

**AN-X2-AB-DHRIO
Data Highway Plus
Communication**

User Manual



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

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

These warnings help to:

WARNING!

- 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-X2-AB-DHRIO (DH+)

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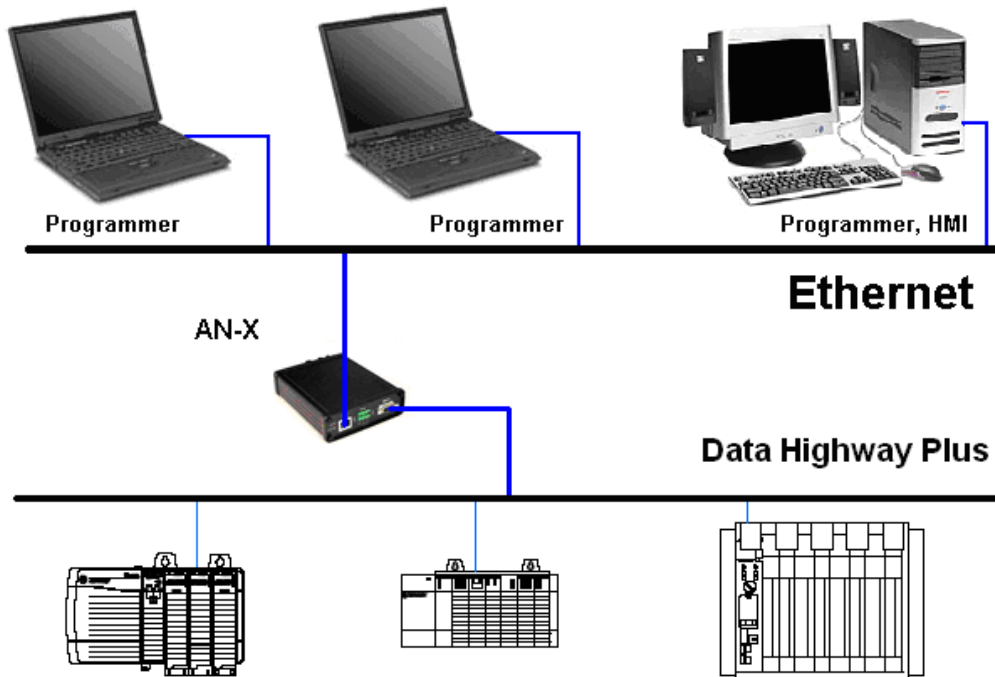
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AN-X2-AB-DHRIO Data Highway Plus Module



The AN-X2-AB-DHRIO module running Data Highway Plus (DH+) firmware connects a computer or other device to an Allen-Bradley Data Highway Plus network, using Ethernet.

The AN-X2-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 (requires firmware version 4.2.1 or above)
- can route messages from Data Highway Plus to destinations on Ethernet (requires firmware version 4.7.1 or above)

You can use the AN-X2-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 21 for details.

You can use a DDE or OPC server, for example RSLinx, on Ethernet to access Data Highway Plus using the AN-X2-AB-DHRIO (DH+). Refer to page 26 for details.

The AN-X2-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-X2-AB-DHRIO (DH+) module monitors the Data Highway Plus network 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, and
- the amount of network time used by each station in sending responses to other stations.

Refer to page 48 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 watchdog timer is implemented in the module's hardware. If the firmware does not kick the watchdog within the timeout period the watchdog times out and places the module into a safe fatal failure state.

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 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

Package Contents

- AN-X2-AB-DHRIO module
- CD containing software and documentation



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- microSD to SD card adapter

Using the microSD Card

The AN-X2 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.

An adapter is provided so you can insert the microSD card in an SD slot in your computer.

The microSD card must be present while the AN-X2 is running.

WARNING! Do not remove the microSD card while the AN-X2 is powered on!

If the AN-X2 is inaccessible from Ethernet because of its settings, or is in an unknown state, you can remove the card and edit the file config.txt. Refer to page 15 for details.

When you have finished editing the file, reinsert the card in the slot at the back of the AN-X2.

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-X2 to retrieve it .

AN-X2 Modes of Operation

There are two AN-X2 modes of operation:

- Maintenance mode. The AN-X2 runs the maintenance firmware at startup. It performs diagnostics (memory tests, etc) and copies any changes from the microSD card. If there are no errors, it starts the AN-X2 in production mode.
- Production mode. This is the normal runtime mode of operation.



Installation

Prevent Electrostatic Discharge

The module is sensitive to electrostatic discharge.

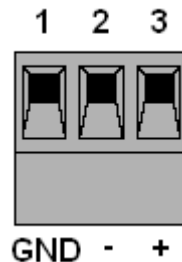
WARNING!

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



Left to right the pins on the power connector are chassis ground, negative voltage and positive voltage. Pin 1 is closest to the Ethernet connector.

The chassis ground should be connected.

Power consumption internally is 200 mA @ 12VDC or 100 mA @ 24VDC.

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

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.

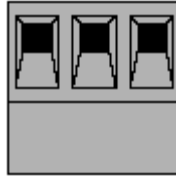
The network cable must be terminated with terminating resistors attached to the physical ends of the network, usually 82 ohm, but refer to Allen-Bradley documentation since some devices require 150 ohm terminators. There should be two and only two terminators on the Data Highway Plus network.

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



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1 sh 2

Line 1 on the AN-X is closest to the power connector.

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

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

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

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.

If you are connecting directly between a computer and AN-X, use a crossover cable, if necessary.

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.



CE Installations

If you are installing the AN-X2 in a location which requires CE, install the following ferrites or their equivalents on the cables:

- Steward 28A2024-0A2 on Ethernet cable close to module, one loop
- Steward 28A2024-0A2 on power cable
- Steward 28A2025-0A2 on DH+/RIO Cable

RIO



DH+



Usually, but not always, the wire colors are:

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

Configuration

The AN-X2-AB-DHRIO (DH+) module connects a computer or other device on Ethernet to a Data Highway Plus network.

Before you can use the AN-X2-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 fixed link-local address 169.254.42.84 (initial configuration only)

All AN-X modules are shipped with the link-local address 169.254.42.84.

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, since initially they will all be set to the same link-local IP address.

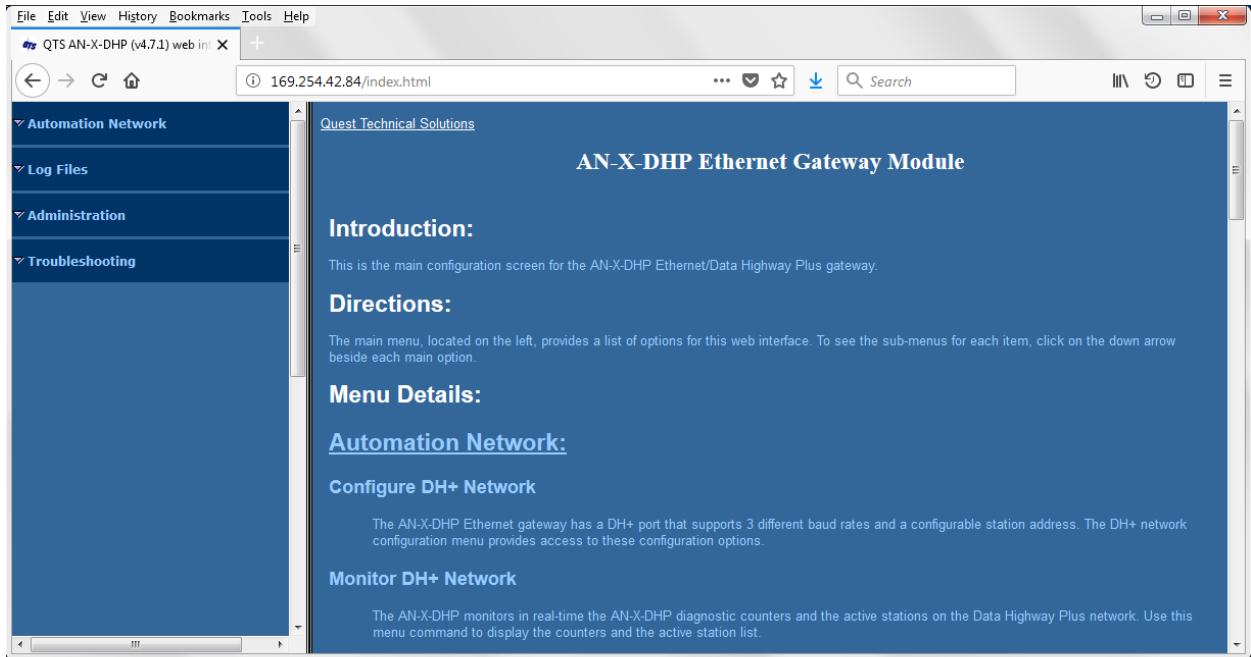
IMPORTANT! If you are connecting AN-X to an existing Ethernet network, consult the network administrator to obtain information about how you should configure AN-X or to obtain a static IP address for AN-X.

You configure the Ethernet properties using the web interface.

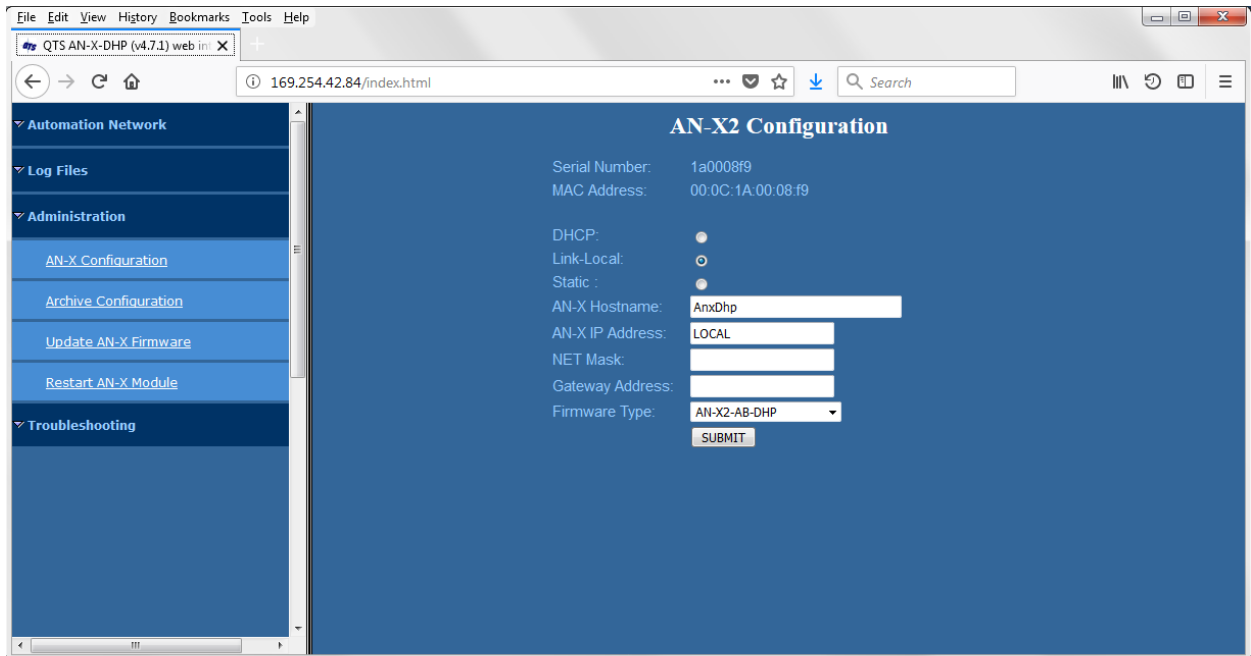
Start a web browser and enter the address 169.254.42.84

TIP The AN-X2 must be on the same subnet as the computer to use the link-local IP address. It cannot be connected through a router.





Select *Administration/AN-X Configuration*. The *AN-X2 Configuration* page appears.



At the top the screen shows the serial number and MAC address of the AN-X being configured. Check either DHCP or Static.



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DHCP

If the AN-X2 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-X2 does not find a DHCP server, it reverts to the default link local address 169.254.42.84 and repeatedly flashes the MS LED red 3 times 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.

Hostname

Enter a *Hostname* for the AN-X2. 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.

Firmware

Select the firmware the AN-X is to load from the list provided. AN-X builds the list from the firmware files on the microSD card that are compatible with the AN-X hardware.

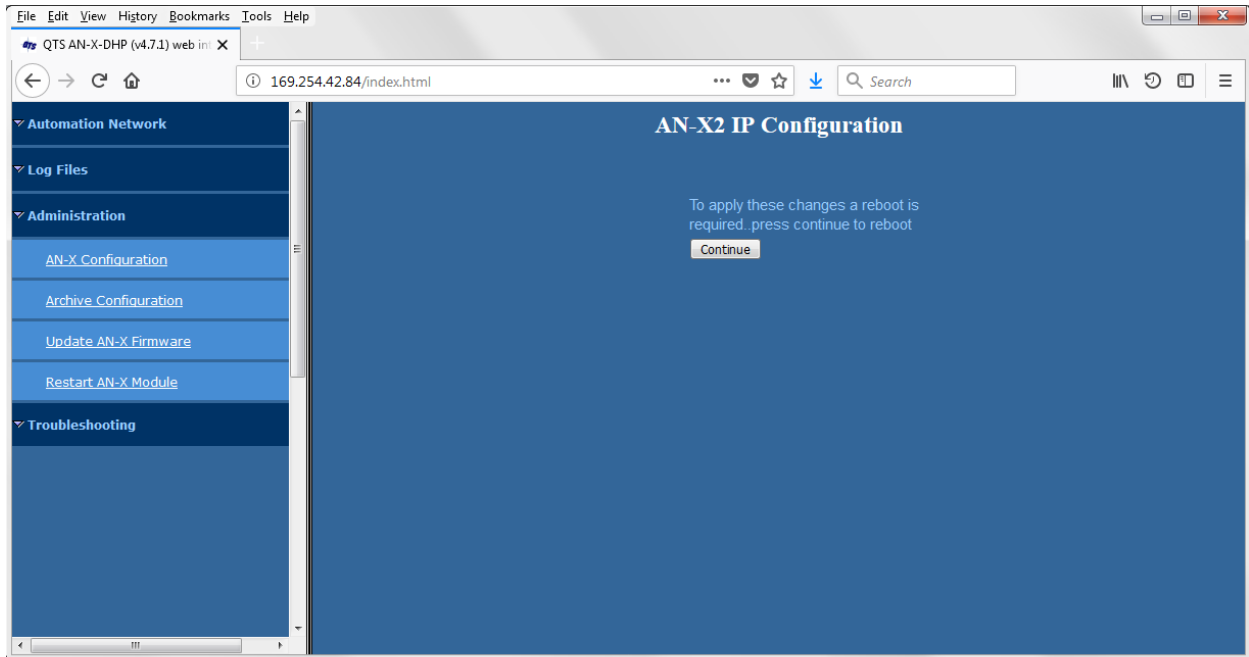
Refer to the technical note on the AN-X distribution for a description of the various firmware files available for the AN-X2-AB-DHRIO.

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**.





Click *Continue* to restart the AN-X2, then wait until the AN-X has completely restarted before continuing.

If you have changed the IP address, you will have to 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 `config.txt`, using a text editor such as Windows Notepad, to set the AN-X2 to the desired configuration.

The Configuration File `config.txt`

The Ethernet configuration and the name of the production firmware file to load are stored in the file `config.txt` on the microSD card.

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

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	LOCAL DHCP static IP address
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
Firmware	Firmware file to run at startup, must be present on microSD card

If you edit the file and AN-X2 finds an error during startup, it flashes an error code on the MS LED, see page 55.

Example config.txt files

Example: Link- Local IP address

```
IP: LOCAL
Hostname: ANX2Dhp
Firmware: AN-X2-AB-DHP
```

Example: DHCP

```
IP: DHCP
Hostname: ANX2Dhp
Firmware: AN-X2-AB-DHP
```

Example: Static IP address

```
IP: 192.168.1.14
NetMask: 255.255.255.0
DefGtwy: 192.168.1.1
HostName: ANX2Dhp
Firmware: AN-X2-AB-DHP
```

If the link-local address is not accessible...

Addresses 169.254.1.0 to 169.254.254.255 are reserved for use on a local network. AN-X2 modules are shipped set to the address 169.254.42.84 for initial configuration. This address is almost always accessible from a computer on the same local Ethernet as the AN-X.

If you cannot access the AN-X2 at address 169.254.42.84 using a web browser, there are two options for setting the AN-X Ethernet parameters.



Option 1: Edit config.txt on the SD card

Turn off power to the AN-X, remove the microSD card, insert it in a card reader in your computer, and edit the file config.txt. Refer to page 12 for details on the file contents.

Replace the microSD card in the AN-X and turn on the power. Confirm that you can access the AN-X at the address you set.

Option 2: Add a route to 169.254.42.84

Open a command prompt window and type

```
route print
```

The routing table appears

```
=====
Interface List
0x1 ..... MS TCP Loopback interface
0x2 ...00 18 8b c5 9d f7 ..... Broadcom 440x 10/100 Integrated Controller - Packet Scheduler
Miniport
=====
=====
Active Routes:
Network Destination        Netmask          Gateway          Interface        Metric
    0.0.0.0                0.0.0.0          10.10.0.1        10.10.0.20       20
   10.10.0.0            255.255.255.0    10.10.0.20       10.10.0.20       20
   10.10.0.20          255.255.255.255    127.0.0.1        127.0.0.1        20
  10.255.255.255      255.255.255.255    10.10.0.20       10.10.0.20       20
 64.215.255.122      255.255.255.255    10.10.0.1        10.10.0.20       20
   127.0.0.0            255.0.0.0        127.0.0.1        127.0.0.1         1
   169.254.0.0          255.255.0.0      10.10.0.20      10.10.0.20      20
   224.0.0.0            240.0.0.0        10.10.0.20       10.10.0.20       20
 255.255.255.255    255.255.255.255    10.10.0.20       10.10.0.20         1

Default Gateway:          10.10.0.1
=====
Persistent Routes:

None
```

If there is no entry in the network destination column that starts with 169.254.0.0 (highlighted above), add a route using

```
route add 169.254.0.0 mask 255.255.0.0 10.10.0.20 metric 20
```



where 10.10.0.20 is replaced with the IP address of the interface in your computer that is connected to the AN-X2.

Repeat the route print command and confirm that the table now has an entry similar to the one shown.

Now try pinging the AN-X2 at 169.254.42.84. You should be able to access it using a browser to set the desired Ethernet configuration.

When you add a route in Windows and you want it to be 'persistent', use the -p option:

```
route -p add 169.254.0.0 mask 255.255.0.0 10.10.0.20 metric 20
```

That puts the route in the registry and it is added at each start up.



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Data Highway Plus Configuration

Use the web interface to set the AN-X station number, the baud rate, 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.

In firmware versions 4.8 and above, 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 (including 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, in this case a write of 100 bytes. It can then send further messages from its queue up to a maximum of 150 bytes in total. 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.

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 handle. In that case, reduce the value of Token Bytes to limit how many messages AN-X is sending.

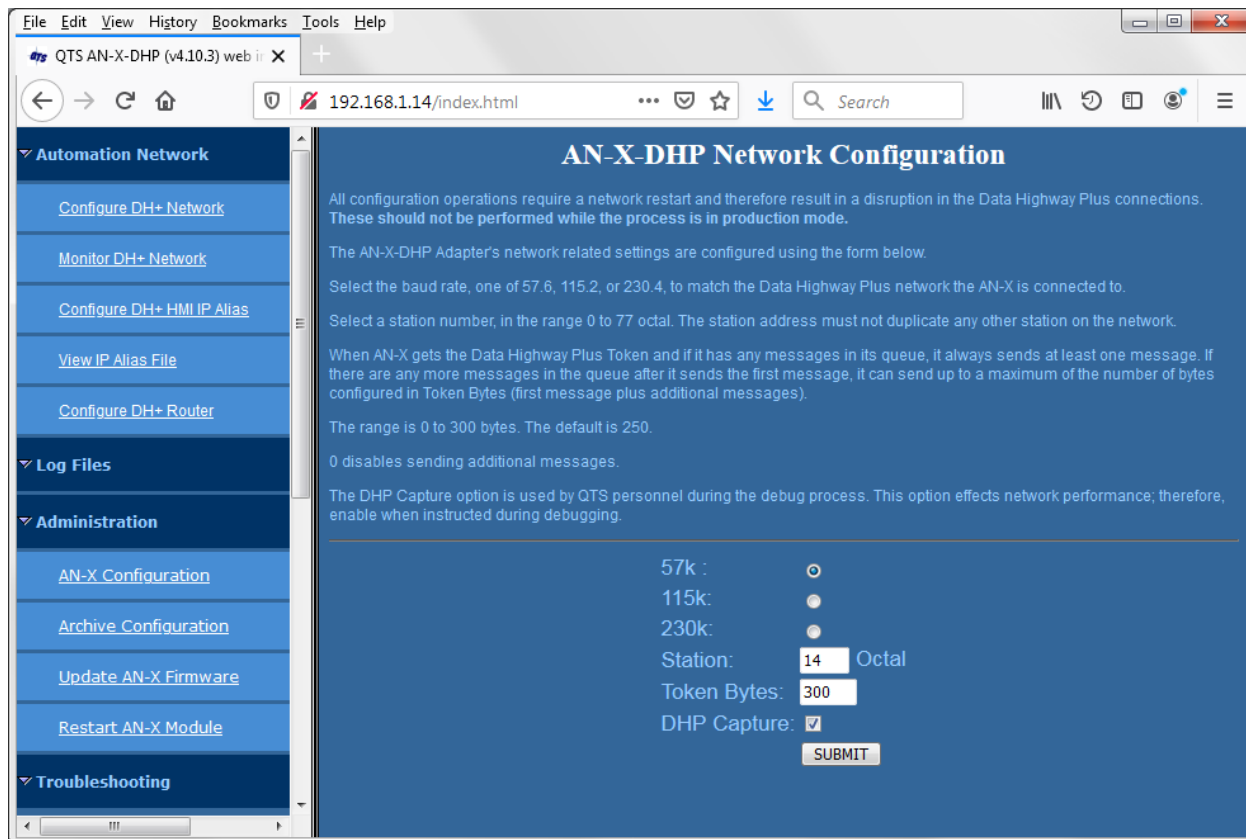
To configure the Data Highway Plus properties of AN-X:

1. Start your web browser and enter the AN-X IP address as the web address.
2. Select *Automation Network/Configure DH+ Network*.
3. Select the baud rate.
4. Enter the Data Highway Plus station number, in octal.



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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.

AN-X defaults to a station address of 20 octal and a baud rate of 57.6 Kbaud.

Select *Automation Network/Monitor DH+ Network* 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 be solid 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 be solid red and the AN-X will return status error 3 to any messages sent to it from Ethernet.

Beginning with version 4.10.1, AN-X supports capturing frames form Data Highway Plus. Check the box to turn on capture and click SUBMIT.

This option is intended to be used only in debugging and only at the direction of technical support personnel.

WARNING!

It should unchecked in normal operation as it may affect the performance of the AN-X on Data Highway Plus.



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 on Data Highway Plus through the AN-X, just as you would with a real 1756-ENET or equivalent Ethernet module and 1756-DHRIO.

Configuring the AN-X2-AB-DHRIO (DH+) in RSLinx

To use an AN-X2-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

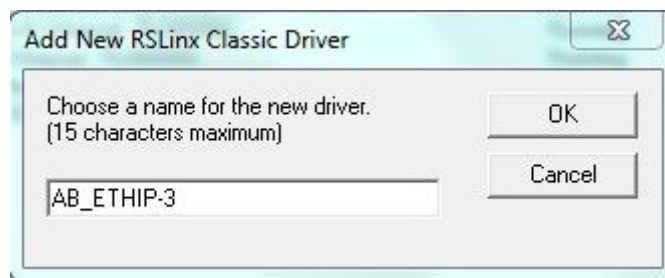
This driver requires AN-X2-AB-DHP firmware version 4.2.1 or above.

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-X2-AB-DHRIO (DH+) in RSLinx.

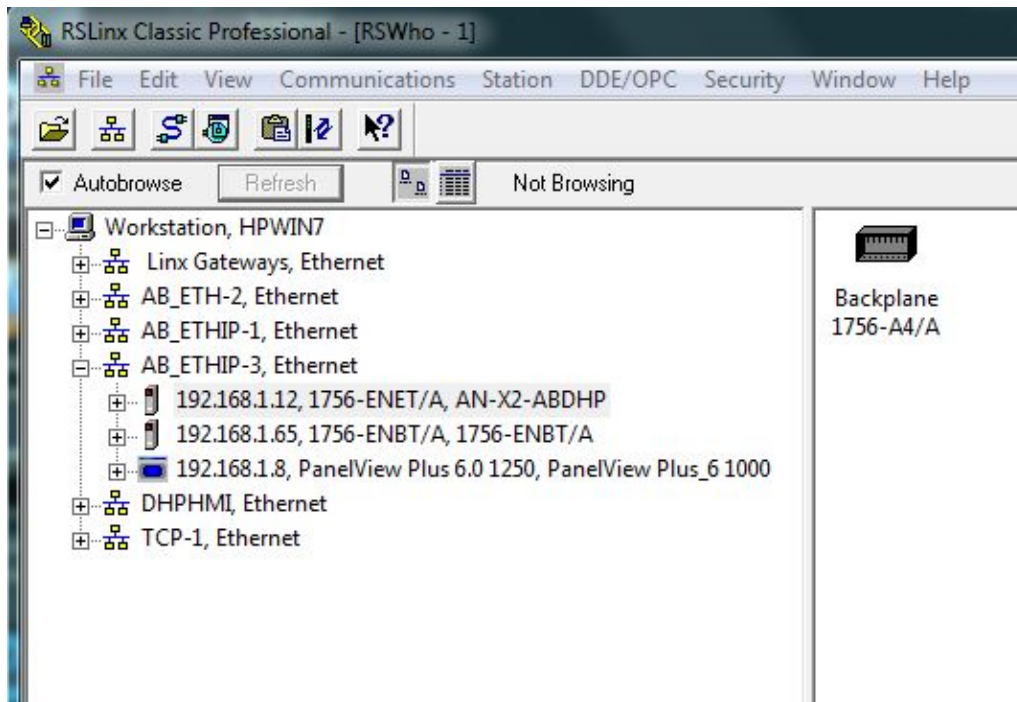
1. Select *Communications/Configure Drivers...*
2. From the list of *Available Driver Types:*, select *EtherNet/IP Driver* and click *Add New...*
3. Give the driver a name



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.



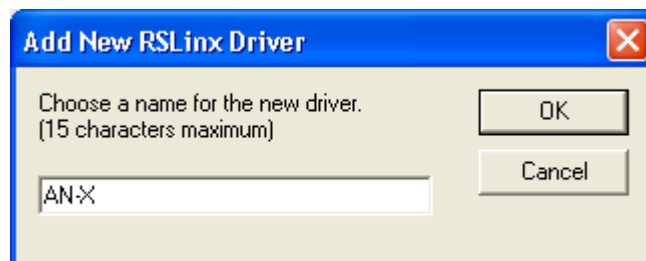


Remote Devices via Linx Gateway Driver

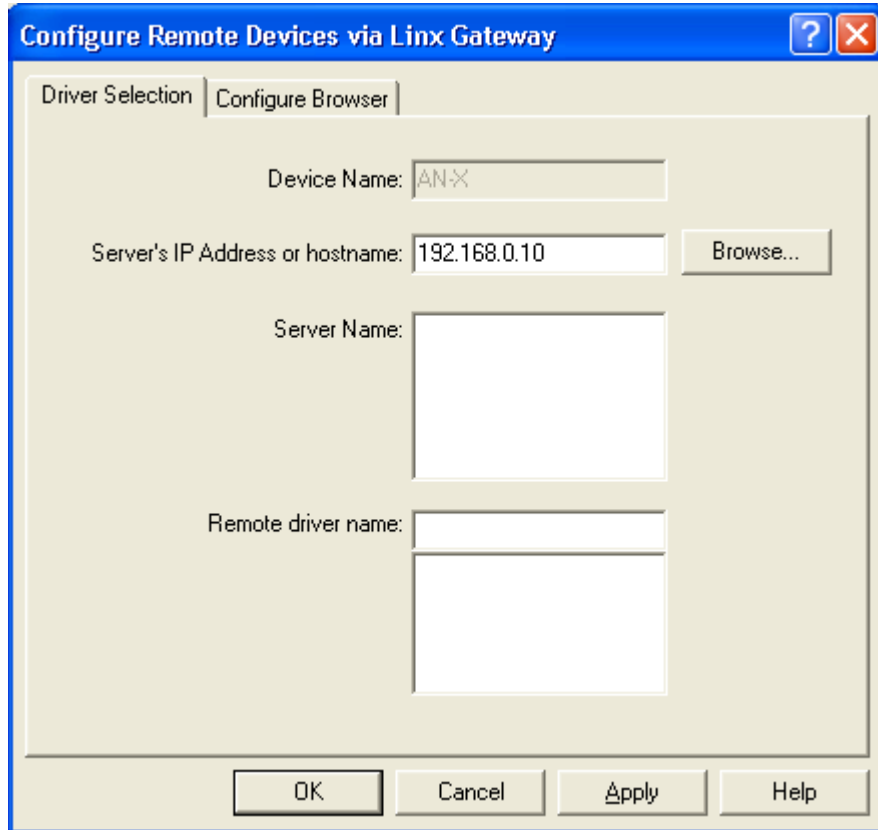
This driver will work for the AN-X base IP address but not for aliased IP addresses (see page 30). For aliased IP addresses, use the Ethernet Devices driver.

Use the following steps to configure the AN-X2-AB-DHRIO (DH+) in RSLinx.

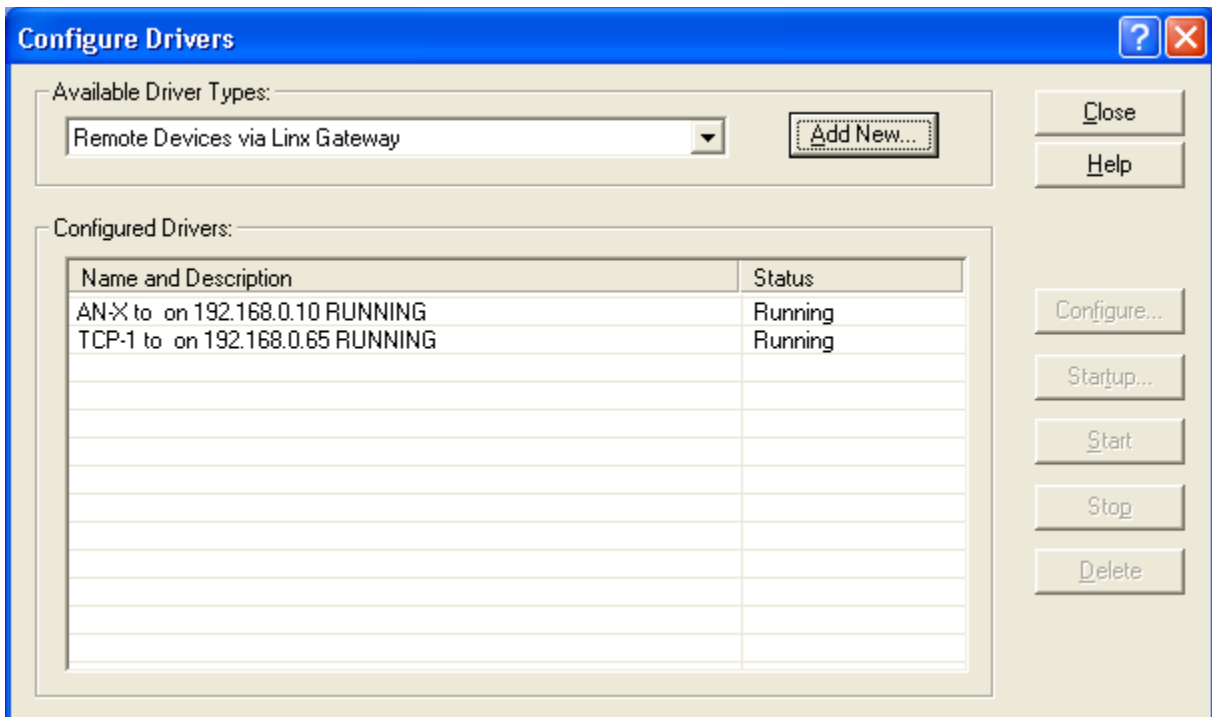
1. Select *Communications/Configure Drivers...*
2. From the list of *Available Driver Types:*, select *Remote Devices via Linx Gateway* and click *Add New...*
3. Give the driver a name.



4. For Server's IP Address or hostname: enter the IP address of the AN-X2-AB-DHRIO (DH+) and click OK.



5. Check that the driver has status Running



6. Click Close.

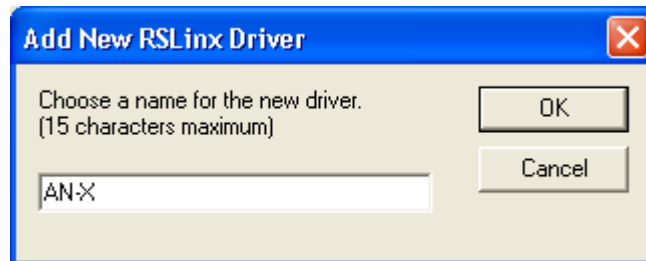


Ethernet Devices Driver

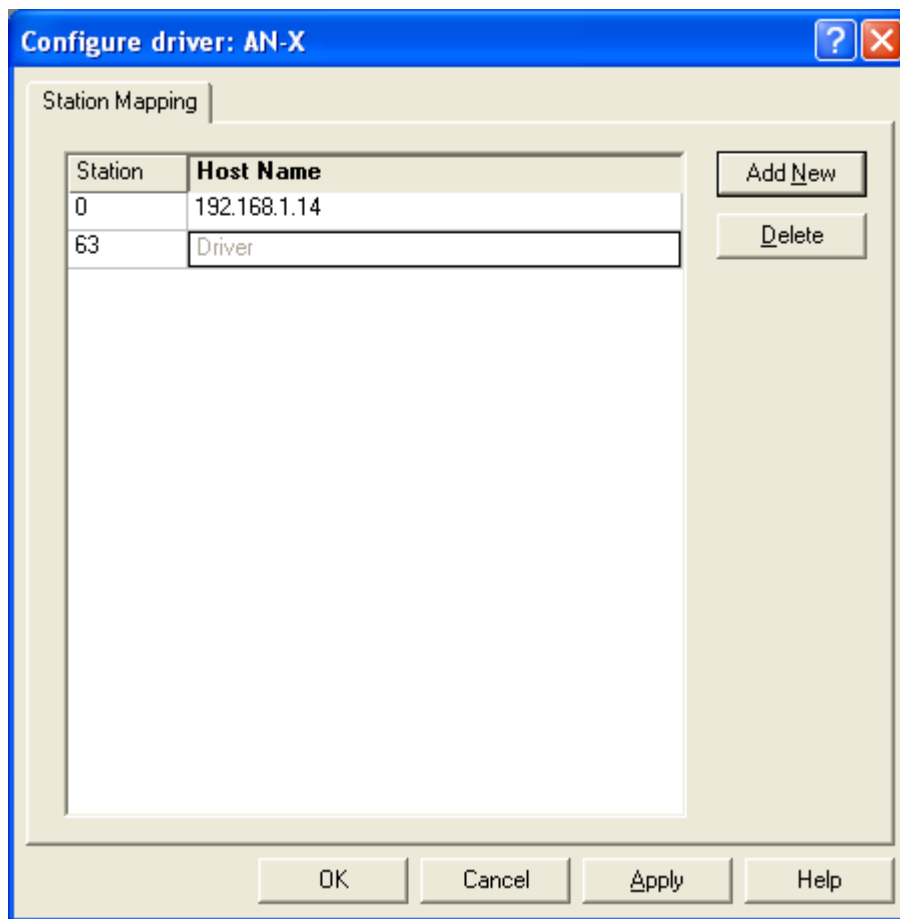
Use this driver for aliased AN-X IP addresses.

Use the following steps to configure the AN-X2-AB-DHRIO (DH+) in RSLinx.

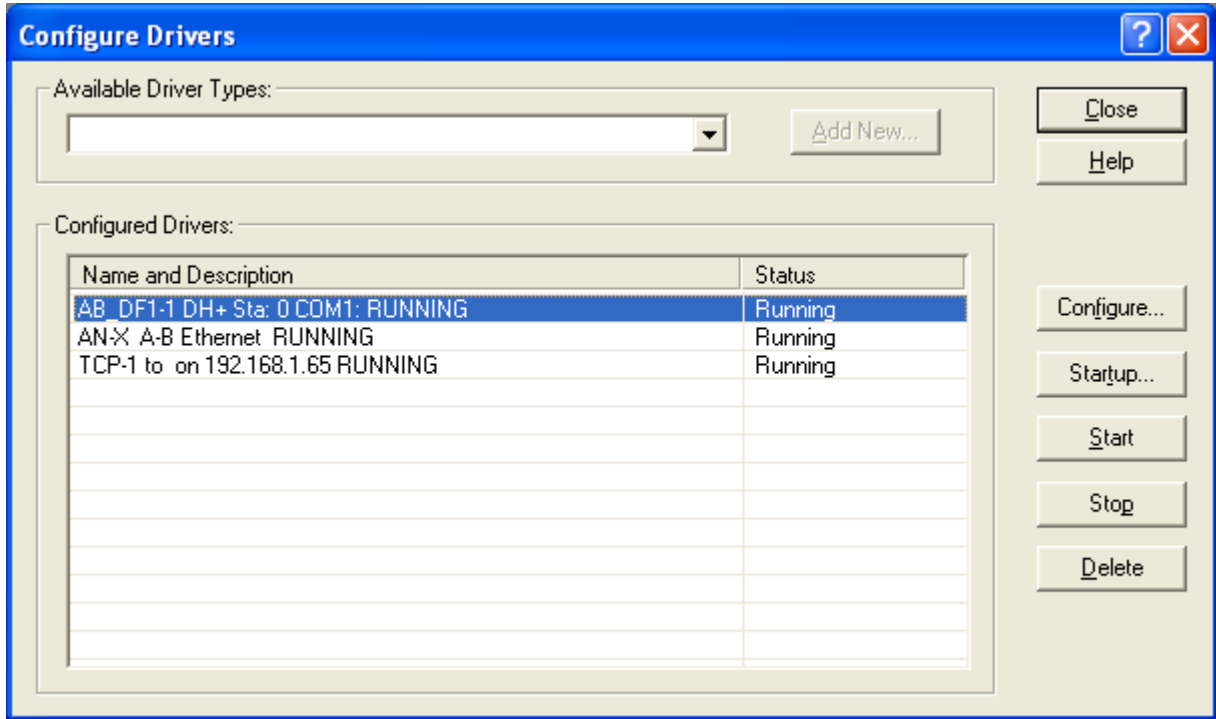
1. Select *Communications/Configure Drivers...*
2. From the list of *Available Driver Types:*, select *Ethernet devices* and click *Add New...*
3. Give the driver a name



4. For Server's IP Address or hostname: enter the aliased IP address on the AN-X2-AB-DHRIO (DH+) and click OK.



5. Check that the driver has status Running



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-X2-AB-DHRIO (DH+).

Multiple applications on a computer can connect to a Data Highway Plus network through the same AN-X2-AB-DHRIO (DH+).



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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-X2-AB-DHRIO (DH+).

From the Ethernet side, the AN-X2-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-X2-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.

Use the AN-X base IP address for messages. Do not use Aliased IP addresses.

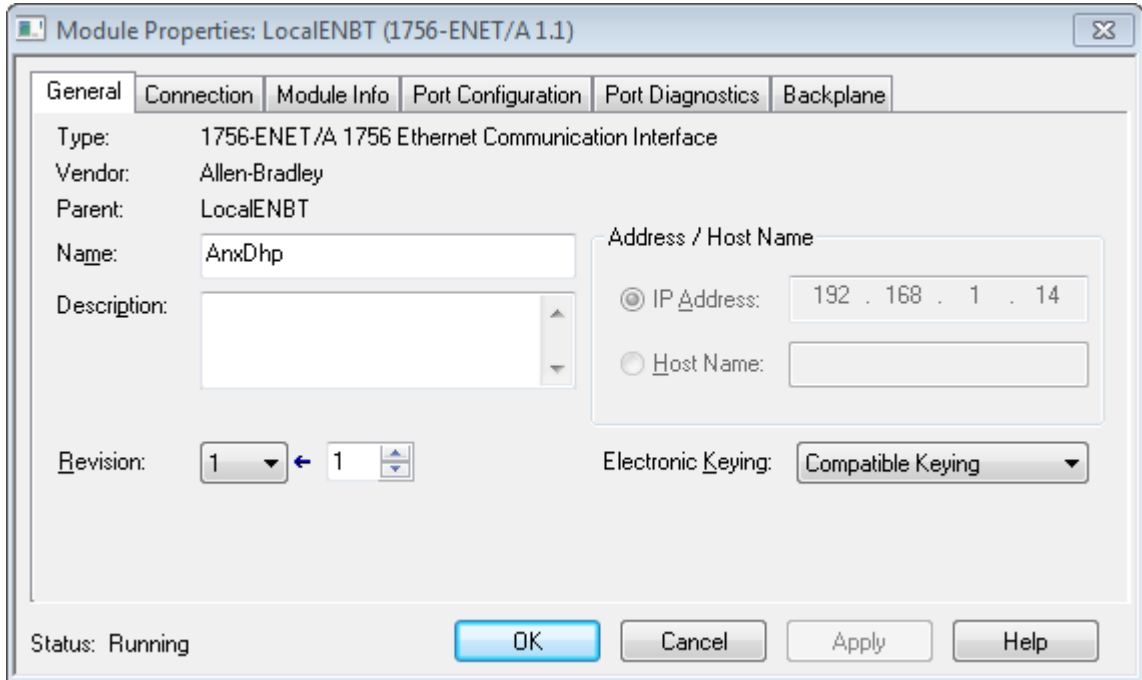
To initiate messages from the Data Highway Plus side, refer to page 33.

Example: Sending Messages to a PLC-5

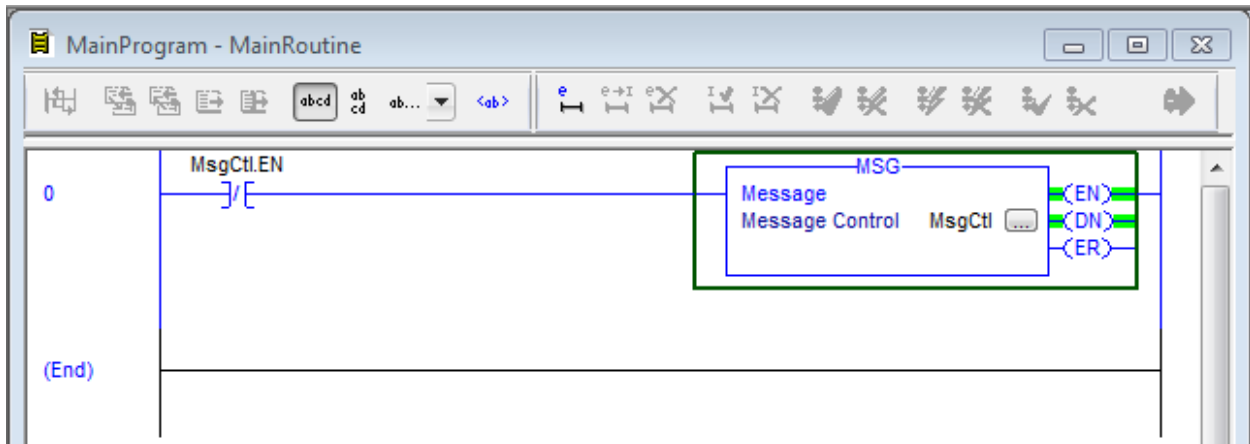
In this example, a ControlLogix is using the AN-X to send PLC-5 Typed Read commands that read 100 integers from file N7:0 in a PLC-5 at address 77 octal on Data Highway Plus.

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.



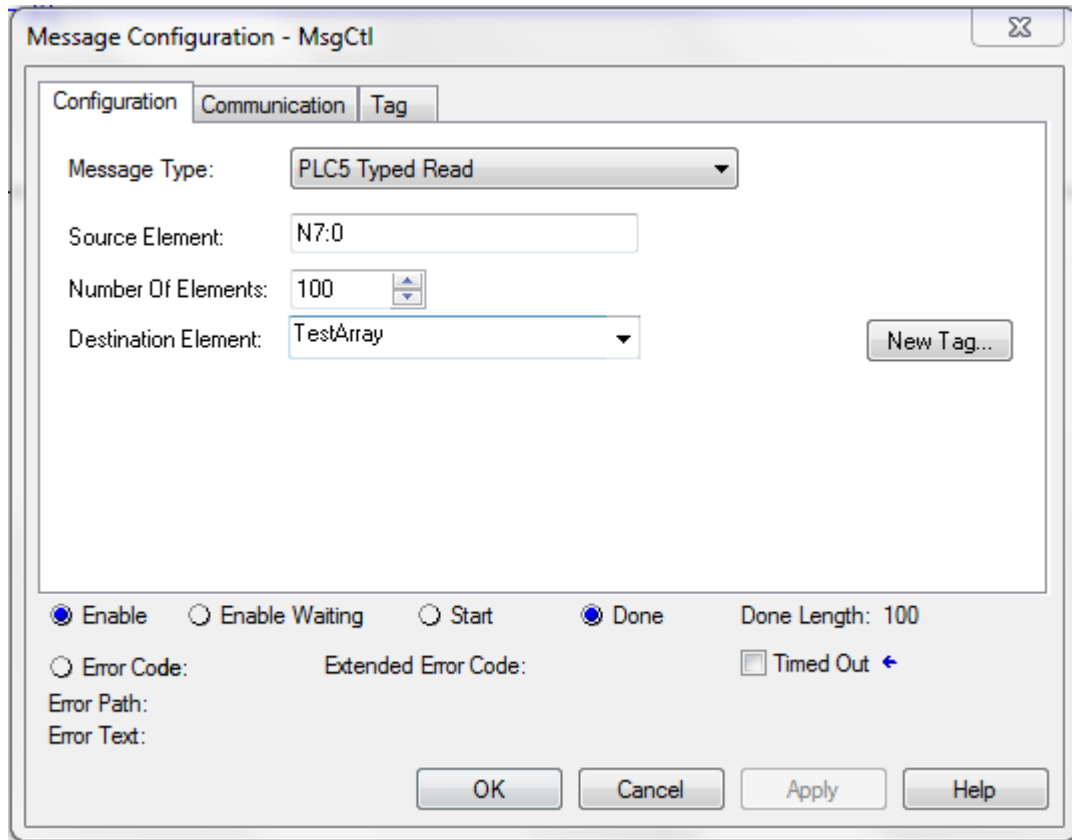


2. Add a MSG instruction in the ControlLogix, along with any logic required to control it



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*.



The screenshot shows the "Message Configuration - MsgCtl" dialog box. It has three tabs: "Configuration", "Communication", and "Tag". The "Configuration" tab is active. The settings are as follows:

- Message Type:** PLC5 Typed Read (dropdown menu)
- Source Element:** N7:0 (text input field)
- Number Of Elements:** 100 (spin box)
- Destination Element:** TestArray (dropdown menu)

At the bottom right of the configuration area is a "New Tag..." button. Below the configuration area are several options:

- Enable
- Enable Waiting
- Start
- Done
- Done Length: 100
- Error Code:
- Extended Error Code:
- Timed Out ←
- Error Path:
- Error Text:

At the bottom of the dialog are four buttons: "OK", "Cancel", "Apply", and "Help".

On the Communication tab:

The screenshot shows the 'Message Configuration - MsgCtl' dialog box with the 'Communication*' tab selected. The 'Path' field contains 'AnxDhp, 1, 1' and has a 'Browse...' button. Below it is a 'Broadcast' dropdown menu. The 'Communication Method' section has three radio buttons: 'CIP', 'DH+' (selected), and 'CIP With Source ID'. The 'DH+' method is configured with 'Channel' set to 'A', 'Destination Link' set to '0', and 'Destination Node' set to '77 (Octal)'. There are also 'Source Link' and 'Source ID' fields, both set to '0'. At the bottom of this section, the 'Connected' and 'Cache Connections' checkboxes are checked. Below the communication method section are several radio buttons: 'Enable' (selected), 'Enable Waiting', 'Start' (selected), and 'Done'. The 'Done Length' is set to '0'. There are also fields for 'Error Code', 'Extended Error Code', and a 'Timed Out' checkbox. At the bottom of the dialog are 'OK', 'Cancel', 'Apply', and 'Help' buttons.

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.

IMPORTANT! With the introduction of routing in firmware 4.7, messages sent via AN-X must now have Destination Link = 0 for local Data Highway Plus messages. Previously this field was ignored.

Message Queues

In firmware versions 4.7 and above, AN-X uses two transmit message queues to improve the responsiveness of write messages.

Write messages are placed in queue 1. When AN-X gets the Data Highway Plus token, it checks queue 1 first and sends the message from there, unless the last message was sent from queue 1, in which case it checks queue 0 first. This ensures that read messages get out in a timely fashion.



Using DHP-HMI IP Aliasing

Overview

AN-X2-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.

IMPORTANT! IP Aliasing requires AN-X DHP firmware 4.2.1 or above.

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 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.

In firmware versions prior to 4.7, when using IP Aliasing, the AN-X responded to Ethernet/IP requests on the base IP address, but not on aliased IP addresses. It responded to CSP requests on the aliased IP addresses, but not on the base IP address.

This allowed devices that support CSP protocol to access DHP devices using the IP alias to DHP mapping.

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 IpAlias.csv file and 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 target device supports both protocols.

IP aliasing with Ethernet/IP requires AN-X2-AB-DHP Firmware version 4.7.1 or later.

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

If possible, reserve a block of 77 IP addresses and create a simple mapping of IP addresses to Data Highway Plus station addresses, for example, reserve 100 - 177 and create any required mappings

TIP

```
AliasIP x.x.x.100 -> DHP 0o00
AliasIP x.x.x.102 -> DHP 0o02
AliasIP x.x.x.127 -> DHP 0o27
```



```
AliasIP x.x.x.177 -> DHP 0o77
```

Transfer/View

Use *Automation Network/Configure DH+ HMI IP Alias* in the web interface to send a configuration file to the AN-X. You must restart 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 *Log Files/HMI IP Alias Log* in the web interface.

To view the current configuration file, use *Automation Network/View IP Alias File*. It may be different from the active configuration if the AN-X has not been restarted since the file was updated.

To transfer a configuration from the AN-X, first view the IP Alias File, click anywhere in the file (right pane), press Ctrl-A to select the contents, then press Ctrl-C to copy the contents to the Windows clipboard and paste them into a text editor such as Windows Notepad.

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



Routing Messages from Data Highway Plus

Beginning with firmware version 4.7.x 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.



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.



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.

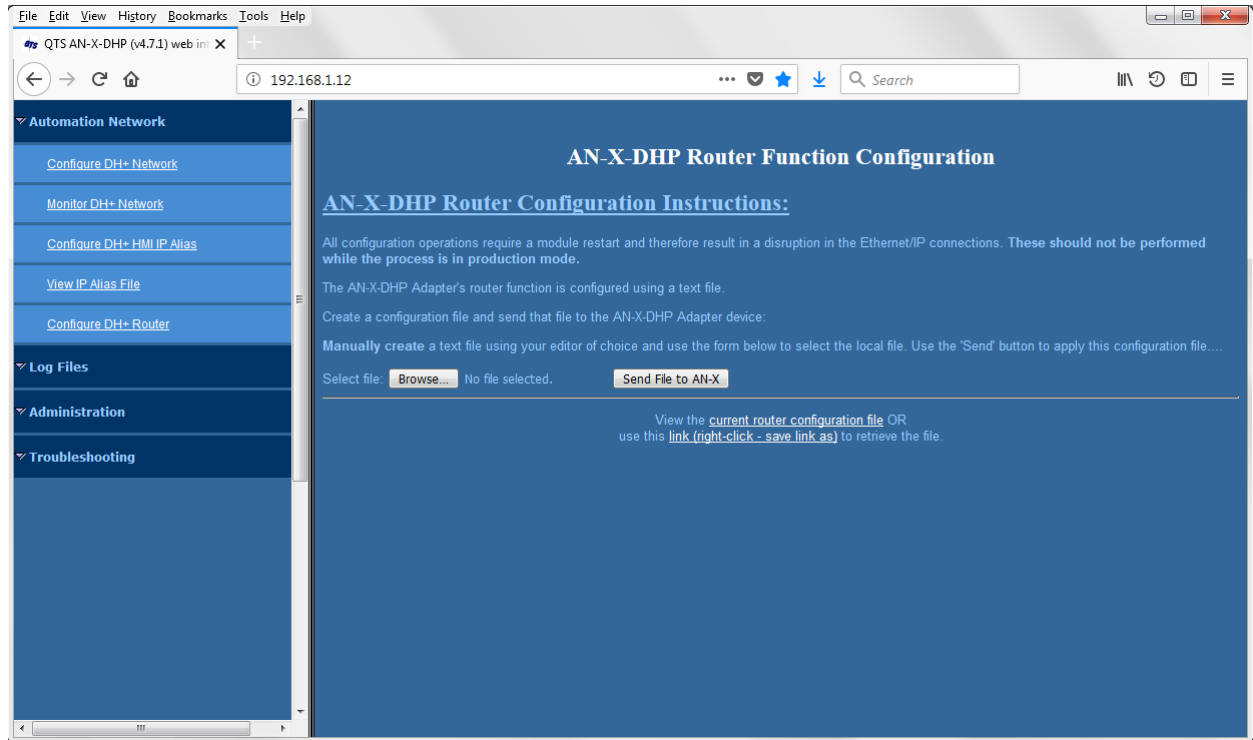
Sample AN-X Router Configuration File

```
; 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.

Viewing the Current Router Configuration

To view the current router configuration, select *Automation Network/Configure DH+ Router* in the web interface, then click on the *View the current router configuration file* link.

To retrieve the current router configuration 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.

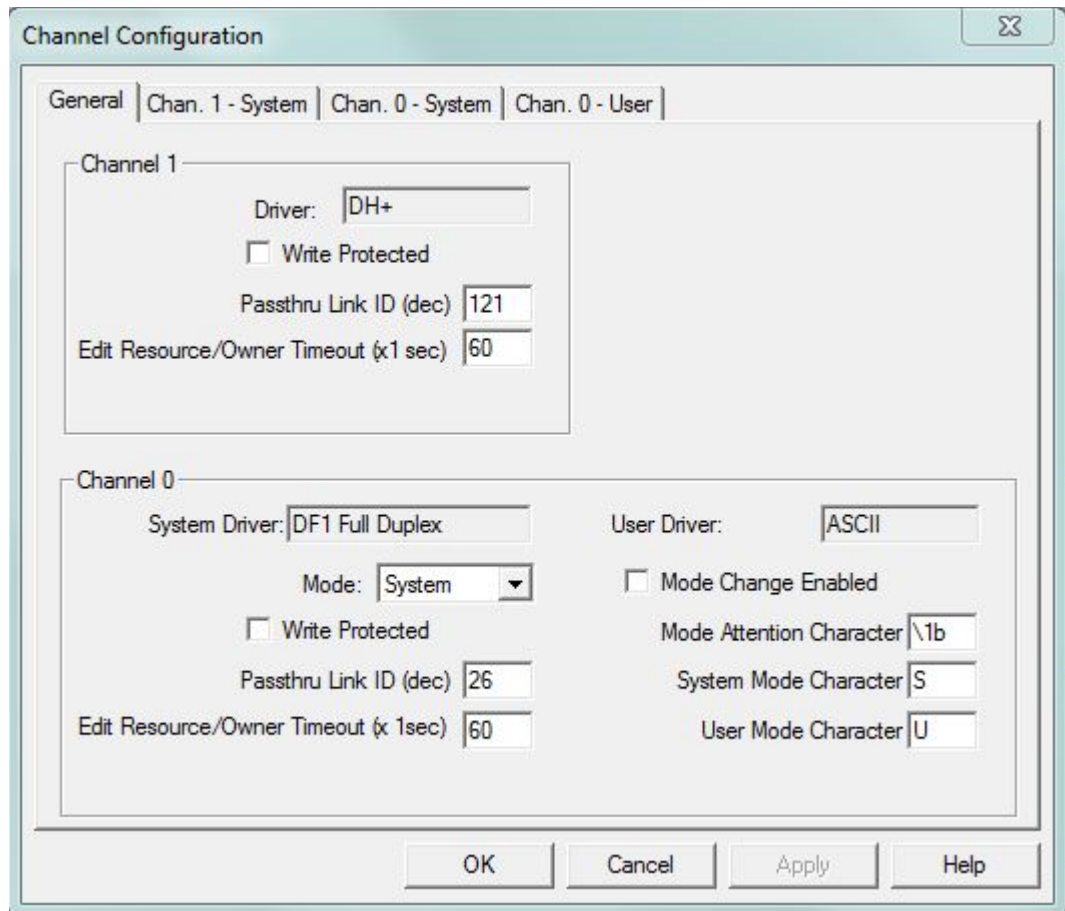


Sending Remote Messages Using AN-X Routing

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
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.

MSG - N21:0 : (14 Elements)

General

This Controller

Communication Command :

Data Table Address :

Size in Elements :

Channel :

Target Device

Message Timeout :

Data Table Address :

Local Bridge Addr (dec): (octal):

Local / Remote :

Remote Bridge Addr (dec):

Remote Station Address (dec):

Remote Bridge Link ID:

Control Bits

Ignore if timed out (TO):

To be retried (NR):

Awaiting Execution (EW):

Continuous Run (CO):

Error (ER):

Message done (DN):

Message Transmitting (ST):

Message Enabled (EN):

Waiting for Queue Space :

Error

Error Code(Hex):

Error Description

No errors



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.

MSG - MG26:0 : (1 Elements)

General

This PLC-5

Communication Command:

Data Table Address:

Size in Elements:

Port Number:

Target Device

Data Table Address:

Local DH+ Node (Octal):

Local / Remote:

Remote Link Type:

Remote Station Address:

Remote Bridge Link ID:

Control Bits

Ignore if timed out (TO):

To be retried (NR):

Awaiting Execution (EW):

Continuous Run (CO):

Error (ER):

Message done (DN):

Message Transmitting (ST):

Message Enabled (EN):

Error

Error Code(Hex):

Error Description

No errors

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.

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



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Using the Web Interface

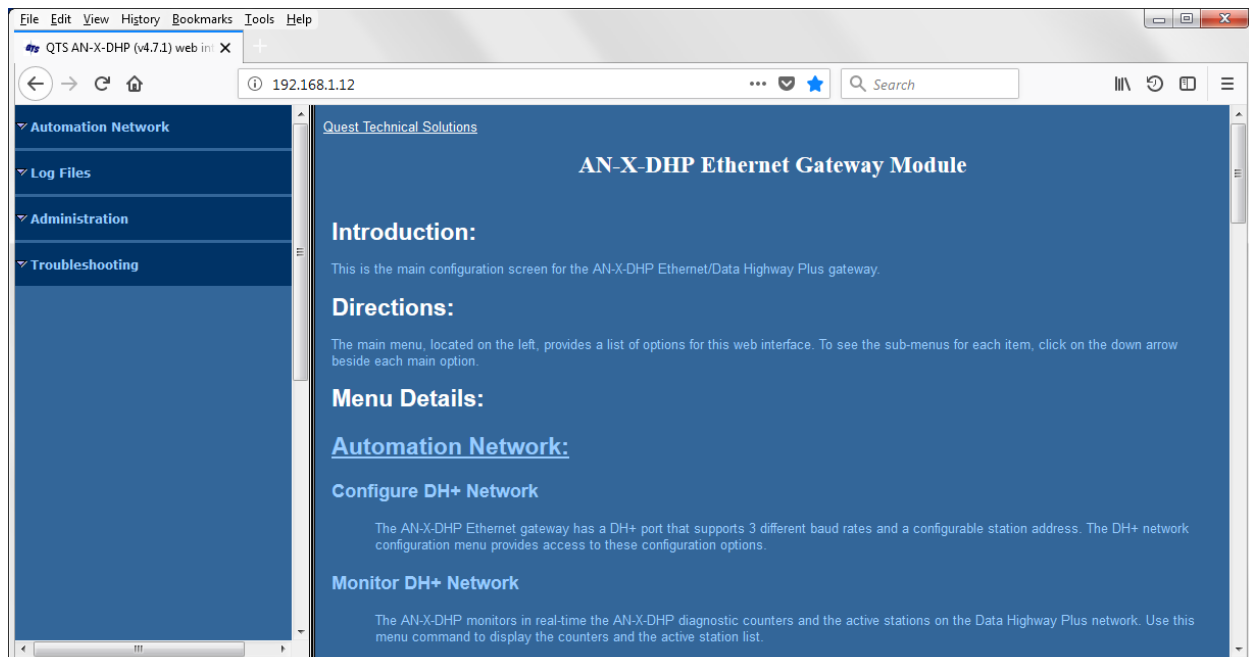
The AN-X module contains a webserver capable of communicating with standard web browsers.

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 loading logs
- configure the Ethernet settings and select the AN-X firmware
- configure aliases and routing
- archive the AN-X configuration
- update the AN-X firmware
- restart 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.

TIP

Browsers may return cached data rather than rereading data that has changed on the AN-X.

If you run into a problem where data appears not to have changed, flush



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the cache in the browser or run the browser in the mode where it doesn't cache data (incognito in Chrome, private browsing in Firefox and Safari, etc.)

In addition, in most browsers you can reload a page while overriding the cache. For example, you can use Ctrl-F5 in Firefox or Internet Explorer, or Shift-F5 in Google Chrome.

Data Highway Plus Configuration

Refer to page 19 for detailed information on Data Highway Plus configuration.

To configure the AN-X on Data Highway Plus:

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

The screenshot shows a web browser window with the URL 192.168.1.14. The page title is "AN-X-DHP Network Configuration". The main content area contains the following text:

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-DHP Adapter's network related 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 and 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 (first message plus additional messages).

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

0 disables sending additional messages.

The form includes the following fields:

- Baud rate: 57k (selected), 115k, 230k
- Station: 14 Octal
- Token Bytes: 250
- SUBMIT button

2. Select the baud rate.
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. The default AN-X configuration is station 20 octal, baud rate 57.6 Kbaud.
5. Click the SUBMIT button to send the values to AN-X.



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/Monitor DH+ Network*.

The screenshot shows the AN-X Network Monitor web interface. The left sidebar contains navigation options: Automation Network, Log Files, Administration, and Troubleshooting. The main content area displays the 'AN-X Network Monitor' title and a description: 'This page shows the various AB DHP diagnostic counters and station information.' Below this is the 'AB DHP Diagnostic Counters' section, which includes a 'Clear Counters' link and a table of diagnostic counters. At the bottom right, there is a 'Station List' table and a 'Refresh Counters' link.

Counter	Counter Value	Counter	Counter Value
SOLICIT ACK BAD	0	ACK TIMEOUT	0
TRANSMIT RETRIES EXHAUSTED	0	TX QUEUE0	37
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	1	TOKEN CLAIMED	0
BAD CRC ON RECEIVED FRAME	0	ILLEGAL PROTOCOL NAKS SENT	0
RX NOISE	0	NO MEMORY NAKS SENT	0
RECEIVED FRAME TOO SMALL	0	RECEIVED FRAME TOO LARGE	0
RETRY OF A FRAME RECEIVED	0	RECEIVE FRAME ABORTED	0
MESSAGES SUCCESSFULLY SENT	8236	MESSAGES SUCCESSFULLY RECEIVED	52916
COMMANDS SUCCESSFULLY SENT	33890	REPLIES SUCCESSFULLY RECEIVED	33890
COMMANDS SUCCESSFULLY RECEIVED	47792	REPLIES SUCCESSFULLY SENT	47777
REPLY COULD NOT BE SENT	0		

Station List
01
37

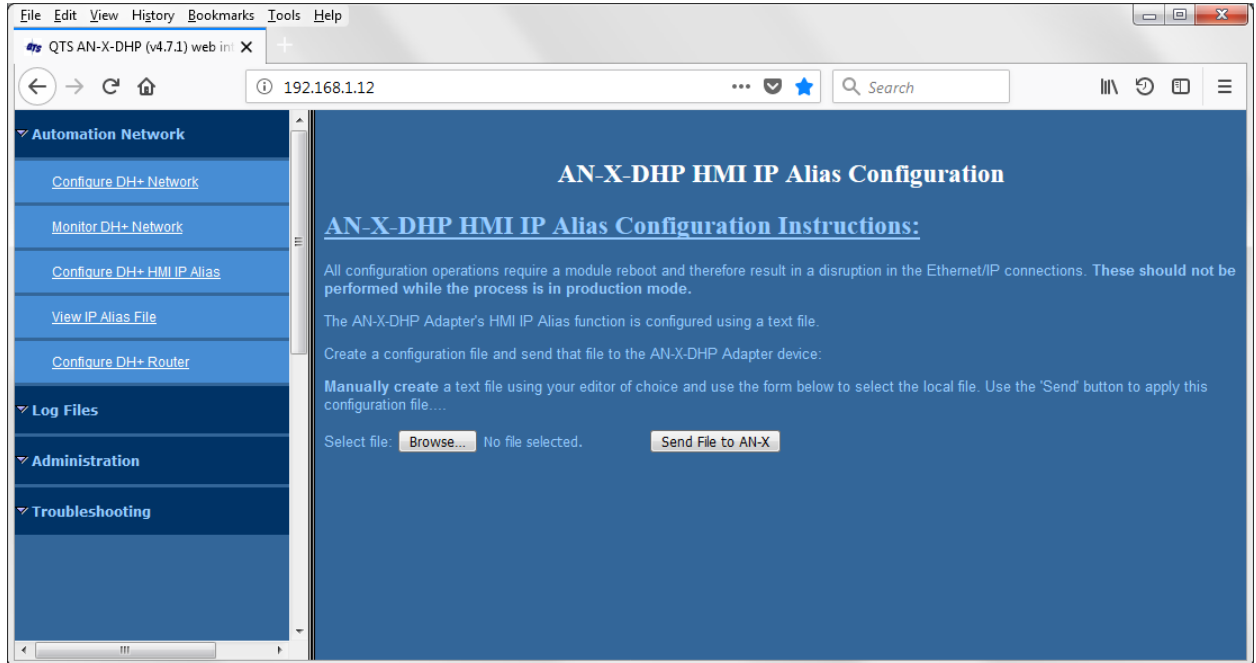
The table at the top of the screen shows the Data Highway Plus diagnostic counters. The table at the bottom of the screen shows the active station list.

To update the display, click the *Refresh Registers* button.

The Data Highway Plus diagnostic counters are described on page 57.

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 30.

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.

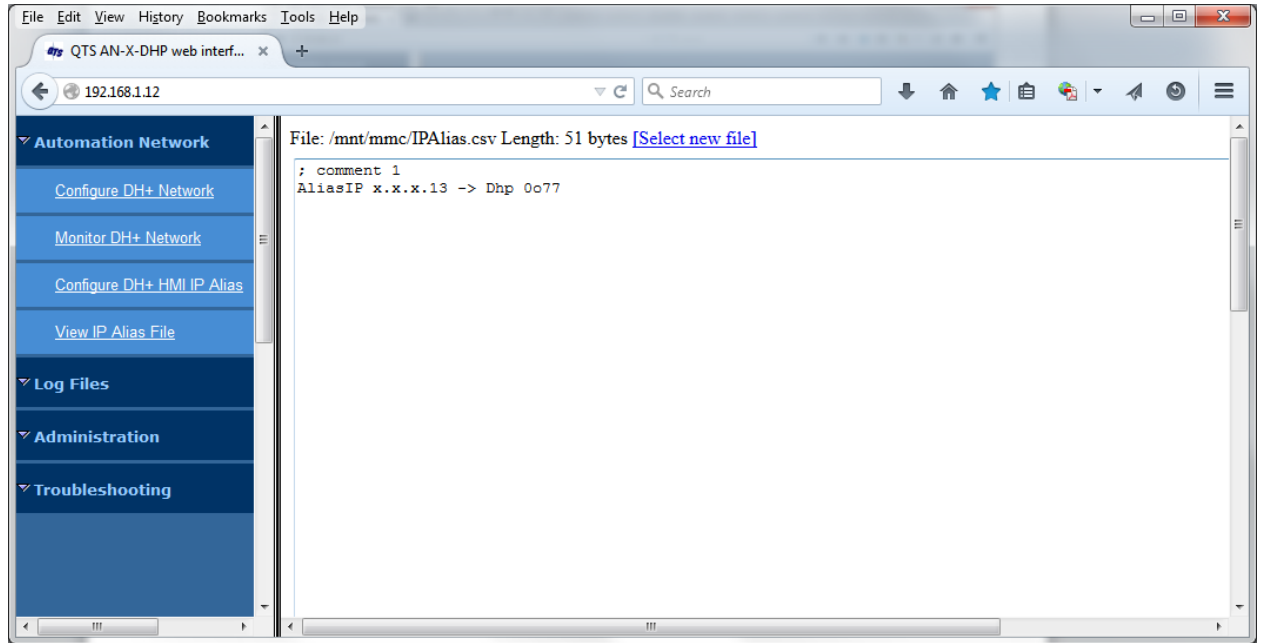
You must restart the AN-X to use the configuration. Click the Reboot link at the bottom of the page to restart the AN-X.

After restarting, use *Log Files/HMI IP Alias Log* to check for errors.

View IP Alias File

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





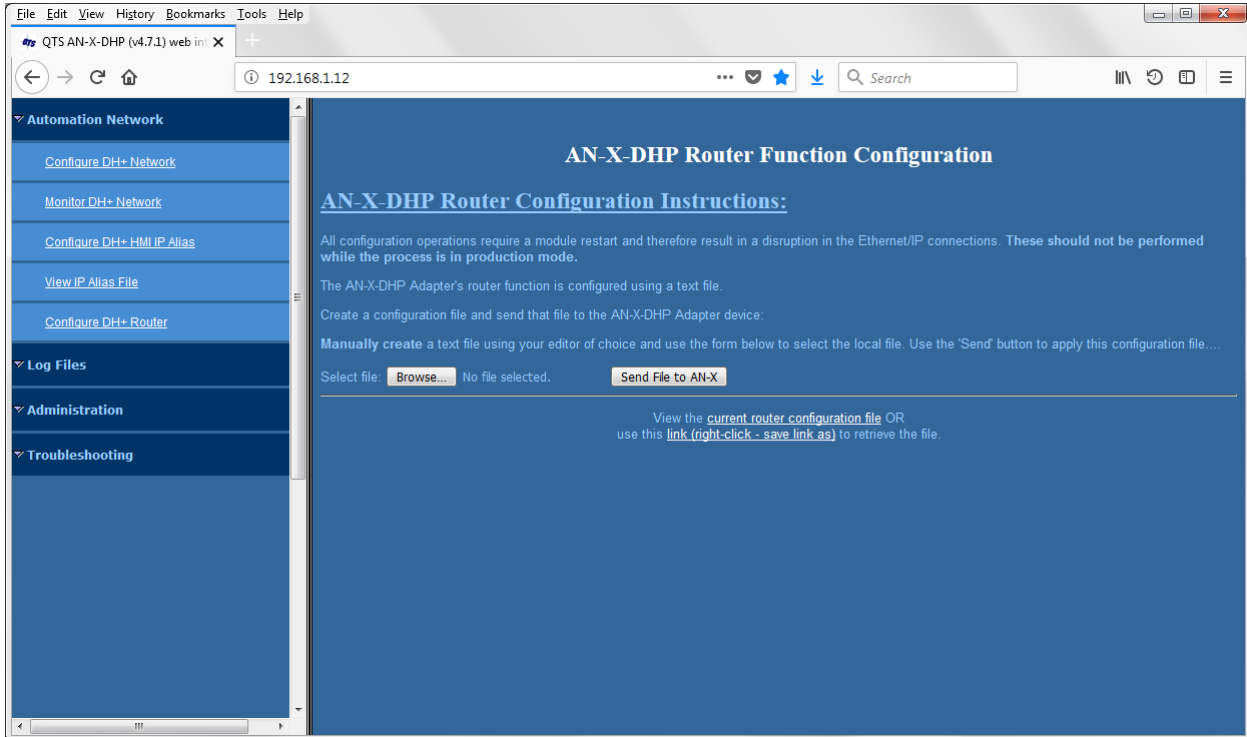
It may be different from the active alias configuration if the AN-X has not been restarted since the file was sent.

To copy the contents, click in the file area (right pane), press Ctrl-A to select the text, then copy the text into a text editor such as Windows Notepad.



Configure DH+ Router

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



Details of the configuration file format are found on page 33.

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 router configuration log file, which shows the result of sending the file.

The Router Configuration log file is also available by selecting *Log Files/ DH+ Router Log* in the web interface, then selecting the *Router Configuration Log* button.

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, In all three logs, the AN-X maintains two log files and switches to the other log file when the current one is full.

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).



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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).

HMI IP Alias Log

The *HMI IP Alias Log* records the startup messages and the current IP Alias configuration.

DH+ Router Log

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

Additionally, the router configuration log is accessible using the Router Configuration Log choice. This is the log that is produced when the DH+ router function is configured.

DH+ Traffic Logs

Firmware version 4.7 and above contains three logs that can be used to identify 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 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.

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% [===]
```



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```
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, double click on the file name.

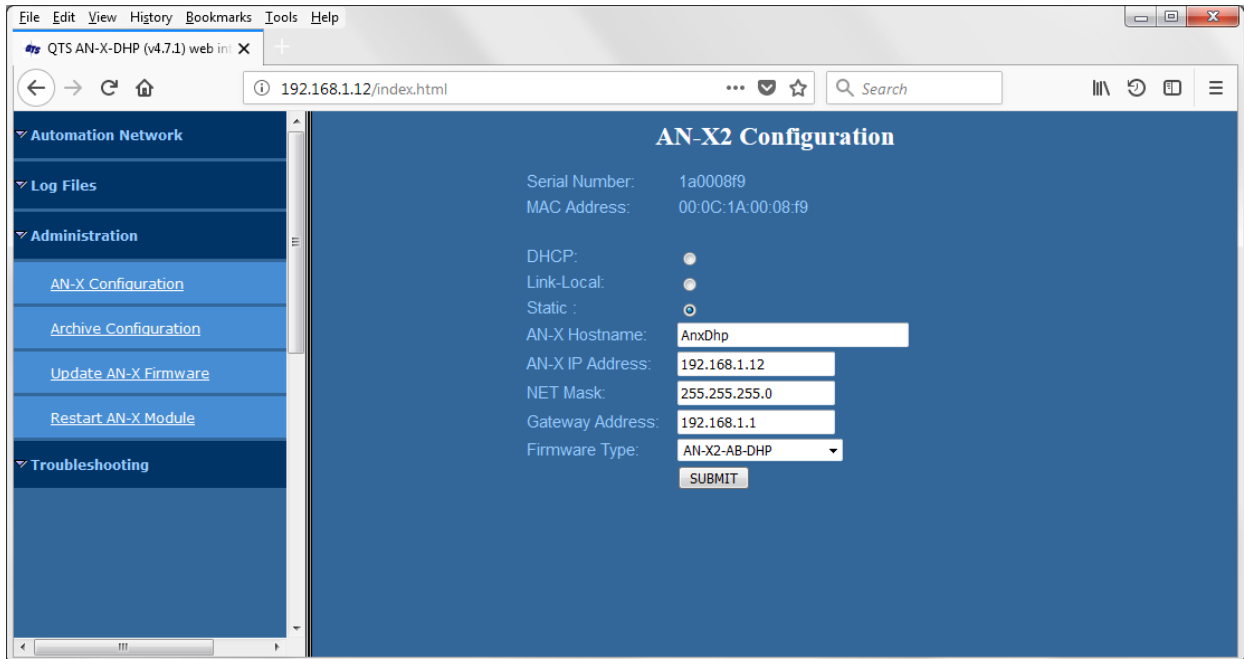
Administration Menu

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

AN-X Configuration

Use *AN-X Configuration* to set the AN-X Ethernet properties and to select the firmware the AN-X is to run.





The top of the screen shows the serial number and MAC Address of the AN-X2 being configured. Check either DHCP or Static.

DHCP

If the AN-X2 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-X2 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.

Hostname

Enter a *Hostname* for the AN-X2. 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



Firmware

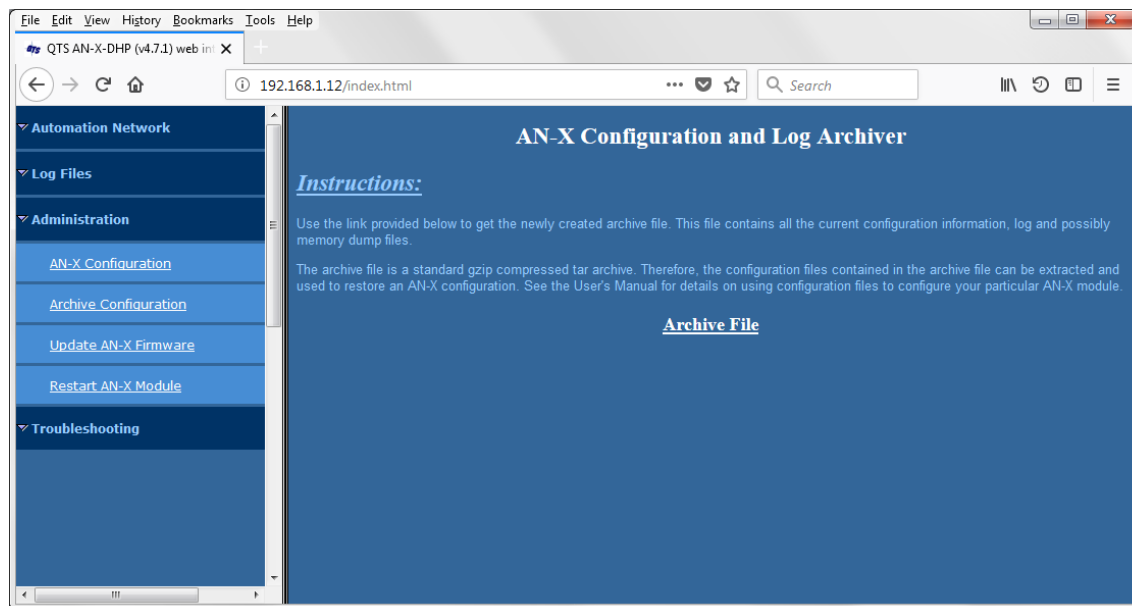
Select the firmware the AN-X is to load from the list provided. AN-X builds the list from the firmware files on the microSD card that are compatible with the AN-X hardware.

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.

Archive Configuration

Use *Administration/Archive Configuration* to create an archive that contains the current AN-X configuration and logs, for use by technical support.



There is often a slight delay while AN-X builds the archive file.

Click the *Archive File* link and enter a filename and location to save the file to your computer.

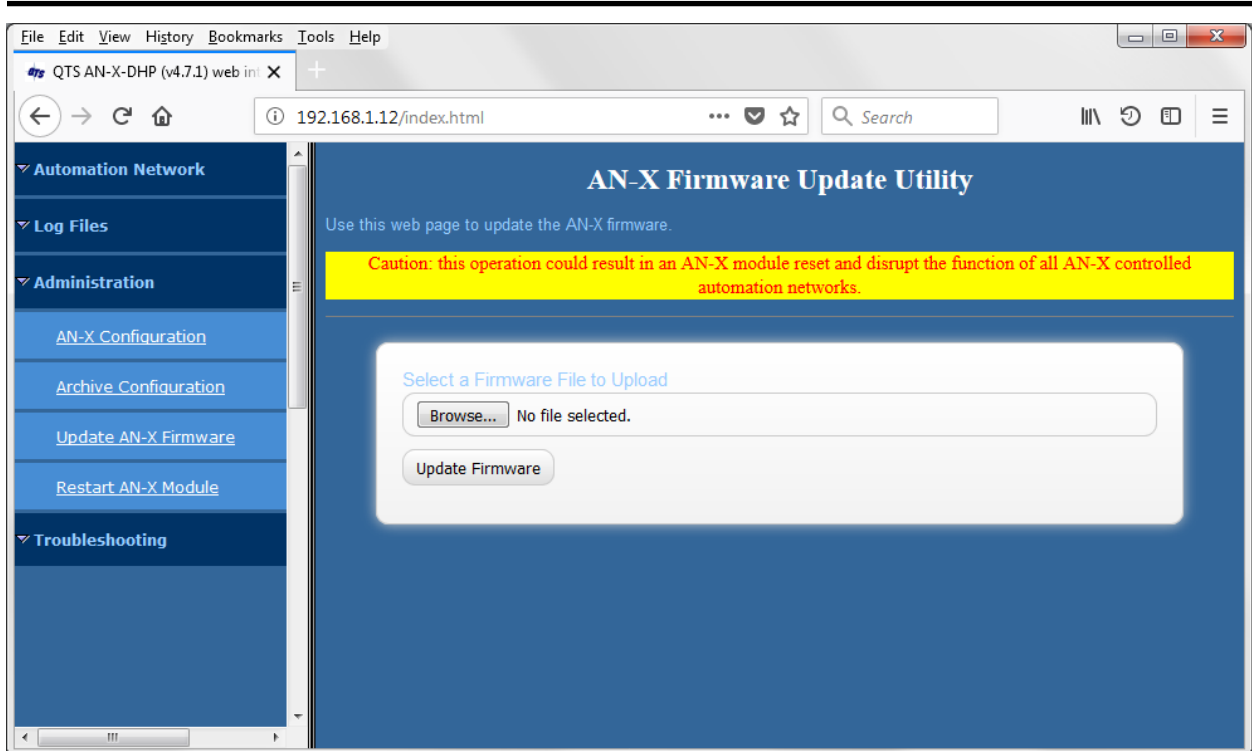
Update AN-X Firmware

Use *Update AN-X Firmware* to send a firmware file to the microSD card on the AN-X. Firmware files for the AN-X2 have names that begin with AN-X2 and have extension *.qtf.

WARNING!

Do not send firmware to the AN-X while applications that use the AN-X are running.





Browse to select the file, then click the *Update Firmware* button to transfer the file.

WARNING!

It is essential that you do not disrupt power while updating firmware, especially maintenance firmware, to the AN-X2 or while the AN-X2 is restarting following a firmware update.

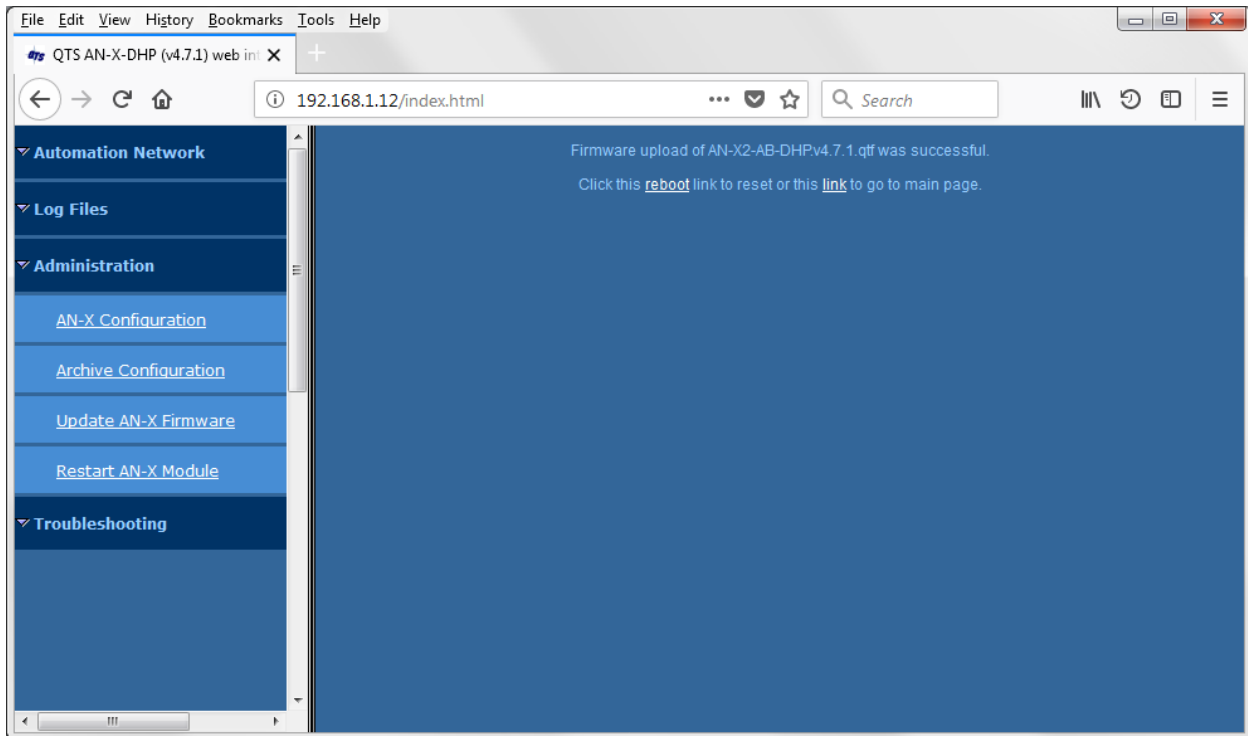
Interrupting power at some points in the update process could render the AN-X inoperative and it will have to be returned to the factory for reinitialization.

AN-X displays status messages in the lower left corner of the page. When the update is complete, AN-X displays a message that indicates the success or failure of the firmware update.



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If you have other files to transmit, return to the main page and continue. Otherwise, restart the AN-X in order to run the updated firmware.

Restart AN-X Module

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

Troubleshooting Menu

The troubleshooting menu contains information that is specific to an automation network, as well as support information.



Troubleshooting

LEDs

The AN-X2-AB-DHRIO (DH+) 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).

In previous versions of the hardware, the MS and NS LEDs were labelled SYS and NET.

Ethernet LEDs

There are two LEDs that indicate the state of the Ethernet connection, on the left side of the AN-X.

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

The lower green Link/Act 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-X2 is not connected to Ethernet, the 10/100 LED is on.

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.

MS LED State	Possible cause
Red 3	DHCP configuration failed
Red 4	Router has failed
Red 5	Ethernet/IP server has failed
Red 6	CSP server has failed
Yellow 2	microSD card not present
Yellow 3	AN-X2 Maintenance firmware file not found on microSD card
Yellow 4	config.txt file not found on microSD card or error parsing file
Yellow 5	Production firmware filename was not specified in config.txt
Yellow 6	AN-X2 production firmware file not found on microSD card
Yellow 7	Production firmware file invalid or error programming to flash
Yellow 8	Daughterboard mismatch
Single red flash	Unscheduled messaging, addressing or connection



MS LED State	Possible cause
	problem
Slow red flash	firmware configuration problem, the Data Highway Plus network configuration failed

NS LED – Network Status

The NS LED indicates the status of the Data Highway Plus network connection.

NS LED State	Description
Solid green	All stations operating correctly
Yellow	No other stations
Solid red or flashing red	Data Highway Plus Network errors

“Railroading” – MS and NS LEDs

AN-X2 alternates (railroads) flashing the MS and NS LEDs to indicate its state.

It railroads the LEDs yellow while it is copying new maintenance or production firmware files from the microSD card to flash memory.

It railroads the LEDs green for 20 to 30 seconds as it starts production mode.

Startup LED Sequence

At startup, the LED sequence is:

- fast yellow flash as maintenance boot code performs memory tests, other startup diagnostics.
- fast yellow flash as maintenance firmware runs
- railroad yellow if firmware files are being updated
- yellow error code if an error occurred in configuration
- railroad green as production firmware starts
- MS and NS LEDs green if everything is running and the AN-X2 is active on the network

Fatal Errors

AN-X2 monitors its operation for “impossible” conditions and generates a fatal error if it detects one. It generates a fatal error code on the MS LED by flashing 8 bits followed by a pause. The least significant bit is first, with green for 1 and red for 0.

If a fatal error occurs, record the MS LED sequence and contact technical support.



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.

Beginning with firmware version 4.7, several previously unused diagnostic counters have been repurposed to provide useful information. They are:

Previous counter	Replaced with
Bad LSAP NAKs received	TX Queue0
Illegal Protocol NAKs received	RX Queue0
Received Ack/NAK too short	TX Queue1
Bad LSAP NAKs sent	RX noise

The 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
TX Queue 1	Number of messages in AN-X transmit queue 1 (write messages)
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.
Received frame too small	AN-X received a frame smaller than the minimum possible size.
Retry of a frame received	AN-X received a frame with the same transaction number as a previous frame. It discards the duplicate frame.
Messages 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	Description
	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 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
No memory NAK received	AN-X sent a message and got a no memory NAK in response.
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	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.
No memory NAKs sent	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.
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.
Messages 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-X2 operating software consists of the maintenance firmware and the runtime firmware.

The maintenance firmware runs at startup. It performs diagnostics, updates any firmware that has been sent to the AN-X, and starts the runtime firmware.

The firmware files are supplied in files that begin with AN-X2 and have extension *qtf*. They are updated using the web interface. Run the command *Administration/Update AN-X Firmware* and select the file you wish to send.

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

The web page displays update messages at the bottom left of the page.

You must restart the AN-X2 to run the firmware that you transferred to the AN-X.

WARNING! It is essential that you do not disrupt power while updating firmware, especially maintenance firmware, to the AN-X2 or while the AN-X2 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.

The web interface displays the version of the firmware the AN-X2 is running on the browser tab at the top of the page. You may have to hover the mouse cursor over the tab to see the full text.

You can also update the firmware by copying *qtf* files to the microSD card using a card reader in your computer. If you do, make sure that there is only one version of each *qtf* file on the microSD card.



Specifications

Parameter	Specification
Function	Bridge between Ethernet and Data Highway Plus network
Maximum Power Consumption	200 mA at 12 VDC, 100 mA at 24 VDC
Maximum Power dissipation	2.4W
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	



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Warranty

Quest Technical Solutions warrants its products to be free from defects in workmanship or material under normal use and service for three years after date of shipment. Quest Technical Solutions will repair or replace without charge any equipment found to be defective during the warranty period. Final determination of the nature and responsibility for defective or damaged equipment will be made by Quest Technical Solutions personnel.

All warranties hereunder are contingent upon proper use in the application for which the product was intended and do not cover products which have been modified or repaired without Quest Technical Solutions approval or which have been subjected to accident, improper maintenance, installation or application, or on which original identification marks have been removed or altered. This Limited Warranty also will not apply to interconnecting cables or wires, consumables nor to any damage resulting from battery leakage.

In all cases Quest Technical Solutions' responsibility and liability under this warranty shall be limited to the cost of the equipment. The purchaser must obtain shipping instructions for the prepaid return of any item under this Warranty provision and compliance with such instruction shall be a condition of this warranty.

Except for the express warranty stated above Quest Technical Solutions disclaims all warranties with regard to the products sold hereunder including all implied warranties of merchantability and fitness and the express warranties stated herein are in lieu of all obligations or liabilities on the part of Quest Technical Solutions for damages including, but not limited to, consequential damages arising out of/or in connection with the use or performance of the Product.



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