

# Scripts and .Net Framework

See ["Namespaces"](#) for the complete programming reference on runtime objects.

All programming in the FactoryStudio application consists of C# or Visual Basic 100% managed code designed to run in the Microsoft .NET framework. Users may create scripts in these languages that are run periodically or when specified events occur. The following sections describe how to create and work with these scripts:

### On this page:

- [Configuring Tasks](#)
- [Configuring Classes](#)
- [Working with the Code Editor](#)
- [Configuring Expressions](#)
- [The Script Namespace](#)



When you are using the code editor, the system constantly compiles the code in the background. You can also build the whole project, as needed. For more information, see ["Running the Application"](#).

For more information about the runtime objects included in FactoryStudio, see the [RuntimeObjects.pdf](#)

Two .Net libraries are available for use with FactoryStudio:

- The internal scripting has built-in methods that you can call using TK.<methodName>. For more information about these methods, see the Toolkits section [Toolkits.html](#). If you use Microsoft Visual Studio, a library is available for use with FactoryStudio. For more information about this library, see the the Toolkits section [Toolkits.html](#).

## Configuring Tasks

Tasks are program units, written in VB.Net or C#, that execute either when a trigger event occurs or periodically at specified intervals. FactoryStudio includes the following built-in tasks:

- **ServerStartup**—Executed when the project starts running. Runs on the server (computer running TServer.exe).
- **ServerShutdown**—Executed when the project shuts down. Runs on the server.
- **ClientStartup**—Executed on each client when the Displays module (TVisualizer.exe) starts running.
- **ClientShutdown**—Executed on each client when the Displays module closes.

### To configure tasks:

- Go to **Edit > Scripts > Tasks**.
- Select a task name, or select the insert row (first row) to create a new task.
- Enter or select information, as needed.

Column	Description
Name	Enter a name for the task. The system lets you know if the name is not valid.
Code	Read-only. This specifies the language used for the code for this task. By default this is the language selected when you created the project. From the Code Editor tab, you can change the code language. To change the project default, go to <b>Info &gt; Settings</b> .
Trigger	Enter or select the event (tag or other object) that should trigger the task execution, if any. The task executes when the value of the object changes.
Period	Enter the time interval that should occur between executions of the task, if there is no trigger.

Domain	Select where the script executes: <ul style="list-style-type: none"> <li>Client—Task executes on each client system. These are tasks that apply locally (on the user's computer), for example, report generation.</li> <li>Server—Task executes on the server system. These are tasks that apply across the application, that is, globally.</li> </ul>
InitialState	Select the task's initial state: <ul style="list-style-type: none"> <li>Enabled—Task is ready to run.</li> <li>Disabled—Task is not ready to run. You may enable the task under specific conditions.</li> </ul>
BuildStatus	Read-only. Status of the task code from the continuous compiling process. <ul style="list-style-type: none"> <li>Green check mark—Task runs without errors.</li> <li>Red X—Task has warnings or errors. Double-click to go to the warning or error. Warnings are information only. Errors will prevent the code from running, but only that specific task. The rest of the application will run.</li> </ul>
BuildErrors	Read-only. Displays any errors encountered during the last build.
EditSecurity	Set the security to enable who can edit the tasks
Description	Enter a description of this task.
[Other columns]	For definitions of other columns that are available in this table, see <a href="#">"Common Column Definitions"</a> .

- Double-click the row to access the Code Editor tab. You can now enter or edit the code for the task. See ["Working with the Code Editor"](#) below.
- Click **Save**.

## Configuring Classes

Classes let you create a repository of class libraries, methods, and functions that you can use across the application. You can call them from tasks, other classes, and displays (code behind).

FactoryStudio comes with the following built-in classes:

- ServerMain—Methods library available for all server tasks.
- ClientMain—Methods library available for all clients.

**To configure classes:**

- Go to **Edit > Scripts > Classes**.
- Select a class name, or select the insert row (first row) to create a new class.
- Enter or select information, as needed.

Column	Description
Name	Enter a name for the class. The system lets you know if the name is not valid.
Code	Read-only. This specifies the language used for the code for this task. By default this is the language selected when you created the project. From the Code Editor tab, you can change the code language. To change the project default, go to <b>Info &gt; Settings</b> .

Domain	Select where the class executes: <ul style="list-style-type: none"> <li>• Client—Class executes on each client system. These are classes that apply locally (on the user's computer), for example, report generation.</li> <li>• Server—Class executes on the server system. These are classes that apply across the application, that is, globally.]</li> </ul>
Content	Read-only. Show the type of the content in the class (i.e.: method or namespace)
EditSecurity	Set the security to enable who can edit the tasks
BuildOrder	Set the order to build the classes
BuildStatus	Read-only. Status of the class code from the continuous compiling process. <ul style="list-style-type: none"> <li>• Green check mark—Class runs without errors.</li> <li>• Red X—Class has warnings or errors. Double-click to go to the warning or error. Warnings are information only. Errors will prevent the code from running, but only that specific class. The rest of the application will run.]</li> </ul>
BuildErrors	Read-only. Displays any errors encountered during the last build.
Description	Enter a description of this class.
[Other columns]	For definitions of other columns that are available in this table, see <a href="#">"Common Column Definitions"</a> .

- Double-click the row to access the Code Editor tab. You can now enter or edit the code for the class. See "Working with the Code Editor" below.
- Apply all namespaces that will be used in your code, e.g.
  - "Using System"
  - "System.IO.StreamReader"
- Click Save.

## Working with the Code Editor

### Editing Code

You can write code in either standard VB.Net or C#. You can also switch between the two. If you change your language selection in the code editor, the system automatically converts existing code to the selected language.

If you need references to your own assemblies, you can use Run > Build > References.

As a fully compliant .NET application, you can find free source code to use, including .NET components, products, and libraries, plus your own libraries that you can use right away.

FactoryStudio does expose many .NET libraries to the application, but there are a few methods that are very frequently required, such as type conversion or copying tags to DataTables or .NET objects, or dynamically changing the communication settings. Those methods are included in a library toolkit. To use those methods, you just need to put TK. in the code editor. Intellisense will respond with a list of all available methods, and provide summary documentation of any method you select.



#### Example

```
double x = TK.ConvertTo<double>("123");
```

To edit code:

- Go to **Edit > Scripts > CodeEditor**.
- From the drop-down list in the main toolbar, select the task or class you want to edit. To create a new task or class, see ["Configuring Tasks"](#) or ["Configuring Classes"](#) earlier in this chapter.
- If needed, from the code editor toolbar, select a different code language.
- You can also format your code to be more readable. To do so, click on Auto Format. A prompt will appear; click "OK".
- Click **Save**.

## Using the .NET Debugger

### *Creating debugger Information*

FactoryStudio has an integrated .NET code debugger. In order to use it, it is necessary that the local computer has cache files with the necessary files to run the debugger. The steps to enable the debugger are:

- Enable the Debug Information on **Run > Build > Messages**
- As necessary, save the source code you want to debug again, so the debug information is created. This step is only necessary the first time you open the project on the computer, as after that, the background compiling will keep generating the necessary debugging information to enable the use of breakpoints and step execution.

### *Attaching the .NET debugger*

In order to have a .NET debugging session, the engineering environment must be connected with the runtime and the .NET debugger attached to server or client process. Follow these steps.

- When Running the project, either on **Run > Test** or **Run > Startup** enable the connect check box.
- If the project is already running, you can go to **Run >Test** or **Run > Startup**, according to the runtime you want to attach, and connect to the runtime system by pressing the connect button on those pages.
- Open any script that has debugging information and press the Attach .NET debugger button. A message on the bottom of the engineering workspace will show that a debugging session is active with the server components or the client components of the running project.
- When the .NET debugger is attached the system will stop on the defined breakpoints and it will also stop automatically when any .NET Exception occurs.

### *Breakpoints, Steps and Watch*

In order to setup a breakpoint, open the desired code, select the line and press Insert Breakpoint on the toolbar.

When the system stops on a breakpoint you can perform step by step execution or hit the continue button.

In order to inspect local .NET variables, tags or project objects, you can select the text in the script editor and, when the execution is stopped on a breakpoint, the toolkit will show the current value of the variable.

You can also add .NET variables or project objects to the Watch window. When adding tags or project objects, you need to use the @ symbols, example @tag.tag1, so the system knows it is a project object, not a local .NET variable. Keep in mind the Watch display is only updated when execution is stopped. If you want to have real-time values for tags and objects you can open the PropertyWatch diagnostics tool.

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## Configuring Expressions

Besides the **Edit > Script > Expressions** table, you can use expressions in several other places in FactoryStudio, using the same syntax described here, to determine a value or to configure a condition.

Expressions are just plain VB.Net expressions, such as arithmetic expressions or calls to script.class methods from the project. Intellisense only shows tags and application objects, but the expressions are compiled using the standard VB.Net compiler, so what you would write in the code editor, should be accepted in expressions as well.

FactoryStudio implements some automated replacements, such as == to =, so the syntax of an expression is very close to that of a C# statement, but with no need to add the ";" on the end.

In this way, both VB.Net and C# programmers are able to use the expression fields seamlessly.

In expressions, you do not need to put @ before tag names. You need the @ in the code editor to differentiate project tags from .NET variables. However, expressions do not have local .NET variables, so you use the project object directly.

For arithmetic operands, you can use the standard operands as described in the .NET documentation.

To allow single-line evaluations, the .NET language has the IIF command, which currently is used only with VB.Net. The IIF command has three parameters.



### Example

IIF (A, B, C)

The first parameter is a condition. That method will return B if condition A is true, and it returns C if the condition is false.



### Example

IIF (tag.A = 1, "True", "False") will return the string "True" if the value of tag.A is 1, or "False" if tag.A has a different value.

In this .NET method, all three parameters are evaluated independent of the condition. For instance, if you have IIF (tag.A = 1, script.class.client.Func1(), script.class.client.Func2()), both Func1 and Func2 will always be executed. Only the return value will be different based on the value of tag.A.

The IF or IIF methods need to evaluate the parameters before calling the method. There are many scenarios where you want to execute only the function according the value. For that scenario FactoryStudio has a method called TIF, which has that behavior.

So, you use the expression:

```
TIF (tag.A = 1, script.class.client.Func1(), script.class.client.Func2())
```

Only the Func1() or Func2() will be executed, according the value of Tag.A

The TIF method is defined in the class library that is automatically exposed for expressions that are in the toolkit function library.

For more complex calculations, you can call a class that you create on the Classes tab. See "Configuring Classes" earlier in this chapter.

**To configure expressions:**

- Go to **Edit > Scripts > Expressions**.
- Select an expression, or select the insert row (first row) to create a new expression.
- Enter or select information, as needed.

Column	Description
Object	Select an existing tag or object.
Expression	Enter the expression. The expression can be a basic mathematical expression, use a class, or be a conditional expression.
Domain	Select where the expression executes: <ul style="list-style-type: none"><li>• Client—Expression executes on each client system. These are expressions that apply locally (on the user's computer), for example, report generation.</li><li>• Server—Expression executes on the server system. These are expressions that apply across the application, that is, globally.]</li></ul>
Execution	Select when the expression executes: <ul style="list-style-type: none"><li>• OnChange—The expression executes when the value of any tag in the expression changes.</li><li>• TriggerOrTimeInterval—The expression executes when the trigger event occurs or when the interval set in the Period elapses.</li><li>• ChangeOrStartup—The expression executes when the value of any tag in the expression changes or at startup.</li><li>• TriggerOrTimeOfDay - The expression executes when trigger event occurs or on a specific time of day</li></ul>
Trigger	Enter or select the tag or object that triggers the expression execution. The expression executes when the value of the object changes.
DisableCondition	Enter or select the tag or object that disables the expression execution.
Time	Specify the time when the expression will run
Label	Set a label to the specified class
BuildMessages	Return the message status after the expression runs
BuildStatus	Read-only. Set after you click <b>Verify</b> . <ul style="list-style-type: none"><li>• Green check mark—Expression runs without errors.</li><li>• Red X—Expression has errors.</li></ul>
BuildErrors	Read-only. Displays any errors encountered during the last build.
[Other columns]	For definitions of other columns that are available in this table, see " <a href="#">Common Column Definitions</a> ".

- Click **Verify** to check the validity of the expression.

## The Script Namespace

The namespace **Script** is the entry point to all objects related to the Scripts module.

The **Script.Task** object lists all configured database connections and their runtime properties.

The **Script.Class** object lists all configured tables and its runtime properties.

See "[Namespaces](#)" for the complete programming reference on runtime objects.