

**AN-X2-ABDHRIO
Remote I/O Drive
Interface Module**

User Manual



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

WARNING!

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

These warnings help to:

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

IMPORTANT!

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

TIP

Identifies information that explains the best way to use the AN-X2-ABDHRIO gateway

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Module Overview



The RIO-DRV communications module is used to connect applications written for Allen-Bradley remote I/O drives to Allen-Bradley Ethernet drives. Typical applications for this module include replacing obsolete remote I/O drives with newer Ethernet drives. For applications where multiple drives exist on a single Remote I/O network, a single AN-X2 gateway can be used to provide data for up to four Ethernet/IP drives.

You must thoroughly understand the application and the details of the operation of the remote I/O drive being replaced and the target Ethernet drive. In particular, it may be necessary to make some changes to the application, depending on the operation of the Ethernet drive.

Remote I/O network features:

- emulates up to 4 racks, with rack numbers from 1 to 76 octal, with any combination of partial racks
- supports all remote I/O baud rates

The AN-X2-ABRIO-DRV module has a web interface for configuration, for monitoring logs, and for performing other administrative functions. You can communicate with the module using any standard web browser such as Internet Explorer.

The module firmware can be updated over Ethernet using the web interface. Refer to page 44 for details.

Hardware Features



The module has:

- LEDs to indicate the status of the connection to the Ethernet (100 and Link/Act)
- a LED to indicate the module's internal state (SYS or MS)
- a LED to indicate the state of communications on the Remote I/O network (NET or NS)
- an Ethernet connector
- a power connector
- a 3-pin Phoenix connector to connect to the remote I/O network

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.

Package Contents

- AN-X2-ABDHRIO module
- CD containing software and documentation
- microSD to SD card adapter
- rubber feet for desktop use

Identifying the AN-X2 versus the Original AN-X

The label on the bottom toward the front says AN-X2.

There is a slot at the back for the microSD card.

When initially powered up:

- AN-X2 railroads (alternates) SYS (or MS) and NET (or NS) LEDs green as it starts up
- without the Ethernet cable attached, the Ethernet 10/100 (upper) LED is on for AN-X2 (both Ethernet LEDs are off for the original AN-X)

Comparisons with the Original AN-X

AN-X2 modules have a microSD card for storage of firmware and configuration data.

You no longer need AnxInit; everything can be done from the web interface or by editing files on the microSD card.

Operation is simplified, there are production and maintenance modes only.

The AN-X2 requires firmware version 4 and above.

The AN-X2 uses the same hardware interface to automation networks.

There are no differences for applications once Ethernet and firmware have been configured.

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

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

If the AN-X2 is inaccessible from Ethernet because of its settings, you can remove the card and edit the file config.txt. Refer to page 12 for details.

Insert the card in the slot at the back of the AN-X2, with the pins facing up.

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.



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Installation

Prevent Electrostatic Discharge

The module is sensitive to electrostatic discharge.

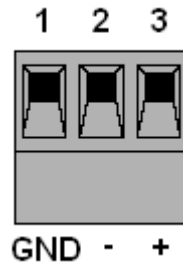
WARNING!

Electrostatic discharge can damage integrated circuits or 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.

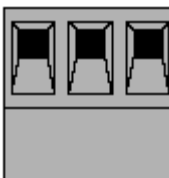
The part number for the power connector is Phoenix MSTB 2.5/3-ST-5.08

Cabling and Termination

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

On the AN-X module, the remote I/O connections should be line 1, shield, line 2.



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 PLC, and so on.

Terminate both ends of a remote I/O network by using external resistors attached to the physical ends of the network. There should be two and only two terminators on the network.

Use 82 ohm resistors if the network operates at 230.4 kbps or if the network operates at 57.6 kbps or 115.2 kbps and none of the devices in the table below are present. The maximum number of physical devices on the network is 32.

Use 150 ohm resistors if the network contains any of the devices in the table below, or if the network operates at 57.6 kbps or 115.2 kbps and you do not require the network to support more than 16 physical devices.

Device Type	Catalog Number	Series
Adapters	1771-AS	All
	1771-ASB	Series A and B
	1771-DCM	All
Miscellaneous	1771-AF	All
	1771-AF1	All

Baud Rate	Maximum Cable Length
57.6 Kbaud	10000 ft
115.2 Kbaud	5000 ft
230.4 Kbaud	2500 ft

The most common causes of connection errors are:

- wiring reversed (lines 1 and 2)
- incorrect baud rate
- other cabling and termination problems
- duplicate or overlapping address

Ethernet Cabling

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

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

If you are connecting directly to the AN-X module, use a crossover cable.

Software Installation

There is no required software installation for the AN-X2-ABDHARIO-DRV. All configuration can be done using the web interface.

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



Quick Start

Step	Operation	See page
1	Power up the AN-X, connect it to Ethernet and assign it an IP address	9
2	Connect AN-X to the Remote I/O network	5
3	Create configuration files	16
4	Use the AN-X web interface to download the configuration files and configure the remote I/O network	31
5	Use the AN-X to transfer between remote I/O and Ethernet	



Ethernet Configuration

Before you can use the AN-X2-ABDHARIO, you must configure its network properties on Ethernet.

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

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 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

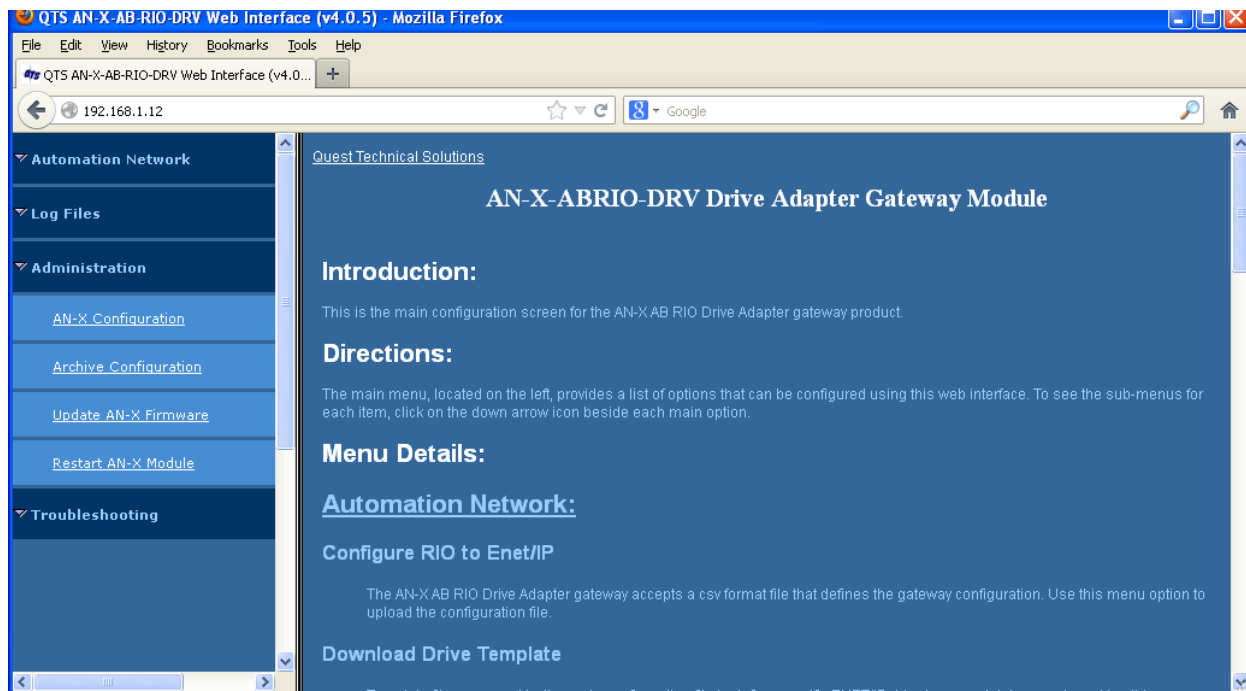
The AN-X2 must be on the same subnet as the computer to use the link-local IP address. It cannot be connected through a router.

TIP

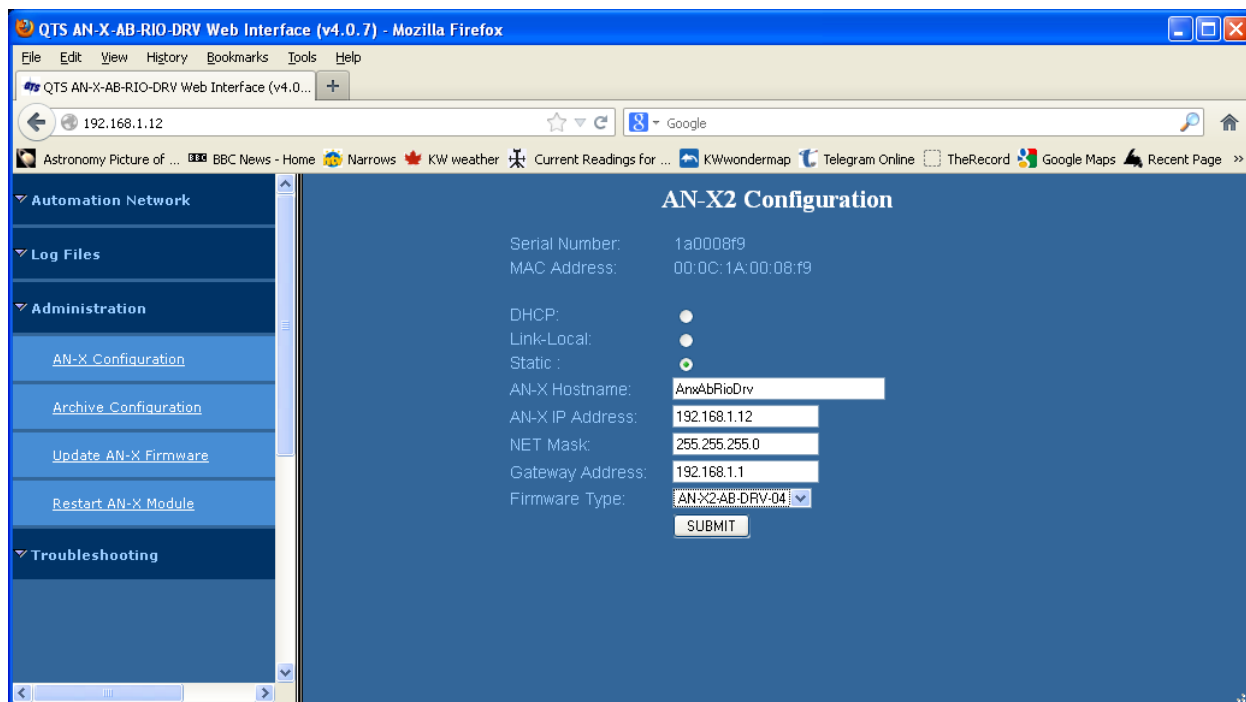
The module is shipped configured for use with the Data Highway Plus firmware. The initial screen you see will be slightly different from that shown below.

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 SYS (or 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.

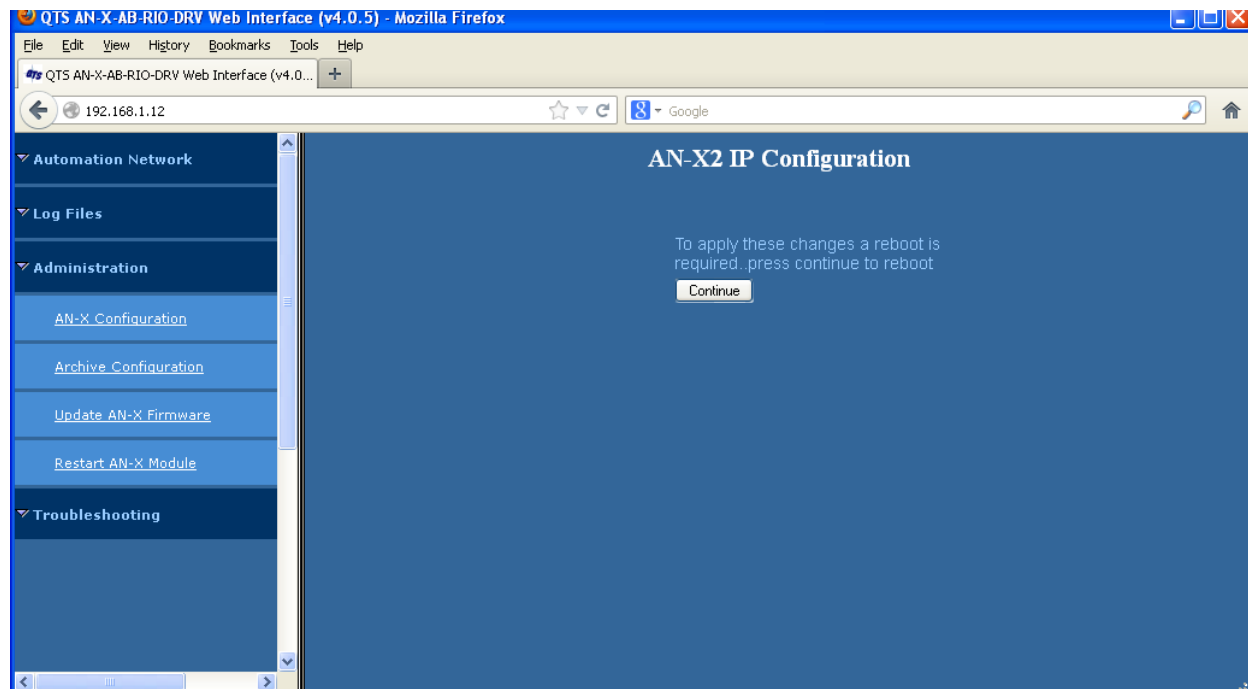
The firmware file for drive operation is AN-X2-AB-DRV-04

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 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

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

The file config.txt is a text file that contains the Ethernet configuration and the name of the firmware file to load.

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.

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 SYS (or MS) LED, see page 42.

Example config.txt files

Example: Link- Local IP address

```
IP: LOCAL
Hostname: ANX2Drv
Firmware: AN-X2-AB-DRV-04
```

Example: DHCP

```
IP: DHCP
Hostname: ANX2Drv
Firmware: AN-X2-AB-DRV-04
```

Example: static IP address

```
IP: 192.168.1.14
NetMask: 255.255.255.0
DefGtwy: 192.168.1.1
HostName: ANX2Drv
Firmware: AN-X2-AB-DRV-04
```

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, 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 now be able to access it using a browser to set the desired Ethernet configuration.



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Configuring the AN-X

The AN-X configuration consists of:

- the main configuration file
- remote I/O template files
- Ethernet drive template files

In the following all numbers except rack are decimal unless otherwise specified. Rack number and remote I/O bit numbers are octal unless otherwise specified. To select the base, prefix a number with 0x - Hex, 0o - Octal, 0d - Decimal.

Main Configuration File

The main configuration file is a comma-separated values (CSV) text file. Fields can be separated by commas or spaces.

It consists of:

- baud rate
- options
- definitions for up to four drives

Within the configuration data, anything after a semicolon is treated as a comment. A comment can be inserted at the end of a line or on a separate line.

The file can also contain blank lines.

You download the configuration to the AN-X using the web interface (see page 31)

To view the current main configuration file, select *Automation Network/Configure RIO to Enet/IP* in the web interface and click the link at the bottom of the page.

Baud Rate

The baud rate is defined by a line that consists of the keyword Baud, followed by a comma, and then one of 57k, 115k or 230k.

Selection	Baud Rate, kbits/second
57k	57.6
115k	115.2
230k	230.4

The baud rate definition must be included in the configuration file.

Example:

Baud, 57k



Options

Include a line with the option `MapReport` to generate a report showing how data is mapped. You can use the mapping file for documentation, debugging and technical support.

You can see the file by using *View All Logs* in the web interface.

If you include a line with the option `FaultRioRacks`, the remote I/O racks emulated by the AN-X come up initially inhibited. When the AN-X gets a good connection with the Ethernet drive, it removes the inhibit on the associated rack. If it loses the connection, the rack is inhibited again. This is useful if the current PLC program monitors rack status to determine if the drive is present.

TIP In developing an application, leave `FaultRioRacks` commented out until the racks are communicating with the remote I/O scanner, then add the option.

Drive Definitions

Drive definitions begin with a line that contains the keyword `Rack`, and end with a line that consists of just the keyword `EndRack`.

The beginning of the drive definition is a line that consists of the keyword `Rack`, followed by a comma, the rack number in octal in the form `0oxx` where `xx` is the rack number from 0 to 76 octal, a comma, the start quarter (1-4), a comma, and the end quarter (1-4).

Examples

```
Rack, 0o01,1,4 ; full rack, rack number 1
```

```
Rack, 0o07,1,1 ; quarter rack starting at the first quarter,
rack number 7
```

The end quarter must be greater than or equal to the start quarter.

There can be a maximum of 4 different drive definitions.

The drive definition includes everything between those two line and consists of:

- block transfer read/write location (optional)
- IP Address of Ethernet drive
- Unicast/multicast
- Requested RPI
- the name of the remote I/O template file



Block Transfers (optional)

The AN-X supports Ethernet/IP unscheduled message execution to read parameters from the drive.

The remote I/O scanner executes a block transfer write containing a list of parameters to be read from the Ethernet drive. The AN-X sends a Scattered-Read message to the Ethernet drive including the list of parameters.. When the AN-X receives a reply, it stores the data in the block transfer read data area. The remote I/O scanner then issues a block transfer read request to retrieve the data.

The format of the remote I/O write and read data matches the format in the 20-COMM-E Ethernet/IP Adapter User Manual, starting at page 6-8.

For example, to read parameters 1, 2, 3, 4, and 5 from a drive, the block transfer write would have length 15 and consist of

```
1 0 0 2 0 0 3 0 0 4 0 0 5 0 0
```

The block transfer read to retrieve the data would have length 15 and the data returned would consist of 5 blocks of three, each containing the parameter number, the least significant word of the parameter value and the most significant word of the parameter value

```
1 LSW MSW 2 LSW MSW ...
```

The requested length (ReqLen, see page 25) would be set to

5 parameters * 6 bytes/parameter = 30.

The maximum number of parameters you can read in a single block transfer is 21.

Block transfer definitions consist of the block transfer type (read or write) and the location (I/O group and slot). The fields may be separated by commas or spaces.

The I/O group must be in the range 0 to 7. The slot must be 0 or 1.

The I/O group is relative to the start of the rack.

IMPORTANT!

If the rack is a half rack starting at the second quarter (I/O group 4), then a value of 2 in the block transfer definition means I/O group 6 in the rack.

The location of the block transfer must not overlap scheduled output data.

Examples

```
btr,7,0
```

```
btw,7,0
```

IP Address

Include a list that consists of the keyword IPAddr, followed by a comma and then the IP address of the Ethernet drive.

Example:

```
IpAddr, 192.168.1.15
```



Unicast/multicast

Include a line with just the keyword Unicast to make the connection to the Ethernet drive a unicast connection.

If the line is not included in the drive definition, AN-X defaults to a multicast connection.

IMPORTANT! Not all Ethernet drives support Unicast connections.

Requested RPI

Include a line that consists of the keyword RPI, followed by a comma, then the requested RPI, in milliseconds

The allowed range is 1 to 750 ms.

The requested RPI must be within the range supported by the Ethernet drive

Example:

```
RPI, 10
```

Remote I/O Template File

Include a line with the keyword Template, followed by the name of the remote I/O template file that defines the mappings of remote I/O data and data on the Ethernet drive.

Remote I/O template files usually start with RioDef.

AN-X appends the extension .csv Do not include it in the name.

The contents of the remote I/O template file are described in the following section.

Sample Main Configuration File

```
Baud, 230k  
;MapReport  
;FaultRioRacks  
Rack, 0o00,1,4  
IpAddr,192.168.1.15  
Unicast  
RPI,10  
Template,RioDef_FullRack  
EndRack
```



Remote I/O Templates

Remote I/O template files are comma-separated values (CSV) text files. Fields can be separated by commas or spaces. The file name usually begins with RioDef_ although that isn't required. The file extension must be .csv

Remote I/O template files contain:

- the name of the template file for the Ethernet drive
- mappings between remote I/O and Ethernet data, possibly including scaling information

The I/O group is relative to the start of the rack to which the template is applied.

If the rack to which the template is applied is a quarter rack located at the end of the rack, then the rack occupies I/O groups 6 and 7. A remote I/O template file that contains an I/O address with I/O group 0 then refers to I/O group 6 in the rack.

IMPORTANT!

If that same template file is used for a rack that starts at I/O group 2, an I/O address with I/O group 0 then refers to I/O group 2 in the rack.

Multiple drives defined at different starting remote I/O addresses can use the same template file if the data mappings are the same.

You can make changes in the template file and all drives using that template will use the change (once you restart the AN-X).

Ethernet Template File Name

Include a line with the keyword Template, followed by the name of the Ethernet template file that defines the data on the Ethernet drive.

Ethernet template files usually start with EthDef.

AN-X appends the extension .csv Do not include it in the name

The contents of the Ethernet template file are described in a later section.

Data Mappings

There are two sections of the remote I/O template file, one for input mappings and the other for output mappings.

Input Mappings

The input mapping section begins with a line with just the keyword Inputs and ends with a line with just the keyword EndInputs.

Mappings consist of the input word or bit address, a space, the symbol <-, a space, and the Ethernet tag name from the Ethernet template file (see page 24)

Word addresses consist of I:n, where n is the I/O group, from 0 to 7.

Bit addresses consist of I:n.b, where b is the bit number, from 0 to 17 octal.



Examples:

```
I:0 <- LogicStatus
```

```
I:2.0 <- Running
```

TIP

You can map one Ethernet input to more than one remote I/O input.

Be careful not to map more than one Ethernet inputs to the same remote I/O input; AN-X doesn't check and both mappings will be active.

Output Mappings

The output mapping section begins with a line with just the keyword Outputs and ends with a line with just the keyword EndOutputs.

Mappings consist of the output word or bit address, a space, the symbol ->, a space, and the Ethernet tag name from the Ethernet template file (see page 24)

Word addresses consist of O:n, where n is the I/O group, from 0 to 7.

Bit addresses consist of O:n.b, where b is the bit number, from 0 to 17 octal.

Examples:

```
O:0 -> Command
```

```
O:2.0 -> Start
```

TIP

You can map one remote I/O output to more than one Ethernet output.

Be careful not to map more than one remote I/O output to the same Ethernet output; AN-X doesn't check and both mappings will be active.

Scaling

The AN-X can apply scaling to the data being mapped.

IMPORTANT!

It's essential that you thoroughly understand the nature of the data being passed and the range of values for the remote I/O data and the allowed range of values for the target Ethernet drive.

IMPORTANT!

The AN-X does not perform any checking on scaled data out of range. We strongly recommend that, wherever possible, you perform scaling in the Ethernet drive rather than in the AN-X.



Bit Data

For bit mappings, the AN-X can flip a bit when it copies the data. Replace the dash in the assignment operator (-> or <-) with a ~, so that the assignment operator becomes ~> or <~.

Examples:

I:2.1 <~ Ready

O:2.0 ~> Halt

Output Data

For mappings to output words, the scaling is appended to the remote I/O address.

For data types int or dint, the scaling can contain an integer multiplier, divisor, or a combination of both.

For data type real, the scaling must be a single floating point multiplier.

TIP Since the allowed scaling parameters depend on the data type, refer to the Ethernet template for the drive when applying scaling.

Examples:

O:2 * 22 -> Speed

O:3 / 47 -> Speed2

O:4 * 9/17 -> Speed3

O:5 * 1.7e3 -> Torque

Input Data

For mappings to input words, the scaling is appended to the Ethernet tag name.

For data types int and dint, the scaling can contain an integer multiplier, divisor, or a combination of both.

For data type real, the scaling must be a single floating point multiplier.

TIP Since the allowed scaling parameters depend on the data type, refer to the Ethernet template for the drive when applying scaling.

Examples:

I:0 <- Response * 2

I:1 <- Feedback / 3

I:2 <- Position * 15 / 79

I:3 <- Speed * .33

TIP Leave a space between the tag name and scaling parameters for input scaling



Sample Remote I/O Template File

```
Template EthDef_PowerFlex_700M

Inputs

I:0.0 <- LogicStatus_Active
I:0.1 <- LogicStatus_Running
I:3   <- SpeedFeedback
I:6   <- Encdr1Position
I:7   <- Encdr1SpdFdbk

EndInputs

Outputs

O:0.0 -> LogicCommand_NormalStop
O:0.1 -> LogicCommand_Start
O:0.17 -> LogicCommand_Jog1
O:3    -> SpeedReference
O:6    -> TorqueTrim
O:7    -> TorqueStep

EndOutputs
```

Sample Remote I/O Template File with Scaling

```
Template EthDef_PowerFlex_700M

Inputs

I:0.0 <- LogicStatus_Active
I:0.0 <- LogicStatus_Running
I:3   <- SpeedFeedback * 22 / 7
I:6   <- Encdr1Position
I:7   <- Encdr1SpdFdbk * 3.14

EndInputs

Outputs

O:0.0 -> LogicCommand_NormalStop
O:0.1 -> LogicCommand_Start
O:0.17 -> LogicCommand_Jog1
O:3 * 4 -> SpeedReference
```



```
O:6 * 1.11 -> TorqueTrim  
O:7 *1.23e6 -> TorqueStep  
EndOutputs
```

Ethernet Templates

Ethernet template files are comma-separated values (CSV) text files. Fields can be separated by commas or spaces. The file name usually begin with EthDef, although that isn't required. The extension must be .csv.

Ethernet template files contain:

- connection point information
- keying information
- unscheduled message parameters (for BTRs/BTWs)
- definitions of tags that contain the name, data type and location of the data on the Ethernet drive

The AN-X is shipped with templates for many common Ethernet drives. These files may require changes for your application since many drives can be configured to have additional scheduled data, version numbers may be different, and so on.

TIP If you need to make changes to an Ethernet Template, copy the file to a new template, rename it, and make the changes in the new file.

Connection Point Information

The scheduled connection point information consists of:

- the assembly instance
- the O->T connection point. O is originator (AN-X), T is target (drive)
- the T->O connection point

Example:

```
AssemIns , 6  
O_T_ConnPt , 2  
T_O_ConnPt , 1
```

Keying Information

Keying information consists of:

- Vendor ID (1 for Allen-Bradley)
- Product type



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- Product Code
- Major Revision
- Minor Revision

The keying information for a drive consists of a line starting with the keyword `Key`, followed by a comma and then each of these fields separated by commas.

A number with leading `0x` indicates that the number is hexadecimal.

If the major revision is preceded by a 'c', then key checking is just for a compatible module: the Product type and code and Major Revision must match and the Minor Revision of the physical module must be equal to or greater than the one specified.

If you comment out or remove the key line in the template file, then no checking is done. This is not a good idea.

Example:

```
Key, 0x01, 0x7b, 0x490, c1, 5
```

Minimum RPI

The minimum RPI supported by the drive is specified in a line that consists of the keyword `MinRpi`, followed by a comma and the numeric value, in milliseconds.

Example:

```
MinRpi, 5
```

If the RPI requested in the main configuration file is less than the minimum RPI supported by the drive, AN-X generates an error.

Unscheduled Message Information

The unscheduled message section begins with a line with just the keyword `UnSchMsg` and ends with a line with just the keyword `EndUnSchMsg`. The is used by BTR/BTW functions for reading parameters.

It contains:

- `service`, the service for the unscheduled message to the drive
- `Class`, target class for the message
- `Instance`, target class instance
- `ReqLen`, the requested length, 3 to 126 bytes

Example:

```
UnSchMsg
```

```
Service 0x4b
```

```
Class 0x93
```

```
Instance 0x00
```



ReqLen 18

EndUnSchMsg

Refer to Allen-Bradley documentation for detailed information.

Input and Output Tags

There are two sections of the Ethernet template file, one for input tags and the other for output tags.

Input Section

The input section begins with a line with the keyword `Inputs`, followed by a comma, and the length of the input data in bytes.

The length in the template files supplied is based on the base configuration for the drive in RSLogix 5000 and includes header information as well as, in some cases, padding data. If your drive is configured with extra scheduled data, copy the standard template to a new template file and modify the length. Add 8 bytes for each block of 2 DINTs or REALs or a combination of DINT and REAL.

The input section ends with a line with just the keyword `EndInputs`.

Tag definitions consist of the keyword `EthTag`, a name, the data type and the location of the data as a word offset into the Ethernet data. The location is enclosed in square brackets.

The default for data location is as 16-bit word offsets. To change this, prefix the offset within the brackets with one of the following:

BYTE keyword changes to BYTE Offset

INT keyword changes to INT Offset (16 bit words, same as default)

DINT keyword changes to DINT Offset (32 bit words)

REAL keyword changes to REAL Offset (32 bit words)

TIP

Examples:

```
EthTag Test1 int[BYTE 1]
```

```
EthTag Test2 dint[INT 3]
```

In the first example, Test1 has data type int and starts at BYTE offset 1.

The name can be up to 63 characters long.

There can be up to 128 input tags.

The datatype can be int, dint or real.

To define a tag for a bit within an int or a dint, append a dot and then the bit number in decimal, 0-15 for ints and 0-31 for dints.



Output Section

The output begins with a line with the keyword Outputs, followed by a comma, and the length of the output data in bytes.

The length in the template files supplied is based on the base configuration for the drive in RSLogix 5000 and includes header information as well as, in some cases, padding data. If your drive is configured with extra scheduled data, copy the standard template to a new template file and modify the length. Add 8 bytes for each block of 2 DINTs or REALs or a combination of DINT and REAL.

The output section ends with a line with just the keyword EndOutputs.

Tag definitions consist of the keyword EthTag, a name, the data type and the location of the data as a word offset into the Ethernet data. The location is enclosed in square brackets.

The default for data location is as 16-bit word offsets. To change this, prefix the offset within the brackets with one of the following:

BYTE keyword changes to BYTE Offset

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DINT keyword changes to DINT Offset (32 bit words)

REAL keyword changes to REAL Offset (32 bit words)

TIP

Examples:

```
EthTag Test1 int[BYTE 1]
```

```
EthTag Test2 dint[INT 3]
```

In the first example, Test1 has data type int and starts at BYTE offset 1.

The name can be up to 63 characters long.

There can be up to 128 output tags.

The datatype can be int, dint or real.

To define a tag for a bit within an int or a dint, append a dot and then the bit number in decimal, 0-15 for ints and 0-31 for dints.

Sample Ethernet Template File

```
AssemIns, 6
O_T_ConnPt, 2
T_O_ConnPt, 1
Key, 0x01, 0x7b, 0x4d, c3, 1
; Unscheduled Msg definition
UnSchMsg
```



```

Service 0x4b
Class 0x93
Instance 0x00
ReqLen 18
EndUnSchMsg
Inputs 30
EthTag LogicStatus int[0]
EthTag LogicStatus_Active int[0].0
EthTag LogicStatus_Running int[0].1
EthTag LogicStatus_CommandDir int[0].2
EthTag LogicStatus_ActualDir int[0].3
EthTag LogicStatus_EnableOn int[0].15
EthTag SpeedFeedback dint[2]
Ethtag Encdr1Position dint[8]
Ethtag Encdr1SpdFdbk real[10]
EndInputs
Outputs 30
EthTag LogicCommand int[0]
EthTag LogicCommand_NormalStop int[0].0
EthTag LogicCommand_Start int[0].1
EthTag LogicCommand_Jog1 int[0].2
EthTag LogicCommand_ClearFault int[0].3
EthTag LogicCommand_SpdRefSel1 int[0].12
EthTag LogicCommand_SpdRefSel2 int[0].13
EthTag LogicCommand_SpdRefSel3 int[0].14
EthTag SpeedReference dint[2]
EthTag TorqueTrim real[8]
EthTag TorqueStep real[10]
EndOutputs

```

Downloading Configurations

Main Configuration File

To download a configuration file to the AN-X-AB-RIO, start the web interface and select *Automation Network/Configure RIO to Enet/IP*.



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To view the file currently being used, select *Automation Network/View Active Configuration*.

Template File

To download a remote I/O or Ethernet template file, select *Automation Network/Download Drive Template*.

Remote I/O and Ethernet template files are stored in the directory *DrvTemplates* on the microSD card on the AN-X.

To view the templates currently stored on the AN-X, select *Automation Network/View Drive Templates*.

If you change a template file and download it, the changes do not take effect until you restart the AN-X.



Using the Web Interface

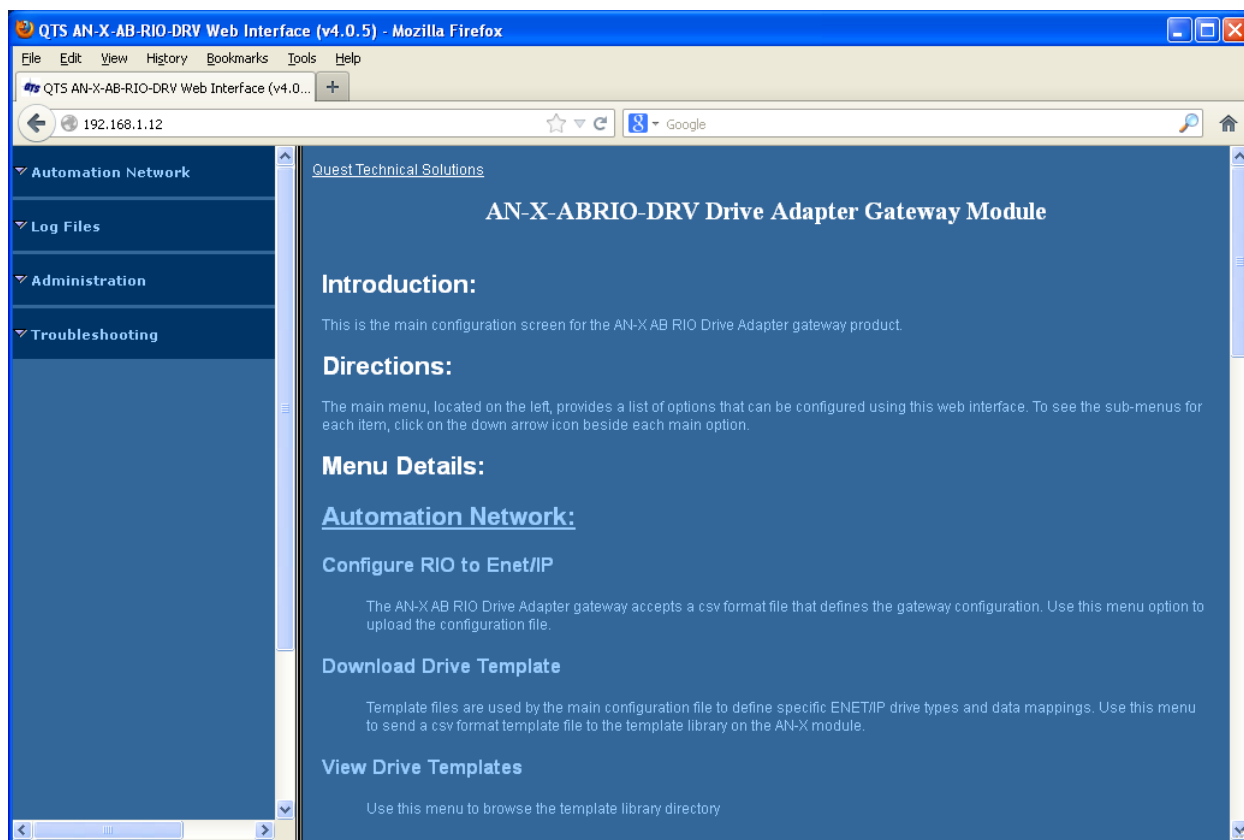
The AN-X module contains a webserver capable of communicating with standard web browsers such as Internet Explorer.

Use the web interface to:

- configure the remote I/O and data mappings
- view the current configuration
- view AN-X logs
- perform administrative functions

It also contains contact information for support.

To use the web interface, you must know the IP address of the AN-X. 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.



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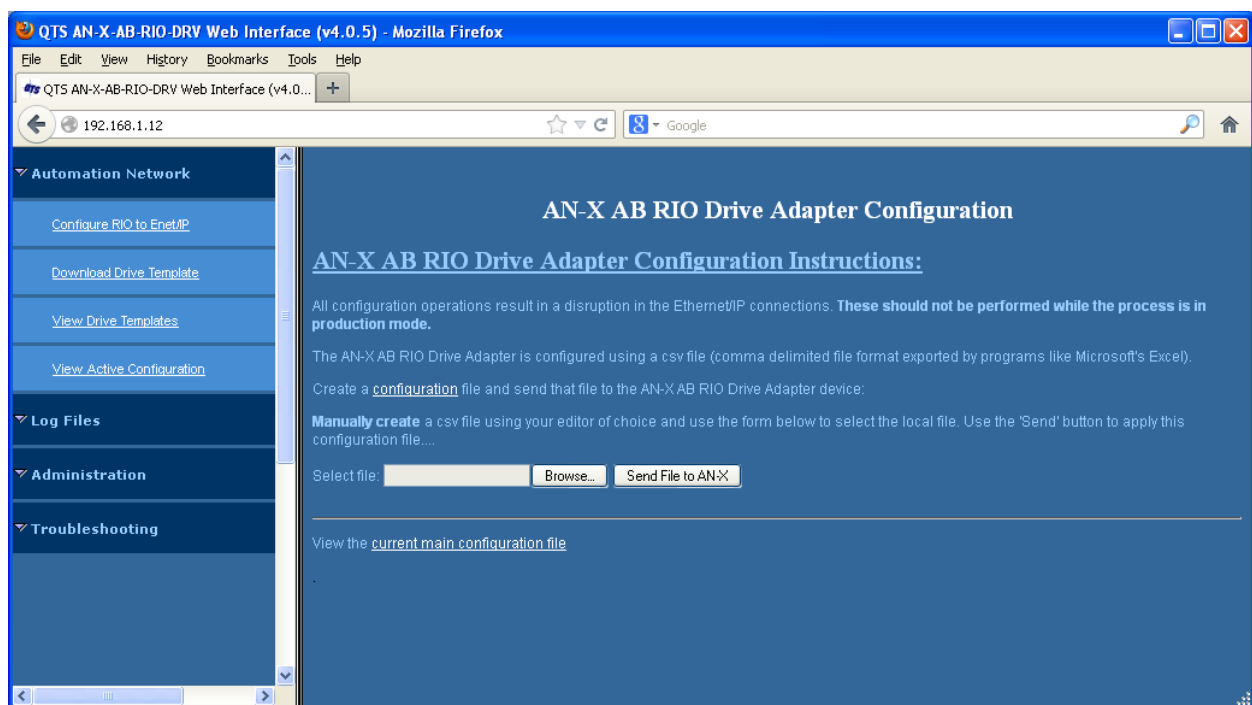


If you run into a problem where data appears not to have changed, flush the cache in the browser or run the browser in the mode where it doesn't cache data (incognito in Chrome, Private browsing in Firefox and Safari, etc.)

Automation Network

Configure RIO to Enet/IP

Select *Automation Network/Configure RIO to Enet/IP* to download a configuration file or drive templates to the AN-X.



First create a configuration file. Refer to page 16 for details on the file format.

Use the *Browse* or *Choose File* button to select the file.

Click the *Send File to AN-X* button to send the file to the AN-X.

AN-X parses the file and displays either the configuration if it has been successful or a message that indicates the source of the error if it fails.

To view the current main configuration file, click the link on this page.

Download Drive Template

Select *Download Drive Template* to download a template file to the AN-X.

Template files are stored in the directory *DrvTemplates* on the microSD card on the AN-X.



You must restart the AN-X to use the downloaded template.

View Drive Templates

Select *Automation Network/View Drive Templates File* to display a list of drive template files stored on the microSD card on the AN-X.

The screenshot shows a web browser window with the address bar at 192.168.1.14. The page title is "AN-X AB RIO Drive Templates". Below the title, it states: "This page shows the template files that are currently stored on this AN-X module's SD card." A section titled "Template Files" contains a table with the following data:

Filename	Size	Date
EthDef_PowerFlex_4-E.csv	1555	2015-02-19 01:27:52
EthDef_PowerFlex_40-E.csv	1774	2015-02-19 01:27:52
EthDef_PowerFlex_400-E.csv	1775	2015-02-19 01:27:52
EthDef_PowerFlex_400-P-E.csv	1776	2015-02-19 01:27:52
EthDef_PowerFlex_40P-E.csv	2132	2015-02-19 01:27:52
EthDef_PowerFlex_4M-E.csv	1737	2015-02-19 01:27:52
EthDef_PowerFlex_70-E.csv	1808	2015-02-19 01:27:52
EthDef_PowerFlex_700-200V-E.csv	1823	2015-02-19 01:27:52
EthDef_PowerFlex_700-400V-E.csv	1823	2015-02-19 01:27:52
EthDef_PowerFlex_700-600V-E.csv	1819	2015-02-19 01:27:52
EthDef_PowerFlex_700-AC-E.csv	693	2015-02-19 01:27:52
EthDef_PowerFlex_7000-E.csv	2049	2015-02-19 01:27:52
EthDef_PowerFlex_7000_2-E.csv	2070	2015-02-19 01:27:52
EthDef_PowerFlex_700AFE-E.csv	1224	2015-02-19 01:27:52
EthDef_PowerFlex_700H-E.csv	1810	2015-02-19 01:27:52
EthDef_PowerFlex_700M.csv	1109	2015-02-19 01:27:52
EthDef_PowerFlex_700S-200V-E.csv	1485	2015-02-19 01:27:52

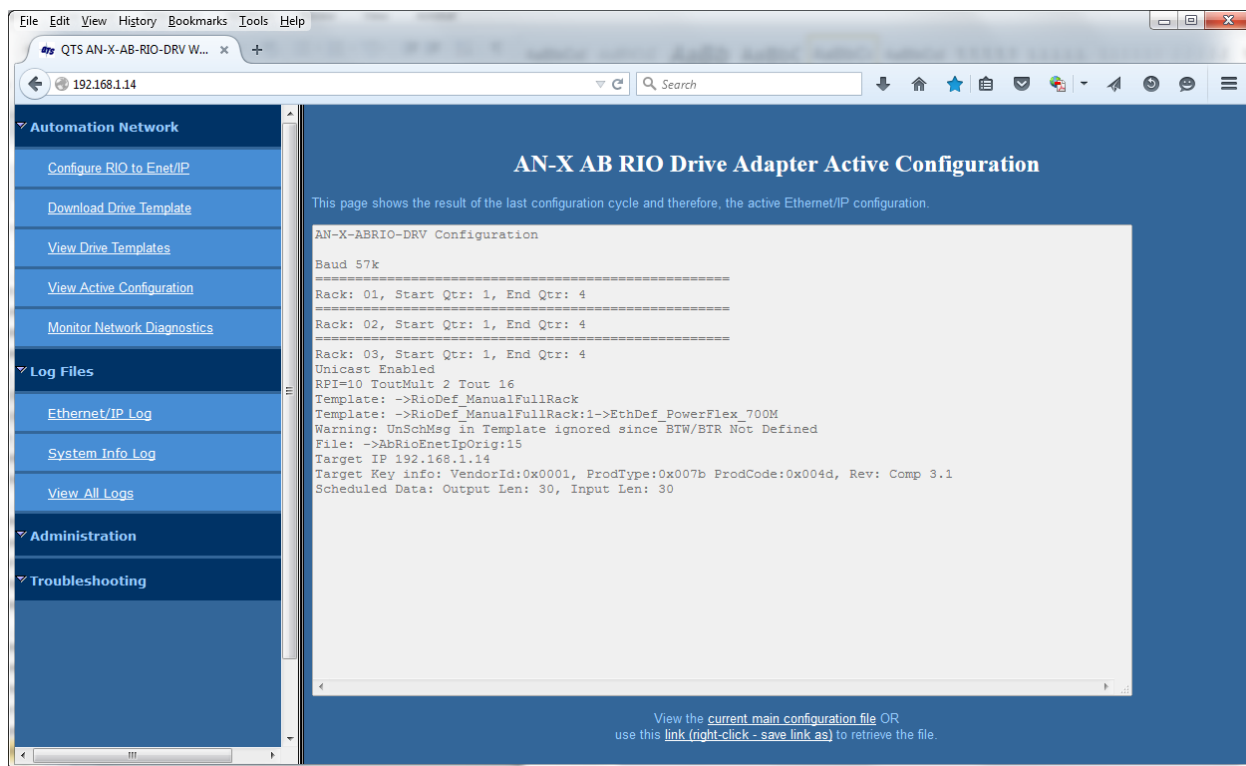
TIP To view the contents of a template file, click on the file name.

View Active Configuration

Select *Automation Network/View Active Configuration* to display the result of the last configuration download.

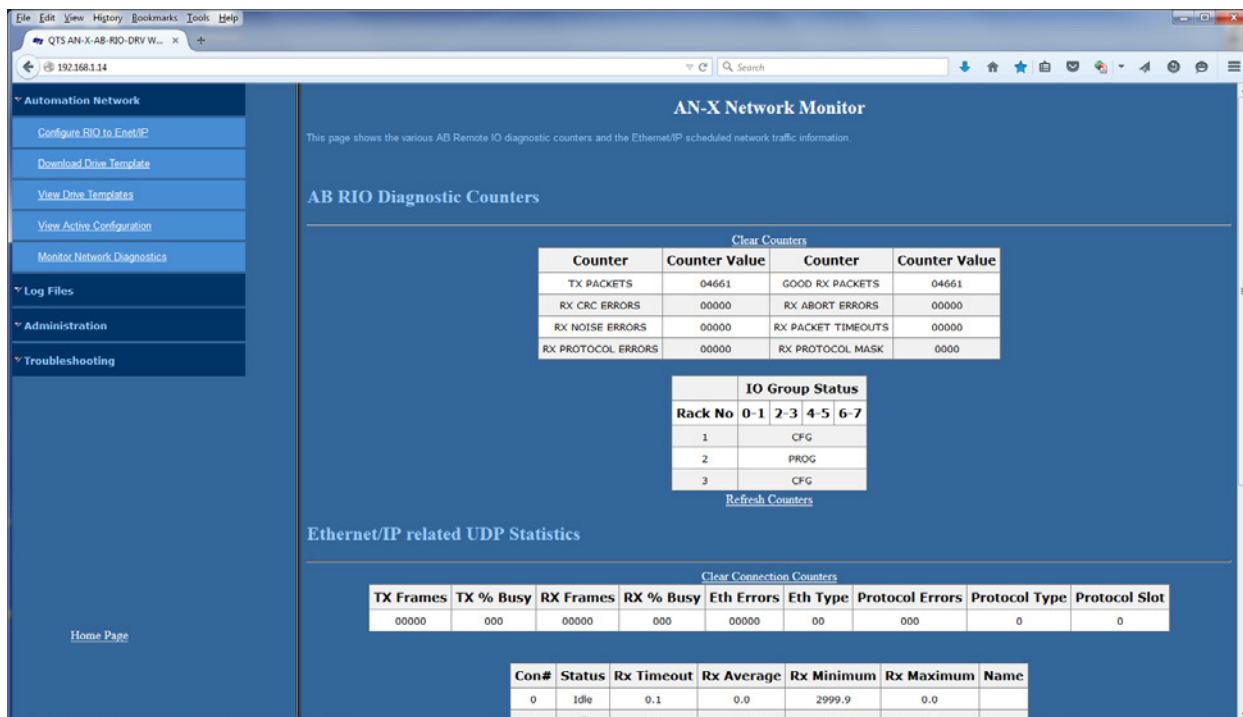
From this page you can also click on the link to view the *current main configuration file* or right click on the *link (right-click – save link as)* link to save the current configuration file to your computer.





Monitor Network Diagnostics

Select *Automation Network/Monitor Network Diagnostics* to display the remote I/O network diagnostic counters, the rack status table, and the Ethernet/IP related UDP Statistics.



To refresh the counters, use the corresponding *Refresh Counters* button or click anywhere in the table.

To clear either set of counters, use the corresponding *Clear Counters* link.

After clearing the counters, refresh the counters.

Remote I/O Diagnostic Counters

Counter	Description
TX PACKETS	Count of transmitted packets
GOOD RX PACKETS	Count of good received packets
RX CRC ERRORS	Received packets with CRC errors
RX ABORT ERRORS	Received packets with abort errors
RX NOISE ERRORS	Received packets with noise errors
RX PACKET TIMEOUTS	Timeouts, packet sent, no reply received
RX PROTOCOL ERRORS	Received packets with protocol errors
RX PROTOCOL MASK	Indicates cause of the last protocol error

Rack Status Table

The rack status table shows the racks configured on the AN-X and the status of those racks.

Possible status values are:

Status value	Description
---	empty
RUN	Rack is being scanned in run mode
PROG	Rack is being scanned in program mode
CFG	Rack configured in ANX but not being scanned Rack inhibited in the PLC Rack reset in the PLC
PLC	Rack being scanned by the PLC but not configured in ANX
INHIBIT	Usually indicates a rack size mismatch between PLC and ANX

In the screen above, racks 1,2 and 3 are full racks. Rack 2 is being scanned in program mode. Racks 1 and 3 are configured in the AN-X but are not being scanned.



Ethernet/IP UDP Statistics

The Ethernet/IP Statistics consist of two portions:

- Global counters
- Statistics for each connection

The Global Counters consist of:

Counter	Description
TX Frames	Count of transmitted frames
TX % busy	Percentage of time the transmitter is not idle
RX frames	Count of received frames
RX % Busy	Percentage of time the receiver is not idle
Eth Errors	Count of Ethernet errors
Eth Type	Type of last error
Protocol Errors	Count of Ethernet protocol errors
Protocol Type	Type of last protocol error
Protocol Slot	Connection number of last protocol error

Clearing the Ethernet counters does not clear the global counters.

The Connection Statistics consist of:

Counter	Description
Connection number	0 to 15
Status	Active or Idle
Rx Timeout	The receive timeout, calculated from the RPI
Rx Average	The average of the last 32 update times, in ms.
Rx Minimum	The minimum update time since the last counter reset, in ms.
Rx Maximum	The maximum update time since the last counter reset, in ms
Name	The name for the connection, from the configuration file



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.

Ethernet/IP Log

The Ethernet/IP log shows messages and errors associated with the Ethernet communication.

There are two log files that are rotated when they become full. Click the *First Enet Log* and *Second Enet Log* buttons to see both files.

Click the *Refresh Log* button at the bottom of the page to refresh the display.

System Info Log

The System Info log records informational messages during startup and normal operation.

Click the *Refresh Log* button at the top of the page to refresh the display.

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.

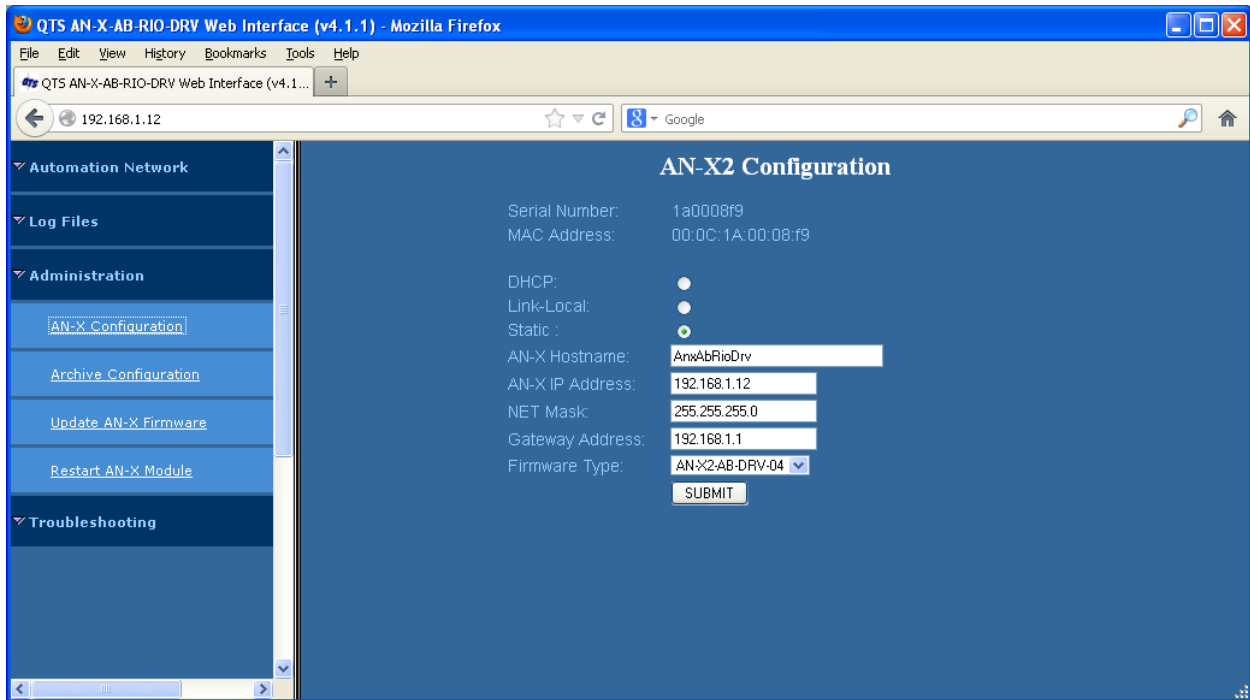
Administration Menu

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

AN-X 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 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 SYS (or 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

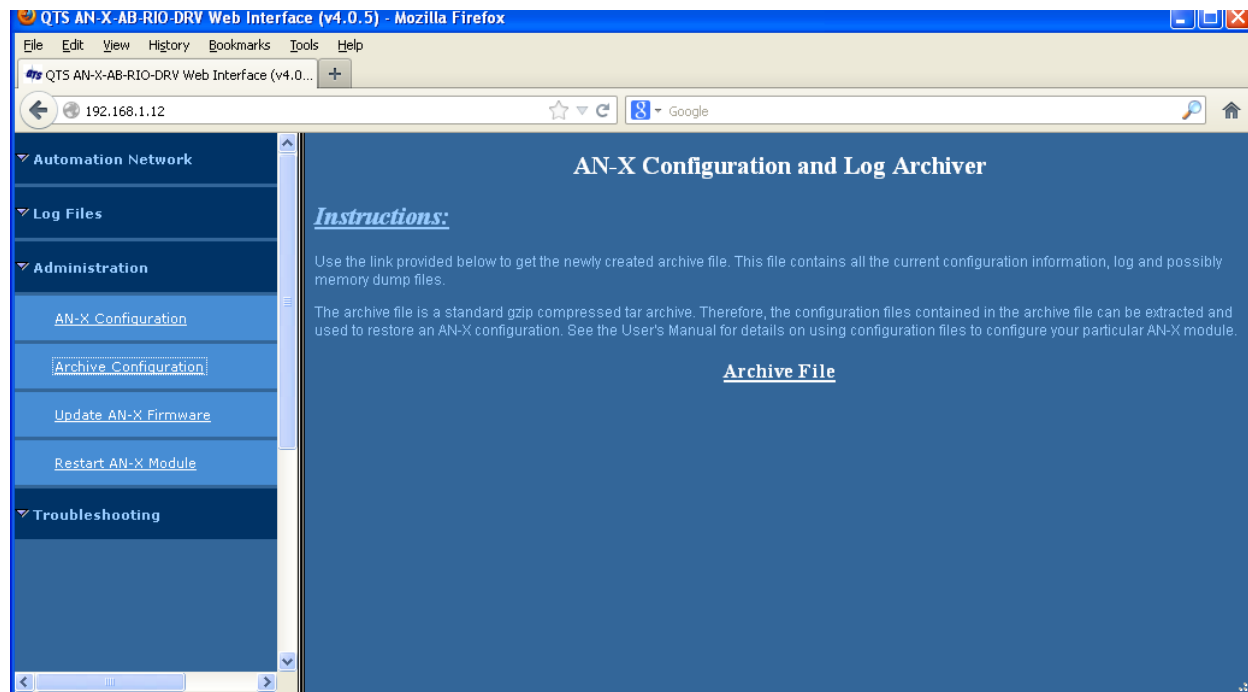
Select the firmware the AN-X is to load from the list provided. AN-X builds the list from the firmware files on the microSD card that are compatible with the AN-X hardware.

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



Click the *Archive File* link and enter a filename and location.

Update AN-X Firmware

Use *Update AN-X Firmware* to download 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.

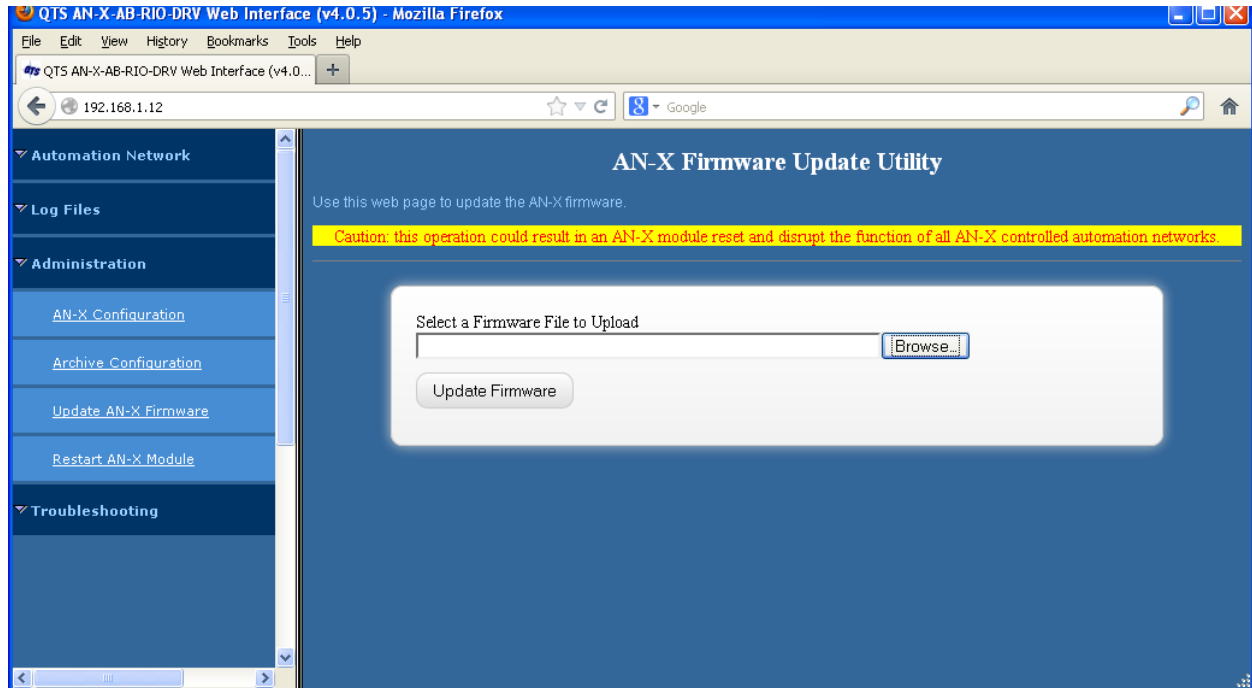


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WARNING!

Do not download 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.

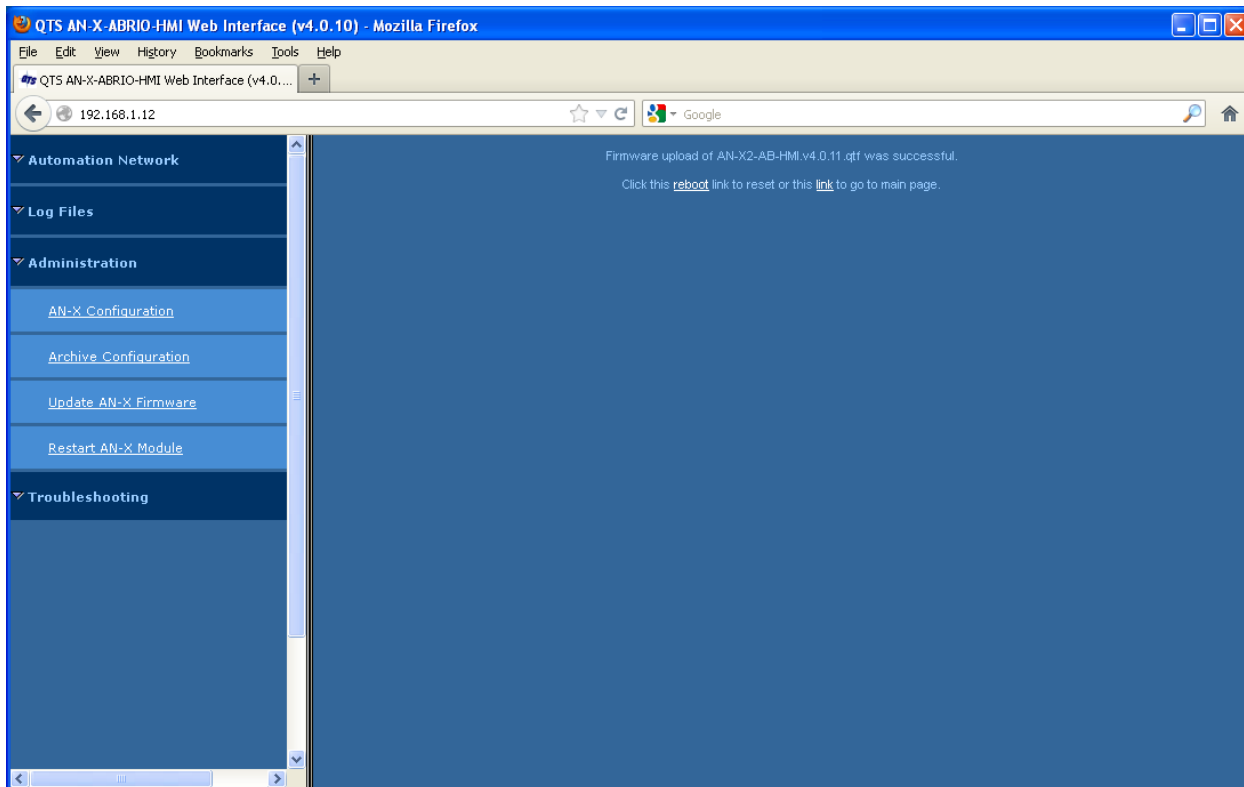
It is essential that you do not disrupt power while downloading firmware, especially maintenance firmware, to the AN-X2 or while the AN-X2 is restarting following a firmware download.

WARNING!

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 download is complete, AN-X displays a message that indicates the success or failure of the download.





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

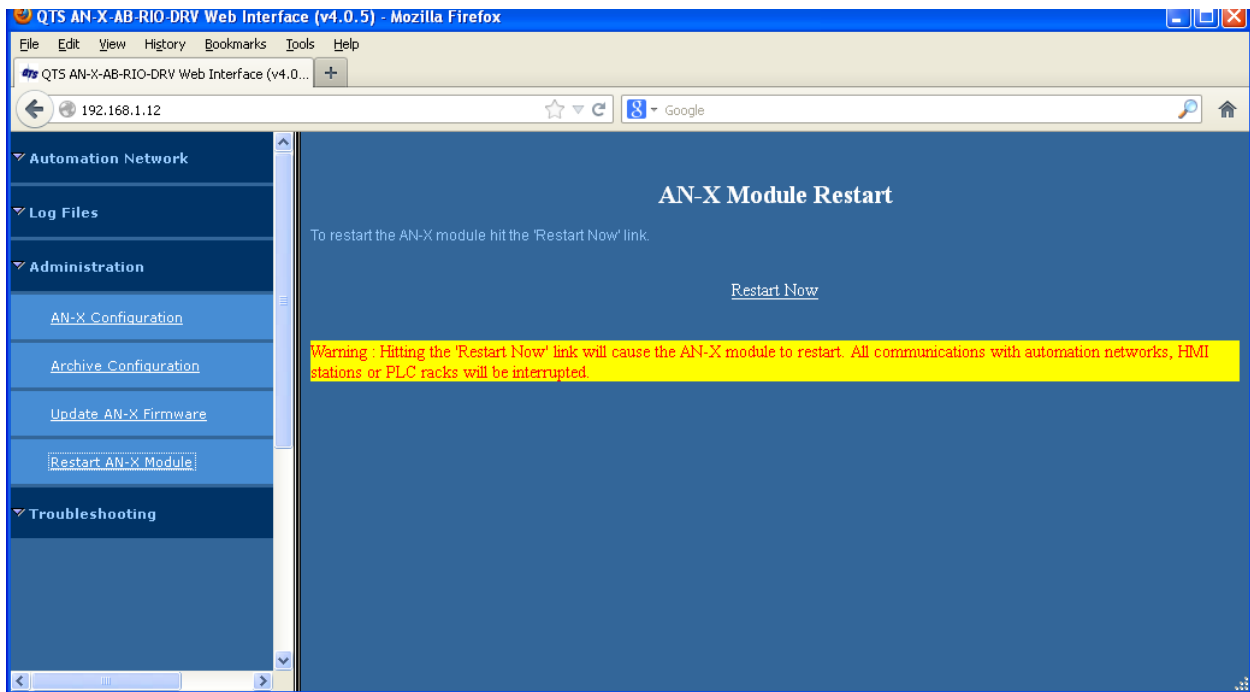
Restart AN-X Module

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



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Click the *Restart Now* link to restart the AN-X.

Troubleshooting Menu

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



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Troubleshooting

LEDs

The AN-X2-ABRIO-DRV has LEDs that indicate the state of the Ethernet connection, the overall module state and the connection to the remote I/O network.

Ethernet LEDs

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

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 at 30 ms intervals and continues blinking as long as activity is present.

If the AN-X2 is not connected to Ethernet, the 10/100 LED is on.

SYS or MS LED

The SYS or MS LED is used by the AN-X operating system and software to indicate the state of operations and errors. Errors or status indication in boot mode cause the LED to flash yellow. Otherwise, the LED flashes red.

The SYS or MS LED 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, and so on.

SYS (or MS) LED State	Possible cause
Red 3	DHCP configuration 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
Yellow 9	Error processing option file or file not found
Yellow 10	Option file mismatch
Flashing red/green	Unscheduled messaging, addressing or connection problem
Flashing red/off	Configuration file problem



“Railroading” – SYS (or MS) and NET (or NS) LEDs

AN-X2 alternates (railroads) flashing the SYS (or MS) and NET (or 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.

NET or NS LED – Network Status

The NET (or NS) LED shows the status of remote I/O communication.

Color	Meaning
Red	A frame receive error has been received in the last second (CRC error, abort, or timeout), stays red for 1 second after the error occurs
Flashing	At least one rack which is being scanned is not being scanned or is in error
Green	All racks are being scanned with no errors

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
- SYS (or MS) and NET (or 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 SYS (or 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 SYS Or MS) LED sequence and contact technical support.



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 downloaded, 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 download.

WARNING!

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

The web page displays the download progress at the bottom left of the page.

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

WARNING!

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

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 tab at the top of the page.

You can also update the firmware by copying *qtf* files to the microSD card from a 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 Remote I/O network
Typical Power Consumption	200 mA @ 12 VDC or 100 mA @ 24 VDC
Maximum Power dissipation	2.4W
Environmental Conditions:	
Operational Temperature	0-50°C (32-122°F)
Storage Temperature	-40 to 85°C (-40 to 185°F)
Relative Humidity	5-95% without condensation



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