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OPC with Measurement Studio 2019

Hans-Petter Halvorsen

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- Measurement Studio
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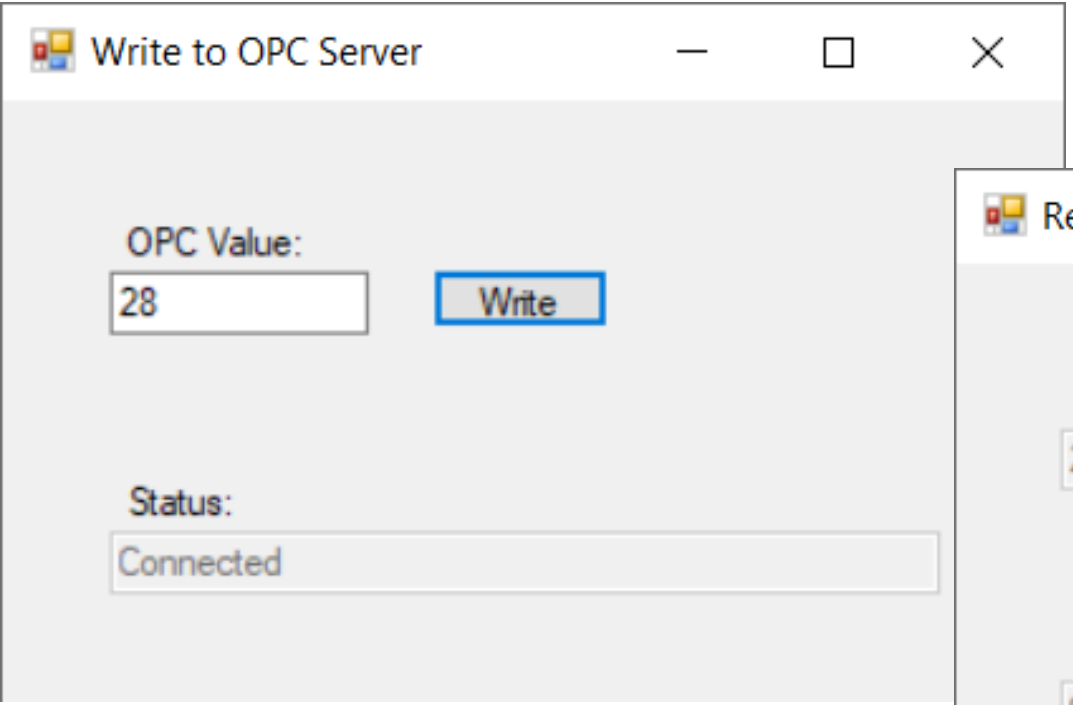
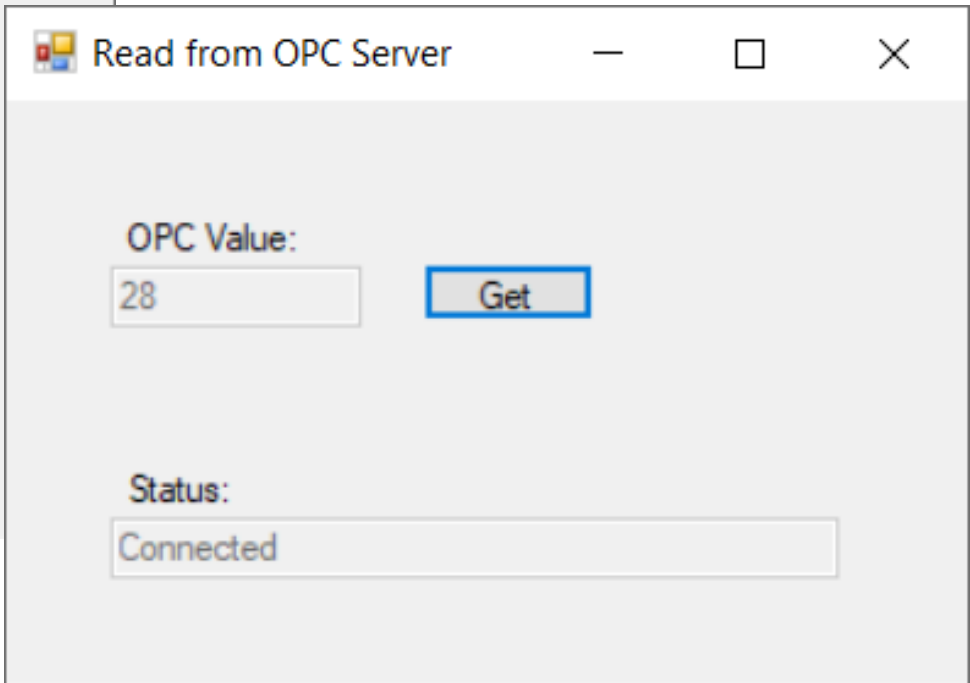
Demo Applications





Tools

- Visual Studio 2019
- Measurement Studio 2019
- LabVIEW 2019 DSC Module Run-Time System
- OPC Server
  - Matrikon OPC Simulation Server

Downloads

- Visual Studio: https://visualstudio.microsoft.com/downloads
- National Instruments: www.ni.com/download
- Matrikon: https://www.matrikonopc.com/products/opc-drivers/opc-simulation-server.aspx

https://www.halvorsen.blog

OPC

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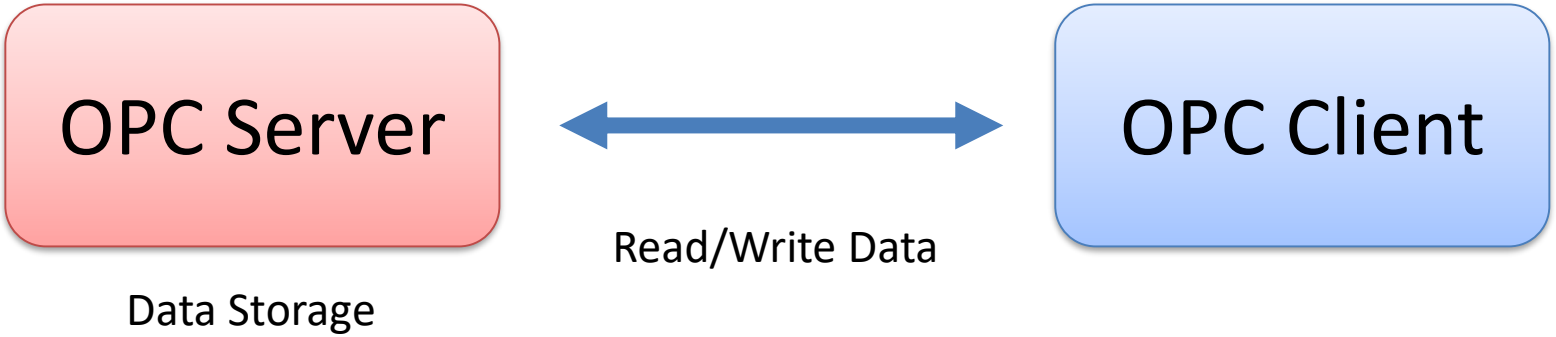
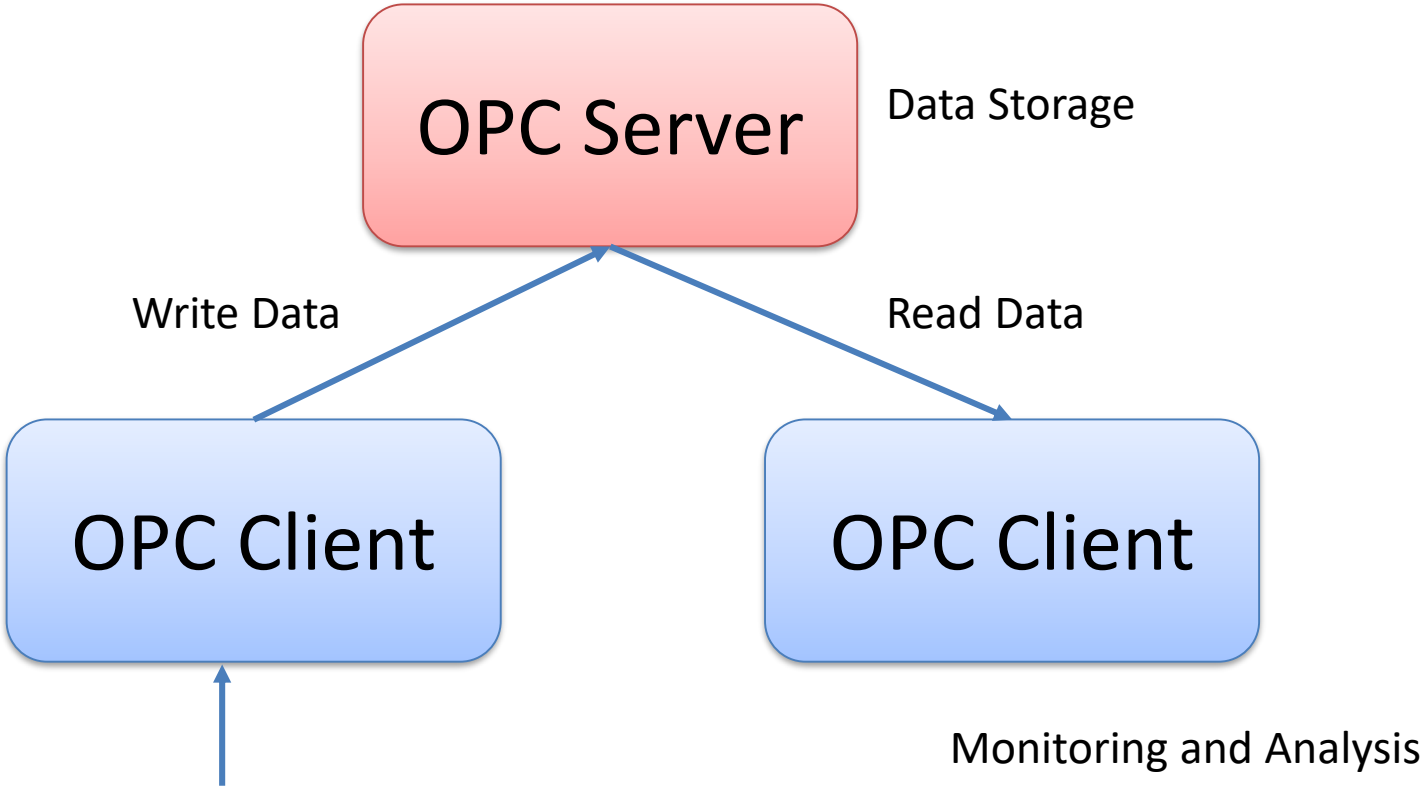
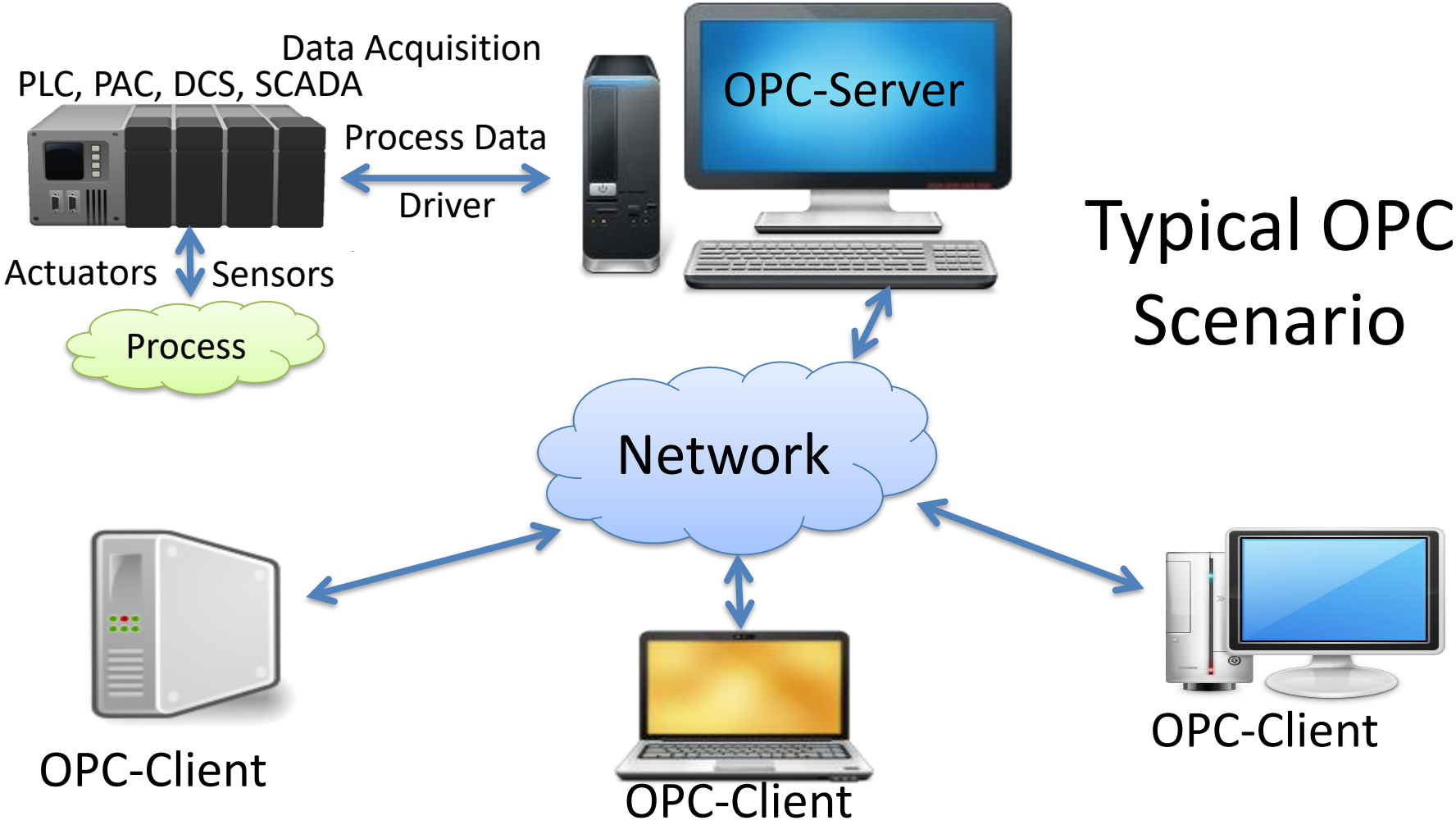
OPC





Measurement Data

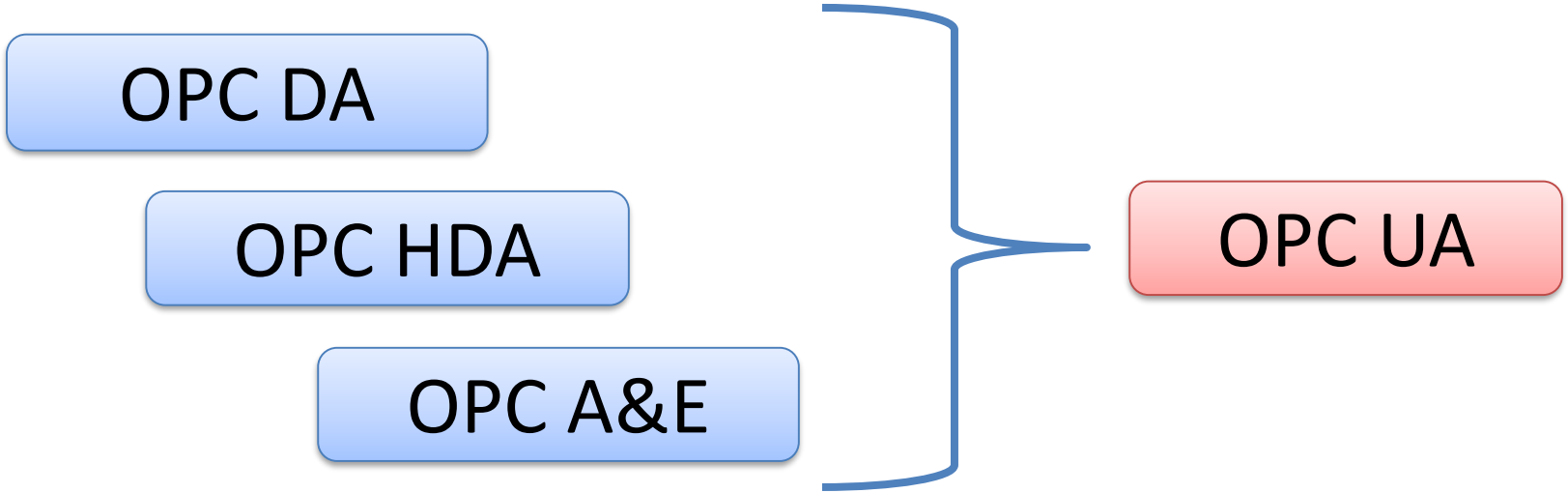
Typical OPC Scenario



OPC Specifications

“Classic” OPC

“Next Generation” OPC



... (Many others)

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Measurement Studio

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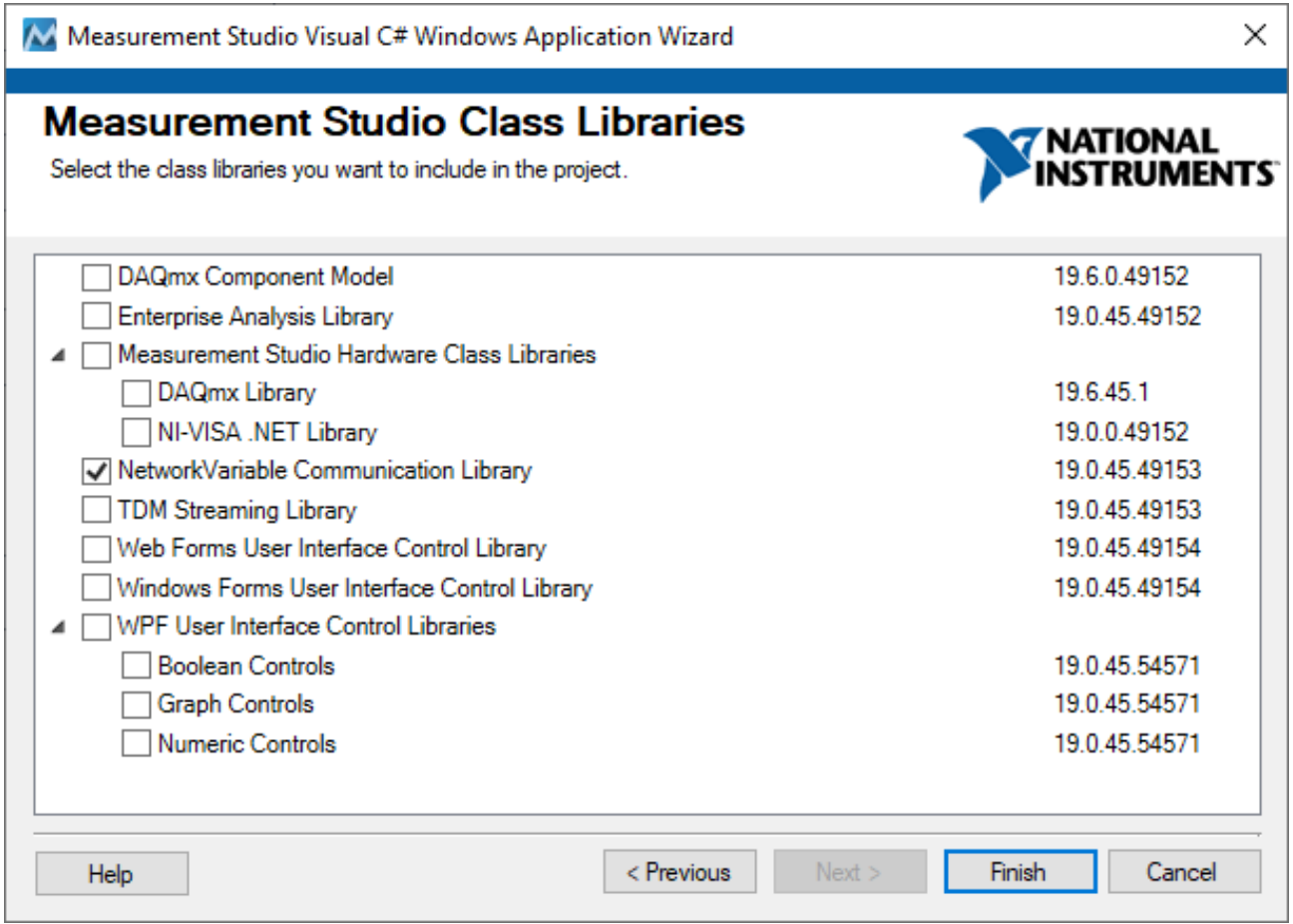
Measurement Studio

- Measurement Studio is an add-on to Visual Studio
  - This means you cannot use Measurement Studio without Visual Studio
  - Measurement Studio contains a set of Class Libraries and some Wizards/Templates for creating Applications using these features
- It supports some of the functionality to Visual Studio/C# users that exist in LabVIEW
- Measurement Studio is developed by National Instruments
- Visual Studio is developed by Microsoft

Measurement Studio

Measurement Studio is an integrated suite of tools and class libraries designed to help developers create measurement and automation Windows Forms, Windows Presentation Foundation (WPF), and Web Forms applications using Microsoft .NET technologies.

Measurement Studio - Class Libraries



Measurement Studio

- Measurement Studio 2015
  - For older version of Visual Studio
  - Can be used in Visual Studio 2019 with some modifications
  - You use "**DataSocket**" functionality to communicate with an OPC Server
- **Measurement Studio 2019**
  - Supports the new Visual Studio 2019
  - They have changed the way you communicate with an OPC Server.
    - The "DataSocket" functionality has been removed!!!
    - You now need to use the "**NetworkVariable**" functionality

Software

- Visual Studio 2019
- Measurement Studio 2019
- LabVIEW DSC Module 2019
  - In order to communicate with an OPC Server using Measurement Studio 2019 you also need the LabVIEW DSC Module (or just the LabVIEW DSC Module Run-Time System).

LabVIEW DSC Module

- LabVIEW DSC Module is an additional module for LabVIEW
- DSC – Datalogging and Supervisory Control
- Exchanging data between Measurement Studio applications and OPC servers requires LabVIEW DSC (LabVIEW DSC Module Run-Time System)

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Distributed System Manager

Hans-Petter Halvorsen

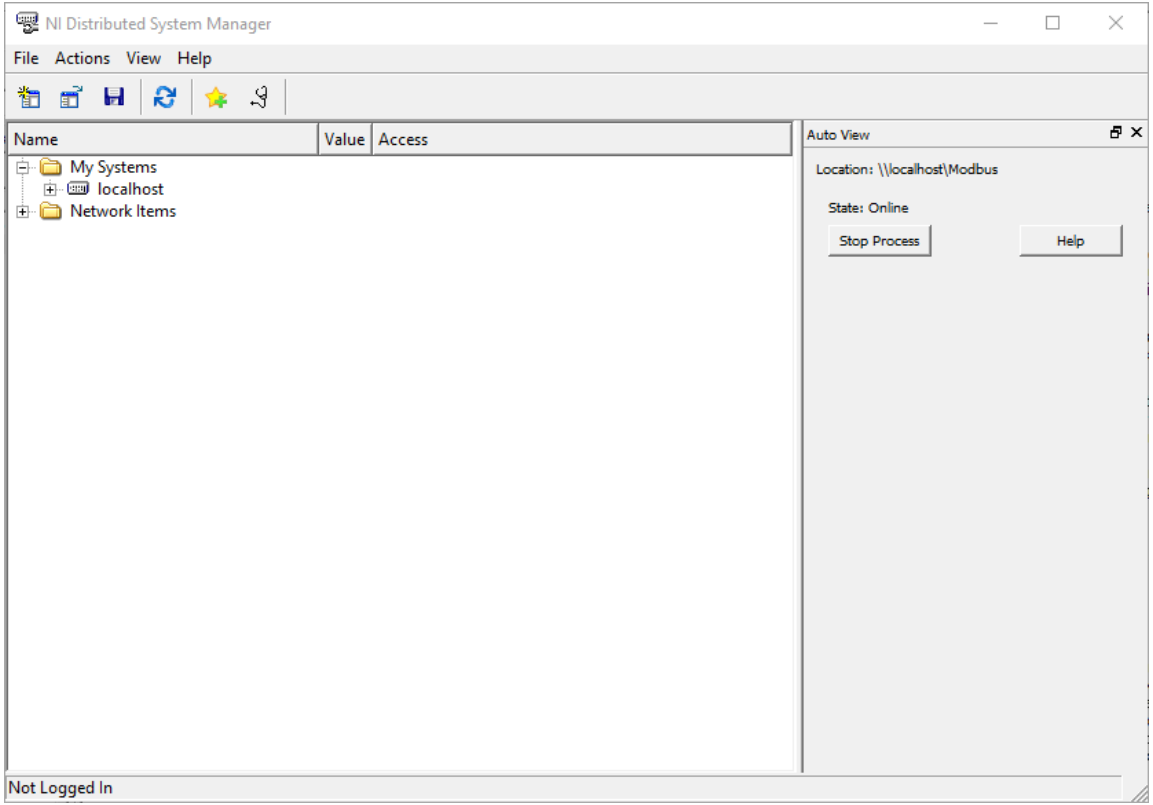
OPC with NetworkVariable

The following paragraphs explain how to use NetworkVariable with an OPC server using the LabVIEW DSC Run-Time System.

1. **Install LabVIEW Datalogging and Supervisory Control (DSC)** Run-Time System.
2. **Install your OPC server**. Only OPC2 and higher are supported by LabVIEW DSC Run-Time System.
3. Select Start»All Programs»National Instruments»**Distributed System Manager** to launch the application.
4. Right-click localhost and select **Add Process** to create a new process. Type Test_Process in the Add Process dialog box and click OK. Grouping variables by process allows you to organize your variables. You can start and stop processes independently, which allows you to easily manage your variables.
5. Right-click on Test_Process and select **Add I/O Server**.
6. For the I/O Server Type, **select OPC Client** and click Continue.
7. Type Test_OPC in the **Enter IO Server Name** dialog box and click OK.
8. **Select the OPC server** that you want to access through the Network Variable API from the list of Registered OPC Servers you installed in step 3 and click OK.
9. Right-click on Test_Process and select **Add Variable** to launch the **Shared Variable Properties** dialog box.
10. In the Shared Variable Properties dialog box, select the **Enable Aliasing** checkbox and click the Browse button.
11. In the Browse for Variable dialog box, select one of the OPC items from the OPC I/O server you configured in step 6.
12. Click OK to **bind the new variable to the OPC source**.
13. Click OK to return to NI Distributed System Manager. Use the new variable as you would any other shared variable. You can access the variable you have configured through the .NET **NetworkVariable class library**, as you would any other network variable.

http://zone.ni.com/reference/en-XX/help/375857B-01/mstudionetvar/netvar_opc/

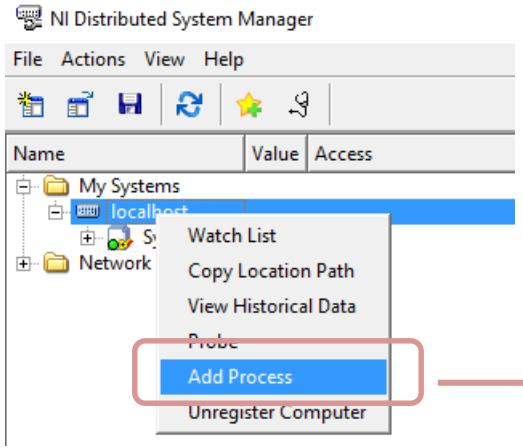
Distributed System Manager

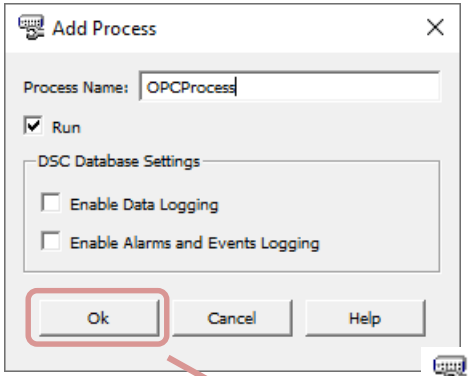


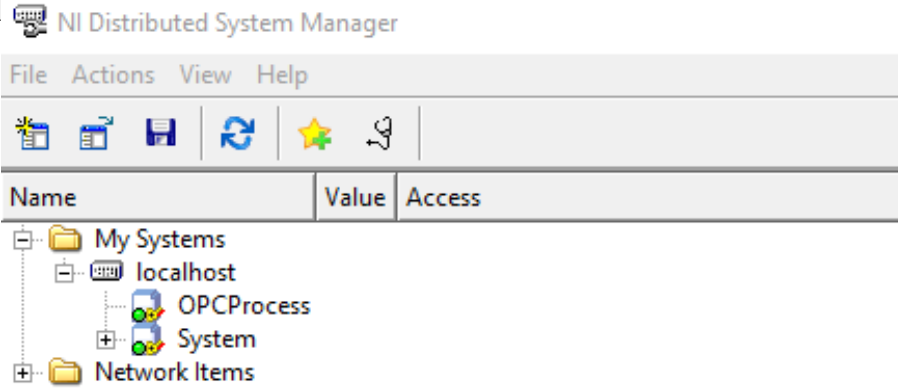
Add Process

- Right-click localhost and select **Add Process** to create a new process.
- Type, e.g., “OPCProcess” in the Add Process dialog box and click OK.
- Grouping variables by process allows you to organize your variables.
- You can start and stop processes independently, which allows you to easily manage your variables.

Add Process

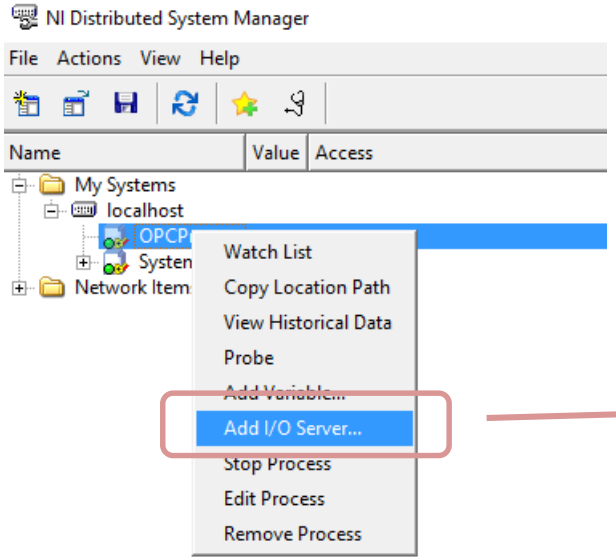

NI Distributed System Manager
File
Actions
View
Help
Name
Value
Access
My Systems
localhost
Network
Watch List
Copy Location Path
View Historical Data
Probe
Add Process
Unregister Computer


Add Process
Process Name:
OPCProcess
Run
DSC Database Settings
Enable Data Logging
Enable Alarms and Events Logging
Ok
Cancel
Help

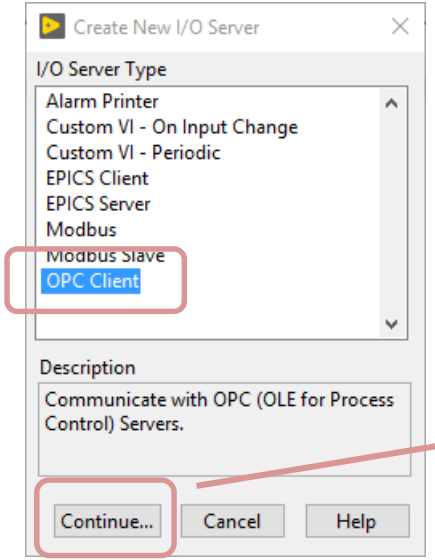

NI Distributed System Manager
File
Actions
View
Help
Name
Value
Access
My Systems
localhost
OPCProcess
System
Network Items

Add I/O Server

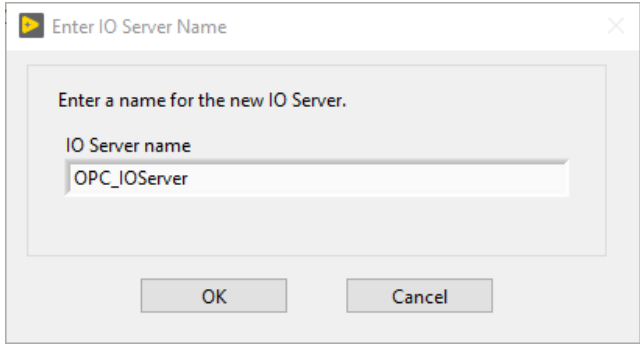
Right-click on “OPCProcess” and select **Add I/O Server**.



For the I/O Server Type, **select OPC Client** and click Continue.

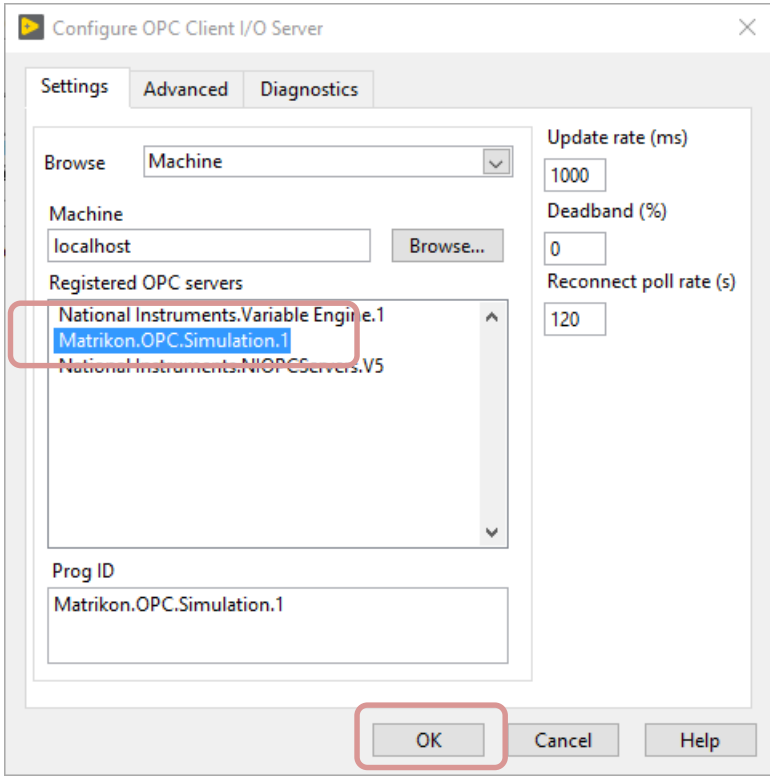


Type, e.g., “OPC_IOServer” in the **Enter IO Server Name** dialog box and click OK.



Select OPC Server

Select the OPC server that you want to access through the Network Variable API from the list of Registered OPC Servers and click OK.



NI Distributed System Manager

File Actions View Help

Name	Value	Access
My Systems		
localhost		
OPCProcess		
OPC_IOServer		
#MonitorACLFile	true	Read/Write
@ClientCount	1	Read
@Clients		Read
Configured Aliases		
NI OPC Client Status		
Simulation Items		
Bucket Brigade		
Random		
Read Error		
Saw-toothed Waves		
Square Waves		
Triangle Waves		
Write Error		
Write Only		
System		
Network Items		

Auto View

Location: \\localhost\OPCProcess\OPC_IOServer

Not Logged In

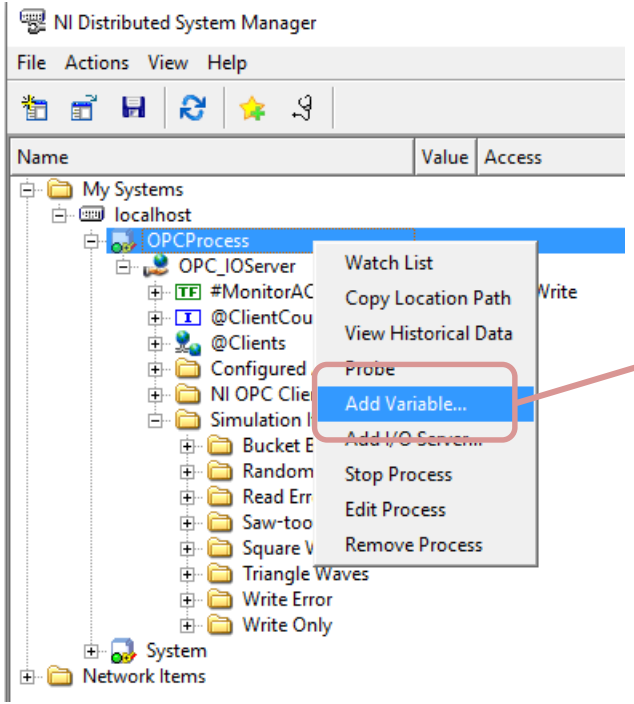
Add Variable

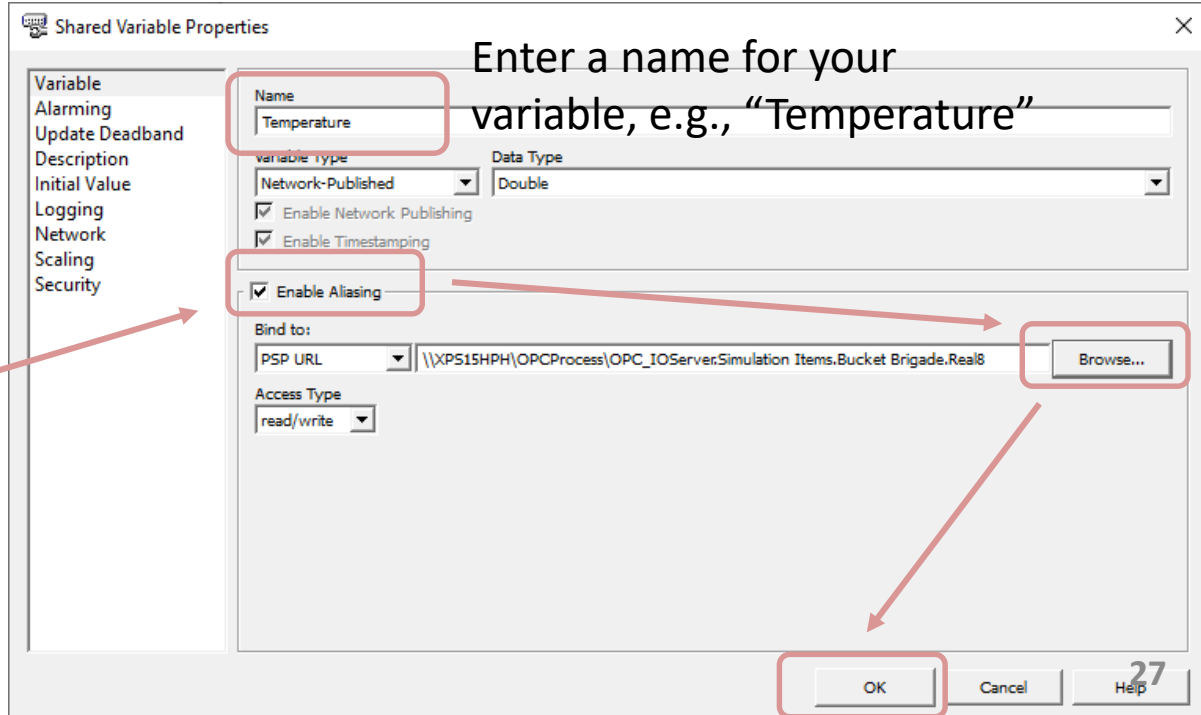
- Right-click on “OPCProcess” and select **Add Variable** to launch the **Shared Variable Properties** dialog box.
- In the Shared Variable Properties dialog box, select the **Enable Aliasing** checkbox and click the Browse button.
- In the Browse for Variable dialog box, select one of the OPC items from the OPC I/O server you configured in step 6.
- Click OK to **bind the new variable to the OPC source**.

Add Variable

Right-click on “OPCProcess” and select **Add Variable** to launch the **Shared Variable Properties** dialog box.

In the Shared Variable Properties dialog box, select the **Enable Aliasing** checkbox and click the Browse button.



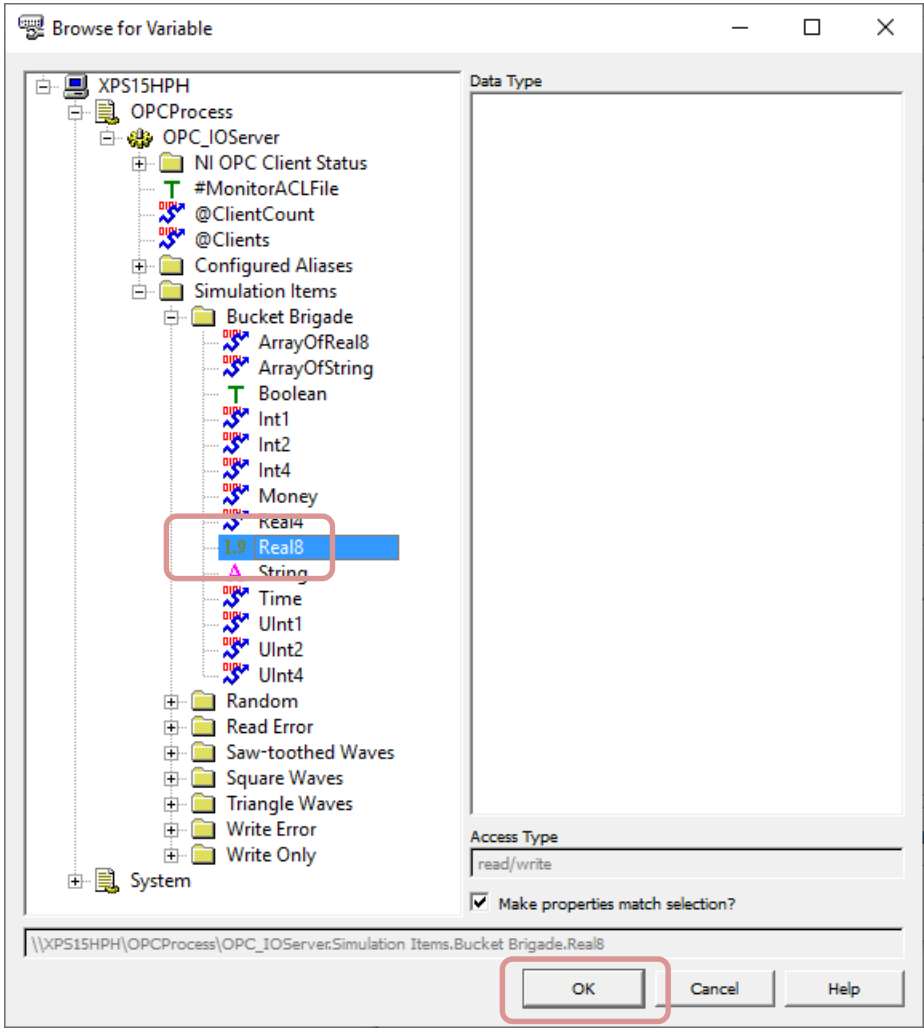


Enter a name for your variable, e.g., “Temperature”

Browse for Variable dialog box

In the Browse for Variable dialog box, select one of the OPC items from the OPC I/O server.

Click OK to **bind the new variable to the OPC source**.



Final Results

NI Distributed System Manager

File Actions View Help

Name	Value	Access
My Systems		
localhost		
OPCProcess		
OPC_IOServer		
#MonitorACLFile	true	Read/Write
@ClientCount	1	Read
@Clients		Read
Configured Aliases		
NI OPC Client Status		
Simulation Items		
Bucket Brigade		
Random		
Read Error		
Saw-toothed Waves		
Square Waves		
Triangle Waves		
Write Error		
Write Only		
Temperature	20	Read/Write
System		
Network Items		

Auto View

Location: \\localhost\OPCProcess\Temperature

Current Value:

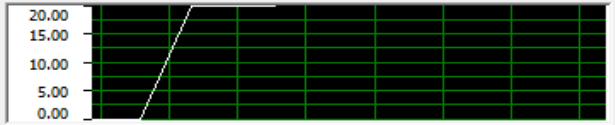
20

New Value:

20

Set

Show Trend



Data Type:	Double
Timestamp:	2020-02-04 15:30:53
Quality:	Good
Access Type:	Read/Write

Help

Not Logged In

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Visual Studio

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OPC in Visual Studio

We need to use the **NetworkVariable.dll** assembly which is part of the Measurement Studio Package

NationalInstruments.NetworkVariable.dll

Path:
C:\Program Files (x86)\National Instruments\Measurement Studio\DotNET\v4.5\AnyCPU\NationalInstruments.NetworkVariable 19.0.45\NationalInstruments.NetworkVariable.dll

Description:
Contains classes to publish and subscribe to live measurement data over the Internet. Provides better scalability and higher performance than DataSocket.

Measurement Studio in Visual Studio

File Edit View Project Build Debug Test Analyze Tools Extensions Window Help Search (Ctrl+Q)

Debu Any CPU

Manage Extensions

Measurement Studio

NI Tools

Measurement Studio Examples

Refresh Project License File

Add/Remove .NET Class Libraries

Update Measurement Studio Project References

Measurement Studio Help

Measurement Studio Getting Started Guide

Measurement Studio Online Resources

Patents

About Measurement Studio

Licenses

Check for Updates

Data Sources

Toolbox

Search Toolbox

General

There are no usable controls in this group. Drag an item onto this text to add it to the toolbox.

OPC in Visual Studio

2 Alternatives

- Alt1: You can use the Measurement Studio Template
- Alt 2: You can use the default Visual Studio Template for creating a C# Win Form Application
  - You need to add the necessary Assemblies manually (“Add Reference” in Visual Studio)
  - You need to add License Information manually (“licenses.licx” in Properties folder)

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Read Data from OPC Server

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Alt 1

Measurement Studio Template

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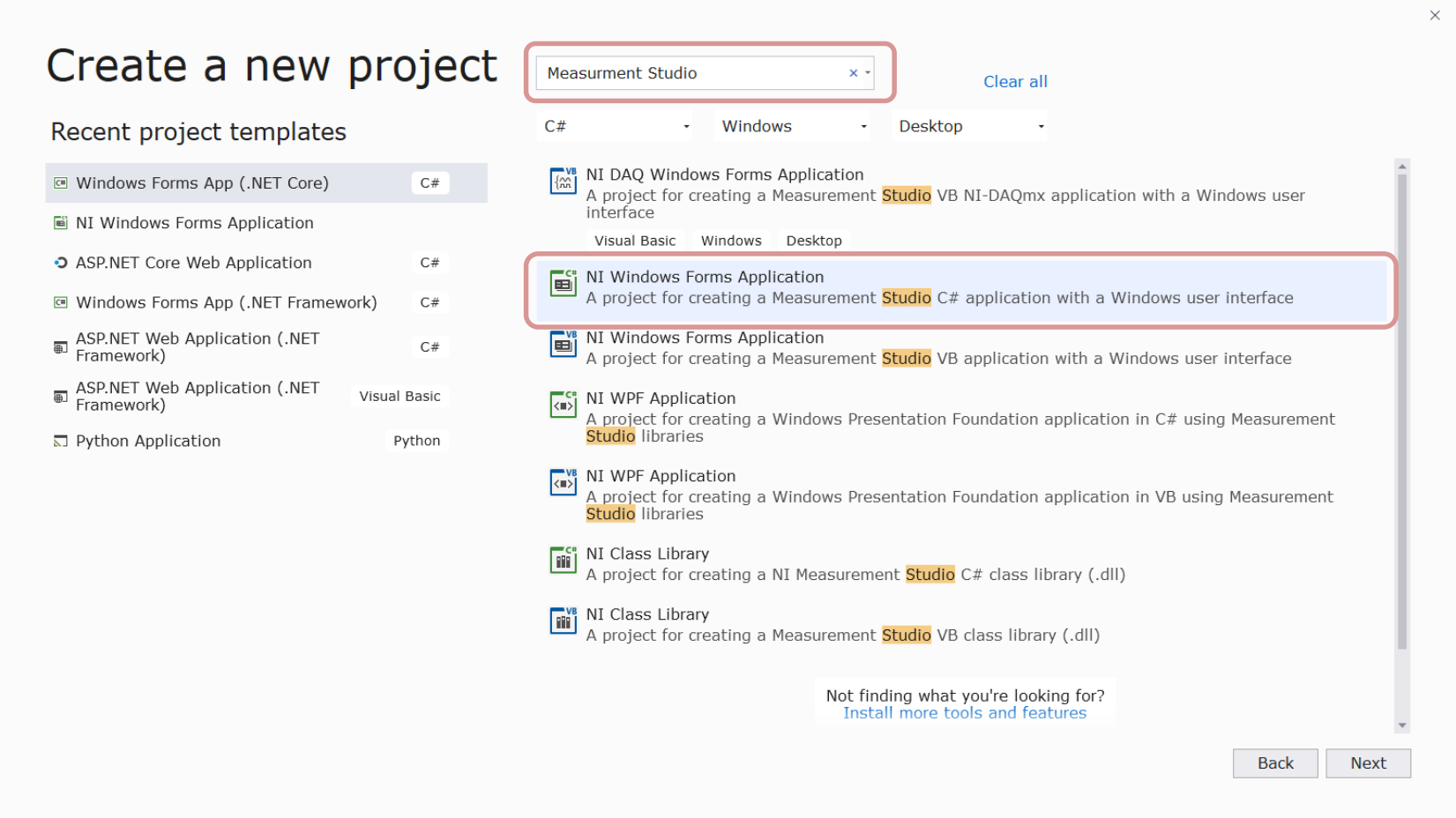
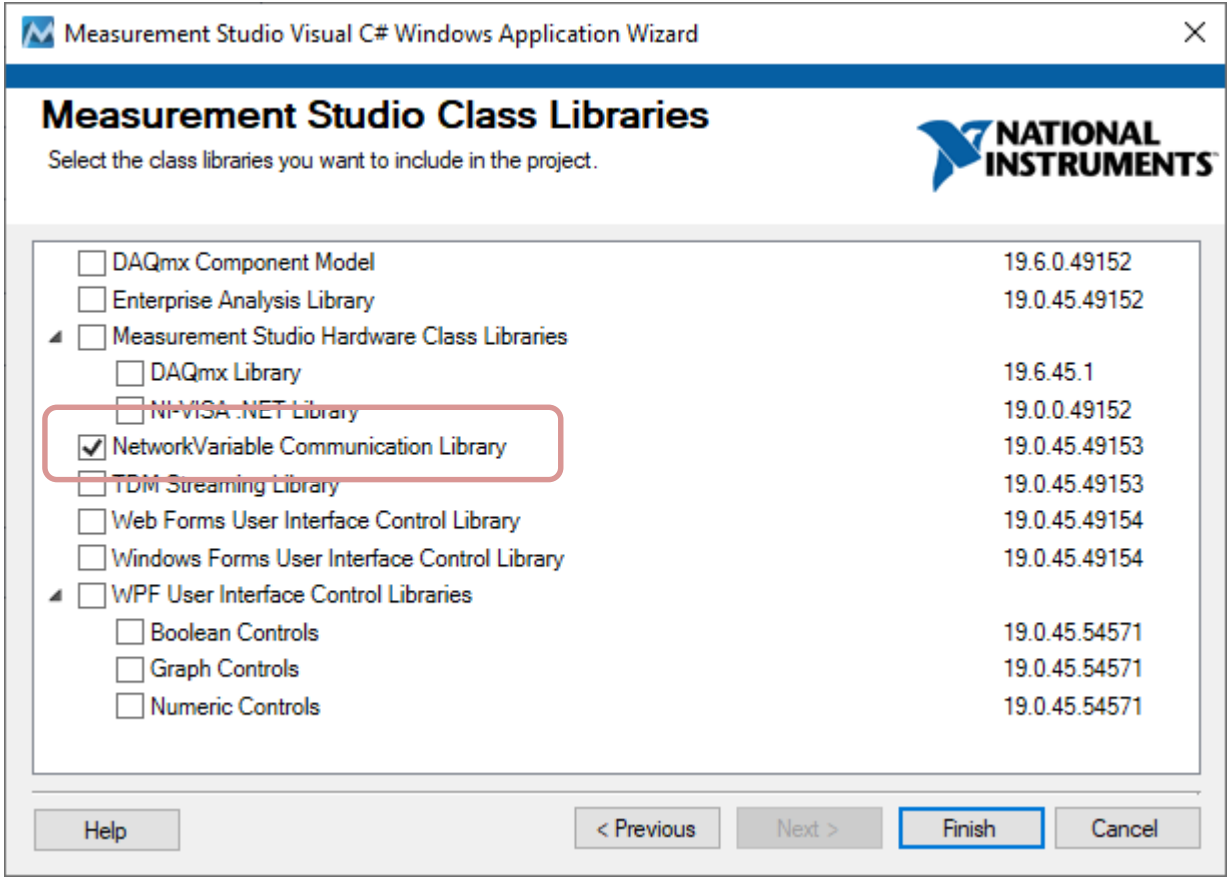
Measurement Studio Templates



Measurement Studio Templates



Visual Studio

File Edit View Project Build Debug Test Analyze Tools Extensions Window Help Search (Ctrl+Q) OpcApp

Debug Any CPU Start Live Share

Data Sources

Toolbox

Search Toolbox

General

There are no usable controls in this group. Drag an item onto this text to add it to the toolbox.

Form1.cs Form1.cs [Design]

OpcApp OpcApp.Form1 Form1()

```
1   using NationalInstruments;
2   using NationalInstruments.NetworkVariable;
3   using NationalInstruments.NetworkVariable.WindowsForms;
4   using System;
5   using System.Collections.Generic;
6   using System.ComponentModel;
7   using System.Data;
8   using System.Drawing;
9   using System.Linq;
10  using System.Text;
11  using System.Threading.Tasks;
12  using System.Windows.Forms;
13
14  namespace OpcApp
15  {
        3 references
16      public partial class Form1 : Form
17      {
            1 reference
18          public Form1()
19          {
20              InitializeComponent();
21          }
22      }
23  }
24
```

110 % No issues found Ln: 6 Ch: 29 SPC CRLF

Solution Explorer

Search Solution Explorer (Ctrl+;)

Solution 'OpcApp' (1 of 1 project)

- OpcApp
  - Properties
    - AssemblyInfo.cs
    - licenses.licx
    - Resources.resx
    - Settings.settings
  - References
    - Analyzers
    - Microsoft.CSharp
    - NationalInstruments.Common
    - NationalInstruments.NetworkVariable
    - System
    - System.Core
    - System.Data
    - System.Data.DataSetExtensions
    - System.Deployment
    - System.Drawing
    - System.Net.Http
    - System.Windows.Forms
    - System.Xml
    - System.Xml.Linq
  - App.config
  - Form1.cs
  - Program.cs

Solution Explorer Team Explorer

Properties

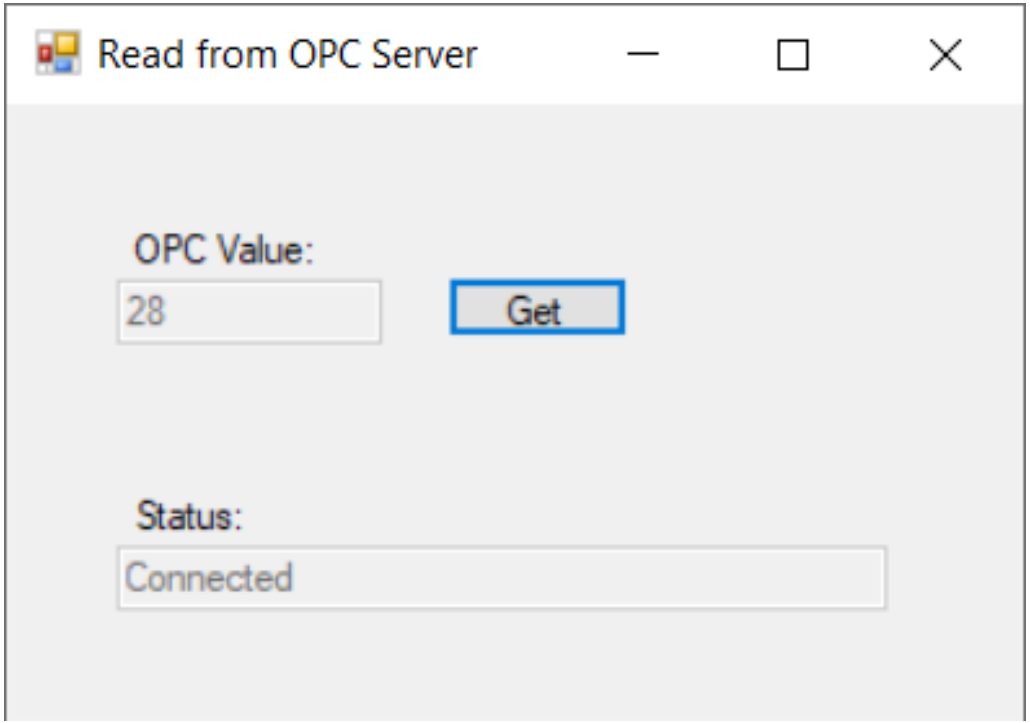
OpcApp Project Properties

Project File	OpcApp.csproj
Project Folder	C:\Temp\OPC\OpcApp\Op

Project File
The name of the file containing build, configu...

Ready Add to Source Control

C# Application – Read from OPC Server



C# Code

```
using NationalInstruments.NetworkVariable;
using System;
using System.Windows.Forms;

namespace OPCExample
{
  public partial class Form1 : Form
  {
    private NetworkVariableReader<double> _reader;
    private const string NetworkVariableLocation = @"\\localhost\Test_Process\Temperature";

    public Form1()
    {
      InitializeComponent();

      ConnectOPCServer();
    }

    private void btnGetData_Click(object sender, EventArgs e)
    {
      NetworkVariableData<double> opcdata = null;
      try
      {
        opcdata = _reader.ReadData();

        txtOpcData.Text = opcdata.GetValue().ToString();
      }
      catch (TimeoutException)
      {
        MessageBox.Show("The read has timed out.", "Timeout");
        return;
      }
    }

    private void ConnectOPCServer()
    {
      _reader = new NetworkVariableReader<double>(NetworkVariableLocation);

      _reader.Connect();

      txtStatus.Text = _reader.ConnectionStatus.ToString();
    }

    private void Form1_FormClosing(object sender, FormClosingEventArgs e)
    {
      _reader.Disconnect();
    }

  }
}
```

```
using NationalInstruments.NetworkVariable;
```

```
private NetworkVariableReader<double> _reader;
private const string NetworkVariableLocation = @"\\localhost\OPCProcess\Temperature";

public Form1()
{
    InitializeComponent();
    ConnectOPCServer();
}
```

```
private void ConnectOPCServer()
{
    _reader = new NetworkVariableReader<double>(NetworkVariableLocation);

    _reader.Connect();

    txtStatus.Text = _reader.ConnectionStatus.ToString();
}
```

```
private void btnGetData_Click(object sender, EventArgs e)
 {
     NetworkVariableData<double> opcdata = null;
      try
       {
           opcdata = _reader.ReadData();
           txtOpcData.Text = opcdata.GetValue().ToString();
        }
        catch (TimeoutException)
        {
           MessageBox.Show("The read has timed out.", "Timeout");
           return;
        }
}
```

```
private void Form1_FormClosing(object sender, FormClosingEventArgs e)
 {
        _reader.Disconnect();
 }
```

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Alt 2

Default Visual Studio Template C# Win Form Application

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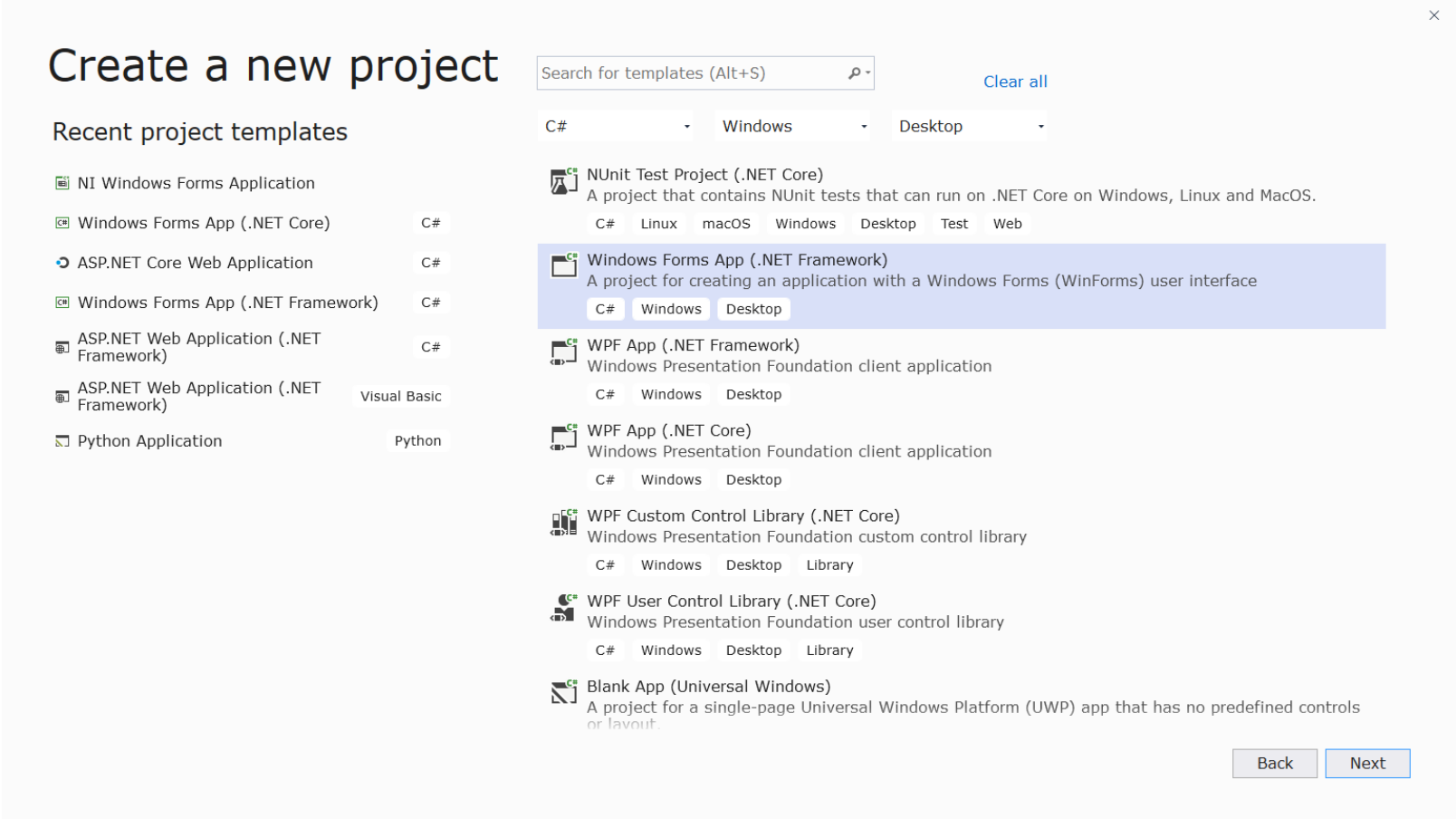
Windows Forms App



Windows Forms App

File Edit View Project Build Debug Test Analyze Tools Extensions Window Help Search (Ctrl+Q) WindowsFormsApp1

Debug Any CPU Start Live Share

Data Sources

Toolbox

Search Toolbox

General

There are no usable controls in this group. Drag an item onto this text to add it to the toolbox.

Form1.cs Form1.cs [Design]

WindowsFormsApp1 WindowsFormsApp1.Form1 Form1()

```
using System;
using System.Collections.Generic;
using System.ComponentModel;
using System.Data;
using System.Drawing;
using System.Linq;
using System.Text;
using System.Threading.Tasks;
using System.Windows.Forms;

namespace WindowsFormsApp1
{
    3 references
    public partial class Form1 : Form
    {
        1 reference
        public Form1()
        {
            InitializeComponent();
        }
    }
}
```

110 % No issues found Ln: 12 Ch: 2 SPC CRLF

Solution Explorer

Search Solution Explorer (Ctrl+¨)

Solution 'WindowsFormsApp1' (1 of 1 project)

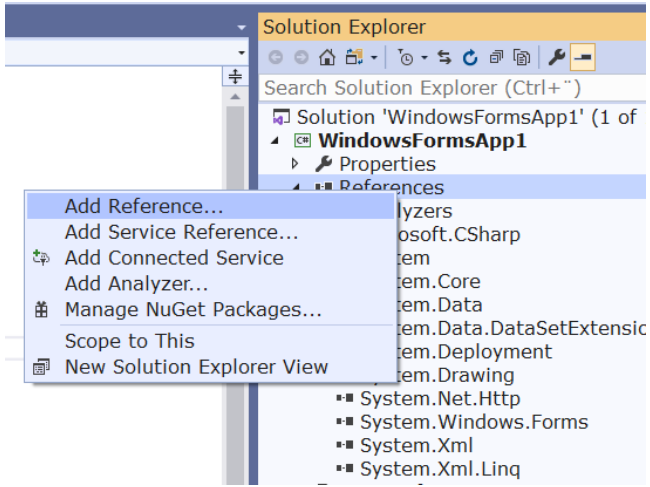
- WindowsFormsApp1
  - Properties
  - References
    - Analyzers
    - Microsoft.CSharp
    - System
    - System.Core
    - System.Data
    - System.Data.DataSetExtensions
    - System.Deployment
    - System.Drawing
    - System.Net.Http
    - System.Windows.Forms
    - System.Xml
    - System.Xml.Linq
  - App.config
  - Form1.cs
  - Program.cs

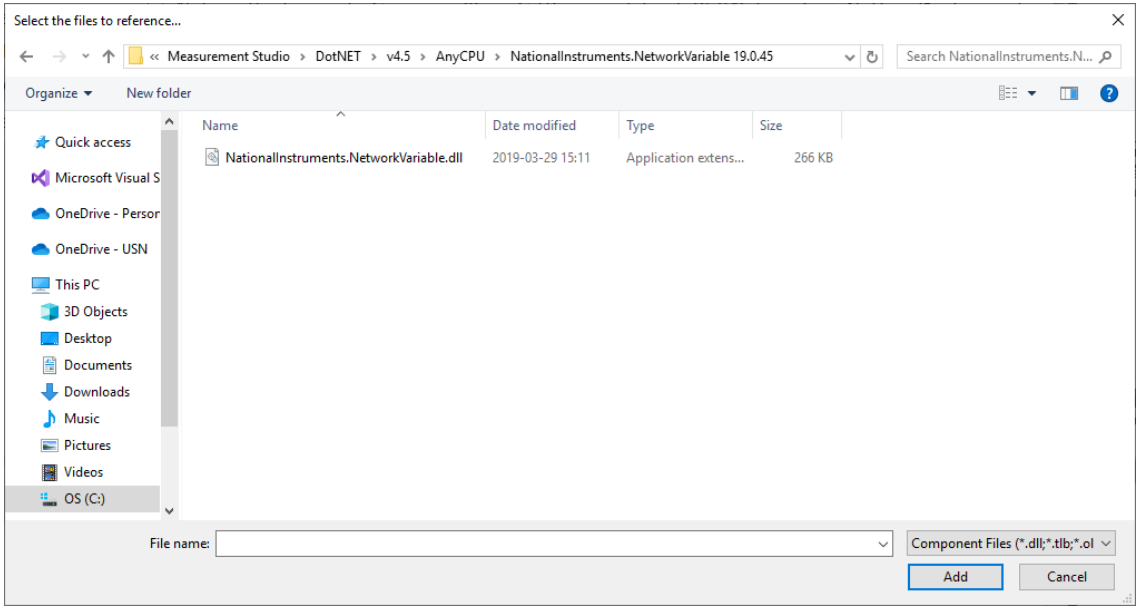
Solution Explorer Team Explorer

Properties

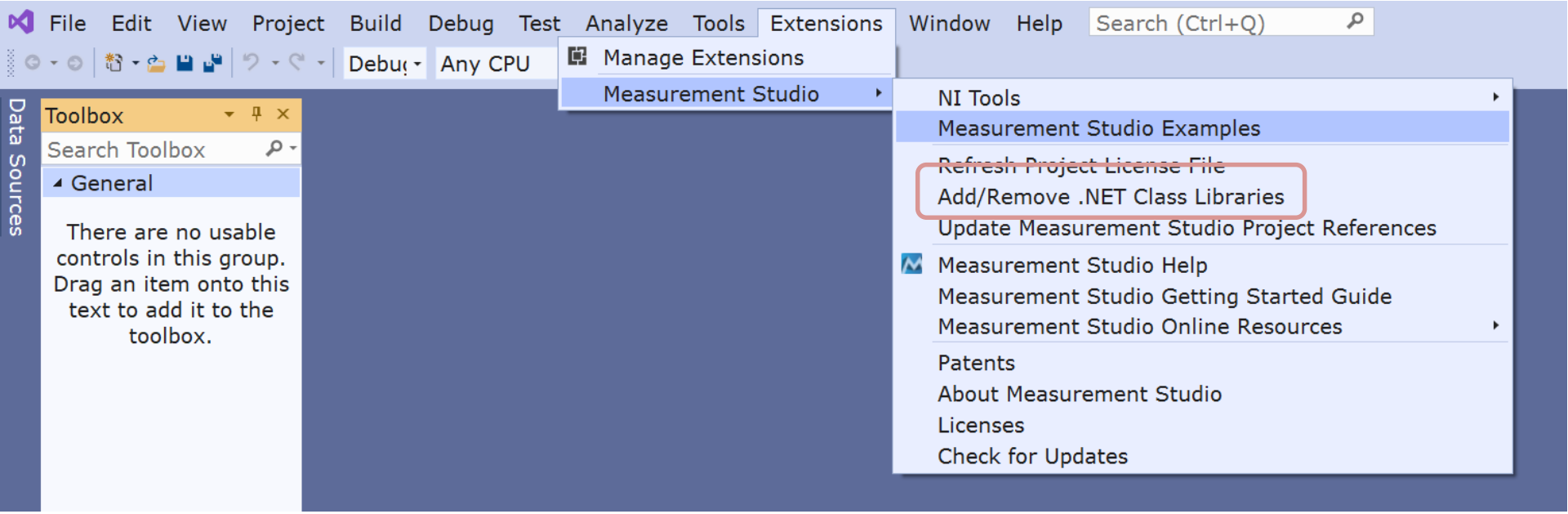
This item does not support previewing Add to Source Control

Manually Add Assembly/Assemblies





Add/Remove Class Libraries



Add/Remove Class Libraries

Measurement Studio Add/Remove Class Libraries Wizard

Measurement Studio Class Libraries

Select the class libraries you want to include in the project.

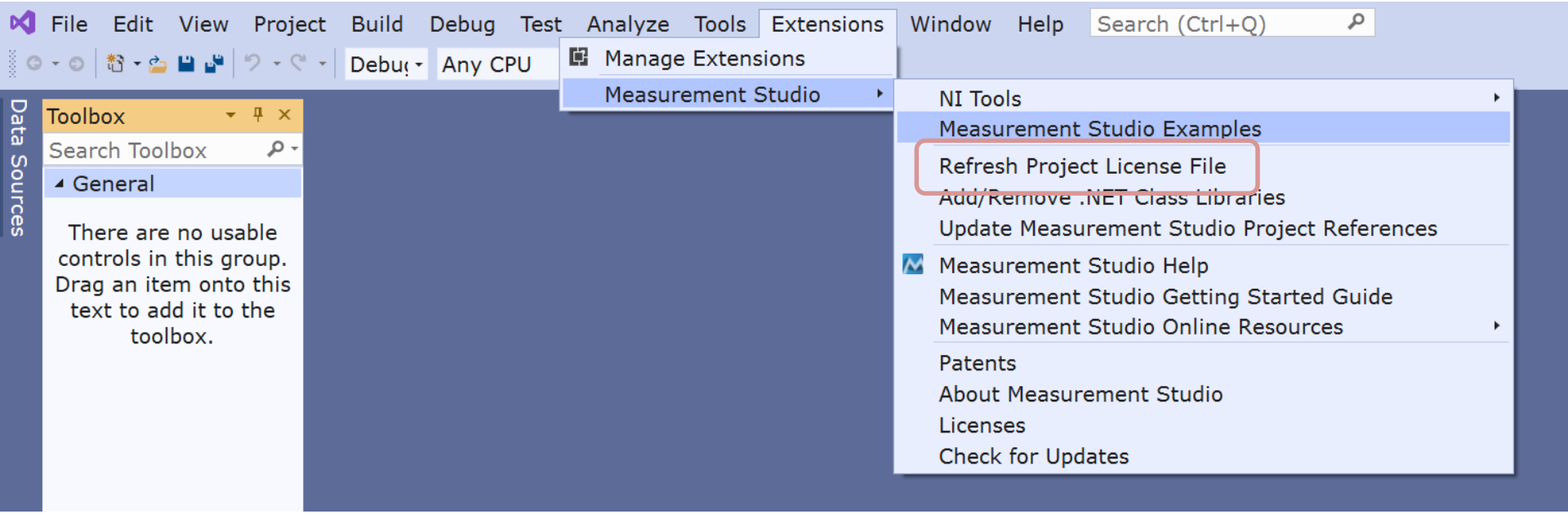
NATIONAL INSTRUMENTS

DAQmx Component Model	19.6.0.49152
Enterprise Analysis Library	19.0.45.49152
Measurement Studio Hardware Class Libraries	
DAQmx Library	19.6.45.1
NI-VISA .NET Library	19.0.0.49152
NetworkVariable Communication Library	19.0.45.49153
TDM Streaming Library	19.0.45.49153
Web Forms User Interface Control Library	19.0.45.49154
Windows Forms User Interface Control Library	19.0.45.49154
WPF User Interface Control Libraries	
Boolean Controls	19.0.45.54571
Graph Controls	19.0.45.54571
Numeric Controls	19.0.45.54571

Help | Finish | Cancel

Refresh Project License File

When the proper Assembly/Assemblies has been added, you may need to refresh the Project License File



Add License Information

File Edit View Project Build Debug Test Analyze Tools Extensions Window Help Search (Ctrl+Q) OpcApp2

Debu Any CPU Start Live Share

Data Sources

Toolbox

Search Toolbox

General

There are no usable controls in this group. Drag an item onto this text to add it to the toolbox.

licenses.licx

```
# The following section of this file was auto-generated by Measurement Studio.  Do not edit or remove this file from t
# This file is used for licensing Measurement Studio components.
# Begin Measurement Studio licenses
NationalInstruments.NetworkVariable.WindowsForms.NetworkVariableBrowserDialog, NationalInstruments.NetworkVariable, Ve
NationalInstruments.NetworkVariable.NetworkVariableLicenser, NationalInstruments.NetworkVariable, Version=19.0.45.4915
NationalInstruments.NetworkVariable.WindowsForms.NetworkVariableDataSource, NationalInstruments.NetworkVariable, Versi
NationalInstruments.NetworkVariable.WebForms.NetworkVariableDataSource, NationalInstruments.NetworkVariable, Version=1
# End Measurement Studio licenses
```

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Error List

Entire Solution 0 Errors 0 Warnings 0 Messages Build + IntelliSe Search Error List

Co... Description Project File L... Su...

Solution Explorer

Search Solution Explorer (Ctrl+¨)

Solution 'OpcApp2' (1 of 1 project)
- OpcApp2
  - Properties
    - AssemblyInfo.cs
    - licenses.licx
  - Resources.resx
  - Settings.settings
  - References
  - App.config
  - Form1.cs
    - Form1.Designer.cs
    - Form1.resx
  - Program.cs

Solution Explorer Team Explorer

Properties

Diagnostic Tools

licenses.licx

The following section of this file was auto-generated by Measurement Studio. Do not edit or remove this file from the project.

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Begin Measurement Studio licenses

NationalInstruments.NetworkVariable.WindowsForms.NetworkVariableBrowserDialog, NationalInstruments.NetworkVariable, Version=19.0.45.49153, Culture=neutral, PublicKeyToken=4febd62461bf11a4

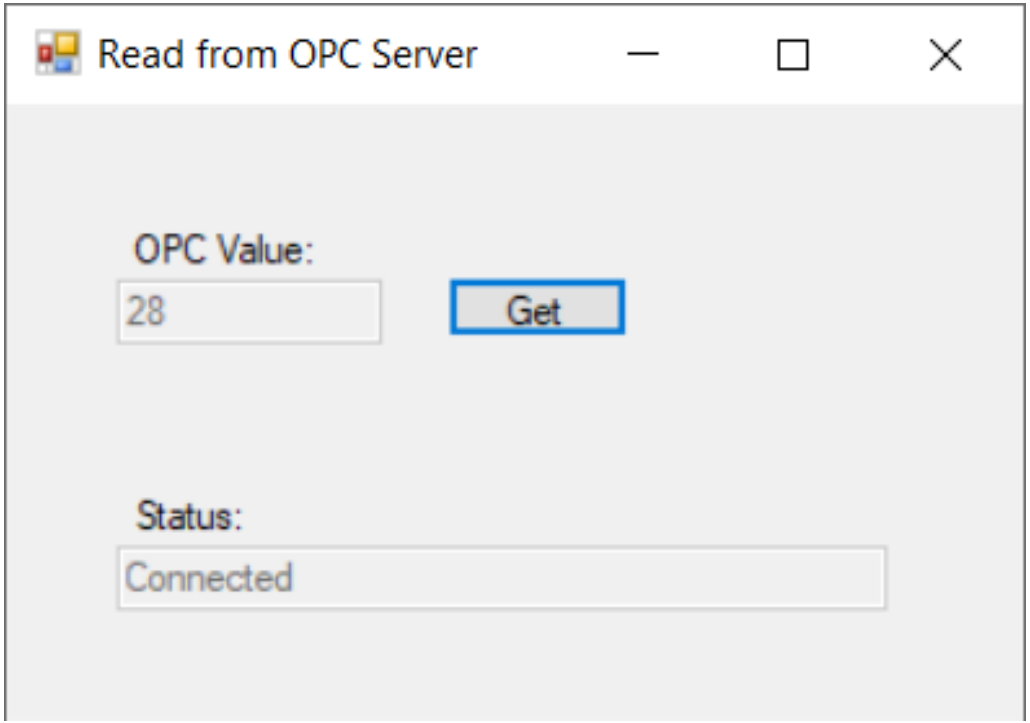
NationalInstruments.NetworkVariable.NetworkVariableLicenser, NationalInstruments.NetworkVariable, Version=19.0.45.49153, Culture=neutral, PublicKeyToken=4febd62461bf11a4

NationalInstruments.NetworkVariable.WindowsForms.NetworkVariableDataSource, NationalInstruments.NetworkVariable, Version=19.0.45.49153, Culture=neutral, PublicKeyToken=4febd62461bf11a4

NationalInstruments.NetworkVariable.WebForms.NetworkVariableDataSource, NationalInstruments.NetworkVariable, Version=19.0.45.49153, Culture=neutral, PublicKeyToken=4febd62461bf11a4

End Measurement Studio licenses

C# Application – Read from OPC Server



C# Code

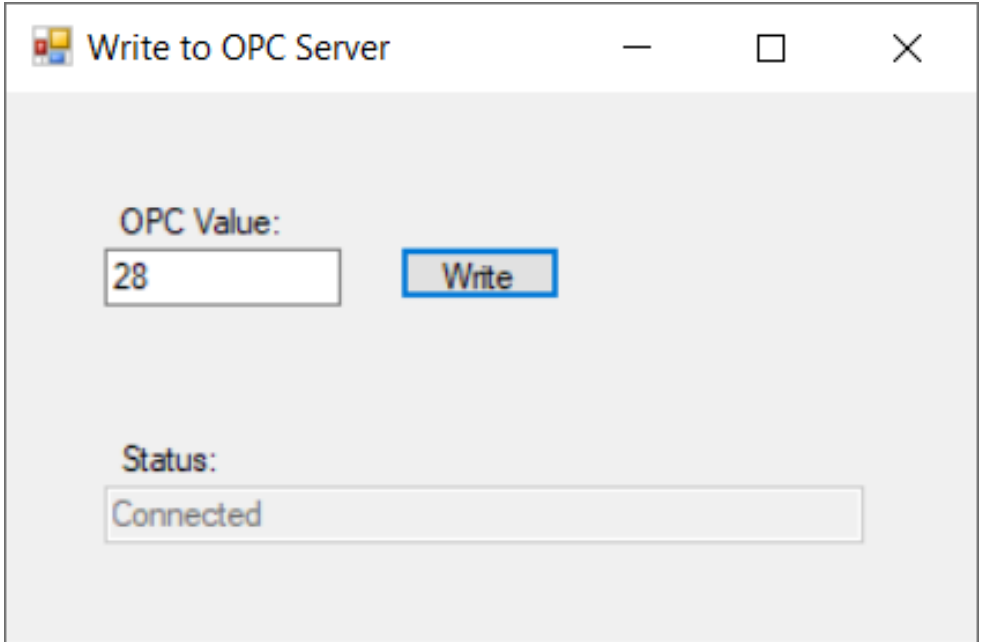
```
using NationalInstruments;
using NationalInstruments.NetworkVariable;
using System;
using System.Windows.Forms;

namespace OPCExample
{
   public partial class Form1 : Form
   {
      private NetworkVariableReader<float> _reader;
      private const string NetworkVariableLocation = @"\\localhost\OPCProcess\opctempdata";

      public Form1()
      {
         InitializeComponent();

         ConnectOPCServer();
      }

      private void btnGetData_Click(object sender, EventArgs e)
      {
         NetworkVariableData<float> opcdata = null;
         try
         {
            opcdata = _reader.ReadData();

            txtOpcData.Text = opcdata.GetValue().ToString();
         }
         catch (TimeoutException)
         {
            MessageBox.Show("The read has timed out.", "Timeout");
            return;
         }
      }

      private void ConnectOPCServer()
      {
         _reader = new NetworkVariableReader<float>(NetworkVariableLocation);

         _reader.Connect();

         txtStatus.Text = _reader.ConnectionStatus.ToString();
      }

      private void Form1_FormClosing(object sender, FormClosingEventArgs e)
      {
         _reader.Disconnect();
      }

   }
}
```

https://www.halvorsen.blog

Write Data to OPC Server

Hans-Petter Halvorsen

C# Application – Write to OPC Server



C# Code

```
using NationalInstruments.NetworkVariable;
using System;
using System.Windows.Forms;

namespace OPCExample
{
   public partial class Form1 : Form
   {
      private NetworkVariableWriter<double> _writer;
      private const string NetworkVariableLocation = @"\\localhost\OPCProcess\Temperature";

      public Form1()
      {
         InitializeComponent();

         ConnectOPCServer();
      }

      private void btnWriteData_Click(object sender, EventArgs e)
      {
         double temperature;
         try
         {
            temperature = Convert.ToDouble(txtOpcData.Text);

            _writer.WriteValue(temperature);
         }
         catch (TimeoutException)
         {
            MessageBox.Show("The read has timed out.", "Timeout");
            return;
         }
      }

      private void ConnectOPCServer()
      {
         _writer = new NetworkVariableWriter<double>(NetworkVariableLocation);

         _writer.Connect();

         txtStatus.Text = _writer.ConnectionStatus.ToString();
      }

      private void Form1_FormClosing(object sender, FormClosingEventArgs e)
      {
         _writer.Disconnect();
      }

   }
}
```

```
using NationalInstruments.NetworkVariable;
```

```
private NetworkVariableWriter<double> _writer;
private const string NetworkVariableLocation = @"\\localhost\OPCProcess\Temperature";

public Form1()
 {
     InitializeComponent();
     ConnectOPCServer();
}
```

```
private void ConnectOPCServer()
{
    _writer = new NetworkVariableWriter<double>(NetworkVariableLocation);

    _writer.Connect();

     txtStatus.Text = _writer.ConnectionStatus.ToString();
}
```

```
private void btnWriteData_Click(object sender, EventArgs e)
{
    double temperature;
    try
    {
        temperature = Convert.ToDouble(txtOpcData.Text);

        _writer.WriteValue(temperature);
    }
    catch (TimeoutException)
    {
        MessageBox.Show("The read has timed out.", "Timeout");
        return;
    }
}
```

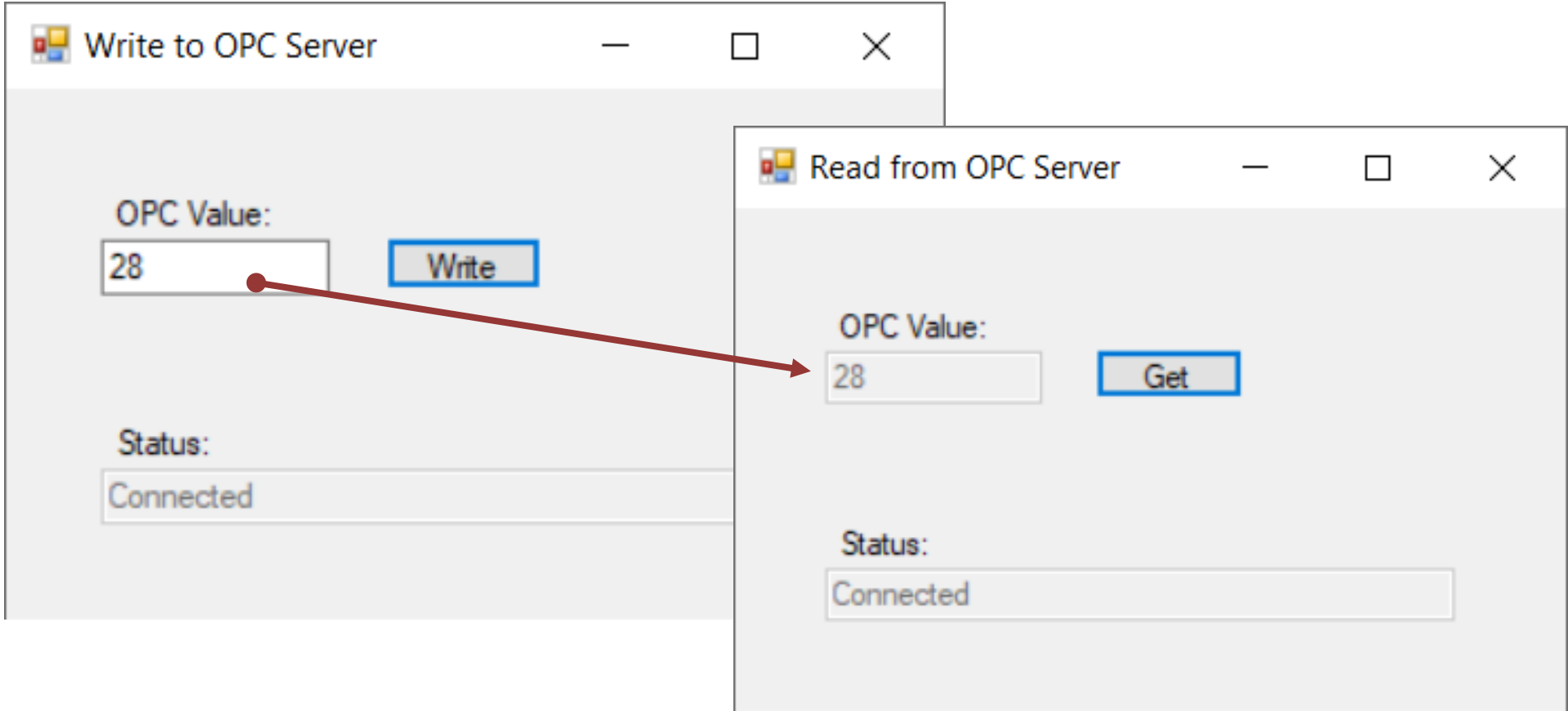
```
private void Form1_FormClosing(object sender, FormClosingEventArgs e)
 {
        _reader.Disconnect();
 }
```

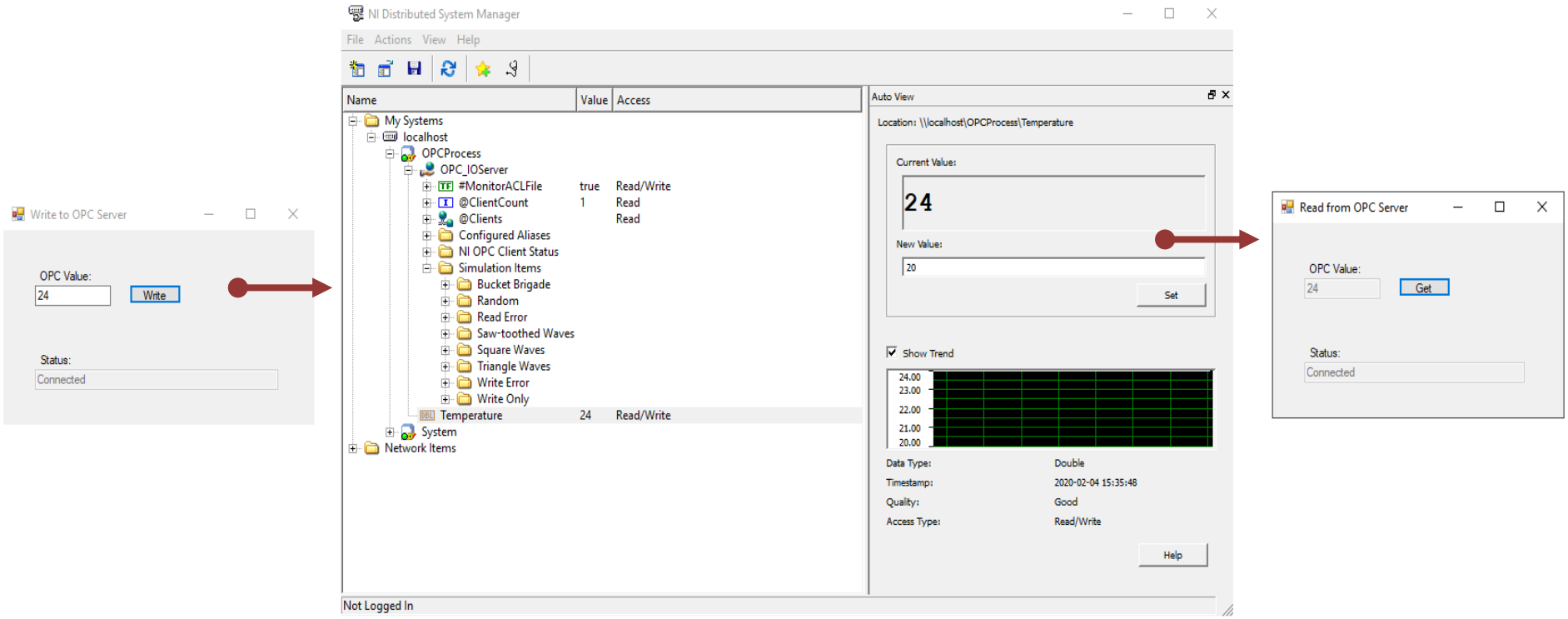
https://www.halvorsen.blog

Write/Read Data to/from OPC Server

Hans-Petter Halvorsen

C# Applications




Write to OPC Server
OPC Value:
24
Write
Status:
Connected
NI Distributed System Manager
File Actions View Help
Name
Value
Access
My Systems
localhost
OPCProcess
OPC_IOServer
#MonitorACLFile true Read/Write
@ClientCount 1 Read
@Clients Read
Configured Aliases
NI OPC Client Status
Simulation Items
Bucket Brigade
Random
Read Error
Saw-toothed Waves
Square Waves
Triangle Waves
Write Error
Write Only
Temperature 24 Read/Write
System
Network Items
Auto View
Location: \\localhost\OPCProcess\Temperature
Current Value:
24
New Value:
20
Set
Show Trend
24.00
23.00
22.00
21.00
20.00
Data Type: Double
Timestamp: 2020-02-04 15:35:48
Quality: Good
Access Type: Read/Write
Help
Not Logged In
Read from OPC Server
OPC Value:
24
Get
Status:
Connected

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