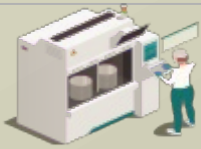


ErgoTech Systems, Inc.

www.secsandgem.com o www.ergotech.com

TransSECS for an OPCUA Server

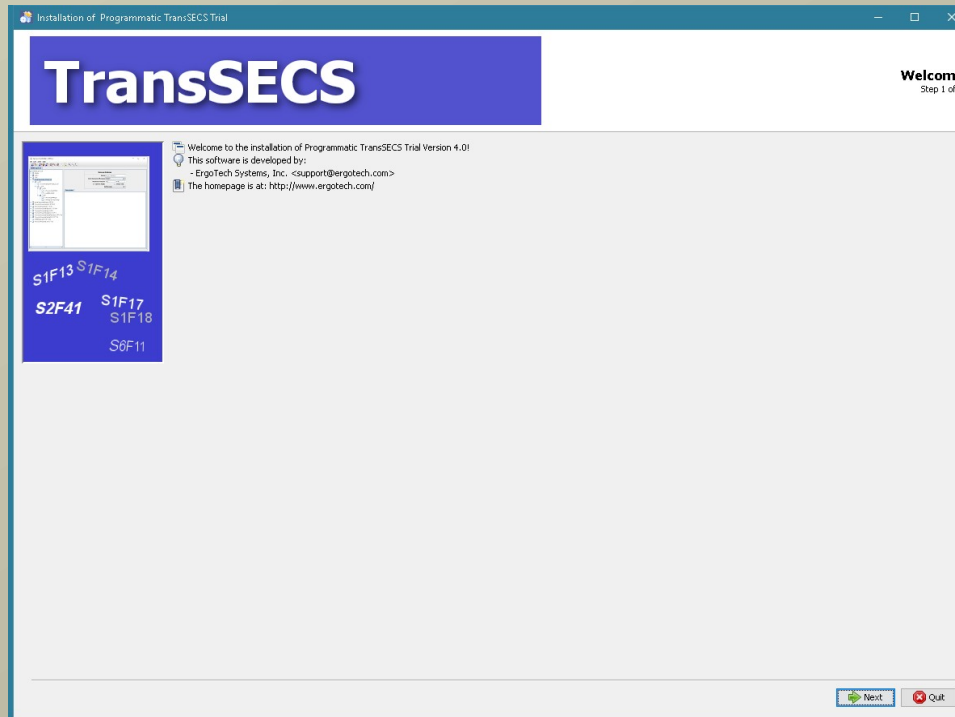
Using Servers TransSECS to Create an
OPCUA SECS/GEM Tool Interface



ErgoTech Systems, Inc.

www.secsandgem.com o www.ergotech.com

Installing TransSECS



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



ErgoTech Systems, Inc.

www.secsandgem.com o www.ergotech.com

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 software interface. The main window is 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 "GEMTool" folder expanded, containing sub-items: CEIDs, ALIDs, VIDs, HostCommandSTART: S2F41 W, HostCommandSTOP: S2F41 W, HostCommandRejectedBadParam: S2F42, and HostCommandReply: S2F42. The main area is divided into two panes. The top pane, titled "Tool Attributes", contains the following fields: Tool Name (GEMTool), Host (radio button), Equip. (radio button), Uses GEM (checked checkbox), Device ID (1), Port (5010), Baud Rate (9600), and Deployment Type (OPCUA Server). Below the "Tool Attributes" pane is a "Description" pane containing 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



ErgoTech Systems, Inc.

www.secsandgem.com o www.ergotech.com

Select the type of server for deployment

Tool Attributes

Tool Name: GEMTool Host Equip.

Uses GEM

Device ID: 1 Port: 5010 Baud Rate: 9600

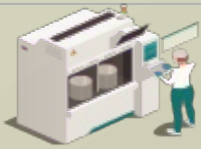
T1: 0.5 T2: 10.0 T3: 45.0 T4: 45.0 T6: 5.0 T7: 10.0

Deployment Type: OPCUA Server

Description: A GEM Tool for testing a minimal subset of SE... host.

MQTT Server

TransSECS Servers has several deployment options. The default is OPCUA. Be sure it is always selected while you work on the project.



ErgoTech Systems, Inc.

www.secsandgem.com o www.ergotech.com

Press the Hammer/Star button to build the project



ErgoTech Systems, Inc.

www.secsandgem.com o www.ergotech.com

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

The screenshot displays the GEMTool software interface. The main window is titled "TransSecs Build:12382 - GEMTool" and features a menu bar (File, Edit, Tools, Help) and a toolbar. The left sidebar shows a tree view of the project structure, including folders for CEIDs, ALIDs, and VIDs, along with various 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), Device ID (1), Port (5010), Baud Rate (9600), and a table of timing parameters (T1 to T7). The "Description" pane contains a text box with the following text: "A GEM Tool for testing a minimal subset of SECS/GEM. Use the GEMHost project as a test host." A "Compilation" popup dialog box is overlaid on the main window, displaying an information icon, the text "Building All Files", and a "Cancel" button. An arrow points from the text above to the "Compilation" popup.

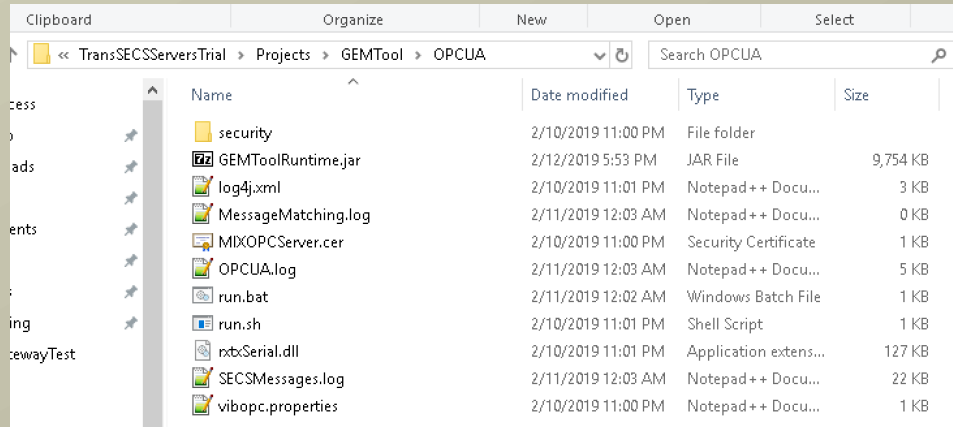
TransSECS has many features which are described in the documentation, but for this demonstration, just building the sample is sufficient.



ErgoTech Systems, Inc.

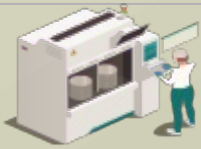
www.secsandgem.com o www.ergotech.com

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 rtxSerial on the system and make appropriate changes to the run.sh file.

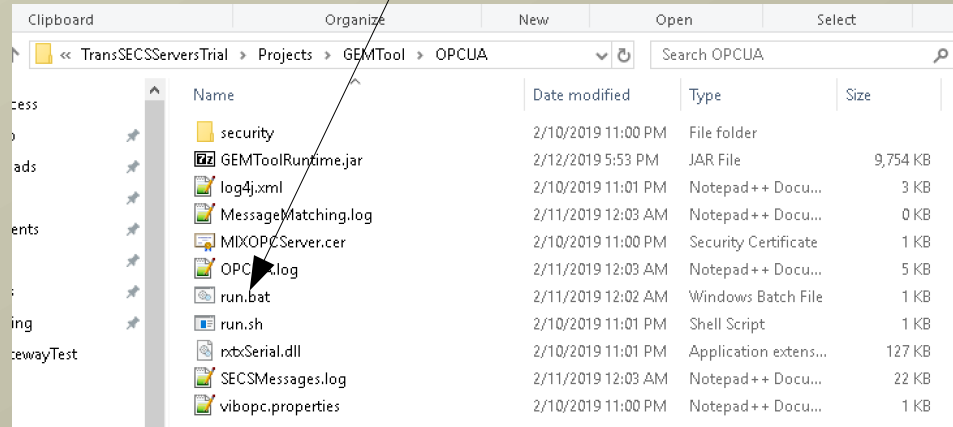
You may need to edit the path to the jre in run.bat if you move the deployment location.

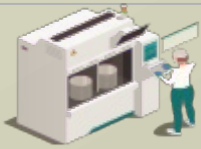


ErgoTech Systems, Inc.

www.secsandgem.com o www.ergotech.com

Run the server with the run.bat file.





ErgoTech Systems, Inc.

www.secsandgem.com o www.ergotech.com

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.



ErgoTech Systems, Inc.

www.secsandgem.com o www.ergotech.com

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



ErgoTech Systems, Inc.

www.secsandgem.com o www.ergotech.com

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.



ErgoTech Systems, Inc.

www.secsandgem.com • www.ergotech.com

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: Port: 5010 Baud Rate: 19200

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

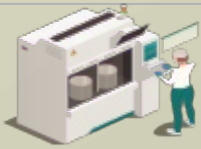
Deployment Type: Test Host Only

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

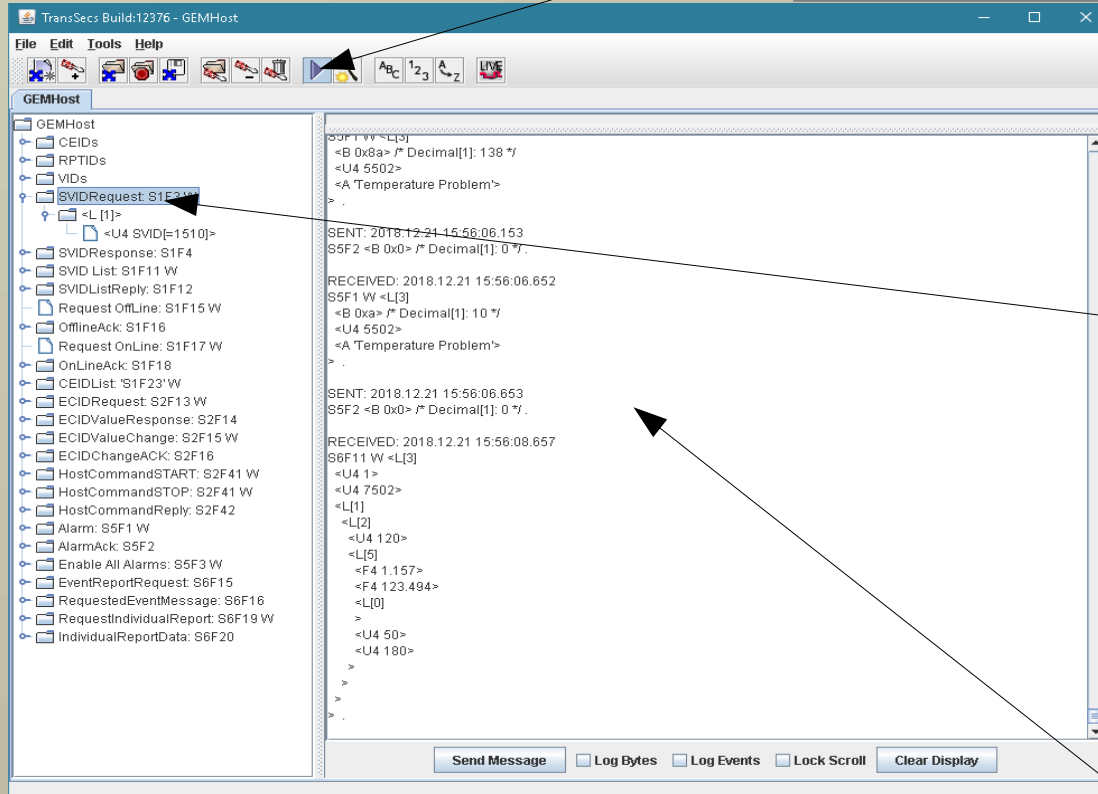


ErgoTech Systems, Inc.

www.secsandgem.com o www.ergotech.com

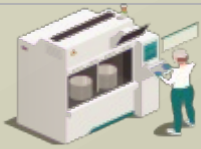
Run TransSECS Test as a host

This arrow shows that the host is running



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)



ErgoTech Systems, Inc.

www.secsandgem.com o www.ergotech.com

Send an S1F3 test message to the tool

Select the S1F3 Message.

The screenshot shows the TransSecs software interface. On the left, a tree view under 'GEMHost' has 'SVIDRequest: S1F3' selected. At the top right, the 'SVID' field contains the value '1510'. The main display area shows a log of messages, including 'RECEIVED: 2019.02.12 19:38:00.291 S2F36 <B 0x0> /> Decimat[1]: 0 %', '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> /> Decimat[1]: 0 %', 'SENT: 2019.02.12 19:38:00.295 S1F1 W', and 'RECEIVED: 2019.02.12 19:38:00.303 S1F2 <L[2] <A Model> <A Rev1.0>'. At the bottom, there is a 'Send Message' button and several checkboxes for 'Log Bytes', 'Log Events', 'Lock Scroll', and 'Clear Display'.

Change the SVID you want to request

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



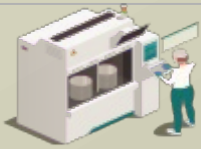
ErgoTech Systems, Inc.

www.secsandgem.com o www.ergotech.com

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

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



ErgoTech Systems, Inc.

www.secsandgem.com o www.ergotech.com

Start UAExpert and Add a new OPCUA Server

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

| 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). |



ErgoTech Systems, Inc.

www.secsandgem.com o www.ergotech.com

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.

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

Certificate

Private Key

Session Settings

Session Name: urn:Win7Dev:UnifiedAutomation:UaExpert

Connect Automatically

OK Cancel



ErgoTech Systems, Inc.

www.secsandgem.com o www.ergotech.com

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). |

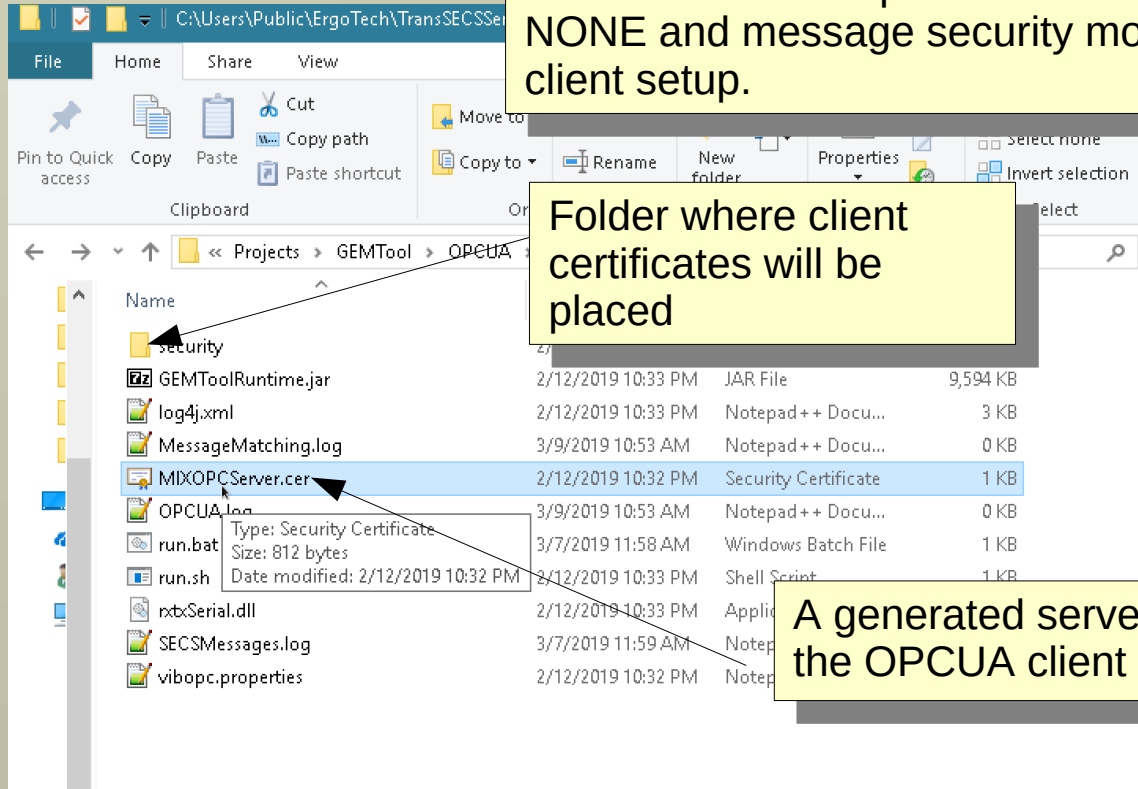


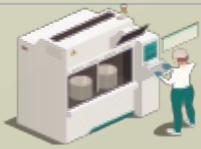
ErgoTech Systems, Inc.

www.secsandgem.com o www.ergotech.com

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.





ErgoTech Systems, Inc.

www.secsandger

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 |

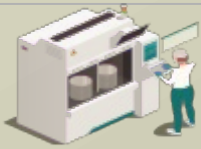
Accept the server certificate temporarily for this session

Trust Server Certificate

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.



ErgoTech Systems, Inc.

www.secsandgem.com o www.ergotech.com

UAExpert Certificate Exchange

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 |

Trust Server Certificate

Accept the server certificate temporarily for this session

Continue Cancel

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



ErgoTech Systems, Inc.

www.secsandgem.com o www.ergotech.com

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.

The screenshot shows the UaExpert interface with the following components:

- Project Tree:** Shows a project structure with 'Servers' containing 'SECS OPCUA Server' and 'Documents' containing 'Data Access View'.
- Data Access View:** A table with columns '#', 'Server', and 'Node'.
- References:** A table with columns 'Reference' and 'Target DisplayName'.
- Log:** A table of system messages.

The Log table contains the following entries:

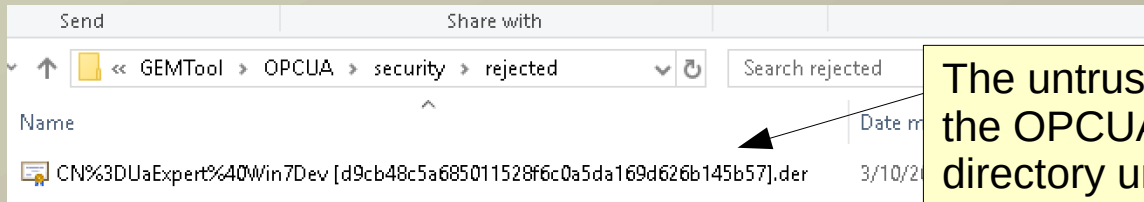
| Timestamp | Source | Server | Message |
|-------------------------|-------------|-------------------|---|
| 3/7/2019 5:35:57.407 PM | Server Node | SECS OPCUA Server | Connecting failed with error 'BadSecurityChecksFailed' |
| 3/7/2019 5:35:57.390 PM | Server Node | SECS OPCUA Server | Error 'BadSecurityChecksFailed' 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' |

Security checks failed.



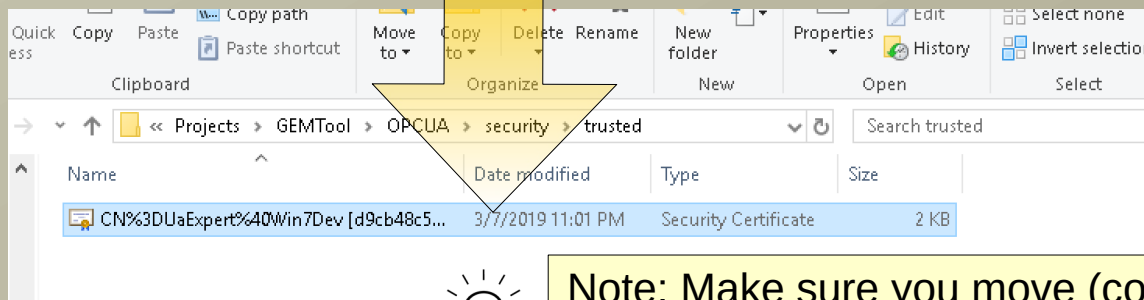
OPCUA Certificate Exchange

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 "Data Access View" and shows a table of variables:

| # | Display Name | Value | Datatype |
|---|--------------------|-------|----------|
| 1 | localremotestate | true | Boolean |
| 2 | onlineofflinestate | true | Boolean |
| 3 | wafercount | 15 | UInt32 |

The "wafercount" variable is highlighted in blue. An arrow points from a yellow callout box to this row. The "Address Space" pane on the left shows a tree view of variables, with "wafercount" selected. The "Log" pane at the bottom shows a series of messages, including:

- Write to node 'NS2[String|gemtool.vids.wafercount]' succeeded [ret = Good]
- Item [NS2[String|gemtool.vids.wafercount] succeeded : RevisedSamplingInterval=250, Revised...
- CreateMonitoredItems succeeded [ret = Good]
- Item [NS2[String|gemtool.vids.wafercount]: SamplingInterval=250, QueueSize=1, DiscardOldes...
- Found existing subscription for ServerId 0
- QascDaModel::dropMimeData
- QascAddressSpaceModel::mimeData
- Browse succeeded.

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



ErgoTech Systems, Inc.

www.secsandgem.com o www.ergotech.com

Test the WaferCount Value in the Host

The screenshot shows the 'TransSecs Build:12384 - GEMHost' application window. The interface includes a menu bar (File, Edit, Tools, Help), a toolbar with various icons, and a main workspace. On the left, a tree view displays a hierarchy of messages under 'GEMHost', including folders for CEIDs, RPTIDs, VIDs, and various SVID-related messages. The 'SVIDRequest: S1F3 W' folder is selected. In the center, a text box labeled 'SVID' contains the value '1510'. On the right, a message log displays the following text:

```
RECEIVED: 2019.03.21 10:59:29.638  
S1F2 <L[2]  
<A 'Model '>  
<A 'Rev1.0'>
```

Below this, a 'Send Message' button is visible. The log also shows a sent message:

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

At the bottom of the log, a received message is shown:

```
RECEIVED: 2019.03.21 11:27:35.920  
S1F4 <L[1]  
<U4 15>
```

Three yellow callout boxes provide instructions:

- The top callout points to the 'SVIDRequest: S1F3 W' folder in the tree view and the 'SVID' text box, stating: "Select the S1F3 message in the GEMHost and change the SVID to 1510 for the Wafer Count".
- The middle callout points to the 'Send Message' button, stating: "Press the Send Message button and see the S1F3 Sent".
- The bottom callout points to the received S1F4 message in the log, stating: "The S1F4 received from the GEMTool with the value '15' which was set in the OPCUA Client".



ErgoTech Systems, Inc.

www.secsandgem.com o www.ergotech.com

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:

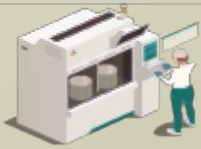
- Project:** Shows a tree view with "Project", "Servers" (SECS OPCUA Server), and "Documents".
- Address Space:** Shows a tree view with "gemtool" and its sub-nodes: "alids", "ceids", "configuration", "hostcommandrejectedbadparam", "hostcommandreply", "errorstatus", "goodstatus", "hckack", "responsestatus", and "sendmessage".
- Data Access View:** A table with columns "#", "Display Name", "Value", and "Datatype". The table contains the following data:

| # | Display Name | Value | Datatype |
|---|--------------------|-------|----------|
| 1 | localremotestate | true | Boolean |
| 2 | onlineofflinestate | true | Boolean |
| 3 | wafercount | 15 | UInt32 |
| 4 | sendmessage | false | Boolean |
- Attributes:** Shows a tree view with "Attribute" and "NodeId". The "NodeId" node is expanded, showing "NamespaceIndex" (2), "IdentifierType" (String), "Identifier" (gemtool.hostco...), and "NodeClass" (Variable).
- References:** Shows a table with columns "Reference" and "Target DisplayName". The table contains the following data:

| Reference | Target DisplayName |
|--------------------|----------------------|
| HasTypeDefiniti... | BaseDataVariableType |
- Log:** Shows a table with columns "Timestamp", "Source", and "Server". The log contains several entries, including "TypeCache", "DA Plugin", and "Attribute Plugin".

A yellow callout box with a black border and a yellow arrow pointing to the "sendmessage" entry in the Data Access View table 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



ErgoTech Systems, Inc.

www.secsandgem.com o www.ergotech.com

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

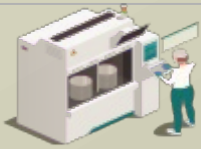
Select the Host Command "STOP" message for testing

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 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 folder "gemtool" containing sub-folders like "alids", "ceids", "configuration", "hostcommandrejectedbadparam", and "hostcommandreply". The "hostcommandreply" folder contains variables like "errorstatus", "goodstatus", "hckack", "responsestatus", and "sendMessage".
- Data Access View:** A table with columns: #, Display Name, Value, and Datatype. It lists four items: 1. localremotestate (true, Boolean), 2. onlineofflinestate (true, Boolean), 3. wafercount (15, UInt32), and 4. sendMessage (true, Boolean). A checkmark is visible in the Value column for "sendMessage", and an arrow points to it from a text box.
- Attributes:** Shows details for the selected "sendMessage" attribute, including NamespaceIndex (2), IdentifierType (String), Identifier (gemtool.hostc...), and NodeClass (Variable).
- References:** Shows a table with columns: Reference, Target, and DisplayName. It lists "HasTypeDefiniti..." and "BaseDataVariableType".
- Log:** A table with columns: Timestamp, Source, Server, and a description of the event. It shows several log entries related to reading and writing to the OPCUA server.

Log Entries:

| Timestamp | Source | Server | Description |
|---------------------------|------------------|-------------------|--|
| 3/21/2019 11:57:23.752 AM | DA Plugin | SECS OPCUA Server | Read attributes of node 'NS2 String gemtool.hostcommandreply.sendMessage' succeeded [ret=... |
| 3/21/2019 11:57:11.274 AM | DA Plugin | SECS OPCUA Server | Read attributes of node 'NS2 String gemtool.hostcommandreply.sendMessage' succeeded [ret=... |
| 3/21/2019 11:57:08.141 AM | Attribute Plugin | SECS OPCUA Server | Read attributes of node 'NS2 String gemtool.hostcommandreply.sendMessage' succeeded [ret=... |
| 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 NodId 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.hckack' 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] |

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



ErgoTech Systems, Inc.

www.secsandgem.com o www.ergotech.com

Test Sending a Message From the Client

The screenshot displays the 'TransSecs Build:12384 - GEMHost' application window. The interface includes a menu bar (File, Edit, Tools, Help), a toolbar with various icons, and a tree view on the left listing folders and files such as 'CEIDs', 'RPTIDs', 'VIDs', and 'HostCommandSTOP: S2F41 W'. The main area shows a 'Command' field with 'STOP' entered. Below this, a log of sent and received messages is visible. A yellow callout box with the text 'Host Command reply was received from the GEMTool' points to the 'RECEIVED: 2019.03.21 13:03:35.387' entry in the log. At the bottom, there are buttons for 'Send Message', 'Log Bytes', 'Log Events', 'Lock Scroll', and 'Clear Display'.

```
Command: STOP

SENT: 2019.03.21 13:03:35.381
S2F37 W <L[2]
<BOOLEAN 1>
<L[2]
<U4 7501>
<U4 7502>
>
> .

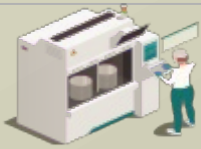
RECEIVED: 2019.03.21 13:03:35.384
S2F38 <B 0x0> /* Decimal[1]: 0 */

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]
```



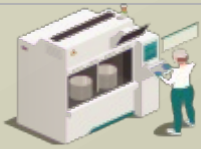
Notes on OPCUA Servers: JSON List Formats

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

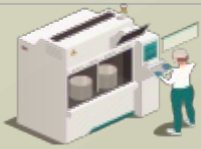
20 - String

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"}  
]}
```



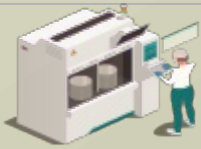
Notes on Tool OPCUA Servers: Triggering Events with DVVALS

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".



ErgoTech Systems, Inc.

www.secsandgem.com o www.ergotech.com

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.