

The IMSL[®] Library for C

Getting Started Guide – A Technical Guide by Rogue Wave Software



www.roguewave.com



The IMSL[®] Library for C Getting Started Guide

by Rogue Wave Software

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Screen shots are provided throughout this document, whenever possible, to provide clarity to the instructions. Note that not all versions of Windows have the same user interface. Adjustments must be made accordingly.

Installing IMSL Library for C

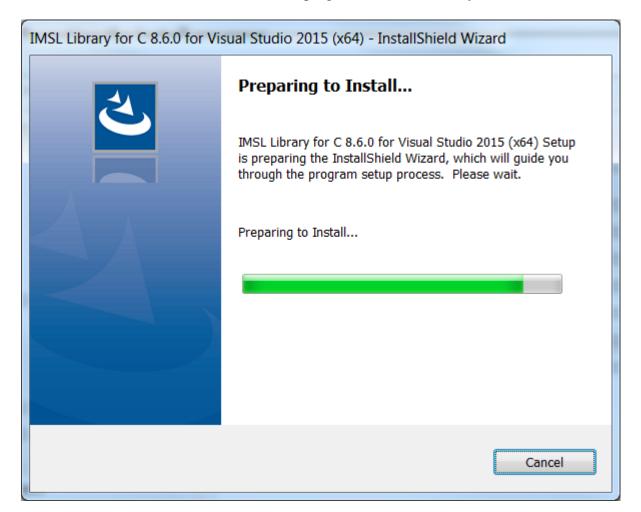
Executing the install program

After you have downloaded the product from the FTP site, unzip the file into a temporary folder, then run "setup.exe" from that folder. You may have to run the Setup program with administrator privileges, depending on your User Account Control settings. To do this, right-click on setup.exe and choose, "Run as administrator".



Welcome

The first window introduces the installation program for IMSL Library for C.





Product Selection

Verify that the proper product for the appropriate version of the compiler is being installed. Press Next> to continue.

IMSL Library for C 8.6.0 for Visual	Studio 2015 (x64)
Rogue Wave Software, Inc.	
Select the desired version of the	IMSL Library for C from the options below.
IMSL LIbrary for C for Visual S	<u>Studio 2015 (x64)</u>
InstallShield	< Back Next > Cancel



MKL/CUDA Acknowledgement

Two enhanced performance versions of IMSL Library for C, MKL-enabled and NVIDIA® CUDA-enabled, are included with the installation. This screen informs you that the MKL and CUDA redistributables are not covered by the IMSL end-user license agreement. Press Yes to continue with the installation program.

IMSL Library for C 8.6.0 for Visual Studio 2015 (x64)	X
MKL and NVIDIA CUDA(TM) Information	No.
Press the PAGE DOWN key to see the rest of the agreement.	
The user can optionally install two additional versions of the IMSL Library for C. Both versions of the Library are installed if this option is chosen. The MKL-enabled version of the MSL Library for C leverages the Intel(R) Math Kernel Library (MKL) to enhance performance in functions that use BLAS, FFTs, or LAPACK routines. Note that MKL is not covered by the IMSL License Agreement. Go to www.intel.com to obtain more information on Intel's MKL License Agreement. The CUDA-enabled version of the IMSL Library for C leverages NVIDIA	
Do you want to continue with the installation?	<u>P</u> rint
< <u>B</u> ack <u>Y</u> es	No



Installation Option

You can select to install only the IMSL version of the product or the two performance versions as well.

IMSL Library for C 8.6.0 for Visual Studio 2015 (x64)	X
Rogue Wave Software, Inc.	
Select the IMSL Library for C from the options below.	
Install MKL-enabled, CUDA-enabled, and IMSL versions of CNL 8.6.0	
Install only the IMSL version of CNL 8.6.0	
TestallChield	
InstallShield <u>Back</u> <u>N</u> ext>	Cancel



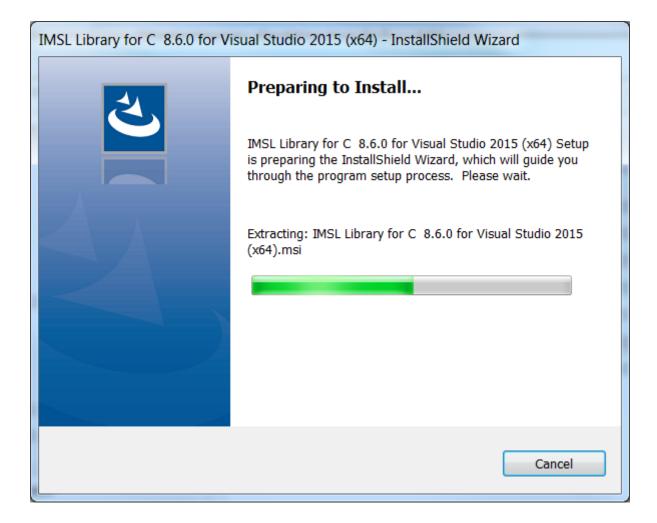
Environment Variable Registration

You are prompted to automatically update environment variables required to use the IMSL Library for C. It is recommended that you perform this update.

System Co	mfiguration Option
?	Setup can automatically update several environment variables in the system registry. For use of the IMSL Library for C within the Visual Studio IDE (Integrated Development Environment), it is recommended that you allow this update. Do you want setup to automatically update the environment variables?
	<u>Y</u> es <u>N</u> o



Installation Start Screen





Initiate the Installation

Press Next > to initiate the installation.

IMSL Library for C 8.6.0 for Vi	sual Studio 2015 (x64)
	Welcome to the InstallShield Wizard for IMSL Library for C 8.6.0 for Visual Studio 2015 (x64) The InstallShield Wizard will install IMSL Library for C 8.6.0 for Visual Studio 2015 (x64) on your computer. To continue, click Next.
	< <u>B</u> ack <u>Next</u> > Cancel



License Agreement

This screen presents the end user license agreement. When you have read the contents and agreed, press Yes to continue the installation.

IMSL Library for C 8.6.0 for Visual Studio 2015 (x64)
License Agreement Please read the following license agreement carefully.
Press the PAGE DOWN key to see the rest of the agreement.
Rogue Wave® Software License Agreement IMSL® C Numerical Library, IMSL® C# Numerical Library, JMSL™ Numerical Library and IMSL® Fortran Numerical Library (March 2015) IMPORTANT - READ CAREFULLY: THIS SOFTWARE LICENSE AGREEMENT IS A LEGAL AGREEMENT BETWEEN YOU AND ROGUE WAVE SOFTWARE, INC. IF YOU ARE INSTALLING THE SOFTWARE FOR PERSONAL USE, THIS AGREEMENT APPLIES TO AND BINDS YOU PERSONALLY. IF YOU ARE INSTALLING THE SOFTWARE AS PART OF YOUR WORK FOR AN ORGANIZATION, THIS AGREEMENT APPLIES TO AND BINDS SUCH ORGANIZATION. "LICENSEE" OR Do you accept all the terms of the preceding License Agreement? If you select No, the setup will close. To install IMSL Library for C 8.6.0 for Visual Studio 2015 (x64), you must accept this agreement. InstallShield
< <u>B</u> ack <u>Y</u> es <u>N</u> o



Confirm MKL/CUDA Installation

If installation of the MKL/CUDA enhanced IMSL Library for C was chosen during the selection process, the installation verifies that this was intended.

IMSL Library for C 8.6.0 for Visual Studio 2015 (x64)	X
MKL-enabled and CUDA-enabled Library Information	
Press the PAGE DOWN key to see the rest of the agreement.	
You have chosen to install two additional versions of the IMSL Library for C. The MKL-enabled version of the IMSL Library for C leverages the Intel(R) Math Kernel Library (MKL) to enhance performance in functions that use BLAS, FFTs, or LAPACK routines. Note that MKL is not covered by the IMSL License Agreement. Go to www.intel.com to obtain more information on Intel's MKL License Agreement. The CUDA-enabled version of the IMSL Library for C leverages NVIDIA CUDA toolkit to enhance performance in functions that use BLAS or FFT routines.	
Do you want to continue with the installation? <u>Print</u> InstallShield	
< <u>B</u> ack <u>Y</u> es <u>N</u> o	



License Number

If you have a license number, enter it at this point. If you do not yet have a license number, or are evaluating the product, input 999999. Press Next> to continue.

I	ASL Library for C 8.6.0 for Visual Studio 2	2015 (x64)		X
	Registration			
	Enter your Rogue Wave license number.			
	999999			
I	nstallShield	< <u>B</u> ack	<u>N</u> ext >	Cancel



Installation Directory

Set the directory where the IMSL Library for C will be installed. The default is C:\<Program Files>\VNI. Use the Browse button to select an alternate location. You may be prompted to create a directory if it does not exist. Press Install> when you are satisfied with the selection.

IMSL Library for C 8.6.0 for Visual Studio 2015 (x64)	X
Choose Destination Location Select folder where setup will install files.	
Setup will install IMSL Library for C 8.6.0 for Visual Studio 2015 (x64) in the following fold	der.
To install to this folder, click Next. To install to a different folder, click Browse and select folder.	t another
Destination Folder	
C:\Program Files (x86)\VNI\	Browse
InstallShield	
< <u>B</u> ack Install >	Cancel



Installation progress

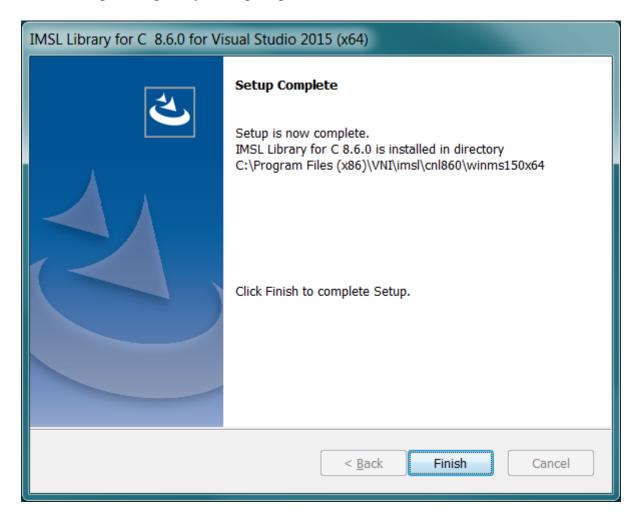
You are updated as the installation proceeds.

IMSL Library for C 8.6.0 for Visual Studio 2015 (x64)	X
Setup Status	
IMSL Library for C 8.6.0 for Visual Studio 2015 (x64) is configuring your new software installation.	
Copying new files	
InstallShield Canc	el



Installation Complete

When the setup is complete, you are prompted to click the Finish button.



Restart

Depending on your system, you may be prompted to restart your computer to properly configure the environment variables. Select the appropriate selection to restart now or later.



License Key Setup

This step is necessary only if you have an evaluation copy of IMSL Library for C.

Create the License File

Using a text editor, create the license file <install_dir>\license\imsl_eval.dat, where <install_dir> is the directory in which IMSL Library for C has been installed. Then, cut and paste the contents of the file you received via e-mail from the Rogue Wave License Administrator.

Note: If due to local conventions or personal choice you do not wish to use the default license file name, set the environment variable IMSL_LIC_FILE to point to the license file name and the location of your choice. (<path>\<name>)



Using the IMSL Library for C

Documentation

Documentation is supplied in both Portable Document Format (PDF) files and HTML files.

The PDF documentation system requires the use of Adobe Systems Incorporated Acrobat Reader(R) 9.0 or later. This software is available at no charge and can be downloaded from the web site www.adobe.com.

To access the documentation, select

Start \rightarrow All Programs \rightarrow Rogue Wave Software \rightarrow IMSL C Numerical Library User's Guide. Choose the desired documentation from the displayed screen.



If your filename associations for PDF files are not set you may prefer starting Acrobat Reader and opening the file(s) C_Math_Library.pdf and C_Stat_Library.pdf located in the <install_dir>\imsl\cnl860\help\pdf subdirectory.

Creating a program

This simple example program solves the following system of linear equations:

```
33x + 16y +72z =129
-24x -10y-57z= -96
18x -11y +7z =8.5
```

Copy the following text into an editor and save the file as cnl.c.

```
/* Program start */
/* The header file for Mathematics of the IMSL Library for C. */
/* For Statistics, use <imsls.h>. */
#include <imsl.h>
main()
{
    /* variable declaration */
    int n = 3;
    float *x;
    static float a [ ] = {33.0, 16.0, 72.0,
                          -24.0, -10.0, -57.0,
                          18.0, -11.0, 7.0;
    static float b [ ] = {129.0, -96.0, 8.5};
    float *p inva;
    /* The main IMSL function call to solve for x in Ax=B.
     * This is the floating point version, to use
     * double-precision arguments, call
     * imsl d lin sol gen */
    x = imsl f lin sol gen(n, a, b, 0);
    /* Optional arguments are included after required
     * arguments. These are usually preceded by a constant
     * named IMSL * indicating which optional argument is
     * being passed. In this example, we request the
     * inverse of the a matrix */
    x = imsl f lin sol gen(n, a, b, IMSL INVERSE, &p inva, 0);
```

```
/* Print the solution x and the inverse of a using
        * write_matrix, a printing utility */
        imsl_f_write_matrix("Solution x", 1, n, x, 0);
        imsl_f_write_matrix("Inverse of A", n, n, p_inva, 0);
}
/* Program end */
```

Run the Example from the Command Prompt

Setting the Environment Variables

The environment variables may be set automatically at installation time. If you chose not to set up the environment automatically, you must run the cnlsetup.bat batch file from the <install_dir>\imsl\cnl860\<env>\bin folder in the IMSL Library for C installation location.

Compile the program from the command line

To use the cl command line compiler, start the Visual Studio 20xx .NET Command Prompt from the Start Menu: Start \rightarrow All Programs \rightarrow Microsoft Visual Studio 20xx \rightarrow Visual Studio Tools \rightarrow Visual Studio 20xx Command Prompt.

Compile the program

Dynamic Library

cl cnl.c \$LINK_CNL_SHARED

Static Library

cl cnl.c \$LINK_CNL_STATIC



Execute the Program

./cnl.ex	e					
		Solution x				
	1 1.0	2 1.5		1.0	3	
		Inverse of A				
1 2 3	0.1464 0.1802 -0.0933	1 0.1899 0.2237 -0.1367	2 0.0403 -0.0321 -0.0113			3

For more information, refer to the readme files in <install_dir>\imsl\cnl860\<env>\notes.

Run the Example From Visual Studio

• Start the Microsoft Visual Studio 20xx Developer Environment

Start \rightarrow All Programs \rightarrow Microsoft Visual Studio 20xx \rightarrow Visual Studio 20xx



• From the Microsoft Visual Studio 20xx Developer Environment create a new project:

File \rightarrow New \rightarrow Project

- Choose the template Visual C++ → Win32 Console Application.
- Change the name and location of the project as needed.
- Verify that the "Create directory for solution" box is checked.
- Click OK.

New Project					? <mark>×</mark>		
▶ Recent		.NET Framework 4.5 Sort by: Default			🚽 📰 📃 Search Installed Templ 🔎 -		
 Installed 		<u></u>	Win32 Console Application	Visual C++	Type: Visual C++		
 Templates Visual Basic Visual C# Visual C++ ATL CLR General MFC Test Win32 Visual F# SQL Server TypeScript Python Other Project T Samples 	- Types		MFC Application Win32 Project Empty Project Makefile Project	Visual C++ Visual C++ Visual C++ Visual C++	A project for creating a Win32 console application		
▷ Online			Click here to go online and	find templates.			
Name: ConsoleApplication2							
Location:	c:\RogueWave\d	locument	s\visual studio 2013\Projects	Browse			
Solution na <u>m</u> e:	cnl				Create <u>directory</u> for solution Add to so <u>u</u> rce control OK Cancel		



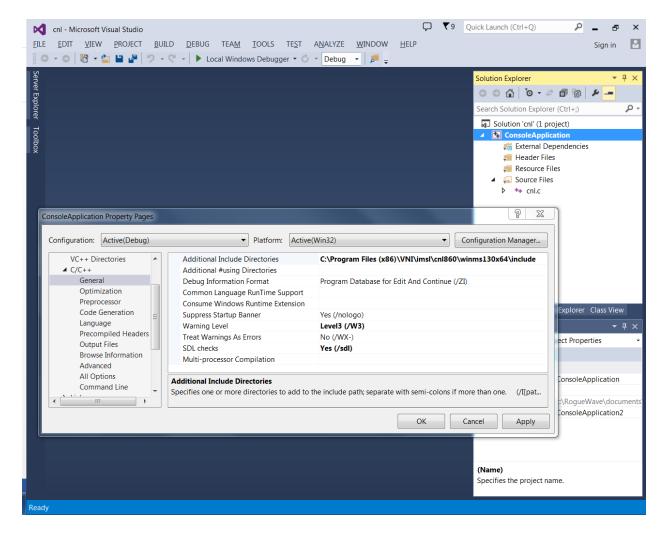
• From the "Win32 Application Wizard" window that is created click on "Application Settings". Choose "Empty Project" and then click "Finish".

Win32 Application Wizard - ConsoleApplication1										
Application Settings										
Overview	Application type:		header files for:							
Application Settings	 <u>Windows application</u> Console application 									
	Static library									
	Additional options:									
	Empty project									
	Export symbols									
	Precompiled header Security Development Lifecyde (SDI)								
	Security Development Lifecyde (checks									
		< Previous Next	> Finish	Cancel						
	and the second s									

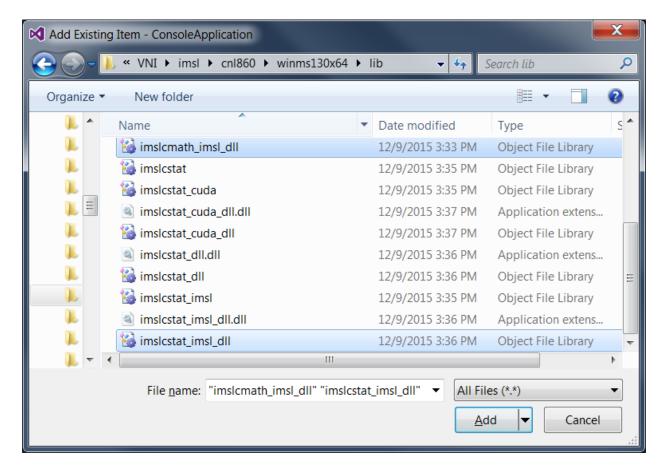
- Add Source Code to the Project:
 - From Solution Explorer right click on the project name.
 - Choose Add \rightarrow Existing Item.
 - Browse to and select the C source file you created above and click Add.



- Add the include files directory to the project:
 - From Solution Explorer right click on the project name Choose Properties
 - Choose Configuration Properties \rightarrow C/C++ \rightarrow General
 - To the right of "Additional Include Directories" add the pathname to the appropriate include files <install_dir>\imsl\cnl860\<env>\include
 - Click OK



- Add the libraries to the project:
 - From Solution Explorer right click on the project name.
 - Choose Add \rightarrow Existing Item.
 - Browse to the directory <install dir>\imsl\cnl860\<env>\lib.
 - Choose the files imslcmath_imsl_dll.lib and imslcstat_imsl_dll.lib.
 - Click "Add".



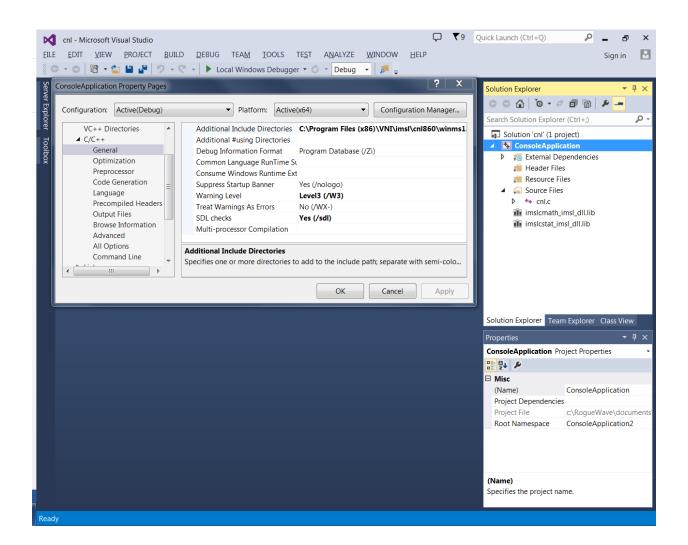


• Copy the Win32 project settings into an x64 project configuration:

Note: This step is not necessary if you are using a 32-bit version of IMSL Library for C.

- From Solution Explorer right-click on the project name.
- Choose Properties.
- Click Configuration Manager to open the Configuration Manager Dialog Box.
- Click the Active Solution Platform list, and then select the <New...> option to open the New Solution Platform Dialog Box.
- Click the Type or select the new platform drop-down arrow, and then select the x-64 platform.
- Click OK. The platform you selected in the preceding step will appear under Active Solution Platform in the Configuration Manager dialog box.
- Click Close in the Configuration Manager dialog box, and then click OK in the Property Pages dialog box.





• Build the solution

From the Microsoft Visual Studio tabs choose Build \rightarrow Build Solution

• Run the program

From the Microsoft Visual Studio tabs click Debug \rightarrow Start Without Debugging

• View the output

Microsoft Visual Studio creates a console window displaying the output



C:\Windows\system32	\cmd.exe		A	a design of the second s		X			
Solution x									
1	2	3				Ξ			
1.0	1.5	1.0							
Inv	Inverse of A								
1	2	3							
1 0.1464	0.1899	0.0403							
2 0.1802	0.2237								
	-0.1367								
Press any key to continue									
					Second second				

For more information, refer to the readme files in
<install_dir>\vni\imsl\cnl860\<env>\notes.

