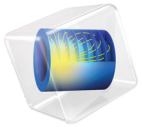

COMSOL Multiphysics

Model Manager Server Manual

6.0

COMSOL

Model Manager Server Manual

Version: COMSOL 6.0

Contact Information

Visit the Contact COMSOL page at www.comsol.com/contact to submit general inquiries or search for an address and phone number. You can also visit the Worldwide Sales Offices page at www.comsol.com/contact/offices for address and contact information.

If you need to contact Support, an online request form is located at the COMSOL Access page at www.comsol.com/support/case. Other useful links include:

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- Product Updates: www.comsol.com/support/updates
- COMSOL Blog: www.comsol.com/blogs
- Discussion Forum: www.comsol.com/forum
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Part number: CM020018

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Chapter 2: Installation

Chapter 3: Administration

1

Introduction

Read this guide to learn how to install and administrate a Model Manager server, a web server that hosts a Model Manager database. The Model Manager server can either be configured to use internal database components managed by the server, or external database components provided and managed by your organization. See the *Model Manager Reference Manual* for details on how to access a Model Manager server database from within the COMSOL Desktop® modeling environment.

In this chapter:

About the Model Manager Server

In this section:

What Can You Do with a Model Manager Server?

A Model Manager database can be shared by multiple users by hosting the database in a *Model Manager server*. You access the database by connecting to the Model Manager server from the COMSOL Multiphysics® software via your organization's internal network. This enables you and your coworkers to collaborate on version-controlled simulation models and data files — all while staying within the COMSOL Desktop modeling environment. Read the *Model Manager Reference Manual* to learn more on what you can do with a Model Manager database accessed via a Model Manager server.

A Model Manager server database uses three separate server components:

- A *relational database management system* (RDBMS) for storing version-controlled simulation models and data files in a *SQL database*.
- A *resources directory* for storing data files whose file sizes are deemed too large to put directly inside the SQL database. These files can, for example, be built, computed, and plotted data generated by models, or auxiliary data files such as CAD and interpolation data.
- An *enterprise search platform* — the Apache Solr™ enterprise search platform — used for Model Manager's search functionality.

An installation of Model Manager server optionally includes the PostgreSQL® relational database management system and the Apache Solr™ enterprise search platform. Installing these *managed server components* enables you to configure a Model Manager server database without installing any additional software. Such a database can be fully managed by the Model Manager server itself, including starting and stopping component subprocesses and handling data backups. A managed server database using default configuration settings is automatically created the first time the Model Manager server is started.

You can also configure a Model Manager server database using an external relational database management system provided by your organization — the supported database platforms are Microsoft® SQL Server®, MySQL®, Oracle® Database, and PostgreSQL®. Similarly, you can configure the database using an external Apache Solr™ installation.

Via the Model Manager server's web interface, administrators can create accounts so that users can access the Model Manager server database from the COMSOL Multiphysics software. Users can also log in to the web interface to update their own account settings.

Where Do I Access the Documentation?

A number of internet resources have more information about COMSOL, including licensing and technical information. The electronic documentation, topic-based (or context-based) help, and the application libraries are all accessed through the COMSOL Desktop.

If you are reading the documentation as a PDF file on your computer, the blue links do not work to open an application or content referenced in a different guide. However, if you are using the Help system in COMSOL Multiphysics, these links work to open other modules, application examples, and documentation sets.

CONTACTING COMSOL BY EMAIL

For general product information, contact COMSOL at info@comsol.com.

COMSOL ACCESS AND TECHNICAL SUPPORT

To receive technical support from COMSOL for the COMSOL products, please contact your local COMSOL representative or send your questions to support@comsol.com. An automatic notification and a case number are sent to you by email. You can also access technical support, software updates, license information, and other resources by registering for a COMSOL Access account.

COMSOL ONLINE RESOURCES

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COMSOL Video Gallery	www.comsol.com/video
Support Knowledge Base	www.comsol.com/support/knowledgebase

Overview of the Manual

This *Model Manager Server Manual* contains information that helps you install, configure, and administrate a Model Manager server. The information in this guide is specific to this functionality. Instructions on how to use the Model Manager in general are included with the *Model Manager Reference Manual*.

TABLE OF CONTENTS AND INDEX

To help you navigate through this guide, see the Contents and Index.

INSTALLING MODEL MANAGER SERVER

The Installation chapter guides you through the installation and startup of a Model Manager server.

ADMINISTRATING MODEL MANAGER SERVER

The Administration chapter contains details on how you configure and administrate a Model Manager server via its web interface.

2

Installation

In this chapter you will learn how to install, start, and secure a Model Manager server.

In this chapter:

Installing Model Manager Server

A Model Manager server installation is similar to a COMSOL Multiphysics® or COMSOL Server™ installation. For detailed information on installation, license files, and license management, see the *COMSOL Multiphysics Installation Guide*.

Before starting a Model Manager server you need to start a license manager. The FlexNet® license manager is installed together with a Model Manager server. A license server is not needed when running a trial license. For more information on the FlexNet® license manager, see the *COMSOL Multiphysics Installation Guide*. You can download the document from www.comsol.com/iog.

A Model Manager server uses a relational database management system for storing version-controlled simulation models and data files in a SQL database. The installation includes the PostgreSQL® relational database management system as an optional component. Alternatively, you can configure a Model Manager server to use an external relational database management system provided by your organization. See External SQL Databases for a list of supported SQL database platforms.

For the Model Manager's search functionality, a Model Manager server uses the Apache Solr™ enterprise search platform. The installation includes this platform as an optional component. You can also configure a Model Manager server to use an external Apache Solr™ installation provided by your organization — see External Search indexes.

Databases with External Server Components

The Model Manager server is supported on Windows®, Linux®, and macOS. The default installation directory for each platform is:

- Windows®: `C:\Program Files\COMSOL\COMSOL60\ModelManagerServer`
- Linux®: `/usr/local/comsol60/modelmanagerserver`
- macOS: `/Applications/COMSOL60/ModelManagerServer`

In this section:

Installing in Windows

Start the Model Manager server installation by using the media that you have received or by using an internet download. In the installer, after selecting your preferred language, choose **New COMSOL Model Manager Server 6.0 Installation**.

LICENSE

In the next step, **License**, select the format of your license in the **License format** list under **License information**. For the **License file** option, write the file path to the license file that you have received from your COMSOL representative in the **License file** field. Click **Browse** to browse to and choose another file path. You can also use the **Port number** and **Hostname** option or **Three-server redundancy** option if your license administrator has given you these details.

At this point, the installer detects the type of license used. The following instructions assume that the license used during installation corresponds to a Model Manager server license.

PRODUCTS

In the next step, **Products**, select the installation location and which software products and components you want to install. All products and components are selected by default.

- **Model Manager Server** — installs the Model Manager server software components.
- **Managed PostgreSQL®** — installs software components for a PostgreSQL® database system managed by the Model Manager server. Clear the check box if you only want to use an external relational database management system provided by your organization.

- **Managed Apache Solr™** — installs software components for an Apache Solr™ search platform managed by the Model Manager server. Clear the check box if you only want to use an external Apache Solr™ installation provided by your organization.
- **License Manager** — installs COMSOL License Manager. You only need to install this on the computer where you would like to run the license manager.

OPTIONS

In the **Options** step:

- Select the **Create COMSOL Model Manager Server 6.0 folder on Windows Start Menu** check box to install Start menu shortcuts (Windows® operating system only).
- Select the **Add Windows Firewall rules for COMSOL programs** check box to add Windows Firewall rules.
- Select the **Check for updates after installation** check box to enable checking for updates after installation.
- In the **Java runtime environment** list, select **Built-in** to use the default Java runtime included with the Model Manager server installation. Select **Custom** if you prefer to use another Java runtime that you have licensed and installed.

LICENSE MANAGER

The **License Manager** step appears if the installer installed the FlexNet® license manager and your computer has been designated to run the license server. If this step does not appear, you can manage the license server using `LMTOOLS`. This step contains the following options:

- The **Install license manager as a Windows service** check box is selected by default; if you clear the check box, the license manager will not be available as a Windows® service.
- The **Path to the debug log file** field contains a file path to the location of the license manager debug log file (default: `C:\comsol.log`). Click **Browse** to browse to and choose another file path.
- The **Service name** field shows the service name, `LMCOMSOL`, for information only.

- Under **Additional license manager options**, you can select any of the following check boxes:
  - Select the **Allow the lmdown command to be executed only from this computer** check box to restrict the execution of the `lmdown` command, which you can use to shut down the license manger, to this computer only.
  - Select the **Disable the lmdown command** check box to make the `lmdown` command unavailable.
  - Select the **Disable the lmremove command** check box to make the `lmremove` command, which you can use to remove a user's license, unavailable.

SERVER

The **Server** step makes it possible to set up Model Manager server as a Windows® service. You can also configure an initial root administrator account, which you can use to log in to the Model Manager server's web interface to continue the server setup once the installation has finished.

Basic Settings

In the **Default Model Manager Server port** field, write the port number that the server will use. The default is `8181`.

Windows Service Settings

There are two ways to install Model Manager server in Windows®. If you select the **Install Model Manager Server as a Windows service** check box (the default), then Model Manager server is installed as a Windows® service. Otherwise, Model Manager server is installed as a regular executable.

Use the **Startup** list to configure how to start Model Manager server when installed as a Windows® service:

- **Disabled** — the service is disabled.
- **Manual** — the service will not be started after the installation. You need to start the service manually.

- **Automatic** — the service is configured to start automatically when the host computer boots or restarts. This is the default choice.
- **Automatic (Delayed Start)** — the service starts automatically but is delayed until all automatic-start threads have finished starting.

The **Automatic** setting provides the highest availability to users of the installed server.

If you choose **Disabled** or **Manual**, you can enable or start the Model Manager server service from the command line or by using the **Manage local services** shortcut installed on the Start menu in Windows®. The same configuration options are also available in the snap-in **Services** in the **Microsoft Management Console** — search for `services` from the Windows® **Control Panel**.

In the **Service account** list, select the computer account that runs the service. You can choose the predefined **LocalService**, **LocalSystem**, or **NetworkService** accounts in Windows®, which have no password. When using other accounts, choose **Custom** and provide a username and password. By default, the installer selects the predefined **LocalService** service account.

It is recommended that you use the **LocalService** account to run Model Manager server as a service. It has sufficient but limited privileges intended for running local services. Alternatively, another account with limited privileges can be used.

Consult the documentation that came with the operating system for more information about service accounts.

Default Local Administrative User

Select the **Create default local administrative user** check box to set a username and a temporary password for a root administrator account. You can use that account to log

in to the Model Manager server's web interface after installation finishes to continue the setup of the server.

Only clear the **Create default local administrative user** check box if you are repairing or updating a previous installation for which a root administrator account already exists.

Troubleshooting

When you click **Next** from the **Server** step, the installer will verify some of the given settings, including employing a test service to check that the given service account details are valid and that the service account has the right permissions to access the installation directories. The following are some common warning and error messages that may arise and suggestions on how to address them:

The given service account does not seem able to start services due to a logon failure. Please verify that it has the right to log on as a service. The installer failed to start the test service. To verify that a custom user account has the right to log on as a service, you can check the security settings for the **Log on as a service** policy under **Control Panel>Administrative Tools>Local Security Policy>Local Security Settings> Local Policies>User Rights Assignments** in Windows®.

The installation directory is not accessible. Please verify that the directory is correct and that the service account has access to this path. The service launcher failed to locate the test service when starting it. The service account either does not see that location or does not have read permissions. Commonly this is caused by using an installation location that either has security permissions that do not include the service account, or by the location being on a network share that is not mounted by the service account.

The given service account is invalid or does not exist or the password is wrong. The test service could not be installed or started due to a problem with the service account. Verify that the account details are correct.

Failed to verify the service account. An unexpected error happened. If you believe that the installation settings are correct, you can proceed with the installation. Further details are given in the `comsolsetup.log` file after the installation.

No administrative user has been defined. You did not specify an administrator account under **Default local administrative user**. In this configuration it will not be possible to

log in to Model Manager server unless the server has already been configured with accounts after a previous installation.

INSTALL

The **Install** step shows a list of the software products and components that will be installed. Click the **Install** button to begin the installation.

FINISH

The last **Finish** step is shown when the installation has finished. You can view an installation log if, for example, there were warnings or errors during the installation.

Installing in Linux and macOS

Installing in the Linux® and macOS operating systems is similar to Installing in Windows. The **Server** step contains Basic Settings and the option of creating a Default Local Administrative User. See Starting Model Manager Server for more information about how to automatically launch Model Manager server after installation on Linux® and macOS.

For security reasons, it is not recommended to use an account with administrative privileges to run Model Manager server.

Modifying an Installation

To modify an existing Model Manager server installation — for example, to change the default port or reset the administrator password — follow these steps:

1. Stop the Model Manager server.

   If installed as a Windows® service (default for Windows®), you can stop the Model Manager server service using the **Manage Local Services** shortcut installed on the Start menu under `COMSOL Launchers`.
2. Start the installer for Model Manager server and select a language.
3. Choose **Add/Remove Products and Reinstall**. If a dialog box is opened, browse to the installation directory.

4 Specify the new configuration in the steps that follow, similarly as for a new installation.

   You can clear the **Create default local administrative user** check box if you have already added an administrative user, ignoring the warning that no administrative user has been defined when clicking **Next**.

5 When the installer has finished, start Model Manager server again.

See Starting Model Manager Server for instructions on how to start and stop the server on different platforms.

RESETTING THE DEFAULT ADMINISTRATOR PASSWORD

You can reset the default administrator password by following the above steps for modifying an existing Model Manager server installation. In the **Server** step, select the **Create default local administrative user** check box and write a new password to reset any existing password.

UNINSTALLING

To uninstall an existing Model Manager server installation, follow these steps:

1 Stop Model Manager server.

   If installed as a Windows® service (default for Windows®), you can stop the Model Manager server service using the **Manage Local Services** shortcut installed on the Start menu under `COMSOL Launchers`.

2 Start the Model Manager server installer and select language.

3 Choose **Uninstall COMSOL Model Manager Server 6.0**. If a dialog box is opened, browse to the installation directory.

4 Click the **Uninstall** button.

Uninstalling a Model Manager server will *not* delete any databases.

Firewalls

You must open up firewalls that exist between the server and your users. Open up for incoming TCP connections to the port given during installation (by default, `8181`) or controlled by the `-port` command option — see Command Options. To improve

security, you can reduce the IP address range to known potential IP addresses for your users.

Internally Model Manager server may launch subprocesses and communicate with them on various ports. These additional ports do not need to be open in the firewall to users of Model Manager server.

Starting Model Manager Server

In this section you will learn how to start a Model Manager server in the Windows®, Linux®, or macOS operating systems.

In this section:

Starting as a Windows Service

By default, Model Manager server is installed as a Windows® service that is set to start automatically. In this case, a link to the Model Manager server web interface is installed on the Start menu as **Model Manager Server**. See Accessing the Web Interface for more information about accessing the web interface and, for example, continuing the setup of a fresh installation.

To manually start or stop the Model Manager server service, or to configure if it is started automatically, use the **Manage Local Services** shortcut installed on the Start menu under `COMSOL Launchers`. The same configuration options are also available in the snap-in **Services** in the **Microsoft Management Console**. Search for `services` from the Windows® **Control Panel**.

Before starting Model Manager server, you need to start a FlexNet® license manager. The license manager can be installed together with Model Manager server — see Installing Model Manager Server.

Starting Manually in Windows

If you cleared the **Install Model Manager Server as a Windows service** check box during installation, you can start a Model Manager server manually by doing one of the following:

- Click the **COMSOL Model Manager Server 6.0** shortcut installed on the Start menu.
- Double-click the Windows® executable in a file browser.
- Run the Windows® executable from a command window.

The Model Manager server executable is located at:

```
<Installation directory>\bin\win64\comsolmodelmanagerserver.exe
```

An example of a typical <*Installation directory*> is:

```
C:\Program Files\COMSOL\COMSOL60\ModelManagerServer
```

For all methods of starting a Model Manager server, the command window displays a short message that the server has started and which port is used. Press Ctrl+C to stop the server and exit the command window.

When Model Manager server has been installed as a Windows® service, the shortcut for starting manually is not available on the Start menu. It is not recommended to start Model Manager server manually via its executable when the service is running. Since the service typically runs under a special system user account, it does not share its configuration settings with a Model Manager server started manually.

Starting in Linux

To start a Model Manager server manually on Linux®, type

```
<Installation directory>/bin/comsol modelmanagerserver
```

To stop the server, press Ctrl+C in the terminal window where it was started.

SYSTEMD SERVICE

Use the following instructions to start Model Manager server in a Linux® version that includes `systemd`:

1 Create a file

```
/usr/lib/systemd/system/comsolmodelmanagerserver60.service
```

with content similar to:

```
[Unit]
Description=COMSOL Model Manager server 6.0
Wants=network.target network-online.target
After=network.target network-online.target

[Service]
Type=exec
User=comsoluser
Group=comsolgroup
TimeoutSec=300
ProtectHome=off
ExecStart=/usr/local/comsol60/modelmanagerserver/bin/comsol
modelmanagerservice

[Install]
WantedBy=multi-user.target
```

You only need to replace the values for `User` and `Group`.

2 Activate the service via:

```
systemctl enable
/usr/lib/systemd/system/comsolmodelmanagerserver60.service
```

3 Start the service via:

```
systemctl start comsolmodelmanagerserver60
```

To stop the Model Manager server service cleanly, run:

```
systemctl stop comsolmodelmanagerserver60
```

Starting in macOS

To start a Model Manager server manually, type

```
<Installation directory>/bin/comsol modelmanagerserver
```

To stop the server, press Ctrl+C in the terminal window where it was started.

Setting Up Model Manager Server for Secure Connections

You are strongly recommended to set up Model Manager server for secure connections by placing it behind a reverse proxy with SSL configured. No particular configuration of Model Manager server itself is required. See also Security.

For more information about setting up a reverse proxy for the Model Manager server, see https://www.comsol.com/support/knowledgebase/1291.

Model Manager Server Preference Directory

Server settings and log files for a Model Manager server are stored in a *preference directory* with default location:

- Windows®: `<user>\.comsol\v60modelmanagerserver`
- Linux®: `<user>/.comsol/v60modelmanagerserver`
- macOS: `<user>/Library/Preferences/COMSOL/v60modelmanagerserver`

with `<user>` being the home directory for the user account running the Model Manager server process. The location when running, for example, as a Windows® service using the predefined **LocalService** user account is:

```
C:\Windows\ServiceProfiles\LocalService\.comsol\
v60modelmanagerserver
```

Two subfolders in the preference directory of particular interest are:

- `db` — containing accounts, database configurations, and other server preferences.
- `logs` — log files for Model Manager server.

Add the subfolder `db` in the Model Manager server's preference directory to your backup routines.

Command Options

You can specify optional command options when starting a Model Manager server using the syntax

```
comsolmodelmanagerserver.exe [<options>]
```

on Windows® and

```
comsol modelmanagerserver [<options>]
```

on Linux® and macOS platforms. See Table 2-1 for various command options available for the server.

TABLE 2-1: COMMAND OPTIONS FOR A MODEL MANAGER SERVER.

OPTION	DESCRIPTION
`-c`	Path to license file.
`-comsolinifile`	Path to `ini`-file to use when launching.
`-h, -help`	Show help message.
`-port`	Port number used by the server.
`-prefsdir`	Path to preference directory.
`-tmpdir`	Path to temporary file directory.
`-v, -version`	Show version information.

Security

The following guidelines summarize the best practices for running the Model Manager server in a secure way:

- Set up the Model Manager server to use transport layer security (that is, HTTPS) when connecting from web browsers and COMSOL Multiphysics. This increases the protection of passwords sent when logging in and reduces the risk of data leaks. The easiest way to get transport layer security is to use a reverse proxy with a certificate, which might already have been set up for other systems.
- Use a low privilege account when running the Model Manager server process. This reduces the risk of escalation attacks to the system. See Installing Model Manager Server for more information.
- Configure the firewall of the computer or network segment where the Model Manager server runs to only expose the main port of Model Manager server to the outside. If running Model Manager server behind a reverse proxy, only expose the port of the reverse proxy to the outside instead.
- If you expose the Model Manager server to the internet, make sure to operate the Model Manager server on a network isolated from your regular corporate network. One option for implementing this is to install the Model Manager server on a computer in a so-called DMZ network located between the internet and your regular corporate network. Another option is to install the Model Manager server utilizing a cloud service provider.
- Ensure that the preference directory of the Model Manager server — see Model Manager Server Preference Directory — is not accessible by untrusted parties.
- You can configure access control for the content stored on the Model Manager server as needed using permissions. You can also use separate instances of the Model Manager server — with each server using their own databases — to isolate different content and user groups. The latter is best practice when exposing the Model Manager server to users outside your organization.

Password Security

Local passwords stored by the Model Manager server are hashed by 100,000 iterations of the PBKDF2WithHmacSHA256 algorithm. This means that an adversary that gets access to the hashed passwords will not easily be able to obtain the original passwords.

However, if an adversary does obtain a local password (for example, by brute-force guessing a weak password), the adversary could log in to the Model Manager server.

By default, the Model Manager server writes hashed local passwords to the file `/db/settings/local.db` in the preference directory — see Model Manager Server Preference Directory. The temporary password set for the Default Local Administrative User during installation is stored using the same hash algorithm in the file `tempadminlogin.properties` in the root of the installation directory.

As mentioned above, it is recommended to use transport layer security (using HTTPS) to protect passwords sent from web browsers and COMSOL Multiphysics to the Model Manager server. A warning is shown in COMSOL Multiphysics, at the time of login, if the connection to the Model Manager server is not secure. Web browsers will show similar warnings.

Passwords saved in COMSOL Multiphysics for connecting to the Model Manager server ("Remember password") are stored encrypted so that only the logged-in user can access them. On Windows®, the encryption is done using the Data Protection API of the operating system. On Linux® and macOS, the encryption is done using a master key stored in the preference directory, protected by file system permissions. The same encryption is used to protect passwords stored by a Model Manager server configured to connect to external SQL database servers or Apache Solr™ servers using password-based authentication methods — see also Databases with External Server Components.

3

Administration

In this chapter you will learn how to configure and administrate a Model Manager server via its web interface. You use the web interface to set up a Model Manager server database as well as to add accounts so that users can connect to such a database from the COMSOL Desktop®. This chapter assumes that you have already installed and started a Model Manager server.

In this chapter:

Accessing the Web Interface

In a web browser, go to `http://localhost:8181`. If you are accessing it remotely, use the server name — computer name and domain, or the local IP address — of your server instead of `localhost`. If you installed with another port number than the default `8181`, use that number instead. Enter your username and password. Click the **Log In** button.

If you entered the credentials for the root administrator account configured during installation — see Default Local Administrative User — you will be prompted to change your temporary password. Write the new password in the **Password** field and then repeat the password in the **Repeat password** field. Click **Save**.

Resetting the Default Administrator Password

Once you are logged in, the web interface will show one of the following two pages:

- The Accounts Page if you logged in using a root administrator account.
- The My Account Page if you logged in using any other account.

You can log out from the web interface by clicking on the user icon in the upper-right corner and selecting **Log Out**.

Changing the Language

Root administrators can change the language used by the Model Manager server:

1. Click **Language** under the **Configuration** section to open the **Language** administration page.
2. Select a language in the list.
3. Click **Save**.

Accounts

Root administrators can create and update accounts via the Model Manager server's web interface to let other users access the Model Manager server from the COMSOL Desktop environment. Any user can also log in to the web interface to change their own account settings.

In this section:

The My Account Page

The **My Account** page, available from the menu in the upper-right corner, lets you edit your own account settings, including setting a new password.

To set a new password:

1. Click the **Password** button.
2. Write your current password in the **Current password** field.
3. Write your new password in the **Password** field and then repeat the password in the **Repeat password** field.
4. Click **Save**.

You can also change your *display name*, an alternative name to your username used for display purposes. Click **Edit** and write a new display name. Click **Save**.

The Accounts Page

The **Accounts** administration page shows all accounts created for the Model Manager server. Click on the name for one of the accounts to show more details for that account. Click the **Add** button to add a new account.

ADDING ACCOUNTS

To add a new account:

1. In the **Name** field, write the username that the account uses to authenticate with the Model Manager server.

2 In the **Display name** field, write an alternative name used for display purposes.

3 Select **Yes** or **No** in the **Root Administrator** list to set whether or not the new account is a root administrator account.

4 In the **Password** field, write the password that the account uses to authenticate with the Model Manager server. Repeat the password in the **Repeat password** field.

   The password can later be changed by the user on The My Account Page.

5 Click **Save**.

Root administrators automatically pass any authorization checks in Model Manager — see also the *Model Manager Reference Manual*. You are strongly encouraged to limit the number of root administrator accounts.

THE ACCOUNT PAGE

The **Account** page lets you view and edit a specific account. Click **Edit** to edit the display name and root administrator status of the account. Click **Change Password** to set a new password for the account. This is useful, for example, if a user forgets their account password — the user may later change the reset password on the **My Account** page. Click **Delete Permanently** to permanently delete the account.

Deleting an account will only remove that user's ability to log in to the Model Manager server. Any information related to the user in a Model Manager server database will be left unchanged.

Managed Server Components

A Model Manager server database is a combination of three separate server components — a SQL database for storing version-controlled simulation models and data files, a directory on the file system for storing large files, and a collection of search indexes used by the Model Manager search functionality. You can either use server components managed by the Model Manager server itself, including starting and stopping component subprocesses and handling backups, or you can use external server components provided by your organization. In the latter case, you will need to handle availability and backups for the server components outside of Model Manager server.

In this section you will learn how to configure *managed server components*, including setting up backups for their *data directories*. You will also learn how to restore such managed server components from a backup. See the next section to learn how you combine these managed server components into a Model Manager server database, optionally swapping out all, or some, of the components with your own external server components.

To configure a database that is entirely managed by the Model Manager server itself, select the **Managed PostgreSQL®** and **Managed Apache Solr™** check boxes in the Products step of the Model Manager server installation.

In this section:

Managed SQL Database Servers

A *managed SQL database server* is a server instance of the PostgreSQL® relational database management system controlled by the Model Manager server itself. The **Managed SQL Database Servers** page shows the configurations of all such managed SQL database servers. A single configuration — **Default managed PostgreSQL® server** — is initially shown in the table. This default managed SQL database server is automatically

created by the Model Manager server when the latter is started for the first time — see also The Default Managed Database.

Links to the **Managed SQL Database Servers** page are hidden in the web interface if you cleared the **Managed PostgreSQL®** check box in the Products step of the Model Manager server installation.

Click on the label of one of the managed SQL database servers to show more details for that managed server. Click the **Add** button to add a new managed SQL database server.

ADDING MANAGED SQL DATABASE SERVERS

You can add a new managed SQL database server to Model Manager server. This is useful if, for example, you want to use different options than the default ones for the automatically added managed SQL database server but at the same time want to keep the default one around as a reference.

To add a new managed SQL database server:

1. Write a label for the managed SQL database server in the **Label** field.
2. Write the path on the file system where the data directory for the managed SQL database server will be created in the **Data directory** field.
3. Select when and how the server is launched in the **Start mode** list. You can select **Automatic** or **Manual**.
4. Select the **Enable backup** check box to enable backups of the data directory. Write the path on the file system where backups will be written to in the **Backup root directory** field. See also Backup of a Managed SQL Database Server.
5. In the **Trigger mode** list under **Restore**, select **Automatic (most recent)** if the data directory should be automatically restored from the most recent backup if it is missing on disk, or if a previous restore has not yet finished, when the managed SQL database server starts. Select **Manual** if a restore requires manual triggering on The Managed SQL Database Server Page. See also Restore of a Managed SQL Database Server.

6 Click **Save** to add the new configuration. The data directory and the backup root directory will be automatically created as needed the next time the managed SQL database server is started.

Place the backup directory on a physical disk different than the disk containing the data directory. Otherwise, you might risk complete data loss in case of a server disk crash.

At least one SQL database needs to be added to the managed SQL database server to use it for a Model Manager server database — see SQL Databases.

THE MANAGED SQL DATABASE SERVER PAGE

The **Managed SQL Database Server** page contains configuration details for a managed SQL database server added to the Model Manager server — see Adding Managed SQL Database Servers.

Click the **Stop** button to stop a running managed SQL database server. Click **Start** to start it.

To edit the configuration for a managed SQL database server, proceed as follows:

1 Deactivate all Model Manager server databases using SQL Databases in the managed SQL database server. See The Database Configuration Page.

2 Stop the managed SQL database server.

3 Click the **Edit** button.

4 Enter the new configuration settings. If you change any directory paths, manually move the corresponding directories on the file system.

5 Click the **Save** button.

6 Start the managed SQL database server if not automatically started.

7 Activate all databases deactivated in the first step.

Click the **Delete Permanently** button to permanently delete the configuration.

Clicking **Delete Permanently** will only delete the configuration for the managed SQL database server; it will not delete its data directory or backup root directory. You can add an existing SQL database server again by adding a new configuration that points to its data directory and backup root directory.

SQL DATABASES

Simulation models and data files are stored in SQL databases in the managed SQL database server. A Model Manager server database uses exactly one SQL database. The databases are stored inside the data directory for the managed SQL database server.

To add a new SQL database, write the name of the database and click the **Add** button under the **Databases** section on the **Managed SQL Database Server** page. The name may only contain the letters a–z and digits 0–9 and must start with a letter. Some specific names are explicitly forbidden — either because these databases already exist internally in the database server or because they are *reserved names*. Model Manager server will show an error message if such a forbidden name is entered. A suggested name is `modelmanager` — the same name used by The Default Managed Database.

The managed SQL database server must be running in order to add new databases.

BACKUP OF A MANAGED SQL DATABASE SERVER

If you enable backup for a managed SQL database server, it will continuously back up any data written to its data directory to a subdirectory inside the *backup root directory*. This backup is *incremental* in the sense that it records all changes made in the server's SQL databases as a transactional log. When you restore a managed SQL database server, including all its SQL databases, this transactional log is replayed.

Since the time it takes to replay the transactional log scales with the running time of the managed SQL database server, it is wise to periodically create a new *base backup*. This is a complete point-in-time snapshot of the managed SQL database server. Once you have created such a base backup, the incremental backup will instead record changes using that backup as a new baseline — thereby speeding up any future restore.

On the **Managed SQL Database Server** page, click the **Trigger Base Backup** button to create a new base backup.

A new base backup is created when you enable backup for a managed SQL database server.

RESTORE OF A MANAGED SQL DATABASE SERVER

If you have configured a managed SQL database server with **Trigger mode** for restoring set to **Automatic (most recent),** a missing data directory will be automatically restored using the most recently backed-up state in the backup root directory when the managed SQL database server is started.

You can also manually restore the data directory of a managed SQL database server by clicking the **Trigger Restore** button on the **Managed SQL Database Server** page. A confirmation dialog box is shown informing you that the following steps will be taken by the Model Manager server:

1. The SQL database server is stopped if currently running.
2. Any existing data directory is renamed to avoid overwriting it with the restored data.
3. The most recent base backup is copied from the backup root directory to the data directory.
4. The SQL database server is launched in recovery mode and restores itself using the most recently found backed-up state — see Backup of a Managed SQL Database Server. Once finished, the SQL database server is made available again.

You are recommended to deactivate any Model Manager server database using SQL Databases in the managed SQL database server before triggering a restore. See The Database Configuration Page.

Managed Resources Directories

A *managed resources directory* is a data directory controlled by the Model Manager server itself. The directory contains files whose file sizes are deemed too large to store directly inside a SQL database. The **Managed Resources Directories** page shows the configurations of all such managed resources directories. A single configuration — **Default managed resources directory** — is initially shown in the table. This default

managed resources directory is automatically created by the Model Manager server when the server is started for the first time — see also The Default Managed Database.

Click on the label of one of the managed resources directories to show more details for that directory. Click the **Add** button to add a new managed resources directory.

ADDING MANAGED RESOURCES DIRECTORIES

You can add a new managed resources directory to Model Manager server. This is useful if, for example, you want to use different options than the default ones for the automatically added managed resources directory but at the same time want to keep it around as a reference.

To add a new managed resources directory:

1. Write a label for the resources directory in the **Label** field.
2. Write the path on the file system where the directory will be created in the **Data directory** field.
3. Select the **Enable backup** check box to enable backups of the data directory. Write the path on the file system where the backup will be written to in the **Backup directory** field. See also Backup of a Managed Resources Directory
4. In the **Trigger mode** list under **Restore**, select **Automatic** if the data directory should be automatically restored from backup if it is missing on disk, or a previous restore has not yet finished, when activating the Model Manager server database using the directory — see The Database Configuration Page. Select **Manual** if a restore requires manual triggering on The Managed Resources Directory Page. See also Restore of a Managed Resources Directory.
5. Click **Save** to add the new configuration.

Place the backup directory on a physical disk different than the disk containing the data directory. Otherwise, you might risk complete data loss in case of a server disk crash.

THE MANAGED RESOURCES DIRECTORY PAGE

The **Managed Resources Directory** page contains details on the configuration of a managed resources directory added to the Model Manager server — see Adding Managed Resources Directories.

To edit the configuration for a managed resources directory, proceed as follows:

1 Deactivate any Model Manager server database using the resources directory, if any — see The Database Configuration Page.

2 Click the **Edit** button.

3 Enter the new configuration settings. If you change any directory paths, manually move the corresponding directories on the file system.

4 Click the **Save** button.

5 Activate the database using the resources directory, if any.

Click the **Delete Permanently** button to permanently delete the configuration.

Clicking **Delete Permanently** will only delete the configuration for the managed resources directory; it will not delete the directory itself. You can add the managed resources directory again using a new configuration that points to the directory and its backup directory.

BACKUP OF A MANAGED RESOURCES DIRECTORY

If you enable backup for a managed resources directory, the Model Manager server will continuously back up any files written to the resources directory to the backup directory.

You can also trigger a complete backup of the whole resources directory — this will back up *all* files in the resources directory to the backup directory. Click the **Trigger Backup** button on the **Managed Resources Directory** page. A backup will then be scheduled to begin if and when the Model Manager server database using the resources directory is activated.

RESTORE OF A MANAGED RESOURCES DIRECTORY

If you have configured a managed resources directory with **Trigger mode** set to **Automatic,** a missing directory will be automatically restored from the backup directory if and when a Model Manager server database using the managed resources directory is activated.

You can also manually restore a managed resources directory by clicking the **Trigger Restore** button on the **Managed Resources Directory** page. A restore will then be scheduled to begin if and when the Model Manager server database using the resources directory is activated. A confirmation dialog box is shown informing you that the following steps will be taken once the restore has begun:

1. The SQL database component of the Model Manager server database will be queried for all files expected to be present in the resources directory.
2. All expected files that are missing from the resources directory are copied from the backup directory.

A triggered restore of a managed resources directory only begins once a Model Manager server database using the resources directory is activated — see The Database Configuration Page.

Managed Search Index Servers

A *managed search index server* is a server instance of the Apache Solr™ enterprise search platform controlled by the Model Manager server itself. The **Managed Search Index Servers** page shows the configurations of all such managed search index servers. A single configuration — **Default managed Apache Solr™ server** — is initially shown in the table. This default managed search index server is automatically created by the Model Manager server when the latter is started for the first time — see also The Default Managed Database.

Links to the **Managed Search Index Servers** page are hidden in the web interface if you cleared the **Managed Apache Solr™** check box in the Products step of the Model Manager server installation.

Click on the label of one of the managed search index servers to show more details for that managed server. Click the **Add** button to add a new managed search index server.

ADDING MANAGED SEARCH INDEX SERVERS

You can add a new managed search index server to Model Manager server. This is useful if, for example, you want to use different options than the default ones for the automatically added managed search index server but at the same time want to keep it around as a reference.

To add a new managed search index server:

1. Write a label for the managed search index server in the **Label** field.
2. Write the path on the file system where the data directory for the managed search index server will be created in the **Data directory** field.

3 Select when and how the server is launched in the **Start mode** list. You can select **Automatic** or **Manual**.

4 Click **Save** to add the new configuration. The data directory will be automatically created as needed the next time the managed search index server is started.

At least two search indexes need to be added to the managed search index server to use it for a Model Manager server database — see Search Indexes.

Unlike Managed SQL Database Servers and Managed Resources Directories, a managed search index server requires no backup.

THE MANAGED SEARCH INDEX SERVER PAGE

The **Managed Search Index Server** page contains details on the configuration of a managed search index server added to the Model Manager server — see Adding Managed Search Index Servers.

Click the **Stop** button to stop a running managed search index server. Click **Start** to start it.

To edit the configuration for a managed search index server, proceed as follows:

1 Deactivate all Model Manager server databases using Search Indexes in the managed search index server. See The Database Configuration Page.

2 Stop the managed search index server.

3 Click the **Edit** button.

4 Enter the new configuration settings. If you change any directory paths, manually move the corresponding directories on the file system.

5 Click the **Save** button.

6 Start the managed search index server if not automatically started.

7 Activate all databases deactivated in the first step.

Click the **Delete Permanently** button to permanently delete the configuration.

Clicking **Delete Permanently** only delete the configuration for the managed search index server; it will not delete its data directory. You can add an existing search index server again by adding a new configuration that points to its data directory.

SEARCH INDEXES

The search data used by the Model Manager search functionality is populated in *search indexes* in the managed search index server. A Model Manager server database requires two search indexes. The search indexes are stored inside the data directory for the managed search index server.

To add a new search index, write the name of the search index and click the **Add** button under the **Search Indexes** section on the **Managed Search Index Server** page. The name may only contain the letters a–z and digits 0–9 and must start with a letter. Suggested names are `assets` and `items` — the same names used by The Default Managed Database.

The search index server must be running in order to add new search indexes.

Unlike the data directories of Managed SQL Database Servers and Managed Resources Directories, the data directory and its search indexes do not require backup as the content can be recreated from that of the SQL database — see Restore of a Managed Search Index Server.

RESTORE OF A MANAGED SEARCH INDEX SERVER

A managed search index server is automatically restored if its data directory is missing when the server is started, although all its search indexes are then empty. The search indexes will be populated with search data when the Model Manager server database using the search indexes is activated.

You can also manually restore the data directory as follows:

1. Deactivate all Model Manager server databases using Search Indexes in the managed search index server. See The Database Configuration Page.
2. Stop the managed search index server.

3 Move any existing data directory to a new location.

4 Start the managed search index server.

At this point, the data directory and its search indexes will be recreated based on the configuration settings of the managed search index server. The search indexes will, however, be empty of search data.

5 Activate all databases deactivated in the first step.

At this point, the empty search indexes will be automatically repopulated with search data loaded from the corresponding SQL database as needed.

Populating the search indexes after a restore may take some time depending on the size of the SQL database.

Model Manager Server Databases

A Model Manager server database consists of the following components:

- A SQL database — either added to a SQL database server managed by the Model Manager server or added to an external SQL database server provided by your organization.
- A resources directory — either a directory managed by the Model Manager server or an external directory.
- Two search indexes — either added to a search index server managed by the Model Manager server or added to an external search index server provided by your organization.

In this section you will learn how to configure a Model Manager server database using these components. You will see that you can use any combination of Managed Server Components and custom server components for the database.

- Database Configurations
- Databases with Managed Server Components
- Databases with External Server Components
- Backup and Restore of a Model Manager Server Database

Database Configurations

The **Database Configurations** page shows the configurations of all Model Manager server databases. If you selected the **Managed PostgreSQL®** and **Managed Apache Solr™** check boxes in the Products step of the Model Manager server installation, the configuration of a single database — **Default managed database** — is initially shown in the table. This database is automatically created by the Model Manager server when the latter is started for the first time — see also The Default Managed Database.

A Model Manager server database can be set as either *active* or *inactive* depending on whether or not it should accept connections from COMSOL Multiphysics. You would typically deactivate a Model Manager server database when you want to change its configuration settings or perform a restore from backup. One of the databases can also be set as the *current* one, which is the default server database that users will connect to when accessing the Model Manager server from COMSOL Multiphysics.

Click on the label of one of the databases on the **Database Configurations** page to show more details for that database. Click the **Add** button to add a new database.

THE DEFAULT MANAGED DATABASE

A default Model Manager server database will be automatically created when the Model Manager server starts for the first time if you selected the **Managed PostgreSQL®** and **Managed Apache Solr™** check boxes when installing the server. This database uses managed server component's with default locations for their data directories and backup directories. These locations are not ideal as backups are placed on the same physical disk as the data itself. You are recommended to either add new Managed Server Components or update the configurations of the automatically added default components.

Place the backup directories for the managed SQL database server and the managed resources directory on a physical disk different than that of their corresponding data directories if you decide to use the default managed database. This will protect you from complete data loss in case of a server disk crash. See The Managed SQL Database Server Page and The Managed Resources Directory Page for instructions.

A default managed database is only created if you selected both the **Managed PostgreSQL®** and **Managed Apache Solr™** check boxes in the Products step of the Model Manager server installation. If you select just one of them, only the corresponding default managed server component will be created.

ADDING DATABASES

You can add a new database to the Model Manager server. This is useful if, for example, you want to use different options than the The Default Managed Database but at the same time want to keep the default database around as a reference.

To add a new database:

1 Write a label for the database in the **Label** field.

2 In the **SQL Database>Type** list, select among the options:

- **Managed** — to use a SQL database in one of the Managed SQL Database Servers. See Managed SQL Databases.
- **Custom** — to use a SQL database in an external SQL database server. See External SQL Databases.

3 In the **Resources Directory>Type** list, select among the options:

- **Managed** — to use one of the Managed Resources Directories.
- **Custom** — to use an external directory on the file system. See External Resources Directories.

4 In the **Search Indexes>Type** list, select among the options:

- **Managed** — to use search indexes in one of the Managed Search Index Servers. See Managed Search Indexes.
- **Custom** — to use search indexes in an external search index server. See External Search indexes.

5 Click the **Save** button.

You need to both activate the database and set it as the current default before users can connect to it from COMSOL Multiphysics — see The Database Configuration Page.

THE DATABASE CONFIGURATION PAGE

The **Database Configuration** page contains details on the configuration of a database added to the Model Manager server.

Click the **Edit** button to edit the configuration for the database.

Click the **Test Connection** button to test if the configuration can be used to connect to the database.

Click the **Deactivate** button to deactivate the database. Users will not be able to connect to the database from COMSOL Multiphysics. Click **Activate** to make the database available again.

If you have configured multiple databases, you can click the **Set as Current** button to set the database as the current default.

Click the **Delete Permanently** button to permanently delete the database configuration.

Clicking **Delete Permanently** will only delete the configuration for the Model Manager server database; it will not delete any data. You can add the database again using a new configuration.

You are recommended to deactivate a database before editing its configuration.

Databases with Managed Server Components

You can configure a Model Manager server database to use components managed by the Model Manager server itself.

MANAGED SQL DATABASES

On the pages for adding or editing a database configuration:

1. Select **Managed** in the **SQL Database>Type** list to use a SQL database in one of your Managed SQL Database Servers.
2. Select a managed SQL database server in the **Server** list.
3. Select the database in the **Database** list.

A SQL database in a managed SQL database server can be used by at most one Model Manager server database.

MANAGED RESOURCES DIRECTORIES

On the pages for adding or editing a database configuration:

1. Select **Managed** in the **Resources Directory>Type** list to use one of your Managed Resources Directories.
2. Select a managed resources directory in the **Directory** list.

A managed resources directory can be used by at most one Model Manager server database.

MANAGED SEARCH INDEXES

On the pages for adding or editing a database configuration:

1. Select **Managed** in the **Search Indexes>Type** list to use search indexes in one of your Managed Search Index Servers.
2. Select a managed search index server in the **Server** list.
3. Select two different search indexes to use in the **Assets** and **Items** lists.

A search index in a managed search index server can be used by at most one Model Manager server database.

Databases with External Server Components

You can configure a Model Manager server database to use custom components managed externally by your organization. This is useful if, for example, you already have a SQL database server installation with associated backup routines set up.

EXTERNAL SQL DATABASES

On the pages for adding or editing a database configuration:

1. Select **Custom** in the **SQL Database>Type** list to use a SQL database in an external SQL database server.
2. Select the type of SQL database platform in the **Platform** list. The supported platforms are:
   - PostgreSQL® Database
   - Microsoft® SQL Server® Database
   - MySQL® Database
   - Oracle® Database

Set up a backup routine for the SQL database server that includes the SQL database used by Model Manager.

PostgreSQL® Database

1. In the **Server name** field, write the name of the computer that the PostgreSQL® database server process runs on. Defaults to `localhost`.

2 In the **Port** field, write the number of the port that the PostgreSQL® database server listens on. Defaults to `5432`.

3 In the **Database name** field, write the name of a SQL database to use by Model Manager.

4 In the **Method** list, select the method of authentication. Select **Password** to authenticate using password-based authentication methods. Select **Passwordless** to authenticate using passwordless authentication methods (for example, SSPI on Windows®).

5 In the **Username** field, write the username used to authenticate with the PostgreSQL® database server.

6 In the **Password** field, write the password used to authenticate with the PostgreSQL® database server. Only available when using passwordless authentication methods.

   The password will be encrypted by Model Manager server and stored in a local SQLite® database in the Model Manager Server Preference Directory— see also Password Security.

Model Manager supports PostgreSQL® version 10.0 and newer.

Microsoft® SQL Server® Database

1 In the **Server name** field, write the name of the computer that the Microsoft® SQL Server® database server process runs on. Defaults to `localhost`.

2 In the **Port** field, write the number of the port that the PostgreSQL® database server listens on. Defaults to `1433`.

3 In the **Database name** field, write the name of a SQL database to use by Model Manager.

4 In the **Instance name** field, write the instance name of the Microsoft® SQL Server® database server.

5 In the **Application name** field, write an application name to use when connecting to the database.

6 Select the **Use integrated security** check box to authenticate using the Windows account running the Model Manager server process.

7 In the **Username** field, write the username used to authenticate with the Microsoft® SQL Server® database server. Only available if the **Use integrated security** check box is cleared.

8 In the **Password** field, write the password used to authenticate with the Microsoft® SQL Server® database server. Only available if the **Use integrated security** check box is cleared.

The password will be encrypted by Model Manager server and stored in a local SQLite® database in the Model Manager Server Preference Directory— see also Password Security.

Model Manager supports Microsoft® SQL Server® 2012 and newer.

MySQL® Database

1 In the **Server name** field, write the name of the computer that the MySQL® database server process runs on. Defaults to `localhost`.

2 In the **Port** field, write the number of the port that the MySQL® database server listens on. Defaults to `3306`.

3 In the **Database name** field, write the name of a SQL database to use by Model Manager.

4 Select the **Use SSL** check box to require secure connections.

5 Select the **Verify server certificate** check box to require that the MySQL® database server's certificate is verified.

6 In the **Username** field, write the username used to authenticate with the MySQL® database server.

7 In the **Password** field, write the password used to authenticate with the MySQL® database server.

The password will be encrypted by Model Manager server and stored in a local SQLite® database in the Model Manager Server Preference Directory— see also Password Security.

Connecting with Model Manager server to MySQL® requires a JDBC driver licensed by your organization. In the file `comsolmodelmanagerserver.ini` found inside the installation directory for Model Manager server:

- Windows®: `<`*`Installation directory`*`>\bin\win64`

- Linux®: `<Installation directory>/bin/glnxa64`
- macOS: `<Installation directory>/bin/maci64`

add the line

```
-Dcs.modelmanager.mysql.jdbcdriver=<Path to JDBC driver>
```

with *<Path to JDBC driver>* being the path to the JDBC driver's JAR file on the file system.

If running as a Windows® service, the file is `comsolmodelmanagerservice.ini`.

Model Manager supports MySQL® version 8.0.20 and newer.

Oracle® Database

1. In the **Server name** field, write the name of the computer that the Oracle® Database server process runs on. Defaults to `localhost`.
2. In the **Port** field, write the number of the port that the Oracle® Database server listens on. Defaults to `1521`.
3. In the **System Identifier** field, write the system identifier (SID) of the Oracle® Database instance.

   Leave this field empty if you want to connect using a service name instead.
4. In the **Service name** field, write the service name for the Oracle® Database instance.

   Leave this field empty if you want to connect using the system identifier instead.
5. In the **Username** field, write the username used to authenticate with the Oracle® Database server.
6. In the **Password** field, write the password used to authenticate with the Oracle® Database server.

   The password will be encrypted by Model Manager server and stored in a local SQLite® database in the Model Manager Server Preference Directory— see also Password Security.

Connecting with Model Manager server to Oracle® Database requires a JDBC driver licensed by your organization. In the file `comsolmodelmanagerserver.ini` found inside the installation directory for Model Manager server:

- Windows®: `<Installation directory>\bin\win64`

- Linux®: <*Installation directory*>/bin/glnxa64
- macOS: <*Installation directory*>/bin/maci64

add the line

```
-Dcs.modelmanager.oracle.jdbcdriver=<Path to JDBC driver>
```

with <*Path to JDBC driver*> being the path to the JDBC driver's JAR file on the file system.

If running as a Windows® service, the file is `comsolmodelmanagerservice.ini`.

Model Manager supports Oracle® Database version 12.2.0.1 and newer.

EXTERNAL RESOURCES DIRECTORIES

On the pages for adding or editing a database configuration:

1. Select **Custom** in the **Resources Directory>Type** list to use an external resources directory.
2. In the **Directory** field, write the path on the file system to a directory.

Set up a backup routine that backs up the resources directory — including all its subfolders and files — to a physical disk separate from that of the resources directory itself.

EXTERNAL SEARCH INDEXES

On the pages for adding or editing a database configuration:

1. Select **Custom** in the **Search Indexes>Type** list to use search indexes stored in an external search index server.
2. In the **Platform** list, select **Apache Solr™ server**.
3. In the **Base URL** field, write the base URL used to connect to the Apache Solr™ server. Defaults to `http://localhost:8983/solr`.
4. In the **Method** list, select the method of authentication. Select **Password** to authenticate using a username and password. Select **None** if the Apache Solr™ server does not require authentication.
5. In the **Username** field, write the username used to authenticate with the Apache Solr™ server.

6 In the **Password** field, write the password used to authenticate with the Apache Solr™ server.

   The password will be encrypted by Model Manager server and stored in a local SQLite® database in the Model Manager Server Preference Directory— see also Password Security.

7 In the **Assets** and **Items** fields, write the names of Apache Solr™ cores to use for the Model Manager server database.

	Model Manager supports Apache Solr™ version 8.7.0 and newer.

	You can optionally set up a backup routine that includes the Apache Solr™ cores used by the Model Manager server database. This will make the restore process run faster as there will be less search data to transfer from the SQL database to the cores.

Backup and Restore of a Model Manager Server Database

You should configure backup of your Model Manager server database to protect from data loss in case of, for example, a server disk crash. Backup for a Model Manager server database using Managed Server Components can be configured from the Model Manager server's web interface. Backup for a database using custom components need to be configured externally from Model Manager server.

BACKUP OF A MODEL MANAGER SERVER DATABASE

Backup for a Model Manager server database involves configuring separate backups for its SQL database and resources directory. Its search indexes do not require backup.

See Backup of a Managed SQL Database Server and Backup of a Managed Resources Directory for the backup of Managed Server Components.

See External SQL Databases and External Resources Directories for the backup of custom server components.

RESTORE OF A MODEL MANAGER SERVER DATABASE

The steps required to restore a Model Manager server database from backup depend on how much has been lost in terms of configuration.

If the Model Manager Server Preference Directory is missing, and there is no backup of that directory available, you will first need to recreate the configuration for the Model Manager server database. For Databases with Managed Server Components, begin by recreating the configuration of each managed server component:

- Adding Managed SQL Database Servers
- Adding Managed Resources Directories
- Adding Managed Search Index Servers

Remember to specify the path for the backup root directory of the managed SQL database server, as well as for the backup directory of the managed resources directory. If you set the **Trigger mode** for restoring to **Automatic (most recent)** for the managed SQL database server, and its data directory is missing on disk, the data directory will be automatically restored from backup when the server starts. Similarly, if the **Trigger mode** for restoring is set to **Automatic**, a managed resources directory is automatically restored if the directory is missing on disk.

Follow the steps in Adding Databases to recreate a configuration for the Model Manager server database — optionally replacing managed server components with external server components.

When a configuration for the Model Manager server database is available (for example, after recreating it):

1. If currently activated, deactivate the Model Manager server database — see The Database Configuration Page for instructions.
2. Restore the SQL database:
   - For an external SQL database server, use the restore functionality specific to the platform.
   - For a managed SQL database server, click the **Trigger Restore** button on the **Managed SQL Database Server** page unless a restore has already been triggered automatically. Wait until the restore finishes. See also Restore of a Managed SQL Database Server.
3. Restore the resources directory:
   - For an external resources directory, copy files from the backup directory to their corresponding location in the resources directory — optionally skipping files already present in the resources directory.
   - For a managed resources directory, click the **Trigger Restore** button on the **Managed Resources Directory** page unless a restore will trigger automatically. The

restore will begin once the database is activated again; see below. See also Restore of a Managed Resources Directory.

4 Restore the search indexes:

- For an external search index server, recreate the search indexes used by the Model Manager server database or, if you have one available, restore the search index server from backup.
- For a managed search index server, follow the steps in Restore of a Managed Search Index Server.

5 Activate the database if not already activated by a previous step.

At this point, if the Model Manager server database uses a managed resources directory, all missing files will be restored from the backup directory to the data directory. All search indexes will also be populated with search data loaded from the SQL database as needed. The time for both of these steps to complete depends on the size of the database.

When the Model Manager server database has been activated, it is possible to connect to the database from COMSOL Multiphysics. Note that search results may be incomplete, however, until all search indexes have been repopulated with search data. Some simulation models and auxiliary data files may also fail to load if they depend on data in the resources directory that have yet to be copied from the backup directory by the ongoing restore.

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