How to Run LabVIEW Programs with Keysight PXI Instruments

PXI systems deliver a PC-based, high performance measurement and automated test platform. In addition to speed, size and scalability, PXI users benefit from an open industry standard, which means that PXI hardware – instrument modules, chassis and other equipment from different vendors can be used interchangeably. National Instrument’s LabVIEW programming environment supports vendor interoperability, allowing test engineers to select from a broad range of instruments, including Keysight’s PXI modules. To facilitate running LabVIEW programs with Keysight instruments, many of the Keysight PXI products come with LabVIEW drivers. Additionally, products with .NET drivers and LabVIEW wrappers can be used in LabVIEW.

This application note demonstrates how to easily use Keysight’s PXI instruments in a LabVIEW program environment. The following topics and examples are covered:

- Using a Keysight instrument’s .NET driver and driver wrapper
- Using a Keysight instrument’s Soft Front Panel (SFP)
- Using Keysight instrument’s LabVIEW G drivers

LabVIEW programmers are familiar with creating a user interface or front panel with controls and indicators for their test program. Test code is added to the front panel using Virtual Instruments (VI) and structures that control the front panel objects. VIs are programs within LabVIEW that emulate instruments. LabVIEW drivers provide various VIs, specific to the capabilities of an instrument, that can be selected by the programmer and used to create test code.

Using a .NET driver and wrapper in LabVIEW

Programming within LabVIEW using an instrument’s .NET driver with a driver wrapper can be easily achieved by first creating a .NET Constructor VI, and then initializing the module to establish control and send configuration, measurement and other commands. The following information includes step-by-step details, using the Keysight M9336A PXIe I/Q arbitrary waveform generator (AWG) as an example, to create the .NET Constructor VI and select VIs for instrument control.
Create a .NET Constructor VI

To use a .NET driver and driver wrapper in LabVIEW, you simply use the .NET palette (Connectivity>>.NET) which includes the available functions.

Begin creating a new VI, within the block diagram, by first opening the Function Palette. Extend the Function Palette (Figure 1) and select Connectivity, select .NET, then select the Constructor VI and place it in the block diagram. A prompt will ask you to select a .NET Constructor. Use the Browse button and select the appropriate assembly (.NET driver with wrapper).

Figure 1. Navigate from the Functions palette to select Connectivity, then, .NET, and Constructor VI.

For a 32-bit version of LabVIEW on a 64-bit OS, the dll is located in this folder: C:\Program Files (x86)\Keysight\MAwg\bin

If you are running 64-bit LabVIEW, or 32-bit LabVIEW on a 32-bit OS, the dll is located in this folder: C:\Program Files\Keysight\MAwg\bin

Select the file KtMAwgDriverWrapper.dll, which corresponds to the M9336A AWG instrument module, and press the OK button.

Specify a constructor by scrolling down the Objects list to highlight KtMAwgWrpper. KtMAwgWrpper will appear in the Constructors field below that. Once you select OK, to close the dialog box the Constructor VI updates with the name KtMAwgWrpper.
To access the properties within the wrapper, select a Property Node from the .NET menu palette. For methods within the wrapper, select the Invoke Node from the .NET menu palette (Figure 2).

![Figure 2](image)

**Figure 2.** Within the .NET menu palette, you can select property nodes and invoke nodes.

### Initialize and establish control of the module

To initialize the module, you need to access the Initialize method within the IVI.NET driver. Select the Invoke Node and place it on the block diagram, connecting the upper line (reference) and the lower line (error). To select a method, click on Method in the VI which opens a list of root interface level methods you can choose from. The Initialize method can be selected by double clicking on it.

Once a method name is selected by double clicking on it, the VI name changes to the selected method and includes any parameters of the method. This example shows the selected Initialize method and the Resource and Options parameters associated with it.

![Figure 3](image)

**Figure 3.** Selecting the Initialize method enables the selectable parameters for Resource and Options.

The IVI help file can be used to help find desired methods that may reside in a different interface. Selecting Browse provides a list of Properties (or Interfaces in the IVI help file) and Methods.
IVI.NET properties are found within the Property Node of the LabVIEW.NET menu. Place the property VI in the block diagram, click on it to select Browse and then select the desired property (Figure 4).

Figure 5 shows a LabVIEW program example that calls Initialize with the Invoke Node, reads the serial number with the Property Node, and finishes by calling Close.
Using a Keysight instrument Soft Front Panel (SFP)

To determine which command to use, and become more familiar with the IVI.NET driver calls you can use a product’s SFP.

You can begin by opening the SFP from the Start menu. From your computer’s start menu select Start->All Programs->Keysight->MAwg->MAwg SFP. Other benefits of using the SFP is that it provides a quick way to determine the AWG’s PXI address, and you can capture and view IVI driver calls (Figure 6) to reference when programming by selecting Tools->Monitor Driver Calls.

This example shows the code generated when “Output Enabled” is selected.

![Figure 6. M9336A PXI AWG Soft Front Panel showing driver commands log.](image)

You can see in the code generated, that to enable the output channel from LabVIEW you will need to access the Output interface on the .NET driver (KtMAwgDriverWrapper assembly).

If you use the SFP as you program in LabVIEW, make sure to close the SFP before running the LabVIEW program.
Using Keysight instrument LabVIEW G drivers

Many of the Keysight PXI instruments include a LabVIEW G driver for seamless integration of Keysight PXI instruments into a LabVIEW test system program. If you already have LabVIEW installed on your test PC or controller, you can simply download one or multiple instrument drivers needed for your application, either from the CD shipped with the Keysight instrument or from the Keysight technical support page. Once the drivers are loaded you can select from the many available VIs or other instrument VIs and begin connecting your program sequence.

Figure 7 shows an example of an M9181x Series DMM AC current measurement VI. The associated Help file includes full description of the adjustable instrument parameters (Figure 8), and their types (DBL, I32, abc, etc.) so you can easily configure and make measurements in a very short time.

![Figure 7. M9181x DMM LabVIEW VI used for making an AC current measurement.](image)

![Figure 8. M9181x DMM LabVIEW VI help file includes instrument parameter descriptions.](image)
Various example programs are provided with each instrument to help accelerate your program development. Here is an example that begins with the initialization of the Keysight M9393A vector signal analyzer:

![Diagram](image)

Figure 9. Program example, begins with initialization of the Keysight M9393A vector signal analyzer.

As the program continues, driver identity properties are established as shown in Figure 10. Then, the vector signal analyzer executes three acquisitions, all for the same length of time, but at different sample rates, resulting in different acquisition lengths. All three acquisitions are captured and held in the digitizer memory simultaneously.

![Diagram](image)

Figure 10.
The vector signal analyzers’ RF characteristics are then set and an immediate trigger is configured for IQ acquisitions as shown in Figure 11.

Figure 11.

The IQ acquisition parameters are set and memory for the measurement is allocated in the digitizer. A copy of the ID and some of the acquisition details is also saved as shown in Figure 12.

Figure 12.
The measurements are now captured and the driver is closed as shown in Figure 13. 

As a LabVIEW programmer, using a Keysight PXI instrument’s G driver provides the familiar, VI programming that you are used to, with access to all the product features and capabilities enabling you to take advantage of a broad range of Keysight PXI instruments.

**Additional information and help**

Keysight provides additional sources of information that can be very helpful while you are developing a test program. Both the IVI.NET driver help file, and, as in the case of the M9336A PXI AWG, a helpful Readme file is provided specifically for the KtMAwg IVI.NET driver. These helpful sources can be found using the following information:

1. An IVI.NET driver help file comes with the PXI instrument drivers and provides information about each method and its parameters.

   Located at: C:\Program Files (x86)\IVI\Microsoft.NET\Framework32\v4.5.50709\Keysight.KtMAwg\<version>\Help\Keysight.KtMAwg.Fx452.chm

   - Expand the highlighted menu items as shown in Figure 14, to see the IktMAwg programming structure.

2. For the M9336A AWG specifically, refer to the “Using KtMAwg IVI.NET Driver from LabVIEW” provided with the module as a Readme file.
Summary

There are many ways you can program PXI instruments with LabVIEW. In this application note, we outlined the most common methods for doing so including:

– Using a .NET driver with driver wrapper,
– Using an instrument's soft front panel, and
– Using a LabVIEW G driver.

Interoperability gives you the freedom to select PXI instruments from multiple vendors. This gives you the ability to choose the performance capabilities you need for your application when developing a LabVIEW based test system. Keysight PXI instruments provide instrument drivers that make it easy to use Keysight products in a LabVIEW test program. Drivers and program examples are readily available for each instrument helping to accelerate your program development.
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