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# About the Customization Guide

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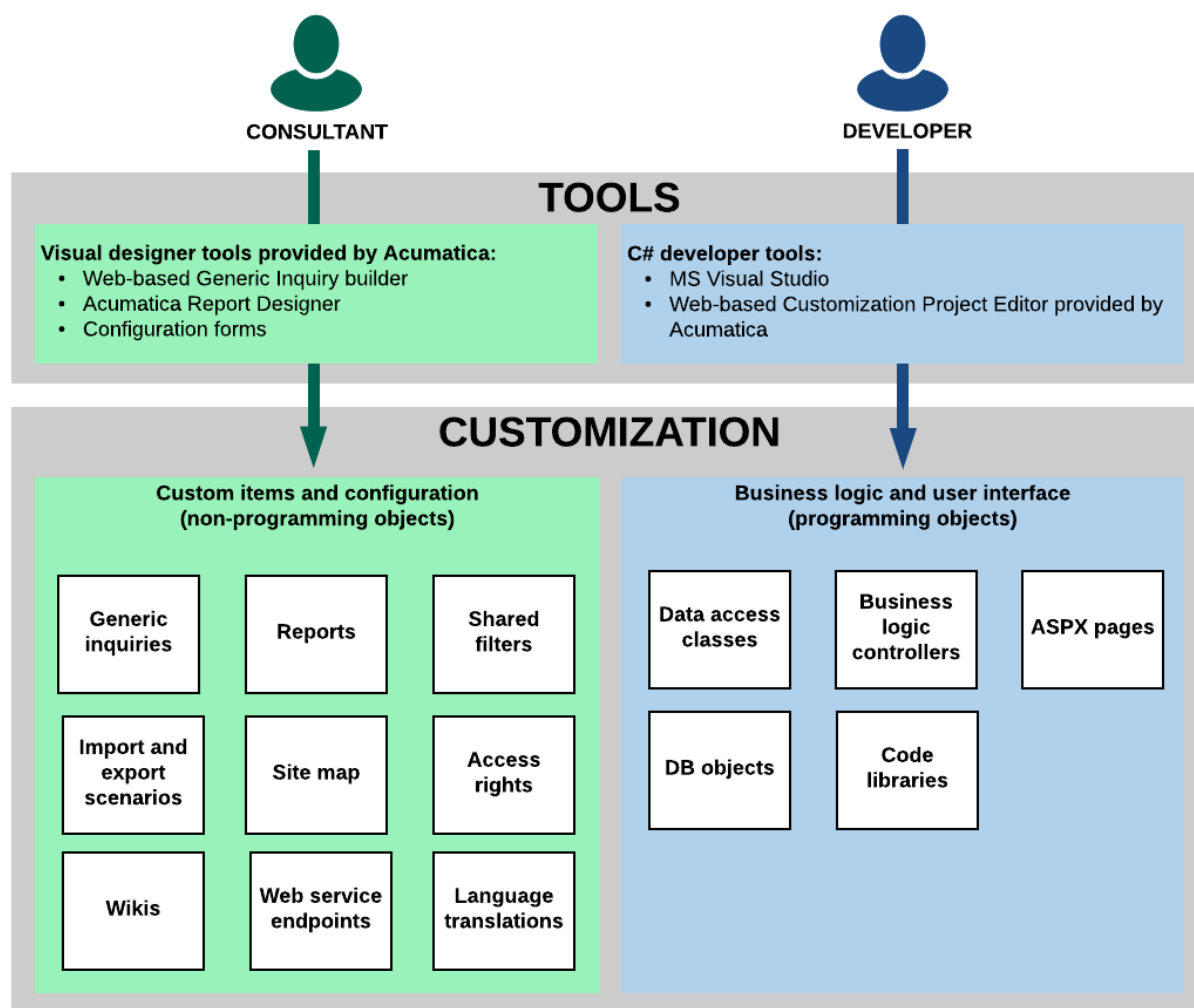
This guide describes the scope of the Acumatica Customization Platform and provides guidelines on how to use the platform capabilities for the customization of Acumatica ERP.

The guide is intended to answer the following questions:

- How to start developing a customization project? ([Getting Started](#))
- How does the Acumatica Customization Platform work? ([Acumatica Customization Platform](#))
- How to create, open, update, delete, publish, unpublish, export, and import a customization project? ([Managing Customization Projects](#))
- How to create, add, update, and delete each type of item (such as screens, data access classes, code, files, and reports) in a customization project? ([Managing Items in a Project](#))
- How to publish a single customization project or multiple project for a site with single tenant or multiple tenants? ([Publishing Customization Projects](#))
- How to create a custom form and customize the look and behavior of an existing form of Acumatica ERP? ([Customizing Elements of the User Interface](#))
- How to create custom code or extensions for an existing data access class or business logic controller? ([Customizing Business Logic](#))
- How to customize an existing table or create a custom table in the database? ([Customizing the Database Schema](#))
- How to use Microsoft Visual Studio to develop the customization code? ([Integrating the Project Editor with Microsoft Visual Studio](#))
- How to integrate with TFS, Git, or another version control system? ([Integrating the Project Editor with a Version Control System](#))
- What can I do to solve an issue that occurs while I am developing or applying a customization? ([Troubleshooting Customization](#))
- Which examples can I use to enhance my understanding of the customization tasks I will perform? ([Examples](#))

# Introduction

You can change the user interface and business logic of Acumatica ERP, as well as build custom application modules that can be added to the system. The following diagram illustrates the different types of changes that you can make to the system within the scope of the customization process.



**Figure: Customization of Acumatica ERP**

As a value-added reseller (VAR), you can deliver end-user customization that might be very specific to each particular customer. At this level, you might want to add custom reports and data filters, and configure generic inquiries for users. These changes do not involve programming unless you also want to modify the business logic and the user interface of the application. For more information on the web-based Generic Inquiry builder and the Acumatica Report Designer, see [Managing Generic Inquiries](#) and [Acumatica Report Designer Guide](#).

As an independent software vendor (ISV), you can develop vertical solutions and add-ons to the core functionality of the system. At this level, you might want to modify the business logic and the UI of the application, which you can do by using the [Acumatica Customization Platform](#). To develop custom application modules, you can use the API that is provided by the Acumatica Framework.

As an original equipment manufacturer (OEM), you can build your own cloud ERP products based on high-level application objects of Acumatica ERP and the underlying Acumatica Framework technology. This type of customization may involve intensive changes at all levels of the system: modifications of the business logic and UI, development of custom modules, and report building.



# Getting Started

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This chapter explains how to start developing a customization project and guides you to various useful chapters about the developing process.



: Before you start developing a customization project, we strongly recommend to take the [T300 training course](#). There you will learn how to set up and start using Acumatica Customization Platform.

## To Start Developing a Customization Project:

1. Make sure you have the prerequired knowledge described in [Knowledge Pre-Requisites](#).
2. Review [System Requirements for Acumatica ERP](#) in the Acumatica ERP Installation Guide.
3. Prepare your operating system according to [Preparing for Installing Acumatica ERP](#) in the same guide.
4. Prepare the environments as described in [To Prepare an Environment](#).
5. In the application instance, assign a *Customizer* role to those who will work on the customization project. See [To Assign the Customizer Role to a User Account](#) for details.
6. If you haven't used version control, set up version control as described in [Integrating the Project Editor with a Version Control System](#). If your team already has a customization project and uses version control:
  - a. Create an empty customization project with predefined name.  
This step is needed because you can load customization project files from version control only in scope of an existing project.
  - b. Download the project from version control.

You are ready to develop your customization project.

## Implementing Customization

As a rule, the process of resolving a customization task includes the following steps:

- *Explore the original code* of your Acumatica ERP application instance. This step is executed in the development environment, which must be the same as the production environment. See [Exploring the Source Code](#) for details.
- *Develop the customization project*. This step is also executed locally in the development environment, which must include all customizations that are included in the production environment. See [To Develop a Customization Project](#) for details.
- *Perform final testing*. In this step, you test the newly developed customization project in the staging environment, which can be a local copy of the customized production environment. The staging environment must include a copy of the production database. See [To Perform Final Testing of a Customization](#) for details.
- *Deploy the customization project*. This step must be executed in the production environment. See [To Deploy a Customization Project](#) for details.



:

The version number of Acumatica ERP used in the development, staging, and production environments should be the same. If they are not, before deploying and publishing a project on the production instance, you should update the application instances to the same version. If the production application instance has been updated (or will be updated soon) to a particular version, you should update the development and staging instances to the target version and repeat all testing

steps. Then, if the tests are successful, you should again create the deployment package to upload it to the production environment.

Also, keep in mind that to carry out the final testing (with the production database) and deployment stages, you must be registered as an internal user with the *Customizer* role assigned.

### In this part

- [Knowledge Pre-Requisites](#)
- [To Prepare an Environment](#)
- [To Assign the Customizer Role to a User Account](#)
- [Exploring the Source Code](#)
- [To Develop a Customization Project](#)
- [To Perform Final Testing of a Customization](#)
- [To Deploy a Customization Project](#)
- [Asking Questions](#)

## Knowledge Pre-Requisites

---

To be able to work on a customization of Acumatica ERP, you should have the following knowledge of technology used in Acumatica Customization Platform.

### Knowledge of technology and programming language used in Acumatica Customization Platform

You should have the following knowledge of technology and programming language:

- Proficiency with **C#** language, including but not limited to the following language features: classes, OOP, custom attributes, generics, delegates, anonymous methods and lambda expressions.
- Knowledge of the main concepts of **ASP.NET** and Web Development: application state, debugging ASP.NET applications using Visual Studio, client and server-side development, Web Forms structure, Web Services.
- Experience with **SQL** Server: SQL queries (where clause, aggregates, sub-queries), database structure (primary keys, data types, denormalization).
- Experience with **IIS**: configuration and deployment of ASP.NET websites, configuring and securing IIS.

The following courses might be useful to get the required knowledge:

- [Programming in C#](#)
- [Querying Microsoft SQL Server 2014](#)
- [Developing Microsoft SQL Server 2014 Databases](#)
- [Visual Studio 2017: Web Development](#)

## To Prepare an Environment

---

As you perform a customization task, you usually need to use three different sites:

- A **development environment**: Your local environment, on which you program and debug the customization code.
- A **production environment**: The target environment of the customer's system that must be customized.
- A **staging (or pre-production) environment**: A copy of the production environment, in which you will test the solution before applying it to the production environment. The staging environment can be created on your local system.

All environments are prepared in the same way as described in the following instruction.

#### To prepare an environment:

1. Install Acumatica ERP.
2. In the Acumatica ERP Configuration Wizard that appears, select **Deploy New Application Instance** to create a local instance of Acumatica ERP for the development environment.
3. On the *Database Configuration* page (Step 2 of 8 of the process of deploying a new instance), create a new database for the development environment.
4. On the *Company Setup* page (Step 3 of 8), specify the desired settings for the company.
5. On the *Instance Configuration* page (Step 6 of 8), as the **Local Path of the Instance**, specify a path outside of the `C:\Program Files (x86)` and `C:\Program Files` folders to avoid an issue with permission to work in these folders. For example, you could enter `C:\AcumaticaSites\MyProject`.

The system creates a new Acumatica ERP instance, adds a new company, and loads the selected data. Use the following initial credentials to log in to the new company:

- **Login:** admin
- **Password:** setup

Change the password when the system prompts you to do so.

6. Log in to Acumatica ERP.

## To Assign the Customizer Role to a User Account

Specialists who will work on customization projects should be assigned the *Customizer* role in the application instance that is to be customized and tested, as well as in the production application that should be updated with the customization project. With this role assigned, the specialists can use the customization tools and facilities of the Acumatica Customization Platform, and upload and publish customization projects.

A user with the *Administrator* role has full access rights in the system and can assign the *Customizer* role to the needed users by using the [Users](#) (SM201010) form.



: The default *admin* user has the *Administrator* role.

If you have the *Administrator* role, do the following to assign the *Customizer* role to a user account:

1. Navigate to **Configuration > User Security > Manage > Users**.
2. In the **Login** box, select the user account to which the *Customizer* role should be assigned.
3. Make sure the user account is not a guest account (in the Summary area) and is not assigned to a guest role (on the **Roles** tab).
4. On the **Roles** tab, select the check box for the *Customizer* role, and click **Save** on the form toolbar.

The screenshot below shows the *Johnson* user account assigned to the *Customizer* role. The account is not a guest account and is not assigned to any guest roles.

The screenshot shows the Acumatica User Security interface. The top navigation bar includes 'ORGANIZATION', 'FINANCE', 'DISTRIBUTION', and 'CONFIGURATION'. The 'CONFIGURATION' tab is active, showing 'Common Settings', 'User Security', 'Row-Level Security', 'Document Management', and 'Email'. The 'User Security' section is expanded, showing 'MANAGE' (Users, User Roles, User Types, Access Rights By Screen, Access Rights By Role) and 'EXPLORE' (Access History, Certificate Replacement, PRINT, User List, Role List, Access Rights By Screen, Access Rights By Role). The 'Users' section is selected, showing a search bar and a list of users. The 'Johnson' user is highlighted, and the 'Roles' tab is active. The 'ADD ACTIVE DIRECTORY USER' section shows the 'Login' field with 'Johnson' and the 'Guest Account' checkbox. Below this is a table of roles with columns 'Selected', 'Role Name', and 'Role Description'. The 'Customizer' role is selected and highlighted.

Selected	Role Name	Role Description
<input type="checkbox"/>	Administrator	System Administrator
<input type="checkbox"/>	Anonymous	Anonymous
<input type="checkbox"/>	Consultant	Consultant
<input checked="" type="checkbox"/>	Customizer	System Customizer
<input checked="" type="checkbox"/>	Employee	Employee
<input type="checkbox"/>	Entry	Entry Clerk
<input type="checkbox"/>	Field-Level Audit	Role that can access Field-Level Audit
<input type="checkbox"/>	Financial	Financial Controller
<input type="checkbox"/>	Guest	External Guest Role
<input checked="" type="checkbox"/>	Internal User	Allows the user to change personal settings, a...
<input checked="" type="checkbox"/>	MAIN Users	MAIN Users
<input type="checkbox"/>	Management	General Management
<input checked="" type="checkbox"/>	OfficeAdministrator	Office Administrator
<input type="checkbox"/>	Portal Admin	Access to portal configuration
<input type="checkbox"/>	Portal User	Portal user
<input type="checkbox"/>	ReportDesigner	Report Designer
<input type="checkbox"/>	Sales	Sales Manager
<input type="checkbox"/>	Wiki Admin	Wiki Administrator to set other users access ri...
<input type="checkbox"/>	Wiki Author	Role provides access rights for creating Wiki a...

**Figure: Assigning the Customizer role to a user account**

After you save your changes, the user gets full access for customization of the system as soon as the user refreshes a form in the web browser.

## User Access Rights for Customization

A user account must be granted the *Customizer* role to have the appropriate access needed for customization of Acumatica ERP.

The default *admin* user account is granted this role. Therefore, if you are a developer who is going to work with a customization project, you can install an application instance of Acumatica ERP on the local computer and use the *admin* user account to start doing the customization. For testing and deployment of the customization, you should also assign the *Customizer* role to the appropriate user accounts on the test instance of the application and on the production instance. On the production instance, only the users who manage the deployment of customization packages should be granted the *Customizer* role.

The users who will be granted the *Customizer* role must be Acumatica ERP internal users. You cannot assign the *Customizer* role to a user if either of the following conditions is true (or if both are true):

- The user has a guest account—that is, the user account has the **Guest Account** check box selected on the [Users](#) (SM201010) form.
- The user is assigned to a guest role. A guest role has the **Guest Role** check box selected on the [User Roles](#) (SM201005) form. The default guest roles are *Anonymous*, *Guest*, and *Portal User*.

A user account that is assigned to the *Customizer* role has access to the following objects of the system:

- The [Customization Menu](#) and [Element Inspector](#), which give this user the ability to inspect the element properties on every form of Acumatica ERP and to add items to a customization project.
- The [Customization Projects](#) (SM204505) form, which is used to manage and publish multiple customization projects. (See also [Customization Projects Form](#) .)
- The [Customization Project Editor](#), which is used to manage and develop the content of a selected customization project.

## Exploring the Source Code

---

Before you start to customize an Acumatica ERP application instance, you should analyze your business requirements to identify the changes in business processes that must be done and to identify the application objects for the customization. We recommend that you learn about the structure of the involved webpages by exploring the `.aspx` pages, the code of the business logic controllers (BLCs), and the data access classes (DACs) that are used within the BLCs.

You can use the [Source Code](#) (SM204570) form (see also [Source Code Browser](#)) to explore the original source code of the application for the following purposes:

- To learn about the structure of the webpages involved in the customization
- To understand which data views are bound with the customized form areas
- To analyze the code that provides the business logic for a form to be customized
- To find and analyze the data views used on a customized webpage
- To understand which data access classes the form being customized is based on
- To learn the attributes of the DAC fields and the relations between DACs

This section contains instructions on how to do the following:

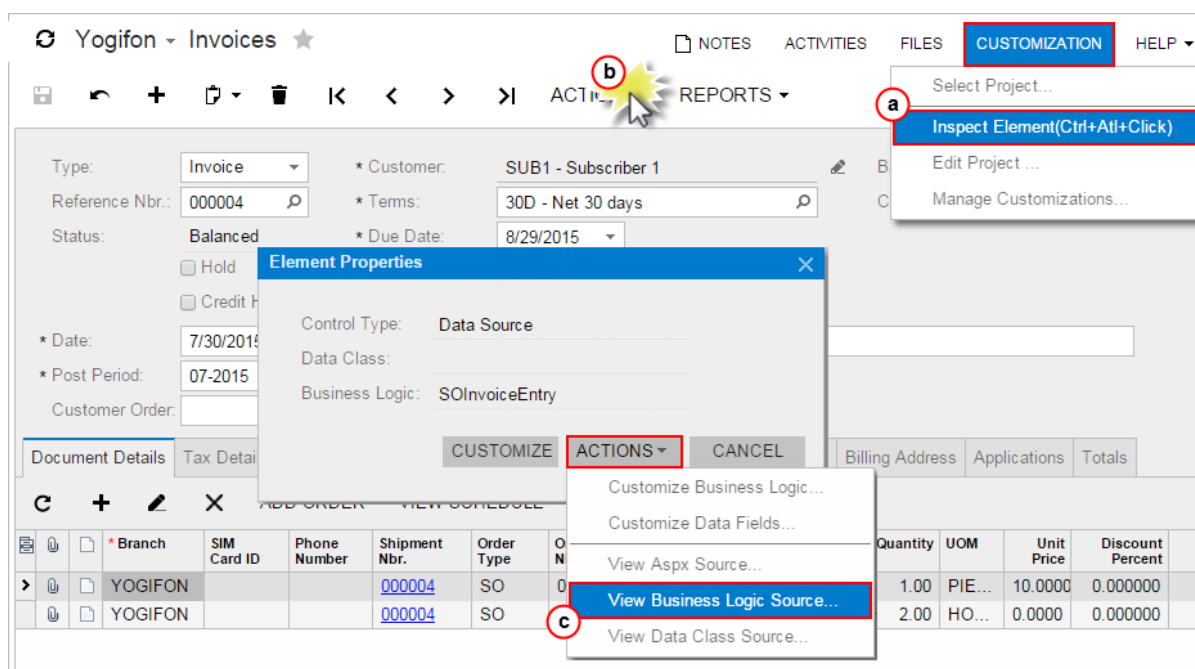
- [To Explore the C# Code of a BLC](#)
- [To Explore the C# Code of a DAC](#)
- [To Explore the ASPX Code of a Page](#)
- [To Find a Customization of the ASPX Code](#)
- [To Find Source Code by a Fragment](#)

### To Explore the C# Code of a BLC

If you need to customize the business logic for a form of Acumatica ERP, you have to explore the original source code of the business logic controller (BLC) that provides the business logic for the form. The goal of exploring the code is to discover the data views, methods, and event handlers of the BLC.

To do this, perform the following actions:

1. On a selected form, click **Customization > Inspect Element**, as item a of the screenshot below shows, to activate the [Element Inspector](#).
2. Click a control or area of the form to open the [Element Properties Dialog Box](#) for the control or area. See item b on the screenshot.
3. In the dialog box, click **Actions > View Business Logic Source** (item c).



**Figure: Selecting the grid container for the customization**

4. In the [Source Code](#) (SM204570) form (see also [Source Code Browser](#)), which opens for the BLC, view the source code in the work area, and use the navigation pane to find a method or event handler by its name and open it.

Also, you can open the original BLC code in the Source Code browser in the following ways:

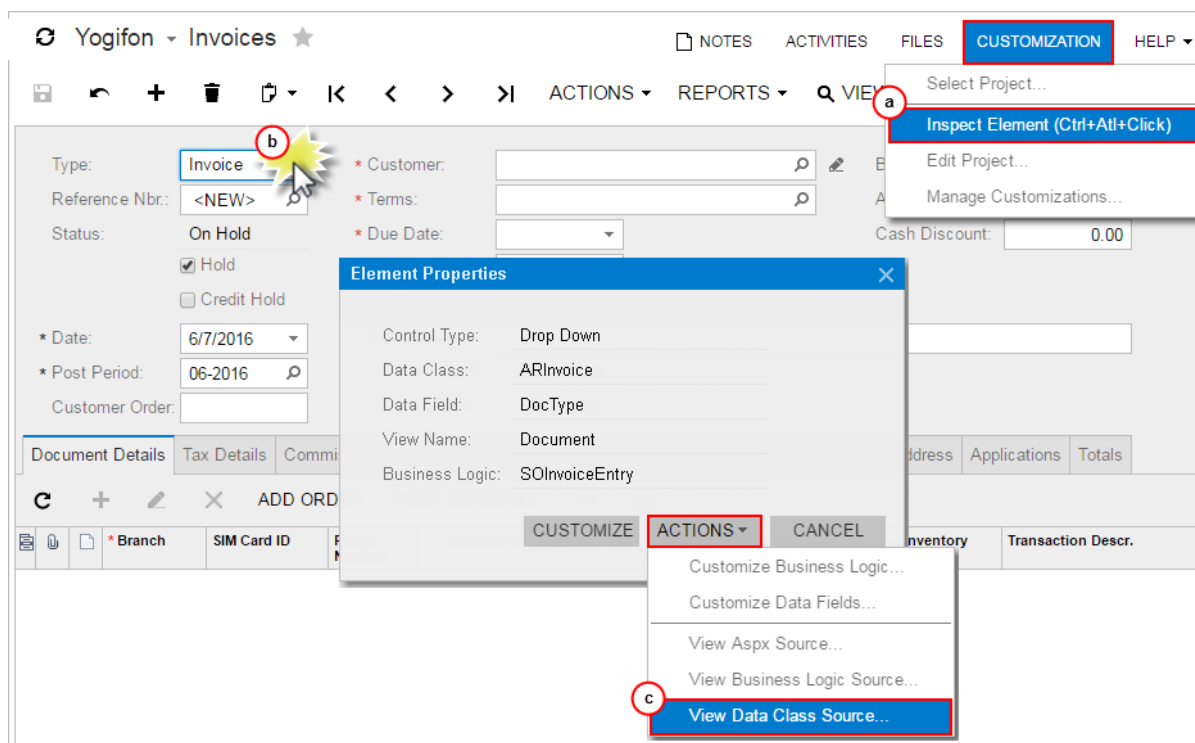
- From the [Code Editor](#), by clicking **View Source** on the page toolbar
- From the [Screen Editor](#), by clicking **View Source** on the toolbar of the **Events** tab

## To Explore the C# Code of a DAC

If you need to customize the attributes of a data field for an existing control or create a new field for a custom control on a form, you may need to explore the original source code of the appropriate DAC.

To do this, perform the following actions:

1. On the selected form, click **Customization > Inspect Element**, as item a of the screenshot below shows, to activate the [Element Inspector](#).
2. Click a control or area of the form to open the [Element Properties Dialog Box](#) for the control or area. See item b on the screenshot.
3. In the dialog box, click **Actions > View Data Class Source** (item c).



**Figure: Selecting the grid container for the customization**

4. On the [Source Code](#) (SM204570) form (see also [Source Code Browser](#)), which opens for the DAC, view the data field declarations in the work area.

Also you can open the original DAC code in the Source Code browser in the following ways:

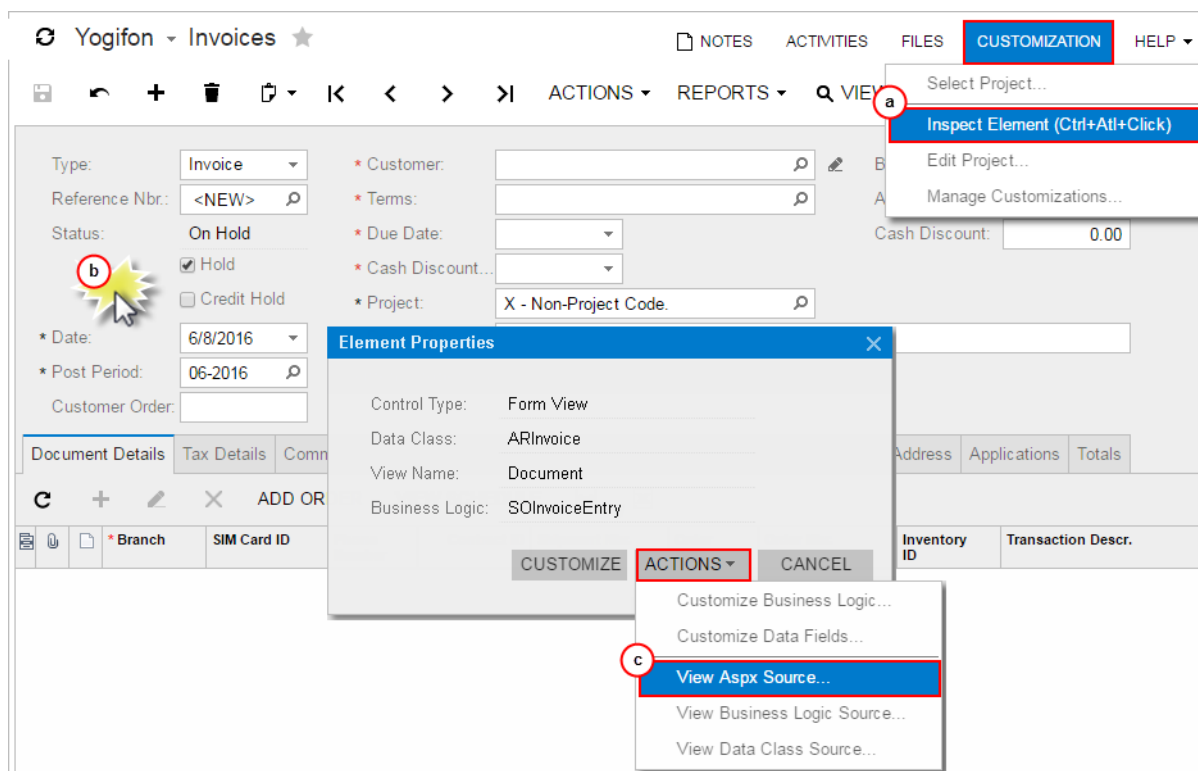
- From the [Data Class Editor](#), by clicking **View Source** on the page toolbar
- From the [Screen Editor](#), by clicking **View Source** on the toolbar of the **Attributes** tab

## To Explore the ASPX Code of a Page

If you need to look closely at the data views that provide data for control containers on a form or to see the corresponding webpage structure—that is, the layout of the containers and the types and properties of the controls—you may need to explore the original ASPX code of the webpage.

To explore this code, perform the following actions:

1. On the selected form, click **Customization > Inspect Element**, as item a in the screenshot below shows, to activate the [Element Inspector](#).
2. Click a control or area of the form to open the [Element Properties Dialog Box](#) for the control or area. See item b on the screenshot.
3. In the dialog box, click **Actions > View ASPX Source** (item c).



**Figure: Selecting the grid container for the customization**

4. On the [Source Code](#) (SM204570) form (see also [Source Code Browser](#)), which opens for the form, view the original ASPX code of the page in the work area.
5. If you need to look closely at the data views that provide data for control containers on the current form, perform a browser search to find the `DataMember` string. The `DataMember` property is used to bind a control container of a form to a data view defined in the business logic controller (BLC) of the form. The property value is the name of the data view.



: Each `DataMember` property value can correspond to any data view name of the BLC. Any container (for example, `PXTab`, `PXGridLevel`, or `PXFormView`) must be bound to a data view declared within a BLC. Any data view except for the main data view can be used by an unlimited number of containers. The main data view must be bound to a single container.

## To Find a Customization of the ASPX Code

If the ASPX code for a form is customized, to explore changes in the code, you use the [Screen Editor](#) of the [Customization Project Editor](#), which you access by using the [Customization Projects](#) (SM204505) form.



: The Source Code browser can display only the original ASPX code of a webpage.

To detect whether a form is currently customized, do the following:

1. Open the form in the browser.
2. Click **Tools** on the title bar of the form.

If the form has been customized, the screen ID has the `CST.` prefix.

Once you know the form has been customized, to find the customization of the ASPX code of the form, perform the following actions:

1. Determine the published customization projects that contain changes for the form as follows:
  - a. Navigate to **System > Customization > Manage > Customization Projects**



- b. On the form, view the list of the customization projects (see the following screenshot)

Acumatica ORGANIZATION FINANCE DISTRIBUTION SYSTEM 11/3/2016 6:48 AM ADMIN

Management Integration Automation Customization

Customization Revision Two HQ Customization Projects CUSTOMIZATION HELP

Type your query here Search

MANAGE Customization Projects

- Generic Inquiry
- Lists as Entry Points
- Pivot Tables
- Dashboards
- Site Map
- Portal Map
- Filters

Publist	Project Name	Level	Screen Names	Description	Created By	Last Modified On
<input type="checkbox"/>	EcommerceSe...		IN202500		admin	10/27/2016
<input type="checkbox"/>	HideSSN		CR303010		admin	7/18/2014
<input type="checkbox"/>	POstatus		PO301000		admin	7/18/2014
<input type="checkbox"/>	StockImage				admin	8/13/2014
<input type="checkbox"/>	StockItemImage		AR303000 SO301000, SO303000		admin	10/27/2016
<input checked="" type="checkbox"/>	YogiFon		AR303000 AR409001, SO301000, SO303000		admin	11/3/2016

**Figure: Viewing the list of customization projects**

- c. In the **Screen Names** column, for the published customization projects (those for which the **Published** check box is selected), scan the form IDs to identify the projects that contains changes for this form.
2. To explore a published project that contains changes for this form, perform the following actions:
- Click the name of the project to open it in the *Customization Project Editor*.
  - In the navigation pane of the editor, click **Screens** to open the Customized Screens page.
  - On the page (see the screenshot below), click the form ID in the **Screen ID** column to open the *Screen Editor* for the form.

Acumatica File Publish Extension Library Source Control

YogiFon Customized Screens

SCREENS

- Data Access
- Code
- Files (5)
- Generic Inquiries (1)
- Reports (1)
- Site Map (3)
- DB Scripts
- System Locales
- Import/Export Scenarios (1)

Screen ID	Title	Is New	Last Modified By	Last Modified On
AR_30_30_00	Customers	<input type="checkbox"/>	admin	10/27/2016
AR_40_90_01	Subscription Usage Details	<input checked="" type="checkbox"/>	admin	10/27/2016
SO_30_10_00	Sales Orders	<input type="checkbox"/>	admin	11/3/2016
SO_30_30_00	Invoices	<input type="checkbox"/>	admin	10/27/2016

**Figure: Viewing the Customized Screens page of the Customization Project Editor**

- In the Screen Editor, select the **View ASPX** tab item to view the customized ASPX code of the node that is currently selected in the Control Tree
- Explore each node of the tree to find the changes, which are highlighted in yellow, as the following screenshot shows.

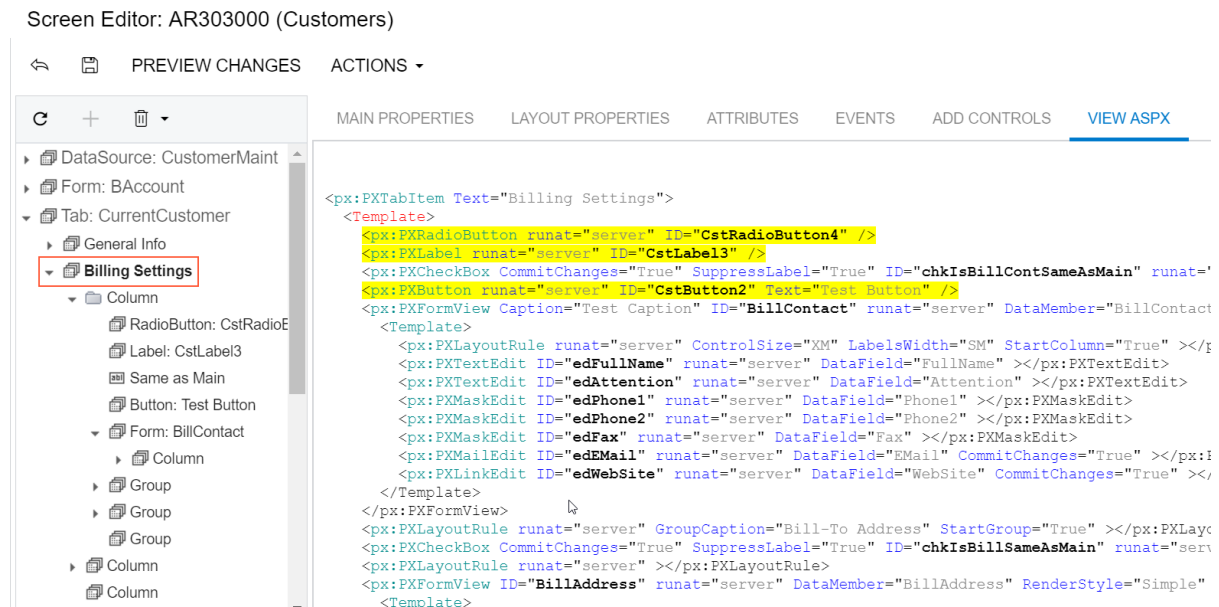


Figure: Viewing the customization of the ASPX code

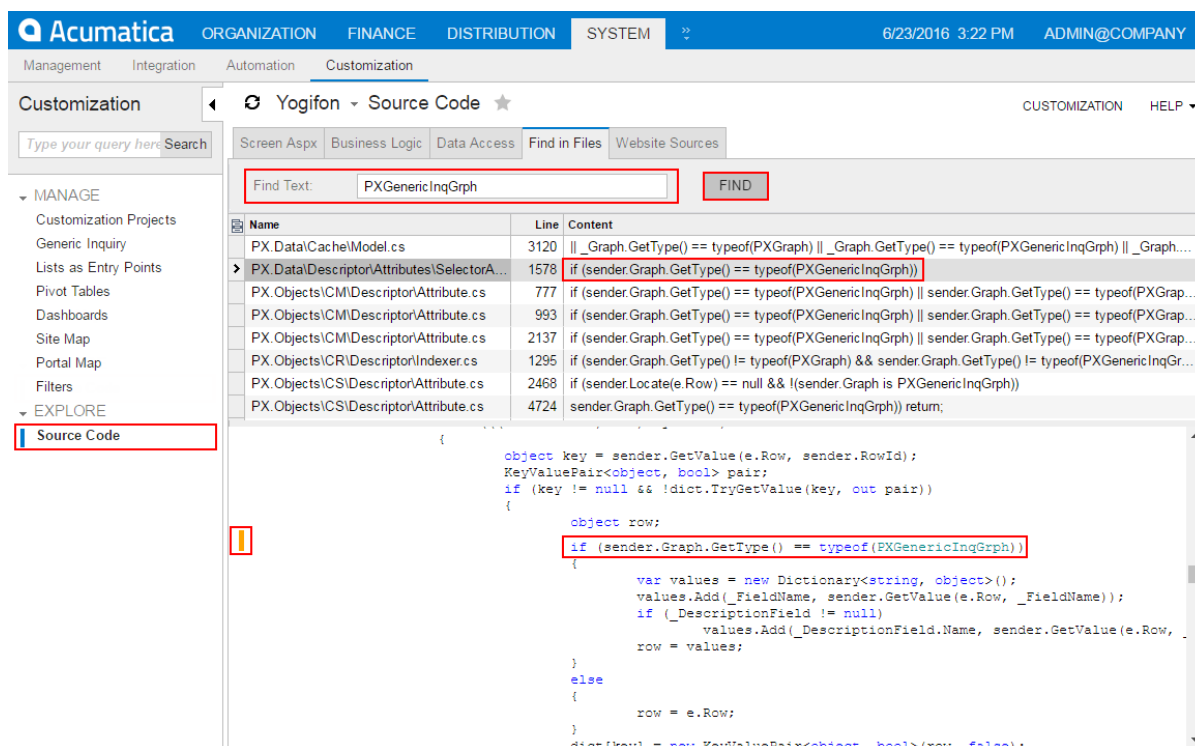
## To Find Source Code by a Fragment

In an instance of Acumatica ERP, a repository with the original C# source code of the application is kept in the \App\_Data\CodeRepository folder of the website. You can use the [Source Code](#) (SM204570) form to find the source code within the repository by a code fragment. (For more information, see also [Source Code Browser](#).)

To do this, perform the following actions:

1. Navigate to **System > Customization > Explore > Source Code**.
2. Click the **File in Files** tab item.
3. In the **Find Text** box, enter (by typing or by copying and pasting) a code fragment.
4. Click **Find** to start the procedure.

The results of the code search are displayed on the form, as the following screenshot shows.



**Figure: Viewing the results of the code search in the Source Code browser**

The form displays the results in the following elements:

- A list of the locations of the specified code fragment in the repository files
  - A text area with the source code of the location selected in the list
5. Explore the use of the code fragment in the original source code by selecting a location in the list and scrolling the code in the text area.

## To Develop a Customization Project

During the development stage, you develop the customization, which involves implementing your planned changes by using the framework and tools provided by the Acumatica Customization Platform.



: We recommend that a separate application instance be used for each developer working on a single project or group of projects. Multiple developers should not work simultaneously with the same project or projects. The customization scope should be divided among the developers on a separate areas so each developer works with a separate application instance. The created customization projects can be sequentially imported into the customer's production environment and applied as if all the divided tasks had been resolved as a single common one.

Follow this recommended workflow during the development process:

1. In your application instance, create a new customization project or select an existing one.
2. Open the project in the [Customization Project Editor](#).
3. Perform the customization steps, such as:
  - Add a UI element. See [Customizing Elements of the User Interface](#) for details.
  - Extend the business logic. See [Customizing Business Logic](#) and [Customizing the Database Schema](#) for details.
  - Customize the database. See [Customizing the Database Schema](#) for details.

After completing each step, validate the changes you have performed.

4. Debug your customization project. See [To Debug the Customization Code](#) for details.
5. Publish the project. See [Publishing Customization Projects](#) for details.
6. Test the customized application instance.

You develop and maintain customization projects by using the [Customization Tools](#) of Acumatica Customization Platform. The platform provides the mechanisms to develop and publish customization projects. After the customization project is ready, you prepare the deployment package to distribute the customization project to the staging or production environment (see [Deployment of Customization](#) for details).

## To Perform Final Testing of a Customization

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After you finished developing your customization, you test it in the staging environment, which can be a local copy of the production environment. The staging environment must include a copy of the production database.

To apply the customization to the staging environment, you have to do the following:

1. Export the deployment package of the customization project in the development environment. See [To Export a Project](#) for details.
2. Prepare the staging environment in accordance with [System Requirements for Acumatica ERP 2019 R1](#).
3. In the staging environment, install a version with the same Acumatica ERP version number that is used in the production environment (see [Installing Acumatica ERP](#) for details). All further actions must be performed in the staging environment.
4. Copy the deployment package file to the system where the staging environment was prepared.
5. Start the application instance.
6. Import the project. See [To Import a Project](#) for details.
7. Explore the project content. Ensure that the project items contain appropriate data.
8. Publish the project. See [Publishing Customization Projects](#) for details.
9. Test the customization.

If you have developed a complex project for an application with multiple customization projects published and you can't address some issues that have emerged during this stage, try to perform the original installation with all previous updates, and then upload the saved content of the current project to the staging environment.

## To Deploy a Customization Project

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After you tested your customization project, you deploy it to the production environment.

To apply the customization to the production environment, perform the following actions:

1. Export the deployment package of the customization project in the development environment. See [To Export a Project](#) for details.
2. Copy the deployment package file to the file system where the production environment is located.
3. Import the project in the production environment, as described in [To Import a Project](#).
4. Publish the project in the production environment to apply the customization. See [Publishing Customization Projects](#) for details.

## Asking Questions

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Acumatica provides several pages, where you can ask your questions about customization process.

### Where To Get Support

- [Stack Overflow](#) - Use it to ask all possible question and share your knowledge.
- [Git Hub](#) - Check Acumatica Git Hub to get free examples.
- [Technical Blog](#) - Google topics and questions that has been answered already.
- [Partner Portal](#) - Access portal to get updates and support.
- Your Acumatica support provider.

# Acumatica Customization Platform

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To customize Acumatica ERP, you can use the following parts of the Acumatica Customization Platform:

- The web-based [Customization Tools](#) to customize the UI and business logic and to gather the changes into a distributable package that can be deployed to and applied on a target system
- The [Customization Framework](#) to develop customization code that changes the business logic of Acumatica ERP

Since an instance of Acumatica ERP consists of the website and the database, you can use the platform to customize both of these components. The website customization can include custom DLLs, custom and modified ASPX files, and files with custom C# code that modifies the UI and business logic of the product. The database customization can include changes in both the data and the schema of the database.

This part describes in detail the technologies implemented in the Acumatica Customization Platform.

## In This Part

- [Customization Project](#)
- [Customization Tools](#)
- [Customization Framework](#)

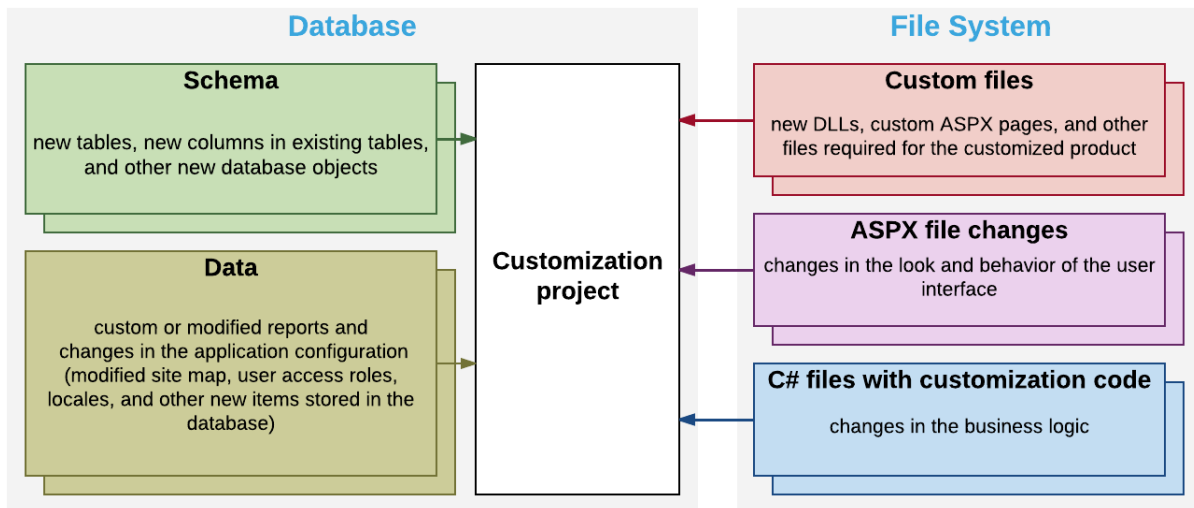
## Customization Project

---

When you use the tools provided by the Acumatica Customization Platform, the platform uses a customization project as a container that holds each change you make during the customization.

An Acumatica Customization Project is a set of changes to the user interface, configuration data, and functionality of Acumatica ERP. As the following diagram shows, a customization project might include any of the following:

- New custom forms and modifications to the existing forms of Acumatica ERP
- Custom C# code
- Custom database scripts
- Custom or modified reports (Acumatica Report Designer reports, generic inquiries, and analytical reports)
- Changes in the application configuration (site map changes, new system locales, integration scenarios, shared reusable filters, access rights of roles to forms, changes of wikis) that are saved in the database for the current tenant
- Additional files that you need for Acumatica ERP customization



**Figure: Content of a customization project**

You develop and maintain customization projects by using the tools of the Acumatica Customization Platform (see [Customization Tools](#) for details). This platform provides the mechanisms to develop, upgrade, publish, unpublish (that is, cancel publication), export, and import a customization project. The content of a customization project is stored in the database of the Acumatica ERP instance.

To perform any customization of the UI or to extend the business logic, you have to create a new customization project or modify an existing one. (See [To Create a New Project](#) and [To Select an Existing Project](#) for details.)

Once you have selected a customization project for development, the customizations you perform will be added to this project. The customization project holds each change you make during the customization; however before the project is published, the changes exist only in the project and are not yet applied to the product. To apply the content of a customization project to Acumatica ERP, you have to publish the project.

When you need to apply the developed customization to a target environment, you should add all the changes and additional files to the customization project and export the project as a deployment package—a complete redistributable customization package. Then in the target environment, you import the package and publish the project.

You can create as many customization projects as you need and independently develop and maintain each customization project for a specific customization task.

### In This Chapter

- [Types of Items in a Customization Project](#)
- [Deployment of Customization](#)
- [Simultaneous Use of Multiple Customizations](#)
- [Customization of a Multitenant Site](#)

## Types of Items in a Customization Project

When you customize an instance of Acumatica ERP by using the [Customization Project Editor](#), the platform keeps all items of a customization project as records in the `CustObject` table of the database. Each record in this table keeps the data of an item, including the XML code of the item in a specific field. When you add an item to the customization project, the platform adds the new record to the table, creates the XML code of the item, and stores the code within the `Content` field of the record.



: You can view the content of an item of a customization project by using the [Item XML Editor](#) of the Customization Project Editor.

## XML Code of the Items

Different item types have XML code that is structured differently. For example, if you create the `UsrPersonalID` bound custom field in the `CR.Contact` DAC (which is mapped to the `SOOrder` table) and the control for the field on the *Customers* (AR303000) form, the customization project might contain the following new objects:

- An item with the following XML code to add the column to the DB table.

```
<Table TableName="Contact">
  <Column TableName="Contact" ColumnName="UsrPersonalID" ColumnType="string"
    AllowNull="True" MaxLength="15" DecimalPrecision="2"
    DecimalLength="15" IsNewColumn="True" IsUnicode="True" />
</Table>
```

- An item with the following XML code to add the field to the DAC.

```
<DAC type="PX.Objects.CR.Contact">
  <Field FieldName="UsrPersonalID" TypeName="string" MapDbTable="Contact"
    TextAttributes="#CDATA" StorageName="AddColumn">
    <CDATA name="TextAttributes">
      <![CDATA[ [PXDBString(15)] [PXUIField(DisplayName="Personal ID")] ]]></CDATA>
    </Field>
</DAC>
```

- An item with the following XML code to add the control to the form.

```
<Page path="~/pages/ar/ar303000.aspx" ControlId="5"
  pageSource="...binary content of the page...">
  <PXFormView ID="DefContact" ParentId="phG_tab_Items#0_DefContact"
    TypeFullName="PX.Web.UI.PXFormView">
    <Children Key="Template">
      <AddItem>
        <PXTextEdit TypeFullName="PX.Web.UI.PXTextEdit">
          <Prop Key="Virtual:ApplyStylesheetSkin" />
          <Prop Key="ID" Value="CstPXTextEdit2" />
          <Prop Key="DataField" Value="UsrPersonalID" />
          <Prop Key="CommitChanges" Value="True" />
        </PXTextEdit>
      </AddItem>
    </Children>
  </PXFormView>
</Page>
```

Note that the items in these code blocks differ by type (`Table`, `DAC`, and `Page`) and structure.

## Item Types Within a Customization Project

All the possible types of items in a customization project are summarized in the following table. The value in the **Can Be Unpublished** column identifies whether the changes introduced by the item type are reversed when you unpublish the customization project. For details on which changes are reversed, see [Unpublishing Customization Projects](#).

Item Type (XML Tag, if differs)	Object	Description	Form for Editing	Can Be Unpublished
<i>Page</i>	A custom form, or changes to an existing form	<ul style="list-style-type: none"> <li>For a custom form, the content of the form, and the path to the <code>.aspx</code> file of the form (the path is required for the system to detect changes of the file</li> </ul>	<i>Screen Editor</i>	Yes



Item Type (XML Tag, if differs)	Object	Description	Form for Editing	Can Be Unpublished
		<p>on the file system in the development environment and to deploy the file while publishing the project)</p> <ul style="list-style-type: none"> <li>For an existing form, the layout change instructions and the action change instructions that have to be applied by the platform to the ASPX code of the form during the project publication</li> </ul>		
<i>AutomationScreenCondition</i>	A condition that changes the business logic of a customized screen	A data set containing a list of conditions for a customized screen	<a href="#">Condition Editor</a>	Yes
<i>AUScreenAction</i>	An action that changes the business logic of a customized screen	A data set containing the properties of an action	<a href="#">Screen Editor</a>	Yes
<i>AUScreenNavigationAction</i>	An action that changes the business logic of a customized screen and navigates to another screen	A data set containing the properties of an action	<a href="#">Screen Editor</a>	Yes
<i>AutomationScreenField</i>	A field to which conditions are applied	A data set containing the properties of a field	<a href="#">Screen Editor</a>	Yes
<i>DAC</i>	Changes to an existing data access class	The data required to create the corresponding extension for the original data access class	<a href="#">Data Class Editor</a>	Yes
<i>Table</i>	Changes to the schema of an existing database table	A definition of the custom columns added to a table for bound custom fields created in the appropriate DAC	<a href="#">Table Editor</a>	No
<i>Code (Graph)</i>	Custom C# code	<ul style="list-style-type: none"> <li>A custom DAC, which has the <code>PX.Data.IBqlTable</code> base class</li> </ul>	<a href="#">Code Editor</a>	Yes

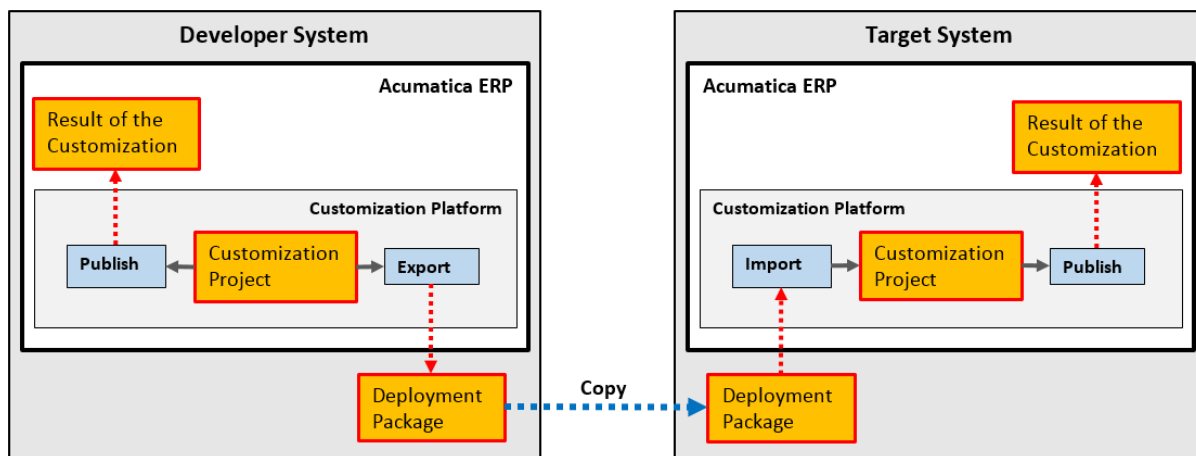
Item Type (XML Tag, if differs)	Object	Description	Form for Editing	Can Be Unpublished
		<ul style="list-style-type: none"> <li>A custom BLC, which has the <code>PXGraph&lt;&gt;</code> base class</li> <li>An extension for an existing DAC, which has the <code>PXCacheExtension&lt;&gt;</code> base class</li> <li>An extension for an existing BLC, which has the <code>PXGraphExtension&lt;&gt;</code> base class</li> <li>A customization plug-in, which has the <code>CustomizationPlugin</code> base class</li> <li>Any custom class, which has no or any base class</li> </ul>		
<i>File</i>	Custom file	The path to a custom file and the GUID of the file content in the file storage of the database. The path is relative to the website folder; new custom forms are added to the project as custom files.	<a href="#">File Editor</a>	Yes
<i>GenericInquiryScreen</i>	Custom or customized generic inquiry	A data set of a custom or customized generic inquiry form	<a href="#">Generic Inquiry</a> (SM208000) form	No
<i>Report</i>	Custom Acumatica Report Designer report	A data set of a custom report created by using the Acumatica Report Designer	Acumatica Report Designer	No
<i>Dashboard</i>	Custom or customized dashboard	A data set of a custom or customized dashboard	<a href="#">Dashboards</a> (SM208600) form	No
<i>SiteMapNode</i>	Custom or customized site map node	A data set of a custom or customized site map node (which includes information about the location of the custom form or report); you should create a custom site map node for each custom form or report included in the customization project	<a href="#">Site Map</a> (SM200520) form	No
<i>Sql</i>	Custom SQL script	A custom database table definition or custom SQL script that has to be executed while	<a href="#">SQL Script Editor</a>	No

Item Type (XML Tag, if differs)	Object	Description	Form for Editing	Can Be Unpublished
		the customization project is published		
<i>Locale</i>	Custom locale	A data set of a custom system locale, which is a set of parameters that defines the language and other local preferences—such as how to display numbers, dates, and times in the user interface—for a group of users	<a href="#">System Locales</a> (SM200550) form	No
<i>XportScenario</i>	Custom integration scenario	A data set of a custom export or import scenario used to perform data migration between a legacy application and Acumatica ERP	<a href="#">Import Scenarios</a> (SM206025) form and <a href="#">Export Scenarios</a> (SM207025) form	No
<i>SharedFilter</i>	Custom shared filter	A data set of a custom reusable shared filter created on a processing or inquiry form	<a href="#">Filters</a> (CS209010) form	No
<i>ScreenWithRights</i>	Custom access rights to a form	A data set of the custom access rights of roles to a form, down to the control of form elements, such as buttons, text boxes, and check boxes	<a href="#">Access Rights by Screen</a> (SM201020) form	No
<i>WikiArticle</i>	Custom wiki module	A data set of a custom wiki and all the articles created within this wiki	<a href="#">Wiki</a> (SM202005) form	No
<i>EntityEndpoint</i>	Custom web service endpoint	A data set of a custom web service endpoint	<a href="#">Web Service Endpoints</a> (SM207060) form	No
<i>ReportDefinition</i>	Custom analytical report	A data set of a custom analytical report, including the data of the predefined sets of rows, columns, and units	<a href="#">Report Definitions</a> (CS206000) form	No
<i>PushNotification</i>	Push notification configuration	A data set that includes the push notification destination and the data query that defines for which data changes Acumatica ERP sends notifications	<a href="#">Push Notifications</a> (SM302000) form	No
<i>BpEvent</i>	Business event	A data set of a business event	<a href="#">Business Events</a> (SM302050) form	No
<i>MobileSiteMap</i>	Mobile app screen	A script for adding or changing a mobile app screen	<a href="#">Mobile App Editor</a>	Yes

Item Type (XML Tag, if differs)	Object	Description	Form for Editing	Can Be Unpublished
<i>CSAttribute</i>	User-Defined Field	A data set of a user-defined field with a list of screens on which the field is displayed	User-Defined Fields Editor	Yes

## Deployment of Customization

Once you have finished a customization project, you can export the project as a deployment package that can be then imported and published as a customization on the end-user systems, as shown in the following diagram.



**Figure: Deployment of customization to target systems**

A deployment package is a redistributable .zip file that includes the full content of a customization project. A deployment package consists of the `project.xml` file and any custom files that you have added to the project, such as external assemblies and custom ASPX pages. You can manually edit the `project.xml` file in an XML Editor in the file system. However we recommend that you modify the project items in the easiest and most reliable way: by using the [Customization Project Editor](#).

When the project is finished, you can download the deployment package to deploy the customization to the target system (see [To Export a Project](#) for details). If you have finished the project, we recommend that you publish the project and test the customization before downloading the deployment package, to ensure that you have no issues. Also, you can download the package to have a backup copy of the customization project you are working on.

You can import a deployment package to work with the customization project or to publish the final customization on the target website (see [To Import a Project](#) for details).



: In MySQL, the maximum size of one packet that can be transmitted to or from a server is 4MB by default. If you use MySQL and want to manage a customization project with the size that is larger than the default maximum value, you have to increase the `max_allowed_packet` variable in the server. The largest possible packet size is 1GB.

## Simultaneous Use of Multiple Customizations

With the Acumatica Customization Platform, you can simultaneously manage multiple customizations by using the [Customization Projects](#) (SM204505) form, also described in [Customization Projects Form](#). You can publish multiple customization projects to an Acumatica ERP instance at once.

When you publish more than one customization project, the platform merges the content of all projects into a single customization project. If different projects include customization for the same object, the platform tries to merge the changes by using the following approach:

- If the changes can be merged, the platform merges them. For example, the platform can merge different properties of the same control in an ASPX page.

- If the changes cannot be merged, as with the same report being in different customization projects, the platform stops the process and displays an error message.

On the [Customization Projects](#) form, you can specify an optional number (level) for each customization project, assigning the highest number to the most important change. The level can be used to resolve conflicts that arise while you are publishing customization projects if multiple modifications of the same objects of an Acumatica ERP instance are merged. As a result, the customization from the project with the highest level is added to the merged project.

Multilevel customizations might be required when you develop an off-the-shelf customization solution that is distributed in multiple editions, or applications that extend the functionality of Acumatica ERP or other software based on Acumatica Framework in multiple markets. You may have a customization that contains a solution common to all markets as well as multiple market-specific customizations, each of which is deployed along with the base customization. Moreover, you can later apply a high-level project to customize deployed solutions for the end user.

However if you have multiple customizations of the same object and have no market requirements to keep multilevel customizations, we recommend that you merge the customizations into a single customization project, as described in [To Merge Multiple Projects](#).

## Customization of a Multitenant Site

The data of each tenant that uses the same instance of Acumatica ERP is isolated in the database.

Because a customization project is stored in the database, by default, the project data belongs to the tenant in which the project is created or imported. When the project is published, the customization applies to both the website files and the database. Because a customization project can contain different types of items, the platform uses a specific approach to apply each type of items to the website, database schema, and database data.

Initially the *Page*, *DAC*, *Table*, *SQL*, and *Code* items of a customization project are stored in the database for a single tenant. However, while the project is being published, the platform creates certain files for these items in the website folder or changes the database schema, if required. The new files and the changed database schema are available from other tenants. As a result, the listed item types are applied for multiple tenants.

During the publication of the project, for each *File* item, the platform creates the file in the file system, so *File* items are shared for multiple tenants as well.

For example, suppose you have logged in to the *MyTenant* tenant and have a customization project that contains only items of the *Page*, *DAC*, *Table*, *Code*, and *File* types. After you have published the project, the customization is applied to each tenant in the instance of Acumatica ERP. But the customization project data is still available only in the *MyTenant* tenant.

However if you publish a customization project that contains items of other types (such as generic inquiries and access rights of roles to forms), the customization does not apply to the website files or to the database schema. This data is stored only in the database, and the application server uses the data from the database at run time. Because this data is tenant-specific, it is available in only the tenant where it was published. Moreover, for all tenants that use the same site, on the Login form and in the **About Acumatica** box, you can see that the website is customized, but you won't see any published project on the [Customization Projects](#) (SM204505) form. This form, also described in [Customization Projects Form](#), displays the customization projects that have been uploaded to the current tenant; therefore, no projects are displayed if they have been uploaded and published under another tenant.

You can publish multiple customization projects for multiple tenants at once. On the [Customization Projects](#) form, you can select the customization projects that you need to publish for multiple tenants and use the **Publish to Multiple Tenants** action to open the **Publish to Multiple Tenants** dialog box. You then select the required tenants and apply the selected customization projects to the selected tenants. (See [To Publish a Customization for a Multitenant Site](#) for details.)

The following table shows the differences in applying a customization to a multitenant website if the customization that has been published from another tenant is shared or not shared for your tenant.

Question	Customization published for a multitenant site from another tenant is shared for your tenant	Customization published for a multitenant site from another tenant is NOT shared for your tenant
Is the customization applied to the application instance (see <a href="#">To Detect Whether a Customization Project Is Applied to the Application</a> for more information) for your tenant?	Yes	Yes
Do changes in the file system ( <i>Page</i> , <i>DAC</i> , and <i>Code</i> items) exist for your tenant?	Yes	Yes
Do changes of the database schema ( <i>Table</i> and <i>SQL</i> items) exist for your tenant?	Yes	Yes
Do custom reports and configuration (such items as <i>Report</i> , <i>SiteMapNode</i> , and <i>SharedFilter</i> ) exist for your tenant?	Yes	<b>No</b>
Does the project list on the <a href="#">Customization Projects</a> form contain the project? (That is, can you access the customization project data from your tenant?)	<b>No</b>	<b>No</b>
Is it necessary to import the customization package to access the customization project data from your tenant?	Yes	Yes
After the customization package is imported for your tenant and added to the list on the <a href="#">Customization Projects</a> form, is the project displayed in the list as an already published one?	Yes	<b>No</b>

## Validation of a Customization Project

A customization project must meet various technical requirements to integrate with and operate within the Acumatica ERP application.

### Acumatica ERP Capabilities to Validate and Check Customization Project Items

To help to develop a customization project that complies with this technical requirements and to help to check the project for compliance with this requirements Acumatica ERP and Customization Project Editor provide the following functionality:

1. Definition of a prefix for the project. All project item names must start with this prefix. You can define this prefix in the Customization Project Editor. For details on defining the project prefix, see [To Manage Prefixes in a Customization Project](#).
2. Validation of one customization project or multiple customization projects, causing the platform to check the following criteria:
  - The database schema changes included in a customization project are valid
  - The customization project doesn't replace or modify the files distributed as part of the standard Acumatica ERP application.
  - The data types of a custom database column correspond to all data access class (DAC) fields bound to it.



: These types of validations should be applied to ISV solutions only.

You can perform this type of validation on the Customization Projects (SM204505) form by using the **Validations** menu on the form toolbar. In the menu, you select the **Validate Highlighted Project** or **Validate Multiple Projects** menu command, depending on whether you want to validate one project or multiple projects correspondingly.

3. Validation of the data consistency in published customization projects, which verifies the correspondence between the data types of DAC fields and field states generated by field attributes at run time. To perform this validation, you invoke the menu commands on the **Validations** menu on the form toolbar of the Customization Projects (SM204505) form as follows:

- To verify that the data type of a DAC field matches with the field states generated at run time, select **Validations > DAC Field Types**.
- To determine whether there are any `PXAttributeFamilyAttribute` violations on a DAC field, select **Validations > DAC Attributes**.
- To verify that DAC fields with lookup boxes defined for a segmented key properly handle foreign key segments by means of `PXDimensionAttribute`, select **Validations > Lookup Definitions**.

4. Analysis of custom files included in the customization project.

You can analyze custom files (assemblies) included in the customization project to verify that the customization project doesn't replace or modify files that are distributed as part of the standard Acumatica ERP application. To do this, in the main menu of the Customization Project Editor, select **Extension Library > Analyze Referenced Assemblies**. A CSV is downloaded with all references made in the project's custom files.

5. Generation of a Workbook with Project Items in Excel format. You can generate this workbook, which is in Excel format, in the Customization Project Editor by selecting **File > Export Project Items Workbook**.

The generated workbook contains a list of solution objects and integration scenarios grouped by the following types:

- Site map nodes
- Mobile site map nodes
- BLCs and BLC extensions
- DACs and DAC extensions
- Push notifications
- Import or export scenarios

### Customization as Part of an ISV Solution

The validation of a customization project is especially important when a customization project is part of an independent software vendor (ISV) solution.

To see technical requirements for a project in the *ISV Software Certification Program* guidelines, go to Acumatica Partner Portal, open the Partner Program section, and click the Acumatica ISV Solution Certification link in the left pane.

### Format of the Validation Results

If any errors or warnings have been detected during project validation, the validation results have the following format:

- <CustomizationProjectName>
    - <CustomizationRuleName>
      - <PathToTheDLL> | <ProjectItemType> | <NameOfTheProjectItem>
- List of rules broken by the specified item.



: The <PathToTheDLL> field is optional. It appears only if a dll file included in the project is analyzed.

## Customization Tools

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Depending on the complexity of the particular customization task, you can employ any the tools implemented in the Acumatica Customization Platform.

For every type of customization, you can use the tools described in the following topics:

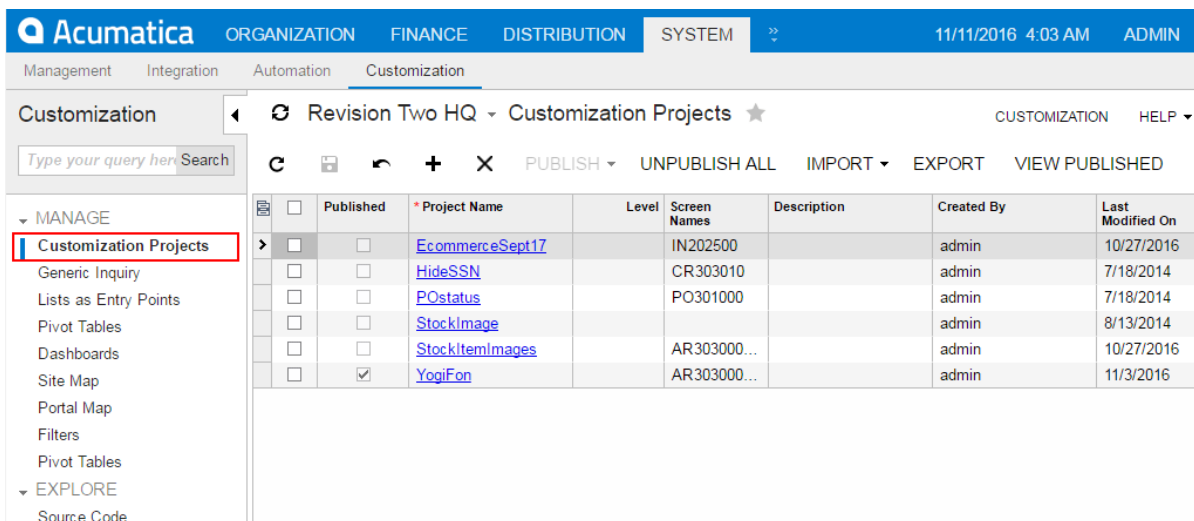
- [Customization Projects Form](#)
- [Customization Menu](#)
- [Element Inspector](#)
- [Customization Project Editor](#)
  - [Screen Editor](#)
    - [ASPX Editor](#)
  - [Data Class Editor](#)
  - [Code Editor](#)
  - [File Editor](#)
  - [SQL Script Editor](#)
  - [XML Editors](#)
    - [Project XML Editor](#)
    - [Item XML Editor](#)
- [Source Code Browser](#)

## Customization Projects Form

The Acumatica Customization Platform stores the data of the customization projects that were created or imported in the database of the instance of Acumatica ERP.

You can manage customization projects on the [Customization Projects](#) (SM204505) form, which is shown in the following screenshot.





**Figure: Viewing the Customization Projects form**

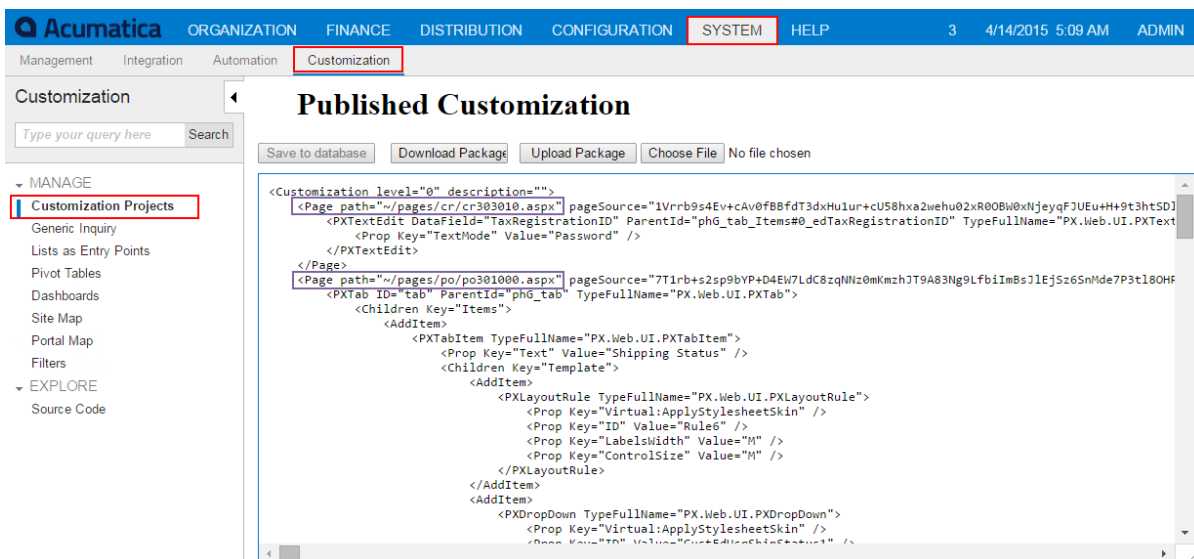
On this form, you can add a new customization project, open a customization project for editing in [Customization Project Editor](#), publish any number of customization projects, cancel the publication of customization projects, export a customization project as the deployment package, import a customization project from an existing deployment package, and delete a customization project. (See [Managing Customization Projects](#) for instructions.)

### Published Customization Page

The Published Customization page of the [Customization Projects](#) (SM204505) form shows the merged XML code of the customization projects that are currently published. On the Published Customization page, you can:

- View the code.
- Download the deployment package that contains the code.

The following screenshot shows the merged project, which contains customizations introduced by two different projects for the forms with the CR303010 and PO301000 identifiers.



**Figure: Viewing the merged XML code of the published customization projects**

The Published Customization page includes a toolbar and a text area for viewing XML code. The text area displays the XML content of a merged customization project. This area is not used for editing the XML code.

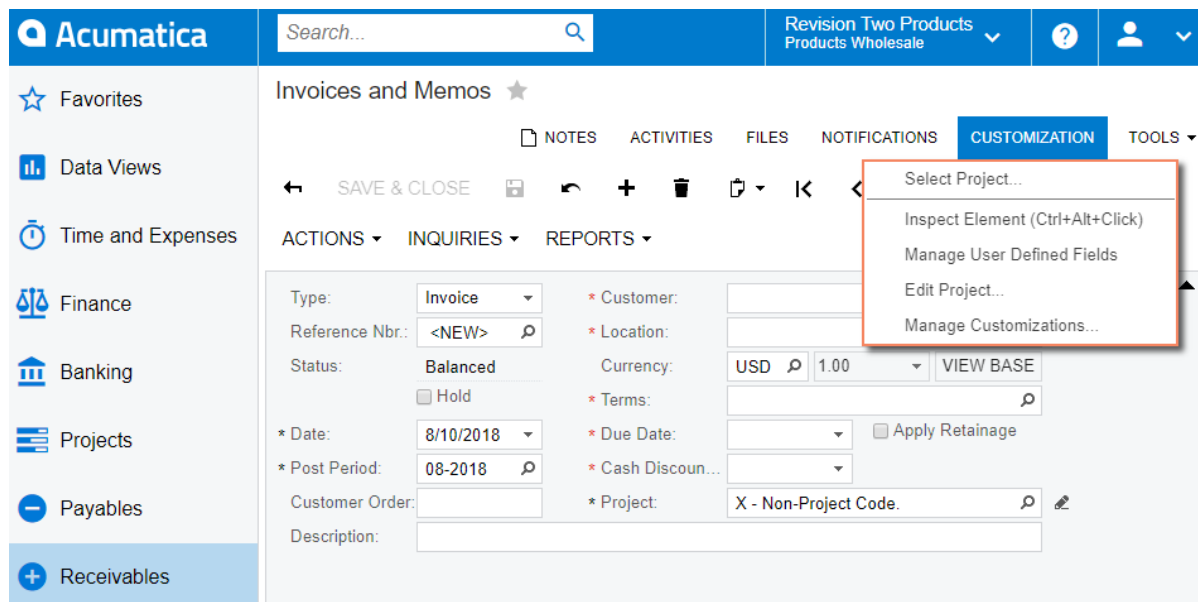
The toolbar buttons of this page are described in the following table.

Button	Description
<b>Save to database</b>	Is not used.
<b>Download Package</b>	Downloads the <code>Customization.zip</code> file, which includes the full content of the merged customization project. You can use this file as a joint deployment package to work with the customization project or to publish the final customization on the target website. See <a href="#">To Merge Multiple Projects</a> for details.
<b>Upload Package</b>	Is not used.
<b>Choose File</b>	Is not used.

## Customization Menu


You can access the **Customization** menu on an opened Acumatica ERP form if you have the *Customizer* role. (For details, see [To Assign the Customizer Role to a User Account](#).)

Click **Customization** on the form to access the **Customization** menu associated with the form, as shown in the following screenshot.



**Figure:**

You can use the following customization-related menu commands.

Command	Description
<b>Select Project</b>	Opens the <a href="#">Select Customization Project Dialog Box</a> , which you use to select an existing customization project or to create a new project for all modifications that you are going to perform.
<b>Inspect Element</b>	<p>Launches the <a href="#">Element Inspector</a>, which gives you an option to select a UI control on the current form and opens the <a href="#">Element Properties Dialog Box</a> for the selected control. You use the dialog box to inspect and customize the control.</p> <p> : You can use the keyboard shortcut Ctrl+Alt+Click to inspect elements on pop-up windows and dialog boxes.</p>

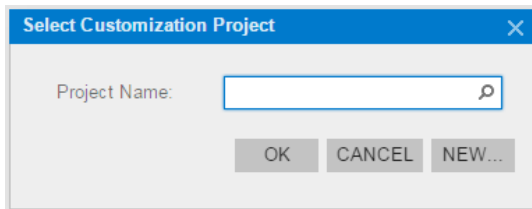
Command	Description
	If you have selected a customization project, all the modifications that you initiate in the inspector will be added to this current project. Otherwise, the inspector opens the <b>Select Customization Project</b> dialog box.
<b>Manage User Defined Fields</b>	Opens the <a href="#">Edit User Defined Fields</a> (CS205020) form, which gives you an opportunity to select user-defined fields for the current form from the previously defined list of <a href="#">Attributes and User-Defined Fields</a> . For details on how to add user-defined user fields see <a href="#">To Add User-Defined Fields to a Form</a> .
<b>Edit Project</b>	Opens the <a href="#">Customization Project Editor</a> for the currently selected customization project.
<b>Manage Customizations</b>	Opens the <a href="#">Customization Projects</a> (SM204505) form.

### Select Customization Project Dialog Box

You use the **Select Customization Project** dialog box to select an existing customization project or to create a new project.

You open the dialog box, shown in the following screenshot, in the following ways:

- From the **Customization** menu of a form—by selecting the **Select Project** command
- From the **Customization** menu of a form—by selecting the **Edit Project** command if there is no currently selected customization project
- From the [Element Properties Dialog Box](#), which you access by clicking the **Customize** button if there is no currently selected customization project



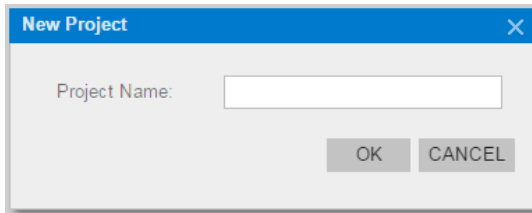
The dialog box contains the following UI controls.

Control	Description
<b>Project Name</b>	Provides the ability to select an existing customization project. The box contains a selector, which you can use to find an existing customization project by the name or by a part of the name.
<b>OK</b>	Confirms your selection and exits the dialog box.
<b>Cancel</b>	Cancels the operation and exits the dialog box.
<b>New</b>	Opens the <a href="#">New Project Dialog Box</a> , where you can create a new project.



If you have selected a customization project, all customizations that you initiate will be added to this current project until you select another project or sign out.

### New Project Dialog Box

You use the **New Project** dialog box, shown in the following screenshot, to create a new customization project.



The dialog box contains the following UI controls.


Control	Description
<b>Project Name</b>	Provides the ability to enter a name of the customization project.  : The customization project name is used as the <code>namespace</code> if you create an extension library from the project. The first character of the name must be a letter or the underscore symbol.
<b>OK</b>	Creates an empty customization project with the specified name and closes the dialog box.  : As soon as you click the <b>OK</b> button, the platform creates a new customization project in the database.
<b>Cancel</b>	Closes the dialog box.

## Element Inspector

You can use the Element Inspector for the following purposes:

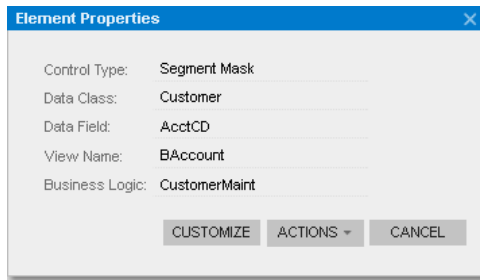
- To view the following reference information for any visual element on a form:
  - Control type
  - Data access class (if applied)
  - Data field (if applied)
  - Data view (if applied)
  - Business logic controller
  - Action name (if applied)
- To view the source code of the ASPX page that contains the UI control for the inspected element
- To view the source code of the data access class that provides data for the inspected element
- To view the source code of the business logic executed for the inspected element
- To start the customization of the inspected element

For a form, you can activate the Element Inspector from the [Customization Menu](#). If you need to activate the inspector for a pop-up panel, dialog box, or other UI element that opens in modal mode and makes the **Customization** menu unavailable for selection, you can press Control-Alt.

After the inspector is activated, the  cursor indicates that you can select a UI element to inspect. If you select an element, the Element Inspector opens the [Element Properties Dialog Box](#).

### Element Properties Dialog Box

The Element Inspector opens the **Element Properties** dialog box, shown below, when you have selected a UI element to inspect.



In this dialog box, you can perform the following:

- Inspect properties of the UI element selected on the form
- With a single click, launch the [Screen Editor](#) for the form to customize the inspected element
- Select an action to do any of the following:
  - Launch the [Code Editor](#) to develop a graph extension for the business logic controller (BLC) bound to the form
  - Launch the [Data Class Editor](#) for the data access class (DAC) that contains the data field of the inspected element to customize the DAC
  - Open the [Source Code Browser](#) to view the following:
    - The ASPX code of the inspected page
    - The source code of the BLC bound to the form
    - The source code of the DAC that contains the data field of the inspected element

The **Element Properties** dialog box contains the following controls.

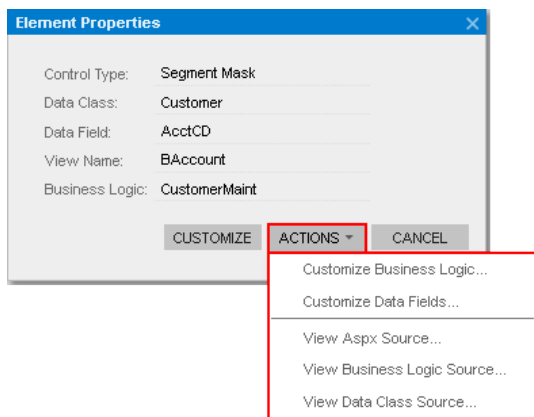
Control	Description
<b>Control Type</b>	The type of the inspected UI element.
<b>Data Class</b>	The name of the DAC to which the field for the inspected element belongs.
<b>Data Field</b>	The string value of the <code>DataField</code> property of the inspected UI element. (It corresponds to the name of the field in the DAC.)
<b>View Name</b>	The name of the data view that provides data for the inspected UI element.
<b>Business Logic</b>	The name of the BLC bound to the form.
<b>Action Name</b>	The name of the action of the inspected toolbar button.
<b>Customize</b>	A button that launches the Customization Project Editor, which opens on the Screen Editor page for the form that contains the inspected element.
<b>Actions</b>	Opens the <b>Actions</b> menu with commands to customize or revise the element source code using the Customization Project Editor (to customize) or the Source Code browser (to view).
<b>Cancel</b>	Cancels the operation and closes the dialog box.

### The Actions Menu

The **Actions** menu, shown in the screenshot below, contains commands you can invoke to customize or revise the code of the following:

- The inspected element
- The current ASPX page on which the element is selected
- The DAC to which the field for the inspected element belongs

- The BLC (graph class) that is bound to the form



The menu contains the following commands.

Command	Description
<b>Customize Business Logic</b>	Creates a graph extension template for the BLC that is bound to the form, adds the template code to the customization project, and opens the Customization Project Editor on the <a href="#">Code Editor</a> page, which loads the BLC extension template so you can edit it.
<b>Customize Data Fields</b>	Opens the Customization Project Editor on the <a href="#">Data Class Editor</a> page in the <b>Edit Attributes</b> section so you can customize the inspected element attributes.
<b>View ASPX Source</b>	Opens the <a href="#">Source Code Browser</a> on the <b>Screen ASPX</b> tab with the source code of the current form.
<b>View Business Logic source</b>	Opens the Source Code browser on the <b>Business Logic</b> tab with the source code of the BLC that is bound to the form.
<b>View Data Class Source</b>	Opens the Source Code browser on the <b>Data Access</b> tab with the source code of the DAC to which the field for the inspected element belongs.



: If you have opened the Customization Project Editor or the Source Code browser, you can access any source code of the website—not only the source code of the inspected element and the current form, DAC, and BLC.

## Customization Project Editor

You can use the Customization Project Editor (Project Editor) to develop and manage the content of a customization project. The editor contains separate pages to add and manage items of the following types in the currently selected customization project:

- Screen (form)
- Data access class (DAC)
- Code (C#)
- File
- Generic inquiry
- Acumatica Report Designer report
- Site map

- Database script (custom column or script)
- Translation (language locale)
- Integration scenario
- Shared reusable filter
- Access rights of roles to forms
- Wiki changes
- Analytical report
- Push notification
- Mobile app screen

(See [Managing Items in a Project](#) for instructions.)

You can launch the Customization Project Editor only if you have selected a customization project. You can launch the editor from any form of Acumatica ERP by using the [Customization Menu](#) or from the [Customization Projects](#) (SM204505) form, also described in [Customization Projects Form](#).

## The Project Editor Webpage

The Project Editor, shown in the following screenshot, looks like a regular webpage that consists of the following parts:

- The main menu for working with the customization project
- A navigation pane, which displays the list of pages used to manage the corresponding project items
- The main area, which displays the list of project items or provides a work area to edit these items

The screenshot shows the Acumatica Customization Project Editor. The navigation pane on the left lists various project items, including Screens, Data Access, and Code. The main area displays a table of custom files.

Object Name	Description	Last Modified By	Last Modified On
App_Data\Mobile\includes\YF401000.xml.inc		admin	4/18/2016
App_Data\Mobile\YogiFonMSM.xml		admin	4/18/2016
Bin\YogiFon_Code.dll		admin	4/18/2016
Pages\YF\YF401000.aspx		admin	4/15/2016
Pages\YF\YF401000.aspx.cs		admin	4/15/2016


In the navigation pane, a node with capitalized name can be expanded to get direct access to items of the appropriate type.

## Main Menu of the Project Editor

The main menu contains the following items and commands.

Item	Command	Description
<b>File</b>	<b>Manage Customization Projects</b>	Opens the <a href="#">Customization Projects</a> (SM204505) form.
	<b>Edit Project XML</b>	Opens the Project XML page, which you can use to edit the XML source code of the current customization project, save it to the database, download the project package, and upload a deployment package to replace the project content.
	<b>Edit Project Items</b>	Opens the Edit Project Items page, which you can use to edit the XML source code of a project item.
	<b>Export Project Package</b>	Exports the deployment package of the project—that is, the ZIP file that contains the project. The file has the same name as the exported customization project has.
	<b>Replace from Package</b>	Initiates the import of a previously exported deployment package from a ZIP file. Provides the <b>Open Package</b> dialog box with the <b>Choose File</b> button and the <b>Upload</b> button to replace the current project content.
<b>Publish</b>	<b>Publish Current Project</b>	Initiates the process of publishing the current customization project. Launches a publication process that opens the <b>Compilation</b> window to output a log with information about the process. If both the validation and compilation of the project are successful, the process makes the <b>Publish</b> button available. This button is used to finalize the publishing and to update the website.
	<b>Multiple Projects</b>	Opens the <a href="#">Customization Projects</a> in a new window.
	<b>Publish with Cleanup</b>	Initiates the process of publishing the current customization project as the <b>Publish Current Project</b> command does, but with the following difference: When the Acumatica Customization Platform publishes a project that contains a database script, the platform executes the script and tries to avoid executing the script at every publication of the project for optimization purposes. Therefore, the platform keeps information about each script that has been executed at least once and has not since been changed in the database, and omits the repeated execution of such scripts. If you run the <b>Publish with Cleanup</b> operation, the platform cleans all the information about previously executed scripts of the customization project and executes this scripts once more while publishing the project.
<b>Extension Library</b>	<b>Create New</b>	Creates a solution for Microsoft Visual Studio in which you can develop an extension library for the customization project. The solution contains the website and extension library projects. This action also downloads the <code>OpenSolution.bat</code> file. The file contains the absolute path to the <code>.sln</code> file in the file system; you can use this file to open the solution in Visual Studio.



Item	Command	Description
		 : By default, the system uses the App_Data\Projects folder of the website as the parent folder for the solution project. If the website folder is outside of the C:\Program Files (x86) and C:\Program Files folders, such as C:\AcumaticaSites\MySite, we recommend that you not change it. Otherwise, we recommend that you specify a parent folder outside these folders to avoid an issue with permission to access files.
	<b>Bind to Existing</b>	Specifies the extension library project in the file system to which the customization code will be moved if you click <b>Move to Extension Lib</b> on the toolbar of the Code Editor.
	<b>Open in Visual Studio</b>	Downloads the OpenSolution.bat file, which is used to open the existing solution in Visual Studio.
	<b>Show Active Extensions</b>	Starts the verification of extensions for data access classes and business logic controllers, and opens the <b>Validate Extensions</b> pop-up window to display the validation log. In the log, every error is highlighted in red. We recommend that you verify extensions if you have upgraded legacy DAC customization.
<b>Source Control</b>	<b>Save Project to Folder</b>	Saves the customization project as a set of files to a local folder that is used for integration with source control systems. Invoking this action opens the <b>Saves Project to Folder</b> dialog box (see <a href="#">To Save a Project to a Local Folder</a> for instructions) so that you can select the name and location of the folder inside a repository.
	<b>Open Project from Folder</b>	Loads the customization project from the repository. (See <a href="#">To Update the Content of a Project from a Local Folder</a> for instructions.)

### Built-In Editors in the Project Editor

To help you work with screens, data access classes, code, custom files, and database scripts in the scope of a customization project, the Project Editor includes the following editors:

- [Screen Editor](#), which is the visual editor for the source code of an .aspx page
- [Data Class Editor](#), which is used to create, develop, manage, and view in XML format the content of extensions for data access classes



: When the project is published, the Acumatica Customization Platform transforms the content of extensions for data access classes from XML format to C# code and saves the code in .cs files in the App\_RuntimeCode folder of the website.

- [Code Editor](#), which is used to manage, develop, and view the customization code (C#) added to the project, including extensions for business logic controllers (BLCs) and DACs
- [File Editor](#), which is a text editor used to edit and review the content of text files included in the customization project
- [SQL Script Editor](#), which is used to add and edit custom SQL scripts in the customization project
- [Table Editor](#), which is used to edit custom tables in the customization project
- [Mobile App Editor](#), which is used to add and update mobile app screens in the customization project

Other types of items are custom data that can be added to the customization project from the database. For these items, the Project Editor provides you the capabilities to add to the project, delete from the project, and reload from the database. To create or edit these items, you can use dedicated forms of Acumatica ERP. For example, to create or edit a generic inquiry in the database, you can use the [Generic Inquiry](#) (SM208000) form.

Also, the Project Editor includes the following editors:

- [ASPX Editor](#), which is used to edit the ASPX code of a page customized by means of the Screen Editor
- [XML Editors](#), which are used to edit and review the XML code of the customization project ([Project XML Editor](#)) or a separate item of the project ([Item XML Editor](#))

## Screen Editor

The Screen Editor is the visual editor for the source code of an ASPX page and the business logic of a screen. You use it to configure ASP.NET containers, such as forms and grids, to specify the properties of UI controls and grids, as well as to configure conditions and apply conditions to actions and fields.

By using the editor, you can perform customizations of a form as follows:

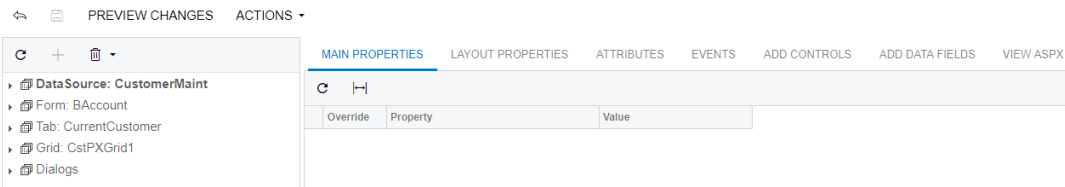
- By configuring the form's layout in any of the following ways:
  - Add a custom form to Acumatica ERP
  - Add a container to a form
  - Add a custom field to a data access class (DAC)
  - Add a control for a field to a container
  - View and modify the properties of a control
  - Change the order of controls in a container
  - Change the order of actions on a form
  - Customize the attributes of a field in a data access class
  - View the modifications made to the original declaration of the form
  - Immediately preview in the browser the changes made during the customization of the layout
- By changing the business logic of the form in any of the following ways:
  - Change properties of an action (**Visibility** and **Enabled**) or a field (**Visibility**, **Enabled**, and **Required**) dynamically by assigning conditions to the properties
  - Add new actions to do any of the following:
    - Run a report
    - Navigate to an existing record
    - Navigate to a form to create a new record

During customization, you can open the Screen Editor in the following ways:

- From the [Element Properties Dialog Box](#), which you access by clicking the **Customize** button on the title bar of the form and selecting **Inspect Element**
- From the Customized Screens page of the [Customization Project Editor](#), by selecting the Screen ID of the screen (form) you want to customize
- From the navigation pane of the Customization Project Editor, by clicking the needed item within the **Screens** folder

The title of each Screen Editor page includes the ID and name (in parentheses) of the form being customized. The page also has a toolbar, control tree pane, and tabs, as the following screenshot shows.

Screen Editor: AR303000 (Customers)



## Page Toolbar

The page toolbar includes standard and page-specific buttons. The page-specific buttons are described below.

Button	Description
<b>Cancel</b>	Cancels the latest edit performed in the Screen Editor.
<b>Save</b>	Saves to the customization project the difference between the modified and original code of the ASPX page, or modifications in the business logic of a form.
<b>Preview Changes</b>	Opens the customized form in a new browser window.
<b>Actions</b>	Provides the following actions: <ul style="list-style-type: none"> <li>• <b>Edit Aspx:</b> Opens the <a href="#">ASPX Editor</a> with the webpage source code.</li> <li>• <b>Open Screen:</b> Opens the original form of Acumatica ERP.</li> <li>• <b>Customize Business Logic:</b> Opens the <a href="#">Code Editor</a> with the extension class template of the business logic container (BLC) that is bound to the form.</li> <li>• <b>Customize Data Class:</b> Opens the <a href="#">Data Class Editor</a> for customization of the DAC that contains the field selected in the Control Tree.</li> </ul>

## Control Tree

The Control Tree displays the hierarchical structure of actions and controls on the webpage. In the tree, you can:

- Select a container, a control, or an action for review or customization.
- Change the order of controls in a container.
- Change the order of actions on a form. The actions are grouped by toolbars on the screen, such as **Standard** and **Form-Specific**. Other available actions are organized under the **Other** group.
- Remove any selected item from the webpage or reset properties of the item to the out-of-the-box state.

The toolbar of the Control Tree includes the following buttons.

Button	Description
Refresh	Refreshes the Control Tree.
Add New Action	Adds new action to the form.
Remove	Removes an item selected in the Control Tree from the form.
Reset Properties	Resets all controls and actions to the out-of-the-box state.

To change the order of controls in a container, manually drag controls on the Control Tree within their containers. You can drag an action in any of the following ways: inside the **Form-Specific** folder, between the **Actions**, **Inquiries**, and **Reports** folders, and to the **Form-Specific** folder.

### Main Properties Tab

On the **Main Properties** tab, you can change the main properties of a selected item; these properties include **Display Name**, **Visible**, and **Enabled**. For the **Enabled**, **Visible**, and **Required** properties, you can specify conditions. The **Required** property is available only for fields.

By default, the values of the **Enabled**, **Visible**, and **Required** properties can be changed to *True* or *False*. If you have added conditions for the screen, you can select a condition for a property. For details on using conditions, see [To Add a Condition](#).

The tab table consists of the following columns.

Column	Description
<b>Override</b>	A check box that indicates whether the property value was changed. This check box is selected automatically if you change the property.
<b>Property</b>	The property name or the name of the property group.
<b>Value</b>	The value of the property.

Depending on the type of the selected action, the **Main Properties** tab also includes a table with additional parameters of the action, which you can configure as well.

### Layout Properties Tab

On the **Layout Properties** tab, you can review and modify the layout properties of the form controls or actions that are defined on the ASPX page.

The tab contains a toolbar and a table. The tab toolbar includes the **Hide Advanced Properties** button (▼) to hide or show advanced properties of the selected control. The tab table consists of the following columns.

Column	Description
<b>Override</b>	A check box that indicates whether the property value was changed. This check box is selected automatically when you change the property.
<b>Property</b>	The name of the property or the property group.
<b>Value</b>	The value of the property.

### Attributes Tab

You use the **Attributes** tab to review and customize the attributes of the DAC field that is bound to the control currently selected in the Control Tree.

The tab consists of a Summary area with the DAC field information and buttons to customize the field attributes.

The Summary area contains the following elements.

Element	Description
<b>Field Name</b>	The name of the field in the DAC. The field name is the name of the public virtual property in the public abstract class of the field.
<b>Data Class</b>	The name of the DAC to which the field belongs.

Element	Description
<b>Original Attributes</b>	The original attributes of the field in Acumatica ERP.

The **Attributes** tab provides the following buttons.

Button	Description
<b>Customize Attributes</b>	Opens the Data Class Editor so you can customize the field attributes in the DAC.
<b>View Source</b>	Opens the <a href="#">Source Code Browser</a> on the <b>Data Access</b> tab that displays the DAC source code.
<b>Override On Screen Level</b>	Opens the Code Editor with the BLC extension class template. The template includes the field attributes and the template of the <code>DACName_FieldPropertyName_CacheAttached()</code> method, which you can use to replace the attributes within the BLC.

### Events Tab

On the **Events** tab, you can view and add event handlers for the selected control.

The tab consists of a Summary area, a toolbar, and a table. The Summary area contains the following elements.

Element	Description
<b>Data Class</b>	The name of the DAC to which the field belongs.
<b>Field Name</b>	The name of the field in the DAC.
<b>Business Logic</b>	The name of the BLC bound to the form.

The tab toolbar includes the following specific buttons.

Button	Description
<b>Add Handler</b>	For the selected event, opens the Code Editor with the BLC extension class template. The class template includes a code template for the event handler, so you should implement only the body of the handler. The button provides the following menu commands: <ul style="list-style-type: none"> <li>• <b>Keep Base Method:</b> Creates the event handler with two parameters, as it is defined in the base BLC. As a result, the event handler is added to the appropriate event handler collection.</li> <li>• <b>Override Base Method:</b> Creates the event handler with an additional parameter to replace the base BLC event handler collection.</li> </ul>
<b>View Source</b>	Opens the Source Code browser with the source code of the BLC bound to the form.

The table holds information about the event handlers used for the control. It contains the following columns.

Column	Description
<b>Event</b>	The event name.

Column	Description
<b>Handled in Source</b>	A check box that indicates whether the event handler is implemented within Acumatica ERP.
<b>Customized</b>	A check box that indicates whether the event handler is customized. This check box is selected automatically when you add the event handler.

### Add Control Tab


On the **Add Control** tab, you can add new containers, controls, and layout rules to the form.

To add a control, drag and drop it to the needed position in the Control Tree. After you have added the control, you can configure its properties on the **Layout Properties** tab.

### Add Data Fields Tab

You can use the **Add Data Fields** tab to manage the controls in the form container that is currently selected in the Control Tree. On this tab, you can create a control for a DAC field and add it to the selected container. You can also create new custom field in a DAC, create a control for the field, and add it to the selected container.

The tab contains the **Data View** drop-down list, a toolbar, and a table. In the **Data View** drop-down list, you can select a DAC to view its fields in the table. The list includes all `DACName (DataViewName)` pairs of the BLC that are bound to the form. The tab toolbar contains the following buttons.

Button	Description
<b>Create Controls</b>	Adds the selected fields to the container selected in the Control Tree.
<b>New Field</b>	<p>Opens the <a href="#">Create New Field Dialog Box</a>, where you can add a new custom field to the DAC that is referenced in the data view selected in the <b>Data View</b> box.</p> <p> : Once you have created a field or multiple fields, you need to publish the customization project before creating a control for the new fields.</p>

The table displays the fields that belong to the selected DAC. The table includes the following columns.

Column	Description
<b>Included</b>	An unlabeled check box that you can use to select a field for which the <b>Create Controls</b> operation will create a control in the object that is currently selected in the Control Tree.
<b>Used</b>	A check box that indicates whether a control for the field exists in the object that is currently selected in the Control Tree. This check box is selected automatically when you create a control for the field.
<b>Field Name</b>	The name and <code>DisplayName</code> (in parentheses) of the field in the DAC.
<b>Control</b>	The type of the UI control.

You can use the following filters of DAC fields displayed in the table.

Filter	Description
<b>All</b>	Fields that are not represented by controls on the form.
<b>Visible</b>	Fields that are visible due to the <code>Visibility</code> field attribute in the DAC.
<b>Custom</b>	New custom fields of the DAC.

## View ASPX Tab

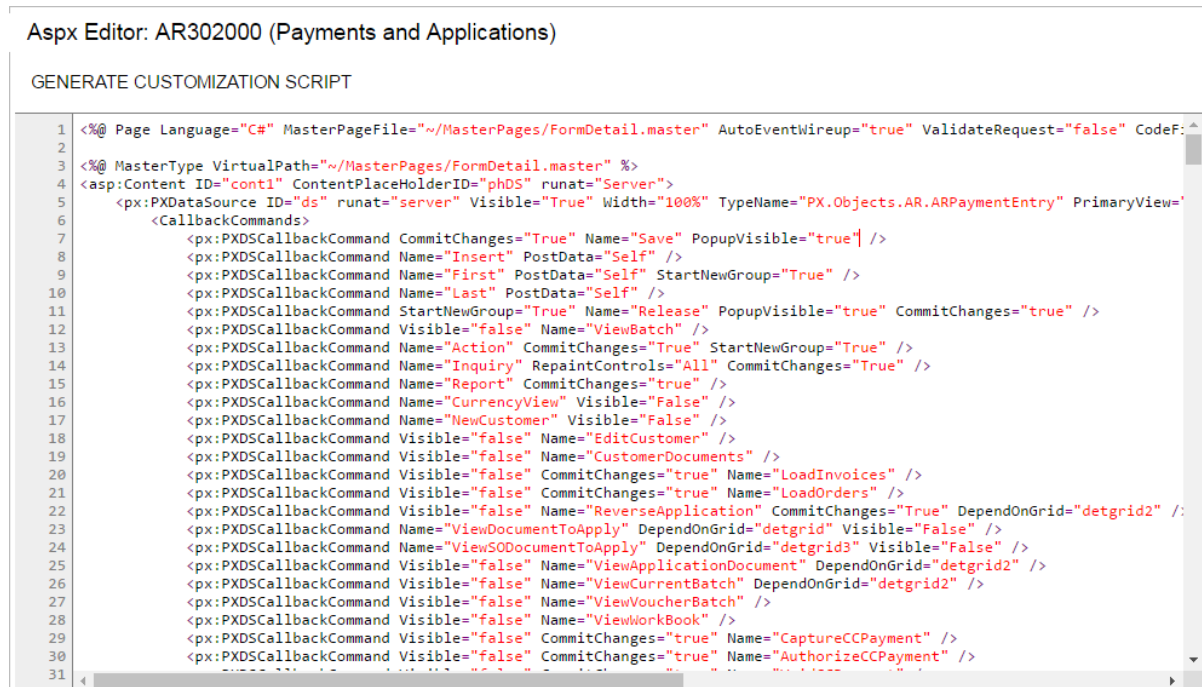
The **View ASPX** tab displays the ASPX code of the control selected in the Control Tree.

## ASPX Editor

You can use the ASPX Editor to edit the ASPX code of a page that has been customized by means of the Screen Editor. You can use this editor instead of the Screen Editor if you prefer a text editor rather than a visual tool.

You can launch the ASPX Editor by clicking **Actions > Edit Aspx** on the toolbar of the Screen Editor.

The ASPX Editor page contains the work area of the editor and a toolbar with only the **Generate Customization Script** button, as shown in the following screenshot.



You use the **Generate Customization Script** button instead of a **Save** button because this action saves to the customization project not the modified ASPX code but the difference between the modified code and the original code of the page.

## Condition Editor

You use the Condition Editor to construct a condition that can be later specified as a property value for a control or an action.

You can open the Condition Editor by clicking **Conditions** under the screen ID in the navigation pane of the Customization Project Editor. The Condition Editor page contains the following parts: a toolbar with the Cancel and Save buttons, the **Conditions** area with the list of the names of the created conditions, and the **Condition Details** area with the rows that make up the condition selected in the **Conditions** area.

## Data Class Editor

You use the Data Class Editor to develop the content of extensions for data access classes (DACs). By using the editor, for example, you can do the following:

- Customize the attributes of the existing fields of a DAC
- Add custom fields to a DAC
- For a selector field, add, delete, and sort the columns of the selector table
- Review the modifications made to an original class

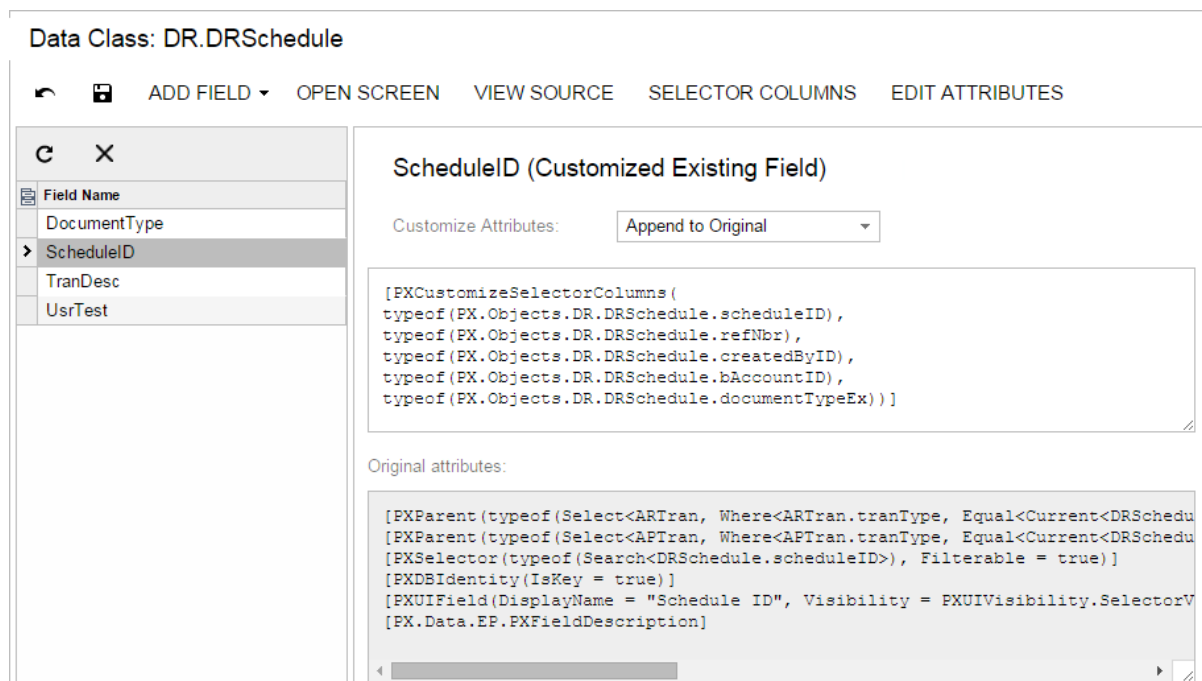
- View the source code of an original data access class
- Navigate to the form on which a field of a class is used

While performing the customization, you can open the editor in the following ways:


- From the **Customization Menu > Inspect Element > Element Properties** dialog box, by selecting the **Customize Data Fields** command on the **Actions** menu
- From the Customized Data Classes page of the Customization Project Editor, by selecting the **Name** field of a DAC
- From the navigation pane of the Customization Project Editor, by clicking an item in the **Data Access** folder

The Data Class Editor page includes the following elements (see the screenshot below):

- The title with the name of the customized class
- A toolbar with standard and page-specific buttons
- A list of the customized fields of the class
- A work area to customize the attributes of the field that is currently selected in the list



The page toolbar contains the following page-specific buttons.

Button	Description
<b>Add Field</b>	Provides the following actions: <ul style="list-style-type: none"> <li>• <b>Create New Field:</b> Opens the <a href="#">Create New Field Dialog Box</a>, which you can use to add a new custom field to the DAC.</li> <li>• <b>Change Attributes of Base Field:</b> Opens the <a href="#">Change Existing Field Dialog Box</a>, which you can use to add an existing field of the DAC to the customization project.</li> </ul>
<b>Open Screen</b>	For the DAC, opens the primary form of Acumatica ERP. <div>  : If there is a primary business logic controller (BLC) for the class, then the primary form is the form bound to this container. Otherwise, the primary form is </div>



Button	Description
	the form bound to the BLC in which the class is the main DAC of the primary view. See the Acumatica Framework training documentation for details.
<b>View Source</b>	Opens the <a href="#">Source Code Browser</a> on the <b>Data Access</b> tab, which displays the DAC source code.
<b>Selector Columns</b>	(Available for only the fields that are selectors.) Opens the <a href="#">Customize Selector Columns Dialog Box</a> , in which you can modify the columns in the selector table.
<b>Edit Attributes</b>	(Unavailable for new custom fields.) Opens the <a href="#">Customize Attributes Dialog Box</a> , which you can use to customize the attributes of the selected field.

You use the list of the currently customized fields of the DAC to select the field that you can review or change in the work area.

The work area of the page consists of the following:

- The title with the name and type (in parentheses: **New Field** or **Customized Existing Field**) of the selected field
- The **Customize Attributes** text area, where you can edit the attributes of the selected field
- The **Original Attributes** text area, where you can view the original attributes of the selected field
- A drop-down list that is visible for only existing customized fields of the data access class, so you can select one of the following ways of applying the changes to the field attributes:
  - *Keep Original*: The original attributes remain on the field until you select another option in this box.
  - *Replace Original*: The original attributes are replaced on the field with the custom attributes specified in the **Customize Attributes** text area.
  - *Append to Original*: The custom attributes are added to the end of the list of the original attributes of the data field. If you use this option, make sure you do not duplicate attributes on the field.



: The platform gives you advanced possibilities to control the field customization by using additional attributes in the DAC extension. See [Customization of Field Attributes in DAC Extensions](#) of [Customization Framework](#) for details.

If you want to change the original attributes in the **Customize Attributes** text area, before typing any text in the area, select the *Replace Original* option. The original attributes will be copied to the **Customize Attributes** text area.

### Create New Field Dialog Box

You can use the **Create New Field** dialog box to add a new data field to the customized DAC.

You can open the dialog box, shown in the following screenshot, in either of the following ways:

- From the **Add Data Fields** tab of the Screen Editor, by clicking the **New Field** button
- From the **Add Field** button of the Data Class Editor, by selecting the **Create New Field** command

The screenshot shows a 'Create New Field' dialog box with the following controls:

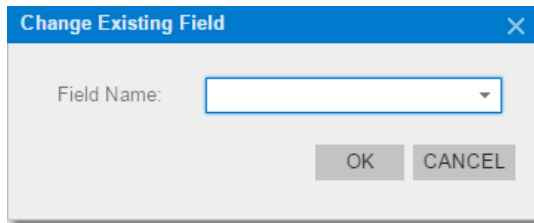
- Field Name:** A text input field.
- Display Name:** A text input field.
- Storage Type:** A dropdown menu currently showing 'DBTableColumn'.
- Data Type:** A dropdown menu currently showing 'string'.
- Length:** A text input field.
- Buttons:** 'OK' and 'CANCEL' buttons at the bottom right.

The dialog box controls are described below.

Control	Description
<b>Field Name</b>	The name of the field in the DAC. Because the field is custom, the <i>Usr</i> prefix is added automatically to the name when the box loses focus.
<b>Display Name</b>	The name of the field to be displayed on the form. The specified string is inserted into the <code>DisplayName</code> parameter of the <code>PXUIField</code> attribute of the field.
<b>Storage Type</b>	The storage type for the field, which can be one of the following: <ul style="list-style-type: none"> <li><i>NonPersistedField</i>: An unbound field of the DAC. The unbound field is added only to the data access class and is not mapped to the database.</li> <li><i>DBTableColumn</i>: An ordinary bound field. The platform adds the database column to the base table by altering the base table schema.</li> <li><i>NameValuePair</i>: A "name-value" bound field. The platform stores the field value in a dedicated table of the database without altering the schema of the base table.</li> </ul>
<b>Data Type</b>	The data type to be used for a custom fields, which can be one of the following: <i>string</i> , <i>int</i> , <i>bool</i> , <i>decimal</i> , <i>datetime</i> , and <i>guid</i> .
<b>Length</b>	(Available if you have selected the <i>string</i> or <i>decimal</i> type.) For the <i>string</i> type, the maximum number of symbols in the field value; for the <i>decimal</i> type, the precision of the value (the maximum total number of decimal digits that will be stored, both to the left of the decimal point and to the right of it).
<b>Decimal</b>	(Available only if you have selected the <i>decimal</i> type.) The scale of the value (that is, the number of decimal digits that will be stored to the right of the decimal point).
<b>OK</b>	Adds the new field with the specified properties to the data access class and closes the dialog box. The field appears in the list of customized fields of the class in the Data Class Editor.
<b>Cancel</b>	Closes the dialog box.

### Change Existing Field Dialog Box

The **Change Existing Field** dialog box, shown below, is used to add an existing field of the data access class (DAC) to the list for customization.



You can open the dialog box by clicking the **Add Field** button of the Data Class Editor and selecting the **Change Attributes of Base Field** command.

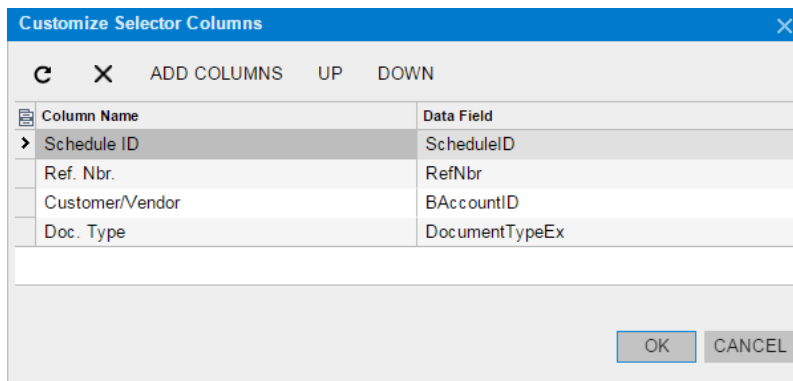
The dialog box controls are described below.

Control	Description
<b>Field Name</b>	The existing field of the DAC you want to change.
<b>OK</b>	Adds the selected field to the list of the customized fields of the data access class, and closes the dialog box.
<b>Cancel</b>	Closes the dialog box.

### Customize Selector Columns Dialog Box

The **Customize Selector Columns** dialog box, shown below, is available for only a selector field. In the dialog box, you can add, delete, and sort columns to customize the selector table. The dialog box contains a toolbar, a table, the **OK** and **Cancel** buttons.

You can open the dialog box from the Data Class Editor by clicking the **Selector Columns** button.



The dialog box toolbar includes the buttons described below.

Button	Description
Refresh	Refreshes the list of columns displayed in the table.
Delete	Deletes the selected column from the selector.
<b>Add Columns</b>	Opens the <a href="#">Add Columns to Selector Dialog Box</a> , which you can use to add columns to the table of this dialog box.
<b>Up</b>	Moves up the selected field so the column moves left in the selector.
<b>Down</b>	Moves down the selected field so the column moves right in the selector.

The table contains information on the selector content and includes the following columns.

Column	Description
<b>Column Name</b>	The value of the <code>DisplayName</code> parameter of the <code>PXUIField</code> attribute of the field.

Column	Description
<b>Data Field</b>	The name of the public virtual property of the field in the DAC.

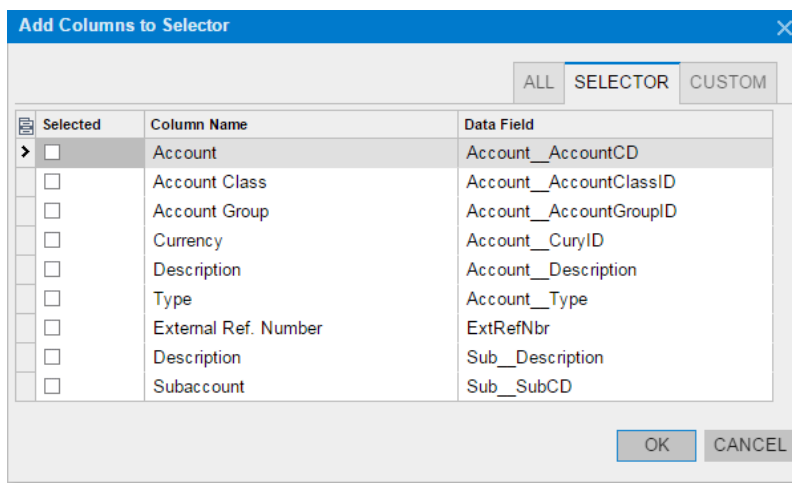
After you click **OK** in the **Customize Selector Columns** dialog box, the system applies the modifications to the selector table. As a result, the `PXCustomizeSelectorColumns` attribute is added to the selector field, and you can view the attribute in the **Customize Attributes** text area of the Data Class Editor. This attribute defines the new set and order of the columns in the selector.

The **Cancel** button closes the dialog box without saving changes to the selector table.

#### *Add Columns to Selector Dialog Box*

The **Add Columns to Selector** dialog box, shown in the following screenshot, is used to add one or multiple columns to the selector table at once. The dialog box contains a table with filters and the **OK** and **Cancel** buttons.

You can open the dialog box from the **Customize Selector Columns** dialog box by clicking the **Add Columns** button.



The table includes the following columns.

Column	Description
<b>Selected</b>	A check box you can use to select fields that will be added to the selector.
<b>Column Name</b>	The value of the <code>DisplayName</code> parameter of the <code>PXUIField</code> attribute of the field.
<b>Data Field</b>	The name of the public virtual property of the field in the DAC.

Each tab of the **Add Columns to Selector** dialog box displays the filtered list of fields. The tabs are described below.

Filter	Description
<b>All</b>	All fields.
<b>Selector</b>	Fields that are selectors.
<b>Custom</b>	New custom fields.

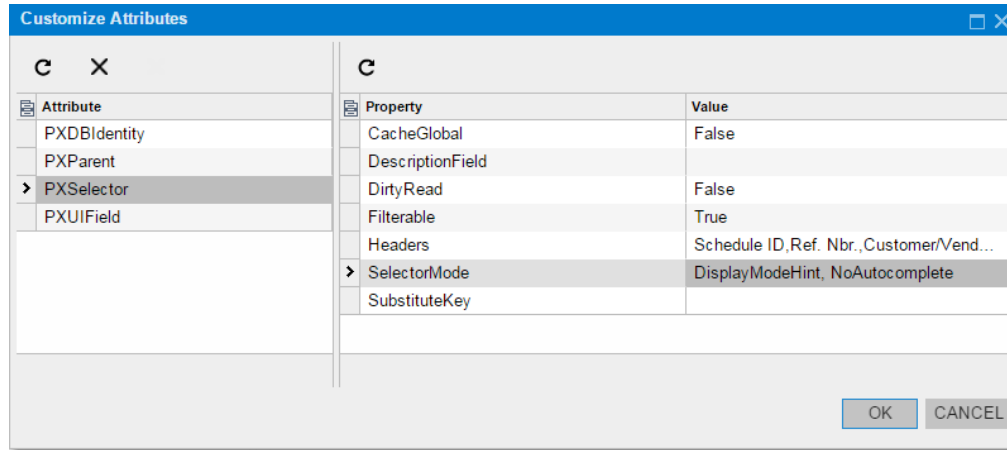
After you click **OK** in the **Add Columns to Selector** dialog box, the system applies the modifications. As a result, the selected columns are added to the table of the **Customize Selector Columns** dialog box.

The **Cancel** button closes the dialog box without saving the changes to the selector table.

## Customize Attributes Dialog Box

The **Customize Attributes** dialog box (shown in the following screenshot) provides the easiest way to edit attributes of the field selected in the Data Class Editor. The dialog box contains an attribute pane, a work area, and the **OK** and **Cancel** buttons.

You can open the dialog box from the Data Class Editor by clicking the **Edit Attributes** button.



The attribute pane includes:

- A toolbar with the **Refresh** and **Delete** buttons.
- The list of the field attributes.

In the list, you can select an attribute to be deleted or edited.

You can use the **Delete** button to delete the selected attribute of the field. After you delete the attribute and click **OK**, the `[PXRemoveBaseAttribute(typeof(AttrNameAttribute))]` attribute is added to the field and you can view the attribute in the **Customize Attributes** text area of the Data Class Editor.

The work area contains a table that lists the parameters of the attribute selected in the list. The table columns are described below.

Column	Description
<b>Property</b>	The name of the parameter.
<b>Value</b>	The original value of the parameter.

In the table, you can enter any string as the parameter value without type validation. If the value of the customized parameter has an incorrect type, it causes a validation error during the publication of the project.

After you click **OK** in the **Customize Attributes** dialog box, the platform applies the modifications to the field. As a result, the `[PXCustimizeBaseAttribute(typeof(AttrNameAttribute), "ParameterName", NewValue)]` attribute is added to the field for each modified parameter. You can view the attribute in the **Customize Attributes** text area of the Data Class Editor.

You can click the **Cancel** button to close the dialog box.

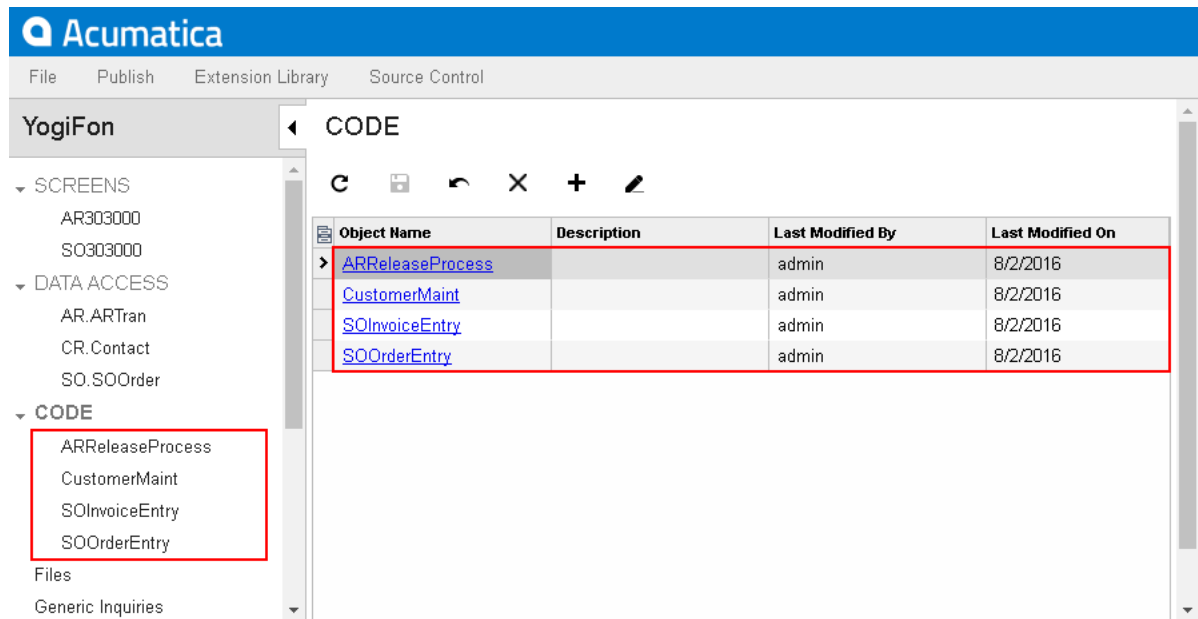
## Code Editor

With the Code Editor, you can develop, view, and edit the customization code that has been added to the project.

You can open the Code Editor in the following ways:

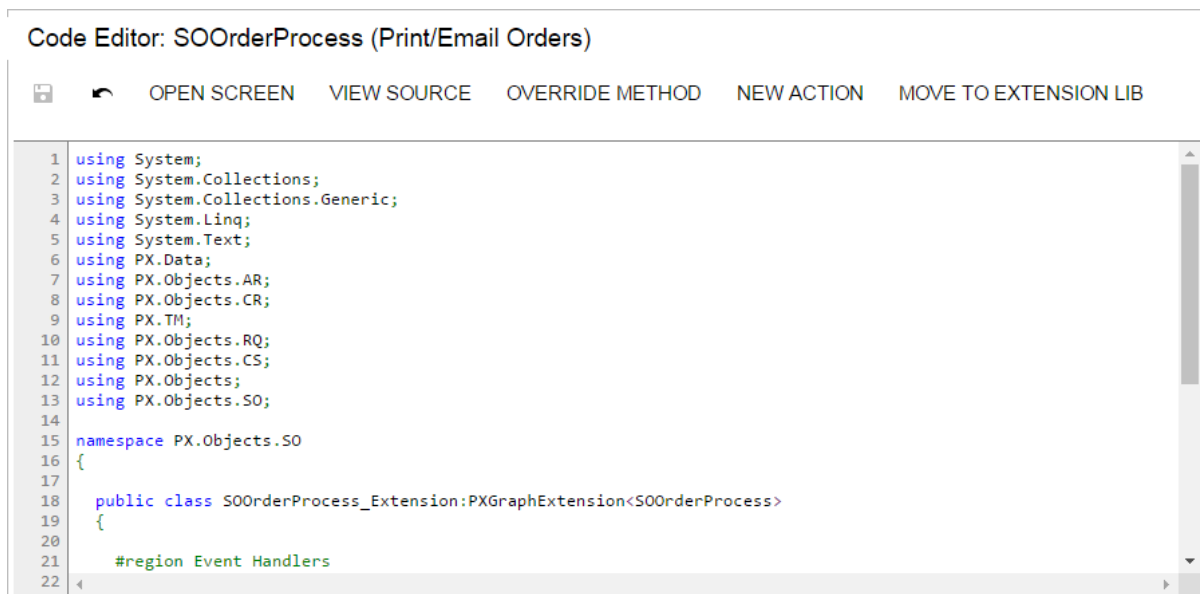
- From a form of Acumatica ERP by using **Customization > Inspect Element** to open the **Element Properties** dialog box, and then clicking **Actions > Customize Business Logic**

- From the Code page of the Customization Project Editor—by clicking the **Object Name** of an existing Code item (see the screenshot below)





- From the navigation pane of the Customization Project Editor, by clicking an item in the **Code** folder

The Code Editor page includes a toolbar and a text area for editing code, as shown in the following screenshot.



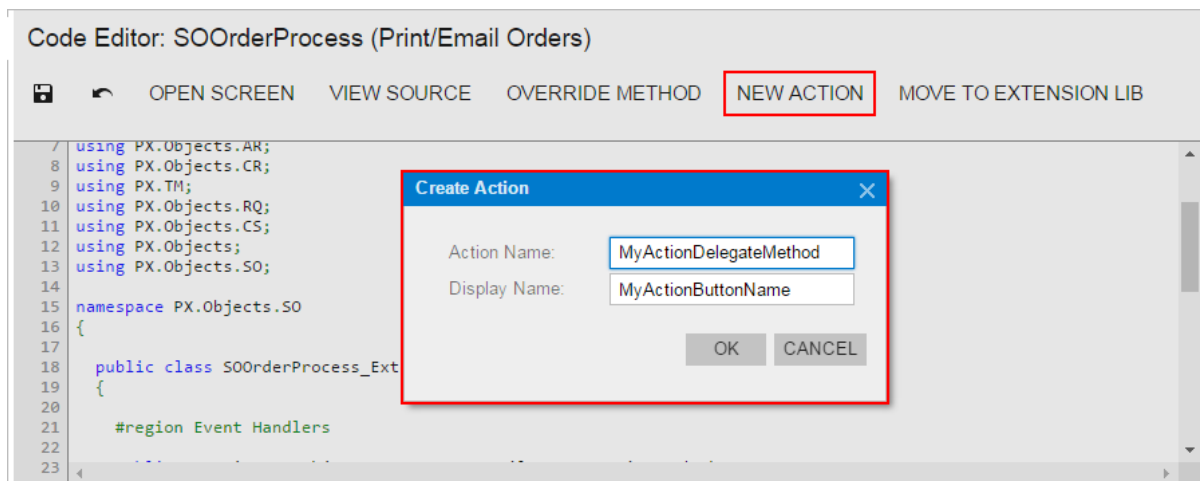
The toolbar buttons of the Code Editor page are described below.

Button	Description
Save	Saves the code in the project.

Button	Description
	 : You can use the Control-S combination on the keyboard to save the code.
<b>Cancel</b>	Cancels unsaved changes in the code.
<b>Open Screen</b>	Opens the form bound to the business logic controller if you are editing the customization code of the business logic executed for a form.
<b>View Source</b>	Opens the <a href="#">Source Code Browser</a> with the original source code of the business logic controller (BLC) if you are editing the customization code of the business logic executed for a form.
<b>Override Method</b>	Opens the <a href="#">Select Methods to Override Dialog Box</a> , which you can use to select multiple virtual methods of the BLC to override.
<b>New Action</b>	Opens the <a href="#">Create Action Dialog Box</a> , which you can use to create a code template for a new action.
<b>Move to Extension Lib</b>	<p>Launches the operation that converts the current <code>Code</code> item into a file of customization code, adds the file to the extension library project in Microsoft Visual Studio, and removes the item from the customization project. See <a href="#">Move to Extension Lib Action</a> for details.</p> <p> : The customization project must be bound to an existing extension library project in Visual Studio before you invoke the <b>Move to Extension Lib</b> operation. See <a href="#">Customization Project Editor</a> for details.</p>

### Create Action Dialog Box

If the *Code* item you are viewing by using the Code Editor is a business logic controller (BLC, also referred to as *graph*) extension, you can create a new action in this BLC. To do this, you can click the **New Action** button of the Code Editor to open the **Create Action** dialog box, shown in the following screenshot.



**Figure: Opening the New Action dialog box**

To create an action declaration in the BLC extension, you should specify the name of the action delegate method in the **Action Name** box and the name of the action button in the **Display Name** box, as shown in the screenshot above, and then click **OK**. The system adds to the graph extension a template of the action declaration that includes the following class members:

- The declaration of the action delegate method

- The declaration of the button attributes to add the button to the form toolbar with the specified name
- The template of the action delegate method

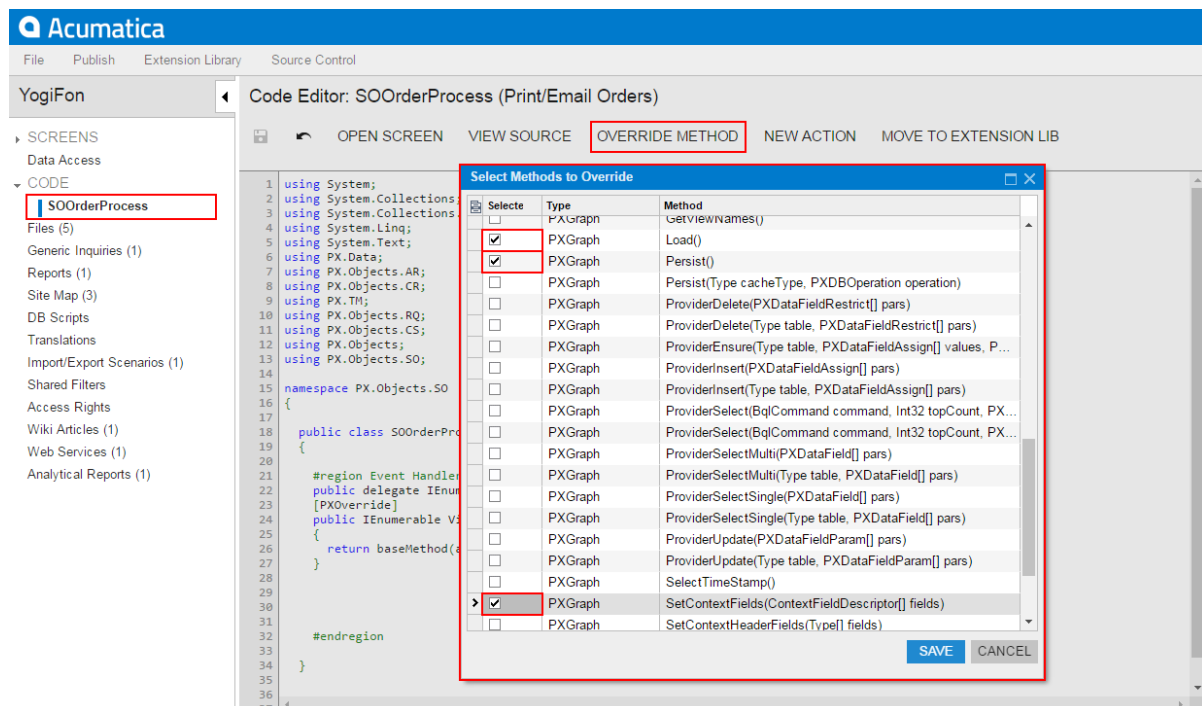
The following example shows the template code for an action.

```
public PXAction<DACName> myActionDelegateMethod;

[PXButton(CommitChanges = true)]
[PXUIField(DisplayName = "MyActionButtonName")]
protected void MyActionDelegateMethod()
{
    // the body of the action delegate method
}
```

### Select Methods to Override Dialog Box

If the *Code* item you are viewing in the Code Editor is a business logic controller (BLC) extension, you can override a virtual method of this BLC. To do this, you can use the **Override Method** action of the Code Editor, which opens the **Select Methods to Override** dialog box, shown in the following screenshot.



**Figure: Opening the Select Methods to Override dialog box**

To add a method to the customization, you should select the check box for the method in the table, as shown in the screenshot, and click **Save**. The system adds to the graph extension a template of an overridden method for each method selected in the table.

The dialog box contains a table that lists the virtual methods of the current BLC and its parent classes, and the **Save** and **Cancel** buttons. You use the table, which contains the following columns, to select the virtual methods that you have to override.

Column	Description
<b>Selected</b>	A check box that you can use to select the virtual method to be overridden in the BLC extension.
<b>Type</b>	The identifier of the class type that contains the declaration of the virtual method.



Column	Description
Method	The signature of the virtual method.

To cancel the operation and close the dialog box, click **Cancel**.

Click **Save** to close the dialog box and launch the process that adds a code template to the BLC extension for each item selected in the table.

When you override a virtual method, the system generates an overridden method template that includes the delegate declaration of the base method, the `PXOverride` attribute, and the method declaration that invokes the base method delegate.

The following example shows the template code to override the `MethodName` method.

```
public delegate returnType MethodNameDelegate(...);
[PXOverride]
public returnType MethodName(..., MethodNameDelegate baseMethod)
{
    return baseMethod(...);
}
```

### Move to Extension Lib Action

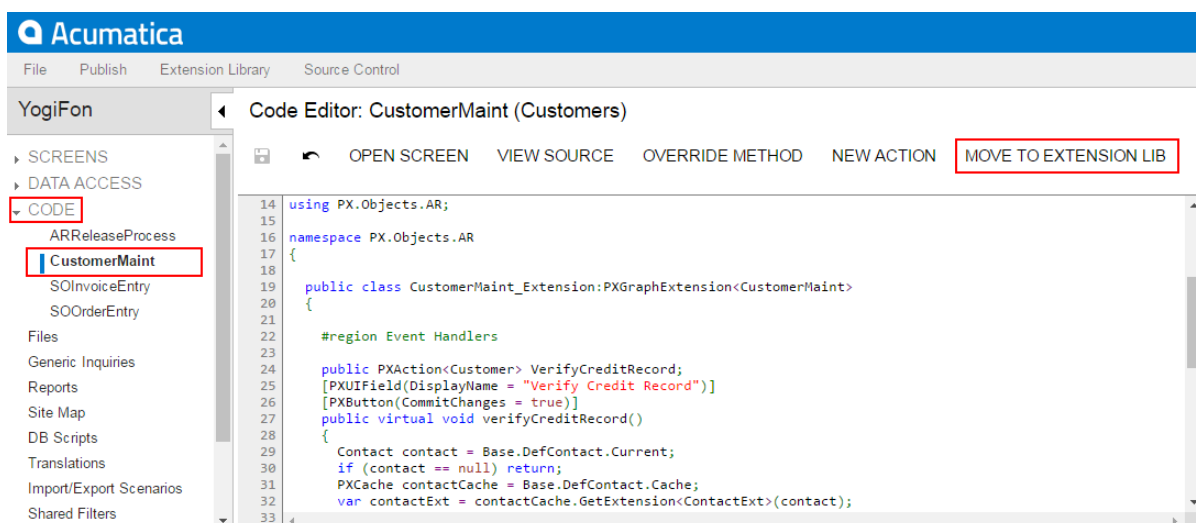
You can develop customization code either as *Code* items in a customization project or as source code included in an extension library project to develop in Microsoft Visual Studio. Some part of a customization may exist in the *Code* items of a customization project, while another part can be included in an extension library that is added to the customization project as a dynamic link library (DLL) file.

If you have a *Code* item in a customization project that you want to move to an extension library to compile it into a DLL, you can use the **Move to Extension Lib** action on the page toolbar of the Code Editor.

Before you launch the operation, be aware that the customization project is bound to an existing extension library. (See [Customization Project Editor](#) for details.)

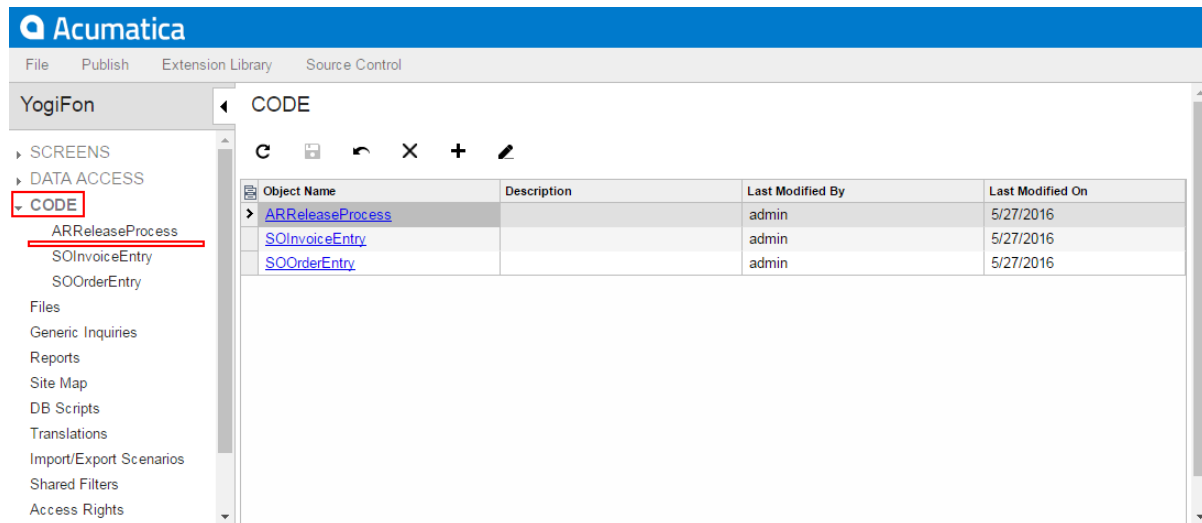
After the operation is complete, the *Code* item that is currently displayed in the work area of the Code Editor is removed from the customization project, and the file with the same source code is appended to the extension library that is bound to the customization project. The system assigns a similar name to the file: For example, if the *Code* item name was `CodeItemName`, the name of the created file will be `CodeItemName.cs`.

For example, suppose you need to move the `CustomerMaint` *Code* item to the `YogiFon` extension library (see the screenshot below).



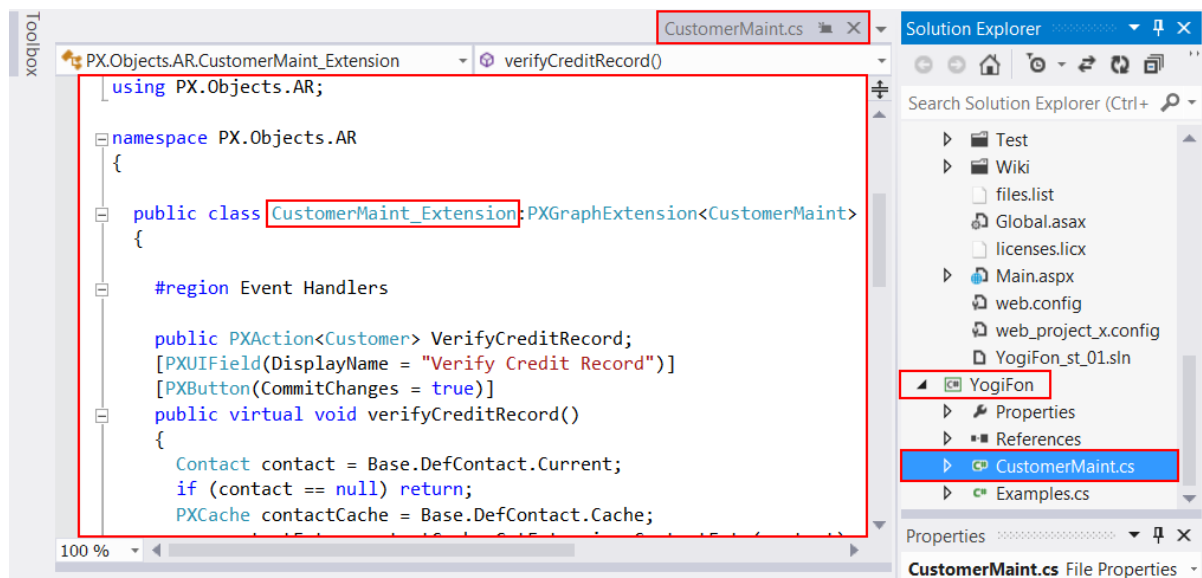
**Figure: Viewing the content of the Code item before you move it to the extension library**

When the operation is complete, the `CustomerMaint` *Code* item is removed from the customization project, as the screenshot below shows.



**Figure: Viewing the Code item list after the operation was performed**

In place of the removed item, the `CustomerMaint.cs` file with the same source code is appended to the bound extension library project, as shown in the screenshot below.



**Figure: Viewing the content of the source code file added to the extension library**

The operation of moving code to an extension library is irreversible. If you need to move source code from an extension library to a *Code* item of a customization project, use the following approach:

- In Visual Studio (or any text editor), open the file, select the needed source code, and copy it to the clipboard.
- Create a new *Code* item in the customization project.
- Delete the code template from the created item.
- Paste the code from the clipboard, and save the *Code* item to the customization project.
- Delete the source code file from the extension library.

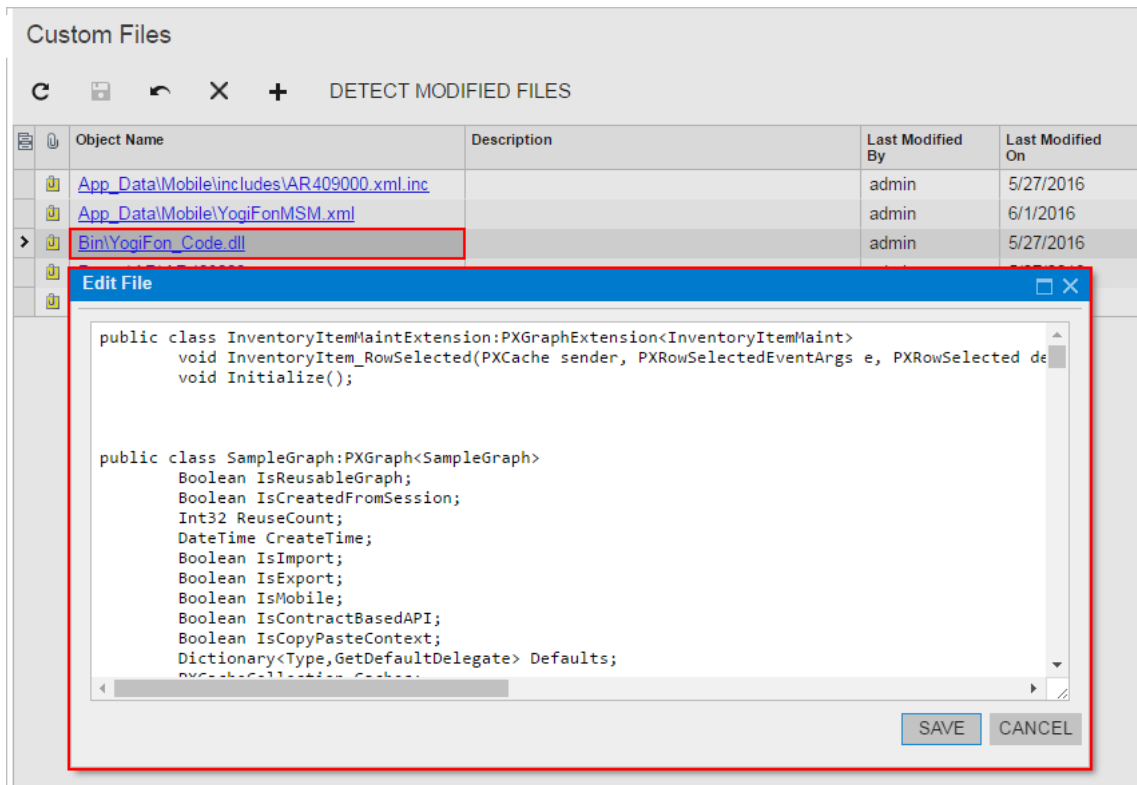
## File Editor

You can use the File Editor to view or edit a custom file added to the customization project.

To open a custom file in the editor, on the Custom Files page of the Customization Project Editor, click the file name in the list of custom files.

You can use the editor as follows with custom files included in the project:

- To review and edit a text file
- To review the content of a binary DLL file (see the following screenshot)



**Figure: Viewing the content of a custom DLL file in the File Editor**



: In the editor, you cannot save changes in DLL files.

If you have used the File Editor to modify a custom file in a customization project and have saved the changes in the database, the changes are not saved in the original file in the file system. If you then click **Detect Modified Files** on the toolbar of the Custom Files page, the platform does not detect a conflict because the file in the database is newer. The platform automatically updates the original file in the file system during the publication of the customization project.

## SQL Script Editor

You use the SQL Script Editor (the **Edit SQL Script** dialog box) to add and edit a custom SQL script. You can open the editor from the Database Scripts page of the Customization Project Editor in the following ways:

- To create an SQL script: By clicking **Add > Script** on the page toolbar
- To edit the script: By doing either of the following:
  - Clicking the name of the script in the **Object Name** column of the table on the Database Scripts page

- Clicking the row of the script in the table on the Database Scripts page and clicking **Edit** on the page toolbar

#### **Edit SQL Script Dialog Box**

The SQL Script Editor has the following elements.

Element	Description
<b>Script Name</b>	The name of the SQL script.
<b>Priority</b>	The priority of the script. The priority can have a value that ranges from –100 to 100. By default, the value is 0.
Unlabeled text area	A text area that you can use to view and edit a custom SQL script.
The SQL Script Editor has the following buttons.	
<b>Specify Database Engine</b>	Opens the <b>Specify Database Engine</b> dialog box, in which you can specify the attribute of the script that indicates on which database servers the script can be executed (Microsoft SQL Server, MySQL Server, or both).
<b>OK</b>	Saves the custom SQL script to the customization project and closes the dialog box.
<b>Cancel</b>	Closes the dialog box without saving the changes to the script.

#### **Table Editor**

You use the Table Editor (the **Edit Table Columns** dialog box) to edit a custom table. You can open the editor from the Database Scripts page of the Customization Project Editor in the following ways:

- By clicking the name of the database table in the **Object Name** column of the table on the Database Scripts page
- By selecting the name of the database table in the table on the Database Scripts page and clicking **Edit** on the page toolbar

#### **Edit Table Columns Dialog Box**

The Table Editor has the following elements.

The table toolbar includes only standard buttons. For the list of standard buttons, see [Table Toolbar](#).

Element	Description
<b>Field Name</b>	The name of the field of the database table.
<b>Script Type</b>	The type of the database script applied to the table.
<b>Data Type</b>	The type of the field of the database table.
The dialog box has the following button.	
<b>Done</b>	Saves the custom columns of the table to the customization project and closes the dialog box.

#### **Mobile App Editor**

You can use the Mobile App Editor to add and update mobile app screens to the customization project.

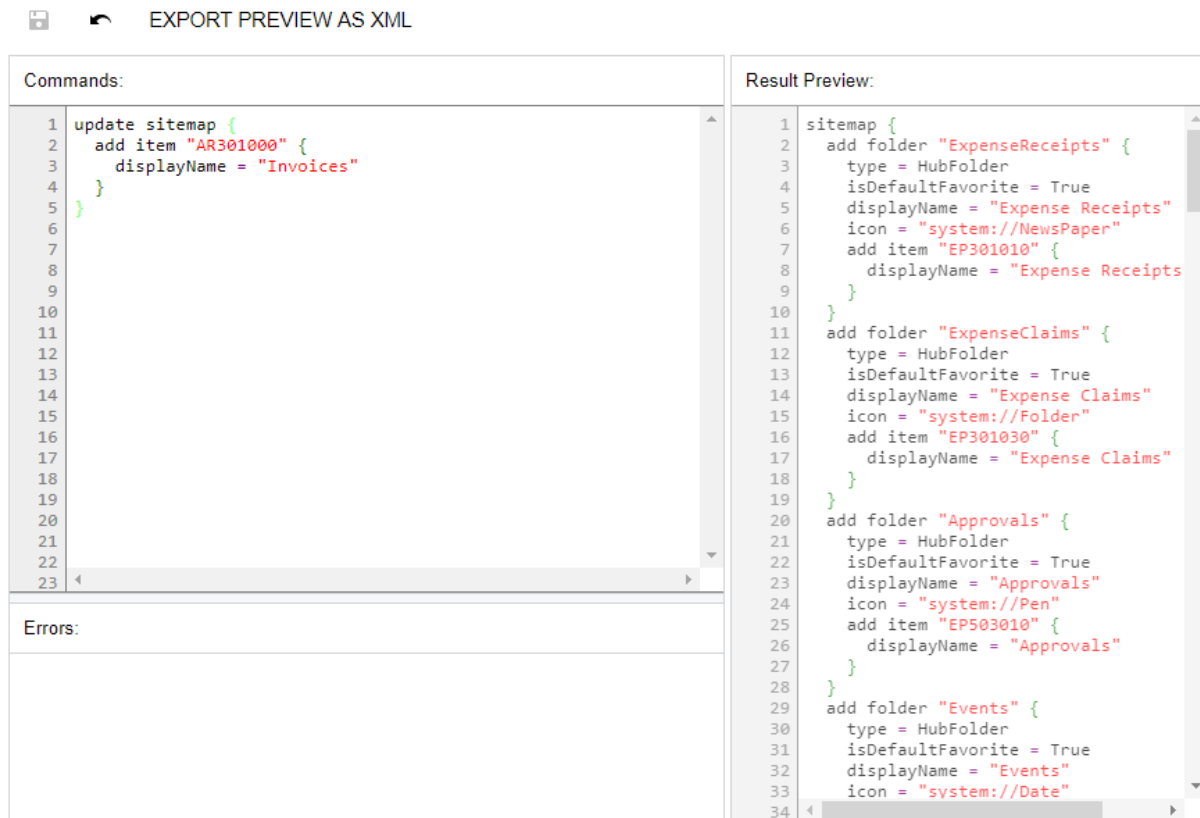
You can open the editor on the Mobile Application page of the Customization Project Editor in one of the following ways:

- If you want to add a new screen to the mobile app, click **Customize > Add New Screen**.

- If you want to update the main menu of the mobile app, click **Customize > Update Main Menu**.
- If you want to update a screen that is already mapped to the mobile app, click **Customize > Update Existing Screen**.

An example of the editor's appearance is presented on the following screenshot.

#### Update: MENU



**Figure: Editing the main menu of the mobile app**

For more details on using the Mobile App Editor, see [Working with Mobile Framework](#).

### XML Editors

In the database, the platform keeps each item of the customization project in XML format.

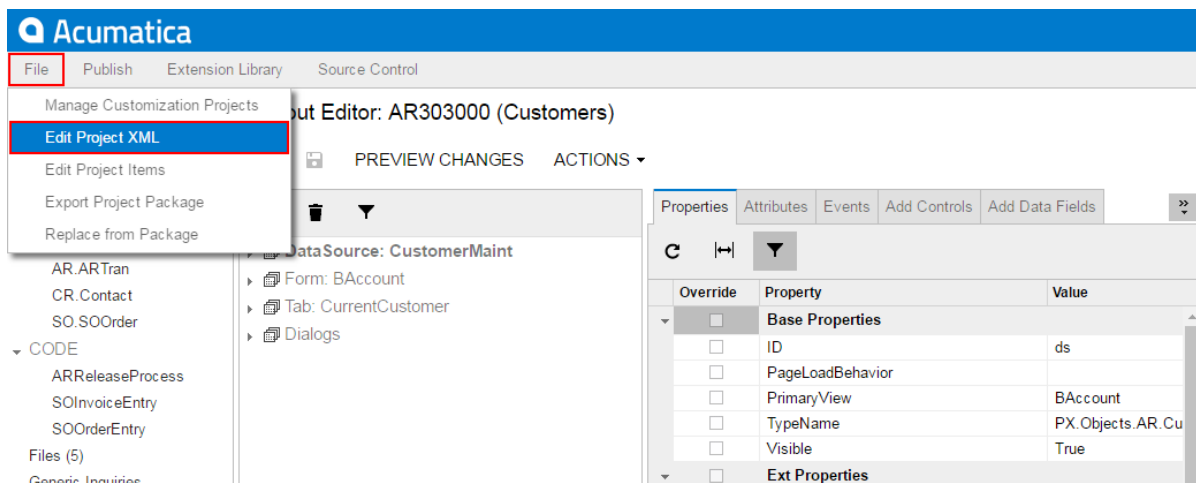
The platform provides the following tools for experienced users to edit the content of a customization project in XML format:

- [Project XML Editor](#)
- [Item XML Editor](#)

#### Project XML Editor

You can use the Project XML Editor to edit and review the content of a customization project in XML format.

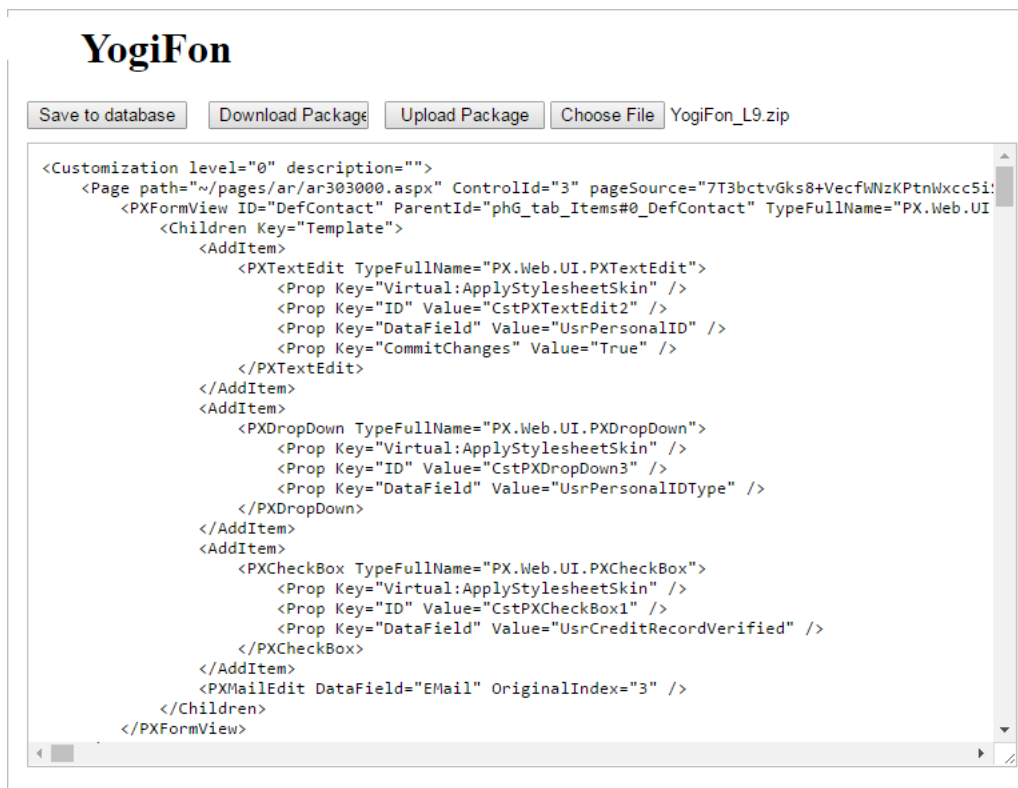
To open the editor, in the Customization Project Editor, click **File > Edit Project XML** on the menu (see the following screenshot).



**Figure: Opening the Project XML Editor**

The editor page, shown in the screenshot below, contains the following UI elements:

- At the top of the page, the name of the customization project that is opened in the editor
- The page toolbar, which includes the file name of a selected deployment package (or the *No file chosen* message) and the following buttons:
  - **Save to database:** To save the XML code of the project to the database
  - **Download Package:** To save the project locally as a deployment package ZIP file that has the same name as the customization project
  - **Upload Package:** To open the deployment package file whose name is currently selected and displayed in the page toolbar
  - **Choose File:** To select a deployment package file
- The work area of the editor

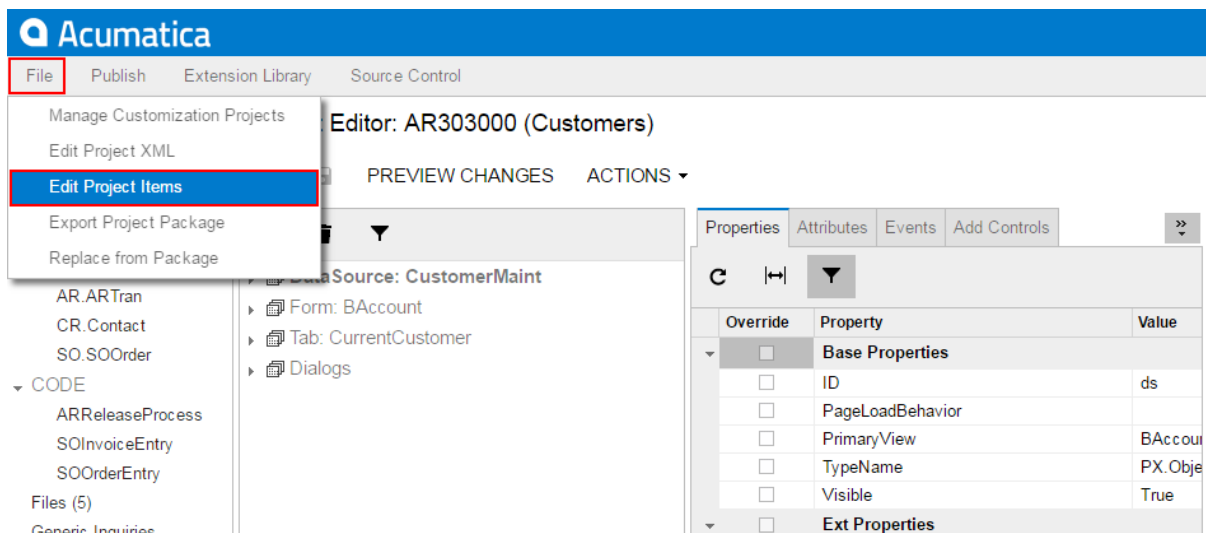


**Figure: Viewing the Project XML Editor page**

## Item XML Editor

You can use the Item XML Editor to edit and review an item of a customization project.

To open the editor, in the Customization Project Editor, click **File > Edit Project Items** on the menu (see the following screenshot).



**Figure: Opening the Item XML Editor**

The editor page, shown in the following screenshot, contains the following UI elements:

- The page toolbar, which contains the **Save** and **Cancel** buttons
- The list of the items in the customization project
- The work area of the editor

Edit Project Items

Object Name	Type	Descr	Exclud	Created By	Creation Date	Last Modified By	Last Modified On
PX.Objects.AR.ARTran	DAC		<input type="checkbox"/>	admin	5/27/2016	admin	5/27/2016
PX.Objects.CR.Contact	DAC		<input type="checkbox"/>	admin	5/27/2016	admin	5/27/2016
PX.Objects.SO.SOOrder	DAC		<input type="checkbox"/>	admin	5/27/2016	admin	5/27/2016
App_Data\Mobile\includes\AR409000.xml.inc	File		<input type="checkbox"/>	admin	5/27/2016	admin	5/27/2016
App_Data\Mobile\YogiFonMSM.xml	File		<input type="checkbox"/>	admin	5/27/2016	admin	6/1/2016
Bin\YogiFon_Code.dll	File		<input type="checkbox"/>	admin	5/27/2016	admin	5/27/2016
Pages\AR\AR409000.aspx	File		<input type="checkbox"/>	admin	5/27/2016	admin	5/27/2016
Pages\AR\AR409000.aspx.cs	File		<input type="checkbox"/>	admin	5/27/2016	admin	5/27/2016
ARReleaseProcess	Code		<input type="checkbox"/>	admin	5/27/2016	admin	5/27/2016
SOInvoiceEntry	Code		<input type="checkbox"/>	admin	5/27/2016	admin	5/27/2016

Source

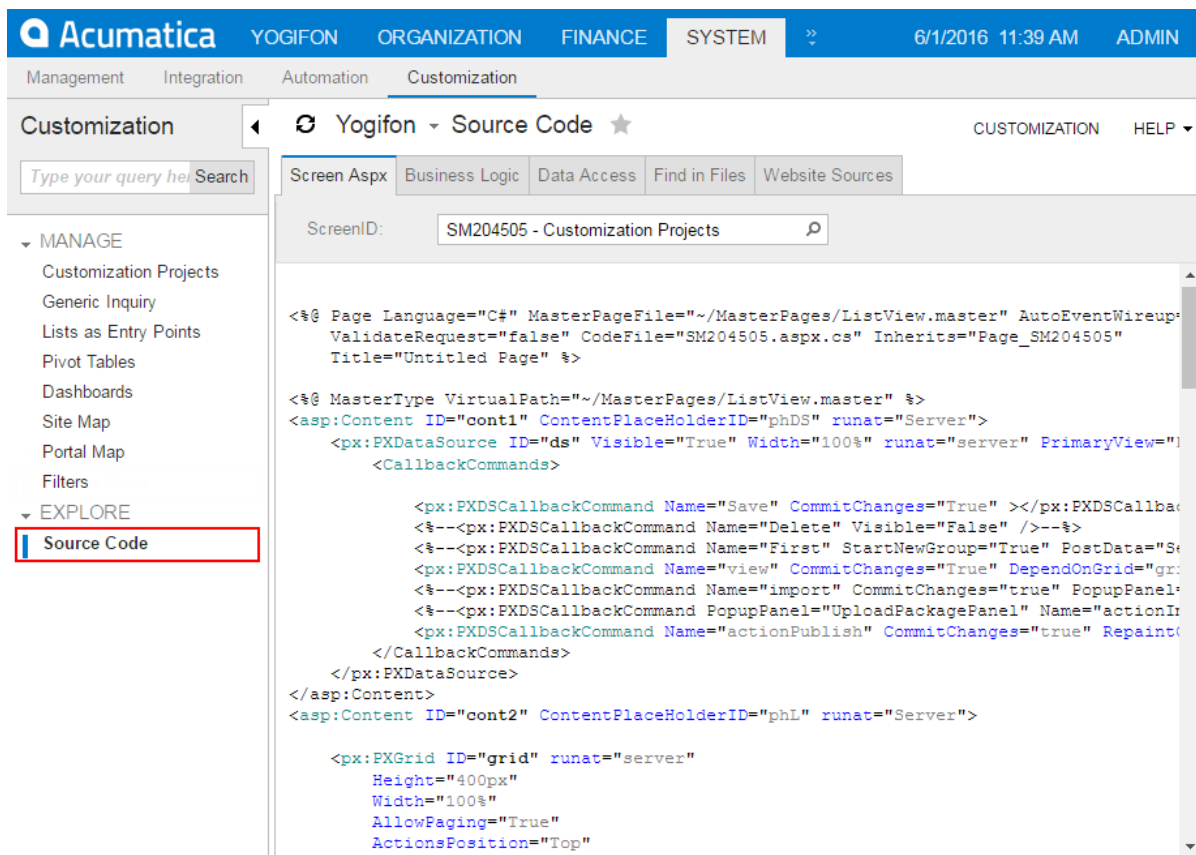
```
<DAC type="PX.Objects.AR.ARTran">
  <Field FieldName="UsrSIMCardID" TypeName="string" MapDbTable="ARTran" TextAttributes="#CDATA" Stor
    <CDATA name="TextAttributes"><![CDATA[[PXDBString(40)]]></CDATA>
[PXUIField(DisplayName="SIM Card ID")]
]></CDATA>
  </Field>
  <Field FieldName="UsrPhoneNumber" TypeName="string" MapDbTable="ARTran" TextAttributes="#CDATA" St
    <CDATA name="TextAttributes"><![CDATA[[PXDBString(15)]]></CDATA>
[PXUIField(DisplayName="Phone Number")]
]></CDATA>
  </Field>
  <Field FieldName="UsrContractID" TypeName="int" MapDbTable="ARTran" TextAttributes="#CDATA" Storag
    <CDATA name="TextAttributes"><![CDATA[[PXDBInt]]></CDATA>
[PXUIField(DisplayName="Contract ID" Enabled = false)]]></CDATA>
```

Figure: Viewing the Item XML Editor page

## Source Code Browser

You can explore the source code of the Acumatica ERP application on the [Source Code](#) (SM204570) form, which is shown in the following screenshot.





**Figure: Viewing the Source Code form**

You can open the browser in the following ways:

- From the *Element Properties Dialog Box*, by selecting one of the following commands in the **Actions** menu:
  - **View ASPX Source:** To explore the source code of current form
  - **View Business Logic Source:** To explore the source code of the business logic controller (BLC) that is bound to the current form
  - **View Data Class Source:** To explore the source code of the data access class (DAC) that contains the data field of the inspected element
- From the *Data Class Editor*, by clicking **View Source** on the page toolbar
- From the *Code Editor*, by clicking **View Source** on the page toolbar
- From the *Screen Editor*, by clicking **View Source** on the toolbar of the **Attributes** or **Events** tab

You can use the Source Code browser for the following purposes:

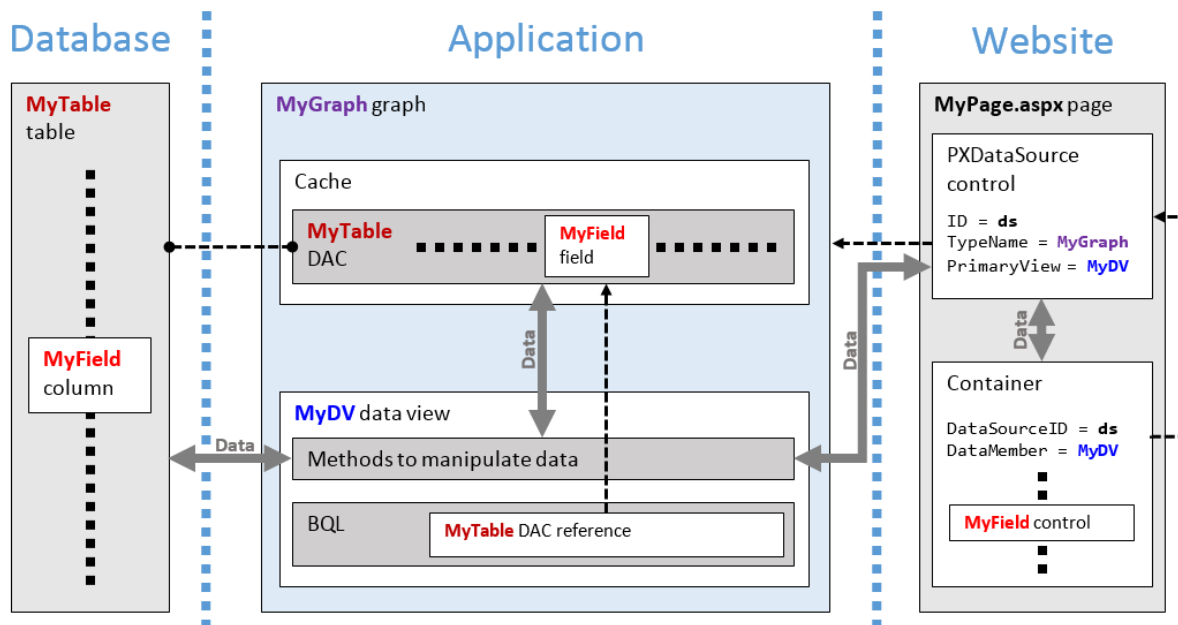
- To search for the following types of source code:
  - ASPX code, by the screen ID or by the screen title. You can search by any part of an ID or of a title.
  - C# source code of a BLC or DAC, by the class name. You can also type any part of the name and select the name from the list of names that match your search string.
  - Any source code, by a text fragment.
- To download a ZIP file with the source code for the website

## Customization Framework

The programming framework of the Acumatica Customization Platform, like Acumatica Framework, is intended for developers experienced in C#.NET. Because the application objects of Acumatica ERP are built on top of Acumatica Framework, the developers need to learn both the programming frameworks to be able to effectively develop quality customizations.

When you have to customize an instance of Acumatica ERP, first you must determine the scope of the customization. For each form that works with data from the database, the instance of Acumatica ERP must contain at least the following objects (see the diagram below):

- An ASPX page: The page must contain, at minimum, the data source control and a control container with controls for data fields.
- A business logic controller (BLC, also referred to as *graph*): The graph must be specified in the `TypeName` property of the data source control of the page. The graph must contain at least one data view, which is specified in the `PrimaryView` property of the data source control as well as in the `DataMember` property of the control container. The graph instance is created on each round trip and initializes the creation of the data view instance based on a BQL statement. The data view provides data manipulations and data flows between the container control, the cache object of the graph, and the corresponding table of the database. The BQL statement contains a reference to at least one data access class that is required to map the database table to data records in the cache object.
- A data access class (DAC): On each round trip, the DAC instance is created in the cache object when the data view processes any operation with the corresponding data.
- A table in the database: The table is mapped to the data access class that defines the data record type in the cache object of the graph instance.



**Figure: Objects required for a form that works with data from a database table**

By using the Acumatica Customization Platform, you can create or customize each of the object types listed above.

### Customization of ASPX Pages

To change the layout and behavior of an Acumatica ERP form, you must customize the corresponding ASPX page. However for customizing an ASPX page, the platform uses an approach that does not require you to change the original ASPX code of the Acumatica ERP form. Instead, the platform can apply the `.aspx` file with the same name from a special subfolder within the website folder, if this file

exists. At run time, while the platform is processing a request to open a form, the platform first tries to find the needed `.aspx` file inside this subfolder to use it instead of the original file. If the file with customized ASPX code is found, the platform opens the customized form. Otherwise, the original form is opened.

To cancel a customization of a page, you need only to delete the file with the appropriate name from the subfolder.

### Customization of Application Classes (BLCs and DACs)

To provide the ability to customize the functionality or business logic of a form, the platform uses the technology based on class extensions. With this technology, to customize a BLC or DAC, the platform does not change the original code of Acumatica ERP. Instead, the platform uses an additional C# file for each class extension.

At run time, the platform automatically detects a class extension during the first initialization of the base (original) class. If an extension is found, the platform replaces the base class with the merged result of the base class and the extension that was found.

To cancel a customization of business logic, you need only to delete the file that contains the appropriate class extension.

This approach makes it easy to apply and cancel any customization of business logic in Acumatica ERP.

### Customization of the Database Schema

The platform provides the following capabilities that you can use to customize the database schema:

- You can create an [SQL script](#) to execute while the customization is applied to an instance of Acumatica ERP.
- You can create a custom bound field to add the corresponding column to a table while the customization is applied to an instance of Acumatica ERP.
- You can define the `UpdateDatabase()` method of a class derived from the `CustomizationPlugin` class to execute an SQL script or a stored procedure from the C# code after the customization is applied to an instance of Acumatica ERP. (See [Custom Processes During Publication of a Customization](#) for details.)

### In This Chapter

- [Changes in Webpages \(ASPX\)](#)
- [Changes in the Application Code \(C#\)](#)
- [Changes in the Database Schema](#)
- [Custom Processes During Publication of a Customization](#)

## Changes in Webpages (ASPX)

To customize the look and behavior of an Acumatica ERP form, you need to change the ASPX code of the form. Because you need to include all the changes in a customization project, you have to perform the form customization by using the [Screen Editor](#) of the Customization Project Editor.

To collect all the changes that you make while you customize a form, the Screen Editor creates a *Page* item with a name that corresponds to the form ID, and includes the item in the currently selected customization project. This item contains XML code with instructions that have to be applied to the ASPX code of the form during the publication of the project.

For example, the following fragment of a *Page* item contains the XML code with the `<AddItem>` tag used to add the `UsrSIMCardID` field as a column to the `Transactions` grid.

```
<PXGridLevel DataMember="Transactions"
```

```

        ParentId="phG_tab_Items#0_grid_Levels#0"
        TypeFullName="PX.Web.UI.PXGridLevel">
    <Children Key="Columns">
        <AddItem>
            <PXGridColumn TypeFullName="PX.Web.UI.PXGridColumn">
                <Prop Key="DataField" Value="UsrSIMCardID" />
                <Prop Key="Width" Value="160" />
            </PXGridColumn>
        </AddItem>
    </Children>
</PXGridLevel>

```

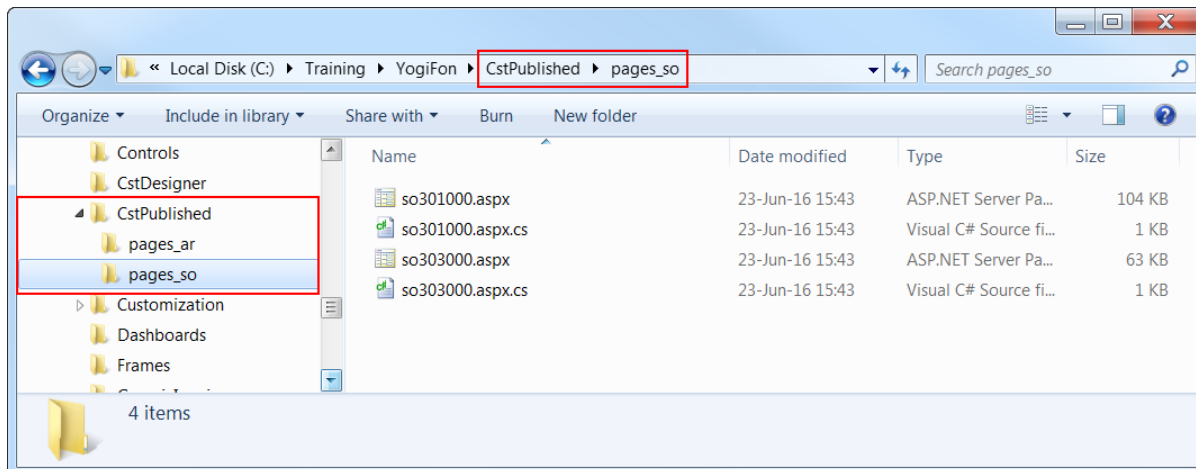
In the XML code above, note that the `<Prop>` tag is used to set the `Width` property of the column to `160`.

With the Screen Editor, you can customize any object in the ASPX code of an Acumatica ERP form and save the resulting changeset to the customization project. To apply the customization to the website, you have to publish the project.

For example, at the publication process, the platform transforms the XML code fragment above to the following fragment of ASPX code.

```
<px:PXGridColumn DataField="UsrSIMCardID" Width="160" />
```

During the publication of the project, the platform applies the XML changeset to the appropriate form to create a customized version of the `.aspx` file with the same name in the `pages_xx` subfolder of the `CstPublished` folder of the website. If the form ID contains the `SO` prefix, the customized ASPX code is located in the `\CstPublished\pages_so` folder, as the following screenshot shows.



**Figure: Viewing the files with customized ASPX code in the CstPublished folder**

After the project has been published, when Acumatica ERP has to display a form, first it tries to find the `.aspx` file of the form in the `CstPublished` folder. If it finds it, Acumatica ERP opens the customized version of the form instead of the original one.

Any customization of Acumatica ERP can be unpublished. If you unpublish a form customization, the platform deletes the corresponding file in the `CstPublished` folder of the website.

## Changes in the Application Code (C#)

In this section, you can find information about the customization of the application functionality, which is provided by the application business logic (implemented in C# code) of data access classes and business logic controllers.

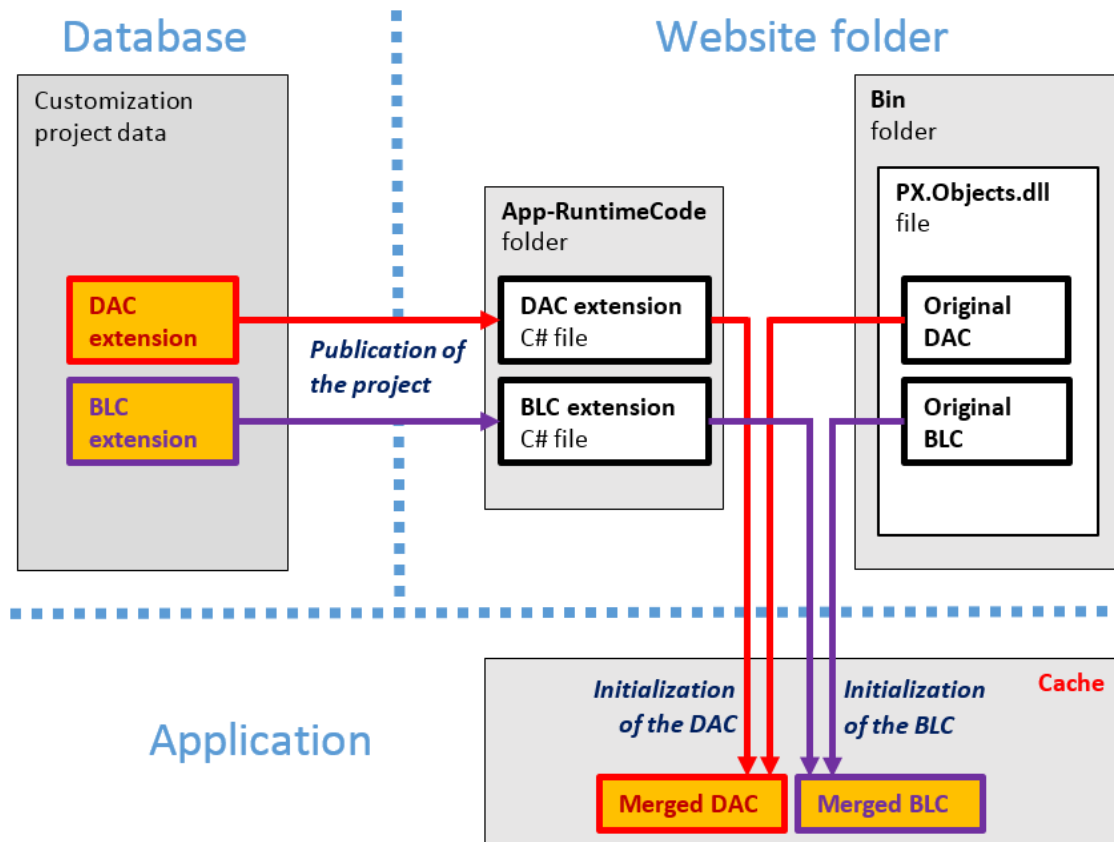
### BLC and DAC Extensions

To give you the ability to customize the functionality or behavior of a form, the Acumatica Customization Platform uses technology based on extension models. When you are resolving a typical

customization task, you generally create extensions for original data access classes and business logic controllers.

An extension for a business logic controller (BLC, also referred to as *graph*) or a data access class (DAC) is a class derived from a generic class defined in the `PX.Data` assembly of Acumatica ERP. To declare an extension for a DAC, you derive a class from the `PXCacheExtension<T>` generic class. To declare an extension of a BLC, you derive a class from the `PXGraphExtension<T>` generic class.

If you have created an extension for a BLC or DAC in a customization project and published the project, the platform applies the extension to the base class at run time. During publication of the project, all the code extensions created for an instance of Acumatica ERP in the project are saved as C# source code files in the `App_RuntimeCode` folder of the application instance (see the diagram below).



**Figure: Use of DAC and BLC extensions for a customization**

At run time, during the first initialization of a base class, the Acumatica Customization Platform automatically finds the extension for the class and applies the customization by replacing the base class with the merged result of the base class and the extension it found.

When you unpublish all customization projects, the platform deletes all the code files from the `App_RuntimeCode` folder. As a result, the platform has no custom code to merge at run time.

### Multilevel Extensions

The Acumatica Customization Platform supports multilevel extensions, which are required when you develop off-the-shelf software that is distributed in multiple editions. Precompiled extensions provide a measure of protection for your source code and intellectual property.

The figure below illustrates the DAC extension model.

```

> PXCacheExtension<Table>
> PXCacheExtension<Extension1,Table>
> PXCacheExtension<Extension2,Extension1,Table>
> PXCacheExtension<Extension3,Extension2,Extension1,Table>
> PXCacheExtension<Extension4,Extension3,Extension2,Extension1,Table>
> PXCacheExtension<Extension5,Extension4,Extension3,Extension2,Extension1,Table>
> PXCacheExtension<Extension6,Extension5,Extension4,Extension3,Extension2,Extension1,Table>
> PXCacheExtension<Extension7,Extension6,Extension5,Extension4,Extension3,Extension2,Extension1,Table>
> PXCacheExtension<Extension8,Extension7,Extension6,Extension5,Extension4,Extension3,Extension2,Extension1,Table>
> PXCacheExtension<Extension9,Extension8,Extension7,Extension6,Extension5,Extension4,Extension3,Extension2,Extension1,Table>
> PXCacheExtensionAttribute

```

**Figure: DAC extension levels**

The figure below illustrates the BLC extension model.

```

> PXGraphExtension<Graph>
> PXGraphExtension<Extension1,Graph>
> PXGraphExtension<Extension2,Extension1,Graph>
> PXGraphExtension<Extension3,Extension2,Extension1,Graph>
> PXGraphExtension<Extension4,Extension3,Extension2,Extension1,Graph>
> PXGraphExtension<Extension5,Extension4,Extension3,Extension2,Extension1,Graph>
> PXGraphExtension<Extension6,Extension5,Extension4,Extension3,Extension2,Extension1,Graph>
> PXGraphExtension<Extension7,Extension6,Extension5,Extension4,Extension3,Extension2,Extension1,Graph>
> PXGraphExtension<Extension8,Extension7,Extension6,Extension5,Extension4,Extension3,Extension2,Extension1,Graph>
> PXGraphExtension<Extension9,Extension8,Extension7,Extension6,Extension5,Extension4,Extension3,Extension2,Extension1,Graph>

```

**Figure: BLC extension levels**

The platform can be used to customize the end production application. You can use multilevel extensions to develop applications that extend the functionality of Acumatica ERP or other software based on Acumatica Framework in multiple markets. You may have a base extension that contains the solution common to all markets as well as multiple market-specific extensions. Every market-specific solution is deployed along with the base extension. Moreover, you can later customize deployed extensions for the end user by using DAC and BLC extensions.



: When extensions can be deployed separately, the application developer should use multiple extension levels. Otherwise, we recommend using a single extension level.

### The Order in Which Extensions Are Loaded

For each DAC or graph type, the system loads and applies extensions at run time as follows:

1. The system collects extensions for the DAC or graph type.
2. The system sorts the list of extensions in alphabetical order.
3. If there is a subscriber to the `PX.Data.PXBuildManager.SortExtensions` event, the system passes the list of extensions in alphabetical order to this subscriber, which can sort extensions in a custom way. A sample implementation of the subscriber is shown in the following code.



: Make sure you use a stable sorting method as the following example does.

```

using System;
using System.Collections.Generic;
using System.Linq;
using System.Web.Compilation;
using Autofac;

```

```

using PX.Data.DependencyInjection;

namespace MyLib
{
    public class ServiceRegistration : Module
    {
        protected override void Load(ContainerBuilder builder)
        {
            builder.ActivateOnApplicationStart<ExtensionSorting>();
        }
        private class ExtensionSorting
        {
            private static readonly Dictionary<Type, int> _order = new
            Dictionary<Type, int>
            {
                { typeof(MultiCurrency), 4 },
                { typeof(SalesPrice), 3 },
                { typeof(Discount), 2 },
                { typeof(SalesTax), 1 },

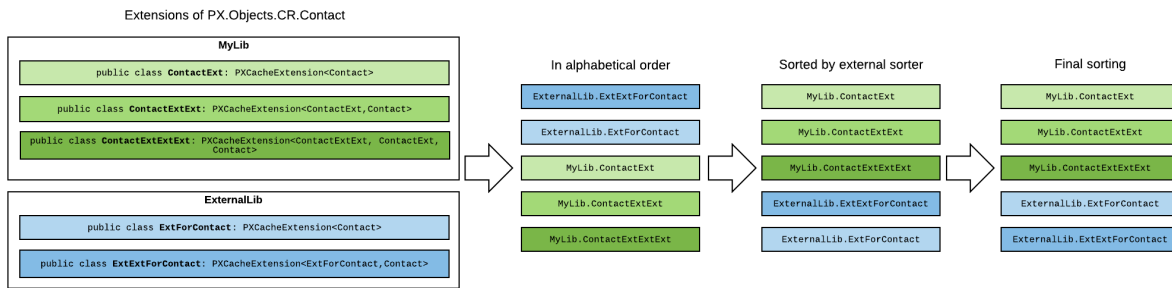
                { typeof(MyGraphExt1), -1 },
                { typeof(MyGraphExt2), -2 },
            };

            public ExtensionSorting()
            {
                PXBuildManager.SortExtensions += StableSort;
            }
            private static void StableSort(List<Type> list)
            {
                if (list?.Count > 1)
                {
                    var stableSortedList = list.OrderByDescending(item =>
                        _order.ContainsKey(item) ? _order[item] : 0).ToList();
                    list.Clear();
                    list.AddRange(stableSortedList);
                }
            }
        }
    }
}

```

4. The system changes the order of dependent extensions (such as `Dac1Ext: PXCacheExtension<Dac1>` and `Dac1ExtExt: PXCacheExtension<Dac1Ext, Dac1>`) so that the higher-level extensions have higher priorities during the merge operation.

Suppose that the website folder contains five extensions of the `Contact` DAC that are available in the `MyLib` and `ExternalLib` namespaces, and the customization project includes an external sorter, which sorts the extensions in a custom way. The following diagram shows how these extensions are sorted. As a result of the sorting in this example, the first extension that is applied is `MyLib.ContactExt`. The `ExternalLib.ExtExtForContact` class has the highest priority during the merge operation.



**Figure: Extension sorting**

## In This Section

- [DAC Extensions](#)
- [Graph Extensions](#)
- [Run-Time Compilation](#)
- [Extension Library](#)

## DAC Extensions

This topic explores the ways provided by the Acumatica Customization Platform to define data access class (DAC) extensions of different levels and shows how different DAC extensions can interact.

To declare a DAC extension, you derive a class from `PXCacheExtension<T>`.

### First-Level DAC Extension

The example below shows a declaration of a first-level DAC extension.

```
class BaseDACExtension : PXCacheExtension<BaseDAC>
{
    public void SomeMethod()
    {
        BaseDAC dac = Base;
    }
}
```

The extension class includes the read-only `Base` property, which returns an instance of the base DAC.

### Second-Level DAC Extension

The example below shows a declaration of a second-level DAC extension.

```
class BaseDACExtensionOnExtension :
    PXCacheExtension<BaseDACExtension, BaseDAC>
{
    public void SomeMethod()
    {
        BaseDAC dac = Base;
        BaseDACExtension dacExt = Base1;
    }
}
```

The extension class includes the following:

- The read-only `Base` property, which returns the instance of the base DAC



- The read-only `Base1` property, which returns the instance of the first-level DAC extension

## Two Variants of a Higher-Level DAC Extension

A definition of an extension of a higher level has two possible variants. In the first variant, you derive the extension class from the `PXCacheExtension` generic class with two type parameters, where the first type parameter is set to an extension of the previous level. In the second variant, you derive the extension class from the `PXCacheExtension` generic class with the same number of type parameters as the level of the extension of the new class. In this case, you set type parameters to extension classes from all lower extension levels, from the previous level down to the base class.

### First Variant of a Higher-Level DAC Extension

The example below shows the declaration of a third- or higher-level DAC extension that derives from the `PXCacheExtension` generic class with two type parameters.

```
class BaseDACMultiExtensionOnExtension :
    PXCacheExtension<BaseDACExtensionOnExtension, BaseDAC>
{
    public void SomeMethod()
    {
        BaseDAC dac = Base;
        BaseDACExtensionOnExtension dacExtOnExt = Base1;
    }
}
```

An extension class defined this way includes the following:

- The read-only `Base` property, which returns the instance of the base DAC
- The read-only `Base1` property, which returns the instance of the DAC extension from the previous level

### Second Variant of a Higher-Level DAC Extension

The example below shows a declaration of a third- or higher-level DAC extension that derives from the `PXCacheExtension` generic class with three or more type parameters.

```
class BaseDACAdvMultiExtensionOnExtension :
    PXCacheExtension<BaseDACExtensionOnExtension, BaseDACExtension, BaseDAC>
{
    public void SomeMethod()
    {
        BaseDAC dac = Base;
        BaseDACExtension dacExt = Base1;
        BaseDACExtensionOnExtension dacExtOnExt = Base2;
    }
}
```

An extension class defined in this way includes the following:

- The read-only `Base` property, which returns the instance of the base DAC
- The read-only `BaseN` properties for all extension levels below the current level, where *N* is the sequence number of an extension level

## Attributes Hierarchy of a DAC Field

Conceptually, a DAC extension is a substitution of the base DAC. The base DAC is replaced at run time with the merged result of the base DAC and every extension discovered.

Each extension on another extension completely overrides the DAC field attributes. The attributes declared on the highest-level extension override all previously declared attributes.

For example, suppose that the attributes of the same DAC field are defined on different extension levels as follows:

- In the base DAC, as shown below

```
[PXUIField(DisplayName = "Base Name")]
[PXDefault("Default base value")]
```

- In the first-level DAC extension, as the following code shows

```
[PXUIField(DisplayName = "Level1 Name", Visible = false)]
```

- In the second-level DAC extension, as shown below

```
[PXUIField(DisplayName = "Level2 Name")]
[PXDefault("Default 2nd level value")]
```

If all the extensions are applied, any field of the second-level DAC extension will have the following parameters specified by attributes:

- Display name: *Level2 Name*
- Visible: *true*
- Default value: *Default 2nd level value*



: You cannot modify the same member of the base DAC in the DAC extensions of the same level. You should use DAC extensions of different levels that successively extend one another.

## DAC Field Read and Write Operations

The Acumatica Framework can access the value of a DAC field only through an instance of the base DAC. The instance of the DAC extension is used to get the field value only when the field is declared in the extension and is not present in the base DAC.

To assign a value to a field, the application developer should use the instance of the base DAC. You must use the instance of a DAC extension to assign a field value when the field is declared within the extension and is not present in the base DAC.

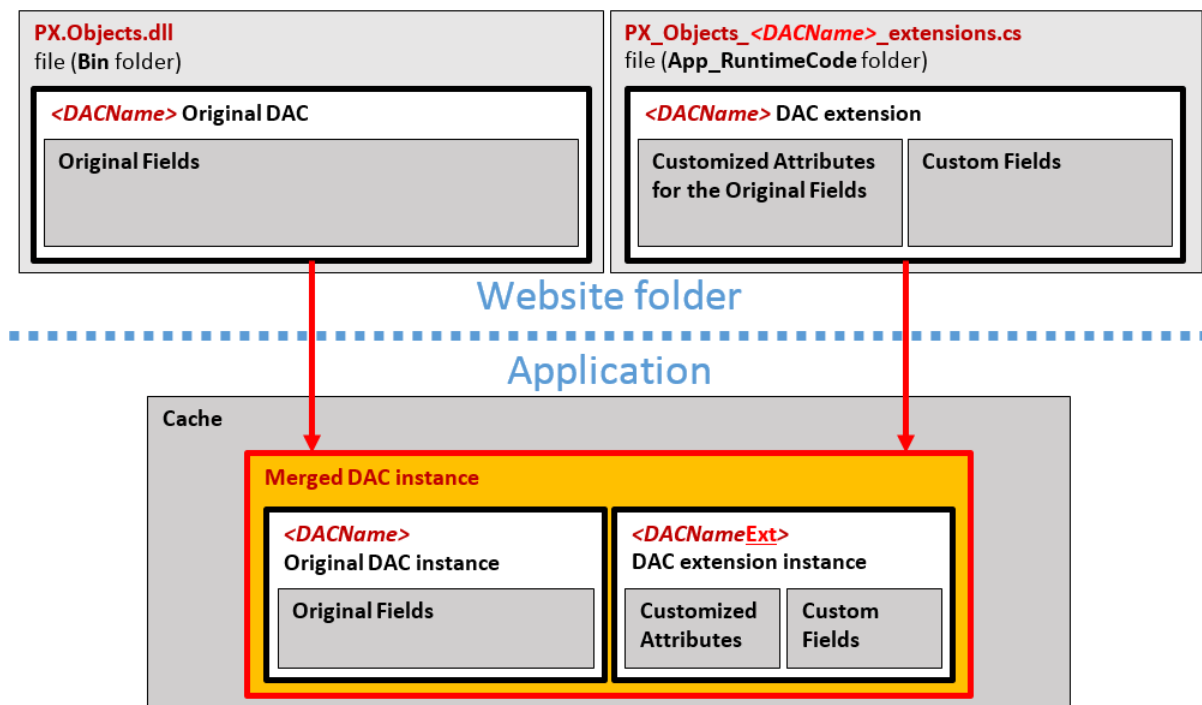
### In This Section

- [Access to a Custom Field](#)
- [Customization of Field Attributes in DAC Extensions](#)
- [Supported DAC Extension Formats](#)

### Access to a Custom Field

You can customize a data access class (DAC) in either of the following ways (see the diagram below):

- By altering the attributes of existing fields. You can use an altered field just as you would any other existing field.
- By declaring new (custom) fields.



**Figure: Analyzing the content of the merged DAC instance in the cache object**

Every custom field is declared within the code of a DAC extension; therefore, at run time, the custom field is accessible only through the DAC extension instance of the cache object.

You can access a custom field:

- [From a Method](#)
- [From a BQL Statement](#)
- [From a Field Attribute](#)

#### *From a Method*

You can access the extension instance through the base (original) DAC object by using one of the following generic methods:

- The `GetExtension<T>(object)` static generic method of the `PXCache<T>` generic class
- The `GetExtension<T>(object)` static generic method declared within the non-generic `PXCache` class



: There are no differences between these generic methods. You can use either one.

For example, you might access an instance of a DAC extension as follows. This example uses the `row` instance of the base DAC to retrieve the `rowExt` DAC extension object.

```
DACNameExt rowExt = PXCache<DACName>.GetExtension<DACNameExt>(row);
```

To access a custom field, use the instance of a DAC extension that contains the field as follows. The code below illustrates the use of the `GetExtension<T>(object)` static generic method of the `PXCache<T>` generic class to access an instance of a DAC extension used to access a custom field.

```
var fieldValue = PXCache<DACName>.GetExtension<DACNameExt>(row).UsrFieldName;
```

You can retrieve a DAC extension object or particular field from it by using the methods of `PXCache`, as shown in the code below. This code demonstrates how you can access a field by using the `GetExtension<>` method.

```
//Access to the field through the GetExtension<> method
//localCategory gets the value of the usrLocalTaxCategoryID custom field
//defined in the InventoryItemExtension DAC extension for the InventoryItem class
protected void InventoryItem_RowUpdating(PXCache sender, PXRowUpdatingEventArgs e)
{
    InventoryItem row = e.NewRow as InventoryItem;
    InventoryItemExtension rowExt =
    sender.GetExtension<InventoryItemExtension>(row);
    string localCategory = rowExt.UsrLocalTaxCategoryID;
    ...
}
```

In event handlers, you can also use the `GetValue()` and `GetValueExt()` methods to access the custom field by its string name, as the code below shows.

```
//Access to the field through the GetValue() method
//localCategory gets the value of the usrLocalTaxCategoryID custom field
//defined in a DAC extension for the InventoryItem class
protected void InventoryItem_RowUpdating(PXCache sender, PXRowUpdatingEventArgs e)
{
    InventoryItem row = e.NewRow as InventoryItem;
    string localCategory = (string)sender.GetValue(row, "usrLocalTaxCategoryID");
    ...
}
```

For custom fields defined in DAC extensions, you can also use other methods of `PXCache` classes, such as `SetValue()` and `SetDefaultExt()`. For more information, see the `PXCache<Table>` class in the API Reference Documentation of Acumatica Framework.

You can refer to the custom field by its BQL name in any methods of Acumatica Framework. The example below shows how you can refer to the field in the `SetEnabled<T>()` method of the `PXUIFieldAttribute` that you can use to configure the UI representation of the field at run time. For more information on available classes and their methods, see the API Reference Documentation of Acumatica Framework.

```
//The usrLocalTaxCategoryID custom field is defined
//in the InventoryItemExtension DAC extension for the InventoryItem class
protected void InventoryItem_RowSelected(PXCache sender, PXRowSelectedEventArgs e)
{
    InventoryItem row = e.Row as InventoryItem;

    PXUIFieldAttribute.SetEnabled<InventoryItemExtension.usrLocalTaxCategoryID>(sender,
    row, true);
    ...
}
```

#### *From a BQL Statement*

In BQL expressions, you have to refer to the custom field by its BQL name in the extension class.

For example, after you have added the `UsrSearchKeywords` field to the `InventoryItemExtension` class, which is a DAC extension for the `InventoryItem` class, the field is accessible in BQL, as shown in the code below.

```
//The usrLocalTaxCategoryID custom field is defined
//in the InventoryItemExtension DAC extension for the InventoryItem class
PXSelect<InventoryItemExtension,
    Where<InventoryItemExtension.usrLocalTaxCategoryID, IsNotNull>>
```

#### *From a Field Attribute*

In DAC extensions, you have to refer to a custom field by its BQL name.

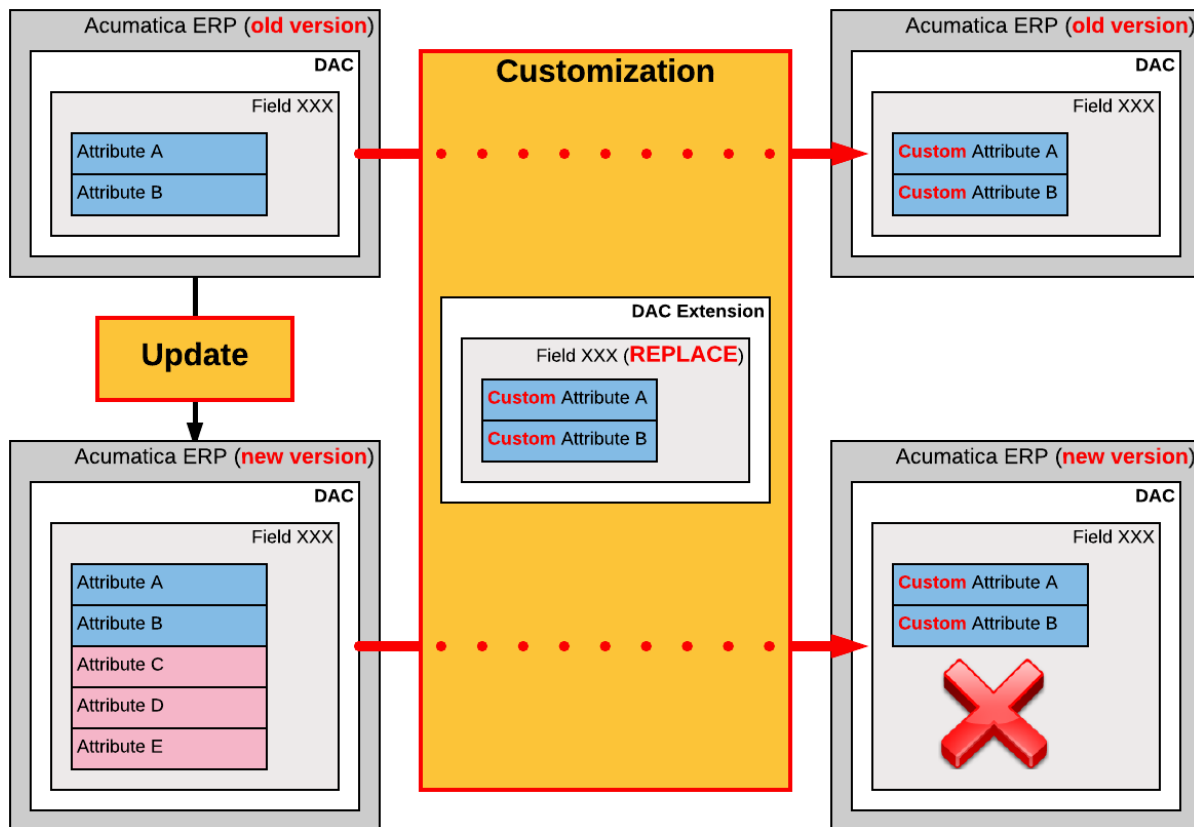
After you have added the `usrSearchKeywords` field to the `InventoryItemExtension` class, which is a DAC extension for the `InventoryItem` class, the field is accessible in other DAC extensions.

For example, if you need to specify the type of the custom DAC field. For example, in attributes, you can use the `typeof` operator, as shown in the code below.

```
//The usrLocalTaxCategoryID custom field is defined
//in the InventoryItemExtension DAC extension for the InventoryItem class
[PXSelector(typeof(InventoryItemExtension.usrLocalTaxCategoryID))]
```

### Customization of Field Attributes in DAC Extensions

If you have a customization that replaces the original attributes of a field with custom attributes, after you upgrade Acumatica ERP to a new version, new functionality may become unavailable, as the following diagram shows.



**Figure: Possible result of using the Replace (default) method to customize the attributes of a DAC field**

To address this issue, the customization framework provides advanced possibilities for you to control the field customization by using additional attributes in the DAC extension.

When you customize Acumatica ERP, you can specify how the system should apply the original and custom attributes to the field. Thus, you can make the customizations more flexible and use the collections of original attributes that could be updated between Acumatica ERP versions.

To specify the way the system should apply the field attributes in a DAC extension, you can use the following attributes.

Attribute	Description
<a href="#"><i>PXMergeAttributes</i></a>	Specifies how to apply custom attributes to the existing ones.
<a href="#"><i>PXRemoveBaseAttribute</i></a>	Removes the specified existing attribute.

Attribute	Description
<a href="#"><i>PXCustomizeBaseAttribute</i></a>	Defines a new value for the specified attribute parameter.
<a href="#"><i>PXCustomizeSelectorColumns</i></a>	Defines the new set and order of the columns in the selector.

### Application Order of the Custom Attributes

The customization attributes described above should be declared in the following order:

1. [\*PXCustomizeBaseAttribute\*](#)
2. [\*PXRemoveBaseAttribute\*](#)
3. [\*PXMergeAttributes\*](#)




: The [\*PXCustomizeSelectorColumns\*](#) works independently and can be declared in any place of the attribute section.


For details on how to customize field attributes for a particular screen, see the [Overriding Attributes of a DAC field in the Graph](#) topic.

### Supported DAC Extension Formats

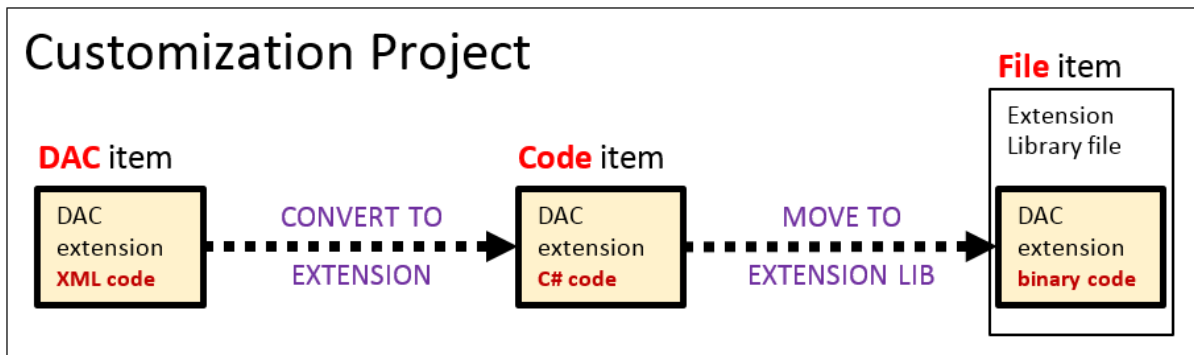
You can keep a DAC customization in a customization project in any of the following ways:

- As a *DAC* item of a customization project in XML format. When you publish the project, the platform creates the DAC extension source code and saves the code in the `<DACItemName>_extensions.cs` file in the `App_RuntimeCode` folder of the website.  
 : The system creates the file name based on the item name by replacing all symbols except letters and digits with the `_` symbol and adding the `_extensions` suffix. For example, the extension code file for the `PX.Objects.CR.Contact` DAC item has the name `PX_Objects_CR_Contact_extensions.cs`.
- As a *Code* item of a customization project that is the C# code of the DAC extension wrapped in XML format. When you publish the project, the platform saves the code in the `<CodeItemName>.cs` file in the `App_RuntimeCode` folder of the website.
- As a `.dll` file of the extension library in the `Bin` folder of the website. The library contains the binary code of the DAC extension. To deploy the extension library to the production environment along with a customization project, you include the extension library in the project as a *File* item. See [Extension Library](#) for details.

By using the [Customization Project Editor](#), you can:

- Convert a *DAC* item to a *Code* item.  
 : The system creates the *Code* name based on the *DAC* item name by using the last word of the name and adding the *Extensions* suffix. For example, the `PX.Objects.CR.Contact` DAC item is converted to the `ContactExtensions` *Code* item.
- Move a *Code* item to the extension library included in the customization project as a *File* item.

If you have a customized data access class that is added to the project as a *DAC* item, then you can click **Convert to Extension** on the page toolbar of the Customized Data Classes page to convert the class changes into the class extension code used to complete the extension development in either the Code Editor or Microsoft Visual Studio (see the diagram below).



**Figure: Converting the code format of a DAC extension in a customization project**

For a *Code* item included in a customization project, if you want to move the code to an extension library to compile it into a .dll file, you can click the **Move to Extension Lib** button on the page toolbar of the [Code Editor](#). After the operation is complete, the *Code* item that is currently displayed in the work area of the Code Editor is removed from the customization project. The file with the same source code is appended to the extension library that is bound to the customization project. If the *Code* item name was `CodeItemName`, the name of the created file will be `CodeItemName.cs`.

## Graph Extensions

This topic explores the ways provided by the Acumatica Customization Platform to define business logic controller (BLC, also referred as *graph*) extensions of different levels, and shows how different BLC extensions can interact.

To declare an extension of a BLC, you derive a class from `PXGraphExtension<T>`.

### First-Level BLC Extension

The example below shows a declaration of a first-level BLC extension.

```
class BaseBLCEExtension : PXGraphExtension<BaseBLC>
{
    public void SomeMethod()
    {
        BaseBLC baseBLC = Base;
    }
}
```

The extension class includes the read-only `Base` property, which returns an instance of the base BLC.

### Second-Level BLC Extension

The example below shows a declaration of a second-level BLC extension.

```
class BaseBLCEExtensionOnExtension :
    PXGraphExtension<BaseBLCEExtension, BaseBLC>
{
    public void SomeMethod()
    {
        BaseBLC baseBLC = Base;
        BaseBLCEExtension ext = Base1;
    }
}
```

The extension class includes the following:

- The read-only `Base` property, which returns the instance of the base BLC
- The read-only `Base1` property, which returns the instance of the first-level BLC extension

## Two Variants of a Higher-Level BLC Extension

A definition of a higher-level BLC extension has two possible variants. In the first variant, you derive the extension class from the `PXGraphExtension` generic class with two type parameters, where the first type parameter is set to an extension of the previous level. In the second variant, you derive the extension class from the `PXGraphExtension` generic class with the same number of type parameters as the level of the extension of the new class. In this case, you set type parameters to extension classes from all lower extension levels, from the previous level down to the base class.

### First Variant of a Higher-Level BLC Extension

The example below shows a declaration of a third- or higher-level BLC extension that is derived from the `PXGraphExtension` generic class with two type parameters.

```
class BaseBLCMultiExtensionOnExtension :
    PXGraphExtension<BaseBLCExtensionOnExtension, BaseBLC>
{
    public void SomeMethod()
    {
        BaseBLC BLC = Base;
        BaseBLCExtensionOnExtension prevExt = Base1;
    }
}
```

An extension class defined in this way includes the following:

- The read-only `Base` property, which returns the instance of the base BLC
- The read-only `Base1` property, which returns the instance of the BLC extension from the previous level

### Second Variant of a Higher-Level BLC Extension

The example below shows a declaration of a third- or higher-level BLC extension that is derived from the `PXGraphExtension` generic class with three or more type parameters.

```
class BaseBLCAdvMultiExtensionOnExtension :
    PXGraphExtension<BaseBLCExtensionOnExtension, BaseBLCExtension, BaseBLC>
{
    public void SomeMethod()
    {
        BaseBLC BLC = Base;
        BaseBLCExtension ext = Base1;
        BaseBLCExtensionOnExtension extOnExt = Base2;
    }
}
```

An extension class defined in this way includes the following:

- The read-only `Base` property, which returns the instance of the base BLC
- The read-only `BaseN` properties for all extension levels below the current level, where *N* is the sequence number of an extension level

Conceptually, a BLC extension is a substitution of the base BLC. The base BLC is replaced at run time with the merged result of the base BLC and every extension the platform found. The higher level of a declaration an extension has, the higher priority it obtains in the merge operation.

## In This Section

- [Event Handlers](#)



- [Customization of a Data View](#)
- [Customization of an Action](#)
- [Override of a Method](#)
- [Overriding Attributes of a DAC field in the Graph](#)

## Event Handlers

The business logic associated with data modifications is implemented through event handlers. Event handlers are methods that are executed when the `PXCache` objects of a particular data access class (DAC) raise data manipulation events.

Every business logic controller (BLC, also referred to as *graph*) instance has a collection of event handlers for each type of data manipulation event. Every collection is filled automatically with event subscribers that are declared within the base (original) BLC and that meet the naming conventions of Acumatica Framework event handlers.

With Acumatica Customization Platform, you can define new event handlers within BLC extensions. You can define an event handler in two possible ways:

- You define the event handler in the same way as it is defined in the base BLC. As a result, the event handler is added to the appropriate event handler collection. Depending on the event type, the event handler is added to either the end of the collection or the start of it. When the event occurs, all event handlers in the collection are executed, from the first to the last one.
- You define the event handler with an additional parameter, which represents the delegate for one of the following:
  - The event handler with an additional parameter from the extension of the previous level, if such an event handler exists.
  - The first item in the collection of event handlers, if no handlers with additional parameters declared within lower-level extensions exist. The collection contains event handlers without the additional parameter from extensions discovered at all levels.

In either case, you can decide whether to invoke the delegate.



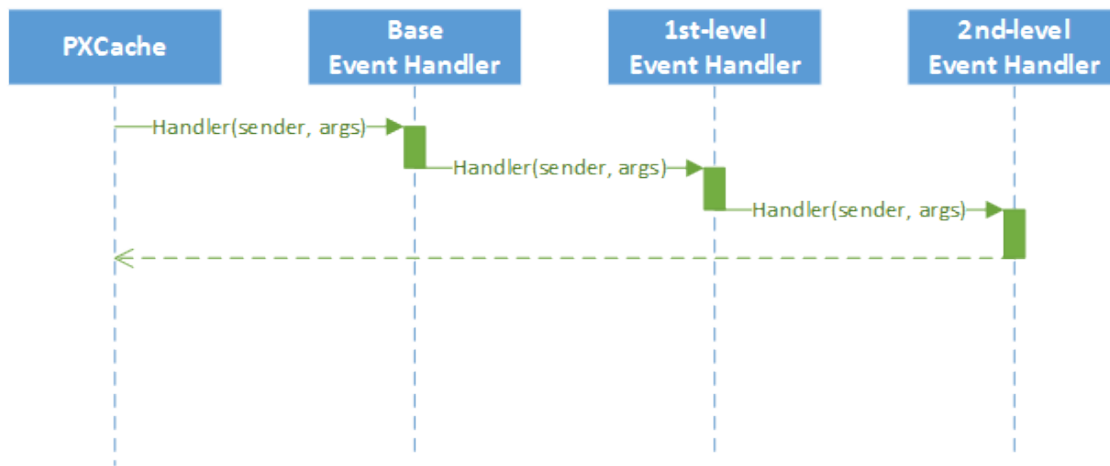
: The `CacheAttached()` event handler declared in the highest-level BLC extension is used to replace base DAC field attributes. Attributes attached to the `CacheAttached()` event handlers within the base BLC or its extensions are attached to the `PXCache` object, each time completely replacing the previous ones, from the base BLC to the highest extension discovered.

## Event Handler Added to the End of the Collection

The following event handlers are added to the end of the collection:

- `FieldUpdated(PXCache sender, PXFieldUpdatedEventArgs e)`
- `RowSelecting(PXCache sender, PXRowSelectingEventArgs e)`
- `RowSelected(PXCache sender, PXRowSelectedEventArgs e)`
- `RowInserted(PXCache sender, PXRowInsertedEventArgs e)`
- `RowUpdated(PXCache sender, PXRowUpdatedEventArgs e)`
- `RowDeleted(PXCache sender, PXRowDeletedEventArgs e)`
- `RowPersisted(PXCache sender, PXRowPersistedEventArgs e)`

The system executes event handlers from the base (original) event handler up to the highest extension level (referred to as the *bubbling strategy*). The lower the BLC extension's level of declaration, the earlier the event subscriber is called. The figure below illustrates this principle.



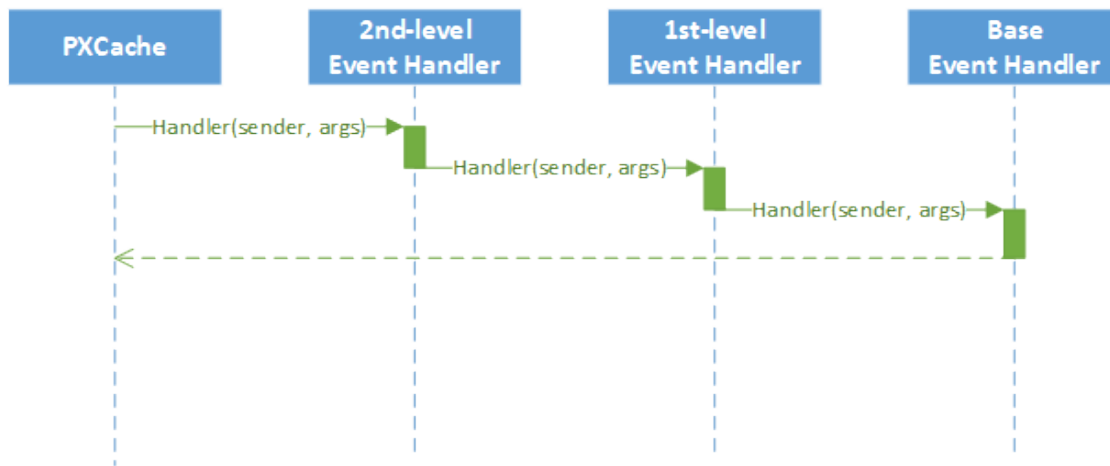
**Figure: Event execution with the bubbling strategy**

### Event Handlers Added to the Beginning of the Collection

The following event handlers are added to the beginning of the collection:

- `FieldSelecting(PXCache sender, PXFieldSelectingEventArgs e)`
- `FieldDefaulting(PXCache sender, PXFieldDefaultingEventArgs e)`
- `FieldUpdating(PXCache sender, PXFieldUpdatingEventArgs e)`
- `FieldVerifying(PXCache sender, PXFieldVerifyingEventArgs e)`
- `RowInserting(PXCache sender, PXRowInsertingEventArgs e)`
- `RowUpdating(PXCache sender, PXRowUpdatingEventArgs e)`
- `RowDeleting(PXCache sender, PXRowDeletingEventArgs e)`
- `RowPersisting(PXCache sender, PXRowPersistingEventArgs e)`
- `CommandPreparing(PXCache sender, PXCommandPreparingEventArgs e)`
- `ExceptionHandling(PXCache sender, PXExceptionHandlingEventArgs e)`

Event handlers are added by the system to the beginning of the collection by using the *tunneling strategy*. The system executes event handlers from the highest extension level down to the base event handler. The higher the BLC extension's level of declaration, the earlier the event subscriber is called. The figure below illustrates this principle.



**Figure: Event execution with the tunneling strategy**

### Event Handlers with an Additional Parameter

The event handler with an additional parameter replaces the base BLC event handler collection. When the event is raised, the system calls the event handler with an additional parameter of the highest-level BLC extension. The system passes a link to the event handler with an additional parameter from the extension of the previous level, if such an event handler exists, or to the first item in the event handler collection. You use a delegate as an additional parameter to encapsulate the appropriate event handler.

The Acumatica Framework provides the following delegates to encapsulate event handlers:

- `PXFieldSelecting(PXCache sender, PXFieldSelectingEventArgs e)`
- `PXFieldDefaulting(PXCache sender, PXFieldDefaultingEventArgs e)`
- `PXFieldUpdating(PXCache sender, PXFieldUpdatingEventArgs e)`
- `PXFieldVerifying(PXCache sender, PXFieldVerifyingEventArgs e)`
- `PXFieldUpdated(PXCache sender, PXFieldUpdatedEventArgs e)`
- `PXRowSelecting(PXCache sender, PXRowSelectingEventArgs e)`
- `PXRowSelected(PXCache sender, PXRowSelectedEventArgs e)`
- `PXRowInserting(PXCache sender, PXRowInsertingEventArgs e)`
- `PXRowInserted(PXCache sender, PXRowInsertedEventArgs e)`
- `PXRowUpdating(PXCache sender, PXRowUpdatingEventArgs e)`
- `PXRowUpdated(PXCache sender, PXRowUpdatedEventArgs e)`
- `PXRowDeleting(PXCache sender, PXRowDeletingEventArgs e)`
- `PXRowDeleted(PXCache sender, PXRowDeletedEventArgs e)`
- `PXRowPersisting(PXCache sender, PXRowPersistingEventArgs e)`
- `PXRowPersisted(PXCache sender, PXRowPersistedEventArgs e)`
- `PXCommandPreparing(PXCache sender, PXCommandPreparingEventArgs e)`
- `PXExceptionHandling(PXCache sender, PXExceptionHandlingEventArgs e)`

For example, for the `FieldVerifying` event, the event handler with an additional parameter looks like `FieldVerifying(PXCache sender, PXFieldVerifyingEventArgs e, PXFieldVerifying del)`.

You can execute `del()` to invoke the event handler to which `del` points, or you can decide not to invoke it. When `del()` points to the base BLC event handler collection, its invocation causes the execution of the whole collection. All other event handlers in the collection are invoked sequentially after the first handler is executed.

Suppose that you have declared event handlers as follows.

```
public class BaseBLC : PXGraph<BaseBLC, DAC>
{
    protected void DAC_RowUpdated(PXCache cache, PXRowUpdatedEventArgs e)
    {

    }

    protected void DAC_Field_FieldVerifying(PXCache sender,
PXFieldVerifyingEventArgs e)
    {

    }
}

public class BaseBLCExt : PXGraphExtension<BaseBLC>
{
    protected void DAC_RowUpdated(PXCache cache, PXRowUpdatedEventArgs e)
    {

    }

    protected void DAC_Field_FieldVerifying(PXCache sender,
PXFieldVerifyingEventArgs e)
    {

    }

    protected void DAC_RowUpdated(PXCache cache, PXRowUpdatedEventArgs e,
PXRowUpdated del)
    {
        if (del != null)
            del(sender, e);
    }

    protected void DAC_Field_FieldVerifying(PXCache sender,
PXFieldVerifyingEventArgs e, PXFieldVerifying del)
    {
        if (del != null)
            del(sender, e);
    }
}

public class BaseBLCExtOnExt : PXGraphExtension<BaseBLCExt, BaseBLC>
{
    protected void DAC_RowUpdated(PXCache cache, PXRowUpdatedEventArgs e)
    {

    }

    protected void DAC_Field_FieldVerifying(PXCache sender,
PXFieldVerifyingEventArgs e)
    {

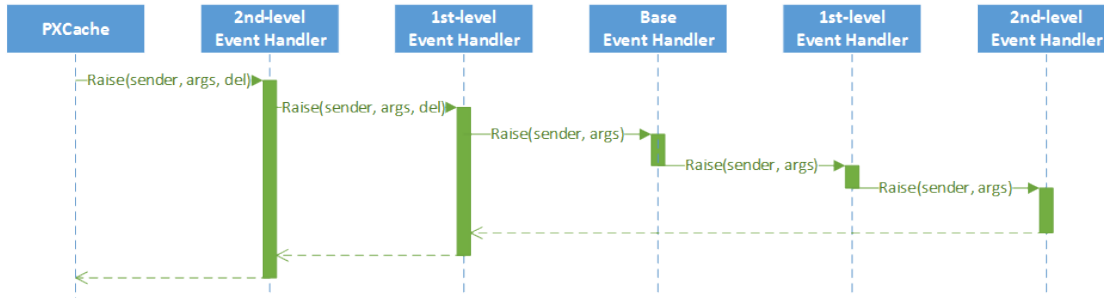
    }

    protected void DAC_RowUpdated(PXCache cache, PXRowUpdatedEventArgs e,
PXRowUpdated del)
    {
        if (del != null)
            del(sender, e);
    }
}
```

```
protected void DAC_Field_FieldVerifying(PXCache sender,
PXFieldVerifyingEventArgs e, PXFieldVerifying del)
{
    if (del != null)
        del(sender, e);
}
}
```

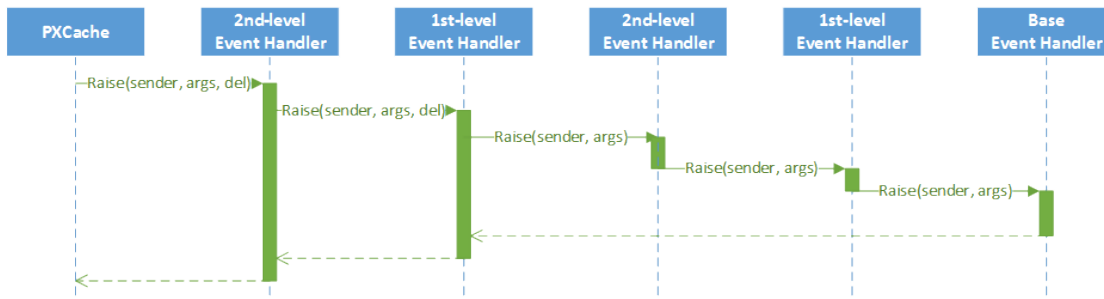
In this case, the `RowUpdated` and `FieldVerifying` event handlers are invoked in the appropriate sequences, explained below.

The following figure illustrates the order in which the `RowUpdated` events are invoked.



**Figure: The order of the `RowUpdated` event handler execution**

The following figure illustrates the order in which the `FieldVerifying` events are invoked.



**Figure: The order of the `FieldVerifying` event handler invocation**

## Customization of a Data View

The platform provides a way to alter or extend the data views defined in a BLC.



: A *data view* is a `PXSelect` BQL expression declared in a BLC for accessing and manipulating data. A data view may contain a delegate, which is an optional graph method that executes when the data view is requested. Every data view is represented by the `PXView` object and placed in the `Views` collection of the appropriate BLC. To construct an instance of the `PXView` class, you use a `PXSelect` BQL expression and an optional delegate from the highest-level extension discovered.

Suppose that you have declared the `Objects` data view within the base BLC, as shown below.

```
public class BaseBLC : PXGraph<BaseBLC, DAC>
{
    public PXSelect<DAC> Objects;
}
```

You can alter a data view within a BLC extension in the following ways:

- By altering the data view within a BLC extension. A data view that is redeclared within a BLC extension replaces the base data view in the *Views* collection of the BLC instance. Consider the following example of a first-level BLC extension.

```
public class BaseBLCExt : PXGraphExtension<BaseBLC>
{
    public PXSelectOrderBy<DAC,
        OrderBy<Asc<DAC.field>>> Objects;
}
```

The *Views* collection of a BLC instance contains the *PXView* object, which uses the *Objects* data view declared within the first-level extension, instead of the data view declared within the base BLC.

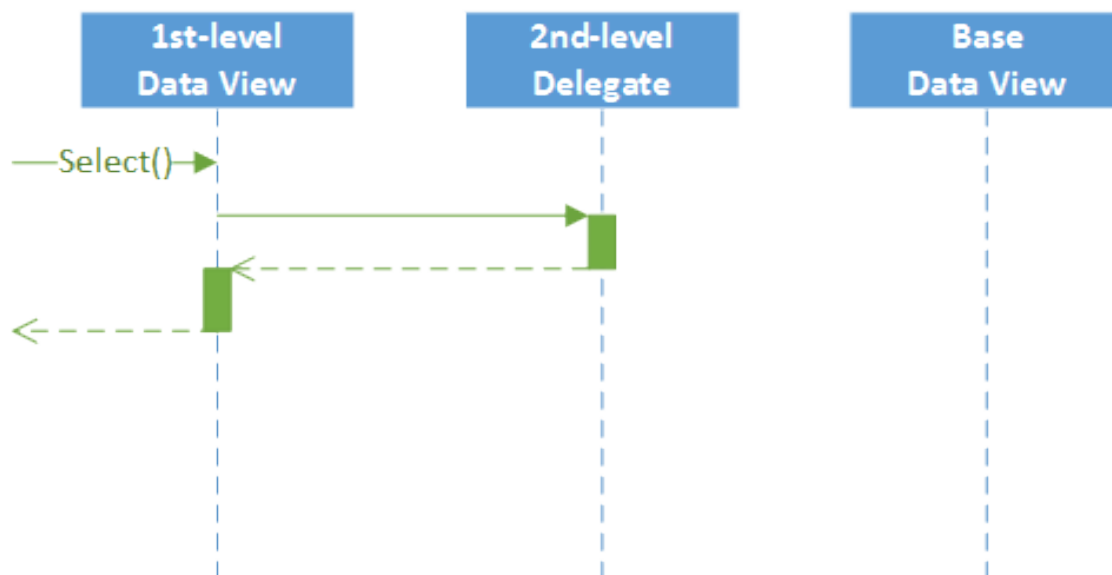


: A data view redeclared within a BLC extension completely replaces the base data view within the *Views* collection of a BLC instance, including all attributes attached to the data view declared within the base BLC. You can either attach the same set of attributes to the data view or completely redeclare the attributes.

- By declaring or altering the data view delegate in a BLC extension. The new delegate is attached to the corresponding data view. Consider the following example of a second-level BLC extension.

```
public class BaseBLCExtOnExt : PXGraphExtension<BaseBLCExt, BaseBLC>
{
    protected IEnumerable objects()
    {
        return PXSelect<DAC>.Select(Base);
    }
}
```

The *Views* collection of a BLC instance contains the *PXView* object, which uses the *Objects* data view declared within the first-level extension, with the *objects()* delegate declared within the second-level extension (see the screenshot below).



**Figure: The interaction among the levels of a BLC extension**

To query a data view declared within the base BLC or a lower-level extension from the data view delegate, you should redeclare the data view within a BLC extension. You do not need to redeclare a data member when it is not meant to be used from the data view delegate. Consider the following example of a second-level BLC extension.

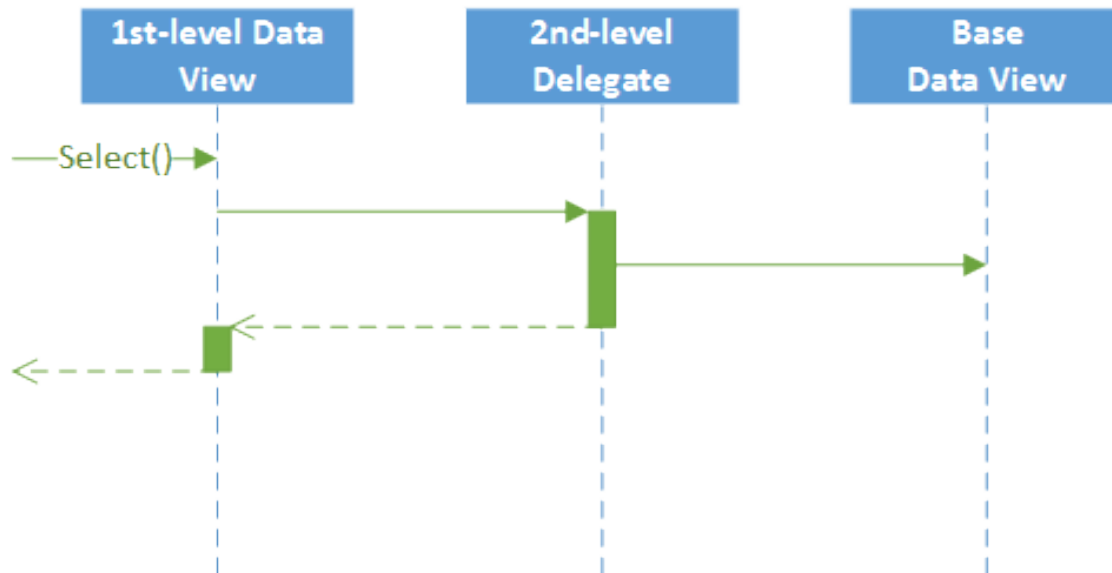
```
public class BaseBLCExtOnExt : PXGraphExtension<BaseBLCExt, BaseBLC>
```

```

{
    protected IEnumerable objects()
    {
        return Base.Objects.Select();
    }
}

```

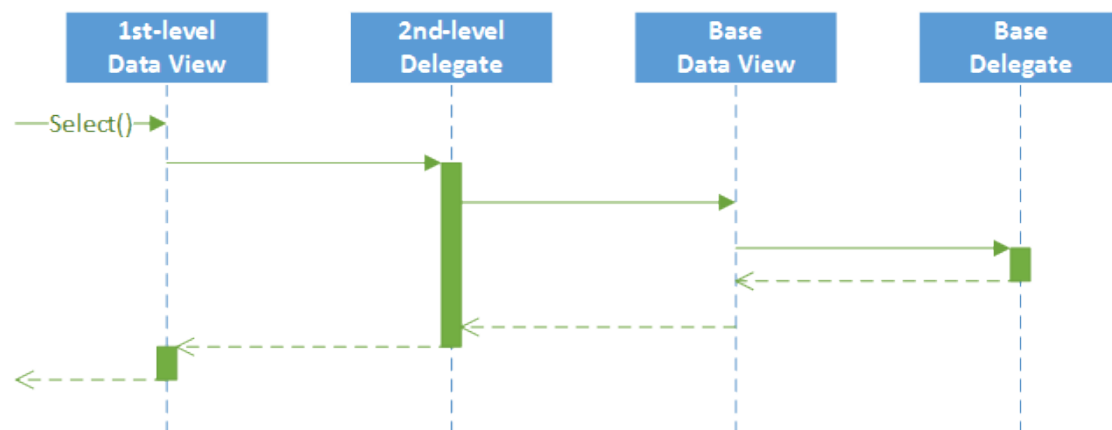
The new delegate queries the data view declared within the base BLC. Having redeclared the data view within the first-level extension, you prevent the data view execution from an infinite loop (see the following screenshot).



**Figure: The view of the base BLC from the second-level delegate**



: If a data view declared within the base BLC contains a delegate, this delegate also gets invoked when the data view is queried from the new delegate (see the following figure).



**Figure: The view with the delegate of the base BLC from the second-level delegate**

### Customization of an Action

The platform provides a way to alter or extend an action defined in a business logic controller (BLC, also referred as *graph*).



: An *action* is a BLC member of the `PXAction` type. An action always has the delegate defined. Every action is represented by the `PXAction` object and placed in the *Actions* collection of the appropriate BLC. To construct an instance of the `PXAction` class, you use a BLC member of the `PXAction` type and a delegate from the highest-level extension discovered.

Suppose that you have declared the `Objects` data view and the `ValidateObjects` action within the base BLC, as shown below.

```
public class BaseBLC : PXGraph<BaseBLC, DAC>
{
    public PXSelect<DAC> Objects;

    public PXAction<DAC> ValidateObjects;
    [PXButton]
    [PXUIField(DisplayName = "Validate Objects")]
    protected virtual void validateObjects()
    {
    }
}
```

You can alter actions within BLC extensions in the following ways:

- By overriding action attributes within a BLC extension.

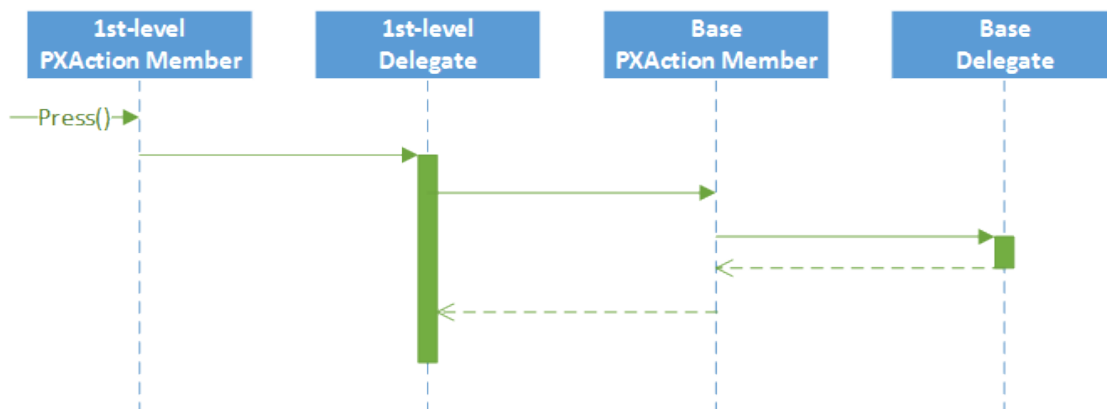
To override action attributes in a BLC extension, you should declare both the BLC member of the `PXAction` type and the delegate. You should attach a new set of attributes to the action delegate. Also, you need to invoke the `Press` method on the base BLC action. Having redeclared the member of `PXAction<>`, you prevent the action delegate execution from an infinite loop. Consider the following example of a first-level BLC extension.

```
public class BaseBLCExt : PXGraphExtension<BaseBLC>
{
    public PXAction<DAC> ValidateObjects;
    [PXButton]
    [PXUIField(DisplayName = "Validate All Objects")]
    protected void validateObjects()
    {
        Base.ValidateObjects.Press();
    }
}
```

The *Actions* collection of a BLC instance contains the `ValidateObjects` action, which consists of the `PXAction` type member and the delegate, both of which were declared within the first-level extension (see the following figure).



: When overriding an action delegate within a BLC extension, you completely redeclare the attributes attached to the action. Every action delegate must have `PXButtonAttribute` (or the derived attribute) and `PXUIFieldAttribute` attached.



**Figure: The interaction among the first-level and base actions**

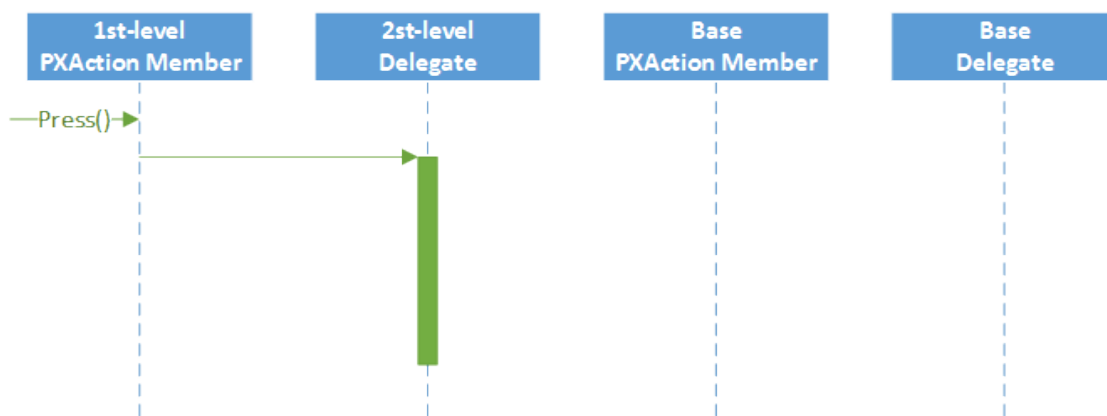
- By overriding the action delegate within the BLC extension.



The new delegate is used by the appropriate action. Consider the following example of a second-level BLC extension.

```
public class BaseBLCExtOnExt : PXGraphExtension<BaseBLCExt, BaseBLC>
{
    [PXButton]
    [PXUIField(DisplayName = "Validate Objects")]
    protected void validateObjects()
    {
    }
}
```

The *Actions* collection of a BLC instance contains the `ValidateObjects` action, which consists of the `PXAction<>` type member declared within the first-level extension and the delegate declared within the second-level extension. To use an action declared within the base BLC or the lower-level extension from the action delegate, you should redeclare the action within a BLC extension. You do not need to redeclare an action when it is not meant to be used from the action delegate.



**Figure: The case when you don't need to redeclare an action**



: To modify the same member of the base BLC or any BLC extension, you should use extensions of higher levels.

### Override of a Method

The platform provides a way to override a method of a BLC.

Suppose that you need to override the `Persist` method of the `BaseBLC` class, which is defined in the code below.

```
public class BaseBLC : PXGraph<BaseBLC>
{
    public virtual void Persist()
    {
        ...
    }
}
```

You can override the method within a BLC extension as follows.

```
public class BaseBLC_Extension : PXGraphExtension<BaseBLC>
{
    public delegate void PersistDelegate();
    [PXOverride]
    public void Persist(PersistDelegate baseMethod)
    {
        ...
    }
}
```

```

        baseMethod();
        ...
    }
}

```

The graph extension should include the declaration of the base method delegate, the `PXOverride` attribute, and the overridden method, which invokes the base method delegate, as the code above shows.

Because the `PXOverride` attribute on the declaration of the method is included in the graph extension, it forces the system to override the original method in the graph instance. Otherwise, the overridden method will never be invoked.

### Overriding Attributes of a DAC field in the Graph

You can override one attribute or multiple attributes of a DAC field for a particular screen without changing the existing behavior of the attribute or attributes for all other screens.

You can do the following to override the attributes of a DAC field:

- Replace the whole set of attributes
- Append an attribute
- Override a single property of an attribute
- Replace one attribute with another

To override attributes, you should declare a `CacheAttached` event handler in the graph that corresponds to the screen for which you want to change the DAC field's behavior. With the declared `CacheAttached` event handler, you use special attributes, depending on what you want to do with the original attributes, as described in the following sections.

### Replacing the Whole Set of Attributes

To override all attributes at once, you should only declare a `CacheAttached` event handler in the graph.

Suppose that the original DAC field attributes are declared as shown in the following code.

```

public class ARInvoice : IBqlTable
{
    [PXDBDecimal(4)]
    [PXDefault(TypeCode.Decimal, "0.0")]
    [PXUIField(DisplayName = "Commission amount")]
    public virtual Decimal? CommAmt
    {
        get;
        set;
    }
}

```

To override a DAC field by using the `CacheAttached` event handler, in the graph corresponding to the screen whose behavior you want to change, declare the `CacheAttached` event handler for the field. The event handler must be named according to the standard conventions for naming graph events that is described in the [Event Handlers](#) topic.

For the `CommAmt` field, the code for the event handler looks like the following.

```

[PXDBDecimal(4)]
[PXDefault(TypeCode.Decimal, "0.0")]
[PXUIField(DisplayName = "Commission Amount")]
[PXAdditionalAttribute(NecessaryProperty = true)]
protected virtual void ARInvoice_CommAmt_CacheAttached(PXCache sender) { }

```

In this example, we added the `PXAdditionalAttribute` to the list of the `CommAmt` field attributes.

The set of attributes on the `CacheAttached` handler redefines the whole set of attributes placed on the specified DAC field. This results in undesired copying of all unmodified attributes, and the DAC and the graph no longer act synchronously. Therefore, we do not recommend using this method unless you intend to override all attributes of a field.

### Appending an Attribute

Acumatica Framework provides a special attribute called [PXMergeAttributesAttribute](#). When placed on a `CacheAttached` event handler for the corresponding DAC field, this attribute allows gives you the ability to reuse the existing attributes of a DAC field.

To append an attribute, you declare the `CacheAttached` event handler with the `PXMergeAttributes` attribute and the new attribute (or attributes), as shown in the following code.

```
[PXMergeAttributes(Method = MergeMethod.Append)]
[PXAdditionalAttribute(NecessaryProperty = true)]
protected virtual void ARInvoice_CommAmt_CacheAttached(PXCache sender) { }
```

This example works similarly to the previous one: It adds the `PXAdditionalAttribute` attribute to the list of the `CommAmt` field attributes, but without code duplication.

### Overriding a Single Property of an Attribute

Acumatica Framework provides a special attribute called [PXCustomizeBaseAttribute](#). When placed on a `CacheAttached` event handler for the corresponding DAC field, this attribute gives you the ability to redefine a single property of an attribute.

For example, suppose that you need to change the UI display name from **Commission Amount** to **Base Currency Commission** for only one screen. The code should look like the following.

```
[PXMergeAttributes(Method = MergeMethod.Append)]
[PXCustomizeBaseAttribute(typeof(PXUIFieldAttribute),
    nameof(PXUIFieldAttribute.DisplayName), "Base Currency Commission")]
protected virtual void ARInvoice_CommAmt_CacheAttached(PXCache sender) { }
```

This example reuses the existing attributes by using the `PXMergeAttributes` attribute and redefines the `PXUIFieldAttribute` attribute by using the `PXCustomizeBaseAttribute` attribute.

### Replacing One Attribute with Another

Acumatica Framework provides a special attribute called [PXRemoveBaseAttribute](#). When placed on a `CacheAttached` event handler for the corresponding DAC field, this attribute gives you the ability to remove the specified attribute.

For example, suppose that you need to replace `PXDefaultAttribute` with `PXDBDefaultAttribute` for only one screen. Further suppose that the original field declaration looks the one shown in the following code.

```
[Site(DisplayName = "Warehouse ID",
    DescriptionField = typeof(INSite.descr))]
[PXDefault(typeof(SOShipment.siteID),
    PersistingCheck = PXPersistingCheck.Nothing)]
public virtual Int32? SiteID { get; set; }
```

Then replacing `PXDefaultAttribute` with `PXDBDefaultAttribute` looks as shown in the following code.

```
[PXMergeAttributes(Method = MergeMethod.Append)]
[PXRemoveBaseAttribute(typeof(PXDefaultAttribute))]
[PXDBDefault(typeof(SOShipment.siteID),
    PersistingCheck = PXPersistingCheck.Nothing)]
protected void SOOrderShipment_SiteID_CacheAttached(PXCache sender) { }
```

In this example, all existing attributes are reused by the `PXMergeAttributes` attribute, the `PXDefaultAttribute` is removed by the `PXRemoveBaseAttribute` attribute, and the new `PXDBDefault` attribute is declared.

### Run-Time Compilation

If you have created an extension for a business logic controller or a data access class in a customization project, during the project publication, the Acumatica Customization Platform stores the code of the class extension in a `.cs` file within the `App_RuntimeCode` folder of the website.

At run time, the platform compiles the code in a separate library that is dynamically merged with the original classes. Run-time compilation is used by default for the code of the *DAC* and *Code* project items. (See [Types of Items in a Customization Project](#) for details.)

Publication of a customization updates the files in the `App_RuntimeCode` folder of the website. Unlike when the `Bin` folder is updated, update of files in the `App_RuntimeCode` folder doesn't cause the application domain to restart. (See [Performing the Publication Process](#) for details.)

### Extension Library

An extension library is a Microsoft Visual Studio project that contains customization code and can be individually developed and tested.

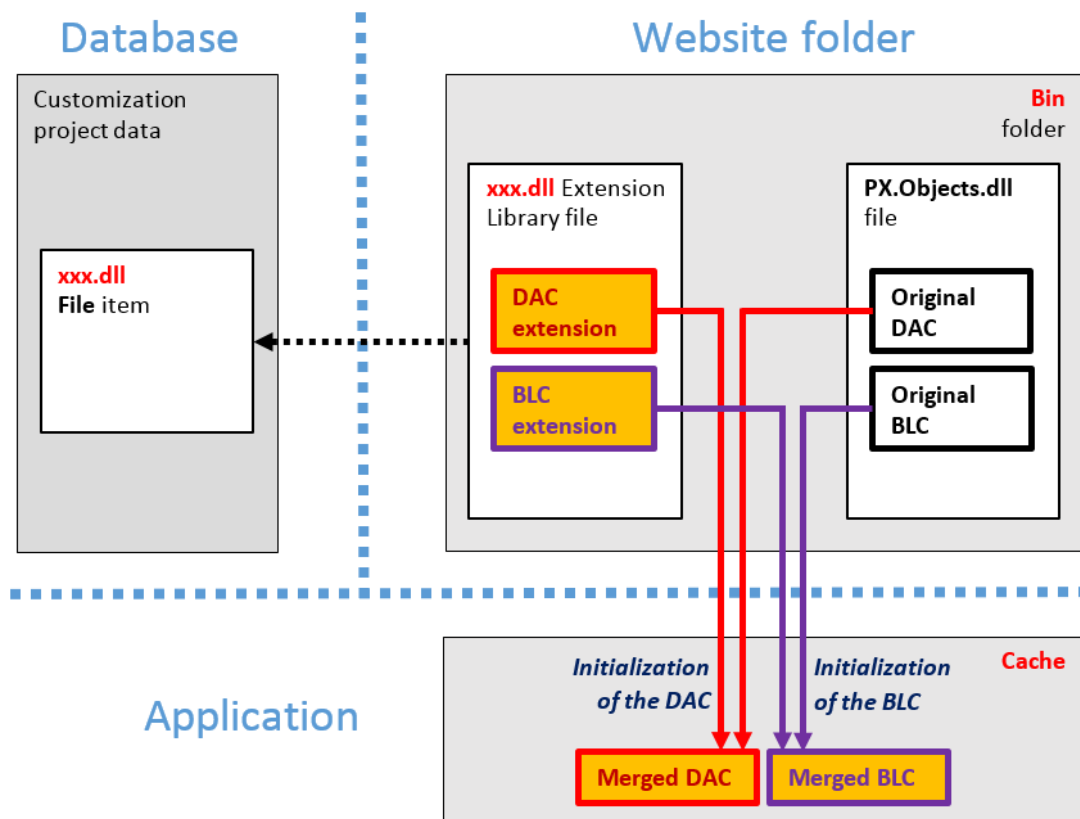
To move your code from your customization project to an extension library, you should first create an extension library and then move desired *Code* and *DAC* items to the extension library. After that you can develop your extension library in Visual Studio. See the following topics for details:

- [To Create an Extension Library](#)
- [To Convert a DAC Item to an Extension Library](#)
- [To Move a Code Item to the Extension Library](#)

If you need to deploy the customization code of an extension library to another system, you have to add the library to a customization project as a *File* item to include it in a customization package. See [To Add a Custom File to a Project](#) for details.

An extension library `.dll` file must be located in the `Bin` folder of the website. At run time during the website initialization, all the `.dll` files of the folder are loaded into the server memory for use by the Acumatica ERP application. Therefore, all the code extensions included in a library are accessible from the application.

During the first initialization of a base class, the Acumatica Customization Platform automatically discovers an extension for the class in the memory and applies the customization by replacing the base class with the merged result of the base class and the extension discovered (see the following diagram).



**Figure: Actual approach to the use of an extension library for a customization**

The use of extension libraries that are precompiled provides a measure of protection for your source code and intellectual property.

### Extension Library (DLL) Versus Code in a Customization Project

While you are developing source code for a customization task, you can either keep the code in the customization project as *DAC* and *Code* items or move the code to an extension library and include the library in the project as a *File* item.

*DAC* and *Code* items are saved in the database, and, if the customization project is published, in the files located in the `App_RuntimeCode` folder of the website. Acumatica Customization Platform compiles all the code located in this folder at run time.

We recommend that you keep the source code in the customization project only if the customization is elementary, such as if the code contains an event handler for a control on a form. When you work with a code item, it is easy to view the code of the applied customization directly in the [Code Editor](#) without Microsoft Visual Studio. However, if you are solving a complex customization task, it is generally better to develop the solution code in an extension library by using Visual Studio.

You can use Visual Studio to develop a *Code* item as well as code in an extension library. But the *IntelliSense* feature in Visual Studio is not available for the source code of a *Code* item if the code either uses custom fields or invokes members of class extensions defined in other *Code* and *DAC* items.

You can later customize deployed extensions for the end user by means of code extensions. Therefore, if the customization is compiled to an extension library, more than one customization can be applied to a single Acumatica ERP form.



: If you have a custom DAC or a DAC extension in one customization and an extension of this custom DAC or a higher-level DAC extension in another customization, a publication of the second customization will fail if the customizations are published in the wrong order. To resolve the issue, convert the DAC extension in the second customization to an extension library. With this approach, no code will be generated during publication, and the order of publication is not important. See [To Convert a DAC Item to an Extension Library](#) for details.

The following table shows the differences in the use of the code in *DAC* and *Code* items and in an extension library.

	Code in <i>DAC</i> and <i>Code</i> items	Code in an Extension Library
Best for:	Quick start of a customization	Development of a customization project when more than one developer is involved
Primary storage:	Database	File system
Location within the website folder:	App_RuntimeCode	Bin
Intellectual property protection:	No—the source code is open in the deployment package	Yes—the source code is not provided in the deployment package
Run-time compilation without the application domain being restarted:	Yes	No
Editor:	<a href="#">Code Editor</a> , Visual Studio	Visual Studio
<i>IntelliSense</i> feature in Visual Studio:	No	Yes
Debugging:	Yes	Yes
Integration with a version control system:	Yes	Yes
Additional:	Can be moved to an extension library when needed	

To make a decision about how to work with the code, you should consider the following questions:

- How much code will be in the customization project?
- Is there a need for replicability of the customization?
- How many developers will take part in coding?
- Do you need to open the source code in the production environment?

We recommend that you use an extension library if any of the following conditions is met:

- You intend to have more than five class extensions for business logic controllers.
- The customization will be deployed on more than one system.
- The customization code will be developed by a team that needs to use a version control system.
- You have a reason to protect the intellectual property of the source code of the solution.

## Changes in the Database Schema

The Acumatica Customization Platform permits the following changes to the database in the scope of a customization project:

- [Creation of custom tables](#)
- [Creation of custom columns in existing tables](#)
- [Creation of views, indexes, and other database objects](#)

### Creation of Custom Tables

We recommend that you create a custom table in the database of your development environment by using a database administration tool, such as SQL Server Management Studio, and then import the table schema from the database to a customization project by using the [Customization Project Editor](#). The project keeps the schema in XML format. While publishing the customization project, the platform

executes a special procedure to create the table by the schema, while meeting all the requirements of Acumatica ERP.

### Creation of Custom Columns in Existing Tables

To create a custom database-bound field, you add a column to the database table and declare the field in the extension of the base (original) DAC.

The new column is appended to the original table by altering the table schema. When you create the database-bound field by using the [Data Class Editor](#), the platform generates the DAC extension code for the new field and adds to the customization project the XML definition of the new column to be created in the database. To be able to create a UI control for the new field to display on a form, you have to publish the project to make the system create the column in the database table and compile the customization code. After the publication, you can add the control for the new field to the form by using the [Screen Editor](#).

### Creation of Views, Indexes, and Other Database Objects

With the platform, you can add to a customization project an SQL script to be executed during the publication of the project. However, we recommend that you avoid doing this.



**Warning:** A possible result of a custom SQL script is the loss of the integrity and consistency of the application data.

If you do add a custom SQL script, you must adhere to the following requirements for the script:

- Because Acumatica ERP supports multitenancy, you must create an SQL script that correctly creates a database object that properly specifies and uses the company mask.
- You must correctly specify the attributes for the script so that the script can be executed on the target database servers: MySQL Server, Microsoft SQL Server, or both. For details about attributes, see [Using the SQL Script Attributes](#).

## Custom Processes During Publication of a Customization

The platform provides you the ability to execute custom processes within the instance of Acumatica ERP at the following times during the publication of a customization project:

- After website files are updated but before the website is restarted
- After the customization has been published and the website is restarted

To implement such processes, you can create a class derived from the `CustomizationPlugin` class, further referred to as the *customization plug-in*, and override one or both of the following methods, which can be invoked at the end of the publication process:

- The `OnPublished()` method is executed right after website files are updated but before the website are restarted. This method is invoked only if run-time compilation is enabled. In a cluster environment, the method is invoked on each cluster node. By using this method, you can update any files within the website except the customization code files located in the `/Bin` folder. For example, you can set up your own UI styles and skins or log-in images.
- The `UpdateDatabase()` method is executed after the customization is published and the website is restarted. In this method, for example, you can already manipulate data in the database by using the business logic implemented in the customization. For example, you can develop source code to import data by using a scenario included in the customization.

In a customization project, you can include multiple classes derived from the `CustomizationPlugin` class.



: The platform does not provide you the ability to set the order of execution of customization plug-ins in a published customization.

For details about how to create a class derived from the `CustomizationPlugin` class, see [To Add a Customization Plug-In to a Project](#).

# Managing Customization Projects

A customization project is a set of changes to the user interface and functionality of Acumatica ERP. A customization project, described more fully in [Customization Project](#), might include the following:

- New custom forms and modifications to existing forms of Acumatica ERP
- Extensions for the business logic
- Custom reports
- Custom application configuration
- Additional files that you need for the customization

In Acumatica ERP, you manage customization projects by means of the [Customization Projects](#) (SM204505) form, which is shown in the screenshot below. (See also [Customization Projects Form](#) for more information.) On this form, you can add a new customization project, open a customization project for editing in the [Customization Project Editor](#), publish any number of customization projects, cancel the publication of customization projects, export a customization project as the deployment package, import a customization project from an existing deployment package, and delete a customization project.

	Published	* Project Name	Level	Screen Names	Description	Created By	Last Modified On
<input type="checkbox"/>	<input type="checkbox"/>	<a href="#">AdvCstAEF</a>		PO301000, PO302000		admin	6/23/2016
<input type="checkbox"/>	<input type="checkbox"/>	<a href="#">AdvUI7</a>		IN202500		admin	6/23/2016
<input type="checkbox"/>	<input type="checkbox"/>	<a href="#">CRMAddOn</a>				admin	6/23/2016
<input type="checkbox"/>	<input type="checkbox"/>	<a href="#">FormActionAEF</a>		SO301000		admin	6/23/2016
<input type="checkbox"/>	<input type="checkbox"/>	<a href="#">GridActionsAEF</a>		CS203000		admin	6/23/2016
<input type="checkbox"/>	<input type="checkbox"/>	<a href="#">KeyWords</a>		IN202500		admin	6/23/2016
<input type="checkbox"/>	<input type="checkbox"/>	<a href="#">PurchaseOrderWizard</a>				admin	6/23/2016
<input type="checkbox"/>	<input type="checkbox"/>	<a href="#">RapidByte</a>				admin	6/23/2016
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<a href="#">YogiFon</a>		AR303000, AR409000, SO301000, SO303000		admin	6/23/2016

**Figure: Viewing the Customization Projects form**



: In MySQL, the maximum size of one packet that can be transmitted to or from a server is 4MB by default. If you use MySQL and want to manage a customization project with the size that is larger than the default maximum value, you have to increase the `max_allowed_packet` variable in the server. The largest possible packet size is 1GB.

## In This Part

- [To Create a New Project](#)
- [To Select an Existing Project](#)
- [To Open a Project](#)
- [To Update a Project](#)
- [To Delete a Project](#)
- [To Export a Project](#)
- [To Import a Project](#)



- [To Replace the Content of a Project from a Package](#)
- [To Merge Multiple Projects](#)
- [To Manipulate Customization Projects from the Code](#)

## To Create a New Project

Because the Acumatica Customization Platform uses a customization project as a container for the customization items, the platform does not permit you to perform any customization without starting a customization project.

You can create a customization project in the following ways:

- [On the Customization Projects form](#)
- [From the \*\*Customization\*\* menu](#)
- [From the Element Inspector](#)

There are no differences between these ways because the result is the same: a new customization project with the specified name is added to the Acumatica ERP instance as a record in the database. The platform can then use this project as a container of customization items.



: Customization project name can contain the following symbols: Latin letters, numbers, dots, underscores, and square brackets. The project name must start with a letter. For example, the name `ISVSolution[18.101.0039][18R1_2018.01.25]` is valid. The names `18R1_ISV` and `R1{ISV}` are not valid.

### Adding a Customization Project on the Customization Projects Form

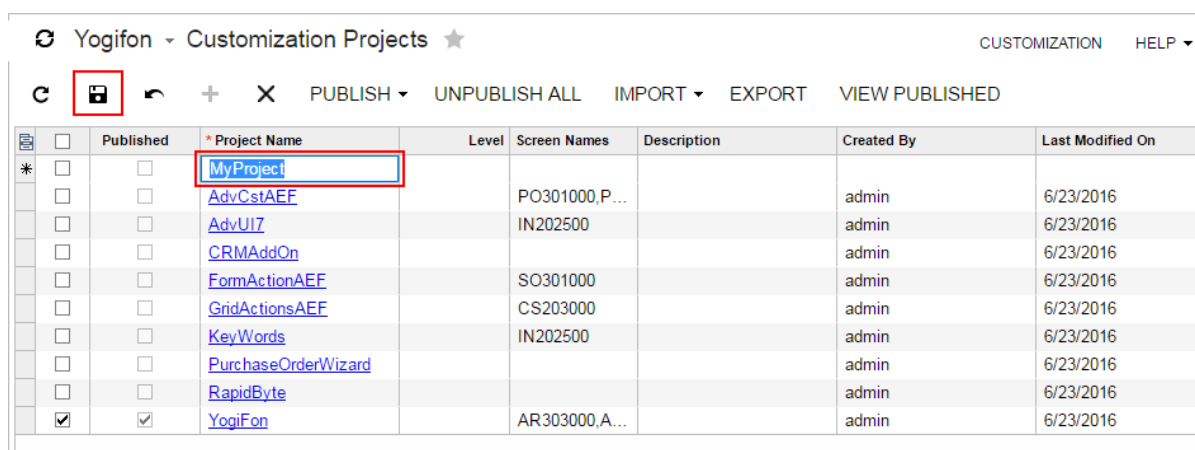
To add a customization project on the [Customization Projects](#) (SM204505) form, perform the following actions:

1. Navigate to **System > Customization > Manage > Customization Projects**.
2. On the form toolbar, click **Add Row (+)**, as shown in the following screenshot, to add a row to the list of the projects on the form.

Publish	Name	Level	Screen Names	Description	Created By	Last Modified On
<input type="checkbox"/>	<a href="#">AdvUI7</a>		IN202500		admin	6/23/2016
<input type="checkbox"/>	<a href="#">CRMAddOn</a>				admin	6/23/2016
<input type="checkbox"/>	<a href="#">FormActionAEF</a>		SO301000		admin	6/23/2016
<input type="checkbox"/>	<a href="#">GridActionsAEF</a>		CS203000		admin	6/23/2016
<input type="checkbox"/>	<a href="#">KeyWords</a>		IN202500		admin	6/23/2016
<input type="checkbox"/>	<a href="#">PurchaseOrderWizard</a>				admin	6/23/2016
<input type="checkbox"/>	<a href="#">RapidByte</a>				admin	6/23/2016
<input checked="" type="checkbox"/>	<a href="#">YogiFon</a>		AR303000,A...		admin	6/23/2016

**Figure: Adding a row to the customization project list**

3. In the new row, specify a unique name for the project, as the screenshot below shows.
4. Click **Save** on the form toolbar to save the new project in the database.



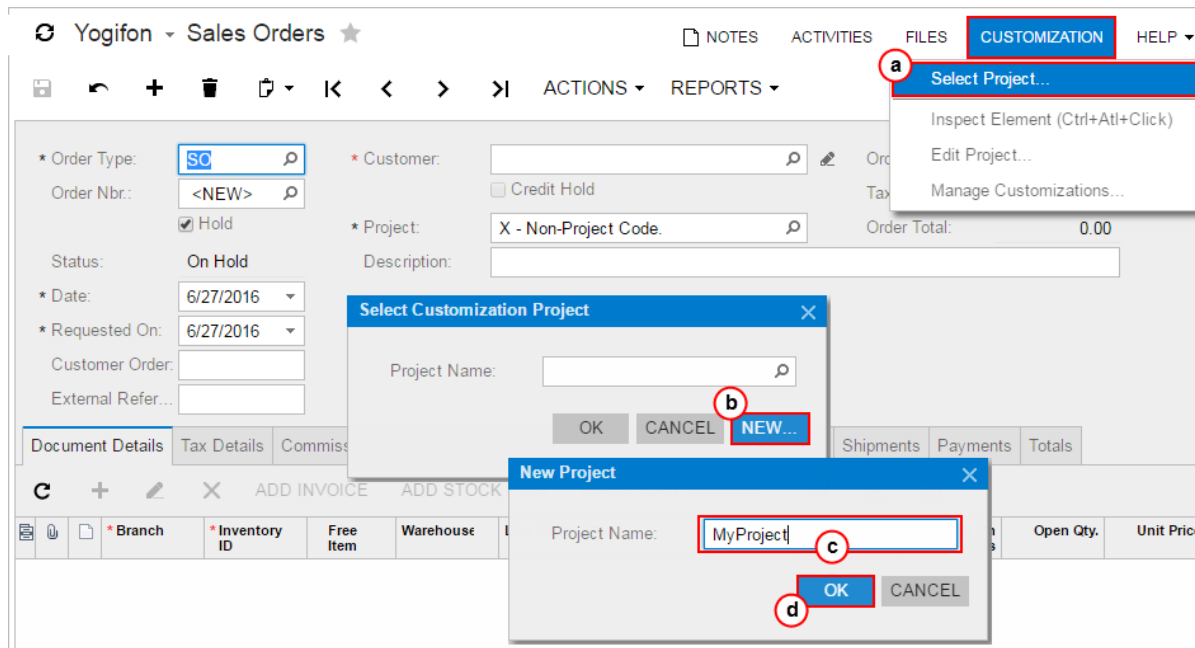
	Published	* Project Name	Level	Screen Names	Description	Created By	Last Modified On
*	<input type="checkbox"/>	MyProject					
	<input type="checkbox"/>	AdvCstAEF		PO301000,P...		admin	6/23/2016
	<input type="checkbox"/>	AdvUI7		IN202500		admin	6/23/2016
	<input type="checkbox"/>	CRMAddOn				admin	6/23/2016
	<input type="checkbox"/>	FormActionAEF		SO301000		admin	6/23/2016
	<input type="checkbox"/>	GridActionsAEF		CS203000		admin	6/23/2016
	<input type="checkbox"/>	KeyWords		IN202500		admin	6/23/2016
	<input type="checkbox"/>	PurchaseOrderWizard				admin	6/23/2016
	<input type="checkbox"/>	RapidByte				admin	6/23/2016
	<input checked="" type="checkbox"/>	YogiFon		AR303000,A...		admin	6/23/2016

**Figure: Entering the new project name**

### Creating a Customization Project from the Customization Menu

To create a customization project from the [Customization Menu](#), perform the following actions:

1. On any form of Acumatica ERP, click **Customization > Select Project**, as the following screenshot shows (item a).
2. In the [Select Customization Project Dialog Box](#), which opens, click **New** (item b).
3. In the [New Project Dialog Box](#), which opens, enter the name of the new project (item c).
4. In this dialog box, click **OK** (item d) to create the project in the database and close the dialog box.



**Figure: Creating a customization project from the Customization menu**

### Creating a Customization Project from the Element Inspector

Suppose that you have not selected a customization project. In the [Element Properties Dialog Box](#), if you have tried to start performing customization by clicking **Customize, Actions >**

**Customize Business Logic**, or **Actions > Customize Data Fields**, the inspector opens the **Select Customization Project** dialog box to force you to select or create a customization project.

To create a customization project from this dialog box, perform the following actions:

1. In the dialog box, click **New**.
2. In the **New Project** dialog box, which opens, enter the name for the new project (item c).
3. In this dialog box, click **OK** to create the project in the database and close the dialog box.

## To Select an Existing Project

Because the Acumatica Customization Platform uses a customization project as a container for the customization items, the platform does not permit you to perform any customization without starting a customization project.

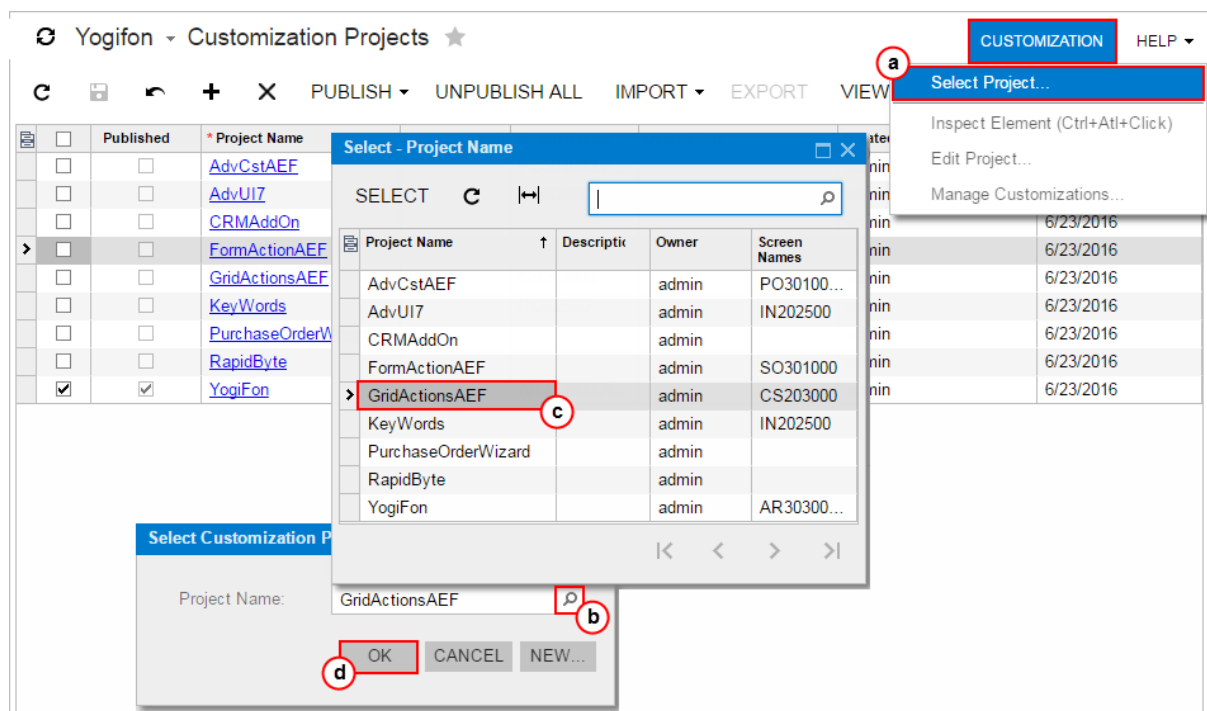
You can select an existing customization project in the following ways:

- *By selecting it from the **Customization** menu*
- *By selecting it from the **Element Inspector***

### To Select a Customization Project from the Customization Menu

To create a customization project from the *Customization Menu*, perform the following actions:

1. On any form of Acumatica ERP, click **Customization > Select Project**, as the following screenshot shows (item a).
2. In the *Select Customization Project Dialog Box*, which opens, click the **Project Name** selector and select a project name (items b and c).
3. In this dialog box, click **OK** (item d) to select the project and close the dialog box.



**Figure: Selecting a customization project from the Customization menu**

### To Select a Customization Project from the Element Inspector

Suppose that you have not selected a customization project. If in the [Element Properties Dialog Box](#), you have tried to perform customization by clicking **Customize, Actions > Customize Business Logic**, or **Actions > Customize Data Fields**, the inspector opens the **Select Customization Project** dialog box to force you to select a customization project.

To select a customization project, in the **Select Customization Project** dialog box, perform the following actions:

1. In the **Project Name** selector, select a project name.
2. Click **OK** to select the project and to close the dialog box.

## To Open a Project

---

If you have selected a customization project, you can open the project for editing in the [Customization Project Editor](#) in the following ways:

- On the [Customization Projects Form](#) : Click the project name in the table.
- From the [Customization Menu](#): Click **Customization > Edit Project**.
- From the [Element Properties Dialog Box](#): Click **Customize, Actions > Customize Business Logic**, or **Actions > Customize Data Fields**.

## To Update a Project

---

If you have modified an item of a customization project in the file system by using an integrated development environment (IDE), such as Microsoft Visual Studio, these changes may not be reflected in the customization project yet. You have to update the project in the database before the publication or export of the deployment package of the project.

To update a customization project, perform the following actions:

1. Open the project in the [Customization Project Editor](#). (See [To Open a Project](#) for details.)
2. In navigation pane of the editor, select **Files** to open the Custom Files page.
3. On the page toolbar, click **Detect Modified Files**, as shown in the screenshot below, to review the files included in the project that could have been modified in the file system but haven't been updated in the customization project yet.

If at least one conflict is detected, the **Modified Files Detected** dialog box opens (also shown in the following screenshot). The dialog box displays each changed file with the check boxes in the **Selected** and **Conflict** columns selected. See [Detecting the Project Items Modified in the File System](#) for details.

4. To update the selected files in the project, on the toolbar of the dialog box, click **Update Customization Project**, as the following screenshot shows.

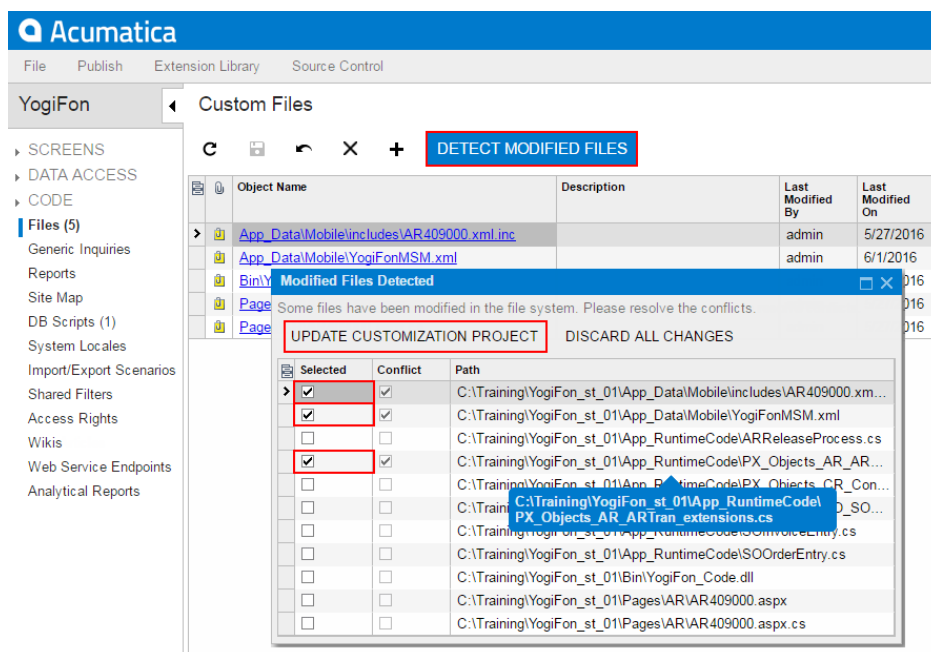


Figure: Updating files in the project

## To Delete a Project

If a customization project is not published, you can delete the project from the instance of Acumatica ERP by using the [Customization Projects](#) (SM204505) form.

To delete a customization project, perform the following actions:

1. Navigate to **System > Customization > Manage > Customization Projects**.
2. In the project list, select the row of the project that has to be deleted, as shown in the screenshot below (item a).
3. On the form toolbar, click **Delete Row** (X), item b in the screenshot, to delete the selected project from the list.
4. On the form toolbar, click **Save** (item c in the screenshot) to save the changes to the database.

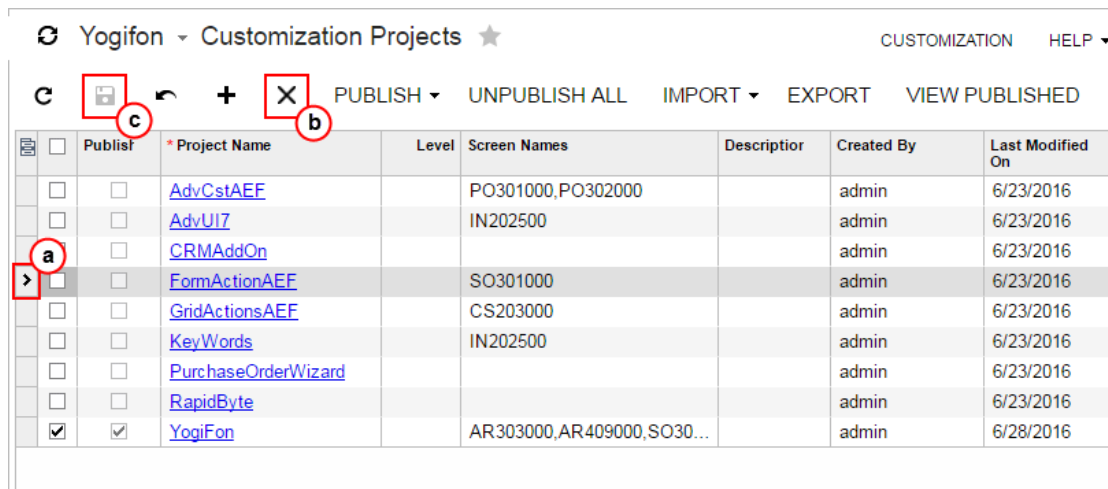


Figure: Deleting a customization project

The platform deletes from the database the project data and the data of the project items. The platform does not delete the files and the objects that were added to the projects from the database, such as site map nodes, reports, user access rights, and integration scenarios.

## To Export a Project

---

You can export (download) a customization project when the project is finished to deploy the customization to the target system. Also, you can download the package to have a backup copy of the customization project you are working on.

Before you download the package, we recommend that you make sure you have included all the needed changes in the customization project. To do this, you take the following actions:

- Make sure that you have added all custom files to the project and uploaded the latest actual version of the files to the project. See [To Update a Project](#) for details.
- Make sure that the database schema is updated in the customization project. See [To Update Custom Tables in the Project](#) for details.
- Make sure you have added the needed site map nodes to the project. See [Site Map](#) for details.
- Publish the project and test the customization before downloading the deployment package, to ensure that you have no issues.

To download the deployment package of a customization project, you should export the project. You can export a customization project in the following ways:

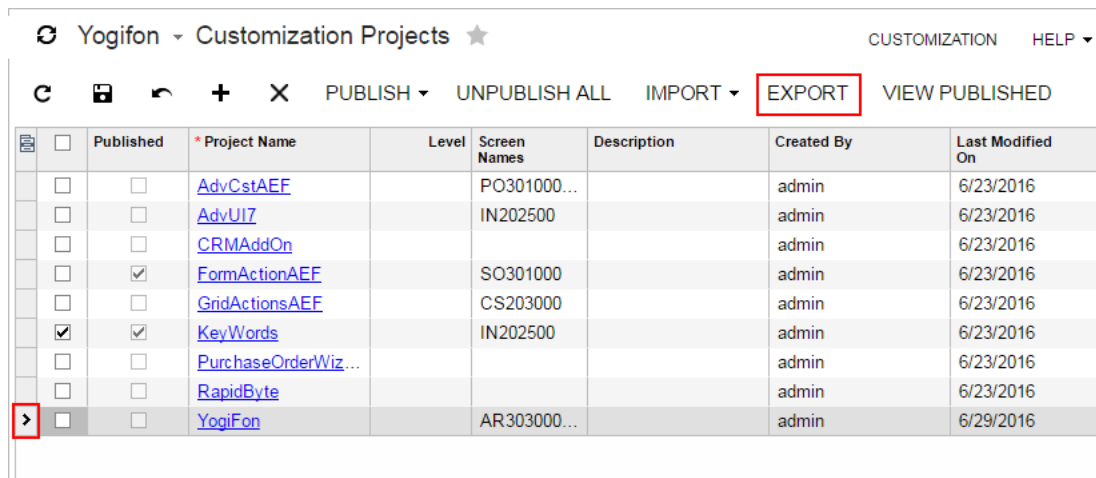
- [By using the Customization Projects form](#)
- [Through the Customization Project Editor](#)

The system creates the deployment package of the project and downloads the `zip` file of the package on your machine. The file has the same name as the customization project. For more information about a deployment package, see [Deployment of Customization](#).

### Exporting a Customization Project by Using the Customization Projects form

To export a customization project by using the [Customization Projects](#) (SM204505) form, perform the following actions:

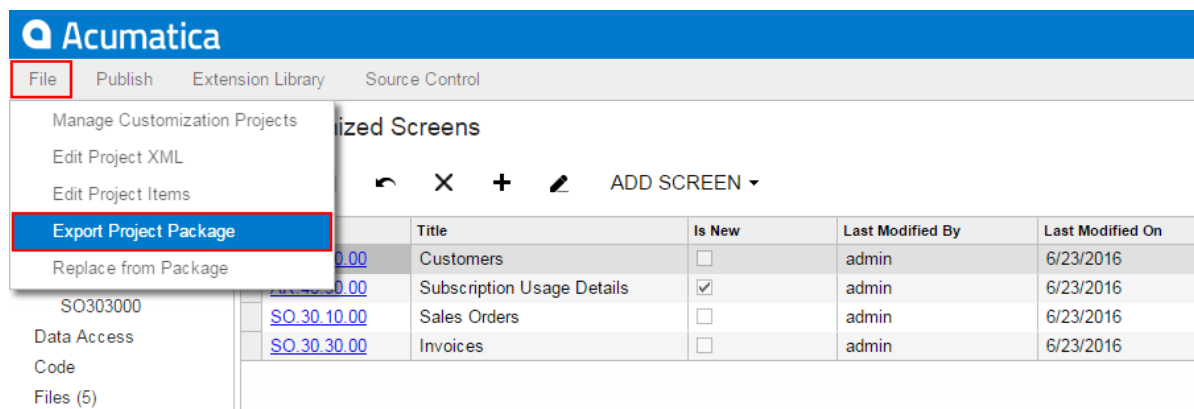
1. Navigate to **System > Customization > Manage > Customization Projects**.
2. In the project list of the form, click the row of the customization project to be exported.  
The row is highlighted in the table, as the screenshot below shows.
3. Click **Export** on the form toolbar to export the highlighted project.



**Figure: Exporting a customization project**

### Exporting the Customization Project Opened in the Customization Project Editor

To export the customization project that is currently opened in the *Customization Project Editor*, click **File > Export Project Package** on the editor menu, as shown in the following screenshot.



**Figure: Exporting the current customization project**

Also, you can export the customization project from the *Project XML Editor* of the *Customization Project Editor* by clicking **Download Package** on the page toolbar, as shown in the following screenshot.

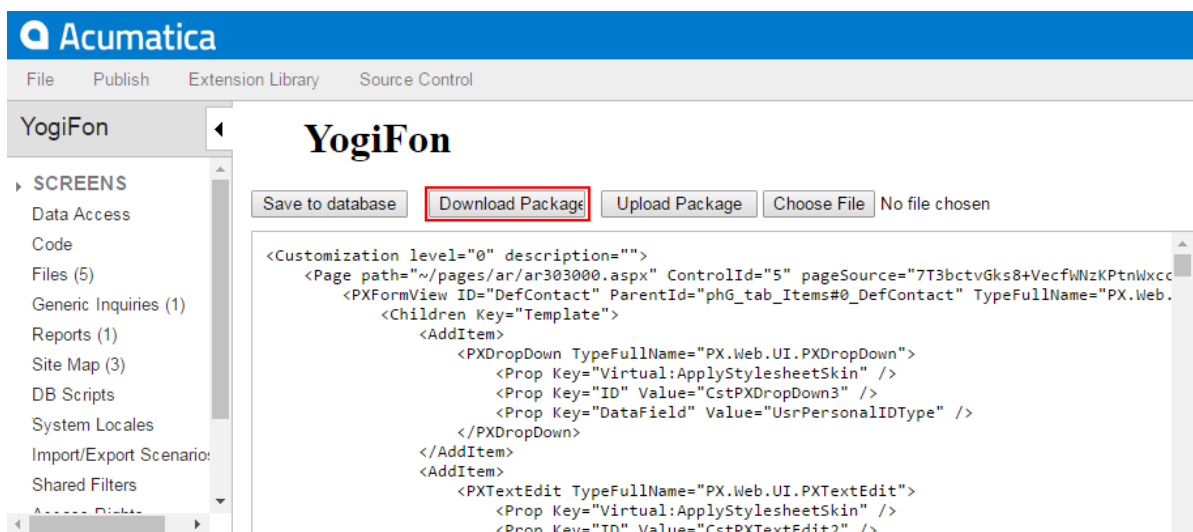


Figure: Exporting the current customization project from the Project XML Editor

## To Import a Project

You can import a deployment package to work with the customization project or to publish the final customization on the target website.



: You can import deployment packages of earlier versions of Acumatica ERP to Acumatica ERP 2019 R1.

To upload the deployment package of a customization project, you should import the project by using the [Customization Projects](#) (SM204505) form. (See [Customization Projects Form](#) for more information.)

To do this, perform the following actions:

1. Navigate to **System > Customization > Manage > Customization Projects**.
2. Click **Import** on the form toolbar, as the screenshot below shows.
3. In the **Open Package** dialog box, which opens, click **Choose File**.
4. In the **Open** dialog box, which opens, select the deployment package file to be uploaded.

The name of the selected file is displayed in the **File path** box of the **Open Package** dialog box, as shown in the screenshot.

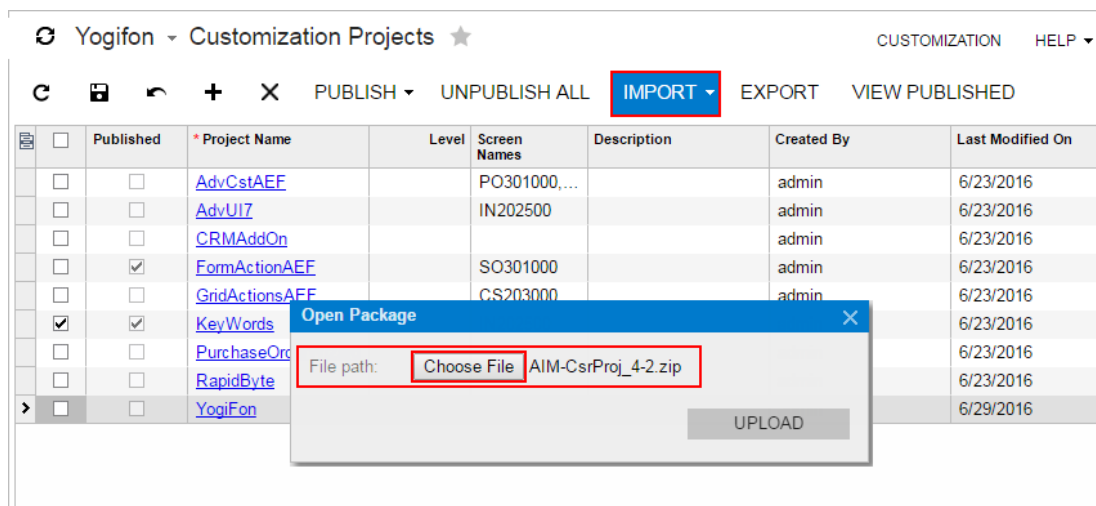


Figure: Importing a customization project



5. In the **Open Package** dialog box, click **Upload**.

The platform uploads the selected package, create the corresponding customization project, and saves the project in the database. As the result, the new customization project appears in the list on the [Customization Projects](#) form; therefore, you can access the project data and manage the project.

## To Replace the Content of a Project from a Package

You might need to upload a newer version of the customization project that has been modified outside the system on which you are working, or upload the project from a backup copy.

You can replace the content of a customization project from a deployment package in the following ways:

- [By using the Customization Projects form](#)
- [Through the Customization Project Editor](#)



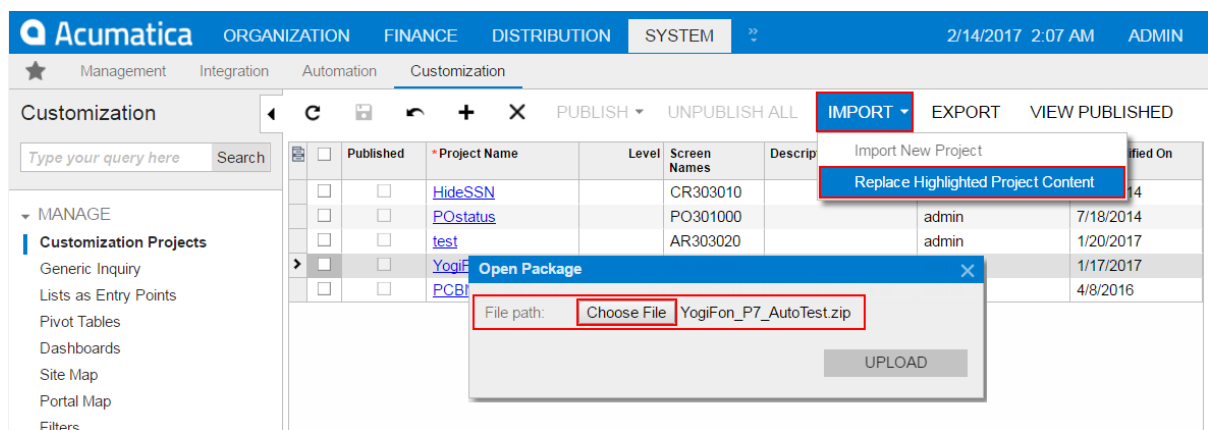
: The platform does not verify the content of a deployment package before replacing a customization project in the database.

### Replacing a Customization Project from a File by Using the Customization Projects Form

To replace the content of a customization project from a file by using the the [Customization Projects](#) (SM204505) form (see also [Customization Projects Form](#) ), perform the following actions:

1. Navigate to **System > Customization > Manage > Customization Projects**.
2. In the project list, click the row of the customization project to be updated, as the screenshot below shows.
3. Click **Import > Replace Highlighted Project Content** on the form toolbar, as the screenshot below also shows.
4. In the **Open Package** dialog box, which opens, click **Choose File**.
5. In the **Open** dialog box, which opens, select the deployment package file to be uploaded.

The name of the selected file is displayed in the **File path** text box of the **Open Package** dialog box, as shown in the screenshot.



**Figure: Replacing the content of a customization project**

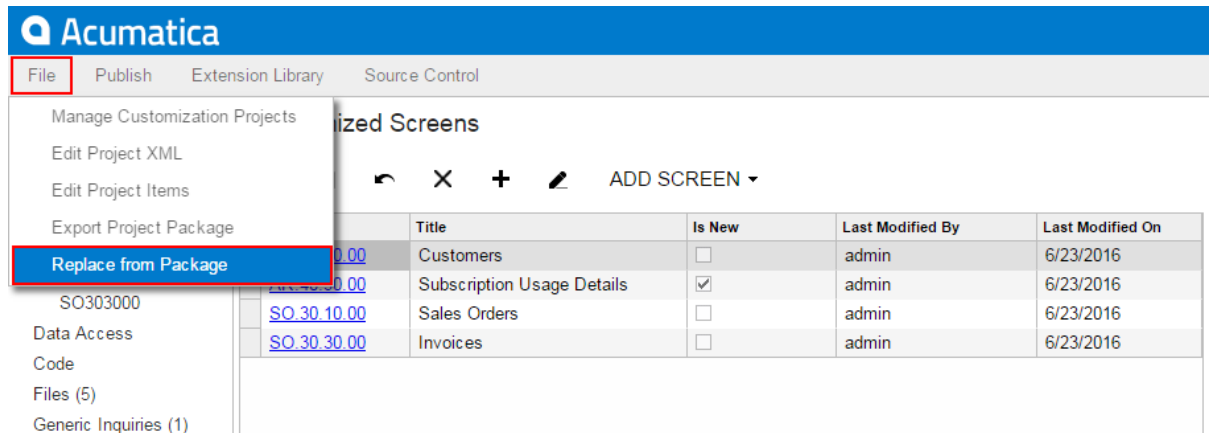
6. In the **Open Package** dialog box, click **Upload**.

The platform uploads the selected package and replaces in the database the content of the selected project with the content of the deployment package.

## Replacing the Customization Project Opened in the Customization Project Editor from a File

To replace the content of a customization project that is currently opened in the *Customization Project Editor*, perform the following actions:

1. Click **File > Replace from Package** on the editor menu, as shown in the following screenshot.



**Figure: Replacing the content of the current customization project**

2. In the **Open Package** dialog box, which opens, click **Choose File**.
3. In the **Open** dialog box, which opens, select the deployment package file to be uploaded.

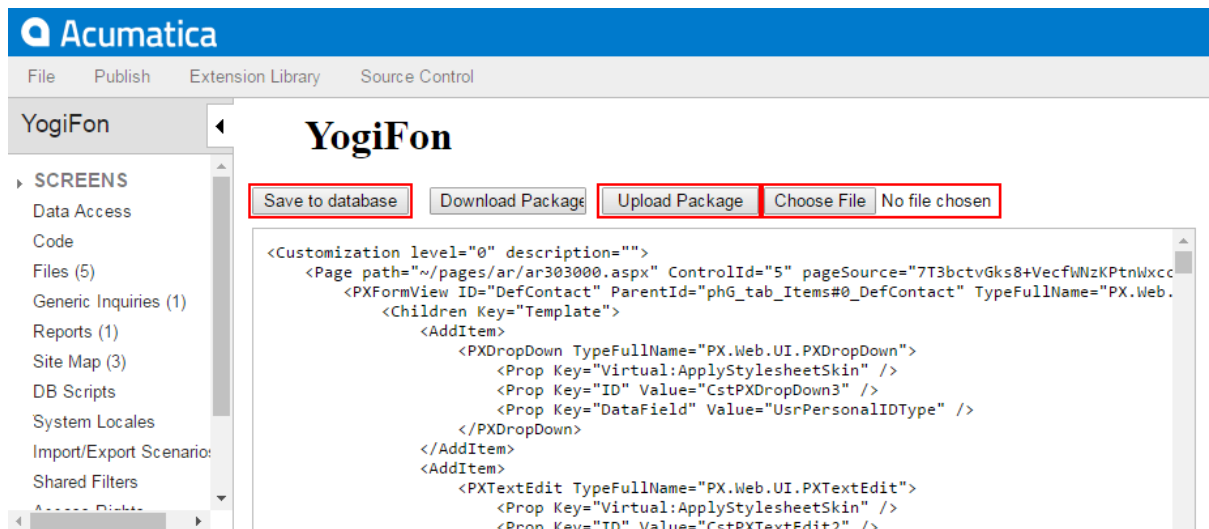
The name of the selected file is displayed in the **File path** text box of the **Open Package** dialog box.

4. In the **Open Package** dialog box, click **Upload**.

The platform uploads the selected package and replaces in the database the content of the selected project with the content of the deployment package.

Also, you can replace the content of the customization project by using the *Project XML Editor* of the Customization Project Editor. To do this, perform the following actions:

1. In the Customization Project Editor, click **File > Edit Project XML** to open the Project XML Editor for the current customization project.
2. On the toolbar of the Project XML Editor, click **Choose File**.
3. In the **Open** dialog box, which opens, select the deployment package file to be uploaded.  
The name of the selected file is displayed in the text box right of the toolbar buttons instead of the *No file chosen* string (which is shown in the screenshot below).
4. On the editor toolbar, click **Upload Package**.



**Figure: Replacing the content of a customization project from the Project XML Editor**

The platform uploads the selected package and displays its XML code in the Project XML Editor.

5. Explore the content of the uploaded package to ensure that this is the needed one.
6. To replace the content of the project that is currently opened in the Customization Project Editor with the content of the uploaded package, click **Save to Database** on the page toolbar.

By using this approach, you can explore the content of the package before replacing the content of the customization project that is currently opened in the Customization Project Editor.

## To Build a Package Based on Existing Files

You may need to build a customization package that is based on a customization project or that uses existing files.

To do that, you can use the `PX.CommandLine` tool provided by Acumatica Customization Platform.

### About the `PX.CommandLine` Tool

The `PX.CommandLine` tool represents an executable file (`PX.CommandLine.exe`) located in the `\Bin` folder of your customization project.

When you run `PX.CommandLine.exe`, you supply a set of command-line parameters where each parameter must be presented in the following format.

```
parameter_name "parameter_value"
```

The `PX.CommandLine` tool has the following syntax.

```
PX.CommandLine.exe
[/website "path\to\web\site\root"]
/method BuildProject
/in "path\to\source\folder"
/out "path\to\output\file.zip"
[/include "path\to\additional\file1.ext" "relative\package\path\to\file2.ext" ...]
[/description "Package description"]
[/level "customization level"]
```

You can use the following parameters:

- `/in`: Required. The path to the folder that will be used as a base for the new customization package. The folder may contain either a customization package that will be modified, or the files that will be included in the new customization project.
- `/out`: Required. The path to the customization package that you build using the `PX.CommandLine` tool. The output is a `.zip` archive.
- `/website`: Optional. A path to a website folder. Use this parameter if the `PX.CommandLine` tool executable file is not located in the `\Bin` folder of your website.
- `/method`: Required. This parameter must always have the `BuildProject` value, which indicates that the tool builds a new project. Other methods of the tool are not available.
- `include`: Optional. The argument consists of two parameters: an absolute path to a file that should be added to the output package, and a relative path inside the `/website` folder where the file is copied after you publish the customization project. This argument may be repeated any number of times.
- `/includeDirectory`: Optional. The argument consists of two parameters: an absolute path to a folder containing files that should be added to the output package, and a relative path to a folder in the website folder where these files are copied after the customization project is published. This argument may be repeated any number of times.
- `/description`: Optional. A description of the output customization package.
- `/level`: Optional. The level of the customization package, which helps Acumatica Customization Platform to resolve conflicts while multiple customization projects are being merged. The value must be an integer. For details about the level of a customization project, see the description of the **Level** column of the [Customization Projects \(SM204505\)](#) form.

### Building a Customization Package by Using the `PX.CommandLine` Tool

To build a customization package by using the `PX.CommandLine` tool, you execute `PX.CommandLine.exe` with the appropriate keys.

For example, if you have a customization package located in the `C:\AcumaticaSites\T300` folder and you want to build a customization package based on this project, the command is as shown in the following code.

```
PX.CommandLine.exe /method BuildProject
/in "C:\AcumaticaSites\T300"
/out "C:\AcumaticaSites\MyNewPackage.zip"
```

This command builds a customization package and puts the resulting `.zip` archive in the `C:\AcumaticaSites\MyNewPackage` folder.

You can also build a new customization package based on a project stored in a source control folder. To do that, execute a command that looks similar the one shown in the following code.

```
PX.CommandLine.exe /website "path_to_Acumatica_website" /method BuildProject
/in "path_to_customization_source_control_folder"
/out "full_name_of_customization_file.zip"
```

## To Merge Multiple Projects

As a rule, it is better to have multiple customization projects instead of a single one. But if you have two or more customization projects that contain changesets with the same items, and if you are sure that each project is valid and that the merged customization applies to the website properly, we recommend that you merge the projects. You use the [Customization Projects \(SM204505\)](#) form as a starting point.

To merge multiple customization projects, perform the following actions:

1. Navigate to **System > Customization > Manage > Customization Projects**.
2. In the project list, select the check boxes for only the projects to be merged.
3. Click **Publish** on the form toolbar.
4. Click **View Published** on the form toolbar to open the [Published Customization Page](#).
5. Click **Download Package** on the page toolbar to download the `Customization.zip` file, which includes the full content of the merged customization project.

The `Customization.zip` file is the deployment package of the merged customization project. You can use the merged project to publish the final customization project on the target website. You can rename the `.zip` file to assign the needed name to the customization project. To upload the deployment package to a target system, import the `.zip` file, as described in [To Import a Project](#).

## To Manipulate Customization Projects from the Code

---

You can use the web service API for manipulating customization projects from the code. Methods of the web service API can be used, for example, to deploy customization packages to local and remote instances of Acumatica ERP.

For manipulating customization projects, the web service API includes the methods, which are accessible through the SOAP API, described in the following topics:

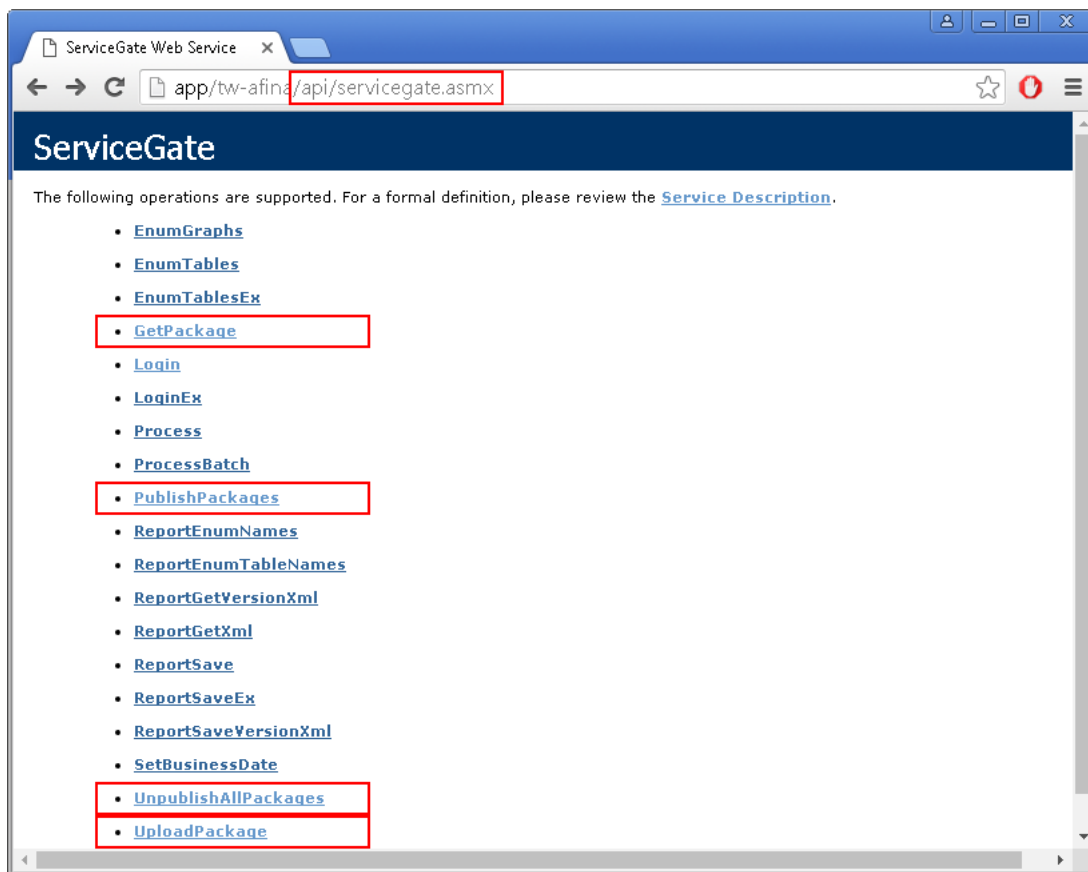
- [GetPackage\(\) Method](#)
- [PublishPackages\(\) Method](#)
- [UnpublishAllPackages\(\) Method](#)
- [UploadPackage\(\) Method](#)



: A user of an application that invokes any of these methods should be assigned the *Customizer* role in the appropriate instance of Acumatica ERP. See [To Assign the Customizer Role to a User Account](#) for details.

The web service used for manipulating customization projects is available under the URL, which is specified in one of the following ways (see the screenshot below):

- `http://<Computer Name>/<Website Name>/api/servicegate.asmx`, such as `http://MyComputer/YogiFon/api/servicegate.asmx`
- `http://<IP Address>/<Website Name>/api/servicegate.asmx`, such as `http://111.222.3.44/YogiFon/api/servicegate.asmx`



**Figure: Accessing the web service through the browser**

To use the listed methods in the code, you should create a service gate for the specified URL and log in, as shown in the following code fragment.

```
var webserviceurl = "http://localhost/AcumaticaInstance/api/ServiceGate.asmx";
var username = "admin";
var password = "123";

var client = new ServiceGate.ServiceGate
{
    Url = webserviceurl,
    CookieContainer = new CookieContainer(),
    Timeout = (int) TimeSpan.FromMinutes(5).TotalMilliseconds
};

var loginResult = client.Login(username, password);

if (loginResult.Code == ErrorCode.OK)
{
    // Use the methods to manipulate customization projects
}
```

## GetPackage() Method

You use the `GetPackage()` method to get the content of a customization project from the database of an Acumatica ERP instance.

### Syntax

```
public byte[] GetPackage(string packageName)
```

## Parameters

- `packageName`: The name of the customization project to be loaded from the database.

## Return Value

The method returns an array of bytes that corresponds to the content of the deployment package `.zip` file.

## Example

The following code logs in to an Acumatica ERP instance, gets the content of the *package1* customization project from the database, and returns the content as a byte array. You can then, for example, save the array to a `.zip` file to download the deployment package in the file system.

```
var webserviceurl = "http://localhost/AcumaticaInstance/api/ServiceGate.asmx";
var username = "admin";
var password = "123";
var packageName = "package1";

var client = new ServiceGate.ServiceGate
{
    Url = webserviceurl,
    CookieContainer = new CookieContainer(),
    Timeout = (int) TimeSpan.FromMinutes(5).TotalMilliseconds
};

var loginResult = client.Login(username, password);

if (loginResult.Code == ErrorCode.OK)
{
    var packageContents = client.GetPackage(packageName);
    //do something with the packageContents package content
}
```

## Usage Notes

If there are multiple tenants in an instance of Acumatica ERP, this method affects the tenant to which the service is logged in. To log in to a specific tenant, add the tenant name to the user name using the following format: *user@MyTenant*.

## PublishPackages() Method

You use the `PublishPackages()` method to publish multiple customization projects that exist in the database of an Acumatica ERP instance.

## Syntax

```
public void PublishPackages(string[] packageNames, bool mergeWithExistingPackages)
```

## Parameters

- `packageNames`: An array of names of the customization projects to be published.
- `mergeWithExistingPackages`: An indicator of whether the specified customization projects must be merged with the customization projects that are currently published in the same instance of Acumatica ERP. If the value of the parameter is *true* and there are published customization projects in the instance, the platform merges the content of the projects specified in the method with the content of the currently published projects and then applies the merged customization to the instance. If the value of the parameter is *false*, the platform cancels the currently applied customization and publishes only the projects specified in the method.

### Example

The following code logs in to an Acumatica ERP instance and publishes the *package1*, *package2*, and *package3* customization projects that exist in the database of the instance.

```
var webserviceurl = "http://localhost/AcumaticaInstance/api/ServiceGate.asmx";
var username = "admin";
var password = "123";
var packageNames = new []{"package1", "package2", "package3"};
var mergeWithExistingPackages = true;

var client = new ServiceGate.ServiceGate
{
    Url = webserviceurl,
    CookieContainer = new CookieContainer(),
    Timeout = (int) TimeSpan.FromMinutes(5).TotalMilliseconds
};

var loginResult = client.Login(username, password);

if (loginResult.Code == ErrorCode.OK)
{
    client.PublishPackages(packageNames, mergeWithExistingPackages);
}
```

### Usage Notes

If there are multiple tenants in an instance of Acumatica ERP, this method affects the tenant to which the service is logged in. To log in to a specific tenant, add the tenant name to the user name using the following format: *user@MyTenant*.

## UnpublishAllPackages() Method

You use the `UnpublishAllPackages()` method to cancel customization of an Acumatica ERP instance.

### Syntax

```
public void UnpublishAllPackages()
```

### Example

The following code logs in to an Acumatica ERP instance and cancels all customization projects that is currently applied to the instance.

```
var webserviceurl = "http://localhost/AcumaticaInstance/api/ServiceGate.asmx";
var username = "admin";
var password = "123";

var client = new ServiceGate.ServiceGate
{
    Url = webserviceurl,
    CookieContainer = new CookieContainer(),
    Timeout = (int) TimeSpan.FromMinutes(5).TotalMilliseconds
};

var loginResult = client.Login(username, password);

if (loginResult.Code == ErrorCode.OK)
{
    client.UnpublishAllPackages();
}
```



## Usage Notes

The method removes all customization changes from the file system, regardless of the tenants where the customization projects were published.

## UploadPackage() Method

You use the `UploadPackage()` method to import a customization project from the file system. The method saves the content of an uploaded deployment package to the database of an instance of Acumatica ERP.

### Syntax

```
public void UploadPackage(string packageName, byte[] packageContents,
                        bool replaceIfPackageExists)
```

### Parameters

- `packageName`: The name of the customization project to be saved in the database.
- `packageContents`: An array of bytes that contains the content of the deployment package .zip file and will be saved in the database.
- `replaceIfPackageExists`: An indicator of whether the customization platform must replace an existing customization project with the same name in the database. If the value of this parameter is *true* and the database contains a customization project with the same name, the platform replaces the project with the specified content. If the value of the parameter is *false* and the database contains a customization project with the same name, an exception occurs.

### Example

The following code logs in to an Acumatica ERP instance, loads the `C:\package1.zip` file content, and saves or updates the `package1` customization project in the database of the instance.

```
var webserviceurl = "http://localhost/AcumaticaInstance/api/ServiceGate.asmx";
var username = "admin";
var password = "123";
var packageName = "package1";
var packageContents = File.ReadAllBytes("C:\\package1.zip");
var replaceIfPackageExists = true;

var client = new ServiceGate.ServiceGate
{
    Url = webserviceurl,
    CookieContainer = new CookieContainer(),
    Timeout = (int) TimeSpan.FromMinutes(5).TotalMilliseconds
};

var loginResult = client.Login(username, password);

if (loginResult.Code == ErrorCode.OK)
{
    client.UploadPackage(packageName, packageContents, replaceIfPackageExists);
}
```

### Usage Notes

If there are multiple tenants in an instance of Acumatica ERP, this method affects the tenant to which the service is logged in. To log in to a specific tenant, add the tenant name to the user name using the following format: `user@MyTenant`.

## To Detect Whether a Customization Project Is Applied to the Application

You can see whether a customization project is applied to the application on the Welcome screen, with more detailed information available on the [Customization Projects](#) (SM204505) form. To detect whether an Acumatica ERP instance is customized, perform the following actions:

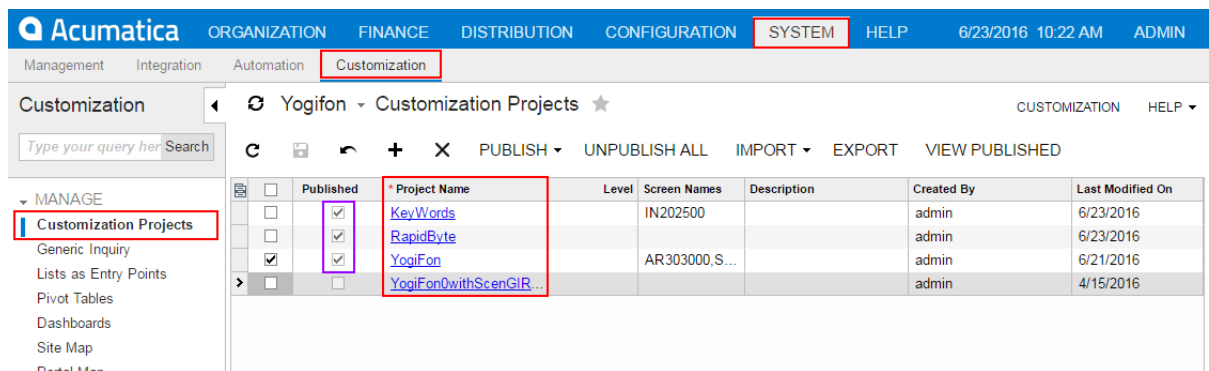
1. Launch the application in the browser.
2. In the bottom of the Welcome screen, check for the presence of the **Customized** string.

If the string exists, it is followed by the names of the customization projects that are currently published, as shown in the following screenshot.



**Figure: Viewing the customization projects that are currently published**

3. Enter your credentials and click **Sign In**.
4. Navigate to **System > Customization > Manage > Customization Projects**.
5. On the form, view the list of the customization projects that are accessible in the application for your tenant (see the following screenshot).



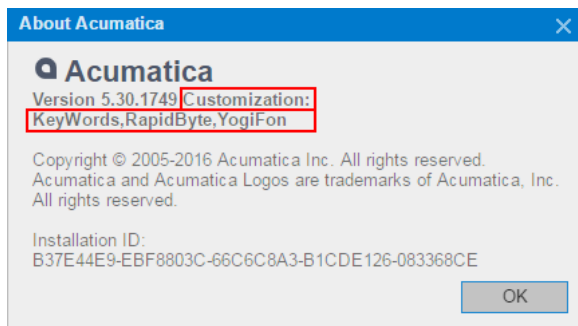
**Figure: Viewing the list of customization projects**



: If a customization project that you know to be published is absent in the list, the project may be published for another tenant. See [Customization of a Multitenant Site](#) for details.

6. In the **Published** column of the list, notice which customization projects have the check box selected. These are the projects that are currently published.
7. Use the [Customization Project Editor](#) to explore the content of each published customization project. To open a project in the editor, click the name of the project.

You can also view the names of the customization projects that are currently published in the **About Acumatica** dialog box, as the following screenshot shows.



**Figure: Viewing the list of the customization projects that are currently published**

To open the dialog box, click **Help > About** on a form of Acumatica ERP.

## To Manage Prefixes in a Customization Project

You can specify a prefix that should be added to any object of the customization project. When validation of the customization project is performed, the platform checks all objects to be sure they have the added prefix.

To add a prefix for a customization project, do the following:

1. On the main menu of the Customization Project Editor, select **File > Validate Project Prefix**. The **Customization Project Prefix** dialog box opens.
2. In the **Project Prefix** box, add the prefix for the customization project. The prefix is two to four characters in length and can be made up of any of the 26 Latin letters (A through Z). Only capital letters are allowed.
3. Click **Save**.

You can perform validation of the project's items to check for the added prefix. To do this, in the **Customization Project Prefix** dialog box, click the **Validate Project Items** button. In the **Validation Result** area, the result of the validation appears.

### Format of the Validation Result

If errors or warnings have been detected during validation, the validation result has the following format:

- <CustomizationProjectName>
  - <CustomizationRuleName>
    - <PathToTheDLL> | <ProjectItemType> | <NameOfTheProjectItem>  
List of rules broken by the specified item.

# Publishing Customization Projects

---

To apply a customization project to an instance of Acumatica ERP, you have to publish the customization project. You can also publish multiple customization projects at once; see [Simultaneous Use of Multiple Customizations](#) for details.

When you publish a customization project, the system applies the changes in the project to the website. After the customization project has been published, users see the modified Acumatica ERP. The changes apply to the website of Acumatica ERP and therefore affect all tenants in the system (see [Customization of a Multitenant Site](#) for details).

The Acumatica Customization Platform provides the following ways to manage the publication process:

1. You can develop and include in a customization project the custom code that is executed during the project publication. See [Custom Processes During Publication of a Customization](#) for details.
2. By using additional attributes in DAC extensions, you can specify how the system should apply the original and custom attributes to the field. See [Customization of Field Attributes in DAC Extensions](#) for details.
3. By using SQL script attributes, you can control the execution of batches in SQL scripts. See [Using the SQL Script Attributes](#) for details.

You can cancel the publication of the project and publish the project again, which you might do often during the development and testing of the customization. The application domain does not restart every time you publish the customization project because [Run-Time Compilation](#) is enabled for the website by default.

Detailed instructions are provided in the following topics:

- [To Publish a Single Project](#)
- [To Publish Multiple Projects](#)
- [To Prepare a Project for Publication](#)
- [To Publish the Current Project](#)
- [To Publish the Current Project with a Cleanup Operation](#)
- [To Publish a Customization for a Multitenant Site](#)
- [Validating Customization Code](#)
- [To View a Published Customization](#)
- [To Unpublish a Customization](#)

## To Prepare a Project for Publication

---

Before you publish a customization project, we recommend that you make sure you have included all the needed changes in the customization project. To do this, you should take the following actions:


- Make sure that you have added all custom files to the project and uploaded the latest version of the files to the project.
- Make sure that the database schema is updated in the customization project. You may have modified custom tables by using a database management tool, such as SQL Management Studio. On the page toolbar of the Database Scripts page, click **Reload From Database**. This action regenerates the database table schema of the custom tables.

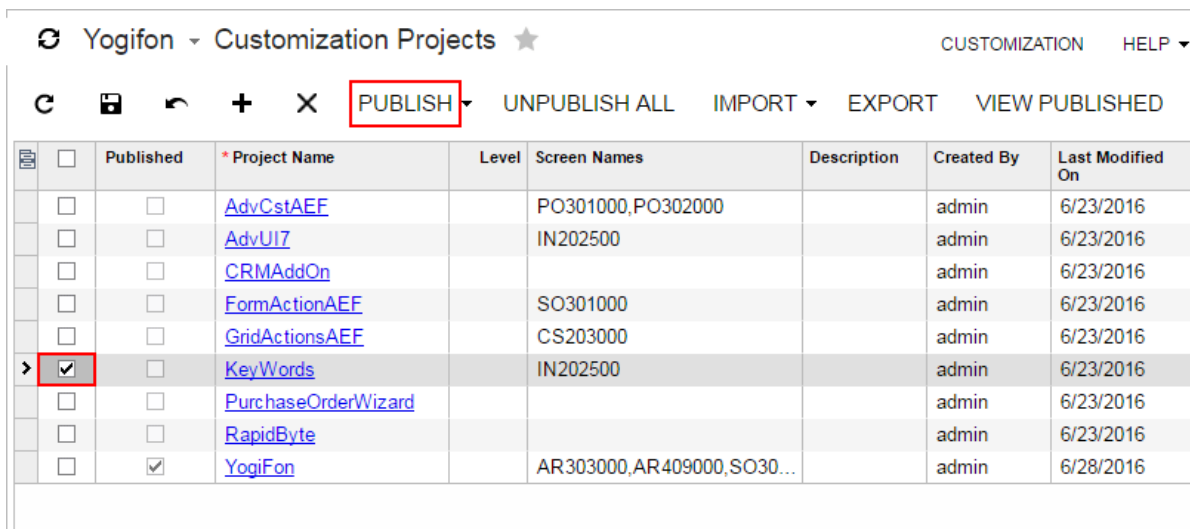
- Open the Site Map page, make sure that you have added the needed site map nodes to the project. If you have modified the site map nodes after you have added them to the project, click **Reload From Database** to update the customization project.
- Make sure that all other objects (such as generic inquiries, system locales, integration scenarios, shared reusable filters, access rights, wikis, web service endpoints, analytical reports, push notifications) are updated in the project. If an object was changed in the application instance, open the appropriate page of the [Customization Project Editor](#), and click **Reload From Database** on the page toolbar to update the corresponding item in the project. (See [To Update a Project](#) for details.)

## To Publish a Single Project

You can publish a single customization project by using the **Publish** action on the [Customization Projects](#) (SM204505) form.

To do this, perform the following actions:

1. Navigate to **System > Customization > Manage > Customization Projects**.
2. In the project list, select the check box (in the unlabeled column) for the needed customization project, as the screenshot below shows.
3. Clear any selected check boxes in this column for other customization projects.  
 : All previously published projects that are not selected will be unpublished.
4. Click **Publish** on the form toolbar to initiate the publication of the selected project.




The screenshot shows the 'Yogifon - Customization Projects' form. The toolbar includes buttons for 'PUBLISH', 'UNPUBLISH ALL', 'IMPORT', 'EXPORT', and 'VIEW PUBLISHED'. The 'PUBLISH' button is highlighted with a red box. Below the toolbar is a table with columns: 'Published', '\* Project Name', 'Level', 'Screen Names', 'Description', 'Created By', and 'Last Modified On'. The 'Published' column contains checkboxes. The 'KeyWords' project is selected, with its checkbox highlighted by a red box.

Published	* Project Name	Level	Screen Names	Description	Created By	Last Modified On
<input type="checkbox"/>	<a href="#">AdvCstAEF</a>		PO301000,PO302000		admin	6/23/2016
<input type="checkbox"/>	<a href="#">AdvUI7</a>		IN202500		admin	6/23/2016
<input type="checkbox"/>	<a href="#">CRMAddOn</a>				admin	6/23/2016
<input type="checkbox"/>	<a href="#">FormActionAEF</a>		SO301000		admin	6/23/2016
<input type="checkbox"/>	<a href="#">GridActionsAEF</a>		CS203000		admin	6/23/2016
<input checked="" type="checkbox"/>	<a href="#">KeyWords</a>		IN202500		admin	6/23/2016
<input type="checkbox"/>	<a href="#">PurchaseOrderWizard</a>				admin	6/23/2016
<input type="checkbox"/>	<a href="#">RapidByte</a>				admin	6/23/2016
<input type="checkbox"/>	<a href="#">YogiFon</a>		AR303000,AR409000,SO30...		admin	6/28/2016

Figure: Publishing a single customization project

## To Publish Multiple Projects

To publish multiple customization projects, you perform the following actions on the [Customization Projects](#) (SM204505) form:

1. Navigate to **System > Customization > Manage > Customization Projects**.
2. In the project list, select the check boxes (in the unlabeled column) for the customization projects you want to publish.  
 : You can save these selections by clicking **Save** on the form toolbar. The form opens with the selections that are previously saved in the database.

3. Click **Publish** on the form toolbar to initiate publication of the selected projects.



: All previously published projects that are not selected will be unpublished.

The platform merges the selected projects into one project and then publishes the project. For more details, see [Performing the Publication Process](#) and [Validating Customization Code](#).

## Performing the Publication Process

When you run the publication process, the Acumatica Customization Platform executes the process in the following stages:

1. If you publish more than one customization project, the platform merges the projects into a single customization project.
2. The platform validates the customization project. (See [Validating Customization Code](#) for details.)
3. If the validation completes successfully, the platform applies the changes to the application instance when you click **Publish** in the **Compilation** window.

When the platform merges multiple projects, if different projects include customization for the same application object, the customization from the project with the highest level (an optional number assigned to each project) is added to the merged project. See [Simultaneous Use of Multiple Customizations](#) for details.



: If you manage multiple customization projects and some projects are published, you do not have to unpublish any projects before other projects are published (leaving the check boxes selected for already-published projects in the list). On the [Customization Projects](#) (SM204505) form, you just need to select any projects you want to publish and click **Publish** on the toolbar. If you clear the check box for a published project, it will be unpublished.

After the publication is complete, you can view the content of the merged customization project by clicking the **View Published** button on the form toolbar of the [Customization Projects](#) form. (See [To View a Published Customization](#) for details.)

After the project is ready, the platform validates and compiles the customization code included in the project. If there are any validation errors, the system displays the error messages in the browser and doesn't compile the code. If the compilation completes successfully, you can click **Publish** in the **Compilation** window to apply the changes contained in the project items to the website.

During the actual publication, the platform applies the changes to the application and database objects and updates the files in the website folder as follows:

- The custom layout is applied to the forms of Acumatica ERP.
- The .cs files with the DAC extension code for the existing data access classes are generated and placed in the file system.
- The .cs files with the BLC extension code for the existing business logic are generated and placed in the file system.
- The .cs files with the custom code (Code items) are generated and placed in the file system.
- The custom files of the project are added to the website folder.
- The custom tables are created in the database, and custom SQL scripts are executed.
- The custom generic inquiries, reports, site map nodes, system locales, integration scenarios, shared reusable filters, access rights, wikis, web-service endpoints, and analytical reports are added to the database.



: We recommend that you back up the database before you publish customization projects, because canceling publication doesn't revert changes made to the database. See [To Unpublish a Customization](#) for details.

After the publication is complete, the application domain always restarts if the project includes assemblies, which are placed in the `/Bin` folder of the website. If you have no assemblies in the project, you can enable run-time compilation and publication will not cause a restart.

If a published customization project contains classes derived from the `CustomizationPlugin` class, the platform launches the implemented custom processes after website files were updated and after the website was restarted. (See [Custom Processes During Publication of a Customization](#) for details.)

After you have published the customization project, the files with the customization code are updated in the file system, and you can work with them in MS Visual Studio. The `.cs` files with code are placed in the `App_RuntimeCode` folder of the website.

## Validating Customization Code

While the Acumatica Customization Platform processes publication of a customization project, the platform validates the customization code included in the project. This validation of the code provides not only checking for syntax and semantics but also checking of the compatibility of the code included in the customization project with the original application code.

If you have a customization project that works properly for the current version of Acumatica ERP and have upgraded an application instance to a newer version, the customization project might not work properly or might even prevent the website from starting after the upgrade. This could occur because the code of Acumatica ERP is continuously developed to implement new features or enhance existing functionality. Thus, the code of an updated instance of Acumatica ERP can become inconsistent with the code in a customization project. For example, if the signature of a method that is overridden in the customization code is changed in the original code, a run-time error may occur in the graph extension. As another example, modified or deleted database columns and tables might cause the functionality of a data access class extension to fail.

The platform checks the compatibility of the code included in a customization project with the original application code every time it publishes the project. If there are any compatibility errors, the platform displays the warning and error messages in the **Compilation** window and stops the publication process. See [Messages for Validation Errors](#) and [To Resolve an Issue Discovered During the Validation](#) for detailed information about, respectively, the error messages and the ways to fix the validation errors.

## To Publish the Current Project

---

If you create a customization project in the [Customization Project Editor](#), the best way to publish the customization project that is under development is to use the **Publish Current Project** menu command provided by the editor. This publication does not influence the publication of other customization projects that exist in the application instance.

To publish the customization project that is currently open in the Customization Project Editor, perform one of the following actions:

- Use the Control+Space combination on the keyboard.
- In the editor menu, select **Publish > Publish Current Project**.

When you perform one of these actions, the platform initiates the publication of the project. If another customization project is already published, the platform merges the projects into a single project, and then compiles and validates the merged project. If the validation succeeds, the platform applies the merged customization to the application instance.

You can publish the customization project as described above again after you have made any change to the project.

## To Publish the Current Project with a Cleanup Operation

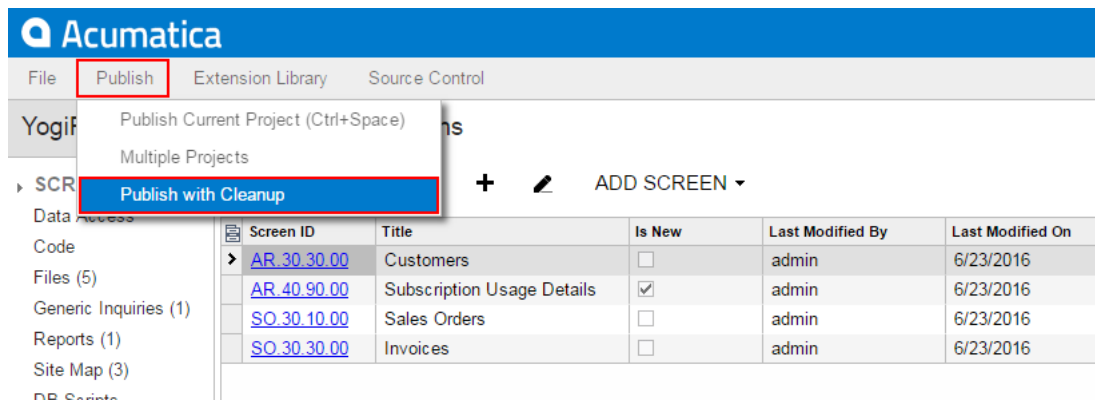
---

If a customization project contains a database script, during the project publication, the platform executes the script. For optimization purposes, to avoid the execution of database scripts during every publication of the project, the platform saves information about each script that has been executed at least once and has not yet been changed in the database, and omits the repeated execution of such scripts. You can force the platform to clean up all such information about previously executed scripts of a customization project and execute the scripts once more while publishing the project.

To do this, perform the following actions:



1. Open the project in the *Customization Project Editor* (see *To Open a Project* for details).
2. On the menu of the editor, click **Publish > Publish with Cleanup**, as shown in the screenshot below, to clean information about previously executed scripts of the project and initiate the process of publishing the customization project.




**Figure: Publishing a customization project with a cleanup operation**


## To Publish a Customization for a Multitenant Site

You can publish a customization project for multiple tenants in a multitenant site; see *Customization of a Multitenant Site* for details. You use the *Customization Projects* (SM204505) form to publish this customization.

To share customization content stored exclusively in the database for multiple tenants, perform the following actions:

1. Navigate to **System > Customization > Manage > Customization Projects**.
2. In the table, select the check boxes in the rows that correspond to the customization projects that you need to publish for multiple tenants.
3. On the toolbar of the form, click **Publish > Publish to Multiple Tenants**.
4. In the **Publish to Multiple Tenants** dialog box, which opens, do the following:
  - a. In the **Selected** column, select check boxes for the tenants to which you want to apply the selected customization projects.
  - b. To skip updating the site files, select the **Apply Changes Only to Database (Skip Website Update)** check box.
 

 : If you have published all the selected customization projects in the website for a single tenant at least once, you do not need to update website files. You can apply only the database changes.
  - c. To execute all database scripts of the selected customization projects, select the **Execute All Database Scripts (Including Previously Executed)** check box.
 

 : When the platform publishes a project that contains a database script, it executes the script and tries to avoid the execution of the script during every publication of the project, for optimization purposes. Therefore, the platform keeps information about each script that is executed at least once and has not yet been changed in the database, and omits the repeated execution of such scripts. If you run the publication with the **Execute All Database Scripts (Including Previously Executed)** check box selected, the platform cleans up such information about previously executed scripts and executes them once more while publishing the project.
  - d. Click **OK**.

The platform applies the customization content to each tenant selected in the dialog box. As a result, the published customization content is saved in the database for each selected tenant.

## To View a Published Customization

You can view the merged content of multiple customization projects that are currently published by using the [Published Customization](#) page of the [Customization Projects](#) (SM204505) form.

When you publish multiple projects at once, the platform merges the projects into a single project and then applies this project to the application instance. (See [To Publish Multiple Projects](#) for details.) To view the content of the merged project, perform the following actions:

1. Navigate to **System > Customization > Manage > Customization Projects**.
2. On the form toolbar, click **View Published** on the toolbar, as the following screenshot shows.

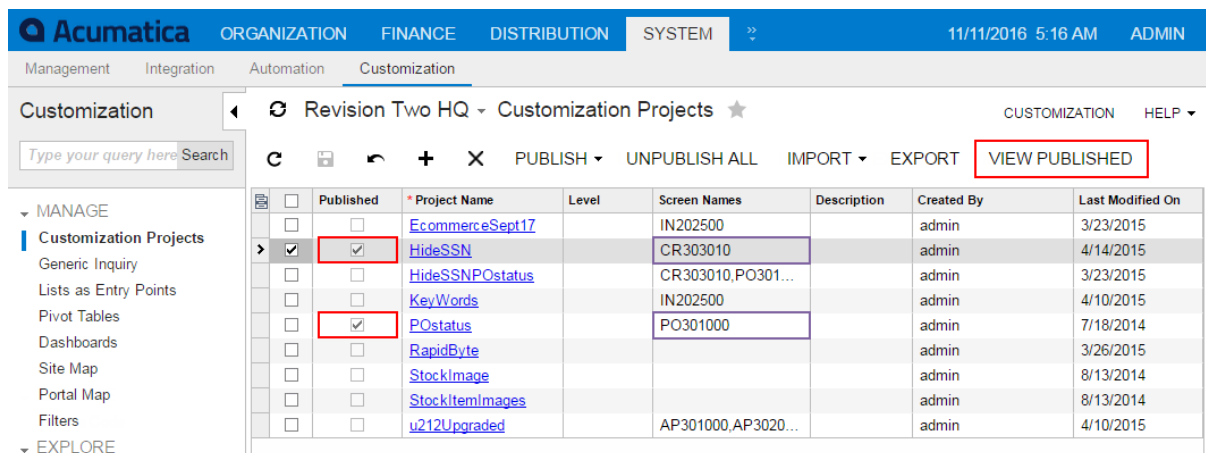


Figure: Opening the Published Customization page

The Published Customization page opens. The screenshot below shows two simultaneously published customization projects, *HideSSN* and *POstatus*. The Published Customization page shows the result of merging these projects.

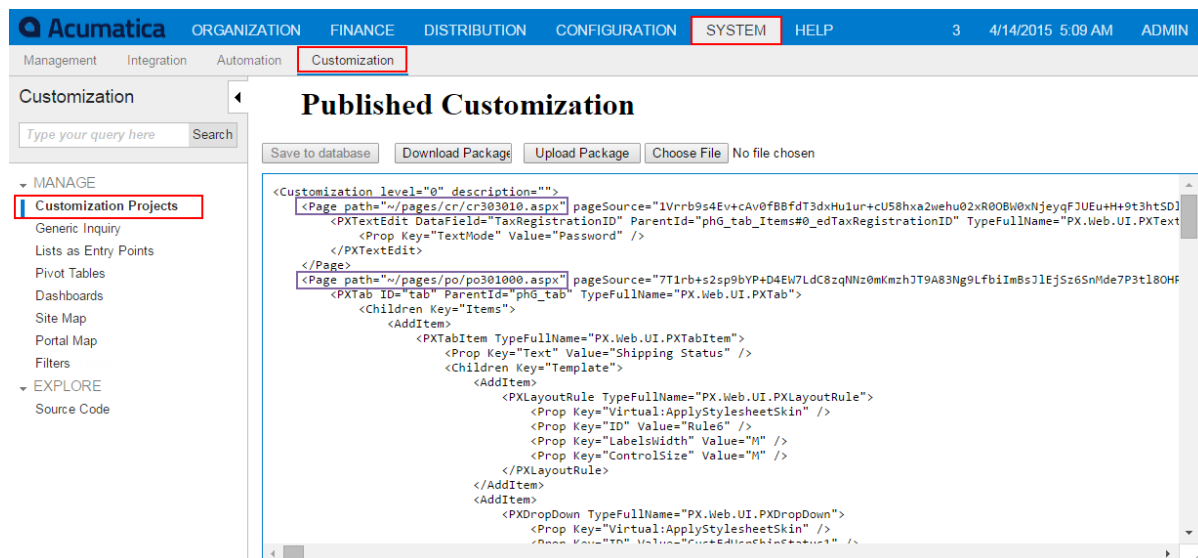


Figure: Viewing the merged XML code of published customization projects

## To Unpublish a Customization

When there are multiple customization projects published in an instance of Acumatica ERP, you can the following options to unpublish the projects:

- [Unpublish all projects](#)
- [Unpublish some projects](#)

In both cases, you use the [Customization Projects](#) (SM204505) form as a starting point.

### To Unpublish All Projects

To remove all customization projects from publication, perform the following actions:

1. Navigate to **System > Customization > Manage > Customization Projects**.
2. On the form toolbar, click **Unpublish All**.

The platform removes all published customization from the Acumatica ERP instance. See [Unpublishing Customization Projects](#) for details.

### To Unpublish Some Projects

To remove some customization projects from publication, perform the following actions:

1. Navigate to **System > Customization > Manage > Customization Projects**.
2. In the project list of the form, be sure the check boxes for projects that you want to remain published are selected, and clear the check boxes for the unnecessary projects.
3. On the form toolbar, click **Publish**.

The platform removes all published customization from the Acumatica ERP instance, merges the content of the customization projects that are currently selected on the form, and applies the merged content to the instance.

## Unpublishing Customization Projects

When you unpublish all customization projects, the system reverses the changes introduced by the customization as follows:

- The forms of Acumatica ERP return to their original layout.
- The `.cs` files of the project with customization code are removed from the website folder in the file system.
- The custom files of these projects are removed from the website folder on the file system.

Some changes aren't reversed, as described below:

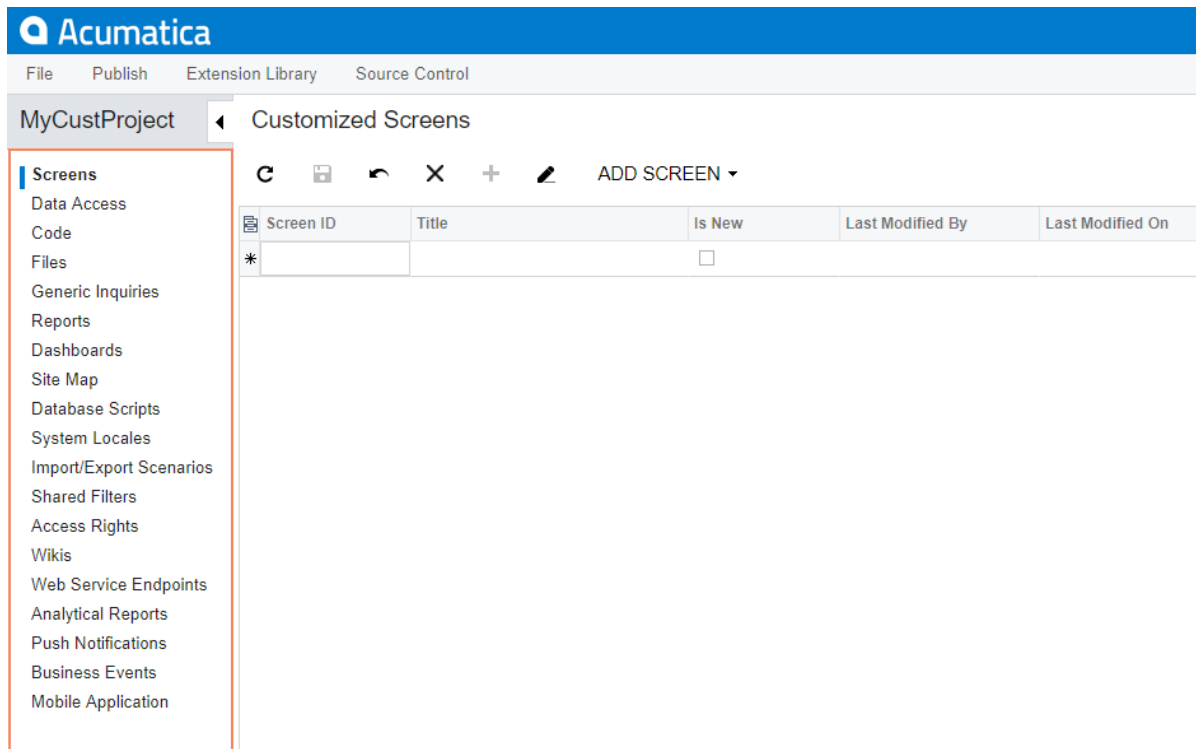
- Database changes remain in the database after the customization is unpublished. Thus, the generic inquiries, reports, changes to the site map, custom tables, custom database objects, and custom data remain in the database. Changes to the site map remain in the navigation menu of Acumatica ERP. If you need to remove these changes, you must do so manually.
- The `.sln` file of the integrated Microsoft Visual Studio solution and its projects (if any) remain in the file system. However the customization code of the unpublished customization project and the external files added to the customization project are removed from the solution.

For example, if a customization project contains a *Report* item and a *SiteMapNode* item for the report, after you publish and unpublish the project, the report and the site map node remain in the database and remain available in the application, so you need to remove them manually.

There is no difference in the unpublishing process for a single-tenant site and a multitenant site: The platform deletes the same files in the file system and keeps all the changes in the database.

# Managing Items in a Project

You use the [Customization Project Editor](#) to manage the items in a customization project. The editor includes a page to support each type of item in a customization project. (See [Types of Items in a Customization Project](#) for details.) By using the navigation pane of the editor, shown in the following screenshot, you can open these pages (each of which is described in detail in the corresponding part of this guide).



**Figure: Viewing the navigation pane of the editor**

## In This Part

- [Customized Screens](#)
- [Customized Data Classes](#)
- [Code](#)
- [Custom Files](#)
- [Generic Inquiries](#)
- [Custom Reports](#)
- [Dashboards](#)
- [Site Map](#)
- [Database Scripts](#)
- [System Locales](#)
- [Import and Export Scenarios](#)
- [Shared Filters](#)

- [Access Rights](#)
- [Wikis](#)
- [Web Service Endpoints](#)
- [Analytical Reports](#)
- [Push Notifications](#)
- [Business Events](#)
- [Mobile Application](#)

## Customized Screens

---

You use the Customized Screens page of the [Customization Project Editor](#) to manage the *Page*, *AUScreenAction*, *AUScreenNavigationAction*, and *AutomationScreenField* items in the customization project. The *Page* item for an existing form contains the instructions about changes to the layout that have to be applied by the platform to the ASPX code of the form during publication of the project. For a custom form, the *Page* item holds the content of the form and the path to the ASPX file of the form. (The path is required so the platform can detect changes of the file in the file system in the development environment and update the file while you publish the project.)

Using the Customized Screens page, you can do the following:

- Modify the layout and actions on an existing form. When you start to modify the layout of an existing form, to store the changes, the platform adds a *Page* item for the form to the customization project. When you use the [Screen Editor](#) to change the form layout, the platform saves each change to this item. The changed logic of the form is saved in the *AUScreenAction*, *AUScreenNavigationAction*, and *AutomationScreenField* items. See [Types of Items in a Customization Project](#) for details about customization project items.
- Create a custom form. To do this, you invoke **Add Screen > Create New Screen** on the Customized Screens page to create the workable template for the form, and add the template to the customization project as a *Page* item, a *Code* item, a *SiteMapNode* item, and two *File* items, as described in [To Add a New Custom Form to a Project](#). You can then develop the custom form by using both the Screen Editor and Microsoft Visual Studio.

The Customized Screens page contains the list of the *Page* items for existing and custom forms added to the customization project.

On the page, you can perform the operations with the customized screens that are described in the following topics:

- [To Add a Page Item for an Existing Form](#)
- [To Delete a Page Item from a Project](#)
- [To Add a New Custom Form to a Project](#)
- [To Delete a Custom Form from a Project](#)
- [To Delete Items from the Project on the Edit Project Items Page](#)
- [To Add a Condition](#)
- [To Add an Action](#)

### To Add a Page Item for an Existing Form

You can add a *Page* item for an existing form to a customization project by using both the [Customization Menu](#) and the [Element Inspector](#), or you can add the item in the [Customization Project Editor](#).

The following sections provide detailed information:

- [To Add a Page Item by Using the Element Inspector](#)

- [To Add a Page Item on the Customized Screens Page](#)

### To Add a Page Item by Using the Element Inspector

To add a *Page* item for an existing form to a customization project by using the [Element Inspector](#), perform the following actions:

1. Open the form in the browser.
2. On the form title bar, click **Customization > Inspect Element** to launch the Element Inspector.
3. On the form, select the UI element (or area) to be customized, to open the [Element Properties Dialog Box](#) for the element (or area).
4. In the dialog box, click **Customize**.
5. If there is no currently selected customization project and the inspector opens the [Select Customization Project Dialog Box](#), select an existing customization project or create a new one.

Acumatica Customization Platform creates the *Page* item for the form, adds the item to the currently selected customization project, and opens the form in the [Screen Editor](#).

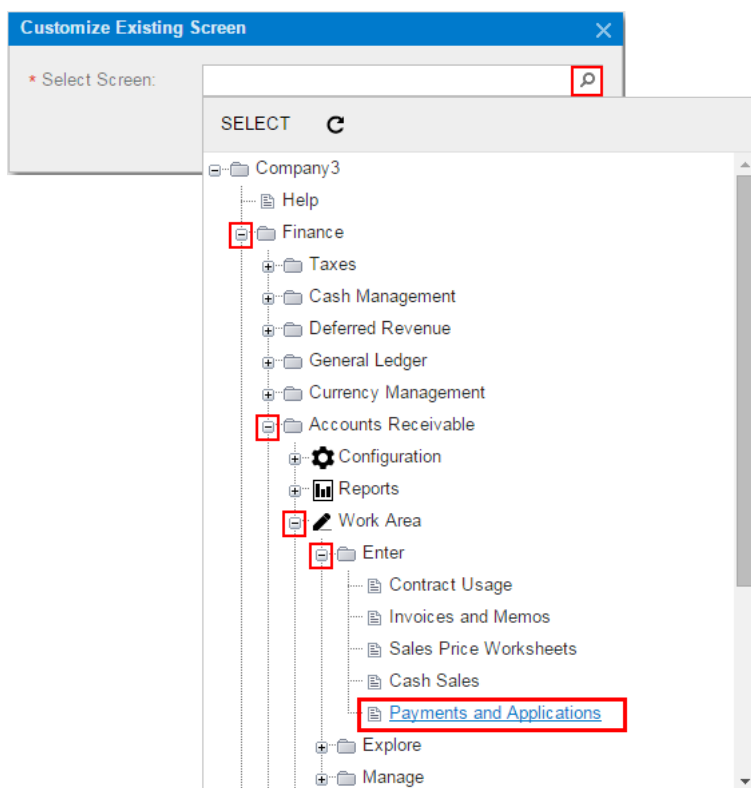
The platform assigns to the new item a name that corresponds to the form ID.

### To Add a Page Item on the Customized Screens Page

To add a *Page* item for an existing form to a customization project by using the Customization Project Editor, perform the following actions:

1. Open the customization project in the editor. (See [To Open a Project](#) for details.)
2. Click **Screens** in the navigation pane to open the Customized Screens page.
3. On the page toolbar, click **Add Screen > Customize Existing Screen**.
4. In the **Customize Existing Screen** dialog box, which opens, double-click the needed form in the tree, which corresponds to the site map of the application.

The following screenshot demonstrates how you can select the Payments and Applications form (**Finance > Accounts Receivable > Work Area > Enter**) in the **Customize Existing Screen** dialog box.



**Figure: Selecting the form in the Customize Existing Screen dialog box**

As soon as you add the item, the *Screen Editor* opens for the form so that you can start changing the form layout.

To go back to the Customized Screens page of the Customization Project Editor, click **Screens** on the navigation pane. You can see that the added form is saved to the list of project items.

As an alternative to selecting a form in the tree, if you know the screen ID of the form, you can add the appropriate item directly to the table of the Customized Screens page. To do this, perform the following actions (shown in the screenshot below):

1. On the page toolbar, click **Add Row (+)**.
2. In the **Screen ID** column of the new row, type the screen ID of the form.
3. On the page toolbar, click **Save** to save the item to the project.

The screenshot below shows the screen ID of the Journal Transactions form entered in the table: GL301000. As soon as you specify the screen ID, press Tab on the keyboard to view the name of the form, which appears in the **Title** column; make you sure you are adding the item for the needed form.

<div> <span>↺</span> <span>🔒</span> <span>↻</span> <span>✕</span> <span>+</span> <span>🔍</span> <span>ADD SCREEN ▾</span> </div>					
Screen ID	Title	Is New	Last Modified By	Last Modified On	
* GL 30.10.00		<input type="checkbox"/>			
AR 30.30.00	Customers	<input type="checkbox"/>	admin	7/27/2016	
SO 30.10.00	Sales Orders	<input type="checkbox"/>	admin	7/27/2016	
SO 30.30.00	Invoices	<input type="checkbox"/>	admin	7/27/2016	

**Figure: Adding the screen ID of an existing form to the table**

To modify the layout of a form, open the Screen Editor for the form by clicking the **Screen ID** of the form in the table or in the navigation pane of the Project Editor.

## To Delete a Page Item from a Project

To remove from a customization project a *Page* Item created for an existing or custom form, perform the following actions:

1. Open the project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. Click **Screens** in the navigation pane to open the Customized Screens page.
3. In the page table, click the item for the form.
4. On the page toolbar, click **Delete Row** (X).
5. On the page toolbar, click **Save** to save the changes to the customization project.

## To Add a New Custom Form to a Project

To add a new custom form to a customization project, perform the following actions:

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. Click **Screens** in the navigation pane to open the Customized Screens page.
3. On the page toolbar, click **Add Screen > Create New Screen**.
4. In the **Create New Screen** dialog box, which opens, specify the following parameters to create the files for the new form:
  - **Screen ID**: The unique identifier of the new form
  - **Graph Name**: The name of the new class of the business logic code for the form (also called *graph*)
  - **Graph Namespace**: The namespace to which the new business logic class should be added
  - **Page Title**: The title of the new form
  - **Template**: The form template that provides the default set of containers on the form
  - **Site Map Parent**: The parent node in the site map to which the new form should be added
5. In the dialog box, click **OK**.



: Before you start editing the created screen in the Screen Editor, you must publish the customization project.

For the new form, the system creates the following items and adds them to the customization project:

- The `.aspx` and `.aspx.cs` files, which appear in the **Files** list of the project items.
- The `.cs` file with the business logic code for the form, which appears in the **Code** list of project items.
- The site map node, which appears in the **Site Map** list of project items.



: To give users the ability to navigate to the form in Acumatica ERP with the Modern UI switched on, you need to specify the position of the new form in the modern UI by using the Menu Editing mode and update the *SiteMapNode* item, as described in [To Update a Site Map Node in a Project](#). For details on the Menu Editing mode, see [Menu Editing Mode in the Modern UI](#) in the Interface Guide.

- The *Page* item, with a name that corresponds to the new screen ID; this item appears in the **Screens** list of project items. This item contains the link to the new page content, which you can later develop by using the [Screen Editor](#).



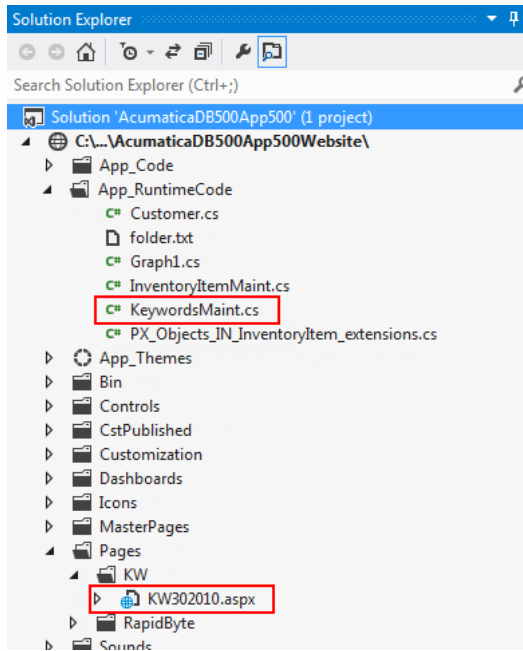
To obtain the actual files in the file system, publish the customization project after you have added the form to the project. After that, the following files are available on the file system:

- The `.aspx` and `.aspx.cs` files in the `Pages/<First segment of ScreenID>/` folder of the website
- The `.cs` file with the business logic code in the `App_RuntimeCode` folder of the website

You can develop business logic code for the custom form in Microsoft Visual Studio later.

The screenshot below shows the files of the custom form that has been added to the customization project (through the **Add Screen > Create New Screen** command) with the following parameters:

- **Screen ID:** `KW302010`
- **Graph Name:** `KeywordsMaint`



**Figure: Viewing the files of the custom form in Visual Studio solution**

## To Delete a Custom Form from a Project

To remove a custom form from a customization project, you have to delete all the items that have been added to the project for the form.

To do this, perform the following actions:

- Delete from the customization project the *Page* item that was added by the New Screen wizard. (See [To Delete a Page Item from a Project](#) for details.)
- Delete from the project the *Code* item that was added by the New Screen wizard. (See [To Delete a Code Item From a Project](#).)
- Delete from the project the `<FormID>.aspx` and `<FormID>.aspx.cs` *File* items that were added by the New Screen wizard. (For more information, see [To Delete a Custom File From a Project](#).)
- Delete from the project the *SiteMapNode* item that was added by the New Screen wizard. (See [To Delete a Site Map Node from a Project](#) for details.)
- If you added other items for the custom form, such as items for the mobile site map or custom files, delete these items.

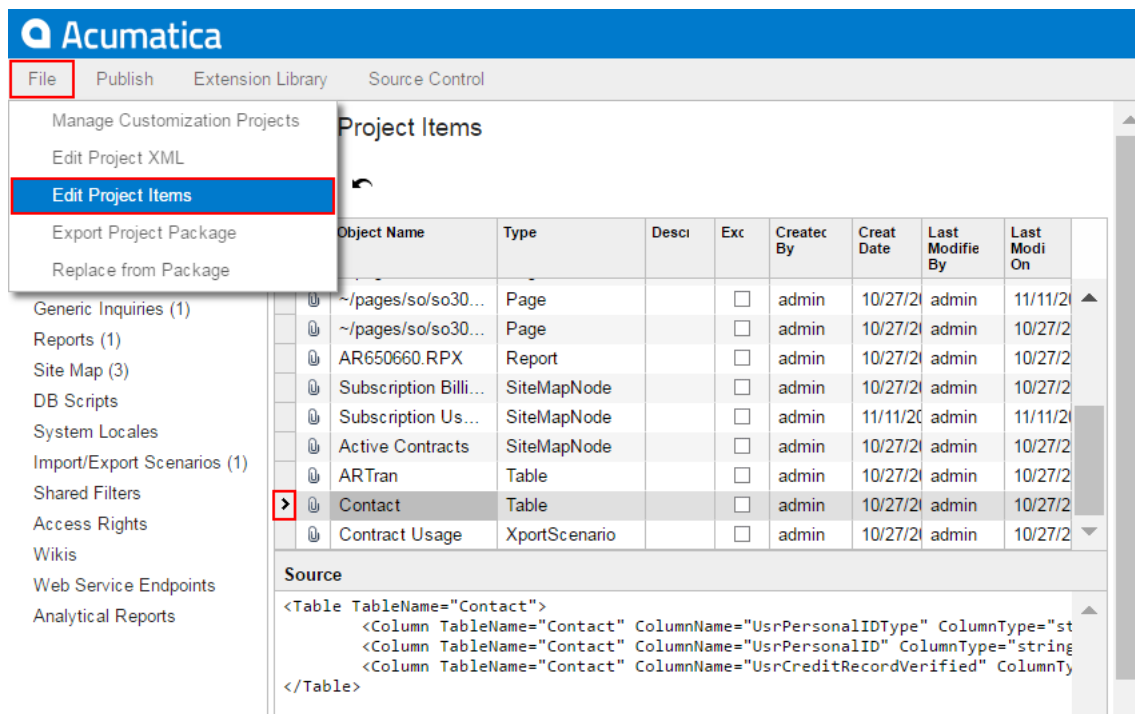
To delete multiple items from the customization project successively on a single page, you can use the Edit Project Items page of the Customization Project Editor. (See [To Delete Items from the Project on the Edit Project Items Page](#) for details.)

The system applies the changes to the file system as soon as you publish the customization project.

## To Delete Items from the Project on the Edit Project Items Page

You can delete multiple items from the customization project on the Edit Project Items page of the Customization Project Editor. To do this, perform the following actions:

1. On the menu of the editor, click **File > Edit Project Items**.
2. In the table of the Edit Project Items page, which opens, click the item to be deleted, as the following screenshot shows.



**Figure: Using the Edit Project Items page to delete an item from the customization project**

3. Press Delete on the keyboard to delete the selected row from the table.
4. If you need to delete multiple items from the project, repeat Steps 2–3 for each item.
5. On the page toolbar, click **Save** to save the change in the project.

## To Add a Condition

You can construct a condition and then specify it as a property value for an action or a control. This way you can change the business logic of the screen.

### Before You Proceed

Conditions can be added to a specific screen. So before adding a condition, you should add the corresponding page item to the customization project. See [To Add a Page Item for an Existing Form](#) or [To Add a New Custom Form to a Project](#) for details.

### To Add a Condition

To add a condition, do the following:

1. In the navigation pane of the Customization Project Editor, click **Conditions** under the screen node you want to customize. The Conditions page opens.
2. In the **Conditions** area, enter the name of the condition you are adding in the **Condition Name** column..

3. In the **Condition Details** area of the Conditions page, configure the condition by adding rows and specifying field values in each row.
4. Click **Save** on the page toolbar.

When you save the added condition, it appears in the lists of possible values for the **Enabled**, **Visible**, and **Required** properties of a control or an action.

### To Display an Action When a Field Has a Specific Value (Example)

Suppose that you want an action to be displayed only when some elements have specific values: On the Sales Orders (SO301000) form, you want the **Print Sales Order/Quote** action to be displayed only when the **Description** box is not empty and when the **Status** is *Open*. To configure this condition, do the following:

1. Add the Sales Orders screen to the list of customized screens, as described in [To Add a Page Item for an Existing Form](#).
2. In the navigation pane of the Customization Project Editor, click **Conditions** under the SO301000 node.  
The Conditions: SO301000 (Sales Orders) page opens.
3. In the **Conditions** area of the opened page, specify the condition's name in the **Condition Name** column: *DescriptionNotEmpty*.
4. In the **Condition Details** of the opened page, add two rows with the following values:
  - Row 1:
    - **Field Name:** *OrderDesc*
    - **Condition:** *Is Not Null*
    - **Operation:** *And*
  - Row 2:
    - **Field Name:** *Status*
    - **Condition:** *Equals*
    - **Value:** *Open*
5. On the page toolbar, click Save.
6. On the navigation pane of the Customization Project Editor, select the **SO301000** node.  
The Screen Editor: SO301000 (Sales Orders) page opens.
7. In the control tree of the opened page, select **DataSource: SOOrderEntry > Toolbar > Form-Specific > Reports > Print Sales Order/Quote**.
8. On the **Main Properties** tab, for the **Visible** property, select the *DescriptionNotEmpty* value.
9. Save your changes, and publish the customization project.
10. In Acumatica ERP, open a sales order with an *Open* status on the Sales Orders form. Clear the description of the order, and save the order. Notice that the **Reports** menu is no longer shown on the toolbar because it contains only one menu command, which does not meet the conditions to be shown in this case.

### To Add an Action

You can use the Screen Editor to add a new action to do any of the following:

- Run a report

- Navigate to a list of records
- Navigate to a form to create a new record

### Before You Proceed

Before adding a action to a screen, you should add the corresponding page item to the customization project as described in the previous instructions.

### To Add a New Action by Using the Screen Editor

To add a new action using Screen Editor:

1. In the navigation pane of the Customization Project Editor, under the **Screens** node, select the page item you added to the customization project.
2. In the control tree of the page, select the group of actions to which you want to add an action. You can add an action to the following action groups:
  - **Form-Specific**
  - **Form-Specific > Actions**
  - **Form-Specific > Inquiries**
  - **Form-Specific > Reports**
3. On the control tree area toolbar, click **Add New Action**.
4. In the **New Action** dialog box, which opens, specify the action type, name, and screen ID. You should specify the screen ID depending on what action type you selected. The following table summarizes the screen you should specify depending on the action type you selected.

Action Type	Screen ID
Run report	The screen ID of the report that you want to run and to which you want to redirect the user such as Sales Order Summary ( <i>SO610500</i> )
Navigation: Search records	The screen ID of the substitute form (which lists the records created on a particular data entry form) to which you want to redirect the user, such as <i>SO3010PL</i> (which is the ID of the substitute form for the Sales Orders entry form)
Navigation: Create record	The screen ID of the form on which a user can create a new record, such as <i>SO301000</i> (which is the ID of the Sales Orders data entry form)

5. In the dialog box, click **OK**.  
The created action appears in the control tree. The action properties appear in the tabs to the right of the control tree. You can change the location of the action by dragging it in the control tree.
6. Configure the action properties, such as **Display Name**.  
On the **Main Properties** tab, configure the properties specific to the action type, which are displayed at the bottom of the tab.
7. Save your changes to the customization project.

## Customized Data Classes

You use the Customized Data Classes page of the [Customization Project Editor](#) to manage *DAC* items in a customization project.



: A *DAC* item contains data in the XML format used by the platform to create an appropriate extension for the original data access class.

The Customized Data Classes page displays the list of *DAC* items for existing data access classes of Acumatica ERP added to the project.

On the page, you can perform several operations with the customized data access classes, as described in the following topics:

- [To Add a DAC Item for an Existing Data Access Class to a Project](#)
- [To Delete a DAC Item from a Project](#)
- [To Convert a DAC Item to a Code Item](#)
- [To Upgrade Technology for Legacy DAC Customization](#)



: You cannot create a custom data access class on this page. Instead, you have to use the [Code](#) page of the editor. Custom classes are added to the project as *Code* items. See [To Create a Custom Data Access Class](#) for details.

You can use Microsoft Visual Studio to work with a *DAC* item of a customization project that is currently published. During the project publication, the platform creates the `PX_Objects_<DACItemName>_extensions.cs` file with the item content in the `App_RuntimeCode` folder of the website. If you make changes to the code in Visual Studio, you have to update the item in the customization project. See [Detecting the Project Items Modified in the File System](#) for details.

### To Add a DAC Item for an Existing Data Access Class to a Project

Before modifying an existing data access class, you have to add a *DAC* item for the class to the customization project. This item is used to store the data of the class extension in XML format. After the item is created, you can modify the class members by using the [Data Class Editor](#). After the customization project is published, the `.cs` file for the item is created in the file system, and you can develop the C# code of the class extension in Microsoft Visual Studio. You can use the Data Class Editor as well as Visual Studio to add custom fields to existing data access classes.

You can add a *DAC* item for an existing data access class to a customization project by using the [Element Inspector](#), or you can create and add the item on the Customized Data Classes page of the Customization Project Editor.

The following sections provide detailed information:

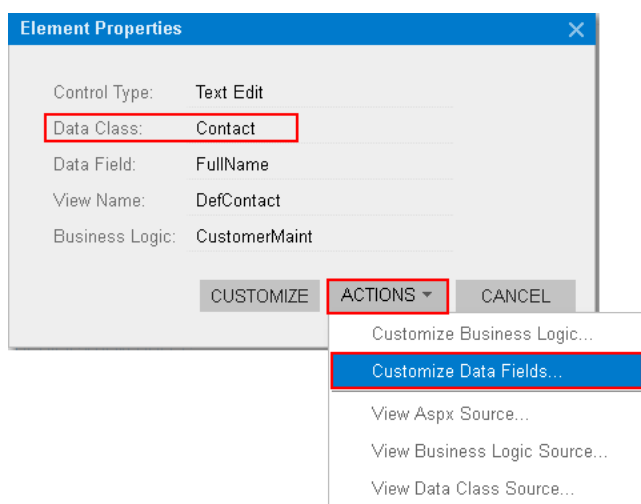
- [To Add a DAC Item by Using the Element Inspector](#)
- [To Add a DAC Item on the Customized Data Classes page](#)

#### To Add a DAC Item by Using the Element Inspector

1. Open the form in the browser.
2. On the form title bar, click **Customization > Inspect Element** to launch the Element Inspector.
3. On the form, select a UI element for a field of the class to be customized to open the [Element Properties Dialog Box](#) for the element.

The dialog box displays the name of the data access class that contains the selected element in the **Data Class** box, as shown in the screenshot below.

4. In the dialog box, click **Actions > Customize Data Fields**.



**Figure: Using the Element Properties dialog box to start customization of the class**

If there is no currently selected customization project, the inspector opens the [Select Customization Project Dialog Box](#) to force you to select an existing customization project or to create a new one.

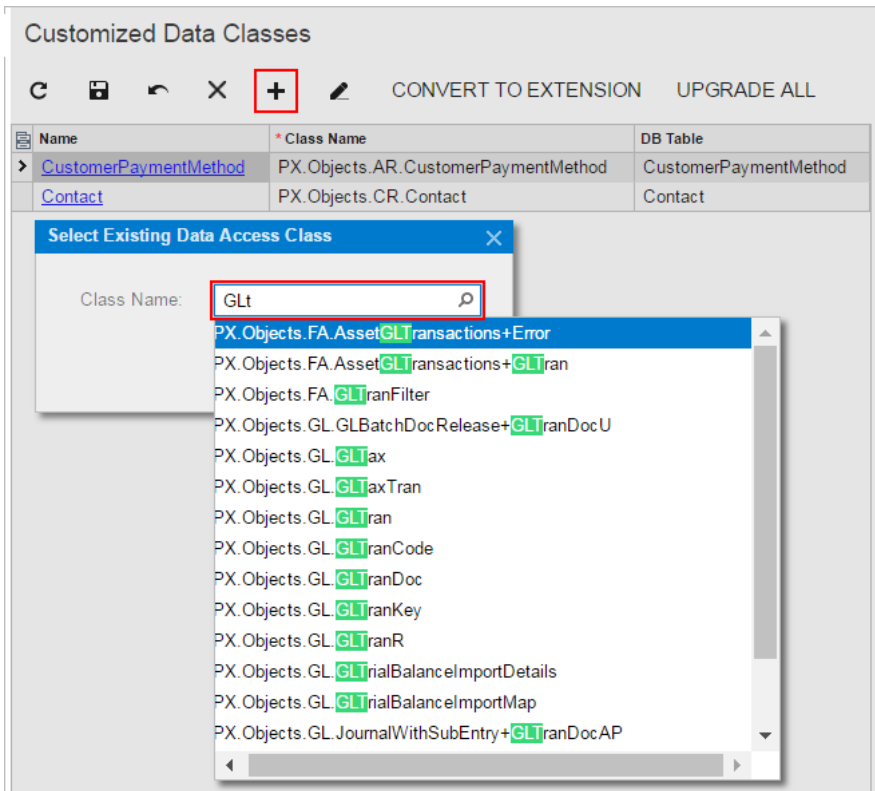
Acumatica Customization Platform creates the *DAC* item for the class, adds the item to the currently selected customization project, and opens the class in the [Data Class Editor](#).

The platform assigns the new item the name of the data access class.

#### **To Add a DAC Item on the Customized Data Classes page**

1. Open the customization project in the editor. (See [To Open a Project](#) for details.)
2. Click **Data Access** in the navigation pane to open the Customized Data Classes page.
3. On the page toolbar, click **Add New Record (+)**.
4. In the **Select Existing Data Access Class** dialog box, which opens, select the class in the **Class Name** box.

You can type the class name in the **Class Name** box or search for the class by a part of its name, as shown in the screenshot below. As soon as you add the class, the [Data Class Editor](#) opens for it so that you can modify the fields of this class and add custom fields to it.



**Figure: Adding an existing data access class to the project**

5. On the page toolbar, click **Save** to save the item in the customization project.

As soon as you have modified the attributes of an existing field of the class or added a new field to the class and saved the changes in Data Class Editor, the class is added to the customization project and appears in the table of the Customized Data Classes page.


To go back to the Customized Data Classes page of the Customization Project Editor, select **Data Access** on the navigation pane. You can see that the added item is saved to the list of project items.

**To Delete a DAC Item from a Project**

To remove changes to an existing data access class from a project, perform the following actions:

- 1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
- 2. Click **Data Access** in the navigation pane to open the Customized Data Classes page.
- 3. In the page table, select the item to be deleted.
- 4. On the page toolbar, click **Delete Row**.
- 5. On the page toolbar, click **Save** to save the changes to the customization project.

If you added a bound custom field to an existing data access class, the platform includes the *DAC* and *Table* items for this class in the customization project.

 : The *Table* item contains a description of custom columns added to a database table for bound custom fields created in the appropriate data access class.

After you publish the customization project at least once, the database schema is changed. Changes to the database schema aren't deleted when you delete the *DAC* and *Table* items and publish the project. You have to remove the changes manually.

You can delete a *DAC* or *Table* item (or another item) from the customization project on the Edit Project Items page of the Customization Project Editor. (See [To Delete Items from the Project on the Edit Project Items Page](#) for details.)

## To Convert a DAC Item to a Code Item

If you have a customized data access class that is added to the project as a *DAC* item, then you can convert the class changes into the class extension code (a *Code* item) to complete the extension development in the Code Editor or in Microsoft Visual Studio. (See [Supported DAC Extension Formats](#) for details.)

To do this, perform the following actions:

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. Click **Data Access** in the navigation pane to open the Customized Data Classes page.
3. In the page table, select the item to be converted, as the screenshot below shows.
4. On the page toolbar, click **Convert to Extension**.



: This action can be applied for only data access classes customized using the technology based on extensions. If you have legacy DAC customization, upgrade it before converting *DAC* items to class extensions. See [To Upgrade Technology for Legacy DAC Customization](#) for details.

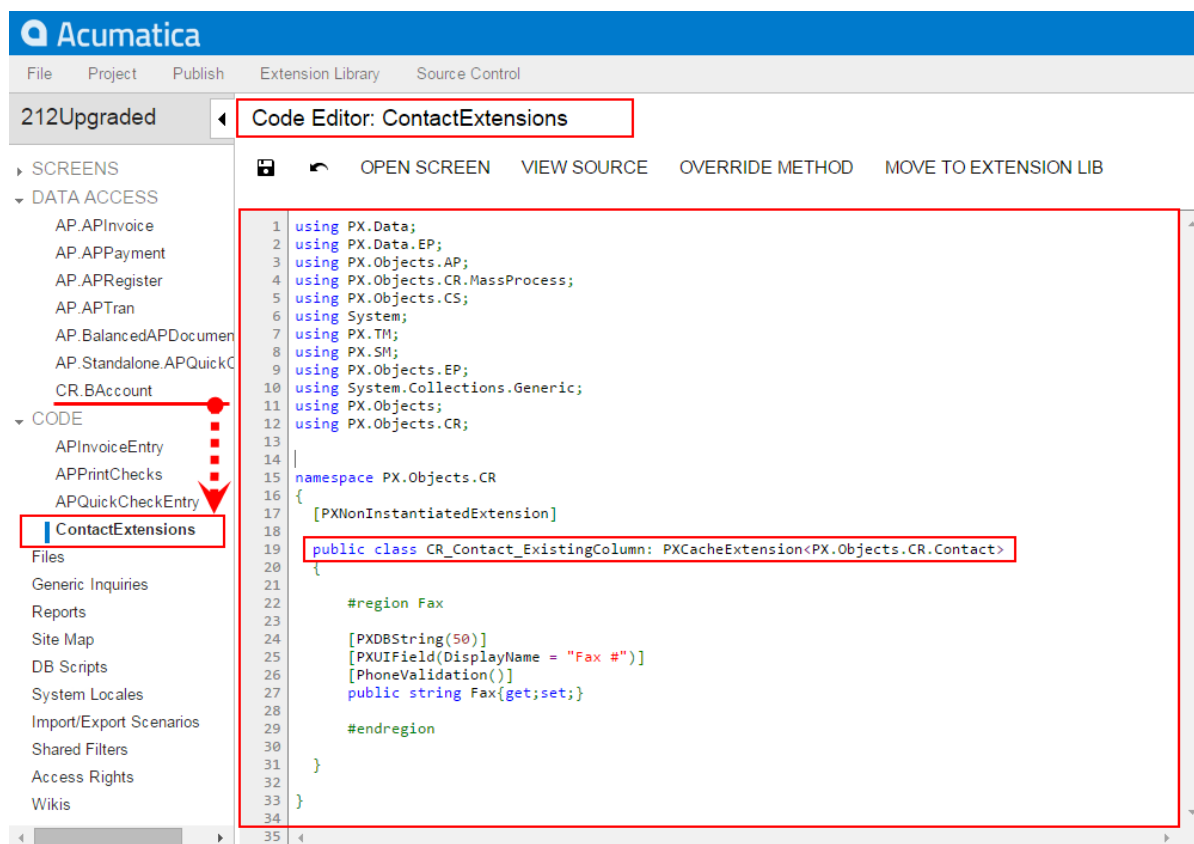
The screenshot shows the Acumatica Customization Project Editor interface. The top navigation bar includes 'File', 'Project', 'Publish', 'Extension Library', and 'Source Control'. The main area is titled '212Upgraded' and 'Customized Data Classes'. On the left, the 'DATA ACCESS' section is expanded, showing a list of items. 'CR.Contact' is selected, indicated by a red circle and a red arrow pointing to the 'Contact' item in the table. The table has three columns: 'Name', 'Class Name', and 'DB Table'. The 'Contact' item is highlighted in blue. The toolbar at the top right includes a 'CONVERT TO EXTENSION' button, which is highlighted with a red box. Below the table, the 'CODE' section is expanded, showing a list of items. 'APQuickCheckEntry' is selected, indicated by a red circle and a red arrow pointing to the 'APQuickCheckEntry' item in the table.

Name	Class Name	DB Table
<a href="#">APInvoice</a>	PX.Objects.AP.APInvoice	APRegister
<a href="#">APPayment</a>	PX.Objects.AP.APPayment	APRegister
<a href="#">APRegister</a>	PX.Objects.AP.APRegister	APRegister
<a href="#">APTran</a>	PX.Objects.AP.APTran	APTran
<a href="#">BalancedAPDocument</a>	PX.Objects.AP.BalancedAPDocument	APRegister
<a href="#">APQuickCheck</a>	PX.Objects.AP.Standalone.APQuickCheck	Projection
<a href="#">BAccount</a>	PX.Objects.CR.BAccount	BAccount
<a href="#">Contact</a>	PX.Objects.CR.Contact	Contact

**Figure: Converting the *DAC* item to the *Code* item**

The platform converts the XML content of the selected item to C# code, deletes the *DAC* item in the customization project, adds the created code to the project as a *Code* item, and opens it in the [Code Editor](#), as shown in the following screenshot.





**Figure: Viewing the result of the conversion**

This operation is irreversible. After you convert the XML data to C# code, you will not be able to work with the item in the Data Class Editor or convert it back to a DAC item. You will be able to edit the code in Code Editor and Visual Studio.



**Attention:** The **Convert to Extension** action also affects all the inherited classes of the specified DAC if the classes are customized.

The system obtains the name of the *Code* item from the DAC name by appending the *Extensions* suffix to it. After the publication of the customization project, the actual customization code of the class is available in the <DACName>Extensions.cs file in the App\_RuntimeCode folder of the website. For example, if you apply the action to the CR.Contact class, as shown in the screenshots above, the operation converts the DAC item to the Code item, automatically giving it the name of ContactExtensions. The action removes the CR.Contact DAC item class from the project and adds the ContactExtensions Code item.

## To Convert a DAC Item to an Extension Library

Only *Code* items can be moved to an extension library. To convert a DAC item to an extension library, you should first convert the DAC item to a Code item.

Also, you might need to complete these instructions if you have a custom DAC or a DAC extension developed in one customization and a DAC extension of this custom DAC or a higher-level DAC extension in another customization. To eliminate dependency and to be able to use the DAC extension in your project, you need to convert the DAC extension to an extension library.

### To Convert a DAC Extension to an Extension Library

1. Convert the DAC item to a Code item, as described in [To Convert a DAC Item to a Code Item](#).
2. Move the Code item to the extension library, as described in [To Move a Code Item to the Extension Library](#).

## To Upgrade Technology for Legacy DAC Customization

In Acumatica Customization Platform 4.2 and earlier versions, the customization of data access classes was implemented through the direct Microsoft Intermediate Language (MSIL) injection of custom fields into `PX.Objects.dll`. This resulted in a complex process of publication in which the original library was replaced with the modified version. In Acumatica Customization Platform 2019 R1, the customization uses the technology based on class extensions and the DAC extension is compiled into a separate library that is dynamically merged with the original DAC by the platform at run time.

If you do not need to change the contents of a customization project, there is no reason to upgrade it. The system will successfully publish the project using the injection of custom fields into `PX.Objects.dll` in the newer version of the system as well. However if you have to continue the development of the project, we recommend that you upgrade the technology of DAC customization in the project.

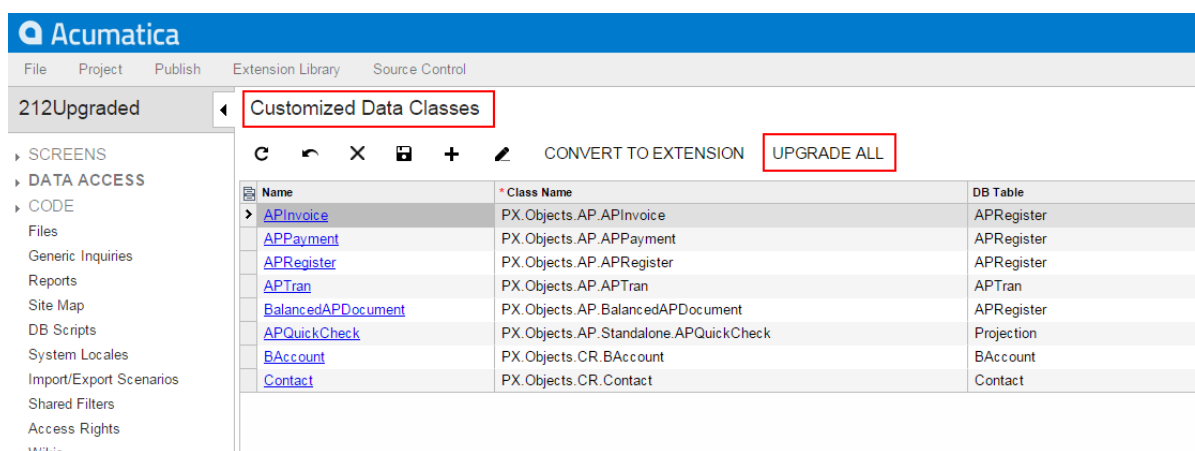
The following sections provide detailed information:

- [To Upgrade a Legacy DAC Customization](#)
- [To Upgrade a Library with a Legacy DAC Customization](#)

### To Upgrade a Legacy DAC Customization

To upgrade the legacy DAC customization to the technology based on class extensions, perform the following actions:

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. Click **Data Access** in the navigation pane to open the Customized Data Classes page.
3. On the page toolbar, click **Upgrade All**, as shown in the following screenshot.



**Figure: Upgrading legacy customization**

This action launches the upgrade wizard, which processes all the project items of the *DAC* and *Code* types to discover and update the following cases of DAC customization based on the MSIL injection technology:

- A field of a data access class does not contain the `StorageName` attribute, which specifies the storage type of the field. For more information about the storage types, see [Create New Field Dialog Box](#).

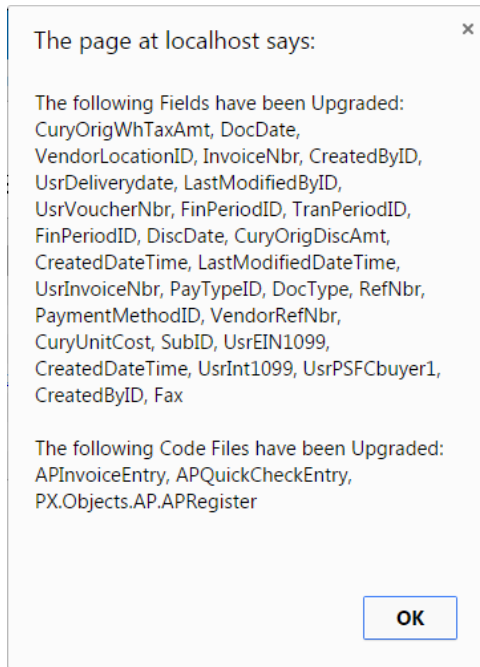


: In the Acumatica Customization Platform, you must select the way a custom field will be stored in the database when you add the field to a data access class.

- The code contains a direct reference to a custom field of a row.
- The code contains a direct reference to an abstract class of a DAC field.

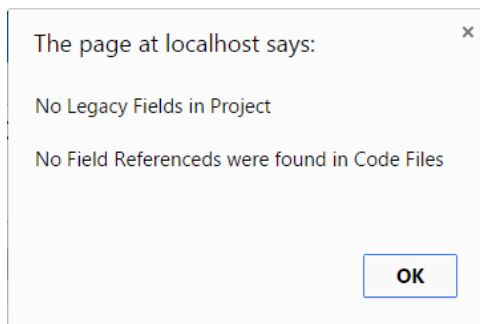
See [Using the Upgrade Wizard](#) for details.

After the process is complete, the wizard opens the message box with the list of the items that have been upgraded (see the screenshot below).



**Figure: Viewing the list of upgraded items**

If there is no legacy customization in the project, the wizard opens a message box with the relevant information (see the screenshot below).



**Figure: Viewing the message box that indicates no legacy customization in the project**

### To Upgrade a Library with a Legacy DAC Customization

If you have legacy customization of data access classes as a library (.dll) and have to modify the customization project, you can add the source code of the library as *Code* items to the customization project and then upgrade it as follows:

1. In the Microsoft Visual Studio project of the library, for each source code file that contains a data access class customization, do the following:
  - a. In Visual Studio (or any text editor), open the file, select **All**, and copy the source code to the clipboard.
  - b. Create a new *Code* item in the customization project.
  - c. Delete the code template from the created item.

- d. Paste the clipboard content into the item and save the *Code* item to the customization project.
2. Upgrade the customization project.
3. Test the upgraded customization project to ensure that the project is valid and applies to the system after publication.
4. If you need to move the source code back to the library, use the clipboard and the copy-paste approach as well.

### Using the Upgrade Wizard

While upgrading the *DAC* items, the wizard does the following:

- Adds the `StorageName` attribute and sets its value to "ExistingColumn" for an existing field.
- Adds the `StorageName` attribute and sets its value to "AddColumn" for a custom field.
- Finds and replaces all references to custom fields in the attributes of other customized fields, such as a `PXSelector`, `PXParent` or `PXFormula`. For example, the wizard inserts the `typeof(DACNameExt.usrFieldName)` reference in the `PXSelector` declaration instead of the `typeof(DACName.usrFileName)` reference.

While upgrading items of the *Code* type, the wizard processes each item to find references to the custom fields and replaces the references by using the following approach:

- The wizard updates the references to the abstract class of the DAC field from `DACName.usrFieldName` to `DACNameExt.usrFieldName`, where the `DACNameExt` is the name of the new extension class.
- The wizard replaces the references to the field `Row.UsrFieldName` with a reference to the field through the DAC extension: `Row.GetExtension<DACNameExt>().UsrFieldName`.

For example, the following code contains the references to the `APRegister.usrVoucherNbr` class and `doc.UsrVoucherNbr` field, which is a field customized based on the MSIL injection technology.

```
sender.RaiseExceptionHandling<APRegister.usrVoucherNbr>(doc,
    doc.UsrVoucherNbr,
    new PXSetPropertyException("..."));
```

After technological upgrade for the customization of DAC classes in the project, the references will look as the following code shows. Now the code refers to the `usrVoucherNbr` class of the `APRegisterExt` extension class that will be generated during publication of the project.

```
sender.RaiseExceptionHandling<APRegisterExt.usrVoucherNbr>(doc,
    doc.GetExtension<APRegisterExt>().UsrVoucherNbr,
    new PXSetPropertyException("..."));
```



**Warning:** There might be a situation when a legacy customization includes two data access classes with custom fields that have the same names, such as `DACName1.usrTheSameFieldName` and `DACName2.usrTheSameFieldName`. When you upgrade the customization, the wizard replaces the `Row.usrTheSameFieldName` references to each field by using the following pattern: `Row.GetExtension<DACName1Ext or DACName2Ext>().usrTheSameFieldName`. The expression `"GetExtension<DACName1Ext or DACName2Ext>"` is invalid and causes a compilation error. You are supposed to review these references and insert the correct reference to the needed class, `DACName1Ext` or `DACName2Ext`.

## Code

You use the Code page of the [Customization Project Editor](#) to manage *Code* items in the customization project. On the page, you can perform the following operations with items:

- Add a new *Code* item of any of the following subtypes to the project:

- *New Graph*: A new business logic controller that is derived from the `PXGraph<>` class
- *New DAC*: A data access class that is derived from the `IBqlTable` class
- *Graph Extension*: A graph extension that is derived from the `PXGraphExtension<>` class
- *DAC Extension*: A DAC extension that is derived from the `PXCacheExtension<>` class
- *Code File*: Custom C# code
- *Customization Plug-in*: A class that is derived from the `CustomizationPlugin` class
- Delete a *Code* item from the project

You can open the [Code Editor](#) for a *Code* item by clicking the object name of the item in the page table.



: You can develop the customization code in the Code Editor. However we recommend that you develop the code in Microsoft Visual Studio (as described in [Integrating the Project Editor with Microsoft Visual Studio](#)) and use the editor for either minor code correction or the insertion of ready portions of code.

To move the code from a *Code* item to the extension library that is bound to the customization project, use the **Move to Extension Lib** action on the Code Editor toolbar.

For detailed information on working with *Code* items, see the following topics:

- [To Create a Custom Business Logic Controller](#)
- [To Create a Custom Data Access Class](#)
- [To Customize an Existing Business Logic Controller](#)
- [To Customize an Existing Data Access Class](#)
- [To Add Custom Code to a Project](#)
- [To Add a Customization Plug-In to a Project](#)
- [To Delete a Code Item From a Project](#)
- [To Move a Code Item to the Extension Library](#)

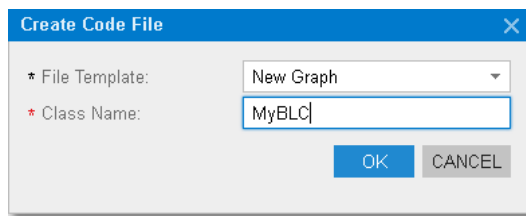
You can use Visual Studio to work with a *Code* item of a customization project that is currently published. During the publication of the project, the platform creates the `<CodeItemName>.cs` file with the item content in the `App_RuntimeCode` folder of the website. If you make changes to the code in Visual Studio, you have to update the item in the customization project. See [Detecting the Project Items Modified in the File System](#) for details.

## To Create a Custom Business Logic Controller

You can add a custom business logic controller to a customization project on the Code page of the Customization Project Editor.

To do this, perform the following actions:

1. Open the customization project in the editor. (See [To Open a Project](#) for details.)
2. Select **Code** in the navigation pane to open the Code page.
3. Click **Add New Record** (+) on the page toolbar.
4. In the **Create Code File** dialog box, which opens, select *New Graph* in the **File Template** box, as the screenshot below shows.
5. In the **Class Name** box, specify the class name of the business logic controller to be created.
6. Click **OK**.



**Figure: Adding a Code item for a custom graph to the project**


The platform creates the code template of the class derived from the `PXGraph<>` class, saves the code as a *Code* item of the project in the database, and opens the item in the [Code Editor](#).

## To Create a Custom Data Access Class

You can add a new data access class (DAC) to a customization project by generating the code from the definition of a database table.

To create a custom data access class for a custom database table and add the created item to a customization project, you have to generate the class template on the Code page of the Customization Project Editor.

To do this, perform the following actions:

1. Create the needed custom table in the database by using a database management tool.
2. Generate the DAC code for the customization project as follows:
  - a. Open the customization project in the Project Editor.
  - b. In the navigation pane, click **Code** to open the Code page.
  - c. On the page toolbar, click **Add New Record (+)**.
  - d. In the **Create Code File** dialog box, which opens, select *New DAC* in the **File Template** box.
  - e. In the **Class Name** box, specify the class name that corresponds to the name of the table created in the database.
  - f.  : If you have just created the table, restart Internet Information Services (IIS) or recycle the application pool to make sure that Acumatica ERP is aware of the new table, because it caches the database schema once, when the domain starts.
  - f. Select the **Generate Members from Database** check box.
  - g. Click **OK**.

The platform does the following:

- Generates the data access class with members that correspond to the table columns. The class is added to the namespace of the customization project.
- Adds the class to the customization project as a *Code* item.
- Saves the customization project.
- Opens the created item in the [Code Editor](#).

You can use the Code Editor to modify the generated code. After you publish the customization project, you can work with the custom data access class in MS Visual Studio.

3. In the Code Editor, define the key fields in the DAC. To include a data field in the key, in the type attribute of the field, you have to add the `IsKey` parameter, as the example below shows.

```
[PXDBString(15, IsKey=true)]
```

4. Add the table definition to the customization project by doing the following:
  - a. In the navigation pane of the Project Editor, click **Database Scripts**.

- b. On the Database Scripts page, which opens, click **Add > Custom Table Schema**.
- c. In the **Add Custom Table Schema** dialog box, which opens, select the custom table in the **Table** box, and click **OK**.

The platform does the following:

- Adds the XML definition of the table to the customization project as an *Sql* item
- Saves the customization project

Every time you publish the customization project, the system checks whether a table with this SQL definition exists in the database. If the table doesn't exist, the system creates the table. If the table exists, the system adjusts the table schema if there is any difference between the existing table schema and the table schema from the customization project (no data is truncated).

## To Customize an Existing Business Logic Controller

You can create the class extension for an existing business logic controller (BLC) and add the *Code* item with the created code to a customization project in several ways, as described in the following sections:

- [To Add a Code Item by Using the Element Inspector](#)
- [To Add a Code Item by Using the Layout Editor](#)
- [To Add a Code Item on the Code page](#)

If you need to extend the code of a BLC that has no webpage associated (such as `ARReleaseProcess`), follow the instructions described in [To Add a Code Item on the Code page](#).

As soon as you add the *Code* item for customization of the business logic to the project, the system generates an extension class for it and opens the code in the [Code Editor](#). You can work with the extension classes in the Code Editor. After you publish the customization project, you can develop the code in MS Visual Studio.

### To Add a Code Item by Using the Element Inspector

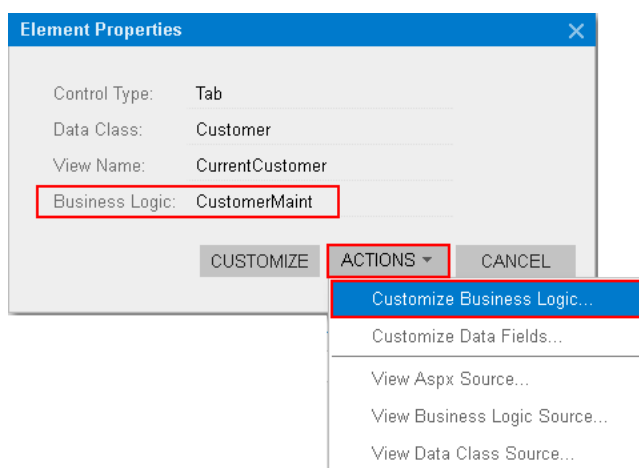
Typically, you want to modify the business logic that is executed for a certain form of Acumatica ERP.

To add a *Code* item for customization of the business logic for an existing form to a customization project by using the [Element Inspector](#), perform the following actions:

1. Open the form in the browser.
2. On the form title bar, click **Customization > Inspect Element** to launch the Element Inspector.
3. On the form, select any UI element to open the [Element Properties Dialog Box](#) for the element.

The **Business Logic** box of the dialog box displays the name of the business logic controller that provides business logic for the form, as shown in the screenshot below.

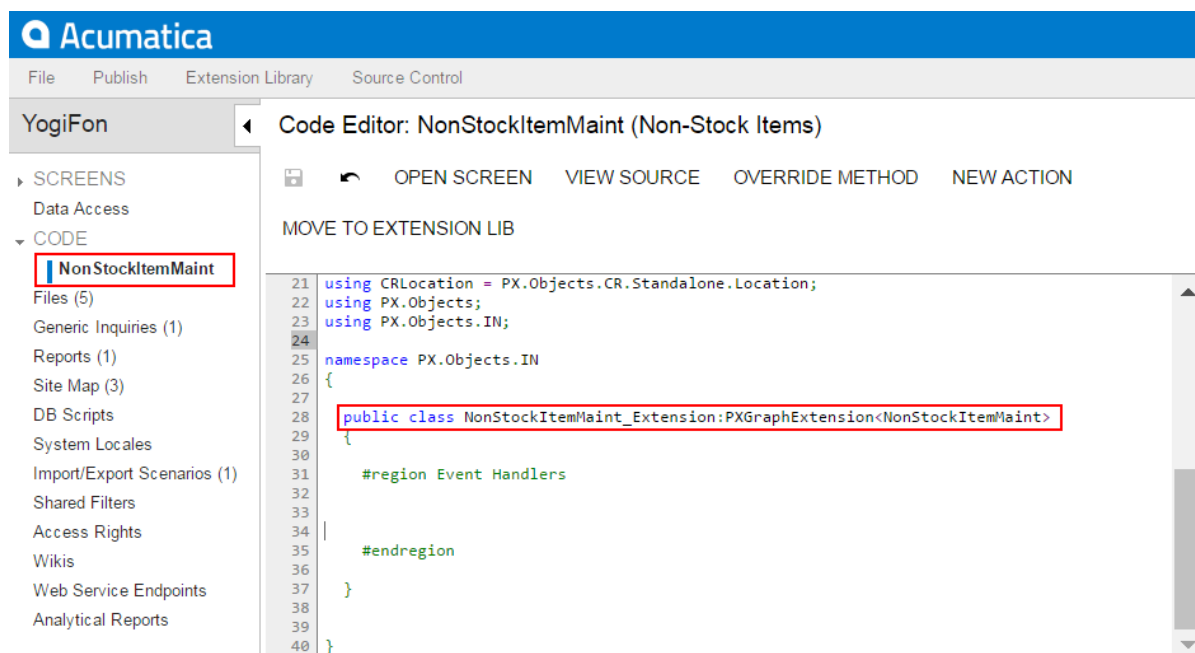
4. In the dialog box, click **Actions > Customize Business Logic**.



**Figure: Using the Element Properties dialog box to customize the business logic for the form**

5. If there is no currently selected customization project and the inspector opens the [Select Customization Project Dialog Box](#), select an existing customization project or to create a new one.

The platform creates the template of the class that is derived from the `PXGraphExtension<>` class, saves the code as a *Code* item of the project in the database, and opens the item in the [Code Editor](#), as shown in the following screenshot.



**Figure: Viewing the created code template in the Code Editor**

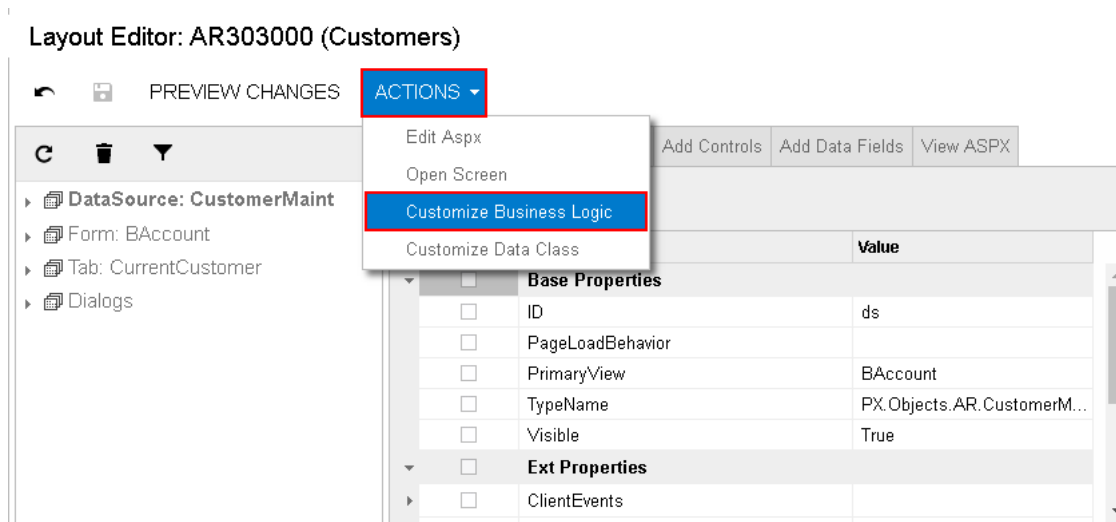
### To Add a *Code* Item by Using the Layout Editor

Often, you start a customization of an Acumatica ERP form in the [Screen Editor](#) and you later want to modify the business logic for this form. To customize the business logic of the form, you can add a *Code* item to a customization project from the Layout Editor.

To do this, perform the following action:



1. On the toolbar of the Layout Editor, click **Actions > Customize Business Logic**, as the following screenshot shows.



**Figure: Starting the customization of the business logic from the Layout Editor**

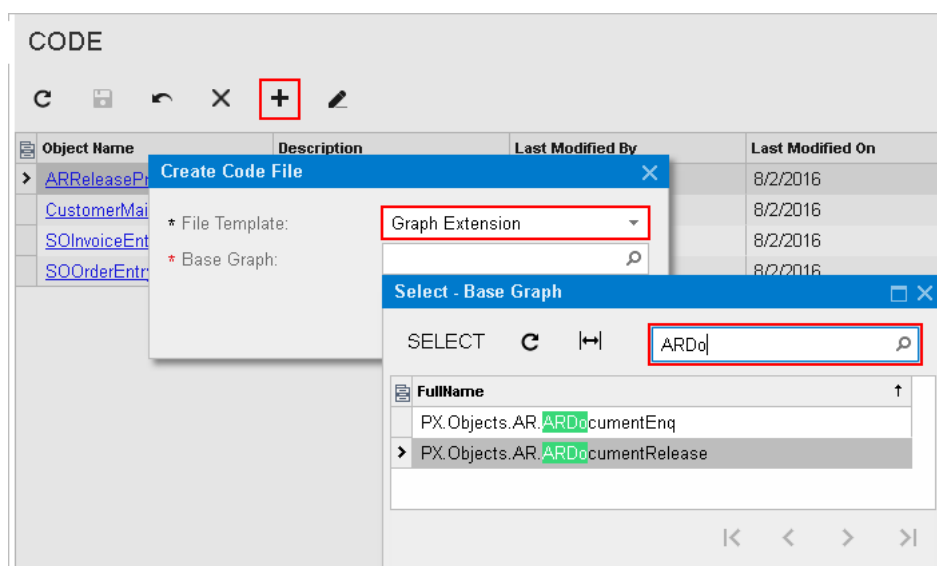
The platform creates the template of the class that is derived from the `PXGraphExtension<>` class, saves the code as a *Code* item of the project in the database, and opens the item in the [Code Editor](#).

### To Add a *Code* Item on the Code page

If you know the name of the business logic controller to be customized, you can create a *Code* item with the graph extension template on the Code page of the Customization Project Editor by using the **Create Code File** dialog box.

To do this, perform the following actions:

1. Open the customization project in the editor. (See [To Open a Project](#) for details.)
2. Click **Code** in the navigation pane to open the Code page.
3. Click **Add New Record (+)** on the page toolbar.
4. In the **Create Code File** dialog box, which opens, select *Graph Extension* in the **File Template** box, as the screenshot below shows.
5. In the **Base Graph** box, select the class name of the business logic controller to be customized.
6. Click **OK**.



**Figure: Adding a Code item with the graph extension to the project**

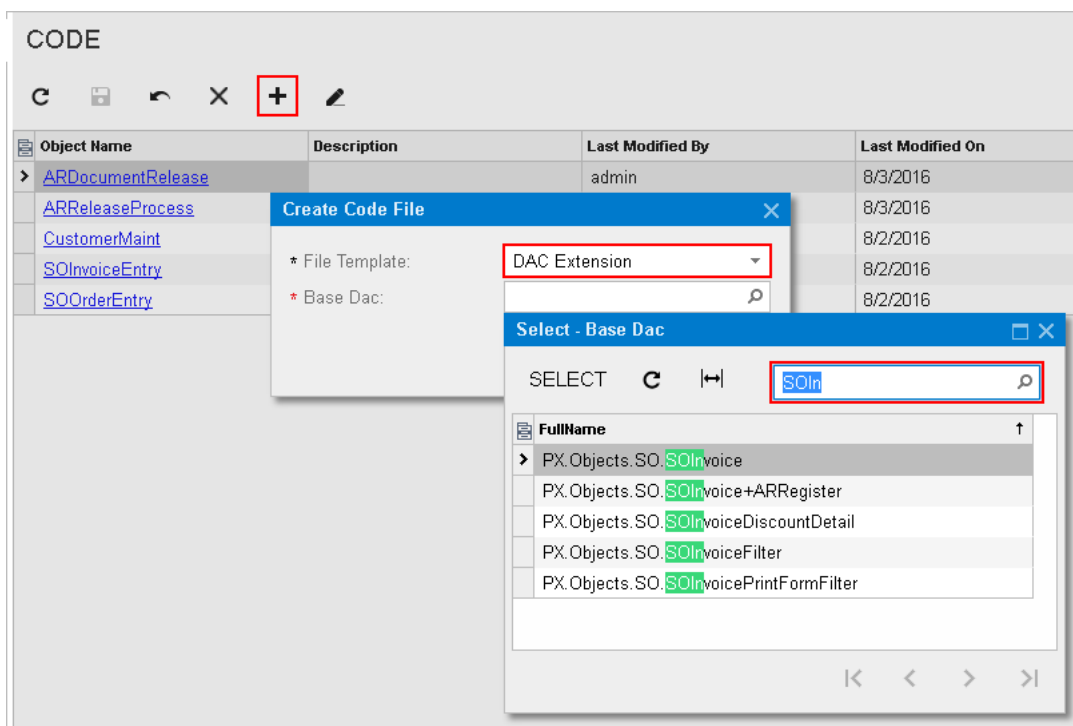
The platform creates the template of the class that is derived from the `PXGraphExtension<>` class, saves the code as a *Code* item of the project in the database, and opens the item in the [Code Editor](#).

## To Customize an Existing Data Access Class

If you know the name of the data access class to be customized, you can create a *Code* item with the DAC extension template on the Code page of the Customization Project Editor by using the **Create Code File** dialog box.

To do this, perform the following actions:

1. Open the customization project in the editor. (See [To Open a Project](#) for details.)
2. Click **Code** in the navigation pane to open the Code page.
3. Click **Add New Record** (+) on the page toolbar.
4. In the **Create Code File** dialog box, which opens, select *DAC Extension* in the **File Template** box, as the screenshot below shows.
5. In the **Base DAC** box, select the name of the data access class to be customized.
6. Click **OK**.



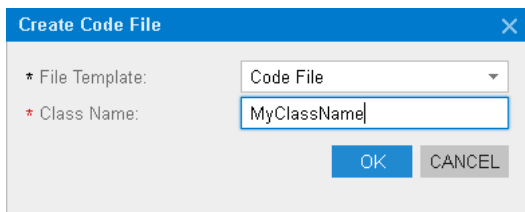
**Figure: Adding a Code item with the DAC extension to the project**

The platform creates the template of the class that is derived from the `PXCacheExtension<>` class, saves the code as a *Code* item of the project in the database, and opens the item in the [Code Editor](#).

## To Add Custom Code to a Project

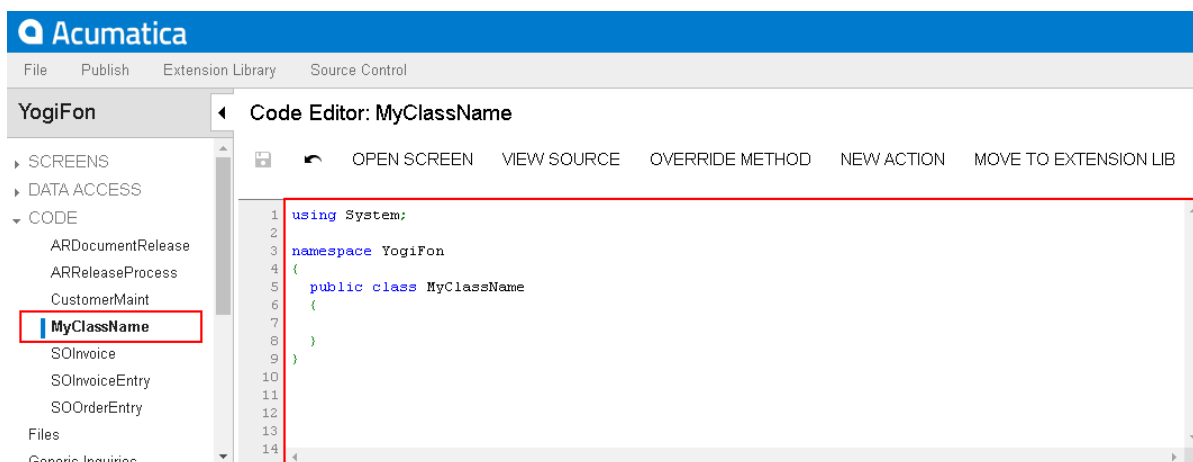
You can add a .cs file with some custom code to a customization project. To do this, perform the following actions:

1. Open the customization project in the editor. (See [To Open a Project](#) for details.)
2. Click **Code** in the navigation pane to open the Code page.
3. Click **Add New Record** (+) on the page toolbar.
4. In the **Create Code File** dialog box, which opens, select *Code File* in the **File Template** box, as the screenshot below shows.
5. In the **Class Name** box, specify the name of the new class to be added to the project.
6. Click **OK**.



**Figure: Adding a Code item for a custom graph to the project**

The platform creates the code template of the new class, saves the code as a *Code* item of the project in the database, and opens the item in the [Code Editor](#), as the following screenshot shows.



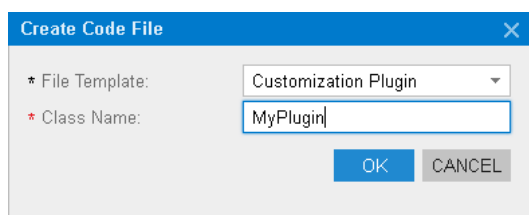
**Figure: Viewing the custom code file added to the project**

## To Add a Customization Plug-In to a Project

As a part of a complex customization, you might need to make changes to the website beyond the customization project. For example, you might need to change the website configuration. In such situations, you can add a customization plug-in to the project with the code to be executed at the end of the publication process.

To add a customization plug-in, perform the following actions:

1. Open the customization project in the editor. (See [To Open a Project](#) for details.)
2. Click **Code** in the navigation pane to open the Code page.
3. Click **Add New Record (+)** on the page toolbar.
4. In the **Create Code File** dialog box, which opens, select *Customization Plug-in* in the **File Template** box, as the screenshot below shows.
5. In the **Class Name** box, enter the name of the plug-in to be added to the project..
6. Click **OK**.



**Figure: Adding a customization plug-in to the project**

The system generates the plug-in code by template, as shown below.

```

using System;
using PX.Data;
using Customization;

namespace YogiFon
{
    //The customization plug-in is used to execute custom actions after the
    customization project has been published
    public class MyPlugin: CustomizationPlugin
    {
        //This method is executed right after website files are updated, but before the
        website is restarted
        //The method is invoked on each cluster node in a cluster environment
        //The method is invoked only if runtime compilation is enabled
        //Do not access custom code published to bin folder; it may not be loaded yet
    }
}
  
```

```

public override void OnPublished()
{
    this.WriteLog("OnPublished Event");
}

//This method is executed after the customization has been published and the
website is restarted.
public override void UpdateDatabase()
{
    this.WriteLog("UpdateDatabase Event");
}
}
}

```

When a customization project that contains a customization plug-in has been published, the corresponding `.cs` file is created in the `App_RuntimeCode` folder of the website.



: The Acumatica Customization Platform uses the `App_RuntimeCode` folder to keep the CS code of the DAC and *Code* items of all the published customization projects. By default, at run time, the platform compiles the code of this folder in a separate library and dynamically links the library to the Acumatica ERP application. (See [Run-Time Compilation](#) for details.) If you set the `UseRuntimeCompilation` key in the `<appSettings>` section of the `web.config` file (located in the website folder) to `False`, the platform uses the `App_Code/Caches` folder instead the `App_RuntimeCode` one for the customization code. In this case, the `OnPublished` method of a customization plug-in cannot be executed. Execution of the `UpdateDatabase` method does not depend on the `UseRuntimeCompilation` key value.

## To Delete a Code Item From a Project

To remove a *Code* item from a project, perform the following actions:

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. Click **Code** in the navigation pane to open the Code page.
3. In the page table, click the item to be deleted.
4. On the page toolbar, click **Delete Row** (X).
5. On the page toolbar, click **Save** to save the changes to the customization project.

You can delete a *Code* item from the customization project on the Edit Project Items page of the Customization Project Editor. (See [To Delete Items from the Project on the Edit Project Items Page](#) for details.)

If you are working in Microsoft Visual Studio, to update the files in the file system, publish the customization project. The `.cs` file of the deleted *Code* item will be removed from the file system.

## To Move a Code Item to the Extension Library

You can develop customization code either as *Code* items in a customization project or as source code included in an extension library project in Microsoft Visual Studio. Some part of a customization may exist in the *Code* items of a customization project, while another part can be in an extension library that is included in the customization project as DLL file. (See [Extension Library](#) for details.)

To move the code from a *Code* item to an extension library, perform the following actions:

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. Click **Code** in the navigation pane to open the Code page.
3. In the page table, click the name of the item to be moved to open the [Code Editor](#) for the item.
4. On the editor toolbar, click **Move to Extension Lib**.



: Before you launch the operation, be sure that the customization project is bound to an existing extension library. (See [Customization Project Editor](#) for details.)

For more information about the operation, see [Move to Extension Lib Action](#). Also, see [Extension Library \(DLL\) Versus Code in a Customization Project](#) for our recommendations about where you should keep your customization code.

## Custom Files

You can add to a customization project any custom file located in the website folder of your instance of Acumatica ERP. When you add a file to a project, the Acumatica Customization Platform stores a copy of the file in the database as a *File* item. A *File* item contains the path to the custom file and the GUID of the file content in the file storage of the database. The path is relative to the website folder. The platform then includes a copy of the file from the database in the deployment package.



: You must include in a customization package any custom files that you need to use with your instance of Acumatica ERP and publish this package on this instance. If you instead copy the files to the website folder of your instance of Acumatica ERP manually, the files will be removed while the instance is being updated.

You use the Custom Files page of the [Customization Project Editor](#) to manage *File* items in the customization project. The page displays the list of *File* items included in the project.

When you publish or export the project, the platform compares each file in the project (in the database) with the original file in the file system and detects the files that have been modified in the file system. If a modified file is found, there is a conflict, and the platform gives you the option to update the files in the project or discard the changes (and use the files from the database). See [Detecting the Project Items Modified in the File System](#) for details.

On the Custom Files page, you can perform the operations with items described in the following topics:

- [To Add a Custom File to a Project](#)
- [To Update a File Item in a Project](#)
- [To Delete a Custom File From a Project](#)

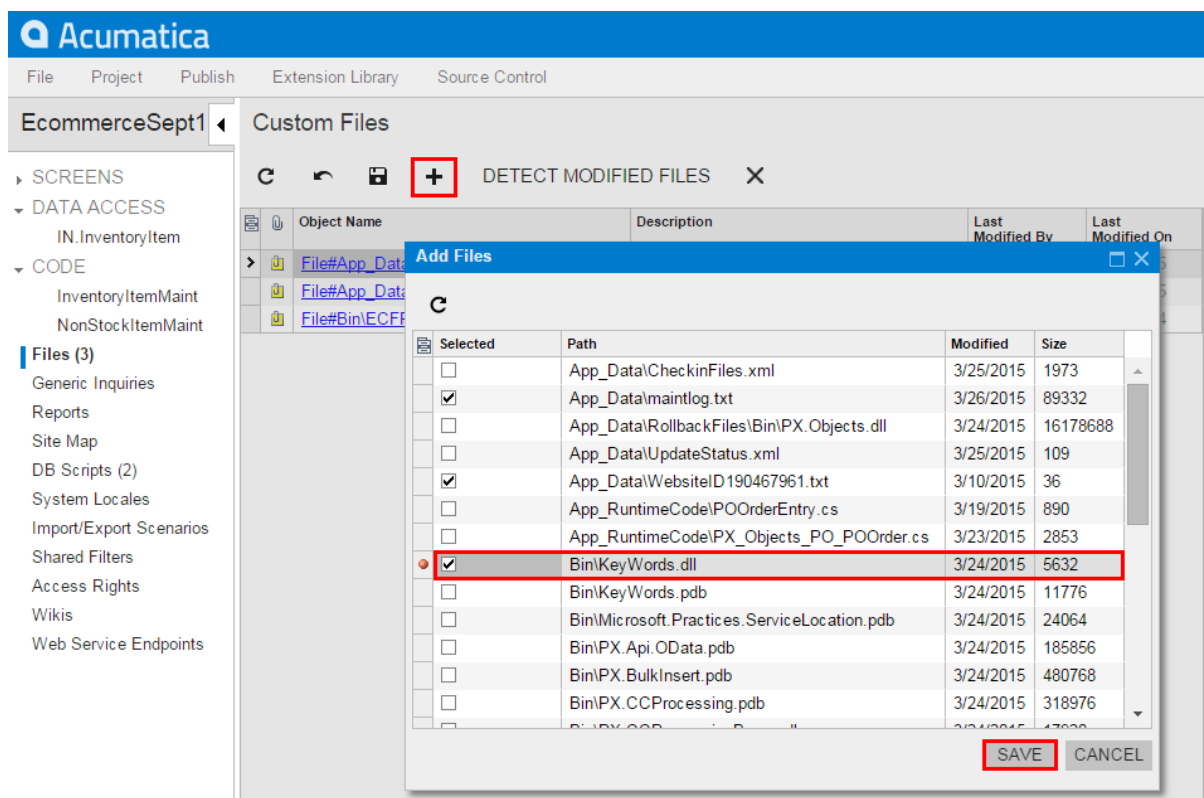
## To Add a Custom File to a Project

To add a custom file to a customization project, do the following:

1. In the file system, place the file in an appropriate folder within the website folder.  
For example, if you need to add an extension library file, place it in the `Bin` folder of the website.
2. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
3. Click **Files** in the navigation pane to open the Custom Files page.
4. On the page toolbar, click **Add New record (+)**.
5. In the **Add Files** dialog box, which opens, find the file in the table and select the check box in the **Selected** column for it, as shown in the following screenshot.



: You can select multiple custom files to add them to the project at the same time.



**Figure: Adding a custom file to the project**



: For any files other than the ones placed in the `Bin` folder, you can click **Refresh** on the toolbar of the **Add Files** dialog box to make the system update the list of files in the table. If you have changed files in the `Bin` folder of the website, you should refresh the page in the browser by pressing F5 on the keyboard.

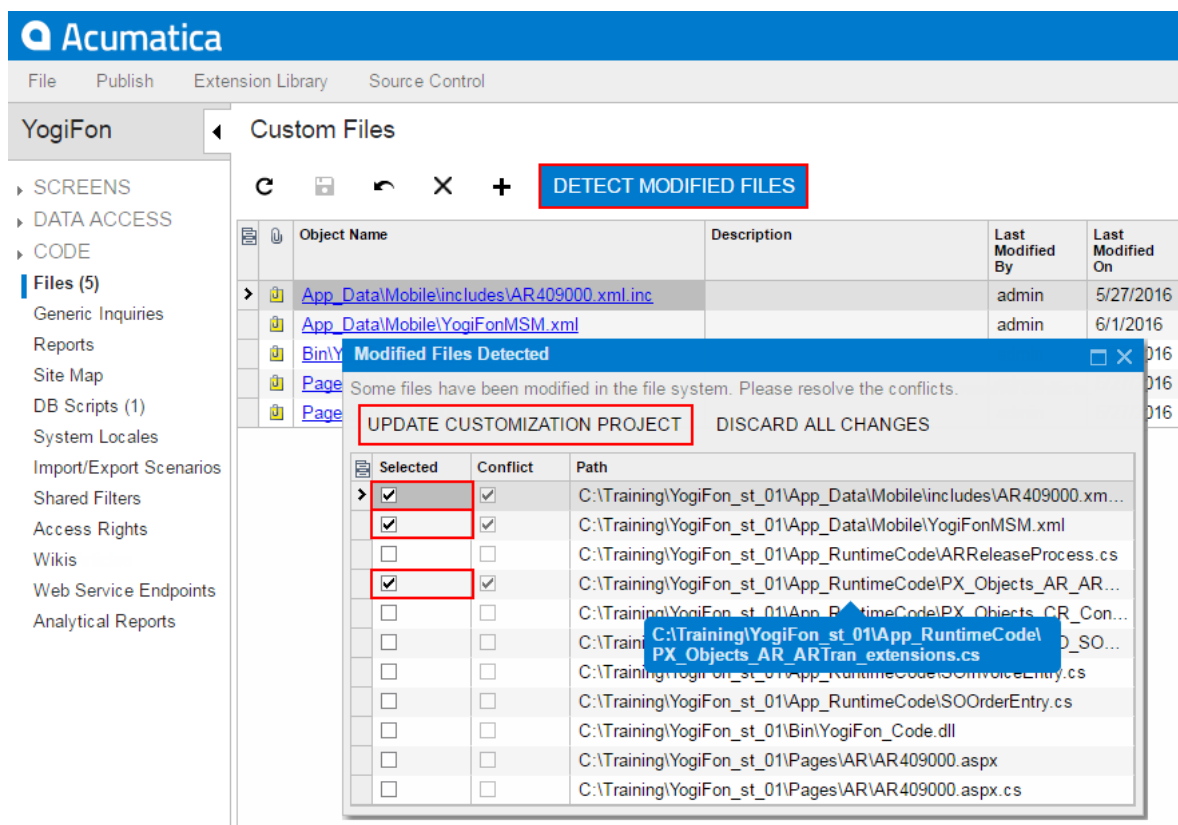
6. In the dialog box, click **Save** to save each selected file to the customization project as a *File* item.

If you modify the file added to a customization project in the file system, you have to update the appropriate *File* item in the project.

## To Update a File Item in a Project

If you have modified a file of a customization project in the file system and need to use the modified version of the file in the project, you have to update the copy of the file in the database. To do this, perform the following actions:

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. Click **Files** in the navigation pane to open the Custom Files page.
3. On the page toolbar, click **Detect Modified Files**, as shown in the screenshot below.
4. In the **Modified Files Detected** dialog box, which opens, ensure that the **Conflict** check box is selected for the file.



**Figure: Updating files in the project**

5. If multiple files in the project were changed, and you do not want to update some files at the moment, clear the selection of these files in the **Selected** column.
6. On the toolbar of the dialog box, click **Update Customization Project** to update the selected files.

If you click **Discard All Changes**, the Acumatica Customization Platform resolves the conflict by overriding the file in the file system using the file copy in the database.

If you make changes to custom files added to a customization project in the file system, the platform does not publish or export the project while a file in the file system differs its copy in the database. You have to resolve all such conflicts before publication or export of the project. See [Detecting the Project Items Modified in the File System](#) for details.

### Detecting the Project Items Modified in the File System

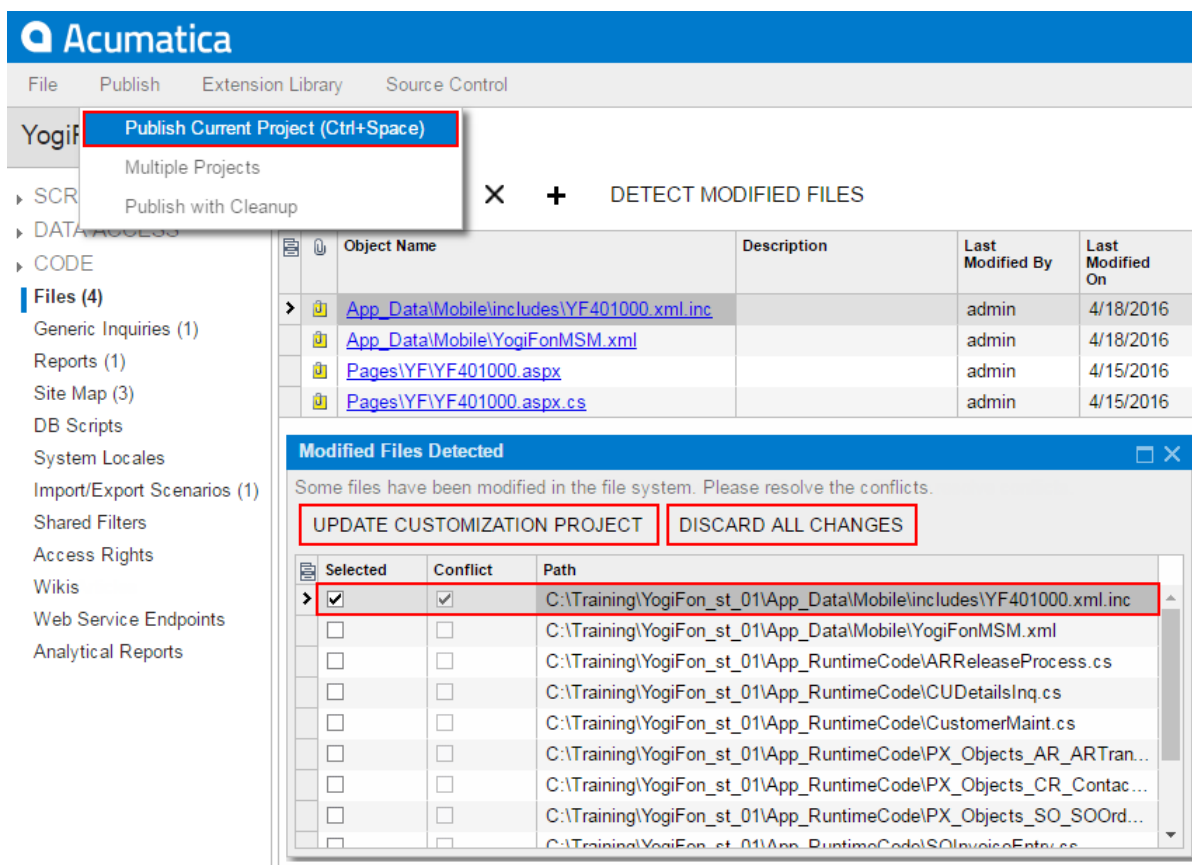
In the website folder in the file system, the platform tracks changes that you make to the following files:

- Files with the customization code added to the customization project as **DAC** items
- Files with the customization code added to the project as **Code** items
- Custom files added to the project

If you make changes to these files in the file system, you have to update them in the project before you publish the project or export the deployment package of the project.

When you run the project publication process or export the project, the Acumatica Customization Platform compares each file in the project (in the database) with the original file and detects the files modified in the file system. If a modified file is found, there is a conflict, and the platform opens the **Modified Files Detected** dialog box (see the screenshot below) to give you the option to update the files in the project or discard the changes and use the files from the database.





**Figure: Viewing the Modified Files Detected dialog box**



: If you have used the *File Editor* of the Customization Project Editor to modify a *File* item in a customization project and saved the changes in the database, the changes are not saved in the original file in the file system. Then if you click **Detect Modified Files** on the toolbar of the Files page, the platform does not detect a conflict because the file in the database is newer. The platform automatically updates the original file during the publication of the customization project.

The **Modified Files Detected** dialog box lists all custom and customized files in the website folder. The **Conflict** check box means that the file version in the file system differs from the file version in the customization project. This could happen, for example, if you have modified the customization code in a file by using MS Visual Studio and the change is not yet reflected in the customization project. You have to resolve all conflicts in the project before you publish the project or export the deployment package of the project.

In the dialog box, you can invoke the following actions for conflicting files:

- **Update Customization Project:** Updates the customization project with the file version from the file system.
- **Discard All Changes:** Keeps the file version that exists in the customization project and discards the changes in the file system.

These actions are performed on the selected files—that is, all conflicting files for which you have selected the check box in the **Selected** column.

You can invoke one action for one individual file and another action for another file. For example, you can first select the files that you want to update in the customization project and click **Update Customization Project**. Then you can click **Discard All Changes** to cancel the changes made to all other conflicting files.

Make sure you have updated all appropriate files before removing all remaining conflicts. If you discard changes, after you publish the customization project, the platform updates all selected conflicting files from the database, therefore the files will return to the original state in the file system.

No conflicts will appear in the **Modified Files Detected** dialog box until a file included in the customization project is modified in the file system again.

## To Delete a Custom File From a Project

To delete a custom file from a customization project, perform the following actions:

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. Click **Files** in the navigation pane to open the Custom Files page.
3. In the page table, click the item to be deleted.
4. On the page toolbar, click **Delete Row (X)**.
5. On the page toolbar, click **Save** to save the changes to the customization project.

The *File* item is deleted from the project. The file remains in the file system and you can add it back to the project, if needed.



**Warning:** If you either publish the customization project after the *File* item is deleted or unpublish all customizations of the website, the platform deletes the original file in the file system.

## Generic Inquiries

---

You use the Generic Inquiries page of the [Customization Project Editor](#) to manage *GenericInquiryScreen* items in the customization project.



: A *GenericInquiryScreen* item contains the data set of a custom or customized generic inquiry form.

The Generic Inquiries page displays the list of the generic inquiries added to the customization project.

On the page, you can perform the operations described in the following topics:

- [To Add a Generic Inquiry to a Project](#)
- [To Delete a Generic Inquiry from a Project](#)
- [To Update Generic Inquiry Items in a Project](#)
- [To Navigate to the Generic Inquiry Form](#)

## To Add a Generic Inquiry to a Project

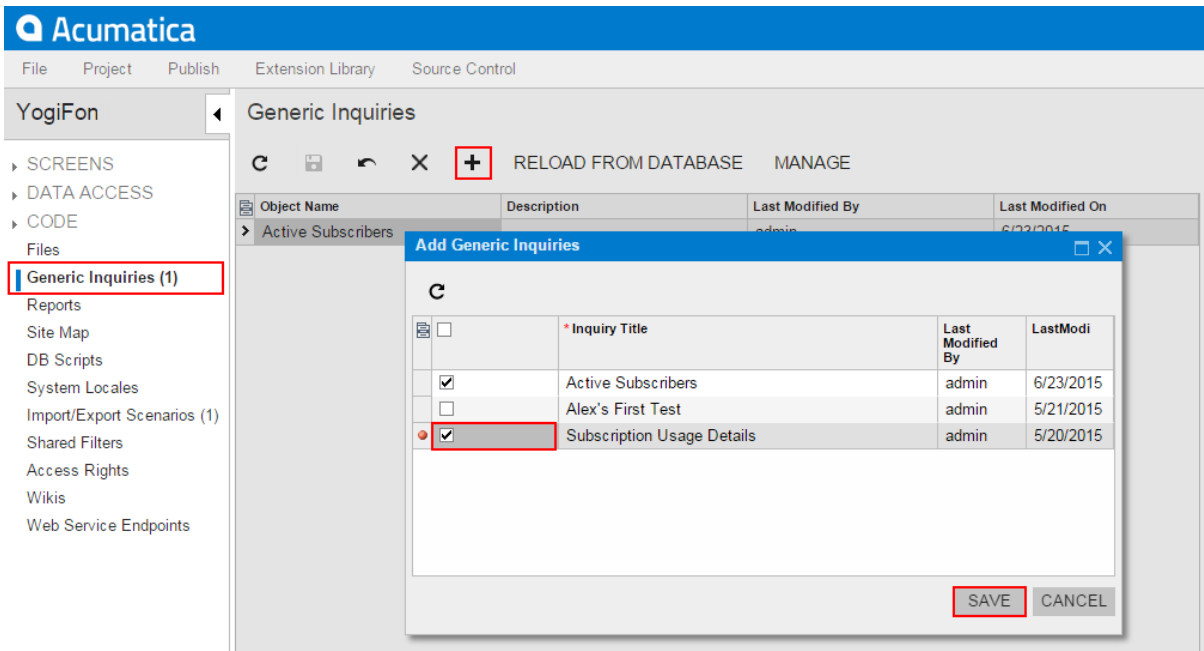
You can add to a customization project a custom or customized generic inquiry—the generic inquiry that is saved in the database for the current tenant. To do this, perform the following actions:

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. Click **Generic Inquiries** in the navigation pane to open the Generic Inquiries page.
3. On the page toolbar, click **Add New Record (+)**, as shown in the screenshot below.
4. In the list of generic inquiries in the **Add Generic Inquiries** dialog box, which opens, select the check box for each generic inquiry form that you want to include in the project.



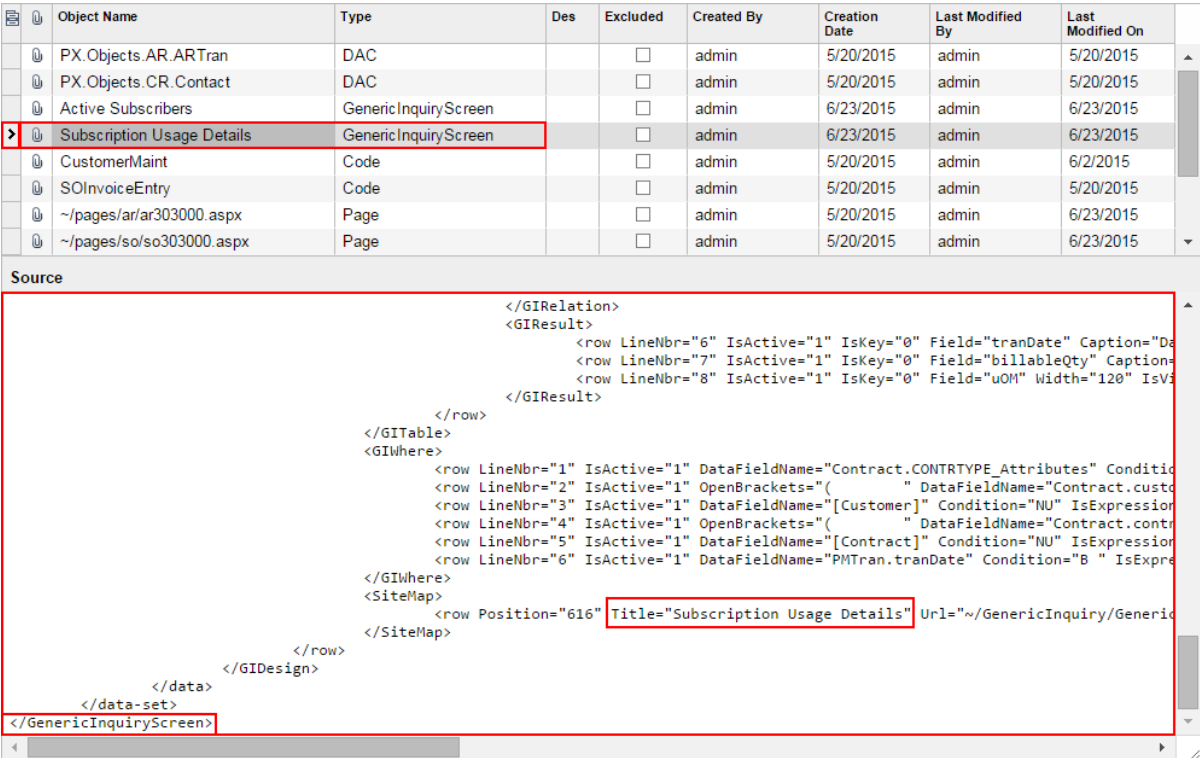
: The **Add Generic Inquiries** dialog box displays all the custom and customized generic inquiries that exist in your instance of Acumatica ERP. You can select multiple generic inquiries to add them to the project simultaneously.

5. In the dialog box, click **Save** to add the selected generic inquiry or inquiries to the customization project.




**Figure: Adding the generic inquiry to the customization project**

The system adds to the project the data for each selected generic inquiry, and you can see each new `GenericInquiryScreen` item in the Project Items table of the [Item XML Editor](#), as shown in the following screenshot.



**Figure: Viewing the new `GenericInquiryScreen` item included in the project**

 : The system automatically includes in the customization project information about the workspace to which the generic inquiry have been added in the modern UI and the site map node in the classic UI along with other information about the generic inquiry.

## To Delete a Generic Inquiry from a Project

To remove a *GenericInquiryScreen* item from a project, perform the following actions:

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. Click **Generic Inquiries** in the navigation pane to open the Generic Inquiries page.
3. In the page table, click the item to be deleted.
4. On the page toolbar, click **Delete Row** (X).
5. On the page toolbar, click **Save** to save the changes to the customization project.

If you delete a *GenericInquiryScreen* item from the project, the generic inquiry remains in the system unless you delete the inquiry by using the [Generic Inquiry](#) (SM208000) form.

If you have added a site map node for a custom inquiry form to the project and removed the inquiry from the project, you should delete the appropriate *SiteMapNode* item. (See [To Delete a Site Map Node from a Project](#) for details.)

## To Update Generic Inquiry Items in a Project

If you have used the [Generic Inquiry](#) (SM208000) form to change a generic inquiry included in the customization project, you have to update the appropriate item in the project. To do this, perform the following actions:

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. Click **Generic Inquiries** in the navigation pane to open the Generic Inquiries page.
3. On the page toolbar, click **Reload From Database**.

The platform updates all the *GenericInquiryScreen* items of the project by using the appropriate data from the database.

## To Navigate to the Generic Inquiry Form

When you are working with the [Customization Project Editor](#), you may need to open the [Generic Inquiry](#) (SM208000) form in the browser. You can use this form, for example, to create a new generic inquiry, to customize an existing one, or to manage existing generic inquiries in Acumatica ERP.

To open the [Generic Inquiry](#) form from the Customization Project Editor, perform the following actions:

1. Select **Generic Inquiries** in the navigation pane to open the Generic Inquiries page.
2. On the page toolbar, click **Manage Inquiries**.

As soon as you save a new inquiry on the [Generic Inquiry](#) form, you can add the inquiry as a *GenericInquiryScreen* item to the project.



: You can limit the list of tables available for constructing generic inquiries on the [Generic Inquiry](#) form. See [Limiting the List of Tables Available for Generic Inquiries](#) for details.

### Limiting the List of Tables Available for Generic Inquiries

You can limit the list of database tables available for constructing generic inquiries on the [Generic Inquiry](#) (SM208000) form in the production environment. To do this, in the development environment, use the following approach:

1. Create the `GITables.xml` configuration file to specify the `Allowed` and `Hidden` collections of masks for the full names of the database tables, as described in [GITables.xml File Content](#).
2. Save the configuration file to the `App_Data` folder of the website.
3. Add the file to a customization project as a *File* item. (See [To Add a Custom File to a Project](#) for details.)

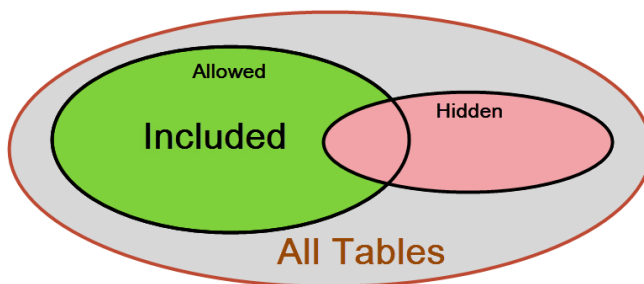
The platform automatically checks whether this file exists in the `App_Data` folder. If the customization project is published in the production environment, the platform applies the file content when a user selects a table for a generic inquiry on the [Generic Inquiry](#) form.

### GITables.xml File Content

The configuration file is in XML format and includes the `GITables` element only. This element must include the `Allowed` section and can also contain the `Hidden` section. Each section is a collection of `Table` elements.

The `Allowed` collection specifies the list of tables that are available for use in generic inquiries constructed on the [Generic Inquiry](#) form. If a table isn't included in the `Allowed` collection, it doesn't appear in the list for selection on the **Table** tab of the form. You can also add the `Hidden` section to the configuration file. This section specifies the tables you want to exclude from the list.

If a table is allowed and not hidden (as illustrated by the green area in the figure below), it is included in the list of the tables available for constructing generic inquiries on the [Generic Inquiry](#) form. Otherwise, the table is not displayed in this list of tables.



Each `Table` element of the `Allowed` and `Hidden` sections contains the `FullName` attribute, which specifies the table name or the mask for a set of tables.

The attribute value is a string that can contain the following wildcard characters:

- An asterisk (\*), which matches any number of characters (or no characters)
- A question mark (?), which matches exactly one character

The example below shows how to exclude the tables by using the `PX.Objects.CR.BAccount` and `PX.*Contact*` masks.

```
<?xml version="1.0" encoding="utf-8"?>
<GITables>
  <Hidden>
    <Table FullName="PX.Objects.CR.BAccount" />
    <Table FullName="PX.*Contact*" />
  </Hidden>
  <Allowed>
    <Table FullName="*" />
  </Allowed>
</GITables>
```

According to the mask with `Contact`, users will not be able to use any tables that contain the word `Contact` in the table name in their inquiries (for example, the `PX.Objects.CR.Contact` table).

To limit the list of database tables by using only the `Allowed` collection, you can empty or remove the `Hidden` section. The following example shows how to include only the tables that matched the `PX.Objects.IN.*` mask.

```
<?xml version="1.0" encoding="utf-8"?>
<GITables>
  <Allowed>
```

```
<Table FullName="PX.Objects.IN.*" />
</Allowed>
</GITables>
```

## Custom Reports

You use the Custom Reports page of the [Customization Project Editor](#) to manage *Report* items in the customization project.



: A *Report* item contains the data set of a custom report created with Acumatica Report Designer.

The Custom Reports page displays the list of the custom reports that have been added to the customization project.

On the page, you can perform the operations described in the following topics:

- [To Add a Custom Report to a Project](#)
- [To Delete a Custom Report from a Project](#)
- [To Navigate a Custom Report in a Project](#)

### To Add a Custom Report to a Project

You can add an Acumatica Report Designer custom report to a customization project. Before adding a report to a project, you have to construct the report in Acumatica Report Designer and save the report to the database. (For more information about reports, see [Acumatica Report Designer Guide](#).)

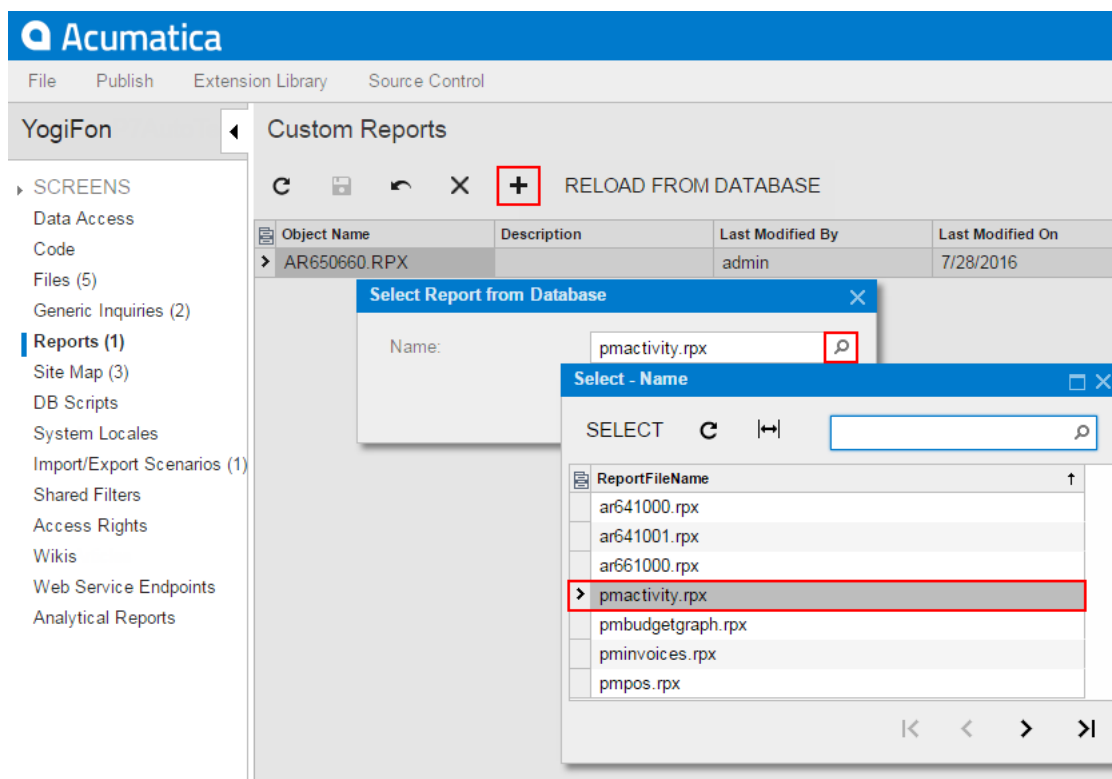
To add a custom report to a project, perform the following actions:

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. Click **Reports** in the navigation pane to open the Custom Reports page.
3. On the page toolbar, click **Add New Record (+)**, as shown in the screenshot below.
4. In **Name** box of the **Select Report from Database** dialog box, which opens, select the report that you want to include in the project.



: If a custom report is created in Acumatica Report Designer and saved as a file in the file system, you cannot add the report to a customization project as a *Report* item.

5. In the dialog box, click **OK** to add the selected report to the customization project.



**Figure: Adding a custom report to the project**



: To give users the ability to navigate to the custom report in Acumatica ERP with either the modern UI or the classic UI switched on, you have to add the appropriate site map node to the customization project, as described in [To Add a Site Map Node to a Project](#).

## To Delete a Custom Report from a Project

To remove a custom report from a project, perform the following actions:

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. Click **Reports** in the navigation pane to open the Custom Reports page.
3. In the page table, click the item to be deleted.
4. On the page toolbar, click **Delete Row** (X).
5. On the page toolbar, click **Save** to save the changes to the customization project.

If you have added a site map node for the custom report to the project, you also have to delete the appropriate *SiteMapNode* item. (See [To Delete a Site Map Node from a Project](#) for details.)

## To Navigate a Custom Report in a Project

If you have used Acumatica Report Designer to change a custom report included in the customization project, you have to update the appropriate item in the project. To do this, perform the following actions:

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. Click **Reports** in the navigation pane to open the Custom Reports page.
3. On the page toolbar, click **Reload From Database**.

The platform updates all the *Report* items that are added to the customization project.

## Dashboards

You use the Dashboards page of the [Customization Project Editor](#) to manage *Dashboard* items in the customization project.



: A *Dashboard* item contains the data set of a custom or customized dashboard.

The Dashboards page displays the list of the dashboards that have been added to the customization project.

On the page, you can perform the operations described in the following topics:

- [To Add a Dashboard to a Project](#)
- [To Delete a Dashboard from a Project](#)
- [To Update Dashboard Items in a Project](#)
- [To Navigate to the Dashboard Form](#)

### To Add a Dashboard to a Project

You can add to a customization project a custom or customized dashboard—the dashboard that is saved in the database for the current tenant. To do this, perform the following actions:

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. Click **Dashboards** in the navigation pane to open the Dashboards page.
3. On the page toolbar, click **Add New Record (+)**.
4. In the list of dashboards in the **Add Dashboards** dialog box, which opens, select the check box for each dashboard that you want to include in the project.



: The **Add Dashboards** dialog box displays all the custom and customized dashboards that exist in your instance of Acumatica ERP. You can select multiple dashboards to add them to the project simultaneously.

5. In the dialog box, click **Save** to add the selected dashboards to the customization project.

The system adds to the project the data for each selected dashboard, and you can see each new *Dashboard* item in the Project Items table of the [Item XML Editor](#).

Alongside with *Dashboard* item, the system adds *Generic Inquiry*, *Site Map*, and *Wiki* items for inquiries, site map nodes, and wiki pages associated with the dashboard. If an inquiry, a site map node, or a wiki page is already added to the customization project, it is not duplicated.



: The system automatically includes in the customization project information about the workspace to which the dashboard have been added in the modern UI and the site map node in the classic UI along with other information about the dashboard.

### To Delete a Dashboard from a Project

To remove a *Dashboard* item from a project, perform the following actions:

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. Click **Dashboards** in the navigation pane to open the Dashboards page.
3. In the page table, click the item to be deleted.
4. On the page toolbar, click **Delete Row (X)**.
5. On the page toolbar, click **Save** to save the changes to the customization project.

If you delete a *Dashboard* item from the project, the dashboard remains in the system unless you delete the dashboard by using the [Dashboards](#) (SM208600) form.



If a site map node or a generic inquiry was added for a custom dashboard to the project (manually or automatically), and you removed the dashboard from the project, you should delete the appropriate *Site Map*, *Generic Inquiry*, or *Wiki* item manually. (See [To Delete a Site Map Node from a Project](#) for details.)

## To Update Dashboard Items in a Project

If you have used the [Dashboards](#) (SM208600) form to change a dashboard included in the customization project or changed its design by modifying the set of widgets, you have to update the appropriate item in the project. To do this, perform the following actions:

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. Click **Dashboards** in the navigation pane to open the Dashboard page.
3. On the page toolbar, click **Reload From Database**.

The platform updates all the *Dashboard* items of the project by using the appropriate data from the database.

## To Navigate to the Dashboard Form

When you are working with the [Customization Project Editor](#), you may need to open the [Dashboards](#) (SM208600) form in the browser. You can use this form, for example, to create a new dashboard, to modify settings of an existing one, or to manage existing dashboards in Acumatica ERP.

To open the [Dashboards](#) form from the Customization Project Editor, perform the following actions:

1. Select **Dashboards** in the navigation pane to open the Dashboards page.
2. On the page toolbar, click **Manage Dashboards**.

As soon as you save a dashboard on the [Dashboards](#) form, you can add the dashboard as a *Dashboard* item to the project.

## Site Map

---

You use the Site Map page of the [Customization Project Editor](#) to manage *SiteMapNode* items in the customization project.



: A *SiteMapNode* item contains the data set of a custom site map node for a custom form or report included in the customization project. The item also includes information about the location of the form or report in the Modern UI (such as workspace to which the form or report included).

The Site Map page displays the list of the custom site map nodes that have been added to the customization project.


On the page, you can perform the operations described in the following topics:

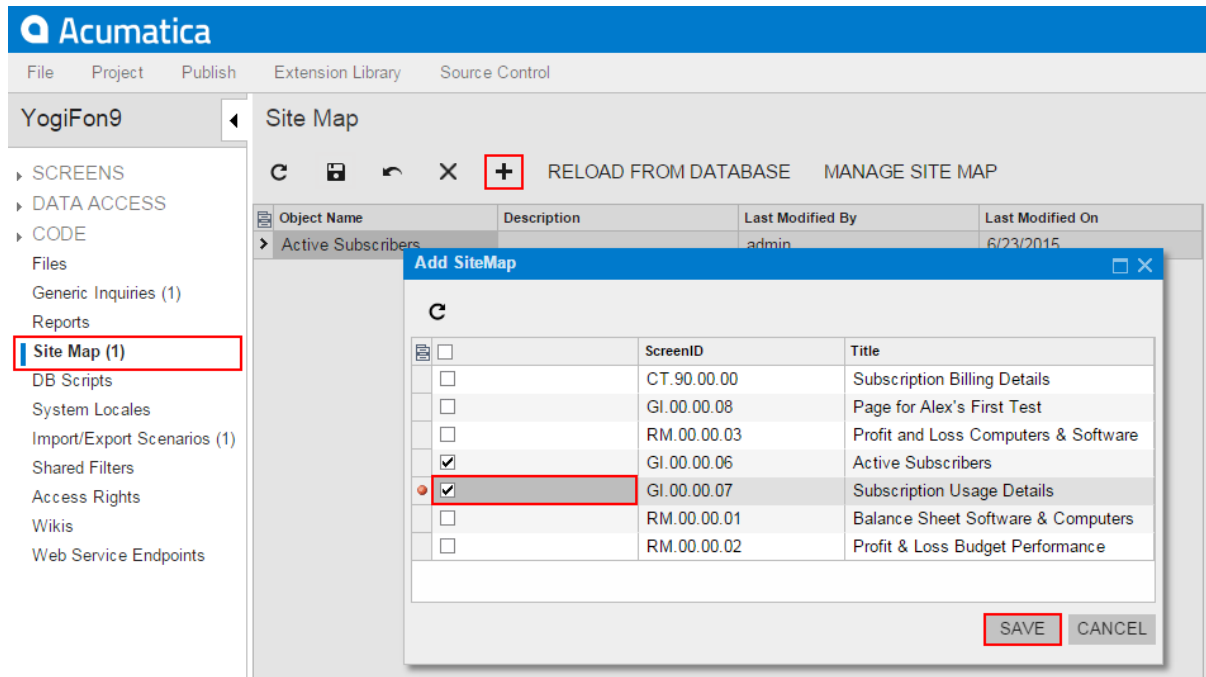
- [To Add a Site Map Node to a Project](#)
- [To Delete a Site Map Node from a Project](#)
- [To Update a Site Map Node in a Project](#)
- [To Navigate to the Site Map Form](#)

## To Add a Site Map Node to a Project

If, for a custom form or report, you have changed the site map in the classic UI or the workspace in the modern UI and saved these changes in the database for the current tenant, you can add these changes to a customization project as a *SiteMapNode* item. To do this, perform the following actions:

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. Click **Site Map** in the navigation pane to open the Site Map page.

- On the page toolbar, click **Add New Record (+)**, as shown in the screenshot below.
  - In the list of site map nodes in the **Add Site Map** dialog box, which opens, select the check box for each screen that you want to include in the project.
-  : The **Add Site Map** dialog box displays all the custom site map nodes that have been created in the site map of Acumatica ERP and the nodes that have been modified in the site map. You can select multiple custom site map nodes to add them to the project simultaneously.
- In the dialog box, click **Save** to add each selected site map node to the customization project.



**Figure: Adding the site map node to the customization project**

The system adds to the project the data from the database for each selected site map node. You can view each new *SiteMapNode* item in the Project Items table of the [Item XML Editor](#).

## To Delete a Site Map Node from a Project

To delete a site map node from a customization project, perform the following actions:

- Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
- Click **Site Map** in the navigation pane to open the Site Map page.
- In the page table, click the item to be deleted.
- On the page toolbar, click **Delete Row (X)**.
- On the page toolbar, click **Save** to save the changes to the customization project.

If you delete a *SiteMapNode* item from the project, the node remains in the site map unless you delete the node on the [Site Map](#) (SM200520) form.

## To Update a Site Map Node in a Project

If you have used the [Site Map](#) (SM200520) form or a workspace of the modern UI of Acumatica ERP to change a site map node included in the customization project, you should update this node in the project. To do this, perform the following actions:

- Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
- Select **Site Map** in the navigation pane to open the Site Map page.

3. On the page toolbar, click **Reload From Database**.

The platform updates all the *SiteMapNode* items of the project by using the appropriate data from the database.

## To Navigate to the Site Map Form

You might need to add to Acumatica ERP a site map node for a custom form, inquiry, or report that you develop for a customization project. To create a custom site map node or modify an existing node, you use the [Site Map](#) (SM200520) form of Acumatica ERP.

To open the [Site Map](#) form from the [Customization Project Editor](#), perform the following actions:

1. Click **Site Map** in the navigation pane to open the Site Map page of the editor.
2. On the page toolbar, click **Manage Site Map**.

As soon as you save changes to an existing site map node or create a custom node on the [Site Map](#) form, you can add the node as a *SiteMapNode* item to the customization project.

## Database Scripts

---

With the Acumatica Customization Platform, you can use custom SQL scripts for the following changes to the database in the scope of a customization project:

- The creation of custom tables
- The creation of views, indexes, and other database objects
- The insertion of data into tables
- The increasing of the size of a text column of a table

See [Changes in the Database Schema](#) for details.

You use the Database Scripts page of the [Customization Project Editor](#) to manage *Sql* and *Table* items in the customization project.



: An *Sql* item contains a custom database table definition or a custom SQL script that has to be executed while the customization project is published. A *Table* item contains a description of the custom columns added to a table for bound custom fields created in the appropriate data access class.

The Database Scripts page displays the list of the custom SQL scripts and customized tables that have been added to the customization project.

When you create a custom table in the database, we recommend that you add the table schema to the customization project, as described in [To Add a Custom Table to a Project](#). To create other database objects or insert data into the tables, you have to compose the corresponding SQL script and add the script to the customization project, as described in [To Add a Custom SQL Script to a Project](#).

On the Database Scripts page, you can perform various operations, as described in the following topics:

- [To Add a Custom Table to a Project](#)
- [To Update Custom Tables in the Project](#)
- [To Add a Custom Column to an Existing Table](#)
- [To Increase the Size of a Column in an Existing Table](#)
- [To Add a Custom SQL Script to a Project](#)
- [To Edit a Custom SQL Script](#)
- [To Delete an Sql or Table Item From a Project](#)

## To Add a Custom Table to a Project

You use the Database Scripts page of the Customization Project Editor to add a custom table to a customization project. You can add a custom table to a project by adding the table schema or by adding a custom SQL script.

Adding the table schema is the optimal way of adding custom tables to the project. When you publish the customization project, the platform executes each SQL script of the project to update the database. If an *Sql* item contains a custom database table definition, to update the database with the table schema, the Acumatica Customization Platform checks whether a table with this name already exists in the database. If the table exists, the platform generates SQL statements to alter the existing table so that it matches the schema. The platform doesn't drop the existing table, and it keeps any data in it. This helps to deploy a newer version of the customization project to a system that is already in use. If the table doesn't exist, the platform generates SQL statements to create the table. SQL statements are generated in the SQL dialect of the database management system. Therefore, if you add custom tables to the project by adding the table schema, you keep the customization project independent from the database management system that hosts the database of Acumatica ERP.

Alternatively, you can add custom tables by adding a custom SQL script that creates the table in the project, as described in [To Add a Custom SQL Script to a Project](#).



: The creation or modification of the System tables is forbidden. A customization project containing such changes will not pass validation tests. For details on the System tables, see [System and Application Tables](#).

### To Add a Custom Table to a Customization Project

1. Create the needed table in the database by using a database administration tool, such as SQL Server Management Studio.



: You have to use a naming convention that provides unique names for your custom tables so that they do not have the names of existing tables of Acumatica ERP.

2. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
3. Click **Database Scripts** in the navigation pane to open the Database Scripts page.
4. On the page toolbar, click **Add > Custom Table Schema**.
5. In the **Add Custom Table Schema** dialog box, which opens, select the custom table in the **Table** box and click **OK**.

Acumatica Customization Platform generates the table schema and adds the schema to the customization project as an *Sql* item.

Below is an example of the *Sql* item that contains the table schema of the custom table *RBProduct*.

```
<Sql TableName="RBProduct" TableSchemaXml="#CDATA">
  <CDATA name="TableSchemaXml"><![CDATA[<table name="RBProduct">
    <col name="ProductID" type="Int" identity="true" />
    <col name="ProductCD" type="NVarChar(15)" />
    <col name="ProductName" type="NVarChar(50)" />
    <col name="Active" type="Bit" />
    <col name="StockUnit" type="NVarChar(20)" />
    <col name="UnitPrice" type="Decimal(19,6)" />
    <col name="MinAvailQty" type="Decimal(25,6)" />
    <col name="TStamp" type="Timestamp" />
    <index name="RBProduct_PK" clustered="true" primary="true" unique="true">
      <col name="ProductID" />
    </index>
  </table>]]></CDATA>
</Sql>
```

## To Update Custom Tables in the Project

After you have added a custom table to the project, you might want to continue making changes to the table by using a database administration tool, such as SQL Server Management Studio. We recommend that you update the table schema in the customization project before you export the deployment package of the project or publish the project.

### To Update the Schema of Custom Tables in the Project

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. Click **Database Scripts** in the navigation pane to open the Database Scripts page.
3. On the page toolbar, click **Reload From Database**.

The platform regenerates the database table schema of all the custom tables added to the project.

## To Add a Custom Column to an Existing Table

You use the Database Scripts page of the Customization Project Editor to add custom columns of an existing table of Acumatica ERP to a customization project. If you add custom fields to a data access class by using the [Data Class Editor](#), you do not need to add the custom columns to the database table manually; Acumatica Customization Platform adds these columns automatically. You may need to add a column manually if you added a custom field to a data access class in code.

### To Add a Custom Column to an Existing Table

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. Click **Database Scripts** in the navigation pane to open the Database Scripts page.
3. On the page toolbar, click **Add > Custom Column to Table**.
4. In the **Add Custom Column to Table** dialog box, which opens, specify the table to which the column should be added and the name and type of the new column, and click **OK**. Acumatica Customization Platform adds the columns to the customization project as a *Table* item.

## To Increase the Size of a Column in an Existing Table

You use the Database Scripts page of the Customization Project Editor to increase the size of a text column of an existing table of Acumatica ERP.



: If you publish the customization project, the changes remain in the Acumatica ERP database even if you unpublish the project.

### To Increase the Size of a Column

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. In the navigation pane, click **Database Scripts** to open the Database Scripts page.
3. On the page toolbar, click **Add > Column Length Increase**.
4. In the **Column Length Increase** dialog box, which opens, specify the following:
  - a. The table in which the column should be altered (**Table**).
  - b. The name of the column that should be altered (**Field Name**).



: Only text fields are available in the list because only their length can be changed.

The **Data Type** field displays the current type and size of the specified column.

- c. The new length of the text field (**New Length**).
5. Click **OK** to save your changes and exit the dialog box.

Acumatica Customization Platform creates a script to alter the column in the application database. You can see the change entry on the Database Scripts page with the **Custom Columns** type.

## To Add a Custom SQL Script to a Project

With the platform, you can add to a customization project an SQL script to be executed during the publication of the project. However, we recommend that you avoid doing this.



**Warning:** A possible result of a custom SQL script is the loss of the integrity and consistency of the application data.

If you do add a custom SQL script, you must adhere to the following requirements for the script:

- Because Acumatica ERP supports multitenancy, you must create an SQL script that correctly creates a database object that properly specifies and uses the company mask.
- You must correctly specify the attributes for the script so that the script can be executed on the target database servers: MySQL Server, Microsoft SQL Server, or both. For details about attributes, see [Using the SQL Script Attributes](#).

### To Add a Custom SQL Script to a Customization Project

1. Prepare, debug, and test the SQL script with a database administration tool, such as SQL Server Management Studio. (See [Creating a Custom SQL Script](#) for details.)
2. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
3. Click **Database Scripts** in the navigation pane to open the Database Scripts page.
4. On the page toolbar, click **Add > Script**.
5. In the **Script Name** box of the [SQL Script Editor](#), which opens, specify the name of the script to be used as the object name of the customization item. (The name can contain only English characters and digits.)
6. Optional: In the **Priority** box, specify the priority of the script. By default, the priority is 0.
7. For each batch that you want to add, do the following:
  - a. Click **Specify Database Engine**, and in the **Attribute** box, select one of the following options:
    - *Skip Batch on MySQL Server*, which adds the `--[mysql: Skip]` attribute to the end of the text in the text area of the script editor.
    - *Skip Batch on Microsoft SQL Server*, which adds the `--[mssql: Skip]` attribute to the end of the text in the text area of the script editor.
    - *Use Interpreter*, which adds the `--[VmSql]` attribute to the end of the text in the text area of the script editor.

For more information on the database script attributes, see [Using the SQL Script Attributes](#).
  - b. In the text area of the editor, below the added attribute, enter the SQL script.

8. In the editor, click **OK** to add the script to the customization project.

If a custom script causes an error, the error message will appear during the publication process when the system executes the custom scripts.

### Creating a Custom SQL Script

To create database objects other than custom tables or to insert data into tables, you can add custom SQL scripts to a customization project. When you publish the project, the Acumatica Customization Platform executes the custom SQL scripts added to the project.



: When you publish a customization project that contains a database script, the Acumatica Customization Platform executes the script during the first publication. The platform keeps information about each script that has been executed at least once and has not since been changed in the database, and omits the repeated execution of these scripts for optimization purposes. If you run the **Publish with Cleanup** operation, the platform cleans all the information about previously executed scripts of the customization project, and executes this script once more while publishing the project. See [Customization Project Editor](#) for details.

As you write scripts, keep the following guidelines in mind:

- You have to use a naming convention that provides unique names for your custom objects so that they do not have the same as existing database objects do.
- A script can be executed multiple times. Therefore, in the script, you have to check whether an object already exists before you create a new one; otherwise, an error will occur when the script runs on a database that already contains the object.

You can prepare the script directly in the dialect of the target database or prepare the script for on-the-fly interpretation by Microsoft SQL Server or MySQL, depending on the target database. So you have the following options:

- **Insert the SQL script prepared for the target database, which is Microsoft SQL or MySQL:** During the publication of the project, the Acumatica Customization Platform executes the script as it is. You can use all the functionality of the SQL dialect of the target database, but this script causes the customization project to depend on the database management system that hosts the database of Acumatica ERP.

You can use SQL script attributes to skip the script batch execution on a database management system. See [Using the SQL Script Attributes](#) for details.

- **Insert the SQL script with support for interpretation for the target database:** Prepare the script in the Microsoft SQL Server dialect, and insert the script with the `-- [VmSql]` attribute. During the publication of the project, the system analyzes the script, generates the corresponding SQL statements in the dialect of the target database, and executes the statements. A customization project that includes only these scripts remains independent from the database management system that hosts the database of Acumatica ERP. However, the interpreter supports a relatively limited set of SQL language elements. See [Writing Custom SQL Scripts for Interpretation](#) for details.

In the script for interpretation, you have to place the `-- [VmSql]` attribute before each batch of the SQL script to be interpreted.

### Using the SQL Script Attributes

You can decorate a batch of an SQL script with various attributes to control the batch execution.



: An SQL batch is a portion of an SQL script located between two `GO` statements.

Attributes are based on the line preceding the batch in the following format.

```
--[Attribute(Parameter1 = Value1, Parameter2 = Value2)]
```

Also, it is possible to specify that an attribute is effective only when the script is executed on a particular platform (MySQL Server or Microsoft SQL Server). To achieve this, add to the beginning of the attribute name a short database platform name followed by a colon, as follows.

```
--[mysql: Attribute(Parameter1 = Value1, Parameter2 = Value2)]
```

```
--[mssql: Attribute(Parameter1 = Value1, Parameter2 = Value2)]
```

The currently used platform names are *azure*, *mssql*, and *mysql*.

We recommend that you use the following attributes for batches in SQL scripts.

Attribute	Description	Parameter	Examples
Native	The script batch will be executed against the database without any changes or attempts to parse and interpret it. You can use SQL clauses that are specific to the target platform.	-	--[mssql: Native]
Skip	A script batch can be skipped when the upgrade is being executed on a specific platform.	-	--[mysql: Skip]
SmartExecute	The whole batch will be executed once for every tenant. (Inter-tenant visibility mechanisms (CompanyMask) are used.) You write your code in T-SQL, and it will be passed to the interpreter.	-	--[SmartExecute]
VmSql	The decorated script batch will be interpreted as T-SQL, and a corresponding script for the current database engine will be generated and executed on the database. The number of correctly translated clauses is a limited subset of T-SQL.	-	--[VmSql]

You can create an SQL script that is executed properly on the MySQL database platform and Microsoft SQL database platform, as shown in the example below. This script contains two batches and demonstrates how to use SQL script attributes to control the execution of the batches.

```
--[mysql: Skip]
--[mssql: Native]
IF OBJECT_ID('dbo.View1', 'V') IS NOT NULL DROP VIEW [View1];
CREATE VIEW [View1] AS (SELECT TOP 10 * FROM [AccountClass] )
GO

--[mysql: Native]
--[mssql: Skip]
DROP VIEW IF EXISTS `View1`;
CREATE VIEW `View1` AS (SELECT * FROM `AccountClass` LIMIT 10 )
GO
```

## Writing Custom SQL Scripts for Interpretation

In custom scripts for interpretation, you can use the data types and SQL statements that are listed below.

### Data Types

The following data types of Microsoft SQL Server are supported for interpretation:

- bit
- char, nchar, varchar, and nvarchar
- smallint, int, and bigint



- `date`, `datetime`, and `datetime2`
- `uniqueidentifier`
- `decimal` and `double`

The following data types of MySQL Server are supported for interpretation:

- `binary`, `varbinary`, and `longblob`
- `char`, `varchar`, and `longtext`
- `tinyint`, `smallint`, `int`, and `bigint`
- `timestamp` and `datetime`
- `decimal` and `double`

## SQL Statements

If you prepare a script for interpretation, you can use the following elements of Transact-SQL:

- **CREATE, ALTER, and DROP statements**
- **SELECT, INSERT, UPDATE, and DELETE statements with WHERE clauses**
- **Logical operators: NOT, AND, OR, and EXISTS**
- **Control-of-flow keywords: IF...ELSE and BEGIN...END**
- **Expressions: CASE, COALESCE, and NULLIF**
- **String functions: LEN, CONCAT, REPLACE, CHAR, RTRIM, LTRIM, SUBSTRING, UPPER, LOWER, REPLICATE, and DATALENGTH**
- **Arithmetic operators: +, -, \*, and /**
- **Mathematical functions: CEILING, ROUND, and FLOOR**
- **Date and time functions: GETDATE, DAYADD, DATEPART, and DATALENGTH**
- **Aggregate functions: ABS, MIN, MAX, SUM, and COUNT**
- **Conversion functions: CAST and CONVERT**
- **System functions: ISNULL and NEWID**
- **System variables: @@ROWCOUNT, @@IDENTITY, and @@FETCH\_STATUS**
- **Cryptographic functions: HASHBYTES with MD5 only**
- **Local variables**
- **Cursors**
- **Scalar subselect**



: The `EXISTS` operator can be applied to the `sys.tables`, `sys.column`, and `sys.indexes` objects. The `DATALENGTH` function can be applied to a string or binary object, and the function returns the object length in bytes.

## VmSQL Variables

In the script for interpretation, you can use the `@@@is_mssql`, `@@@is_azure`, and `@@@is_mysql` variables. The following table contains the values of these variables for Microsoft SQL Server, Microsoft Azure SQL Database, and MySQL Server.

SQL Server	@@@is_mssql	@@@is_azure	@@@is_mysql
MS SQL Server	1	0	0
MS Azure SQL Database	1	1	0
MySQL Server	0	0	1

### Error Messages

Unsupported data types cause the following error: *Cannot figure out DbType for SqlDataTypeOption.*


Unsupported elements can cause the following errors:

- *Date interval ... not recognized*: This indicates that the dates are specified in an unknown format in the functions that work with datetime formats.
- *Unknown algorithm in hashbytes ... not implemented*: If you get this error, an unknown algorithm is specified in the `HASHBYTES` function. Currently, the interpreter supports MD5 only.
- *Function ... not implemented*: This means that the script contains an unknown function that cannot be interpreted.

## To Edit a Custom SQL Script

You can edit a custom SQL script once it is added to a customization project. To do this, perform the following actions:

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. Click **Database Scripts** in the navigation pane to open the Database Scripts page.
3. In the table on the page, click the row of the script to be edited.
- 4.

On the page toolbar, click  (**Edit**) to open the [SQL Script Editor](#) for the selected item.



: You can click the name of a *Script* item in the **Object Name** column of the table to open the SQL Script Editor for the item.

## To Delete an Sql or Table Item From a Project

To delete an *Sql* or *Table* item from a customization project, perform the following actions:

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. Click **Database Scripts** in the navigation pane to open the Database Scripts page.
3. In the table on the page, click the row of the item to be deleted.
- 4.

On the page toolbar, click  (**Delete Row**).

The item is removed from the customization project. The database objects that have been created or altered if you have published the customization project remain in the database.

## System Locales

You use the System Locales page of the [Customization Project Editor](#) to manage *Locale* items in the customization project.



: A *Locale* item contains the data set of a system locale, which is a set of parameters that defines the language and other local preferences—such as how to display numbers, dates, and times in the user interface—for a group of users.

The System Locales page displays the list of the system locales that have been added to the customization project.

On the page, you can perform various operations, as described in the following topics:

- [To Add a System Locale to a Project](#)
- [To Delete a System Locale from a Project](#)
- [To Update a Custom System Locale in a Project](#)
- [To Navigate to the System Locales Form](#)

## To Add a System Locale to a Project

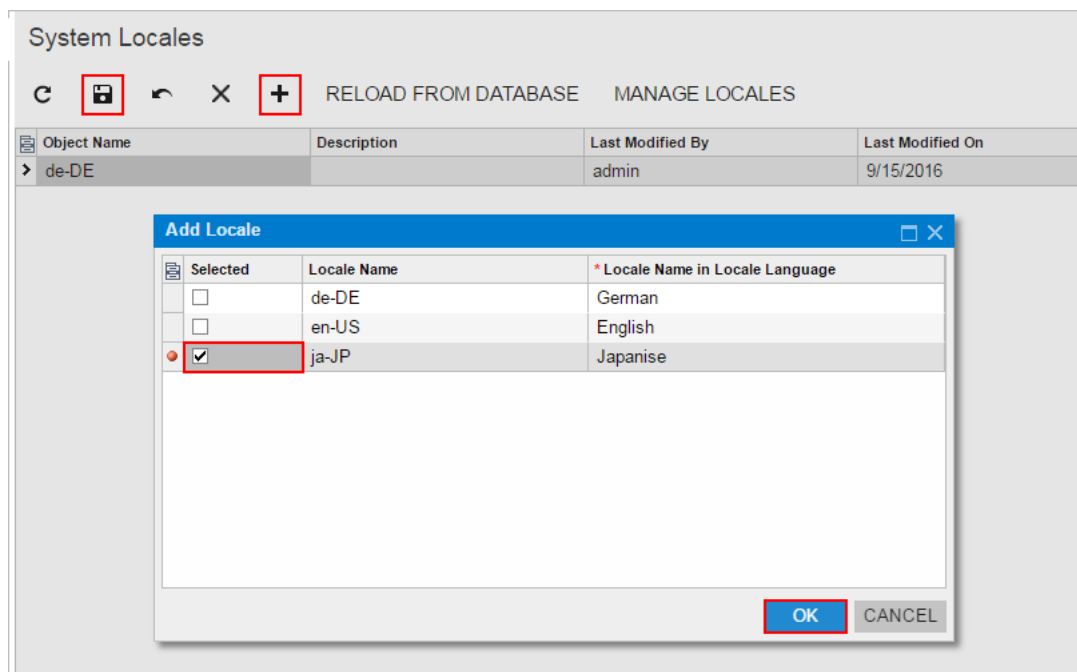
You can add a system locale to a customization project. To do this, perform the following actions:

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. Click **System Locales** in the navigation pane to open the System Locales page.
3. On the page toolbar, click **Add New Record (+)**, as shown in the screenshot below.
4. In the list of system locales in the **Add Locale** dialog box, which opens, select the check box for each locale that you want to include in the project.



: The **Add Locale** dialog box displays all the system locales that exist in your instance of Acumatica ERP. You can select multiple system locales to add them to the project simultaneously.

5. In the dialog box, click **OK** to add each selected locale to the page table.
6. On the page toolbar, click **Save** to save the changes to the customization project.



**Figure: Adding the system locale to the customization project**

The system adds to the project the data from the database for each selected system locale. You can view each new *Locale* item in the Project Items table of the [Item XML Editor](#), as shown in the following screenshot.

Edit Project Items

	Object Name	Type	Description	Exclude	Created By	Creation Date	Last Modified By	Last Modified On
	Item Availability Data	Generalization		<input type="checkbox"/>	admin	9/1/2016	admin	9/1/2016
	ARReleaseProcess	Code		<input type="checkbox"/>	admin	9/1/2016	admin	9/1/2016
	CustomerMaint	Code		<input type="checkbox"/>	admin	9/1/2016	admin	9/1/2016
	SOInvoiceEntry	Code		<input type="checkbox"/>	admin	9/1/2016	admin	9/1/2016
	SOOrderEntry	Code		<input type="checkbox"/>	admin	9/1/2016	admin	9/1/2016
	de-DE	Locale		<input type="checkbox"/>	admin	9/15/2016	admin	9/15/2016
>	ja-JP	Locale		<input type="checkbox"/>	admin	9/15/2016	admin	9/15/2016
	~/pages/ar/ar303000.aspx	Page		<input type="checkbox"/>	admin	9/1/2016	admin	9/1/2016
	~/pages/so/so303000.aspx	Page		<input type="checkbox"/>	admin	9/1/2016	admin	9/1/2016
	AR650660.RPX	Report		<input type="checkbox"/>	admin	9/1/2016	admin	9/1/2016

Source

```
<Locale>
  <data-set>
    <relations format-version="3" relations-version="20160101" main-table="Locale">
      <link from="LocalizationTranslation (Locale)" to="Locale (LocaleName)" />
      <link from="LocalizationTranslation (IdValue)" to="LocalizationValue (Id)" type="ToMaster" />
      <link from="LocalizationResource (IdValue)" to="LocalizationValue (Id)" />
      <link from="LocalizationResourceByScreen (IdRes, IdValue)" to="LocalizationResource (Id, IdValue)" />
    </relations>
    <layout>
      <table name="Locale">
        <table name="LocalizationTranslation" uplink="(LocaleName) = (Locale)" />
      </table>
      <table name="LocalizationValue">
        <table name="LocalizationResource" uplink="(Id) = (IdValue)">
          <table name="LocalizationResourceByScreen" uplink="(Id, IdValue) = (IdRes, IdValue)" />
        </table>
      </table>
    </layout>
    <data>
      <Locale>
        <row LocaleName="ja-JP" Description="Japanese" TranslatedName="Japanese" IsActive="true" />
      </Locale>
    </data>
  </data-set>
</Locale>
```

Figure: Viewing the XML code of the *Locale* item included in the project

## To Delete a System Locale from a Project

To remove a *Locale* item from a project, perform the following actions:

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. Click **System Locales** in the navigation pane to open the System Locales page.
3. In the page table, click the item to be deleted.
4. On the page toolbar, click **Delete Row** (X).
5. On the page toolbar, click **Save** to save the changes to the customization project.

If you delete a *Locale* item from the project, the system locale remains in the system unless you delete the locale by using the [System Locales](#) (SM200550) form.

## To Update a Custom System Locale in a Project

If you have used the [System Locales](#) (SM200550) form to change a system locale included in a customization project, you have to update the appropriate item in the project. To do this, perform the following actions:

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)

2. Click **System Locales** in the navigation pane to open the System Locales page.
3. On the page toolbar, click **Reload From Database**.

The platform updates all the *Locale* items of the project by using the appropriate data from the database.

## To Navigate to the System Locales Form

You might need to add a system locale to Acumatica ERP during customization. To manage system locales in Acumatica ERP, you use the [System Locales](#) (SM200550) form.

In the [Customization Project Editor](#), to open the [System Locales](#) form, perform the following actions:

1. Click **System Locales** in the navigation pane to open the System Locales page of the editor.
2. On the page toolbar, click **Manage Locales**.

As soon as you add a system locale to the system on the [System Locales](#) form, you can add the locale as a *Locale* item to the customization project. For more information about system locales, see [System Locales](#) in the User Guide.

## Import and Export Scenarios

You use the Import and Export Scenarios page of the [Customization Project Editor](#) to manage *XportScenario* items in the customization project.



: An *XportScenario* item contains the data set of a custom export or import scenario used to perform data migration between a legacy application and Acumatica ERP.

The Import and Export Scenarios page displays the list of the integration scenarios that have been added to the customization project.

On the page, you can perform a variety of operations, including the following:

- [To Add an Integration Scenario to a Project](#)
- [To Delete an Integration Scenario from a Project](#)
- [To Update an Integration Scenario in a Project](#)
- [To Navigate to the Import Scenarios Form](#)

## To Add an Integration Scenario to a Project

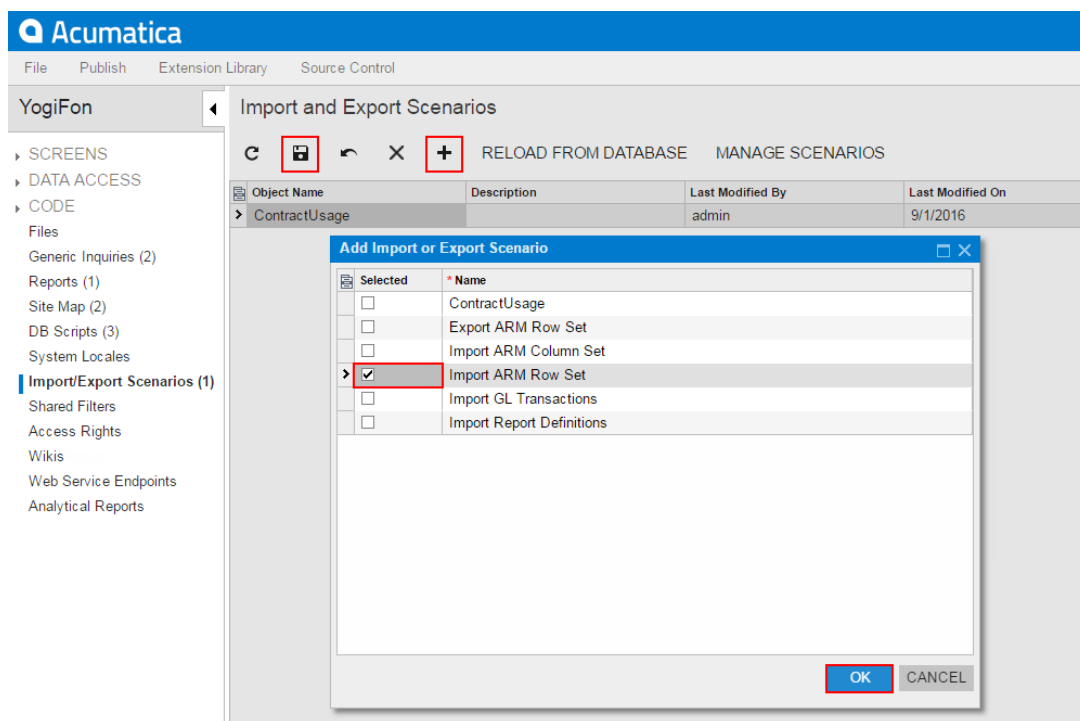
You can add a custom integration scenario to a customization project. To do this, perform the following actions:

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. Click **Import/Export Scenarios** in the navigation pane to open the Import and Export Scenarios page.
3. On the page toolbar, click **Add New Record (+)**, as shown in the screenshot below.
4. In the list of integration scenarios in the **Add Import or Export Scenario** dialog box, which opens, select the check box for each scenario that you want to include in the project.



: The **Add Import or Export Scenario** dialog box displays all the custom integration scenarios that exist in your instance of Acumatica ERP. You can select multiple integration scenarios to add them to the project simultaneously.

5. In the dialog box, click **OK** to add each selected integration scenario to the page table.
6. On the page toolbar, click **Save** to save the changes to the customization project.



**Figure: Adding an integration scenario to the customization project**

The system adds to the project the data from the database for each selected integration scenario. You can view each new *XportScenario* item in the Project Items table of the [Item XML Editor](#), as shown in the following screenshot.

Edit Project Items

Object Name	Type	Desc	Exclud	Created By	Creation Date	Last Modified By	Last Modified On
APAddress	Sql		<input type="checkbox"/>	admin	9/13/2016	admin	9/13/2016
MyScript	Sql		<input type="checkbox"/>	admin	9/13/2016	admin	9/14/2016
Script_For_Interpreter	Sql		<input type="checkbox"/>	admin	9/16/2016	admin	9/16/2016
ARTran	Table		<input type="checkbox"/>	admin	9/1/2016	admin	9/1/2016
Contact	Table		<input type="checkbox"/>	admin	9/1/2016	admin	9/1/2016
SOOrder	Table		<input type="checkbox"/>	admin	9/1/2016	admin	9/1/2016
HelpRoot_Customize	WikiArticle		<input type="checkbox"/>	admin	9/19/2016	admin	9/19/2016
ContractUsage	XportScenario		<input type="checkbox"/>	admin	9/1/2016	admin	9/19/2016
Import ARM Row Set	XportScenario		<input type="checkbox"/>	admin	9/19/2016	admin	9/19/2016

Source

```
<XportScenario>
  <data-set>
    <relations format-version="3" relations-version="20160101" main-table="SYMMapping">
      <link from="SYMMapping (ProviderID, NoteID)" to="SYProvider (ProviderID, NoteID)" type="ToMaster" />
      <link from="SYMMapping (NoteID)" to="Note (NoteID)" type="ToMaster" />
      <link from="SYProvider (NoteID)" to="Note (NoteID)" type="ToMaster" />
      <link from="SYProviderField (ProviderID)" to="SYProvider (ProviderID)" />
      <link from="SYProviderField (NoteID)" to="Note (NoteID)" type="Note" />
      <link from="SYProviderObject (ProviderID)" to="SYProvider (ProviderID)" />
      <link from="SYProviderObject (NoteID)" to="Note (NoteID)" type="Note" />
      <link from="SYProviderParameter (ProviderID)" to="SYProvider (ProviderID)" />
      <link from="SYProviderParameter (NoteID)" to="Note (NoteID)" type="Note" />
      <link from="SYMMappingCondition (MappingID)" to="SYMMapping (MappingID)" />
      <link from="SYMMappingCondition (NoteID)" to="Note (NoteID)" type="Note" />
      <link from="SYMMappingField (MappingID)" to="SYMMapping (MappingID)" />
      <link from="SYMMappingField (NoteID)" to="Note (NoteID)" type="Note" />
      <link from="SYImportCondition (MappingID)" to="SYMMapping (MappingID)" />
      <link from="SYImportCondition (NoteID)" to="Note (NoteID)" type="Note" />
    </relations>
    <layout>
      <table name="SYMMapping">

```

Figure: Viewing the XML code of the *XportScenario* item included in the project

An *XportScenario* item contains all the data required for the integration scenario. Therefore, the item includes the data of the data provider.

## To Delete an Integration Scenario from a Project

To remove an *XportScenario* item from a project, perform the following actions:

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. Click **Import/Export Scenarios** in the navigation pane to open the Import and Export Scenarios page.
3. In the page table, click the item to be deleted.
4. On the page toolbar, click **Delete Row (X)**.
5. On the page toolbar, click **Save** to save the changes to the customization project.

If you delete an *XportScenario* item from the project, the integration scenario remains in the system unless you delete the scenario by using the [Import Scenarios](#) (SM206025) form.

## To Update an Integration Scenario in a Project

If you have used the [Import Scenarios](#) (SM206025) form to change an integration scenario included in a customization project, you have to update the appropriate item in the project. To do this, perform the following actions:

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)

2. Click **Import/Export Scenarios** in the navigation pane to open the Import and Export Scenarios page.
3. On the page toolbar, click **Reload From Database**.

The platform updates all the *XportScenario* items of the project by using the appropriate data from the database.

## To Navigate to the Import Scenarios Form

You might need to add an import or export scenario to Acumatica ERP during customization. To manage import scenarios in Acumatica ERP, you use the [Import Scenarios](#) (SM206025) form.

In the [Customization Project Editor](#), to open this form, perform the following actions:

1. Select **Import/Export Scenarios** in the navigation pane to open the Import and Export Scenarios page.
2. On the page toolbar, click **Manage Scenarios**.

To manage export scenarios in Acumatica ERP, you use the [Export Scenarios](#) (SM207025) form.

As soon as you add an integration scenario to the system on the [Import Scenarios](#) or [Export Scenarios](#) form, you can add the scenario as an *XportScenario* item to the customization project. For more information about integration scenarios, see the [Preparing Data for Import and Export by Using Scenarios](#) in the Integrations guide.

## Shared Filters

Users can create reusable filters, which are available on processing and inquiry forms in Acumatica ERP, to filter the data in the table part of the form; these filters can be reused anytime after creation. Reusable filters can be shared among all users of the system.

You use the Shared Filters page of the [Customization Project Editor](#) to manage *SharedFilter* items in the customization project.



: A *SharedFilter* item contains the data set of a custom reusable shared filter created on a processing or inquiry form of Acumatica ERP.

The Shared Filters page displays the list of the custom reusable shared filters that have been added to the customization project.

On the page, you can perform several operations, as described in the following topics:

- [To Add a Shared Filter to a Project](#)
- [To Delete a Shared Filter from a Project](#)
- [To Update a Shared Filter in a Project](#)
- [To Navigate to the Filters Form](#)

## To Add a Shared Filter to a Project

You can add a custom reusable shared filter to a customization project. To do this, perform the following actions:

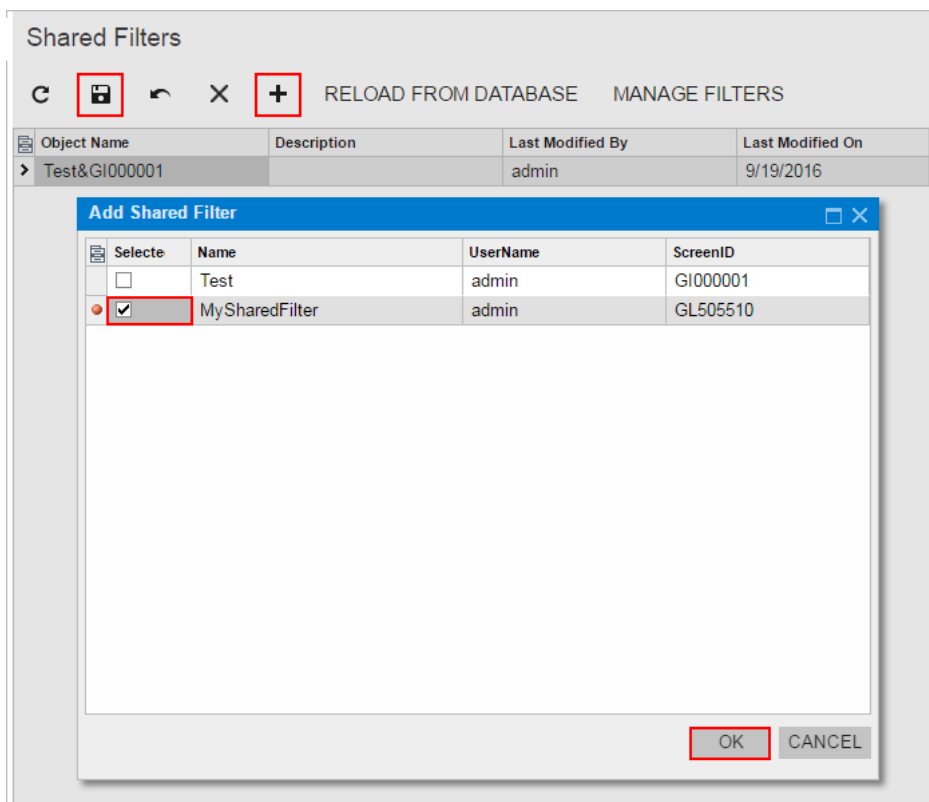
1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. Click **Shared Filters** in the navigation pane to open the Shared Filters page.
3. On the page toolbar, click **Add New Record (+)**, as shown in the screenshot below.
4. In the list of integration scenarios in the **Add Shared Filter** dialog box, which opens, select the check box for each filter that you want to include in the project.





: The **Add Shared Filter** dialog box displays all the custom shared filters that exist in your instance of Acumatica ERP. You can select multiple shared filters to add them to the project simultaneously.

5. In the dialog box, click **OK** to add the selected filter or filters to the page table.
6. On the page toolbar, click **Save** to save the changes to the customization project.



**Figure: Adding the shared filter to the customization project**

The system adds to the project the data from the database for each selected shared filter. You can view each new *SharedFilter* item in the Project Items table of the [Item XML Editor](#), as shown in the following screenshot.

Edit Project Items

	Object Name	Type	Descri	Exclud	Created By	Creation Date	Last Modified
	SOOrderEntry	Code		<input type="checkbox"/>	admin	9/17/2016	adm
	de-DE	Locale		<input type="checkbox"/>	admin	9/15/2016	adm
	en-US	Locale		<input type="checkbox"/>	admin	9/19/2016	adm
	ja-JP	Locale		<input type="checkbox"/>	admin	9/15/2016	adm
	~/pages/ar/ar303000.aspx	Page		<input type="checkbox"/>	admin	9/1/2016	adm
	~/pages/so/so303000.aspx	Page		<input type="checkbox"/>	admin	9/1/2016	adm
	AR650660.RPX	Report		<input type="checkbox"/>	admin	9/19/2016	adm
	Profit & Loss Budget Performance	ReportDefinition		<input type="checkbox"/>	admin	9/19/2016	adm
	RM000001	ScreenWithRights		<input type="checkbox"/>	admin	9/19/2016	adm
>	MySharedFilter&GL505510	SharedFilter		<input type="checkbox"/>	admin	9/19/2016	adm
	Test&GI000001	SharedFilter		<input type="checkbox"/>	admin	9/19/2016	adm
	Subscription Billing Details	SiteMapNode		<input type="checkbox"/>	admin	9/1/2016	adm
	Finance	SiteMapNode		<input type="checkbox"/>	admin	9/19/2016	adm
	Active Contracts	SiteMapNode		<input type="checkbox"/>	admin	9/1/2016	adm

Source

```
<SharedFilter>
  <data-set>
    <relations format-version="3" relations-version="20160101" main-table="FilterH
      <link from="FilterRow (FilterID)" to="FilterHeader (FilterID)" />
    </relations>
    <layout>
      <table name="FilterHeader">
        <table name="FilterRow" uplink="(FilterID) = (FilterID)" />
      </table>
    </layout>
    <data>
      <FilterHeader>
        <row FilterID="417" UserName="admin" ScreenID="GL505510" ViewN
```

Figure: Viewing the XML code of the *SharedFilter* item included in the project

## To Delete a Shared Filter from a Project

To remove a *SharedFilter* item from a project, perform the following actions:

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. Click **Shared Filters** in the navigation pane to open the Shared Filters page.
3. In the page table, click the item to be deleted.
4. On the page toolbar, click **Delete Row (X)**.
5. On the page toolbar, click **Save** to save the changes to the customization project.

If you delete a *SharedFilter* item from the project, the custom reusable shared filter remains in the system unless you delete the filter. You can delete the filter by using the [Filters](#) (CS209010) form, as described in [To Delete a System Filter](#), or by using the form to which the filter is applied, as described in [To Delete a Filter](#).

## To Update a Shared Filter in a Project

If you have used the [Filters](#) (CS209010) form or the form to which the filter is applied to change a shared filter included in a customization project, you have to update the appropriate item in the project. To do this, perform the following actions:

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. Click **Shared Filters** in the navigation pane to open the Shared Filters page.

3. On the page toolbar, click **Reload From Database**.

The platform updates all the *SharedFilter* items of the project by using the appropriate data from the database.

## To Navigate to the Filters Form

You might need to add or change a reusable shared filter in Acumatica ERP during a customization. To manage shared filters in Acumatica ERP, you use the *Filters* (CS209010) form.

In the *Customization Project Editor*, to open this form, perform the following actions:

1. Click **Shared Filters** in the navigation pane to open the Shared Filters page.
2. On the page toolbar, click **Manage Filters**.

For more information about reusable filters, see *Saving of Filters for Future Use* in the Interface Guide.

## Access Rights

In Acumatica ERP, you can control access to system objects at broad and granular levels, down to the control of form elements, such as buttons, text boxes, and check boxes. Users are assigned to roles, and you give these roles the appropriate levels of access rights to system objects—suites, modules, forms, and form elements.

You use the Access Rights page of the *Customization Project Editor* to manage *ScreenWithRights* items in the customization project.



: A *ScreenWithRights* item contains the data set of custom access rights of roles to a form, down to the control of form elements.

The Access Rights page displays the list of the custom access rights of roles that have been added to the customization project.

On the page, you can perform several operations, as described in the following topics:

- [To Add Access Rights to a Project](#)
- [To Delete Access Rights from a Project](#)
- [To Update Access Rights in a Project](#)
- [To Navigate to the Access Rights by Screen Form](#)

## To Add Access Rights to a Project

When you create or change the access rights by screen, role, or user in an instance of Acumatica ERP, these changes are saved in the database for the current tenant.

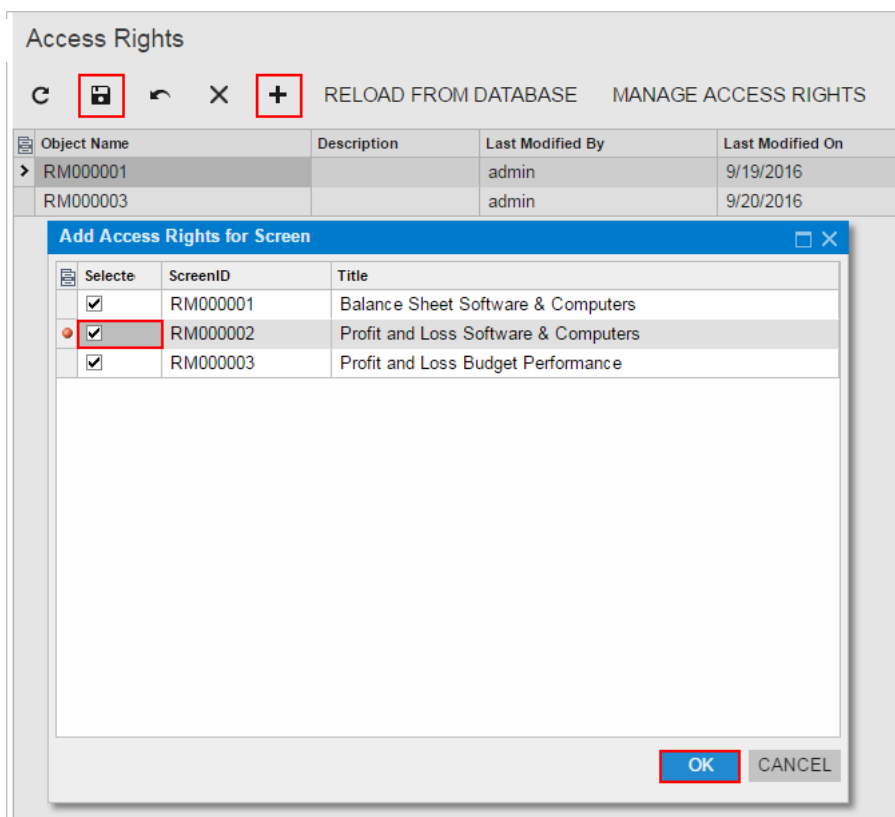
You can add to a customization project the access rights of roles by screen that are saved in the database for the current tenant. To do this, perform the following actions:

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. Click **Access Rights** in the navigation pane to open the Access Rights page.
3. On the page toolbar, click **Add New Record (+)**, as shown in the screenshot below.
4. In the **Add Access Rights for Screen** dialog box, which opens, in the list of custom access rights of roles by screen, select the check box for the access rights that you want to include in the project.



: The **Add Access Rights for Screen** dialog box displays all the custom access rights of roles that exist in your instance of Acumatica ERP. You can select multiple access rights of roles to add them to the project simultaneously.

5. In the dialog box, click **OK** to add the selected access rights of roles to the page table.
6. On the page toolbar, click **Save** to save the changes to the customization project.



**Figure: Adding the access rights to the customization project**

The system adds to the project the data from the database for the selected access rights of roles. You can view each new *ScreenWithRights* item in the Project Items table of the [Item XML Editor](#), as shown in the following screenshot.

Edit Project Items

	Object Name	Type	Descri	Exc	Created By	Creati Date	Last Modifie By
	AR650660.RPX	Report		<input type="checkbox"/>	admin	9/19/201	ad
	Profit & Loss Budget Performance	ReportDefinition		<input type="checkbox"/>	admin	9/19/201	ad
	RM000001	ScreenWithRights		<input type="checkbox"/>	admin	9/19/201	ad
>	RM000002	ScreenWithRights		<input type="checkbox"/>	admin	9/20/201	ad
	RM000003	ScreenWithRights		<input type="checkbox"/>	admin	9/20/201	ad
	MySharedFilter&GL505510	SharedFilter		<input type="checkbox"/>	admin	9/19/201	ad
	Test&GI000001	SharedFilter		<input type="checkbox"/>	admin	9/19/201	ad
	Subscription Billing Details	SiteMapNode		<input type="checkbox"/>	admin	9/1/2016	ad

Source

```
<ScreenWithRights>
  <data-set>
    <relations format-version="3" relations-version="20160101" main-table="
      <link from="RolesInCache (ScreenID)" to="SiteMap (ScreenID)" />
      <link from="RolesInGraph (ScreenID)" to="SiteMap (ScreenID)" />
      <link from="RolesInMember (ScreenID)" to="SiteMap (ScreenID)" />
      <link from="Roles (Rolename, ApplicationName)" to="RolesInCache
      <link from="Roles (Rolename, ApplicationName)" to="RolesInGraph
      <link from="Roles (Rolename, ApplicationName)" to="RolesInMembe
    </relations>
    <layout>
      <table name="SiteMap">
        <table name="RolesInCache" uplink="(ScreenID) = (Screen
        <table name="RolesInGraph" uplink="(ScreenID) = (Screen
        <table name="RolesInMember" uplink="(ScreenID) = (Scree
      </table>
    </layout>
  </data-set>
</ScreenWithRights>
```

**Figure: Viewing the XML code of the *ScreenWithRights* item included in the project**

A *ScreenWithRights* item contains all the data required for the access rights of roles to the screen. Therefore, the item includes the data of all the roles applied to the screen.

## To Delete Access Rights from a Project

To remove a *ScreenWithRights* item from a project, perform the following actions:

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. Click **Access Rights** in the navigation pane to open the Access Rights page.
3. In the page table, click the item to be deleted.
4. On the page toolbar, click **Delete Row** (X).
5. On the page toolbar, click **Save** to save the changes to the customization project.

If you delete a *ScreenWithRights* item from the project, the customization of the access rights of roles remain in the system unless you delete the changes of access rights from the database.

## To Update Access Rights in a Project

If you have used Acumatica ERP forms to change access rights included in a customization project, you have to update the appropriate items in the project. To do this, perform the following actions:

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. Click **Access Rights** in the navigation pane to open the Access Rights page.
3. On the page toolbar, click **Reload From Database**.

The platform updates all the *ScreenWithRights* items of the project by using the appropriate data from the database.

## To Navigate to the Access Rights by Screen Form

You might need to change the access rights of roles in Acumatica ERP during customization. To manage access rights of roles by screen in Acumatica ERP, you use the [Access Rights by Screen](#) (SM201020) form.

To open this form from the [Customization Project Editor](#), perform the following actions:

1. Click **Access Rights** in the navigation pane to open the Access Rights page.
2. On the page toolbar, click **Manage Access Rights**.

As soon as you change the access rights of roles in Acumatica ERP, the system saves the changes in the database for your tenant, and you can add the access rights as a *ScreenWithRights* item to the customization project. For more information about the access rights of roles, see [Managing User Access Rights](#) in the System Administration Guide.

## Wikis

---

You use the Wikis page of the [Customization Project Editor](#) to manage *WikiArticle* items in the customization project.



: A *WikiArticle* item contains the data set of a custom wiki and all the articles created within this wiki.

The Wikis page displays the list of the custom wikis that have been added to the customization project.

On the page, you can perform several operations, as described in the following topics:

- [To Add a Custom Wiki to a Project](#)
- [To Delete a Custom Wiki from a Project](#)
- [To Update a Custom Wiki in a Project](#)
- [To Navigate to the Wiki Form](#)

## To Add a Custom Wiki to a Project

In Acumatica ERP, you can create a new wiki or modify the properties of an existing one. For example, you can change the access rights to wiki folders and edit the list of categories available for the wiki. Any change to wikis is saved for the appropriate wiki in the database for the current tenant.

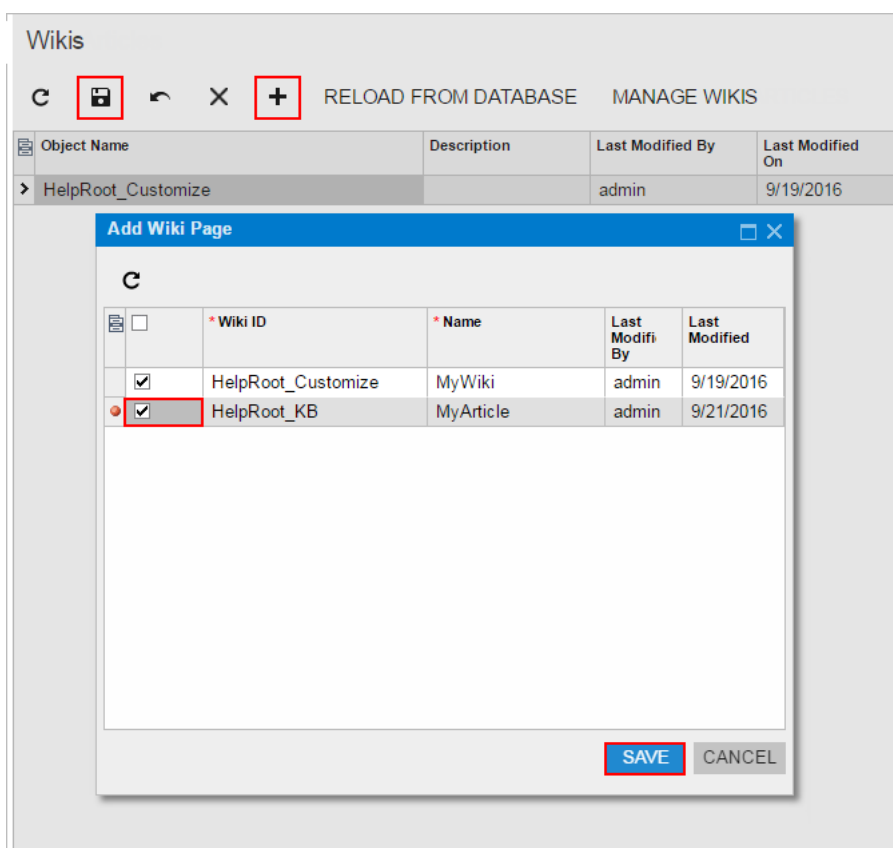
You can add to a customization project the wiki that are saved in the database for the current tenant. To do this, perform the following actions:

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. Click **Wikis** in the navigation pane to open the Wikis page.
3. On the page toolbar, click **Add New Record (+)**, as shown in the screenshot below.
4. In the list of custom wikis in the **Add Wiki Page** dialog box, which opens, select the check box for each wiki that you want to include in the project.



: The **Add Wiki Page** dialog box displays all the custom wikis that exist in your instance of Acumatica ERP. You can select multiple wikis to add them to the project simultaneously.

5. In the dialog box, click **OK** to add the selected wiki to the page table.
6. On the page toolbar, click **Save** to save the changes to the customization project.



**Figure: Adding the custom wiki to the customization project**

The system adds to the project each selected wiki. You can view each new *WikiArticle* item in the Project Items table of the [Item XML Editor](#), as shown in the following screenshot.

Edit Project Items

	Object Name	Type	Descripti	Excl	Created By	Creatic Date	Last Modified By	Last Modifie On
	Active Contracts	SiteMapNode		<input type="checkbox"/>	admin	9/1/2016	admin	9/1/2
	APAddress	Sql		<input type="checkbox"/>	admin	9/13/2016	admin	9/13/
	MyScript	Sql		<input type="checkbox"/>	admin	9/13/2016	admin	9/14/
	Script_For_Interpreter	Sql		<input type="checkbox"/>	admin	9/16/2016	admin	9/16/
	ARTran	Table		<input type="checkbox"/>	admin	9/1/2016	admin	9/1/2
	Contact	Table		<input type="checkbox"/>	admin	9/1/2016	admin	9/1/2
	SOOrder	Table		<input type="checkbox"/>	admin	9/1/2016	admin	9/1/2
	HelpRoot_Customize	WikiArticle		<input type="checkbox"/>	admin	9/19/2016	admin	9/19/
>	HelpRoot_KB	WikiArticle		<input type="checkbox"/>	admin	9/21/2016	admin	9/21/
	ContractUsage	XportScenario		<input type="checkbox"/>	admin	9/1/2016	admin	9/19/

Source

```
<WikiArticle>
  <data-set>
    <relations format-version="3" relations-version="20160101" main-table="WikiArticle">
      <link from="WikiAccessRights (PageID)" to="WikiPage (PageID)" />
      <link from="WikiPageLanguage (PageID)" to="WikiPage (PageID)" />
      <link from="WikiRevision (PageID, Language, PageRevisionID)" to="WikiPage (PageID)" />
      <link from="WikiRevision (UID)" to="Dual (UID)" type="NewUID" />
      <link from="WikiPage (PageID)" to="WikiDescriptor (PageID)" type="NewUID" />
      <link from="WikiDescriptor (PageID)" to="WikiDescriptorExt (PageID)" type="NewUID" />
      <link from="WikiCss (CssID)" to="WikiDescriptor (CssID)" />
      <link from="WikiFileInPage (PageID, Language, PageRevisionID)" to="UploadFile (FileID)" type="NewUID" />
      <link from="UploadFileRevision (FileID, FileRevisionID)" to="UploadFile (FileID)" type="NewUID" />
    </relations>
  </data-set>
</WikiArticle>
```

Figure: Viewing the XML code of the *WikiArticle* item included in the project

A *WikiArticle* item contains all the data required to recreate the corresponding wiki in any instance of Acumatica ERP.

## To Delete a Custom Wiki from a Project

To remove a *WikiArticle* item from a project, perform the following actions:

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. Click **Wikis** in the navigation pane to open the Wikis page.
3. In the page table, click the item to be deleted.
4. On the page toolbar, click **Delete Row** (X).
5. On the page toolbar, click **Save** to save the changes to the customization project.

If you delete a *WikiArticle* item from the project, the custom wiki remains in the system unless you delete the wiki by using the [Wiki](#) (SM202005) form.

## To Update a Custom Wiki in a Project

If you have changed a wiki included in a customization project by using Acumatica ERP forms, you have to update the appropriate item in the project. To do this, perform the following actions:

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. Click **Wikis** in the navigation pane to open the Wikis page.
3. On the page toolbar, click **Reload From Database**.

The platform updates all the *WikiArticle* items of the project by using the appropriate data from the database.



## To Navigate to the Wiki Form

You might need to add a new wiki or edit an existing one in Acumatica ERP during customization. To manage wikis in Acumatica ERP, you use the [Wiki](#) (SM202005) form.

To open this form from the [Customization Project Editor](#), perform the following actions:

1. Click **Wikis** in the navigation pane to open the Wikis page.
2. On the page toolbar, click **Manage Wikis**.

As soon as you create or change a wiki in the system, the system saves this wiki in the database for the current tenant, you can add the wiki as a *WikiArticle* item to the customization project. For more information about wikis, see [Managing Wikis](#) in the System Administration Guide.

## Web Service Endpoints

Acumatica ERP provides web services for integration with external systems. Through the web services of Acumatica ERP, external systems can get data records from Acumatica ERP and process these records; new or updated records can also be saved to Acumatica ERP. You can configure contract-based web service endpoints in an instance of Acumatica ERP and include the new configuration in a customization project as an *EntityEndpoint* item.

You use the Web Service Endpoints page of the [Customization Project Editor](#) to manage *EntityEndpoint* items in the customization project.



: A *EntityEndpoint* item contains the data set of a custom contract-based web service endpoint.

The Web Service Endpoints page displays the list of the custom contract-based web service endpoints that have been added to the customization project.

On the page, you can perform several operations, as described in the following topics:

- [To Add a Custom Web Service Endpoint to a Project](#)
- [To Delete a Custom Web Service Endpoint from a Project](#)
- [To Update a Custom Web Service Endpoint in a Project](#)
- [To Navigate to the Web Service Endpoints Form](#)

## To Add a Custom Web Service Endpoint to a Project

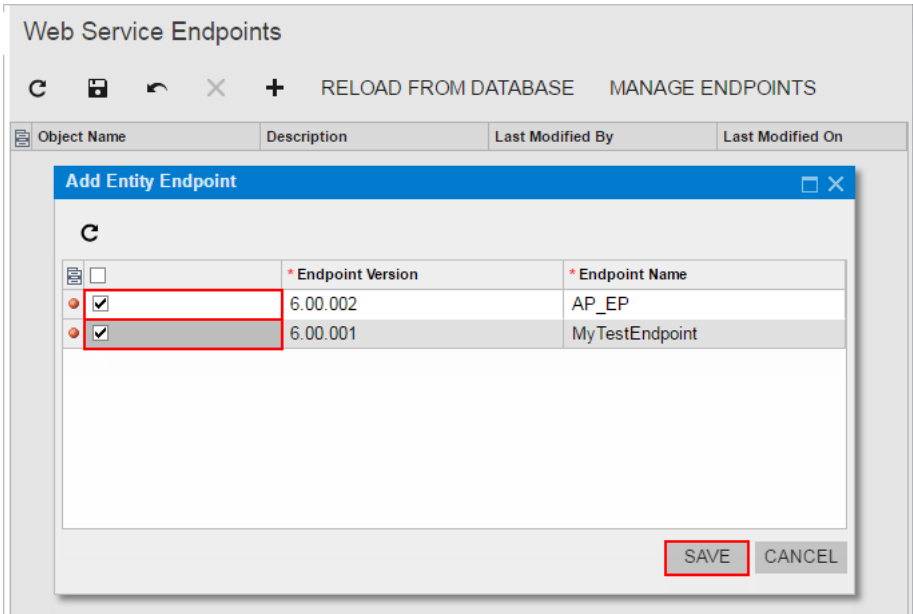
To add a custom contract-based web service endpoint to a customization project, perform the following actions:

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. Click **Web Service Endpoints** in the navigation pane to open the Web Service Endpoints page.
3. On the page toolbar, click **Add New Record (+)**, as shown in the screenshot below.
4. In the list of custom contract-based web service endpoints in the **Add Entity Endpoint** dialog box, which opens, select the check box for each endpoint that you want to include in the project.



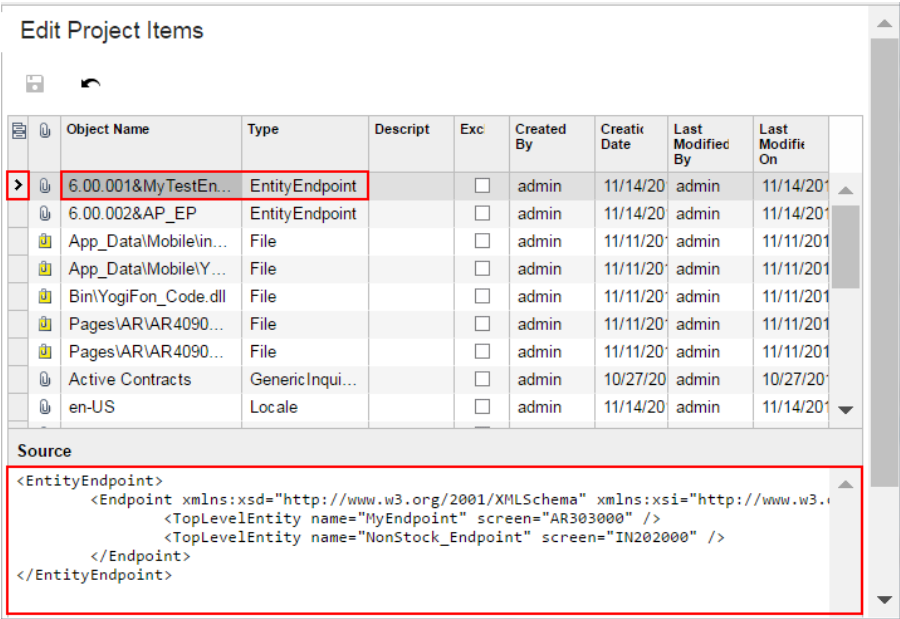
: The **Add Entity Endpoint** dialog box displays all the custom contract-based web service endpoints that exist in your instance of Acumatica ERP. You can select multiple endpoints to add them to the project simultaneously.

5. In the dialog box, click **OK** to add each selected endpoint to the page table.
6. On the page toolbar, click **Save** to save the changes to the customization project.



**Figure:** Adding the custom contract-based web service endpoint to the customization project

The system adds to the project the data from the database for each selected web service endpoint . You can view each new *EntityEndpoint* item in the Project Items table of the *Item XML Editor*, as shown in the following screenshot.



**Figure:** Viewing the XML code of the *EntityEndpoint* item included in the project

### To Delete a Custom Web Service Endpoint from a Project

To remove a *EntityEndpoint* item from a project, perform the following actions:

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. Click **Web Service Endpoints** in the navigation pane to open the Web Service Endpoints page.
3. In the page table, click the item to be deleted.
4. On the page toolbar, click **Delete Row (X)**.

5. On the page toolbar, click **Save** to save the changes to the customization project.

If you delete a *EntityEndpoint* item from the project, the custom contract-based web service endpoint remains in the system unless you delete the endpoint by using the [Web Service Endpoints](#) (SM207060) form.

## To Update a Custom Web Service Endpoint in a Project

If you have used the [Web Service Endpoints](#) (SM207060) form to change a custom contract-based web service endpoint included in a customization project, you have to update the appropriate item in the project. To do this, perform the following actions:

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. Click **Web Service Endpoints** in the navigation pane to open the Web Service Endpoints page.
3. On the page toolbar, click **Reload From Database**.

The platform updates all the *EntityEndpoint* items of the project by using the appropriate data from the database.

## To Navigate to the Web Service Endpoints Form

You might need to configure contract-based web service endpoints in Acumatica ERP during customization. To manage contract-based web service endpoints in Acumatica ERP, you use the [Web Service Endpoints](#) (SM207060) form.

To open this form from the [Customization Project Editor](#), perform the following actions:

1. Click **Web Service Endpoints** in the navigation pane to open the Web Service Endpoints page of the editor.
2. On the page toolbar, click **Manage Endpoints**.

As soon as you configure a web service endpoint on the [Web Service Endpoints](#) form, the system saves the endpoint data in the database for the current tenant, and you can add the endpoint as a *EntityEndpoint* item to the customization project. For more information about the contract-based web services API, see [Configuring the Contract-Based REST and SOAP API](#) in the Integration Development Guide.

## Analytical Reports

Analytical reports are used to display the consolidated and summarized data in a view defined by the report designer at the report design stage. The analytical reports are used to provide the summarized and aggregated values in a variety of views: the data in the analytical report can be displayed in the monthly, yearly, and quarterly views, and the data can provide information from the point of view of departments, selected account classes, and other dimensions.

In Acumatica ERP, you can modify defined analytical reports, create a new analytical report, and delete existing reports. You can add the analytical reports that have been created or modified to the customization project as *ReportDefinition* items.

You use the Analytical Reports page of the [Customization Project Editor](#) to manage *ReportDefinition* items in the customization project.



: A *ReportDefinition* item contains the data set of a custom analytical report, including the data of a predefined sets of rows, columns, and units.

The Analytical Reports page displays the list of the custom analytical reports that have been added to the customization project.

On the page, you can perform a variety of operations, as described in the following topics:


- [To Add a Custom Analytical Report to a Project](#)
- [To Delete a Custom Analytical Report from a Project](#)

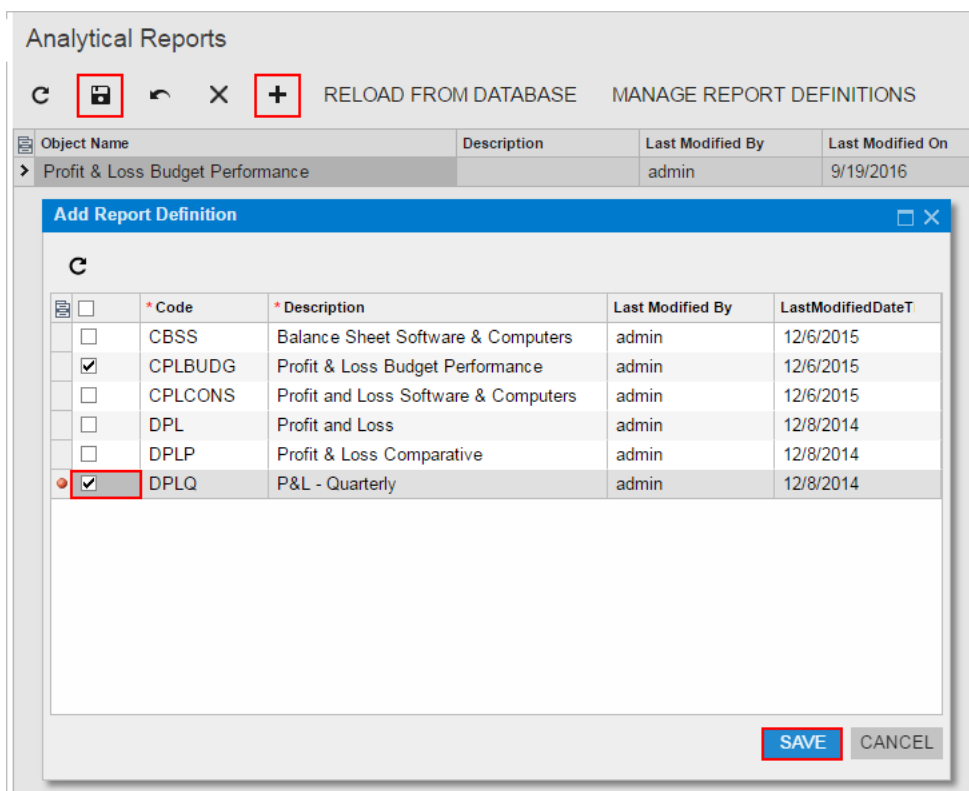
- [To Update a Custom Analytical Report in a Project](#)
- [To Navigate to the Report Definitions Form](#)

## To Add a Custom Analytical Report to a Project

You can add a custom analytical report to a customization project. To do this, perform the following actions:

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. Click **Analytical Reports** in the navigation pane to open the Analytical Reports page.
3. On the page toolbar, click **Add New Record** (+), as shown in the screenshot below.
4. In the list of custom analytical reports in the **Add Report Definition** dialog box, which opens, select the check box for each report that you want to include in the project.
 

 : The **Add Report Definition** dialog box displays all the custom analytical reports that exist in your instance of Acumatica ERP. You can select multiple custom analytical reports to add them to the project simultaneously.
5. In the dialog box, click **OK** to add each selected analytical report to the page table.
6. On the page toolbar, click **Save** to save the changes to the customization project.



**Figure: Adding the custom analytical report to the customization project**

The system adds to the project the data from the database for each selected custom analytical report. You can view each new item in the Project Items table of the [Item XML Editor](#), as shown in the following screenshot.

Edit Project Items

	Object Name	Type	Description	Exclud	Created By	Creation Date	Last Modified E
	ja-JP	Locale		<input type="checkbox"/>	admin	9/15/2016	admin
	~/pages/ar/ar303000.aspx	Page		<input type="checkbox"/>	admin	9/1/2016	admin
	~/pages/so/so303000.aspx	Page		<input type="checkbox"/>	admin	9/1/2016	admin
	AR650660.RPX	Report		<input type="checkbox"/>	admin	9/19/2016	admin
>	P&L - Quarterly	ReportDefinition		<input type="checkbox"/>	admin	9/21/2016	admin
	Profit & Loss Budget Perf...	ReportDefinition		<input type="checkbox"/>	admin	9/19/2016	admin
	RM000001	ScreenWithRights		<input type="checkbox"/>	admin	9/19/2016	admin
	RM000002	ScreenWithRights		<input type="checkbox"/>	admin	9/20/2016	admin
	RM000003	ScreenWithRights		<input type="checkbox"/>	admin	9/20/2016	admin

Source

```
<ReportDefinition>
  <data-set>
    <relations format-version="3" relations-version="20160101" main-table="RMReport"
      <link from="RMColumn (ColumnSetCode)" to="RMColumnSet (ColumnSetCode)"
      <link from="RMColumn (NoteID)" to="Note (NoteID)" type="Note" />
      <link from="RMColumn (NoteID)" to="RMColumnKvExt (RecordID)" type="RowK
      <link from="RMColumnHeader (ColumnSetCode, ColumnCode)" to="RMColumn (C
      <link from="RMColumnHeader (NoteID)" to="Note (NoteID)" type="Note" />
      <link from="RMColumnHeader (NoteID)" to="RMColumnHeaderKvExt (RecordID)
      <link from="RMColumn (DataSourceID)" to="RMDDataSource (DataSourceID)" t
      <link from="RMRow (DataSourceID)" to="RMDDataSource (DataSourceID)" type
      <link from="RMUnit (DataSourceID)" to="RMDDataSource (DataSourceID)" typ
      <link from="RMReport (DataSourceID)" to="RMDDataSource (DataSourceID)" t
```

Figure: Viewing the XML code of the ReportDefinition item included in the project

A *ReportDefinition* item contains all the data required to recreate the corresponding analytical report in any instance of Acumatica ERP.



: To give users the ability to navigate to the custom analytical report in Acumatica ERP with either the modern UI or the classic UI switched on, you have to add the appropriate site map node to the customization project, as described in [To Add a Site Map Node to a Project](#).

## To Delete a Custom Analytical Report from a Project

To remove a *ReportDefinition* item from a project, perform the following actions:

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. Click **Analytical Reports** in the navigation pane to open the Analytical Reports page.
3. In the page table, click the item to be deleted.
4. On the page toolbar, click **Delete Row** (X).
5. On the page toolbar, click **Save** to save the changes to the customization project.

If you delete a *ReportDefinition* item from the project, the analytical report remains in the system unless you delete the report by using the [Report Definitions](#) (CS206000) form.

## To Update a Custom Analytical Report in a Project

If you have used the [Report Definitions](#) (CS206000) form to change an analytical report included in a customization project, you have to update the appropriate item in the project. To do this, perform the following actions:

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. Click **Analytical Reports** in the navigation pane to open the Analytical Reports page.

3. On the page toolbar, click **Reload From Database**.

The platform updates all the *ReportDefinition* items of the project by using the appropriate data from the database.

## To Navigate to the Report Definitions Form

You might need to add an analytical report to Acumatica ERP during customization. To manage analytical reports in Acumatica ERP, you use the [Report Definitions](#) (CS206000) form.

To open this form from the [Customization Project Editor](#), perform the following actions:

1. Click **Analytical Reports** in the navigation pane to open the Analytical Reports page.
2. On the page toolbar, click **Manage Report Definitions**.

As soon as you add a new analytical report to the system or change an existing analytical report on the [Report Definitions](#) form, the report is saved in the database for the current tenant, and you can add the report to the customization project as a *ReportDefinition* item. For more information about analytical reports, see [Managing Analytical Reports](#) in the Reporting Tools Guide.

## Push Notifications

---

Push notifications are notifications in JSON format that are sent by Acumatica ERP to notification destinations when specific data changes occur in Acumatica ERP. External applications can receive the notifications and process them to retrieve the information about the changes.

For more information about push notifications in Acumatica ERP, see [Configuring Push Notifications](#).

You can add the push notification definitions to a customization project as *PushNotification* items. A *PushNotification* item contains the data set of a push notification definition. A push notification definition includes the push notification destination and the data query, which defines the data changes for which Acumatica ERP sends notifications.

You use the Push Notifications page of the [Customization Project Editor](#) to manage *PushNotification* items in the customization project. This page displays the list of the push notification definitions that have been added to the customization project.

On the page, you can perform a variety of operations, as described in the following topics:

- [To Add Push Notification Definitions to a Project](#)
- [To Delete Push Notification Definitions from a Project](#)
- [To Update Push Notification Definitions in a Project](#)
- [To Navigate to the Push Notifications Form](#)

## To Add Push Notification Definitions to a Project

You can add any number of push notification definitions to a customization project as *PushNotification* items. A *PushNotification* item contains all the data required to recreate the corresponding push notification definition in any instance of Acumatica ERP.

To add a push notification definition to the project, perform the following actions:

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. In the navigation pane, click **Push Notifications** to open the Push Notifications page.
3. On the page toolbar, click **Add New Record (+)**.
4. In the list of push notification definitions in the **Add Push Notifications** dialog box, which has opened, select the unlabeled check box in the row of each definition that you want to include in the project.



: The **Add Push Notifications** dialog box displays all the push notification definitions that are configured in your instance of Acumatica ERP.

5. Click **OK** to add each selected notification definition to the page table and close the dialog box.
6. On the page toolbar, click **Save** to save your changes to the customization project.
7. For each data query that defines the data changes for which Acumatica ERP should send notifications in the added push notification definition or definitions, do one of the following:
  - If the data query has been defined with a generic inquiry, add the generic inquiry to the customization project, as described in [To Add a Generic Inquiry to a Project](#).
  - If the data query has been defined with a built-in definition, make sure that the built-in definition is available in the customization project: The built-in definition can be added as either a *Code* item (if the definition is added directly to the customization project as a class) or a *File* item (if the definition is added to the customization project as a class in a DLL file).
8. Optional: In the Customization Project Editor, click **File > Edit Project Items** on the menu. In the Project Items table of the Item XML Editor, verify that the system has added to the project the data from the database for each selected push notification definition. For details on the Item XML Editor, see [Item XML Editor](#).

## To Delete Push Notification Definitions from a Project

To remove a *PushNotification* item or multiple *PushNotification* items from a project, perform the following actions:

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. In the navigation pane, click **Push Notifications** to open the Push Notifications page.
3. In the page table, click the item to be deleted.
4. On the page toolbar, click **Delete Row (X)**.
5. Repeat the two previous steps for each item to be deleted.
6. On the page toolbar, click **Save** to save your changes to the customization project.



: If you delete a *PushNotification* item from the project, the push notification definition remains in the system unless it is deleted on the [Push Notifications](#) (SM302000) form.

## To Update Push Notification Definitions in a Project

If a push notification included in a customization project has been changed (or if multiple push notification definitions have been changed) on the [Push Notifications](#) (SM302000) form, you have to update the appropriate item (or items) in the project. To do this, perform the following actions:

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. In the navigation pane, click **Push Notifications** to open the Push Notifications page.
3. On the page toolbar, click **Reload From Database**.

The platform updates all the *PushNotification* items of the project with the data in the database.

## To Navigate to the Push Notifications Form

You might need to add a push notification definition to Acumatica ERP during customization. To manage push notifications in Acumatica ERP, you use the [Push Notifications](#) (SM302000) form. For more



information about push notifications, see [Configuring Push Notifications](#) in the Integration Development Guide.

To open this form directly from the [Customization Project Editor](#), perform the following actions:

1. In the navigation pane, click **Push Notifications** to open the Push Notifications page.
2. On the page toolbar, click **Manage Notifications**.

This opens the [Push Notifications](#) form, where you can select a particular push notification definitions or create a new one.



: As soon as you add a new push notification definition to the system or change an existing push notification definition on the [Push Notifications](#) form, the push notification definition is saved in the database for the current tenant. You can add the definition to the customization project, as described in [To Add Push Notification Definitions to a Project](#). If you have changed a push notification definition that is already included in a customization project, you have to update the appropriate item in the project, as described in [To Update Push Notification Definitions in a Project](#).

## Business Events

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To configure the system to monitor a business process, on the [Business Events](#) (SM302050) form, you define a *business event* that relates to this business process and that causes the system to perform an action or multiple actions in the system. The business event is a data change or a set of conditions checked for on a schedule. For details on the business events, see [Business Events Related to Data Changes](#) and [Business Events Monitored on a Schedule](#).

You can add the business events to a customization project as *BpEvent* items. A *BpEvent* item contains the data set of a business event. The item includes the following information:

- The general information about the business event (such as its name and type)
- The trigger conditions of the business event
- The schedule of the business event (if the conditions of the business event are checked for on a schedule)
- The generic inquiry parameters (if any parameter values have been specified for the business event)
- The email notification templates (if the business event has email notification templates as subscribers)
- The link to the *GenericInquiryScreen* item related to the business event, which the system adds to the customization project as a separate item
- The links to the *XportScenario* items related to the business event, which the system adds to the customization project as separate items (if the business event has import scenarios as subscribers)

You use the Business Events page of the [Customization Project Editor](#) to manage *BpEvent* items in the customization project. This page displays the list of the business events that have been added to the customization project.

On the page, you can perform a variety of operations, as described in the following topics:

- [To Add Business Events to a Project](#)
- [To Delete Business Events from a Project](#)
- [To Update Business Events in a Project](#)
- [To Navigate to the Business Events Form](#)



## To Add Business Events to a Project

You can add any number of business events to a customization project as *BpEvent* items. A *BpEvent* item contains all the data required to recreate the corresponding business event in any instance of Acumatica ERP.

To add a business event to the project, perform the following actions:

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. In the navigation pane, click **Business Events** to open the Business Events page.
3. On the page toolbar, click **Add New Record (+)**.
4. In the list of business events in the **Add Business Events** dialog box, which has opened, select the unlabeled check box in the row of each business event that you want to include in the project.



: The **Add Business Events** dialog box displays all the business events that are configured in your instance of Acumatica ERP.

5. Click **OK** to add each selected business event to the page table and close the dialog box.
6. Optional: In the Customization Project Editor, click **File > Edit Project Items** on the menu. In the Project Items table of the Item XML Editor, verify that for each selected business event, the system has added to the project the data of the business event from the database (*BpEvent* item), the related generic inquiry (*GenericInquiryScreen* item), and, if the business scenario has any import scenarios as subscribers, the import scenario (*XportScenario* item) for each import scenario subscriber. For details on the Item XML Editor, see [Item XML Editor](#).

## To Delete Business Events from a Project

To remove a *BpEvent* item or multiple *BpEvent* items from a project, perform the following actions:

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. In the navigation pane, click **Business Events** to open the Business Events page.
3. In the page table, click the item to be deleted.
4. On the page toolbar, click **Delete Row (X)**.
5. Repeat the two previous steps for each item to be deleted.
6. On the page toolbar, click **Save** to save your changes to the customization project.



: If you delete a *BpEvent* item from the project, the business event remains in the system unless it is deleted on the [Business Events](#) (SM302050) form.

7. If you want to remove from the customization project the generic inquiry that the removed business event used, perform the instructions in [To Delete a Generic Inquiry from a Project](#).
8. If you want to remove from the customization project any of the import scenario scripts that the removed business event used, for each import scenario script, perform the instructions in [To Delete an Integration Scenario from a Project](#).

## To Update Business Events in a Project

If a business event included in a customization project has been changed (or if multiple business events have been changed) on the [Business Events](#) (SM302050) form, you have to update the appropriate item (or items) in the project. To do this, perform the following actions:

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. In the navigation pane, click **Business Events** to open the Business Events page.
3. On the page toolbar, click **Reload From Database**.

The platform updates all the *BpEvent* items of the project with the data in the database.



: If you have changed the generic inquiry used in the business event or the import scenario of the business event, you need to update each changed item separately on the corresponding page of the Customization Project Editor, as described in [To Update Generic Inquiry Items in a Project](#) and [To Update an Integration Scenario in a Project](#), respectively. If you have changed the notification template of the business event, the system updates the notification template in the customization project automatically when you update the business event.

## To Navigate to the Business Events Form

You might need to add a business event to Acumatica ERP during customization. To manage business events in Acumatica ERP, you use the [Business Events](#) (SM302050) form. For more information about business events, see [Business Process Monitoring](#) in the User Guide.

To open this form directly from the [Customization Project Editor](#), perform the following actions:

1. In the navigation pane, click **Business Events** to open the Business Events page.
2. On the page toolbar, click **Manage Business Events**.

This opens the [Business Events](#) form where you can select a particular business event or create a new one.



: As soon as you add a new business event to the system or change an existing business event on the [Business Events](#) form, the business event is saved in the database for the current tenant. You can add the business event to the customization project, as described in [To Add Business Events to a Project](#). If you have changed a business event that is already included in a customization project, you have to update the appropriate item in the project, as described in [To Update Business Events in a Project](#).

## Mobile Application

An Acumatica mobile client application uses the Mobile API to access the data of the forms that are mapped for mobile apps in the instance of Acumatica ERP. The metadata of the mobile site map is used to configure the user interface of the mobile client application. You can expose any form of Acumatica ERP on your mobile device if the mobile site map includes the metadata for the form. Accessing and using Acumatica ERP mobile app is provided by the Acumatica Mobile Framework.

You can customize the Acumatica ERP mobile app by adding new screens to it or updating existing screens. You perform customization of the mobile app using the Mobile Application page of the Customization Project Editor.

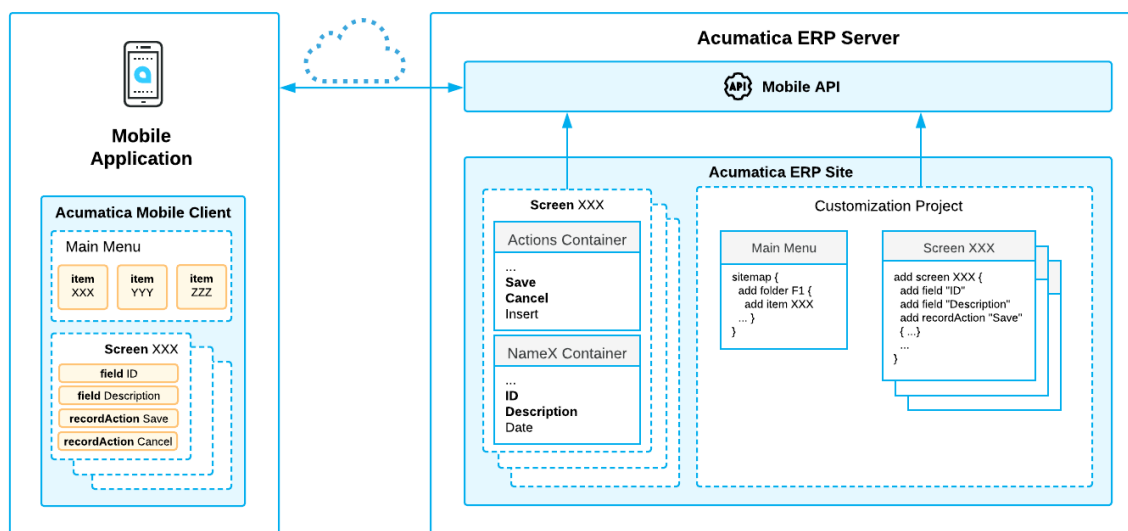
On the page you can perform a variety of operations, as described in the following topics:

- [To Add a Form To Mobile Site Map](#)
- [To Update Main Menu of a Mobile App](#)
- [To Update a Mobile App Screen](#)
- [To Remove a Screen of a Mobile App](#)
- [To Reverse Changes Made to Mobile App](#)

For details on how to customize a mobile app using Acumatica Mobile Framework see in the [Working with Mobile Framework](#) guide.

## To Add a Form To Mobile Site Map

Suppose that you need to add to the mobile app a screen that corresponds to an Acumatica ERP form. The form ID is XXX. The desired mobile screen has to contain the `Date` and `Description` fields and the `Insert` and `Delete` actions of the original XXX form of Acumatica ERP.



**Figure: Use of MSDL to configure a screen in the mobile app**

The diagram shows how the Acumatica Mobile Framework uses the MSDL code to configure the XXX screen in the mobile app. (See [Configuring the Mobile Site Map](#) for details.) You declare the desired screen, containers, fields, actions and other objects by using Mobile Site Map Definition Language (MSDL) in the Customization Project Editor. The objects you want to be displayed on the mobile app screen must be present on the original Acumatica ERP form (See [Getting the WSDL Schema](#)).

After you publish your customization project, the screen you have defined using MSDL appears in the mobile app.

## To Add a Screen to the Mobile Site Map

1. Get the WSDL schema for the original XXX screen of Acumatica ERP, as described in [Getting the WSDL Schema](#).
2. Open the Customization Project Editor.
3. On the page toolbar of the Mobile Application page, click **Customize > Add New Screen**.
4. In the **Add New Screen** dialog box, which opens, enter the form ID of the Acumatica ERP form (and thus of the corresponding screen in the mobile app) that you want to add to the mobile app, and click **OK**.

The `Add: <screen_name>` page opens. The row with the `add` screen and its details appears in the list of modified screens on the Mobile Application page of the Customization Project Editor.

5. Notice that the initial code of the screen includes only one `add` instruction.

```
add screen <screen_ID> {
# you can add commands here
# ObjectAttribute = Value
}
```

(See [add](#) for details about the instruction.)

6. Implement the code of the new screen in the **Commands** area of the Add page. For details, see [Screens](#).

While implementing the code, use the WSDL schema to understand which actions and fields are available for the form you are adding. For details, see [Getting the WSDL Schema](#).

7. Save your changes.

Your commands are applied to the site map. If any errors have occurred, you can see them in the **Errors** area of the page. If your changes have been applied successfully, you can see the updated site map of the main menu in the **Result Preview** area of the form.

8. On the Update: MENU page, add a shortcut for the new screen in the main menu, as illustrated in the following code.

```
add item <screen_ID> {
  visible = True
  displayName = "screen_title" }
```

9. Save your changes, and publish the project.

## To Update Main Menu of a Mobile App

You can update the main menu of the customized Acumatica mobile app by using the Customization Project Editor.

### To Update the Main Menu of a Mobile App

1. Open the Customization Project Editor.
2. On the page toolbar of the Mobile Application page, click **Customize > Update Main Menu**.  
The Update: MENU page opens. The *Update MENU* appears in the list of modified screens on the Mobile Application page of the Customization Project Editor.
3. In the **Result Preview** area of the Update: MENU page, explore the original code of the main menu.
4. In the **Commands** area of the Update: MENU page, implement your code using Mobile Site Map Definition Language (MSDL). For details, see [Main Menu](#).
5. Save your changes.  
Your commands are applied to the menu. If any errors have occurred, you can see them in the **Errors** area of the form. If your changes have been applied successfully, you can see the updated site map of the main menu in the **Result Preview** area of the form.
6. Publish your customization project.

## To Update a Mobile App Screen

You can update an existing screen of a customized mobile app by using the Customization Project Editor.

### To Update a Screen of a Mobile App

1. Open the Customization Project Editor.
2. On the page toolbar of the Mobile Application page, click **Customize > Update Existing Screen**.
3. In the **Update Existing Screen** dialog box, which appears, specify the ID of the screen you want to update, and click OK.

The Update: <screen\_name> page opens. The new *update* screen with its details appears in the list of modified screens on the **Mobile Application** page of the Customization Project Editor.

4. Explore the original code of the screen in the **Result Preview** area of the Update page.
5. Implement your code using Mobile Site Map Definition Language (MSDL) in the **Commands** area of the Update page. For details, see [Screens](#).
6. Save your changes.

Your commands are applied to the site map. If any errors have occurred, you can see them in the **Errors** area of the page. If your changes have been applied successfully, you can see the updated site map of the main menu in the **Result Preview** area of the form.

7. Publish the customization project.

## To Remove a Screen of a Mobile App

You can remove a screen of a customized mobile app by using the Customization Project Editor.

### To Remove a Screen of a Mobile App

1. Open the Customization Project Editor.
2. On the page toolbar of the Mobile Application page, click **Customize > Remove Existing Screen**.
3. In the **Remove Existing Screen** dialog box, which appears, specify the ID of the screen you want to remove, and click **OK**.

The selected screen is removed. The *Remove <screen\_name>* row appears in the list of modified screens on the Mobile Application page of the Customization Project Editor.

## To Reverse Changes Made to Mobile App

When you are customizing the mobile site map in the Customization Project Editor, you might need to go back to the out-of-the-box site map and base functionality. You can return to the original site map to one tenant or to all tenants without removing the other changes you have made in the customization project.

### To Reverse Changes Made to the Mobile Site Map

1. Open the Customization Project Editor.
2. Click **Mobile Application** in the navigation pane to open the Mobile Application page.
3. If you want to reverse the changes to the current tenant only, on the page toolbar, click **Clear Current Tenant**. If you want to reverse the changes to all tenants, on the page toolbar, click **Clear All Tenants**.

The mobile app customization is unpublished from the selected tenants.

To return to your changes, publish your customization project, as described in [To Publish the Current Project](#).

## User-Defined Fields

---

The Customization Project Editor includes the User-Defined Fields page, which is shown in the screenshot below. On this page, you can do the following:

- Update fields properties that have been updated by users in an instance of Acumatica ERP by clicking the **Reload From Database** action.

- Add a new user-defined field based on existing attributes. For details on defining attributes, see [Attributes and User-Defined Fields](#).
- View detailed information about a user-defined field.
- Modify the list of screens on which the field is displayed.
- Remove an existing user-defined field.

You can add a user-defined field either on the applicable form of Acumatica ERP or on the User-Defined Fields page of the Customization Project Editor. Any user-defined fields you add in the Customization Project Editor are added to the current customization project with all other items; when the project has been completed, it can be exported and imported.

The screenshot shows the 'User-Defined Fields' page. On the left is a navigation pane with a list of categories: SCREENS, Data Access, Code, Files, Generic Inquiries, Reports, Dashboards, Site Map, Database Scripts, System Locales, Import/Export Scenarios, Shared Filters, Access Rights, Wikis, Web Service Endpoints, Analytical Reports, Push Notifications, Business Events, Mobile Application, and 'User-Defined Fields (2)' which is currently selected. The main content area has a toolbar with icons for refresh, save, undo, delete, add, and edit, along with buttons for 'RELOAD FROM DATABASE' and 'MANAGE'. Below the toolbar is a table with the following data:

Attribute ID	Description	Screen ID	Last Modified By	Last Modified On
<a href="#">BURDEN</a>	Project Burden Perce...	AP301000	admin admin	1/9/2019
<a href="#">COLOR</a>	Color	SO303000,SO302000,SO3010...	admin admin	1/9/2019

**Figure: The User-Defined Fields page**

## To Add a User-Defined Field to a Customization Project

To add a user-defined field to customization project, you can use a field previously defined in Acumatica ERP, or create a field in Customization Project Editor. After that you can include the field in the current customization project.

### To Add a New User-Defined Field

To add a new user-defined field, proceed as follows:

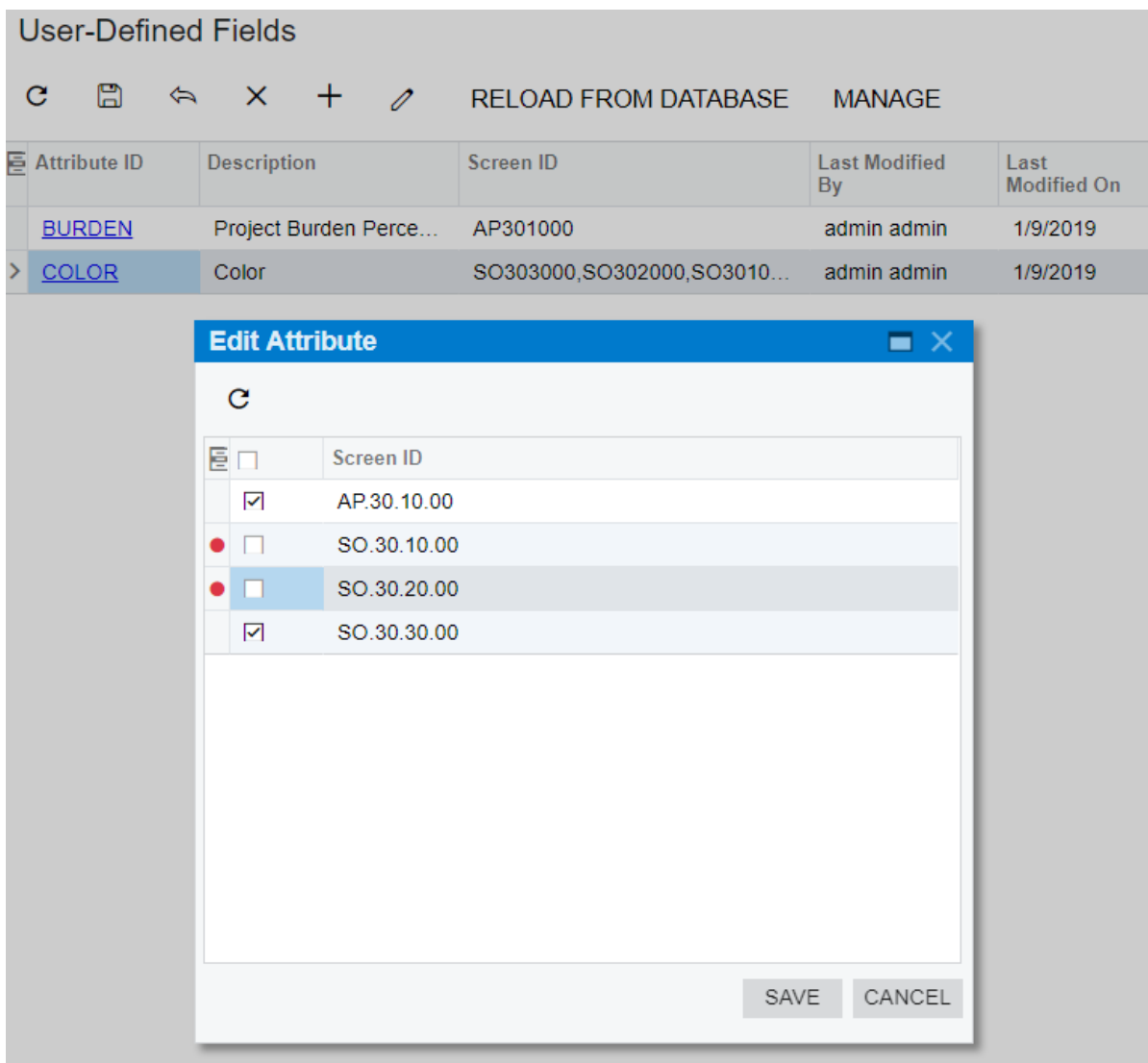
1. On the navigation pane of the Customization Project Editor, click **User-Defined Fields** to open the User-Defined Fields page.
2. On the page toolbar, click **Add New Record**.
3. In the **Add User-Defined Fields** dialog box, which opens, select an attribute for the user-defined field you are adding, and click **Save**.

The user-defined field appears in the list on the User-Defined Fields page, and the dialog box is closed. Now you need to specify the IDs of the screens on which the field will appear. By default, the added field appears with all screens where it is used in the instance.

4. In the row with the user-defined field, click the link in the **Attribute ID** column.
5. In the **Edit Attribute** dialog box (see the following screenshot), which opens, select the forms for which you want to save the fields in the customization project.



: In this dialog box, you can see only the IDs of the screens for which the user-defined field was added. To add a user-defined field to a screen, on the title bar of the screen, select **Customization** > **Manage User-Defined Fields** and add the field.

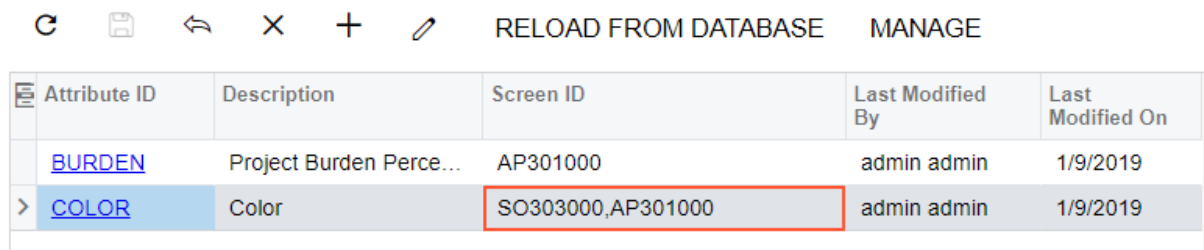


**Figure: The Edit Attribute dialog box**

6. Click **Save** to save your changes, close the dialog box, and return to the User-Defined Fields page.

The selected form IDs are listed in the **Screen ID** column of the user-defined field you edited, as shown in the following screenshot.

## User-Defined Fields



Attribute ID	Description	Screen ID	Last Modified By	Last Modified On
<a href="#">BURDEN</a>	Project Burden Perce...	AP301000	admin admin	1/9/2019
> <a href="#">COLOR</a>	Color	SO303000,AP301000	admin admin	1/9/2019

**Figure: The list of user-defined fields after being edited**

- On the page toolbar, click **Save**.




# Customizing Elements of the User Interface

You can customize the user interface by creating a new form or by changing the content and layout of a form that already exists in Acumatica ERP.

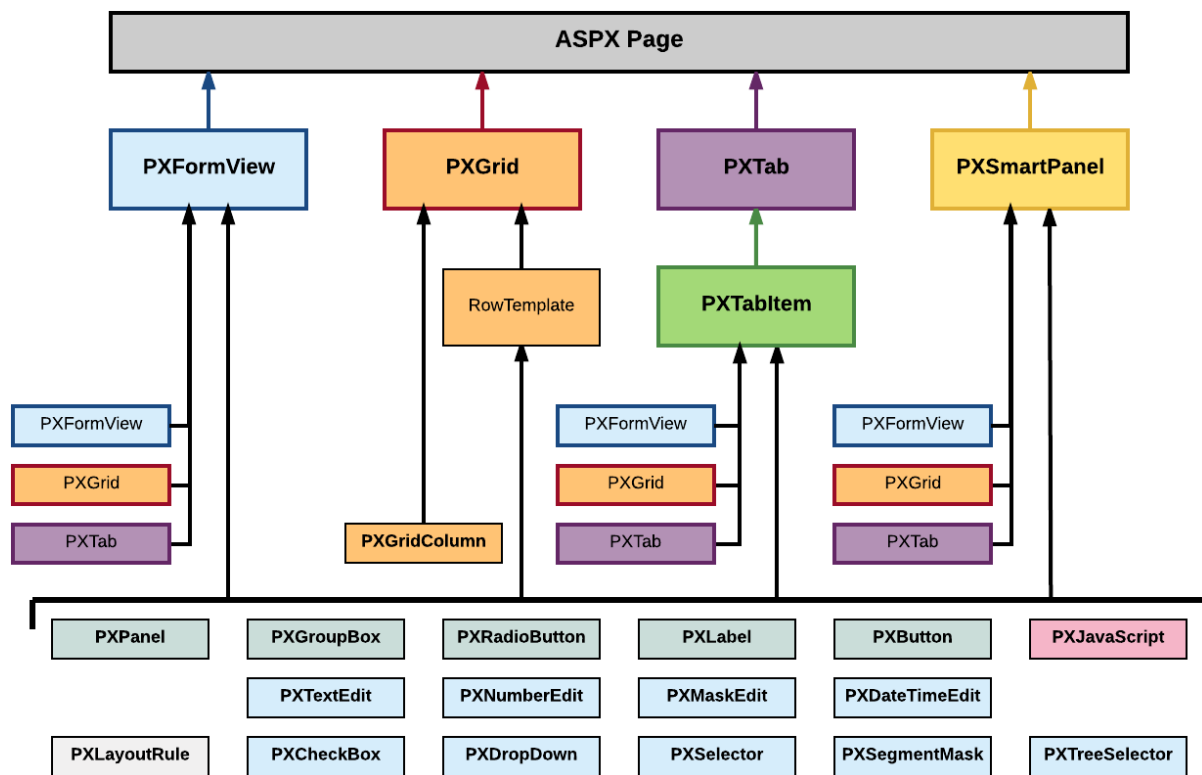
This part is intended to describe how to use the visual [Screen Editor](#) to develop the ASPX code of a custom form and modify the ASPX code of an existing form.

The following table lists most of the types of ASPX objects supported in the Acumatica Customization Platform.

Object	Description
PXDataSource	A data source control that connects to a graph instance on the Acumatica ERP server, retrieves data from the graph instance, and sends data to the graph instance; it also provides the data processing for the control containers that are defined in the ASPX page. In Acumatica ERP, a page must contain a single <code>PXDataSource</code> control.
PXFormView	A data-bound UI container control that renders a single record from its associated data source.
PXGrid	A data-bound UI container control that renders a table with multiple records from its associated data source. The object can be displayed in form view mode for a single record and provides paging buttons that can be used to navigate between records. To define form view mode, the <code>PXGrid</code> control must include the <code>RowTemplate</code> element, which can contain controls for the record fields and layout rules for these controls.
PXGridColumn	In a <code>PXGrid</code> container, an object that defines the data field and properties of a column in the grid.
RowTemplate	In a <code>PXGrid</code> container, an object that defines a record field and layout for each control to be rendered in form view mode for the grid.
PXTab	A data-bound UI container control that renders tabs defined by child <code>PXTabItem</code> containers.
PXTabItem	In a <code>PXTab</code> container, a container control that renders a single record from the data source specified for the parent <code>PXTab</code> container.
PXSmartPanel	An UI container control that renders a dialog box.
PXLayoutRule	In a container with controls for a single data record, a component that defines a layout rule used to organize the controls within a row or column.
PXPanel	In a container with controls for a single data record, a container with a caption used to group controls. In a dialog box, it is often used as a container to display a horizontal row of buttons with right alignment.
PXGroupBox	In a container with controls for a single data record, a container with a caption used to group controls. It is designed to be used as a radio button container to render a drop-down field as a set of radio buttons. It contains scripts with logic to support a nested radio button for each value of a drop-down field.
PXRadioButton	In a <code>PXGroupBox</code> container, a radio button that is used for a single constant value of a drop-down field.  : In Acumatica ERP, a radio button can work properly only in a <code>PXGroupBox</code> container that is used for a drop-down data field.
PXLabel	In a container with controls for a single data record, an element to display text.
PXButton	In a container with controls for a single data record, an element to display a button control. In a dialog box, it is usually included in a <code>PXPanel</code> container.

Object	Description
PXJavaScript	In a container with controls for a single data record, a control to keep JavaScript code.
PXTextEdit	In a container with controls for a single data record, a text box to display and edit the value of a <code>string</code> field.
PXNumberEdit	In a container with controls for a single data record, a box to display and edit the value of a <code>decimal</code> or <code>int</code> field.
PXMaskEdit	In a container with controls for a single data record, a text box to display and edit the value of a <code>string</code> field that has the format specified in the data access class.
PXDateTimeEdit	In a container with controls for a single data record, a box to display and select the value of a <code>datetime</code> field.
PXCheckBox	In a container with controls for a single data record, a check box to display and select the value of a <code>bool</code> field.
PXDropDown	In a container with controls for a single data record, a combo box to display, edit, and select the value of a field with a list attribute, such as <code>PXStringList</code> , <code>PXIntList</code> , or <code>PXDecimalList</code> .
PXSelector	In a container with controls for a single data record, a lookup control to display, search, and select the value of a field with the <code>PXSelector</code> attribute.
PXSegmentMask	In a container with controls for a single data record, a lookup control with a specified segmented key value that identifies a data record and consists of one segment or multiple segments, with a list of possible values defined for each segment.
PXTreeSelector	In a container with controls for a single data record, a lookup control to select a value for a field with a <code>PXTreeSelector</code> attribute from a tree control.

When you use the Screen Editor to add a UI element to another UI element on a form, you should understand the rules that are used for nesting objects in ASPX code for Acumatica ERP forms. The following diagram shows which ASPX objects can be included in other ASPX objects.



**Figure: Nesting rules for elements of an ASPX page**

In the diagram, if an arrow goes from object A to object B, it means that multiple instances of object A can be included in a single object B. For example, `PXTab` can contain multiple `PXTabItem` objects.



- The `PXGrid` object can contain a single `RowTemplate` object.
- The `PXSmartPanel` object is used to describe the content of a dialog box.
- A control for a data field (also referred as *box*)—such as `PXTextEdit`, `PXSelector`, and `PXCheckBox`—can be included in ASPX objects of the following types:
  - `PXFormView`
  - `RowTemplate`
  - `PXTabItem`
  - `PXSmartPanel`

### In This Part

- [Custom Form](#)
- [Existing Form](#)
- [Form Container \(`PXFormView`\)](#)
- [Grid Container \(`PXGrid`\)](#)
- [Tab Container \(`PXTab`\)](#)
- [Tab Item Container \(`PXTabItem`\)](#)
- [Dialog Box \(`PXSmartPanel`\)](#)
- [Box \(Control for a Data Field\)](#)
- [Layout Rule \(`PXLayoutRule`\)](#)

- [Panel \(PXPanel\)](#)
- [Group Box \(PXGroupBox\)](#)
- [Label \(PXLabel\)](#)
- [Radio Button \(PXRadioButton\)](#)
- [Button \(PXButton\)](#)
- [Java Script \(PXJavaScript\)](#)
- [Toolbars, Action Buttons, and Menus](#)
- [Other Control Types](#)

## Custom Form

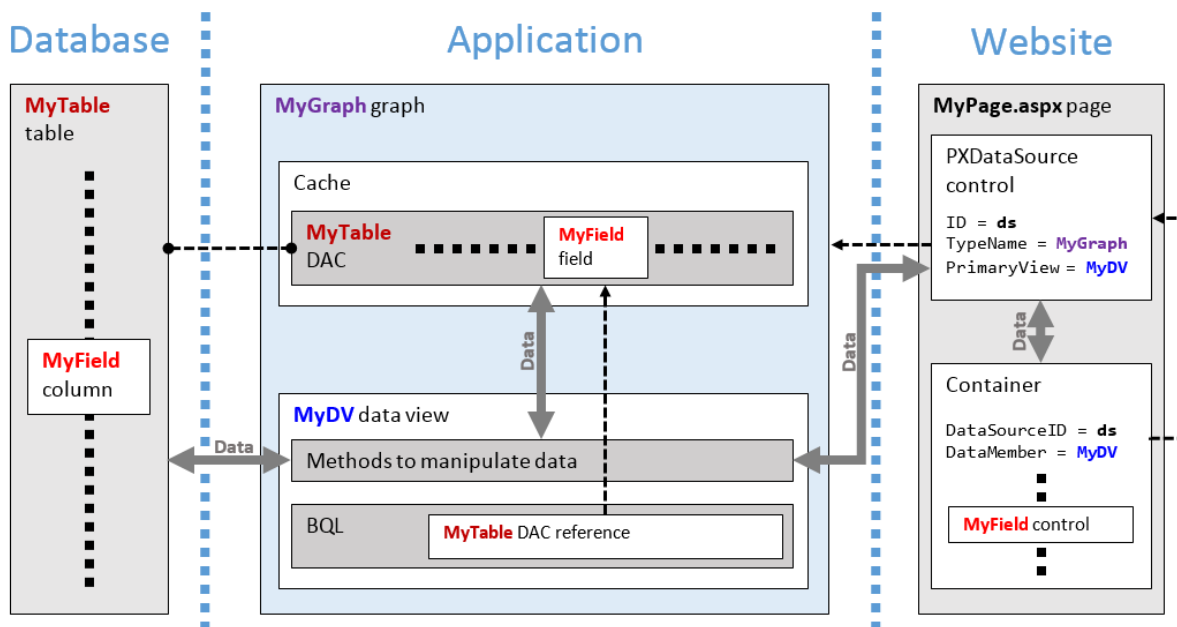
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By using the Acumatica Customization Platform, you can develop a custom form from scratch and add it to a customization project. To create a new form, you have to create the following types of code:

- ASPX page that contains a description of the UI elements of the form
- CS code that provides the business logic for the form

For each form that works with data from the database, the instance of Acumatica ERP must contain at least the following objects (see the diagram below):

- An ASPX page: The page must contain at least the data source control and a container with controls for data fields.
- A business logic controller (BLC, also referred to as *graph*): The graph must be specified in the `TypeName` property of the data source control of the page. The graph must contain at least one data view, which is specified in the `PrimaryView` property of the data source control and in the `DataMember` property of the container. The graph instance is created on each round trip and initializes the creation of the data view instance based on a BQL statement. The data view provides data manipulation and data flows between the data source control of the ASPX page, the cache object of the graph, and the corresponding table of the database. The BQL statement contains a reference to at least one data access class that is required to map the database table to data records in the cache object.
- A data access class (DAC): On each round trip, the DAC instance is created in the cache object when the data view processes any operation with the corresponding data.
- A table in the database: The table is mapped to the data access class that defines the data record type in the cache object of the graph instance.



**Figure: Objects required for a form that works with data from a database table**

For a custom form to be enabled in an instance of Acumatica ERP, the site map of the instance must contain information about the form.

You use the [Customization Project Editor](#) to perform operations with custom forms, as described in the following topics:

- [To Develop a Custom Form](#)
- [To Create a Custom Form Template](#)
- [To Delete a Custom Form from a Project](#)

## To Develop a Custom Form

To create and develop a custom form within a customization project, you can use the following approach:

1. Plan the functionality, content, and user interface of the new form.
2. If the custom form requires data from a new table, create the table in the database by using a database administration tool, such as SQL Server Management Studio. (See [To Add a Custom Table to a Project](#) for details.)
3. Create a workable form template by using the New Screen wizard, as described in [To Create a Custom Form Template](#).

After you have created a custom form template and published the customization project, you can develop the form in the same way as you customize an existing form of Acumatica ERP. (See [Existing Form](#) for details.) Because the code templates are added to the `App_RuntimeCode` folder of the Acumatica ERP website, you can develop the code in Microsoft Visual Studio.

4. **C#:** Create data access classes that contain the data field declarations required for the form controls. (See [To Create a Custom Data Access Class](#) for details.)
5. **C#:** In the graph template, define BQL statements in data views to manage data fields declared in data access classes. (See [To Add a New Member](#) for details.)
6. **ASPX:** If needed, add nested containers to the main containers of the form template. (See [To Add a Nested Container](#) for details.)
7. **C#:** For each nested container, in the graph template, define the appropriate data views.
8. **ASPX:** For each added container, specify the name of an appropriate data view in the `DataMember` property. (See [To Set a Container Property](#) for details.)

9. **ASPX:** If required, for each added container, specify other properties. (See [To Set a Container Property](#) for details.)
10. **ASPX:** Add controls for data fields to each container. (See [To Add a Box for a Data Field](#) for details.)
11. **ASPX:** Specify properties for controls. (See [To Set a Box Property](#) for details.)
12. **C#:** Develop business logic for the form in the graph (See [Customizing Business Logic](#) for details.)
13. **ASPX:** If required, add dialog boxes, as described in [To Add a Dialog Box](#).

We recommend that you use the [Screen Editor](#) to create the content of an ASPX page and Visual Studio to develop the business logic for a page. (See [Integrating the Project Editor with Microsoft Visual Studio](#) for details.)

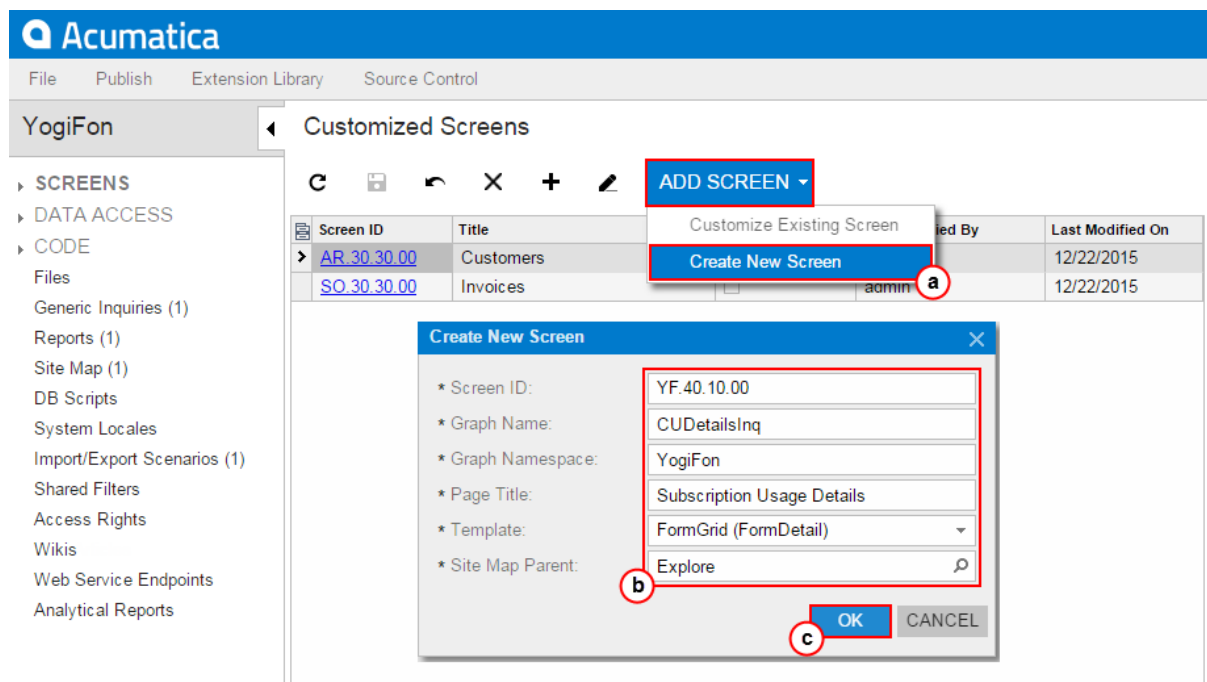
## To Create a Custom Form Template

To create a workable template for a custom form by using the New Screen wizard and include the template in a customization project, perform the following actions:

1. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
2. Select the **Screens** node in the navigation pane of the editor to open the Customized Screens page.
3. On the page toolbar, click **Add Screen > Create New Screen**, as item a in the screenshot below shows.
4. In the **Create New Screen** dialog box, which opens, specify values for input controls as follows (item b in the screenshot):
  - a. **Screen ID:** Enter an ID of a custom form in the XX.\*\*.\*\* format, which consists of the following parts:
    - a. Two-letter code of the module in Acumatica ERP
 
 : You can use a single unique two-letter code for all custom forms in a solution. Please check the **Pages** folder of the website in the production environment to ensure that the code you want to use is not already used in the instance of Acumatica ERP.
    - b. Two-digit code indicating the form type:
      - a. 10: Setup form
      - b. 20: Maintenance form
      - c. 30: Data entry form
      - d. 40: Inquiry form
      - e. 50: Processing form
      - f. 60: Report form
    - c. Two-digit code indicating the form sequential number
    - d. Two-digit code indicating the subform sequential number
  - b. **Graph Name:** Enter a unique name for the new graph.
  - c. **Graph Namespace:** By default, the New Screen wizard specifies the customization project name as the namespace ID. If you want to change the default ID, enter the ID of an existing or a new namespace for the new graph.
  - d. **Page Title:** Enter the title to be used as the form title in Acumatica ERP.
  - e. **Template:** Select one of the following ASPX page templates for the custom form.

Template	Description
<i>Form</i> (FormView)	A record-editing page with one <code>PXFormView</code> container
<i>Grid</i> (GridView)	A record-editing page with one <code>PXGrid</code> container
<i>Tab</i> (TabView)	A record-editing page with one <code>PXTab</code> container
<i>FormTab</i>	A record-editing page with <code>PXFormView</code> and <code>PXTab</code> containers
<i>FormGrid</i> (FormDetail)	A master-detail editing page with <code>PXFormView</code> and <code>PXGrid</code> containers
<i>TabGrid</i> (TabDetail)	A master-detail page with <code>PXTab</code> and <code>PXGrid</code> containers

- f. **Site Map Parent:** Select a parent site map node to place the form in this location in the site map of Acumatica ERP.
5. Click **OK** (item c) to create the new form.



**Figure: Using the New Screen wizard to create the new form**

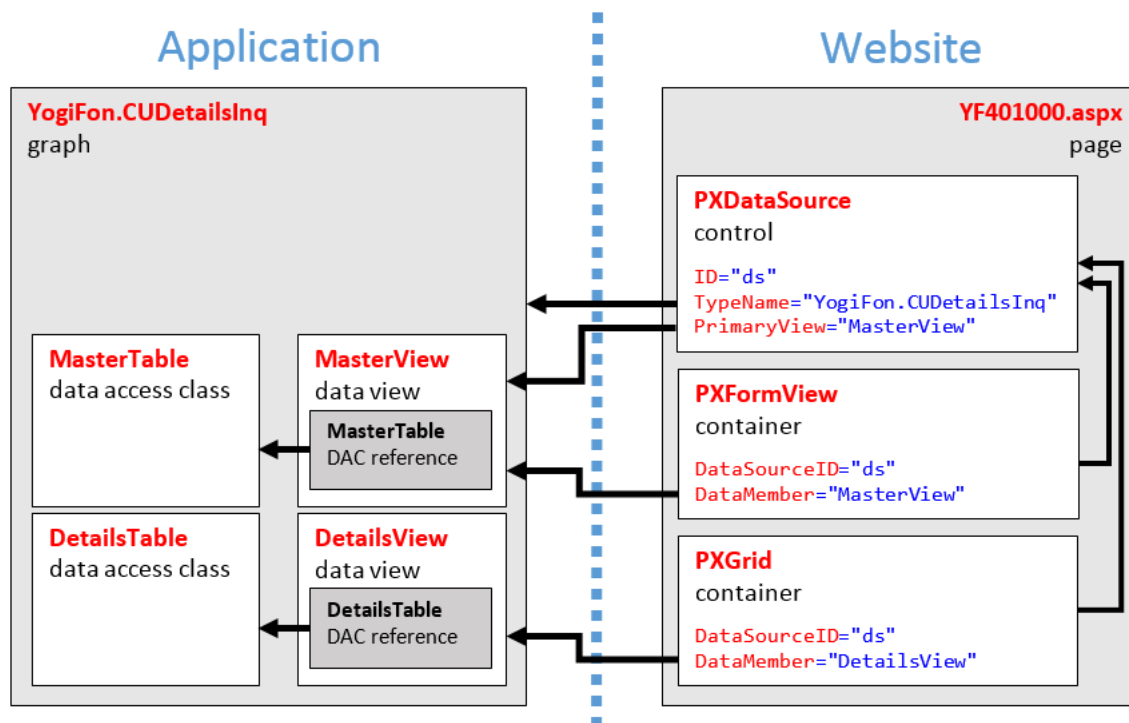
The wizard creates the form template and adds the following items to the customization project.

Item	Description
<i>File</i>	Contains the <code>Pages\XX\XX*****.aspx</code> file with the ASPX code template that has been selected for the new form. The name of the file corresponds to the value that is entered in the <b>Screen ID</b> box. The file is located in the <code>Pages\XX</code> folder of the Acumatica ERP website, where <code>XX</code> is the two-letter code of the screen ID.
<i>File</i>	Contains the <code>Pages\XX\XX*****.aspx.cs</code> file with the C# code for the ASPX page.
<i>Code</i>	Contains the code template of the business logic controller (BLC, also referred to as <i>graph</i> ) for the new form. This item is saved in the database. When you publish the project, the

Item	Description
	platform creates a copy of the code in the file with the same name in the <code>App_RuntimeCode</code> folder of the Acumatica ERP website. You can develop the code in Microsoft Visual Studio.
<i>Page</i>	Contains the link to the new page content, which you can later develop by using the <a href="#">Screen Editor</a> .
<i>SiteMapNode</i>	Contains the site map object of the new form.

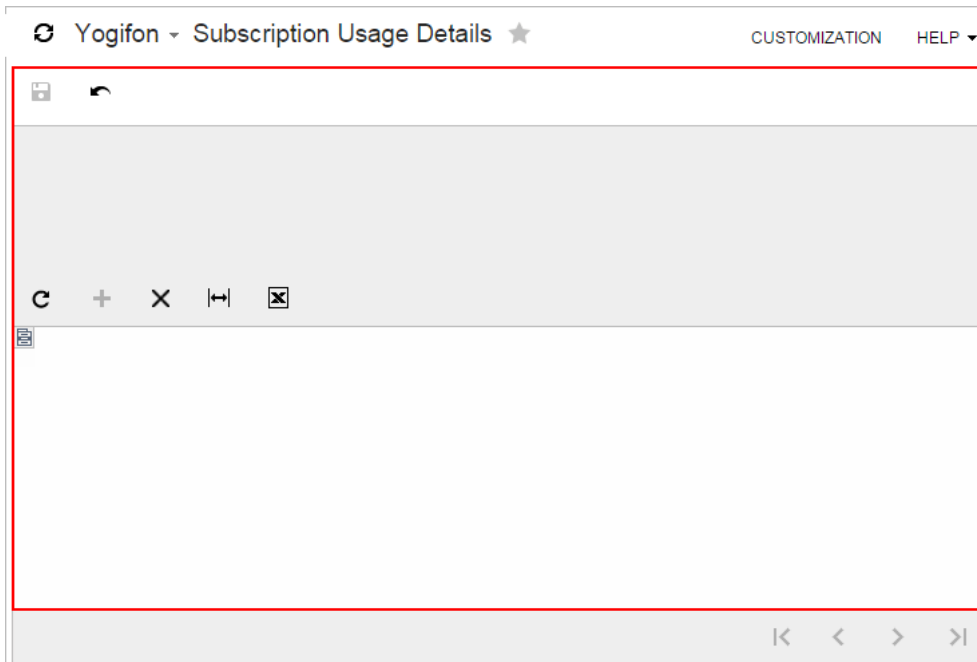
For example, if you enter in the **Create New Screen** dialog box the values that are displayed in the screenshot above, the wizard creates code templates for both the *CUDetailsInq* business logic controller and the *YF401000* page, which contain all the components required for the form template to work properly (see the following diagram).

**Figure: Analyzing the content of the new form template**



You can publish the customization project to ensure that it is valid and the custom form can be opened in the browser. At the moment, the form does not contain a control for a field, as the following screenshot shows.





**Figure: Viewing the new form**

## To Delete a Custom Form from a Project

To remove a custom form from a customization project, you have to delete all the items that have been added to the project for the form.

To do this, perform the following actions:

- Delete from the customization project the *Page* item that was added by the New Screen wizard. (See [To Delete a Page Item from a Project](#) for details.)
- Delete from the project the *Code* item that was added by the New Screen wizard. (See [To Delete a Code Item From a Project](#).)
- Delete from the project the `<FormID>.aspx` and `<FormID>.aspx.cs` *File* items that were added by the New Screen wizard. (For more information, see [To Delete a Custom File From a Project](#).)
- Delete from the project the *SiteMapNode* item that was added by the New Screen wizard. (See [To Delete a Site Map Node from a Project](#) for details.)
- If you added other items for the custom form, such as items for the mobile site map or custom files, delete these items.

To delete multiple items from the customization project successively on a single page, you can use the Edit Project Items page of the Customization Project Editor. (See [To Delete Items from the Project on the Edit Project Items Page](#) for details.)

The system applies the changes to the file system as soon as you publish the customization project.

## Existing Form

You can customize the user interface of an existing form of Acumatica ERP by using the [Screen Editor](#). The editor is a visual tool that you can use to perform the following changes in the ASPX code for a form:

- Add or delete a container.
- Add or delete a button or radio button. (See [Button \(PXButton\)](#) and [Radio Button \(PXRadioButton\)](#) for details.)
- Add or delete a layout rule. (See [Layout Rule \(PXLayoutRule\)](#) for details.)

- Add or delete a Java script. (See [Java Script \(PXJavaScript\)](#) for details.)
- Create or delete a control for a data field. (See [Box \(Control for a Data Field\)](#) for details.)
- Change the properties of an element in the ASPX code. (See [To Set a Container Property](#), [To Set a Box Property](#) and [To Set a Layout Rule Property](#) for details.)

In Acumatica ERP, an ASPX page must contain a single `PXDataSource` control. You can add the following types of containers immediately to the level of an ASPX page, where the `PXDataSource` control is defined:

- [Form Container \(PXFormView\)](#)
- [Grid Container \(PXGrid\)](#)
- [Tab Container \(PXTab\)](#)
- [Dialog Box \(PXSmartPanel\)](#)

The order of containers in the ASPX page defines the order of appropriate areas with controls on the form.

Detailed instructions on the customization of an existing form are provided in the following topics:

- [To Start a Customization of a Form](#)
- [To Delete a Customization of a Form](#)
- [To Add a Form Container](#)
- [To Add a Tab Container](#)
- [To Add a Grid Container](#)
- [To Add a Dialog Box](#)
- [To Delete a Container](#)

The changeset of a form is stored in the database as a *Page* item of a customization project. During the publication of the project, the Acumatica Customization Platform applies the changeset to the form to create a customized version of the `.aspx` file with the same name in the `pages_xx` subfolder of the `CstPublished` folder of the website.

For example, if you customize the [Customers](#) (AR303000) form and publish the project, the platform creates the `ar303000.aspx` and `ar303000.aspx.cs` files in the `\CstPublished\pages_ar` folder. If you delete these files, Acumatica ERP uses the original files from the `\Pages\AR` folder to display this form. However if you again publish the customization project, the platform recreates these files, and Acumatica ERP uses the customized version of the form.

We recommend that you use the [Screen Editor](#) to customize the content of an ASPX page, the [Data Class Editor](#) to modify data access classes, and MS Visual Studio to extend the business logic for a page. (See [Integrating the Project Editor with Microsoft Visual Studio](#) for details.)

## To Start a Customization of a Form

To start the customization of a form, you have to open the form in the [Screen Editor](#). To do this, you commonly perform the following operations:

1. Open the form in the browser.
2. On the form title bar, click **Customization > Inspect Element** to launch the [Element Inspector](#).
3. On the form, click the UI element (or area) to be customized; this opens the [Element Properties Dialog Box](#) for the element (or area).
4. In the dialog box, click **Customize**.
5. If there is no currently selected customization project and the inspector opens the [Select Customization Project Dialog Box](#), select an existing customization project or create a new one. (See [To Select an Existing Project](#) and [To Create a New Project](#) for details.)

If the customization project does not contain a changeset for the form, the [Customization Project Editor](#) adds a *Page* item for the form to the project, to keep the changeset to the ASPX code of the form in the database. The form is opened in the [Screen Editor](#), and you can start customization of the form.

When you click **Save** on the editor toolbar, the editor updates the *Page* item in the database.

## To Delete a Customization of a Form

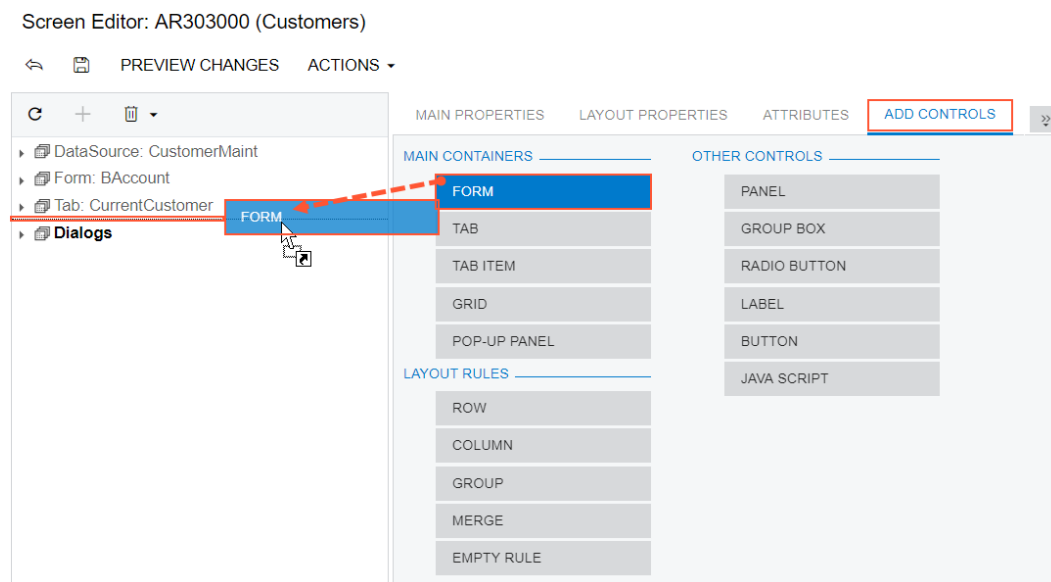
If a customization project contains changes to multiple objects of Acumatica ERP, and you need to remove customization for only a single form, perform the following operations:

1. Remove from the project the *Page* item for the form. (See [To Delete a Page Item from a Project](#) for details.)
2. Publish the project, as described in [To Publish the Current Project](#).

## To Add a Form Container

You can add a new `PXFormView` container to a form of Acumatica ERP. To do this, perform the following actions:

1. Open the form in the [Screen Editor](#), as described in [To Add a Page Item for an Existing Form](#).
2. In the editor, click the **Add Controls** tab item.
3. From the **Main Containers** group, drag the **Form** container to the required place in the Control Tree, as shown in the following screenshot.



**Figure: Adding a form container to a form**



: The area of a form container is visible on a customized form only if it contains at least one visible control.

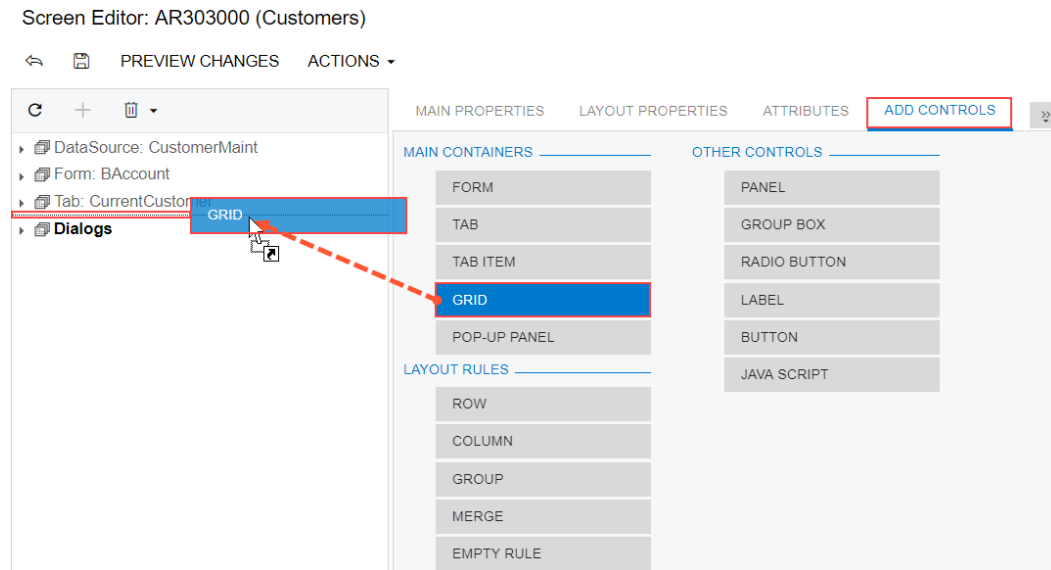
4. In the Control Tree, select the form container that has been added, and specify the item properties, as described in [To Set a Container Property](#).
5. Click **Save** on the toolbar of the Screen Editor to save your changes to the customization project.

For more information about `PXFormView`, see [Form Container \(PXFormView\)](#).

## To Add a Grid Container

You can add a new `PXGrid` container to an existing form of Acumatica ERP. To do this, perform the following actions:

1. Open the form in the [Screen Editor](#), as described in [To Add a Page Item for an Existing Form](#).
2. In the editor, click the **Add Controls** tab item.
3. From the **Main Containers** group, drag the **Grid** container to the required place in the Control Tree, as shown in the following screenshot.



**Figure: Adding a grid container to the tab**



: A grid is visible on a customized form only if it contains at least one column for a field.

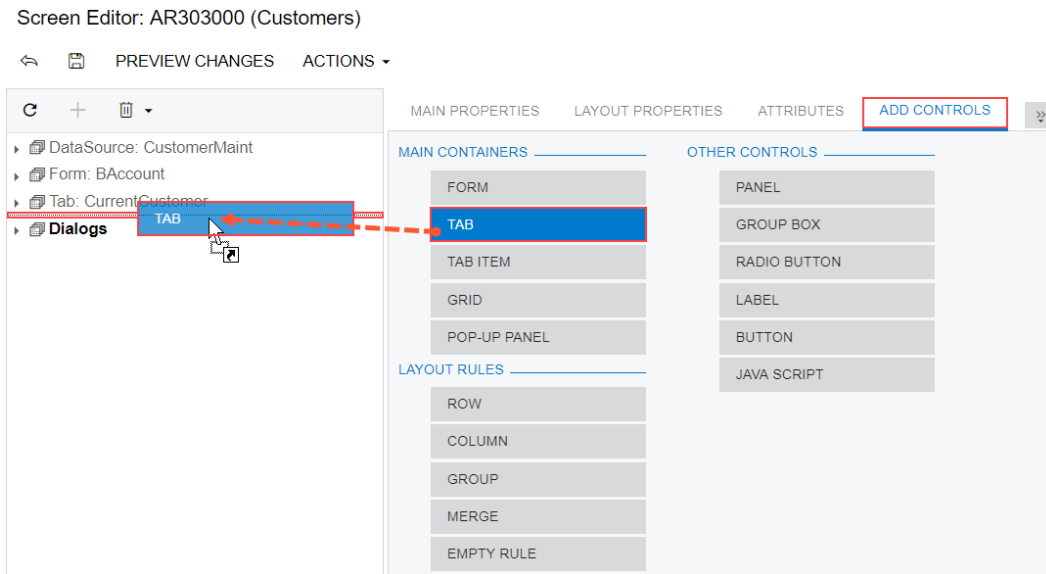
4. In the Control Tree, select the grid that has been added, and specify the item properties, as described in [To Set a Container Property](#).
5. Click **Save** on the toolbar of the Screen Editor to save your changes to the customization project.

For more information about `PXTab`, see [Tab Container \(PXTab\)](#).

## To Add a Tab Container

You can add a new `PXTab` container to an existing form of Acumatica ERP. To do this, perform the following actions:

1. Open the form in the [Screen Editor](#), as described in [To Add a Page Item for an Existing Form](#).
2. In the editor, click the **Add Controls** tab item.
3. From the **Main Containers** group, drag the **Tab** container to the required place in the Control Tree, as shown in the following screenshot.



**Figure: Adding a tab container to the tab**

The `PXTab` container cannot exist without nested `PXTabItem` containers. Therefore, when you add a `PXTab` container, the Screen Editor creates a nested `PXTabItem` container.



: A tab container is visible on a customized form only if there is at least one control for a field in a nested `PXTabItem` container.

4. In the Control Tree, select the tab that has been added, and specify the item properties, as described in [To Set a Container Property](#).
5. Click **Save** on the toolbar of the Screen Editor to save your changes to the customization project.

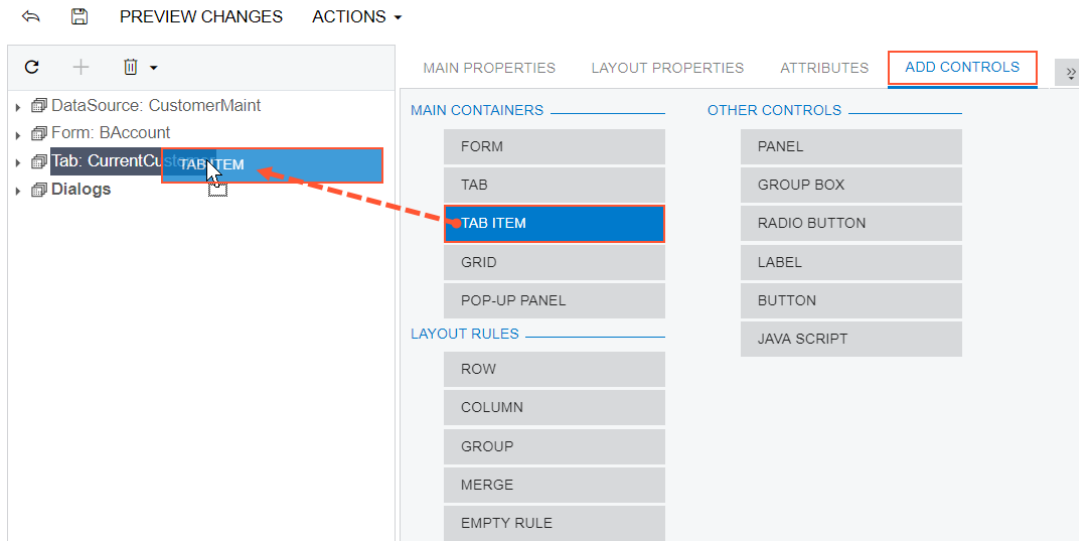
For more information about `PXTab`, see [Tab Container \(PXTab\)](#).

### To Add a New Tab Item to a Tab

You can add a new `PXTabItem` container to a tab on an existing form of Acumatica ERP. To do this, perform the following actions:

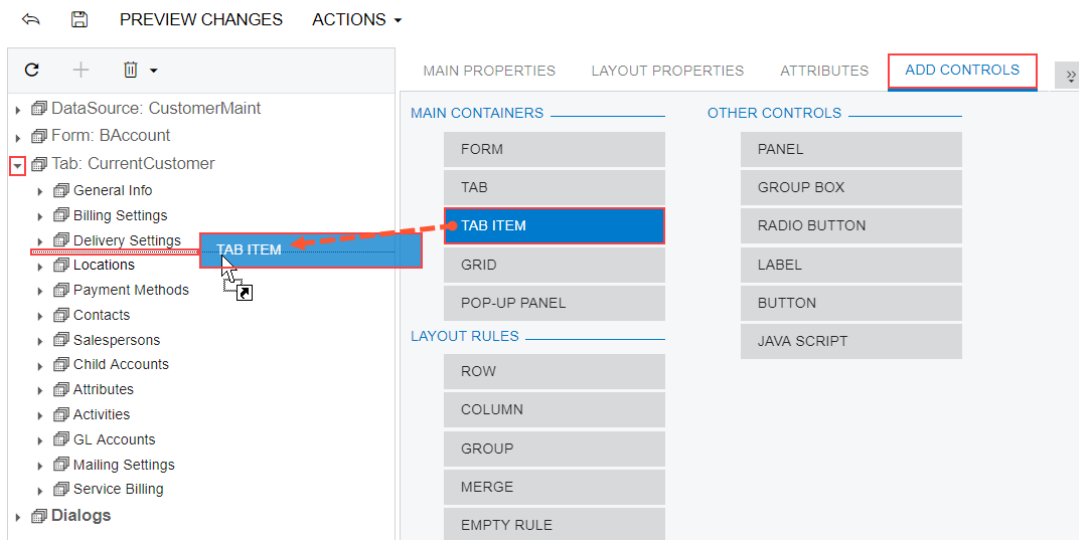
1. Open the form in the [Screen Editor](#), as described in [To Add a Page Item for an Existing Form](#).
2. In the editor, click the **Add Controls** tab item.
3. From the **Main Containers** group of the tab item, drag the **Tab Item** container above the customized tab, as shown in the following screenshot.

## Screen Editor: AR303000 (Customers)

**Figure: Adding a tab item to the tab**

If the tab contains multiple tab items and you need to add a tab item to a certain position in the tab, you should expand the tab node in the Control Tree to see the existing tab items and drag the **Tab Item** container to the required position, as the following screenshot shows.

## Screen Editor: AR303000 (Customers)

**Figure: Adding a tab item to a certain position in the tab**

: A tab item is visible if it contains at least one control for a field.

4. In the Control Tree, select the tab item that has been added, and specify the item properties, as described in [To Set a Container Property](#).
5. Click **Save** on the toolbar of the Screen Editor to save your changes to the customization project.

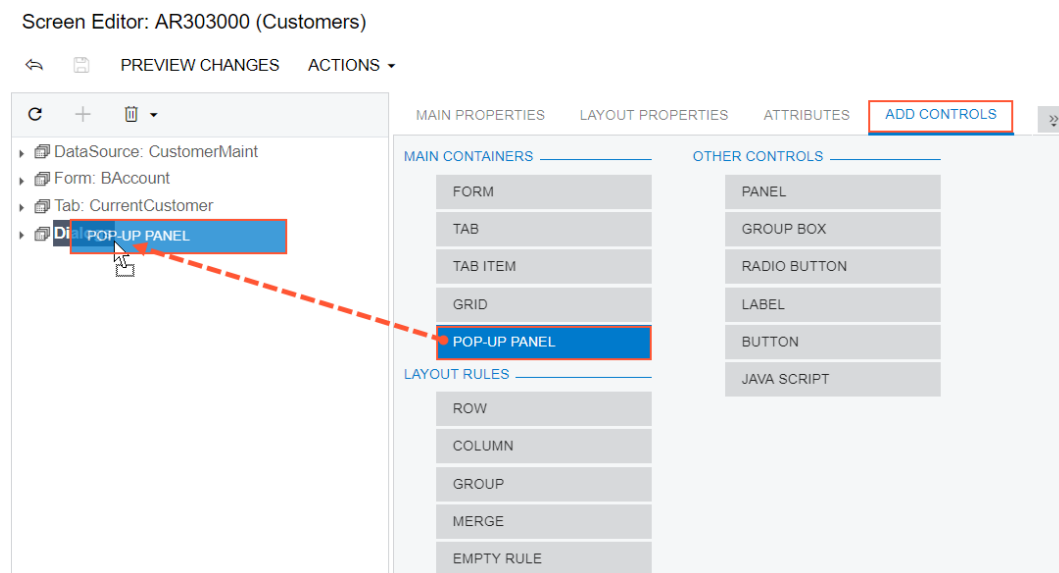
## To Add a Dialog Box

You can add a custom dialog box to an Acumatica ERP form. If the dialog box must contain controls for data fields, you should generally perform the following operations:

- Add a new `PXSmartPanel` container to the ASPX page, as described in this topic.
- If needed, define a custom data access class with the declaration of the data fields to be used for controls in the dialog box. See [To Create a Custom Data Access Class](#) for details.
- If needed, in the extension for the graph that is specified in the `TypeName` property of the `PXDataSource` control of the ASPX page, add business logic for the dialog box. (See [To Customize an Existing Business Logic Controller](#) for details.) For example, in the graph extension, you can do the following:
  - Declare a new data view that provides data for the dialog box controls, as described in [To Add a New Member](#)
  - Add an action (with a button on the form toolbar) to open the dialog box
  - Add other business logic for the dialog box
- If the smart panel container must include a box for a data field, add a data-bound container, such as `PXFormView`. Then bind the new container to the data view declared in the graph or graph extension (see [Use of the DataMember Property of Containers](#) in the Acumatica Framework Guide for details) whose BQL statement refers to the data access class with the field declaration.
- If the smart panel must contain a row of buttons, add a nested `PXPanel` container with the `SkinID` property set to `Buttons` (see [Use of the SkinID Property of Containers](#) in the Acumatica Framework Guide for details), and add the buttons to the nested panel, as described in [To Add Another Supported Control](#).

To add a new `PXSmartPanel` container to an ASPX page, perform the following actions:

1. Open the form in the [Screen Editor](#), as described in [To Add a Page Item for an Existing Form](#).
2. In the editor, click the **Add Controls** tab item.
3. From the **Main Containers** group of the tab item, drag the **POPUP PANEL** container into the **Dialogs** node in the Control Tree, as shown in the following screenshot.



**Figure: Adding a form container to a form**



: A dialog box can be displayed if it contains at least one visible control.

4. In the Control Tree, select the new container that has been added.

You can delete a container from an Acumatica ERP form. To do this, perform the following actions:

- ## Form Container (PXFormView)

An ASPX page can contain `PXFormView` as a main container. A form container, as the diagram below shows, can be also included in the following types of containers:

- 
- The diagram illustrates the ASPX Page structure and its components. At the top is the **ASPX Page** container. Below it, four main components are shown: **PXFormView** (blue), **PXGrid** (gray), **PXTab** (gray), and **PXSmartPanel** (yellow). Each of these components has a corresponding sub-component below it: **PXFormView** (blue), **PXGrid** (orange), and **PXTab** (purple) are shown as sub-components of **PXFormView**. **PXGrid** (gray), **RowTemplate** (gray), and **PXTabItem** (green) are shown as sub-components of **PXGrid**. **PXFormView** (blue), **PXGrid** (gray), and **PXTab** (gray) are shown as sub-components of **PXTab**. **PXFormView** (blue), **PXGrid** (gray), and **PXTab** (gray) are shown as sub-components of **PXSmartPanel**. At the bottom, a horizontal bar contains a list of components: **PXPanel**, **PXGroupBox**, **PXRadioButton**, **PXLabel**, **PXButton**, and **PXJavaScript**. Below this bar, a grid of components is shown: **PXTextEdit**, **PXNumberEdit**, **PXMaskEdit**, **PXDateTimeEdit**, **PXLayoutRule**, **PXCheckBox**, **PXDropDown**, **PXSelector**, **PXSegmentMask**, and **PXTreeSelector**.

A form container can include multiple ASPX objects of the following types:

- A data-bound UI container control: `PXFormView`, `PXGrid`, and `PXTab`



- A layout rule: `PXLayoutRule`
- A box for a data field: `PXTextEdit`, `PXNumberEdit`, `PXMaskEdit`, `PXDateTimeEdit`, `PXCheckBox`, `PXDropDown`, `PXSelector`, `PXSegmentMask`, and `PXTreeSelector`
- Another control: `PXPanel`, `PXGroupBox`, `PXRadioButton`, `PXLabel`, `PXButton`, and `PXJavaScript`

A box for a data field can be added to a form container if the container is bound to a data view declared within the graph that provides business logic for the ASPX page. If you want to bind a form container to a data view, you must specify the properties as follows for the appropriate `PXFormView` object:

- The `DataSourceID` property value must be equal to the value of the `ID` property of the `PXDataSource` control.
- The `DataMember` property must contain the name of the data view that is declared in the graph and provides data for the controls of the form container.

To create a new form container in an ASPX page, follow the instructions described in [To Add a Form Container](#).

To delete a form container from an ASPX page, follow the instructions described in [To Delete a Container](#).

For detailed information on working with the content of a form container, see the following topics:

- [To Open a Container in the Screen Editor](#)
- [To Set a Container Property](#)
- [To Add a Nested Container](#)
- [To Add a Box for a Data Field](#)
- [To Add a Layout Rule](#)
- [To Add Another Supported Control](#)
- [To Reorder Child UI Elements](#)
- [To Delete a Child UI Element](#)

## To Open a Container in the Screen Editor

You perform the customization of a container by using the [Screen Editor](#). To open a container of an Acumatica ERP form in the editor, perform the following actions:

1. Open the form in the browser.
2. On the form title bar, click **Customization > Inspect Element** to launch the [Element Inspector](#).
3. On the form, click the area of the container to be customized, which opens the [Element Properties Dialog Box](#) for the container.
4. In the dialog box, click **Customize**.
5. If there is no currently selected customization project and the inspector opens the [Select Customization Project Dialog Box](#), select an existing customization project or create a new one. (See [To Create a New Project](#) and [To Select an Existing Project](#) for details.)

If the customization project does not contain a changeset for the form, the [Customization Project Editor](#) adds to the project a *Page* item for the form to keep the changeset to the ASPX code of the form in the database. The container is opened in the [Screen Editor](#), and you can start the customization of the container.

When you click **Save** on the editor toolbar, the editor updates the *Page* item in the database.

## To Set a Container Property

To include in a customization project changes to the properties of a container, you have to modify the properties by using the [Screen Editor](#). To start setting the properties of a container, perform the following actions:

1. Open the container in the Screen Editor, as described in [To Open a Container in the Screen Editor](#).
2. Ensure that the container node is selected in the Control Tree of the editor. Click the arrow left of the node to expand the node if needed.
3. Click the **Main Properties** or **Layout Properties** tab to open the list of properties for the container.
4. Specify values for the required properties.
5. Click **Save** to save your changes to the customization project.

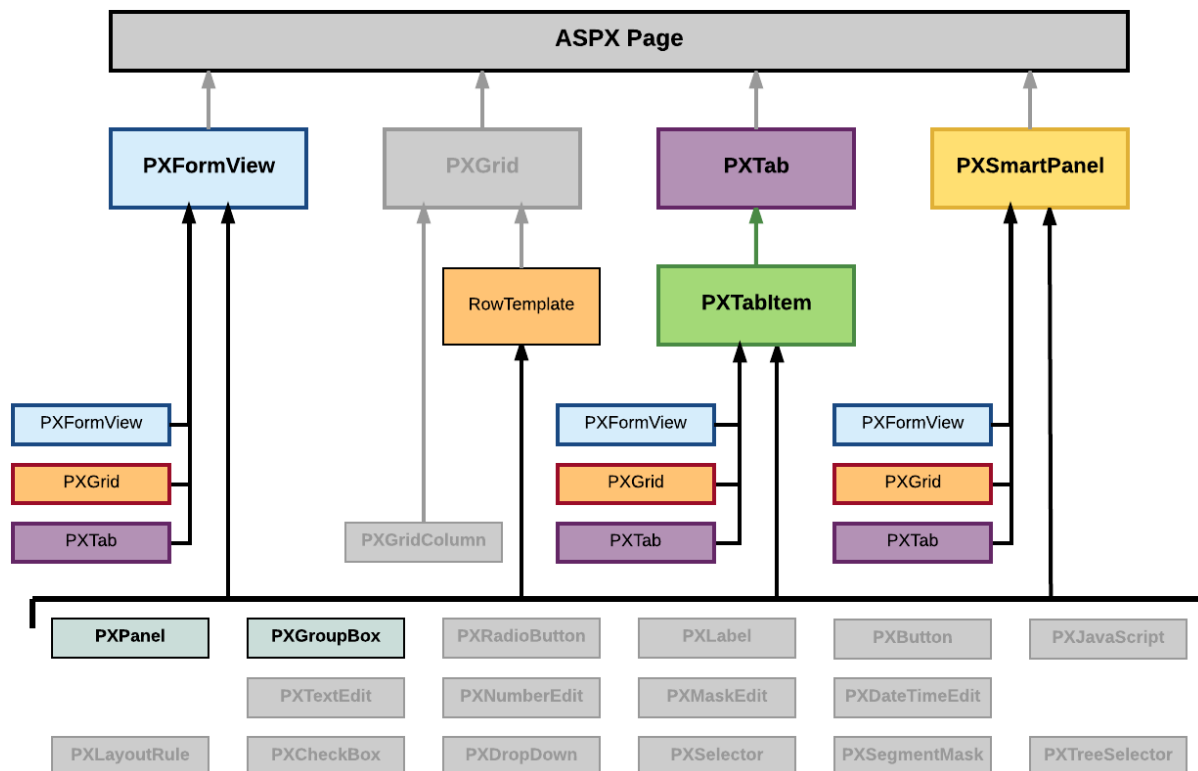
For detailed information about the `DataMember` property, see [Use of the DataMember Property of Containers](#) in the Acumatica Framework Guide.

In Acumatica ERP, for the `PXFormView`, `PXGrid`, and `PXPanel` containers, there are predefined values for the `SkinID` property. For details, see [Use of the SkinID Property of Containers](#) in the Acumatica Framework Guide.

If you plan to use a container in the mobile site map, specify the `Caption` property of the container, as described in [Use of the Caption Property of Containers](#) in the Acumatica Framework Guide.

## To Add a Nested Container

A `PXGrid` container cannot include a nested container. A `PXTab` container can include only `PXTabItem` containers. You can add any container as a nested container to a `PXFormView`, `PXTabItem`, or `PXSmartPanel` container, as the following diagram shows.



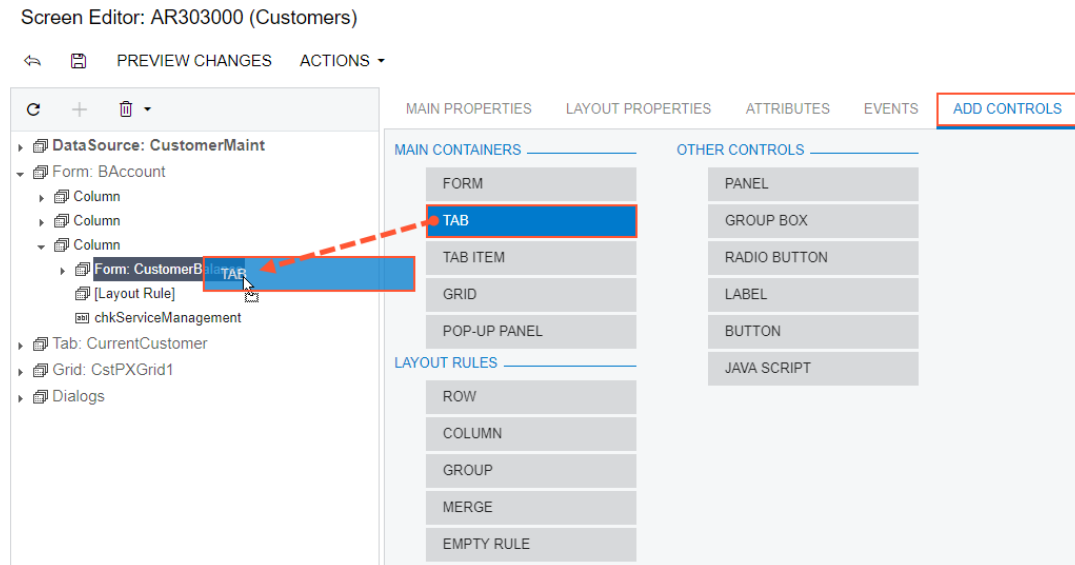
**Figure: Nesting rules for containers on an ASPX page**

You can include the `PXPanel` and `PXGroupBox` container controls in the `PXFormView`, `RowTemplate`, `PXTabItem`, and `PXSmartPanel` containers.

To add a nested container to a parent container, perform the following actions:

1. Open the parent container in the Screen Editor, as described in [To Open a Container in the Screen Editor](#).

2. Ensure that the container node is selected in the Control Tree of the editor. Click the arrow left of the node to expand the node if needed.
3. Click the **Add Controls** tab item (see the screenshot below).
4. From the **Main Containers** or **Other Controls** group, drag the required type of the nested container into the parent container in the Control Tree, as shown in the following screenshot.



**Figure: Adding a nested container to a parent container**



: A nested container is visible on the customized form only if it contains at least one visible control.

5. If required, specify properties for the new container, as described in [To Set a Container Property](#).
6. Click **Save** to save changes in the customization project.

## To Add a Box for a Data Field

The Acumatica Customization Platform supports the following types of boxes for data fields:

- `PXTextEdit`
- `PXNumberEdit`
- `PXMaskEdit`
- `PXDateTimeEdit`
- `PXCheckBox`
- `PXDropDown`
- `PXSelector`
- `PXSegmentMask`
- `PXTreeSelector`

(See the table in [Customizing Elements of the User Interface](#) for field type descriptions.)

You can add a box for a data field without restrictions immediately to a `PXFormView` or `PXTabItem` element that has the `DataMember` property defined. Also, you can add a box for a data field to a `PXPanel` or `PXGroupBox` container that has the `DataMember` property inherited from the parent container.

Also, you can add a box for a data field to a `RowTemplate` element of a `PXGrid` container that is bound to a data view whose BQL statement refers to the data access class that contains the field declaration.

To add a box for a data field to a container that is bound to a data view, perform the following actions:

1. Open the parent container in the Screen Editor, as described in [To Open a Container in the Screen Editor](#).
2. Ensure that the container node is selected in the Control Tree of the editor. Click the arrow left of the node to expand the node if needed.
3. Click the **Add Data Fields** tab item (see the screenshot below).
4. If you need to create a control for a data field that is not accessible through the data view specified for the container in the `DataMember` property but is accessible through another data view of the same graph, and if the **Data View** box is available, select the needed data view in this box. (For details, see [Use of Multiple Data Views for Boxes in Containers](#) in the Acumatica Framework Guide.)



: On the **Add Data Fields** tab item of the Screen Editor, if you change the predefined data view in the **Data View** box and create a control for a data field from the field list for the selected data view, the editor concatenates the data view name with the field name in the `DataField` property of the created control.

5. On the tab item, click the **All**, **Visible**, or **Custom** filter for the fields provided by the data view to view the appropriate field list.



: You can create a custom field immediately on the **Add Data Fields** tab item by clicking the **New Field** action and then using the [Create New Field](#) dialog box.

6. Find the required data field in the list, and if the field is not used (the check box in the **Used** column is cleared for the field), select the check box for the field in the first (unlabeled) column, as the following screenshot shows.

Screen Editor: AR303000 (Customers)

PREVIEW CHANGES ACTIONS ▾

DataSource: CustomerMaint

Form: BAccount

Tab: CurrentCustomer

General Info

Column

Form: DefContact

Column

Company Name

Attention

Email

Web

Phone 1

Phone 2

Fax

Account Ref. #

BAccount.LocaleName

Form: DefAddress

Column

Billing Settings

Delivery Settings

Locations

MAIN PROPERTIES LAYOUT PROPERTIES ATTRIBUTES **ADD DATA FIELDS**

Data View: Lead/Contact(DefContact)

CREATE CONTROLS NEW FIELD ALL **VISIBLE** CUSTOM

	Used	Field Name	Control
<input type="checkbox"/>	<input type="checkbox"/>	DisplayName (Display Name)	Selector
<input type="checkbox"/>	<input type="checkbox"/>	DuplicateFound (Duplicate Found)	CheckBox
<input type="checkbox"/>	<input checked="" type="checkbox"/>	EEmail (Email)	TextEdit
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Fax	TextEdit
<input type="checkbox"/>	<input type="checkbox"/>	FaxType (Fax Type)	ComboBox
<input type="checkbox"/>	<input type="checkbox"/>	FirstName (First Name)	TextEdit
<input type="checkbox"/>	<input checked="" type="checkbox"/>	FullName (Company Name)	TextEdit
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Gender	ComboBox
<input type="checkbox"/>	<input type="checkbox"/>	IsActive (Active)	CheckBox
<input type="checkbox"/>	<input type="checkbox"/>	IsAddressSameAsMain (Same as in Account)	CheckBox
<input type="checkbox"/>	<input type="checkbox"/>	IsConvertible (Can Be Converted)	CheckBox
<input type="checkbox"/>	<input type="checkbox"/>	LanguageID (Language/Locale)	Selector
<input type="checkbox"/>	<input type="checkbox"/>	LanguageID_description (Description)	TextEdit
<input type="checkbox"/>	<input type="checkbox"/>	LanguageID_Locale_description (Description)	TextEdit

**Figure: Selecting a data field for which a box to be created**



: You can select multiple data fields to create multiple boxes simultaneously.

7. On the list toolbar, click **Create Controls**.

The platform creates a box for the selected data field and adds a node for the box to the Control Tree.

8. Click **Save** to save the changes in the customization project.

You can change the location of a control in a container. See [To Reorder Child UI Elements](#) for details.

For more information about boxes, see [Box \(Control for a Data Field\)](#).

## To Add a Layout Rule

In a container with multiple controls, the `PXLayoutRule` component is used to provide the following UI customization capabilities:

- Placing controls in multiple rows to uniformly distribute them on the form or tab area of a form
- Placing controls in multiple columns in a row
- Spanning controls across multiple columns in a row
- Merging controls into one row to align them horizontally
- Adjusting the widths of controls and labels in a column
- Hiding the labels of controls
- Grouping controls for users' convenience

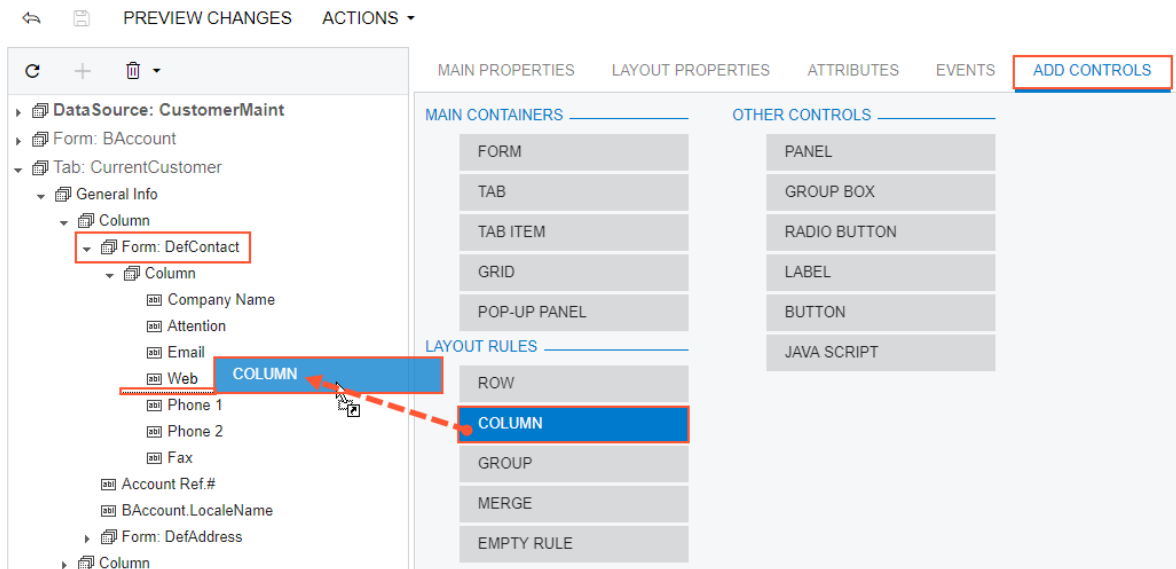
The [Screen Editor](#) supports the following types of the `PXLayoutRule` component (with the respective predefined properties noted):

- **Row:** A layout rule with the `StartRow` property, which is set to `True`
- **Column:** A layout rule with the `StartColumn` property, which is set to `True`
- **Group:** A layout rule with the `StartGroup` property, which is set to `True`
- **Merge:** A layout rule with the `Merge` property, which is set to `True`
- **Empty Rule:** A layout rule without predefined properties

To add a layout rule to a container, perform the following actions:

1. Open the container in the Screen Editor, as described in [To Open a Container in the Screen Editor](#).
2. Ensure that the container node is selected in the Control Tree of the editor. Click the arrow left of the node to expand the node if needed.
3. Click the **Add Controls** tab item (see the screenshot below).
4. From the **Layout Rules** group, drag the required type of the rule to the needed location in the Control Tree within the container, as shown in the following screenshot.

Screen Editor: AR303000 (Customers)

**Figure: Adding a layout rule to a container**

: A layout rule is visible on the customized form only if it contains at least one visible control.

5. If required, specify properties for the new layout rule.



: In any rule, you can configure any properties that you need. Some properties affect only the next control under the `PXLayoutRule` component, while other properties affect all controls under the rule until the next rule is encountered. Some properties require a corresponding ending rule. See [To Set a Layout Rule Property](#) for details.

6. Click **Save** to save your changes in the customization project.

If you add a layout rule beneath another layout rule, you can override the properties of the `PXLayoutRule` component, which apply to the underlying controls. See [Layout Rule \(PXLayoutRule\)](#) for more information about using layout rules.

## To Add Another Supported Control

You use the [Screen Editor](#) to add to a container a control of any of the following types, which are supported in the Acumatica Customization Platform (listed under **Other Controls** on the **Add Controls** tab item):

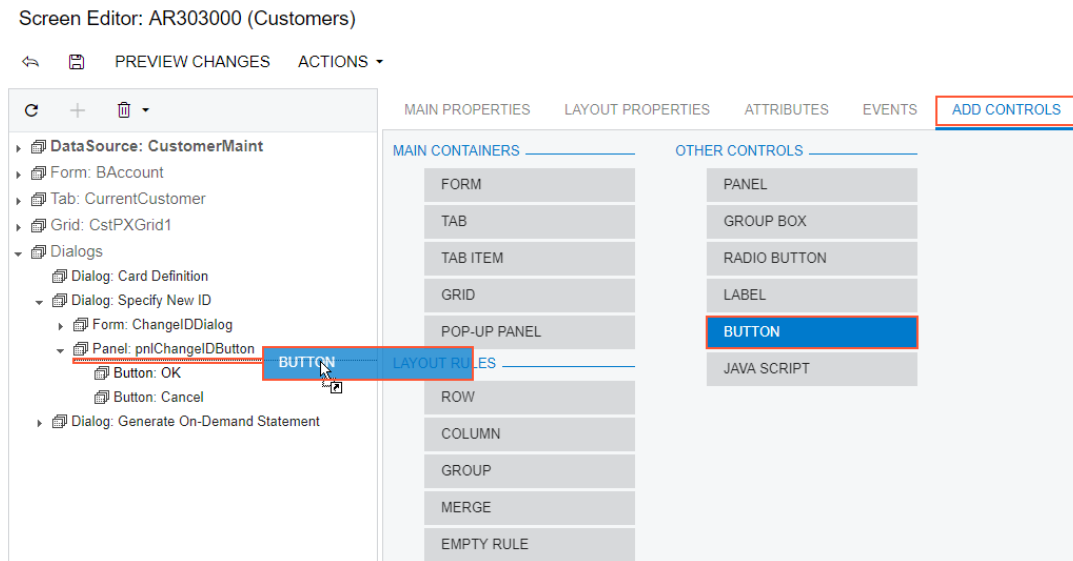
- [Panel \(PXPanel\)](#)
- [Group Box \(PXGroupBox\)](#)
- [Label \(PXLabel\)](#)
- [Radio Button \(PXRadioButton\)](#)
- [Button \(PXButton\)](#)
- [Java Script \(PXJavaScript\)](#)

We recommend that you not include a `PXRadioButton` control in a container that neither is bound to a data view nor inherits the `DataMember` property from the parent container.

You can nest a control of the listed types in a `PXPanel` or `PXGroupBox` container. However the `PXGroupBox` control type is especially designed to be used as a radio button container to render a drop-down field as a set of radio buttons. It contains scripts with the logic to support a nested radio button for each value of a drop-down field. So we recommend that you use `PXGroupBox` exclusively to include radio buttons.

To add a control of one of the listed types to a container, perform the following actions:

1. Open the container in the Screen Editor, as described in [To Open a Container in the Screen Editor](#).
2. Ensure that the container node is selected in the Control Tree of the editor. Click the arrow left of the node to expand the node if needed.
3. Click the **Add Controls** tab item (see the screenshot below).
4. From the **Other Controls** group, drag the required control type to the needed location in the Control Tree within the container, as shown in the following screenshot.



**Figure: Adding a layout rule to a container**

5. If required, specify properties for the new control.
6. Click **Save** to save your changes in the customization project.

## To Reorder Child UI Elements

You can reorder UI elements in a container manually by dragging them in the Control Tree of the [Screen Editor](#). However before you start to move elements, note the following simple rules:

- You can move a child element anywhere within its parent container control.
- To move an element within a container, you have to drag the element to the required place.
- Any element moved within a container is automatically aligned according to the nearest `PXLayoutRule` component placed above it. (See [Layout Rule \(PXLayoutRule\)](#) for details.)

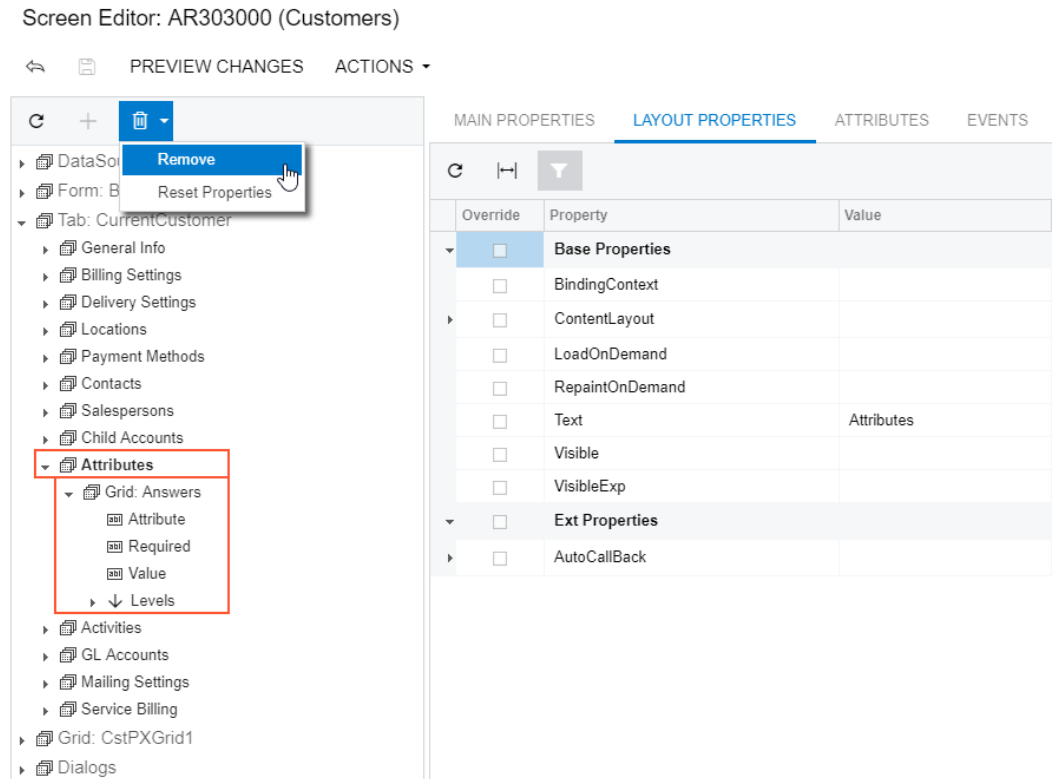
To move an element within a container, perform the following actions:

1. Open the container in the Screen Editor, as described in [To Open a Container in the Screen Editor](#).
2. Ensure that the container node is selected and expanded in the Control Tree of the editor. Click the arrow left of the node to expand the node if needed.
3. In the Control Tree, drag the element to the required position.  
The Screen Editor moves the element with all its child elements to the new position in the container.
4. Click **Save** to save your changes to the customization project.

## To Delete a Child UI Element

You can delete a child UI element from a container. To do this, perform the following actions:

1. Open the container in the Screen Editor, as described in [To Open a Container in the Screen Editor](#).
2. In the Control Tree of the editor, click the arrow left of the container node to expand the node.
3. Select the UI element to be deleted.
4. On the toolbar of the Control Tree, click **Remove > Remove**, as the following screenshot shows.



**Figure: Deleting an UI element**

The platform deletes all child elements of the deleted object.



**Warning:** If you delete a `PXLayoutRule` component, all the controls under this layout rule are deleted too.

5. Click **Save** on the toolbar of the Screen Editor to save your changes to the customization project.

## Grid Container (PXGrid)

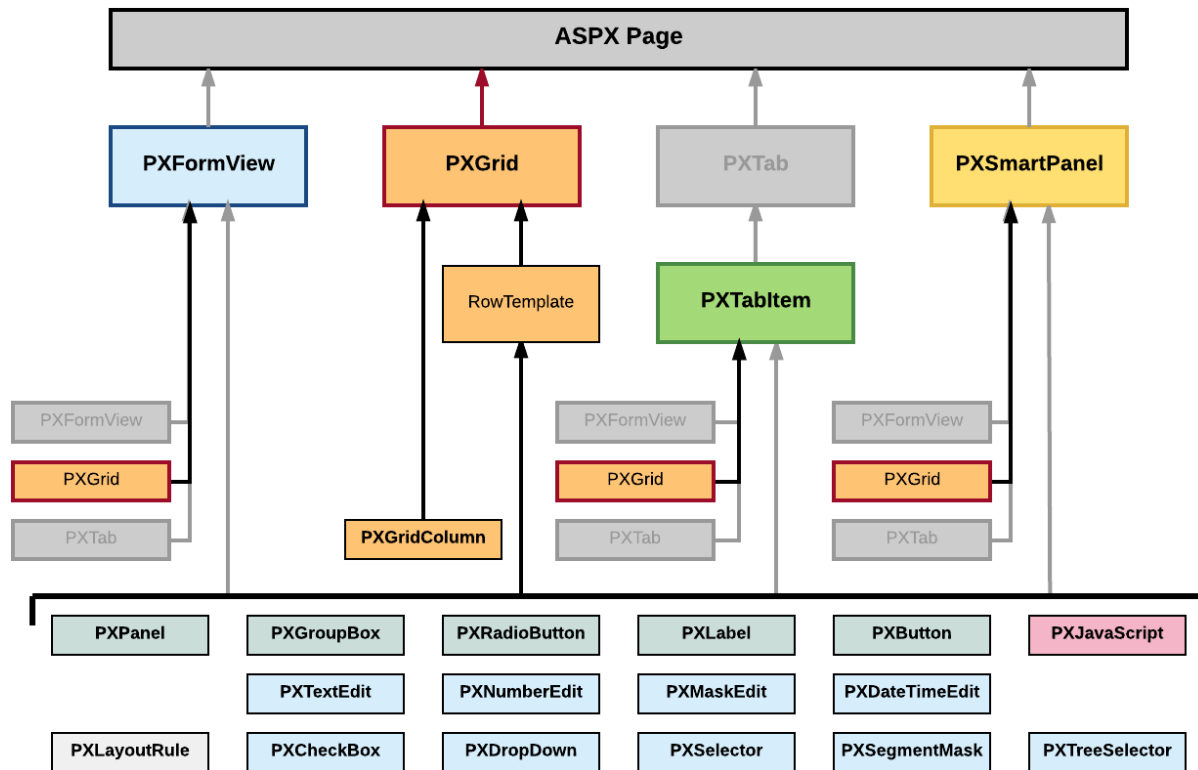
`PXGrid` is a data-bound UI container control that renders a table with multiple records from its associated data source. For a single record, the object can be displayed in form view mode, which provides navigation buttons to move between records. For form view mode to be defined, `PXGrid` must include the `RowTemplate` element, which can contain controls for the record fields and layout rules for these controls.

An ASPX page can contain `PXGrid` as a main container that is included immediately in the page. A grid container, as the diagram below shows, can also be included in the following types of containers:

- `PXFormView`
- `PXTabItem`



- PXSmartPanel



**Figure: Nesting rules for a PXGrid container in an ASPX page**

A grid container can include multiple `PXGridColumn` objects and a single `RowTemplate` element. In the ASPX code, grid columns are included in the `Columns` element, whereas controls for the form view of the grid belong to the `RowTemplate` element, as the following code snippet shows.

```
<px:PXGrid ID="grid" ... DataSourceID="ds" ...>
  ...
  <Columns>
    ...
    <px:PXGridColumn DataField="Qty" TextAlign="Right" Width="81px"
    AutoCallBack="True" />
    ...
  </Columns>
  <RowTemplate>
    ...
    <px:PXNumberEdit ID="edQty" runat="server" DataField="Qty" />
    ...
  </RowTemplate>
  ...
</px:PXGrid>
```

In this code, you can see descriptions of both a grid column and a box for the same `Qty` data field.

To create a new grid in an ASPX page, follow the instructions described in [To Add a Grid Container](#).

To delete a grid from an ASPX page, follow the instructions described in [To Delete a Container](#).

For detailed information on working with the content of a grid container, see the following topics in this section:

- [To Add a Column for a Data Field](#)
- [To Add a Control to the Form View of a Grid](#)
- [To Provide Hyperlinks for a Grid Column](#)

The following topics may also be useful as you work with a grid container:

- [To Open a Container in the Screen Editor](#)
- [To Set a Container Property](#)
- [To Reorder Child UI Elements](#)
- [To Delete a Child UI Element](#)

## To Add a Column for a Data Field

In a grid, you can create a column for a data field if the grid container is bound to a data view declared within the graph that provides business logic for the ASPX page. To bind a grid container to a data view, you must specify the properties as follows for the appropriate `PXGrid` object:

- The `DataSourceID` property value must be equal to the value of the `ID` property of the `PXDataSource` control.
- The `DataMember` property must contain the name of the data view that is declared in the graph and provides data for the grid.

To add a column to a grid that is bound to a data view, perform the following actions:

1. Open the grid container in the Screen Editor, as described in [To Open a Container in the Screen Editor](#).
2. In the Control Tree of the editor, ensure that the grid node is selected. Click the arrow left of the node to expand the node if needed.
3. In the editor, click the **Add Data Fields** tab item (see the screenshot below).
4. On the tab item, select the **All, Visible** (as shown below), or **Custom** filter for the data fields provided by the data view, to open the appropriate field list.



: You can create a custom field immediately on the **Add Data Fields** tab item by using the [Create New Field](#) dialog box.

5. Find the required data field in the list, and if the field is not used (that is, if the check box in the **Used** column is cleared for the field), select the check box in the unlabeled first column for the field.



- :
- You can select multiple data fields to create multiple columns simultaneously.
  - In the **Field Name** column of the list, a data field of a joined data access class (DAC) has a name that consists of the DAC name, two underscore characters, and the field name, such as `Product__Active`. If you create a grid column for this field, the new `PXGridColumn` element refers to the field as shown in the following ASPX code.

```
<px:PXGridColumn DataField="Product__Active" ... />
```

6. On the list toolbar, click **Create Controls**.

The platform creates a column for the selected data field, appends this column to the end of the grid column list, and adds a node for the column to the appropriate position in the Control Tree.



: If you need to locate the new column in a position after some existing column, you can select this existing column before you click **Create Controls**. Then the editor inserts new grid columns after the column that is selected in the Control Tree.

At any time, you can change the position of a column in a grid. See [To Reorder Child UI Elements](#) for details.

7. If needed, specify the following properties of the new column:
  - `Type`—to define a specific type of data in a column (for details, see [Use of the Type Property of PXGridColumn](#) in the Acumatica Framework Guide)
  - `CommitChanges`—to enable callbacks on the column field (for details, see [Use of the CommitChanges Property of Boxes](#) in the Acumatica Framework Guide)

- `DisplayMode`—to define the mode of displaying a value in the column (for details, see [Use of the DisplayMode Property of PXGridColumn](#) in the Acumatica Framework Guide)



: If you need to provide hyperlinks to redirect the user from a column cell to another Acumatica ERP form, follow the recommendations described in [To Provide Hyperlinks for a Grid Column](#).

8. Click **Save** to save your changes to the customization project.

## To Add a Control to the Form View of a Grid

If the `AllowFormEdit` property of a grid is set to `True`, the user can switch the grid to form view mode to display the grid columns as controls on the form. This mode gives you the capability to edit a single record selected in the grid.

Therefore, to add a box for a data field to the form view of a grid, you have to add the box to the `RowTemplate` element in the ASPX code. To do this in the [Screen Editor](#), perform the following actions:

1. Open the grid container in the Screen Editor, as described in [To Open a Container in the Screen Editor](#).
2. In the Control Tree of the editor, click the arrow left of the node to expand the node.
3. Click the arrow left of the **Levels** node to expand the node, and then expand the node that appears, which has the same name as the grid does.



: In the Control Tree, the Screen Editor assigns to a grid node the `Grid:<DataMember>` name, where the `<DataMember>` is the value of the `DataMember` property of the grid container. To the node that corresponds to the `RowTemplate` element of the grid, the editor assigns the same `<DataMember>` name.

4. If the expanded node contains other expandable nodes, such as `Columns` nodes, expand them to see which boxes are currently included in the form view of the grid.



: The `RowTemplate` element can contain layout rules, which are used to arrange controls in the form view of the grid. Also, you can use this element to provide specific properties of columns in the grid.

5. If you need to place the new box in a position below some existing box, select the node of this box in the Control Tree before you add a new control. (In the screenshot below, the `Mailing ID` node is currently selected in the tree.)
6. In the editor, click the **Add Data Fields** tab item.
7. On the tab item, click the **All**, **Visible**, or **Custom** filter for the data fields provided by the data view to open the appropriate field list.



: You can create a custom field immediately on the **Add Data Fields** tab item by using the [Create New Field](#) dialog box.

8. Find the required data field in the list, and if the field is not used (that is, if the check box in the **Used** column is cleared for the field), select the check box for the field in the first column, as the following screenshot shows.

Screen Editor: AR303000 (Customers)

PREVIEW CHANGES ACTIONS

Used	Field Name	Control
<input checked="" type="checkbox"/>	CommissionPct (Commission %)	NumberEdit
<input type="checkbox"/>	CreatedByID (Created By)	Selector
<input type="checkbox"/>	CreatedByID_Creator_displayName (Created By)	TextEdit
<input type="checkbox"/>	CreatedByID_Creator_Username (Created By)	TextEdit
<input type="checkbox"/>	CreatedByID_description (Created By)	TextEdit
<input type="checkbox"/>	IsDefault (Default)	CheckBox
<input type="checkbox"/>	LastModifiedByID (Last Modified By)	Selector
<input type="checkbox"/>	LastModifiedByID_description (Last Modified By)	TextEdit
<input type="checkbox"/>	LastModifiedByID_Modifier_displayName (Last Mo	TextEdit
<input type="checkbox"/>	LastModifiedByID_Modifier_Username (Last Modif	TextEdit
<input type="checkbox"/>	LocationID (Location ID)	SegmentMask
<input type="checkbox"/>	LocationID_description (Location Name)	TextEdit
<input type="checkbox"/>	LocationID_LocationExtAddress_descr (Location N	TextEdit
<input type="checkbox"/>	SalesPersonID (Salesperson ID)	SegmentMask
<input checked="" type="checkbox"/>	SalesPersonID_description (Name)	TextEdit
<input type="checkbox"/>	SalesPersonID_SalesPerson_descr (Name)	TextEdit

**Figure: Selecting a data field to create a control on the form view of the grid**



: You can select multiple data fields to create multiple columns simultaneously.

## 9. On the list toolbar, click **Create Controls**.

The platform creates a box for the selected data field and adds a node for the box to the appropriate position in the Control Tree. At any time, you can change the position of a column in a grid. See [To Reorder Child UI Elements](#) for details.

## 10. If needed, specify properties for the new control.



: If you need to provide hyperlinks to redirect the user from a column cell to another Acumatica ERP form, follow the recommendations described in [To Provide Hyperlinks for a Grid Column](#).

## 11. Click **Save** to save your changes to the customization project.

# To Provide Hyperlinks for a Grid Column

To provide hyperlinks for an existing column in a grid, perform the following actions:

1. Add the `PXSelector` attribute for the field used to create the column.
2. For the field, create a selector control in the `RowTemplate` element of the `PXGridLevel` container of the ASPX page, as described in [To Add a Control to the Form View of a Grid](#).
3. Set the `AllowEdit` property of the selector control to `True`.



: A selector control contains the value of the key field of a data record from a particular table. Therefore, the control can be used to redirect a user to the form designed to edit the data record.

After you have completed these actions:

- The column fields contain hyperlinks to redirect the user to the data entry form for the records defined by the fields.

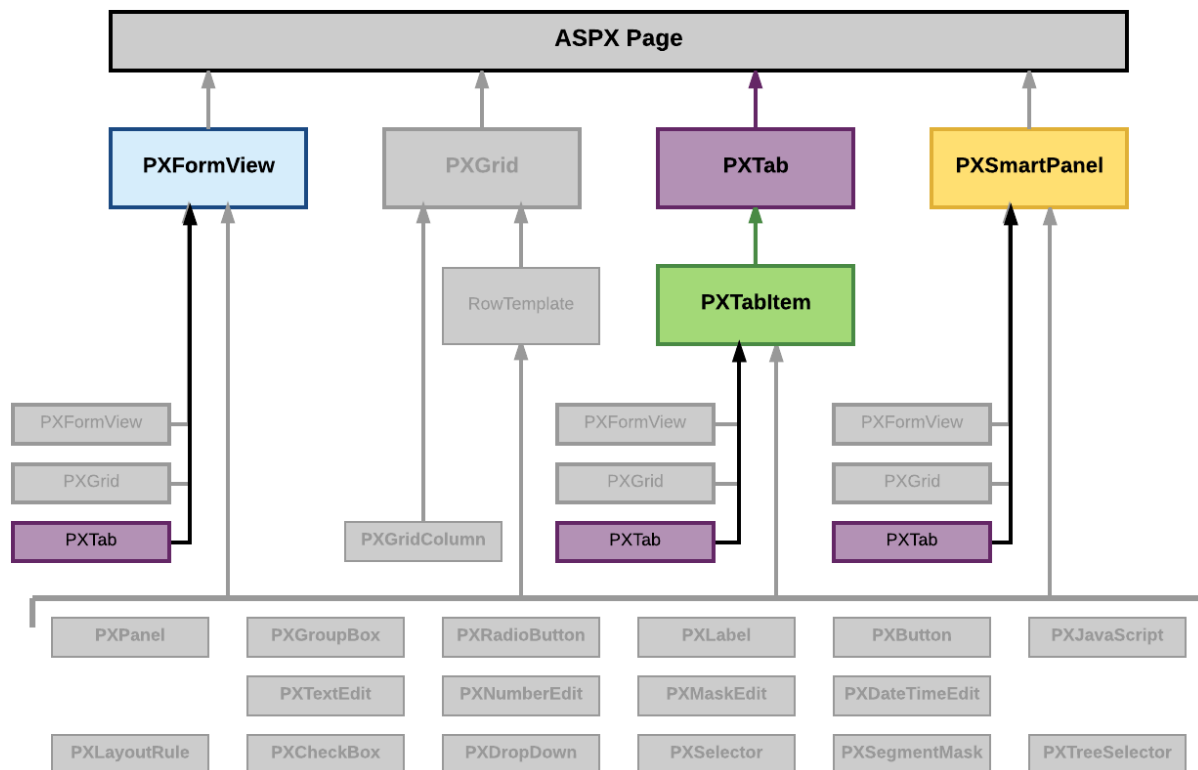
- If the form view for the grid is available, the following interface elements appear on the form view:
  - The text box created for the field
  - The **Edit** button, which provides the required redirection to the data entry form for the record defined by the value in the text box

## Tab Container (PXTab)

PXTab is a data-bound UI container control that renders tabs defined by child PXTabItem containers.

An ASPX page can contain PXTab as a main container. A tab container, as the diagram below shows, can be also included in the following types of containers:

- PXFormView
- PXTabItem
- PXSmartPanel



**Figure: Nesting rules for a PXTab container in an ASPX page**

A tab container can include only PXTabItem container controls.

A box for a data field can be added immediately to a child PXTabItem container if the parent PXTab container is bound to a data view declared within the graph that provides business logic for the ASPX page. To bind a tab container to a data view, you must specify the properties as follows for the appropriate PXTab object:

- The `DataSourceID` property value must be equal to the value of the `ID` property of the `PXDataSource` control.
- The `DataMember` property must contain the name of the data view that is declared in the graph and provides data for the controls of a child container that is not a data-bound UI container.

To create a new tab container in an ASPX page, follow the instructions described in [To Add a Tab Container](#).



- [To Add a Nested Container](#)
- [To Add a Box for a Data Field](#)
- [To Add a Layout Rule](#)
- [To Add Another Supported Control](#)
- [To Reorder Child UI Elements](#)
- [To Delete a Child UI Element](#)

## Dialog Box (PXSmartPanel)

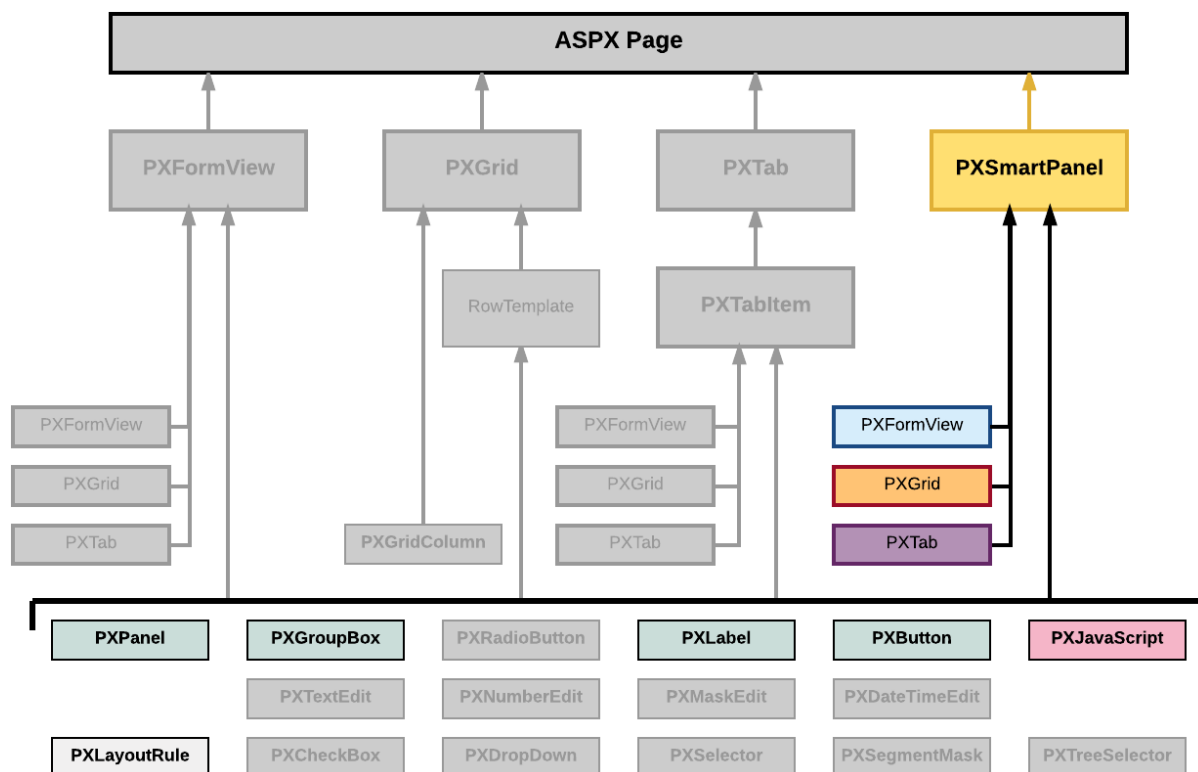
PXSmartPanel is a UI container control that renders a dialog box.

A PXSmartPanel container does not have the `DataMember` property; therefore, it cannot contain a UI element for a data field. To add a box for a data field to a dialog box, in the appropriate PXSmartPanel container, you have to include the data-bound container that can contain the required data field.

However without binding a data view, you can create, for example, a message box with the controls that contain all required data in the ASPX code.

A PXSmartPanel container can include multiple ASPX objects of the following types (see the diagram below):

- A data-bound UI container control: PXFormView, PXGrid, and PXTab
- A layout rule: PXLayoutRule
- Another control: PXPanel, PXGroupBox, PXLabel, PXButton, and PXJavaScript



**Figure: Nesting rules for a PXSmartPanel container in an ASPX page**



: A box for a data field cannot be added immediately to a dialog box because this type of container cannot be bound to a data view.

To create a new dialog box in a form, follow the instructions described in [To Add a Dialog Box](#).

To delete a dialog box from a form, follow the instructions described in [To Delete a Container](#).

In Acumatica ERP, a dialog box usually contains a container for data fields and a `PXPanel` container with `PXButton` elements to get a response from the user. See [Panel \(PXPanel\)](#) and [To Use a Button in a Dialog Box](#) for details.

For detailed information on working with the content of a dialog box, see the [To Open a Smart Panel in the Screen Editor](#) topic in this section. You will find additional information in the following topics:

- [To Set a Container Property](#)
- [To Add a Nested Container](#)
- [To Add Another Supported Control](#)
- [To Reorder Child UI Elements](#)
- [To Delete a Child UI Element](#)

## To Open a Smart Panel in the Screen Editor

If you need to activate the [Element Inspector](#) for a pop-up panel, a dialog box, or another UI element that opens in modal mode and makes the [Customization Menu](#) unavailable for selection, you can press Control-Alt.

To open a smart panel in the [Screen Editor](#), perform the following actions:

1. Open the form in the browser.
2. On the form, open the needed dialog box by using the appropriate action.
3. On the keyboard, press the Control-Alt combination.



: The Element Inspector is activated while you keep the Control-Alt combination pressed on the keyboard.

4. Click anywhere inside the dialog box to open the [Element Properties](#) dialog box.
5. In the dialog box, click **Customize**.
6. If there is no currently selected customization project and the inspector opens the [Select Customization Project Dialog Box](#), select an existing customization project or create a new one (see [To Create a New Project](#) and [To Select an Existing Project](#) for details).

If the customization project does not contain a changeset for the form, the [Customization Project Editor](#) adds to the project a *Page* item for the form to keep your changes in the database. The smart panel element is opened in the [Screen Editor](#), and you can start to customize the dialog box.

When you click **Save** on the editor toolbar, the editor updates the *Page* item in the database.

## Box (Control for a Data Field)

You can use a control for a data field, also referred as a *box*, to display and edit the value of the field on a form.

The Acumatica Customization Platform supports the following types of boxes.

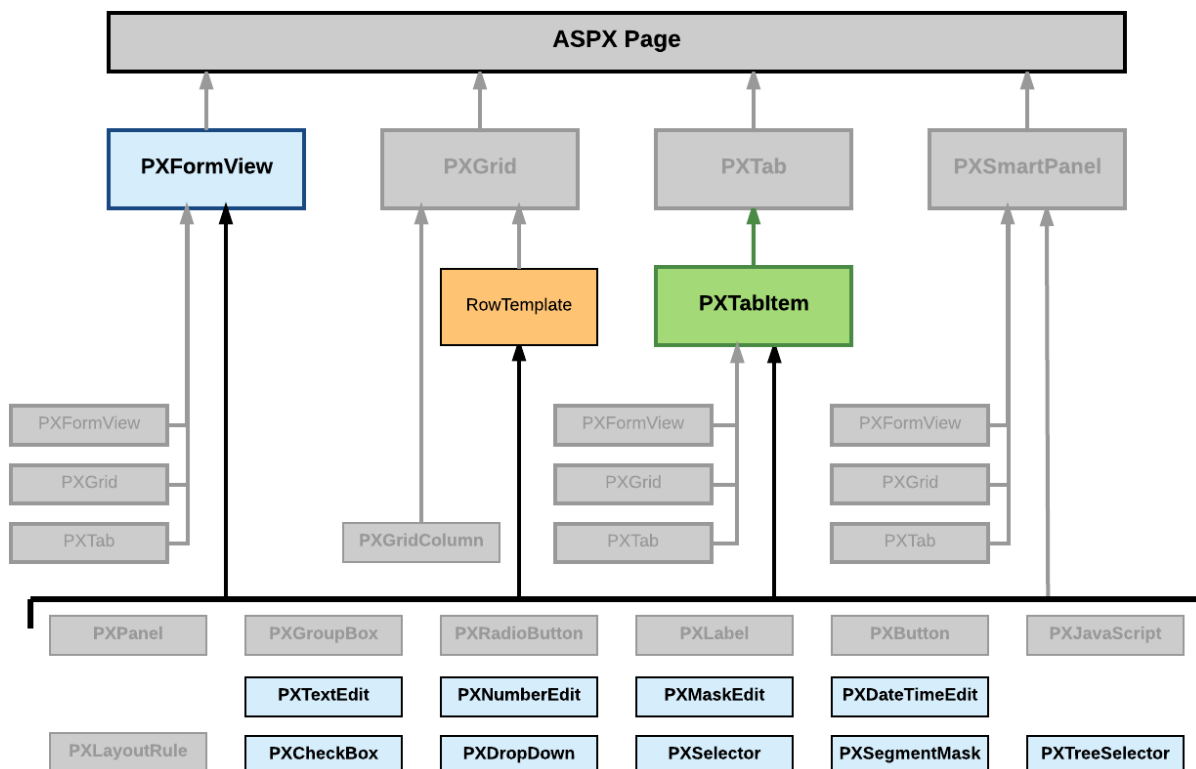
Object	Description
<code>PXTextEdit</code>	A text box to display and edit the value of a <code>string</code> field.
<code>PXNumberEdit</code>	A box to display and edit the value of a <code>decimal</code> or <code>int</code> field.
<code>PXMaskEdit</code>	A text box to display and edit the value of a <code>string</code> field that has the format specified in the data access class.
<code>PXDateTimeEdit</code>	A box to display and select the value of a <code>datetime</code> field.
<code>PXCheckBox</code>	A check box to display and select the value of a <code>bool</code> field.



Object	Description
PXDropDown	A combo box to display, edit, and select the value of a field with a list attribute, such as PXStringList, PXIntList, or PXDecimalList.
PXSelector	A lookup control to display, search for, and select the value of a field with the PXSelector attribute.
PXSegmentMask	A lookup control with a specified segmented key value that identifies a data record and consists of one segment or multiple segments, where the list of possible values is defined for each segment.
PXTreeSelector	A lookup control to select a value for a field with a PXTreeSelector attribute.

A box, as the diagram below shows, can be immediately added to the following types of containers:

- PXFormView
- RowTemplate
- PXTabItem



**Figure: Nesting rules for a box bound to a data field**

To create a box in a container, follow the instructions described in [To Add a Box for a Data Field](#).

To delete a box from a container, follow the instructions described in [To Delete a Child UI Element](#).

For detailed information on customizing a box, see the following topics:

- [To Select a Box in the Screen Editor](#)
- [To Set a Box Property](#)
- [To Change the Type of a Box](#)

## To Select a Box in the Screen Editor

To start the customization of a box, you have to select it in the [Screen Editor](#). To do this, perform the following actions.

1. Open the form that contains the box to be customized so that the box is displayed on the screen.
2. On the form title bar, click **Customization > Inspect Element** to launch the [Element Inspector](#).
3. On the form, click the box to open the [Element Properties Dialog Box](#) for the box.
4. In the dialog box, click **Customize**.
5. If there is no currently selected customization project and the inspector opens the [Select Customization Project Dialog Box](#), select an existing customization project or create a new one. (See [To Select an Existing Project](#) and [To Create a New Project](#) for details.)

If the customization project does not contain a changeset for the form, the [Customization Project Editor](#) adds to the project a *Page* item for the form, to keep the changeset to ASPX code of the form in the database. The container of the box is opened in the [Screen Editor](#), and the box is selected in the Control Tree of the editor. Therefore you can start customization of the box.

When you click **Save** on the editor toolbar, the editor updates the *Page* item in the database.

## To Set a Box Property

To include in a customization project changes to properties of a box, you have to modify the properties by using the [Screen Editor](#). To start setting the properties of a box, perform the following actions:

1. Select the box in the Screen Editor, as described in [To Select a Box in the Screen Editor](#).
2. Click the **Layout Properties** tab item to open the list of properties for the box.
3. Specify values for the required properties.
4. Click **Save** to save your changes to the customization project.

For detailed information about the `CommitChanges` property, see [Use of the CommitChanges Property of Boxes](#) in the Acumatica Framework Guide.

You can assign a predefined size abbreviation (such as *XXS*, *L* or *XL*) for the `LabelsWidth` and `Size` properties of a box. See [Predefined Size Values](#) in the Acumatica Framework Guide for details.

## To Change the Type of a Box

For a data field, you can create a control of any type that is supported in Acumatica ERP. However to avoid issues with rendering controls and processing control values, you have to have an appropriate control for each data field. Therefore, if you have changed the type of a data field, you should recreate all the controls that exist on Acumatica ERP forms for this field.

For example, a text edit box for the *MyFieldName* `PXDBString` field can be defined in the ASPX code as follows.

```
<px:PXTextEdit ... DataField="MyFieldName" />
```

Suppose that you have added the `PXStringList` attribute for the field in the data access class to use the control for the field as a drop-down box. Then you need to redefine the control as follows.

```
<px:PXDropDown ... DataField="MyFieldName" />
```

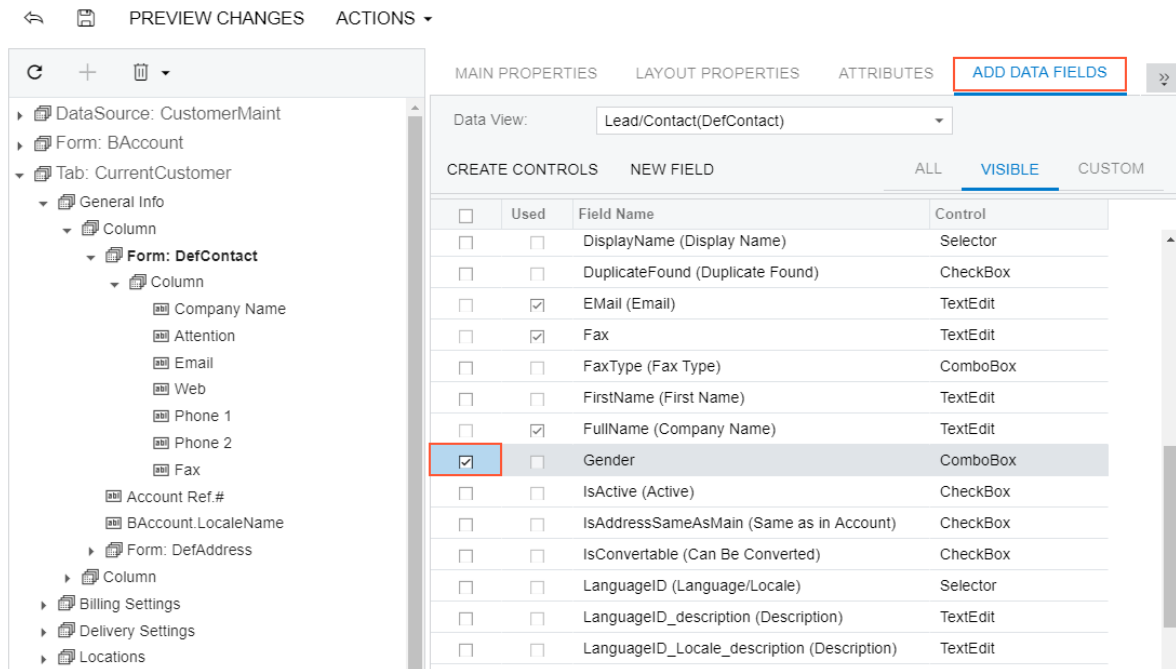
Because this change must be saved in a customization project, you have to use the [Screen Editor](#) to delete the old definition of the box and to add the new one.

To change the type of a box in a container on a form and to include this modification in a customization project, perform the following actions:

1. Select the box in the Screen Editor, as described in [To Select a Box in the Screen Editor](#).
2. On the toolbar of the Control Tree, click **Delete**.

3. Click the **Add Data Fields** tab item (see the screenshot below).
4. If you need to create a control for a data field that is not accessible through the data view specified for the container in the `DataMember` property, but is accessible through another data view of the same graph, and the **Data View** box gives you the availability to select a data view, select the needed data view in this box. (See [Use of Multiple Data Views for Boxes in Containers](#) in the Acumatica Framework Guide for details.)
5. On the tab item, click the **All**, **Visible**, or **Custom** filter for the fields provided by the data view selected in the **Data View** box to view the appropriate field list.
6. Find the required data field in the **Field Name** column of the list and select the check box for the field in the unlabeled first column, as the following screenshot shows.

Screen Editor: AR303000 (Customers)



**Figure: Selecting a data field for which a box is to be created**

For each data field in the list, the Screen Editor presets the most appropriate control type. However you can select another control type to be created for a field.



: The control type must match the field type. Otherwise, the control cannot work properly with the field data. If you create a control that does not match the data field, you have to update the data field in the DAC (see [To Customize a Field on the DAC Level](#) for details) or in the graph. (See [To Customize a Field on the Graph Level](#) for details.)

7. If you need to change the type of the control to be created, select the needed type in the **Control** column of the selected field.
8. On the list toolbar, click **Create Controls**.  
The platform creates a box for the selected data field and adds to the Control Tree a node for the box.
9. Click **Save** to save your changes to the customization project.

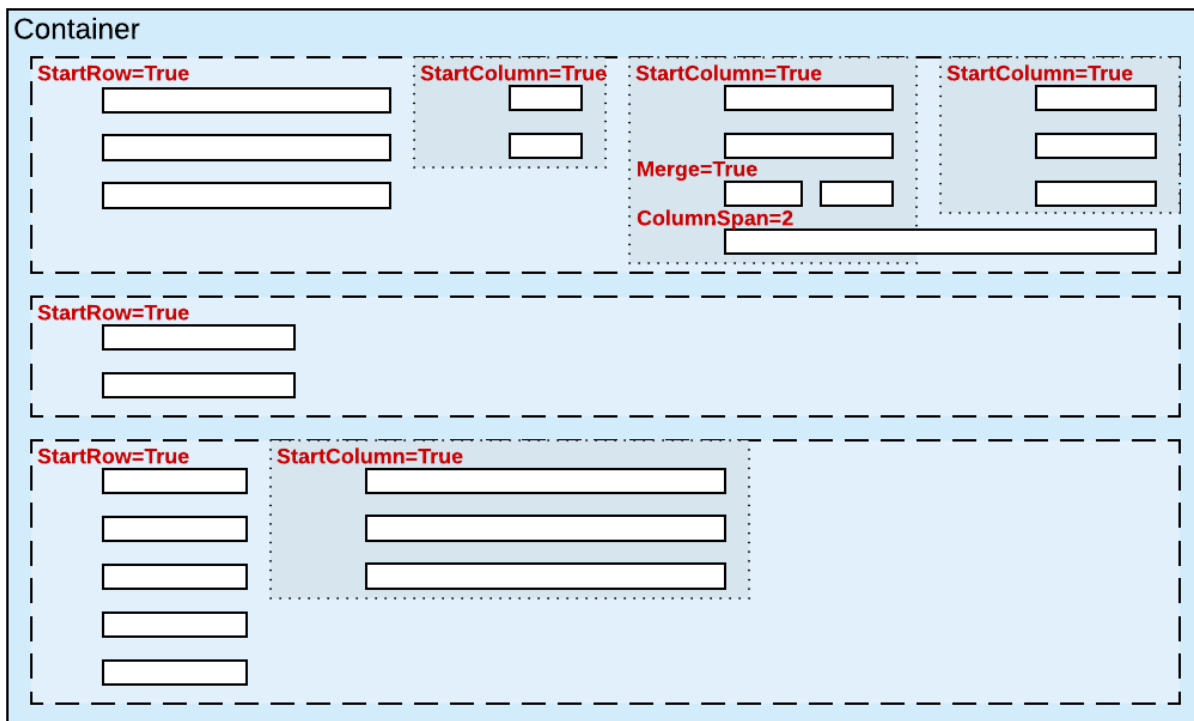
## Layout Rule (PXLayoutRule)

The layout of a form is organized into a table of controls, with each control located within a certain column and row. The columns and rows are defined by `PXLayoutRule` components added to the layout

of the form. The properties of the `PXLayoutRule` component provide the position of the underlying controls and their size and appearance in the UI.

You can use the `PXLayoutRule` component to do the following to manage the layout of UI elements within a container:

- Place controls in multiple rows and columns to uniformly distribute them on the form or tab area of a form (see the diagram below)
- Cause controls to span multiple columns
- Merge controls into one row of the column to align them horizontally
- Adjust the widths of controls and labels
- Hide the labels of controls
- Group controls for users' convenience



**Figure: Layout rules to arrange controls within a container**

A layout rule, as the diagram below shows, can be immediately added to the following types of containers:

- `PXFormView`
- `RowTemplate`
- `PXTabItem`
- `PXSmartPanel`

The Acumatica Customization Platform supports the following properties for a `PXLayoutRule` component.

Property	Description
ColumnSpan	Specifies the number of columns spanned by a control placed below the target <code>PXLayoutRule</code> component. This property applies to a single control that is under the layout rule in the ASPX code. (See <a href="#">Use of the ColumnSpan Property of PXLayoutRule</a> in the Acumatica Framework Guide for details.)
ColumnWidth	Defines the width (in pixels) of a column containing controls. You can set the property to a predefined value (see <a href="#">Predefined Size Values</a> in the Acumatica Framework Guide for details) or to a value in pixels. The specified width is applied to the column and is not changed when the <code>LabelsWidth</code> property value is specified for the same <code>PXLayoutRule</code> component and when the <code>Size</code> , <code>Width</code> , or <code>LabelWidth</code> property value is specified for a control contained within a column. (See <a href="#">Use of the ColumnWidth, ControlSize, and LabelsWidth Properties of PXLayoutRule</a> in the Acumatica Framework Guide for details.)
ControlSize	Defines the width for the controls placed within a column. The <code>ControlSize</code> property value is assigned from the predefined list of items. (See <a href="#">Predefined Size Values</a> in the Acumatica Framework Guide for details.) The specified size is applied to all controls contained within the column if you do not override the size separately for a control by specifying the <code>Size</code> or <code>Width</code> property values. (See <a href="#">Use of the ColumnWidth, ControlSize, and LabelsWidth Properties of PXLayoutRule</a> in the Acumatica Framework Guide for details.)
GroupCaption	Specifies the caption for the group of controls that is started from the control placed under this rule in the ASPX code. Any rule that has the <code>GroupCaption</code> property value set requires a rule with the <code>EndGroup</code> property value set to <code>True</code> below the last control of the group in the code. All controls between the starting and ending group rules are included in the group. (See <a href="#">Use of the GroupCaption, StartGroup, and EndGroup Properties of PXLayoutRule</a> in the Acumatica Framework Guide for details.)

Property	Description
EndGroup	Indicates that the control above the rule in the ASPX code is the last control in the group that starts from the <code>PXLayoutRule</code> component with a specified <code>GroupCaption</code> property value. (See <a href="#">Use of the GroupCaption, StartGroup, and EndGroup Properties of PXLayoutRule</a> in the Acumatica Framework Guide for details.)
LabelsWidth	Defines the width (in pixels) of the control labels placed within a column. You select the <code>LabelsWidth</code> property value from the predefined list of items (see <a href="#">Predefined Size Values</a> in the Acumatica Framework Guide for details) or by typing the width in pixels. The specified size is applied to all control labels contained within the column if you do not override the size separately for a control by specifying the <code>LabelWidth</code> property value. (See <a href="#">Use of the ColumnWidth, ControlSize, and LabelsWidth Properties of PXLayoutRule</a> in the Acumatica Framework Guide for details.)
Merge	Is used to merge controls into one row and to horizontally align the controls that are placed under this rule in the ASPX code. The first <code>PXLayoutRule</code> component added under this rule in the code stops the merging, and the next control is placed alone beneath the merged controls as the leftmost control of the current column. To cancel merging for all controls that follow, you must add the <code>PXLayoutRule</code> component without the adjusted property value. (See <a href="#">Use of the Merge Property of PXLayoutRule</a> in the Acumatica Framework Guide for details.)
StartGroup	Starts the group of controls from the control placed under this rule in the ASPX code. If the <code>GroupCaption</code> property value is not set to <code>True</code> , the group is displayed without a caption. Any rule that has the <code>StartGroup</code> property value set requires a rule with the <code>EndGroup</code> property value set to <code>True</code> below the last control of the group in the code. All controls between the starting and ending group rules in the code are included in the group. (See <a href="#">Use of the GroupCaption, StartGroup, and EndGroup Properties of PXLayoutRule</a> in the Acumatica Framework Guide for details.)
StartRow	If set to <code>True</code> , starts a new row for the controls following this rule. (See <a href="#">Use of the StartRow and StartColumn Properties of PXLayoutRule</a> in the Acumatica Framework Guide for details.)
SuppressLabel	Hides all control labels within a column. All control labels placed within the column are hidden if you do not override them separately for a control by specifying a <code>SuppressLabel</code> property value. (See <a href="#">Use of the SuppressLabel Property of PXLayoutRule</a> in the Acumatica Framework Guide for details.)

By specifying the values of these properties, you can make a variety of changes to the UI. Some properties affect only the next control under the `PXLayoutRule` component in the ASPX code. Other properties affect all controls under the rule until the next rule is encountered in the code. Still other properties require a corresponding ending rule. For instance, the rule with the `GroupCaption` property value specified requires that a corresponding rule be set with the `EndGroup` property value. All controls in the code between the `GroupCaption` and `EndGroup` rules become part of the group.

To create a layout rule in a container, follow the instructions described in [To Add a Layout Rule](#).

To delete a layout rule from a container, perform the actions described in [To Delete a Child UI Element](#).

For detailed information on working with the content of a grid container, see the following topics:

- [To Select a Layout Rule in the Screen Editor](#)
- [To Set a Layout Rule Property](#)

## To Select a Layout Rule in the Screen Editor

To start the customization of a layout rule, you have to select it in the [Screen Editor](#). To do this, perform the following actions.

1. Open the form that contains the container with the layout rule, so that the container is displayed on the screen.

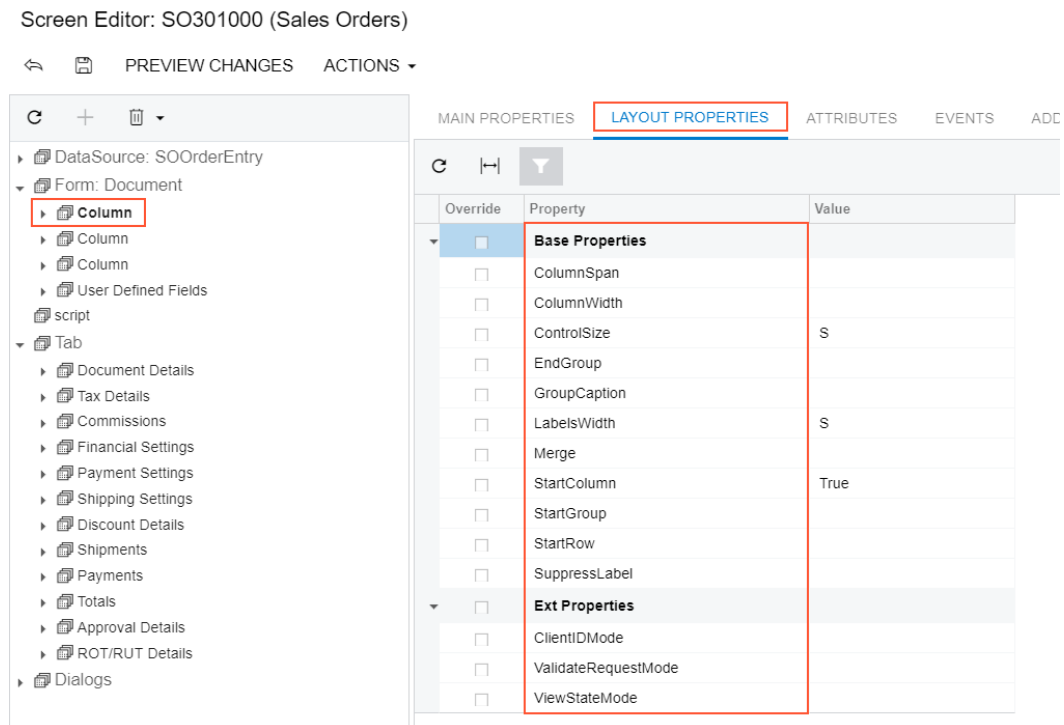
- On the form title bar, click **Customization > Inspect Element** to launch the [Element Inspector](#).
- On the form, click the area of the container to be customized, to open the [Element Properties Dialog Box](#) for the container.
- In the dialog box, click **Customize**.
- If there is no currently selected customization project and the inspector opens the [Select Customization Project Dialog Box](#), select an existing customization project or create a new one. (See [To Select an Existing Project](#) and [To Create a New Project](#) for details.)  
If the customization project does not contain a changeset for the form, the [Customization Project Editor](#) adds to the project a *Page* item for the form to keep in the database the changeset to the ASPX code of the form. The container is opened in the [Screen Editor](#) and selected in the Control Tree of the editor.
- If the required layout rule is not displayed in the Control Tree, expand the subnodes of the container node to display the rule.
- In the Control Tree, select the layout rule to start the customization.

When you click **Save** on the editor toolbar, the editor updates the *Page* item in the database.

## To Set a Layout Rule Property

To include in a customization project changes to properties of a layout rule, you have to modify the properties by using the [Screen Editor](#). To start setting the properties of a layout rule, perform the following actions:

- Select the layout rule in the Screen Editor, as described in [To Select a Layout Rule in the Screen Editor](#).
- Click the **Layout Properties** tab item to open the list of layout properties for the rule. (See the following screenshot.)



**Figure: Viewing the list of layout rule properties in the Screen Editor**

- Specify values for the required properties.
- Click **Save** to save changes in the customization project.

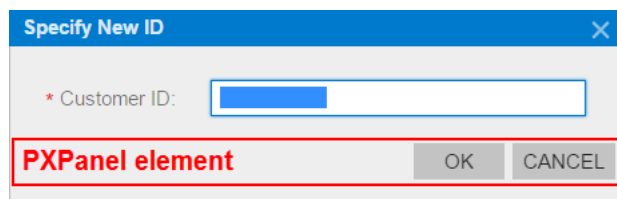
The most important properties of the `PXLayoutRule` component are described in the following topics of the Acumatica Framework Guide:

- [Use of the StartRow and StartColumn Properties of PXLayoutRule](#)
- [Use of the ColumnWidth, ControlSize, and LabelsWidth Properties of PXLayoutRule](#)
- [Predefined Size Values](#)
- [Use of the ColumnSpan Property of PXLayoutRule](#)
- [Use of the Merge Property of PXLayoutRule](#)
- [Use of the GroupCaption, StartGroup, and EndGroup Properties of PXLayoutRule](#)
- [Use of the SuppressLabel Property of PXLayoutRule](#)

## Panel (PXPanel)

In a container with controls for a single data record, you can use a `PXPanel` element as a container with a caption to group controls. However we recommend that you use the `PXLayoutRule` component for this purpose. (See [Layout Rule \(PXLayoutRule\)](#) for details.)

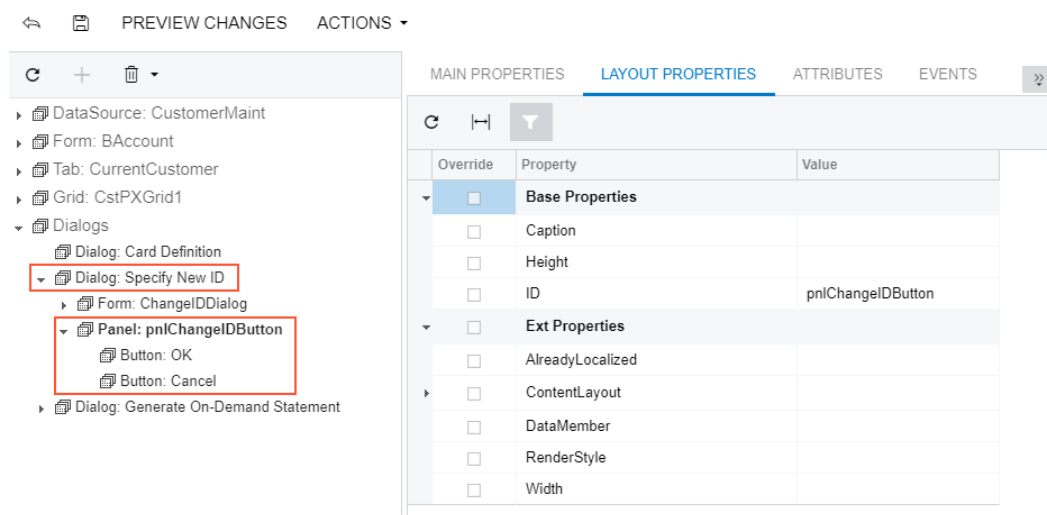
In Acumatica ERP, a panel is used as a container to display a horizontal row of buttons with right alignment in a dialog box (see [Dialog Box \(PXSmartPanel\)](#) for details), as the following screenshot shows.



**Figure: Using a panel as a button container in a dialog box**

If you open the dialog box displayed in the screenshot above in the Screen Editor, you can see that the panel is located below a form container and contains two buttons.

Screen Editor: AR303000 (Customers)



**Figure: Viewing the panel content in the Screen Editor**

You can add the `PXPanel` element to a dialog box and buttons to this element, as described in [To Add Another Supported Control](#) and [To Use a Button in a Dialog Box](#). In a panel, to arrange buttons in a



horizontal row with right alignment, you can specify the `SkinID` property of the `PXPanel` element, as described in [Use of the SkinID Property of Containers](#) in the Acumatica Framework Guide.

## Group Box (PXGroupBox)

In a container with controls for a single data record, you can use a `PXGroupBox` element as a container with a caption to group controls. However we recommend that you use the `PXLayoutRule` component for this purpose. (See [Layout Rule \(PXLayoutRule\)](#) for details.)

In Acumatica ERP, the `PXGroupBox` element is designed to be exclusively used as a radio button container to render a drop-down data field as a set of radio buttons. It contains scripts with the logic to support a nested radio button for each value of a drop-down field.

A group box for a drop-down data field can be immediately added to the following types of containers:

- `PXFormView`
- `RowTemplate`
- `PXTabItem`

To add a `PXGroupBox` element to a container, follow the instructions described in [To Add Another Supported Control](#).

To delete a group box from a container, follow the instructions described in [To Delete a Child UI Element](#).

For detailed information on customizing a group box, see the following topics:

- [To Open a Group Box in the Screen Editor](#)
- [To Create a Group Box for a Drop-Down Field](#)
- [To Set a Group Box Property](#)

## To Open a Group Box in the Screen Editor

To start the customization of a group box on a form, you have to open it in the [Screen Editor](#). To do this, perform the following actions:

1. Open the form to display the appropriate set of radio buttons in the browser.



: In Acumatica ERP, a radio button can work properly only in a `PXGroupBox` container that is used for a drop-down data field.

2. On the form title bar, click **Customization > Inspect Element** to launch the [Element Inspector](#).



: If you need to activate the [Element Inspector](#) for a pop-up panel, a dialog box, or another UI element that opens in modal mode and makes the [Customization Menu](#) unavailable for selection, you can press Control-Alt.

3. On the form, click the area with radio buttons to open the [Element Properties](#) dialog box for the group box.
4. In the dialog box, click **Customize**.
5. If there is no currently selected customization project and the inspector opens the [Select Customization Project Dialog Box](#), select an existing customization project or create a new one. (See [To Create a New Project](#) and [To Select an Existing Project](#) for details.)

If the customization project does not contain a changeset for the form, the [Customization Project Editor](#) adds to the project a *Page* item for the form, to keep the changeset to the ASPX code of the form in the database. The group box is opened in the [Screen Editor](#), and you can start the customization of the box and the nested radio buttons.

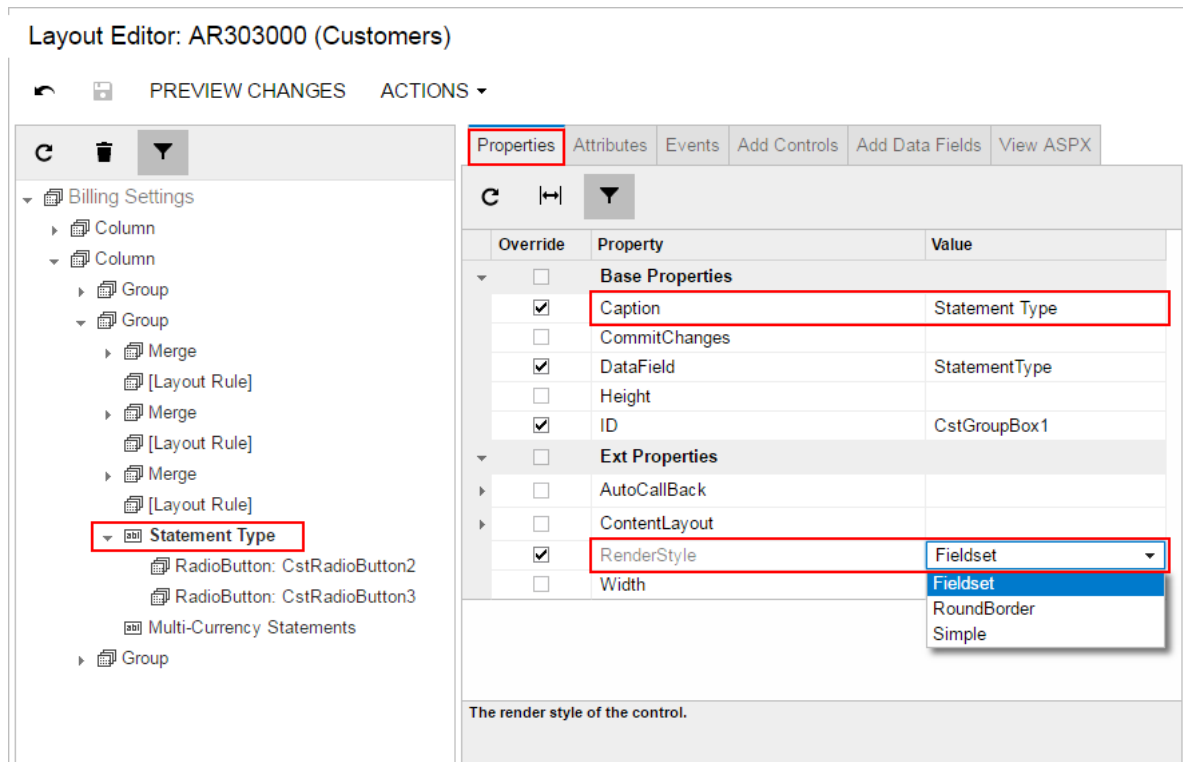
When you click **Save** on the editor toolbar, the editor updates the *Page* item in the database.

## To Create a Group Box for a Drop-Down Field

In Acumatica ERP, the `PXDropDown` box type is generally used to display on a form a field with a list attribute, such as `PXStringList`, `PXIntList`, or `PXDecimalList`. However if you want to display such a field as a set of radio buttons, where one radio button is used to display and select each single constant value of the field, you can create a `PXGroupBox` element and include `PXRadioButton` elements in it.

To create a group box for a drop-down data field in a container, perform the following actions:

1. Open the container in the Screen Editor, as described in [To Open a Container in the Screen Editor](#).
2. In the container, add a group box, as described in [To Add Another Supported Control](#).
3. For the new group box, specify the `DataField` property to bind the box to the data field. See [To Set a Group Box Property](#) and [Use of the DataField Property of PXGroupBox](#) for details.
4. If required, specify the `Caption` and `RenderStyle` properties of the group box, as the following screenshot shows.



**Figure: Setting the properties of a group box**

(See [Use of the Caption Property of PXGroupBox](#) and [Use of the RenderStyle Property of PXGroupBox](#) in the Acumatica Framework Guide for details.)

5. For each value defined in the field list, do the following:
  - a. To the group box node of the Control Tree, add a radio button, as described in [To Add Another Supported Control](#).
  - b. In the C# code, find the value (usually it is an one-symbol value) in the list.
  - c. On the **Layout Properties** tab item, enter this value in the `Value` property.
6. Click **Save** to save changes in the customization project.

For example, as the result of the described actions for the `StatementType` data field with the `O` and `B` values defined in the list, you might get the following ASPX code.

```
<px:PXGroupBox runat="server" ID="CstGroupBox1" DataField="StatementType"
    Caption="Statement Type" RenderStyle="Fieldset">
    <Template>
        <px:PXRadioButton runat="server" ID="CstRadioButton2" Value="O" />
        <px:PXRadioButton runat="server" ID="CstRadioButton3" Value="B" />
    </Template>
</px:PXGroupBox>
```

## To Set a Group Box Property

To include changes to the properties of a group box in a customization project, you have to modify the properties by using the [Screen Editor](#). To start setting the properties of a group box, perform the following actions:

1. Select the group box in the Screen Editor, as described in [To Open a Group Box in the Screen Editor](#).
2. Click the **Layout Properties** tab item to open the list of properties for the group box.
3. Specify values for the required properties.
4. Click **Save** to save your changes to the customization project.

To bind a group box to a data field, you have to specify the `DataField` property, as described in [Use of the DataField Property of PXGroupBox](#) in the Acumatica Framework Guide.

To set a caption for a group box, you use the `Caption` property. (See [Use of the Caption Property of PXGroupBox](#) in the Acumatica Framework Guide for details.)

To define the style of the group box on the form, you have to select a value of the `RenderStyle` property, see [Use of the RenderStyle Property of PXGroupBox](#) in the Acumatica Framework Guide for details.

## Label (PXLabel)

In a container with controls for a single data record, you can use a `PXLabel` element to display text. For example, you should use a label to render on a form static text that is stored in the ASPX code.

A `PXLabel` element can be immediately added to the following types of containers:

- `PXFormView`
- `RowTemplate`
- `PXTabItem`
- `PXSmartPanel`

You can view the use of the `PXLabel` elements, for example, in the **Aging Settings** group on the Statement Cycles (AR202800) form, shown in the following screenshot.

The screenshot shows the Acumatica Accounts Receivable Statement Cycles form. The left sidebar contains a navigation menu with 'Statement Cycles' highlighted. The main form area is divided into three sections: GENERAL SETTINGS, AGING SETTINGS, and FINANCE CHARGE SETTINGS. In the AGING SETTINGS section, there is a table with columns 'Aging Period', 'Days Due', and 'Message Description'. The 'Aging Period' column has four rows labeled 1, 2, 3, and 4. The 'Days Due' column has four rows with values 0, 0, 0, and 'Over Days'. The 'Message Description' column has four rows with asterisks. The 'FINANCE CHARGE SETTINGS' section has checkboxes for 'Apply Overdue Charges' and 'Require Overdue Charges Calculation Before Statement', and a field for 'Overdue Charge ID'.

**Figure: Viewing the labels on the Statement Cycles form**

The use of a label can be required when a field contains a quantity, but you need to add a unit type for the value. For example, if you need to display a field as **Duration** [value] **Days**, where *Duration* is the value of the `DisplayName` parameter of the `PXUIField` attribute of the field, you have to add a `PXLabel` element that contains the *Days* string constant. To arrange the label in the same column as the field, you need to use the `Merge` layout rule, as described in [To Set a Layout Rule Property](#) and [Use of the Merge Property of PXLayoutRule](#).

You can add the `PXLabel` element to a container, as described in [To Add Another Supported Control](#).

To delete a label from an ASPX page, follow the instructions described in [To Delete a Child UI Element](#).

## Radio Button (PXRadioButton)

In Acumatica ERP, a radio button can work properly only in a `PXGroupBox` container. (See [Group Box \(PXGroupBox\)](#) for details.) A `PXGroupBox` element contains scripts to provide the appropriate logic to use a nested radio button for a single constant value of a bound drop-down data field.

To use a `PXRadioButton` element on a form, follow the instructions described in [To Create a Group Box for a Drop-Down Field](#).

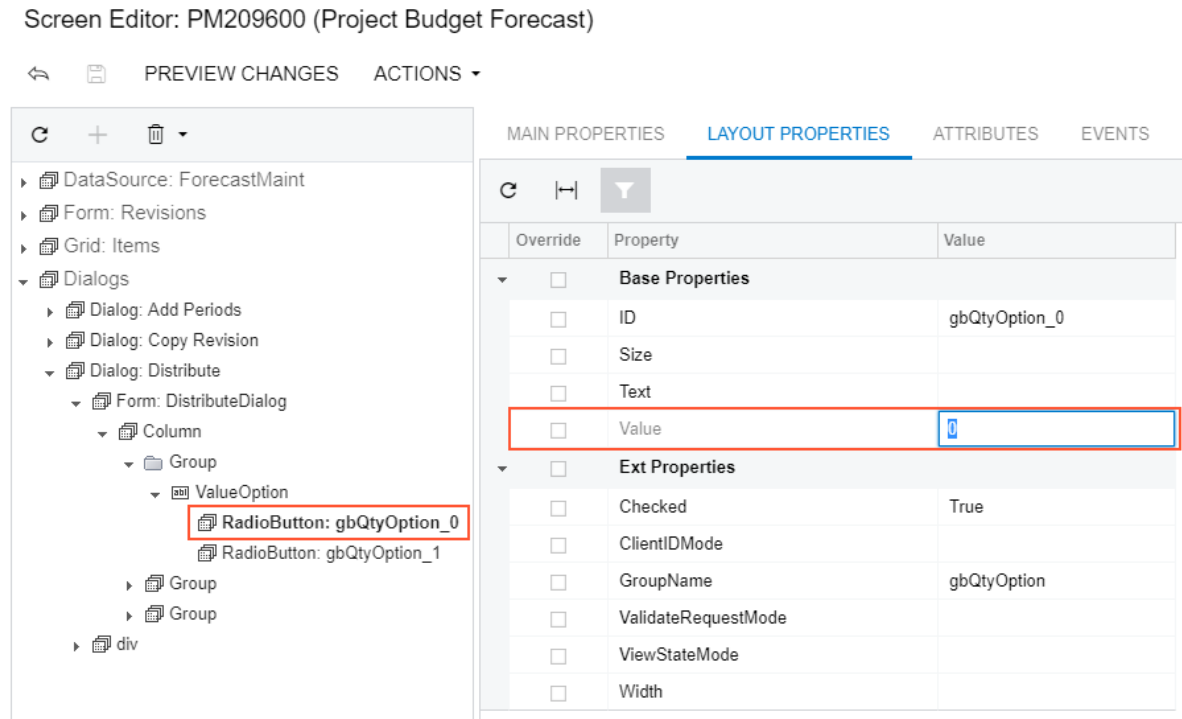
To bind a radio button to a value from the list of a drop-down data field, follow the instructions described in [To Bind a Radio Button to a Value in the List of a Data Field](#).

### To Bind a Radio Button to a Value in the List of a Data Field

In the parent group box, to bind a radio button to a value in the list of a drop-down data field that is bound to this group box, perform the following actions:

1. Open the group box in the Screen Editor, as described in [To Open a Group Box in the Screen Editor](#).
2. In the Control Tree, select the node of the radio button.
3. Click the **Layout Properties** tab item to open the list of properties for the radio button.

4. Set the `Value` property to an appropriate value (usually it is a one-symbol value) of the list defined in the C# code, as the following screenshot shows.



**Figure: Setting the `Value` property of a radio button**

5. Click **Save** to save your changes to the customization project.

## Button (PXButton)

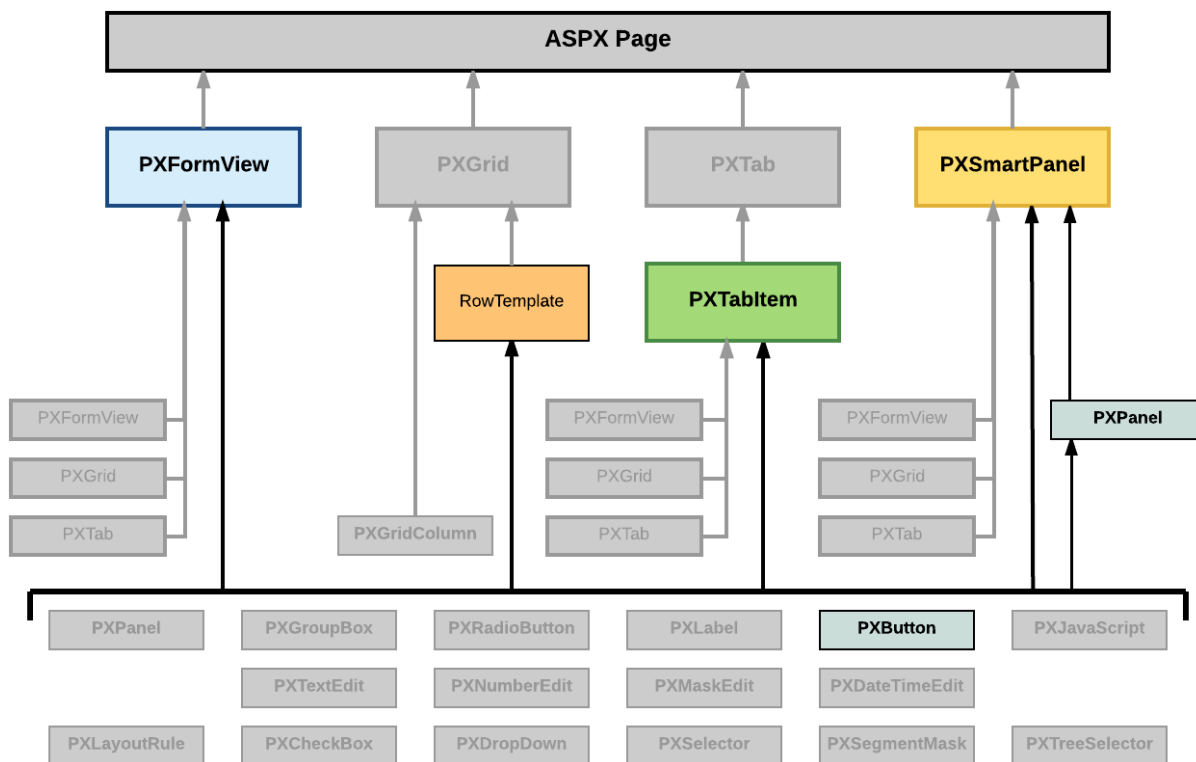
In Acumatica ERP, the `PXButton` element is used for the following purposes:

- In a dialog box—to display a button that closes the dialog box and returns a predefined `DialogResult` value
- In a container with controls for a single data record (including a dialog box) of a form—to display a button that invokes a method defined in the graph, which provides the business logic for the form

The most common use case of the `PXButton` element is in a dialog box.

A button, as the diagram below shows, can be immediately added to the following types of containers:

- `PXFormView`
- `RowTemplate`
- `PXTabItem`
- `PXSmartPanel`
- `PXPanel`



**Figure: Nesting rules for a button in an ASPX page**

To create a button in a container, follow the instructions described in [To Add Another Supported Control](#).

To delete a button from a container, follow the instructions described in [To Delete a Child UI Element](#).

For detailed information about using a button, see the following topics:

- [To Use a Button in a Dialog Box](#)
- [To Use a Button to Invoke a Method](#)

## To Use a Button in a Dialog Box

In a dialog box, you can create buttons of the following types:

- A standard button that invokes no method but closes the dialog box and returns a specified predefined value, which can be processed by the method that has opened the dialog box



: To arrange buttons in a horizontal row with right alignment in a dialog box, we recommend that you use the `PXPanel` container with the `SkinID` property set to `Buttons`.

- A button that invokes a method of the graph that provides business logic for the form

To add a standard button to a `PXPanel` container of a dialog box, perform the following actions:

1. Add the button to a `PXPanel` container, as described in [To Add Another Supported Control](#).
2. In the Control Tree of the Screen Editor, select the node of the new button.
3. Click the **Layout Properties** tab item to open the list of properties for the button.
4. Specify values for the following properties:

- a. `DialogResult`: Specify the value that is returned when the button closes the dialog box. Set the property to one of the following values defined in the `WebDialogResult` enumerator.

Value	Description
OK	The user clicked a button with the <code>DialogResult</code> property set to <code>OK</code> .

Value	Description
<i>Cancel</i>	The user clicked a button with the <code>DialogResult</code> property set to <i>Cancel</i> .
<i>Abort</i>	The user clicked a button with the <code>DialogResult</code> property set to <i>Abort</i> .
<i>Retry</i>	The user clicked a button with the <code>DialogResult</code> property set to <i>Retry</i> .
<i>Ignore</i>	The user clicked a button with the <code>DialogResult</code> property set to <i>Ignore</i> .
<i>Yes</i>	The user clicked a button with the <code>DialogResult</code> property set to <i>Yes</i> .
<i>No</i>	The user clicked a button with the <code>DialogResult</code> property set to <i>No</i> .

When the user clicks the added button, the dialog box is closed, and the specified value is returned to the method that has opened the dialog box.

- b. **Text:** Specify the text to be displayed on the button.



: In the `Text` property of a standard button, you can define any text, regardless of the value of the `DialogResult` property.

5. Click **Save** to save changes in the customization project.

The following ASPX code snippet creates a panel with two standard buttons arranged a horizontal row with right alignment.

```
<px:PXPanel ... SkinID="Buttons">
  <px:PXButton ... DialogResult="OK"      Text="Next" />
  <px:PXButton ... DialogResult="Cancel" Text="Return" />
</px:PXPanel>
```

If you need to include in the same dialog box a button that invokes a method of the graph, you can add the button to the same `PXPanel` container and set the button properties as described in [To Use a Button to Invoke a Method](#).

## To Use a Button to Invoke a Method

You can use the `PXButton` element on a form to invoke a method of the graph that provides business logic for the form.

To include in a container a button that invokes a method of the graph, perform the following actions:

1. Open the container in the Screen Editor, as described in [To Open a Container in the Screen Editor](#).
2. Add the button to the container, as described in [To Add Another Supported Control](#).
3. In the Control Tree of the Screen Editor, select the node of the new button.
4. Click the **Layout Properties** tab item to open the list of properties for the button.
5. Specify values for the following properties:

- a. **CommandSourceID:** Set the property to the value specified in the `ID` property of the `PXDataSource` control.

- b. **CommandName:** In the property, specify the name of the method to be invoked when the user clicks the button on the form.



: The method must be defined in the graph that is specified in the `TypeName` property of the `PXDataSource` control.

- c. **Text:** Specify the text to be displayed on the button.

6. Click **Save** to save your changes to the customization project.

The following ASPX code creates a button that invokes the *MethodName* method referenced in the *PXDataSource* control with the *ID* property set to *ds*.

```
<px:PXButton ... CommandName="MethodName" CommandSourceID="ds" Text="ButtonText" />
```

The *MethodName* method must be referenced in a *PXDSCallbackCommand* element of the *PXDataSource* control as follows.

```
<px:PXDataSource ID="ds" ... TypeName="PX.Objects.<GraphName>" ...>
  <CallbackCommands>
    ...
    <px:PXDSCallbackCommand Name="MethodName" Visible="False" ... />
    ...
  </CallbackCommands>
</px:PXDataSource>
```



: You can see all available *PXDSCallbackCommand* elements in the Control tree. They are added there automatically.

## Java Script (PXJavaScript)

The *PXJavaScript* element is designed to keep JavaScript code in an ASPX page.

A *PXJavaScript* control can be immediately added to the following types of containers:

- *PXFormView*
- *RowTemplate*
- *PXTabItem*
- *PXSmartPanel*
- *PXPanel*

To create a JavaScript control in a container, follow the instructions described in [To Add Another Supported Control](#).

To delete a JavaScript control from a container, follow the instructions described in [To Delete a Child UI Element](#).

For a detailed example of using a JavaScript control, see [How do I play a sound in response to a custom action or button in Acumatica?](#).

## Toolbars, Action Buttons, and Menus

On an Acumatica ERP form, toolbars, action buttons, and menus are the types of UI elements that are created and processed by the graph that is specified in the *TypeName* property of the *PXDataSource* control and provides business logic for the form. Therefore, these UI elements cannot be created or customized by using the Screen Editor. See [Customizing Business Logic](#) for details.

The standard page toolbar buttons include data manipulation (**Insert**, **Delete**, **Save**, and **Cancel**), navigation (**Next**, **Previous**, **First**, and **Last**), and clipboard (**Copy** and **Paste**). Every toolbar button corresponds to an action declared in the graph. You can use explicit or implicit declaration of actions to add standard buttons to the toolbar. To add standard toolbar buttons to the form and add selector controls, in the graph class declaration, specify the main DAC as the second type parameter of *PXGraph*, as the following code shows.

```
public class GraphName : PXGraph<GraphName, MainDACName>
{
    public PXSelect<MainDACName> PrimaryDataViewName;
```



```
}
```

To add a custom action to a form toolbar, you use [Code Editor](#) to create the action declaration in the graph extension. See [To Add an Action](#) for details.

To create a menu on a form toolbar, in the graph or graph extension, you have to declare one action as a menu holder on the toolbar, and then declare all required actions and add these actions to the menu holder by using the `AddMenuAction` method of the `PXAction` class.

## Other Control Types

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The Acumatica Customization Platform does not support some control types, such as `PXSplitContainer` and `PXTreeView`, that are supported by the Acumatica Framework. However the Acumatica Customization Platform gives you the ability to add a control of an unsupported type to an Acumatica ERP form and save the change to a customization project.

To do this, perform the following actions:

1. Open the form in the [Screen Editor](#), as described in [To Start a Customization of a Form](#).
2. On the editor toolbar, click **Actions > Edit ASPX** to open the ASPX code of the form in the [ASPX Editor](#).
3. Modify the code in the editor.
4. Click **Generate Customization Script** to save to the customization project the changes to the *Page* item for the form.

After you have added a new control to the customization project, you can select the control node in the Control Tree of the Screen Editor and specify the control properties, as described in [To Set a Box Property](#).

# Customizing Business Logic

---

Business logic is implemented by overloading certain methods invoked by the system in the process of manipulating data. For such procedures as inserting a data record or updating a data record, the cache controllers generate series of events causing invocation of the methods called event handlers. The application is able to interfere in the series of events on different stages. For this purpose, the application implements methods that are executed as event handlers. Business logic can be divided into common logic relevant to different parts of the application and the logic specific to an application form. The common logic is implemented through event handler methods defined in attributes, while the screen-specific logic is implemented as methods in the associated graph.

You use [Customization Tools](#) of the Acumatica Customization Platform to customize business logic for forms of Acumatica ERP.

The customization of existing business logic is based on the extension technology, which is described in greater detail in [DAC Extensions](#) and [Graph Extensions](#).

This part contains detailed instructions on how to customize a data access class, data field, graph, data view and an action of Acumatica ERP and how to include the changeset in a customization project.

## In This Part

- [Data Access Class](#)
- [Data Field](#)
- [Graph](#)
- [Data View](#)
- [Action](#)

## Data Access Class

---

A data access class (DAC) is used to represent a database table in the code of Acumatica ERP. If a DAC is bound to the database, it must have the same class name as the database table. A data access class is inherited from the `IBqlTable` class and contains data field declarations.

You can use [Customization Project Editor](#) to do the following:

- Create a new DAC
- Add a custom field to an existing DAC
- Customize the declaration of a data field of an existing DAC

For detailed information on customizing data access classes, see the following topics:

- [To Start the Customization of a Data Access Class](#)
- [To Add a Custom Data Field](#)
- [To Create a New DAC](#)
- [To Create a DAC Extension](#)

See [Data Field](#) for detailed instructions on the customization of a data field.

## To Start the Customization of a Data Access Class



: Before you start a DAC customization, we recommend that you check the possibility to use the appropriate business entity attributes, which can be defined on the Attributes form (CS205000), instead of custom fields. See [Usage Entity Attributes Instead of Custom Fields](#) for details.

You might need to customize an existing data access class in the following cases:

- On a form, you want to create a custom data field to be used for a custom control.
- In Acumatica ERP, you want to change the business logic for a data field in the DAC.



**Important:** If multiple Acumatica ERP forms contain controls for the same field, changing an attribute of the field in the DAC modifies the behavior of these controls for the field on all forms.

If you know the name of the data access class to be customized, you can first add a *DAC* item for the class on the Customized Data Classes page of the *Customization Project Editor* (see *To Add a DAC Item for an Existing Data Access Class to a Project* for details) and then click the item to open it in the *Data Class Editor*.

You usually start the customization of a data access class on a form that contains boxes used by users to work with data of an appropriate business entity, such as a sales order invoice.

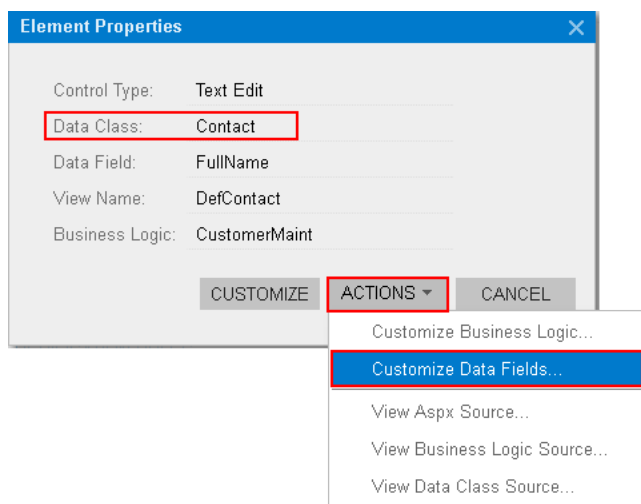
To start the customization of a DAC from a form, perform the following actions:

1. Open the form in the browser.
2. On the form title bar, click **Customization > Inspect Element** to launch the *Element Inspector*.



: If you need to activate the *Element Inspector* for a pop-up panel, a dialog box, or another UI element that opens in modal mode and makes the *Customization Menu* unavailable for selection, you can press Control-Alt.

3. On the form, click the area with the boxes that are used for the data of the business entity, to open the *Element Properties* dialog box for the area.
4. In the **Data Class** box of the dialog box, view the name of the DAC for the element you clicked. (See the following screenshot.) If you are not sure that this DAC is the needed one, click **Cancel** and repeat Step 3.
5. Click **Actions > Customize Data Fields**, as the following screenshot shows.



**Figure: Using the Element Properties dialog box to start the customization of the class**

6. If there is no currently selected customization project and the inspector opens the *Select Customization Project Dialog Box*, select an existing customization project or create a new one (see *To Create a New Project* and *To Select an Existing Project* for details).

If the customization project does not contain a *DAC* item for the data access class, the *Customization Project Editor* adds the item to the project to keep the changes in the database. The *DAC* is opened in the *Data Class Editor*, and you can start the customization of the class.

When you click **Save** on the editor toolbar, the editor updates the *DAC* item in the database.

## Usage Entity Attributes Instead of Custom Fields

Under some circumstances, you will find it best to use entity attributes defined on the Attributes form (CS205000; **Configuration > Common Settings > Common Settings**), while under other circumstances, custom fields will help you better meet the requirements of your customization task.

You might use attributes under the following circumstances:

- You don't need a complex layout for attribute fields because they aren't used for manual input, so you can use the easiest way of creating additional fields.
- You'd prefer an approach that helps you to localize customizations that you make to the system to a limited number of spaces, which in turn helps you to avoid having scattered changes throughout the system.

The use of custom fields provides more functionality than attributes do. Using attributes as columns in a grid can present difficulties. For example, in a grid, you can display columns for either all attributes or none of them. Also, you cannot rename a column for an attribute in a grid.

You might use custom fields under the following circumstances:

- These fields are for manual input and you need a nice-looking layout for them.
- You also have some business logic of validation based on a custom field, so you might need the customization code for these fields.

## To Add a Custom Data Field

You can add a custom data field to an existing data access class by using the [Screen Editor](#) or [Data Class Editor](#), as described in the following sections:

- [By Using the Data Class Editor](#)
- [By Using the Screen Editor](#)

Both of the editors opens the [New Field](#) dialog box, which you use to enter the parameters of the new field and to launch the New Field wizard, which includes an XML declaration of the new field in the *DAC* item for the modified data access class. If the *DAC* item for the modified data access class is absent in the customization project, the wizard creates the appropriate item. Also, the wizard creates a *Table* item with a description of the custom column added to the table for the custom field.

You can select the way a custom field will be stored in the database when you add the field to a data access class. You can add a custom field as one of the following:

- Without mapping to the database
- As a new column to the database table by altering the table schema
- As a name-value pair to a dedicated table without altering the table schema

The detailed information is described in the following sections:

- [To Add a Custom Field Without Mapping to the Database](#)
- [To Add a Custom Field as a New Column](#)
- [To Add a Custom Field as a Name-Value Pair](#)
- [To Delete a Custom Field](#)

To be able to create a control for the new field to be displayed on a form, you have to publish the project to make the system create the column in the database table and compile the customization code. After the publication, you can add the control for the new field to a form by using the Screen Editor. See [To Add a Box for a Data Field](#) or [To Add a Column for a Data Field](#) for details.

### By Using the Data Class Editor

You generally use the [Data Class Editor](#) to add a custom field to a data access class (DAC) and store the changes in the customization project as a *DAC* item. To do this, perform the following actions:

1. Start customization of the data access class, as described in [To Start the Customization of a Data Access Class](#).
2. On the toolbar of the Data Class page, click **Add Field > Create New Field**.
3. In the **New Field** dialog box, which opens, specify the custom field parameters that are described in [Create New Field Dialog Box](#).
4. Click **OK** to save changes in the customization project.

### By Using the Screen Editor

If you customize a form by using the [Screen Editor](#), you may need to create a custom data field to be used to create a new control on the form. By using the editor, you can create a new field in the main DAC of the data view that provides data for the object selected in the Control Tree. To do this, perform the following actions:

1. In the Control Tree of the Screen Editor, select the node of a container to which you intend to add a new control, or a subnode within the container node.
2. Click the **Add Data Fields** tab item.
3. On the table toolbar of the tab item, click **New Field**.
4. In the **New Field** dialog box, which opens, specify the custom field parameters, which are described in [Create New Field Dialog Box](#).
5. Click **OK** to save your changes to the customization project.

### To Add a Custom Field Without Mapping to the Database

To add a custom field without mapping to the database, perform the following actions:

1. Open **Create New Field** dialog box for the data access class [By Using the Data Class Editor](#) or [By Using the Screen Editor](#).
2. In the dialog box, specify the custom field parameters and select *NonPersistedField* in **Storage Type**.
3. Click **OK** to add the field to the data access class.

The New Field wizard includes an XML declaration of the new field in the *DAC* item for the modified data access class. The new field declaration contains the data type attribute that specifies an unbound field, such as `[PXString]`.

### To Add a Custom Field as a New Column

To add a custom field as a new column that will be appended to the original table of Acumatica ERP, perform the following actions:

1. Open the **Create New Field** dialog box for the data access class [by using the Data Class Editor](#) or [by using the Layout Editor](#).
2. In the dialog box, specify the custom field parameters and select *DBTableColumn* in the **Storage Type** box to make the system append the column to the original table in the database.
3. Click **OK** to add the field to the data access class.

The New Field wizard includes an XML declaration of the new field in the *DAC* item for the modified data access class. If the *DAC* item for the modified data access class is absent in the customization project, the wizard creates the appropriate item. Also, the wizard creates a *Table* item with a description of the custom column to be created in the database table for the custom field.

### To Add a Custom Field as a Name-Value Pair

To add a custom field a name-value pairs stored in a dedicated table of Acumatica ERP, perform the following actions:

1. Open **Create New Field** dialog box for the data access class *By Using the Data Class Editor* or *By Using the Screen Editor*.
2. In the dialog box, specify the custom field parameters and select *NameValuePair* in **Storage Type**.
3. Click **OK** to add the field to the data access class.

The New Field wizard includes an XML declaration of the new field in the *DAC* item for the modified data access class. If the *DAC* item for the modified data access class is absent in the customization project, the wizard creates the appropriate item. The wizard doesn't generate any definitions to change the database schema.

### To Delete a Custom Field

To delete a custom field or custom attributes on a field from the data access class, open the data access class in the Data Class Editor and delete the custom field from the field list. If you work in Microsoft Visual Studio, publish the customization project to update the file with the customized data access class in the file system. After the project has been published, the customization will be removed from the data access class.

## To Create a New DAC

You can add a new data access class (DAC) to a customization project by generating the code from the definition of a database table.

To create a custom data access class for a custom database table and add the created item to a customization project, you have to generate the class template on the Code page of the Customization Project Editor.

To do this, perform the following actions:

1. Create the needed custom table in the database by using a database management tool.
2. Generate the DAC code for the customization project as follows:
  - a. Open the customization project in the Project Editor.
  - b. In the navigation pane, click **Code** to open the Code page.
  - c. On the page toolbar, click **Add New Record (+)**.
  - d. In the **Create Code File** dialog box, which opens, select *New DAC* in the **File Template** box.
  - e. In the **Class Name** box, specify the class name that corresponds to the name of the table created in the database.
 
 : If you have just created the table, restart Internet Information Services (IIS) or recycle the application pool to make sure that Acumatica ERP is aware of the new table, because it caches the database schema once, when the domain starts.
  - f. Select the **Generate Members from Database** check box.
  - g. Click **OK**.

The platform does the following:

- Generates the data access class with members that correspond to the table columns. The class is added to the namespace of the customization project.
- Adds the class to the customization project as a *Code* item.
- Saves the customization project.

- Opens the created item in the [Code Editor](#).

You can use the Code Editor to modify the generated code. After you publish the customization project, you can work with the custom data access class in MS Visual Studio.

3. In the Code Editor, define the key fields in the DAC. To include a data field in the key, in the type attribute of the field, you have to add the `IsKey` parameter, as the example below shows.

```
[PXDBString(15, IsKey=true)]
```

4. Add the table definition to the customization project by doing the following:
  - a. In the navigation pane of the Project Editor, click **Database Scripts**.
  - b. On the Database Scripts page, which opens, click **Add > Custom Table Schema**.
  - c. In the **Add Custom Table Schema** dialog box, which opens, select the custom table in the **Table** box, and click **OK**.

The platform does the following:

- Adds the XML definition of the table to the customization project as an *Sql* item
- Saves the customization project

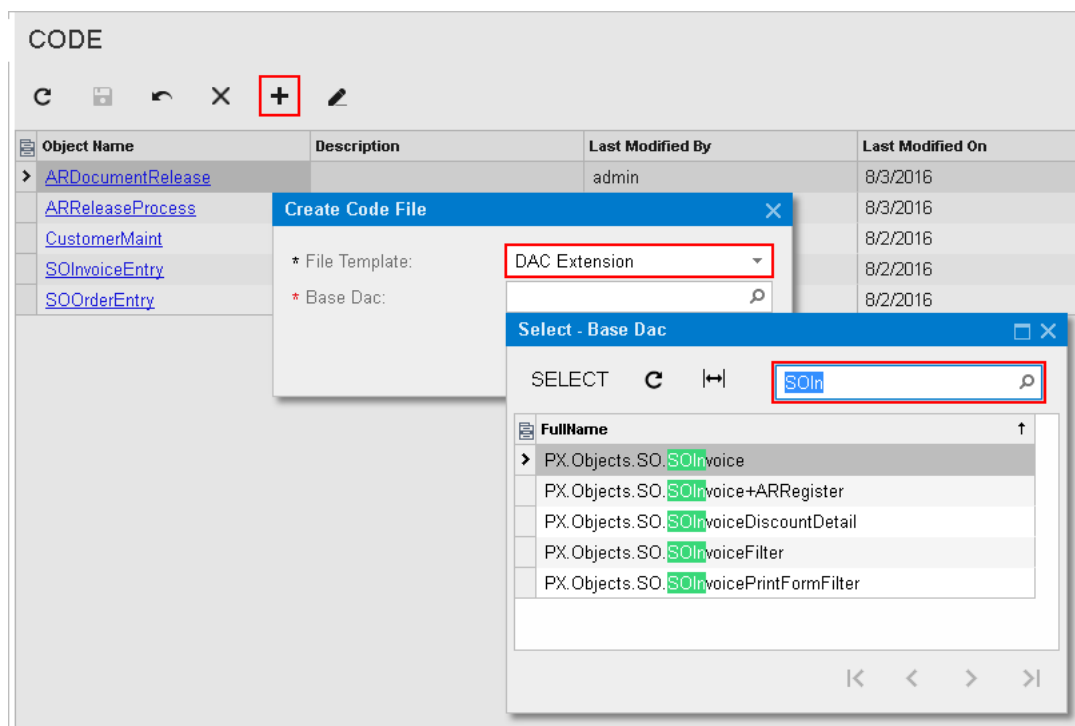
Every time you publish the customization project, the system checks whether a table with this SQL definition exists in the database. If the table doesn't exist, the system creates the table. If the table exists, the system adjusts the table schema if there is any difference between the existing table schema and the table schema from the customization project (no data is truncated).

## To Create a DAC Extension

If you know the name of the data access class to be customized, you can create a *Code* item with the DAC extension template on the Code page of the Customization Project Editor by using the **Create Code File** dialog box.

To do this, perform the following actions:

1. Open the customization project in the editor. (See [To Open a Project](#) for details.)
2. Click **Code** in the navigation pane to open the Code page.
3. Click **Add New Record (+)** on the page toolbar.
4. In the **Create Code File** dialog box, which opens, select *DAC Extension* in the **File Template** box, as the screenshot below shows.
5. In the **Base DAC** box, select the name of the data access class to be customized.
6. Click **OK**.



**Figure: Adding a Code item with the DAC extension to the project**

The platform creates the template of the class that is derived from the `PXCacheExtension<>` class, saves the code as a *Code* item of the project in the database, and opens the item in the *Code Editor*.

## Data Field

In a data access class (DAC), a data field declaration consists of the following elements:

- A public abstract class that implements the `PX.Data.IBqlField` interface. This abstract class is used as a *type* to reference the field in the BQL statements specified in the data views and attributes added to data field declarations.
- Attributes that provide the common business logic for the field. On a field, you use attributes to define the data field specification, which includes multiple parameters, such as the data type, default value, and field caption in the UI. The type attribute, such as `PXDBString` and `PXDBDecimal`, is the only mandatory attribute of a DAC field.
- A public virtual property of a nullable data type that corresponds to the data type of this field. This property keeps the value of the data field. The attributes are added to the property and not to the abstract class of the data field declaration.

For a data field, you can customize only field attributes. You do this in one of the following ways:

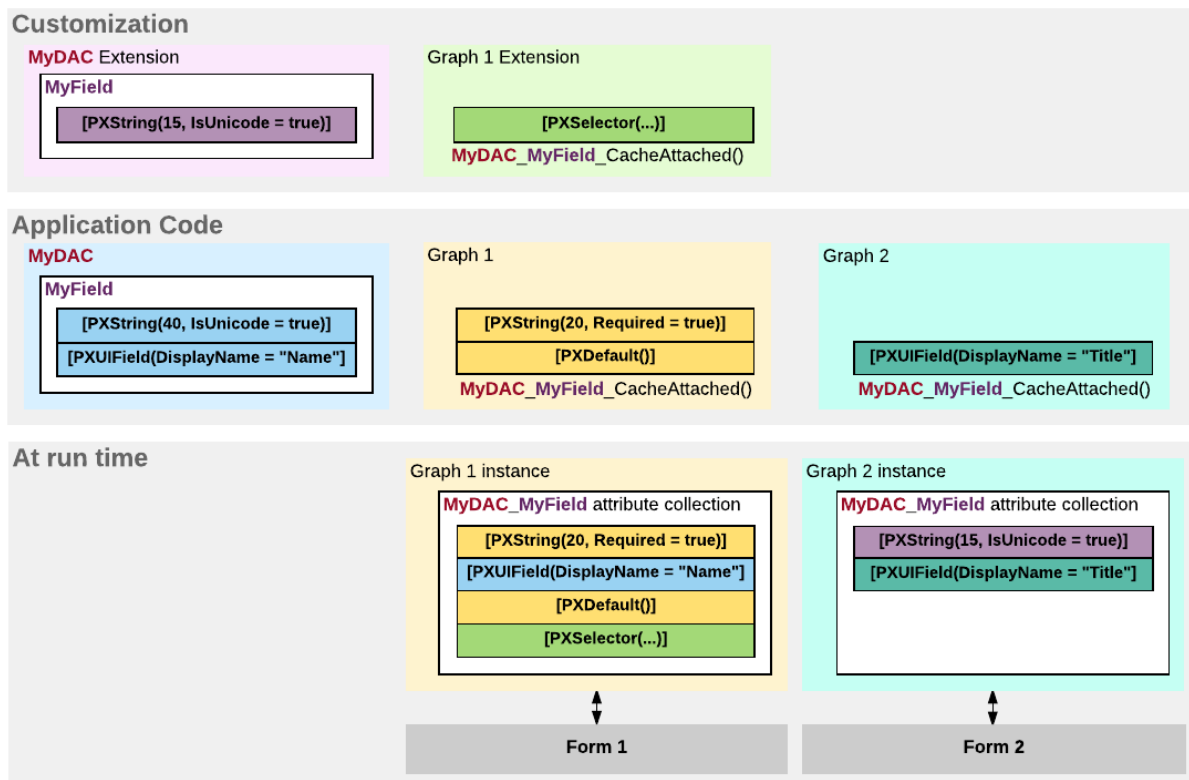
- In the DAC (on the DAC level)
- In a graph (on the graph level)

On the DAC level, you can customize the attributes of a field by adding, deleting, replacing, or modifying an attribute in the DAC extension by using the *Data Class Editor*.

On the graph level, you can define a new set of attributes for a field and apply changes by means of the `DACName_FieldPropertyName_CacheAttached()` event handler in the graph extension.

The following diagram shows an example that demonstrates how the attributes of a field declared in a data access class can be changed on the DAC and graph levels for two forms.





: In the example, as recommended in [Customization of Field Attributes in DAC Extensions](#), the `CacheAttached()` event handler is always used to merge the custom attributes of the field with the original ones instead of replacing them on the graph level.

**Figure: Example of the customization of attributes for a data field on the DAC and graph levels**

On the diagram, you can see that the attribute collection for the same data field in the cache object can be different for graphs that provide business logic for different forms.

For detailed information on customizing a data field, see the following topics:

- [To Customize a Field on the DAC Level](#)
- [To Customize a Field on the Graph Level](#)
- [To Set a Default Value](#)
- [To Change the Label of a Field](#)
- [To Make a Field Mandatory](#)
- [To Customize the Table of a Selector Field](#)
- [To Add an Event Handler for a Field](#)
- [To Provide Multi-Language Support for a Field](#)

## To Customize a Field on the DAC Level

If an attribute is added to a field declaration within a data access class (DAC), the common business logic of this attribute is applied to each data record of this type for each graph that uses this class. Therefore, if multiple Acumatica ERP forms contain controls for the same field, a change to an attribute of the field in the DAC modifies the behavior of these controls for the field on all forms.

You can use the [Data Class Editor](#) to customize the attributes of an existing data field in the DAC and to store the changes in the customization project as a *DAC* item. Because the goal of the customization of a field on the DAC level is to change the behavior or appearance of controls for the field on all forms, you start the customization of a data field from any form that contains a control for the field.

To customize a data field from a form that contains a control for the field, perform the following actions:

1. Open the form in the browser and make the control visible on the form.
2. On the form title bar, click **Customization > Inspect Element** to launch the *Element Inspector*.



: If you need to activate the *Element Inspector* for a pop-up panel, a dialog box, or another UI element that opens in modal mode and makes the *Customization Menu* unavailable for selection, you can press Control-Alt.

3. On the form, click the control to open the *Element Properties* dialog box for the control.
4. In the dialog box, click **Actions > Customize Data Fields**.
5. If there is no currently selected customization project and the inspector opens the *Select Customization Project Dialog Box*, select an existing customization project or create a new one. (See *To Select an Existing Project* and *To Create a New Project* for details.)

If the customization project does not contain a *DAC* item for the data access class, the *Customization Project Editor* adds the item to the project to keep the changes in the database. The *DAC* is opened in the *Data Class Editor*, and the needed field is added to list of customized fields of the *DAC*.

6. In the list of customized fields of the *DAC*, click the name of the field to be customized.

Now you can start the customization of the field on the *DAC* level.

The *Data Class* editor shows the custom and original attributes of the field in the work area, and you can use the following objects:

- The **Customize Attributes** text area: Use this area to define the custom attributes of the field.
- A drop-down list that is visible for only existing customized fields of the data access class: In this list, select one of the following ways of applying the custom attributes to the field:
  - *Keep Original*: The original attributes remain on the field until you select another option in this box.
  - *Replace Original*: The original attributes of the field are replaced with the custom attributes specified in the **Customize Attributes** text area.
  - *Append to Original*: The custom attributes are added to the end of the list of the original attributes of the data field. If you use this option, make sure you do not duplicate the attributes of the field.
- The **Selector Columns** toolbar action, which is available for only the fields that are selectors: Use this action to open the *Customize Selector Columns* dialog box, in which you can modify the columns in the selector table.
- The **Edit Attributes** toolbar action, which is unavailable for a custom field: Invoke this action to change the values of parameters for the existing original attributes of the selected field.

When you click **Save** on the editor toolbar, the editor updates the *DAC* item in the database.

### To Start the Customization of a Field from the Screen Editor

If you customize a form by using the *Screen Editor*, you may need to change the attributes a data field to change the appearance or behavior of an appropriate control on the form. If the control node is selected in the Control Tree, you can open the *Data Class* editor for the field immediately from the Screen Editor. To do this, perform the following actions:

1. Click the **Attributes** tab item.
2. On the tab item, click **Customize Attributes**.

If the *DAC* item for the data access class that contains the field declaration is absent in the customization project, the Acumatica Customization Platform creates an appropriate item and saves it in the database. Then the platform opens the item in the *Data Class* editor, and you can customize the attributes of the field.

## To Customize a Field on the Graph Level

If an attribute is added to a field declaration within a graph, the common business logic of this attribute is applied to each data record of this type on the graph level for only this graph. Therefore, if multiple Acumatica ERP forms contain controls for the same field, a change of an attribute of the field within the graph modifies the behavior of a single control for the field on only the form for which the graph provides business logic.

Because the goal of customizing a field on the graph level is to change the behavior or appearance of a specific control for the field on a specific form, you start the customization of a data field from the form.

To customize a field on the graph level, perform the following actions:

1. Open the form in the browser and make the control visible on the form.
2. On the form title bar, click **Customization > Inspect Element** to launch the *Element Inspector*.



: If you need to activate the *Element Inspector* for a pop-up panel, a dialog box, or another UI element that opens in modal mode and makes the *Customization Menu* unavailable for selection, you can press Control-Alt.

3. On the form, click the control to open the *Element Properties* dialog box for the control.
4. In the dialog box, click **Actions > Customize**.
5. If there is no currently selected customization project and the inspector opens the *Select Customization Project Dialog Box*, select an existing customization project or create a new one. (See *To Select an Existing Project* or *To Create a New Project* for details.)  
If the customization project does not contain a changeset for the form, the *Customization Project Editor* adds to the project a *Page* item for the form, to keep the changeset to the ASPX code of the form in the database. The container of the control is opened in the *Screen Editor*, and the control is selected in the Control Tree of the editor.
6. Click the **Attributes** tab item, which is used to review and customize the attributes of the DAC field that is bound to the control currently selected in the Control Tree.
7. Click **Override On Screen Level** to create in the graph extension the code template, which includes the original attributes of the field and the `DACName_FieldPropertyName_CacheAttached()` event handler, which replaces the attributes within the graph.

If the customization project does not contain an extension for the graph, the *Customization Project Editor* adds to the project a *Code* item for the graph extension, to keep the code in the database. Then the Acumatica Customization Platform opens the *Code* item in the Code Editor, and you can start the customization of the field on the graph level.

In the graph extension, you can define the field attributes as you need to. However you can use one of the following approaches to customize the attributes of a field on the graph level:

- Define a new set of custom attributes to replace the original attributes of the field (as in the created template).
- Use the `PXCustomizeBaseAttribute`, `PXMergeAttributes`, `PXRemoveBaseAttribute`, and `PXCustomizeSelectorColumns` attributes to customize the original attributes of a field instead of replacing it with custom ones.

We recommend that you use the second approach, which is described in *Customization of Field Attributes in DAC Extensions*.

When you click **Save** on the Code editor toolbar, the editor updates the *Code* item in the database.



: You can develop the customization code in the Code Editor. However we recommend that you develop the code in Microsoft Visual Studio (as described in *Integrating the Project Editor with Microsoft Visual Studio*) and use the editor for either minor code corrections or the insertion of completed portions of code.

## To Set a Default Value

When a user creates a new record of a business entity through a form of Acumatica ERP, you might need to set a default value for a data field. You use the `PXDefault` attribute for a data field to set a

constant as the default value, or you provide a BQL query to obtain a value from the database or data records from the cache. The default value is assigned to the field when a data record holding this field is inserted into the cache.



: If the default value is taken from a field that can be auto-generated by the database (such as an ID), you should use the `PXDBDefault` attribute instead of the `PXDefault` attribute.

You can set a default value for an original or custom text field on the DAC and graph levels. The following sections provide detailed information:

- [To Set a Default Value for an Original Field on the DAC Level](#)
- [To Set a Default Value for an Original Field on the Graph Level](#)
- [To Set a Default Value for a Custom Field on the DAC Level](#)

### To Set a Default Value for an Original Field on the DAC Level

To set a default value for a field used on multiple forms, you should customize the original attributes of the field in the data access class extension. To do this, perform the following actions:

1. Open the field in the Data Class Editor, as described in [To Customize a Field on the DAC Level](#).
2. In the **Customize Attributes** box, select *Append to Original*.
3. In the edit area below the box, add the `PXDefault` attribute and define a default value for the attribute.
4. Click **Save** on the editor toolbar to save your changes to the customization project.

### To Set a Default Value for an Original Field on the Graph Level

To set a default value for a field used on a single form, you should customize the original attributes of the field in the graph extension. To do this, perform the following actions:

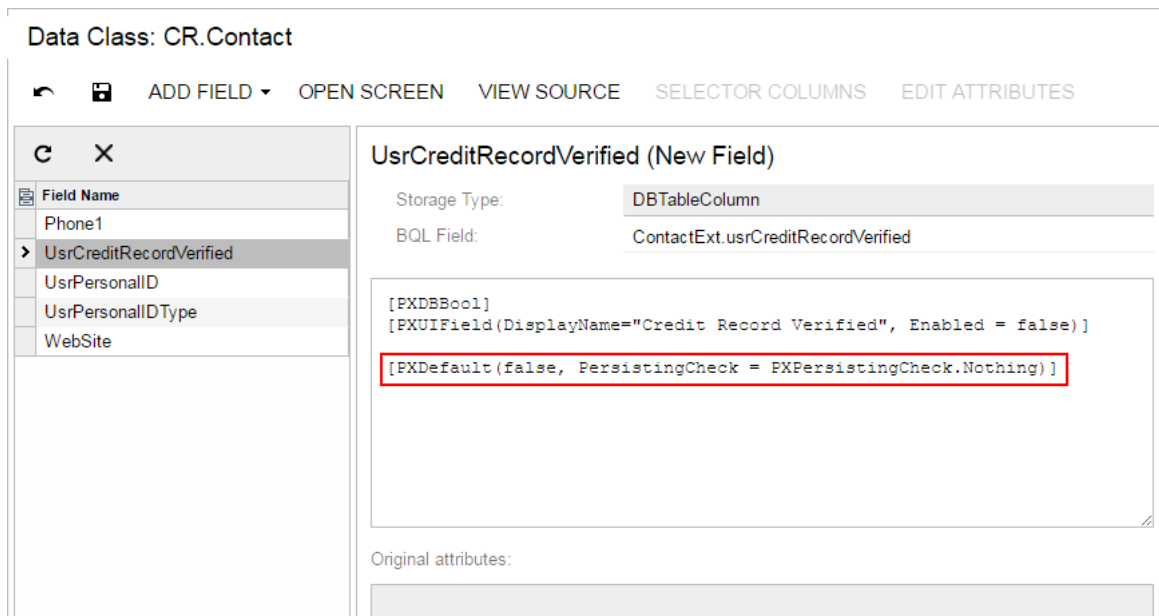
1. Create the code template that includes the original attributes of the field and the `DACName_FieldPropertyName_CacheAttached()` event handler, which replaces the attributes within the graph, as described in [To Customize a Field on the Graph Level](#).
2. By using the Code editor, replace the original attributes in the template, as shown in the following code snippet.

```
[PXMergeAttributes(Method = MergeMethod.Append)]
[PXDefault(false, PersistingCheck = PXPersistingCheck.Nothing)]
protected void DACName_FieldPropertyName_CacheAttached(PXCache cache)
{
}
```

3. Click **Save** on the editor toolbar to save your changes to the customization project.

### To Set a Default Value for a Custom Field on the DAC Level

If you need to set a default value for a custom data field on the DAC level, you add the `PXDefault` attribute and define a default value for the attribute in the edit area of the Data Class editor, as shown in the following screenshot.



**Figure: Setting a default value for a custom field**

## To Change the Label of a Field

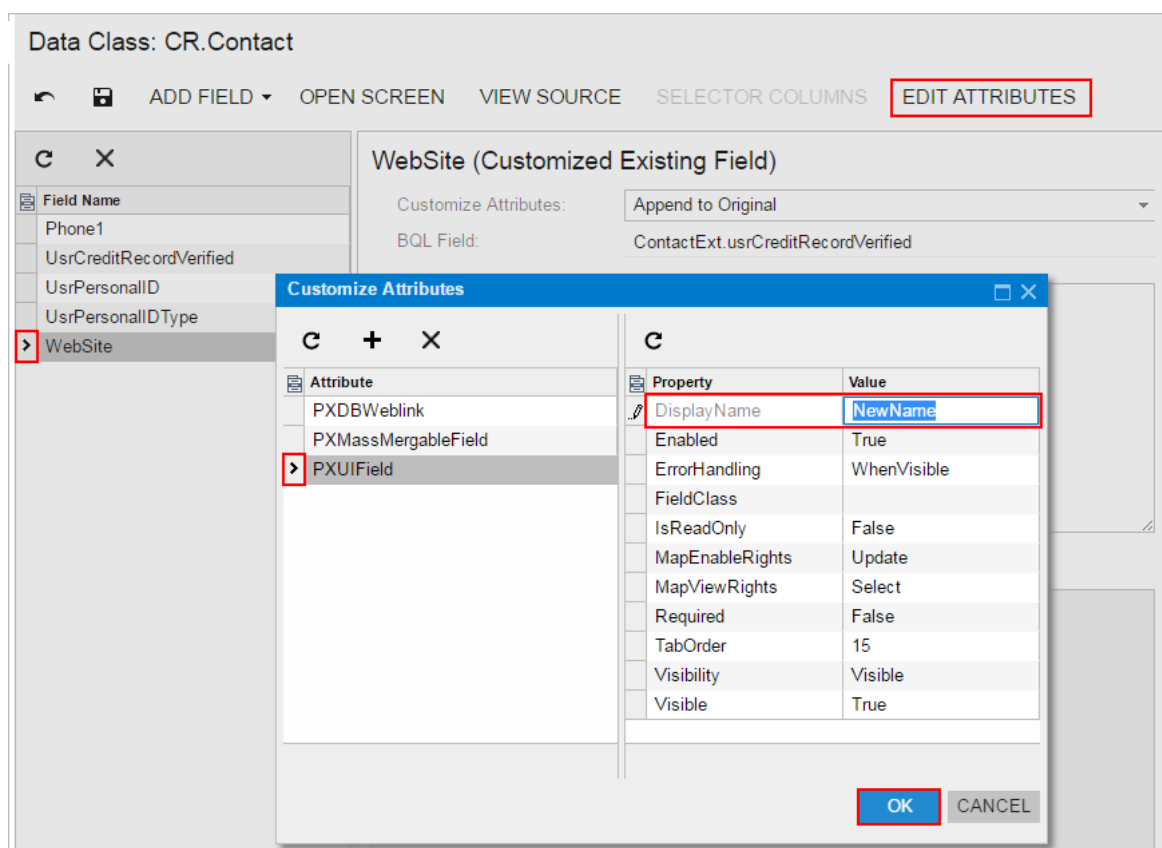
You can change the label for an original data field on the DAC and graph levels. The following sections provide detailed information:

- [To Change the Label of a Field on the DAC Level](#)
- [To Change the Label of a Field on the Graph Level](#)

### To Change the Label of a Field on the DAC Level

To change the label of a control for a field used on multiple forms, you should customize the `PXUIField` attribute of the field in the data access class extension. To do this, perform the following actions:

1. Open the field in the Data Class Editor, as described in [To Customize a Field on the DAC Level](#).
2. In the **Customize Attributes** box, select *Append to Original*.
3. In the editor, click **Edit Attributes** on the page toolbar.
4. In the **Attribute** list of the **Customize Attributes** dialog box, which opens, click the `PXUIField` attribute to select it.
5. In the parameter list, specify a new label for the `DisplayName` parameter, as the screenshot below shows.
6. Click **OK** to exit the dialog box.
7. Click **Save** on the editor toolbar to save your changes to the customization project.



**Figure: Changing the display label of a field**

As a result, the editor adds the following attribute for the field to the DAC extension.

```
[PXCustomizeBaseAttribute(typeof(PXUIFieldAttribute), "DisplayName", "NewName")]
```

### To Change the Label of a Field on the Graph Level

To change the label of a field for a single form, you should customize the `PXUIField` attribute of the field in the graph extension. To do this, perform the following actions:

1. Create the code template that includes the original attributes of the field and the `DACName_FieldPropertyName_CacheAttached()` event handler, which replaces the attributes within the graph, as described in [To Customize a Field on the Graph Level](#).
2. By using the Code editor, replace the original attributes in the template, as shown in the following code snippet.

```
[PXCustomizeBaseAttribute(typeof(PXUIFieldAttribute), "DisplayName",
    "NewName")]
protected void DACName_FieldPropertyName_CacheAttached(PXCache cache)
{
}
```

3. Click **Save** on the editor toolbar to save your changes to the customization project.

### To Make a Field Mandatory

If a field is mandatory for input, the user has to specify a value for the field before saving the record that contains the field. To make a field mandatory for input, you use the `PXDefault` attribute without parameters. A mandatory field is marked by an asterisk (\*) on the form to cue the reader that a value

must be specified for it. To mark a control for a mandatory field with an asterisk, you set the `Required` parameter of the `PXUIField` attribute to `true`.

You can make an original or custom field mandatory and mark a control for the field with an asterisk on the DAC and graph levels. The following sections provide detailed information:

- [To Make an Original Field Mandatory on the DAC Level](#)
- [To Make a Custom Field Mandatory on the DAC Level](#)
- [To Make a Field Mandatory on the Graph Level](#)

### To Make an Original Field Mandatory on the DAC Level

To make an original field mandatory and mark the control for the field with an asterisk on multiple forms with an asterisk, you should customize the original attributes of the field in the data access class extension. To do this, perform the following actions:

1. Open the field in the Data Class Editor, as described in [To Customize a Field on the DAC Level](#).
2. In the **Customize Attributes** box, select *Append to Original*.
3. In the edit area below the box, add the `PXDefault` attribute without parameters.
4. In the editor, click **Edit Attributes** on the page toolbar.
5. In the **Attribute** list of the **Customize Attributes** dialog box, which opens, click the `PXUIField` attribute to select it.
6. In the parameter list, set the `Required` parameter to `True`.
7. Click **OK** to exit the dialog box.

The edit area of the editor must contain the following code:

```
[PXDefault]
[PXCustomizeBaseAttribute(typeof(PXUIFieldAttribute), "Required", true)]
```

8. Click **Save** on the editor toolbar to save your changes to the customization project.

### To Make a Custom Field Mandatory on the DAC Level

If you need to set a default value for a custom data field, you add the `PXDefault` attribute without parameters and set the `Required` parameter of the `PXUIField` attribute to `True`, as in the following code snippet.

```
[PXDefault]
[PXUIField(..., Required = true)]
```

### To Make a Field Mandatory on the Graph Level

To make a field mandatory and mark the field with an asterisk for the field control used on a single form, you should customize the field attributes in the graph extension. To do this, perform the following actions:

1. Create the code template that includes the field attributes and the `DACName_FieldPropertyName_CacheAttached()` event handler, which replaces the attributes within the graph, as described in [To Customize a Field on the Graph Level](#).
2. By using the Code editor, replace the original attributes in the template, as shown in the following code snippet.

```
[PXDefault]
[PXCustomizeBaseAttribute(typeof(PXUIFieldAttribute), "Required", true)]
protected void DACName_FieldPropertyName_CacheAttached(PXCache cache)
```

```
{
}
```

3. Click **Save** on the editor toolbar to save your changes to the customization project.

## To Customize the Table of a Selector Field

For a selector field, you use the [Data Class Editor](#) to add, delete, and sort the columns of the selector table and store the changes in the customization project as a *DAC* item.

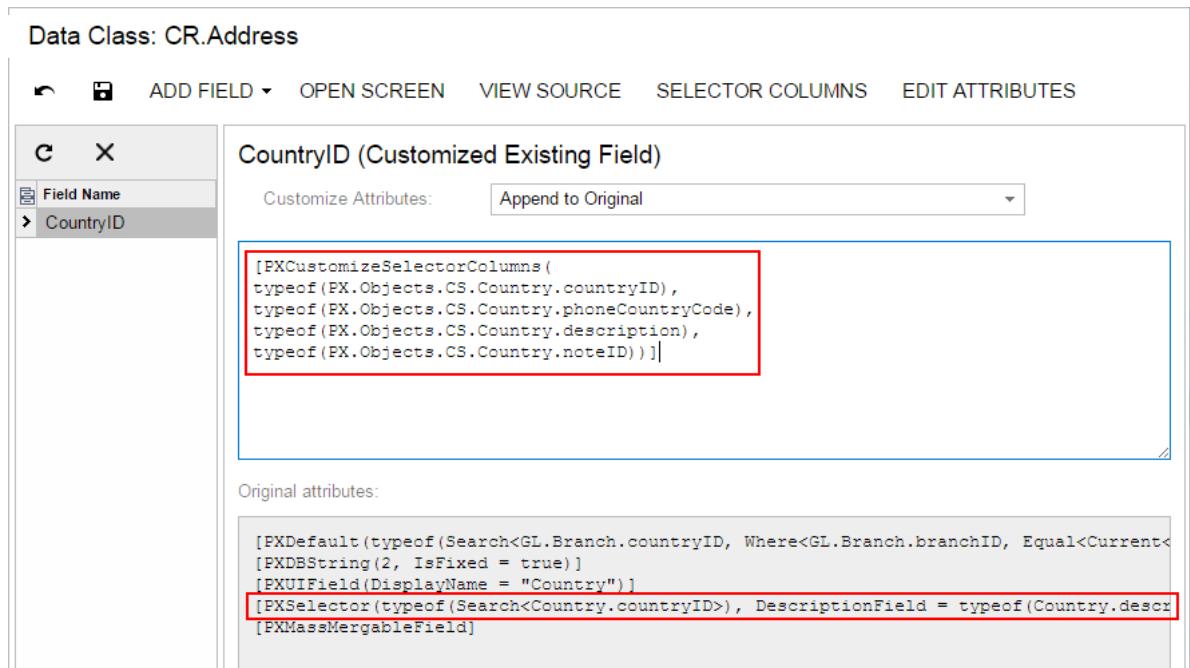
You can customize the table of an original selector field on the data access class (DAC) and graph levels. The following sections provide detailed information:

- [To Customize the Table of an Original Selector Field on the DAC Level](#)
- [To Customize the Table of an Original Selector Field on the Graph Level](#)

### To Customize the Table of an Original Selector Field on the DAC Level

To customize the table of an original selector field for all controls for the field, you should customize the `PXSelector` attribute of the field in the data access class extension. To do this, perform the following actions:

1. Open the field in the Data Class Editor, as described in [To Customize a Field on the DAC Level](#).
2. In the editor, click **Selector Columns** on the page toolbar.
3. In the **Customize Selector Columns** dialog box, which opens, make the required changes.  
You can use this dialog box to add new columns to the selector table and to reorder columns in the table. (See [Customize Selector Columns Dialog Box](#) for details.)
4. Click **OK** to add the `PXCustomizeSelectorColumns` attribute for the field in the edit area of the Data Class editor based on your changes, as shown in the following screenshot.



**Figure: Viewing the `PXCustomizeSelectorColumns` attribute in the Data Class editor**

5. Click **Save** on the editor toolbar to save your changes to the customization project.



## To Customize the Table of an Original Selector Field on the Graph Level

To customize the selector table for the selector control on a single form, you should customize the `PXSelector` attribute of the appropriate field in the graph extension. To do this, perform the following actions:

1. Create the code template that includes the field attributes and the `DACName_FieldPropertyName_CacheAttached()` event handler that replaces the attributes within the graph, as described in [To Customize a Field on the Graph Level](#).
2. By using the Code editor, replace the original attributes in the template, as shown in the following code snippet.

```
[PXCustomizeSelectorColumns(<NEW CONTENT OF THE PXSELECTOR ATTRIBUTE>)]
protected void DACName_FieldPropertyName_CacheAttached(PXCache cache)
{
}
```

3. Click **Save** on the editor toolbar to save your changes to the customization project.

## To Add an Event Handler for a Field

You can add an event handler for an original or custom field on the graph and DAC levels. The following sections provide detailed information:

- [To Add an Event Handler for a Field on the Graph Level](#)
- [To Add an Event Handler for a Field on the DAC Level](#)

### To Add an Event Handler for a Field on the Graph Level

To add an event handler for a field control used on a single form, perform the following actions:

1. Open the form in the browser and make the control visible on the form.
2. On the form title bar, click **Customization > Inspect Element** to launch the [Element Inspector](#).
 
 : If you need to activate the [Element Inspector](#) for a pop-up panel, a dialog box, or another UI element that opens in modal mode and makes the [Customization Menu](#) unavailable for selection, you can press Control-Alt.
3. On the form, click the control for which you are adding an event handler to open the [Element Properties](#) dialog box for the control.
4. In the dialog box, click **Actions > Customize**.
5. If there is no currently selected customization project and the inspector opens the [Select Customization Project Dialog Box](#), select an existing customization project or create a new one. (See [To Select an Existing Project](#) or [To Create a New Project](#) for details.)

If the customization project does not contain a changeset for the form, the [Customization Project Editor](#) adds a *Page* item for the form to the project to keep the changeset to ASPX code of the form in the database. The container of the control is opened in the [Screen Editor](#), and the control is selected in the Control Tree of the editor.

6. If you need to provide additional business logic to process a control value immediately after the value is changed, follow the instructions described in [To Add an Event Handler](#). If you need to override the existing business logic for the field, follow the instructions described in [To Override an Event Handler](#).

## To Add an Event Handler for a Field on the DAC Level

Typically, you develop an event handler to provide the business logic for a field on the graph level. However if you need to add the same business logic for a field used on multiple forms, you add the event handler on the DAC level as follow:

1. Create a custom attribute, as described in Lesson 8 of the [T200 Acumatica Framework Fundamentals](#) course.
2. Add the needed event handler to the custom attribute.
3. Add the custom attribute to the field, as described in [To Customize a Field on the DAC Level](#).

## To Provide Multi-Language Support for a Field

Acumatica ERP 5.3 supports locale-specific settings and the translation of the strings used on the application interface. Starting with Version 6, Acumatica ERP also provides the functionality to translate user input to multiple languages and store translations in the database. (See [Locales and Languages](#) for details.)

For example, if there are multiple active system locales in an instance of Acumatica ERP, and a text field on a form is declared as a multi-language field, the field control displays the value for the current locale. If the database does not contain a value for the current locale, the control displays the value for the default system locale.

To declare a text field as a multi-language one, in the data access class, you should use the `PXDBLocalizableString` attribute instead of `PXDBString` or `PXDBText`. The `PXDBText` attribute has to be replaced with the `PXDBLocalizableString` one without any length specified.



:

- Please do not confuse the `PXDBLocalizableString` attribute with `PXDBLocalizedString`. The `PXDBLocalizedString` attribute is deprecated and should not be used in the customization code.
- By default, starting with Acumatica ERP 6, the system supports multilingual user input for some boxes listed in [Boxes that Have Multi-Language Support](#). If the `PXDBString` attribute for a box from the list was customized in the earlier versions, after you upgrade to Acumatica ERP 6, the box will not have multi-language support. To resolve the issue, we recommend that you replace the `PXDBString` attribute with `PXDBLocalizableString` in the customization code.

You can provide multi-language support for an original or custom text field. The following sections provide detailed information:

- [To Provide Multi-Language Support for an Original Field on the DAC Level](#)
- [To Provide Multi-Language Support for an Original Field on the Graph Level](#)
- [To Provide Multi-Language Support for a Custom Field](#)

## To Provide Multi-Language Support for an Original Field on the DAC Level

To provide multi-language support for a field used on multiple forms, you should customize the original attributes of the field in the data access class extension. To do this, perform the following actions:

1. Open the field in the Data Class Editor, as described in [To Customize a Field on the DAC Level](#).
2. In the editor, click **Edit Attributes** on the page toolbar.
3. In the **Customize Attributes** dialog box, which opens, select the `PXDBString` (or `PXDBText`) attribute, and click **Delete** (X) on the toolbar.
4. Click **OK** to save your changes and close the dialog box.
5. In the **Customize Attributes** box of the editor, select *Append to Original*, as shown in the screenshot below.
6. In the work area below the box, add the `PXDBLocalizableString` attribute, which has the same parameters as the deleted `PXDBString` (or `PXDBText`) attribute.

7. Click **Save** on the editor toolbar to save your changes to the customization project.

For example, after you perform these actions for the **Description** field on the Sales Orders form (SO301000; **Distribution** > **Sales Orders** > **Work Area** > **Enter**), the **Customize Attributes** area of the Data Class editor contains the following code (as shown in the screenshot below).

```
[PXDBLocalizableString(255, IsUnicode = true)]
[PXRemoveBaseAttribute(typeof(PXDBStringAttribute))]
```



**Figure: Providing multi-language support for the Description field of the Sales Orders form**

### To Provide Multi-Language Support for an Original Field on the Graph Level

To provide multi-language support for a field used on a single form, you should customize the original attributes of the field in the graph extension. To do this, perform the following actions:

1. Create the code template, which includes the original attributes of the field and the `DACName_FieldPropertyName_CacheAttached()` event handler, which replaces the attributes within the graph, as described in [To Customize a Field on the Graph Level](#).
2. By using the Code editor, replace the original attributes in the template, as shown in the following code snippet.

```
[PXMergeAttributes(Method = MergeMethod.Merge)]
[PXDBLocalizableString(255, IsUnicode = true)]
protected void DACName_FieldPropertyName_CacheAttached(PXCache cache)
{
}
```

3. Click **Save** on the editor toolbar to save the changes to the customization project.

### To Provide Multi-Language Support for a Custom Field

If you need to create a custom text box with multi-language support, first you create a custom field with the `PXDBString` attribute. Then in the DAC, you replace this attribute name with `PXDBLocalizableString`.

## Graph

A business logic controller (BLC, also referred as *graph*) is used to provide the business logic for an Acumatica ERP form. A graph instance is created when a data request occurs and discarded after the request is processed.

With Acumatica Framework, the application programmer is restricted from direct database access and from writing SQL queries. Database specifics are hidden for the application behind data access classes, and the SQL queries are constructed declaratively through Business Query Language (BQL). Through a set of generic classes, the BQL library provides a rich syntax for building the equivalents of SQL queries of any complexity. Unlike SQL statements, BQL statements operate with data access classes, rather than database tables, and provide compatibility between different database engines. The BQL library supports MS SQL and MySQL database engines, as well as access to the database through the ODBC provider.

Each graph contains the `Caches` collection of cache objects and the `Views` collection of data view objects. The framework handles these objects automatically; you don't have to initialize and control them. A `PXView` data view object contains two main parts:

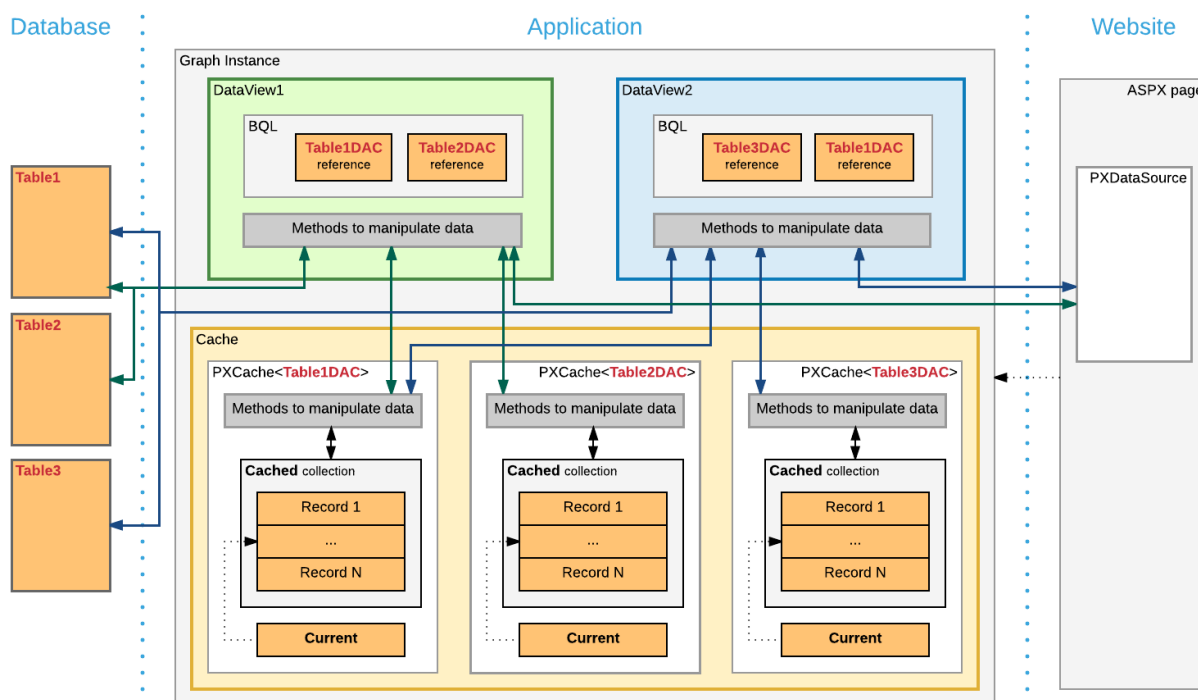
- The BQL command, which is defined by the type of the data view
- The optional delegate, which constructs the data set that is returned instead of the BQL command's execution result

`PXView` objects, like graphs, are initialized and destructed on each round trip.



: The order in which data views are defined in a graph is important, because it defines the order of saving data to the database. (This order, however doesn't define the order in which data views are executed.) The data view that you specify in the `PrimaryView` property should always be defined first in the graph.

If a BQL statement of a data view refers to multiple data access classes (DACs), the data view creates the `PXCache` object for each DAC to keep appropriate data records, as shown in the following diagram.



**Figure: Example of two data views working with the records of three DACs**

If multiple data views contain a reference to the same DAC, for this DAC, the graph cache contains a single `PXCache` object that is used by the data views.

On a webpage, you bind each container to a data view that provides data for the container. To bind a container and a data view, you specify the data view name in the `DataMember` property of the container

in the ASPX code. When a webpage requests data, the system invokes the `ExecuteSelect()` method of the graph with the data view name passed as an argument to execute every data view bound to the containers of the webpage. Note that data views that aren't bound to a container are not executed by a request from the UI.

When a data record is modified on the page, the framework invokes the `ExecuteInsert()`, `ExecuteUpdate()`, or `ExecuteDelete()` method of the graph, passing the name of the data view as an argument. The graph gets the data view by its name and invokes the corresponding method of the data view.



: You shouldn't use the `ExecuteSelect()`, `ExecuteInsert()`, `ExecuteUpdate()`, and `ExecuteDelete()` methods for purposes other than debugging.

You use the [Customization Tools](#) of the Acumatica Customization Platform to create a custom graph and to create new members and override existing ones in an existing graph.

For detailed information on creating a custom graph and customizing an existing graph, see the following topics:

- [To Start the Customization of a Graph](#)
- [To Create a Custom Graph](#)
- [To Add a New Member](#)
- [To Add an Action](#)
- [To Add an Event Handler](#)
- [To Override an Event Handler](#)
- [To Override a Virtual Method](#)

## To Start the Customization of a Graph

You can create the class extension for an existing business logic controller (BLC) and add the *Code* item with the created code to a customization project in several ways, as described in the following sections:

- [To Add a Code Item by Using the Element Inspector](#)
- [To Add a Code Item by Using the Layout Editor](#)
- [To Add a Code Item on the Code page](#)

If you need to extend the code of a BLC that has no webpage associated (such as `ARReleaseProcess`), follow the instructions described in [To Add a Code Item on the Code page](#).

As soon as you add the *Code* item for customization of the business logic to the project, the system generates an extension class for it and opens the code in the [Code Editor](#). You can work with the extension classes in the Code Editor. After you publish the customization project, you can develop the code in MS Visual Studio.

### To Add a Code Item by Using the Element Inspector

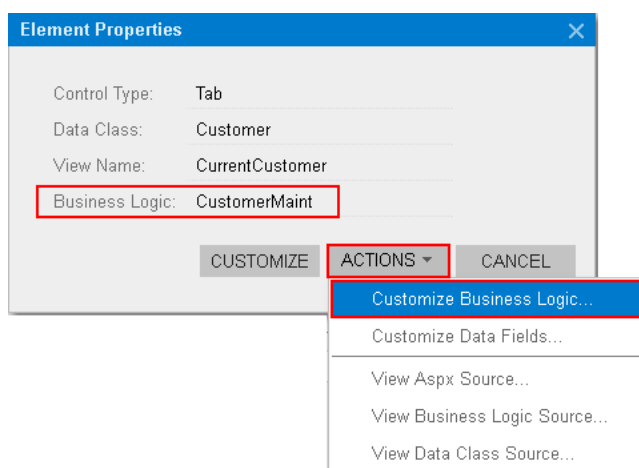
Typically, you want to modify the business logic that is executed for a certain form of Acumatica ERP.

To add a *Code* item for customization of the business logic for an existing form to a customization project by using the [Element Inspector](#), perform the following actions:

1. Open the form in the browser.
2. On the form title bar, click **Customization > Inspect Element** to launch the Element Inspector.
3. On the form, select any UI element to open the [Element Properties Dialog Box](#) for the element.

The **Business Logic** box of the dialog box displays the name of the business logic controller that provides business logic for the form, as shown in the screenshot below.

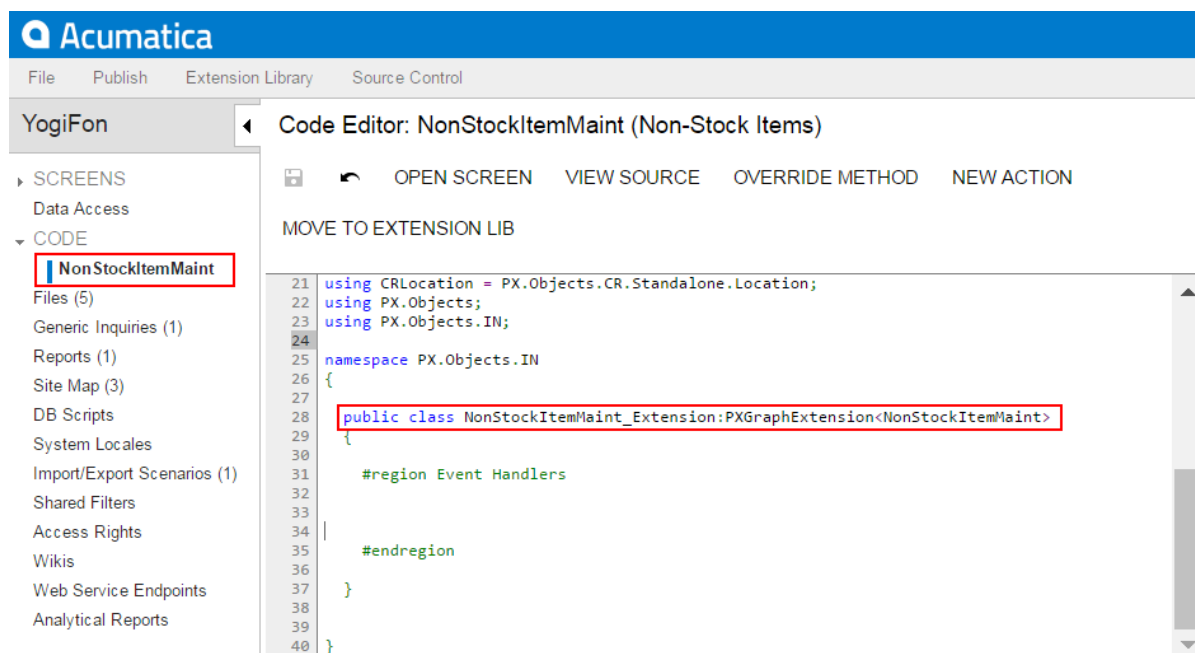
4. In the dialog box, click **Actions > Customize Business Logic**.



**Figure: Using the Element Properties dialog box to customize the business logic for the form**

5. If there is no currently selected customization project and the inspector opens the [Select Customization Project Dialog Box](#), select an existing customization project or to create a new one.

The platform creates the template of the class that is derived from the `PXGraphExtension<>` class, saves the code as a *Code* item of the project in the database, and opens the item in the [Code Editor](#), as shown in the following screenshot.



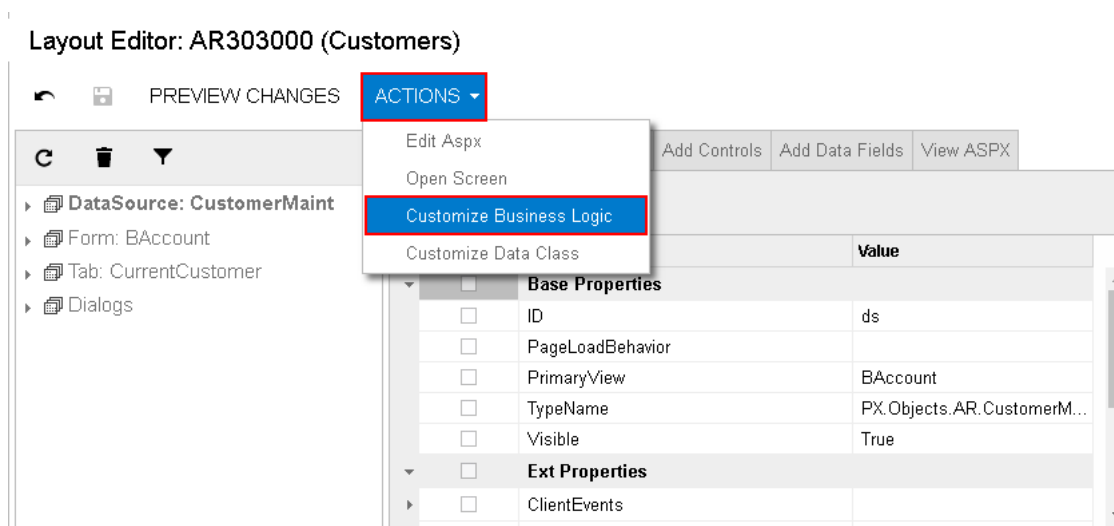
**Figure: Viewing the created code template in the Code Editor**

### To Add a *Code* Item by Using the Layout Editor

Often, you start a customization of an Acumatica ERP form in the [Screen Editor](#) and you later want to modify the business logic for this form. To customize the business logic of the form, you can add a *Code* item to a customization project from the Layout Editor.

To do this, perform the following action:

1. On the toolbar of the Layout Editor, click **Actions > Customize Business Logic**, as the following screenshot shows.



**Figure: Starting the customization of the business logic from the Layout Editor**

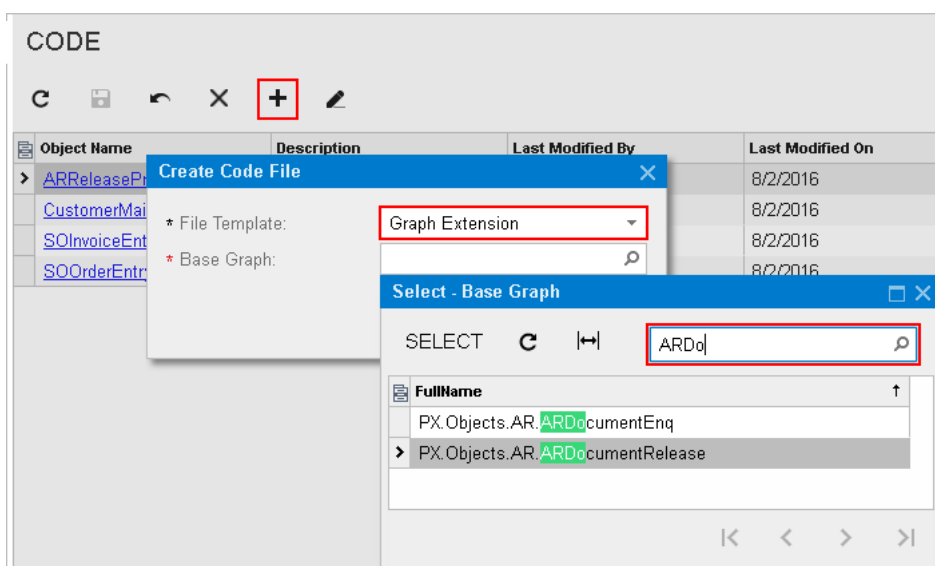
The platform creates the template of the class that is derived from the `PXGraphExtension<>` class, saves the code as a *Code* item of the project in the database, and opens the item in the [Code Editor](#).

### To Add a *Code* Item on the Code page

If you know the name of the business logic controller to be customized, you can create a *Code* item with the graph extension template on the Code page of the Customization Project Editor by using the **Create Code File** dialog box.

To do this, perform the following actions:

1. Open the customization project in the editor. (See [To Open a Project](#) for details.)
2. Click **Code** in the navigation pane to open the Code page.
3. Click **Add New Record (+)** on the page toolbar.
4. In the **Create Code File** dialog box, which opens, select *Graph Extension* in the **File Template** box, as the screenshot below shows.
5. In the **Base Graph** box, select the class name of the business logic controller to be customized.
6. Click **OK**.



**Figure: Adding a Code item with the graph extension to the project**

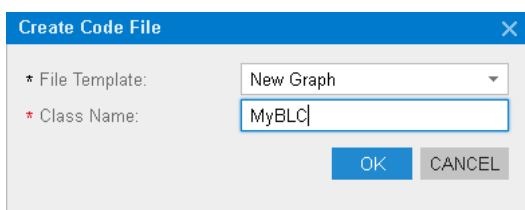
The platform creates the template of the class that is derived from the `PXGraphExtension<>` class, saves the code as a *Code* item of the project in the database, and opens the item in the [Code Editor](#).

## To Create a Custom Graph

You can add a custom business logic controller to a customization project on the Code page of the Customization Project Editor.

To do this, perform the following actions:

1. Open the customization project in the editor. (See [To Open a Project](#) for details.)
2. Select **Code** in the navigation pane to open the Code page.
3. Click **Add New Record** (+) on the page toolbar.
4. In the **Create Code File** dialog box, which opens, select *New Graph* in the **File Template** box, as the screenshot below shows.
5. In the **Class Name** box, specify the class name of the business logic controller to be created.
6. Click **OK**.



**Figure: Adding a Code item for a custom graph to the project**

The platform creates the code template of the class derived from the `PXGraph<>` class, saves the code as a *Code* item of the project in the database, and opens the item in the [Code Editor](#).

## To Add a New Member

You can add a new member (such as a variable, data view, or method) to a custom graph or to an extension for a graph in Acumatica ERP.



Initially, the code of a custom graph or an extension for an existing graph is saved in the appropriate *Code* item of the customization project. If the project has not been published, you can use only the [Code Editor](#) to add a new member to the graph code.

After the customization project has been published, the code is also saved in the corresponding C# file in the `App_RuntimeCode` folder of the website. (See [Changes in the Application Code \(C#\)](#) for details.) You can open the file in Microsoft Visual Studio and use Visual Studio to add a new member to the graph code. To do this, perform the following actions:

1. In Visual Studio, click **File > Open > Web Site**, and select your Acumatica ERP development environment.
2. Open the `App_RuntimeCode\<CodeItemName>.cs` file.
3. In the code, add the needed class member.
4. Save the file.
5. In the Customization Project Editor, select the **Files** node in the navigation pane.
6. On the Custom Files page, which opens, click **Detect Modified Files** on the page toolbar.
 
 : The customization platform compares the content of each file added to the site with the content of the associated item of the customization project in the database. If a difference is detected, the platform opens the **Modified Files Detected** dialog box so you can resolve the detected conflicts. You can either update the customization project in the database or discard the file changes in the file system to resolve the conflicts.
7. In the **Modified Files Detected** dialog box, which opens, ensure that the modified code file is selected.
8. Click **Update Customization Project** on the dialog box toolbar to update the *Code* item that is saved in the database.

If the graph code is included in an extension library whose binary file is added to the customization project as a *File* item, you can use Visual Studio to add a new member to the graph code in the library solution. (See [Extension Library](#) for details.) If you make changes to the extension library file in the file system, you have to update the appropriate *File* item in the customization project. See [To Update a File Item in a Project](#) for details.

## To Add an Action

To add a new action to the toolbar of an original form of Acumatica ERP, you have to add to the appropriate graph extension the action declaration, toolbar button declaration, and action delegate method. (See [To Start the Customization of a Graph](#) for details.)

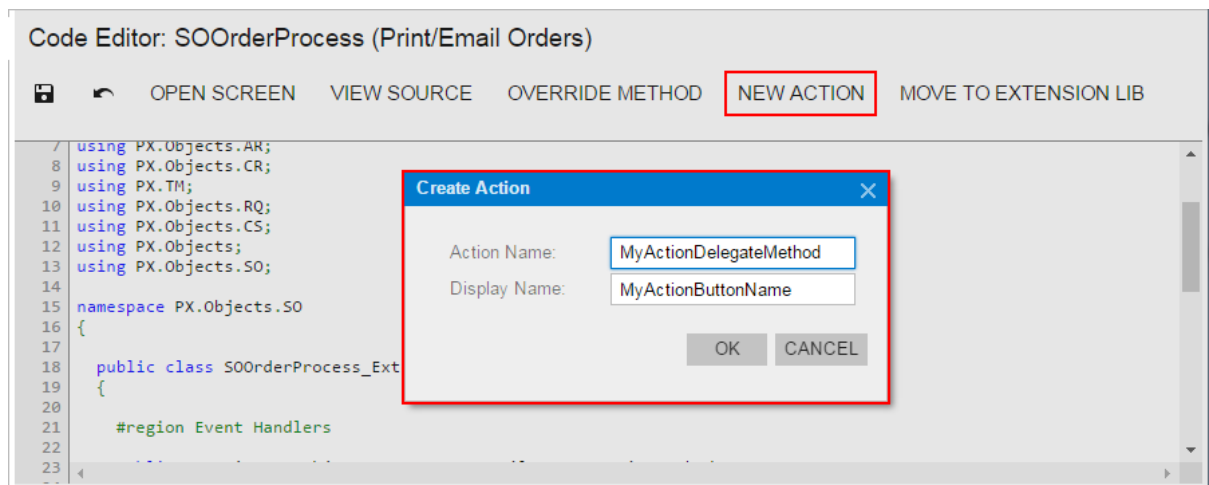
To add a new action to the toolbar of a custom form, you have to add the action code to the appropriate custom graph. (See [To Create a Custom Form Template](#) and [To Create a Custom Graph](#) for details.)



: You can also add an action in the Screen Editor. For details, see [To Add an Action](#).

You can use the [Code Editor](#) to add an action template to the graph extension or custom graph that is saved in a customization project as a *Code* item and currently opened in the editor. To do this, perform the following actions:

1. Click the **New Action** button of the Code Editor to open the **Create Action** dialog box.
2. In the dialog box, specify the name of the action delegate method in the **Action Name** box and the name of the action button in the **Display Name** box, as shown in the following screenshot.



**Figure: Opening the New Action dialog box**

3. Click **OK** to create the action template and add it to the item.

The system adds to the code a template of the action declaration that includes the following class members:

- The declaration of the action delegate method
- The declaration of the button attributes to add the button to the form toolbar with the specified name
- The template of the action delegate method

The following example shows the template code for an action.

```
public PXAction<DACName> myActionDelegateMethod;

[PXButton(CommitChanges = true)]
[PXUIField(DisplayName = "MyActionButtonName")]
protected void MyActionDelegateMethod()
{
    // the body of the action delegate method
}
```

If the code of a graph extension or custom graph is moved to an extension library whose binary file is added to the customization project as a *File* item, you should develop the action code from scratch by using Visual Studio. If you make changes to the extension library file in the file system, you have to update the appropriate *File* item in the customization project. See [To Update a File Item in a Project](#) for details.

## To Add an Event Handler

If you customize a form, you may need to provide additional business logic for processing a control value immediately after the value is changed.

To implement business logic for data changed by the user on an original form, you should add event handlers for data fields (or data records) to the extension of the graph that provides business logic for the form.

To process data modification on a custom form, you should add event handlers for data fields (or data records) to the appropriate custom graph.

You can use the [Screen Editor](#) to add to the appropriate customization code a workable template of an event handler for a data field (or data record) that can be modified on a form. To do this, perform the following actions:

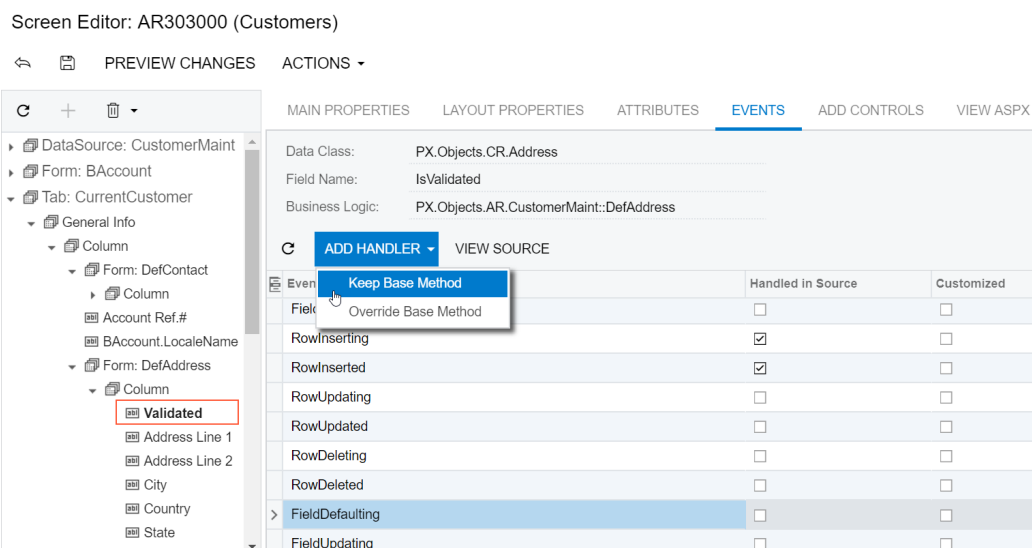
1. Open the form in the browser and make the control for the field visible on the form.

- On the form title bar, click **Customization > Inspect Element** to launch the *Element Inspector*.



: If you need to activate the *Element Inspector* for a pop-up panel, dialog box, or another UI element that opens in modal mode and makes the *Customization Menu* unavailable for selection, you can press Control-Alt.

- On the form, click the control to open the *Element Properties* dialog box for the control.
- In the dialog box, click **Actions > Customize**.
- If there is no currently selected customization project and the inspector opens the *Select Customization Project Dialog Box*, select an existing customization project or create a new one. (See *To Create a New Project* and *To Select an Existing Project* for details.)  
If the customization project does not contain a changeset for the form, the *Customization Project Editor* adds to the project a *Page* item for the form, to keep the changeset to the ASPX code of the form in the database. The container of the control is opened in the *Screen Editor*, and the control is selected in the Control Tree of the editor.
- Select the node of the control in the Control Tree.
- Click the **Layout Properties** tab item to open the list of properties for the control.
- In the list, set the `CommitChange` property to *True*. (For detailed information about the property, see *Use of the CommitChanges Property of Boxes* in the Acumatica Framework Guide.)
- Click **Save** to save your changes in the customization project.
- Click the **Events** tab item to open the list of available event types for the control.
- In the list, click the type of the event that you want to process for the field to highlight the type, as shown in the screenshot below.
- On the list toolbar, click **Add Handler > Keep Base Method**.



**Figure: Adding an event handler for a data field**

If there is no extension for the graph that provides business logic for the form in the customization project, the Acumatica Customization Platform creates a template for the extension and saves it as a *Code* item in the database. Then the platform adds to the graph extension a template for the event handler highlighted in the list and opens the *Code* item in the *Code Editor*, as shown in the following screenshot.

Code Editor: CustomerMaint (Customers)

OPEN SCREEN VIEW SOURCE OVERRIDE METHOD NEW ACTION MOVE TO EXTENSION LIB

```

14 using PX.Objects.AR;
15 using PX.Objects.CT;
16
17 namespace PX.Objects.AR
18 {
19
20     public class CustomerMaint_Extension:PXGraphExtension<CustomerMaint>
21     {
22
23         #region Event Handlers
24
25         protected void Contact_UsrPersonalID_FieldDefaulting(PXCache cache, PXFieldDefaultingEventArgs e)
26         {
27
28             var row = (Contact)e.Row;
29
30         }
31
32
33

```

**Figure: Viewing the event handler template**

In the template, the event handler has two parameters, as is defined in the base graph. As a result, the event handler is added to the appropriate event handler collection.

When you publish the customization project, the platform saves the graph extension as a C# source code file in the `App_RuntimeCode` folder of the website. You can later develop the event handler in Microsoft Visual Studio. (See [Integrating the Project Editor with Microsoft Visual Studio](#) for details.)

## To Override an Event Handler

If you customize a form, you may need to override the business logic that processes a control value immediately after the value is changed.

To implement business logic for data changed by the user on an original form, you should add event handlers for data fields (or data records) to the extension of the graph that provides business logic for the form.

To process data modification on a custom form, you should add event handlers for data fields (or data records) to the appropriate custom graph.

You can use the [Screen Editor](#) to add to the appropriate customization code a workable template of an event handler that overrides the base event handler for a data field (or data record). To do this, perform the following actions:

1. Open the form in the browser and make the control for the field visible on the form.
2. On the form title bar, click **Customization > Inspect Element** to launch the [Element Inspector](#).



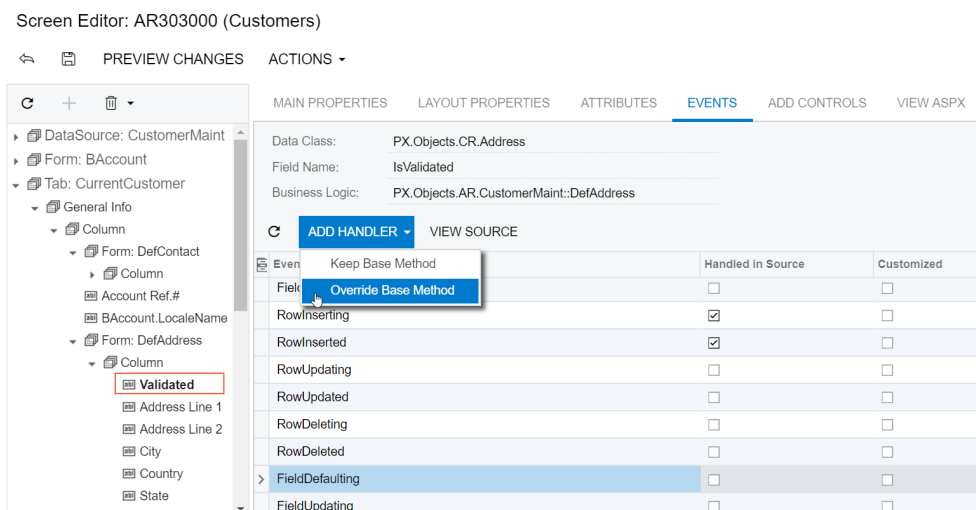
: If you need to activate the [Element Inspector](#) for a pop-up panel, dialog box, or other UI element that opens in modal mode and makes the [Customization Menu](#) unavailable for selection, you can press Control-Alt.

3. On the form, click the control to open the [Element Properties](#) dialog box for the control.
4. In the dialog box, click **Actions > Customize**.
5. If there is no currently selected customization project and the inspector opens the [Select Customization Project Dialog Box](#), elect an existing customization project or create a new one. (See [To Create a New Project](#) and [To Select an Existing Project](#) for details.)

If the customization project does not contain a changeset for the form, the [Customization Project Editor](#) adds a *Page* item for the form to the project, to keep the changeset to the ASPX code of the form in the database. The container of the control is opened in the [Screen Editor](#), and the control is selected in the Control Tree of the editor.

6. Select the node of the control in the Control Tree.

7. Click the **Layout Properties** tab item to open the list of properties for the control.
8. In the list, ensure that the `CommitChange` property is set to `True`. (For detailed information about the property, see [Use of the CommitChanges Property of Boxes](#) in the Acumatica Framework Guide.)
9. Click **Save** to save your changes in the customization project.
10. Click the **Events** tab item to open the list of available event types for the control.
11. In the list, click the type of the event that you want to process for the field to highlight the type, as shown in the screenshot below.
12. On the list toolbar, click **Add Handler > Override Base Method**.



**Figure: Adding an event handler for a data field**

If there is no extension for the graph that provides business logic for the form in the customization project, the Acumatica Customization Platform creates a template for the extension and saves it as a *Code* item in the database. Then the platform adds to the graph extension a template for the event handler highlighted in the list and opens the *Code* item in the [Code Editor](#), as shown in the following screenshot.



**Figure: Viewing the event handler template**

In the template, the event handler has an additional parameter to replace the base event handler collection of the graph.

When you publish the customization project, the platform saves the graph extension as a C# source code file in the `App_RuntimeCode` folder of the website. You can later develop the event handler in Microsoft Visual Studio. (See [Integrating the Project Editor with Microsoft Visual Studio](#) for details.)

## To Override a Virtual Method

In a graph extension, you can override the virtual methods defined within the base graph. As with the event handlers, you have two options:

- You can define the override method with exactly the same signature—that is, the return value, the name of the method, and all method parameters—as the overridden base virtual method has. As a result, the method is added to the queue of all override methods. When the system invokes the base method, all methods in the queue are executed sequentially, from the first one to the last one. The lower the level the BLC extension has, the earlier the system invokes the override method.
- You can define the override method with an additional parameter, which represents the delegate for one of the following:
  - The override method with an additional parameter from the extension of the previous level, if such a method exists
  - The base virtual method, if no override methods with additional parameters declared within lower-level extensions exist

In both cases, you should attach the `PXOverride` attribute to the override method declared within the BLC extension, as described in the following sections below:

- [Override Method That Is Added to the Override Method Queue](#)
- [Override Method That Replaces the Original Method](#)

### Override Method That Is Added to the Override Method Queue

By declaring an override method with exactly the same signature as the overridden base virtual method has, you extend the base method execution. The base BLC method is replaced at run time with the queue of methods, which starts with the base BLC method. When the system invokes the base method, all methods in the queue are executed sequentially, from the first one to the last one. The lower the level the BLC extension has, the earlier the system invokes the override method. If the system has invoked the base method, you have no option to prevent the override method queue from execution. To prevent the base method executions, see the [Override Method That Replaces the Original Method](#) section below.

To add an override method that is added to the override method queue, perform the following actions:

1. Create the graph extension, as described in [To Start the Customization of a Graph](#).
2. In the Code Editor, click **View Source** to view the code of the base graph in the [Source Code Browser](#).



: In an instance of Acumatica ERP, a repository with the original C# source code of the application is kept in the `\App_Data\CodeRepository` folder of the website.

3. In the browser, select and copy the code of the method.
4. In the Code Editor, paste the method code in the graph extension.
5. In the graph extension, insert the `PXOverride` attribute immediately before the method signature.
6. Clear the method body.
7. Develop the code of the method.
8. Click **Save** in Code Editor to save your changes.

### Override Method That Replaces the Original Method

The override method with an additional parameter replaces the base BLC virtual method. When the virtual method is invoked, the system invokes the override method with an additional parameter of

the highest-level BLC extension. The system passes a link to the override method with an additional parameter from the extension of the previous level, if such a method exists, or to the base virtual method.

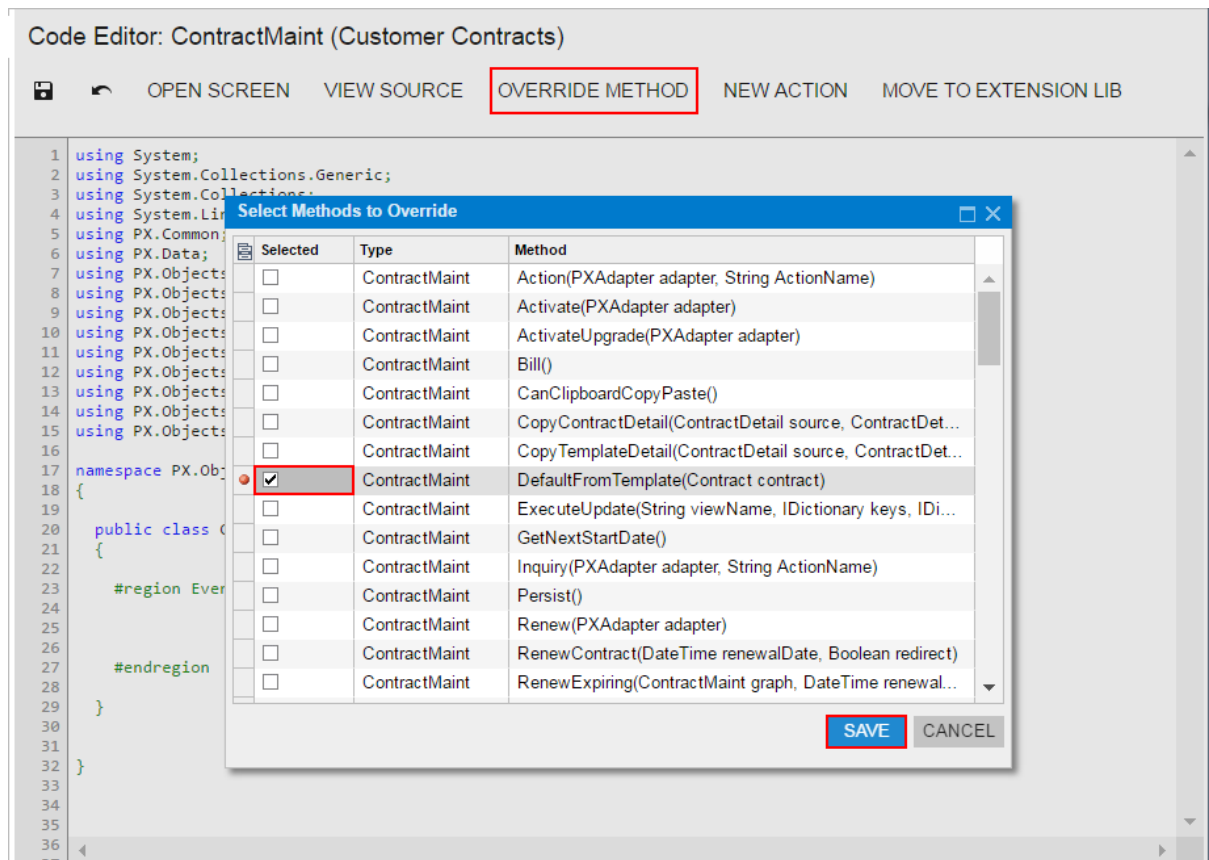
You use a delegate as an additional parameter to encapsulate the method with exactly the same signature as the base virtual method. If the base virtual method contains a list of parameters, then you should not use the same list of parameters when you declare the override method with an additional parameter. To declare a `MyMethod` override method with an additional parameter within a BLC extension, you can use the following example.

```
public class BaseBLCExt : PXGraphExtension<BaseBLC>
{
    public delegate ReturnType MyMethodDelegate([List of Parameters]);
    [PXOverride]
    public ReturnType MyMethod([List of Parameters,] MyMethodDelegate baseMethod)
    {
        return baseMethod(adapter);
    }
}
```

You can decide whether to call the method pointed to by the delegate. By invoking the base method, you also start the execution of the override method queue.

To add an override method that replaces the base BLC virtual method, perform the following actions:

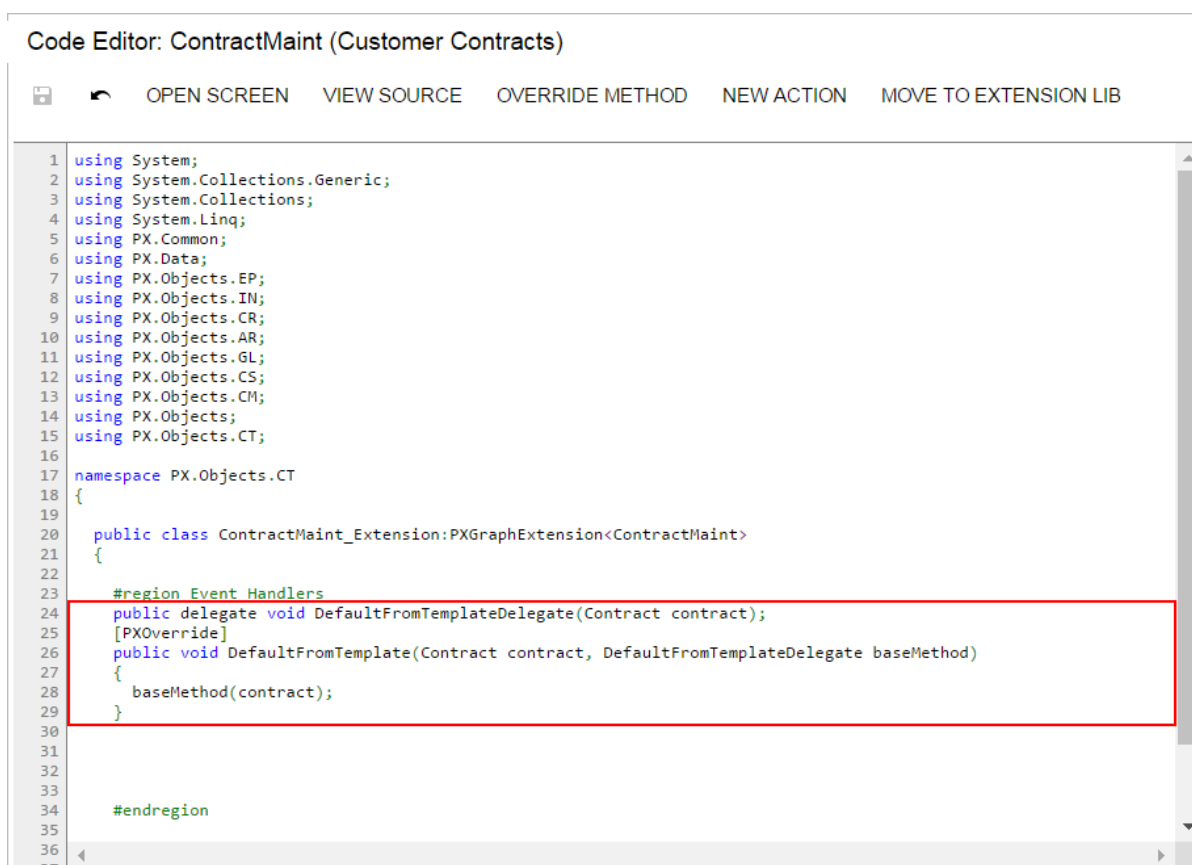
1. Create the graph extension, as described in [To Start the Customization of a Graph](#).
2. In the Code Editor, click **Override Method**, as shown in the screenshot below.
3. In the **Selected** column of the **Select Methods to Override** dialog box, which opens, select the method to be overridden.
4. Click **Save** to add the code template for the override method to the graph extension.



**Figure: Selecting a method to be overridden**

Once the override method template has been created (see the following screenshot), you can implement the needed code within the template.





**Figure: Viewing the override method template in the Code Editor**

When you publish the customization project, the platform saves the graph extension as a C# source code file in the `App_RuntimeCode` folder of the website. You can later develop the event handler in Microsoft Visual Studio. (See [Integrating the Project Editor with Microsoft Visual Studio](#) for details.)

## Data View

In a business logic controller (BLC, also referred to as *graph*), a *data view* is a `PXView` object that is used to access and manipulate data. In an ASPX page, to obtain data for controls, each container has to be bound to a data view of the BLC that is bound to the `PXDataSource` control of the page.

A data view object contains two main parts:

- The BQL command, which is defined by the type of the data view
- The optional delegate, which constructs the data set that is returned instead of the result of the execution of the BQL command

In a graph extension, you can include the following member types:

- Declaration of a custom data view
- Redefinition for an existing data view
- Declaration of the delegate for an existing data view
- An override method for an existing data view delegate

To declare a custom data view in a graph extension, you can follow the instructions described in [To Add a New Member](#).

For detailed information on customizing a data view, see the following topics:

- [To Override a Data View](#)
- [To Add a Data View Delegate](#)
- [To Override a Data View Delegate](#)

## To Override a Data View

To modify a data view, you have to redefine the data view in the graph extension class. The data view redefined within a BLC extension completely replaces the base data view within the *Views* collection of a graph instance, including all attributes attached to the data view declared within the base graph. You can either attach the same set of attributes to the data view or completely redeclare the attributes. For details, see [Graph Extensions](#). The data view must have exactly the same identifier, which is referred to in the appropriate container in the ASPX page.

To redefine a data view in the graph extension, perform the following actions:

1. Create the graph extension, as described in [To Start the Customization of a Graph](#), if required.
2. In the Code Editor, click **View Source** to view the code of the base graph in the [Source Code Browser](#).



: In an instance of Acumatica ERP, a repository with the original C# source code of the application is kept in the `\App_Data\CodeRepository` folder of the website.

3. In the browser, select and copy the data view declaration.
4. In the Code Editor, paste the data view declaration in the graph extension.
5. In the graph extension, redefine the data view declaration as required.
6. Click **Save** in the Code Editor to save your changes.

## To Add a Data View Delegate

By default, when a data view object is requested by the UI or you invoke the `Select()` method on the object, the system executes the query specified in the data view declaration. However you can define a dynamic query, which is an optional graph method (called the data view delegate) that is executed when the data view is requested. If no dynamic query is defined in the graph, Acumatica Framework executes the BQL statement from the data view declaration.

You can use the data view delegate in the following cases:

- If you construct the query dynamically at run time by adding `Where<>` and `Join<>` clauses depending on some condition, typically a filter
- If the query retrieves data fields that cannot be calculated declaratively by attributes—for instance, if you retrieve values aggregated by calculated data fields
- If the result set has data records that aren't retrieved from the database and are composed dynamically in code

In a graph extension, to define the delegate for a data view, you should redeclare the data view and add a method that has the same name as the data view but uses a different case of the first letter (for example, if the data view name is *MyDataView*, the name of the delegate must be *myDataView*). The delegate returns an `IEnumerable` object, as shown in the code below.

```
// The delegate for the MyDataView data view
protected virtual IEnumerable myDataView()
{
    // The code to be used to construct the query dynamically at run time, execute
    // the query, and return the list of retrieved records
}
```



: When you declare or alter a data view delegate within a graph extension, the new delegate is attached to the corresponding data view. To query a data view declared within the base graph or lower-level extension from the data view delegate, you should redeclare the data view within the graph extension. You do not need to redeclare a generic `PXSelect<Table>` data member in the graph extension when it will not be used from the data view delegate. For details, see [Graph Extensions](#).

You can add a data view delegate to a custom graph or to an extension for an existing graph, which is saved in the appropriate *Code* item of the customization project. See [To Create a Custom Graph](#) and [To Start the Customization of a Graph](#) for details.

If the project has not been published, you can use only the [Code Editor](#) to add a new member to the graph code.

After the customization project has been published, the code is also saved in the corresponding C# file in the `App_RuntimeCode` folder of the website. (See [Changes in the Application Code \(C#\)](#) for details.) You can open the file in Microsoft Visual Studio and use Visual Studio to add a data view delegate to the graph code. To do this, perform the following actions:

1. In Visual Studio, click **File > Open > Web Site**, and select your Acumatica ERP development environment.
2. Open the `App_RuntimeCode\<CodeItemName>.cs` file.
3. In the code, develop the delegate for the data view.



: An example of implementation of a data view delegate for a custom graph is described in Step 11.7 of the [T300 Acumatica Customization Platform](#) course. See [Declaring or Altering a BLC Data View Delegate](#) for an example of a data view delegate for a graph extension.

4. Debug the code by using Visual Studio, as described in [To Debug the Customization Code](#).
5. Save the file.
6. In the Customization Project Editor, select the **Files** node in the navigation pane.
7. On the Custom Files page, which opens, click **Detect Modified Files** on the page toolbar.



: The customization platform compares the content of each file added to the site with the content of the associated item of the customization project in the database. If a difference is detected, the platform opens the **Modified Files Detected** dialog box so you can resolve the detected conflicts. You can either update the customization project in the database or discard the file changes in the file system to resolve the conflicts.

8. In the **Modified Files Detected** dialog box, which opens, ensure that the modified code file is selected.
9. Click **Update Customization Project** on the dialog box toolbar to update the *Code* item that is saved in the database.

## To Override a Data View Delegate

You can modify the data view delegate—that is, the method that is invoked when the records are retrieved through the data view. To do this, perform the following actions:

1. Create the graph extension, as described in [To Start the Customization of a Graph](#), if required.
2. In the Code Editor, click **View Source** to view the code of the base graph in the [Source Code Browser](#).



: In an instance of Acumatica ERP, a repository with the original C# source code of the application is kept in the `\App_Data\CodeRepository` folder of the website.

3. In the browser, select and copy the data view declaration and the data view delegate.



: The override data view delegate must have exactly the same signature—the return value, the name of the method, and any method parameters—as the base data view delegate.

4. In the Code Editor, paste the code in the graph extension.



: When you declare or alter a data view delegate within a graph extension, the new delegate is attached to the corresponding data view. To query a data view declared within the base graph or a lower-level extension from the data view delegate, you should redeclare the data view within the graph extension. You do not need to redeclare a generic `PXSelect<Table>` data member in the graph extension when it will not be used from the data view delegate. For details, see [Graph Extensions](#).

5. In the graph extension, rewrite the data view delegate code as you need to.

6. Click **Save** in the Code Editor to save your changes.

## Action

---

An *action* is a graph member of the `PXAction` type. An action always has the delegate defined. Every action is represented by the `PXAction` object and placed in the *Actions* collection of the appropriate graph. To construct an instance of the `PXAction` class, you use a graph member of the `PXAction` type and a delegate from the highest-level extension discovered.

To modify the business logic of an action that is defined within a graph, you should override the action delegate.

To rename, disable, or hide an action button, you should override the action attributes.

The redefined action delegate must have exactly the same signature—that is, the return value, the name of the method, and any method parameters—as the base action delegate has. You always have to redefine the action delegate to alter either its delegate or the attributes attached to the action. To use the action declared within the base graph or a lower-level extension from the action delegate, you should redefine the generic `PXAction<TNode>` data member within the graph extension. You do not need to redefine the data member when it is not meant to be used from the action delegate. For details, see [Graph Extensions](#). When you redefine an action delegate, you have to repeat the attributes attached to the action. Every action delegate must have `PXButtonAttribute` (or the derived attribute) and `PXUIFieldAttribute` attached.

For detailed information on customizing an action, see the following topics:

- [To Start the Customization of an Action](#)
- [To Override an Action Delegate Method](#)
- [To Rename an Action Button](#)
- [To Disable or Enable an Action](#)
- [To Hide or Show an Action](#)

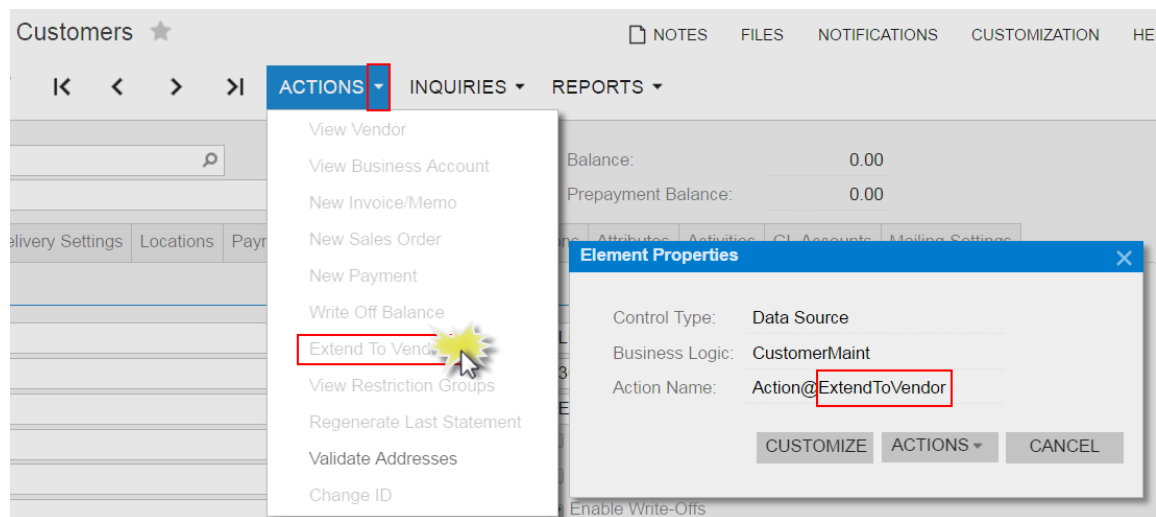
## To Start the Customization of an Action

If you need to customize an action represented by a button on a form, perform the following actions:

1. To find the declaration of the action, do the following:
  - a. Open the form in the browser, and make the button visible on the form (if it isn't when the form is brought up).
  - b. On the form title bar, click **Customization > Inspect Element** to launch the [Element Inspector](#).
  - c. On the form, click the button to open the [Element Properties](#) dialog box for the button.



: If the action command is a part of an action menu, open the menu to display the command and use the keyboard shortcut Ctrl+Alt+Click to inspect the action item in the menu, as shown in the following screenshot.



**Figure: Displaying the action name in the Element Properties dialog box**

- d. In the dialog box, click **Actions > View Business Logic Source** to open the source code of the graph whose name is displayed in the Business Logic box of the Element Properties dialog box.



: In an instance of Acumatica ERP, the repository with the original C# source code of the application is kept in the \App\_Data\CodeRepository folder of the website.

- e. In the **Methods** list of the [Source Code](#) browser, which opens for the graph, search for and click the action name to display the action delegate method in the work area of the browser, as the following screenshot shows.



**Figure: Viewing the action delegate method in the Source Code browser**

- f. If the search fails, try to find the action declaration in the base class of the graph.



: If the button has an unique name, you can also find the action declaration in the Source Code Browser, as described in [To Find Source Code by a Fragment](#), by using the button name as a code fragment.

2. Explore the action declaration in the source code of the original graph.
3. Select and copy the action declaration.
4. Create an extension for the graph, as described in [To Start the Customization of a Graph](#), if needed.
5. In the graph extension, paste the action declaration and develop the needed code to change the behavior and appearance of the action.

## To Override an Action Delegate Method

With the technology based on extension models, an action from base graph is always completely replaced by the identically named action declared within a graph extension.

To override an action delegate method in a graph extension, you should declare both the graph member of the `PXAction` type and the delegate. You should attach a new set of attributes to the action delegate declared within the graph extension. Also, you need to invoke the `Press()` method on the base graph action. Because you have redeclared the member of `PXAction`, you have prevented the action delegate execution from infinite loops.



: If you have a customization that replaces an original action declaration statically, after you upgrade Acumatica ERP to a new version, new functionality of the action may become unavailable.

Do the following to override an action delegate method:

1. Explore the original action declaration and copy the declaration to the graph extension, as described in [To Start the Customization of an Action](#).



**Attention:** We recommend that you not remove or change any attributes of the action.

2. In the action declaration, replace the action delegate with the following code template.

```
public virtual IEnumerable myAction(PXAdapter adapter)
{
    return Base.MyAction.Press(adapter);
}
#endregion
```

3. In the code template, replace `myAction` and `MyAction` with the appropriate names.
4. In the template, redefine the action delegate arguments and return type based on the signature of the base action delegate.
5. Implement the needed code in the override action delegate.
6. Click **Save** in the Code Editor to save your changes.

## To Rename an Action Button

To rename an action button, you should redefine the `DisplayName` parameter of the `PXUIField` attribute for the button.

You can change attributes of an action button in one of the following ways:

- [Dynamically at run time, in the `Initialize\(\)` method of the graph extension](#)
- [Statically, by overriding the action attributes in the graph extension](#)

### To Rename an Action Button Dynamically at Run Time

1. Explore the original action declaration, as described in [To Start the Customization of an Action](#) but without copying the declaration to the graph extension.

2. In the graph extension, add the following code.

```
#region Extended initialization

public override void Initialize()
{
    base.Initialize();
    Base.MyAction.SetCaption("NEW NAME");
}

#endregion
```

3. In the added code, replace `MyAction` with the action name and specify the needed button name.
4. Click **Save** in Code Editor to save the changes.

### To Rename an Action Button Staticly

To override action attributes in a graph extension statically, you should declare both the graph member of the `PXAction` type and the delegate. You should attach a new set of attributes to the action delegate, declared within the graph extension. Also, you need to invoke the `Press()` method on the base graph action. Because you have redeclared the member of `PXAction`, you have prevented the action delegate execution from infinite loops.



: If you have a customization that replaces an original action declaration statically, after you upgrade Acumatica ERP to a new version, the new functionality of the action may become unavailable.

To rename an action button statically, perform the following actions:

1. Explore the original action declaration, and copy the declaration to the graph extension, as described in [To Start the Customization of an Action](#).
2. In the action declaration, specify the required name for the action button in the `PXUIField` attribute, as the following code snippet shows.

```
...
[PXUIField(DisplayName = "NEW NAME", ...)]
...
```



**Attention:** We recommend that you not remove or change other attributes of the action.

3. Replace the action delegate with the following code template.

```
public virtual IEnumerable myAction(PXAdapter adapter)
{
    return Base.MyAction.Press(adapter);
}

#endregion
```

4. In the code template, replace `myAction` and `MyAction` with the appropriate names.
5. In the template, redefine the action delegate arguments and return type based on the signature of the base action delegate.
6. Click **Save** in the Code Editor to save your changes.

### To Disable or Enable an Action

To disable or enable an action button, you can redefine the `Enabled` parameter of the `PXUIField` attribute for the button. However we recommend that you change the attribute dynamically at run time in the `Initialize()` method of the graph extension.



: If you have a customization that replaces an original action declaration statically, after you upgrade Acumatica ERP to a new version, any new functionality of the action may become unavailable.

To disable or enable an action button, do the following:

1. Explore the original action declaration, as described in [To Start the Customization of an Action](#) but without copying the declaration to the graph extension.
2. In the graph extension, add the following code.

```
#region Extended initialization

public override void Initialize()
{
    base.Initialize();
    Base.MyAction.SetEnabled(false);
}

#endregion
```



: To enable the action button, use *true* instead of *false* for the `SetEnabled` method call.

3. In the added code, replace `MyAction` with the action name.
4. Click **Save** in the Code Editor to save your changes.

## To Hide or Show an Action

To hide or show an action button, you should redefine the `Visible` parameter of the `PXUIField` attribute for the button.

You can change attributes of an action button by using one of the following approaches:

- *Dynamically at run time, in the `Initialize()` method of the graph extension*
- *Statically, by overriding the action attributes in the graph extension*
- *Statically, by changing visibility of the button in the ASPX code*

### To Hide or Show an Action Button at Run Time

1. Explore the original action declaration, as described in [To Start the Customization of an Action](#) but without copying the declaration to the graph extension.
2. In the graph extension, add the following code.

```
#region Extended initialization

public override void Initialize()
{
    base.Initialize();
    Base.MyAction.SetVisible(false);
}

#endregion
```



: To show the action button, use *true* instead of *false* for the `SetVisible` method call.

3. In the added code, replace `MyAction` with the action name.
4. Click **Save** in the Code Editor to save your changes.

### To Hide or Show an Action Button Statically

To override action attributes in a graph extension statically, you should declare both the graph member of the `PXAction` type and the delegate. You should attach a new set of attributes to the action delegate



declared within the graph extension. Also, you need to invoke the `Press()` method on the base graph action. Because you have redeclared the member of `PXAction`, you prevent the action delegate execution from infinite loops.



: If you have a customization that replaces an original action declaration statically, after you upgrade Acumatica ERP to a new version, any new functionality of the action may become unavailable.

To hide or show the action button, perform the following actions:

1. Explore the original action declaration and copy the declaration to the graph extension, as described in [To Start the Customization of an Action](#).
2. In the action declaration, set the `Visible` parameter of the `PXUIField` attribute to *false*, as the following code snippet shows.



: To show the action button, set the `Visible` parameter to *true*.

```
...
[PXUIField(..., Visible = false)]
...
```



**Attention:** We recommend that you not remove or change other attributes of the action.

3. Replace the action delegate with the following code template.

```
public virtual IEnumerable myAction(PXAdapter adapter)
{
    return Base.MyAction.Press(adapter);
}
```

4. In the code template, replace `myAction` and `MyAction` with the appropriate names.
5. In the template, redefine the action delegate arguments and return type based on the signature of the base action delegate.
6. Click **Save** in the Code Editor to save your changes.

### To Hide or Show an Action Button in the ASPX Code

If a callback command for the button is declared in the `PXDataSource` control, you can hide the button by customizing the ASPX code. To do this, perform the following actions:

1. Open the form in the browser and make the button visible on the form.
2. On the form title bar, click **Customization > Inspect Element** to launch the [Element Inspector](#).
3. On the form, click the button to open the [Element Properties](#) dialog box for the button.



: If the button is a part of an action menu, inspect the menu button instead of the button.

4. In the dialog box, click **Customize**.
5. If there is no currently selected customization project and the inspector opens the [Select Customization Project Dialog Box](#), select an existing customization project or create a new one.  
If there is no a *Page* item for the form in the customization project, the Acumatica Customization Platform creates such item, adds the item to the project, and opens the form in the [Screen Editor](#).
6. In the Control Tree of the editor, click the arrow left of the `PXDataSource` node to expand it.

7. Select the `PXDSCallbackCommand` element with the button name.
8. Click the **Layout Properties** tab item to open the list of properties for the callback.
9. Set the `Visible` property of the element to *False* to hide the button.



10. Click **Save** to save your changes to the customization project.

# Customizing the Database Schema

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You can use the platform to customize the database of an Acumatica ERP instance. The database customization can include changes in both the data and the schema of the database.

To change the database schema, you can add to a customization project the following scripts:

- A script to create a custom table
- A script to create a custom column in an existing table
- A script to create an extension table for an existing table
- A custom script

When you publish a customization project with a database script, which changes the database schema, the script is executed. Changes to the database schema aren't deleted when you unpublish the project or delete the script and publish the project once more. You have to remove the changes to the database schema manually.

For detailed information on creating custom database scripts and adding the scripts to a customization project, see the following topics:

- [To Create a Custom Table](#)
- [To Create a Custom Column in an Existing Table](#)
- [To Create an Extension Table](#)
- [To Add a Custom SQL Script to a Customization Project](#)

## To Create a Custom Table

---

You use the Database Scripts page of the Customization Project Editor to add a custom table to a customization project. You can add a custom table to a project by adding the table schema or by adding a custom SQL script.

Adding the table schema is the optimal way of adding custom tables to the project. When you publish the customization project, the platform executes each SQL script of the project to update the database. If an *Sql* item contains a custom database table definition, to update the database with the table schema, the Acumatica Customization Platform checks whether a table with this name already exists in the database. If the table exists, the platform generates SQL statements to alter the existing table so that it matches the schema. The platform doesn't drop the existing table, and it keeps any data in it. This helps to deploy a newer version of the customization project to a system that is already in use. If the table doesn't exist, the platform generates SQL statements to create the table. SQL statements are generated in the SQL dialect of the database management system. Therefore, if you add custom tables to the project by adding the table schema, you keep the customization project independent from the database management system that hosts the database of Acumatica ERP.

Alternatively, you can add custom tables by adding a custom SQL script that creates the table in the project, as described in [To Add a Custom SQL Script to a Project](#).



: The creation or modification of the System tables is forbidden. A customization project containing such changes will not pass validation tests. For details on the System tables, see [System and Application Tables](#).

### To Add a Custom Table to a Customization Project

1. Create the needed table in the database by using a database administration tool, such as SQL Server Management Studio.



: You have to use a naming convention that provides unique names for your custom tables so that they do not have the names of existing tables of Acumatica ERP.

2. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
3. Click **Database Scripts** in the navigation pane to open the Database Scripts page.
4. On the page toolbar, click **Add > Custom Table Schema**.
5. In the **Add Custom Table Schema** dialog box, which opens, select the custom table in the **Table** box and click **OK**.

Acumatica Customization Platform generates the table schema and adds the schema to the customization project as an *Sql* item.

Below is an example of the *Sql* item that contains the table schema of the custom table *RBProduct*.

```
<Sql TableName="RBProduct" TableSchemaXml="#CDATA">
  <CDATA name="TableSchemaXml"><![CDATA[<table name="RBProduct">
    <col name="ProductID" type="Int" identity="true" />
    <col name="ProductCD" type="NVarChar(15)" />
    <col name="ProductName" type="NVarChar(50)" />
    <col name="Active" type="Bit" />
    <col name="StockUnit" type="NVarChar(20)" />
    <col name="UnitPrice" type="Decimal(19,6)" />
    <col name="MinAvailQty" type="Decimal(25,6)" />
    <col name="TStamp" type="Timestamp" />
    <index name="RBProduct_PK" clustered="true" primary="true" unique="true">
      <col name="ProductID" />
    </index>
  </table>]]></CDATA>
</Sql>
```

## To Create a Custom Column in an Existing Table

Because you can need a new column in an existing database table only for a bound data field, the Acumatica Customization Platform automatically creates a custom column when you create a custom bound data field by using the New Field wizard.

To add a custom field as a new column that will be appended to the original table of Acumatica ERP, perform the following actions:

1. Open the **Create New Field** dialog box for the data access class *by using the Data Class Editor* or *by using the Layout Editor*.
2. In the dialog box, specify the custom field parameters and select *DBTableColumn* in the **Storage Type** box to make the system append the column to the original table in the database.
3. Click **OK** to add the field to the data access class.

The New Field wizard includes an XML declaration of the new field in the *DAC* item for the modified data access class. If the *DAC* item for the modified data access class is absent in the customization project, the wizard creates the appropriate item. Also, the wizard creates a *Table* item with a description of the custom column to be created in the database table for the custom field.

After you publish the customization project at least once, the database schema is changed. Changes to the database schema aren't deleted when you unpublish the project or delete the *DAC* and *Table* items and publish the project once more. You have to remove the changes manually.

## To Create an Extension Table

The Acumatica Customization Platform provides the following options to create a custom column in a table of the database:

- Add the column to the original table
- Create a separate table that is an extension of the original table, and add the column to the extension table

In some cases, you may need to store new field values in a separate table or use this table independently from the original database table. You can use the Acumatica Customization Platform to create a separate extension database table. This table must include all main key fields from the original database table and your new fields. You should create a DAC extension that holds the new fields and is mapped to the extension table. The platform will automatically synchronize the extension table with the original database table by expanding every create, retrieve, update, and delete operation on the base (original) DAC to each discovered DAC extension that is mapped to an extension table.

To declare a DAC extension that is mapped to an extension table, perform the following actions:

1. Create an extension table in the database according to the requirements described in [Requirements for an Extension Table Schema](#).
2. Declare a DAC extension mapped to the created table, as described in [DAC Extension Mapped to an Extension Table](#).

By using the `PXTable` attribute, you specify that the DAC extension is mapped to the extension table with the same name.

## Requirements for an Extension Table Schema

You should ensure that the following requirements are met when you create an extension table:

- The extension table should have the same set of main key columns as the original database table has.
- The extension table must include the following columns if they are declared within the original database table:
  - `[CompanyID][int] NOT NULL`
  - `[DeletedDatabaseRecord][bit] NOT NULL`
- For an extension table that can be used separately, you should also declare the following audit columns:
  - `[tstamp][timestamp] NULL`
  - `[CreatedByID][uniqueidentifier] NOT NULL`
  - `[CreatedByScreenID][char] ( 8 ) NOT NULL`
  - `[CreatedDateTime][datetime] NOT NULL`
  - `[LastModifiedByID][uniqueidentifier] NOT NULL`
  - `[LastModifiedByScreenID][char] ( 8 ) NOT NULL`
  - `[LastModifiedDateTime][datetime] NOT NULL`

The example below shows the declaration of the `InventoryItemTableExtension` extension table. Notice that this table will not be used independently from the original database table.

```
CREATE TABLE [dbo].[InventoryItemTableExtension]
(
    [CompanyID] [int] NOT NULL,
    [InventoryID] [int] NOT NULL,
```

```

[DeletedDatabaseRecord] [bit] NOT NULL,
[ExtTableDescr] [nvarchar](256) NULL
CONSTRAINT [InventoryItemTableExtension_PK] PRIMARY KEY CLUSTERED
(
    [CompanyID] ASC,
    [InventoryID] ASC
)
WITH (PAD_INDEX = OFF,
    STATISTICS_NORECOMPUTE = OFF,
    IGNORE_DUP_KEY = OFF,
    ALLOW_ROW_LOCKS = ON,
    ALLOW_PAGE_LOCKS = ON)
ON [PRIMARY]
) ON [PRIMARY]
ALTER TABLE [dbo].[InventoryItemTableExtension] ADD DEFAULT ((0))
FOR [DeletedDatabaseRecord]
GO

```

## DAC Extension Mapped to an Extension Table

You can define a DAC extension mapped to an extension table by using either the default *Inner Join* way or the optional *Left Outer Join* way. To specify which way is used, you need to set the value for the `IsOptional` parameter of the `PXTable` attribute. By default, the system sets this parameter value to *false*. You need to specify the `IsOptional` parameter value only if you need to set its value to *true*.

```

[PXTable(IsOptional = value)]
public class TableExtension : PXCacheExtension<BaseDAC>
{ ... }

```

If the DAC contains surrogate and natural keys, then the `PXTable` attribute attached to the DAC extension should reference the surrogate key as well as other database key fields (but not the natural key). If the DAC doesn't have surrogate and natural keys, no key fields should be specified in the `PXTable` attribute. See the following code example of the declaration of the `PXTable` attribute with key references.

```

[PXTable(typeof(BaseDAC.surrogateKey),
    typeof(BaseDAC.otherDBKeyField),
    IsOptional = value)]
public class TableExtension : PXCacheExtension<BaseDAC>
{ ... }

```



**!!!** : The natural key is a user-friendly value that is not used as a key in the database. The surrogate key, which is the internal value corresponding to the natural key, is not shown to the user and is assigned by the system. When you use a natural key, the DAC field that serves as a surrogate key is bound to the database key column, but is not marked as key within its attributes.

In the sample code shown below, the `Location` database table contains both the surrogate `LocationID` key and the natural `LocationCD` key. The `Location` database table main key contains the `BAccountID` and `LocationID` columns. Because `LocationCD` is a natural key, we need to specify the corresponding surrogate key, `LocationID`, as well as the other database key field, `BAccountID`, in the `PXTable` attribute.

```

[PXTable(typeof(Location.locationID),
    typeof(Location.bAccountID))]
public class LocationTableExtension : PXCacheExtension<Location>
{ ... }

```

## The Left Outer Join Way

The following example shows the declaration of a DAC extension mapped to an extension table with the *Left Outer Join* way. Notice that the `IsOptional` parameter of the `PXTable` attribute is set to `true`.

```
[PXTable(IsOptional = true)]
class LeftJoinTableExtension : PXCacheExtension<BaseDAC>
{
}
```

The *Left Outer Join* way covers the common steps required to add an extension tables to a customization project. For details on populating an extension table with records, see [SQL Script Editor](#).

The *Left Outer Join* way:

- Can be used when the original and extension database tables are not necessarily synchronized.
- Causes an extension table record to be created when the appropriate original table record is created or updated.
- Never excludes an original database table record from the result set.
- Calculates the default field values if no extension table record is found.
- Can be used as a standalone DAC.

The following example shows the declaration of the `InventoryItemTableExtension` DAC extension mapped to the extension table with the *Left Outer Join* way.

```
[PXTable(typeof(InventoryItem.inventoryID), IsOptional = true)]
public class InventoryItemTableExtension : PXCacheExtension<InventoryItem>
{
    #region ExtTableDescr
    public abstract class extTableDescr : PX.Data.IBqlField
    {
    }
    [PXDBString(255)]
    [PXDefault("Additional description")]
    [PXUIField(DisplayName = "Ext_Table Description")]
    public string ExtTableDescr { get; set; }
    #endregion
}
```

Suppose that you have added the corresponding **Ext\_Table Description** control to the header area of the Stock Items (IN202500) form. If you open the form, by clicking navigation buttons on the form toolbar, you can ensure that all the stock items are visible, while the **Ext\_Table Description** control has the default *Additional description* value set, as the screenshot below illustrates.

The screenshot shows the Acumatica interface with the 'DISTRIBUTION' tab selected. The 'Inventory' section is active, and the 'New York - Stock Items' form is open. The 'Ext\_Table Description' field is highlighted with a red box, containing the text 'Additional description'. The 'Inventory ID' is '301KITSTD3', and the 'Item Status' is 'Active'. The 'Description' is 'Std kit #3'. The 'General Settings' tab is selected, showing 'ITEM DEFAULTS' and 'UNIT OF MEASURE' sections. The 'Item Class' is 'MISC - Miscellaneous', and the 'Base Unit' is 'PC'. The 'Type' is 'Finished Good', and 'Is a Kit' is checked. The 'Valuation Method' is 'Standard'. The 'Physical Inventory' section shows 'PI Cycle' and 'ABC Code' fields.

**Figure: Exploring the behavior of the customized Stock Items form**

If you update a data record (by changing the value of any control, including **Ext\_Table Description**), a new database record is added to the extension table, as the following two screenshots illustrate.

The screenshot shows the same Acumatica interface, but the 'Ext\_Table Description' field is now highlighted with a red box and contains the text 'After adding and saving any extension comment, a new record is added to the extension table'. The 'Inventory ID' is now '301KITSTD3 - Std kit #3', and the 'Description' is 'Std kit #3'. The 'General Settings' tab is selected, showing 'ITEM DEFAULTS' and 'UNIT OF MEASURE' sections. The 'Item Class' is 'MISC - Miscellaneous', and the 'Base Unit' is 'PC'. The 'Type' is 'Finished Good', and 'Is a Kit' is checked. The 'Valuation Method' is 'Standard'. The 'Physical Inventory' section shows 'PI Cycle' and 'ABC Code' fields.

**Figure: Entering and saving the description in the new control**



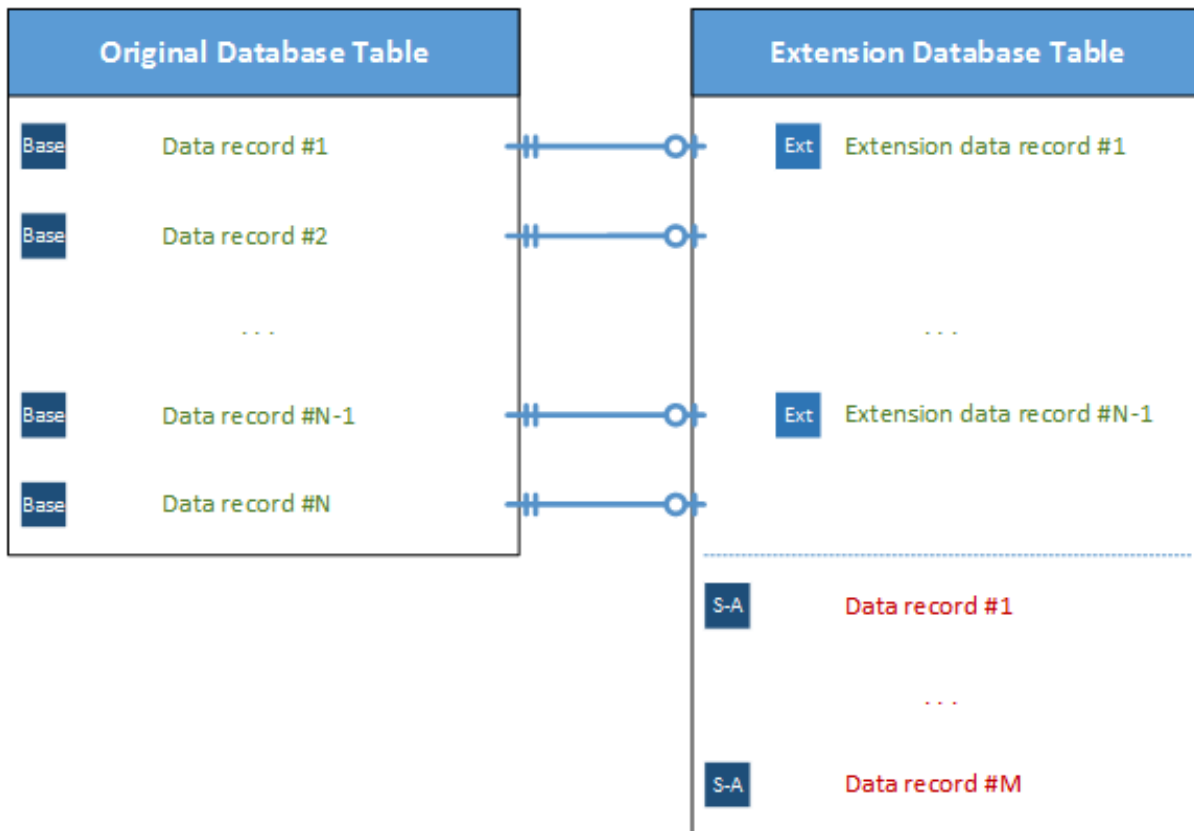
When you use the *Left Outer Join* way, data records within the original and extension tables are not necessarily synchronized (as the figure below illustrates); data record synchronization works as follows:

- If an appropriate data record does not exist within an extension table when the system queries the original table, the system automatically generates and assigns default values to every field of the DAC extension that is mapped to the extension table; otherwise, DAC extension field values are read from the database.
- When a new record is inserted into the original table, the system automatically inserts a new record into the extension table.
- If a data record does not exist within an extension table when the system updates the original table, the system automatically inserts a data record into the extension table. Otherwise, if there are no modified fields of the DAC extension that is mapped to the extension table, the system does not update the extension table data record.
- When the system deletes the data record in the original table, it automatically deletes the appropriate data record from the extension table, if such a record exists.



To use an extension table independently from the original database table, you should declare a data view by using a DAC extension that is mapped to an extension table as the main DAC, as shown below.

In the example of the data view declaration above, extension table data records have no reference to the original database table records. You can work with these data records just as you would work with any other DAC instance.



**Figure: Exploring data record synchronization when the Left Outer Join way is used**

### The Inner Join Way

The *Inner Join* is the default way.

The following example shows the declaration of a DAC extension mapped to an extension table with the default *Inner Join* way.

```
[PXTTable]
class InnerJoinTableExtension : PXCACHEExtension<BaseDAC>
{
}

```

The *Inner Join* way:

- Can be used only when the original table and extension table are always synchronized.
- Causes an extension table record to be automatically created only when the appropriate original database table record is created.
- Requires the main key column values to be copied from the original table to each extension table.
- Excludes an original database table record from the result set when no corresponding extension table record is found.
- Can be used as a standalone DAC.

The sample code below shows the declaration of the `InventoryItemTableExtension` DAC extension, which is mapped to the extension table by using the default *Inner Join* way.

```
[PXTTable(typeof(InventoryItem.inventoryID))]
public class InventoryItemTableExtension : PXCACHEExtension<InventoryItem>

```

```

{
    #region ExtTableDescr
    public abstract class extTableDescr : PX.Data.IBqlField
    {
    }
    [PXDBString(255)]
    [PXDefault("Additional description")]
    [PXUIField(DisplayName = "Ext_Table Description")]
    public string ExtTableDescr { get; set; }
    #endregion
}

```

If you again open the Stock Items (IN202500) form, by clicking navigation buttons on the form toolbar of the Stock Items form, you will see that only one stock item is visible, and it has the modified

### **Ext\_Table Description.**

To have access to the other database table records, you need to populate the extension table with the appropriate records. You can do this by using the following script.

```

INSERT INTO [dbo].[InventoryItemTableExtension]
SELECT
    CompanyID,
    InventoryID,
    0,
    N'Additional description'
FROM [dbo].[InventoryItem]
WHERE NOT EXISTS
(
    SELECT * FROM [dbo].[InventoryItemTableExtension] AS t
    WHERE t.CompanyID = [dbo].[InventoryItem].CompanyID
        AND t.InventoryID = [dbo].[InventoryItem].InventoryID
)
GO

```

After you copy data records from the `InventoryItem` database table to the `InventoryItemTableExtension` user extension table, you will notice that all stock items are visible again.

When you use the *Inner Join* way, the data records within the base and extended tables must always be synchronized (see the screenshot below). With this way, data record synchronization works as follows:

- If an appropriate data record does not exist within an extension table when the system queries the original table, the system excludes the original table record from the result set.
- When a new record is inserted into the original table, the system automatically inserts a new record into the extension table.
- When the system updates the data record in the original table, it does not update the extension table if there are no modified fields of the DAC extension that is mapped to the extension table.
- When it deletes the original table data record, the system automatically deletes the appropriate data record from the extension table, if such a record exists.



: To use the extension table independently from the original database table, you should declare a data view by using a DAC extension, which is mapped to an extension table, as the main DAC (for details, see the [The Left Outer Join Way](#) section).

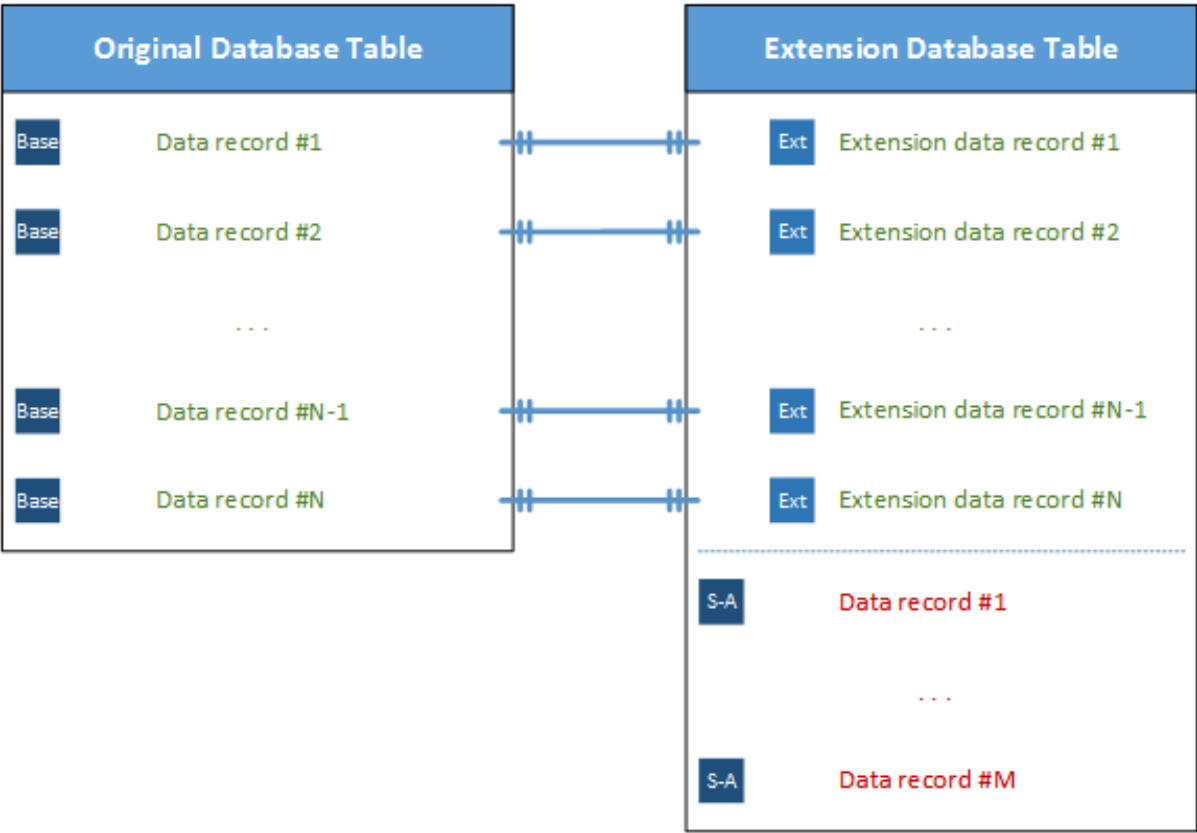


Figure: Exploring data record synchronization when you use the Inner Join way

## To Add a Custom SQL Script to a Customization Project

With the platform, you can add to a customization project an SQL script to be executed during the publication of the project. However, we recommend that you avoid doing this.



**Warning:** A possible result of a custom SQL script is the loss of the integrity and consistency of the application data.

If you do add a custom SQL script, you must adhere to the following requirements for the script:

- Because Acumatica ERP supports multitenancy, you must create an SQL script that correctly creates a database object that properly specifies and uses the company mask.
- You must correctly specify the attributes for the script so that the script can be executed on the target database servers: MySQL Server, Microsoft SQL Server, or both. For details about attributes, see [Using the SQL Script Attributes](#).

### To Add a Custom SQL Script to a Customization Project

1. Prepare, debug, and test the SQL script with a database administration tool, such as SQL Server Management Studio. (See [Creating a Custom SQL Script](#) for details.)
2. Open the customization project in the Customization Project Editor. (See [To Open a Project](#) for details.)
3. Click **Database Scripts** in the navigation pane to open the Database Scripts page.
4. On the page toolbar, click **Add > Script**.

5. In the **Script Name** box of the [SQL Script Editor](#), which opens, specify the name of the script to be used as the object name of the customization item. (The name can contain only English characters and digits.)
6. Optional: In the **Priority** box, specify the priority of the script. By default, the priority is 0.
7. For each batch that you want to add, do the following:
  - a. Click **Specify Database Engine**, and in the **Attribute** box, select one of the following options:
    - *Skip Batch on MySQL Server*, which adds the `--[mysql: Skip]` attribute to the end of the text in the text area of the script editor.
    - *Skip Batch on Microsoft SQL Server*, which adds the `--[mssql: Skip]` attribute to the end of the text in the text area of the script editor.
    - *Use Interpreter*, which adds the `--[VmSql]` attribute to the end of the text in the text area of the script editor.

For more information on the database script attributes, see [Using the SQL Script Attributes](#).
  - b. In the text area of the editor, below the added attribute, enter the SQL script.
8. In the editor, click **OK** to add the script to the customization project.

If a custom script causes an error, the error message will appear during the publication process when the system executes the custom scripts.

# Integrating the Project Editor with Microsoft Visual Studio

---

You do not need to install MS Visual Studio to customize the Acumatica ERP UI or to develop a simple changes of business logic, because the platform includes the [Customization Tools](#), which are designed for these purposes and available in your web browser. However you can use Visual Studio to develop the customization code.

If you plan to use Visual Studio on the server that hosts the website of Acumatica ERP 2019 R1, the environment where you install and use Acumatica Framework or Acumatica ERP should meet particular requirements, which are described in [System Requirements for Acumatica Framework 2019 R1](#).

To use Visual Studio while customizing Acumatica ERP, you can select one of the following approaches:

- Create an [Extension Library](#), develop the customization code in Visual Studio, compile the DLL binary file within the `Bin` folder of the website, and add this custom file to the customization project
- Develop and debug the customization code of a customization project on the fly by using Visual Studio

This part of the guide describes the second approach, because the first one is obvious and does not require any integration between the Customization Project Editor and Visual Studio.

To use the second approach, you should perform the following steps each time you want to use Visual Studio to develop and debug the customization code on the fly:

1. In [Data Class Editor](#), create extensions for existing data access classes if required, as described in [To Create a DAC Extension](#).
2. In [Code Editor](#), for business logic controllers, create new classes or class extensions that contain required code templates, as described in [To Create a Custom Graph](#) and [To Start the Customization of a Graph](#).
3. Publish the customization project to obtain the corresponding C# files within the `App_RuntimeCode` website folder. (See [Performing the Publication Process](#) for details.).\
4. By using Visual Studio, develop, modify, and debug the customization code in these files on the fly. (See [To Debug the Customization Code](#) for details.)
5. In the Customization Project Editor, update the code in the customization project, as described in [To Synchronize Code Changes with the Customization Project](#).

## In This Chapter

- [To Work with a Code Item](#)
- [To Work with Data Access Classes](#)
- [To Debug the Customization Code](#)
- [To Synchronize Code Changes with the Customization Project](#)
- [To Create an Extension Library](#)
- [Useful Tips](#)

## To Work with a Code Item

---

The [Code Editor](#) does not provide facilities you can use in Microsoft Visual Studio to develop and debug any source code in customization projects. To start working with a *Code* item in Visual Studio, perform the following instructions:

1. Publish the customization project, as described in [Publishing Customization Projects](#).

After you have published the customization project, the `<CodeItemName>.cs` file with the item code is placed in the `App_RuntimeCode` folder of the website.

2. Launch Visual Studio.

3. To open the `<CodeItemName>.cs` file in Visual Studio, on the main menu, click **File > Open > File**, and select the file in the **Open File** dialog box, which opens.



: If you need to debug the customization code, you have to open the website instead of the file. See [To Debug the Customization Code](#) for details.

4. After you have finished editing the source code of the item, click **Save** to save your changes in the file.

Because the `App_RuntimeCode` folder contains the customization code that is published, the changes in the file are immediately applied to the application instance.

5. Open or refresh the form that uses the code, to make sure that the business logic has been changed for the form.



: If an error exists in the changed file, the website might be corrupted. You can recover the website, for example, in one of the following ways:

- Debug the code
- Undo the changes
- Publish the customization project again to update the files in the `App_RuntimeCode` folder
- Delete the file from the `App_RuntimeCode` folder

6. To update the *Code* item in the customization project, follow the instructions described in [To Synchronize Code Changes with the Customization Project](#).

## To Work with Data Access Classes

---

You can use Microsoft Visual Studio to work with a data access class (DAC) that has been added to a customization project.

A customization project can contain code for a DAC in the following item types (see [Supported DAC Extension Formats](#) for details):

- As a *DAC* item with XML data for an existing DAC
- As a *Code* item with the code of an existing DAC extension
- As a *Code* item with the code of a custom DAC
- In a *File* item that keeps a `.dll` file of the extension library that contains the binary code of a DAC extension or custom DAC

Once a customization project is published, you can use Visual Studio to develop, modify, and debug the customization code of a *Code* item on the fly. However, you cannot use this approach for a *DAC* item.

If you need to work in Visual Studio with the code of the DAC whose changeset is added to a customization project as a *DAC* item in XML format, perform the following actions:

1. Follow the instructions described in [To Convert a DAC Item to a Code Item](#) to convert the item to the *Code* item.
2. Follow the instructions described in [To Work with a Code Item](#) to change the code of the DAC extension.

## To Debug the Customization Code

---

The [Code Editor](#) does not provide facilities you can use to debug a code item of a customization project. We recommend that you use Microsoft Visual Studio to develop and debug any source code in

customization projects. To start debugging an existing *Code* item in Visual Studio, perform the following instructions:


1. Publish the customization project, as described in [Publishing Customization Projects](#).
2. In the file system, open in a text editor the `web.config` file located in the website folder.
3. In `<system.web>` tag of the file, locate the `<compilation>` element.
4. Set to *true* the `debug` attribute of the element, as follows.

```
<compilation debug="true" ...>
```



: See [Debug Mode in ASP.NET Applications](#) for details.

5. In a browser, launch your instance of Acumatica ERP to have a running process in the system.
6. Launch Visual Studio.
7. To open the website of your instance of Acumatica ERP in Visual Studio, on the main menu, click **File > Open > Web Site**, and select the website folder in the **Open Web Site** dialog box, which opens.
8. In the Solution Explorer of Visual Studio, expand the `App_RuntimeCode` website folder, and double-click the file of the *Code* item to open it.
9. In the item source code, which opens, set a breakpoint on the line of the code where you need to stop the process for debugging.
10. On the main menu, click **Debug > Attach to Process**, and in the **Attach to Process** dialog box, which opens, select the `w3wp.exe` process in the list of **Available Processes**.
 

 : In the dialog box, ensure that the **Show processes from all users** check box is selected. If the check box is cleared, the list will not display the `w3wp.exe` process record.
11. In the browser, open the form of Acumatica ERP whose business logic code you want to debug.
12. In the browser, run an operation that invokes the fragment of the code that contains the breakpoint.

The process will be stopped at the breakpoint, and you can debug the code in Visual Studio.

## To Synchronize Code Changes with the Customization Project

When you create a *Code* item in a customization project, Acumatica Customization Platform performs the following actions:

- Saves the item content in the database as a *Code* item
- Adds the item ID to the customization project

When you publish the project, the platform creates the `<CodeItemName>.cs` file in the `App_RuntimeCode` website folder of the current instance of Acumatica ERP.

If you use the [Code Editor](#) to modify a *Code* item and click **Save** on the page toolbar, the platform saves the changes only in the database. To update files in the `App_RuntimeCode` folder, you have to publish the project again.

If you have modified the item code in Microsoft Visual Studio, you have to synchronize the changes with the item in the database. To do that, do the following:

- Follow the instructions described in [To Update a File Item in a Project](#) to update files in the customization project.

For more information about the synchronization mechanism provided by the Acumatica Customization Platform, see [Detecting the Project Items Modified in the File System](#).



## To Create an Extension Library

---

To develop customization code in an extension library, you should first create this extension library. This topic describes how to create the extension library using the Customization Project Editor.

### To Create an Extension Library

1. On the main menu of the Customization Project Editor, click **Extension Library > Create New**. The **Create Extension Library** dialog box opens.
2. Specify the location and name of the Visual Studio project that will contain the extension library.
3. Click **OK** to close the dialog box and start the process of creating the library.

During the process, Acumatica Customization Platform creates the following files in the folder specified in the dialog box.

File	Description
<Project_name>.sln	The Microsoft Visual Studio Solution file
Solution.bat	The Windows batch file to open the website solution in Microsoft Visual Studio
Solution.lnk	The shortcut file to the project to open the website solution in Microsoft Visual Studio
folder.lnk	The shortcut file to the website folder
<Project_name>/<Project_name>.csproj	The Visual C# Project file
<Project_name>/Examples.cs	The Visual C# Source file that contains examples of source code to customize data access classes and business logic controllers
<Project_name>/Properties/AssemblyInfo.cs	The Visual C# Source file that contains general information about the assembly

The platform also creates the `OpenSolution.bat` batch file, which is a copy of the `Solution.bat` file created in the solution project folder. Depending on the settings of your browser, the `OpenSolution.bat` file is saved either in the Downloads folder or in another location.

## Useful Tips

---

Here are some tips and tools that you can use to simplify your development process.

### Organize team development

If several developers are working on the customization project, it is important to organize a continuous team development. Here are several essential points for it:

- Organize a centralized source control, where all developers can push the work they've done. To integrate the changes into source control, you can use automation scripts.
- All developers should have a local version of Visual Studio, project's database and repository. This ensures independent development and debugging at all times.

- Every developer should have Acumatica ERP instance in the same directory and with the same name. This helps to maintain the same references of the extension library (DLL) to the project's / `bin` folder.
- All changes to the customization project and Acumatica ERP related development should be stored in the source control. Code should be stored as a part of Visual Studio project. UI, database, and data changes should be included into a customization project and also stored in source control.
- Developers may work on different features in separate branches and merge their work to the main branch only when the changes are completed and tested.
- You can do parts of continuous integration manually on your local machine and automatically on the build server from centralized repository.

### Use Acuminator

You can simplify customization development in Visual Studio by using Acuminator - a static code analysis and colorizer tool. Acuminator provides diagnostics and code fixes for common developer challenges related to Acumatica Framework. Also, Acuminator can colorize and format BQL statements, and can collapse attributes and parts of BQL queries.

To use Acuminator in Visual Studio:

1. Download Acuminator from [the Visual Studio Marketplace](#).  
You get a Visual Studio extension installer (VSIX file).
2. Install Acuminator by launching the downloaded VSIX file.

Acuminator is ready for use. To check it, open your customization project in Visual Studio. BQL statements and DAC code Acumatica Framework should be highlighted.

# Integrating the Project Editor with a Version Control System

---

If a customization task is large or complex or it is implemented by a group of developers, you might need to use a version control system for the customization project. The platform supports the integration of the [Customization Project Editor](#) with a version control system.

The Customization Project Editor includes the **Source Control** menu, which contains the following commands to integrate the editor with a version control system:

- **Save Project to Folder:** Saves the customization project as a set of files to a local folder that is used for integration with a source control system. When you invoke this action, the system opens the **Saves Project to Folder** dialog box so that you can select the name and location of the folder inside a repository.
- **Open Project from Folder:** Loads the customization project from the repository.
- **Set Up Source Control:** Opens the **Source Control Setup** dialog box, which you can use to specify a configuration string for connection to a version control system, if required.

For detailed information on integrating the editor with a version control system, see the following topics:

- [To Save a Project to a Local Folder](#)
- [To Update the Content of a Project from a Local Folder](#)
- [To Configure a Connection String](#)
- [To Integrate the Customization Project Editor with Source Control](#)

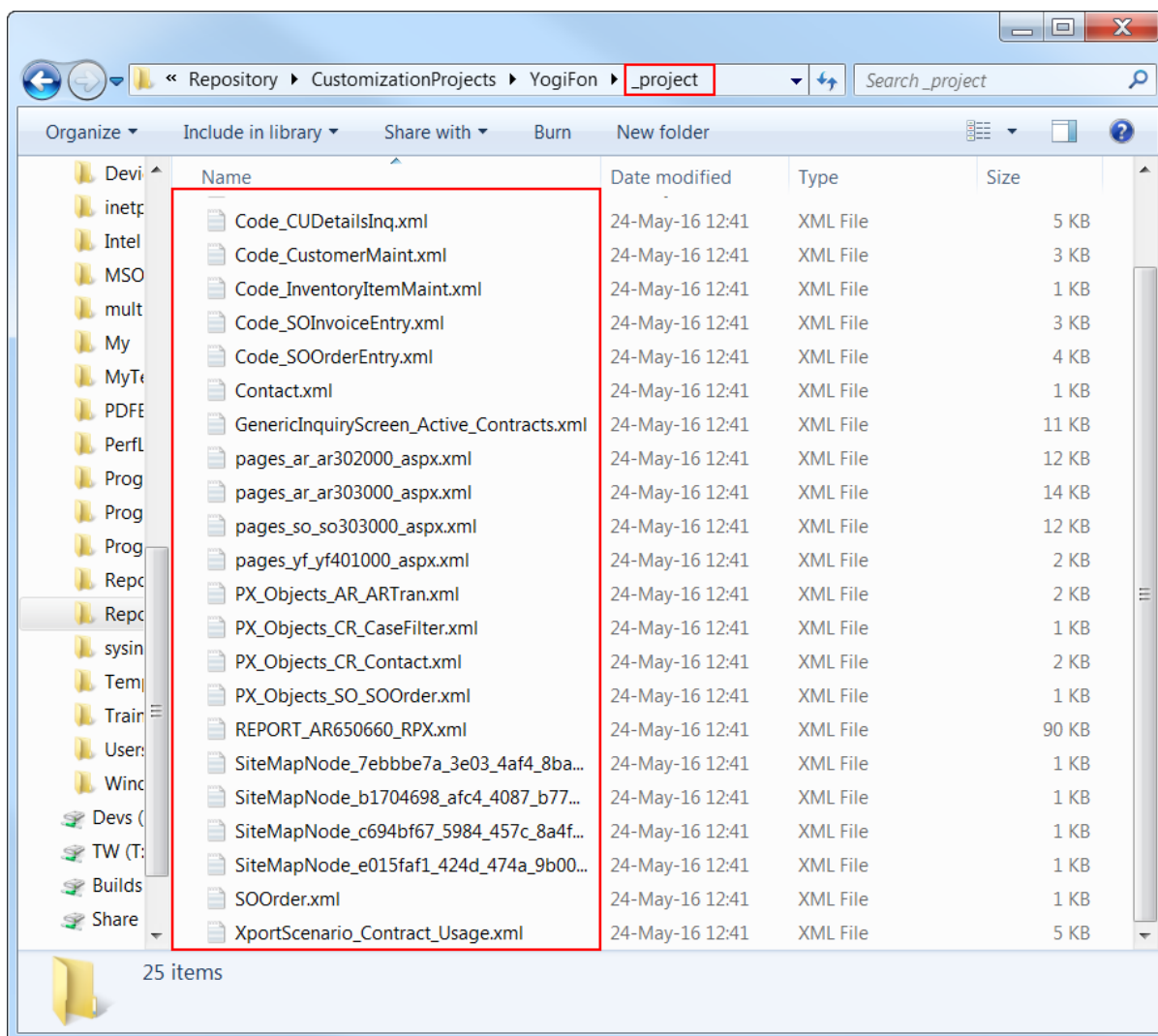
## To Save a Project to a Local Folder

---

You can save a customization project as set of files to a local folder that can be used for integration with a source control system. To do this, perform the following actions:

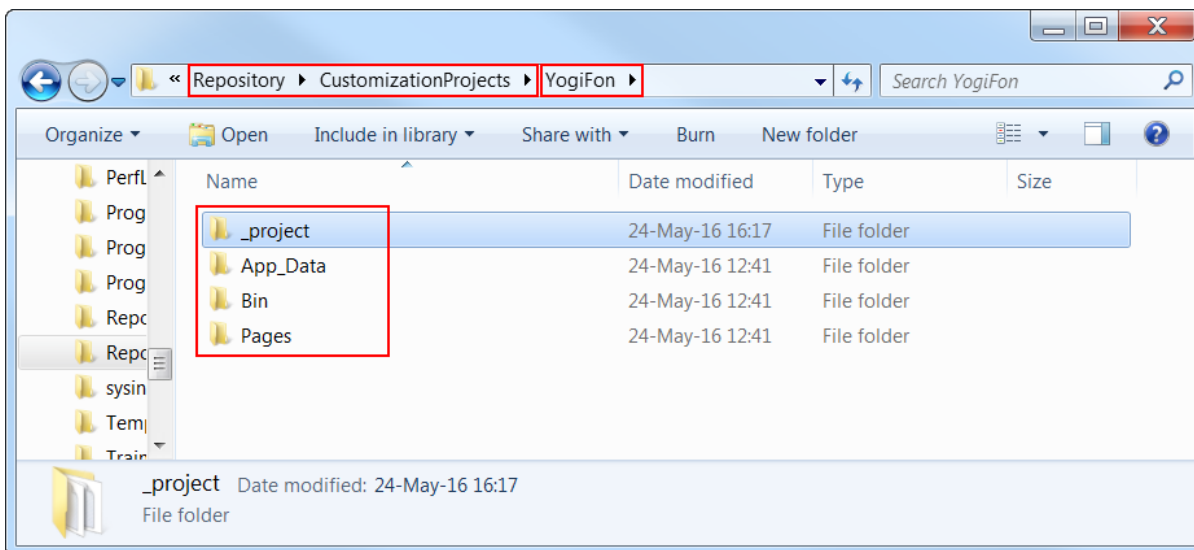
1. Open the project in the [Customization Project Editor](#).
2. On the editor menu, click **Source Control > Saves Project to Folder**.
3. In the **Saves Project to Folder** dialog box, which opens, do the following:
  - a. In the **Parent Folder** selector, select the parent folder.
  - b. In the **Project Name** box, specify the name of the new folder to be used as the project storage.
4. Click **OK**.

Within the selected parent folder, the platform creates the folder with the project name that you have specified. This folder includes at least the `_project` subfolder that contains an XML file for each item of the project, as the following screenshot shows.



**Figure: Viewing the content of the .project folder**

If the customization project contains custom files, the platform keeps the paths to these files. Therefore, the project folder includes the corresponding folders for these custom files, as shown in the following screenshot.



**Figure:** Viewing the folders inside the project folder

## To Update the Content of a Project from a Local Folder

If you have saved a customization project to a local folder by invoking the **Source Control > Saves Project to Folder** command of the *Customization Project Editor*, you can update the content of the project that is currently opened in the editor with the data from the folder.

To do this, perform the following actions:

1. On the editor menu, click **Source Control > Open Project from Folder**.
2. In the **Containing Folder** box of the **Open Project from Folder** dialog box, which opens, select the local folder that contains the files of the needed customization project.



**Attention:** If the folder is empty, the content of the project in the database is cleared.

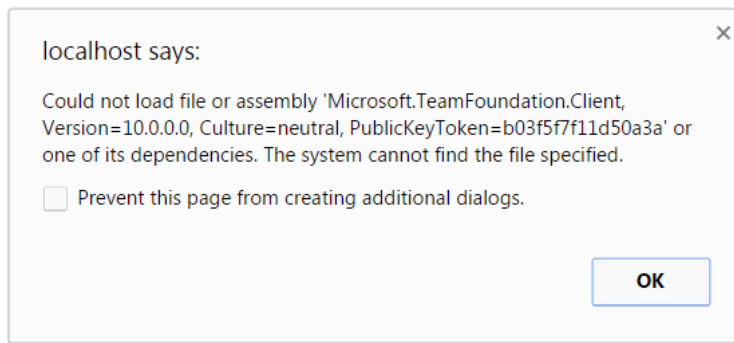
3. Click **OK**.

## To Configure a Connection String

To use a self-made or third-party plug-in to integrate with a version control system, you can specify the configuration string required to connect the *Customization Project Editor* with the version control system through the plug-in. To do this, perform the following actions:

1. Open the customization project in the Customization Project Editor.
2. On the editor menu, click **Source Control > Set Up Source Control**.
3. In **Config** box of the **Source Control Setup** dialog box, which opens, specify the plug-in to be used and the data required by the plug-in to connect to the version control system.
4. Click **OK**.

The editor tries to connect with the version control system by using the specified configuration string. If the connection fails, the editor displays an error message with the issue description, as the following screenshot shows.



**Figure:** Viewing the box with a connection error message

## To Integrate the Customization Project Editor with Source Control

---

To start tracking changes in a customization project by using source control, perform the following actions:

1. Configure Visual Studio to use source control.
2. In Visual Studio, do the following:
  - a. Open your customization project, and add it to the source control.
  - b. Sync your project with the latest server version.

Before starting the project development, you have to do the following each time:

1. Get the latest version of the customization project from the server.
2. Load the project from the local storage, as described in [To Update the Content of a Project from a Local Folder](#).

After the project has been modified, you have to do the following:

1. Update the project in the local storage, as described in [To Save a Project to a Local Folder](#).
2. Check in the changes to the server.

# Troubleshooting Customization

This part is intended to describe how to solve issues that occur while you are developing or applying a customization. It will be under ongoing development to cover all the approaches and ways required to solve each typical issue that is result of an error in customization or a misunderstanding of the platform features.

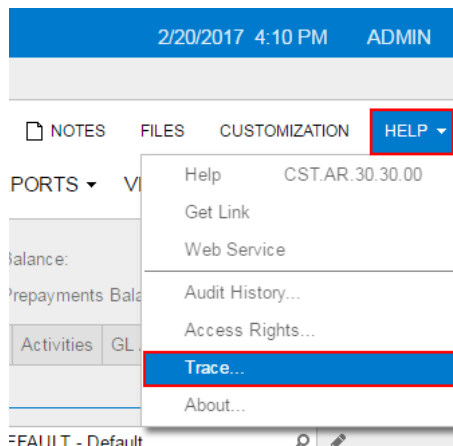
## In This Part

- [To Discover the Method That Has Thrown an Exception](#)
- [To Write to the Trace Log from the Code](#)
- [To Log All Exceptions to a File](#)
- [To Debug the Customization Code](#)
- [To Validate a BQL Statement](#)
- [To Measure the Execution Time of a BQL Statement](#)
- [To Discover the Cause of Performance Degradation](#)
- [To Force the Platform to Execute Database Scripts](#)
- [To Resolve Issues While Upgrading a Customized Website](#)

## To Discover the Method That Has Thrown an Exception

If an exception has occurred at run time and a message box with an error or a warning has been displayed on the form, you can easily discover the method that has thrown the exception. To do this, perform the following actions:

1. Read the message, and close the message box.
2. On a form of Acumatica ERP, click **Help > Trace**, as shown in the following screenshot.



**Figure: Opening the Acumatica Trace page**

3. On the Acumatica Trace page, which opens to display the trace log, find the appropriate error message, and click the arrow left of the **Details** label for the message to show the detailed information on the error.

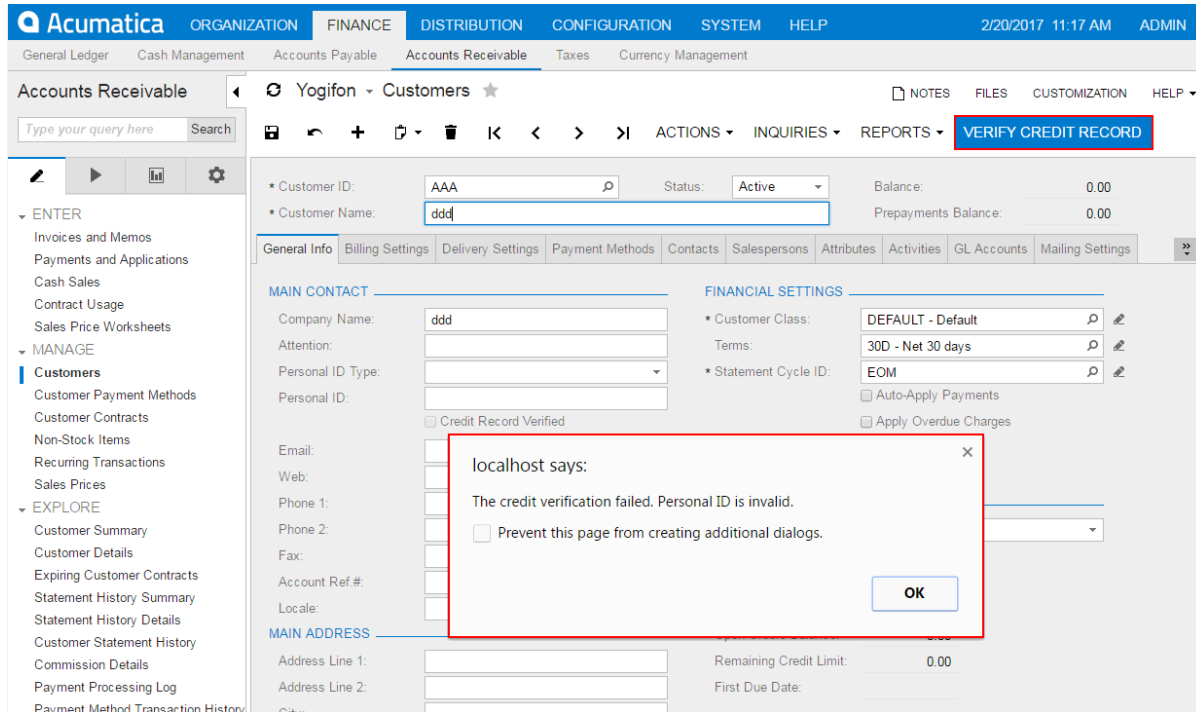
In the list of the method calls that were on the stack at the moment of the error, the upper method is the one that threw the exception.



: By default, the trace log is stored on the Acumatica ERP server for the current user session. If the user opens two Acumatica ERP forms simultaneously in two tabs or windows of a browser, the Acumatica ERP server creates a subsession for each opened form and stores the trace logs separately for each subsession. After a session or subsession of the user is completed (due to the user logging off or being timed out), the server clears the appropriate log.

To save the trace logs of all subsessions of all users in a single file on the server, a user with the *Administrator* role has to change the `web.config` file of the Acumatica ERP instance to configure the appropriate trace provider. See the *Trace* section of [Using Logs](#) for details.

For example, if you open the [Customers](#) (AR303000) form of an Acumatica ERP instance in which the *YogiFon* customization project is published (see the [T300 Acumatica Customization Platform](#) training course for details) and click **Verify Credit Record** on the form toolbar, the system shows an error message, as the following screenshot shows.



**Figure: Viewing a message box with an error**

On the Acumatica Trace page, as the following screenshot shows, you can find the error message. After you expand the error details, you can see that the exception has been thrown by the `CustomerMaint_Extension.VerifyCreditRecord()` method.



## Acumatica Trace:

[Expand All](#)
[Collapse All](#)

**Error:** **Error #14: Inserting 'GL Batch' record raised at least one error. Please review the errors.** [Send](#)

Raised At: 2/20/2017 7:16:28 PM      Screen: GL.30.10.00      Command: Save

Details:

**Error:** **The credit verification failed. Personal ID is invalid.** [Send](#)

Raised At: 2/20/2017 7:15:23 PM      Screen: AR.30.30.00      Command: VerifyCreditRecord

Details:

2/20/2017 7:15:23 PM Error:  
The credit verification failed. Personal ID is invalid.

```

at PX.Objects.AR.CustomerMaint_Extension.VerifyCreditRecord()
at PX.Data.PXAction.1.<<C__DisplayClass3.U.<.ctor>B__U(PXAdapter adapter)
at PX.Data.PXAction.1.a(PXAdapter A_0)
at PX.Data.PXAction.1.d__31.MoveNext()
at PX.Data.PXAction.1.d__31.MoveNext()
at PX.Web.UI.PXBaseDataSource.tryExecutePendingCommand(String viewName, String[] sortcolumns, Boolean[] descendings, Object[] searches,
Object[] parameters, PXFilterRow[] filters, DataSourceSelectArguments arguments, Boolean& closeWindowRequired, Int32& adapterStartRow,
Int32& adapterTotalRows)
at PX.Web.UI.PXBaseDataSource.ExecuteSelect(String viewName, DataSourceSelectArguments arguments, PXDSSelectArguments pxarguments)

```

Version: 6.10.0121      Customization: YogiFon

Figure: Viewing the needed method in the list of method calls

## To Write to the Trace Log from the Code

When you are developing and troubleshooting the customization code, you may need to know what happens during code execution (for example, an action being called or an event being raised). You can write information to the trace log directly from your code by using one of the following static methods of the `PXTrace` static class:

- `public static void WriteError(string message)`
- `public static void WriteError(Exception e)`
- `public static void WriteWarning(string message)`
- `public static void WriteWarning(Exception e)`
- `public static void WriteInformation(string message)`
- `public static void WriteInformation(Exception e)`
- `public static void WriteVerbose(string message)`



: For reference information on the `PXTrace` class methods, see the API Reference.

To manage writing information to the trace log, you can use the following methods of the `PXTrace` static class:

- `public static Serilog.ILogger WithStack()`

By default, the stack trace is not collected so that the project does not impair system performance. To turn on the collection of the stack trace, call the `WithStack` method, as the following code example shows. Note that in the presented code, the stack trace is collected only if the appropriate logging level has been set up.

```
PXTrace.WithStack().Information("some info");
```

- `public static Serilog.ILogger WithSourceLocation()`



: To use the `WithStack` and `WithSourceLocation` methods, you must include the external *Serilog* library. We recommend using the *Serilog* library located in the `Bin` folder of Acumatica ERP.

The `WithStack` and `WithSourceLocation` methods can be chained with `Serilog.ILogger` methods.

### Adding the Method to the Customization Code

If you want to avoid changes in the customization project, you can add this method to the customization code that has already been applied to the application instance. To do this, perform the following actions:

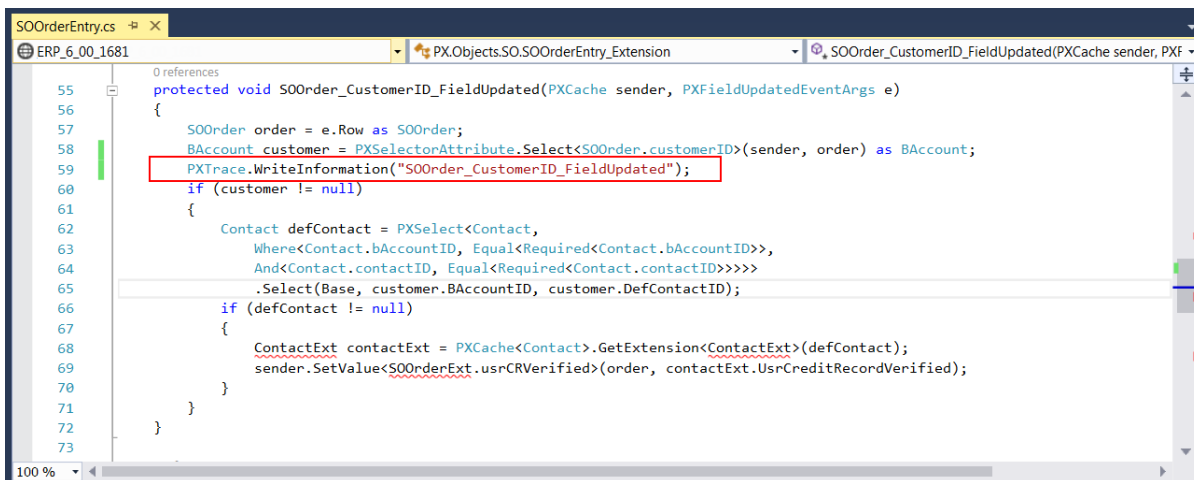
1. Make sure that the customization project that contains the code you are debugging has been published. If the project is unpublished, publish it, as described in [Publishing Customization Projects](#).
2. Launch Microsoft Visual Studio.
3. In Visual Studio, open the file with the code that is currently saved in the `App_RuntimeCode` website folder.
4. Add a call of one of the methods listed above to the appropriate code sample.
5. Save your changes to the file.
6. In the browser, open or refresh the form that you are troubleshooting.
7. On the form, perform the sequence of actions that invokes the changed code.
8. Click **Help > Trace** to open the Acumatica Trace page.
9. On the page, explore the trace log to make sure that the changed code sample has been executed.



: When you publish or export the project, the Acumatica Customization Platform compares the code in the `App_RuntimeCode` website folder with the appropriate code in the database and discovers the files that have been changed in the file system. If a modified file is found, there is a conflict, and the platform opens the **Modified Files Detected** dialog box, in which you can direct the system to update the files in the project or discard the changes. See [Detecting the Project Items Modified in the File System](#) for details.

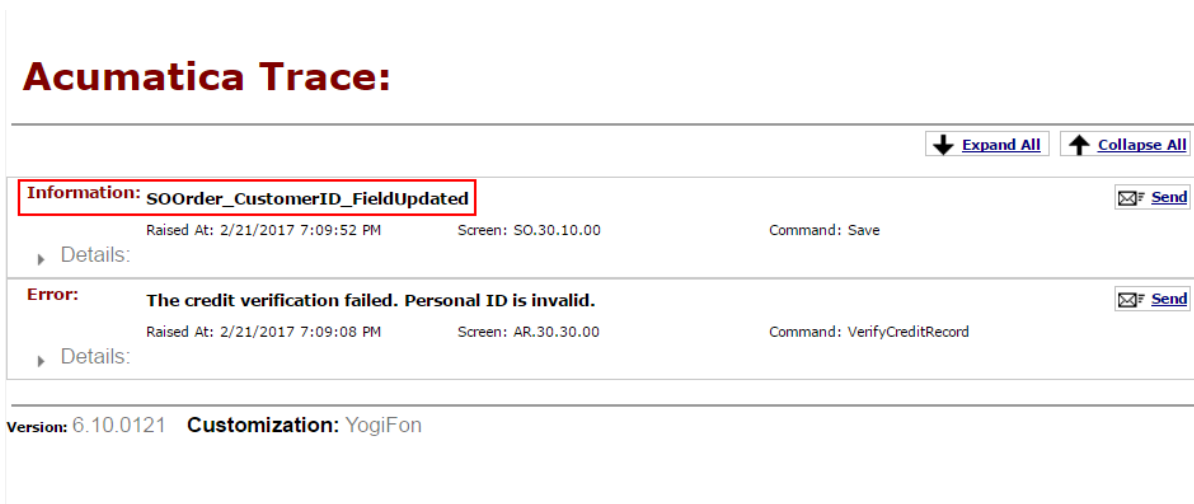
### Adding the `WriteInformation()` Method

As an example of using the static methods of the `PXTrace` static class, suppose that you open in Visual Studio the `SOOrderEntry.cs` file of the *YogiFon* customization project, which is published (see the [T300 Acumatica Customization Platform](#) training course for details). You then add the `PXTrace.WriteInformation("SOOrder_CustomerID_FieldUpdated")` method call to the `SOOrder_CustomerID_FieldUpdated()` event handler of the `SOOrderEntry_Extension` class, as shown in the following screenshot. In this example, the specified text string is written to the trace log every time the `CustomerID` field is updated on the Sales Orders (SO301000) form.



**Figure: Adding the WriteInformation method call to the code**

If you were to refresh the form in the browser, change the customer ID in the **Customer** box, and click **Help > Trace** to open the Acumatica Trace page, the trace log would contain a record with the text specified in the WriteInformation method call, as the following screenshot shows.



**Figure: Viewing the information record in the trace log**



: By default, the trace log is stored on the Acumatica ERP server for the current user session. If the user opens two Acumatica ERP forms simultaneously in two tabs or windows of a browser, the Acumatica ERP server creates a subsession for each opened form and stores the trace logs separately for each subsession. After a session or subsession of the user is completed (due to the user logging off or being timed out), the server clears the appropriate log.

To save the trace logs of all subsessions of all users in a single file on the server, a user with the *Administrator* role has to change the `web.config` file of the Acumatica ERP instance to configure the appropriate trace provider. See the *Trace* section of *Using Logs* for details.

## Specifying the Logging Level

Events that you log in code have different logging levels. You can specify a logging level in `web.config` so that only events up to that level will be logged. You set up the logging level by using the following settings in the `web.config` file:

- `system.web/pxtrace/@minimumLevel`

- `system.web/pxtrace/add/@minimumLevel`
- `appSettings/add[@key="serilog:minimum-level"]/@value`

The logging levels are presented in the table below. By default, the `Verbose` level is specified.

Logging level	Methods
Error	<code>WriteError</code>
Warning	<code>WriteWarning</code>
Information	<code>WriteInformation</code>
Verbose	<code>WriteVerbose</code>

## To Log All Exceptions to a File

Acumatica ERP provides a mechanism you can use for catching and logging all exceptions in the system. (See the *First-Chance Exception Log* section of [Using Logs](#) for details.) If you have been assigned the *Administrator* role, you can activate this mechanism and specify the name of the log file. To do this, perform the following actions:

1. In the file system, open in a text editor the `web.config` file located in the website folder.
2. Within the `<appSettings>` tag of the file, turn on the `EnableFirstChanceExceptionsLogging` key, as follows.

```
<add key="EnableFirstChanceExceptionsLogging" value="True" />
```

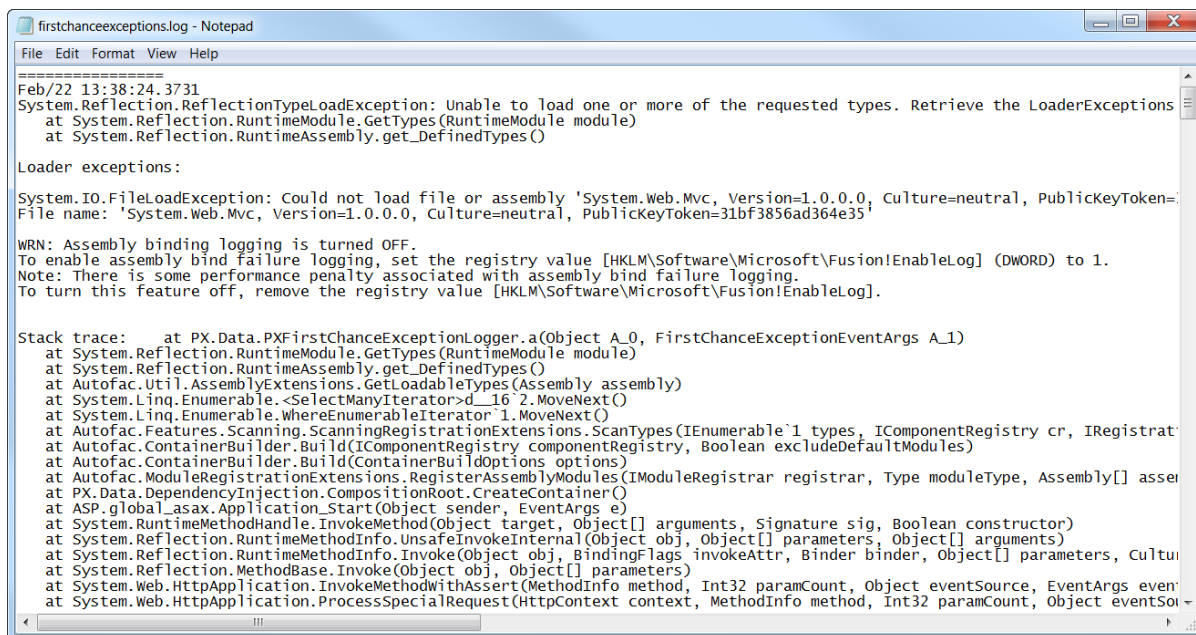
3. If you need to change the log file name, which is `firstchanceexceptions.log` by default, you can specify the needed name in the `FirstChanceExceptionsLogFileName` key, as follows.

```
<add key="FirstChanceExceptionsLogFileName" value="MyLog.log" />
```



: By default, the first-chance exception log file is saved in the `App_Data` folder of the website.

You can open the log file in a text editor to view the content of the first-change exception log, as the following screenshot shows.



**Figure: Viewing the first-chance exception log**

## To Debug the Customization Code

The [Code Editor](#) does not provide facilities you can use to debug a code item of a customization project. We recommend that you use Microsoft Visual Studio to develop and debug any source code in customization projects. To start debugging an existing *Code* item in Visual Studio, perform the following instructions:

1. Publish the customization project, as described in [Publishing Customization Projects](#).
2. In the file system, open in a text editor the `web.config` file located in the website folder.
3. In `<system.web>` tag of the file, locate the `<compilation>` element.
4. Set to `true` the `debug` attribute of the element, as follows.

```
<compilation debug="true" ...>
```



: See [Debug Mode in ASP.NET Applications](#) for details.

5. In a browser, launch your instance of Acumatica ERP to have a running process in the system.
6. Launch Visual Studio.
7. To open the website of your instance of Acumatica ERP in Visual Studio, on the main menu, click **File > Open > Web Site**, and select the website folder in the **Open Web Site** dialog box, which opens.
8. In the Solution Explorer of Visual Studio, expand the `App_RuntimeCode` website folder, and double-click the file of the *Code* item to open it.
9. In the item source code, which opens, set a breakpoint on the line of the code where you need to stop the process for debugging.
10. On the main menu, click **Debug > Attach to Process**, and in the **Attach to Process** dialog box, which opens, select the `w3wp.exe` process in the list of **Available Processes**.



: In the dialog box, ensure that the **Show processes from all users** check box is selected. If the check box is cleared, the list will not display the `w3wp.exe` process record.

11. In the browser, open the form of Acumatica ERP whose business logic code you want to debug.
12. In the browser, run an operation that invokes the fragment of the code that contains the breakpoint.

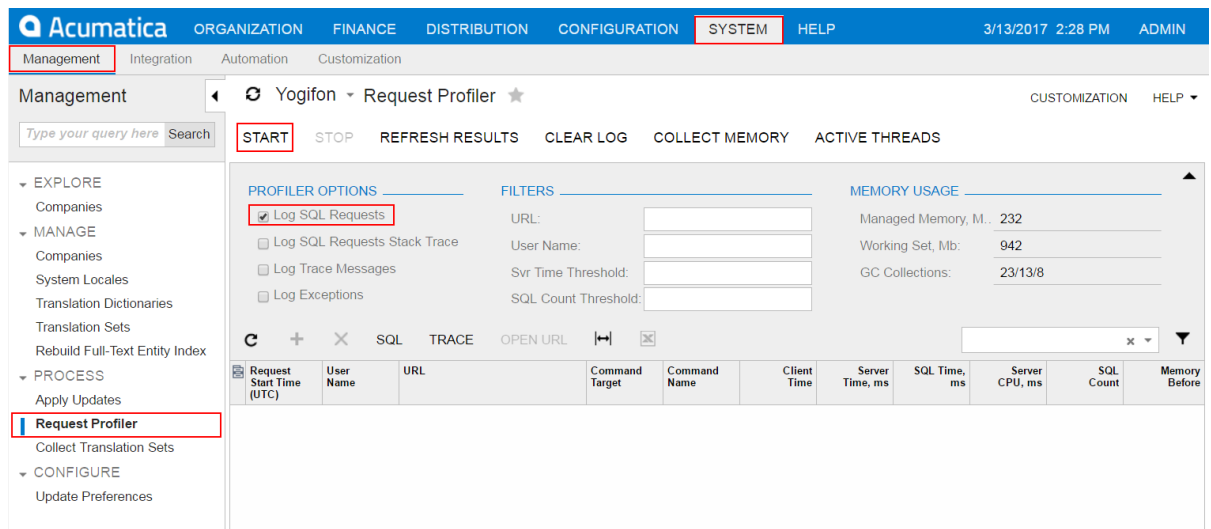
The process will be stopped at the breakpoint, and you can debug the code in Visual Studio.

## To Validate a BQL Statement

Suppose that you have a BQL statement in the customization code that does not work properly or you want to make sure that a BQL statement is correctly converted into an SQL query. To validate the BQL statement, you can use the Request Profiler.

To do this, perform the following actions:

1. Open the [Request Profiler](#) form (SM205070) in the browser.
2. In the **Profiler Options** section, select the **Log SQL Requests** check box, which indicates that the SQL request data should be stored in the database.
3. On the form toolbar, click **Start**, as shown in the following screenshot.



**Figure: Launching the SQL Profiler**

4. In the browser, open the form that uses the customization code with the BQL statement.
5. On this form, perform the action that executes the BQL statement.
6. Open the [Request Profiler](#) form (SM205070).
7. On the form toolbar, click **Refresh Results** to refresh the log table.
8. In the **Command Name** column of the log table, find the URL request that is related to the needed BQL statement.
9. Select the needed URL request, as shown in the screenshot below.
10. On the table toolbar, click **SQL** to open the **SQL Profiler** pop-up panel.

Yogifon ▾ Request Profiler ★ CUSTOMIZATION HELP ▾

START STOP REFRESH RESULTS CLEAR LOG COLLECT MEMORY ACTIVE THREADS

**PROFILER OPTIONS**

☒ Log SQL Requests

☐ Log SQL Requests Stack Trace

☐ Log Trace Messages

☐ Log Exceptions

**FILTERS**

URL:

User Name:

Svr Time Threshold:

SQL Count Threshold:

**MEMORY USAGE**

Managed Memory, M.: 545

Working Set, Mb: 1006


GC Collections: 25/14/8

⌂ + × **SQL** TRACE OPEN URL |⏮|⏭|⏪|⏩|

Request Start Time (UTC)	User Name	URL	Command Target	Command Name	Client Time	Server Time, ms	SQL Time, ms	Server CPU, ms	SQL Count	Memory Before
13 Mar 14:37	admin	~/pages/so/so301000.aspx	ctl00\$phF...	Save	1190	1,076.28	613.92	390.00	45	632,578,144
13 Mar 14:37	admin	~/pages/so/so301000.aspx	ctl00\$ph...	InitRow	254	212.20	34.18	187.20	8	196,227,720
13 Mar 14:37	admin	~/pages/so/so301000.aspx	ctl00\$ph...	DropDown	397	310.90	114.00	187.20	16	225,363,960
13 Mar 14:37	admin	~/pages/so/so301000.aspx	ctl00\$ph...	Refresh	263	201.01	39.00	171.60	14	258,139,968
13 Mar 14:37	admin	~/pages/so/so301000.aspx	ctl00\$ph...	FetchRow	1163	1,056.57	651.17	405.60	57	288,126,112
13 Mar 14:37	admin	~/pages/so/so301000.aspx	ctl00\$ph...	Save	344	239.12	30.69	234.00	8	334,333,784
13 Mar 14:37	admin	~/pages/so/so301000.aspx	ctl00\$ph...	InitRow	534	177.62	1.99	187.20	2	368,854,280
13 Mar 14:37	admin	~/pages/so/so301000.aspx	ctl00\$ph...	FetchRow	387	281.14	40.49	234.00	28	395,784,232
13 Mar 14:37	admin	~/pages/so/so301000.aspx	ctl00\$ph...	Save	328	221.80	12.87	202.80	12	436,446,552
13 Mar 14:37	admin	~/pages/so/so301000.aspx	ctl00\$ph...	RepaintTab	483	136.20	7.22	140.40	2	471,869,080
13 Mar 14:37	admin	~/pages/so/so301000.aspx	ctl00\$ph...	RepaintTab	169	129.53	1.72	124.80	2	493,179,616
13 Mar 14:38	admin	~/pages/so/so301000.aspx	ctl00\$phD...	Save	771	659.12	333.07	312.00	54	515,342,336

⏮ ⏪ ⏩ ⏭

**Figure: Opening the SQL Profiler pop-up panel for the selected URL request**

11. On the panel, in the list of SQL requests for the currently selected URL request, find and click the SQL request that corresponds to the BQL statement.
12. On the panel toolbar, click **Switch Between Grid and Form** (  ), as shown in the following screenshot, to view the SQL statement of the selected request.

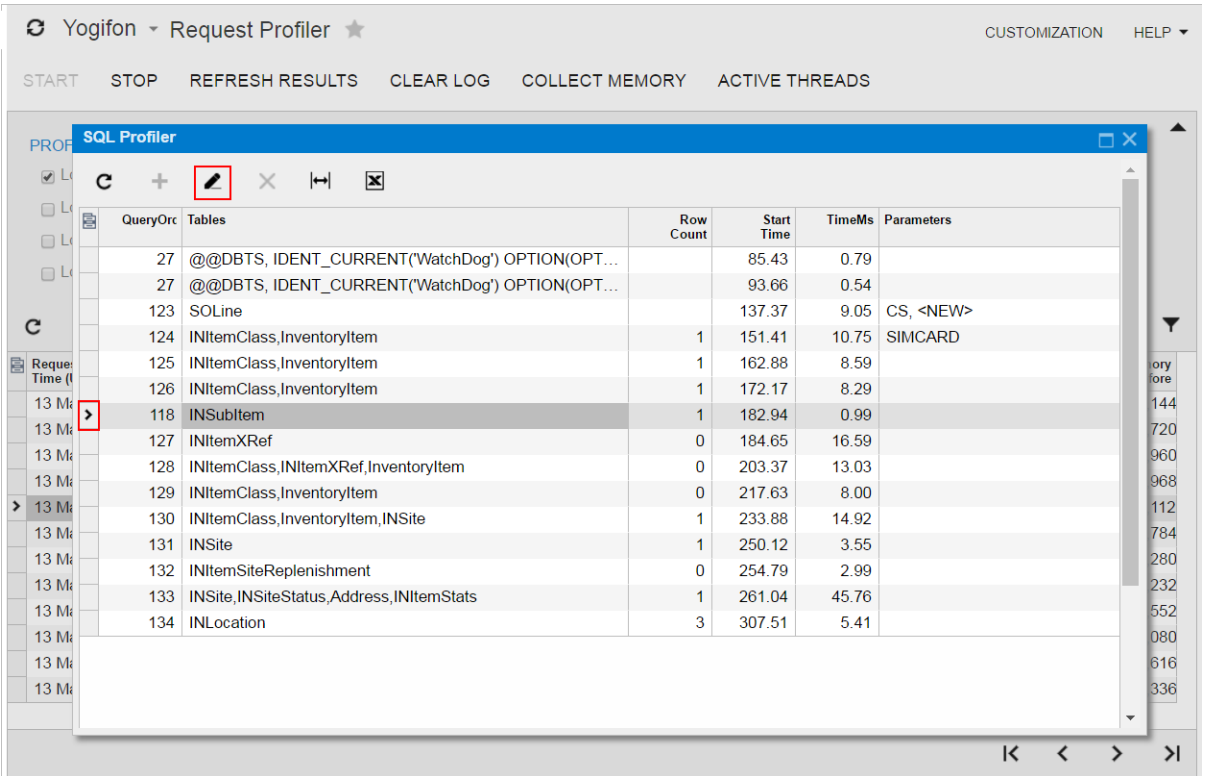



Figure: Switching the panel to display the content of the selected SQL request

 : Because you know the name of the table that you use in the BQL statement, we recommend that you specify the name as a filter in the **Tables** column of the SQL profiler table, as the following screenshot shows.

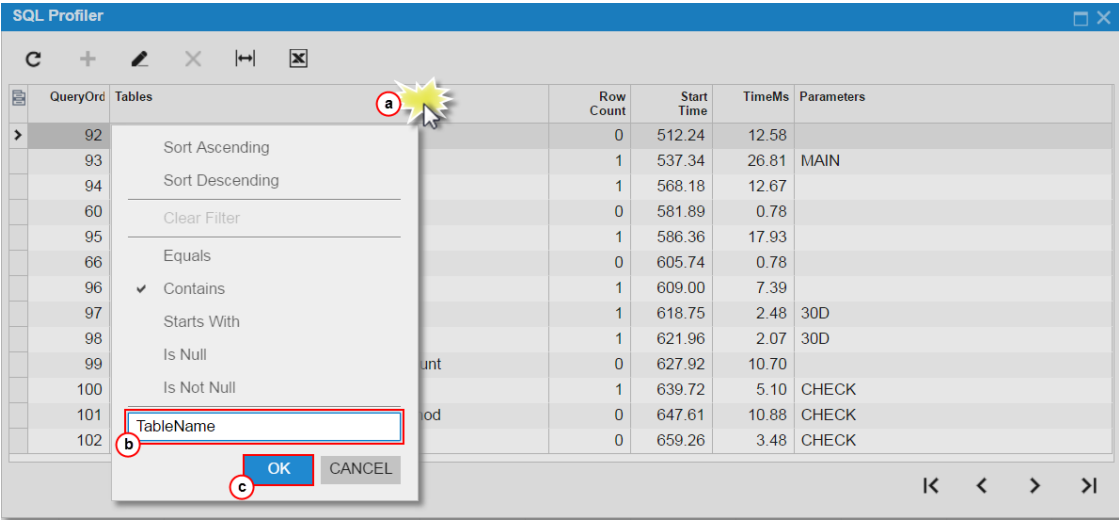
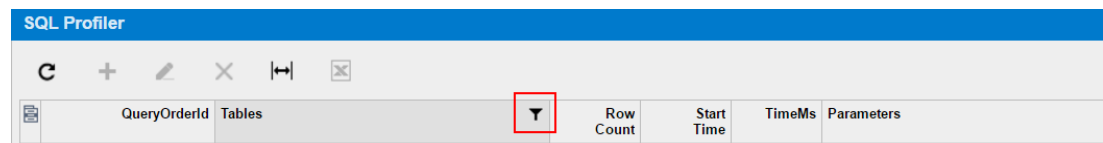


Figure: Setting a filter for the SQL request list

If the BQL statement contains a parameter, you can also use the parameter to filter the list.

If a filter is specified for a column of the table of the **SQL Profiler** pop-up panel, the filter icon is displayed in the column caption, as shown in the following screenshot.

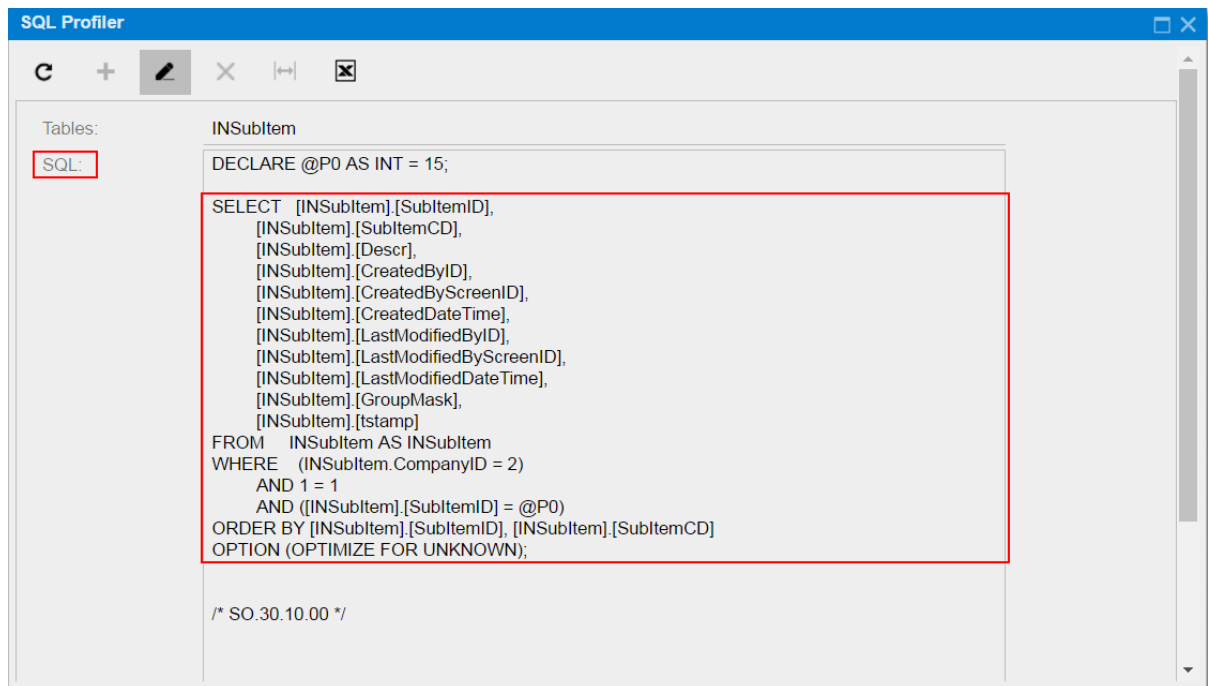




**Figure: Viewing the filter icon on the panel**

A filter is applied to the list for every URL request until you clear the filter.

13. In the SQL area of the panel, shown in the following screenshot, view the SQL statement to validate the BQL statement used in the customization code.



**Figure: Viewing the SQL statement**

14. On the form toolbar of the [Request Profiler](#) form (SM205070), click **Stop** to stop the Request Profiler.



: We recommend that you activate the *Log SQL Requests* mode for only a limited period because it can degrade system performance.

15. On the form toolbar, click **Clear Log** to delete the SQL request data from the database.

## To Measure the Execution Time of a BQL Statement

Suppose that in the customization code you have a BQL statement that can affect system performance. To measure the execution time of the BQL statement, you can use the Request Profiler.

To do this, perform the following actions:

1. Open the [Request Profiler](#) form (SM205070) in the browser.
2. In the **Profiler Options** area of the form, select the **Log SQL Requests** check box, that indicates that the SQL request data should be stored in the database.
3. On the form toolbar, click **Start**, as shown in the following screenshot.

Acumatica ORGANIZATION FINANCE DISTRIBUTION CONFIGURATION **SYSTEM** HELP 3/13/2017 2:28 PM ADMIN

Management Integration Automation Customization

Management Management **Yogifon** Request Profiler ★ CUSTOMIZATION HELP ▼

Type your query here Search **START** STOP REFRESH RESULTS CLEAR LOG COLLECT MEMORY ACTIVE THREADS

**PROFILER OPTIONS** **FILTERS** **MEMORY USAGE**

☒ Log SQL Requests ☐ Log SQL Requests Stack Trace ☐ Log Trace Messages ☐ Log Exceptions

URL: User Name: Svr Time Threshold: SQL Count Threshold:

Managed Memory, M.: 232 Working Set, Mb: 942 GC Collections: 23/13/8

C + X SQL TRACE OPEN URL x ▼

Request Start Time (UTC)	User Name	URL	Command Target	Command Name	Client Time	Server Time, ms	SQL Time, ms	Server CPU, ms	SQL Count	Memory Before
--------------------------	-----------	-----	----------------	--------------	-------------	-----------------	--------------	----------------	-----------	---------------

Request Profiler Collect Translation Sets Update Preferences

**Figure: Launching the SQL Profiler**

4. In the browser, open the form that uses the customization code with the BQL statement.
5. On the form, perform the action that executes the BQL statement.
6. Open the [Request Profiler](#) form (SM205070).
7. On the form toolbar, click **Refresh Results** to refresh the log table.
8. In the **Command Name** column of the log table, find the URL request that is related to the needed BQL statement.
9. Click the needed URL request, as shown in the screenshot below.
10. On table toolbar, click **SQL** to open the **SQL Profiler** pop-up panel.

Yogifon - Request Profiler ★ CUSTOMIZATION HELP ▾

START STOP REFRESH RESULTS CLEAR LOG COLLECT MEMORY ACTIVE THREADS

**PROFILER OPTIONS**  
☒ Log SQL Requests  
☐ Log SQL Requests Stack Trace  
☐ Log Trace Messages  
☐ Log Exceptions

**FILTERS**  
 URL:   
 User Name:   
 Svr Time Threshold:   
 SQL Count Threshold:

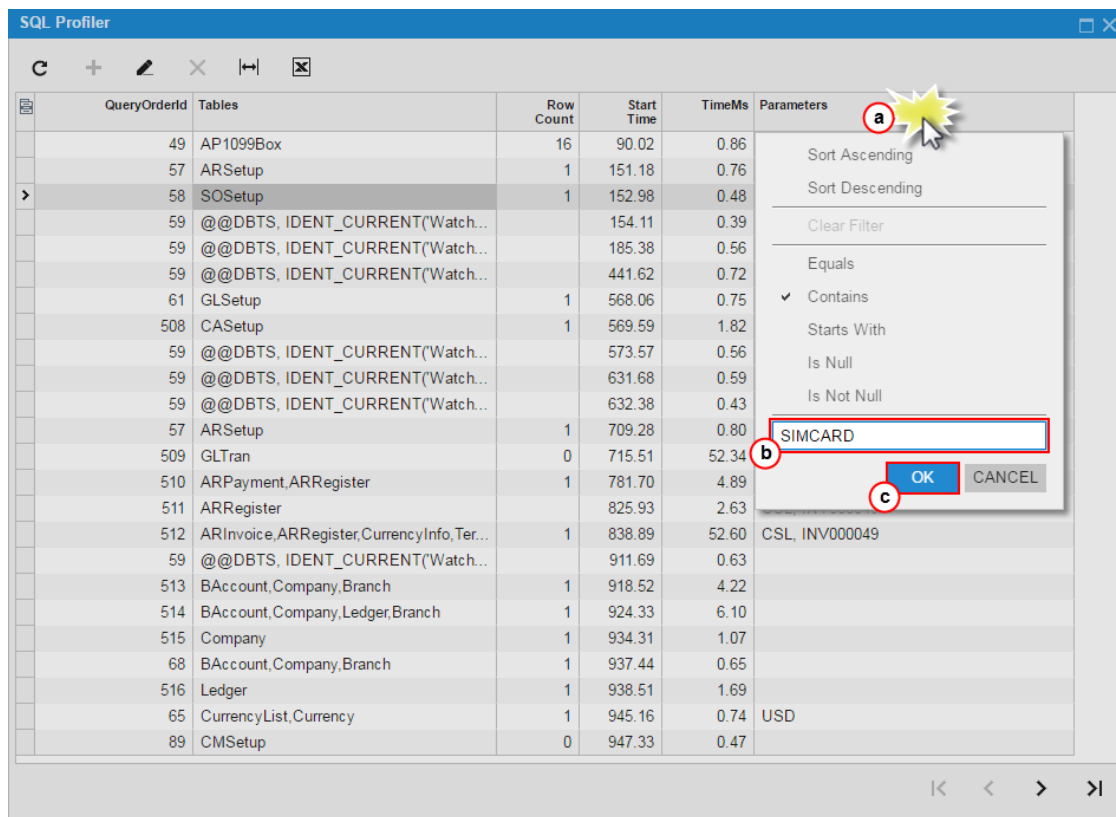
**MEMORY USAGE**  
 Managed Memory, Mb: 359  
 Working Set, Mb: 908  
 GC Collections: 44/28/14

☒ C 
 ☐ + 
 ☐ × 
 ☒ SQL 
 TRACE 
 OPEN URL 
  x ▾

Request Start Time (UTC)	User Name	URL	Command Target	Command Name	Client Time	Server Time, ms	SQL Time, ms	Server CPU, ms	SQL Count	Memory Before
14 Mar 13:23	admin	~/?screenid=so303000&do...		HTML		877.67	429.65	546.00	45	168,097,160
14 Mar 13:23		~/?screenid=so303000&do...				880.60	0.00	0.00	0	00
14 Mar 13:23		~/?screenid=so303000&do...				1,082.46	28.78	0.00	6	00
14 Mar 13:23	admin	~/pages/so/so303000.aspx	ctl00\$phDS\$ds	ReloadPage	8027	5,153.32	1,712.46	842.41	136	240,672,000
14 Mar 13:23	admin	~/pages/so/so303000.aspx		HTML		7,255.21	464.38	1,154.41	93	234,168,816
14 Mar 13:24	admin	~/pages/in/in202000.aspx	ctl00\$phDS\$ds	ReloadPage	2215	833.12	224.71	483.60	27	294,172,704
14 Mar 13:24	admin	~/pages/in/in202000.aspx		HTML		1,360.69	22.58	265.20	21	324,765,216
14 Mar 13:25	admin	~/pages/in/in202500.aspx		HTML		1,042.70	233.04	686.40	31	163,568,208
14 Mar 13:25	admin	~/pages/in/in202500.aspx	ctl00\$phDS\$ds	ReloadPage	1909	1,747.40	419.83	234.00	36	222,056,384
14 Mar 13:26	admin	~/pages/in/in202500.aspx	ctl00\$phG\$tab	Save	937	761.67	342.66	421.20	47	337,184,728
14 Mar 13:26	admin	~/pages/so/so301000.aspx	ctl00\$phDS\$ds	ReloadPage	1263	1,029.38	509.48	530.40	68	463,617,960
14 Mar 13:26	admin	~/pages/so/so301000.aspx	ctl00\$phF\$form	Save	1054	934.13	569.49	374.40	45	284,636,480
14 Mar 13:27	admin	~/pages/so/so301000.aspx	ctl00\$phG\$tabSt...	FetchRow	671	559.44	255.73	296.40	55	419,420,312
14 Mar 13:27	admin	~/pages/so/so301000.aspx	ctl00\$phDS\$ds	Save	628	515.92	199.40	312.00	54	364,512,184
14 Mar 13:27	admin	~/pages/so/so301000.aspx	LongRun	Action@PrepareInvo...		2,307.33	1,227.04	982.81	369	440,416,544
14 Mar 13:27	admin	~/pages/so/so303000.aspx	ctl00\$phDS\$ds	Save	778	621.89	255.23	343.20	52	357,328,152
14 Mar 13:28	admin	~/pages/so/so303000.aspx	LongRun	Action@Release		5,798.21	3,537.37	3,135.62	761	433,680,128

**Figure: Opening the SQL Profiler pop-up panel for the selected URL request**

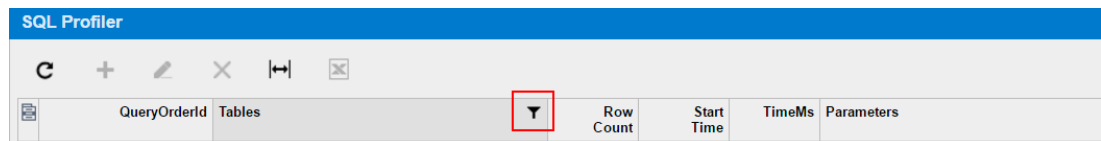
11. On the panel, in the table, specify filters for one or both of the **Tables** and **Parameters** columns to shorten the list, as follows:
  - a. Click the column caption to open a simple filter for the column, as the following screenshot shows.
  - b. Enter the name of the needed table (for the **Tables** column) or parameter (for the **Parameters** column) that is used in the BQL statement you are referring to.
  - c. Click **OK** to save the filter.



**Figure: Setting a filter for the SQL request list**



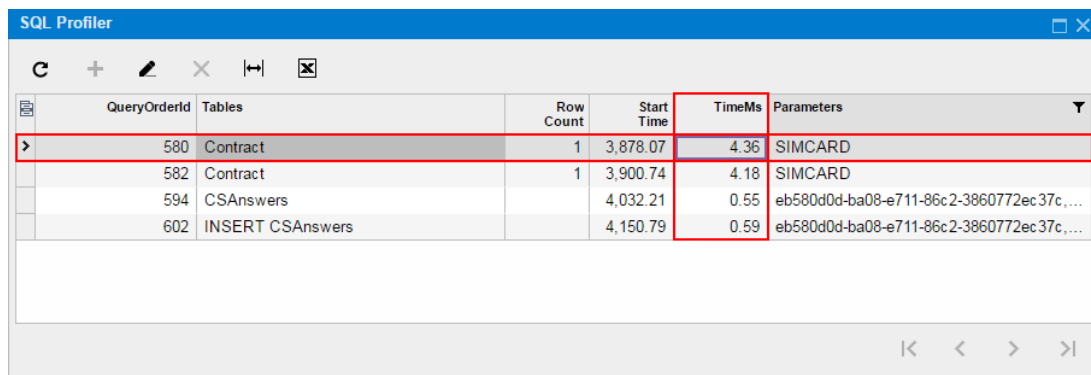
: If a filter is specified for a column of the table of the **SQL Profiler** pop-up panel, the filter icon is displayed in the column caption, as shown in the following screenshot.



**Figure: Viewing the filter icon on the panel**

The filter is applied to the list for every URL request until you clear the filter.

12. In the filtered list of SQL requests for the currently selected URL request, find the SQL request that corresponds to the BQL statement.



**Figure: Viewing the duration of the selected SQL request**

The execution time of the SQL request is displayed in the **TimeMs** column.

- On the form toolbar of the [Request Profiler](#) form (SM205070), click **Stop** to stop the Request Profiler.



: We recommend that you activate the *Log SQL Requests* mode for only a limited period because it can degrade system performance.

- On the form toolbar, click **Clear Log** to delete the SQL request data from the database.

## To Discover the Cause of Performance Degradation

Suppose that after publishing a customization project, you notice that the Acumatica ERP performance on a customized form is degraded. To check whether the content of the customization project is the cause of the performance degradation and to find the code fragment that affects system performance, you can use the Request Profiler.

The following sections provide detailed information:

- [To Check Whether a Customization Project Affects System Performance](#)
- [To Find the Code Fragment That Is Affecting System Performance](#)




### To Check Whether a Customization Project Affects System Performance

To check whether a customization project degrades the Acumatica ERP performance, perform the following actions:

- Unpublish all customization projects, as described in [To Unpublish a Customization](#).
- Open the [Request Profiler](#) form (SM205070) in the browser.
- In the **Profiler Options** section, select the **Log SQL Requests** check box, which indicates that the SQL request data should be stored in the database.
- On the form toolbar, click **Start**, as shown in the following screenshot.

**Figure: Launching the SQL Profiler**

- In the browser, open the form that you suspect has experienced performance issues since the customization project was published.
- Reload the page by using the browser toolbar button.
- On the form, sequentially perform multiple actions available on the form toolbar, such as **Refresh** or **Save**. Be sure to execute each action that is customized on the form.

8. On the form toolbar of the [Request Profiler](#) form (SM205070), click **Refresh Results** to refresh the log table.
9. On the table toolbar, click **Export to Excel** (  ) to save the log data to a Microsoft Excel file.
10. Publish the customization project, as described in [To Publish a Single Project](#).
11. Return to the [Request Profiler](#) form, and on the form toolbar, click **Clear Log** to clear the table.
12. In the browser, open the form that you use for the performance test.
13. Perform the same sequence of actions that you did in Step 6 and Step 7.
14. Return to the [Request Profiler](#) form, and on the form toolbar, click **Refresh Results** to refresh the log table.
15. On the table toolbar, click **Export to Excel** (  ) to save the log data to a Microsoft Excel file.
16. In Microsoft Excel, open the Microsoft Excel files you have saved to compare the duration values for the same actions.  
  
Customization of the business logic for a form can degrade the system performance, however the duration of an action can increase by no more than 10 percent. If the duration of an action on the customized form is more than 10 percent longer than the duration of the same action before customization, then the customization code must be reworked. To do this, follow the instructions described in [To Find the Code Fragment That Is Affecting System Performance](#).
17. On the form toolbar of the [Request Profiler](#) form (SM205070), click **Stop** to stop the Request Profiler.  
  
 : We recommend that you activate the *Log SQL Requests* mode for only a limited period because it can degrade system performance.
18. On the form toolbar, click **Clear Log** to delete the SQL request data from the database.

### To Find the Code Fragment That Is Affecting System Performance

If you have confirmed that the system performance is degraded on a customized form, you can use the Request Profiler to discover the code fragment that is causing the performance degradation. To do this, perform the following actions:

1. Open the [Request Profiler](#) form (SM205070) in the browser.
2. In the **Profiler Options** section, select the **Log SQL Requests** check box, which indicates that the SQL request data should be stored in the database.
3. Select the **Log SQL Requests Stack Trace** check box, which indicates that the SQL request stack trace data should be stored in the database.
4. On the form toolbar, click **Start**.
5. In the browser, open the customized form that you have confirmed as experiencing performance degradation.
6. On the form, sequentially perform the actions that you identified as executing too slowly.
7. On the form toolbar of the [Request Profiler](#) form (SM205070), click **Refresh Results** to refresh the log table.
8. In the log table, rearrange the log records in descending order to find the URL requests with the highest values in each of the columns described below.

Column	Description
<b>Server Time, ms</b>	The aggregate duration of the URL request execution on the server (in milliseconds).
<b>SQL Time, ms</b>	The aggregate duration of execution of all the SQL requests in the URL request (in milliseconds).
<b>Server CPU, ms</b>	The aggregate duration of CPU usage during the URL request (in milliseconds).
<b>SQL Count</b>	The count of the SQL requests to the database in the URL request. This count is the difference between the total number of the SQL requests in the URL request and the number of requests to the cache.

9. Select a record that has an unusually large value in any column listed in the previous step, and then click **SQL** on table toolbar, as shown in the following screenshot, to open the **SQL Profiler** pop-up panel.

Yogifon - Request Profiler

START STOP REFRESH RESULTS CLEAR LOG COLLECT MEMORY ACTIVE THREADS

PROFILER OPTIONS: ☒ Log SQL Requests, ☐ Log SQL Requests Stack Trace, ☐ Log Trace Messages, ☐ Log Exceptions

FILTERS: URL: , User Name: , Svr Time Threshold: 500, SQL Count Threshold:

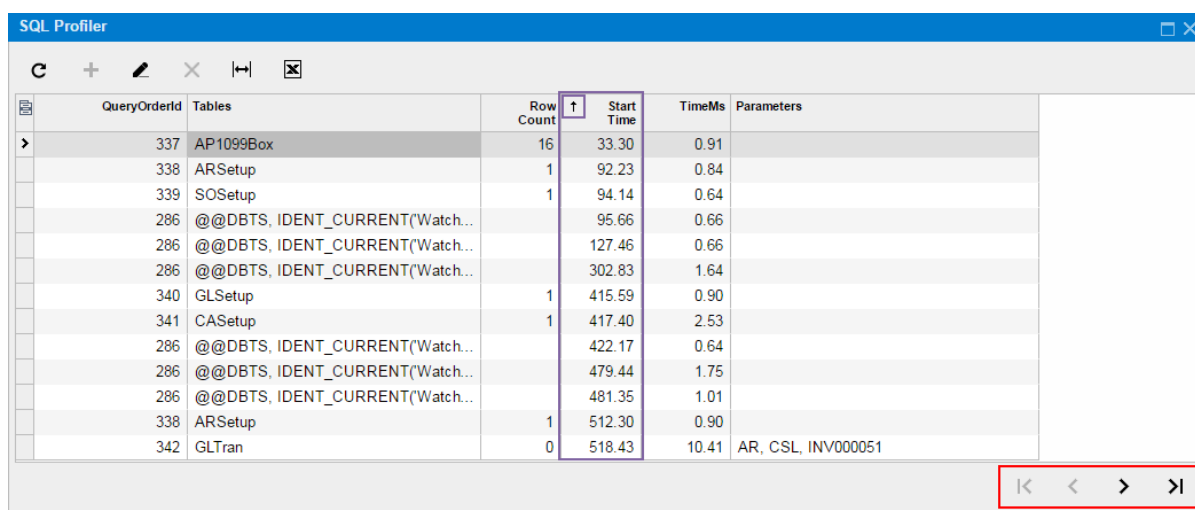
MEMORY USAGE: Managed Memory, Mb: 69, Working Set, Mb: 460, GC Collections: 6/3/3

SQL TRACE OPEN URL

Request Start Time (UTC)	User Name	URL	Command Target	Command Name	Client Time	Server Time, ms	SQL Time, ms	Server CPU, ms	SQL Count	Memory Before
14 Mar 13:23	admin	~/pages/so/so303000.aspx		HTML		7,255.21	464.38	1,154.41	93	234,168,816
14 Mar 13:28	admin	~/pages/so/so303000.aspx	LongRun	Action@Release		5,798.21	3,537.37	3,135.62	761	433,680,128
14 Mar 13:23	admin	~/pages/so/so303000.aspx	ctl00\$phDS\$ds	ReloadPage	8027	5,153.32	1,712.46	842.41	136	240,672,000
14 Mar 13:27	admin	~/pages/so/so301000.aspx	LongRun	Action@PrepareIn...		2,307.33	1,227.04	982.81	369	440,416,544
14 Mar 13:25	admin	~/pages/in/in202500.aspx	ctl00\$phDS\$ds	ReloadPage	1909	1,747.40	419.83	234.00	36	222,056,384
14 Mar 13:24	admin	~/pages/in/in202000.aspx		HTML		1,360.69	22.58	265.20	21	324,765,216
14 Mar 13:23	admin	~/?screenid=so303000&docty...				1,082.46	28.78	0.00	6	00
14 Mar 13:25	admin	~/pages/in/in202500.aspx		HTML		1,042.70	233.04	686.40	31	163,568,208
14 Mar 13:26	admin	~/pages/so/so301000.aspx	ctl00\$phDS\$ds	ReloadPage	1263	1,029.38	509.48	530.40	68	463,617,960
14 Mar 13:26	admin	~/pages/so/so301000.aspx	ctl00\$phF\$form	Save	1054	934.13	569.49	374.40	45	284,636,480
14 Mar 13:23	admin	~/?screenid=so303000&docty...				880.60	0.00	0.00	0	00
14 Mar 13:23	admin	~/?screenid=so303000&docty...		HTML		877.67	429.65	546.00	45	168,097,160
14 Mar 13:24	admin	~/pages/in/in202000.aspx	ctl00\$phDS\$ds	ReloadPage	2215	833.12	224.71	483.60	27	294,172,704
14 Mar 13:26	admin	~/pages/in/in202500.aspx	ctl00\$phG\$tab	Save	937	761.67	342.66	421.20	47	337,184,728
14 Mar 13:27	admin	~/pages/so/so303000.aspx	ctl00\$phDS\$ds	Save	778	621.89	255.23	343.20	52	357,328,152
14 Mar 13:27	admin	~/pages/so/so301000.aspx	ctl00\$phG\$tab...	FetchRow	671	559.44	255.73	296.40	55	419,420,312
14 Mar 13:27	admin	~/pages/so/so301000.aspx	ctl00\$phDS\$ds	Save	628	515.92	199.40	312.00	54	364,512,184


Figure: Opening the SQL Profiler pop-up panel for the selected URL request

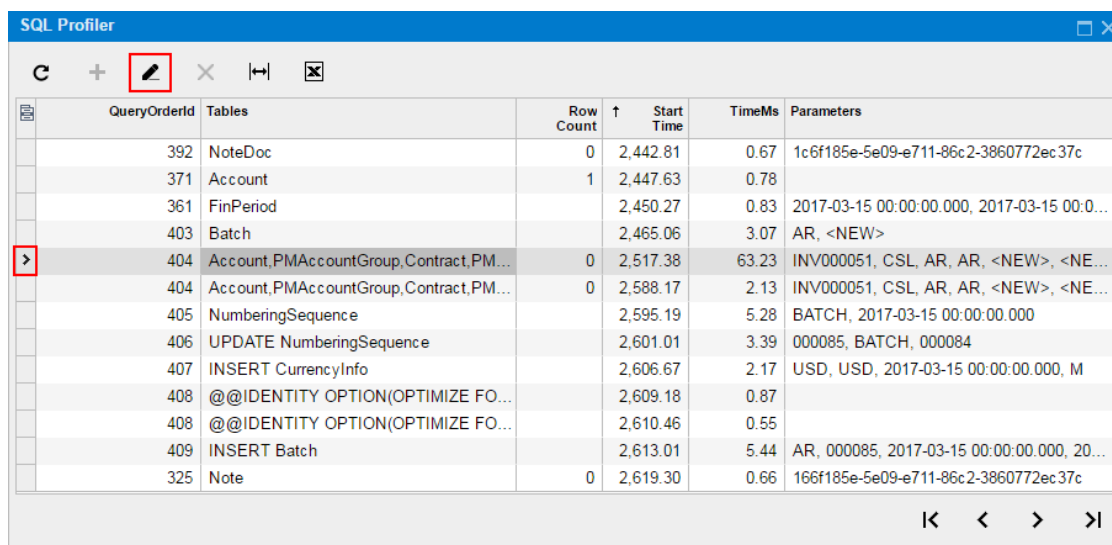
10. In the panel, use the standard table navigation buttons to explore the list of SQL requests, which are initially ordered by start time (see the following screenshot).



QueryOrderId	Tables	Row Count	Start Time	TimeMs	Parameters
337	AP1099Box	16	33.30	0.91	
338	ARSetup	1	92.23	0.84	
339	SOSetup	1	94.14	0.64	
286	@@DBTS, IDENT_CURRENT('Watch...		95.66	0.66	
286	@@DBTS, IDENT_CURRENT('Watch...		127.46	0.66	
286	@@DBTS, IDENT_CURRENT('Watch...		302.83	1.64	
340	GLSetup	1	415.59	0.90	
341	CASetup	1	417.40	2.53	
286	@@DBTS, IDENT_CURRENT('Watch...		422.17	0.64	
286	@@DBTS, IDENT_CURRENT('Watch...		479.44	1.75	
286	@@DBTS, IDENT_CURRENT('Watch...		481.35	1.01	
338	ARSetup	1	512.30	0.90	
342	GLTran	0	518.43	10.41	AR, CSL, INV000051

**Figure: Viewing navigation buttons on the SQL Profiler pop-up panel**

11. If needed, in the SQL profiler table, rearrange records by the value in the **TimeMs** column in descending order to find the SQL requests with the longest duration.
12. To view the SQL statement and the stack trace for an SQL request, select the request in the table and then click **Switch Between Grid and Form** (  ), as shown in the following screenshot.



QueryOrderId	Tables	Row Count	Start Time	TimeMs	Parameters
392	NoteDoc	0	2,442.81	0.67	1c6f185e-5e09-e711-86c2-3860772ec37c
371	Account	1	2,447.63	0.78	
361	FinPeriod		2,450.27	0.83	2017-03-15 00:00:00.000, 2017-03-15 00:00:00.000
403	Batch		2,465.06	3.07	AR, <NEW>
404	Account,PMAccountGroup,Contract,PM...	0	2,517.38	63.23	INV000051, CSL, AR, AR, <NEW>, <NE...
404	Account,PMAccountGroup,Contract,PM...	0	2,588.17	2.13	INV000051, CSL, AR, AR, <NEW>, <NE...
405	NumberingSequence		2,595.19	5.28	BATCH, 2017-03-15 00:00:00.000
406	UPDATE NumberingSequence		2,601.01	3.39	000085, BATCH, 000084
407	INSERT CurrencyInfo		2,606.67	2.17	USD, USD, 2017-03-15 00:00:00.000, M
408	@@IDENTITY OPTION(OPTIMIZE FO...		2,609.18	0.87	
408	@@IDENTITY OPTION(OPTIMIZE FO...		2,610.46	0.55	
409	INSERT Batch		2,613.01	5.44	AR, 000085, 2017-03-15 00:00:00.000, 20...
325	Note	0	2,619.30	0.66	166f185e-5e09-e711-86c2-3860772ec37c

**Figure: Switching the panel to display the SQL statement and the stack trace of the selected SQL request**

13. In the stack trace, find the method that is causing the performance degradation.
14. Launch Microsoft Visual Studio.
15. In Visual Studio, open the file with the method; the file is currently saved in the `App_RuntimeCode` website folder.
16. Analyze the method body to find the code snippet that is causing the issue.
17. On the form toolbar of the *Request Profiler* form (SM205070), click **Stop** to stop the Request Profiler.





: We recommend that you activate the *Log SQL Requests* mode for only a limited period because it can degrade system performance.

**18.** On the form toolbar, click **Clear Log** to delete the SQL request data from the database.

## To Force the Platform to Execute Database Scripts

---

You can discover that the database scripts that are included in a customization project have not been executed by the Acumatica Customization Platform when you publish the project. This issue arises when you have first published the project and then changed the scripts.

When you publish the project, the platform executes all the scripts included in the project. For optimization purposes, to avoid the execution of database scripts during every publication of the project, the platform saves information about each script that has been executed at least once and has not yet been changed in the database, and omits the repeated execution of such scripts.

To force the platform to clean up all such information about previously executed scripts of a customization project and execute the scripts again while publishing the project, follow the instructions described in [To Publish the Current Project with a Cleanup Operation](#).

## To Resolve Issues While Upgrading a Customized Website

---

If you have a customization project that works properly for the current version of Acumatica ERP and you need to upgrade an application instance to a newer version, the customization project might not work properly or might even prevent the website from starting after the upgrade. This happens because the code of Acumatica ERP is continuously developed to implement new features or enhance existing functionality, so the code of an updated instance of Acumatica ERP can become inconsistent with the code in a customization project. For example, if the signature of a method that is overridden in the customization code is changed in the original code, a run-time error may occur in the graph extension. As another example, modified or deleted database columns and tables might cause the functionality of a data access class extension to fail.

### Validation Process

To prevent these issues between the customization and the current version of Acumatica ERP, before you upgrade a customized instance of Acumatica ERP to a new version, the Acumatica Customization Platform validates the compatibility of the code included in all currently published customization projects with the application code of the update version. This validation process executes the following checks in the code of the published customization to detect the breaking changes in the code of Acumatica ERP:

- In graph extensions:
  - Checking the signature for each method that is overridden by using the `PXOverride` attribute.
  - Checking the existence of each base graph.
- In data access class extensions, if a field attribute is overridden:
  - Checking the field existence.
  - Checking that the field type is not changed. (If the customization code uses the field value as decimal and the field type is changed, for example, from `PXDBDecimal` to `PXDBString` that is currently binding this field to a database column of the string type, an exception will occur on a request to the database.)
- In binary DLL files:
  - Checking all the referenced methods, properties, fields, return types, and signatures.



: In some specific cases, a binary file can be updated automatically with a new signature. For example, in a referenced graph, the process updates the BQL statement that is changed for a data view. If a changed signature is detected and cannot be fixed automatically, an error is reported, and the validation fails.

This validation protects a customized website from an update that contains breaking changes and might make the website unworkable.

### Upgrade of a Customized Website

You can upgrade an instance of Acumatica ERP in one of the following ways:

- On the Application Maintenance page of the Acumatica ERP Configuration Wizard. (See [Updating Acumatica ERP by Using the Configuration Wizard](#) for details.)
- On the [Apply Updates](#) form (SM203510; **System** > **Management** > **Process**). (See [Updating Acumatica ERP by Using the Web Interface](#) for details.)



: You must include in a customization package any custom files that you need to use with your instance of Acumatica ERP and publish this package on this instance. If you instead copy the files to the website folder of your instance of Acumatica ERP manually, the files will be removed while the instance is being updated.

When you start upgrading a customized instance of Acumatica ERP to a newer version, the platform launches the validation process, to check the published customization compatibility with the new version code to detect breaking changes. If the validation fails, the platform cancels the upgrade process and shows an appropriate error message. (See [Messages for Validation Errors](#) for details.)

To upgrade a customized instance of Acumatica ERP, follow the instructions presented in the following topics:

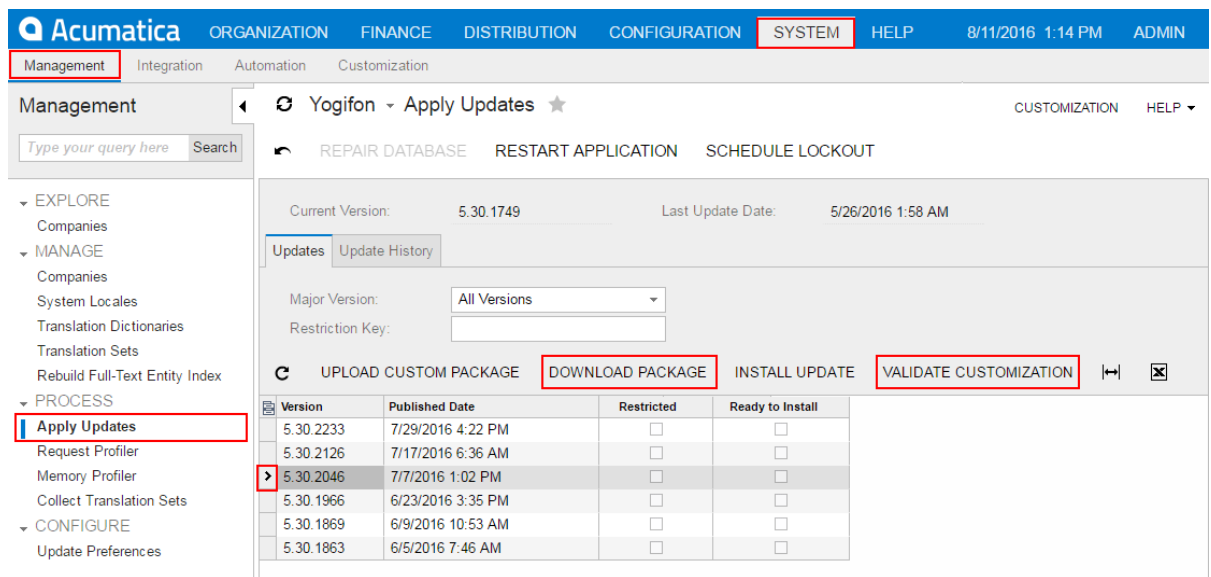
- [To Validate the Compatibility of the Published Customization with a New Version Before an Upgrade](#)
- [To Resolve an Issue Discovered During the Validation](#)
- [To Use the Technical Release Notes to Find the Breaking Changes](#)
- [To Use an Ignore List for the Validation Errors](#)

## To Validate the Compatibility of the Published Customization with a New Version Before an Upgrade

You can validate the compatibility of the currently published customization with an updated version before you start the upgrade process.

To do this, perform the following actions:

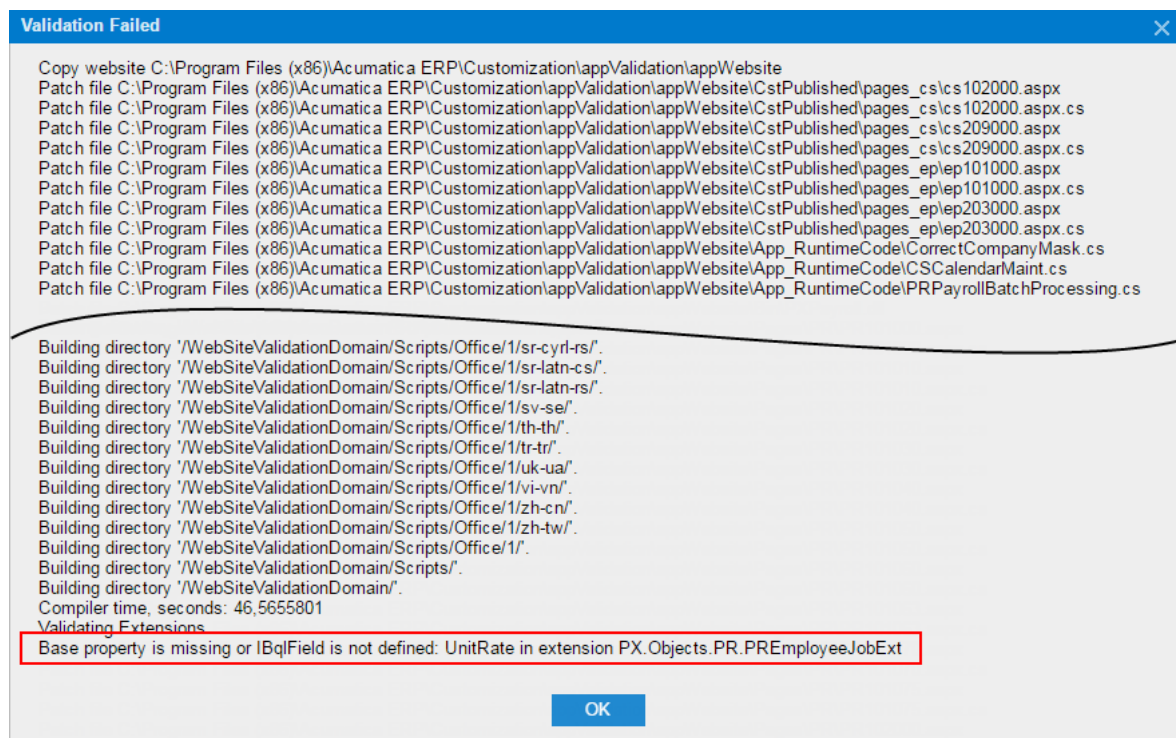
1. Navigate to the [Apply Updates](#) form (SM203510; **System** > **Management** > **Process**).
2. On the **Updates** tab of the form, in the table of available updates, click the product version to which you want to upgrade your Acumatica ERP instance, as shown in the screenshot below.
3. On the table toolbar, click **Download Package**.  
When the download is complete, the **Ready to Install** check box is automatically selected.
4. In the table toolbar, click **Validate Customization** to start the process of validating the compatibility of the currently published customization code with the code of the selected product version.



**Figure: Validating the product version**

If the validation succeeds, you know that you can upgrade your Acumatica ERP instance to the selected version without an issue occurring.

If the validation fails, the **Validation Failed** window opens to display the list of the executed checks and discovered errors, as the following screenshot shows.



**Figure: Viewing an error message in the Validation Failed window**

To resolve any discovered issues, we recommend that you use the approach described in [To Resolve an Issue Discovered During the Validation](#).

## To Resolve an Issue Discovered During the Validation

If you need to upgrade an Acumatica ERP instance in the production environment, if the validation of the compatibility of the code included in all currently published customization projects with the code of the new product version fails, do the following:

- If the customization was developed by a third-party, please contact their support department directly.
- If you are a developer of this customization:
  1. Learn what the error message means. (See [Messages for Validation Errors](#) for details.)
  2. Find the customization code fragment related to the error, and try to resolve the issue you have discovered yourself by using the error description.
  3. Check the technical release notes for the selected product version to ensure that the reason of the error is a change in the product code, and find the recommendation to solve the issue. (See [To Use the Technical Release Notes to Find the Breaking Changes](#) for details.)
  4. In your development environment:
    - a. Install the needed version of Acumatica ERP and deploy the new application instance. (See [Installing Acumatica ERP Locally](#) for details.)
    - b. Import all customization projects. (See [To Import a Project](#) for details.)
    - c. Validate and fix the customization code in each project.



: If you are unable to resolve an issue yourself, please contact Acumatica support. You can create a support case for the issue on the [Support](#) page of the [Acumatica Partner Portal](#).

If you are sure that a discovered error is not really an error, you can force the validation process to ignore the error. See [To Use an Ignore List for the Validation Errors](#) for details.

5. In the production environment:
  - a. Unpublish all customization projects. (See [To Unpublish a Customization](#) for details.)
  - b. Upgrade the Acumatica ERP instance. (See [Updating Acumatica ERP by Using the Web Interface](#) for details.)
  - c. Update the customization projects. (See [To Replace the Content of a Project from a Package](#) for details.)
  - d. Publish the fixed customization projects. (See [Publishing Customization Projects](#) for details.)



: The validation that detects breaking changes is by default turned on in an instance of Acumatica ERP. If you need to temporarily omit this validation, you can turn off the `CheckCustomizationCompatibility` key by including the following string in the `<appSettings>` section of the `web.config` file located in the website folder:

```
<add key="CheckCustomizationCompatibility" value="False" />
```

We do not recommend that you turn off the validation permanently.

### Messages for Validation Errors

This topic, which is intended to be used by developers, describes the messages that may occur during the validation of the customization code compatibility with the code of Acumatica ERP.

#### Failed to resolve method reference

This error occurs if the validation process finds in a custom DLL a reference to a method that is absent with the same signature in the code of Acumatica ERP.

The following example of the error message informs you that the `AM.Objects.dll` file contains a reference to the `System.Void PX.Data.PXLineNbrAttribute::.ctor(System.Type)` method, which has not been declared or has another signature in the `PX.Data` assembly.

```
AM.Objects.dll
Failed to resolve method reference:
System.Void PX.Data.PXLineNbrAttribute::.ctor(System.Type)
declared in
PX.Data, Version=1.0.0.0, Culture=neutral, PublicKeyToken=3b136cac2f602b8e
```

Because the customization code is consistent with the previous version of Acumatica ERP, this error occurs because the method overridden in the customization code has been removed or its signature has been changed in the update. To ensure that this change is implemented in the code of the new version of Acumatica ERP, see the technical release notes for this version, as described in [To Use the Technical Release Notes to Find the Breaking Changes](#).

To fix the error, in the code of the specified extension library, you should refer to an appropriate method declared in the assembly.

### Failed to resolve type reference

This error occurs if the validation process finds in a custom DLL a reference to a type whose declaration is absent in the code of Acumatica ERP.

The following example of the error message informs you that the `FETempFix.dll` file contains the reference to the `PX.Data.PXGraphWithActionsBase`2` type that is not declared in the `PX.Data` assembly.

```
FETempFix.dll
Failed to resolve type reference:
PX.Data.PXGraphWithActionsBase`2
declared in
PX.Data, Version=1.0.0.0, Culture=neutral, PublicKeyToken=3b136cac2f602b8e
```

To fix the error, in the code of the specified extension library, you have to refer to an appropriate type declared in the assembly.

### Could not resolve

This error occurs if the validation process finds a reference to a custom DLL that cannot be found.

The following example of the error message informs you that the `FullRegen.dll` file contains the `ADODB` reference, which cannot be resolved.

```
FullRegen.dll
Could not resolve:
ADODB, Version=7.0.3300.0, Culture=neutral, PublicKeyToken=b03f5f7f11d50a3a
```

To fix the error, in the code of the specified extension library, you have to refer to a DLL file located in the `Bin` folder of the website.

### Declaring Type missing

This error occurs if the validation process finds, in the customization code located in the `App_RuntimeCode` folder of the website, a reference to a type whose declaration is absent in the code of Acumatica ERP.

The following example of the error message informs you that the `PX.Objects.EP.CRBaseActivityMaint`1<PX.Objects.CR.CRTaskMaint>` class contains a reference to the `BaseBAccount` type, which is undeclared.

```
Declaring Type missing:
BaseBAccount
from
PX.Objects.EP.CRBaseActivityMaint`1<PX.Objects.CR.CRTaskMaint>
```

To fix the error, in the corresponding *Code* or *DAC* item of the customization project, you have to refer to the appropriate type.

### Referenced Field missing

This error occurs if the validation process finds, in the customization code located in the `App_RuntimeCode` folder of the website, a reference to a field that is undeclared in the data access class (DAC).

The following example of the error message informs you that the `PX.Objects.CS.CSAnswers` data access class does not contain the `_EntityID` field.

```
Referenced Field missing:
_EntityID
from
PX.Objects.CS.CSAnswers
```

To fix the error, in the corresponding *Code* or *DAC* item of the customization project, you have to refer to the appropriate field.

### Base property is missing or IBqlField is not defined

This error can occur if the validation process finds a data access class extension that contains a reference of a field with both of the following implementation features:

- The field name does not contain the *Usr* prefix.
- The DAC extension does not contain the `IBqlField` declaration.

For such cases, the validation determines that the DAC extension overrides a field existing in the code of Acumatica ERP. If this field cannot be found in the code of Acumatica ERP, the validation reports about the error.

The following example of the error message informs you that the `Age` field is referenced in the `CQHRIS.ContactExtension` extension of the `CQHRIS.Contact` data access class; however the code of Acumatica ERP does not contain the field declaration.

```
Base property is missing or IBqlField is not defined:
Age
in extension
CQHRIS.ContactExtension
```

If the field is custom, to fix the error, you have to add the `IBqlField` declaration in the DAC extension. If the code refers to a field that was removed from the code of Acumatica ERP, you should alter the DAC extension to make it consistent with the base class.

## To Use the Technical Release Notes to Find the Breaking Changes

If you need to know all the changes that have been performed in some version of Acumatica ERP and may affect reports, customizations, and integration built in a prior version, see the list of changes in the Technical Release Notes document for the new version.

The Technical Release Notes documents contain the following lists of breaking changes:

- Removed screens
- Removed tables
- Removed fields
- Modified field types
- Removed data access classes
- Removed graphs
- Removed constants
- Other removed classes
- Modified interfaces and abstract classes
- Other breaking changes
- Other breaking fields

To download a Technical Release Notes document for the needed version of Acumatica ERP, perform the following actions:

1. In the browser, open [Acumatica Partner Portal](#).
2. In the **Product Links** list of the webpage, click **Download Acumatica**.
3. In the **Links** list at right side of the webpage, which opens, click **Release Notes**.
4. On the Release Notes webpage, which opens, select the tab for the needed version of Acumatica ERP, and then click the link for the Technical Release Notes document for this version, as the following screenshot shows.

**Acumatica**  
ENGAGE Portal

Partner Program Training Sales Marketing Support Services

**Current Products**  
Acumatica 5.3  
Acumatica 4.2  
Field Services

**Beta Products**  
Acumatica 6 Beta  
Payroll 5.x Beta

**Previous Versions**  
Acumatica 5.2  
Acumatica 5.1  
Acumatica 5.0  
Acumatica 4.1  
Acumatica 4.0  
Acumatica 3.0  
Acumatica Pre 3.0

**Documentation**  
Product Guides (PDF)  
Release Notes

## Release Notes

Acumatica distributes fixes in builds. Builds keep a product current. They include fixes to issues that are reported through the partner community. Builds may also fix issues that our support, development and product management teams deems important.

Builds are cumulative. Each new build contains all the fixes that are in previous builds, together with any new fixes. You do not have to install a previous build before you install the latest build.

Acumatica <b>5.3</b>	5.2	5.1	5.0	4.2	4.1	4.0	3.0
----------------------	-----	-----	-----	-----	-----	-----	-----

[Release Notes for Build 5.30.2233 \(released on 2016-07-29\)](#)  
[5.3 Initial Release Notes](#)  
[5.3 Initial Technical Notes](#)

### Previous 5.3 Updates

[Release Notes for Build 5.30.2126 \(released on 2016-07-18\)](#)  
[Release Notes for Build 5.30.2046 \(released on 2016-07-08\)](#)  
[Release Notes for Build 5.30.1966 \(released on 2016-06-24\)](#)  
[Release Notes for Build 5.30.1869 \(released on 2016-06-10\)](#)

**Figure: Downloading the Technical Release Notes on the Partner Portal**

After you have downloaded the document, you can use it to search for the object that is specified in the error message that occurred during the validation process.



: The Technical Release Notes document contains information about the changes in the selected version of Acumatica ERP. If you upgrade an instance of Acumatica ERP, for example, from Version 5.2 to Version 6.0, you should explore the technical release notes for Versions 5.3 and 6.0.

If the object is found, and the document contains information about how to fix the issue, use the information. Otherwise, on the [Support](#) page of the portal, click **New Support Case** to create a support case for the issue.

## To Use an Ignore List for the Validation Errors

If validation of the compatibility of the published customization with the new version fails, the platform cancels the upgrade process and shows an appropriate error message. However for some cases when you are sure that a discovered error is not really an error, you can force the validation process to ignore the error, so you can continue the process of upgrading of the customized instance of Acumatica ERP. Also, you may need to ignore, for example, an error in a third-party DLL file.

To force the validation process to ignore an error, perform the following actions:

1. In the `App_Data` folder of the website, create a `.txt` file whose name has the *CstValidationIgnore* prefix, such as `CstValidationIgnore.txt` or `CstValidationIgnore_ProjectName.txt`.



: You can create multiple `CstValidationIgnore*.txt` files with ignore lists for an instance of Acumatica ERP.

2. In the tool used for the upgrade, which may be the Acumatica ERP Configuration Wizard or the [Apply Updates](#) form (SM203510; **System** > **Management** > **Process**), select the error message and copy it to the clipboard.

3. In the file, paste the error message from the clipboard.



: You can add multiple error messages to each of multiple files with ignore lists.

4. Save the file.

5. Determine which the customization project has the code that provokes the error message.

6. Add the file with the ignore list to the project (see [To Add a Custom File to a Project](#) for details) so it will ignore the error when you publish the project in the production environment.



: While it validates a customization project before the project publication, the Acumatica Customization Platform ignores all the errors that are specified in the `CstValidationIgnore*.txt` files with the *CstValidationIgnore* prefix in the file name if these files are located in the `App_Data` folder of the website.

As a result, if you publish the customization project or upgrade an Acumatica ERP instance where the project is published, the validation process omits the error that is specified in the file.



# Examples

---

This part of the guide is intended to describe examples of how you can customize the user interface and business logic of Acumatica ERP forms.

## In This Part

- [Examples of User Interface Customization](#)
- [Examples of Functional Customization](#)

## Examples of User Interface Customization

---

*UI customization* includes changing the look and behavior of forms, tweaking form design, and manually editing the .aspx code. UI customization is always related to the .aspx code of the corresponding forms and represents *aspx changesets* that are added to the existing .aspx code.

For customization to the layout of existing forms, you can use the [Screen Editor](#) that you open from the Customization Project Editor.

For the layout design of new forms, you should use the Screen Editor that you open from Microsoft Visual Studio.

The next topics describe the rules for user interface customization and give examples of typical UI customization tasks:

- [Dragging, Moving, and Deleting UI Controls and Grid Columns](#)
- [Adding Input Controls](#)
- [Adding Advanced Controls](#)
- [Adding Columns to a Grid](#)
- [Modifying Columns in a Selector](#)
- 

## Dragging, Moving, and Deleting UI Controls and Grid Columns

This topic describes in detail how to change the placement of UI controls by dragging them and how to use the facilities of the Screen Editor to delete or move UI controls and grid columns.

### Dragging and Dropping UI Controls

Before you start to manually move UI controls by dragging them in the Control Tree of the Screen Editor, note the following simple rules:

- You can move a UI control anywhere within its container control.
- To move a UI control within a container, you have to drag the element to the required place.
- Any UI control moved within a form is automatically aligned according to the nearest **PXLayoutRule** component placed above it. (See [Layout Rule \(PXLayoutRule\)](#) for details.)

On the Stock Items (IN202500) form, suppose that you want to move up the **Is a Kit** check box, to make it the first control in the first column of the **General Settings** tab area, as the screenshot below illustrates.

## Stock Items

← SAVE & CLOSE    ↩    +    🗑    ⌂    <    >    >|    ACTIONS ▾    INQUIRIES ▾

---

\* Inventory ID:     Product Workgroup:   
 Item Status: **Active**    Product Manager:   
 Description:

---

GENERAL SETTINGS    PRICE/COST INFO    WAREHOUSE DETAILS    VENDOR DETAILS    ATTRIBUTES    PACKAGING    CROSS-REFERENCE

---

**ITEM DEFAULTS**

\* Item Class:     **UNIT OF MEASURE**  
 Type: **Finished Good**    \* Base Unit:   
☐ Is a Kit    \* Sales Unit:   
 Valuation Method: **Standard**    \* Purchase Unit:   
 \* Tax Category:     **+**    **×**  
 \* Posting Class:     \* From Unit:     Multiply/Divid    Conversion Factor    To Unit  
 \* Lot/Serial Class:                   
 Auto-Incremental Value:   
 Country Of Origin:

**WAREHOUSE DEFAULTS**

Default Warehouse:     **PHYSICAL INVENTORY**  
 Default Issue From:     PI Cycle:   
 Default Receipt To:     ABC Code:   
    ☐ Fixed ABC Code  
 Movement Class:     ☐ Fixed Movement Class

**Figure: Viewing the form before dragging the UI control**

To move the check box:

1. Click the **Customization** menu on the form and choose the **Inspect Element** command.
2. Click the **Is a Kit** check box.
3. Click the **Customize** button on the **Element Properties** dialog box.

The customization item is added to the current project if you have selected one by using the **Customization > Select Project** command, or you will be asked to select the customization project to add the item to it.

4. In the Control Tree of the Screen Editor, drag the **Is a Kit** check box to the position above the **Item Class** control.
5. Save the changes to the customization project, and publish the customization project.

## Screen Editor: IN202500 (Stock Items)

PREVIEW CHANGES ACTIONS ▾

↻ + 🗑️ ▾

DataSource: InventoryItemMaint  
 Form: Item  
 Tab: ItemSettings  
 General Settings  
 Column  
 Group  
 Item Class  
 Type  
 Is a Kit  
 Valuation Method  
 Tax Category  
 Posting Class  
 Lot/Serial Class  
 Auto-Incremental Value  
 Country Of Origin  
 Group  
 Column  
 Subitems

MAIN PROPERTIES    LAYOUT PROPERTIES    ATTRIBUTES    EVENTS

Override	Property	Value
<input type="checkbox"/>	Display Name	Is a Kit
<input type="checkbox"/>	Enabled	
<input type="checkbox"/>	Visible	
<input type="checkbox"/>	Required	

**Figure: Moving the UI control to the required position**

The check box appears at the new position (see the following screenshot).

## Stock Items

⬅️ SAVE & CLOSE    🗑️    ↻    +    🗑️ ▾    ⬅️ < > ➡️    ACTIONS ▾    INQUIRIES ▾

\* Inventory ID:     Product Workgroup:   
 Item Status: Active    Product Manager:   
 Description:

GENERAL SETTINGS    PRICE/COST INFO    WAREHOUSE DETAILS    VENDOR DETAILS    ATTRIBUTES    PACKAGING    CROSS-REFERENCE

ITEM DEFAULTS    UNIT OF MEASURE

☐ Is a Kit  
 \* Item Class:   
 Type: Finished Good  
 Valuation Method: Standard  
 \* Tax Category:   
 \* Posting Class:   
 \* Lot/Serial Class:   
 Auto-Incremental Value:   
 Country Of Origin:

\* Base Unit:   
 \* Sales Unit:   
 \* Purchase Unit:

From Unit    Multiply/Divid    Conversion Factor    To Unit

WAREHOUSE DEFAULTS    PHYSICAL INVENTORY


Default Warehouse:   
 Default Issue From:   
 Default Receipt To:

PI Cycle:   
 ABC Code:   
 Movement Class:   
☐ Fixed ABC Code  
☐ Fixed Movement Class

**Figure: Noticing the new placement of the check box**


### Moving and Deleting UI Controls and Grid Columns

You use the Screen Editor to implement advanced customization of a form—for instance, if you need to shift a column within a grid, to delete a UI control or table column from a form area, or to change the position of a UI control on a form while having the capability to change its original container.

 : After changing containers, you should perform functional changes concerning the code of appropriate main data access classes (DACs) or data views of business logic controllers (BLCs, also referred to as *graphs*). For details, see [Customizing DAC Attributes](#).

Suppose that you have to customize the **General Settings** and **Warehouse Details** tabs of the Stock Items (IN202500) form as follows:

1. Delete the **Auto-Incremental Value** input control. (See the first screenshot below.)
2. Move down the **Tax Category** control so that it is placed under the **Lot/Serial Class** control, as the first screenshot also illustrates.

 : The **Lot/Serial Class** field is visible if the **Lot and Serial Tracking** feature is enabled on the Enable/Disable Features (CS100000) form.

3. Move to the left the **Status** column of the details table so that it is placed at the right of the **Default** column, as shown in the second screenshot below

Stock Items

← SAVE & CLOSE    ↩    +    -    🗑    ⏪    <    >    ⏩    ACTIONS ▾    INQUIRIES ▾

---

\* Inventory ID:     Product Workgroup:   
 Item Status: **Active**    Product Manager:   
 Description:

**GENERAL SETTINGS**    PRICE/COST INFO    WAREHOUSE DETAILS    VENDOR DETAILS    ATTRIBUTES    PACKAGING    CROSS-REFERENCE

---

**ITEM DEFAULTS**    ☐ Is a Kit

\* Item Class:        
 Type: **Finished Good**      
 Valuation Method: **Standard**      
 \* Tax Category:       
 \* Posting Class:       
 \* Lot/Serial Class:       
 Auto-Incremental Value:       
 Country Of Origin:

**UNIT OF MEASURE**

\* Base Unit:       
 \* Sales Unit:       
 \* Purchase Unit:       
 +    ×      
 \* From Unit    Multiply/Divid    Conversion Factor    To Unit

**WAREHOUSE DEFAULTS**

Default Warehouse:       
 Default Issue From:       
 Default Receipt To:

**PHYSICAL INVENTORY**

PI Cycle:       
 ABC Code:       
☐ Fixed ABC Code      
 Movement Class:       
☐ Fixed Movement Class

**Figure: Viewing the General Settings tab before changes**

## Stock Items

← SAVE & CLOSE    ↩    +    🗑    ⏪    <    >    ⏩    ACTIONS ▾    INQUIRIES ▾

Inventory ID:     Product Workgroup:   
 Item Status:     Product Manager:   
 Description:

GENERAL SETTINGS    PRICE/COST INFO    **WAREHOUSE DETAILS**    VENDOR DETAILS    ATTRIBUTES    PACKAGING    CROSS-REFERENCE

🔄    +    ✎    ✕    ADD WAREHOUSE DETAIL    |⏪    ⏩|

	Default	Warehouse	Default Receipt To	Default Issue From	Status	Inventory Account	Inventory Sub.	Product Workgroup	Product

**Figure: Viewing the details table of the Warehouse Details tab before changes**

To open the Screen Editor, open the Stock Items (IN202500) form, click the **Customization** menu, choose the **Inspect Element** command, select the **Auto-Incremental Value** control on the form, and click the **Customize** button on the **Element Properties** dialog box.

The Control Tree of the editor displays content of the **General Settings** tab item, to which the **Auto-Incremental Value** control belongs. This control is currently selected and highlighted in bold.



: To view all controls and containers of the customized form on the tree, click the filter button of the tree toolbar.

To delete the selected control, click the **Delete** button of the tree toolbar.

Screen Editor: IN202500 (Stock Items)

←    🗑    PREVIEW CHANGES    ACTIONS ▾

🔄    +    🗑    ▾

- DataSources
- Form: It
- Tab: ItemSettings
  - General Settings
    - Column
      - Group
        - Is a Kit
        - Item Class
        - Type
        - Valuation Method
        - Tax Category
        - Posting Class
        - Lot/Serial Class
        - Auto-Incremental Value**
        - Country Of Origin
      - Group
      - Column
      - Subitems

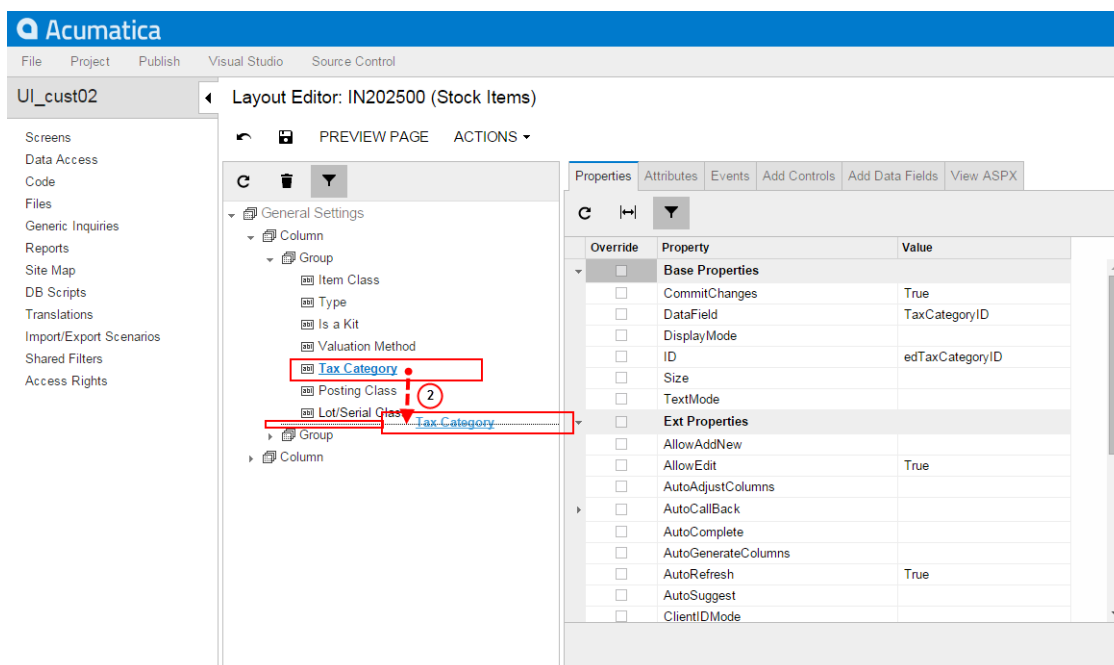
Remove    Reset Properties

MAIN PROPERTIES    LAYOUT PROPERTIES    ATTRIBUTES    EVENTS

Override	Property	Value
<input type="checkbox"/>	Display Name	Auto-Incremental Value
<input type="checkbox"/>	Enabled	
<input type="checkbox"/>	Visible	
<input type="checkbox"/>	Required	

**Figure: Removing the selected UI control**

Now you should move down the **Tax Category** UI control, to place it under the **Lot/Serial Class** control. Select the **Tax Category** UI control on the tree, drag it and drop to the required position, as the screenshot below illustrates.



**Figure: Moving the control on the Control Tree**

Thus, to change the placement of a UI control, you select it on the Control Tree of the Screen Editor, drag it and drop to place this control appropriately in relation to other UI controls.

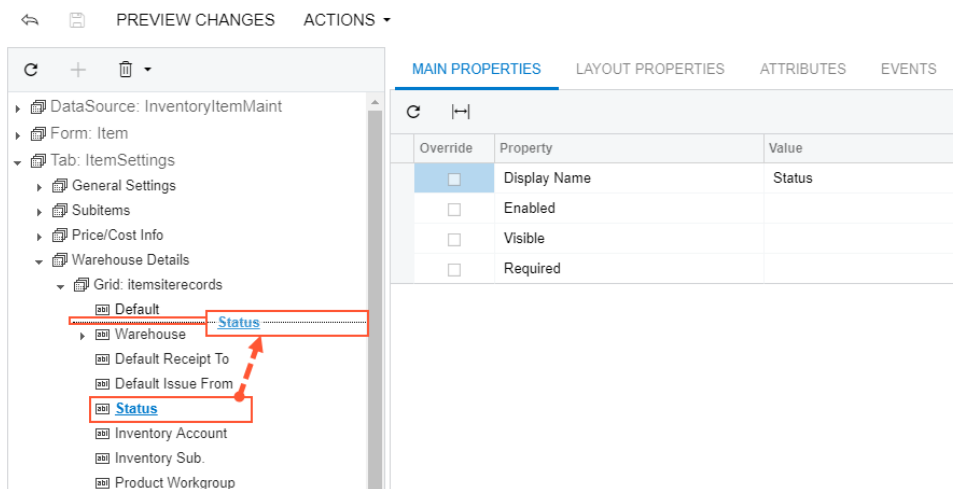
Click **Save** on the toolbar of the Screen Editor to save changes to the current customization project.

To begin moving the **Status** column, you can:

- Open the Stock Items (IN202500) form and use the Element Inspector for the **Status** column on the form
- Open the Screen Editor for the form and find the column in the Control Tree

Drag and drop the **Status** control to the required position in the tree, as the screenshot below illustrates.

Screen Editor: IN202500 (Stock Items)



**Figure: Moving the grid column to the left**

Thus, to change the placement of a grid column, you find the column in the Control Tree of the Screen Editor and drag it to the desired position.

Click **Save** on the toolbar of the Screen Editor to save changes to the current customization project.

After you publish the project, you will see the modified **General Settings** tab on the Stock Items (IN202500) form, as the following screenshot illustrates.

Stock Items ☆

← SAVE & CLOSE [Icons] ACTIONS ▾ INQUIRIES ▾

---

\* Inventory ID: [Text] ⓘ      Product Workgroup: [Text] ⓘ  
 Item Status: Active ▾      Product Manager: [Text] ⓘ  
 Description: [Text]

---

GENERAL SETTINGS   PRICE/COST INFO   WAREHOUSE DETAILS   VENDOR DETAILS   ATTRIBUTES   PACKAGING   CROSS-REFERENCE

---

**ITEM DEFAULTS**

☐ Is a Kit

\* Item Class: [Text] ⓘ  
 Type: Finished Good ▾  
 Valuation Method: Standard ▾  
 \* Posting Class: [Text] ⓘ  
 \* Lot/Serial Class: [Text] ⓘ  
 \* Tax Category: [Text] ⓘ  
 Country Of Origin: [Text] ⓘ

**UNIT OF MEASURE**

\* Base Unit: [Text] ⓘ  
 \* Sales Unit: [Text] ⓘ  
 \* Purchase Unit: [Text] ⓘ

⌂ + ×

* From Unit	Multiply/Divid	Conversion Factor	To Unit

**WAREHOUSE DEFAULTS**

Default Warehouse: [Text] ⓘ  
 Default Issue From: [Text] ⓘ  
 Default Receipt To: [Text] ⓘ

**PHYSICAL INVENTORY**

PI Cycle: [Text] ⓘ  
 ABC Code: [Text] ⓘ  
☐ Fixed ABC Code  
 Movement Class: [Text] ⓘ  
☐ Fixed Movement Class

**Figure: Viewing the modified General Settings tab of the form**

If you open the **Warehouse Details** tab of this form, you will see that the column of the details table has been moved to the left, as shown in the screenshot below.

Stock Items ☆

← SAVE & CLOSE [Icons] ACTIONS ▾ INQUIRIES ▾

---

\* Inventory ID: [Text] ⓘ      Product Workgroup: [Text] ⓘ  
 Item Status: Active ▾      Product Manager: [Text] ⓘ  
 Description: [Text]

---

GENERAL SETTINGS   PRICE/COST INFO   **WAREHOUSE DETAILS**   VENDOR DETAILS   ATTRIBUTES   PACKAGING   CROSS-REFERENCE

---

⌂ + ✎ × ADD WAREHOUSE DETAIL [Icons]

	Default	Status	Warehouse	Default Receipt To	Default Issue From	Inventory Account	Inventory Sub.	Product Workgroup	Proc

**Figure: Viewing the moved column on the Warehouse Details tab**

If you need to analyze the added content (changeset) of the customization project, open the project in the Project Editor, choose the **Edit Project Items** command on the **File** menu item and select the **Object Name** field of the customized object (see the screenshot below).

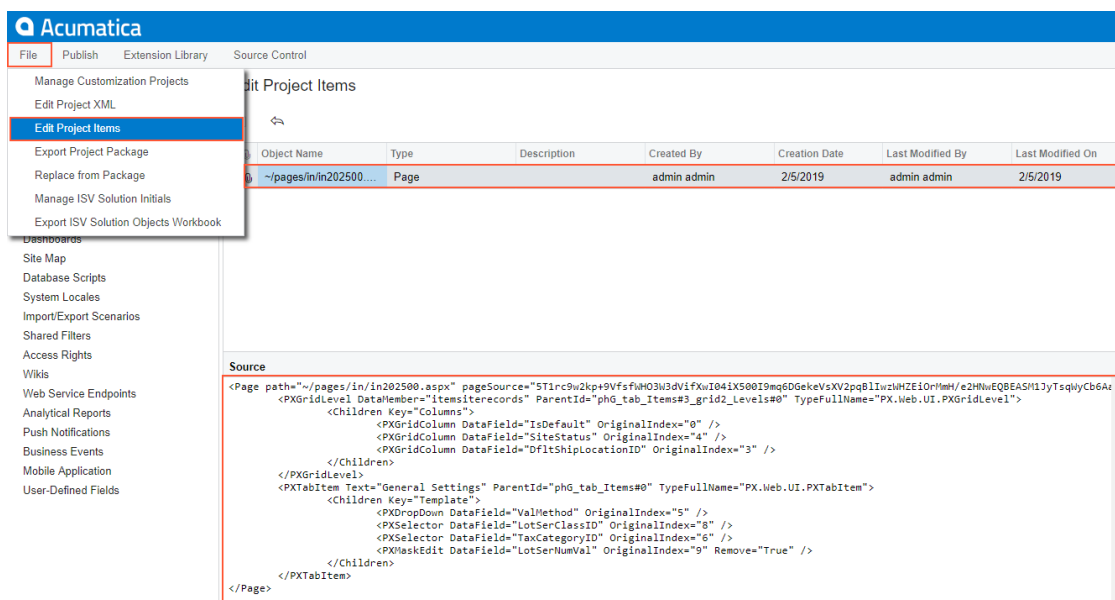


Figure: Analyzing the added content of the customization project

## Adding Input Controls

If you need to add a control onto a form, you use the Screen Editor.

The screenshot below illustrates the original Journal Transactions (GL301000) form. Suppose that you want to add a text field (for instance, the **CreatedByID** selector of the *GL Batch* DAC) below the **Auto Reversing** check box.

Journal Transactions

← SAVE & CLOSE [Icons] RELEASE ACTIONS ▾ REPORTS ▾

Module: AR	* Branch: PRODWHOLE - Products Wholesale	Type: Normal
Batch Number: AR004284	* Ledger: ACTUAL - Actual Ledger	Orig. Batch Number:
Status: Posted	Currency: USD 1.00 VIEW BASE	Debit Total: 500.00
<input type="checkbox"/> Hold	<input type="checkbox"/> Auto Reversing <input type="checkbox"/> Reversing Entry	Credit Total: 500.00
* Transaction D... 12/15/2018		
* Post Period: 12-2018		
Description:		

VIEW SOURCE DOCUMENT RECLASSIFICATION HISTORY [Icons]

	* Branch	* Account	Description	* Subaccount	Project/Con	Project Task	Ref. Number	Trans Date	Quantity	UOM
>	PRODWHOLE	10200	Company Chec...	000-000	X		001403	12/15/20	0.00	
	PRODWHOLE	11000	Accounts Rece...	000-000	X		001403	12/15/20	0.00	

Figure: Viewing the original form

To open the Screen Editor, open the Journal Transactions (GL301000) form, click the **Customization** menu, choose the **Inspect Element** command, select the **Auto Reversing** control, and click the **Customize** button on the **Element Properties** dialog box.

The editor is opened with the **Auto Reversing** control selected and highlighted in bold in the tree of controls.

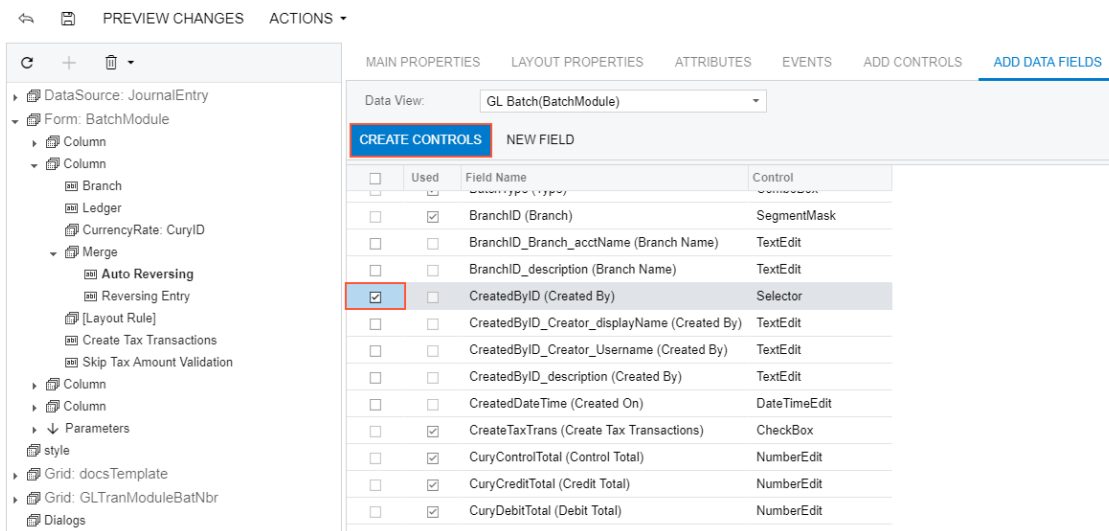
To create a control below the selected item in the tree:

1. Click on the **Add Data Field** tab.



2. Select the **CreatedByID** field in the list on the tab.
3. Click the **Create Controls** button on the tab toolbar.

Screen Editor: GL301000 (Journal Transactions)



**Figure: Creating a control below the selected one in the tree of controls**

Adjust the placement of a UI control so that it is after the *[Layout Rule]* node by dragging it to the needed place.

Click **Save** on the toolbar of the Screen Editor to save changes to the current customization project.

After publishing the customization project, you will see the added field on the *Journal Transactions* form, as the screenshot below illustrates.

Journal Transactions

The screenshot shows the 'Journal Transactions' form. The 'Created By' field is highlighted with a red box, showing the value 'admin - admin admin'. The form includes fields for Module (AR), Batch Number (AR004284), Status (Posted), Transaction Date (12/15/2018), Post Period (12-2018), and Description. The 'Created By' field is highlighted with a red box.

Branch	Account	Description	Subaccount	Project/Con	Project Task	Ref. Number	Trans Date	Quantity	UOM
PRODWHOLE	10200	Company Chec...	000-000	X		001403	12/15/20	0.00	
PRODWHOLE	11000	Accounts Rece...	000-000	X		001403	12/15/20	0.00	

**Figure: Viewing the customized form**

To view the fragment of the .aspx code that represents the customization result, open the form in the Screen Editor and select the **View ASPX** tab. The customized fragment is highlighted in yellow, as the screenshot below illustrates.

Screen Editor: GL301000 (Journal Transactions)

PREVIEW CHANGES ACTIONS

MAIN PROPERTIES LAYOUT PROPERTIES ATTRIBUTES EVENTS ADD CONTROLS ADD DATA FIELDS **VIEW ASPX**

DataSource: JournalEntry

- Form: BatchModule
  - Column
    - Branch
    - Ledger
    - CurrencyRate: CuryID
    - Auto Reversing
    - Reversing Entry
    - [Layout Rule]
    - Created By
    - Create Tax Transactions
    - Skip Tax Amount Validation
  - Column
  - Column
  - Parameters
  - style
  - Grid: docsTemplate
  - Grid: GLTranModuleBatNbr
  - Dialogs

```

<px:PXFormView ID="form" runat="server" Width="100%" DataMember="BatchModule" Caption="Batch Summary" NoteIndicator
NotifyIndicator="True" DefaultControlID="edModule" DataSourceID="ds" TabIndex="18100" >
<Parameters>
<px:PXQueryStringParam Name="Batch.module" QueryStringField="Module" Type="String" OnLoadOnly="True" ></px:PXQu
</Parameters>
<Template>
<px:FXLayoutRule runat="server" StartColumn="True" LabelWidth="5" ControlSize="5" ></px:FXLayoutRule>
<px:FXDropDown ID="edModule" runat="server" DataField="Module" ></px:FXDropDown>
<px:FXSelector ID="edBatchNbr" runat="server" DataField="BatchNbr" AutoRefresh="True" DataSourceID="ds" ></px:FX
<px:FXDropDown ID="edStatus" runat="server" DataField="Status" Enabled="False" ></px:FXDropDown>
<px:FXCheckBox ID="chkHold" runat="server" DataField="Hold" OnValueChange="Commit" ></px:FXCheckBox>
<px:FXDateTimeEdit ID="edDateEntered" runat="server" DataField="DateEntered" OnValueChange="Commit" ></px:FXDat
<px:FXSelector ID="edFinPeriodID" runat="server" DataField="FinPeriodID" OnValueChange="Commit" DataSourceID="d
<px:FXLayoutRule runat="server" ColumnSpan="3" ></px:FXLayoutRule>
<px:FXTextEdit ID="edDescription" runat="server" DataField="Description" ></px:FXTextEdit>

<px:FXLayoutRule runat="server" StartColumn="True" LabelWidth="5" ControlSize="XM" ></px:FXLayoutRule>
<px:FXSegmentMask ID="edBranchID" runat="server" DataField="BranchID" OnValueChange="Commit" DataSourceID="ds"
<px:FXSelector ID="edLedgerID" runat="server" DataField="LedgerID" OnValueChange="Commit" DataSourceID="ds" Aut
<pxa:FXCurrencyRate ID="edCury" runat="server" DataMember="Currency_"
DataField="CuryID" RateTypeView="Batch_CurrencyInfo" DataSourceID="ds"></pxa:FXCurrencyRate>
<px:FXLayoutRule runat="server" LabelWidth="5" ControlSize="XM" Merge="True"></px:FXLayoutRule>
<px:FXCheckBox ID="chkAutoReverse" runat="server" DataField="AutoReverse" OnValueChange="Commit" ></px:FXCheckB
<px:FXCheckBox ID="AutoReverseCopy" runat="server" DataField="AutoReverseCopy" OnValueChange="Commit"></px:FXC
<px:FXLayoutRule runat="server" ></px:FXLayoutRule>
<px:FXSelector runat="server" ID="CstPXSelector2" DataField="CreatedByID" />
<px:FXCheckBox ID="chkCreateTaxTrans" runat="server" CommitChanges="True" DataField="CreateTaxTrans"></px:FXChe
<px:FXCheckBox ID="chkSkipTaxValidation" runat="server" CommitChanges="True" DataField="SkipTaxValidation"></px:

```

**Figure: Analyzing the changeset of the .aspx code**

To view the changes to the layout of the form introduced by the new control, open the project in the Project Editor, choose the **Edit Project Items** command on the **File** menu item and select the **Object Name** field of the customized object (see the screenshot below). You can see the new **Page** item that contains the .aspx code changeset.

Acumatica

File Publish Extension Library Source Control

Manage Customization Projects

Edit Project XML

**Edit Project Items**

Export Project Package

Replace from Package

Manage ISV Solution Initials

Export ISV Solution Objects Workbook

Dashboards

Site Map

Database Scripts

System Locales

Import/Export Scenarios

Shared Filters

Access Rights

Wikis

Web Service Endpoints

Analytical Reports

Push Notifications

Business Events

Mobile Application

User-Defined Fields

Edit Project Items

Object Name	Type	Description	Created By
~/pages/gl301000.aspx	Page		admin admin
~/pages/in202500.aspx	Page		admin admin

Source

```

<Page path="~/pages/gl301000.aspx" ControlID="2" pageSource="vVtbc9u4FX7endn/wOG0Z7IPtixn00ISOVNbik23cuyV1HubByIhC
<PXFormView ID="form" ParentID="phf_form" TypeFullName="PX.Web.UI.PXFormView">
  <Children Key="Template">
    <AddItem>
      <PXSelector TypeFullName="PX.Web.UI.PXSelector">
        <Prop Key="Virtual:ApplyStylesheetSkin" />
        <Prop Key="ID" Value="CstPXSelector2" />
        <Prop Key="DataField" Value="CreatedByID" />
      </PXSelector>
    </AddItem>
    <PXCheckBox DataField="CreateTaxTrans" OriginalIndex="17" />
  </Children>
</PXFormView>
</Page>

```

**Figure: Analyzing the added content of the customization project**

: As a rule, if you add a new data field, you need to perform some additional actions related to the functional customization. For an example of a new data field, see [Adding Data Fields](#).

## Adding Advanced Controls

Suppose that you need to customize the Stock Items (IN202500) form and you have divided the customization task into the following steps:

- [Adding a new tab item](#) onto the form.
- [Adding a panel onto the tab item](#).

- [Adding an UI control onto the new panel.](#)



: This step is needed to make the added tab and its content visible at run time; otherwise, empty container controls aren't displayed.

The original Stock Items (IN202500) form is shown on the screenshot below.

Stock Items

← SAVE & CLOSE + ACTIONS ▾ INQUIRIES ▾

\* Inventory ID: AACOMPUT01 Product Workgroup:   
 Item Status: Active ▾ Product Manager:   
 Description: Acer Laptop Computer

GENERAL SETTINGS PRICE/COST INFO WAREHOUSE DETAILS VENDOR DETAILS ATTRIBUTES PACKAGING CROSS-REF

**ITEM DEFAULTS**

\* Item Class: ELECCOMP -400-COMPUTERS - Cc   
 Type: Finished Good ▾  
☐ Is a Kit  
 Valuation Method: Average ▾  
 \* Tax Category: EXEMPT - Exempt Tax Category   
 \* Posting Class: ELE - Electronics & Computers   
 \* Lot/Serial Class: NOTTRACKED - Not Tracked   
 Auto-Incremental Value:   
 Country Of Origin:

**UNIT OF MEASURE**

\* Base Unit: EA   
 \* Sales Unit: EA   
 \* Purchase Unit: EA   
 + - ×  

* From Unit	Multiply/Divid	Conversion Factor	To Unit

**WAREHOUSE DEFAULTS**

Default Warehouse: WHOLESALE - HQ Wholesale Wareh   
 Default Issue From: R1S1 - Row 1 Shelf 1   
 Default Receipt To: RECEIVING - Receiving

**PHYSICAL INVENTORY**

PI Cycle:   
 ABC Code:   
☐ Fixed ABC Code  
 Movement Class:   
☐ Fixed Movement Class

**Figure: Viewing the Stock Items form before changes**

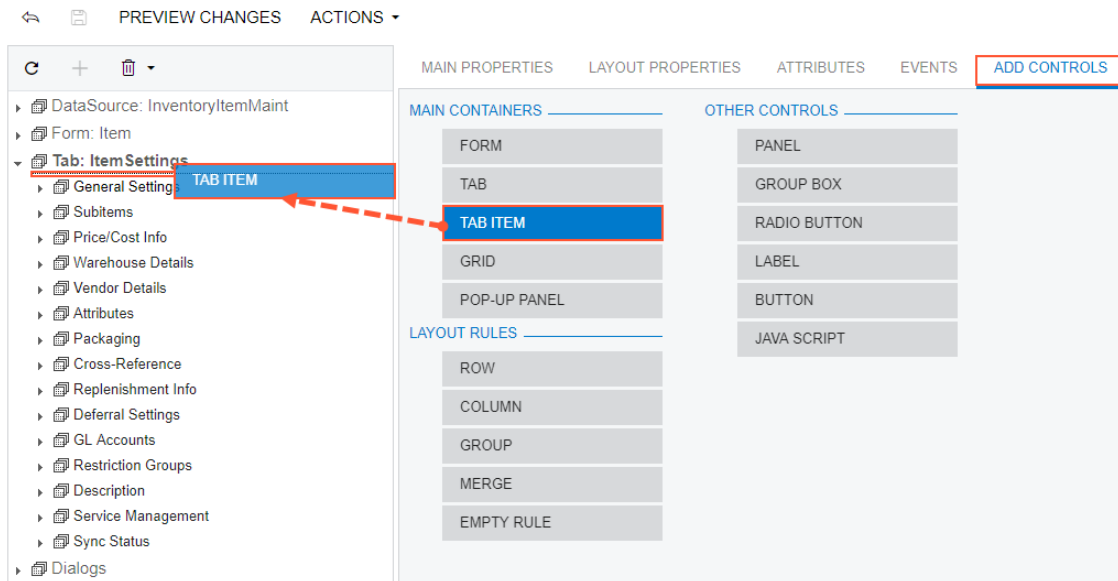
### Adding a New Tab Item

Suppose that you need to add the **Relative Positioning Layout** tab item to the Stock Items (IN202500) form and set its position as the leftmost one.

To do this, perform the following actions:

1. On the Stock Items (IN202500) form, click the **Customization** menu, choose **Inspect Element**, select the tab control, and click **Customize** on the **Element Properties** dialog box.
2. In the Screen Editor that appears, click the *Tab: ItemSettings* node in the Control Tree to view all items of the tab.
3. Open the **Add Controls** tab of the Screen Editor.
4. Drag and drop the **Tab Item** (*PXTabItem*) container above the *General Settings* node in the tree, as shown in the screenshot below.

Screen Editor: IN202500 (Stock Items)



**Figure: Adding a tab item to the left position on the tab area of the Stock Items form**

5. Select the *TabItem* node that has been added.
6. Select the **Layout Properties** tab of the Screen Editor.
7. Select the **Text** property and enter *Relative Positioning Layout* to specify the name of the new tab.
8. Click **Save** on the toolbar of the Screen Editor to save changes to the current customization project.

Thus, to add a new tab item to a tab, you have to expand the tab node in the Control Tree of the Screen Editor, select the **Add Controls** tab in the editor, drag and drop the **Tab Item** container to place this control appropriately in relation to other items in the tab.

A container is visible on the form if the container contains a visible field control. So at the moment you cannot view the **Relative Positioning Layout** tab item on the Stock Items (IN202500) form even after the customization project is published or on the form preview that can be opened by clicking **Preview Changes** in the Screen Editor.

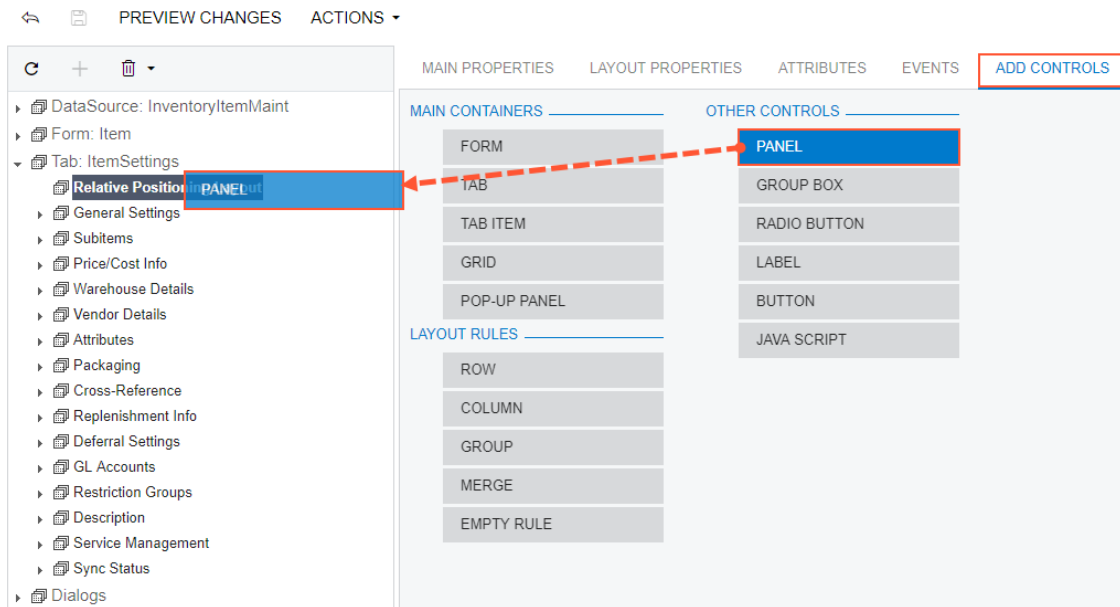
### Adding a Panel onto the PXTabItem Container Control

Now you have to add a panel (*PXPanel* control) onto the created *PXTabItem* control (that is, onto the new tab item), which is empty at the moment.

Complete the following steps:

1. Open the **Add Controls** tab of the Screen Editor.
2. On the opened tab item, find and drag the **Panel** (*PXPanel*) control.
3. Drop it into the *Relative Positioning Layout* tab item in the tree of controls, as shown in the screenshot below.

Screen Editor: IN202500 (Stock Items)



**Figure: Adding a panel onto the created *PXTabItem* container control**

4. Select the *Panel: CstPanel/1* node that has been added.
5. Select the **Layout Properties** tab of the Screen Editor.
6. Select the **Caption** property and enter `Audit` to specify the name of the new panel.
7. Click **Save** on the toolbar of the Screen Editor to save changes to the current customization project.

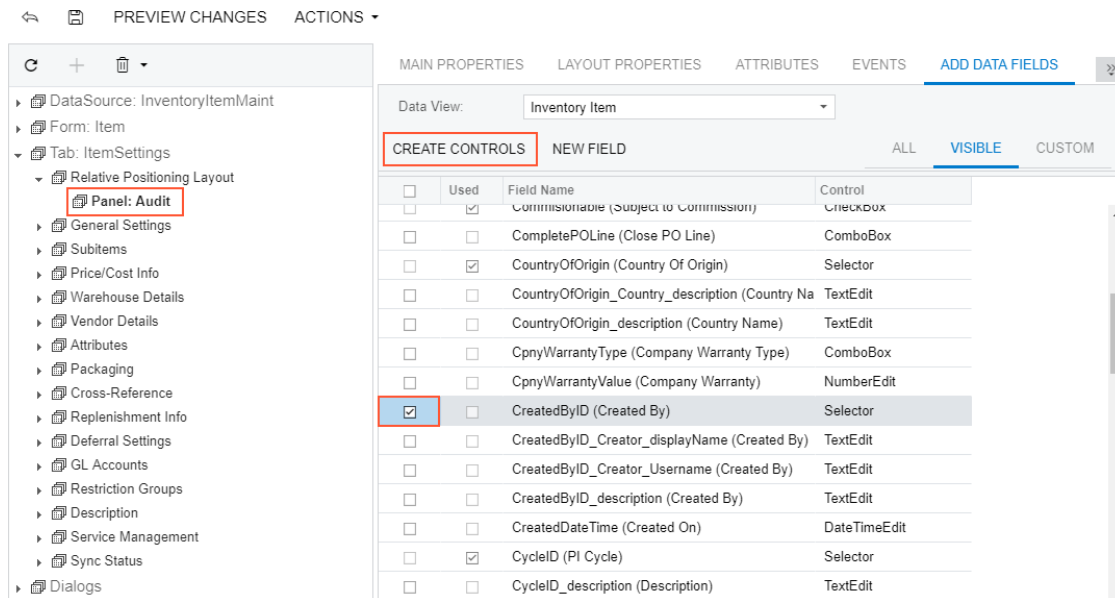
Thus, to add a new control to a container, you have to open the Screen Editor, find the container in the Control Tree, select the **Add Controls** tab in the editor, find the required type of the control, and drag and drop the needed control onto the container. Then you can specify the properties of the created control.

### Adding a UI Control onto the *PXPanel* Control

The panel is still not visible on the tab because it doesn't contain any visible controls. Add a control to the panel, as described below:

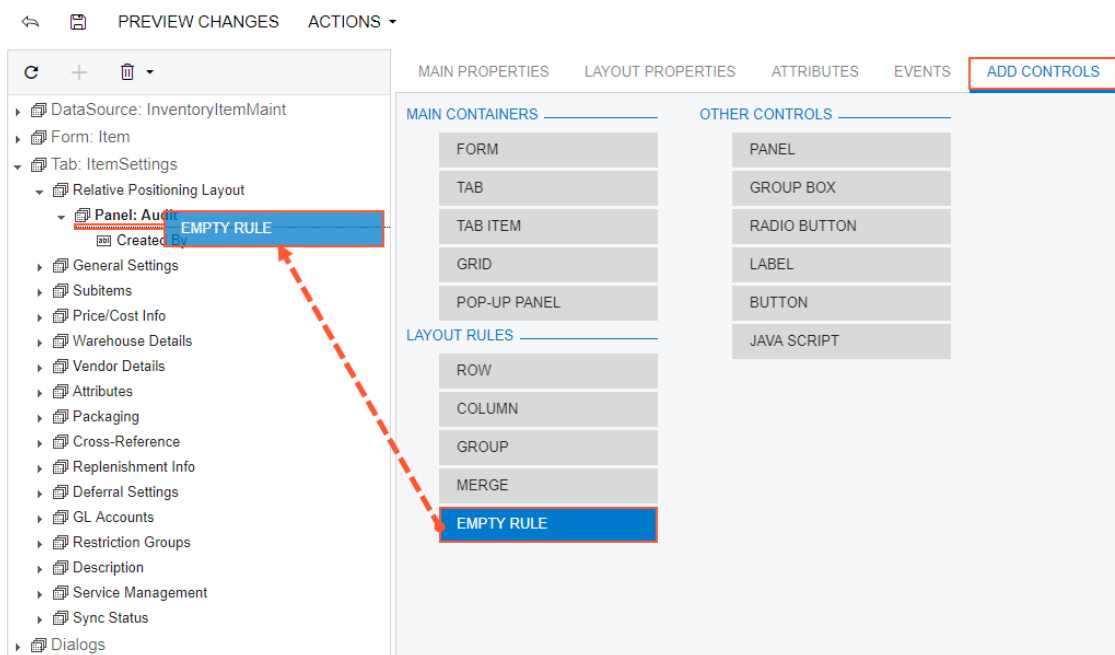
1. Select the *Panel: Audit* node in the tree of controls.
2. Open the **Add Data Fields** tab of the Screen Editor.
3. Select the **CreatedByID** field in the list that at the moment displays the visible fields of the *Inventory Item* data access class.
4. Click **Create Controls** on the tab toolbar (see the screenshot below).

Screen Editor: IN202500 (Stock Items)

**Figure: Adding a UI control to the *PXPanel* container control**

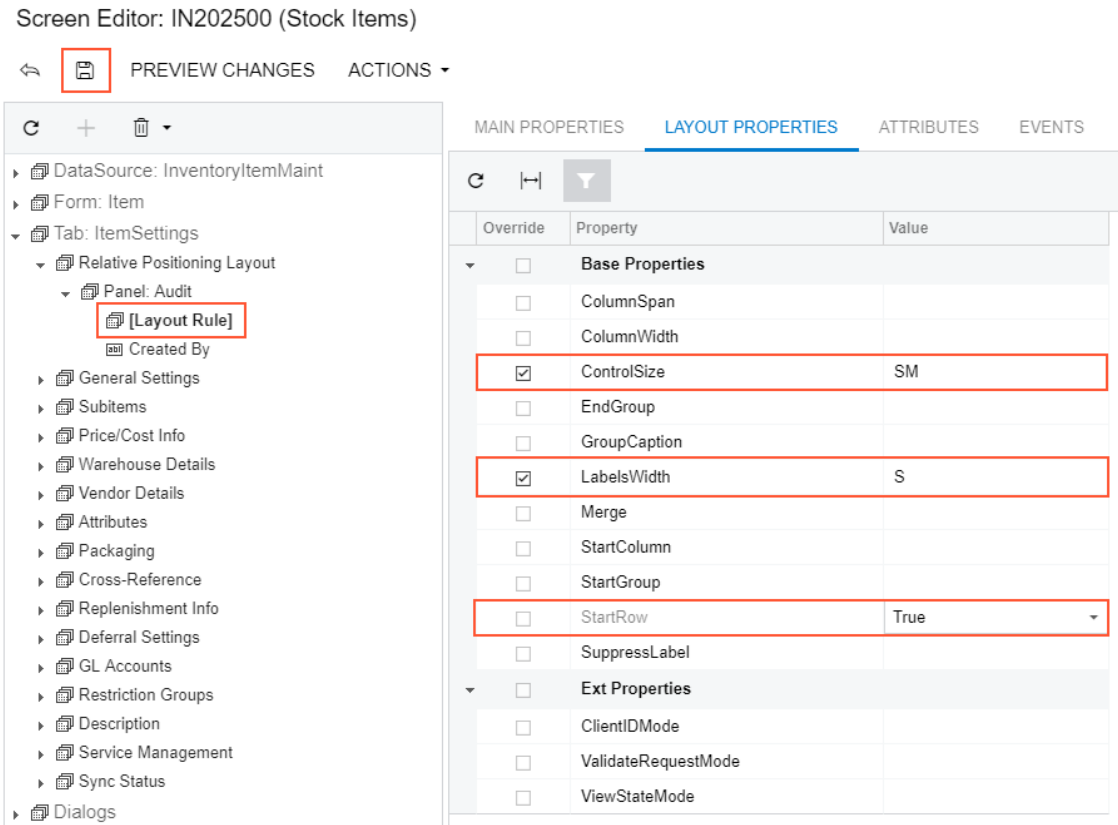
5. Click the *Panel: Audit* node to expand and view the created control in the tree of controls.
6. Open the **Add Controls** tab of the Screen Editor.
7. Drag the **Empty Rule** (*PXLayoutRule*) control and drop it above the *Created By* control in the tree, as shown in the screenshot below.

Screen Editor: IN202500 (Stock Items)

**Figure: Adding the *PXLayoutRule* onto the panel**

8. In the Control Tree, select the *Layout Rule* node that has been added.
9. Select the **Layout Properties** tab of the Screen Editor.

10. Type **SM** as the **ControlSize** property value and **s** as the **LabelWidth** property value.
11. Set the **StartRow** property to *True*, as shown in the screenshot below.



**Figure: Setting property values for the added *PXLayoutRule* object**

12. Click **Save** on the toolbar of the Screen Editor to save changes to the customization project.

After you save your changes, the Layout Rule transforms into a Control Tree node inside the *Panel: Audit* node according to specified properties. In this case, you see the *Created By* node is now inside the *Row* node which has the Layout Rule's properties.

Thus, to apply a layout rule to controls, you have to place the layout rule above the controls. Then you can specify the properties of the created layout rule.

To view the changes, click **Preview Page** on the toolbar or publish the project and review the changes on the Stock Items (IN202500) form after the customization has been applied.

The control is displayed on the panel on the **Relative Positioning Layout** tab (see the screenshot below) that has been added in [Adding a New Tab Item](#).

## Stock Items

← SAVE & CLOSE    +    K < > > I ACTIONS ▾ INQUIRIES ▾

\* Inventory ID:     Product Workgroup:

Item Status:     Product Manager:

Description:

RELATIVE POSITIONING LAYOUT    GENERAL SETTINGS    PRICE/COST INFO    WAREHOUSE DETAILS    VENDOR DETAILS

**Audit**

Created By:

Figure: Viewing the added UI control at run time

To view the fragment of the .aspx code that represents the customization result, open the form in the Screen Editor and select the **View ASPX** tab. The customized fragment is highlighted in yellow, as the screenshot below illustrates.

Screen Editor: IN202500 (Stock Items)

← PREVIEW CHANGES ACTIONS ▾

MAIN PROPERTIES    LAYOUT PROPERTIES    ATTRIBUTES    EVENTS    ADD CONTROLS    ADD DATA FIELDS    **VIEW ASPX**

DataSource: InventoryItemMaint

Form: Item

Tab: ItemSettings

Relative Positioning Layout

Panel: Audit

Row

Created By

General Settings

SubItems

Price/Cost Info

Warehouse Details

Vendor Details

Attributes

Packaging

Cross-Reference

Replenishment Info

Deferral Settings

GL Accounts

Restriction Groups

Description

Service Management

Sync Status

Dialogs

```
<px:PXTab ID="tab" runat="server" Width="100%" Height="606px" DataSourceID="ds" DataMember="ItemSettings" FilesIndicator="Fa"
  <AutoSize Enabled="True" Container="Window" MinHeight="150" ></AutoSize>
  <Items>
    <px:PXMenuItem Text="Relative Positioning Layout">
      <Templates>
        <px:FXPanel runat="server" ID="CstPanel1" Caption="Audit">
          <px:FXLayoutRule runat="server" ID="CstLayoutRule3" ControlSize="SM" LabelWidth="SM" StartRow="True" />
          <px:FXSelector runat="server" ID="CstFXSelector2" DataField="CreatedBy" /></px:FXPanel></Template></px:PXMenuItem>
        <px:FXMenuItem Text="General Settings">
          <Template>
            <px:FXLayoutRule runat="server" StartColumn="True" LabelWidth="SM" ControlSize="XM" ></px:FXLayoutRule>
            <px:FXLayoutRule runat="server" StartGroup="True" GroupCaption="Item Defaults" ></px:FXLayoutRule>
            <px:FXSegmentMask CommitChanges="True" ID="edItemClassID" runat="server" DataField="ItemClassID" AllowEdit="True"
            <px:FXDropDown ID="edItemType" runat="server" DataField="ItemType" ></px:FXDropDown>
            <px:FXCheckBox SuppressLabel="True" ID="chkXtItem" runat="server" DataField="XtItem" ></px:FXCheckBox>
            <px:FXDropDown CommitChanges="True" ID="edValMethod" runat="server" DataField="ValMethod" ></px:FXDropDown>
            <px:FXSelector ID="edTaxCategoryID" runat="server" DataField="TaxCategoryID" AllowEdit="True" CommitChanges="True"
            <px:FXSelector CommitChanges="True" ID="edPostClassID" runat="server" DataField="PostClassID" AllowEdit="True" ></
            <px:FXMaskEdit ID="edLotSerNumVal" runat="server" DataField="LotSerNumVal" CommitChanges="True"></px:FXMaskEdit>
            <px:FXSelector runat="server" ID="edCountryOfOrigin" DataField="CountryOfOrigin" ></px:FXSelector>
            <px:FXLayoutRule runat="server" StartGroup="True" GroupCaption="Warehouse Defaults" ></px:FXLayoutRule>
            <px:FXSegmentMask CommitChanges="True" ID="edDfltSiteID" runat="server" DataField="DfltSiteID" AllowEdit="True" >
            <px:FXSegmentMask CommitChanges="True" ID="edDfltShipLocationID" runat="server" DataField="DfltShipLocationID" Aut
            <px:FXLayoutRule runat="server" Merge="True" ></px:FXLayoutRule>
            <px:FXSegmentMask Size="s" ID="edDefaultSubItemID" runat="server" DataField="DefaultSubItemID" AutoRefresh="True"
            <px:FXCheckBox ID="chkDefaultSubItemOnEntry" runat="server" DataField="DefaultSubItemOnEntry" ></px:FXCheckBox>
            <px:FXLayoutRule runat="server" ></px:FXLayoutRule>
            <px:FXLayoutRule ID="FXLayoutRule2" runat="server" StartColumn="True" LabelWidth="SM" ControlSize="XM" ></px:FXLA
            <px:FXLayoutRule runat="server" GroupCaption="Unit of Measure" StartGroup="True" ></px:FXLayoutRule>
```

Figure: Viewing the changes to the layout of the form

If you need to analyze the added content (changeset) of the customization project, in the Customization Project Editor, choose the **Edit Project Items** command on the **File** menu item and select the **Object Name** field of the customized object (see the screenshot below). The **Page** item represents the changes to the .aspx code.



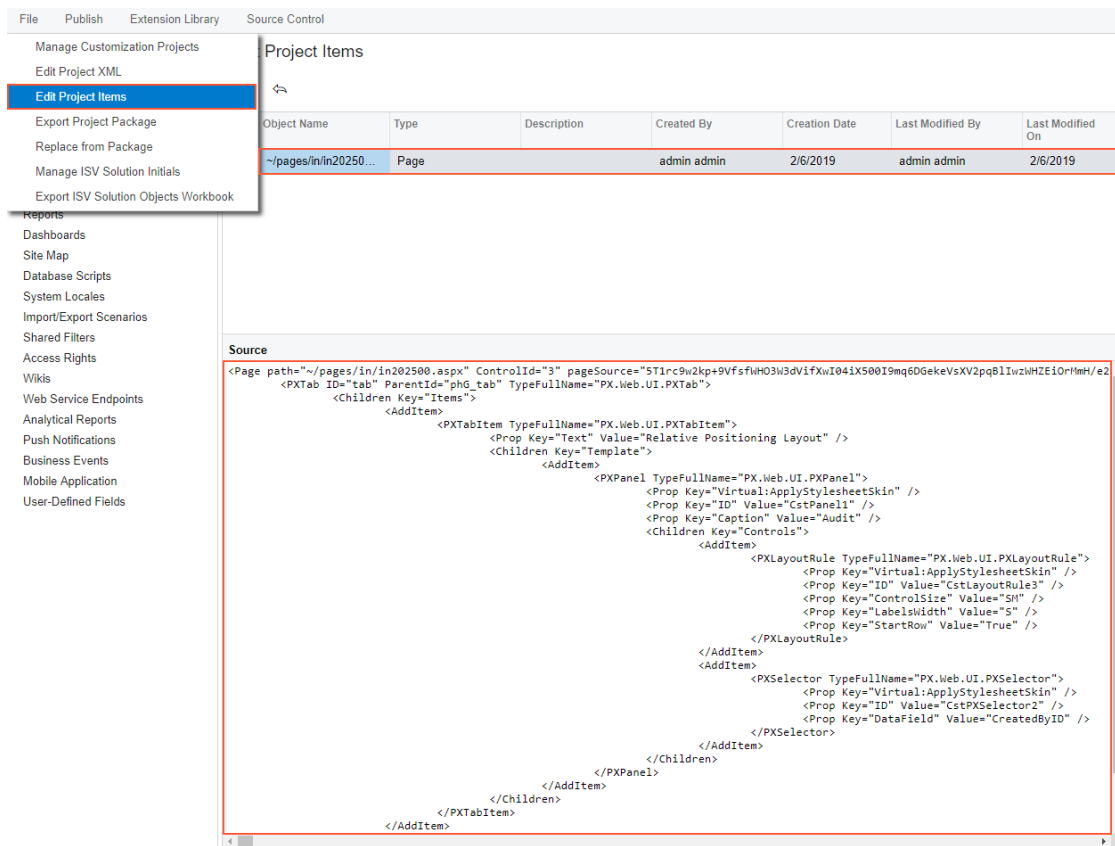


Figure: Analyzing the added content of the customization project

## Adding Columns to a Grid

Suppose that you need to add a column to the details table (grid) of the Journal Transactions (GL301000) form shown in the screenshot below.

Journal Transactions

SAVE & CLOSE    +    -    K    <    >    X    RELEASE    ACTIONS    REPORTS

Module: **AR**    \* Branch: **PRODWHOLE - Products Wholesale**    Type: **Normal**  
 Batch Number: **AR004284**    \* Ledger: **ACTUAL - Actual Ledger**    Orig. Batch Number:  
 Status: **Posted**    Currency: **USD 1.00**    **VIEW BASE**    Debit Total: **500.00**  
☐ Hold    ☐ Auto Reversing    ☐ Reversing Entry    Credit Total: **500.00**

\* Transaction D... **12/15/2018**  
 \* Post Period: **12-2018**  
 Description:

VIEW SOURCE DOCUMENT    RECLASSIFICATION HISTORY    [Icon]    [Icon]

	* Branch	* Account	Description	* Subaccount	Project/Con	Project Task	Ref. Number	Trans Date	Quantity	UOM	Debit Amount
>	PRODWHOLE	10200	Company Chec...	000-000	X		001403	12/15/20	0.00		500.00
	PRODWHOLE	11000	Accounts Rece...	000-000	X		001403	12/15/20	0.00		0.00

Figure: Viewing the original form

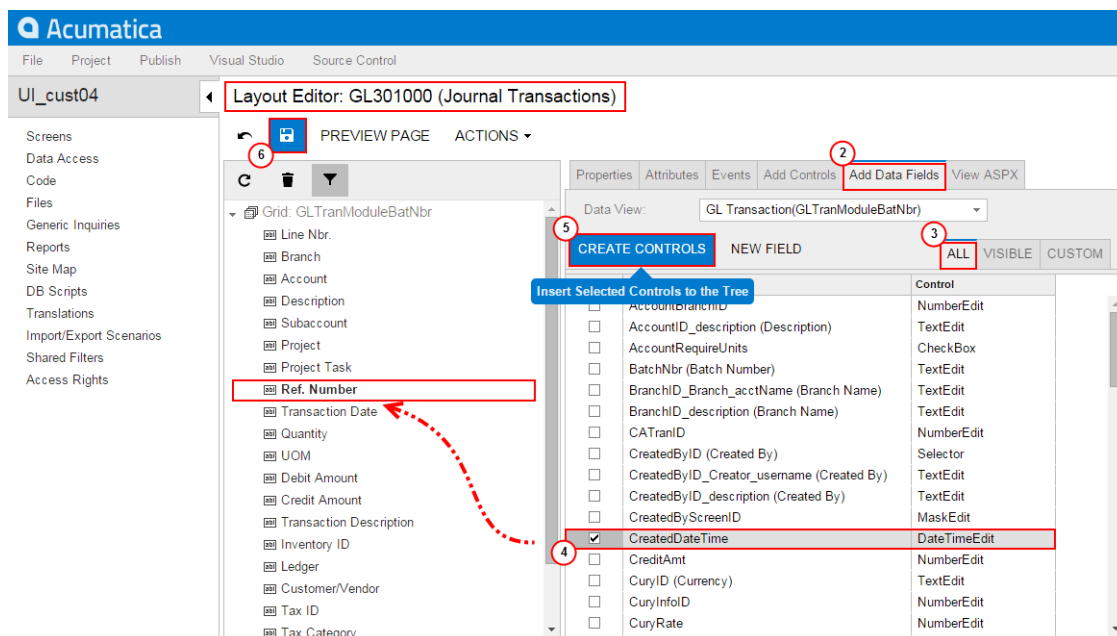
For instance, suppose that you need to add the column for the *CreateDateTime* data field to the position after the **Ref. Number** column.

To do this, perform the following actions:

1. On the Journal Transactions (GL301000) form, click the **Customization** menu, choose **Inspect Element**, select the **Ref. Number** column header, and click **Customize** on the **Element Properties** dialog box.
2. In the Screen Editor, open the **Add Data Fields** tab.
3. Apply the **All** filter to the list of the fields.
4. Select the *CreateDateTime* field in the list, as shown in the screenshot below.
5. Click **Create Controls** in the tab toolbar.



: New columns are added to the grid in the position after the item selected in the Control Tree of the Screen Editor. If you need to change the placement of a UI control, select the control on the tree, drag and drop it to the needed place.



**Figure: Adding the column to the grid**

6. Click **Save** on the toolbar of the Screen Editor to save changes to the current customization project.

Thus, to add new columns to a grid, you have to open the grid node on the Control Tree of the Screen, select the **Add Data Fields** tab in the editor, select needed fields in the list on the tab, click **Create Controls**, and then drag and drop new columns to desired positions inside the grid. You can add a column for any field that belongs to any data access class (DAC) of any data view of the business logic controller bound to the form. To select a DAC to view its fields in the list, use the **Data View** drop-down list on the **Add Data Fields** tab.

To view the changes on the form, click **Preview Page** on the toolbar or publish the project and review the changes on the Journal Transactions (GL301000) form after the customization has been applied.



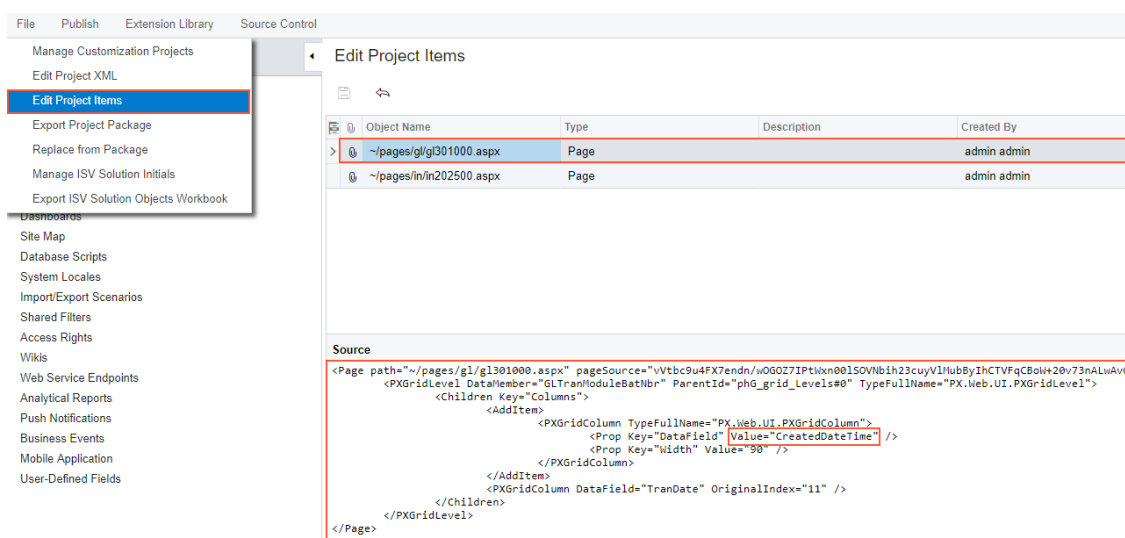


Figure: Analyzing the added content of the customization project

## Modifying Columns in a Selector

If you add columns to a selector, you give the user the capability to see more information about each item in the lookup window, so the user can select the appropriate data record.

The screenshot below illustrates the original view of the **Batch Number** lookup window (also referred to as *selector*). The **Batch Number** is a control on the form of the Journal Transactions (GL301000) form. The lookup window of this control includes eight columns, as shown in the screenshot below.

Journal Transactions

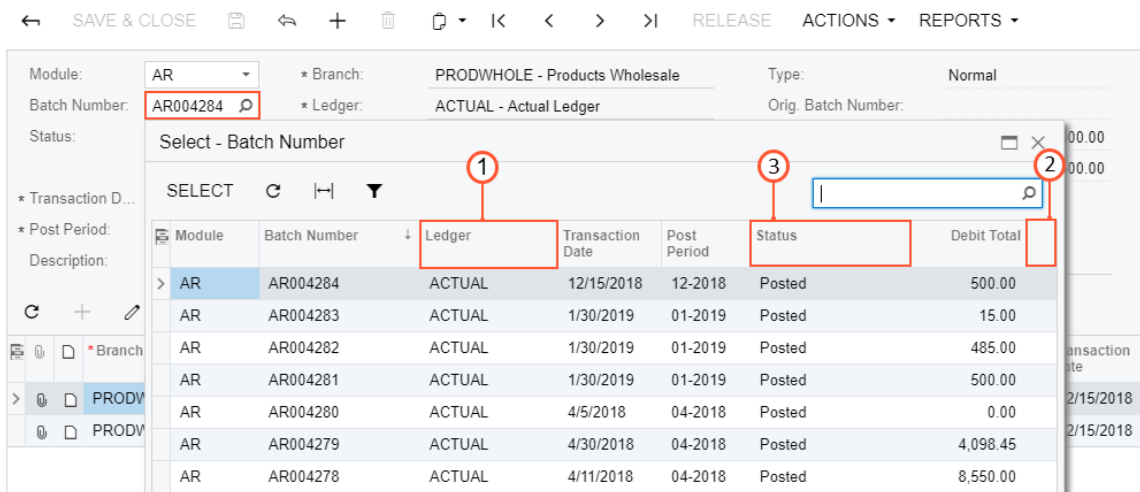


Figure: Viewing the current structure and content of the lookup window

Suppose the UI customization task for the **Batch Number** selector includes the following steps (see the screenshot above):

1. Deleting an existing column, such as the **Ledger** column.
2. Adding a column for the **Created By** field to the place after the **Currency** column.
3. Changing the order of the selector columns, so the **Status** column moves to the position between the **Credit Total** and **Currency** columns.

To do this, perform the following actions:

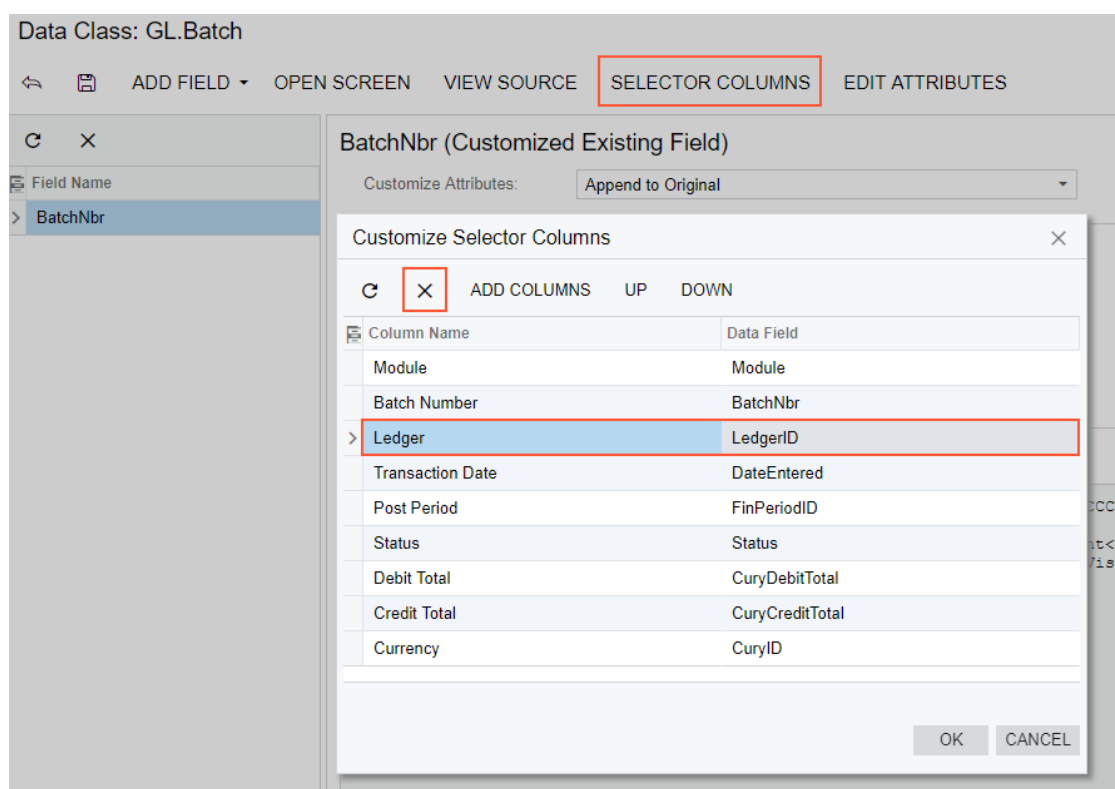
1. On the Journal Transactions (GL301000) form, click the **Customization** menu, choose **Inspect Element**, select the **Batch Number** control, click **Actions** on the **Element Properties** dialog box and select the **Customize Data Fields** command.

The Data Class Editor appears with only the **BatchNbr** field in the list of the customized fields of the class. The field is already selected in the field; therefore the work area of the editor holds information about the field.



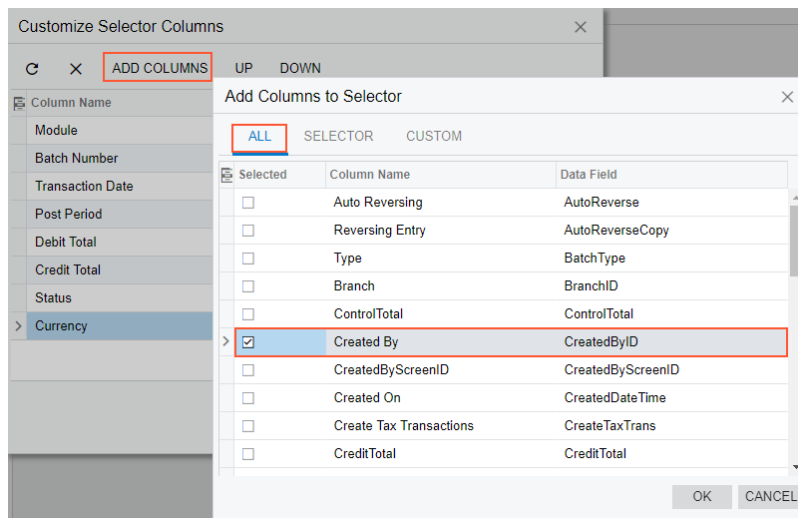
: The selected field type is selector, so the **Selector Columns** button is enabled in the editor toolbar.

2. Click **Selector Columns** to open the **Customize Selector Column** dialog box, as shown in the screenshot below.
3. In the table of the **Customize Selector Column** dialog box, select the row with the **Ledger** column.
4. Click **Delete Row** to delete the selected **Ledger** column from the selector.



**Figure: Deleting the selected column from the selector**

5. Click **Add Columns** on the toolbar of the **Customize Selector Column** dialog box to open the **Add Columns to Selector** dialog box.
6. In the **Add Columns to Selector** dialog box, select the **All** tab to view all fields of the customized data access class (DAC) in the table.
7. In the table, select the row with the **Created By** column name.
8. Click **OK** to add the selected field to the table of the **Customize Selector Column** dialog box.



**Figure: Adding the column for the field to the table of the Customize Selector Column Dialog**



: New columns are added to the position after the last existing column of the selector.

The **Created By** column is created in the table of the **Customize Selector Column** dialog box at the rightmost position. Therefore, you do not need to move this column inside the selector. But you still have to move the **Status** column to position between the **Credit Total** and **Currency** columns.

9. Select the row with the **Status** column.
10. Click **Down** twice to move the selected row to the required position, as shown in the screenshot below.
11. Click **OK** on the **Customize Selector Column** dialog box to apply the changes to the selector.
12. Click **Save** on the toolbar of the Data Class Editor to save the changes to the current customization project.

After you click **OK** in the **Customize Selector Columns** dialog box, the system applies the modifications to the selector table. As a result, the `PXCustomizeSelectorColumns` attribute is added to the selector field and you can view the attribute in the **Customize Attributes** text area of the Data Class Editor (see the screenshot below). This attribute defines the new set and order of the columns in the selector.

## Data Class: GL.Batch

ADD FIELD ▾ OPEN SCREEN VIEW SOURCE SELECTOR COLUMNS EDIT ATTRIBUTES

Field Name

> BatchNbr

### BatchNbr (Customized Existing Field)

Customize Attributes: Append to Original ▾

```
[PXCustomizeSelectorColumns(
  typeof(PX.Objects.GL.Batch.module),
  typeof(PX.Objects.GL.Batch.batchNbr),
  typeof(PX.Objects.GL.Batch.dateEntered),
  typeof(PX.Objects.GL.Batch.finPeriodID),
  typeof(PX.Objects.GL.Batch.curyDebitTotal),
  typeof(PX.Objects.GL.Batch.curyCreditTotal),
  typeof(PX.Objects.GL.Batch.status),
  typeof(PX.Objects.GL.Batch.curyID),
  typeof(PX.Objects.GL.Batch.createdByID))]

```

Original attributes:

```
[PXDBString(15, IsUnicode = true, IsKey = true, InputMask = ">CCCCCCCCCCCCCCCC")]
[PXDefault()]
[PXSelector(typeof(Search<Batch.batchNbr, Where<Batch.module, Equal<Current<Batch.mod
[PXUIField(DisplayName="Batch Number", Visibility=PXUIVisibility.SelectorVisible)]
[BatchModule.Numbering()]
[PXFieldDescription]

```

Figure: Viewing the changes in the Customize Attributes text area

After publishing the project, open the Journal Transactions (GL301000) form, click the Magnifier icon of the **Batch Number** control, and view the lookup window. Notice the absence of the deleted column, the position of the moved **Status** column, and the presence of the **Created By** column, as shown in the screenshot below.

Select - Batch Number

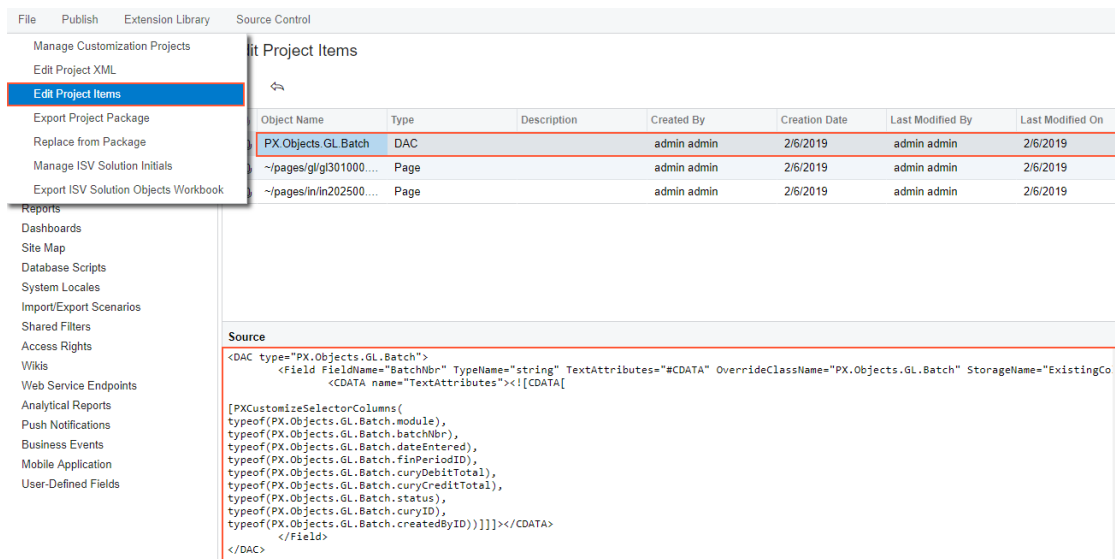
SELECT ↺ ↻ ↱ ⌵ 🔍

Module	Batch Number	Transaction Date	Post Period	Debit Total	Credit Total	Status	Currency	Created By
> AR	AR004284	12/15/2018	12-2018	500.00	500.00	Posted	USD	admin
AR	AR004283	1/30/2019	01-2019	15.00	15.00	Posted	USD	admin
AR	AR004282	1/30/2019	01-2019	485.00	485.00	Posted	USD	admin
AR	AR004281	1/30/2019	01-2019	500.00	500.00	Posted	USD	admin
AR	AR004280	4/5/2018	04-2018	0.00	0.00	Posted	USD	admin
AR	AR004279	4/30/2018	04-2018	4,098.45	4,098.45	Posted	USD	admin
AR	AR004278	4/11/2018	04-2018	8,550.00	8,550.00	Posted	USD	admin
AR	AR004277	4/1/2018	04-2018	48,327.28	48,327.28	Posted	USD	admin
AR	AR004276	4/16/2018	04-2018	17,600.00	17,600.00	Posted	USD	admin
AR	AR004275	4/4/2018	04-2018	6,500.00	6,500.00	Posted	USD	admin
AR	AR004274	4/3/2018	04-2018	286,818.50	286,818.50	Posted	USD	admin
AR	AR004273	4/1/2018	04-2018	27,202.50	27,202.50	Posted	USD	admin
AR	AR004272	4/6/2018	04-2018	2,800.00	2,800.00	Posted	USD	admin
AR	AR004271	4/2/2018	04-2018	17,000.00	17,000.00	Posted	USD	admin
AR	AR004270	4/1/2018	04-2018	7,840.00	7,840.00	Posted	USD	admin
AR	AR004269	4/6/2018	04-2018	78,427.50	78,427.50	Posted	USD	admin
AR	AR004268	4/19/2018	04-2018	18,918.00	18,918.00	Posted	USD	admin
AR	AR004267	4/1/2018	04-2018	30,000.00	30,000.00	Posted	USD	admin
AR	AR004266	4/5/2018	04-2018	273,302.00	273,302.00	Posted	USD	admin
AR	AR004265	4/2/2018	04-2018	18,918.00	18,918.00	Posted	USD	admin

⏪ ⏴ ⏵ ⏩

Figure: Viewing the modified structure and content of the lookup window

If you need to analyze the added content (changeset) of the customization project, open the project in the Project Editor, choose the **Edit Project Items** command on the **File** menu item, and select the **Object Name** field of the customized object (see the screenshot below). The *DAC* object represents the changes to the data access class code.



**Figure: Analyzing the added content of the customization project**

## Examples of Functional Customization

*Functional customization* means modifications of the data structure and original application business logic. These modifications are related either to the code of the appropriate data access classes (DACs) or business logic controllers (BLCs, also referred to as *graphs*).

The Acumatica Customization Platform provides the tools and the framework that is based on class extensions and provides the following key features:

- You can deploy multiple projects that extend DACs or BLCs.
- Extensions are precompiled, which provides a measure of protection for your source code and intellectual property.
- The framework provides an advanced level of control over the business logic and a multilevel extension model.
- The platform implements an auto-discovery mechanism, which makes the deployment and upgrade processes straightforward.

The topics of this section describe the rules and methods of functional customization and give examples of customization projects that resolve typical functional customization tasks:

- [Adding Data Fields](#)
- [Customizing DAC Attributes](#)
- [Modifying a BLC Action](#)
- [Modifying a BLC Data View](#)
- [Declaring or Altering a BLC Data View Delegate](#)
- [Extending BLC Initialization](#)
- [Altering the BLC of a Processing Form](#)
- [Adding or Altering BLC Event Handlers](#)
- [Altering BLC Virtual Methods](#)



## Adding Data Fields

You can add to a form a UI control based on a new data field. To do this, you can use the following ways:


- Use the Data Class Editor to create the data field and use the Screen Editor to add the control onto the required area of a form.
- Define the data field in code, add the Table customization item for adding the column to the database table if the field is bound, and use the Screen Editor to add the control onto the required area of a form.

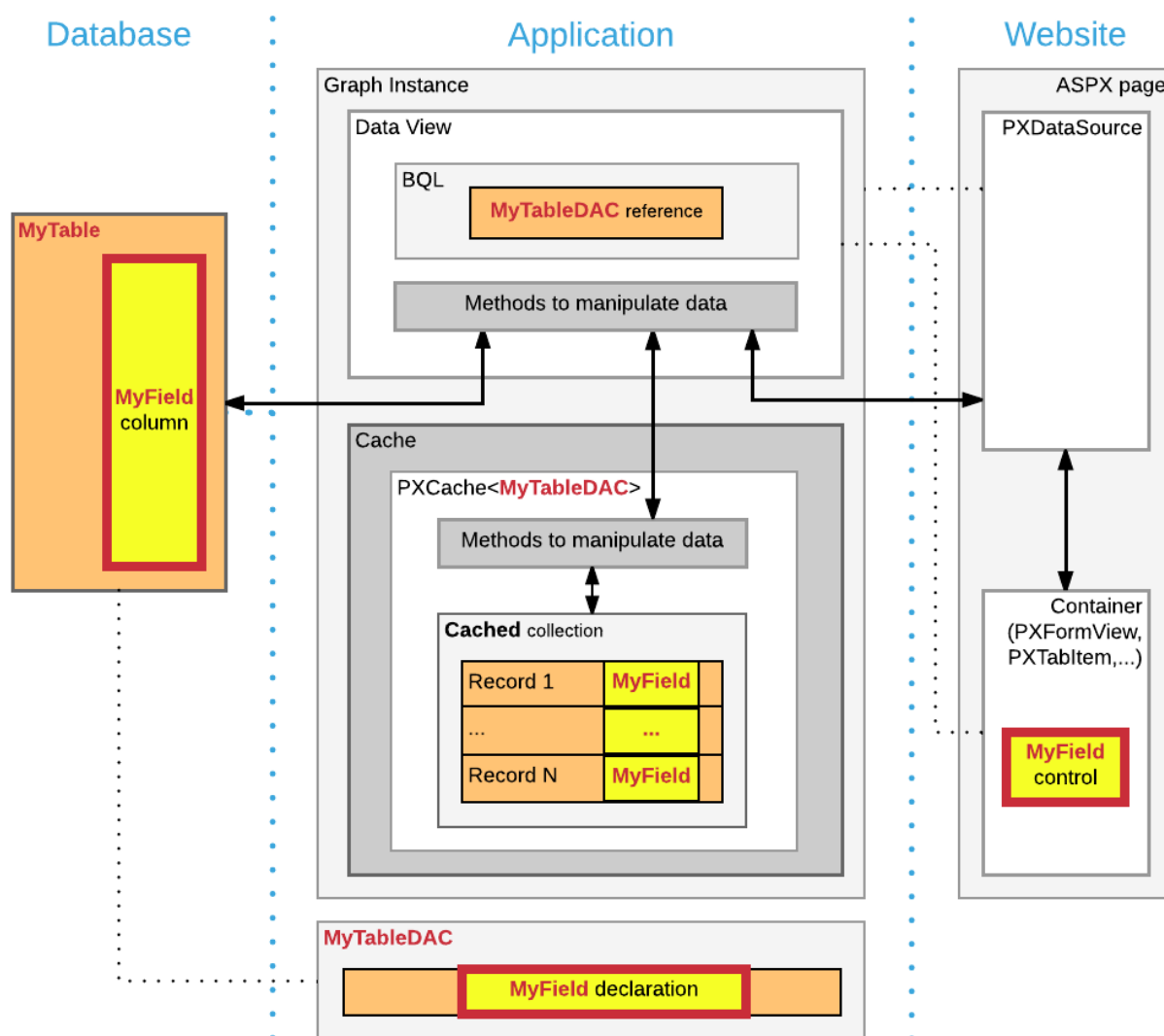
These approaches are described in greater detail below.

- [Adding a Data Field From the Data Class Editor](#)
- [Adding a Data Field From Code](#)

### Adding a Data Field From the Data Class Editor

Suppose that you have to add an input UI text box for a bound data field to the [Stock Items](#) (IN202500) form. To do this, you have to (see the diagram below):

- Add a data field to the code of the appropriate DAC (the functional customization step)
  - Add a column to the database table (a customization change to the database structure that is a part of functional customization)
-  : You have to add a database column only for bound data fields. Bound data field means the field values are saved in the database. If you define an unbound field, skip this step.
- Add a control for the field onto the form area (the UI customization step)



**Figure: Adding a bound field to a webpage**

Suppose you have to add the new **Search Keywords** text box to the Stock Items form to the location shown on the screenshot.

#### Stock Items

← SAVE & CLOSE    📄    ↶    +    🗑    ⌂    <    >    >⌂    ACTIONS ▾    INQUIRIES ▾

---

\* Inventory ID:     Product Workgroup:

Item Status:     Product Manager:

Description:

----->

RELATIVE POSITIONING LAYOUT    GENERAL SETTINGS    PRICE/COST INFO    WAREHOUSE DETAILS    VENDOR DETAILS

**Figure: The customization task of adding the new field to the form**

To add this text box, do the following:

1. Add the field to the appropriate DAC as follows:

- a. Open the data access class that provides fields for the form area on the Stock Items form in Data Class Editor. To do this, open the Stock Items form, select **Customization** > **Inspect Element** on the form title bar, and click the form area of the Stock Items form.

The following information of the control and the data access class should appear in the **Element Properties** dialog box:

- **Control Type:** *Form View*
- **Data Class:** *InventoryItem*
- **Business Logic:** *InventoryItemMaint*

*InventoryItem* is the data access class that provides the data fields for UI controls on the form. Therefore, you have to add the new data field to the extension of this class.

- b. In the **Element Properties** dialog box, select **Actions** > **Customize Data Fields** to open the Data Class Editor for the *InventoryItem* class.



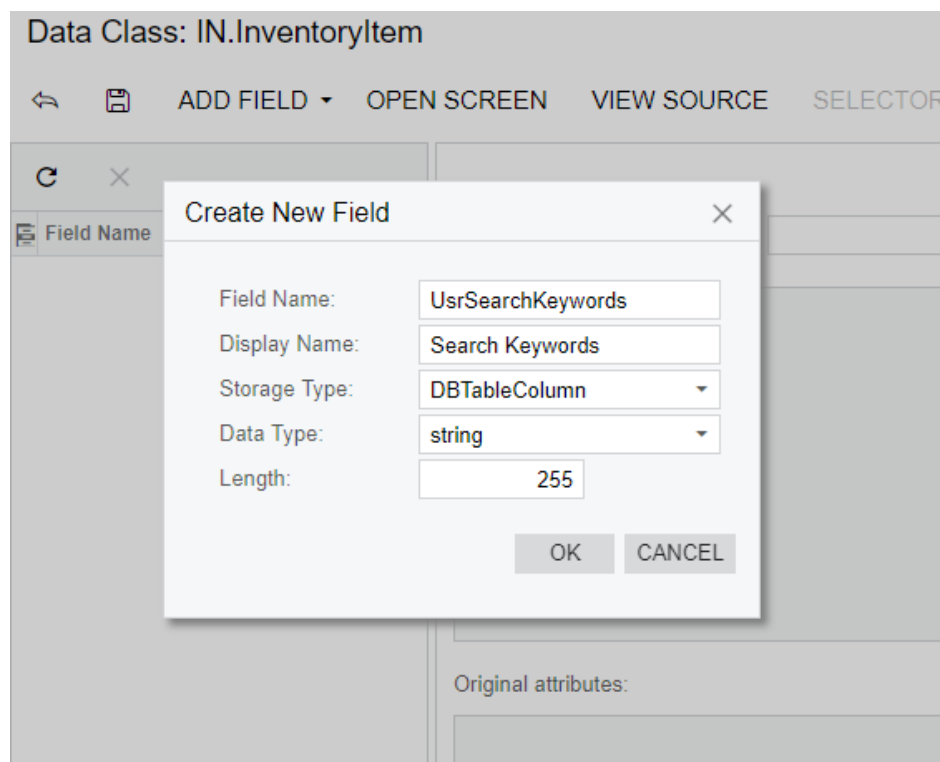
: If you haven't selected the current project yet, you will be asked to select the customization project to which the customization of the data access class will be added. You can select the current project to automatically add all customizations that you initiate from the Element Inspector by using the **Customization** > **Select Project** menu to the project. For more information, see [Select Customization Project Dialog Box](#).

- c. In the Data Class Editor, select **Add Field** > **Create New Field** on the toolbar.
- d. In the **Create New Field** dialog box, specify the following parameters for the new field:
  - **Field Name:** *SearchKeywords*
  - **DisplayName:** *Search Keywords*
  - **Storage Type:** *DBTableColumn*
  - **Data Type:** *string*
  - **Length:** *255*

As soon as you move the focus out of the **Field Name** box, the system adds the *Ust* prefix to the field name (see the screenshot below), which provides the distinction between the base fields and new custom fields that you add to the class. Keep the prefix in the field name and click **OK** to add the data field to the class.



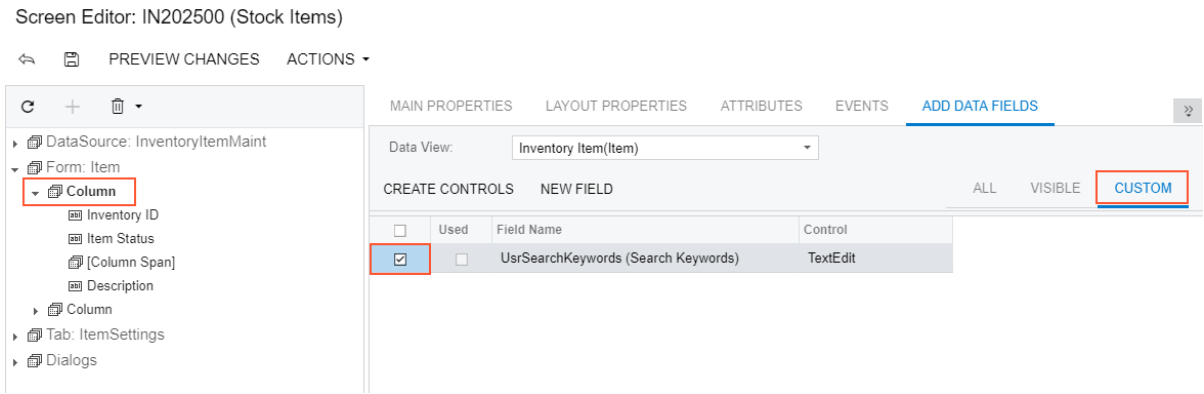
: If you select the *DBTableColumn* storage type, the system automatically adds schema for the new database column to the customization project. For more information on parameters that you specify for new fields, see [Create New Field Dialog Box](#).



**Figure: Adding the new data field to the class**

To the customization project, the system adds the new field as the extension to the `InventoryItem` data access class, and adds the `Table` item for adding the corresponding column to the database table.

- e. Click **Save** on the toolbar of the Data Class Editor to save the changes to the project. After you save the added field, you can see the added project item in the **Database Scripts** page of the Customization Project Editor.
2. Publish the customization project. You need to do it at this point to be able to add the UI control for the new field because when the project is published the system compiles the customization code and updates the database schema with the new column. For more information, see [Publishing Customization Projects](#).
3. Add the control to the form. Do it as follows:
  - a. Add the Stock Items form to the customization project. To do this, you can use the Element Inspector or select **Screens** on the navigation pane of the Customization Project Editor, and add the Stock Items form to the list by selecting **Add Screen > Customize Existing Screen** on the toolbar.
  - b. Open the form in the Screen Editor. In the Control Tree, expand the **Form: Item** container and select and expand the first column within the container to set up the position to which the new control will be added.
  - c. Select the **Add Data Fields** tab of Screen Editor.
  - d. Leave the **Data View** box empty. (The box specifies the data access class by which the fields are filtered in the table below.)
  - e. Select the **Custom** filter on the tab and select the check box for the `UsrSearchKeywords` field in the table, as the following screenshot shows.

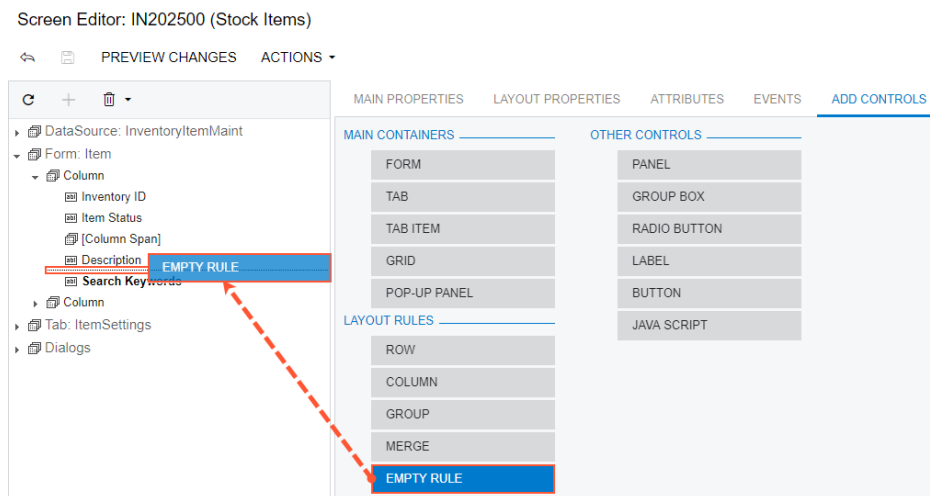


**Figure: Adding the control for the data field**

- f. Click **Create Controls** on the toolbar of the tab. The control for the **Search Keywords** field will be added to the tree.

Now you have to adjust the position and size of the control on the form. Drag and drop the **Search Keywords** control at the end of the column after the **Description** control and click **Save** to save the changes to the project.

4. Adjust the size of the control. To do that you have to place an instance of the `PXLayoutRule` component right above the control and configure it as follows:
  - a. Select the **Add Controls** tab of Screen Editor and drag and drop an **Empty Rule** component to the position above the **Search Keywords** control in the tree, as the screenshot below shows.



**Figure: Adding an Empty Rule component to the tree to adjust the size of the control**

- b. Select the `[Layout Rule]` node that appears in the Control Tree and switch to the **Layout Properties** tab of Screen Editor.
- c. On the **Layout Properties** tab, set the **ColumnSpan** property to `2`, which specifies the span of the control on two columns of the layout on the form. Click **Save** to save the changes to the project. After you save these changes, the `[Layout Rule]` node is renamed to `[Column Span]` according to the property the rule is changing.



: The controls are organized in two columns on the form. For more information about positioning controls, see [Layout Rule \(PXLayoutRule\)](#).

The customization to the layout of the form is ready.



: While working with Screen Editor, you can click **Preview Page** to view how the changes will affect the layout of the form.

Publish the project again to view the changes applied to the *Stock Items* (IN202500) form. After you publish the project, verify that the customized Stock Items form looks as needed according to the customization task. The customization items for form layout, data access class, and database schema have been added to the project. The new **Search Keywords** text box will appear on the Stock Items form on every system where you publish the customization project.

The DAC extension code that has been generated for the new field is given below. The system has generated a DAC extension class for `InventoryItem` and added the data field definition to the class. For more information about extension classes, see [DAC Extensions](#).

```
public class PX_Objects_IN_InventoryItem_Extension_AddColumn:
    PXCacheExtension<PX.Objects.IN.InventoryItem>
{
    #region UsrSearchKeywords
    public abstract class usrSearchKeywords : IBqlField{}
    [PXDBString(255)]
    [PXUIField(DisplayName="Search Keywords")]
    public virtual string UsrSearchKeywords
    {
        get; set;
    }
    #endregion
}
```

You can open the customization code in MS Visual Studio and work with the code there. For more information, see [Integrating the Project Editor with Microsoft Visual Studio](#).

### Adding a Data Field From Code

If you work with the customization code in MS Visual Studio, you can define a new data field in DAC extension code and then create the control on the form.

Suppose that you have to add an input UI text box for a bound data field to the *Stock Items* (IN202500) form. To do this, you have to:

- Add a data field to the code of the appropriate DAC (the functional customization step)
- Add a column to the database table (a customization change to the database structure that is a part of functional customization)



: You have to add a database column only for bound data fields. Bound data field means the field values are saved in the database. If you define an unbound field, skip this step.

- Add an input UI text box onto the form area of the form (the UI customization step)

Suppose you have to add the new **Local Tax Category** selector to the Stock Items form, as the screenshot below shows.

## Stock Items

← SAVE & CLOSE    📁    ↶    +    📄    🗑️    ⏪    <    >    ⏩    AC

\* Inventory ID:

Item Status:

Description:

GENERAL SETTINGS

ITEM DEFAULTS

\* Item Class:

Type:

Valuation Method:

\* Tax Category:

Local Tax Category:

\* Posting Class:

AACOMPUT01 - Acer Laptop Comput

Product Workgroup:

Select - Local Tax Category

SELECT    ↺    ⇄    🔍

Tax Category ID	Description
EXEMPT	Exempt Tax Category
TAXABLE	Taxable Goods and Services

< < > >

ELE - Electronics & Computers

**Figure: The customization task of adding the new field to the form**

If you want to work with the DAC extension code in the integrated MS Visual Studio solution without use of Data Class Editor, you can develop the code in a .cs file added to the customization project as a custom Code item or in a .cs file in a separate add-on project in the solution. We recommend that you use either Data Class Editor or develop the entire customization code in an add-on project in MS Visual Studio, but do not mix up the approaches. For more information, see [Integrating the Project Editor with Microsoft Visual Studio](#).

To add the UI control for the bound data field created from code, perform the following actions:

1. In MS Visual Studio, define the custom `usrLocalTaxCategoryID` data field in the DAC extension class, as listed below.

```
using PX.Data;
using PX.Objects.IN;
using PX.Objects.TX;

namespace PX.Objects.IN
{
    public class InventoryItemExtension: PXCacheExtension<InventoryItem>
    {
        #region UsrLocalTaxCategoryID
        public abstract class usrLocalTaxCategoryID : PX.Data.IBqlField
        {
        }
        [PXDBString(10, IsUnicode = true)]
        [PXUIField(DisplayName = "Local Tax Category")]
        [PXSelector(typeof(TaxCategory.taxCategoryID),
            DescriptionField = typeof(TaxCategory.descr))]
        public string UsrLocalTaxCategoryID { get; set; }
        #endregion
    }
}
```

```
}
}
```



: In this example, the .cs file with the DAC extension code is added to the customization project as a custom `Code` item. When you develop extensions in custom `Code` items, define the extension classes in the namespace of the original class. For more information about adding custom `Code` items to the project, see [Code](#).

2. Update the customization project with the new customization code. To do this, open the customization project that corresponds to the MS Visual Studio solution in the Customization Project Editor, select the **Files** list of project items and click **Detect Modified Files**.

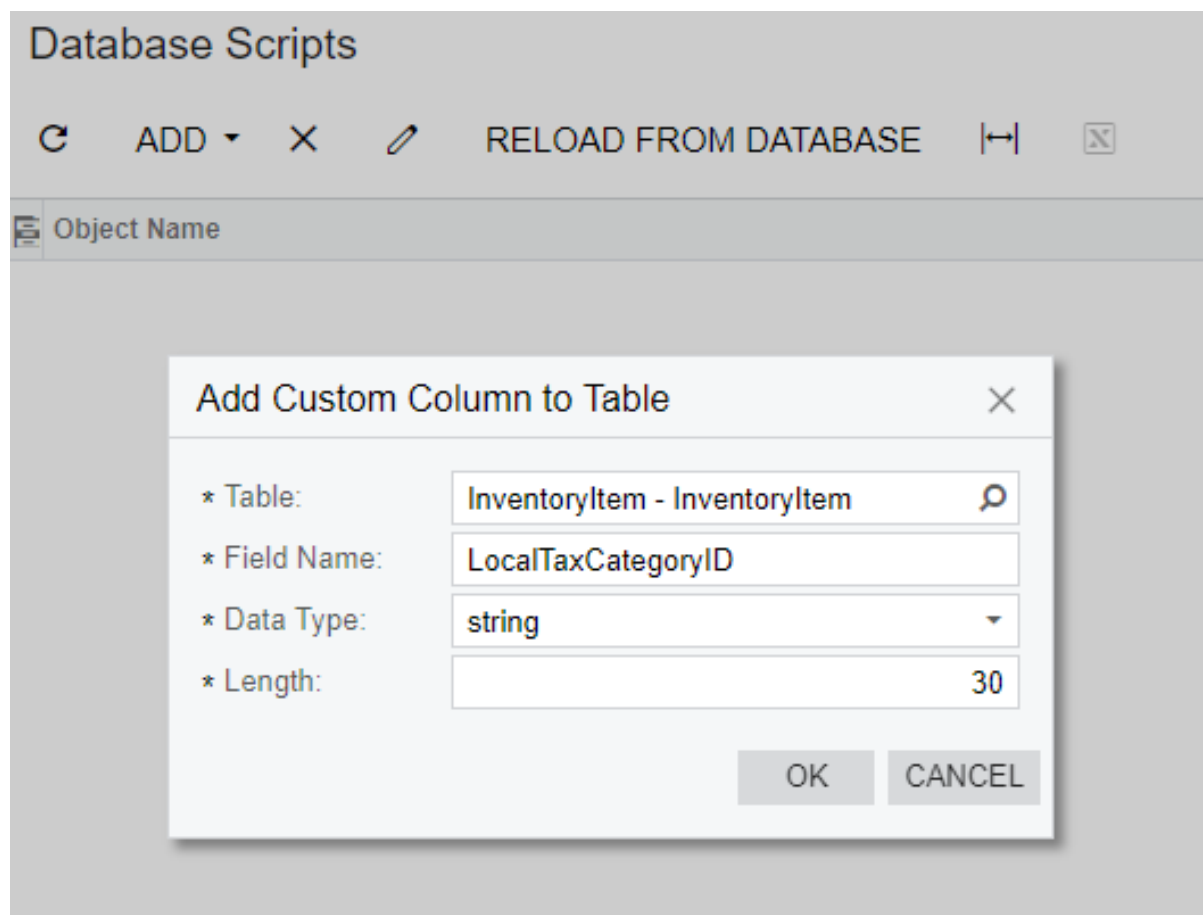


: If you build an assembly with the DAC extension code, update the assembly file in the customization project. For more information, see [To Update a File Item in a Project](#).

In the **Modified Files Detected** dialog box, select the conflicting file of the custom `Code` item and click **Update Customization Project** to update the code in the project.

3. Add the database schema for the custom field to the project as follows:
  - a. On the **Database Scripts** page of the Customization Project Editor, click **Add > Custom Column to Table**. In the **Add Custom Column to Table** dialog box which opens, fill in the following values and click **OK**:
    - **Table Name:** *InventoryItem*
    - **Field Name:** `LocalTaxCategoryID` (without the *Usr* prefix)
    - **Field Type:** *string*
    - **Length:** 10






**Figure: Adding the database schema for a custom DAC field created from code**

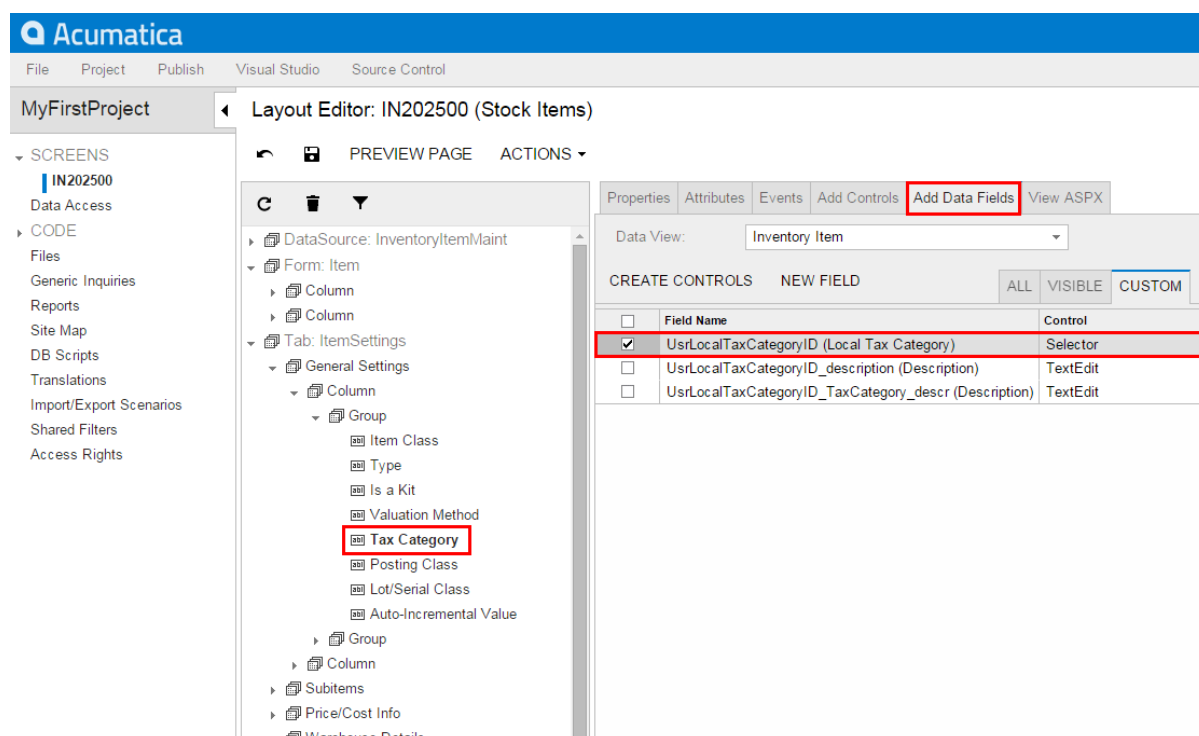


: We recommend that you add the database schema for the a custom column, as shown above, and do not alter the original schema of the table by a custom SQL script.

- b. Publish the customization project to make the system add the column to the database and compile the customization code. To do this, select **Publish > Publish Current Project** on the menu of Customization Project Editor.
4. Add the UI control for the custom field to the Stock Items form. To do this, open the form in Screen Editor.

 : You can add an existing form to the customization project by using the Element Inspector or directly from Project Editor. See [Customized Screens](#) for details.

  - a. Select the **Tax Category** control in the Control Tree to add the new control below it.
  - b. On the **Add Data Fields** tab, select the check box for the **Local Tax Category** selector in the table and click **Create Controls** to add the control to the tree (see the screenshot below).



**Figure: Adding the control for the data field**

- c. Click **Save** on the toolbar to save the layout changes.
  - d. Preview the customized form by clicking **Preview Page** on the toolbar or publish the customization project to view the changes applied to the *Stock Items* form.
5. Verify that the customized Stock Items form looks as needed according to the customization task (see above). The customization items for the form layout, custom code (or external assembly file), and database schema have been added to the customization project. The new **Local Tax Category** text box will appear on the Stock Items form on every system where you publish the customization project.

## Customizing DAC Attributes

To modify or extend the behavior that is defined within a data access class (DAC), you should append or override the field attributes declared within the DAC.

Suppose that you have a customization task to modify the Invoices (SO303000) form, and that this task consists of the following requirements:

1. The **Customer Order** data field on the form area (see the screenshot below) must have the *None* value when the user has not specified the reference number of the customer.
2. The values of the **Discount Percent** column must be limited to a range of -30 to 25 percent instead of the original range of -100 to 100 percent.

Invoices

SAVE & CLOSE    NOTES    ACTIVITIES    FILES

←    +    -    <    >    ACTIONS    REPORTS

Type: Invoice	* Customer: ABCSTUDIOS - ABC Studios Inc	Detail Total: 78,920.00
Reference Nbr.: AR005779	* Location: MAIN - Primary Location	Discount Total: 0.00
Status: Open	Currency: USD 1.00 VIEW BASE	VAT Taxable T... 0.00
<input type="checkbox"/> Hold	* Terms: 30D - 30 Days	VAT Exempt T... 0.00
<input type="checkbox"/> Credit Hold	* Due Date: 5/19/2018	Tax Total: 0.00
* Date: 4/19/2018	* Cash Discount: 5/19/2018	Write-Off Total: 0.00
* Post Period: 04-2018	* Project/Contract: X - Non-Project Code	Balance: 78,920.00
Customer Order: ABCSTUDIOS		Amount: 78,920.00
Description: Electronics - Drop Shipped Order		Cash Discount: 0.00

DOCUMENT DETAILS    TAX DETAILS    COMMISSIONS    FREIGHT DETAILS    FINANCIAL DETAILS    PAYMENT INFORMATION    ADDRESS DETAILS    DISCOUNT DETAILS    APPLICATIONS

Branch	Shipment Nbr.	Order Type	Order Nbr.	Inventory ID	Transaction Descr.	Discount Percent	Warehouse	Location	Quantity
PRODWHOLE	PR000646	SO	SO004239	ELEKINDLE	Kindle Fire 8.9" Tablet HD	0.000000	RETAIL	<SPLIT>	80.00
PRODWHOLE	PR000646	SO	SO004239	AACOMPUT01	Acer Laptop Computer	0.000000	WHOLESALE	<SPLIT>	110.00

**Figure: Viewing the original form**

To begin implementing the first requirement, inspect the properties of the **Customer Order** UI control. To do this, on the **Customization** menu, select **Inspect Element** and click the box or label of the control on the form. The system should retrieve the following information of the control that will display in the **Element Properties** dialog box:

- **Control Type:** *Text Edit*. The type of the UI control.
- **Data Class:** *ARInvoice*. The data access class that contains the inspected field.
- **Data Field:** *InvoiceNbr*. The field that is represented by the **Customer Order** control on the form.
- **Business Logic:** *SOInvoiceEntry*. The business logic controller (BLC, also referred to as *graph*) that provides the logic executed on the *Invoices* form.

To modify attributes of the DAC field, select **Actions > Customize Data Fields** in the **Element Properties** dialog box. In the **Select Customization Project** dialog box, specify the project to which you want to add the customization item for the data field and click **OK**.

Data Class Editor opens for customization of the *InvoiceNbr* field of the *ARInvoice* data access class.

Suppose that you decided to append an attribute to the DAC field to specify the default value for the field. Do it as follows:

1. in the **Customize Attributes** box select *Append to Original*.
2. In the text area, type `[PXDefault("None")]`.
3. Save your changes in the Data Class Editor.



: Acumatica Framework 2019 R1 provides advanced possibilities to control the field customization by using additional attributes in the DAC extension. See the [Customization of Field Attributes in DAC Extensions](#) for details.

Data Class: AR.ARInvoice->AR.ARRegister

ADD FIELD ▾ OPEN SCREEN VIEW SOURCE SELECTOR COLUMNS EDIT ATTRIBUTES

Field Name

> InvoiceNbr

InvoiceNbr (Customized Existing Field)

Customize Attributes: Append to Original ▾

[PXDefault("None")]

**Figure: Appending an attribute to the DAC field**

The system adds the customized data access class to the **Data Access** list of project items. For more information, see [Customized Data Classes](#).

To view the changes applied to the Invoices form, publish the customization project and add a new document on the Invoices form. When you add a new document, the system will insert the *None* default value into the **Customer Order** box as you have specified with the `PXDefault` attribute.

To implement the second requirement of the task, inspect the **Discount Percent** column on the **Document Details** tab of the Invoices form. To do this, on the **Customization** menu, select **Inspect Element** and click the area of the **Discount Percent** column header. The system should retrieve the following information of the control that will display in the **Element Properties** dialog box:

- **Control Type:** *Grid Column*. The type of the UI control.
- **Data Class:** *ARTran*. The data access class that contains the inspected field.
- **Data Field:** *DiscPct*. The field that is represented by the **Discount Percent** column in the table.
- **Business Logic:** *SOInvoiceEntry*. The business logic controller (BLC, also referred to as *graph*) that provides the logic executed on the *Invoices* form.

To modify attributes of the DAC field, select **Actions > Customize Data Fields** in the **Element Properties** dialog box. In the **Select Customization Project** dialog box, specify the project to which you want to add the customization item for the data field and click **OK**.

Data Class Editor opens for customization of the `DiscPct` field of the `ARTran` data access class.

The `PXDBDecimal` attribute specifies the range of valid values for the field. According to the customization task, you have to modify the minimum and maximum values specified in the attribute. To do this, you have to replace the original attributes with the custom ones as follows:

1. In the **Customize Attributes** box, select *Replace Original*. The original attributes will be copied to the text area where you enter custom attributes.
2. For the `PXDBDecimal` attribute, change the minimum and maximum values, as listed below.

```
[PXDBDecimal(6, MinValue = -30, MaxValue = 25)]
[PXUIField(DisplayName = "Discount Percent")]
[PXDefault(TypeCode.Decimal, "0.0")]
```

3. Click **Save** in Data Class Editor to save the changes.



: If you replace attributes, you have to repeat all attributes that you want to remain on the data field.

## Data Class: AR.ARTran

[↶](#)
[📄](#)
 ADD FIELD ▾
 OPEN SCREEN
 VIEW SOURCE
 SELECTOR COLUMNS
 EDIT ATTRIBUTES

Field Name	DiscPct (Customized Existing Field)
> DiscPct	<div>           Customize Attributes:           <span>Replace Original ▾</span> </div> <pre>[PXDBDecimal(6, MinValue = -30, MaxValue = 25)] [PXUIField(DisplayName = "Discount Percent")] [PXDefault(TypeCode.Decimal, "0.0")]</pre> <div>Original attributes:</div> <pre>[PXDBDecimal(6, MinValue = -100, MaxValue = 100)] [PXUIField(DisplayName = "Discount Percent")] [PXDefault(TypeCode.Decimal, "0.0")]</pre>

**Figure: Replacing attributes on the data field**

The system adds the customized data access class to the **Data Access** list of project items. For more information, see [Customized Data Classes](#).






To test the result of the customization, publish the customization project, open the Invoices form, insert a new document, and add a record to the details table, as shown in the screenshot below. If you try to specify a value in the **Discount** column greater than 25 percent or less than -30 percent, the system will automatically correct the value to the maximum 25 or minimum -30, respectively.



## Modifying a BLC Action

To modify the behavior of an action that is defined within a business logic controller (BLC, also referred to as *graph*), you should override an action delegate.





Suppose that you need to rename the **Release** button to **Extended Release** on the Receipts (IN301000) form, which is shown in the following screenshot.

## Receipts

← SAVE & CLOSE   +    < > >I **RELEASE** REPORTS ▾

Reference Nbr.: 000671  Transfer Nbr.: Total Qty.: 600.00  
 Status: **Balanced** External Ref.: Total Cost: 102,344.75  
☐ Hold Description:  
 \* Date: 4/6/2018 ▾  
 \* Post Period: 04-2018 

**TRANSACTION DETAILS** FINANCIAL DETAILS

 + × ALLOCATIONS ADD ITEM   






		* Branch	* Inventory ID	* Warehouse	Location	Quantity	* UOM	Unit Cost	Ext. Cost	Lo
>		PRODWHOLE	<a href="#">ELEBOSE1</a>	RETAIL	STORAGE	275.00	EA	209.30	57,557.50	
		PRODWHOLE	<a href="#">ELEBOSE2</a>	RETAIL	STORAGE	300.00	EA	104.97	31,491.00	
		PRODWHOLE	<a href="#">ELECOMP2</a>	RETAIL	STORAGE	25.00	EA	531.85	13,296.25	

Figure: Viewing the original Receipts form



To do this, you have to find the business logic controller for the form and modify the display name of the action that corresponds to the **Release** button as follows:

- Find the business logic controller for the form, on the **Customization** menu, select **Inspect Element** and click the button caption on the form. The system should retrieve the following information of the button, which appears in the **Element Properties** dialog box:
  - Control Type:** *DS Callback Command*. The type of the UI control.
  - Business Logic:** *INReceiptEntry*. The business logic controller that contains the code of the action that is represented by the **Release** button.

Thus, to rename the button, you have to change the `DisplayName` parameter of the `PXUIField` attribute for the `Release` action in the BLC extension for the *INReceiptEntry* class.

- Modify the attributes of the action, by doing the following:
  - Select **Actions > Customize Business Logic** in the Element Properties dialog box
  - In the **Select Customization Project** dialog, specify the project to which you want to add the customization item for the business logic controller of the form and click **OK**.  
 The Code Editor opens for customization of the business logic code of the form (see the screenshot below). The system generates the BLC extension class in which you can develop the customization code. (See [Graph Extensions](#) for details.)

## Code Editor: INReceiptEntry (Receipts)



 OPEN SCREEN   VIEW SOURCE   OVERRIDE METHOD   NEW ACTION   MOVE TO EXTENSION LIB

```

1 using System;
2 using System.Collections;
3 using System.Collections.Generic;
4 using PX.Data;
5 using PX.Objects.CM;
6 using PX.Objects.CS;
7 using PX.Objects.GL;
8 using PX.Objects.PM;
9 using System.Text;
10 using PX.Data.DependencyInjection;
11 using PX.LicensePolicy;
12 using PX.Objects;
13 using PX.Objects.IN;
14
15 namespace PX.Objects.IN
16 {
17     public class INReceiptEntry_Extension : PXGraphExtension<INReceiptEntry>
18     {
19         #region Event Handlers
20
21         #endregion
22     }
23 }
24

```

**Figure: The BLC extension class generated for customization of the business logic code executed for the Receipts form**

- c. Modify the `DisplayName` parameter of the `PXUIField` attribute for the `Release` action by redefining the action in the BLC extension class, to which the attributes are attached. Insert the code listed below into the `INReceiptEntry_Extension` class, as shown in the screenshot below. In the `DisplayName` parameter, you specify the new name for the button, *"Extended Release"*.

```

#region Customized Actions
public PXAction<INRegister> release;
[PXUIField(DisplayName = "Extended Release",
           MapEnableRights = PXCacheRights.Update,
           MapViewRights = PXCacheRights.Update)]
[PXProcessButton]
protected IEnumerable Release(PXAdapter adapter)
{
    return Base.release.Press(adapter);
}
#endregion

```

The redefined action delegate must have exactly the same signature—that is, the return value, the name of the method, and any method parameters—as the base action delegate has. You always have to redefine the action delegate to alter either its delegate or the attributes attached to the action. To use the action declared within the base BLC or a lower-level extension from the action delegate, you should redefine the generic `PXAction<TNode>` data member within the BLC extension, as shown in the code above. You do not need to redefine the data member when it is not meant to be used from the action delegate. For details, see [Graph Extensions](#). When you redefine an action delegate, you have to repeat the attributes attached to the action. Every action delegate must have `PXButtonAttribute` (or the derived attribute) and `PXUIFieldAttribute` attached.

3. Click **Save** in Code Editor to save the changes.

The system adds the customization to the business logic code to the **Code** list of project items. See [Code](#) for details.

To view the result of the customization, publish the customization project and open the Receipts form. Verify that the button caption has changed to **Extended Release**. Click this button for a document with the *Balanced* status and verify that the release procedure works exactly as it worked before publication of the current customization project.

## Modifying a BLC Data View

A *data view* is a `PXSelect` BQL expression declared in a business logic controller (BLC, also referred to as *graph*) for accessing and manipulating data. A data view may contain a delegate that is used to extend data access. To modify the data view, you have to alter the appropriate `PXSelect` BQL expression.

Suppose that you need to filter the rows on the **Vendor Details** tab of the Stock Items (IN202500) form. Open the original Stock Items form and create an item that has multiple vendor records on the **Vendor Details** tab, one or more of which has a **Lot Size** column value that equals 0.00, as the screenshot below illustrates.

Your task is to modify the selection of records for the **Vendor Details** tab so that only the records that have a non-zero **Lot Size** value are retrieved to the tab. To resolve this customization task, you have to redeclare the data view that provides the data displayed on the tab.

Stock Items NO

← SAVE & CLOSE + - K < > ACTIONS INQUIRIES

---

\* Inventory ID: AACOMPUT01 - Acer Laptop Comput Product Workgroup:    
 Item Status: Active Product Manager:    
 Description: Acer Laptop Computer

---

GENERAL SETTINGS PRICE/COST INFO WAREHOUSE DETAILS **VENDOR DETAILS** ATTRIBUTES PACKAGING CROSS-REFERENCE REPLENISHMENT INFO DEFERRAL

---

Acti	Def	* Vendor ID	Vendor Name	Local	Warehouse	* Purch Unit	Vendor Inventory ID	Lead Time (days)	Add. Lead Time (Days)	Min. Order Freq. (Days)	Min. Order Qty.	Max Order Qty.	Lot Size	EOQ
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	ELEFAS...	East COM Electronic Supplies	MAIN		EA	ACERLA...		2	0	10.00	100.00	1.00	0.00
<input checked="" type="checkbox"/>	<input type="checkbox"/>	ELEEM...	Emperor Office Equipment	MAIN		EA	ACERLA...		5	0	0.00	0.00	3.00	0.00
<input checked="" type="checkbox"/>	<input type="checkbox"/>	AAVEN...	Goto Vendor Inc	MAIN		EA			5	0	0.00	0.00	0.00	0.00
<input checked="" type="checkbox"/>	<input type="checkbox"/>	INDICHI...	ICHICO Electronics Industry Co.	MAIN		EA			0	0	0.00	0.00	5.00	0.00

**Figure: Viewing the original Stock Items form**



The data for the **Vendor Details** tab is provided by the `VendorItems` data view that is defined in the `InventoryItemMaint` class—that is, the business logic controller for the Stock Items form. To resolve the customization task, you have to redefine the `VendorItems` data view in the BLC extension for the business logic controller of the form as follows:

1. Select the business logic controller for customization, on the **Customization** menu, select **Inspect Element** and click the **Vendor Details** tab. The system should retrieve the following information that appears in the **Element Properties** dialog box:
  - **Business Logic:** *InventoryItemMaint*. The business logic controller that provides the logic for the *Stock Items* form.
2. Select **Actions > Customize Business Logic** in the **Element Properties** dialog box.
3. In the **Select Customization Project** dialog box, specify the project to which you want to add the customization item for the business logic controller of the form and click **OK**.

The Code Editor opens for customization of the business logic code of the form (see the screenshot below). The system generates the BLC extension class in which you can develop the customization code. (See [Graph Extensions](#) for details.)



## Code Editor: InventoryItemMaint (Stock Items)



 OPEN SCREEN   VIEW SOURCE   OVERRIDE METHOD   NEW ACTION   MOVE TO EXTENSION LIB

```

1  using System;
2  using System.Collections;
3  using System.Collections.Generic;
4  using System.Linq;
5  using System.Text;
6  using System.Text.RegularExpressions;
7  using PX.Api.Models;
8  using PX.Common;
9  using PX.Data;
10 using PX.Objects.AP;
11 using PX.Objects.AR;
12 using PX.Objects.CR;
13 using PX.Objects.CS;
14 using PX.Objects.DR;
15 using PX.Objects.GL;
16 using PX.Objects.PO;
17 using PX.Objects.RUTROT;
18 using PX.Objects.SO;
19 using PX.Objects.Common.Discount;
20 using PX.SM;
21 using PX.Web.UI;
22 using CRLocation = PX.Objects.CR.Standalone.Location;
23 using ItemStats = PX.Objects.IN.Overrides.INDocumentRelease.ItemStats;
24 using PX.Objects;
25 using PX.Objects.IN;
26
27 namespace PX.Objects.IN
28 {
29     public class InventoryItemMaint_Extension : PXGraphExtension<InventoryItemMaint>
30     {
31         #region Event Handlers
32
33         #endregion
34     }
35 }

```

**Figure: The BLC extension class generated for customization of the business logic code executed for the Stock Items form**

4. In the BLC extension class for `InventoryItemMaint`, redefine the `VendorItems` data view, as listed below.

```

public POVendorInventorySelect<POVendorInventory,
    LeftJoin<InventoryItem,
        On<InventoryItem.inventoryID, Equal<POVendorInventory.inventoryID>>,
        LeftJoin<Vendor,
            On<Vendor.bAccountID, Equal<POVendorInventory.vendorID>>,
            LeftJoin<Location,
                On<Location.bAccountID, Equal<POVendorInventory.vendorID>,
                And<Location.locationID,
                    Equal<POVendorInventory.vendorLocationID>>>>>>>,
                Where<POVendorInventory.inventoryID,
                    Equal<Current<InventoryItem.inventoryID>>,
                    And<POVendorInventory.lotSize, Greater<decimal0>>>, InventoryItem>
                VendorItems;

```

To modify a data view, you have to redefine the data view in the BLC extension class. The data view redefined within a BLC extension completely replaces the base data view within the `Views` collection of a BLC instance, including all attributes attached to the data view declared within the base BLC. You can either attach the same set of attributes to the data view or completely redeclare the attributes. For details, see [Graph Extensions](#). The data view must have exactly the same identifier, `VendorItems`, which is referred in the UI control.

5. Click **Save** in Code Editor to save the changes.

The system adds the customization to the business logic code to the **Code** list of project items. See [Code](#) for details.

To view the result of the customization, publish the customization project and open the Stock Items form. Verify that the records are filtered on the **Vendor Details** tab as required according to the customization task (only the records with non-zero **Lot Size** are retrieved).

## Declaring or Altering a BLC Data View Delegate

You can modify the data view delegate—that is, the method that is invoked when the records are retrieved through the data view.



: For this example, you have to enable the *Warehouses* feature in the system to view the **Warehouse Details** tab on the Stock Items (IN202500) form.

For the Stock Items form, suppose that you have to make the system display the default warehouse in the **Default Receipt To** column for those records for which this column is empty. Your customization task specifies that the default warehouse for such records is the **Default Receipt To** warehouse of the default record selected on the **Warehouse Details** tab.

Open the Stock Items form and select the **Warehouse Details** tab to view the original tab, which is shown in the screenshot below.

Stock Items

Stock Items

← SAVE & CLOSE [Icons] ACTIONS ▾ INQUIRIES ▾

\* Inventory ID: AACOMPUT01 - Acer Laptop Comput [Search] Product Workgroup: [Search]  
 Item Status: Active ▾ Product Manager: [Search]  
 Description: Acer Laptop Computer

GENERAL SETTINGS PRICE/COST INFO **WAREHOUSE DETAILS** VENDOR DETAILS ATTRIBUTES PACKAGING CROSS-REFERENCE

ADD WAREHOUSE DETAIL [Icons]

Default	Warehouse	Default Receipt To	Default Issue From	Status	Inventory Account	Inventory Sub.	Product Workgroup	Product Manager
<input type="checkbox"/>	RETAIL	STORAGE	STORAGE	Active	12100	ELE-000		
<input checked="" type="checkbox"/>	WHOLESALE	RECEIVING	R1S1	Active	12100	WID-000		



**Figure: Viewing the original Stock Items form**

To resolve this task, you have to modify the logic that retrieves the records to the **Warehouse Details** tab—that is, the modify the delegate of the data view that provides data for the tab. The data view that provides data for the tab is *itemsiterecords* that is defined in the business logic controller of the form. The business logic controller of the form is the *InventoryItemMaint* class. Do the following:

1. Select the business logic controller for customization, on the **Customization** menu, select **Inspect Element** and click the **Warehouse Details** tab. The system should retrieve the following information that appears in the **Element Properties** dialog box:
  - **Business Logic:** *InventoryItemMaint*. The business logic controller that provides the logic for the *Stock Items* form.
2. Select **Actions > Customize Business Logic** in the **Element Properties** dialog box.
3. In the **Select Customization Project** dialog box, specify the project to which you want to add the customization item for the business logic controller of the form and click **OK**.

The Code Editor opens for customization of the business logic code of the form (see the screenshot below). The system generates the BLC extension class in which you can develop the customization code. (See [Graph Extensions](#) for details.)

## Code Editor: InventoryItemMaint (Stock Items)



 OPEN SCREEN    VIEW SOURCE    OVERRIDE METHOD    NEW ACTION    MOVE TO EXTENSION LIB

```

1  using System;
2  using System.Collections;
3  using System.Collections.Generic;
4  using System.Linq;
5  using System.Text;
6  using System.Text.RegularExpressions;
7  using PX.Api.Models;
8  using PX.Common;
9  using PX.Data;
10 using PX.Objects.AP;
11 using PX.Objects.AR;
12 using PX.Objects.CR;
13 using PX.Objects.CS;
14 using PX.Objects.DR;
15 using PX.Objects.GL;
16 using PX.Objects.PO;
17 using PX.Objects.RUTROT;
18 using PX.Objects.SO;
19 using PX.Objects.Common.Discount;
20 using PX.SM;
21 using PX.Web.UI;
22 using CRLocation = PX.Objects.CR.Standalone.Location;
23 using ItemStats = PX.Objects.IN.Overrides.INDocumentRelease.ItemStats;
24 using PX.Objects;
25 using PX.Objects.IN;
26
27 namespace PX.Objects.IN
28 {
29     public class InventoryItemMaint_Extension : PXGraphExtension<InventoryItemMaint>
30     {
31         #region Event Handlers
32
33         #endregion
34     }
35 }

```

**Figure: The BLC extension class generated for customization of the business logic code executed for the Stock Items form**

To resolve the customization task, you have to redefine the `itemsiterecords` data view and implement the needed logic in the `itemSiteRecords()` data view delegate.

4. Add the code that is listed below to the BLC extension class for `InventoryItemMaint`

```

#region Customized Data Views
public PXSelectJoin<INItemSite,
    InnerJoin<INSite,
        On<INSite.siteID, Equal<INItemSite.siteID>>,
        LeftJoin<INSiteStatusSummary,
            On<INSiteStatusSummary.inventoryID, Equal<INItemSite.inventoryID>,
            And<INSiteStatusSummary.siteID, Equal<INItemSite.siteID>>>>>>
    itemsiterecords;

protected IEnumerable itemSiteRecords()
{
    int? dfltReceiptLocationID = null;
    foreach (var res in Base.itemsiterecords.Select())
    {
        INItemSite site = (INItemSite)res;
        if (site.DfltReceiptLocationID != null && site.IsDefault == true)
            dfltReceiptLocationID = site.DfltReceiptLocationID;
        else if (site.DfltReceiptLocationID == null && dfltReceiptLocationID !=
            null)
            site.DfltReceiptLocationID = dfltReceiptLocationID;
        yield return res;
    }
}
#endregion

```

When you declare or alter a data view delegate within a BLC extension, the new delegate is attached to the corresponding data view. To query a data view declared within the base BLC or lower-level extension from the data view delegate, you should redeclare the data view within the BLC extension. You do not need to redeclare a generic `PXSelect<Table>` data member when it will not be used from the data view delegate. For details, see [Graph Extensions](#).

The redeclared data view delegate must have exactly the same signature—the return value, the name of the method, and any method parameters—as the base data view delegate.

5. Click **Save** in Code Editor to save the changes.

The system adds the customization to the business logic code to the **Code** list of project items. See [Code](#) for details.

To view the result of the customization, publish the customization project and open the Stock Items form. Verify that the default warehouse is displayed for all records as needed according to the customization task. The default warehouse is taken from the **Default Receipt To** warehouse of the record selected as *Default* in the table.

## Extending BLC Initialization

During the initialization of a business logic controller (BLC, also referred to as *graph*), you can retrieve additional preferences, change field settings, or configure the processing form. You can extend the BLC initialization by implementing the needed logic in a BLC extension. To extend the initialization process, you have to override the `Initialize()` method of the `PXGraphExtension<T>` class and do not use the constructor of the BLC extension class for that. During the BLC initialization, the system calls the `Initialize()` methods of all extension levels, from the lowest to the highest. See [Graph Extensions](#) for details.

In this example, you will create an extension of the `InventoryItemMaintExtension` BLC, which overrides the `Initialize()` method to change the display name of the `InventoryItem` data access class (DAC) field from *Inventory ID* to *Inventory Item ID* during the initialization of the base (original) BLC instance.

If you open the Stock Items (IN202500) form, you can see its original view with the **Inventory ID** control (see the following screenshot) that corresponds to the `InventoryItem` DAC field.

Stock Items

← SAVE & CLOSE 📄 ↶ + 📄 ▾ 🗑️ ⏪ ⏩ ⏴ ⏵ ACTIONS ▾ INQUIRIES ▾

* Inventory ID:	AACOMPUT01 - Acer Laptop Comput 🔍	Product Workgroup:	
Item Status:	Active ▾	Product Manager:	
Description:	Acer Laptop Computer		

GENERAL SETTINGS PRICE/COST INFO WAREHOUSE DETAILS VENDOR DETAILS ATTRIBUTES PACKAGING CROSS

**Figure: Viewing the original Stock Items form**

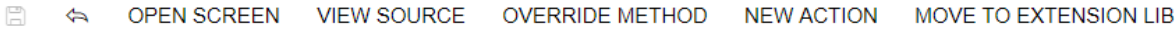
To complete the example, do the following:

1. Select the business logic controller for customization, on the **Customization** menu, select **Inspect Element** and click the **Inventory ID** label. The system should retrieve the following information that appears in the **Element Properties** dialog box:
  - **Business Logic:** *InventoryItemMaint*. The business logic controller that provides the logic for the *Stock Items* form.
2. Select **Actions > Customize Business Logic** in the **Element Properties** dialog box.

3. In the **Select Customization Project** dialog box, specify the project to which you want to add the customization item for the business logic controller of the form and click **OK**.

The Code Editor opens for customization of the business logic code of the form (see the screenshot below). The system generates the BLC extension class in which you can develop the customization code. (See [Graph Extensions](#) for details.)

Code Editor: InventoryItemMaint (Stock Items)



```

1 using System;
2 using System.Collections;
3 using System.Collections.Generic;
4 using System.Linq;
5 using System.Text;
6 using System.Text.RegularExpressions;
7 using PX.Api.Models;
8 using PX.Common;
9 using PX.Data;
10 using PX.Objects.AP;
11 using PX.Objects.AR;
12 using PX.Objects.CR;
13 using PX.Objects.CS;
14 using PX.Objects.DR;
15 using PX.Objects.GL;
16 using PX.Objects.PO;
17 using PX.Objects.RUTROT;
18 using PX.Objects.SO;
19 using PX.Objects.Common.Discount;
20 using PX.SM;
21 using PX.Web.UI;
22 using CRLocation = PX.Objects.CR.Standalone.Location;
23 using ItemStats = PX.Objects.IN.Overrides.INDocumentRelease.ItemStats;
24 using PX.Objects;
25 using PX.Objects.IN;
26
27 namespace PX.Objects.IN
28 {
29     public class InventoryItemMaint_Extension : PXGraphExtension<InventoryItemMaint>
30     {
31         #region Event Handlers
32
33         #endregion
34     }
35 }

```

**Figure: The BLC extension class generated for customization of the business logic code executed for the Stock Items form**

4. Override the `Initialize()` method; in the method, set the display name of the `InventoryItem` data access class (DAC) field to *Inventory Item ID*. (For demonstrative purposes, the code also retrieves the `INSetup` data record and shows how you can implement the logic depending on values of the record.)



: Do not define constructors of BLC extension classes; always use the `Initialize()` method to implement the needed initialization logic.

Add the code that is listed below to the BLC extension class for `InventoryItemMaint`.

```

#region Extended initialization
public override void Initialize()
{
    PXUIFieldAttribute.SetDisplayName<InventoryItem.inventoryCD>(
        Base.Item.Cache,
        "Inventory Item ID");
    //retrieval of the setup record that stores preferences of the Inventory
    module
    INSetup setup = Base.insetup.Current;
    if (setup.UpdateGL != true)
    {
        // Do some actions here
    }
}

```

```

    }
}
#endregion

```

In this method, you change the display name of the `InventoryCD` field of the `InventoryItem` DAC. You do this by calling the `SetDisplayName()` static method of `PXUIFieldAttribute`. Also, you obtain the `INSetup` DAC instance by using the `Current` property of the `INSetup` data view. In your customization tasks, you may need to perform some actions that depend on field values of this setup DAC instance.

You do not need to explicitly invoke the `Initialize()` method on the previous extension levels; these methods are called automatically. Invoking `base.Initialize()` makes no sense, because the `base` variable points to the base class, which is `PXGraphExtension` (not the base graph). The `PXGraphExtension` class defines `Initialize()` as an empty method.

5. Click **Save** in Code Editor to save the changes.

The system adds the customization to the business logic code to the **Code** list of project items. See [Code](#) for details.

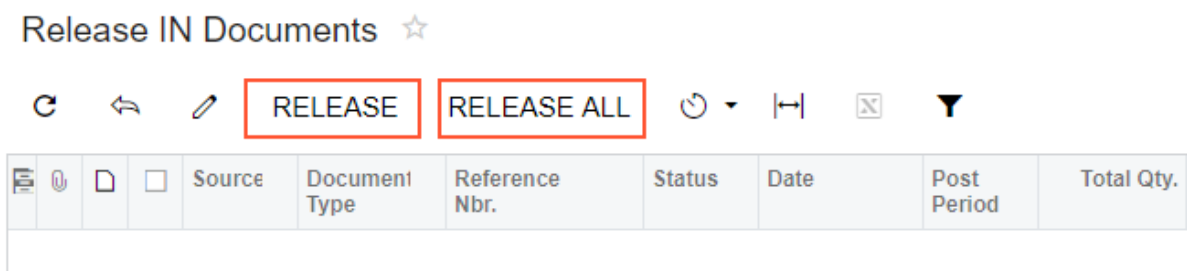
To view the result of the customization, publish the customization project and open the Stock Items form. Verify that the label has changed to **Inventory Item ID**.

## Altering the BLC of a Processing Form

For most processing forms of Acumatica ERP, the processing method, the button captions that are displayed on the toolbar of the form are set up during the BLC initialization (*business logic controller*, also referred to as *graph*)—that is, in the constructor of the BLC that provides the logic for the processing form, or in the `RowSelected` event handler of the main view data access class (DAC). To modify the logic that is executed during the BLC initialization, you have to create a BLC extension class and implement the needed logic in the `Initialize()` method overridden in the extension class; do not use the constructor for that.

For example, to disable the **Release All** button and modify the functionality of the **Release** button of the Release IN Documents (IN501000) form, you create an extension on the `INDocumentRelease` BLC and override the `Initialize()` method as follows:

1. Open the Release IN Documents form to see its original view (see the screenshot below). Notice that the **Release** and **Release All** buttons are both available for clicking.

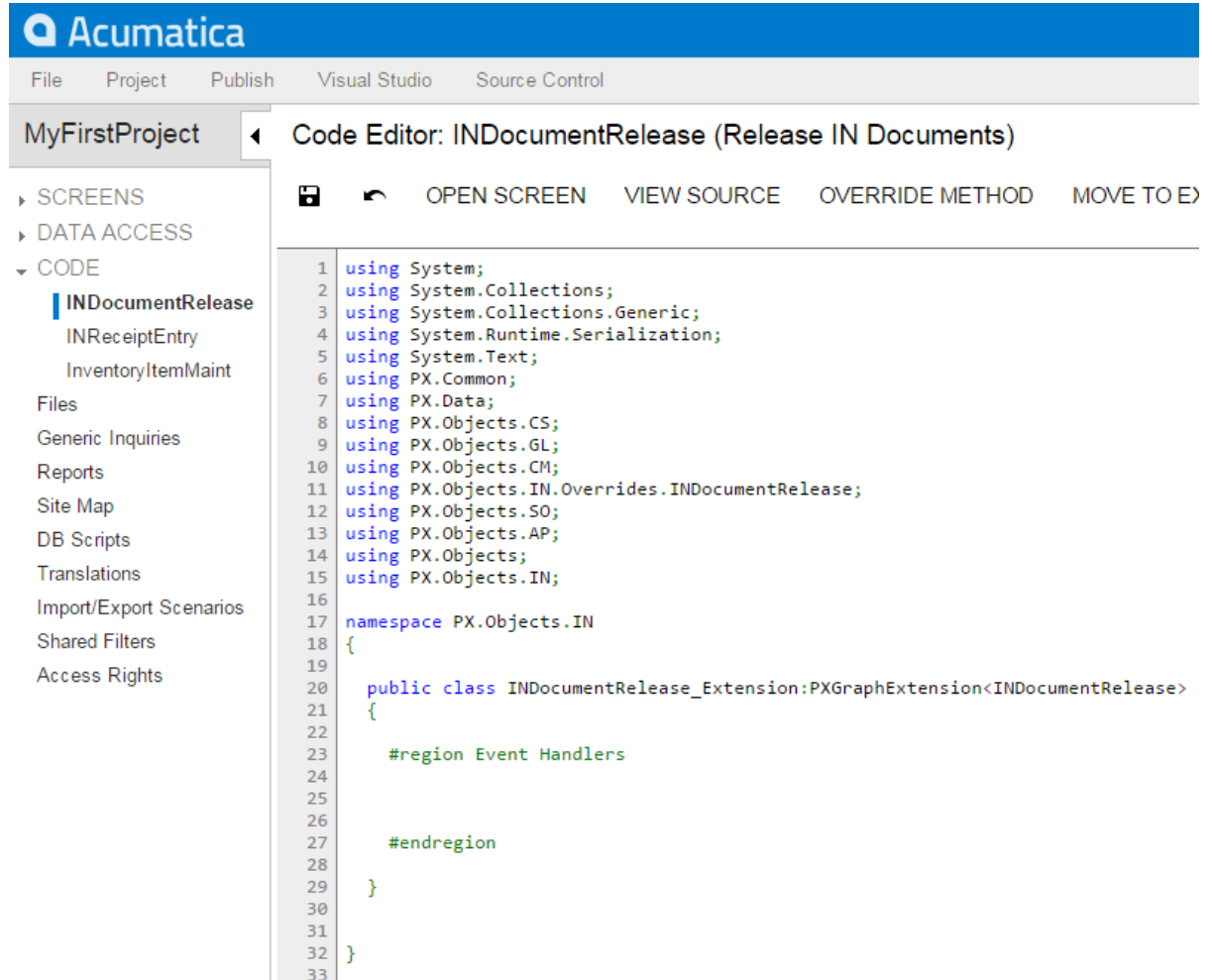


**Figure: Analyzing the original Release IN Documents form**

2. Select the business logic controller for customization, on the **Customization** menu, by clicking **Inspect Element** and selecting any element on the form, for example, the **Release** button. The system should retrieve the following information that appears in the **Element Properties** dialog box:
  - **Business Logic:** `INDocumentRelease`. The business logic controller that provides the logic for the *Release IN Documents* form.

3. Select **Actions > Customize Business Logic** in the Element Inspector. In the **Select Customization Project** dialog box, specify the project to which you want to add the customization item for the business logic controller of the form and click **OK**.

The Code Editor opens for customization of the business logic code of the form (see the screenshot below). The system generates the BLC extension class in which you can develop the customization code. (See [Graph Extensions](#) for details.)



**Figure: The BLC extension class generated for customization of the business logic code executed for the Release IN Documents form**

4. Override the `Initialize()` method. In the method, disable the **Release All** button on the toolbar of the form, set the processing method, and set the method for asking the confirmation from the user before running the process.



: Do not define constructors of BLC extension classes; always use the `Initialize()` method to implement the needed initialization logic.

To the BLC extension class for `INDocumentRelease`, add the code that is listed below.

```

#region Extended initialization
public override void Initialize()
{
    // Disable the Process All button
    Base.INDocumentList.SetProcessAllEnabled(false);
    //If set by the SetParametersDelegate, the method is executed before the
    processing is run
}

```

```

//and provides conditional processing depending on the confirmation from
the user
//If the method returns true, the system executes the processing method
//that is set by SetProcessDelegate
Base.INDocumentList.SetParametersDelegate(delegate(List<INRegister>
documents)
{
    return Base.INDocumentList.Ask("IN Document Release",
                                   "Are you sure?",
                                   MessageButtons.YesNo) ==

WebDialogResult.Yes;
});
Base.INDocumentList.SetProcessDelegate(delegate(INRegister doc)
{
    INDocumentRelease.ReleaseDoc(new List<INRegister>() { doc }, true);
});
}
#endregion

```

For another example of extending the BLC initialization, see [Extending BLC Initialization](#).

5. Click **Save** in Code Editor to save the changes.

The system adds the customization to the business logic code to the **Code** list of project items. See [Code](#) for details.

To view the result of the customization, publish the customization project and open the Release IN Documents form. Notice that the **Release All** button has become unavailable. Select a few check boxes for documents to be released and click **Release**. The dialog box appears with the question that you have added in the BLC code. Click **Yes** to release the documents or **No** to cancel the operation and exit the dialog box.

## Adding or Altering BLC Event Handlers

The following examples of customization tasks demonstrate how you can implement custom handlers for events in extension classes to business logic controllers (BLCs, also referred to as *graphs*).

- [Implementing a Handler That is Appended to the Collection of Base Handlers](#)
- [Implementing a Handler That Replaces the Collection of Base Handlers](#)
- [Adding an Event Handler From the Screen Editor](#)

### Implementing a Handler That is Appended to the Collection of Base Handlers

When you define an event handler in the BLC extension class with the same declaration, as it is defined in the base (original) BLC, this handler is added to the appropriate event handler collection. Depending on the event type, the event handler is appended to either the end of the collection or the start of it. When the event occurs, all event handlers in the collection are executed, from the first one to the last one. For details, see [Event Handlers](#).

Suppose that you need to add validation of **Local Tax Category** on the **General Settings** tab of the Stock Items (IN202500) form. **Local Tax Category** that is shown in the screenshot below is a custom field that has been added to the form, as described in the example of [Adding Data Fields](#). **Local Tax Category** is linked to the custom `UsrLocalTaxCategoryId` data field defined in the DAC extension for the `InventoryItem` data access class.

Your task is to check whether the selected **Local Tax Category** is the same as the selected **Tax Category** of the item and add a warning message that appears for the **Local Tax Category** box if they are the same.



## Stock Items

The screenshot shows the 'Stock Items' form with a modal dialog box titled 'Select - Local Tax Category'. The dialog box contains a search bar and a table with the following data:

Tax Category ID	Description
EXEMPT	Exempt Tax Category
TAXABLE	Taxable Goods and Services

The background form shows the following fields:

- \* Inventory ID: AACOMPUT01 - Acer Laptop Comput...
- Item Status:
- Description:
- GENERAL SETTINGS
- ITEM DEFAULTS
- \* Item Class:
- Type:
- Valuation Method:
- \* Tax Category:
- Local Tax Category:
- \* Posting Class: ELE - Electronics & Computers

**Figure: The control for the custom field on the Stock Items form**

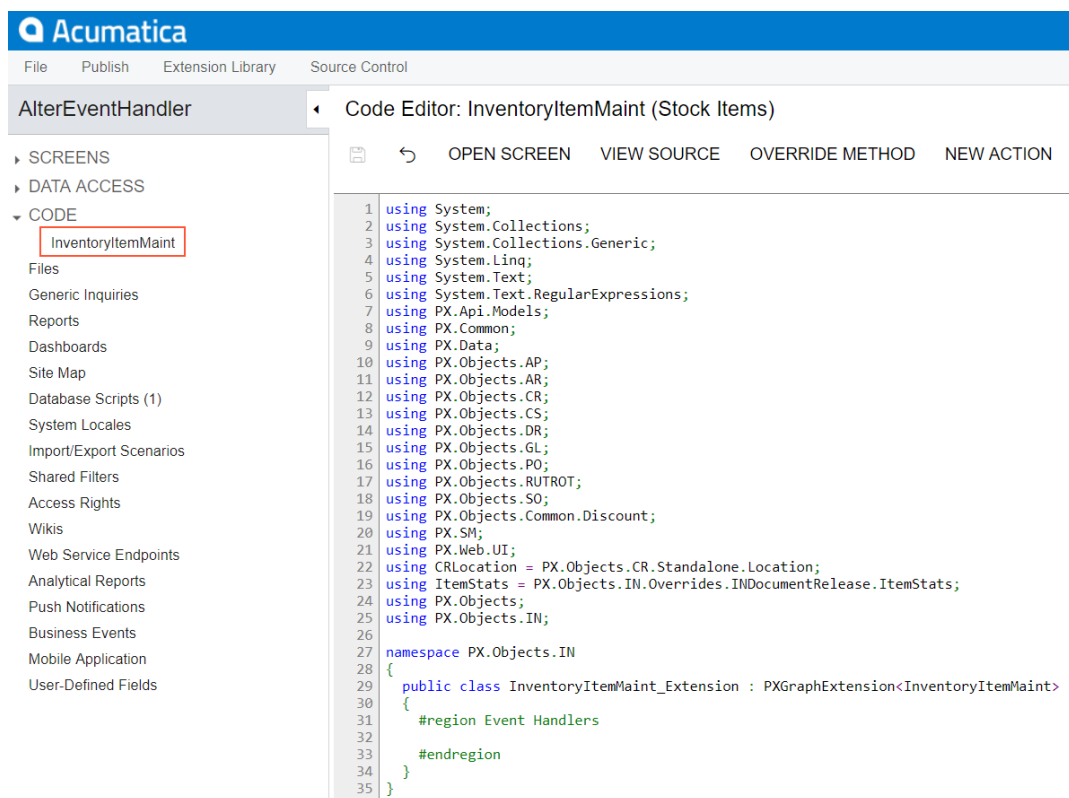
To resolve the task, you implement validation of fields on the `RowUpdating` event handler that you will add to the BLC extension for the Stock Items form. In this variant of implementation, the validation will occur when the user attempts to save the `InventoryItem` record. In the handler, you compare the `TaxCategoryID` and `UsrLocalTaxCategoryID` fields and return an error message that displays for the **Local Tax Category** box if the values are equal. Do the following:

1. Select the business logic controller for customization by clicking **Customization > Inspect Element** and clicking the **Warehouse Details** tab on the Stock Items form. The system should retrieve the following information that appears in the **Element Properties** dialog box:

- **Business Logic:** `InventoryItemMaint`. The business logic controller that provides the logic for the Stock Items form.

Select **Actions > Customize Business Logic** in the **Element Properties** dialog box. In the **Select Customization Project** dialog box, specify the project to which you want to add the customization item for the business logic controller of the form and click **OK**.

The Code Editor opens for customization of the business logic code of the form (see the screenshot below). The system generates the BLC extension class in which you can develop the customization code. (See [Graph Extensions](#) for details.)



**Figure: The BLC extension class generated for customization of the business logic code executed for the Stock Items form**

2. Add the following code to the BLC extension class for InventoryItemMaint:

```

#region Event Handlers
protected void InventoryItem_RowUpdating(PXCache sender,
    PXRowUpdatingEventArgs e)
{
    InventoryItem row = e.NewRow as InventoryItem;
    InventoryItemExt rowExt = sender.GetExtension<InventoryItemExt>(row);
    if (row.TaxCategoryID != null && rowExt.UsrLocalTaxCategoryID != null &&
        row.TaxCategoryID == rowExt.UsrLocalTaxCategoryID)
    {
        sender.RaiseExceptionHandling<InventoryItemExt.usrLocalTaxCategoryID>(
            row,
            rowExt.UsrLocalTaxCategoryID,
            new PXSetPropertyException("Tax category and local tax category
            should differ",
                PXErrorLevel.Warning));
    }
}
#endregion

```

The event handler checks whether the `TaxCategoryID` and `UsrLocalTaxCategoryID` field values are not null and do not equal each other. If these conditions are not satisfied, the handler issues the warning that will be shown on the **Local Tax Category** box in the UI, which corresponds to the `UsrLocalTaxCategoryID` field.



: The field is accessed by its string name by using the `GetValue()` method on the cache. There is a number of ways how you can access customization objects from code. See [Access to a Custom Field](#) for details.

3. Click **Save** in the Code Editor to save the changes.

The system adds the customization to the business logic code to the **Code** list of project items. See [Code Editor](#) for details.

To view the result of the customization, publish the customization project and open the Stock Items form. To test the validation, select an item on the form, set the **Local Tax Category** the same as the **Tax Category** of the item and click **Save**. The warning message appears for the **Local Tax Category** box, as it was required by the task. To view the warning message, point the mouse to the warning icon, as shown on the screenshot below.

## Stock Items

←
SAVE & CLOSE
📁
↶
+
📄 ▼
🗑️
⏪

\* Inventory ID:

Item Status:

Description:

AACOMPUT01 - Acer Laptop Comput 🔍

Active ▼

Acer Laptop Computer

⚠️ GENERAL SETTINGS
PRICE/COST INFO
WAREHOUSE DET

ITEM DEFAULTS

\* Item Class:

Type:

Valuation Method:

\* Tax Category:

⚠️ Local Tax Category:

ELECCOMP -400-COMPUTERS 🔍 ✎

Finished Good ▼

☐ Is a Kit

Average ▼

EXEMPT - Exempt Tax Category 🔍 ✎

EXEMPT - Exempt Tax Category 🔍 ✎

computers 🔍 ✎

Tracked 🔍 ✎

Auto-Incremental Value:

⚠️ Tax category and local tax category should differ

Figure: The warning message appears on saving attempt

## Implementing a Handler That Replaces the Collection of Base Handlers

In a BLC extension, you can define an event handler so that the handler replaces the base BLC event handler collection. To do this, you declare the event handler with an additional parameter, as described below. When the event is raised, the system calls the event handler with an additional parameter of the highest-level BLC extension. The system passes the link to the event handler with an additional parameter from the extension of the previous level, if such an event handler exists, or to the first item in the event handler collection (also described in [Event Handlers](#)). In the event handler that replaces the collection of handlers of the base BLC, you can invoke the collection of base handlers as well as implement the logic to be executed before and after the base collection.

Suppose that you need to resolve the same customization task, as described above—that is, you have to add validation of **Local Tax Category** on the **General Settings** tab of the Stock Items form. To resolve the task, you implement validation in the `RowUpdating` event handler that you define in the BLC extension for the `InventoryItemMaint` class.

If you define the event handler, as listed below, the handler will replace the collection of handlers of the base BLC. The code of the replacing handler that is given below introduces the same behavior of the Stock Items form as the code of the event handler that is added to the collection, as described above in [Adding a Handler to the Collection of Base Handlers](#). In the handler below, you invoke the base handlers first and then validate the `TaxCategoryID` and `UsrLocalTaxCategoryID` fields and return an error message that displays for the **Local Tax Category** box if the validation fails.

```
#region Event Handlers
protected void InventoryItem_RowUpdating(
    PXCACHE cache, PXRowUpdatingEventArgs e, PXRowUpdating InvokeBaseHandler) {
    //execute the collection of base handlers
    if(InvokeBaseHandler != null) InvokeBaseHandler(cache, e);
    //add the validation of Local Tax Category
    InventoryItem row = e.NewRow as InventoryItem;
    InventoryItemExt rowExt = cache.GetExtension<InventoryItemExt>(row);
    if (row.TaxCategoryID != null && rowExt.UsrLocalTaxCategoryID != null &&
        row.TaxCategoryID == rowExt.UsrLocalTaxCategoryID)
    {
        cache.RaiseExceptionHandling<InventoryItemExt.usrLocalTaxCategoryID>(
            row,
            rowExt.UsrLocalTaxCategoryID,
            new PXSetPropertyException("Tax category and local tax category should
differ",
                PXErrorLevel.Warning));
    }
}
#endregion
```



: Notice the three parameters within the event handler declaration. When the event is raised, the system calls the event handler, passing a link to the first item in the base BLC event handler collection. You execute `InvokeBaseHandler()` to invoke the collection of event handlers defined in the base BLC. Depending on a customization task, you can skip the execution of base handlers or implement the needed logic before the base handlers are invoked.

## Adding an Event Handler From the Screen Editor





To add a custom handler for a row or field event to the customization project, you can use the Screen Editor, as described below.





: For this example, you have to enable the *Lot and Serial Tracking* feature in the system to view the **Lot/Serial Class** box on the **General Settings** tab of the *Stock Items* form.

Suppose that on the Stock Items form you need to replace the warning message that appears on the **Lot/Serial Class** box for an incompatible class selected in the box (see the screenshot below) with an error message.

## Stock Items

← SAVE & CLOSE   +   K



\* Inventory ID: AACOMPUT01 - Acer Laptop Comput 


Item Status: Active 

Description: Acer Laptop Computer


**! GENERAL SETTINGS** PRICE/COST INFO WAREHOUSE DET



**ITEM DEFAULTS**



\* Item Class: ELECCOMP -400-COMPUTERS - Co  



Type: Finished Good 

☐ Is a Kit

Valuation Method: Average 

\* Tax Category: EXEMPT - Exempt Tax Category  

\* Posting Class: ELE - Electronics & Computers  

**! Lot/Serial Class: NOTTRACKED**  

**IN Error: Lot/serial class cannot be changed when its tracking method is not compatible with the previous class and the item is in use.**

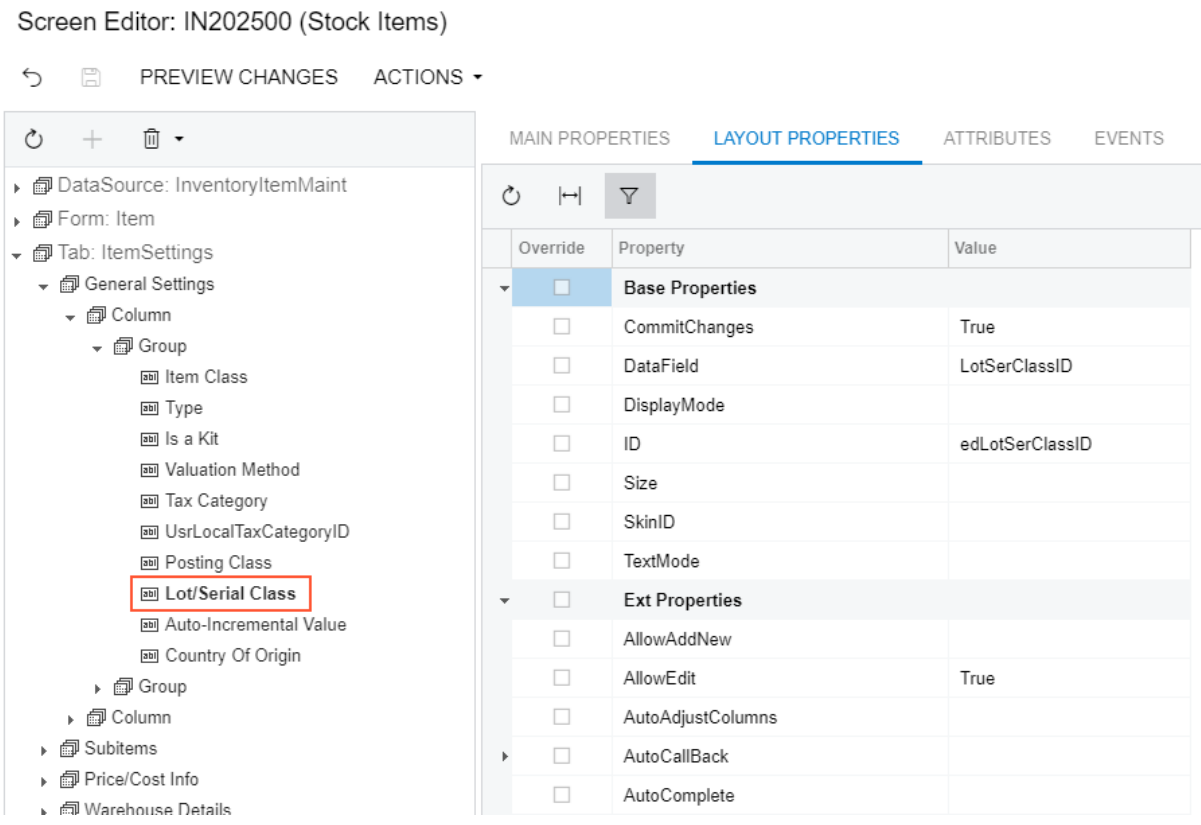
**WAREHOUSE DEFAULTS**

**Figure: The original warning message on the Stock Items form**

To resolve the task, you have to modify the logic of validation of the DAC field that corresponds to the **Lot/Serial Class** box. You have to implement a custom handler for the `FieldVerifying` event on the DAC field. Do the following:


- Find the DAC field and add the event handler to the customization project for it, open the form in Screen Editor. To do this, on the **Customization** menu, select **Inspect Element** and click the label or the box area of the **Lot/Serial Class** control. The system should retrieve the following information that appears in the **Element Properties** dialog box:
  - Control Type:** *Selector*. The type of the inspected UI control.
  - Data Class:** *InventoryItem*. The data access class that contains the field corresponding to the inspected control.
  - Data Field:** *LotSerClassID*. The data field that is linked to the inspected control.
  - Business Logic:** *InventoryItemMaint*. The business logic controller that provides the logic for the Stock Items form.
- Click **Customize** in the Element Inspector. In the **Select Customization Project** dialog box, specify the project to which you want to add the customization item for the business logic controller of the form and click **OK**.

Screen Editor opens for the form already navigated to the inspected control, as the screenshot below shows.



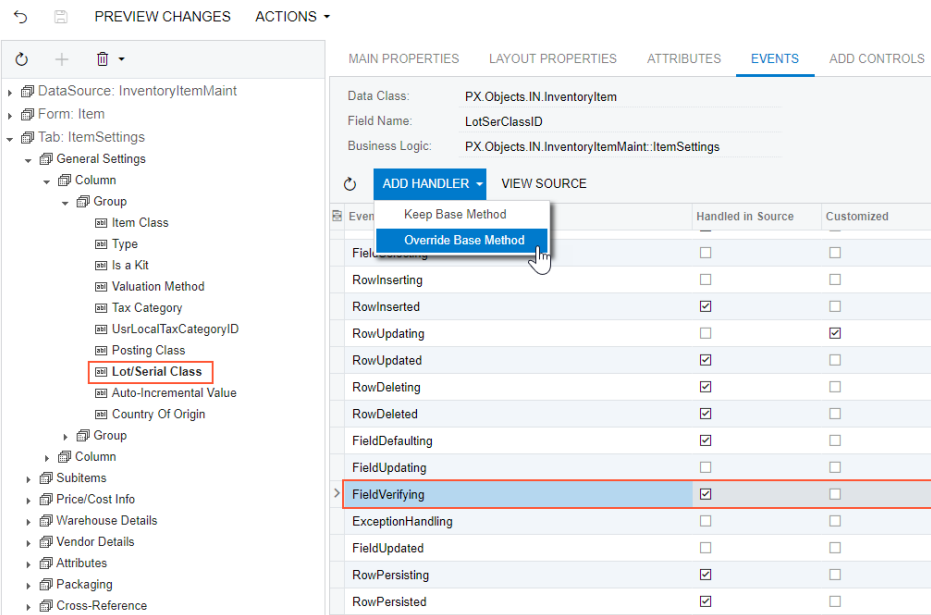
**Figure: Screen Editor opened for the inspected element**

3. Add the `FieldVerifying` event handler for data field underlying the **Lot/Serial Class** control. To do this, first select the **Events** tab and find the `FieldVerifying` event in the grid. The selected check box in the **Handled in Source** column means that the `FieldVerifying` event is already handled for the `LotSerClassID` field in the original business logic controller, `InventoryItemMaint` class.

 : The **Events** tab displays the events depending on the control selected in the tree. The tab shows the field events if you select a control that is linked to a data field (that is, has the `DataField` property specified) and the row events of the parent container that is linked to a data view (that is, has the `DataMember` property specified). If you select a container that is not linked to a data view or data field, the tab shows no events.

Add a custom handler for the `LotSerClassID` field to the customization project by clicking the **FieldVerifying** event in the table and then clicking **Add Handler** on the toolbar (see the screenshot below).

Screen Editor: IN202500 (Stock Items)



**Figure: Adding an event handler to the customization project**

The system generates the definition of the event handler, adds the definition to the BLC extension class for the form, and opens the Code Editor with the generated code as shown below. The system generates handlers with three input parameters; a handler with such definition replaces the collection of event handlers implemented in the original BLC, which is described in [Implementing a Handler That Replaces the Collection of Base Handlers](#). You can modify the generated code as needed.

```
protected void InventoryItem_LotSerClassID_FieldVerifying(
    PXCache cache,
    PXFieldVerifyingEventArgs e,
    PXFieldVerifying InvokeBaseHandler)
{
    if(InvokeBaseHandler != null)
        InvokeBaseHandler(cache, e);
    var row = (InventoryItem)e.Row;
}
```

4. Modify the generated code, as listed below, and click **Save** in Code Editor to save the changes to the customization project. In the code, you catch the exception that could be thrown from the original handlers and create another exception with the error message instead of the original one.

```
protected void InventoryItem_LotSerClassID_FieldVerifying(
    PXCache cache, PXFieldVerifyingEventArgs e, PXFieldVerifying
    InvokeBaseHandler)
{
    try
    {
        if(InvokeBaseHandler != null) InvokeBaseHandler(cache, e);
    }
    catch (PXSetPropertyException ex)
    {
        cache.RaiseExceptionHandling<InventoryItem.lotSerClassID>(
            e.Row,
            e.NewValue,
            new PXSetPropertyException(
```

```

        ex.MessageNoPrefix, PXErrorLevel.Error));
    }
}

```

##### 5. Publish your customization project.

To view the result of the customization, publish the customization project and open the Stock Items form. To test the validation, select an incompatible class in the **Lot/Serial Class** box, as shown in the screenshot below. The error message appears for the box instead of a warning message.

## Stock Items

← SAVE & CLOSE [Icons]

\* Inventory ID: AAMACHINE1 - Injection molding machine [Search]

Item Status: Active [Dropdown]

Description: Injection molding machine - serial numbered

✖ GENERAL SETTINGS PRICE/COST INFO WAREHOUSE DEFAULTS

ITEM DEFAULTS

\* Item Class: INDEQUIP -300-MOLDING - Molding [Search] [Edit]

Type: Finished Good [Dropdown]

☐ Is a Kit

Valuation Method: Specific [Dropdown]

\* Tax Category: EXEMPT - Exempt Tax Category [Search] [Edit]

Local Tax Category: [Search]

\* Posting Class: IND - Industrial Equipment [Search] [Edit]

✖ Lot/Serial Class: LREX [Search] [Edit]

Lot/serial class cannot be changed when its tracking method is not compatible with the previous class and the item is in use.

WAREHOUSE DEFAULTS

Figure: The error message that appears on selecting an incompatible class

## Altering BLC Virtual Methods

In a BLC extension, you can override virtual methods defined within a business logic controller (BLC, also referred to as *graph*). As with the event handlers, you have two options:

- You can define the override method with exactly the same signature—that is, the return value, the name of the method, and all method parameters—as the overridden base virtual method. As a result, the method is added to the queue of all override methods. When the system invokes the



base method, all methods in the queue are executed sequentially, from the first to the last one. The lower the level the BLC extension has, the earlier the system invokes the override method.

- You can define the override method with an additional parameter, which represents the delegate for one of the following:
  - The override method with an additional parameter from the extension of the previous level, if such a method exists.
  - The base virtual method, if no override methods with additional parameters declared within lower-level extensions exist.

In both cases, you should attach the `PXOverrideAttribute` to the override method declared within the BLC extension. See the topics below for details.

- [Override Method That is Added to the Override Method Queue](#)
- [Override Method That Replaces the Original Method](#)

### Override Method That is Added to the Override Method Queue

By declaring an override method with exactly the same signature as the overridden base virtual method, you extend the base method execution. The base BLC method is replaced at run time with the queue of methods that starts with the base BLC method. When the system invokes the base method, all methods in the queue are executed sequentially, from the first to the last one. The lower the level the BLC extension has, the earlier the system invokes the override method. If the system has invoked the base method, you have no option to prevent the override method queue from execution. To prevent the base method executions, see [Override Method That Replaces the Original Method](#) below.

Suppose that you need to modify the behavior of the Journal Transactions (GL301000) form.

Open *Journal Transactions* and explore its original behavior. Start by adding a new journal transaction, selecting an account, and setting the **Debit Amount** to 2000.00. Then add one more journal transaction and select a different account, and notice that the **Credit Amount** is set by default to 2000.00 to balance the batch, as the following screenshot illustrates.

The screenshot shows the Acumatica Journal Transactions form. The left sidebar has a menu with 'Journal Transactions' highlighted. The main form area shows a batch with two entries. The first entry is 'Petty Cash USD' with a Debit Amount of 2,000.00. The second entry is 'Office Expense' with a Credit Amount of 2,000.00. The 'Credit Amount' for the second entry is highlighted with a red box, indicating it is set by default to balance the batch.

Branch	Account	Description	Subaccount	Debit Amount	Credit Amount	Transaction Description
MAIN	100000	Petty Cash USD	US-00-00-00-000	2,000.00	0.00	
MAIN	710000	Office Expense	US-00-00-00-000	0.00	2,000.00	

**Figure: The Credit Amount by default is set to balance the batch**

Suppose that you need this form to work differently, so that if the user first inserts a debit entry, by default each **Credit Amount** value equals 0.00, to make the user add the required values manually. If the user first inserts a credit entry, a **Debit Amount** value should also equal 0.00 by default, so

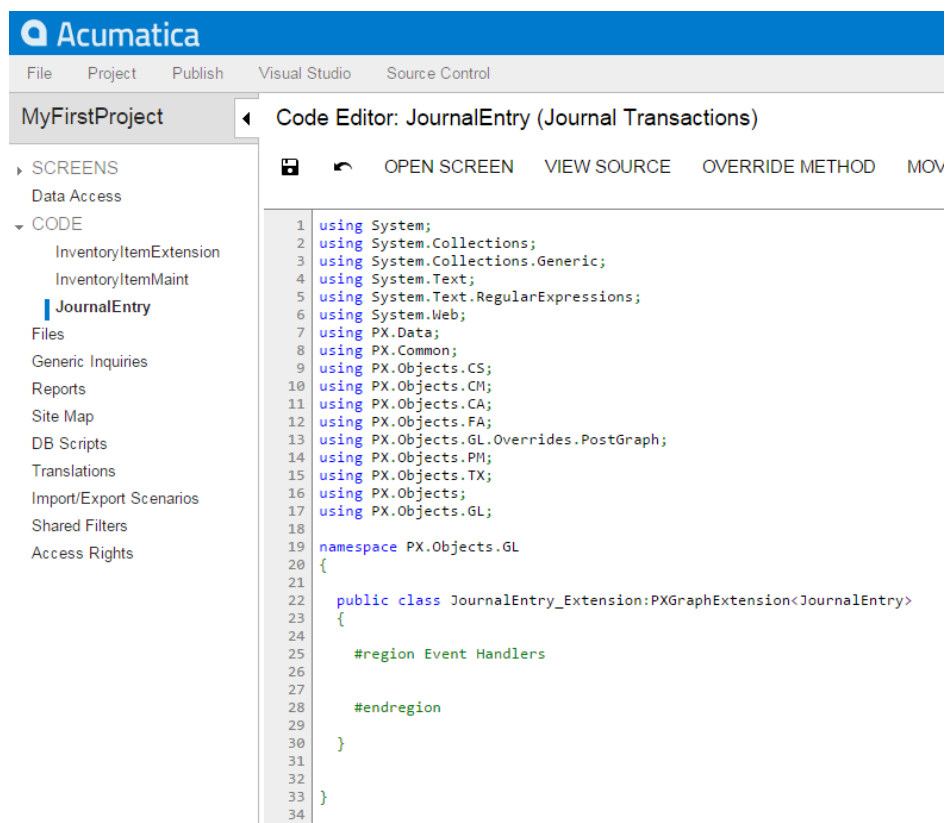
that the user must add the needed values. You can implement this behavior in the `PopulateSubDescr` method that you have to override in a BLC extension for the `JournalEntry` class.

To select the business logic controller for customization, on the **Customization** menu, select **Inspect Element** and click any element on the form, for example, the form area. The system should retrieve the following information that appears in the **Element Properties** dialog box:

- **Business Logic:** *JournalEntry*. The business logic controller that provides the logic for the *Journal Transactions* form.

Select **Actions > Customize Business Logic** in the Element Inspector. In the **Select Customization Project** dialog box, specify the project to which you want to add the customization item for the business logic controller of the form and click **OK**.

The Code Editor opens for customization of the business logic code of the form (see the screenshot below). The system generates the BLC extension class in which you can develop the customization code. (See [Graph Extensions](#) for details.)



**Figure: The BLC extension class generated for customization of the business logic code executed for the Journal Transactions form**

To the BLC extension class for `JournalEntry`, add the code that is listed below.

```

[PXOverride]
public void PopulateSubDescr(PXCache sender, GLTran row, bool externalCall)
{
    decimal difference = (Base.BatchModule.Current.CuryCreditTotal ?? decimal.Zero)
        -
        (Base.BatchModule.Current.CuryDebitTotal ?? decimal.Zero);
    if (difference != 0)
    {
        if (row.CuryCreditAmt == Math.Abs(difference))
        {
            row.CuryCreditAmt = 0;
        }
    }
}

```

```

    }
    else if (row.CuryDebitAmt == Math.Abs(difference))
    {
        row.CuryDebitAmt = 0;
    }
}
}

```

In the code, you override the `PopulateSubDescr` method of the original BLC by adding the new method to the queue of override methods to be executed. The system invokes the base method first, and then executes the override method. The override method resets the value of the **Credit Amount** or the **Debit Amount** to 0.00.

Click **Save** in Code Editor to save the changes.



**Figure: The override method implemented in the BLC extension class**

To view the result of the customization, publish the customization project and open the Journal Transactions (GL301000) form.

Test the modified behavior of *Journal Transactions*. Add a new journal transaction, select an account, and set the **Debit Amount** to 2000.00. Then add one more journal transaction and select a different account, and notice that the **Credit Amount** is set by default to 0.00. You must manually specify the amount for every journal entry to make the batch balanced. Otherwise, you will not be able to save the batch with the Balanced status, and you will see the appropriate error message on the **Debit Total** box.



: You should also test the case when the user first adds a transaction with a **Credit Amount**: Then the **Debit Amount** must equal 0.00 by default.

Customization | FINANCE | DISTRIBUTION | 13 (10) | 12/19/2014 7:02 AM | ADMIN@CUSTOMIZATIONTEST

Accounts Payable | Accounts Receivable | Fixed Assets | Deferred Revenue | Taxes | Currency Management

New York - Journal Transactions ★

NOTES | ACTIVITIES | FILES | CUSTOMIZATION

RELEASE | ACTIONS | REPORTS

Module: GL | Branch: MAIN - New York | Orig. Batch Number: | Debit Total: 2,000.00

Batch Number: <NEW> | Ledger: ACTUAL | Credit Total: 0.00

Status: Balanced | Currency: USD | 1.00 | VIEW BASE

☐ Hold | ☐ Auto Reversing | ☐ Reversing Entry

\* Transaction Date: 12/19/2014

\* Post Period: 11-2014

Description:

Branch	Account	Description	Subaccount	Debit Amount	Credit Amount	Transaction Description
MAIN	100000	Petty Cash USD	US-00-00-00-000	2,000.00	0.00	
MAIN	710000	Office Expense	US-00-00-00-000	0.00	0.00	

**Figure: Viewing the result of the customization**

## Override Method That Replaces the Original Method

The override method with an additional parameter replaces the base BLC virtual method. When the virtual method is invoked, the system invokes the override method with an additional parameter of the highest-level BLC extension. The system passes a link to the override method with an additional parameter from the extension of the previous level, if such a method exists, or to the base virtual method.

You use a delegate as an additional parameter to encapsulate the method with exactly the same signature as the base virtual method. If the base virtual method contains a `params` parameter, then you should not use the `params` keyword when you declare the override method with an addition parameter. For example, to declare an `ExecuteInsert` override method with an additional parameter within a BLC extension, you can use the following code.

```
public class BaseBLCExt : PXGraphExtension<BaseBLC>
{
    [PXOverride]
    public int ExecuteInsert(string viewName, IDictionary values, object[]
parameters,
                           Func<int, string, IDictionary, object[]> del)
    {
        if (del != null)
        {
            del(viewName, values, parameters)
        }
    }
}
```

You can decide whether to call the method pointed to by the delegate. By invoking the base method, you also start the override method queue execution.

Suppose that you need to modify the logic of generating batches on release of Accounts Receivable documents.

For example, open the Invoices and Memos (AR301000) form and explore its original behavior. Create and save an invoice, clear the **Hold** check box, click the **Release** button, and notice that a new GL batch has been generated by the system while the system releases the invoice. You can see the batch

number on the **Financial Details** tab of the *Invoices and Memos* form, as the following screenshot shows.

The screenshot shows the Acumatica Accounts Receivable Invoices and Memos form. The 'RELEASE' button is highlighted in red. The 'Financial Details' tab is active, showing a batch number of 00004482, which is also highlighted in red. The form displays various fields for invoice details, including Type, Reference Nbr., Status, Date, Post Period, Customer, Currency, Terms, Due Date, Cash Discount, and Project. A summary table on the right shows totals for Detail Total, Discount Total, VAT Taxable, VAT Exempt, Tax Total, Balance, Amount, and Cash Discount.

**Figure: The batch has been generated during release of the Accounts Receivable invoice**

Suppose that you need to prevent generation of batches during release of Accounts Receivable documents. You can implement the new behavior in the `Persist` method that you have to override in a BLC extension for the `JournalEntry` class. In the override method, you need to handle execution of the `Persist` method of the original BLC. Therefore, you have to implement the override method with an additional parameter, as described below.

To the BLC extension class for `JournalEntry`, add the code that is listed below. For example, you can add the override method to the `JournalEntry_Extension` BLC extension class generated by the system, as described above in [Override Method That is Added to the Override Method Queue](#).

```
[PXOverride]
public void Persist(Action del)
{
    if (Base.BatchModule.Current != null &&
        Base.BatchModule.Cache.GetStatus(Base.BatchModule.Current) ==
        PXEntryStatus.Inserted &&
        Base.BatchModule.Current.Module == "AR")
    {
        return;
    }
    if (del != null)
    {
        del();
    }
}
```

The code modifies the logic so that the system will not invoke the base virtual method if the batch is being generated from the Accounts Receivable module; otherwise, the system executes the base business logic.

To view the result of the customization, publish the customization project and open the Invoices and Memos form.

To test the modified behavior of the Invoices and Memos form, add and save a new invoice, clear the **Hold** check box, and click the **Release** button. Notice that no new GL batch is generated by the system while it releases the invoice. Open the **Financial Details** tab. No batch number is displayed, as the following screenshot illustrates.

The screenshot shows the 'New York - Invoices and Memos' form. The 'RELEASE' button is highlighted with a red box. The 'Financial Details' tab is selected, showing the following information:

Document Details		Financial Details		Billing Address		Tax Details		Salesperson Commission		Discount Details		Applications	
Type:	Invoice	Customer:	CUSTOMER1 - Customer1	Detail Total:	100.00								
Reference Nbr.:	001015	Currency:	USD 1.00	Discount Total:	0.00								
Status:	Open	Terms:	07D - 7 Days	VAT Taxable ...	0.00								
	<input type="checkbox"/> Hold	* Due Date:	12/26/2014	VAT Exempt ...	0.00								
Date:	12/19/2014	* Cash Discoun...	12/19/2014	Tax Total:	0.00								
Post Period:	11-2014	Project:	X - Non-Project Code.	Balance:	100.00								
Customer Order:				Amount:	100.00								
Description:				Cash Discount:	0.00								

Below the tabs, the 'LINK TO GL' section shows the 'Batch Nbr.' field is empty (highlighted with a red box). The 'TAX AND COMMISSION' section shows 'Customer Tax Zone', 'Customer Usage Type', 'Salesperson ID', 'Total Commissionable' (0.00), and 'Commission Amt.' (0.00). The 'DEFAULT PAYMENT INFO' section shows 'Payment Method' (CHECK - Check), 'Card/Account No.', and 'Cash Account' (102000 - Bank of America Chec).

**Figure: No batch has been generated by the system for the Accounts Receivable Invoice**

## Customizing the Release Process for CA Documents

You can use customize the release process for several forms in the following ways:

- By overriding the `Insert***Transaction` methods. This way you will be able to manage the process of inserting a line to the General Ledger.
- By subscribing to the `RowPersisting` and `RowPersisted` events. This way you will be able to access the following caches of the `CAReleaseProcess` class:

```
public PXSelect<CAAdj> CAAdjustments;
public PXSelect<CATransfer> CATransfers;
public PXSelect<CATaxTran> TaxTrans;
public PXSelect<CAExpense> TransferExpenses;
public PXSelect<SVATConversionHist> SVATConversionHist;
public PXSelect<CADailySummary> DailySummary;
```

Such customization is available for actions which include the `ReleaseDocProc<TCADocument>` method call. These action are the following:

- The **Release** action on the Release Cash Transactions (CA502000) form
- The **Release** action on the Transactions (CA304000) form
- The **Release** action on the Funds Transfers (CA301000) form
- The **Process** action on the Process Bank Transactions (CA306000) form

- The **Release** action on the Journal Vouchers (GL304000) form
- The **Release** action on the Bank Deposits (CA305000) form

### Overriding the Insert\*\*\*Transaction methods

The following methods are available for customization:

- ```
public virtual GLTran InsertDocumentTransaction(
    JournalEntry, GLTran, GLTranInsertionContext)
```

The method inserts the content of the form header.

- ```
public virtual GLTran InsertSplitTransaction(
    JournalEntry, GLTran, GLTranInsertionContext)
```

The method inserts the lines of the **Document Details** tab of the form.

- ```
public virtual GLTran InsertRoundingTransaction(
    JournalEntry, GLTran, GLTranInsertionContext)
```

The method processes the rounding of the document lines sum and document total.

- ```
public virtual GLTran InsertDepositChargeTransaction(
    JournalEntry, GLTran, GLTranInsertionContext)
```

The method is available only for the Bank Deposits form and inserts the lines of the **Charges** tab of the form.

The `GLTranInsertionContext` context parameter of the methods contains the context of the release process. That means the kind of record being released is the field of the `GLTranInsertionContext` class instance, which is not null. The context parameter is assigned the corresponding value by the system. The class members are presented below.

```
public class GLTranInsertionContext
{
    public virtual CAAdj CAAdjRecord { get; set; }
    public virtual CASplit CASplitRecord { get; set; }
    public virtual CATaxTran CATaxTranRecord { get; set; }

    public virtual CATransfer CATransferRecord { get; set; }
    public virtual CAExpense CAExpenseRecord { get; set; }

    public virtual CADeposit CADepositRecord { get; set; }
    public virtual CADepositDetail CADepositDetailRecord { get; set; }
    public virtual CADepositCharge CADepositChargeRecord { get; set; }

    public virtual CATran CATranRecord { get; set; }
}
```

### Customizing the Release of a Transaction (an Example)

Suppose you have a custom field on the Transactions form, and you need to display it on the separate column in the lines of the Journal Transaction form. Then you need to complete the following steps:

1. Add a custom field to the Transactions form. See example in the [Adding Input Controls](#) topic. For example, add the `CreatedDateTime` field of the `Transactions` data view. The customized screen in the Screen Editor is shown on the screenshot below.

## Screen Editor: CA304000 (Transactions)

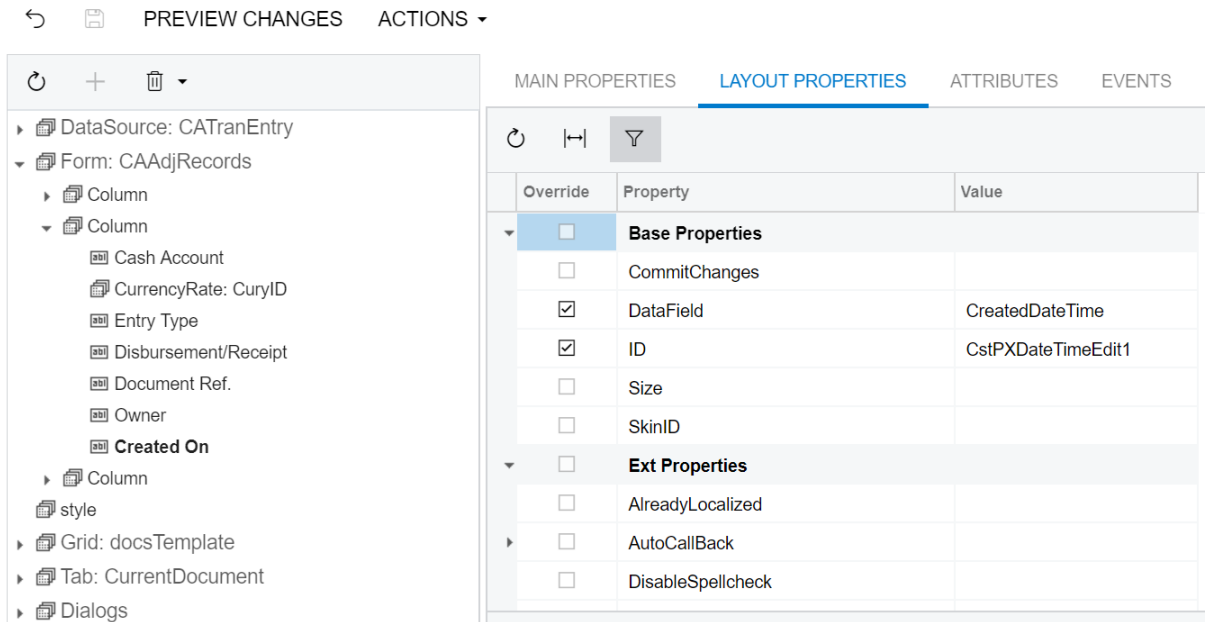


Figure: The customized Transactions screen

2. Add a custom column to the grid on the Journal Transactions form. See example in the [Adding Columns to a Grid](#) topic.

For example, add the corresponding *CreatedOn* field to the form grid. The corresponding Data Access is shown on the screenshot below.

## Data Class: GL.GLTran

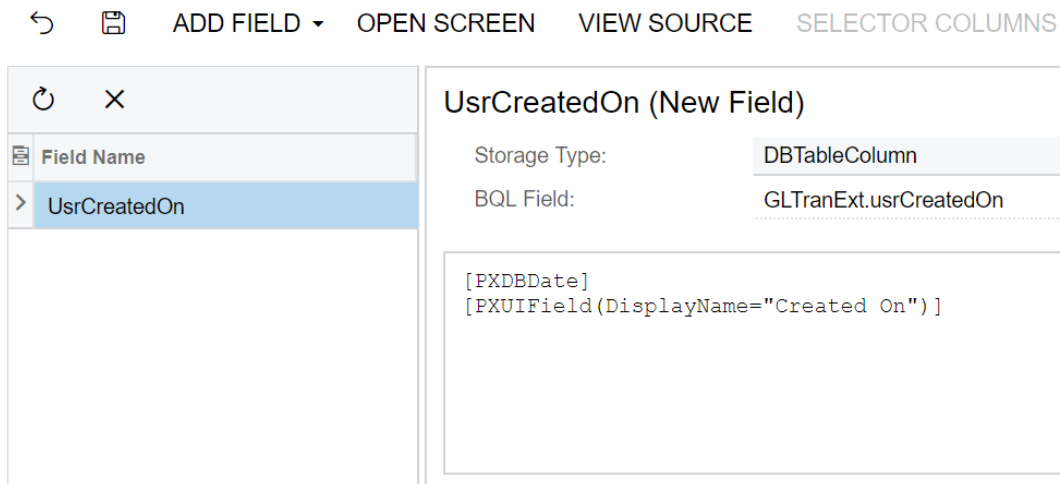


Figure: The GLTran DAC extension

3. Customize the business logic of the Transactions form by overriding the `InsertDocumentTransaction` method as follows:
  - a. Before you start overriding the `InsertDocumentTransaction`, you should understand which field of the `GLTranInsertionContext` class is changed depending on which form is used. You are overriding the Release action on the Transactions form, so open Element



Inspector for this form's header and see which Data Class and View Name it has. Their names correspond to types and fields of the `GLTranInsertionContext` class.

So, for the Transactions form, you need the `CAAdj` DAC as shown on the following screenshot.

Element Properties	
Control Type:	Form View
Data Class:	CAAdj
View Name:	CAAdjRecords
Business Logic:	CATranEntry

CUSTOMIZE ACTIONS CANCEL

**Figure: The Element Properties dialog box of the Transactions form**

- b. In the Code Editor of the Customization Project Editor, select **Add New Record**.
- c. In the **Create Code File** dialog box that opens, specify the following values and click **OK**.
  - **File Template:** *Graph Extension*
  - **Class Name:** *CAReleaseProcess*

The **Code Editor: CAReleaseProcess** page opens.

- d. On the **Code Editor: CAReleaseProcess** page, select **Override Method**.
- e. On the **Select Methods to Override** panel, select the `InsertDocumentTransaction` method, and click **Save**.

The code for overriding the `InsertDocumentTransaction` method is generated as follows.

```
public delegate GLTran InsertDocumentTransactionDelegate(
    JournalEntry je,
    GLTran tran,
    CAReleaseProcess.GLTranInsertionContext context);
[PXOverride]
public GLTran InsertDocumentTransaction(
    JournalEntry je,
    GLTran tran,
    CAReleaseProcess.GLTranInsertionContext context,
    InsertDocumentTransactionDelegate baseMethod)
{
    return baseMethod(je, tran, context);
}
```

- f. In the method's body, insert the following code where you detect whether the current context (a record of the `CAAdj` type that was found in paragraph a) is not empty.

```
if (context.CATranRecord != null)
{
```

```

var adj = PXSelect<CAAdj, Where<CAAdj.tranID,
Equal<Required<CAAdj.tranID>>>>.Select(Base,
context.CATranRecord.TranID);
if(adj!=null)
{
    // some code
}
}

```

Now you can work with the record's fields inside the `if` statement.

- g. As the original task requires, assign the custom field (`CreatedDateTime`) to the released transaction's custom field (`UsrCreatedOn`) as shown in the code below.

```

GLTranExt tranExt =
Base.Caches[typeof(GLTran)].GetExtension<GLTranExt>(tran);
tranExt.UsrCreatedOn = context.CATranRecord.CreatedDateTime;

```

The complete code of the `CAReleaseProcess_Extension` class should look as follows.

```

public class CAReleaseProcess_Extension :
PXGraphExtension<CAReleaseProcess>
{
    #region Event Handlers
    public delegate GLTran InsertDocumentTransactionDelegate(
        JournalEntry je, GLTran tran,
        CAReleaseProcess.GLTranInsertionContext context);
    [PXOverride]
    public GLTran InsertDocumentTransaction(
        JournalEntry je,
        GLTran tran,
        CAReleaseProcess.GLTranInsertionContext context,
        InsertDocumentTransactionDelegate baseMethod)
    {
        if (context.CATranRecord!= null)
        {
            var adj = PXSelect<CAAdj, Where<CAAdj.tranID,
            Equal<Required<CAAdj.tranID>>>>.Select(Base,
            context.CATranRecord.TranID);
            if(adj!=null)
            {
                GLTranExt tranExt =
                Base.Caches[typeof(GLTran)].GetExtension<GLTranExt>(tran);
                tranExt.UsrCreatedOn = context.CATranRecord.CreatedDateTime;
            }
        }
        return baseMethod(je,tran,context);
    }
    #endregion
}

```






4. Publish the customization project.



To test the implemented customization, do the following:

1. Open the Transactions form. Note the **Created On** field in the form's header. Create a transaction and release it. The released transaction is shown on the screenshot below.







## Transactions

NOTES ACTIVITIES FILES NOTIFICATIONS CUSTOMIZATION

← SAVE & CLOSE   +    < > >> ACTIONS ▾ INQUIRIES ▾ 00:00:02

Tran. Type:	Cash Entry	* Cash Account:	10200 - Company Checking Account	Amount:	5.00
Reference Nbr.:	000159 	Currency:	USD 1.00  VIEW BASE	VAT Taxable T...	0.00
Status:	Released	* Entry Type:	BANKFEE - Bank Fees	VAT Exempt T...	0.00
	<input type="checkbox"/> Hold	Disbursement/...	Disbursement	Tax Total:	0.00
* Tran. Date:	2/26/2019	* Document Ref.:	234		
* Fin. Period:	02-2019	Owner:	EP00000002 - Baker Maxwell, Mr.		
		Created On:	2/26/2019 8:06		
Description:	This is test				

TRANSACTION DETAILS TAX DETAILS FINANCIAL DETAILS

 +     









		* Branch	Item ID	Description	Quantity	UOM	Price	Amount	* Offset Account	Account Desc
>		PRODWH...		Bank Fees	1.00		5.00	5.00	61100	Bank Service




Figure: The released transaction on the customized Transactions form







2. In the **Financial Details** tab, click the generated batch number.
3. The Journal Transactions form opens. Note the **Created On** column in the form's grid. Only the first line corresponding to the transaction's header has the **Created On** column value filled.

## Journal Transactions

NOTES ACTIVITIES FILES NOTIFICATIONS CUSTOMIZATION HELP ▾

SAVE & CLOSE   +    < > >> RELEASE ACTIONS ▾ REPORTS ▾

Module:	CA 	* Branch:	PRODWHOLE - Products Wholesale	Type:	Normal
Batch Number:	CA000154 	* Ledger:	ACTUAL - Actual Ledger	Orig. Batch Number:	
Status:	Posted	Currency:	USD 1.00  VIEW BASE	Debit Total:	5.00
	<input type="checkbox"/> Hold	<input type="checkbox"/> Auto Reversing	<input type="checkbox"/> Reversing Entry	Credit Total:	5.00
* Transaction D...	2/26/2019				
* Post Period:	02-2019				
Description:	This is test				

 +   VIEW SOURCE DOCUMENT RECLASSIFICATION HISTORY   





		* Branch	Created On	* Account	Description	* Subaccount	Project/Con	Project Task	Ref. Number
>		PRODWHOLE	2/26/2019	10200	Company Checking Account - HQ	000-000	X		000159
		PRODWHOLE		61100	Bank Service Charges	000-000	X		000159

Figure: The customized Journal Transactions form



: You can use the same approach to customize the process of releasing AP and AR documents.