

# SIEMENS

## SINUMERIK

### SINUMERIK 840D sl/828D SINUMERIK Integrate for Engineering Access MyMachine / OPC UA

Commissioning Manual

Preface

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Valid for:

CNC Software    Version 4.5 SP3




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## Legal information

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 <b>DANGER</b>
indicates that death or severe personal injury <b>will</b> result if proper precautions are not taken.
 <b>WARNING</b>
indicates that death or severe personal injury <b>may</b> result if proper precautions are not taken.
 <b>CAUTION</b>
indicates that minor personal injury can result if proper precautions are not taken.
<b>NOTICE</b>
indicates that property damage can result if proper precautions are not taken.


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# Preface

## SINUMERIK documentation

The SINUMERIK documentation is organized in the following categories:

- General documentation
- User documentation
- Manufacturer/service documentation

## Additional information

You can find information on the following topics at [www.siemens.com/motioncontrol/docu](http://www.siemens.com/motioncontrol/docu):

- Ordering documentation/overview of documentation
- Additional links to download documents
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## My Documentation Manager (MDM)

Under the following link you will find information to individually compile OEM-specific machine documentation based on the Siemens content:

[www.siemens.com/mdm](http://www.siemens.com/mdm)

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- [www.siemens.com/sitrain](http://www.siemens.com/sitrain)  
SITRAIN - Siemens training for products, systems and solutions in automation technology
- [www.siemens.com/sinutrain](http://www.siemens.com/sinutrain)  
SinuTrain - training software for SINUMERIK

## FAQs

You can find Frequently Asked Questions in the Service&Support pages under Product Support. <http://support.automation.siemens.com>

## **SINUMERIK**

You can find information on SINUMERIK under the following link:

[www.siemens.com/sinumerik](http://www.siemens.com/sinumerik)

## **Target group**

This document addresses commissioning engineers, machine tool manufacturers and plant operating companies. The document provides detailed information that commissioning engineers require to setup the SINUMERIK Integrate Access MyMachine / OPC UA software.

## **Benefits**

The Configuration Manual instructs the target group on how to install and uninstall the software correctly.

## **Standard scope**

This documentation only describes the functionality of the standard version. Additions or revisions made by the machine manufacturer are documented by the machine manufacturer.

Other functions not described in this documentation might be executable in the control. This does not, however, represent an obligation to supply such functions with a new control or when servicing.

For the sake of simplicity, this documentation does not contain all detailed information about all types of the product and cannot cover every conceivable case of installation, operation, or maintenance.

## **Technical Support**

You will find telephone numbers for other countries for technical support in the Internet under <http://www.siemens.com/automation/service&support>

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# Introduction

## Overview

OPC Unified Architecture (OPC UA) is a standard communication protocol for the industrial environment.



### Software option

You require the following software option in order to use this function: SINUMERIK Integrate for Engineering "Access MyMachine / OPC UA".

Important features include:

- Independent of any particular platform
- Security
- Service call timeouts
- Heartbeat
- Buffering

Today, two protocols are available for transport via the network:

#### 1. Binary protocol

URL: `opc.tcp://ServerTCP port 4840`

Optimized for

- Low overhead
- Low usage of resources
- Interoperability

#### 2. Web service (SOAP)

URL: `http://Server`

Ports 80 (http) and 443 (https)

Optimized for

- Tool support (used from "Java" or under ".NET")
- Firewall compatibility

Information is provided in what is known as the "address space". This is comprised of "nodes" and "references". Detailed information on this is provided on the OPC Foundation page: [www.opcfoundation.org](http://www.opcfoundation.org)

The binary protocol is supported in the SINUMERIK environment. Currently, OPC UA Data Access is offered as service.





## Setting-up OPC UA components

### 2.1 Requirement

The OPC UA components can be installed on PCU, NCU and PPU target systems.

The following steps are necessary to do this:

1. Extending the system configuration
2. Creating the OPC UA configuration file
3. Adapting the OPC UA configuration file
4. Setting the license
5. Enabling the communication port
6. Checking the HMI time
7. Performing a restart

### 2.2 Setup

#### Procedure

1. In order that the OPC UA components start when SINUMERIK Operate runs up, the system configuration must be appropriately extended. To do this, copy the template file ".../siemens/sinumerik/hmi/template/MiniWeb\_<Target system>\_systemconfiguration.ini" to ".../oem/sinumerik/hmi/cfg/systemconfiguration.ini".

---

#### Note

- The file name changes to "systemconfiguration.ini". The prefix "MiniWeb\_<Target system>\_" must be removed after copying.
  - If the ".../oem/sinumerik/hmi/cfg/systemconfiguration.ini" file already exists, then you only have to copy the content of the template file.
- 

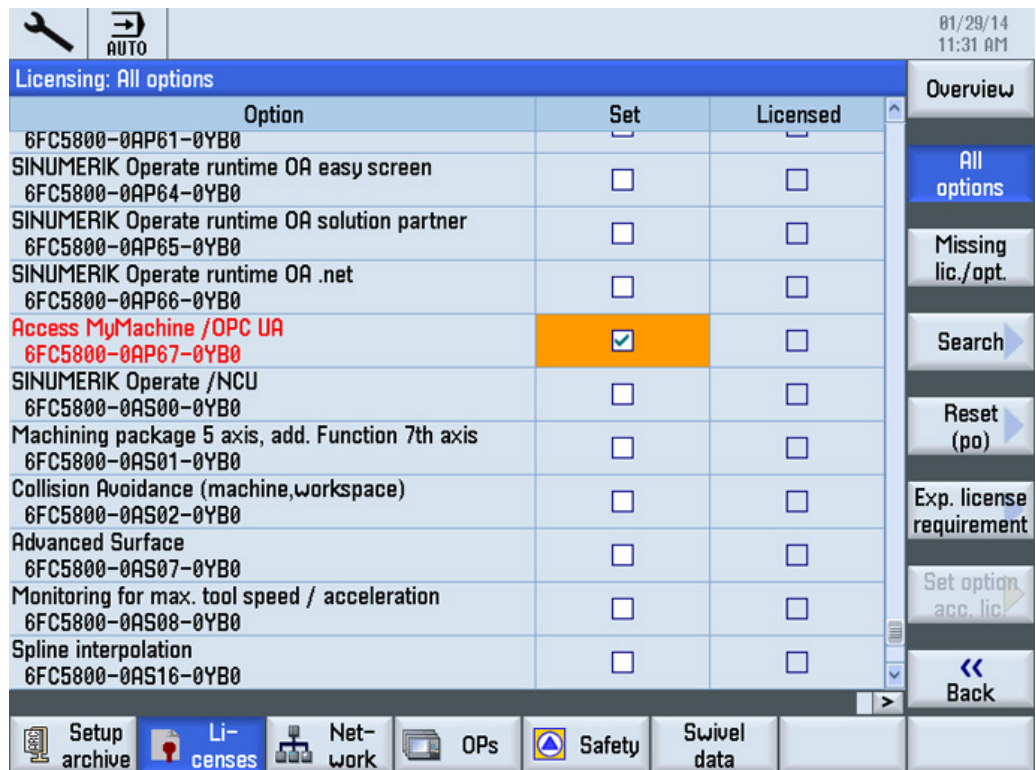
2. To do this, copy the template file ".../siemens/sinumerik/hmi/template/cfg/OPC\_UAApplication.xml" to ".../oem/sinumerik/hmi/miniweb/WebCfg/OPC\_UAApplication.xml".
3. Open the copied file ".../oem/sinumerik/hmi/miniweb/WebCfg/OPC\_UAApplication.xml" with a text editor.

4. Replace all the "localhost" entries in the file with the IPv4 address of the target system.
  - For the NCU and PPU: -X130
  - For the PCU 50: Local Area Connection 2

**Example**

```
<?xml version="1.0" standalone="yes"?>
<OPCUAAPPLICATION>
  <KEYS
    PublicKey="MiniWeb OPCUA_certificate.crt"
    PrivateKey="keys/MiniWeb OPCUA_key.crt"
    CAKey="" />
  <SESSION
    MaxSessionCount="100" />
  <BROWSE
    MaxNodesPerBrowse="50" />
  <SUBSCRIPTION
    MinSamplingRate="100"
    MaxKeepAlive="20"
    MinPublishRate="1000" />
  <BUILDINFO
    ProductName="Sinumerik OPC UA"
    ProductUri="http://automation.siemens.com"
    ManufacturerName="Siemens AG I DT MC"
    SoftwareVersion="4.4.0"
    BuildNumber="1" />
  <APPLICATIONDESCRIPTION
    ApplicationUri="urn:192.168.10.224:miniweb"
    ApplicationNameLocale="en_en"
    ApplicationNameText="Sinumerik OPC UA OEM"
    DNSNAME="192.168.10.224" />
  <ENDPOINTDESCRIPTION
    URL="opc.tcp://192.168.10.224:4840" />
  <NODEMANAGEMENT
    TargetProviderName="NodeManagementProvider" />
>
</OPCUAAPPLICATION>
```

5. To access data with OPC UA clients, set the "Access MyMachine / OPC UA" license via the "Startup > Licenses" operating area.



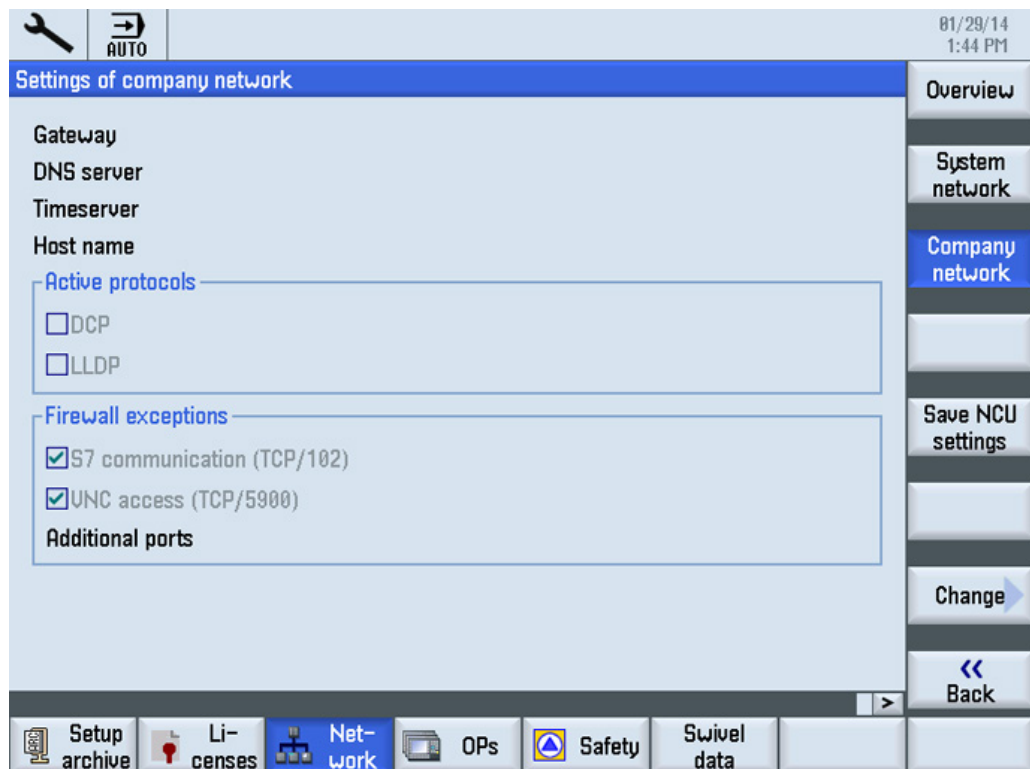
6.

### Note

Only perform this step on the NCU and PPU target system.

Enable the OPC UA communication port (TCP port 4840) via the "Startup > Network > Company network" operating area.

7. Press the "Change" button.



8. Add the TCP port 4840 and confirm the changes with "OK".

Settings of company network

Gateway

DNS server

Timeserver

Host name

Active protocols

☐ DCP

☐ LLDP

Firewall exceptions

☒ S7 communication (TCP/102)

☒ UNC access (TCP/5900)

Additional ports

Cancel

OK

Setup archive Li-censes Net-work OPs Safety Swivel data

01/29/14 1:45 PM

9. You must correctly set the HMI time so that the OPC UA communication functions.

### Note

The certificate (MiniWeb OPCUA\_certificate.crt) provided with the system is valid between April 8, 2013 and April 8, 2043. If the time is set outside of this period, the OPC UA communication does not function.

10. Perform a restart of the SINUMERIK Operate and a reset (po) to activate the changes and the license.



## Testing the connection

### Requirement

To test the connection, you can use the "Sample client" of the OPC Foundation ([www.opcfoundation.org](http://www.opcfoundation.org)).

### Note

It is not possible to establish an encrypted connection (e.g. "Basic128Rsa15"). Presently, only a connection without security is supported!

### Procedure

1. Start the OPC UA "Sample client".

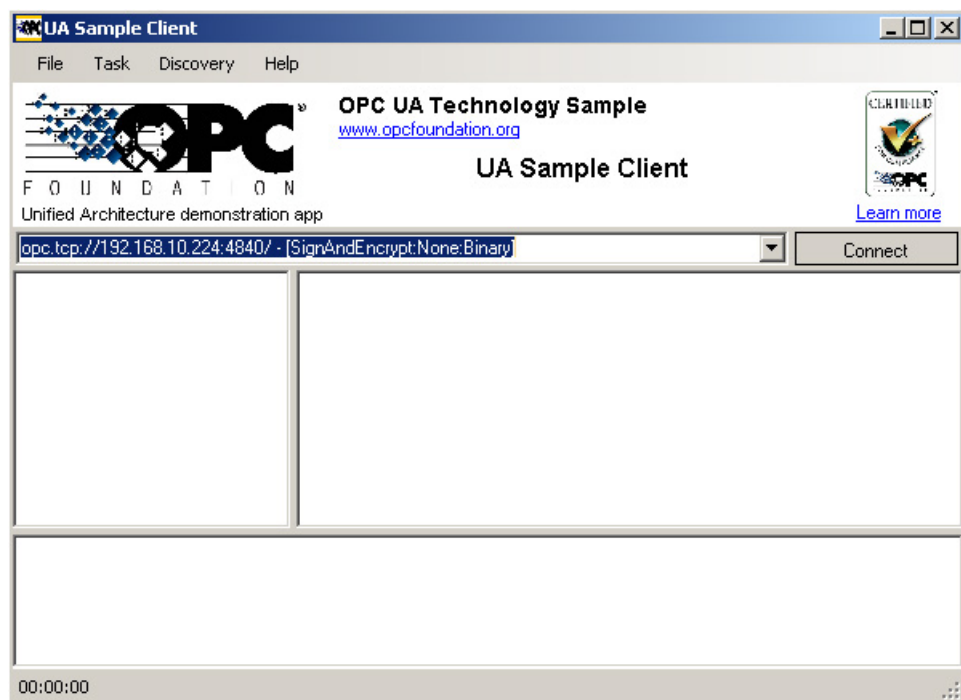


Figure 3-1 Sample Client main window

2. Select the "New" entry from the drop-down list.  
The "Discover Servers" window opens.

- Now enter the IPv4 address of the target system and click the "Discover" button.

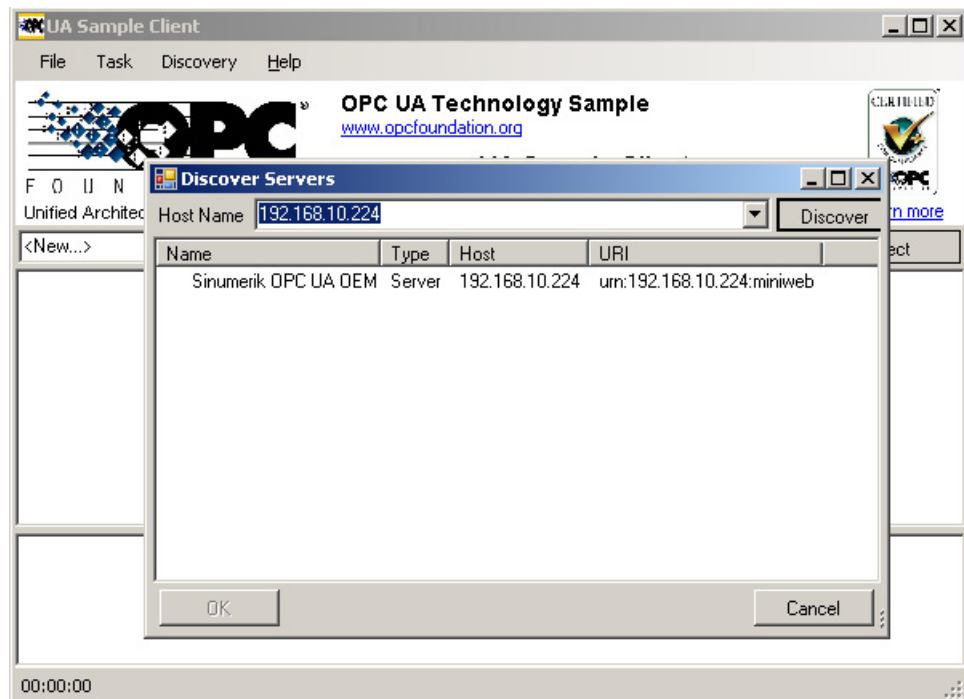


Figure 3-2 Discover servers

- The SINUMERIK OPC UA server appears in the list. Select the server and confirm with "OK".
- Return to the main window and click the "Connect" button.



6. To establish a simple connection without security, make the following settings and confirm with "OK".

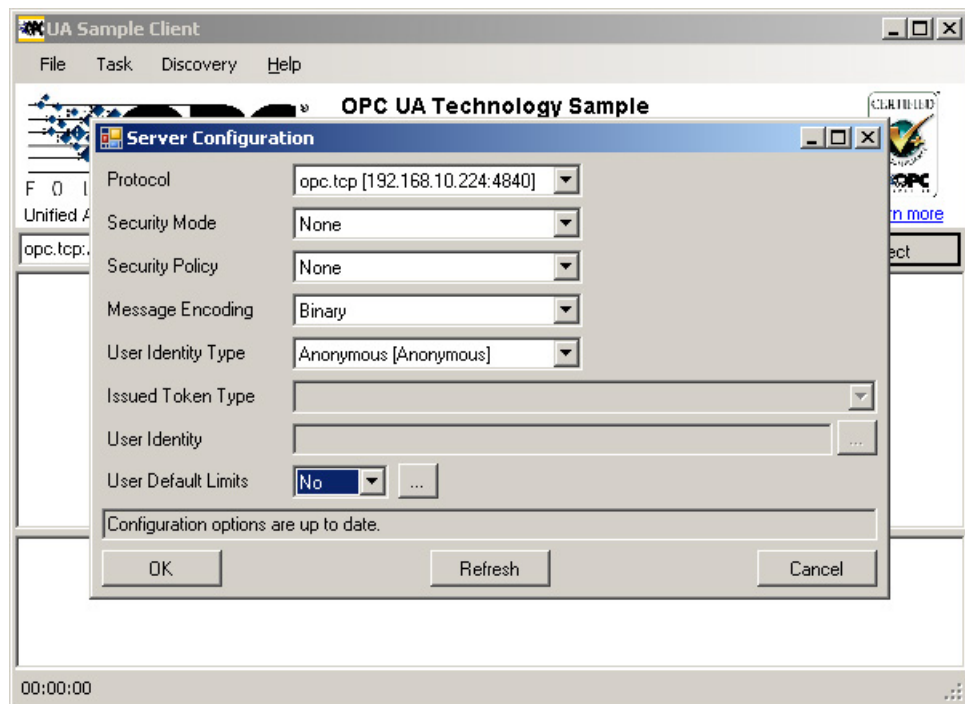


Figure 3-3 Server configuration

7. Confirm the following "Open Session" dialog with "OK".

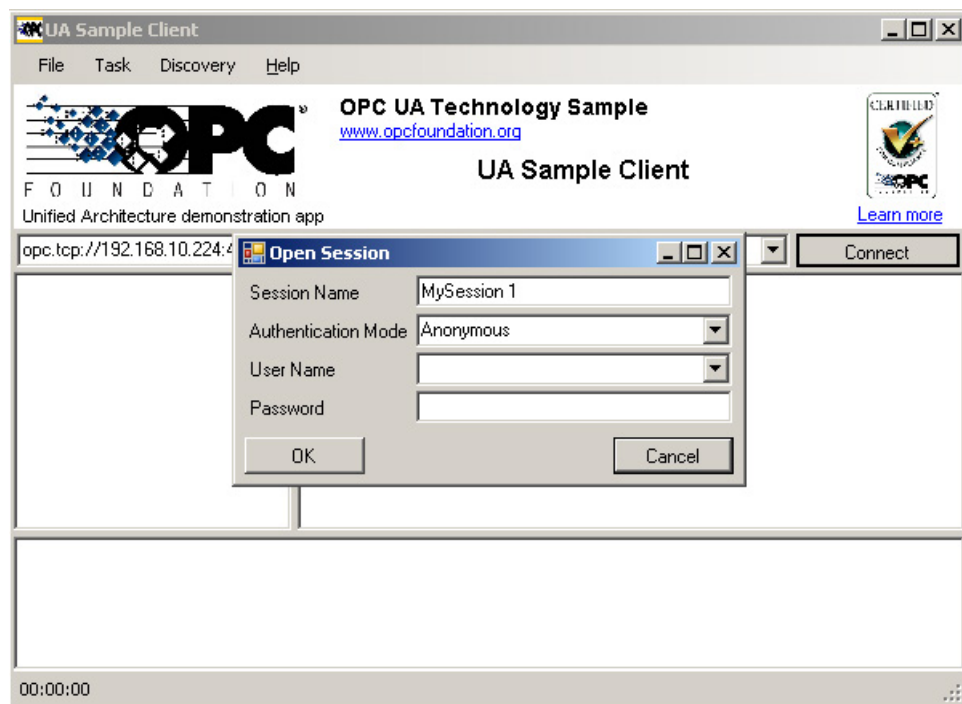


Figure 3-4 Open session

The connection to the SINUMERIK OPC UA server has now been established and the available address space is displayed.

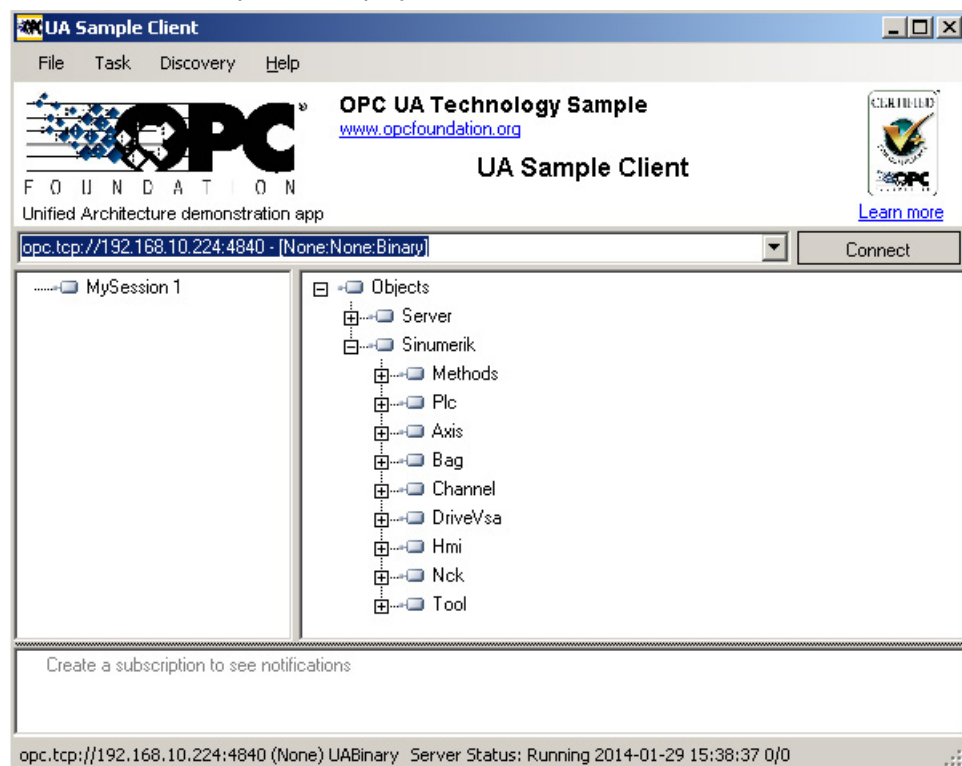


Figure 3-5 Address space of the SINUMERIK OPC UA server

8. Now navigate to a nodeID (e.g. R-parameter at Sinumerik > Channel > Parameter > R) and right-click the corresponding entry. You can now test various functions:
  - E.g. read, write, setup monitoring

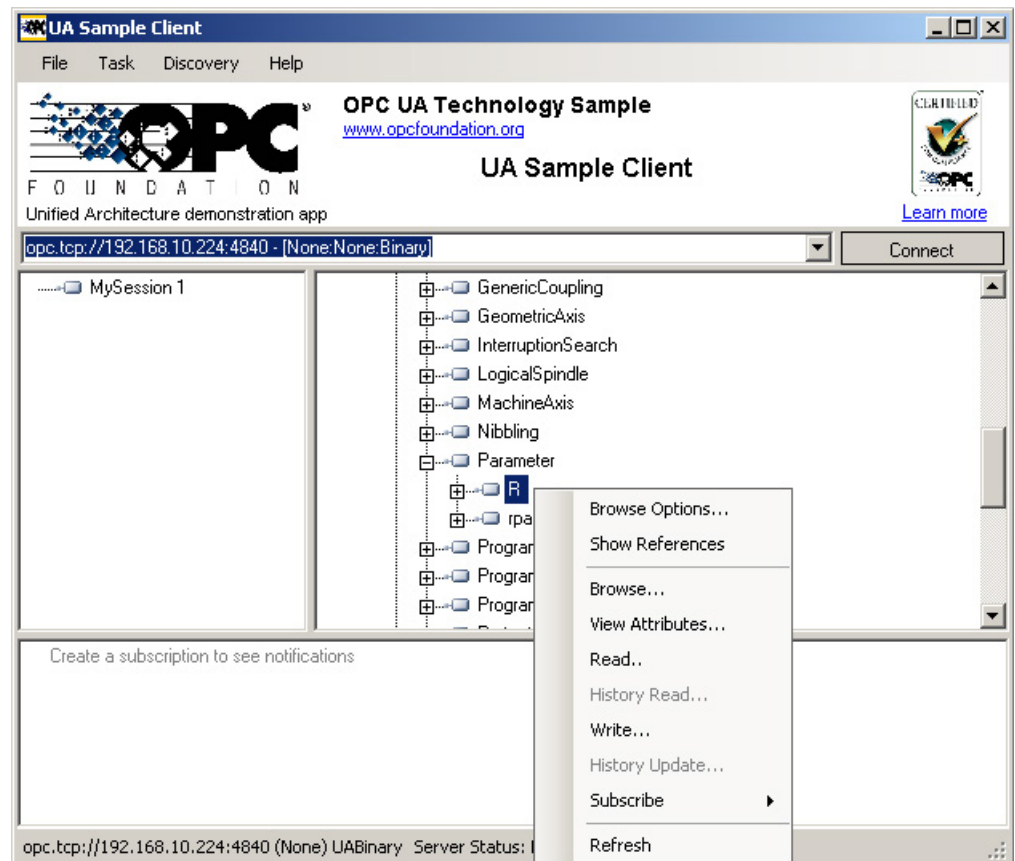


Figure 3-6 NodeID "Sinumerik &gt; Channel &gt; Parameter &gt; R"

- The attributes of a nodeID can be viewed via the "View Attributes" entry. One of these attributes is "Value", which supplies the appropriate value of R1.

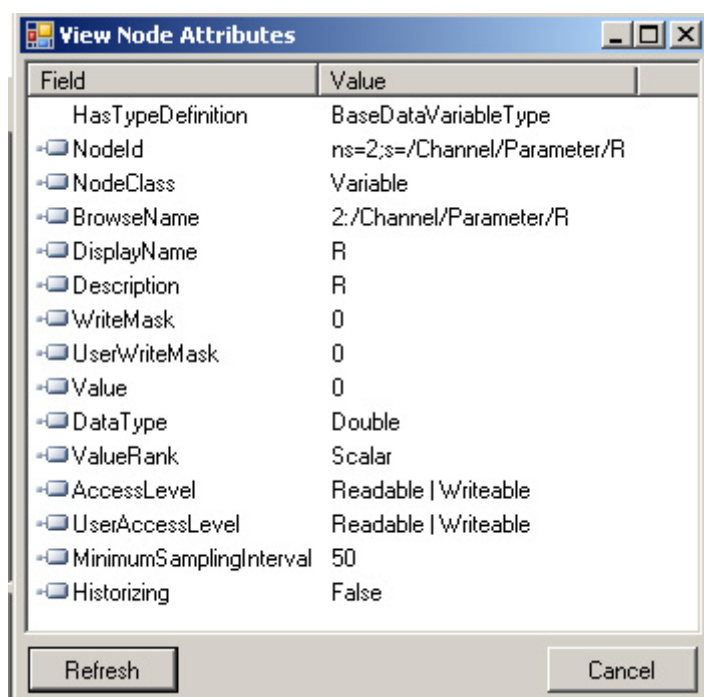


Figure 3-7 Viewing node attributes

# OPC UA data access

## Objective of the section

This section describes the functional scope and the SINUMERIK-specific special features of the OPC UA data access interface.

---

### Note

The communication time is not guaranteed. As a consequence, realtime tasks cannot be implemented using the OPC UA data access interface.

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Detailed information on the OPC UA specification can be found at [www.opcfoundation.org](http://www.opcfoundation.org)

## 4.1 Functional scope

Using the OPC UA data access interface, data can be accessed on the NC and PLC. In particular, variables can be read and written, and you can be notified when a value changes.

In addition, the following two methods are available for reading and writing:

- Sinumerik/Methods/ReadVar
- Sinumerik/Methods/WriteVar

Only individual variables can be accessed. Accesses to arrays and simultaneous access to several variables (multivariable access operations) are not supported. These types of access operations result in the "BadUnknownResponse" error.

---

### Note

#### Limited number of simultaneously monitored variables

The number of variables from the "Sinumerik" object that can be monitored simultaneously is limited:

- SINUMERIK 828D, maximum 20 variables
- SINUMERIK 840Dsl, maximum 200 variables

If you attempt to monitor more variables, the "BadWaitingForInitialData" error is returned.

---

### 4.1.1 Browsing

Please observe the following points while browsing:

- The displayed variables always represent only the first parameter of the corresponding first OPI unit.  
Example: The R parameters are found at "Sinumerik > Channel > Parameter > R". The corresponding identifier is called: "/Channel/Parameter/R", which is eventually mapped to "/Channel/Parameter/R[u1, 1]". If you want to access other parameters, then you must correspondingly extend the identifier; you cannot directly accept the identifiers obtained when browsing, e.g. "/Channel/Parameter/R[u2, 56]".
- The address space of the NC also contains variables that are not available in a corresponding machine configuration. They return a "BadAttributeInvalid" as value.
- The address space of the PLC, GUDs, machine data and setting data cannot be accessed via browsing. Whether access is possible and how the identifiers are composed, is explained in Section Variable paths (Page 23).

### Address space of the NC

If the OPC UA data access interface is browsed, then the address space of the NC is mapped under "Sinumerik".

---

#### Note

All variables that cannot be accessed via browsing (PLC, machine data, setting data, variables with parameters) can only be read and written via the "ReadVar" and "WriteVar" methods.

---

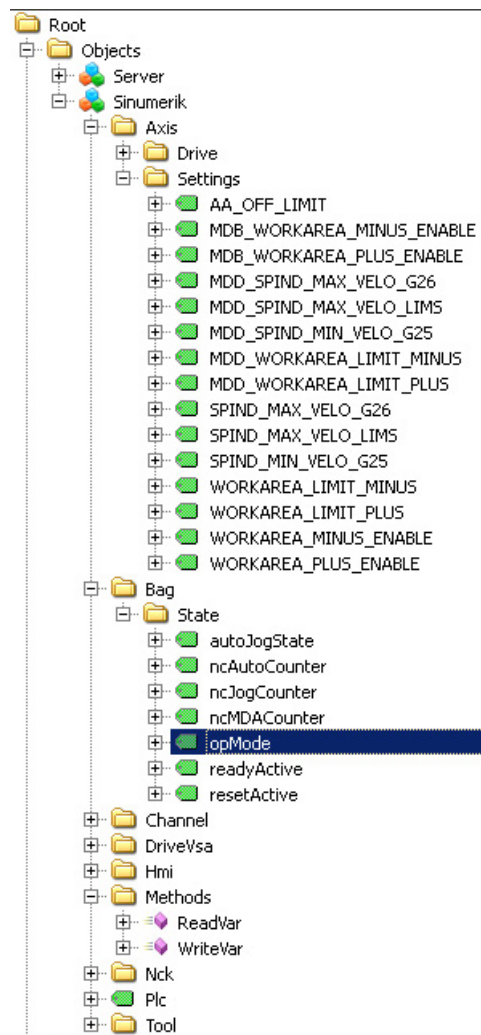


Figure 4-1 Excerpt from browsing the OPC UA data access interface

## 4.1.2 Variable paths

### Variable paths for NC access operations

The variable paths for NC axis operations are stored in the address space of the SINUMERIK Operate OPC UA server. Pay attention to the correct upper-case and lower-case of the nodeId. The respective identifier of the nodeId provides information on the correct notation.

You can obtain additional information on this from the List Manuals for 840D sl and 828D sl "NC variable and interface signals".

4.1 Functional scope

Attribute	Value
[-] NodeId	NodeId
NamespaceIndex	2
IdentifierType	String
Identifier	/Channel/Parameter/R
NodeClass	Variable
BrowseName	2, "/Channel/Parameter/R"
DisplayName	"en_us", "R"
Description	"en_us", "R"
WriteMask	0
UserWriteMask	0
[-] Value	
SourceTimestamp	1/30/2014 3:17:25.822 PM
ServerTimestamp	1/30/2014 3:17:25.822 PM
SourcePicoSeconds	0
ServerPicoSeconds	0
Value	66
[-] DataType	Double
NamespaceIndex	0
IdentifierType	Numeric
Identifier	11
ValueRank	-1
ArrayDimensions	BadAttributeIdInvalid
AccessLevel	Readable, Writeable
UserAccessLevel	Readable, Writeable
MinimumSamplingInterval	50
Historizing	false

Figure 4-2 Identifier for R parameter

The displayed NC variables always represent only the first parameter of the corresponding NC data area (channel, TO area, mode group).

Example

The R parameters are found under the identifier `"/Channel/Parameter/R"`, which is eventually mapped to `"/Channel/Parameter/R[u1, 1]"`. If you want to access other parameters, then you must correspondingly extend the identifier, e.g. `"/Channel/Parameter/R[u2, 56]"`.

Table 4- 1 Examples of variable paths (NC accesses)

Variable path	Description
<code>/Channel/Parameter/R[u1,10]</code>	R parameter 10 in channel 1.
<code>/Channel/GeometricAxis/name[u2,3]</code>	Name of the 3rd axis in channel 2.
<code>/Channel/GeometricAxis/actToolBasePos[u1,3]</code>	Position of the 3rd axis in channel 1.

Variable paths for GUD accesses

Access to GUDs is not possible.

Variable paths for machine and setting data

The variable path for machine data and setting data comprises a defined prefix and the machine data or setting data name.

The following prefixes are possible:



Table 4- 2 Prefixes for machine and setting data

Area	Prefix
General machine data	/NC/_N_NC_TEA_ACX
Channel-specific machine data	/NC/_N_CH_TEA_ACX
Axis-specific machine data	/NC/_N_AX_TEA_ACX
General setting data	/NC/_N_NC_SEA_ACX
Channel-specific setting data	/NC/_N_CH_SEA_ACX
Axis-specific setting data	/NC/_N_AX_SEA_ACX

Machine data arrays are 1-indexed for access.

Table 4- 3 Examples of variable paths (machine and setting data access operations)

Variable path	Description
/NC/_N_NC_TEA_ACX/\$MN_IPO_CYCLE_TIME	IPO cycle clock (general MD)
/NC/_N_CH_TEA_ACX/\$MC_DISPLAY_AXIS[u2, 1]	Display axis on HMI (channel-specific MD)
/NC/_N_AX_SEA_ACX/\$SA_LEAD_TYPE[u2]	Type of master value (axis-specific SD)

#### Note

Machine and setting data can be read and written via the "ReadVar" and "WriteVar" methods. Monitoring is not possible.

## Variable paths for PLC access operations

The variable path for PLC access operations corresponds generally to the S7 syntax. Use the "/Plc" prefix and the appropriate addressing from the table below. Both SIMATIC and IEC addressing can be used for this.

#### Note

The data type is converted during access with the OPC UA data access interface. Refer to the following table for the data type conversions.

Table 4- 4 PLC syntax

Area	Address (SIMATIC)	Address (IEC)	Permissible data types	OPC UA data type
Output image	Ax.y	Qx.y	BOOL	Boolean
Output image	ABx	QBx	BYTE, CHAR, STRING	UInt32 String

#### 4.1 Functional scope

Area	Address (SIMATIC)	Address (IEC)	Permissible data types	OPC UA data type
Output image	AWx	QWx	<b>WORD</b> , CHAR, INT,	UInt32 Int32
Output image	ADx	QDx	<b>DWORD</b> , DINT, REAL	UInt32 Int32 Double
Data block	DBz.DBXx.y	DBz.DBXx.y	<b>BOOL</b>	Boolean
Data block	DBz.DBBx	DBz.DBBx	<b>BYTE</b> , CHAR, STRING	UInt32 String
Data block	DBz.DBWx	DBz.DBWx	<b>WORD</b> , CHAR, INT	UInt32 Int32
Data block	DBz.DBDx	DBz.DBDx	<b>DWORD</b> , DINT, REAL	UInt32 Int32 Double
Input image	Ex.y	Ix.y	<b>BOOL</b>	Boolean
Input image	EBx	IBx	<b>BYTE</b> , CHAR, STRING	UInt32 String
Input image	EWx	IWx	<b>WORD</b> , CHAR, INT	UInt32 Int32
Input image	EDx	IDx	<b>DWORD</b> , DINT, REAL	UInt32 Int32 Double
Bit memory	Mx.y	Mx.y	<b>BOOL</b>	Boolean
Bit memory	MBx	MBx	<b>BYTE</b> , CHAR, STRING	UInt32 String
Bit memory	MWx	MWx	<b>WORD</b> , CHAR, INT	UInt32 Int32
Bit memory	MDx	MDx	<b>DWORD</b> , DINT, REAL	UInt32 Int32 Double
Counters	Zx	Cx	<b>WORD</b>	UInt32

Notes regarding the table:

- In the table, "x" stands for the byte offset in the area; "y," for the bit number in the byte; and "z," for the data block.
- The **bold data type** is the default data type in each case and does not have to be specified when addressing. In addition, the specifications DB2.DBB5.BYTE and DB2.DBB5 are equivalent, for example.

Table 4- 5 Examples of variable paths (PLC accesses)

Variable path	Description
/Plc/M5.0	Memory bit 0 at byte offset 5.
/Plc/DB5.DBW2	Word (16-bit) at byte offset 2 in data block 5.
/Plc/DB8.DBB2:STRING	UTF8 string starting at byte offset 2 in data block 8.
/Plc/DB100.DBB1	Byte at byte offset 1 in data block 100.

Note the following:

---

**Note**

- If the CHAR or STRING data type is used, UTF8 characters are read.
  - Variables of the STRING type contain the maximum length in the first byte and the actual length in the second byte. When strings are written, the maximum length does not change.
  - For the STRING data type in conjunction with a byte access (e.g. /Plc/DB99.DBB0:STRING), the maximum string length is 255 characters. As a result of the UTF8 formatting, for some characters (e.g. for the "µ"), two bytes are required, so that the maximum string length is correspondingly reduced.
- 

### 4.1.3 Supported services

The following services of the OPC UA data access specification are supported:

- ActivateSessionService
- AddNodesService
- AddReferencesService
- BrowseNextService
- BrowseService
- CallService
- CloseSessionService
- CreateMonitoredItemsService
- CreateSessionService
- CreateSubscriptionService
- DeleteMonitoredItemsService
- DeleteNodesService
- DeleteReferencesService
- DeleteSubscriptionService
- FindServersService
- GetEndpointsService
- ModifyMonitoredItemsService
- PublishService
- ReadService
- RegisterNodesService
- RepublishService

- SetMonitoringModeService
- SetPublishingModeService
- TransferSubscriptionsService
- TranslateBrowsePathsToNodeIdsService
- UnregisterNodesService
- WriteService

#### 4.1.4 Special features with regard to the OPC UA specification

##### **TranslateBrowsePathsToNodeIdsService**

If a non-existing nodeId is specified in TranslateBrowsePathsToNodeIds, then "BadNoMatch" is returned instead of BadNodeIdUnknown".

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