PowerFactory 2022

OPC Unified Architecture (UA) Guide

PF2022

POWER SYSTEM SOLUTIONS
MADE IN GERMANY

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October 25, 2021
Revision 1

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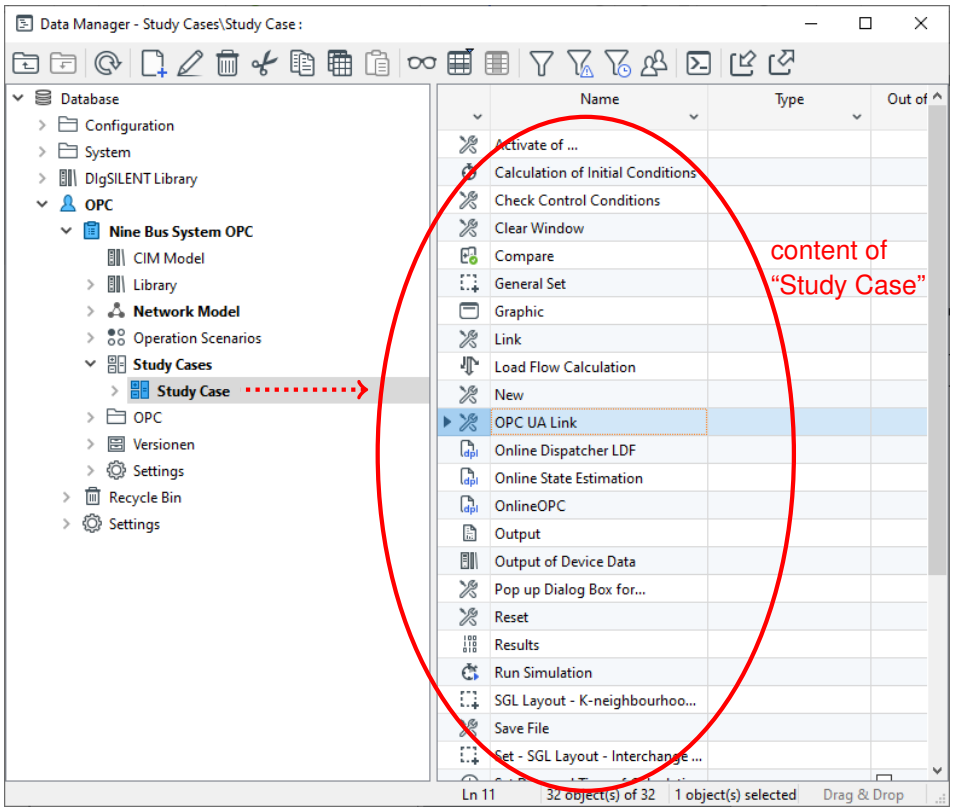
1 Preliminaries

This document demonstrates the ability of *DIgSILENT* ***PowerFactory*** to exchange operational data with an OPC[1] server. The document is related to the *OPC-DA guide* (see file "PowerFactory OPC-DA Guide.pdf") and therefore it will not explain all steps in detail, because the OPC-UA link behaves like the OPC-DA link after it was started. Especially the configuration of ***PowerFactory*** (chapter 3.2 *OPC-DA guide*) and the description of ***PowerFactory*** objects (chapter 2.4 and 3.3 *OPC-DA guide*) should be read.
Unfortunately there is no free OPC-UA server available that can easily be configured. Hence this document will not explain the setup of an OPC-UA server.

2 OPC Example

2.1 *PowerFactory* Configuration

Please start *DIgSILENT* ***PowerFactory*** and import the delivered example project (OPCExample.pdf). Then open the data manger and navigate to the active study case. If you need further information about these steps, please consider the *OPC-DA guide* chapter 2.4. Now the OPC connection can be configured.

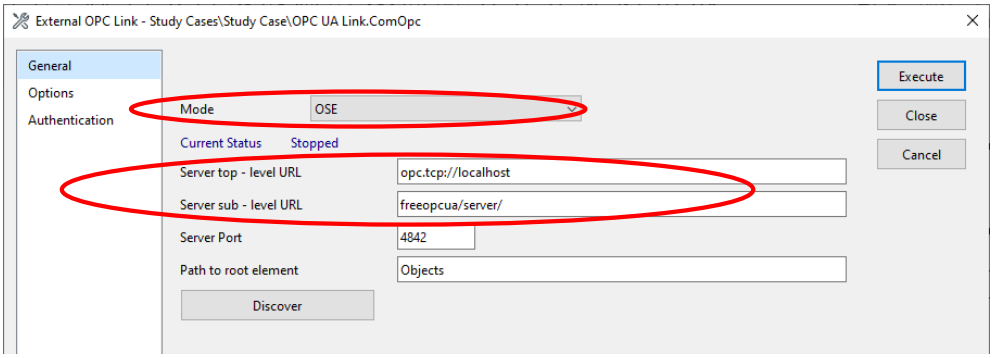


[1] OPC-UA = Open Platform Communication-Unified Access

1. Open the dialog sheet for the object named “OPC UA Link” on the right side of the data manager by performing a double click on the element name. This “OPC UA Link” object rules the communication with the external server.

2. Configure the link object as follows:

   - **Mode**, i.e. “OPC OSE”
     (There are two general OPC links available: OPC OSE for Online State Estimation and OPC TDS for Time Domain Simulation.)
   - **Server top - level URL**, i.e. “opc.tcp:\\localhost”
     (The address of the computer running the OPC-UA server including the protocol type. This value is the equivalent to the *Computer Name* of the ComLink-object.)
   - **Server sub - level URL**, i.e. “freeopcua/server” (The name of the server to use. This value is the equivalent to the *Prog ID* field of the ComLink-object. The link will append this value to the top-level URL to establish a connection.)
   - **Server Port**, i.e. “4842” (The port to use for the communication with the server.)
   - **Path to root element**, i.e. “Objects” (All OPC-Tags are resolved relative to this root element. If you specify ”.”, then the server root element is used.)

   For a first connection check, you can press the ***Discover*** button. This will establish a connection to the OPC server and will list all values below the defined root element in the output window. You will see an error if the connection could not be established. If the settings are correct, press the ***Execute*** button to connect to the server.

3. On success, an info message will be printed to the output window containing information about the resolved variables. It can for instance look like:

   ```
   info - Connection established to server opc.tcp://localhost:4842/
       freeopcua/server/
   info - Found 152 valid OPC items and 0 invalid items
   ```

4. If you open and press the *Execute* button again, the connection to the server will be closed.

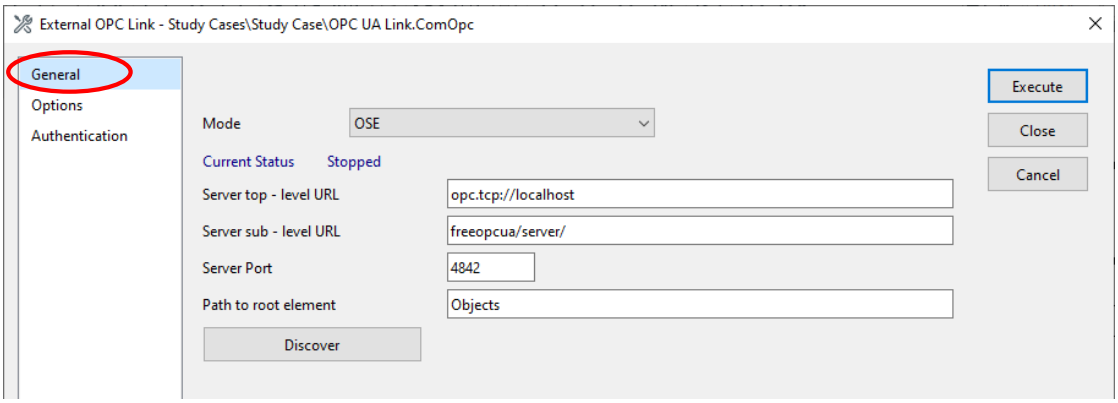
Now the OPC connection is configured and can be used to send and receive data.

3 Details on *PowerFactory* 's OPC Connection

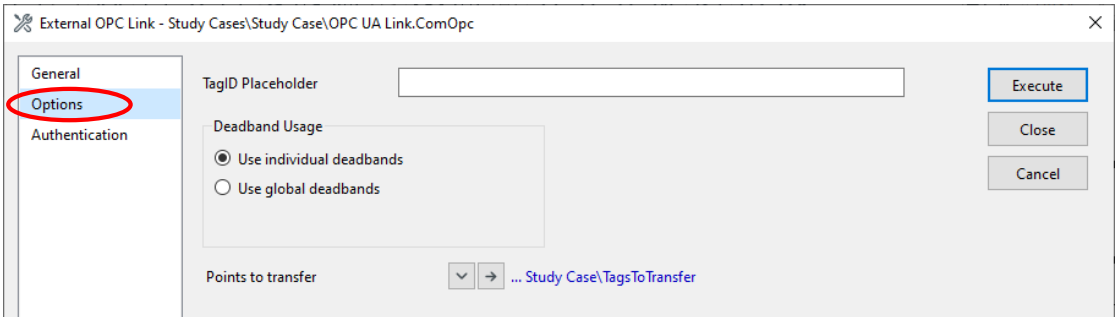
This chapter gives some information on the OPC link and how data is exchanged with an OPC server. The connection is established using an instance of the class ComLOPC. This object holds the OPC client configuration and is responsible for sending and receiving data.

3.1 Options

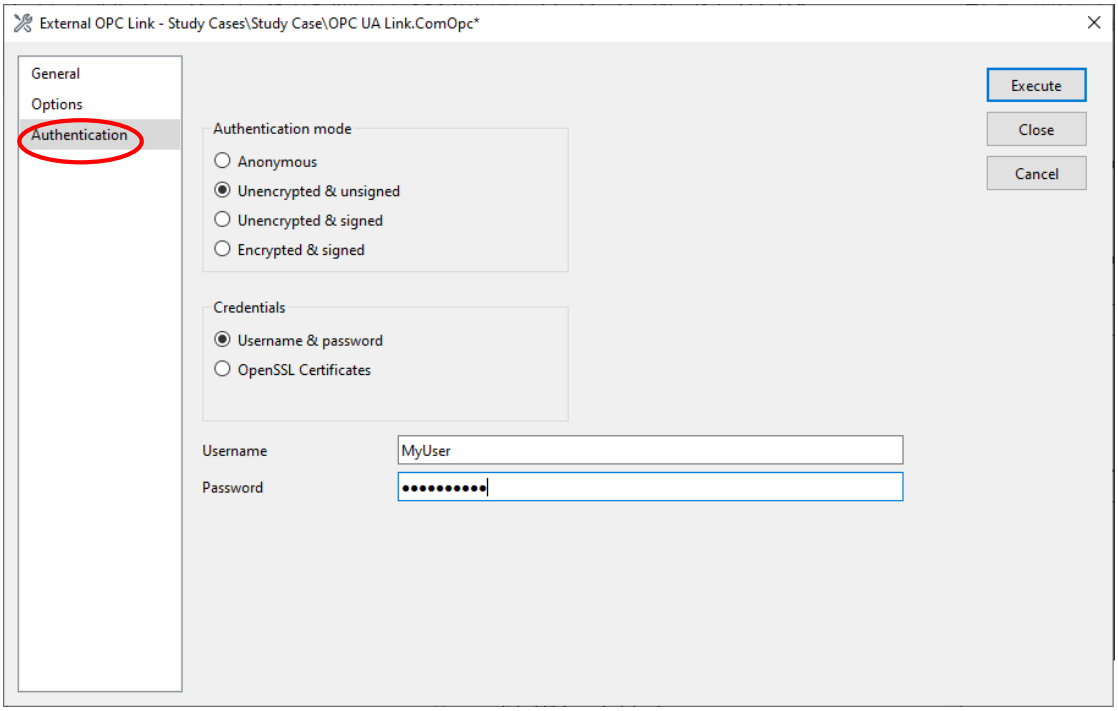
The following configuration options are available:



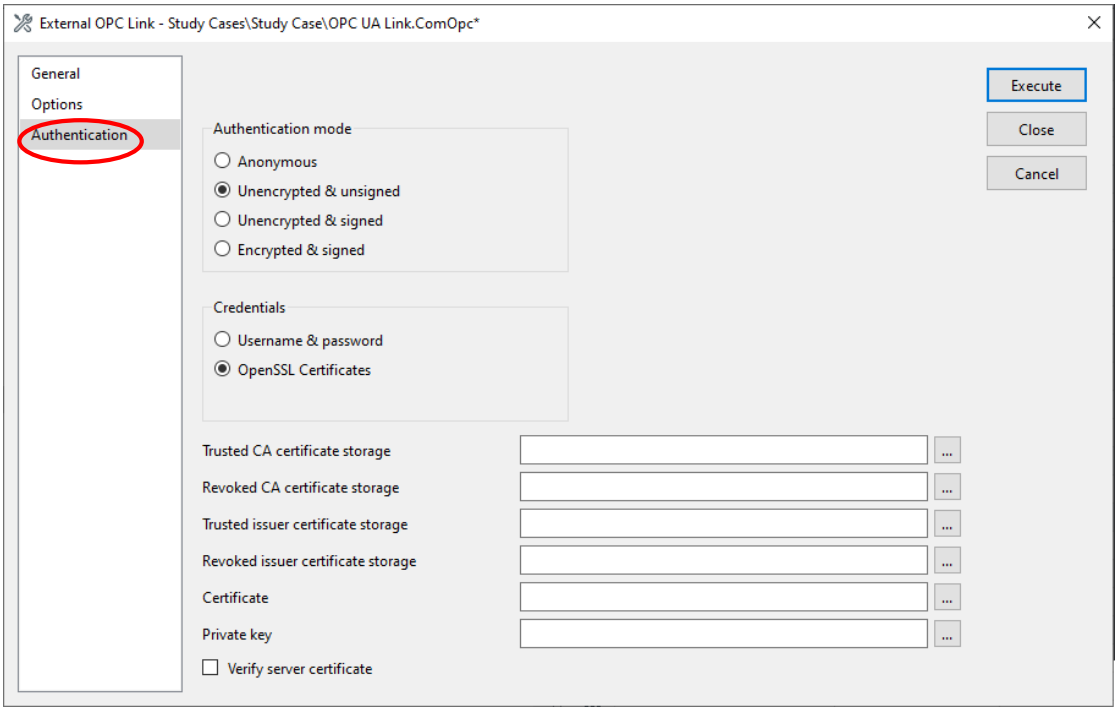
Mode	Selection of connection type. This affects the way how input data is set to the ***PowerFactory*** objects. For OPC there are two possible modes available: • OSE: Received values are directly used in LDF / SE calculation. • TDS: Received values are transformed into simulation events. These events are processed by a running simulation.
Server top - level URL	The address of the computer running the OPC-UA server including the protocol type (see also section 2.1).
Server sub - level URL	The name of the server to use (see also section 2.1).
Server Port	The port to use for the communication 2.1).
Path to root element	All OPC-Tags are resolved relative to this root element. If you specify ".", then the server root element is used.
The complete connection URL is combined out of the sub-level and top-level information as well as the port number.	



TagID Placeholder	This is a kind of keyword replacement list that offers the possibility to adapt OPC tag names to different environments / OPC servers. The replacement will be applied to all OPC tags for all configured measurement objects. The list must be of form key=value[;key2=value2]*. Example: TagID = %group%.G1_V_CTRL using a replacement list of %group%=PF1 would result in a tag PF1.G1_V_CTRL. Simply adjusting the replacement would also allow to connect to a different group, e.g. %group%=PF2 leads to PF2.G1_V_CTRL
Deadband Usage	Value changes are only processed if the difference between the last value that was transferred and the actual values is greater than this deadband (only used for floating point numbers). Since ***PowerFactory*** 2017 SP1 the deadband value is used for sent and received values to minimize the network traffic and the number of generated events. • Use individual deadbands: deadband value (absolute value) is specified in each external measurement object (see 2.2 External Measurement Objects) • Use global deadbands: one deadband (absolute value) is specified for all external measurement objects (individual deadband is ignored)
Points to transfer	This selection was introduced with ***PowerFactory*** 2019 and could be used to restrict the tags (StaExt* elements) that should be used by the connection. It could either be set to a single tag, a selection set (SetSelect object) or to none. If none is chosen, all tags are transferred. With the help of this property, it is possible to use multiple OPC servers at the same time. Each server can use an individual subset of the defined measurement points.



Authentication mode	Authentication mechanism used for the OPC connection. • Anonymous: No credentials are used to set-up the server connection. • Unencrypted & unsigned: The specified credentials are passed to the server. The connection itself does not use any encryption to protect the transferred data. • Unencrypted & signed: The specified credentials are passed to the server. The connection itself does not use encryption to protect the data, but uses certificates to make sure that no man in the middle attack is performed. The basic 256 bit algorithm is used. • Encrypted & signed: The specified credentials are passed to the server. The connection itself uses encryption and certificates to secure the communication. The basic 256 bit algorithm is used.
Credentials	The credentials, which shall be used for the OPC connection: • Username & password: Simple login with username and password.



- OpenSSL Certificates: OpenSSL certificates could be used to establish the server connection. The following folders must be specified in order to use this option.
  - Trusted CA certificate storage: This folder should contain all **.der* files of certificate authorities that are valid for the communication.
  - Revoked CA certificate storage: This folder should contain all **.der* files of certificate authorities that are not valid anymore.
  - Trusted issuer certificate storage: This folder should contain all **.der* files of issues that are valid for the communication.
  - Revoked issuer certificate storage: This folder should contain all **.der* files of issues that are not valid anymore.
  - Certificate: The **.der* file of the client that should be used for the communication.
  - Private key: The **.pem* file of the client that should be used for the communication.
  - Verify server certificate: If this box is unchecked, the server certificate is not checked for the connection.

3.2 Connecting / Disconnecting

Connecting or disconnecting is done by pressing the button *Execute*:

If there is currently no active connection, a new one will be established. After the connection was successfully initiated, the external data link object searches for all external measurement objects that are calculation relevant (in an active grid) and not out of service. For each of these objects, a subscription to the corresponding OPC item is established. This is only done on creating the connection. Changing an external measurement object while the connection is established has no effect.

Pressing *Execute* while the connection is active will terminate this connection.

The connection status is always displayed on the dialog of the data link object: