AN-X4-AB-DHRIO

Data Highway Plus

Communication

User Manual

Because of the variety of uses for the products described in this publication, those responsible for the application and use of these products must satisfy themselves that all necessary steps have been taken to assure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes and standards. In no event will Quest Technical Solutions be responsible or liable for indirect or consequential damage resulting from the use or application of these products.

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Throughout this manual we use notes to make you aware of safety considerations.

WARNING!

Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss.

These warnings help to:

- identify a hazard
- avoid the hazard
- recognize the consequences

IMPORTANT!

Identifies information that is especially important for successful application and understanding of the product.

TIP

Identifies information that explains the best way to use the AN-X4-AB-DHRIO (DH+)

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AN-X4-AB-DHRIO Data Highway Plus Module

The AN-X4-AB-DHRIO module running Data Highway Plus (DH+) firmware connects a computer or other device on Ethernet to an Allen-Bradley Data Highway Plus network.

The AN-X4-AB-DHRIO (DH+) module:

- can act as any valid Data Highway Plus station number, from 0 to 77 octal

- supports all Data Highway Plus baud rates, 57.6, 115.2 and 230.4 Kbaud

- maintains Data Highway Plus diagnostic counters

- can route messages from Ethernet to Data Highway Plus, using IP aliasing

- can route messages from Data Highway Plus to destinations on Ethernet, using the router function

You can use the AN-X4-AB-DHRIO (DH+) module with Rockwell programming software to communicate with PLCs such as the PLC-5 over Data Highway Plus from a computer on Ethernet. Refer to page 18 for details.

You can use a DDE or OPC server, for example RSLinx, on Ethernet to access Data Highway Plus using the AN-X4-AB-DHRIO (DH+). Refer to page 23 for details.

The AN-X4-AB-DHRIO (DH+) module has a web interface for configuration of the Data Highway Plus station number and baud rate and for monitoring diagnostic counters and the active station list. You can communicate with the module using any standard web browser.

The AN-X4-AB-DHRIO (DH+) module monitors the Data Highway Plus network traffic and displays usage statistics such as:

- overall network loading

- the percentage of network time used for the commands from each station plus the percentage of network time used by responses to those commands, to identify the stations creating the most network traffic
- the amount of network time used by each station in sending responses to other stations, to identify heavily loaded stations

Refer to page 44 for details.

You use the web interface to send various configuration files to the AN-X and to retrieve them, and to update the AN-X firmware.

A jabber inhibit timer is implemented in the module's hardware. If the network transmitter is on longer than 150% of the longest network frame time, the transmitter is forced off and the module is placed into a safe fatal failure state.

Hardware Features

The module has:

- LEDs to indicate the status of the connection to the Ethernet, its own internal state, and the state of the connection to the Data Highway Plus network

- an Ethernet connector

- a 3-pin Phoenix connector to connect to the Data Highway Plus network

- a power connector

- a microSD card for storage of configuration data and firmware

The pinouts on the power and the Data Highway Plus connectors match those on the AN-X2. Cables for the AN-X2 can be connected to the AN-X4 without change, though they may need to be rotated 180 degrees.

Package Contents

- AN-X4-AB-DHRIO module
- Phoenix Power and Data Highway Plus connectors

Using the MicroSD Card

The AN-X4 microSD card stores configuration data and firmware.

There are no restrictions on the size or speed of the card. The format must be FAT-16 or FAT-32.

The microSD card must be present while the AN-X4 is running.

WARNING!   Do not remove the microSD card while the AN-X4 is powered on!

There are several configuration files on the SD card.

Function	File
Ethernet configuration	IPCfg\IPConfig.txt
Data Highway Plus Configuration	Dhp\AnxDhpCfg.txt
Alias Configuration	Dhp\AnxDhpCfgHmiAlias.txt
Router Configuration	Dhp\AnxDhpCfgRouter.txt
Firmware to run	Firmware\FirmwareCfg.txt

All files should be created and editied with a plain text editor such as Windows Notepad.

If the AN-X4 is inaccessible from Ethernet because of its settings, or is in an unknown state, you can power down the AN-X4, remove the microSD card and edit the file IPConfig.txt. Refer to page 14 for details.

When you have finished editing the file, reinsert the card in the slot at the back of the AN-X4 and restart the AN-X4.

WARNING!   If you remove the card to edit the configuration file, push the card in straight or the card might fall inside the case and you will have to disassemble the AN-X4 to retrieve it .

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Comparison with the AN-X2

If you are familiar with the AN-X2, or are replacing an AN-X2 with an AN-X4, you should be aware of the following:

- The power and Data Highway Plus cables are the same, but may need to be rotated 180 degrees.

- The configuration files are similar but are saved in different locations on the microSD card

- The web interface is improved

- The errors displayed on the LEDs have changed

- You can run different versions of the same firmware, e.g., Data Highway Plus firmware, for example for debugging

- As shipped, searches for a DHCP IP address at startup for 10 seconds, then reverts to static IP address 192.168.0.246

- Case is smaller

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Installation

Prevent Electrostatic Discharge

The module is sensitive to electrostatic discharge.

WARNING!

Electrostatic discharge can damage integrated circuits and semiconductors. Follow these guidelines when you handle the module:

- Touch a grounded object to discharge static potential
- Do not touch the connector pins

Power

AN-X requires DC power input of anywhere from 12 to 24 VDC
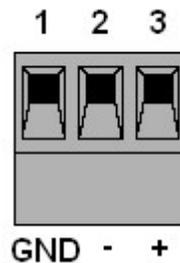
The pins on the power connector are chassis ground, negative voltage and positive voltage. Pin 1 is closest to the Ethernet connector.

Power consumption is 240 mA @ 12VDC or 120 mA @ 24VDC.

The part number for the power connector is Phoenix MSTB 2.5/3-ST-5.08 (1757022)

Data Highway Plus Cabling and Termination

Follow Allen-Bradley cabling recommendations for Data Highway Plus. Refer to *Approved Vendor List for DH, DH+, DH-485, and Remote I/O Cables*, publication ICCG-2.2, February 1996.

The network cable must be terminated with terminating resistors attached to the physical ends of the network, usually 82 ohm, but refer to Allen-Bradley documentation since some devices require 150 ohm terminators. There should be two and only two terminators on the Data Highway Plus network.

On the AN-X module, the Data Highway Plus connections should be line 1, shield, line 2.

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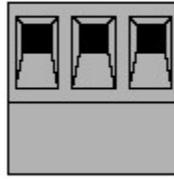
Line 2 on the AN-X is closest to the Ethernet connector and the NS LED.

Check the wiring to ensure that line 1 on the AN-X is connected to line 1 on the PLCs, and other devices.

The part number for the connector is Phoenix MSTB 2.5/3-ST-5.08 (1757022)

The most common causes of Data Highway Plus connection errors are:

- wiring reversed (lines 1 and 2)

- incorrect baud rate

- other cabling and termination problems

- terminating resistors shorted to shield wires

- duplicate stations

Usually, but not always, the wire colors are:

	Data Highway Plus	Remote I/O
Line 1	Clear	Blue
Line 2	Blue	Clear

Ethernet Cabling

AN-X has a standard RJ-45 connector for connecting to Ethernet.

If you are connecting AN-X to an existing network through a router or switch, use a standard Ethernet cable.

Hazardous Location Considerations

This equipment is suitable for use in Class I, Division 2, Groups A, B, C and D OR non-hazardous locations.

Device is to be mounted inside an environmentally suitable enclosure that requires a tool to access.

Device is for indoor use only.

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Configuration

The AN-X4-AB-DHRIO (DH+) module connects a computer or other device on Ethernet to a Data Highway Plus network.

Before you can use the AN-X4-AB-DHRIO (DH+), you must configure its network properties, on Ethernet and on Data Highway Plus.

Initial Ethernet Configuration

AN-X can be configured:

* to use a static (unchanging) IP address

* to obtain its IP address from a DHCP server

* to use the factory default setting, where AN-X waits for 10 seconds for a DHCP server to assign it an IP address. If it does not obtain an IP address within 10 seconds, it reverts to a static address of 192.168.0.246.

AN-X4 modules are shipped with the factory default setting.

Unless you have control of the DHCP server, in most applications you will assign the AN-X a static IP address. Otherwise the DHCP server may assign a different IP address each time AN-X powers up, and any software that accesses the AN-X module would have to be reconfigured.

If you are using multiple AN-X modules, connect and configure them one at a time.

IMPORTANT!	If you are connecting AN-X to an existing Ethernet network, consult the network administrator to obtain information about how you should configure AN-X or to obtain a static IP address for AN-X.

You configure the Ethernet properties either by:

* using the web interface

* editing files on the microSD card

To use the web interface, you must know the IP address of the AN-X, either the address assigned by the DHCP server or the default address of 192.168.0.246

Enter the IP address in the address bar of your browser.

Select *Administration/AN-X IP Configuration*. The *AN-X IP Configuration* page appears.

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At the top the screen shows the serial number and MAC address of the AN-X being configured.

Check either DHCP or Static.

DHCP

If the AN-X4 finds a DHCP server on the network, it obtains an IP address and other network parameters (netmask and default gateway) from the DHCP server.

To find the address assigned, look at the DHCP server or use a network tool that displays devices on the network.

If the AN-X has been configured for DHCP and it does not find a DHCP server, it waits forever for a DHCP server and repeatedly flashes the MS LED yellow 2 times followed by a pause. The NS LED will be solid red.

Static IP Address

If you select static IP address, enter:

• the IP address for the AN-X.

• the netmask for the AN-X

• the default gateway for your network.

You must enter a valid default gateway address even if there is no device at the gateway address on the network.

Factory Default Setting

The AN-X is shipped with a factory default setting that looks for a DHCP server for 10 seconds, then reverts to an IP address of 192.168.0.246. Note that if the AN-X is later able to obtain an IP address from a DHCP server, it will take the DHCP assigned address.

Hostname

Enter a *Hostname* for the AN-X4. This name is used internally by AN-X and may be used to identify the AN-X if you have a DNS server on your network. The name can be from 1 to 30 characters long.

Submitting the Configuration

Once you have entered all required parameters, click SUBMIT to write the configuration to the file config.txt on the microSD card. The changes do not take effect until the AN-X restarts.

The following page appears when you click SUBMIT.
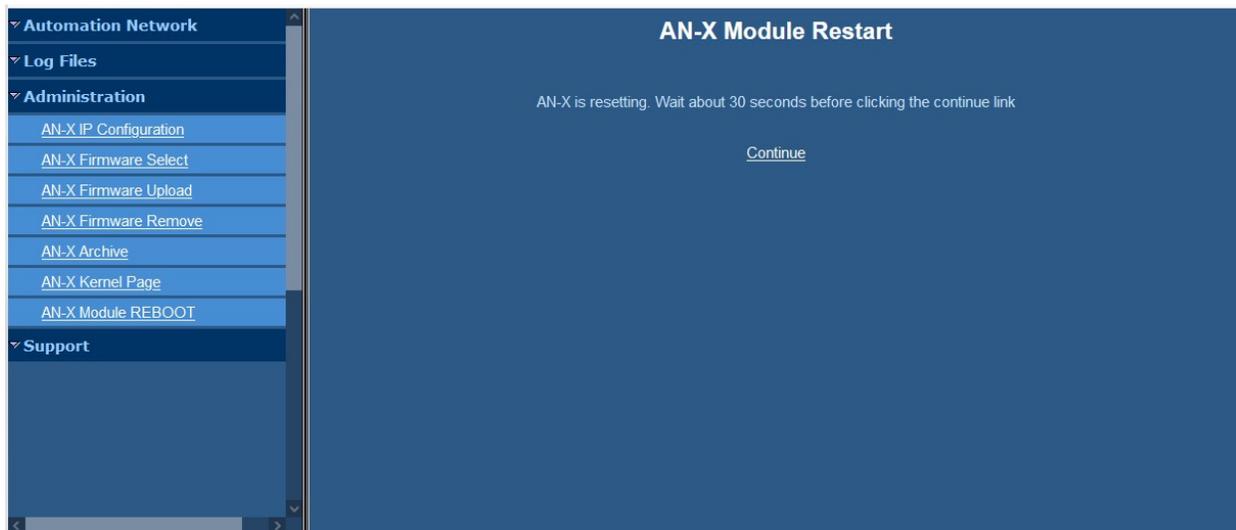
Wait until the AN-X has completely restarted, then click *Continue*.

If you have changed the IP address, enter the new IP address in the browser's address field.

Reconfiguring an AN-X from an Unknown State

It sometimes happens that an AN-X has been previously configured with an IP address that causes it to be inaccessible on the current Ethernet network or that the IP address is unknown.

Remove the microSD card and edit the file IPCfg\IPConfig.txt, using a text editor such as Windows Notepad, to set the AN-X4 to the desired Ethernet configuration.

The Configuration File IPCfg\IPConfig.txt

The Ethernet configuration is stored in the file IPCfg\IPConfig.txt on the microSD card.

When you perform the *Administration/AN-X Configuration* command from the web interface, it writes the results to that file.

Each line consists of a keyword followed by a colon and then a value.

Example:

```
IP: 192.168.1.12
```

Anything after a semicolon on a line is treated as a comment.

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Keyword	Possible Values
IP	Factory
	DHCP
	static IP address, e.g., 192.168.1.187
Netmask	Ethernet netmask, used only if IP is a static IP address
DefGtwy	default gateway, used only if IP is a static IP address
Hostname	Ethernet host name, from 1 to 30 characters

If you edit the file and AN-X finds an error in the file contents during startup, it flashes an error code on the MS LED, see page 50.

Example IPCfg\IPConfig.txt files

Example: Factory default

```
IP: Factory
Hostname: ANX4
```

Example: DHCP

```
IP: DHCP
Hostname: ANX4
```

Example: Static IP address

```
IP: 192.168.1.14
NetMask: 255.255.255.0
DefGtwy: 192.168.1.1
HostName: ANX4
```

Firmware to Run

In addition to the Ethernet configuration, you will also need to edit the file *Firmware\FirmwareCfg.txt* to select the firmware file to run. The contents of the file must exactly match the name of one of the fimware files on the AN-X or the AN-X will not start up.

Example:

```
AN-X4-AB-DHP.v4.12.52.qtf
```

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Data Highway Plus Configuration

Use the web interface to set the AN-X baud rate, station number, and how much data the AN-X can send when it gets the Data Highway Plus token.

The baud rate can be one of 57.6, 115.2 or 230.4 kbits/second.

The station number can be from 0 to 77 octal.

AN-X can send multiple messages when it gets the Data Highway Plus token.

When AN-X gets the Data Highway Plus token, it always sends at least one message if it has any messages in its queue.

If there any more messages in the queue after it sends the first message, it can send up to a maximum of the number of bytes configured in Token Bytes (less the number of bytes in the first message).

For example, if Token Bytes is set to 250, when AN-X gets the token, it can send the first message in its queue, for example, a write message that is 100 bytes long. It can then send further messages from its queue up to a maximum of 150 bytes in total (250 – 100 bytes). It takes the messages in the order in which they are found in the queue.

The range of Token Bytes is 0 to 300 bytes. The default is 250. A value of 0 disables sending additional messages on the token.

Setting Token Bytes can improve the performance of AN-X on the Data Highway Plus network but it can also load the destination station if AN-X is sending many messages to the same destination. Monitor the No Memory NAKs diagnostic counter. If this counter is incrementing, it indicates that some destination is receiving more messages than it can process. In that case, reduce the value of Token Bytes to limit how many messages AN-X is sending.

To configure the Data Highway Plus properties of AN-X:

1. Start your web browser and enter the AN-X IP address as the web address.

2. Select *Automation Network/DH+ Configure*.

3. Select the baud rate.

4. Enter the Data Highway Plus station number, in octal.

5. Set the value for Token Bytes or accept the default value of 250.

6. Click the SUBMIT button to send the values to AN-X.

As shipped, AN-X defaults to a station address of 20 octal, a baud rate of 57.6 Kbaud and Token Bytes of 250..

Select *Automation Network/DH+ Monitor* to view the active station list and confirm that you can see other stations on the network.

If you duplicate the station number of another station on the Data Highway Plus network, the AN-X will not go online. The NS LED will alternate yellow and red and the AN-X will return status error 3 to any messages sent to it from Ethernet.

If another station comes online with the same Data Highway Plus address as the AN-X, AN-X will take itself offline. The NS LED will alternate yellow and red and the AN-X will return status error 3 to any messages sent to it from Ethernet.

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Using Programming Software

AN-X emulates a 4-slot ControlLogix rack with a 1756-ENET in Slot 0 and a 1756-DHRIO in slot 1. The emulated DHRIO has only channel A since the AN-X has only one Data Highway Plus network port. A computer running programming software such as RSLogix 5 can connect to a PLC-5 or other PLC on Data Highway Plus through the AN-X , just as you would with a real 1756-ENET or equivalent Ethernet module and a 1756-DHRIO.

Configuring the AN-X4-AB-DHRIO (DH+) in RSLinx

To use an AN-X4-AB-DHRIO (DH+) module with Rockwell programming software such as RSLogix 5, you must first configure a driver in RSLinx to access the AN-X module.

The following instructions assume that:

- AN-X has been configured and is active on the Ethernet network

- AN-X has been connected to the Data Highway Plus network

- the AN-X Data Highway Plus station number and baud rate have been assigned and are compatible with the existing Data Highway Plus network

EtherNet/IP Driver

In most cases, this driver is the one you will find most convenient.   Note that this driver may already have been added to your RSLinx configuration. You don't need to add another instance for the AN-X.

This driver works for the AN-X base IP address but not for aliased IP addresses. For aliased IP addresses, use the Ethernet Devices driver.

Use the following steps to configure the AN-X4-AB-DHRIO (DH+) in RSLinx.

1. Select *Communications/Configure Drivers…*

2. From the list of *Available Driver Types:*, select *EtherNet/IP Driver* and click *Add New…*

3. Give the driver a name
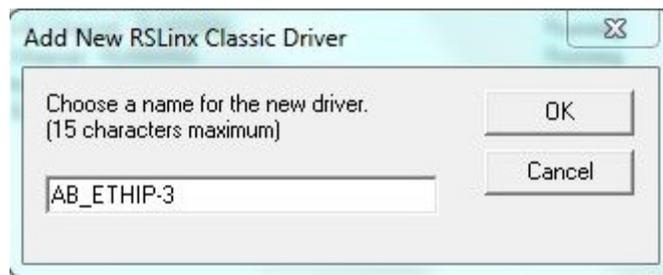
4. Select the adapter that connects the computer to the subnet on which the AN-X is found. Click Close.

The AN-X will now appear when you expand the driver in RSLinx.
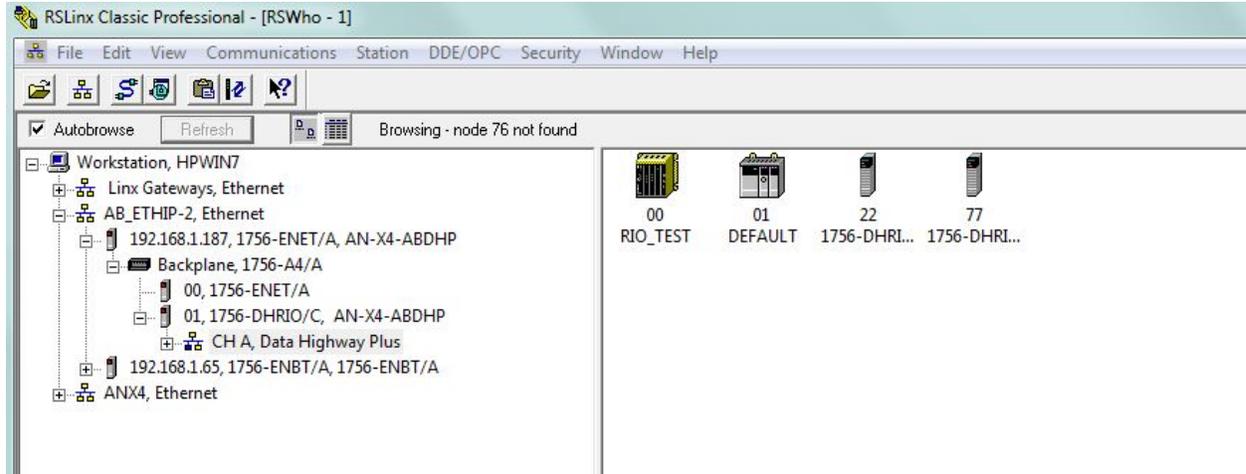
Remote Devices via Linx Gateway Driver

This driver will work for the AN-X base IP address but not for aliased IP addresses (see page 27). For aliased IP addresses, use the Ethernet Devices driver.

Use the following steps to configure the AN-X4-AB-DHRIO (DH+) in RSLinx.

1. Select *Communications/Configure Drivers...*

2. From the list of *Available Driver Types:*, select *Remote Devices via Linx Gateway* and click *Add New...*

3. Give the driver a name.
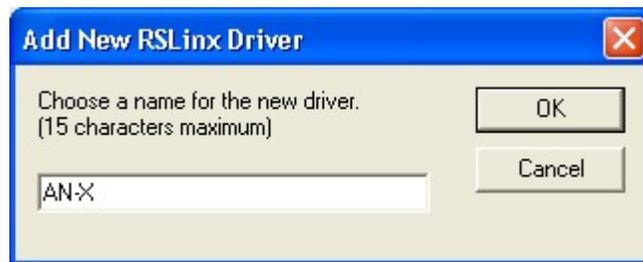
4. For Server's IP Address or hostname: enter the IP address of the AN-X4-AB-DHRIO (DH+) and click OK.

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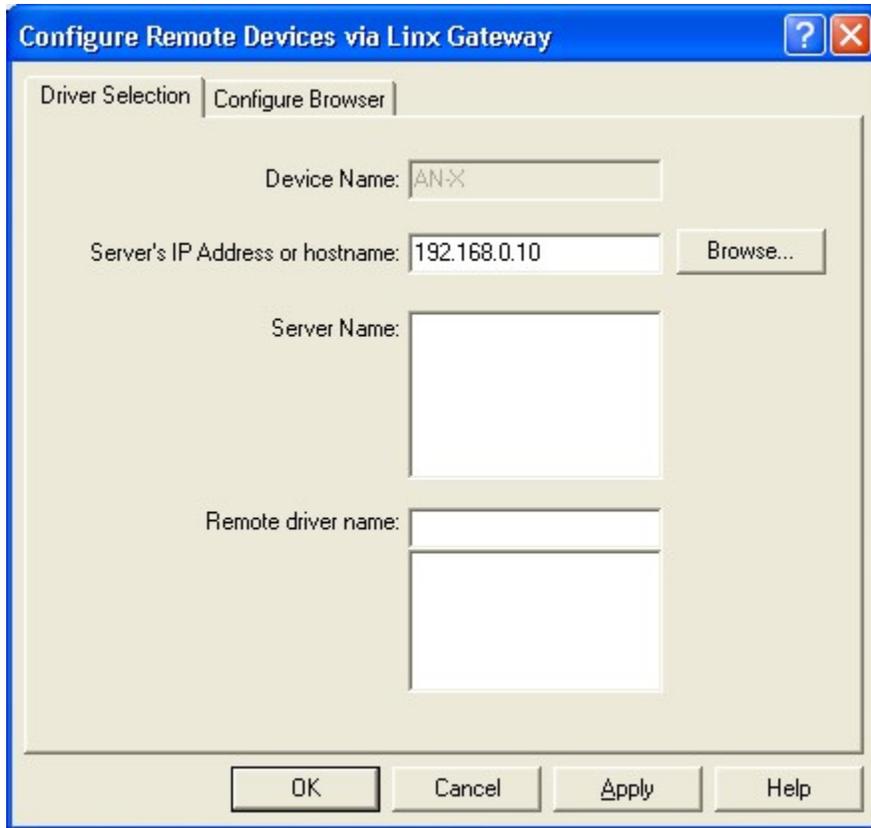
5. Check that the driver has status Running

6. Click *Close*.

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Ethernet Devices Driver

Use this driver for aliased AN-X IP addresses.

Use the following steps to configure the AN-X4-AB-DHRIO (DH+) in RSLinx.

1. Select *Communications/Configure Drivers…*

2. From the list of *Available Driver Types:*, select *Ethernet devices* and click *Add New…*

3. Give the driver a name
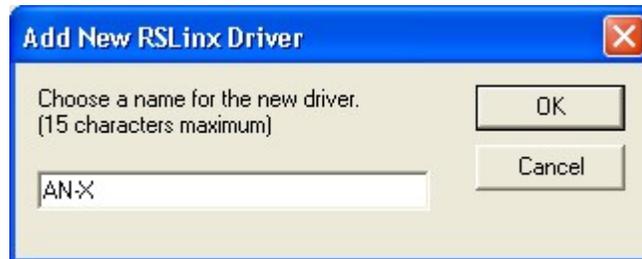
4. For Server's IP Address or hostname: enter the IP address on the AN-X4-AB-DHRIO (DH+) and click OK.

5. Check that the driver has status Running

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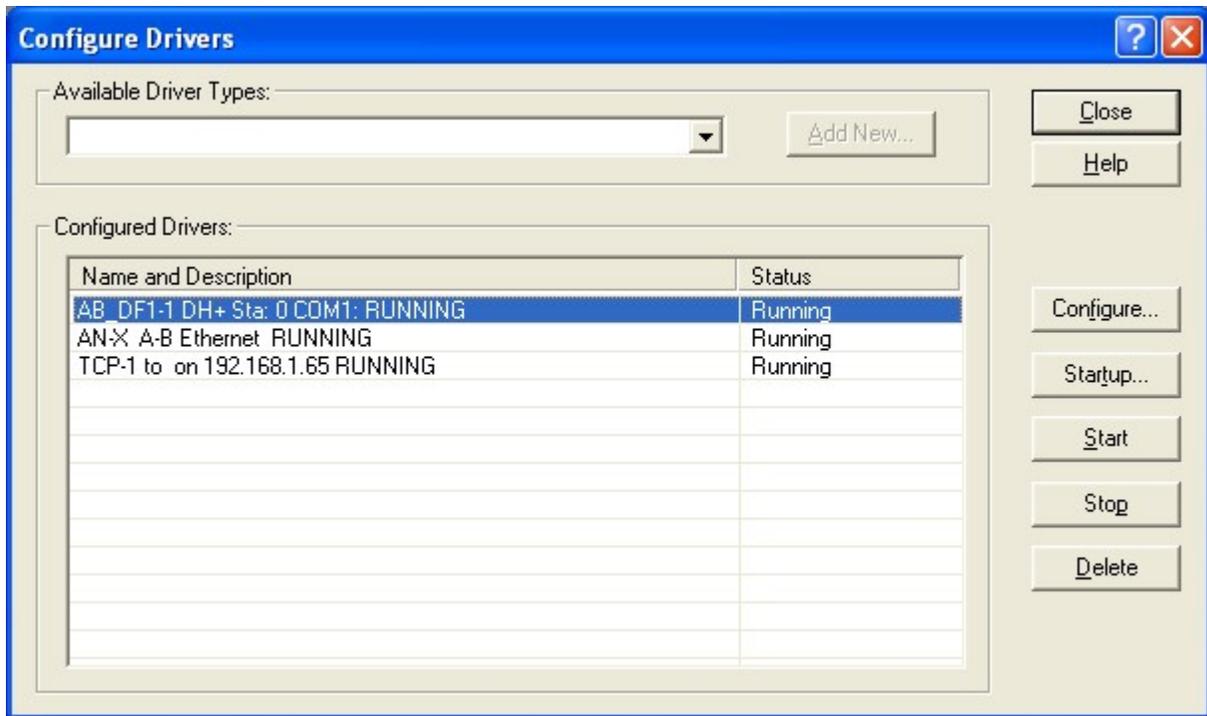
6. Click *Close*

Using the Programming Software

To go online with programming software such as RSLogix 5, browse the network and go online.

Multiple Programmer Access

Multiple computers can connect to a Data Highway Plus network through a single AN-X4-AB-DHRIO (DH+).

Multiple applications on a computer can connect to a Data Highway Plus network through the same AN-X4-AB-DHRIO (DH+).

Using DDE/OPC and Unscheduled Messages

DDE/OPC

You can use a DDE or OPC server, such as RSLinx, to access data using the AN-X4-AB-DHRIO (DH+).

From the Ethernet side, the AN-X4-AB-DHRIO (DH+) looks like a 4-slot ControlLogix rack with a 1756-ENET module in slot 0 and a 1756-DHRIO in slot 1.

Configure the AN-X module as you would a ControlLogix rack with a 1756-ENET Ethernet module and 1756-DHRIO Data Highway Plus module.

Example: RSLinx

To configure a topic in RSLinx to access data using the AN-X4-AB-DHRIO (DH+):

1. Create a new topic. From the main menu select *DDE/OPC/Topic Configuration*. Click *New* and give the topic a name.

2. For the *Data source*, browse the path to the destination device and click *Apply*.

3. On the Data Collection tab, check that the *Processor Type* is set to the correct type. Check *Polled Messages* and select an appropriate update rate. Leave everything else unchecked. Click *Apply*.

4. You do not need to set anything on the *Advanced Communication* tab.

5. Click *Done* to complete the topic configuration.

You should now be able to access data using any DDE or OPC client capable of communicating with RSLinx.

Sending Unscheduled Messages

You can send messages from devices such as a ControlLogix to destinations on Data Highway Plus using MSG instructions. For example, you can send messages to read or write data on a PLC-5 or SLC 5/04.

To initiate messages from the Data Highway Plus side, refer to page 30.

Example: Sending Messages to a PLC-5

In this example, a ControlLogix is using the AN-X to send PLC-5 Typed Read commands that read 100 integers from file N7:0 in a PLC-5 at address 77 octal on Data Highway Plus.

1. Add an AN-X to the Ethernet associated with the local 1756-ENBT or equivalent module, as a 1756-ENET/A. Give it a Name and set the IP address to the address of the AN-X.
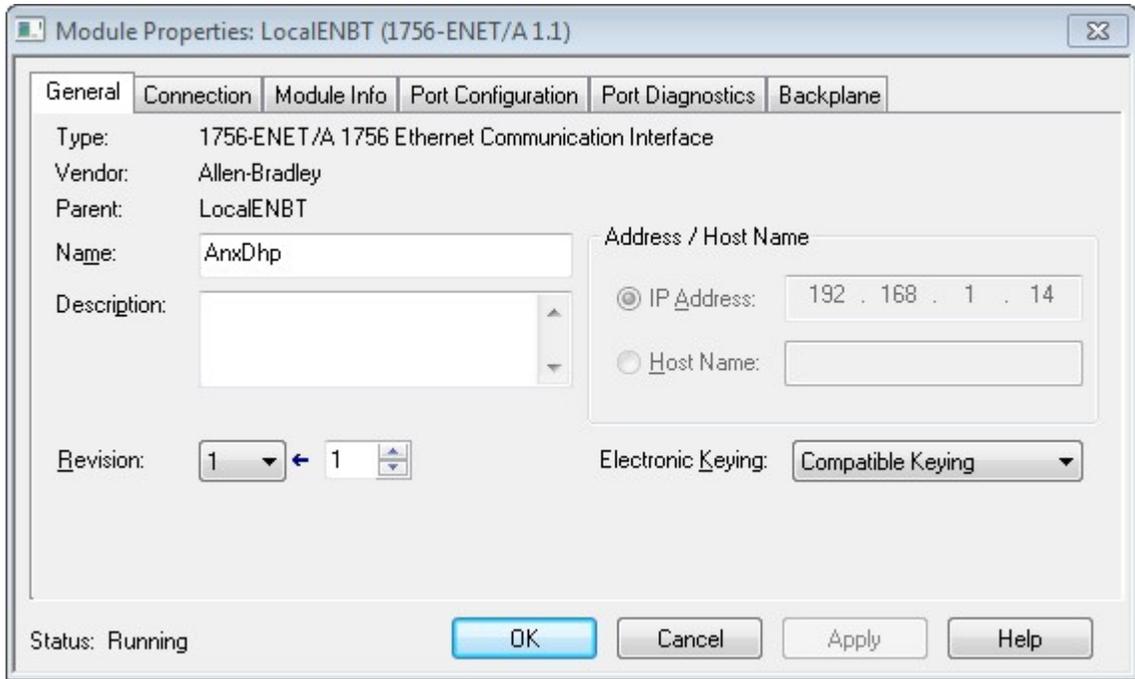
2. Add a MSG instruction in the ControlLogix, along with any logic required to control it

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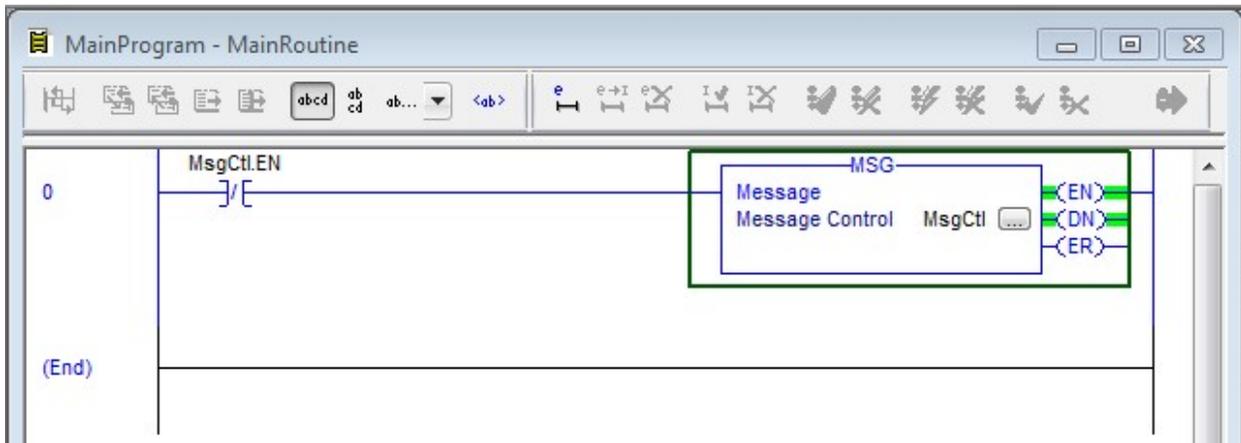
3. Configure the MSG instruction.

On the *Configuration* tab, select the *Message Type* (PLC5 Typed Read), *Source Element* (N7:0), *Number of Elements* and *Destination Element*.

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On the Communication tab:

For the path, type or browse the AN-X name, followed by 1,1 (backplane and slot number of the emulated 1756-DHRIO)

For the communication path, select DH+. Set the Channel to A and the destination node to the PLC-5 Data Highway Plus station address. Set the other fields as shown.

Message Queues

AN-X uses two transmit message queues to improve the responsiveness of write messages. The queues are identified as queue 0 and queue 1.

Write messages are placed in queue 1, which has a higher priority. When AN-X gets the Data Highway Plus token, it prioritizes queue 1, but ensures queue 0 messages are sent in a timely fashion as well.

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Using DHP-HMI IP Aliasing

Overview

AN-X4-DHP supports IP aliasing, which makes it possible for Ethernet PanelViews or other clients that don't support CIP routing to access PLC-5s or SLCs on Data Highway Plus.

The AN-X can be configured to respond as more than one IP address, each of which is mapped to a different Data Highway Plus station address.

IMPORTANT!   Use IP Aliasing only if the AN-X is using a static IP address.

Client applications can access Data Highway Plus stations by sending messages to these aliased IP addresses. AN-X then sends the messages to the DHP station associated with the aliased IP address and returns the replies to the appropriate Ethernet sender.

If multiple computers talk through an AN-X to the same PLC, the AN-X keeps track of who sent the message and sends the reply to the appropriate Ethernet IP address.

Aliased IP addresses are configured in a simple text file, which is sent to the AN-X using the web interface.

Aliased IP addresses must be on the same subnet as the AN-X base IP address configured on the *Configuration/AN-X Configuration* page of the web interface. The upper three bytes of the alias IP address must be the same as the corresponding three bytes of the AN-X base IP address.

Aliased AN-X IP addresses must not conflict with other devices on the Ethernet network.

The AN-X Data Highway Plus diagnostic counters increment for all messages through the AN-X.

If the destination Data Highway Plus station is offline, AN-X returns STS error 02, destination did not acknowledge.

Ethernet/IP on Aliased Addresses

The AN-X-DHP firmware supports two Ethernet protocols that allow access to Data Highway Plus, an older Allen-Bradley protocol called Client Server Protocol (CSP) and Ethernet/IP.

Some devices (HMIs etc.) don't support CSP, they support only Ethernet/IP.

If the device supports Ethernet/IP with CIP routing, it will work using the AN-X base address and no aliasing is needed.

If the device supports Ethernet/IP but does not support CIP routing, we need both Ethernet/IP and IP alias to DHP mapping for the AN-X to respond to Ethernet/IP requests on aliased IP addresses.

To enable this, add the keyword "AliasEnetIP" to the alias configuration file, configure appropriate IP aliases and transfer the modified configuration file to the AN-X.

This is a global setting and affects all aliased addresses. The only reason not to enable it all the time is that some devices may get confused since the AN-X reports back as an ENET module.

You can connect to a device at an aliased address using Ethernet/IP and CSP at the same time if the HMI client supports both protocols.

Alias Configuration File

Create a text file for the IP alias configuration.

Each line is of the form

```
AliasIP x.x.x.13 -> Dhp 0o77
```

and maps an IP address to a Data Highway Plus address.

Enter the IP address exactly as shown, with the three x's.

IMPORTANT! AN-X can alias only on the lower byte of the IP address, even on larger subnets. On smaller subnets, limit the lower byte to the maximum value for the subnet.

Only the final digit in the IP address can be specified. It must be from 1 to 255. For example, if the AN-X base IP address is 192.168.1.12 and the aliased address is x.x.x.13, then the aliased IP address is 192.168.1.13

The Data Highway Plus station address can be entered in octal by preceding the numerical value by 0o (zero and lower case oh). In the example shown the address is 77 octal.

There can be up to 63 alias definitions in the configuration file.

Anything after a semicolon, either at the end of a line or on a line by itself, is treated as a comment.

TIP Allocate one IP address for one DHP address

Configure Aliases

Use *Automation Network/HMI IP Alias Configure* in the web interface to send a configuration file to the AN-X. Browse to select the filename, then click *Send File to AN-X* to transfer the file.

You must reboot the AN-X to use the new configuration.

IMPORTANT! Aliases are configured only after the AN-X restarts. Errors in the configuration file appear only after a restart.

Check the HMI IP Alias Log after the AN-X restarts to see if there are any errors.

To view the currently active configuration, use *Automation Network/HMI/IP Alias View* in the web interface.

Refer to page 42 for detailed information on using the web interface to configure aliases.

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Accessing Data

Use the following examples to create a connection using DHP-HMI IP aliasing.

Example: PanelView RSLinx Enterprise

Under Communication Setup:

1. Select Ethernet

2. Add a device

3. Select from Ethernet PLC devices a ControlNet PLC-5 similar to your target (not an Ethernet PLC!)

Example: RSLinx

Use the *Ethernet Devices* driver in RSLinx.

Add a device at the aliased IP address.

When you create a DDE/OPC topic, uncheck *Use Maximum Packet Size (Ethernet)* on the Data Collection tab in the DDE/OPC Topic Configuration

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Routing Messages from Data Highway Plus

AN-X can route messages from Data Highway Plus either to devices on Ethernet/IP or over Ethernet/IP to devices on another Data Highway Plus.

Routing is configured using a text file which contains:

- a local link id definition
- at least one routing definition

The AN-X distribution has technical notes with detailed examples of routing applications.

Local LinkID

The local LinkId is defined by a line with the keyword LocalLinkID followed by a number from 1 to 199

Example:

```
LocalLinkID 121
```

AN-X uses the Local Link ID is used to identify this particular Data Highway Plus network.

The Local Link ID must be unique for any path that Data Highway Plus messages from the AN-X take and it must always exist in the router configuration file.

You use the Local Link ID when you build a return path in bridging applications.

Routing Definitions

Each routing definition consists of a link id and a path.

Link ID

The link ID is a number from 0 to 199, which identifies the route.

LinkID 0 is a special case; it defines a default route.

If a Data Highway Plus station sends a local message to the Data Highway Plus address of the AN-X itself, the ANX uses the path defined with link ID 0 to route the message.

Multiple stations can send local messages to the AN-X. The AN-X sends the messages using the default route and returns the replies to the appropriate sender. If no default route has been defined, the AN-X returns an error.

A routing definition with Link ID 0 does not have to be included in the configuration.

Routing Path

The path consists of a series of keywords and parameters that route the message to the destination Data Highway Plus network or destination device.

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DH+ Router Key Words

Keyword	Description
LocalLinkID <dd>	Local Link ID, 1 - 199
Eth <d.d.d.d>	Ethernet Path Entry, followed by an IP address
PLCCSP <d.d.d.d>	Endpoint of path is an older CSP Protocol PLC. Must be followed by an IP address
Slot <d>	BackPlane Slot Entry, slot range 0-255
PORT <d> <d>	Manual CIP Port Path Entry, must be followed by exactly 2 parameters. Each parameter has range 0-255
CLX	Endpoint of path is a ControlLogix processor
PLC	Endpoint of path is an Ethernet/IP PLC-5 or SLC
DHA	Endpoint of path is channel A on a 1756-DHRIO
DHB	Endpoint of path is channel B on a 1756-DHRIO

Keywords are not case sensitive.

The first entry in a path must be either Eth or PlcCsp.

If a path begins with Eth, the final entry in the path must be one of CLX, PLC, DHA or DHB.

If a path begins with PlcCsp, it must be followed by the IP address of the destination device and nothing else.

Anything after a semicolon, either at the end of a line or on a line by itself, is treated as a comment.

Examples:

In these examples, the AN-X is at IP address 192.168.1.12, Data Highway Plus station address 37 octal and local Link ID 121.

Example 1

```
1 Eth 192.168.1.65 Slot 1 CLX
```

The routing definition uses link ID 1. It routes messages from the AN-X across Ethernet to IP address 192.168.1.65 (a 1756-ENBT), then to slot 1, which contains a ControlLogix processor.

Remote messages sent on Data Highway Plus to the AN-X using link ID 1 will use this path.

To send messages to a ControlLogix, you must first create a compatibility file using RSLogix 5000. Go offline, select Logic, then Map PLC/SLC messages. Enter a file number and the associated ControlLogix tag.

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Example 2

```
0 Eth 192.168.1.65 Slot 1 CLX
```

This path in this routing definition is the same as the previous example, but now the Link ID is 0. Local messages sent on Data Highway Plus to the AN-X station address (37) will by default use this path.

Example 3

```
15 Eth 192.168.1.57 PLC
```

The routing definition uses link ID 15. It routes messages from the AN-X across Ethernet to an Ethernet/IP enabled PLC-5 at IP address 192.168.1.57.

Remote messages sent on Data Highway Plus using link ID 15 will use this path.

Example 4

```
16 PlcCsp 192.168.1.58
```

The routing definition uses link ID 16. It routes messages from the AN-X across Ethernet to an older Ethernet PLC-5 that doesn't support Ethernet/IP, at IP address 192.168.1.58. It uses the older CSP Ethernet protocol.

Remote messages sent on Data Highway Plus using link ID 16 will use this path.

Example 5

```
2 Eth 192.168.1.65 Port 1 1 CLX
```

This routing definition uses link ID 2. The path is the same as in example 1, but instead of the Slot keyword, it uses Port, with parameters 1 1 (backplane and slot number).

It routes messages from the AN-X across Ethernet to IP address 192.168.1.65 (a 1756-ENBT), then across the backplane to slot 1, which contains a ControlLogix processor.

Remote messages sent on Data Highway Plus using link ID 2 will use this path.

Refer to Ethernet/IP documentation for detailed information on possible port values.

Example 6

```
122 Eth 192.168.1.14 Slot 1 DHA
```

This routing definition uses link ID 122.

It shows how to route messages through another AN-X at IP address 192.168.1.14, to a second Data Highway Plus. AN-X emulates a 4-slot ControlLogix rack with a 1756-ENET in Slot 0 and a 1756-DHRIO in slot 1. The emulated DHRIO has only channel A since the AN-X has only one Data Highway Plus network port.

This Link ID must match the Local Link ID of the second AN-X.

The second AN-X must have a routing table entry

```
121 Eth 192.168.1.12 Slot 1 DHA
```

to return replies to the original AN-X, which has local link ID 121.

Example 7

```
127 Eth 192.168.1.65 Slot 2 DHB
```

This routing definition uses link ID 127.

It shows how to route messages across Ethernet to a 1756-ENBT at IP address 192.168.1.65, across the backplane to a 1756-DHRIO in slot 2, and then to another Data Highway Plus network connected to channel B on the 1756-DHRIO.

You must use RSLinx to configure the 1756-DHRIO routing table with a return path to the originating AN-X at IP address 192.168.1.12 and local Link ID 121.

Right click on the 1756-DHRIO module and select Module Configuration, then select the Routing Table tab.

# Sample AN-X Router Configuration File

```
; AN-X-DHP Routing Table

LocalLinkID  121

0 Eth 192.168.1.65 Slot 1 CLX

1 Eth 192.168.1.65 Slot 1 CLX

122 Eth 192.168.1.14 Slot 1 DHA

132 PlcCsp 101.122.166.15

142 Eth 101.101.122.166 Slot 1 DHA
```

Configuring the Router Function on the AN-X

Use *Automation Network/Configure DH+ Router* in the web interface to send a configuration file to the AN-X.

Browse to select the file, then click the *Send File to AN-X* button to send the file to the AN-X.

The AN-X displays result of transmitting the file.

AN-X displays the result of the configuration. The upper pane shows the configuration file it downloaded. The lower pane shows the router configuration log. Always check the log after you configure the router to ensure there were no errors.

The Router Configuration log is also available by selecting *Automation Network/DH+ Router View*.

Viewing the Current Router Configuration

To view the current router configuration, select *Automation Network/DH+ Router View* in the web interface.

To retrieve the current router configuation from the AN-X, select *Automation Network/Configure DH+ Router* in the web interface, then right click on the *(right-click - save link as)* link and save the file.

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Sending Remote Messages Using AN-X Routing

SLC Remote Messages

The Data Highway Plus channel on the SLC must be configured to accept replies to remote messages from the AN-X.

1. In the Project tree, right click on *Controller/Channel Configuration* and select *Open*. Select the *General* tab.

2. In the Channel 1 area, enter the AN-X Local Link ID in the Passthru Link ID (dec) box.

3. Click OK.
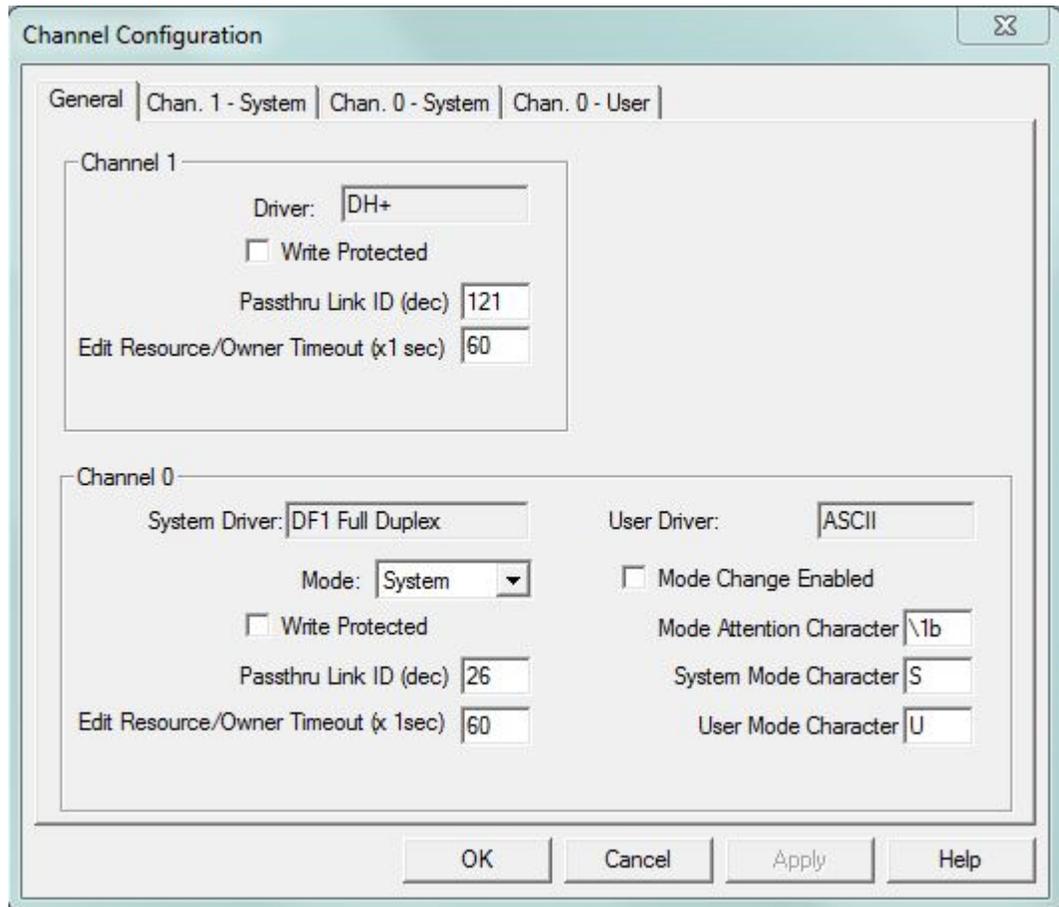
Now create a MSG instruction in the SLC.

In the *This Controller* area, select an appropriate Communication Command, Data Table Address and Size. Set the Channel to match the Data Highway Plus channel on the SLC.

In the *Target Device* area:

1. Set an appropriate timeout or accept the default

2. Enter the Data Table Address in the destination device

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3. Set the Local Bridge Address to match the Data Highway Plus address of the AN-X that is routing the message.

4. Set Local/Remote to Remote.

5. Set the Remote Bridge Address to 0

6. Set the Remote Station address to be the Data Highway Plus address of the destination device.

7. Set the Remote Bridge Link ID to be the Link ID of the routing table entry in the AN-X.

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PLC-5 Remote Messages

In the PLC-5, no pass thru is necessary; you create message instructions to use the routing definitions in the AN-X.

In the *This PLC-5* area, set:

- the Communication Command to an appropriate message type

- the Data Table Address to the address for the read or write on this PLC-5

- the Size in Elements to the numbers of words to read or write

- the Port Number to the Data Highway Plus port on the PLC-5

In the Target Device area, set:

- the Data Table address to the Data Table address on the remote device

- the Local DH+ Node to the address of the AN-X doing the routing

- Local/Remote to Remote

- the Remote Link Type to Data Highway

- the Remote Station Address to the Data Highway Plus station address of the remote device (if applicable). If the routing path ends in another Data Highway Plus network, the remote station address is used; otherwise, it is ignored.

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- the Remote Bridge Link ID to the Link ID for the path to the target from the AN-X routing table

Using the Web Interface

The AN-X module contains a webserver capable of communicating with standard web browsers.

Use the web interface to:

- set the Data Highway Plus station number, baud rate, and token bytes

- monitor Data Highway Plus diagnostic counters and the active station list

- view AN-X logs, including the Data Highway Plus traffic logs

- configure the Ethernet settings

- upload, select and remove firmware files on the AN-X

- configure aliases and routing

- archive the AN-X configuration

- update the AN-X firmware

- reboot the AN-X

It also contains contact information for support.

To access the web interface, start your web browser and type the AN-X IP address where you normally enter web addresses in the browser.
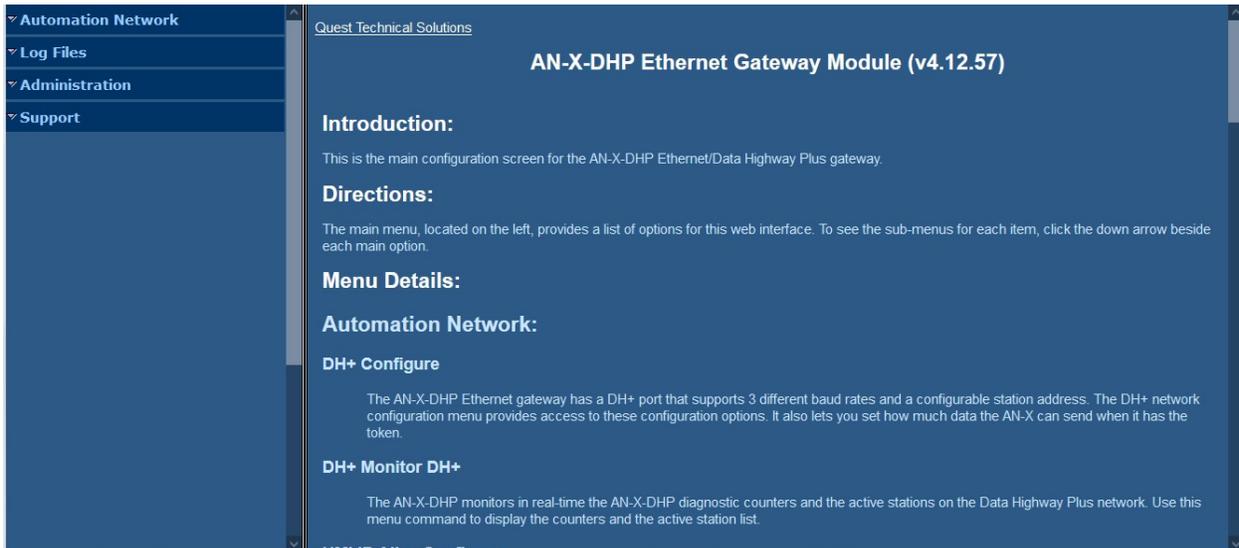
The left pane contains commands. Click on the arrows at the left of the main headings to expand or contract the sections.

The contents of the right pane depend on the current command being executed.

Data Highway Plus Configuration

Refer to page 16 for detailed information on Data Highway Plus configuration.

To configure the AN-X on Data Highway Plus:

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1. Select *Automation Network/Configure DH+ Network* to set the station number and baud rate.

AN-X-DHP Network Configuration

All configuration operations require a network restart and therefore result in a disruption in the Data Highway Plus connections. **These should not be performed while the process is in production mode.**

The AN-X Data Highway Plus network settings are configured using the form below.

Select the baud rate, one of 57.6, 115.2, or 230.4, to match the Data Highway Plus network the AN-X is connected to.

Select a station number, in the range 0 to 77 octal. The station address must not duplicate any other station on the network.

When AN-X gets the Data Highway Plus Token, if it has any messages in its queue, it always sends at least one message. If there are any more messages in the queue after it sends the first message, it can send up to a maximum of the number of bytes configured in Token Bytes (including the number of bytes in the first message).

The range is 0 to 300 bytes. The default is 250.

A setting of 0 disables sending more than 1 message per token.

57k :	●
115k:	○
230k:	○
Station:	22 Octal
Token Bytes:	24
	SUBMIT

2. Select the baud rate to match the baud rate of the network

3. Enter the station number in the Station field. It can range from 0 to 77 octal. 0 is not recommended as a Data Highway Plus station number.

4. Enter a value for Token Bytes.

5. Click the SUBMIT button to send the values to AN-X.

The default AN-X configuration is station 20 octal, baud rate 57.6 Kbaud, Token Bytes 250.

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Monitor Diagnostic Counters

To use the web interface to view the Data Highway Plus diagnostic counters and active station list on AN-X, select *Automation Network/DH+ Monitor*.

DHP Diagnostic Counters

Clear Counters   Refresh Counters   ✔ Auto Refresh

Counter	Value	Counter	Value
SOLICIT ACK BAD	0	ACK TIMEOUT	0
TRANSMIT RETRIES EXHAUSTED	0	TX QUEUE0	0
RX QUEUE	0	TX QUEUE1	0
NO MEMORY NAK REC'V	0	RECEIVED ACK/NAK TOO LONG	0
TOKEN PASS TIME OUT	0	TOKEN PASS RETRIES EXHAUSTED	0
TOKEN CLAIM SEQUENCE ENTERED	0	TOKEN CLAIMED	0
BAD CRC ON RECEIVED FRAME	0	ILLEGAL PROTOCOL NAKS SENT/DUP STN	0
RX NOISE	0	NO MEMORY NAKS SENT/ONLY STN	0
RECEIVED FRAME TOO SMALL	0	RECEIVED FRAME TOO LARGE	0
RETRY OF A FRAME RECEIVED	0	RECEIVE FRAME ABORTED	0
FRAMES SUCCESSFULLY SENT	17908	FRAMES SUCCESSFULLY RECEIVED	342
COMMANDS SUCCESSFULLY SENT	25149	REPLIES SUCCESSFULLY RECEIVED	25149
COMMANDS SUCCESSFULLY RECEIVED	0	REPLIES SUCCESSFULLY SENT	0
REPLY COULD NOT BE SENT	0		

Station List (Octal)

00	01	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	*22	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	76	77

The table at the top of the screen shows the Data Highway Plus diagnostic counters. The table at the bottom of the screen shows the active station list.

By default the counters and station list update once a second.

To update the display immediately, click *Refresh Counters* or click anywhere on the page.

To disable automatic updates, uncheck *Auto Refresh*. If you disable auto refresh and leave the DH+ Monitor screen and return to it, auto refresh will again be enabled.

To clear the counters, click *Clear Counters*.

The Data Highway Plus diagnostic counters are described on page 52.

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In the active station list, the AN-X is shown with an asterisk in front of the station number.

Configure DH+ HMI IP Aliasing

To configure Data Highway Plus IP aliasing, select *Automation Network/Configure DH+ HMI IP Alias*.
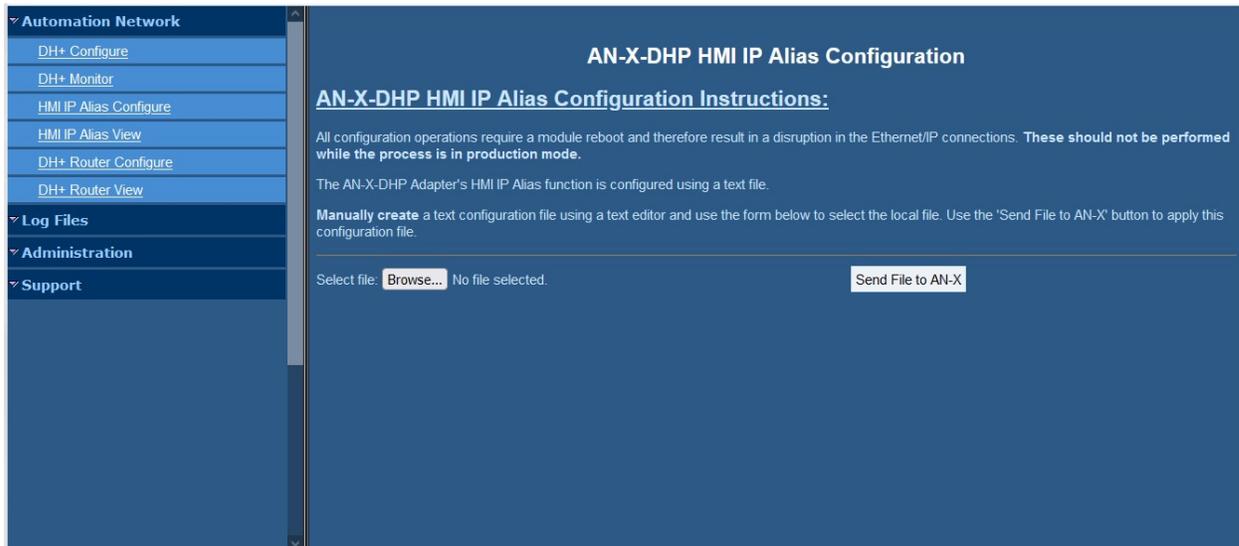
Details of the configuration file format are found on page 27.

Browse to select the file, then click the *Send File to AN-X* button to send the file to the AN-X.

The AN-X displays the result of sending the file.

You must reboot the AN-X to use the configuration. Click the Reboot link at the top of the page to restart the AN-X.

After rebooting, use *Automation Network/HMI IP Alias View* to view the configuration file that was downloaded and the configuration log to check for errors.

View IP Alias File

To view the IP alias file, select *Automation Network/HMI IP Alias View*.

The upper pane shows the most recently downloaded alias configuration file.

It may be different from the active alias configuration if the AN-X has not been rebooted since the file was sent.

Use the Link button to upload the configuration file to your computer.

The lower pane shows the most recent configuration log. Again, it will only be the active configuration if the AN-X has been rebooted since the configuration file was sent.

Always check the configuration log after downloading an alias configuration file and restarting.

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Configure DH+ Router

Configuring the router disrupts any current Ethernet traffic on the AN-X and should only be done when the AN-X is in production mode.

To configure Data Highway Plus IP routing, select *Automation Network/DH+ Router Configure*.

Browse to select the file, then click the *Send File to AN-X* button to send the file to the AN-X.

AN-X displays the result of the configuration. The upper pane shows the configuration file it downloaded. The lower pane shows the router configuration log. Always check the log after you configure the router to ensure there were no errors.

The Router Configuration log is also available by selecting *Automation Network/DH+ Router View*.

Log Files

AN-X maintains various logs to record diagnostic and error messages. Use the *Log Files* menu in the web interface to view these logs.

In all cases except the Alias Log and the System Info logs, when the current log file becomes full, AN-X renames it so you can access it as the previous log file.

Ethernet/IP Log

The *Ethernet/IP Log* shows messages and errors associated with Ethernet/IP and Data Highway Plus operations that are initiated from Ethernet (base IP address).

Ethernet AB/CSP/HMI Log

The *Ethernet AB/CSP/HMI Log* displays messages and errors associated with AB Ethernet CSP and Data Highway Plus operations that are initiated from Ethernet (aliased IP addresses).

DH+ Router Log

The *DH+ Router Log* displays runtime messages and errors associated with messages initiated on Data Highway Plus and routed to Ethernet using the DH+ router function (Ethernet/IP or CSP).

DH+ Traffic Logs

There are three logs that can be used to measure total Data Highway Plus network traffic and the traffic on individual stations.

The logs are:

- the Data Highway Plus Total Traffic Log
- the Data Highway Plus Station Traffic Log
- the Data Highway Plus Response Traffic Log

In each log, the percentages are the ratio of the number of bytes to the total bytes that could be sent in the time period at the current baud rate.

The sum of the station percentages should be approximately equal to the total percent.

The numbers are based on 6 second samples.

DH+ Total Traffic Log

The DH+ Total Traffic Log shows the percentage of network time on the local DH+ being used by all stations. It measures the overall loading of the network. The maximum possible loading is about 75%. The rest of the network time is used for interpacket spacing, ACKs/NAKs, token passing, and soliciting new stations coming online.

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Each sample consists of a sample serial number, the text 'Tot', the total traffic percentage, and a text graphic representing the percentage.

The serial numbers can be used to identify which of the two rotating logs is currently active and also to correlate entries with Station and Reply logs.

The text graphics show one = sign for each 5 percent.

DH+ Station Traffic Log

The DH+ Station Traffic Log shows the percentage of network time used for the commands from each station plus the percentage of network time used by responses to those commands. It measures the amount of network traffic (commands and corresponding replies) each station is creating. It is useful to identify which stations are creating the most traffic on the network.

Each sample consists of:

- the text 'Stn' and a sample serial number

- a list of stations and its station percentage, along with a text graphic representing the percentage

The serial numbers can be used to identify which of the two rotating logs is currently active and also to correlate entries with Total Traffic and Reply logs.

The text graphics show one = sign for each 5 percent

DH+ Response Traffic Log

The DH+ Response Traffic Log shows the amount of network time used by each station in sending responses to messages from other stations. It measures the amount of network traffic each station is generating in response to commands from other stations. It is useful for identifying nodes that are heavily loaded by commands from other nodes.

Each sample consists of:

- the text 'Rsp' and a sample serial number

- a list of stations and its response percentage, along with a text graphic representing the percentage

The serial numbers can be used to identify which of the two rotating logs is currently active and also to correlate entries with Total Traffic and Station logs.

The text graphics show one = sign for each 5 percent

Traffic Logs Examples

In this example, station 0 is a PLC-5, station 1 is a SLC-5/04, station 37 is an AN-X and station 77 is a 1756-DHRIO.

The PLC-5 and SLC are sending messages to each other. A ControlLogix is reading stat from both the PLC-5 and SLC through the 1756-DHRIO. A computer running RSLinx is reading diagnostics from the PLC-5 and SLC through the AN-X.

```
Total Traffic Log
600 Tot 71% [==============
```

```
601 Tot 72% [==============
602 Tot 71% [==============
603 Tot 72% [==============

Station Traffic Log
 Stn 600
00 21% [====
01 23% [====
37 10% [==
77 16% [===
 Stn 601
00 19% [===
01 22% [====
37 13% [==
77 17% [===
 Stn 602
00 19% [===
01 20% [====
37 12% [==
77 19% [===
 Stn 603
00 20% [====
01 21% [====
37 12% [==
77 18% [===

Response Traffic Log
 Rsp 600
00 42% [=======
01 22% [====
77  0% [
 Rsp 601
00 41% [=======
01 24% [====
77  0% [
 Rsp 602
00 42% [=======
01 22% [====
77  0% [
 Rsp 603
00 41% [=======
01 24% [====
77  0% [
```

Even though there are just 4 stations on the network, the network is almost saturated. The total traffic log shows that the total traffic is over 70%, near the practical maximum of about 75%.

Adding more messages will likely slow down existing traffic.

System Info Log

The *System Info Log* records informational messages during AN-X startup and normal operation. This is mostly used by technical support and does not contain information useful to the end user.

View All Logs

Use *View All Logs* to list and view all the AN-X logs. To view a log file, click on the file name.

Administration Menu

The *Administration* menu contains items used to configure, control and update the AN-X.

AN-X IP Configuration

Use *Administration/AN-X IP Configuration* to set the AN-X Ethernet properties.

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The top of the screen shows the serial number and MAC Address of the AN-X4 being configured.

To configure Ethernet on the AN-X, check DHCP, Static or Factory.

DHCP

If the AN-X4 finds a DHCP server on the network, it obtains an IP address and other network parameters (netmask and default gateway) from the DHCP server.

To find the address assigned, you have to look at the DHCP server.

When you submit the changes, if the AN-X4 does not find a DHCP server, it reverts to the default link local address 169.254.42.84 and repeatedly flashes the MS LED 3 times red followed by a pause.

Static IP Address

If you select static IP address, enter:

• the IP address for the AN-X.

• the netmask for the AN-X

• the default gateway for your network.

You must enter a valid default gateway address even if there is no device at the gateway address on the network.

Factory

Select Factory to return AN-X to its initial state as shipped. In Factory mode, it waits 10 seconds for a DHCP server to assign it an IP address. If it fails to obtain an IP address, it reverts to a static IP address of 192.168.0.246.

In Factory mode, AN-X cannot connect to the Data Highway Plus network.

If, after AN-X has reverted to the static address and a DHCP server comes online, AN-X obtains an IP address from the DHCP server.

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Hostname

Enter a *Hostname* for the AN-X4. This name is used internally by AN-X and may be used to identify the AN-X if you have a DNS server on your network. The name can be from 1 to 30 characters long. The default hostname is ANXxxxxxx, where xxxxxx is the serial number of the AN-X module.

AN-X Firmware Select

Use *Administration/AN-X Firmware Select* to select a firmware (*.qtf) file the AN-X is to run from the list. AN-X builds the list from the firmware files on the microSD card that are compatible with the AN-X hardware.

Click SUBMIT to run the firmware you have selected. You must REBOOT the AN-X to run the firmware you selected.

AN-X Firmware Upload

Use *Administration/AN-X Firmware Upload* to upload a firmware (*.qtf) file to the AN-X. Uploading a qtf file automatically selects the file. You must REBOOT the AN-X to run the firmware you uploaded.

AN-X Firmware Remove

Use *Administration/AN-X Firmware Remove* to remove a firmware (*.qtf) file from the AN-X.

You cannot remove the file that is currently running on the AN-X.

AN-X Archive

Use *Administration/AN-X Archive* to create an archive that contains the current AN-X configuration and logs, for use by technical support.
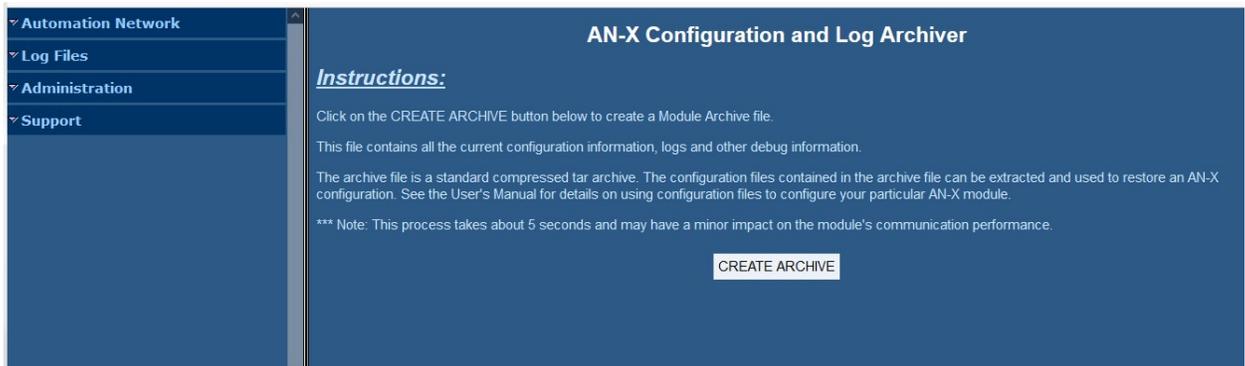
Click the CREATE ARCHIVE button to create the archive file. There is a slight delay while AN-X builds the archive file.

Once AN-X has built the archive file it displays a second web page. Click the *Download Archive File* button to save the file to your computer.

AN-X Kernel Page

Use *Administration.AN-X Kernel Page* to display the version of the Linux kernel on the AN-X.

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This page is also displayed if the AN-X fails to load firmware at startup. If that happens, use *Administration/Firmware Select* to select a firmware file, then REBOOT the AN-X.

AN-X Module REBOOT

Use the *Administration/AN-X Module REBOOT* to restart the AN-X module, for example, after changing Ethernet parameters or after updating firmware.

Support Menu

Contact Information

The Support contains contact information and links if you need help with the AN-X.

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Troubleshooting

LEDs

The AN-X4-AB-DHRIO has LEDs that indicate the state of the Ethernet connection, the connection to Data Highway Plus network status (NS) and the overall module status (MS).

Ethernet LEDs

There are two LEDs that indicate the state of the Ethernet connection, above the Ethernet connector.

The yellow LED is on if the link is running at 100 Mbits/second and is off otherwise.

The green LED is off if the link is inactive and is on if the link is active. If activity is detected, the link blinks and continues blinking as long as activity is present.

If the AN-X4 is not connected to Ethernet, both LEDs are off.

MS LED

The MS LED is used by the AN-X operating system and software to indicate the state of operations and errors.

It should be used in conjunction with the logs to locate the cause of problems.

In the following, red/3 means three red flashes followed by a pause.

Powerup/Reboot

MS LED	NS LED	Meaning
RED	RED	Initial Boot Code / Secondary Program Loader (SPL)
YELLOW	RED	U-Boot
RED	RED	Kernel Starting
YELLOW/2	RED	Waiting for IP (DHCP) or invalid IPConfig.txt
YELLOW/3	RED	Factory Mode, could not find AN-X4-TEST-xx Firmware
YELLOW/4	RED	Firmware/FirmwareCfg.txt Not Found
YELLOW/5	RED	Firmware image in FirmwareCfg.txt Not Found
YELLOW/6	RED	Firmware Image Invalid (Bad ChkPat)
YELLOW/7	RED	Firmware Image Board ID Mismatch
YELLOW/8	RED	Startup Script Not Found
GREEN/2	OFF	Factory mode

Data Highway Plus Operation

MS LED	Meaning
YELLOW/9	DH+ Failed to start
RED/4	Router Server exited
RED/5	Ethernet/IP Server exited
RED/6	RED/6 Ethernet CSP Server exited
GREEN	No Ethernet Comm errors
RED/blink	Ethernet Comm Error - Check logs

NS LED	Meaning
GREEN	No DH+ errors
RED/blink	DH+ Comm Error - Check Diag Counters
YELLOW	DH+ - No other nodes
RED	DH+ Excessive errors
RED/YELLOW alternating	Duplicate station

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Data Highway Plus Diagnostic Counters

AN-X maintains Data Highway Plus diagnostic counters. Use *Automation Network/Monitor DH+ Network* in the web interface to view the diagnostic counters.

The diagnostic counters are:

Counter	Description
Solicit ACK Bad	Solicit ACK bad (not to AN-X, bad ACK value, or source is not the station AN-X solicited)
Transmit retries exhausted	AN-X retries messages up to 3 times (4 in total). If it still hasn't successfully sent the message, it discards the message and returns an error.
RX Queue	Number of messages in the AN-X receive queue
No memory NAK received	AN-X sent a message and got a no memory NAK in response.
Token pass timeout	AN-X passed the token but there was no response from the destination in the timeout period. AN-X retries the token pass up to 3 times.
Token claim sequence entered	AN-X increments this counter when there is no network activity (no token passing, etc.). It then starts soliciting for stations to pass the token to.
Bad CRC on received frame	AN-X received a frame with a bad CRC. Usually caused by cabling and termination.
RX noise	If AN-X detects a carrier on the network and then the carrier disappears before a frame starts, it increments this counter. **** changed
Received frame too small	AN-X received a frame smaller that the minimum possible size. **** changed
Retry of a frame received	AN-X received a frame with the same transaction number as a previous frame. It discards the duplicate frame.
Frames successfully sent	16-bit counter. AN-X increments this counter when it sends a message (command or reply) successfully. It also increments the commands successfully sent or replies successfully sent counter.
Commands successfully sent	16-bit counter. AN-X increments this counter when it successfully sends a command to another station.
Commands successfully received	16-bit counter. AN-X increments this counter when it receives a command from another station.
Reply could not be sent	AN-X increments this counter when it receives a command but could not deliver the reply.
ACK timeout	AN-X was expecting an ACK in response to a message but nothing

Counter	Description
	was received in the timeout period. Sometimes caused by sending messages to stations that do not exist.
TX Queue 0	Number of messages in AN-X transmit queue 0
TX Queue 1	Number of messages in AN-X transmit queue 1 (write messages)
Received ACK/NAK too long	AN-X was expecting an ACK and received a frame that was longer than 3 characters instead.
Token pass retries exhausted	AN-X retries the token pass up to 3 times. If it still fails, it increments this counter, removes the destination from its active station list, and tries to pass the token to its successor.
Token claimed	Not used.
Illegal protocol NAKs sent/ Dup Stn	If AN-X receives a message that is shorter than the minimum length (6 characters), it increments this counter and sends an illegal protocol NAK to the sender. It also increments this counter if it is a duplicate station
No memory NAKs sent Only Stn	If AN-X receives a message and is out of buffer space, it increments this counter and sends a no memory NAK to the sender. It also increments this counter if it is the only station
Received frame too large	AN-X received a frame that was larger than the maximum possible size (308 bytes, including the 2 CRC bytes).
Receive frame aborted	AN-X increments this counter when it receives a message that doesn't finish, either because the source aborted the message or because the source went offline.
Frames successfully received	16-bit counter. AN-X increments this counter when it receives a message (command or reply). It also increments the commands successfully received or replies successfully received counter.
Replies successfully received	16-bit counter. AN-X increments this counter when it receives a reply to a command it sent to another station.
Replies successfully sent	16-bit counter. AN-X increments this counter when it successfully sends a reply to another station.

Counters are 8 bits except as noted in the table.

Counters roll over when they reach their maximum value, at 255 for 8 bit counters and 65535 for 16-bit counters.

The diagnostic counters are cleared when you reconfigure the Data Highway Plus network parameters on AN-X. They can also be cleared from the web interface.

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Updating the Firmware

The AN-X4 firmware files are supplied in files that begin with AN-X4 and have extension *qtf*.

AN-X4 can have multiple versions of the same firmware, for example, different versions of the the Data Highway Plus qtf. You can use the web interface to:

- download firmware files to the AN-X4
- select which version is to run
- remove firmware files using the web interface.

Run the command *Administration/Select AN-X Firmware* to select the file you wish to run.

WARNING!   Do not update firmware to the AN-X while applications that use the AN-X are running.

You must restart the AN-X4 to run the firmware that you selected or transferred to the AN-X.

WARNING!   It is essential that you do not disrupt power while updating firmware, especially maintenance firmware, to the AN-X4 or while the AN-X4 is restarting following a firmware update.

Interrupting power at some points in the update process could render the AN-X inoperative and it would have to be returned to the factory for reinitialization.

You can also copy firmware files to the directory /Firmware on the microSD card using a card reader in your computer. If you do so, you will also need to update the file FirmwareCfg.txt in the same directory to run the file you copied over. The contents of FirmwareCfg.txt must match exactly the name of one of the firmware files on the AN-X, including the version.

Example

AN-X4-AB-DHP.v4.12.54.qtf

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Specifications

Parameter	Specification
Function	Bridge between Ethernet and Data Highway Plus network
Maximum Power Consumption	240 mA at 12 VDC, 120 mA at 24 VDC
Maximum Power dissipation	2.9W
Environmental Conditions:	Temperature code T6
Operational Temperature	0-50°C (32-122°F)
Storage Temperature	−40 to 85°C (−40 to 185°F)
Relative Humidity	5-85% without condensation
Maximum altitude	2000 meters
Pollution degree 2	

Support

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