

# CaoOPCUA (OPC UA Server)

Version 1.5.0

User's guide

June 25, 2024

Note:

**[Revision history]**

| Version | Date       | Content   |
|---------|------------|---|
| 1.0.0   | 2014-02-10 | First edition.  |
| 1.0.1   | 2014-06-12 | Added Appendix A  |
| 1.0.2   | 2016-02-02 | Added additional description of item attribute.   |
| 1.0.3   | 2016-07-26 | Supported variables that have references to a same parent object.                           |
| 1.1.0   | 2018-05-29 | I8, UI 8 type was supported.  |
| 1.1.1   | 2019-02-14 | Added log output.   |
| 1.1.2   | 2020-03-12 | Supports multiple writing.  |
| 1.1.3   | 2020-06-17 | Fixed the problem of reconnecting the controller.   |
| 1.1.3   | 2020-07-08 | Corrected the description of VARIANT type data.   |
| 1.1.4   | 2020-07-13 | Fixed a bug when reconnecting.  |
| 1.1.5   | 2020-10-06 | Fixed a bug in type conversion.   |
| 1.1.6   | 2021-02-09 | Fixed a bug when encrypting.<br>Fixed a bug in the user name.<br>Fixed a bug in log output. |
| 1.1.7   | 2021-03-12 | Memory leak was corrected.  |
| 1.2.0   | 2021-07-20 | Update of internally used library.  |
|         | 2021-08-23 | Added description of node ID and access path.   |
| 1.2.1   | 2021-09-03 | Obfuscation of source code.   |
| 1.2.2   | 2021-11-02 | Memory leak was corrected.  |
| 1.3.0   | 2021-11-04 | Added security policy.  |
| 1.3.1   | 2021-11-22 | Fixed a bug in IPv6.  |
|         | 2021-11-25 | Supports multiple IP addresses for certificates.  |
| 1.3.2   | 2021-11-29 | Fixed a bug in multiple AE controllers.   |
| 1.4.0   | 2022-07-29 | Update of internally used library.  |
| 1.5.0   | 2024-06-25 | Update of internally used library.  |
|         |            |   |



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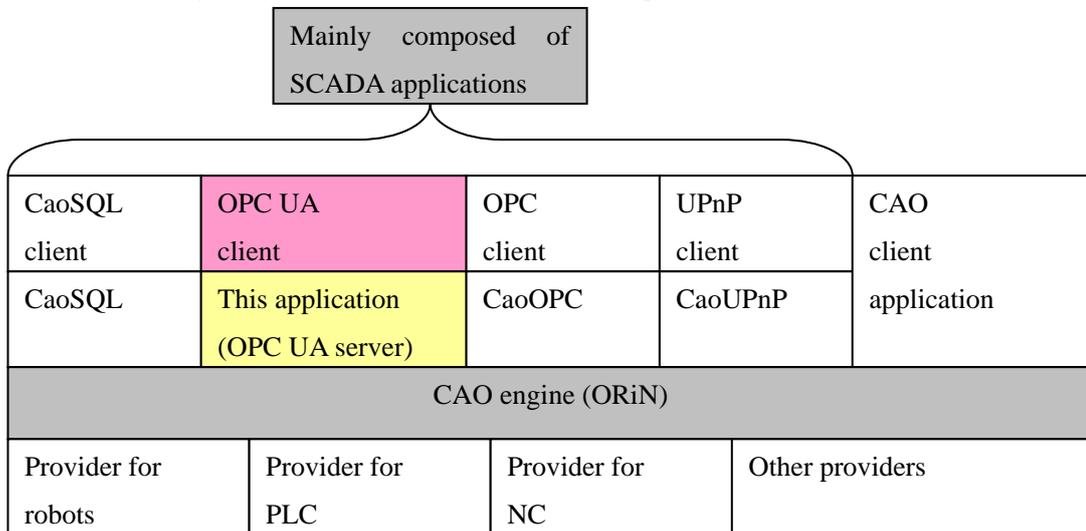
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# 1. Introduction

This is a user's guide for CaoOPCUA that performs as a client application of CAO (Controller Access Object).

CaoOPCUA is an OPCUA server that regards CAO module as a FA device, and provides various OPC UA functions (OLE for Process Control Unified Architecture) to CAO module (Figure 1-1). Because CAO is a module that enables communication between various FA devices, CaoOPCUA that is an application on the upper layer of CAO can consequently connect with various FA devices.

In addition, because CaoOPCUA provides OPCUA server function, it can use commercial OPC UA client software. It means CAO provider can be handled by the OPC UA client application as well as the CAO client application; this will bring you the wide variety of system development.



**Figure 1-1 CAO application's overview**

## 2. Overview of CaoOPCUA

### 2.1. Overview

The figure below shows the composition of CaoOPCUA. CaoOPCUA is middleware that connects the OPCUA client with CAO, and behaves as the OPCUA server that processes the request from OPCUA client with CAO function. CaoOPCUA is an independent process (out process server) and it provides service to multiple OPC UA clients.

Information that are provided by CaoOPCUA as OPC UA server and server motion option items need to be set with a dedicated setting tool "CaoOPCUAConfig" beforehand.

This tool utilizes the CaoSQLConfig to set necessary parameters for the CaoController object, CaoVariable object, and the CaoOPCUA motion option. Parameters and options that have been set by this tool are stored in INI file and csq file, and will be referred at the CaoOPCUA startup.

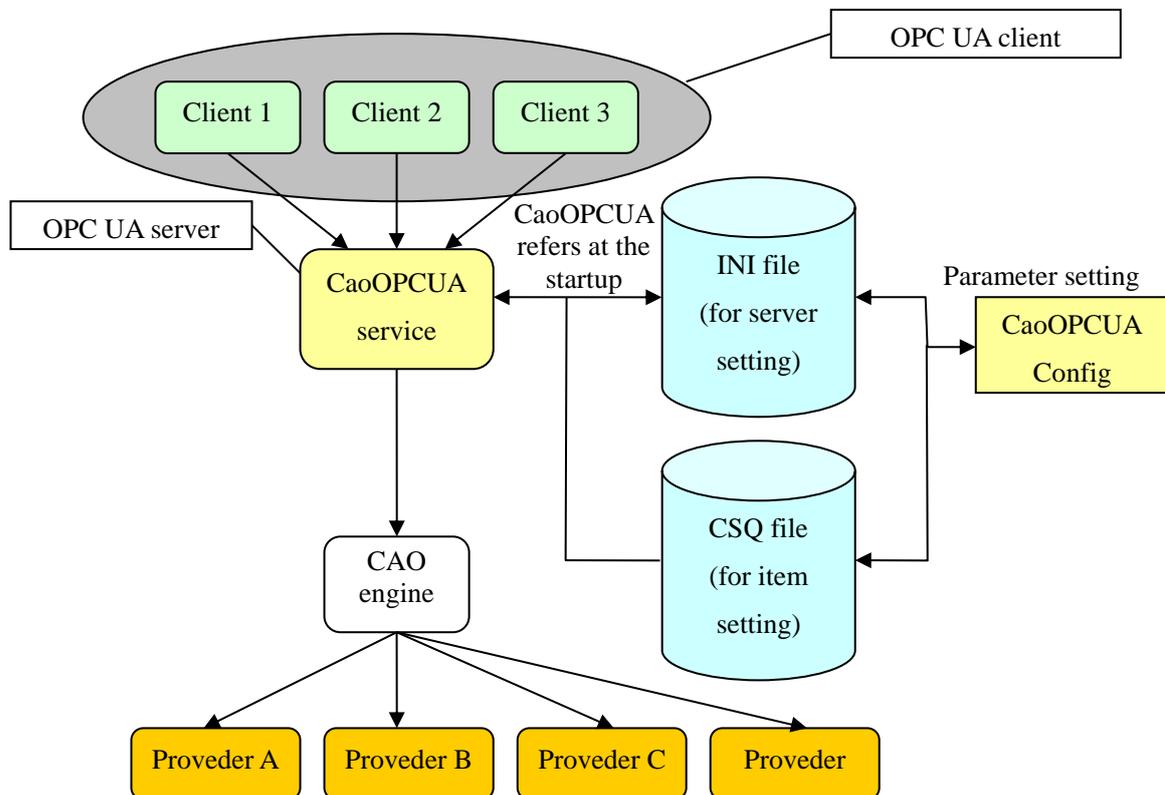


Figure 2-1 CaoOPCUA diagram

## 2.2. Node ID

CaoOPCUA uses the node ID to uniquely identify the item.

The node ID consists of the following elements.

|                 |   |   |
|-----------------|---|---|
| Namespace index | : | Defines the namespace for node IDs. In CaoOPCUA, in order of controller name, <ul style="list-style-type: none"><li>• Serial number starting from 4 (CaoOPCUA version 1.1.7 or lower)</li><li>• Serial number starting from 5 (CaoOPCUA version 1.2.0 or higher)</li></ul> Will be allocated. |
| Identifier type | : | The data type of the identifier is fixed to a character string.   |
| Identifier      | : | It will be the item name.   |

## 2.3. Access path

CaoOPCUA supports AccessPath for compatibility with OPC. For AccessPath, the fixed "OPCUA.CAO" and the controller name (CaoOPCUA controller name)<sup>1</sup> set by the CaoOPCUAConfig tool are used.

AccessPath = OPCUA.CAO / <CaoOPCUA controller name>

<sup>1</sup> Note that it is not the Controller Name (Cao controller name).



### 3.1.2. CaoOPCUA server setting

Set the CaoOPCUA server.

This section explains the minimally required setting for the startup. For details, refer to [4.CaoOPCUAConfig](#).

- ① Start CaoOPCUAConfig
- ② From the Menu bar, point to [Action], click [Option] to open OPC UA tab.

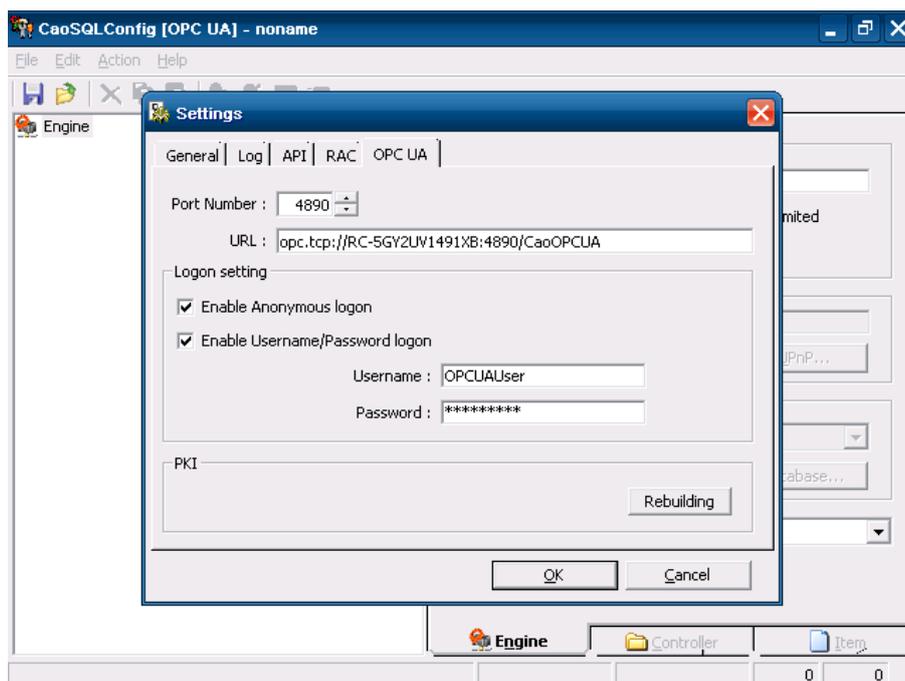
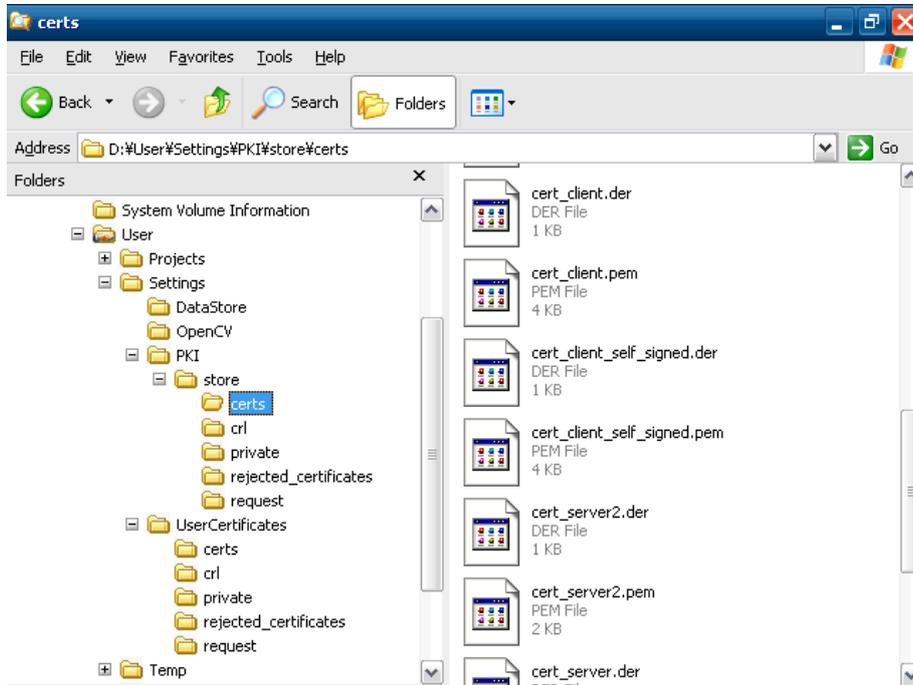


Figure 3-2 CaoOPCUAConfig

- ③ Create PKI (Public Key Infrastructure)  
Click [Rebuilding] button.

- ④ Folders are created as shown below, at the same time, necessary files are created in each folder.



**Figure 3-3 PKI (Public Key Infrastructure) folder**

- ⑤ Click [OK] to close the setting dialog.

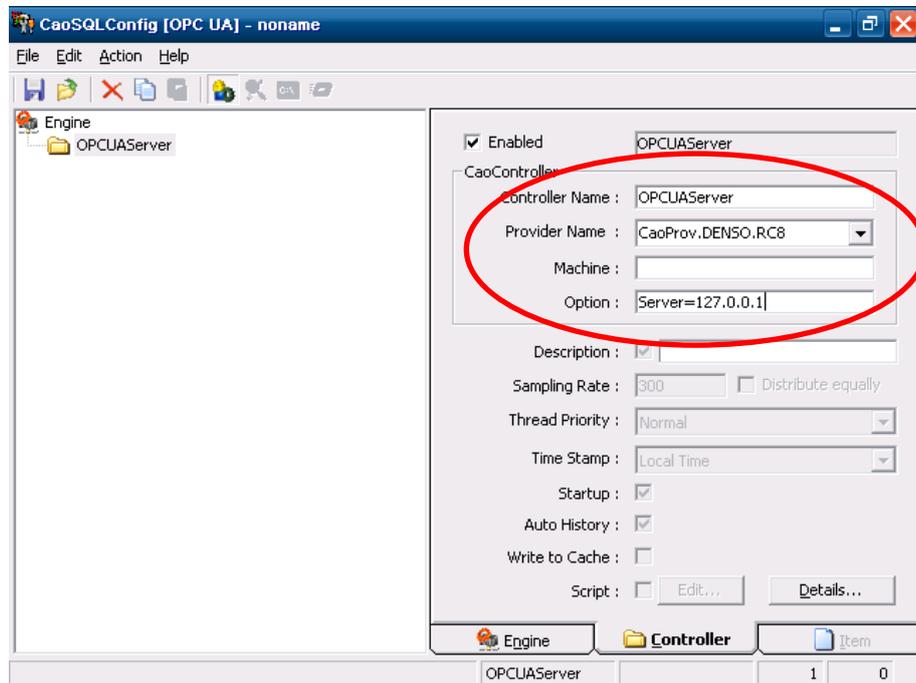
### 3.1.3. Controller and Variable settings

- ① Add a controller and variables

Since the way of adding the controller and variables differs between ORiN providers, this example assumes that the RC8 is used. Do the following procedures with making reference to your provider's user's guide by replacing the controller and variables written here with the actual ones.

- (1) From the Menu bar, point to [Edit], select [AddController]
- (2) Enter arbitrary controller name. In this example, "OPCUAServer" is entered.
- (3) From the Provider Name combo box, select [CaoProv.DENAO.RC8]

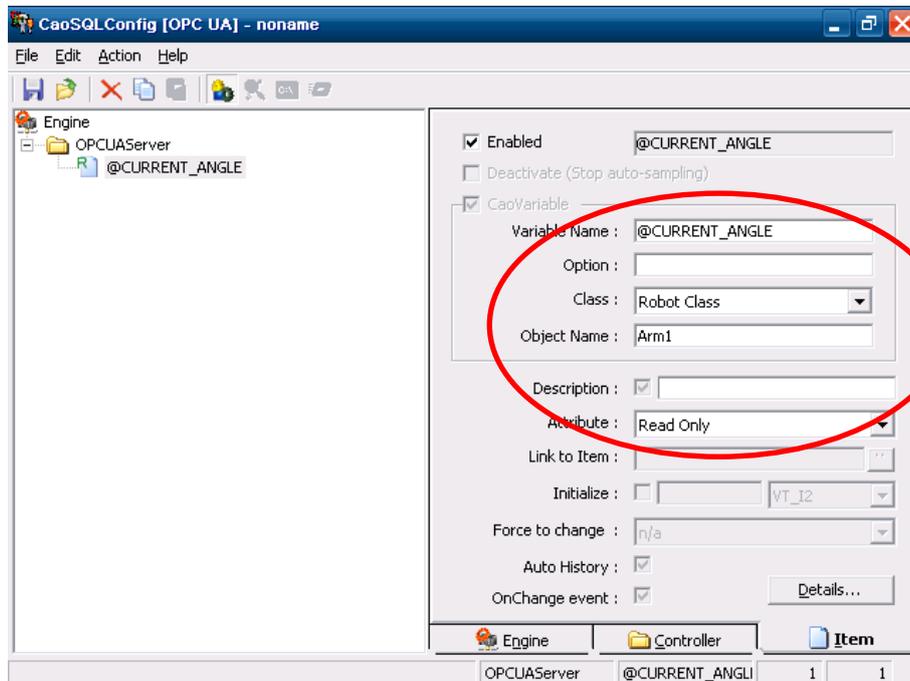
- (4) In the Option textbox, enter [Server = 127.0.0.1]



**Figure 3-4 Controller setting**

- (5) From the Menu bar, point to [Edit], click [AddItem]

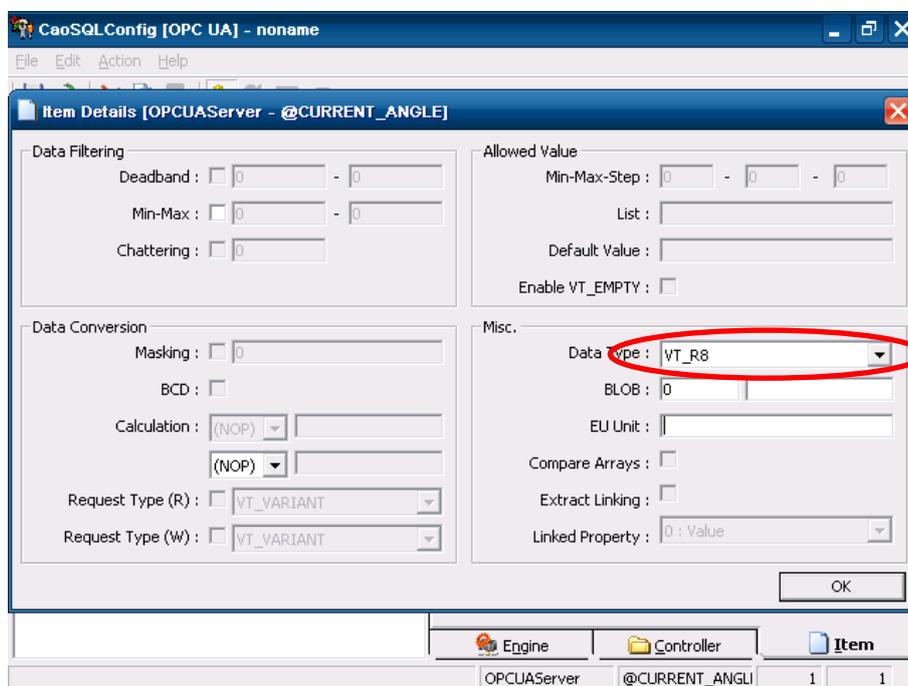
- (6) In the Variable Name textbox, enter [ @CURRENT\_ANGLE ]. From the Class combo box, select [ Robot class ]. In the Object name textbox, enter [ Arm1 ]. From the Attribute combo box, select [ Read Only ].



**Figure 3-5 Item setting**

- (7) Click [Details...]

- (8) From the Misc. pane, on the Data Type combo box, select [VT\_R-8bytes floating-point type]



**Figure 3-6 Item Details**

- (9) Click [OK] to close the Item Details dialog.
- ② From the Menu bar, point to [File], select [SaveAs]
- ③ Save the setting in arbitrary location with an arbitrary name.

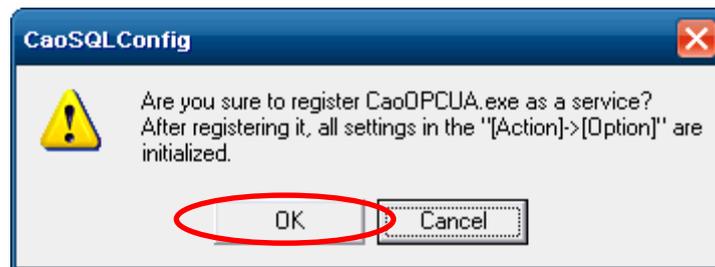
(In this example, C:\Documents and Settings\All Users\Application Data\OPCUA\CaoOPCUA.csq.)

Note: To set items for DENSO RC8 Robot controller, save the file as CaoOPCUA.csq, and then sent it to RC8 with WINCAPSIII.

### 3.1.4. CaoOPCUA server registration and startup

Register and start the CaoOPCUA server as a service.

- ① From the Menu bar of CaoOPCUAConfig, point to [Action], select [Register as service]
- ② On the CaoSQLConfig dialog shown below, click [OK] button



**Figure 3-7 Service confirmation dialog**

- ③ From the Menu bar, point to [Action], select [Service Start]
- ④ Close the CaoOPCUAConfig.

### 3.2. Connection from the OPCUA client to the CaoOPCUA server

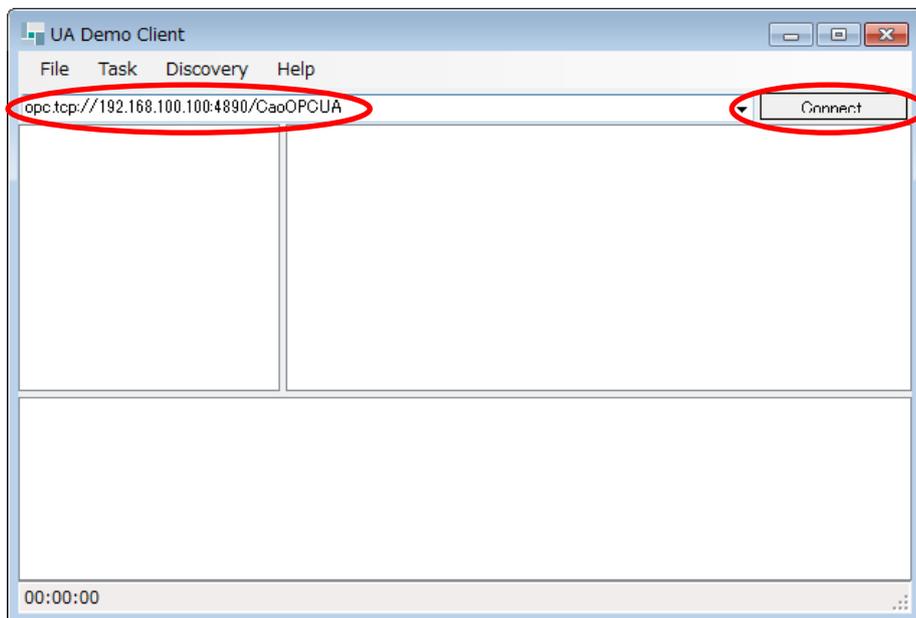
This section explains how to connect to the CaoOPCUA server from a general OPCUA client.

#### 3.2.1. UA Demo Client (manufactured by Softing)

This subsection explains how to connect the CaoOPCUA server with UA Demo Client (manufactured by Softing).

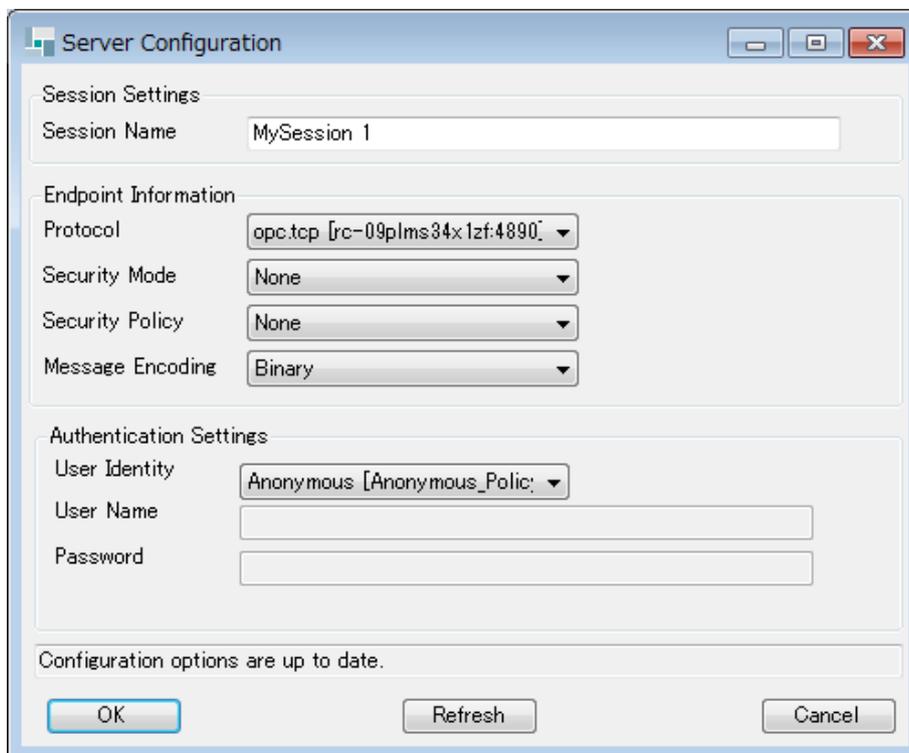
- ① Start "UA Demo Client".
- ② In the URL textbox, enter URL by following the format of "opc.tcp://[Computer name]:[Port number]/CaoOPCUA", and then click [Connect].

Example) opc.tcp://192.168.100.100:4890/CaoOPCUA



**Figure 3-8 Adding URL and Establish connection**

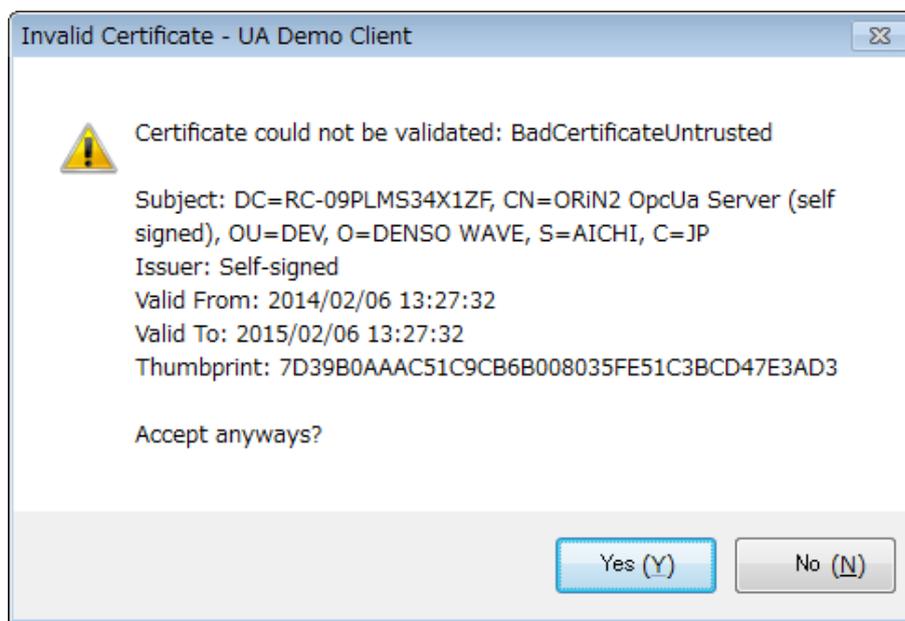
- ③ Once the following dialog is displayed, select [None] from both Security Mode and Security Policy combo boxes, and then click [OK] to close the dialog.



**Figure 3-9 Server setting**

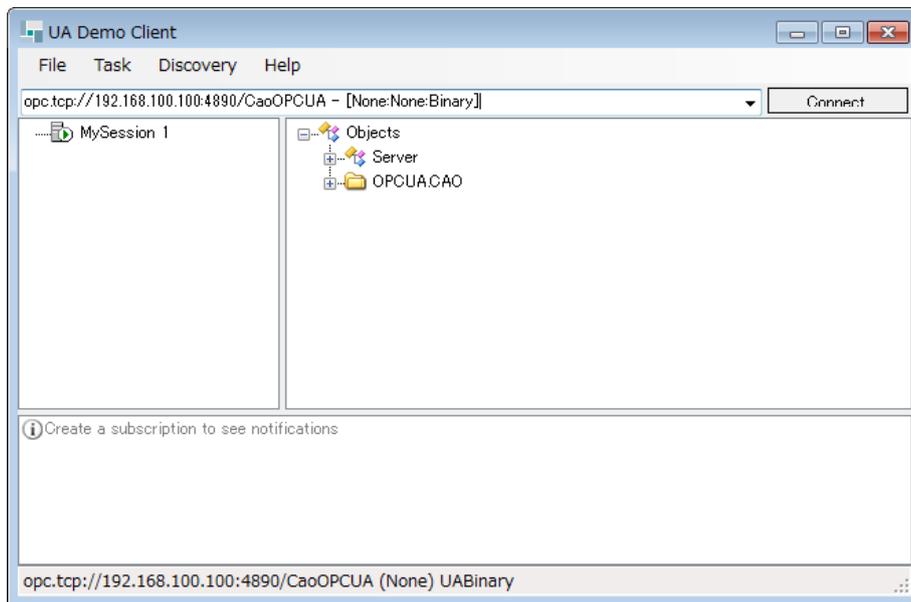
- ④ If the following dialog is displayed, click [Yes (Y)] to close the dialog.

\*This warning is displayed when the certificate of the server application is not registered in the client application certificate trust list. To avoid displaying this message, add the certificate of the server application to the client application certificate trust list.



**Figure 3-10 Warning message for invalid certificate**

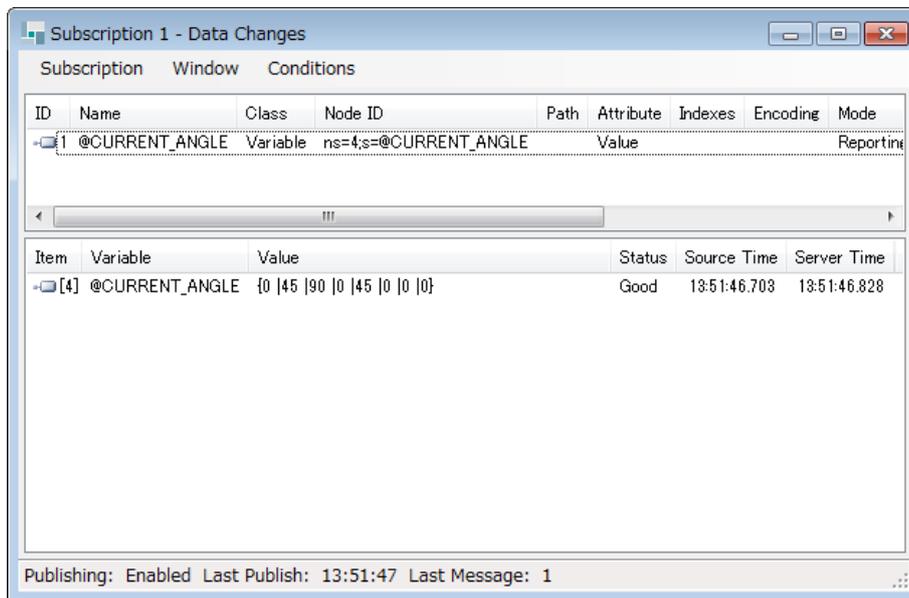
- ⑤ If the connection is completed correctly, the following window is displayed.



**Figure 3-11 Connection completed**

- ⑥ Expand [OPCUA.CAO] - [OPCUAServer], and then right-click [CURRENT\_ANGLE], select [Subscribe] - [New...]
- ⑦ In the displayed dialog, click [OK].

- ⑧ The following dialog is displayed. You can check the variable value of [@CURRENT\_ANGLE]

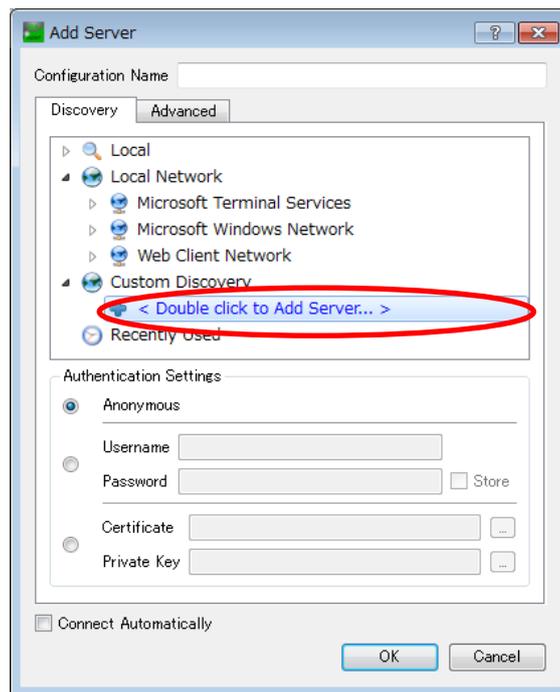


**Figure 3-12 Variable values**

### 3.2.2. Unified Automation “UaExpert”

This subsection explains the way of connection to the CaoOPCUA server by means of UaExpert manufactured by Unified Automation.

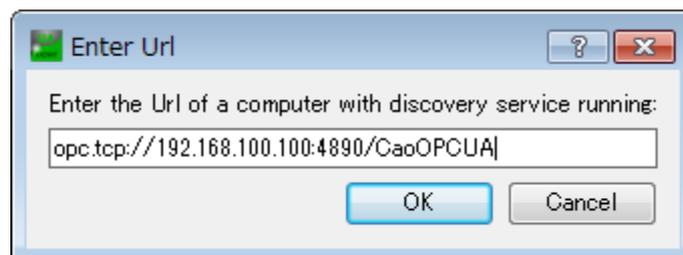
- ① Start UaExpert
- ② From the Menu bar, point to [Server], select [Add]
- ③ Double-click <Double click to Add Server...>



**Figure 3-13 Adding server**

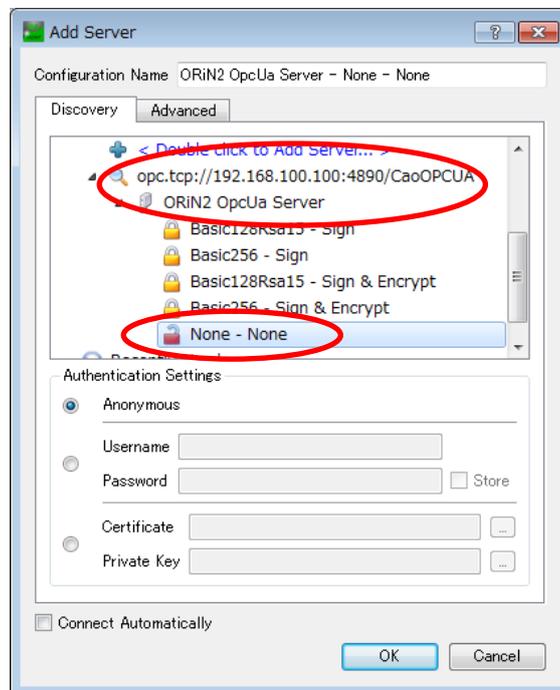
- ④ In the text box of the displayed dialog, enter URL by following the format of “opc.tcp://[Computer name]:[Port number]/CaoOPCUA”, and then click [OK] to close the dialog.

Example) opc.tcp://192.168.100.100:4890/CaoOPCUA



**Figure 3-14 Adding URL**

- ⑤ Select and double-click the server that has been added, double-click [ORiN2 OpcUa Server], and then select [None-None].



**Figure 3-15 Server selection**

- ⑥ Click [OK] to close the Add Server dialog.
- ⑦ While the newly added server is selected, from the Menu bar, point to [Server], and then select [Connect].

⑧ Check an applicable option button, and then click [OK].

- Accept this certificate permanently
- Accept this certificate temporarily for this session

※This warning is displayed when the certificate of the server application is not registered in the client application certificate trust list. To avoid displaying this message, add the certificate of the server application to the client application certificate trust list.



**Figure 3-16 Warning message for invalid certificate**

⑨ From the Address Space, point to [OPCUA.CAO], select [OPCUAServer]

⑩ Drag [@CURRENT\_ANGLE] to [Default DA View]

- ① The following dialog is displayed. You can check the variable value of [`@CURRENT_ANGLE`]

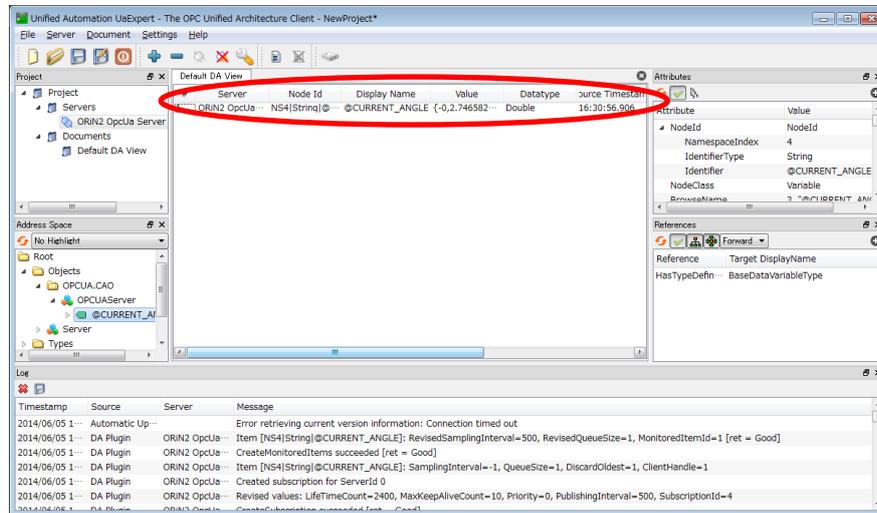


Figure 3-17 UaExpert connection

### 3.3. Details of CaoOPCUA

#### 3.3.1. Application certificate

To start CaoOPCUA, application certificate and the private key file are required. These are stored in the [certs] folder and the [private] folder in [%PKI%store] under the settings destination.

Certificate file is “cert\_server\_self\_signed.der” under the [certs] folder.

Private Key file is “private\_key\_server\_self\_signed.pem” under the [private] folder.

If these file do not exist, the service fails to start.

#### 3.3.2. Security policy and Security mode

In CaoOPCUA, you can define and select the combination of the security policy and the security mode depending on the security requirement.

##### 3.3.2.1. Security policy

The security policy has following three levels.

**Table 3-1 Security policy**

|                     |  |
|---------------------|--|
| None                | No security.   |
| Basic128Rsa15       | Deprecated. This feature is reserved for compatibility. <sup>2</sup> |
| Basic256            | Deprecated. This feature is reserved for compatibility. <sup>2</sup> |
| Basic256Sha256      | Average security.  |
| Aes128Sha256RsaOaep | High security.   |
| Aes256Sha256RsaPss  | Ultra high security.   |

<sup>2</sup> Encryption algorithm is known to be broken. This policy shall not be used any more.

### 3.3.2.2. Security mode

The security mode has following three levels.

**Table 3-2 Security mode**

|                |   |
|----------------|---|
| None           | No security is set                      |
| Sign           | Message has a sign but is not encrypted |
| SignAndEncrypt | Message has a sign and is encrypted     |

### 3.3.2.3. Available security combinations

The table below shows the available combinations between the security policy and the security mode in CaoOPCUA.

**Table 3-3 Available combination between security policy and security mode**

| Security policy     | Security mode  |
|---------------------|----------------|
| None                | None           |
| Basic128Rsa15       | Sign           |
| Basic128Rsa15       | SignAndEncrypt |
| Basic256            | Sign           |
| Basic256            | SignAndEncrypt |
| Basic256Sha256      | Sign           |
| Basic256Sha256      | SignAndEncrypt |
| Aes128Sha256RsaOaep | Sign           |
| Aes128Sha256RsaOaep | SignAndEncrypt |
| Aes256Sha256RsaPss  | Sign           |
| Aes256Sha256RsaPss  | SignAndEncrypt |

### 3.3.2.4. Certificate required for the connection with security

CaoOPCUA needs to be certificated by the certification when the connection is established with a security, which means the condition that both the security level and the security policy are set to "None". This can be achieved by storing the certificate file of the client application in the [cert] folder in the PKI store ([¥PKI¥store] folder under the settings destination) on the CaoOPCUA server. This process enables you to establish the connection with security.

For the connection settings, refer to the operation manual of the OPCUA client application that you use.

### 3.3.3. User authentication and authority

CaoOPCUA has following three types of user authentications. Based on the information of the user authentication, CaoOPCUA provides appropriate authority to the connected user.

**Table 3-4 User authentication and authority**

|                            |  |                      |
|----------------------------|--|----------------------|
| Anonymous authentication   | An authentication that does not require a user name, password, certification or private key. | Variable: Read only  |
| User name authentication   | Authentication with a user name and password   | Variable: Read/Write |
| Certificate authentication | Authentication with a certificate and private key  | Variable: Read/Write |

#### 3.3.3.1. Anonymous authentication

This is an anonymous user authentication. In CaoOPCUA, a user who logs in with an anonymous authentication can read the variable but cannot write in. This authentication requires no special setting.

#### 3.3.3.2. User name Authentication

This is an authentication with a user name and password. In CaoOPCUA, a user who logs in with the user name authentication can read and write variables. A user name that has been registered in the server setting is available in this step. For the connection settings, refer to the operation manual of the OPCUA client application that you use.

#### 3.3.3.3. Certificate Authentication

This is an authentication with a certificate and private key. In CaoOPCUA, a user who logs in with the certificate authentication can read and write variables.

### 3.3.3.3.1. User certificate

To authenticate the certificate, you need to prepare a user certificate in the following steps.

- ① With the client PC, prepare files for the x.509 certificate and the private key.
- ② Save the x.509 certificate file in the user certificate store (“¥UserCertificate¥certs” in the settings destination) under the CaoOPCUA server.
- ③ With the OPCUA client application, perform the certificate authentication, and then connect to the server.

For the connection settings, refer to the operation manual of the OPCUA client application that you use.

## 4. CaoOPCUAConfig

### 4.1. Overview

CaoSQLConfig for CaoOPCUA (hereafter, CaoOPCUAConfig) is a tool to set CaoOPCUA motion parameters in machines, parameters required for creating CAO controller objects and CAO variable objects. To activate CaoOPCUAConfig, add “OPCUA” in the argument of CaoSQLConfig (“CaoSQLComfig.exe OPCUA”) when startup. Information specified here will be stored in a INI file and a csq file, and will be read at the CaoOPCUA startup.

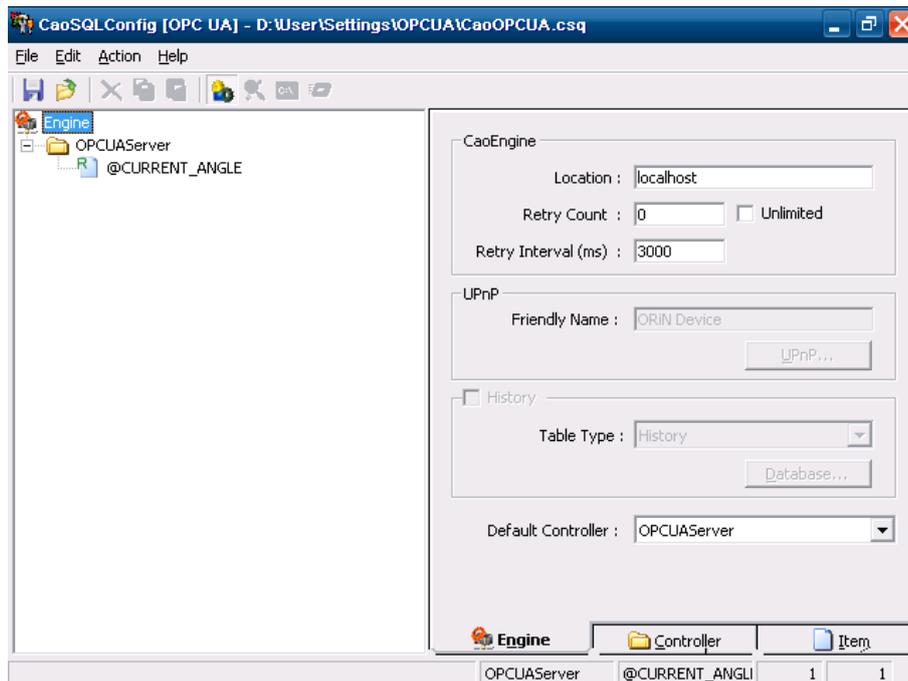


Figure 4-1 CaoOPCUAConfig window

### 4.2. How to operate CaoOPCUA Config

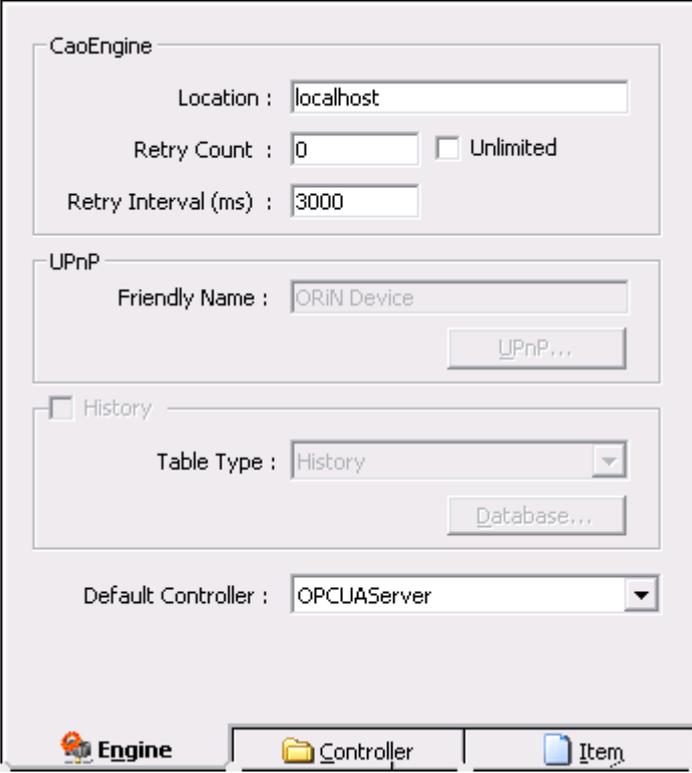
#### 4.2.1. Tab input

CaoSQLConfig window is composed of two parts; the tree view on the left side and the tabs on the right side. Tabs on the right side include information of the currently selected node on the tree. Selecting a desired node from the tree view will display the corresponding tab. When the engine node is selected on the left side pane, the information on the engine will be displayed on the right pane. Also, selecting the controller node and the item node will display the information on controller and the information on item, respectively.

Note that the consistency of the input data is not assured. If the data is inconsistent, an error will occur at the CaoOPCUA execution and the inputted data might be deleted from the CaoOPCUA list. Please examine the data carefully before you input it with CaoOPCUAConfig.

#### 4.2.1.1. Engine tab

The engine tab displays the information according to the format specified by Figure 3-2. The information on engine can be set as you want. A default name is applied to the CaoOPCUA workspace name. For the default controller name, you can select only from the currently existing controller names.



The screenshot shows the 'Engine' configuration tab. It includes the following fields and controls:

- CaoEngine** section:
  - Location: localhost
  - Retry Count: 0, with an 'Unlimited' checkbox.
  - Retry Interval (ms): 3000
- UPnP** section:
  - Friendly Name: ORIN Device
  - UPnP... button
- History** section:
  - History checkbox (unchecked)
  - Table Type: History (dropdown menu)
  - Database... button
- Default Controller**: OPCUAServer (dropdown menu)

At the bottom, there are three tabs: 'Engine' (active), 'Controller', and 'Item'.

**Figure 4-2 Engine tab**

You can set the following elements in the Engine tab.

##### **[Location] – Machine name**

Enter the machine name where you want to execute CAO.exe. If it remains empty, Cao.exe will start in local.

##### **[Retry Count, Unlimited] – Number of retry, Unlimited retries**

If the Unlimited check box is selected, CaoOPCUA retries to open CaoController unlimitedly when it fails. You can also set the desired number of retry by entering the number in the Retry Count text box.

##### **[Retry Interval (ms)]**

Enter the time period between the failure and the next retry start by milliseconds.

**[Default Controller]**

Unsupported

**4.2.1.2. Controller tab**

The controller tab displays the information according to the format specified by Figure 4-3.

**Figure 4-3 Controller tab**

Information on the Controller tab can be set as you want except for the CaoOPCUA Controller name, because it needs to have unique information within the registered information. To change the CaoOPCUA Controller name, from the Menu bar, point to “Edit”, and then select “Rename”. For the controller name, a capital letter and a small letter are not distinguished, and a name composed of figures only is not allowed. In addition, signs of ¥, \$, # are not available.

You can set the following elements in the controller tab.

**[Enabled] – Set this controller to Enable/Disable**

If this checkbox is selected, this controller is enabled. If this check box is not selected, this controller is not activated at the CaoOPCUA startup.

**[CaoOPCUA Controller name]**

Specify the CaoOPCUA controller name.

**[Controller Name, Provider Name, Machine, Option]****– Controller name, Provider name, Machine name, Option**

These parameters are transferred at the AddController execution. Entered values are directly used.

**[Description] – Detailed information**

Unsupported

**4.2.1.3. Item tab**

The item tab displays the information shown in Figure 4-4. Same as the controller tab, the item name cannot be changed. To change the item name, from the Menu bar, point to “Edit”, and then select “Rename”. For the item name, a capital letter and a small letter are not distinguished, and a name composed of figures only is not allowed. In addition, signs of ¥, \$, # are not available.

|     |                |   |   |
|-----|----------------|---|---|
| RC8 | @CURRENT_ANGLI | 1 | 1 |
|-----|----------------|---|---|

**Figure 4-4 Item tab**

You can set the following elements in the Item tab.

**[Enabled] – Switch the item between Enable and Disable**

If this checkbox is selected, this item is enabled. If this check box is not selected, this item is not sampled.

**[Item name] – Name**

Specify the item name. This item name is used as an ItemID.

**[Variable Name] – Variable name**

Specify a variable object name of CAO. A capital letter and a small letter are distinguished. This variable name is used when CaoVariable object is obtained. (ICaoController::GetVariable)

**[Option] – Option**

Specify options that you want to add at the CaoVariable object creation. This option is used when CaoVariable object is obtained. (ICaoController::GetVariable)

**[Class] – Class**

Select the type of the variable class. This class is used when CaoVariable object is obtained. (ICaoController::GetVariable)

**[Attribute] – Attribute**

Set the attribute of the item

If an item handles array elements, the item determines the number of array element based on the actual value obtained by devices.

Therefore, if item's attribute is set to "Write", the item will not be able to obtain values. As a result, the item will be handled as a single item instead of an array-type.

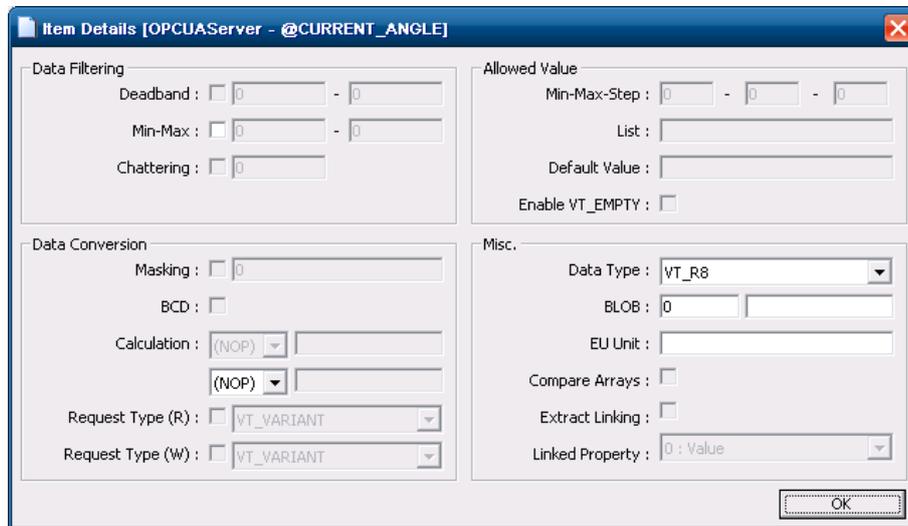
If there is a need of writing the array type item's value, set the attribute to "Read/Write".

**[Initialize] – Setting for value initializations**

Set an initial value for each item. This is not necessary for the real device in most cases, however it might be practical when the controller equips DataStore provider. This setting is available for the item which attribute is "writable" when CaoVariable object is obtained. (ICaoController::GetVariable)

**[Description] – Detailed information**

Unsupported

**[Item Details] – Detail settings for items****Figure 4-5 Item Details setting dialog****[Min - Max] –Low EU, High EU setting**

Unsupported

**[Data Type] – Data type**

Set the native data type (Canonical Data Type) of items. Table 4-1 lists available data types.

**Table 4-1 Available data types for items**

| Data type  | Size (byte) | Description  |
|------------|-------------|--|
| VT_BOOL    | 2           | -1:True, 0:False   |
| VT_I1      | 1           | Signed integer   |
| VT_UI1     | 1           | Unsigned integer   |
| VT_I2      | 2           | Single-precision (16-bit) signed integer   |
| VT_UI2     | 2           | Single-precision (16-bit) unsigned integer   |
| VT_I4      | 4           | Double-precision (32-bit) signed integer   |
| VT_UI4     | 4           | Double-precision (32-bit) unsigned integer   |
| VT_R4      | 4           | Single-precision (32-bit) floating-point   |
| VT_R8      | 8           | Double-precision (64-bit) floating-point   |
| VT_CY      | 8           | Currency type<br>A fixed-point number with four digits to the right of the decimal point. It is stored in an eight-byte signed integer scaled by 10,000. |
| VT_BSTR    | variable    | Character string<br>Unicode character and null terminator  |
| VT_DATE    | 8           | Same as VT_R8. Aggregate days from 1899/12/30.   |
| VT_VARIANT | variable    | VARIANT type   |

**[BLOB] – BLOB size, BLOB setting**

Unsupported

**[EU Unit] – EU unit setting**

Unsupported

## 4.2.2. Menu

The basic operations of CaoOPCUAConfig are available from the Menu bar. Some menus can be selected by right-click the tree view; these functions are the same as that of selected from the menu bar.

### 4.2.2.1. File menu

Execute saving, loading and other processing for the created data.

Extension is different depending on the operation.

For “**Open**”, “**Save**” and “**SaveAs...**”, use “**csq**”.

For “**Import**” and “**Export**”, use “**csx**”.

For import and export from and to a CSV file, use “**csv**”.

#### [New]

Create a new csq file

#### [Open]

Read setting information from the specified csq file<sup>3</sup>

When the reading is canceled, the reading result is not reflected.

#### [Save]

Write the current setting over the csq file

#### [Save As...]

Save the current setting in the csq file.

#### [Import...]

From the csx file, add a node to the currently selected node.

#### [Export...]

Output the currently selected node to the csx file.

#### [Import from CSV file]

From the csv file, add a node to the currently selected node.

#### [Export to CSV file]

Output the currently selected node to the csv file.

---

<sup>3</sup> If your computer is Win9x/Me, note that the data loss might occur because the OS has restriction against the file reading of 64K or larger file size.

**[Exit]**

Exit CaoOPCUAConfig program.

**4.2.2.2. Edit menu**

Execute editing, such as adding and deleting of items.

**[Add Controller]**

Add a controller that you want to read from the CaoOPCUA. The same controller name as the existing controller cannot be added. Note that the capital letter and the small letter are not distinguished. Once a valid name is entered, it will be added to the tree. The detailed information is selected from the tab on the right of the window.

**[Add Item]**

Add an item to the currently selected node of the tree view. The same item name as the item name that exists in the selected controller cannot be added. Note that the capital letter and the small letter are not distinguished. Once a valid name is entered, it will be added to the tree. The detailed information is selected from the tab on the right of the window.

**[Rename]**

Rename the controller/item that is currently selected from the tree view. Already registered controller/item name cannot be changed. Note that the capital letter and the small letter are not distinguished

**[Delete]**

Delete the node selected from the tree view. When a controller is deleted, all items registered in the controller are recurrently deleted. Or, you can do the same process by pressing the Delete key on the keyboard while the item is selected on the tree

**[Copy]**

Copy the selected node from the tree view. If the controller is copied, registered items are copied as well. Note that the trigger information is not copied. "Paste" will add a clone of the copied information to the node.

**[Paste]**

Paste the copied information to the node with a new name.

**[Sort]**

Sort the node of the selected level by ascending order.

#### 4.2.2.3. Action menu

Action menu provides the CaoOPCUA.exe-related settings, such as language, log, security and others. Setting will be stored in the INI file.

##### [Option]

Display the CaoOPCUA option setting dialog

##### [General]

The General tab includes the process priority setting and the language setting.

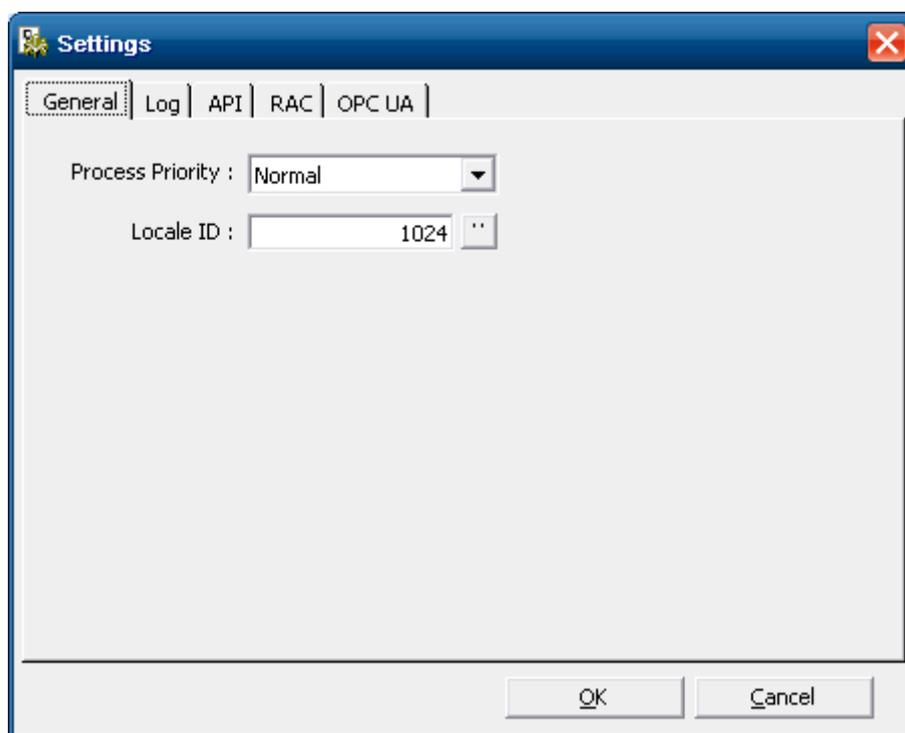


Figure 4-6 CaoOPCUA environment setting (General)

##### [Process Priority]

Set the process priority of CaoOPCUA. The order of the priority is as follows.

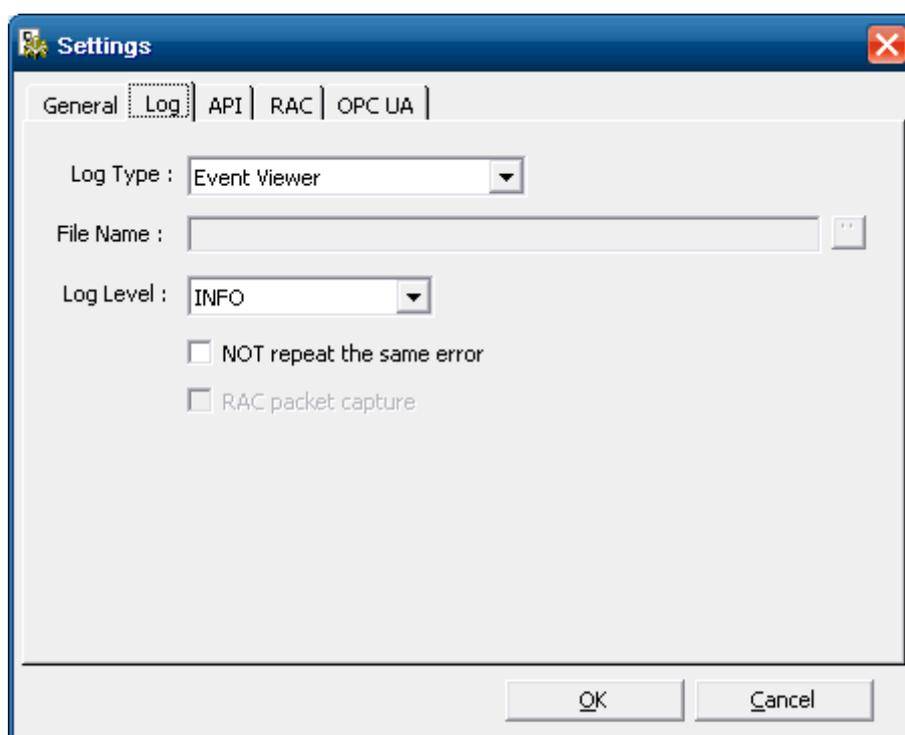
Real time > High > **Normal** > Idle

##### [Locale ID]

Set the language ID to be used.

### [Log]

The Log tab includes CaoOPCUA log output-related settings.



**Figure 4-7 CaoOPCUA environment settings (Log)**

### [Log Type]

Select the output type of log of CaoOPCUA.exe.

Table 4-2 lists available log type for output.

**Table 4-2 Log type**

| Output to    | Description  |
|--------------|--|
| Console      | Output to the console                                    |
| Message box  | Output to the message box (When the service is running)  |
| Event viewer | Output to the event viewer (When the service is running) |
| Debug viewer | Output debug   |
| Text file    | Output to the specified text file.                       |

### [File Name]

Set the file path to output the log which file type is Text file.

### [Log Level]

Set the log output level. The following five log levels are available. "FATAL" is the highest severity level whereas "DEBUG" is the lowest severity level. The default setting is "INFO".

FATAL > ERROR > WARN > **INFO** > DEBUG

### [NOT repeat the same error]

Inhibit recurring same error output. If this checkbox is selected, the error message caused by the repeatedly occurring error is issued only once.

### [API]

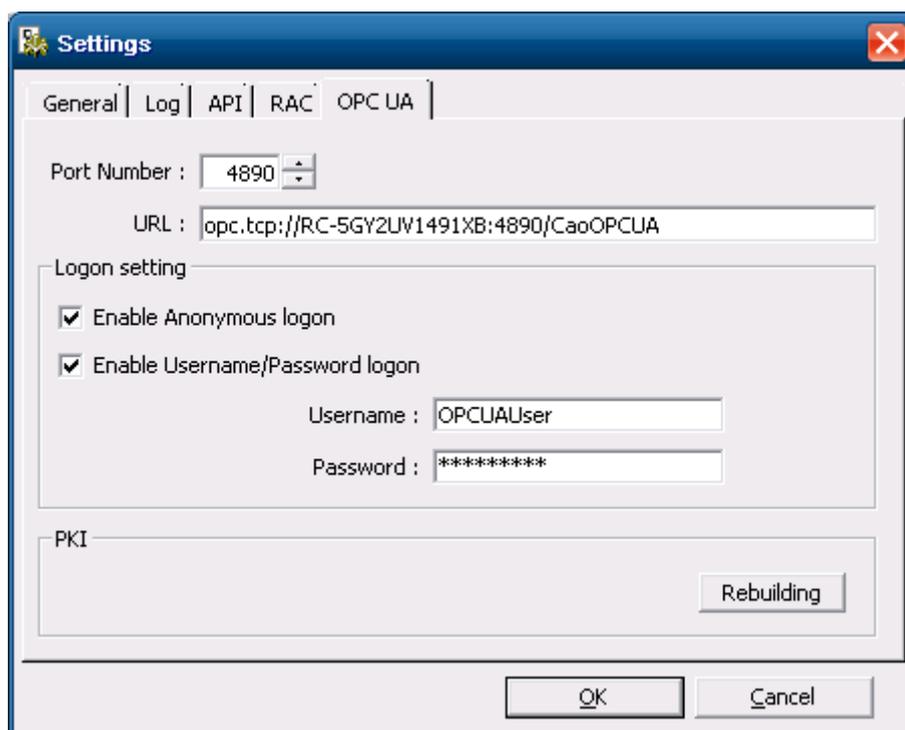
No items are available

### [RAC]

No items are available

### [OPC UA]

The OPC UA tab includes the port number, logon and PKI settings of CaoOPCUA.



**Figure 4-8 CaoOPCUA environment settings (OPC UA)****[Port Number]**

Specify the port number that CaoOPCUA server uses. Note that the port number used by other application cannot be used.

**[URL]**

This URL is automatically created based on the specified port number and the computer name.

**[Logon setting]**

This pane provides you to set Logon-related settings

**[Enable Anonymous Logon]**

Set whether the anonymous logon is allowed or not. If this checkbox is not selected, anonymous logon is not allowed.

**[Enable Username /Password logon]**

Set whether the logon with the username and password is allowed or not. If this checkbox is not selected, logon with the username and password is not allowed.

**[Username]**

Enter the username that is used for the Username/Password logon. Note that the username textbox is activated only when the Enable Username/Password logon checkbox is selected.

**[Password]**

Enter the password that is used for the Username/Password logon. Note that the Password textbox is activated only when the Enable Username/Password logon checkbox is selected. Entered password will be displayed by “\*”.

**[PKI]**

PKI-related setting (PKI = Public Key Infrastructure)

**[PKI Rebuilding]**

Create a setting destination folder and file necessary for the PKI storage. The newly created path will be determined by the following rule.

- ① The path specified by environment variable “CAOOPCUA<sup>4</sup>”, if it exists.
- ② If ① is not exist, the path of a special folder “CSIDL\_COMMON\_APP\_DATA” + “¥OPCUA”.

**[Update]**

Create folders and files required for the PKI (Public Key Infrastructure) in the specified path. Pressing this will update the PKI Settings destination on the server.

**4.2.2.4. Help menu**

Helps and the license registration menus are stored.

**[Version information]**

This displays version information.

---

<sup>4</sup> Environmental variables registered in RC8

### 4.3. INI file component information

The following shows the INI file components that are set by CaoOPCUAConfig.

In CaoOPCUAConfig, items written in bold type can be changed.

INI file name: CaoOPCUA.ini

[ ]: Section Name

<>: Key Name

|                               |        |  |
|-------------------------------|--------|--|
| [System]                      |        |  |
| ---< <b>ProcessPriority</b> > | DWORD  | CaoOPCUA Process priority  |
| ---< <b>LCID</b> >            | DWORD  | Locale ID  |
| [Log]                         |        |  |
| ---< <b>LogType</b> >         | DWORD  | Log type setting   |
| ---< <b>FileName</b> >        | String | Path name when the log type is File  |
| ---< <b>LogLevel</b> >        | DWORD  | Log level setting  |
| ---< <b>NotRepeatError</b> >  | DWORD  | Error log repeat setting   |
| [Server]                      |        |  |
| ---< <b>ServerPort</b> >      | DWORD  | Port number of OPC UA server   |
| ---<AutoStart>                | DWORD  | Enable/Disable switch of OPC UA server   |
| [Logon]                       |        |  |
| ---< <b>AnonymousLogon</b> >  | DWORD  | Enable/Disable switch of anonymous user logon to OPC UA server                             |
| ---< <b>UserLogon</b> >       | DWORD  | Username of OPC UA server Enable/Disable switch of password logon<br>Enable/Disable switch |
| ---< <b>UserName</b> >        | String | Username of OPC UA server  |
| ---< <b>UserPassword</b> >    | String | Password of OPC UA server  |
| [Path]                        |        |  |
| ---< <b>CSQPath</b> >         | String | Path name of csq file  |

## 5. OPC UA provider

### 5.1. Overview

This chapter briefly explains “CAO provider for OPC UA Connection (hereafter, OPCUA provider)”, which establishes a connection with PLC (Programmable Logic Controller) through the OPC UA (OLE for Process Control Unified Architecture) server. For details about OPCUA provider, refer to [OPC UA Provider User's Guide](#).

With this provider, CAO-compatible tools can access a PLC and a display where OPCUA server is equipped, as well as a robot.

This OPCUA provider allows an Item that is obtained by the OPCUA server to refer to CaoVariable object for the value.

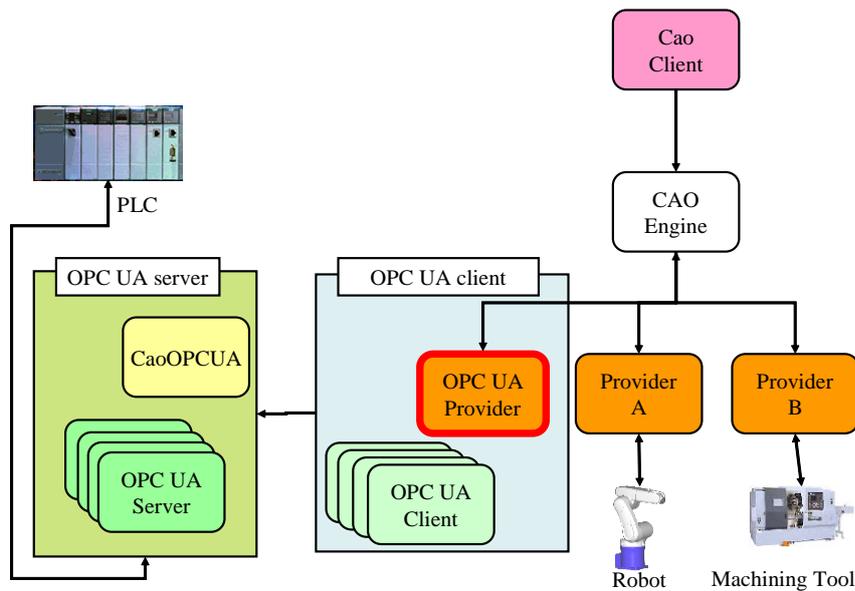


Figure 5-1 CAO Provider for OPC UA connection

## 5.2. Method and Property

### 5.2.1. CaoWorkspace::AddController method

The following shows AddController method for CaoWorkspace class of the CAO.

```
AddController
(
    "<Controller name>",           // Controller name
    "CaoProv.OPCUA",              // Provider name, Fixed.
    "<Machine name>",             // Machine name that the provider runs.
    "<Option>"                    // Option character string (OPC UA option)
)
```

In this example, <Provider name> is fixed, <Machine name> means other provider.

For about the format of <Option>, refer to the [OPC UA Provider User's Guide](#).

The following show the sample code.

```
AddController
(
    "OPCUAServer",
    "CaoProv.OPCUA",              // Provider name is fixed
    "",                          // Start with localhost
    "Server=opc.tcp://10.6.235.64:4890/CaoOPCUA, AccessPath=OPCUA.CAO/OPCUAServer, Security=0:0"
);
```

### 5.2.2. CaoController::AddVariable method

The following shows the CaoController::AddVariable method of CAO.

```
CaoController:: AddVariable
(
    "<Variable name>",           // Item ID.
    "<Option>"                    // Optional character string (OPC UA option)
)
```

To use OPC UA provider, set the argument as shown below.

**<Variable name> ::= <Item ID>**

**<Option> ::= [[AccessPath=<Access path>]]**

For about the format of <Option>, refer to [OPC UA Provider User's Guide](#).

The following shows the sample code.

```
AddVariable
(
    "@CURRENT_ANGLE",           // Item ID os "@CURRENT_ANGLE"
    ""
);
```

## Appendix A. CaoOPCUA server using RC8

CaoOPCUA is incorporated in DENSO RC8 robot controllers. To use this service, you need to purchase OPCUA server license for RC8. You need to purchase one license for every RC8 robot controller.

The following shows procedures for CaoOPCUA server setup with RC8.

### Appendix A.1. CaoOPCUA server startup

This section describes how to run the CaoOPCUA server from the RC8.

1. License registration
  - 1-1. Start the teach pendant, and then select [F6: Setting]-[F8: Option]-[F1: Extension]
  - 1-2. Press [F5: Add], and then enter the license key consisted of 24 figures.
  - 1-3. Confirm that the OPCUA server function is enabled, as shown in Figure A-1.

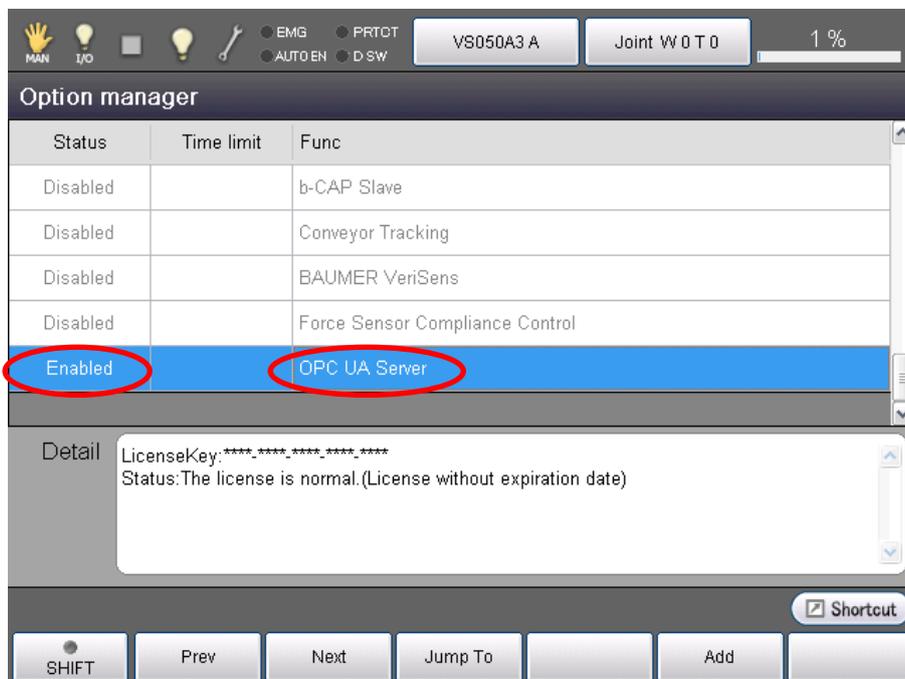


Figure A - 1 License key registration

## 2. Initialize OPCUA server

2-1. Start the teach pendant, and then select [F6: Setting]-[F5: Communication and Token]- [8:OPCUA Server]

2-2. Set each parameter as follows.

[Enabled] : ON

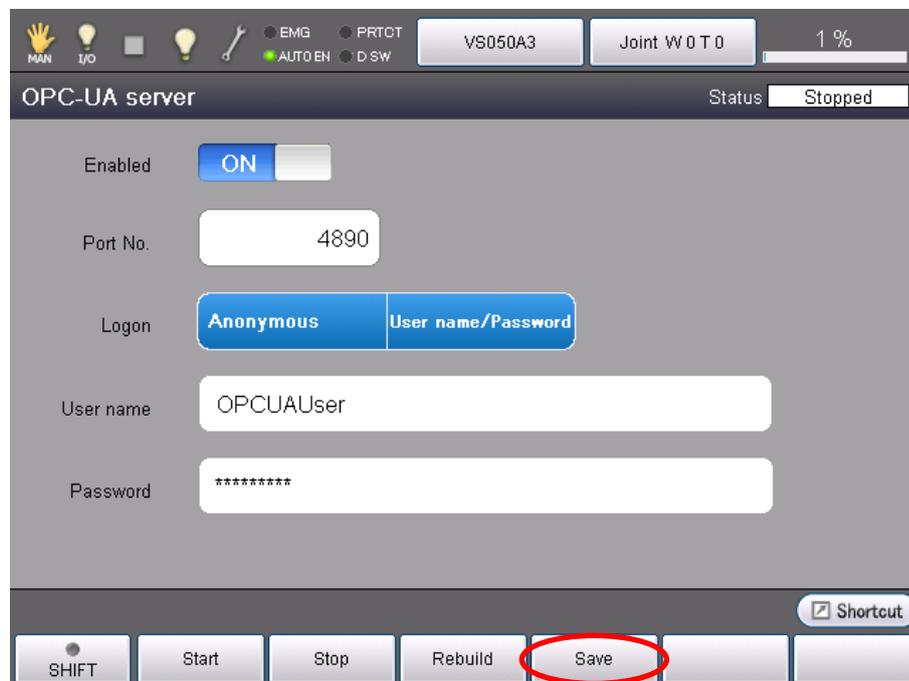
[Port No.] : 4890

[Logon] : Anonymous ON, User Name/Password ON

[User name] : Arbitrary name (In this example, OPCUAUser)

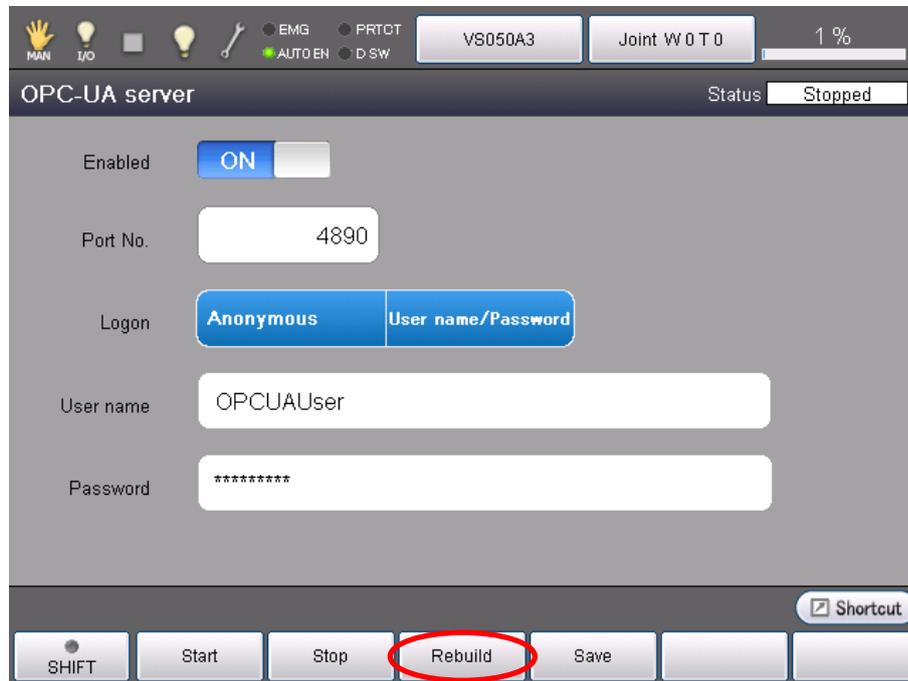
[Password] :Arbitrary

For details, refer to [CaoOPCUA server setting](#).



**Figure A-2 Save the settings**

2-3. Press [Rebuild] to rebuild security data.



**Figure A-3 Rebuilding security data**

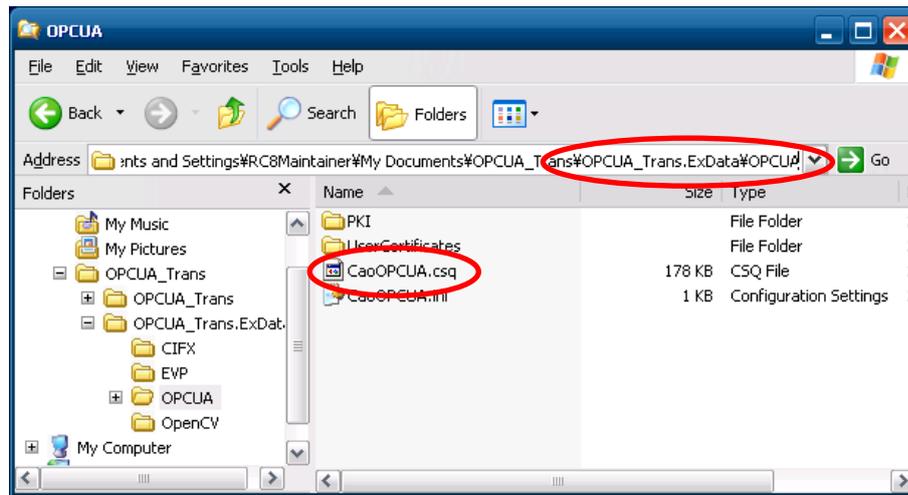
3. Creating a public item (creating a csq file)
  - 3-1. Perform “Controller and Variable setting”.  
For details, refer to “CaoOPCUAConfig”.
  - 3-2. Save the item information to the csq file.

#### 4. Sending item data to RC8

4-1. Start WINCAPSIII and create a new project by reading data from the RC8.

For details, refer to “WINCAPSIII GUIDE”.

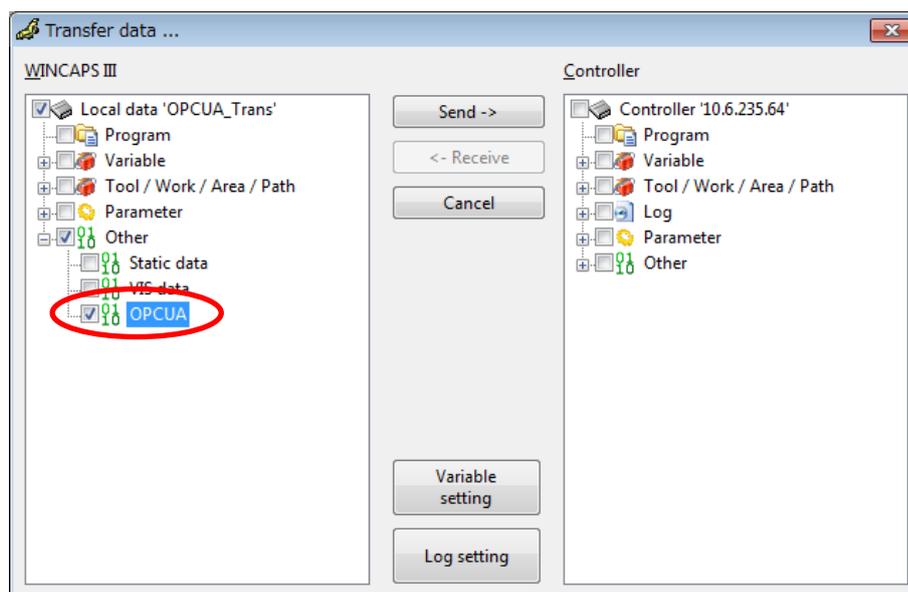
4-2. Copy a “CaoOPCUA.csq” file to “(project name).ExData\OPCUA” which is stored under the newly created WINCAPSIII project folder. This “CaoOPCUA.csq” file is a file that you have just created in the previous step “3.Creating a public item”. (In this example, “OPCUA\_Trans” is used as a project name.)



**Figure A-4. Copy the CaoOPCUA.csq file**

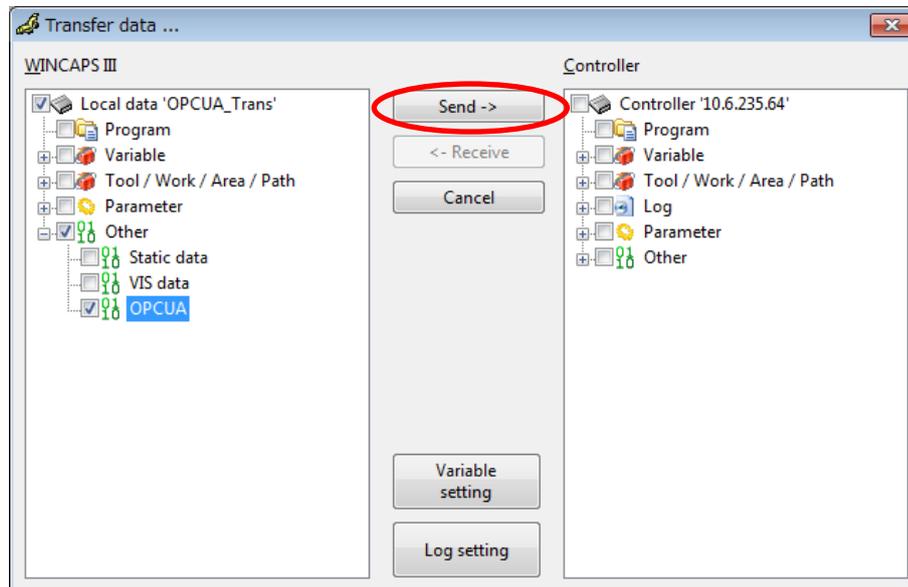
4-3. From the top menu of WINCAPSIII, click [Connect]-[Transfer data...].

4-4. On the WINCAPSIII(W) pane, click [Others], and then select the [OPCUA] checkbox.



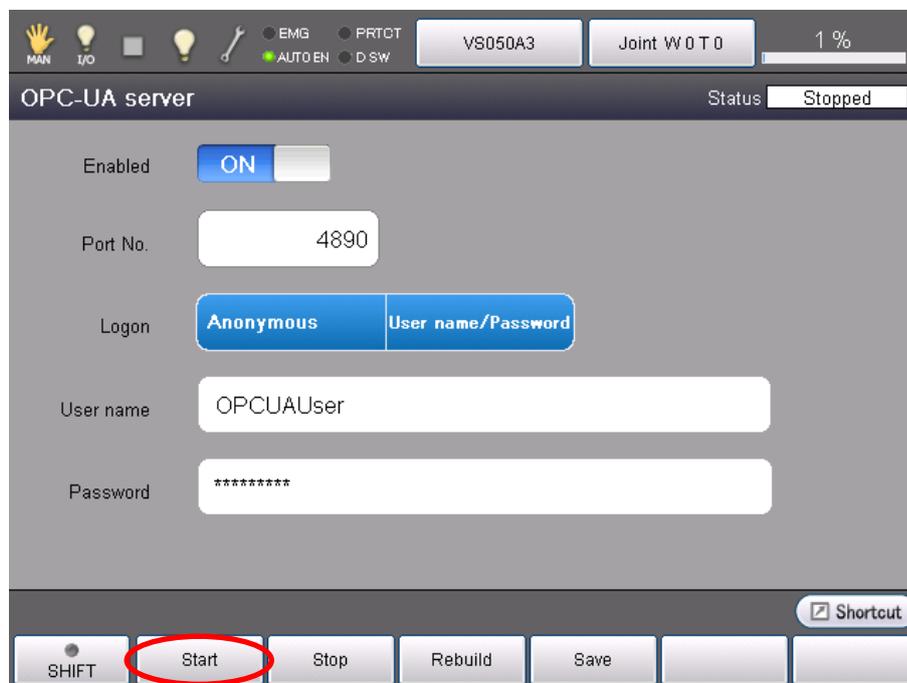
**Figure A-5. Data transfer**

4-5. Click [Send].

**Figure A-6. Sending data**

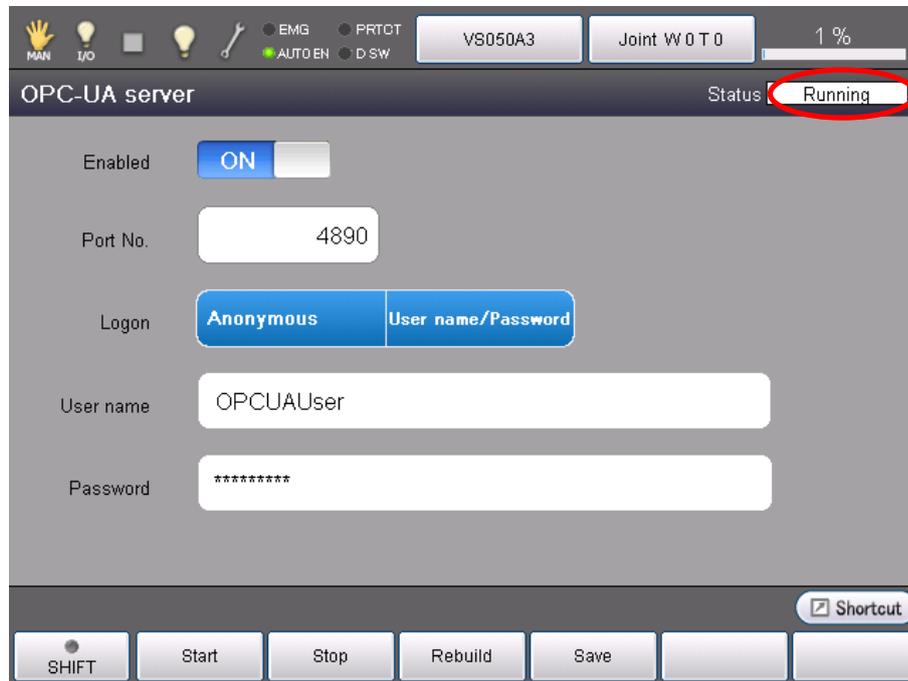
## 5. Startup of OPCUA server

- 5-1. Start the teach pendant. From the top menu, [F6:Setting]-[F5:Communication and Token]-[8:OPCUA server].
- 5-2. Press [Start].



**Figure A-7 Starting OPCUA server**

5-3. Confirm that the [Running] is displayed in the [Status] area.



**Figure A-8 OPCUA server running status**

## Appendix A.2. Editing CaoOPCUA server items

To edit RC8 item data, perform the following procedures.

### 1. Receiving item data

- 1-1. Start WINCAPSIII and create a new project by reading data from the RC8.  
For details, refer to “WINCAPSIII GUIDE”.
- 1-2. From the top menu of WINCAPSIII, click [Connect]-[Transfer data...].
- 1-3. On the Controller(C) pane, click [Others], and then select the [OPCUA] checkbox.

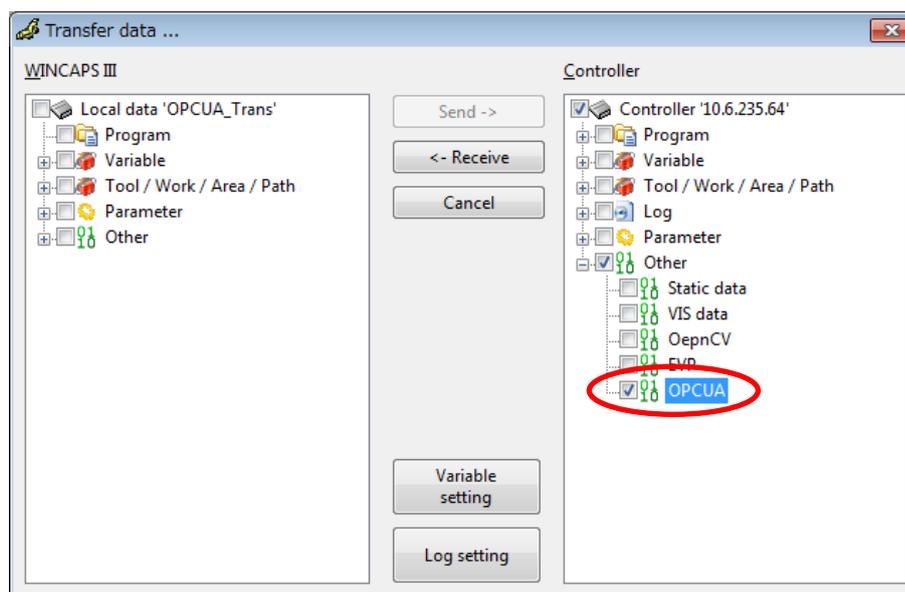


Figure A-9 Data transfer

1-4. Click [Receive].

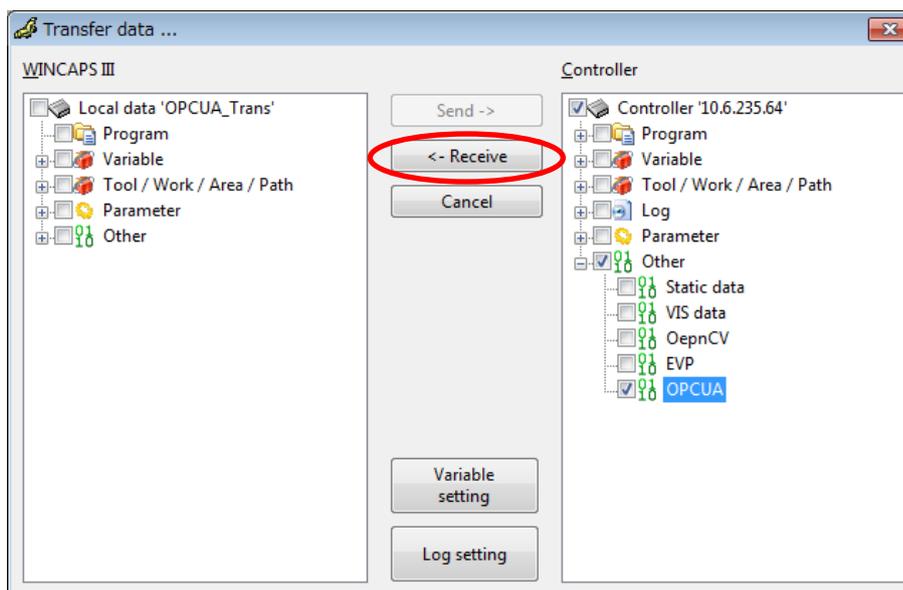


Figure A-10 Receiving data

1-5. Received data will be stored in “*project name.ExData¥OPCUA¥*” which is under the created WINCAPSIII project folder. (In this example, “OPCUA\_Trans” is used as a project name.)

② On the VRCAdmin tab, select [8:CaoOPCUA Service] checkbox.

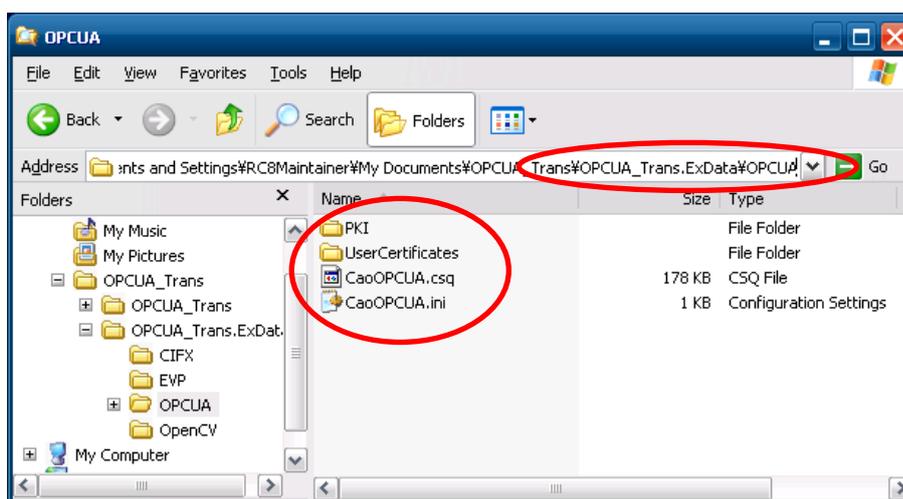


Figure A-11 Received data

## 2. Editing Item data

2-1. Start CaoOPCUAConfig, and then open CaoOPCUA.csq file which have been received in A.2.1.

2-2. Edit items. For about the way of editing, see *3.1.3 Controller and Variable Setting, Step (5)*.  
For more details, refer to “CaoOPCUAConfig”.

2-3. Overwrite CaoOPCUA.csq.

## 3. Sending Item data

3-1. Send items. For about the way of sending, see .

## Appendix A.3. Secure connection with CaoOPCUA server

To establish secure connection with CaoOPCUA server, you need to transfer a certificate file where each OPCUA client has and a user certificate, which is an optional item, to RC8 with WINCAPSIII.

### 1. Prepare a client application's certificate file

For detailed information, refer to each client application's manual.

### 2. Receive data.

Create a new WINCAPSIII project, and then receive data. For detailed information, refer to 1.

### 3. Copy a client application's certificate file

Copy a client application's certificate file to “*project name. ExData\OPCUA\PKI\store\certs*” which is under the created WINCAPSIII project folder.

### 4. Copy a user certificate file.

Copy a user certificate file to “*project name. ExData\OPCUA\UserCertificate\certs*” which is under the created WINCAPSIII project folder.

For detailed information, refer to 3.3.3.3.1.

Note: This operation is not required when you logon with “Anonymous account” or “User name and Password”.

### 5. Send data.

Send data. For the way of sending data, refer to 4-3.

### 6. Establish secure connection

For detailed information, refer to 3.3.2.