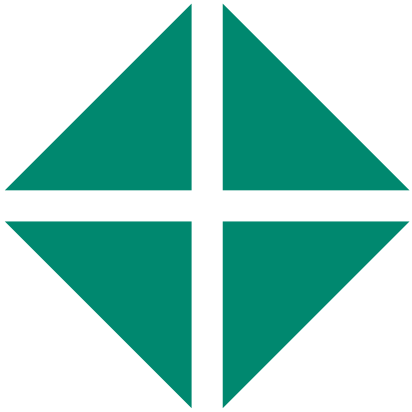
cytiva

# UNICORN 7.6

## OPC Manual



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# 1 Introduction

This chapter contains important user information, compatibility information and a description of the intended use of UNICORN™ OPC server.

## OPC server

UNICORN OPC server provides a standardized integration interface to support integration between UNICORN and other software systems such as Laboratory Information Systems (LIMS) and Manufacturing Execution Systems (MES or SCADA). OPC enables open connectivity via open standards created in collaboration with leading automation manufacturers worldwide, including Microsoft®.

OPC provides inter-operability between system components by creating and maintaining open standard specifications. The benefit of following standard specifications in system implementations is greater independence for hardware and software components. This leads to higher flexibility, better quality and overall lower maintenance costs for the system solution. The first standard developed was the Data Access specification, which therefore has the broadest client support.

UNICORN OPC server supports the following three areas:

- UNICORN OPC Data Access gives access to all process data (i.e., real-time values, valve status, process step information and commands). UNICORN Alarm & Events server informs an OPC client application that a system parameter has exceeded an upper or lower limit value. The UNICORN Alarm & Events server also provides information about the process (***RunLog***).
- UNICORN Historical Data Access allows any OPC client application to access the entire batch result generated by UNICORN.
- UNICORN OPC Security controls client access to the UNICORN OPC Data Access, Alarms & Events and Historical Data Access to protect sensitive information and to guard against unauthorized modification of process parameters. This is an important security feature.

## UNICORN server supported OPC standards and versions

| **Product 1 supports:** | |
|---|---|
| Data Access (DA) | 1.0 custom interface<br>2.05A custom interface<br>3.0 custom interface |
| Alarms & Events (A&E) | 1.1 custom interface |

| Product 1 supports: | |
|---|---|
| Historical Data Access (HDA) | 1.1 custom interface<br>1.2 custom interface |
| Security | 1.0 custom interface |

To ensure high compatibility, UNICORN OPC has been compliance tested. See the OPC homepage:

www.opcfoundation.org

This document requires basic knowledge of UNICORN, as well as OPC clients. Refer to the UNICORN manuals and *Application Notes* for detailed information about configuring OPC for specific OPC clients.

# 2 UNICORN OPC server general settings

This chapter provides the required system settings for the OPC server.

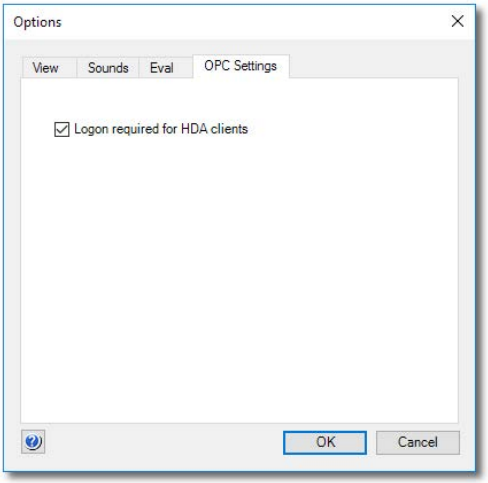
## In this chapter

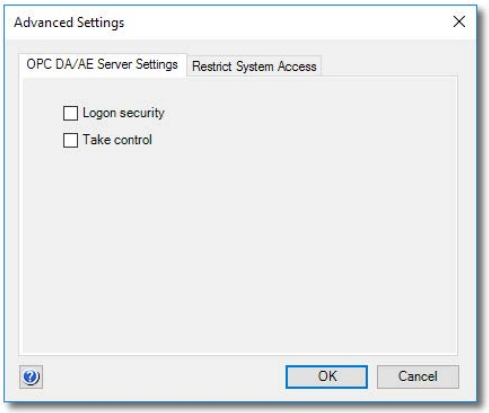

| Section | | See page |
|---|---|---|
| 2.1 | System start up | 7 |
| 2.2 | Logon security | 8 |
| 2.3 | System connection (Take Control) | 9 |

# 2.1 System start up

## UNICORN Administration

When the server is executed, it first checks the basic configuration. This basic configuration is adjustable from ***UNICORN Administration***'s ***Options*** dialog box for HDA server and ***Advanced Settings*** dialog in ***System Properties*** for AE and DA servers (***Tools*** →***System Properties*** →***Edit*** →***Advanced Settings***).




***Note:*** *The OPC connection is not allowed when the system is in* ***Initializing state****.*

# 2.2 Logon security

UNICORN OPC server supports OPC private security. When enabled, the client must log in before accessing any items.

All UNICORN users can log into OPC by giving username with/without the access group to which user belongs to. For example "`username@accessgroupname`" or "`username`". If the access group is not given during login, then the first available access group for that user will be taken. User access rights are depending on the access group chosen. It is not possible to change password or administer users through OPC. User management is handled through UNICORN ***Administration*** module.

***Logon security*** enables the OPC security interface. Since not all clients support this interface, the default installation setting is ***OFF***. When the interface is enabled, the server requires all clients to login before they can access data. This applies to all interfaces, that is, DA, AE or HDA.

## OPC interface dependencies

| **Security v 1.0** | | |
|---|---|---|
| Data Access<br>v 1.0, 2.05A, 3.0 | Alarms & Events<br>v 1.1 | Historical Data Access<br>v 1.2 |

If the ***Logon security*** option is ***OFF***, the server disables the security interface. Instead, it uses "OPC" user when communicating with UNICORN.

## 2.3 System connection (Take Control)

The ***Take Control*** flag is used when OPC is connecting to the system. If the flag is set to ***ON***, the ***AssignState*** is set to ***Connected in control***. Otherwise, it is set to the default value ***Connected in view***. However, if another user already has control over the system, OPC is assigned ***Connected in view*** state.

# 3 UNICORN OPC remote

This chapter contains information about configuring remote access, recommended settings and the related error codes.

## In this chapter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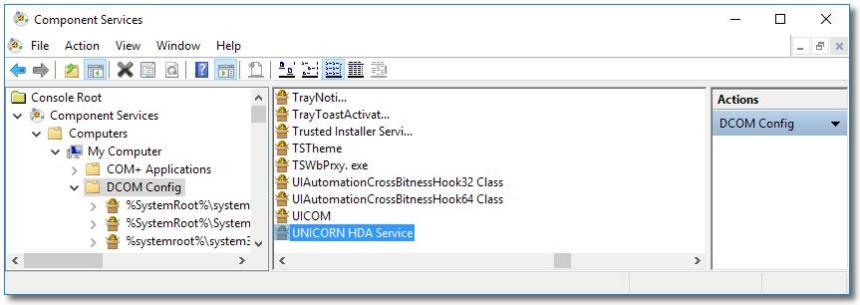
| 3.3 | UNICORN OPC custom error codes | 35 |
| 3.4 | Connection Identifiers | 36 |

# 3.1 Security settings

UNICORN OPC supports remote access via DCOM. Some DCOM security settings might have to be altered to get it to work. The configuration can be changed through ***Component Services***.

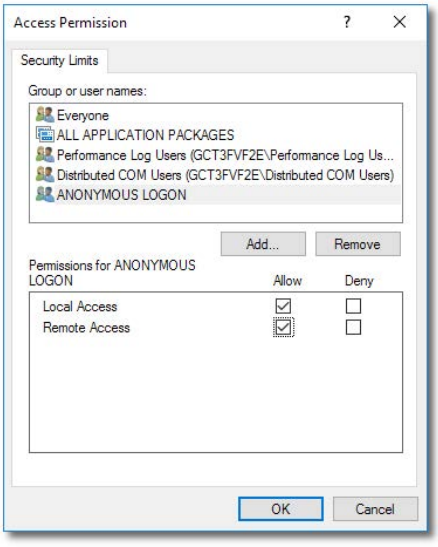
## Component Services




The recommended security settings for ***UNICORN HDA Service*** and ***UNICORN Instrument Server*** are shown below. For detailed instructions, see *Troubleshoot communication issues, on page 25*.

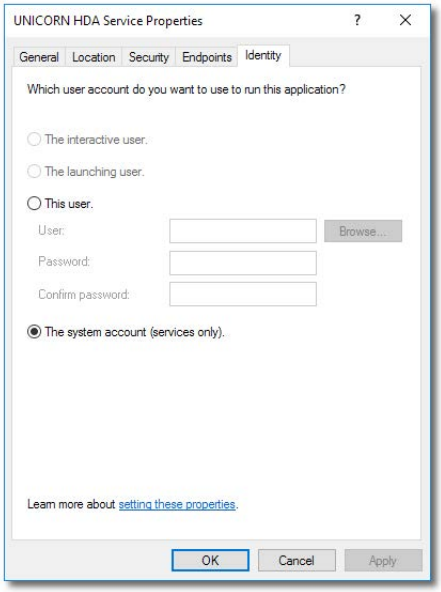
- Add ***Access Permission*** to the users ***ANONYMOUS LOGON***, ***Everyone***, ***INTERACTIVE***, ***NETWORK*** and ***SYSTEM***.

## UNICORN *Access Permission* window




- Set ***Which user do you want to use to run this application?*** in the ***Identity***-tab to ***The system account (services only)***.

## *UNICORN HDA Server Properties* window



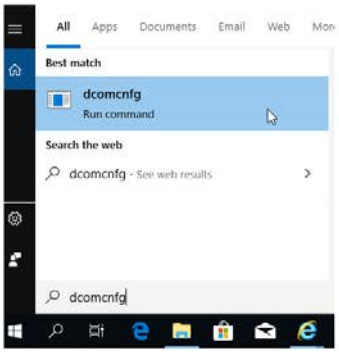

## Open DCOM communications port

If you are using a firewall, make sure that port 135 is open.

## DCOM encryption settings for OPC

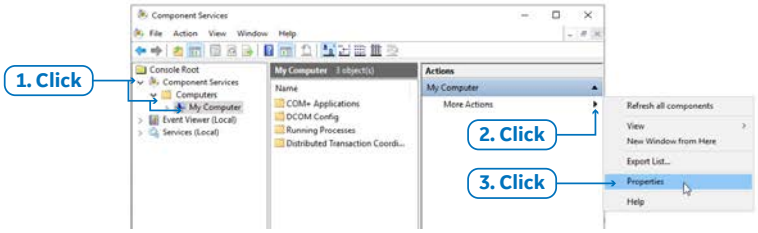
## Server-side settings

| Step | Action |
|---|---|
| 1 | Click the Windows search icon, type in `dcomcnfg` and then click ***dcomcnfg***. |

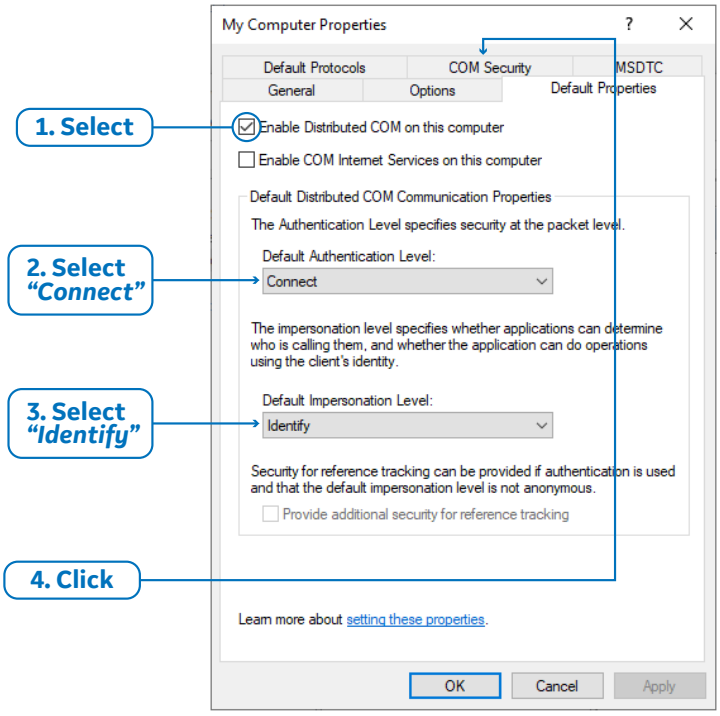



**IMPORTANT**
If you are logged in as Administrator, you will be prompt for confirmation. Click ***Yes*** to proceed.

| | |
|---|---|
| 2 | Follow the instructions in the following illustration: |

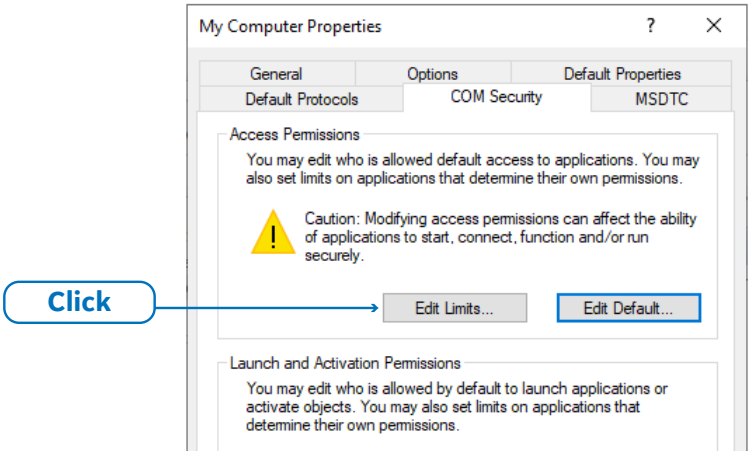


| Step | Action |
|---|---|
| 3 | **a.** For **non-encrypted** DCOM communication, follow the instructions in the following illustration: |

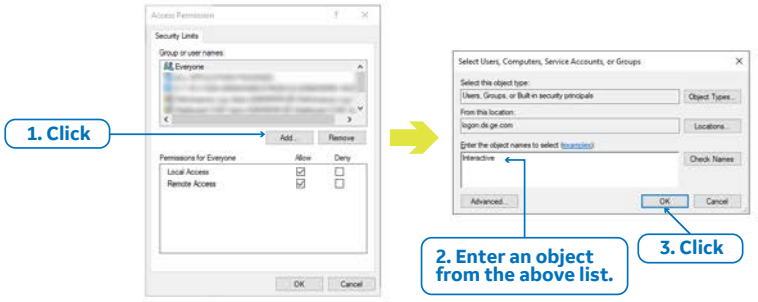



**b.** For **encrypted** DCOM communication, only change from ***Connect*** to ***Packet Privacy*** under ***Default Authentication level***. See the previous image for reference.

| Step | Action |
|---|---|
| 4 | Click ***Edit Limits***. |

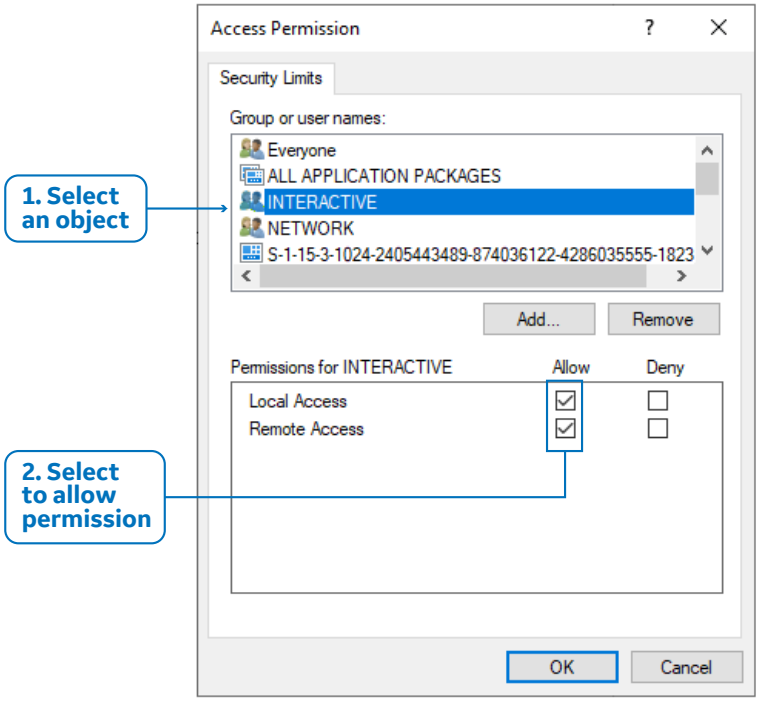



| | |
|---|---|
| 5 | Add the following users (objects) as described in the following illustration:<br>• Everyone (by default it is available)<br>• Interactive<br>• Network<br>• System<br>• Anonymous Login |

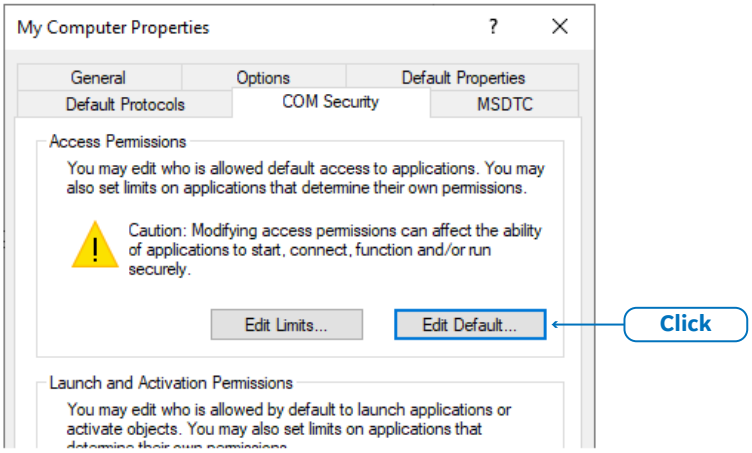



| | |
|---|---|
| 6 | Repeat step 5 for all the users in the list. |

| Step | Action |
|---|---|
| 7 | Provide permissions to the users as illustrated below: |

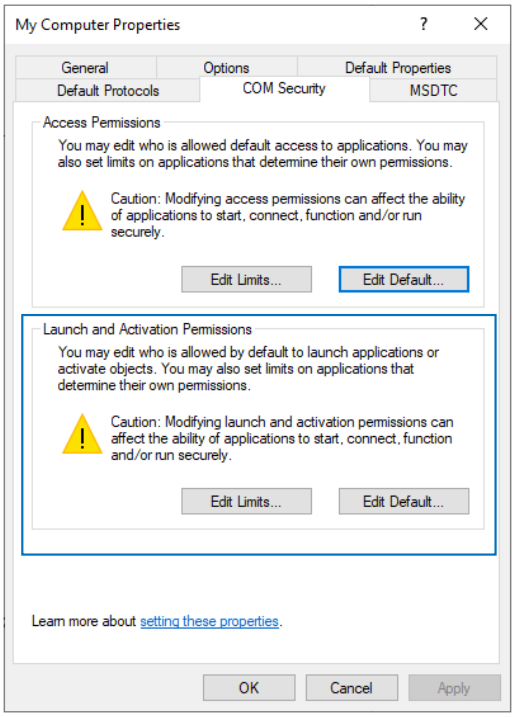



| | |
|---|---|
| 8 | Repeat step 7 for all the added (see step 5) users. |
| 9 | Click ***Edit*** in the ***My Computer Properties*** window. |

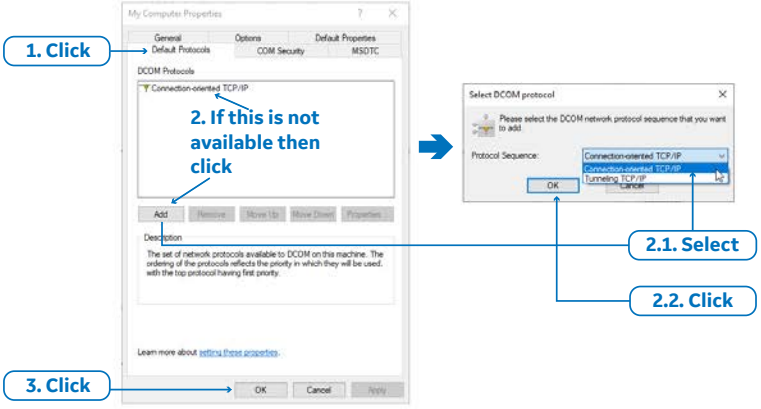



| | |
|---|---|
| 10 | Repeat step 5 - step 7. |

| Step | Action |
|---|---|
| 11 | Repeat step 5 to step 10 for ***Launch and Activation Permissions***. |

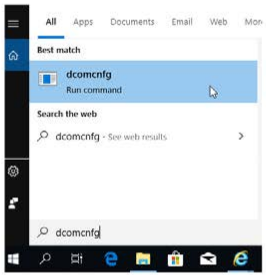



| | |
|---|---|
| 12 | Follow the instructions in the following illustration: |



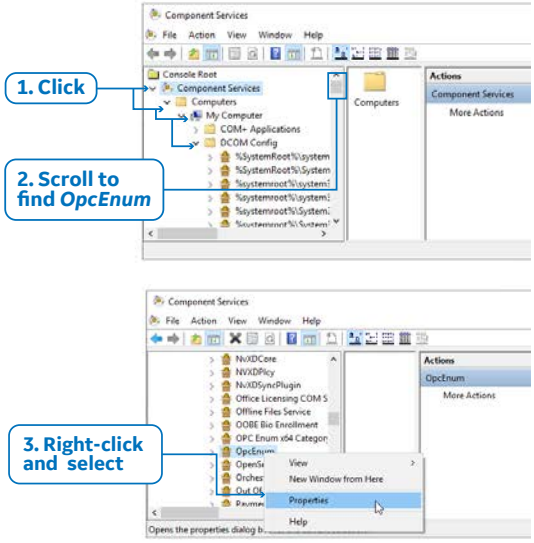

## OPC Enum

1. Click the Windows search icon, type in `dcomcnfg` and then click ***dcomcnfg***.

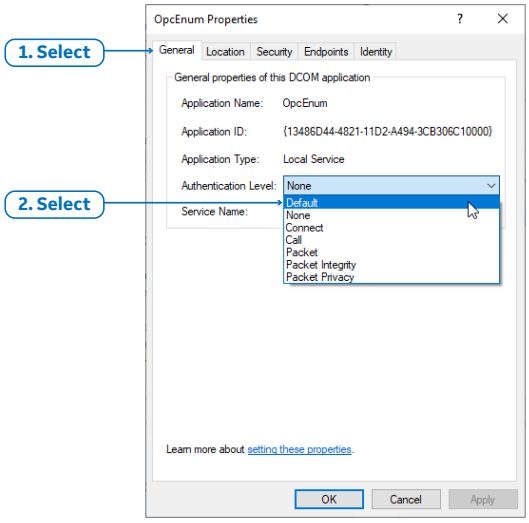



**IMPORTANT**
If you are logged in as Administrator, you will be prompt for confirmation. Click ***Yes*** to proceed.

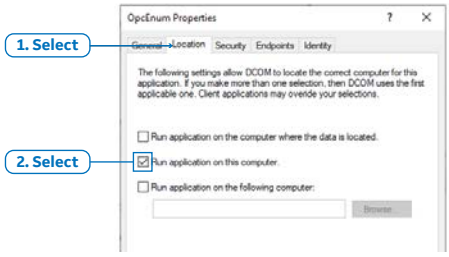
2. Follow the instructions in the following illustrations:



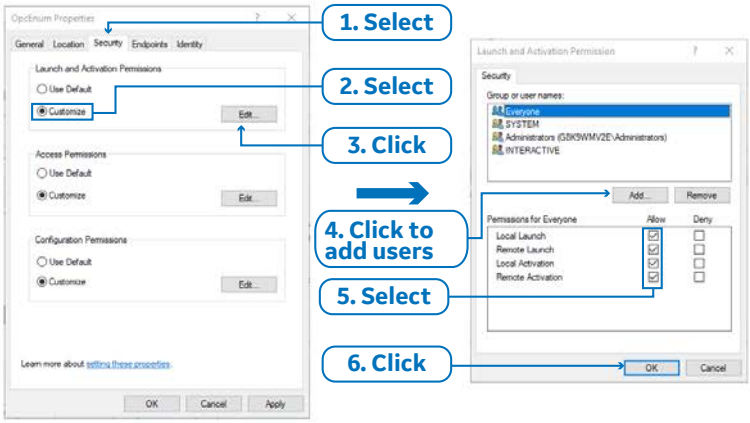

3. In the ***General*** tab, set the ***Authentication level*** to ***Default***.



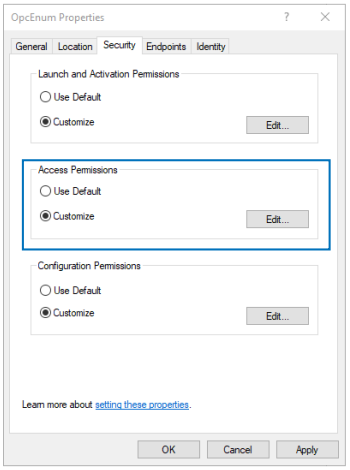

4. Under the ***Location*** tab select ***Run application on this computer***.

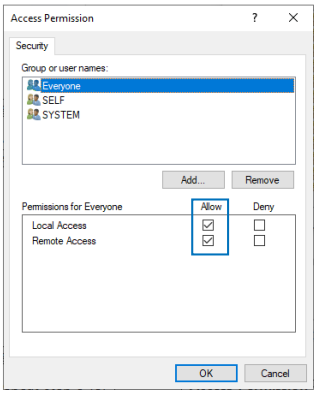



5. Allow permission for ***Everyone, Interactive, Network, Anonymous***, and ***System*** following the instructions in the illustration:

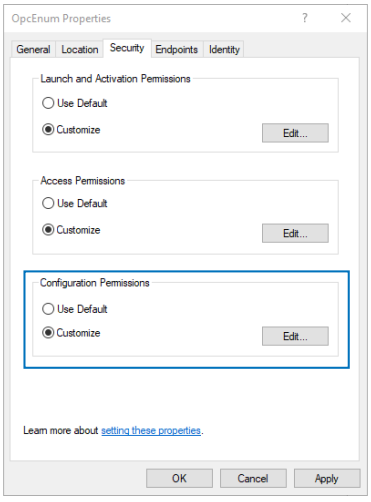


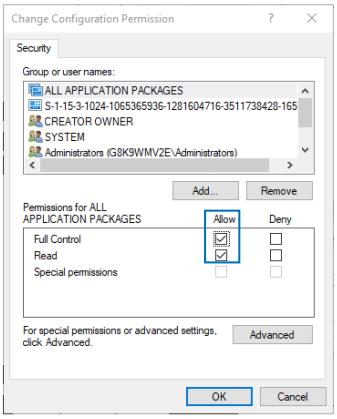

6. Repeat step 5 for ***Access Permission***.



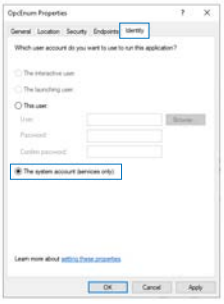




7. Repeat step 6 for ***Configuration Permissions***.

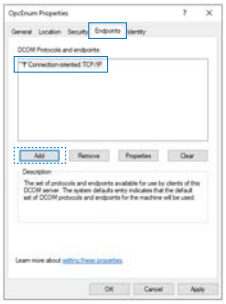



8. In the ***Identity*** tab, select ***The system account***.



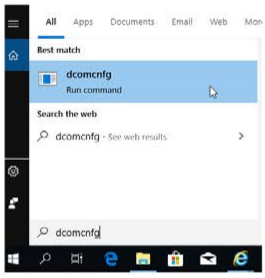
9. In the ***Endpoints*** tab, check if the ***DCOM Protocol and endpoint session*** has ***Connection-oriented TCP/IP***. If no, click ***Add*** and add ***Connection-oriented TCP/IP***.



10. Click ***Apply*** and then ***OK*** to save the settings and close the ***OpcEnum Properties*** window.

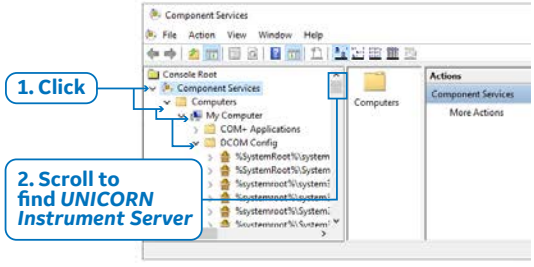
## UNICORN Instrument Server

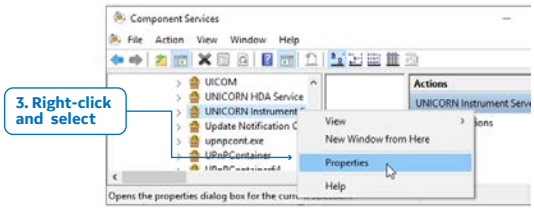
1. Click the Windows search icon, type in `dcomcnfg` and then click ***dcomcnfg***.



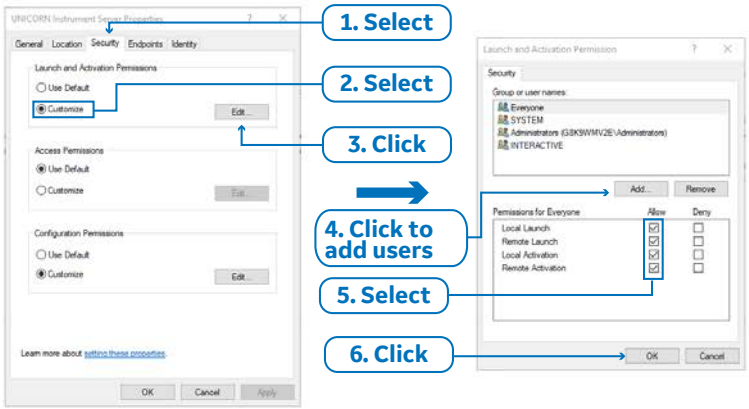

> **IMPORTANT**
> If you are logged in as Administrator, you will be prompt for confirmation. Click ***Yes*** to proceed.

2. Follow the instructions in the following illustrations:






3. In the ***General*** tab, set the ***Authentication level*** to ***Connect***.
4. In the ***Security*** tab select:
   - ***Customize*** for ***Launch and Activation Permissions***,
   - ***Use Default*** for ***Access Permissions***,
   - ***Customize*** for ***Access Permissions***.
5. Follow the instructions in the illustration:



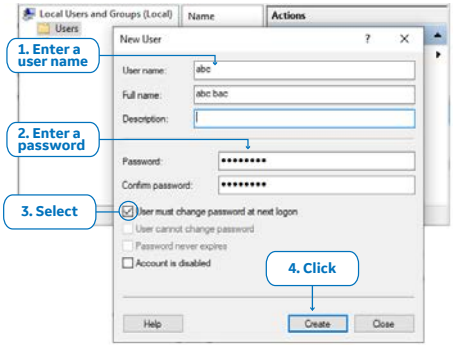

6. In the ***Identity*** tab, make sure that either ***The interactive user*** or ***The system account*** is selected.
7. Click ***Apply*** and then ***OK*** to save the settings and close the ***UNICORN Instrument Server Properties*** window.

## Create new user

1. In the Windows search button, type in `lusrmgr.msc` and then click ***lusrmgr.msc***.

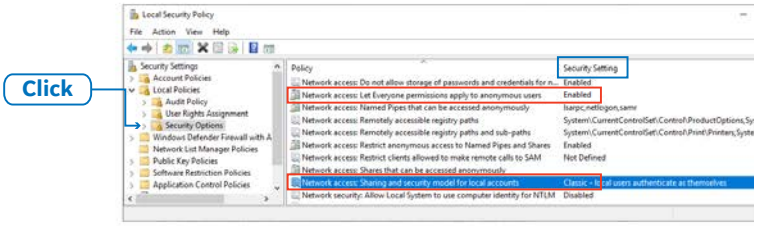
> **IMPORTANT**
> If you are logged in as Administrator, you will be prompt for confirmation. Click ***Yes*** to proceed.

2. Right-click ***Users*** and then select ***New User***.
3. Follow the instructions in the following illustration:



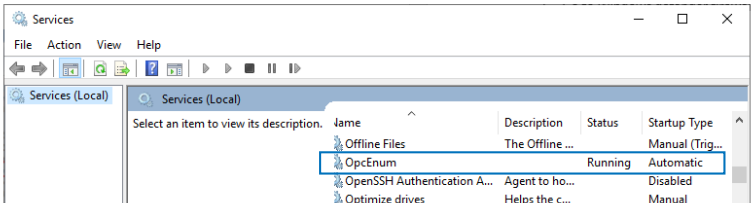

## Set security option

1. In the Windows search button, type in `secpol.msc` and then click ***secpol.msc***.
2. Make sure that the ***Security Setting*** for the items highlighted in following illustration are ***Enabled*** and ***Classic-local users authenticate as themselves***:




## Check OpcEnum status

1. In the Windows search button, type in `services` and then click ***Services***.
2. Make sure that ***OpcEnum*** is ***Running*** with ***Automatic*** as ***Startup Type***.




## Firewall settings

1. In the Windows search button, type in `firewall.cpl` and then click ***firewall.cpl***.
2. Click ***Turn Windows Defender Firewall on or off*** in the left menu and then select ***Turn ON Windows defender firewall*** for both public and private network settings.
3. Add firewall ports as Inbound.

1. Click ***Advanced*** on the left menu.
2. Click ***Inbound Rules*** on the left menu.
3. Enable ***File and Printer Sharing*** (***Right-click Enable***).

   ***Note:*** *Client and server machines must be able to ping each other.*
4. Close this window.

4. In the ***Windows Defender Firewall***, click ***Allow an app or feature.....*** on the left menu.
5. Make sure that the following are added in the ***Allowed app*** list:

   - OpcEnum
   - DCOM
   - DCOM Port
   - TCP Ports for UNICORN

   If error occurs, see *Event ID-10016*.

## Client-side settings

1. Do the steps 1 to 6 as described in *Server-side settings, on page 12*.
2. Do the steps as described in *OPC Enum, on page 17*.
3. Do the steps as described in *Firewall settings, on page 23*.

# 3.2 Configuration

## Use domain users

It is easier to setup a secure OPC communication between a remote OPC client and the OPC server if the computers in the network are connected to a domain server and the domain users are logged onto each computer.

If the computers are not connected to a domain, add them to a workgroup and create users with the same credentials on all computers in the network.

## Get DCOM call/activation log

Detailed information on error caused by incorrect DCOM configuration is logged in the Windows event log. Follow the instruction below to retrieve the information.

In the registry below the key `HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Ole\` add the following ***DWORD*** values:

- `ActivationFailureLoggingLevel` - ***DWORD*** value with value `1`.
- `CallFailureLoggingLevel` - ***DWORD*** value with value `1`.

## Troubleshoot communication issues

Communication failure between an OPC client and an OPC server is often caused by DCOM security issues. There is no DCOM configuration that works on all systems since it depends on the operating system used, network settings, computer configuration and the required security level.

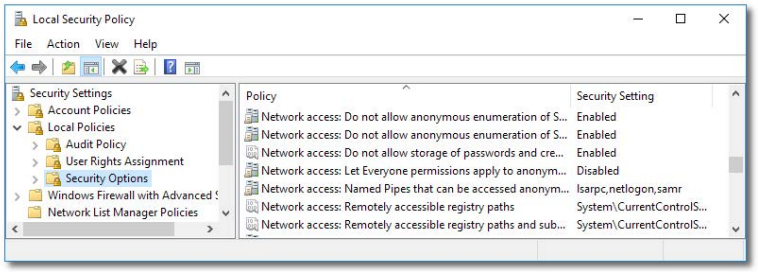
***Note:*** *In case of communication issues, it is recommended to first remove all DCOM security settings to get the communication working and then gradually increase the security level.*

Follow the instructions below to troubleshoot communication issues.

1. Turn off Windows firewall
2. Change local security policy
3. Change default (system wide) DCOM settings
4. Change server specific DCOM configuration

## Change local security policy

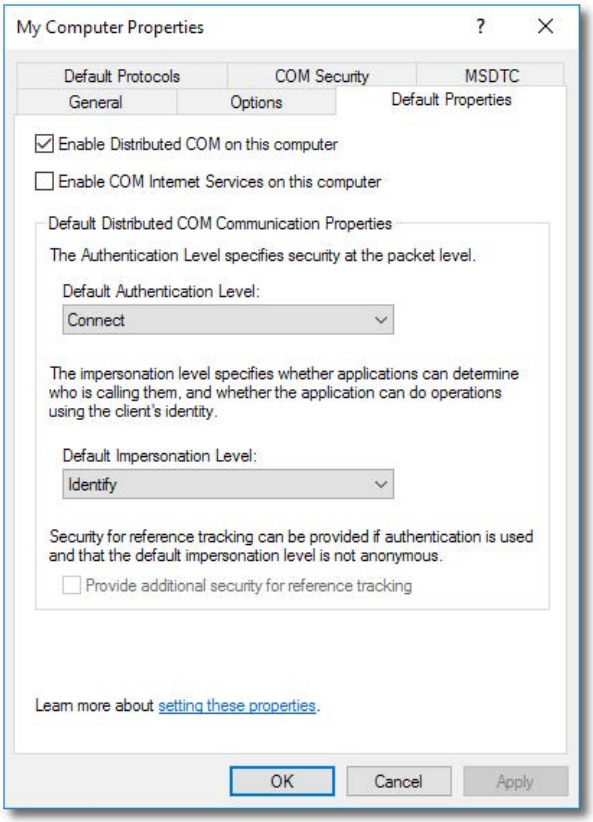
| Step | Action |
|---|---|
| 1 | Type "`Local Security Policy`" in the Windows Start menu search field, click the ***Local Security Policy*** item that is displayed as the search result. |

| Step | Action |
|---|---|
| 2 | Expand ***Security Settings*** →***Local Policies*** →***Security Options***   |
| 3 | Set ***Network access →Let Everyone permissions apply to anonymous users*** to ***Enabled***. |
| 4 | Set ***Network access →Sharing and security model for local accounts*** to ***Classic – local users authenticate as themselves***. |

## Change default DCOM settings system wide

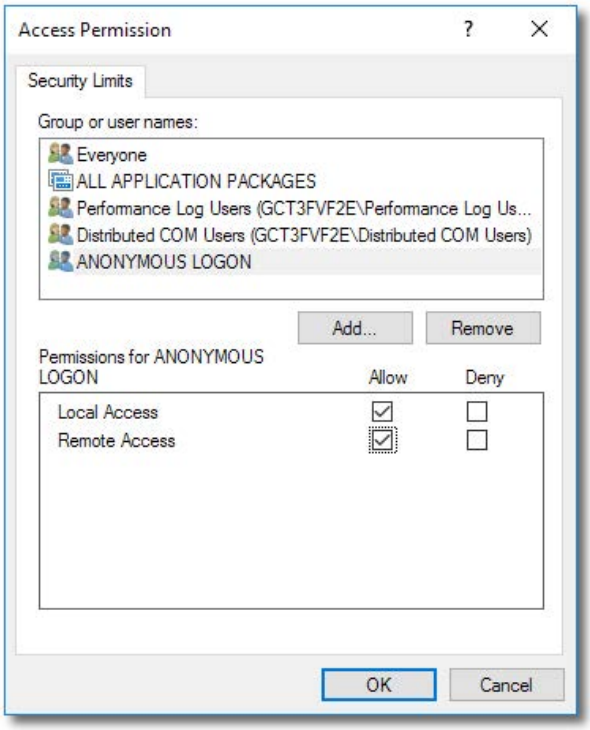
| Step | Action |
|---|---|
| 1 | Type "`Component Services`" in the Windows start menu search field, click the ***Component Services*** item that is displayed as the search result. |

| Step | Action |
|---|---|
| 2 | Expand ***Component Services*** →***Computers***. Right-click ***My Computer***, then select ***Properties***. In ***Default Properties*** tab set ***Default Authentication Level*** to ***Connect***. |



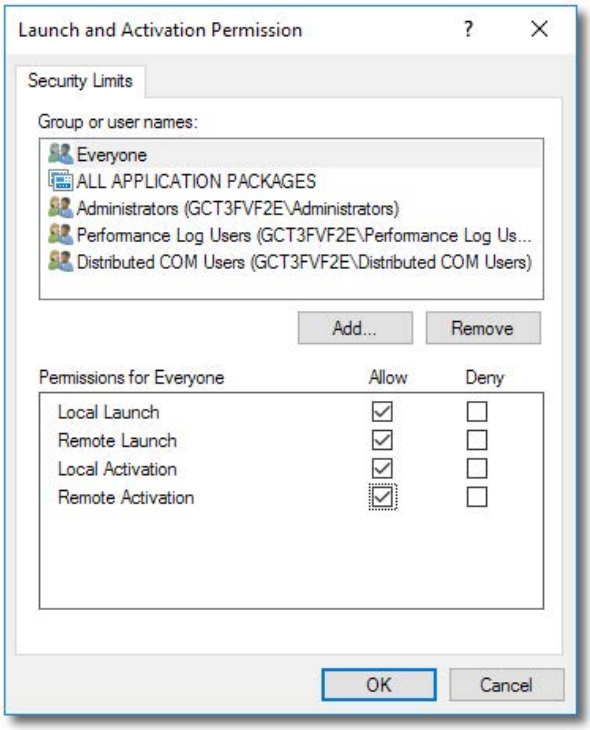

| | |
|---|---|
| 3 | In ***COM Security*** tab, ***Access Permissions*** pane, click ***Edit Limits***. |

| Step | Action |
|---|---|
| 4 | Add ***Interactive***, ***Network*** and ***System*** users. Set the ***Everyone***, ***Interactive***, ***Network*** and ***System*** users to have both ***Local Access*** and ***Remote Access***. Click ***OK***. |




| | |
|---|---|
| 5 | In ***COM Security*** tab, ***Launch and Activation Permissions*** pane, click ***Edit Limits***. |

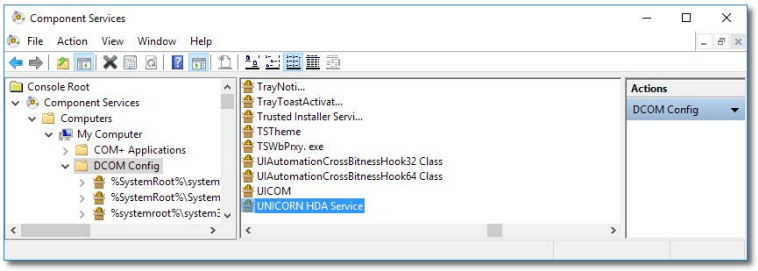
| Step | Action |
|---|---|
| 6 | Add ***Anonymous Logon***, ***Interactive***, ***Network***, ***System*** and ***Everyone***. Set them to have ***Local Launch***, ***Remote Launch***, ***Local Activation*** and ***Remote Activation*** permissions. |



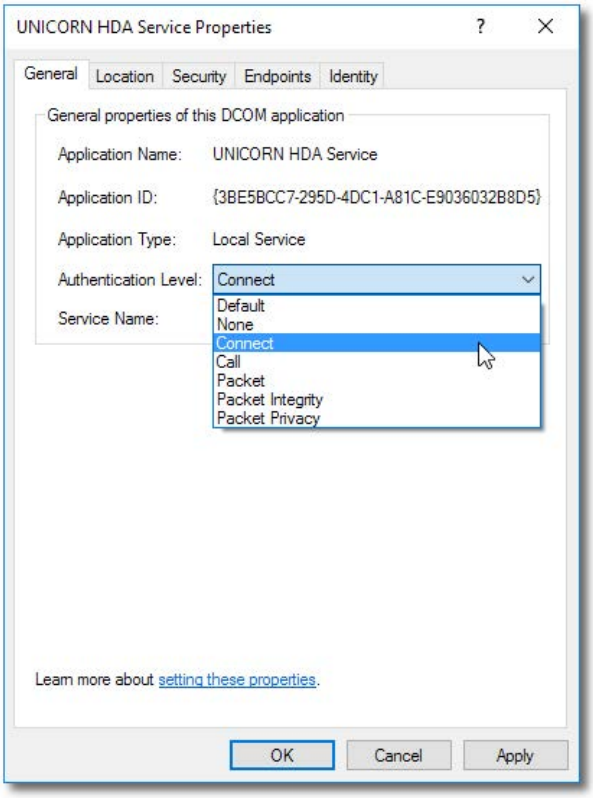

| | |
|---|---|
| 7 | Click ***OK*** to close the ***Launch Permission*** window. |

## Change server-specific DCOM configuration

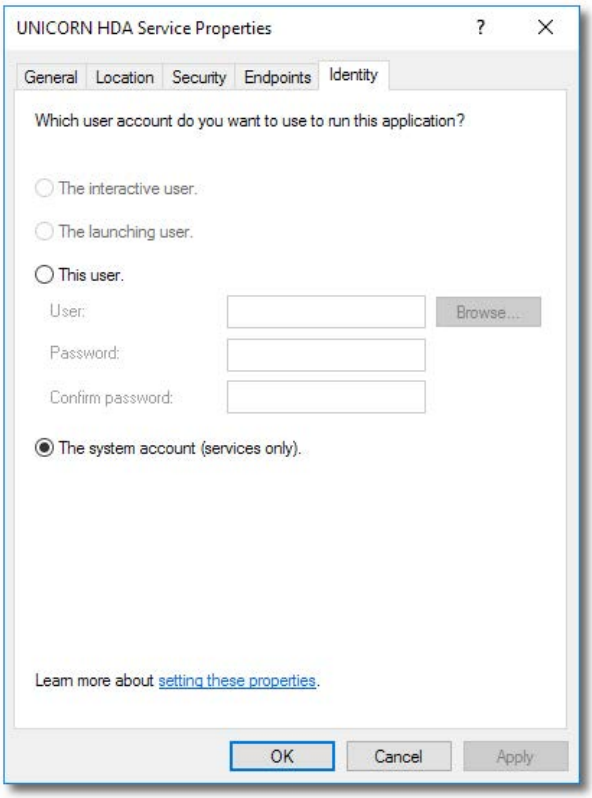
| Step | Action |
|---|---|
| 1 | Expand ***Component Services*** →***Computers*** →***My Computer*** →***DCOM Config***. Answer ***Yes*** on any question asked when expanding ***DCOM Config***. |
| 2 | Locate ***UNICORN HDA Service, UNICORN Instrument Server*** and ***OpcEnum*** in the list. |
| 3 | Right-click ***UNICORN HDA Service***, select ***Properties***. |



| Step | Action |
|---|---|
| 4 | In the ***General*** tab, set ***Authentication level*** to ***Connect***. |

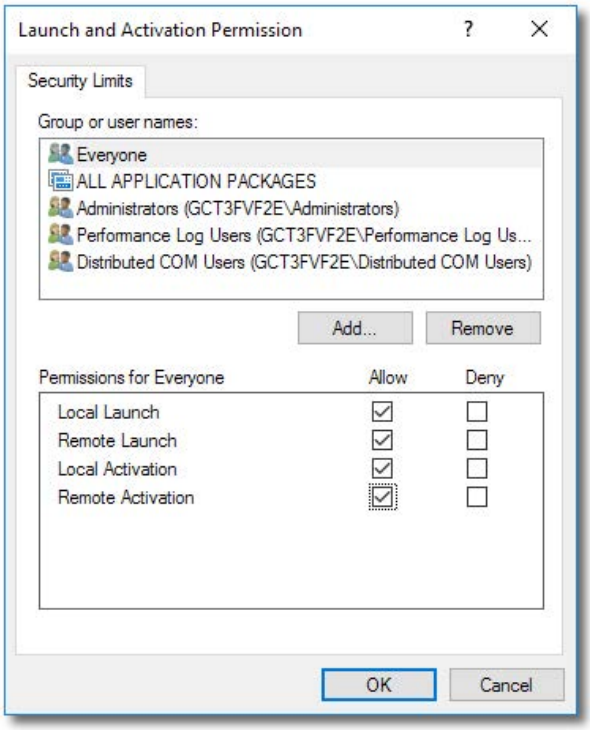


| Step | Action |
|---|---|
| 5 | In the ***Identity*** tab, set ***Authentication level*** to ***The system account (services only)*** (or to ***The interactive user***, if not a service) |



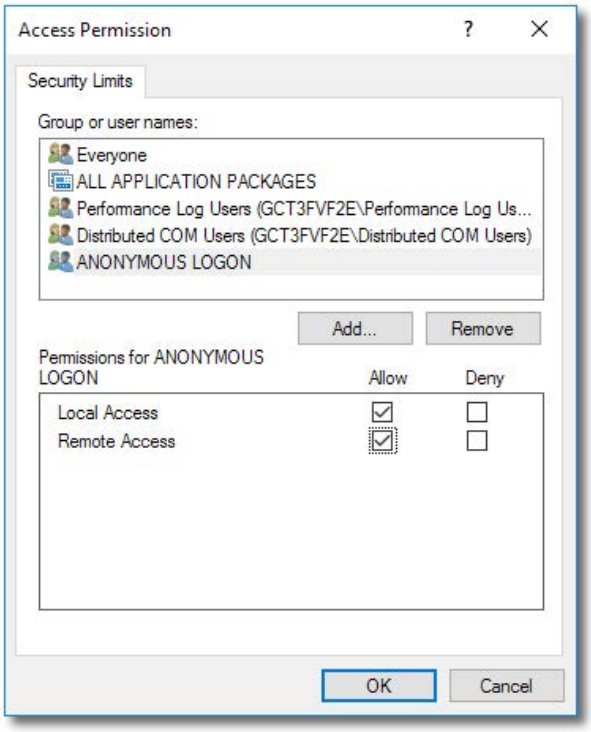

| | |
|---|---|
| 6 | Click the ***Security*** tab, then in the ***Launch and Activation Permissions*** pane click ***Customize***, then click ***Edit***. |

| Step | Action |
|---|---|
| 7 | Set the ***INTERACTIVE***, ***NETWORK***, ***Everyone*** and ***SYSTEM*** users ***Permissions*** to ***Allow Local Launch***, ***Remote Launch***, ***Local Activation*** and ***Remote Activation***. |




| | |
|---|---|
| 8 | Click ***OK*** to close the ***Launch and Activation Permissions window***. |
| 9 | In the ***Access Permissions*** pane click ***Customize***, then click ***Edit***. |

| Step | Action |
|---|---|
| 10 | Set the ***INTERACTIVE***, ***NETWORK***, ***Everyone*** and ***SYSTEM*** users ***Permissions*** to ***Allow Local Access*** and ***Remote Access***. |




| | |
|---|---|
| 11 | Click ***OK*** to close the ***Access Permission*** window |
| 12 | Click OK to close the ***UNICORN HDA Service Properties*** window. |
| 13 | Redo step 3 to 12 for ***UNICORN Instrument Server*** and ***OpcEnum***. |

## 3.3 UNICORN OPC custom error codes

The server defines several custom error codes that extend the OPC error codes. They are returned when reading or writing items. The error codes can be avoided by checking the ***OPC_PROP_RIGHTS*** property (for OPC Data Access) of an item. UNICORN OPC defines ***UNICORN_OPC_SECURITYACCESS*** and ***UNICORN_OPC_CONTROLACCESS*** to indicate if the item is accessible or not.

| Custom error code | is returned if... |
|---|---|
| ***UNICORN_OPC_E_ACCESSDENIED (0xC0048002)*** | ...the client tries to read/write to an item to which, the user for some reason currently does not have access. If security is enabled, the error code is returned if no user is logged in or if access to the user set-up of UNICORN is denied. |
| ***UNICORN_OPC_E_NOTINCONTROL (0xC0048003)*** | ...the client tries to write to an item and the OPC server is not in control of the system. To gain control, write ***Control (1)*** to the ***AssignState*** item in the ***STATE*** branch. If another UNICORN user is in control of the system, taking control will fail. |
| ***ServerVendorEFailedToTakeControl (0xC0048004)*** | ...the client failed to get control of the system. |
| ***ServerVendorEQuestionsNotAnswered (0xC0048006)*** | ...a mandatory question is not answered prior to starting a method run. |

## 3.4 Connection Identifiers

An OPC client can connect to the below connection identifiers, respectively, for DA, AE, and HDA servers:

| OPC interface | ProgID | CLSID |
|---|---|---|
| DA 2.05A | UNICORN_DAServer20.System1.1 | {03635E5D-8B72-4A00-99B9-692AC7451F83} |
| DA 3.0 | UNICORN_DAServer30.System1.1 | {1A509DE1-6B6C-47AC-B629-B5894F9D80B6} |
| AE 1.1 | UNICORN_AEServer11.System1.1 | {0FEB68A8-BC41-4D98-AB5C-8374A2F2C1F3} |
| HDA 1.2 | UNICORN_HDAServer12.1 | {E6E8E03C-A36E-4F6F-9BFB-F279D12A0188} |

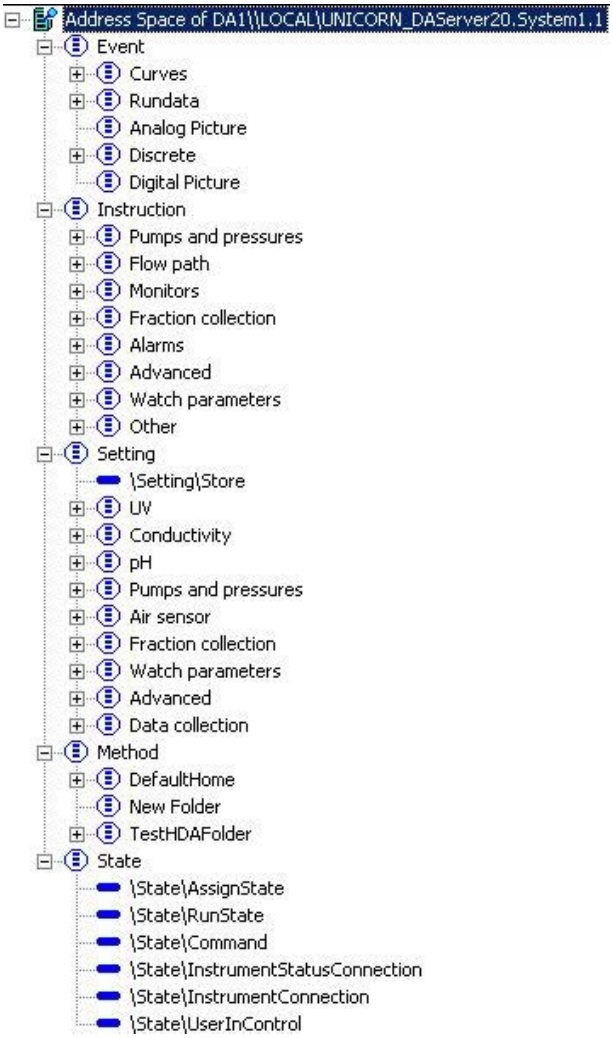
***Note:*** *Other connection identifiers exist but only intended for internal use.*

# 4 UNICORN OPC Data Access address space

This chapter provides information about UNICORN OPC Data Access address space, method execution, settings, run data, picture data etc.

The OPC Data Access (DA) address space is a real-time representation of process control data for connected instruments.

## Data Access address space view



***Tip:*** *The address space depends on the instrument configuration. Different items will appear depending on the instrument configuration used.*

## In this chapter


| Section | | See page |
|---|---|---|
| 4.1 | Run data and Picture data | 39 |
| 4.2 | Trend data | 41 |
| 4.3 | Manual instructions | 43 |
| 4.4 | Method execution | 50 |
| 4.5 | State | 63 |
| 4.6 | Recommendations | 72 |

# 4.1 Run data and Picture data

UNICORN run data are available via the `EVENT\Rundata` branch and, can be analog or digital depending on data type. Picture data are available via `EVENT\ANALOGPICTURE` and `EVENT\DIGITALPICTURE`.

Example location (<=> ***OPC total Item ID***) in server configuration tree:

```
Event\Rundata\Accumulated time
Event\Rundata\System flow
Event\Rundata\BufferPrep
Event\Analog Picture\UV1
Event\Digital Picture\Frac Comp
```

## Properties for analog data

Properties for analog data are:

| PID | Description | Data type |
|---|---|---|
| 1 | Canonical data type | ***VT_I2*** |
| 2 | Current value | ***VT_R4*** or ***VT_I4*** |
| 3 | Quality | ***VT_I2*** |
| 4 | Timestamp | ***VT_DATE*** |
| 5 | Access rights | ***VT_I4*** |
| 6 | Server scan rate | ***VT_R4*** |
| 7 | EU type | ***VT_I4*** |
| 8 | Value texts | ***VT_ARRAY→VT_BSTR*** |
| 100 | EU unit | ***VT_BSTR*** |
| 102 | High EU | ***VT_R8*** |
| 103 | Low EU | ***VT_R8*** |
| 5001 | Decimals | ***VT_R8*** |

## Properties for binary data

Properties for binary data are:

| PID | Description | Data type |
|---|---|---|
| 1 | Canonical data type | ***VT_I2*** |

| PID | Description | Data type |
|---|---|---|
| 2 | Current value | ***VT_I4*** |
| 3 | Quality | ***VT_I2*** |
| 4 | Timestamp | ***VT_DATE*** |
| 5 | Access rights | ***VT_I4*** |
| 6 | Server scan rate | ***VT_R4*** |
| 7 | EU type | ***VT_I4*** |
| 8 | Value texts | ***VT_EMPTY*** |
| 102 | Maximum value | ***VT_R8*** |
| 103 | Minimum value | ***VT_R8*** |

## 4.2 Trend data

UNICORN trend data are available via the `EVENT\Curves`. These data have the highest resolution. ***ANALOGTREND*** data are always an array of values.

### *BINARYTREND* data

***BINARYTREND*** contains textual trending data:

| Data | Description |
|---|---|
| ***CurrentMethod*** | Name of the current running method. |
| ***CurrentResult*** | Name of the current result to which the method run is saved. |
| ***CurrentScouting*** | Scouting number. |
| ***CurrentBlock*** | Name of the block currently executing. |
| ***RunLog*** | Messages for the current run. |
| ***Fractions*** | Current fraction mark. |
| ***Inject ions*** | Current injection mark. |

Example location (<=> ***OPC total Item ID***) in server configuration tree:

`Event\Curves\UV1`

`Event\Discrete\Injections`

### Properties for analog data

Properties for analog data are:

| PID | Description | Data type |
|---|---|---|
| 1 | Canonical data type | ***VT_I2*** |
| 2 | Current value | ***VT_ARRAY \| VT_R4*** |
| 3 | Quality | ***VT_I2*** |
| 4 | Timestamp | ***VT_DATE*** |
| 5 | Access rights | ***VT_I4*** |
| 6 | Server scan rate | ***VT_R4*** |
| 100 | EU unit | ***VT_BSTR*** |
| 102 | Maximum value | ***VT_R8*** |
| 103 | Minimum value | ***VT_R8*** |

| PID | Description | Data type |
|---|---|---|
| 5001 | Decimals | ***VT_R8*** |

## Properties for binary data

Properties for binary data are:

| PID | Description | Data type |
|---|---|---|
| 1 | Canonical data type | ***VT_I2*** |
| 2 | Current value | ***VT_BSTR*** |
| 3 | Quality | ***VT_I2*** |
| 4 | Timestamp | ***VT_DATE*** |
| 5 | Access rights | ***VT_I4*** |
| 6 | Server scan rate | ***VT_R4*** |

# 4.3 Manual instructions

UNICORN manual instructions from the ***Manual Instructions*** box in ***System Control*** are available in the ***INSTRUCTION*** branch. To execute an instruction, first enter the parameter values and then enter 0 or 1 to execute the item, or 2 to ignore the instruction. When 2 is entered, the instruction reaches UNICORN layer but UNICORN ignores the instruction.

If the instruction in UNICORN uses text, it is possible to get that text from the EU type.

During method runs, manual instruction parameters will be updated with current values, that is, flow changes are reflected in the flow parameter.

## In this section


| Section | | See page |
|---|---|---|
| 4.3.1 | Start methods | 44 |
| 4.3.2 | Execute parameter | 45 |
| 4.3.3 | Analog parameter | 46 |
| 4.3.4 | Digital parameter | 47 |
| 4.3.5 | String parameter | 48 |
| 4.3.6 | Virtual output instructions feature | 49 |

## 4.3.1 Start methods

It is recommended not to start runs by sending manual commands from OPC.

***Note:*** *It is recommended not to start manual runs via OPC. Start methods instead and then send manual commands only if needed during the method run.*

## 4.3.2 Execute parameter

Execute parameter is related to instruction information of the instrument configuration. The parameter name is constructed by adding "`_Execute`" to the actual instruction name. Set the scan rate to the fastest update rate of the server (i.e., 500 ms).

The canonical data type is ***VT_I2***. The instruction description is read from instrument configuration.

Instruction execute objects are only ***OPC_WRITABLE***. Enter `0` or `1` to execute the item, or `2` to ignore the instruction. When `2` is entered, the instruction reaches UNICORN layer but UNICORN ignores the instruction.

***Note:*** *The instructions can only be executed if the module is in control of UNICORN system.*

Instruction execution leads to run state ***MANUAL (5)***, unless already in ***RUN*** state. It is possible to change run state to ***END (4)*** by using the state control object.

Quality is good on successful execution of the instruction, which means that the corresponding manual command is successfully submitted.

### Implemented properties

Implemented execute parameter properties are as follows:

| PID | Description | Data type |
|---|---|---|
| 1 | Canonical data type | ***VT_I2*** |
| 2 | Current value | ***VT_EMPTY*** |
| 3 | Quality | ***VT_I2*** |
| 4 | Timestamp | ***VT_DATE*** |
| 5 | Access rights | ***VT_I4*** |
| 6 | Server scan rate | ***VT_R4*** |
| 7 | EU type | ***VT_I4*** |
| 8 | Value texts | ***VT_ARRAY→VT_BSTR*** |
| 101 | Item description | ***VT_BSTR*** |
| 102 | Maximum value | ***VT_R8*** |
| 103 | Minimum value | ***VT_R8*** |

Example location (***<=> OPC total Item ID***) in server configuration tree:

```
\Instruction\Pumps and pressures\System flow\System
flow_Execute
```

## 4.3.3 Analog parameter

Unit, parameter description, minimum and maximum values are read from instrument configuration. The canonical data type is either ***VT_I4*** or ***VT_R4***. If instrument configuration position names are defined, the EU type becomes ***OPC_ENUMERATED***, otherwise ***OPC_ANALOG***. Set the scan rate to the fastest update rate of the server (i.e., 500 ms).

Analog parameter objects are both ***OPC_READABLE*** and ***OPC_WRITABLE***, but only from/to ***CACHE***. When executing an instruction (described above), the ***CACHE*** value is included in the manual command structure.

***Note:*** *The instructions can only be executed if the module is in control of UNICORN system.*

### Implemented properties

Implemented analog parameter properties are as follows:

| PID | Description | Data type |
|---|---|---|
| 1 | Canonical data type | ***VT_I2*** |
| 2 | Current value | ***VT_R4*** or ***VT_I4*** |
| 3 | Quality | ***VT_I2*** |
| 4 | Timestamp | ***VT_DATE*** |
| 5 | Access rights | ***VT_I4*** |
| 6 | Server scan rate | ***VT_R4*** |
| 7 | EU type | ***VT_I4*** |
| 8 | Value texts | ***VT_ARRAY→VT_BSTR*** |
| 100 | EU unit | ***VT_BSTR*** |
| 101 | Item description | ***VT_BSTR*** |
| 102 | High EU | ***VT_R8*** |
| 103 | Low EU | ***VT_R8*** |
| 5001 | Decimals | ***VT_R8*** |

Example location (<=> ***OPC total Item ID***) in server configuration tree:

```
\Instruction\Pumps and pressures\System flow\Flow rate
```

## 4.3.4 Digital parameter

The canonical data type is always ***VT_I2***. Parameter description, open and close labels are read from instrument configuration. If instrument configuration position names are defined, the EU type becomes ***OPC_ENUMERATED***, otherwise ***OPC_NOENUM***. Set the scan rate to the fastest update rate of the server (which means 500 ms).

Digital parameter objects are both ***OPC_READABLE*** and ***OPC_WRITABLE***, but only from/to ***CACHE***. When executing an instruction (described above), the ***CACHE*** value is included in the manual command structure.

***Note:*** *The instructions can only be executed if the module is in control of UNICORN system.*

### Implemented properties

Implemented digital parameter properties are: as follows:

| PID | Description | Data type |
|---|---|---|
| 1 | Canonical data type | ***VT_I2*** |
| 2 | Current value | ***VT_I2*** |
| 3 | Quality | ***VT_I2*** |
| 4 | Timestamp | ***VT_DATE*** |
| 5 | Access rights | ***VT_I4*** |
| 6 | Server scan rate | ***VT_R4*** |
| 7 | EU type | ***VT_I4*** |
| 8 | Value texts | ***VT_ARRAY→VT_BSTR*** |
| 100 | EU unit | ***VT_BSTR*** |
| 101 | Item description | ***VT_BSTR*** |
| 106 | Maximum value | ***VT_R8*** |
| 107 | Minimum value | ***VT_R8*** |
| 5001 | Decimals | ***VT_R8*** |

Example location (<=> ***OPC total Item ID***) in server configuration tree:

```
\Instruction\Flow path\Inlet A\Position
```

## 4.3.5 String parameter

The canonical data type is always ***VT_BSTR***. The EU type is always ***OPC_NOENUM***. Set the scan rate to the fastest update rate of the server (which means 500 ms).

String parameter objects are both ***OPC_READABLE*** and ***OPC_WRITABLE***, but only from/to ***CACHE***. When executing an instruction (described above), the ***CACHE*** value is included in the manual command structure. The actual parameter is converted to an integer value before the instruction is executed.

***Note:*** *The instructions can only be executed if the module is in control of UNICORN system.*

### Implemented properties

Implemented string parameter properties are as follows:

| PID | Description | Data type |
|---|---|---|
| 1 | Canonical data type | ***VT_I2*** |
| 2 | Current value | ***VT_BSTR*** |
| 3 | Quality | ***VT_I2*** |
| 4 | Timestamp | ***VT_DATE*** |
| 5 | Access rights | ***VT_I4*** |
| 6 | Server scan rate | ***VT_R4*** |
| 7 | EU type | ***VT_I4*** |
| 8 | Value texts | ***VT_EMPTY*** |
| 101 | Item description | ***VT_BSTR*** |

Example location (<=> ***OPC total Item ID***) in server configuration tree:

`\Instruction\Other\Set mark\Mark text`

## 4.3.6 Virtual output instructions feature

This feature may exist depending on the UNICORN instrument configuration. If the UNICORN instrument configuration contains virtual output instructions then they will be visible below `INSTRUCTION\VirtualOutput`.

The following differs when comparing to other instructions:

- Virtual output instructions can be executed by an OPC client even though the client is not in control of the system.
- Virtual output instructions are not visible in the UNICORN run log.

# 4.4 Method execution

A UNICORN method can be run via the ***METHOD*** branch.

The ***METHOD*** branch is dynamic. Whenever a new method is created or an existing method is modified, the ***METHOD*** branch has to be browsed again to see the changes and has to reconfigure the items to use. If a method is deleted, it is removed from the address space. Depending on the general server settings, different users are shown in the ***METHOD*** branch.

Each method file contains several items.

## In this section


| Section | | See page |
|---|---|---|
| 4.4.1 | Scout Run Index | 51 |
| 4.4.2 | Run Method | 52 |
| 4.4.3 | Result Name | 54 |
| 4.4.4 | Batch ID | 55 |
| 4.4.5 | StartNotes | 56 |
| 4.4.6 | MethodNotes | 57 |
| 4.4.7 | PreCompile | 58 |
| 4.4.8 | Questions | 59 |
| 4.4.9 | Variables | 61 |

## 4.4.1 Scout Run Index

***Scout Run Index*** is used to include any scout runs. When a client writes `0`, all scout runs will be included in the method run unless the excluded flag is set for any particular run. Entering any particular scout run number will include only that run in the method run. The canonical data type is ***VT_I2*** and the EU type is always ***OPC_NOENUM***. Set the scan rate to the fastest update rate of the server (which means 500 ms).

The object is always ***OPC_READABLE*** and ***OPC_WRITEABLE***. The object is writable only when in control of the system. Executing the method stores the text in the result

### Implemented properties

Implemented scout run index properties are as follows:

| PID | Description | Data type |
|---|---|---|
| 1 | Canonical data type | ***VT_I2*** |
| 2 | Current value | ***VT_I2*** |
| 3 | Quality | ***VT_I2*** |
| 4 | Timestamp | ***VT_DATE*** |
| 5 | Access rights | ***VT_I4*** |
| 6 | Server scan rate | ***VT_R4*** |
| 102 | Maximum value | ***VT_R8*** |
| 103 | Minimum value | ***VT_R8*** |

Location (<=> ***OPC total Item ID***) in server configuration tree:

`\Method\DefaultHome\OPCSystem1(Manual)\TestMethod1\Scout Run Index`

## 4.4.2 Run Method

Available methods are read from the share directory of the current user, OPC user, or all users, depending on setup. The canonical data type is ***VT_I2*** and the EU type is always ***OPC_ENUMERATED***. Set the scan rate to the fastest update rate of the server (which means 500 ms).

Defined object values are as follows:

| Value | Description |
|---|---|
| 0 | Execute |
| 1 | Execute |
| 2 | NoExecute<br><br>***Note:***<br>*This is to ignore the instruction.* |

The object is ***OPC_READABLE*** and ***OPC_WRITEABLE***.

When a client writes ***END (3)*** to the state command, the current run state is checked to see if the result to be saved or not. If a method is running, the run state is ***RUN (0)***, ***PAUSE (1)*** or ***HOLD (2)*** and the result is saved. Other run states imply that it is a manual run being executed and the result is saved in the `[SystemName](Manual)` folder.

If a method is started when another method is already running, then the method will be placed the queue.

Quality is good when a method command is successfully issued. Writing the method run command stores the start notes, batch number, variables and questions before the method executes. The method will not start if a result name is not given.

### Implemented properties

Implemented properties are as follows:

| PID | Description | Data type |
|---|---|---|
| 1 | Canonical data type | ***VT_I2*** |
| 2 | Current value | ***VT_EMPTY*** |
| 3 | Quality | ***VT_I2*** |
| 4 | Timestamp | ***VT_DATE*** |
| 5 | Access rights | ***VT_I4*** |
| 6 | Server scan rate | ***VT_R4*** |
| 7 | EU type | ***VT_I4*** |

| PID | Description | Data type |
|---|---|---|
| 8 | Value texts | ***VT_ARRAY→VT_BSTR*** |
| 102 | Maximum value | ***VT_R8*** |
| 103 | Minimum value | ***VT_R8*** |

Location (<=> ***OPC total Item ID***) in server configuration tree:

`\Method\DefaultHome\OPCSystem1(Manual)\TestMethod1\Run Method`

## 4.4.3 Result Name

The canonical data type is ***VT_BSTR*** and the EU type is always ***OPC_NOENUM***. Set the scan rate to the fastest update rate of the server (i.e., 500 ms). Result name objects are both ***OPC_READABLE*** and ***OPC_WRITABLE***, but only readable from ***CACHE***. If a result name is set up in OPC, then UNICORN will not generate a result name. If not, then UNICORN will generate a unique result name when the method starts.

***Note:*** *The methods can only be run if the module is in control of UNICORN system.*

### Implemented properties

Implemented result name properties are as follows:

| PID | Description | Data type |
|---|---|---|
| 1 | Canonical data type | ***VT_I2*** |
| 2 | Current value | ***VT_BSTR*** |
| 3 | Quality | ***VT_I2*** |
| 4 | Timestamp | ***VT_DATE*** |
| 5 | Access rights | ***VT_I4*** |
| 6 | Server scan rate | ***VT_R4*** |

Example location (<=> ***OPC total Item ID***) in server configuration tree:

`\Method\DefaultHome\OPCSystem1(Manual)\TestMethod1\Result Name`

## 4.4.4 Batch ID

Batch ID is used to set the batch number before running a method. The canonical data type is ***VT_BSTR*** and the EU type is always ***OPC_NOENUM***.

Set the scan rate to the fastest update rate of the server (which means 500 ms).

Batch ID objects are both ***OPC_READABLE*** and ***OPC_WRITABLE***, but only readable from ***CACHE***. Clients write the batch number to the object. If a batch ID is set up in OPC, then UNICORN will not generate a batch ID. If a batch ID is not setup in OPC, then UNICORN will generate a unique batch ID when the method starts.

***Note:*** *The methods can only be run if the module is in control of UNICORN system.*

### Implemented properties

Implemented batch ID properties are: as follows:

| PID | Description | Data type |
|---|---|---|
| 1 | Canonical data type | ***VT_I2*** |
| 2 | Current value | ***VT_BSTR*** |
| 3 | Quality | ***VT_I2*** |
| 4 | Timestamp | ***VT_DATE*** |
| 5 | Access rights | ***VT_I4*** |
| 6 | Server scan rate | ***VT_R4*** |

Example location (<=> ***OPC total Item ID***) in server configuration tree:

`\Method\DefaultHome\OPCSystem1(Manual)\TestMethod1\Batch ID`

## 4.4.5 StartNotes

***StartNotes*** is used to read and write the start notes. The canonical data type is ***VT_BSTR*** and the EU type is always ***OPC_NOENUM***.

Set the scan rate to the fastest update rate of the server (which means 500 ms).

***StartNotes*** objects are ***OPC_READABLE*** and ***OPC_WRITEABLE***. The object is writable only when in control of the system. Executing the method stores the text in the result.

### Implemented properties

Implemented start notes properties are as follows:

| PID | Description | Data type |
|---|---|---|
| 1 | Canonical data type | ***VT_I2*** |
| 2 | Current value | ***VT_BSTR*** |
| 3 | Quality | ***VT_I2*** |
| 4 | Timestamp | ***VT_DATE*** |
| 5 | Access rights | ***VT_I4*** |
| 6 | Server scan rate | ***VT_R4*** |

Example location (<=> ***OPC total Item ID***) in server configuration tree:

`\Method\DefaultHome\OPCSystem1(Manual)\TestMethod1\StartNotes`

## 4.4.6 MethodNotes

***MethodNotes*** is used to read the method notes. The canonical data type is ***VT_BSTR*** and the EU type is always ***OPC_NOENUM***.

Set the scan rate to the fastest update rate of the server (which means 500 ms).

***MethodNotes*** objects are ***OPC_READABLE***.

### Implemented properties

Implemented method notes properties are as follows:

| PID | Description | Data type |
|---|---|---|
| 1 | Canonical data type | ***VT_I2*** |
| 2 | Current value | ***VT_BSTR*** |
| 3 | Quality | ***VT_I2*** |
| 4 | Timestamp | ***VT_DATE*** |
| 5 | Access rights | ***VT_I4*** |
| 6 | Server scan rate | ***VT_R4*** |

Example location (<=> ***OPC total Item ID***) in server configuration tree:

`\Method\DefaultHome\OPCSystem1(Manual)\TestMethod1\Method Notes`

## 4.4.7 PreCompile

The canonical data type is always ***VT_BSTR*** (text string value). The EU type is always ***OPC_NOENUM***. Set the scan rate to the fastest update rate of the server (which means 500 ms).

This forces UNICORN OPC to compile the method and check if it is runnable on this system. If it is, the result will be an xml string containing "`Succeed`" as the status. If not, the string will contain an error text.

### Implemented properties

Implemented method compile properties are as follows:

| PID | Description | Data type |
|---|---|---|
| 1 | Canonical data type | ***VT_I2*** |
| 2 | current value | ***VT_BSTR*** |
| 3 | Quality | ***VT_I2*** |
| 4 | Timestamp | ***ST_DATE*** |
| 5 | Access rights | ***VT_I4*** |
| 6 | Server scan rate | ***VT_R4*** |

Example location (<=> ***OPC total Item ID***) in server configuration tree:

```
\Method\DefaultHome\OPCSystem1(Manual)
\TestMethod1\PreCompile Method
```

## 4.4.8 Questions

The ***QUESTIONS*** branch is used to read and write the start protocol questions. One object is created for each question in a start protocol. Objects are added to the ***QUESTIONS*** branch for every method. The canonical data type is either ***VT_BSTR*** or ***VT_UI4***, depending on the question type.

Table 4.1: Question types and data types

| Data type | Question type |
|---|---|
| ***NoReply*** | ***VT_BSTR***, ***OPC_NOENUM*** |
| ***Entry field*** | ***VT_BSTR***, ***OPC_NOENUM*** |
| ***Multiple choice*** | ***VT_UI4***, ***OPC_ENUMERATED*** as ***VT_ARRAY \| VT_BSTR*** |
| ***Integer*** | ***VT_BSTR***, ***OPC_NOENUM*** |
| ***Float*** | ***VT_BSTR***, ***OPC_NOENUM*** |

***Integer*** and ***Float*** can have minimum and maximum ranges. Writing out of range is not allowed. Empty strings are valid unless the mandatory flag is set. Authorized questions are allowed without supplying any signature. Also, it is possible to run methods without answering all the questions unless the mandatory flag is set.

Set the scan rate to the fastest update rate of the server (which means 500 ms).

***Question*** objects are ***OPC_READABLE*** and ***OPC_WRITEABLE***. The object is writable only when in control of the system. Executing the method stores the answers in the result.

### Implemented properties

Implemented properties are as follows:

| PID | Description | Data type |
|---|---|---|
| 1 | Canonical data type | ***VT_I2*** |
| 2 | Current value | ***VT_BSTR*** or ***VT_UI4*** |
| 3 | Quality | ***VT_I2*** |
| 4 | Timestamp | ***VT_DATE*** |
| 5 | Access rights | ***VT_I4*** |
| 6 | Server scan rate | ***VT_R4*** |
| 7 | EU type | ***VT_I4*** |
| 8 | Value texts | ***VT_ARRAY→VT_BSTR*** |

| PID | Description | Data type |
|---|---|---|
| 102 | Maximum value | ***VT_R8*** (if ***Float***, ***Integer*** or ***Multiple***) |
| 103 | Minimum value | ***VT_R8*** (if ***Float***, ***Integer*** or ***Multiple***) |

Example location (<=> ***OPC total Item ID***) in server configuration tree:

```
\Method\DefaultHome\OPCSystem1(Manual)
\TestMethod1\Question(s)\Question1{Mandatory}
```

## 4.4.9 Variables

The ***VARIABLES*** branch is used to read and write the method variables. One object is created for each method variable. Objects are added to the ***VARIABLES*** branch for every method if the ***StartProtocol*** for the method supports the variable value change. The variables on the following are not supported:

- Scouting
- Instruction breakpoint
- Frac-950 Fractionation instruction parameters
- Frac-950 Peak Fractionation parameters

The canonical data type depends on the following variable types:

Table 4.2: Data types and variable types

| Data type | Variable type |
|---|---|
| ***Float*** | ***VT_R4***, ***OPC_NOENUM*** |
| ***Integer*** | ***VT_I4***, ***OPC_NOENUM*** |
| ***String*** | ***VT_BSTR***, ***OPC_NOENUMR*** |
| ***Multiple choice*** | ***VT_I4***, ***OPC_ENUMERATED*** as ***VT_ARRAY \| VT_BSTR*** |

***Integer*** and ***Float*** have minimum and maximum ranges. Writing out of range is not allowed.

Set the scan rate to the fastest update rate of the server (which means 500 ms).

***Variables*** objects are ***OPC_READABLE*** and ***OPC_WRITEABLE***. The object is writable only when in control of the system. Executing the method uses the variable settings during method run.

### Implemented properties

Implemented start protocol variables general properties are as follows:

| PID | Description | Data type |
|---|---|---|
| 1 | Canonical data type | ***VT_I2*** |
| 2 | Current value | ***VT_R4***, ***VT_I4***, ***BSTR*** or ***VT_UI4*** |
| 3 | Quality | ***VT_I2*** |
| 4 | Timestamp | ***VT_DATE*** |
| 5 | Access rights | ***VT_I4*** |
| 6 | Server scan rate | ***VT_R4*** |

## Properties of start protocol variables specific variables

***Float***, ***Integer*** or ***Multiple choice*** also implements the following properties:

| PID | Description | Data type |
|---|---|---|
| 7 | EU type | ***VT_I4*** |
| 8 | Value texts | ***VT_ARRAY→VT_BSTR*** |
| 100 | Unit | ***VT_BSTR*** |
| 101 | Description | ***VT_BSTR*** |
| 102 | Maximum value | ***VT_R8*** |
| 103 | Minimum value | ***VT_R8*** |
| 5000 | Default value | ***VT_R4***, ***VT_I4***, ***VT_BSTR*** or ***VT_UI4*** |

Example location (<=> ***OPC total Item ID***) in server configuration tree:

```
\Method\DefaultHome\OPCSystem1(Manual)\TestMethod1\Method
Variable(s)\Inlet B
```

# 4.5 State

The ***STATE*** branch contains important state information for the system.

## In this section


| Section | | See page |
|---|---|---|
| 4.5.1 | AssignState | 64 |
| 4.5.2 | RunState | 65 |
| 4.5.3 | Command | 67 |
| 4.5.4 | InstrumentConnection | 69 |
| 4.5.5 | InstrumentStatusConnection | 70 |
| 4.5.6 | UserInControl | 71 |

## 4.5.1 AssignState

***AssignState*** enables the client to change assign mode to UNICORN system. Default assign mode is ***View***, a mode where the client can monitor ***EVENT*** and ***STATE*** branch items. By changing mode to ***Control***, it is also possible to execute instructions, run methods and save system settings. The canonical data type is ***VT_I4*** and the EU type is always ***OPC_ENUMERATED***. Set the scan rate to the fastest update rate of the server (which means 500 ms).

### Object values

Defined assign state values are as follows:

| Value | State |
|---|---|
| 0 | ***View*** |
| 1 | ***Control*** |

Quality is good if a correct ***AssignState*** is written to the object, otherwise bad.

### Implemented properties

Implemented assign state properties are as follows:

| PID | Description | Data type |
|---|---|---|
| 1 | Canonical data type | ***VT_I2*** |
| 2 | Current value | ***VT_I4*** |
| 3 | Quality | ***VT_I2*** |
| 4 | Timestamp | ***VT_DATE*** |
| 5 | Access rights | ***VT_I4*** |
| 6 | Server scan rate | ***VT_R4*** |
| 7 | EU type | ***VT_I4*** |
| 8 | Value texts | ***VT_ARRAY→VT_BSTR*** |
| 102 | Maximum value | ***VT_R8*** |
| 103 | Minimum value | ***VT_R8*** |

Example location (<=> ***OPC total Item ID***) in server configuration tree:

`\STATE\AssignState`

## 4.5.2 RunState

### Object values

The canonical data type is ***VT_I2*** and the EU type is always ***VT_I4***. Set the scan rate to the fastest update rate of the server (which means 500 ms).

Defined object values (meaning the state) are as follows:

- ***Ready***
- ***Method Run***
- ***System Pause***
- ***Hold***
- ***Pause Hold***
- ***Hold Pause***
- ***Manual Pause***
- ***Wash***
- ***Alarms and errors***
- ***Initializing system***
- ***Resetting***
- ***Starting method run***
- ***Starting manual run***

Quality is good on successful request of run state data or on valid update from online data, otherwise bad.

### Implemented properties

Implemented run state properties are as follows:

| PID | Description | Data type |
|---|---|---|
| 1 | Canonical data type | ***VT_I2*** |
| 2 | Current value | ***VT_I4*** |
| 3 | Quality | ***VT_I2*** |
| 4 | Timestamp | ***VT_DATE*** |
| 5 | Access rights | ***VT_I4*** |
| 6 | Server scan rate | ***VT_R4*** |
| 7 | EU type | ***VT_I4*** |
| 8 | Value texts | ***VT_EMPTY*** |
| 102 | Maximum value | ***VT_R8*** |

| PID | Description | Data type |
|---|---|---|
| 103 | Minimum value | ***VT_R8*** |

Example location (<=> ***OPC total Item ID***) in server configuration tree:
`\STATE\RunState`

## 4.5.3 Command

### Object values

The canonical data type is ***VT_I2*** and the EU type is always ***OPC_ENUMERATED***. Set the scan rate to the fastest update rate of the server (which means 500 ms).

Defined object values are as follows:

| Value | State |
|---|---|
| 0 | ***Pause*** |
| 1 | ***Hold*** |
| 2 | ***Continue*** |
| 3 | ***End*** |
| 4 | ***Next breakpoint*** |

Method command objects are ***OPC_WRITABLE***. Writing a valid value causes the utility object to submit a manual command.

***Note:*** *Methods can only be run if the module is in control of UNICORN system.*

When a client writes ***END (3)***, the current run state is checked to see if the result should be saved or not. If a method is running, the run state is ***RUN (1)***, ***PAUSE (4)*** or ***HOLD (5)*** and the result is saved. Other run state values imply a manual instruction being executed and the result is created in the `[SystemName] (Manual)` folder.

### Implemented properties

Implemented general command properties are:

| PID | Description | Data type |
|---|---|---|
| 1 | Canonical data type | ***VT_I2*** |
| 2 | Current value | ***VT_I2*** |
| 3 | Quality | ***VT_I2*** |
| 4 | Timestamp | ***VT_DATE*** |
| 5 | Access rights | ***VT_I4*** |
| 6 | Server scan rate | ***VT_R4*** |
| 7 | EU type | ***VT_I4*** |
| 8 | Value texts | ***VT_ARRAY→VT_BSTR*** |
| 102 | Maximum value | ***VT_R8*** |

| PID | Description | Data type |
|---|---|---|
| 103 | Minimum value | ***VT_R8*** |

Example location (<=> ***OPC total Item ID***) in server configuration tree:
`\STATE\Command`

## 4.5.4 InstrumentConnection

### Object values

***InstrumentConnection*** handles the instrument connection state. The canonical data type is ***VT_I4***. Set the scan rate to the fastest update rate of the server (which means 500 ms).

Defined object values are as follows:

| Value | State |
|---|---|
| 0 | ***Ready*** |
| 1 | ***Scanning*** |
| 2 | ***Unknown*** |

***InstrumentConnection*** objects are ***OPC_READABLE***.

***Note:*** *The instrument connection must be valid (connected) for the other items to work as expected.*

### Implemented properties

Implemented instrument connection properties are as follows:

| PID | Description | Data type |
|---|---|---|
| 1 | Canonical data type | ***VT_I2*** |
| 2 | Current value | ***VT_I4*** |
| 3 | Quality | ***VT_I2*** |
| 4 | Timestamp | ***VT_DATE*** |
| 5 | Access rights | ***VT_I4*** |
| 6 | Server scan rate | ***VT_R4*** |
| 7 | EU type | ***VT_I4*** |
| 8 | Value texts | ***VT_ARRAY→VT_BSTR*** |
| 102 | Maximum value | ***VT_R8*** |
| 103 | Minimum value | ***VT_R8*** |

Example location (<=> ***OPC total Item ID***) in server configuration tree:

`\STATE\InstrumentConnection`

# 4.5.5 InstrumentStatusConnection

## Object values

***InstrumentStatusConnection*** handles the instrument status state. The canonical data type is ***VT_I2***. Set the scan rate to the fastest update rate of the server (which means 500 ms).

Defined object values are as follows:

| Value | Connection |
|---|---|
| 0 | Yes |
| 1 | Partially |
| 2 | No |

***InstrumentStatus*** objects are ***OPC_READABLE.***.

***Note:*** *The instrument status must be valid (ready) if the other items are to work as expected.*

## Implemented properties

Implemented instrument status properties are as follows:

| PID | Description | Data type |
|---|---|---|
| 1 | Canonical data type | ***VT_I2*** |
| 2 | Current value | ***VT_I4*** |
| 3 | Quality | ***VT_I2*** |
| 4 | Timestamp | ***VT_DATE*** |
| 5 | Access rights | ***VT_I4*** |
| 6 | Server scan rate | ***VT_R4*** |
| 7 | EU type | ***VT_I4*** |
| 8 | Value texts | ***VT_ARRAY→VT_BSTR*** |
| 102 | Maximum value | ***VT_R8*** |
| 103 | Minimum value | ***VT_R8*** |

Example location (<=> ***OPC total Item ID***) in server configuration tree:

`\STATE\InstrumentStatusConnection`

# 4.5.6 UserInControl

## Object values

***UserInControl*** handles the instrument control state. The canonical data type is ***VT_I2***. Defined object value is the user name of the current user.

***UserInControl*** objects are ***OPC_READABLE***.

## Implemented properties

Implemented instrument status properties are as follows:

| PID | Description | Data type |
|---|---|---|
| 1 | Data Type | ***VT_I2*** |
| 2 | Value | ***VT_BSTR*** |
| 3 | Quality | ***VT_I2*** |
| 4 | Time stamp | ***VT_DATE*** |
| 5 | Access right | ***VT_I4*** |
| 6 | Scan rate | ***VT_R4*** |

Example location (<=> ***OPC total Item ID***) in server configuration tree:

`\STATE\UserInControl`

## 4.6 Recommendations

It is recommended to write to items synchronously. The server handles both synchronous and asynchronous writes but when making asynchronous writes it is up to the client to wait until the server is ready with previous asynchronous write.

All items whose names ends with _***EXECUTE*** are used as "batch" commands to execute methods and instructions with parameters and system settings. Before writing to the _***EXECUTE*** item, the items, which are included in the "batch" (for example, instruction parameters) have to be written. A recommendation is to add a delay before writing to the _***EXECUTE*** items since when using a mirroring client between two OPC servers it has been seen that item writes might arrive to the UNICORN OPC server in an incorrect order.

***Note:*** *UNICORN system settings are available via the* ***SETTINGS*** *branch, which works like the* ***INSTRUCTION*** *branch with one exception. There is only one execute instruction,* `\Setting\Store`*, to store all system settings at once.*

***Note:*** *System settings can only be saved when the system is in* ***Ready*** *state. If UNICORN changes system settings, it updates the settings parameters in OPC.*

# 5 UNICORN OPC Alarms & Events address space

This chapter describes UNICORN OPC Alarms & Events address space, various types of alarms, run log, error messages and event categories.

The Alarms & Events address space shows the internal alarm functionality of the instrument configuration. Each item in the address space might trigger an alarm or event.

Each component's failure/loss triggers an alarm and the AE client connected in control/view of the system is notified. If the connection to the instrument is lost, then AE client is notified through the restart error alarm. Once the restart error occurs and when the connection issue has been fixed thereafter, then either the UNICORN Instrument Server computer has to be restarted or the restart error has to be acknowledged in UNICORN ***System Control***.

In order to acknowledge alarms or warnings from the OPC client, the client (UNICORN OPC server) has to be in control of the system. To take control, use the ***Data Access*** server in parallel and take control over the system via the ***AssignState*** item. It is also possible to use the ***TakeControl*** option.

The UNICORN OPC AE server does not support the inactive/acknowledged/enabled state. UNICORN OPC AE server will not be able to notify that the alarm or warning becomes inactive. It only notifies if the signal reaches an alarm or warning state, but it will not notify the opposite when reaching the normal state.

## Alarms & Events address space view


***Tip:*** *The address space depends on the instrument configuration. Different items will appear depending on which instrument configuration is used.*

## In this chapter


| Section | | See page |
|---|---|---|
| 5.1 | Alarms and errors | 74 |
| 5.2 | Event categories | 76 |

# 5.1 Alarms and errors

## Analog alarm

There are always four conditions for analog alarm objects (sources). Corresponding condition names are as follows:

1. ***LO_ALARM***
2. ***LO_WARNING***
3. ***HI_ALARM***
4. ***HI_WARNING***

Both ***Condition Events*** and ***Tracking Events*** can be generated. ***Condition Events*** are generated when a condition becomes active or inactive and when a condition is acknowledged. ***Tracking Events*** are generated when a condition is disabled but still active or inactive and unacknowledged. The event categories are ***Level*** for ***Condition Events*** and ***Enable/Disable*** for ***Tracking Events***. No attributes are supported for analog alarms.

No attributes are supported for analog alarms.

Example location (<=> ***OPC qualified source name***) in server area space:

```
Analog alarms.Cond2
```

## Digital alarm

There is only one condition for each digital alarm object (source). The condition names for the two different types are:

1. ***WARNING***
2. ***ALARM***

Both ***Condition Events*** and ***Tracking Events*** can be generated. ***Condition Events*** are generated when a condition becomes active or inactive and when a condition is acknowledged. ***Tracking Events*** are generated when a condition is disabled but still active or inactive and unacknowledged. Event categories are ***DiscreteW*** or ***DiscreteA*** for ***Condition Events*** and ***Enable/Disable*** for ***Tracking Events***. No attributes are supported for digital alarms.

Example location (<=> ***OPC qualified source name***) in server area space:

```
Digital alarms.FlowWarning
```

## Errors

This is the error dialog box in UNICORN ***System Control***. The event category of the simple error event is ***Run Log***. The event category of the condition error event is ***Errors***.

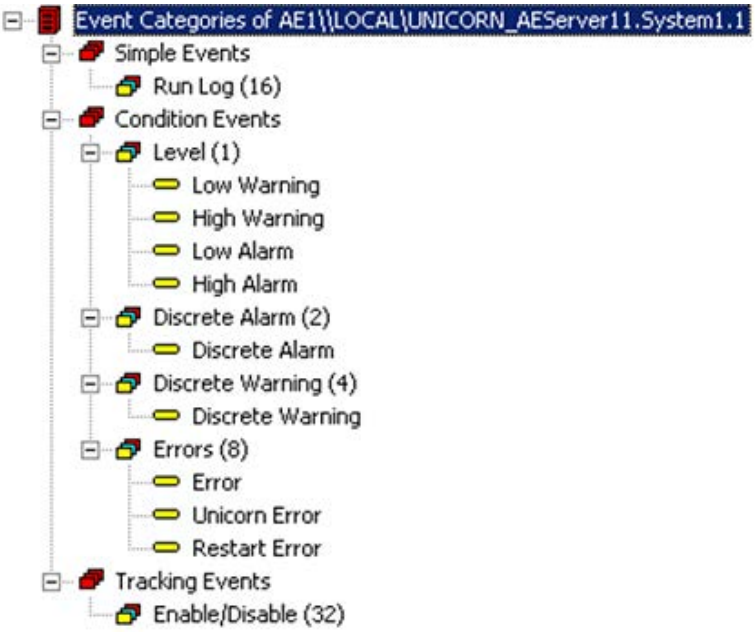
No attributes are defined for error events and no acknowledgements are required for this event type.

Location (<=> ***OPC qualified source name***) in server area space:

```
Other.Errors
```

# 5.2 Event categories

### *Alarms & Events* address space view




### Event categories for UNICORN OPC server

Event categories for UNICORN OPC server are defined as follows:

| UNICORN Alarm & Event | Event types | Event categories |
|---|---|---|
| ***Analog Alarm*** | ***OPC_CONDITION_EVENT***<br>***OPC_TRACKING_EVENT*** | ***Level*** (ID=1)<br>***Enable/Disable*** (ID=32) |
| ***Digital Alarm*** | ***OPC_CONDITION_EVENT***<br>***OPC_TRACKING_EVENT*** | ***Discrete Alarm*** (ID=2) or<br>***Discrete Warning*** (ID=4) |
| ***Error*** | ***OPC_SIMPLE_EVENT***<br>***OPC_CONDITION_EVENT*** | ***Run Log*** (ID=16)<br>***Errors*** (ID=8) |

# 6 UNICORN OPC Historical Data Access address space

This chapter provides information about UNICORN OPC Historical Data Access (HDA) address space, audit trail, HDA XML format definition etc.

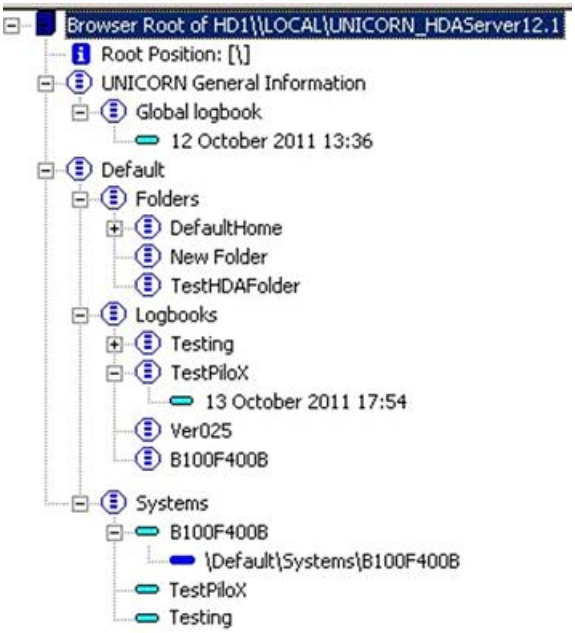
The HDA address space is dynamic. A result file can be browsed whenever a new result is created. If a result is deleted, it is removed from the address space.

***Tip:*** *The address space depends on the result files that have been created based on a specific instrument configuration. Different items will appear in the result file depending on the instrument configuration used when the result file was created.*

## In this chapter


| Section | | See page |
|---|---|---|
| 6.1 | AuditTrail | 80 |
| 6.2 | Result file information | 81 |
| 6.3 | UNICORN OPC HDA XML format definition | 88 |

## HDA address space view

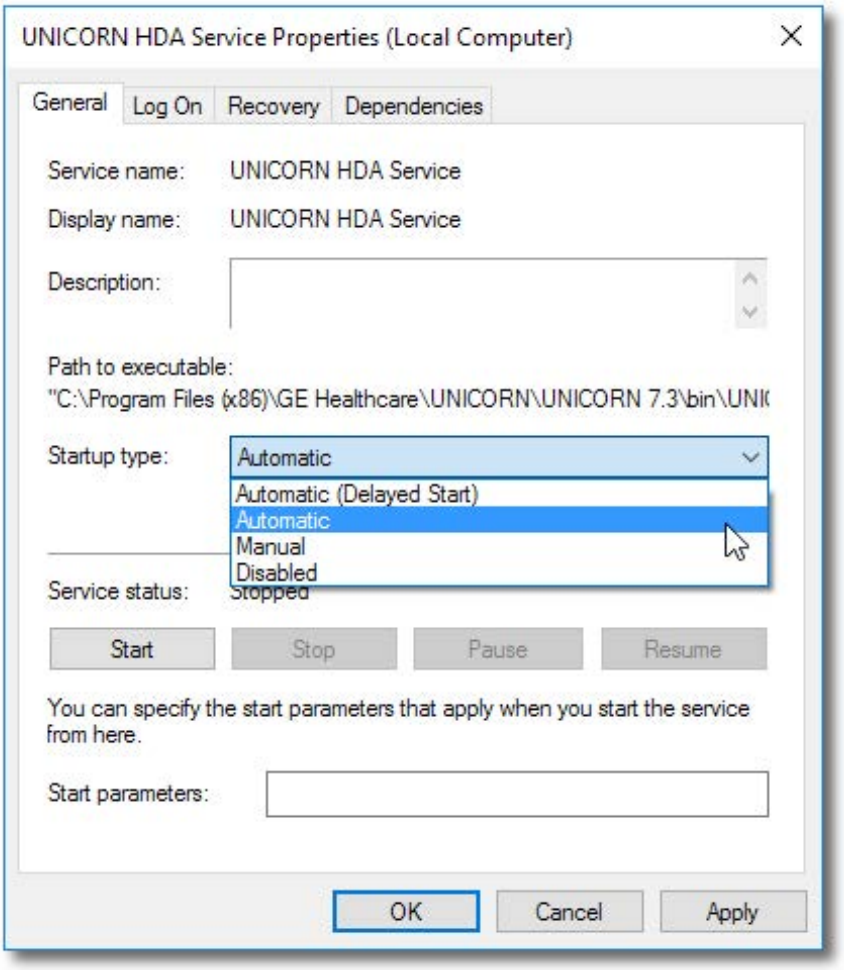



***Tip:*** *The address space depends on the result files that has been created based on a specific instrument configuration. Different items will appear in the result file depending on which instrument configuration that was used when the result file was created.*

## Configuration and settings

UNICORN HDA Service supports manual activation by default. The UNICORN HDA Service settings have to be altered to get it to start automatically. The setting can be changed through the Services-utility (`Run: services.msc` to start it).

To start automatically, change ***Startup Type*** through ***UNICORN HDA Service Properties*** window.




The HDA address space is dynamic. A result file can be browsed whenever a new result is created. If a result is deleted, it is removed from the address space. The UNICORN HDA server only supports one OPC client connection.

# 6.1 AuditTrail

***AuditTrail*** from UNICORN are available under the HDA server address space. The global logbook is found under the ***UNICORN GENERAL INFORMATION*** branch and the system specific logs are found under the ***Logbooks*** folder in the user (for example ***Default***) folder.

## Attributes defined by *AuditTrail*

Each ***AuditTrail*** leaf (item) has the following attributes defined:

| Name | Description | Data type |
|---|---|---|
| ***Datatype*** | Item data type | ***VT_UI4*** |
| ***ItemId*** | Item ID | ***VT_BSTR*** |
| ***StartLowFileTime*** | Start time low ***FILETIME*** | ***VT_UI4*** |
| ***StartHighFileTime*** | Start time high ***FILETIME*** | ***VT_UI4*** |
| ***EndLowFileTime*** | End time low ***FILETIME*** | ***VT_UI4*** |
| ***EndHighFileTime*** | End time high ***FILETIME*** | ***VT_UI4*** |

Start and end time are equal for a leaf. Time is set to the creation time of the audit trail file, meaning the renew time.

# 6.2 Result file information

Each result file contains ***Curves***, ***Documentation*** and ***Peak tables***.

Information about the system is available under the ***Systems*** folder in the user folder.

## In this section


| Section | | See page |
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| 6.2.1 | Curves | 82 |
| 6.2.2 | Documentation | 84 |
| 6.2.3 | Peak tables | 86 |
| 6.2.4 | Systems | 87 |

## 6.2.1 Curves

All curves in a result file are listed as items directly under the result file branch in the address space.

### Attributes supported by *Curves*

Each curve has a number of supported attributes that allow the kind of curve, the item represents to be identified:

| Name | Description | Data type |
|---|---|---|
| ***Datatype*** | Item data type | ***VT_UI4*** |
| ***EngUnits*** | Unit | ***VT_BSTR*** |
| ***NormalMaximum*** | Maximum value | ***VT_R8*** |
| ***NormalMinimum*** | Minimum value | ***VT_R8*** |
| ***Itemid*** | Item ID | ***VT_BSTR*** |
| ***CurveType*** | Curve type | ***VT_I2*** |
| ***StartLowFileTime*** | Start time low ***FILETIME*** | ***VT_UI4*** |
| ***StartHighFileTime*** | Start time high ***FILETIME*** | ***VT_UI4*** |
| ***EndLowFileTime*** | End time low ***FILETIME*** | ***VT_UI4*** |
| ***EndHighFileTime*** | End time high ***FILETIME*** | ***VT_UI4*** |
| ***ZeroLowFileTime*** | Zero tlime low ***FILETIME*** | ***VT_UI4*** |
| ***ZeroHighFileTime*** | Zero time high ***FILETIME*** | ***VT_UI4*** |
| ***TimeInt*** | Sample time interval in sec | ***VT_R8*** |
| ***FirstInjectionLowFileTime*** | First injection time low ***FILETIME*** | ***VT_UI4*** |
| ***FirstInjectionhighFileTime*** | First injection time high ***FILETIME*** | ***VT_UI4*** |
| ***ChromStartLowFileTime*** | Chrom start time low ***FILETIME*** | ***VT_UI4*** |
| ***ChromStartHighFileTime*** | Chrom start time high ***FILETIME*** | ***VT_UI4*** |
| ***UnicornRawData*** | UNICORN raw curve data | ***VT_BSTR*** |

### Types of *Curves*

There are several types of curves (***HDA_CURVE_TYPE***):

| Curve type | Data type |
|---|---|
| ***HDA_CURVETYPE_GENERIC_RAW*** | Array of ***VT_R8*** |
| ***HDA_CURVETYPE_GENERIC_EVALUATED*** | Array of ***VT_R8*** |
| ***HDA_CURVETYPE_FRACMARKS_RAW*** | Array of ***VT_BSTR*** |
| ***HDA_CURVETYPE_FRACMARKS_EVALUATED*** | Array of ***VT_BSTR*** |
| ***HDA_CURVETYPE_INJECTIONMARKS_RAW*** | Array of ***VT_BSTR*** |
| ***HDA_CURVETYPE_INJECTIONMARKS_EVALUATED*** | Array of ***VT_BSTR*** |
| ***HDA_CURVETYPE_SETMARKS_RAW*** | Array of ***VT_BSTR*** |
| ***HDA_CURVETYPE_SETMARKS_EVALUATED*** | Array of ***VT_BSTR*** |

## Curve types bit mask

In addition to curve type, a bit mask is added to the type:

| Curve type bit mask | Description |
|---|---|
| ***HDA_CURVETYPE_TIMEDEFINED*** | Curve data exist as time axis |
| ***HDA_CURVETYPE_VOLUMEDEFINED*** | Curve data exist as volume axis |
| ***HDA_CURVETYPE_MARKERDEFINED*** | Curve data exists as text (both time and volume axes) |

The first injection time and chrom start time might not always be defined for a curve. The start time is not the absolute time when the curve was created. Instead, the result file creation time is used as a base. The real absolute time for a curve is read from chrom start time. The difference is usually around 10 to 15 seconds.

***Note:*** *chrom time is only defined on RAW curve types.*

Zero time defines the time of zero. The curve can start at any time before and after zero time. It can even end before zero time. Applying zero time to a curve allows zero to be located on the x-axis.

The result file might contain curves only stored in volume base. These curves cannot be read and will fail ***ReadRaw/ReadProcessed***, since the HDA specification only allows time as x-axis. However, the volume curves are available via the ***HDA_UNICORN_RAW_DATA*** attribute. This attribute returns all curve data (both time and volume) as an XML-formatted string.

The low and high attributes are mapped to the ***dwLowDateTime*** and ***dwHighDateTime*** members of the ***FILETIME*** structure to enable ***FILETIME*** accuracy on the client side.

## 6.2.2 Documentation

Evaluation in UNICORN has a documentation dialog for each result file. The ***DOCUMENTATION*** branch for each result file in HDA contains the same data as ***Evaluation*** in documentation.

### Items in *Documentation*

The following items are available:

| Item | Data type |
|---|---|
| ***BatchNumber*** | ***String*** |
| ***BufferPro*** | ***XML string*** |
| ***Calibration*** | ***XML string*** |
| ***Columns*** | ***XML string*** |
| ***Evaluation logbook*** | ***XML string*** |
| ***Evaluation procedures*** | ***XML string*** |
| ***FracXY*** | ***XML string*** |
| ***Run logbook*** | ***XML string*** |
| ***Method name*** | ***String*** |
| ***Method creator*** | ***String*** |
| ***Method creation date*** | ***DateTime*** |
| ***Method created for system*** | ***String*** |
| ***Method last modifier*** | ***String*** |
| ***Method last modification date*** | ***DateTime*** |
| ***Method signatures*** | ***XML string*** |
| ***Method notes*** | ***XML string*** |
| ***Start notes*** | ***XML string*** |
| ***Run notes*** | ***XML string*** |
| ***Evaluation notes*** | ***XML string*** |
| ***Method strategy notes*** | ***String*** |
| ***Result name*** | ***String*** |
| ***Result creator*** | ***String*** |

| Item | Data type |
|---|---|
| ***Result creation date*** | ***DateTime*** |
| ***Result run system*** | ***String*** |
| ***Batch number*** | ***String*** |
| ***Result signatures*** | ***XML string*** |
| ***Result strategy used components*** | ***XML string*** |
| ***Scouting*** | ***XML string*** |
| ***System Settings*** | ***XML string*** |
| ***Snapshot*** | ***XML string*** |
| ***Text Instructions*** | ***XML string*** |
| ***Variables*** | ***XML string*** |
| ***Method Instrument Configuration*** | ***XML string*** |
| ***Result Instrument Configuration*** | ***XML string*** |
| ***Questions*** | ***XML string*** |

## Attributes in *Documentation*

Each documentation item defines the following attributes:

| Attribute | Description | Data type |
|---|---|---|
| ***DataType*** | Item data type | ***VT_UI4*** |
| ***Itemid*** | Item ID | ***VT_BSTR*** |
| ***StartLowFileTime*** | Start time low ***FILETIME*** | ***VT_UI4*** |
| ***StartHighFileTime*** | Start time high ***FILETIME*** | ***VT_UI4*** |
| ***EndLowFileTime*** | End time low ***FILETIME*** | ***VT_UI4*** |
| ***EndHighFileTime*** | End time high ***FILETIME*** | ***VT_UI4*** |

Start and end times are equal in the ***DOCUMENTATION*** branch. To get data from ***ReadRaw***, this time stamp must be included in the time range, otherwise no data will be returned.

## 6.2.3 Peak tables

The ***PEAK TABLES*** branch contains all peak tables stored in the result file. When reading from the item, the peak table is returned as an XML-formatted string.

### Items in *Peak Tables*

Each item defines the following attributes:

| Attribute | Description | Data type |
|---|---|---|
| ***Datatype*** | Item data type | ***VT_UI4*** |
| ***Itemid*** | Item ID | ***VT_BSTR*** |
| ***StartLowFileTime*** | Start time low ***FILETIME*** | ***VT_UI4*** |
| ***StartHighFileTime*** | Start time high ***FILETIME*** | ***VT_UI4*** |
| ***EndLowFileTime*** | End time low ***FILETIME*** | ***VT_UI4*** |
| ***EndHighFileTime*** | End time high ***FILETIME*** | ***VT_UI4*** |

## 6.2.4 Systems

Information about the system is available under the ***Systems*** folder in the user folder.

### Items in *Systems*

Each system leaf defines the following attributes:

| Attribute | Description | Data type |
|---|---|---|
| ***Datatype*** | Item data type | ***VT_UI4*** |
| ***StartLowFileTime*** | Start time low ***FILETIME*** | ***VT_UI4*** |
| ***StartHighFileTime*** | Start time high ***FILETIME*** | ***VT_UI4*** |
| ***EndLowFileTime*** | End time low ***FILETIME*** | ***VT_UI4*** |
| ***EndHighFileTime*** | End time high ***FILETIME*** | ***VT_UI4*** |
| ***ItemId*** | Item ID | ***VT_BSTR*** |

## 6.3 UNICORN OPC HDA XML format definition

The XML format is defined for each result file item. This section describes the different XML structures.

## In this section


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## 6.3.1 BufferPro, v 1.0

This XML structure is exported by reading the ***BufferPro*** leaf.

***Note:*** *For migrated UNICORN 5.x results, the* ***BufferPro*** *OPC item contains* ***BufferPrep*** *data. Both the S function and the S function share the same storage format.*

### *BufferPro* XML structure

| Tag name | Description |
|---|---|
| ***BufferPro*** | Root item |
| ***RecipeName*** | Recipe name |
| ***pHRange*** | pH range, separated with "**-**" |
| ***B100*** | 100% buffer B |
| ***AcidOrBase*** | Acid or base name |
| ***Salt*** | Salt name and salt stock concentration |
| ***Notes*** | Recipe name |
| ***Buffer*** | Specifications of the different buffers |
| ***Name*** | Buffer name |
| ***pKa1*** | $pK_a1$ |
| ***pKa2*** | $pK_a2$ |
| ***pKa3*** | $pK_a3$ |
| ***dpKa1dt*** | $dpk_a1$ delta |
| ***dpKa2dt*** | $dpk_a2$ delta |
| ***dpKa3dt*** | $dpk_a3$ delta |
| ***AcidicProtons*** | Number of acidic protons |
| ***ChargeDeprotonatedIon*** | Number of charge deprotonated ions |
| ***SaltName*** | Salt name |
| ***ChargeAnion*** | Number of charged anions |
| ***ChargeCation*** | Number of charged cations |

## 6.3.2 Calibration, v 1.0

This XML structure is exported by reading the ***Calibration*** leaf.

### *Calibration* XML structure

| Tag name | Description |
|---|---|
| ***CalibrationList*** | Root item |
| ***Calibration*** | A calibration |
| ***Tagname*** | Name of item that has been calibrated |
| ***Date*** | Date |
| ***Username*** | User name |
| ***Point1*** | Point 1 |
| ***Point2*** | Point 2 |
| ***Constant*** | Constant |
| ***Offset*** | Offset |
| ***Remote*** | Calibration local or remote. (YES/NO) |
| ***P*** | Proportional control component |
| ***I*** | Integral control component |
| ***D*** | Derivative control component |
| ***ReferenceValue1*** | Reference value 1 |
| ***ReferenceValue2*** | Reference value 2 |
| ***CalibrationConstantDescription1*** | Calibration constant description 1 |
| ***CalibrationConstantValue1*** | Calibration constant value 1 |
| ***CalibrationConstantDescription2*** | Calibration constant description 2 |
| ***CalibrationConstantValue2*** | Calibration constant value 2 |
| ***CalibrationConstantDescription3*** | Calibration constant description 3 |
| ***CalibrationConstantValue3*** | Calibration constant value 3 |

## 6.3.3 EvaluationLog, v 1.0

This XML structure is exported by reading the ***Evaluation logbook*** leaf.

### *EvaluationLog* XML structure

| Tag name | Description |
|---|---|
| ***EvaluationLog*** | Root item. |
| ***Item*** | Item containing evaluation logbook event. |

## 6.3.4 Run logbook, v 1.1

This XML structure is exported by reading the ***Run logbook*** leaf.

### *Logbook* XML structure

| Tag name | Description |
|---|---|
| ***Logbook*** | Root item |
| ***Item*** | A logbook item |
| ***AccumulatedTime*** | Accumulated time in seconds |
| ***AccumulatedVolume*** | Accumulated volume, including unit |
| ***Event*** | Logbook event |
| ***EventType*** | Event type |
| ***EventSubType*** | Subtype of event |

## 6.3.5 SignatureList, v 1.0

This XML structure is exported by reading the ***Method Signatures*** and ***Result Signatures*** leaves.

### *SignatureList* XML structure

| Tag name | Description |
|---|---|
| ***SignatureList*** | Root item |
| ***Signature*** | A signature |
| ***Username*** | Name of user |
| ***Fullname*** | Full name of user |
| ***Position*** | Position of user |
| ***Date*** | Date, formatted in server local time |
| ***Meaning*** | Signature meaning |
| ***Locked*** | If present, the file is locked against further change |

## 6.3.6 SnapshotList, v 1.0

This XML structure is exported by reading the ***Snapshot*** leaf.

***Note:*** *To get the actual y-axis value, use the time or volume value as a reference into the curves.*

### *SnapshotList* XML structure

| Tag name | Description |
|---|---|
| ***SnapshotList*** | Root item |
| ***Chromatogram*** | A signature |
| ***Name*** | Name of chromatogram |
| ***Snapshot*** | Run number |
| ***TimeRetention*** | Time retention |
| ***VolumeRetention*** | Volume retention |
| ***Curve*** | Curve |
| ***Name*** | Curve name |
| ***Unit*** | Curve unit |
| ***Time Value*** | Time stamp of snapshot |
| ***Volume Value*** | Volume stamp of snapshot |

## 6.3.7 UsedComponents, v 1.0

This XML structure is exported by reading the ***Result Strategy Used Components*** leaf.

### *UsedComponents* XML structure

| Tag name | Description |
|---|---|
| ***UsedComponents*** | Root item. |
| ***Component*** | Component name used during run. |

## 6.3.8 Notes, v 1.0

This XML structure is exported by reading the ***Method Notes***, ***Start Notes***, ***Run Notes***, and ***Evaluation Notes*** leaves.

### *Notes* XML structure

| Tag name | Description |
|---|---|
| ***Notes*** | Root item, the note follows. |

## 6.3.9 ScoutingList, v 1.1

This XML structure is exported by reading the ***Scouting*** leaf.

***Note:*** *To get the actual y-axis value, use the time or volume value as a reference into the curves.*

### *ScoutingList* XML structure

| Tag name | Description |
|---|---|
| ***ScoutingList*** | Root item. |
| ***Scouting*** | A scouting run. |
| ***TotalNumberOfScoutings*** | Total number of scouting items available. |
| ***RunScouting*** | If available, this item indicates the scouting run number of this result file. |
| ***Run*** | Run number. |
| ***ThisScoutingWasUsedDuringRun*** | This leaf is available if this scouting run was used when the method was run. The run number is the same as ***RunScouting***. |
| ***Variable*** | Variables defined in this run. |
| ***Block*** | Block name of this variable. |
| ***Name*** | Name of variable. |
| ***Unit*** | Unit, only included if variable has a unit. |
| ***Value*** | Value of variable. |

## 6.3.10 SettingsList, v 1.0

This XML structure is exported by reading the ***System Settings*** leaf.

### *SettingsList* XML structure

| Tag name | Description |
|---|---|
| ***SettingsList*** | Root item. |
| ***Group*** | A group. |
| ***GroupName*** | The name of the group. |
| ***Instruction*** | Instruction names. There is at least one instruction per group. |

## 6.3.11 TextInstructions, v 1.0

This XML structure is exported by reading the ***Text Instructions*** leaf.

### *TextInstructions* XML structure

| Tag name | Description |
|---|---|
| ***TextMethod*** | Root item, the complete text method follows. Each row is separated by a carriage return and a new line. |

## 6.3.12 VariableList, v 1.1

This XML structure is exported by reading the ***Variables*** leaf.

### Start protocol variables XML structure

| Tag name | Description |
|---|---|
| ***VariableList*** | Root item. |
| ***Variable*** | A variable. |
| ***Block*** | Block name of the variable. |
| ***Name*** | The variable name. |
| ***VisibleInScouting*** | Indicates if the variable is visible in scouting. |
| ***VisibleInDetails*** | Indicates if the variable is visible in details only. |
| ***Value*** | Value. Can be a number or a string, depending on the variable. |
| ***Unit*** | Unit of the value. Not included if no unit is present. |

## 6.3.13 QuestionList, v 1.0

This XML structure is exported by reading the ***Questions*** leaf.

### Start protocol questions XML structure

| Tag name | Description |
|---|---|
| ***QuestionList*** | Root item |
| ***Item*** | A question item |
| ***Question*** | The question |
| ***Answer*** | The answer |

## 6.3.14 PeakTable, v 1.1

This XML structure is exported by reading leaves under the ***PEAK TABLES*** branch.

### *PeakTable* XML structure

| Tag name | Description |
|---|---|
| ***PeakTable*** | Root item |
| ***Summary*** | Summary of the peak table |
| ***TotalNumberOfDetectedPeaks*** | Total number of peaks |
| ***TotalArea*** | Total area |
| ***Unit*** | Unit used. |
| ***AreaInEvaluatedPeaks*** | Area in evaluated peaks |
| ***RationPeakareaTotalarea*** | Ratio peak area/total area |
| ***TotalPeakDuration*** | Total peak duration |
| ***ColumnHeight*** | Column height |
| ***ColumnV0*** | Column $V_0$ |
| ***ColumnVt*** | Column $V_t$ |
| ***SourceCurve*** | Source curve name |
| ***Baseline*** | Baseline |
| ***Rejection*** | Rejection |
| ***MinHeight*** | Minimum height |
| ***MinWidth*** | Minimum width |
| ***MaxWidth*** | Maximum width |
| ***MinArea*** | Minimum area |
| ***MaxNumberOfPeaks*** | Maximum number of peaks |
| ***Quantitation*** | Quantitation (molecular size, standard addition, internal standard, external standard, recovery) |
| ***Peak*** | A peak |
| ***No*** | Peak number |
| ***Name*** | Peak name |

| Tag name | Description |
|---|---|
| ***Retention*** | Retention |
| ***Start*** | Start |
| ***End*** | End |
| ***Width*** | Width |
| ***Area*** | Area |
| ***AreaPerTotalArea*** | Area/total area |
| ***AreaPerPeakArea*** | Area/peak area |
| ***Height*** | Height |
| ***WidthAtHalfHeight*** | Width at half peak height |
| ***HeightAtStart*** | Height at start |
| ***HeightAtEnd*** | Height at end |
| ***BaselineAtStart*** | Baseline at start |
| ***BaselineAtMax*** | Baseline at max |
| ***BaselineAtEnd*** | Baseline at end |
| ***ConductivityHeightStart*** | Conductivity height at start |
| ***ConductivityHeightMax*** | Conductivity height at maximum |
| ***ConductivityHeightEnd*** | Conductivity height at end |
| ***FractionTubeAtStart*** | Fraction tube at start |
| ***FractionTubeAtMax*** | Fraction tube at maximum |
| ***FractionTubeAtEnd*** | Fraction tube at end |
| ***PeakStartType*** | Peak start type (dropline, skim, baseline, skimdrop, unknown) |
| ***PeakEndType*** | Peak end type (dropline, skim, baseline, skimdrop, unknown) |
| ***Sigma*** | Sigma |
| ***Resolution*** | Resolution |
| ***CapacityFactor*** | Capacity factor |
| ***Kav*** | $K_{av}$ |
| ***PlateHeight*** | Plate height |

| Tag name | Description |
|---|---|
| ***PlatesPerMeter*** | Plates per meter |
| ***AsymmetryStart*** | Asymmetry start |
| ***AsymmetryEnd*** | Asymmetry end |
| ***Asymmetry*** | Asymmetry |
| ***AverageConductivity*** | Average conductivity |
| ***ExtinctionCoefficient*** | Extinction coefficient |
| ***ExtCoeffConcentration*** | Concentration calculated using extinction coefficient. |
| ***ExtCoeffAmount*** | Amount calculated using extinction coefficient. |
| ***Concentration*** | Concentration |
| ***Amount*** | Amount |
| ***MolecularSize*** | Molecular size |
| ***Type*** | Type |

## 6.3.15 Unicorn raw, v 1.0

This XML structure is exported by reading the attribute ***HDA_UNICORN_RAW_DATA*** for a ***Curve*** leaf.

### *UnicornRawData* XML structure

| Tag name | Description |
|---|---|
| ***UnicornRawData*** | Root item. |
| ***Name*** | Name of curve. |
| ***Type*** | Curve type. Does not contain the bit mask, which the ***HDA_CURVE_TYPE*** does, only the actual type. |
| ***Unit*** | Curve unit (y-axis). |
| ***TimeUnit*** | Unit of time curve (x-axis). |
| ***VolumeUnit*** | Unit of volume curve (x-axis). |
| ***CurveMin*** | Minimum value of y-axis. |
| ***CurveMax*** | Maximum value of y-axis. |
| ***ZeroAdjust*** | Present if zero adjust is enabled. |
| ***ZeroAdjustTime*** | Zero adjust time. |
| ***ZeroAdjustVolume*** | Zero adjust volume. |
| ***StartTimeRetention*** | Retention start time. |
| ***InjectionTimeRetention*** | Injection start time. |
| ***NumberOfTimeDataPoints*** | Number of curve time data points. |
| ***CTD*** | Curve Time Data. This is repeated for all time data points. The values are assigned as attributes to the tag (x and y attributes). |
| ***StartVolumeRetention*** | Retention start volume. |
| ***InjectionVolumeRetention*** | Injection start volume. |
| ***NumberOfVolumeDataPoints*** | Number of curve volume data points. |
| ***ColumnVolumeDefined*** | Present if column volume is defined. |
| ***ColumnVolume*** | Column volume value for curve. |
| ***ColumnVolumeUnit*** | Unit of ***ColumnVolume*** curve (X-axis). |

| Tag name | Description |
|---|---|
| ***CVD*** | Curve Volume Data. This is repeated for all volume data points. The values are assigned as attributes to the tag (***x***, ***y*** and, if available, ***cv***). |
| ***CMD*** | Curve Markers Data. This is repeated for all marker (text) data points. The values are assigned as attributes to the tag (***t*** = time, ***v*** = volume, ***t1*** = text1 and, if available, ***t2*** = text2). |

## 6.3.16 Columns, v 1.1

This XML structure is exported by reading the ***Columns*** leaf.

### *Columns* XML structure

| Tag name | Description |
|---|---|
| ***Columns*** | Root item. |
| ***Column*** | A column. |
| ***Name*** | Name of column. |
| ***Height*** | Height of column. Attribute mandatory defines if item is mandatory. Attribute unit defines unit of value. |
| ***Diameter*** | Diameter of column. Attribute mandatory defines if item is mandatory. Attribute unit defines unit of value. |
| ***Volume*** | Volume of column. Attribute mandatory defines if item is mandatory. Attribute unit defines unit of value. |
| ***VolumeUnit*** | Height of column. Attribute mandatory defines if item is mandatory. |
| ***Technique*** | Technique used by column. Attribute mandatory defines if item is mandatory. |
| ***Vt*** | Total volume of column. Attribute mandatory defines if item is mandatory. Attribute unit defines unit of value. |
| ***Vo*** | Empty volume of column. Attribute mandatory defines if item is mandatory. Attribute unit defines unit of value. |
| ***MaxPressure*** | Maximum pressure of column. Attribute mandatory defines if item is mandatory. Attribute unit defines unit of value. |
| ***DefaultFlowrate*** | Default flow rate of column. Attribute mandatory defines if item is mandatory. Attribute unit defines unit of value. |
| ***MaxFlowrate*** | Maximum flow rate of column. Attribute mandatory defines if item is mandatory. Attribute unit defines unit of value. |

| Tag name | Description |
|---|---|
| ***TypPeakWidthAtBase*** | Typical peak width at base. Attribute mandatory defines if item is mandatory. Attribute unit defines unit of value. |
| ***pHLongMax*** | Long-term maximum pH. Attribute mandatory defines if item is mandatory. |
| ***pHLongMin*** | Long-term minimum pH. Attribute mandatory defines if item is mandatory. |
| ***pHShortMax*** | Short-term maximum pH. Attribute mandatory defines if item is mandatory. |
| ***pHShortMin*** | Short-term minimum pH. Attribute mandatory defines if item is mandatory. |
| ***AverageParticleDiameter*** | Average particle diameter. Attribute mandatory defines if item is mandatory. Attribute unit defines unit of value. |
| ***Code*** | Code of column. Attribute mandatory defines if item is mandatory. |
| ***TypicalLoadingRange*** | Typical loading range. Attribute mandatory defines if item is mandatory. |
| ***MolWeightRange*** | Molecular weight range. Attribute mandatory defines if item is mandatory. Attribute unit defines unit of value. |

## 6.3.17 EvaluationProcedures, v1.0

This XML structure is exported by reading the ***Evaluation procedure*** leaf.

### *EvaluationProcedures* XML structure

| Tagname | Description |
|---|---|
| ***EvaluationProcedures*** | Root item. |
| ***EvaluationProcedure*** | An evaluation procedure. |
| ***Name*** | Name of evaluation procedure. |
| ***WasRun*** | Indicates if the evaluation procedure was run during method run. |

## 6.3.18 FracXY, v 1.0

This XML structure is exported by reading the ***FracXY*** leaf.

### *FracXY* XML structure

| Tagname | Description |
|---|---|
| ***FracXY*** | Root item |
| ***FractionOrder*** | Fraction order (Serpentine row, Row-by-row, Serpentine column or Column-bycolumn) |
| ***Name*** | Name of rack |
| ***Group*** | Rack group |
| ***Name*** | Name of rack group |
| ***LastTube*** | Last tube of group |

## 6.3.19 AuditTrail, v 1.1

This XML structure is exported by reading a ***Global Logbook*** or ***System Logbook*** leaf.

### *AuditTrail* XML structure

| Tag name | Description |
|---|---|
| ***AuditTrail*** | Root item. |
| ***Type*** | Type of audit trail: ***Global***, ***System*** or ***Backup***. ***Backup*** is used when accessing a direct audit trail file address. |
| ***CheckSumError*** | If this item is available, the file has been modified outside UNICORN or is corrupt. |
| ***Audit*** | An audit item. |
| ***Time*** | Time of audit. |
| ***TimeZone*** | Time zone. |
| ***Message*** | Audit message. |
| ***Details*** | Log entry details. |

## 6.3.20 Method/Result Instrument Configuration, v 1.0

This XML structure is exported by reading a ***Method Instrument Configuration*** or ***Result Instrument Configuration*** leaf.

### Method/Result Instrument Configuration XML structure

| Tag name | Description |
|---|---|
| ***InstrumentConfiguration*** | Root item |
| ***Name*** | Name of instrument configuration |
| ***Version*** | Instrument configuration version |
| ***Help text*** | Instrument configuration help text |
| ***StrategyName*** | The instrument configuration name |
| ***StrategyNotes*** | The instrument configuration notes |
| ***PhaseConfiguration*** | Phase configuration name and version |
| ***TemplateMethodConfiguration*** | Protocol configuration name and version |
| ***PerformanceTestConfiguration*** | Performance test configuration name and version |
| ***FlowSchemeConfiguration*** | Flow scheme configuration name and version |
| ***VIDConfiguration*** | VID configuration name and version |
| ***FirmwareConfiguration*** | Firmware configuration name and version |
| ***CompatibleUNICORNClientVersion*** | UNICORN version |
| ***CompatibleUNICORNInstrumentServerVersion*** | UNICORN version |

## 6.3.21 System

This XML structure is exported by reading a ***System*** leaf.

### System XML structure

| Tag name | Description |
|---|---|
| ***SystemName*** | Name of system. |
| ***SystemType*** | Type of system. |
| ***InstrumentConfiguration*** | Instrument configuration name and version. |
| ***SystemIsNonActive/SystemIsActive*** | Active system. |
| ***ControlledByUNICORNInstrumentServer*** | Instrument server computer name.<br>***Note:***<br>*Displayed only if the system is Active.* |
| ***InstrumentSerialNo*** | Instrument serial number. |
| ***ConnectionBasedOnSerial/ ConnectionBasedOnIP*** | Type of connection based on serial number or instrument IP address. |
| ***InstrumentIPAddress*** | Instrument IP address. |

# 7 Reference Information

## In this chapter


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# 7.1 DA server supported OPC interfaces

## OPC Server

| Interface | 1.0 | 2.05A | 3.0 | Optional interface |
|---|---|---|---|---|
| ***IUnknown*** | Required | Required | Required | |
| ***IOPCServer*** | Required | Required | Required | |
| ***IOPCCommmon*** | N/A | Required | Required | |
| ***IConnectionPointContainer*** | N/A | Required | Required | |
| ***IOPCItemProperties*** | N/A | Required | N/A | |
| ***IOPCBrowse*** | N/A | N/A | Required | |
| ***IOPCServerPublicGroups*** | Optional | Optional | N/A | Not implemented |
| ***IOPCBrowseAddressSpaceBrowse*** | Optional | Optional | N/A | Not implemented |
| ***IOPCItemIO*** | N/A | N/A | Required | Implemented |

## OPCGroup

| Interface | 1.0 | 2.05A | 3.0 | Optional interface |
|---|---|---|---|---|
| ***IUnknown*** | Required | Required | Required | |
| ***IOPCItemMgt*** | Required | Required | Required | |
| ***IOPCGrouptStateMgt*** | Required | Required | Required | |
| ***IOPCGrouptStateMgt2*** | N/A | N/A | Required | |
| ***IOPCPublicGroupStateMgt*** | Optional | Optional | N/A | Not implemented |
| ***IOPCSyncIO*** | Required | Required | Required | |
| ***IOPCSyncIO2*** | N/A | N/A | Required | |
| ***IOPCAsyncIO2*** | N/A | Required | Required | |
| ***IOPCAsyncIO3*** | N/A | N/A | Required | |
| ***IOPCItemDeadbandMgt*** | N/A | N/A | Required | |
| ***IOPCItemSamplingMgt*** | N/A | N/A | Optional | Implemented |
| ***IConnectionPointContainer*** | N/A | Required | Required | |

| Interface | 1.0 | 2.05A | 3.0 | Optional interface |
|---|---|---|---|---|
| ***IOPCAsyncIO*** | Required | Optional | N/A | |
| ***IDataObject*** | Required | Optional | N/A | |

# 7.2 AE server supported OPC interfaces

## OPCEventServer

| Interface | AE v1.1 | Optional interface |
|---|---|---|
| ***IOPCEventServer*** | Required | |
| ***IOPCEventServer2*** | Optional | Not implemented |
| ***IOPCEventAreaBrowser*** | Optional | Implemented |

## OPCEventSubscription Object

| Interface | AE v1.1 | Optional interface |
|---|---|---|
| ***IUnknown*** | Required | |
| ***IOPCEventSubscriptionMgt*** | Required | |
| ***IConnectionPointContainer*** | Required | |
| ***IOPCEventSubscriptionMgt2*** | Optional | Not implemented |

## OPC Common Requirements

| Interface | AE v1.1 | Optional interface |
|---|---|---|
| ***IOPCCommon*** | Required | |

# 7.3 HDA server supported OPC interfaces

## Custom interface

| Interface | HDA v1.20 | Optional interface |
|---|---|---|
| ***IOPC_HDAServer*** | Required | |
| ***IOPCHDA_Browser*** | Required | |
| ***IOPCHDA_SyncRead*** | Required | |
| ***IOPCCommon*** | Required | |
| ***IOPCHDA_SyncUpdate*** | Optional | Not implemented |
| ***IOPCHDA_SyncAnnotations*** | Optional | Not implemented |
| ***IOPCHDA_AsyncRead*** | Optional | Not implemented |
| ***IOPCHDA_AsyncUpdate*** | Optional | Not implemented |
| ***IOPCHDA_AsyncAnnotations*** | Optional | Not implemented |
| ***IOPCHDA_Playback*** | Optional | Not implemented |
| ***IConnectionPointContainer*** | Required if any ***Async*** interface is supported | Not implemented |

## OPC security requirements

| Interface | HDA v1.2 | Optional interface |
|---|---|---|
| ***IOPCSecurityPrivate*** | Required | |

# 7.4 Differences between UNICORN OPC 5.x and UNICORN OPC 7.0

## OPC server

| Feature | OPC 5.x | OPC 7.0 |
|---|---|---|
| Number of OPC servers supported per UNICORN Instrument Server computer[1] | 4 | 1 |
| OPC servers (DA & AE) | External | part of OPC service inside the UNICORN Instrument Server |
| HDA memory cache | Yes | No |
| HDA file cache | Yes | No |

## Data access

| Feature | OPC 5.x | OPC 7.0 |
|---|---|---|
| Support for DA 3.0 interface | No | Yes |
| Ability to handle asynchronous commands from client | Yes | Yes[2] |
| Method queueing | No | Yes |
| Zero deadband feature | Yes | No |
| Quarternary gradient variables | No | Yes |
| Perform scouting runs from OPC | No | Yes |

## Historical data access

| Feature | OPC 5.x | OPC 7.0 |
|---|---|---|
| Support for multiple HDA clients | Yes | No |
| Support browsing through all systems | No | Yes |
| Display instrument configuration (strategy) details. | No | Yes |

1 ÄKTAprocess™ and ÄKTApilot™ only
2 Better handling since the commands are also queued up.

## Alarms & Events

| Feature | OPC 5.x | OPC 7.0 |
|---|---|---|
| ***RunLog*** event | Condition event | Simple event |
| Support for events like ***Accumulated time*** and ***Accumulated volume*** | Yes | No |
| Restart error event | No | Yes |

## Security

| Feature | OPC 5.x | OPC 7.0 |
|---|---|---|
| Automatic creation of the OPC user | No | Yes |
| Support for access group based login for UNICORN users | No | Yes |

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