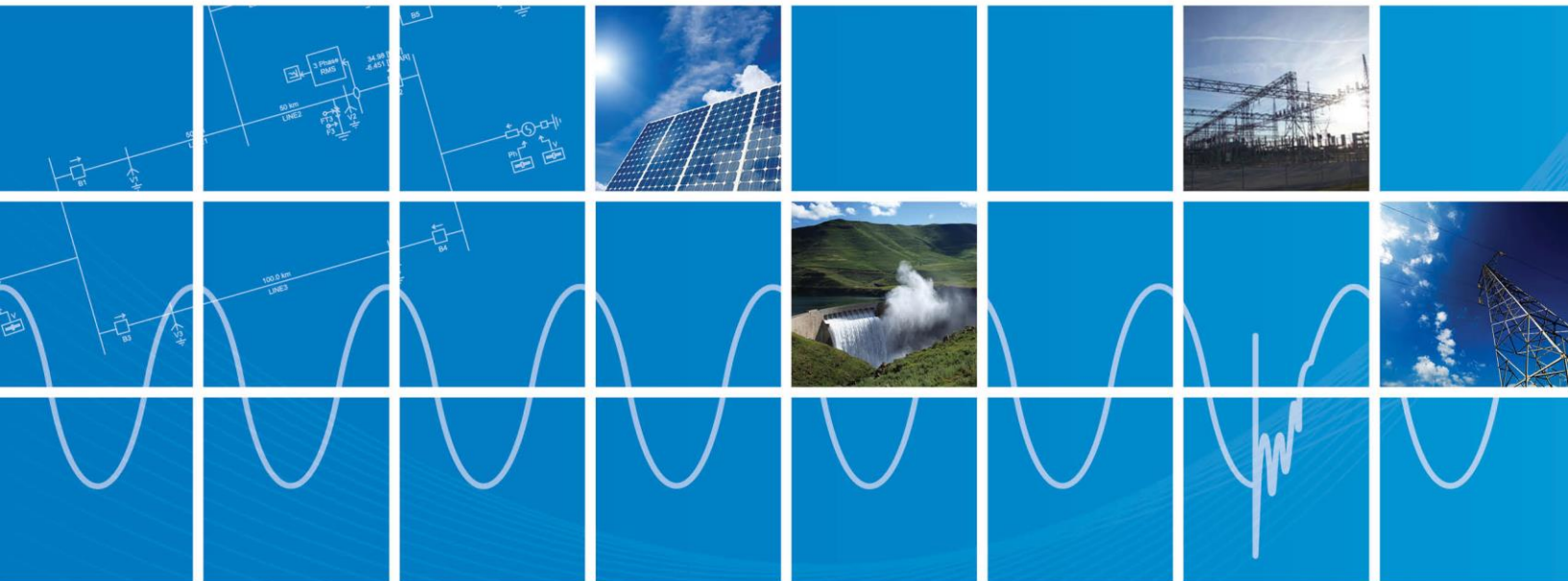




PSCAD™

Setting up the Intel® Compiler for Compiling PSCAD Projects

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Powered by Manitoba Hydro International Ltd.
211 Commerce Drive
Winnipeg, Manitoba
R3P 1A3 Canada
mhi.ca





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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.

The newest family of Intel Fortran compilers, "Intel oneAPI", version 19.2, is available for free. PSCAD users may download and install this version without a license. Please see this [article](#) for setup tips for setting up without an Intel license.

However, if an older version of Intel Fortran compiler must be used (v19.1 or older), a license for using Intel must be used. A new license can be purchased, and would be authorized for running Intel 19.2 and older. 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" Toolkit and "HPC" Toolkit) may be purchased through MHI. Please see further information on [selection](#) and [Intel oneAPI](#).

Note

You will need a special license in order to use your Intel oneAPI license to run older versions of Intel (e.g. Intel 14). Please see Step 12.b of this [article](#) for further information.

An alternative option to using 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 (single-user) or Team (multi-user) 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

This document is a guide for setting up your Intel Fortran Compiler and Microsoft Visual Studio software, when using a license for Intel. To set up the free Intel Fortran Compiler (Intel oneAPI), please refer instead to the tips listed in this [article](#).

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

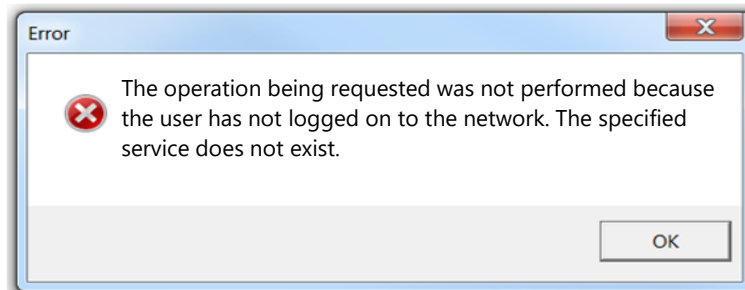
This section provides some tips for setting up Visual Studio Professional Edition and Enterprise Editions.

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.

Setup Tips

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. The standalone editions of Visual Studio may be obtained from Microsoft® ([Current Version](#) / [Older Version](#)).
Or to obtain a download from the [MHI Support desk](#), please indicate the version and edition of Visual Studio, as well as your PSCAD license number.
3. A [Microsoft user account](#) is required for the installation, 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.



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

5. For Visual Studio 2015 and later:

- This version is only supported with PSCAD v4.6.1 and newer.
- 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:



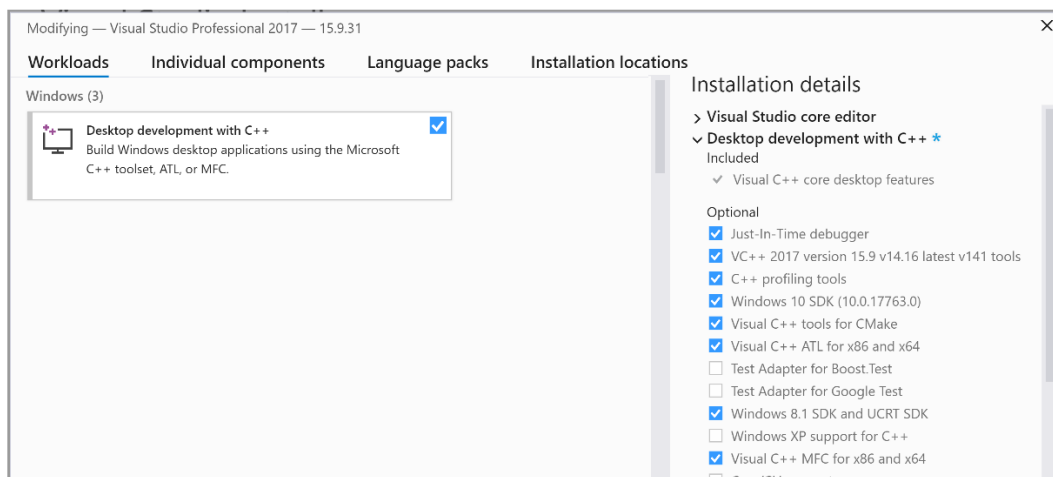
Warning!

To update an existing installation of VS 2015, it is recommended to uninstall-then-reinstall this software. It is not recommended to "modify" your existing installation.

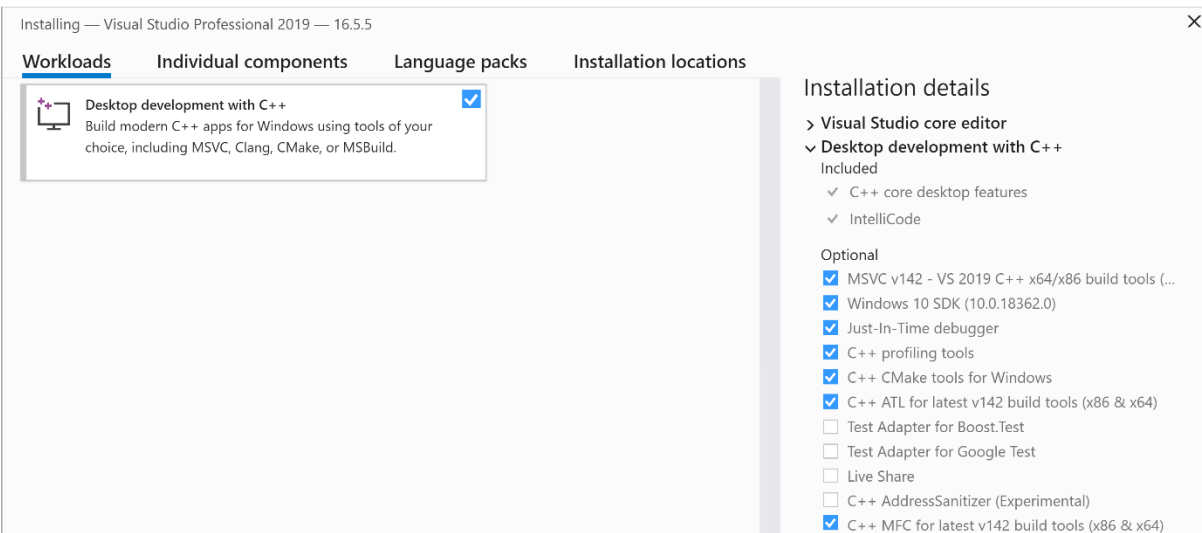
Note

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

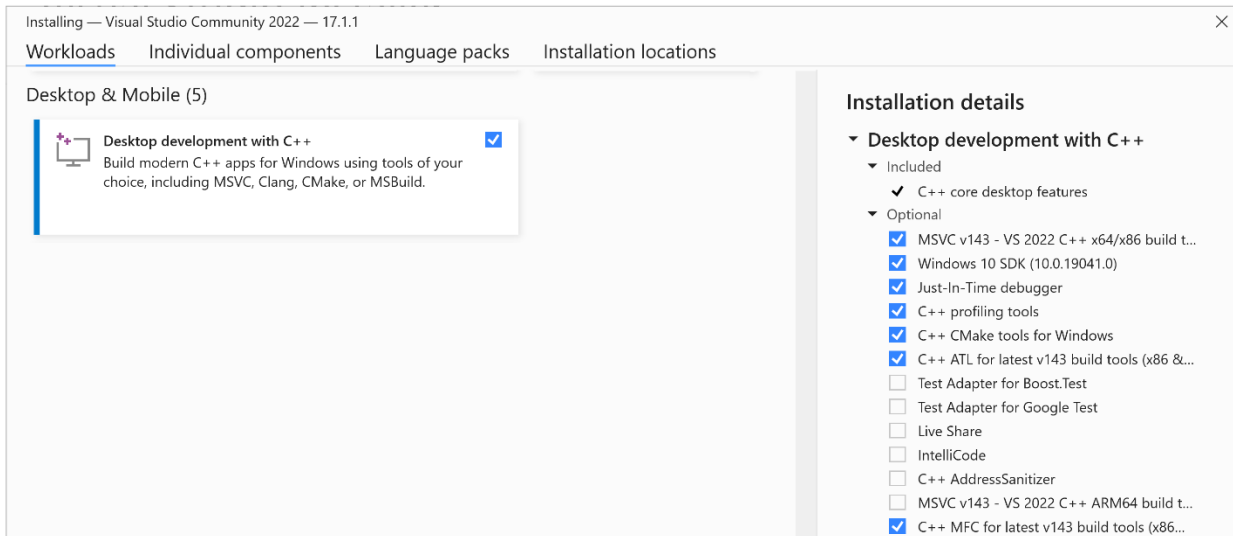
- For Visual Studio 2017, the items as shown as selected in the screenshot below include everything that must be installed for a successful PSCAD compiling setup:



- 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:



- For Visual Studio 2022, 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

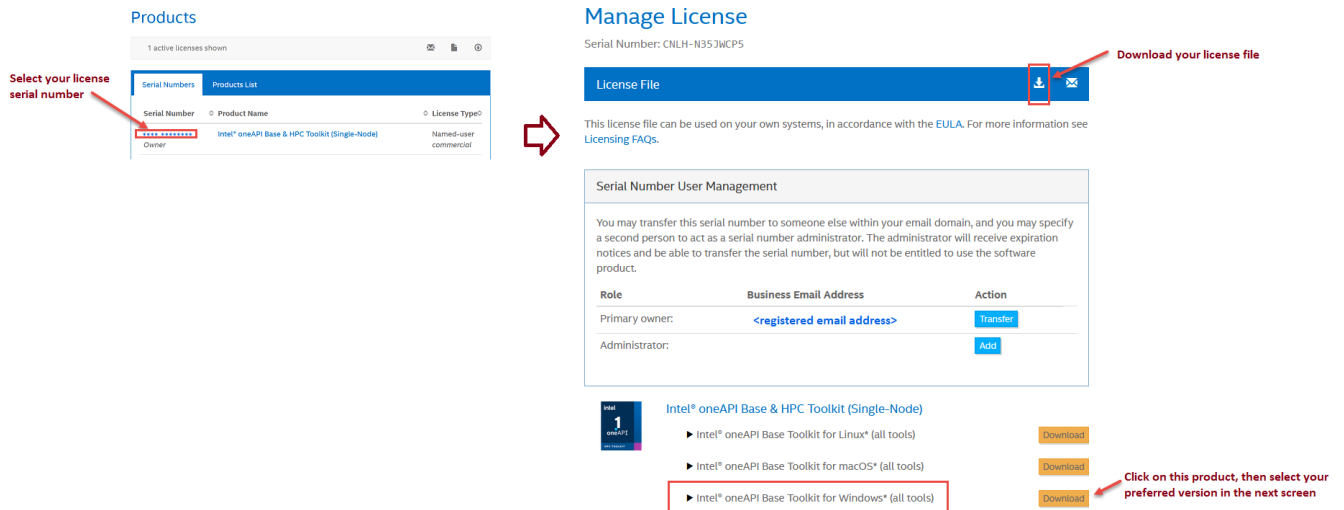
This section provides instructions for setting up the Intel Fortran compiler.

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.
- Register your license [here](#). You can then log in or register a user account.
- Download your license file and your Intel software as shown:



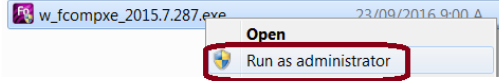
The image shows two screenshots from the Intel licensing website. The left screenshot, titled 'Products', shows a table with columns for 'Serial Number', 'Product Name', and 'License Type'. A red box highlights the 'Serial Number' column, with an arrow pointing to it and the text 'Select your license serial number'. The right screenshot, titled 'Manage License', shows the 'License File' section with a download icon. A red arrow points to this icon with the text 'Download your license file'. Below this, there is a 'Serial Number User Management' section with a table for adding administrators. At the bottom, there is a list of products under the heading 'Intel® oneAPI Base & HPC Toolkit (Single-Node)'. A red box highlights the 'Intel® oneAPI Base Toolkit for Windows* (all tools)' product, with an arrow pointing to it and the text 'Click on this product, then select your preferred version in the next screen'.

Note

If the version you require is not available, please contact the [MHI support desk](#) for assistance.

- Save your downloaded license file to the following location (create any folders as required):
C:\Program Files (x86)\Common Files\Intel\Licenses
- To set up 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:

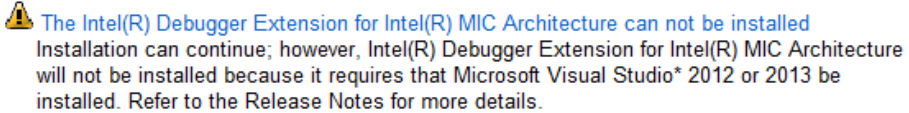


- The “Welcome” page will display any detected issues prior to performing the installation. Ensure to read through any messages, and if required, resolve the issue before proceeding with the installation. The following are some examples:

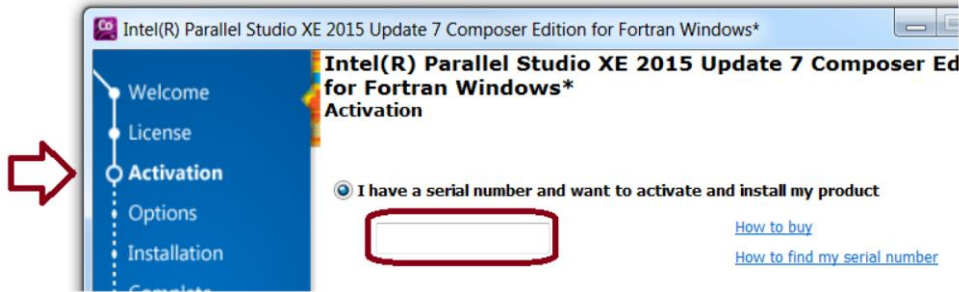
For example, required prerequisite software might be missing, so the Intel Fortran installation may not proceed. In this case, install the missing software and restart the Intel compiler installation.

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.

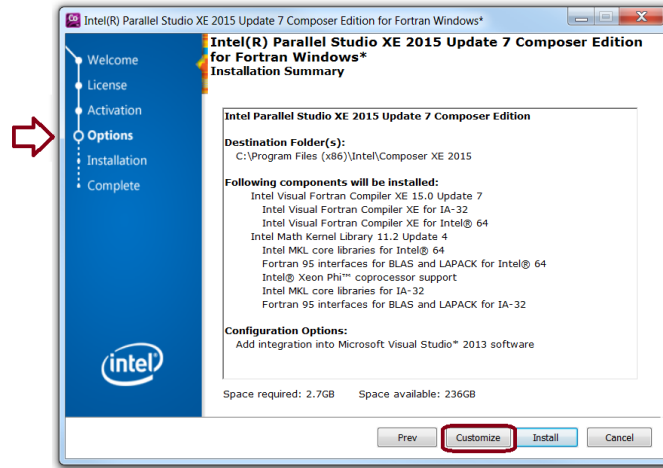


- On the Activation page, the installer may detect your license file, and suggest you use the detected license. If this occurs, select the option to proceed. Or, if the license file is not detected, paste in your 12-digit license key (determine your license key as per Step (a) above), then select “Next”.

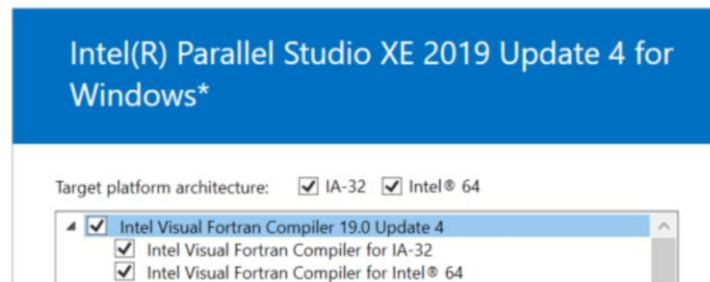


Note - If any errors associated with the license key display, please refer to the [Product Licensing FAQ website](#).

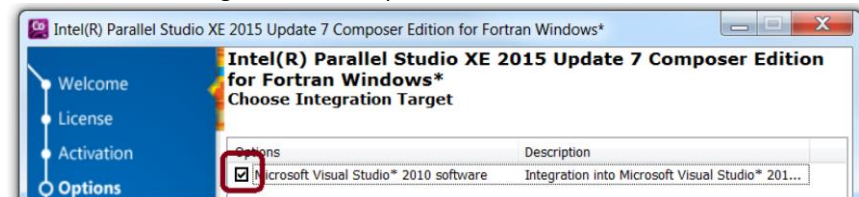
- On the "Options" page, select "Customize" so that you will be prompted to review the software to be installed as well as the Visual Studio integration:



- 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 / Community).
 - 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:



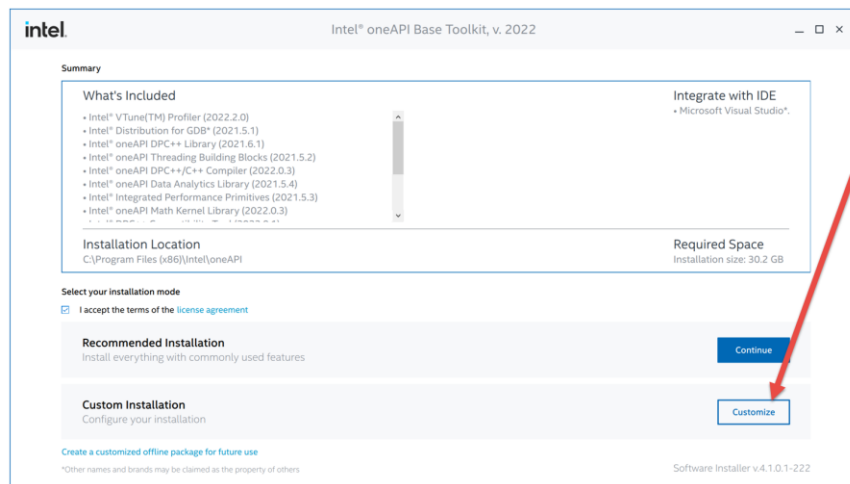
- The installation should proceed, and can take several minutes.

f. For Intel 19.2 (oneAPI):

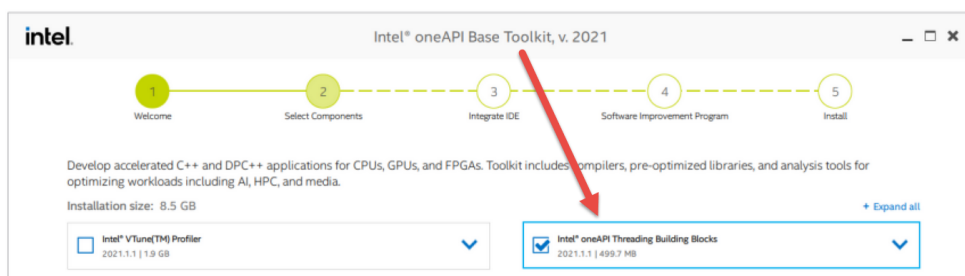
- Unzip the two files (Base Kit and HPC Kit), and save them to a folder on a local drive (e.g. on your desktop). This might take a few minutes.



- FIRST, launch the “BaseKit” file (right-click on the unzipped file, and select “Run as administrator”). You will be prompted through the installation.
- Select the option to “Customize” your installation when prompted:

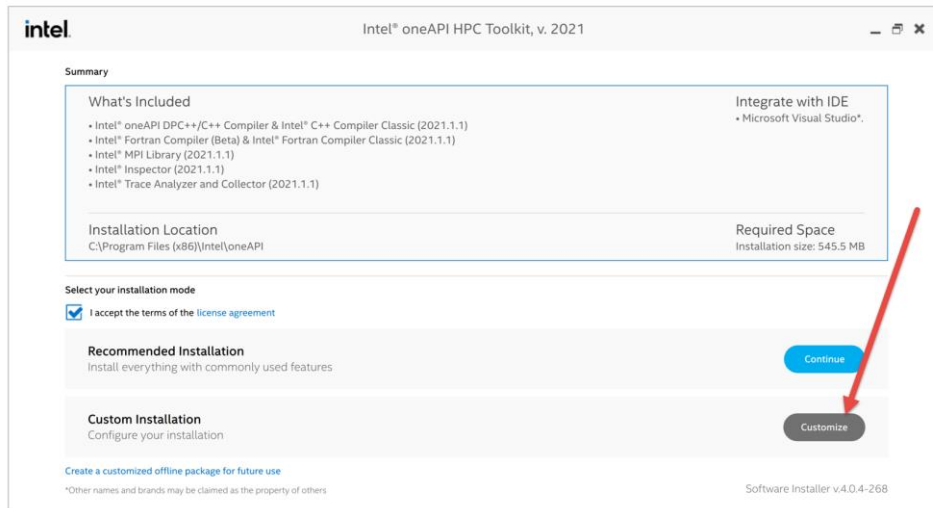


- In the “Select Components” page, select as a minimum, the one item as shown as selected in the image below:

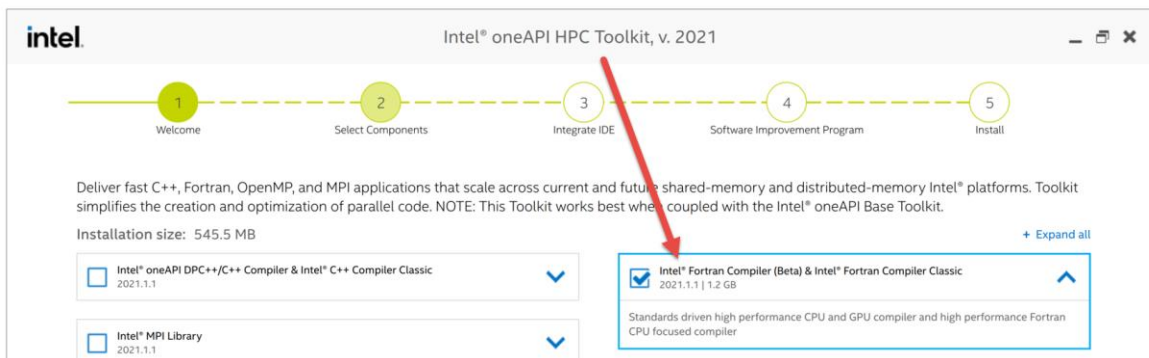


- Second, launch the HPC Kit (right-click on the unzipped file, and select “Run as administrator”). You will be prompted through the installation.

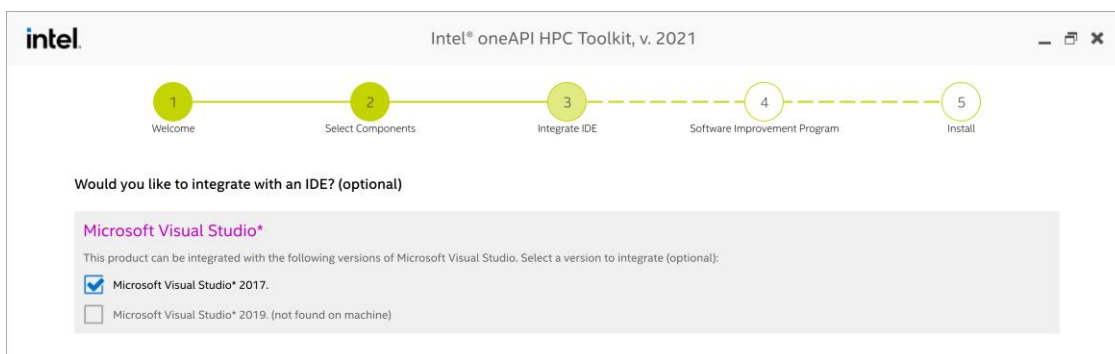
- Customize your installation by selecting “Customize” on this page:



- 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:



- g. When the installation is complete, log out then log back in on your machine before proceeding, to apply the changes.



- h. Refer to Section 3.3 to ensure that PSCAD program files are properly set to use the installed version of Visual Studio.
- i. Then proceed to Section 4 to test your setup, prior to running your own cases.



3.3. Configuring PSCAD Program Files

3.3.1 Toggle PSCAD to Use Visual Studio 2013 and Older or Visual Studio 2015 and Newer

Refer to this [article](#) for information on setting this.

3.3.2 Update PSCAD Configuration File to Detect Newer Versions of Intel

Refer to this [article](#) for information on updating this file.



4. Ensuring your Setup Works

Once the Intel Fortran and Visual Studio software are installed (Section 3), you should test your setup by trying to build a simple PSCAD case. If this case builds without any errors, then your setup should be ready for compiling your own cases.

Please see this [article](#) for instructions on testing your setup.

5. Troubleshooting

5.1 Installation Issues

Several installation issues that have been encountered by our customers are documented in the solutions manual posted to this [article](#).

5.2 Compiling Issues

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

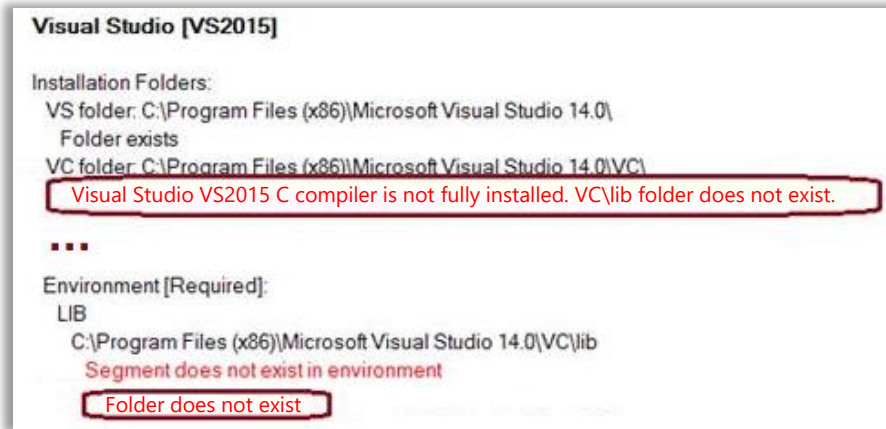
5.3 Licensing Issues

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 (floating licenses were discontinued), some tips for troubleshooting activation issues are available in this [article](#). Related Build errors in PSCAD similar to the following might appear:

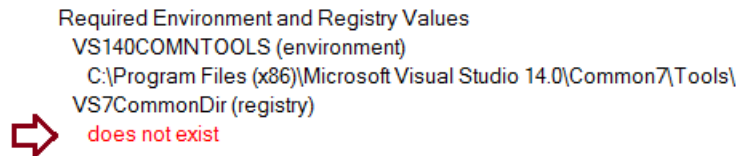
- c. **For Visual Studio 2015+:** If the Medic detects that the common tools registry value does not exist (see example below), then Visual Studio 2015+ must be re-installed. , however, ensure to apply the tip listed in Section 3.1 Setup Tip #5.



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.

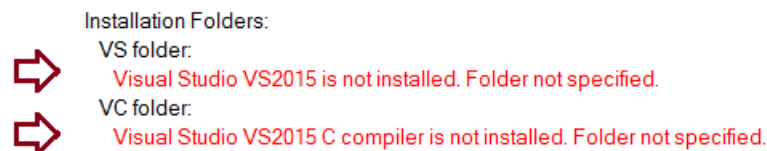


- b. **For any version of Visual Studio:** If the Medic detects the errors as shown in the following examples, then there is a problem with the installation, and Visual Studio should be re-installed:

- 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:



- 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

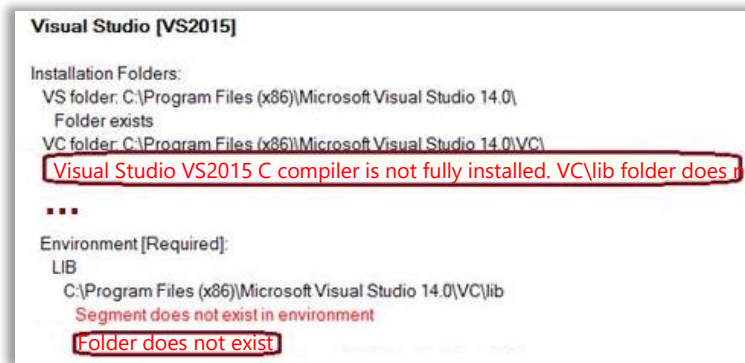
Visual Studio [VS2012]

...
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.



- 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:

- 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
```

- 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:

- 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
- Update your software to v4.3 or later (the latest version is preferred), or
- 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
11	Updates to Sections 1.3, 1.4, 1. 3.1, 3.2, 3.3, 4, 5.1, 5.3	09/Jan/2023