

AN-X-AMXCAPT

AutoMax

Capture

Module

User Manual



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

WARNING!

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

These warnings help to:

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

IMPORTANT!

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

TIP

Identifies information that explains the best way to use the AN-X-AMXCAPT

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AN-X-AMXCAPT Module Overview

This document is a user guide for the AN-X-AMXCAPT capture module. It connects to a computer using Ethernet and makes it possible to capture frames on an AutoMax DCS or remote I/O network.

The module passively monitors network traffic and captures all network frames, with timestamps to microsecond precision. It does not occupy a drop on the network.

The Windows utility supplied transfers the network frames captured by AN-X to the host computer over Ethernet.

You can choose to store network frames to one continuous file, or you can have AN-X act as a ring buffer, storing only the data for the previous user-specified number of minutes.

Post-capture filtering lets you select specific frames to store to a text file, based on the criteria you supply.

Filtered network data can be viewed with any text editor.

The module firmware can be updated over Ethernet using the Windows utility supplied. Refer to page 47 for details.

Hardware Features



The module has:

- LEDs to indicate the status of the connection to the Ethernet, its own internal state, and the state of the connection to the network
- an Ethernet connector
- a 9-pin D-shell connector to connect to the AutoMax network
- a power connector

Package Contents

- AN-X-AMXCAPT module
- CD containing software and documentation

Other Requirements

To transfer data over Ethernet requires:

- 100 Mbit/second Ethernet network and hardware
- Ethernet network should use switches, not hubs

Modes of Operation

There are three AN-X modes of operation:

- Boot mode. The AN-X is running its low level startup firmware.
- Configuration mode. This is the mode when you are updating the firmware in the AN-X.
- Production mode. This is the normal runtime mode of operation.

Installation

Prevent Electrostatic Discharge

The module is sensitive to electrostatic discharge.

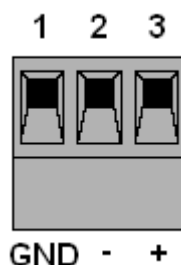
WARNING!

Electrostatic discharge can damage integrated circuits or semiconductors. Follow these guidelines when you handle the module:

- Touch a grounded object to discharge static potential
- Do not touch the connector pins

Power

AN-X requires a DC power input of anywhere from 12 to 24 VDC.



Left to right the pins on the power connector are chassis ground, negative voltage and positive voltage.

The chassis ground should be connected.

Power consumption internally is 300 mA @ 12VDC or 150 mA @ 24VDC.

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

Cabling and Termination

Use a standard drop cable and passive tap (M/N 57C380) to connect the module to the coaxial network cable. The drop cable is a multi-conductor cable with 9-pin D-shell connectors at each end. Connect one end to the connector on the module and the other end to the passive tap.

The passive tap has two BNC connectors for connection to the coaxial cables and terminating loads.

The network coaxial cable must be terminated with 75 ohm terminating loads attached to the taps at the physical ends of the network. There should be two and only two terminators on the network.

The cable must be RG-59/U.

Ethernet Cabling

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

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

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

Software Installation

You must uninstall any previous version of the software before you can install a new version. Use the Windows Control Panel Add and Remove Programs to remove the old version.

Insert the CD supplied with the AN-X module and run the program setup.exe on the CD.

Basic Configuration

The AN-X-AMXCAPT module connects a computer or other device on Ethernet to a Reliance AutoMax DCSnet or remote I/O network.

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

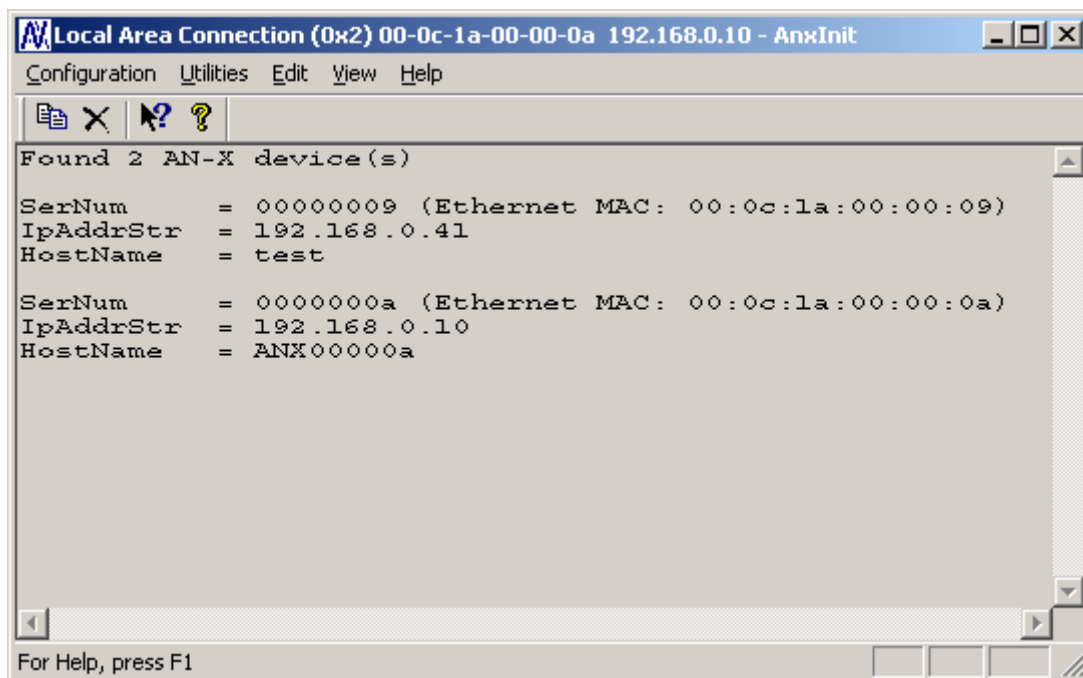
No configuration is required on the AutoMax network.

Ethernet Configuration

AN-X can be configured to use a static (unchanging) IP address or it can be configured to obtain its IP address from a DHCP server.

Unless you have control of the DHCP server, in most applications you will want to configure AN-X to use 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.

AN-X is shipped with DHCP enabled. If it finds a DHCP server on the network, the DHCP server assigns it an IP address. You can use the utility AnxInit to find the IP address that the DHCP server has assigned. Select *Utilities/Locate All AN-X Modules* and AnxInit will locate the AN-X and display its IP address.



```
Local Area Connection (0x2) 00-0c-1a-00-00-0a 192.168.0.10 - AnxInit
Configuration Utilities Edit View Help
Found 2 AN-X device(s)
SerNum      = 00000009 (Ethernet MAC: 00:0c:1a:00:00:09)
IpAddrStr   = 192.168.0.41
HostName    = test
SerNum      = 0000000a (Ethernet MAC: 00:0c:1a:00:00:0a)
IpAddrStr   = 192.168.0.10
HostName    = ANX00000a
For Help, press F1
```

If AN-X does not find a DHCP server within about three minutes of starting up, it reverts to a temporary static IP address of 192.168.0.41. If

AN-X is using this temporary IP address, it repeatedly flashes the SYS LED three times followed by a pause.

IMPORTANT! Use this temporary IP address only for initial setup of AN-X. AN-X will not function for its intended purpose at the temporary IP address.

If you are using multiple AN-X modules, configure one at a time, especially if there is no DHCP server on the network, since they will all revert to the same temporary IP address when they fail to find a DHCP server.

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 and to obtain a static IP address for AN-X.

IMPORTANT! The AN-X must be on the local Ethernet when you set its IP address.

You configure the Ethernet properties using the Windows utility AnxInit supplied with AN-X.

Use the *Configuration/AN-X IP Settings* command to start the AN-X IP configuration wizard, which takes you step by step through the IP configuration process.

Step 1

In step 1, you identify the AN-X you are configuring.

Step 1: AN-X Selection

Select this computer's Ethernet adapter that's on the same Ethernet subnet as the AN-X module you want to configure (you may only have one Ethernet adapter in your computer)

Local Area Connection

Enter the Ethernet MAC Address of the AN-X module you want to configure. You can get this from the label on the AN-X module or by selecting Utilities/Locate All AN-X Modules (if the module's current IP address is on the same subnet).

00-0c-1a-00-00-09

Enter the IP address on the local subnet that you intend the AN-X module to use.

192 . 168 . 0 . 9

Next >> Exit

1. Select the Ethernet adapter that's connected to the AN-X. In most cases there will be just one Ethernet adapter in the computer. The AN-X must be on the same subnet as the computer.

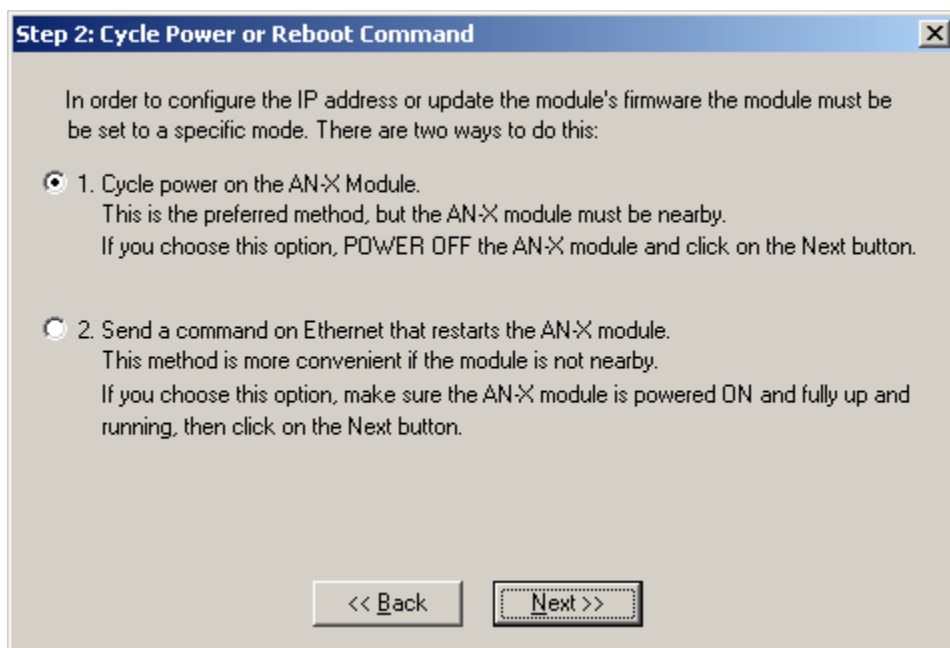
2. Enter the MAC address of the AN-X you are configuring. This is printed on the AN-X label. It consists of six pairs of hexadecimal digits, separated by hyphens. In the example above, it's 00-0c-1a-00-00-09.

If the AN-X is already online, you can obtain its MAC address using the *Utilities/Locate All AN-X Modules* command.

3. Enter the IP address you intend the AN-X to use.

Step 2

In step 2, you choose a method of restarting AN-X to put it in boot mode.

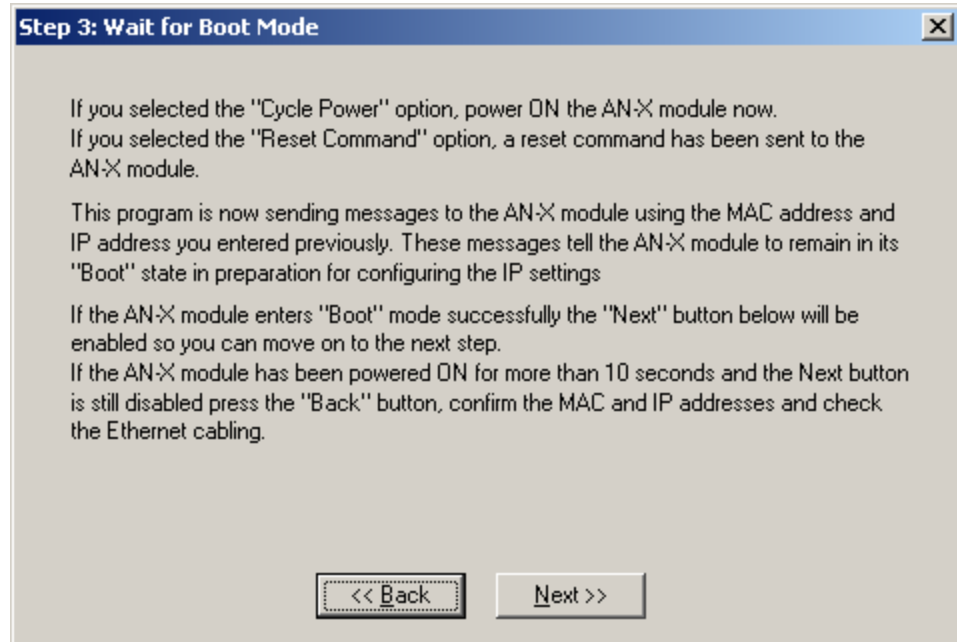


The preferred method is to cycle power on the AN-X. Select the first option on the screen and click the *Next >>* button.

The second method, useful if the AN-X is not easily accessible, is to send it a command over Ethernet. The AN-X must be powered on and completely running for this method to work. For example, if this is the first time you are configuring a new AN-X, allow sufficient time for it to acquire an IP address from a DHCP server or to time out and use its default IP address (about 3 minutes). Select the second option on the screen and click the *Next >>* button.

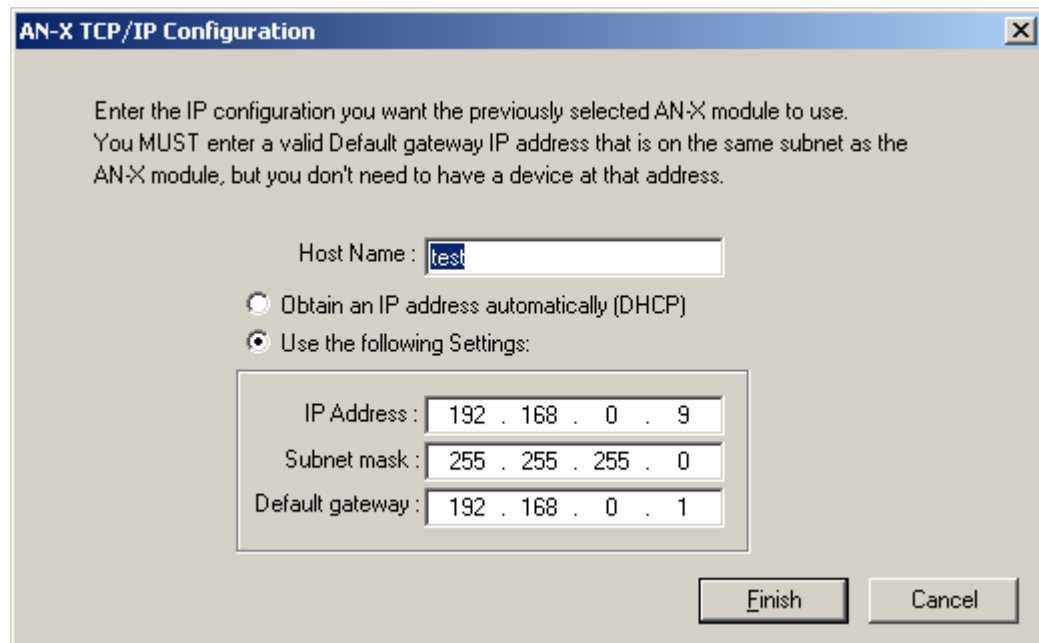
Step 3:

Wait for AN-X to enter boot mode. While AnxInit is waiting, the *Next>>* button will be disabled. When AN-X is in boot mode, the *Next>>* button will be enabled.



If the AN-X does not enter boot mode within about 10 seconds, return to the previous screens and check the entries.

The AN-X TCP/IP Configuration dialog appears.



Enter a *Host Name* for the AN-X. 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 31 characters long.

To configure the AN-X to obtain its IP address from a DHCP server on the network, select *Obtain an IP address automatically (DHCP)*

To configure the AN-X to use a static IP address, select *Use the following Settings* and enter:

- the desired IP address for the AN-X.
- the Subnet mask 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.

Click OK to complete the configuration.

If you Cancel the *Configuration/AN-X IP Settings* command, AN-X is left running the boot code. Use the *Utilities/Restart AN-X* command to restart the AN-X.

Example: Standalone Computer

A typical example is a laptop computer running the AutoMax programming software and connecting directly to an AN-X to program an AutoMax processor.

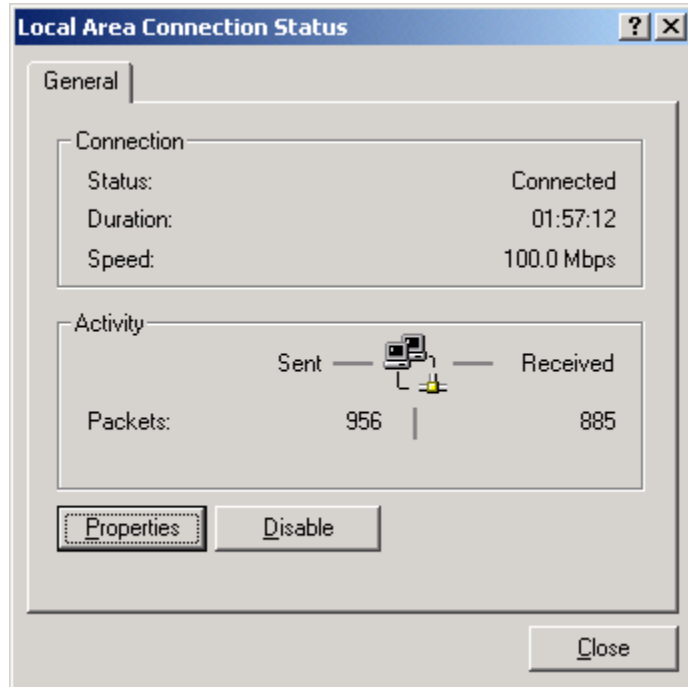
Since you are connecting directly from the computer to AN-X, use a crossover Ethernet cable.

The following instructions assume Windows 2000. The procedure for Windows NT and Windows XP is very similar. They also assume that an Ethernet network card has been installed in the computer and that AnxInit has been installed on the computer.

TIP

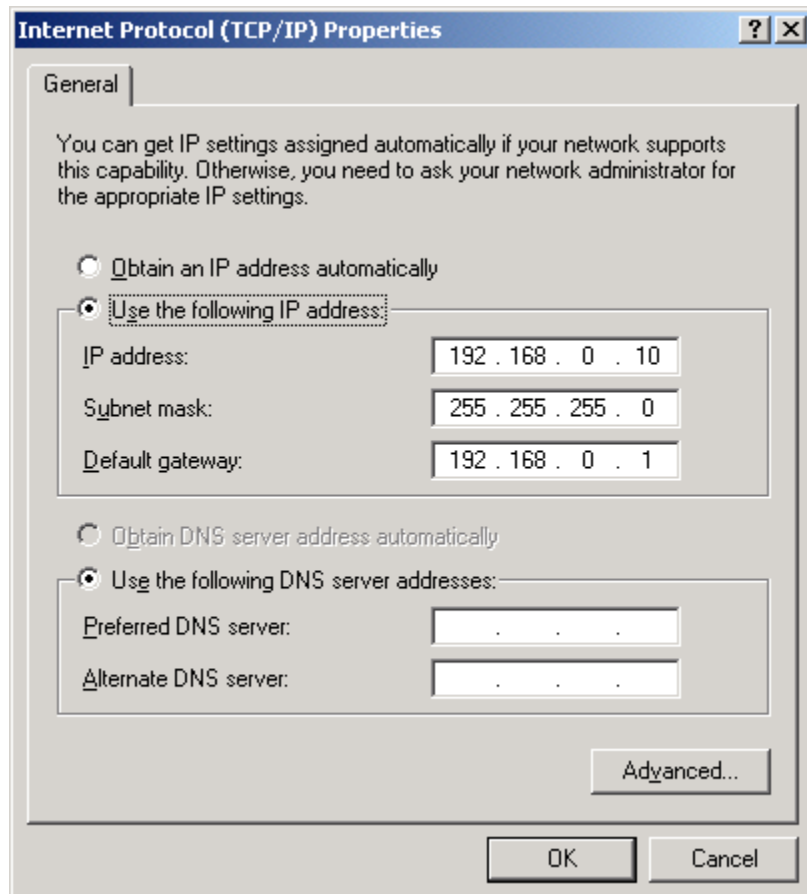
The parameters in this example will work when you set up any standalone computer to work with AN-X.

First configure the computer to use a static IP address. From the Start menu, select *Start/Settings/Network and Dialup Connections*. Double click on *Local Area Connection*.



Click the *Properties* button.

Double click on *Internet Protocol (TCP/IP)*.



In this example, we will assign the computer an IP address of 192.168.0.10

Set the Subnet mask to 255.255.255.0 (standard mask for the Class C network address of 192.168.0.x).

Set the Default gateway to 192.168.0.1 (this address does not exist on the Ethernet network but AN-X requires a valid default gateway entry).

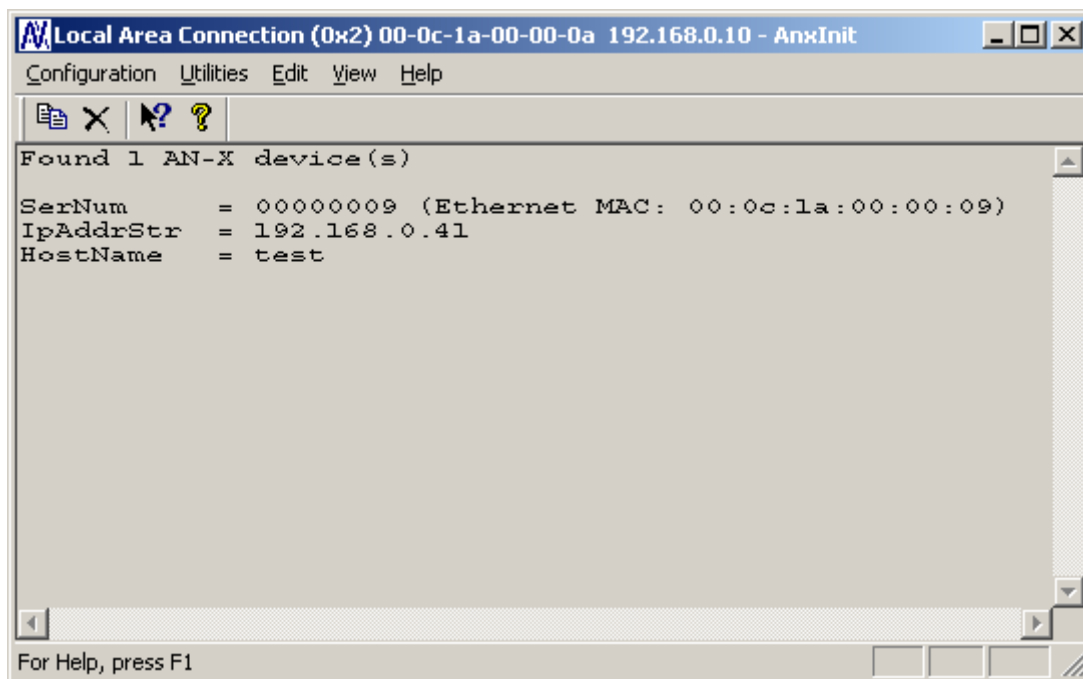
Click OK to accept the settings

Connect the computer to AN-X using the crossover cable.

If this is the first time you have used the AN-X module, it will look for a DHCP server on the network. It waits about three minutes, then reverts to a default IP address of 192.168.0.41

Power up the AN-X and wait for the search for a DHCP server to time out. When the search for a DHCP server times out, AN-X will flash the SYS LED red three times followed by a pause repeatedly.

Run AnxInit. Select *Utilities/Locate All AN-X Modules* and confirm that the AN-X is found.



Select *Utilities/Select An AN-X* and enter the MAC Address and IP address.

The screenshot shows a dialog box titled "Set Ethernet & IP Address". It has a dropdown menu for "Adapter" set to "Local Area Connection". Below it are text input fields for "Ethernet MAC Address" (00-0c-1a-00-00-09) and "IP Address" (192 . 168 . 0 . 41). At the bottom are "OK" and "Cancel" buttons.

Click *OK* to accept the setting.

Select *Utilities/AN-X IP Configuration*.

The screenshot shows a dialog box titled "AN-X TCP/IP Configuration". It contains the following text: "Enter the IP configuration you want the previously selected AN-X module to use. You MUST enter a valid Default gateway IP address that is on the same subnet as the AN-X module, but you don't need to have a device at that address." Below this is a "Host Name" field with "test". There are two radio buttons: "Obtain an IP address automatically (DHCP)" (unselected) and "Use the following Settings:" (selected). Below the radio buttons is a group box containing three fields: "IP Address" (192 . 168 . 0 . 20), "Subnet mask" (255 . 255 . 255 . 0), and "Default gateway" (192 . 168 . 0 . 1). At the bottom are "Finish" and "Cancel" buttons.

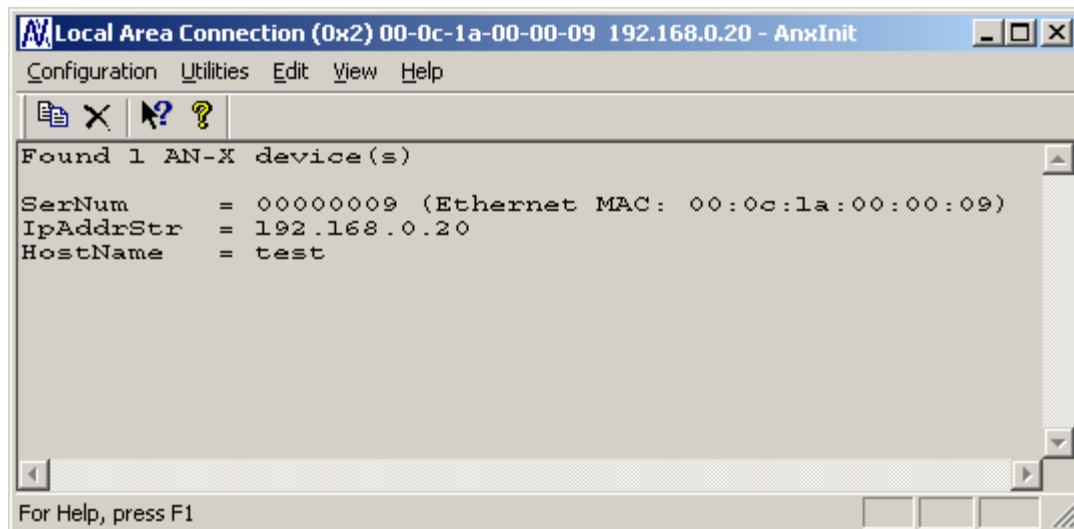
Enter an IP Address. In this case we chose 192.168.0.20

Enter the same Subnet mask and Default gateway that you entered for the computer. The default gateway address does not exist on the network but AN-X requires that the field have a valid entry.

Click *Finish* to accept the settings.

Select *Utilities/Restart AN-X* to restart AN-X with the new parameters.

When the AN-X has restarted (SYS LED is solid green), select *Utilities/Locate All AN-X Modules* and confirm that the AN-X is found with the new parameters.



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. To reconfigure it to a known state, run the command *Configuration/AN-X IP Settings* to start the AN-X IP Configuration Wizard and reconfigure AN-X.

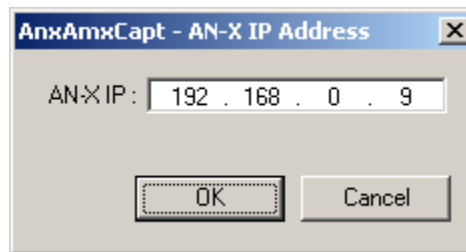
Capturing and Displaying Network Data

Use the Windows AnxAmxCapt utility to capture network frames, transfer them from the AN-X to the computer, store them to hard disk, and view them.

Setting the AN-X IP Address

Select *Config/Set AN-X IP Address*.

AnxAmxCapt displays the AN-X-IP Address dialog.



Enter the IP address of the AN-X module that you wish to use to capture AutoMax network data.

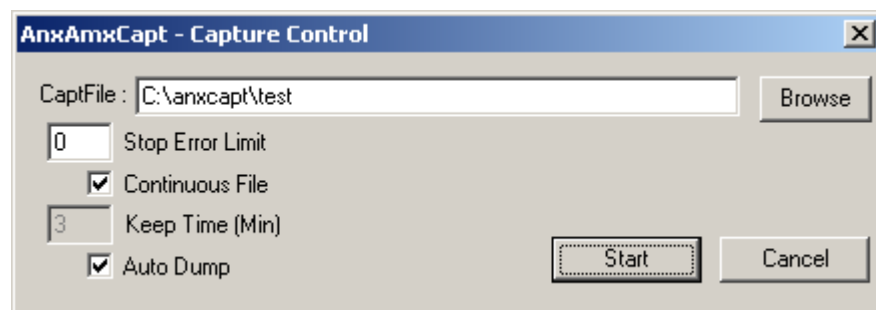
Refer to page 6 for information on setting the AN-X IP address.

Capturing Network Frames

Select *Capture/Acquire* or click on the Capture button.



AnxAmxCapt displays the Capture Control dialog.



Type or browse in the capture file (*CaptFile*) name.

Enter a value for the *Stop Error Limit*. The stop error limit is the number of network errors that can occur in the current file before the capture stops automatically. A value of 1 means that the capture stops on the first error. The default value of 0 causes the capture to continue if there

are network errors. If you are using the ring buffer method of capture, and the error limit is not 0, the error count is reset to 0 each time a new file is opened.

TIP

You can use the Stop Error Limit to trap a transient or rarely occurring error. Uncheck *Continuous File*, set the *Keep Time* to 2 minutes and set the *Stop Error Limit* to 1. The capture will capture network frames until the first error occurs, then stop.

You can also use the Stop Error limit to capture bursts of errors. Set the Stop Error Limit to the threshold value, for example 5 or 10, and run the capture as in the previous example.

If you check *Continuous File*, the network data is stored in one continuous file.

If *Continuous File* is unchecked, AnxAmxCapt acts as a ring buffer, creating new files and deleting old ones. It creates a new file for each minute the capture is running, naming the file based on the name you supply and the current time. For example, if you supply the name Test and the current time is 14:53 (2:53 P.M.), it starts storing data in a file called Test.1453.AmxCapt. The next file is called Test.1454.AmxCapt, and so on.

TIP

For captures over long periods of time, use ring buffer mode. Continuous capture is better suited for short captures. If you use continuous capture and the computer is turned off or anything goes wrong, all captured data could be lost. Using ring buffer mode, if the computer is turned off, only data for the last minute could be lost.

If *Continuous File* is unchecked, you must enter a value for *Keep Time (min)*. The keep time is the number of minutes of data that will be stored. The default is 2. As it creates each new file, it deletes the file older than the keep time. The value of Keep Time can range from 2 to 1439 minutes.

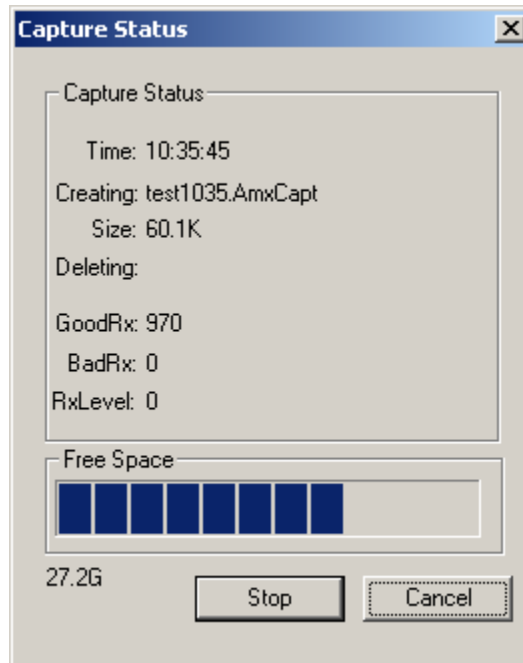
TIP

If you want to preserve a capture file, move it to another directory, since otherwise a later capture could inadvertently delete it.

If *Auto Dump* is checked, AnxAmxCapt automatically executes a *Capture/Dump* command when the capture ends.

Click *Start* to begin capturing network frames.

AnxAmxCapt displays the *Capture Status* dialog box.



It shows the current time, the file currently being used to store the capture data, the file size, the file being deleted (ring buffer mode only), the number of good frames received, and the number of bad frames received.

GoodRx is the number of frames with good status that have been captured.

BadRx is the number of frames with bad status (CRC error, abort, overrun, or noise) that have been captured in the current file. If you are using the ring buffer method of capture and the stop error limit is non-zero, BadRx is reset each time a new file opens.

The Free Space progress bar shows the amount of free space remaining on the disk drive.

To stop the capture, click *Stop*.

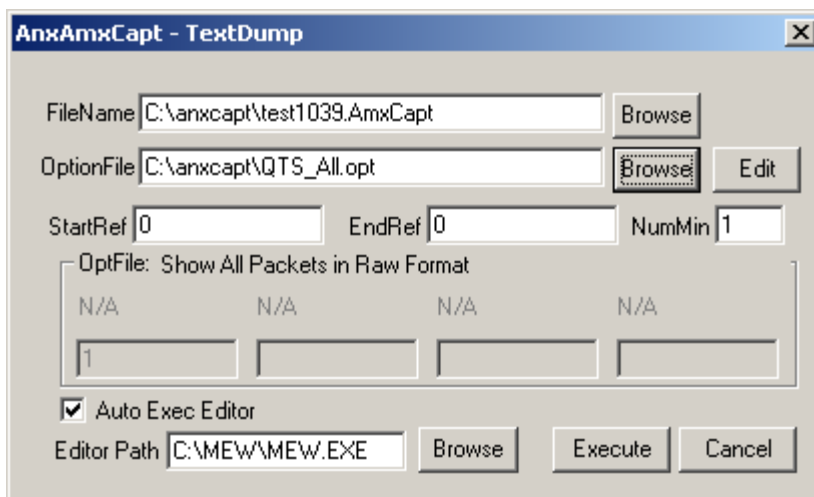
To cancel the capture, click *Cancel*. This stops the capture but does not delete any captured data files. If AutoDump was checked, the Dump command is not executed.

Selecting Frames of Interest

Select *Capture/Dump* or click the *Dump to Text* button.



AnxAmxCapt displays the TextDump dialog.



Browse or type the capture file name into the *FileName* box. AnxAmxCapt appends the option file name to the name you supply, and then appends the extension “.txt”. For example, if the capture file is Test1413.AmxCapt and the option file is QTS_All.opt, the text file created is Test1413_QTS_All.txt

Browse or type the Option File name into the *OptionFile* box. Option files control which frames are selected from the capture file, and the format they are saved in. To display all messages, select the QTS_All.opt option file. For detailed information on option files, refer to page 19.

Click *Edit* to edit the option file. If you make changes to the option file, you may need to browse it in again in order for the changes to take effect.

If you want to select just a portion of the file, enter starting (*StartRef*) and ending (*EndRef*) reference numbers. Leave both as 0 if you want to include all the network frames. Normally you locate the event of interest, then use the starting and ending reference numbers to display frames around that event.

If you obtained the capture using the ring buffer method, *NumMin* determines the number of consecutive capture files from which frames are to be extracted. If the capture was obtained using the continuous file method, set *NumMin* to 1.

After AnxAmxCapt stores the selected frames to a text file, you can have it automatically open the file in your text editor. Check *Auto Exec Editor* and browse or type the path to the editor in the *Editor Path* box.

Click *Execute* to dump the selected frames to the text file.

Option Files

Option files are used to define which frames are extracted from captured data.

Option files consist of various option lines that control which frames are selected.

Comments

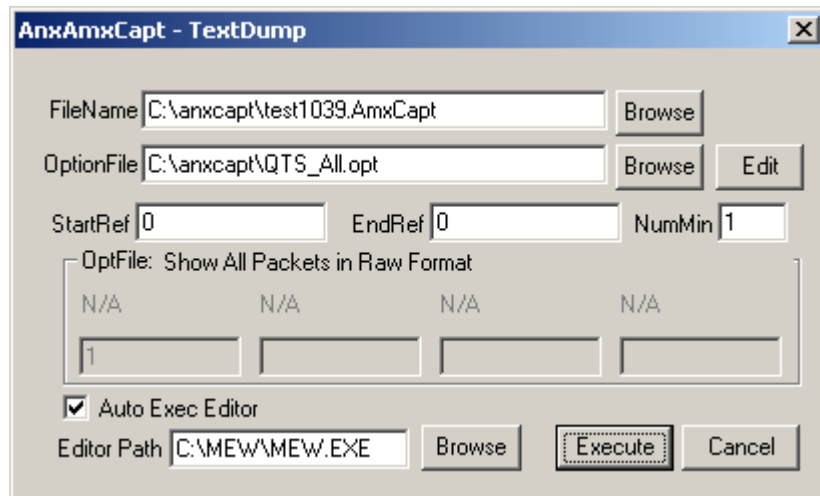
Lines beginning with a semicolon are comments and are ignored.

Description

Use the Descrip= option line to display a description in AnxAmsCapt. “Descrip=” is followed by the text to be displayed. For example,

Descrip=Show All Packets in Raw Format

causes the description to appear as shown:



The description can be up to 55 characters long.

Reference Numbers

Each frame has an associated reference number, which can be used to uniquely identify that frame.

To suppress the inclusion of reference numbers, include the NoRef option line.

Example:

NoRef

Frames with Bad Status

Frames with bad status are shown with an asterisk before the frame data. For example,

```
357: a 0:00.748,593 *255< 05^ 55- 00 00 00 00 00
```

To suppress the inclusion of frames with bad status, include the NoBad option line.

However, badly formed frames are automatically displayed, whether they are selected by the contents of the option file or not, along with some indication of the cause of the problem. For example,

```
9289: a 0:00:19.423,410 d 5,666 g 2,545 ...FrmLen?(1)1e
```

See also Detailed Status on page 23.

Timestamps

The TmeAbs option line sets the format of the frame timestamp. It specifies the units used to display the timestamp. Possible values are:

hr – hours

mn – minutes

sc – seconds

ms – milliseconds

us – microseconds

Any character after the unit is displayed. For example, hr:mn causes the time to be displayed as 12:37, with a colon between the hours and the minutes.

Example:

```
TimeAbs hr:mn:sc.ms,us
```

The frame timestamp can be identified by a leading ‘a’ in the captured data, for example,

```
2: a 0:00:00.002,975 255< 05^ 1- 0000 0000 0000 0000 0000 0000...
```

Two other times can be displayed using the same format.

The TimeGap option line displays the gap time, which is the time from the end of the previous frame to the start of the current frame.

Example:

```
TimeGap ms.us
```

The gap time can be identified by a leading ‘g’ in the capture, for example,

```
2: a 0:00:00.002,975 g 0.001,054 255< 05^ 1- 0000 0000...
```


The TmeDelta option line displays the delta time, which is the time from the start of the previous frame shown to the start of the current frame.

Example:

TimeDelta ms.us

The delta time can be identified by a leading 'd' in the capture, for example,

```
2: a 0:00:00.002,975 d 0.002,975 g 0.001,054 255< 05^ 1- 0000
0000...
```

TIP

You can use the delta time to display update times for a drop. Modify the option file QTS_UpdFromDrop.opt to display the delta time and include a delta time graph, set the drop number to the drop of interest and display the selected frames.

```
3: a 0.006,823 d 6.823 d..... | 255< 06^ 1- 0000
8: a 0.015,232 d 8.409 d..... | 255< 06^ 1- 0000
11: a 0.020,729 d 5.497 d..... | 255< 16^ 1- 0000
18: a 0.029,401 d 8.672 d..... | 255< 06^ 1- 0000
21: a 0.035,198 d 5.797 d..... | 255< 06^ 1- 0000
26: a 0.043,606 d 8.408 d..... | 255< 06^ 1- 0000
29: a 0.049,077 d 5.471 d..... | 255< 06^ 1- 0000
32: a 0.054,557 d 5.480 d..... | 255< 06^ 1- 0000
35: a 0.060,042 d 5.485 d..... | 255< 06^ 1- 0000
38: a 0.065,532 d 5.490 d..... | 255< 06^ 1- 0000
```

Graphs

The gap time and the delta time can be displayed as a text graph in the frame data.

The GrphGap option line sets the format of the gap time graph. The parameters are the full scale width, in characters, and the full scale time, using the time units described previously. Times are shown graphically using period '.' characters.

Example: The following option line reserves 20 character spaces, corresponding to a full scale of 5 ms

GrphGap 20 5ms

The gap time graph can be identified by a leading 'g'. The end of the graph can be identified by a '|' character.

Example of a gap graph, showing the gap times and gap graph, produced using GrphGap 20,5:

```

1: a 0:00:00.000,000 g  2,252 g..... |
2: a 0:00:00.002,975 g  1,054 g....  |
3: a 0:00:00.009,338 g  0,184 g      |
4: a 0:00:00.013,163 g  0,527 g..   |
5: a 0:00:00.015,998 g  0,182 g      |
6: a 0:00:00.019,821 g  0,528 g..   |
7: a 0:00:00.020,536 g  0,181 g      |
8: a 0:00:00.021,167 g  2,027 g..... |
9: a 0:00:00.023,297 g  1,053 g....  |
10: a 0:00:00.029,659 g  0,176 g      |
11: a 0:00:00.033,476 g  0,527 g..   |
12: a 0:00:00.036,311 g  0,182 g      |
13: a 0:00:00.040,125 g  0,527 g..   |

```

If the gap time graph overflows the given scale, the beginning and end of the graph are shown as asterisks, for example,

```

1: a 0:00:00.000,000 g  2,252 g*          *

```

The GrphDelta option line sets the format of the delta time graph. The parameters are the full scale width, in characters, and the full scale time, using the time units described previously. Times are shown graphically using period '.' characters.

Example:

GrphDelta 20 5ms

The delta time graph can be identified by a leading 'd'. The end of the graph can be identified by a '|' character.

Example of a delta time graph, showing the delta times and delta time graph:

```

1: a 0:00:00.000,000 d  0,000 d      |
2: a 0:00:00.002,975 d  2,975 d..... |
3: a 0:00:00.009,338 d  6,363 d..... |
4: a 0:00:00.013,163 d  3,825 d..... |
5: a 0:00:00.015,998 d  2,835 d..... |
6: a 0:00:00.019,821 d  3,823 d..... |
7: a 0:00:00.020,536 d  0,715 d.     |
8: a 0:00:00.021,167 d  0,631 d.     |

```

```

9: a 0:00:00.023,297 d 2,130 d.... |
10: a 0:00:00.029,659 d 6,362 d..... |
11: a 0:00:00.033,476 d 3,817 d..... |
12: a 0:00:00.036,311 d 2,835 d.... |
13: a 0:00:00.040,125 d 3,814 d..... |
14: a 0:00:00.040,839 d 0,714 d. |

```

If the delta time graph overflows the given scale, the beginning and end of the graph are shown as asterisks, for example,

```
3: a 0:00:00.009,338 d 6,363 d* *
```

Frame Data

Detailed Status

If the DetailSts option line is present, detailed status information is displayed for each frame.

Immediately before the frame data are four columns, one each for CRC error, noise error, abort error and overrun error. If the column contains a period, there has been no error or the corresponding type in the frame.

Example: Frame 354 has no errors, frame 355 has CRC and abort errors, etc.

```

354: a 0:00:00.689,797 d 0,824 g 2,106 ...255< 05^ 6- 17
355: a 0:00:00.691,197 d 2,400 g 2,106 c.a.255< 05^ 6- 17
356: a 0:00:00.693,510 d 2,313 g 1,143 c... 6< 00^
357: a 0:00:00.698,756 d 4,246 g 1,054 c...255< 05^ 2- 4f
358: a 0:00:00.703,543 d 5,787 g 2,105 c...255< 05^ 2- 4f
359: a 0:00:00.707,389 d 3,846 g 2,096 c...255< 05^ 2- 41
360: a 0:00:00.711,217 d 3,828 g 2,555 ...255< 05^ 4- 00

```

If DetailedSts is not present, frames with bad status are shown with an asterisk in place of the detailed status information.

Data Format

The following option lines control the display of register data for DCSNet I/O update frames (CTL = 5 or CTL = 6).

Option line	Show register data as...
ShowRegInt	integers, -32768 to 32767
ShowRegUns	unsigned integers, 0 to 65535

Option line	Show register data as...
ShowRegHex	hexadecimal, 0000 to FFFF
ShowRegBin	binary, 0000 0000 0000 0000 to 1111 1111 1111 1111

By default, all data is shown as bytes.

The following example shows the same in each format.

Default, bytes

```
4: a 0.004,958 g..... | 255< 05^ 55- 12 34 ff ff 33 33...
```

Hexadecimal

```
4: a 0.004,958 g..... | 255< 05^ 55- 1234 ffff 3333...
```

Integer

```
4: a 0.004,958 g..... | 255< 05^ 55- 4660 -1 13107...
```

Unsigned integer

```
4: a 0.004,958 g..... | 255< 05^ 55- 4660 65535 13107...
```

Binary

```
4: a 0.004,958 g..... | 255< 05^ 55- 00010010-00110100...
```

CRC

To include the frame CRC, use the ShowCrc option line.

CRCs are shown at the end of the frame, enclosed in square brackets.

Example:

```
6: a 0:00:00.019,821 255< 05^ 3- 00 00 00 00 00 00 00 00  
[95f5]
```

Equations

You can create an equation to control which frames are stored and displayed. The beginning of the equation is marked by the option line showonly. The end of the equation is marked by the option line consisting of the '#' character. There can be only one equation in an option file.

Example:

showonly

(Ctl=CTL_MSG) or (Ctl=CTL_ACK)

#

Equations consists of keywords, parameters, and constants, connected by operators.

Keywords

The equation can include the following keywords, which are described in detail below.

Keyword	Description
STS	Frame status
Len	Frame length (included the 3 byte header but not the CRC)
Dst	Frame destination
Ctl	Frame control
Drop	Frame drop
DataByte[ofs]	Data byte at offset 'ofs' into the frame data
DataWord[ofs]	Data word at offset 'ofs' into the frame data
CmdArg[num]	Passed parameters, see page 28
GapTme	Gap time, see page 20

Frame Status, STS

The frame status can be one of the following:

Value	Symbolic name	Description
0x00	STSOK	Good status
0x01	STSCRC	CRC error
0x02	STSNOISE	Noise error
0x04	STSABORT	Status abort, frame did not complete
0x80	STSOVERUN	Overrun error, frame did not terminate properly

Since multiple bits may be set in STS, mask STS with the bit you wish to examine before you make any comparisons.

Example: The following equation selects frames with CRC errors.

showonly

(STS & STSCRC = STSCRC)

#

Example: The following equation selects all frames with errors.

```
showonly
```

```
STS <> 0
```

```
#
```

Frame Length, Len

The frame length includes the three byte header but does not include the CRC bytes.

Example: The following equation selects frames with only a header.

```
showonly
```

```
Len <= 3
```

```
#
```

Frame Destination, Dst

The first byte of the frame is the destination.

For I/O updates the destination is 255 (broadcast) since all drops see updates to and from all other drops.

Example: The following equation selects frames with destination 255.

```
showonly
```

```
Dst = 255
```

```
#
```

Frame Control, Ctl

The second byte of the frame is the frame control, Ctl, which identifies the type of frame. Possible values are:

Value	Symbolic name	Description
0	CTL_INIT_REQ	Init request
1	CTL_INIT_RSP	Init response
2	CTL_TOKPASS	Token pass
3	CTL_ACK	Acknowledge
4	CTL_TOKRET	Token return
5	CTL_UPDTOSLV	I/O update to slave drop
6	CTL_UPDTOMAS	I/O update to master
7	CTL_MSG	Directed message

The symbolic names can be used in the equation.

Mask off the upper bits of the CTL byte before using them in comparisons.

Example: The following equation selects frames that consist of updates to slaves or to the master.

showonly

```
((CTL&0x0F)=CTL_UPDTOSLV) OR
((CTL&0x0F)=CTL_UPDTOMAS)
```

#

Frame Drop

On I/O updates to or from the master, the third byte in the message is the frame drop. On updates from the master, the frame drop is the drop being updated with output data. On updates to the master, the frame drop is the drop sending the input data.

Example: The following equation selects frames that are I/O updates from drop 2 to the master

showonly

```
((CTL&0x0F)= CTL_UPDTOMAS) AND (drop = 2)
```

#

Data Values, DataByte[ofs] and DataWord[ofs]

Offsets start from 0 and begin immediately after the three-byte frame header.

In the following frame, DataByte[0] is 12 hexadecimal (or 0x12), DataByte[1] is 34 hexadecimal (or 0x34), and so on.

```
4: a 0.004,958 g..... | 255< 05^ 55- 12 34 ff ff...
```

In the following frame, DataWord[0] is 1234 hexadecimal or 0x1234, DataWord[1] is FFFF hexadecimal or 0xFFFF.

```
4: a 0.004,958 g..... | 255< 05^ 55- 1234 ffff
```

Parameters

If you have passed in one or more parameters, you can access them using CmdArg[0], CmdArg[1], CmdArg[2], or CmdArg[3].

Example: The following equation, from the option file QTS_UpdFromDrop.opt, selects frames that are updates to the master and that have a drop matching the value passed in as the first parameter.

showonly

```
((Ctl&0xf)=CTL_UPDTOMAS) &&
```

```
(Drop=CmdArg[0])
```

#

See page 28 for information on how to pass in parameters.

GapTme

The gap time, GapTme, is the time in microseconds between the end of the previous frame and the start of the current frame.

Example: The following equation selects frames with gap times greater than 10 milliseconds (10000 microseconds)

showonly

```
GapTme > 10000
```

#

Constants

Constants can be entered in the following formats:

Format	Data range
Signed integer	-32768 to 32767
Hexadecimal	0x0000 to 0xFFFF

Passing In Parameters

You can pass in up to four parameters to be used in the equation. Parameters are defined by the keywords “ArgName0=”, “ArgName1=”, “ArgName2=”, “ArgName3=”

followed by the parameter description, for example,

```
ArgName0=From Drop
```

AnxAmxCapt displays the description and lets you enter a value, as shown.

Operators

You can use the following operators to define the equation.

Operator	Description
<>	not equal
!=	not equal
<=	less than or equal
>=	greater than or equal
==	equal
=	equal
>	greater than
<	less than
&&	logical AND
AND	logical AND
	logical OR
OR	logical OR
!	logical NOT
&	bitwise AND
	bitwise OR
^	bitwise exclusive OR
*	multiply
/	divide

Operator	Description
%	modulus
+	add
-	subtract
~	complement
(left parenthesis
)	right parenthesis

Sample Option Files

The sample option files provided with the AN-X module include:

Option File	Description
QTS_All.opt	Selects all frames
QTS_UpdToDrop.opt	Selects I/O updates to a specific slave drop
QTS_UpdFromDrop.opt	Selects I/O updates from a specific slave drop
QTS_Messages.opt	Selects directed messages

Typically you would create a new option file by editing and modifying one of the sample option files.

Captured Data Format

The following sample output shows a capture from DCSNet, selected using the sample option file QTS_All.opt. Lines have been truncated for clarity. The network consists of a DCS master and a single slave drop 55.

```

10: a 0.017,109 g.... | 255< 00^ 53-
11: a 0.018,323 g..... | 255< 05^ 55- 11 11 22 22 33 33 44 44 55 55 66 66
12: a 0.021,285 g.. | 255< 26^ 55- 00 00 00 00 00 00 00 00 00 00 00 00
13: a 0.022,563 g.... | 255< 00^ 54-
14: a 0.023,779 g..... | 255< 05^ 55- 11 11 22 22 33 33 44 44 55 55 66 66
15: a 0.026,741 g.. | 255< 26^ 55- 00 00 00 00 00 00 00 00 00 00 00 00
16: a 0.028,020 g.... | 255< 00^ 1-
17: a 0.029,235 g..... | 255< 05^ 55- 11 11 22 22 33 33 44 44 55 55 66 66
18: a 0.032,197 g.. | 255< 26^ 55- 00 00 00 00 00 00 00 00 00 00 00 00
19: a 0.033,477 g.... | 255< 00^ 2-

```

```

20: a 0.034,692 g..... | 255< 05^ 55- 11 11 22 22 33 33 44 44 55 55 66 66
21: a 0.037,651 g.. | 255< 26^ 55- 00 00 00 00 00 00 00 00 00 00 00 00
22: a 0.038,933 g... | 255< 00^ 3-
23: a 0.040,148 g..... | 255< 05^ 55- 11 11 22 22 33 33 44 44 55 55 66 66
24: a 0.043,107 g.. | 255< 26^ 55- 00 00 00 00 00 00 00 00 00 00 00 00
25: a 0.044,387 g... | 255< 00^ 4-
26: a 0.045,600 g..... | 255< 05^ 55- 11 11 22 22 33 33 44 44 55 55 66 66
27: a 0.048,560 g.. | 255< 26^ 55- 00 00 00 00 00 00 00 00 00 00 00 00
28: a 0.049,840 g... | 255< 00^ 5-
29: a 0.051,054 g..... | 255< 05^ 55- 11 11 22 22 33 33 44 44 55 55 66 66
30: a 0.054,015 g.. | 255< 26^ 55- 00 00 00 00 00 00 00 00 00 00 00 00
31: a 0.055,302 g... | 255< 00^ 6-
32: a 0.056,517 g..... | 255< 05^ 55- 11 11 22 22 33 33 44 44 55 55 66 66

```

Each line starts with a reference number. For example, the first line shown has a reference number of 10.

Next is the frame timestamp. The first frame has a timestamp of 0.015245 seconds.

This is followed by a graph of the gap time.

The next three bytes are the frame header.

The first byte of the header is the destination, 255 for all frames shown in this example. This indicates a broadcast frame. All DCS frames are broadcast, since all drops must monitor I/O updates to all other drops.

The second byte of the header is the Ctl byte. It indicates the frame type.

The third byte of the header is the drop. On I/O updates from the master, the drop is the drop number receiving the data. On I/O updates to the master, the drop is the drop sending the data.

After the header is the frame I/O data. On updates from the master, the first data on every update is the global broadcast data, in this case 11 11 22 22 33 33...), followed by the register data to the drop.

Using AnxInit

AnxInit is a 32-bit Windows application supplied with AN-X to perform the following functions:

- Locate and identify AN-X modules on the Ethernet network
- Select a specific AN-X for configuration
- Set the IP address and other network parameters for an AN-X
- Restart an AN-X
- Display information about the selected AN-X
- Read the kernel parameters for the selected AN-X
- Update the flash (low level firmware) on the selected AN-X
- Update the firmware on the selected AN-X
- Patch the firmware on the selected AN-X

In addition, it can be used to:

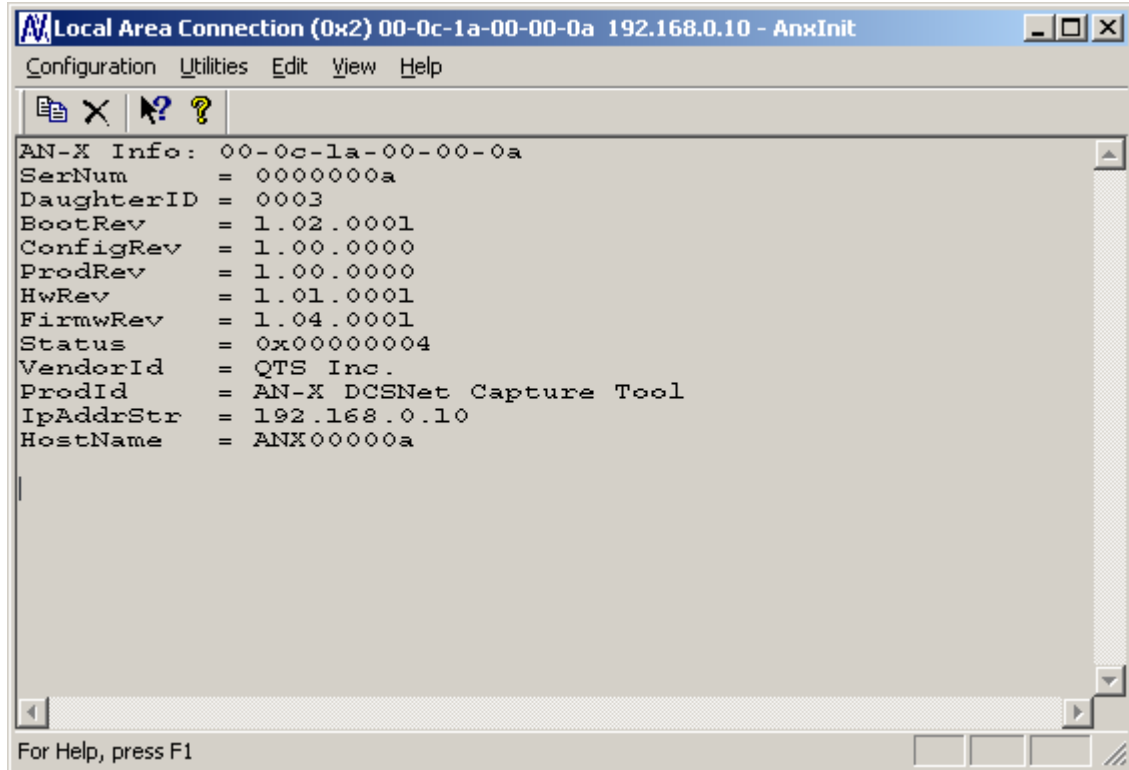
- clear the AnxInit log
- copy the contents of the log to the clipboard for use by another application. This is often useful for technical support

AnxInit Log

AnxInit logs messages in its main window. These messages are often useful for determining the cause of errors or for technical support.

To clear the log, select *Edit/ClearLog*.

To copy the contents of the Log to the Windows clipboard so that they can be pasted into another application, select *Edit/Copy*.

A screenshot of a Windows utility window titled "Local Area Connection (0x2) 00-0c-1a-00-00-0a 192.168.0.10 - AnxInit". The window has a menu bar with "Configuration", "Utilities", "Edit", "View", and "Help". Below the menu bar is a toolbar with icons for file operations and help. The main area displays the following text:

```
AN-X Info: 00-0c-1a-00-00-0a
SerNum    = 0000000a
DaughterID = 0003
BootRev   = 1.02.0001
ConfigRev = 1.00.0000
ProdRev   = 1.00.0000
HwRev     = 1.01.0001
FirmwRev  = 1.04.0001
Status    = 0x00000004
VendorId  = QTS Inc.
ProdId    = AN-X DCSNet Capture Tool
IpAddrStr = 192.168.0.10
HostName  = ANX00000a
```

The status bar at the bottom of the window contains the text "For Help, press F1" and some empty buttons.

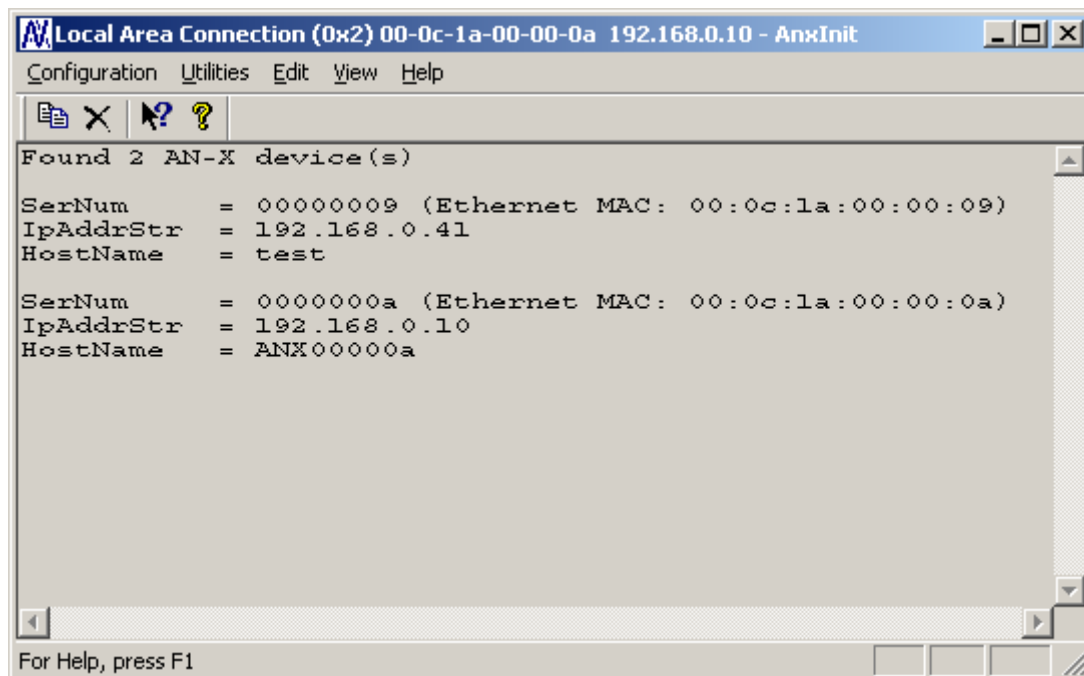
AN-X Log

Locating Available AN-X Modules

To locate all accessible AN-X modules on the Ethernet network, select *Utilities/Locate All AN-X Modules*.

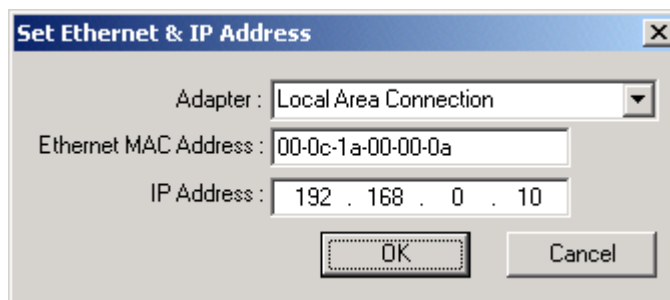
AnxInit displays a list of the AN-X modules it finds, showing their MAC IDs, IP addresses and host names.

This command is useful for determining IP addresses when they have been set by a DHCP server or for confirming that an AN-X is accessible.



Selecting an AN-X

Before you can perform an operation on an AN-X, you must select it. Choose *Utilities/Select An AN-X* to select a specific AN-X.



From the Adapter list, select the network adapter that connects to the Ethernet network that contains the AN-X.

In the *Ethernet MAC Address* field, enter the MAC Address of the AN-X you wish to select. It can be found on the AN-X label or using the *Locate All AN-X Modules* command. The format is as shown above, six pairs of hexadecimal digits separated by hyphens.

In the *IP Address* field, enter the Ethernet IP address of the AN-X you wish to select. It can be found using the *Locate All AN-X Modules* command. The format is as shown above, four decimal numbers each in the range 0 to 255.

Both MAC address and IP address must match the settings on the AN-X in order for communication to occur.

Click OK to select the AN-X.

The title bar of AnxInit shows the MAC Address and IP Address of the currently selected AN-X.

Set AN-X IP Configuration

Utilities/AN-X IP Configuration sets the AN-X IP address and hostname.

The AN-X must be on the local Ethernet to set its IP address.

First select the AN-X using the *Utilities/Select An AN-X command*.

Next select *Utilities/AN-X IP Configuration*. The *AN-X TCP/IP Configuration* dialog appears.

Enter a *Host Name* for the AN-X. 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 31 characters long.

To configure the AN-X to obtain its IP address from a DHCP server on the network, select *Obtain an IP address automatically (DHCP)*

To configure the AN-X to use a static IP address, select *Use the following Settings* and enter the following:

- the desired IP address for the AN-X.
- the Subnet mask 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.

Click OK to complete the configuration.

Utilities/AN-X IP Configuration resets the selected AN-X. Use the *Utilities/Restart AN-X* to restart the AN-X in production mode.

If you Cancel the *Utilities/AN-X IP Configuration* command, AN-X is left running the boot code. Use the *Utilities/Restart AN-X* command to restart the AN-X.

Restart an AN-X

Use the *Utilities/Restart AN-X* command to restart the currently selected AN-X.

AN-X Info

The *Utilities/AN-X Info* command provides information about the currently selected AN-X in the log window.

The information shown:

AN-X Info	Ethernet MAC address
SerNum	Serial number
DaughterID	Daughterboard ID, 3 for AN-X-AMXCAPT
BootRev	Boot code version
ConfigRev	Configuration kernel version
ProdRev	Production kernel version
HwRev	Hardware version
FirmwRev	Firmware release version (depends on current operating mode)
Status	see below
VendorId	Vendor ID
ProdId	Product ID
IpAddrStr	IP address assigned using <i>Utilities/AN-X IP Configuration</i>
HostName	name assigned using <i>Utilities/AN-X IP Configuration</i>

In boot mode, FirmwRev, Vendor ID and Product ID are not valid, and IpAddrStr and HostName are not shown.

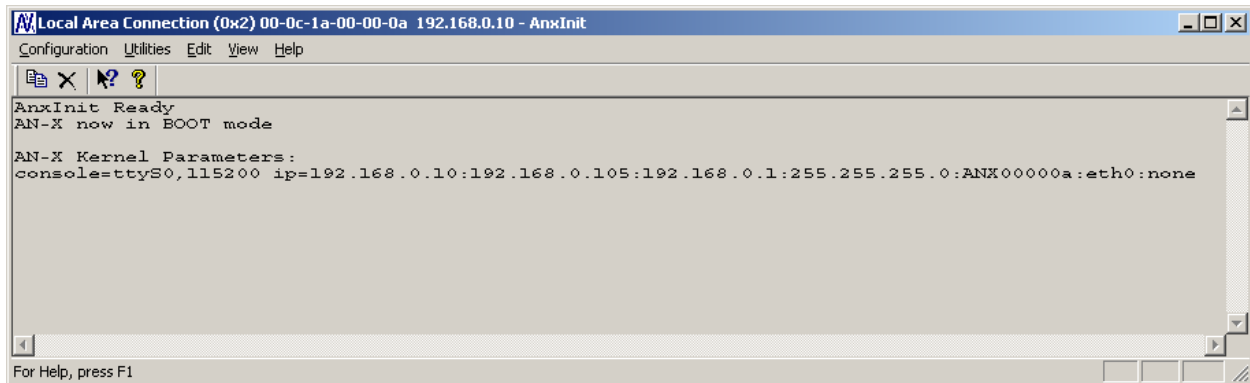
Possible status values are:

Value	Meaning
1	Boot mode
2	Configuration mode
4	Production mode

Read Kernel Parameters

The *Utilities/Read Kernel Parameters* command displays various communications parameters for the currently selected AN-X

This command resets the AN-X. You will be warned and given the opportunity to cancel the command.



The *Utilities/Read Kernel Parameters* command leaves the AN-X running the boot code. Use the *Utilities/Restart AN-X* command to restart the AN-X in production mode.

Run Config Mode

The *Utilities/Run Config Mode* command is used to restart the currently selected AN-X in configuration mode (normally used internally for updating firmware).

This command is not used in normal operation but may be required for technical support.

The AN-X is in configuration mode when the SYS LED flashes red twice, followed by a pause.

To exit configuration mode, use the *Utilities/Restart AN-X* command to restart AN-X in production mode.

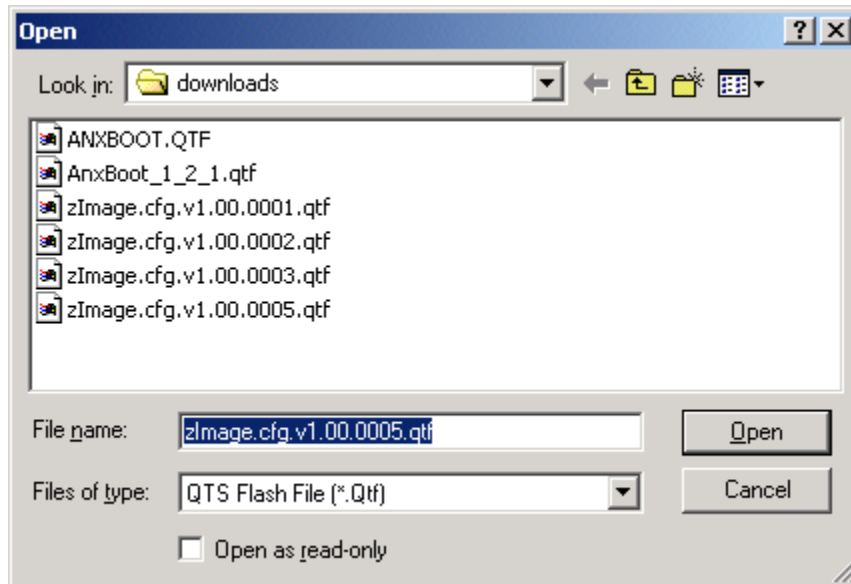
Update AN-X Flash

The *Utilities/Update AN-X Flash* command updates the low-level firmware (boot code, configuration kernel, production kernel).

Files have extension qtf.

This command resets the AN-X. You will receive a warning and be given the opportunity to Cancel the command.

If you cancel at the filename dialog, the AN-X has already been reset and is in boot mode. Use the *Utilities/Restart AN-X* command to restart it in production mode.



Update Firmware

There are two ways to update all the firmware in an AN-X module.

1. The *Configuration/Firmware Update* command starts the firmware update wizard, which takes you step by step through the firmware update process.
2. The *Utilities/Update Firmware* command updates all the firmware on an AN-X you have selected using the *Utilities/Select An AN-X* command.

Firmware files have extension *bin*.

Firmware Update Wizard

Select the *Configuration/Firmware Update* command to start the firmware update wizard.

Step 1:

In step 1, you identify the AN-X you are configuring.

Step 1: AN-X Selection

Select this computer's Ethernet adapter that's on the same Ethernet subnet as the AN-X module you want to configure (you may only have one Ethernet adapter in your computer)

Local Area Connection

Enter the Ethernet MAC Address of the AN-X module you want to configure. You can get this from the label on the AN-X module or by selecting Utilities/Locate All AN-X Modules (if the module's current IP address is on the same subnet).

00-0c-1a-00-00-09

Enter the IP address on the local subnet that you intend the AN-X module to use.

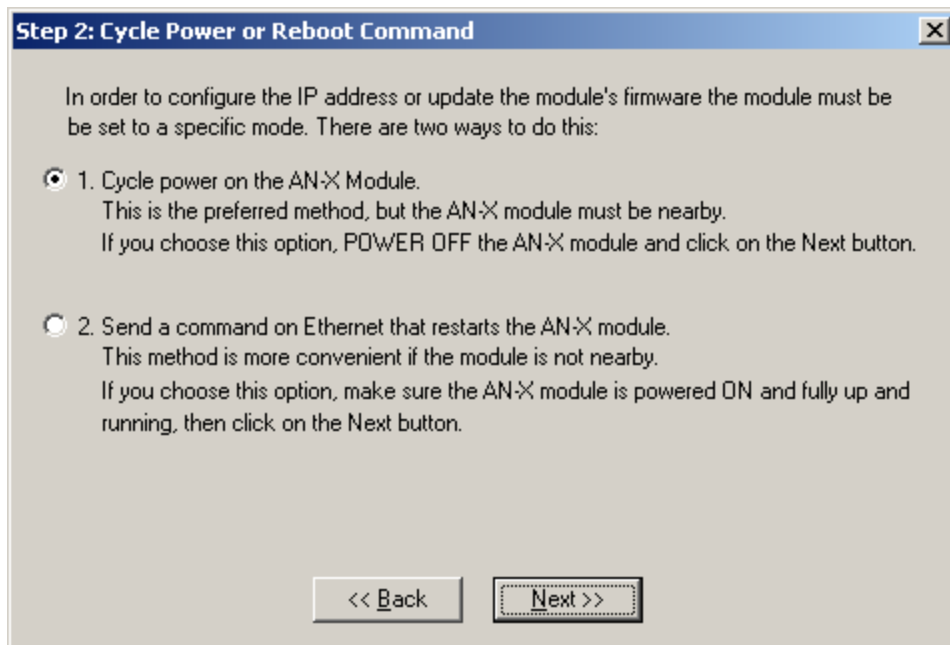
192 . 168 . 0 . 9

Next >> Exit

1. Select the Ethernet adapter that's connected to the AN-X. In most cases there will be just one Ethernet adapter in the computer. The AN-X must be on the same subnet as the computer.
2. Enter the MAC address of the AN-X you are updating. This is printed on the AN-X label. It consists of six pairs of hexadecimal digits, separated by hyphens. In the example above, it's 00-0c-1a-00-00-09.
If the AN-X is already online, you can obtain its MAC address using the *Utilities/Locate All AN-X Modules* command.
3. Enter the IP address of the AN-X you want to update

Step 2

In step 2, you choose a method of restarting AN-X to put it in config mode.

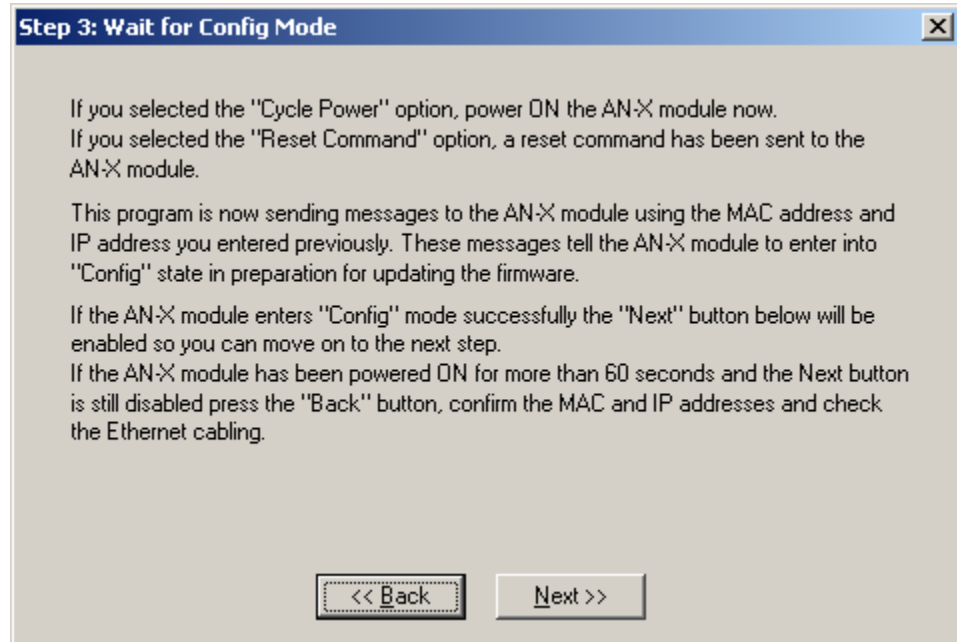


The preferred method is to cycle power on the AN-X. Select the first option on the screen and click the *Next >>* button.

The second method, useful if the AN-X is not easily accessible, is to send it a command over Ethernet. The AN-X must be powered on and completely running for this method to work. For example, if this is the first time you are configuring a new AN-X, allow sufficient time for it to acquire an IP address from a DHCP server or to time out and use its default IP address (about 3 minutes). Select the second option on the screen and click the *Next >>* button.

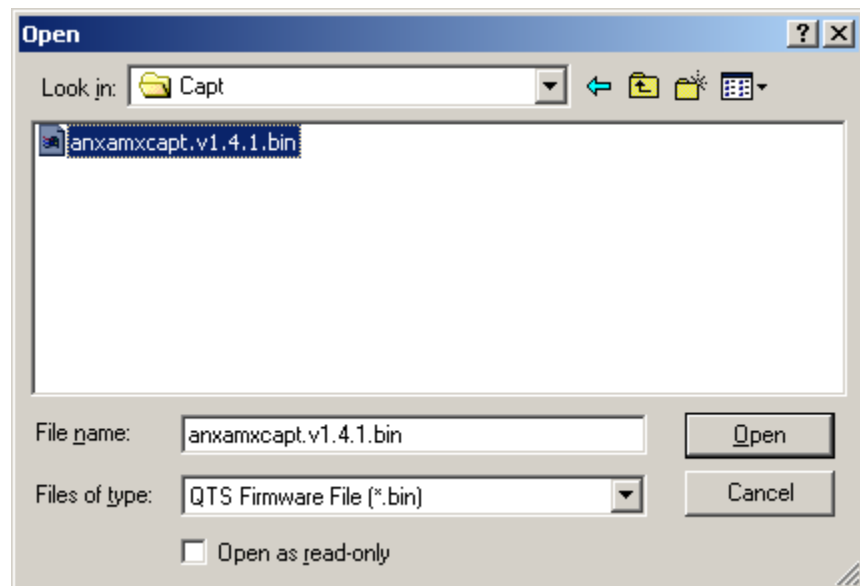
Step 3:

Wait for AN-X to enter config mode. While AnxInit is waiting, the *Next>>* button will be disabled. When AN-X is in boot mode, the *Next>>* button will be enabled.



If the AN-X does not enter config mode within about 60 seconds, return to the previous screens and check the entries.

Click the *Next*>> button, and select the firmware file you want to download and click *Open*.



AnxInit transfers the firmware file and restarts the AN-X.

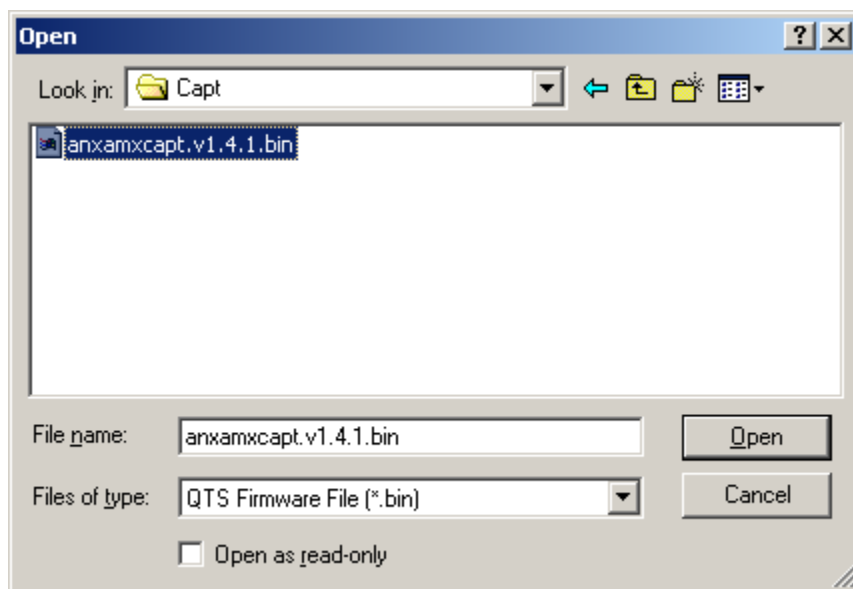
Update Firmware Command

The *Utilities/Update Firmware* command updates all the firmware on an AN-X you have previously selected using the *Utilities/Select An AN-X* command.

This command resets the AN-X. You will receive a warning and be given the opportunity to Cancel the command.

If you cancel at the filename dialog, the AN-X has already been reset and is in configuration mode. Use the *Utilities/Restart AN-X* command to restart it in production mode.

Click the *Next>>* button, and select the firmware file you want to download and click *Open*.

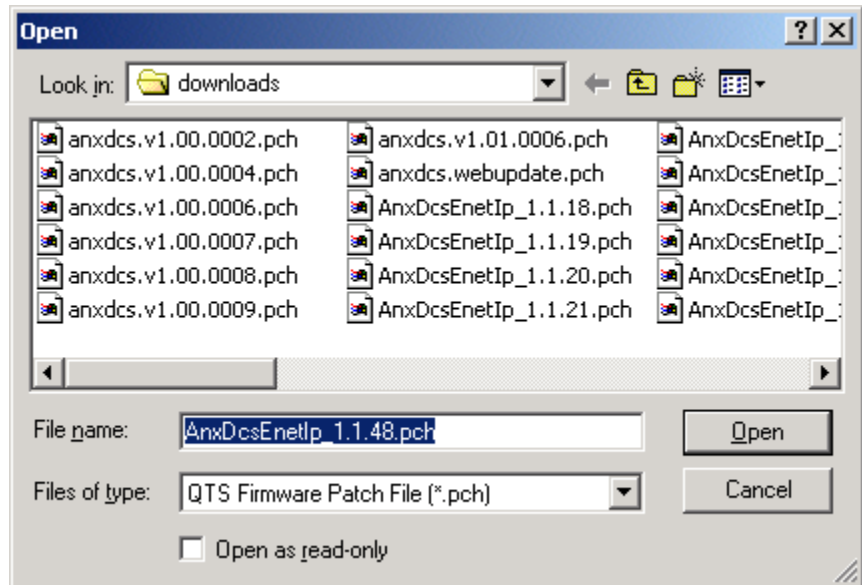


AnxInit transfers the firmware file and restarts the AN-X.

Patch Firmware

The *Utilities/Patch Firmware* command applies small patches to the firmware running on the AN-X.

These patch files have extension *pch*.



This command resets the AN-X. You will receive a warning and be given the opportunity to Cancel the command.

You do not have to reconfigure the AN-X after applying a patch. All configuration information will be left intact.

When the patch has been applied, AnxInit restarts the AN-X in production mode.

If you cancel at the filename dialog, the AN-X has already been reset and is in configuration mode. Use the *Utilities/Restart AN-X* command to restart it in production mode.

Using the Web Interface

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

The web interface is used for viewing AN-X logs.

To use the web interface, you need to know the IP address of the AN-X. Run AnxInit and use the *Utilities/Locate All AN-X Devices* command to find all AN-X devices on the Ethernet network.

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.

Log Files

AN-X maintains various logs to record diagnostic and error messages. Use the Utilities menu in the web interface to view these logs.

System Error Log

The System Error log records errors that occur during AN-X operation. This log is normally empty.

System Info Log

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

View All Logs

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

Administration Menu

The Administration Menu is used to view and edit files on AN-X. It is password protected and is used only for AN-X technical support.

Troubleshooting

LEDs

The AN-X-AMXCAPT has LEDs that indicate the state of the Ethernet connection, the overall module state, and the network state

Ethernet LEDs

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

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

The green Link/Act LED is off if the link is inactive and is on if the link is active. If activity is detected, the link blinks at 30 ms intervals and continues blinking as long as activity is present.

SYS LED

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

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

In the following, red 3 means three red flashes followed by a pause, and so on.

SYS LED State	Possible cause
Red 2	AN-X is in config mode
Red 3	DHCP configuration failed
Red 4	Fatal application error, check logs for cause
Red 5	Application memory access violation, check logs
Red 6	Application failed, illegal instruction, check logs
Red 7	Application crashed, unknown cause, check logs
Fast red flash	Reconfiguration
Slow red flash	script or application problem during startup

At startup, the SYS LED sequence is:

- boot code starts – fast flashing red
- boot code loads a kernel – solid red
- if the configuration kernel is loaded, 2 red flashes followed by a pause
- if the production kernel loads with no errors, solid green

NET LED – Network Status

The NET LED indicates the status of the AutoMax network. It operates only while the capture is running. When no capture is running, the NET LED is off.

Colour	Meaning
Green	Have received a good frame within the last 3 ms
Yellow	Have not received a frame in the last 3 ms
Red	Have received a frame with bad status. Stays on for about 1 second

Updating the Firmware

The AN-X operating software consists of several parts:

- boot code, runs at startup
- configuration kernel, runs when you update firmware
- production kernel, runs in normal operation
- application software, for AutoMax remote I/O communication, scheduled communication with ControlLogix and unscheduled messaging

The boot code and kernels are supplied in file with extension *qtf* and are updated using the AnxInit utility. Run the command *Utilities/Update AN-X Flash* and select the file you wish to download. Refer to page 37 for details.

Firmware files contain the application programs for AN-X and have extension *bin*. They are downloaded using the command *Configuration/Firmware Update* or *Utilities/Update Firmware* in AnxInit. Refer to page 38 for details.

Occasionally individual patch files are released. They have extension *pch* and are downloaded using the *Utilities/Patch Firmware* command in AnxInit. Refer to page 42 for details.

Reading Version Numbers

To read the version numbers of the various software components:

Boot code	AnxInit – AN-X Info
Configuration kernel	AnxInit – AN-X Info
Production kernel	AnxInit – AN-X Info
Firmware	AnxInit – AN-X Info (version depends on current mode, boot, configuration or production)

Obtaining the Latest Software

Version numbers and software for the most recent AN-X releases are available from the QTS website, www.qtsusa.com

Specifications

Parameter	Specification
Function	Captures frames from AutoMax DCSNet or remote I/O network
Description	Processor: 100MHz IDT MIPS FLASH memory: 64M RAM: 64M
Typical Power Consumption	300 mA @ 12 VDC or 150 mA @ 24 VDC
Maximum Power dissipation	3.6W
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

Support

Technical support is available from Quest Technical Solutions.

Quest Technical Solutions
4110 Mourning Dove Court
Melbourne FL 32934
321 757-8483

website: www.qtsusa.com

email: support@qtsusa.com

If you need to make a return, contact QTS to obtain a return authorization number.