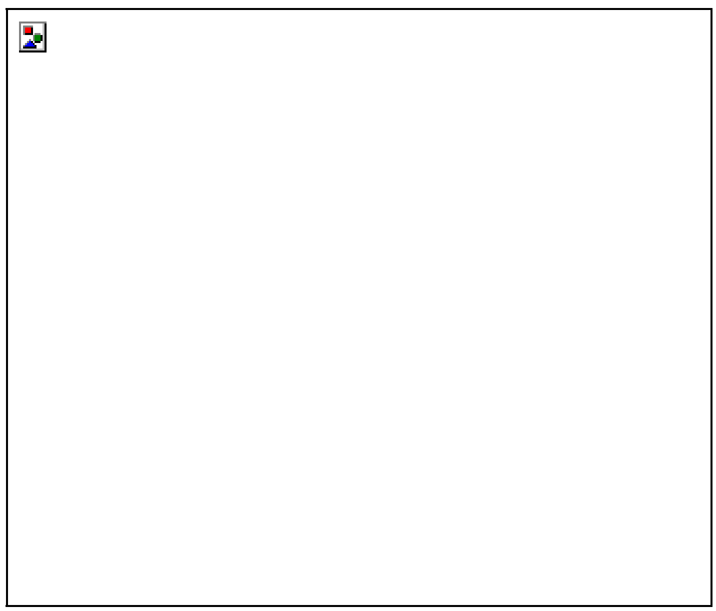


Figure 4-CHE4. An Enable Control dialog window with a selection error

The *Enable Control* dialog windows for the V200 and V213 are similar to those for the MUX-bus signal conditioning family. The selection windows for these two modules do not include the *All* buttons or the *A, B, C, D* markings, since there is no restriction to the pattern of enabled and disabled channels.

When an *Enable Control* selection is saved, the associated *Channel_Enabled* properties in the *Configuration Database* are written as *Yes* or *No*, depending upon the channel selections that have been made. These properties can be written directly into the database, using the *Mainframe Configuration Utility*. However, the error checking is not present until you use the *Enable Control* dialog window. This utility displays the current *Channel_Enabled property* settings in the database.

Configuration Database (Config)

Overview

The configuration information for the DAQ Director is held in a Microsoft Access database. This Configuration Database contains the information required to initialize and operate all the modules in the VXI mainframe. In addition, the Configuration Database can contain application-specific parameters, such as engineering unit assignments, transducer identification, and calibration information.

The KSC Module Library is an Access database supplied with the system that contains the information necessary to build a Configuration Database. The standard location for this database is: *..\DAQ_Director\Library\KSC Module Library.mdb* The fields in a typical table within this database are:

- *DbProperty*—This field represents the various properties for the module.
- *Global*—This field indicates that the property is common to the entire module or to a module channel.
- *Default Value*—This field represents the default value that is inserted in a new Configuration Database.
- *Property Type*—This field designates the property type:
  - *Type -1* This property is fixed and cannot be viewed.
  - *Type 0* This property represents a parameter and cannot be changed.
  - *Type 1* This property represents text and allows freeform entry.
  - *Type 2* This property allows selection of options from a drop-down box.
- *Option_n*—These fields represent the drop-down box options for a particular property.

Only *Option_1* and *Option_2* are shown in the following figure, which represents the first 6 fields and 14 records of the V208 Module Library database table.

DbProperty	Global	DefaultValue	PropertyType	Option_1	Option_2
AppendDataFile	Global	No	2	Yes	No
CalEU(1)	Channel	-10	0	unused	unused
CalEU(2)	Channel	10	0	unused	unused
CalRaw(1)	Channel	-10	0	unused	unused
CalRaw(2)	Channel	10	0	unused	unused
Channel_Enabled	Channel	Yes	2	Yes	No
Channel_Name	Channel	Spare#	1	unused	unused
Channel_Type	Channel	Analog_Input	0	unused	unused
ChannelCount	Global	4	1	unused	unused
ConfigAddrSpace	Global	A16	-1	unused	unused
Counts_Volt	Channel	3200	0	unused	unused
Data_Source	Global	No	2	Yes	No
Data_Type	Global	Unsigned_Integer	-1	Unsigned_Byte	Signed_Byte
DataFileName	Global	Default	-1	unused	unused

Figure 4-CON1. The KSC Module Library for the V208 in an Access database table

When you create a new Configuration Database, an Access database file is created with tables for each of the modules in your configuration. The Property Values are set to the default values from the KSC Module Library. Figure 4-2 displays the four primary fields in the database property table for the V208 ADC covered by the example in Chapter 3. If you followed this example, you would have saved this database as *demo1.mdb*. This database contains only one table because only one module was contained in this configuration.
All of the global properties for the V208 are shown here. These are the properties that affect the entire module, such as *Enable_Clock* and *SamplesPerChannel.*

Channel	DbProperty	DbValue	PropertyType
Global	Module	V208_Slot4	0
Global	Node_Address	1	0
Global	ChannelCount	4	0
Global	Front_Panel_Trig_Out	Disabled	2
Global	Transient_Start_Trigger	Disabled	2
Global	Test_Mode	Continuous	2
Global	Node_Address	1	1
Global	Data_Source	No	2
Global	NSM_DataType	16	-1
Global	ConfigAddrSpace	A16	-1
Global	Suffix_Offset	20	-1
Global	Make_Data_File	Yes	-1
Global	Data_Type	Unsigned_Integer	-1
Global	ModuleEnabled	Yes	2
Global	PostTriggerSamples	200	1
Global	Module_Type	AD	0
Global	Front_Panel_Trig_In	Disabled	2
Global	DSP_Groups	0	-1
Global	AppendDataFile	No	2
Global	DataFileName	Default	-1
Global	Sample_Clock_Source	Internal	2
Global	Enable_Clock	Yes	2
Global	External_Clock_Rate	0	1
Global	SamplesPerChannel	200	1
Global	Multibuffer_Segments	4	2
Global	MUX_Capacity	2048	-1
Global	Sample_Clock_Output	Disabled	2
Global	Module_Limits_Trigger_Line	Disabled	2
Global	InternalCalibrate	Yes	2
Global	SyncGroupName	None	2
Global	DecimateDataBy	1	1
Global	Data_Type	Unsigned_Integer	-1
Global	Clock_Setting	2000 Hz	2

Figure 4-CON2. The Configuration Database global parameters for a V208 ADC

The V208, if used without one or more signal conditioning modules, contains four channels. This figure shows the portion of the Configuration Database relating only to Channel 1. The property list for the other three channels is the same as for Channel 1.

Channel	DbProperty	DbValue	PropertyType
1	EUConversion_Type	Polynomial	2
1	Channel_Type	Analog_Input	0
1	Transducer_ID	Unknown	1
1	MaxEUScale	10.5	1
1	MinEUScale	-10.5	1
1	Low_Limit_EU	-10	0
1	High_Limit_EU	10	0
1	Counts_Volt	3200	0
1	Channel_Name	Slot4_Ch1	1
1	Initials	ksc	0
1	UnitsOfMeasure	Volts	1
1	PolyCon(1)	0	0
1	Channel_Enabled	Yes	2
1	CalRaw(1)	-10	0
1	CalRaw(2)	10	0
1	CalEU(1)	-10	0
1	CalEU(2)	10	0
1	LiveCal	No	0
1	Offset_Volts	32767	0
1	PolyCon(2)	1	0
1	PolyOrder	1	0
1	Module_Limit_Level	0	1
1	Module_Limit_Enable	No	2
1	Module_Limits_Slope	+	2
1	EU_Limit_Check	No	2
1	ManualEUAdder	0	1
The properties for Channels 2, 3 and 4 are the same as for Channel 1.			

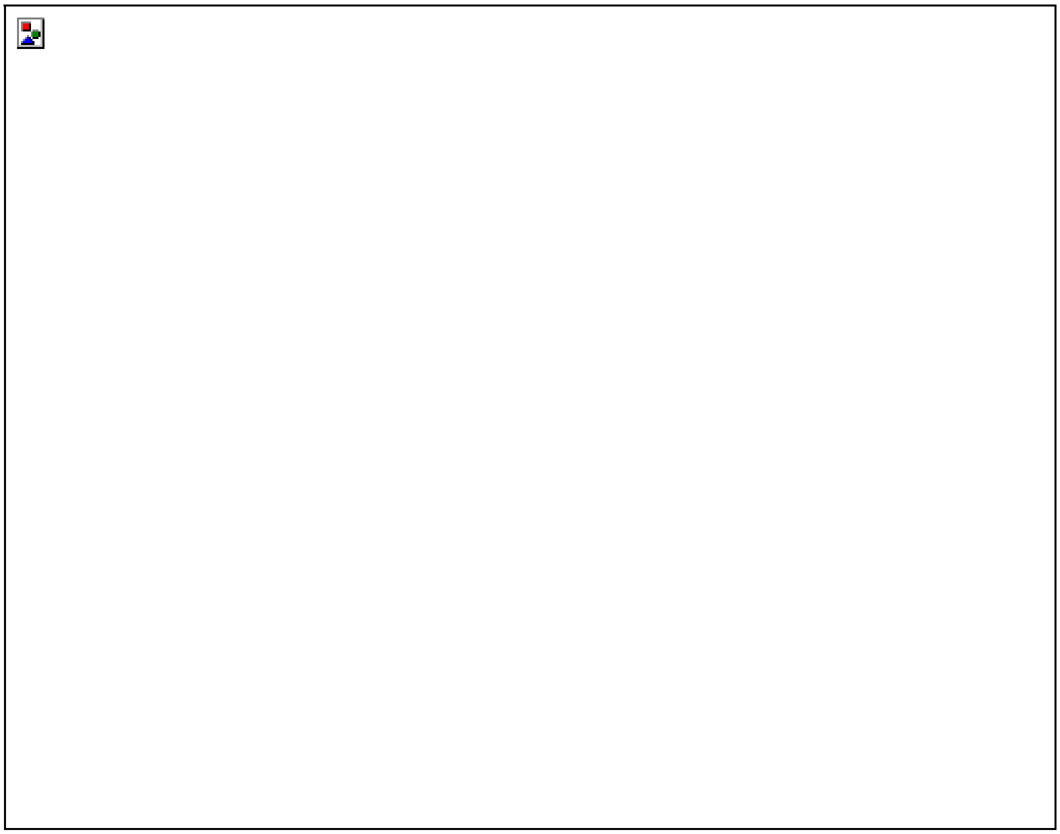
Figure 4-CON3. The Configuration Database channel parameters for a V208 ADC

The standard location for this file is: *..\DAQ_Director\Database\demo1.mdb.* We have shown the Access database files in the two previous figures to provide a better understanding of the DAQ Director configuration database. These figures represent the database tables as viewed in Microsoft Access. DAQ Director includes a simplified interface to the Configuration Database. It is not *necessary to be an Access user or to have Access installed* on the host Computer.

The Mainframe Configuration Utility

View/change Configuration Database—This selection opens the *Mainframe Configuration* dialog. From this dialog you can create a new database, open an existing database, view and make changes to module properties within a database, save a new or changed database and makes a database the current database. It can also update the database to the latest revision level.

When you click the *Config* button on the toolbar in the main DAQ Director window, you open the *Mainframe Configuration Utility*. If no configuration database is present, the body of this dialog will be blank. If one or more databases are present, it will represent the currently active database.



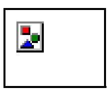
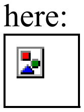


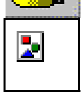
Figure 4-CON4. The Mainframe Configuration Utility dialog

The *Mainframe Configuration Utility* dialog contains five toolbar buttons. They are described here:

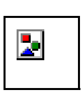


Create New Database—This selection is used to create a new configuration database. There is no practical limit to the number of databases that can be present on your local or network drive.

Select a Database for Editing—This selection opens a file dialog that allows you to select a database for editing from the list of existing databases.



Save Database—This selection saves any changes that you have made to the database that is open for editing. Note that this action *does not* make this the currently active database.



Select New Configuration—This selection opens a file dialog that allows you to select a database to be currently active from the list of existing databases

Update Configuration—This selection opens a file dialog that allows you to select a database and make that database compatible with a new release of the KSC module library.

Channel Enable/disable—This selection allows you to selectively enable and disable channels. This button is present only when the selected ADC module or ADC module with signal conditioning module combination supports the disabling of channels. Refer to the topic, *Channel Enable/disable,* for more information.

Creating and Editing a New Configuration Database

If you click the *Create New Database* button in the *Configuration Utility* dialog box, a file dialog opens. You can enter a desired file name (for your particular test or configuration) in the *File Name* box and click *Open*. A new database, with that file name, is created. Since *Resman* had previously determined the configuration, this database contains properties for your configuration, a V208 in Slot 4 in this example.

There are pull-down options for the *Channel* selection on the *Mainframe Configuration Utility* dialog. As a typical example, with a V208 in Slot 4, they are:

- *V208_Slot4 Channel=All*—The dialog displays the individual channel properties for all of the channels, starting with Channel1, and not the global properties.
- *V208_Slot4 Channel=Global*—The dialog displays the global properties (those which are common to the entire module) and not the individual channel properties.
- *V208_Slot4 Channel=n*—The dialog displays the individual channel properties for the selected channel (1 to 4 in the case of the V208), and not the global properties.

Click the *Channel* pull-down and select *V208_Slot4 Channel = Global*. This allows you to view the global parameters (those that are common to all channels).

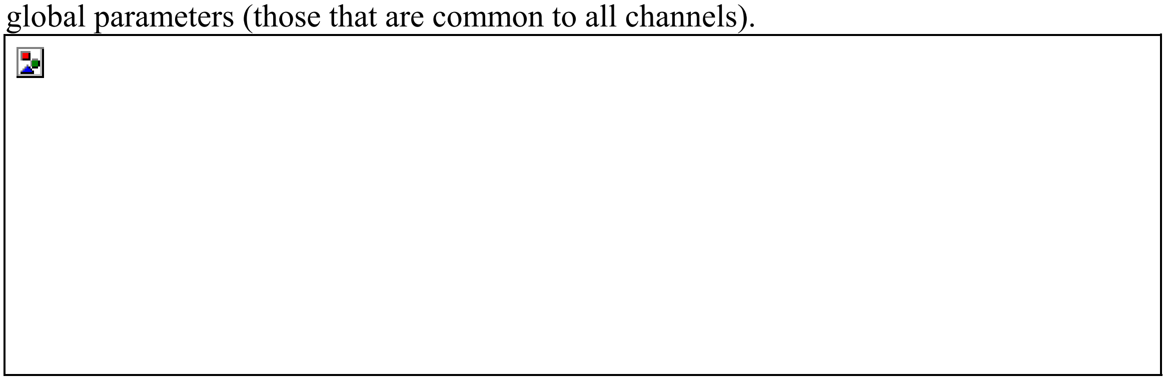


Figure 4-CON5. Selecting global parameters for viewing

You can now select a new *per-channel* clock setting property, for example. The default value in the KSC library is *1000 Hz*. Click the pull-down for the value of the *Clock_Setting* property. This gives you a list of clock settings for the V208. If you select 2*000 Hz* from the list, it would cause each of the four channels in the V208 to be sampled at 2000 Hz.

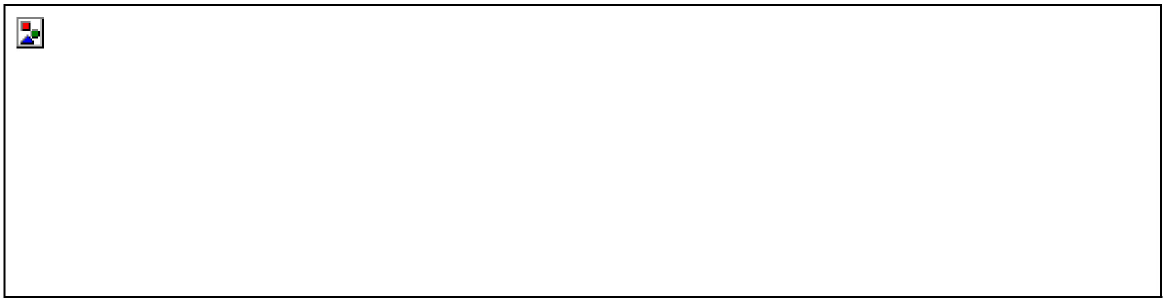
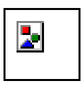


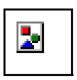
Figure 4-CON6. Selecting the clock rate for each channel

Data fields in the *Configuration Database Utility* window are either *read-only* or *editable.* The read-only fields are for information only and you cannot change them. The editable fields either have an unlimited choice of valid entries, such as *Channel_ Name*, or a limited number of valid choices, such as *Clock_Setting*. If the number of choices is limited, you are presented with a *pull-down* selector, which contains all the valid choices.

Saving Your Changes and Making a New Configuration Database Active

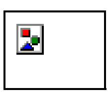


When you have updated all of the desired global and/or channel properties, click the *Save Database* button on the *Mainframe Configuration Utility* toolbar to save the changes that you have made to your new database. *If you do not save your changes, they may be lost.*



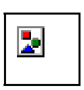
Click the *Select New Configuration* button. When the dialog opens, highlight your new database, then click the *Open* button. This makes your new database the current database. You can then click the *Close Box* in the upper right corner of the *Configuration Utility* window to close it and return you to the main DAQ Director window. Note that the status line at the bottom of the window indicates that your new database is the currently active database.

Editing an Existing Configuration Database

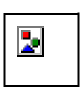


If you are at the DAQ Director main window, click the *Config* button to open the *Mainframe Configuration Database*.

Click the *Select Database for Editing* button on the *Configuration Database* window. This selection opens a file dialog that allows you to select a database for editing from the list of existing databases.



When you have updated all of the desired global and/or channel properties, click the *Save Database* button on the *Mainframe Configuration Utility* toolbar to save the changes that you have made to your new database. *If you do not save your changes, they may be lost.*



Click the *Select New Configuration* button. When the dialog opens, highlight your new database, then click the *Open* button. This makes your new database the current database.

You can then click the *Close Box* in the upper right corner of the *Configuration Utility* window to close it and return you to the main DAQ Director window.

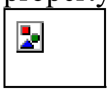
Using an Existing Database as a Basis for a New Database

You may wish to use an existing database as a basis for a new database to be edited while not overwriting the current database file. To make a “clone” of an existing file:

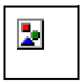
Open the *Windows NT Explorer*. Highlight the *currentfilename.mdb* file in the *..\DAQ_Director\database* directory. Press *Control-C* followed by *Control-V* to copy the file and paste a copy of it in the same directory. Windows NT will name the new file *Copy of currentfilename.mdb*. Select and click the file name to rename this file *newfilename.mdb.*. This will be your new configuration database, using the *currentfilename* database as a starting point. Using the new file, follow the directions under *Editing an Existing Configuration Database.*

Updating Configurations to the Current Release of the KSC Module Library

The KSC Module Library may be updated to add new modules and/or change property information for existing module. If you receive an updated library file and wish to reflect any property changes in any of your existing Configuration Databases, you can do so with this utility.



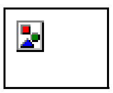
If you are at the DAQ Director main window, click the *Config* button to open the *Mainframe Configuration Database*.



Clicking the *Update Configuration* button opens a file dialog that allows you to select a database and make that database compatible with a new release of the KSC library. You can repeat this operation for all configuration databases that you wish to update.

You can then click the *Close Box* in the upper right corner of the *Configuration Utility* window to close it and return you to the main DAQ Director window.

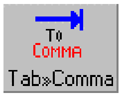
Select New Configuration from Main DAQ Director Window



You can select a *Configuration Database* from the main DAQ Director window. Clicking the *New Cfg* button displays an *Open File* dialog that allows you to select a configuration database from the list of existing databases. Clicking the *Open* button makes your selection the current database.

Convert Tab- to Comma-delimited File

See also: **Demultiplex Data**



This selection allows a data file that is formatted in tab-delimited form (as from *Demultiplex Data*) to be converted to comma-delimited form in order to match the requirements of a particular data analysis application. It opens a dialog window similar to that shown below.

Select the file that you wish to convert and click the *Convert* button. The dialog indicates *Working* while the file is being converted, then it indicates *Successfully created* when the conversion is complete. You can then close the dialog. The converted file retains the same basic file name, with a *.csv* extension instead of the *.tda* extension found on the tab-delimited file.

Figure 4-CNV1. The selection dialog for converting from a tab- to a comma-delimited file

Following is a portion of a comma-delimited file for a V208 ADC, used alone. All of the header information is shown, followed by the first ten data points for all four channels. For more information about the file parameters, refer to **Demultiplex Data** in this chapter.

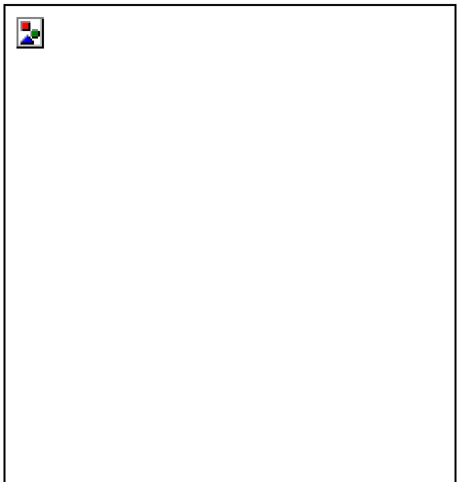
```
Channel Names,,,,,Slot4_Ch1,Slot4_Ch2,Slot4_Ch3,Slot4_Ch4
Units of Measure,,,,,Volts,Volts,Volts,Volts
Conversion Type,,,,,Polynomial,Polynomial,Polynomial,Polynomial
Counts per Volt,,,,, 3200 , 3200 , 3200 , 3200
Zero Offset(counts),,,,, 32767 , 32767 , 32767 , 32767
Calibration voltage point 1,,,,,-10 ,-10 ,-10 ,-10
Calibration voltage point 2,,,,, 10 , 10 , 10 , 10
Calibration voltage point 3,,,,, 0 , 0 , 0 , 0
Calibration voltage point 4,,,,, 0 , 0 , 0 , 0
Calibration voltage point 5,,,,, 0 , 0 , 0 , 0
Calibration voltage point 6,,,,, 0 , 0 , 0 , 0
Calibration voltage point 7,,,,, 0 , 0 , 0 , 0
Calibration voltage point 8,,,,, 0 , 0 , 0 , 0
Calibration voltage point 9,,,,, 0 , 0 , 0 , 0
Calibration voltage point 10,,,,, 0 , 0 , 0 , 0
Engineering Unit calibration point 1,,,,,-10 ,-10 ,-10 ,-10
Engineering Unit calibration point 2,,,,, 10 , 10 , 10 , 10
Engineering Unit calibration point 3,,,,, 0 , 0 , 0 , 0
Engineering Unit calibration point 4,,,,, 0 , 0 , 0 , 0
Engineering Unit calibration point 5,,,,, 0 , 0 , 0 , 0
```

```
Engineering Unit calibration point 6,,,,, 0 , 0 , 0 , 0
Engineering Unit calibration point 7,,,,, 0 , 0 , 0 , 0
Engineering Unit calibration point 8,,,,, 0 , 0 , 0 , 0
Engineering Unit calibration point 9,,,,, 0 , 0 , 0 , 0
Engineering Unit calibration point 10,,,,, 0 , 0 , 0 , 0
Polynomial coefficient 1,,,,, 0 , 0 , 0 , 0
Polynomial coefficient 2,,,,, 1 , 1 , 1 , 1
Polynomial coefficient 3,,,,, 0 , 0 , 0 , 0
Polynomial coefficient 4,,,,, 0 , 0 , 0 , 0
Polynomial coefficient 5,,,,, 0 , 0 , 0 , 0
Polynomial coefficient 6,,,,, 0 , 0 , 0 , 0
Polynomial coefficient 7,,,,, 0 , 0 , 0 , 0
Polynomial coefficient 8,,,,, 0 , 0 , 0 , 0
Polynomial coefficient 9,,,,, 0 , 0 , 0 , 0
Polynomial coefficient 10,,,,, 0 , 0 , 0 , 0
Polynomial order ,,,,, 1 , 1 , 1 , 1
Manual EU Adder ,,,,, 0 , 0 , 0 , 0
363,14,34, 57.11,363:14:34:57.1100000,-9.3 , 5.412813 , 5.039688 , 0.1065625
363,14,34,57.112,363:14:34:57.1120000,-8.347187 , 5.411562 , 5.04 , 0.10625
363,14,34,57.114,363:14:34:57.1140000,-4.216875 , 5.412813 , 5.0425 , 0.10875
363,14,34,57.116,363:14:34:57.1160000, 1.519375 , 5.415312 , 5.04625 , 0.11125
363,14,34,57.118,363:14:34:57.1180000, 6.647188 , 5.418437 , 5.05 , 0.114375
363,14,34,57.12,363:14:34:57.1200000, 9.232187 , 5.420625 , 5.052187 , 0.115625
363,14,34,57.122,363:14:34:57.1220000, 8.29375 , 5.421875 , 5.0525 , 0.1153125
363,14,34,57.124,363:14:34:57.1240000, 4.18375 , 5.421563 , 5.050625 , 0.11375
363,14,34,57.126,363:14:34:57.1260000,-1.541875 , 5.417812 , 5.045938 , 0.11
363,14,34,57.128,363:14:34:57.1280000,-6.701875 , 5.413437 , 5.042188 , 0.1075
```

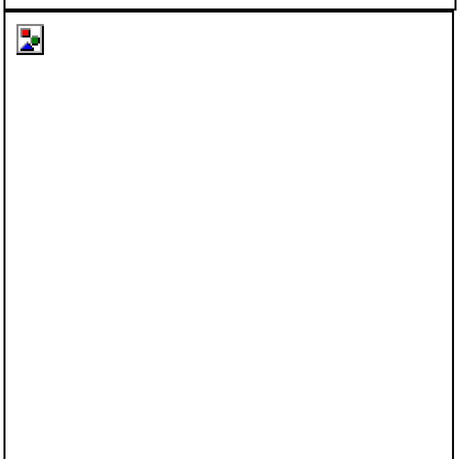
Figure 4-CNV2. A typical comma-delimited file for the V208 ADC

DAQ Director Control Panel

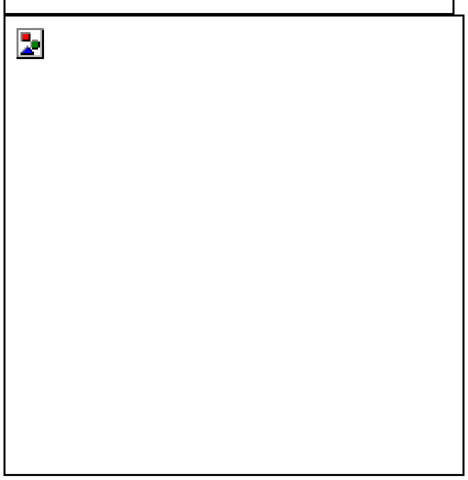
See also: **Data Engine**



Starting the data engine(s) opens the DAQ Director *Control Panel* (if it is not already open). This window displays the status of DAQ Director activity. The initial state of the Control Panel is shown here.



The next action that occurs when one or more data engines are initializing is the *Make Button* procedure. In the following example, a button is created for a V208 ADC module in Slot 4. The indicator is yellow, showing that the data engine is being initialized.



In this example, we have a V208 ADC in Slot 4 and a V243 96-channel Low-level Signal Conditioning module in Slot 5. The V243 communicates with the V208 via MUX-bus in the VXI backplane.

The Control Panel Message Center displayed the automatic internal calibration of each of the 96 channels in the V243, followed by a PROCEED message that would have allowed other data engines to initialize if they were present.

Finally, the Control Panel indicates that the V208 data engine is running, and the indicator turns green.

Stopping the data engine displays a *Terminated* message and turns the indicator red.

Figure 4-CNP1. The DAQ Director Control Panel showing a data engine starting sequence

DAQ Director Main Window

Select *Programs* | *KineticSystems DAQ Director II* | *Control Panel* from the Windows Start Menu or double-click the DAQ Director shortcut on the Windows Desktop (if you had created one) to start DAQ Director. The DAQ Director Main Window opens as shown below.

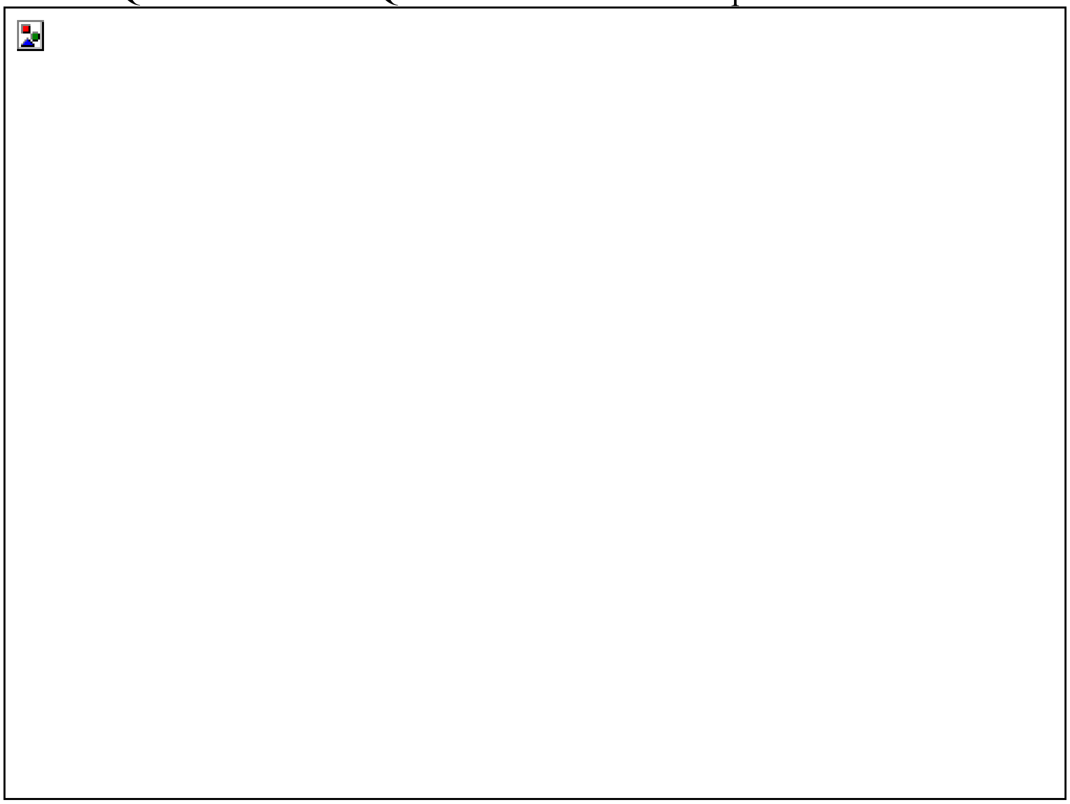
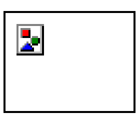


Figure 4-MW1. The DAQ Director Main Window

The DAQ Director applications and utilities are spawned by left-clicking the appropriate buttons on the toolbar. You can refer to the button descriptions found at the beginning of Chapter 3 as well as the details found in this chapter to learn more about their features.



If you are an advanced user and recognize all of the toolbar button icons, you can remove the captions, allowing the buttons to fit on one line. To do this, click the *KscSys* viewer button.

If you find this statement commented out in the Notepad window, **SpawnCaptions = No*, remove the "*" to make the statement active. If the statement is not present, add it. Select *File* | *Save* on the Notepad window, then exit the window. Exit the DAQ Director Main Window. When you next run DAQ Director, the toolbar will display as shown in the following figure. To return to a toolbar with captions, comment out this statement with an "*."

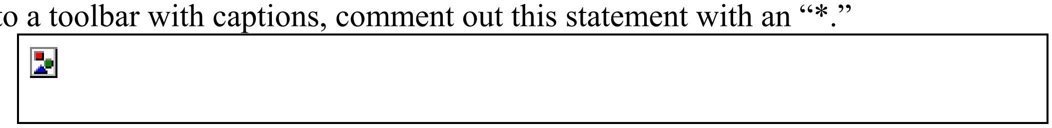


Figure 4-MW2. The DAQ Director toolbar without toolbar captions

The DAQ Director toolbar buttons are divided into seven types. You can display any combination of button groups by right-clicking on the toolbar and checking the appropriate boxes. The change is activated by left-clicking in the white area of the DAQ Director main window. The following figure shows the display of nine buttons from the *Operation* and *Displays* groups.

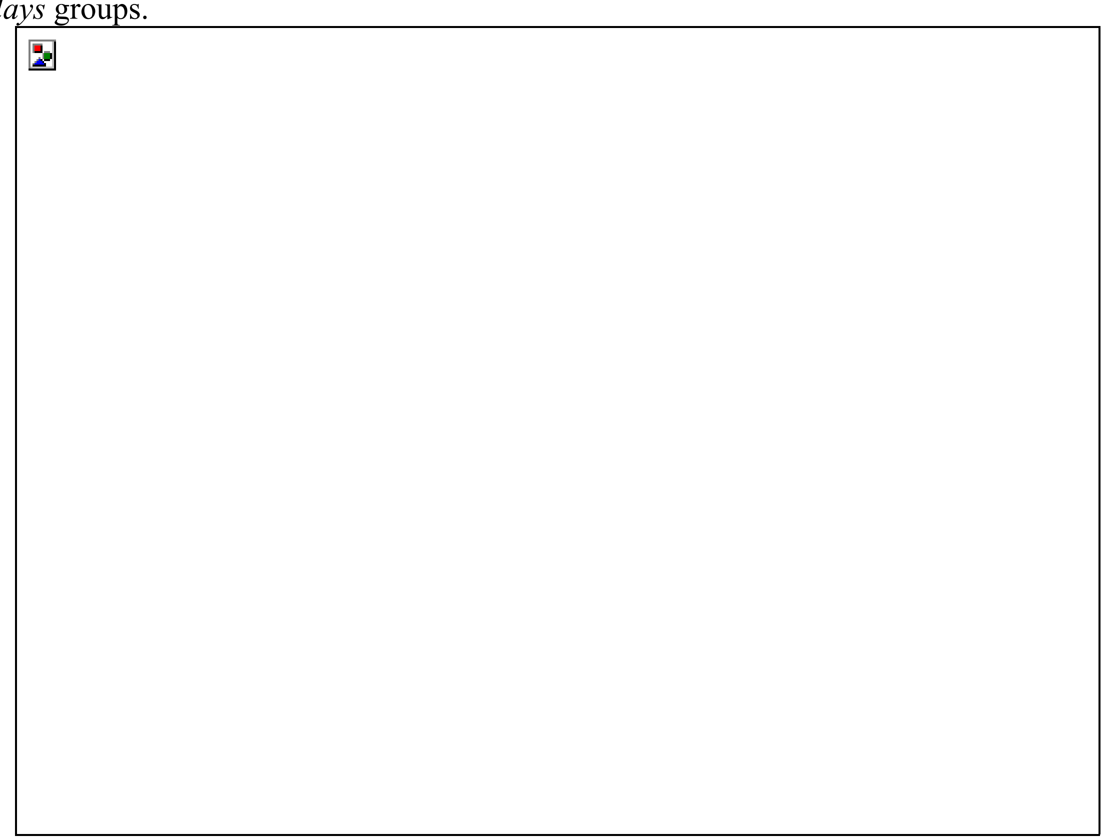
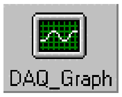


Figure 4-MW3. Displaying selected button groups

DAQGraph Utility (DAQ_Graph)



Display Graphical Data—This selection displays a viewer that presents the data in graphical form as it is acquired from the ADC module (continuous mode) or from the Multibuffer (transient mode). The *DAQGraph* opens as seen in the following figure.

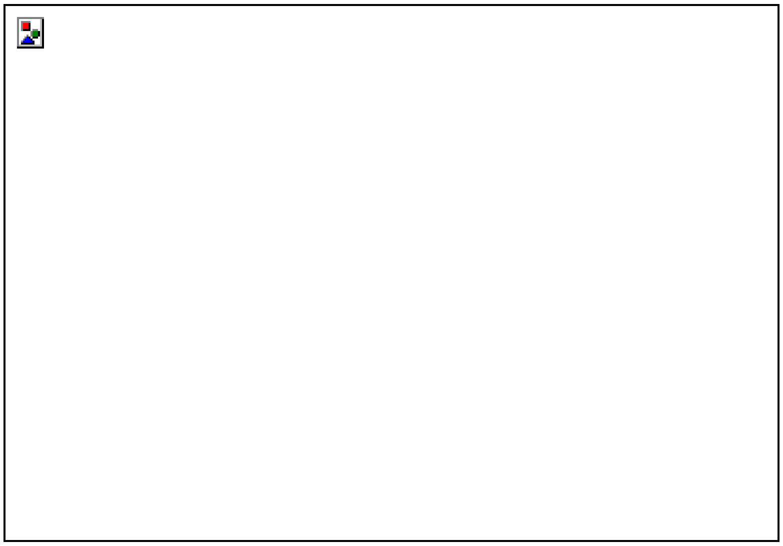
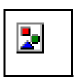


Figure 4-DGR1. The DAQGraph window



Click the *Select Channels to Display* button to open the *Select Channels* dialog. Select the desired ADC module from the *Digitizer* pull-down. Select the channel(s) to view from the *Available Channels* listing. The indicator for a selected channel changes to a check mark.
You can remove a channel from the to-be-viewed list, by clicking it again. Its indicator changes back to *X*. Click *OK* to complete the selection.

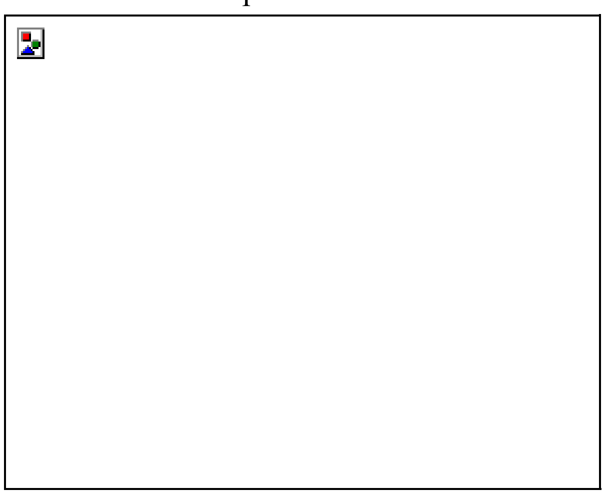
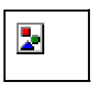


Figure 4-DGR2. The Select Channels dialog window

A graph window opens with the selected channel(s). If more than one channel were selected, each channel would be displayed, using a different color. (The default color setting.) You can resize the *DAQGraph* window or the *Graph 1* window by dragging, or you can view either window full-screen. The initial horizontal scale is determined by the *Clock* and *SamplesPerChannel* properties in the *Configuration Database*. The initial vertical scale is determined by the *MaxEUScale* and *MinEUScale* properties.

Figure 4-DGR3. A DAQGraph window containing a Graph window



Click the *Open New Window* button to create another graph window, as shown in the following figure. Each time you click this button, a new graph window is created.

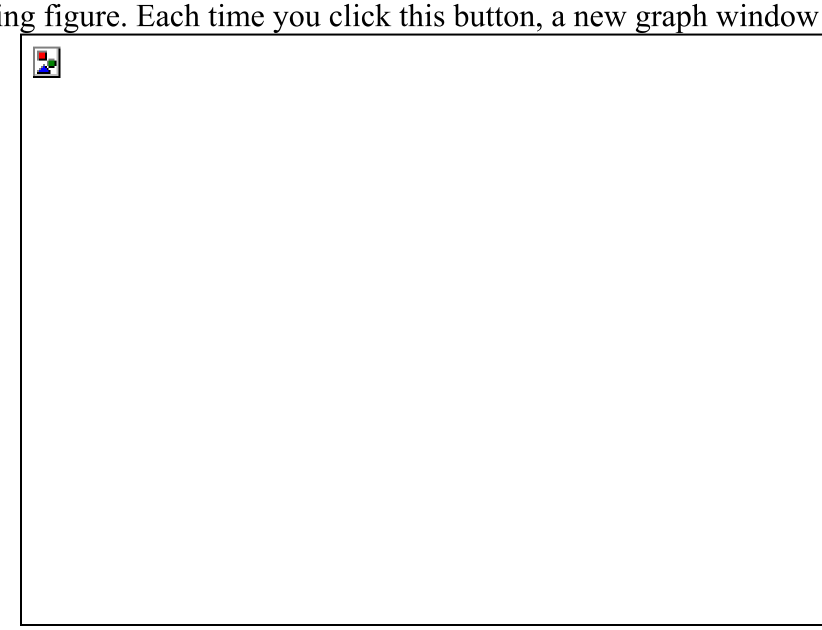
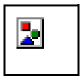


Figure 4-DGR4. Using the Open New Window button to create a new graph window



Click the _Print_ button to cause the DAQGraph screen to be printed, using the default printer. Another printer can be selected, using the *File|Printer..* menu item. You may need to change the color of the waveform(s) for presentation on a black-and-white printer.

Copying an Image—You can copy a DAQGraph screen to the Windows clipboard to use the graph as part of a report. Use *File|Copy* or press *Cntrl-C* to copy the image to the clipboard. You can use an application, such as *Photoshop* or *Picture Publisher* to crop the image. You can then copy the cropped image and paste it into Microsoft *Word* or a similar application. You may need to change the color of the waveform(s) for presentation on a black-and-white printer. A typical image is shown in the following figure.

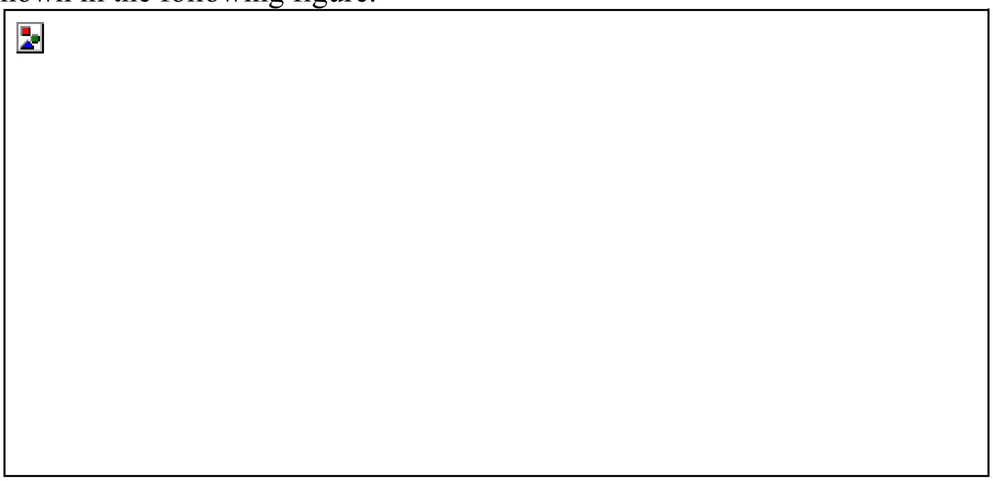
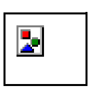


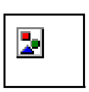
Figure 4-DGR5. A graph window copied for use in a report

Display Mode—This menu item, *View|Display Mode,* selects one of three display modes:

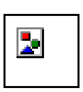
- *Automatic*—The display is updated each time data is transferred from the VXI mainframe.
- *Periodic*—The display is updated at a periodic rate that you select. You select this rate by the menu item, *View|Refresh Timer Interval*. This opens a dialog window that allows you to enter a period in milliseconds. Entering *1000*, for example, will result in a periodic-mode display update once each second.
- *Manual*—The display is only updated when you click the *Refresh* button described below.



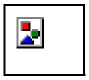
Click the _Stop_ button to stop the refresh timer and "freeze" the display (*Display Mode = Automatic* or *Periodic)*. The waveform will remain stationary and any changes in the waveform will not be displayed. The button turns from red to green and its text changes to *Start*.



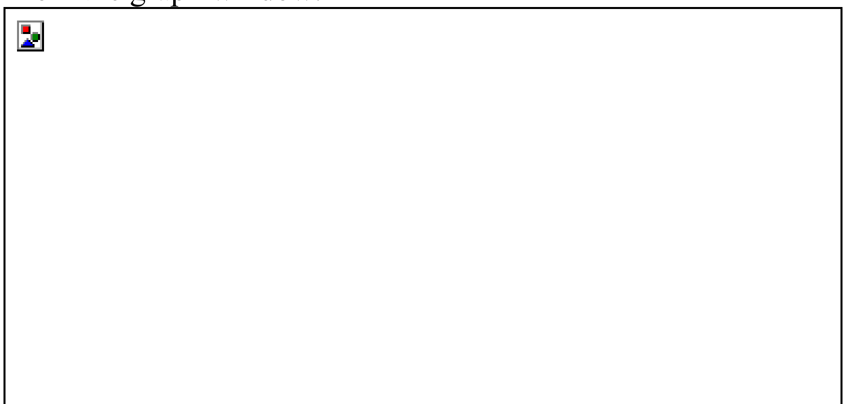
Click the _Start_ button to start the refresh timer and "unfreeze" the display (*Display Mode = Automatic* or *Periodic)*. The waveform now follows the input signal. The button turns from green to red and its text changes to *Stop*.



Click the _Refresh_ button to update the display. This action will update if the display is "frozen" by the *Stop* button or the *Display Mode* is set to *Manual*.



Click the *Reference Line* button to display a vertical reference line in the active graph. You can move this line to the left or right by using the left or right arrow keys.. The current position relative to the horizontal axis is shown on the status line at the bottom of the *DAQGraph* window. In the example below, the time between two peaks was measured as *80 ms – 46 ms = 34 ms.* Clicking the *Reference Line* button again removes the line from the graph window.



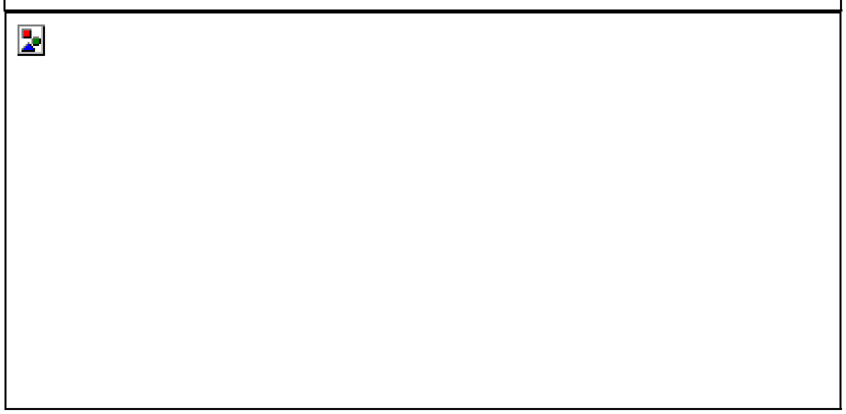
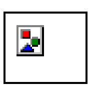


Figure 4-DGR6. Using the Reference Line to measure a waveform period



Click the *Show/hide Grid* button to toggle the display grid *On* or *Off*. When the grid is *Off*, a dashed horizontal line is present, as shown in the following figure.

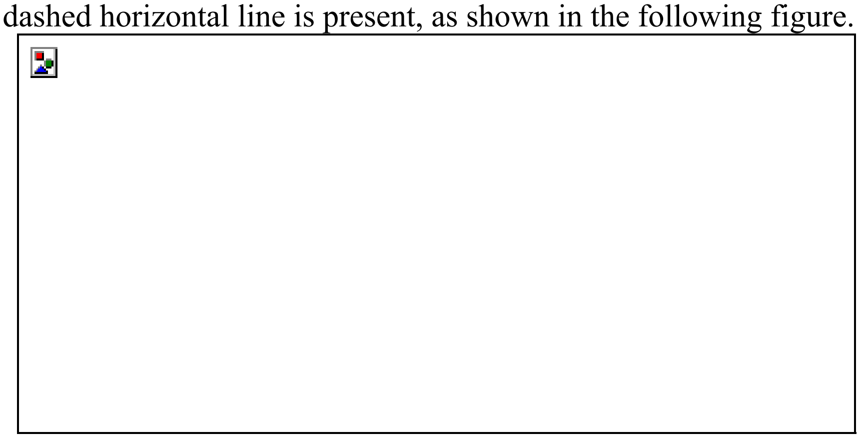
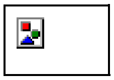


Figure 4-DGR7. A graph window with the grid removed



Click the pull-down on the *Zoom* button to select the desired magnification level in the *Y* (amplitude) or *X* (time) direction.

A waveform with ±0.8 Volts amplitude is shown in the first image below. The full scale for the ADC module is ±10.5 Volts. The pull-down is selected, and *Y x 10* is highlighted. Releasing the left mouse button causes the full-scale range to be changed to ±1.05 Volts (a 10x magnification) as shown in the second image. The *X* zoom can be used in the same manner to increase the magnification of the *X* axis.

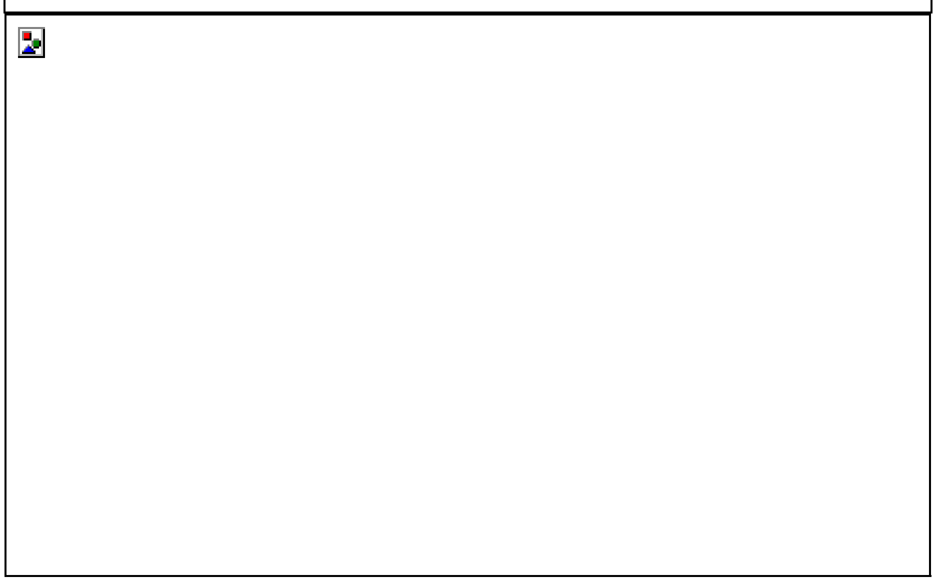
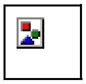


Figure 4-DGR8. Making a zoom-level selection to magnify the Y axis



Click the *Color Palate* button to change the color of a graph image. If more than one image is present, first click the image label at the bottom of the window to make it current. Then click the *Color Palate* button to open the *Color* window. Select the new color by clicking it. Then click *OK* to activate the selection. Repeat this process to change any other images.

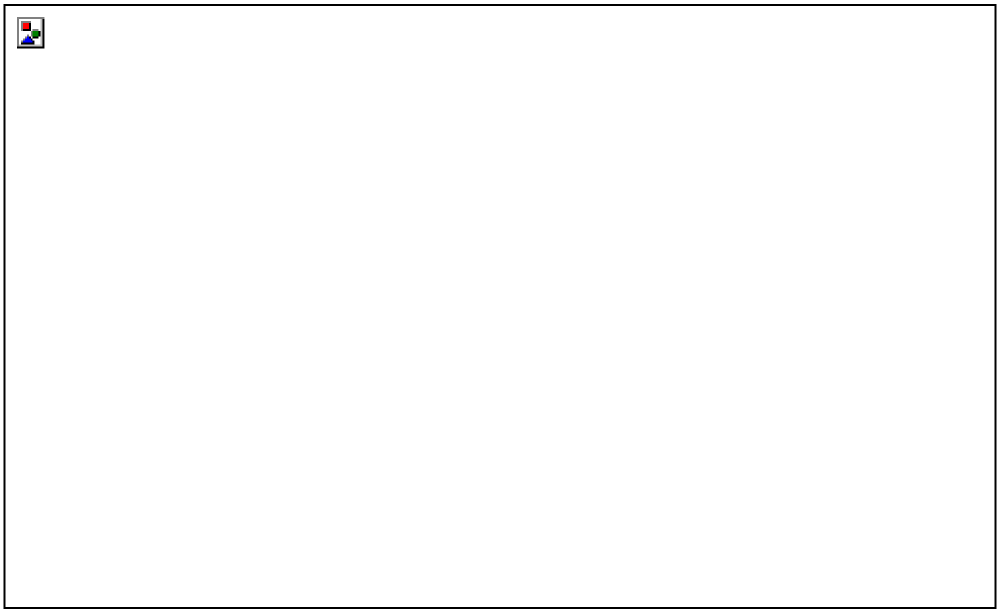
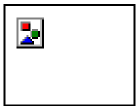
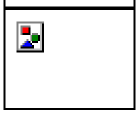


Figure 4-DGR9. Using the Color Palate to change graph image colors

Data Engine (Start/stop Data)

See also: **DAQ Director Control Panel**

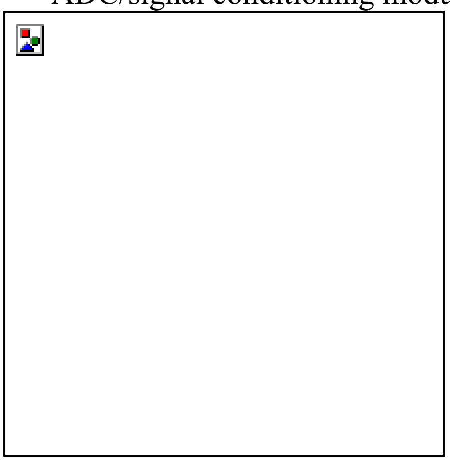




Associated with each module in the VXI mainframe is a DAQ Director *Data Engine*—an executable to control that module for data acquisition or control. When you click the green *Start Data Engine* button on the DAQ Director main toolbar, a DAQ Director *Control Panel* window opens and starts the data engine. Once the data engine becomes active, the toolbar button turns red and becomes the *Stop Data Engine* button, used to stop the data engine. If more than one module were present, their data engines would be activated in sequence.

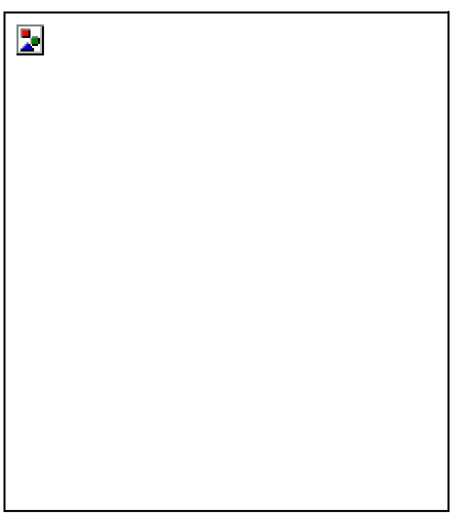
There are the following exceptions to the relationship of a module to a data engine:

- The V200 ADC contains two groups that can be independently clocked. Each group contains 8 channels for a 16-channel V200 and 16 channels for a 32-channel V200. Because of this, each V200 causes two data engines to execute.
- When a V207 or V208 ADC is used with one or more signal conditioning modules (V241, V243, V246, V252 or V253), a data engine is created only for the V207 or V208. Each ADC/signal conditioning module combination operates as a unit, using the ADC data engine.



As described under **DAQ Director Control Panel**, a *Control Panel* opens (if it is not already open) and displays the sequence for starting the data engine(s). In the example shown here, the data engine for a V208 ADC in Slot 4 was created, followed by a data engine for a V305 Contact Input module in Slot 6. Both indicators are green, indicating that both data engines are running.

Figure 4-DE1. DAQ Director Control Panel showing the sequence for running two data engines.



When a data engine opens, it is automatically minimized. To view a data engine, left-click it in the Windows NT toolbar or hold down the *Ctrl* key and press *Tab* until the desired data engine is in focus, then release the keys. This is a typical example of an ADC data engine.

When the data engine starts running, it creates a binary file with header information. For example, a V208 in Slot 4 creates a file, *V208_Slot4.bin,* in the *..\DAQ_Director\Data* directory.

Figure 4-DE2. The data engine window for a V208 ADC

The controls and displays on this data engine are:

- *Top-left Display*—This indicator is normally white and turns red if there is a data overrun.
- *Top-center Display*—This indicator shows the instantaneous data value in counts.
- *Channel*—This pull-down menu selects the channel to be in focus for the instantaneous data and quick-plot display. This display is useful as a quick check on system operation.
- *Message Display*—This window displays messages received by this executable. Typical messages are *Record, Stop Record* and *Terminate*. The *Record* or *Stop Record* buttons on this data engine do not affect this message display.
- *Plot*—Clicking this button opens a quick-plot display. It closes the display if it is already open.
- *Display Info*—This window displays setup information associated with the data engine.
- *Clear*—Clicking this button clears the *Display Info* window.
- *Record*—Clicking this button starts data recording to disk for continuous data acquisition mode. It starts data acquisition to the V208 multibuffer memory when operating in transient mode (as set up in the configuration database). This button only affects this data engine, while the *Record* button on the main toolbar affects all running data engines associated with input-data modules. Please refer to the *Recording* topic in this chapter for more information about data recording.
- *Stop Record*—Clicking this button stops data recording for this data engine.

Clicking the *Plot* button expands the data engine window to include the quick-plot area. The horizontal axis for this real-time graph represents the number of data points set by the *Samples per Channel* setting in the *Configuration Database*. The vertical axis ranges from *–Full Scale* (0 counts) to *+Full Scale* (65,535 counts). This is raw ADC data without any calibration correction. You can change the channel being displayed by selecting the desired channel from the *Channel* pull-down menu. A typical expanded data engine window is shown in the following figure.

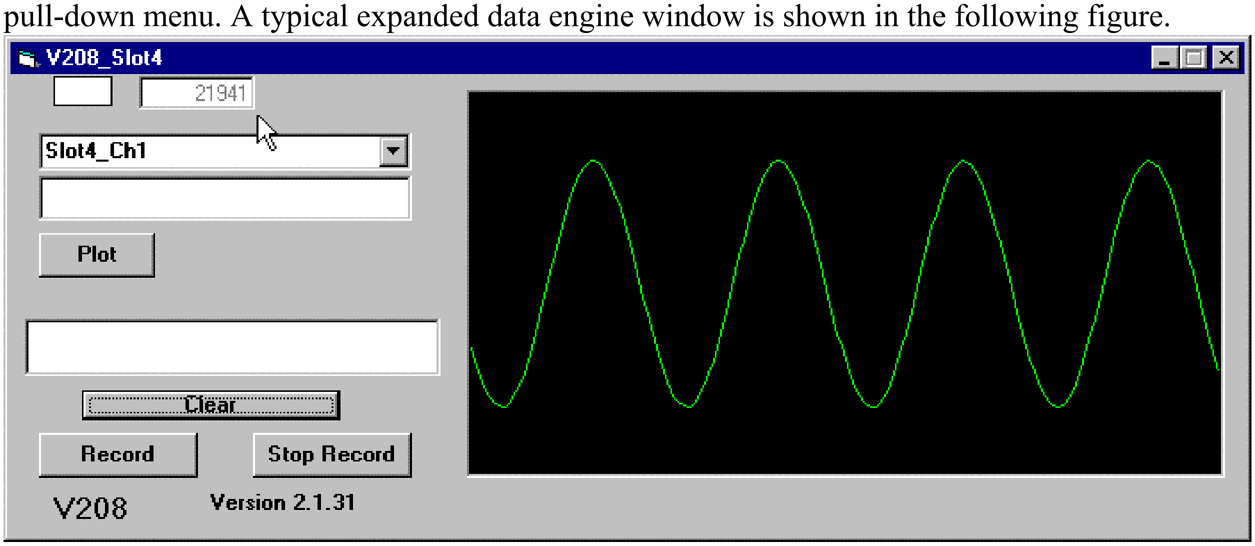
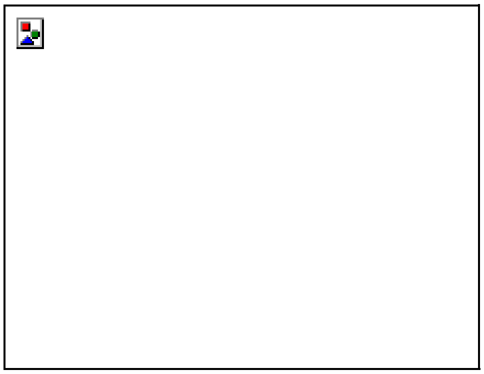


Figure 4-DE3. The V208 Data Engine window expanded to show the quick-plot display

This graphical display can adversely affect system performance, so it should be selected only to check operation of the data engine. The data engine window should be collapsed or minimized during normal operation.

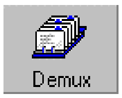


The characteristics of a data engine window depend upon the particular VXI module that they represent. This figure shows the data engine window for the V305 24-channel Contact-input module. The input status indicator for each channel is white when that channel is OFF (no voltage applied), and it changes color when that channel is ON. You can click the *Record* button to start recording to disk at the clock rate set for this module in the *Configuration Database*.

Figure 4-DE4. The data engine window for the V305 Contact-input module

Demultiplex Data (Demux)

See also: **Convert Tab- to Comma-delimited File**



This selection causes data that is stored in interlaced form to be demultiplexed (Channel 1 data block, Channel 2 data block, …), converted to engineering units and stored in tab-delimited ASCII, allowing the data to be readily viewed in Excel or similar applications.

Clicking the *Demux* button opens the *Demultiplex_Data_Files* dialog window. You can then select from the list of binary files to be demultiplexed. Multiple files may be selected. Engineering unit conversion will also occur if you have that checkbox checked. A pull-down menu allows you to select *.bin, .dat* or *all files* to view. When you have highlighted your selection, click *Go*. The indicator window shows *Currently processing…*

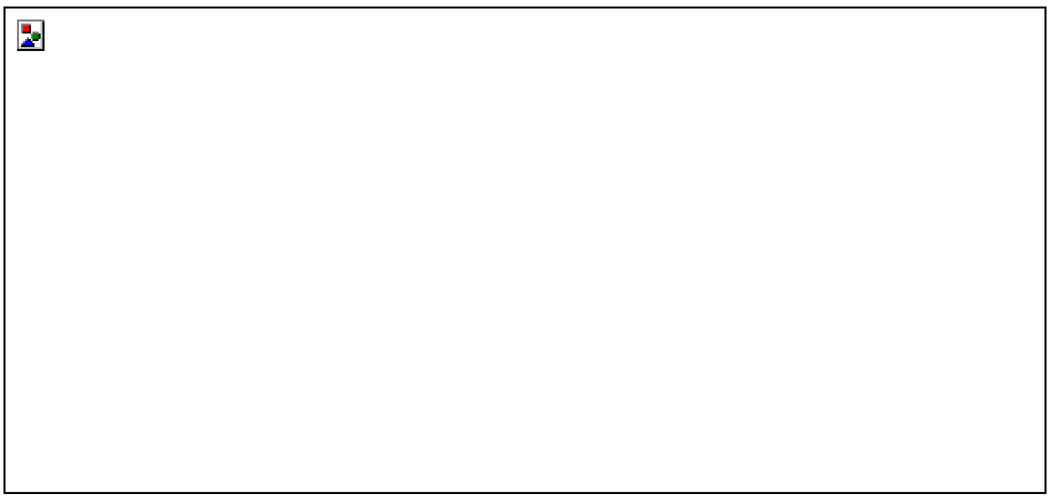


Figure 4-DMX1. The Demultiplex_Data_Files dialog while conversion is underway

Once conversion is complete, the dialog indicator changes to *Finished processing files.* The new file has been created, and you can close the dialog window by clicking the *Exit* button. For example, a *V208_Slot4.bin* file creates a *V208_Slot4.tda* file (tab-delimited ASCII). A comma-delimited file can then be created by clicking the *Tab to Comma* button. For details, refer to **Convert Tab- to Comma-delimited File** in this chapter.

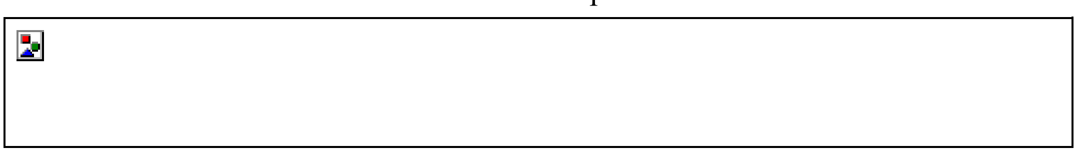


Figure 4-DMX2. The Demultiplex_Data_Files dialog when finished processing files

Digital Output Control (Dig Out)

This selection displays a window that contains buttons for controlling digital output channels. Each button is a toggle to select the state of the associated output channel (OFF or ON). You configure each button, its association with an output data channel, and its color when OFF or ON in the *kscsys.cfg* file.

The format for a control button definition is:

ControlButton =

OnBackColor,OnTextColor,OnCaption,OffBackColor,OffTextColor,OffCaption,Channel,InitialState

where:

- *OnBackColor* is the button color with the button in its *On* state.
- *OnTextColor* is the caption color with the button in its *On* state.
- *OnCaption* is the button caption text with the button in its *On* state.
- *OffBackColor* is the button color with the button in its *Off* state.
- *OffTextColor* is the text color with the button in its *Off* state.
- *OffCaption* is the button text with the button in its *Off* state.
- *Channel* is the channel and module definition (such as *Slot7_Ch1).*
- *InitialState* is the initial state of the channel (*Off* or *On).*

The following statements in kscsys.cfg would produce four buttons that are red in their *Off* state and green in their *On* state

```
ControlButton = Green,Black,Blower,Red,White,Blower,Slot7_Ch1,Off
ControlButton = Green,Black,Lights,Red,White,Lights,Slot7_Ch2,Off
ControlButton = Green,Black,High Voltage,Red,White,High Voltage,Slot7_Ch3,Off
ControlButton = Green,Black,Arm Model,Red,White,Arm Model,Slot7_Ch4,Off
```

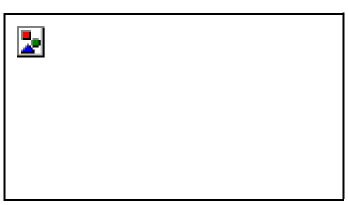
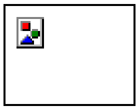


Figure 4-DOC1. A Digital Control window with four buttons

The Digital Control window opens with a 2 x n button cluster. You can arrange the buttons in a single row by dragging the right side of the window.

Display Digital Data (Dig_Disp)



This selection opens a viewer that presents the current value of the analog data in digital format. This viewer opens with the number of channel monitor windows selected in the previous display. You can select the channels to be monitored, and you can add channel monitor windows.

The following figure shows a digital display window with viewers for four channel of a V243 Low-level Signal Conditioning module.

- To add an additional viewer click *Add* at the top of the window once for each viewer to add.
- To give the display file a new name, select the *File* | *Save As* menu item, then enter the file name.
- To retrieve a saved display file, select the *File* | *Open* menu item, then select the desired file.

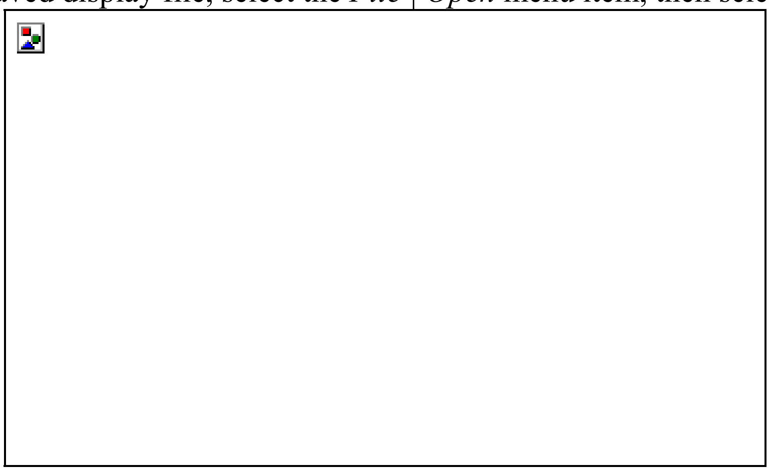


Figure 4-DD1. A typical Digital Display window with four channel viewers

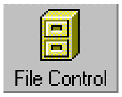
The elements of a display block are:

- The voltage display is the average of a number of channels. That number is set by the *SamplesPerChannel* property in the *Configuration Database*.
- The limit check display indicates if limit checking is enabled or disabled. If enabled the indicator turns from green to red if the selected limit is being exceeded.
- The channel pull-down is used to select the channel to be displayed.

You can open more than one Digital Data Display window.

File Control

See also: **Recording**



When the data engine(s) are running, this selection opens a *File Control* form. It allows you to select a data engine and create a data file name. This allows you to create a unique binary file name for each data run.

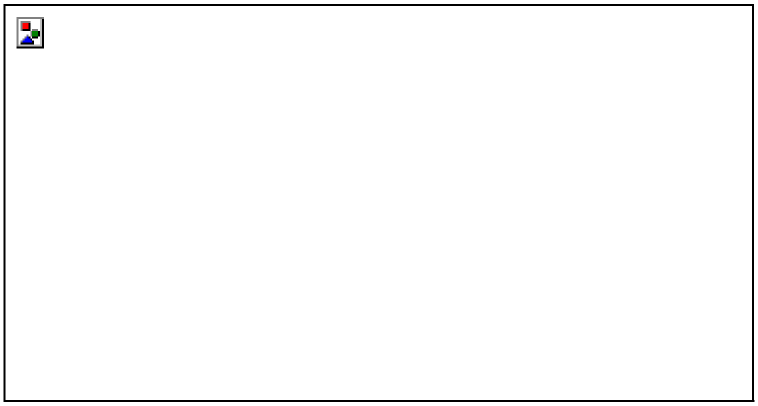


Figure 4-FC1. The File Control dialog

Creating a New Data File Header from the Toolbar

1. To create a new data file header while the data engines are running, click the *File Control* pushbutton on the DAQ Director main toolbar. The *File_Control* form will appear.
2. Select the *Data Engine* for which you wish to create a file header from the pull-down menu.
3. Enter the name of the file in the entry box labeled *File Name*. You should not include the extension (*.bin*).
4. Determine if you want a unique number added to the file name. If so, check the check box. Insert the number in the *Next Number* entry box.
5. Click *Create.* The file header will be created in the *Data* directory.
   If you selected a unique number to be added and that number was *1*, the file name for this example will be: *YourFileName.1.bin*
6. Repeatedly pressing *Create* while the form is open will either recreate the file header, or if *Add Unique ID Number* is checked, additional file headers will be created while incrementing the ID number with each file creation.

Opening a Newly Created File for Archiving

After creating a new header file, you may open it for archiving by clicking *Open*. This sends a *Close File* command to the data engine, followed by an *Open File* command with the file name appended. An acknowledgement of these messages can be observed in the Mailbox Message window.

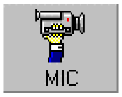
Creating a New Data File Header Using the Mailbox

1. To create a new file header using a mailslot message while the engines are running, send the following message to the address, *KineticSystems_DAQ_Director*.
2. CreateFile,*V207_N1_Slot4,YourFileName*, where *V207_N1_Slot4* is the name of the digitizer. This will create a file named *YourFileName.bin*
   If the message is modified by appending *,1* to the end as in the example:
   CreateFile,V207_N1_Slot4,YourFileName,1
   The file created will be named *YourFileName.1.bin*
3. If, after supplying a seed number as in the past example, the message is modified by appending *,Next* to the end as in the following example:
   CreateFile,V207_N1_Slot4,YourFileName,Next
   The next file created will be named *YourFileName.2.bin*
4. Sending the message *CreateFile,V207_N1_Slot4,YourFileName,Next* repeatedly will continue to create new file headers with unique incrementing ID numbers.

Creating a New Data File Header and Opening the File for Archiving Using the Mailbox

Follow the preceeding instructions in *Creating a New Data File Header Using the Mailbox* with the following exception: Modify the *CreateFile* command to read *CreateFile+Open*.

GI/FOXI Control (MIC)



This selection opens a dialog window that provides interactive control of the KineticSystems Grand Interconnect or FOXI computer interface.

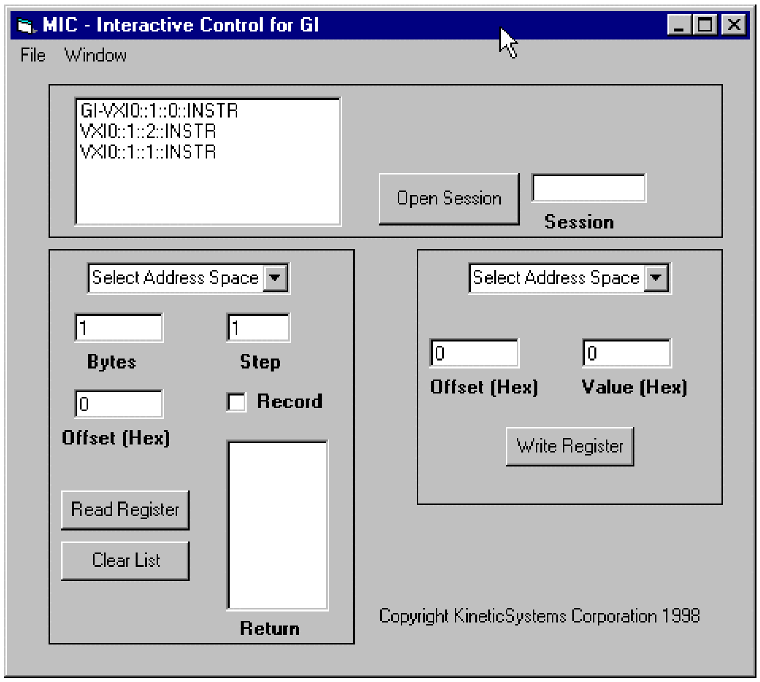
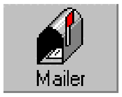


Figure 4-GFX1. Ad dialog window for the interactive control of the GI or FOXI

Mailer



This selection opens a dialog box that allows you to send mailbox messages and view received messages. This send/receive message utility is used primarily for diagnostic purposes.

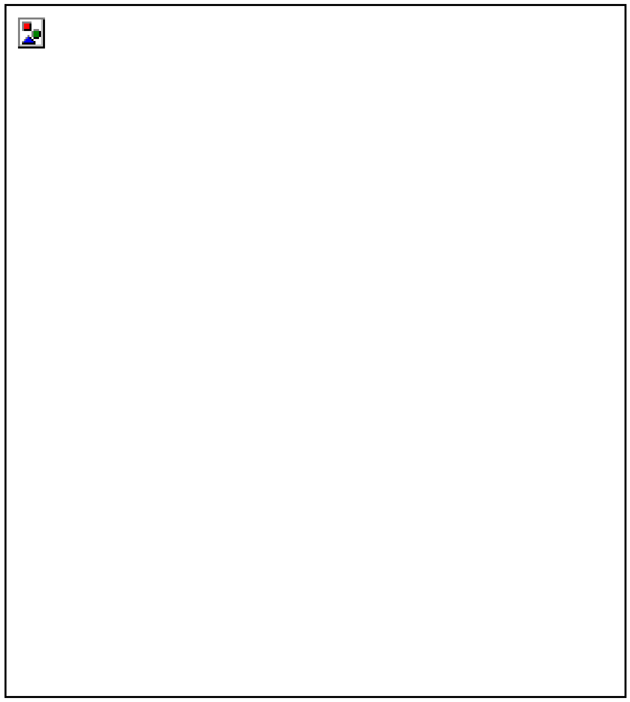


Figure 4-MLR1. The Mailer dialog window

New Configuration (New Cfg)

See also: **Configuration Database**

This selection displays an *Open File* dialog that allows you to select a *Configuration Database* from the list of existing databases and make it the current database by clicking the *Open* button.

Figure 4-NCF1. Using the New Cfg button to select a Configuration Database

PID Loop Controller

This PID controller utility allows DAQ Director to support PID (*Proportional Integral Derivative*) closed-loop control loops. This software application is sold separately.

PID Background

Controllers are designed to eliminate the need for continuous operator attention. Cruise control in a car and a house thermostat are common examples of how controllers are used to automatically adjust some variable to hold the measurement (or process variable) at the set-point. The set-point is where you would like the measurement to be. Error is defined as the difference between the set-point and the measurement. A *PID controller* is a device that employs each of the three basic feedback control modes: *proportional* (P), *integral* (I), and *derivative* (D).

Proportional Control

For proportional control, the controller output, p(t), is proportional to the error signal, e(t), by a factor of K_c, the dimensionless controller gain

$$p(t) = K_c e(t)$$

The controller gain is adjusted to increase or decrease the sensitivity of the controller output to the deviations between setpoint and the controlled variable. Taking the Laplace transform gives the following transfer function:

$$G_c = K_c$$

The advantage of proportional-only control is its simplicity. If offsets can be tolerated, the use of a proportional controller may be optimal. However, it will not eliminate the steady-state errors that occur after a set-point change or a sustained load disturbance.

Integral Control

Integral control depends on the integral of the error signal over time. The integral time constant,τ_I, is the adjustable controller parameter with units of time.

$$p(t) = (1/\tau_I)\int_0^t e(t)dt$$

The primary advantage of integral control is that it eliminates offset. This happens because p(t) will change until the error signal is zero, thus eliminating a deviation between the controlled variable and setpoint in the steady state. The disadvantage of integral-only control is that the controller will not respond until the error signal has persisted for some period of time.

To counteract this problem, controllers have been developed that combine the use of proportional and integral control. The result is a proportional-integral (PI) controller, which is commonly used because of the immediate-acting proportional control coupled with the corrective-acting integral control. The PI controller transfer function is:

$$G_c = K_c(\tau_I s + I)/\tau_I s$$

Derivative Control

Derivative control is used to anticipate the future behavior of the error signal by using corrective action based on the rate of change in the error signal.

$$p(t) = \tau_D(de/dt)$$

Derivative action is used to stabilize the controlled process. When the error signal is increasing greatly, the controller output is large. The error signal decreases, and the process is eventually stabilized. A disadvantage of derivative control is that controller output is zero when the error signal is constant. To counteract this problem, proportional-derivative (PD) controllers have been developed to improve the dynamic response of the controlled variable. The transfer function of a PD controller is:

$$G_c = K_c(1 + \tau_D s)$$

Proportional-Integral-Derivative Control

A three mode proportional-integral-derivative (PID) controller combines the advantages of each individual mode of control. The ideal PID controller output equation is:

$$p(t) = K_c[e(t) + (1/\tau_I)\int_0^t e(t^*)dt^* + \tau_D(de/dt)]$$

and the transfer function is:

$$G_c = K_c(1 + 1/\tau_I s + \tau_D s)$$

The PID controller provides quick-acting corrective control of most process variables. Adding integral control to a proportional controller will eliminate the steady-state error, but will increase overshoot and settling time. By adding derivative control, the overshoot and settling time can be reduced. A PID controller is not used for highly noisy control variables like flow control, because the derivative response will amplify the random fluctuations in the system.

Installation

Copy the files from the PID controller distribution to the DAQ Director folder on your hard disk. This installs the PID utility to DAQ Director.

Hardware Options

The following VXIbus I/O modules can be used as part of PID control loop(s):

For output:

- V266 16, 32, or 64-channel, 16-bit DAC

For input:

- **V207** 16-bit, 500,000 Sample/s ADC Subsystem
- **V208** 16-bit, 100,000 Sample/sec ADC Subsystem
- **V241** 96-channel, High-level, Scanning MUX (Use with V207 or V208)
- **V243** 16- to 96-channel, Low-level Signal Conditioner (Use with V208)

- **V246** 8-channel Bridge Signal Conditioner (Use with V207 or V208)
- **V253** 16-channel, Programmable Gain/Analog Filter (Use with V207 or V208)

Setup

Launch DAQ Director, allowing the main window to open.

Click the *KscSys* button on the main toolbar to open the configuration file editor window.

Add the following lines to the Boolean Settings section of the configuration file if they are not already present:

```
PIDRun = yes
PID = yes
```

With PIDRun = yes, the PID controller will auto-run when DAQ Director is launched. If PIDRun = no, the PID controller can be started by sending a message, typically from a button. With PID = yes, A PID database can be created. The configuration file editor window is shown in Figure 4-PID01.

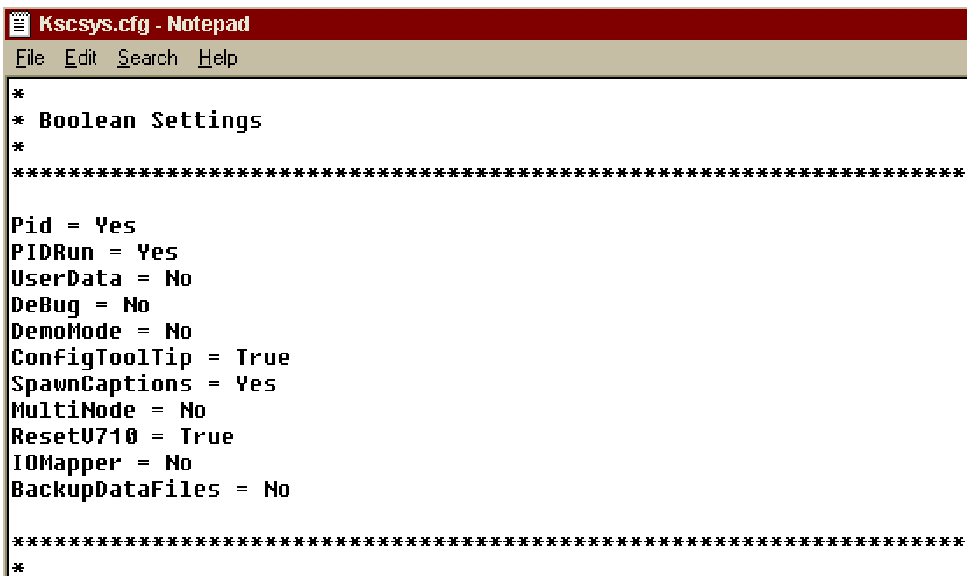


Figure 4-PID01. The configuration file editor window showing PID controller entries

The module data engines normally start in ransom order. It is necessary for the engines associated with the PID controller to start before the PID controller itself starts. Entries must be made in the Settings section of the *Kscsys.cfg* file. An example of this is shown here and in Figure 4-PID02.

```
SpawnFirst = V208_S[ot3
SpawnFirst = V266_S[ot5
```

Enter the information that is appropriate for the module combinations that form the PID controller I/O in your system.

Close the editor window and save any changes.

```
* Settings
*
********************************************************************

UserSlot = 99
InternalCalRange = .1
V710CommPort = 1                    *Change to 1 if using the V710
SC2xBalanceCon = .089               *Theoretical Value is .09768
MaximumV710s = 20
B350Slot = 12
TransientWaitTime = 20
TC_ReferenceGain = 10X2
*NetworkDevice = PSI.192.92.103.137
Meters_16Size = 16
Meters_16Rate = 200
Digital_16Size = 16
Digital_16Rate = 200
Meter_1Rate = 100
OpenTC_TestPeriod = 15
SpawnFirst = V208_Slot3
SpawnFirst = V266_Slot5

********************************************************************
```

Figure 4-PID02. The config file editor window with entries to control the engine spawn order

Exit DAQ Director and launch it again so that any changes made to the *Kscsys.cfg* file will take effect.

Click the *ResMan* button to run the Resource Manager (ResMan).

Once the Resource Manager has finished, click the *Suffix* button to view the modules, including model suffix, found.

A typical window is shown in Figure 4-PID02. Note that the PID controller routine is active, as indicated by the *KPID* item in the suffix viewer window.

```
Suffix.tbl - Notepad
File  Edit  Search  Help
1        3        V208     ZD32
1        4        V243     VA91
1        5        V266     ZA11
1        0        KPID
```

Figure 4-PID03. A suffix viewer window, showing that *KPID* is active

PID Controller Start-up

After launching DAQ Director, the engines associated with the PID controller start. In this example, the V208 engine starts, followed by the V366 engine, and finally the KPID controller itself. This is shown in Figure 4-PID04.

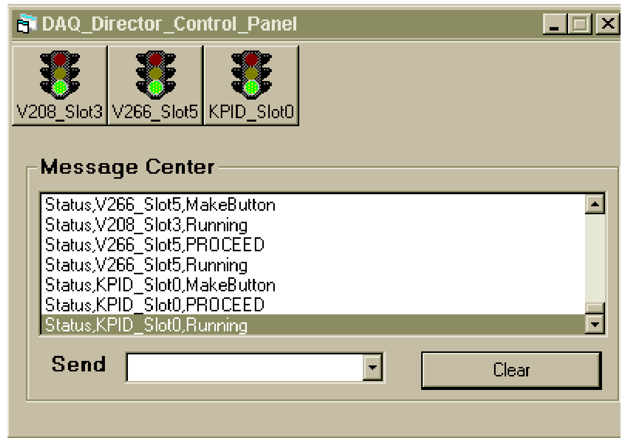


Figure 4-PID04. The DAQ Director Control Panel showing engine start-up

Once the PID controller is running, its dialog window opens. The title of this window is *KPID_Slot0* since the controller resides in software. Initially the *General* tab are as shown in Figure 4-PID05. The controller supports up to 10 PID control loops.

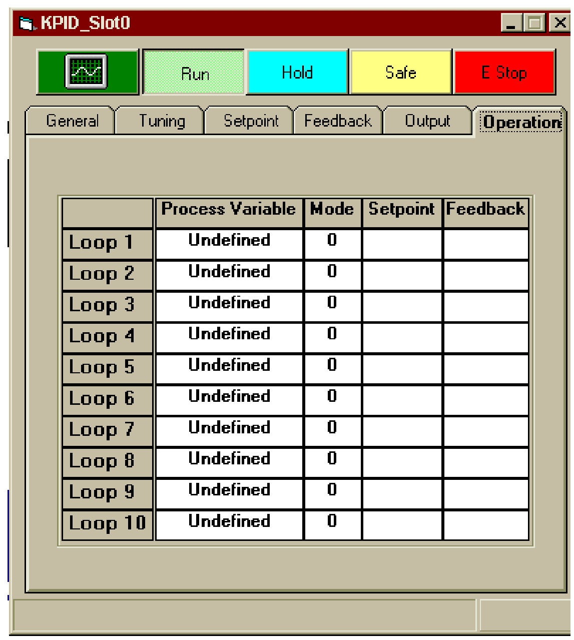


Figure 4-PID05. The PID Controller window showing the initial General tab values

Setup for Loop 1

Select the *Feedback tab.* Select *Loop 1*, followed by *Mode 1* (of 3) as shown here. Each loop can have up to three modes with different setpoints, etc.

.

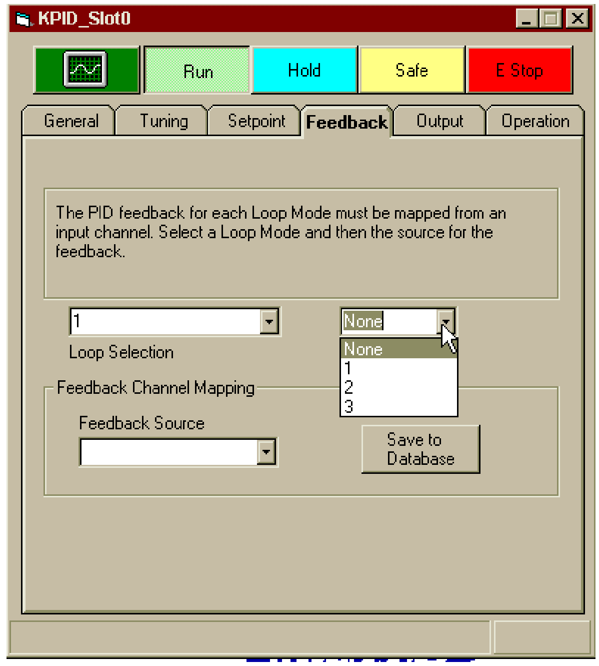


Figure 4-PID06. Feedback mode selection

In this example we have a V298 ADC in Slot 3 and its associated V246 signal conditioner in Slot 4. Use the *Feedback Channel Mapping* pulldown to select the input channel that you are using for feedback on Loop 1 as shown here.

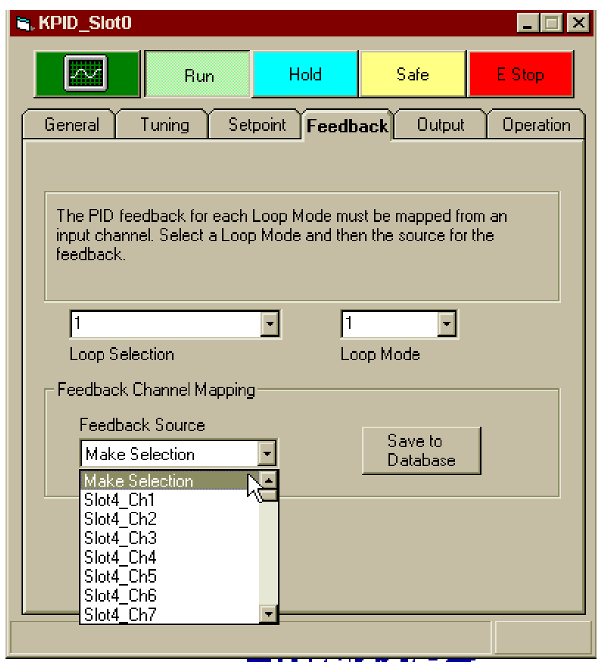


**Figure 4-PID07.
Selecting the feedback channel**

To save your selections click the *Save to Database* button as shown here.

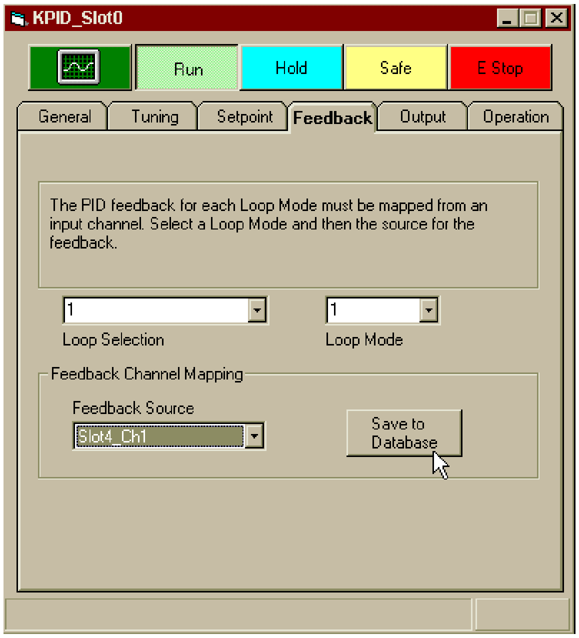


Figure 4-PID08.
Saving your selections to the database

Select the *Feedback* tab. Select *Loop 1*, followed by the *Output Channel* (from the V266 in Slot 5 in this example) as shown here. To save your selections click the *Save to Database*

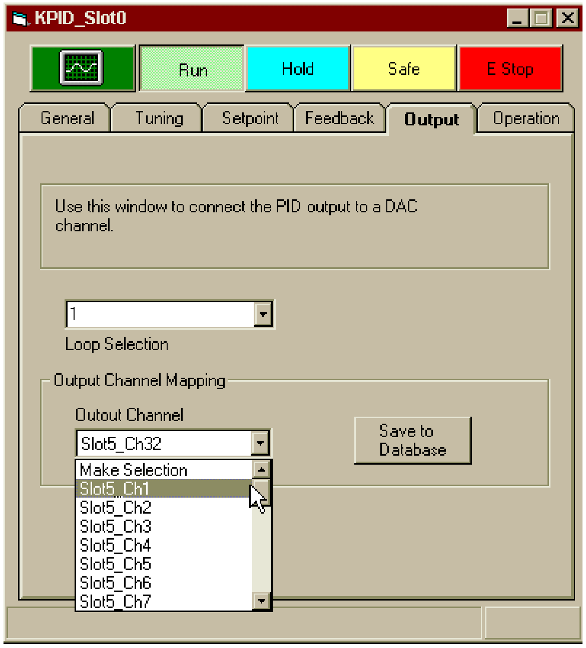


Figure 4-PID09.
Selecting the Output channel

Select the *Setpoint* tab. The PID setpoint for each loop and loop mode can be mapped from an input channel or placed into PID Name Shared Memory by an application or through the messaging system. Select a Loop Mode, then the *Setpoint Source*. lick *Save to Database* to save your selection.

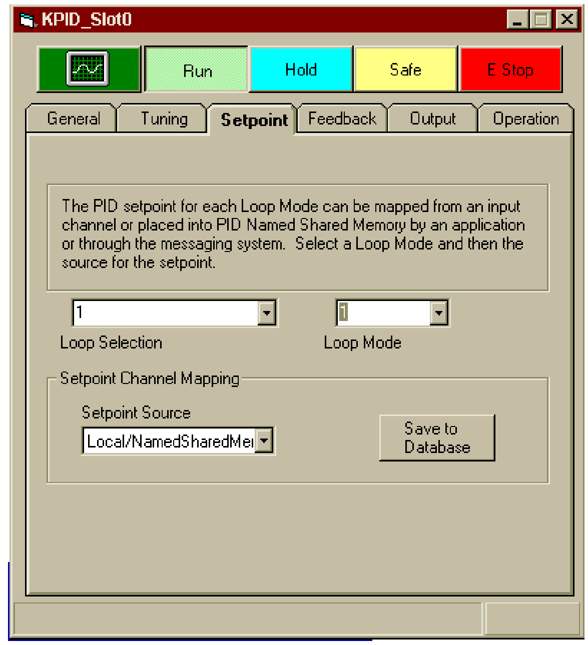


Figure 4-PID10. Selecting the Setpoint source

Click the *General* tab. This section now reflects the current settings for Loop 1, including default parameters. Other loops can be viewed via the *Make Loop Selection* pulldown.

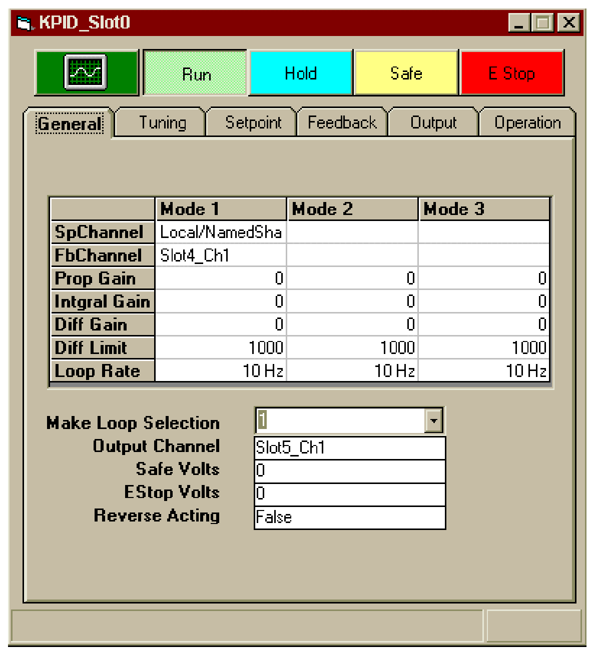


Figure 4-PID11.
Viewing the current parameters

Select the *Tuning* tab. This form is used to select the tuning parameters for the PID control loops. The current loop and loop mode are selected by the *Loop Selected* and *Loop Mode* pulldowns. The setpoint source is set to *Local Source* (controlled by elements on this form) or *System Settings* (controlled by the source selected on the *Setpoint* form). Generally, the external loop is non-inverting (a more positive steady-state output voltage results in a more positive feedback voltage). If the loop is inverting, the *Reverse Acting* box must be marked,

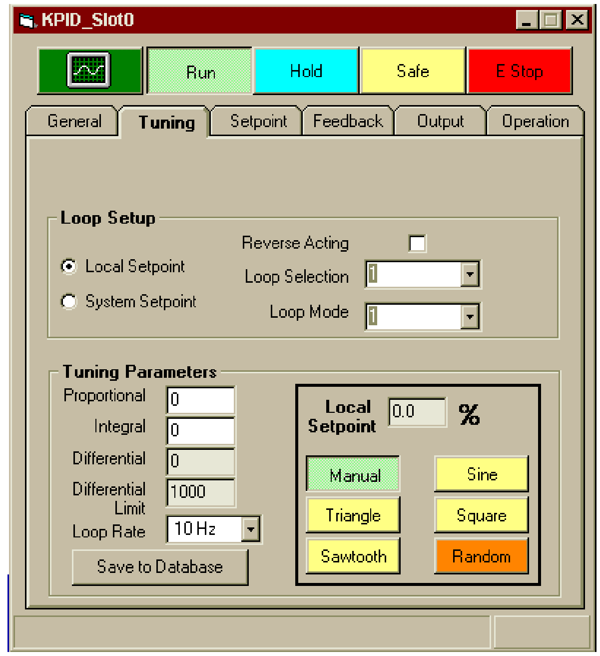


Figure 4-PID12.
Selecting the local or system setpoint

The update rate for the selected loop and loop mode is chosen by using the *Loop Rate* pulldown. Rates from 1 Hz to 100 Hz can be chosen in a 1, 2, 5, 10, 20, 50, 100 Hz progression.

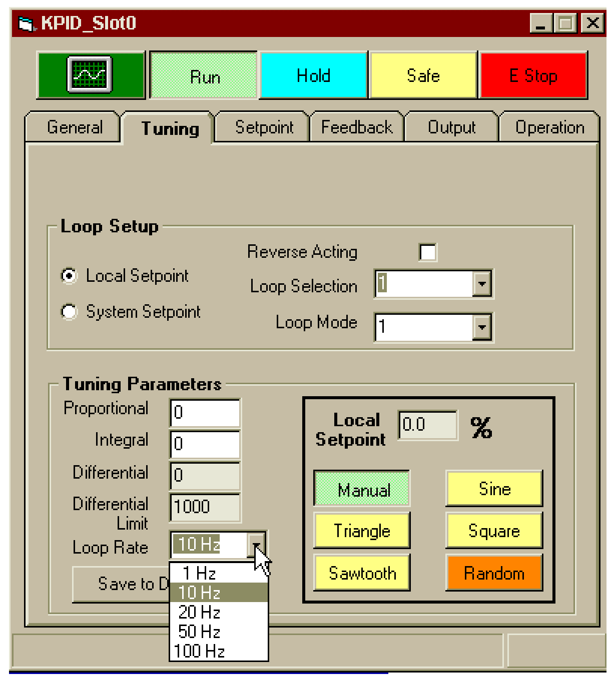


Figure 4-PID13. Selecting the loop rate

With the setpoint source set to *Local Setpoint*, click the *Manual* button, The *Local Setpoint* value (in percent) can be entered. However, PID performance cannot be evaluated with a static setpoint.

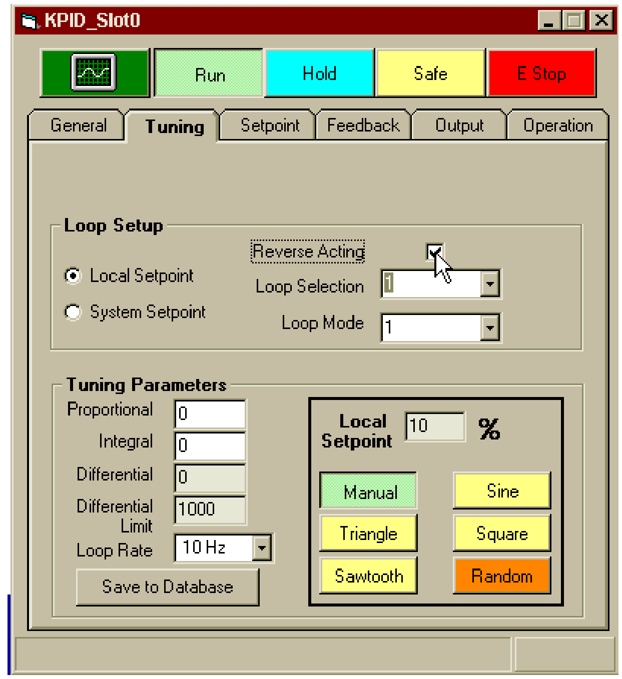


Figure 4-PID14.
Entering a manual steady-state setpoint value

As an aid to tuning a PID loop, various waveforms can be produced (sine, square, triangle, sawtooth and random), In the example here the *Loop Rate* was set to 100 Hz and the *Sine* button was clicked, The *Min %* was set to 10, and the *Max %* was set to 20. This sets the peak-to-peak excursion of the waveform. The repetition rate for one period of the waveform was set to 1 second. Various values were entered for the *Proportional, Integral* and *Differential Tuning Parameters*. An appropriate *Differential Limit* selection protects against extraneous excursions of the demand and aids loop stability.
Clicking the Tuning *Graph* button in the upper left corner of the window opens a *Graph* window, as shown in Figure 4-PID16.

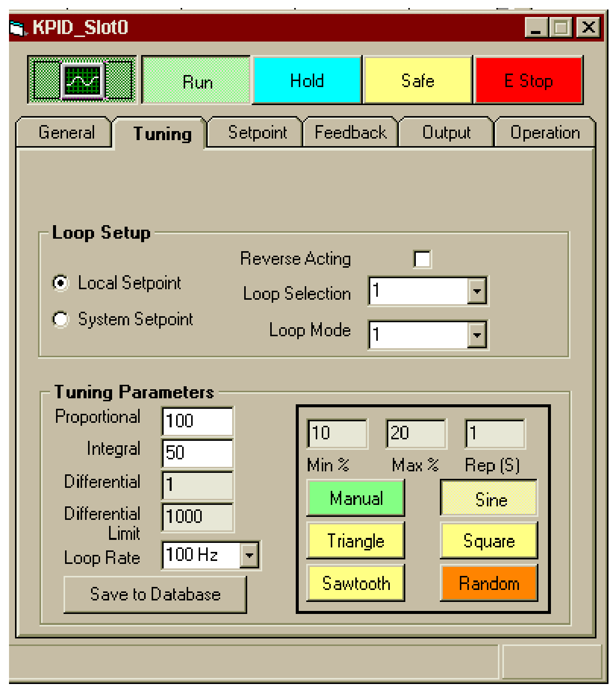


Figure 4-PID15.
Using the built-in signal source for tuning

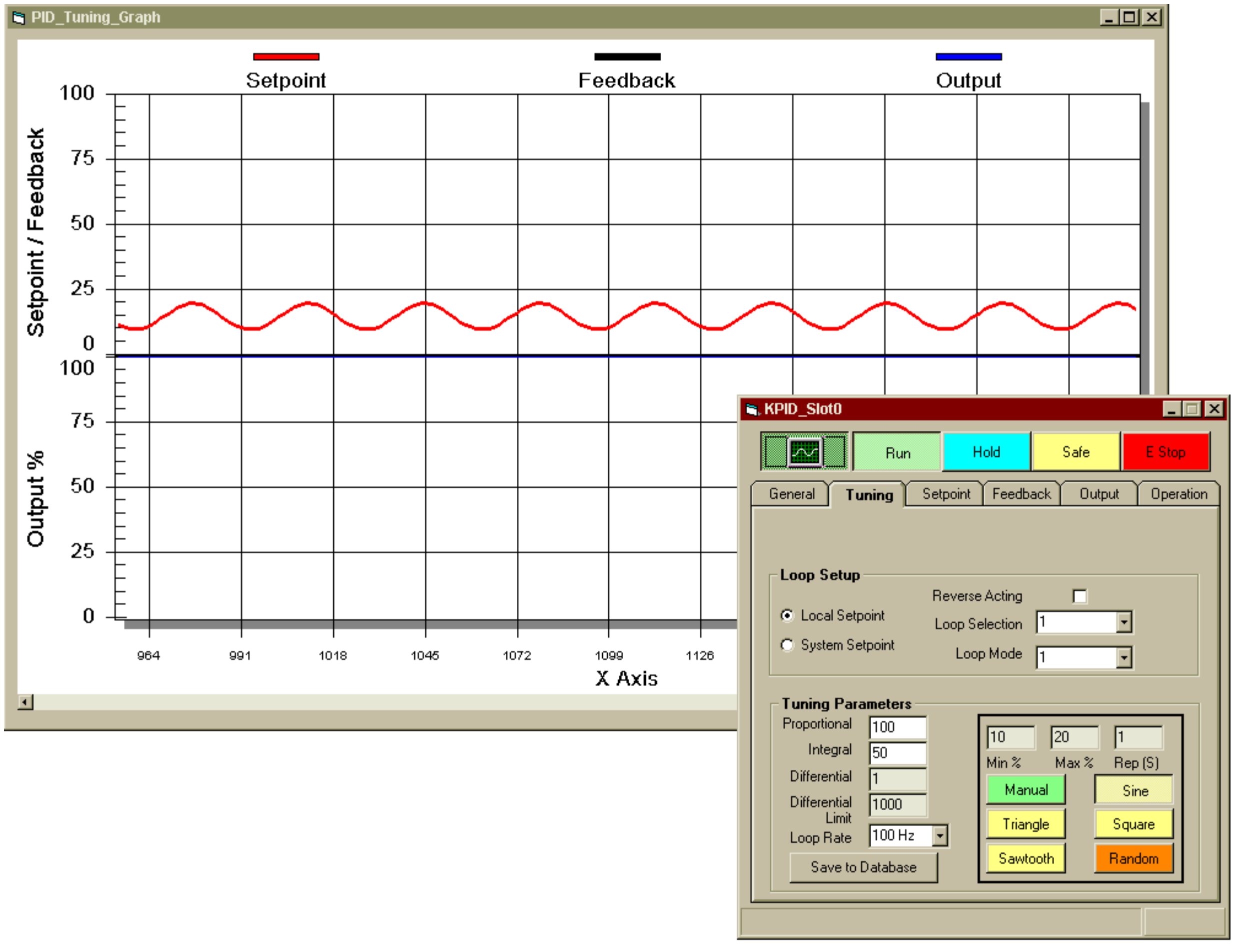


Figure 4-PID16. The Tuning Graph window showing the sine wave setpoint

Selecting the PID Loop State

The state of currently selected PID Loop is selected by clicking one of the four buttons at the top of the window. These buttons are:

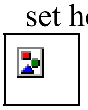
Run - This button causes the currently selected loop to assume the normal run state.

Hold - This button causes the controller output to maintain its current value, ignoring any changes in the feedback signal.

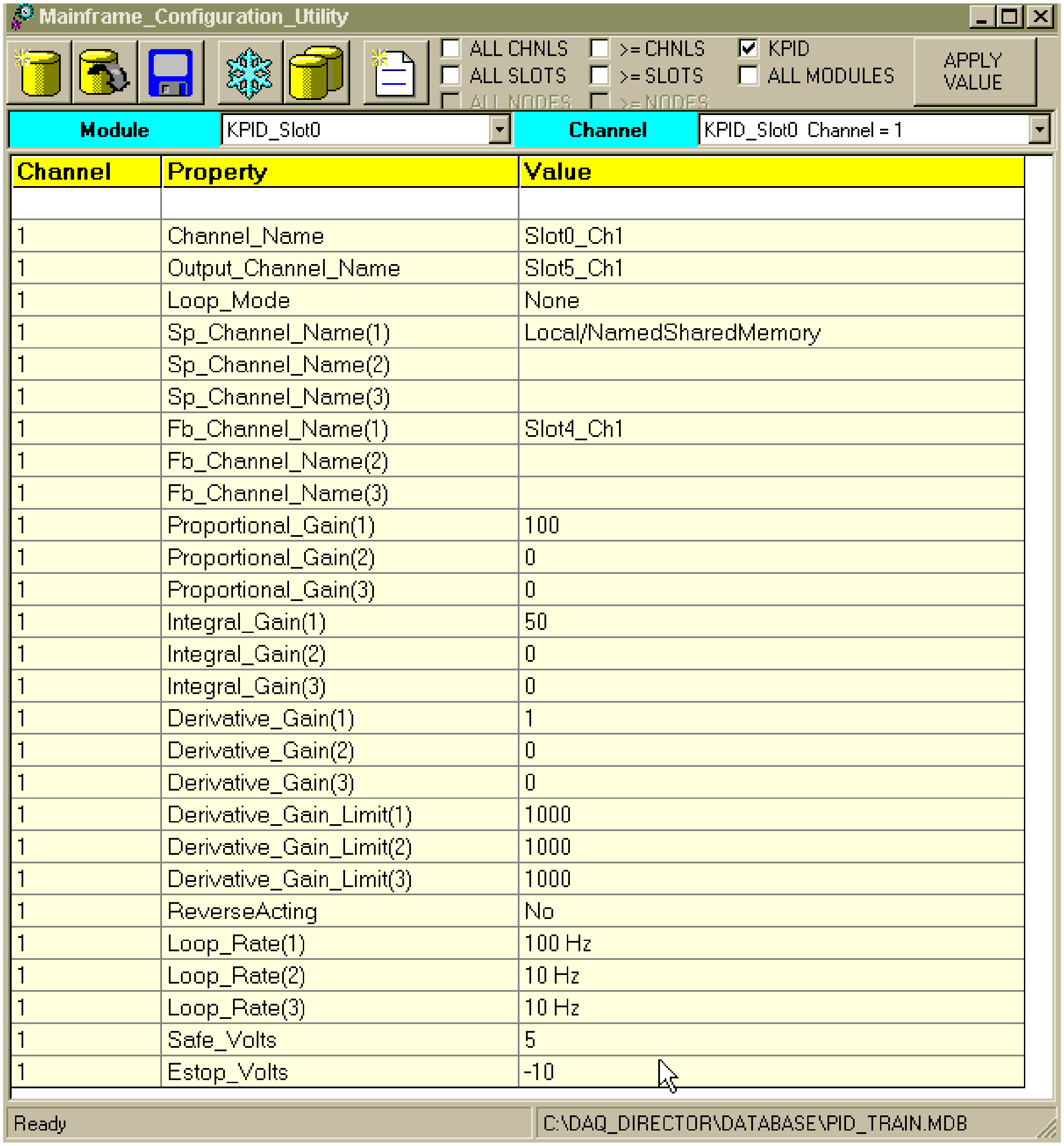
Safe - This button moves the setpoint to a predetermined "safe" value, ignoring the current setpoint source. This value is set in the Configuration Database.

E Stop - This immediately sets the controller to an "emergency stop" value as set in the Configuration Database.

Open the *Configuration Utility.* Select *KPID_Slot0* from the *Module* pulldown and *KPID_Slot0 Channel = 1* from the *Channel* pulldown to view the engine properties for *Loop 1*. Properties that have been set from within the PID engine window appear in this window. Other properties, such as *Safe_Volts* and *Estop_Volts* can be set here. See Figure 4-PID17.



Save any changes to the *Configuration Database.*



Channel	Property	Value
1	Channel_Name	Slot0_Ch1
1	Output_Channel_Name	Slot5_Ch1
1	Loop_Mode	None
1	Sp_Channel_Name(1)	Local/NamedSharedMemory
1	Sp_Channel_Name(2)	
1	Sp_Channel_Name(3)	
1	Fb_Channel_Name(1)	Slot4_Ch1
1	Fb_Channel_Name(2)	
1	Fb_Channel_Name(3)	
1	Proportional_Gain(1)	100
1	Proportional_Gain(2)	0
1	Proportional_Gain(3)	0
1	Integral_Gain(1)	50
1	Integral_Gain(2)	0
1	Integral_Gain(3)	0
1	Derivative_Gain(1)	1
1	Derivative_Gain(2)	0
1	Derivative_Gain(3)	0
1	Derivative_Gain_Limit(1)	1000
1	Derivative_Gain_Limit(2)	1000
1	Derivative_Gain_Limit(3)	1000
1	ReverseActing	No
1	Loop_Rate(1)	100 Hz
1	Loop_Rate(2)	10 Hz
1	Loop_Rate(3)	10 Hz
1	Safe_Volts	5
1	Estop_Volts	-10

Figure 4-PID17. The Configuration Database view of a PID channel

The various waveforms are obvious from their names (*sine*, *square*, etc.). One that is less obvious is *random*. This source, as shown in Figure 4-PID18, is useful for checking loop stability.

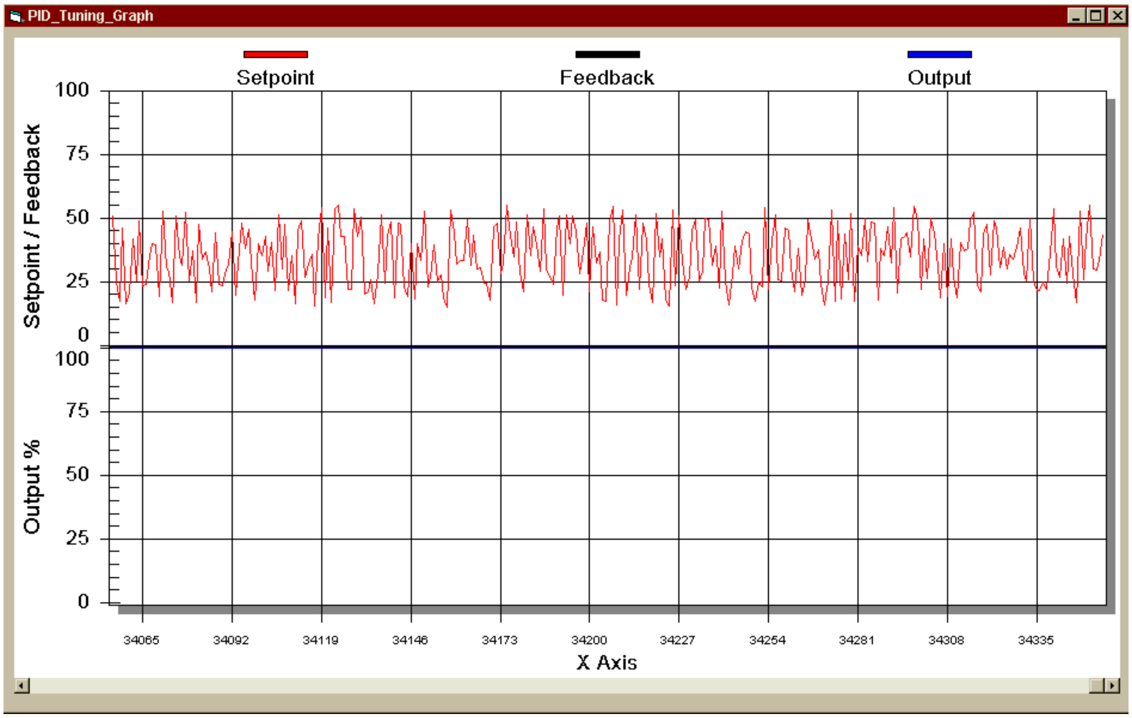


Figure 4-PID18. The PID Graph window, showing the random setpoint source

Responses to various tuning conditions are shown in Figures 4-PID19 TO 4-pid22.

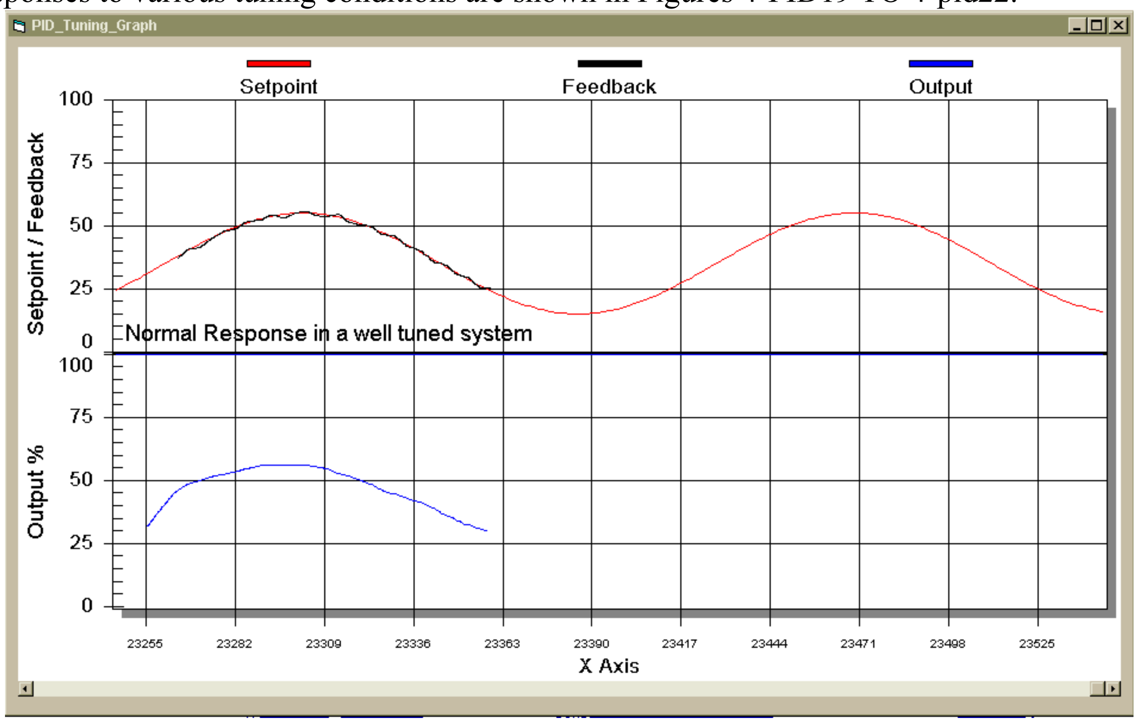


Figure 4-PID19. Sine wave - normal response, well tuned

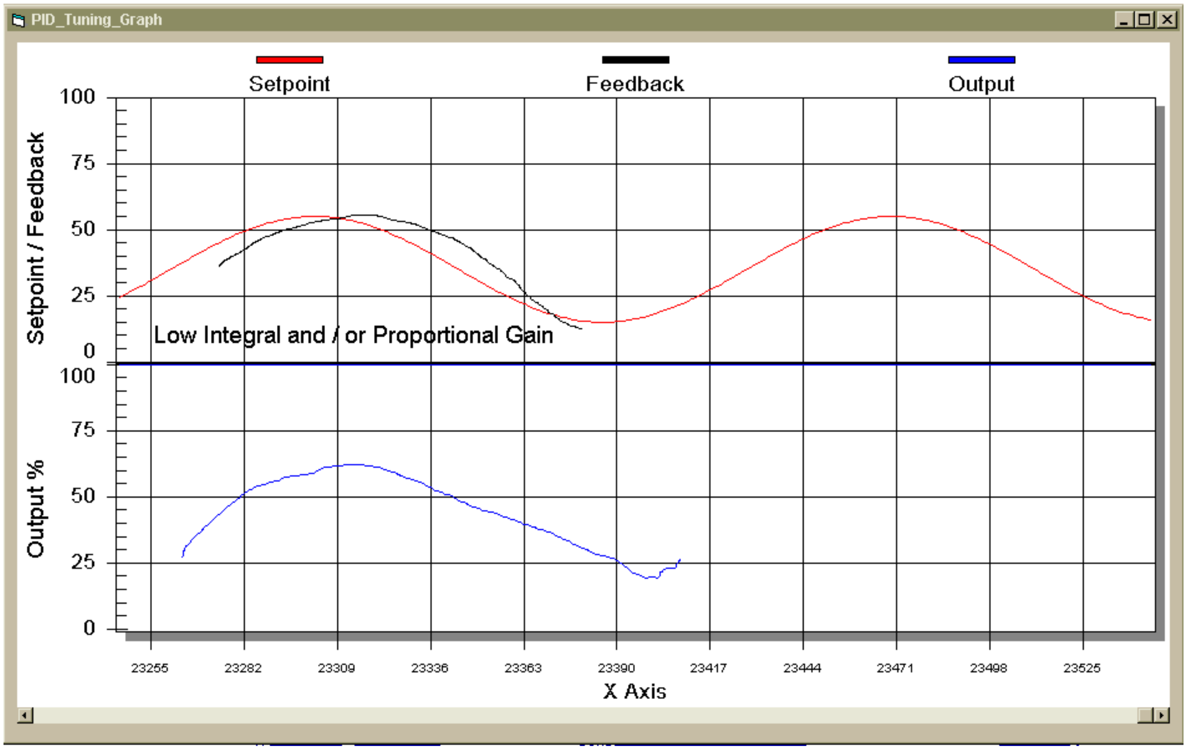


Figure 4-PID20. Low integral and/or proportional gain

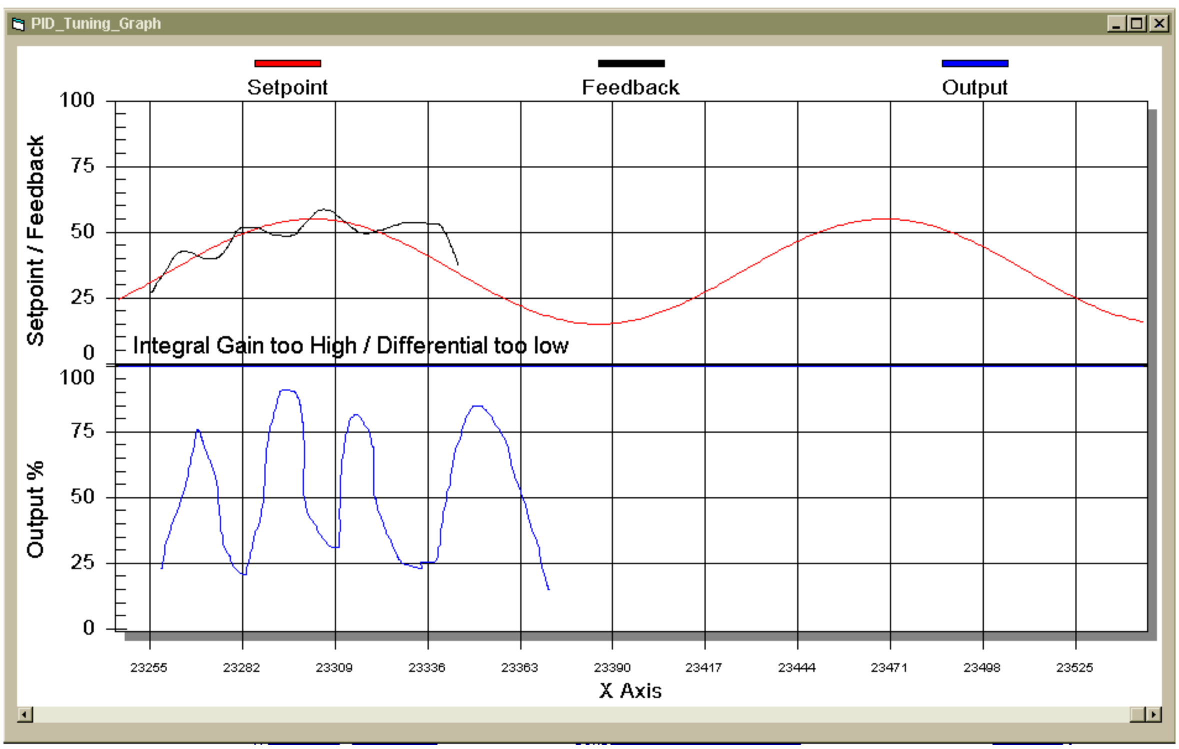


Figure 4-PID21. Sine wave - integral gain too high, proportional gain too low

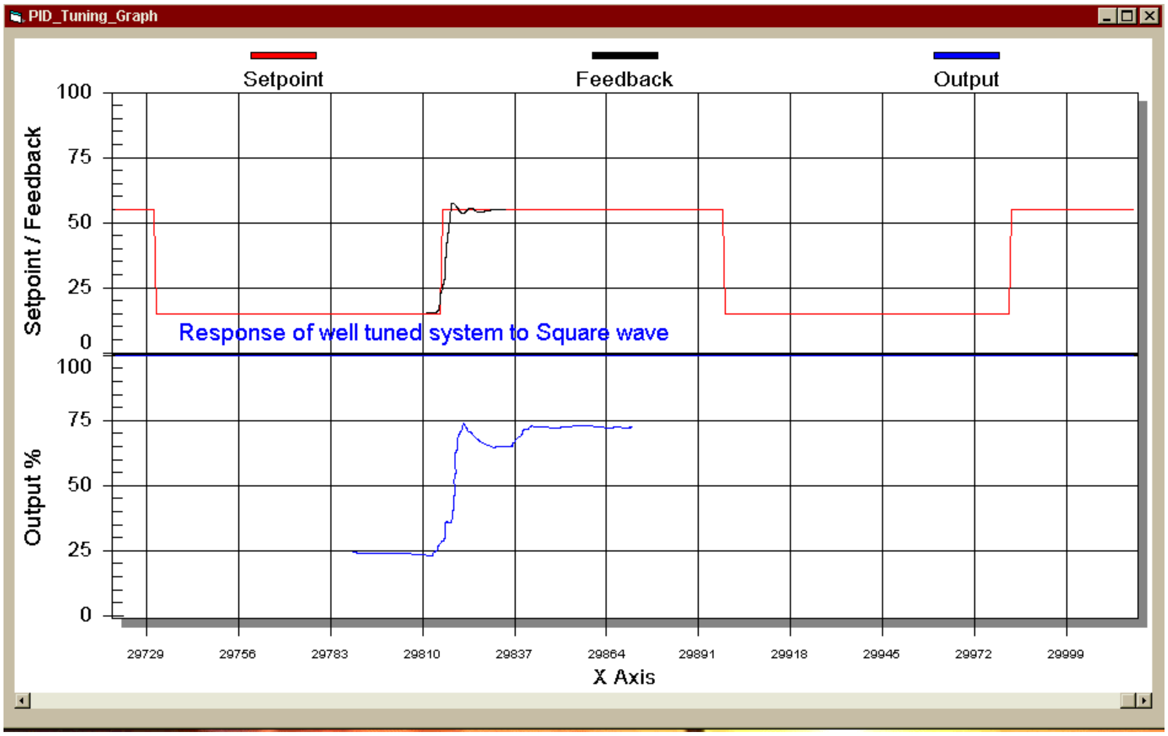


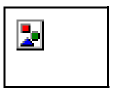
Figure 4-PID22. Square wave - normal response, well tuned

Pulse Train Utility (P_Train)

Overview

P_Train is a DAQ Director utility that will generate up to 16 channels of precise pulse-train output data for loading into a Kinetic Systems V285 DAC/Waveform Generator module. Once loaded into the V285, the waveforms from all channels can be simultaneously played back through the V285 output ports. The output ports can be wired to your test equipment to precisely control the timing of events relative to a particular test. You can make the V285 output compatible with TTL/CMOS logic. This utility can operate in either 8-channel or 16-channel modes. All waveforms and program setup information is saved when you exit the program. When you restart this utility, it will restore all of its previous settings.

P_Train Details



You start the *Pulse Train Utility* by clicking the *P_Train* button on the DAQ Director main toolbar. An editing window opens. If you have not previously created any waveforms, it is as shown below.

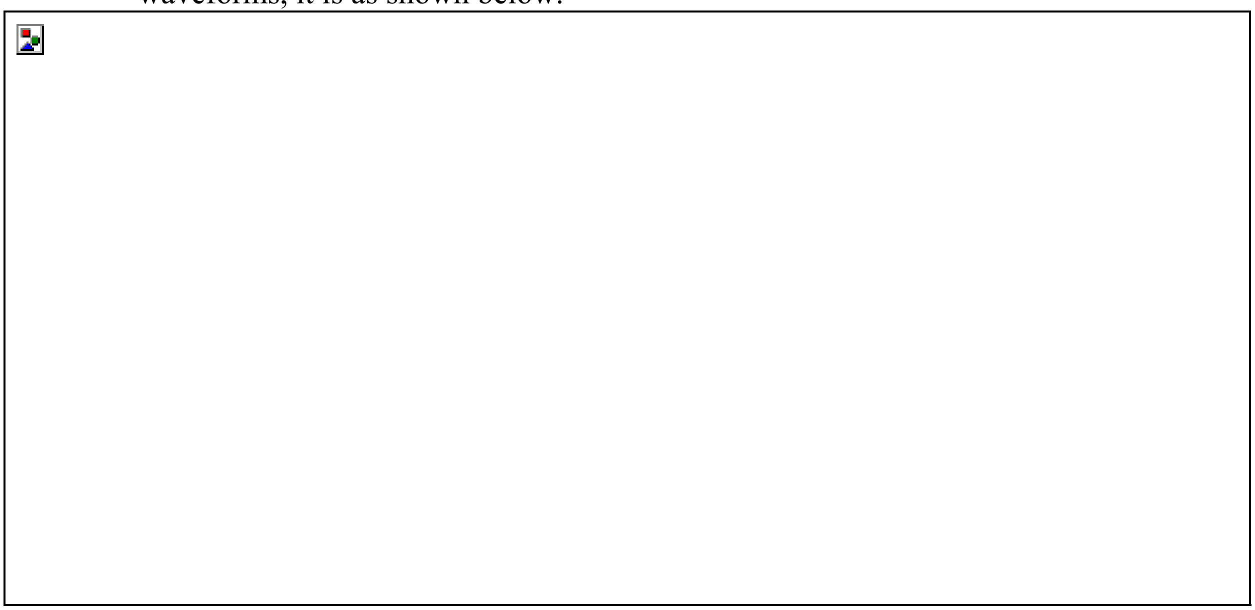


Figure 4-PTU1. An editing window for the Pulse Train Utility

The first time this utility is accessed, it will default to 8 channels, 1000 data points per channel and a clock rate of 1000 Hz. These settings can be changed once you have become familiar with the utility's operation. There are two display modes, *Data Points* and *Milliseconds*. With the default settings, both display modes represent a range from *0* to *1000*. Checking a checkbox disables a particular channel, as shown in the following figure. Unchecking a checkbox returns that channel to its original pulse settings.

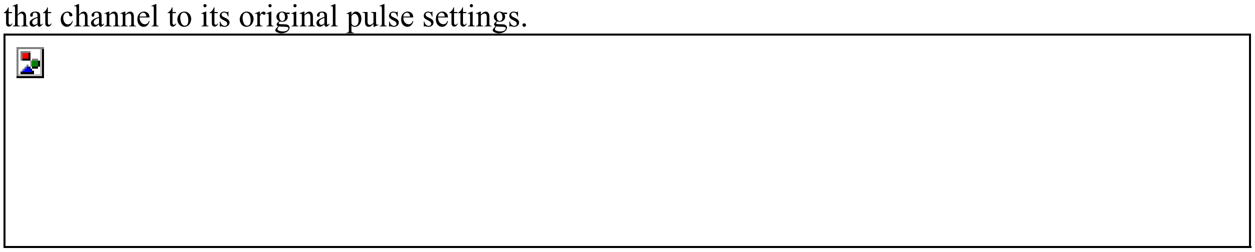


Figure 4-PTU2. Disabling a pulse train channel

Creating, Moving and Deleting Transitions

Once the P_Train editing window is open, a light blue entry bar is displayed for each active channel. When you place the mouse pointer over one of these blue bars, a red vertical cursor is displayed, along with a small white box. This box shows the cursor's horizontal position in data points or milliseconds, depending upon the display mode selected at the top of the window.

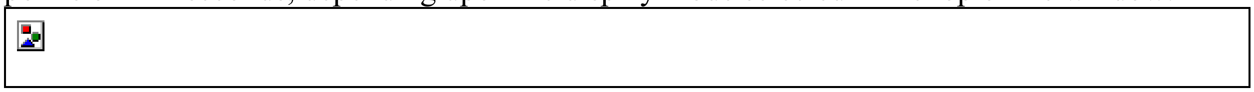


Figure 4-PTU3. Use the mouse to select a cursor location

Signal transitions are created by moving the mouse cursor within the blue area to the desired location and double-clicking the left mouse button. A transition will appear at the cursor location. Once a transition has been created, notice that as the mouse pointer is moved close to the transition, the pointer changes to a double horizontal arrow to indicate that the transition is in focus. When a transition is in focus, it can be deleted by double clicking or moved by depressing the left mouse button and dragging the transition to a new location.

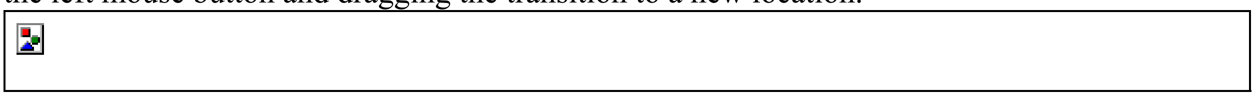


Figure 4-PTU4. Double-click the cursor to create a signal transition

Expanding the Editing Range

If you have P_Train set for a large number of data points, it may be difficult to position the cursor precisely to a desired data point. To facilitate positioning a transition when there are a large number of data points, give the transition focus by moving the mouse pointer over it. Then press the "X" (eXpand) key on the keyboard. The transition in focus will be moved to the center of the blue bar and the coordinate system will change to display only 400 data points (in our 1000-point example), allowing finer control over cursor positioning. If even finer control is desired, repeat the process and the coordinate system will change to 200 data points, etc.

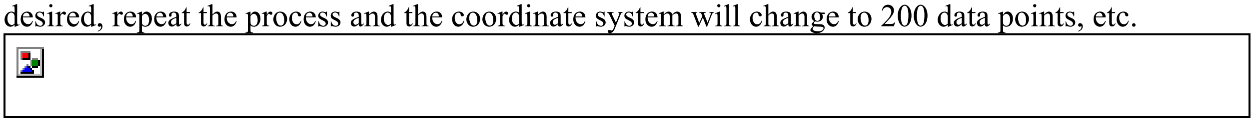


Figure 4-PTU5. Expand the scale for finer positioning resolution

Whenever the coordinate system is expanded in this way, the background color for the expanded channel will change to gray, to indicate that the channel display is expanded. The coordinate system can be restored to normal by double-clicking the gray background.

Changing Display Units

Cursor position and tags can be displayed in either data points or milliseconds by selecting one of the *Display Mode* option buttons at the top of the window. When one of the option buttons is selected, the cursor as well as all existing tags are instantly changed to the selected units. The range for the *millisecond* display is based upon the sample clock setting and number of data points that are currently in effect, while the range for the *data points* display is based on the number of data points only.

Changing the Polarity of a Waveform

The easiest way to change the polarity of a waveform is to create a temporary transition in the unused portion at the far left of the blue bar. When this transition is created, all of the transitions to the right of it will change in polarity. The temporary transition can then be dragged off the left edge of the blue bar.

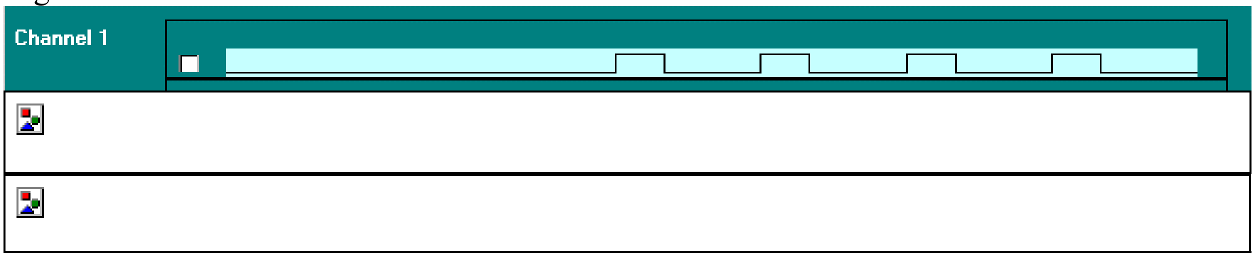


Figure 4-PTU6. Change the polarity of a waveform by creating a temporary transition

Adding/Deleting Bookmark Tags

Locations of transitions can be tagged by positioning the mouse indicator at the desired location for the tag and depressing the "M" (Mark) key. Tags can be created when the coordinate system is in the normal mode or in the expanded mode. In order to delete a tag, the cursor must be positioned in the precise location that the tag is marking and then the "M" key must be depressed. Tags can not be relocated by dragging; they must be deleted and then reapplied.

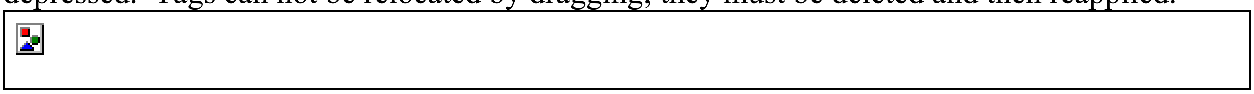
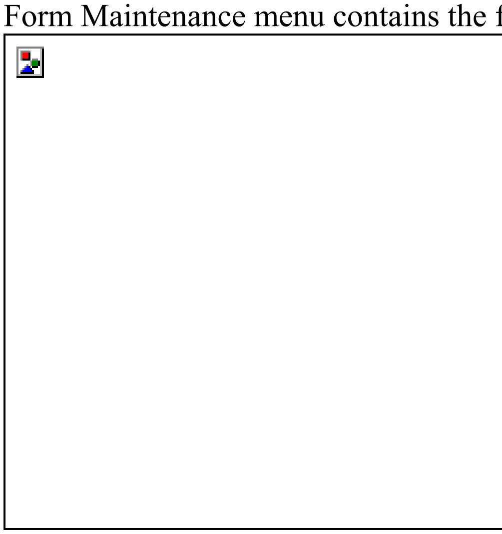


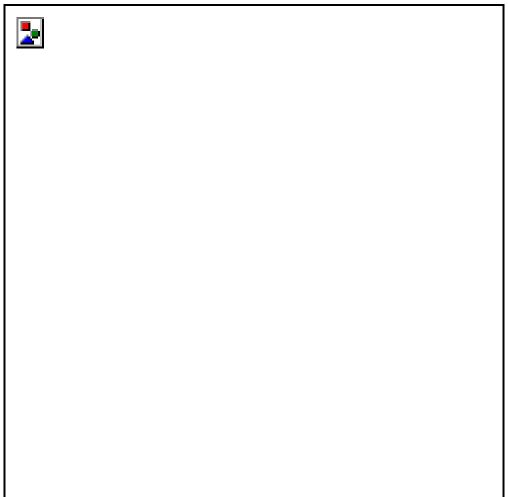
Figure 4-PTU7. Add or delete bookmark tags

Making Global Settings

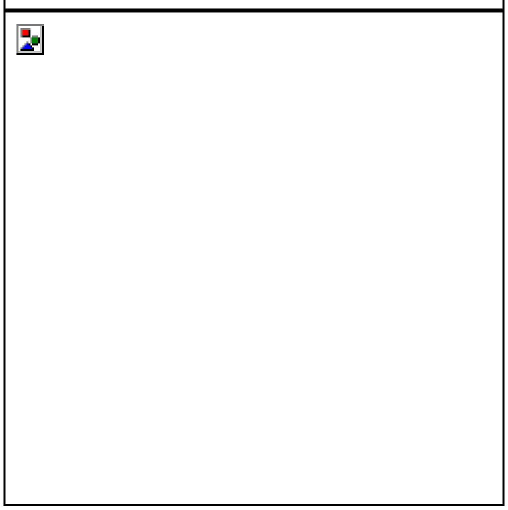
By right-clicking on an open area on the main form, a Form Maintenance menu will be displayed from which various global operations can be performed. A convenient place to right-click would be in the green area to the right or left of the "Display Mode" box at the top of the screen. The Form Maintenance menu contains the following tabs: *File, Clear, Setup and Data.*



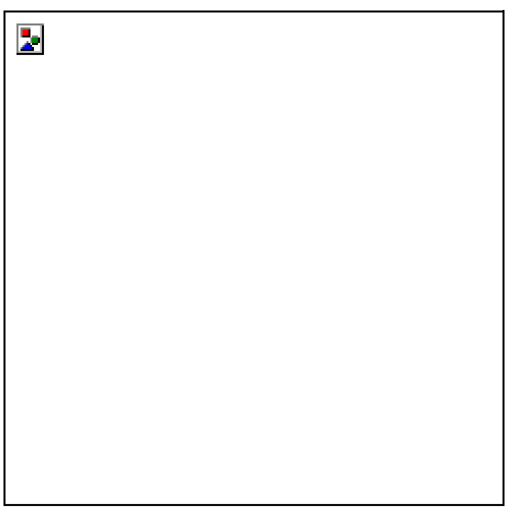
File Tab—This tab controls the actual creation of output files for each of the active channels. Two text boxes are displayed on this tab; one for the base file name and a second for the file location. You can browse to select a directory for the files.
Output files names begin with the base file name followed by *Chnl_nn.tda*, where *nn* represents the channel number. For example, if *Test* were entered in the *Base Output File Name* text box, the output file for *Channel 1* would be named *Test_Chnl_01.tda*. To create the output files, check the *Create Output Files* checkbox and click the Apply button.



Clear Tab—This tab controls the global clearing of transitions, bookmark tags or both. Use the option buttons to select the desired clearing option, then click the *Apply* button to clear the selected parameter(s) for all channels.



Setup Tab—This tab contains several setup features. The text box labeled *Data Points* is used to set the number of data points that will be displayed for each channel. The *Clock Freq* text box is used to set the V285 clock frequency. Valid settings range from *100* to *500000* in a 1, 2, 5, .. progression. This setting also determines how time is displayed on the *P_Train* screen when the display mode is set to milliseconds. If, for instance, the *Clock Freq* setting is 2000, then each data point will represent 1/2000, or 0.5 milliseconds. There are two option buttons on this tab that allow selection of an 8 or 16-channel display. You must be using a 16-channel V285 for the 16-channel selection to be valid.
Click the *Apply* button for the new settings to take effect.

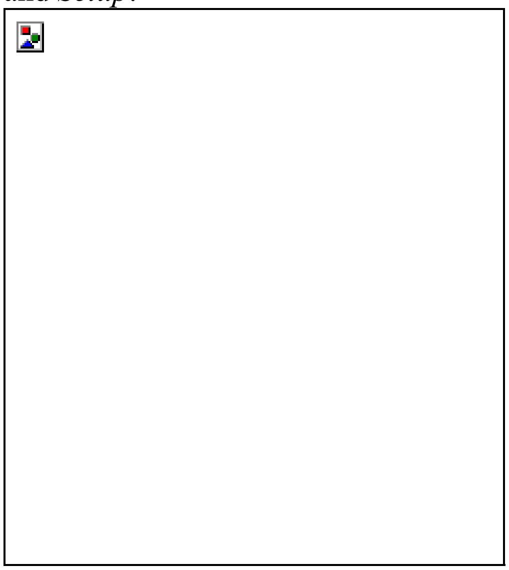


Data Tab—This tab is used to set the values that will be sent to the output file (and presented as voltages at the V285 channel output) for high and low transition values. Using these text boxes, output can be in counts, volts or engineering units of your choice (controlled by the V285 configuration settings). The values shown here represent 5 and 0 volts for TTL/CMOS compatibility.
Click the *Apply* button for your selections to take effect.

Figure 4-PTU8. Make global settings with the Form Maintenance menu

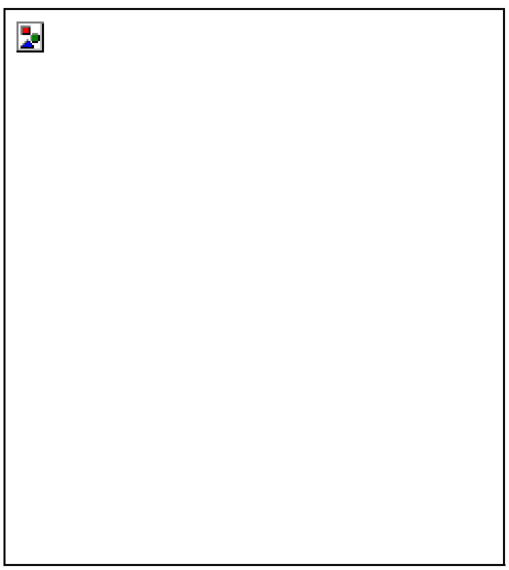
Making Individual Channel Settings

If you right-click within a channel's blue bar, a tabbed menu is displayed that allows various operations to be performed on that individual channel. The name of the channel is displayed in the title bar of this menu window. This window includes the following tabs: *Clear, Clock, Shift* and *Setup*.



Clear Tab—This tab controls the clearing of transitions, bookmark tags or both for the selected channel. Use the option buttons to select the desired clearing option, then click the *Apply* button to clear the selected parameter(s) for this channel.

Figure 4-PTU9. Clear transitions and/or bookmark tags for one channel



Clock Tab—This tab allows you to precisely create one or more pulses. All text box entries are in data points, *not milliseconds*. In this example we have selected the following:

- A LOW signal at the start.
- An offset delay until the first pulse of 500 data points.
- A pulse ON time of 100 data points.
- A pulse OFF time of 200 data points.
- Two pulses.

Click *Apply* when you have completed your entries. The result is shown below, with tags manually added. If you had selected a HIGH signal at the start, then the ON time would have been with the pulse LOW.

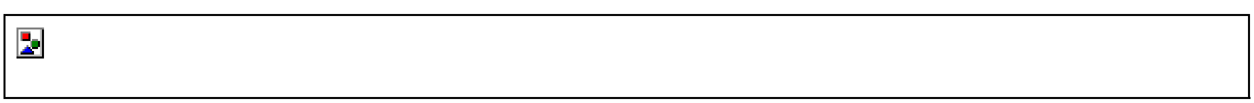
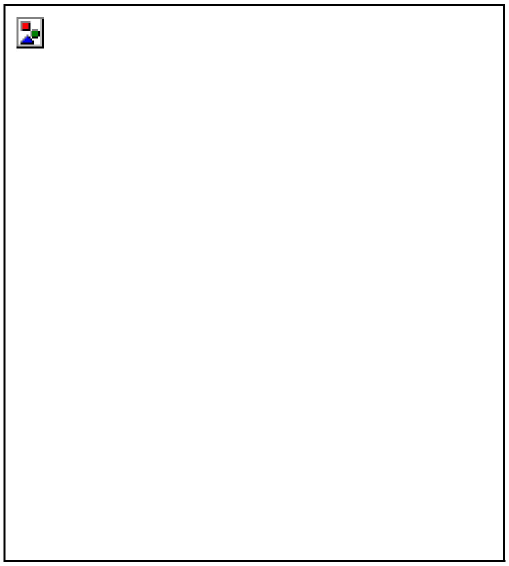


Figure 4-PTU10. Use the Clock tab to create one or more pulses



Shift Tab—This tab allows you to precisely shift the entire pulse train, starting with the first transition, to the left or right by a selected number of counts.
Click *Apply* when you have completed your entries.
The result is shown below, with tags manually added.
The pulse train is shifted 300 counts to the left, with the first pulse starting at 200 counts instead of 500 counts.

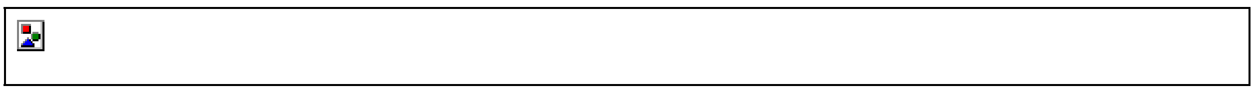
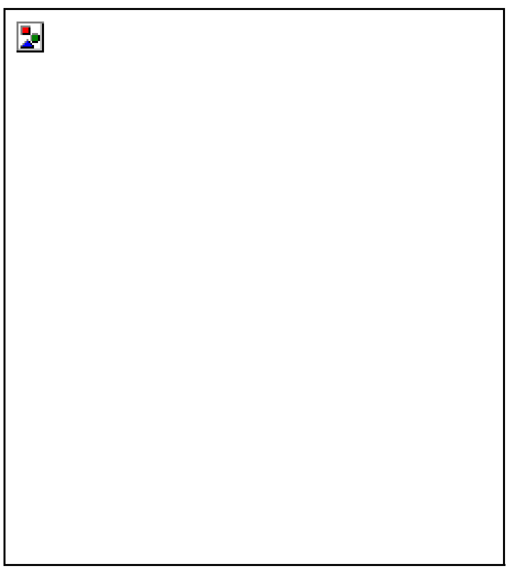


Figure 4-PTU11. Use the Shift tab to change the pulse delay



Setup Tab—This tab allows you to change the title that appears to the left of a channel pulse-entry rectangle.
Click *Apply* when you have completed your entries.

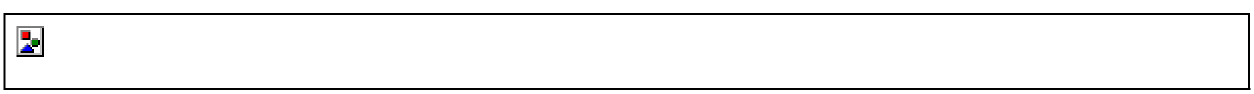


Figure 4-PTU12. Enter a new channel name for Channel 1.

V285 Configuration Database Settings

The settings that you have selected with the P_Train *Form Maintenance* dialog *do not* configure the V285 module. You must perform this configuration with the DAQ Director *Mainframe Configuration Utility*. For information on creating, opening, editing and saving configuration databases, please refer to **Configuration Database** earlier in this chapter

With the V285 *Mainframe Configuration Database* in view, make the following *Global* selections:

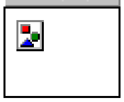
- *Clock_Setting*—Select the desired clock rate from the pull-down list to agree with the P_Train selection.. Valid clock rates range from 100 Hz to 500000 Hz. For the example above, a clock rate of 1000 Hz was used (one data point per millisecond).
- *SamplesPerChannel*—Enter the number of data points that you have previously selected for P_Train (1000 in the example above).
- Playback_Mode—Select the desired playback mode, *Continuous* or *One-Shot,* from the pull-down list. In one-shot mode, playback is initiated via a trigger pulse on the *Trig In* SMB front panel connector of the V285. In continuous mode, the pulse stream is continuously repeated.

Make the following *Channel* selections for *each* active channel:

- Channel_Data_Source—You should select *File* from the pull-down list.
- DataFileName—You must provide a complete path to the input data file. When you select the data entry field for this setting, a file selection dialog will be displayed. You can then select the desired file.
- *UnitsOfMeasure—*From the pull-down list, select *Counts, Volts or Eng Units*, depending upon the values that were represented in the P_Train configuration. In the earlier example, we desired to have the output pulses range from 0 to 5 volts, so *Volts* would be selected from the pull-down list here.

Recording (Start/stop Record)

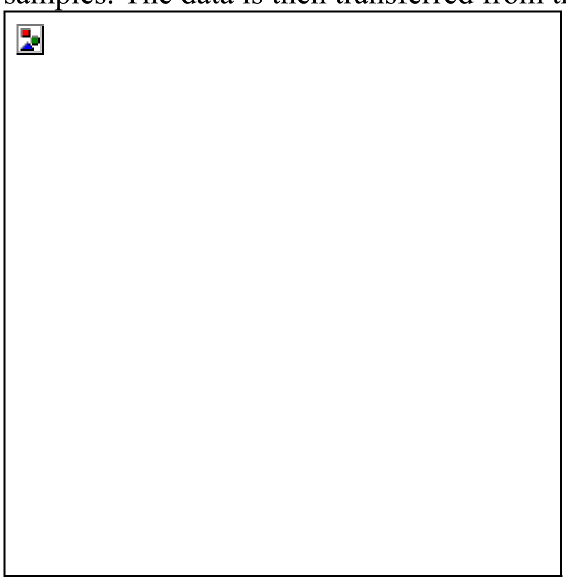
See also: **Data Engine**



Start/stop Recording—This button has two states, *Record Start* (green) and *Record Stop* (red). When green, selecting it starts continuous data recording to disk, turning it red. Selecting it again stops the recording to disk. Operation is somewhat different for transient recording.

When an input-module data engine is active and configured for continuous data acquisition, clicking the green *Start Record* button starts the transfer of data to a binary file that was created when the data engine was started. The file is named *filename.bin*, where the default name for the file is the same as the data engine (*V208_Slot4.bin*, for example). The file is placed in the location defined in *kscsys.cfg*..

When a data engine is configured for transient mode, clicking the *Start Record* button causes data to be acquired to the ADC module's multibuffer RAM memory (used as a circular buffer for transient mode). When a trigger is received, recording continues for the selected post-trigger samples. The data is then transferred from the multibuffer to disk.



The DAQ Director Control Panel *Message Center* shows two start/stop recording sequences followed by a selection to stop the V208 data engine. In this example, continuous data recording has been configured. The second recording sequence is appended to the first in the binary file.

Figure 4-REC1. The DAQ Director Control Panel showing two recording sequences

The composition of the recorded binary data file is as follows:

Step	Description
1.	16 bit signed integer = Number of Channels in a data scan
2.	32 bit signed long integer = Number of samples per channel in each Multibuffer
3.	16 bit signed integer = index indicating type of data archived

Data Type Index Definition:

UNSIGNED_BYTE = 1 ' Byte - 8 bits Unsigned
SIGNED_BYTE = 2 ' Byte - 8 bits Signed
VB_BOOLEAN = 3 'Boolean - 8 bits 1 = True, 0 = False
UNSIGNED_INTEGER = 4 ' Integer - 16 bits Unsigned
SIGNED_INTEGER = 5 ' Integer - 16 bits Signed
UNSIGNED_LONG = 6 '6 = Long - 32 bits Unsigned

SIGNED_LONG = 7 '7 = Long - 32 bits Signed
SIGNED_SINGLE = 8 '8 = Single - 32 bits Floating Point Signed
SIGNED_DOUBLE = 9 '9 = Double - 64 bits Floating Point Signed

4. 16 bit signed integer = Number of cal points in the calibration table (No Longer used)
5. 32 bit signed long integer = Sample clock rate in Hz
6. Skip one byte
7. 1000 bytes of unused space - reserved for future requirements - Skip this
8. Channel names - String data - each name is tab delimited and the last name is followed by an ASCII 11
9. Skip one byte
10. Channel Units- String data - each unit is tab delimited and the last unit is followed by an ASCII 11
11. Skip one byte
12. Conversion Type- String data - each Type is tab delimited and the last type is followed by an ASCII 11

    The possible Conversion Types at this time are:

    None (No Conversion)
    Volts
    Linear (mx + b)
    Polynomial
    (Thermocouple) TYPE_B
    (Thermocouple) TYPE_C
    (Thermocouple) TYPE_E
    (Thermocouple) TYPE_J
    (Thermocouple) TYPE_K
    (Thermocouple) TYPE_N
    (Thermocouple) TYPE_R
    (Thermocouple) TYPE_S
    (Thermocouple) TYPE_T
    (Thermocouple) TC Reference
13. 8 byte double precision number as many as there are channels (Step 1) - Counts per Volt
14. 8 byte double precision number as many as there are channels (Step 1) - Counts Offset

    Note: Currently all files store ten calibration points per channel.
15. 8 byte double precision number as many as there are channels (Step 1) - Cal Point n - Volts Measured

    Note: Repeat step 15 ten times because space for 10 calibration points is always allocated.
16. 8 byte double precision number as many as there are channels (Step 1) - Cal Point n - Engineering Units

    Note: Repeat step 16 ten times because space for 10 cal points is always allocated.
17. 8 byte double precision number as many as there are channels (Step 1) – Polynomial coefficient n

    Note: Repeat step 17 ten times because space for 10 – Polynomial coefficients is always allocated.
18. 16 bit signed integer as many as there are channels (Step 1) - polynomial order for each channel

19. 8 byte double precision number as many as there are channels (Step 1) – Manual E.U. Adder (Tare)
20. Skip 4 unused bytes

    Now we get to the data.

21.. 6 long integer (4 byte) values for time stamp information

Bit #	15 – 12	11 - 8	7 - 4	3 – 0
TIME0 Sample	Not Used	Not Used	Not Used	Days (Hundreds)
TIME1 Sample	Days (Tens)	Days (Units)	Hours (Tens)	Hours (Units)
TIME2 Sample	Minutes (Tens)	Minutes (Units)	Seconds (Tens)	Seconds (Units)
TIME3 Sample	Seconds (10E-1)	Seconds (10E-2)	Seconds (10E-3)	Seconds (10E-4)
TIME4 Sample	Seconds (10E-5)	Seconds (10E-6)	Seconds (10E-7)	Not Used

22. Read the raw data using the Data Type established in step 3. The data length is (Number of Channels) * (Number of Samples). This was determined in Step 1 and Step 2.
23. Repeat steps 21 and 22. If a new recording event took place, then step 21 will produce new data, however if the recording was continuous, step 21 will yield all zeros.

This concludes the description of the file structure. One important item to note is that the number of bytes in the header information is completely undefined. The delimiters must be used to find your way through.

.

Reset Internal Calibration Values (Reset Cal) See also: **Calibration**

Reset Internal Calibration— This selection opens a dialog box that allows you to select one or more channels and reset the internal calibration constants for those channels. It changes the internal calibration parameters to theoretical values. Highlight the desired channels from the *Channel List*, and click *Add* to move them to the *Selected Channels* list. Click *Reset Internal Cal* to reset the values for the selected channels.

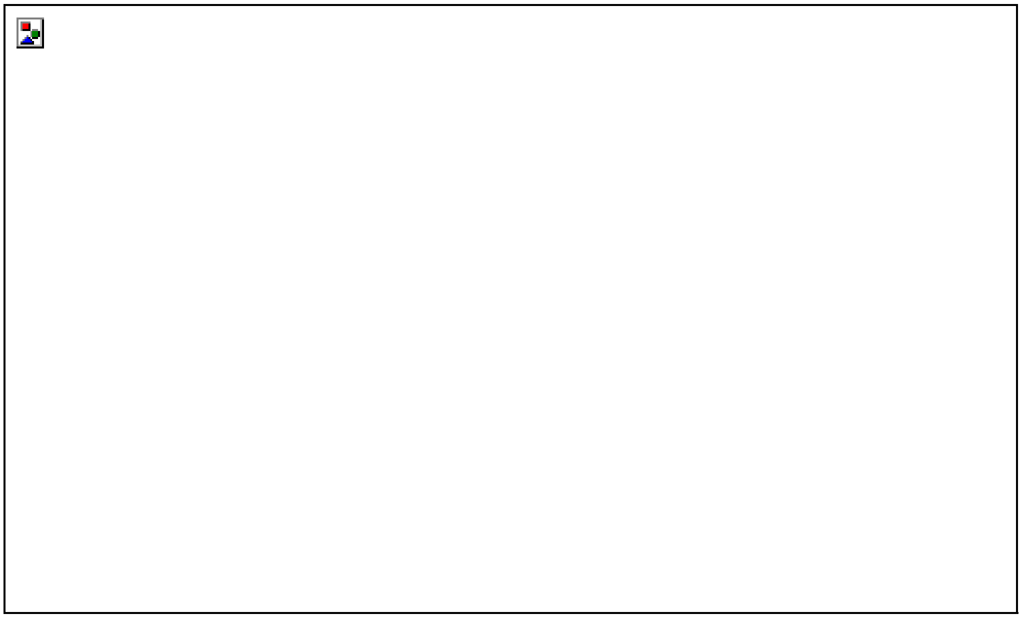
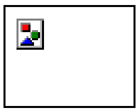


Figure 4-RES1. The dialog window for resetting internal calibration constants

Resource Manager (Resman)

See also: **View Resman Table**
View Suffix Table

The Resource Manager (Resman) is a standard VXIbus software utility that interrogates the modules in the VXI mainframe, allocates memory space and sets up the VXI configuration. Resman must be executed before any VXI activity can take place.



Click the *Resman* button on the toolbar to run the VXI Resource Manager (*Resman*). A DOS window opens while *Resman* interrogates the modules in the VXI mainframe to create a *Resman table* of the configuration. The DOS window closes when *Resman* is complete.

If *Resman* cannot complete (if the mainframe is OFF, for example), *Resman* halts, and the DOS window remains open. In that case, use the Window Close box to close it.

Figure 4-RSM1. The DOS window showing the Resource Manager execution sequence

Run Sequencer (Run Seq)

See also: **Sequence Editor**

Run Sequencer—This selection displays a dialog box that allows you to select, load and execute any of the command sequences that you created with the Sequence Editor. This automates the execution of preconfigured test sequences.
Clicking the *Run Seq* button opens a dialog window, allowing you to run any of the sequence files that you have previously created with the *Sequence Editor*.

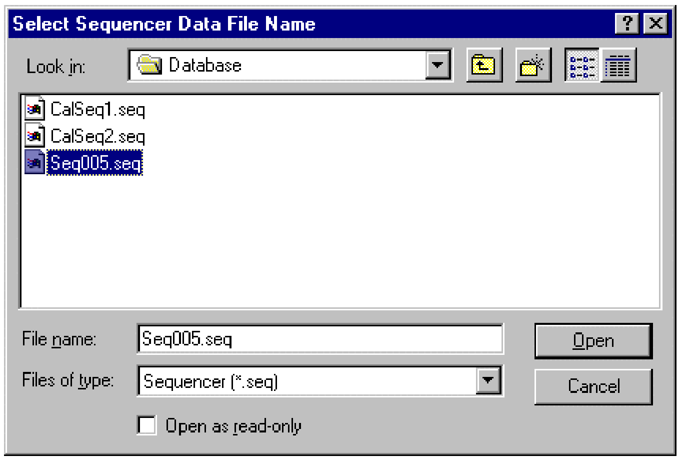


Figure 4-RSQ1. The dialog for selecting a sequence to run

Following is a typical sequence list, from the file *Shunt_Off.seq*. This file is located in the *,,,\DAQ_Director\Database* directory. You can click the *Start* button to execute this list. The highlighted line will move to the END statement. This is useful for troubleshooting a list.

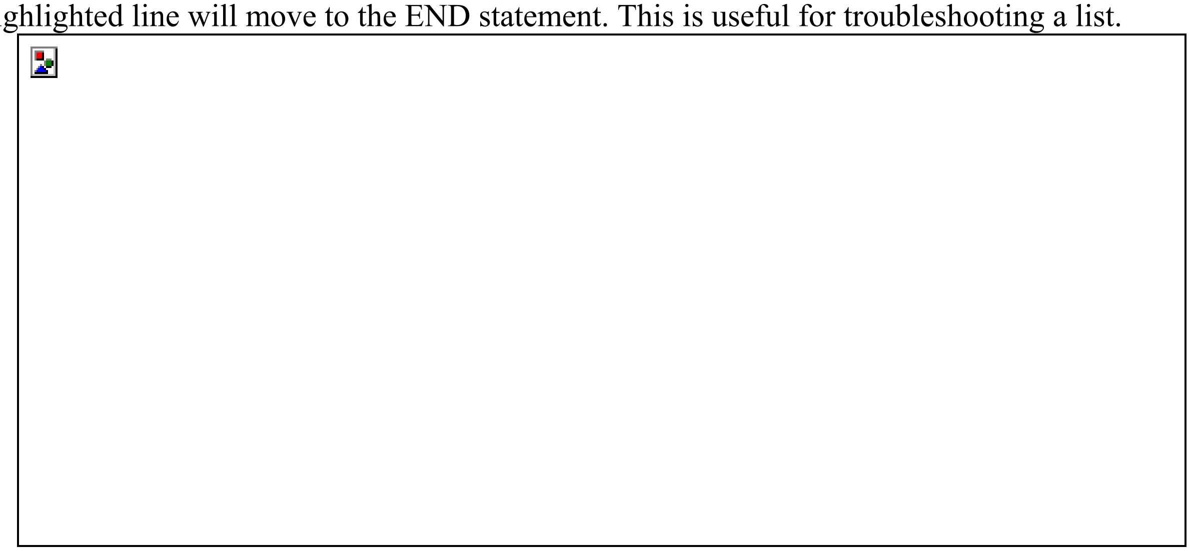
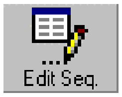


Figure 4-RSQ2. The Sequencer window with a sequence list loaded

Sequence Editor (Edit Seq)

See also: **Run Sequencer**



Open Sequence Editor—This selection displays the *Sequence Editor* dialog. This editor allows you to create a sequence of commands that will be automatically executed whenever you wish. You can create and save a sequencer file for each of your tests.

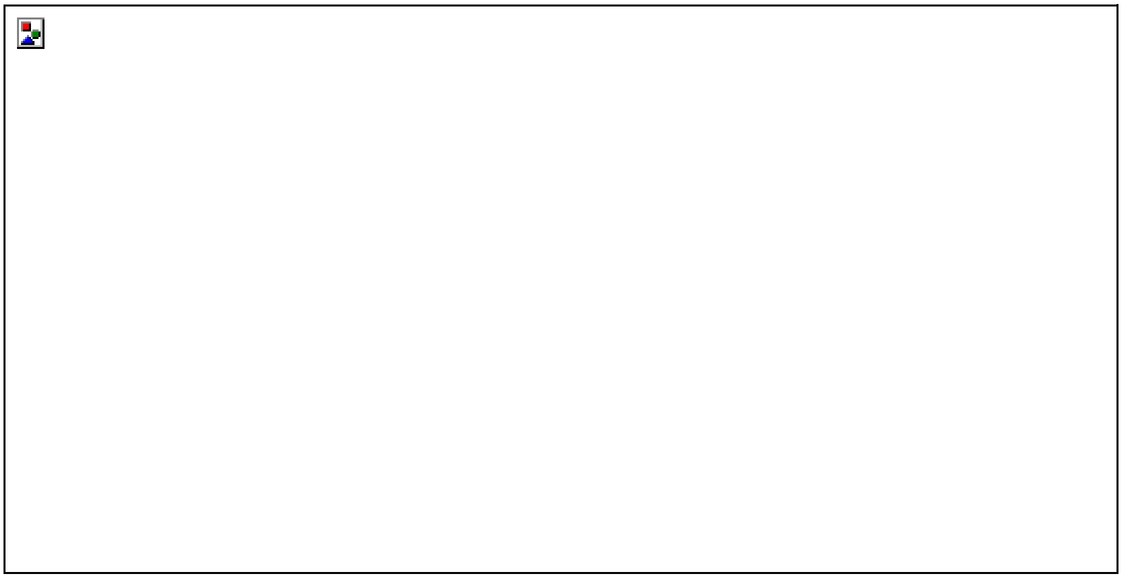


Figure 4-SEQ1. The Sequence Editor dialog, showing the Command pull-down menu

The functions of the *Sequence_Editor* toolbar buttons are as follows:

Creates a new *Sequence File* for editing.

Opens an existing *Sequence File* for editing.

Saves the *Sequence File* that is currently in the *Sequence Editor*.

Saves the *Sequence File* that is currently in the *Sequence Editor* with a new filename.

Selects the C*alibration Command* list. These keywords are now on the pull-down. This is an icon with red blocks.

Selects the *Operational Command* list. These keywords are now on the pull-down. This is an icon with light green blocks.

The functions of the five green editing buttons are as follows:

Appends the sequence line in the editing window to the end of the current list.

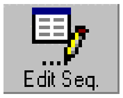
Inserts the sequence line in the editing window before the highlighted line in the list.

Displays the currently highlighted sequence line in the editing window.

Updates the line being edited (commits the edit).

Deletes the currently highlighted sequence line.

Creating a New Sequence File

1. 

Open the *Sequence Editor.*
2. or Click the icon with the red blocks to select the *Calibration Command* list or click the icon with the green blocks to select the *Operational Command* list, depending upon the type of sequence you wish to create.
A *Command Reference* is presented in *Appendix A*.
3. Use the pull-down menu to select the first command to be placed in the list. Text-entry box(es) appear to the right of the command in the editing window. When you place the mouse pointer within a text window, tool tips are presented to aid in the entry. The following figure shows the *SLEEP* command and the *Time* text-entry box. You would enter the length of time to delay before advancing to the next step in this box. Note that the line number appears in the *Line* box.

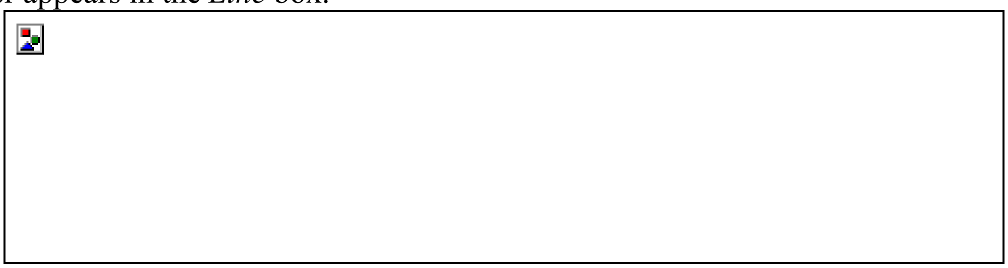


Figure 4-SEQ2. A command in the editing window

4. Click the *Append* button to add this command, as shown in the following figure.

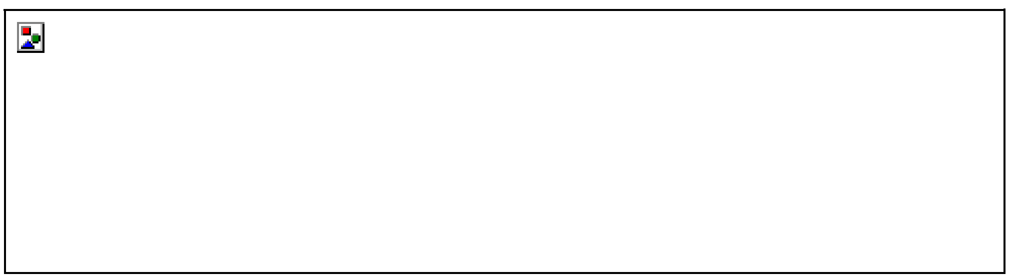
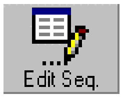


Figure 4-SEQ3. Adding a command to the sequence list

5. Repeat Steps 3 and 4 to add additional commands to the sequence list. Use the green editing buttons described earlier in this topic to modify or delete commands.
6. Click the *Save* button to save your command sequence. If you are saving this sequence for the first time, a *Save* dialog window opens. Otherwise, the sequence updates the current file.

Editing a Current Sequence File

1. 

Open the *Sequence Editor.*
2. Click *File Open* and select the sequence file that you wish to edit.
3. Follow the steps just described for creating a new sequence file. Use the green editing keys described earlier to add, edit or delete command sequence lines.
4. Click *Save* to save your command sequence.

A Sequence Edit Example

The following example is a comprehensive calibration and linearity test. This example uses the *Calibration* commands.

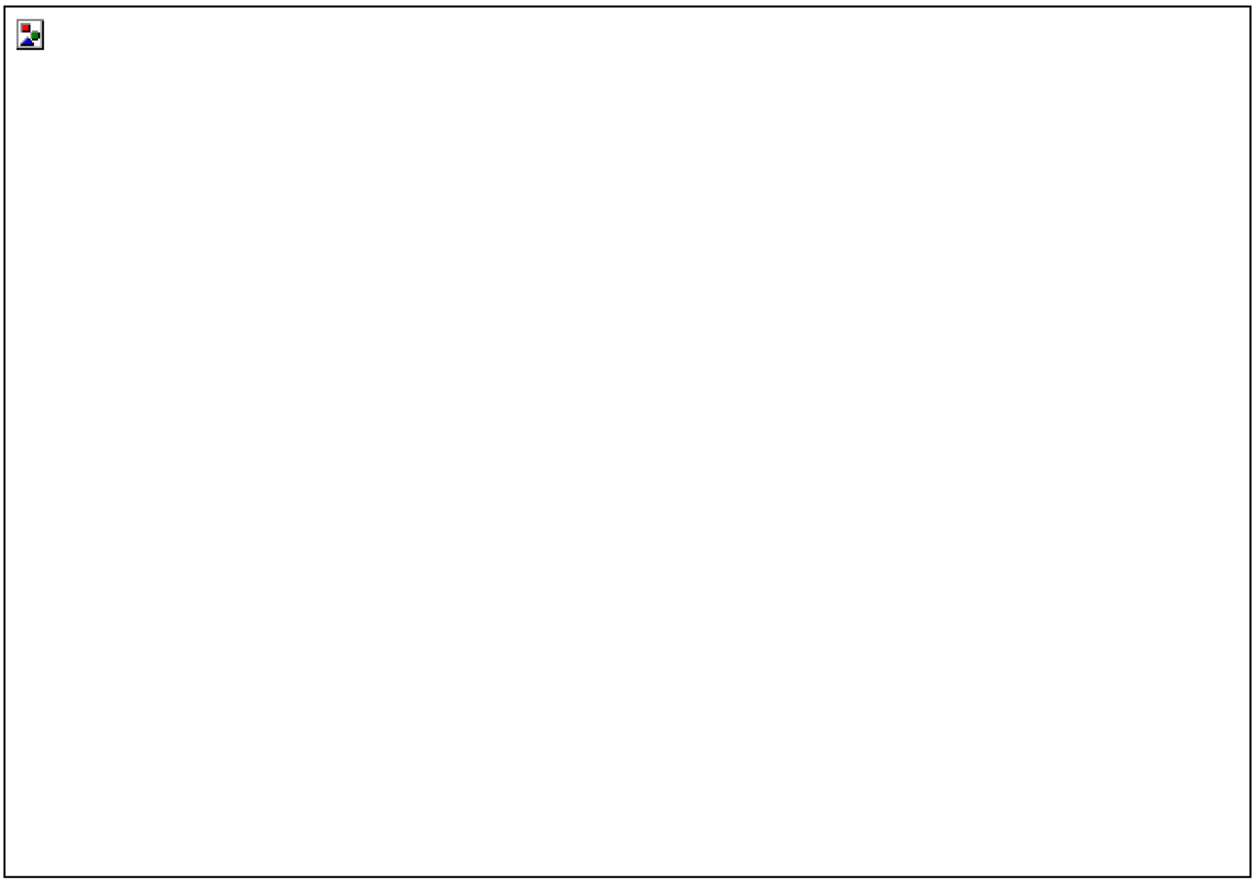
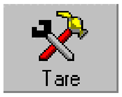


Figure 4-SEQ4. A calibration/linearity test sequence in the Sequence Editor

Tare, Set/clear (Tare)



Clicking this button opens a dialog window that allows you to select one or more channels and arithmetically remove the tare offset based upon current transducer conditions. You can also clear the tare settings.

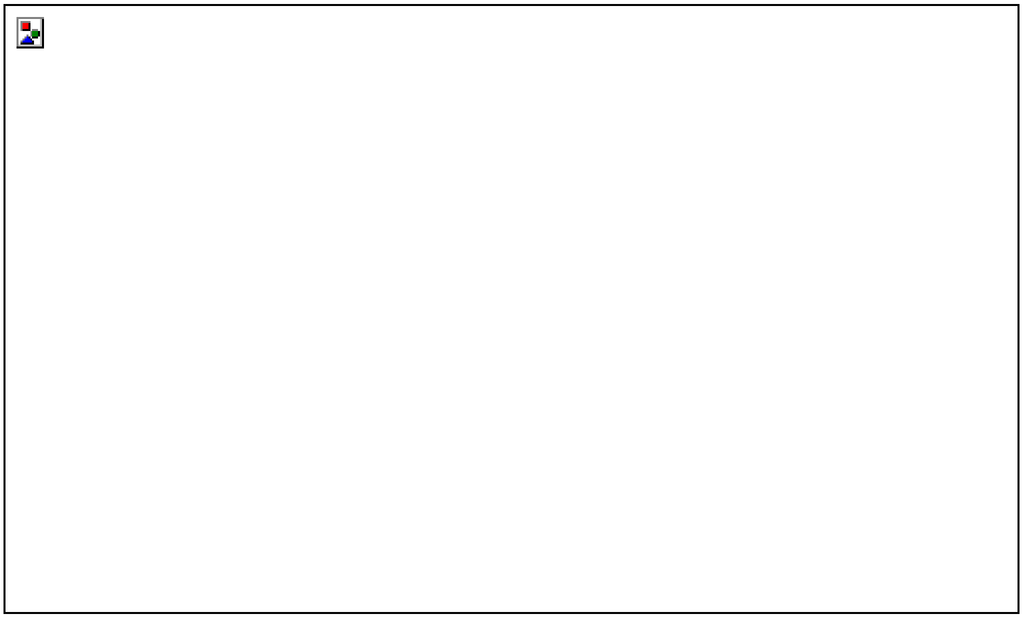
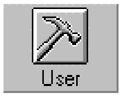


Figure 4-TAR1. The dialog window for removing tare offsets

Bridge transducers such as strain gages are generally not in balance when in a steady-state rest condition. The voltage offset on those channels is known as *tare*. This utility removes that tare in the database by providing a manual E.U. adder for channels that use a polynomial or linear transfer function.

- Block the channels in the *Channel List* window whose tare you wish to remove, then click *Add* to move those channels to the S*elected Channels* list.
- Enter your name or initials in the *User Identification* box. This information is stored in the data file.
- Remove channels from the *Selected Channels* list by selecting them and clicking *Remove*.
- Remove the tare offsets by clicking *Set Tare Values*.

User Buttons (User)



This selection displays a group of user-defined pushbuttons. The color, label text and action for each button would have been previously created in the *kscsys.cfg* file.

You can create user-defined buttons that can control virtually any action in DAQ Director, including command sequences. You can also create buttons that open various data displays. The statement takes the form: User Button = *BackColor|CaptionColor|Caption|Type|Argument*
Where:

- *BackColor* is background color for the button.
- *CaptionColor* is the color of the caption text.
- *Caption* is the caption text on the button.
- *Type* is the button type (*M* for *send a message*, *X* for *spawn an executable*).
- *Argument* is as follows:
  - *Type M: Domain|Address|Message*
  - *Type X: Path\myfile.exe|Command Line Argument (if any)|Show* or *Hide*

Following are examples of *User Buttons* as entered in a kscsys.cfg file. The first two buttons are of the *M* type and send mailer messages. The next two buttons spawn executables, *Meter_1.exe* and *Meter_16.exe*, respectively.

```
UserButton = Green|Black|Start|M|.|Mailer|This is a test

UserButton = Green|Black|Ignition|M|.|Mailer|Test Button Two
UserButton = Yellow|Black|1 Meter|X|c:\DAQ_Director\Meter_1.exe||Show
UserButton = Yellow|Black|16 Meters|X|c:\DAQ_Director\Meters_16.exe||Show
```

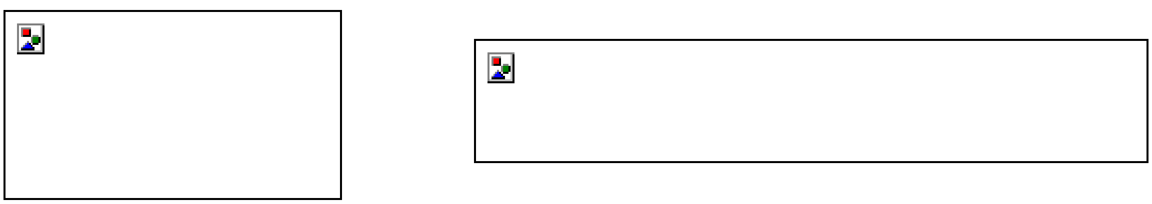


Figure 4-UB1. Typical User Button windows

The *User Buttons* window opens with a 2 x n button cluster. You can arrange the buttons in a single row by dragging the right side of the window.

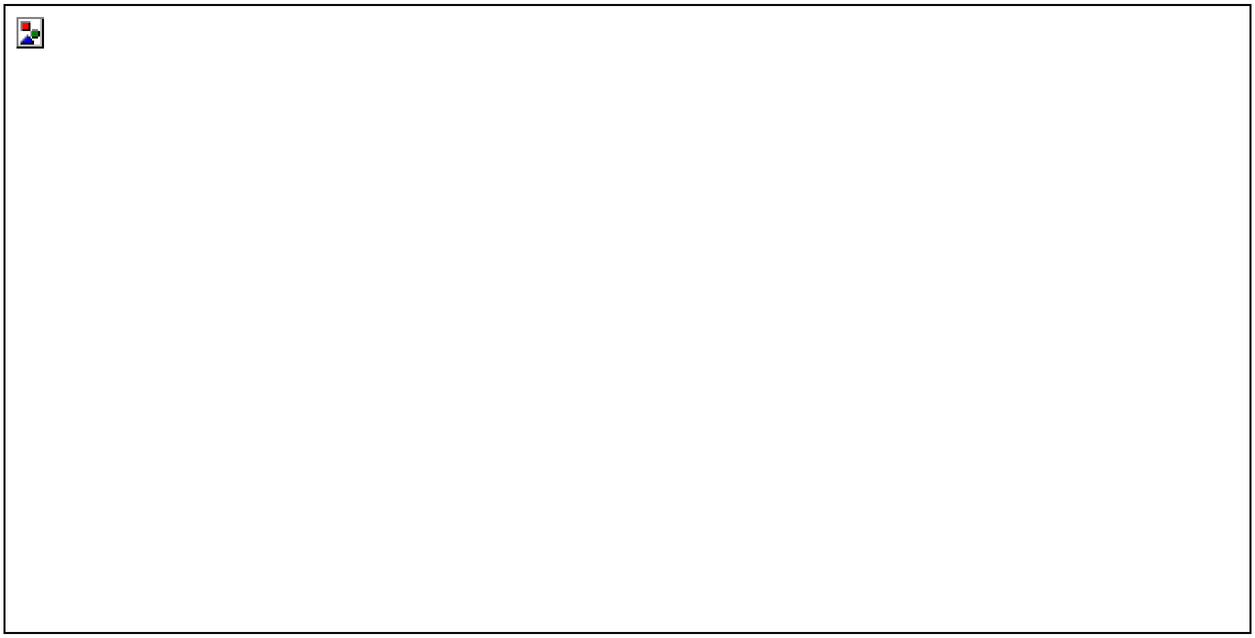


Figure 4-UB2. A single large meter is spawned by the *1 Meter* button

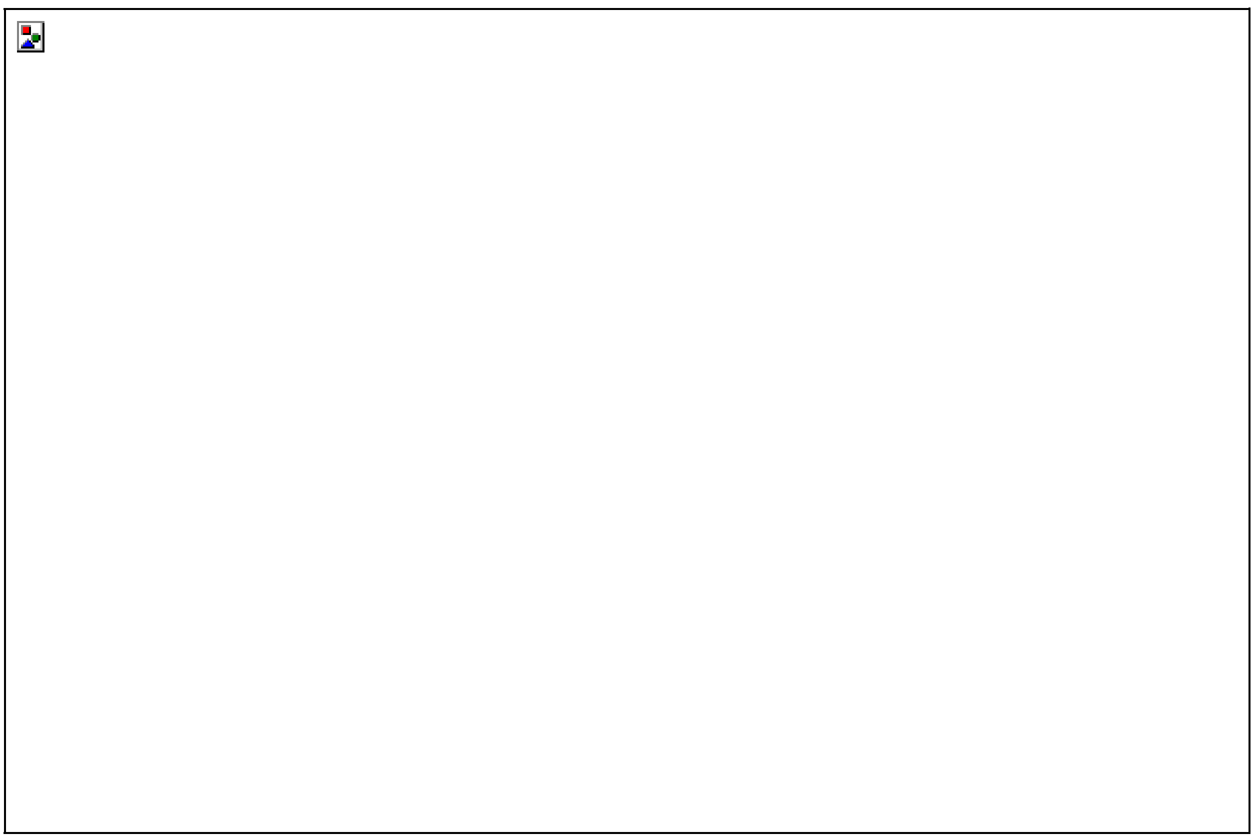
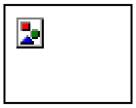


Figure 4-UB3. Sixteen small meters are spawned by the *16 Meters* button

View/edit Setup File (KscSys)



This selection opens a Notepad window that displays the contents of the kscsys.cfg setup file. You can change, add or delete setup parameters. Saving a modified window will cause the changes to go into effect the next time DAQ Director is run.

A variety of setup information for DAQ Director is stored in the text file, *kscsys.cfg*. This file is located in the *..\DAQ_Director\Library* directory. Rudimentary information such as file paths and file names is held in this file. You may specify the location of various system components by making entries in the file. This arrangement allows the central storage of information on the network. In this manner, multiple DAQ Director systems may access the same configuration information.

The following table represents a typical kscsys.cfg setup file for a typical DAQ Director system. Those lines that begin with "*" are inactive (commented out).

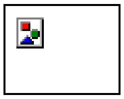
```
SequenceDataPath=c:\DAQ_Director\Database

ResmanExePath = c:\Program Files\KineticSystems\Grand Interconnect\Resman
ResmanTblPath = c:\Program Files\KineticSystems\Grand Interconnect\Resman\Resman.tbl
SuffixTblPath = c:\Program Files\KineticSystems\Grand Interconnect\Resman\Suffix.tbl
*SuffixTblPath = c:\nivxi\win32\Suffix.tbl
*ResmanExePath =c:\nivxi\win32
*ResmanTblPath = c:\nivxi\tbl\Resman.tbl
ModuleLibraryPath =c:\DAQ_Director\Library
ModuleLibraryName = KSC Module Library.mdb
ConfigDatabasePath = c:\DAQ_Director\Database
ConfigDatabaseName = demo1.mdb
TCTablesPath = c:\DAQ_Director\Library\tctables.txt
VBPath = c:\Program Files\Microsoft Visual Studio\VB98\VB6.exe
DataFilePath = c:\DAQ_Director\Data
ConfigToolTip = True
LogFilePath = c:\DAQ_Director\Logs
DeBug = No
InternalCalRange = .1
SpawnWallpaper = c:\DAQ_Director\Library\Images\ks2blu.wmf
V710CommPort = 0
ResetV710 = True
MaximumV710s = 20
B350Slot = 12
TransientWaitTime = 20
TC_ReferenceGain = 10X2

*NetworkDevice = PSI.192.92.103.137
Meters_16Size = 16
Meters_16Rate = 200
Digital_16Size = 16
Digital_16Rate = 200
Meter_1Rate = 100
**=OnBackColor,OnTextColor,OnCaption,OffBackColor,OffTextColor,OffCaption,Channel,InitialState
ControlButton = Green,Black,Blower,Red,White,Blower,Slot7_Ch1,Off
ControlButton = Green,Black,Lights,Red,White,Lights,Slot7_Ch2,Off
**=BackColor,TextColor,Caption,Type(M or E),Argument(M = Domain,Address,Message - X = Path and EXE
Name,Command Line Argument,Show or Hide)
UserButton = Green|Black|Start|M|.|Mailer|This is a test
UserButton = Green|Black|Ignition|M|.|Mailer|Test Button Two
UserButton = Yellow|Black|1 Meter|X|c:\DAQ_Director\Meter_1.exe||Show
```

```
UserButton = Yellow|Black|16 Meters|X|c:\DAQ_Director\Meters_16.exe||Show
MailCommand = TERMINATE
MailCommand = RECORD
MailCommand = STOP RECORD
MailCommand = SHOW
MailCommand = HIDE
MailCommand = START
MailCommand = RESET
MailCommand = VERSION
MailCommand = SESSION
MailCommand = CLOSE FILE
MailCommand = OPEN FILE
MailCommand = ?FILE NAME
MailCommand = ?FILE OPEN
SpawnFirst = V208_Slot3
```

Figure 4-VSF1. A typical kscsys.cfg setup file

View Resman Table (ResMan)

See also: **Resource Manager** **View Suffix Table**



Click the *ResMan* button on the toolbar to open a *Notepad* window to view the contents of the *Resman table*. This table contains the configuration information obtained by the execution of the Resource manager.

Resman determined that a V160 was present in Slot 0, a V243 was in slot 5, a V208 was in Slot 4.and that the manufacturer of all three products is KineticSystems (VXI manufacturer Code f29), along with other information. Close the *Notepad* window after you have viewed it. If Resman could not interrogate the modules (because the VXI mainframe was OFF, for example), the Notepad window would be blank.

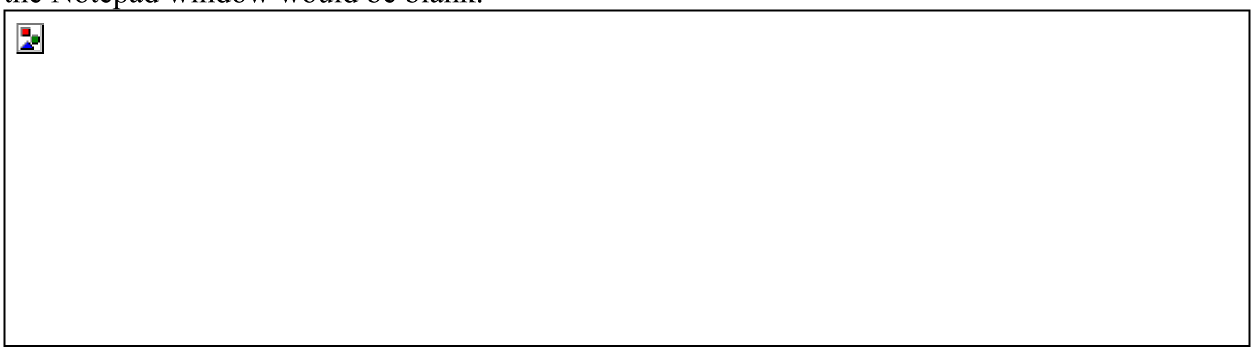


Figure 4-VRT1. Viewing the Resman table

View Suffix Table (Suffix)

See also: **Resource Manager**
View Resman Table

This selection opens a *Notepad* window that displays the contents of the Suffix table. This file contains the mainframe node address as well as the slot location, the model number and the model suffix of each of the I/O modules. The batch file that runs *Resman* also runs the *GetSuffix utility* that creates a *Suffix table*.

The module suffix in KineticSystems products indicates a particular set of ordering options (memory size, number of channels, etc.). This information is needed by DAQ Director. It can be read from the modules' *Suffix register.* This diagnostic utility can be used to determine which modules, including suffix information, have been found to be in the system. In the figure below, a V243-ZA21 was found in Slot 5 and a V208-ZD22 was found in Slot 4. Both modules are in mainframe Node 1 (GI/FOXI Address 01).

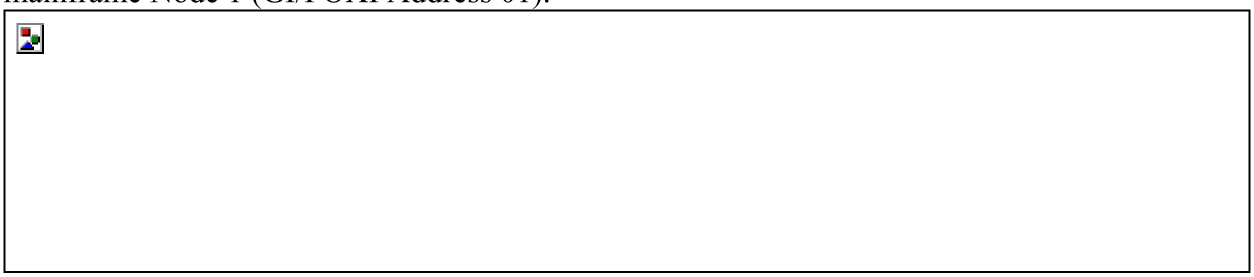


Figure 4-VST1. Viewing the Suffix table

Chapter 5: Appendices

Appendix A: Sequence Commands

Operational Sequence Commands

Following is a list of the operational sequence commands. For more information, refer to the *Sequence Editor* topic in Chapter 4.

Command	Description
EXECUTE:	Start another program (process). The parameters required are Path and Name, Command line, and Window style.
MESSAGE:	Creates a message box. This can be used for prompts to the user during an automated sequence.
SEND:	Sends a mailbox message to another process. The parameters required are Domain, Address, Message.
SETVALUE:	Allows a sequence to set a value in Named Shared Memory. The parameters required are Channel Name and Value.
SLEEP:	Causes the sequence to delay execution for the number of seconds specified. The only parameter required is time expressed in seconds.
TERMINATE:	Terminates a form.
WAITMESSAGE:	Waits for a specific message from another process. The required parameters are Sender, Message, Maximum time to wait before the sequence proceeds.
WAITVALUE:	Waits for a channel to attain a specified value then allows the sequence to progress. The parameters required are Channel Name, Operator, Value, Maximum time to wait before the sequence proceeds.

Calibration Sequence Commands

Following is a list of the calibration sequence commands. For more information, refer to the *Calibration* and *Sequence Editor* topics in Chapter 4.

Command	Description
ACQUIRE:	Acquires a calibration point. An additional parameter specifying the point is required. The first point is 1, etc.
AVERAGE:	Averages up to four stored data points. There are 4 additional parameters where the selected points may be specified.
BEGIN:	Marks the beginning of a sequence file. This command is not seen in the editor command set. It is added automatically by the Sequence editor.
BEGINLISTLOOP:	Marks the beginning of a Loop.
DBTOCURRENT:	Moves value returned from a ReadDb function to the current numeric value. This allows a dB value to be stored for future use.
DIVIDE:	Division of the specified stored values. (Total = Parameter1/Parameter2)
ENABLESAVE:	This allows the Save button to be disabled or enabled on the Multi-Calibrate control toolbar.

END:	Indicates the end of a sequence. This command is not seen in the editor command set. It is added automatically by the Sequence editor.
ENDLISTLOOP:	Marks the end of a loop.
EXECUTE:	Start another program (process). The parameters required are Path and Name, Command line, and Window style.
INSERTCAL%:	Inserts a voltage to the selected channel which corresponds to a percentage of full scale range. Full scale range is defined by MaxEUScale and MinEUScale. The voltage source is the internal calibrator.
INSERTCALV:	Inserts a voltage to the selected channel, using the internal calibrator.
LISTBOX:	Allows the user to select channels during an automated sequence. The channels selected are then operated on by the subsequent loop.
MESSAGE:	Creates a message box. This can be used for prompts to the user during an automated sequence.
MULTIPLY:	Multiplication of up to 4 stored values. (Total = Parameter1 * Parameter2 * Parameter3 * Parameter4)
OPENACQUIRE:	Opens the acquire form in Multi-point calibration. If it is not desirable to show the form, an optional parameter is added. 1 causes the form to remain hidden.
OPENDATAFILE:	Allows the sequence to programmatically open the calibration data file. The parameters are Path and File Name, optionally another parameter (Append) may be added to cause the data file to be appended to a previous file.
READDB:	Reads a value from the database. The required parameter is Property Name.
READVOLTS:	Returns the average value of the last multibuffer transfer. The value is held in volts.
SAVE:	This function will save the polynomial constants to the current configuration database.
SELECTCHANNEL:	Selects a channel for calibration. This function may be called repeatedly in order to select several channels to calibrate at once.
SEND:	Sends a mailbox message to another process. The parameters required are Domain, Address, Message.
SETCALEU:	Enter the Engineering Unit value of a calibration point. Additional parameters are Calibration point and Engineering Unit value.
SETCALMODE:	Specify if the calibration mode is Live calibration or Text entry.
SETCALPOINTS:	Specify the number of calibration points.
SETCALREF:	Specify a channel for the calibration reference value if required.
SETCALVOLTS:	Enter the complementary voltage value for a calibration point. Additional parameters are Calibration point and voltage value. Used in Text entry mode only.
SETVALUE:	Allows a sequence to set a value in Named Shared Memory. The parameters required are Channel Name and Value.

SLEEP:	Causes the sequence to delay execution for the number of seconds specified. The only parameter required is time expressed in seconds.
SOLVE:	Performs a least squares curve fit for the set of calibration values supplied.
STORE:	Stores current data value for the selected channel into temporary memory. Many points for each channel may be stored. These values may be used for averaging and other mathematical functions. The point number must be included as an additional parameter.
SUBTRACT:	Subtraction of stored values. Up to 4 stored values may be subtracted. (Total = Parameter1 - Parameter2 - Parameter3 - Parameter4)
SUM:	Summation of up to 4 parameters. (Total = Parameter1 + Parameter2 + Parameter3 + Parameter4)
TERMINATE:	Terminates a form.
TEST:	Displays a reverse calculation of the parameters and polynomial constants previously determined.
TOFRONT:	This will make the selected form be the top most form on the display.
USERID:	Enter the user identification. This will be stored in the Initials property of the database.
VALIDATE:	Performs a linearity test on a calibration point. Parameter1 specifies what fraction of FullScaleEU (Stored in database) is tested. This value is then projected to full scale and compared with the MaxLinearityError property stored in the database. The result is kept in a file named Validate.txt in the Data directory. If this is performed at the end of an automated calibration routine, it will set the Accept / Reject b8utton on the polynomial display, thereby causing unacceptable calibration values to not be saved. By adding the word Message to Parameter2, the user will be notified of a negative result from a Validation test.
WAITMESSAGE:	Waits for a specific message from another process. The required parameters are Sender, Message, Maximum time to wait before the sequence proceeds.
WAITVALUE:	Waits for a channel to attain a specified value then allows the sequence to progress. The parameters required are Channel Name, Operator, Value, Maximum time to wait before the sequence proceeds.
WRITEDB:	Writes a value to a specified property in the current configuration database. The first parameter specifies the property name and the second parameter specifies the value to be written. If the second parameter is @ then the current value in memory is written, otherwise the value in parameter 2 is written.