

MATLAB Demonstrations for your WaveMaster oscilloscope

What is MATLAB?

MATLAB is the language of technical computing.

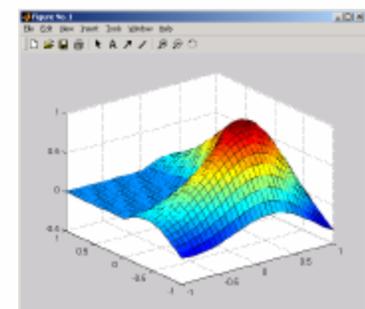
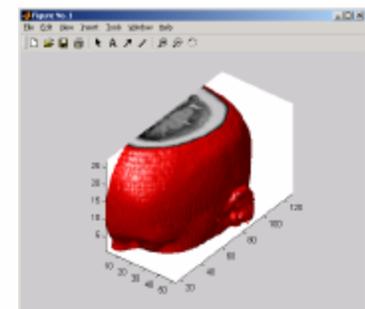
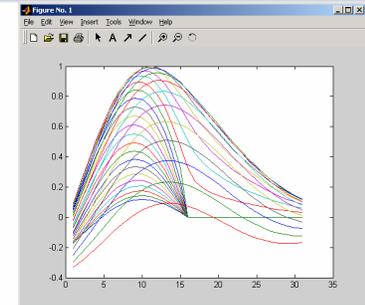
It includes functions for

- Analysis & visualization
- Algorithm development, modeling, and simulation

More than 60 application-specific toolboxes

Used for test and measurement applications

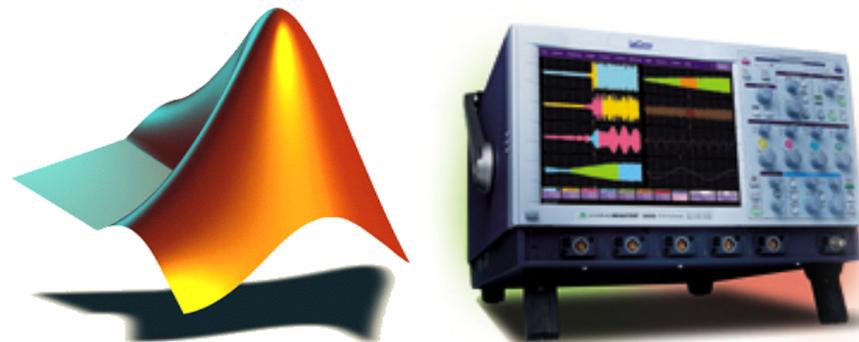
- As tools for engineers from R&D to factory floor
- To explore and present ideas, concepts, and methods



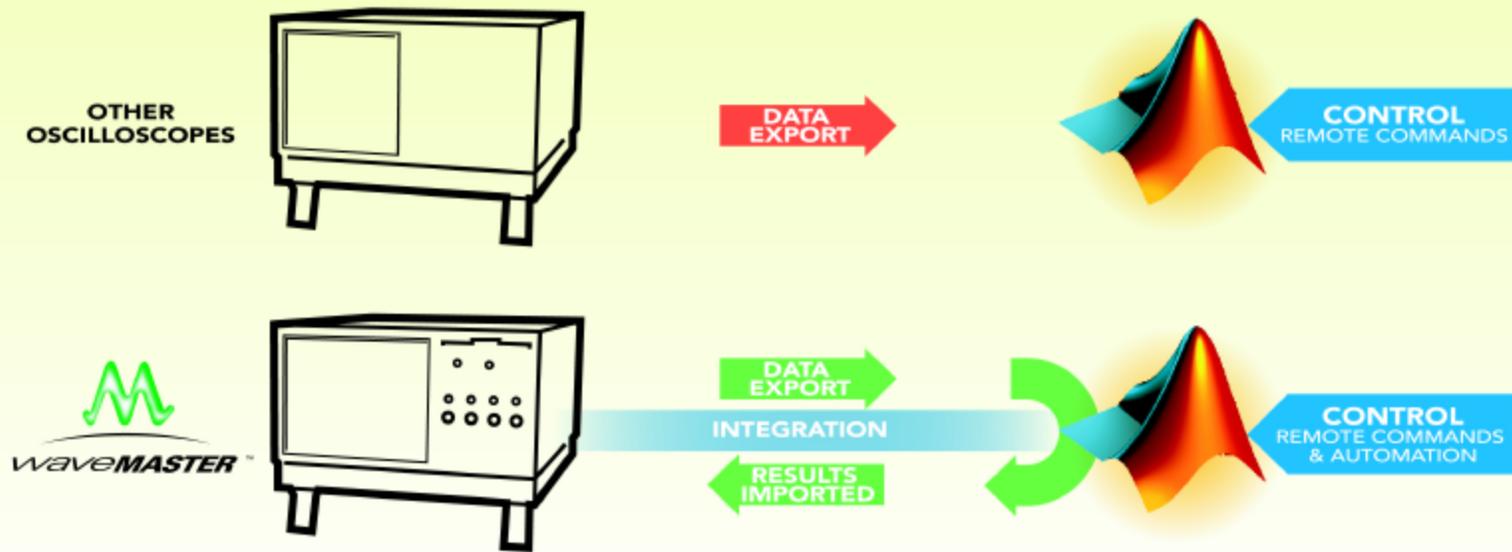
MATLAB is integrated with your WaveMaster DSO

MATLAB combines mathematical computing, visualization, and a powerful language to provide a flexible environment for technical computing.

With the WaveMaster XDEV option, MATLAB is completely integrated with your oscilloscope. Instead of exporting data to MATLAB, MATLAB integrates into your WaveMaster DSO seamlessly.



The LeCroy Difference using XDEV



Installing MATLAB:

1. Obtain your Personal License Passcode (PLP) from <http://www.mathworks.com/lecroy>.
2. Turn off any virus-checking software running on your oscilloscope.
3. Exit from any applications you have running.
4. Place the MathWorks product CD in your CD-ROM drive and follow the prompts. Be sure to select installation for MATLAB. Other products, such as the Signal Processing Toolbox, are also available for you to trial. Simply select them from the dialog box during the installation.

If you have any problems during installation, you can visit our support site at:
www.mathworks.com/support

Installing Demo Files and Read Me Info

1. Insert the MATLAB Demo File CD into the WaveMaster CD-ROM.
2. Exit from any other applications you have running
3. View the contents of the CD using Windows Explorer
4. Double click on the **Setup.exe** installer program
5. Follow the on-screen instructions. Do not change the default folder location.
6. After installation, you may access this presentation and guide electronically in the directory **MATLABDemosHelp**. The file name is **MATLAB-WaveMaster XDEV Intro**.

MATLAB on the WaveMaster DSO

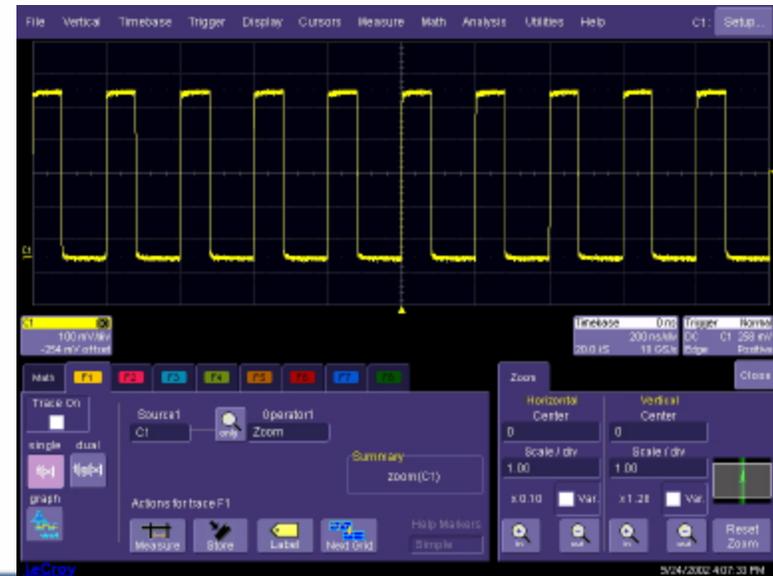
MATLAB can be directly integrated into the WaveMaster DSO in two ways:

- Using a function F1 through F8, MATLAB returns a waveform that is displayed inside the scope.
- Using a parameter P1 through P8, MATLAB returns a parameter that is displayed on the scope.

Example: Selecting a MATLAB Function

The following example illustrates how to select a MATLAB function:

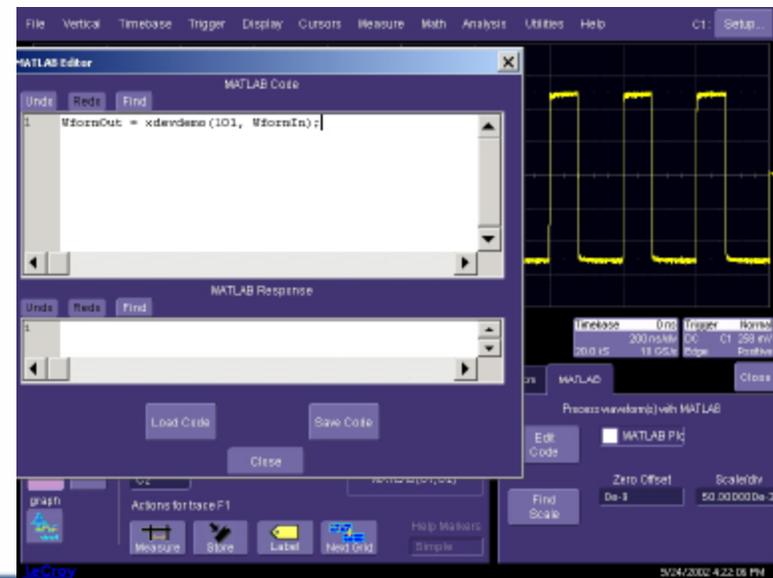
1. Connect the AUX OUT signal on the WaveMaster to Ch1.
2. On the WaveMaster Top Menu, select **Utilities, Utilities Setup**, and then select the **AUX Output** tab. Make sure that the amplitude is set to 1.0V and the frequency is set to 5 MHz.
3. Setup the WaveMaster to display about 10 square waves.
4. On the WaveMaster Top Menu, select **Math, F1 Setup**. You'll see the screen image on the right.



Selecting a MATLAB Function, continued

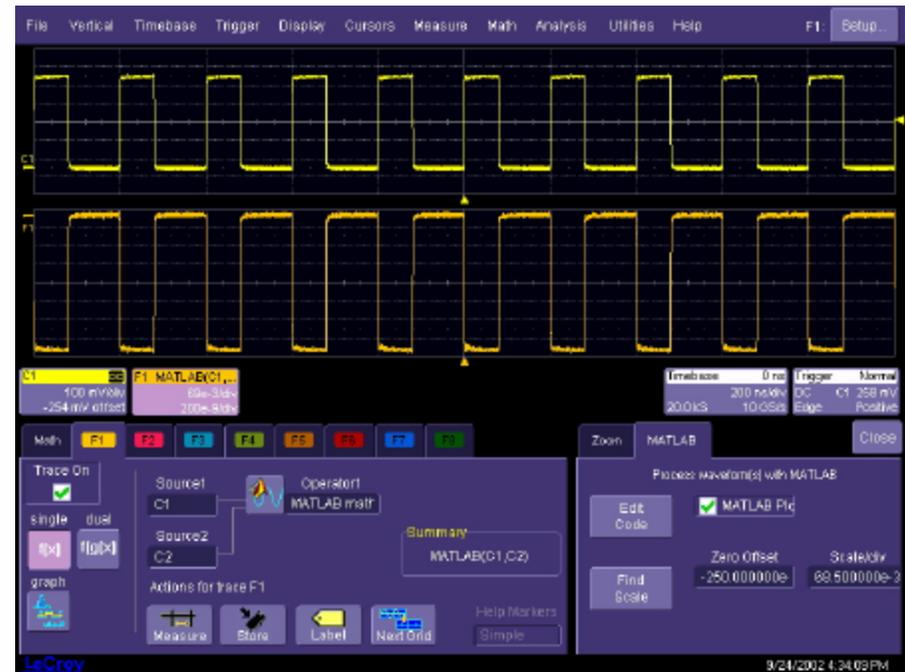
5. Select the **C1** as Source1, **None** as Source2, and select **MATLAB Math** as Operator1. (Note: MATLAB Math is contained in the Custom Category). The MATLAB program will open, so expect about a delay while this happens.
6. Select the **MATLAB tab** on the right hand dialog box, press **Edit Code**. Replace the existing text with the following:

```
WformOut = xdevdemo(101,WformIn1);
```
7. Press **Close**.



Selecting a MATLAB Function, continued

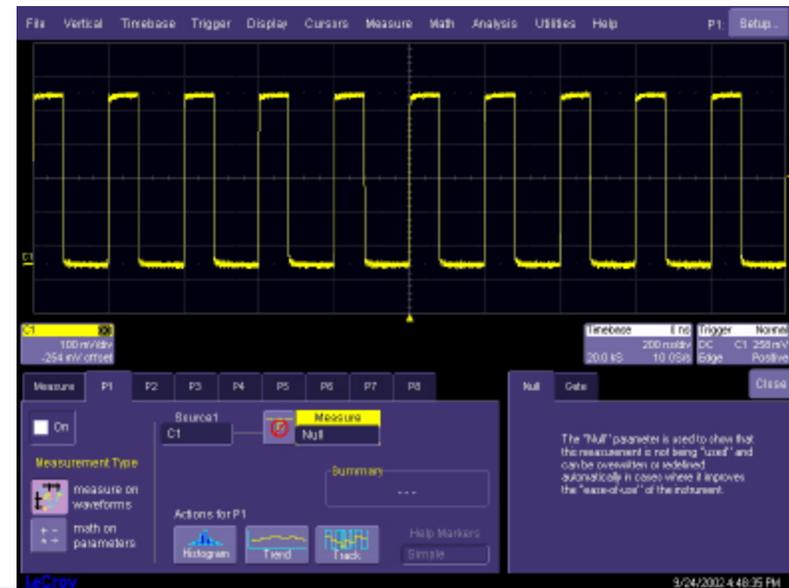
8. Turn the F1 trace ON by checking the check box on the left side of the dialog box.
9. The MATLAB calculated waveform will appear on the scope display. Note that you may have to press Find Scale to properly scale the waveform.
10. Other MATLAB demonstration functions may be integrated by changing the MATLAB command line to call a different demo function, or you may write your own MATLAB functions. Reference the tables on the following pages for numbers and descriptions of other demo MATLAB functions.



Selecting a MATLAB Parameter

The following example illustrates how to select a MATLAB parameter:

1. On the WaveMaster Top Menu, select **Utilities, Utilities Setup**, and then select the **AUX Output** tab. Make sure that the amplitude is set to 1.0V and the frequency is set to 5 MHz.
2. Setup the WaveMaster to display about 10 square waves.
3. On the WaveMaster Top Menu, select **Measure, My Measure**, and the **P1 Tab**. You'll see the screen image on the right:



How to Select a MATLAB Parameter, continued

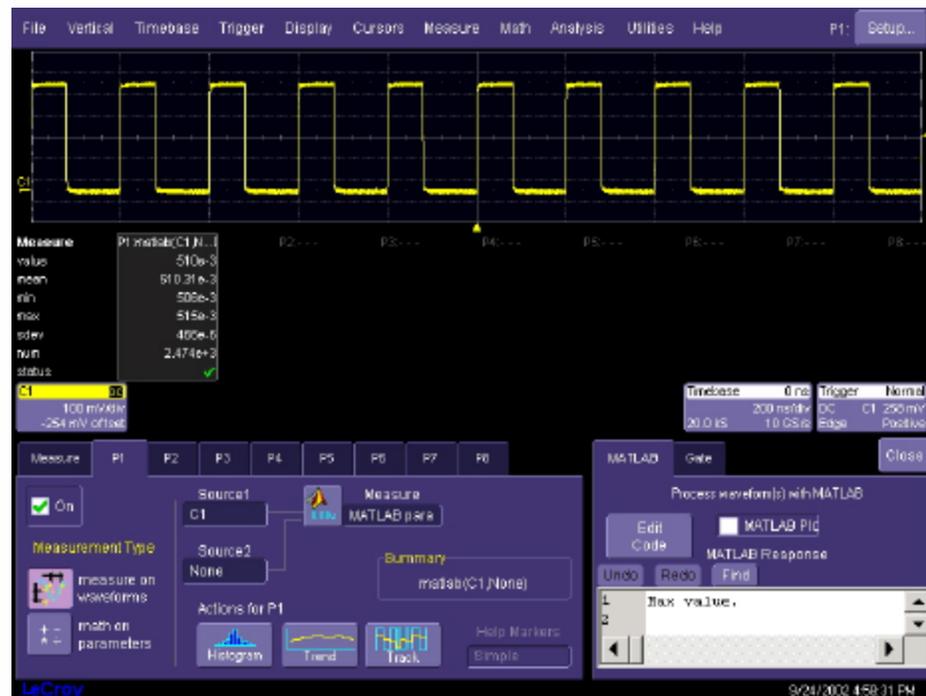
4. Select the **C1** as Source1, **None** as Source2, and select **MATLAB Parameter** as Operator1. (Note: MATLAB Parameter is contained in the Custom Category). The MATLAB program will open, so expect about a delay while this happens.
5. Select the **MATLAB tab** on the right hand dialog box, press **Edit Code**. Replace the existing text with the following:

```
ParamOut = xdevdemo(506,WformIn1);
```
6. Press **Close**.



How to Select a MATLAB Parameter, continued

7. Turn the P1 parameter ON by checking the check box on the left side of the dialog box.
8. The MATLAB calculated parameter will appear on the scope display. In the top menu, select **Measure, Statistics On** to view statistics.
9. Other MATLAB parameter demos may be integrated by changing the MATLAB command line to call a different demo parameter, or you may write your own MATLAB parameters. Reference the tables on the following pages for numbers and descriptions of other demo MATLAB parameters.



MATLAB Demonstration Files

The MATLAB demo files for your WaveMaster DSO, include examples for:

1. Manipulating and analyzing waveforms
2. Filtering
3. Finding primary sinewaves
4. Frequency domain analysis
5. Parameter calculations

The MATLAB demo functions and parameters are located in your WaveMaster **USERDATA** (D:\Scripts) directory.

Example Functions

The following is a list of available example functions for your WaveMaster oscilloscope. To try any of the functions, simply reference the Code Example at the bottom of each list.

Waveform manipulation and analysis

Demo Number	Description
101	Invert the waveform
102	Square the waveform
103	Create a square wave pulse
104	Create a pulse at zero crossing
105	Find zero crossing times with interpolation

Code Example:

```
wformOut = xdevdemo(101, wformIn1);
```

Filtering

Demo Number	Description
201	Low pass filter
202	Band pass filter
203	High pass filter

Code Example:

```
WformOut = xdevdemo(201, WformIn1);
```

Finding Primary sinewaves

Demo Number	Description
301	Recover primary sinewave
302	Remove primary sinewave
303	Recovers multiple primary sinewaves
304	Alternative method for same calculation as demonstration 303.

Code Example:

```
WformOut = xdevdemo(301, WformIn1);
```

Frequency Domain Analysis

Demo Number	Description
401	Power spectral density
402	Power spectral density with zero padding

Code Example:

```
WformOut = xdevdemo(401, WformIn1);
```

Parameter Calculation

Demo Number	Description
501	Ration of points above 0.5V
502	Standard deviation
503	Mean
504	Variance
505	Median
506	Max
507	Min

Code Example:

```
ParamOut = xdevdemo(501, WformIn1);
```

Additional Examples:



MATLAB CENTRAL

The MATLAB Central File Exchange contains hundreds of files contributed by MATLAB users and developers.

www.mathlabcentral.com

More Information

To get help on how to write your own MATLAB functions:

1. Start MATLAB by going to your Windows desktop and double clicking on the MATLAB icon.
2. Type `help` at the command prompt or use the “help” menu.
3. In order to see a list of demos type `demo` at the command prompt.

To learn more about using MATLAB with your WaveMaster DSO:

Go to WaveMaster **HELP**, select **Contents**, **Customization**, then **Calling MATLAB**.

Questions or Comments?

Thank you for evaluating MATLAB.

For questions or comments about installing and using your MATLAB evaluation, contact us at the following:

E-mail: support@mathworks.com

Web: www.mathworks.com/support

To speak with a MathWorks sales representative, call:

US/Canada: 508-647-7000 and press 3

Outside the US: visit our Web site for international office information