Modules in Kentico allow you to add custom functionality. You can extend all aspects of the system, including:

- the administration interface
- the data model (custom objects and database tables)
- business logic and general functionality (for example using event handlers)

All of the default modules in Kentico are **sealed** – you cannot edit their properties, or create new classes, UI elements, permissions and settings. When you create your own modules, they are in "development mode" on the given Kentico instance, and you can modify them in any way.

The system provides a **Custom** module by default, which is always in development mode.

- You can use the module to perform quick, non-transferable customizations.
- The Custom module also serves as a container for custom objects from previous Kentico versions after performing an upgrade or import.

For creating modular custom functionality, we strongly recommend creating your own separate modules.

You can choose between two different approaches of developing and deploying your custom modules:

Modules deployed via installation packages

- Deployment using NuGet packages
- Module files are included in a separate project within the Kentico solution during development
- All module code is compiled in a library (DLL) when installed on other instances
- Cannot be used to transfer modules for development on other instances, because the modules become sealed during the deployment

See Creating installation packages for modules for more information.

For an example showing how to develop a module that supports the creation of installation packages, go to the Example - Creating a packageable module page.

Modules deployed via Export / Import

- Deployment using the Kentico export and import features
- Provides an option to seal the modules during export or to leave them unsealed and available for further development after import
- Requires manual selection of related database objects for each export package
- The export cannot transfer DLL files along with the module

See the remaining parts of **this page** for an example of module development and additional details.

Creating custom modules

The following sections are an example that demonstrates how to create a basic custom module (does not include steps required to create Installation packages for the module). The module provides a "Company overview" that allows management of custom *Office* objects.

Important: It is necessary to follow ***all*** of the sections below in the presented order. Skipping steps may prevent subsequent sections from working correctly.

Start by defining the module in the Kentico administration interface:

1. Open the **Modules** application.
2. Click **New module**.
3. Type *Company overview* into the **Module display name**.

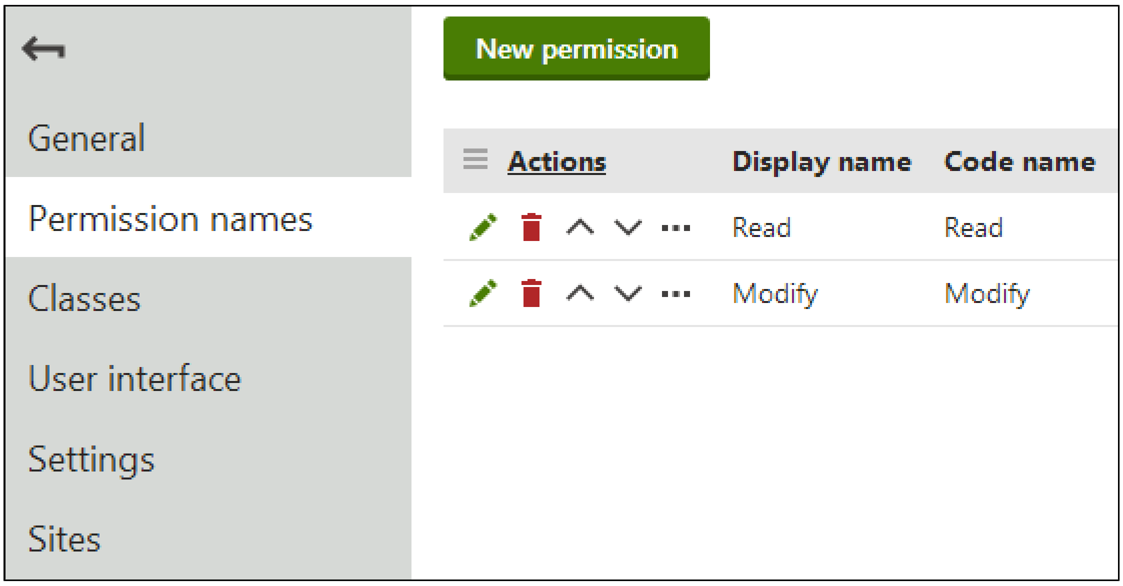
    - The system automatically uses *CompanyOverview* as the Module code name. Do NOT start the code names of custom modules with the **cms.** prefix, which is reserved for Kentico modules.
4. Click **Save**. The system creates the module and opens its editing interface.
5. Switch to the **Sites** tab and assign the module to your sites.

Defining module permissions

1. While editing the module in the **Modules** application, select the **Permission names** tab.
2. Click **New permission**.
3. Type ***Read*** into the **Permission display name**. The permission also automatically uses *Read* as the code name.
4. Enable **Display in matrix**.
5. Click **Save**.
6. Return to the list of permissions and click **New permission** again.
7. Type ***Modify*** into the **Permission display name**.
8. Enable **Display in matrix**.
9. Click **Save**.

Read and *Modify* are standard permissions that the system checks automatically for various purposes, including access of the module's user interface and editing of the module's objects.

We recommend defining the **Read** and **Modify** permissions for all custom modules that have their own user interface and data. Without the permissions, only users with the Global administrator privilege level can edit objects that belong to the module.



Actions	Display name	Code name
	Read	Read
	Modify	Modify

Adding classes to modules

Module classes represent objects in Kentico. The classes serve as containers for configuration such as data fields, editing form definitions, and search settings. Classes also have associated code that provides an API for manipulating the given object.

To create a custom class for the sample module:

1. Edit the module in the **Modules** application.
2. Select the **Classes** tab.
3. Click **New class**.
4. Fill in the **Class display name** and **Class**: *Office*
5. Click **Next**.
6. In step 2, leave the default values and click **Next**.

Notice the **Include Guid field** and **Include LastModified field** checkboxes. If selected, the system automatically creates data fields for storing GUID identifiers and last modified timestamps. These two fields are necessary if you wish to use Staging or Export and Import functionality with objects of the given class.

See also: Enabling export and staging for the data of classes

7. Define the class's data fields. Click **New field**, set the properties, and click **Save** for each field:
   - **Field name**: OfficeDisplayName
   - **Data type**: Text
   - **Required**: Yes (checked)
   - **Field caption**: Display name
   - **Form control**: Text box

   - **Field name**: OfficeName
   - **Data type**: Text
   - **Required**: Yes (checked)
   - **Unique**: Yes (checked)
   - **Field caption**: Code name
   - **Form control**: Code name (select via the *(more items...)* option)

   - **Field name**: OfficeAddress
   - **Data type**: Text
   - **Size**: 400
   - **Field caption**: Office address
   - **Form control**: Text box
8. Click **Next** once the required fields are defined.
9. Click **Finish** to complete the creation of the class.

The system automatically creates a database table for storing the class's data.

Creating object type resource strings

The system uses resource strings to display the names of class object types. By default, such strings do not exist for custom classes. Without an appropriate string, a custom class object type uses a default name (equal to the resource string key), which makes it difficult to find and identify in the administration interface.

To create a resource string for your class's object type name:

1. Open the **Localization** application.
2. On the **Resource strings** tab, click **New string**.
3. Enter the following **Key**: *ObjectType.CompanyOverview_Office* (the general format is *ObjectType.<class code name with an underscore>*)
4. Type the following text for the English version of the key: *Custom office*
   - You can optionally enter translations for other languages that you use for the administration interface.
5. Click **Save**.

The system now uses the text of the resource string in the administration interface, for example in object type selectors.

Generating class code

The system provides a tool for automatically generating the basic code required for the API of the custom class:

1. Switch to the **Code** tab of the class.
2. The required system fields should automatically be mapped to the corresponding fields of the class (Display name, Code name, GUID, Last modified).
   - When creating your own classes, adjust the settings as necessary and click **Generate code**.

3. Click **Save code**.

The system generates **Info** and **InfoProvider** classes for the custom class in *~/App_Code/CMSModules/CompanyOverview*. The default Info and InfoProvider classes are sufficient for basic functionality, but you can extend the code to create an API for your custom class. To learn how to set the metadata of your classes in the Info code, see Setting the type information for module classes.

Note: On web application installations, the system generates the files in the **Old_App_Code** folder. You need to manually include the files into the **CMSApp** project and build the solution (or move the files into your own custom module project).

Compiling module code into assemblies

We recommend storing your module's code files within a separate assembly (*Class Library* project) in the Kentico solution. This allows you to compile the files into a single DLL, and provides various advantages, such as:

- Cleaner separation of custom module code from the default code of the Kentico web project.
- Compilation performance – the module code is compiled into a DLL and does not require runtime compilation that slows down the web project.
- Better accessibility of your custom classes from external applications or projects (for example projects running automated tests).
- Easier re-usability across multiple projects.

To create a separate module assembly:

1. Open your Kentico solution in Visual Studio.
2. Create a new *Class Library* project in the Kentico solution.
3. Add references to the required Kentico libraries (DLLs) for the module project:
    - Right-click the project and select **Add -> Reference**.
    - Select the **Browse** tab of the **Reference manager** dialog, click **Browse** and navigate to the ***Lib*** folder of your Kentico web project.
    - Add references to the following libraries (and any others that you use in the module's code):
        - **CMS.Base.dll**
        - **CMS.Core.dll**
        - **CMS.DataEngine.dll**
        - **CMS.Helpers.dll**
4. Reference the custom module project from the Kentico web project *(CMSApp* or *CMS)*.
5. Edit the module project's **AssemblyInfo.cs** file (in the *Properties* folder).
6. Add the **AssemblyDiscoverable** assembly attribute:

```
using CMS;

[assembly:AssemblyDiscoverable]
```

7. Move all classes related to the module into the module project (including any *Info* and *InfoProvider* classes generated for the module's classes in the Kentico project's *App_Code* or *Old_App_Code* folder).
8. **Build** the custom module project.

The system can now work with the module's code in the given assembly.

Building the module interface

You can use the portal engine to develop custom pages in the administration interface for your modules. The portal engine allows you to perform most of the work directly in your browser, and build UI elements out of page templates and web parts.

Creating the module interface manually

If you do not wish to use the portal engine to build your module's interface, you can design UI elements as standard web forms in Visual Studio.

To learn more, see Manually creating the interface for custom modules.

The following sections describe how to create a basic editing interface for the *Office* objects used by the sample *Company overview* module.

Office listing element

1. In the **Modules** application, edit the **Company overview** module.
2. Open the **User interface** tab.
3. Select the **CMS -> Administration -> Custom** element in the tree.
4. Click **New element** (+).
5. Set the following properties for the element:
   - **Display name**: Company overview
   - **Module**: Company overview
   - **Element icon type**: Class
   - **Element icon CSS class**: icon-app-localization
   - **Type**: Page template
   - **Page template**: Object listing (click *Select* to choose the template)
6. Click **Save**.

The UI element's position in the user interface tree under the **CMS -> Administration -> (Category)** section identifies the new element as an application.

By default, the element only checks the *Read* permission of the related module, and does not have any other access restrictions. For more information about the settings of UI elements, see Reference - Managing UI elements.

The purpose of the element is to display a list of all *Office* objects in the system. You need to set the properties of the *Object listing* page template for the UI element:

1. Switch to the element's **Properties** tab.
2. Select ***Custom office (companyoverview.office)*** as the **Object type**.
3. Click **Save**.

Every listing page requires an XML grid definition, specified by the **Grid definition path** property. With the property empty, the system attempts to load the grid definition from the default location for the given module and object type.

For the purposes of the example, open your project in Visual Studio and create the default.xml file in the following location (manually create the required folder structure):

- ***~/App_Data/CMSModules/CompanyOverview/UI/Grids/CompanyOverview_Office/default.xml***

default.xml

```
<?xml version="1.0" encoding="utf-8" ?>
<grid>
        <actions>
                <action name="edit" caption="$General.Edit$" fonticonclass="icon-edit" 
fonticonstyle="allow" />
                <action name="#delete" caption="$General.Delete$" fonticonclass="icon-
bin" fonticonstyle="critical" confirmation="$General.ConfirmDelete$" />
        </actions>
        <columns>
                <column source="OfficeDisplayName" caption="Office name" wrap="false" 
localize="true">
                        <filter type="text" size="200" />
                </column>
                <column source="OfficeAddress" caption="Address" width="100%" />
        </columns>
        <options>
                <key name="DisplayFilter" value="true" />
        </options>
</grid>
```

The **Object listing** template uses the Kentico UniGrid control. To learn how to create XML definitions for object lists, see Reference - UniGrid definition.

The example above defines two basic actions for the listed objects:

- **edit** - handled automatically for portal engine elements (the listing element must have a child element whose code name starts with the *Edit* keyword)
- **#delete** - a predefined UniGrid action for deleting Kentico objects. The functionality is ensured by the default API that you generated for the *Office* class.

New office element

1. Select **Company overview** in the UI element tree.
2. Click **New element** (+).
3. Set the following properties for the element:
    - **Display name**: New office
    - **Code name**: NewOffice (**Important**: The code name of elements for creating new objects under listings must always start with the ***New*** keyword)
    - **Module**: Company overview
    - **Display breadcrumbs**: yes (allows users to easily return to the list of offices)
    - **Page template**: New / Edit object
4. Click **Save**.

The *New* element allows users to create new offices from the listing page. If you switch to the **Properties** tab, you can see that the element automatically inherits the **Object type** from the parent listing page (*Custom office*).

Office editing element

1. Select **Company overview** in the UI element tree.
2. Click **New element** (+).
3. Set the following properties for the element:
    - **Display name**: Edit office

    - **Code name**: EditOffice (**Important**: The code name of elements for editing objects under listings must always start with the ***Edit*** keyword)
    - **Module**: Company overview
    - **Display breadcrumbs**: yes (allows users to easily return to the list of offices)
    - **Page template**: New / Edit object
4. Click **Save**.

The *Edit* element provides the editing form used when editing offices on the listing page.

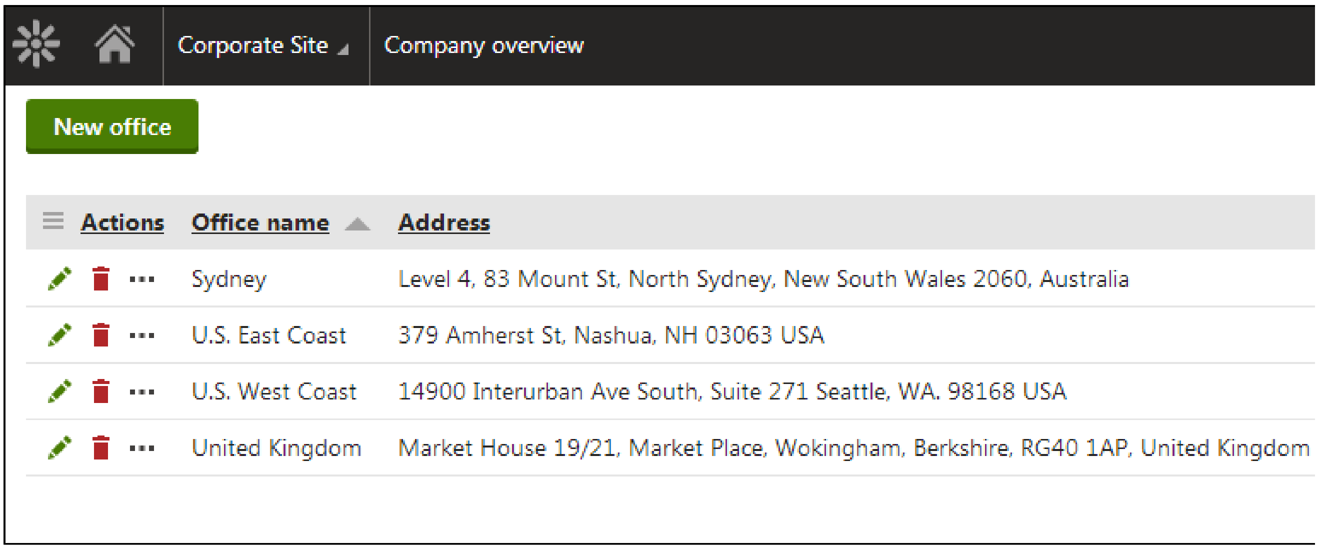
If you switch to the **Properties** tab you can see that the element automatically inherits the **Object type** from the parent listing page (*Custom office*).

Tip: For complex objects, you can build an editing interface with multiple tabs:

1. Select the **Vertical tabs** page template for the *Edit* element.
2. Create any number of child elements with editing forms or other required content.

The tabs element automatically generates a tab menu for the child elements. You can find an example on the Creating custom binding classes page.

The user interface of the custom module is now ready. If you refresh the administration interface header and expand the application list, you can find the **Company overview** application in the **Custom** category. The application displays a listing page, where you can create, edit and delete offices. Users who do not have the Global administrator privilege level can only access the list if they have the *Read* permission for the *Company overview* module, and create, edit and delete offices if they have the *Modify* permission.



Actions	Office name	Address
	Sydney	Level 4, 83 Mount St, North Sydney, New South Wales 2060, Australia
	U.S. East Coast	379 Amherst St, Nashua, NH 03063 USA
	U.S. West Coast	14900 Interurban Ave South, Suite 271 Seattle, WA. 98168 USA
	United Kingdom	Market House 19/21, Market Place, Wokingham, Berkshire, RG40 1AP, United Kingdom

In addition to defining custom objects and creating a user interface, you can also use custom modules to execute your own code. See Initializing modules to run custom code for more information.

Exporting custom modules

You can use the export feature to transfer custom modules to other instances of Kentico, or prepare module packages for the Kentico Marketplace. Deployment of modules using content staging is NOT supported.

The module export includes files from the following folders:

- **~/CMSModules/<module code name>** - you can use this folder to store store custom web forms, user controls or other files used by the module.
- **~/App_Code/CMSModules/<module code name>** - stores any required code files, such as the module's *Info* and *InfoProvider* classes.

- **~/App_Data/CMSModules/<module code name>** - stores data files, such as XML definitions for listing pages.

Exporting modules with a separate assembly

If you are using a separate assembly (*Class Library* project) for the module's code, the resulting DLL is NOT automatically included in the export of the module. When using custom assemblies, you need to transfer the DLLs to the target project manually.

Creating export packages for modules

To export your custom modules:

1. Open the **Sites** application.
2. Click **Export**.
3. Enter a **File name** for the export package
4. Leave the **Do not preselect any objects** option selected and click **Next**.
5. Click **Global objects -> Development -> Modules** in the object tree and select your module.
6. (Optional) Select the **Seal the selected modules** checkbox if you want to seal the modules during export.
    - Sealing a module means that when the package is imported on another instance of Kentico, the module will no longer be in development mode (i.e. it will not be possible to edit the module's properties, or create new classes, UI elements, permissions and settings).
    - If you do NOT seal the modules, you will be able to further develop the modules after importing them to another instance.

    Note: You cannot export a module again from instances where it is sealed. You always need to prepare module export packages on an instance where the module is in development mode.

7. Click **Global objects -> Development -> Resource strings** and select the ***ObjectType.<Class name>*** resource strings for your module's classes.
8. Click **Next**.

The system creates an export package containing the module, its user interface and all related files.

If the exported module is not assigned to any specific sites in the data of the export package, the subsequent import process automatically assigns the module to all available sites.

Exporting via installation packages

Alternatively, you can deploy custom modules using *installation packages*. To create installation packages for modules, you need to take additional steps while developing the module. For more information see:

- Creating installation packages for modules
- Example - Creating a packageable module

Exporting data of module classes

You cannot transfer the data of a module's classes within a single export package along with the module itself. A single import operation cannot import both the module's class definitions and the data.

If you wish to provide default class data for your module, the recommended approach is to prepare a separate export package containing the required data. You can import the data after the module and its classes are successfully imported.

See also: Enabling export and staging for the data of classes