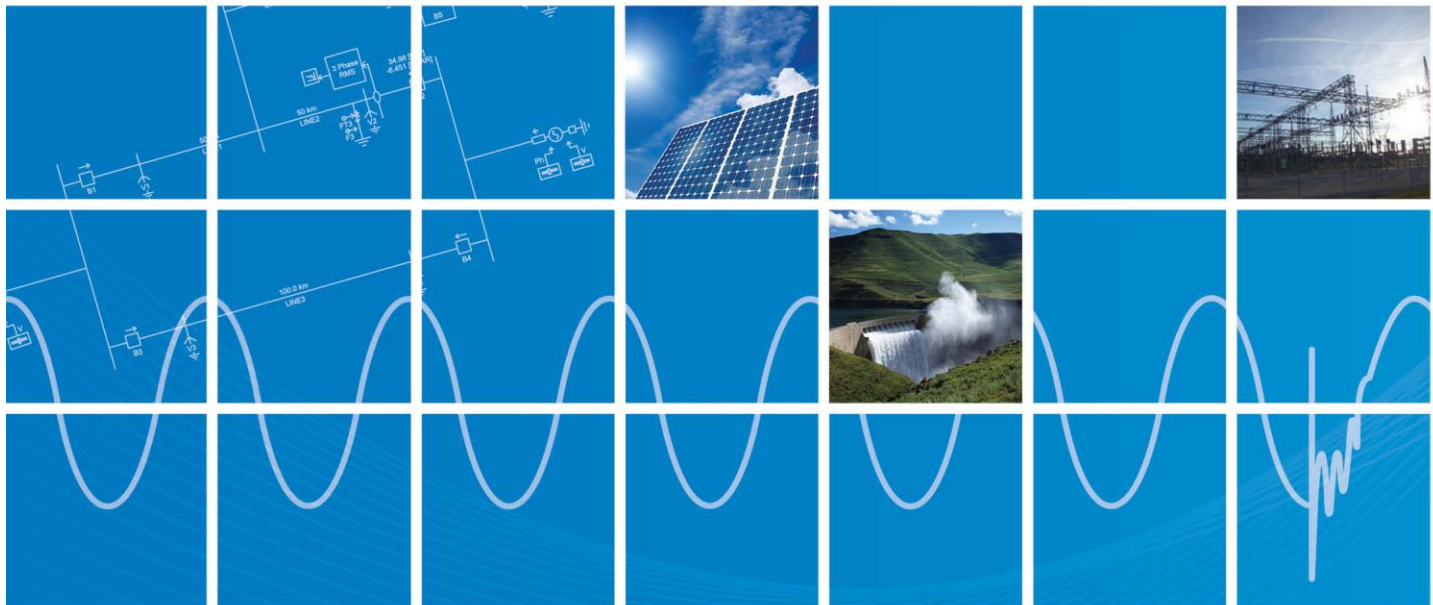




PSCAD™

Setting up the Intel® Compiler for Compiling PSCAD Projects

Revision: 10
February 8, 2021



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1.	INTRODUCTION.....	1
1.1	SCOPE.....	1
1.2	DISCLAIMER.....	1
1.3	ABOUT THE SOFTWARE.....	1
1.4	ABOUT YOUR INTEL FORTRAN COMPILER LICENSE.....	2
1.5	HOW TO USE THIS MANUAL.....	2
2.	SELECTING YOUR SOFTWARE.....	3
3.	SETTING UP YOUR SOFTWARE.....	4
3.1	SETTING UP MICROSOFT® VISUAL STUDIO STANDALONE EDITIONS.....	4
3.2.	SETTING UP THE INTEL® COMPILER.....	6
3.3.	CONFIGURING PSCAD PROGRAM FILES.....	11
4.	ENSURING YOUR SETUP WORKS.....	12
5.	TROUBLESHOOTING.....	14
5.1	INSTALLATION ISSUES.....	14
5.2	COMPILING ISSUES.....	15
5.3	LICENSING ISSUES.....	15
5.4	MESSAGES IN THE FORTRAN MEDIC TOOL.....	16
6.	COMMON QUESTIONS.....	20



1. Introduction

1.1 Scope

This manual provides information related to setting up the Intel® Fortran compiler and Microsoft® Visual Studio software for compiling PSCAD projects. Also included are troubleshooting tips and resources for further information.

1.2 Disclaimer

The information in this manual was not provided by Intel nor by Microsoft, and is not intended to supersede or replace any data provided by these developers.

This information is only provided as a courtesy to our PSCAD users, and if there are any discrepancies between the content herein and with the developers' content, the developers' content shall take precedence.

1.3 About the Software

PSCAD is designed to work with a compiler to convert input code (Fortran code and c-code) into executable files that, when run, compute the simulation results. The combination of Intel compiler and Microsoft® Visual Studio software are used as the compiling software.

For the convenience of our PSCAD customers, a license for the Intel compiler may be purchased through MHI (sales@pscad.com). Specifically, a "named-user" license for the new Intel oneAPI (v19.2+), "single-node" edition, "Classic" version (Base and HPC Toolkit) may be purchased through MHI. Please note that this license can be used for licensing earlier versions of the Intel compiler. Please see further information on [selection](#) and [Intel oneAPI](#).

An alternative option to purchasing the Intel Fortran compiler and Visual Studio software combination is to use one of the free GFortran compilers that come bundled with PSCAD. The GFortran compilers come with both Fortran code and c-code readers. Information to help with this selection is available in this [article](#).



1.4 About your Intel Fortran Compiler License

An Intel Fortran compiler Named-User (single-user) license may be purchased through MHI (sales@pscad.com) or other authorized agent. Alternatively, either named-user or floating licenses may be purchased through [Intel](#).

For a description of the named-user and floating licenses, refer to Section 6 Item (e).

A new license comes with “active support” that is valid for one year from the date of purchase. Active support entitles you to software updates and access to support from Intel. The active support may be extended through the [Intel website](#).

1.5 How to use this Manual

It is recommended that the software setup be completed in the order as presented in this manual. First, the software versions and edition should be selected as per Section 2, to ensure that suitable and compatible software will be installed.

Second, the software should be installed in the order presented in Section 3, to help ensure that the two software, Intel Fortran compiler and Visual Studio, are properly integrated.

Third, your setup should be tested as per Section 4 to ensure that the software is properly installed and integrated, before trying to build your own projects.

Section 5 contains some solutions to common installation and licensing issues. Section 6 assists with some common software and licensing questions.



2. Selecting your Software

To select your Intel Fortran edition and version, please refer to this [article](#).

Note

If you already have a license for an Intel Fortran compiler, you can determine what versions your license supports by logging in and entering your license key on the [Intel website](#) (format: ####-#####.). MHI does not have access to this information.

To select your Microsoft Visual Studio edition and version, please refer to this [article](#).

If there are any questions on selecting your software combination, please feel free to contact our support desk (support@mhi.ca).

3. Setting up your Software

3.1 Setting up Microsoft® Visual Studio Standalone Editions

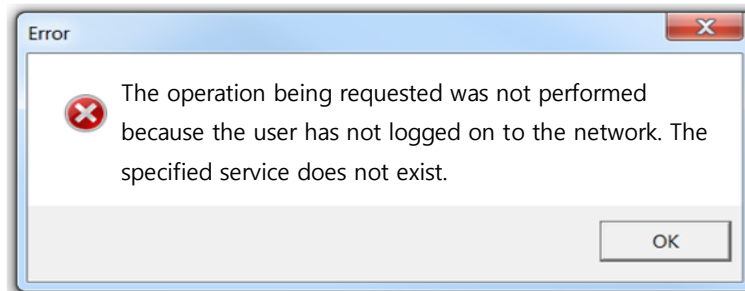
This section provides some tips for setting up Visual Studio Professional Edition and Enterprise Editions.

Requirements

1. Ensure a suitable edition and version has been selected as per Section 2.
2. Windows administrator privileges.
3. When downloading the installation files, extract the files, and save them to a folder on your local drive. Do not run the installation from zipped files. Do not run the installation from network or remote drives.

Notes

1. When using a standalone edition of Visual Studio, Visual Studio must be installed prior to the Intel Fortran compiler, to allow these two software to integrate.
2. A [Microsoft user account](#) is required, and you must be logged in during the installation. If the following error displays during the installation, you are not logged in on your Microsoft user account. To resolve this, log in, then retry the installation.



3. If downloading an older version, you will be prompted to register with “Visual Studio Dev Essentials”.

4. For Visual Studio 2015 and later:

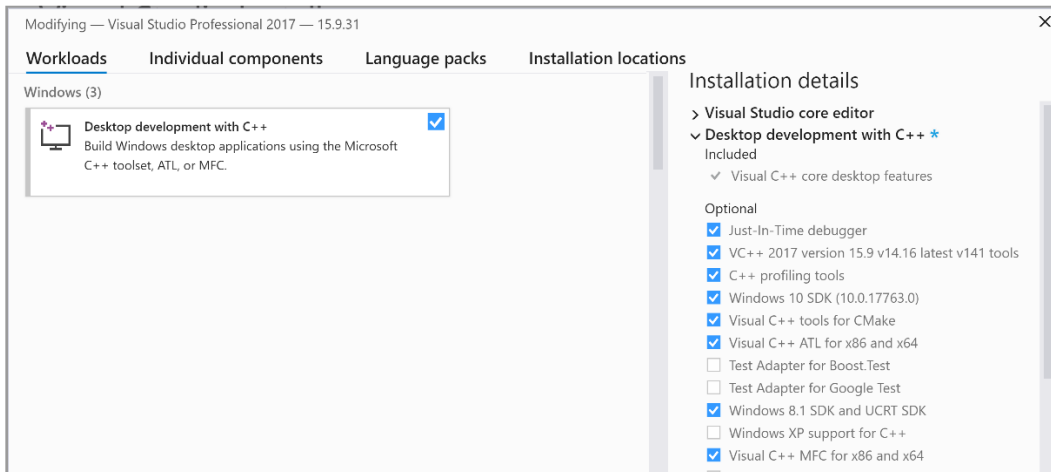
- This version is only supported with PSCAD v4.6.1 and later.
- For Visual Studio 2015, the items as shown as selected in the screenshot below include everything that must be installed for a successful PSCAD compiling setup:



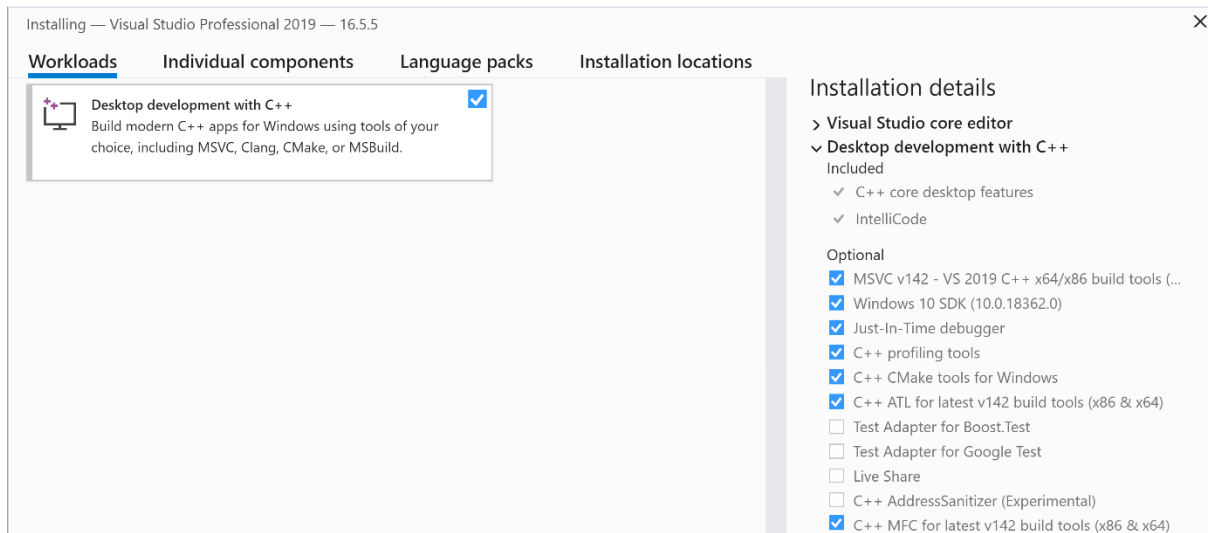
Note

If these required items are not installed, the Fortran Medic tool will display the error as shown in Section 5.4 Step (d).

- For Visual Studio 2017, the items as shown as selected in the screenshot below include everything that must be installed for a successful PSCAD compiling setup:



- For Visual Studio 2019, the items as shown as selected in the screenshot below include everything that must be installed for a successful PSCAD compiling setup:



- Refer to Section 3.3 to ensure that PSCAD program files are properly set to use the installed version of Visual Studio.

3.2. Setting up the Intel® Compiler

This section provides instructions for setting up the Intel Fortran compiler.

Requirements

- Ensure that a suitable version has been selected as per Section 2.
- Windows administrator privileges.
- Internet connection (or, to perform an installation with no Internet connection, please refer Section 6, Item (b)).
- If any standalone editions of Visual Studio will be used with the compiler, this software must be installed before installing the Intel Fortran compiler (Section 3.1).

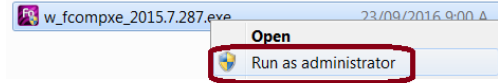
Set up the Intel Fortran Compiler as follows:

- Upon purchasing Intel Fortran compiler from MHI, you will receive an e-mail with your new license key.
- Ensure to register your license [here](#). You should then be directed to log in or register a user account, and download the software.

Note – Your Intel user account will give you access to v19.2 and older versions. If the version you require is not available, please contact the MHI support desk for assistance (support@mhi.ca).

c. For Intel 19.1 and older (Parallel Studio XE Composer Edition for Fortran):

- Extract (unzip) the file, and save it to a local machine on which you have permissions (e.g. new folder on your desktop).
- Right-click on the unzipped file, select “Run as administrator”, and proceed through the installation. For example, for version 2015:

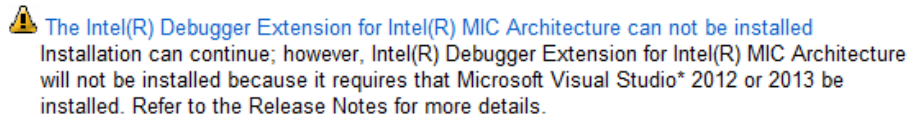


- The “Welcome” page will display any detected issues prior to performing the installation. Ensure to read through any messages, and if required, resolve the issue before proceeding with the installation. The following are some examples:

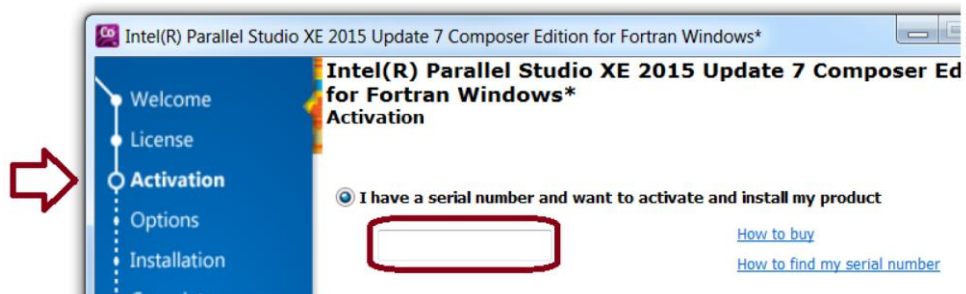
For example, required prerequisite software might be missing, so the Intel Fortran installation may not proceed. In this case, install the missing software and restart the Intel compiler installation.

For example, required prerequisite software might be missing, so that the bundled Microsoft Visual Studio Shell Edition cannot be installed (comes with Intel 19.0 update 2 and older). If you have determined that you require this free bundled edition of Visual Studio per Section 2, then install the missing software and restart the Intel compiler installation.

For example, if a message similar to the following displays, this message may be disregarded. This message is simply indicating that because Visual Studio is not already installed (e.g. Professional Edition), the “Debugger”, which is not required for compiling PSCAD cases, cannot be installed.

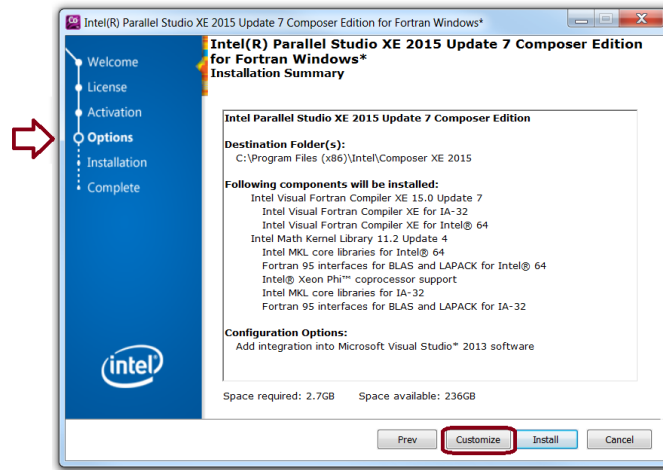


- On the Activation page, paste in your license key (determine your license key as per Step (a) above), then select “Next”.

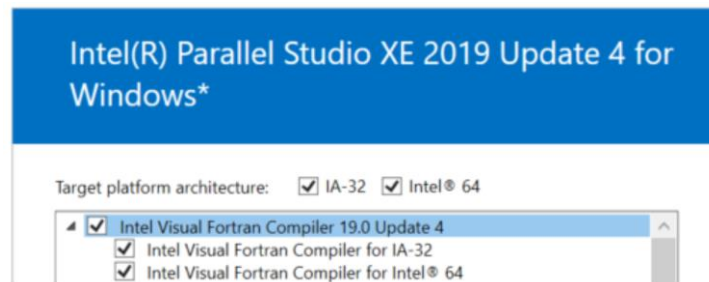


Note - If any errors associated with the license key display, please refer to the [Product Licensing FAQ website](#).

- On the "Options" page, select "Customize" so that you will be prompted to review the software to be installed as well as the Visual Studio integration:



- When prompted to select the items to install, select the "Intel Visual Fortran Compiler for IA-32" and "Intel Visual Fortran Compiler for Intel(R) 64" as shown in the example below:



- Select or de-select Visual Studio Shell edition as required. Some tips are listed below:
 - This option will be applicable only for the Intel compiler 19 Update 2 and earlier (removed as of Intel compiler Update 3+).
 - Ensure the Visual Studio Shell edition is selected for installation if you do not have a standalone edition of Visual Studio (e.g. Professional / Enterprise).
 - Or, you choose whether to de-select the Visual Studio Shell edition if you will be using a standalone edition of Visual Studio.
- When prompted to choose integration, select the Visual Studio software with which you want the Intel Fortran to integrate, for example:



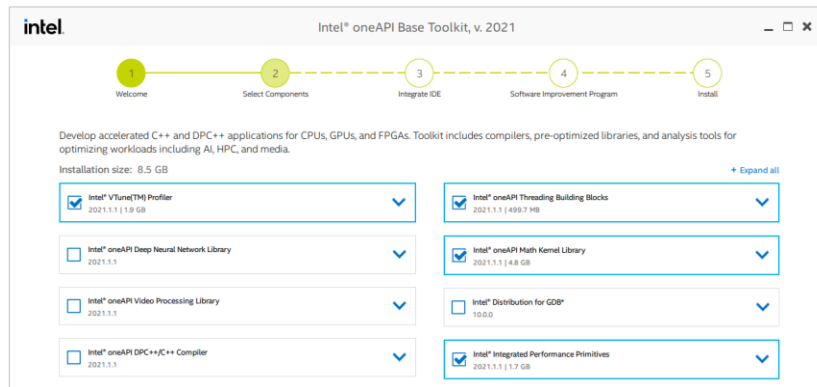
- The installation should proceed, and can take several minutes.

d. For Intel 19.2 (oneAPI):

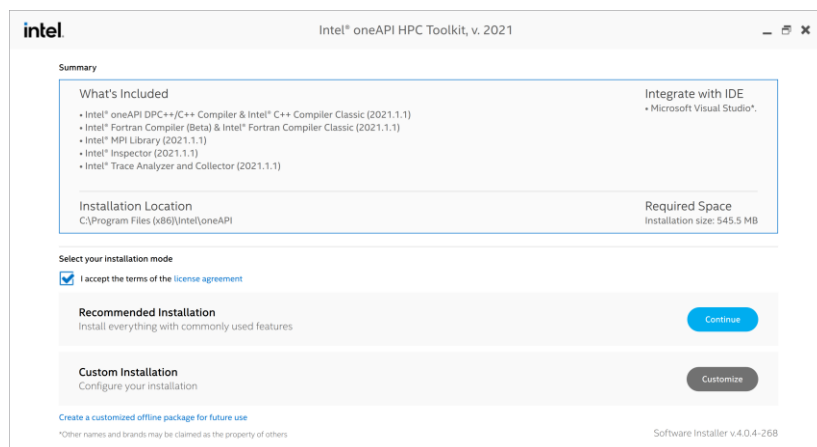
- Unzip the two files (Base Kit and HPC Kit), and save them to a folder on a local drive (e.g. on your desktop). This might take a few minutes.



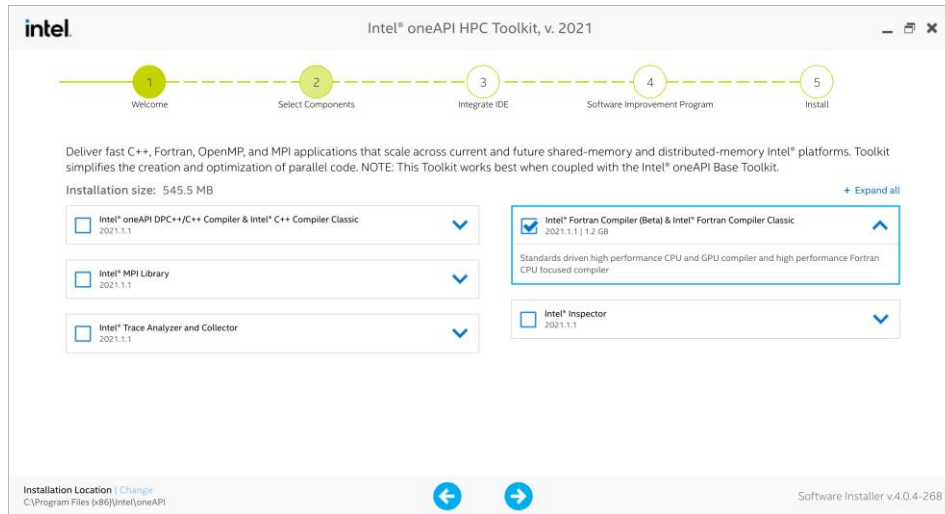
- FIRST, launch the “BaseKit” file (right-click on the unzipped file, and select “Run as administrator”). You will be prompted through the installation. In the “Select Components” page, select as a minimum, the four items as shown as selected in the image below:



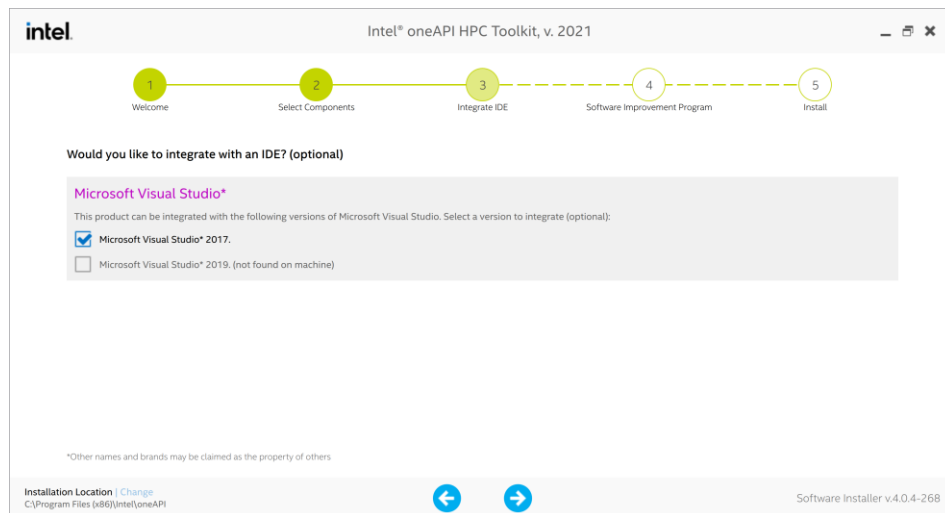
- Second, launch the HPC Kit (right-click on the unzipped file, and select “Run as administrator”). You will be prompted through the installation.
- Customize your installation by selecting “Customize” on this page:



- In the “Select Components” page, select as a minimum, the one item as shown as selected in the image below:



- Select the version of Visual Studio with which to integrate:



- e. When the installation is complete, log out then log back in on your machine before proceeding, to apply the changes.
- f. Refer to Section 3.3 to ensure that PSCAD program files are properly set to use the installed version of Visual Studio.
- g. Proceed to Section 4 to test your setup, prior to running your own cases.



3.3. Configuring PSCAD Program Files

Due to changes made to Visual Studio libraries as of VS 2015, PSCAD Program Files must now be toggled to either be able to use VS 2013 and older or VS 2015 and newer.

Specifically, if using Intel 15 and newer, then PSCAD program files must be properly toggled.

For further information and instructions on these settings, please refer to this [article](#).

Note - Intel 14 and older is not affected by the status of the PSCAD program files settings.

4. Ensuring your Setup Works

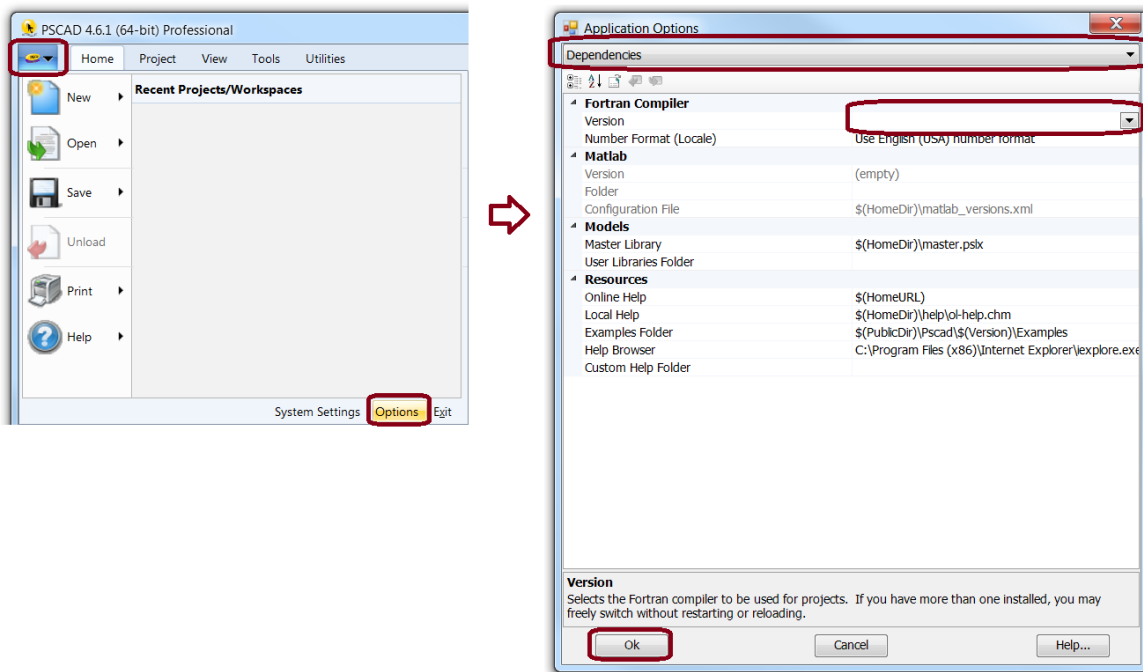
Once the Intel Fortran and Visual Studio software are installed, you should test your setup by trying to build a simple PSCAD case. If this case builds without any errors, then your setup is ready for compiling your own cases.

Requirement

Software must be installed (PSCAD, the Intel compiler and Visual Studio).

Proceed as follows:

- a. Ensure that you properly toggled PSCAD program files as per Section 3.3, if necessary.
- b. Launch and license PSCAD, select the Intel Fortran version in the PSCAD application as shown, then select “OK”:

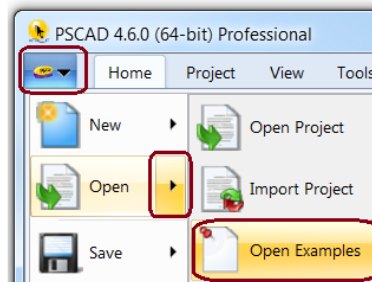


- c. If Intel Fortran is not available for selection in the application, PSCAD has not been able to detect the compiler for some reason. To try to resolve this, please refer to Step 1 in this [article](#). If the matter persists, please send in the items listed in Steps 2.c and 2.f of this [article](#) to support@mhi.ca, along with your PSCAD license number and a description of the problem, to help us to determine the cause.

d. If Intel Fortran was successfully selected in Step (a), perform the following:

- Load the vdiv.pscx project from the path shown below, and run the project. This will test your compiler setup for Fortran code.

C:\Users\Public\Documents\Pscad4.x\Examples x64\tutorial\vdiv.pscx



- If your projects will contain c-code, load one of the c-code projects from the path shown below, and run the project. This will test your compiler setup for Fortran code and c-code.

C:\Users\Public\Documents\Pscad4.x\Examples x64\CInterface\

- If there are no build errors during compiling, your setup is good, and you may proceed to run your own cases using this compiler.
- Or, if there are build errors, then there is a problem with your setup. To try to resolve this, please refer to Step 1 in this [article](#). If the matter persists, please send in the items listed in Steps 2.c and 2.f of this [article](#) to support@mhi.ca, along with your PSCAD license number and a description of the problem, to help us to determine the cause.

5. Troubleshooting

5.1 Installation Issues

When attempting to install or update Intel Fortran, you encounter one of the following errors:

Installation success or error status: 1603

Error 0x80070643

Error 997. Overlapped I/O operation error – 0x8007063

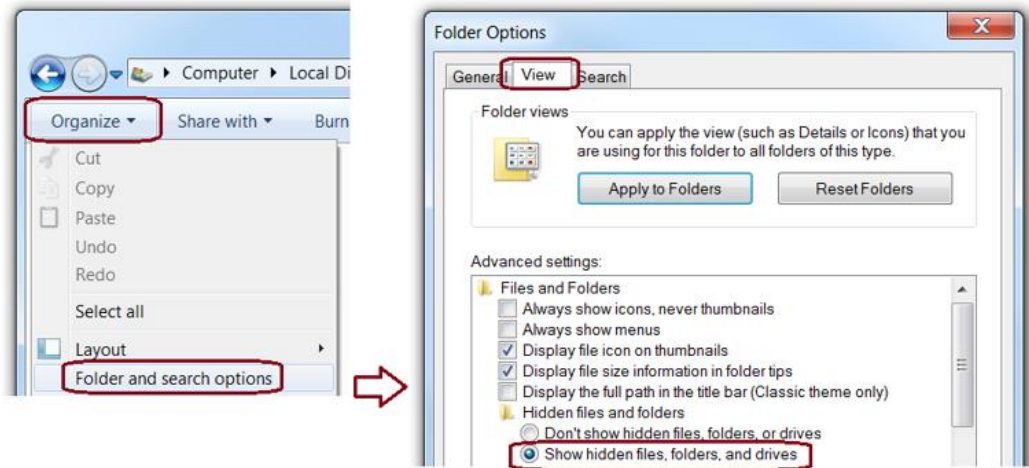
This is a known issue with the security patch KB2918614 released on August 12, 2014. This issue occurs because update 2918614 uses cryptographic keys and certificates for hashing the installation files together with the logged-in user profile. However, cryptographic keys and certificates cannot be used by mandatory or temporary user profiles. Therefore, when a user uses a mandatory or temporary user profile to install any MSI package, the MSI package installation fails and the error message returns.

The issue may resolved as follows:

- a. Browse to C:\ProgramData\Microsoft\Crypto\RSA\S-1-5-18
- b. Ensure you have full ownership of it, or have the owner log in
- c. Rename the folder
- d. Retry the installation

Note

If the ProgramData folder is hidden, set hidden folders to display as follows:



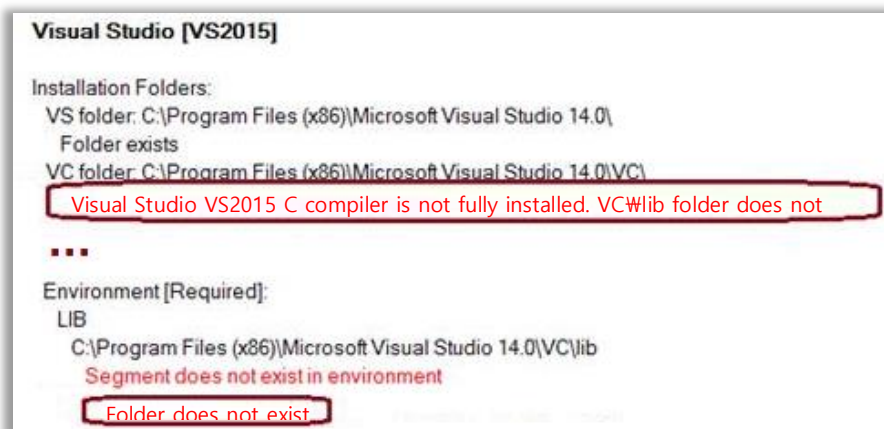
5.2 Compiling Issues

Refer to the [Resolving Issues](#) manual to help with troubleshooting any compiling issues.

5.3 Licensing Issues

The following are some of the more frequent licensing issues that we have seen:

- a. How to troubleshoot a single-user (named-user) licensing issue:
 - Check that the license is installed in the following location as applicable:
 - On a Windows 64-bit operating system:
C:\Program Files (x86)\Common Files\Intel\Licenses\
 - On a Windows 32-bit operating system:
C:\Program Files\Common Files\Intel\Licenses
 - Check whether the license supports the particular version being run. This may be done by reviewing the status of your license, by entering your license key [here](#) (for example in the format of #####-#####).
 - Check the licensing log file, located as per Section 6, Item (c).
 - If the above suggestions do not resolve the matter, it is recommended to contact Intel Support as per Section 6 Item (h).
- b. For a floating license for the Intel compiler, some tips for troubleshooting activation issues are available in this [article](#). Related Build errors in PSCAD similar to the following might appear:
- c. **For Visual Studio 2015+:** If the Medic detects that the common tools registry value does not exist (see example below), then Visual Studio 2015+ must be re-installed, however, ensure to apply the tip listed in Section 3.1 Note (4).



5.4 Messages in the Fortran Medic Tool

The Fortran Medic tool may be used to review software installation. This tool may be run as per Steps a-d of this [article](#), and reviewed as follows:

- a. If an error pertaining to the Common Directory not existing displays, similar to the example shown below, this can normally be disregarded, as it does not normally affect compiling.

```
Required Environment and Registry Values
VS140COMNTOOLS (environment)
C:\Program Files (x86)\Microsoft Visual Studio 14.0\Common7\Tools\
VS7CommonDir (registry)
➡ does not exist
```

- b. **For any version of Visual Studio:** If the Medic detects the errors as shown in the following examples, then there is a problem with the installation, and Visual Studio should be re-installed:

- o Scroll down to the Visual Studio installation, for example VS 2015:

Visual Studio [VS2015]

- o The VS folder and / or the VC folder is not installed:

```
Installation Folders:
VS folder:
➡ Visual Studio VS2015 is not installed. Folder not specified.
VC folder:
➡ Visual Studio VS2015 C compiler is not installed. Folder not specified.
```

- o For Visual Studio 2015, the VC\lib folder is not fully installed:

Visual Studio [VS2015]

```
Installation Folders:
VS folder: C:\Program Files (x86)\Microsoft Visual Studio 14.0\
Folder exists
VC folder: C:\Program Files (x86)\Microsoft Visual Studio 14.0\VC\
➡ Visual Studio VS2015 C compiler is not fully installed. VC\lib folder does not exist.
...
Environment [Required]:
LIB
C:\Program Files (x86)\Microsoft Visual Studio 14.0\VC\lib
➡ Segment does not exist in environment
Folder does not exist
```

- Any of the folders for “required” variables do not exist:

```
Environment [Required]:
LIB
  VC\lib
  Segment does not exist in environment
  Folder does not exist
  C:\Program Files (x86)\Windows Kits\8.1\Lib\winv6.3\um\x86
  Segment does not exist in environment
  Folder does not exist
PATH
  VC\bin
  Segment does not exist in environment
  Folder does not exist
  Common7\IDE
  Segment does not exist in environment
  Folder does not exist
```

- Either of the following conflicts are displayed:

```
⇒ Conflicts
  Unable to determine ProductDir
  The required VS7CommonDir registry value is not set.
```

- c. **For Visual Studio 2010, 2012 or 2013:** If the Medic detects that the common tools registry value does not exist (see examples below), compiling might not work. In some cases, the Medic can actually repair the missing variable (as documented in the [Resolving Issues](#) manual, Appendix A.5, Item 17).

Visual Studio [VS2010]

```
...
Required Environment and Registry Values
VS100COMNTOOLS (environment)
  does not exist
```

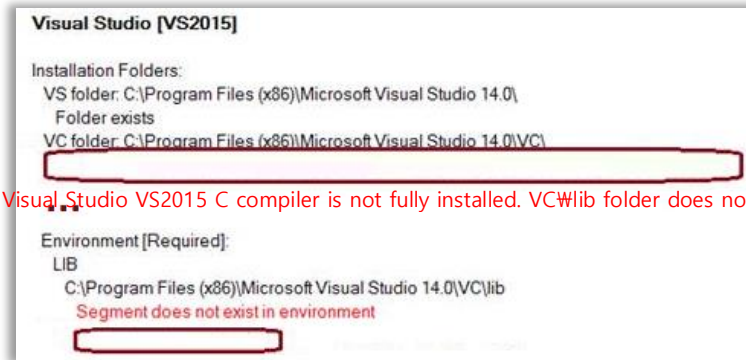
Visual Studio [VS2012]

```
...
Required Environment and Registry Values
VS110COMNTOOLS (environment)
  does not exist
```

Visual Studio [VS2013]

```
...
Required Environment and Registry Values
VS120COMNTOOLS (environment)
  does not exist
```

- d. **For Visual Studio 2015+:** If the Medic detects that the common tools registry value does not exist (see example below), then Visual Studio 2015+ must be re-installed, however, ensure to apply the tip listed in Section 3.1 Note 4.



Visual Studio VS2015 C compiler is not fully installed. VC\lib folder does not

Folder does not exist

- e. **For any version of PSCAD:** If the Medic detects the error as shown in the screenshot below, then more recent versions of Intel Fortran will not be detected and therefore cannot be used with PSCAD:
 - Scroll down to “Installed PSCAD Versions” and then to the version you are using (e.g. v4.6.2).
 - If the error as shown below exists, right-click on the error and select the option to update the fortran_compilers.xml file:

Installed PSCAD versions

```

PSCAD X4 Release (4.6.2 (x86)) [Release date: 2017.06.29 16:46:54 ]
Installed by: Installshield
Install folder: C:\Program Files (x86)\PSCAD46
Folder exists
App folder: C:\Program Files (x86)\PSCAD46\bin\win
master.pslx (version = 4.6.2, revised = 2017.06.14 17:04:13)
fortran_compilers.xml (date: 2015.02.19 timestamp: 2015.02.12 state: outdated)
matlab_versions.xml (timestamp: 2016.05.30 state: latest)
TLine.exe (version = 2016.08.11)
ZSLib2.dll (version = 2017.06.29 16:40:50)
IF9 emtdc.cfg (version = Intel 10 and VS 2005 or better)
EMTDC (for Intel 15 and later
▶ Configure EMTDC for Visual Studio 2015 and later
32-bit
emtdc.lib, main.obj: Configured for VS 2010, 2012, and 2013 (state = 62)
User profile file: C:\Users\eve\AppData\Local\Manitoba HVDC Research Centre\PSCAD\user_profile_46.xml
File exists
english_locale: <true>
external_tools.xml
File exists
    
```



Conflicts
 The PSCAD 4.6.2 fortran_compilers.xml file is outdated and will not detect the latest Intel Fortran compilers
 File: C:\Program Files (x86)\PSCAD46\fortran_compilers.xml

- This should allow you to run any of the newer supported versions of Intel Fortran.

f. **For any version of Visual Studio or Intel Fortran Compiler:** If the Medic detects that the “folder exists”, but the “segment does not exist in environment” for any of the “required” variables (see examples below), this error may be disregarded; PSCAD can still compile cases if this error is present. The following are examples for both Visual Studio and Intel Fortran compiler:

- o Example for Visual Studio 2015:

```
Environment [Required]:
LIB
C:\Program Files (x86)\Microsoft Visual Studio 14.0\VC\lib
➡ Segment does not exist in environment
Folder exists
C:\Program Files (x86)\Windows Kits\8.1\Lib\winv6.3\um\x86
➡ Segment does not exist in environment
Folder exists
PATH
C:\Program Files (x86)\Microsoft Visual Studio 14.0\VC\bin
➡ Segment does not exist in environment
Folder exists
C:\Program Files (x86)\Microsoft Visual Studio 14.0\Common7\IDE
➡ Segment does not exist in environment
Folder exists
```

- o Example for Intel Fortran 17:

```
Environment [Required]:
LIB
C:\Program Files (x86)\IntelSWTools\compilers_and_libraries_2017.4.210\windows\Compiler\lib\IA32
➡ Segment does not exist in environment
Folder exists
PATH
C:\Program Files (x86)\IntelSWTools\compilers_and_libraries_2017.4.210\windows\Bin\IA32
➡ Segment does not exist in environment
Folder exists
```

Note

The above step is applicable for PSCAD v4.3 and later. If you are using PSCAD v4.2 and any of the above errors are present, then PSCAD may not compile cases using this software. To resolve this, your options are as follows:

- o Contact our support desk (support@mhi.ca) for assistance with setting up this software. Ensure to include your PSCAD license number and the log file from your Fortran Medic tool. Or
- o Update your software to v4.3 or later (the latest version is preferred), or
- o Switch your compiler, use the free GNUFortran compiler.

6. Common Questions

The following Intel “Frequently Asked Questions” webpages contains detailed descriptions and setup instructions:

- [Installation](#)
- [Licensing](#)

The following is a listing of some of the common questions that we have seen:

- a. What do the Intel compiler and Microsoft Visual Studio software do?

The Intel Fortran software compiles Fortran code into object files (.obj). The Visual Studio software links all of the object files, and builds the executable file (.exe) to run the simulation.

Note

If the project contains c-code, an edition of Visual Studio containing a c-compiler must be used, and will also compile the c-code into object files (.obj).

- b. Where is the license file located?

- On a Windows 64-bit operating system:
C:\Program Files (x86)\Common Files\Intel\Licenses\
- On a Windows 32-bit operating system:
C:\Program Files\Common Files\Intel\Licenses

- c. Where is the licensing log file that is used to troubleshoot a floating licensing issue located?

C:\Program Files (x86)\Common Files\Intel\Licenses\Logs\instman.log

- d. How to obtain an earlier version of the software?

- Sign in to your Intel Website user account, and download the software.
- If the required version is not available, please contact the MHI support desk (support@mhi.ca).

- e. What is the difference between a named-user (single-user) license and a floating license?

A named-user license is limited to one user, and is hosted locally on the user’s PSCAD machine. A floating license can be shared with multiple users, as it is hosted on the customer’s license server and shared over the network.

- f. How to move a license to a new machine?

Please refer to the Intel website, [here](#).

- g. How to review the status of your products?

Please display the Intel website, [here](#), and enter your license key, for example in the format of #####-#####.



h. How to obtain support through Intel?

- Refer to the Get Help portal, [here](#).

i. How to know which version is “integrated” when more than one version is installed? For example, if there are multiple versions of Visual Studio installed, which version is integrated with the Intel Fortran software?

Our newest Fortran Medic utility can be used to determine this. Please see this [article](#) for instructions.



DOCUMENT TRACKING

Rev.	Description	Date
0	Initial	30/Jun/2016
1	Added Section 6, minor improvements	15/May/2017
2	Major re-organization of sections; Added details for selecting appropriate software and setting up software, commonly asked questions and reference to Intel website assistance, troubleshooting section, and details on software and licensing	18/Oct/2017
3	Update to Section 4 Step (c) and Section 5 Step (b)	08/Nov/2017
4	Update to New Branding Guidelines	21/Nov/2018
5	Added content to Sections 2.2 and 5 General improvements	25/Nov/2018
6	Update to Intel 19 Update 3 – Visual Studio Shell Edition no longer available Rebranding to MHI General improvements	10/Apr/2019
7	Update to Section 2.2; General improvements	21/May/2019
8	Update to Sections 1.3, 2.2 and 6	30/May/2019
9	Revised and moved information from Sections 2.1 and 2.2 into Section 2; Deleted Sections 2.1 and 2.2 Update to Sections 1.3, 3.1, 3.2, and 4	13/May/2020
10	Update to Title, update to Intel oneAPI, and general cleanup	08/Feb/2021