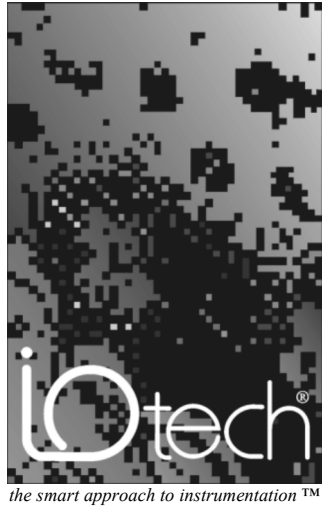


IOtech® LabVIEW™ Substitution VIs

A Guide to using Virtual Instruments in LabVIEW™ for DaqBoard/2000 Series Boards



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471-0902, rev 3.0

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Foreword

IOtech LabVIEW Substitution VIs can be used to replace NI-DAQ™ VIs. The Substitution VIs provide a means of using IOtech DaqBoard/2000 Series boards with LabVIEW programs, while maintaining the NI-DAQ look and feel.

Note that this document serves as a supplement to both DaqBoard/2000 Series and LabVIEW documentation.

This document is intended for use by individuals who:

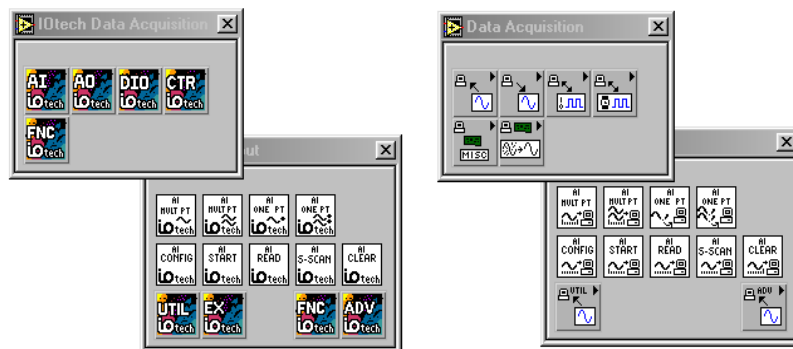
- Want to convert LabVIEW VIs so they may be used with IOtech Daqboard/2000 Series boards.
- Are familiar with LabVIEW VIs and would like to create new VIs for use with IOtech Daqboard/2000 Series boards.



IOtech LabVIEW Substitution VIs do not support DBK signal conditioning options.

IOtech LabVIEW Substitution VIs are compatible with LabVIEW versions 5.1 and higher. There are no special system requirements for using the substitution VIs, other than those specified for the version of LabVIEW used.

LabVIEW support is provided for basic Analog Input, Analog Output, Digital IO, and Counter Functions. Each includes program examples that can be modified, or used as is.



IOtech Main and Analog Input palettes

National Main and Analog Input palettes

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IOtech LabVIEW Substitution VIs are included on the IOtech Data Acquisition CD, versions 2.4 and higher. The following steps take into account that you have previously installed a DaqBoard/2000 Series board and 32-bit DaqBook/DaqBoard Support. If this is not the case, install your DaqBoard support software and your DaqBoard/2000 Series board according to one of the following documents. The first two documents are available on our website, www.iotech.com.

- *DaqBoard/2000 Series Installation Guide* (1033-0940, rev 3.0 or higher)
- *DaqBoard/2000 Series Users Manual* (1033-0901, rev. 2.0 or higher)
- *DaqBoard/2000 Compact PCI Documentation*

Complete the following steps to successfully launch and run the installation program.

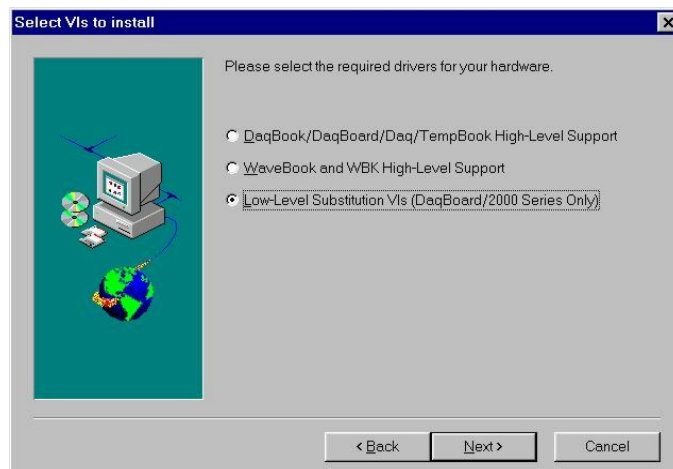
1. Start Windows.
2. Close all running applications.
3. Insert the Data Acquisition CD into your CD-ROM drive and wait for the CD to auto-run.

If the CD does not start on its own:

- (a) click the desktop's <Start> button
- (b) choose the Run command
- (c) select the CD-ROM drive, then select the **setup.exe** file
- (d) click <OK>

An *Opening Screen* will appear.

4. Click the <ENTER SETUP> button.
5. From the hardware selection screen [which follows a licensing agreement], select **DaqBoard2000 Boards** from the drop-down list.
6. On the resulting software options screen, select **LabVIEW**. You can select, or de-select other software options as applicable to your system.
7. Follow the screen prompts until the "Select VIs to Install Screen Appears." (Following figure).




"Select VIs to Install" Screen

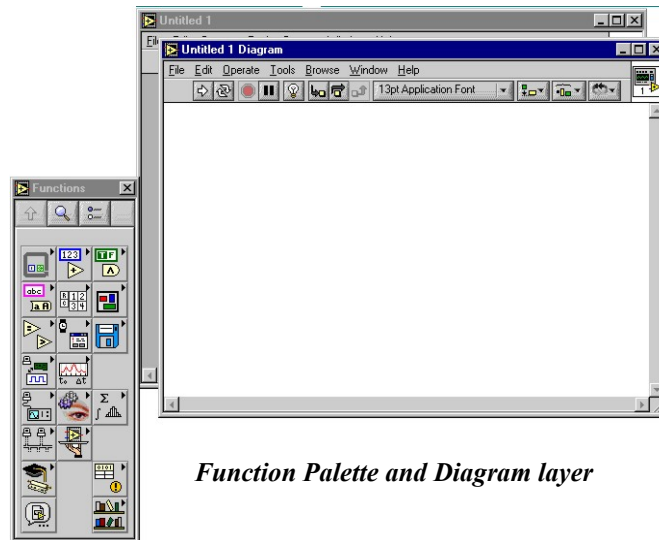
8. Select **Low-Level Substitution VIs (DaqBoard/2000 Only)**, as indicated in the preceding figure.
9. Click **Next**.

The software will now be installed in a sub-directory named *IOtech Data Acquisition*. This sub-directory is located within the LabVIEW directory. A shortcut, located under DaqXSoftware, can be reached via the Windows Start Menu.

Adding the IOtech Menu to a Palette Set in LabVIEW 6i 2

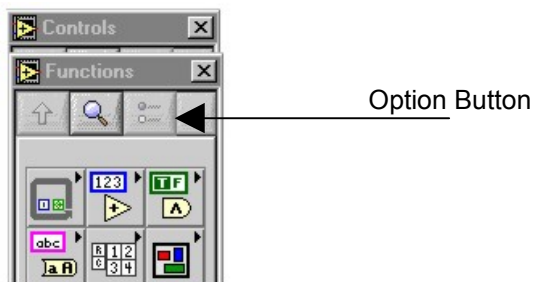
 **Note!** This chapter applies to LabVIEW 6i only. In LabVIEW 5 menu addition is automatic.

1. Start LabVIEW and select New VI.
2. From the “Window” pull down menu select Show Diagram.
3. From the “Window” pull down menu select Show Functions Palette.



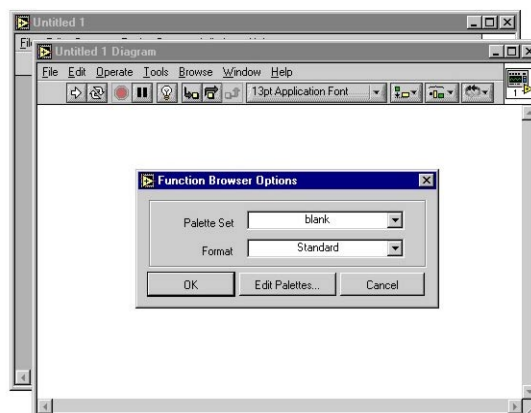
Function Palette and Diagram layer

4. Click on the Options button within the functions palette.



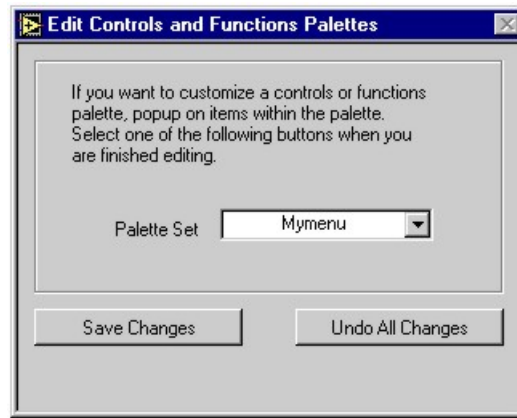
Option Button in the Function Palette

5. In the Function Browser Options click Edit Palettes ...



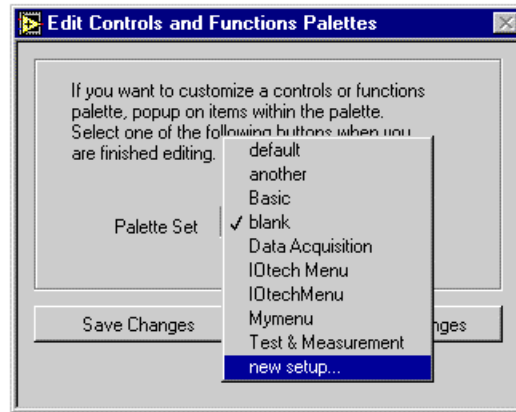
Function Browser Options

- You will get a menu box titled “Edit Controls and Function Palettes.”



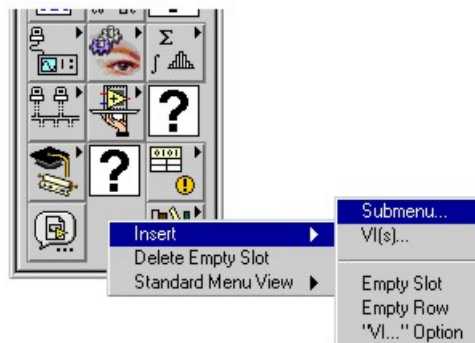
Edit Controls and Function Palettes

- Select new setup from the Palette Set menu and enter a new name such as “Mymenu.” in the text box.



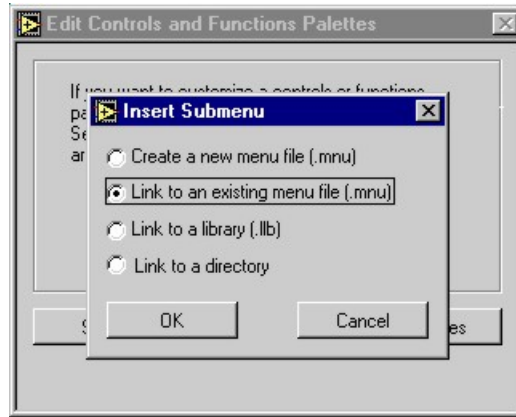
Palette Set Menu

- Click Save Changes.
- Return to the diagram layer of your new VI.
- Click on the Option button and make sure the newly created menu item is the one selected. If not, select it at this time In the Function Browser Options and click OK.
- Right click on a blank area within the function palette. This will allow insertion of a sub menu.



Function Palette Resulting From Right Click on a Blank Area

- Choose “Link to an existing menu file (.mnu).”

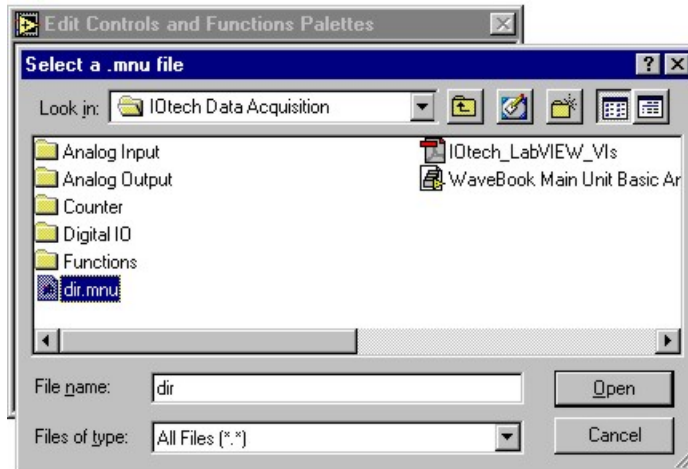


Insert Submenu

- Click <OK>
- Use the directory search window to find the dir.mnu menu within the Iotech Data Acquisition folder under LabVIEW.



If you have installed both version 5 and version 6i on the same computer, it is possible that this folder would be under LabVIEW 5 rather than LabVIEW 6i.



Directory Search Window

- Highlight the directory menu.
- Click <Open>.

The IOtech menu now appears in the function palette, as can be seen in the lower-center of the right-hand figure.

The IOtech functions are now available for use.



Modified Function Palette



Overview

The *IOtech Data Acquisition* sub-directory contains folders for the various types of Virtual Instruments. Each folder contains pertinent sample programs. The folders are designated:

- **Analog Input**
- **Analog Output**
- **Counter**
- **Digital IO**

In addition to these four VI folders, the sub-directory also contains a Documentation folder. The folders can be accessed from the Windows Start Menu, under the LabVIEW directory (located under DaqXSoftware).

IOtech LabVIEW Substitution VIs were designed to emulate National Instruments VIs. The substitutions can be made in applications where an IOtech DaqBoard/2000 Series board is being used to replace a NI-DAQ “E” Series device, a PC-LPM-16, or an AT-MIO-16 “H” or “L” Series board; however, for the AT-MIO-16 L, the x500 gain-setting will not be supported. NI devices can typically be replaced with little effort. An example follows shortly.

Supported VIs		
Easy VIs	Intermediate VIs	Advanced VIs
AI Sample Channel	AI Clear	AI Buffer Config
AI Sample Channels	AI Config	AI Buffer Read
AI Acquire Waveform	AI Continuous Scan	AI Clock Config
AI Acquire Waveforms	AI Read One Scan	AI Control
AO Update Channel	AI Read	AI Group Config
AO Update Channels	AI Single Scan	AI Hardware Config
AO Generate Waveform	AI Start	AI Parameter
AO Generate Waveforms	AI Waveform Scan	AI SingleScan
Read from Digital Line	AO Clear	AI Trigger Config
Read from Digital Port	AO Config	AO Buffer Config
Write to Digital Line	AO Continuous Gen	AO Buffer Write
Write to Digital Port	AO Start	AO Clock Config
Count Events or Time	AO Wait	AO Control
Measure Pulse Width or Period	AO Waveform Gen	AO Group Config
	AO Write One Update	AO Hardware Config
	AO Write	AO Parameter
	DIO Clear	AO Single Update
	DIO Config	AO Trigger and Gate Config
	DIO Read	Digital Buffer Config
	DIO Single Read_Write	Digital Buffer Control
	DIO Start	Digital Buffer Read
	DIO Wait	Digital Clock Config
	DIO Write	Digital Group Config
	Adjacent Counters	Digital Single Read
	Counter Read	Digital Single Write
	Counter Start	Digital Trigger Config
	Counter Stop	DIO Port Config
	Event or Time Counter Config	DIO Port Read
	Pulse Width or Period Meas Config	DIO Port Write
	Wait+ (ms)	CTR Control
		CTR Group Config
		CTR Hardware Config
		CTR Mode Config
		Channel To Index

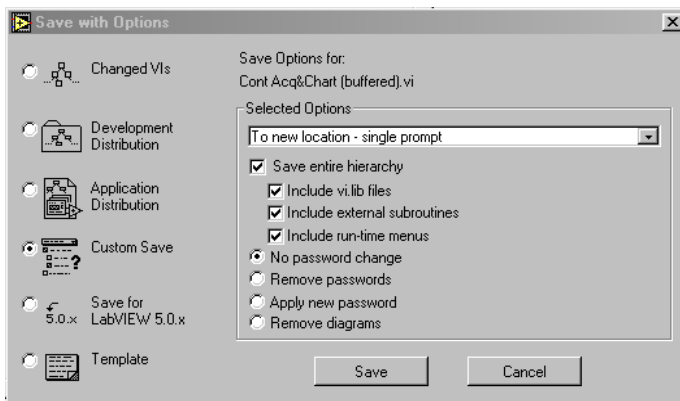
An “IOtech LabVIEW Substitution VIs” Walk-Through

In this walk-through we will use IOtech LabVIEW Substitution VIs to modify the National Instruments **Cont Acq&Chart (buffered).vi**. The **Cont Acq&Chart (buffered).vi** example can be accessed via the LabVIEW Help menu under the “Search Examples-Data Acquisition(Daq) Analog Input” sub-heading.



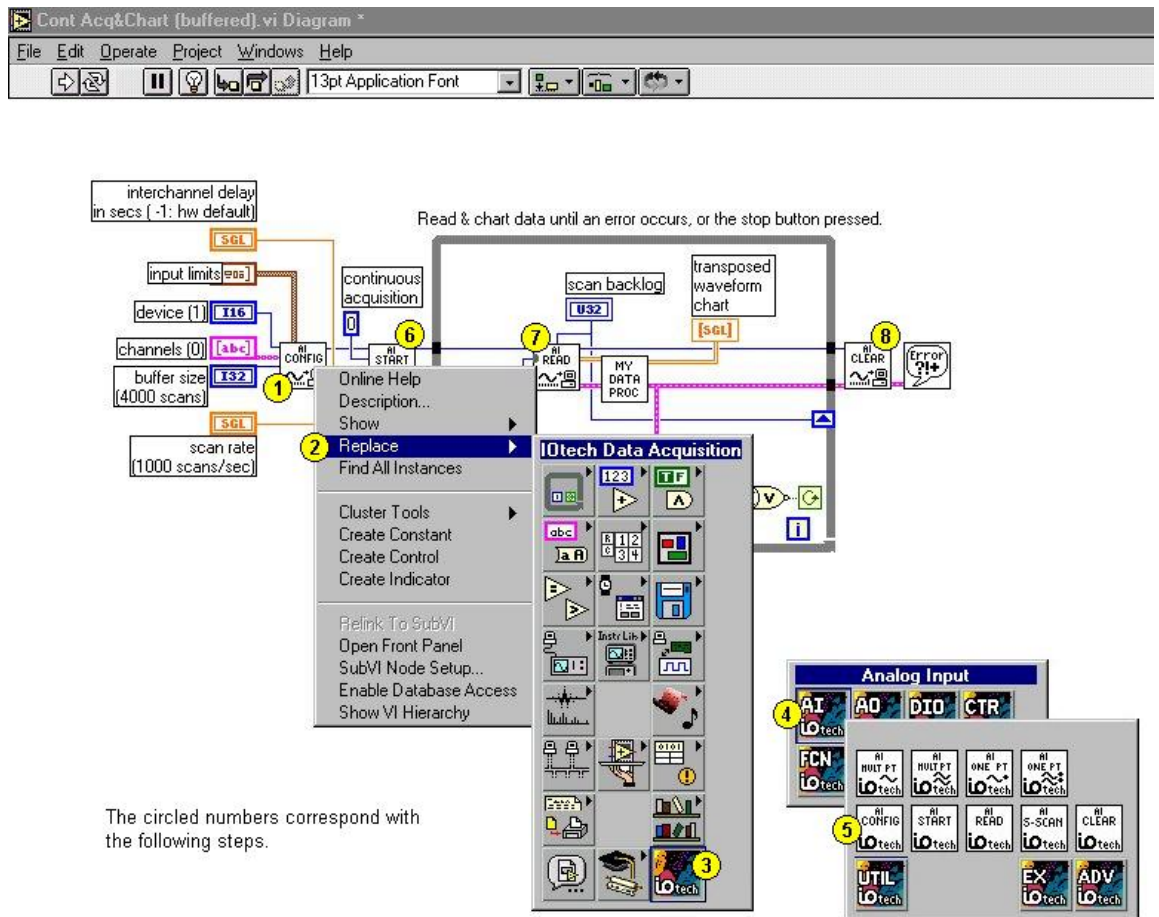
If you intend to use both National Instruments™ Hardware and IOtech DaqBoards, we recommend that you create a new folder in which to keep your converted VIs.

1. Pull-down the File menu.
2. Select “**Save With Options.**”
3. Refer to the following figure. Select “**Custom Save.**” This will allow you to make the IOtech LabVIEW Substitution VIs while keeping the National Instrument VIs.
4. In the “Selected Options” section of screen, choose the options as indicated in the following figure. These are:
 - **To new location – single prompt**
 - **Save entire hierarchy**
 - **Include vi.lib files**
 - **Include external subroutines**
 - **Include run-time menus**
 - **No password change**



Performing a Custom Save of Cont Acq&Chart (buffered).vi

5. Click “**Save**” and create a new folder in which to keep your IOtech LabVIEW Substitution VIs.
6. Close the National Instruments example.
7. Open the **Cont Acq&Chart (buffered).vi** version you just saved from the location chosen in step 5.
8. Look at the Virtual Instruments Diagram for **Cont Acq&Chart (buffered)**. See following figure.



Replacing the VIs within the Cont Acq&Chart (buffered).vi Diagram

In this example there are four hardware-related items that need replaced,

- AI Config
- AI Start
- AI Read
- AI Clear



Two other Virtual Instruments, *My Data Proc* and the *Error* handler have no associated IOtech LabVIEW Substitution VI, as they do not directly pertain to hardware. *My Data Proc* and the *Error* handler, should not be altered.

For the following steps, refer to the above figure as needed.

1. Right-click on **AI Config**. A list of options appears.
2. Move the mouse-pointer over the **Replace** option. The **Functions Palette** will appear.
3. Move the mouse-pointer over the **IOtech Data Acquisition Button** -- The **IOtech Data Acquisition Palette** will appear.
4. Move the mouse-pointer over IOtech's "AI" button -- The **Analog Input** function palette will appear.
5. Click the IOtech **AI Config.vi**.
IOtech LabVIEW Substitution VI now replaces the original **AI Config.vi**.

Note: When the mouse-pointer moves over the IOtech AI Config VI, the Analog Input function pallet's title bar will show **IO_AI Config.vi**. The names of some high-level and low-level VIs look very similar. When replacing VIs, the proper IOtech LabVIEW Substitution VI can be recognized by the following naming convention:

"IO_" will be appended to the beginning of the original LabVIEW VI name. In this example **AI Config.vi** is replaced with **IO_AI Config.vi**.

6. Right-click on **AI Start**; then repeat steps 2 through 4. At what would be step 5, select **AI Start**.
7. Right-click on **AI Read**; then repeat steps 2 through 4. At what would be step 5, select **AI Read**.
8. Right-click on **AI Clear**; then repeat steps 2 through 4. At what would be step 5, select **AI Clear**.

Testing, Debugging, and Saving the New Application

Testing

You should always verify that your Virtual Instruments function as you expect them to. For example, if you modified an Analog Input VI, you should connect a known signal to the inputs and verify functionality. If you modified an Analog Output VI you should use an oscilloscope, or meter, to verify the actual output.

Debugging your Application

If testing your application shows that it does not function properly, debug the application as follows:

1. Using the *IOtech Control Panel Applet*, verify that the DaqBoard/2000 Series board has been properly installed and configured. Correct installation and configuration issues as applicable.
2. Physically check all hardware connections. Correct improper connections.
3. Determine if LabVIEW is communicating with the DaqBoard/2000 device.
 - (a) Go to the LabVIEW Directory.
 - (b) Go to the IOtech Data Acquisitions Functions Palette.
 - (c) Open and Run the IOtech LabVIEW Substitution VI named “**Install Test**.”
 - (d) Open and Run the “Install Test” VI.

Running Install Test generates a list of every DaqBoard/2000 Series board that is located in your PC. You can run a communications test on a specific board. *If the test does not pass*, contact product support. Chapter 4 includes contact information. *If the test does pass*, proceed to step 4.

4. Run one of the example programs to ensure that LabVIEW and the DaqBoard/2000 Series Board are communicating properly.

If you cannot resolve the problem, review Chapter 4, *Issues and Caveats*. If the problem still can't be resolved, seek customer assistance. Note that Chapter 4 includes contact information for product support.

Saving your Application

Save your application using LabVIEW's standard save procedure. If you are using both IOtech and National Instrument devices it is a good idea to save your VIs in separate folders.

Intended Use – IOtech LabVIEW Substitution VIs are intended for LabVIEW users who are replacing one of the following devices with an IOtech DaqBoard/2000 Series board.

- National Instruments “E” series board
- PC-LPM-16
- AT-MIO-16 “H” or “L” series board, with this exception, IOtech LabVIEW Substitution VIs do not support the x500 gain-setting on the AT-MIO-16 L board.



If you need to access the full functionality of DaqBoard/2000 Series boards, the IOtech LabVIEW API VIs must be used.

No Signal Conditioning DBK Support – Architectural differences exist between IOtech and National Instruments boards. For this reason, certain features that are available in DaqBoard/2000 Series boards [and in National Instruments boards] are not supported by the Substitution VIs. For example, the **Substitution VIs do not support DBK signal conditioning options.**

DSP – Some of the Low Level NI-DAQ VIs reference DSP handles to buffers. The DSP handle functionality is automatic in the DaqBoard/2000 Series and the VI DSP handles are simply ignored. Any VIs that are dependant on *reading from* or *writing to* a buffer [using either a DSP handle or a buffer offset] will not function properly when replaced.

Trigger Types – Attempting to use a trigger type that is not supported will result in error 10083. Refer to DaqBoard/2000 Series documentation for a list of valid trigger types.

Analog Input Range Settings – It is often the case that IOtech and National Instruments devices have different range and gain settings. Gain selection for DaqBoard/2000 Series boards is automatic and is based on the user-selected voltage limits.

Analog Output – Live update of an output buffer is not supported. If an output buffer needs to be changed, then the output must be stopped, changed, and restarted.

Counters and Timers – Low-speed frequency measurement and signal timing can be accomplished with the examples located under the IOtech CTR VI Palette. The support of this section is restricted to *event counting* in 16-bit and 32-bit counter lengths. Frequency measurements can be made using event counting within a known time frame. See the “**Measure Frequency.vi**” within the IOtech CTR Palette under examples.



The CTR example VIs are **NOT** exact replacements for NI-DAQ VIs and **will require program modification** if they are to be used. You can run the examples to determine application suitability.

Pulse and Square Wave Generation – Pulse and square wave generation are limited with the IOtech DaqBoard/2000 Series boards. Square wave generation can be accomplished with the example square wave generation VI located under Digital IO.



The square wave generation VI example is **NOT** an exact replacement for NI-DAQ VIs and **will require program modification** if it is to be used. You can run the example to determine suitability for your application.

Analog Output VIs can provide functionality for applications that make use of *one-shot pulse* or *square waves with asymmetrical duty cycles*.

Questions and Answers

- Q: Who should I contact if I have questions that are not answered by my documentation?
A: If you believe you are having a problem with IOtech LabVIEW Substitution VIs or IOtech Hardware, contact IOtech. Contact information is provided at the end of this chapter.
- Q: What is meant by “IOtech LabVIEW Substitution VI”?
A: IOtech has developed a series of the VIs that emulate the NI-DAQ VIs. These IOtech VIs are referred to as IOtech LabVIEW Substitution VIs.
- Q: How do I install VIs?
A: Refer to chapter 1 of this document for installation instructions.
- Q: How are Substitution VIs accessed and where are they physically located?
A: Substitution VIs can be accessed from within LabVIEW through the Function Palette. The VIs are physically located under
...**Program Files\National Instruments\Labview(X)\IOtech Data Acquisition**
- Q: What version(s) of LabVIEW do I need to have?
A: IOtech LabVIEW Substitution VIs are supported by LabVIEW versions 5.1 and higher.
- Q: What operating systems are supported?
A: IOtech LabVIEW Substitution VIs are supported by Windows 9x, Me, NT, 2000, and XP.
- Q: Are there any examples on how to use IOtech LabVIEW Substitution VIs? If so, where are they?
A: Program examples exist for each function. They are located in the sub-palette, or sub-directory, below the major function. For example: IOtech Data Acquisition\Analog Input\Examples)
- Q: Can I use both IOtech and NI devices?
A: You may use IOtech and National Instruments boards in the same machine and even within the same program as long as (1) the IOtech LabVIEW Substitution VIs are used to control IOtech boards, and (2) the NI-DAQ VIs are used to control the National Instruments boards. You cannot mix VIs.
- Q: Can I use boards other than those manufactured by IOtech and National Instruments, providing these devices have LabVIEW support?
A: Yes, but you will need to use NI compatible virtual instruments that were developed for those specific devices, providing those VIs exist.
- Q: What do I have to do to my existing LabVIEW application to make it work?
A: If you have an existing National Instruments board-based test system, and you want to convert it for use with An IOtech DaqBoard/2000 Series board, you must replace all the NI-DAQ Device Specific VIs with the corresponding IOtech LabVIEW Substitution VIs.
- Q: Can I use the IOtech LabVIEW Substitution VIs with National Instruments examples, or with higher level VIs?
A: Yes, refer to the examples.
- Q: How do I determine that a VI substitution operation was successful?
A: Test the modified application using known input and output values.
- Q: Will using IOtech LabVIEW Substitution VIs change the performance of my LabVIEW application?
A: Under most circumstances, no. The IOtech LabVIEW Substitution VIs do not introduce any additional processor overhead. If you must have absolute peak performance consider using the IOtech API LabVIEW VIs. Note that these are stand-alone VIs that cannot be used with the Substitution VIs.

Customer Assistance

To report problems and receive support, call or e-mail our Applications department, or visit our web site. When you contact us, please provide the following information so support personnel can help you most efficiently:

- Hardware model numbers and software version numbers.
- Operating system, type of computer, and device information in the Windows control panel
- Results of tests, such as the Daq* Configuration control panel.
- Hardware setup and software configuration.
- Information on input and/or output signals, as applicable.
- The replacement steps you performed, e.g., what VIs did you replace and what were the before and after results.

All equipment returned to the manufacturer must have an RMA (Return Material Authorization) number. You can obtain an RMA number by calling the Customer Service or Applications departments. When returning the equipment, use the original shipping container (or equivalent) to prevent damage. Put the RMA number on your shipping label to ensure that your shipment will be handled properly. After receiving your equipment, we will fax a confirmation form that summarizes the charges (if applicable) and expected return date.

IOtech can be reached by one of the following means:

Phone: **(440) 439-4091**

Fax: **(440) 439-4093**

E-mail (Product Information/Sales): sales@iotech.com

E-mail (Technical Support): productsupport@iotech.com

Internet: <http://www.iotech.com>

Mail: **IOtech, Inc. • 25971 Cannon Road • Cleveland, Ohio 44146-1833**



Notes