

Using DNP3 with the NPort Series

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Applies to	NPort 5000 A: 5100A series, 5200A series, 5400A series, IA5250A NPort 5000: 5100 series, 5200 series, 5400 series, 5600 series, IA5150, IA5250
OS	Windows OS

In this application note, we will cover the following topics:

1. Introduction to DNP3 Networks
2. DNP3 Setup Using NPort UDP Mode
3. DNP3 Setup Using NPort TCP Server/Client Mode
4. DNP3 Communication Verification

Introduction to DNP3 Networks

DNP3 (Distributed Network Protocol) is a set of communications protocols used between components in process automation systems. It was developed for communications between various types of data acquisition and control equipment. It plays a crucial role in SCADA systems, where it is used by SCADA master stations (aka Control Centers), remote terminal units (RTUs), and intelligent electronic devices (IEDs). It is primarily used for

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About Moxa

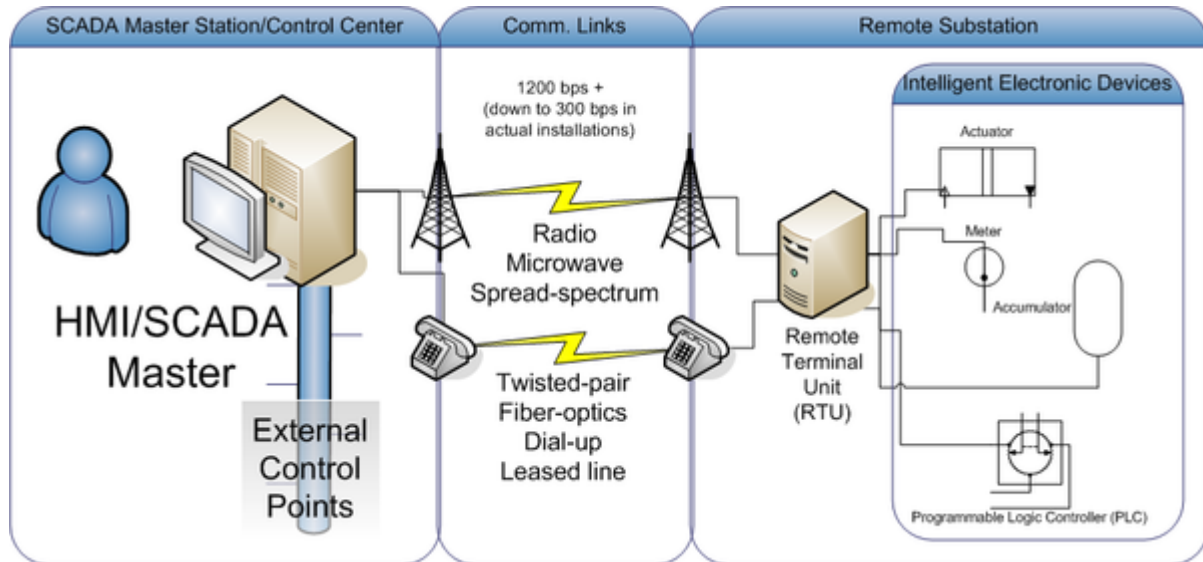
Moxa manufactures one of the world's leading brands of device networking solutions. Products include serial boards, USB-to-serial hubs, media converters, device servers, embedded computers, Ethernet I/O servers, terminal servers, Modbus gateways, industrial switches, and Ethernet-to-fiber converters. Our products are key components of many networking applications, including industrial automation, manufacturing, POS, and medical treatment facilities.

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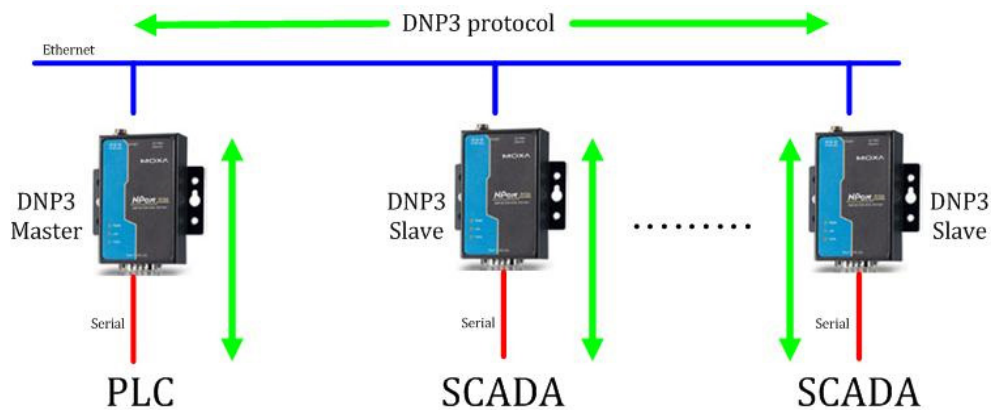
communications between a master station and RTUs or IEDs. ICCP, the Inter-Control Centre Protocol, is used for inter-master station communications.



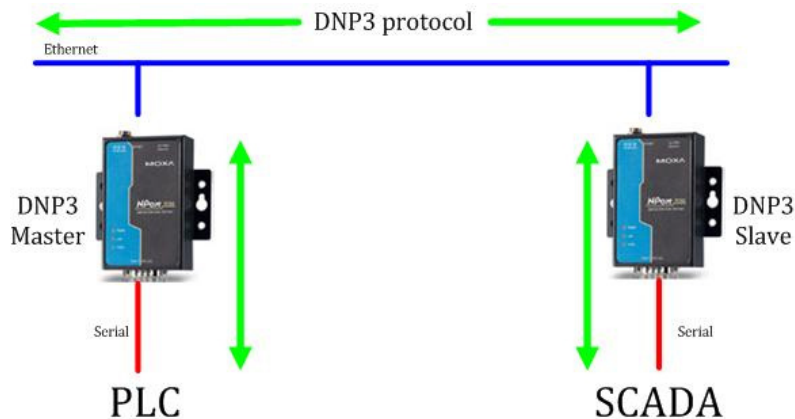
This application note describes two proven methods for DNP3 communications using the NPort A series. In this case, these NPort servers can be located at remote locations, eliminating costly modem connections while providing real-time access to serial devices via Ethernet. In TCP server/client mode, we defined the DNP3 master as TCP server and DNP3 slave as TCP client. There are two serial applications with the DNP3 device. We used these two examples to demonstrate how to build a DNP3 network with the NPort server.

1. A network with one DNP3 master and multiple DNP3 slaves, using UDP mode or TCP server/client mode. TCP server/client mode supports a maximum of 4 slaves.
2. A network with one DNP3 master and one DNP3 slave, using UDP or TCP server/client mode.

User can setup the suitable application topology for DNP3 communication environment. Please refer to topic 2 ~ 4 for setting configuration of NPort and verify it work properly.



DNP3 – single-master to multi-slave environment



DNP3 single master to single slave environment

DNP3 Setup Using NPort UDP Mode

First, verify that the IP and serial interfaces of the NPort and DNP3 slaves are configured properly. In this case, NPort's IP as the DNP3 master is 192.168.1.1 and the IP addresses for DNP3 slaves should be 192.168.1.12~ 192.168.1.14. UDP mode can support single or multiple slaves in a DNP3 network.

Setting the NPort as the DNP3 master

1. Select UDP as the mode of operation, use the broadcast IP as the destination IP. For example, we used 192.168.1.255 as the destination IP when slave's IP are between 192.168.1.12 and 192.168.1.14.

2. Because the default port for the DNP3 is 20000, we should change the UDP local port to 20000. This ensures that the master and slave can communicate with each other.

Operating Settings

Port=1

Operation mode:

Data Packing

Packing length: (0 - 1024)

Delimiter 1: (Hex) Enable

Delimiter 2: (Hex) Enable

Delimiter process: (Processed only when Packing length is 0)

Force transmit: (0 - 65535 ms)

UDP Mode

	Begin	End	Port
Destination IP address 1	<input type="text" value="192.168.1.255"/>	<input type="text"/>	<input type="text" value="20000"/>
Destination IP address 2	<input type="text"/>	<input type="text"/>	<input type="text" value="4001"/>
Destination IP address 3	<input type="text"/>	<input type="text"/>	<input type="text" value="4001"/>
Destination IP address 4	<input type="text"/>	<input type="text"/>	<input type="text" value="4001"/>

Local Listen port:

Apply the above settings to all serial ports (Local listen port will be enumerated automatically).

Setting the NPort as the DNP3 Slave

1. Select UDP as the mode of operation, and enter the IP address of the DNP3 master as the destination IP address.
2. Because the default port for the DNP3 is 20000, we should change the UDP local port to 20000. This ensures that the master and slave can communicate with each other.

Operating Settings

Port=1

Operation mode:

Data Packing

Packing length: (0 - 1024)

Delimiter 1: (Hex) Enable

Delimiter 2: (Hex) Enable

Delimiter process: (Processed only when Packing length is 0)

Force transmit: (0 - 65535 ms)

UDP Mode

	Begin	End	Port
Destination IP address 1	<input type="text" value="192.168.1.1"/>	<input type="text"/>	<input type="text" value="20000"/>
Destination IP address 2	<input type="text"/>	<input type="text"/>	<input type="text" value="4001"/>
Destination IP address 3	<input type="text"/>	<input type="text"/>	<input type="text" value="4001"/>
Destination IP address 4	<input type="text"/>	<input type="text"/>	<input type="text" value="4001"/>

Local Listen port:

Apply the above settings to all serial ports (Local listen port will be enumerated automatically).

DNP3 setup using NPort TCP server/client mode

First, verify that the IP and serial interfaces of the NPort and DNP3 slaves are configured properly. In this case, NPort's IP as the DNP3 master is 192.168.1.1 and the IP addresses for DNP3 slaves should all be 192.168.1.14. TCP server/client mode can support either single-master to single-slave topology, or single-master to multiple-slaves (max. 4 slaves) topologies in a DNP3 network.

Settings the NPort as the DNP3 master

1. Select TCP server mode and the NPort (DNP3) master will wait for slaves (max. 4 slaves) to connect.
2. Because the default port for the DNP3 is 20000, we should change the TCP local port to 20000. This ensures that the master and slave can communicate with each other.

Operating Settings	
Port 1	
Operation mode	TCP Server Mode
TCP alive check time	7 (0 - 99 min)
Inactivity time	0 (0 - 65535 ms)
Max connection	1
Ignore jammed IP	<input checked="" type="radio"/> No <input type="radio"/> Yes
Allow driver control	<input checked="" type="radio"/> No <input type="radio"/> Yes
Data Packing	
Packing length	0 (0 - 1024)
Delimiter 1	0 (Hex) <input type="checkbox"/> Enable
Delimiter 2	0 (Hex) <input type="checkbox"/> Enable
Delimiter process	Do Nothing (Processed only when Packing length is 0)
Force transmit	0 (0 - 65535 ms)
TCP Server Mode	
Local TCP port	20000
Command port	966
<input type="button" value="Submit"/>	

Settings the NPort as the DNP3 slave

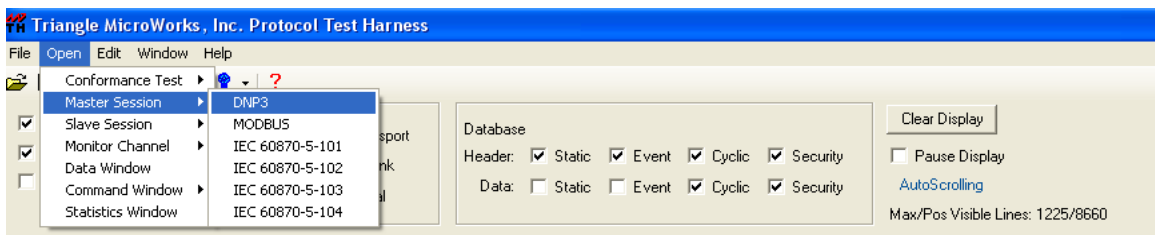
1. Select TCP client mode and enter the DNP3 master IP address as the destination IP address. For this example, we set the destination IP to 192.168.1.1, same as the DNP master IP address.
2. Because the default port for the DNP3 is 20000, we should change the TCP local port to 20000. This ensures that the master and slave can communicate with each other.

Port 1	
Operation mode	TCP Client Mode
TCP alive check time	7 (0 - 99 min)
Inactivity time	0 (0 - 65535 ms)
Ignore jammed IP	<input checked="" type="radio"/> No <input type="radio"/> Yes
Data Packing	
Packing length	0 (0 - 1024)
Delimiter 1	0 (Hex) <input type="checkbox"/> Enable
Delimiter 2	0 (Hex) <input type="checkbox"/> Enable
Delimiter process	Do Nothing (Processed only when Packing length is 0)
Force transmit	0 (0 - 65535 ms)
TCP Client Mode	
Destination IP Address	
Destination IP address 1	192.168.1.1 : 20000
Destination IP address 2	: 4001
Destination IP address 3	: 4001
Destination IP address 4	: 4001
Designated Local Port 1	20000 (0 - 65535, 0 represents assigned automatically.)
Designated Local Port 2	5012 (0 - 65535)

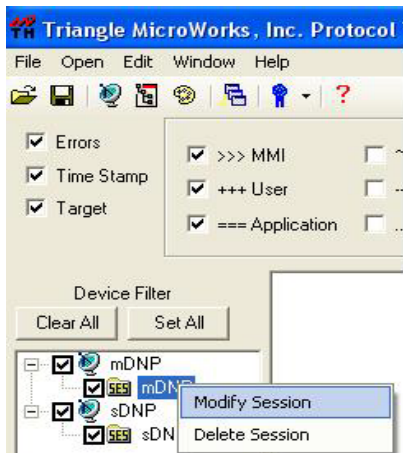
DNP3 Communication Verification

After the DNP3 network has been set up, user can now verify the DNP3 communication by using the following steps. User can simulate DNP3 requests and responses via this tool to check DNP3 communication.

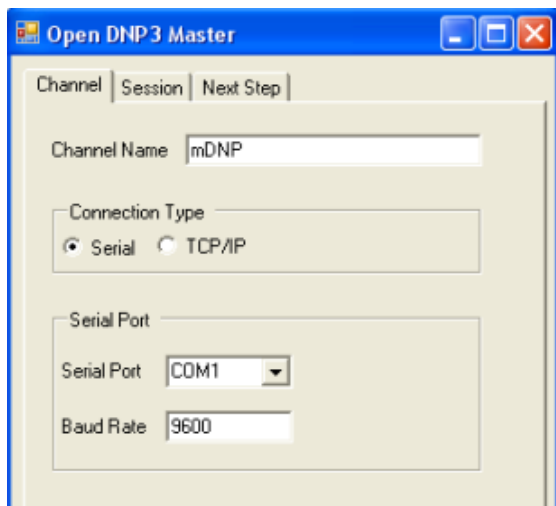
1. Install the "Protocol Test Harness" application and open it.
2. Select Open->Master Session ->DNP3



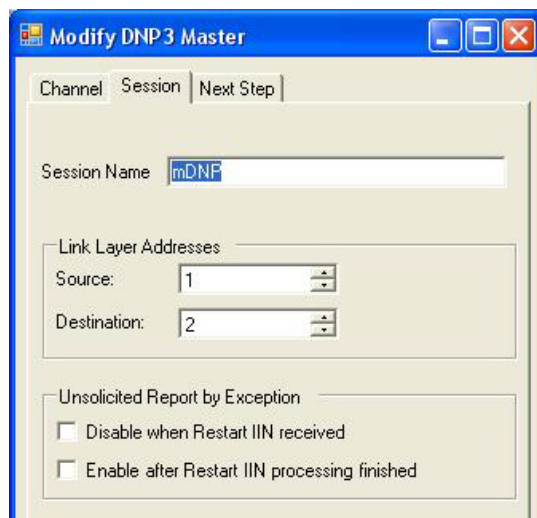
3. Right click 'mDNP', select 'Modify Session' to input DNP3 master settings.



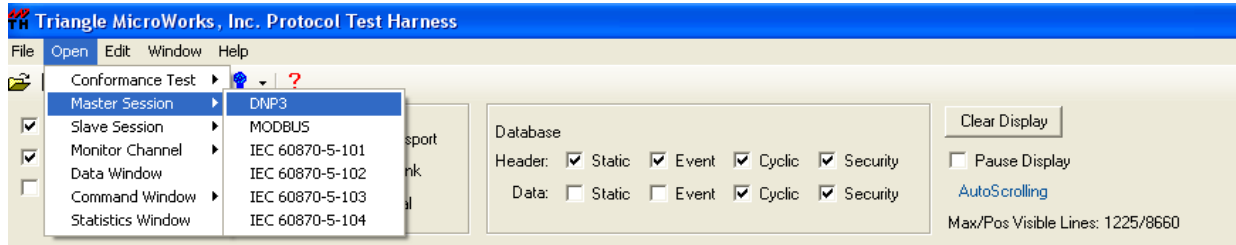
4. Select the 'Channel' tab and set serial/TCP parameters



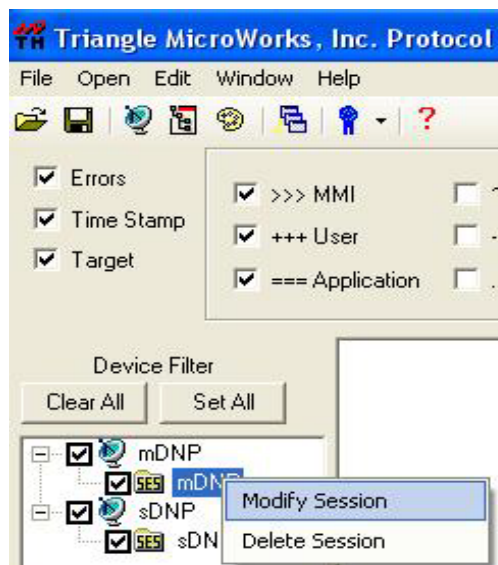
5. Select the 'Session' tab to set link layer address



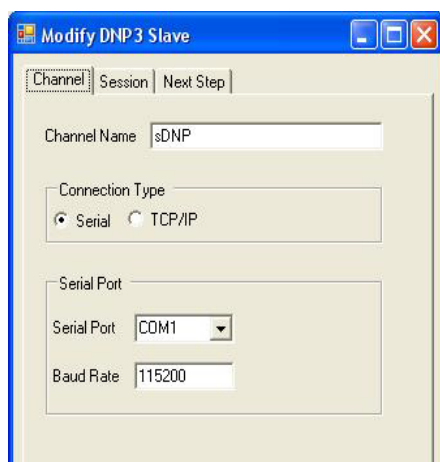
6. Select Open->Master Session ->DNP3 to create DNP slave



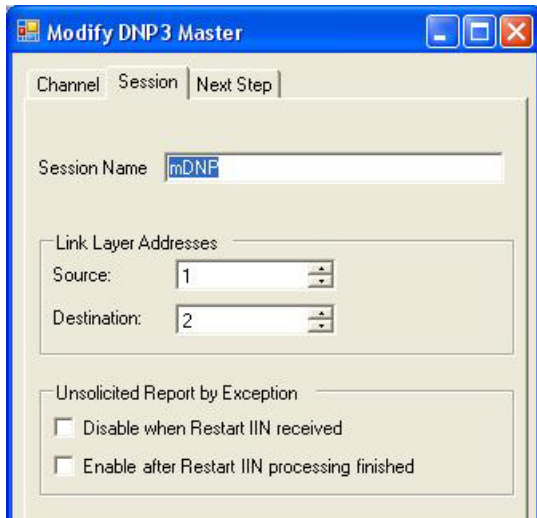
7. Right click 'mDNP' and select 'Modify Session' to input DNP3 slave settings



8. Select the 'Channel' tab and set serial/TCP parameters

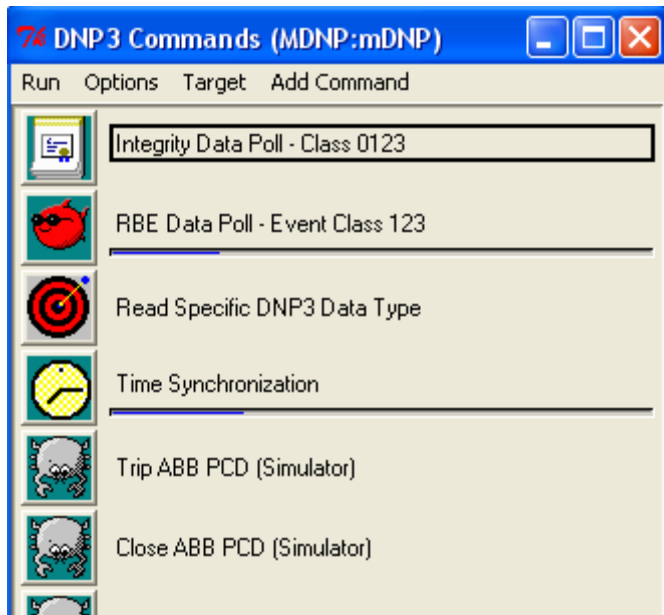


9. Choose 'Session' to set link layer address



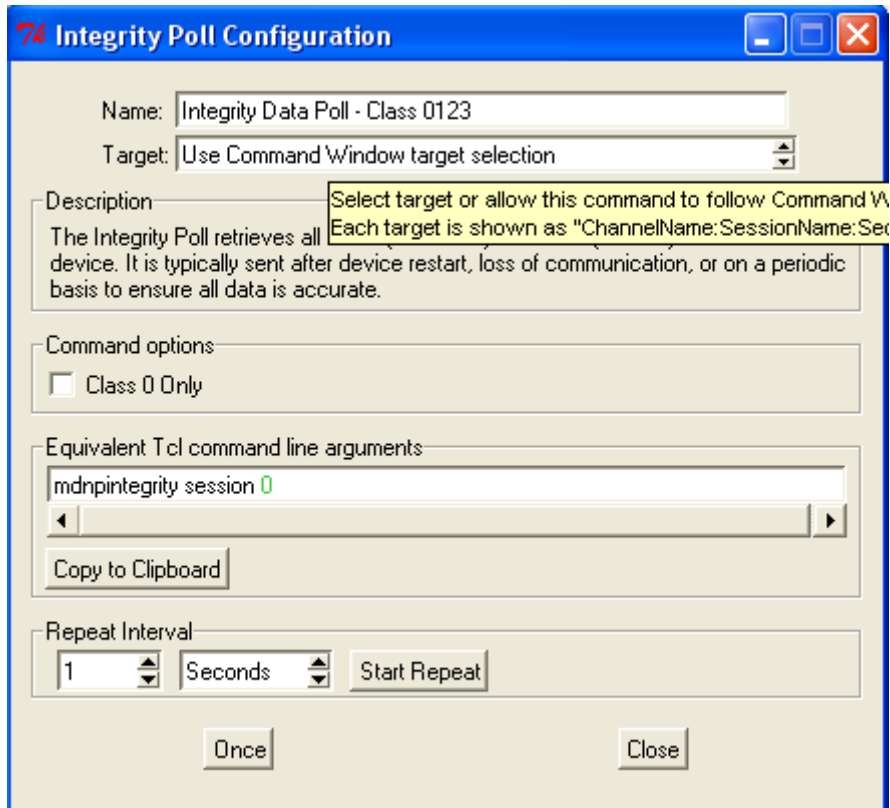
10. On the DNP3 Commands window

11. Click 'Integrity Data Poll - Class 0123'

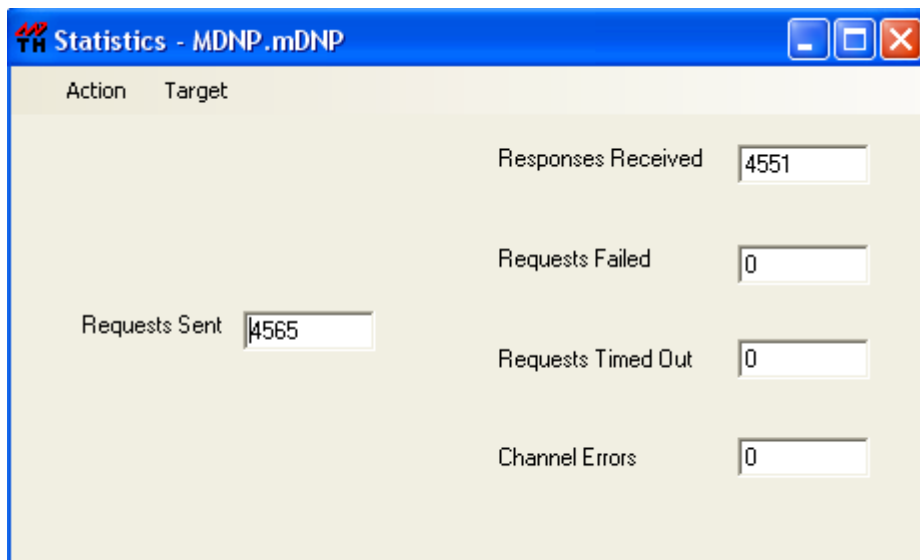


12. Set repeat interval to 1 second

13. Click 'Start repeat' to start testing



14. On Statistics window, we can see both the "Requests Sent" and "Responses Received" counts are increasing.



15. Under normal operation, "Requests Failed", "Requests Time Out", and "Channel Errors" should not have values. If errors are displayed, recheck the configurations.

We used the utility called "Protocol Test Harness" to simulate the DNP3 network. If you would like to use this utility, it can be found here:

<http://www.trianglemicroworks.com/DownloadTestHarnessRequest.aspx>