AN-X4-ABDHRIO

Remote I/O Drive

Interface Module

User Manual

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

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

WARNING!	Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. These warnings help to: • identify a hazard • avoid the hazard • recognize the consequences
IMPORTANT!	Identifies information that is especially important for successful application and understanding of the product.
TIP	Identifies information that explains the best way to use the AN-X2-ABDHRIO gateway

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Module Overview

The RIO-DRV communications module is used to convert applications written for Allen-Bradley remote I/O drives to Ethernet/IP drives or devices. 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-X 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. AN-X maps input and output data between remote I/O and Ethernet.

Remote I/O network features:

- AN-X emulates up to 4 racks, with rack numbers from 0 to 76 octal, with any combination of partial racks

- AN-X supports all remote I/O baud rates

- AN-X monitors other racks and block transfers on the same remote I/O network. Racks emulated by the AN-X are called active racks. Other racks being monitored on the remote I/O network are called monitored racks.

The AN-X-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.

The module firmware can be updated over Ethernet using the web interface. Refer to page 57 for details.

Current firmware and Ethernet drive templates can be found at

http://qtsusa.com/dist/AN-X4/AB/RIO-DRV/

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.

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
Drive Configuration zip file	RioDrv*.zip
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 16 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 files, 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.

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-DRV

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

- The RIO-DRV configuration is now done from a single zip file that contains the top-level configuration file and all remote I/O and Ethernet drive template files

- AN-X4 does not support multicast connections, all connections are unicast

- The web interface is improved, it now has data displays for discrete and block transfer data, as well as live updates of data

General

- The status and errors displayed on the LEDs have changed

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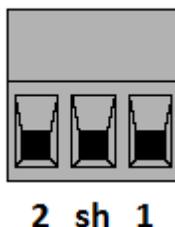
On the AN-X module, the remote I/O connections should be as shown. The wiring in the connector is that same as for the AN-X2 but the connector is rotated 180 degrees on the AN-X4. A remote I/O cable for the AN-X2 can be used without change on the AN-X4.

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.

Quick Start

Step	Operation	See page
1	Power up the AN-X, connect it to Ethernet and assign it an IP address	14
2	Connect the AN-X to the Remote I/O network	11
3	Create configuration files and zip them up into a single zip file	18
4	Use the AN-X web interface to download the configuration zip file	37
5	Use the AN-X to transfer data between remote I/O and Ethernet	

Ethernet Configuration

Before you can use the AN-X, you must configure it 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.

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.

▼ Administration
   AN-X IP Configuration
   AN-X Firmware Select
   AN-X Firmware Upload
   AN-X Firmware Remove
   AN-X Diagnostic Capture
   AN-X Kernel Page
   AN-X Kernel Update
   AN-X Module REBOOT
▼ Support

AN-X Module Restart

AN-X is resetting. Wait about 30 seconds before clicking the continue link
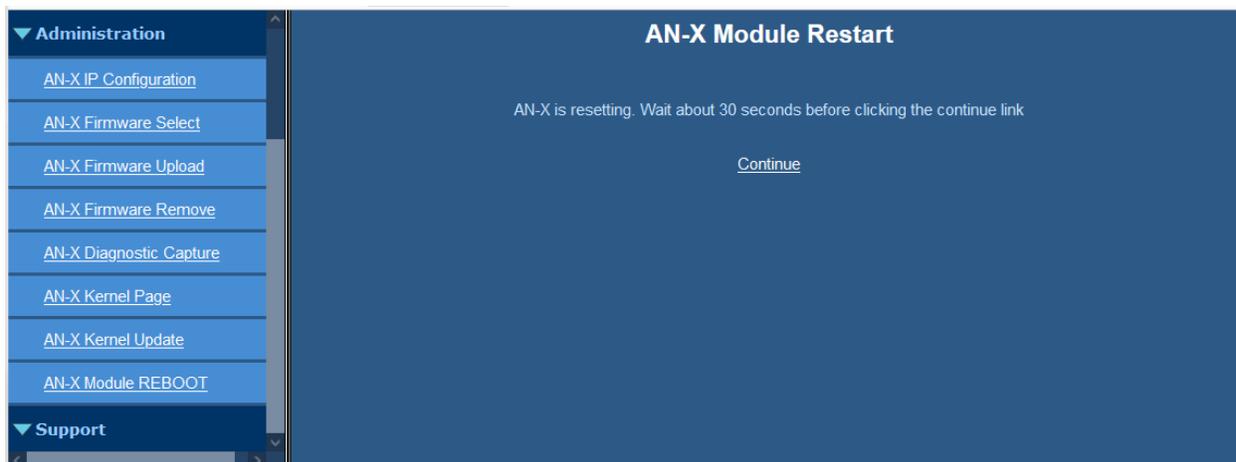
Continue

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

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

Reconfiguring an AN-X from an Unknown State

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

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

The Configuration File IPCfg\IPConfig.txt

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

When you perform the *Administration/AN-X Configuration* command from the web interface, 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.

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

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

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-DRV.v4.08.33.qtf
```

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Configuring the AN-X

The AN-X drive configuration consists of:

- the main configuration file (AnxAbRioDrvCfg.txt)

- Ethernet drive template files, generally EthDef*.csv, which contain the properties of the Ethernet drives

- remote I/O template files, generally RioDef*.csv, which contain the mappings between remote I/O data and Ethernet data for the drives

Zip up the main configuration file, the Ethernet drive template files, the remote I/O template files into a single zip file, then send the zip file to the ANX. The name of the zip file doesn't matter. The order of the individual files in the zip file doesn't matter. There can be no paths in the zip file.

TIP

Create a working directory into which you place the main configuration file and any required remote I/O and Ethernet drive template files.

Make any necessary changes to the template files in the working directory.

When you are have created and edited all the necessary files, zip up the files in the working directory and use the AN-X web interface to download the zip file and configure the AN-X.

TIP   Get each drive (up to 4) working separately, then put them all together

TIP

Ethernet template files can be downloaded from

http://qtsusa.com/dist/AN-X4/AB/RIO-DRV/Templates/

Main Configuration File

The main configuration file is a text file. The file name must be AnxAbRioDrvCfg.txt

The main configuration file 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 37)

To view the current main configuration file, select *Automation Networks/Configuration View* in the web interface.

Baud Rate

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

FaultRioRacks

If you include a line with the option FaultRioRacks, the remote I/O racks emulated by the AN-X initially come up inhibited. When the AN-X gets a good connection with the corresponding 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 remote I/O 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.

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.

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

The corresponding diagnostic counters still increment with each error.

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Rack Status Poll Option

The AN-X monitors the run status on each remote I/O rack. If the rack isn't being scanned in run mode or times out, the AN-X scans the corresponding Ethernet drive in program mode.

The rack status poll option, RackStsPoll, controls the polling period. It can be used to tune the responsiveness of the polling.

Option	Description
RackStsPoll	This is the poll period for clearing the run status for the racks. 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, for example if the remote I/O network goes away, it clears all the status bits immediately. This is much more responsive.

> **TIP**   Make the RackStsPoll time at least twice the remote I/O scan time.

Unscheduled Message Logging Option

The AN-X can use block transfers to send Ethernet unscheduled messages to read parameters or to execute other messages. The UnschMsgDebug option causes the AN-X to log the Ethernet messages sent and received to the RIO-DRV log for debugging.

Logging unscheduled messages is useful for debugging but quickly fills the log. Generally it is disabled once unscheduled messages are working correctly.

Example:

```
109:18.358 630 : 192.168.1.12     c3 MSG: Unscheduled Message Request

109:18.358 730 :Req: 0e 03 20 01 24 01 30 07

109:18.362 560 : 192.168.1.12     c3 MSG: Unscheduled Message Response

109:18.362 670 :Rsp: 8e 00 00 00 0b 41 4e 2d 58 2d 41 42 2d 53 43 41 4e 00 00 00

(decoded as                   A  N  -  X  -  A  B  -  S  C  A  N)
```

Drive Definitions

Drive definitions may begin with an optional name. The name must immediately precede the drive definition.

The name consists of the keyword Name followed by the name enclosed in double quotes.

Example:

```
Name "700S"
```

If you do not explicitly include a name, AN-X generates a default name based on the rack number and starting and ending quarters, such as Rk00_1-4.

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

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

Examples:

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

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

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

The drive definition ends with a line that consists of just the keyword EndRack.

There can be a maximum of 4 different drive definitions.

The drive definition includes everything between those two lines (Rack and EndRack) and consists of:

- the requested RPI
- the name of the Ethernet Template file
- the name of the Remote I/O template file
- IP Address of Ethernet drive
- Unicast (optional)
- block transfer read/write location (optional)

IMPORTANT!   The Ethernet template file must precede the remote I/O template file in the main configuration file.

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. Filenames cannot contain spaces.

Example:

```
Template EthDef_PowerFlex_700S_2P-200V-E
```

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 on page 27.

Remote I/O Template File Name

Include a line with the keyword Template, followed by the name of the remote I/O template file that maps the data between remote I/O and the data on the Ethernet drive. File names cannot include spaces.

Example:

```
Template RioDef_700S
```

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 on page 32.

IP Address

Include a list that consists of the keyword IPAddr and the IP address of the Ethernet drive.

Example:

```
IpAddr 192.168.1.15
```

Unicast

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

IMPORTANT!   AN-X4 supports only unicast connections and that is the default

Requested RPI

Include a line that consists of the keyword RPI and the requested RPI, in milliseconds

The allowed range is 1 to 750 ms.

The requested RPI must be equal to or greater than the minimum RPI supported by the Ethernet drive, defined as MinRpi in the Ethernet template file.

Example:

```
RPI 10
```

Block Transfers (optional)

The AN-X supports sending Ethernet/IP unscheduled messages to the drive. It uses block transfers to execute the messages. The block transfer write sends the message and the block transfer read retrieves the results.

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The block transfer locations are defined by lines that start with BTR and BTW followed by the location (I/O group and slot). The I/O group must be in the range 0 to 7. The slot must be 0 or 1.

Both block transfer read and block transfer write locations must be included. They are usually the same location but they are not required to be the same.

IMPORTANT!   Unlike the rack definitions, the block transfer locations are absolute rack locations.

For example, if a rack is defined as in the main configuration file as a quarter rack second quarter so I/O groups 2 and 3

Rack 4 2 2

in the riodef file an input for I/O group 2 would use a mapping

I:0   <- SpeedFeedback / 65535

i.e., relative to the start of the rack

but a block transfer for I/O group 2 would use

btr 2 1

i.e., an absolute location

IMPORTANT!   The location of the block transfers must not overlap remote I/O output data.

Examples

```
Btr 7 0
Btw 7 0
```

There are two modes of operation:

- In the original mode, the AN-X uses the Ethernet/IP unscheduled message defined in the Ethernet template file to read parameters in the drive. Any drives that use the template use the same message.

- Using BT Defined Unscheduled Message mode, the Ethernet/IP unscheduled message is defined in the block transfer write sent to the AN-X. The remote I/O scanner can use the block transfers to send different messages by changing the contents of the block transfer write.

Original Mode

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 28) 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.

BT Defined Unscheduled Message Mode

In BT Defined Unscheduled MSG mode, the Service, Class, Instance, Attribute and Request Len are taken from Offsets 0 to 3 of the BTW Data. This allows multiple types of messages to be sent using block transfers.

To use BT Defined Unscheduled message mode, include the following line in the EthDef file:

```
UnSchMsgBT ; Enable BT Defined Unscheduled MSG
```

and comment out the UnSchMsg section of the EthDef file.

The CIP MSG Request arguments are mapped in the block transfer write data as follows:

Offset	Description
BTW[0] Low Byte	CIP Data Length in bytes (BTW Ofs 4)
BTW[0] Hi Byte	CIP Service Code
BTW[1]	CIP Class
BTW[2]	CIP Instance
BTW[3]	CIP Attribute

The CIP MSG Response arguments are mapped in the block transfer read data as follows:

Offset	Description
BTR[0]	GenSTS (0xffff=Busy, 0x0000=NoError)
BTR[1]	ExtSTS if GenSTS!=0, RspDataLen in bytes if

	GenSTS=0
BTR[2..63]	Data Portion of CIP Response

Example: Reading from an Identity object

Identity Object, class 0x01, instance 1

Attribute	Description	Type
1	Vendor ID	UINT
2	Device type	UINT
3	Product code	UINT
4	Revision	USINT/USINT
6	Serial number	UDINT
7	Product name	Short string

Service	Service Code
Get attribute single	0x0e
Get attribute all	0x01

To read the product code from the identity object, the block transfer write is:

Offset	Description
BTW[0] Low Byte	0x00, no data appended
BTW[0] Hi Byte	0x0e, get attribute single
BTW[1]	0x01, class 1
BTW[2]	0x01, instance 1
BTW[3]	0x03, attribute 3, product code

The block transfer write then consists of 4 words:

```
0x0e00 0x0001 0x0001 0x0003
```

The BTW length in the PLC must be long enough to include the data required to build the UnschdMSG.

For example, reading the ID object using BT Defined UnschdMSG, the BTW must be at least 4 words to get the CIP arguments to the AN-X.

The block transfer read contains

```
0x0000  0x0002 0x005a
```

(no error, length 2 bytes, value 0x005a)

Any CIP Data write data required for the message has to be included in the block transfer write as well. For example, an Attribute write command that has 4 bytes of CIP data would require 2 extra words (6 words in total) for a BT Defined UnschdMSG.

The BTR length in the PLC must be long enough to read the CIP Status header for BT Defined UnschdMSG (2 words) plus the CIP data bytes in the reply.

Example 2: Reading the entire identity object

The service code is 0x01, get attribute all, and the attribute is 0, so the block transfer write consists of 4 words:

```
0x0100 0x0001 0x0001 0x0000
```

The returned block transfer read contains

```
0x0000 0x001a … (followed by 0x1a = 26 bytes of data)
```

Debugging Unscheduled Messages

Include the option

```
UnschMsgDebug
```

in the configuration file to log debug messages to the RIO-DRV log. For the example of reading the product code from the identity object, the log contains

```
168:23.122 490 : 192.168.1.22    c0 MSG: Unscheduled Message Request

168:23.122 590 :Req: 0e 03 20 01 24 01 30 03

168:23.125 700 : 192.168.1.22    c0 MSG: Unscheduled Message Response

168:23.125 760 :Rsp: 8e 00 00 00 5a 00
```

For the example of reading the entire identity object, the log contains

```
182:41.439 540 : 192.168.1.22    c0 MSG: Unscheduled Message Request

182:41.439 630 :Req: 01 02 20 01 24 01

182:41.442 660 : 192.168.1.22    c0 MSG: Unscheduled Message Response

182:41.442 760 :Rsp: 81 00 00 00 01 00 0c 00 5a 00 04 02 60 00 5e e4 45 40 0b 31 37
39 34 2d 41 45 4e 54 2f 42
```

Sample Main Configuration File

```
Baud 230k

FaultRioRacks

Rack 0o001 1 4

Template EthDef_test

Template RioDef_FullRack

IpAddr 192.168.1.15

Unicast
```

```
RPI 10
EndRack
```

Ethernet Templates

Ethernet template files are text files. Fields can be separated by commas or spaces. The file name usually begins with EthDef, although that isn't required. The extension must be .csv.

Ethernet template files contain:

- Input and output data lengths

- connection point information

- keying information

- unscheduled message parameters (for BTRs/BTWs) or a keyword instructing the AN-X to get its unscheduled message from the block transfer write

- definitions of tags that contain the name, data type and location of the data on the Ethernet drive

There are 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	Ethernet template files can be downloaded from http://qtsusa.com/dist/AN-X4/AB/RIO-DRV/Templates/

TIP	If you need to make changes to an Ethernet Template, copy the file to a new template file, 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
- 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 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 allows compatible versions as well as exact matches. Version matching depends on the compatible flag; the target decides whether it is compatible.

WARNING!   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 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 when you configure it.

Unscheduled Message Information

The unscheduled message section is used to send usnscheduled messages to read parameters from the drive (in original mode, see page 22)

IMPORTANT!   If you are using BT Defined Unscheduled MSG mode, comment out the UnschMsg section in the Ethernet template file and add the line

UnSchMsgBT

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

The unscheduled message section 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 the Target Device 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.

Tags define the Ethernet data associated with the drive.

Inputs 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 4 bytes for each block of DINT or REAL and 2 bytes for each INT.

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 an offset into the Ethernet data. The default is for the offset to be 16-bit words. The offset is enclosed in square brackets.

Offsets are from the beginning of data. To specify an offset from the beginning of the header, prefix the offset with the keyword header, fo example

```
EthTag Input_Word_0        int[header 0]
```

TIP

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

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)

There can be no space between the modifier and the opening bracket.

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 (period, decimal point) and then the bit number in decimal, 0-15 for ints and 0-31 for dints.

Outputs 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.

TIP

The default for data location is as16-bit word offsets. To change this, prefix the offset within the brackets with one of the following modifiers:

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)

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
```

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```
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
```

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 mappings between remote I/O and Ethernet data, possibly including scaling information

REALLY IMPORTANT!

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 (fourth quarter), 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 1 then refers to I/O group 7 in the rack.

If that same template file is used for a rack that starts at I/O group 2 (second quarter), an I/O address with I/O group 1 then refers to I/O group 3 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 don't have to maintain different riodef files for each drive if they are all the same. You can make changes in one place!

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 27)

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 input 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 27)

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 invert 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

```
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

```
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
```

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Building and Downloading the Configuration

Working Directory

Create a working directory into which you place the main configuration file and any required remote I/O and Ethernet drive template files.

Make any necessary changes to the template files in the working directory.

When you are have created and edited all the necessary files, zip up the files in the working directory and use the AN-X web interface to download the zip file and configure the AN-X.

Configuration ZIP 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*.

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

Using the Web Interface

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

Use the web interface to:

- configure the remote I/O and data mappings
- view the current configuration
- view remote I/O discrete and block transfer data
- monitor remote I/O and Ethernet diagnostic and error counters
- view AN-X logs
- perform administrative functions such as assigning the IP parameters, uploading or selecting firmware, updating the kernel, and so on

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.

Automation Network

Configure RIO-DRV

Select *Automation Network/Configure RIO-DRV* to download a configuration zip file to the AN-X.

First create a configuration zipfile. Refer to page 18 for details on the file format.

Use the *Browse* button to select the file.

Click the *Send zip 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.

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 the current configuration from 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-DRV Configuration Ver 4.6.2

UnschMsgDebug

FaultRioRacks

Baud:230k

Conn:0

Name:Rk00_1-4

Rack:00 Qtr 1-4 ^^^^

  Template: ->EthDef_test
```

```
  Template: ->RioDef_test
RPI:10 ToutMult:2 Tout:160
BTR IO Group: 7, Slot: 0
BTW IO Group: 7, Slot: 0
Target IP: 192.168.1.22
Target Key info: VendorId:0x0000 ProdType:0x0000 ProdCode:0x0000 Rev:  0.0
Scheduled Data: Output Len: 22 Input Len: 22
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 is shown as ^^^^.

Click on one of the links (right-click - save link as) to upload and save the current configuration file or a sample configuration file.

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RIO Discrete Data

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

Home Page
▼ **Automation Networks**
Configure RIO-DRV
Configuration View
RIO Discrete Data
RIO Block Transfers
RIO Diagnostics
Ethernet/IP Diagnostics
▼ **Log Files**
▼ **Administration**
▼ **Support**

A-B RIO Discrete Data Monitor

Clear Max Rack   Refresh   ☑ Auto Refresh ☑ Hex ☐ WrtEna

Out	0	1	2	3	4	5	6	7
0	ffff	ffff	ffff	ffff	0000	0000	0000	0000

Inp	0	1	2	3	4	5	6	7
0	ffff	0000	0001	0000	0000	0000	0000	0000

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 from the remote I/O scanner
- RIO Inputs monitored from other I/O Racks or input data from drives

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 on *Clear Max Rack*, 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:0 Block Transfer Monitor

Clear Counters   Refresh   ✓ Auto Refresh   ✓ Hex ☐ WrtEna

BTR	0	1	2	3	4	5	6	7	8	9		
0	0000	001a	0001	000c	005a	0204	0060	e45e	4045	310b	BTR Len	32
10	3937	2d34	4541	544e	422f	0000	0000	0000	0000	0000	Max Len	32
20	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	BTR Upd	0
30	0000	0000	Undef								Upd Cur	0
											Upd Min	65535
											Upd Max	0

BTW	0	1	2	3	4	5	6	7	8	9		
0	0100	0001	0001	0000	Undef						BTW Len	4
											Max Len	4
											BTW Upd	0
											Upd Cur	0
											Upd Min	65535
											Upd Max	0

The screen shows the block transfer read and write data for the selected location (rack, I/O group and slot).

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 reads or writes on the remote I/O network.

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 length of the most recent block transfer
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.

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.

	IO Group Status			
Rack	**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			

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

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

Counter	Description
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.

Ethernet/IP Diagnostics

The Ethernet/IP Statistics consist of two portions:

- Scheduled Ethernet Counters
- Statistics for each connection

The Scheduled Ethernet Counters consist of:

Scheduled Ethernet Counters			
Tx Frames	1491	Rx Frames	1491
Tx Errors	0	Rx Errors	0
Tx ErrMask	0000	Rx ErrMask	0000
Tx Ovrruns	0		

Counter	Description
TX Frames	Count of transmitted frames
RX frames	Count of received frames
Tx Errors	Count of Ethernet transmit errors
Rx Errors	Count of Ethernet receive errors
Tx ErrMask	Transmit error mask, bits set to indicate type of transmit error
RxErrMask	Receive error mask, bits set to indicate type of receive eror
Tx Ovrruns	Count of transmit overruns

Transmit Error Mask	Bit	Description
TX_ERR_BAD_START	0	Internal State error
TX_ERR_OPER_INV	1	TX Copy table operation invalid

Receive Error Mask	Bit	Description
RX_ERR_CID_MISM	0	Connection ID Mismatch - Could happen if we close a connection, then receive more data
RX_ERR_LEN_MISM	1	The length of the RX UDP packet doesn't match what we expect
RX_ERR_OPER_INV	2	RX Copy table operation invalid

The Scheduled Ethernet Connections table contains information for each connection:

Scheduled Ethernet Connections											
Connection			Tx Tme		Rx Tme		Tx Count		Rx Count	
Num	Name	State	RPI	Cur	Max	Cur	Max	Good	Bad	Good	Bad
0	700S	Act/RUN	20.0	20.0	20.1	20.0	20.0	6766	0	6766	0
1		Idle	0.0	0.0	0.0	0.0	0.0	0	0	0	0
2		Idle	0.0	0.0	0.0	0.0	0.0	0	0	0	0
3		Idle	0.0	0.0	0.0	0.0	0.0	0	0	0	0

Counter	Description
Num	Connection number , 0 to 3
Name	The name for the connection, from the configuration file
State	Active or Idle
RPI	The configured RPI for the connection
Cur Tx Time	The most recent transmit time
Max Tx Time	The maximum transmit time since the last counters reset
Cur Rx Time	The most recent receive time
Max Rx Time	The maximum receive time since the last counters reset
Tx Count Good	Count of good transmit frames
Tx Count Bad	Count of transmit frames with errors
Rx Count Good	Count of good receive frames
Rx Count Bad	Count of receive frames with errors

Statistics are invalid after a configuration download. Clear the counters to reset them.

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.

RIO-DRV Log

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

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

Click the *Refresh Log* button to refresh the display.

System Info Log

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

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

Click the *Refresh Log* button 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 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.

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 disrupts 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 bar as the file is transferred. When the transfer is complete, the AN-X still has to copy the kernel file to the microSD card. When the file copy is complete, the AN-X displays a message to indicate that the file was copied successfully. Stay on this web page until AN-X indicates that the file has been written to the microSD card, then click the REBOOT button to restart the AN-X.

AN-X Module REBOOT

Use the *Administration/AN-X Module REBOOT* to restart the AN-X module.

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-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, above the Ethernet connector.

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

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

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

MS (Module Status) and NS (Network Status) LEDs

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

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

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

Powerup/Reboot

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

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-DRV 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 AN-X4-ABRIO-RIO-DRV.*.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-DRV.v4.08.51.qtf
```

In addition, it is occasionally necessary to update the kernel on the AN-X. Kernel files have extension *.qtk. Refer to page 54 for information on how to update the kernel.

You can obtain latest firmware from http://qtsusa.com/dist/AN-X4/AB/

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Specifications

Parameter	Specification
Function	Bridge between Ethernet and Remote I/O network
Typical Power Consumption	240 mA @ 12 VDC or 120 mA @ 24 VDC
Maximum Power dissipation	2.9W
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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Support

How to Contact Us: Sales and Support

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Asia Pacific

Languages Spoken: Chinese, English

+603.7724.2080, support.AP@prosoft-technology.com

Europe – Middle East – Africa

Languages Spoken: French, English

+33 (0) 5.34.36.87.20, support.EMEA@prosoft-technology.com

North America

Languages Spoken: English, Spanish

+1.661.716.5100, support@prosoft-technology.com

Latin America (Brasil)

Languages Spoken: Portuguese, English

+55.11.5083.3776, support.brazil@prosoft-technology.com

Latin America (Spanish Speaking Countries)

Languages Spoken: Spanish, English

+52.222.399.6565, latinam@prosoft-technology.com

The latest support contact information is found at

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

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