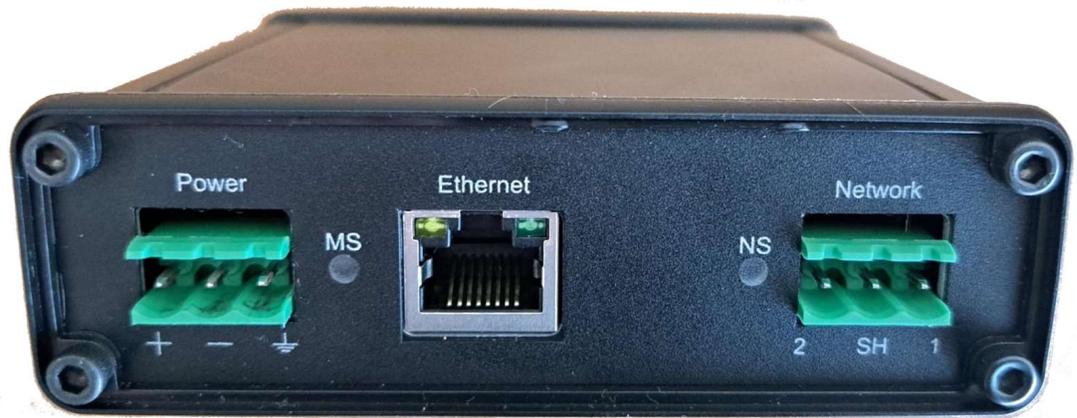


AN-X4-AB-BRG
Ethernet
Data Highway Plus / Blue Hose
IP Bridge

User Manual



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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-BRG

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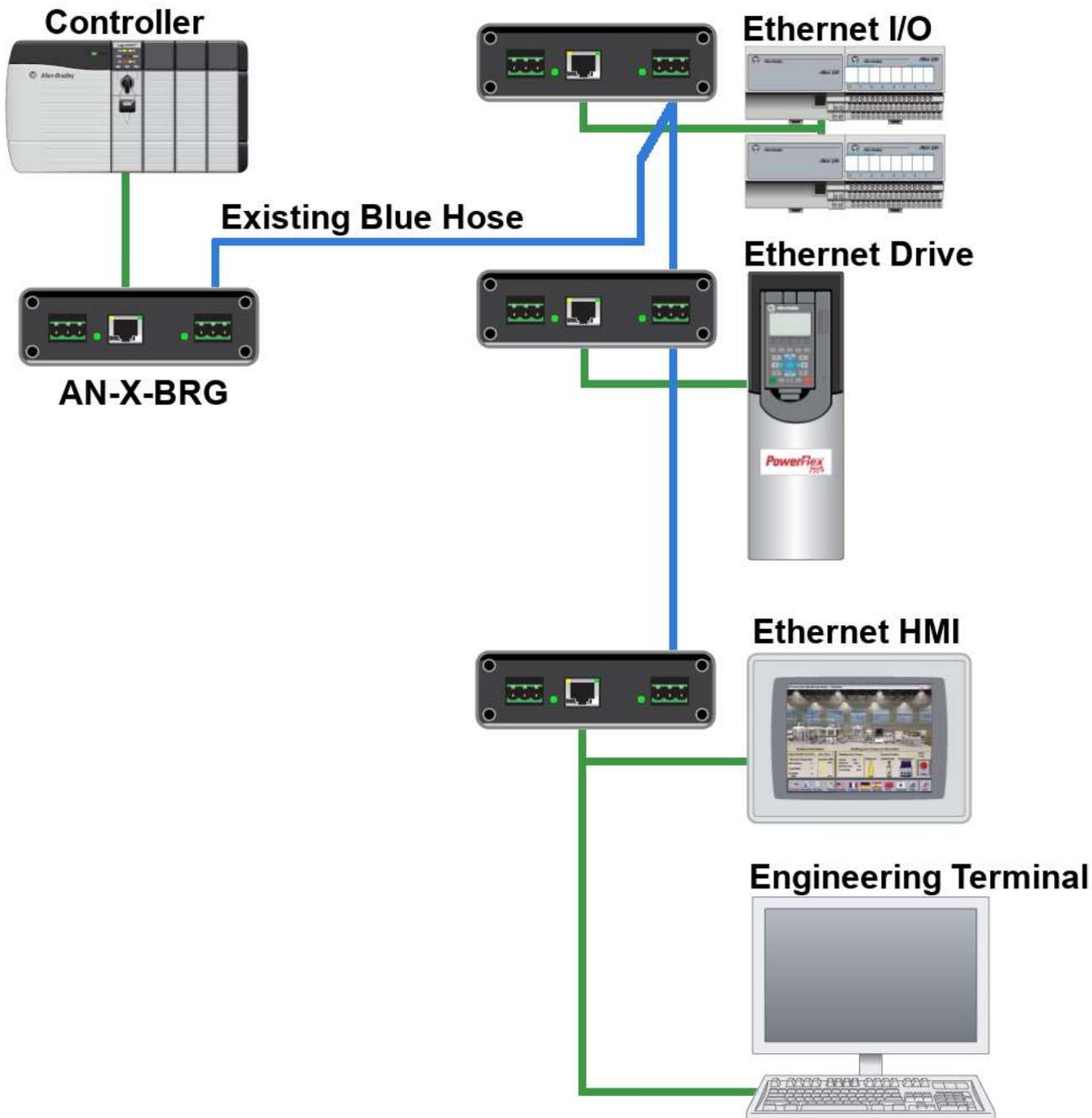


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Introduction

The AN-X4-AB-DHRIO module running AN-X4-AB-BRG firmware (referred to hereafter as AN-X-BRG) acts as an IP bridge between two or more Ethernet networks.

Example



Operation

The AN-X-BRG module listens promiscuously to all messages on its Ethernet port and uses its “BridgeIP” mappings to forward messages out its DH+/BH port to other AN-X-BRG modules.

The destination AN-X-BRG module forwards the messages received from its DH+/BH port to its Ethernet port and the devices connected.

This allows the use of existing Blue Hose cabling for:

- Controllers and Ethernet I/O
 - ControlLogix to Ethernet/IP I/O for example
- HMI and SCADA to Controllers
 - PanelView etc.
- Programming terminals to Controllers
 - RSLogix5000

There can be up to 64 AN-X-BRG modules on a DH+/BH network, each connecting to different Ethernet networks.

Existing Allen-Bradley Remote I/O Blue Hose networks can be used, but all RIO devices must be removed or powered down.

The AN-X-BRG module has a web interface for configuration and monitoring. Any standard web browser may be used.

The AN-X-BRG module monitors the DH+/BH network traffic and displays usage statistics such as:

- overall network loading
- the percentage of network time used for the messages from each station

The web interface is used to send or retrieve the bridge configuration text file on the AN-X, 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
Bridge Configuration	Brg\AbBrgCfg.txt
Firmware to run	Firmware\FirmwareCfg.txt

All files should be created and edited 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 17 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 (7/64 Allen wrench).

Installation

Prevent Electrostatic Discharge

The module is sensitive to electrostatic discharge.

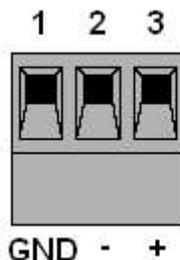
WARNING!

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)

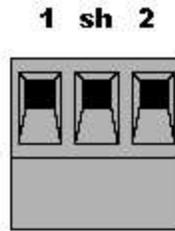
DH+/BH Cabling and Termination

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.





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 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.

IP Bridging

Bridge Mode

Data Highway Plus Mode

- Uses standard Data Highway Plus protocol
- Existing DH+ stations can be connected to the network
- Bandwidth is shared with between DH+ and Bridge traffic
- Supports standard DH+ baud rates and network lengths
 - 10,000 feet at 57.6 kbaud
 - 5,000 feet at 115.2 kbaud
 - 2,500 feet at 230.4 kbaud

Blue Hose Mode

- Uses Miller encoding to double the baud rate with same Blue Hose signal rate.
- ONLY AN-X-BRG modules can be connected to the Blue Hose network.
- Supports doubled baud rates
 - 10,000 feet at 115.2 kbaud
 - 5,000 feet at 230.4 kbaud
 - 2,500 feet at 460.8 kbaud

Choosing the Mode

If standard DH+ devices will co-exist on the network, then choose DHP mode at the existing baud rate since it's compatible with the other DH+ devices and the length of the network.

Note that the AN-X4-AB-BRG firmware does not provide access to the existing DH+ stations, it only bridges IP messages. Use AN-X4-AB-DHP firmware on a separate AN-X4-AB-DHRIO module for this functionality.

If only AN-X-BRG modules are on the network, use Blue Hose mode. Use the highest baud rate for the length of the cable. When using an existing network, you can choose double the previous DH+/RIO baud rate.

Typical Applications

- Existing run of Blue Hose between buildings or spanning large distances that would be difficult and/or expensive to replace with Ethernet or fiber.
- Updating from Remote I/O to Ethernet I/O.
- Updating HMI's from DH+ to Ethernet.
- Programming software or other software to a distant controller.



- Any other case where IP access is required between areas that Blue Hose spans.
 - SCADA, web monitoring etc.

Bandwidth Limitations

Since bandwidth is limited on Blue Hose (460.8 kbaud max) care must be taken to limit IP traffic sent between AN-X-BRG modules.

Remote I/O

If the existing RIO network was fast enough for the process, the same bandwidth is available for IP traffic.

However, IP traffic and Blue Hose token passing add overhead.

Using Blue Hose Mode doubles the bandwidth, which makes up for the extra overhead.

For example, if your existing RIO network spanned 4,000 feet and ran at 115.2 kbaud, you can run the AN-X-BRG at 230.4 kbaud.

When configuring the replacement Ethernet I/O, be careful to use the smallest data sizes possible. On Ethernet the size doesn't matter as much, since Ethernet has so much bandwidth available.

When bridging through Blue Hose, larger message sizes consume the limited bandwidth very quickly.

Use the slowest I/O update times (RPI) possible for the application. This should be comparable to the old RIO update times.

Data Highway Plus

If the existing DH+ network was fast enough for the process, the same bandwidth is available for IP traffic.

However, IP traffic adds overhead.

If none of the existing DH+ stations are to be used, the AN-X-BRG can use Blue Hose Mode. This doubles the bandwidth and makes up for the extra overhead.

If some existing DH+ stations are still needed, the IP traffic will impact the DH+ traffic and care must be taken to ensure the process still operates correctly.

Bandwidth/Traffic Monitoring

The AN-X-BRG shows the bandwidth usage as a percentage of the raw bandwidth available.

The maximum possible loading is about 75%. The rest of the network time is used for inter packet spacing, ACKs/NAKs, token passing, and soliciting new stations coming online.

If this number exceeds 60% or so, additional traffic will affect update times for existing traffic.

Total Traffic Log shows usage for all messages from all stations.

Station Traffic Log shows usage by each station.

Priority Transmit Queue

The AN-X-BRG has two queues for sending DH+/BH messages, Normal and Priority.

Messages from the Priority queue are always sent first. If there are no messages in the Priority queue, the Normal queue is checked.

This is used to ensure critical messages, such as Ethernet/IP Schedule I/O or HMI updates are always deterministic and not affected by other traffic such as monitoring device's web pages etc.

The DH+/BH Monitor web page shows current TX Queues and Queue Full counters.

Care must be taken to make sure the Priority queue does not become so busy that the Normal queue fills up and stalls.

IP Bridge/Station Mapping

The AN-X-BRG only bridges IP messages that are mapped to specific DH+/BH stations.

The AN-X-BRG configuration contains “BridgeIP” entries that map a device's IP address to the remote AN-X-BRG station its connected to.

The upper 3 bytes of AN-X-BRG module IP addresses on the same DH+ or BH network must match.

The upper 3 bytes of mapped IP devices must match the AN-X-BRG modules.

The upper 3 bytes of IP devices accessing bridged IP devices through AN-X modules must match.

For example, if the AN-X-BRG modules are 10.10.0.110 and 10.10.0.111, all IP devices to be bridged must be 10.10.0.x.

The network mask can allow more than 8 bits (255.255.0.0 for example), but any IP devices using the AN-X-BRG must have matching values in their IP upper 3 bytes.

See the sample configuration file on the AN-X-BRG web page for more details.

When the AN-X-BRG receives an Ethernet message to an IP address that's mapped in its configuration, it encapsulates it into DH+/BH messages and send them to the mapped AN-X-BRG station.

The destination AN-X-BRG module extracts and assembles the Ethernet message and sends it out its Ethernet port to the destination IP address.

The destination AN-X-BRG automatically generates a return mapping (if required) so when the reply comes back, the AN-X-BRG knows how to return it over DH+/BH to the originating AN-X-BRG, which then extracts the Ethernet reply and sends it out its Ethernet port to the IP address that sent the original message.

UDP broadcast messages are not bridged by default, but can be enabled for specific UDP ports (44818 to enable RSLinx browsing for example).



IP Configuration

Before you can use the AN-X-BRG, you must configure its Ethernet network IP properties.

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.

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

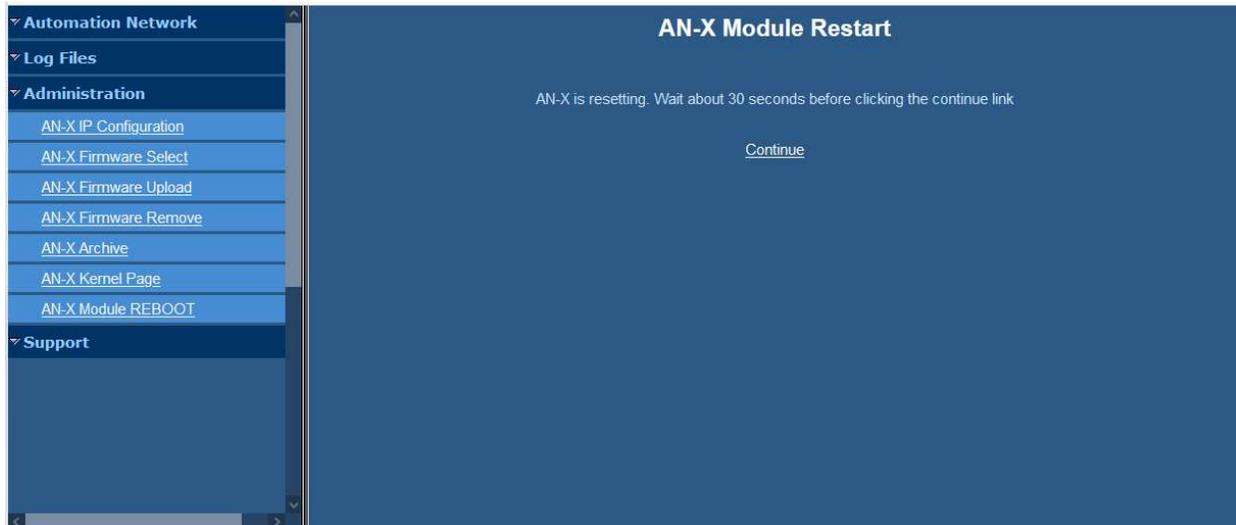
Enter a Hostname for the AN-X4. This name is used internally by AN-X and may be used to identify the AN-X if you have a DNS server on your network. The name can be from 1 to 30 characters long.



Submitting the Configuration

Once you have entered all required parameters, click **SUBMIT** to write the configuration to the file `IPCfg\IPConfig.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: 10.10.0.110
```

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

Keyword	Possible Values
IP	Factory DHCP static IP address, ex, 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 33.

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: ANX4BRG
```

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 firmware files on the AN-X or the AN-X will not start up.

Example:

```
AN-X4-AB-BRG.v4.01.01.qtf
```



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Bridge Configuration

AN-X-BRG bridge operation are configured using a text file.

Generally the sample AbBrgCfg.txt file from the module's web interface is used as the starting point.

Automation Network/BRG Configuration Sample

The configuration file consists of:

- Bridge Mode (DHP or BH)
- DH+/BH Configuration
- IP/Station Mappings
- UDP broadcasting
- Priority UDP/TCP port assignments

Sample Bridge Configuration File

The sample bridge configuration file may be retrieved using the AN-X-BRG web interface.

Automation Network/BRG Configuration Sample

Bridge Mode

Example:

```
ModeBH ; ModeDHP or ModeBH
```

If neither ModeDHP or ModeBH is defined, the configuration will fail and the module will not enter Bridge mode.

Commenting out the mode may be useful for temporarily disabling bridging operations.

AN-X-BRG modules ship with the mode commented out so the module will not try to bridge incorrectly before a valid configuration is sent.

DH+/BH Configuration

Baud

Example:

```
Baud 230k ; ModeDHP: 57k, 115k, 230k / ModeBH: 115k, 230k, 460k
```

In Data Highway Plus mode, valid baud rates are 57k, 115k or 230k.

In Blue Hose mode, valid baud rates are 115k, 230k or 460k.

Station

Example:

```
Station 1 ; 0-77 octal
```

The station number is 0 to 77, defined in octal, but can be overridden with '0d' or '0x' (77 = 0d63 = 0x3f).

In BH mode, it may be useful to specify the station and station mappings in decimal.

For Example:

```
Station 0d18
```

Tokbytes

Example:

```
Tokbytes 300 ; Max Message bytes per Token
```

The AN-X-BRG can send multiple messages when it gets the 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 this number of bytes (including the number of bytes in the first message).

For example, if Tokbytes is set to 300, when AN-X-BRG gets the token, it can send the first message in its queue, as an example, a write command that's 100 bytes long. It can then send further messages from its queue up to a maximum of 200 bytes in total (300-100). 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 300. A value of 0 disables sending additional messages.

For bridging applications set Token Bytes to 300 unless the AN-X is on a Data Highway Plus network and is slowing down other nodes.

Setting Token Bytes can improve the performance of AN-X on the 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.

IP/Station Mapping

BridgeIP

Example:

```
;BridgeIP x.x.x.<IpLowByte> -> STN <Dest Station> (see details below)
```

```
BridgeIP x.x.x.84 -> STN 10 ; Flex I/O - Connected to Ethernet on AN-X at Station 10
```

```
BridgeIP x.x.x.85 -> STN 10 ; Flex I/O - Connected to Ethernet on AN-X at Station 10
```

```
BridgeIP x.x.x.94 -> STN 11 ; PowerFlex - Connected to Ethernet on AN-X at Station 11
```

```
BridgeIP x.x.x.100 -> STN 12 ; HMI - Connected to Ethernet on AN-X at Station 12
```

```
BridgeIP x.x.x.110 -> STN 10 ; AN-X-AB-BRG - Allows monitoring of the remote AN-X-BRG
```

```
BridgeIP x.x.x.111 -> STN 11 ; AN-X-AB-BRG - Allows monitoring of the remote AN-X-BRG
```

```
BridgeIP x.x.x.112 -> STN 12 ; AN-X-AB-BRG - Allows monitoring of the remote AN-X-BRG
```



Mappings consist of:

- Keyword BridgeIP
- destination IP address (low byte only) in the form x.x.x.IP_Low_Byte
- separator ->
- keyword STN
- destination Data Highway Plus or Blus Hose station address

The station number is 0 to 77 octal, but can be overridden with '0d' or '0x' (77 = 0d63 = 0x3f).

In BH mode, it may be useful to specify the station and station mappings in decimal.

In the example, if this AN-X-BRG has an IP address 10.10.0.101 and receives an Ethernet message from 10.10.0.50 destined for 10.10.0.84, it sends the message out its DH+/BH port to station 10.

When the station 10 AN-X-BRG receives the message from its DH+/BH port, it sends the message out its Ethernet port to IP address 10.10.0.84.

If a mapping for the source IP (10.10.0.50 station 1) does not exist, it creates that mapping automatically.

When the reply message comes back, the process is repeated in reverse.

The station 10 AN-X-BRG receives the message into its Ethernet port then sends it out its DH+/BH port to station 1.

The station 1 AN-X-BRG receives the message from its DH+/BH port and sends it out its Ethernet port.

The IP address must be entered with the leading three x's, for example x.x.x.84

The IP address low byte must be in the range from 1 to 254, 0 and 255 are invalid.

Up to 254 mappings are allowed in the configuration file (enough for all valid IP lower byte values).

FwdBcast

Example:

```
;FwdBcast <Prot> <Port>
```

```
FwdBcast UDP 44818 ; Allow RSLinx to browse bridged IP's
```

By default, broadcast IP packets are not bridged.

In order for some software such as the RSLinx to browse the bridged Ethernet networks, AN-X-BRG must bridge broadcast UDP messages.

Other application may require broadcast messages to be bridged for proper operation as well.

Broadcast bridging is enabled for specific UDP ports as follows:

- Keyword FwdBcast
- UDP
- UDP port number (1-65535)

Up to 15 FwdBcast entries are allowed.

Don't enable any more UDP broadcast ports than are necessary. Especially be careful of high volume broadcast ports. Broadcast messages can quickly overload the DH+/BH network.

Priority

Example:

```
;Priority <Prot> <Port>

Priority UDP 2222 ; Ethernet/IP Scheduled I/O

;Priority TCP 44818 ; Ethernet/IP Unscheduled Traffic (Programming S/W, HMI etc)

;Priority TCP 502 ; Modbus TCP

;Priority TCP 2222 ; A-B CSP, Old PLC-5s on Ethernet (Old Programming S/W, HMI etc)
```

AN-X-BRG has two queues for messages going out its DH+/BH port, Normal and Priority.

Messages from the Priority queue are always sent first.

If there are no messages in the Priority queue, the Normal queue is checked.

This is used to ensure critical packets, such as Scheduled I/O or HMI updates are always updated deterministically and not affected by other traffic such as monitoring device's web pages etc.

You assign specific UDP or TCP ports to the Priority queue to improve performance and determinism for specific applications. For example, you can assign scheduled Ethernet/IP traffic to the high priority queue to avoid connection timeouts.

- Keyword Priority
- UDP or TCP
- UDP or TCP port number (1-65535)

Priority entries are needed in AN-X-BRG modules at both ends of the bridge so replies are transmitted using the high priority queue.

There can be up to 15 entries for the priority queue.

If too much traffic is configured on the Priority queue, the purpose is defeated.

Typical entries:

Traffic type	Protocol	Port
Ethernet/IP unscheduled data	TCP	44818
Ethernet/IP scheduled data	UDP	2222
Modbus TCP	TCP	502

IMPORTANT!

All configuration operations require a module reboot and therefore result in a disruption of bridge operations. **These should not be performed while the process is in production mode.**



Using the Web Interface

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

Use the web interface to:

- configure bridge operation
- view and retrieve sample bridge configuration file
- monitor DH+/BH diagnostic counters and the active station list
- view AN-X logs, including the DH+/BH traffic logs
- configure IP settings
- upload, select and remove firmware files on the AN-X
- retrieve Diagnostic Capture file
- 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 screenshot shows the web interface for the AN-X-AB-BRG Ethernet Bridge Module (v4.1.1). The left pane is a navigation menu with the following items:

- Home Page
- Automation Network (expanded)
 - BRG Configure
 - BRG Configuration View
 - BRG Configuration Sample
 - BH Monitor
- Log Files
- Administration
- Support

The right pane displays the following content:

Quest Technical Solutions

AN-X-AB-BRG Ethernet Bridge Module (v4.1.1)

Introduction:

This is the main configuration screen for the AN-X-AB DH+/BH Ethernet to Data Highway Plus or Blue Hose gateway. Then AN-X-AB-BRG firmware has two modes of operation, "Data Highway Plus" (DH+) and "Blue Hose" (BH).

DH+ mode uses standard Data Highway Plus protocol and can be connected to an existing DH+ network. Standard DH+ baud rates are supported (57.6k, 115.2k and 230.4k).

BH mode uses Miller encoding which allows double the baud rate for the same signal rate on the Blue Hose cable. ** Only AN-X-AB-BRG modules can be connected to the Blue Hose network in this mode. It cannot be connected to any DH+ stations. BH baud rates are 115.2k, 230.4k and 460.8k.

Directions:

The main menu, located on the left, provides a list of options that can be configured using this web interface. To see the sub-menus for each item, click on the down arrow icon beside each main option.

Menu Details:

Automation Network:

BRG Configure:

The AN-X-AB-BRG Ethernet Bridge is configured using a text file. This selection is used to send the Bridge configuration text file.

BRG Configuration View:

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.

DH+/BH Monitor

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

BH Diagnostic Counters

[Clear Counters](#)
[Refresh Counters](#)
 Auto Refresh

Counter	Value	Counter	Value
Solicit ACK Bad	0	ACK Timeout	0
TX Retries Exhausted	0	TX Normal Queue	0
RX Queue	0	TX Priority Queue	0
No Memory NAK Rec'd	0	Rec'd ACK/NAK Too Long	0
Token Pass Timeout	0	Token Pass Failed	0
Token Claim Sequence	0	Token Claimed	0
RX CRC Error	0	Duplicate Station	0
RX Noise	0	No Memory NAKS Sent/Only Strn	0
RX Frame Too Small	0	RX Frame Too Large	0
RX Duplicate	0	RX Abort	0
TX Frames	26364	RX Good Frames	11864
TX Commands	18993	RX Replies	0
RX Commands	7755	TX Replies	0
TX Reply Failed	0	TX Normal Queue Full	0
		TX Priority Queue Full	0

Station List (Octal)

-	-	-	-	-	-	-	-
-	-	-	-	*14	-	16	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-

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 34.

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

BRG Configure

Use this selection to send a bridge configuration text file to the AN-X-BRG.

AN-X AB Bridge Configure

Bridge Configuration Instructions:

All Bridge configuration operations require a module reboot and therefore result in a disruption in the Ethernet Bridge operation. **This should not be performed while the process is in production mode.**

The AN-X-AB-BRG Bridge is configured using a text file.

Start with the **Sample Configuration** or **Manually create** a text configuration file using a text editor such as Notepad and use the form below to select the file on your computer.
Use the 'Send File to AN-X' button to send this configuration file.

Select file: No file chosen

BRG Configuration View

Use this selection to view the current bridge configuration and the configuration lo on the AN-X-BRG module.

AN-X AB Bridge Current Configuration

Configuration File:

```
; AN-X2-AB-DHPBRG Sample Bridge Configuration File
; Lines beginning with semicolons are considered comments and are ignored
; Remove semicolons from examples below to enable mappings
; Copy and modify lines from examples below as needed

ModeBH                ; ModeDhp or ModeBH
Baud                   460k    ; 57k, 115k, 230k for DHP - 115k, 230k, 460k for BH
Station               14      ; In octal
Tokbytes              300     ; Max Msg bytes per Token

BridgeIP x.x.x.84      -> STN 16
BridgeIP x.x.x.94      -> STN 16
BridgeIP x.x.x.110     -> STN 16

FwdBcast UDP 44818    ; Allow RSLinx to browse bridged IP's

; Priority <Prot> <Port>
Priority UDP 2222      ; Ethernet/IP Scheduled I/O
Priority TCP 44818     ; Ethernet/IP Unscheduled Traffic (Programming S/W, HMI etc)
Priority TCP 502       ; Modbus TCP
;Priority TCP 2222    ; Old A-B CSP, Old PLC-5s on Ethernet (Old Programming S/W, HMI etc)
```

Retrieve [Current DHP Router Configuration](#) or [Sample DHP Router Configuration](#) (right-click - save link as)

Bridge Configuration Log:

```
AnxAbBrgCfg Ver 4.1.1
Security Key Match

Inf AnxHostName=Anx4b AnxIp=10.10.0.111 AnxMac=00:0c:1a:00:80:1a
ModeBH
Baud=460k    ; 57k, 115k, 230k for DHP - 115k, 230k, 460k for BH
Station=14 (12 Dec)
TokBytes=300
BridgeIP 10.10.0.84 -> STN 16 (14 dec)
BridgeIP 10.10.0.94 -> STN 16 (14 dec)
BridgeIP 10.10.0.110 -> STN 16 (14 dec)
FwdBcast UDP 44818
Priority UDP 2222
Priority TCP 44818
Priority TCP 502
Inf Brg Config parsed successfully
Inf Brg PRU Loaded successfully
AN-X-AB Bridge configured successfully
```

Note that if the AN-X-BRG has not been restarted after a new configuration has been sent, the configuration log may not match the configuration file.



BRG Configuration Sample

Use this selection to view and retrieve the sample configuration file on the AN-X-BRG.

AN-X AB Bridge Sample Configuration

Sample Bridge Configuration File:

```

; AN-X-AB-BRG Sample Bridge Configuration File

; Lines beginning with semicolons are considered comments and are ignored
; Remove semicolons from examples below to enable mappings
; Copy and modify the sample below as needed

;ModeDHP          ; ModeDHP or ModeBH (see "Modes" below) uncomment to enable configuration

Baud      230k    ; ModeDHP: 57k, 115k, 230k / ModeBH: 115k, 230k, 460k
Station   1      ; 0-77 octal
Tokbytes  300    ; Max Message bytes per Token

;BridgeIP x.x.x.<IpLowByte> -> STN <Dest Station> (see details below)
BridgeIP x.x.x.84 -> STN 10    ; CLX I/O - Connected to Ethernet on AN-X at Station 10
BridgeIP x.x.x.85 -> STN 10    ; CLX I/O - Connected to Ethernet on AN-X at Station 10

BridgeIP x.x.x.94 -> STN 11    ; Flex I/O - Connected to Ethernet on AN-X at Station 11
BridgeIP x.x.x.95 -> STN 11    ; Flex I/O - Connected to Ethernet on AN-X at Station 11

BridgeIP x.x.x.100 -> STN 12   ; HMI      - Connected to Ethernet on AN-X at Station 12

BridgeIP x.x.x.110 -> STN 10   ; AN-X-AB-BRG - This allows monitoring of the remote AN-X
BridgeIP x.x.x.111 -> STN 11   ; AN-X-AB-BRG - This allows monitoring of the remote AN-X
BridgeIP x.x.x.112 -> STN 12   ; AN-X-AB-BRG - This allows monitoring of the remote AN-X

;BridgeIP x.x.x.114 -> STN 16   ; Not used (semicolon disables)
;BridgeIP x.x.x.119 -> STN 16   ; Not used (semicolon disables)

;FwdBcast <Prot> <Port> (see details below)
FwdBcast UDP 44818 ; Allow RSLinx to browse bridged IP's

;Priority <Prot> <Port> (see details below)
Priority UDP 2222 ; Ethernet/IP Scheduled I/O
;Priority TCP 44818 ; Ethernet/IP Unscheduled Traffic (Programming S/W, HMI etc)
;Priority TCP 502 ; Modbus TCP
;Priority TCP 2222 ; Old A-B CSP, Old PLC-5s on Ethernet (Old Programming S/W, HMI etc)

;ModeDHP or ModeBH
;-----
;ModeDHP mode uses standard Data Highway Plus protocol and can be connected to an existing DH+
network.
; Standard DH+ baud rates are supported (57.6k, 115.2k and 230.4k).
;
;ModeBH uses Miller encoding which allows double the baud rate for the same signal rate on the Blue
Hose cable.
; ** Only AN-X-BRG modules in ModeBH can be connected to the Blue Hose network in this mode. It
cannot be
; connected to any DH+ stations.

```

Retrieve [Sample Bridge Configuration](#)

Log Files

DH+/BH Traffic Logs

Traffic logs are used to measure DH+/BH network traffic.

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+/BH Total Traffic Log

The DH+/BH Total Traffic Log shows the percentage of network time on the local DH+/BH network 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 inter-packet 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+/BH Station Traffic Log

The DH+/BH 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.

Bridge operation only uses commands. Response information is shown only if there are actual DH+ stations 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

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.

The log shows automatically generated IP/Station mappings and the first instance of Priority messages.



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.

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.

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 Diagnostic Capture

Use Administration/AN-X Diagnostic Capture to create a compressed zip file that contains the current AN-X configuration and logs, for use by technical support.

The screenshot shows a web interface for 'AN-X Diagnostic Capture'. On the left is a sidebar with a dark blue background and white text, containing a 'Home Page' link and several expandable sections: 'Automation Network', 'Log Files', 'Administration', and 'Support'. Under 'Administration', there are links for 'AN-X IP Configuration', 'AN-X Firmware Select', 'AN-X Firmware Upload', 'AN-X Firmware Remove', 'AN-X Diagnostic Capture', 'AN-X Kernel Page', 'AN-X Kernel Update', and 'AN-X Module REBOOT'. The main content area has a dark blue background with white text. It is titled 'AN-X Diagnostic Capture' and includes the following text:

Instructions:

Click on the CREATE CAPTURE button below to create a Diagnostic Capture zip file.

This file contains the current configuration, logs and other diagnostic information which is useful for troubleshooting by technical support staff.

*** Note: This process takes about 5 seconds and may have a minor impact on the module's communication performance.

At the bottom of the main content area, there is a white button with the text 'CREATE CAPTURE'.

Click the CREATE CAPTURE button to create the file. There is a slight delay while AN-X builds the file.

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

AN-X Kernel Page

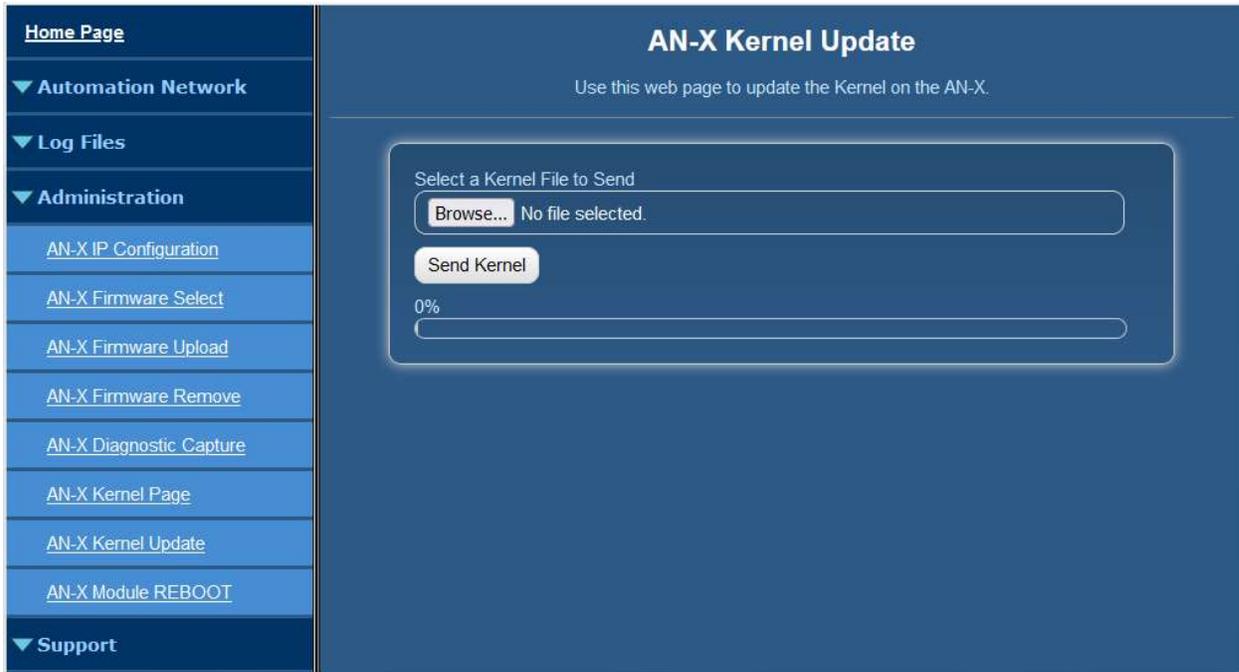
Use *Administration.AN-X Kernel Page* to display the version of the Linux kernel on the AN-X.

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 Kernel Update

Occasionally we release a new version of the Linux kernel for the AN-X. Use *Administration/AN-X Kernel Update* to send the kernel (*.qtk) file to the AN-X.

Click the Browse button to select the file, then click Send Kernel to transfer the file.



AN-X displays a progress bar as the file is transferred. When the transfer is complete, the AN-X still has to copy the kernel file to the microSD card. When the file copy is complete, the AN-X displays a message to indicate that the file was copied successfully. Stay on this web page until AN-X indicates that the file has been written to the microSD card, then click the REBOOT button to restart 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-X-BRG has LEDs that indicate the state of the Ethernet connection, the overall module state and the connection to the DH+/BH network.

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 (Module Status) and NS (Network Status) LEDs

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 for example 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

Bridge Operation

MS LED	Meaning
GREEN	Configured successfully
Fast red flash	Errors in configuration file
Red Pulse (250 ms)	Bridge Error (see System Log)

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

DH+/BH Diagnostic Counters

AN-X-BRG maintains DH+/BH diagnostic counters. Use *Automation Network/DH+/BH Monitor* 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)
TX 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 rec'd	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	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.
RX CRC error	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.
RX frame too small	AN-X received a frame smaller than the minimum possible size.



	**** changed
RX Duplicate	AN-X received a frame with the same transaction number as a previous frame. It discards the duplicate frame.
TX Frames	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.
TX Commands	16-bit counter. AN-X increments this counter when it successfully sends a command to another station.
RX Commands	16-bit counter. AN-X increments this counter when it receives a command from another station.
TX Reply Failed	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 Normal Queue	Number of messages in AN-X transmit queue 0
TX Priority Queue	Number of messages in AN-X transmit queue 1 (write messages)
Rec'd ACK/NAK Too Long	AN-X was expecting an ACK and received a frame that was longer than 3 characters instead.
Token Pass Failed	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.
Duplicate Station	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
RX Frame Too Large	AN-X received a frame that was larger than the maximum possible size (308 bytes, including the 2 CRC bytes).
RX Abort	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.
RX Good Frames	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.
RX Replies	16-bit counter. AN-X increments this counter when it receives a reply

	to a command it sent to another station.
TX Replies	16-bit counter. AN-X increments this counter when it successfully sends a reply to another station.
TX Normal Queue Full	16-bit counter. A Normal IP message was to sent out the DH+/BH port, but the TX normal queue was full.
TX Priority Queue Full	A Priority IP message was to sent out the DH+/BH port, but the TX priority queue was full.

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 can be cleared from the web interface using the *Clear Counters* link.



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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-BRG.v4.01.01.qtf

Specifications

Parameter	Specification
Function	IP Bridge Ethernet and DH+/BH 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	



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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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