

Discovering New Techniques of Creating, Editing, and Transferring Arbitrary Waveforms

with the Agilent U2761A Function/
Arbitrary Waveform Generator

Introduction

Today, during the designing of electronic components and circuits for computers, peripherals, and consumer electronic products, the pulse pattern generator is most likely the tool to be considered for device characterization. For most applications, the function/arbitrary generator is used to generate arbitrary waveforms and the resulting waveforms can be transferred into the device under test and analyzed through the device, confirming the proper operations or pinpointing a fault in the device.

Standard built-in waveforms in the instrument may not suit your application requirements and you may need a custom waveform to address your specific application tests. In some cases, you may even have an arbitrary waveform file and plan to reuse the waveform in other test system. Modern function/arbitrary generators normally present a flexible, versatile, and affordable solution to address the mentioned challenges.

Application Note



This application note will help you explore the features of the function/arbitrary generator such as creating a complex arbitrary waveform by using software, importing and reusing existing waveform files on the same instrument, and starting your instrument configuration programming easily with the free Command Logger and Code Converter functions.



Agilent Technologies

1 An easy way to generate your custom arbitrary waveform

The Agilent U2761A is a 20 MHz USB modular function generator with arbitrary waveform and pulse generation capability. The U2761A is able to produce ten standard waveforms such as sine, square, triangular, pulse, ramp, exponential, arbitrary waveforms, and sophisticated modulated waveforms for electronic functional testing and electronic troubleshooting.

The U2761A adopts the latest direct digital synthesis (DDS) technology that digitally creates arbitrary waveforms and frequencies from a single and fixed frequency source. DDS offers the precision of digitally controlled logic to increase the stability and accuracy of the output signal for clean, low distortion sine waves and square waves with fast rise and fall time of up to 20 MHz and linear ramp waves of up to 200 kHz.

In many practical applications, most engineers used the function/arbitrary waveform generator to define and to create their own custom arbitrary waveforms to suit their measurement requirements.

The Agilent Measurement Manager (AMM) software offers three built-in arbitrary waveforms that you can use immediately during measurements. The U2761A supports arbitrary waveforms up to 65536 (64K) data points. In this section, we will provide you an example on how to create and store a custom arbitrary waveform (Figure 1) by using the AMM.

The AMM is a graphical interface application software that provides a friendly soft front-panel interface, bundled with each USB modular product purchase. This helps you to configure your test system quickly, make measurements efficiently, and enable flexible analysis of your measured data.



Figure 1. An arbitrary waveform

1. Launch the AMM

Connect the U2761A to your PC and launch the AMM. The U2761A soft front-panel will appear.

2. Select the Generate Arbitrary Waveform function

Click  to select the Generate Arbitrary Waveform function.

3. Set the waveform period

Select **Period** from the waveform properties panel on the right. Select an appropriate waveform period.

For our example, we will set the period of our waveform to 10 ms.



4. Set the waveform voltage limits

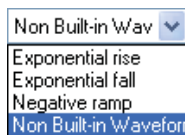
Select **HiLevel** and **LoLevel** to set the high and low voltage levels of the waveform. The upper limit must be greater than the lower limit.

For our example, we will set the upper limit and lower limit of our waveform to 2.0 V and 0 V respectively.



5. Start the Arbitrary Waveform Editor

Select **Non Built-in Waveform** from the arbitrary waveform preset drop down list and click  to start the *Arbitrary Waveform Editor*.



6. Select the interpolation method

Click  to enable or disable *linear interpolation* between the user-defined points. Interpolation is enabled by default and the waveform editor makes a straight-line connection between the points in this mode. If interpolation is disabled, the waveform editor maintains a constant voltage level between the points and creates a 'step-like' waveform.

7. Start waveform editing process

Click  to enable the freehand draw mode or  to enable the line draw mode. To enable or disable the grid reference, toggle . You can start drawing your desired waveform now.

To edit the waveform, click either  to add line(s) or point(s),  to edit point(s),  to delete point(s), or  to clear current arbitrary graph.

8. Send the waveform to the U2761A

Click  **Send Waveform** to send the waveform to the U2761A. Once the "Send waveform in progress" task has completed, the "Send waveform has completed message" will be displayed.

9. Save the waveform

To save the waveform for future use, click . Select **Compatible With Intuilink** and click **Ok**. Type an appropriate file name and click **Save** to save the file.

10. Exit from the waveform editor

To exit the waveform editor, click .

11. Generate the waveform from the U2761A

Click  to generate the arbitrary waveform from the U2761A.



Learn more about the Agilent
Measurement Manager at
www.agilent.com/find/AMM

CREATE YOUR CUSTOM WAVEFORM

With these few simple steps, you can now create an arbitrary waveform using AMM arbitrary waveform editor, and subsequently store or generate the waveform.

2 How to import IntuiLink waveform file to your U2761A

Next, we will show how you can easily upload the complex custom arbitrary waveform file, which you have created from the Agilent IntuiLink Waveform Editor software. You can import the waveform file through the AMM and generate the waveform for your measurement.

The Agilent IntuiLink Waveform Editor is a powerful standalone application for creating and editing arbitrary waveforms.

You can download the IntuiLink Waveform Editor, free of charge at www.agilent.com/find/IntuiLink.

Follow the steps on the right to import an IntuiLink waveform file to your AMM, and to generate the waveform from the U2761A.

Agilent Technologies, Inc. has made available a library of well-engineered arbitrary waveforms commonly used in the electronics industry for users of the Agilent U2761A. Whether you are working in R&D or manufacturing test, you can use the library as a head start in creating arbitrary waveforms that emulate real-world signals. The waveforms can be used directly, or they can be used as a reference to create the exact waveform for your application. The waveform files are in .CSV format and can be read by using the Agilent U2761A Waveform editor in the AMM software.

For more information or to download the waveforms, please visit www.agilent.com/find/U2761A.

1. Launch the AMM

Launch the AMM if you have already not done so. Connect the U2761A to your PC and launch the AMM. The U2761A soft front-panel will appear.

2. Select the Generate Arbitrary Waveform function

Click  to select the *Generate Arbitrary Waveform* function.

3. Upload your custom waveform file

Click  from the arbitrary waveform editor toolbar to select and locate your custom waveform (*.csv format) file. Click **Open** to upload the waveform to the AMM.

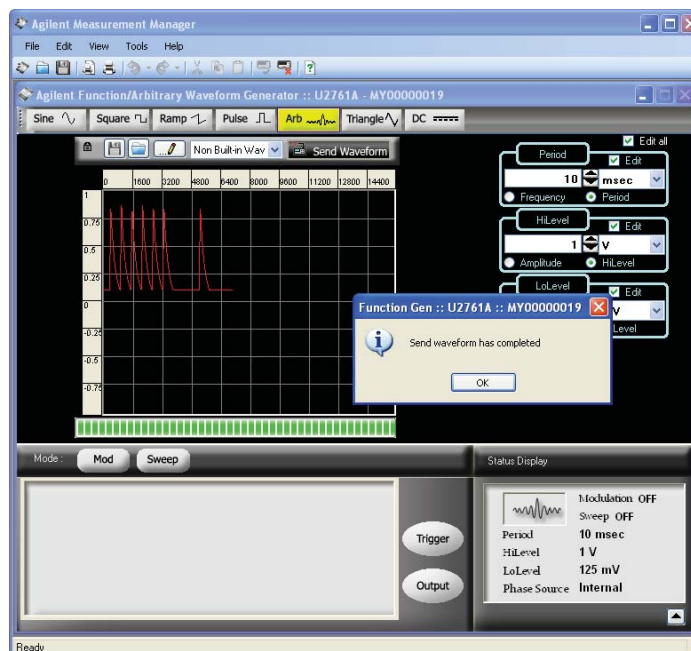
Once the waveform file has been successfully uploaded, the custom waveform will appear on the AMM Generate Arbitrary Waveform screen.

4. Send the arbitrary waveform to the U2761A

Click  to send your custom waveform to the U2761A. Once the “Send waveform in progress” task has completed, the “Send waveform has completed message” will be displayed.

5. Generate the waveform from the U2761A

Click  to generate the arbitrary waveform from the U2761A.



3 Additional tools to start your programming

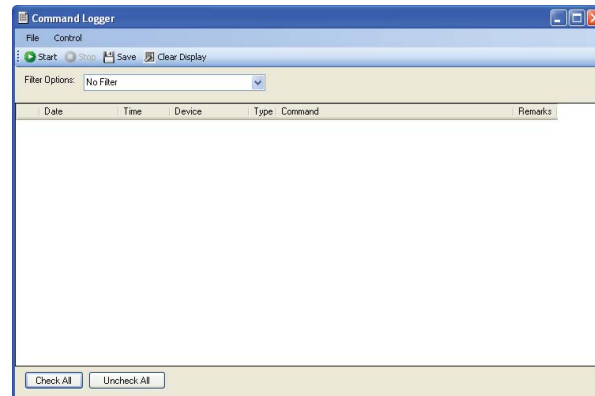
The AMM bundled along with your function/arbitrary waveform generator allows you to start performing measurements promptly without you having to write any programming codes. You can make additional use of the *Command Logger* and *Code Converter* functions provided with the AMM as tools to create your own unique program snippet.

The Command Logger function allows you to capture and review the SCPI commands sequence easily. The Code Converter helps to ease your programming tasks by converting the logged SCPI commands into snippets of Agilent VEE, or Microsoft® Visual Basic, Visual C++, or Visual C# codes.

Follow the steps below to enable the Command Logger and Code Converter functions.

1. Launch the Command Logger

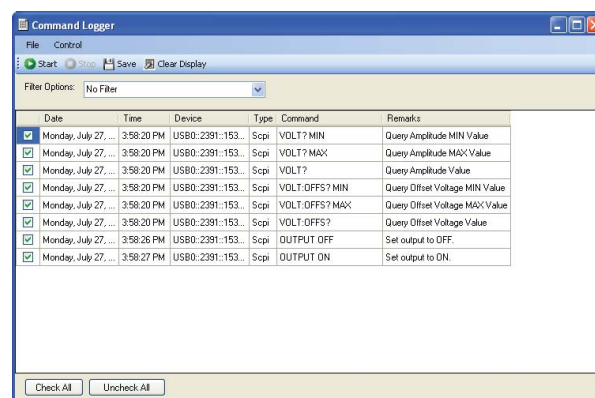
Launch the AMM if you have already not done so. From the AMM toolbar menu, click **Tools > Command Logger**. The Command Logger will appear.



2. Start the Command Logger

Click **Start** to start the device configuration SCPI command logging. Ensure that you have enabled the Command Logger before starting the device configuration.

The Command Logger is able to effectively capture all configuration commands in sequence. The time the command is executed is recorded as well. An example of the Command Logger screen with commands captured is shown below.



3. Save the logged commands

You need to save the commands recorded in the Command Logger first before you can use the Code Converter function to convert your configuration SCPI commands to a real programming code.

To save the file, click **Save**. Rename the file with an appropriate file name and click **Save** to store the file (*.clg format) in the default Command Logger folder.

4. Launch the Code Converter

Click **File > Convert Command File** to start the code conversion procedure.

The Convert Command window will appear. You can select to convert your codes to either the Agilent VEE 8.5 or to Microsoft Visual Basic 2005, Visual C# 2005, or Visual C++ 2005 language. Click **OK** once you have made your selection to proceed with the conversion.

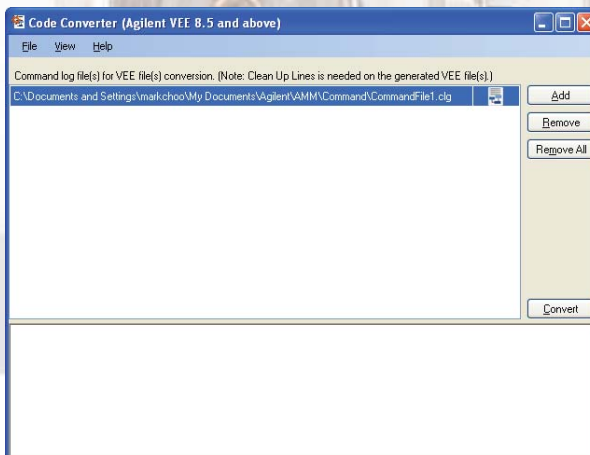


- If you chose Agilent VEE 8.5 as your desired software language, see “Converting to Agilent VEE” below.
- If you chose Microsoft Visual Basic 2005, Visual C# 2005, and Visual C++ 2005 as your desired software language, see “Converting to Microsoft Visual Basic, Visual C#, or Visual C++” on page 7.

Converting to Agilent VEE

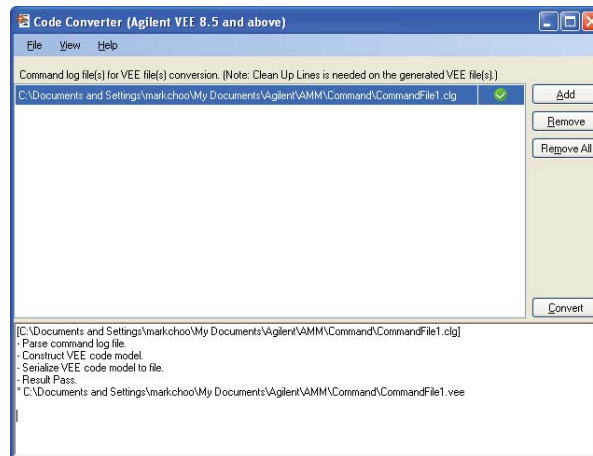
1. Select your saved command logger file

Click **Add** to select the command file to be converted. Locate your saved command logger file and click **Open**. The converted configuration SCPI command file path will be displayed on the Code Converter screen.



2. Complete the code conversion procedure

To complete the conversion into your desired output programming language, click **Convert**.

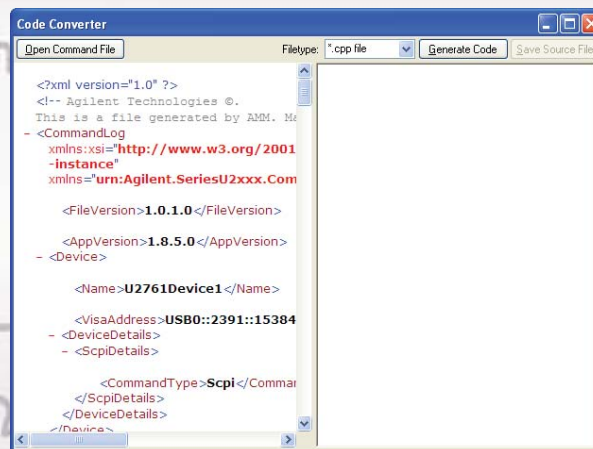


The converted command logger file (*.vee format) will be saved automatically in the default Command Logger folder.

Converting to Microsoft Visual Basic, Visual C#, or Visual C++

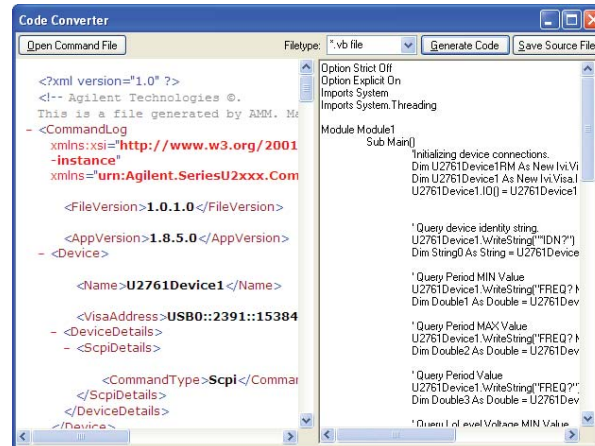
1. Select your saved command logger file

Click **Open Command File** to select the command file to be converted. Locate your saved command logger file and click **Open**. Your converted configuration SCPI command codes will be displayed on the Code Converter screen.



2. Complete the code conversion procedure

To complete the conversion into your desired output programming language, select your desired program file type (*.vb format for Visual Basic, *.cpp format for Visual C++, and *.cs for Visual C#) from the Filetype drop down menu and click **Generate Code**. The converted codes will appear in the right panel.

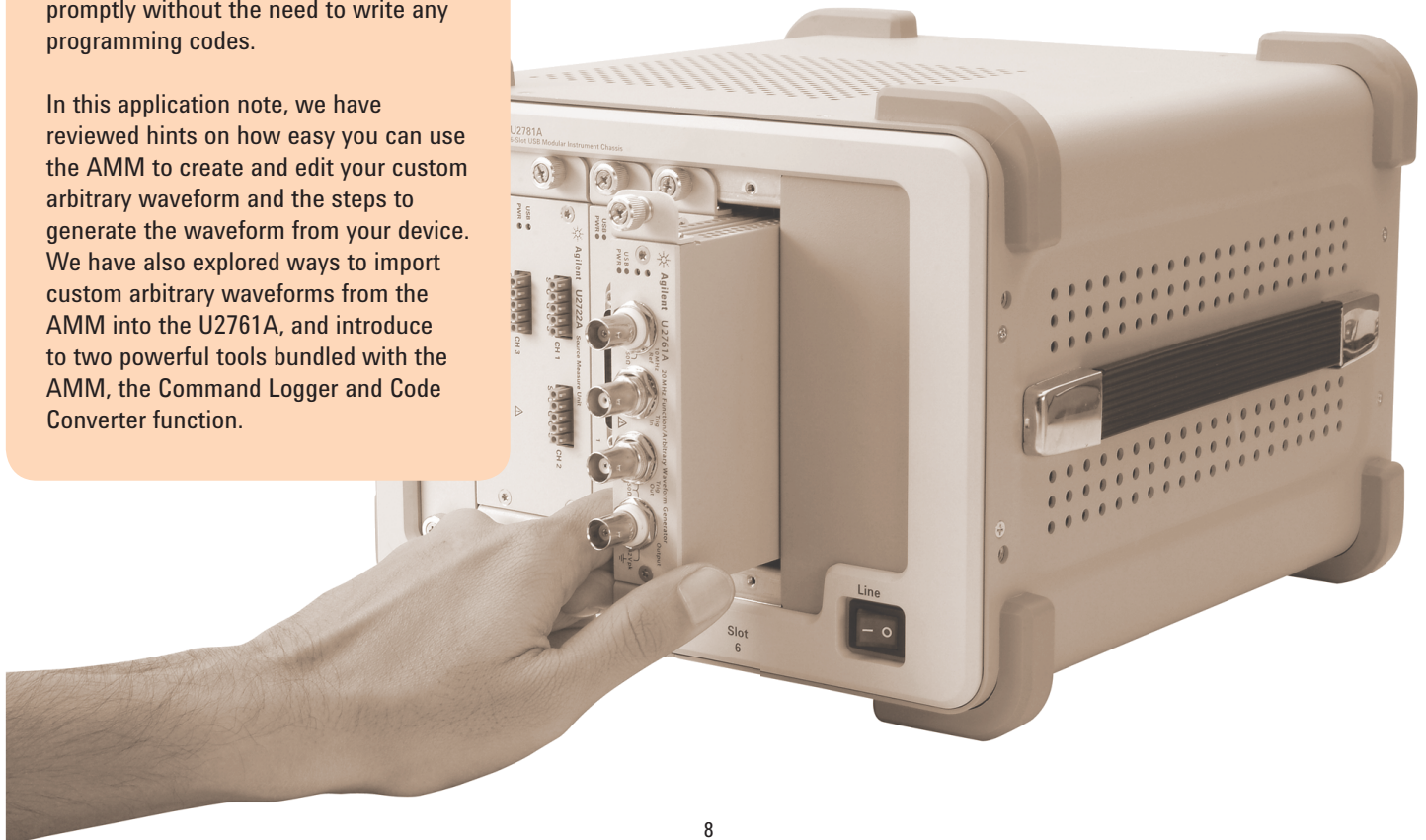


CONCLUSION

The U2761A function/arbitrary waveform generator offers a quick and easy way for you to create, edit, and download your arbitrary waveform. Ten different preset waveforms are provided for you to start performing your measurements promptly without the need to write any programming codes.

In this application note, we have reviewed hints on how easy you can use the AMM to create and edit your custom arbitrary waveform and the steps to generate the waveform from your device. We have also explored ways to import custom arbitrary waveforms from the AMM into the U2761A, and introduce to two powerful tools bundled with the AMM, the Command Logger and Code Converter function.

Click **Save Source File** to store your converted codes. Locate your desired folder destination and click **Save**.





Agilent Email Updates

www.agilent.com/find/emailupdates
Get the latest information on the products and applications you select.



Agilent Direct

www.agilent.com/find/agilentdirect
Quickly choose and use your test equipment solutions with confidence.



www.agilent.com/find/open
Agilent Open simplifies the process of connecting and programming test systems to help engineers design, validate and manufacture electronic products. Agilent offers open connectivity for a broad range of system-ready instruments, open industry software, PC-standard I/O and global support, which are combined to more easily integrate test system development.

Remove all doubt

Our repair and calibration services will get your equipment back to you, performing like new, when promised. You will get full value out of your Agilent equipment throughout its lifetime. Your equipment will be serviced by Agilent-trained technicians using the latest factory calibration procedures, automated repair diagnostics and genuine parts. You will always have the utmost confidence in your measurements. For information regarding self maintenance of this product, please contact your Agilent office.

Agilent offers a wide range of additional expert test and measurement services for your equipment, including initial start-up assistance, on-site education and training, as well as design, system integration, and project management.

For more information on repair and calibration services, go to:

www.agilent.com/find/removealldoubt

Product specifications and descriptions in this document subject to change without notice.

www.agilent.com

www.agilent.com/find/usbmodular

www.agilent.com/find/U2761A

For more information on Agilent Technologies' products, applications or services, please contact your local Agilent office. The complete list is available at:

www.agilent.com/find/contactus

Americas

Canada	(877) 894-4414
Latin America	305 269 7500
United States	(800) 829-4444

Asia Pacific

Australia	1 800 629 485
China	800 810 0189
Hong Kong	800 938 693
India	1 800 112 929
Japan	0120 (421) 345
Korea	080 769 0800
Malaysia	1 800 888 848
Singapore	1 800 375 8100
Taiwan	0800 047 866
Thailand	1 800 226 008

Europe & Middle East

Austria	01 36027 71571
Belgium	32 (0) 2 404 93 40
Denmark	45 70 13 15 15
Finland	358 (0) 10 855 2100
France	0825 010 700*
	*0.125 €/minute
Germany	07031 464 6333**
Ireland	1890 924 204
Israel	972-3-9288-504/544
Italy	39 02 92 60 8484
Netherlands	31 (0) 20 547 2111
Spain	34 (91) 631 3300
Sweden	0200-88 22 55
Switzerland	0800 80 53 53
United Kingdom	44 (0) 118 9276201

Other European Countries:

www.agilent.com/find/contactus

Revised: October 1, 2008

© Agilent Technologies, Inc. 2009
Printed in USA, December 11, 2009
5990-4570EN



Agilent Technologies