

FICO® Xpress Optimization

Last update 15 June, 2020

8.10

INSTALLATION GUIDE

FICO® Xpress Installation Guide

FICO® **Decisions**

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FICO® Xpress Optimization

Deliverable Version: A

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Version 8.10

Contents

1	FICO Xpress Installation	1
1.1	Introduction	1
1.2	Community License	1
1.3	Obtaining a Full License File	1
1.4	Downloading the Installation Packages	2
1.5	Installing Xpress on Microsoft Windows	2
1.5.1	Installation Prerequisites for Windows Installation	2
1.6	Installing a Static License	4
1.7	Installing a Floating License	5
1.8	Specifying Additional Installation Options	6
1.9	Installation on Linux or Unix	8
1.9.1	Prerequisites for Linux Installations	9
1.9.2	Automated installation on Linux or Unix	11
1.10	Installation on Macintosh	11
1.10.1	Environment variables	11
1.11	Manual Installation	12
1.11.1	Manual Microsoft Windows Installation	12
1.11.2	Manual Linux/Unix Installation	13
1.12	Patch Installation	14
1.12.1	Windows Patch Installation	15
1.12.2	Linux/Unix Patch Installation	15
1.12.3	Macintosh Patch Installation	15
2	FICO Xpress Licensing	17
2.1	Using a Static License	17
2.2	Using a Floating License	17
2.2.1	Setting Up the License Manager	17
2.2.2	Setting Up the Clients	18
2.2.3	Using the Client and Server on the Same Machine	18
2.2.4	Stopping the License Manager	18
2.2.5	Custom Port Number	19
2.2.6	Connection Retries	19
2.2.7	Logging	19
2.2.8	License Status	20
2.2.9	Replacing the License File	20
2.3	Troubleshooting Licensing Issues	21
2.4	Licensing Error Messages and Suggested Resolutions	21
2.5	Dongle Licenses (for Microsoft Windows Machines)	23
2.5.1	Displaying the Dongle Number	23
2.5.2	Installing the HASP Dongle Device Driver	23
2.5.3	Notes for Xpress Release 13 (and Earlier) Users with Dongles	23
2.6	Dongle Licenses (for Linux Machines)	23
2.6.1	Displaying the Dongle Number	24
2.6.2	Installing the HASP Dongle Device Driver	24
2.7	Community License	24

2.8	Redundant Server Licenses	24
2.9	Virtualization	25
2.9.1	Static Licensing	25
2.9.2	Floating Licensing	25
2.9.3	Application and Enterprise Licensing	25
2.9.4	Virtualization Recommendation	25
2.9.5	Using HASP Dongles with VMware	25
2.9.6	Using HASP Dongles with Microsoft Virtual PC	27
2.9.7	Using HASP Dongles with Microsoft Virtual Server	27
3	Supported Platforms	28
3.1	Operating System and Hardware	28
3.2	Xpress Solver - Xpress Optimizer and Xpress Nonlinear	28
3.2.1	Python Support	28
3.3	Xpress Mosel	29
3.3.1	Python Support	29
3.3.2	R support	30
3.3.3	Data Sources	30
3.4	Xpress Solver - Xpress Kalis	30
3.5	Interfaces	30
3.5.1	Java	30
3.5.2	.NET	30
3.5.3	Knitro	31
	Creating FICO Xpress Runtime Distributions	32
	Runtime Libraries and Other Dependencies	32
	Dongles	36
	Floating Licenses	36
	Appendix	38
A	Contacting FICO	38
	Product support	38
	Product education	38
	Product documentation	38
	Sales and maintenance	39
	Related services	39
	FICO Community	39
	About FICO	39
	Index	40

CHAPTER 1

FICO Xpress Installation

1.1 Introduction

This document describes how to install the FICO Xpress Optimization Suite and the licensing configuration options for the software.

For installation instructions pertaining to FICO® Xpress Insight, please see the Xpress Insight Installation guide.

Note: For the purposes of this guide, Option_1 (Node Locked), Option_2 (USB Dongle), and Community licenses are referred to as "static" licenses. Option_3 (Floating) licenses are referred to as "floating" licenses.

If you have any problems with your Xpress license, please refer to the sections on [2.3](#), and [2.4](#). These sections also tell you what information you must supply to FICO Support if you cannot resolve the problem on your own.

1.2 Community License

The Community license enables development, modelling, and deployment of the industry leading FICO Xpress Optimization software, free of charge. It can be enabled during installation on Windows; it is automatically enabled during installation on the Mac. The solvers in the Community license are limited in problem size. In this edition, the sum of the number of rows (constraints) and columns (variables) is restricted to 5000, the number of non-linear tokens (measure of the complexity for non-linear expressions) is restricted to 1000, and the number of user functions (black box optimization) is restricted to 1. You can unlock these capabilities by purchasing and installing a Full license.

1.3 Obtaining a Full License File

You can obtain a license file, `xpauth.xpr`, from FICO Sales (or your Xpress supplier). The full license file removes the problem size limits imposed by a Community license. This applies to both new users and users upgrading from earlier releases. The full license file removes the restrictions imposed on problem size by a Community license.

License files are generated using information from the output from the **Xpress Host ID** tool. If you are requesting a static license, run the tool using the following procedure on the machine that will host the installation; For a floating license, follow the steps to run the tool on the server.

- Using Microsoft Windows, you can run this tool from the Start menu, or by browsing in Windows Explorer to navigate to the `<installationdir>\bin` folder and double clicking `xphostid.exe`.

- If you use Unix, the tool is installed in the `<installationdir>\bin` folder as `xphostid`.

If you are upgrading from an earlier release, you must also supply their ASSC (support) reference number.

A license authorizes the use of all minor releases within a major release. For example, a license file for Xpress 8.4 authorizes the installation of all 8.4 minor releases (8.4.1, 8.4.2, and so forth). A new license file is required for a new major release such as Xpress 8.5.

1.4 Downloading the Installation Packages

To install Xpress, use the installer packages available from the downloads area of the FICO Xpress website. When downloading a new release, make sure that you pick the correct installer for your system and license. For example, if you want to use a Linux 64-bit Xpress, make sure this is the package you download (and not, for example, Linux 32-bit).

There are three types of installer;

- an *InstallShield* Windows version (Windows 32-bit, 64-bit)
- an install script version for all the Linux and Unix installers, and
- a DMG file for Macintosh.

To install an Xpress patch rather than a full Xpress installation, see the section [1.12](#).

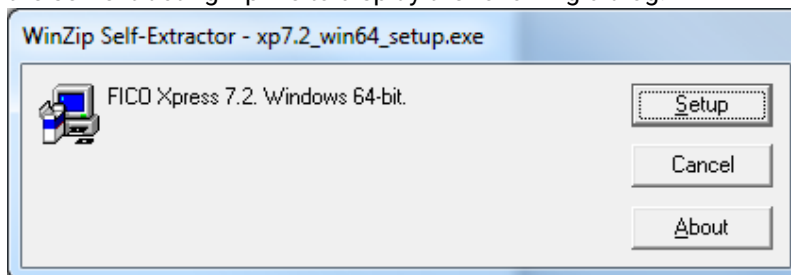
1.5 Installing Xpress on Microsoft Windows

Use the Microsoft Windows *InstallShield* installers, which are contained and run from the self-extracting zip files downloaded from the FICO Xpress website.

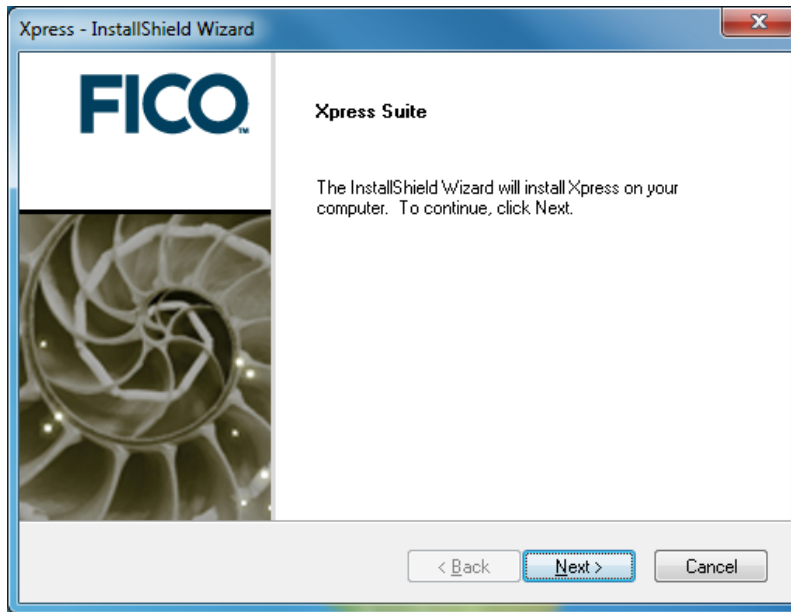
1.5.1 Installation Prerequisites for Windows Installation

There are no prerequisites for Windows installations.

1. To install the software, double-click the left mouse button on the file you downloaded; this causes the self-extracting zip file to display the following dialog:



2. Click **Setup** and wait a few moments for the files to be prepared and the installer to run. Once the files have been extracted from the package, the *InstallShield* installer displays the following window:

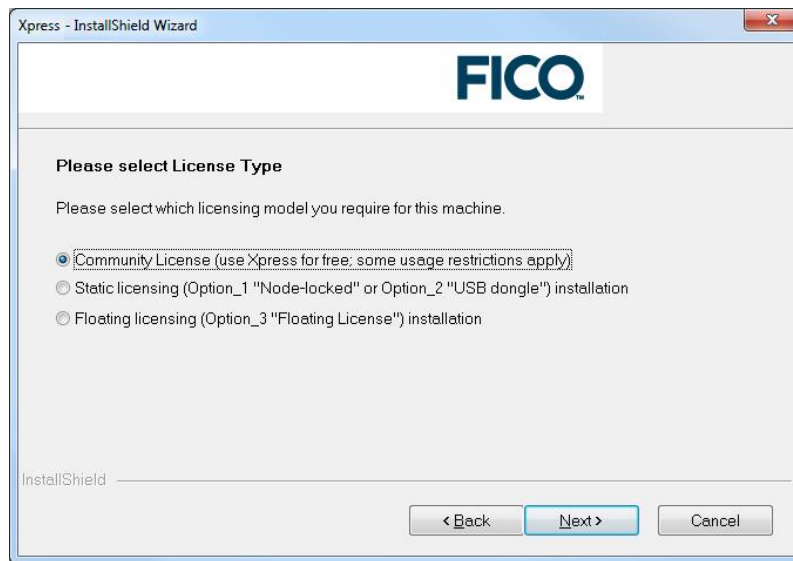


3. Click **Next** to continue with the installation. Click **Back** if you want to return to the previous screen.
4. Next you will be presented with the Xpress licensing agreement as shown below:



It is important that you read this agreement and make sure that you agree to its terms and conditions. Use the scroll bar (highlighted in green) to read the complete agreement. Click **Print** to print the agreement text.

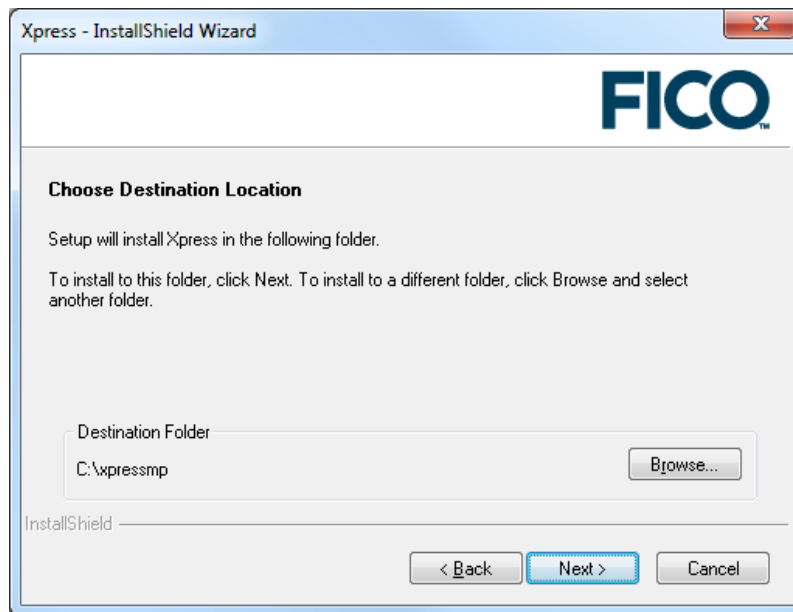
5. Click **Yes** if you agree with the terms. (If you click **No**, the installer will automatically close.)
6. Accept the default installation location (or navigate to the desired location) then select what type of license you wish to use:



- **Community License:** Choose this to use the software with the free FICO Xpress Community License for academic and commercial use. The capacity limitations previously listed in [1.2](#) apply. The software will install for the local machine only.
- **Static Licensing:** Choose this to use the software with a **paid** or **evaluation** license. The software will install for the local machine only. Click **Next**. See [1.6](#) to continue the installation.
Note that if you select the Static licensing option and plan on using a dongle to license Xpress, you will be able to move the dongle between machines, but only one machine at a time can access the software.
- **Floating Licensing:** Choose this to use the software with a **paid** license. The software will install for the current network. Click **Next**. See [1.7](#) to continue the installation.

1.6 Installing a Static License

1. Select where you want the software installed. The default location of `C:\xpressmp` is suitable for most installations, unless you already have a folder on your C drive named `xpressmp`, or if you do not have permission to install software to the default location.

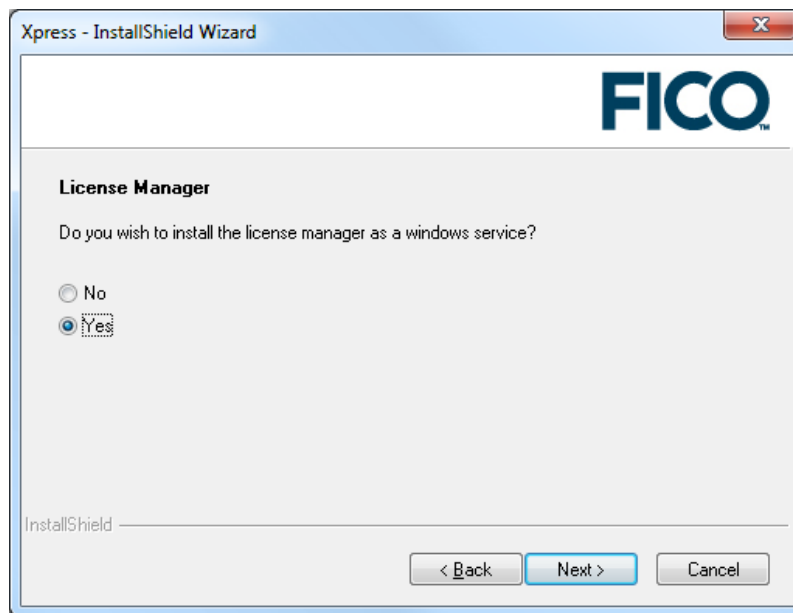


2. Click **Next**.
3. To continue the installation, see [1.8](#).

1.7 Installing a Floating License

1. At this point you will be prompted to specify whether the installation is for the client (the machine that runs the Xpress software and requests licenses from elsewhere), or the server (the machine that runs the license manager and grants or refuses licenses to client machines). For more information see [FICO Xpress Licensing](#).

The following screen will display:

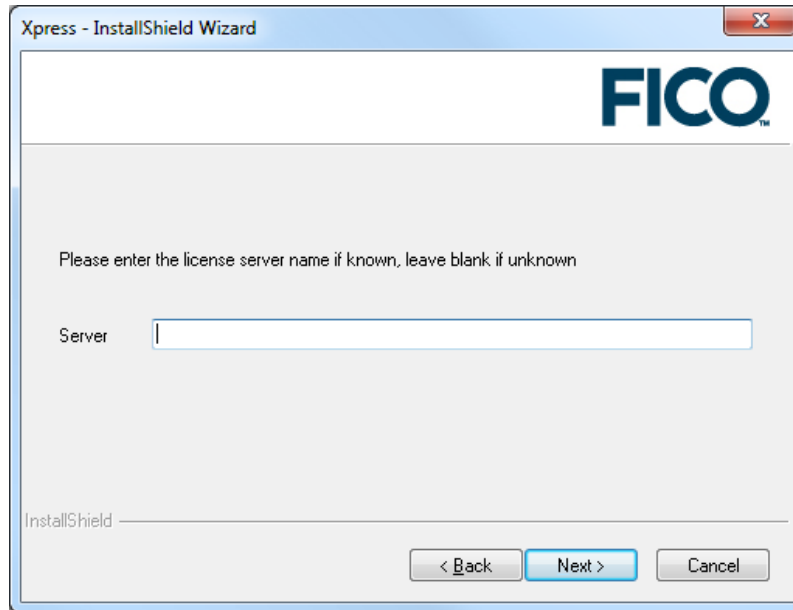


2. Click **Yes** if you want the XPserver license manager to be run as a Windows service. (This means

that the license server will be started automatically in the background, which is often the easiest and best way to run the license manager.)

You can also start the license manager as a standard program by running the `runlmgr.bat` file. For more information see [FICO Xpress Licensing](#).

3. Click **Next**.
4. For the installer to fully setup your configuration, it needs to know from which server to make license requests. If you do not know what the server is called, then ask your system administrator for the name of the FICO Xpress license server.

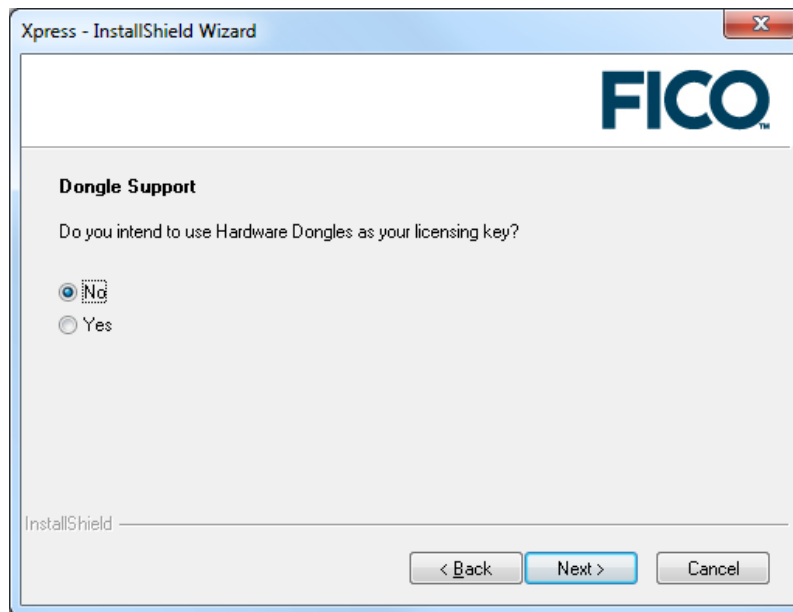


If the name of the server is unknown, but you would like to continue with the installation, leave **Server** empty and click **Next**. This creates a license file with an empty field for the server name. Once the server name is known, you can open the license file (located in `<installationdir>\bin`) with any text file editor and type the server name between the quotes in the line `use_server server=""`.

5. To continue the installation, see [1.8](#).

1.8 Specifying Additional Installation Options (For Static or Floating License)

1. At this point in the installation, you can specify whether you intend to use dongles as your licensing key. (Dongles are small USB objects that look similar to a USB memory stick.) Dongles can be used if you want to use Xpress on multiple machines, running the software on one machine at a time. This option is useful when you do not want to lock the license to one particular computer but rather to one particular dongle.

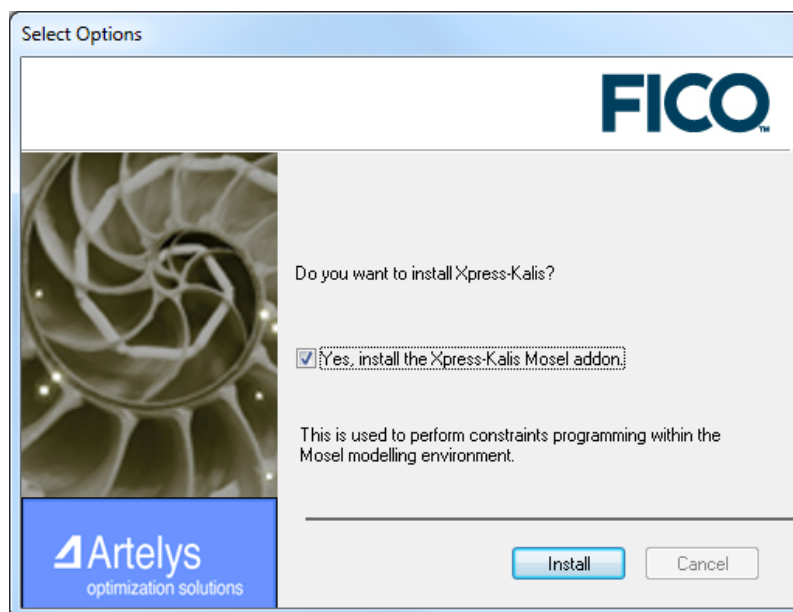


2. Specify whether you intend to use dongles:

- Select **Yes** and click **Next** if you wish to use dongles. This step ensures that the driver software, required by Windows so that it can understand the dongle, is installed during the Xpress installation process.
- If you select **No** and then later decide you do need the dongle drivers, see [2.5](#). Click **Next**.

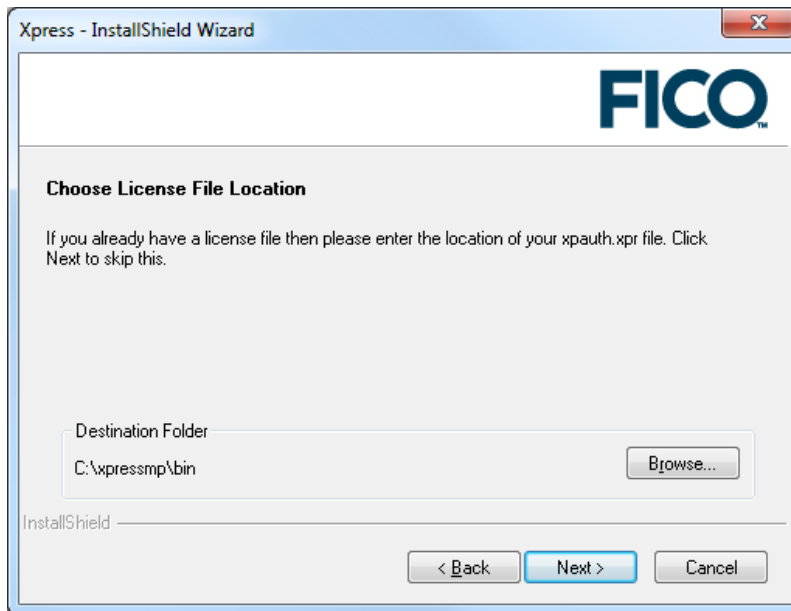
3. Specify whether you want to install the Xpress Kalis constraint programming add-on. This add-on can be used within the Mosel modeling environment. The default option is to install this add-on, but you must have a license which allows its use in order to use the Kalis functionality. If you select to install this option, you must agree to the Artelys Kalis terms and conditions.

Click **Install**.

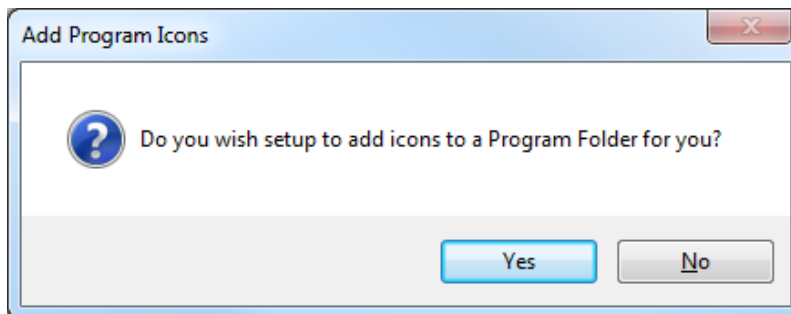


The software will now install. This may take a few minutes.

- After the software has installed, you will be prompted to point to the license file and the environment variables must be set.



- If you have a license file from FICO Support, click **Browse** and enter the folder in which the license file (`xpauth.xpr`) is located. Click **Next**.
 - If you do not have a license file from FICO Support, you can continue; however the license file created in the Xpress installation directory will not be a valid file, just a temporary placeholder until you have a valid license.
- Click **Yes** if you want to have the Xpress software added as an option on the Windows Start menu.



You have now successfully installed Xpress.

Note: Should the installer fail to function correctly then the software can be installed manually. See [1.11](#) for details.

1.9 Installation on Linux or Unix

To install Xpress on Linux and Unix variants, use the install script contained within the downloaded tar archive file. You must untar the required files from the downloaded file. As such, it is recommended that you not perform this task from your base directory.

1.9.1 Prerequisites for Linux Installations

Note: If you have an Xpress license, it is recommended that you make a note of the full directory path that contains the file (*xpauth.xpr*) before you begin installation since you will need this information.

1. To extract the files from the tar archive and start the installation script, enter the following commands. (For this example the installation is for an 8.4 Linux 64-bit version; as such, your tar file may have a slightly different name depending on the Xpress version and system on which you are installing.)

```
tar xf xp8.8.0_linux_x86_64_setup.tar
cd xp8.8.0_linux_x86_64_setup
./install.sh
```

After script start up, you will be prompted to answer a series of questions to set up the installation. (You can exit the installation process at any time by pressing the *Ctrl* and *c* at the same time.)

2. Specify the type of licensing you wish to use: choose from community (free FICO Xpress Community License for academic and commercial use; the capacity limitations previously listed in 1.2 apply), static (one computer, or a dongle for a non-server installation) or floating. Also note the following when responding to the prompts:
 - In this and all of the other installation questions, valid options are visible in the question text surrounded by square brackets. For example, at this point there are three options: (c)ommunity or (s)tatic or (f)loating. Therefore valid entries are **c** or **s** or **f**.
 - When the question requires a yes/no answer, you must type **y** or **n**.
 - When entering a directory path, type the full path, or press *Enter* to accept the offered default path.
3. If you opted to install a floating license, you will be prompted to indicate whether you want a (s)erver or a (c)lient installation. If you will be connecting to another computer (or another XPserver Xpress license manager on the same machine) then enter **c**; if you want to make this machine the license server then enter **s**.
4. Determine where to install the software: The default is `/opt/xpressmp`. Press *Enter* to accept the default. To install to a different location, enter the full path, making sure to use forward slashes `" / "`. You may enter the relative path if you wish, but this may affect how the environment variables are set later in the installation process. The supported method is to enter the full path.
5. Using the Xpress Kalis constraint programming engine: this is an optional component for use in the Mosel modeling environment. It requires the relevant licensing option in order to authorize its use; however, anyone can install the add-on provided they accept the terms and conditions.

If you select the default option (to install Kalis) the Kalis licensing agreement is displayed. This can be scrolled through quickly using the Space bar key, or scrolled through slowly using the up and down arrow keys or *Enter*. Pressing **q** stops the display of the licensing agreement, at which point you will be asked if you agree to its terms. Press **n** or **y**.
6. Add Xpress installation paths to your `.bashrc` file: by doing this, Xpress command-line tools can be accessed from any Bourne shell (bash) you create. If not, you will have to manually source the `xpvars.sh` file to use Xpress tools. Press **n** or **y**.
7. License file: you will be prompted to indicate whether you have an Xpress license file from FICO Support.

- *If you do not have a license, enter **n**.* At this point, you can stop the installation in order to obtain the license file from FICO Support and then perform the installation once you have it. Or you can continue with the installation and get the license file at a later date. If you choose the latter option, you will need to place the license file in the `bin` directory of your Xpress installation. For instance, in the preceding example, (`/opt/xpressmp`) you would copy the `xpauth.xpr` license file in to the `/opt/xpressmp/bin` directory.
- *If you indicated earlier that you have an Xpress license and provided its location, you will be prompted whether you want to copy the license file to the default directory (which is `/opt/xpressmp/bin` for this example). This is the default option.*

If you decide not to use the default location for the Xpress license, Xpress will still work correctly; however you should make a careful note of where the license file is stored in case it requires updating at a later date. (Once installation is complete, the location you have set for the license file should be pointed to by the `XPRESS` environment variable.)

The files will now be extracted from the tar archive. Depending on the speed of the computer, this may take only a few seconds or it may take as long as a few minutes.

8. *If you indicated earlier that you were installing a floating client, you will now be prompted for the name of your license server. If you know the name, enter it now. If you do not know the server name, press **Enter** and make a note of the onscreen instructions for entering the server name at a later date. (You can alter the server name in the `xpauth.xpr` license file using any text editor, such as Emacs or Vi.)*
9. On completion, the installer generates two script files, one for the Bourne shell (`xpvars.sh`) and another for the C shell (`xpvars.csh`). These scripts should be run, as detailed in the installer output, to set up the shell environment so that Xpress runs correctly. Add them to any user profiles or service startup scripts that will be making use of Xpress.
10. If you need to set any custom environment variables for Xpress (in the Bourne shell) you can create a file called `xpvars.local.sh` alongside the generated `xpvars.sh` file and export custom environment variables from this script.
11. *If you did not have your license file while performing the installation, you will need to set the `XPRESS` environment variable to point to it once you do have it. The instructions for doing this from the command line are described within the installer output.*
12. *If you want to add the change to `XPRESS` to a more permanent script that can be run whenever the shell is opened, then the best option would be to edit the relevant `xpvars` script in the `bin` directory of your Xpress installation. You can edit these files with any Linux/Unix text editor by altering the line relating to the `XPRESS` environment variable (since this is the location of the license file).*
13. *If you indicated earlier that you were installing a floating server installation, the install script attempts to start the XPserver license manager.*
14. *If you do not have a server license, then an error message is displayed. If it starts successfully, then any log messages from it will be output in to the `xpress.log` file. By default the `xpress.log` file is written to `/var/tmp/xpress.log`. For more information, see [FICO Xpress Licensing](#).*
15. The Knitro solver component for Xpress NonLinear has a dependency on `libgfortran.so.3` on Linux platforms. If `libgfortran` is not present it needs to be installed on the system, e.g. using a command such as

```
yum install libgfortran
```

Once the environment variables have been set using the script and a valid license file is present, then the Xpress software is ready to use.

1.9.2 Automated installation on Linux or Unix

As well as the guided installation detailed in the previous section you can also use the Xpress installation script as an automated installer by providing command-line options.

To get a list of the available options run:

```
./install.sh -h
```

You can specify as many options as you like, if there are any required options missing you will be prompted for these with interactive prompts. If you require the installation to be fully automated make sure you supply all the necessary options so that the interactive prompts do not appear.

Here is an example of a fully automated installation assuming you are in a directory containing the Xpress tar archive and a valid `xpauth.xpr` license file:

```
mkdir xp84
tar xf xp8.8.0_linux_x86_64_setup.tar -C xp84
pushd xp84/xp8.8.0_linux_x86_64_setup
./install.sh -l static -a .. -d /opt/xpressmp -k yes
popd
```

1.10 Installation on Macintosh

The macOS application is downloaded in a DMG file.

1. If you have Xpress installed, back up any existing Xpress licence file, then open the **Applications** folder. Right click on the FICO Xpress folder and select **Move to Trash** to uninstall.
2. Double-click the downloaded *FICO Xpress for Mac installer.dmg* file to display the license agreement.
3. Click **Agree** to continue the installation. A Finder window is displayed, showing the application and a shortcut to your **Applications** folder.
4. Drag the **FICO Xpress** icon to your **Applications** folder to install the application.
 - The FICO Xpress folder includes a copy of **Xpress Workbench** that provides direct support for the authoring, editing, executing and debugging of Xpress Mosel models and FICO Xpress Solutions. You can create a shortcut to the **Xpress Workbench** application by opening the **Applications > FICO Xpress** folder and dragging the Workbench icon to the Dock.
5. Optionally, copy the **FICO Xpress Examples** folder, that contains a range of useful resources including code examples, to your preferred location and unzip it.
6. When the installation is complete, unmount the DMG file. Ctrl-click in the Finder window and select **Eject "FICO Xpress Installer"**. You can then delete the DMG file
7. Finally, create a new folder in `<HOME>/Documents/` named `FICO Xpress Config` and copy the license file to it.

1.10.1 Environment variables

To use the command-line tools, certain environment variables need updating. At a console or in a shell script, enter

```
. /Applications/FICO\ Xpress/xpressmp/bin/xpvars.sh
```

and the variables will be set.

Note: The backslash (\) between "FICO" and "Xpress" is needed to escape the space character.

1.11 Manual Installation

In the unlikely event that the provided installers fail to function correctly, the software can be extracted manually.

To perform a manual installation on Windows, you must have a program capable of uncompressing zip files. WinZip or WinRar are suitable, although any program with this functionality should work.

Unix and Linux variants should by default contain the necessary programs to unzip and extract from the tar archives. If you do not have an extraction program, you will need to install one. If this is the case and your previous attempt at automatic installation using the install script failed, then the lack of an extraction program may be the cause. In this case, install the required tools and attempt an automatic installation again.

The differences between the automatic and manual installation methods are as follows:

- Files are not installed selectively as the whole archive will be uncompressed.
- Not all environment variables are automatically set.
- The dongle driver installation will not be run automatically (Windows).
- The file shortcuts will not automatically be added to the Start menu (Windows).
- The XPserver license manager will not be automatically configured to run as a service.

1.11.1 Manual Microsoft Windows Installation

Should the *InstallShield* installation fail, the files may be extracted using any program capable of reading and extracting from zip files as follows:

1. Rename the downloaded installation file extension from `.exe` to `.zip`.
2. Extract the files from the zip file to the folder from where you want to install.
3. Copy your license file in to the `bin` folder of the installation directory. If you are working with a Community License, rename or copy the provided file `community-xpauth.xpr` to `xpauth.xpr`.
4. Read the `license.txt` file in your installation folder and make sure you agree with the terms and conditions. (If you do not agree, then cancel the installation and delete the software.)
5. Add the `XPRESSDIR` environment variable and point towards the `xpressmp` folder of the installation directory. You can set this by going to the **Start menu** » **Settings** » **Control Panel** » **System** » **Advanced** » **Environment Variables**, and creating a new environment variable. Use the full path.
6. Add the path `%XPRESSDIR%/bin` to the `PATH` environment variable. (This allows the system to find the relevant Xpress libraries and executables.)
7. To add links to the programs on the Start menu, select **Start menu** » **Settings** » **Taskbar and Start Menu**. Click on the **Start Menu** tab and click **Customize**. Click **Add**. The Microsoft Windows wizard will display so that you can add the programs to the Start menu. You may want to add `optimizer.exe` and `xpworkbench.exe` as basic links,

although a number of other executables are available. (See the `bin` folder in the installation directory.)

If you installing a floating server license, you need only add links to `XPserver.exe`, or the configuration batch file `runlmgr.bat`.

8. *If you installing a floating server license, you can delete all files and folders except the following:*
 - `xpserver.exe` in the `bin` folder.
 - `xphostid.exe` in the `bin` folder.
 - `xplicstat.exe` in the `bin` folder.
 - `xprl.dll` in the `bin` folder.
 - `runlmgr.bat` in the `bin` folder.
 - The `tools` folder, if you require dongle licensing, from the main Xpress folder.
 - `License.txt` from the main Xpress folder.
 - The licensing folder from the `docs` folder.
9. *If you are going to use dongles for licensing, then install the dongle drivers found in the `tools\dongle\hasp` directory of your Xpress folder. Use a Windows console as it requires the addition of command-line arguments. You can open a Windows console by running `cmd` using the **Start** >> **Run** menu. See 2.5 for more information.*
10. Set up the XPserver license manager. See [FICO Xpress Licensing](#) for instructions.

1.11.2 Manual Linux/Unix Installation

As mentioned previously, if the installation fails, it is likely that there was a problem using the standard zip and tar programs. If this is not the case, then you can manually install the software by following these steps:

1. If you have not done so, untar the downloaded installer (if you have attempted to install via the automated install script then you have already performed this step). This command extracts the files from the tar archive:

```
tar xf name_of_downloaded_installer.tar
```

2. The extracted files include the installation script `install.sh`. Move the `.gz` file to the directory where you want to install the software.
Decompress the `.gz` file using the following command:

```
gunzip name_of_gz_file.gz
```

3. The preceding command extracts another tar archive which itself contains the installation files and may be unarchived using the following:

```
tar xf name_of_new_tar_file.tar
```

4. The installation directory should now contain several directories of files and several license and html files. Read the license files and make sure you agree with the terms and conditions; if you do not agree to them, delete the software and discontinue the installation.
5. Copy your `xpauth.xpr` license file to the `bin` directory of the Xpress installation. If you are working with a Community License, rename or copy the provided file `community-xpauth.xpr` to `xpauth.xpr`.

6. Set the relevant environment variables so that your system can find the Xpress executables, runtime libraries and license file. For example, on a Linux system using the C shell:

```
setenv XPRESSDIR your_xpress_install_directory
setenv PATH $XPRESSDIR/bin:$PATH
setenv LD_LIBRARY_PATH $XPRESSDIR/lib:$LD_LIBRARY_PATH
setenv CLASSPATH $XPRESSDIR/lib/xprs.jar:$CLASSPATH
setenv CLASSPATH $XPRESSDIR/lib/xprb.jar:$CLASSPATH
setenv CLASSPATH $XPRESSDIR/lib/xprm.jar:$CLASSPATH
setenv XPRESS $XPRESSDIR/bin
```

The name of the environment variable used to find shared libraries varies by system; on Linux and Solaris it's usually `LD_LIBRARY_PATH` and on macOS you should use `DYLD_LIBRARY_PATH` instead. If unsure, consult your system administrator.

You may find it useful to create a small shell script that sets these variables, or to set them in a script that runs automatically as you log in.

7. If you plan to use the `xssh:` protocol to connect to a Mosel optimization service running from this installation of FICO Xpress, execute the following commands to generate a unique machine key:

```
cd $XPRESSDIR/bin
./xprmsrv -key new
```

8. *If you are performing a Linux installation and require the use of dongles for licensing, install the dongle drivers now. See [2.6](#).*
9. If you are installing a floating server license, you only need a few of the files and can remove the rest. You must keep the following files in order for the XPserver license manager to function correctly:
 - `xpserver` in the `bin` directory.
 - `xplicstat` in the `bin` directory.
 - `runlmgr` in the `bin` directory.
 - All files which begin with `libxprl` in the `lib` directory.
 - The `licensing` directory in the `docs` directory.
 - `xphostid` in the `utils` directory.
 - `license.txt` from the main Xpress installation directory.
10. To setup the XPserver license manager, follow the instructions as described in [FICO Xpress Licensing](#).

1.12 Patch Installation

Patch, or maintenance, releases are releases that only include updated files for parts of the Xpress software. They may be released to fix a particular bug, improve performance or to add a new feature. The larger maintenance releases can be downloaded from the FICO Xpress website. They are bundled with installers and can be installed by themselves. The patch releases (which are often individual files or programs) are usually found on the FICO Xpress download site and must be applied to a previous installation of FICO Xpress.

If you have reported an issue with the software and a fix is now available, you are usually notified by email from the Support system that the fix is available to download using the ftp site and where on the site to download the fix.

1.12.1 Windows Patch Installation

1. Using your zip file extraction program (such as WinZip or WinRar) extract the patch files. In most cases, these will be replacements for library or executable files found in the `bin` folder of the Xpress installation, or the `.dso` files found in the `dso` folder of the installation.
2. If you know where the replacement file(s) should be copied, copy them to the correct destination, overwriting the older file. (You can always rename the older file if you still want access to it.) If you are uncertain where the new file should go, search from the Xpress installation directory for the name of the file. To do this, right-click on the Xpress installation folder and select **Search** from the menu. Enter the name of the file you wish to replace in the **All or part of the file name** box and click **Search**. The resulting list indicates where in the Xpress installation the file can be found.

After the patch is placed in the correct location in the installation, the software may be run as normal and the updated files will be automatically used.

Note: If you plan to install multiple copies of Xpress on one system, make sure that the folder you are applying the patch to is the correct one and that the `XPRESS`, `PATH` and `MOSEL_DSO` environment variables point towards the correct folders.

1.12.2 Linux/Unix Patch Installation

1. Using your gunzip file extraction and tar archive programs, extract the patch files. On most systems this can be achieved using:

```
gunzip patchfilename.tar.gz
tar xf patchfilename.tar
```

In most cases, these will be replacements for library or executable files are found in the `lib` and `bin` folders of the Xpress installation, or the `.dso` files found in the `dso` folder of the installation.

2. If you know where the replacement file(s) should be copied, copy them to the correct destination, overwriting the older file. (You can always rename the older file if you still want to have access to it.) If you are uncertain where the new file should go, search on the Xpress installation directory for the name of the file. You can do this using the `find` command from the Xpress installation directory:

```
find . -name name_of_file_to_be_replaced
```

3. Running the preceding command results in generating a list of files with matching names. You may find that if you are searching for a particular minor revision of a file, such as `libxprs.so.18.10.05`, that no matching name is found. This is to be expected as the Linux/Unix library files are named as per their revision and contain symbolic links (`libxprs.so` and `libxprs.so.18.10` in this case) which point to the actual library file.

After the patch is placed in the correct location in the installation, the software can be run as normal and the updated files will be automatically used.

If you are attempting to install multiple copies of Xpress on one system, ensure that the folder you are applying the patch to is the correct one and that the `XPRESS`, `XPRESSDIR`, `PATH`, `LIBPATH` (or `SHLIB_PATH` or `LD_LIBRARY_PATH`, depending on the system used) and `MOSEL_DSO` environment variables point towards the correct folder.

1.12.3 Macintosh Patch Installation

1. If the patch file named `patch.tar.gz` has been saved to the Downloads folder, the command to extract the patch files is

```
tar -xf ~/Downloads/patch.tar.gz -C /Applications/FICO Xpress/xpressmp/
```

2. After the patch has been extracted to the correct location, the software may be run as normal and the updated files will be automatically used.

CHAPTER 2

FICO Xpress Licensing

2.1 Using a Static License

Note: This section applies to Option_1 (Node-locked) and Option_2 (USB Dongle) licenses.

1. Install the license file (`xpauth.xpr`) that you received from FICO Support by saving/copying the file into your `xpressmp\bin` directory.
For UNIX machines, copy the `xpauth.xpr` file into a convenient directory, such as `xpress/bin`, and set the `XPRESS` environment variable to the following directory:

```
bash$ export XPRESS=/opt/xpressmp/bin
csh% setenv XPRESS /opt/xpressmp/bin
```

The `XPRESS` environment variable is only used by Xpress to find the license file and only on Unix. Setting `XPRESS` on Windows will have no effect.

2. You are now ready to use the Xpress product.

2.2 Using a Floating License

Note: This section applies to Option_3 (Floating) licenses.

A floating license requires a license manager to be run on a designated machine that is called the *license server*. Any instance of Xpress that is started on any machine contacts the license server over the network for authorization before continuing. This guide refers to those machines running Xpress as *client machines*.

2.2.1 Setting Up the License Manager

Note: This section applies to Option_3 (Floating) licenses.

1. To use a floating license, you must designate a machine on your network to be the license server. This machine must be on the same IP subnet as the client machines, and must allow incoming connections on TCP port 27100 (or another of your choice as described in the section ??).
2. Run the Xpress installer on the server machine. The installer is a wizard that step you through the installation process.
 - On UNIX machines you will be prompted for a license file. Enter the path to the folder containing the file `xpauth.xpr` that you received from FICO Support. The license file will automatically be copied into the server installation.

- *For Windows NT/2000 or later only:* You will be asked whether to install the license manager as a Windows service. To install the license manager as a service you must have Administrator privileges, so if you do not have Administrator privileges choose **No** when prompted.
- 3. *For Microsoft Windows installations only:* Copy the server license file you received from Xpress Support (`xpauth.xpr`) into the `bin` folder of Xpress installation directory.
- 4. Before you run Xpress on any of the client machines, start the license manager on the server.
 - On Windows, use the shortcut on the Start menu to start the license manager. If you installed the license manager as a Windows service you can also start and stop it using the Services control panel applet.
 - You can also start the license manager from a Unix shell or Windows command prompt (or DOS box) using one of the following commands:

```
runlmgr start    (for the standalone license manager and the Unix license manager)
runlmgr starts   (for the license manager Windows service)
```

The license manager remains running until you stop it manually or restart the computer, in which case it will need to be restarted before Xpress can be used again.

2.2.2 Setting Up the Clients

Note: This section applies to Option_3 (Floating) licenses.

1. To set up a client machine to use a floating license, you must first install Xpress on the client machine. When the installer asks you whether this is a server machine or a client, choose client. Enter the path where you want to install Xpress.
2. During installation you will be prompted to enter the hostname of your license server. Enter the hostname of your machine, together with any qualifying domain if necessary. For example:

```
uranos.ficdash.co.uk
```

Note: It is not necessary to run the license manager on the client machines.

2.2.3 Using the Client and Server on the Same Machine

Note: This section applies to Option_3 (Floating) licenses.

- To run the Xpress software on your server machine: Install the client and server in different folders. Install the client first (as described earlier) and then install the server. When prompted for an install path, enter a different path.
- To install the client and server into the same folder: Install the client first, and then the server. You may also have to edit the `use_server` line of your license file to point the client at your local machine, since both client and server will use the same license file for this type of configuration.

2.2.4 Stopping the License Manager

Note: This section applies to Option_3 (Floating) licenses.

At times you may wish to take your license server process offline, for maintenance or upgrade purposes, for example.

- On Windows, you can stop (and start) the license server using the links placed in the Xpress area of the Start menu.
- If you are using a Unix machine (or for Windows users who do not/cannot use the Start menu option just described) you can control the license server using the `runlmgr` script manager from a Unix shell or Windows command prompt (or DOS box):

```
runlmgr stop    (for the standalone license manager and the Unix license manager)
runlmgr stops   (for the license manager Windows service)
```

2.2.5 Custom Port Number

Note: This section applies to Option_3 (Floating) licenses.

You may need to configure the license manager to use a particular TCP port, such as in those cases where you are running another service on your server machine which is conflicting with the Xpress license manager, or if you want to make a rule in your firewall to allow incoming connections on this port. Use the following instructions to do so:

1. Edit the license file on the server and add a server line specifying the port number. For example:

```
server port="12840"
```

2. Edit the license file on the client and add the following port directive to the `use_server` line. For example:

```
use_server server="our_server_machine" port="12840"
```

3. Restart the license server application in order for it to re-read the license file.

2.2.6 Connection Retries

Note: This section applies to Option_3 (Floating) licenses.

In some cases, where the license server resides on a high-traffic machine or you have a large number of client applications, it may be helpful to automatically retry failed connections. Using this feature, if a client fails to connect to a license server, it will retry for a specified number of attempts, leaving an exponentially increasing delay between retries, rather than returning an error. To do this, follow the following instructions:

1. Edit the license file on the client and add the `retries` directive to the `use_server` line. For example, to retry a failed connection 5 times before returning an error:

```
use_server server="our_server_machine" retries="5"
```

2.2.7 Logging

Note: This section applies to Option_3 (Floating) licenses.

By default the license server process creates a log file called `xprl_server.log` in a temporary folder on the server machine.

- On Windows machines, the server logfile is created in the temporary folder by default, which is typically the folder `Local Settings\Temp` within the profile of the user account used to run the server; however in some circumstances it may appear in `C:\Windows\Temp`.

- On Unix machines the server logfile is generally found in either `/tmp` or `/var/tmp`.

To fine-tune the server's logging: edit the server license file and add a `logging` line. For example, you can change the location of the logfile as follows:

```
logging file="C:\logs\xprl_server.log"
```

or on Unix machines:

```
logging file="/var/log/xprl_server.log"
```

To change the level of detail that will be placed in the log file, use the `logginglevel` command. For example:

```
logging level="verbose"
```

The default detail level is `normal`. Other levels are `quiet` (log only serious errors), `verbose` (log more detail than `normal`) and `debug` (which should only be used under the direction of FICO support).

To change the log file size: By default the log file should not get much larger than 128 kilobytes; if you find this is not enough and want to store more logging data you can set the `maxsize` directive to the number of kilobytes you want to retain. For example:

```
logging maxsize="256"
```

2.2.8 License Status

Note: This section applies to Option_3 (Floating) licenses.

When using a server license, you may want to quickly review the current state of all the licenses. For example, you may want to find out who is using a license that you want to use yourself.

You can use the supplied command-line tool `xplicstat` to summarize which licenses are in, as well as which tokens can still be checked out. For floating licenses only, the tool will also output the time the license was locked and the IP address of the machine that locked it. Use the `xplicstat` command in conjunction with a client `xpauth.xpr` file and at least one `use_server` line.

Using Windows, this command will look for this in the same folder as the executable. On Unix machines, this command will use the `XPRESS` environment variable. You can also specify an alternate location using the `-xpress` command-line flag. For example:

```
xplicstat -xpress C:\xpressmp\bin\xpauth.xpr
```

2.2.9 Replacing the License File

If you need to upgrade or renew your license, contact FICO Support to send you a new `xpauth.xpr` file, which you must place in the same location as the original `xpauth.xpr` as follows:

- For Option_1 (Node Locked) or Option_2 (USB Dongle) licenses, this location is in the `bin` sub-folder of the Xpress installation.
- For Option_3 (Floating) licenses, you must place it in the `bin` subfolder of the Xpress server installation on the server machine. Restart the server process in order to force the server to reread the license file.

2.3 Troubleshooting Licensing Issues

If there is a problem with your Xpress license, the error message provides information about the problem.

For floating licenses, also check the `xprl_server.log` log file for any recent error messages. If the license server fails to start, check the Windows event log (or `/var/log/messages` on Unix systems) for any errors.

Refer to the following section 2.4 for common errors and probable causes and/or resolutions.

If you do not resolve the problem by reviewing this section, try the following steps:

1. Upgrade to the latest version of Xpress.
2. If you have a portable Windows machine with a license tied to your Ethernet address, and you are having problems when the machine is not connected to a network, it may have *Media Sense* enabled. This disables the Ethernet card when no network is connected to save power. Disable Media Sense by following the instructions on Microsoft's website:
<http://support.microsoft.com/default.aspx?scid=kb;EN-US;q239924>.
3. If you are running Windows XP and the Xpress host ID tool does not show any host IDs, your network adapters may be bridged. To fix this, use the Control Panel and select **Network and Internet Connections**, and click **Network Connections** (depending on your set-up, you may instead have to double-click Network Connections as soon as you open the Control Panel). If the window contains a section entitled Network Bridge, right click the Network Bridge icon and choose **Delete**. Now re-run the Xpress host ID tool to find out the host ID of your computer.

If you still have problems, please contact FICO Support, giving full details about the error number and message obtained, along with a description of the circumstances under which it occurred.

2.4 Licensing Error Messages and Suggested Resolutions

These error messages are displayed by executable software, including Xpress Workbench, Optimizer console, and Mosel console. If you are using any of the Xpress libraries, the error message can be obtained using the `XPRSgetlicerrmsg` (Optimizer and BCL) or `XPRMgetlicerrmsg` (Mosel) functions. For floating licenses they may also show in the `xprl_server.log` log file.

If you obtain an error number not listed here, report the error number and message to FICO Support, along with a description of the circumstances under which it occurred.

- 1 ***The license file (xpauth.xpr) could not be found.***
Make sure you have the correct license file in the correct location. Under Windows, the `xpauth.xpr` file must be placed in the Xpress bin directory (the directory on the path containing the Xpress DLLs). Under Unix, the `XPRESS` environment variable must be set to the directory containing the `xpauth.xpr` file. Note that the `XPRESS` environment variable has no effect under Windows.
- 2 ***There is an error in your license file...***
or
- 8 ***Your license file has not been signed by Xpress Support / has an incorrect signature.***
or
- 11 ***Your license is invalid as it specifies an invalid / no expiry date.***
Your license file is corrupt—try replacing it with the license file originally sent to you by FICO Support. If the original license file sent to you is invalid, then request a new license file. Attach

the corrupted license file and provide the error code number—this indicates to FICO Support exactly what is wrong with the file.

4 *The maximum number of simultaneous users has been reached.*

Your license file specifies a limit on the number of copies of Xpress that can be used simultaneously and that limit has been reached. Close one of the copies of Xpress, or wait until another user has finished with Xpress, or upgrade your license.

9 *The license file only supports host ID(s) (id1,...)*

Your license is locked to a different host from that which you are trying to run Xpress (or for floating licenses, the license is locked to a different server machine from the one you are using). If you need a license for this machine, contact Xpress Support.

If you receive error #9 and you are sure your license is locked to your machine's hostid, it may be that Xpress cannot detect your hostid. If you have an Ethernet license, disable *Media Sense*, as described earlier in this section. If you have a dongle, make sure that it is plugged in and to manually install the dongle drivers from your latest Xpress installation, as described in the section 2.5.2.

10 *Your license expired on (date).*

Your license has expired. Contact FICO Support to renew it or to obtain an upgrade.

14 *Could not connect to server...*

Check that the server computer is visible over the network. Enter the following command:

```
ping name_of_license_server
```

Also, verify that the license server application, `xpsrvr`, is currently running on the server machine. Check the logfile for errors. If you have a firewall, ensure that it is not blocking communications to and from the Xpress license server application.

20 *License could not be checked out on redundant servers.*

A quorum (two out of three) of redundant license servers could not be obtained for this license. Either insufficient redundant license servers are active, or the license is already checked out on the other two redundant license servers. (*This error can only occur when using a redundant server license.*)

21 *Your license only supports release (rel).*

Your license is for a previous release of Xpress. Be sure that you are not using an old license and that Xpress is finding the correct license file by following the suggested resolution in (#2) above.

If your license only covers a previous release, contact FICO Support to upgrade it.

32 *Not within local subnet*

Your license only permits you to connect to the license server from machines within the same subnet as the license server machine. If you attempt to connection from a machine outside of your subnet this error is triggered.

89 *Your license only supports platform(s) (plat1,...).*

Your license file does not support the platform that you are using to run Xpress. Contact FICO Support if you want to upgrade.

103 *Your license does not allow Xpress to be run on a Terminal Services server*

You can only use Xpress on a Terminal Services server with a Workstation or Server license. If you require a license upgrade, please contact your supplier.

259 *This is an OEM license and you have incorrectly specified the OEM number.*

You have either called an initialization function without first calling the OEM licensing function or you specified the wrong OEM number in your call to the licensing function. Check your OEM documentation to be sure that you are using the correct initialization sequence. Note

that OEM numbers issued for releases earlier than Xpress-MP 2003 are invalid with Xpress-MP 2003 and beyond. If in any doubt, confirm your OEM number with FICO Support.

2.5 Dongle Licenses (for Microsoft Windows Machines)

Under Windows, licenses are available that are locked to a dongle rather than to the host ID or Ethernet address of the computer. A license file is still required; it will contain the four-digit dongle number in place of the computer's host ID or Ethernet address. The dongle is used only to provide a unique four-digit dongle number to which the license file is locked. The license is only valid when run on the machine to which the dongle is currently attached. All license details, including the Xpress features authorized, whether the license is static or floating, the release of Xpress authorized, and so forth, are contained in the license file.

2.5.1 Displaying the Dongle Number

The dongle number can be obtained by running the Xpress Host ID tool (see 1.3 for more information). Note that the dongle must be connected to your computer and the dongle device driver must be installed and running (as described below).

2.5.2 Installing the HASP Dongle Device Driver

When installing Xpress for Windows, the setup program automatically tries to install the appropriate device driver. For the driver to install correctly, you must have Administrative privileges and restart the computer once installation is complete.

To enable the dongle drivers for Windows to be installed manually, use the software located in the `tools\dongle` directory. To install the driver, navigate to the `tools\dongle\sentinelhasp` folder and run the `haspdinst.exe` program with a `-i` flag. For example:

```
haspdinst -i
```

2.5.3 Notes for Xpress Release 13 (and Earlier) Users with Dongles

Releases of Xpress prior to Xpress-MP 2003 used a different mechanism: the license information was included in the dongle itself, and different types of dongle were supplied depending on whether the license was static or floating. When using your existing dongle with Xpress-MP 2003 or later, all information on the dongle, apart from the four-digit dongle number, is ignored. Since your dongle does not need to be updated to work with 2003 or later, it still supports previous releases of Xpress.

If you have a *NetHASP* dongle (red plastic casing), for use with a floating license, the *NetHASP* license manager is no longer used, and can be disabled. Floating licenses are now administered by the *xpserver* license manager as described in this document. The *NetHASP* dongle acts as an ordinary dongle and must be attached to the license server.

2.6 Dongle Licenses (for Linux Machines)

Under x86 32-bit and 64-bit x86 Linux, licenses are available that are locked to a dongle rather than to the host ID or Ethernet address of the computer. A license file is still required: this will contain the four digit dongle number in place of the computer's host ID or Ethernet address.

The dongle is used to provide a unique four-digit dongle number to which the license file is locked. The license is only valid when run on the machine to which the dongle is currently attached. All license

details, including the Xpress features authorized, whether the license is static or floating, the release of Xpress authorized, and so forth, are contained in the license file.

2.6.1 Displaying the Dongle Number

The dongle number can be obtained by running the Xpress Host ID tool (see the section 1.3). Note that the dongle must be connected to your computer and the dongle device driver installed and running (as described below).

2.6.2 Installing the HASP Dongle Device Driver

The dongle driver is not automatically installed when installing Xpress on a Linux machine. In order for your dongle to be recognized, you must download the Linux dongle drivers from the FICO Xpress client download page. You must login with your root account, extract all the files from the `aksusbd-1.16.1-i386.tar.gz` archive within the `Sentinel_LDK_Linux_Run-time-Installer_script.tar` archive and run the `dinst` script which will install the HASP dongle driver daemon. After this, the Xpress software should recognize the dongle you plug in. (Try running the `xphostid` tool to check this. If it reports a `hostid` starting with `'di'` then it can see your dongle and the driver is correctly installed.)

2.7 Community License

The Community license enables development, modelling, and deployment of the industry leading FICO Xpress Optimization software, free of charge. The solvers included in the Xpress Community License are only limited in problem size. In this edition, the sum of the number of rows (constraints) and columns (variables) is restricted to 5000, the number of nonlinear tokens (measure of the complexity for nonlinear expressions) is restricted to 1000, and the number of user functions (black box optimization) is restricted to 1.

2.8 Redundant Server Licenses

A redundant server license is a special type of license for use in mission-critical environments. It relies on not one license server but three, of which at least two must be active to authorize Xpress. This way, if one license server machine happens to fail, your applications can still use Xpress using the remaining two servers until the problem is corrected.

To obtain a redundant server license, contact your supplier.

1. You must install the license server application on all three license server machines. Edit your server license file and ensure that the machine names in the `use_server` lines match with the names of your three license server machines. For example:

```
use_server server="main_server" hostid="mx001731e8216c"
use_server server="backup_server_1" hostid="mx002831e8216d"
use_server server="backup_server_2" hostid="mx0017ff88216e"
```

Install the same server license file on all three redundant server machines.

2. In the client license, list the three redundant license servers, marked as redundant license servers, as follows:

```
use_server server="main_server" redundant="1"
use_server server="backup_server_1" redundant="1"
use_server server="backup_server_2" redundant="1"
```

Xpress will try to connect to each of the redundant license servers in turn, until it successfully establishes a connection with one of them.

Keep in mind that you cannot use Xpress when only one redundant license server is active. Xpress will only license successfully if two or three of the redundant license servers are available.

2.9 Virtualization

Xpress software supports the most common virtualization technologies including VMWare, Microsoft Virtual PC/Server, App-V, and so forth.

2.9.1 Static Licensing

Xpress version 7.0 and later supports static (node locked) licensing on virtualized hardware.

USB Dongle licenses are compatible with VMware but are unsupported by Virtual PC and Virtual Server.

2.9.2 Floating Licensing

All versions of Xpress support the use of floating licenses with virtualization technologies. However, while the clients can be virtual guest operating systems, the license manager itself must be executed on a non-virtual operating system.

2.9.3 Application and Enterprise Licensing

Xpress version 7.0 and later supports application and enterprise licensing on virtualized hardware.

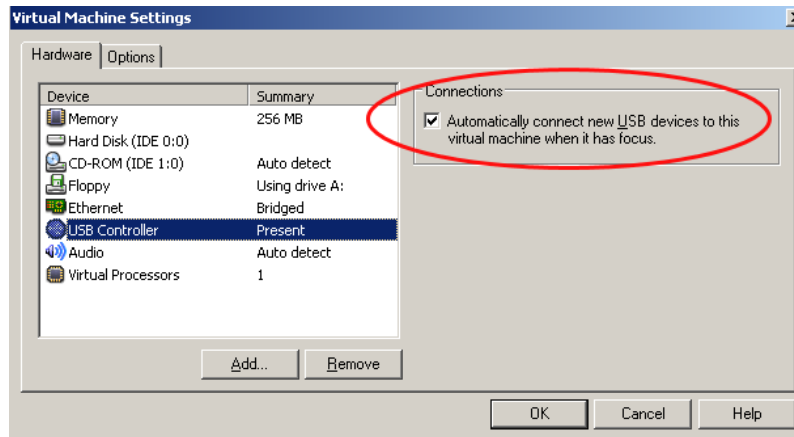
2.9.4 Virtualization Recommendation

Virtualization is most commonly deployed in a server environment to consolidate resources. The limitations of dongles described earlier make their use unsuitable for most server installations.

FICO recommends that floating or application/Enterprise licensing be used with virtualization technologies as these configurations provide the most reliable means of complying with the terms and conditions of the client's licensing agreement. The license server can be installed as a service on a host operating system or another real machine, locked to the hardware. Virtual guest operating systems are then able to request licenses as necessary over the local network.

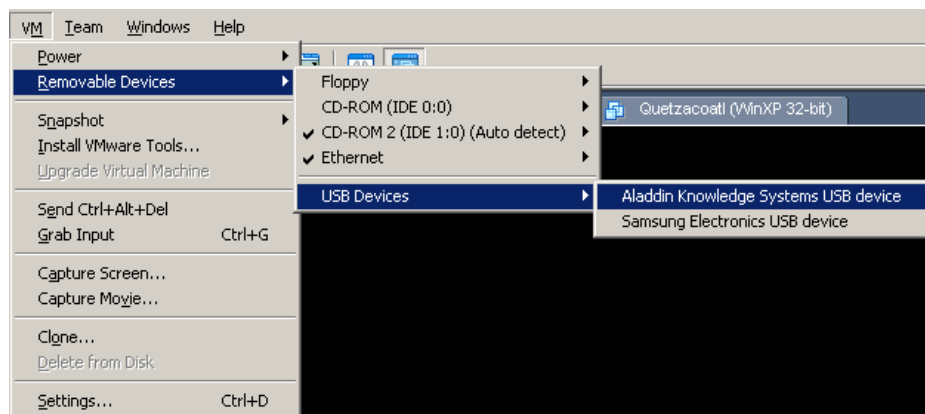
2.9.5 Using HASP Dongles with VMware

1. In order to use dongles from a virtual machine running under VMWare, open your virtual machine's settings and ensure the option **Automatically connect new USB devices to this virtual machine when it has the focus** is selected, as shown in the following example:

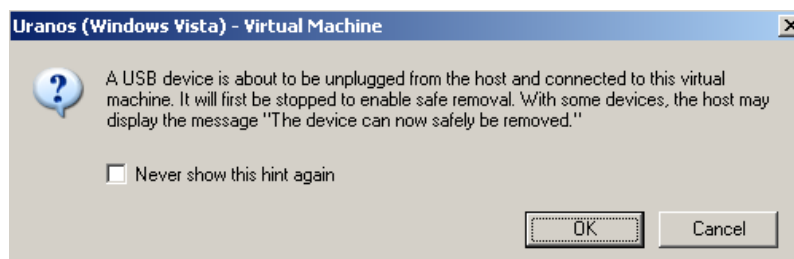


With this option activated, any USB device you plug in *while the virtual machine has the focus* will be connected to the virtual machine, rather than to the host operating system.

2. You can now install Xpress as normal. Select to use hardware dongles as the licensing key when prompted by the installer. Click in the virtual machine window to ensure it has the focus, and if you plug in your dongle now, it should connect to the operating system and be recognized when you run Xpress.
3. Should you plug in your dongle when the virtual machine does not have the focus, it will be connected to the host operating system instead. To disconnect it from the host and connect it to the virtual machine, bring up the VM menu from VMware, slide across Removable Devices and USB Devices, and select Aladdin Knowledge Systems USB Device as shown in the following example:



4. You will be requested to disconnect the dongle from the host and reattach it to the virtual machine. Click **OK**.



2.9.6 Using HASP Dongles with Microsoft Virtual PC

Warning: Hardware dongles are not currently supported under Microsoft Virtual PC (including Microsoft Virtual PC 2007). In addition, it is important that you do not try to install the HASP dongle drivers on a virtual machine hosted by Virtual PC as it has been observed that this can damage the virtual machine, in extreme situations leading to it becoming unbootable. When the Xpress installer prompts you whether to use hardware dongles for licensing, answer **No**.

2.9.7 Using HASP Dongles with Microsoft Virtual Server

Microsoft Virtual Server currently does not support any USB devices, including dongles, except for keyboards & mice. It is not possible to use Xpress with a dongle license through Microsoft Virtual Server.

CHAPTER 3

Supported Platforms

3.1 Operating System and Hardware

The following are the supported platform, operating system, and processor combinations for FICO Xpress.

3.2 Xpress Solver - Xpress Optimizer and Xpress Nonlinear

Xpress Solver is the framework that supports all of FICO's optimization solver technologies, including Xpress Optimizer and Xpress Nonlinear.

These can be used within our modeling language Xpress Mosel or directly from Python.

Platform	Operating System	Processor
Windows 64-bit	Windows 8 Windows 10 Windows Server 2012 R1 and R2 Windows Server 2016 R1 and R2 Windows Server 2019	Any AMD64 or Intel EM64T enabled 64-bit CPU
Linux 64-bit	RHEL 6 RHEL 7	Any AMD64 or Intel EM64T enabled 64-bit CPU
macOS 64-bit	10.13 (High Sierra) 10.14 (Mojave) 10.15 (Catalina)	Intel EM64T enabled 64-bit CPU
Solaris 64-bit	Solaris 10 Solaris 11	Any AMD64 or Intel EM64T enabled 64-bit CPU

3.2.1 Python Support

Xpress Solver (Xpress Optimizer and the Nonlinear solvers) can be used with the following Python versions.

Xpress Versions	Python Support
8.6.0 to 8.6.5	Python 2.7
8.7.0 to 8.7.2	Python 3.4
8.8.0 to 8.8.2	Python 3.5
	Python 3.6
	Python 3.7
8.6.6 and above	Python 2.7
8.7.3 and above	Python 3.5
8.8.3 and above	Python 3.6
	Python 3.7
	Python 3.8

3.3 Xpress Mosel

The Xpress Mosel language allows the user to define his models in a form that is close to algebraic notation and to solve them in the same environment.

It interfaces to statistics packages such as R or Matlab. Mosel provides a module *python3.dso* that implements functionality for exchanging data between a Mosel model and Python 3 (C Python) and for calling Python 3 scripts.

Platform	Operating System	Processor
Windows 64-bit	Windows 8 Windows 10 Windows Server 2012 R1 and R2 Windows Server 2016 R1 and R2	Any AMD64 or Intel EM64T enabled 64-bit CPU
Linux 64-bit	RHEL 6 RHEL 7	Any AMD64 or Intel EM64T enabled 64-bit CPU
macOS 64-bit	10.13 (High Sierra) 10.14 (Mojave) 10.15 (Catalina)	Intel EM64T enabled 64-bit CPU
Solaris 64-bit	Solaris 10 Solaris 11	Any AMD64 or Intel EM64T enabled 64-bit CPU

- Xpress Workbench is the premier choice as IDE (Integrated Development Environment) for standalone Mosel models and Xpress Insight apps. It integrates with Insight for remote debugging
- Xpress IVE is deprecated but still available for Mosel on Windows only.
- Mosel connectivity to spreadsheets is available on Windows, Linux, and macOS.

3.3.1 Python Support

Mosel provides a module *python3.dso* that implements functionality for exchanging data between a Mosel model and Python 3 (CPython) and for calling Python 3 scripts. The Mosel run-time library loads and runs the Python interpreter. Xpress Mosel can be used with the following Python versions:

- Python 3.4.3 to Python 3.7.5

Note The Mosel module `python3.dso` cannot be used with Python 3.8.0

3.3.2 R support

The R interface for Xpress Mosel makes it possible to easily exchange data with R and execute R scripts, or evaluate expressions in the R language, from within a Mosel model.

- Mosel supports R versions 3.0 to 3.6.x

Note Download the version of R from the R Project web site at www.r-project.org, targeting the same platform as Mosel. Therefore, if you have Windows 64-bit Mosel installed, download a matching R version.

3.3.3 Data Sources

Mosel can connect to data in memory through files, databases and web services. It connects to any ODBC-enabled data source, has a specific Oracle driver and drivers for Excel, CSV, XML, JSON as well as its own DAT format. Users can implement custom drivers and use Mosel's free form reading and writing capabilities.

3.4 Xpress Solver - Xpress Kalis

Xpress Kalis provides access to the Artelys Kalis Constraint Programming (CP) solver from a Mosel module allowing the user to formulate and solve CP models in the Mosel language.

Xpress Kalis combines a finite domain solver and a solver over continuous (floating point) variables. All data handling facilities of the Mosel environment, including data transfer in memory and ODBC access to databases can be used with Xpress Kalis.

Platform	Operating System	Processor
Windows 64-bit	Windows 8 Windows 10 Windows Server 2012 R1 and R2 Windows Server 2016 R1 and R2	Any AMD64 or Intel EM64T enabled 64-bit CPU
Linux 64-bit	RHEL 6 or later	Any AMD64 or Intel EM64T enabled 64-bit CPU

3.5 Interfaces

3.5.1 Java

The interfaces for calling Xpress libraries from Java require a minimum of Java 6 (internal version: 1.6.0); compatible distributions of Oracle Java and OpenJDK are supported.

The Mosel module *mosjvm* works with Java 8 and 11. Distributions other than Oracle Java, OpenJDK, and Amazon Corretto are not supported.

3.5.2 .NET

The interfaces for calling Xpress libraries from .NET work with .NET Framework 3.5+ and .NET Core 3.0+ (they are available on Windows platforms only).

3.5.3 Knitro

On Linux platforms, the Knitro solver component requires *libgfortran* (version `libgfortran.so.3`) to be installed on the system.

Creating FICO Xpress Runtime Distributions

For distributing an application that uses some portion of FICO Xpress Optimization to end-users we recommend that you distribute the whole installation package, but if you only want to distribute parts of it then here is how to do it.

Runtime Libraries and Other Dependencies

1. Make sure that there is no other Xpress software, library files or license files on the path or in any directories used or accessed by your application – in particular, be careful that no earlier releases of Xpress software are present.
2. The files you need to *run* (but not *compile*) applications depend on which of the Xpress libraries you are using. Here we give the files required for Windows and Solaris; the files required for other Unix operating systems are similar to those required for Solaris, but the exact file names sometimes differ in an obvious way. (The suffix X in Solaris file names indicates the version number.) All of these files (with the exception of your particular license file, `xpauth.xpr`) should be taken from the current Xpress release distribution. See note 9 below for an explanation of the UNIX symbolic links required for UNIX installations.

- An **Optimizer application** requires the files

	Windows	Solaris	Notes
<i>Optimizer library</i>	<code>xprs.dll</code>	<code>libxprs.so.*</code>	
<i>Optimizer library Java wrapper</i>	<code>javaxprs.dll</code>	<code>libjavaxprs.so</code>	(Java and MATLAB Java only)
<i>Xpress support library</i>	<code>xprl.dll</code>	<code>libxprl*</code>	
<i>Python interface</i>	<code>xpress*.pyd</code>	<code>xpress*.so</code>	(Python only)
<i>Optimizer library .NET wrapper</i>	<code>xprsdn.dll</code> <code>mscorlib.dll</code>	N/A	(Windows .NET only)
<i>MATLAB interface</i>	<code>xprs*.mexw*</code>	<code>xprs*.mex*</code>	(MATLAB only)
<i>Knitro library</i>	<code>xknitro.dll</code> <code>xknitronl.dll</code> <code>libiomp5md.dll</code>	<code>libxknitro.so.*</code> <code>libxknitronl.so.*</code>	(if required)
<i>License file</i>	<code>xpauth.xpr</code>	<code>xpauth.xpr</code>	

- A **BCL application** requires the files

<i>Optimizer library</i>	xprs.dll	libxprs.so.*	
<i>BCL library</i>	xprb.dll	libxprb.so.*	
<i>BCL library Java wrapper</i>	xprb_J.dll	libxprb_J.so	(Java only)
<i>Optimizer library Java wrapper</i>	javaxprs.dll	libjavaxprs.so	(Java only, if required)
<i>BCL library .NET wrapper</i>	xprndn.dll mscoree.dll	N/A	(Windows .NET only)
<i>National language support</i>	xprnls.dll	libxprnls.so	(Windows only)
<i>VB library extensions</i>	xprvb.dll	N/A	(VB only)
<i>Xpress support library</i>	xprl.dll	libxprl.*	
<i>License file</i>	xpauth.xpr	xpauth.xpr	

■ **A Mosel (run-time library) application** requires the files

<i>Optimizer library</i>	xprs.dll	libxprs.so.*	(if required, see additional dependencies below)
<i>Mosel library</i>	xprm_rt.dll	libxprm_rt.so.*	
<i>Mosel executable</i>	mosel.exe	mosel	(required for remote connections or Mosel command line)
<i>Mosel library Java wrapper</i>	xprm_rtJ.dll	libxprm_rtJ.so.*	(Java and MATLAB Java only)
<i>Mosel compiler library</i>	xprm_mc.dll	libxprm_mc.so.*	(if required, e.g. by executable)
<i>Mosel compiler library Java wrapper</i>	xprm_mcJ.dll	libxprm_mcJ.so.*	(Java only; if required)
<i>Mosel library .NET wrapper</i>	xprmdn.dll mscoree.dll	N/A	(Windows & .NET only)
<i>Mosel library .NET wrapper helper DLL</i>	xprndn-c-helper.dll	N/A	(Windows & .NET only)
<i>MATLAB interface</i>	moselexec.mexw*	moselexec.mex*	(MATLAB only)
<i>National language support</i>	xprnls.dll	libxprnls.so	
<i>Mosel modules or packages used</i>	XXX.dso XXX.bim	XXX.dso XXX.bim	(as required, see additional dependencies below)
<i>VB library extensions</i>	xprmvb.dll	N/A	(VB only)
<i>Xpress support library</i>	xprl.dll	libxprl.*	
<i>License file</i>	xpauth.xpr	xpauth.xpr	

- Certain **Mosel modules or packages** have **additional dependencies**, so these files also need to be provided if you use the specified component:

<i>advmod.bim</i>	<i>mmxprs.dso</i>	
<i>aec2.bim</i>	<i>mmjobs.dso mmhttp.dso mmssl.dso</i> <i>mmsystem.dso mmxml.dso</i> Windows: <i>mplink.exe mpscp.exe</i>	
<i>dmp.dso</i>	<i>mmhttp.dso mmsystem.dso</i> Windows: <i>jansson.dll</i> Unix: <i>libjansson.so.*</i>	
<i>executor.bim</i>	<i>mmjobs.dso mmhttp.dso mmxml.dso</i> <i>mmsystem.dso executor.dso</i> Windows: <i>jansson.dll</i> Unix: <i>libjansson.so.*</i>	
<i>fssappstudio.bim</i>	<i>mmxml.dso mmsystem.dso</i>	
<i>hadoop.dso</i>	<i>libjava.so</i>	(Linux only)
<i>kalis.dso</i>	Windows: <i>Kalis.dll xprs.dll</i> Linux: <i>libKalis.so libxprs.so.*</i> <i>libstdc++.so.* libgcc_s.so.*+</i>	(Windows and Linux)
<i>matlab.dso</i>	(MATLAB installation required)	
<i>mmhttp.dso</i>	<i>mmjobs.dso mmsystem.dso</i>	
<i>mminsight.bim</i>	<i>mminsight.dso mmxprs.dso</i> <i>mmxml.dso</i> <i>mmsystem.dso mmhttp.dso mmjobs.dso</i> <i>trusteddsn.dso mmssl.dso</i> <i>s3.dso s3.bim debugarchive.bim</i> <i>mminsightannotations.bim</i>	
<i>mmjobs.dso</i>	Windows: <i>xprm_mc.dll</i> Unix: <i>libxprm_mc.so.*</i>	
<i>mmoci.dso</i>	(Oracle Instant Client installation required)	
<i>mmrobust.dso</i>	<i>mmxprs.dso</i> Windows: <i>xprs.dll</i> / Unix: <i>libxprs.so.*</i>	
<i>mmsheet.dso</i>	Windows: <i>libxl.dll</i>	(Windows, Linux, OSX)
<i>mmssl.dso</i>	<i>mmsystem.dso</i> Windows: <i>LIBEAY32.dll SSLEAY32.dll</i> Unix: <i>libssl.so.* libcrypto.so.*</i>	
<i>mmsvg.bim</i>	<i>mmsystem.dso mmjobs.dso</i> <i>mmxml.dso mmsvg.tgz</i>	
<i>mmxml.dso</i>	<i>mmsystem.dso</i>	

<i>mmxnlp.bim</i>	mmxprs.dso mmnl.dso mmjobs.dso mmsystem.dso mmxnlp.dso Windows: xprs.dll / Unix: libxprs.so.* Knitro solver (optional): Windows: xknitro.dll xknitronl.dll libiomp5md.dll Unix: libxknitro.so.* libxknitronl.so.*	
<i>mmxprs.dso</i>	Windows: xprs.dll / Unix: libxprs.so.*	
<i>nlsolv.dso</i>	Windows: amplxpress.exe xprs.dll Unix: amplxpress libxprs.so.*	
<i>python3.dso</i>	(Python 3 installation required)	
<i>r.dso</i>	(R installation required)	
<i>s3.bim</i>	mmjobs.dso mmssl.dso mmxml.dso mmsystem.dso mmhttp.dso s3.dso Windows: jansson.dll Unix: libjansson.so.*	
<i>zlib.dso</i>	Unix: libz.so.*	(no extra dependency on Windows)
<i>mmssl executable</i>	Windows: mmssl.exe / Unix: mmssl	(required for https setup)
<i>xprmsrv executable</i>	Windows: LIBEAY32.dll ssh.dll Unix: libssh.so.* libcrypto.so.*	(for remote connections)

- If you are using a **floating license**, you also need these files:

<i>Xpress license manager</i>	xpserver.exe	xpserver
<i>License state query tool</i>	xplicstat.exe	xplicstat

- Some of the components of FICO Xpress Optimization contain open source software. When redistributing parts of Xpress please make sure that you also include the corresponding files from the `licenses` subdirectory of the Xpress distribution.

- Copy all of the Xpress files listed above to one directory on your end-user's computer. This can be any directory, but we strongly recommend that you use the directory containing your application program.
If you are building a runtime distribution for **Mosel** applications we recommend that you maintain the same subdirectory structure (with directories `bin`, `dso`, `lib`, and if you are using MATLAB also `matlab`) as the original Xpress distribution.
- Windows** requirement: Add the directory containing the Xpress files to the Windows `PATH`, so that Windows knows where to find the Xpress DLLs.
- Unix** only: Set the environment variable for locating shared libraries on your platform (`LD_LIBRARY_PATH` for Linux and Solaris, `DYLD_LIBRARY_PATH` on macOS) to point to the directory containing the Xpress libraries.
- Unix** only: Set the environment variable `XPRESS` to point to the directory containing the Xpress license file, `xpauth.xpr`. (Do not set the `XPRESS` environment variable under Windows – the license file will be looked for in the same directory as the Xpress DLLs, and while setting `XPRESS` has no effect, if it was set it might confuse the user or support.)

7. If you are using **Mosel**, set the environment variable `MOSEL_DSO` to point to the directory containing the Mosel DSO files.
8. Under **Windows**: Do *not* pass an explicit path argument (to `XPR?license` or `XPR?init`) when initializing Xpress to specify the location of the security files. Do *not* set the `XPRESS` environment variable. Do *not* put the Xpress license file (`xpauth.xpr`) into a different directory from that containing all other Xpress library files and DLLs listed above. Doing any of these will add to the complexity of the Xpress licensing procedure, potentially cause a licensing error, and make it difficult to support your application on your end-user's computer.
9. **Unix** symbolic links: The tar file distributions contain symbolic links e.g. `libxprs.so.17.10.01` $\rightarrow$ `libxprs.so.17.10` $\rightarrow$ `libxprs.so` (`.so` extension may vary between UNIX platforms). In the example above, the binary file has the full version number postfixed to enable the support team to easily identify the exact version number being used. The intermediate filename without the 3rd element of the version number is used internally by one Xpress component to link to another. The link with no version number is used to support the version-independent documentation, examples and example makefiles.
In general, it is possible to remove the soft links and rename the libraries, with the following exceptions. The security library must be made available as `libxprl.so.yyyy` for all Xpress components to use. If any components (including Xpress Optimizer console) other than the Xpress Optimizer runtime library are to be used then the Xpress Optimizer runtime library must be made available as `libxprs.so.xx.yy`.

Dongles

10. If you are using Xpress dongles, you must install the dongle driver on your end-user's computer. You can obtain the files necessary to do this from the fico.com website:

- For **HASP** dongles on **Windows**, you need the file

```
\windows\dongle\hasp\hinstall.exe
```

Administrator privileges are required to install the dongle driver. To install the driver, execute

```
hinstall -i -criticalmsg
```

The driver does not normally start up until the computer is re-booted.

- For **HASP** dongles on **Linux** you need the file `HDD_Linux_dinst.tar.gz` (available from the Xpress client area download page); to install the dongle driver daemon you must uncompress this archive somewhere convenient, switch to your superuser account and run the supplied `dinst` shell script.

Floating Licenses

11. Users with floating licenses: make sure the Xpress license manager is installed and running on the server machine. Please refer to the chapter 2 for full instructions and troubleshooting. If you wish to install the license server as a service on Windows machines, run `xpservice -service install` and to remove the service, `xpservice -service remove`
12. Users with floating licenses: when creating your installer for the client machines you will have to construct an `xpauth.xpr` file for connecting to the server. This file should contain one line as follows:

```
use_server name="<servername>"
```

Where <servername> is the name of the license server machine. You may wish to prompt the user for this information as part of the install process.

APPENDIX A

Contacting FICO

FICO provides clients with support and services for all our products. Refer to the following sections for more information.

Product support

FICO offers technical support and services ranging from self-help tools to direct assistance with a FICO technical support engineer. Support is available to all clients who have purchased a FICO product and have an active support or maintenance contract. You can find support contact information and a link to the Customer Self Service Portal (online support) on the Product Support home page (www.fico.com/en/product-support).

The FICO Customer Self Service Portal is a secure web portal that is available 24 hours a day, 7 days a week from the Product Support home page. The portal allows you to open, review, update, and close cases, as well as find solutions to common problems in the FICO Knowledge Base.

Please include 'Xpress' in the subject line of your support queries.

Product education

FICO Product Education is the principal provider of product training for our clients and partners. Product Education offers instructor-led classroom courses, web-based training, seminars, and training tools for both new user enablement and ongoing performance support. For additional information, visit the Product Education homepage at www.fico.com/en/product-training or email producteducation@fico.com.

Product documentation

FICO continually looks for new ways to improve and enhance the value of the products and services we provide. If you have comments or suggestions regarding how we can improve this documentation, let us know by sending your suggestions to techpubs@fico.com.

Please include your contact information (name, company, email address, and optionally, your phone number) so we may reach you if we have questions.

Sales and maintenance

If you need information on other Xpress Optimization products, or you need to discuss maintenance contracts or other sales-related items, contact FICO by:

- Phone: +1 (408) 535-1500 or +44 207 940 8718
- Web: <http://www.fico.com/optimization> and use the available contact forms

Related services

Strategy Consulting: Included in your contract with FICO may be a specified amount of consulting time to assist you in using FICO Optimization Modeler to meet your business needs. Additional consulting time can be arranged by contract.

Conferences and Seminars: FICO offers conferences and seminars on our products and services. For announcements concerning these events, go to www.fico.com or contact your FICO account representative.

FICO Community

The FICO Community is a great resource to find the experts and information you need to collaborate, support your business, and solve common business challenges. You can get informal technical support, build relationships with local and remote professionals, and improve your business practices. For additional information, visit the FICO Community (community.fico.com/welcome).

About FICO

FICO (NYSE:FICO) powers decisions that help people and businesses around the world prosper. Founded in 1956 and based in Silicon Valley, the company is a pioneer in the use of predictive analytics and data science to improve operational decisions. FICO holds more than 165 US and foreign patents on technologies that increase profitability, customer satisfaction, and growth for businesses in financial services, telecommunications, health care, retail, and many other industries. Using FICO solutions, businesses in more than 100 countries do everything from protecting 2.6 billion payment cards from fraud, to helping people get credit, to ensuring that millions of airplanes and rental cars are in the right place at the right time. Learn more at www.fico.com.

Index

Numbers

1, 21
2, 21
4, 22
8, 21
9, 22
10, 22
11, 21
14, 22
20, 22
21, 22
32, 22
89, 22
103, 22
259, 22

B

BCL, 32

C

Community license, 1
size limits, 1

D

dongle, 36
DYLD_LIBRARY_PATH, 14, 35

F

floating license, 35

I

installer packages, 2

L

LD_LIBRARY_PATH, 14, 35
library
runtime, 32
license
dongle, 6, 17
floating, 5, 17
static, 4, 17
license manager, 5, 17
license server, 17

M

Mosel, 33
module, 33
package, 33
MOSEL_DSO, 36

O

open source licenses, 35
Optimizer, 32

P

PATH, 35

R

runtime distribution, 32
runtime library, 32

X

xpauth.xpr, 1, 13, 17
XPRESS, 17, 35, 36
Xpress Host ID tool, 1
XPRESSDIR, 12, 14
xprl_server.log, 21
XPRMgetlicerrmsg, 21
XPRSgetlicerrmsg, 21
xssh, 14