AN-X4-ABRIO-HMI   *User Manual*

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

Any illustrations, charts, sample programs, and layout examples shown in this publication are intended solely for purposes of example. Since there are many variables and requirements associated with any particular installation, Quest Technical Solutions does not assume responsibility or liability (to include intellectual property liability) for actual use based upon the examples shown in this publication.

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

WARNING!

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

These warnings help to:

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

IMPORTANT!

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

TIP

Identifies information that explains the best way to use the AN-X4-ABRIO-HMI

AN-X4-AB-DHRIO for Remote I/O HMI

The AN-X4-ABRIO-HMI communications module is used to connect HMI, SCADA, or MES systems to data on an Allen-Bradley Remote I/O network. Typical applications include replacing obsolete HMIs that have built-in Remote I/O cards with newer HMI terminals that connect to an EtherNet/IP network such as a Panelview.

For applications where multiple HMI terminals exist on a single Remote I/O network, a single AN-X gateway can be used to provide data to these HMI terminals.

Remote I/O network features include:

- emulates up to 63 racks, with rack numbers from 0 to 76 octal, in any combination of partial racks

- monitors other racks on the remote I/O network

- supports all remote I/O baud rates

- supports block transfer reads and writes at all possible locations on these racks

Ethernet IP devices access data on the AN-X as PLC-5 input (I), output (O), status (S), integer (N), binary (B) and floating point (F) files.

The AN-X4-ABRIO-HMI module has a web interface for configuration, for monitoring data, logs and diagnostic counters, and for performing other administrative functions. You can communicate with the module using any standard web browser.

The module firmware can be updated over Ethernet using the web interface. Refer to page 40 for details.

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.

You can obtain the latest firmware from http://qtsusa.com/dist/AN-X4/AB/RIO-HMI/ along with some quick start instructions here http://qtsusa.com/dist/AN-X4/

Hardware Features
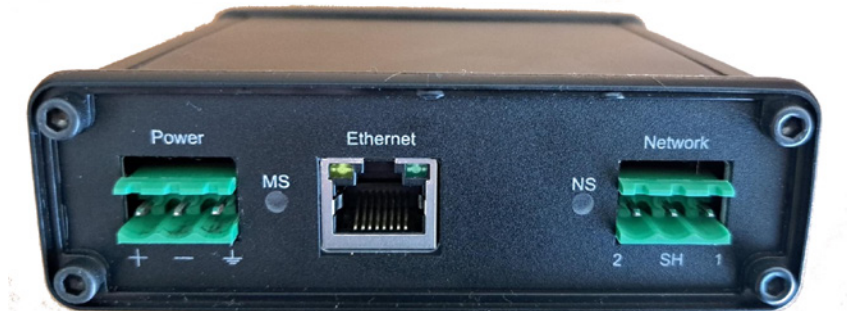
The module has:

- LEDs to indicate the status of the connection to the Ethernet, its own internal state (MS), and the state of the connection to the remote I/O network (NS)

- an Ethernet connector

- a 3-pin Phoenix connector to connect to the remote I/O network

- a 3-pin Phoenix power connector

- a microSD card for storage of configuration data and firmware

The pinouts on the power and the remote I/O connectors match those on the AN-X2. Cables for the AN-X2 can be connected to the AN-X4 without change, though they are rotated 180 degrees.

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Package Contents

- •   AN-X4-ABRIO module

- •   Phoenix power and network connectors

- •   microSD card

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 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
Remote I/O Configuration	RioHmi\AnxAbRioHmiCfg.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 14 for details.

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

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

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Comparison with the AN-X2

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

RIO-HMI

- The power and remote I/O cables are the same, but need to be rotated 180 degrees.

- The RIO-HMI configuration files are slightly changed and are saved at different locations on the microSD card

- The web interface is improved, now has data displays for discrete and block transfer data

- The remote I/O capabilities are greatly improved

- Block transfer by length can now be defined at any location. There can now be up to 64 possible block transfer read lengths and 64 possible block transfer write lengths

- AN-X4 allows you to specify all other block transfer locations, as well as the block transfer by length location.

- AN-X supports monitored racks on the same remote network, including discrete and block transfer data. AN-X4 does not require an active rack definition, it can be monitor only

- The status file information has been expanded

General

- The status and errors displayed on the LEDs have changed

- You can select a different version of the same firmware, e.g., remote I/O HMI firmware, for testing and debugging

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

- The case is smaller

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)

The power connector is the same as the AN-X2 but is rotated 180 degrees.

Remote I/O 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.

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 remote I/O network.

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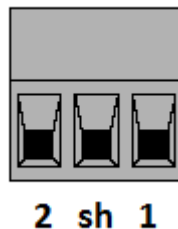
On the AN-X module, the remote I/O connections should be as shown. The wiring in the connector is that same as for the AN-X2 but the connector is rotated 180 degrees on the AN-X4. A remote I/O cable for the AN-X2 can be used without change on the AN-X4.

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 Remote I/O connection errors are:

- wiring reversed (lines 1 and 2)
- incorrect baud rate
- other cabling and termination problems
- terminating resistors shorted to shield wires
- duplicate racks

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 hazardous locations 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.

Configuration

Before you can use the AN-X4-AB-DHRIO, 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 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 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 by either:

- 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. If the address was assigned by a DHCP server, you can look in the network router to determine the IP address assigned.

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

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

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

Check either DHCP or Static.

DHCP

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

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

If the AN-X has been configured for DHCP and it does not find a DHCP server, it waits indefinitely 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.

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The default hostname is ANXxxxxxx, where xxxxxx is the serial number of the AN-X module.

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 REBOOT.
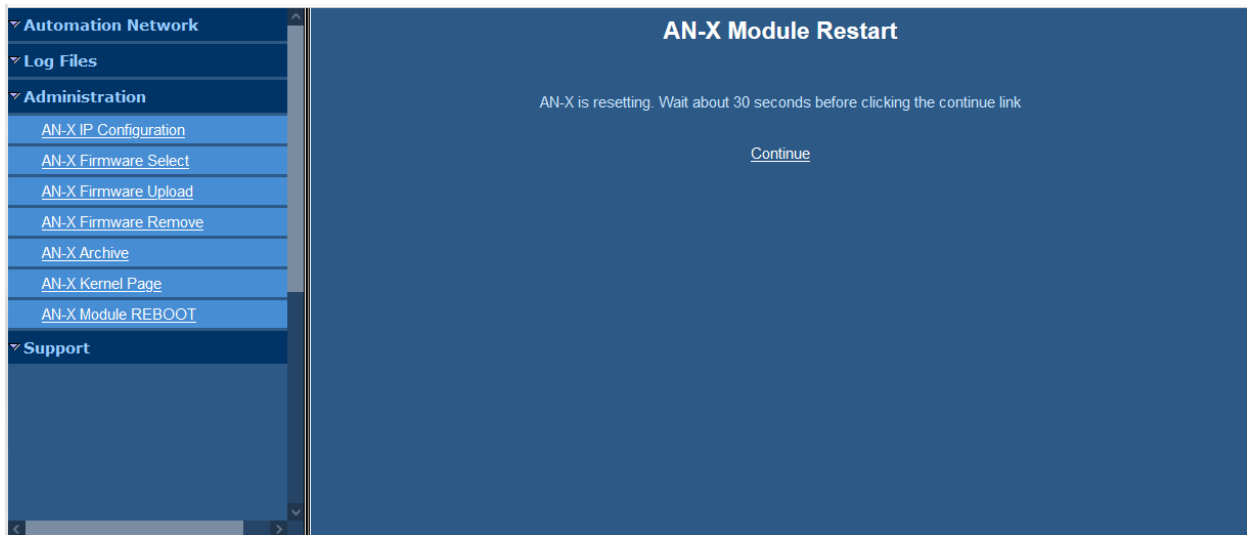
Wait until the AN-X has completely restarted, then click *Continue*.

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 IP Configuration* command from the web interface, the AN-X writes the results to that file.

Each line consists of a keyword followed by a value.

Example:

```
IP: 192.168.1.12
```

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

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

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

Example IPCfg\IPConfig.txt files

Example: Factory default

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

Example: DHCP

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

Example: Static IP address

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

Firmware to Run

In addition to the Ethernet configuration, you may 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-ABRIO-HMI.v4.09.67.qtf
```

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Remote I/O Configuration

## Configuring a Remote I/O Network

The remote I/O configuration consists of:

- the baud rate
- rack definitions
- block transfer definitions
- LED control and other global options

AN-X emulates some racks and monitors any other racks on the same network. Emulated racks are called active racks. Racks being monitored are called monitored racks.

Configuration File

The remote I/O configuration is defined in a text file. Refer to page 18 for a sample configuration file.

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 transfer the configuration to the AN-X using the web interface (see page 27)

Baud Rate

The baud rate is defined by a line that consists of the keyword Baud and 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
```

Racks

Racks are defined by lines that consist of the keyword Rack, the rack number in octal in the form 0onn (leading zero-oh) where nn is the rack number from 0 to 76 octal, the start quarter (1-4), and the end quarter (1-4).

By default, rack numbers are octal. You can override with 0d for decimal or 0x for hexadecimal, or specify explicitly with 0o.   Rack 76 is treated as octal 76.

Examples:

```
Rack 0o01 1 4  ; rack 1, full rack, start quarter 1, end quarter 4

Rack 0o07 1 1  ; rack 7, quarter rack, start quarter 1, end quarter 1
```

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

Monitored racks do not need to be defined. If monitored racks are present on the network, they will appear automatically and their input and output data will be immediately available in the web interface and in the data files.

Block Transfers

Block transfer definitions contain the block transfer type (btr for read or btw for write), the location (rack number, I/O group and slot), the PLC-5 file address (file type, file number and offset) where the HMI can access the data, and the block transfer length that is mapped. AN-X will accept block transfers of any length up to 64, the length is just what's mapped to a PLC file.

```
btr  rack number  I/O group slot PLC-5 file and offset length

btw  rack number  I/O group slot PLC-5 file and offset length
```

The rack number is in the form 0onn where nn is the rack number from 0 to 76 octal.

By default, rack numbers are octal. You can override with 0d for decimal or 0x for hexadecimal, or specify explicitly with 0o. Rack 76 is treated as octal 76.

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

The slot must be 0 or 1.

The PLC-5 file can be either an integer (N) file, a binary (B) file or a floating point (F) file. The file number can be from 3 to 999. The offset can be from 0 to 999. The offset + length cannot exceed 1000.

For integer and binary files, the block transfer length can be from 1 to 64.

For floating point data, the length is the number of floats, from 1 to 32.

For compatibility with previous versions, if the file type (N, B, or F) is omitted, it is assumed to be integer.

Data file mappings for block transfer reads and block transfer writes cannot overlap.

Examples:

```
btr 0o01 0 0 N31:0 1

btw 0o01 0 1 B32:0 1

btr 0o01 1 0 F33:0 7
```

If the same file number is used more than once, the file type for a given file number must not be changed.

Bad Example (Don't do this!)

```
btr 0o01 0 0 N31:0 1

btr 0o01 0 1 B31:10 1
```

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File 31 is first set to type integer (N). It cannot be changed to type binary (B).

Another Bad Example (Don't do this!)

```
btr 0o01 0 0 N31:0 10
```

```
btr 0o01 0 1 N31:5 1
```

The data mappings overlap.

Block transfers on monitored racks must be defined so that the block transfer data gets mapped to a data (N, B or F) file and is available from the Ethernet side.

Sample Configuration

```
Baud 57k       ;define baud rate for remote IO network (57k,115k,230k)

Rack  0o01 1 4 ;define rack at octal address 01, start quarter 1, end quarter 4

btr 0o01 0 0 N31:0 64 ;define btr, rack 01, group 0, slot 0 -> N31:0, length is 64

btw 0o01 0 0 N31:128 64 ;define btw, rack 01, group 0, slot 0 -> N31:128, length is
64
```

Block Transfers by Length

For compatibility with some existing PanelView applications, AN-X4-ABRIO-HMI supports a block transfer by length mode, where multiple block transfers of different lengths are defined at the same I/O location (rack, I/O group and slot). When the remote I/O scanner requests a block transfer at that location, the AN-X uses the requested length to select which data to access.

Block transfers by length are defined by lines that start with either BtrByLen or BtwByLen.

There can be up to 64 block transfer read by length definitions at an I/O location, corresponding to lengths 1 to 64. The same is true for block transfer writes by length.

There can be only one block transfer read by length location (rack, I/O group and slot) and only one block transfer write by length location (rack, I/O group and slot), but the block transfer read location does not have to be the same as the block transfer write location.

Block transfers by length must be defined on racks that are being emulated by the AN-X (active racks).

Sample Block Transfer by Length Configuration

```
Baud 57k ;define baud rate for remote I/O network

Rack 0o01 1 1

btrbylen 0o01 0 0 N31:0 1 ; each BTR definition must have a different length

btrbylen 0o01 0 0 N32:0 2

btwbylen 0o01 0 0 N33:0 1 ; each BTW must have a different length

btwbylen 0o01 0 0 N33:3 32
```

LED Control Options

By default, AN-X flashes the NS LED whenever there is a remote I/O network error.

There are configuration file options for overriding this behaviour for each possible type of network error.

The following options in the configuration file prevent the NS LED flashing for the corresponding error. The corresponding diagnostic counters still increment with each error.

Option	Corresponding error
LedIgnNoise	Noise errors
LedIgnAbort	Abort errors
LedIgnCrc	CRC errors
LedIgnTout	Timeout errors
LedIgnPrcl	Protocol errors

Other Options

There are two options for clearing the status bits.

Option	Description
RackStsPoll	This is the poll period for clearing the OutSts, InpSts and RunSts bits, S2:16 - S2:63
	The default is 250 ms, the allowed range is 10-44000 ms
	It may take 2 poll periods to clear the status bits, since the polling and the I/O scan are asynchronous.
	If the AN-X receives 20 bad packets or timeouts without a good packet, it clears all the status bits. This is much more responsive.
BtStsPoll	This is the poll period for clearing the BtSts bits, S2:64-S2:189
	The default is 2000ms, the allowed range is 10-44000 ms
	It may take up to 2 poll periods to clear the status bits.

Sending the Configuration to the AN-X

To transfer the configuration file to the AN-X, start the web interface and select *Automation Network/Configure RIO-HMI*.

After the download, AN-X displays the configuration log. Check whether there are any errors. If the download was successful, the end of the log shows

INF Configuration Successful

Sample Configuration File

```
Baud 57k  ; define baud rate (57k, 115k, 230k)


; options, uncomment to use
;LedIgnNoise
;LedIgnAbort
;LedIgnCrc
;LedIgnTout
;LedIgnPrcl


;Note: Rack and Bt Status timeouts are between 1 and 2 poll periods
;RackStsPoll  250  ; Rack Poll Period in ms (S2:8 - S2:63 ) Def  250
;BtStsPoll   2000  ; Block Transfer Poll Period in ms (S2:64 - S2:189) Def 2000


; rack definitions
Rack 0o00 1 1 ; rack 0 consists of 4 quarter racks
Rack 0o00 2 2
Rack 0o00 3 3
Rack 0o00 4 4


Rack 0o01 1 4 ; racks 1, 2 and 3 are full racks
Rack 0o02 1 4
Rack 0o03 1 4


btr  0o02 0 0 N7:0  12   ; block transfer read mapped to integer file
btw  0o02 0 0 N7:20 10   ; block transfer write mapped to integer file
btr  0o02 0 1 B3:0  2    ; block transfer read mapped to binary file
btr  0o02 1 0 F8:0  2    ; block transfer read mapped to float file


btrbylen 0o00 3 1 N10:10   1 ; block transfer read by length
btrbylen 0o00 3 1 N10:20   2
btrbylen 0o00 3 1 N10:30   3
btrbylen 0o00 3 1 N10:40   4
btrbylen 0o00 3 1 N10:800 64


btwbylen 0o02 3 0 N11:10   1 ; block transfer write by length
btwbylen 0o02 3 0 N11:20   2
btwbylen 0o02 3 0 N11:30   3
btwbylen 0o02 3 0 N11:40   4
btwbylen 0o02 3 0 N11:800 64
```

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Accessing Data

PanelView

Use FactoryTalk View Studio to add the RSLinx Enterprise device shown.
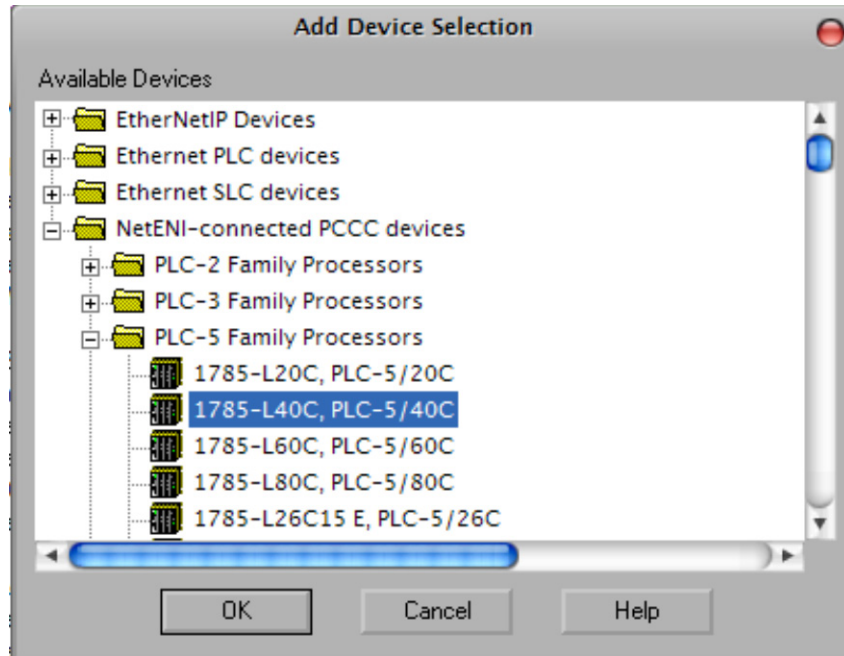
	IMPORTANT!	Create your RSLinx Enterprise shortcut with NetENI-connected PCCC devices. *Do not use ProSoft ANX connected device.*

Other HMIs

Access data on the AN-X as you would any other PLC-5.

I/O Data

Discrete I/O Data

Discrete data is mapped to PLC-5 I (input) and O (output) files, based on the rack and I/O group.

Block Transfer Data

Block transfer data can be mapped to PLC-5 integer (N) files, binary (B) files, or floating point (F) files, at the offsets you specify in the remote I/O configuration.

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Status File Information

AN-X maps remote I/O diagnostic counters, rack status and block transfer status to a PLC-5 status file. An HMI can access the data by reading the status file.

The following tables show the contents.

Diagnostic Counters

Counter	Status file	Description
TX FRAMES	S2:0	Transmitted packets
RX FRAMES	S2:1	Good received packets
CRC ERRORS	S2:2	CRC errors
ABORT ERRORS	S2:3	Abort errors
NOISE ERRORS	S2:4	Noise errors
TIMEOUTS	S2:5	Timeouts, packet sent, no reply
PROTOCOL ERRORS	S2:6	Protocol errors
PROTOCOL MASK	S2:7	Indicates cause of protocol error
UpdCur	S2:8	Update time for the last scan, in ms
UpdAvg	S2:9	Average time of the last 32 scans, in ms
UpdMin	S2:10	Minimum scan time, in ms, since the last reset
UpdMax	S2:11	Maximum scan time, in ms, since the last reset
	S2:12-S2:15	Reserved

The minimum update time is set to 65535 on reset.

The maximum update time is set to 0 on reset.

Rack status

Status table element	Contents
S2:16	Output Status racks 00-03
S2:17	Output Status racks 04-07
S2:18	Output Status racks 10-13
S2:19	Output Status racks 14-17
S2:20	Output Status racks 20-23
S2:21	Output Status racks 24-27
S2:22	Output Status racks 30-33
S2:23	Output Status racks 34-37
S2:24	Output Status racks 40-43
S2:25	Output Status racks 44-47
S2:26	Output Status racks 50-53

Status table element	Contents
S2:27	Output Status racks 54-57
S2:28	Output Status racks 60-63
S2:29	Output Status racks 64-67
S2:30	Output Status racks 70-73
S2:31	Output Status racks 74-76
S2:32	Input Status racks 00-03
S2:33	Input Status racks 04-07
S2.34	Input Status racks 10-13
S2:35	Input Status racks 14-17
S2:36	Input Status racks 20-23
S2:37	Input Status racks 24-27
S2:38	Input Status racks 30-33
S2:39	Input Status racks 34-37
S2:40	Input Status racks 40-43
S2:41	Input Status racks 44-47
S2:42	Input Status racks 50-53
S2:43	Input Status racks 54-57
S2:44	Input Status racks 60-63
S2:45	Input Status racks 64-67
S2:46	Input Status racks 70-73
S2:47	Input Status racks 74-76
S2:48	Run Status racks 00-03
S2:49	Run Status racks 04-07
S2:50	Run Status racks 10-13
S2:51	Run Status racks 14-17
S2:52	Run Status racks 20-23
S2:53	Run Status racks 24-27
S2:54	Run Status racks 30-33
S2:55	Run Status racks 34-37
S2:56	Run Status racks 40-43
S2:57	Run Status racks 44-47
S2:58	Run Status racks 50-53
S2:59	Run Status racks 54-57
S2:60	Run Status racks 60-63

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Status table element	Contents
S2:61	Run Status racks 64-67
S2:62	Run Status racks 70-73
S2:63	Run Status racks 74-76

Each rack status word contains 4 bits per rack, with the low bit corresponding to a rack starting at I/O group 0, etc.

Output status means AN-X is receiving output packets from the scanner for that rack address.

Input status means AN-X is receiving input packets from that rack address to the scanner or, on active racks, is sending input packets in response to output packets from the scanner.

Run status means that the rack is being scanned in run mode.

The status bits are set for discrete packets only, not block transfer packets.

If a scanner is sending outputs to a rack and the rack is responding, but the scanner is not happy with the rack's response (most likely rack size mismatch), the InpSts bit will be set because we are getting (or sending) valid input packets. If the scanner continues to send RST packets, because it's not happy, the OutSts bit for the rack will not be set.

AN-X clears the rack status bits by polling for updates at the rate set by RackStsPoll in the configuration file. The default poll period is 250 ms. The allowed range is 10ms – 44000 ms.

It may take up to two poll periods to clear the status bits since the polling and I/O scan are asynchronous.

Example:

Rack 0 consists of a three quarter rack starting at I/O group 0 (first quarter) and a quarter rack starting at I/O group 6 (fourth quarter)

If the racks are being scanned, bit 0 in S2:16 is set corresponding to the three quarter rack, and bit 3 is set corresponding to the quarter rack.

Example:

Rack 2 consists of a half rack starting at I/O group 2.

If the rack is being scanned, bit 9 in S2:16 is set.

Example:

S2:16 contains the output status for racks 0-3. It consists of 16 bits, 0000 0000 0000 0000.

There are 4 bits per rack, one bit for each possible starting quarter rack.

Rack   3   2   1   0

Qtr   4321 4321 4321 4321

S2:16 bits   0000 0000 0000 0000

For any rack, if a bit is set, it indicates that the rack at that starting I/O group is being scanned.

I/O groups 6-7 Quarter 4	I/O groups 4-5 Quarter 3	I/O groups 2-3 Quarter 2	I/O groups 0-1 Quarter 1
FULL RACK			

For a full rack, bit 0 is set if the rack is being scanned and Is 0 otherwise.

4321

0001

I/O groups 6-7 Quarter 4	I/O groups 4-5 Quarter 3	I/O groups 2-3 Quarter 2	I/O groups 0-1 Quarter 1
HALF RACK		HALF RACK	

4321

0101   Both half racks are being scanned

0100   One half rack being scanned, one half rack not being scanned

0001   One half rack being scanned, one half rack not being scanned

0000   Both half racks not being scanned

I/O groups 6-7 Quarter 4	I/O groups 4-5 Quarter 3	I/O groups 2-3 Quarter 2	I/O groups 0-1 Quarter 1
QUARTER RACK	QUARTER RACK	QUARTER RACK	QUARTER RACK

4321

1111   Four quarter racks being scanned

….

0000   Four quarter racks not being scanned

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Block Transfer Status

Block transfer status is mapped to S2:64 to S2:189.

There are 32 bits (2 words) per rack. The first word contains the status for I/O groups 0-3; the second word contains the status for I/O groups 4-7.

The offset for the first word of block transfer status for a rack is given by:

ofs = Rack(decimal) * 2 + 64

The even bits correspond to block transfer writes. The odd bits correspond to block transfer reads.

When a BT is updated, the corresponding bit is set.

Word 0

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
I/O group	3	3	3	3	2	2	2	2	1	1	1	1	0	0	0	0
Slot	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0
R/W	R	W	R	W	R	W	R	W	R	W	R	W	R	W	R	W

Word 1

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
I/O group	7	7	7	7	6	6	6	6	5	5	5	5	4	4	4	4
Slot	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0
R/W	R	W	R	W	R	W	R	W	R	W	R	W	R	W	R	W

AN-X clears the block transfer status bits by polling for block transfer updates at the rate set by BtStsPoll in the configuration file. The default poll period is 2000 ms. The allowed range is 10ms – 44000 ms.

It may take up to two poll periods to clear the status bits since the polling and I/O scan are asynchronous.

Using the Web Interface

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

Use the web interface to:

- configure RIO-HMI operation
- monitor discrete data, block transfers and network diagnostics
- view AN-X logs
- configure the Ethernet settings
- create a diagnostic capture file for use by technical support
- update the AN-X firmware and kernel
- select and remove firmware files on the AN-X
- reboot the AN-X

It also contains contact information for support.

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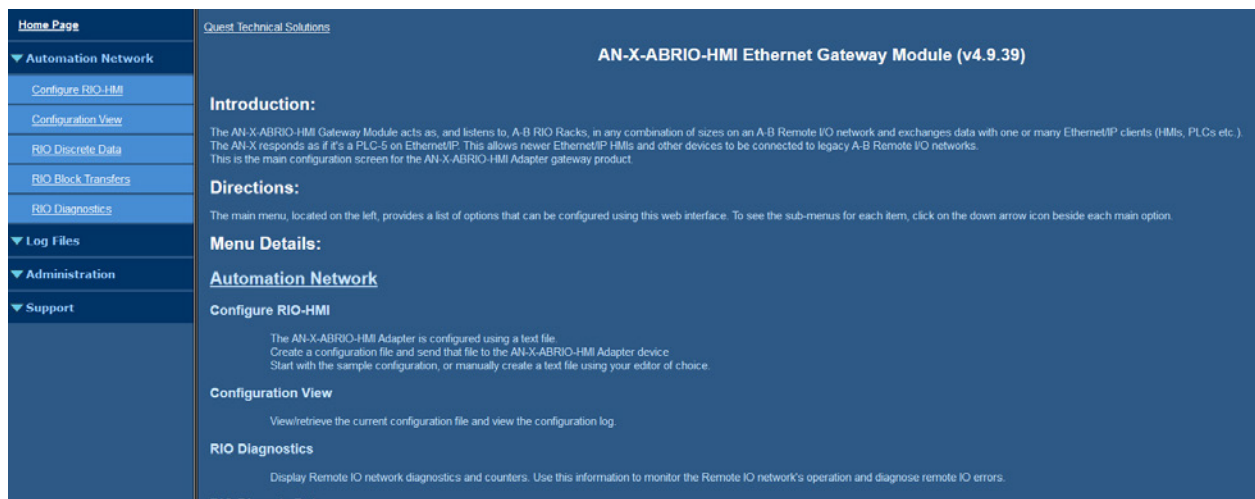
The left pane contains commands. Click on the arrows at the left of the main headings to expand or contract the sections.

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

Automation Network

Remote I/O HMI Configuration

Refer to page 16 for detailed information on remote I/O configuration.

To configure the AN-X:

1. Select *Automation Network/Configure RIO-HMI*.

2. Browse and select the configuration file

3. Click the *Send File to AN-X* button

4. Review the result of the download. Correct any errors reported by AN-X.

Configuration View

Use *Automation Network/Configuration View* to:

- Display the last configuration downloaded

- Display the configuration log, which shows the result to the last download

- Upload and store the configuration on the AN-X

- Upload and store the sample configuration stored on the AN-X as a starting point for creating a configuration file.

The screen consists of two panes. The upper pane shows the last configuration downloaded. The lower pane shows the configuration log.

It shows the result of the last configuration download.

Example:

AN-X-ABRIO-HMI Configuration

Baud 57k

Rack: 00 Qtr 1-4 ^^^^

Rack: 01 Qtr 1-4 ^^^^

BTR: R00 G0 S0 -> B003:000 Len: 10

BTR: R01 G0 S0 -> N012:010 Len: 10

RackStsPoll 249

BtStsPoll   2000

INF Configuration Successful

Racks are shown with a graphic that indicates the occupied quarter racks for each rack definition. For example, a quarter rack might be shown as ^___ or _^__ or __^_ or ___^, depending on the starting I/O group.

Similarly a full rack would be shown as ^^^^.

Click on the link (right-click - save link as) to upload and save the current configuration file or a sample configuration file.
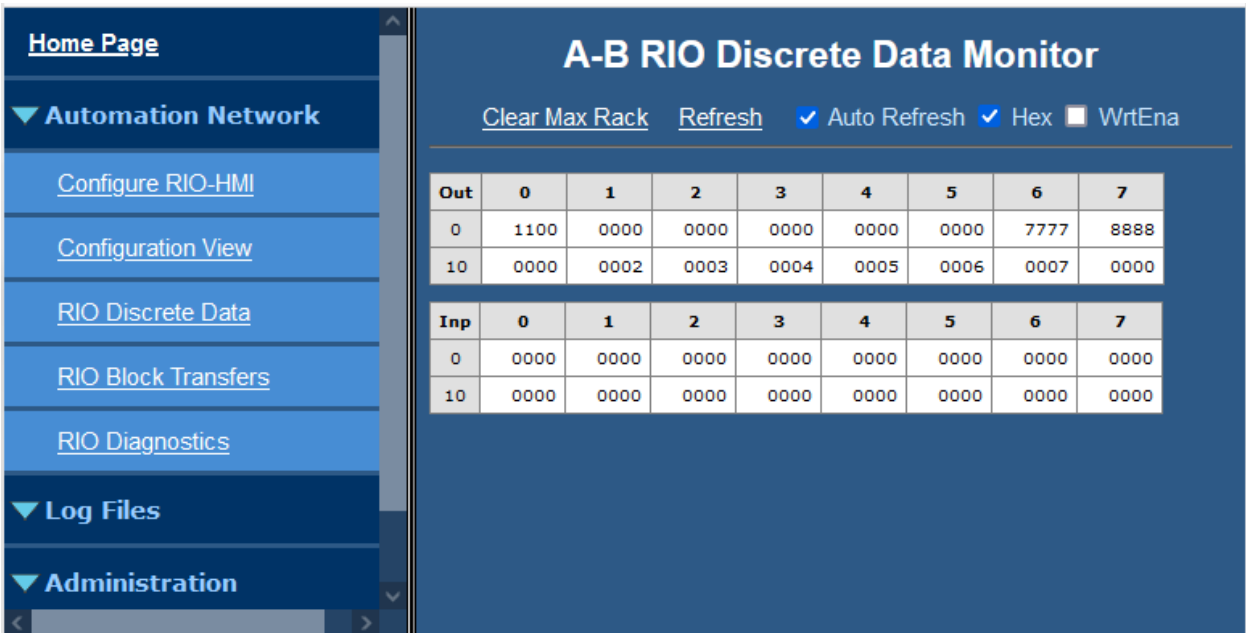
RIO Discrete Data

Use *Automation Network/RIO Discrete Data* to display the discrete data on all active and monitored racks.

By default, the display shows the data in hexadecimal. Uncheck Hex to change the display to decimal.

If Auto Refresh is on, the display refreshes once a second.

You can refresh the screen at any time by clicking Refresh.

Check WrtEna to write RIO I/O data directly.

WARNING! WrtEna is meant to be used for commisioning and testing by qualified personnel only.

Note: I/O data entered here may be overwritten by:

- RIO Outputs
- RIO Inputs mapped to Ethernet/IP
- RIO Inputs monitored from other I/O Racks

When WrtEna is on, select a location to edit data and an edit box opens at the top of the screen. Type the new value in the edit box, and press:

- enter to accept the value, clear the edit window and remain at the same place
- shift-enter to accept the value, leave the value in the edit box and move to the next editable space

- ctrl-enter to accept the value, increment the value in the edit box, and move to the next editable space

At the start, the display is based on configured racks. If the AN-X hears other racks, for example higher numbered racks, it resizes the display to show those racks as well. If you click the *Clear Max Rack* link, the display reverts to the initial display, based on the configured racks.

RIO Block Transfers

Use *Automation Network/RIO Block Transfers* to display a table of all possible block transfer locations, organized by rack, I/O group and slot, and whether the block transfer is a read or write.

A-B RIO Block Transfers

Clear Counters & Max Rack   Refresh   ✔ Auto Refresh   **Click on any BT Location to Monitor**

Grp	0				1				2				3				4				5				6				7			
Slot	0		1		0		1		0		1		0		1		0		1		0		1		0		1		0		1	
Rack	W	R	W	R	W	R	W	R	W	R	W	R	W	R	W	R	W	R	W	R	W	R	W	R	W	R	W	R	W	R	W	R
0		0																														
1		0																														

Any cell in the table with a number indicates a location where a block transfer has been defined on an active or monitored rack. The numbers are counters, from 0-63, that indicate how many times the block transfer has been updated. The counters wrap around to 0 after they reach 63.

If *Auto Refresh* is on, the display refreshes once a second.

You can refresh the screen at any time by clicking *Refresh*.

At the start, the display is based on configured racks. If the AN-X hears other racks, for example higher numbered racks, it resizes the display to show those racks as well. If you click the *Clear Counters & Max Rack* link, the display reverts to the initial display, based on the configured racks.

Click on any location in the table to display the Block Transfer Monitor web page for that location. If Auto Refresh is on, you may have to click several times if the screen is being updated at the time you click.

A-B RIO Rack:1 Grp:7 Slot:1 Block Transfer Monitor

Clear Counters   Refresh   ✔ Auto Refresh   ■ Hex ■ WrtEna

BTR	0	1	2	3	4	5	6	7	8	9		
0	0	0	0	0	0	0	0	0	0	0	BTR Len	20
10	0	0	0	0	0	0	0	0	0	0	Max Len	20
F8:0											BTR Upd	999
											Upd Cur	268
											Upd Min	267
											Upd Max	268

BTW	0	1	2	3	4	5	6	7	8	9		
0	0	0	0	0	0	0	0	0	0	0	BTW Len	10
N9:0											Max Len	10
											BTW Upd	1000
											Upd Cur	267
											Upd Min	267
											Upd Max	268

The screen shows the block transfer read and write data for the selected location (rack, I/O group and slot) and the address to which the data is mapped. If the block transfer has not been mapped, the display shows the address as Undef.

By default, the display shows the data in decimal. Check Hex to change the display to hexadecimal.

Check WrtEna to write RIO I/O data directly.

WARNING!   WrtEna is meant to be used for commisioning and testing by qualified personnel only.

When WrtEna is on, select a location to edit data and an edit box opens at the top of the screen. Type the new value in the edit box, and press:

- enter to accept the value, clear the edit window and remain at the same place
- shift-enter to accept the value, leave the value in the edit box and move to the next editable space
- ctrl-enter to accept the value, increment the value in the edit box, and move to the next editable space

Note: I/O data entered here may be overwritten by block transfer writes or by block transfer reads on monitored racks or block transfer reads mapped to Ethernet.

The screen shows statistics for the block transfer reads and writes at that location (rack, I/O group and slot).

The statistics consist of:

Item	Description
BTR/BTW Len	The most recent length
Max Len	The maximum length observed since the last reset
BTR/BTW Upd	Count of the number of updates
Upd Cur	The current update time, in ms
Upd Min	The minimum update time, in ms, since the last reset
Upd Max	The maximum update time, in ms, since the last reset

The minimum update time is set to 65535 when you clear the counters.

If the block transfer is a block transfer read or write by length, there will be an additional control that lets you select a specific length to see the data for that length.

BTbyLEN: 1

Use the up and down arrows to select the length or type it in directly.

RIO Diagnostics

Use *Automation Network/RIO Diagnostics* to display:

- the IO Group Status table
- the diagnostic counters for the currently selected rack
- the Network Diagnostic counters

IO Group Status Table

The IO Group status table shows the current rack numbers and the rack structure.

Active racks are shown as they are configured. Monitored racks are shown as they are observed on the remote I/O network.

Rack	IO Group Status			
	0	2	4	6
0	MRUN			
1	RUN	RUN	RUN	RUN
2	RUN	RUN	RUN	RUN
3	RUN	MRUN	RUN	MRUN
7	MRUN			
76	MRUN			

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The states shown in the table are:

State displayed	Explanation
RUN	Active Rack - Good Status - Run Mode
PROG	Active Rack - Good Status - Prog Mode
*TOUT	Active Rack - Timeout - not being scanned (may be configuration mismatch)
RST	Active Rack - Scanner sending reset (may be configuration mismatch)
*MERR	Monitored Rack - Scanner sending reset
MRUN	Monitored Rack - Good Status - Run Mode
MPROG	Monitored Rack - Good Status - Prog Mode
---	Empty Rack Location

If *Auto Refresh* is on, the display refreshes once a second.

You can refresh the screen at any time by clicking *Refresh*.

Click on any rack or partial rack to select it in the diagnostic counters table. If Auto Refresh is on, you may have to click several times if the screen is being updated when you click.

Diagnostic Counters for the Selected Rack

This table shows the counters for the currently selected rack. The rack number and starting I/O group are shown in the table heading.

The counters increment for discrete input and output packets, and do not include block transfer packets.

Rack 03 Grp 6 Counters	
Out Rx	36922
Inp Rx	0
Rack Upd Cur	21
Rack Upd Min	0
Rack Upd Max	14572

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The counters displayed are:

Counter	Description
Out Rx	Count of received good packets from the scanner to this rack
Inp Rx	Count of received good input packets from a monitored rack
Rack Upd Cur	Most recent update time, in ms, for the selected rack
Rack Upd Min	Minimum update time, in ms, observed for the selected rack
Rack Upd Max	Maximum update time, in ms, observed for the selected rack

If *Auto Refresh* is on, the display refreshes once a second.

You can refresh the screen at any time by clicking *Refresh*.

Click *Clear Counters* to reset the counters. All are set to 0 except the minimum update time which is set to 65535.

Network Diagnostic Counters

The network diagnostic counters are diagnostic and error counters for the entire remote I/O network.

Network Diagnostic Counters			
Tx Frames	13010	Rx Frames	26021
Crc Errors	1	Abort Errors	0
Noise Errors	0	Timeouts	1
Net Upd Cur	21	Net Upd Avg	21
Net Upd Min	0	Net Upd Max	14587
Prot Errors	0	Prot Err Mask	0000
Prot Desc	None		

The counters are:

Counter	Description
Tx Frames	Count of frames transmitted by the AN-X
Rx Frames	Count of frames received by the AN-X
Crc Errors	Count of frames with CRC errors
Abort Errors	Count of frames with abort errors
Noise Errors	Count of frames with noise errors
Timeouts	Count of timeouts
Net Upd Cur	Update time for the last scan, in ms
Net Upd Avg	Average scan time of the last 32 scans, in ms
Net Upd Min	Minimum scan time, in ms, since the last reset
Net Upd Max	Maximum scan time, in ms, since the last reset
Prot Errors	Count of frames with protocol errrors
Prot Error Mask	16 bit mask that indicates the cause of the protocol errors

In addition, AN-X displays a short description corresponding to the lowest bit set in the protocol mask.

Mask Bit	Error Displayed
0	RxShort (<2)
1	RxLong

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Mask Bit	Error Displayed
2	Out Mism
3	Mon Mism
4	Mon Ext Mism
5	BTW Unexpected
6	BTW Len Mism
7	BTR Unexpected
8	BTR Len Mism
9	Act BTR Unexpected
10	RxShort (Prt)
11	BTW Data Short
12	Mon Inp Short
13	BT Rsp Ignored
14	Mon BTW Unexpected
15	Mon BTR Unexpected

You can override turning the NS LED on for specific network errors with options in the configuration file. Refer to page 19.

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.

When the current log file becomes full, AN-X renames it so you can access it as the previous log file.

RIO-HMI Log

The *RIO-HMI Log* shows messages and errors associated with Ethernet/IP and remote I/O operations that are initiated from Ethernet.

System Info Log

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

View All Logs

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

Administration Menu

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

AN-X IP Configuration

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

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, 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.

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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, the AN-X 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 remote I/O 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.

WARNING!   Updating the AN-X firmware will disrupt RIO and Ethernet communication. Make sure your process is in a safe state.

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 zip file that contains the current AN-X configuration and logs, for use by technical support.

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.

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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 bas 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.

Support Menu

Contact Information

The contact information contains information and links if you need support for the AN-X.

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Troubleshooting

LEDs

The AN-X4-ABRIO-HMI has LEDs that indicate the state of the Ethernet connection, the connection to the remote I/O network status (NS) and the overall module status (MS).

Ethernet LEDs

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

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

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

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

MS and NS 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

Remote I/O Operation

MS LED	Meaning
GREEN	Configured successfully
Slow red flash	Errors in configuration file
Red Pulse (250 ms)	Ethernet/IP Error (see RIO-MHI Log)
RED/5	Ethernet/IP server shutdown

NS LED	Meaning
GREEN	All Active racks are being scanned
YELLOW	Receiving good packets, but not all active racks are being scanned
RED	Receive packet error, or not receiving any good packets
RED/YELLOW alternating	RIO watchdog

.

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 RIO-HMI 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.

WARNING!   Updating the AN-X firmware will disrupt RIO and Ethernet communication. Make sure your process is in a safe state.

Run the command *Administration/Firmware Upload* to upload a qtf file to the AN-X. Uploading a file automaticallly selects that file

To change the firmware the AN-X is running, run the command *Administration/Select AN-X Firmware* to select the file you wish to run.

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

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-ABRIO-HMI.v4.09.38.qtf

In addition, it is occasionally necessary to update the kernel on the AN-X. Kernel files have extension *.qtk. Refer to page 42 for information on how to update the kernel.

You can obtain latest firmware from qtsusa.com/dist/AN-X4_Dist/

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Specifications

Parameter	Specification
Function	Bridge between Ethernet and remote I/O 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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Support

How to Contact Us: Sales and Support

Sales and Technical Support for this product are provided by ProSoft Technology. Contact our worldwide Sales or Technical Support teams directly by phone or email:

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The latest support contact information is found at

https://www.prosoft-technology.com/Services-Support/Customer-Support

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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