



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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Installing IMSL Library for C

1. Executing the install program

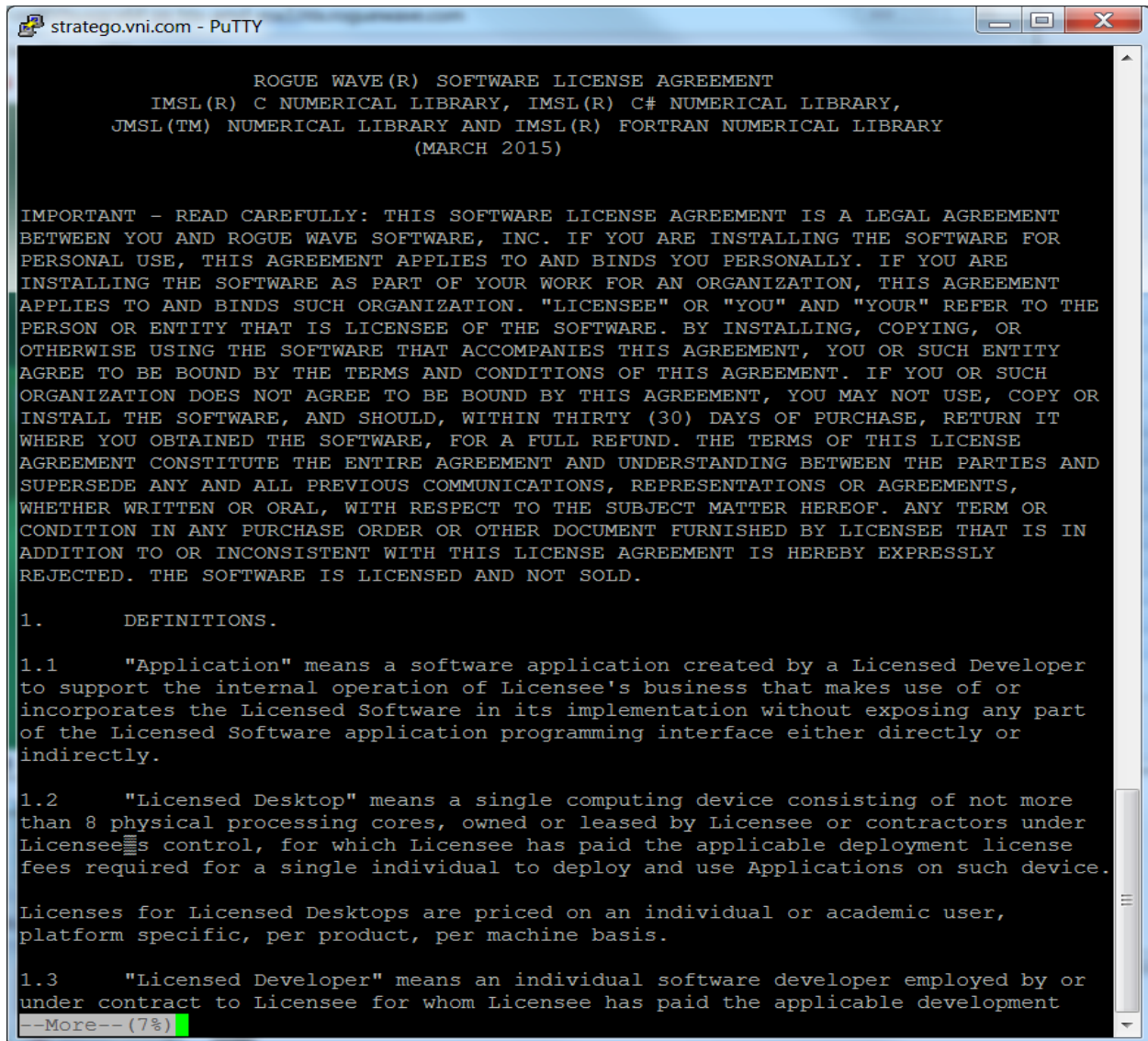
With downloaded files

Confirm you have the appropriate tar file for the hardware platform and operating system. The `<tarfile>` in the commands below have a name like `cn1860rdhgc483x64.tar`. Execute the following commands from the directory that contains the downloaded archive:

```
tar xf <tarfile>
imsl/install/imsl_install
```

2. License Agreement

This screen presents the end user license agreement. Press the <space bar> to scroll through to read the contents.



```
stratego.vni.com - PuTTY

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      IMSL (R) C NUMERICAL LIBRARY, IMSL (R) C# NUMERICAL LIBRARY,
      JMSL (TM) NUMERICAL LIBRARY AND IMSL (R) FORTRAN NUMERICAL LIBRARY
      (MARCH 2015)

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incorporates the Licensed Software in its implementation without exposing any part
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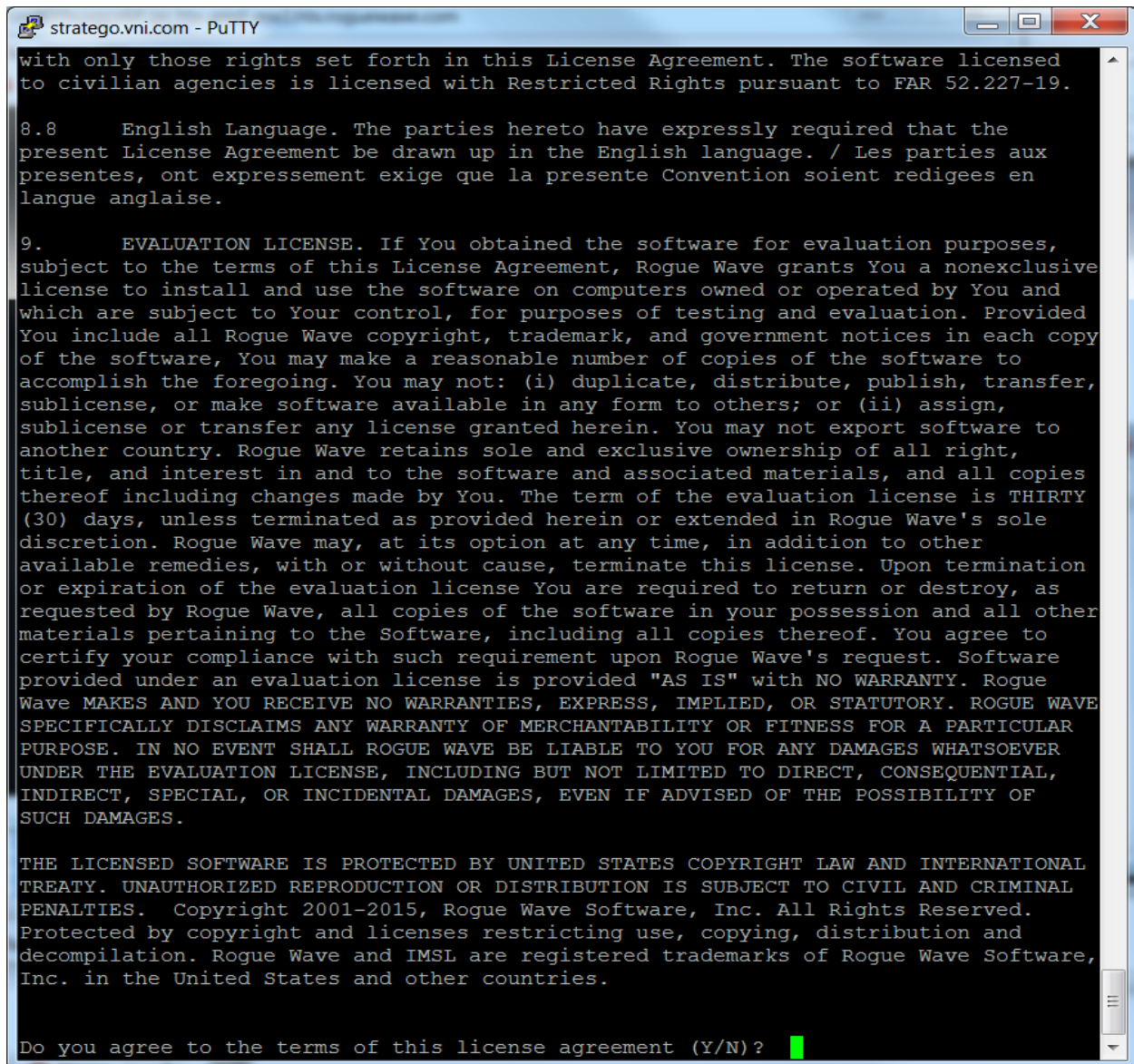
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under contract to Licensee for whom Licensee has paid the applicable development
--More-- (7%)
```

3. License Agreement, Continued

When you reach the end of the license agreement, enter “y” and press <Enter> to continue the installation.



```
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langue anglaise.

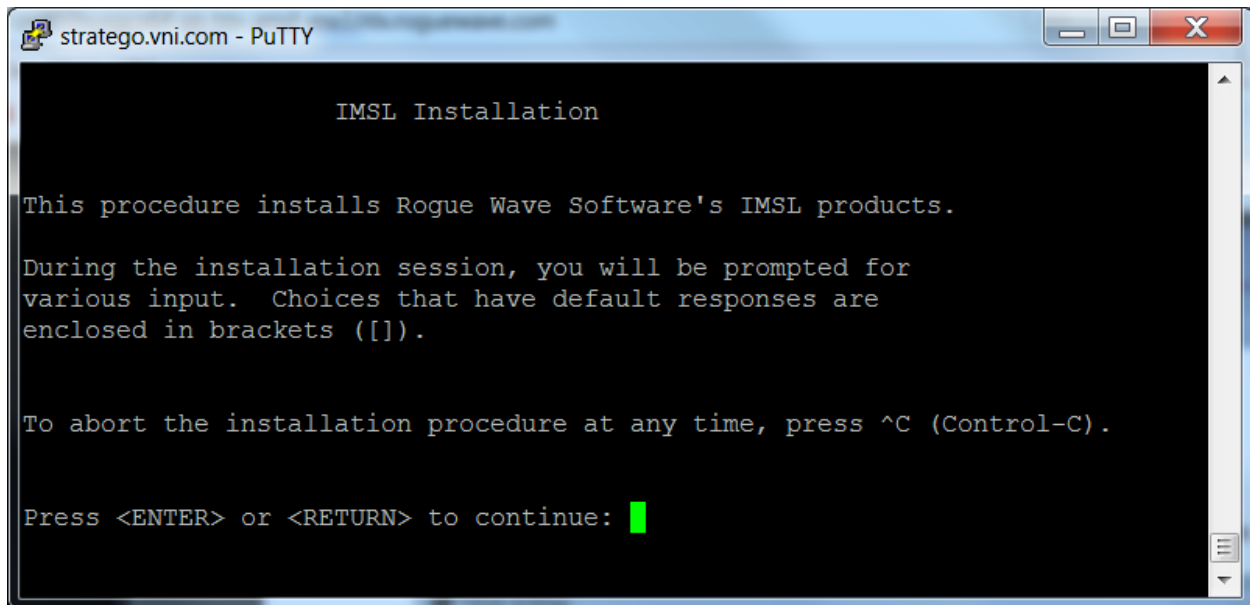
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Do you agree to the terms of this license agreement (Y/N)? █
```

4. Installation Information

This is the introduction to the rest of the install procedure. Press <Enter> to continue.



The screenshot shows a PuTTY terminal window titled "stratego.vni.com - PuTTY". The terminal content is as follows:

```
IMSL Installation

This procedure installs Rogue Wave Software's IMSL products.

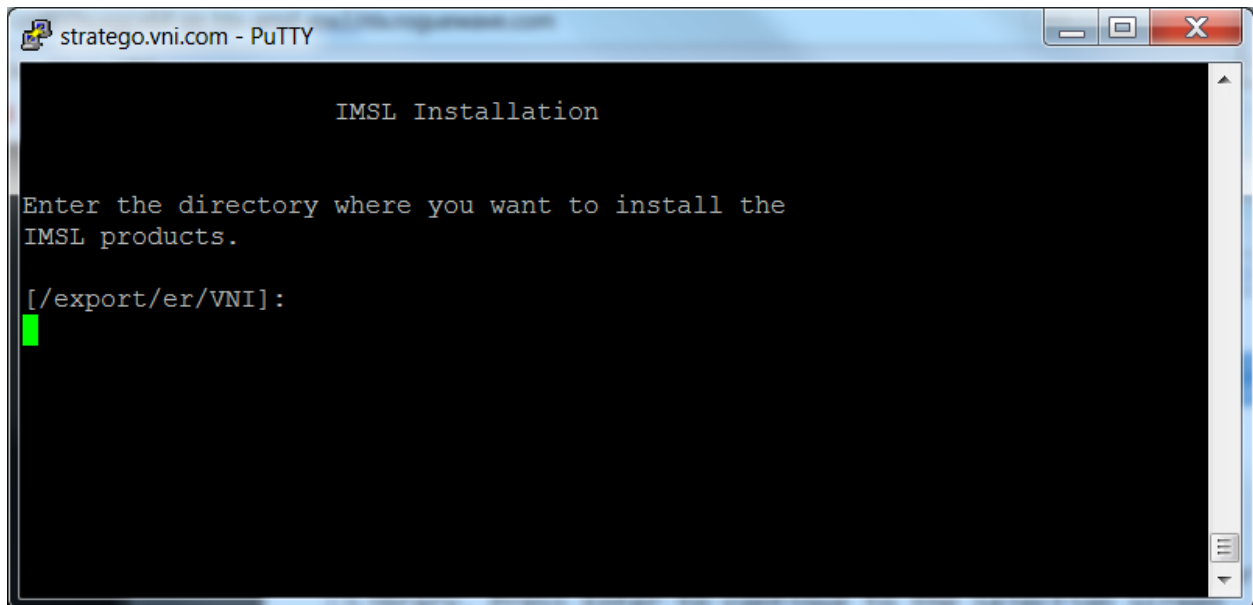
During the installation session, you will be prompted for
various input. Choices that have default responses are
enclosed in brackets ([]).

To abort the installation procedure at any time, press ^C (Control-C).

Press <ENTER> or <RETURN> to continue: █
```

5. Install Directory

Set the directory where the IMSL Library for C will be installed. The default is the directory from where the installation script is executed. You are prompted for confirmation. Press <Enter> when you are satisfied with the target directory.



```
stratego.vni.com - PuTTY

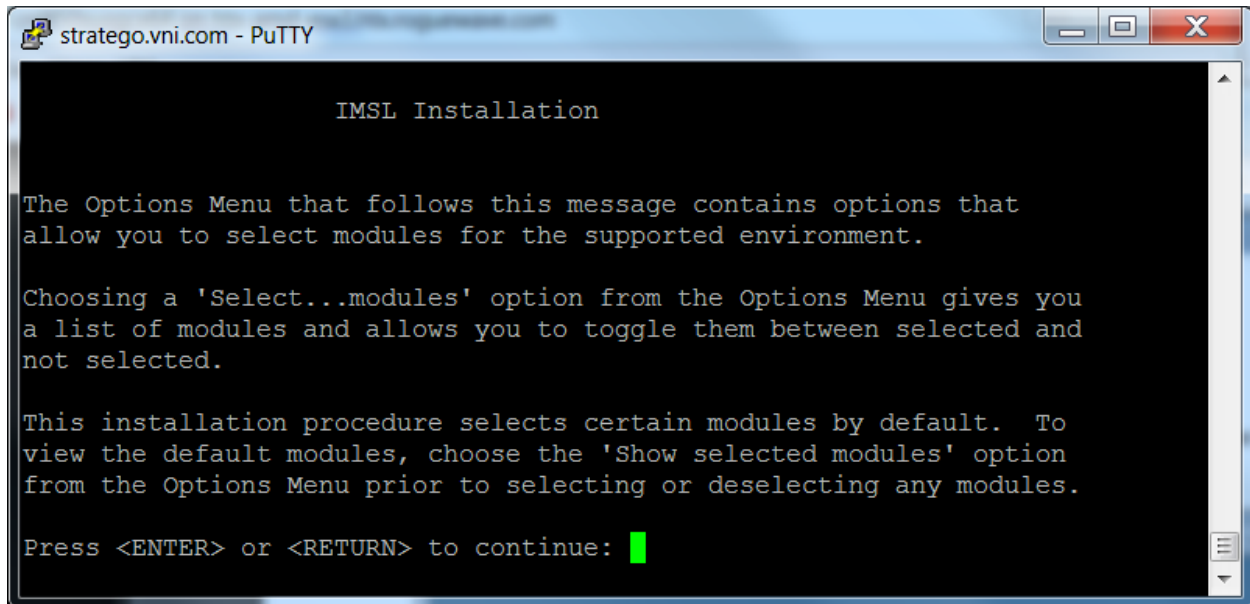
IMSL Installation

Enter the directory where you want to install the
IMSL products.

[/export/er/VNI]:
```


6. Module Selection

This introduces the various modules that are available for installation as part of the IMSL Library for C. Press <Enter> to continue to the selection screen



```
stratego.vni.com - PuTTY

IMSL Installation

The Options Menu that follows this message contains options that
allow you to select modules for the supported environment.

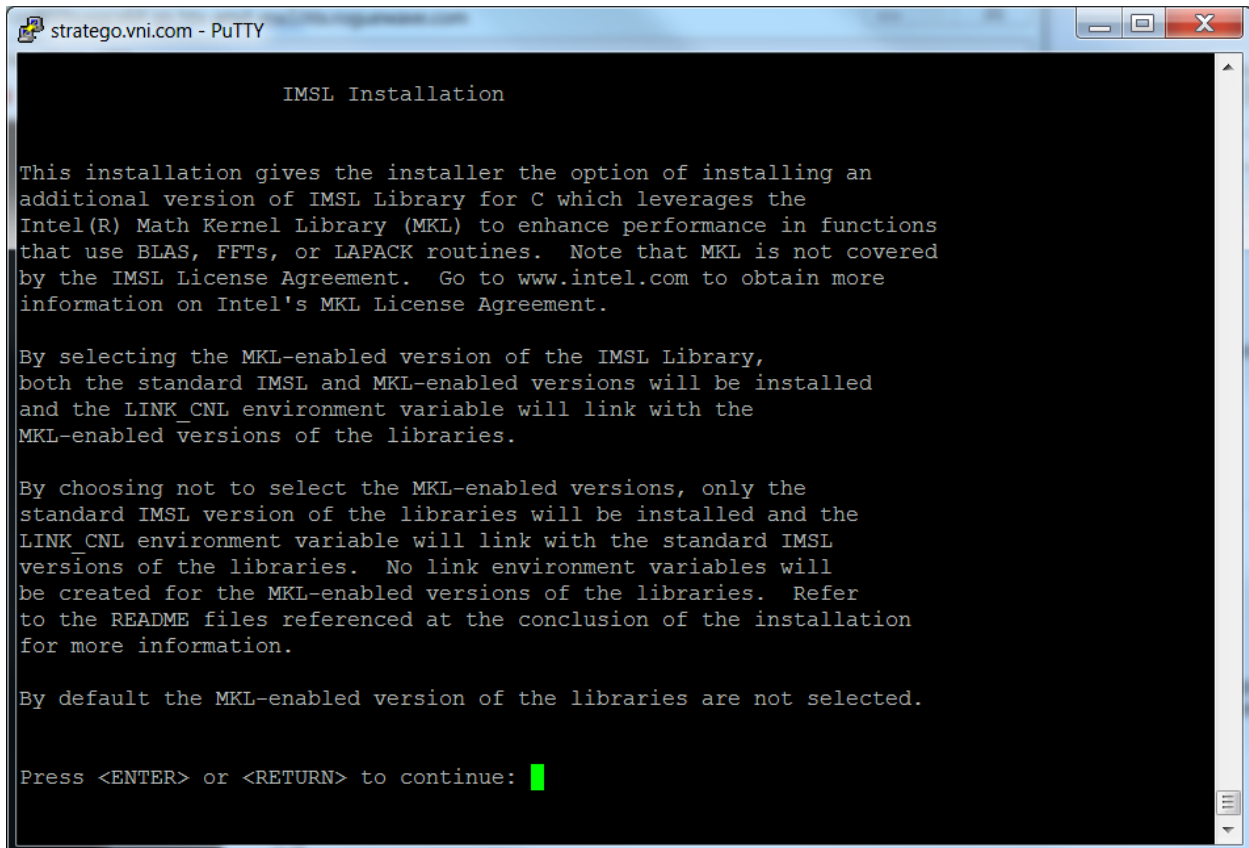
Choosing a 'Select...modules' option from the Options Menu gives you
a list of modules and allows you to toggle them between selected and
not selected.

This installation procedure selects certain modules by default. To
view the default modules, choose the 'Show selected modules' option
from the Options Menu prior to selecting or deselecting any modules.

Press <ENTER> or <RETURN> to continue: █
```

7. MKL Information

Information about the MKL performance versions of the IMSL Library for C are presented. Installation of this module is not required. Press <Enter> to continue.



```
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IMSL Installation

This installation gives the installer the option of installing an
additional version of IMSL Library for C which 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.

By selecting the MKL-enabled version of the IMSL Library,
both the standard IMSL and MKL-enabled versions will be installed
and the LINK_CNL environment variable will link with the
MKL-enabled versions of the libraries.

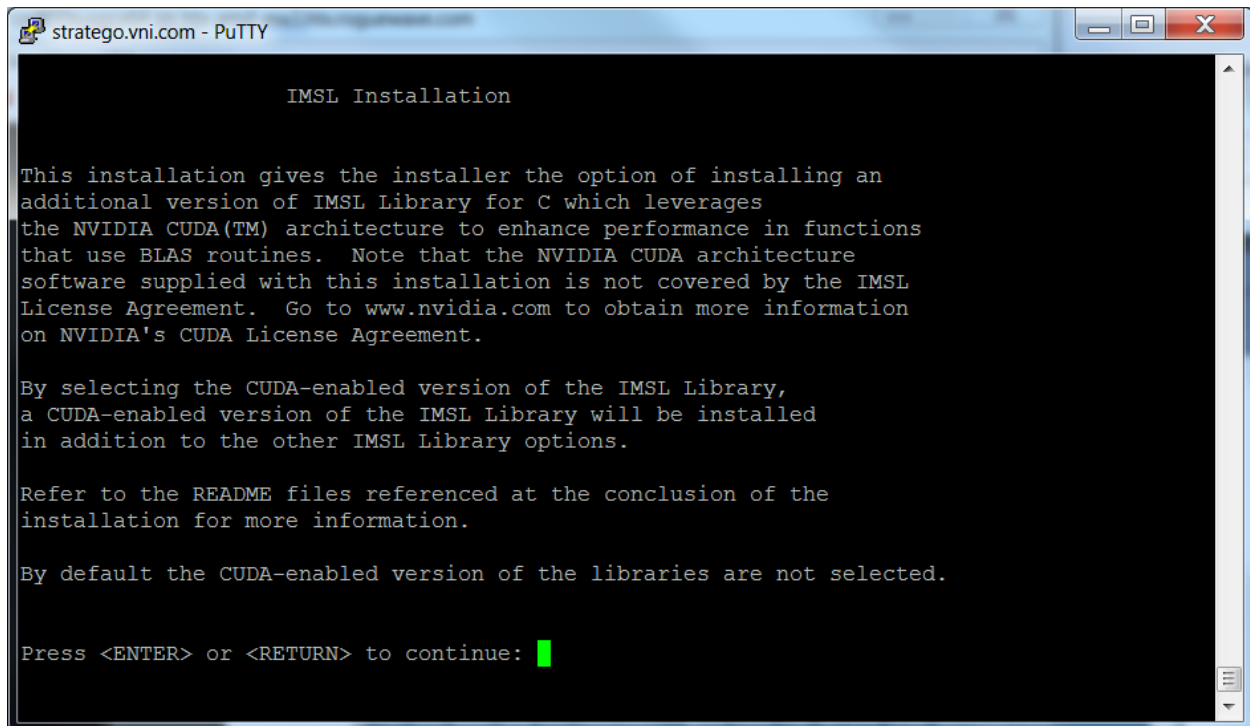
By choosing not to select the MKL-enabled versions, only the
standard IMSL version of the libraries will be installed and the
LINK_CNL environment variable will link with the standard IMSL
versions of the libraries. No link environment variables will
be created for the MKL-enabled versions of the libraries. Refer
to the README files referenced at the conclusion of the installation
for more information.

By default the MKL-enabled version of the libraries are not selected.

Press <ENTER> or <RETURN> to continue: █
```

8. CUDA Information

Information about the CUDA performance versions of the IMSL Library for C is presented. Installation of this module is not required. Press <Enter> to continue.



The screenshot shows a PuTTY terminal window titled "stratego.vni.com - PuTTY". The terminal content is as follows:

```
IMSL Installation

This installation gives the installer the option of installing an
additional version of IMSL Library for C which leverages
the NVIDIA CUDA(TM) architecture to enhance performance in functions
that use BLAS routines. Note that the NVIDIA CUDA architecture
software supplied with this installation is not covered by the IMSL
License Agreement. Go to www.nvidia.com to obtain more information
on NVIDIA's CUDA License Agreement.

By selecting the CUDA-enabled version of the IMSL Library,
a CUDA-enabled version of the IMSL Library will be installed
in addition to the other IMSL Library options.

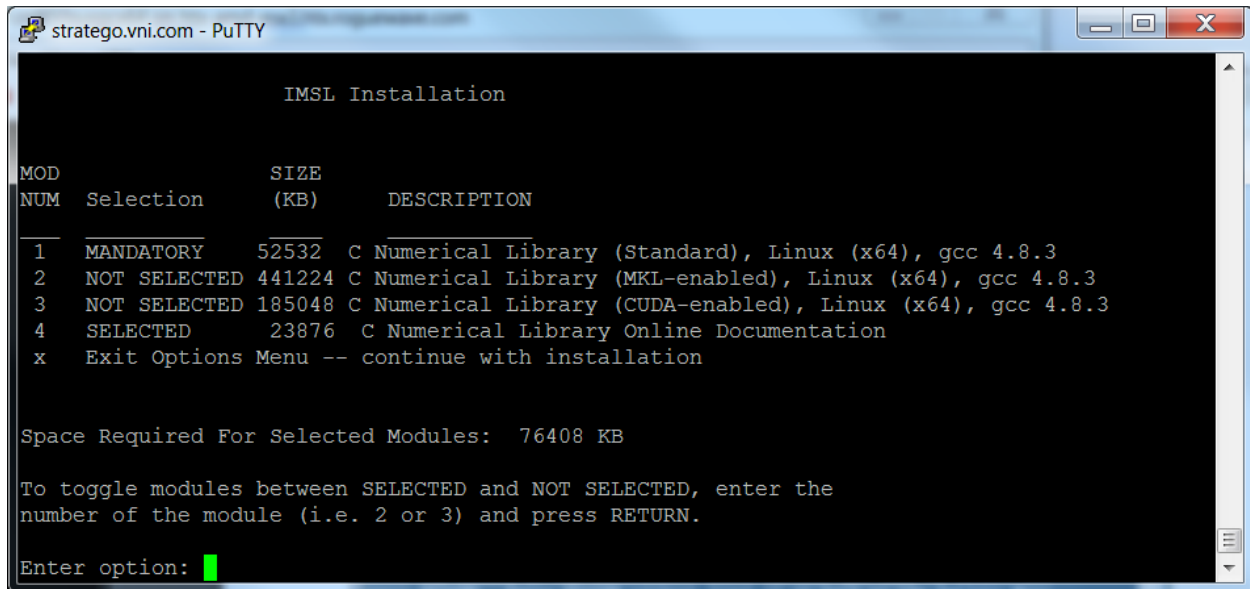
Refer to the README files referenced at the conclusion of the
installation for more information.

By default the CUDA-enabled version of the libraries are not selected.

Press <ENTER> or <RETURN> to continue: █
```

9. Module Selection

Review the list of available modules for Linux and type the corresponding numbers to toggle the selection. Select `x` to exit this menu.



```
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IMSL Installation

MOD          SIZE
NUM Selection (KB)  DESCRIPTION
-----
1  MANDATORY  52532  C Numerical Library (Standard), Linux (x64), gcc 4.8.3
2  NOT SELECTED 441224 C Numerical Library (MKL-enabled), Linux (x64), gcc 4.8.3
3  NOT SELECTED 185048 C Numerical Library (CUDA-enabled), Linux (x64), gcc 4.8.3
4  SELECTED    23876  C Numerical Library Online Documentation
x  Exit Options Menu -- continue with installation

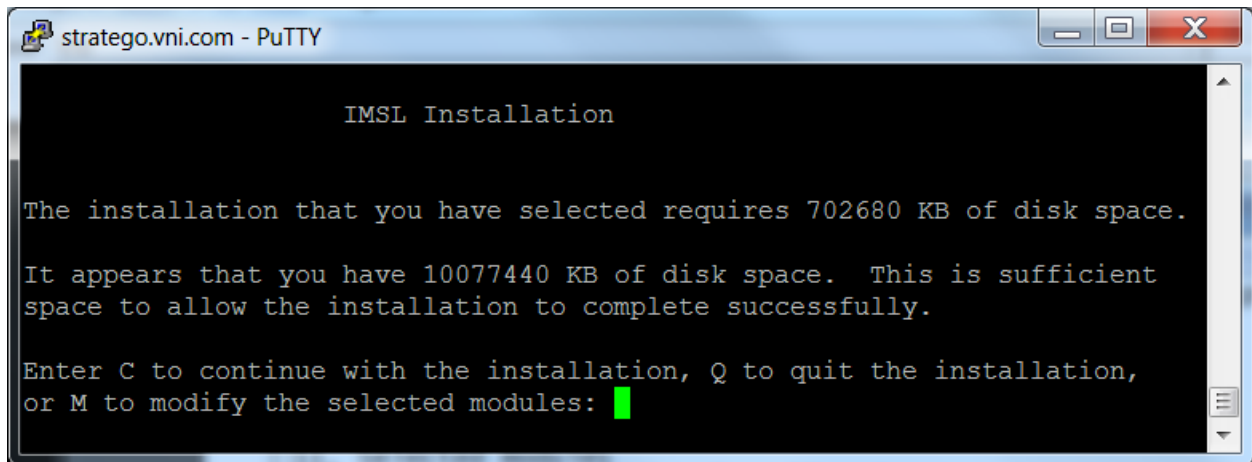
Space Required For Selected Modules: 76408 KB

To toggle modules between SELECTED and NOT SELECTED, enter the
number of the module (i.e. 2 or 3) and press RETURN.

Enter option: █
```

10. Hard Disk Space Confirmation

Before any files are copied, the required disk space is computed and compared to the amount of disk space available. If there are no problems, enter `c` and press `<Enter>` to continue. Enter `q` to quit the install program or `m` to modify the selected modules.



```
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IMSL Installation

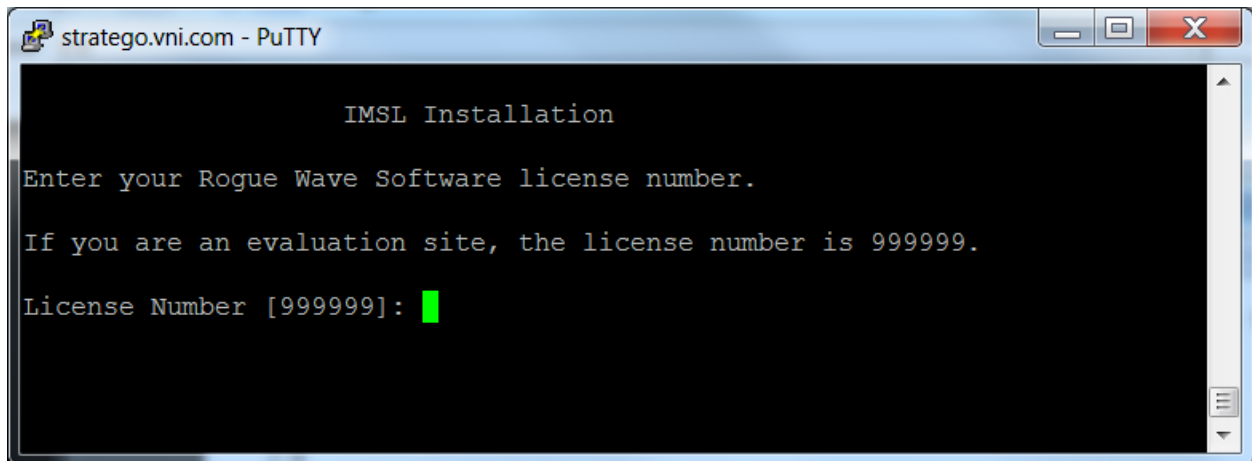
The installation that you have selected requires 702680 KB of disk space.

It appears that you have 10077440 KB of disk space. This is sufficient
space to allow the installation to complete successfully.

Enter C to continue with the installation, Q to quit the installation,
or M to modify the selected modules: █
```

11. 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, use the default 999999. Press `<Enter>` to continue.



```
stratego.vni.com - PuTTY

IMSL Installation

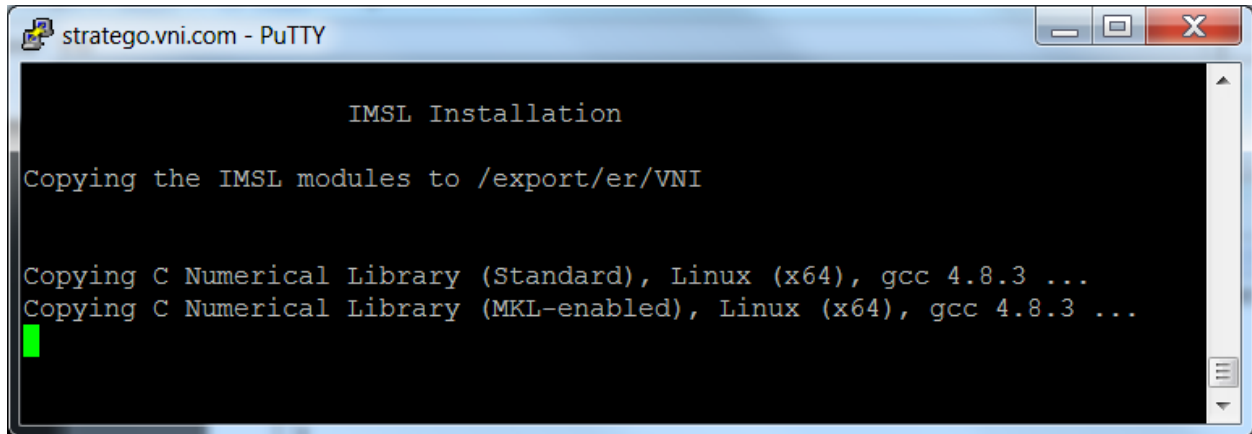
Enter your Rogue Wave Software license number.

If you are an evaluation site, the license number is 999999.

License Number [999999]: █
```

12. Installation Progress

You are updated as the installation progresses and informed about the number of files processed.



```
stratego.vni.com - PuTTY

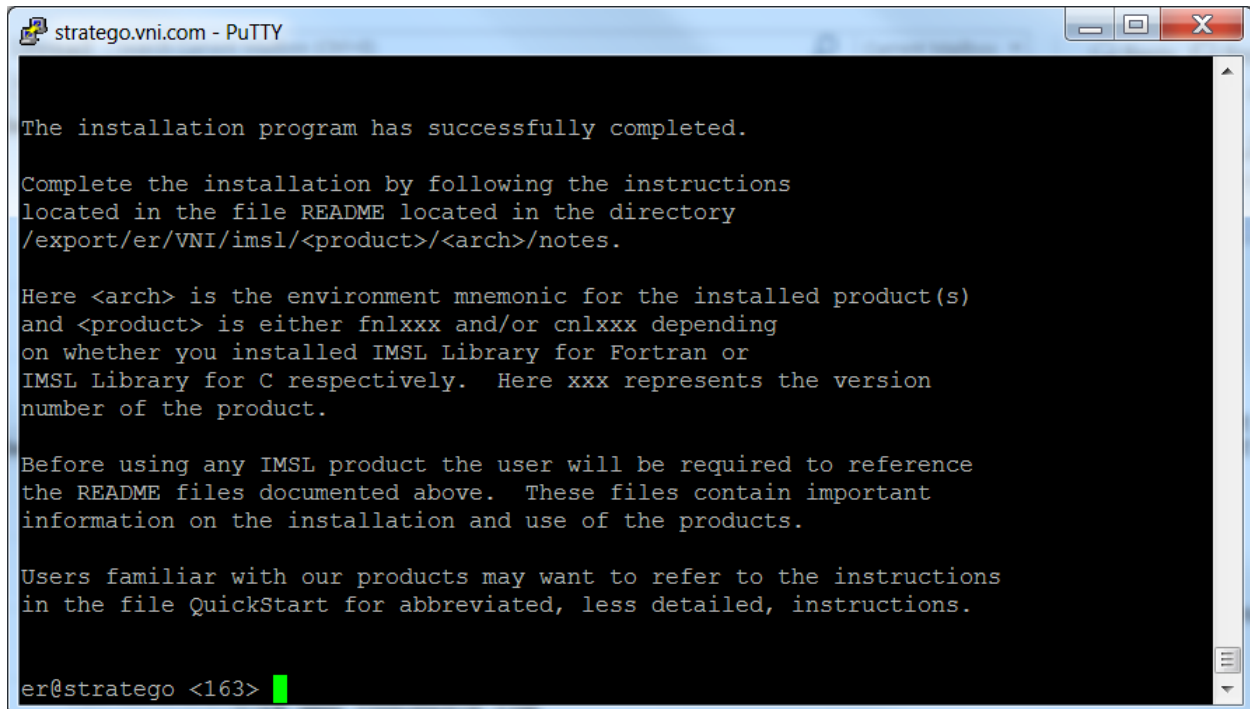
IMSL Installation

Copying the IMSL modules to /export/er/VNI

Copying C Numerical Library (Standard), Linux (x64), gcc 4.8.3 ...
Copying C Numerical Library (MKL-enabled), Linux (x64), gcc 4.8.3 ...
█
```

13. Installation Complete

When the install program is finished decompressing and copying files, you are presented with summary notes and returned to the command prompt



```
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The installation program has successfully completed.

Complete the installation by following the instructions
located in the file README located in the directory
/export/er/vni/imsl/<product>/<arch>/notes.

Here <arch> is the environment mnemonic for the installed product(s)
and <product> is either fnlxxx and/or cnlxxx depending
on whether you installed IMSL Library for Fortran or
IMSL Library for C respectively. Here xxx represents the version
number of the product.

Before using any IMSL product the user will be required to reference
the README files documented above. These files contain important
information on the installation and use of the products.

Users familiar with our products may want to refer to the instructions
in the file QuickStart for abbreviated, less detailed, instructions.

er@stratego <163> █
```

License Key Setup

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

1. 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>`)

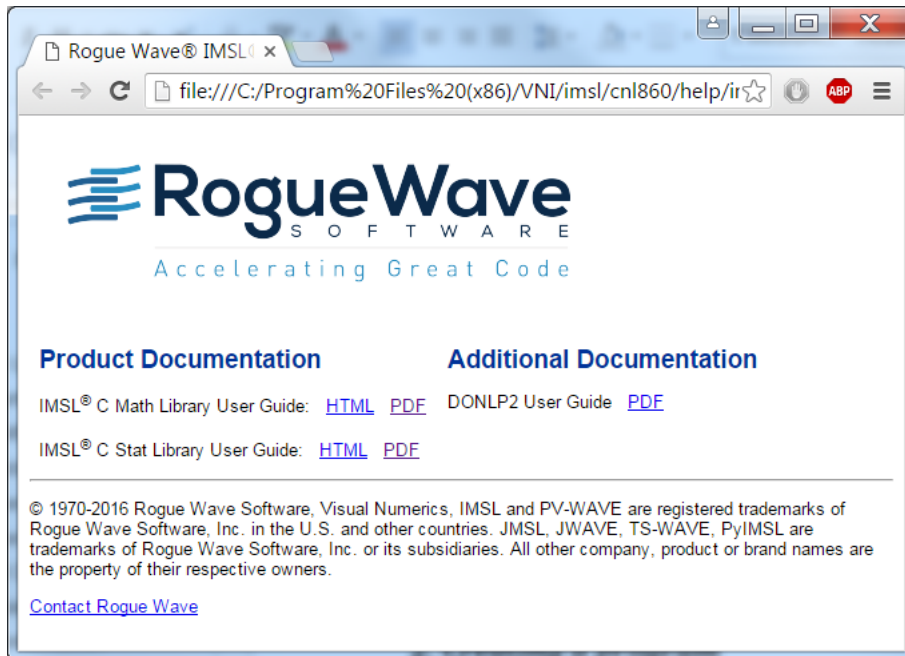
Using the IMSL Library for C

1. 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, open the file `imsl.html` located in the `<install_dir>/imsl/cn1860/help` directory using your web browser.



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 pdf subdirectory.

2. Creating a program

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

$$\begin{aligned} 33x + 16y + 72z &= 129 \\ -24x - 10y - 57z &= -96 \\ 18x - 11y + 7z &= 8.5 \end{aligned}$$

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 */

```

3. Compiling and running the program

The following steps detail how to compile and execute a program that uses the IMSL Library for C for UNIX/Linux.

1. Setting the Environment Variables

The various environment variables used in compilation must be configured a setup shell script. Which shell script to use depends on the shell:

For the IMSL Library for C Version 8.6 on Linux:

C Shell

```
source <install_dir>/imsl/cnl860/<env>/bin/cnlsetup.csh
```

bash, bourne, K Shell

```
. <install_dir>/imsl/cnl860/bin/cnlsetup.sh
```

2. Compile the program

Shared Library

```
$CC $CFLAGS cnl.c -o cnl $LINK_CNL_SHARED
```

Static Library

```
$CC $CFLAGS cnl.c -o cnl $LINK_CNL_STATIC
```

3. Execute the program

```
./cnl
```

```

                Solution x
                1          2          3
                1.0          1.5          1.0

                Inverse of A
                1          2          3
1          0.1464          0.1899          0.0403
2          0.1802          0.2237          -0.0321
3          -0.0933          -0.1367          -0.0113
```

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