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TransSECS for an OPCUA Server

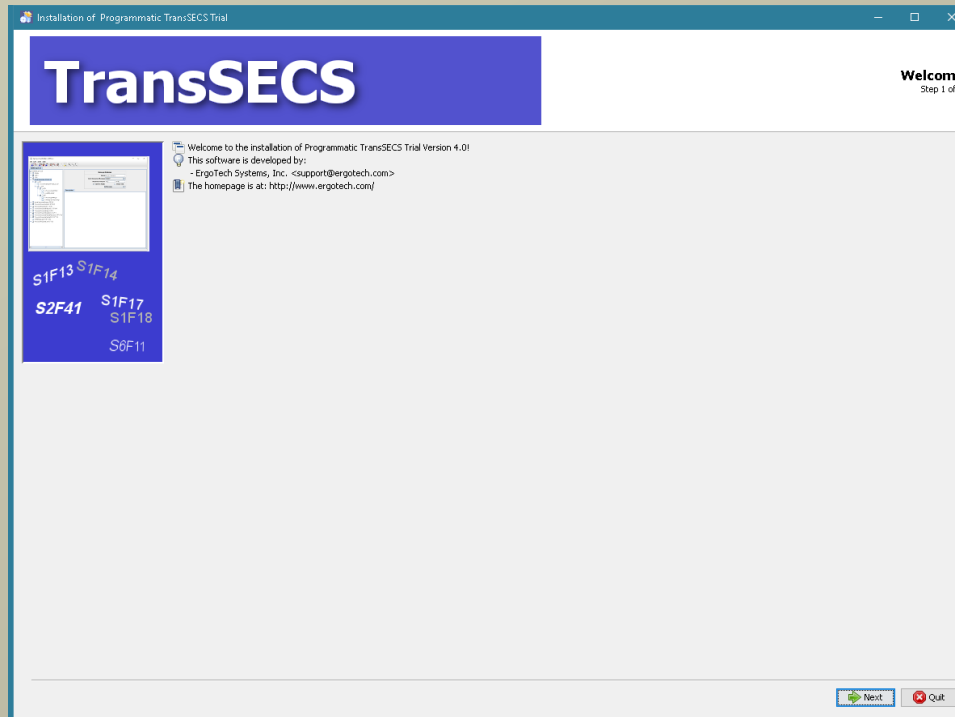
Using Servers TransSECS to Create an
OPCUA SECS/GEM Tool Interface



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Installing TransSECS



Double click on the installer and click **Next** when prompted. Once installed, start the TransSECS Builder application (MIStudioSuite/TransSECS/Builder/TransSECS.exe)



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The example GEMTool will be loaded when you start the TransSECS Builder

The tool interface defaults to running on port 5010 (HSMS)

The screenshot displays the TransSECS Builder application window titled "TransSECS Build:12382 - GEMTool". The interface includes a menu bar (File, Edit, Tools, Help) and a toolbar. On the left, a tree view shows the project structure under "GEMTool", including folders for CEIDs, ALIDs, and VIDs, and several HostCommand entries. The main area is divided into two panes. The top pane, titled "Tool Attributes", contains the following configuration fields: "Tool Name" (GEMTool), "Host" (radio button), "Equip." (radio button), "Uses GEM" (checked checkbox), "Device ID" (1), "Port" (5010), "Baud Rate" (9600), a row of test parameters (T1:0.5, T2:0.0, T3:45.0, T4:45.0, T6:5.0, T7:10.0), and "Deployment Type" (OPCUA Server). The bottom pane, titled "Description", contains the text: "A GEM Tool for testing a minimal subset of SECS/GEM. Use the GEMHost project as a test host." Two yellow callout boxes with arrows point to the "Port" field (5010) and the "Device ID" field (1).

and Device ID 1



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Select the type of server for deployment

The screenshot shows the 'GEMTool' application window. The 'Tool Attributes' dialog box is open, displaying the following fields:

- Tool Name: GEMTool
- Host: Host Equip.
- Uses GEM:
- Device ID: 1
- Port: 5010
- Baud Rate: 9600
- T1: 0.5, T2: 10.0, T3: 45.0, T4: 45.0, T6: 5.0, T7: 10.0
- Deployment Type: OPCUA Server (selected)

The 'Deployment Type' dropdown menu is open, showing the following options:

- OPCUA Server
- OPCLegacy/DA Server
- MQTT Server

A yellow callout box points to the 'MQTT Server' option with the text: "TransSECS Servers has several deployment options. The default is OPCUA. Be sure it is always selected while you work on the project."



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Press the Hammer/Star button to build the project

TransSecs Build:12382 - GEMTool

File Edit Tools Help

GEMTool

Compiles all code for project.

Tool Attributes

Tool Name: GEMTool Host Equip.

Uses GEM

Device ID: 1 Port: 5010 Baud Rate: 9600

T1: 0.5 T2: 10.0 T3: 45.0 T4: 45.0 T6: 5.0 T7: 10.0

Deployment Type: OPCUA Server

Description

A GEM Tool for testing a minimal subset of SECS/GEM. Use the GEMHost project as a test host.



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When the "Compilation" popup closes the build is complete.
This may take a minute or so.

The screenshot displays the 'TransSECS Build:12382 - GEMTool' application window. The interface includes a menu bar (File, Edit, Tools, Help) and a toolbar. On the left, a tree view shows the project structure under 'GEMTool', including folders for CEIDs, ALIDs, and VIDs, along with host command settings. The main area is divided into two panes: 'Tool Attributes' and 'Description'. The 'Tool Attributes' pane contains fields for Tool Name (GEMTool), Host (radio button), Equip. (radio button), Uses GEM (checkbox), Device ID (1), Port (5010), Baud Rate (9600), and a table of timing parameters (T1 to T7). The 'Description' pane contains text about the tool's purpose. A 'Compilation' popup window is overlaid on the main interface, displaying an information icon, the text 'Building All Files', and a 'Cancel' button. An arrow points from the text above to the 'Compilation' popup.

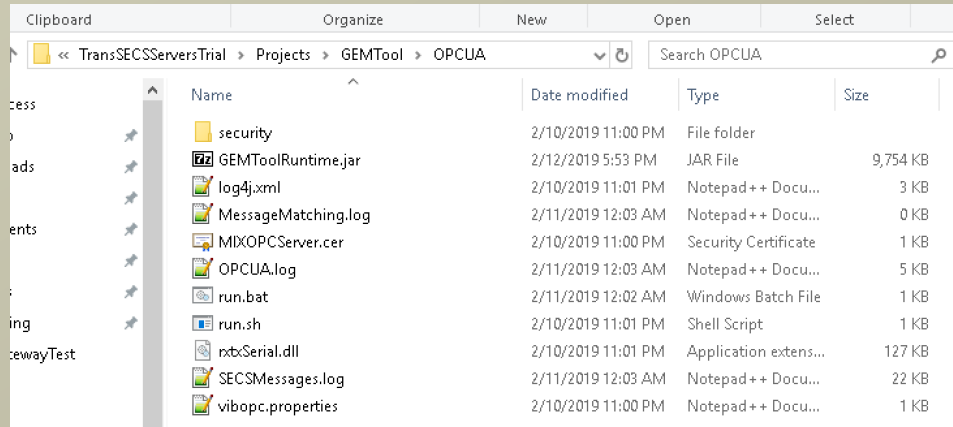
TransSECS has many features which are described in the documentation, but for this demonstration, just building the sample is sufficient.



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After the code is generated the server code for the tool will be in the Projects/GEMTool/OPCUA directory.



Everything you need to run on Windows is in this directory. For Linux systems you will need install rxtxSerial on the system and make appropriate changes to the run.sh file.

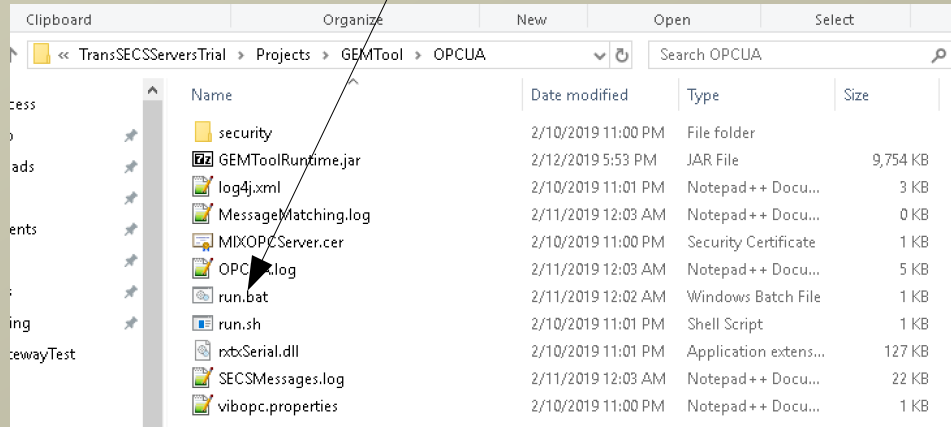
You may need to edit the path to the jre in run.bat if you move the deployment location.



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Run the server with the run.bat file.





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Run the SECS/GEM Interface as an OPCUA Server

```
C:\WINDOWS\system32\cmd.exe

C:\Users\Public\ErgoTech\TransSECSServersTrial\Projects\GEMTool\OPCUA>java deploy.GEMTool.EquipmentController
Started tool GEMTool on port 5010 device id 1
2019-03-09 10:53:21.291 [createFolderNode( gemtool:gemtool)]2019-03-09 10:53:21.291
2019-03-09 10:53:21.291 [createFolderNode( vids:gemtool/vids)]2019-03-09 10:53:21.291
2019-03-09 10:53:21.306 [creatingNode( s5flreplybit:com.ergotech.secs.gem.GemECID periodic false)]2019-03-09 10:53:21.306
2019-03-09 10:53:21.306 [createFolderNode( configuration:gemtool/configuration)]2019-03-09 10:53:21.306
2019-03-09 10:53:21.306 [creatingNode( port:deploy.GEMTool.EquipmentController$1 periodic false)]2019-03-09 10:53:21.306
2019-03-09 10:53:21.306 [creatingNode( deviceid:deploy.GEMTool.EquipmentController$1 periodic false)]2019-03-09 10:53:21.306
2019-03-09 10:53:21.306 [creatingNode( passivet1:deploy.GEMTool.EquipmentController$1 periodic false)]2019-03-09 10:53:21.306
2019-03-09 10:53:21.306 [creatingNode( passivet2:deploy.GEMTool.EquipmentController$1 periodic false)]2019-03-09 10:53:21.306
2019-03-09 10:53:21.306 [creatingNode( passivet3:deploy.GEMTool.EquipmentController$1 periodic false)]2019-03-09 10:53:21.306
2019-03-09 10:53:21.306 [creatingNode( passivet4:deploy.GEMTool.EquipmentController$1 periodic false)]2019-03-09 10:53:21.306
2019-03-09 10:53:21.306 [creatingNode( passivet5:deploy.GEMTool.EquipmentController$1 periodic false)]2019-03-09 10:53:21.306
2019-03-09 10:53:21.306 [creatingNode( passivet6:deploy.GEMTool.EquipmentController$1 periodic false)]2019-03-09 10:53:21.306
2019-03-09 10:53:21.306 [creatingNode( passivet7:deploy.GEMTool.EquipmentController$1 periodic false)]2019-03-09 10:53:21.306
2019-03-09 10:53:21.306 [creatingNode( passivet8:deploy.GEMTool.EquipmentController$1 periodic false)]2019-03-09 10:53:21.306
2019-03-09 10:53:21.306 [creatingNode( baudrate:deploy.GEMTool.EquipmentController$1 periodic false)]2019-03-09 10:53:21.306
2019-03-09 10:53:21.306 [creatingNode( persistencefilename:deploy.GEMTool.EquipmentController$1 periodic false)]2019-03-09 10:53:21.306
2019-03-09 10:53:21.306 [createFolderNode( hostcommandstart:gemtool/hostcommandstart)]2019-03-09 10:53:21.306
2019-03-09 10:53:21.322 [creatingNode( cpvalue:deploy.GEMTool.HostCommandSTART periodic false)]2019-03-09 10:53:21.322
2019-03-09 10:53:21.322 [vib.utils.VIBOPC > setValueObject( PrimaryOutPort:0 ) setValueObject="RecipeName" ]]2019-03-09 10:53:21.322
2019-03-09 10:53:21.322 [creatingNode( responsestatus:deploy.GEMTool.HostCommandSTART periodic false)]2019-03-09 10:53:21.322
2019-03-09 10:53:21.322 [creatingNode( errorstatus:deploy.GEMTool.HostCommandSTART periodic false)]2019-03-09 10:53:21.322
2019-03-09 10:53:21.322 [creatingNode( command:deploy.GEMTool.HostCommandSTART periodic false)]2019-03-09 10:53:21.322
2019-03-09 10:53:21.322 [vib.utils.VIBOPC > setValueObject( PrimaryOutPort:3 ) setValueObject="START" ]]2019-03-09 10:53:21.322
2019-03-09 10:53:21.322 [creatingNode( goodstatus:deploy.GEMTool.HostCommandSTART periodic false)]2019-03-09 10:53:21.322
2019-03-09 10:53:21.322 [creatingNode( spoolfulltime:com.ergotech.secs.gem.GemSVID periodic false)]2019-03-09 10:53:21.322
2019-03-09 10:53:21.322 [vib.utils.VIBOPC > setValueObject( PrimaryOutPort:0 ) setValueObject="0" ]]2019-03-09 10:53:21.322
2019-03-09 10:53:21.322 [creatingNode( spoolcounttotal:com.ergotech.secs.gem.GemSVID periodic false)]2019-03-09 10:53:21.322
2019-03-09 10:53:21.322 [vib.utils.VIBOPC > setValueObject( PrimaryOutPort:0 ) setValueObject="0" ]]2019-03-09 10:53:21.322
2019-03-09 10:53:21.337 [creatingNode( cclock:com.ergotech.secs.gem.GemCLOCK periodic false)]2019-03-09 10:53:21.337
2019-03-09 10:53:21.337 [vib.utils.VIBOPC > setValueObject( PrimaryOutPort:0 ) setValueObject="0" ]]2019-03-09 10:53:21.337
```

When you run the generated run.bat, the tool's SECS/GEM will be running on Port 5010 and Device ID 1 as an OPCUA server.



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Run the SECS/GEM Interface as an OPCUA Server

```
C:\WINDOWS\system32\cmd.exe

C:\Users\Public\ErgoTech\TransSECSServersTrial\Projects\GEMTool\OPCUA>java deploy.GEMTool.EquipmentController
Started tool GEMTool on port 5010 device id 1
2019-03-09 10:53:21.291 [createFolderNode( gemtool:gemtool)]2019-03-09 10:53:21.291
2019-03-09 10:53:21.291 [createFolderNode( vids:gemtool/vids)]2019-03-09 10:53:21.291
2019-03-09 10:53:21.306 [creatingNode( s5flreplybit:com.ergotech.secs.gem.GemECID periodic false)]2019-03-09 10:53:21.306
2019-03-09 10:53:21.306 [createFolderNode( configuration:gemtool/configuration)]2019-03-09 10:53:21.306
2019-03-09 10:53:21.306 [creatingNode( port:deploy.GEMTool.EquipmentController$1 periodic false)]2019-03-09 10:53:21.306
2019-03-09 10:53:21.306 [creatingNode( deviceid:deploy.GEMTool.EquipmentController$1 periodic false)]2019-03-09 10:53:21.306
2019-03-09 10:53:21.306 [creatingNode( passivet1:deploy.GEMTool.EquipmentController$1 periodic false)]2019-03-09 10:53:21.306
2019-03-09 10:53:21.306 [creatingNode( passivet2:deploy.GEMTool.EquipmentController$1 periodic false)]2019-03-09 10:53:21.306
2019-03-09 10:53:21.306 [creatingNode( passivet3:deploy.GEMTool.EquipmentController$1 periodic false)]2019-03-09 10:53:21.306
2019-03-09 10:53:21.306 [creatingNode( passivet4:deploy.GEMTool.EquipmentController$1 periodic false)]2019-03-09 10:53:21.306
2019-03-09 10:53:21.306 [creatingNode( passivet5:deploy.GEMTool.EquipmentController$1 periodic false)]2019-03-09 10:53:21.306
2019-03-09 10:53:21.306 [creatingNode( passivet6:deploy.GEMTool.EquipmentController$1 periodic false)]2019-03-09 10:53:21.306
2019-03-09 10:53:21.306 [creatingNode( passivet7:deploy.GEMTool.EquipmentController$1 periodic false)]2019-03-09 10:53:21.306
2019-03-09 10:53:21.306 [creatingNode( passivet8:deploy.GEMTool.EquipmentController$1 periodic false)]2019-03-09 10:53:21.306
2019-03-09 10:53:21.306 [creatingNode( baudrate:deploy.GEMTool.EquipmentController$1 periodic false)]2019-03-09 10:53:21.306
2019-03-09 10:53:21.306 [creatingNode( persistencefilename:deploy.GEMTool.EquipmentController$1 periodic false)]2019-03-09 10:53:21.306
2019-03-09 10:53:21.306 [createFolderNode( hostcommandstart:gemtool/hostcommandstart)]2019-03-09 10:53:21.306
2019-03-09 10:53:21.322 [creatingNode( cpvalue:deploy.GEMTool.HostCommandSTART periodic false)]2019-03-09 10:53:21.322
2019-03-09 10:53:21.322 [vib.utils.VIBOPC > setValueObject( PrimaryOutPort:0 ) setValueObject="RecipeName" ]]2019-03-09 10:53:21.322
2019-03-09 10:53:21.322 [creatingNode( responsestatus:deploy.GEMTool.HostCommandSTART periodic false)]2019-03-09 10:53:21.322
2019-03-09 10:53:21.322 [creatingNode( errorstatus:deploy.GEMTool.HostCommandSTART periodic false)]2019-03-09 10:53:21.322
2019-03-09 10:53:21.322 [creatingNode( command:deploy.GEMTool.HostCommandSTART periodic false)]2019-03-09 10:53:21.322
2019-03-09 10:53:21.322 [vib.utils.VIBOPC > setValueObject( PrimaryOutPort:3 ) setValueObject="START" ]]2019-03-09 10:53:21.322
2019-03-09 10:53:21.322 [creatingNode( goodstatus:deploy.GEMTool.HostCommandSTART periodic false)]2019-03-09 10:53:21.322
2019-03-09 10:53:21.322 [creatingNode( spoolfulltime:com.ergotech.secs.gem.GemSVID periodic false)]2019-03-09 10:53:21.322
2019-03-09 10:53:21.322 [vib.utils.VIBOPC > setValueObject( PrimaryOutPort:0 ) setValueObject="0" ]]2019-03-09 10:53:21.322
2019-03-09 10:53:21.322 [creatingNode( spoolcounttotal:com.ergotech.secs.gem.GemSVID periodic false)]2019-03-09 10:53:21.322
2019-03-09 10:53:21.322 [vib.utils.VIBOPC > setValueOb
2019-03-09 10:53:21.337 [creatingNode( clock:com.ergot
2019-03-09 10:53:21.337 [vib.utils.VIBOPC > setValueOb
```

The SECS/GEM OPCUA Server endpoint URL is
opc.tcp://127.0.0.1:12686/MIXOPCServer



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Test the SECS/GEM Interface with TransSECS GEMHost using TransSECSTest.exe

Name	Date modified	Type	Size
application.properties	12/21/2018 1:30 PM	Notepad++ Docu...	1 KB
build_properties.log	12/21/2018 1:00 PM	Notepad++ Docu...	9 KB
ErgoTech.lic	10/11/2018 3:39 PM	LIC File	1 KB
log4j.xml	10/11/2018 3:38 PM	Notepad++ Docu...	3 KB
MessageMatching.log	12/21/2018 12:59 ...	Notepad++ Docu...	0 KB
pid.txt	12/21/2018 12:59 ...	Notepad++ Docu...	1 KB
secs.dtd	10/11/2018 3:38 PM	DTD File	5 KB
SECSMessages.log	12/21/2018 1:30 PM	Notepad++ Docu...	6 KB
transsecs.ico	10/11/2018 3:38 PM	Icon	3 KB
TransSecsAntProject.xml	10/11/2018 3:38 PM	Notepad++ Docu...	56 KB
TransSECSProjectBuildLog.txt	12/21/2018 1:00 PM	Notepad++ Docu...	102 KB
TransSECSTest	10/11/2018 3:38 PM	File	98 KB
TransSECSTest.conf	10/11/2018 3:38 PM	CONF File	10 KB
TransSECSTest.exe	10/11/2018 3:38 PM	Application	112 KB
wrapper.log	12/21/2018 1:00 PM	Notepad++ Docu...	3 KB

This starts TransSECS with the GEMHost project which runs as a Host to test the tool interface.

Note: If the ExtendedHost is loaded when TransSECSTest is started, use the File menu to load the GEMHost project.



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Run TransSECS as a test host

Set to LIVE mode before building the GEMHost project

Tool Attributes

Tool Name: GEMHost Host Equip.

Tool IP Addr...: localhost Uses GEM

Device ID: 1 Port: 5010 Baud Rate: 19200

T1|0.5 T2|10.0 T3|45.0 T4|45.0 T6|5.0 T7|10.0

Deployment Type: Test Host Only

Description

Sample Host for TransSECS. Use with the GEMTool project.

Build with the Hammer/
Star button

After the Host is built it will run and automatically connect to the GEMTool and set up event reports and enable alarms



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Run TransSECS Test as a host

This arrow shows that the host is running

The screenshot shows the 'TransSECS Build:12376 - GEMHost' application window. The left pane displays a tree view of the GEMHost structure, with 'SVIDRequest: S1F23 W' selected. The right pane shows a log of messages, including 'SENT: 2018.12.21 15:56:06.153' and 'RECEIVED: 2018.12.21 15:56:06.652'. The 'Send Message' button is highlighted at the bottom.

Select a primary (outgoing) message and Press "Send Message" button to send it

Messages sent and received will be shown in the Messages panel (when a message is selected)



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Send an S1F3 test message to the tool

Select the S1F3 Message.

The screenshot shows the TransSecs software interface. On the left is a tree view under 'GEMHost' with various message types listed. The 'SVIDRequest: S1F3' item is selected. In the center, there is a text input field labeled 'SVID' containing the value '1510'. On the right, a message log displays several received and sent messages, including S1F1, S1F2, and S1F3. At the bottom of the window, there is a 'Send Message' button, along with checkboxes for 'Log Bytes', 'Log Events', and 'Lock Scroll', and a 'Clear Display' button.

Change the SVID you want to request

Press the Send Message button to send the message to the tool



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The sent message and its reply will appear
in the Message Panel

GEMHost

SVID 1510

```
SENT: 2019.02.12 19:38:00.292
S2F37 W <L[2]
<BOOLEAN 1>
<L[2]
<U4 7501>
<U4 7502>
>
.
RECEIVED: 2019.02.12 19:38:00.295
S2F38 <B 0x0> /* Decimal[1]: 0 */
.
SENT: 2019.02.12 19:38:00.295
S1F1 W .
RECEIVED: 2019.02.12 19:38:00.303
S1F2 <L[2]
<A Model>
<A Rev1.0>
>
.
SENT: 2019.02.12 19:38:56.540
S1F3 W <L[1]
<U4 1510>
>
.
RECEIVED: 2019.02.12 19:38:56.541
S1F4 <L[1]
<U4 0>
>
.
```

Send Message Log Bytes Log Events Lock Scroll Clear Display

The S1F3 message

The S1F4 reply



Test an OPCUA Client Connection

This example will use the UAExpert Reference Client to test the OPCUA SECS/GEM Server.

<https://www.unified-automation.com/products/development-tools/uaexpert.html>

The steps are basically the same for any OPCUA Client:

- 1) Run the OPCUA Client
- 2) configure a connection to the SECS/GEM OPCUA Server
- 3) connect to the SECS/GEM OPCUA Server
- 4) resolve security certificate issues



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Start UAExpert and Add a new OPCUA Server

Right Click on the Servers node to add a new OPCUA server connection

Attributes

Attribute	Value
-----------	-------

References

Reference	Target DisplayName
-----------	--------------------

Log

Timestamp	Source	Server	Message
3/9/2019 11:05:45.267 AM	UaExpert		UaExpert is ready to use.
3/9/2019 11:05:45.257 AM	UaExpert		Loaded GDS Plugin (Static Plugin).
3/9/2019 11:05:45.257 AM	UaExpert		Loaded Data Logger Plugin (Static Plugin).
3/9/2019 11:05:45.257 AM	UaExpert		Loaded Server Diagnostic Plugin (Static Plugin).
3/9/2019 11:05:45.257 AM	UaExpert		Loaded Image Viewer Plugin (Static Plugin).
3/9/2019 11:05:45.257 AM	UaExpert		Loaded UA Performance Plugin (Static Plugin).
3/9/2019 11:05:45.257 AM	UaExpert		Loaded UA Method Plugin (Static Plugin).
3/9/2019 11:05:45.257 AM	UaExpert		Loaded UA Events Plugin (Static Plugin).
3/9/2019 11:05:45.257 AM	UaExpert		Loaded UA History Plugin (Static Plugin).
3/9/2019 11:05:45.257 AM	UaExpert		Loaded Data Access Plugin (Static Plugin).



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Configure the Server in UAExpert

Name the OPCUA Server connection

Enter the Endpoint URL for the SECS/GEM OPCUA Server

Select the Security Policy and Message Security Mode. All choices, including NONE is valid for the SECS/GEM OPCUA Server.

A screenshot of the 'Add Server' dialog box in UAExpert. The dialog has a title bar with a question mark and a close button. It contains several sections: 'Configuration Name' with a text box containing 'SECS OPCUA Server'; 'Discovery' and 'Advanced' tabs; 'Server Information' with an 'Endpoint Url' text box containing 'opc.tcp://127.0.0.1:12686/MIXOPCServer'; 'Security Settings' with a 'Security Policy' dropdown menu set to 'Basic256Sha256' and a 'Message Security Mode' dropdown menu set to 'Sign & Encrypt'; 'Authentication Settings' with radio buttons for 'Anonymous', 'Username', 'Certificate', and 'Private Key', and corresponding text boxes; and 'Session Settings' with a 'Session Name' text box containing 'urn:Win7Dev:UnifiedAutomation:UaExpert'. At the bottom, there is a checkbox for 'Connect Automatically' and 'OK' and 'Cancel' buttons.

Add Server

Configuration Name SECS OPCUA Server

Discovery Advanced

Server Information

Endpoint Url opc.tcp://127.0.0.1:12686/MIXOPCServer

Security Settings

Security Policy Basic256Sha256

Message Security Mode Sign & Encrypt

Authentication Settings

Anonymous

Username

Password Store

Certificate

Private Key

Session Settings

Session Name urn:Win7Dev:UnifiedAutomation:UaExpert

Connect Automatically

OK Cancel



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Connect to the OPCUA Server

Unified Automation UaExpert - The OPC Unified Architecture Client - NewProject*

File View Server Document Settings Help

Project

- Project
 - Servers
 - SECS OPCUA Serv
 - Documents
 - Data Access View

Address Space

Data Access View

References

Log

Right Click on the newly added server to select "Connect"

Timestamp	Source	Server	Message
3/10/2019 9:31:12.173 PM	DiscoveryWidget		Adding Server server application name not configured with URL opc.tcp://127.0.0.1:12686/MIX...
3/10/2019 9:31:08.604 PM	UaExpert		UaExpert is ready to use.
3/10/2019 9:31:08.596 PM	UaExpert		Loaded GDS Plugin (Static Plugin).
3/10/2019 9:31:08.596 PM	UaExpert		Loaded Data Logger Plugin (Static Plugin).
3/10/2019 9:31:08.596 PM	UaExpert		Loaded Server Diagnostic Plugin (Static Plugin).
3/10/2019 9:31:08.596 PM	UaExpert		Loaded Image Viewer Plugin (Static Plugin).
3/10/2019 9:31:08.596 PM	UaExpert		Loaded UA Performance Plugin (Static Plugin).
3/10/2019 9:31:08.596 PM	UaExpert		Loaded UA Method Plugin (Static Plugin).
3/10/2019 9:31:08.596 PM	UaExpert		Loaded UA Events Plugin (Static Plugin).
3/10/2019 9:31:08.596 PM	UaExpert		Loaded UA History Plugin (Static Plugin).

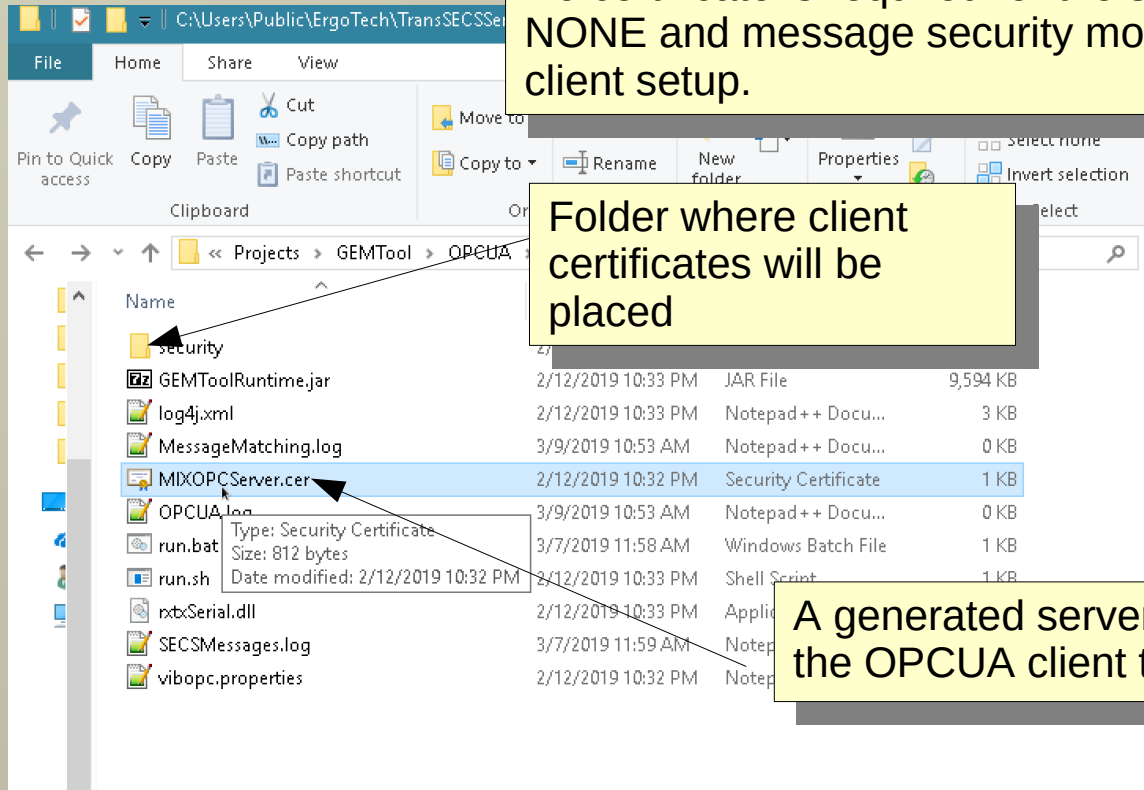


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OPCUA Certificates

OPCUA requires certificates for authentication. Note: No certificate is required for the security policy NONE and message security mode NONE in the client setup.





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UAExpert Certificate Exchange

During the first connection to the OPCUA Server the server's security certificate will be imported by UAExpert.

Validating the certificate of server 'server application name not configured' returned

Name	Trust Status
MIXOPCServer	Untrusted

Subject

Common Name	MIXOPCServer
Organization	ErgoTech
OrganizationUnit	
Locality	
State	
Country	
DomainComponent	

Issuer

Common Name	MIXOPCServer
Organization	ErgoTech
OrganizationUnit	
Locality	
State	
Country	
DomainComponent	

Validity

Valid From	Tue Feb 12 22:32:12 2019
Valid To	Fri Feb 9 22:32:12 2029

Info

Serial Number	770F156A
Signature Algorithm	RSA-SHA256
Cipher Strength	RSA (2048 bit)
Thumbprint (SHA1)	54BEB743DE81A713AAED6D97A96AC6EF12F4CE7D

Trust Server Certificate

Accept the server certificate temporarily for this session

Continue Cancel

The certificate has been imported but is not trusted.

For UAExpert, this certificate can be trusted by using the "Trust Server Certificate" button. For other clients, read the documentation for a similar procedure to install and trust the certificate.



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UAExpert Certificate Exchange

Certificate Validation

The certificate of server '**server application name not configured**' was validated successfully.

Good

Certificate Chain

Name	Trust Status
MIXOPCServer	Trusted

Certificate Details

Subject

Common Name	MIXOPCServer
Organization	ErgoTech
OrganizationUnit	
Locality	
State	
Country	
DomainComponent	

Issuer

Common Name	MIXOPCServer
Organization	ErgoTech
OrganizationUnit	
Locality	
State	
Country	
DomainComponent	

Validity

Valid From	Tue Feb 12 22:32:12 2019
Valid To	Fri Feb 9 22:32:12 2029

Info

Serial Number	770F156A
Signature Algorithm	RSA-SHA256
Cipher Strength	RSA (2048 bit)
Thumbprint (SHA1)	54BEB743DE81A713AAED6D97A96AC6EF12F4CE7D

Accept the server certificate temporarily for this session

The SECS/GEM OPCUA Server certificate is now installed for UAExpert and is trusted.



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UAExpert Certificate Exchange

There is one more certificate related step before the server connection can be made. The client has given the server its own certificate but it is not yet trusted by the SECS/GEM OPCUA Server.

Unified Automation UaExpert - The OPC Unified Architecture Client - transsecs

File View Server Document Settings Help

Project

- Project
 - Servers
 - SECS OPCUA Server
 - Documents
 - Data Access View

Address Space

References

Reference	Target DisplayName
-----------	--------------------

Log

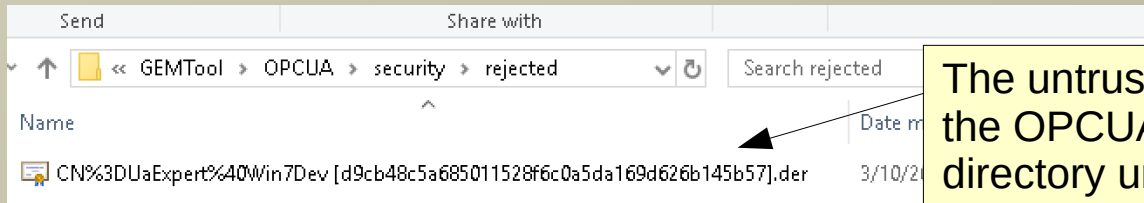
Security checks failed.

Timestamp	Source	Server	Message
3/7/2019 5:35:57.407 PM	Server Node	SECS OPCUA Server	Connecting failed with error 'BadSecurityChecksFailed'
3/7/2019 5:35:57.390 PM	Server Node	SECS OPCUA Server	Error 'BadSecurityChecksFailed' was returned during OpenSecureChannel
3/7/2019 5:35:57.390 PM	General		[uastack] OpcUa_TcpConnection_ProcessResponse: Reason: security checks failed
3/7/2019 5:35:57.390 PM	General		[uastack] OpcUa_TcpConnection_ProcessResponse: Status 0x80130000!
3/7/2019 5:35:57.390 PM	General		[uastack] OpcUa_TcpConnection_ProcessResponse: Error Message!
3/7/2019 5:35:57.344 PM	Server Node	SECS OPCUA Server	Used UserTokenType: Anonymous
3/7/2019 5:35:57.344 PM	Server Node	SECS OPCUA Server	ApplicationUri: 'urn:ergotech:mix:server'
3/7/2019 5:35:57.344 PM	Server Node	SECS OPCUA Server	Security policy: 'http://opcfoundation.org/UA/SecurityPolicy#Basic256Sha256'
3/7/2019 5:35:57.344 PM	Server Node	SECS OPCUA Server	Endpoint: 'opc.tcp://127.0.0.1:12686/MIXOPCServer'



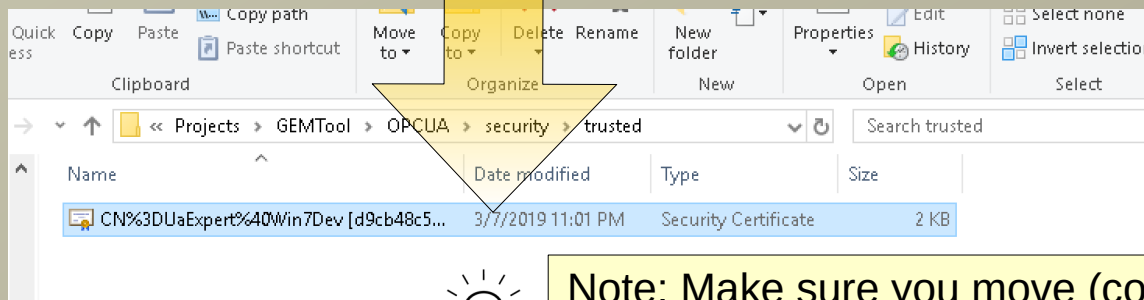
OPCUA Certificate Exchange

The UAExpert client certificate has been installed in the OPCUA server directory as "rejected" because it needs approval to be trusted. Browse to the OPCUA server security "rejected" folder to find this certificate.



The untrusted client certificate is in the OPCUA server "security" directory under "rejected"

Move this certificate to the "trusted" subdirectory of the OPCUA server security folder.



Note: Make sure you move (copy/delete) the certificate from the rejected, do not leave the certificate in "rejected"



UAExpert Successful Connection

After reconnecting to the server the client has successfully connected

Browse this node to see the OPCUA tags for the GEMTool

Log

Timestamp	Source	Server	Message
3/10/2019 10:09:14.425 PM	AddressSpaceM...	SECS OPCUA Server	Browse succeeded.
3/10/2019 10:09:14.421 PM	AddressSpaceM...	SECS OPCUA Server	Browse succeeded.
3/10/2019 10:09:14.418 PM	Server Node	SECS OPCUA Server	Revised values: SessionTimeout=120000, SecureChannelLifetime=3600000
3/10/2019 10:09:14.418 PM	Server Node	SECS OPCUA Server	Successfully connected UA server.
3/10/2019 10:09:14.409 PM	Server Node	SECS OPCUA Server	Connection status of server 'SECS OPCUA Server' changed to 'Connected'.
3/10/2019 10:09:14.409 PM	AddressSpaceM...	SECS OPCUA Server	Registered for ModelChangeEvents
3/10/2019 10:09:14.366 PM	General		The signature algorithm returned in the server signature does not match the algorithm expecte...
3/10/2019 10:09:14.275 PM	Server Node	SECS OPCUA Server	Used UserTokenType: Anonymous
3/10/2019 10:09:14.275 PM	Server Node	SECS OPCUA Server	ApplicationUri: 'urn:ergotech:mix:server'
3/10/2019 10:09:14.275 PM	Server Node	SECS OPCUA Server	Security policy: 'http://opcfoundation.org/UA/SecurityPolicy#Basic256Sha256'



OPCUA Client Test

One of the more important client connections for a tool interface are to the VIDs in the OPCUA Server.

#	Display Name	Value	Datatype
1	localremotestate	true	Boolean
2	onlineofflinestate	true	Boolean

OnlineOfflineState and LocalRemoteState need to both be boolean true for the fab Host to connect to the tool as Online-Remote. The tool should start out with both false for safety reasons. These should be connected to your HMI client as buttons or switches for operator control.



OPCUA Client Test

Change a value in the OPCUA Client and test that this VID is changed in the SECS/GEM interface.

The screenshot displays the Unified Automation UaExpert interface. The main window is titled "Unified Automation UaExpert - The OPC Unified Architecture Client - NewProject*". The interface includes a menu bar (File, View, Server, Document, Settings, Help), a toolbar, and several panes:

- Project:** Shows a tree view with "Project", "Servers" (containing "SECS OPCUA Server"), and "Documents".
- Address Space:** Shows a tree view with "No Highlight" and a list of variables including "s5f1replybit", "setpoint", "softrev", "spoolcountactual", "spoolcounttotal", "spoolfulltime", "spoolstarttime", "timeformat", and "wafercount".
- Data Access View:** A table showing the current state of variables:

#	Display Name	Value	Datatype
1	localremotestate	true	Boolean
2	onlineofflinestate	true	Boolean
3	wafercount	15	UInt32
- Attributes:** Shows details for the selected "wafercount" variable, including NamespaceIndex (2), IdentifierType (String), Identifier (gemtool.vids.w...), NodeClass (Variable), and DisplayName ("wafercount").
- References:** Shows a reference to "BaseDataVariableType".
- Log:** A list of messages with timestamps and details, including:
 - 3/21/2019 10:58:37.921 AM Reference Plugin SECS OPCUA Server Browse succeeded.
 - 3/21/2019 10:58:37.968 AM AddressSpaceM... SECS OPCUA Server QascAddressSpaceModel::mimeData
 - 3/21/2019 10:58:38.671 AM DA Plugin SECS OPCUA Server QascDaModel::dropMimeData
 - 3/21/2019 10:58:38.671 AM DA Plugin SECS OPCUA Server Found existing subscription for ServerId 0
 - 3/21/2019 10:58:38.671 AM DA Plugin SECS OPCUA Server Item [NS2]String[gemtool.vids.wafercount]: SamplingInterval=250, QueueSize=1, DiscardOldes...
 - 3/21/2019 10:58:38.671 AM DA Plugin SECS OPCUA Server CreateMonitoredItems succeeded [ret = Good]
 - 3/21/2019 10:58:38.671 AM DA Plugin SECS OPCUA Server Item [NS2]String[gemtool.vids.wafercount] succeeded : RevisedSamplingInterval=250, Revised...
 - 3/21/2019 10:58:38.671 AM DA Plugin SECS OPCUA Server Write to node 'NS2[String[gemtool.vids.wafercount]' succeeded [ret = Good]

wafercount has been added and its value changed to 15 in the OPCUA client.



Test the WaferCount Value in the Host

TransSecs Build:12384 - GEMHost

File Edit Tools Help

GEMHost

- GEMHost
 - CEIDs
 - RPTIDs
 - VIDs
 - SVIDRequest: S1F3 W
 - <L [1]>
 - SVIDResponse: S1F4
 - SVID List: S1F11 W
 - SVIDListReply: S1F12
 - Request OffLine: S1F15 W
 - OfflineAck: S1F16
 - Request OnLine: S1F17 W
 - OnLineAck: S1F18
 - CEIDL
 - ECIDF
 - ECIDV
 - ECIDV
 - ECIDC
 - HostC
 - HostC
 - HostCom
 - Alarm: S5F1 W
 - AlarmAck: S5F2
 - Enable All Alarms: S5F3 W
 - EventReportRequest: S6F15
 - RequestedEventMessage: S6F16
 - RequestIndividualReport: S6F19 W
 - IndividualReportData: S6F20

SVID 1510

S1F1 W .

RECEIVED: 2019.03.21 10:59:29.638

S1F2 <L[2]

<A 'Model '>

<A 'Rev1.0'>

3

27.581

SEN 2019.03.21 11:27:35.918

S1F3 W <L[1]

<U4 1510>

>

RECEIVED: 2019.03.21 11:27:35.920

S1F4 <L[1]

<U4 15>

>

Send Message Log

Select the S1F3 message in the GEMHost and change the SVID to 1510 for the Wafer Count

Press the Send Message button and see the S1F3 Sent

The S1F4 received from the GEMTool with the value "15" which was set in the OPCUA Client



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Test Sending a Message From the Client

The screenshot shows the Unified Automation UaExpert software interface. The main window is titled "Unified Automation UaExpert - The OPC Unified Architecture Client - NewProject*". The interface includes a menu bar (File, View, Server, Document, Settings, Help), a toolbar, and several panes:

- Project:** Shows a tree view with "Project", "Servers" (SECS OPCUA Server), and "Documents".
- Address Space:** Shows a tree view with "gemtool" and its sub-nodes: "alids", "ceids", "configuration", "hostcommandrejectedbadparam", "hostcommandreply", "errorstatus", "goodstatus", "hckack", "responsestatus", and "sendmessage".
- Data Access View:** A table showing the current state of variables. The "sendmessage" variable is highlighted in blue.
- Attributes:** Shows the attributes of the selected "sendmessage" variable, including "NamespaceIndex", "IdentifierType", "Identifier", "NodeClass", and "BrowseName".
- References:** Shows the references of the selected variable, including "HasTypeDefinition" and "BaseDataVariableType".
- Log:** Shows a list of events with columns for "Timestamp", "Source", "Server", and "Message".

A yellow callout box with a large yellow arrow pointing to the "sendmessage" variable in the Data Access View contains the following text:

To prepare to send the reply message to the Host, add the "sendMessage" tag from the hostcommandreply message so that it is ready to use

#	Display Name	Value	Datatype
1	localremotestate	true	Boolean
2	onlineofflinestate	true	Boolean
3	wafercount	15	UInt32
4	sendmessage	false	Boolean

Reference	Target DisplayName
HasTypeDefiniti...	BaseDataVariableType

Timestamp	Source	Server	Message
3/21/2019 11:46:43.473 AM	TypeCache	SECS OPCUA	
3/21/2019 11:46:43.467 AM	DA Plugin	SECS OPCUA	
3/21/2019 11:46:43.467 AM	DA Plugin	SECS OPCUA S	
3/21/2019 11:46:43.463 AM	DA Plugin	SECS OPCUA Server	Item [NS2]String[gemtool.hostcommandreply.sendMessage]: SamplingInterval=250, QueueSiz...
3/21/2019 11:46:43.462 AM	DA Plugin	SECS OPCUA Server	Found existing subscription for ServerId 0
3/21/2019 11:46:43.462 AM	DA Plugin	SECS OPCUA Server	QascDaModel::dropMimeData
3/21/2019 11:46:42.824 AM	AddressSpaceM...	SECS OPCUA Server	QascAddressSpaceModel::mimeData
3/21/2019 11:46:41.746 AM	Attribute Plugin	SECS OPCUA Server	Read attributes of node 'NS2]String[gemtool.hostcommandreply.sendMessage] succeeded [ret...



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Test Sending a Message From the Client

TransSecs Build:12384 - GEMHost

File Edit Tools Help

GEMHost

- GEMHost
 - CEIDs
 - RPTIDs
 - VIDs
 - SVIDRequest: S1F3 W
 - <L [1]>
 - SVIDResponse: S1F4
 - SVID List: S1F11 W
 - SVIDListReply: S1F12
 - Request OffLine: S1F15 W
 - OfflineAck: S1F16
 - Request OnLine: S1F17 W
 - OnLineAck: S1F18
 - CEIDList: 'S1F23' W
 - ECIDRequest: S2F13 W
 - ECIDValueResponse: S2F14
 - ECIDValueChange: S2F15 W
 - ECIDChangeACK: S2F16
 - HostCommandSTART: S2F41 W
 - HostCommandSTOP: S2F41 W
 - HostCommandReply: S2F42
 - Alarm: S5F1 W
 - AlarmAck: S5F2
 - Enable All Alarms: S5F3 W
 - EventReportRequest: S6F15
 - RequestedEventMessage: S6F16
 - RequestIndividualReport: S6F19 W
 - IndividualReportData: S6F20

Command STOP

SENT: 2019.03.21 11:27:35.918
S1F3 W <L[1]
<U4 1510>
>
>

RECEIVED: 2019.03.21 11:27:35.918
S1F4 <L[1]
<U4 15>
>
>

SENT: 2019.03.21 11:56:00.00
S2F41 W <L[2]
<A 'STOP'>
<L[0]
>
>

Send Message Log Bytes Log Events Lock Scroll

Send a Host command from the GEMHost to the GEMTool so that the tool may send a response message using the OPCUA sendMessage tag

Select the Host Command "STOP" message for testing

Press the Send Message Button to send the command to the tool

Host Command was sent to the GEMTool



Quickly send the reply from the OPCUA Client before the T3 timeout



Test Sending a Message From the Client

The screenshot shows the Unified Automation UaExpert software interface. The main window displays the Data Access View for the SECS OPCUA Server. The Data Access View table is as follows:

#	Display Name	Value	Datatype
1	localremotestate	true	Boolean
2	onlineofflinestate	true	Boolean
3	wafercount	15	UInt32
4	sendmessage	<input checked="" type="checkbox"/>	Boolean

The Log window at the bottom shows the following entries:

Timestamp	Source	Server	Message
3/21/2019 11:57:23.752 AM	DA Plugin	SECS OPCUA Server	Write to node 'NS2 String gemtool.hostcommandreply.sendmessage' succeeded [ret = Good]
3/21/2019 11:57:11.274 AM	DA Plugin	SECS OPCUA Server	Read attributes of node 'NS2 String gemtool.hostcommandreply.sendmessage' succeeded [ret = Good]
3/21/2019 11:57:08.141 AM	Attribute Plugin	SECS OPCUA Server	Read attributes of node 'NS2 String gemtool.hostcommandreply.sendmessage' succeeded [ret = Good]
3/21/2019 11:57:08.140 AM	Reference Plugin	SECS OPCUA Server	Browse succeeded.
3/21/2019 11:57:04.889 AM	TypeCache	SECS OPCUA Server	Reading type info of NodeId NS0 Numeric 6 succeeded
3/21/2019 11:57:04.884 AM	Reference Plugin	SECS OPCUA Server	Browse succeeded.
3/21/2019 11:57:04.884 AM	Attribute Plugin	SECS OPCUA Server	Read attributes of node 'NS2 String gemtool.hostcommandreply.hcack' succeeded [ret = Good].
3/21/2019 11:56:48.404 AM	DA Plugin	SECS OPCUA Server	Write to node 'NS2 String gemtool.hostcommandreply.sendmessage' succeeded [ret = Good]

A yellow callout box with a black border contains the following text:

Send the S2F42 Host Command Reply by setting the sendMessage value to boolean true in the OPCUA Client.



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Test Sending a Message From the Client

TransSecs Build:12384 - GEMHost

File Edit Tools Help

GEMHost

Command: STOP

SENT: 2019.03.21 13:03:35.381
S2F37 W <L[2]
<BOOLEAN 1>
<L[2]
<U4 7501>
<U4 7502>
>
>
RECEIVED: 2019.03.21 13:03:35.384
S2F38 <B 0x0> /* Decimal[1]: 0 */
SENT: 2019.03.21 13:03:35.384
S1F1 W .
RECEIVED: 2019.03.21 13:03:35.387
S1F2 <L[2]
<A 'Model '>
<A 'Rev1.0'>
>
SENT: 2019.03.21 13:03:54.776
S2F41 W <L[2]
<A 'STOP'>
<L[0]
>
>
RECEIVED: 2019.03.21 13:04:00.926
S2F42 <L[2]
<B 0x0> /* Decimal[1]: 0 */
<L[0]

Host Command reply was received from the GEMTool

Send Message Log Bytes Log Events Lock Scroll



Notes on OPCUA Servers: JSON List Formats

List elements are JSON formatted, such as { "values": [] }

For example, the recipe list for an S7F20 might look like:

```
{ "values": [ "recipe1", "recipe2", "recipe3", "recipe4" ] }
```

There are more things you can do with the JSON format for the lists, including making lists of lists and specifying the SECS format for the data in the list.



Notes on OPCUA Servers: JSON List Formats

If a specific type is required, it can be specified if needed. For example for the recipe list, the data is ASCII, type 20:

```
{ "values": [ "recipe1","recipe2", "recipe3", "recipe4"], type:"20" }
```

type is defined by the SECS Standard:

00 - List

10 - Binary (can be an array)

11 - Boolean

20 - String

30 - 8 byte floating point

34 - 4 byte floating point

40, 41, 42, 44 - 8, 1,2,4 byte signed integers

50, 51, 52, 54 - 4 byte signed integer



Notes on OPCUA Servers: JSON List Formats

Each element of the array can have a different type in this format (this might be useful in some message replies with different data types):

```
{"values":[  
    {"value":"1.2", "type":"34"},  
    {"value":"Test", "type":"20"},  
    {"value":[5,6,7,8], "type":"10"},  
    {"value":1, "type":"10"}  
]}
```



Notes on Tool OPCUA Servers: Triggering Events with DVVALS

Events can be triggered with a list of DVVALS, so if you need to do this you can define the list, then use this as the trigger input to the CEID. If you are using DVVALS in your project you would associate the DVVALS when you define your CEID.

DVVALS as a JSON String sent to the trigger of a CEID:

```
{ "values":[  
  { dvid:WaferCount, dvval:15 },  
  { dvid:23456, dvval:\\"Hello World\" }  
]}
```

You can specify any VID with either its name (for example WaferCount), or its vid number (for example 23456) as the above example demonstrates.



Notes on OPCUA Servers: Host Commands

If you publish the whole host command, the structure is a list (with the host command), then the list elements for the parameters for the command.

It may look something like:

```
{ "values": [ { "value":"PP-SELECT", type:"20" } ] } { "values":  
[ { "values": [ LOTID ], type:"20" } { "values":  
[ { "value":"CHAMBER", type:"20" } ] { "value":"1", type:"51" } } ] }  
{ "values": [ PPID ], type:"20" } ] }
```



Notes on OPCUA Servers: vibopc.properties

The vibopc.properties file has some settings which control some aspects of the OPCUA runtime. This file is located in the OPCUA deployment directory.

VIBOPC.NoMethodSupport

This defaults to false. If set to true opcua methods are generated for operations such as sending messages. Some OPCUA clients do not support methods.

VIBOPC.UnderscoreCreatePaths

This defaults to true. This allows you to define vid names with underscores which will generate a tree structure for the vids. For example a vid "robot_xaxis" will generate a tag structure /toolname/vids/robot/xaxis".



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That's it.

Now you're ready to program your OPCUA Client application to complete integration of the SECS/GEM interface. You should update your tool data values (SVIDs) as they change and can trigger alarms (ALIDs) and events (CEIDs) and send and receive messages as needed. You may need to handle host commands and send the host command replies from your OPCUA client using the sendMessage tags. More host command message handling can be added, and also there are options for manually handling recipe messages, or you can set up simple automatic recipe handling.