Integration Objects'

Solution for Real Time Process Data Calculation

OPC Calculation Engine
Version 1.0 Rev.0

USER GUIDE

OPC Compatibility
OPC Data Access 1.0A
OPC Data Access 2.00
OPC Data Access 2.05a
OPC Data Access 3.00

OPC Calculation Engine User Guide Version 1.0 Rev .0
Published June 2016

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PREFACE

ABOUT THIS USER GUIDE

This user guide:

- Describes the main features of the OPC Calculation Engine,
- Lists the system requirements for installing and running the OPC Calculation Engine solution,
- And explains how to run, configure, and use the OPC Calculation Engine application.

TARGET AUDIENCE

This document is intended for any potential users of Integration Objects' OPC Calculation Engine. Basic knowledge of OPC DA (Data Access) specifications is assumed.

DOCUMENT CONVENTIONS

Convention	Description
`Monospaced type`	Indicates a file reference
Bold	Click/selection action required
	Information to be noted

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INTRODUCTION

1. Overview

Based on Microsoft's OLE/COM technology, OPC is an industrial communication standard that enables production facilities to easily transfer data between their various processes and applications. The OPC DA specification enables reliable reading of real-time data. Manufacturers need to manipulate the OPC data to get the needed results. However, the use of OPC data to derive other data in real time is at the same time an important and delicate task.

Integration Objects' OPC Calculation Engine is a powerful OPC client that allows you to configure and perform multithreaded calculations based on OPC tag values collected from the OPC DA servers available in the network. It reduces the complexity of calculations, offers an easy way to update the calculations, and enables the user to write the calculations' results to any OPC server or save them in a relational database.

2. Architecture

The following diagram illustrates the OPC Calculation Engine typical system architecture. It communicates with the available OPC DA Servers connected to the network, and then parses and calculates all operations in the OPC Calculation Engine service.

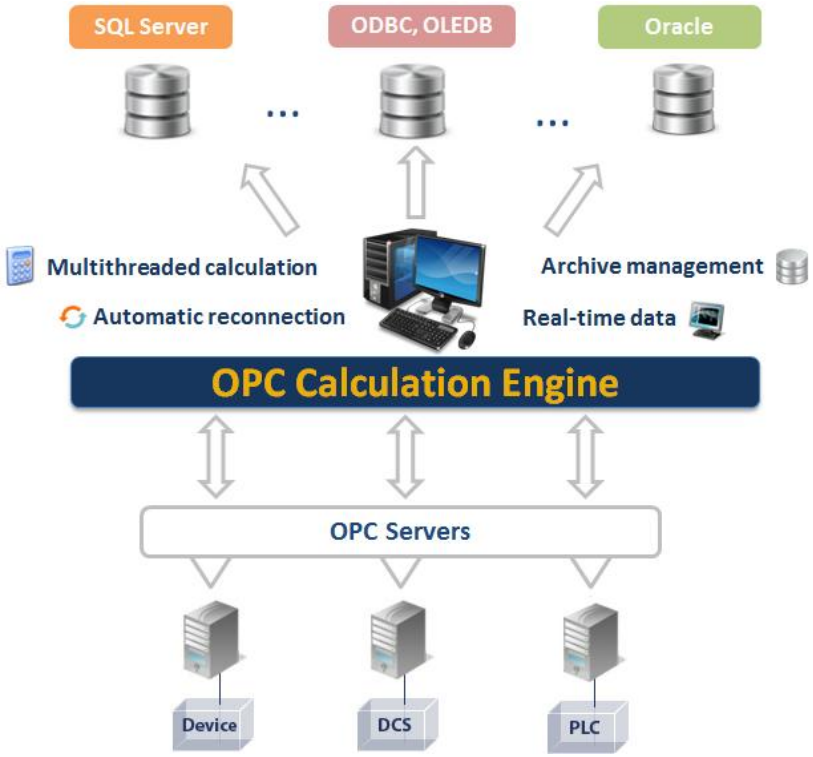

Figure 1: OPC Calculation Engine Architecture

Calculation results are also sent to the specified OPC DA Servers already available in the connection list.

3. Features

The Integration Objects' OPC Calculation Engine features include:

- **Real-time Process Data Calculation**
  Integration Objects' OPC Calculation Engine calculates, in real-time, calculation operations in which operands could be values of OPC DA Items. OPC Calculation Engine supports mathematical and arithmetic operations such as summation, multiplication, exponentiation, average and trigonometric functions, etc.

- **Windows Service Calculator**
  The calculations are executed by a Windows service running in the background, thus guaranteeing continuous data calculation.

- **Intuitive User Interface**
  With its user-friendly interface, the OPC Calculation Engine's graphical user interface enables users to easily configure, save, and load calculation operations without any programming effort.

- **Open Architecture**
  The calculated data are exposed through OPC DA servers.

- **Log Capabilities**
  The application records messages in log files using different logging levels. This enables the end-user to track the execution and diagnose any encountered problems.

- **Archiving Capabilities**
  The OPC Calculation Engine supports archiving real-time calculated data into the following databases: SQL Server databases, Oracle Databases, MS Access Databases, OLEDDB databases and ODBC databases.

4. Operating Systems Compatibility

The OPC Calculation Engine supports the following operating systems:

- Windows 10
- Windows 8
- Windows 7 (32 and 64 bits)
- Windows Server 2012
- Windows Server 2008 (32 and 64 bits)

5. OPC Compatibility

The OPC Calculation Engine supports the following OPC DA standard versions:

- OPC Data Access 1.0a
- OPC Data Access 2.00
- OPC Data Access 2.05a
- OPC Data Access 3.00

6. System Requirements

The following are the minimum requirements to run the OPC Calculation Engine:

	Description
Processor	1 GHz (higher recommended)
RAM	1 GB (higher recommended)
Disk Space	500 MB hard disk space for full installation

Table 1: System Requirements

GETTING STARTED

1. Pre-Installation Considerations

In order to properly run the OPC Calculation Engine, the following software components need to be installed on the target system:

- The OPC core components 3.00, which consist of all shared OPC modules including the DCOM proxy/stub libraries, the OPC Server Enumerator, .NET wrappers, etc.
- .NET Framework version 4.0 or higher.

Also, make sure there is no firewall or antivirus blocking the application.

The table below lists the prerequisites to communicate with databases per feature:

Feature	Database Connector Pre-requisite
Oracle	Requires Oracle Data Access Component for Oracle Client (ODAC)
MS Access	Requires the Office OLEDB Driver
MS SQL Server	No pre-requisites need to be installed
MySQL	No pre-requisites need to be installed
ODBC	
Oracle	Requires ODAC. ODAC must have the same version as your Oracle database.
MS SQL Server	Requires Microsoft ODBC Driver for SQL Server
Excel / MS Access	Requires Microsoft Access Database Engine
MySQL	Requires MySQL Connector/ODBC.
OLEDB	
Oracle	Requires ODAC. ODAC includes the Oracle Provider for OLE DB.
MS SQL Server	Requires Microsoft OLE DB Provider for SQL Server
Excel / MS Access	Requires Microsoft Access Database Engine

Table 2: Database Connector Pre-requisites

2. Installing and Running

To install the OPC Calculation Engine application:

Double-click on the **Integration Objects' OPC Calculation Engine installation package**. The installation welcome dialog box will appear.

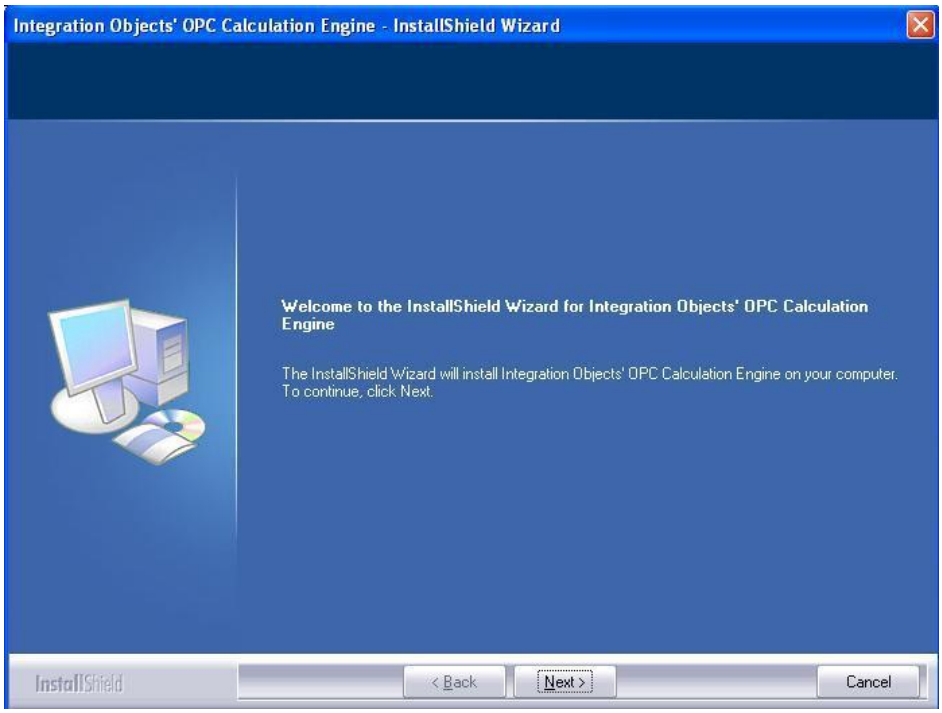

Figure 2: Installation Welcome Dialog Box

Click the **Next** button. The license agreement will be displayed.

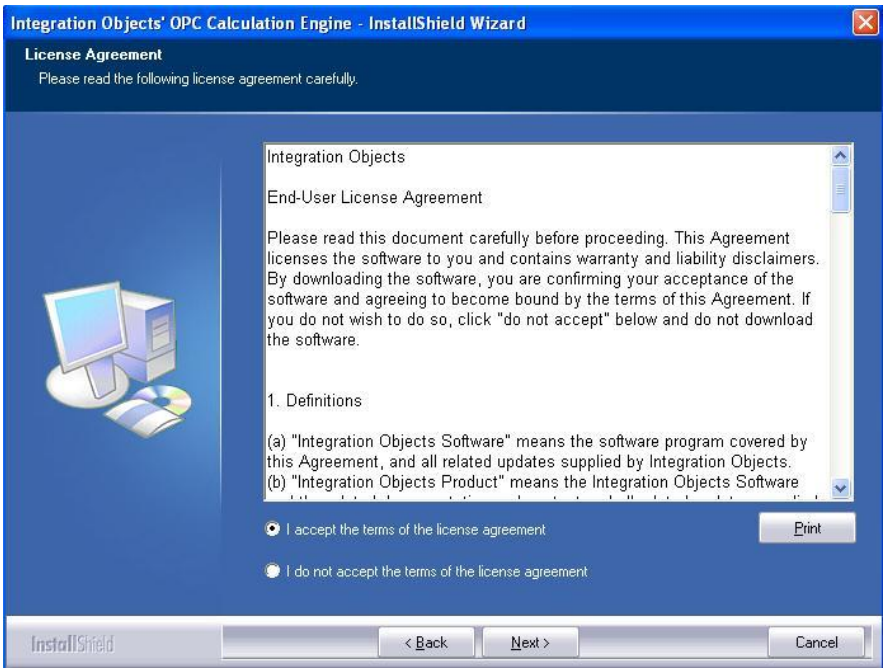

Figure 3: License Agreement Dialog Box

After reading the license agreement and accepting all its terms, click the **Next** button. The customer information dialog box will appear.

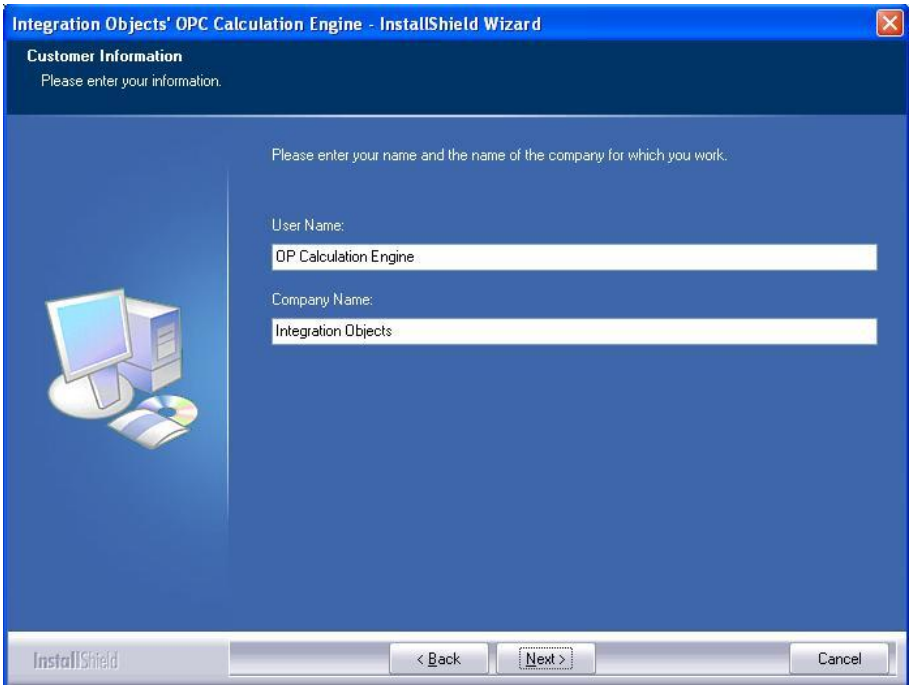

Figure 4: Customer Information Dialog Box

Add the user name and the company name and then click the **Next** button. The dialog box for choosing the destination folder will be displayed.

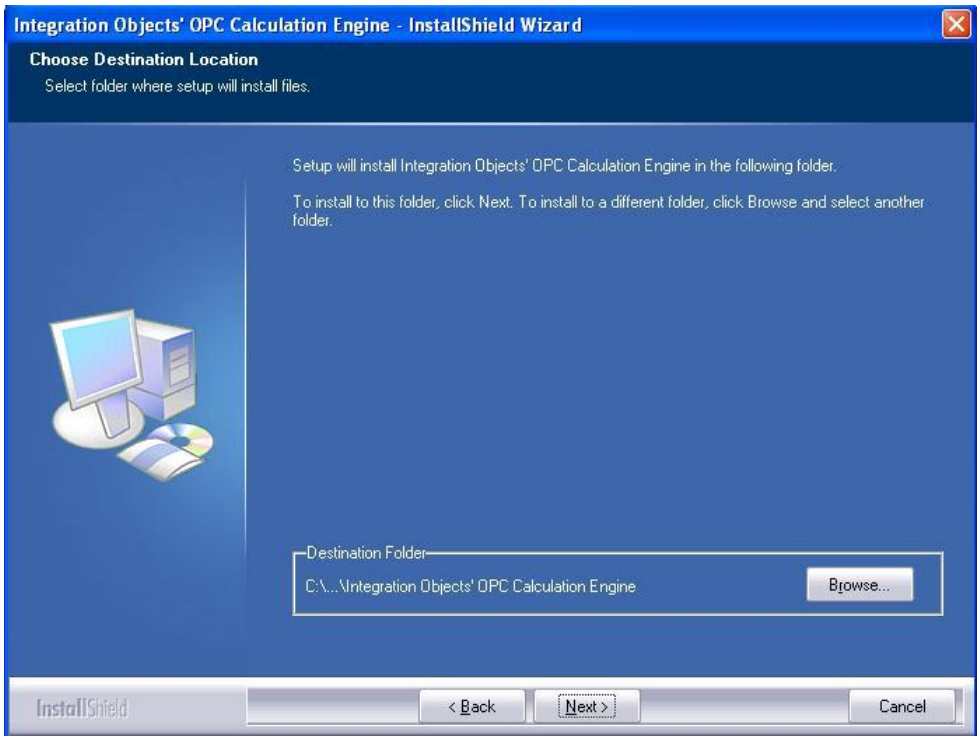

Figure 5: Choose Destination Folder Dialog Box

Click the **Next** button to continue with the chosen installation path, or the **Browse** button to select a different destination folder. The installation dialog box will then appear.

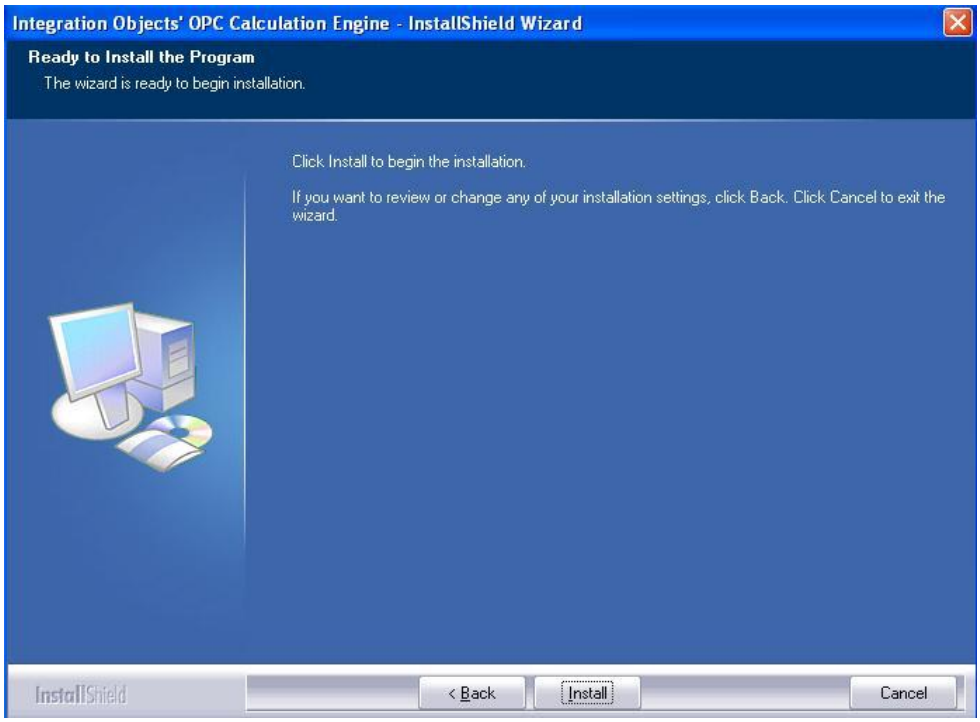

Figure 6: Installation Dialog Box

Click the **Install** button to start installation.

The setup will, then, copy the necessary files to the chosen target folder, create shortcut icon to launch the OPC Calculation Engine GUI from the Start menu and the desktop and make an un-installation entry in the Add/Remove Programs in the Control Panel.

The Installation Complete dialog box will then be displayed.

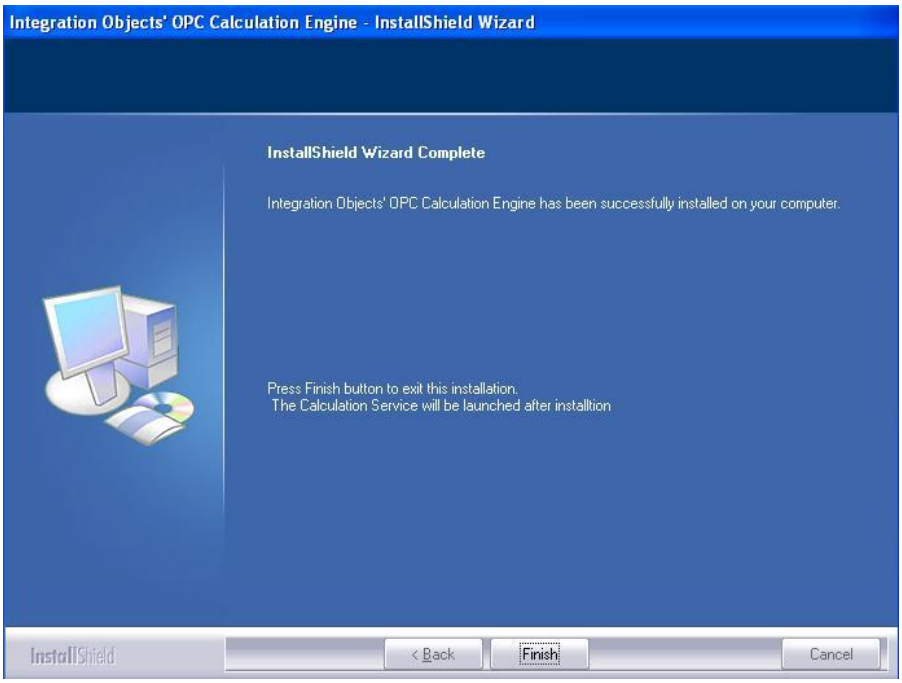

Figure 7: Installation Completed Dialog Box

3. Starting-up

The OPC Calculation Engine can be started manually from the OPC Calculation Engine's shortcut in the start menu. This will start the graphical user interface and consequently the service if it is not already running.

To do so, click on Start ➔ Programs ➔ Integration Objects ➔ OPC Calculation Engine ➔ Calculation Engine

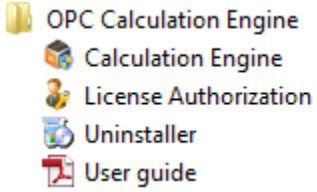

Figure 8: Starting the OPC Calculation Engine User Interface

4. Removing the OPC Calculation Engine

To uninstall the OPC Calculation Engine, follow the steps below:

1. Click the **Uninstaller** shortcut icon available in the start menu, as illustrated below.

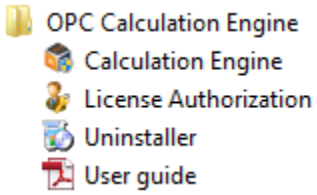

Figure 9: Uninstaller Icon in the Start Menu

The following dialog box will appear:

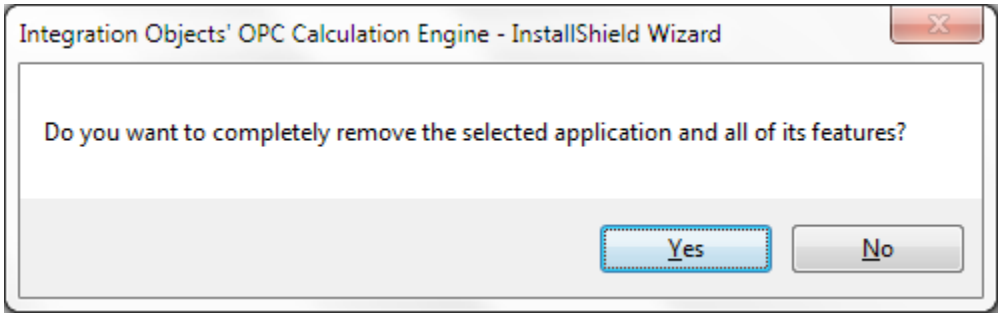

Figure 10: OPC Calculation Engine Uninstall Confirmation

2. Click the **Yes** button to start the uninstallation.

3. The wizard will then take you through the removal steps. At the end, click **Finish** when the un-installation is complete.

The OPC Calculation Engine can also be manually removed as follows:

1. Go to the **Control Panel**.
2. Click **Add/Remove Programs**.
3. In the Add/Remove Programs dialog screen, select **Integration Objects' OPC Calculation Engine**.
4. Click **Change/Remove** then **OK**.

USING OPC CALCULATION ENGINE

In this section, you will find an overview of the OPC Calculation Engine user interface as well as the steps required to configure and use the application.

1. Main Interface Overview

The OPC Calculation Engine user interface allows you to connect to multiple OPC Servers and configure the calculation operations.

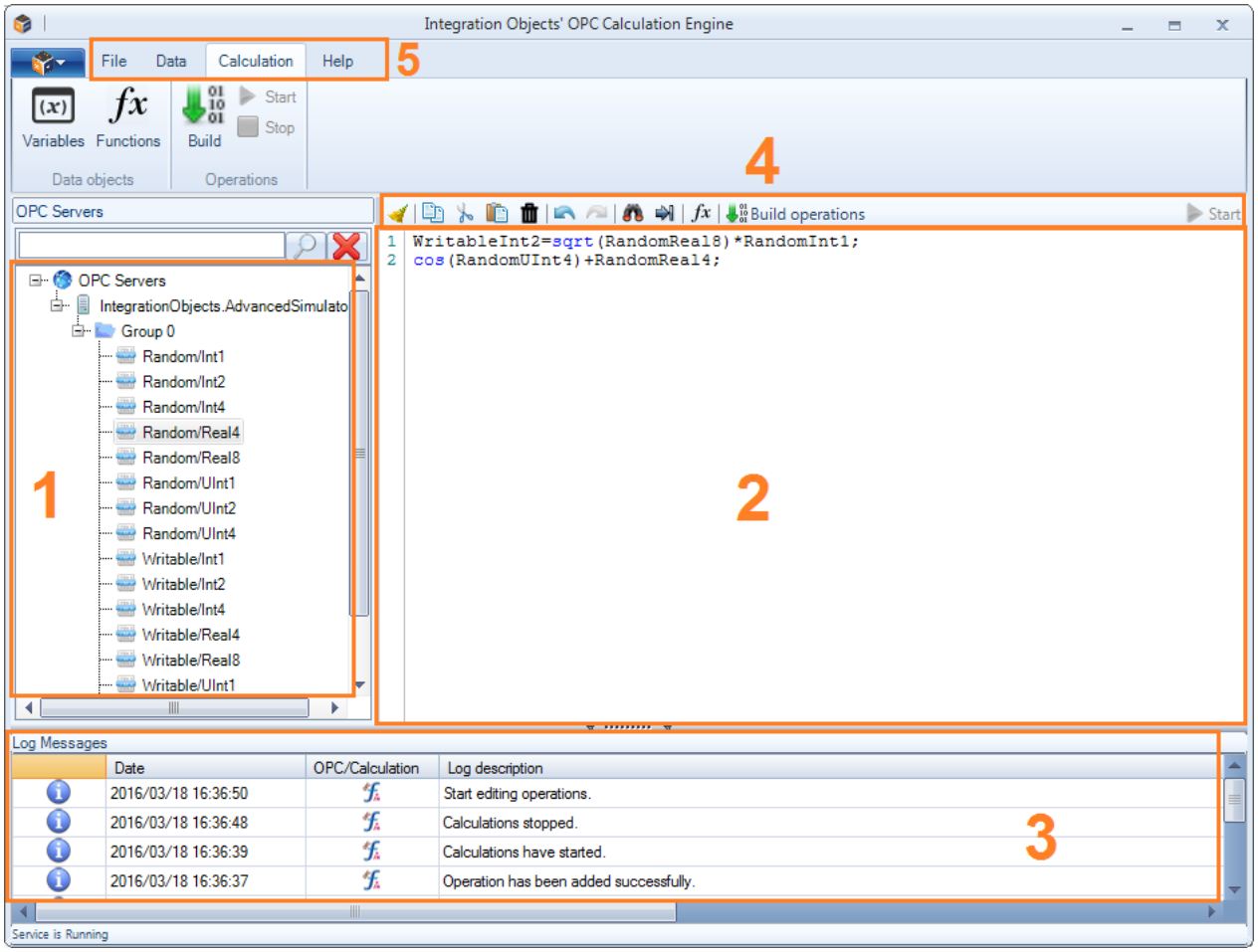

Figure 11: OPC Calculation Engine Main View

There are five parts in the main user interface, as highlighted above:

- OPC servers list (1): This part is a tree browser displaying the connected OPC servers, the groups and items.
- Operation editor (2): In this part, you can configure the calculation operations and check results.
- Log messages browser (3): This part displays log messages. The most recent messages are displayed at the top of the messages list.
- Operation toolbar (4): In this part, different buttons are available to help users edit the operations.
- Menu bar (5): This part contains File menu, Data menu, Calculation menu and Help menu. These menus provide access to functions that help the user interact with the application.

When launching the OPC Calculation Engine, a new empty configuration will be automatically created**.**

2. Start Menu

2.1. Overview

Click on the top left button to open the start menu as shown below:

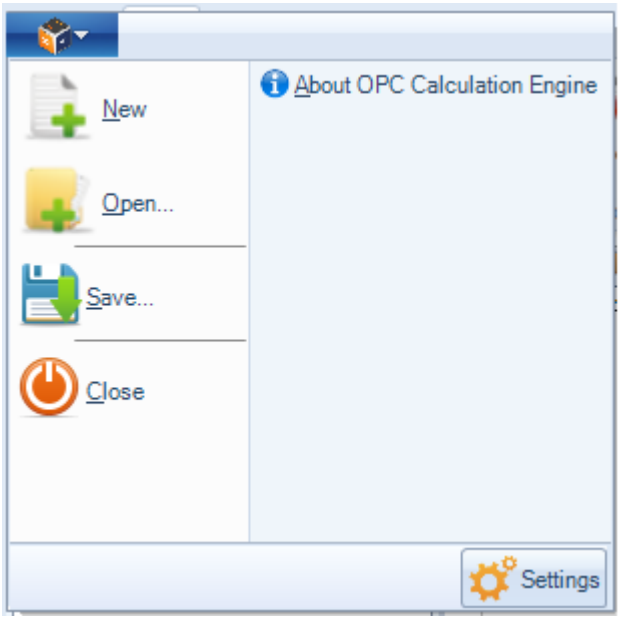

Figure 12: Start Menu

Using the start menu, you can**:**

- **New** - Create a new project by hitting the **New** button.

- **Open** - Open an existing configuration by clicking "Open" and selecting the appropriate ".oce" configuration file.
- **Save** - Save your current configuration by clicking **Save**.
- **Close** - Close the application using the **Close button**.
- **About OPC Calculation Engine** - View the about information.
- **Settings** - Check and edit the current settings using the **Settings** button. As illustrated in the figure below, the user can:
    - Enable user authentication when opening the interface
    - Change the user interface theme
    - Configure the log parameters

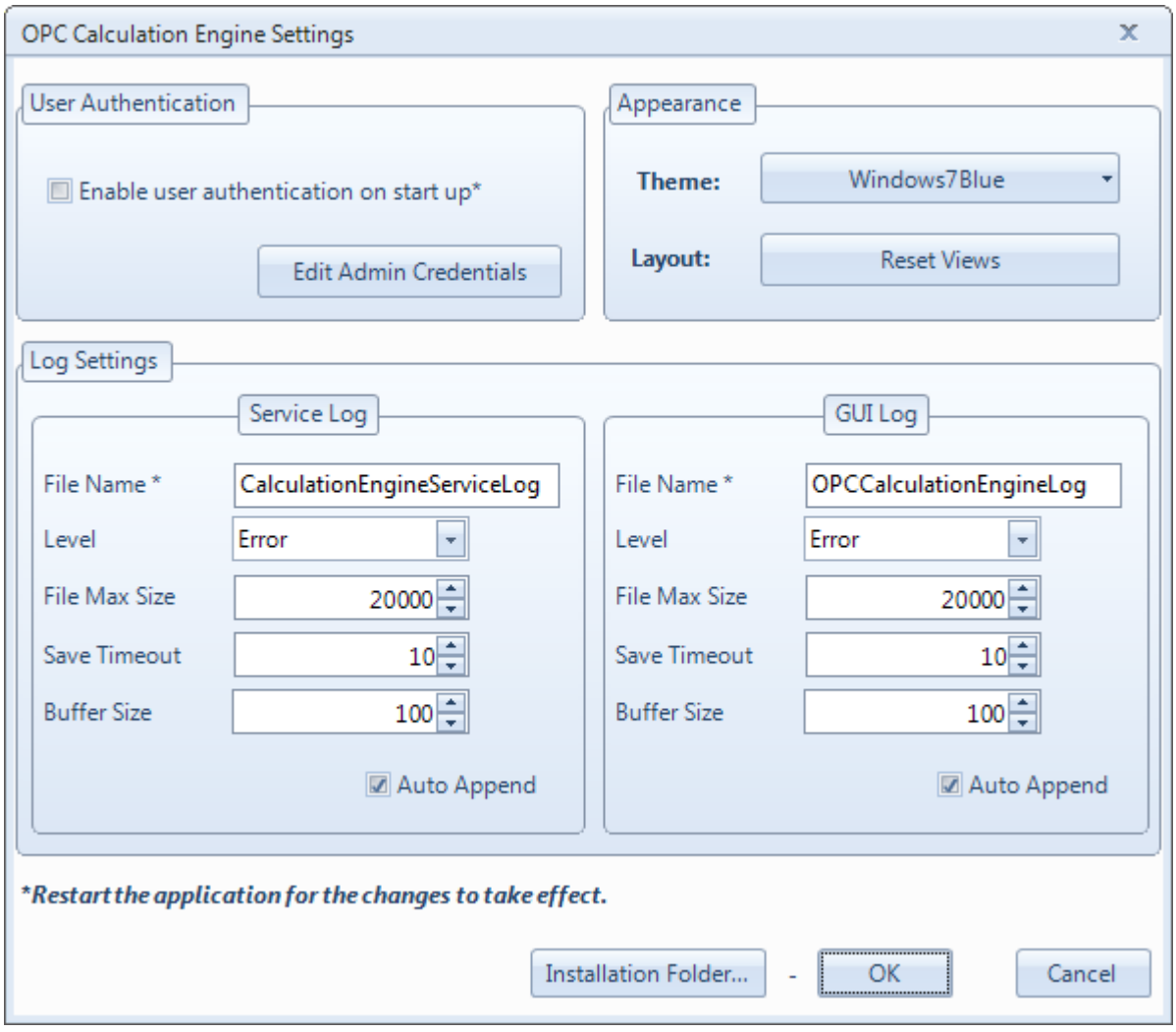

Figure 13: OPC Calculation Engine Settings

2.2. Managing Administrator Account

2.2.1. Login into OPC Calculation Engine

When starting the application, if the user had enabled the user authentication feature, the OPC Calculation Engine will ask for the login credentials.

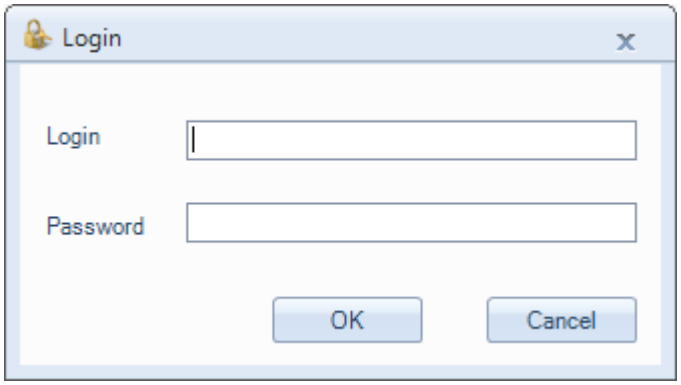

Figure 14: Login Window

The default login is:

- Login: OCEAdmin
- Password: OCE@2dmin

2.2.2. Edit Administrator Credentials

To edit your login credentials (user name and password), open the OPC Calculation Engine Settings, click **Edit Admin Credentials** and the following window will be displayed:

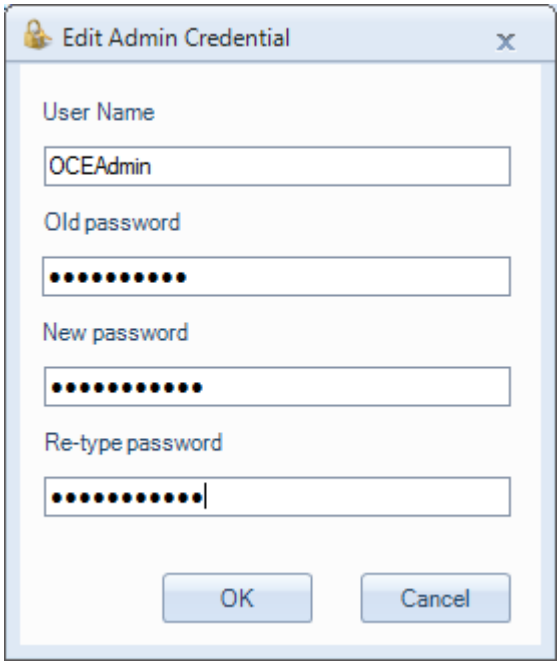

Figure 15: Edit Admin Credentials

It is recommended that users change the default password once they complete the installation.

3. File Menu

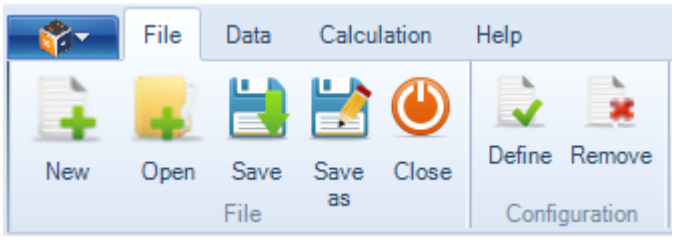

Figure 16: File Menu

Using the file menu, you can**:**

- Open an existing configuration by clicking **Open** and selecting the appropriate ".oce" configuration file.
- Save your current configuration by clicking **Save** or **Save As**.
- Close the application by clicking the **Close** button.
- Click the **Define** button to define the default configuration to be loaded automatically at the application start-up. It will prompt a file dialog screen. Select your saved configuration and then click the **OK** button.
- To remove the default configuration, click the **Remove** button.

4. OPC Functionalities

You can access to the different OPC functionalities using the Data menu available in the menu bar as illustrated below:

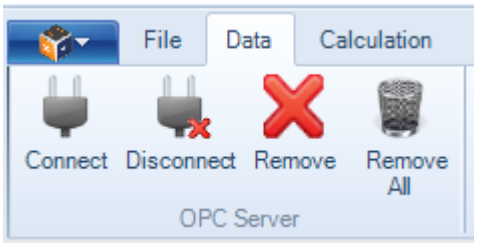

Figure 17: Data Menu Bar

4.1. OPC Servers Management

4.1.1. Add an OPC Connection

You can connect to different local and remote OPC DA servers by clicking the **Connect** button available in the Data menu or by right clicking the OPC Servers root node and selecting **Connect to OPC DA Server** as shown below.

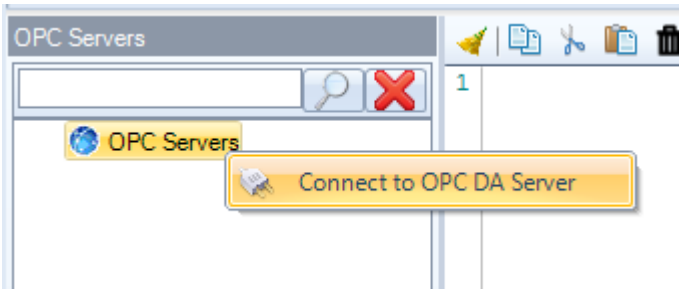

Figure 18: Connect to OPC DA Server

The connection dialog box is shown in the figure below:

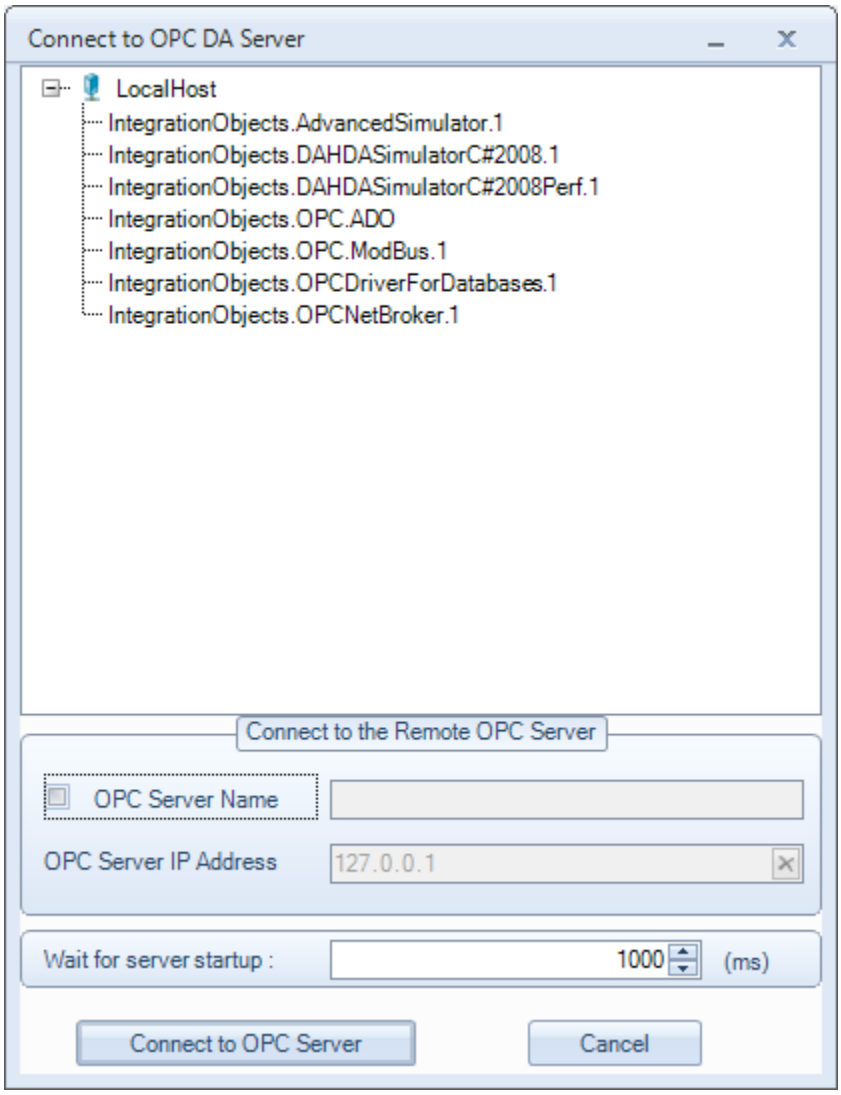

Figure 19: OPC Server Connection Dialog Box

You can either browse the list of the OPC DA servers available in your local machine, or manually enter:

- The Server name (ProgID) of your OPC DA server
- The IP Address of the machine that hosts this OPC Server.

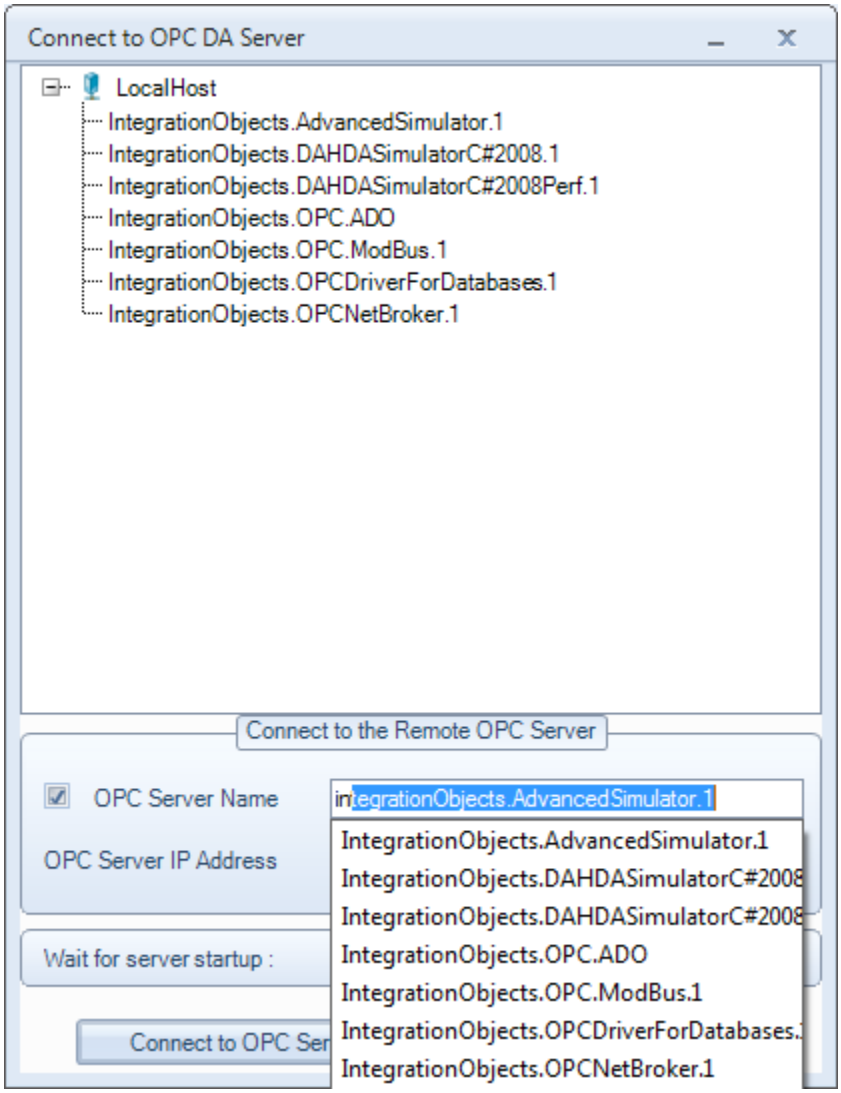

Figure 20: Enter the OPC Server Name

If the OPC connection succeeds, a new node representing the new connection will be added to the OPC Servers tree view.
Right click on any added server node and the following menu will be displayed.

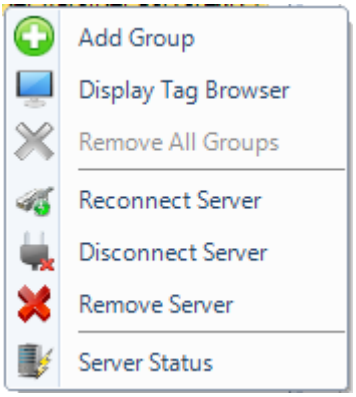

Figure 21: The OPC Server Context Menu

4.1.2. Delete an OPC Connection

To remove an OPC Server, click the **Remove Server** button in the server context menu. The OPC connection will be then released, and the selected server node and its children nodes will be consequently removed from the OPC Servers tree view.

4.1.3. Delete all OPC Connections

To remove all added OPC servers, click the **Remove All Servers** button on the menu bar or in the item's menu when you right click on the OPC Servers.

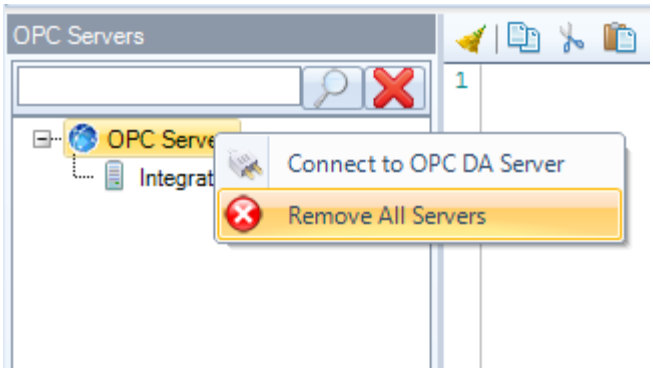

Figure 22: Remove All Servers

All servers nodes will be then deleted from the OPC Servers tree view and all OPC connections will be released.

4.1.4. View OPC Server Status

To view the OPC Server status, select your OPC server node, right click on it and select **Server Status** from the displayed menu.

The following dialog screen will appear:

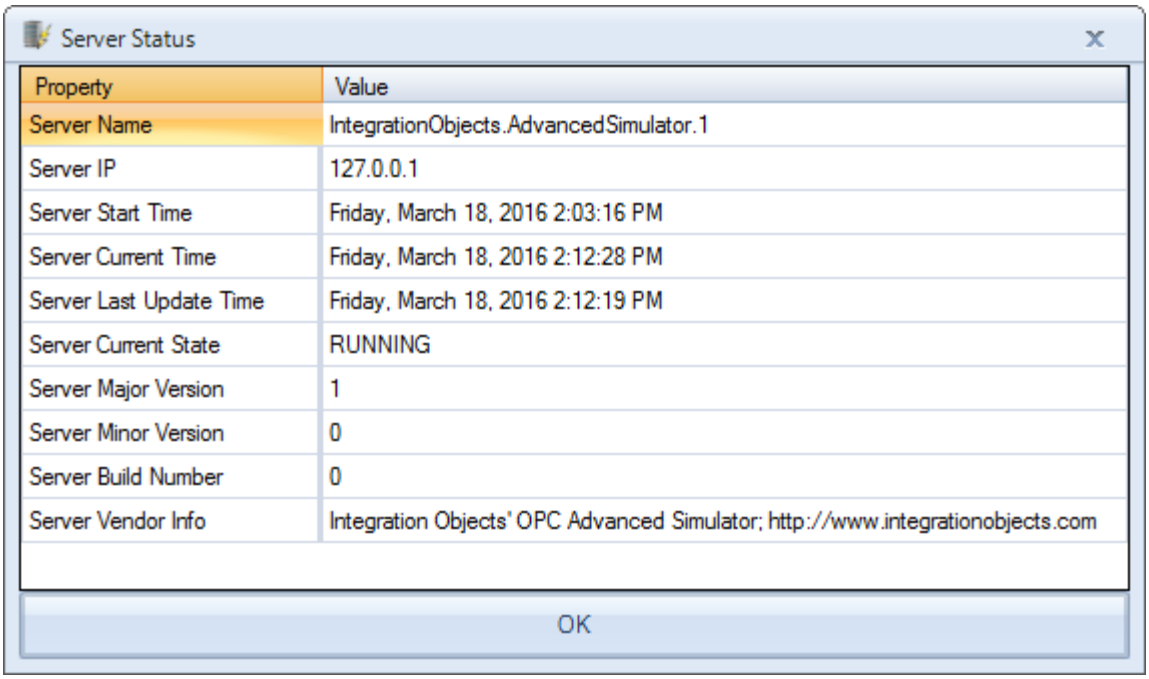

Figure 23: Server Status Dialog Screen

This screen provides you with the current status information of the selected OPC server.

4.1.5. Browse the OPC Server

You can browse the server address space (all branches and items) for any OPC DA Server that supports OPC DA browsing. To browse your OPC server, right click on your OPC server node and choose **Display Tag Browser** from the server context menu.

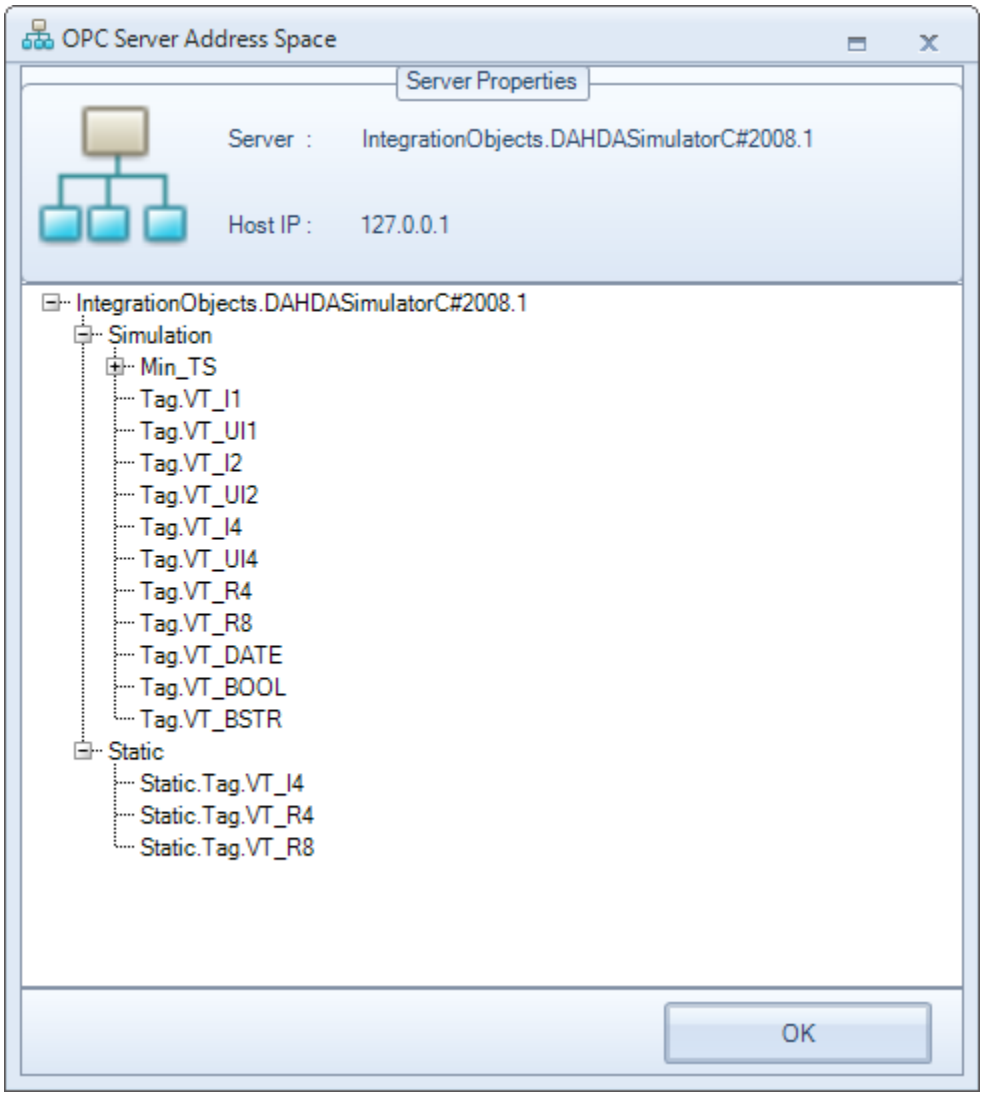

Figure 24: OPC Server Address Space

4.2. Add an OPC Group

To add a new OPC group to a connected OPC server, right click on the server node and select **Add Group** from the displayed menu.
The following dialog screen will appear:

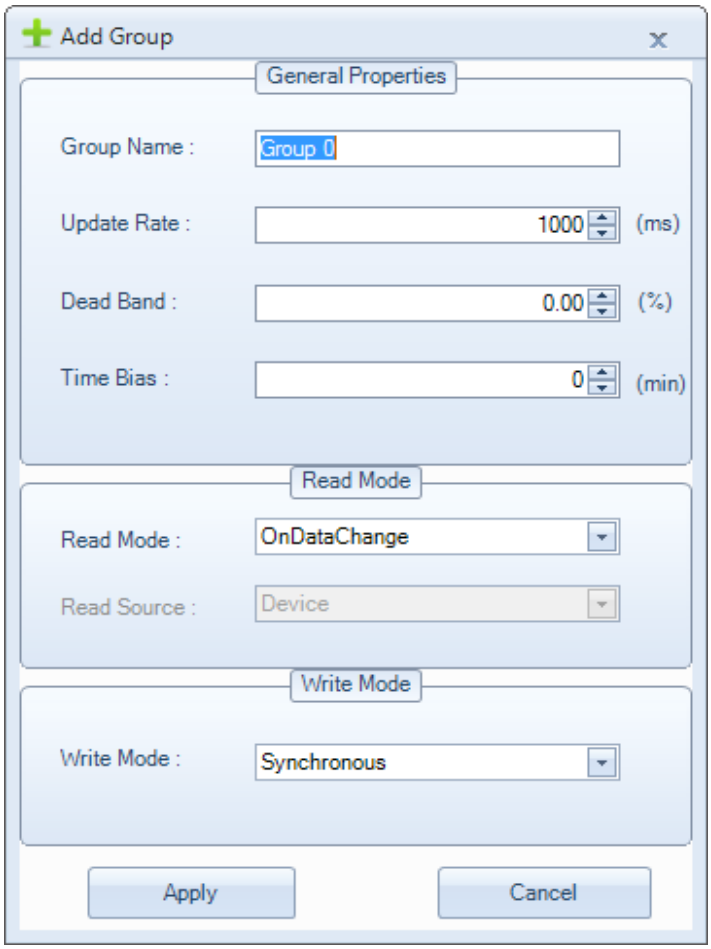

Figure 25: Add Group Dialog Box

General Properties

- **Group Name**: The name must be unique among the other groups already created in the OPC Server.
- **Update Rate**: specifies the fastest rate at which data changes for this group may be sent by the server. Passing 0 indicates that the server should use its fastest available update rate. The update rate is specified in milliseconds.
- **%Dead Band**: is the range through which the input may be varied without initiating a response. It specifies the change percentage in an item value that will cause a notification of this value to a client. Specifying a 0.0 value indicates that all changes are to be received.
- **Time Bias**: The purpose of the Time Bias is to indicate the time zone in which the data was collected. Enter 0 to use the default system Time Bias.

- **Read Mode:** indicates the read mode to be used for the group. We can distinguish three read modes:

  - ✓ **OnDataChange** (for OPC DA version 2.05 and higher)

  - ✓ **Synchronous:** allows a client to perform synchronous read requests to the OPC server. There are two types of read source:
    - DEVICE: reading data from the device
    - CACHE: reading data from the OPC Server cache

  - ✓ **Asynchronous (I/O 2.0):** allows a client to perform asynchronous read requests to an OPC DA version 2.0 or higher compliant server.

- **Write Mode:** indicates the write mode to be used for the group. We can distinguish two write modes:

  - ✓ **Synchronous:** allows the client to send synchronous write requests to the OPC server.

  - ✓ **Asynchronous (I/O 2.0):** allows the client to send asynchronous write requests to the OPC server (for OPC DA version 2.0 or higher).

4.3. OPC Group Management

Right click on the selected OPC Group node and the following context menu will be displayed.

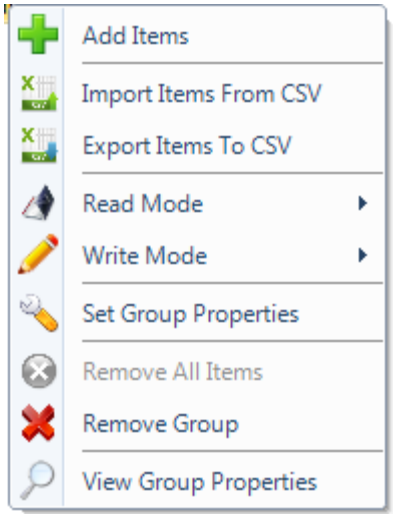

Figure 26: OPC Group Context Menu

4.3.1. Add OPC Items

To add OPC items to a group, click on **Add Items** context menu item. The **Add Items** window will be displayed. Then, drag and drop items from the left side items tree to the right side grid view and click the **Apply** button.

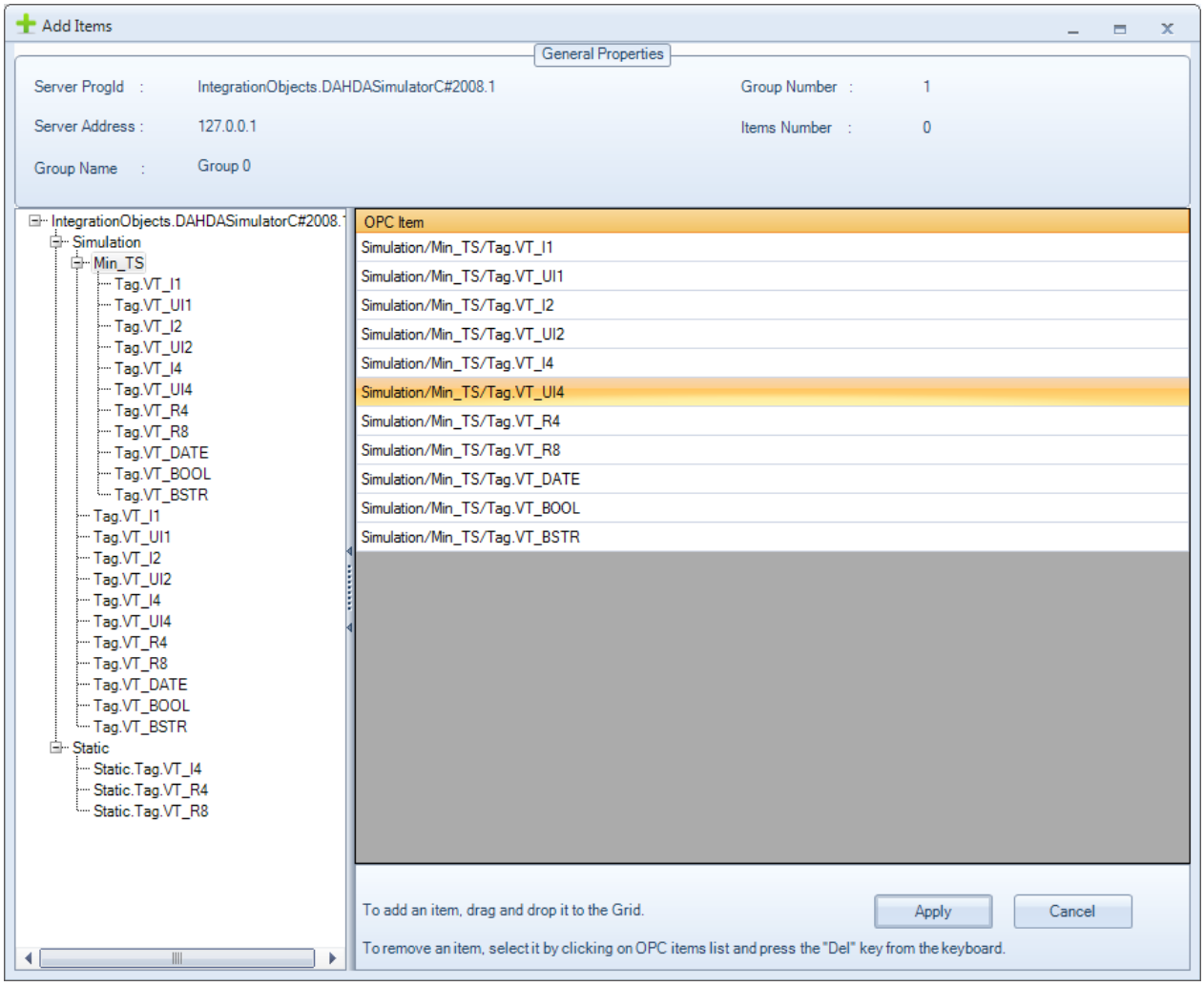

Figure 27: The Add Items Dialog Box

To add all items, you can drag and drop the branch node that contains the OPC Items to the grid view or right click on the node and press the **Add** menu item or select multiple tags using the mouse and the shift key in your keyboard. To remove items from the selected list, you can select multiple items using the shift key in your keyboard and delete them using the **Del** key or press the **Remove selected items** menu item.

4.3.2. Import Items from CSV

You can import a tags configuration from a CSV file using the **Import Items from CSV** button available in the group right click context menu. The CSV file should have the following format: Item ID, Item State and Item Data Type.

4.3.3. Export Items to CSV

You can export added tags into a CSV file using the **Export Items to CSV** option. The file will include all OPC tags with the following properties: Item ID, Item State, and Item Data Type.

4.3.4. Change the Read Mode

To change the read mode of the OPC group, click the **Read Mode** context menu item, you will have the list of available read mode as shown below.

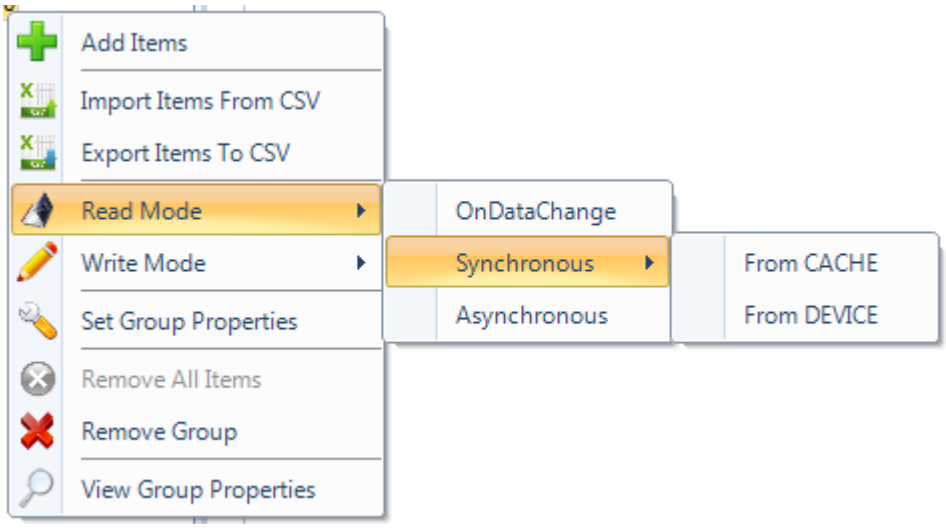

Figure 28: Group Read Mode

4.3.5. Change the Write Mode

To change the current group's write mode, click the **Write Mode** context menu item and select the new mode as shown below.

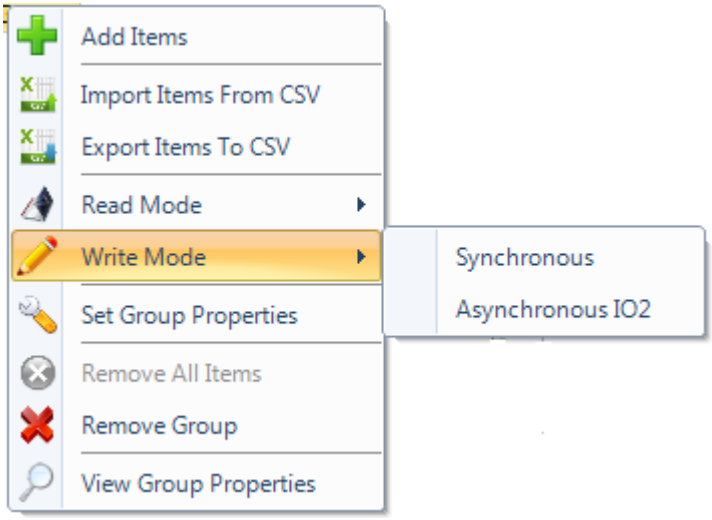

Figure 29 : Group Write Mode

4.3.6. Set Group Properties:

To change the properties of an OPC group, click on the **Set Group Properties** context menu item. The following dialog screen will be prompted:

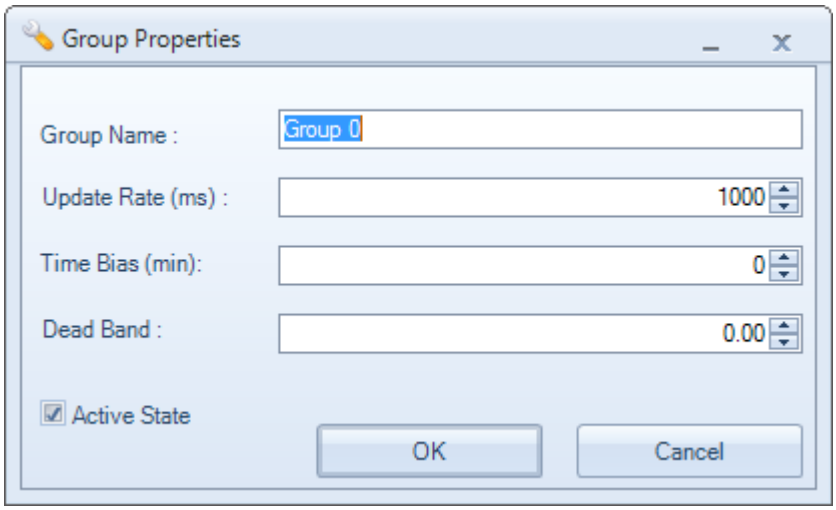

Figure 30: Group Properties Dialog Box

Using this dialog box, you can:

- Change the name of the OPC Group. Note that the group name must be unique,
- Update the other group properties which are the update rate, the time bias and the dead band),

- Activate/Deactivate the group state by checking/un-checking the **Active State** check box.

You can also use this dialog screen to view the current information related to the selected group.

4.3.7. Remove All Items

To delete all items of the group, select the related group node and click the "**Remove All Items**" context menu item. All added items will be removed from the tree view.

4.3.8. Remove OPC group

You can delete an OPC group by clicking on the **Remove Group** context menu item. The group node (and all added tags to the group) will be deleted from the OPC Servers tree view.

4.4. OPC Item Management

This section describes how to manage OPC items. In the following description, it is assumed that at least one OPC item is already added to an OPC group.
Right click on the OPC item node, the following context menu will be displayed:

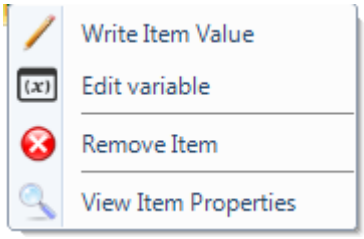

Figure 31: OPC Item Context Menu

4.4.1. View Item Properties

You can view the tag properties in a new window. This screen view shows all information related to tags:

- Tag Identifier
- Tag Current Value
- Tag Data Type

- Tag Quality
- Tag Time Stamp Tag Access Rights
- Tag Description
- DA Server ProgID
- DA Server Address
- Group Name
- The Variable Name correspondent to this tag

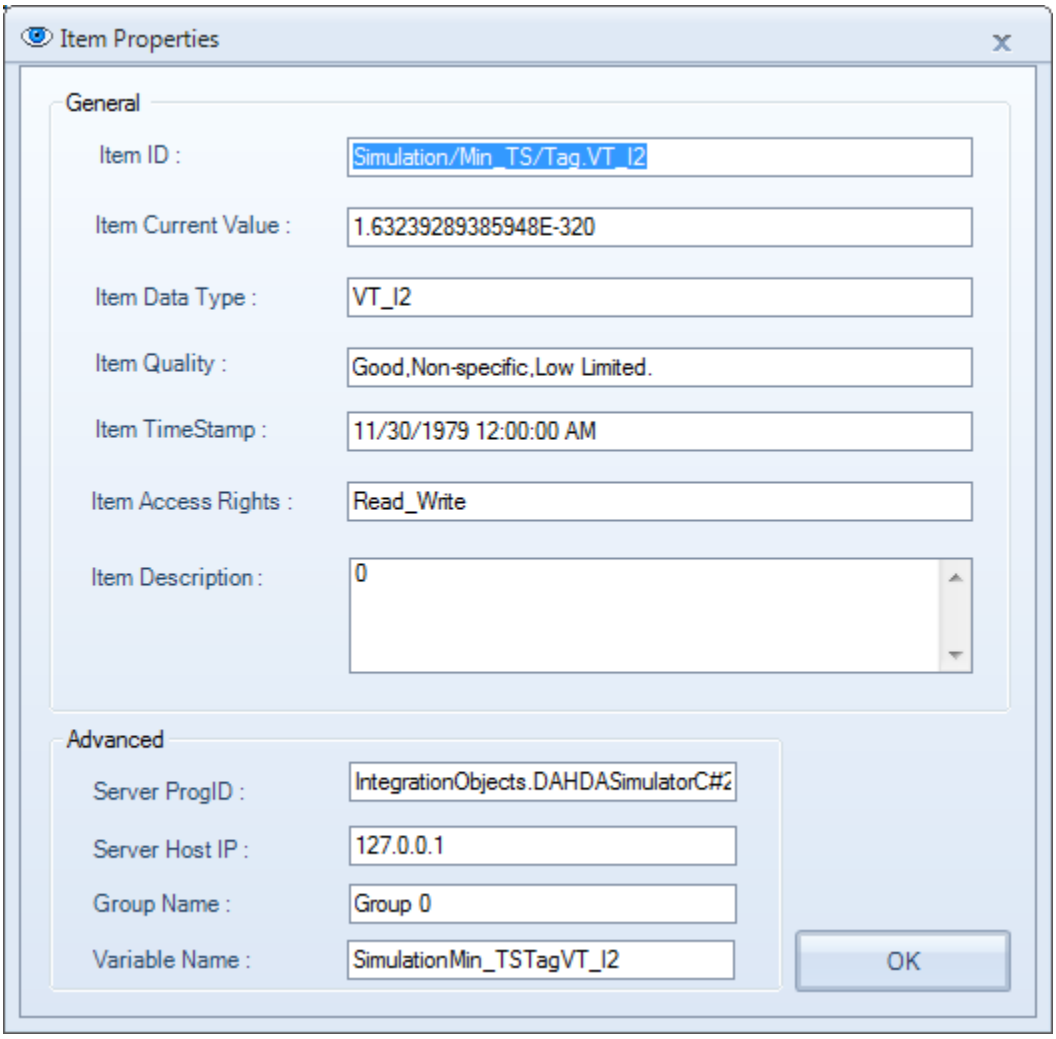

Figure 32: View OPC Item Properties

4.4.2. Remove an OPC Item

You can remove an OPC Item by clicking the **Remove Item** context menu item. The OPC item will be removed from the tree view.

4.4.3. Write Item Value

To write a value to an OPC item, first, you need to set the write mode of the related OPC group. Then, right click on the item and select the **Write Item Value** context menu item. The following dialog screen will appear:

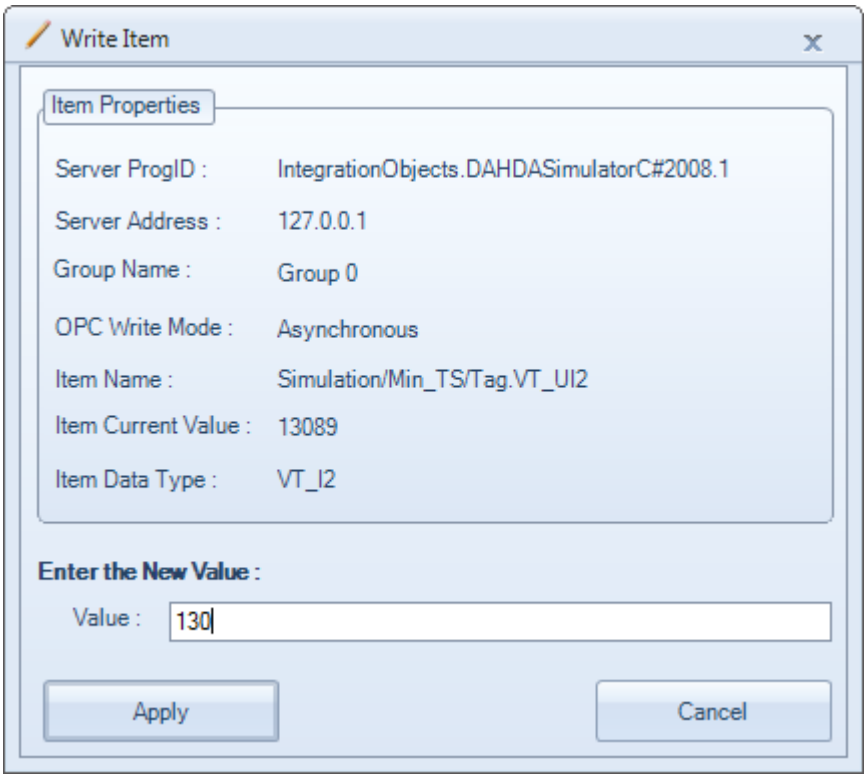

Figure 33: Write Item Dialog Box

This dialog box displays the following information:

- The OPC Server ProgID
- The OPC Server Address
- The OPC Group Name
- The current Write mode specified for the related OPC group
- The Item ID

- The Item Data Type
- The Item Current Value

To complete the write operation, enter the new value to be written to the item and click the **Apply** button to confirm.

4.5. OPC Automatic Reconnection

Whenever a communication problem occurs with any connected OPC Server, the OPC Calculation Engine automatically starts the OPC reconnection procedure in order to reestablish the communications.
During the time interval in which the connection to the requested OPC Server is lost, the corresponding OPC items will be kept in their latest status and the server node will be highlighted by a red icon and disabled.
Once the communication is reestablished and the reconnection is successful, the OPC Server will be enabled back and the execution of the calculations will be resumed.

5. Archiver Functionalities

The archiver stores the calculations results in the following types of database:

- SQL Server databases.
- Oracle databases.
- MS Access databases.
- Databases using OLEDB connection provider.
- Databases using ODBC connection provider.

In this section, we will describe the necessary steps to configure an archiver.

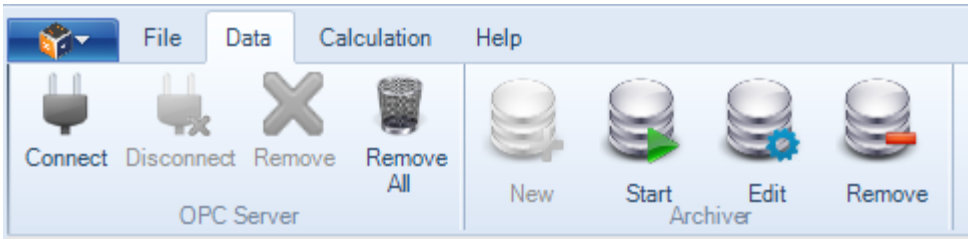

Figure 34: Data Ribbon Bar

5.1. Add New Archiver

To add a new archiver, click the **New** button available in the archiver category in the ribbon bar. The following wizard will appear to take you through the different configuration steps:

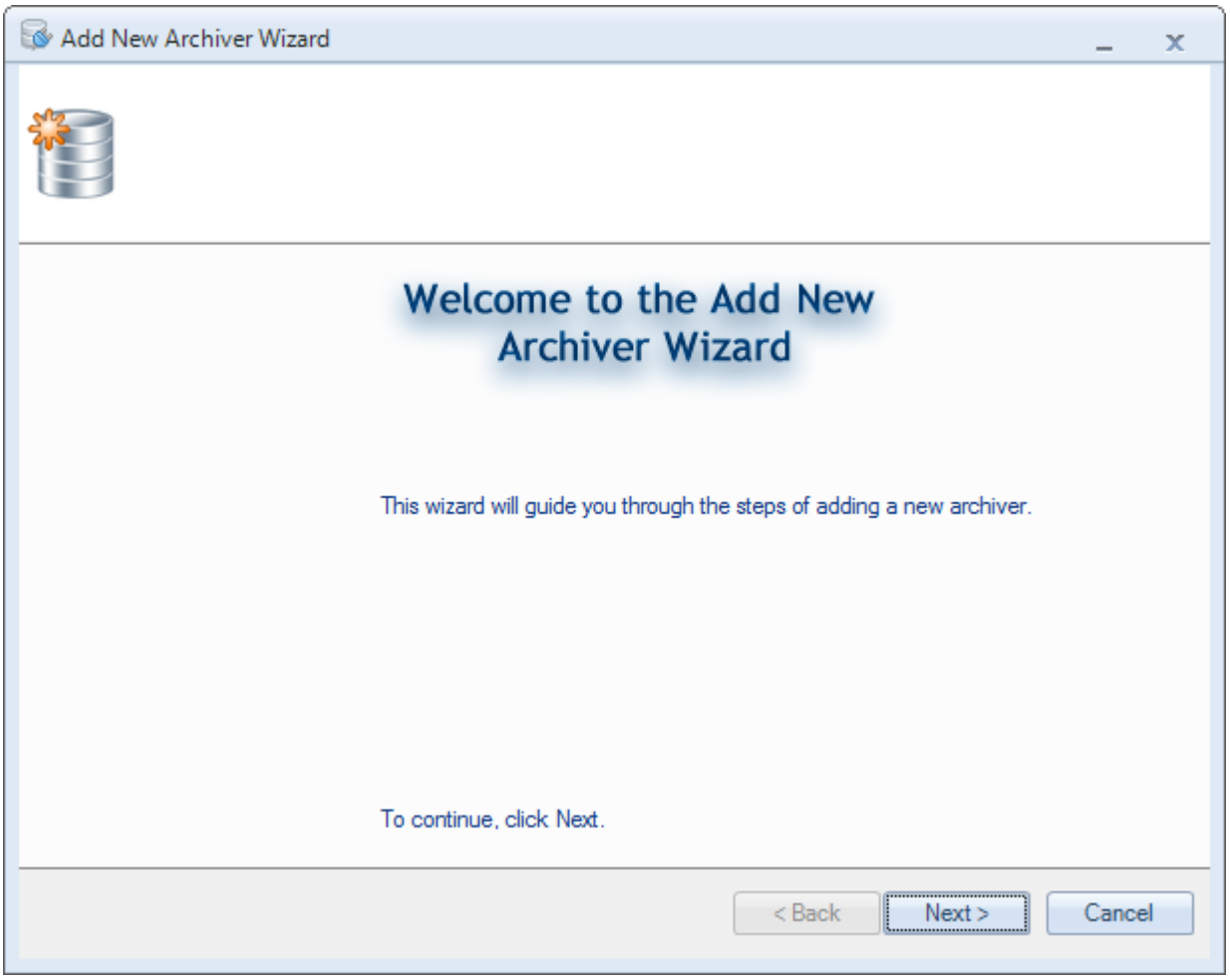

Figure 35: Add New Archiver Wizard

Step 1: Click the **Next** button. The following window will be displayed:

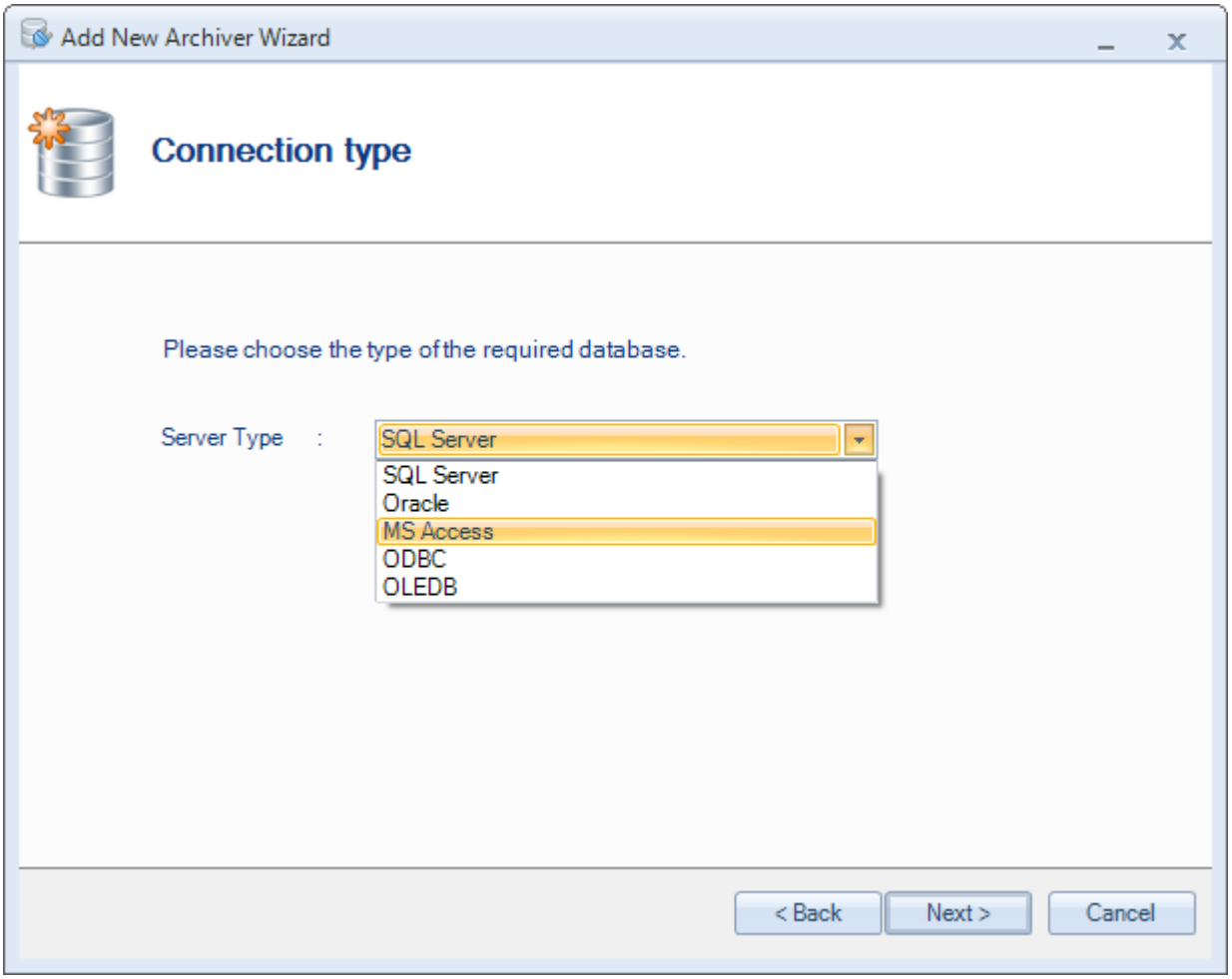

Figure 36: Selecting Database Type

You can archive data in the following historian types:

- SQL Server database,
- Oracle database,
- MS Access database,
- ODBC database,
- And/or OLEDB database.

Step 2: Select the database type. Click the **Next** button. You will then be prompted to configure your connection string depending on the selected database type:

- **SQL Server Type:** if you select SQL server database, the following window will be displayed:

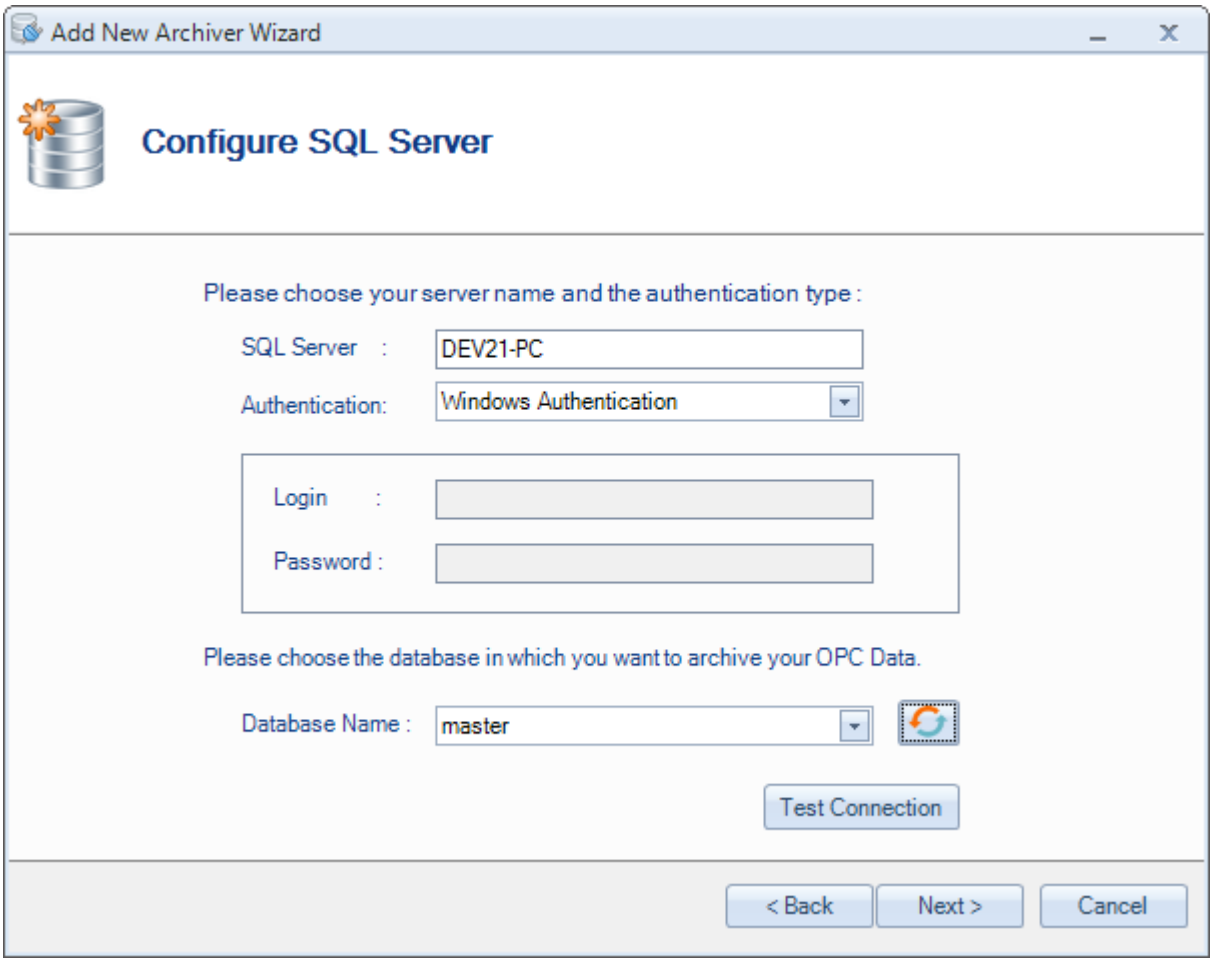

Figure 37: SQL Server Connection Dialog Box

- **Server name:** The name of the SQL Server is available in your network.
- **Authentication:** To connect, you can choose one of the two following authentication modes:
    - ✓ Windows Authentication
    - ✓ SQL Server Authentication: In this case, you have to specify the login and the password used by the SQL Server driver when connecting to SQL Server.

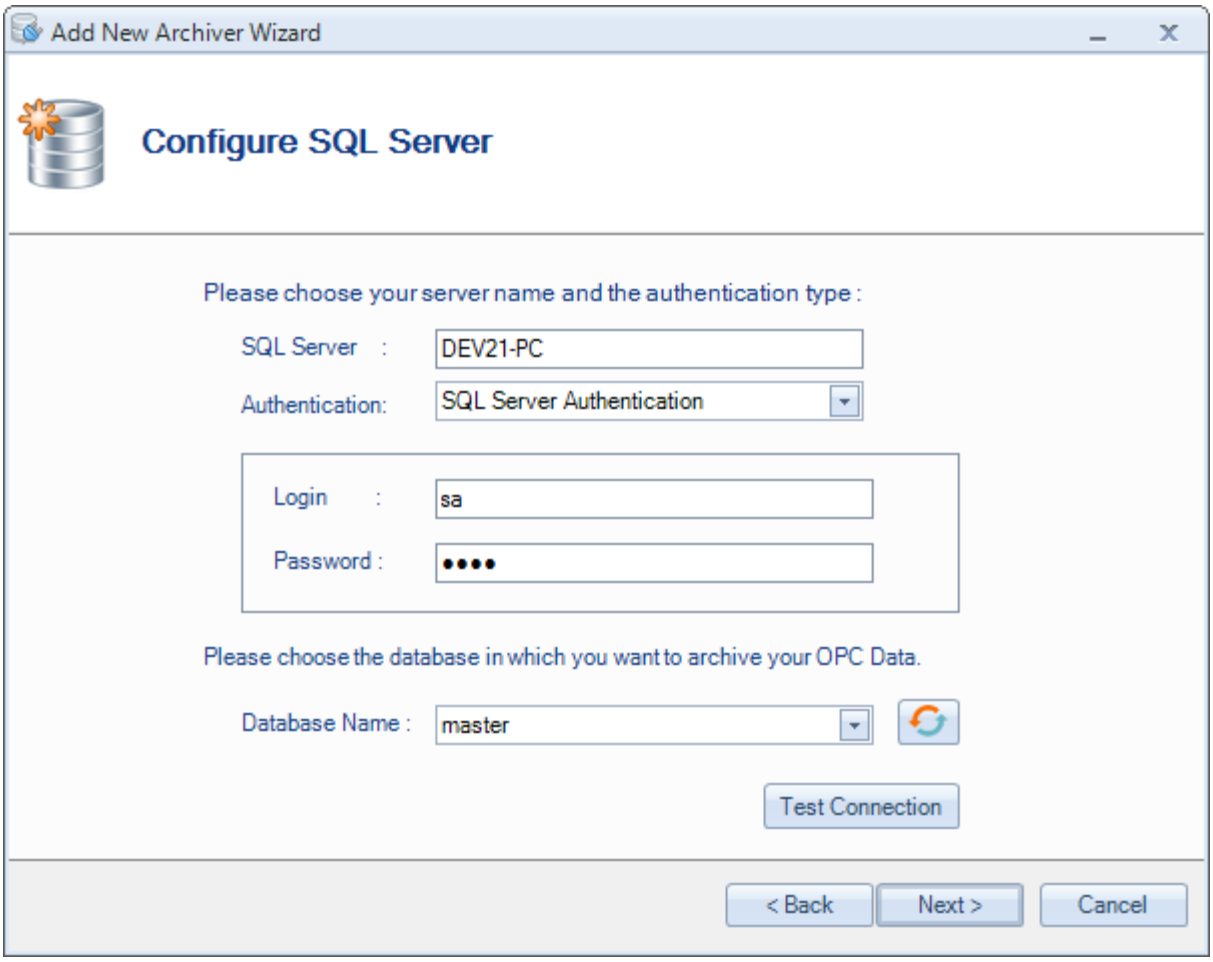

Figure 38: SQL Server Authentication Mode

- **Oracle Type:** if you select Oracle database, the following window will be displayed:

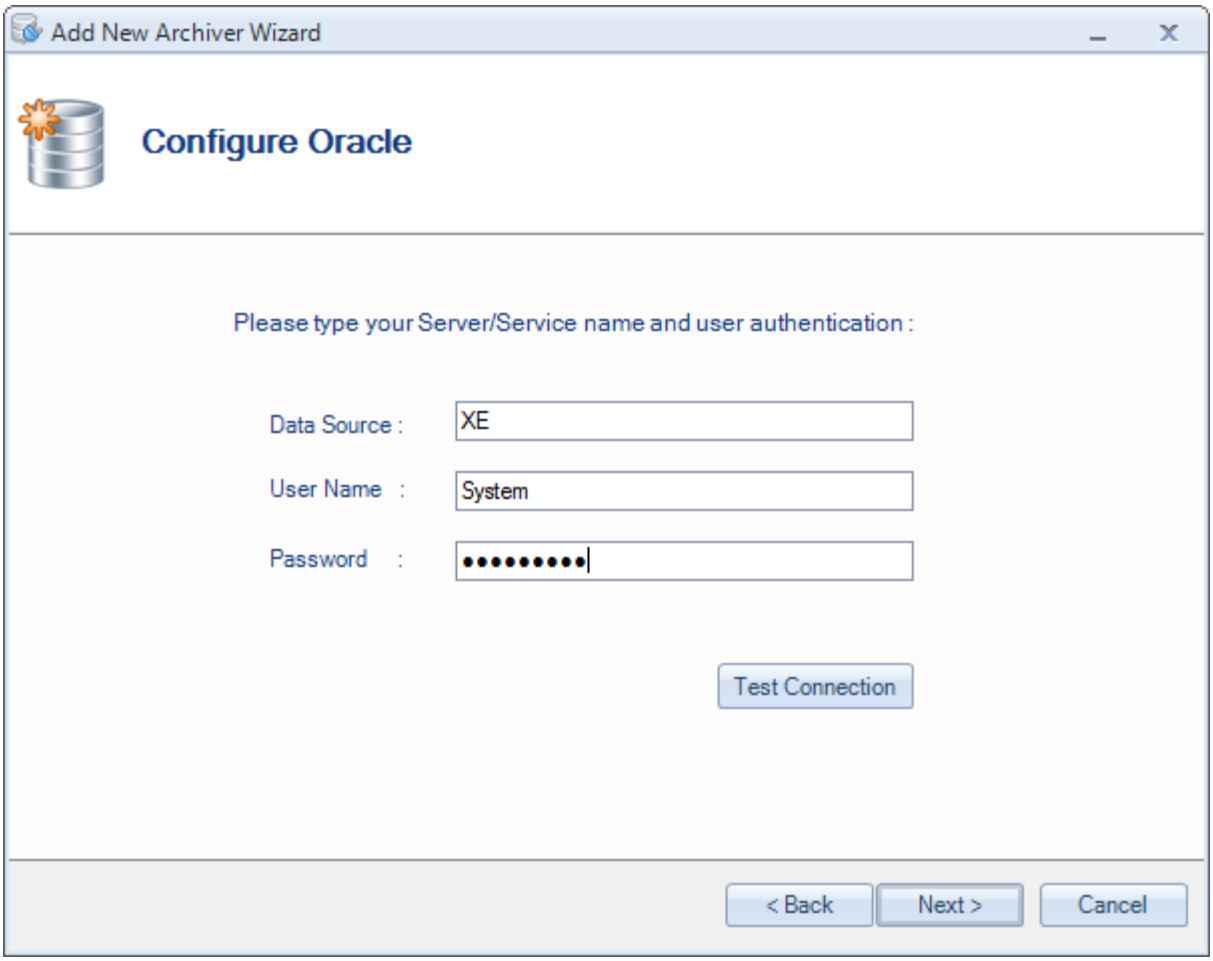

Figure 39: Oracle Connection Dialog Box

- **Data Source:** The Oracle data source name.
- **User Name:** The user account login.
- **Password:** The user account password.

- **MS Access Type**: if you select MS Access database, the following window will be displayed:

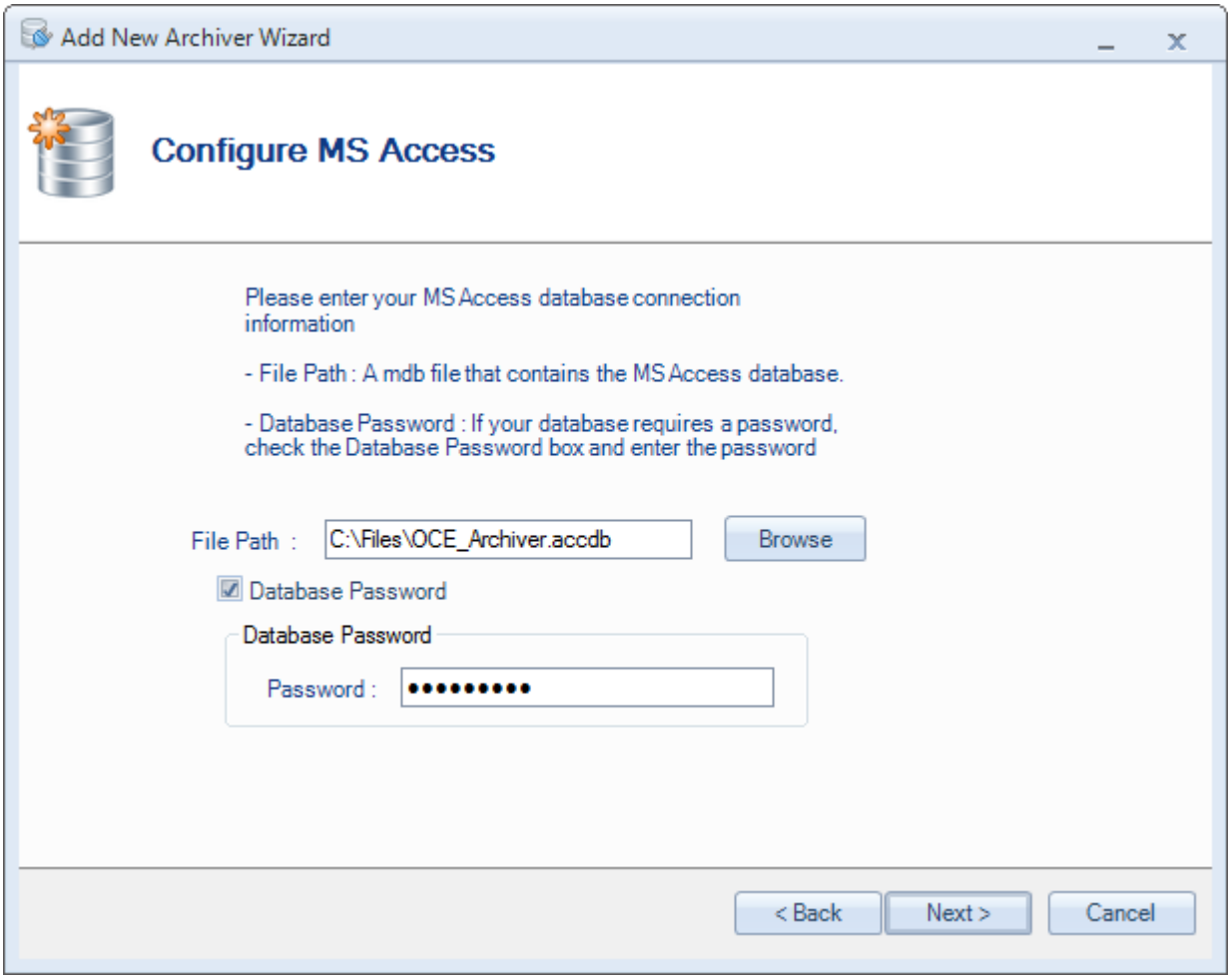

Figure 40: MS Access Connection Dialog Box

You can browse the path to the MS Access File or manually type the path in the **File Path** text box.
If your MS Access database requires a password, check the **Database Password** box and enter the password in the **Password** field.
This type of configuration could only be used for local connections. In order to connect remotely to any MS access database, you should select the ODBC connection configuration.

- **ODBC Type:** if you select an ODBC database type, the following window will be displayed:

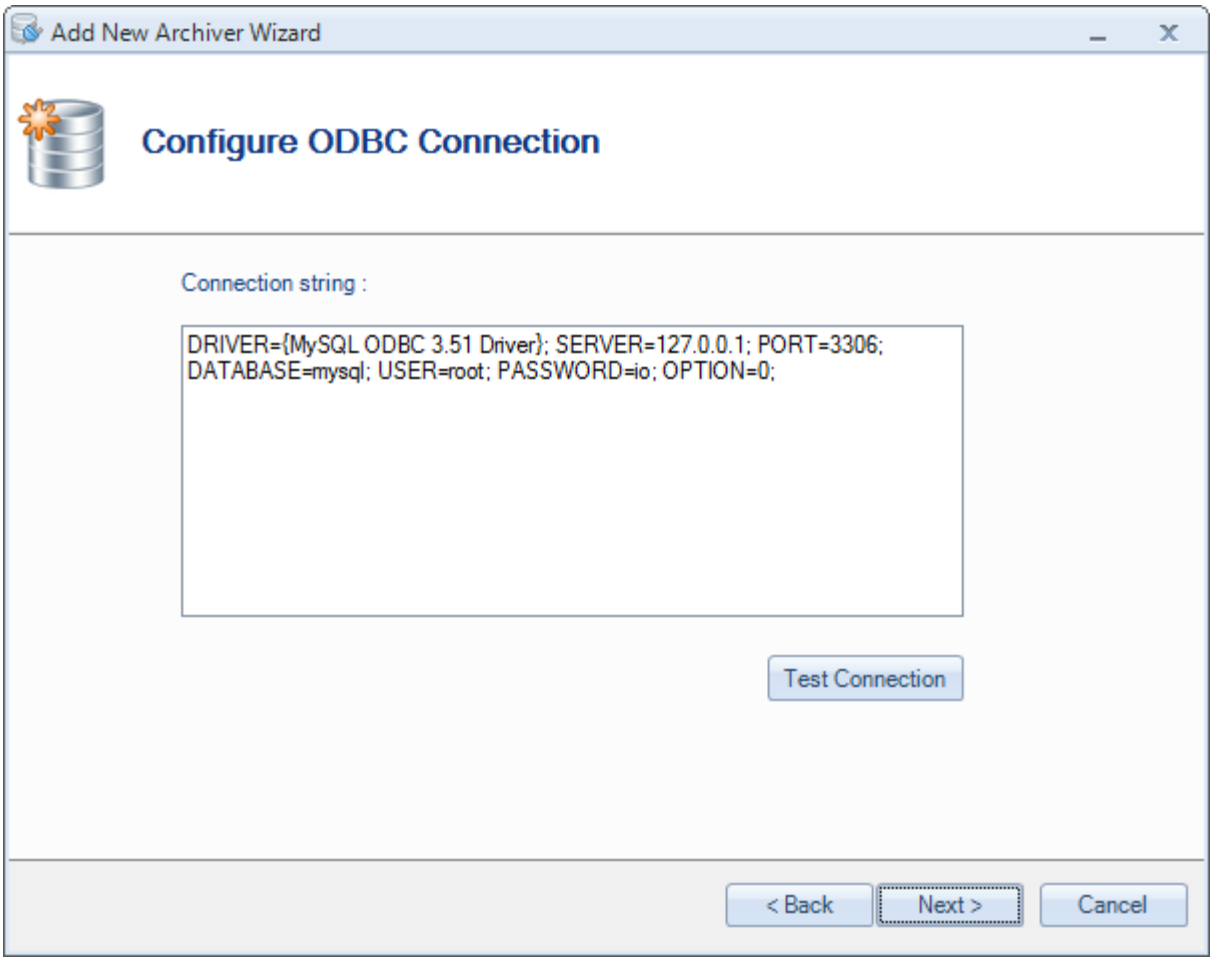

Figure 41: ODBC Connection String Dialog Box

In this dialog box, you need to enter the connection string of your database. The example in the above figure shows a connection string for the 3.51.17 version of the MySQL driver.

- **OLEDB Type:** if you select an OLEDB Historian type, the following window will be displayed:

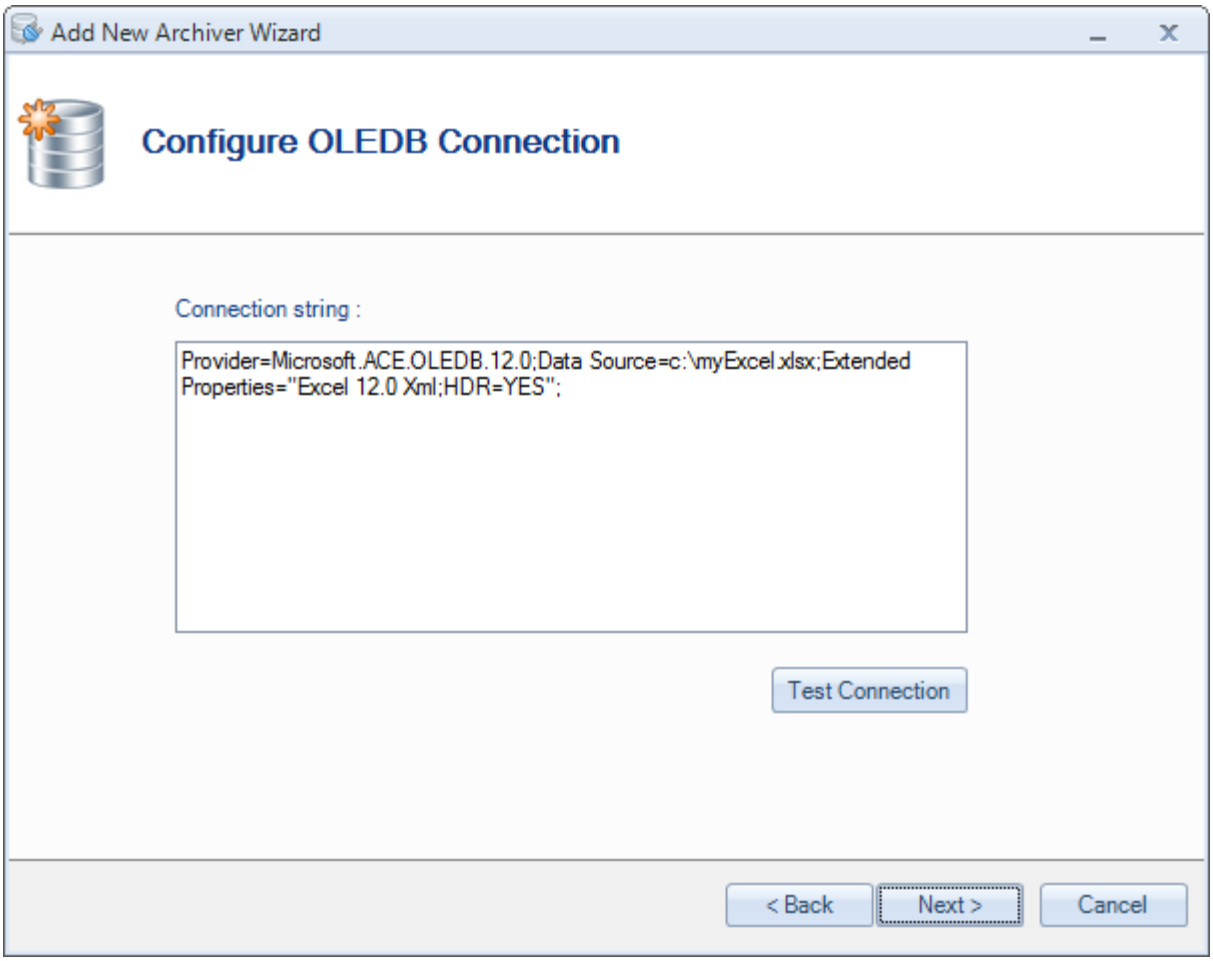

Figure 42: OLEDB Connection String Dialog Box

In this dialog box, you need to enter the connection string of your OLEDB historian. The example in the above figure shows a connection string for an Excel 2007 (and later) spreadsheet.

Step 3: After entering the necessary connection parameters, click the **Next** button and the following window will be displayed:

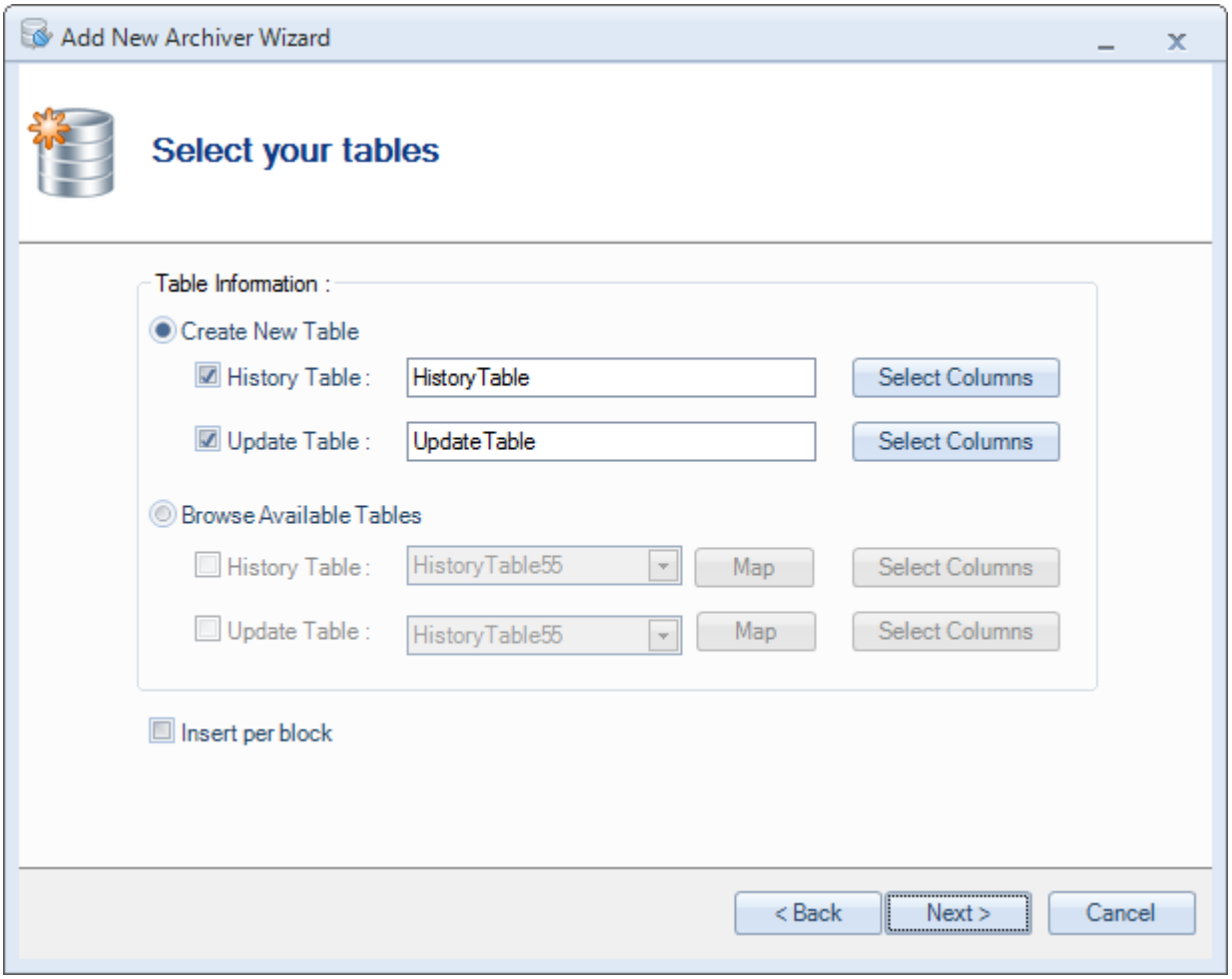

Figure 43: Select Tables Dialog Box

The OPC Calculation Engine offers the possibility to archive the data in existing tables or to create new ones.
When checking the **Insert per block** option, you can take advantage of database versions that support the functionality of inserting multiple data in a single operation.

Note that the "Insert per block" functionality does not apply for the OLEDB and ODBC archives.

To select your tables, you can:

- ***Create new Table***: If you choose this option, the OPC client will create two new tables into the selected database:

  1. History Table: The history table is used to save all received data.
  By default, the created table has the following columns:
  - Operation ID: The operation's identifier.

- Operation Result: The operation's current result.
- Operation Time Stamp: The time stamp at which the data was calculated.

2. Update Table: The update table will contain only the last received values of the OPC tags. By default, created columns are the same as previously listed for the history table.

To add more columns to the tables, click on **Select columns** and check the wanted columns to be added. You can add the following properties:

- Operation Expression:The operation's syntax.
- Destination Tag: The OPC Item where the result is written.

- ***Browse Available Tables***: In this option, the OPC Calculation Engine browses the list of available tables under the selected database as illustrated below.

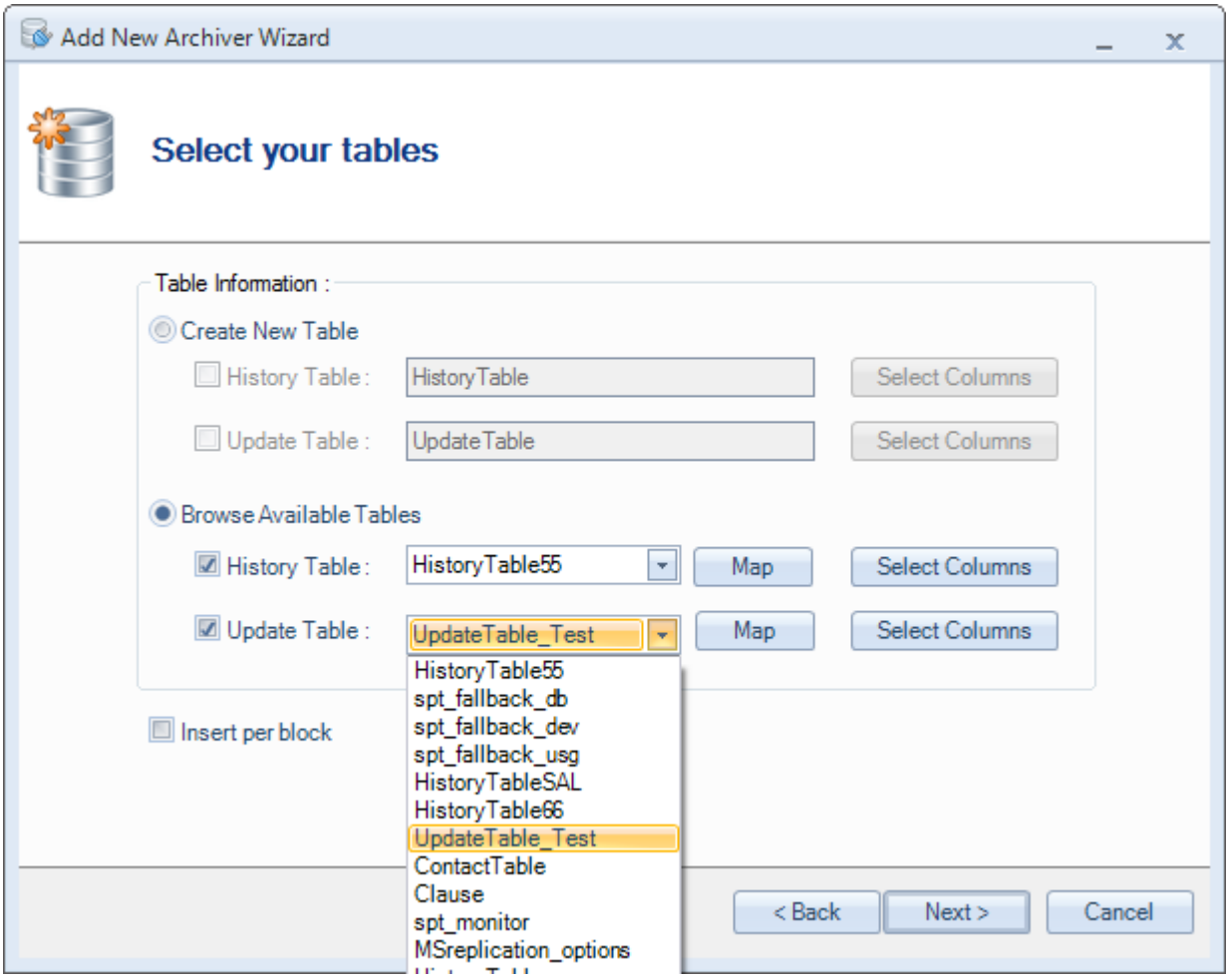

Figure 44: Browse Existing Tables

After selecting an existing table, you will need to map fields of the tables. Click the **Map** button to proceed:

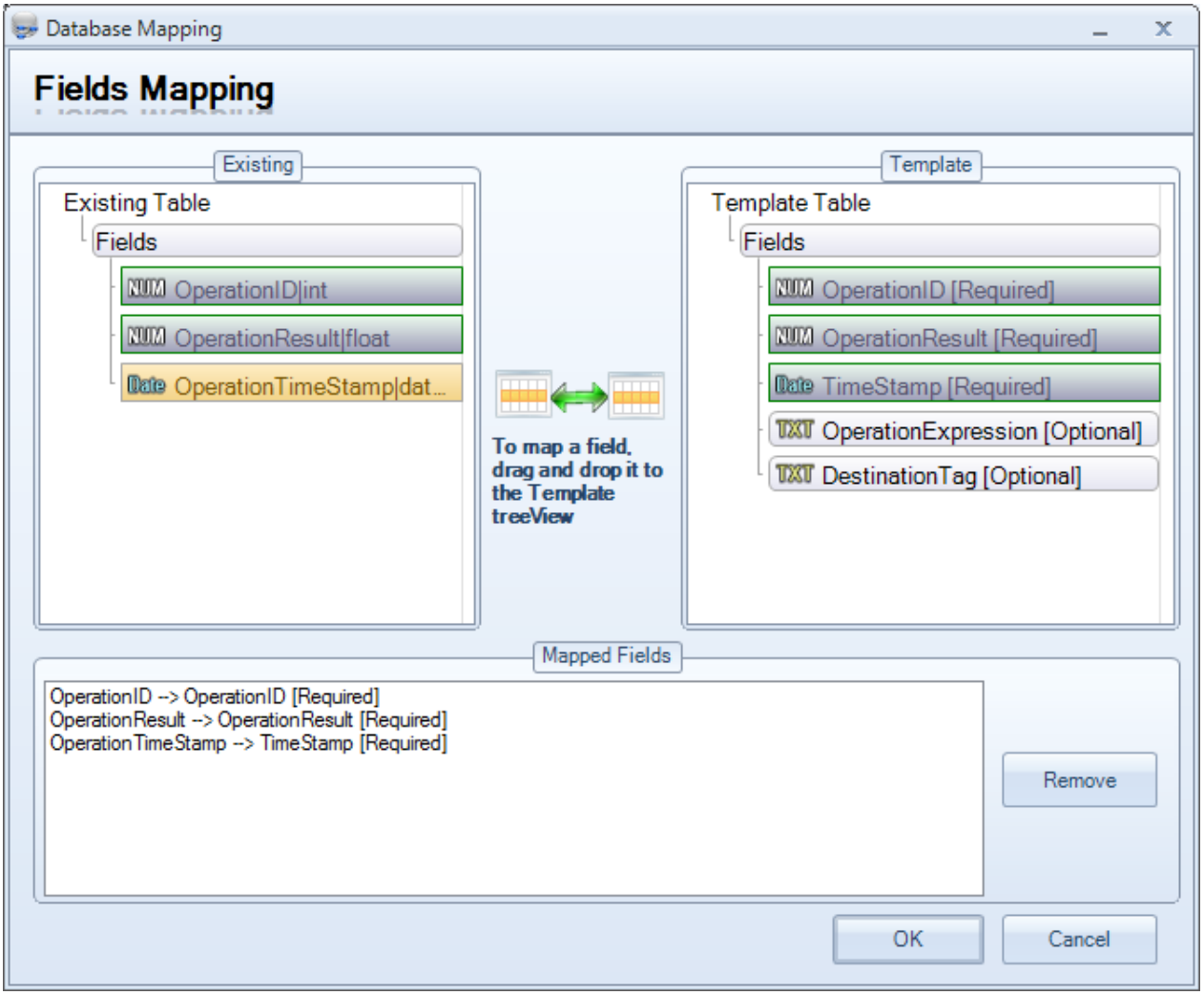

Figure 45: Fields Mapping

In this dialog box, you have to match which data will be associated to the columns of the selected table. The Template Table in the right side is the default table of the archiver. The existing table in the left side is the table previously selected. To do the mapping, drag and drop the field from the existing table to the corresponding one in the template table.

Mapped fields will appear in the text zone "Mapped Fields" at the bottom of the dialog screen. You can select the item and click the **Remove** button if you want to cancel the mapping operation.

Step 5: Click the **Next** button to proceed and the following window will appear to summarize your archiver configuration.

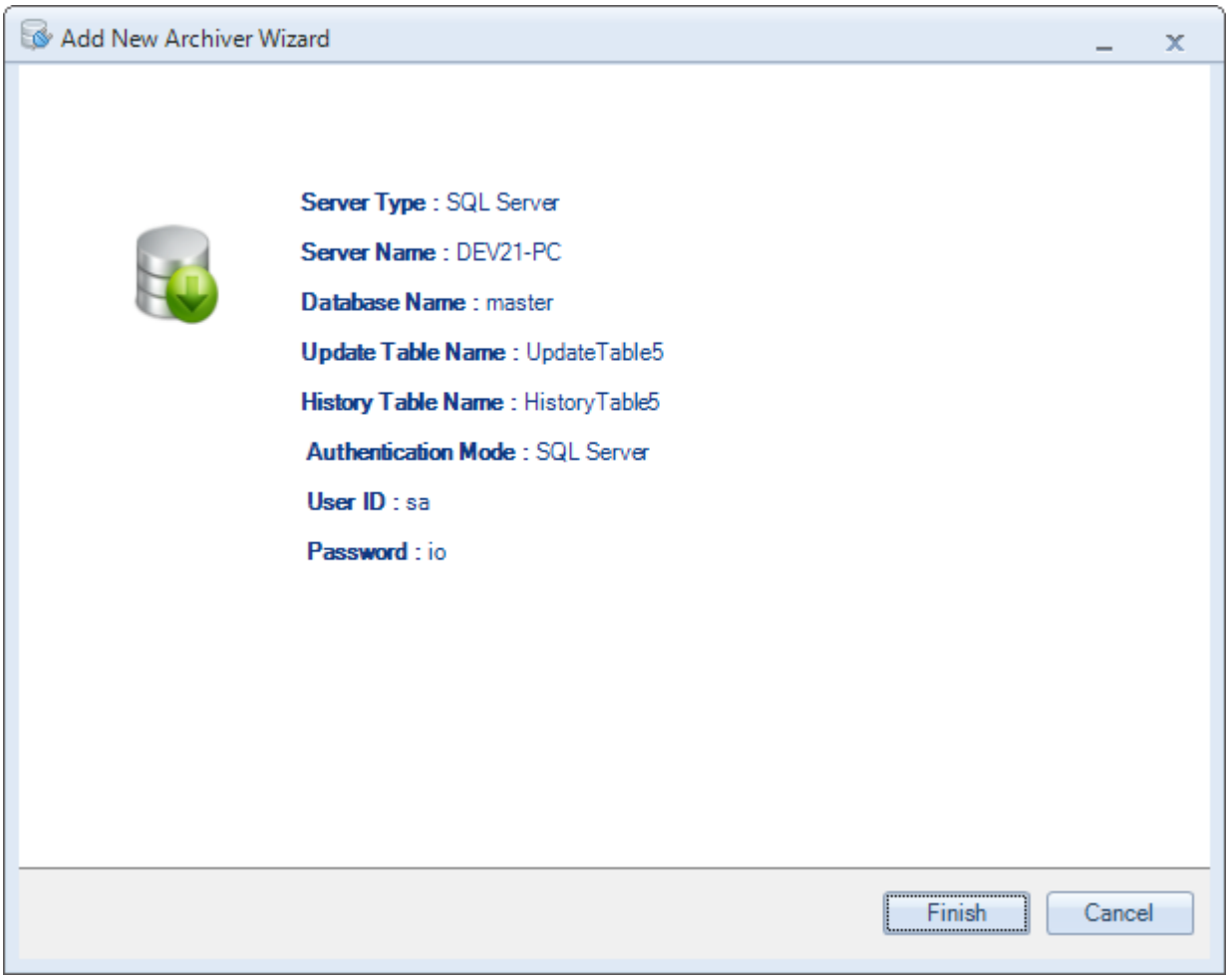

Figure 46: Archiver Configuration Summary

Click the **Finish** button to complete the process.

5.2. Start Archiver

To start the archiving process, go to the data ribbon bar and click the **Start** in the Archiver category.

Figure 47: Start Archiver

5.3. Stop Archiver

If the archiver is running, you can stop it by clicking the **Stop** button.

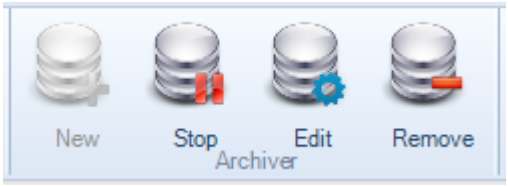

Figure 48: Stop Archiver

5.4. Edit Archiver

Click the "**Edit**" button in the archiver category of the Data ribbon bar to modify the table settings of an existing Archiver.
If you have both an Update Table and a History Table configured, you need to choose which table you need to modify first.

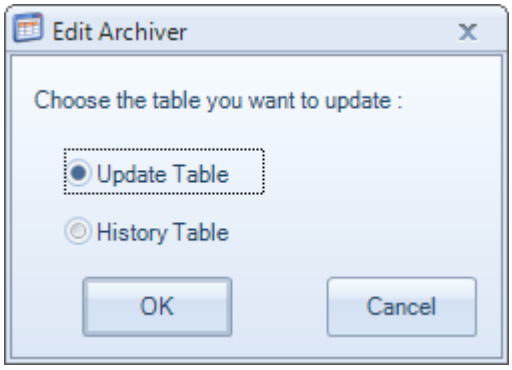

Figure 49: Choose Table

When you choose to create new history and update tables, only OperationID, Operation Result, and Operation Time Stamp columns are selected by default.

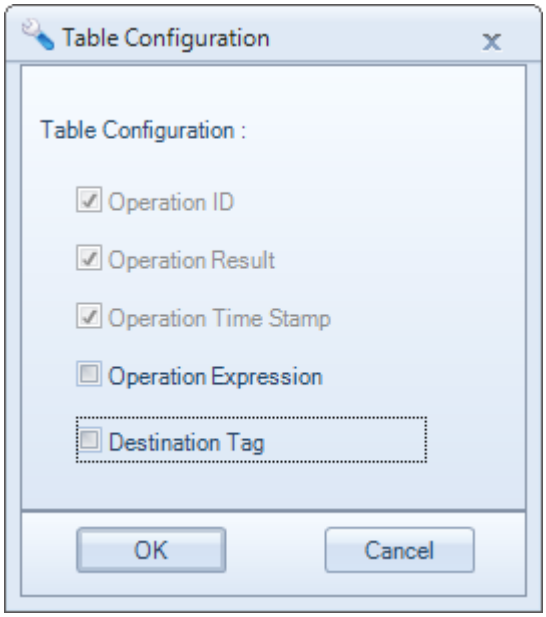

Figure 50: Table Configuration

To archive the Operation Expression and/or the Destination Tag, you have to check the related options. Then, click the **OK** button.

Note that when you choose to create new history and update tables, only OperationID, OperationResult and OperationTimeStamp columns are enabled by default.

5.5. Remove Archiver

To remove the Archiver, click the **Remove** button available in the Archiver category of the Data ribbon bar.

6. Calculation Functionalities

OPC Calculation Engine enables you to easily define your calculation equations in the operation editor.

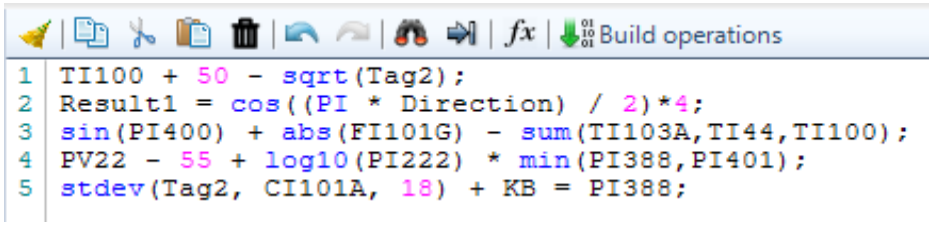

Figure 51: Calculation Operation Examples

As illustrated above, each operation should end with a semi-colon (;). You can write down all operations in one single line or in multiple ones.
You can write the operation's result in an OPC Item. To do so, you can use the equal sign (=). For example, in the line 2 of the above figure, the result of the calculation will be written into "Result1" tag.

The user can edit the operations using the different functionalities present in the operation tool bar shown below.

Figure 52: Operation Tool Bar

The operation tool bar enables you to:

- Clear all operations
- Copy the selected zone of text
- Cut the selected zone of text
- paste the selected zone of text
- Undo/Redo a previous change
- Find and replace a specific text
- Go to a specific line
- Show the predefined functions in the OPC Calculation Engine
- Build you operations
- Start calculations
- Stop calculations

6.1. Variables

Equations are built using variables. A variable can be an OPC item or a constant. You can use the OPC items with their default names or define new variables using a friendlier name.

6.1.1. Add a variable

To add a new variable, go to the calculation tab in the ribbon bar menu as shown in the figure below.

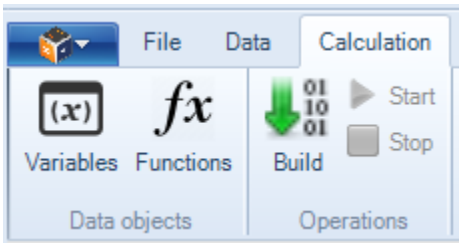

Figure 53: Calculation Tab

Now, click on the **Variables** button. A dialog window containing your previously added variables should appear.
Right click on the variables node, select **Add Variable** from the displayed menu and then choose the type of variable you want to add.

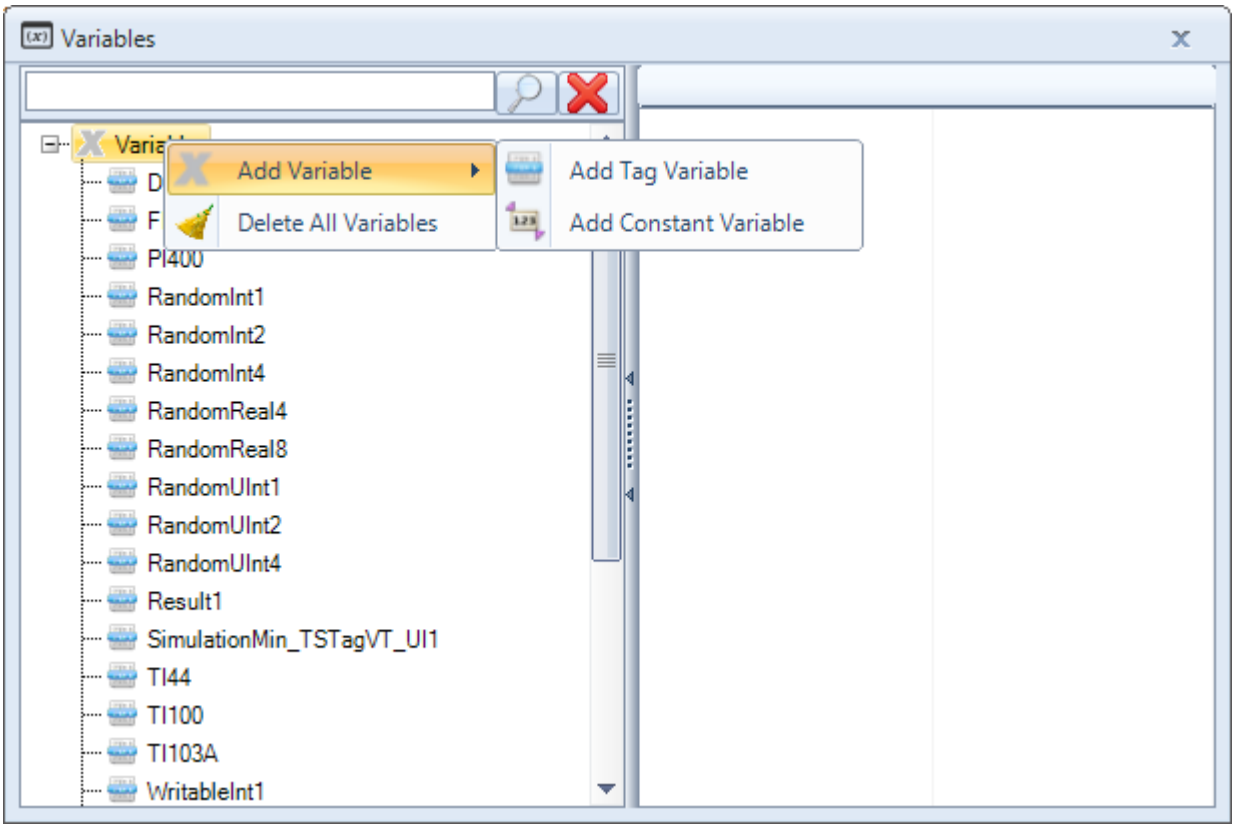

Figure 54: Add a New Variable

Adding a constant variable will add a variable whose value do not change. This type of variables is generally useful to manage engineering unit conversion, adding a bias, etc.

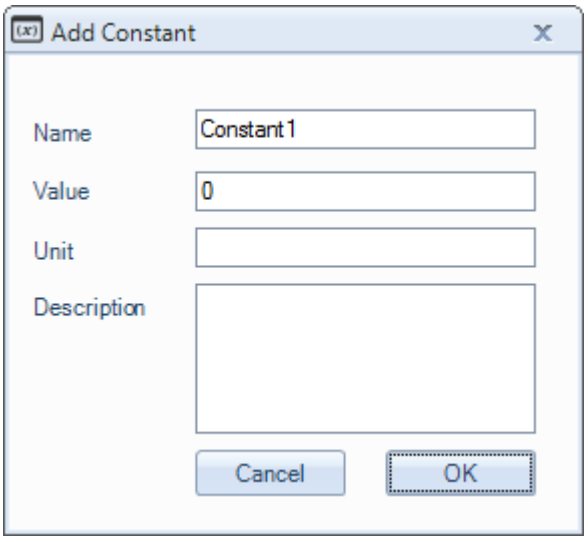

Figure 55: Add a Constant Variable

When choosing **Add Tag Variable**, the following dialog box form will appear:

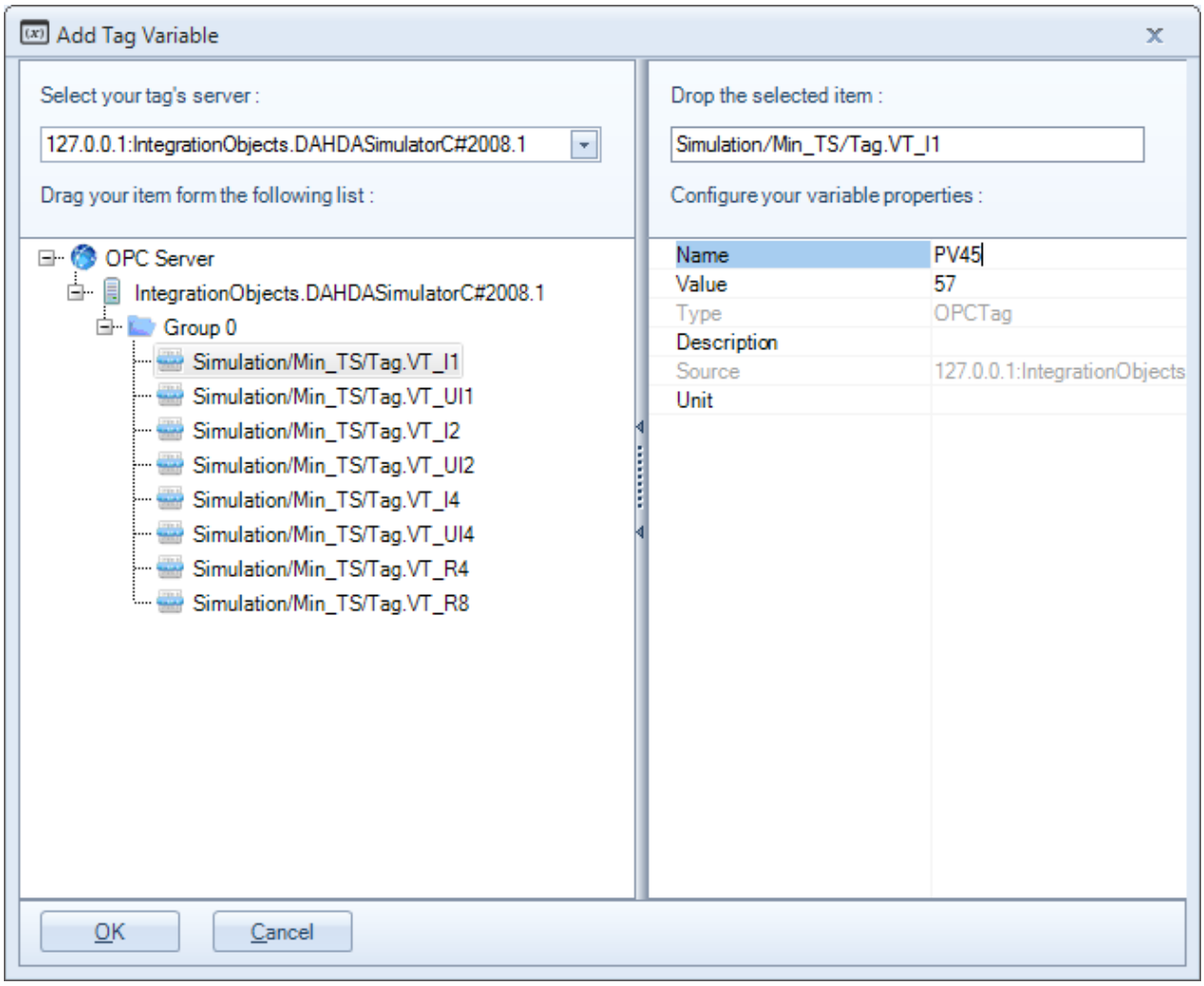

Figure 56: Add a Tag Variable

Select your server where your tag resides, then drag and drop the tag to the right text box. Below are the properties of the tag variable:

- Name : that will be used as an alias
- Value : you can assign a default value to the tag
- Description
- Unit

To edit a tag variable from the tag list in your main interface, right click on the tag from the available list and then click on **Edit variable** button, as shown in the figure below.

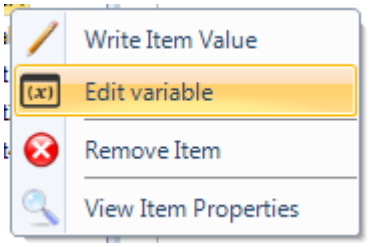

Figure 57: Edit a Variable

The following window should appear:

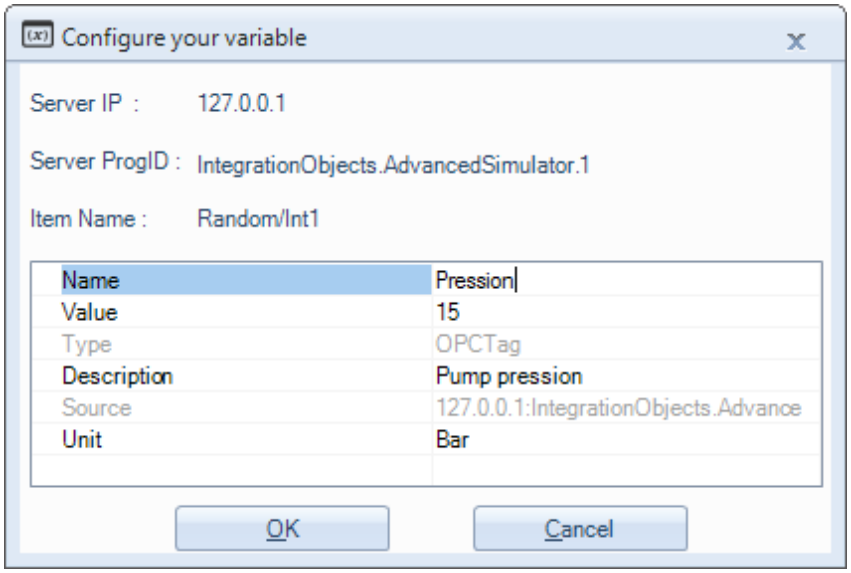

Figure 58: Configure a Variable

6.1.2. Delete a variable

To remove a variable, go to the variables window, right click on a variable and select **Delete Variable** from the displayed menu as illustrated below:

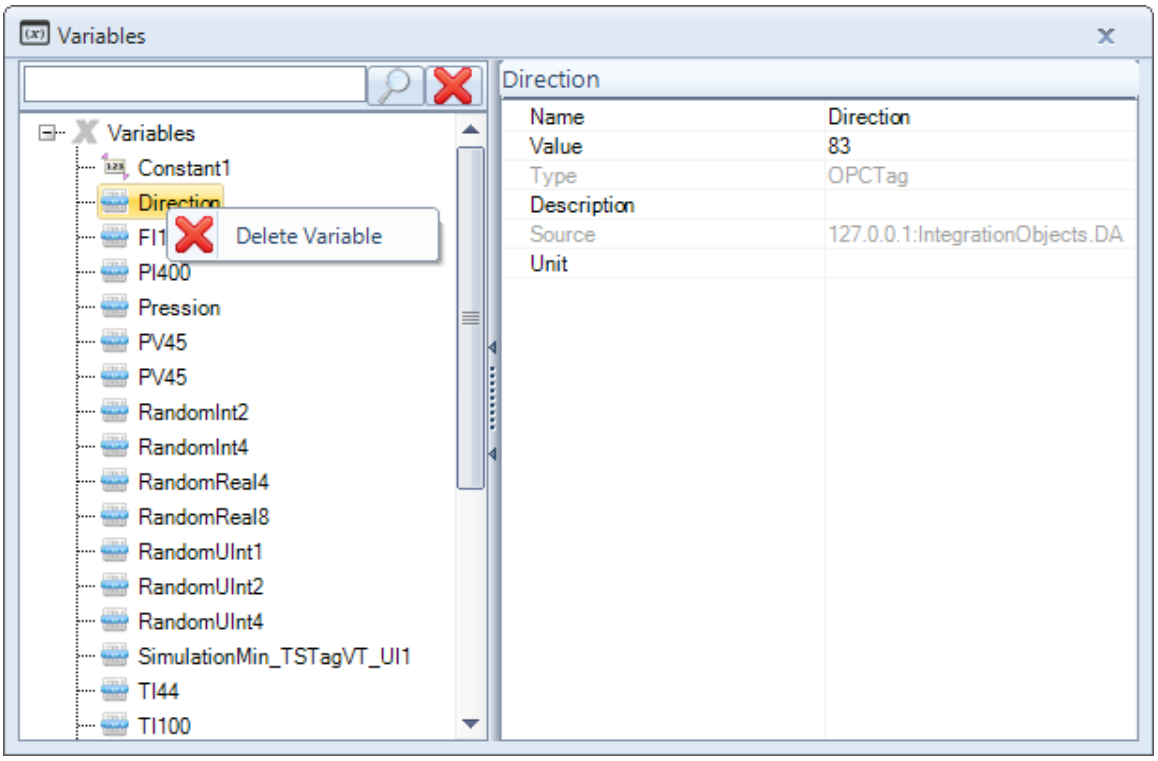

Figure 59: Delete a Variable

6.2. Edit Operations

The user can edit the calculation operations using his keyboard. He can also use the different functionalities offered by the operation tool bar.

6.2.1. Find & Replace

To search for a specific word, sentence, or part of a word, you can use the find and replace functionality (CTRL+F).

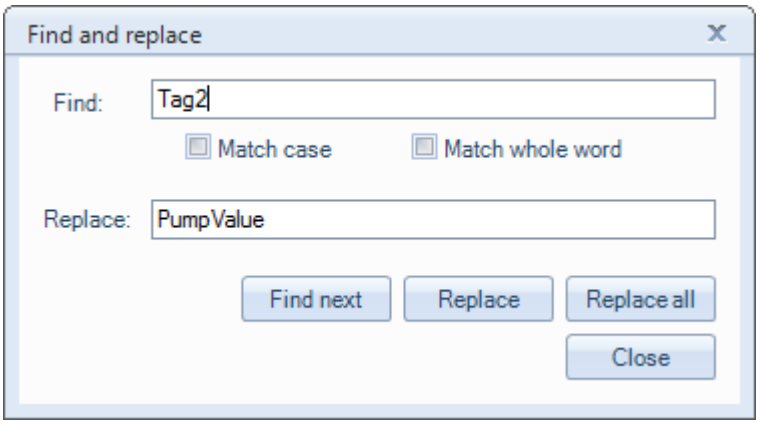

Figure 60 : Find & Replace

You can also replace the word that you want to find using the same window.

6.2.2. Go to Line

To go to a specific line in your calculations, click on **GoTo** option (CTRL+G) and the following window will be prompted.

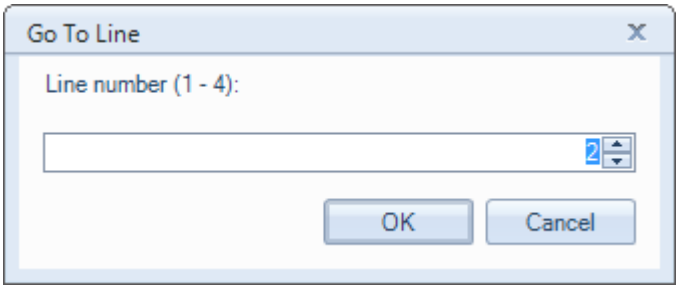

Figure 61: Go To Line

6.2.3. Predefined Functions

To check the list of the predefined functions, go to the calculation tab in the menu bar and click the **Functions** button. The below window should appear:

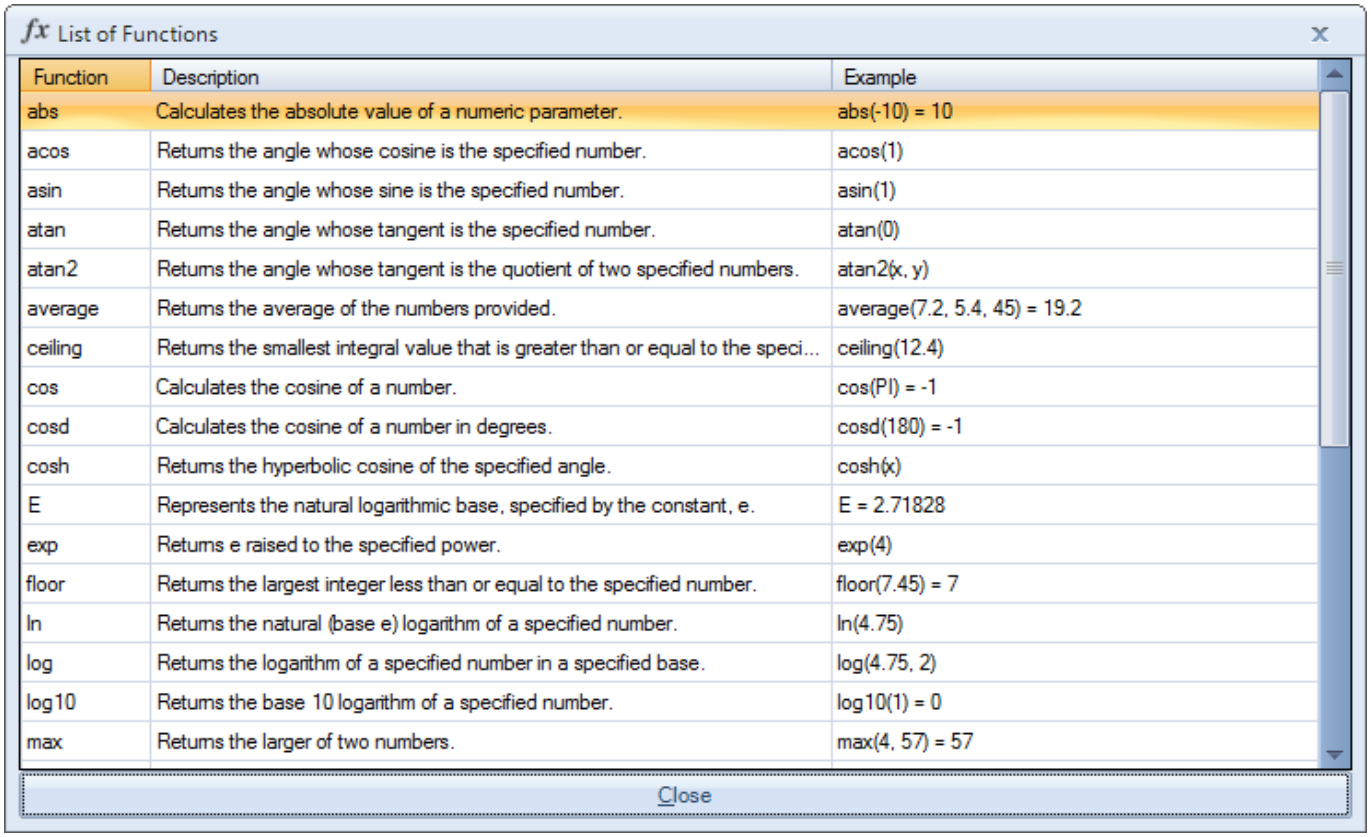

Figure 62: List of Predefined Functions

Here is the list of available functions in the OPC Calculation Engine:

Function	Description	Example
abs	Calculates the absolute value of a numeric parameter.	abs(-10) = 10
acos	Returns the angle whose cosine is the specified number.	acos(1)
asin	Returns the angle whose sine is the specified number.	asin(1)
atan	Returns the angle whose tangent is the specified number.	atan(0)
atan2	Returns the angle whose tangent is the quotient of two specified numbers.	atan2(x, y)
cosh	Returns the hyperbolic cosine of the specified angle.	cosh(x)
cos	Calculates the cosine of a number.	cos(PI) = -1
cosd	Calculates the cosine of a number in degrees.	cosd(180)= -1
exp	Returns e raised to the specified power.	exp(4)
ceiling	Returns the smallest integral value that is greater than or equal to the specified decimal number.	ceiling(12.4)
floor	Returns the largest integer less than or equal to the specified number.	floor(7.45) = 7

ln	Returns the natural (base e) logarithm of a specified number.	ln(4.75)
log	Returns the logarithm of a specified number in a specified base.	log(4.75, 2)
log10	Returns the base 10 logarithm of a specified number.	Log10(1)
max	Returns the larger of two numbers.	Max(4, 57) = 57
min	Returns the smaller of two numbers.	Min(4, 57) = 4
power	Returns a specified number raised to the specified power.	Power (2, 4) = 16
rand	Returns a random number between 0.0 and 1.0.	rand()
sum	Sum the entered values	Sum (10, 5, 4) = 19
trunc	Returns a number truncated to a specified number of digits.	trunc(67.84) = 67
average	Returns the average of the numbers provided.	average(7.2, 5.4, 45) = 19.2
stdev	Estimates standard deviation based on a sample. The standard deviation is a measure of how widely values are dispersed from the average value.	stdev(130,132,127, 135)
sin	Calculates the sin of a number.	sin(45)
sind	Calculates the sin of a number in degrees.	sind(90)= -1
sinh	Returns the hyperbolic sin of the specified angle.	sinh(0.75)
sqrt	Calculates the square root of a number.	sqrt(25)
tan	Returns the tangent of the specified angle.	tan(30)
tand	Returns the tangent of the specified angle in degrees.	tand(45)= 1
tanh	Returns the hyperbolic tangent of the specified angle.	tanh(0.1)

Table 3: Predefined Functions List

Variables	Description	values
E	Represents the natural logarithmic base, specified by the constant, e.	2.71828
PI	Represents the ratio of the circumference of a circle to its diameter, specified by the constant, π.	3.14159

Table 4: Predefined Variables List

6.3. Build Operations

Before starting the calculations, you should build the operations to check if there are any syntax errors, incorrect operations, or missing variables.

If the calculation operations are valid, you will get the following figure:

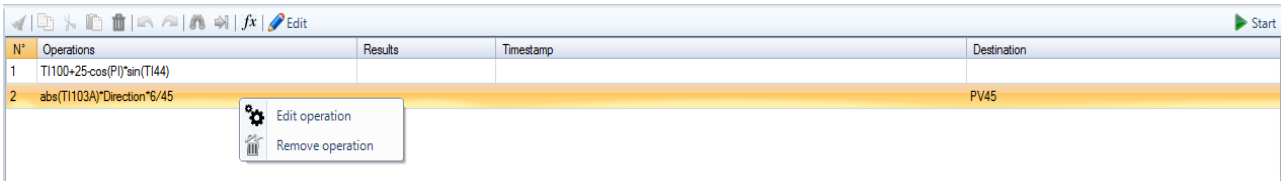

Figure 63: Build Operations

To edit or remove the operation, right click on it and choose the action you want to execute.

When right click in the blank space, the user can choose either to add a new operation without getting back to the edit mode or to remove all the expressions.

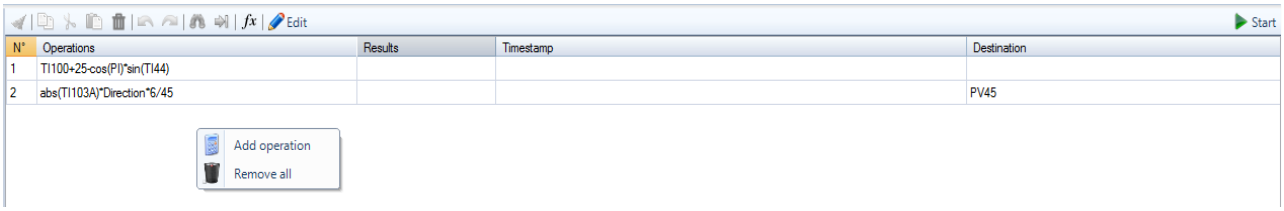

Figure 64: Add/Remove Context Menu

If you select to add a new calculation operation, the following dialog box will appear:

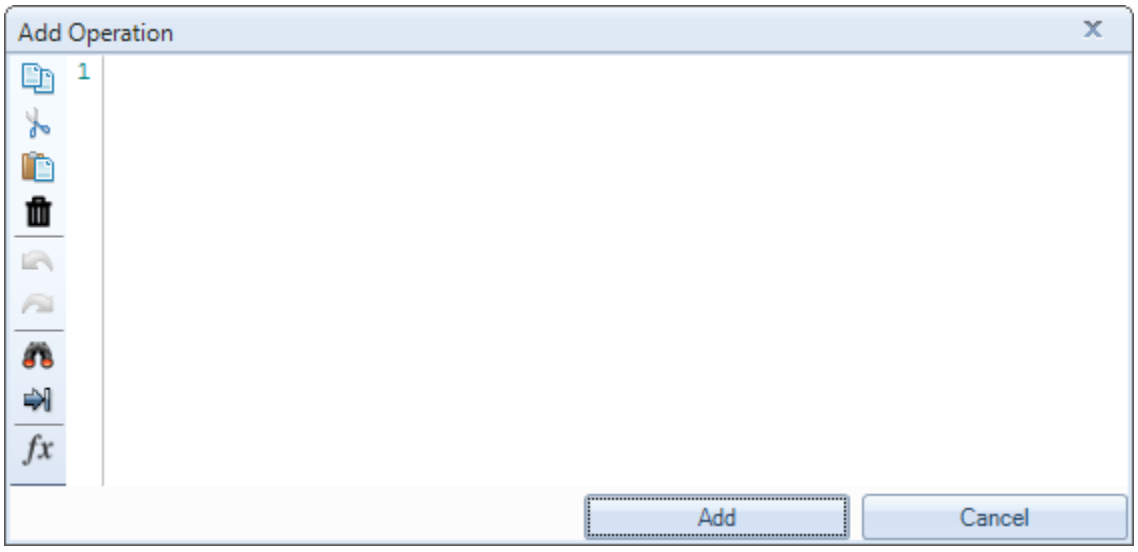

Figure 65: Add Operation Workspace

Write your operation and click on **Add**. If the syntax is correct, it will be added to the operations list.

6.4. Start/Stop Calculations

After building the operations, you can start the calculations. To do so, click the **Start** button available in the calculation tab or the operation tool bar, as illustrated in the figure below.

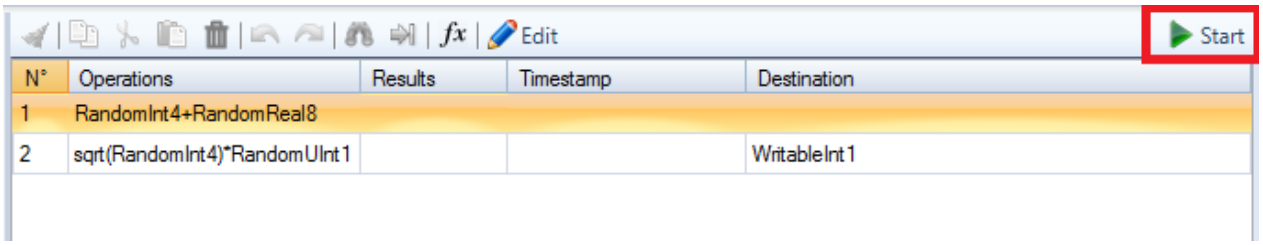

Figure 66: Start Calculations

Once the calculations are started, the OPC Calculation Engine will show your operations and their respective results, as shown in the figure below:

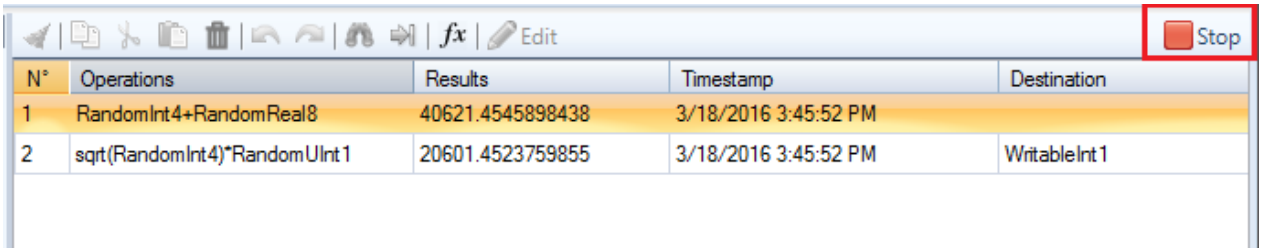

Figure 67: Calculation Operation Results

To stop the calculation process, click the **Stop** button in the calculation tab or in the operation tool bar.

TROUBLESHOOTING

Case 1: Cannot launch the OPC Calculation Engine

If you are using an evaluation license, you should first check the license validity by launching the License Authorization tool. You can start it directly from the startup menu:

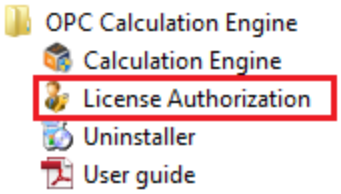

Figure 68: License Authorization

If the License Authorization tool shows that the demo has expired and you want to activate it using your full activation license, you should in this case follow the steps below:

- Click the **Register** button from the License Authorization form as highlighted below:

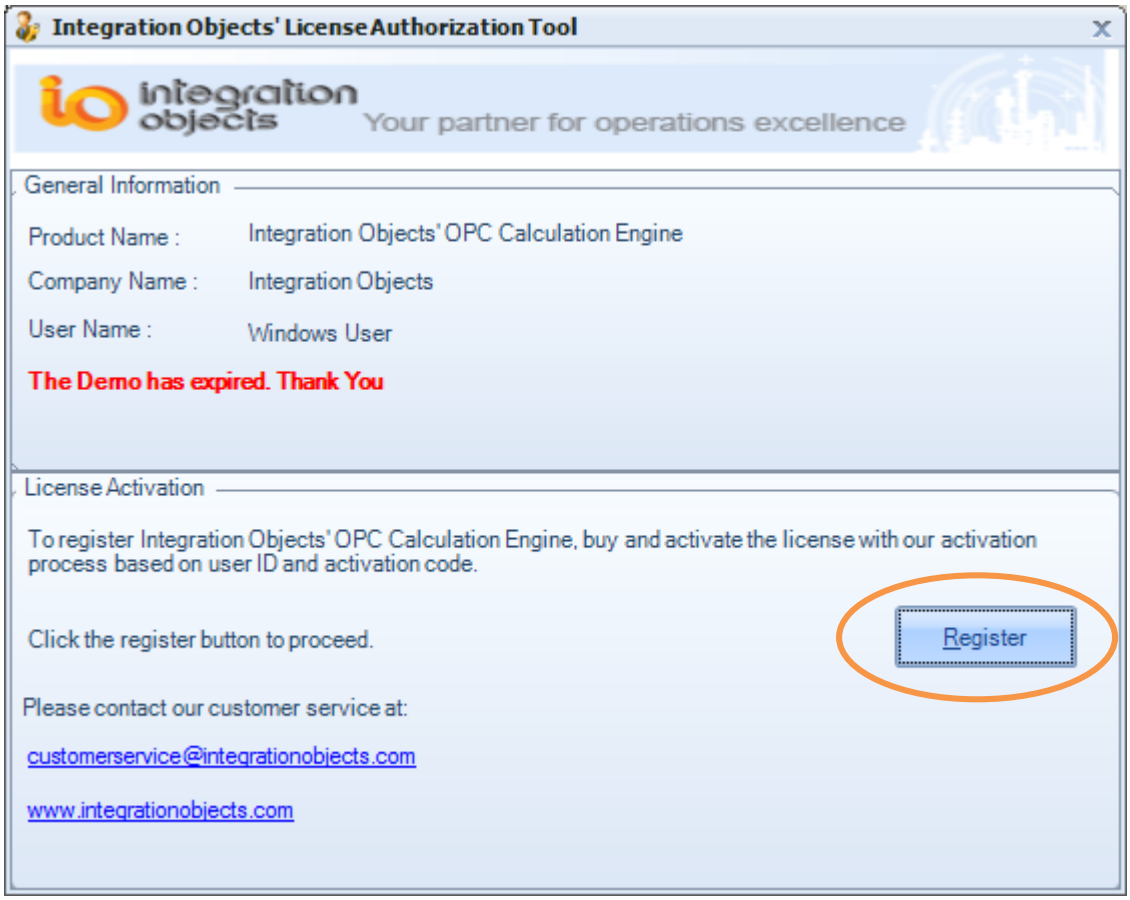

Figure 69: License Authorization (Demo Expired Case)

- Copy and send the **User ID** to the sales team { sales@integrationobjects.com } so they can generate the dedicated activation code.

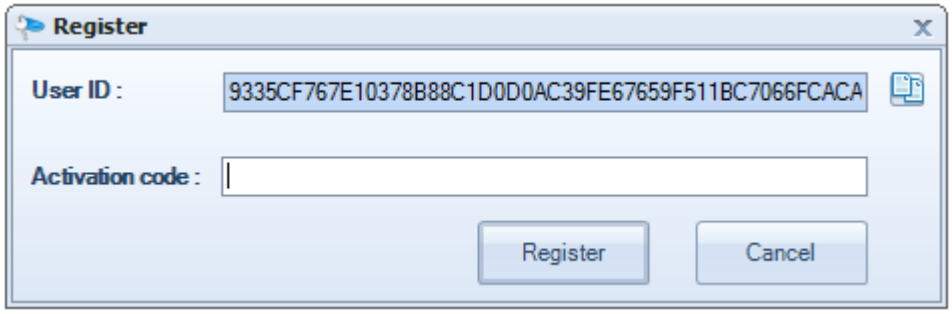

Figure 70: License Registration

- Enter the received code in the Activation code field and click the **Register** button.

Case 2: Cannot start the OPC Calculation Engine service

In case the OPC Calculation Engine service could not be started, check if:

1. The license is still valid (see the first case)
2. The user has the privileges to run the service.

In order to check and change the user running the OPC Calculation Engine service, please proceed as follows:

1. Open the windows service manager
2. Right click on "Integration Objects' OPC Calculation Engine" and select "Properties"
3. Go to the "Log on" tab.
4. Check "This account" and enter the user credentials for the service as illustrated in the figure below:

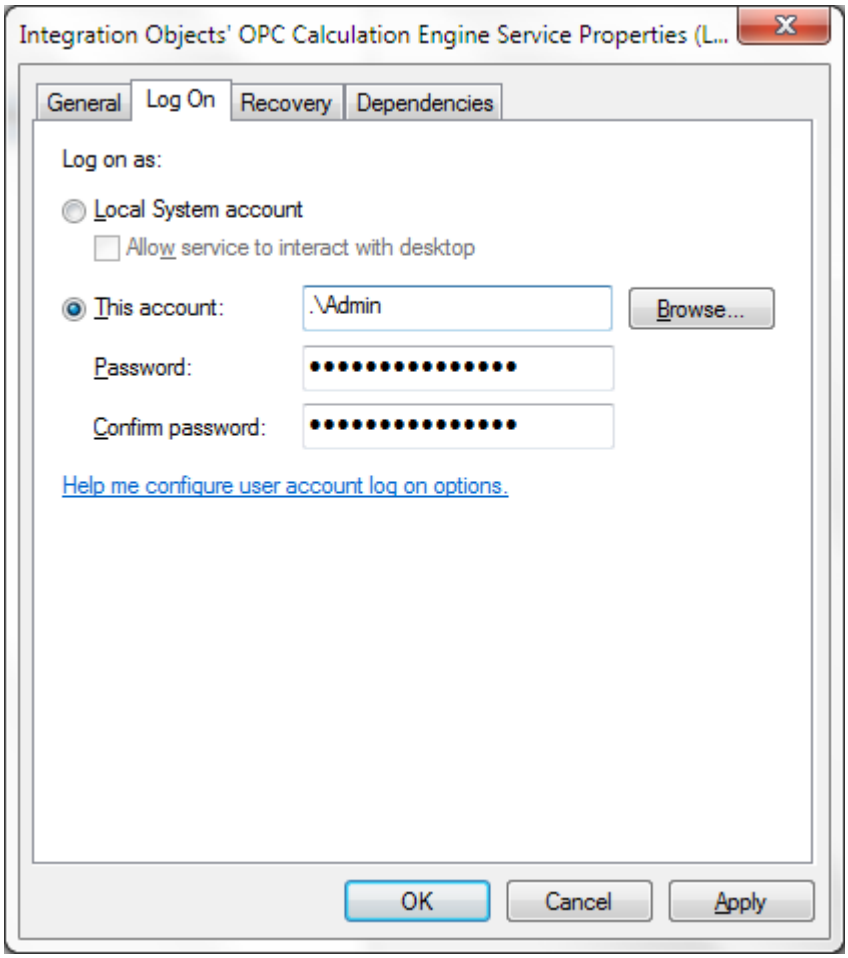

Figure 71: OPC Calculation Engine Service Log On

5. Click the OK button.

Case 3: Cannot connect to a local OPC Server

You should check whether the OPC Core Components are installed in your machine.
If they are already installed, you should use the regsvr32 command as shown below to register them again:

1. Example (Windows 7, 64 bit, System Drive "C :"):

    regsvr32 C:\Windows\SysWOW64\opcproxy.dll
    regsvr32 C:\Windows\ SysWOW64\opccomn_ps.dll

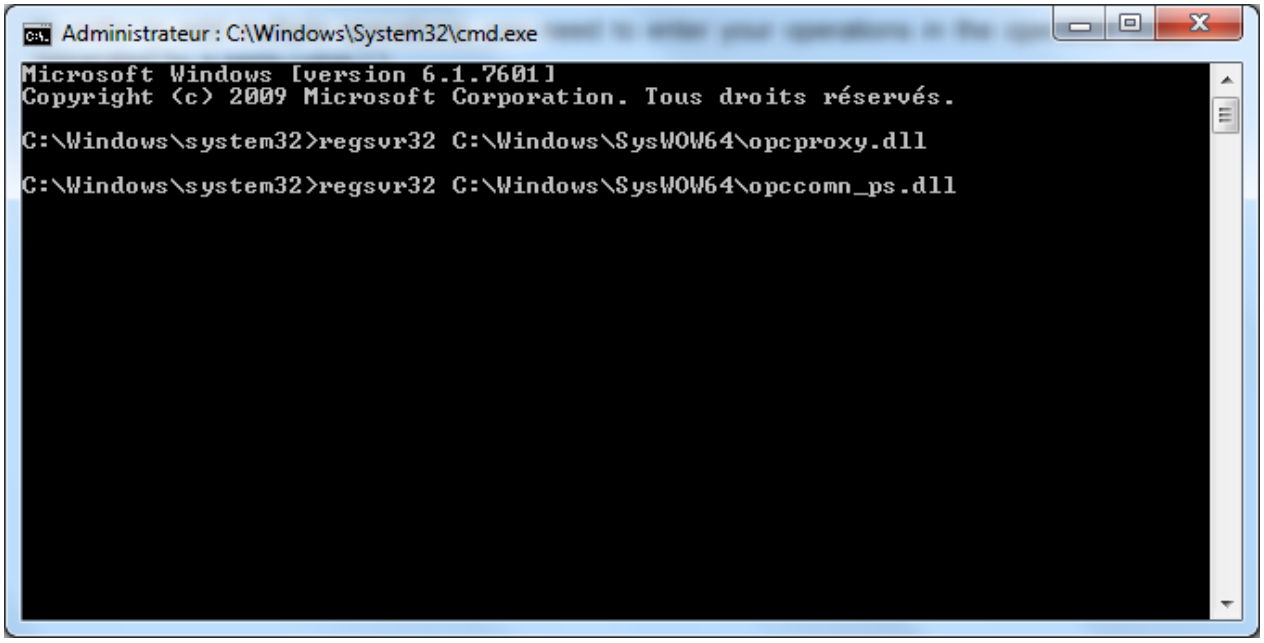

Figure 72: Register OPC Core Components on Windows 7 64 bit

2. Example (Windows 7, 32 bit, System Drive "C :"):

    regsvr32 "C:\WINDOWS\system32\opcproxy.dll"
    regsvr32 "C:\WINDOWS\system32\opccomn_ps.dll"

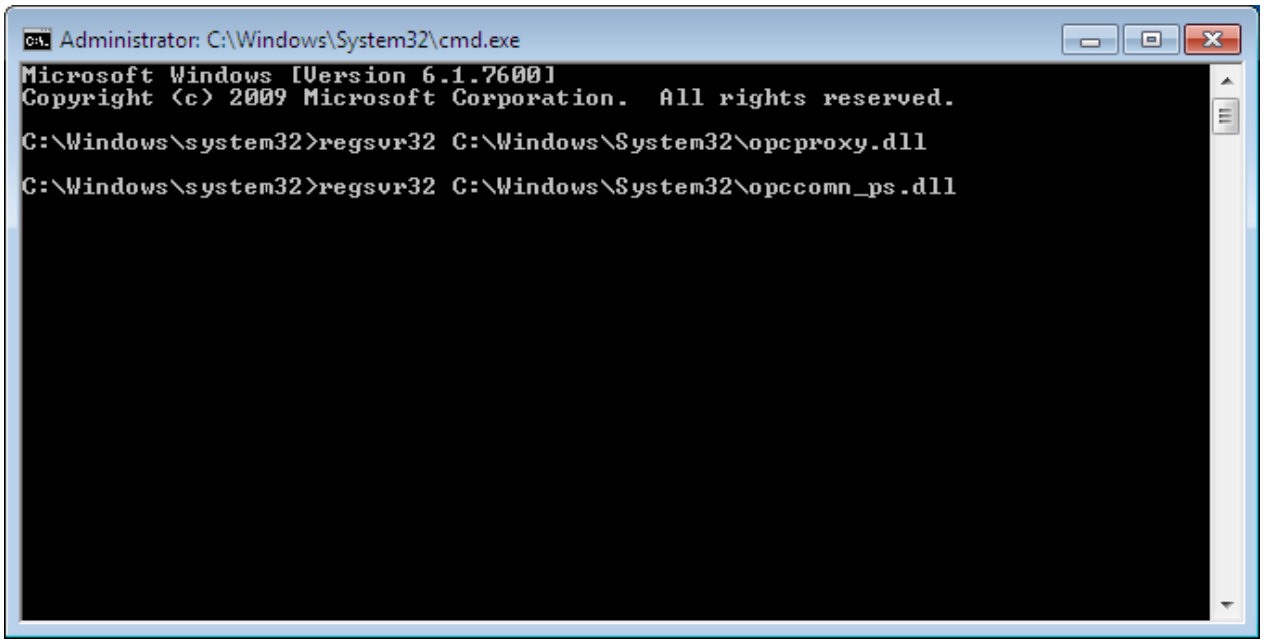

Figure 73:Register OPC Core Components on Windows 7 32 bit

You can also repair the installation OPC Core Components using the installation wizard.

Case 4: Cannot add multiple operations. We added each operation on a separate line

In order to add multiple operations, you need to enter your operations in the operation editor separated by a semi-colon (;).
You can also write one operation on multiple lines for visibility.

You can omit the semi-colon for your last operation.

Case 5: Cannot create a table in your database

When creating an archiver, you may encounter an issue when connecting to a database or creating a table due to a lack of privileges as shown in the figure below:

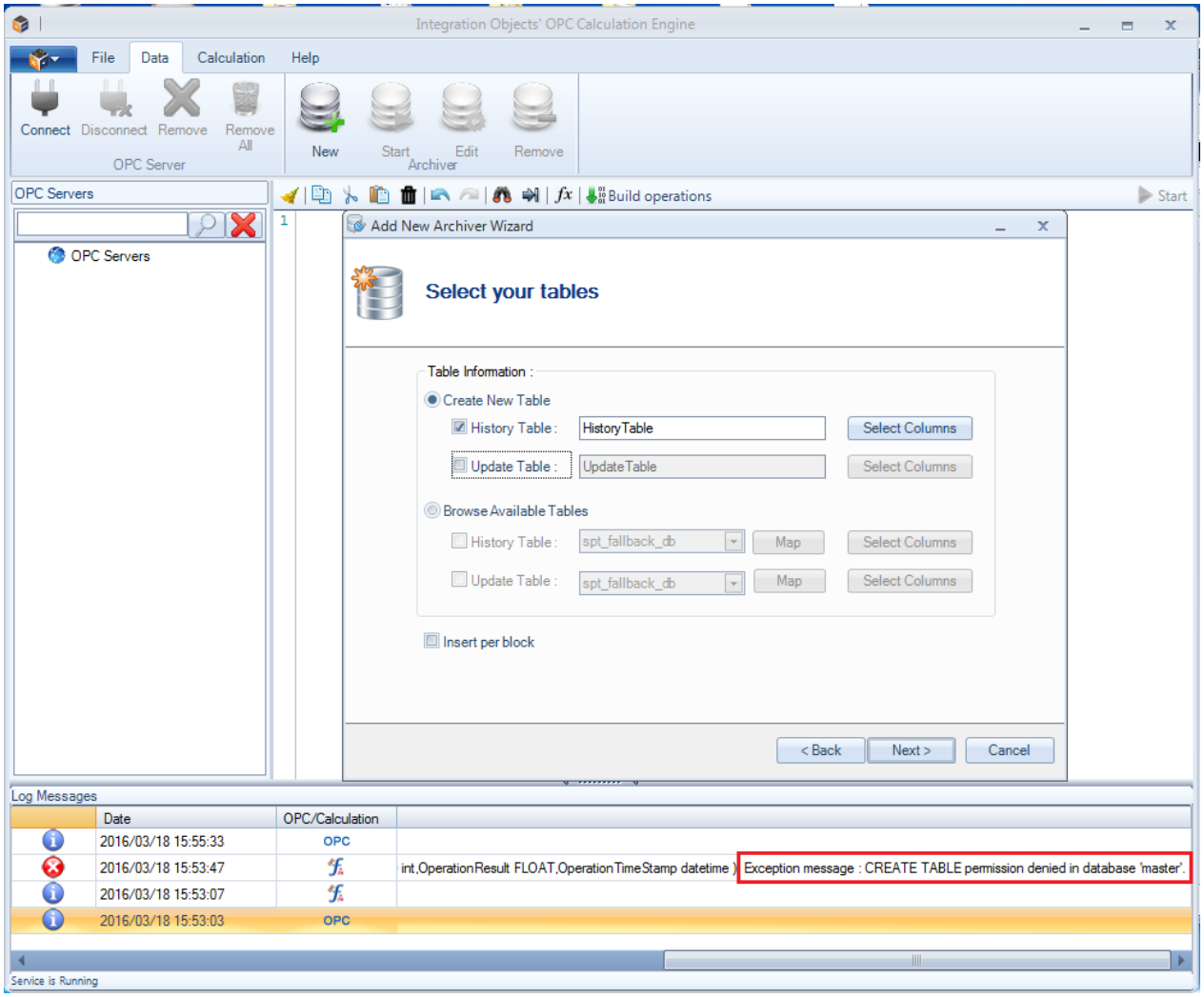

Figure 74: Permission Denied when Creating a Table

In this case, you need to either grant the right permissions to the user account of the OPC Calculation Engine service or run the service with a user account having the required database privileges.

FREQUENTLY ASKED QUESTIONS

1. Can I connect to multiple servers using OPC Calculation Engine?

Yes, the OPC Calculation Engine allows you to connect to multiple servers.

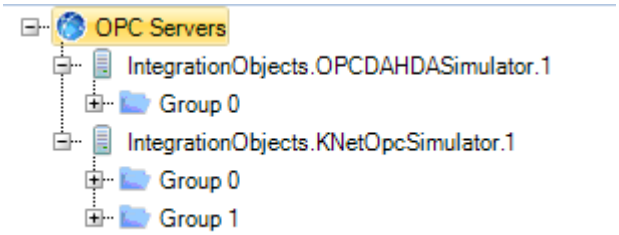

Figure 75: Connect to Multiple OPC Servers

2. Can I enter multiple operations?

Yes, you can enter multiple operations. You only need to keep in mind to separate operations by a semi-colon (;).

3. Can I write operation result into an OPC Item?

Yes. To do so, you need to assign the result of your operation to your OPC Item. Use the equal sign (=) for that purpose.

4. Can I archive my real-time calculation operations?

The OPC Calculation Engine enables you to archive your calculated data. It supports SQL Server, Oracle, MS Access, OLEDB, and ODBC databases.
If you want to archive real-time raw data using an OPC DA interface, you recommend using the OPC Easy Archiver solution.
You can find more details about our archivers under the following URL: https://integrationobjects.com/opc-products/opc-data-archiving .

5. Does the OPC Calculation Engine support reconnection to the OPC DA Servers?

Yes, the OPC Calculation Engine implements the automatic reconnection.

6. What happens if an operation contains items from different OPC servers and we lose the connection to one server?

The calculation will continue using the last known value of the disconnected OPC item.

7. How can I set a default configuration?

To set a default configuration, please proceed as follows:

- From your file tab, click the **Save** button to save your configuration.
- Then, click on the **Define** button. Browse and select the saved configuration.

Your default configuration is now defined. When restarting the OPC Calculation Engine, the defined configuration will be automatically loaded.

8. How can I remove the default configuration?

To do so, click the **Remove** button available in the configuration category of the file menu.

OPC CALCULATION ENGINE TRACING CAPABILITIES

The OPC Calculation Engine has comprehensive tracing capabilities. It generates 2 log files, which are:

- The `CalculationGUILog.LOG` that records errors and debug information of the graphical user interface.
- The `CalculationServiceLog.LOG` that records errors and debug information of the service.

If difficulties occur, the log files can be extremely valuable for troubleshooting. Under normal operation, the logs contain very little information.

These log files are generated at start-up under the installation folder of the OPC Calculation Engine.

The OPC Calculation Engine incorporates the `Configuration.xml` configuration file. The configuration parameters have default settings and can be changed by editing the configuration file.

To change the configuration parameters of the `Configuration.xml` file shown below, you can either make the changes from the OPC Calculation Engine Settings dialog or open the file in a text editor and edit the parameters.

```
<GeneralConfig xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xsd="http://www.w3.org/2001/XMLSchema">
  <Style>Windows7Blue</Style>
  <ColorStyle>Empty</ColorStyle>
<DefaultConfigPath>DefaultConfigPath\DefaultConfigFileName.oce</DefaultConfigPath>
  <GUILogSettings>
    <GUILogLevel>Error</GUILogLevel>
    <GUILogFileName>OPCCalculationEngineLog</GUILogFileName>
    <GUIAutoAppend>true</GUIAutoAppend>
    <GUIEnableLog>true</GUIEnableLog>
    <GUIBufferSize>100</GUIBufferSize>
    <GUIFileMaxSize>20000</GUIFileMaxSize>
    <GUIAutoSaveTimeOut>10</GUIAutoSaveTimeOut>
  </GUILogSettings>
  <ServiceLogSettings>
    <ServiceLogLevel>Error</ServiceLogLevel>
    <ServiceLogFileName>CalculationEngineServiceLog</ServiceLogFileName>
    <ServiceAutoAppend>true</ServiceAutoAppend>
    <ServiceEnableLog>true</ServiceEnableLog>
    <ServiceBufferSize>100</ServiceBufferSize>
    <ServiceFileMaxSize>20000</ServiceFileMaxSize>
    <ServiceAutoSaveTimeOut>10</ServiceAutoSaveTimeOut>
  </ServiceLogSettings>
</GeneralConfig>
```

The parameters are listed in the following table:

Setting	Description	Default Value
Style	The OPC Calculation Engine style.	Windows7Blue
ColorStyle	The OPC Calculation Engine color style.	Empty
GUILogSettings		
GUILogLevel	There are five log levels: 1. Control: Logs only control messages. This log level is the lowest level. 2. Error: Logs error and control messages. 3. Warning: Logs warning, error and control messages.	Error

	4. Inform: Logs information, warning, error and control messages. 5. Debug: Logs all messages. This is the highest level. The higher the log level, the more information are recorded. We recommend using level "**Control**" for a better performance of the service. The other levels are dedicated for troubleshooting purposes.	
GUILogFileName	The OPC Calculation Engine GUI log file name.	OPCCalculationEngineLog
GUIAutoAppend	Set to true to continue writing log messages in the existing log file or to false to create a new file.	True
GUIEnableLog	True to create a GUI log file, by default it's true.	True
GUIBufferSize	The maximum number of messages to be stored in the runtime memory before launching a write action in the hard disk. The specified value must be greater than 100.	100
GUIFileMaxSize	The maximum log file size, in bytes. Once this size is reached during runtime, the log file will be overwritten.	20000
GUIAutoSaveTimeOut	Specifies the time period to wait before writing the log messages stored in the in-memory buffer to the hard disk. Note that the minimum value is 10 seconds.	10
ServiceLogSettings		
ServiceLogLevel	There are five log levels: 1. Control: Logs only control messages. This log level is the lowest level. 2. Error: Logs error and control messages. 3. Warning: Logs warning, error and control messages. 4. Inform: Logs information, warning,	Error

	error and control messages. 5. Debug: Logs all messages. This is the highest level. The higher the log level, the more information are recorded. We recommend using level "Control" for a better performance of the service. The other levels are dedicated for troubleshooting purposes.	
ServiceLogFileName	The OPC Calculation Engine Service log file name	CalculationEngineService Log
ServiceAutoAppend	Set to true to continue writing log messages in the existing log file or to false to create a new file.	True
ServiceEnableLog	True to create a Service log file.	True
ServiceBufferSize	The maximum number of messages to be stored in the runtime memory before launching a write action in the hard disk. The specified value must be greater than 100.	100
ServiceFileMaxSize	The maximum log file size, in bytes. Once this size is reached during runtime, the log file will be overwritten.	20000
ServiceAutoSaveTimeOut	Specifies the time period to wait before writing the log messages stored in the in-memory buffer to the hard disk. Note that the minimum value is 10 seconds.	10

You can also monitor the application log from the main menu.

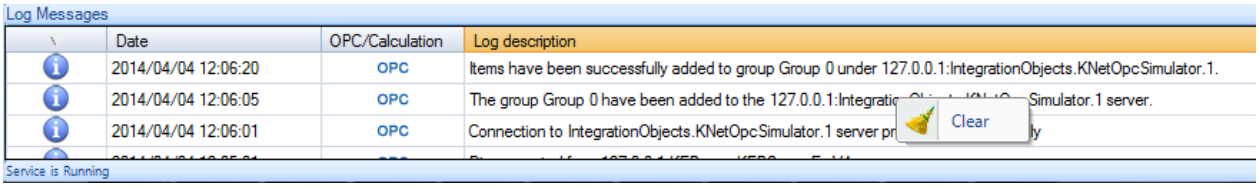

Figure 76: Clear Log Messages

To clear the log entries, right click on it and select **Clear** from the displayed menu.

For additional information on this guide, questions or problems to report, please contact:

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