

OPC UA

Data Format Converter



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Introduction

NeuroCheck Data Format Converter in general

A so called Data Format Converter (abbreviated DFC) is a communication driver that converts data that is generated in NeuroCheck into a format that is suitable to a certain kind of hardware or file and vice versa. For a detailed introduction of Data Format Converter and the communication flow see NeuroCheck User Manual (chapter data exchange).

OPC UA Data Format Converter

The OPC UA Data Format Converter (DFC) acts as a OPC UA Client application and allows NeuroCheck to connect to a OPC UA Server. Using the DFC input and output pins, NeuroCheck can write or read values from nodes on that Server. This also allows for the remote control of NeuroCheck via Process Pins of the DFC.

Open Platform Communications Unified Architecture (OPC UA) is a specification for industrial communication. It contains various aspects like security, encoding or the information model used on servers. The user of this DFC should have a basic knowledge of OPC UA principles and keywords. This DFC does not implement the full spectrum of OPC UA features. For an overview of supported features see [Supported OPC UA Features](#).

Other Resources

For more information on OPC UA, access to the full specification and other resources visit opcfoundation.org.

Installation

Supported operating systems

You can use the NeuroCheck OPC UA Data Format Converter with all operating systems NeuroCheck itself supports.

- Microsoft® Windows® 7 (32 bit and 64 bit)
- Microsoft® Windows® 10 (32 bit and 64 bit)
- Microsoft® Windows® 11 (32 bit and 64 bit)

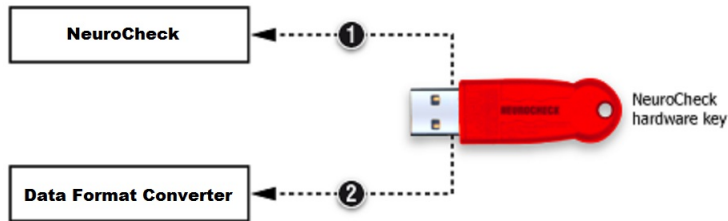
NeuroCheck OPC UA Data Format Converter

For Installation of the NeuroCheck OPC UA Data Format Converter complete the following steps.

1. Extract all files from the zip archive to their respective destination folders:
 - Copy all files located within the `/Binaries` directory to the main NeuroCheck installation directory (e.g., `C:\Program Files\NeuroCheck 6.2\`).
 - Copy all files located within the `/Documentation` directory to the `/Documentation/Help` subdirectory within the NeuroCheck installation directory (e.g. `C:\Program Files\NeuroCheck 6.2\Documentation\Help\`).
2. Configure the data format converter as new converter in NeuroCheck:
 - a. In NeuroCheck, open the Data Format Converter Manager (Menu **System | Data Format Converter Manager**)
 - b. Click **New ...** to start the NeuroCheck **Data Format Converter Wizard**.
 - c. Select option **Other** on the first page and continue.
 - d. On the second page, select **OPC UA** and continue.
 - e. Select the new converter node.
 - f. Choose **Properties ...** to open the converter settings dialog and configure the settings for your application (see Converter Properties).
 - g. Close the properties dialog with **OK**.
3. Close the NeuroCheck **Data Format Converter Manager** with **OK**.

Licensing

This section describes the licensing mechanism for this NeuroCheck Data Format Converter.



1. Protection of NeuroCheck

NeuroCheck requires a valid license which is provided as hardware security key (dongle). You obtain the standard NeuroCheck license by purchasing the software from your local NeuroCheck dealer.

2. Protection of OPC UA Data Format Converter

In addition to the standard NeuroCheck license, also a license for the NeuroCheck **OPC UA Data Format Converter** is required. The protection of the Data Format Converter is stored as special flag in the same dongle as for the NeuroCheck license. The Data Format Converter allows a couple of read or write operations in demo mode, then a message box informs about the missing license. You have to confirm that message box before a new set of executions is possible.

In order to get the license for the OPC UA Data Format Converter, please contact your local NeuroCheck partner. The license can be added to a standard NeuroCheck license by remote-programming of the dongle. The remote-programming works in the same way as a NeuroCheck update.

Supported OPC UA Features

General

This Data Format Converter only supports a subset of encodings and services provided by an OPC UA server. This section gives an overview of the supported features and functionality regarding to the OPC UA specification.

Encodings and Protocols

Only one data encoding is supported:

- UA Binary

The supported communication protocols are:

- OPC UA TCP

Security

OPC UA defines multiple Security Profiles and Security Policies to sign and encrypt messages, authenticate applications and users and authorize server access.

Supported User Authentication methods are:

- User Name Password
- X509 Certificate
- None (Anonymous)

Supported Security Modes are:

- Sign and Encrypt
- Sign
- None

Supported Security Policies are:

- Aes128Sha256RsaOaep
- Aes256Sha256RsaPss
- Basic256
- Basic256Sha256
- Basic128Rsa15
- None

Services

OPC UA describes several Services a client can call on a server. Supported Service Sets are:

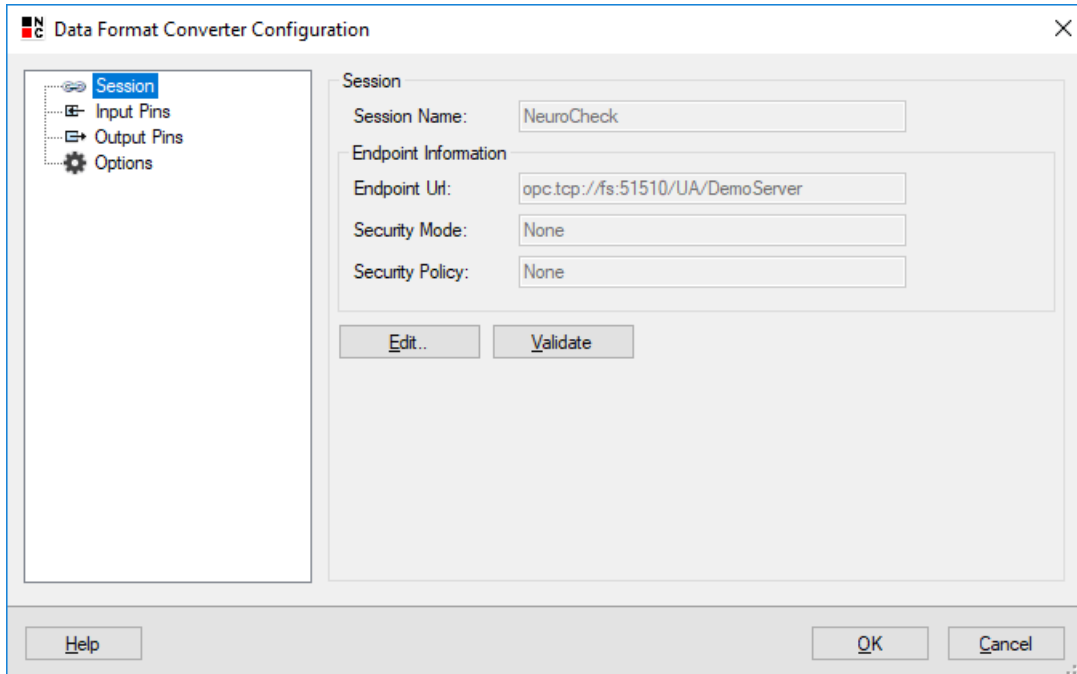
Service Set	Description
Discovery	The user can discover available Endpoints through the property dialog when configuring a Session.
Secure Channel and Session	Each DFC Channel can create one Session and a corresponding Secure Channel.
Views	When configuring a Pin the user can browse the server Address Space and navigate between Nodes.
Attributes	The actual values of Nodes are provided as Value Attributes of Variable Nodes. The DFC supports reading and writing to the Value Attribute of Variable Nodes.
Subscriptions	Enables the DFC to receive notifications whenever the value of a Node associated to a Pin has changed.

PubSub is currently not supported.

Converter Properties Dialog: Session

Session Page

 [Screenshot of Properties Dialog](#)



On this page you can configure the OPC UA Session that describes the connection to a Server Endpoint. The information displayed on this page is only an quick overview of the configured Session. To edit the Session, use the Edit Button.

Edit Session Dialog

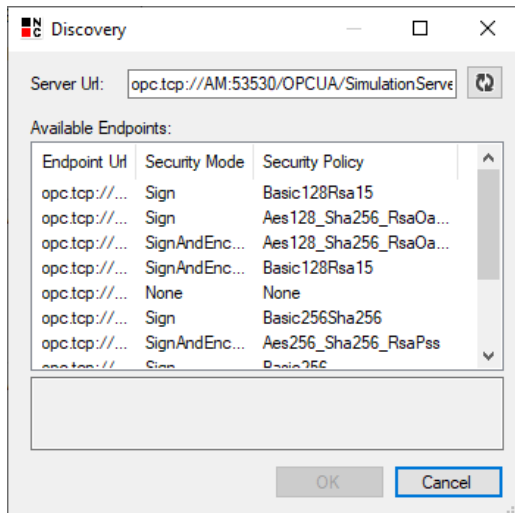
☑ Screenshot of Edit Session Dialog

Element	Description
Session Name	Human readable name that identifies the Session, the user should provide a name that is unique for the instance of the Client.
Endpoint Information	
Endpoint Url	The network address used to access the server. Use the '...' button to open the Discovery Dialog and find valid Endpoints.
Security Mode	The Security Mode associated with the selected Endpoint.
Security Policy	The Security Policy associated with the selected Endpoint.
Authentication	
User Identity	The method of user identification supported by the endpoint. The combo box contains the values supported by the selected endpoint.
User Name / Certificate	Depending on the User Identity chosen provide your user name or path to a certificate recognized by the server.
Password	The password for the chosen user name or certificate.
Advanced Endpoint Information	

Element	Description
Application Name	The name of the application associated with the selected Endpoint.
Application Type	The type of the application associated with the selected Endpoint.
Application Uri	A unique identifier of the application associated with the selected Endpoint.

Discovery Dialog

[Screenshot of Discovery Dialog](#)



Most of the parameters described in the previous section are predetermined or restricted by the Endpoint provided by a server. To find Endpoints use the '...' button next to the Endpoint Url field in the Edit Session Dialog.

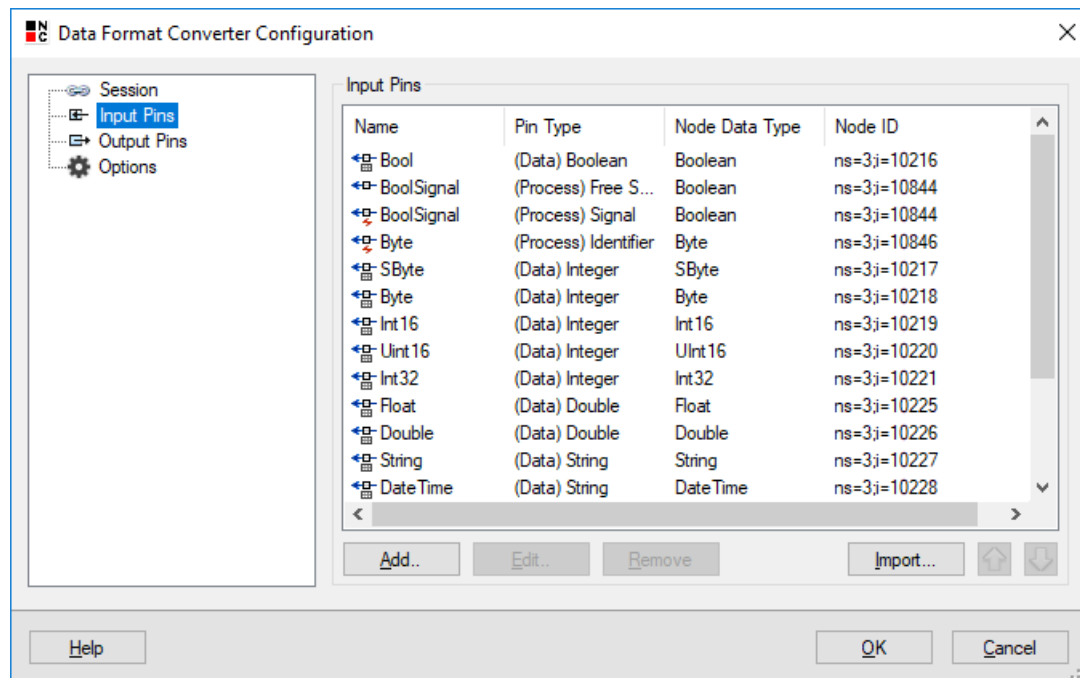
When querying an url, first the FindServers Service will be called and then the GetEndpoints Service on all returned Servers. If a Discovery Server address is entered, Endpoints from multiple servers might be returned. For each returned Endpoint the following parameters will be displayed. The returned endpoints will be filtered for the UA Binary encoding, as this is the only encoding supported by the DFC.

Element	Description
Server Url	The URL on which to query for available endpoints.
Endpoint Url	The URL associated with the Endpoint.
Security Mode	The Security Mode associated with the Endpoint.
Security Policy	The Security Policy associated with the Endpoint.

Converter Properties Dialog: Input Pins

Input Pins

 Screenshot of Properties Dialog



On this page you can configure the input pins to read from an OPC UA server. A pin is connected to a specific Variable Node in the Address Space of a server.

Element	Description
Input Pins	Shows the list of configured input pins to read from an OPC UA server. Use button Add or Add from table to insert new data pins. The list shows the following columns. • Pin name: The name of the pin, freely chosen by the user. • Pin Type: The type of the pin, e.g. (Data) String, (Process) Signal, (Process) Identifier etc. • Node Data Type: The OPC UA data type of the associated Node. • Node ID: The Node ID of the associated Node. This identifies the Node in the server Address Space.
Add ...	Click here to define a new pin and append it to the list.
Edit ...	Click here to edit the currently selected pin.
Remove	Click here to remove the selected pin(s) from the list.
Import...	Click here to import pins from a .csv file. The expected format is described in Pin Import Format .
Up	Click here to move the selected pin upward in the list.
Down	Click here to move the selected pin downward in the list.

Configure Pin Dialog

 Screenshot of Configure Pin Dialog

Configure Pin

Pin Info

Name:

Data type: ⏏ (Data) String ▾

Node Properties

Node ID: ...

Data Type: ▾

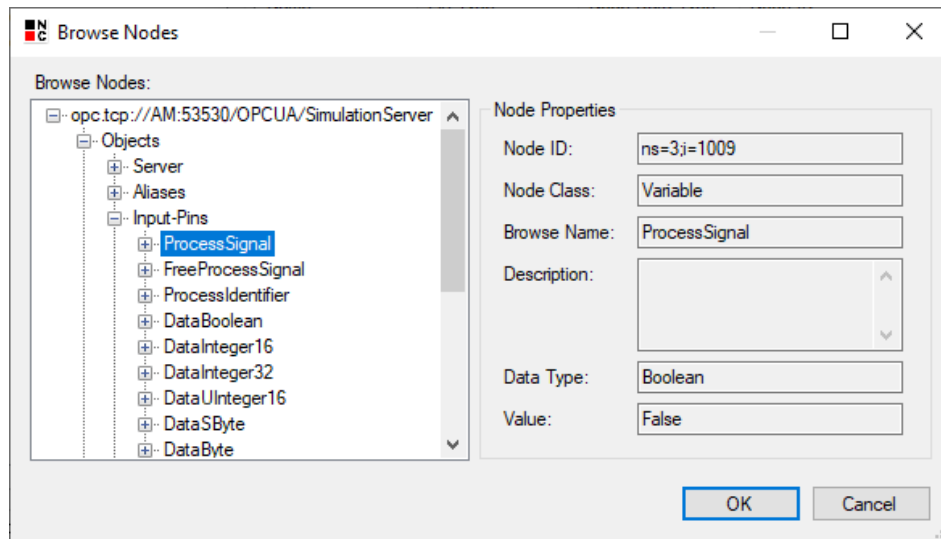
OK Cancel

With this dialog pins can be modified or added to the input pin list.

Element	Description
Pin Info	
Name	The name of the pin.
Data Type	The NeuroCheck pin type.
Node Properties	
Node ID	The Node ID of the associated Node. Clicking on the '...' button will open the Browse Nodes Dialog. The DFC will not check the validity of the Node ID to support an offline configuration of the pins. In case the server doesn't recognize the Node ID, or the data type of the associated Node is not supported, you will get an error when reading or writing. It is recommended you use the Browse Nodes Dialog to select the Node you want to connect to your pin.
Data Type	The OPC UA data type of the associated Node. This data type must be convertible to the NeuroCheck data type. For supported conversions see Supported Data Type Conversions .

Browse Nodes Dialog

❑ Screenshot of Browse Nodes Dialog



Using the '...' button next to the Node ID in the Configure Pin Dialog will open the Browse Nodes Dialog. It allows you to navigate through the server Address Space to view and select a Node you want to connect to your pin. When entering a Node ID before pressing the '...' button, the DFC will attempt to inversely browse the address space and show the location of the node in the hierarchical tree.

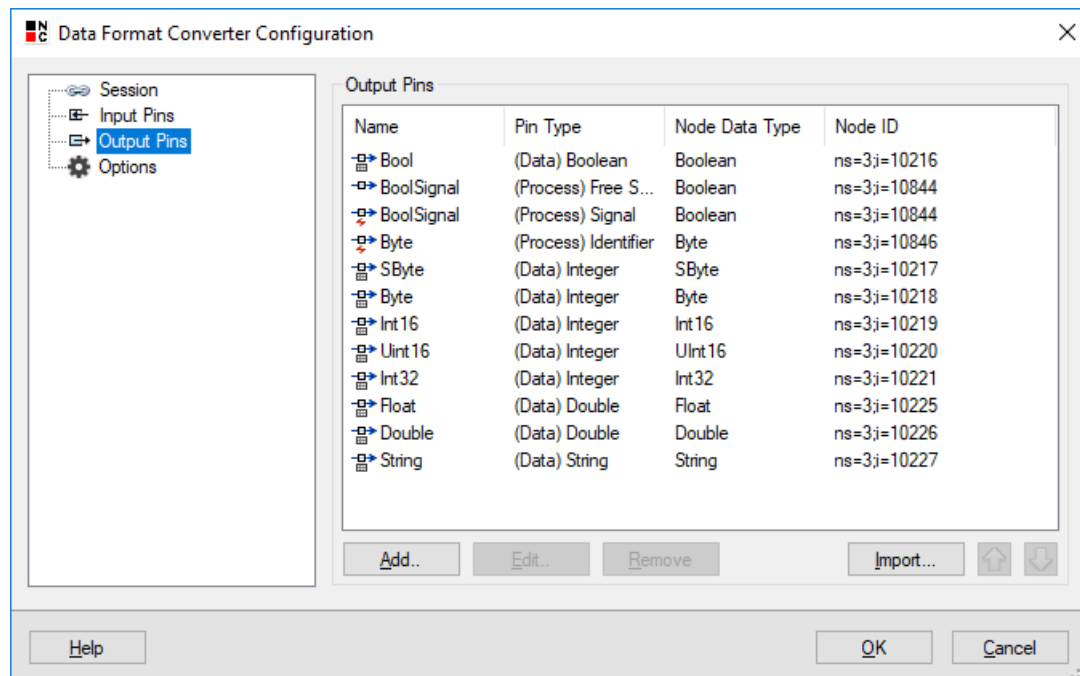
Only Variable Nodes with a supported OPC UA data type attribute will be selectable.

Element	Description
Browse Nodes	The tree view shows the address space of the server in its hierarchical structure. Expanding a Node will show its child nodes. The address space is usually organized by Object Nodes with Variable Nodes being present only in the deeper structures of the tree. Clicking on a Node will read its properties and show them in the Node Properties display to the right.
Node Properties	
Node ID	The Node ID of the node.
Node Class	The OPC UA Node Class. Only Variable Nodes are connectable to a pin.
Browse Name	The human readable Node Name in the address space. This name is the text shown in the tree view.
Description	Nodes may optionally contain a description. The description is displayed here.
Data Type	The OPC UA data type of the associated Node. Only Variable Nodes contain a data type attribute.
Value	In case of a Variable Node the current value is displayed here.

Converter Properties Dialog: Output Pins

Output Pins

 [Screenshot of Properties Dialog](#)

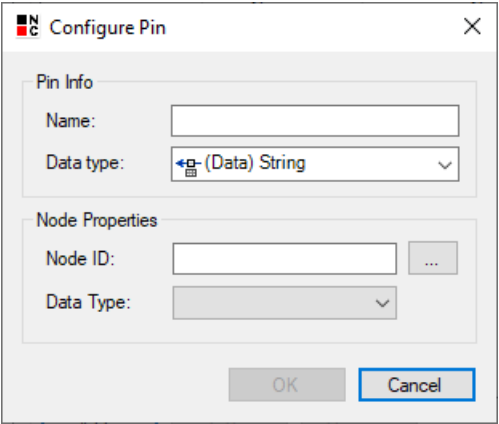


On this page you can configure the input pins to read from an OPC UA server. A pin is connected to a specific Variable Node in the Address Space of a server.

Element	Description
Input Pins	Shows the list of configured input pins to read from an OPC UA server. Use button Add or Add from table to insert new data pins. The list shows the following columns. • Pin name: The name of the pin, freely chosen by the user. • Pin Type: The type of the pin, e.g. (Data) String, (Process) Signal, (Process) Identifier etc. • Node Data Type: The OPC UA data type of the associated Node. • Node ID: The Node ID of the associated Node. This identifies the Node in the server Address Space.
Add ...	Click here to define a new pin and append it to the list.
Edit ...	Click here to edit the currently selected pin.
Remove	Click here to remove the selected pin(s) from the list.
Import...	Click here to import pins from a .csv file. The expected format is described in Pin Import Format .
Up	Click here to move the selected pin upward in the list.
Down	Click here to move the selected pin downward in the list.

Configure Pin Dialog

[Screenshot of Configure Pin Dialog](#)

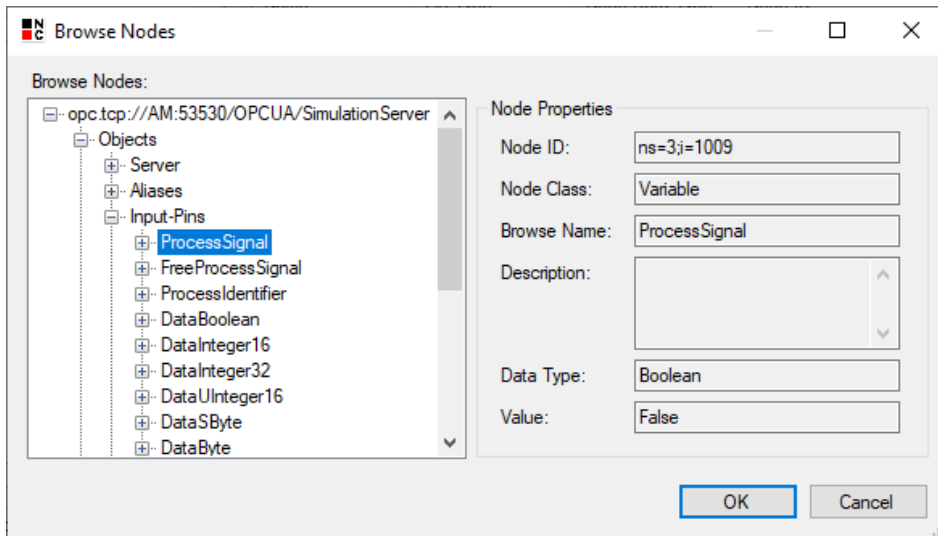


With this dialog pins can be modified or added to the input pin list.

Element	Description
Pin Info	
Name	The name of the pin.
Data Type	The NeuroCheck pin type.
Node Properties	
Node ID	The Node ID of the associated Node. Clicking on the '...' button will open the Browse Nodes Dialog. The DFC will not check the validity of the Node ID to support an offline configuration of the pins. In case the server doesn't recognize the Node ID, or the data type of the associated Node is not supported, you will get an error when reading or writing. It is recommended you use the Browse Nodes Dialog to select the Node you want to connect to your pin.
Data Type	The OPC UA data type of the associated Node. This data type must be convertible to the NeuroCheck data type. For supported conversions see Supported Data Type Conversions .

Browse Nodes Dialog

[Screenshot of Browse Nodes Dialog](#)



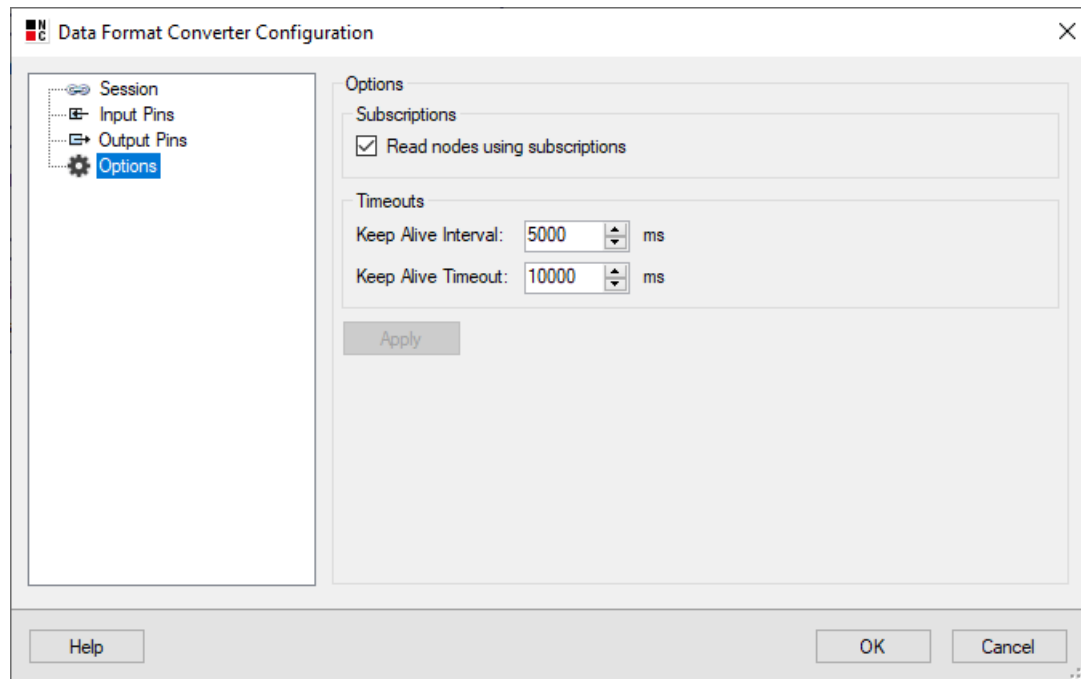
Using the '...' button next to the Node ID in the Configure Pin Dialog will open the Browse Nodes Dialog. It allows you to navigate through the server Address Space to view and select a Node you want to connect to your pin. When entering a Node ID before pressing the '...' button, the DFC will attempt to inversely browse the address space and show the location of the node in the hierarchical tree.

Only Variable Nodes with a supported OPC UA data type attribute will be selectable.

Element	Description
Browse Nodes	The tree view shows the address space of the server in its hierarchical structure. Expanding a Node will show its child nodes. The address space is usually organized by Object Nodes with Variable Nodes being present only in the deeper structures of the tree. Clicking on a Node will read its properties and show them in the Node Properties display to the right.
Node Properties	
Node ID	The Node ID of the node.
Node Class	The OPC UA Node Class. Only Variable Nodes are connectable to a pin.
Browse Name	The human readable Node Name in the address space. This name is the text shown in the tree view.
Description	Nodes may optionally contain a description. The description is displayed here.
Data Type	The OPC UA data type of the associated Node. Only Variable Nodes contain a data type attribute.
Value	In case of a Variable Node the current value is displayed here.

Converter Properties Dialog: Options

☑ Screenshot of Properties Dialog



Element	Description
Subscriptions	If enabled, the DFC will receive notifications whenever the value of a Node associated to a Pin has changed. If disabled, the DFC will periodically read the value of the Nodes in order to detect any changes.
Keep Alive Interval	The DFC will periodically read the Server Status Node to ensure the session stays alive and will not time out. This parameter specifies the interval time in ms.
Keep Alive Timeout	If no answer is received for the Keep Alive Timeout value after the Keep Alive Interval, the Session will be declared disconnected and a reconnect will be attempted periodically.
Apply	Apply the chosen values to the current session.

Import Pins File Format

Multiple pins can be imported at once from an external .csv file from the pin setting pages. The required file format is described in this section.

A description of three exemplary pins could look like this:

```
IN,Text Input Value,D_STRING,ns=3;i=10235,LocalizedText
OUT,Process Out,P_FSIG;ns=3;i=10216,Boolean
OUT,Float Output,D_DOUBLE,ns=3;i=10226,Double
```

Each pin is represented by a single line in the file. Each line must have five elements separated by a comma. The order of the elements is as follows:

- Pin Direction
- Pin Name
- Pin Type
- Node ID
- Node Data Type

The possible values for each element are described in the following table.

Element	Description
Pin Direction	If the pin is input or output. Possible Values: • IN - Input pin • OUT - Output pin
Pin Name	The name of the pin. Specified as a string.
Pin Type	NeuroCheck pin type. Possible Values: • D_BOOL - Data Boolean • D_INT - Data Integer • D_DOUBLE - Data Double • D_STRING - Data String • P_FSIG - Free Process Signal • P_SIG - Process Signal • P_ID - Process Identifier
Node ID	Node ID of the connected OPC Node. Specified as a string.
Node Data Type	OPC data type of the connected OPC Node. Must exactly match the supported types. See Supported Data Type Conversions .

Supported Data Type Conversions

This section describes which OPC data types and the respective combination with NeuroCheck data types are supported.

OPC UA Data Type	NeuroCheck Data Type	Readable	Writable
Boolean	Boolean	Yes	Yes
SByte	Integer	Yes	Yes
Byte	Integer	Yes	Yes
Int16	Integer	Yes	Yes
UInt16	Integer	Yes	Yes
Int32	Integer	Yes	Yes
UInt32	-	No	No
Int64	-	No	No
UInt64	-	No	No
Float	Double	Yes	Yes
Double	Double	Yes	Yes
String	String	Yes	Yes
DateTime	String	Yes	Yes
Guid	String	Yes	Yes
ByteString	-	No	No
XmlElement	String	Yes	No
NodeId	-	No	No
ExpandedNodeId	-	No	No
StatusCode	String	Yes	
QualifiedName	String	Yes	
LocalizedText	String	Yes	No
DataValue	-	No	No

This section shows the specific SIMATIC OPC data types and the respective combination with NeuroCheck data types that are supported.

OPC UA SIMATIC Data Type	NeuroCheck Data Type	Readable	Writable
BYTE	Integer	Yes	Yes

OPC UA SIMATIC Data Type	NeuroCheck Data Type	Readable	Writable
WORD	Integer	Yes	Yes
DWORD	Integer	Yes	Yes
LWORD	-	No	No
CHAR	String	Yes	Yes
WCHAR	-	No	No
STRING	String	Yes	Yes

This section shows the Standard Built-in Data Types that are supported.

NodeId (ns=0)	OPC UA DataType	NeuroCheck Data Type	Readable	Writable
i=1	Boolean	Boolean	Yes	Yes
i=2	SByte	Integer	Yes	Yes
i=3	Byte	Integer	Yes	Yes
i=4	Int16	Integer	Yes	Yes
i=5	UInt16	Integer	Yes	Yes
i=6	Int32	Integer	Yes	Yes
i=7	UInt32	Integer	Yes	Yes
i=10	Float	Double	Yes	Yes
i=11	Double	Double	Yes	Yes
i=12	String	String	Yes	Yes

The conversions needed are all executed implicitly. When writing from Integer or Double to a data type with a smaller range, the provided value must lie inside the range of the target data type. If not, the write will produce an error. For example when writing to a Byte value the provided Integer must lie between 0 and 255.

Security Infrastructure

OPC UA uses public key cryptography for connection security. This section describes how the public key infrastructure (PKI) required for this kind of system is realized.

Message security is provided by the OPC UA Secure Channel, that natively uses SSL/TLS. Both technologies use X509 certificates and a certificate store. The certificate store is realized as a folder structure inside the NeuroCheck project directory. This means that the application certificate and trust lists are unique for each NeuroCheck project. The following table describes the parts of the PKI and their respective location.

Certificate Store	Location	Description
Application Certificate Store	<ProjectDir>\Software Extensions\OPC UA\PKI\own	This store must contain the application certificate. The store must contain the private and public keys.
Trusted Peer Store	<ProjectDir>\Software Extensions\OPC UA\PKI\trusted	This store contains the certificates of trusted peer applications.
Trusted Issuer Store	<ProjectDir>\Software Extensions\OPC UA\PKI\issuer	This store contains the certificates of trusted certificate authorities. This store may contain a /clr subdirectory that contains .clr revocation lists.
Rejected Certificate Store	<ProjectDir>\Software Extensions\OPC UA\PKI\rejected	Certificates rejected during the connection process are placed into this store by the application.

Important notes

- If no application certificate is present during initialisation, the DFC will create a self signed certificate and place it into the application certificate store.
- The user is fully responsible for managing the certificate stores. The implications of using certificates, such as expiration dates and revocation status should be understood to prevent interruptions in communication.

Info Dialog

This dialog displays information about the NeuroCheck OPC UA Data Format Converter.

Element	Description
Description	The description of the Data Format Converter
File	The driver assembly name the Data Format Converter
Version	The version of the data format converter
Copyright	The copyright of the data format converter

Support Services

For technical support, please contact your local NeuroCheck partner or NeuroCheck GmbH:

Phone: +49 (0) 7146 - 89 56-40

E-Mail: support@neurocheck.com

Web: www.neurocheck.com

Before contacting us, please provide some important information about your system:

- **Information about your NeuroCheck installation and your PC setup:**

Use the NeuroCheck Diagnostics tool to check your installation and computer configuration.

The NeuroCheck Diagnostics is installed in the "Tools" folder within your NeuroCheck installation.

- **Log file information:**

Logging for NeuroCheck can be activated in **System > Software Settings > Diagnosis > Logging**.

