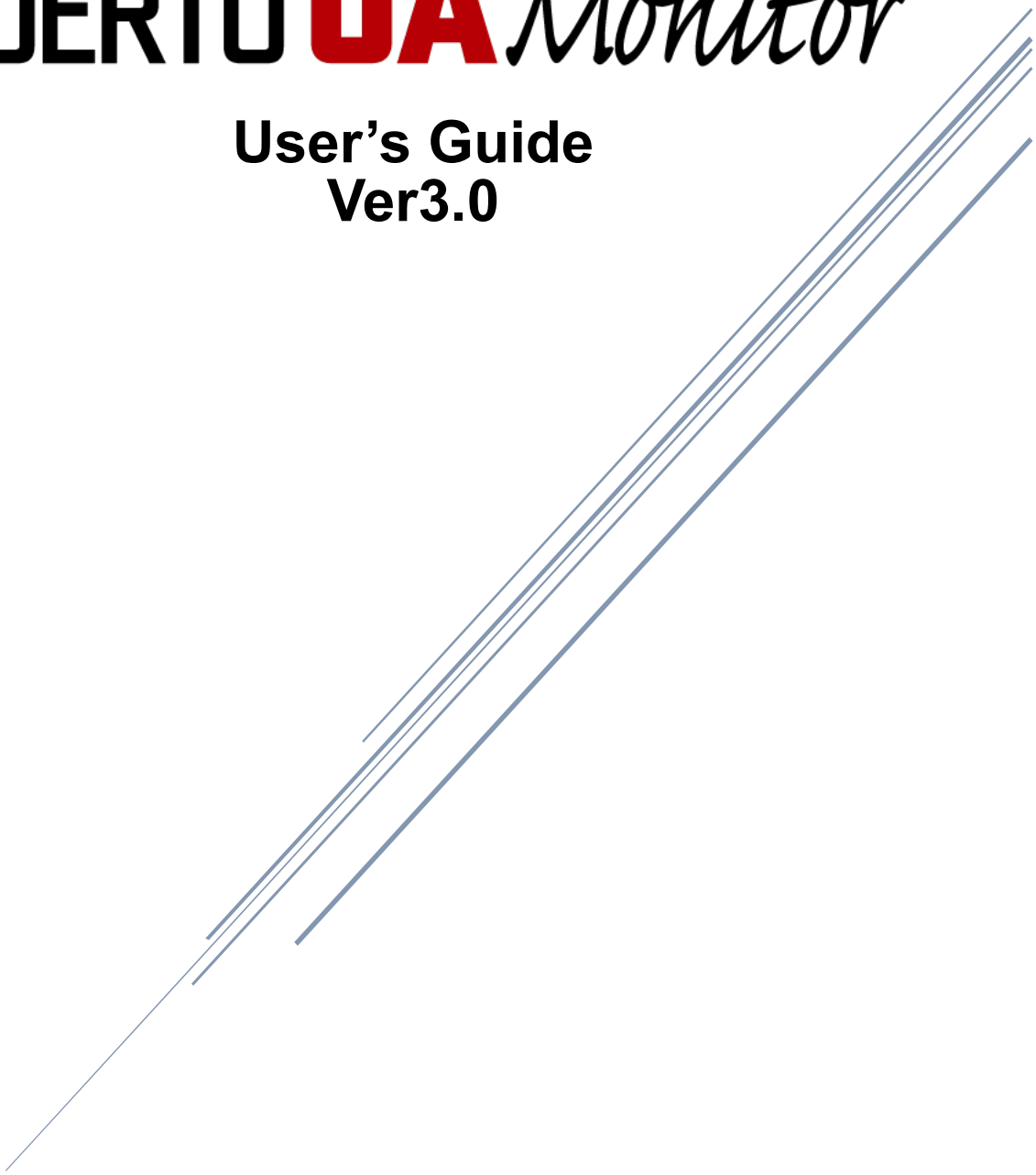
PUERTO UA Monitor

User's Guide
Ver3.0



1. Overview

1.1. Overview

This document is a user's guide to UaMonitor (and later, UA Monitor), Microsoft Excel add-on for the OPC UA client. OPC UA provides secure communication while remotely monitoring or analyzing your system running in Excel.

1.2. What is OPC UA?

Since the concept of Germany's industrial policy "Industrie 4.0" was announced in 2011, Bundesamt für Sicherheit in der Informationstechnik (BSI) has conducted a security assessment of OPC UA. It was released at the Hannover Messe in 2015 and received high praise. As a result, OPC UA has spread to the industrial industry, especially in Europe, and has been attracting worldwide attention in recent years.

OPC UA is a communication standard that enables "Utilization" by adding value to the information obtained from the concepts of "Connection", "Security", and "Communication". OPC UA is not limited to data exchange, but also integrates all the specifications of OPC Classic (DA, AE, HDA) released in the past. Of course, it is also capable of sufficient operation while ensuring security. Therefore, it is possible to collaborate with other standardized technologies.

In Europe, a working group of robots and machine tools within the German Machine Industry Federation (VDMA) is actively promoting the standardization of specifications using OPC UA. At AUTOMATICA held in Munich, Germany in 2018, a robot equipped with OPC UA was demonstrated. Since many machine tools equipped with OPC UA were exhibited at the exhibition in September 2019, it is expected that OPC UA products will spread to the market in the future.

1.3. What is UA Monitor?

UA Monitor is an OPC UA client add-in software that can communicate directly with the OPC UA server on Microsoft Excel (hereafter EXCEL). Therefore, the OPC UA function can be used as a part of Excel without having to start the application of another process. Figure 1 is displayed as the OPC UA ribbon (menu).

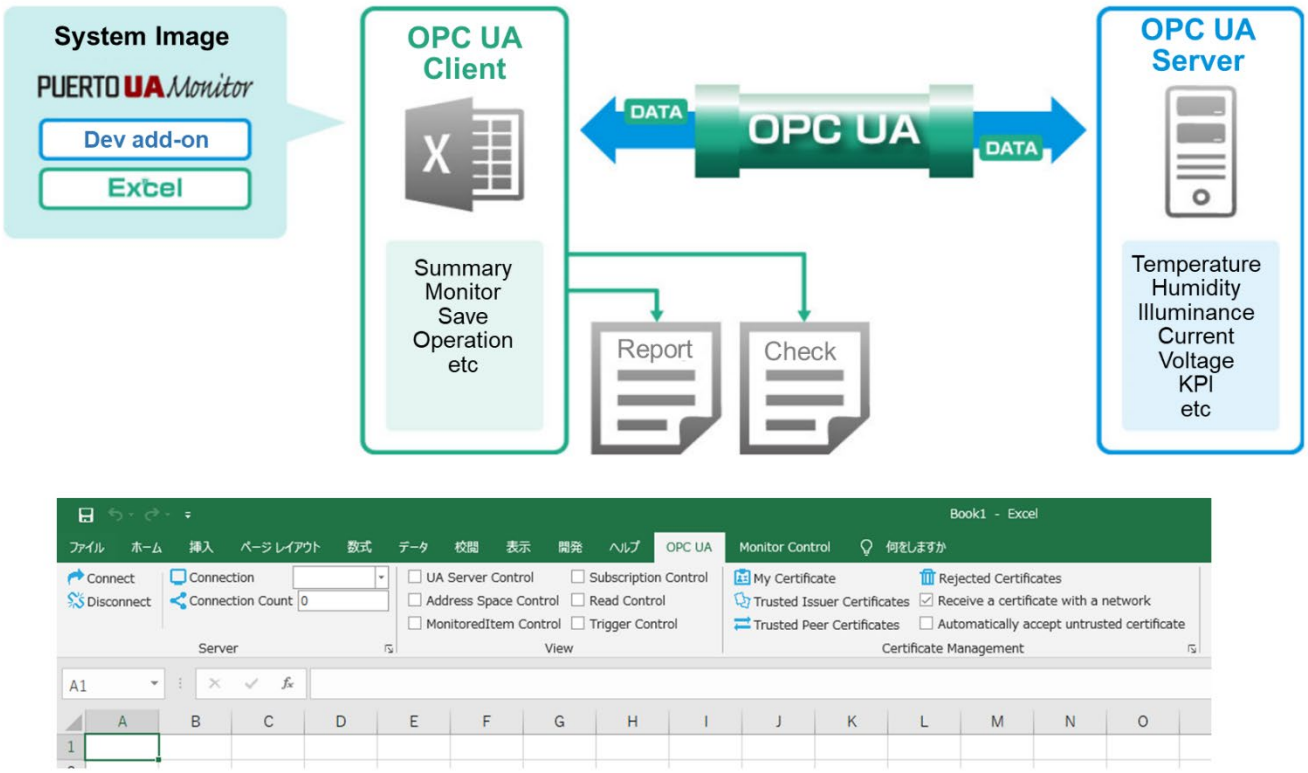


Figure 1 Image and application example of UA Monitor

2. Specifications

2.1. Functional overview

2.1.1. Linkage to Excel

By operating as an EXCEL add-in software, UA Monitor operates as a part of EXCEL so that EXCEL has the function of OPC UA client.

UA Monitor can reflect the acquired data in EXCEL cells and auto shapes (graphics). After that, you can perform the work that has been done in the past by using the powerful functions of EXCEL and graphs in cooperation with the functions of EXCEL.

2.1.2. User interface configuration

After installing UA Monitor, a new ribbon "OPC UA" and "Monitor Control" will be added.

"OPC UA" ribbon

" OPC UA " ribbon has functions for executing OPC UA communication, and you can manage the certificate in addition to the communication management here.

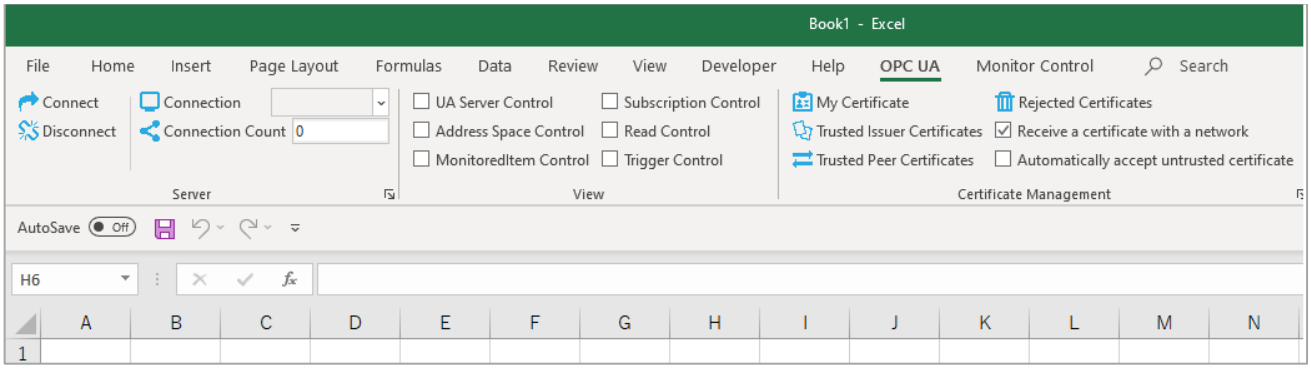
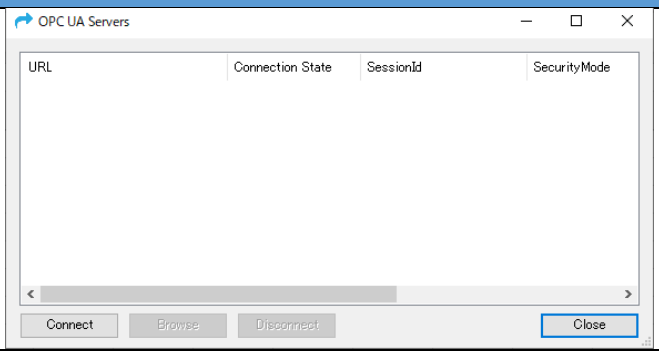
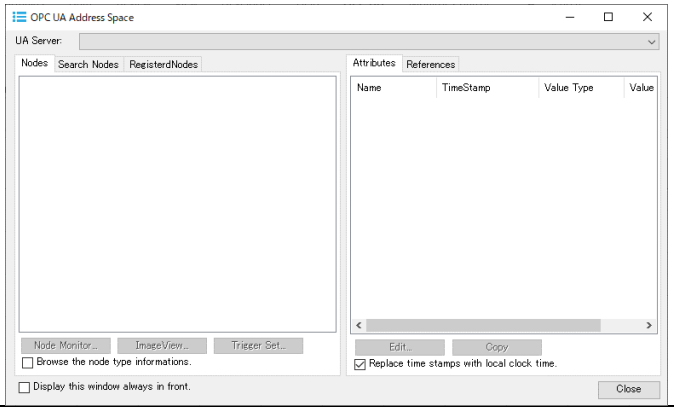
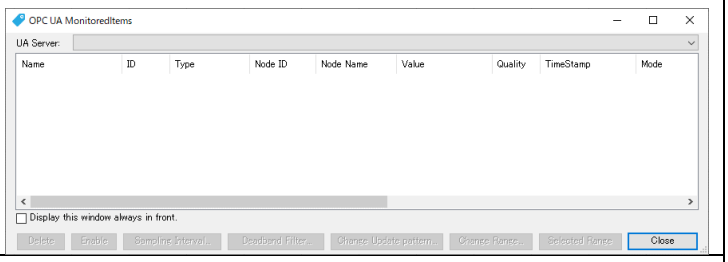
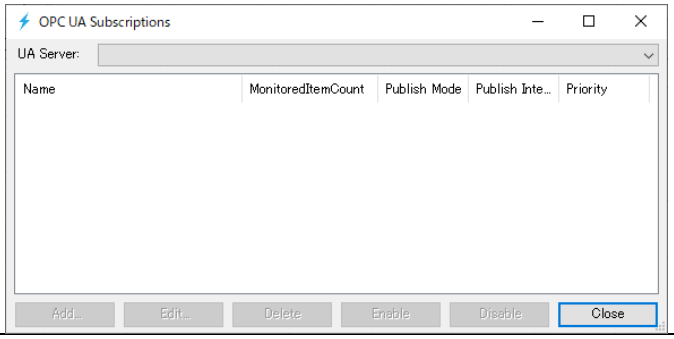


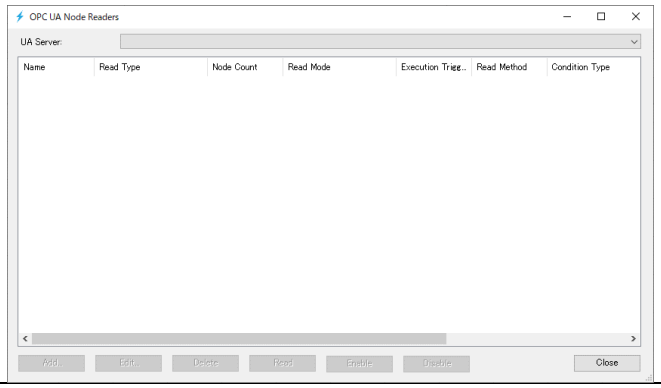
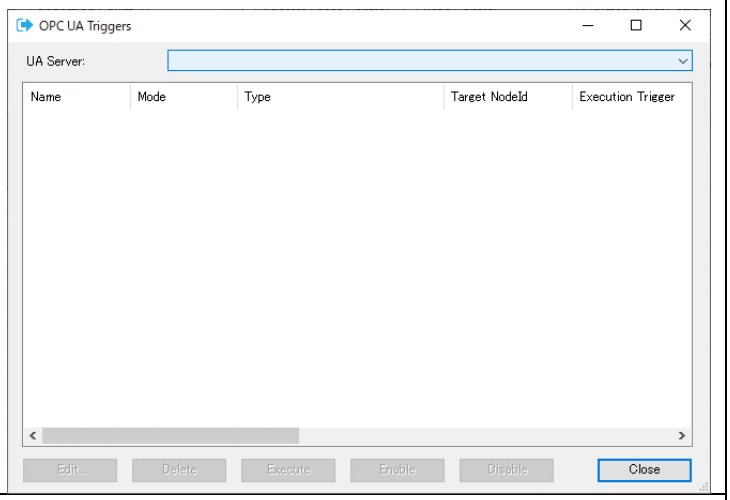
Figure 2 "OPC UA" ribbon

Table 1 shows the explanation of the "OPC UA" ribbon structure.

Table 1 Item Description of " OPC UA " ribbon

category	name	Explanation
Server	Connect	Start the connection with the OPC UA server to get the data.
	Disconnect	Disconnect from the OPC UA server.
	Connection	Display a list of the endpoint of the OPC UA server you are currently connected to via drop-down.
	Connection Count	The number of OPC UA servers currently connected.
View	UA Server Control	Display a list of the end point of the OPC UA server that is currently connected in a different screen. Check to display the screen or uncheck to close the screen.

category	name	Explanation
		
	Address Space Control	Display the nodes hierarchically. Check to display the screen or uncheck to close the screen. 
	MonitoredItem Control	Show value change notifications and display the update screen for read values. Check to display the screen or uncheck to close the screen. 
	Subscription Control	Display the screen to manage the interval of values that have changed in the UA server. Check to display the screen or uncheck to close the screen. 
	Read Control	Display the screen to read node values from the

category	name	Explanation
		UA server. Check to display the screen or uncheck to close the screen. 
	Trigger Control	Display the established UA server node's writing trigger or method trigger on separate screens. Check to display the screen or uncheck to close the screen. 
Certificate management	My Certificate	Display the certificate information assigned to UaMonitor.
	Trusted Issuer Certificates	Display the screen to manage the trusted issuer certificates.
	Trusted Peer Certificates	Display the screen to manage the trusted certificates.
	Rejected Certificates	Display the screen to manage the rejected issuer certificates.
	Receive a certificate with a network	Receive a network certificate.
	Automatically accept untrusted certificate	Automatically accept untrusted certificates over the network.

"Monitor Control" Ribbon

"Monitor operation" is a collection of auxiliary functions as a monitor. Auxiliary functions include a function to save (hereinafter referred to as archive) or restore (hereinafter referred to as restore) the created screen and connection status as they are, and to save a file or copy a sheet after a certain period of time.

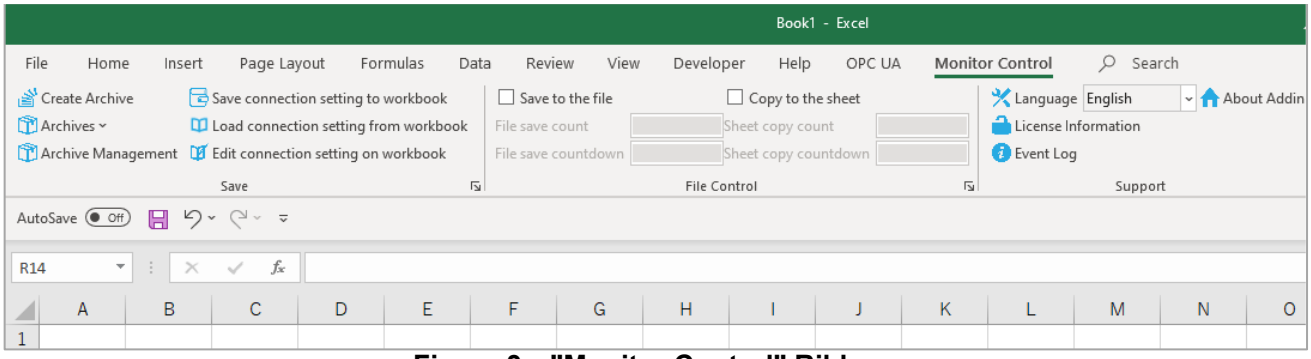
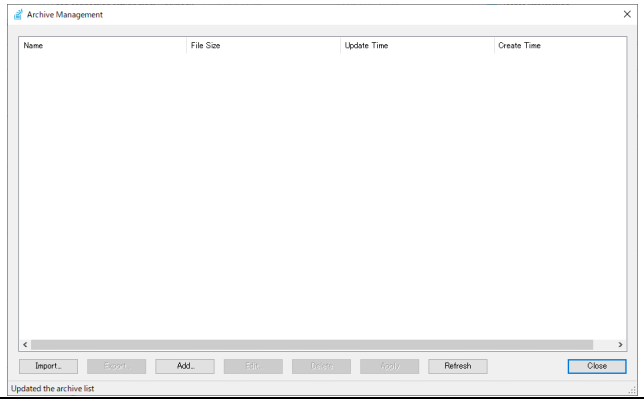
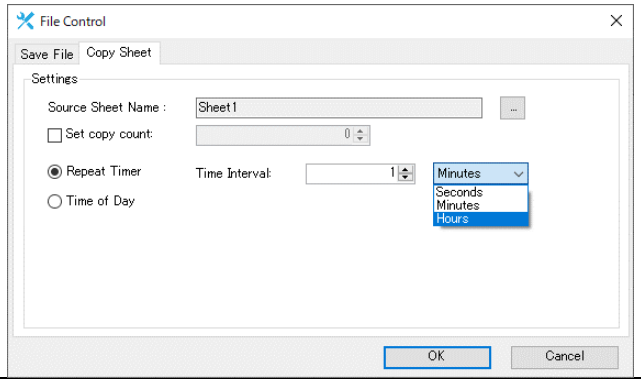
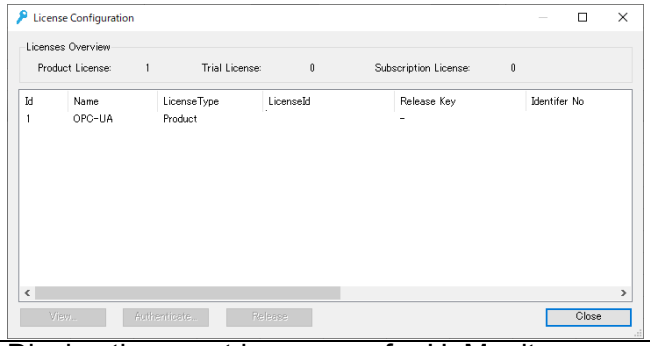
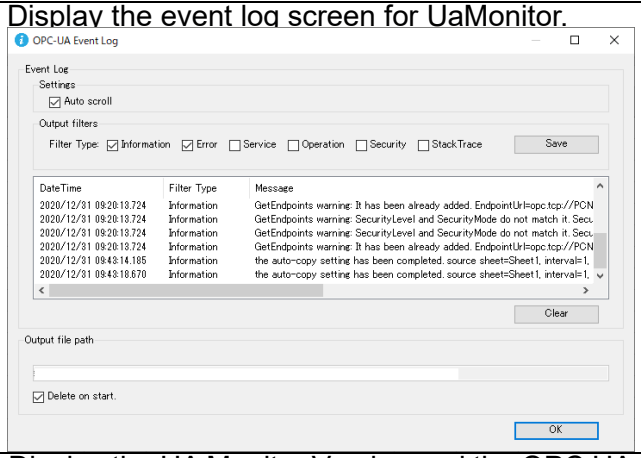


Figure 3 "Monitor Control" Ribbon

Table 2 describes the monitor operation ribbon configuration.

Table 2 Item description of " Monitor Control" ribbon

category	name	Explanation
Save	Create Archive	Save the created screen and the connection status.
	Archives	Display the list of saved archives in the drop-down. Click the archive in the drop-down to restore the archives.
	Archive Management	Display the list of the saved archives. You can edit the UA Server URL or remove the Archive. 
	Save connection setting to workbook	Save the connection with the UA server, monitoring settings, etc. to the currently active Excel workbook. When you open a workbook that connection settings are stored, the dialog box is displayed.
File Control	Save to the file	Save the file at regular time intervals.
	Copy to the sheet	Copy the sheets at regular time intervals. The copied sheet name will be "Selected sheet name

category	name	Explanation
		(number)". 
Support	Language	Select the language you want to be supported. Supported languages; - English - Japanese The initial value depends on the language setting of the OS in use. For example, if your supported OS is in Japanese, Japanese will be selected by default.
	License Information	Display a screen that shows the function license information of UaMonitor. 
	Event Log	Display the event log screen for UaMonitor. 
	About Addin	Display the UA Monitor Version and the OPC UA Stack Version.

2.1.3. Supported languages

The languages supported by UA Monitor are: The default language is Japanese if the Windows OS is Japanese. Otherwise, English will be selected.

Table 2 Supported languages

Supported Languages	Notation on UA Monitor
Japanese	Japanese
English	English

2.1.4. Microsoft Office version running UA Monitor

The Office versions that UA Monitor runs on are below.
UA Monitor recommends the office version that Microsoft supports.

Table 3 Supported Microsoft Office version for UA Monitor

Version
Office 2016
Office 2019
Office 365 ProPlus

※Please contact us if you are using Office 2013 or earlier.

2.2. Communication specifications

2.2.1. OPC UA Service

Table 5 shows the supported OPC UA services for UA Monitor. The OPC UA Service Name column matches the service name defined in OPC UA.

Table 4 OPC UA service

Service Category	OPC UA Service Name	Explanation	Support Ver
Discovery	FindServers	a service to get the URL list of UA server.	1.0
	GetEndpoints	a service to get the connection information provided by the UA server.	1.0
SecureChannel	CreateSecureChannel	a service for establishing a communication channel.	1.0
	CloseSecureChannel	a service for disconnecting the communication channel.	1.0
Session	CreateSession	a service for creating a session after establishing a communication channel.	1.0
	ActivateSession	an API for activating the created session. You may need a "username / password" and "certificate " to activate the session.	1.0
	CloseSession	A service that closes a session.	1.0
View	Browse	A service for browsing the address space in the UA server.	1.0
	BrowseNext	a service to get the rest of the information when you can not get all by Browse.	2.0
	RegisterNodes	a service for registering frequently used nodes in the UA server.	2.0
	UnregisterNodes	a service for unregistering the registered node from the UA server.	2.0
Attribute	Read	a service that reads node attributes and values.	1.0
	History Read	a service that reads attributes and history values from nodes.	3.0
	Write	a service that writes values to node attributes and values.	2.0
Subscription	CreateSubscription	an API that creates a subscription that notifies clients when there is a change in value within the UA server.	1.0
	ModifySubscription	a service that changes subscription	1.0

Service Category	OPC UA Service Name	Explanation	Support Ver
		settings.	
	SetPublishingMode	a service that changes the notification mode of a subscription.	1.0
	Publish	a service that requests notification of value changes.	1.0
	DeleteSubscriptions	a service that deletes a subscription.	1.0
MonitoredItem	CreateMonitoredItems	a service that creates an item that monitors whether the value changes in the UA server or a monitoring item for receiving events.	1.0
	SetMonitoringMode	a service that changes the monitoring mode of monitored items.	1.0
	DeleteMonitoredItems	a service that deletes monitored items.	1.0
Method	Call	a service that calls functions (methods) on the UA server from the UA client.	2.0

2.2.2. Data Type

Table 6 shows the OPC UA data types supported by UA Monitor.

Table 5 Supported Data types

<table>
<tr><th>Type</th><th>Explanation</th></tr>
<tr><td>NodeId</td><td>an identifier that uniquely identifies a node within the UA server. It has the following structure.
<table>
<tr><th>name</th><th>type</th><th>explanation</th></tr>
<tr><td>NodeId</td><td>Structure</td><td></td></tr>
<tr><td>namespaceIndex</td><td>UInt16</td><td>An index that identifies the namespace.</td></tr>
<tr><td>identifierType</td><td>Enum</td><td>The format and data type of the identifier. There are the following types.
・NUMERIC = 0
・STRING = 1
・GUID = 2
・OPAQUE = 3</td></tr>
<tr><td>identifier</td><td>*</td><td>Node identifier.</td></tr>
</table>
UA Monitor handles NodeId in the format of " ns=[namespaceIndex];[identifierType]=[value]". For example, it is displayed as follows.

<NodeId value>
For NUMERIC, ns=2;i=19
For STRING, ns=2;s=default:Data.Static.Scalar.Int16Value
For GUID, ns=5;g=8e07978e-59d5-f1a4-6776-905a2ab3078b

"ns" is an abbreviation for namespace. "i" is an abbreviation for the number int. "s" is an abbreviation for the string identifier. "g" is an abbreviation for the GUID identifier.</td></tr>
<tr><td>ExpandedNodeId</td><td>An identifier that uniquely identifies a node within the UA server. Unlike NodeId, ExpandedNodeId can specify NamespaceURI instead of NamespaceIndex.

UA Monitor handles ExpandedNodeId in the format of " ns=[namespaceURI];[identifierType]=[value]".</td></tr>
<tr><td>QualifiedName</td><td>A character structure that combines a namespace and a string. It has the following structure.
<table>
<tr><th>name</th><th>type</th><th>Explanation</th></tr>
<tr><td>QualifiedName</td><td>Structure</td><td></td></tr>
<tr><td>namespaceIndex</td><td>UInt16</td><td>An index that identifies the namespace.</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Type</th><th>Explanation</th></tr>
<tr><td></td><td>
<table>
<tr><td>name</td><td>String</td><td>The text part of the QualifiedName. The maximum string length is 512 characters.</td></tr>
</table>

UA Monitor handles QualifiedName in the format of " namespaceIndex:name". For example, it is displayed as follows.

< QualifiedName value>
3:猴子
</td></tr>
<tr><td>LocalizedText</td><td>A structure that combines a locale identifier and a string. It has the following structure.
<table>
<tr><th>name</th><th>type</th><th>Explanation</th></tr>
<tr><td>LocalizedText</td><td>Structure</td><td></td></tr>
<tr><td>text</td><td>String</td><td>A localized String.</td></tr>
<tr><td>locale</td><td>LocaleId</td><td>Locale identifier (such as "en-US")</td></tr>
</table>
</td></tr>
<tr><td>Boolean</td><td>Either TRUE or FALSE.</td></tr>
<tr><td>Byte</td><td>The Value Range : 0 ～255</td></tr>
<tr><td>ByteString</td><td>The value converted to a byte array.</td></tr>
<tr><td>DateTime</td><td>A value that represents the moment expressed as a date or time.</td></tr>
<tr><td>Double</td><td>A value that conforms to the IEEE 754-1985 double precision data type definition.</td></tr>
<tr><td>Float</td><td>A value that conforms to the IEEE 754-1985 single precision data type definition.</td></tr>
<tr><td>Guid</td><td>A value that is a 128- bit globally unique identifier.</td></tr>
<tr><td>SByte</td><td>A value that is a signed integer between -128 and 127.</td></tr>
<tr><td>Image</td><td>The value of ByteString that represents the image.</td></tr>
<tr><td>ImageBMP</td><td>A ByteString value that represents an image in BMP format.</td></tr>
<tr><td>ImageGIF</td><td>The value of ByteString that represents the image in GIF format.</td></tr>
<tr><td>ImageJPG</td><td>A ByteString value that represents a JPEG format image.</td></tr>
<tr><td>ImagePNG</td><td>The value of ByteString that represents the image in PNG format.</td></tr>
<tr><td>Integer</td><td>A value of a numeric abstract data type.
UA Monitor treat it as optimal numeric types (SByte, Int16, Int32, Int64) by the value.</td></tr>
<tr><td>UInteger</td><td>A value of a numeric abstract data type. UA Monitor treat it as optimal numeric types (Byte, UInt16, Uint32, UInt64) by the value.</td></tr>
<tr><td>Int16</td><td>A signed integer value in the range -32,768 to 32,767.</td></tr>
<tr><td>Int32</td><td>A signed integer value in the range -2,147,483,648 to 2,147,483,647.</td></tr>
<tr><td>Int64</td><td>A signed integer value in the range -9,223,372,036,854,775,808 to 9,223,372,036,854,775,807.</td></tr>
<tr><td>Number</td><td>A value of a numeric abstract data type.
UA Monitor treat it as optimal numeric types (Byte, SByte, Int16, Int32, Int64, UInt16, Uint32, UInt64, The Double, Float) by the value.</td></tr>
<tr><td>UInt16</td><td>An unsigned integer value in the range 0 to 65,535.</td></tr>
<tr><td>UInt32</td><td>An unsigned integer value in the range 0 to 4,294,967,295.</td></tr>
<tr><td>UInt64</td><td>An unsigned integer value in the range 0 to 18,446,744,073,709,551,615.</td></tr>
<tr><td>UtcTime</td><td>A UTC (Coordinated Universal Time) value that represents the moment expressed as a date or time. UA Monitor treats it as DateTime.</td></tr>
<tr><td>XmlElement</td><td>The value expressed in XML. If there is an error in the interpretation, the value will be empty. The details of the error are output to the event log.</td></tr>
<tr><td>String</td><td>UTF-8 encoded string value.</td></tr>
<tr><td>Variant</td><td>A generic value that can store values of all types shown above.</td></tr>
<tr><td>NodeId Array</td><td>An array value of NodeId type.</td></tr>
<tr><td>ExpandedNodeId Array</td><td>An array value of ExpandedNodeId type.</td></tr>
<tr><td>QualifiedName Array</td><td>An array value of QualifiedName type.</td></tr>
<tr><td>LocalizedText Array</td><td>An array value of LocalizedText type.</td></tr>
<tr><td>Boolean Array</td><td>An array value of Boolean type.</td></tr>
<tr><td>Byte Array</td><td>An array value of Byte type.</td></tr>
<tr><td>DateTime Array</td><td>An array value of DateTime type.</td></tr>
<tr><td>Double Array</td><td>An array value of Double type.</td></tr>
<tr><td>Float Array</td><td>An array value of Float type.</td></tr>
</table>

Type	Explanation
Guid Array	An array value of Guid type.
SByte Array	An array value of SByte type.
Integer Array	An array value of Integer type.
UInteger Array	An array value of UInteger type.
Int16 Array	An array value of Int16 type.
Int32 Array	An array value of Int32 type.
Int64 Array	An array value of Int64 type.
Number Array	An array value of Number type.
UInt16 Array	An array value of UInt16 type.
UInt32 Array	An array value of UInt32 type.
UInt64 Array	An array value of UInt64 type.
UtcTime Array	An array value of UtcTime type.
XmlElement Array	An array value of XmlElement type.
String Array	An array value of String type.
Variant Array	An array value of Variant type.

2.2.3. Security mode

Table 7 shows the security modes supported by UA Monitor.

Table 6 Supported security modes

Item name	Explanation
None	Communicate without security.
Sign	Communicate with signed data.
SignAndEncrypt	Communicate with encrypted and signed data.

2.2.4. Security policy

Table 8 shows the security policies supported by UA Monitor.

Table 7 Supported security policies

Item name	Remarks
Basic128Rsa15	The policy that we do not recommend using it due to encryption strength issues.
Basic256	
Basic256Sha256	
Aes128_Sha256_RsaOaep	
Aes256_Sha256_RsaPss	

2.2.5. User authentication method

Table 9 shows the user authentication methods supported by UA Monitor.

Table 8 Supported user authentication methods

Item name	Explanation
Anonymous	Activate the session as an anonymous user.
UserName	Activate the session using user information (username and password). User information that is not allowed will be rejected by the UA server.
Certificate	Enable the session using the user information of Certificate (PFX format). User information that is not allowed will be rejected by the UA server.

2.3. Restrictions

Table 10 shows the restrictions for UA Monitor.

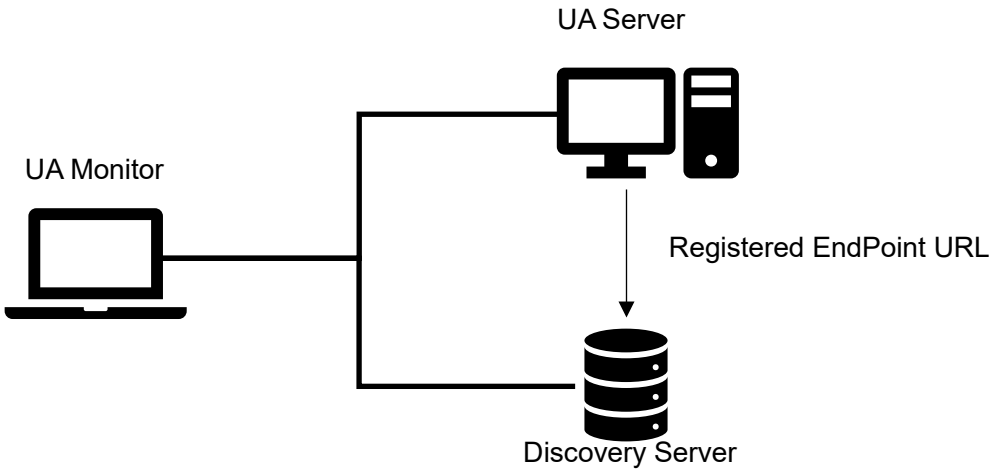
Table 9 Restrictions

Summary	Explanation
Please install Microsoft Excel.	UA Monitor is an add-on for Microsoft Excel. Therefore, Microsoft Excel must be installed before installing UA Monitor.
Please install the dependent libraries.	UA Monitor uses the components shown below. Therefore, these components must be installed in advance. -Microsoft .NET Framework 4.7.2 -Microsoft Visual Studio 2010 Tools for Office Runtime If the PC to be installed is connected to the Internet, these components can be automatically downloaded and installed. If you do not have an internet connection, download the component from Microsoft 's site and install it manually.
Please do not include Japanese in your PC name.	UA Monitor has the function to generate digital certificates. The host name of the digital certificate to be generated will be the name of your PC, but if you include Japanese for your PC name, you will not be able to generate the digital certificate. Therefore, please do not use Japanese for the PC name. If you include Japanese, please change the PC name to alphanumeric characters.

UA Monitor is suitable for creating reports and forms.	UA Monitor not only provides the ability to read and write the address space of the server, but also provides many OPC UA services, so UA Monitor is suitable for debugging of server, reporting, and making forms. Therefore, UA Monitor is expected to be used for report generation. For long-term monitoring, we recommend using a PC with a lot of resources.

3. Connection procedure

3.1. System configuration



Tool Software

Company/Organization	Figure Name	Name	Version
OPC Foundation	UA Server	UA Sample Server	1.4.357.28
OPC Foundation	Discovery Server	Local Discovery Server	1.03.400
Puerto Co., Ltd.	UA Monitor	UA Monitor	3.0.X

3.2. Operating procedure

3.2.1. Directly specified connection procedure

This section describes the procedure for connecting to the UA server from the OPC UA client UA Monitor. This procedure requires you to know the endpoint URL of the UA server in advance.

Figure 4 shows the connection sequence.

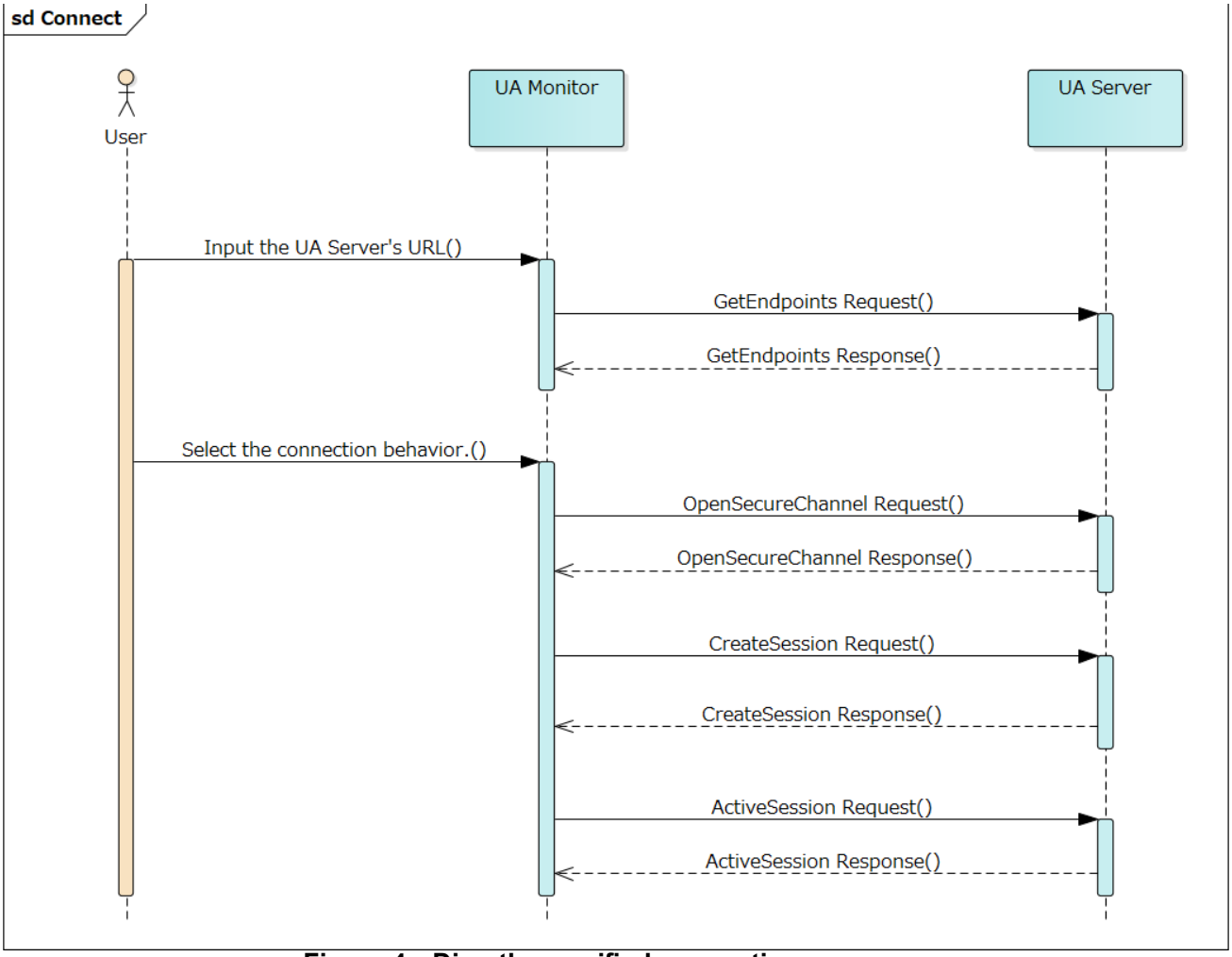
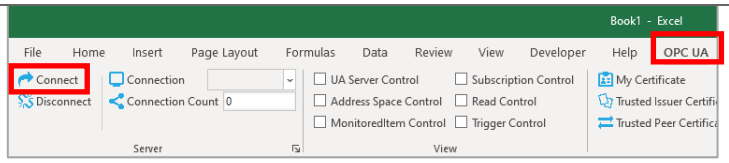
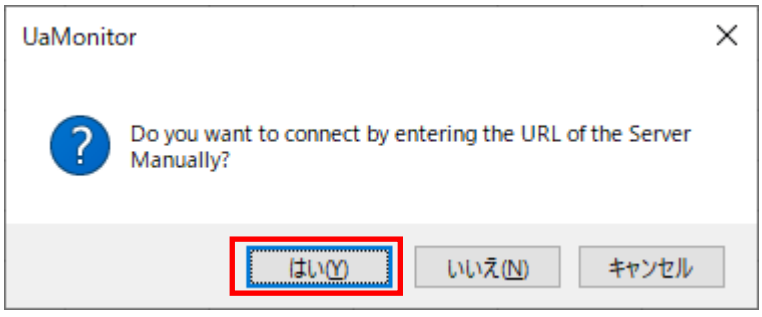
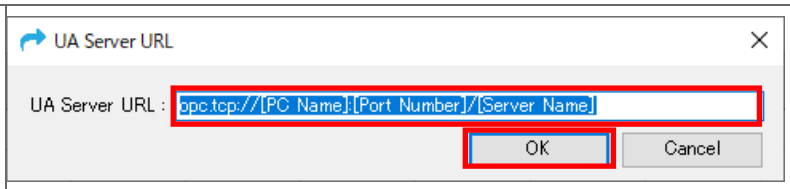
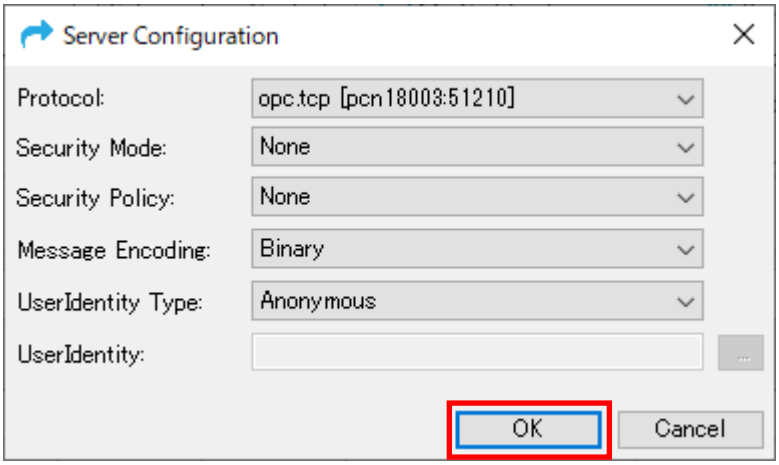
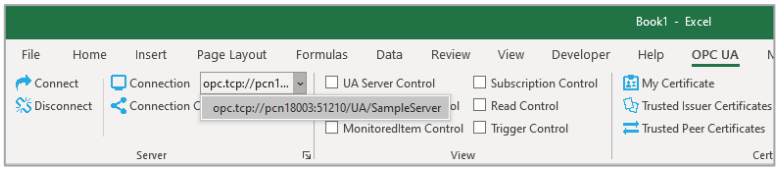


Figure 4　Directly specified connection sequence

The details of the operation procedure are described below.

1	Start EXCEL	
2	Click the "Connect" button on the " OPC UA " tab.	
3	Click the "Yes" button.	

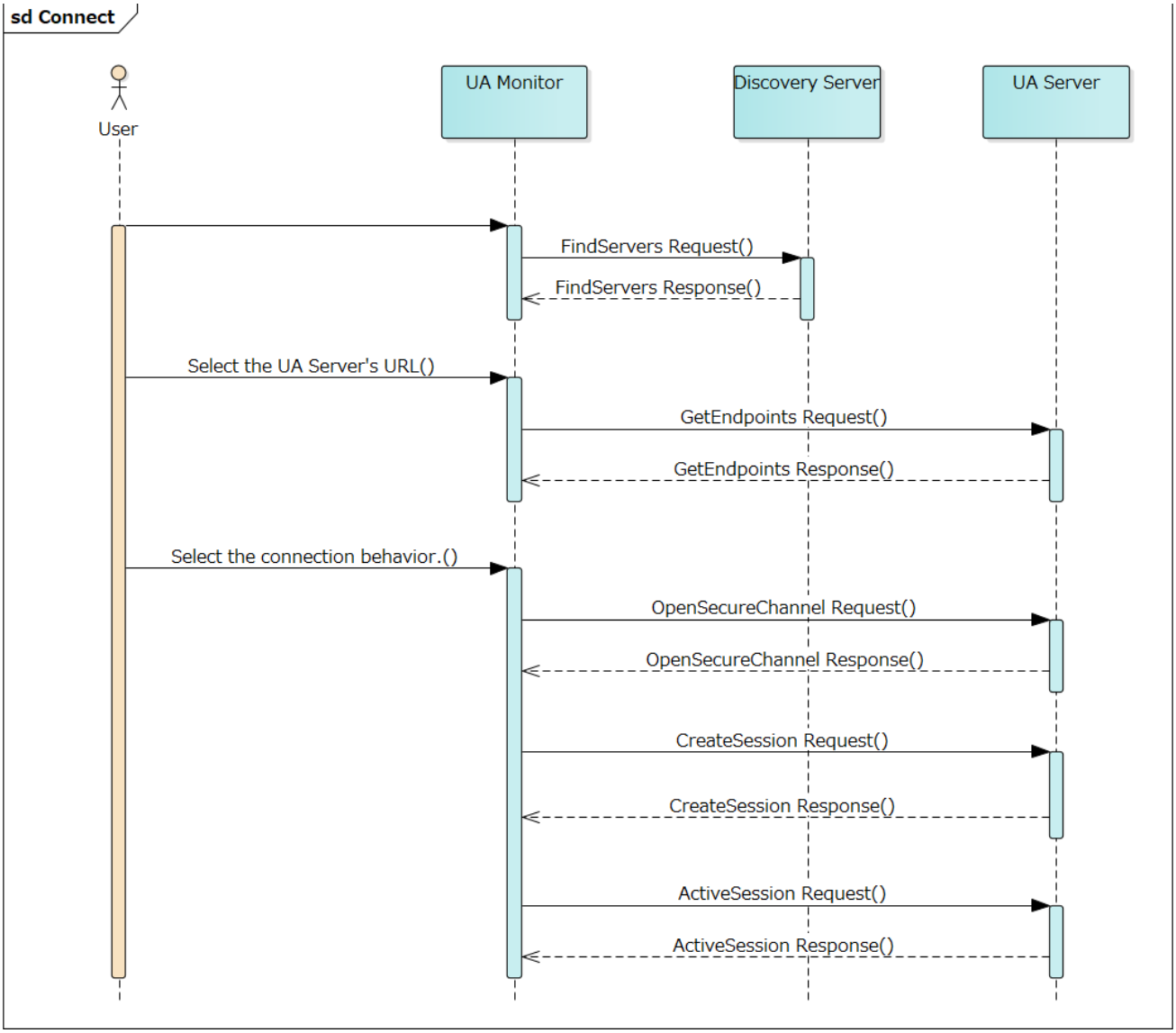
4	Enter the endpoint URL for the UA server. ※*you can specify IP address for [PC name].* Click the " OK " button.	 *When connecting via TCP, specify in the format of " opc.tcp : // [PC name]: [port number] / [server name] " .* *When connecting via HTTP, specify in the format of " http: // [PC name]: [port number] / [server name] " .* *When connecting via HTTPS, specify in the format of " https: // [PC name]: [port number] / [server name] " .*
5	Set the connection method. *Protocol* : *opc.tcp* *Security Mode* : *None* *Security Policy* : *None* *Message Encoding* : *Binary* *UserIdentity Type* : *Anonymous*	
6	Confirm the endpoint URL is added to the connection	

3.2.2. Connection procedure via Discovery server

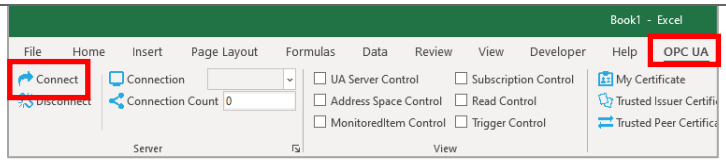
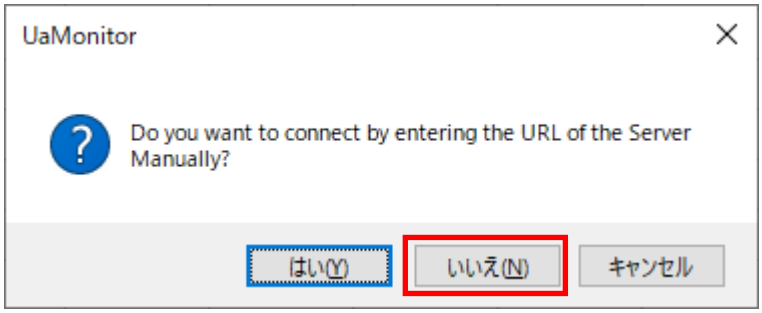
This section describes the procedure for connecting to the UA server from the OPC UA client UA Monitor. This procedure is useful if you do not know the endpoint URL of the UA server in advance.

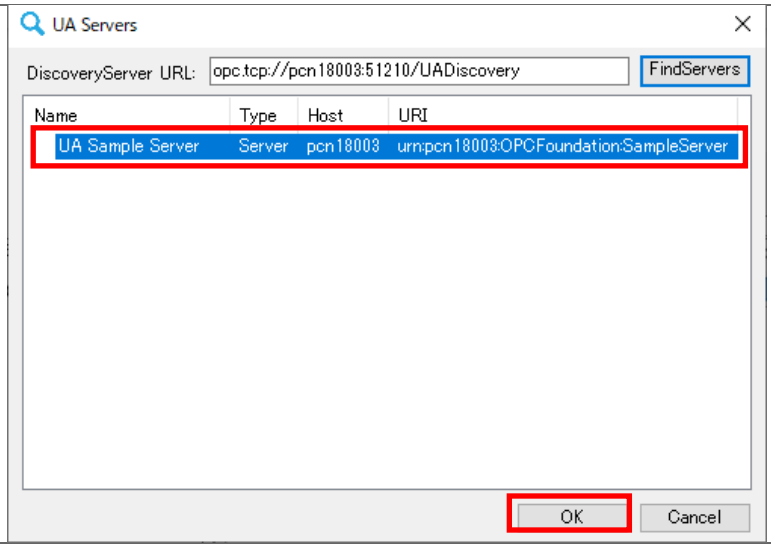
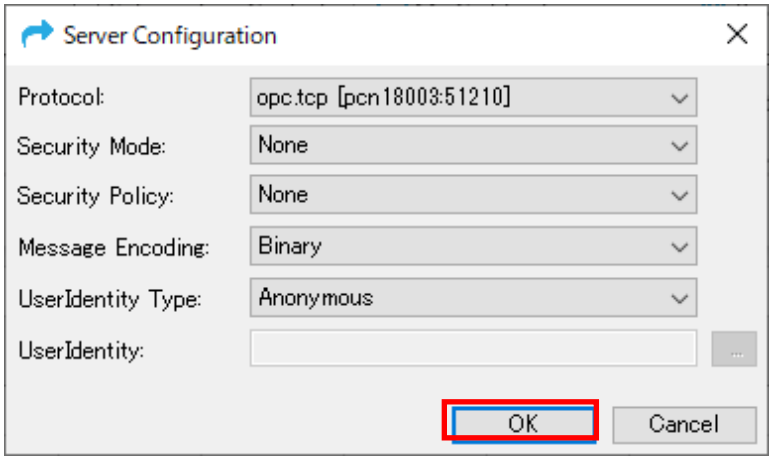
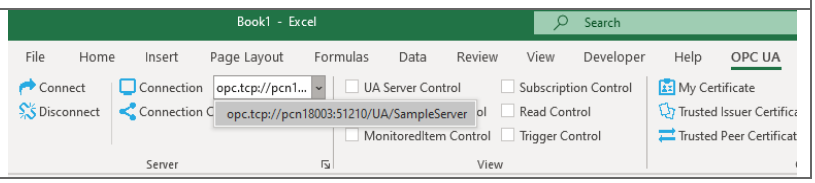
The connection sequence is shown in Figure 5.

Figure 5　Connection sequence via Discovery server



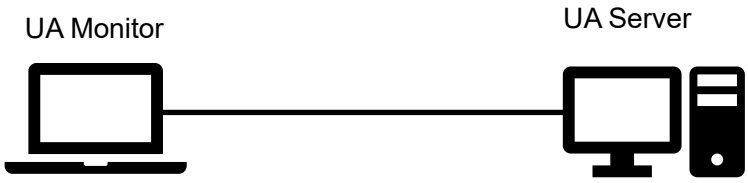
The details of the operation procedure are described below.

1	Start EXCEL.	
2	Click the "Connect" button on the " OPC UA " tab.	
3	Click the "No" button.	

4	Select UA server. Click the " OK " button.	
5	Set the connection method. *Protocol* : *opc.tcp* *Security Mode* : *None* *Security Policy* : *None* *Message Encoding* : *Binary* *UserIdentity Type* : *Anonymous*	
6	Confirm the endpoint URL is added to the connection.	

4. READ (value reading) procedure

4.1. System configuration



Tool software

Company/Organization	Figure Name	Name	Version
OPC Foundation	UA Server	UA Sample Server	1.4.357.28
Puerto Co., Ltd.	UA Monitor	UA Monitor	3.0.X

4.2. Operating procedure

4.2.1. READ by EXCEL cooperation

UA Monitor can read node values on the UA server, and set reflect destination of node values to the EXCEL cell or shape (figure). After reflecting the value in the cell or shape, you can use the functions and graphs that are the original functions of EXCEL.

Figure 6 shows the sequence of reading node values.

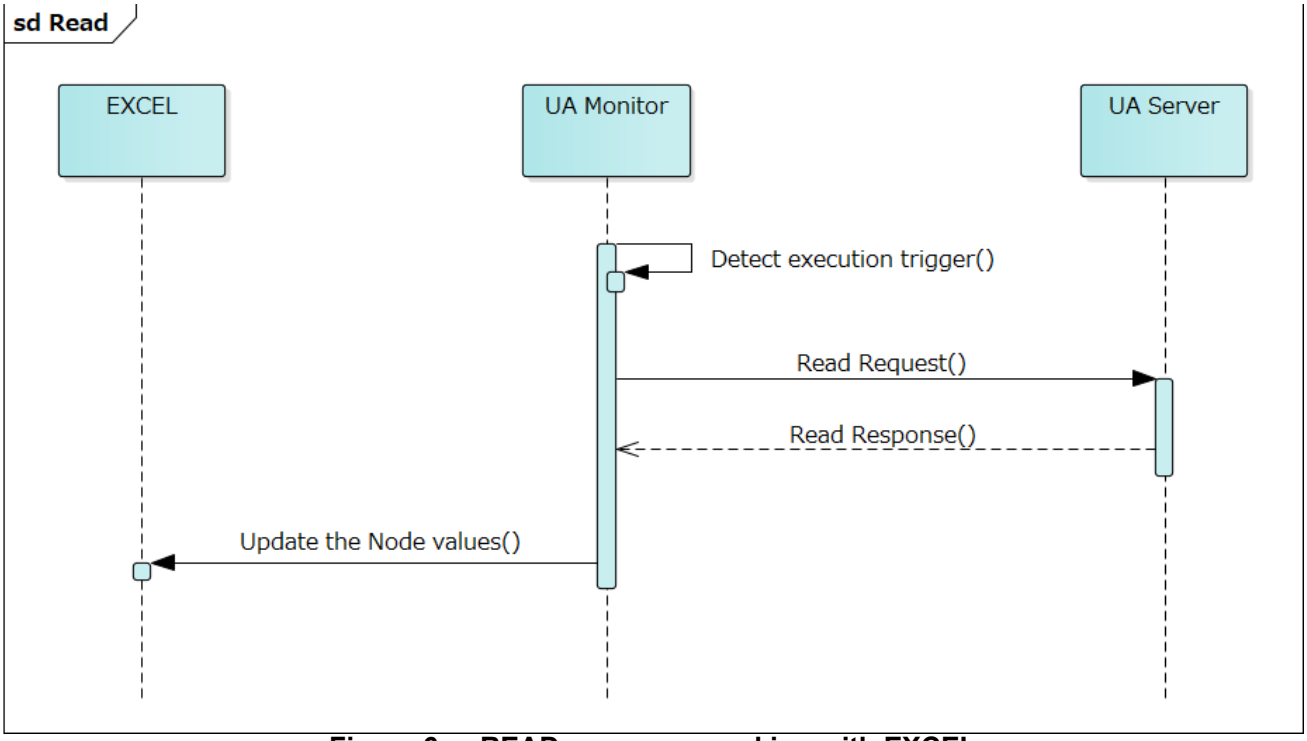
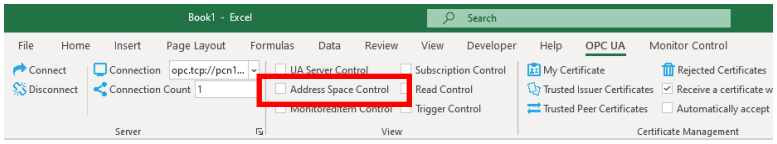
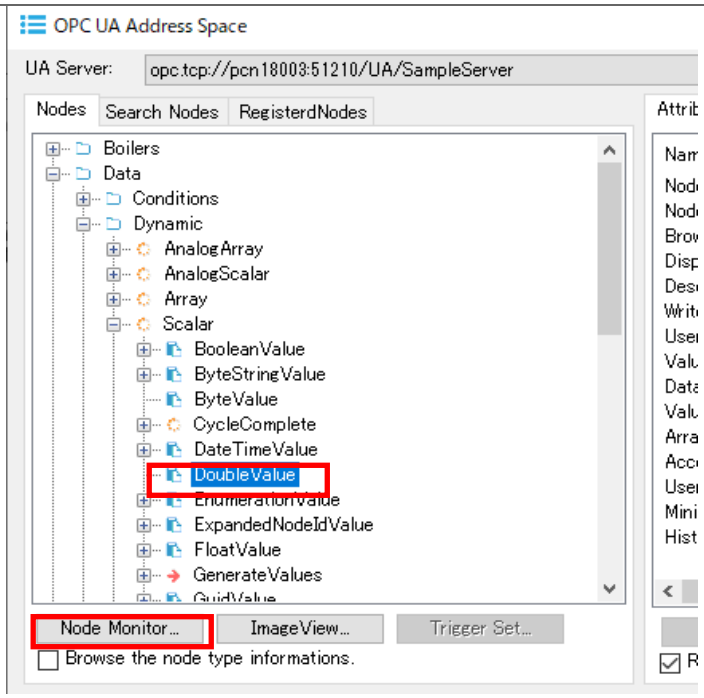
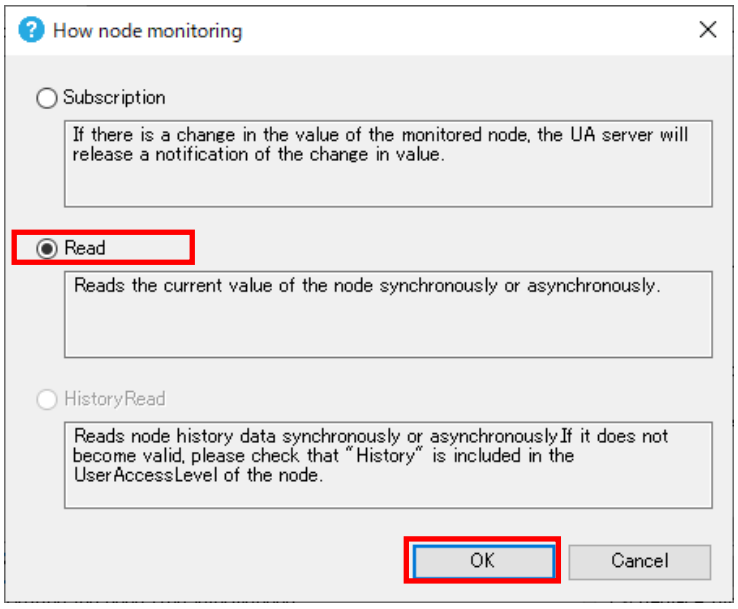
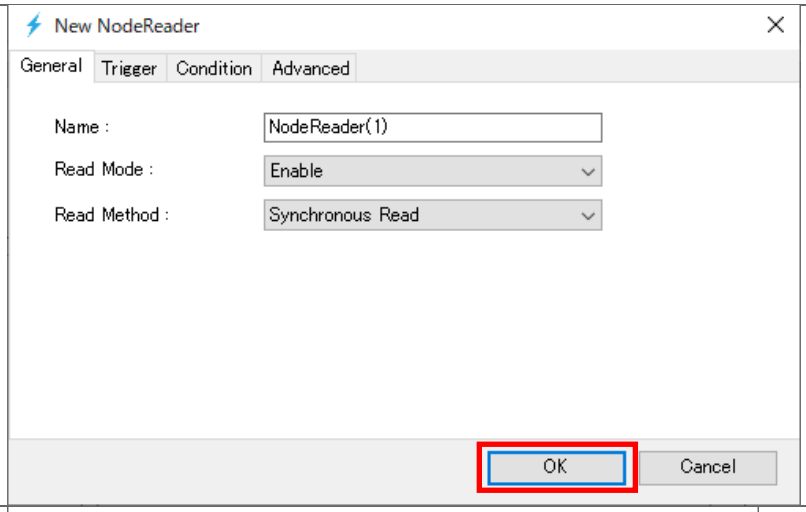
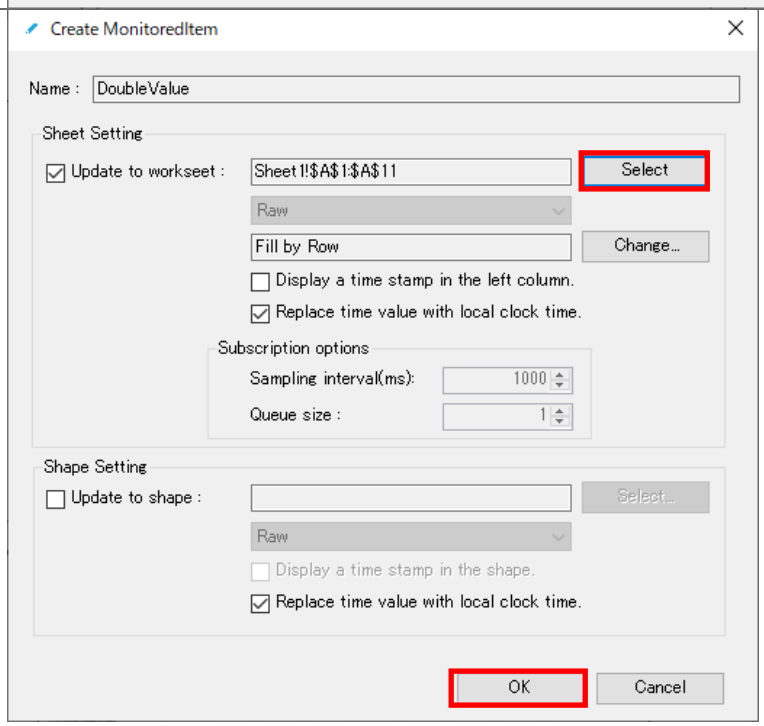
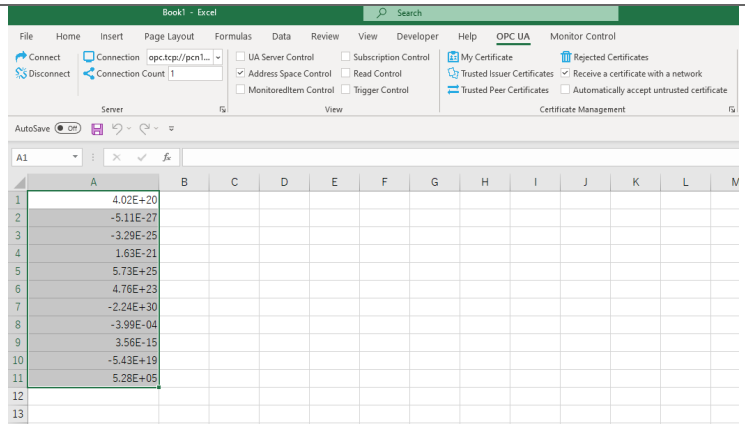


Figure 6 READ sequence working with EXCEL

The details of the operation procedure are described below. The connection procedure is omitted here.

1	Check "Address Space Control".	
2	Select any node on the "Nodes" tab (left display area). Click the "Node Monitor..." button.	
3	Click "Read". Click the "OK" button.	

4	Click the " OK " button.	
5	Select the range on EXCEL where you want to reflect the node value. Click the "Select" button in the "Sheet Settings" group. Click the " OK " button.	
6	Confirm that the value is reflected in the specified range.	

4.2.2. READ by dedicated GUI

UA Monitor can browse the UA server's address space (information model) by dedicated GUI. by selecting a node on the server, you can read the value of the node and other informations.

Figure 7 shows the sequence of reading node value.

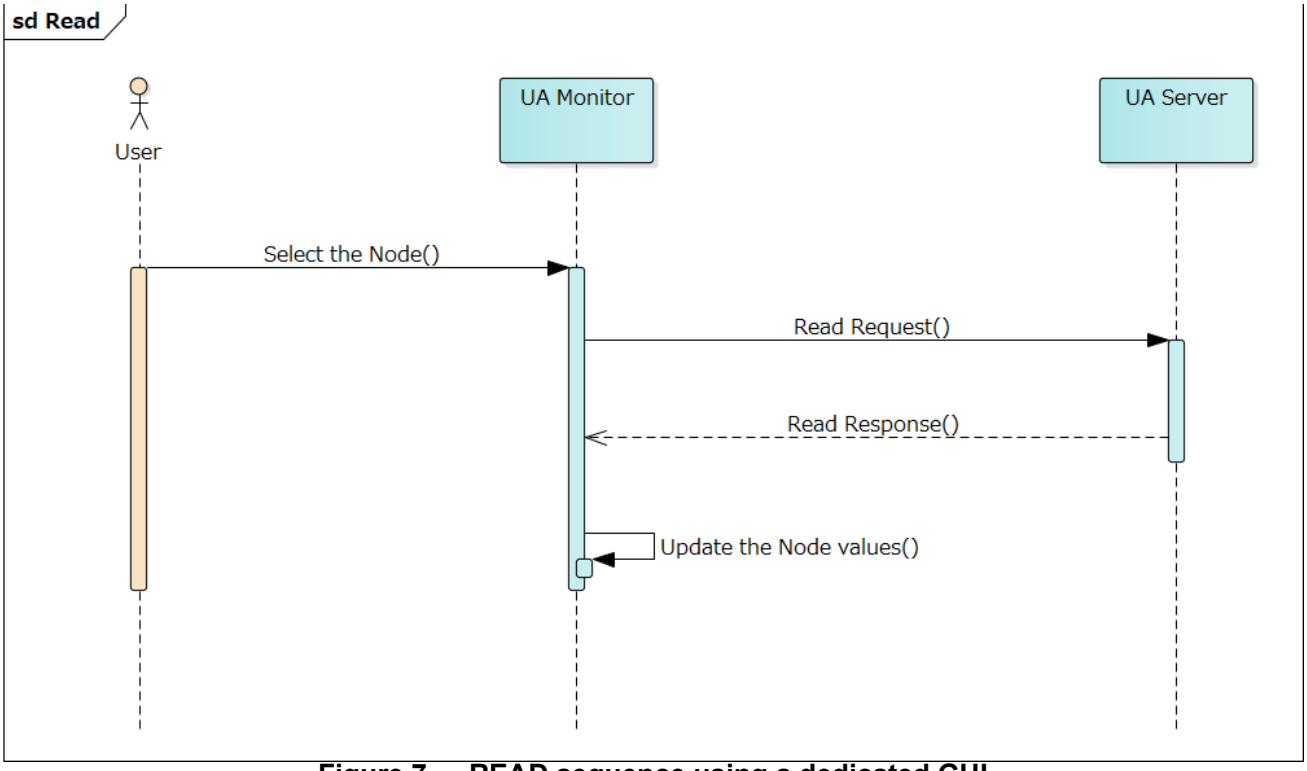
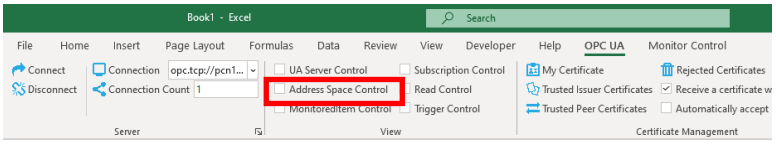
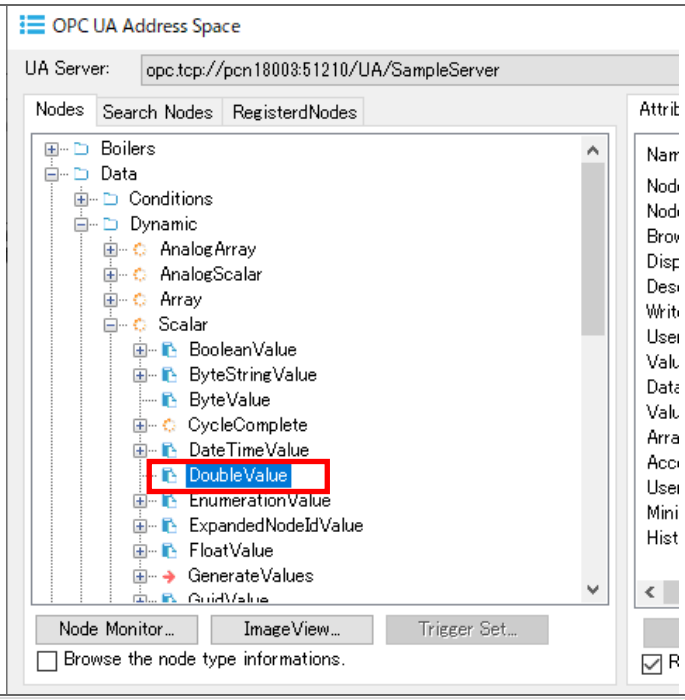
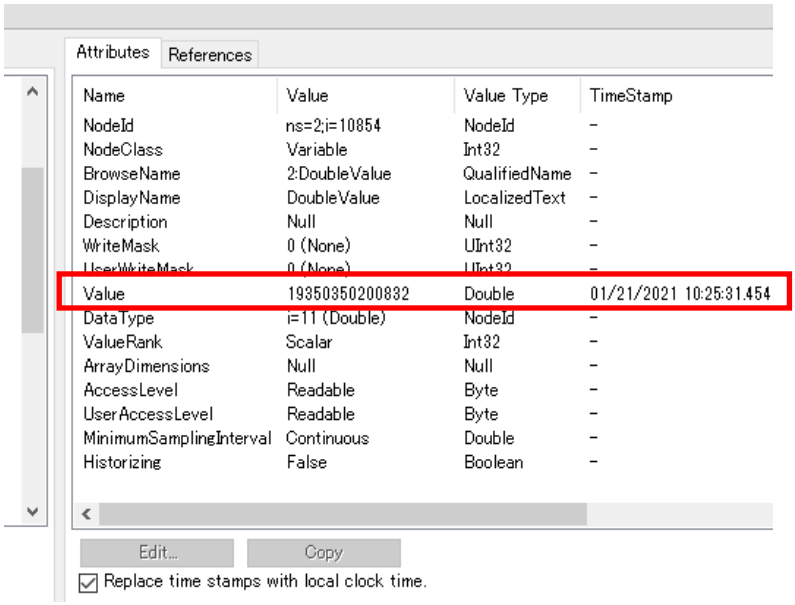


Figure 7 READ sequence using a dedicated GUI

The details of the operation procedure are described below. The connection procedure is omitted here.

1	Check "Address Space Control".	
2	Select any node on the "Nodes" tab (left display area).	

3	Confirm that the node value is displayed on the "Attributes" tab (right display area). *All displayed items are called node attributes.* *In these attributes, "Value" is the node value.*	

4.3. Setting screen specifications

This section describes the specifications of the setting screen shown in Figure 8.

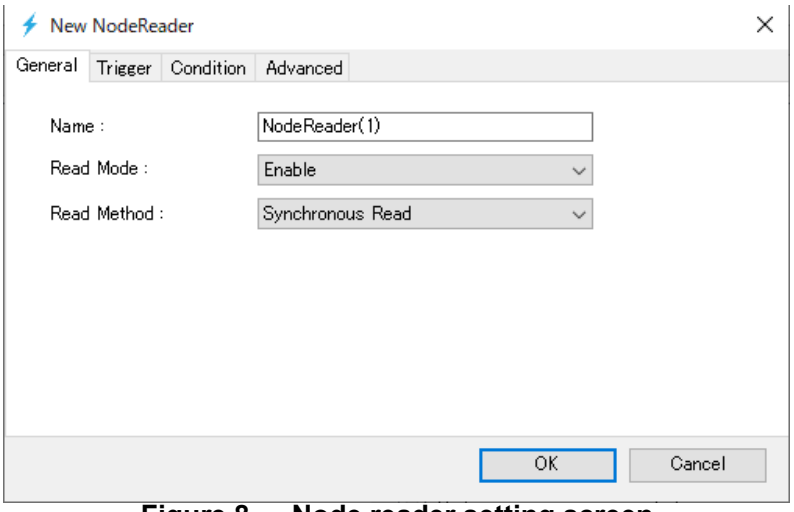


Figure 8 Node reader setting screen

"General" tab
This section describes the specifications of the "General" tab screen.

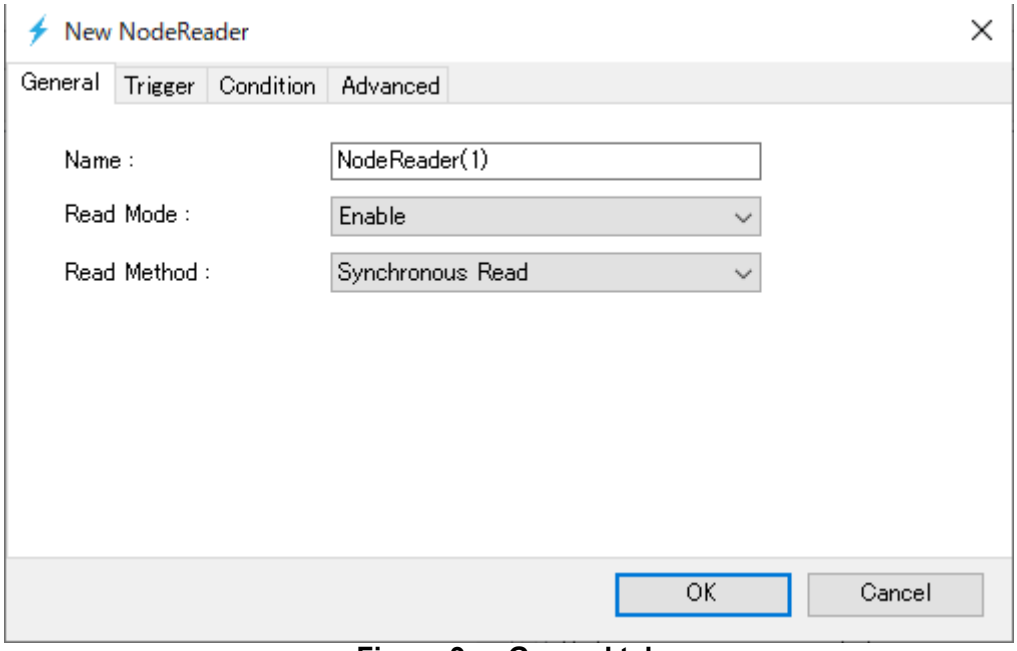


Figure 9 General tab

Table 11 shows the item descriptions on the "General" tab screen.

Table 10 Screen item list

Item name	Explanation
Name	The name of the node reader.
Read Mode	Select Enable or disabled.
Read Method	the reading process method. Select Synchronous Read or Asynchronous Read.

"Trigger" tab
This section describes the specifications of the " Trigger " tab screen. On this tab, you can set the execution timing (fixed cycle, event) of READ processing.

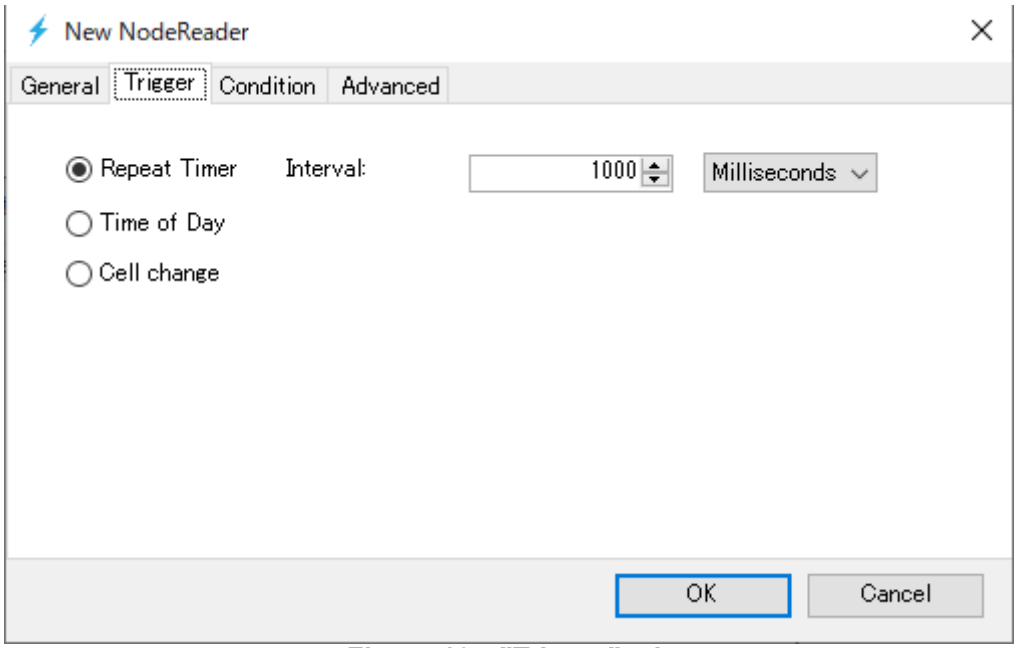
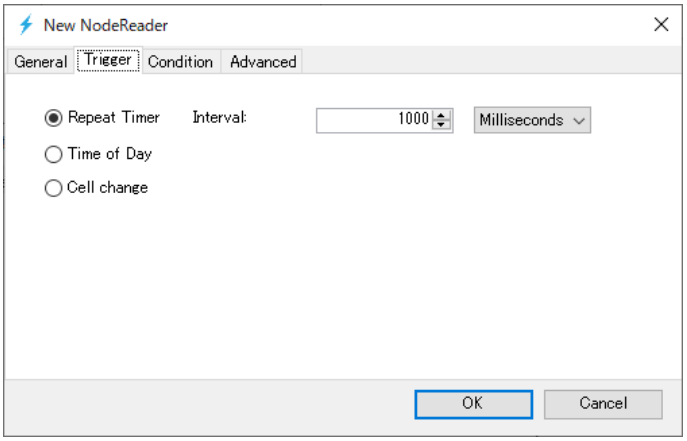
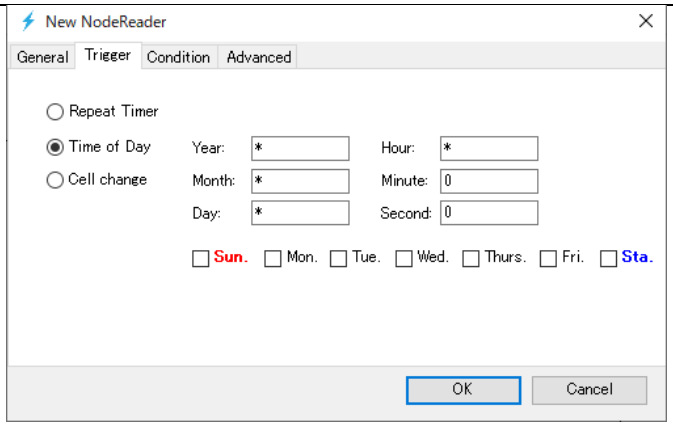
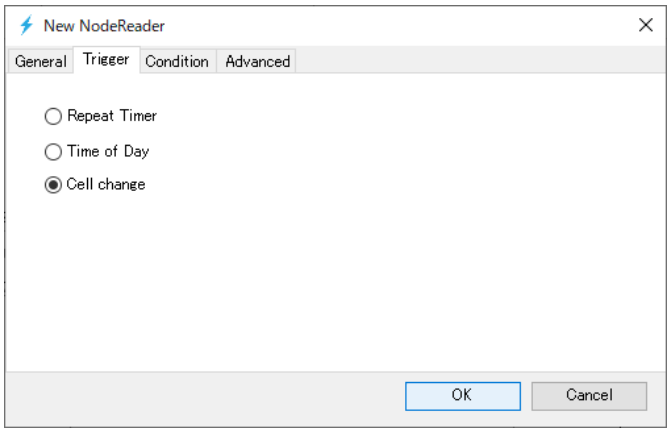


Figure 10 "Trigger" tab

Table 12 shows the item description of the "Trigger" tab screen.

Table 11 Screen item list

Item name	Explanation
Repeat Timer	Set the execution cycle of the node reader.  The time units are: ・Milliseconds ・Seconds ・Minutes ・Hours
Time of Day	Set the execution time and day of the week for the node reader.

	 An asterisk (*) means a wildcard. For example, in the case of the setting shown above, it is executed every year, every month, every day, every hour at 0 minutes and 0 seconds.
Cell change	Execute the node reader when the cell value of EXCEL changes. 

"Condition" tab
This section describes the specifications of the "Condition" tab screen. Execution conditions can be added to the "Conditions" tab when it is time to execute the trigger settings. If there is no condition, READ processing is executed every time the trigger setting is executed.

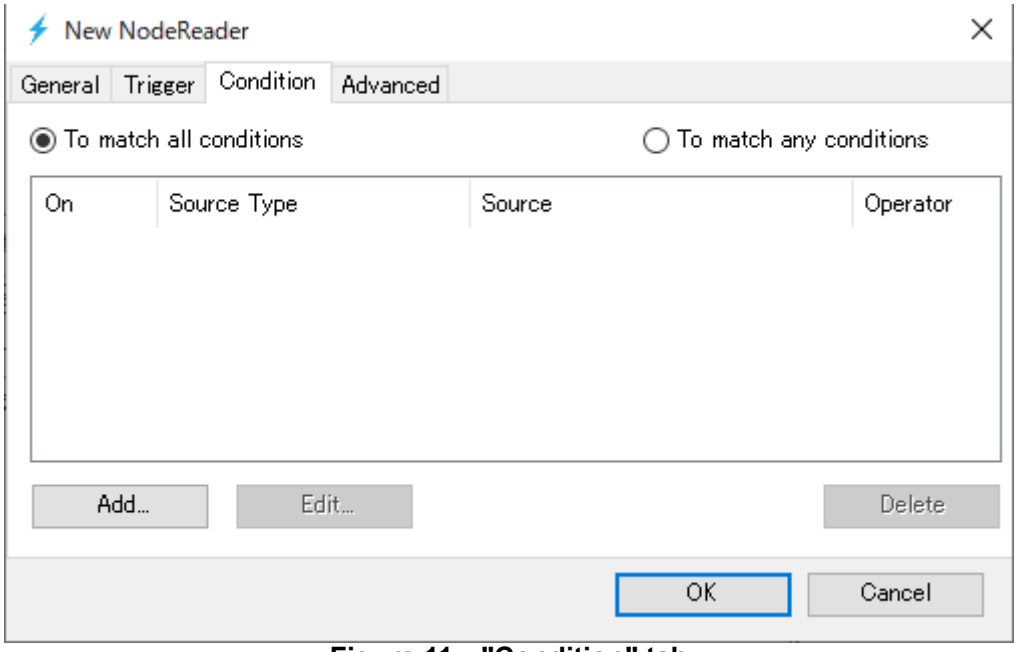


Figure 11 "Condition" tab

Table 13 shows the item descriptions on the "Condition" tab screen.

Table 12 Screen item list

Item name	Explanation
To match all conditions	READ processing is executed only when all the set conditions are matched.
To match any conditions	READ processing is executed when even one of the set conditions is matched.
Add…	When clicked, the screen for adding a condition is displayed.
Edit…	It is valid when you select a condition that has already been registered. Click to display the screen for editing the conditions.
Delete	It is valid when you select a condition that has already been registered. Click to delete the condition.

"Advanced" tab

This section describes the specifications of the "Advanced" tab screen.

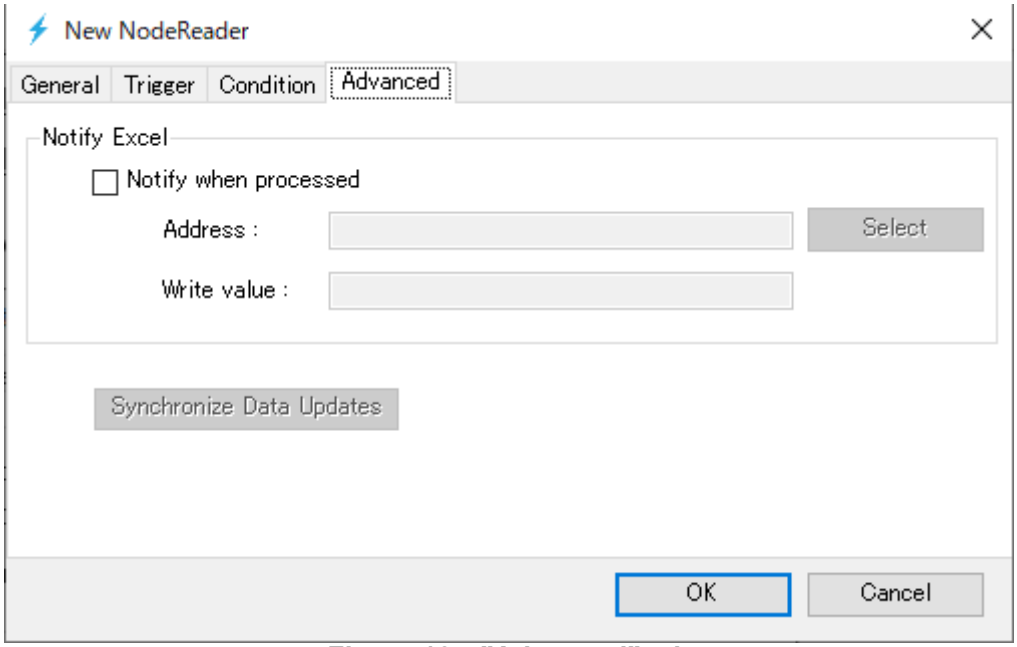
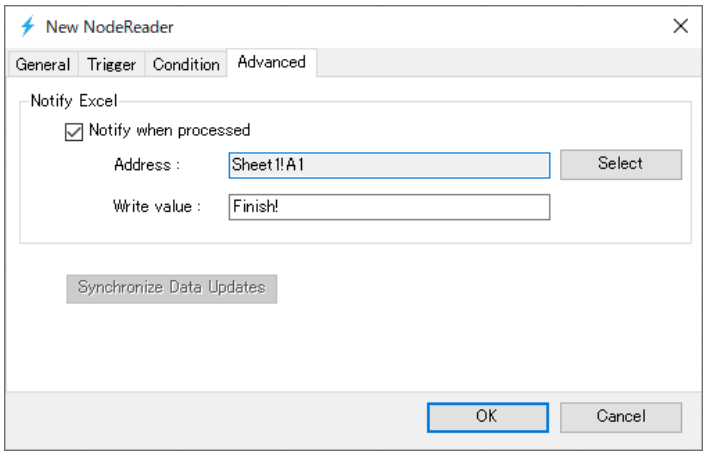
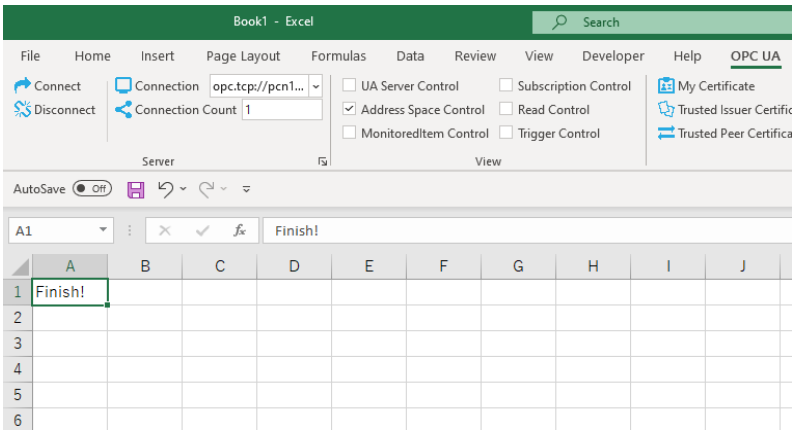
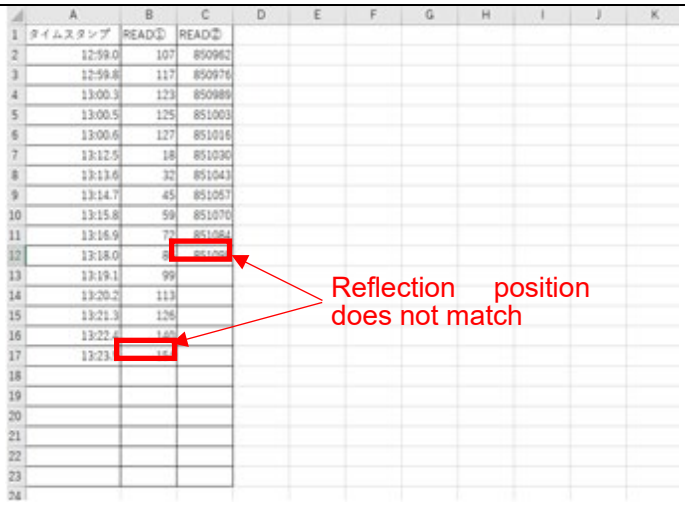


Figure 12 "Advanced" tab

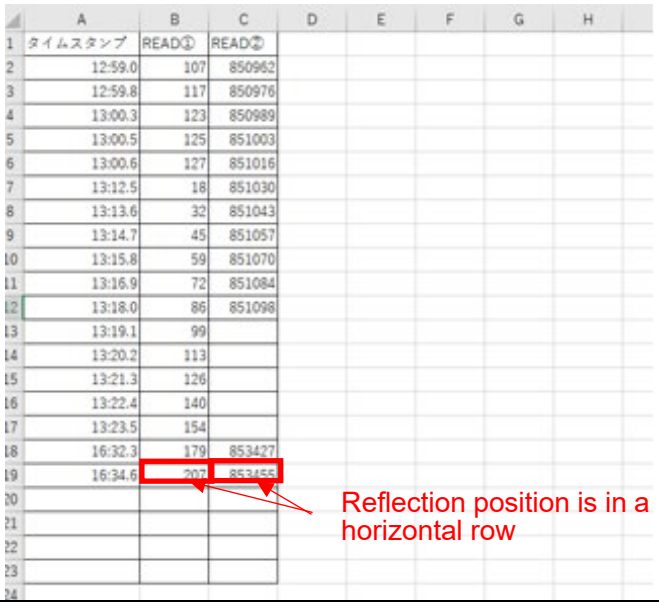
Table 14 shows the item descriptions on the " Advanced" tab screen.

Table 13 Screen item list

item name	Explanation
Notify Excel	Set the value specified in the "write value" (the numeric, string either possible) to the EXCEL cell specified in the "Address" after executing the process. For example, if you want to set “Finish!” on the A1 cell of Sheet1 after executing the READ processing, you need to set as follows.  The value is set in the specified cell as shown in the figure below after execution. 
Synchronize Data Updates	It is enabled when you read a plurality of node value. If you read a plurality of node value every each row, the read node value is aligned with the same line. For example, if READ ① is set as the read target first and then the read target is added to READ ②, the reflection positions of the values will not match.

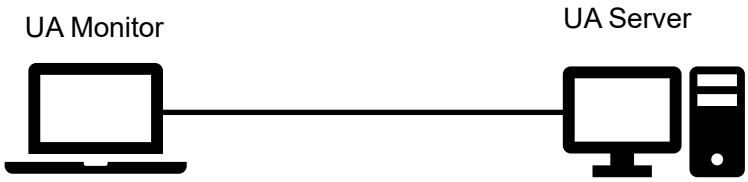


At that time, when the function is executed, the values will be reflected in a horizontal row as shown in the figure below.



5. HISTORY READ procedure

5.1. System configuration



Tool software

Company/Organization	Figure Name	Name	Version
OPC Foundation	UA Server	Historical Access Server	1.4.357.28
Puerto Co., Ltd.	UA Monitor	UA Monitor	3.0.X

5.2. Operating procedure

5.2.1. READ by EXCEL cooperation

UA Monitor can read historical node values on the UA Server, and set reflect destination of historical node values to the EXCEL cell or shape (figure). After reflecting the value in the cell or shape, you can use the functions and graphs that are the original functions of EXCEL.

Figure 13 shows the sequence of reading historical node values.

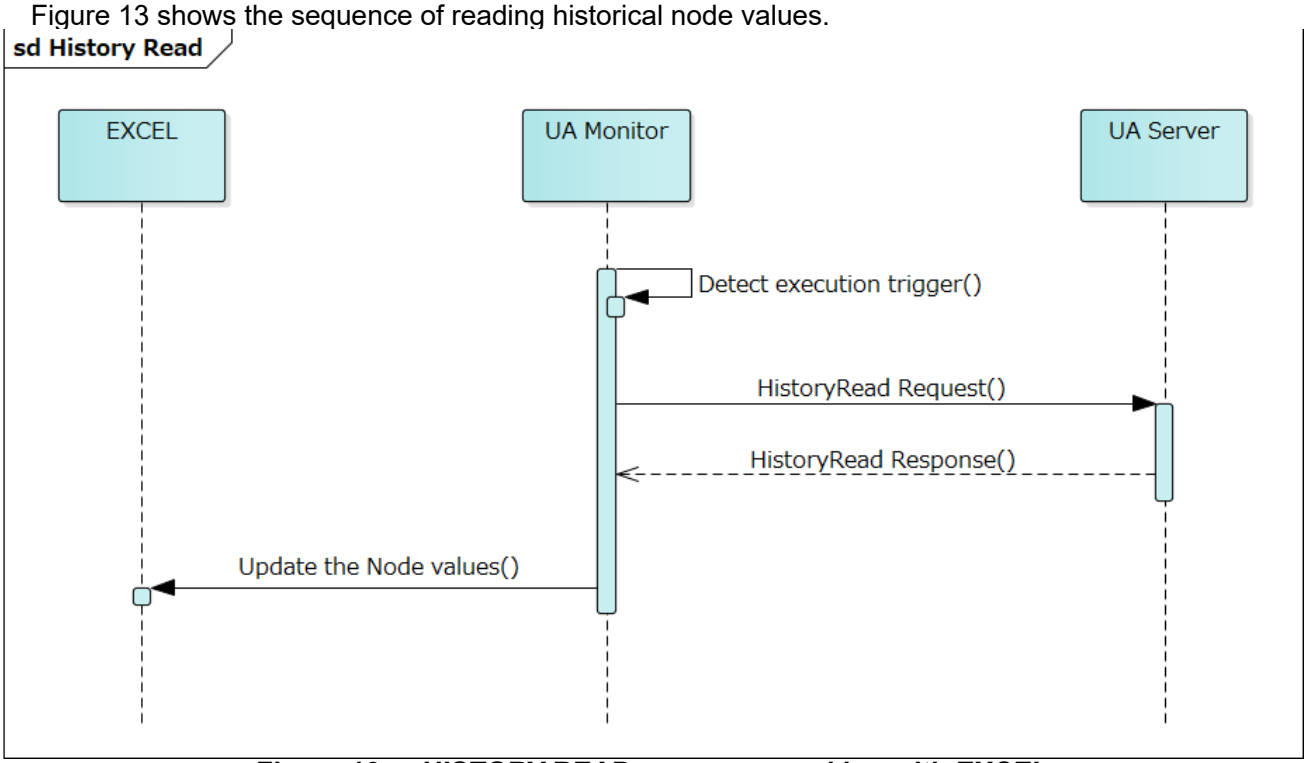
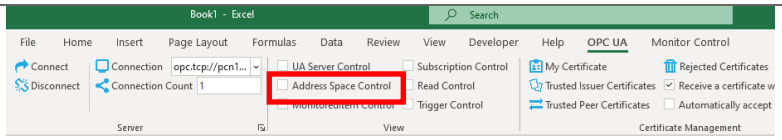
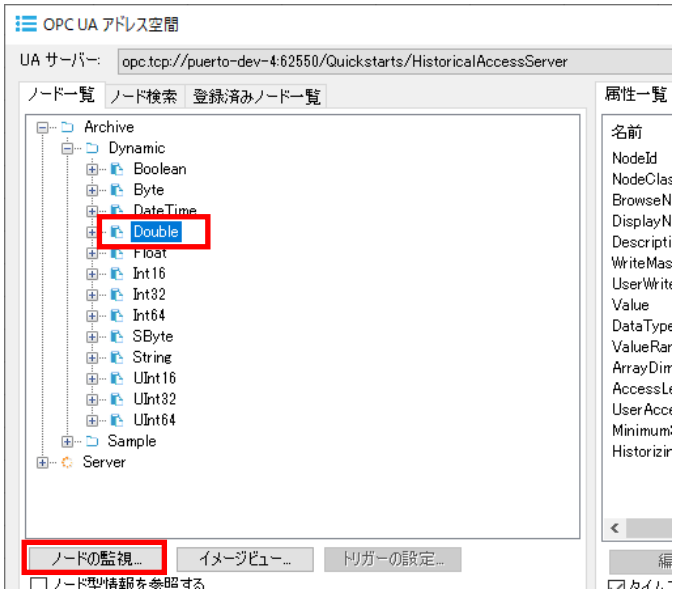
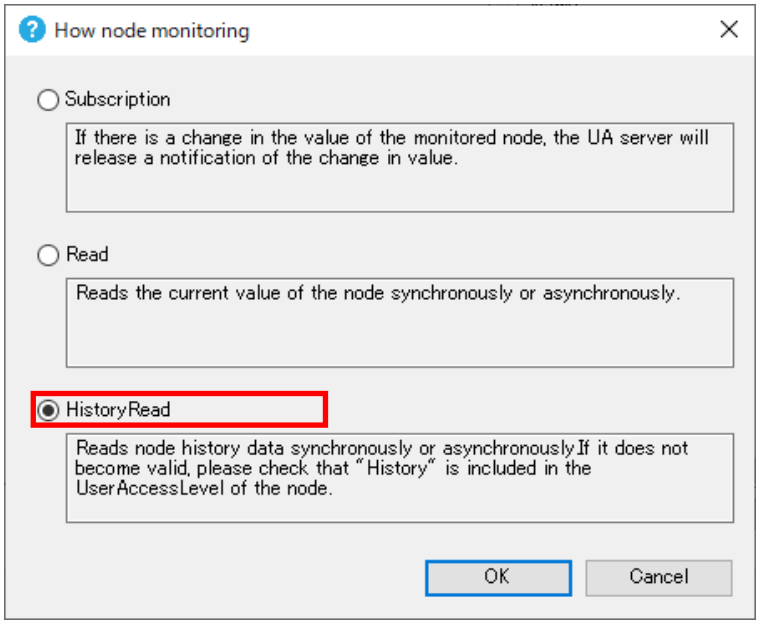
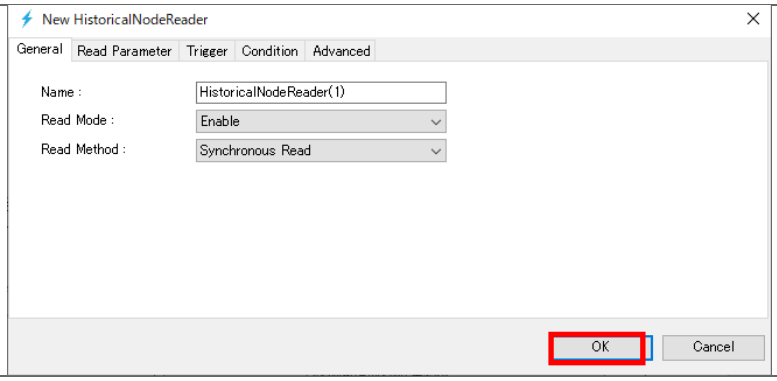
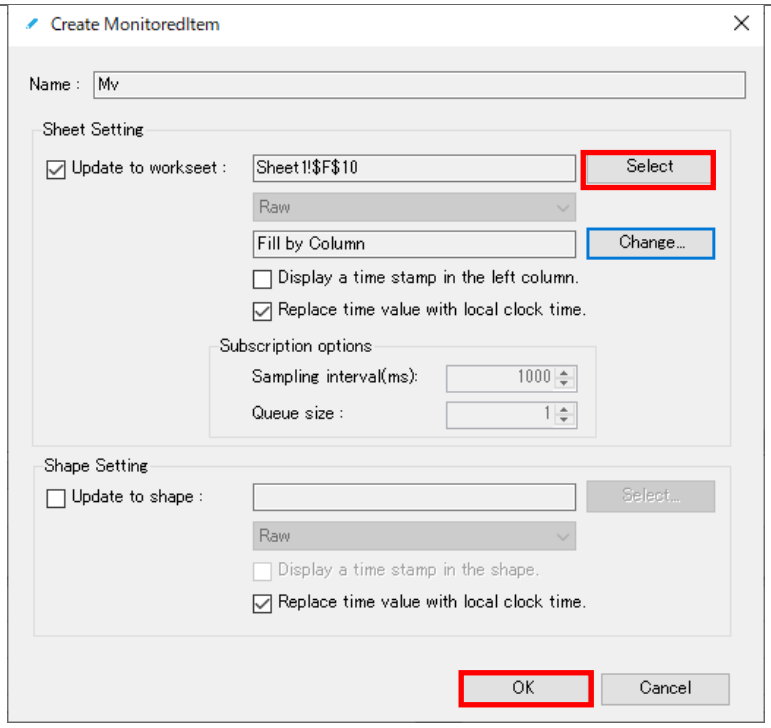
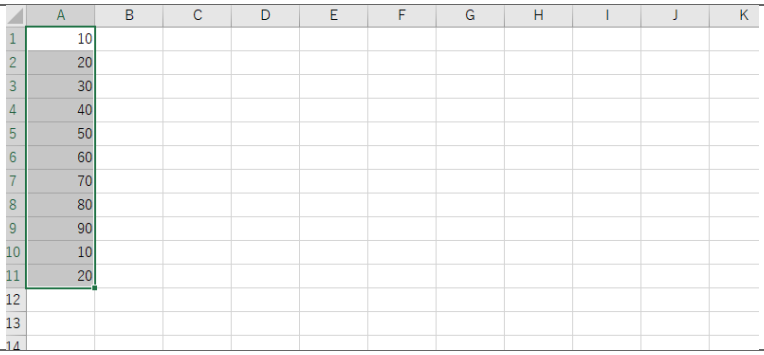


Figure 13 HISTORY READ sequence working with EXCEL

The details of the operation procedure are described below.
The details of the operation procedure are described below. The connection procedure is omitted here.

1	Check "Address Space Control".	
2	Select any node on the "Nodes" tab (left display area). Click the "Node Monitor..." button.	
3	Click "History Read". Click the " OK " button.	
4	Click the "OK" button.	

5	Select the range on EXCEL where you want to reflect the node value. Click the "Select" button in the "Sheet Settings" group. Click the " OK " button.	
6	Confirm that the value is reflected in the specified range.	

5.3. Setting screen specifications

This section describes the specifications of the setting screen shown in Figure 14.

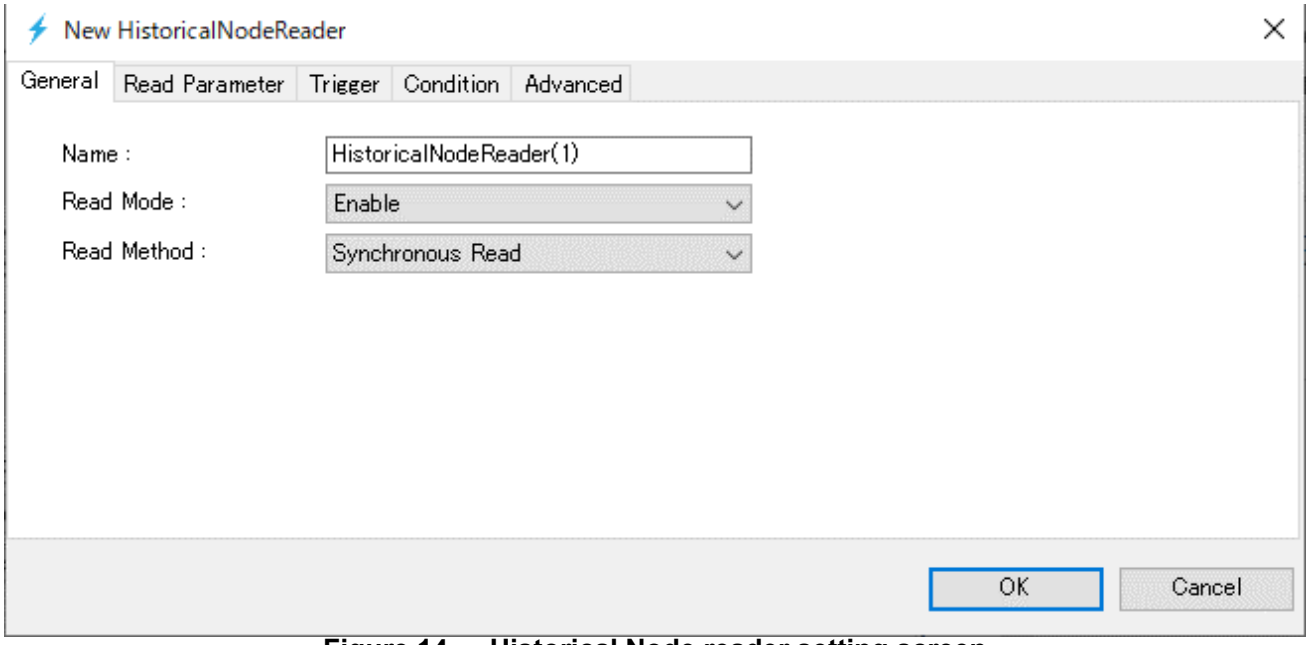


Figure 14 Historical Node reader setting screen

"General" tab

This section describes the specifications of the "General" tab screen.

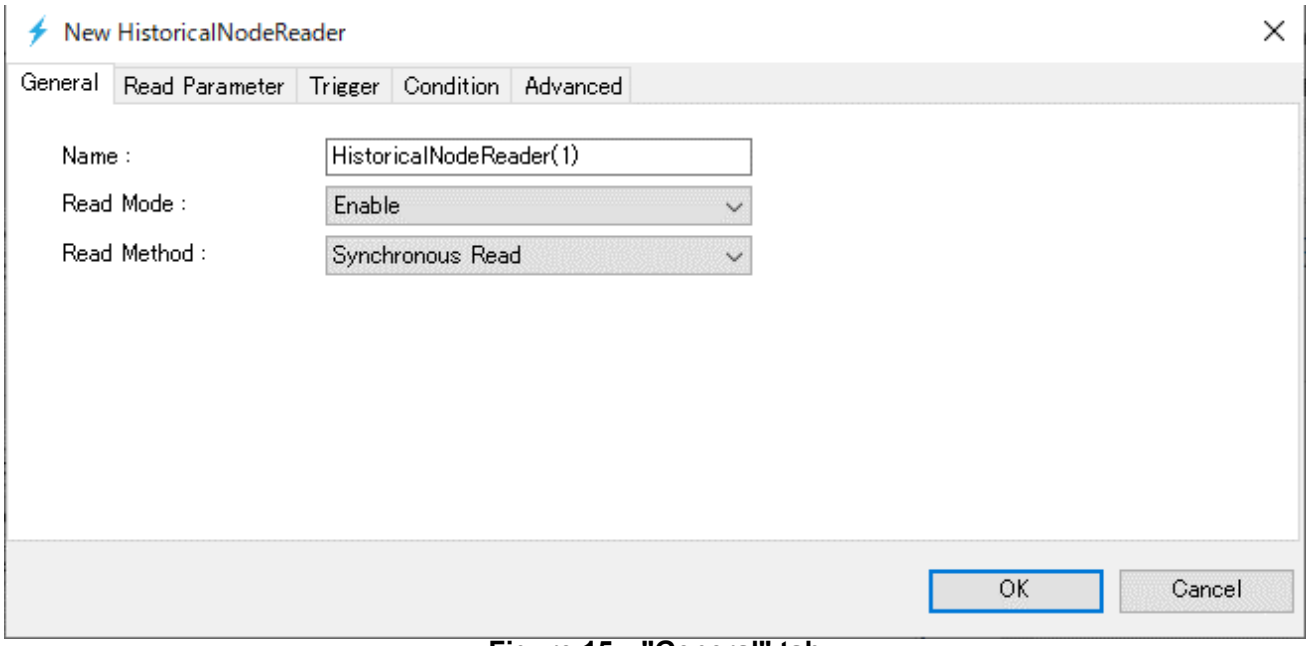


Figure 15 "General" tab

Table 15 shows the item descriptions on the "General" tab screen.

Table 14 Screen item list

Item name	Explanation
Name	The name of the node reader.
Read Mode	Select Enable or disabled.
Read Method	the reading process method. Select Synchronous Read or Asynchronous Read.

"Read Parameter" tab

This section describes the specifications of the "Reading Parameter" tab screen. On this tab, You can specify the input parameters to use when executing the HISTORY READ processing.

There are five patterns for this parameter, Fig. 16, Fig. 17, Fig. 18, Fig. 19, and Fig. 20, but they cannot be used together.

The parameters shown in Figure 16 use the start and end times as parameters for history reading.

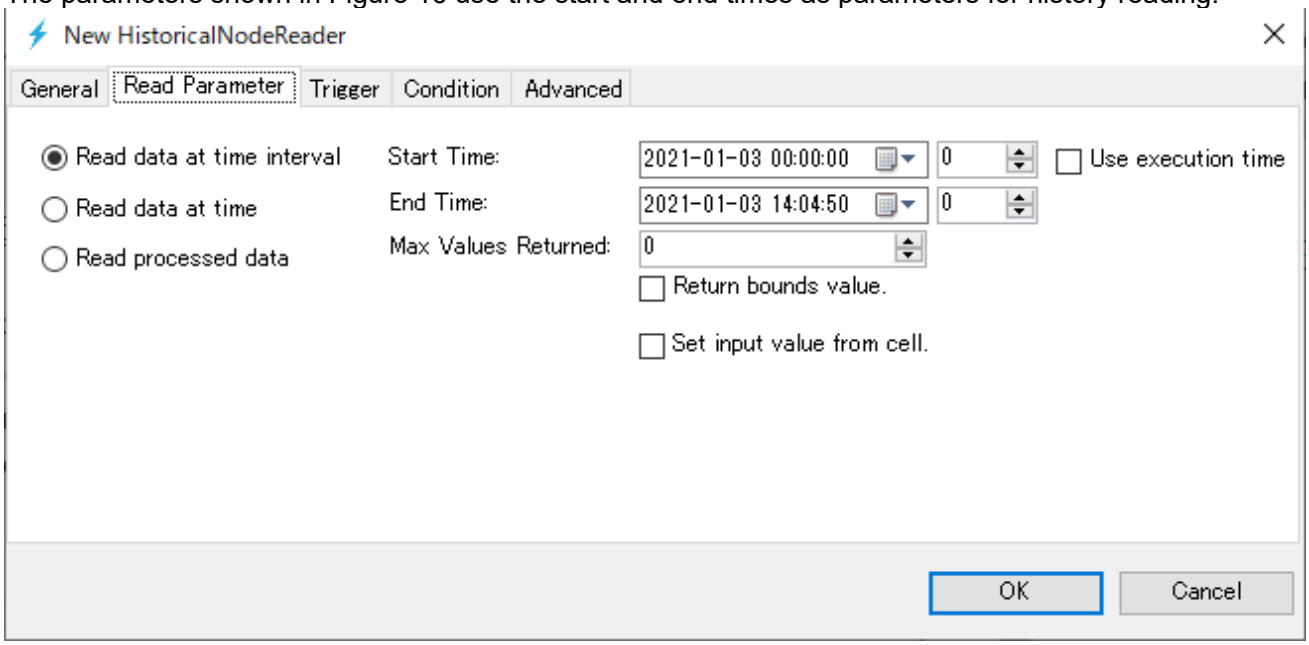


Figure 16 "Read Parameter①" tab

For the parameters shown in Fig. 17, the execution time of history reading is used as the start time, and the end time of the time retroactive from that execution time is used as the history reading parameter.

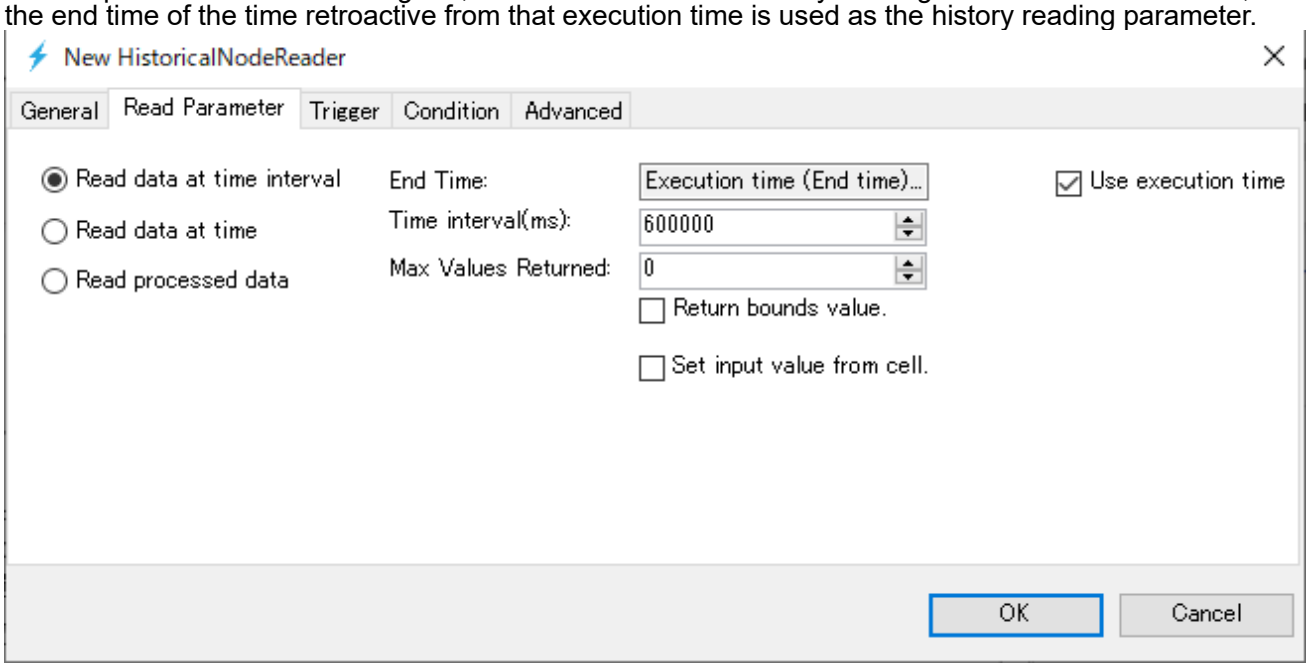


Figure 17 "Read Parameter②" tab

The parameters shown in Figure 18 use a specific time as a parameter for reading history. If there is no data at the time you specify in UA history server, an error may be returned.

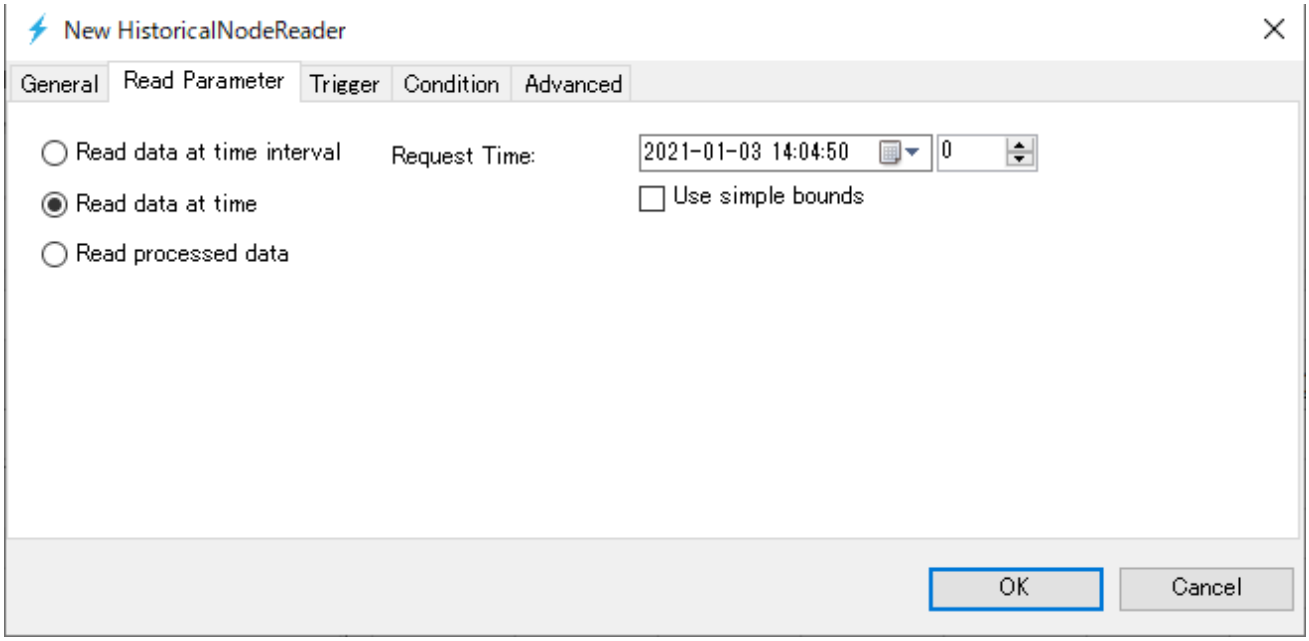


Figure 18 "Read Parameter③" tab

The parameters shown in Figure 19 use the start and end times as parameters for reading history. Then, specify the processing interval, and specify the aggregation method at the "Average " part.

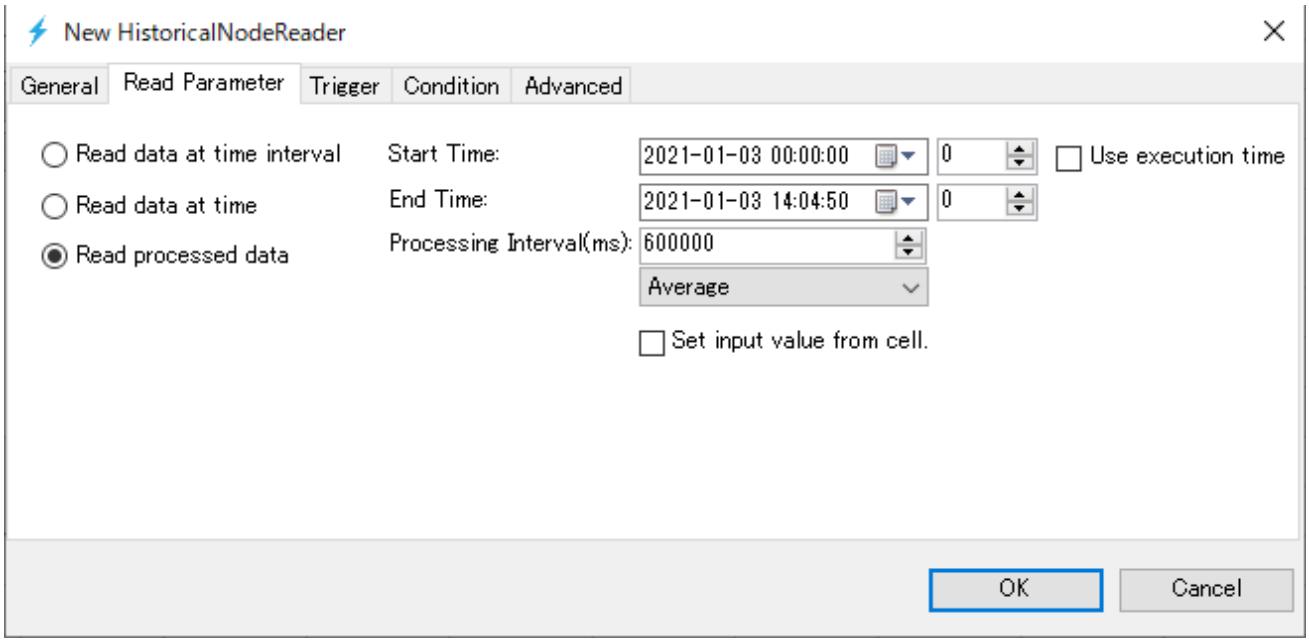


Figure 19 "Read Parameter④" tab

For the parameters shown in Fig. 20, the execution time of history reading is used as the start time, and the end time of the time retroactive from that execution time is used as the history reading parameter. Then, specify the processing interval, and specify the aggregation method in the "Average" part.

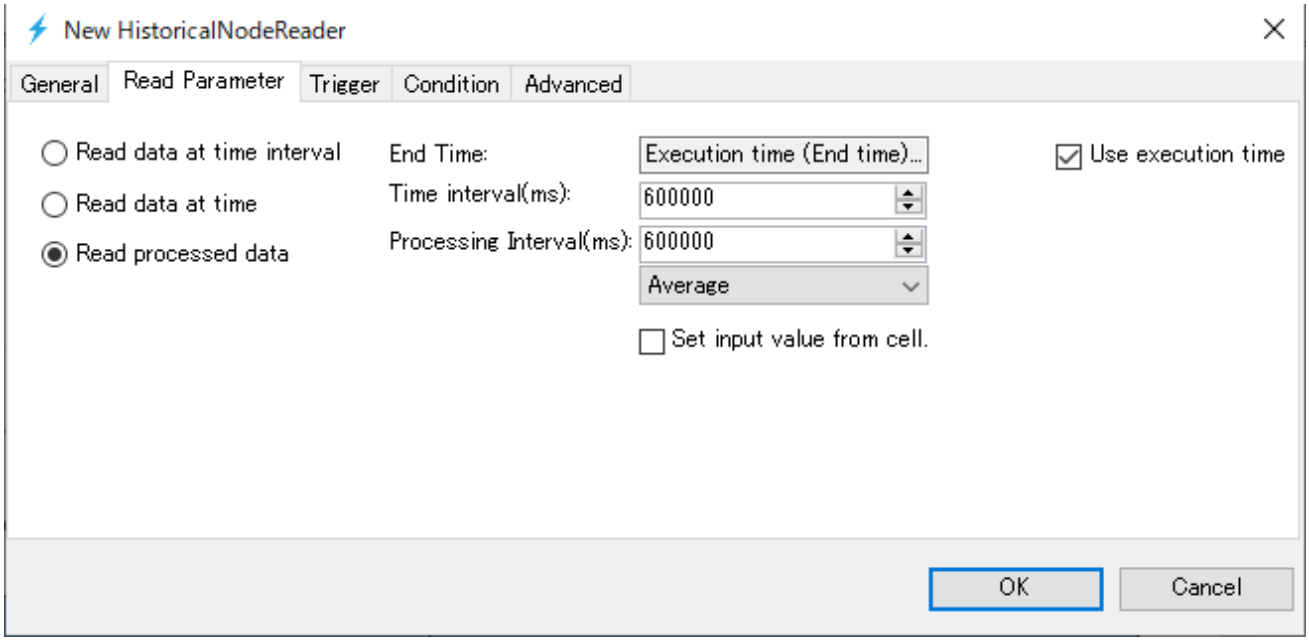


Figure 20 "Read Parameter⑤" tab

Table 16 shows the item descriptions on the "Read Parameter" tab screen.

Table 15 Screen item list

Item name		Explanation
Read data at time interval	Start Time	The start time of the data you want to read. At the right side of the date and time, you can specify the number of milliseconds.
	End Time	The end time of the data you want to read. At the right side of the date and time, you can specify the number of milliseconds.
	Max Values Returned	Specify the number of results to return to the UA server.
	Return bounds value.	Specify whether to return the last value of the previous cycle as the first value at the specified time.
	Set input value from cell.	Specify the start time and end time with cell values. If you check this, you need to specify the cell address of the input source.
Read data at time	Request Time	Specify the time of the data you want to get.
Read processed data	Start Time	The start time of the data you want to read. At the right side of the date and time, you can specify the number of milliseconds.
	End Time	The end time of the data you want to read. At the right side of the date and time, you can specify the number of milliseconds.
	Processing Interval(ms)	Specify the time interval to aggregate. Do not specify a time interval that exceeds the "start time" and "end time" time intervals.
	"Average" drop box	Specify the aggregation method.
	Set input value from cell.	Specify the start time and end time with cell values. If you check this, you need to specify the cell address of the input source.

"Trigger" tab
This section describes the specifications of the "Trigger" tab screen. On this tab, you can set the execution timing (fixed cycle, event) of the HISTORY READ processing.

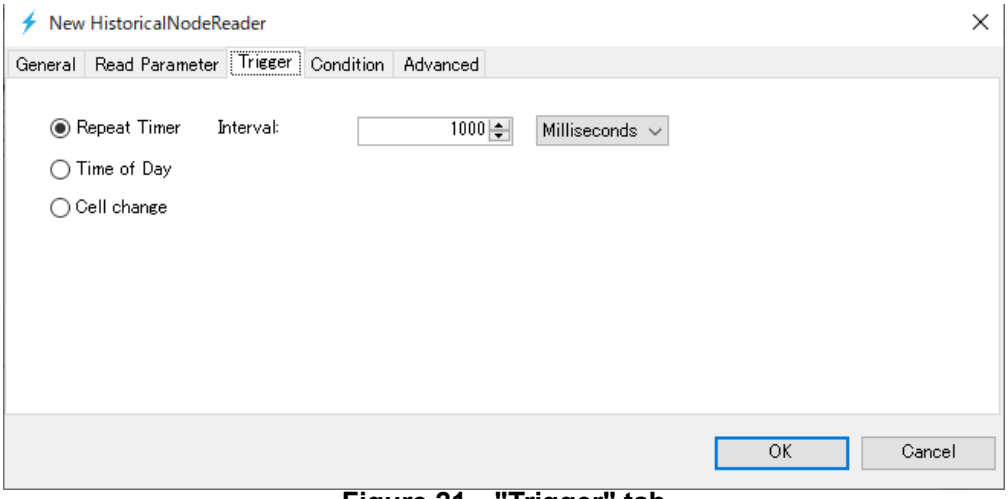
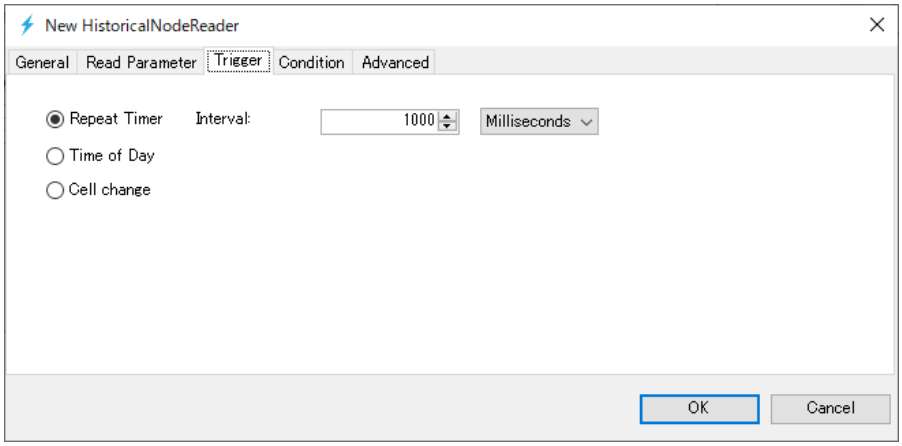
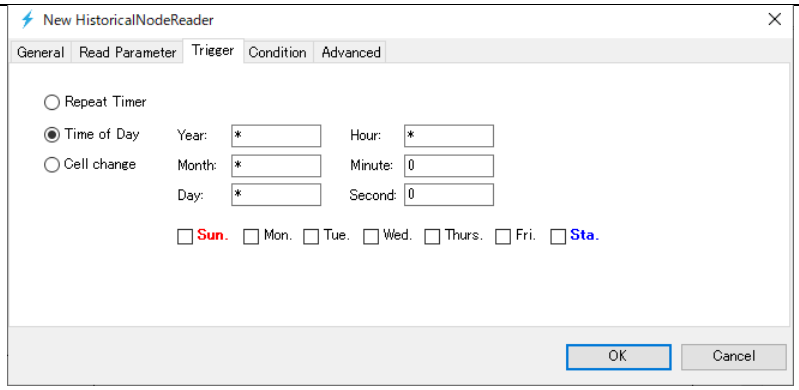
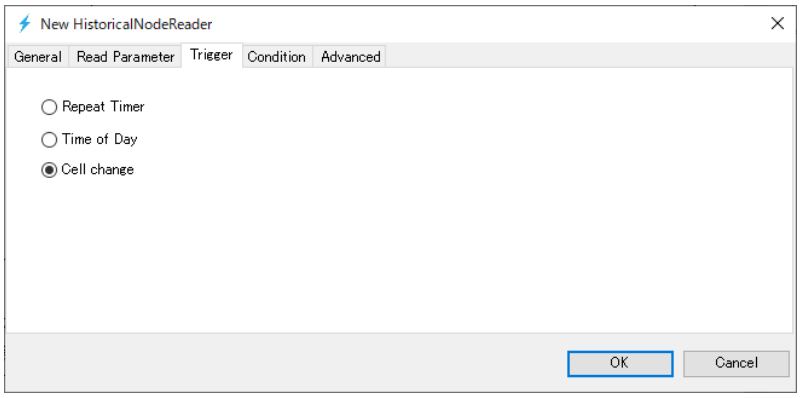


Figure 21 "Trigger" tab

Table 17 shows the item descriptions on the "Trigger" tab screen.

Table 16 Screen item list

Item name	Explanation
Repeat Timer	Set the execution cycle of the history node reader.  The time units are: ・Milliseconds ・Seconds ・Minutes ・Hours
Time of Day	Set the execution time and day of the week for the history node reader.

	 An asterisk (*) means a wildcard. For example, in the case of the setting shown above, it is executed every year, every month, every day, every hour at 0 minutes and 0 seconds.
Cell change	Execute the node reader when the cell value of EXCEL changes. 

"Condition" tab

This section describes the specifications of the "Condition" tab screen. On this tab, execution conditions can be added when it is time to execute the trigger settings. If there are no conditions, the HISTORY READ processing is executed every time the trigger setting is executed.

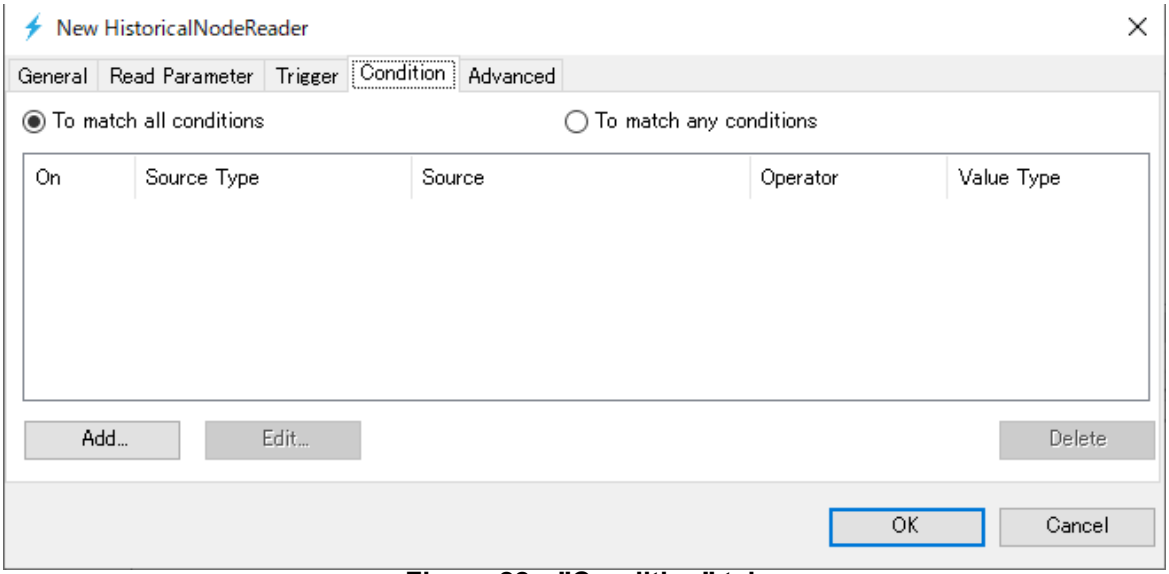


Figure 22 "Condition" tab

Table 18 shows the item descriptions on the "Condition" tab screen.

Table 17 Screen item list

Item name	Explanation
To match all conditions	HISTORY READ processing is executed only when all the set conditions are matched.
To match any conditions	HISTORY READ processing is executed when even one of the set conditions is matched.
Add…	When clicked, the screen for adding a condition is displayed.
Edit…	It is valid when you select a condition that has already been registered. Click to display the screen for editing the conditions.
Delete	It is valid when you select a condition that has already been registered. Click to delete the condition.

"Advanced" tab
This section describes the specifications of the "Advanced" tab screen.

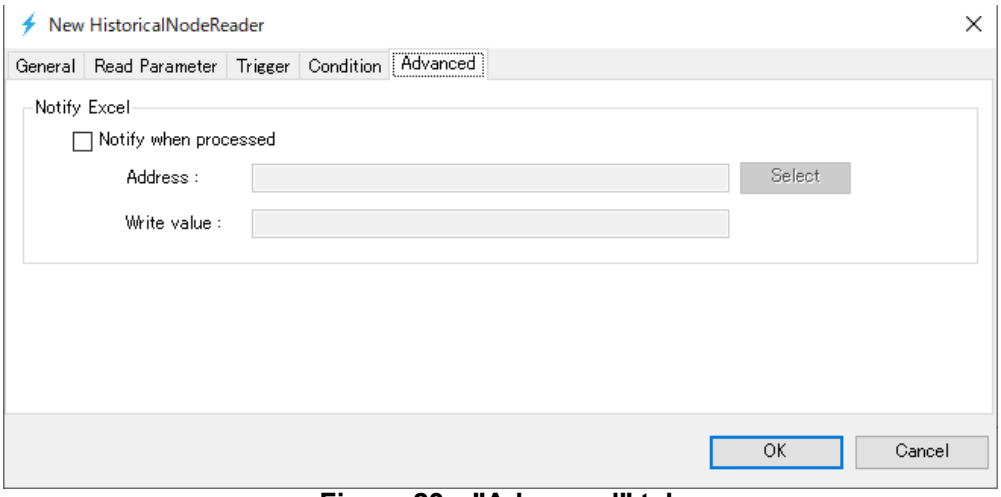
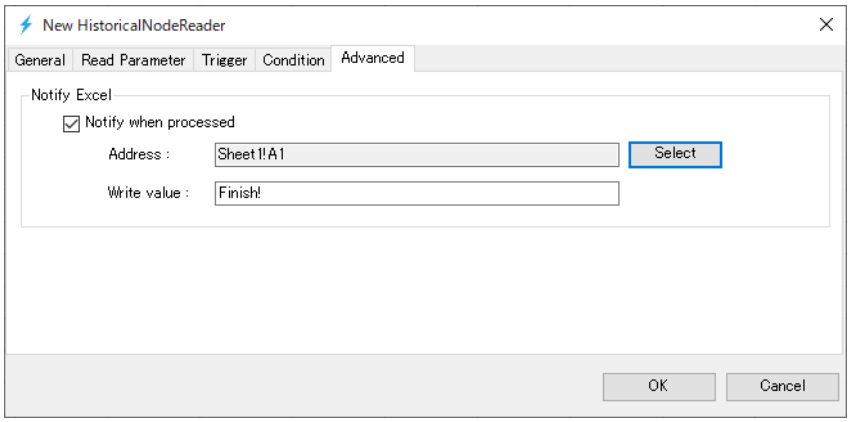
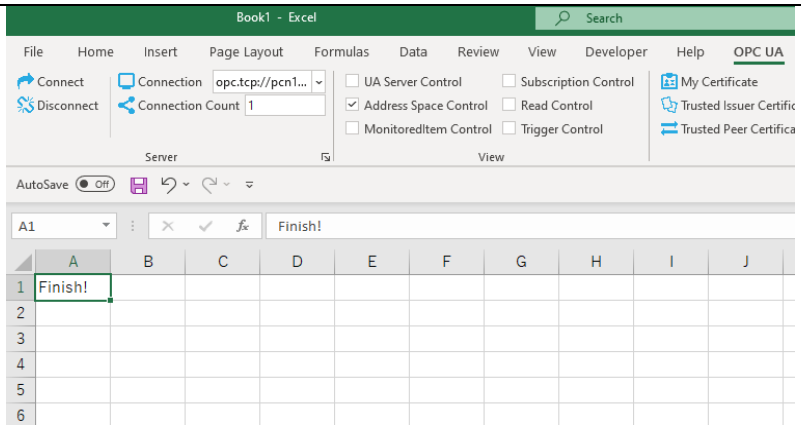


Figure 23 "Advanced" tab

Table 19 shows the item descriptions on the "Advanced" tab screen.

Table 18 Screen item list

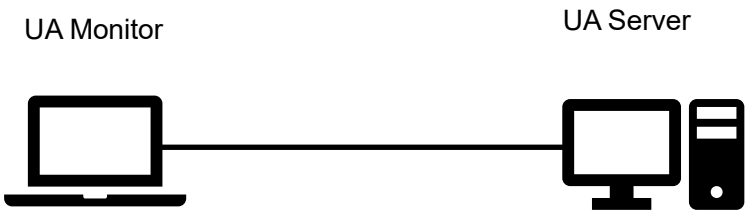
Item name	Explanation
Notify Excel	Set the value specified in the "Write value" (the numeric, string either possible) to the EXCEL cell specified in the "Address" after executing the process. For example, if you want to set "Finish!" on the A1 cell of Sheet1 after executing the HISTORY READ processing, you need to set as follows.  The value is set in the specified cell as shown in the figure below after execution.

Book1 - Excel
Search
File
Home
Insert
Page Layout
Formulas
Data
Review
View
Developer
Help
OPC UA
Connect
Disconnect
Connection
opc.tcp://pcn1...
Connection Count
1
Server
UA Server Control
Address Space Control
MonitoredItem Control
Subscription Control
Read Control
Trigger Control
View
My Certificate
Trusted Issuer Certific
Trusted Peer Certifica
AutoSave
Off
A1
Finish!
A
B
C
D
E
F
G
H
I
J
1
2
3
4
5
6
Finish!

6. Subscription (receive value change notification) procedure

6.1. System configuration



Company/Organization	Figure Name	Name	Version
OPC Foundation	UA Server	UA Sample Server	1.4.357.28
Puerto Co., Ltd.	UA Monitor	UA Monitor	3.0.X

6.2. Operating procedure

6.2.1. Read by EXCEL cooperation

UA Monitor can receive the value change notification on the UA server, and set reflect destination of node values to the EXCEL cell or shape (figure). After reflecting the value in the cell or shape, you can use the functions and graphs that are the original functions of EXCEL.

Figure 24 shows the sequence of receiving the value change notification.

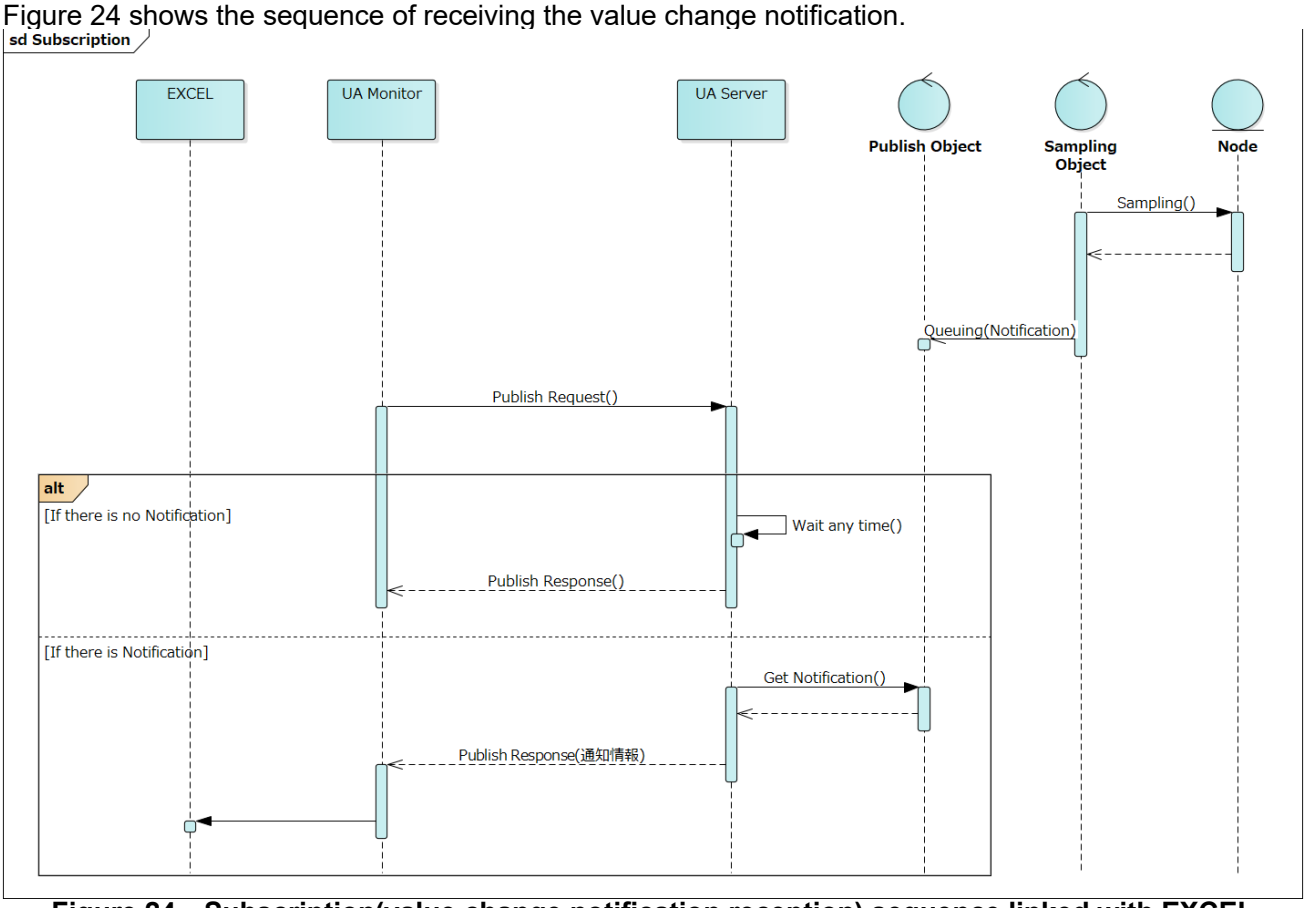
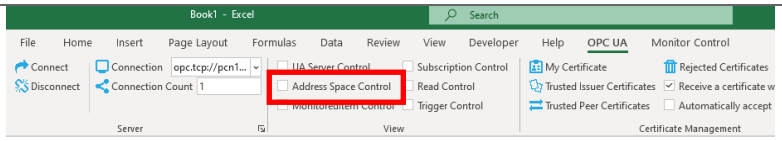
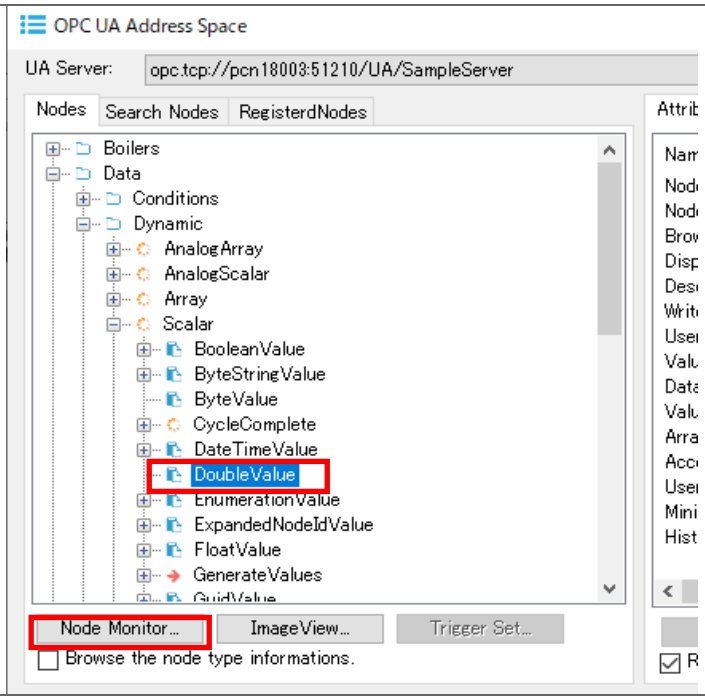
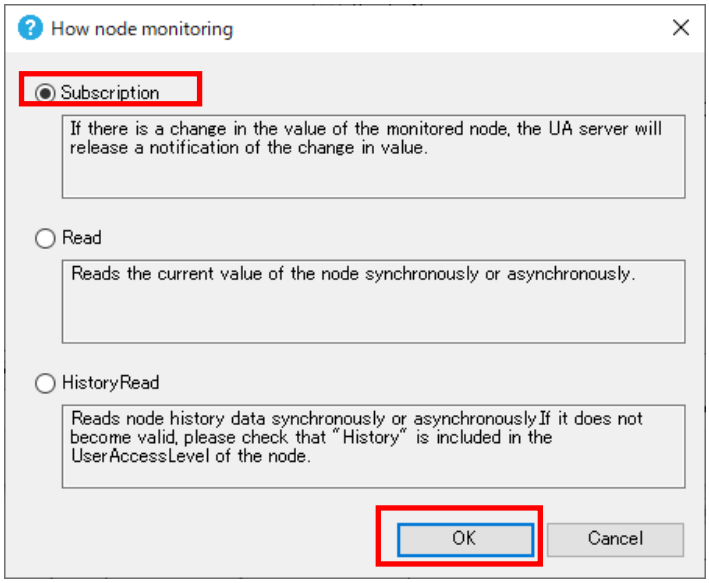
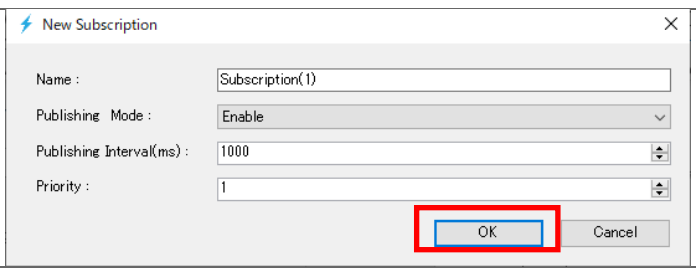
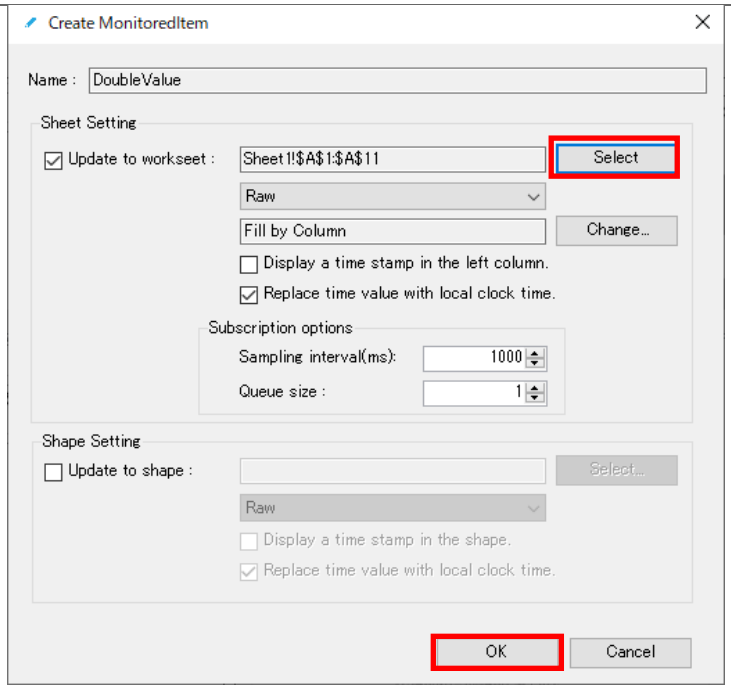
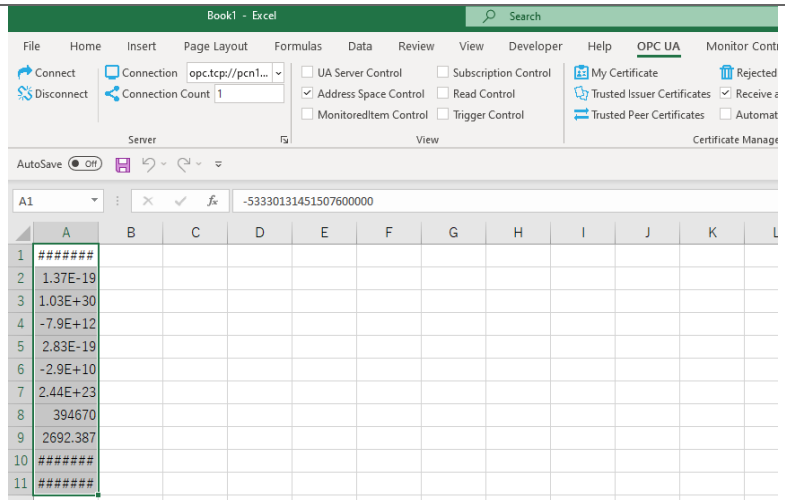


Figure 24 Subscription(value change notification reception) sequence linked with EXCEL

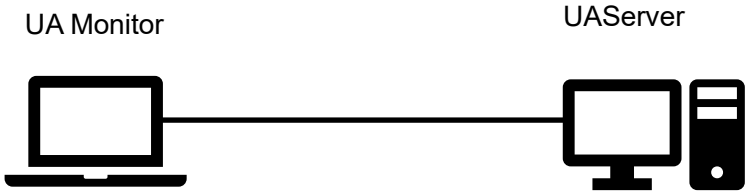
The details of the operation procedure are described below. The connection procedure is omitted here.

1	Check "Address Space Control".	
2	Select any node on the "Nodes" tab (left display area). Click the "Node Monitor..." button.	
3	Click "Subscription". Click the " OK " button.	
4	Click the " OK " button.	

5	Select the range on EXCEL where you want to reflect the node value. Click the "Select" button in the "Sheet Settings" group. Click the " OK " button.	
6	Confirm that the value is reflected in the specified range.	

7. Subscription (event reception) procedure

7.1. System configuration



Tool Software

Company/Organization	Figure Name	Name	Version
OPC Foundation	UA Server	Alarm Condition Server	1.4.357.28
Puerto Co., Ltd.	UA Monitor	UA Monitor	3.0.X

7.2. Operating procedure

7.2.1. Read by EXCEL cooperation

UA Monitor can receive the event notification on the UA server, and set reflect destination of node values to the EXCEL cell.

Figure 25 shows the sequence of receiving the event notification.

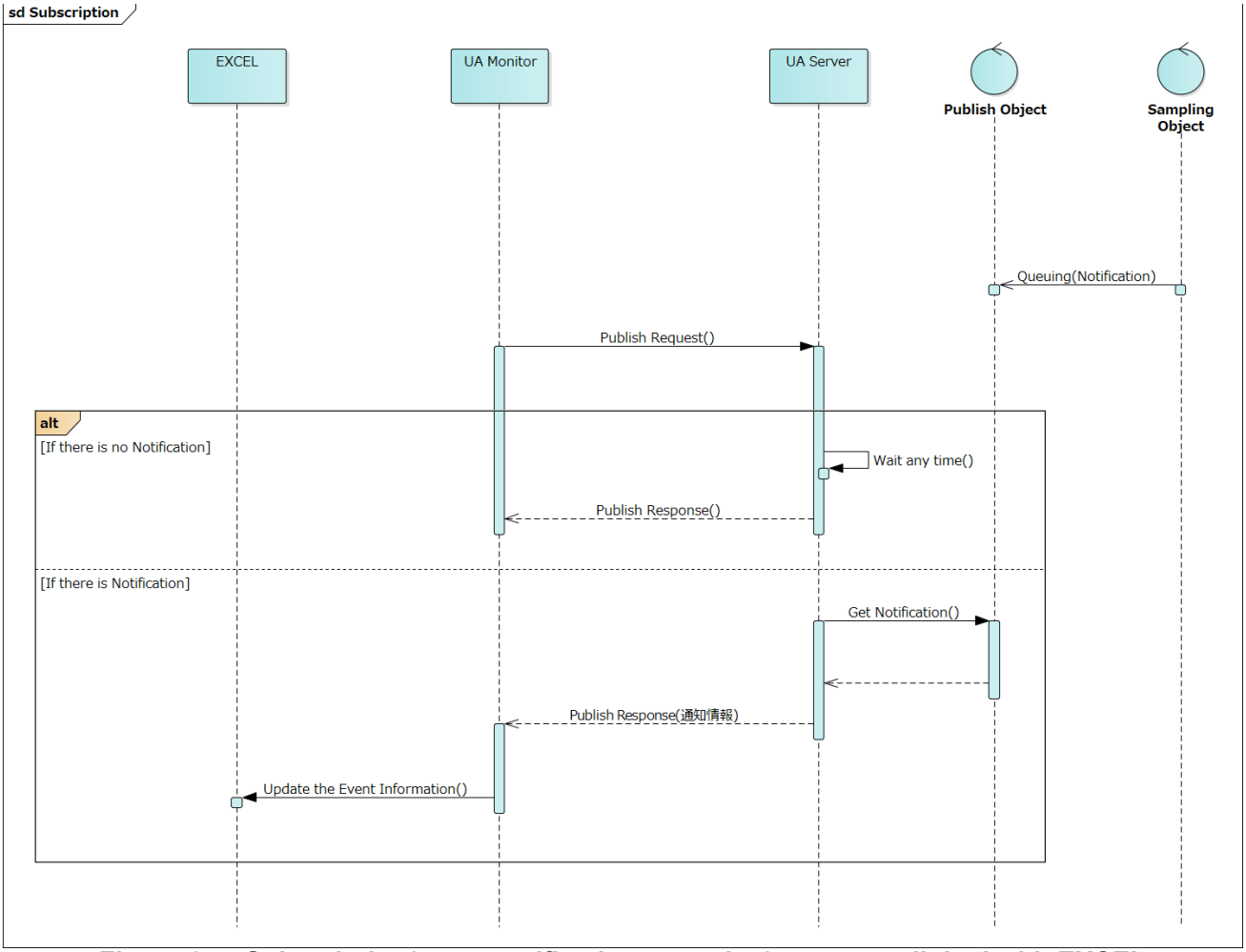
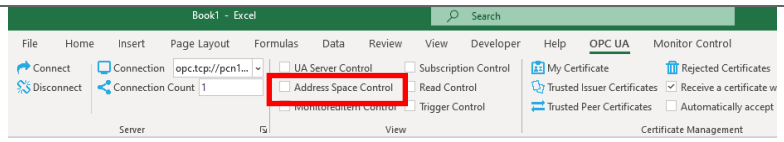
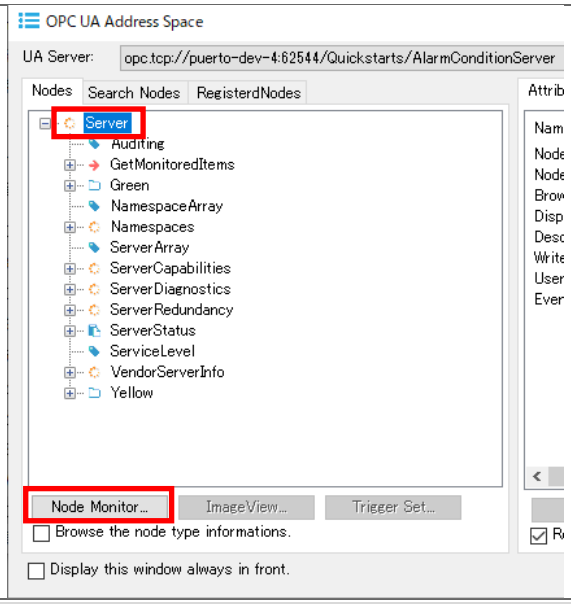
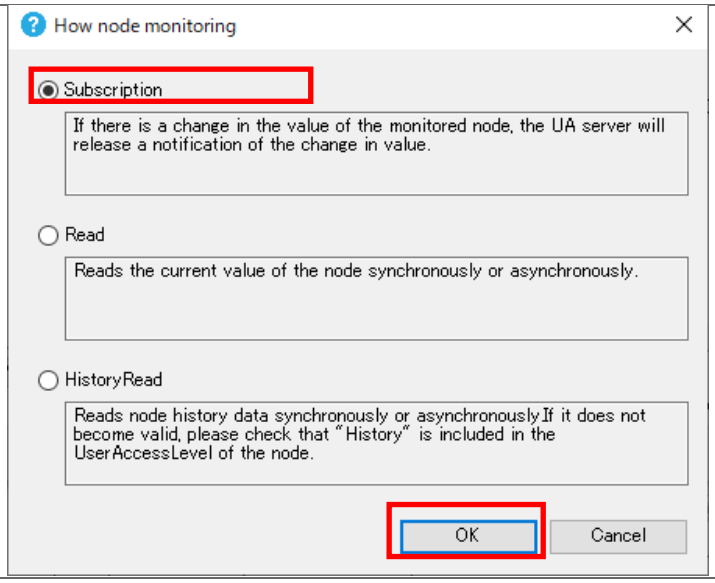
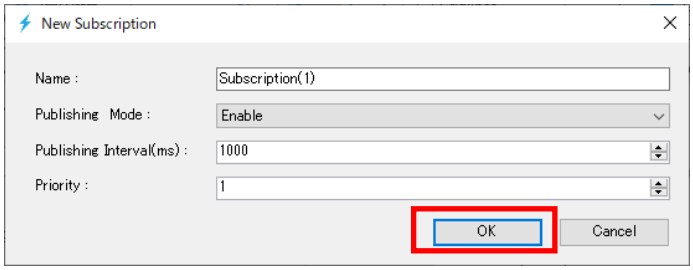
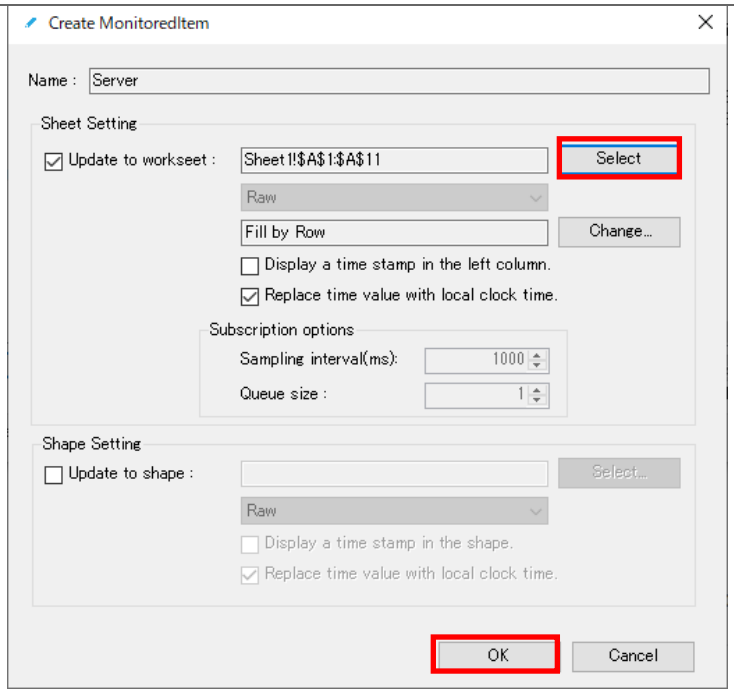
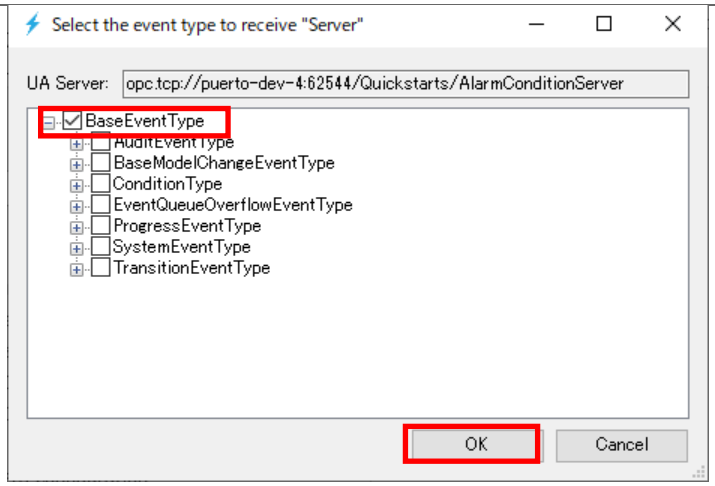
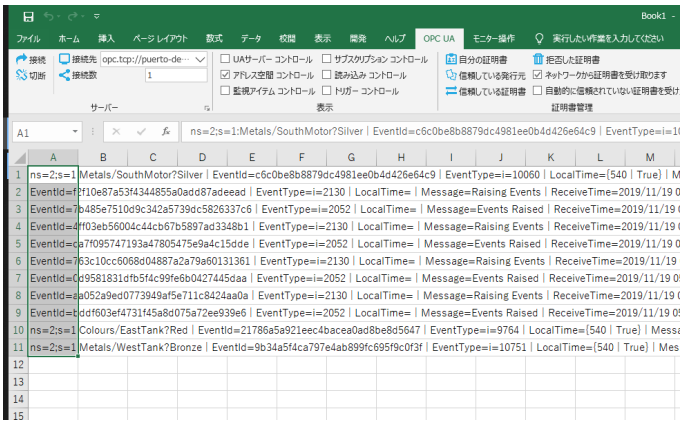


Figure 25 Subscription(event notification reception) sequence linked with EXCEL

The details of the operation procedure are described below. The connection procedure is omitted here.

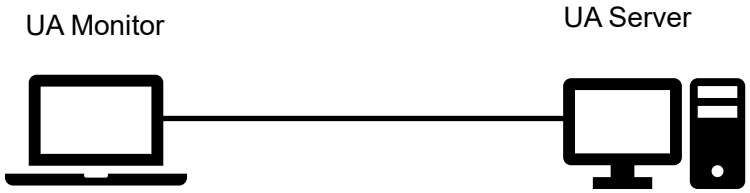
1	Check "Address Space Control".	
2	Select any node on the "Nodes" tab (left display area). Click the "Node Monitor..." button.	

3	Click "Subscription". Click the " OK " button.	
4	Click the " OK " button.	
5	Select the range on EXCEL where you want to reflect the node value. Click the "Select" button in the "Sheet Settings" group. Click the " OK " button.	

6	Check "BaseEventType". Click the " OK " button.	 *If you want to receive only some events, check the nested event type.*
7	Confirm that the value is reflected in the specified range.	

8. WRITE procedure (variable trigger)

8.1. System configuration



Tool software

Company/Organization	Figure Name	Name	Version
OPC Foundation	UA Server	UA Sample Server	1.4.357.28
Puerto Co., Ltd.	UA Monitor	UA Monitor	3.0.X

8.2. Operating procedure

8.2.1. Read by EXCEL cooperation

UA Monitor can edit the node value on the UA Server. The value writing function in UA Monitor is called "variable trigger". The value to be edited is not limited to a fixed value, but the cell value of EXCEL or the calculation result by the EXCEL function can be used as an argument of WRITE.

Figure 26 shows the sequence for writing node values.

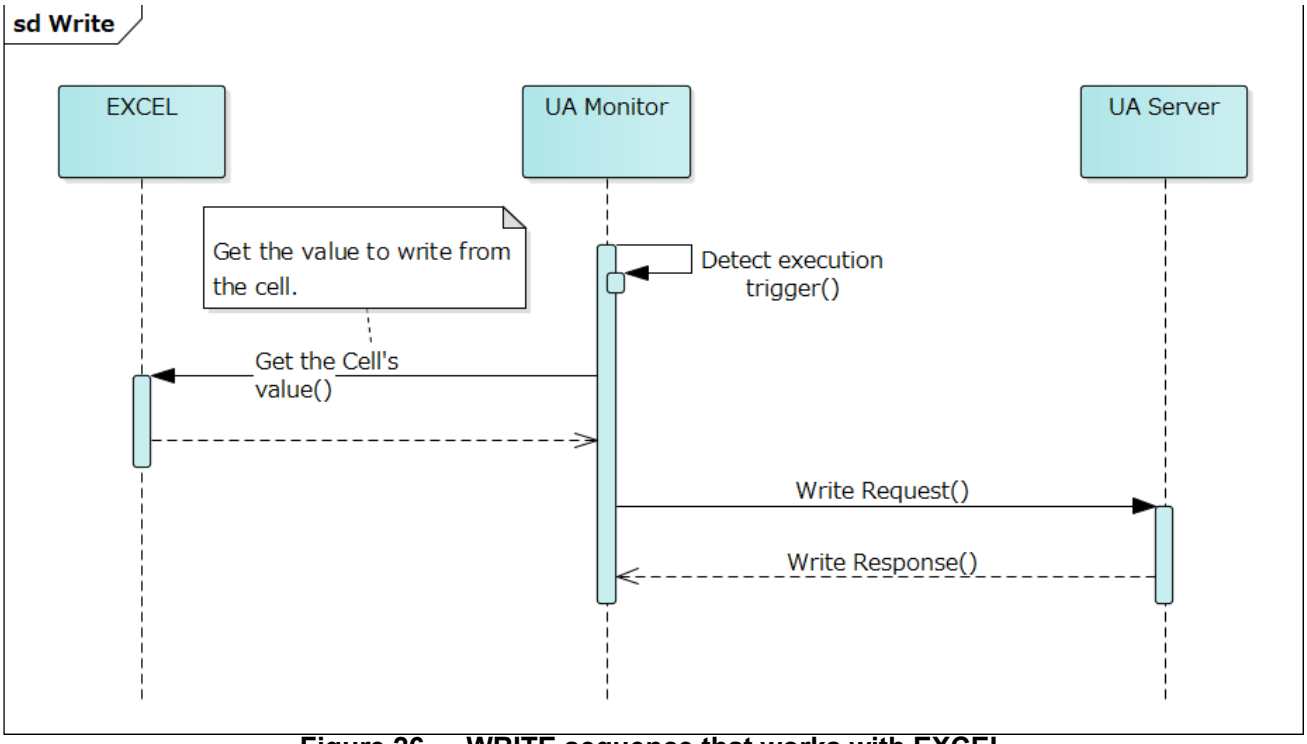
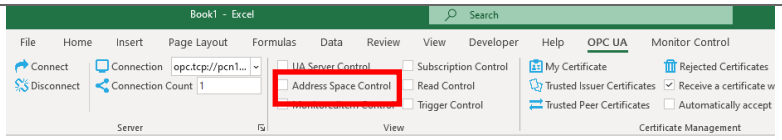
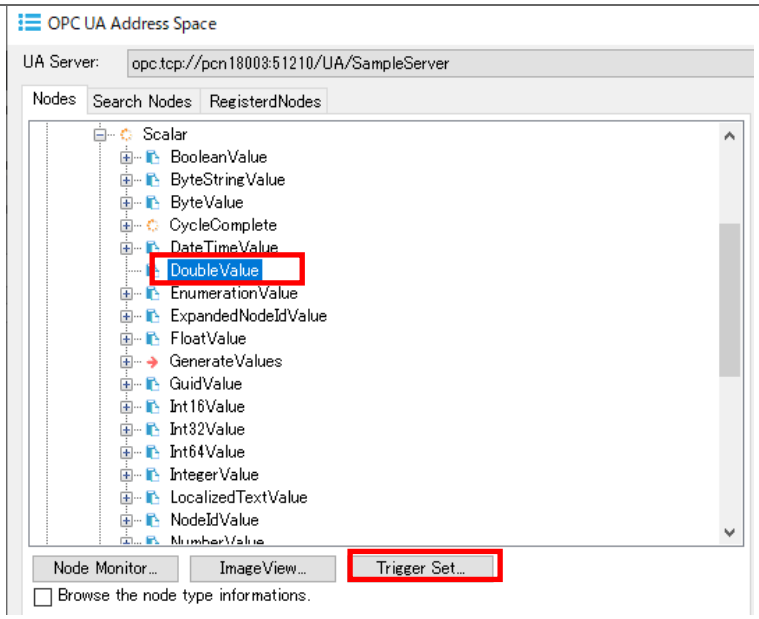
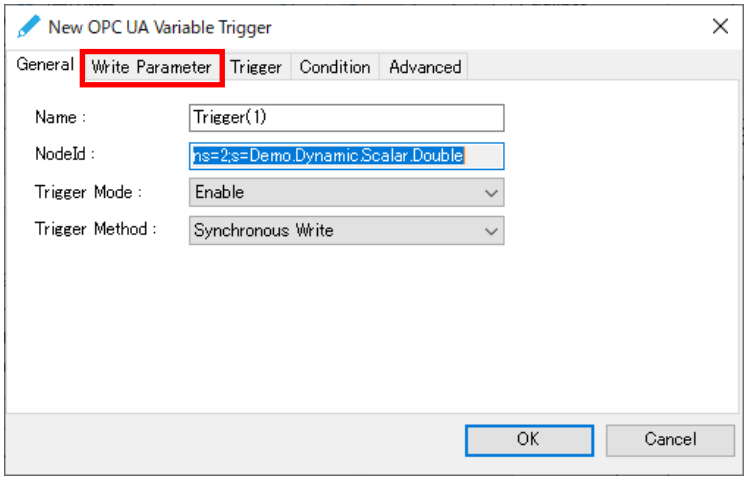
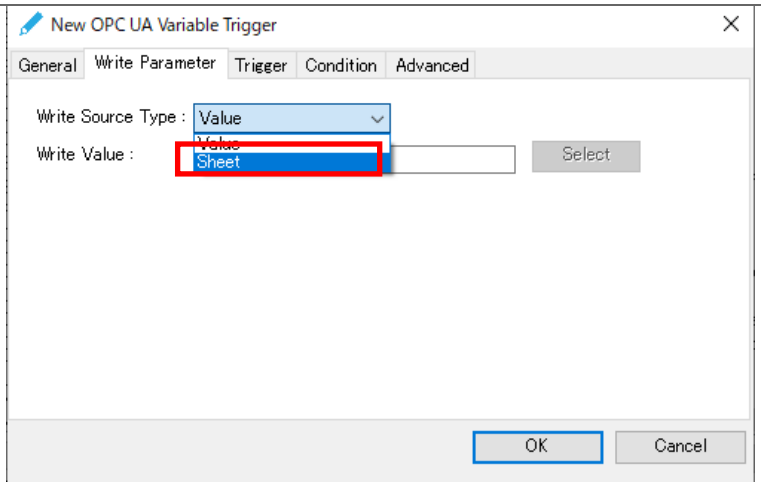
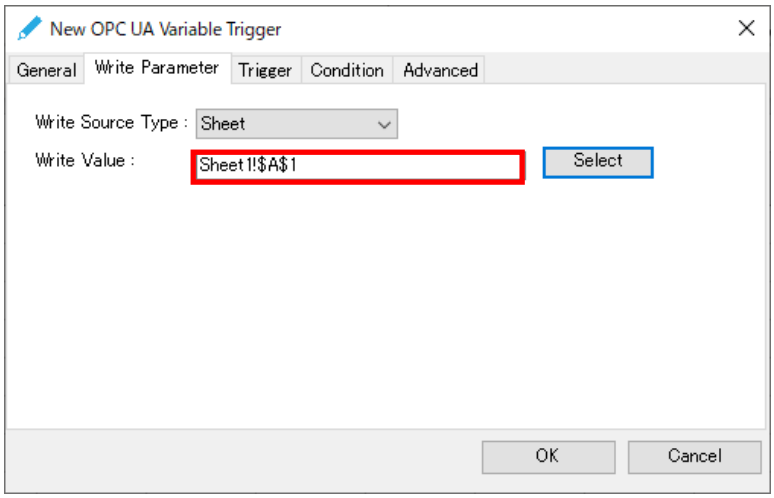
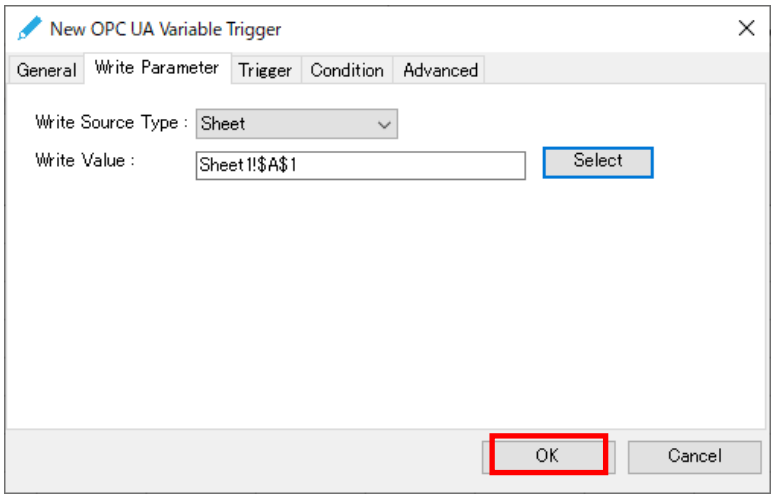
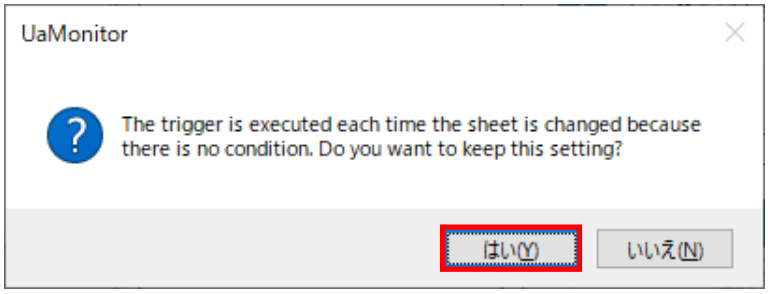
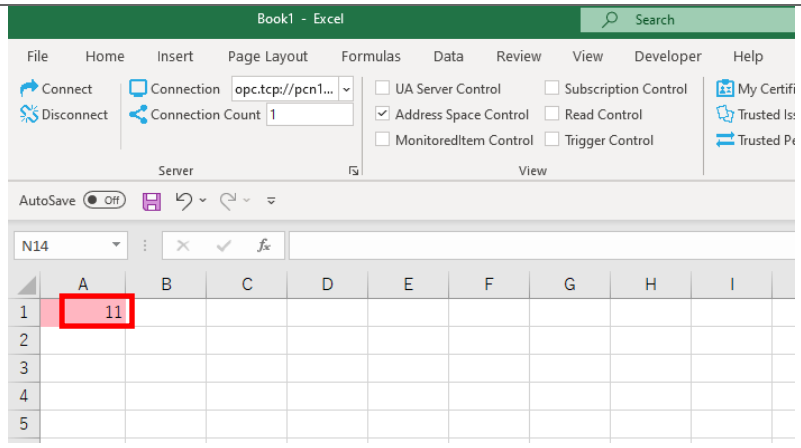
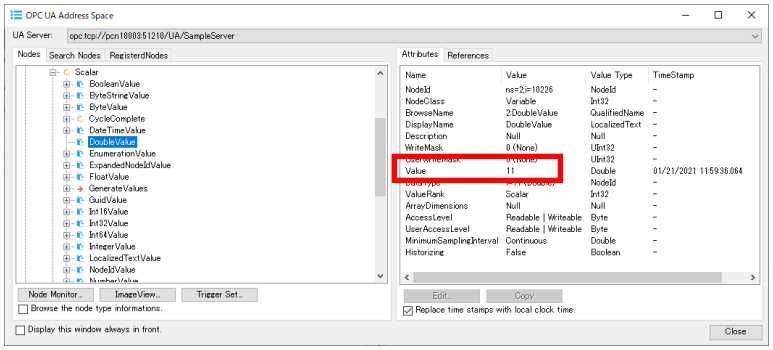


Figure 26 WRITE sequence that works with EXCEL

The details of the operation procedure are described below. The connection procedure is omitted here.

1	Check "Address Space Control".	
2	Select any node on the "Nodes" tab (left display area). Click the "Trigger Set..." button.	
3	Select "Write Parameter" tab.	
4	Select the write source type as "Sheet".	

		If you select " Sheet ", the address of the cell on the currently selected EXCEL will be entered. If you want to specify another cell address, select the cell on EXCEL and click the "Select" button. 
5	Click the " OK " button.	
6	Click the "Yes" button.	

7	Change the value of the cell set for writing and click the enter key. Confirm that the node value of the write destination node is " 11 " using the dedicated GUI.	 *Set " 11 " here.* 

8.2.2. WRITE by dedicated GUI

UA Monitor can browse UA server's address space (information model) by using dedicated GUI. Then, you can edit the read node value by using dedicated GUI.

Figure 27 shows the sequence for writing node values.

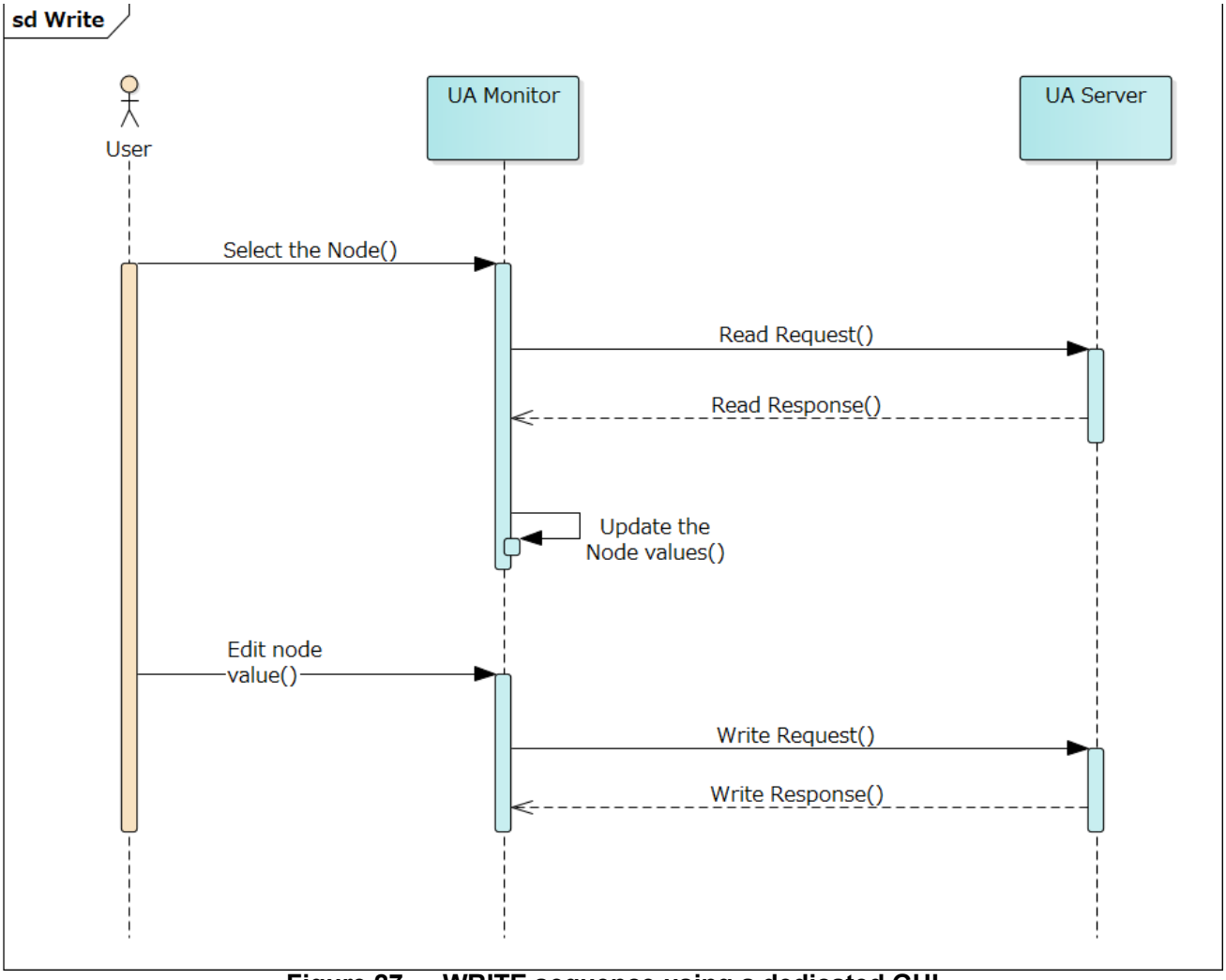
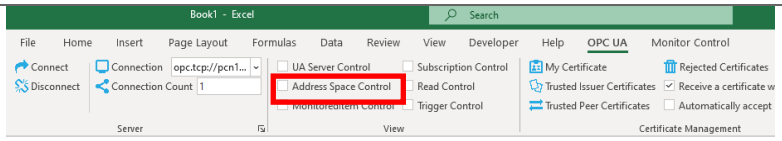
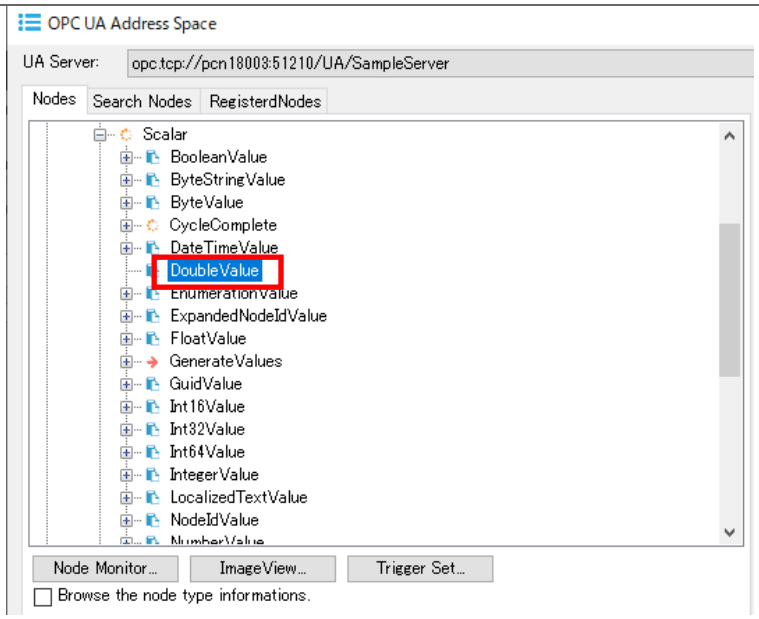
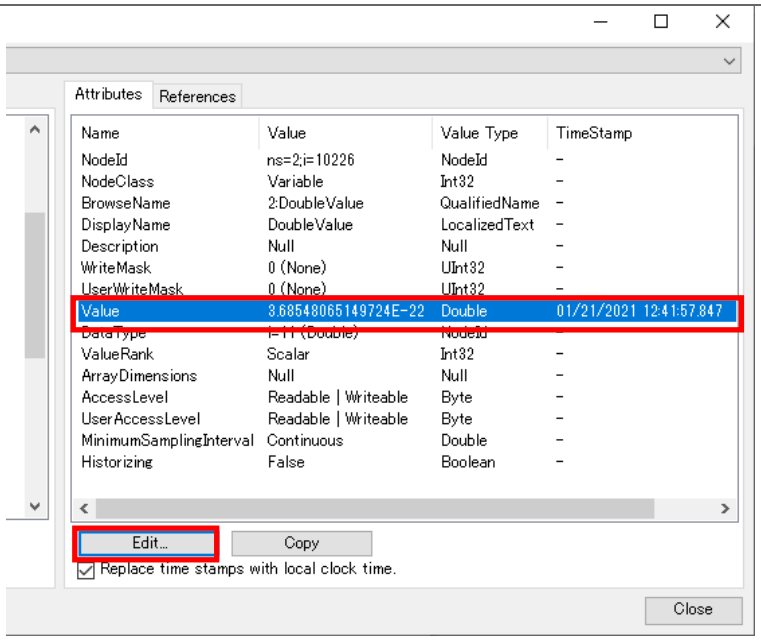
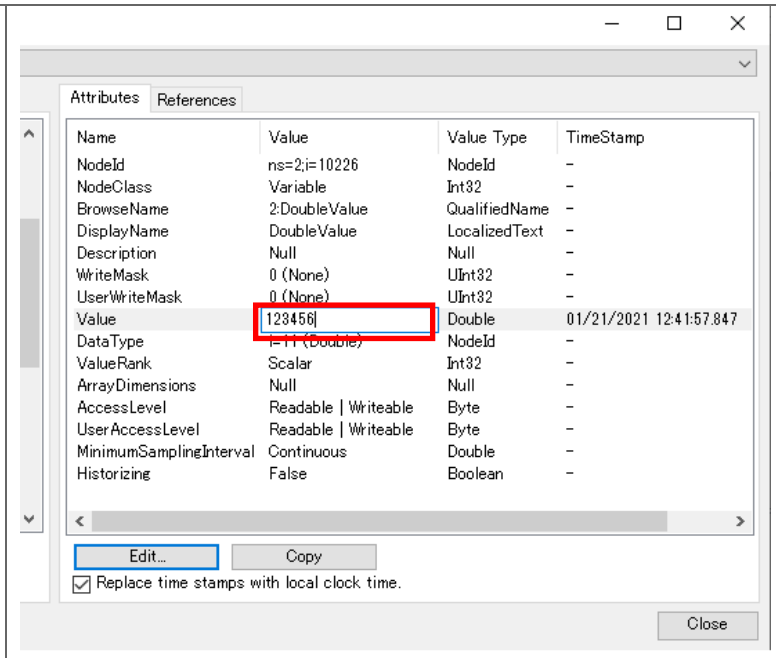


Figure 27 WRITE sequence using a dedicated GUI

The details of the operation procedure are described below. The connection procedure is omitted here.

1	Check "Address Space Control".	
2	Select any node on the "Nodes" tab (left display area).	
3	Select the "Value" on the "Attribute List" tab (right display area). Click the "Edit…" button.	

4	Change the value.	

8.3. Setting screen specifications

This section describes the specifications of the setting screen shown in Figure 28.

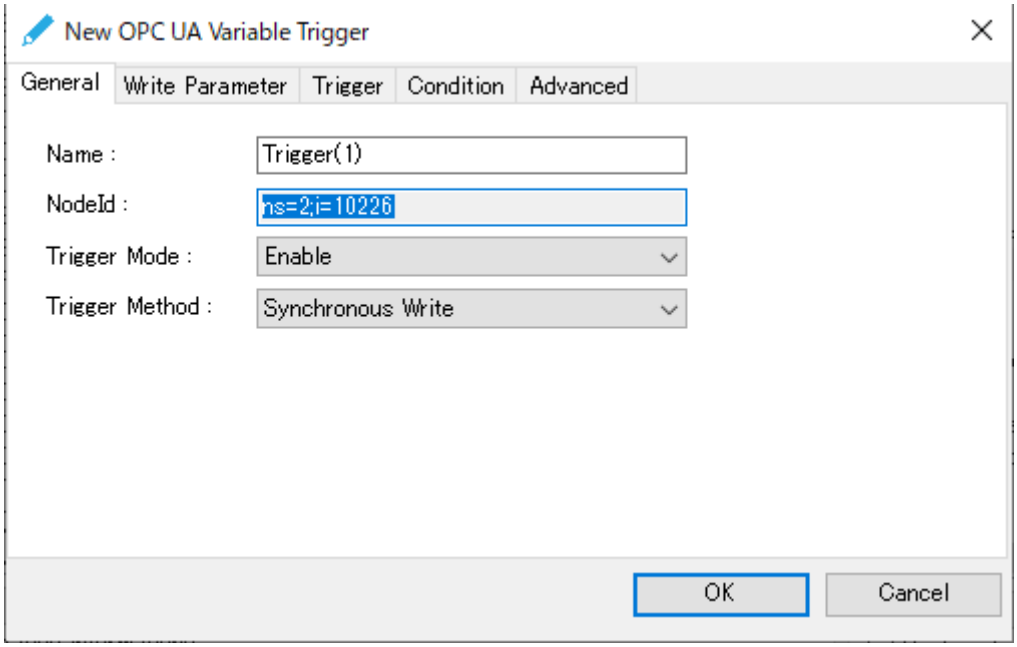


Figure 28 Variable trigger setting screen

"General" tab

This section describes the specifications of the "General" tab screen.

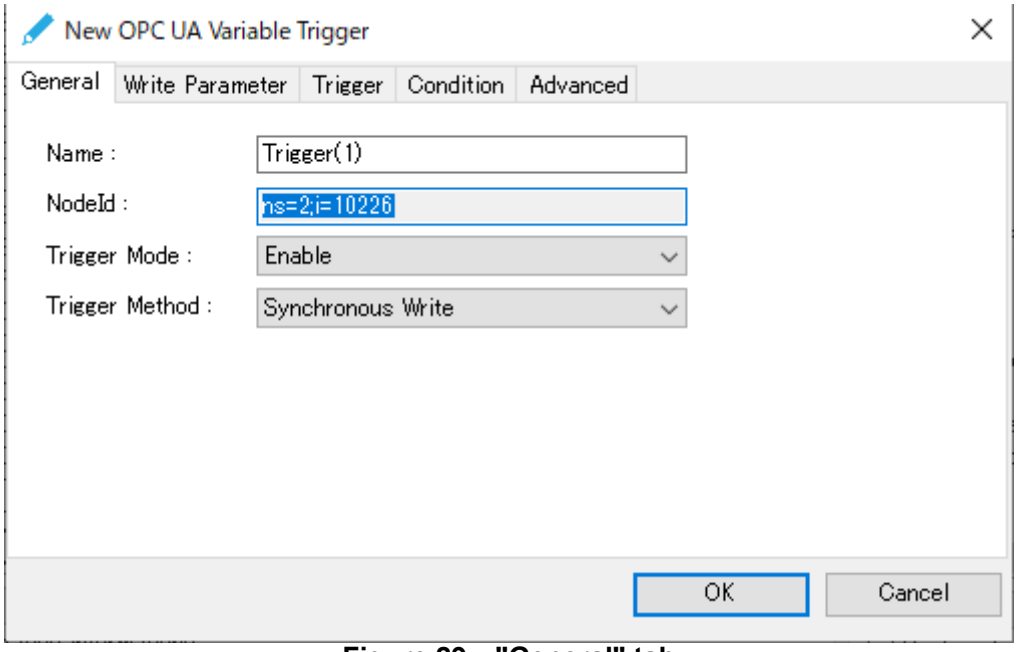


Figure 29 "General" tab

Table 20 shows the item descriptions on the "General" tab screen.

Table 19 Screen item list

item	Explanation
Name	The name of the variable trigger.
NodeId	The nodeId to write to.
Trigger Mode	Select Enable or Disable.
Trigger Method	This is the write processing method. ・ Synchronous Write ・ Asynchronous Write

"Write Parameter" tab
This section describes the specifications of the "Write Parameter" tab screen. On this tab, specify the input parameters to use when performing the WRITE processing. There are two patterns for this parameter, Fig. 30 and Fig. 31, but they cannot be used together.

The parameters shown in Figure 30 use fixed values as write parameters.

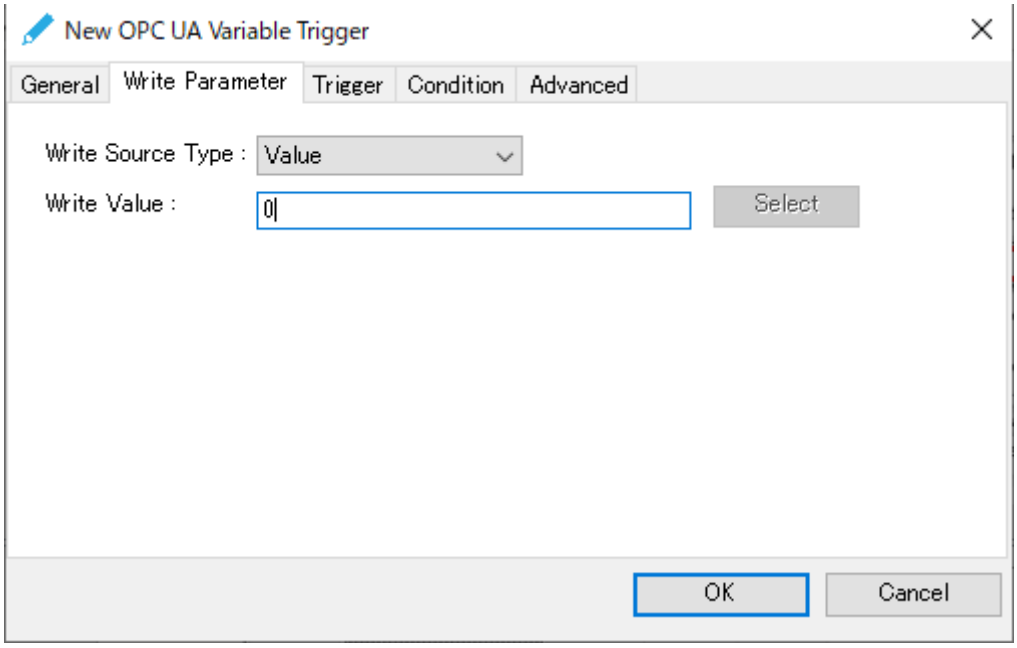


Figure 30 "Write Parameter①" tab

The parameters shown in Figure 31 use cell values as write parameters.

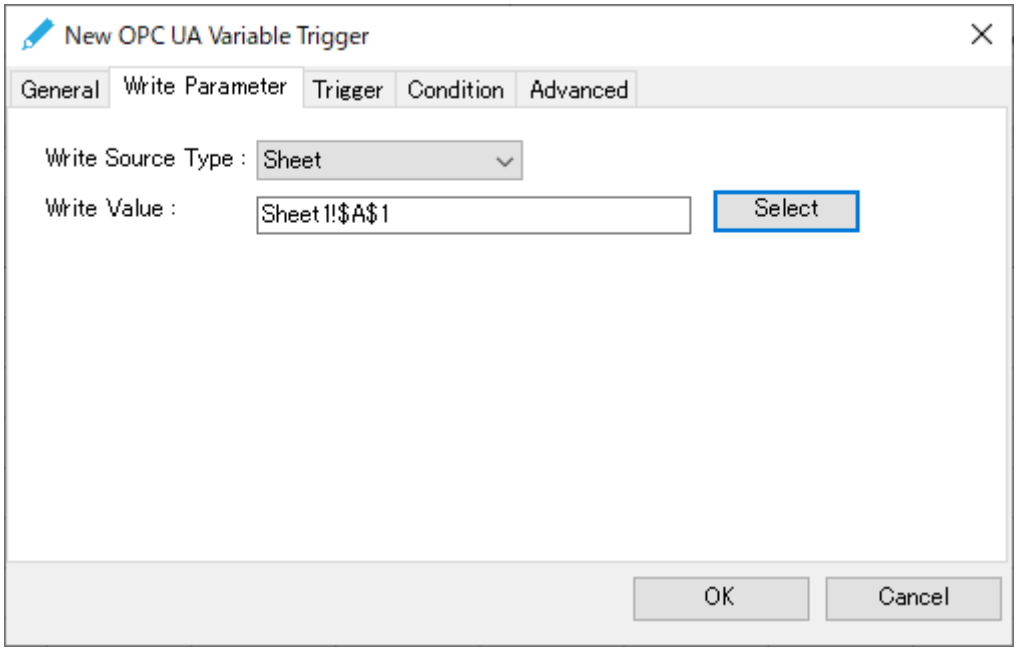


Figure 31 "Write Parameter②" tab

Table 21 shows the item descriptions on the "Write Parameter" tab screen.

Table 20 Screen item list

Item name	Explanation
Write Source Type	Set the acquisition source type of the value to be written. The acquisition source types are as follows. ・ Value : use the fixed value. (Default) ・ Sheet : use the cell value of EXCEL.
Write Value	If the Writing Source Type is "Value", set a fixed value to be written. If the Writing Source Type is "Sheet ", set the address where the cell value is set.

	In this case, you cannot select multiple cells.

"Trigger" tab

This section describes the specifications of the "Trigger" tab screen. On this tab, set the execution timing (fixed cycle, event) of WRITE processing.

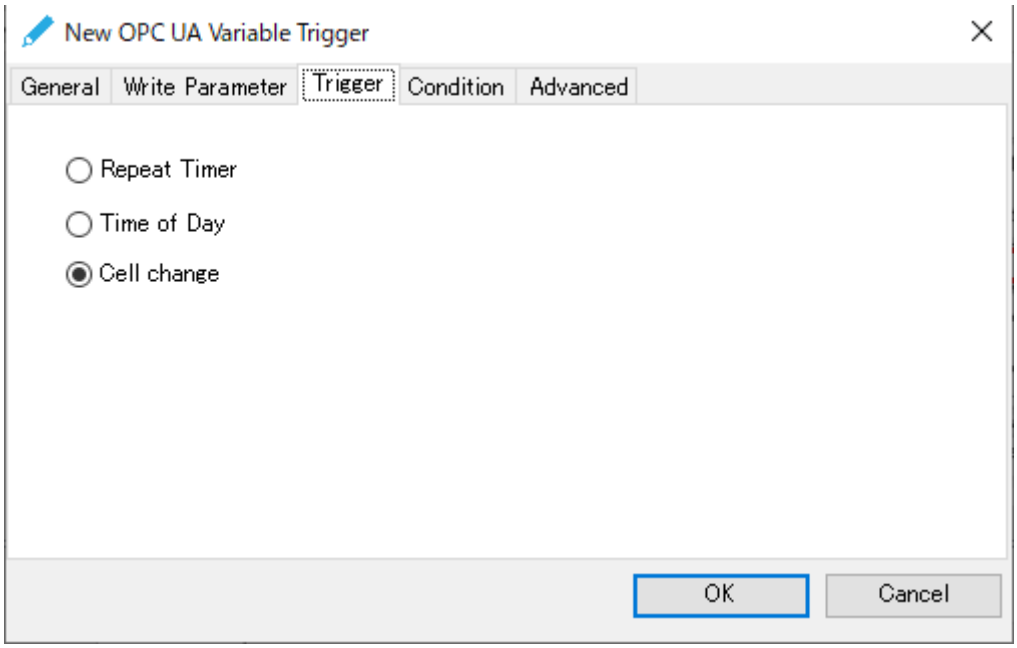
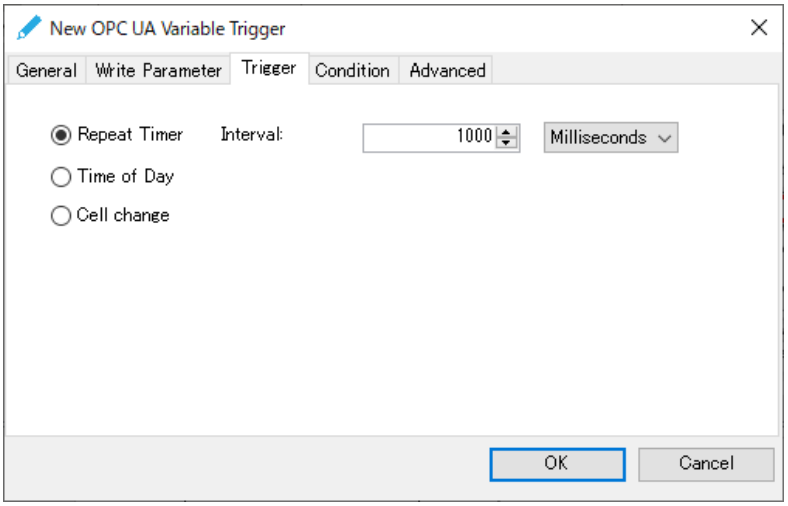
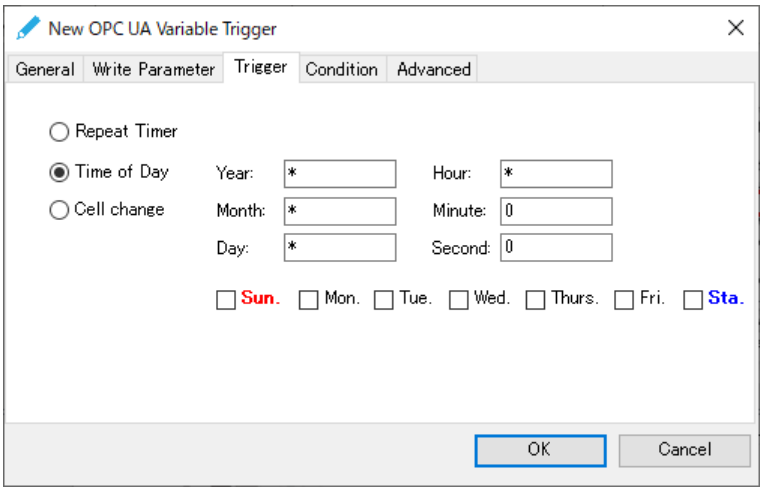
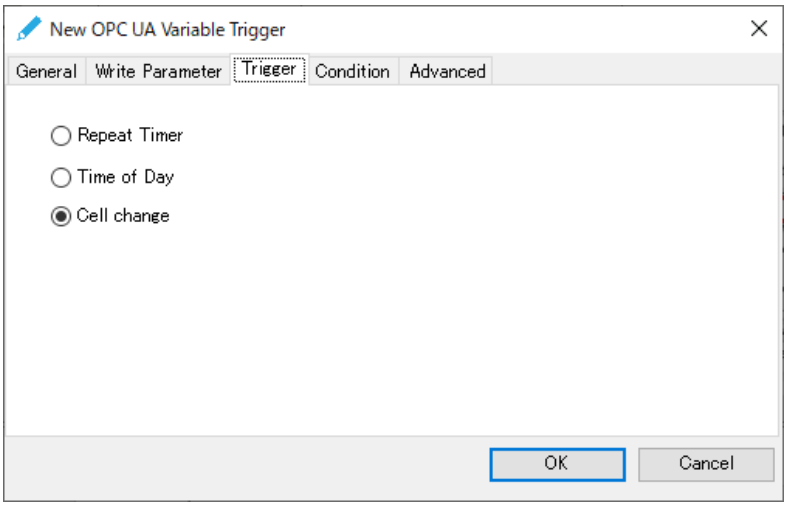


Figure 32 "Trigger" tab

Table 22 shows the item descriptions on the "Trigger" tab screen.

Table 21 Screen item list

Item name	Explanation
Repeat Timer	Set the execution cycle of the variable trigger.  The time units are: ・Milliseconds ・Seconds ・Minutes ・Hours

Time of Day	Set the execution time and day of the week for the variable trigger.  An asterisk (*) means a wildcard. For example, in the case of the setting shown above, it is executed every year, every month, every day, every hour at 0 minutes and 0 seconds.
Cell change	Execute a variable trigger when the cell value of EXCEL changes. 

"Condition" tab
This section describes the specifications of the "Condition" tab screen. On this tab, execution conditions can be added when it is time to execute the trigger settings. If there are no conditions, WRITE processing is executed every time the trigger setting is executed.

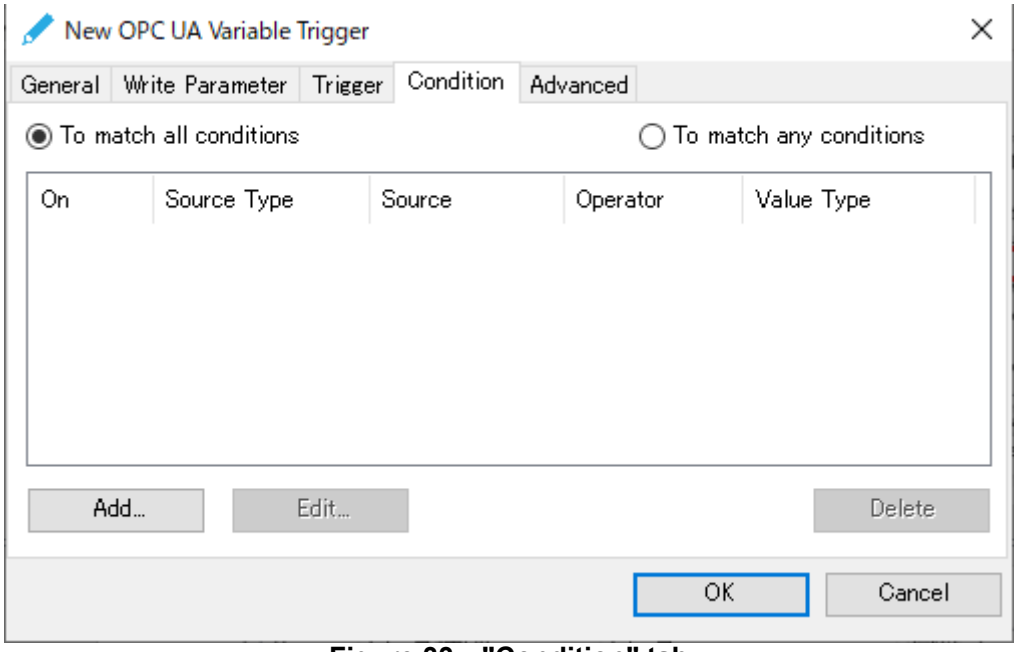


Figure 33 "Condition" tab

Table 23 shows the item descriptions on the "Condition" tab screen.

Table 22 Screen item list

Item name	Explanation
To match all conditions	WRITE processing is executed only when all the set conditions are matched.
To match any conditions	WRITE processing is executed when even one of the set conditions is matched.
Add…	When clicked, the screen for adding a condition is displayed.
Edit…	It is valid when you select a condition that has already been registered. Click to display the screen for editing the conditions.
Delete	It is valid when you select a condition that has already been registered. Click to delete the condition.

"Advanced" tab

This section describes the specifications of the "Advanced" tab screen.

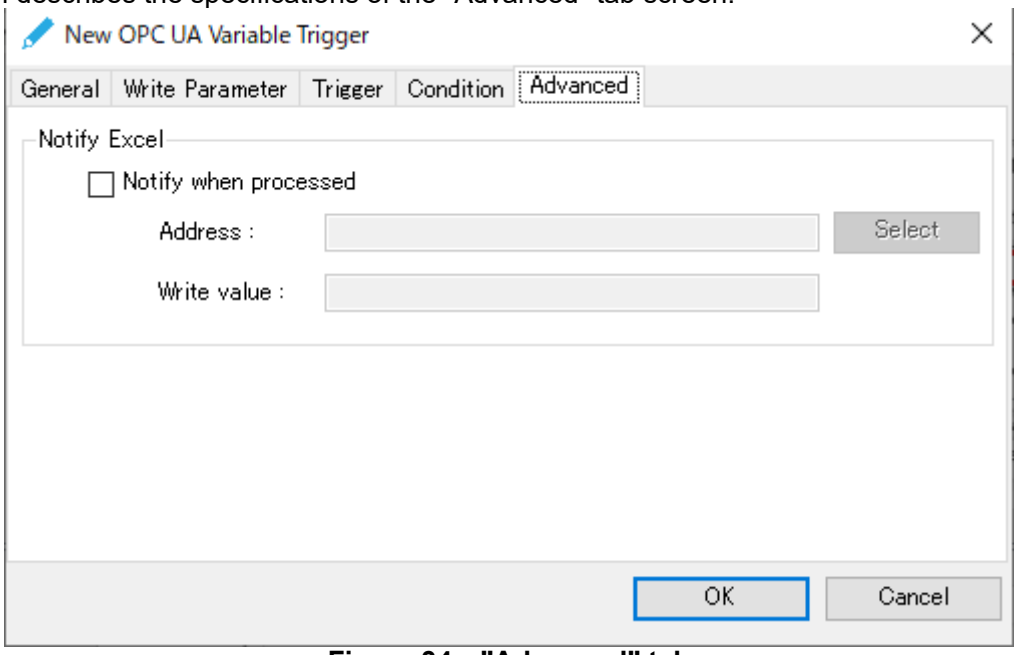
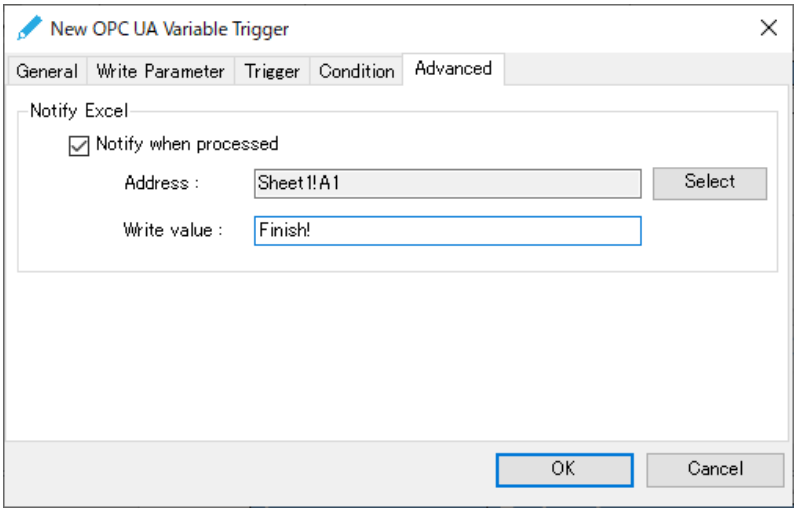
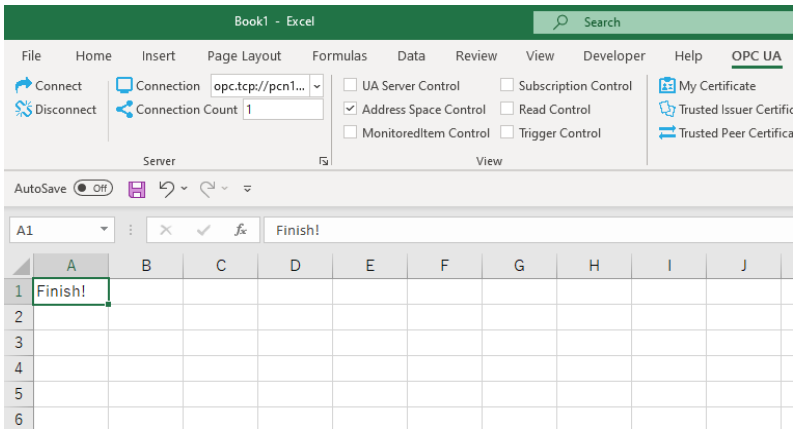


Figure 34 "Advanced" tab

Table 24 shows the item descriptions on the "Advanced" tab screen.

Table 23　Screen item list

Item name	Explanation
Notify Excel	Set the value specified in the "Write value" (the numeric, string either possible) to the EXCEL cell specified in the "Address" after executing the process. For example, if you want to set “Finish!” on the A1 cell of Sheet1 after executing the WRITE processing, you need to set as follows.  The value is set in the specified cell as shown in the figure below after execution. 

9. CALL (method execution) procedure (method trigger)

9.1. System configuration

Tool software

Company/Organization	Figure Name	Name	Version
OPC Foundation	UAServer	UA Sample Server	1.4.357.28
Puerto Co., Ltd.	UA Monitor	UA Monitor	3.0.X

9.2. Operating procedure

9.2.1. CALL by EXCEL cooperation

UA Monitor can execute the method node on the UA Server. The value writing function in UA Monitor is called "method trigger". The method node can pass input parameters at run time and can use fixed values for the input parameters, or the cell values of EXCEL or the calculation results of the EXCEL function.

The method node also returns the output parameters to the UA Monitor after execution. You can set the reflection destination of the returned output parameter value to the cell or shape (figure) of EXCEL. After reflecting the value in the cell or shape, you can use the functions and graphs that are the original functions of EXCEL.

Figure 35 shows the CALL sequence that works with EXCEL.

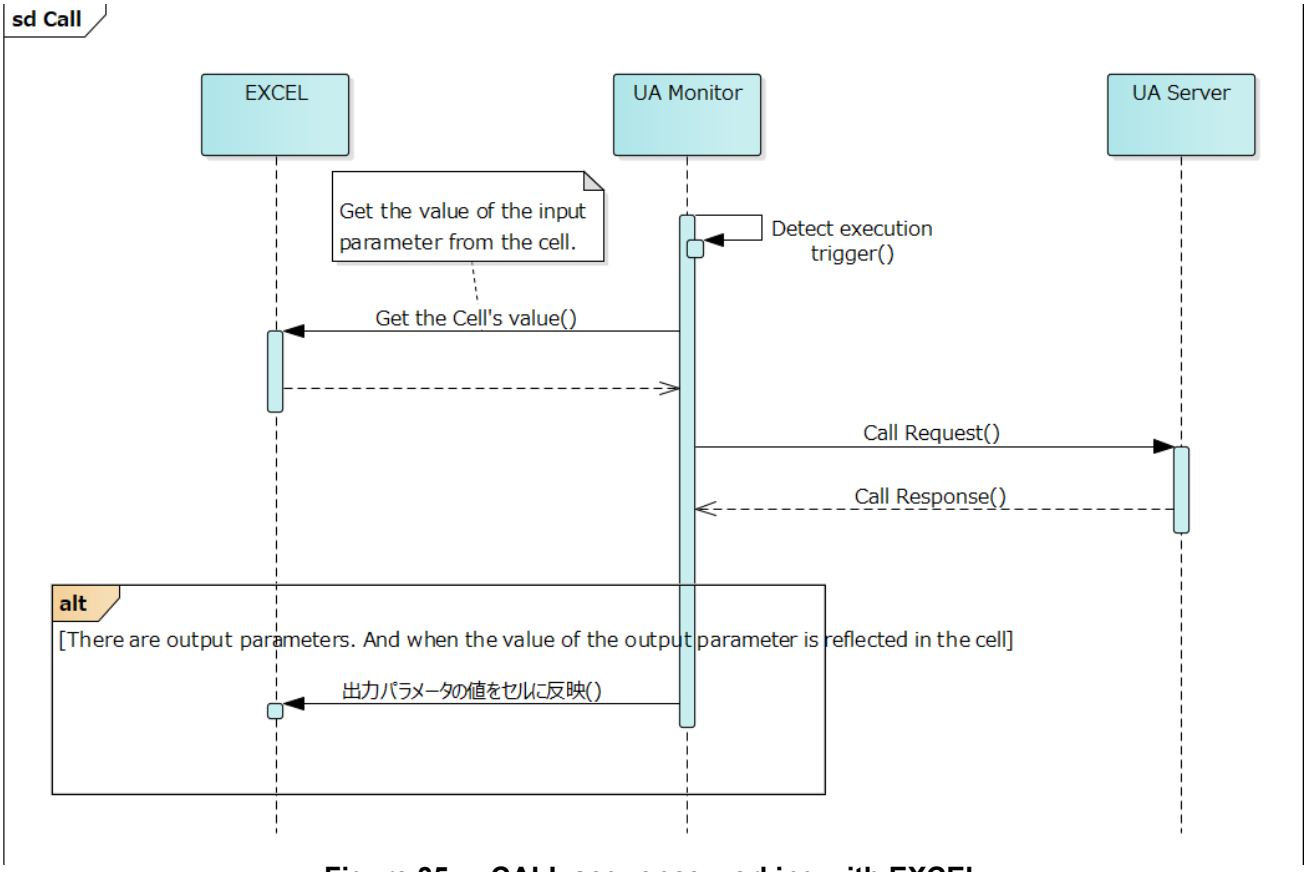
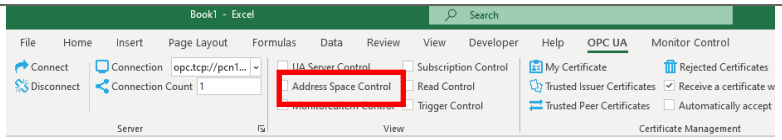
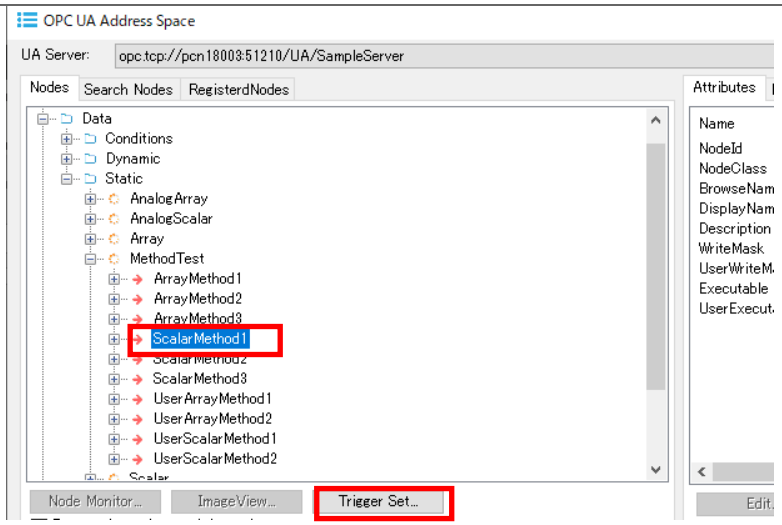
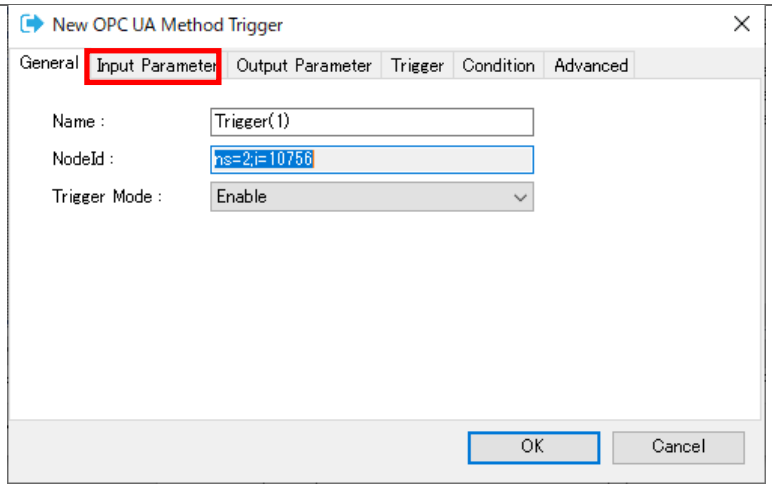
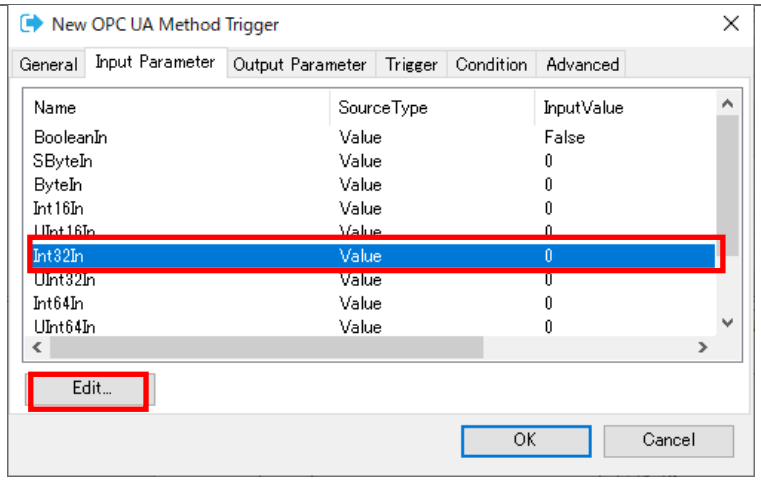
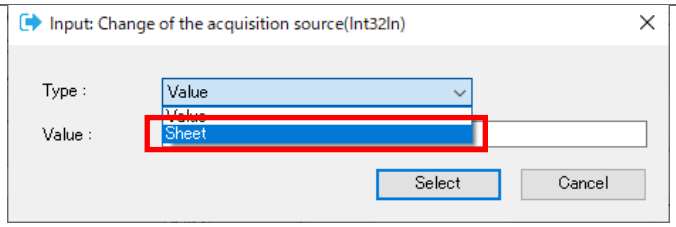
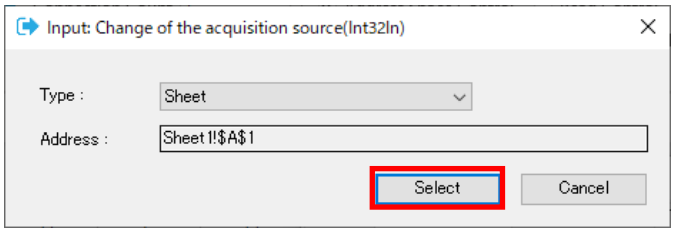
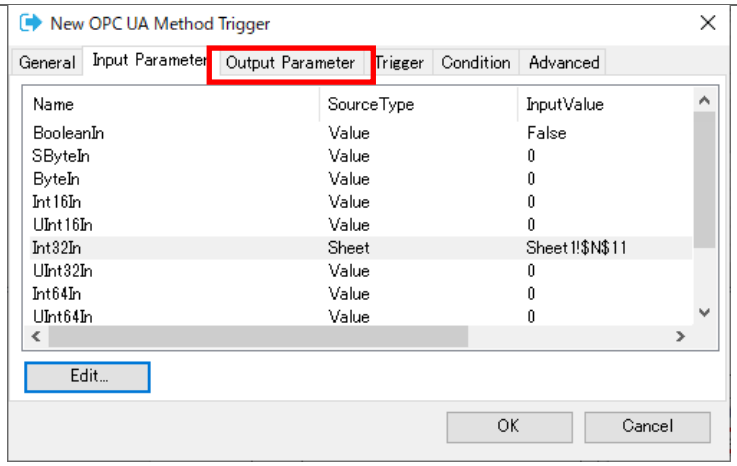
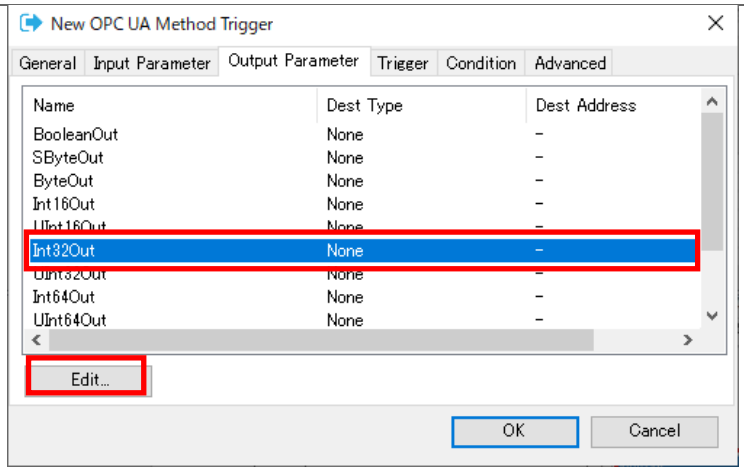
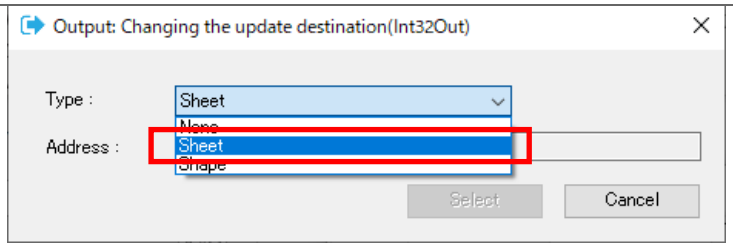
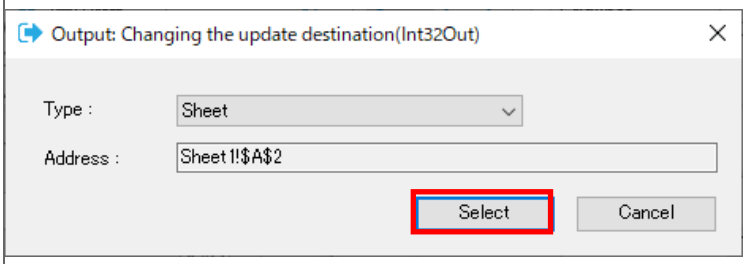


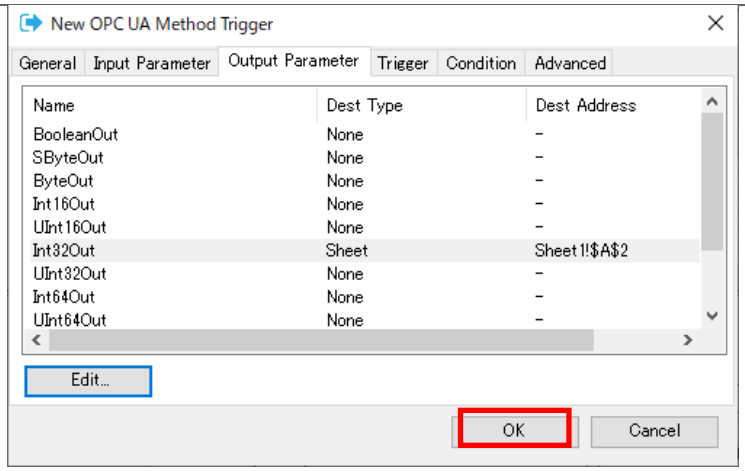
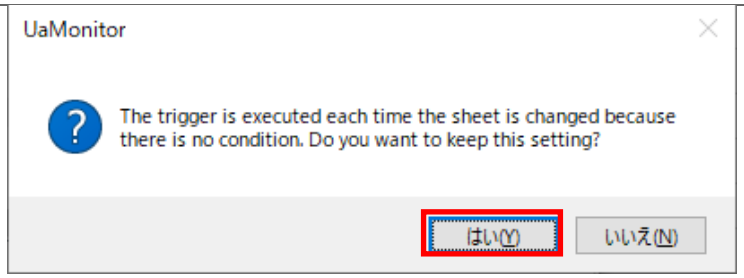
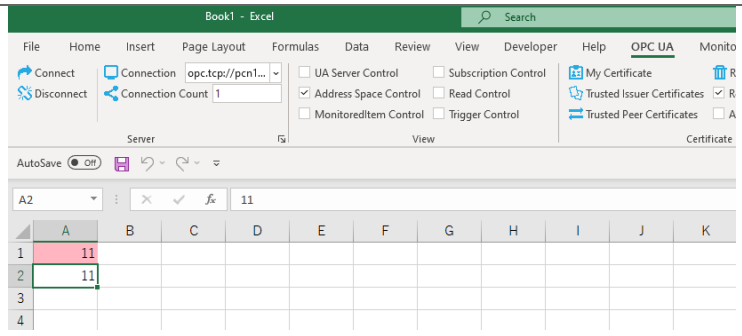
Figure 35 CALL sequence working with EXCEL

The details of the operation procedure are described below. The connection procedure is omitted here.

1	Check "Address Space Control".	
2	Select any method node on the "Nodes" tab (left display area). Click the "Trigger Set..." button.	

3	Select "Input Parameter" tab.	
4	Select any input parameter. *Here, set "Int 32In".* Click the "Edit…" button.	 *A fixed value is set as the initial value for the input parameter.* ✓ *False for Boolean types.* ✓ *0 for numeric types.* ✓ *the current time when the screen is opened for DateTime types.* ✓ *An empty String for String Types.*
5	Select Type as "Sheet". Click the "Select" button.	  *If you select "Sheet", the address of the cell on the currently selected EXCEL will be entered. If you want to specify another cell address, select the cell on EXCEL and click the "Select" button.*

6	Select the "Output Parameter" tab.	
7	Select any output parameter. *Here, set "Int 32Out".* Click the "Edit…" button.	 *The output parameter is set to " None " as an initial value, which indicates that nothing is processed.*
8	Select Type as "Sheet". Click the "Select" button.	 *If you select " Sheet", the address of the cell on the currently selected EXCEL will be entered. If you want to specify another cell address, select the cell on EXCEL and click the "Select" button.* 

9	Click the " OK " button.	
10	Click the "Yes" button.	
11	Change the cell value set for the input parameter and click the enter key. When the method node is executed, confirm that the value of the input parameter is reflected in the cell set in the output parameter.	 *Here, set "11".*

9.3. Setting screen specifications

This section describes the specifications of the setting screen shown in Figure 36.

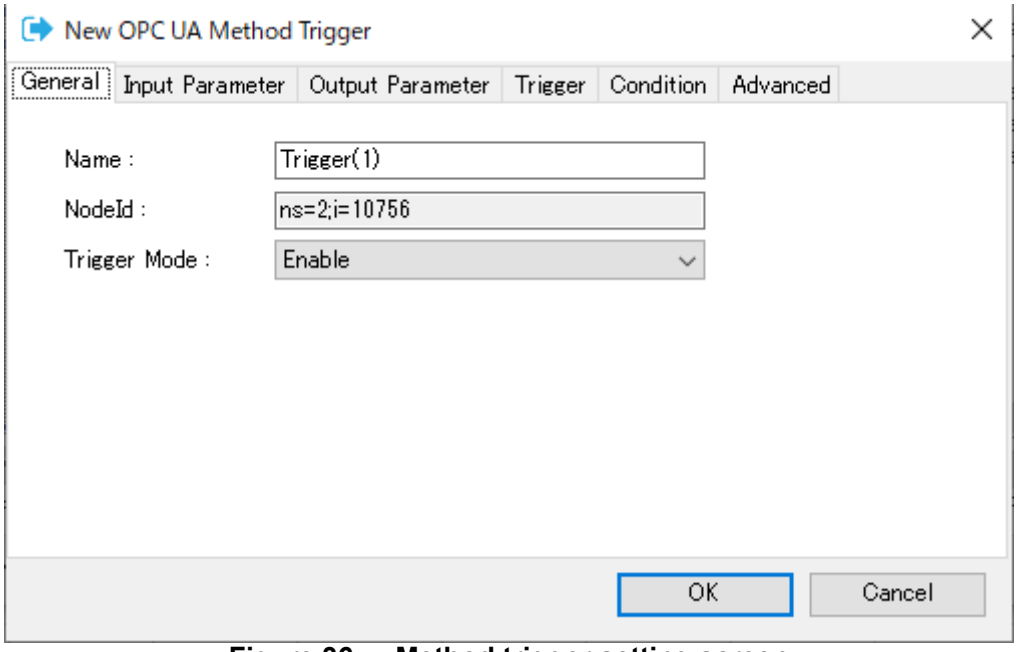


Figure 36 Method trigger setting screen

"General" tab
This section describes the specifications of the "General" tab screen.

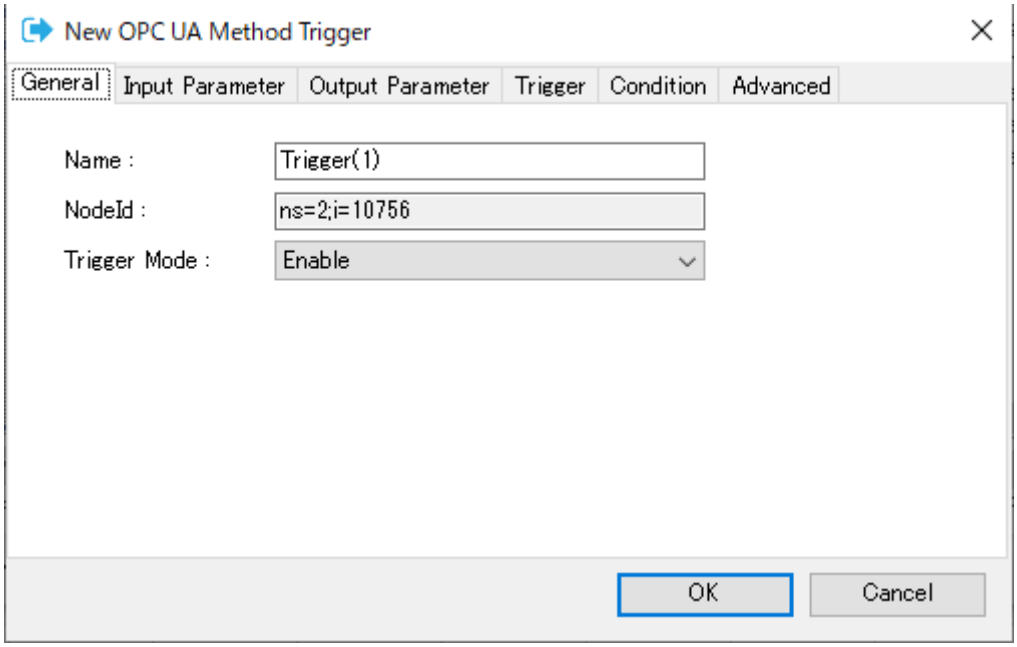


Figure 37 "General" tab

Table 25 shows the item descriptions on the "General" tab screen.

Table 24 Screen item list

Item name	Explanation
Name	The name of the method trigger.
NodeId	The node Id of the CALL destination.
Trigger Mode	Select Enable or Disable.

"Input Parameter" tab
This section describes the specifications of the "Input Parameter" tab screen. On this tab, specify the input parameters to use when executing the CALL processing.

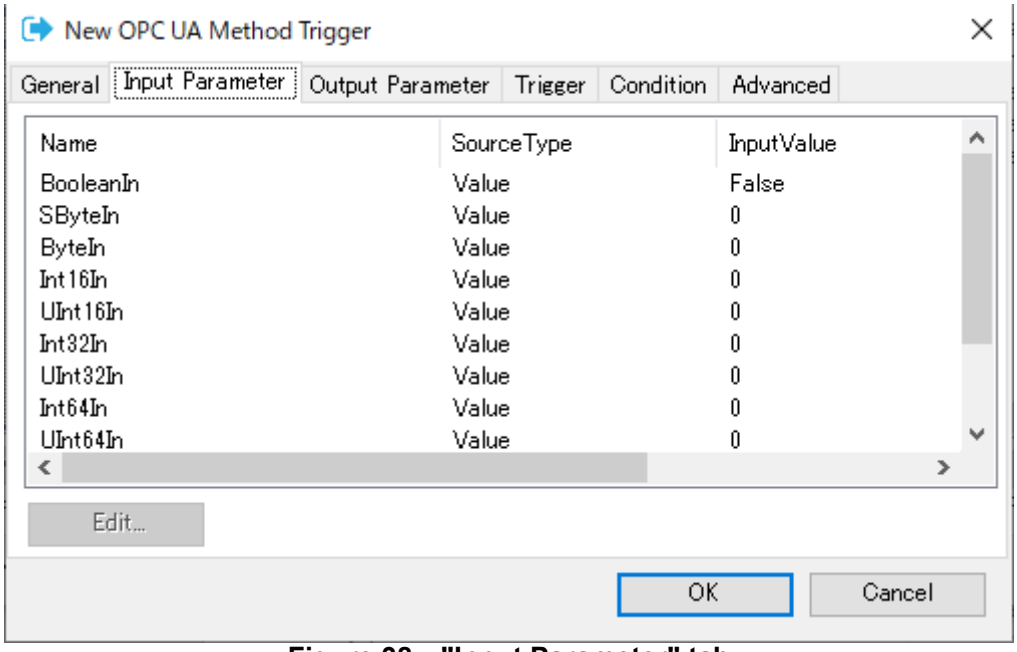


Figure 38 "Input Parameter" tab

Table 26 shows the item descriptions on the "Input Parameter" tab screen.

Table 25 Screen item list

Item name	Explanation
Name	The name of the Input Parameter.
SourceType	Set the source type of the input value. The source types are as follows. · Value : The value indicating of the use of the fixed value. (Default value) · Sheet : The value indicating of the use of the cell value of EXCEL.
InputValue	If the source type is "Value", set a fixed value as the input value. If the source type is "Sheet", set the address where the cell value is set. You cannot select multiple cells.
ValueType	The type of the input value. This value is retrieved and set by UA Monitor from the UA server.

"Output Parameter" tab
This section describes the specifications of the "Output Parameter" tab screen. On this tab, specify the output parameters to use when executing the CALL processing.

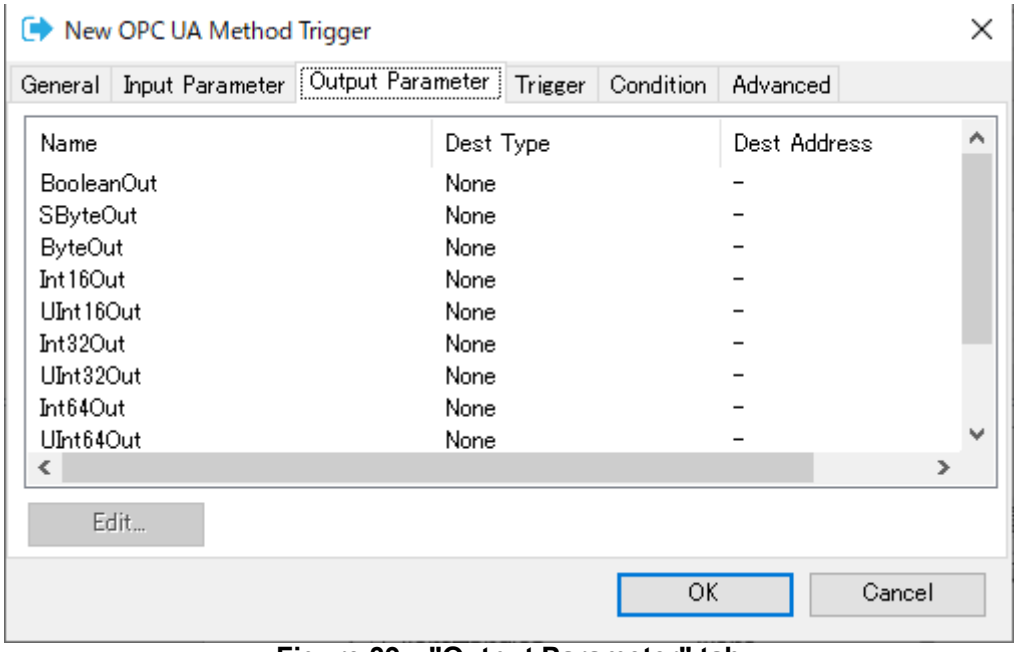


Figure 39 "Output Parameter" tab

Table 27 shows the item descriptions on the "Output Parameter" tab screen.

Table 26 Screen item list

Item name	explanation
Name	The name of the output parameter.
Dest Type	Set the update destination type of the output value. The update destination types are as follows. · None : the type to be terminated without processing the CALL return value (Default value) · Sheet : the type to set the CALL return value to EXCEL cell. · Shape: the type to set the CALL return value to EXCEL shape.
Dest Address	If the dest type is "Sheet", the CALL return value is set in the cell of the specified address. You cannot select multiple cells. If the dest type is " Shape", the CALL return value is set in the shape of the specified address.

"Trigger" tab

This section describes the specifications of the "Trigger" tab screen. On this tab, set the execution timing (fixed cycle, event) of CALL processing.

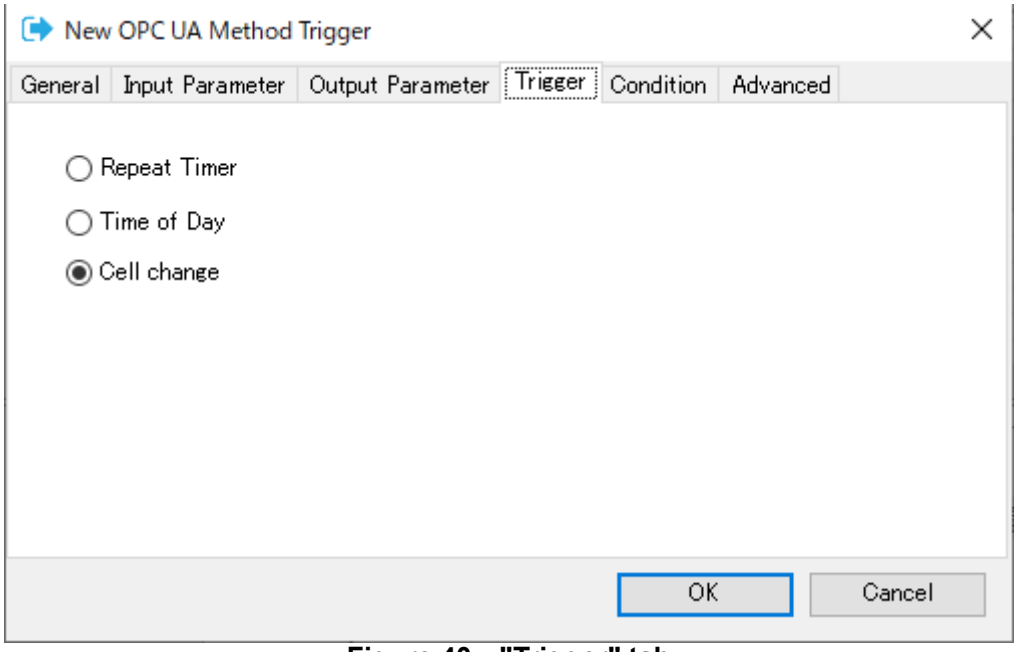
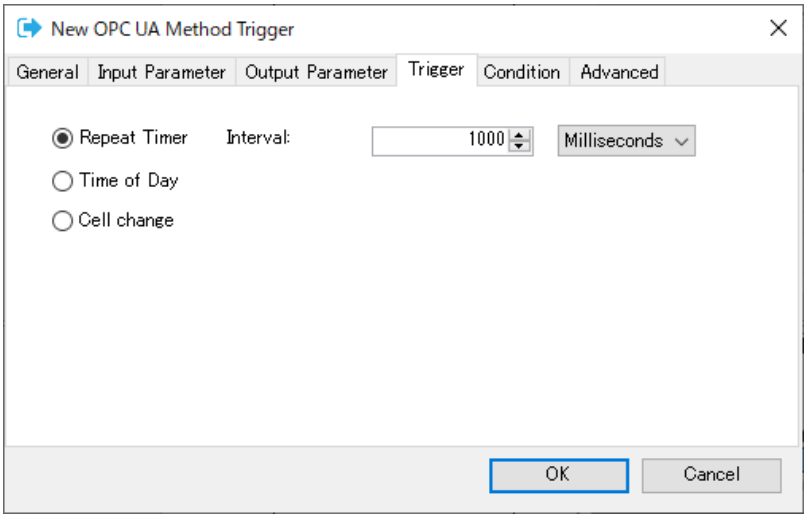
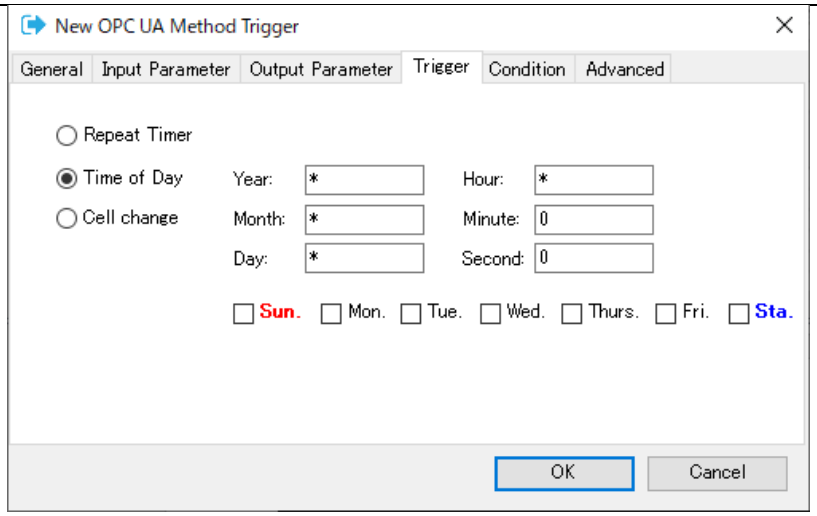


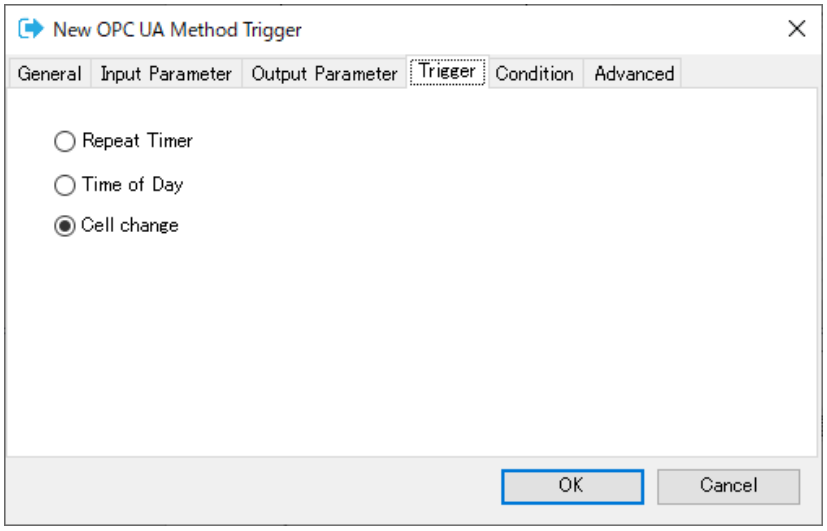
Figure 40 "Trigger" tab

Table 28 shows the item descriptions on the "Trigger" tab screen.

Table 27 Screen item list

Item name	Explanation
Repeat Timer	Set the execution cycle of the method trigger.  The time units are: ・Milliseconds ・Seconds ・Minutes ・Hours
Time of Day	Set the execution time and day of the week for the method trigger.

<table>
<tr><td></td><td> 

An asterisk (*) means a wildcard. For example, in the case of the setting shown above, it is executed every year, every month, every day, every hour at 0 minutes and 0 seconds.</td></tr>
<tr><td>Cell change</td><td>Execute a method trigger when the cell value of EXCEL changes. 
</td></tr>
</table>

"Condition" tab
This section describes the specifications of the "Condition" tab screen. On this tab, execution conditions can be added when it is time to execute the trigger settings. If there are no conditions, CALL processing is executed every time the trigger setting is executed.

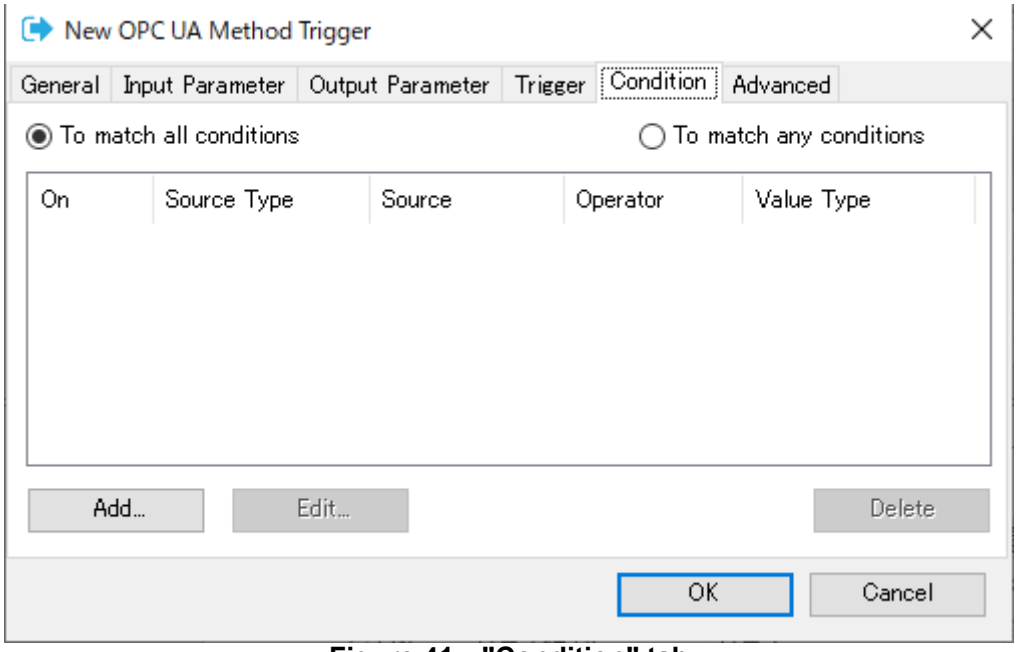


Figure 41 "Condition" tab

Table 29 shows the item descriptions on the "Condition" tab screen.

Table 28 Screen item list

Item name	explanation
To match all conditions	CALL processing is executed only when all the set conditions are matched.
To match any conditions	CALL processing is executed when even one of the set conditions is matched.
Add…	When clicked, the screen for adding a condition is displayed.
Edit…	It is valid when you select a condition that has already been registered. Click to display the screen for editing the conditions.
Delete	It is valid when you select a condition that has already been registered. Click to delete the condition.

"Advanced" tab

This section describes the specifications of the "Advanced" tab screen.

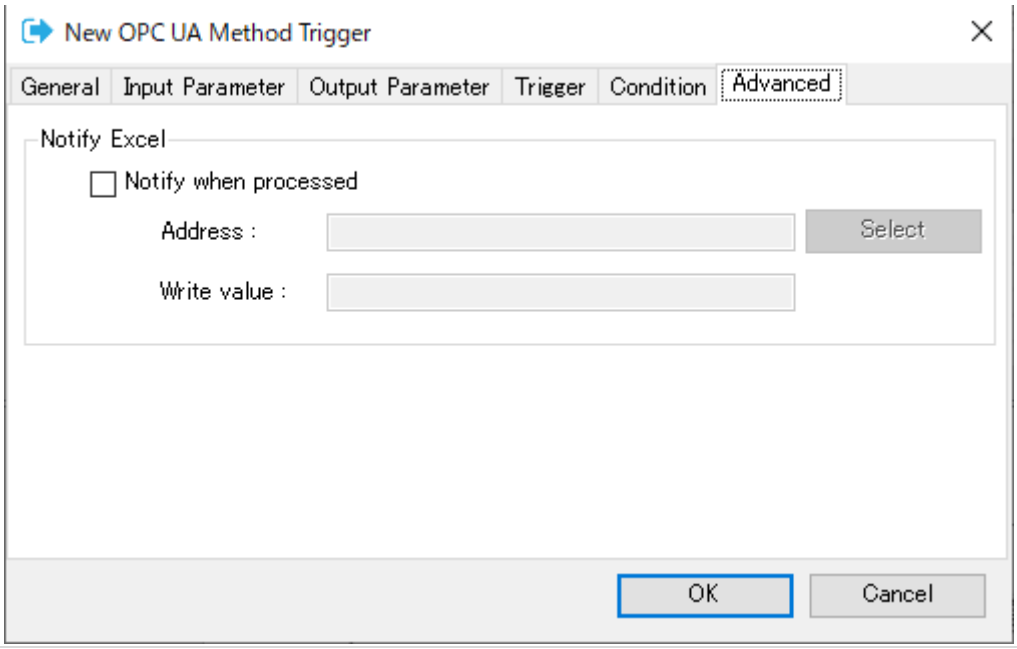
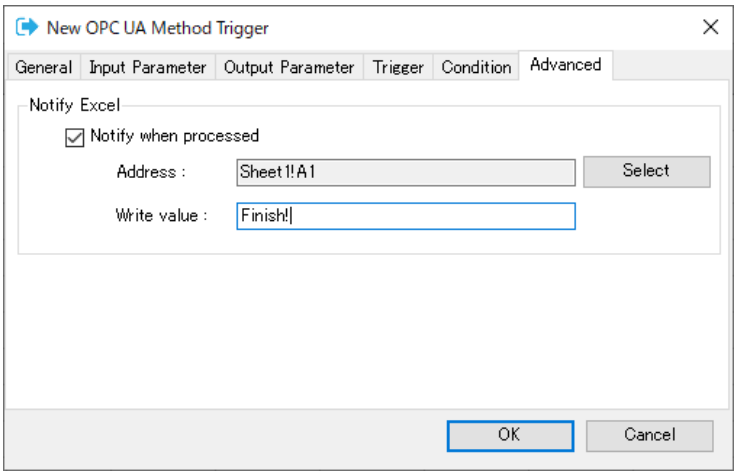
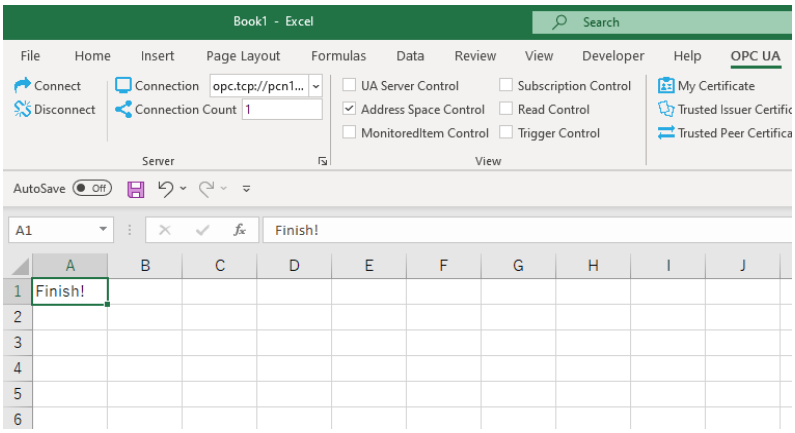


Figure 42　"Advanced" tab

Table 30 shows the item descriptions on the "Advanced" tab screen.

Table 29　Screen item list

項目	説明
Notify Excel	Set the value specified in the "Write value" (the numeric, string either possible) to the EXCEL cell specified in the "Address" after executing the process. For example, if you want to set “Finish!” on the A1 cell of Sheet1 after executing the CALL processing, you need to set as follows.  The value is set in the specified cell as shown in the figure below after execution. 

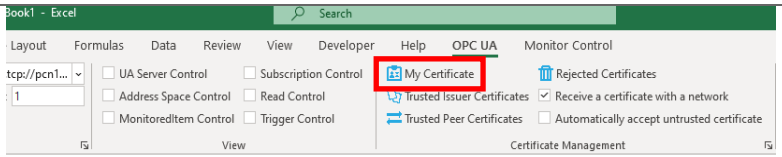
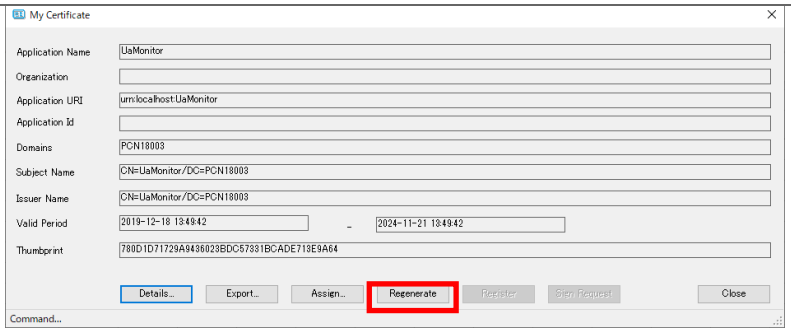
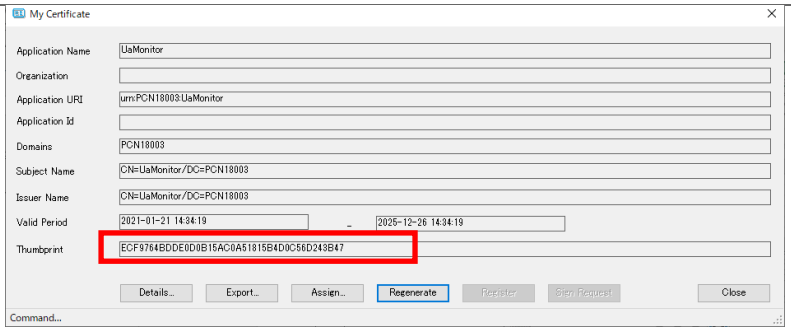
10. Certificate management

10.1. Operating procedure

10.1.1. Regenerate of self- signed certificate

OPC UA uses application certificates (hereafter referred to as certificates) to establish secure communication. UA Monitor also uses an application certificate, but it has the ability to regenerate the certificate itself.

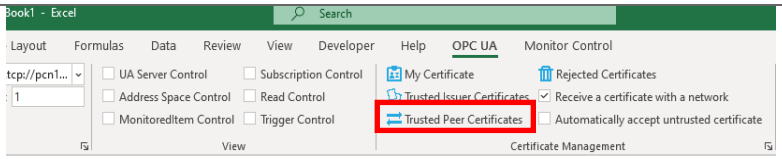
The details of the operation procedure are described below.

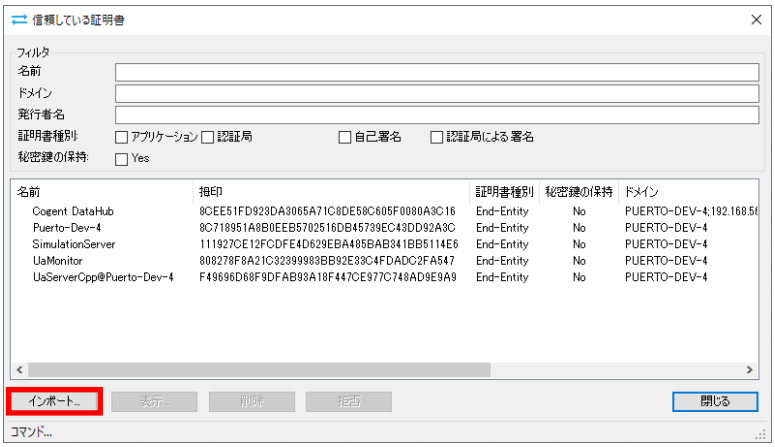
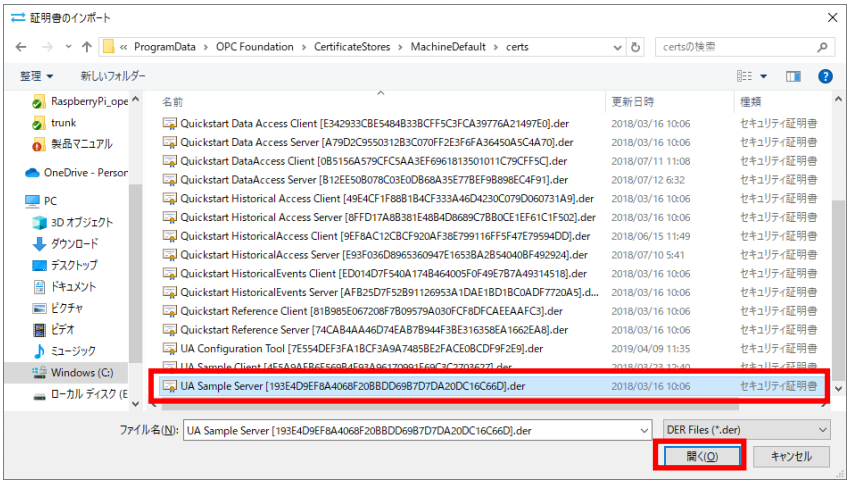
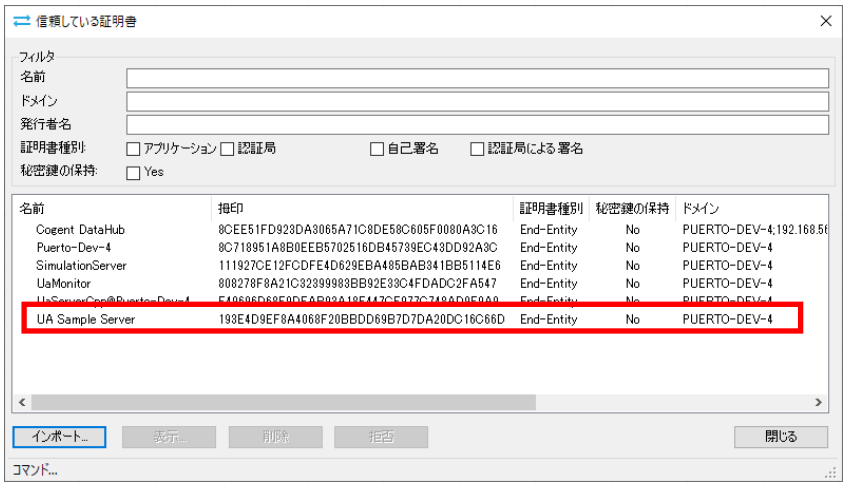
1	Click the "My Certificate" button.	
2	Click the "Regenerate" button.	
3	Confirm that the thumbprint value has changed.	 *If successful thumbprint is updated.*

10.1.2. Certificate Trust

To communicate between UA Monitor and UA Server, you need to replace the certificate.
This section describes how to pre-trust the UA Server's Certificate.

The details of the operation procedure are described below.

1	Click the "Trusted Peer Certificates" button.	

2	Click the "Import…" button.	
3	Select the certificate (*.DER). Click the "Open" button.	
4	Confirm that the UA Sample Server has been added.	

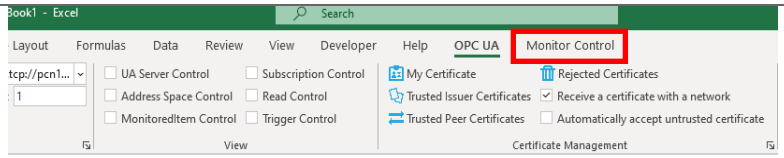
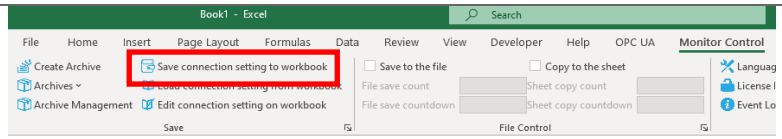
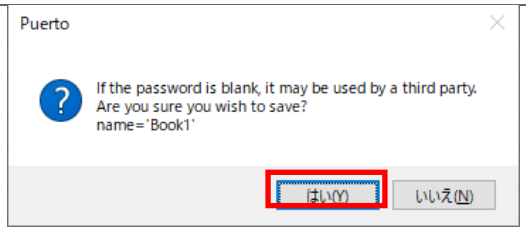
11. Save screen and connection information

11.1. Operating procedure

11.1.1. Save to EXCEL book

UA Monitor can save the created EXCEL screen and the connection information to the UA Server in the EXCEL book. By saving to an EXCEL book, you can resume the connection the next time you open the saved EXCEL book.

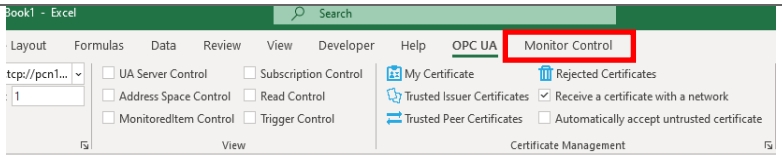
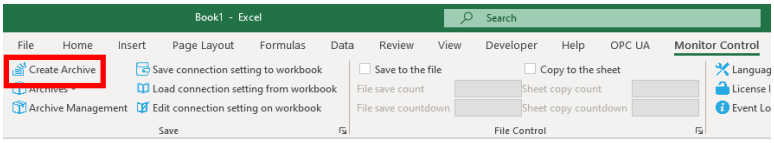
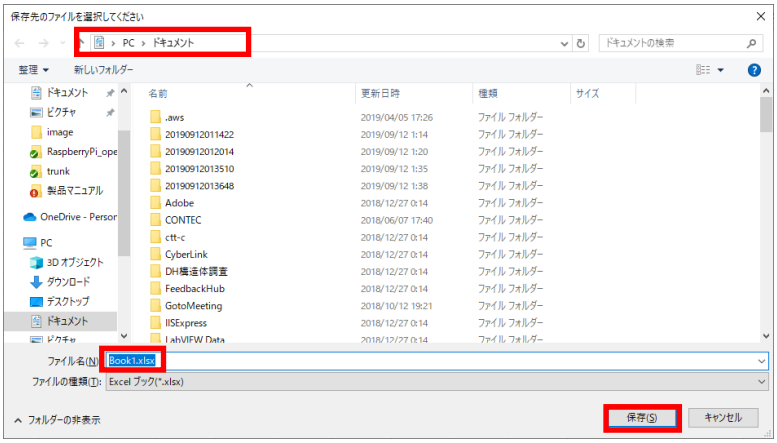
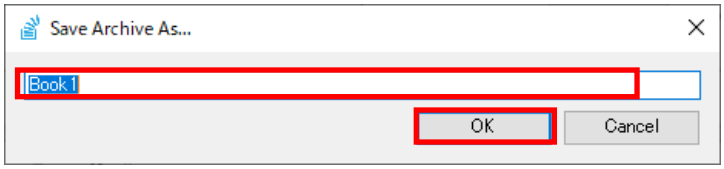
The details of the operation procedure are described below. Here, the connection procedure, READ setting, etc. are omitted.

1	Click the "Monitor Control" ribbon.	
2	Click the "Save connection setting to workbook " button.	
3	Enter your password. Click the "OK" button.	
4	If you leave the password empty and click the "OK" button, a warning dialog is displayed. If there is no problem in the left empty, click the "Yes" button.	 *Care must be taken in management as shown in the message in the figure.*
5	Save the EXCEL book.	

11.1.2. Save to XML

UA Monitor can save the created EXCEL screen and the connection information to the UA Server in the XML file. By Saving in the XML file, you can resume the connection from the XML file. The saved XML file is called an "archive".

The details of the operation procedure are described below. Here, the connection procedure, READ setting, etc. are omitted.

1	Click the "Monitor Control" ribbon.	
2	Click the "Create Archive" button.	
3	Set the save destination and file name. Click the "Save" button.	
4	Set the archive name. Click the "OK" button.	

12. Use case

12.1. Use case 1

A user who has a production line that manufactures a certain company's product manually inputs the production record and the number of defects of the day at a regular time every day, and creates daily report that calculate the target achievement rate by comparing with the plan. Since multiple PLCs are used in each production line process, it takes time to create a daily report. In order to shorten the time required to create this daily report, the user uses the OPC UA on-board PLC and UA Monitor for work improvement that reduces the workload of workers.

By using the Excel screen of UA Monitor and the function to save and restore the connection settings, just start Excel at a regular time every day, the daily report values will be automatically entered instead of being manually entered. This not only shortens the time required to create a form, but also prevents erroneous input of numerical values, allowing workers to focus on filling in reports, making it easier to create forms. Of course, even though it is a production line, it also uses the security function of OPC UA, so security measures can be taken at the same time.

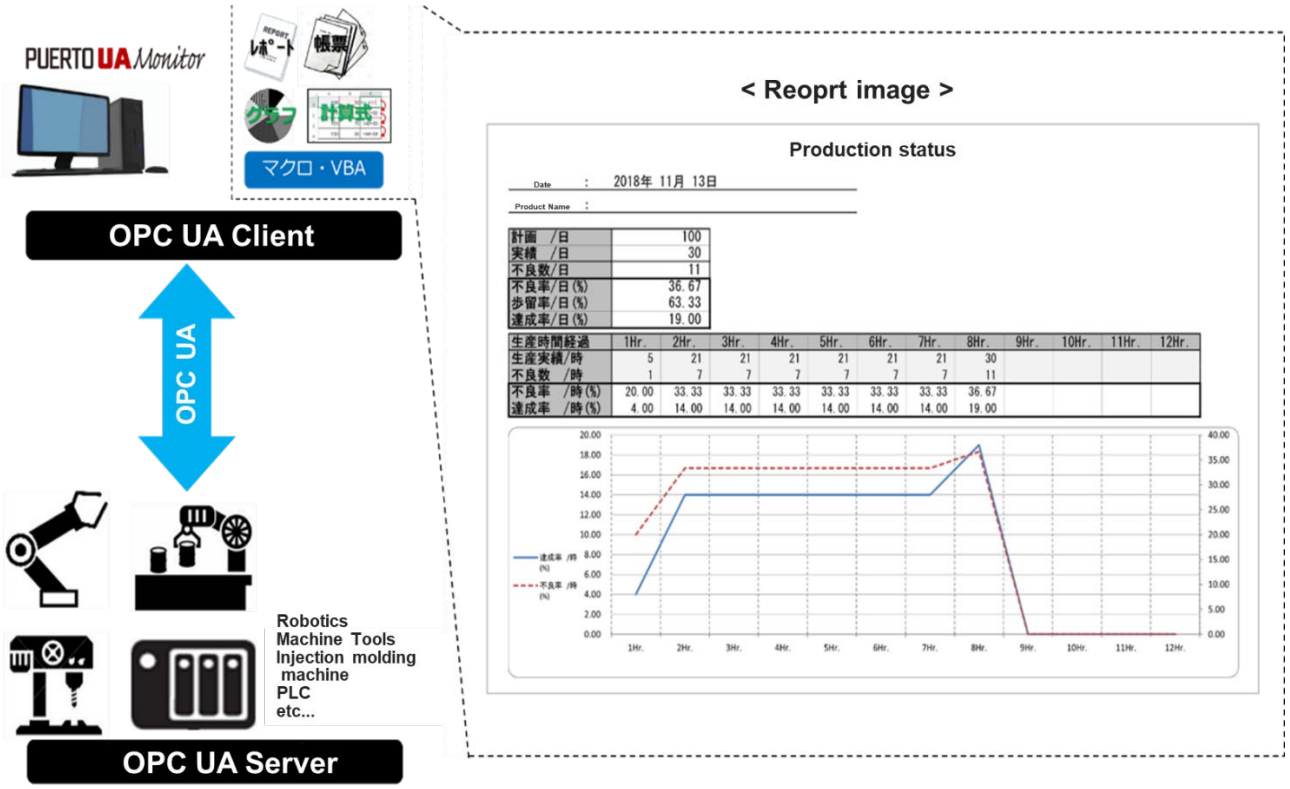


Figure 43 Automation of form creation using UaMonitor

12.2. Use case 2

This is an example of remotely monitoring the operating status of the company's factory from the head office using Excel. The company's factory and the head office are connected by a closed network, and a demilitarized zone (DMZ) is installed between the head office and the company's factory, and an OPC UA server for operation monitoring is installed on the DMZ . The OPC UA client in the factory notifies the OPC UA server on the DMZ of information such as temperature and humidity in addition to the actual value and the number of defects. From the head office, worker use UA Monitor, which is an OPC UA client, to check the environment, collect actual data, create forms, and create reports from EXCEL.

By utilizing OPC UA for communication and arranging DMZs between bases in this way, even if the OPC UA server in the DMZ is damaged, the DMZ can be used as a stepping stone to prevent damage to the network in the head office and factory.

By connecting with the OPC UA client from between bases, it is not necessary to open a connection port in the firewall, so information can be shared safely without lowering the security level.

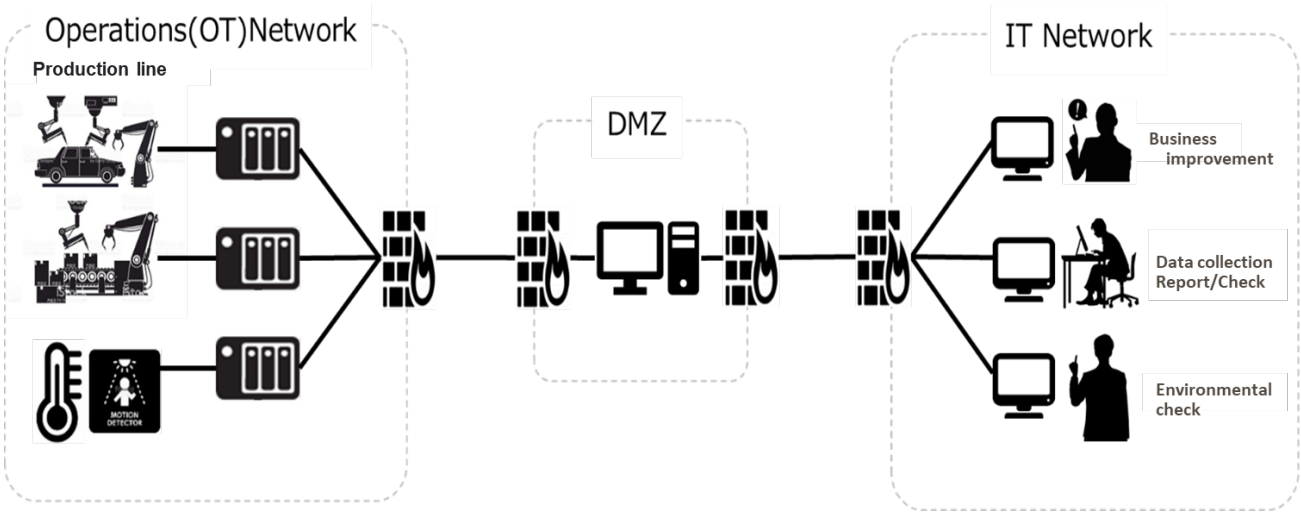


Figure 44 Remote monitoring using DMZ

Annex A. OPC UA Error Code List

Message	Error code	explanation
Good	0x00000000	Communication or processing was successful.
BadUnexpectedError	0x80010000	An unexpected error occurred.
BadInternalError	0x80020000	An internal error occurred as a result of a programming or configuration error.
BadOutOfMemory	0x80030000	Not enough memory to complete the operation.
BadResourceUnavailable	0x80040000	An operating system resource is not available.
BadCommunicationError	0x80050000	A low level communication error has occurred.
BadEncodingError	0x80060000	Encoding halted because of invalid data in the objects being serialized.
BadDecodingError	0x80070000	Decoding halted because of invalid data in the stream.
BadEncodingLimitsExceeded	0x80080000	The message encoding/decoding limits imposed by the stack have been exceeded.
BadRequestTooLarge	0x80B80000	The request message size exceeds limits set by the server.
BadResponseTooLarge	0x80B90000	The response message size exceeds limits set by the client.
BadUnknownResponse	0x80090000	An unrecognized response was received from the server.
BadTimeout	0x800A0000	The operation has timed out.
BadServiceUnsupported	0x800B0000	The server does not support the requested service.
BadShutdown	0x800C0000	The operation was canceled because the application has shut down.
BadServerNotConnected	0x800D0000	The operation could not be completed because the client is not connected to the server.
BadServerHalted	0x800E0000	The server has stopped and cannot process any requests.
BadNothingToDo	0x800F0000	There was nothing to do because the client passed a list of operations with no elements.
BadTooManyOperations	0x80100000	The request could not be processed because too many operations were specified.
BadTooManyMonitoredItems	0x80DB0000	The request could not be processed because there are too many monitoring items in the subscription.
BadDataTypeIdUnknown	0x80110000	The extended object cannot be restored because the data type ID is not recognized.
BadCertificateInvalid	0x80120000	The certificate specified as a parameter is invalid.
BadSecurityChecksFailed	0x80130000	An error occurred verifying security.
BadCertificateTimeInvalid	0x80140000	The certificate has expired or is not yet valid.
BadCertificateIssuerTimeInvalid	0x80150000	The issuer certificate has expired or is not yet valid.
BadCertificateHostNameInvalid	0x80160000	The host name used to connect to the server does not match the host name in the certificate.
BadCertificateUriInvalid	0x80170000	The URI specified in the Application Description does not match the certificate URI.
BadCertificateUseNotAllowed	0x80180000	The certificate cannot be used for the requested operation.
BadCertificateIssuerUseNotAllowed	0x80190000	The issuer certificate cannot be used for the requested operation.

Message	Error code	explanation
BadCertificateUntrusted	0x801A0000	The certificate is not trusted.
BadCertificateRevocationUnknown	0x801B0000	It was not possible to determine if the certificate has been revoked.
BadCertificateIssuerRevocationUnknown	0x801C0000	It was not possible to determine if the issuer certificate has expired.
BadCertificateRevoked	0x801D0000	The certificate has been revoked.
BadCertificateIssuerRevoked	0x801E0000	The issuer certificate has been revoked.
BadCertificateChainIncomplete	0x810D0000	The certificate chain is incomplete.
BadUserAccessDenied	0x801F0000	The user does not have permission to perform the requested operation.
BadIdentityTokenInvalid	0x80200000	The user ID token is invalid.
BadIdentityTokenRejected	0x80210000	The user ID token is valid, but the server rejected it.
BadSecureChannelIdInvalid	0x80220000	The specified secure channel is not valid.
BadInvalidTimestamp	0x80230000	The time stamp is outside the range allowed by the server.
BadNonceInvalid	0x80240000	The nonce is not a random value or is not the correct length.
BadSessionIdInvalid	0x80250000	The session ID is invalid.
BadSessionClosed	0x80260000	The session was closed by the client.
BadSessionNotActivated	0x80270000	The session cannot be used because ActivateSession has not been called.
BadSubscriptionIdInvalid	0x80280000	The subscription ID is invalid.
BadRequestHeaderInvalid	0x802A0000	The request header is missing or invalid.
BadTimestampsToReturnInvalid	0x802B0000	The timestamp that returns the parameter is invalid.
BadRequestCancelledByClient	0x802C0000	The request was canceled by the client.
BadTooManyArguments	0x80E50000	There are too many arguments.
BadLicenseExpired	0x810E0000	The server requires a license to operate in general or to perform a service or operation, but existing license is expired.
BadLicenseLimitsExceeded	0x810F0000	The server has limits on number of allowed operations / objects, based on installed licenses, and these limits where exceeded.
BadLicenseNotAvailable	0x81100000	The server does not have a license which is required to operate in general or to perform a service or operation.
BadNoCommunication	0x80310000	Communication with the data source is defined, but not established, and there is no last known value available.
BadWaitingForInitialData	0x80320000	The UA server is waiting to get the value from the data source.
BadNodeIdInvalid	0x80330000	The node id syntax is invalid.
BadNodeIdUnknown	0x80340000	The node id does not exist in the address space of the UA server.
BadAttributeIdInvalid	0x80350000	The specified attribute Id is not supported on the specified node.
BadIndexRangeInvalid	0x80360000	The index range parameter syntax is invalid.
BadIndexRangeNoData	0x80370000	No data exists within the specified index range.
BadDataEncodingInvalid	0x80380000	Data encoding is invalid.
BadDataEncodingUnsupported	0x80390000	The UA server does not support the data encoding required by the node.
BadNotReadable	0x803A0000	Nodes are not allowed to read or subscribe.
BadNotWritable	0x803B0000	Writing to the node is not allowed.
BadOutOfRange	0x803C0000	The value is out of range.

Message	Error code	explanation
BadNotSupported	0x803D0000	The requested operation is not supported.
BadNotFound	0x803E0000	A requested item was not found or a search operation ended without success.
BadObjectDeleted	0x803F0000	The object has been deleted and cannot be used.
BadNotImplemented	0x80400000	The requested operation is not implemented.
BadMonitoringModeInvalid	0x80410000	The monitoring mode is invalid.
BadMonitoredItemIdInvalid	0x80420000	The monitored item ID does not refer to a valid monitored item.
BadMonitoredItemFilterInvalid	0x80430000	The item filter parameter to be monitored is invalid.
BadMonitoredItemFilterUnsupported	0x80440000	The UA server does not support the requested monitoring item filter.
BadFilterNotAllowed	0x80450000	Monitoring filters cannot be used in combination with the specified attributes.
BadStructureMissing	0x80460000	Required fields for structuring are missing or null.
BadEventFilterInvalid	0x80470000	The event filter is invalid.
BadContentFilterInvalid	0x80480000	Content filtering is disabled.
BadFilterOperatorInvalid	0x80C10000	An unrecognized operation was provided to the filter.
BadFilterOperatorUnsupported	0x80C20000	A valid operator has been provided, but the UA server does not support this filter operator.
BadFilterOperandCountMismatch	0x80C30000	The number of operands provided to the filter operation, the pre-against has been provided operand was not synchronize.
BadFilterOperandInvalid	0x80490000	The operand used in the content filter is invalid.
BadFilterElementInvalid	0x80C40000	The referenced element is not a valid element in the content filter.
BadFilterLiteralInvalid	0x80C50000	The referenced literal is not a valid value.
BadContinuationPointInvalid	0x804A0000	Providing continuation points is effective.
BadNoContinuationPoints	0x804B0000	The operation could not be processed because all continuation points have been assigned.
BadReferenceTypeIdInvalid	0x804C0000	The reference type ID does not refer to a valid reference type node.
BadBrowseDirectionInvalid	0x804D0000	The reference direction is invalid.
BadNodeNotInView	0x804E0000	The node is not part of the view.
BadServerUriInvalid	0x804F0000	The server URI is not a valid URI.
BadServerNameMissing	0x80500000	The server name is not specified.
BadDiscoveryUrlMissing	0x80510000	DiscoveryUrl is not specified.
BadSempahoreFileMissing	0x80520000	The semaphore file specified by the client is invalid.
BadRequestTypeInvalid	0x80530000	The security token request type is invalid.
BadSecurityModeRejected	0x80540000	The security mode does not meet the requirements set by the server.
BadSecurityPolicyRejected	0x80550000	The security policy does not meet the requirements set by the server.
BadTooManySessions	0x80560000	The server has reached the maximum number of sessions.
BadUserSignatureInvalid	0x80570000	The user token is unsigned or invalid.
BadApplicationSignatureInvalid	0x80580000	The signature generated by the client certificate is missing or invalid.
BadNoValidCertificates	0x80590000	The client did not provide at least one software certificate that is valid and meets the profile requirements for the server.
BadIdentityChangeNotSupported	0x80C60000	The server does not support changing the user ID assigned to a session.

Message	Error code	explanation
BadRequestCancelledByRequest	0x805A0000	The request was canceled by the client with the cancellation service.
BadParentNodeIdInvalid	0x805B0000	The parent node id does not refer to a valid node.
BadReferenceNotAllowed	0x805C0000	The reference could not be created because it violates the constraints imposed by the data model.
BadNodeIdRejected	0x805D0000	The requested node id was rejected because the requested node id was invalid or the server was unable to specify the node id by the client.
BadNodeIdExists	0x805E0000	The requested node id is already in use by another node.
BadNodeClassInvalid	0x805F0000	The node class is invalid.
BadBrowseNameInvalid	0x80600000	The browse name is invalid.
BadBrowseNameDuplicated	0x80610000	Reference names are not unique among nodes that share the same relationship with their parents.
BadNodeAttributesInvalid	0x80620000	Node attributes are not valid for node classes.
BadTypeDefinitionInvalid	0x80630000	The type definition node id does not reference an appropriate type node.
BadSourceNodeIdInvalid	0x80640000	The source node id does not reference a valid node.
BadTargetNodeIdInvalid	0x80650000	The target node id does not reference a valid node.
BadDuplicateReferenceNotAllowed	0x80660000	The reference type between the nodes is already defined.
BadInvalidSelfReference	0x80670000	The server does not allow this type of self reference on this node.
BadReferenceLocalOnly	0x80680000	The reference type is not valid for a reference to a remote server.
BadNoDeleteRights	0x80690000	The server will not allow the node to be deleted.
UncertainReferenceNotDeleted	0x40BC0000	The server was not able to delete all target references.
BadServerIndexInvalid	0x806A0000	The server index is not valid.
BadViewIdUnknown	0x806B0000	The view id does not refer to a valid view node.
BadViewTimestampInvalid	0x80C90000	The view timestamp is not available or not supported.
BadViewParameterMismatch	0x80CA0000	The view parameters are not consistent with each other.
BadViewVersionInvalid	0x80CB0000	The view version is not available or not supported.
UncertainNotAllNodesAvailable	0x40C00000	The list of references may not be complete because the underlying system is not available.
BadNotTypeDefinition	0x80C80000	The provided node id was not a type definition node id.
UncertainReferenceOutOfServer	0x406C0000	One of the references to follow in the relative path references to a node in the address space in another server.
BadTooManyMatches	0x806D0000	The requested operation has too many matches to return.
BadQueryTooComplex	0x806E0000	The requested operation requires too many resources in the server.
BadNoMatch	0x806F0000	The requested operation has no match to return.
BadMaxAgeInvalid	0x80700000	The max age parameter is invalid.
BadSecurityModeInsufficient	0x80E60000	The operation is not permitted over the current secure channel.
BadHistoryOperationInvalid	0x80710000	The history details parameter is not valid.
BadHistoryOperationUnsupported	0x80720000	The server does not support the requested operation.
BadInvalidTimestampArgument	0x80BD0000	The defined timestamp to return was invalid.
BadWriteNotSupported	0x80730000	The server does not support writing the combination of value, status and

Message	Error code	explanation
		timestamps provided.
BadTypeMismatch	0x80740000	The value supplied for the attribute is not of the same type as the attribute's value.
BadMethodInvalid	0x80750000	The method id does not refer to a method for the specified object.
BadArgumentsMissing	0x80760000	The client did not specify all of the input arguments for the method.
BadTooManySubscriptions	0x80770000	The server has reached its maximum number of subscriptions.
BadTooManyPublishRequests	0x80780000	The server has reached the maximum number of queued publish requests.
BadNoSubscription	0x80790000	There is no subscription available for this session.
BadSequenceNumberUnknown	0x807A0000	The sequence number is unknown to the server.
BadMessageNotAvailable	0x807B0000	The requested notification message is no longer available.
BadInsufficientClientProfile	0x807C0000	The client of the current session does not support one or more Profiles that are necessary for the subscription.
BadStateNotActive	0x80BF0000	The sub-state machine is not currently active.
BadTcpServerTooBusy	0x807D0000	The server cannot process the request because it is too busy.
BadTcpMessageTypeInvalid	0x807E0000	The type of the message specified in the header invalid.
BadTcpSecureChannelUnknown	0x807F0000	The SecureChannelId and/or TokenId are not currently in use.
BadTcpMessageTooLarge	0x80800000	The size of the message specified in the header is too large.
BadTcpNotEnoughResources	0x80810000	There are not enough resources to process the request.
BadTcpInternalError	0x80820000	An internal error occurred.
BadTcpEndpointUrlInvalid	0x80830000	The server does not recognize the QueryString specified.
BadRequestInterrupted	0x80840000	The request could not be sent because of a network interruption.
BadRequestTimeout	0x80850000	Timeout occurred while processing the request.
BadSecureChannelClosed	0x80860000	The secure channel has been closed.
BadSecureChannelTokenUnknown	0x80870000	The token has expired or is not recognized.
BadSequenceNumberInvalid	0x80880000	The sequence number is not valid.
BadProtocolVersionUnsupported	0x80BE0000	The applications do not have compatible protocol versions.
BadDeviceFailure	0x808B0000	There has been a failure in the device/data source that generates the value that has affected the value.
BadSensorFailure	0x808C0000	There has been a failure in the sensor from which the value is derived by the device/data source.
BadOutOfService	0x808D0000	The source of the data is not operational.
BadDeadbandFilterInvalid	0x808E0000	The deadband filter is not valid.
BadConditionAlreadyDisabled	0x80980000	This condition has already been disabled.
BadConditionAlreadyEnabled	0x80CC0000	This condition has already been enabled.
BadInvalidArgument	0x80AB0000	One or more arguments are invalid.
BadConnectionRejected	0x80AC0000	Could not establish a network connection to remote server.
BadDisconnect	0x80AD0000	The server has disconnected from the client.
BadConnectionClosed	0x80AE0000	The network connection has been closed.
BadInvalidState	0x80AF0000	The operation cannot be completed because the object is closed, uninitialized or in some other invalid state.

Message	Error code	explanation
BadEndOfStream	0x80B00000	Cannot move beyond end of the stream.

Revision history

Revision	Date of issue	Revised content
1.0	2016/07/23	Create New
2.0	2017/12/23	A description of additional features for OPC Foundation certification.
2.1	2018/03/11	Added error code list.
3.0	2019/12/10	Document format change.
3.1	2020/08/28	Reflects GUI changes.

PUERTO UA Monitor
User's Guide

Created by Puerto Co., Ltd.

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