



## TOP Server V5 to MicroLogix 1400

### Using DNP3 Ethernet Driver

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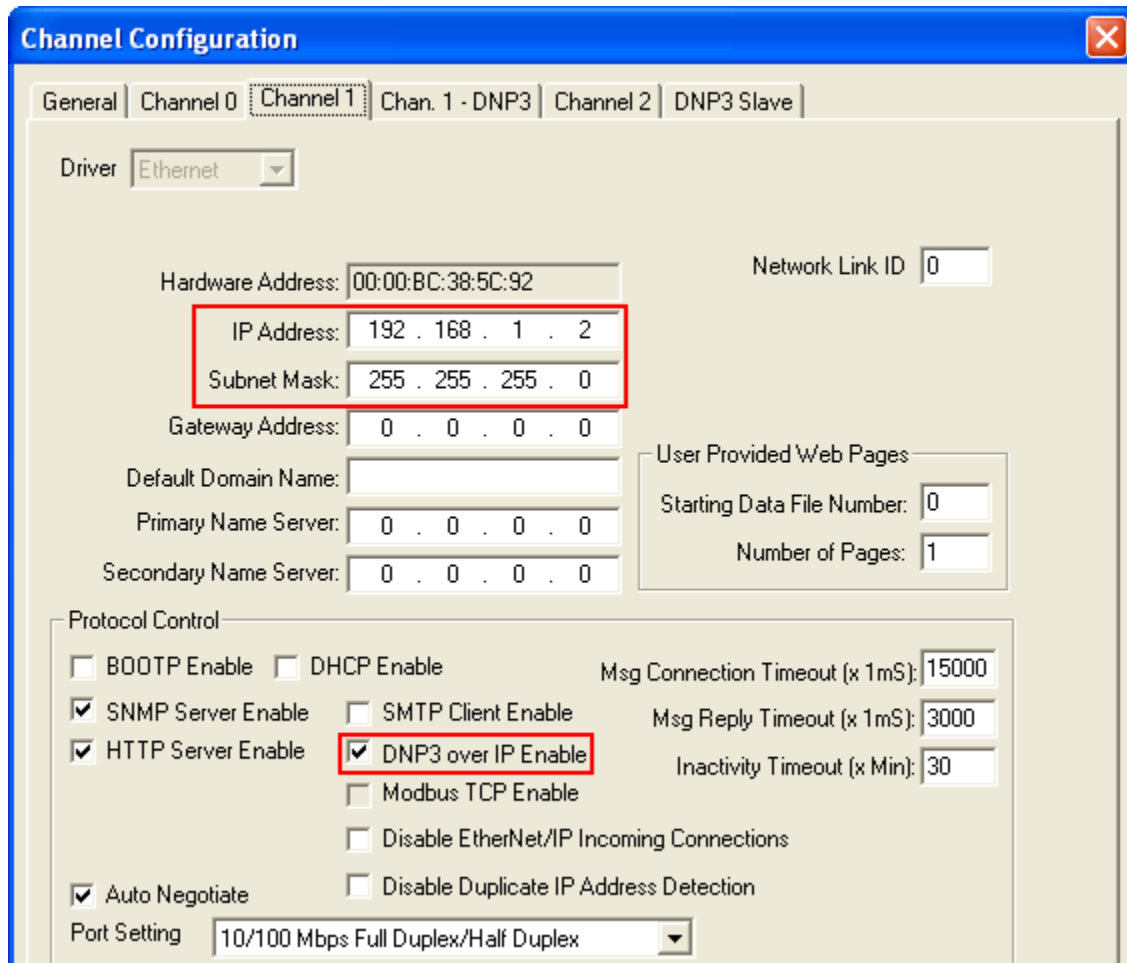
## Introduction

This document is meant as a quick-start reference for getting TOP Server V5 connected to your AB MicroLogix 1400 Series B controller using DNP3 Ethernet. It is not meant to replace vendor documentation and guides for configuring DNP3 capabilities in an AB MicroLogix 1400 controller.



## Configuring the MicroLogix 1400 as a DNP3 Slave

1. Create a new MicroLogix 1400 Series B project using RSLogix 500/Micro version 8.30 or higher.
2. Configure Channel 1 for DNP3 Slave by checking **DNP3 over IP Enable** and configure an appropriate static **IP Address** and **Subnet Mask**:



**Channel Configuration**

General Channel 0 **Channel 1** Chan. 1 - DNP3 Channel 2 DNP3 Slave

Driver: Ethernet

Hardware Address: 00:00:BC:38:5C:92 Network Link ID: 0

IP Address: 192 . 168 . 1 . 2  
Subnet Mask: 255 . 255 . 255 . 0

Gateway Address: 0 . 0 . 0 . 0

Default Domain Name:

Primary Name Server: 0 . 0 . 0 . 0

Secondary Name Server: 0 . 0 . 0 . 0

User Provided Web Pages

Starting Data File Number: 0

Number of Pages: 1

Protocol Control

☐ BOOTP Enable ☐ DHCP Enable

☒ SNMP Server Enable ☐ SMTP Client Enable

☒ HTTP Server Enable ☒ **DNP3 over IP Enable**

☐ Modbus TCP Enable

☐ Disable EtherNet/IP Incoming Connections

☒ Auto Negotiate ☐ Disable Duplicate IP Address Detection

Port Setting: 10/100 Mbps Full Duplex/Half Duplex

Msg Connection Timeout (x 1mS): 15000

Msg Reply Timeout (x 1mS): 3000

Inactivity Timeout (x Min): 30



3. Click on the **Chan. 1 - DNP3** tab. Enter **10** for Diagnostic File Number and leave the other fields at their default values for now:

**Channel Configuration**

General | Channel 0 | Channel 1 | **Chan. 1 - DNP3** | Channel 2 | DNP3 Slave

DNP3 over IP Configuration

Slave Node Address: 1

☐ Enable Self-Address(0xFFFC)

**Diagnostic File Number: 10**

☐ Enable Master Address Validation

DNP3 Master Node Address

Master Node0: 0 Master Node2: 0 Master Node4: 0

Master Node1: 0 Master Node3: 0

☐ Enable Access Control for Master IP addresses

Master IP0: 0 . 0 . 0 . 0

Master IP1: 0 . 0 . 0 . 0

Master IP2: 0 . 0 . 0 . 0

Master IP3: 0 . 0 . 0 . 0

Master IP4: 0 . 0 . 0 . 0

End Point Type

☒ Listening

☐ Dual

☐ Datagram Only

Master TCP Port Number (Unsol): 20000

Master UDP Port Number (Init Unsol): 20000

Master UDP Port Number (Unsol): 20000

Keep Alive Interval (x1s): 10

Local Port Number(TCP): 20000

Local Port Number(UDP): 20000



4. The Diagnostic File is used to store and display Channel Status diagnostic information specific to DNP3 over Ethernet:

The image shows a software window titled "Channel Status" with a blue title bar and standard Windows window controls. Inside the window, there are four tabs: "Channel 0", "Channel 1", "Channel 1 - Ext" (which is selected), and "Channel 2". The main content area is titled "DNP3 Slave Application Layer" and contains two columns of diagnostic data, each with a label and a text input field containing the value "0".

DNP3 Slave Application Layer	
Application Layer Error Code =	Received Confirm FC Counter =
Application Layer Error Count =	Received Read FC Counter =
FC last error =	Received Write FC Counter =
Last Trans IIN in response =	Received Etc FC Counter =
Data file Num last error request =	Trans Solicited Res FC Counter =
Data element Num last error request =	Trans Unsolicited Res FC Counter =
Transport Layer Error Code =	Number of events to be reported =
Transport Layer Error Count =	FC : Function Code

At the bottom left of the main area is a "Clear" button. At the bottom right, there are two labels: "Res : Response" and "Trans : Transmitted".



5. Click on the **DNP3 Slave** tab:

**Channel Configuration**

General | Channel 0 | Channel 1 | Channel 2 | Chan. 1 - DNP3 | **DNP3 Slave**

**DNP3 Slave**

Application Layer

☐ Enable Confirmation

Max Response Size: 2048

Confirmation Timeout (x1ms): 10000

Number of Retries: 0

Select Timeout (x1s): 10

Time Sync. Interval (x1mins): 0

☐ Enable Time Sync. On Start Up Only

Channel for Unsolicited Responses: Chan. 1

☐ Send Init. Unsol. Null Resp. on Restart

☐ Enable Unsolicited On Start Up

Enable Unsolicited for Class:

	Class1	Class2	Class3
Number of Events	10	10	10
Hold Time after Events (x1s)	5	5	5

**DNP3 Object File Numbers**

	Data Files	Config Files	Class Flag/OL	T/D
Binary Input	0	0	0	
Binary Output	0		0	
Counter (16bits)	0	0		0
Counter (32bits)	0	0		0
Frozen Counter (16bits)		0		
Frozen Counter (32bits)		0		
Analog Input (16bits)	0	0		0
Analog Input (32bits)	0	0		0
Analog Input (Short Floating)	0	0		0
Analog Output (16bits)	0		0	
Analog Output (32bits)	0		0	
Analog Output (Short Floating)	0		0	
Double Bit Input	0	0	0	
Small BCD	0	0		

T/D : Threshold/Deadband  
OL : OnLine/OffLine

**Default Variation**

Config File Number: 0

**Data Set**

	Object File Numbers	Max Number of Files
Prototypes	0	0
Descriptors	0	0

**Secure Authentication**

☐ Enable Secure Authentication

☒ Enable Aggressive Mode

Critical FCs File Number: 0

Expected Session Key Change Interval (x1s): 1800

Expected Session Key Change Count: 2000

Reply Timeout (x100ms): 20

Maximum Error Count: 2

HMAC Algorithm: 2

User Info Config File Number: 0

Dagnostic File Number: 0

OK Cancel Apply Help



6. Enter 3 for Binary Input DNP3 Object Data File Number:

DNP3 Object File Numbers		Data Files		Config Files	
		Class	Flag/OL	T/D	
Binary Input	3	0	0		
Binary Output	0		0		
Counter (16bits)	0	0		0	
Counter (32bits)	0	0		0	
Frozen Counter (16bits)		0			
Frozen Counter (32bits)		0			
Analog Input (16bits)	0	0		0	
Analog Input (32bits)	0	0		0	
Analog Input (Short Floating)	0	0		0	
Analog Output (16bits)	0		0		
Analog Output (32bits)	0		0		
Analog Output (Short Floating)	0		0		
Double Bit Input	0	0	0		
Small BCD	0	0			

T/D : Threshold/Deadband  
OL : OnLine/OffLine

- At this point we have mapped bits B3/0-B3/15 as 16 Binary Inputs (Index 0-15). DNP Binary Inputs are assigned to Group Number 1. They can be read from TOP Server in "packed format" using Variation 1 or "with flags" using Variation 2.
- Click **Apply** to save the channel configuration and download the file to a MicroLogix 1400 (using Ethernet or the channel 2 serial port). Be sure to apply the channel configuration at the end of the download.
- Switch the MicroLogix to Remote Run mode.

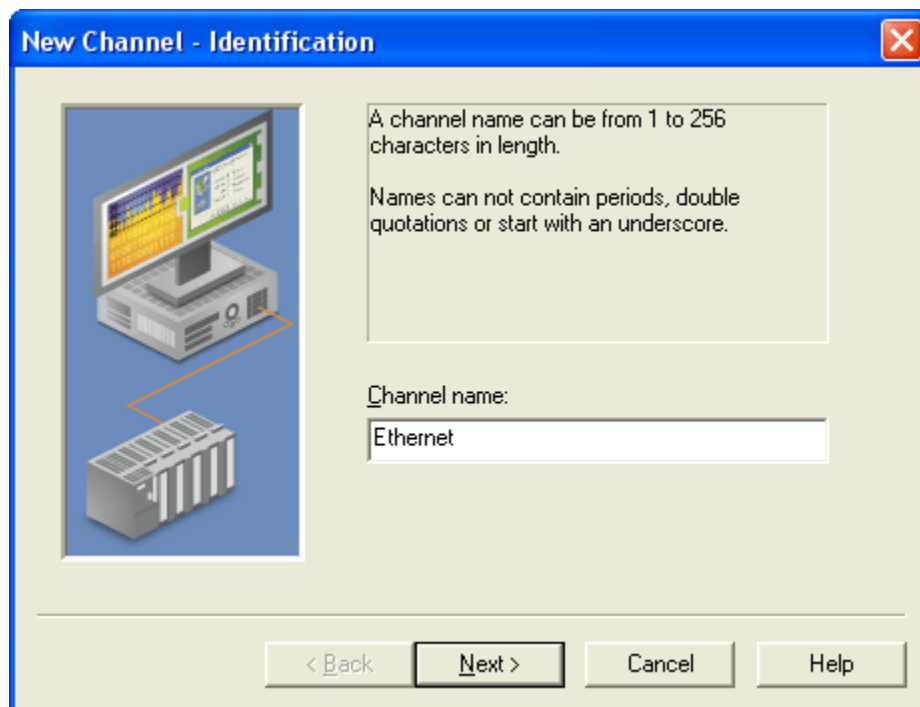


## Configuring TOP Server as a DNP3 Master

1. Next, if you haven't already, download and install the [TOP Server DNP3 Ethernet OPC server](#).
2. After the installation is complete, run TOP Server.



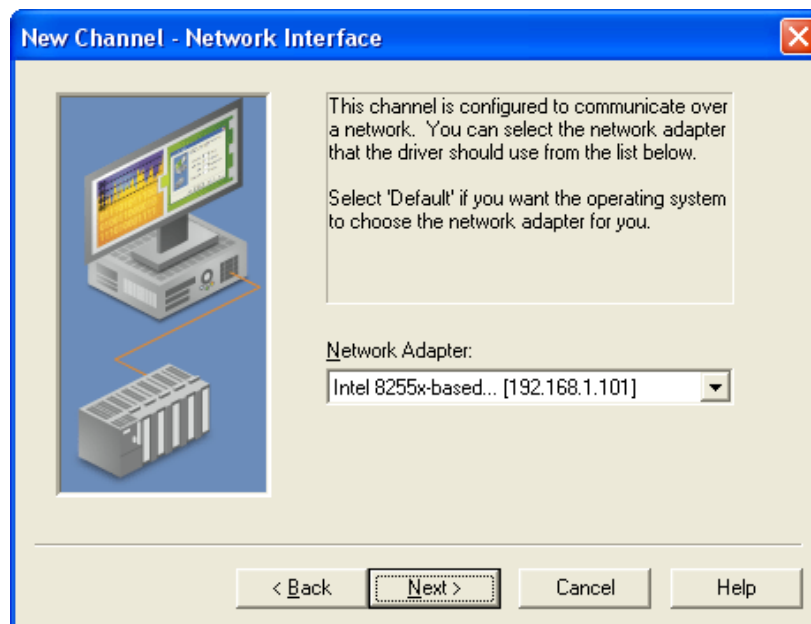
3. Click on **Click to add a channel**, enter **Ethernet** for the **Channel name** and click **Next**.



4. Select **DNP Master Ethernet** for the **Device driver**, check **Enable diagnostics** and click **Next**:



5. Select the appropriate **Network Adapter** and click **Next**:



6. Leave Write Optimizations at default values and click **Next**:

**New Channel - Write Optimizations**

You can control how the server processes writes on this channel. Set the optimization method and write-to-read duty cycle below.

Note: Writing only the latest value can affect batch processing or the equivalent.

Optimization Method

☐ Write all values for all tags

☐ Write only latest value for non-boolean tags

☒ Write only latest value for all tags

Duty Cycle

Perform  writes for every 1 read

< Back   Next >   Cancel   Help

7. Leave **Virtual Network** as **None** and click **Next**:

**New Channel - Advanced**

This driver is capable of limiting data transmissions to one channel at a time. To enable, assign this channel to a Virtual Network. All channels in a network will be granted permission to communicate in a round-robin manner. Select None to disable.

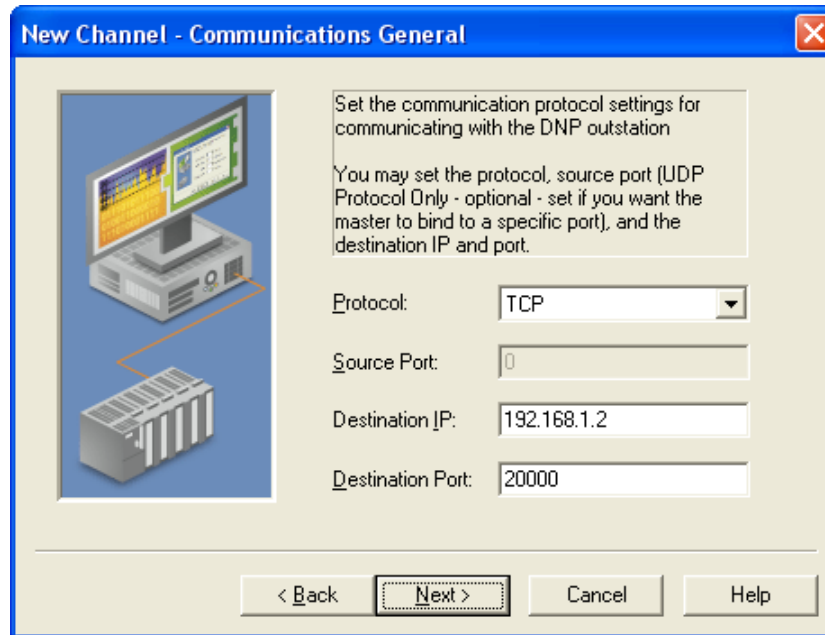
Communication Serialization

Virtual Network:

< Back   Next >   Cancel   Help



8. Configure the **Destination IP** address to match the MicroLogix 1400 IP address and click **Next**.



**New Channel - Communications General**

Set the communication protocol settings for communicating with the DNP outstation

You may set the protocol, source port (UDP Protocol Only - optional - set if you want the master to bind to a specific port), and the destination IP and port.

Protocol: TCP

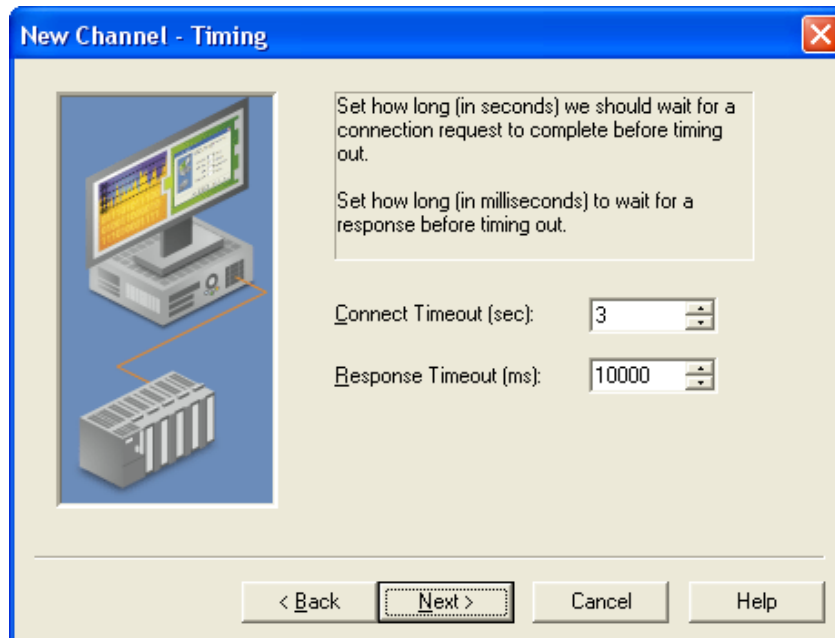
Source Port: 0

Destination IP: 192.168.1.2

Destination Port: 20000

< Back Next > Cancel Help

9. Leave Channel Timing settings at default and click **Next**.



**New Channel - Timing**

Set how long (in seconds) we should wait for a connection request to complete before timing out.

Set how long (in milliseconds) to wait for a response before timing out.

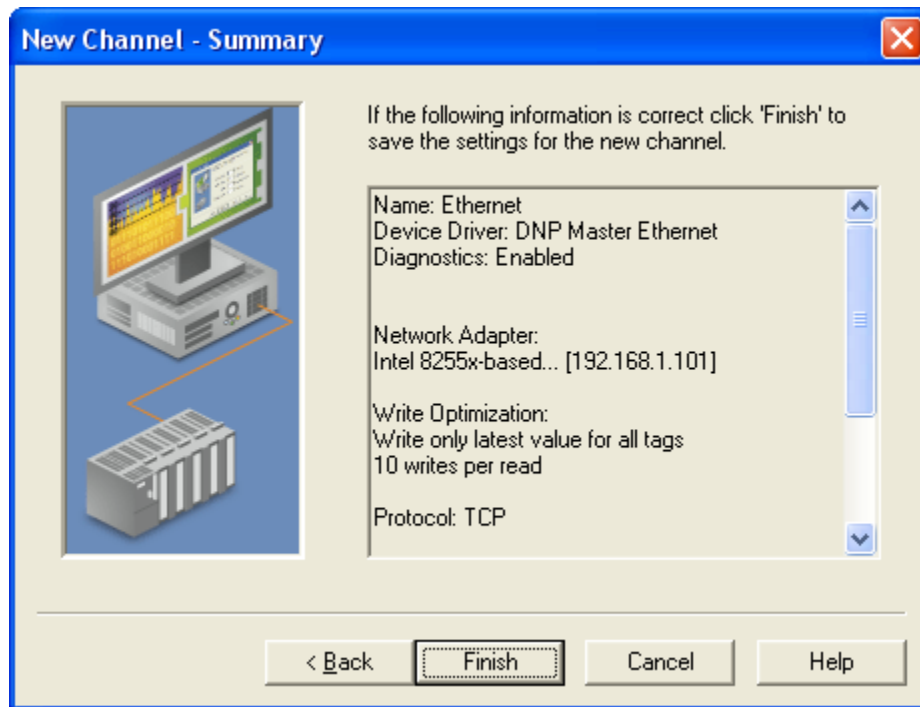
Connect Timeout (sec): 3

Response Timeout (ms): 10000

< Back Next > Cancel Help



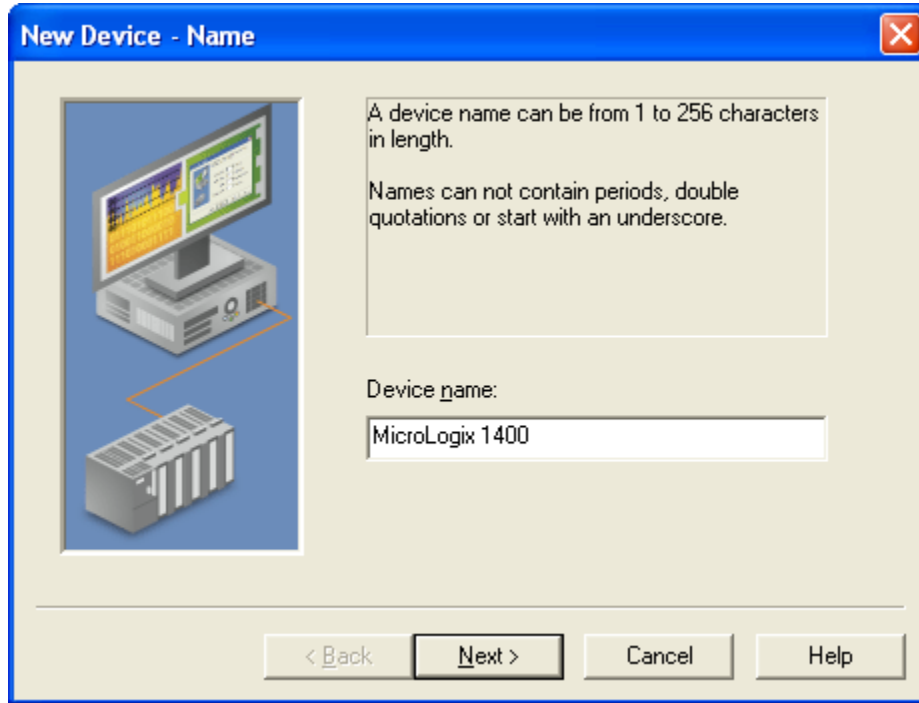
10. Click **Finish** to save the settings for the new channel:



11. Click on **Click to add a device:**



12. Enter **MicroLogix 1400** for **Device Name** and click **Next**.



**New Device - Name**

A device name can be from 1 to 256 characters in length.

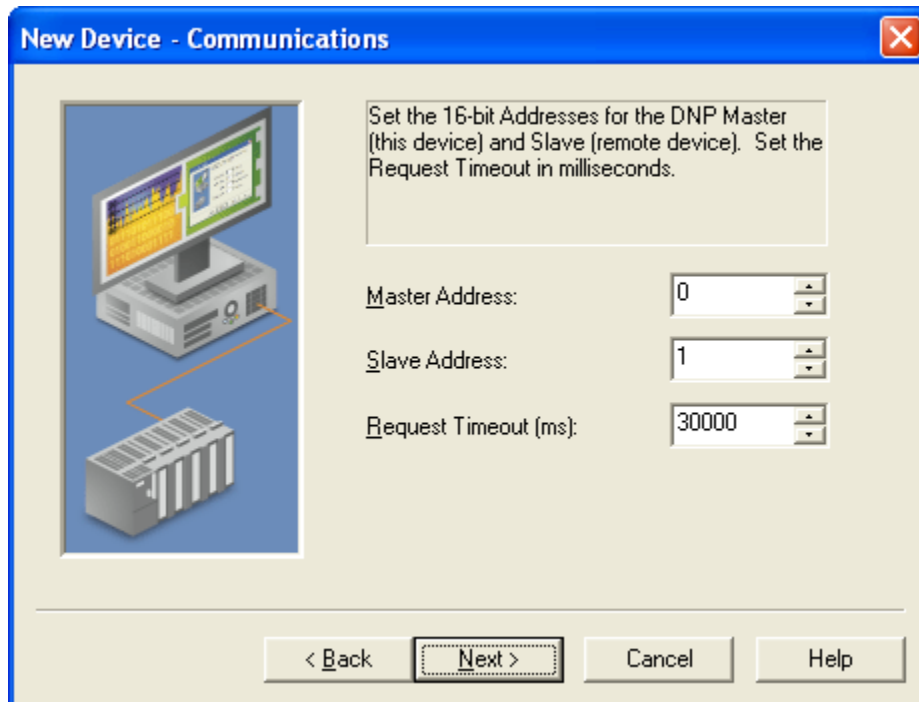
Names can not contain periods, double quotations or start with an underscore.

Device name:

MicroLogix 1400

< Back   Next >   Cancel   Help

13. Enter **0** for **Master Address** and **1** for **Slave Address** and click **Next**.



**New Device - Communications**

Set the 16-bit Addresses for the DNP Master (this device) and Slave (remote device). Set the Request Timeout in milliseconds.

Master Address: 0

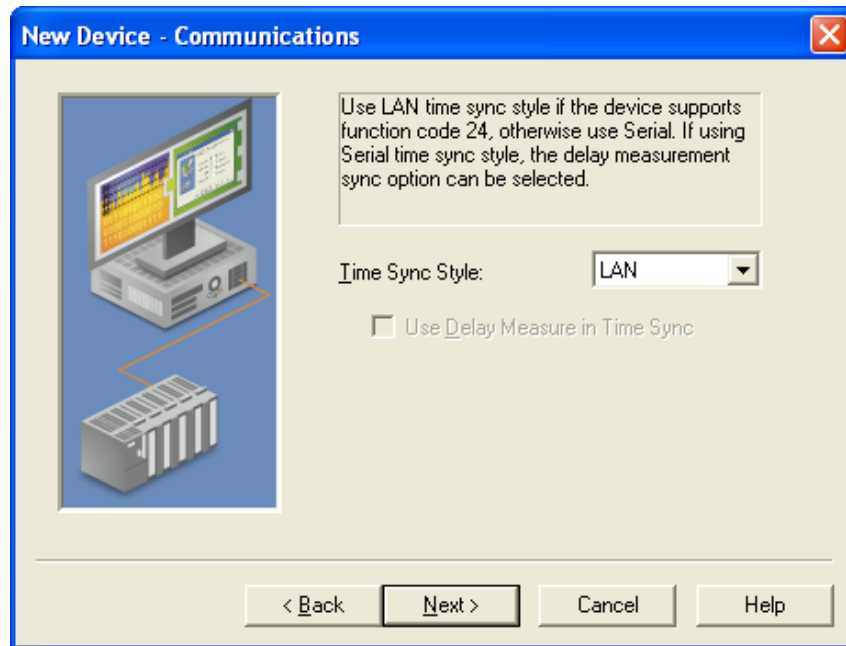
Slave Address: 1

Request Timeout (ms): 30000

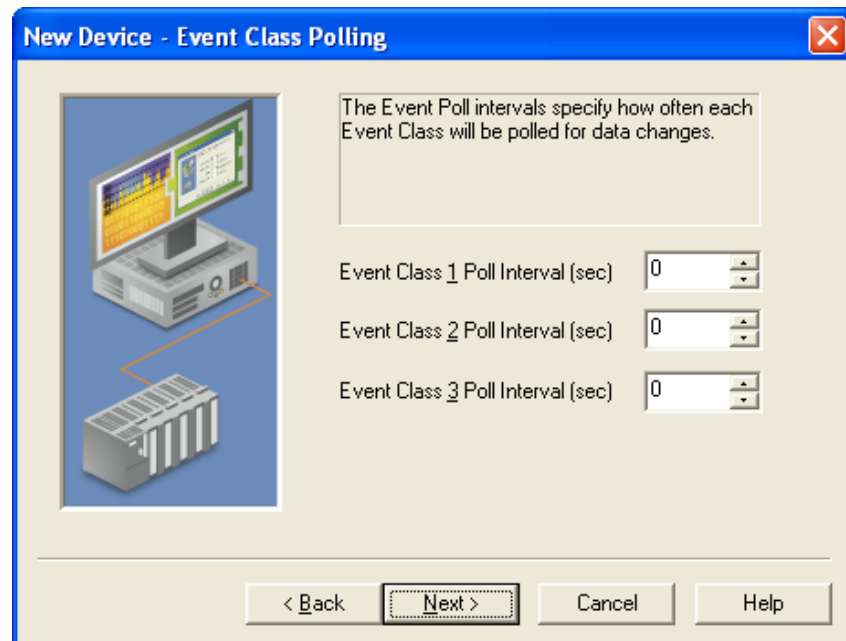
< Back   Next >   Cancel   Help



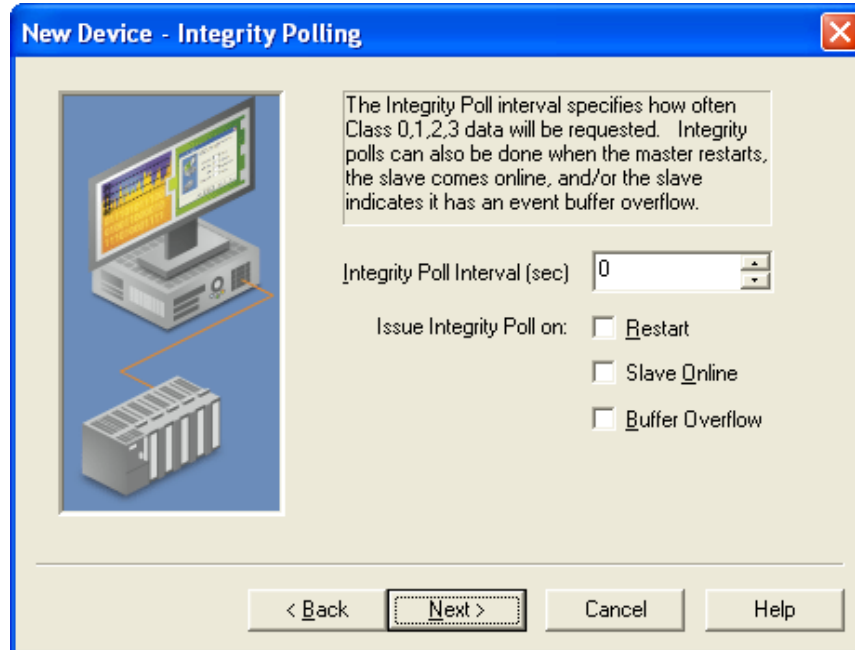
14. Leave **Time Sync Style** as **LAN** and click **Next**.



15. In the Event Class Polling settings, disable the polling for now by setting the **Event Class X Poll Intervals** to zero and click **Next**.



16. In the Integrity Polling settings, disable the polling for now by setting the **Integrity Poll Interval** to zero, uncheck the check boxes and click **Next**:



**New Device - Integrity Polling**

The Integrity Poll interval specifies how often Class 0,1,2,3 data will be requested. Integrity polls can also be done when the master restarts, the slave comes online, and/or the slave indicates it has an event buffer overflow.

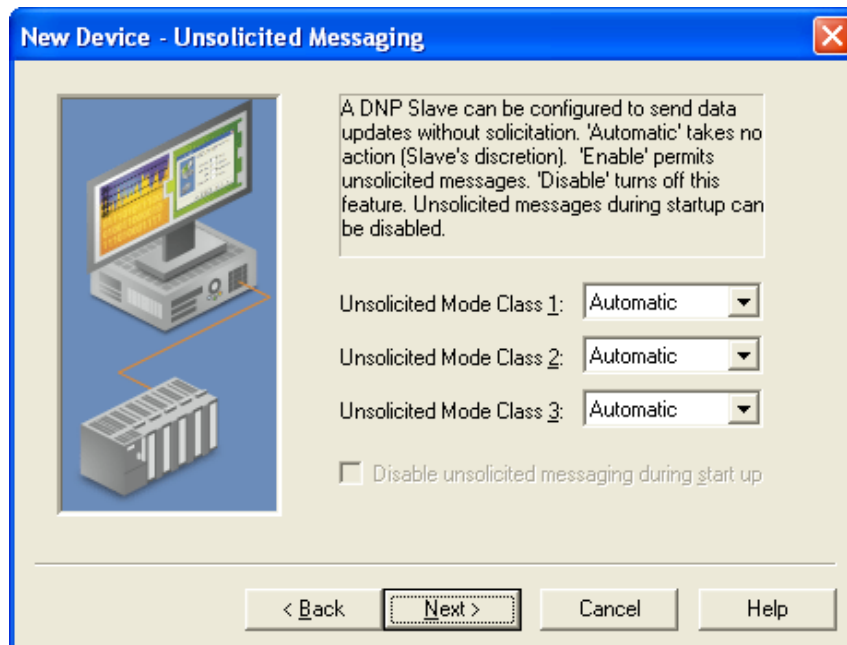
Integrity Poll Interval (sec)

Issue Integrity Poll on:

- ☐ Restart
- ☐ Slave Online
- ☐ Buffer Overflow

< Back   **Next >**   Cancel   Help

17. Leave **Unsolicited Mode Class X** as **Automatic** and click **Next**:



**New Device - Unsolicited Messaging**

A DNP Slave can be configured to send data updates without solicitation. 'Automatic' takes no action (Slave's discretion). 'Enable' permits unsolicited messages. 'Disable' turns off this feature. Unsolicited messages during startup can be disabled.

Unsolicited Mode Class 1:

Unsolicited Mode Class 2:

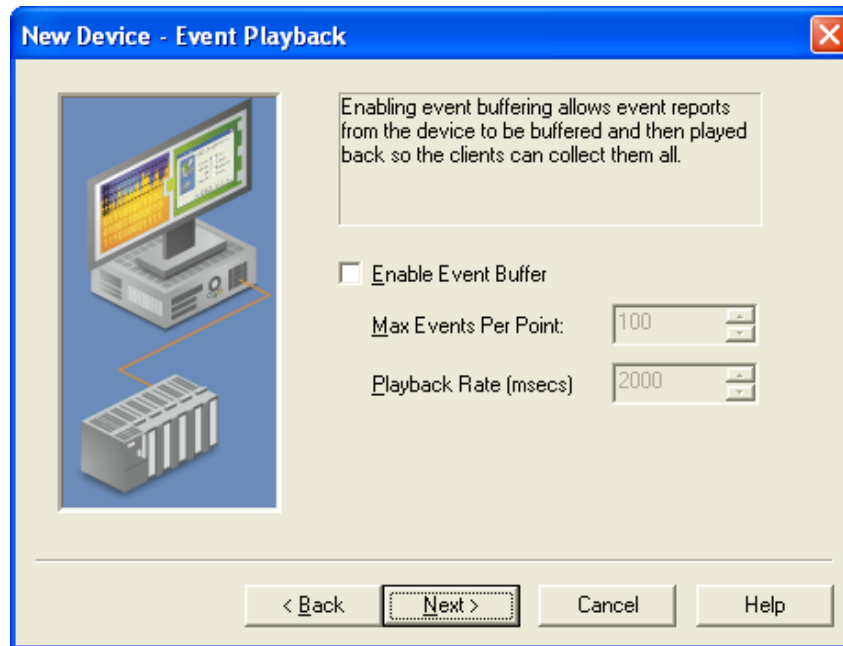
Unsolicited Mode Class 3:

☐ Disable unsolicited messaging during start up

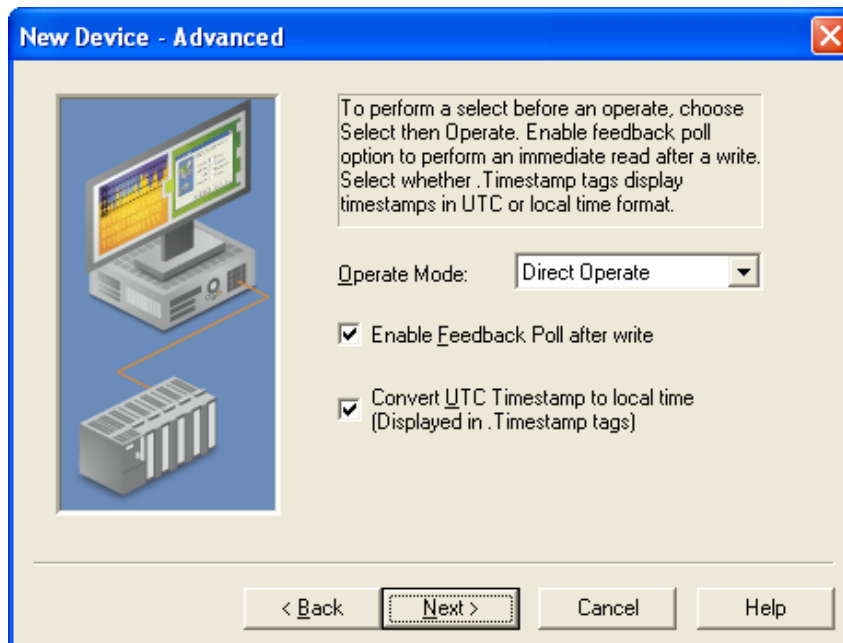
< Back   **Next >**   Cancel   Help



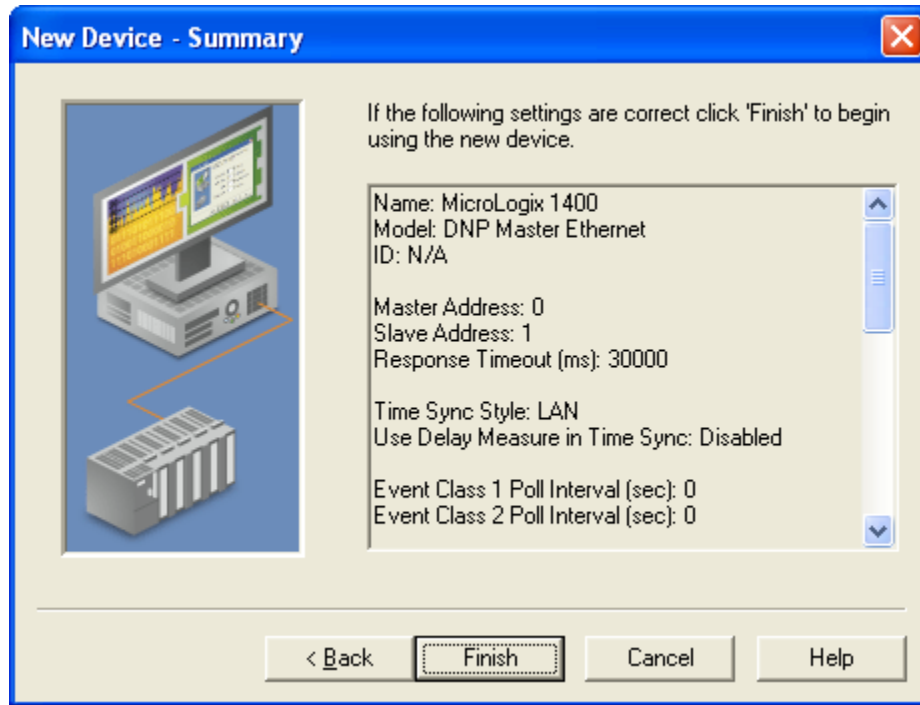
18. Leave **Enable Event Buffer** unchecked and click **Next**:



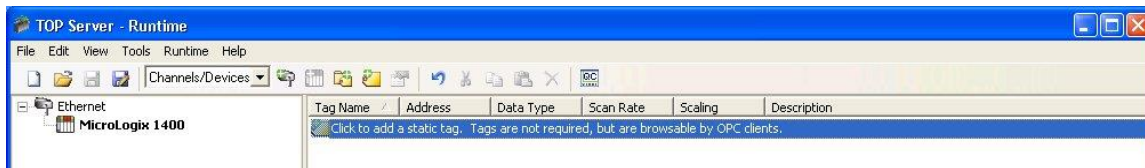
19. Leave **Operate Mode** as **Direct Operate**, make sure both check boxes are checked and click **Next**:



20. Click **Finish** to save the settings for the new device:



21. Next click **Click to add a static tag**:



22. Enter **B3/0** for the **Name** and **1.1.0.Explicit** (Group 0.Variation 1.Index 0) for the **Address**. Verify **Boolean** for the **Data type**, **Read Only** for the **Client access**, and leave **Scan Rate** at **100** milliseconds. Click **Apply** and then **OK**:

**Tag Properties**

General | Scaling

Identification

Name: B3/0

Address: 1.1.0.Explicit

Description:

Data properties

Data type: Boolean

Client access: Read Only

Scan rate: 100 milliseconds

Note: The scan rate is only used for client applications that do not specify a rate when referencing this tag (e.g., non-OPC clients)

OK Cancel Apply Help

23. Your TOP Server is now configured with a single DNP3 tag:

Tag Name	Address	Data Type	Scan Rate	Scaling	Description
B3/0	1.1.0.Explicit	Boolean	100	None	

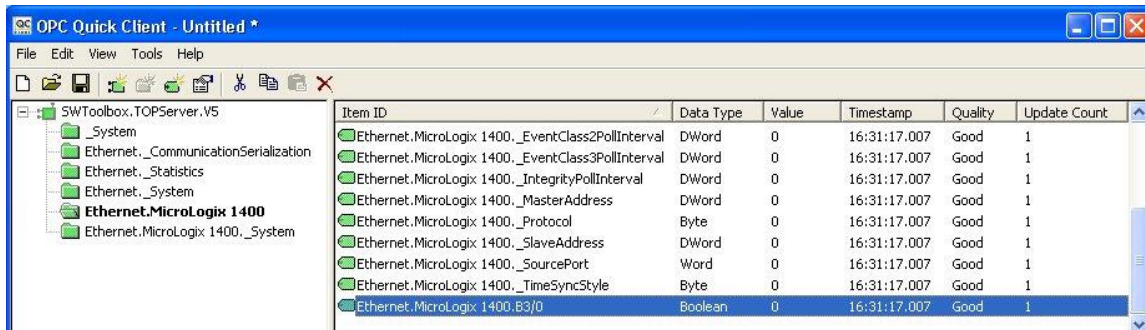


## Testing Device Connection with OPC Quick Client

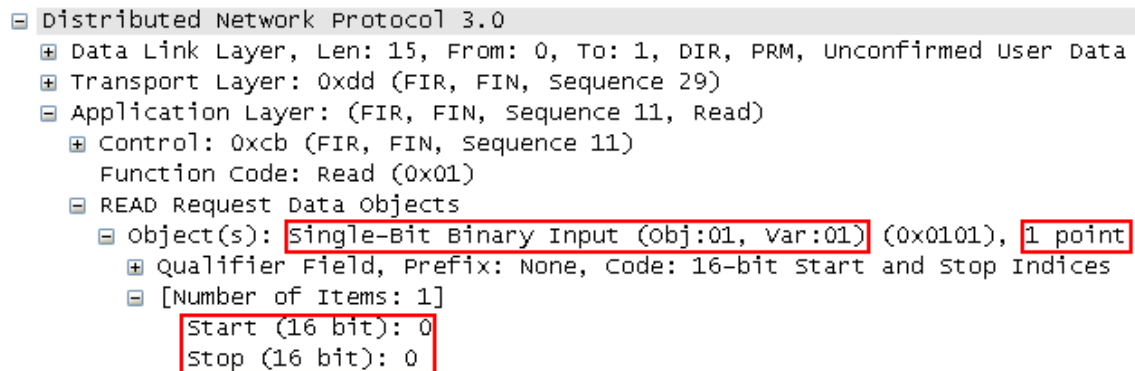
1. Click Tools and select OPC Quick Client:



2. Click on **Ethernet.MicroLogix 1400** and, if your Ethernet connection is correct, the status of **Quality** for this tag should be **Good**, indicating that the value of tag B3/0 has been read out of the MicroLogix 1400:



3. Because we gave the tag address an Explicit sub-type, TOP Server is reading this specific binary input once a second. We can see the read command initiated by TOP Server and the response from the MicroLogix in the following Wireshark Ethernet packet captures:



```

Distributed Network Protocol 3.0
+ Data Link Layer, Len: 16, From: 1, To: 0, PRM, Unconfirmed User Data
+ Transport Layer: 0xdc (FIR, FIN, Sequence 28)
+ Application Layer: (FIR, FIN, Sequence 10, Response)
  + Control: 0xca (FIR, FIN, Sequence 10)
    Function Code: Response (0x81)
  + Internal Indications: Digital outputs in Local (0x2000)
  + RESPONSE Data Objects
    + Object(s): Single-Bit Binary Input (Obj:01, Var:01) (0x0101), 1 point
      + Qualifier Field, Prefix: None, Code: 8-bit Start and Stop Indices
      + [Number of Items: 1]
      + Point Number 0, Value: 0
        [Point Index: 0]
        .... ...0 = value (bit): off
  
```

4. Note that there is no timestamp returned in this read response, so the OPC Quick Client timestamp is the computer time when the last data value change was received.
5. By design, DNP3 is an event driven protocol, so there is no need for TOP Server to constantly read a value in order to determine whether it changed or not. Now, we will go back and configure the MicroLogix to generate an event (with timestamp) every time bit B3/0 gets toggled, and configure TOP Server to poll for events instead of constantly reading individual values.



## DNP3 Class Polling Configuration - Controller

1. Go offline with the MicroLogix 1400 and in the DNP3 Slave channel configuration tab, create a Binary Input Class file by entering in the next available data table file number, **11**, clicking **Yes** to **Size (in # of elements)** **1**, and clicking **OK** to apply the channel configuration:

DNP3 Object File Numbers

Data Files: Config Files

	Class	Flag/OL	T/D
Binary Input	11	0	
Binary Output	0	0	

Create DNP3 Binary Input Config File Table (Data File #11)?

Yes No

Size (in # of elements)

1

Analog Output (32bits) 0 0

Analog Output (Short Floating) 0 0

Double Bit Input 0 0 0

Small BCD 0 0

T/D : Threshold/Deadband  
OL : OnLine/OffLine

2. Word B11:0 now defines the Class (1, 2 or 3) for Binary Inputs 0-15. We will assign these Binary Inputs to Class 1 by setting the value of B11:0 to 1:

Data File B11 (dec) -- BI Cfg

Offset	0	1	2	3	4	5	6	7	8	9
B11:0	1									

B11:0

Radix: Decimal

Symbol:

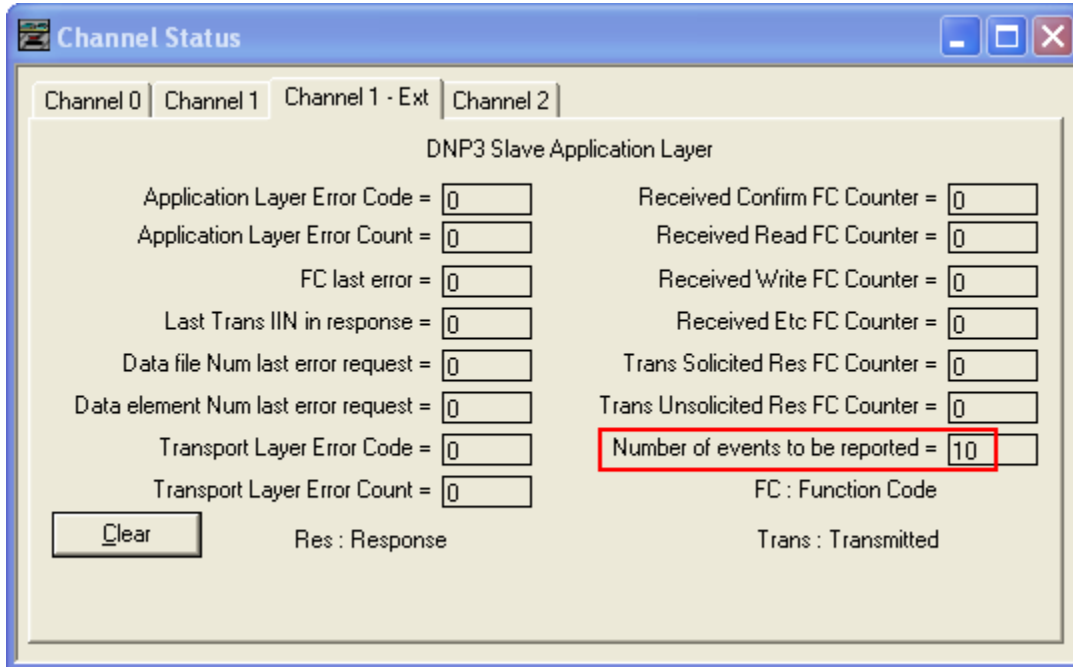
Columns: 10

Desc:

B11 Properties Usage Help



3. Now all we have to do is download the updated file to the MicroLogix. Whenever bit B3/0 toggles, an event will automatically be generated.
4. Now if you go online with the MicroLogix and monitor the Channel 1 – Ext tab under Channel Status while toggling bit B3/0 on and off, you should see the **Number of events to be reported** incrementing:



**Channel Status**

Channel 0 | Channel 1 | Channel 1 - Ext | Channel 2

**DNP3 Slave Application Layer**

Application Layer Error Code = 0	Received Confirm FC Counter = 0
Application Layer Error Count = 0	Received Read FC Counter = 0
FC last error = 0	Received Write FC Counter = 0
Last Trans IIN in response = 0	Received Etc FC Counter = 0
Data file Num last error request = 0	Trans Solicited Res FC Counter = 0
Data element Num last error request = 0	Trans Unsolicited Res FC Counter = 0
Transport Layer Error Code = 0	<b>Number of events to be reported = 10</b>
Transport Layer Error Count = 0	FC : Function Code

Clear      Res : Response      Trans : Transmitted



## DNP3 Class Polling Configuration – TOP Server

1. Next we need to modify the TOP Server driver so that it polls for Class 1 events, instead of constantly reading B3/0.
2. Close OPC Quick Client if you haven't already, then on TOP Server, double click on tag **B3/0** and change the **Address** from **1.1.0.Explicit** to **1.1.0.Value** and click **OK**:

**Tag Properties**

General | Scaling

**Identification**

Name: B3/0

Address: 1.1.0.Value

Description:

**Data properties**

Data type: Boolean

Client access: Read Only

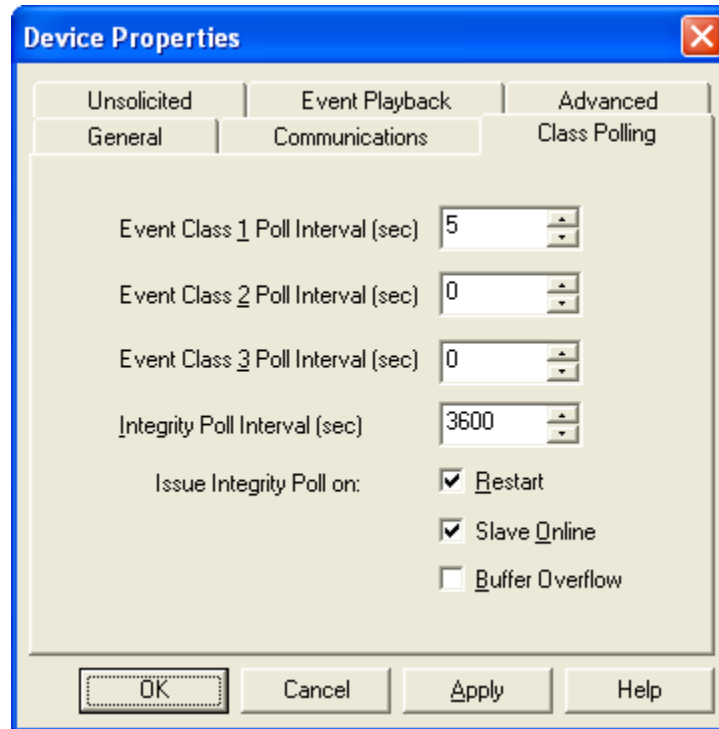
Scan rate: 100 milliseconds

Note: The scan rate is only used for client applications that do not specify a rate when referencing this tag (e.g., non-OPC clients)

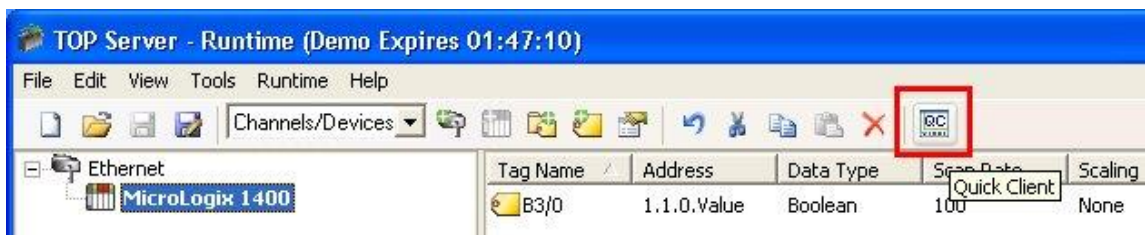
OK Cancel Apply Help



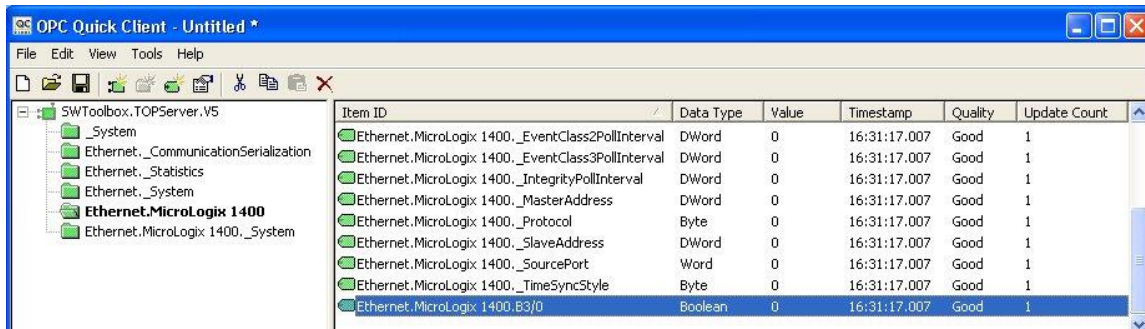
- Click on **MicroLogix 1400** to bring up the **Device Properties** and then click on the **Class Polling** tab. Enter **5** for the **Event Class 1 Poll Interval** and **3600** for the **Integrity Poll Interval**, check **Restart** and **Slave Online**, and then click **OK**:



- Now TOP Server will transmit a Class 0 (Integrity) Poll every hour, to which the MicroLogix will respond with the current (static) value of every configured DNP point (currently Binary Inputs 0-15), and every 5 seconds TOP Server will poll for any Class 1 events that have been logged by the MicroLogix.
- This time open up OPC Quick Client by clicking on the QC icon:



6. Click on **Ethernet.MicroLogix 1400** and, if your Ethernet connection is correct, the status of **Quality** tag B3/0 should be **Good**, indicating that the value of this tag has been read out of the MicroLogix 1400:



Item ID	Data Type	Value	Timestamp	Quality	Update Count
Ethernet.MicroLogix 1400._EventClass2PollInterval	DWord	0	16:31:17.007	Good	1
Ethernet.MicroLogix 1400._EventClass3PollInterval	DWord	0	16:31:17.007	Good	1
Ethernet.MicroLogix 1400._IntegrityPollInterval	DWord	0	16:31:17.007	Good	1
Ethernet.MicroLogix 1400._MasterAddress	DWord	0	16:31:17.007	Good	1
Ethernet.MicroLogix 1400._Protocol	Byte	0	16:31:17.007	Good	1
Ethernet.MicroLogix 1400._SlaveAddress	DWord	0	16:31:17.007	Good	1
Ethernet.MicroLogix 1400._SourcePort	Word	0	16:31:17.007	Good	1
Ethernet.MicroLogix 1400._TimeSyncStyle	Byte	0	16:31:17.007	Good	1
Ethernet.MicroLogix 1400.B3/0	Boolean	0	16:31:17.007	Good	1

7. The Class 1 poll that TOP Server is sending is requesting Variation 2, which is the event data with an absolute timestamp. Notice that TOP Server assumes that the RTU timestamp is set to UTC, but if it's not, there will be a time offset in the timestamp based on the PC's time zone setting.
8. Now if you go back to being online with the MicroLogix and monitor the Channel 1 – Ext tab under Channel Status, you should see the **Number of events to be reported** at zero, because the MicroLogix already transmitted the logged events in response to TOP Server's Class 1 poll.
9. Currently the MicroLogix timestamp is based on its own RTC, because we left its time sync configuration at default, which is none.



## DNP3 Time Sync and Unsolicited Messaging - Controller

1. Now we will go back and set the MicroLogix to sync up with the Master after a power cycle and every hour thereafter.
2. Under the **DNP3 Slave** tab, set the **Time Sync. Interval** to **60** minutes and apply:

DNP3 Slave  
Application Layer

☐ Enable Confirmation

Max Response Size: 2048

Confirmation Timeout (x1ms): 10000

Number of Retries: 0

Select Timeout (x1s): 10

**Time Sync. Interval (x1mins): 60**

☐ Enable Time Sync. On Start Up Only

Channel for Unsolicited Responses: Chan. 1

☐ Send Init. Unsol. Null Resp. on Restart

☐ Enable Unsolicited On Start Up

	Class1	Class2	Class3
Enable Unsolicited for Class	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Number of Events	10	10	10
Hold Time after Events (x1s)	5	5	5

3. When the MicroLogix requests to be time synced, TOP Server sets the RTU clock for UTC time, based on the PC's clock and time zone setting.
4. Next we want to configure the MicroLogix to send event data as Unsolicited Responses and for TOP Server to accept those. That way, we can greatly reduce the amount of polling done by the Master.
5. Under the **DNP3 Slave** tab, make sure the Channel for Unsolicited Responses is set to Chan. 1, check **Enable Unsolicited for Class 1**, set the **Number of Class 1 Events** to **2** and leave **Hold Time after Events** at **5** seconds. Click **Apply** to accept:

DNP3 Slave  
Application Layer

☐ Enable Confirmation

Max Response Size: 2048

Confirmation Timeout (x1ms): 10000

Number of Retries: 0

Select Timeout (x1s): 10

Time Sync. Interval (x1mins): 60

☐ Enable Time Sync. On Start Up Only

Channel for Unsolicited Responses: Chan. 1

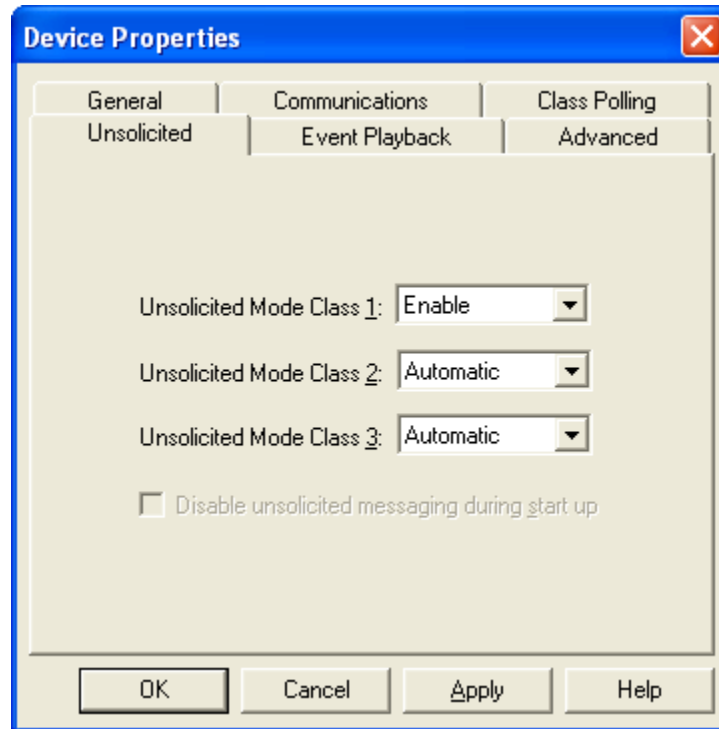
☐ Send Init. Unsol. Null Resp. on Restart

☒ Enable Unsolicited On Start Up

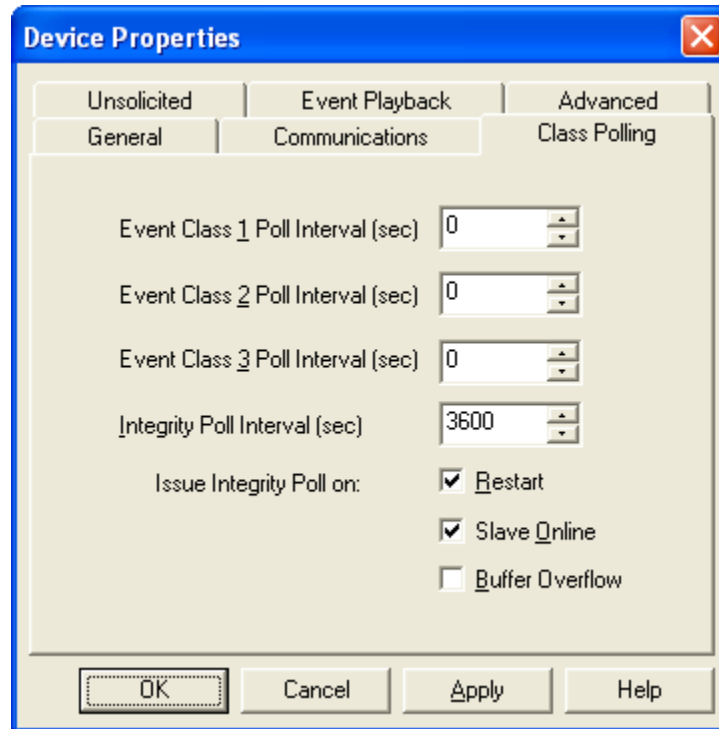
	Class1	Class2	Class3
Enable Unsolicited for Class	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Number of Events	2	10	10
Hold Time after Events (x1s)	5	5	5



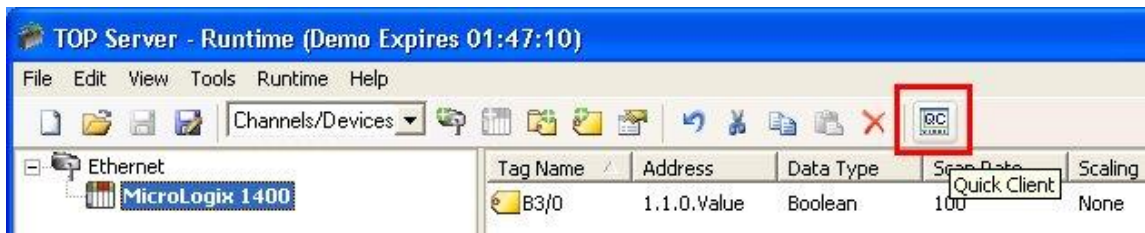
6. Close OPC Quick Client if you haven't already. In TOP Server, double click on **MicroLogix 1400** and under the **Unsolicited** tab, change **Unsolicited Class 1 Mode** to **Enable** and click **Apply** to accept:



7. Next, under the **Class Polling** tab, set the **Event Class 1 Poll Interval** to **0**. This will stop TOP Server from polling except for an Integrity Poll every hour (based on the current settings). Click **OK**:



8. Open up OPC Quick Client again by clicking on the QC icon:



9. Click on **Ethernet.MicroLogix 1400** and, if your Ethernet connection is correct, the status of **Quality** for tag B3/0 should be **Good**. Notice that after toggling bit B3/0 in the MicroLogix 1400, that the time stamp now shows local time because the RTC in the controller was synchronized to UTC time by the DNP3 Master, but displayed in local time based on the TOP Server setting :

Item ID	Data Type	Value	Timestamp	Quality	Update Count
Ethernet.MicroLogix 1400._EventClassPollInterval	DWord	0	16:31:17.007	Good	1
Ethernet.MicroLogix 1400._EventClassPollInterval	DWord	0	16:31:17.007	Good	1
Ethernet.MicroLogix 1400._IntegrityPollInterval	DWord	0	16:31:17.007	Good	1
Ethernet.MicroLogix 1400._MasterAddress	DWord	0	16:31:17.007	Good	1
Ethernet.MicroLogix 1400._Protocol	Byte	0	16:31:17.007	Good	1
Ethernet.MicroLogix 1400._SlaveAddress	DWord	0	16:31:17.007	Good	1
Ethernet.MicroLogix 1400._SourcePort	Word	0	16:31:17.007	Good	1
Ethernet.MicroLogix 1400._TimeSyncStyle	Byte	0	16:31:17.007	Good	1
Ethernet.MicroLogix 1400.B3/0	Boolean	0	16:31:17.007	Good	1

10. Next, go online with the MicroLogix and display both **Channel 1 – Ext Channel Status** and the **B3 Data File**. Toggle bit B3/0 once and you should see **Number of events to be reported** increment to 1 and then go back to zero after five seconds. You should also see **Trans Unsolicited Res FC Counter** increment by 1, as well as **Received Confirm FC Counter**.

**Channel Status**

Channel 0 | Channel 1 | Channel 1 - Ext | Channel 2

DNP3 Slave Application Layer

Application Layer Error Code = 0	Received Confirm FC Counter = 1
Application Layer Error Count = 0	Received Read FC Counter = 0
FC last error = 0	Received Write FC Counter = 0
Last Trans IIN in response = 0	Received Etc FC Counter = 0
Data file Num last error request = 0	Trans Solicited Res FC Counter = 0
Data element Num last error request = 0	Trans Unsolicited Res FC Counter = 1
Transport Layer Error Code = 0	Number of events to be reported = 0
Transport Layer Error Count = 0	FC : Function Code

Clear Res : Response Trans : Transmitted

**Data File B3 (bin) -- BINARY**

Offset	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
B3:0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

B3/0 Radix: Binary Columns: 16

Symbol: Desc: B3 Properties Usage Help



11. If you toggle B3/0 twice in less than five seconds, you should see that the Unsolicited Response was sent immediately based on the Channel Status counters. This behavior is due to the Unsolicited Response configuration in the MicroLogix. Rather than trigger an Unsolicited Response after every event, the MicroLogix will wait until either two events have been generated, or five seconds since the first event was generated, whichever comes first:

DNP3 Slave  
Application Layer

☐ Enable Confirmation

Max Response Size: 2048

Confirmation Timeout (x1ms): 10000

Number of Retries: 0

Select Timeout (x1s): 10

Time Sync. Interval (x1mins): 60

☐ Enable Time Sync. On Start Up Only

Channel for Unsolicited Responses: Chan. 1

☐ Send Init. Unsol. Null Resp. on Restart

☒ Enable Unsolicited On Start Up

Enable Unsolicited for Class:

	Class1	Class2	Class3
Enable Unsolicited for Class	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Number of Events	2	10	10
Hold Time after Events (x1s)	5	5	5

12. Next let's look at the effect of the online/offline flag for Binary Input 0. By default, B10 is offline when the MicroLogix is in Program mode and online when the MicroLogix is in Run mode.
13. Switch the MicroLogix to Remote Program mode. Now when you toggle B3/0, the tag's **Quality** will indicate **Bad**:

Tag Name	DataType	Value	Timestamp	Quality	Count
Ethernet.MicroLogix 1400.SlaveAddress	DWord	1	14:15:07.427	Good	1
Ethernet.MicroLogix 1400.B3/0	Boolean	0	14:26:44.624	Bad	5

14. Return the MicroLogix to Remote Run mode, toggle B3/0 and note that the **Quality** returns to **Good**.



15. If you want to have control over the online/offline flag while the controller is in Run mode, you may create a Binary Input Online/Offline file in the MicroLogix. Go offline with the MicroLogix and enter in **12** for the **Binary Input Flag/OL** config file on the **DNP3 Slave Channel Configuration** tab. Click **Apply** and then **Yes** to **Size (in # of elements)** 1:

DNP3 Object File Numbers		Data Files		Config Files	
				Class	Flag/OL T/D
Binary Input	3			11	12
Binary Output	0				0
Counter (16bits)	0		0		0
Counter (32bits)	0		0		0
Frozen Counter (16bits)			0		
Frozen Counter (32bits)			0		

Create DNP3 Binary Input Online Config File Table (Data File #12)?

Yes

No

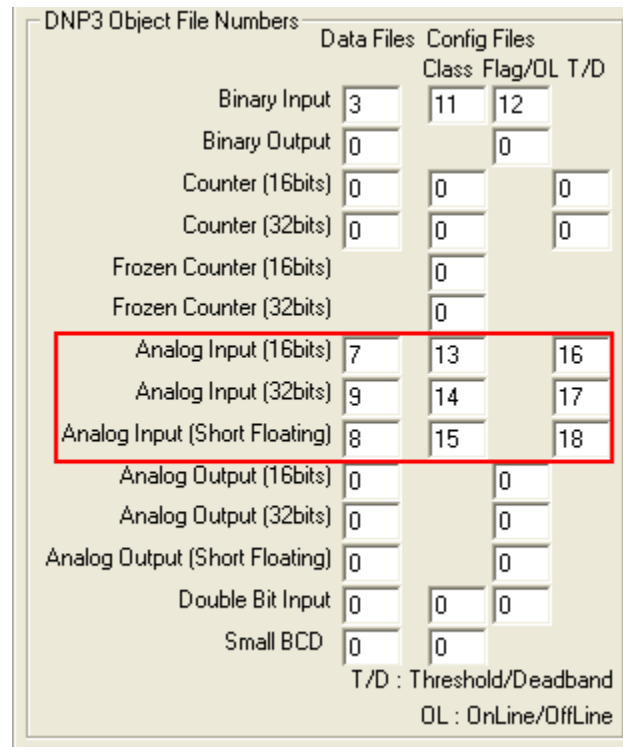
Size (in # of elements)

T/D : Threshold/Deadband  
OL : OnLine/OffLine

16. Now download this program to the MicroLogix and go to Run mode. Notice that in OPC Quick Client, the **Quality** is still **Bad** for B3/0. This is because bits B12/0-15 now indicate whether Binary Inputs B3/0-15 are online (=1) or offline (=0). Set bit B12/0 to 1, toggle bit B3/0 to initiate an Unsolicited Response and now the **Quality** should change to **Good**. The **Quality** will still indicate **Bad** if an Unsolicited Response is generated while the controller is in Program mode.
17. Next we will create mappings for Analog Inputs and configure them to generate Unsolicited Responses as well. There are three DNP3 Analog Input types supported by the MicroLogix: Integer (16-bit), Long or DINT (32-bit) and Float or REAL (32-bit).



10. After going offline with the MicroLogix, enter in the numbers listed below on the **DNP3 Slave Channel Configuration** tab. Click **Apply** and then **Yes** to **Size (in # of elements)** 1 for all files:



The image shows a screenshot of the 'DNP3 Object File Numbers' configuration window. It has two main sections: 'Data Files' and 'Config Files'. Under 'Data Files', there are fields for Binary Input (3), Binary Output (0), Counter (16bits) (0), Counter (32bits) (0), Frozen Counter (16bits) (0), and Frozen Counter (32bits) (0). Under 'Config Files', there are fields for Class (11), Flag/OL (12), T/D (0), and OL (0). A red box highlights the 'Analog Input' section, which includes Analog Input (16bits) (7), Analog Input (32bits) (9), and Analog Input (Short Floating) (8). The 'T/D' field is labeled 'T/D : Threshold/Deadband' and the 'OL' field is labeled 'OL : OnLine/OffLine'.

11. Go ahead and download the updated file to the MicroLogix, switch the MicroLogix to Run and go online.
12. We have now configured three DNP3 Analog Inputs that we can read in OPC Quick Client after we create the tags in TOP Server. First close OPC Quick Client. Analog Inputs are Group 30 objects. We are going to read N7 using Variation 4 (16-bit without flags), L9 using Variation 3 (32-bit without flags) and F8 using Variation 5 (short floating point with flags). These Variations are the default Variations returned by the MicroLogix when an Integrity (Class 0) poll is received. The index numbering starts in the 16-bit "Short" integer file, then continues in the 32-bit "Long" integer file and then concludes in the 32-bit "Float" file. Create the three additional tags as shown below in TOP Server:

Tag Name	Address	Data Type	Scan Rate	Scaling	Description
B3/0	1.1.0.Value	Boolean	100	None	
F8	30.5.2.Explicit	Float	100	None	
L9	30.3.1.Explicit	Long	100	None	
N7	30.4.0.Explicit	Short	100	None	



13. Restart OPC Quick Client and notice that while the **Quality** for **L9** and **N7** is **Good**, it is still **Bad** for **F8**. This is because F8 Variation includes Flags, and we haven't set its Online bit yet:

Item ID	Data Type	Value	Timestamp	Quality	Update Count
Ethernet.MicroLogix 1400.N7	Short	0	14:39:23.591	Good	2
Ethernet.MicroLogix 1400.L9	Long	0	14:39:23.571	Good	2
Ethernet.MicroLogix 1400.F8	Float	0	14:39:23.551	Bad	2
Ethernet.MicroLogix 1400.B3/0	Boolean	0	14:29:59.656	Good	1

14. The Flag bits for Analog Inputs are contained in the Class Config Files. Therefore, we will set the Class of each of the Analog Inputs to 2 (by setting bit 1 in each of their Class Config words) and set the Online bit on (by setting bit 8 in the same word).
15. In order to set up Unsolicited Response capability for the Analog Inputs, we need to enable Class 2 Unsolicited Responses in the MicroLogix and then make the corresponding changes in TOP Server. While Online with the MicroLogix, go to the Channel Configuration DNP3 Slave tab, check **Enable Unsolicited for Class 2** and set the **Number of Events** to **2**. Click **OK** and **Apply**.

Channel for Unsolicited Responses: Chan. 1

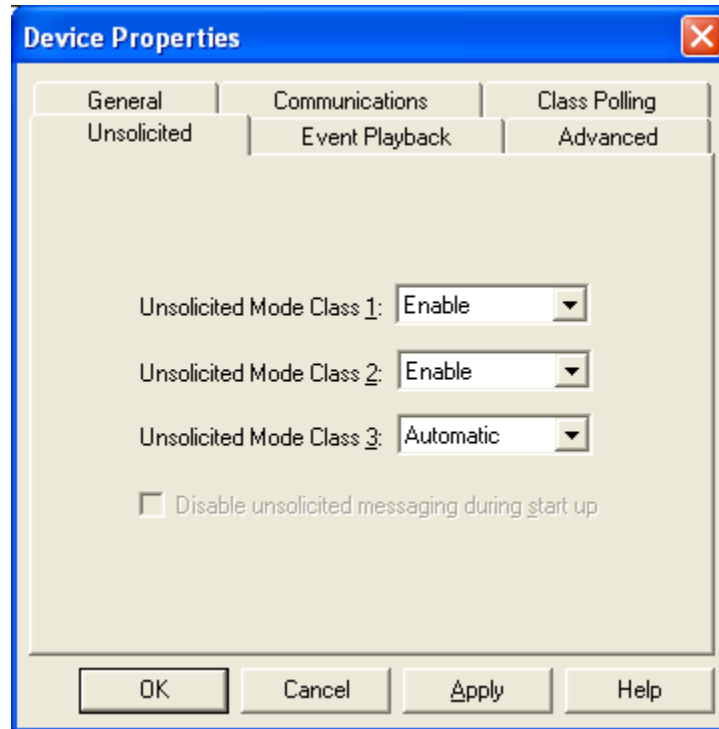
☐ Send Init. Unsol. Null Resp. on Restart

☒ Enable Unsolicited On Start Up

	Class1	Class2	Class3
Enable Unsolicited for Class	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Number of Events	2	2	10
Hold Time after Events (x1s)	5	5	5



16. Close OPC Quick Client if you haven't already. In TOP Server, double-click on **MicroLogix 1400** and under the **Unsolicited** tab, change **Unsolicited Class 2 Mode** to **Enable** and click **OK** to accept:



17. Next, double click on each of the Analog tags and change their **Address** from **\*.Explicit** to **\*.Value** and click **OK**:

Tag Name ▲	Address	Data Type	Scan Rate	Scaling	Description
B3/0	1.1.0.Value	Boolean	100	None	
F8	30.5.2.Value	Float	100	None	
L9	30.3.1.Value	Long	100	None	
N7	30.4.0.Value	Short	100	None	

18. Open OPC Quick Client and verify that **Quality** is **Good** on all of the tags:

Item ID ▼	Data Type	Value	Timestamp	Quality	Update Count
Ethernet.MicroLogix 1400.N7	Short	0	15:02:15.443	Good	1
Ethernet.MicroLogix 1400.L9	Long	0	15:02:15.443	Good	1
Ethernet.MicroLogix 1400.F8	Float	0	15:02:15.443	Good	1
Ethernet.MicroLogix 1400.B3/0	Boolean	0	15:02:15.443	Good	1



19. Change each analog input in the MicroLogix data table and verify that the new Value is displayed and the Update Count increments:

Item ID	Data Type	Value	Timestamp	Quality	Update Count
Ethernet.MicroLogix 1400.N7	Short	12345	15:08:46.996	Good	2
Ethernet.MicroLogix 1400.L9	Long	1234567890	15:09:47.073	Good	2
Ethernet.MicroLogix 1400.F8	Float	12345.7	15:09:10.029	Good	2
Ethernet.MicroLogix 1400.B3/0	Boolean	1	15:10:09.810	Good	2

20. Notice that currently any change to these analog inputs will generate an event. It is more typical to apply a “deadband” around the analog input values within which an event won’t be generated. We previously created the Deadband Config Files for these analog inputs, however we left them at their default values of 0. While online with the MicroLogix, apply more useful deadbands: 10 in N16:0 for N7, 0.1 in F18:0 for F8 and 100000 in L17:0 for L9. Verify for yourself that adding or subtracting a value less than or equal to the deadband will not trigger an event, but a value greater than the deadband does trigger an event and an Unsolicited Response with the new Value.

