

DNP3 Driver Guide

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This documents usage of the DNP3 driver on the Niagara N4 platform.

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OVERVIEW

This document serves as a guide for using the DNP3 driver on the Niagara N4 platform.

System Compatibility

This driver integrates with the serial port (RS232) or IP port of JACE controller.

DNP3 Supported Functions

- Point discovery

Compatible devices:

- This driver was written to strict specifications of the DNP3 protocol and will be compatible for all devices that are also strictly DNP3 with no further additions to the protocol.
- Only functions and object types listed in this documentation are supported.
- Object types supported and not supported:
 - Analog Inputs, with and without flags
 - Analog Outputs, with and without flags
 - Binary Inputs, with and without flags
 - Binary Outputs, with and without flags
 - Group 10 Variation 1
 - Group 12 Variation 1. Group 12 will read using Group 10 Variation 1.
 - Direct Write function is used for binary output writes.
 - Counters, with and without flags
 - Frozen Analog Inputs, with and without flags
 - Frozen Counters, with and without flags
 - Analog Inputs/Outputs Data Formats
 - 16 bit Integer
 - 32 bit Integer
 - 32 bit float
 - 64 bit float
 - Counters Data Formats
 - 16 bit Integer
 - 32 bit Integer
 - Binary Input/Output Formats
 - Single Bit
 - Double Bit (not currently supported)

Niagara Compatibility

This software will function on all Niagara N4 4.*n.nnn* platforms.

Workflow Summary

1. Install module
2. Add Driver object
3. License Driver object
4. Add
5. Add or Discover Points

PHYSICAL CONNECTION

The driver can communicate through the RS232 com port on the JACE (com1) or on either IP port. Connection type is dependent on whether or not the serial network or the IP network is being used.

MODULE INSTALLATION

Install the driver module on the computer where Niagara N4 Workbench will be run. To install, place a copy of the file in the modules directory of your Niagara N4 installation. This is typically C:\Niagara\Niagara-3.n.nnn\modules.

Install the module on the target station. Using a Niagara N4 Workbench where the module has already been installed, connect to the station's platform service. Go to the Software Manager and install.

ADDING THE DRIVER OBJECT

Open the driver palette in the engineering tool. Copy and paste the Dnp3Driver object under the Drivers node in the station database.

License the driver object.

LICENSING THE DRIVER OBJECT

Every network must be licensed. Unlicensed networks will operate in demo mode for 2 hours. After demo mode expires, the station must be restarted to resume operation, but it is otherwise safe to build a database.

Licensing is managed on an object in your database. The licensing object is located on the property sheet of the Dnp3Driver. It has the following properties.

- Product Code – Text automatically generated by the driver that is needed to generate a license key.
- License Key – Where the key to validate the license must be entered.
- Devices – The number of devices under all networks to license.

Set the number of devices. Copy the value of the “Product Code” property that is automatically generated. You should highlight the value and copy it by pressing CTRL-C. Send the product code to your Kodaro representative. They will respond with a text string for you to enter in the “License Key” property.

You must restart the station after changing the “License Key”.

The exact text and case of the product code and license key are critical. Do not send screen shots. Highlight the text, copy it using CTRL-C and paste into an email.

ADDING NETWORK OBJECTS

Open the driver palette in the engineering tool. Copy and paste the appropriate network object under the driver node in the station database.

Configure the connection properties such as serial ports, addressing and credentials. The network acts as a device manager and makes no real communication connection. Configure the network’s “Master Address” property to that of the expected configuration of the field devices.

AUTO DISCOVERY

Once the network object is connected, it is time to discover devices. In the Dnp3DeviceManager view, select the “New” button. For serial devices, you need to set only the Address property for communications.

For IP communications you need to set the Address property along with the following:

- Remote Host – This is the IP Address of the device
- Remote Port – This is the port on which to communicate. Default for DNP2 is 20000.

Both serial and IP communications also have a property called “Override Network Master.” This allows multiple devices to live under a single network object that have been configured to listen to different master addresses.

MANUALLY ADDING POINTS

Once device objects have been added, double click the “Points” icon in the device manager view, or from the device property sheet. This takes you to the point manager view.

When adding points, choose the correct “Type” in the add dialog.

Set the point address. See section “System Compatibility” for supported object types.

To discover points, go to the point manager and select the “Discover” button. This will attempt to find all instances of the object types supported for this driver. Returned numerical data are currently assumed to be of 16 integer length and added to the database as such.

COMPONENT REFERENCE

Dnp3Driver

This is the root node of the driver. It represents a tree of DNP3 networks.

Properties:

- **License** – See the section title “Licensing”.

Dnp3IPNetwork

A network-level component in the Niagara 4 architecture and has standard network component properties (see “Driver Architecture/Common Network Components” in the *Niagara 4 User Guide* for more information).

The following properties are unique or have special importance:

- **Message Queue** – The message queue is where serial transactions are queued up and executed in synchronous order. This object has some properties that are informational in nature only. There is also a dump action which will print the contents of the queue to console.
- **Tuning Policies** – Policies such as when to write values and polling frequency are configured here.
- **State** – The current state of the serial connection to the device.
- **Max Message Size** – Sets the maximum number of bytes that a device can receive from a single message stream.
- **Master Address** – This is the address of the DNP3 Master Device.

Dnp3Serial Network

A network-level component in the Niagara 4 architecture and has standard network component properties (see “Driver Architecture/Common Network Components” in the *Niagara 4 User Guide* for more information).

The following properties are unique or have special importance:

- **Serial Config** – Where to configure your serial port. By default this is already configured on COM1 to the correct settings.
- **Message Queue** – The message queue is where serial transactions are queued up and executed in synchronous order. This object has some properties that are informational in nature only. There is also a dump action which will print the contents of the queue to the console.

- **Turning Policies** – Policies such as when to write values and polling frequency are configured here.
- **State** – The current state of the serial connection to the device.
- **Max Message Size** – Sets the maximum number of bytes that a device can receive from a single message stream.

Dnp3Device

This is a device-level component in the Niagara 4 architecture and has standard device properties (see “Driver Architecture/Common Network Components” in the *Niagara 4 User Guide* for more information).

The following properties are unique or have special importance:

- **Override NetworkMaster** – Use a different master than the one specified on the network object.
- **Master Address** – Used to override the network master setting if “Override Network Master” is set to true.
- **Address** – This is the address of the DNP3 Device.
- **Remote Host** – This is the IP address of an IP based DNP3 device.
- **Remote Port** – The port on which to connect to an IP based DNP3 device. Default 20000.
- **Internal Indications** – This is used to monitor the state of messages on the device.
- **Unsolicited Messages** – This enables or disables the unsolicited messaging at the device level.
- **Restart Time** – This is loaded with the time the device will be down for communications during a warm or cold restart and is dependent on the device to determine this. It is reset to 0 once the restart time has elapsed.
- **Ping Timeout** – This is the amount of time to wait after a ping request is sent out.

Dnp3ProxyExt

The following properties are unique or have special importance:

- **Address** – This is the name used in a point log to poll the value. Typically this is also known as the point object index in Dnp3 protocol.
- **Device Facets** – The facets are used to map values into Niagara. For Boolean and Enum points, it is important the trueText/falseText or enum range be set.
- **Object Type** – This is where the Dnp3 object type is set. See section “System Compatibility” for supported object types.
- **Data Type** – Use this to set the data format type, i.e. 16 bit or 32 bit. See section “System Compatibility” for supported data types.
- **Status Flags** – Status bit information for the specific object index. This also includes a time stamp that differs from the poll time to indicate the last time these values were reported.

- **Last Event Abs Time** – This is the absolute time of the last time this value was reported. This differs from that of the poll time. The poll time indicates the last time the N4 framework has updated its value and the Last Event Abs Time indicates the last time the controller reported the value.

Special properties for Binary Output Object Type only. These properties become hidden or visible when the Object Type property is set or changed from Binary Output. A refresh of the property sheet is necessary to display correctly when the type is changed.

- **Variation** – Allows selection of the DNP3 variation for the group type selected. Currently only variation 1 is supported.
- **Operation Type** – Select the DNP3 operation used when setting a binary output. Options are NULL, PULSE_ON, PULSE_OFF, LATCH_ON and LATCH_OFF. Consult device documentation to determine how these options are interpreted as it is device specific.
- **Trip Closed Code** – Select the DNP3 Trip Closed Code used when setting a binary output. Options are NULL, CLOSE and TRIP. Consult device documentation to determine how these options are interpreted as it is device specific.
- **On Time** – Length to pulse on. Consult device documentation to determine how these options are interpreted as it is device specific.
- **Off Time** – Length to pulse off. Consult device documentation to determine how these options are interpreted as it is device specific.

Frozen Analog Inputs or Frozen Counters are currently the only two that will implement these actions. When either of these is chosen the action will become visible.

- **Freeze** – Performs the Dnp3 Freeze function on the object. This action will be hidden unless the object type is determined to be of a frozen type. When either of these is chosen the action will become visible.
- **Freeze and Clear** – Performs the Dnp3 Freeze function on the object. This action performs the same in the N4 framework as the “Freeze Action.”

TROUBLESHOOTING

Problems in General

- Is the driver licensed? Has the demo mode expired?
- Turn on debug and watch the console. Anything obvious?
 - Debug property is on the network property sheet.
 - Watch the Application Director console.
- Performance issues
 - Look at the Message Queue on the network property sheet
 - Discovery will be on the urgent queue. Are there a lot of messages on the urgent queue?
 - Invoke the dump action on the message queue and look at the application director to see what is on the queue.
- Try to rule out the driver.
 - Does the problem exist in other software such as HyperTerminal?

Trouble Connecting

- Check license state.
- Check the SerialConfig object on the network.
 - Is the correct com port selected?
 - Is it in use by another driver?
 - Is the baud rate correct?
- Turn on debug
 - Anything printing on console?
 - Try connecting with HyperTerminal.
 - Usually a cable problem if manually wired.
 - Does the output look wacky?
 - Verify the baud rate is correct.
- Check the IP Network object
 - Is the correct remote host selected?
 - Is the correct remote port selected?
 - Can you ping the host on that port from another location on the network?
 - Use the reconnect action to verify a connection is established.

Read Problems

- What is the fault cause in the point manager or on the point Proxy Ext?
- Try increasing the timeout.
- Could be a performance problem, look at the message queue (see Problems in General)

HISTORY

August 06, 2018: 4.0.22.18.2

- Move miscellaneous error messaging to logger
- Better handling of socket failures with IP connection loss

August 03, 2018: 4.0.22.18.2

- Fix memory leak on IP Network connections
- Better handling of multiple transport packets

April 05, 2018: 4.0.22.18.1

- Changed Logging methods to be compliant with N4.3 security enhancements
- Added module-permissions.xml to account for N4.3 security enhancements.

June 06, 2017: 4.0.22.17

- Fixed wrong device message matching from network level processing.

May 9, 2016: 4.0.22.16

- N4 conversion converted from 3.8.38.0.7

March 25, 2016: 3.8.38.0.7

- Fixed 16 bit signed integer data type for all DNP3 objects using this encoding

March 14, 2017: 3.8.38.0.6

- Updated driver guide for Niagara 4

November 24, 2015: 3.8.38.0.6

- Additional Binary Output Properties Exposed
- Event logging added

June 17, 2014: 3.8.37

- Support for Binary Output Group 12, Variation 1 added.

April 4, 2014: 3.7.106.2

- Support for addressing above 255 added for points.

February 26, 2014: 3.7.106.1

- Deprecated Remote Host and Remote Port properties removed from Dnp3IpNetwork. Deprecated due to version 3.25.3
- Remote User and Remote Pass properties removed from Dnp3Device.

February 25, 2014: 3.7.106

- Processor object type declaration fixed preventing network state connect

October 12, 2011: 3.5.25.4

- Added max message queue to network object

2011: 3.5.25

- Initial release.
- Connection moved from network to device level
- Device master address override added
- Device ping timeout added