

OPC UA driver for the REXYGEN system (the `OpcUaDrv` module)

User guide

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Chapter 1

The OpcUaDrv driver and the REXYGEN system

Licence: [Additional I/O](#)

1.1 Introduction

This manual describes the `OpcUaDrv` driver for handling of communication over the OPC UA protocol within the REXYGEN system. The driver was developed by the REX Controls company.

OPC UA is an open communication protocol for industrial automation. Unlike legacy OPC, OPC UA is a multi-platform protocol, it may work as a web service and it offers many advanced functions like diagnostics, method calls and various levels of security and authentication in addition to standard events and data access. OPC UA is becoming a preferred communication interface of many devices from various companies.

OPC UA is not a suitable protocol for hard real-time communication between control devices, but is sufficient for soft real-time applications in many cases. A main utilization areas of OPC UA are human-machine interfaces and interconnection of various devices in a heterogeneous environment. See the OPC UA specification [1] for more details.

1.2 Installation of the driver on the target device

1.2.1 Windows machines

The target part of the driver, which is used for running REXYGEN `OpcUaDrv` on Windows 10/11 is included in the Development tools of the REXYGEN system.

1.2.2 Linux machines

If there is no **RexCore** runtime module installed on your target device, install it first using the Getting started guide of **REXYGEN** [2]. The installation includes all necessary drivers including **OpcUaDrv**.

If you want to install **OpcUaDrv** separately, it can be done from the Linux terminal using the command

```
sudo apt-get install rex-opcuadrvt
```

1.3 Alternatives

Apart from the **OpcUaDrv** there is also a standalone **OPC UA server for REXYGEN** application. This application is connected to **REXYGEN** and exposes all the data signals defined in the **REXYGEN** algorithm as **OPC UA Nodes**. See **OPC UA server - User guide** [3] for more details.

In comparison to the **OPC UA server for REXYGEN** the **OpcUaDrv** lets user to include **OPC UA** blocks in the control algorithm to not only expose selected signals as a server but to also communicate with other devices as a client both through the **OPC UA** protocol.

Chapter 2

Including the driver in the project

The driver is included in the project as soon as the driver is added to the project main file and the inputs and outputs are connected in the control algorithm(s).

2.1 Adding the OpcUaDrv driver

The project main file with the `OpcUaDrv` driver included is shown in Figure 2.1.

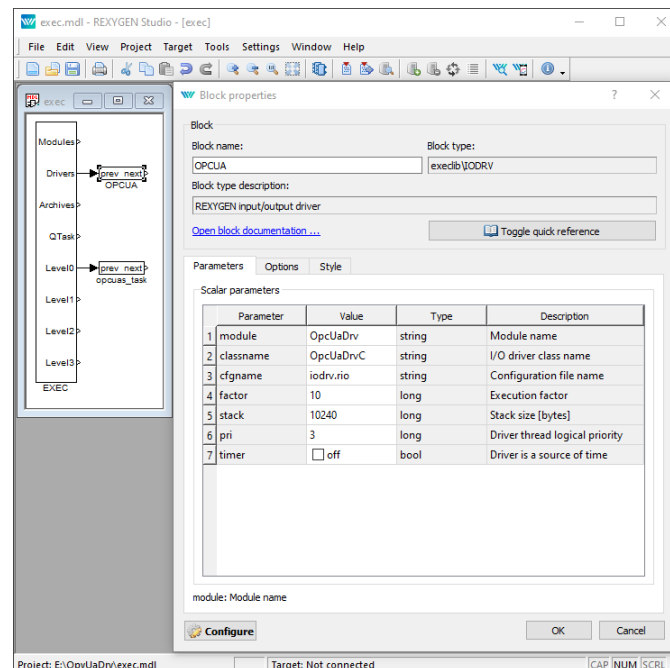


Figure 2.1: An example of project main file with the `OpcUaDrv` driver included

To include the driver in the project a block of type `IODRV` must be connected to the **Drivers**

output of the main **EXEC** block. The name of this block (**OPCUA**, see Fig. 2.1) must be used as a prefix of all blocks and input and output signals provided by this driver.

The most important parameters of **IODRV** block are:

- **module** – name of the module linked to the driver, in this case **OpcUaDrv**
- **classname** – class of the driver, which defines the role of the target device:
 - OpcUaDrvC** – for OPC UA Client
 - OpcUaDrvS** – for OPC UA Server
- **cfgname** – name of the driver configuration file, e.g. **opcua_cfg.rio**
- **factor** – multiple of the **EXEC** block's **tick** parameter defining the execution period of the driver

The above mentioned parameters of the **IODRV** function block are configured in **REXYGEN** Studioprogram. The configuration dialog is shown also in Fig. 2.1.

The **Configure** button opens the configuration dialog of the **OpcUaDrv** driver, which is described in chapter 2.2.

2.2 Configuration dialog of the OpcUaDrv driver

The configuration dialog can be activated from **REXYGEN** Studio by pressing the **Configure** button in the parameters dialog of the **IODRV** block (renamed to **OPCUA**, see chapter 2.1).

2.3 OPC UA Client

Single instance of the driver can process multiple client connections. The configuration dialog for OPC UA Client driver is shown in Figure 2.2 and has a form of a table of the client connections with buttons for adding, editing and deleting a connection. The configuration dialog for the client connection is shown in Figure 2.3.

Client connection parameters:

Alias – mandatory, *Alias* must be specified in the name of the flags and blocks that belong to the context of this connection.

URL – address of the server

Reconnection timeout – number of seconds to wait between connection attempts

Read/Write timeout – number of seconds to wait for Read/Write operations to finish

Authentication – section for authentication configuration

Security – section for security configuration

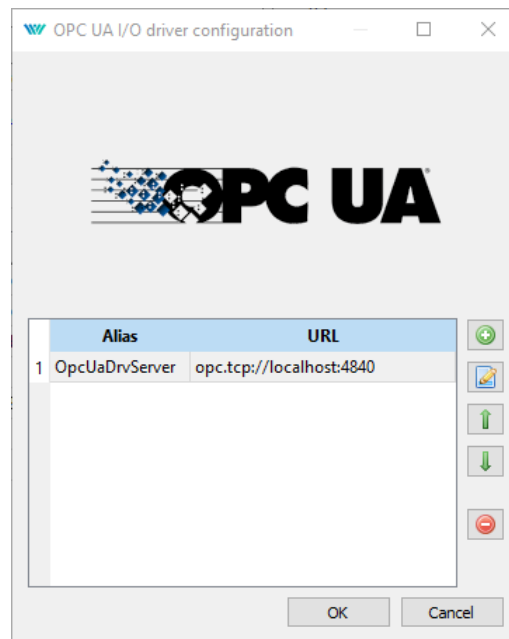


Figure 2.2: OPC UA Client driver – table of clients

Namespace definitions – section for definition of the namespaces as they are defined on the server

- Indexes of the namespaces are used to compose the **NodeId** parameter of the OPC UA blocks.
- During the initialization of the connection the namespaces defined in the table get resolved and the indexes on the client side get translated to the real indexes on the server side.

2.4 OPC UA Server

The configuration dialog for OPC UA Server driver is shown in Figure 2.4.

Server parameters:

Port – port of the server

Application URI – identifier of the application

- Application URI must be the same as the URI defined in the certificate used by the server.
- If a custom certificate is configured Application URI must be set to match. Leave empty otherwise.

Namespace – namespace to be used for all nodes

Edit OPC UA client

Alias:

URL:

Reconnection timeout [s]:

Read/Write timeout [s]:

Authentication

Authentication mode:

Username:

Password:

Security settings

Security policy:

Security mode:

Namespace definitions

	Index	Namespace URL
1	0	http://opcfoundation.org/UA/
2	1	urn:REX:OpcUaDrv

OK Cancel

Figure 2.3: OPC UA Client driver – configuration of a client

Certificate path – path on the target device to a custom certificate to be used

Private key path – path on the target device to a custom private key to be used

Authentication mode – configuration of the authentication

- *Anonymous* – no authentication
- *Username/Password* – authentication by a username and password

Username – username

Password – password

Security policy – policy to be used as user token policy during authentication

The image shows a Windows-style dialog box titled "OPC UA I/O driver configuration". At the top center is the OPC UA logo, which consists of a stylized globe with blue and black dots and the text "OPC UA" in bold black letters. Below the logo are several input fields and dropdown menus. The "Port:" field contains the value "4840". The "Application URI:" field is empty. The "Namespace:" field contains the value "urn:REX:OpcUaDrv". Below these is a "Security" section with two empty text boxes for "Certificate path:" and "Private key path:". Underneath is an "Authentication" section. The "Authentication mode:" dropdown menu is set to "Username/Password". The "Username:" field contains the value "rexygen". The "Password:" field is masked with seven dots and has a small eye icon to its right. The "Security policy:" dropdown menu is set to "Basic256Sha256". At the bottom right of the dialog are two buttons: "OK" and "Cancel".

OPC UA I/O driver configuration

OPC UA

Port: 4840

Application URI:

Namespace: urn:REX:OpcUaDrv

Security

Certificate path:

Private key path:

Authentication

Authentication mode: Username/Password

Username: rexygen

Password: ●●●●●●●

Security policy: Basic256Sha256

OK Cancel

Figure 2.4: OPC UA Server driver configuration

Chapter 3

Connecting the inputs and outputs and using function blocks in the control algorithm

The inputs and outputs of the driver must be interconnected with the individual tasks (.mdl files). The individual tasks (QTASK or TASK blocks) are connected to the QTask, Level0, ..., Level3 outputs of the main EXEC block.

3.1 Direct input and output signals

The inputs and outputs of the `OpcUaDrv` driver can be accessed as shown in Fig. 3.1.

First block of the `From` type allowing the user to read connection status has the `Goto tag` set to `OPCUAC__OpcUaServer_ConnectionStatus`. Another block of the `From` type allowing the user to read status of the server has `Goto tag` set to `OPCUAS__Status`. The blocks always have the name of the driver block as a prefix right at the beginning of the tag followed by two _ characters (underscore). If the block belongs to the client driver the name of the driver with underscores must be followed by the alias of the client connection defined in the driver configuration dialog and another underscore.

3.2 Function blocks

3.2.1 OPC UA Client

The OPC UA Client driver is responsible only for maintaining the connection to the server. To read a value of an OPC UA Node over the OPC UA protocol the `OpcUaReadValue` block must be used. To write value an OPC UA Node the `OpcUaWriteValue` block must be used. The function blocks of the `OpcUaDrv` driver can be used as shown in Fig. 3.1. The blocks always have the name of the driver block prefix right at the beginning of the tag followed by two _ characters (underscore) and that is followed by an *Alias* identifying

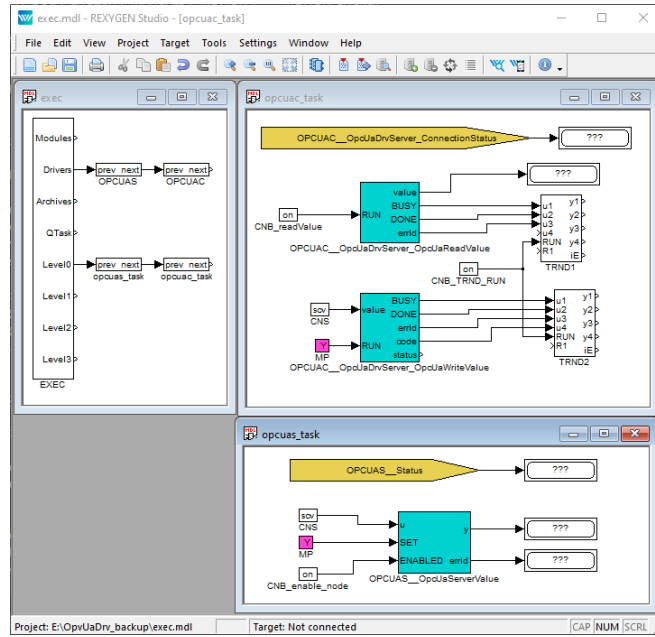


Figure 3.1: Example of input and output flags of the `OpcUaDrv` driver

the client connection. To learn more about the `OpcUaReadValue` and `OpcUaWriteValue` blocks see [4].

3.2.2 OPC UA Server

The OPC UA Server driver is responsible for handling all the communication from the clients. To create and expose an OPC UA Node the `OpcUaServerValue` block must be used. The function blocks of the `OpcUaDrv` driver can be used as shown in Fig. 3.1. The blocks always have the name of the driver block as a prefix right at the beginning of the tag followed by two `_` characters (underscore). To learn more about the `OpcUaServerValue` block see [4].

Chapter 4

Examples

To get started quickly the following examples can be used as a reference and you can modify them for your application.

- 0408-01 OPC UA Communication/OPC UA Data Exchange – The example demonstrates communication between a Client and a Server which are both implemented in REXYGEN.

Chapter 5

Troubleshooting

In the case that the diagnostic tools of the REXYGEN system (e.g. **Watch** mode in the REXYGEN Studio) report unexpected or incorrect values of inputs or outputs, it is desirable to test the functionality outside the REXYGEN system. There are many free programs that can be used for monitoring of the OPC UA communication such as [Ua-Expert](#).

In the case that the given input or output works with other software tools and does not work in the REXYGEN system, report the problem to us, please. E-mail is preferred, reach us at support@rexygen.com. Please include the following information in your description to help us process your request as soon as possible:

- Identification of the REXYGEN system you are using. Simply export it to a file using the REXYGEN Studio (Target → Licensing... → Export).
- Short and accurate description of your problem.
- The configuration files of the REXYGEN system (.mdl and .rio files) reduced to the simplest case which still demonstrates the problematic behavior.

Appendix A

Licensing options

From the licensing point of view, there are several versions of the **RexCore** runtime module to provide maximum flexibility for individual projects. The table below compares the individual variants.

The function blocks are divided into several licensing groups. The **STANDARD** function blocks are always available, the other groups require activation by a corresponding licence.

	RexCore DEMO	RexCore Starter	RexCore Plus	RexCore Professional	RexCore Ultimate
<i>Function blocks</i>					
STANDARD	•	•	•	•	•
ADVANCED	•	—	•	•	•
REXLANG	•	—	•	•	•
MOTION CONTROL	•	—	○	○	•
COORDINATED MOTION	•	—	○	○	•
AUTOTUNING	—	—	○	○	•
MATRIX	•	—	○	○	•
<i>I/O drivers</i>					
Basic I/O drivers	•	•	•	•	•
Additional I/O drivers	•	○	○	•	•

(• ... included, ○ ... optional, — ... not available)

See the Function Blocks - Reference Manual for details about licensing of individual function blocks.

Bibliography

- [1] OPC Foundation. OPC Unified Architecture Specification. <https://opcfoundation.org/developer-tools/specifications-unified-architecture>, 2020.
- [2] REX Controls s.r.o.. *Getting started with REXYGEN*, 2020. [→](#).
- [3] REX Controls s.r.o.. *OPC UA server for REXYGEN – user guide*, 2019. [→](#).
- [4] REX Controls s.r.o.. *Function blocks of REXYGEN – reference manual*, 2020. [→](#).

