WaveAce Integration with WaveStation

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Summary

Debugging sometimes requires transfer of signals from oscilloscope to waveform generator. This document describes how to transfer signals from the WaveAce oscilloscope to the WaveStation waveform generator and vice versa.

Introduction

All circuit designers hope for first-pass prototyping success, a scenario in which the circuit or subsystem under test performs exactly as intended and exhibits predictable, desired behavior. Unfortunately, this is rarely the case. Rather, the "real world" intervenes, in which the circuit's behavior is not up to the design specification and requires debugging. Enter the waveform generator and associated software for PCs, with which engineers can create ideal waveforms, edit them, and transfer them to the generator for use in debugging. Conversely, those less-than-ideal waveforms found in the real world can be captured, analyzed, and stored with an oscilloscope. Subsequently, they too can be transferred to the waveform generator for use in further debug as a reference.

About the WaveStation

LeCroy's WaveStation family of function/arbitrary waveform generators, shown in Figure 1, serves as a vehicle for waveform creation. With 14-bit resolution and a sample rate of 125 Msamples/sec., WaveStation creates signals with great accuracy. That accuracy is enhanced by WaveStation's low jitter, low harmonic distortion, and low inter-channel skew. It also is unusual amongst instruments in its class in that it comes standard with two output channels, enabling it to drive differential signals.

Figure 1: Shown is LeCroy's WaveStation 2052 function/arbitrary waveform generator, which sports a bandwidth of 50 MHz, a 125-Msample/sec sampling rate, 14-bit resolution, and 16 kpoints of memory per channel

About the WaveAce

When teamed with an oscilloscope such as LeCroy's WaveAce series of instruments, shown in Figure 2, WaveStation becomes a formidable debugging tool. The WaveAce oscilloscopes come in bandwidths from 40 MHz to 300 MHz and with sample rates of up to 2 GS/s. A long memory of up to 1 Mpts/channel (2 Mpts/channel when interleaved) means that a sizable record of a signal is retained. The oscilloscopes also offer advanced triggering options, a 7" wide screen, 32 automatic measurements, and four math functions as well as fast-Fourier transform (FFT) capabilities.

Figure 2: Shown is the WaveAce 2034 oscilloscope, which offers a 300-MHz bandwidth, four channels, and maximum sampling rate of 2 GS/s. All WaveAce instruments feature a 7" wide display

Preparing for Signal Transfers

Given that both the WaveAce and WaveStation have USB host and USB device ports, it's relatively simple to transfer waveforms to and from a PC and from one to the other. This is accomplished by connecting both instruments to the PC via USB cable and installing necessary PC software.

The first step is to download and install WaveStation software, which is freely available from the LeCroy website. WaveStation software allows quick, easy creation and/or editing of waveforms on the PC as well as for transfer of those waveforms to the WaveStation hardware. It's important to note that the WaveStation's rear-panel USB device port must be enabled for a USBRAW connection. This is achieved by opening the instrument's Utility menu and using the following sequence of button presses: Interface →USB Setup → USBRAW → Done. This will enable the WaveStation software to communicate with the WaveStation hardware.

Facilitating a USB connection between the WaveAce oscilloscope and the PC also requires installation of NI VISA drivers as well as the NI Measurement and Automation Explorer application. These can be downloaded from NI's support page.

Transfers from WaveAce to WaveStation

Getting signals from WaveStation into WaveAce is a simple matter of connecting the output of the signal generator to the input of the oscilloscope via coaxial cable. Transferring signals from WaveAce to WaveStation is even simpler once the USB connections with the PC are established. The following is a step-by-step procedure for sending a real-world signal from the WaveAce oscilloscope to the WaveStation arbitrary signal generator. The procedure assumes correct installation of all necessary software and hardware drivers.

1. Connect both instruments to the PC via USB cables. Turn on both of the instruments.

2. For this demonstration, a WaveAce 2034 oscilloscope and LeCroy's WaveSource 100 oscilloscope evaluation signal source were used to generate and acquire a pulsed signal as shown in Figure 3. Of course, any signal of interest may be acquired. A WaveStation 2052 served as the waveform generator.
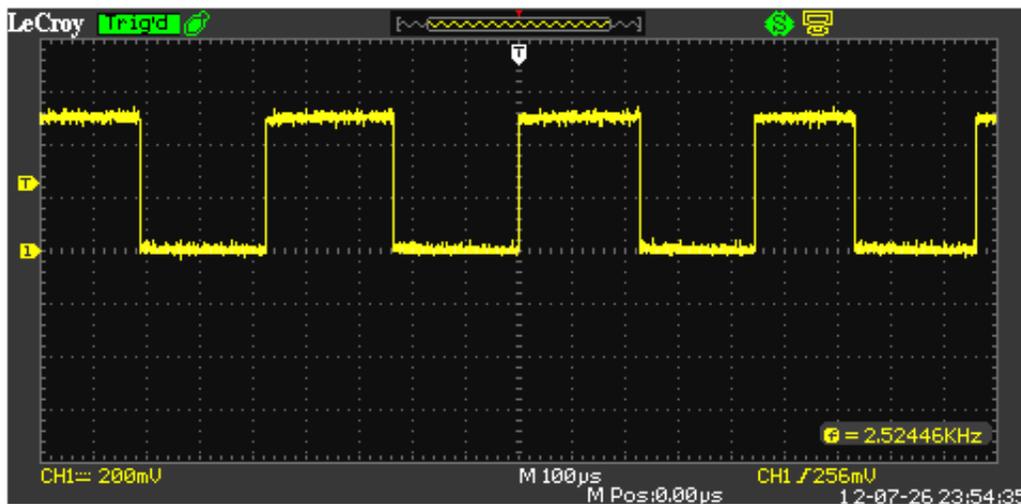
Figure 3: A screen capture of the WaveAce oscilloscope shows the acquired signal from the WaveSource 100 evaluation source

3. On the PC, open National Instruments' Measurement & Automation Explorer application. The application will automatically detect the WaveAce as shown in Figure 4. Note that the oscilloscope's USB port must be set to USBTMC. This is accomplished in the oscilloscope's Utility menu.
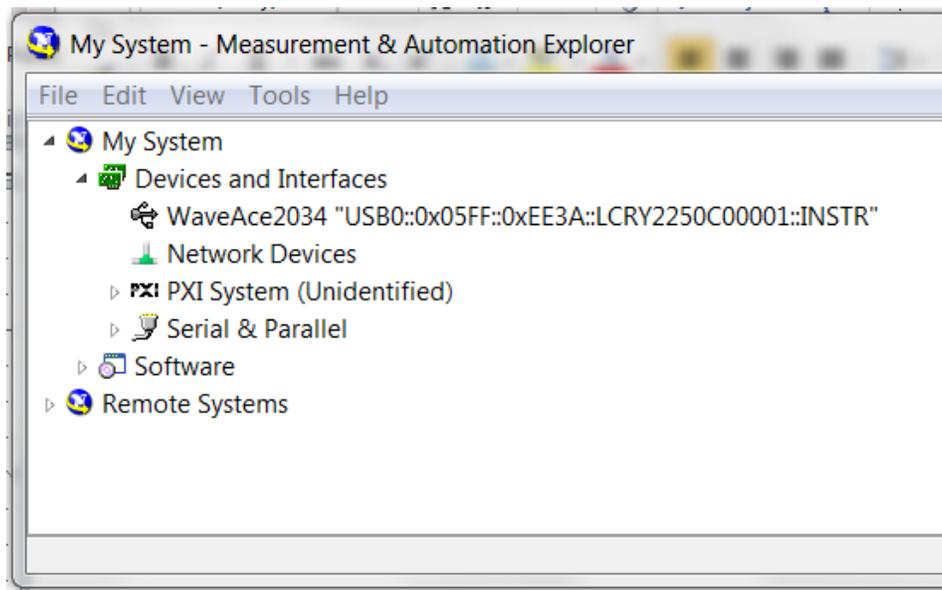
Figure 4: National Instruments' Measurement & Automation Explorer application automatically detects that the WaveAce 2034 oscilloscope is connected to the PC via USB

4. Open WaveStation software on the PC and click Communication in the menu bar. Then click on the Import Waveform from Scope option, which opens the dialog box shown in Figure 5. Be sure to check the appropriate channel box. Then click on Import.
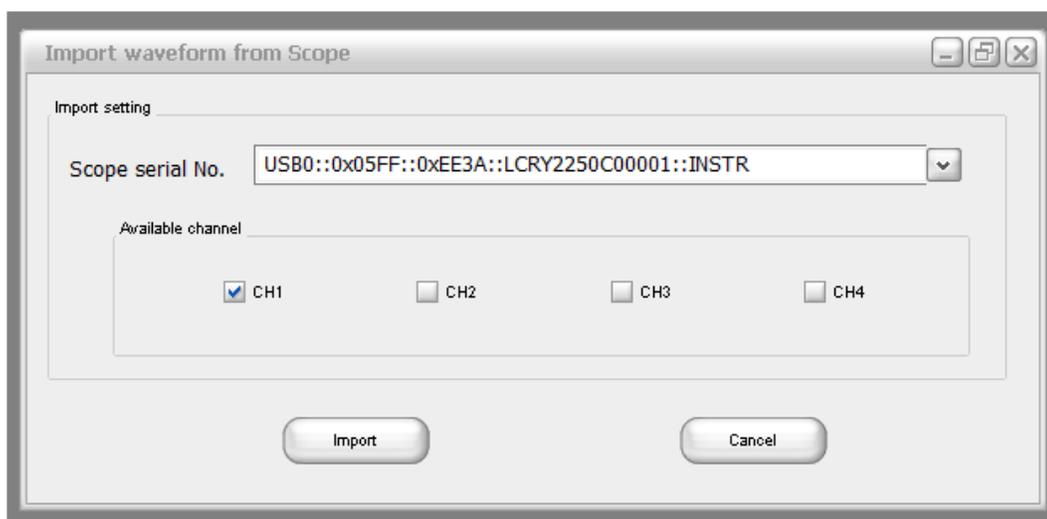
Figure 5: The Import Waveform from Scope dialog box displaying the WaveAce's serial number and providing for channel selection

5. A window will open in the WaveStation software showing the waveform imported from the WaveAce oscilloscope as shown in Figure 6.
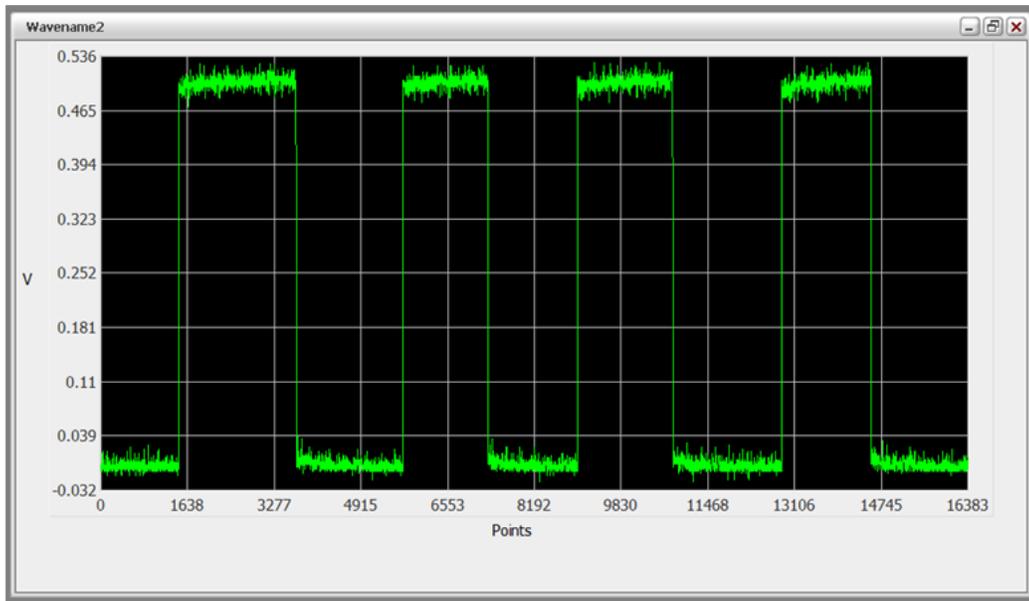
Figure 6: The waveform imported from the WaveAce oscilloscope as seen in the WaveStation software

6. Ensure that the WaveStation's USB port is enabled for a USBRAW connection as discussed earlier.

7. Click the Send Wave button at the bottom of the WaveStation software's interface. In the Send Wave dialog box, click Send.

8. On the WaveStation, ensure that the signal sent to the instrument is highlighted (it should be by default) and touch Select as shown in Figure 7.
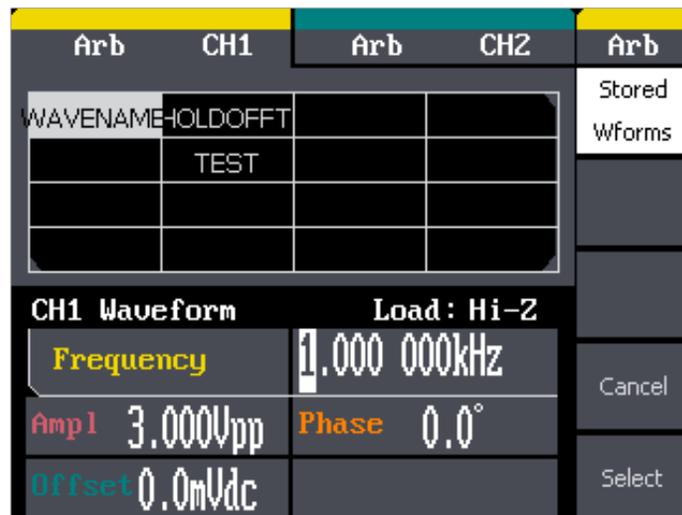
Figure 7: After executing the Send Wave command in the WaveStation software, the WaveStation instrument screen shows the file ready for opening

9. The signal from the WaveAce oscilloscope is now loaded into the WaveStation as shown in Figure 8. Compare this image with Figures 3 and 6.
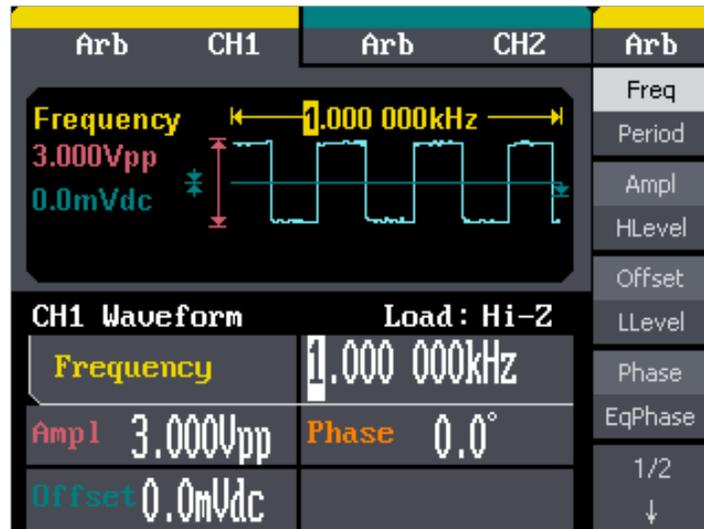
Figure 8: This screen capture from the WaveStation shows the imported waveform from the WaveAce oscilloscope as seen in Figures 3 and 6

Further Capabilities of WaveStation Software

A great feature of the WaveStation utility is its ability to create customized waveforms. Simply open a new file, which brings up a dialog box that allows naming the file and setting other parameters such as peak-to-peak voltage and frequency/period. From there, the waveform can be created, shaped, and edited with mathematical operators, digital filtering, point-by-point editing, and a waveform-drawing utility. The final result is pushed to the WaveStation waveform generator using the software's Send Wave function.

A further addition to the toolbox is LeCroy's WaveStudio software, a free connectivity tool that interfaces the WaveAce oscilloscope (or any LeCroy digital oscilloscope) to a PC running the Windows XP, Vista, or Windows 7 operating systems, with support for 32 and 64 bits. It provides a fast and easy way to analyze acquired waveforms offline, or remotely control the oscilloscope from your desktop.