USER GUIDE

quadbox

TX/RX, BI-DIRECTIONAL TRANSPORT MEDIA CONVERSION MODULES

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1.1 DOCUMENTATION AND SAFETY OVERVIEW

This manual provides instructions for the installation, operation, and maintenance of the Quadbox series transport media conversion modules built by PESA.

It is the responsibility of all personnel involved in the installation, operation, and maintenance of the equipment to know all the applicable safety regulations for the areas they will be working in. ***Under no circumstances should any person perform any procedure or sequence in this manual if the procedural sequence will directly conflict with local Safe Practices. Local Safe Practices shall remain as the sole determining factor for performing any procedure or sequence outlined in this document.***

1.2 WARNINGS, CAUTIONS, AND NOTES

Throughout this document, you should notice various Warnings, Cautions, and Notes. These addendum statements supply necessary information pertaining to the text or topic they address. It is imperative that audiences read and understand the statements to avoid possible loss of life, personal injury, and/or destruction/damage to the equipment. These additional statements may also provide added information that could enhance the operating characteristics of the equipment (i.e., Notes). Examples of the graphic symbol used to identify each type of statement and the nature of the statement content are shown in the following paragraphs:

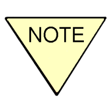
1.2.1 WARNING

	**Warning statements identify conditions or practices that can result in loss of life or permanent personal injury if the instructions contained in the statement are not complied with.**

1.2.2 CAUTION

	**Caution statements identify conditions or practices that can result in personal injury and/or damage to equipment if the instructions contained in the statement are not complied with.**

1.2.3 NOTE

	**Notes are for information purposes only. However, they may contain invaluable information important to the correct installation, operation, and/or maintenance of the equipment.**

Chapter 2 Introduction

2.1 DESCRIPTION

PESA's Quadbox TX/RX bi-directional transport media converter module provides versatile, low cost copper (coax) to fiber and fiber to copper conversion for SDI signals where two-way video connections are required. Each module contains two transmitter (TX) channels and two receiver (RX) channels that offer easy solutions for transport media conversion applications or signal extension over fiber, up to 10kM. Each TX/RX module provides two independent bi-directional conversion channels for SD, HD or 3G-SDI signals, compliant with SMPTE 259M, 292M, 372M and 424M, utilizing a dedicated 2.97 Gbps optical transport per fiber port. Conversion channels are grouped as TX and RX pair 1 and 2.

Each transmitter channel accepts a video input signal through a BNC connector over copper coax cable and provides the signal as a fiber output; each receiver channel accepts a video signal through a fiber input port and provides the output signal through a BNC connector. Modules may be used as standalone "bricks" or mounted in an optional 1 Rack Unit (RU) frame that holds up to 4 modules, and includes a power supply that powers all modules in the rack from a single input power source. Figure 2-1 shows front and rear view of a typical TX/RX bi-directional Quadbox module.

Figure 2-1 Typical Quadbox Bi-Directional Transport Media Converter Module

Status monitoring and module configuration for Quadbox TX/RX is done through graphical user interface (GUI) menu screens of PESA's Cattrax controller application installed on a host PC running the Windows® 2000, XP, Vista or Windows 7 Operating System, as discussed in Chapter 5 of this manual.

Every Quadbox TX/RX module is equipped with both Ethernet and USB connectivity ports. Single modules may be connected individually to the host PC through the USB port. Status monitoring and set-up configuration may be performed on a single module over the direct USB connection using the supplied Cattrax controller application.

When Quadbox TX/RX modules are installed on an Ethernet network, Cattrax can be used as a real-time status monitor or to issue commands to any desired module. Each module may be assigned a unique identifier name, called its alias, for easy identification on a network installation, or any installation where multiple Quadbox modules are used.

2.2 QUADBOX FEATURES

- Two bi-directional copper/fiber conversion ports per module
- 1310 nm optical laser transport signals
- Supports singlemode and multimode fiber cable
- Supports both 62.5 micron and 50 micron multimode fiber cable
- Software setting for output reclocking or by-pass mode
- Up to four TX/RX modules can be packaged in a 1RU space
- Supports redundant power in the 1 RU frame
- Ethernet port for network capabilities
- USB for local setup and diagnostics
- Supports SMPTE 259M-C, 292M, 372M, and 424M
- Up to 2.97Gb/s per port
- 12VDC, 90-240VAC 60/50Hz power brick for standalone modules

2.3 QUADBOX TX/RX MODULE

Each Quadbox TX/RX module provides two independent, bi-directional transmit/receive pairs – labeled TX1, RX 1 and TX2, RX 2, as shown by Figure 2-2. Each conversion port of the pair operates independently – allowing a great deal of versatility for integrating the Quadbox TX/RX module into a wide range of installation applications.

Each transmitter (TX) channel accepts an input of SDI video over coaxial cable through its chassis mounted BNC connector. The SDI input is processed to a fiber media compatible format and is available at the output port of the bi-directional SFP module.

Each receiver (RX) channel accepts an input of SDI video over fiber optic cable through the input port of its bi-directional SFP module. This input is processed to a coax cable compatible format and is available at the BNC output connector for the pair.

Figure 2-2 pictorially illustrates input and output ports of a typical Quadbox TX/RX module.

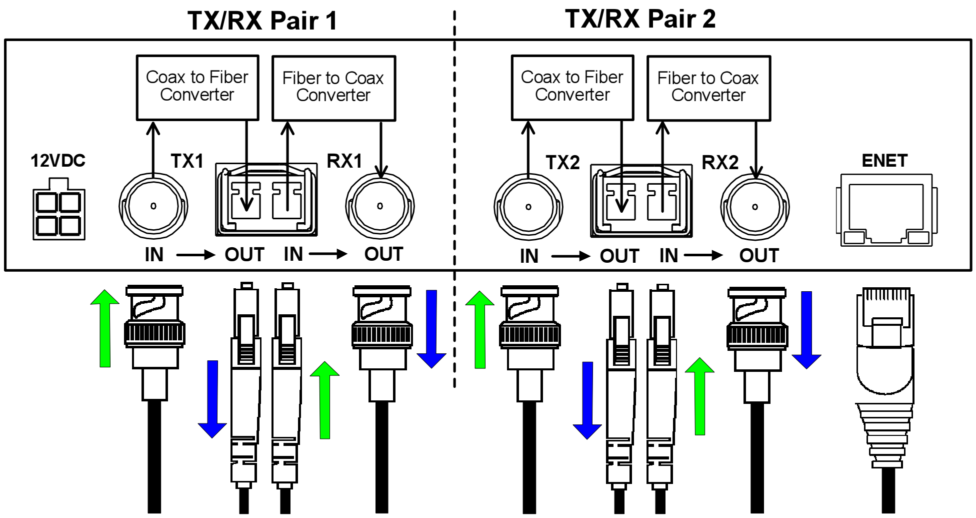


Figure 2-2 Quadbox TX/RX Module I/O Connections

Rear panel connectors are illustrated in Figure 2-2. The function of each is discussed below:

12VDC Operating power (12 VDC) from an external supply is attached to this connector. When the module is used standalone, power is derived from a furnished power supply. If the module is mounted in a rack frame, power for all modules in the frame, plus the frame cooling fans, is derived from a single power brick connected to the frame power distribution panel. A connecting cable connects between the frame power distribution panel and the module power input connector.

Fiber There are two fiber module ports – one transmit and one receive – associated with each TX/RX pair; these are labeled TX 1 OUT and RX 1 IN, and TX 2 OUT and RX 2 IN, respectively. Either singlemode or multimode fiber cable can be used - optical cable runs up to 10 kilometers are possible using singlemode fiber; runs up to 400 meters are possible when using multimode fiber cable.

BNC Connectors There are two BNC connectors for coaxial cable – one transmit and one receive – associated with each TX/RX port pair; these are labeled TX 1 IN and RX 1 OUT, and TX 2 IN and RX 2 OUT, respectively.

Ethernet (ENET) This is a standard 10/100, base-T Ethernet network connector for CAT5E cable. When a TX/RX module is installed on the facility network, status and configuration operations may be performed at any time through the host PC Cattrax application.

Front panel Status LEDs and connector are illustrated in Figure 2-3. The function of each is discussed below:

Figure 2-3 Tx/Rx Front Panel Layout

Status LEDs	There are LEDs mounted on the front side of the module, labeled BNC and FIB (fiber) for both PORT 1 and PORT 2. When an LED is lit, it indicates the corresponding *output* port is locked to the incoming signal.
USB	The USB connector allows the transmit module to communicate with a host PC over a standard USB bus. This connector is used when initially entering operational and set-up parameters to the module via the GUI application. It is not necessary to keep the module attached to the host PC during normal operation.
ACTIVE	There is a single LED, labeled ACTIVE, located on the module front panel. When lit, it indicates the Quadbox module is connected to a source of power and is in an operational state.

2.4 SPECIFICATIONS

Electrical

Input Type	BNC - 75 Ohm
Number of Inputs	4 BNC
Output Type	SFP 1310nm (Fiber Transport) Dual Transmitter
Number of Outputs	Up to 4 (One or Two Dual SFP Fiber Modules)
Signal Formats	SMPTE 259M, 292M, 372M, 424M

SMPTE 424M Specifications for transport

Return Loss	>15dB 5MHz to 1.485MHz; >10dB 1.485 to 2.97MHz
Signal Amplitude	800mV (p-p)
DC offset	0.0V, +/- 0.5V
Rise/Fall Time	<135ps (20% - 80%)
Overshoot	< 10%
Jitter	<0.2UI (SMPTE 292M), <0.3UI (SMPTE 424M), compliant with SMPTE RP-184
Cable EQ	3G-SDI: Auto to 80m; HD-SDI: Auto to 100m, SDI (270Mbs): Auto to 300m

Signal Operations

Polarity	All Paths Non-Inverted

Optical

Connector Type	SFP Module, LC Connector
Wavelength	1310nm
Mode	Singlemode
Module	Small Form Factor, Hot Pluggable
Compliance	ITU-T G.957
Data rates	270Mbs up to 2.97Gbs

The fiber module used with Quadbox is a class 1 laser product compliant with FDA Radiation Performance Standards, 21 CFR Subchapter J. This component is also class 1 laser compliant according to International Safety Standard IEC-825-1.

Number	Up to Four Fiber Optic Cable
Connector type	LC simplex
Operating distance	9/125u - 10km (6.25 miles); 50/125u - 400m (1200ft), 62.5/125u - 200m (600ft)

Operating distances are approximate, cable loss and other interconnects can affect total light loss between TX and RX extenders.

Transmitter Power	Singlemode -9dBm min, -3dBm max.
Receiver Sensitivity	Singlemode -20dBm min, -1dBm max.

Dimensions

Receiver/Transmitter	6.75 (171.45)W x 6.25 (158.75)D x .825 (20.96)H
Rack Mount Kit	19.00 (482.6)W x 6.25 (158.75)D x 1.75 (44.45)H
Weight	0.5 lbs/unit (Transmitter or Receiver)
Weight	1.6 lbs (Rack Mount with PS)
Weight	(four units in rack mount) 3.65 lbs

Environmental & Miscellaneous Specifications

Operating Temp	-20C to 60C
Storage Temp	-40C to 75C
Relative Humidity	9% to 95% non-condensing
MTBF	> 57,000 Hours
Power Source	90-240VAC, 50/60Hz source
Power to unit	12VDC
Power Consumption	4.5W Max per module
Cooling	Convection / Fans in 1RU frame
Rack Mount	yes, with optional 1RU rack frame

Diagnostic Specifications

LED	Power and Optical Links

Control Specifications

Input connection	USB mini-connector / Ethernet RJ-45
Program	Windows based GUI with diagnostics, supports Windows NT, 2000, XP

Chapter 3 Basic Fiber Optic Tutorial

3.1 INTRODUCTION

Fiber optic technology is widely used in video and audio communication applications, and offers many advantages in speed, efficiency and reliability over conventional copper cable such as:

- Exceptional Bandwidth
- Immune to Electromagnetic Interference
- No Electromagnetic Emissions
- Light Weight

There are, however, many considerations that must be included when planning, installing or maintaining fiber optic devices in a facility. Many PESA users are familiar with optic devices, but for those who would like more information we have prepared this very basic tutorial section to help make your installation easier, and acquaint you with the type of fiber devices used in PESA's Quadbox.

Fiber-optic systems use light pulses to transmit information over fiber optic cables rather than electrical signals to transmit information over copper wires. The fiber communication link found in Quadbox is unidirectional, with the signal originating at a transmitter device, travelling over the fiber cable path to a receiver device. Just as with any transmission system, data integrity at the receiving end depends a great deal on the path the signal takes from transmitter to receiver.

3.2 FIBER OPTIC CABLE

Perhaps more than with any other link in the chain, signal losses and other degradations that often occur in the cable path can have a profound effect on the overall functionality of the system. The type of cable used, signal propagation, connectors, patch fields and any other elements in the path are all factors that can cause signal strength loss within the cable path.

Think of a fiber cable as a very long tube with a mirror coating on the inside. If we shine a light in one end we can see light come out at the far end - even if there is a bend in the tube. Light pulses travel through fiber optic cable because of a principle called total internal reflection. This principle states that when the angle of incidence exceeds a critical value, light cannot get out of the tube; instead, the light bounces back in. Since the angle of incidence is always equal to the angle of reflection the reflected light will again be reflected. The light continues this bouncing path down the length of the fiber optic cable. If light strikes the cable core at an angle less than the critical angle then it is attenuated very rapidly with propagation distance. Every type of fiber optic cable is subject to losses, primarily through dispersion and scattering of light within the cable itself. The faster the source light fluctuates, the greater the risk of dispersion.

A fiber optic cable is composed of two concentric layers - the core and the cladding; light is piped through the core. In addition to the two inner layers, there is an exterior coating called the jacket, as shown by Figure 3-1. The jacket protects the core and cladding from shocks that might affect their optical or physical properties, and also provides protection from abrasions, solvents and other contaminants. The jacket has no optical properties and does not affect propagation of light within the core. Fiber optic cables have extremely small diameters – typically ranging from 8 microns to approximately 100 microns. To get some appreciation of how small these sizes actually are, a typical human hair has a diameter of 100 microns. Fiber cable sizes are usually expressed by first giving the core size followed by the cladding size. For example, 8/125 indicates a core diameter of 8 microns and a cladding diameter of 125 microns, 100/140 indicates a core diameter of 100 microns and a cladding diameter of 140 microns, etc.

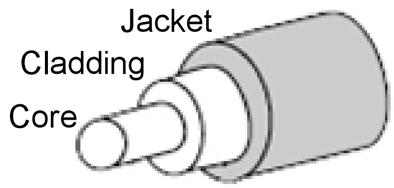


Figure 3-1 Fiber Optic Cable, Basic Cross Section

There are a variety of fiber cable types, but the two most common types you will encounter are called **multimode** and **singlemode**. Regardless of cable type, the construction of fiber cable is the same. Typical core sizes used with devices such as Quadbox are 8 -9 microns for singlemode and 50 - 62.5 microns for multimode.

Before we discuss the differences between these cable types – let's briefly introduce the term ***mode*** as it relates to fiber optic cables. In a previous paragraph we said that light travels through fiber by reflections off the coating. We know that when light enters the cable it can propagate in many different paths down the fiber - the larger the diameter of the fiber, the more potential paths for light to disperse. Wavelength of the light source also plays a factor in dispersion characteristics. Each path the light follows is called a **mode**, and different cable diameters and other characteristics determine the amount of potential modes that can occur within the fiber.

3.2.1 SINGLEMODE CABLE

Singlemode fiber optic cable is a single strand of glass fiber with a very narrow diameter of 8.3 to 10 microns through which only one mode will propagate. It offers higher bandwidth capacity than multimode fiber but requires a narrow light source; typically a light source with wavelength 1310 or 1550nm is used. Singlemode fiber has a much smaller core than multimode. The small core and single light-wave virtually eliminate any distortion that could result from overlapping light pulses, providing the least signal attenuation and the highest transmission lengths of any fiber cable type.

3.2.2 MULTIMODE CABLE

Multimode fiber optic cable is larger in diameter than singlemode, with typical core diameters of 50 or 62.5 microns. Multimode fiber provides high bandwidth at high speeds over medium distances. Light entering the core is dispersed into numerous paths, or modes, as they travel through the core. Typically a light source with a wavelength of 850 or 1300nm is used with multimode cable. In long cable run installations, multiple paths of light can cause signal distortion at the receiving end, resulting in data errors.

3.3 FIBER TRANSMITTER AND RECEIVER DEVICES

At the signal origination point, the transmitter device accepts a signal input and converts the electrical variations of the signal to variations of a light source. Usually the light source is either a LASER device or a LED, operating at extremely short wavelengths, typically in the 850 nanometer (nm) to 1,500 nm range; and over a specified output power level range, depending on the transmitter device used. Transmitter devices used with Quadbox modules contain a LASER light source. Light pulses from the transmitter are focused through a lens into the fiber-optic cable. At the signal destination point, the receiver device accepts an input of modulated light from the transmitter and converts it back to an electrical signal.

Both transmitter and receiver devices are typically specified for use with either singlemode or multimode cable, depending on the operating wavelength among other factors. Devices used in PESA Quadbox Modules are designed for use with singlemode cable; however, under most circumstances it is permissible to use multimode cable with Quadbox, refer to Paragraph 3.6.

Fiber transmit and receive modules are available in a number of different sizes and styles. Quadbox modules all use Small Form-Factor Pluggable (SFP) devices that install into metal sleeve carriers mounted to the module circuit card. Each module uses a type LC connector to interface with fiber cable.

3.4 OPTICAL POWER AND LOSS BUDGET

Every fiber receiver device is specified with a minimum and maximum input power level range that the device can receive in order to properly decode incoming data. With fiber devices proper power level is even more important than with some other systems in that not only can too little power cause serious degradation of the signal, but too MUCH power at the input causes receiver saturation, resulting in data degradation. Specified usable power range for receiver modules used in PESA devices varies between products, but an average range for our example purposes here would be a minimum input of -20dBm to a maximum of -1dBm.

On the transmitter side, devices are also specified with minimum and maximum output power levels. Power output levels can vary within the specified range between devices for a number of reasons; plus transmitter output levels degrade over time. Transmitter power range and degradation must be carefully considered during all phases of planning and installation. Specified power range for transmitter modules used in PESA devices varies between products, but a typical range for the following examples would be from a minimum output of -9dBm to a maximum of -3dBm; and PESA recommends that you should expect 2-3dB degradation in power output over time.

Careful planning and loss calculations must be conducted in order to ensure the most reliable signal transfer. When planning a fiber installation, the ***optical loss budget*** is critical – thankfully, in most installations, it's not a complicated parameter to calculate.

Many factors must be considered for potential signal loss. All fiber optic cable presents a certain amount of signal loss, dependent on length, cable type and other factors. Loss specifications for a particular cable are always available from the manufacturer. In addition to cable losses, typical cable paths have connectors on each end of each piece of cable, the path may be routed through connector panels, or the cable may be spliced in one or more locations along the path – each of these elements also introduce a certain amount of signal loss. By adding the loss value introduced by each element in the path, plus the loss introduced by the cable itself, we can arrive at the total loss value for the entire cable path.

Previously we said that the receiver device required a light input power level within a specified range in order to operate properly. In order to ensure the receiver gets the proper input power, we need to consider the specified output power of the transmitter device, time degradation of transmit output power, cable path losses, and the input power requirement for the receiver. If we take the input power requirement of the receiver and subtract that value from the output power of the transmitter, we have calculated the maximum loss that can exist in the path between the devices. This value is termed the **optical loss budget**, since it is the maximum amount of power loss that can be distributed over every element in the fiber cable path. Once we perform the loss calculations, it is possible that the input power to the receiver is too strong in which case we would need to consider inserting power attenuators in the cable path. Let's consider an example:

- A good rule of thumb is to use the *minimum* specified receiver input power and the *minimum* specified transmitter output power when performing your worst-case loss calculations. It is also good practice to add an additional 2-3dB ***safety margin*** to the calculated maximum loss value to compensate for degradation of transmitter output power and other possible losses over time.
- Using typical values specified for Quadbox devices, we can calculate the **worst-case** optical loss between transmitter and receiver
- Where Minimum XMTR output power is -9dBm (specified)

  Minimum RCVR input power is -20dBm (specified)

  [(-20dBm) – (-9dBm)] = -11dB, or stated another way, 11dB would be the maximum permitted power loss between XMTR and RCVR at worst-case device performance
- Adding in a Safety Margin of an additional potential 3dB loss

  [(-11dB) + (3dB)] = -8dB
- -11dB being the maximum amount of acceptable power loss, plus our 3dB added safety margin yields an **Optical Loss Budget** of -8dB, or stated another way, 8dB would be the maximum permitted TOTAL loss between XMTR and RCVR assuming both transmit and receive devices are operating at the very minimum levels specified by the manufacturer.

Now, we must calculate the total loss introduced by the cable path. In order to do this we must obtain the loss factor for the cable we are using from the manufacturers specifications. This value is typically given as the amount of loss in dB for a given length of cable. We must also count the number of connectors, splices, jacks, and all other potential loss elements in the cable path since each of these elements has a specific loss value.

For best accuracy, it is a good idea to obtain loss value from data supplied by the manufacturer of each of the loss elements in the path; however, for quick reference Table 3-1 provides typical values often encountered in fiber installations.

Source Wavelength and Cable Type	Cable Size (Microns)	Cable Attenuation (Per kilometer)	Connector Attenuation (Per Connection)	Splice Attenuation (Per Splice)
850 nm/Multimode	62.5/125	3 dB	0.5 dB	0.1 dB
1300 nm/Multimode	62.5/125	1 dB	0.5 dB	0.1 dB
850 nm/Multimode	50/125	3 dB	0.5 dB	0.1 dB
1300 nm/Multimode	50/125	1 dB	0.5 dB	0.1 dB
1310 nm/Singlemode	9/125	0.3 dB	0.5 dB	0.1 dB
1550 nm/Singlemode	9/125	0.2 dB	0.5 dB	0.1 dB

Table 3-1 Average Fiber Optic Loss Values

Assume we are installing a fiber run of 9/125 singlemode cable over a total distance of 2.5 kilometers through a patch panel using two cables with a connector on each end of each cable. We are connecting this cable path to a transmitter device operating at a wavelength of 1310nm.

- Referring to Table 1 we see that 9/125 cable at 1310nm presents a loss of 0.3dB per km, so we can easily calculate cable loss for our run

  2.5km X 0.3dB/km = 0.75dB cable loss

- Calculate loss for the connectors

  4 connectors X 0.5dB/connector = 2dB connector loss

- We can now calculate total cable path loss

  0.75dB cable loss + 2dB connector loss = 2.75dB total cable path loss

Since our loss budget, with safety margin added, was 8dB, this path falls easily within that range and would offer a reliable fiber link between Quadbox modules even if the optical devices were operating at worst-case performance.

Calculating optical losses is really not complicated, but is vitally important when planning any fiber installation.

3.5 QUADBOX DEVICE POWER METERS

The Quadbox GUI Fiber Module Status screen provides direct readout of optical device operating power levels. The monitor screen for transmit modules provides a readout of actual output power from the transmitter device; and the screen for receive modules indicates power level of the light source present at the input of the device. In our example power loss calculation, we used the worst-case specified values for both XMTR and RCVR devices; typically, each device is going to perform well above specified minimum levels. You can use these meter displays to verify proper functionality of fiber links. If you are using these readings for calculating loss budget for a specific installation, remember to allow a safety margin for transmitter output fluctuations and degradation over time.

3.6 SINGLEMODE AND MULTIMODE CABLE CONSIDERATIONS

When using singlemode cable, there should be no problems with receiver saturation using Quadbox supplied transmit and receive modules. Even if the transmitter is operating at its upper specified output level of -3dBm, and the cable path presents a loss factor of no more 1dB, the power level reaching the receiver input would be -4bBm which is below the specified maximum input level.

In most circumstances it is permissible to use multimode cable with Quadbox optical devices. However, due to using a singlemode driver with multimode cable, there is a potential that the optical signal might arrive at the receiver input at a level that is too high, or too distorted to provide proper data decoding. Due to the nature of multimode cable, light can arrive at the receiver from multiple paths causing overload, or it can suffer from dispersion distortion. Overload problems usually manifest from short runs of multimode cable between XMTR and RCVR; and dispersion distortion typically occurs with long cable runs. If you are experiencing signal reliability issues with multimode cable due to overload, these can often be eliminated by using a signal attenuator between the end of the cable run and the input of the receiver module.

3.7 MIXED SINGLEMODE AND MULTIMODE CABLE TEST CASES

As discussed in paragraph 3.6, certain conditions can, and often do, occur that cause data errors when using multimode cable as the interconnect medium between TX and RX modules designed and intended for singlemode cable connection. Scenarios presented in the following paragraphs, and illustrated by Figure 3-2, provide results of tests conducted in an actual working environment intended to produce the most reliable data transmission using multimode cable. The test article used in these configurations is a PESA Cheetah V5 Generation 2 Media Extender fiber transmitter module; however, all PESA fiber devices should exhibit similar performance characteristics. Based on the results of these tests, PESA recommends that the interconnect solution presented in **Test Condition A** should be used with all multimode cable installations.

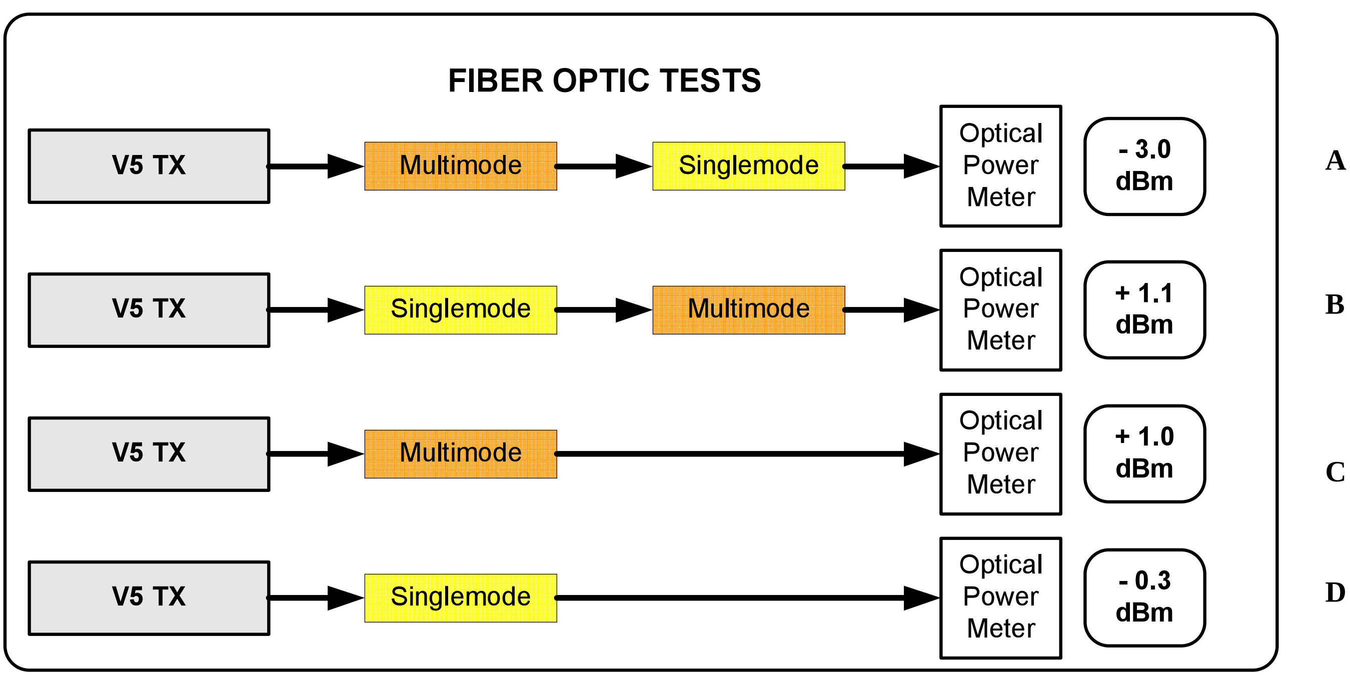


Figure 3-2 Test Case Scenarios and Power Level Results

Cheetah V5 Gen 2 with Cheetah 128 Fiber Router Field Test

A flight pack was interconnected to the routing switcher with multimode tactical fiber interconnect cable (FIBER MULT), with multiple individual fiber cables, transporting multiple fiber signals. The FIBER MULT is 100 meters in length. Because the router uses singlemode SFP fiber TX and RX modules, there was some question as to how the router and the flight pack should be interconnected with the multimode FIBER MULT. Testing revealed the V5 TX module in the flight pack was overdriving the SFP RX in the router when multimode fiber cable was used. Four different interconnect combinations were tried as depicted in Figure 3-2.

Test Condition A

The multimode FIBER MULT was connected directly to the V5 TX output and a singlemode fiber jumper (3 meters) was inserted at the opposite end (router input end) of the multimode FIBER MULT. The optical power was measured at about -3.0 dBm indicating the multimode FIBER MULT to singlemode interconnection introduced about -4.0 dB loss. The other end of the singlemode fiber jumper was connected to the router input. There were no CRC errors and the signal worked through the router using this interconnection as -3.0 dBm is well within the specified optical input range of the router SFP RX module of -20dBm to -1dBm.

Given the multimode FIBER MULT is the standard interconnect between the V5 TX and RX modules in the communications flight pack and the router I/O AND given the FIBER MULT is always 100 meters in length, it appears test condition A is the best option for this interconnection.

Test Condition B

The singlemode fiber jumper (3 meters) was inserted directly between the V5 TX output in the flight pack and the multimode FIBER MULT with the opposite end of the FIBER MULT connected directly to the router fiber input. The power level was measured at the router end of the multimode FIBER MULT at +1.1dBm.

Test Condition C

The multimode FIBER MULT was connected directly between the V5 TX output in the flight pack with the opposite end of the FIBER MULT connected directly to the router fiber input. The power level was measured at the router end of the multimode FIBER MULT at +1.0dBm which is apx. +2 dBm over the -1.0 limit.

There was only a nominal difference in measured optical signal level of test conditions B and C and the signal did not work through the router in either B or C test conditions. It was determined the router input was overdriven by about +2.0dBm in both B and C test cases. The GUI factory test mode also indicated multiple CRC errors.

Test Condition D

For comparison, a singlemode fiber optic jumper (3 meters) was connected directly to the output of the V5 TX and the other end connected directly to the power meter. The optical power into the meter measured -0.3 dBm or -1.3dBm less than the Multimode Only fiber optic cable jumper.

3.8 FIBER INSTALLATION AND MAINTENANCE CONSIDERATIONS

Fiber optic cable, like any other cable, is available in bulk spools of varying lengths without connectors attached. Be aware that some degree of specialized training, skill and equipment is required when installing connectors on the ends of fiber optic cable or splicing two cable ends together. In some installations it may be necessary, due to routing requirements or other constraints, to run bulk cable and attach connectors once the cable is in place. For easier and quicker installation, pre-assembled fiber optic cables, in various lengths, with connectors attached are readily available from a number of sources. PESA highly recommends that, unless you have training in working with optical cable and the necessary equipment, you purchase pre-assembled cables if at all possible for your installation. If using pre-assembled cabling is not feasible for your installation, consider procuring the services of a trained fiber technician, certified for fiber terminations, to install connectors and verify cable continuity before proceeding with Quadbox installation.

Another point you must consider when installing fiber cable is the minimum bend radius. This specification is provided by the manufacturer's data sheet for a particular cable and indicates the maximum amount the cable can be bent towards a 180 degree fold without damaging the cable or seriously degrading performance. Use extra care when pulling cable around corners, over-bending can cause breaks in the glass fiber.

One final point on dealing with optical cable - be sure that the optical connectors are clean and dust free. Each end of a fiber cable connection is normally fitted with a small lens to direct the light source. Remember that the core of even multimode cable is smaller in diameter than a human hair, and the core of a singlemode cable is considerably smaller than multimode. So you can see that dust and dirt, even small amounts, can greatly degrade performance of an optical data transmission system. Always keep dust caps on cable connector ends and optical receptacle connectors when cables are not attached. NEVER touch the end of the optical connector or receptacle with your bare skin. Any source of grease and dirt, even in minute amounts, can seriously degrade performance of the optics.

The core conductor of fiber optic cable is normally attached to a connector equipped with a fiber-end lens. This assembly mates to the optical transmit or receive device by inserting the connector end into its mating receptacle with very slight pressure. A snap latch secures the end into the receptacle. To remove cable-end connector from an optical device, gently press the latch tab and pull cable from receptacle. Immediately replace dust caps on the end of each fiber cable conductor and the optical module connector receptacle.

CAUTION	**Dust, even small amounts, can greatly degrade performance of an optical data transmission system. Always keep the dust caps on the cable connector ends and the optical receptacle connectors when the cables are not attached. NEVER touch the end of the optical connector or receptacle with your bare skin. Grease and dirt, even minute amounts, can seriously degrade performance of the optics.**

Chapter 4 Installation

4.1 GENERAL INSTALLATION CONSIDERATIONS

Quadbox modules are shipped from the factory pre-configured for the specified module type. In most installations, no further configuration should be required. There are very few restrictions on placement of modules. Locate each module for convenient access to video source signals or destination points. Ensure that a source of primary power is available and that each module has clearance for cooling air. If the installation has modules installed on a network, ensure that an Ethernet drop is convenient. It is not necessary that Quadbox modules be continuously connected to a network or host PC for operation. Network connection allows monitoring of modules and executing on-the-fly changes to operational parameters. Monitoring and configuration functions may be performed on a single module over a USB connection to a host PC if the modules are not installed on a network.

4.2 INSTALLING QUADBOX TX/RX MODULES

Transmit channels (TX 1 and TX 2) accept a video input over coaxial cable through the panel mounted BNC connector labeled IN and convert the signal to a fiber output available at the SFP module port labeled OUT. Fiber outputs may be connected to the receiver ports of a remote Quadbox TX/RX module for bi-directional media extension applications; or directly connected to a dedicated Quadbox receiver module or to the fiber input of any compatible fiber optic router, such as the PESA Cheetah routers, or other fiber interface device.

Receive ports (RX 1 and RX 2) accept a video input over fiber optic cable through the panel mounted SFP module port labeled IN and convert the signal to an electrical output available at the BNC connector port labeled OUT for connection to coaxial cable. Fiber inputs may be connected to the transmitter ports of another Quadbox TX/RX module for bi-directional media extension applications; or directly connected to a dedicated Quadbox transmitter module or to the fiber output of any compatible fiber optic router, such as the PESA Cheetah routers, or other fiber interface device.

Install each TX/RX module as follows:

- Connect copper transport video input signals to the BNC coaxial cable connectors of each transmitter (TX) channel labeled IN
- Connect singlemode or multimode fiber optic cable from output destinations to the SFP optical module port of each transmitter (TX) channel labeled OUT
- Connect fiber transport video input signals using singlemode or multimode fiber optic cable to the SFP optical module port of each receiver (RX) channel labeled IN
- Connect coaxial cable from output destinations to the BNC connectors of each receiver (RX) channel labeled OUT
- Connect the module to a facility network using CAT5E cable fitted with an RJ45 connector attached to the Ethernet port on the module
- Connect the power plug from the external power supply to the module power connector and connect the power supply to a source of primary power.

When power is first applied to a TX/RX module, the four LED status indicators will light, along with the LED labeled ACTIVE. As the processor executes its start-up procedure, the status lights will one-by-one extinguish. When start-up is completed, the LEDs indicate signal presence at the indicated module output port. The ACTIVE LED remains lit indicating the module is powered and operating.

Chapter 5 System Set-Up and Configuration

5.1 INTRODUCTION TO THE CATTRAX CONTROL APPLICATION

Set-up, configuration and monitoring functions for Quadbox TX/RX modules are performed through graphical user interface (GUI) menu screens of PESA's Cattrax controller application installed on a host PC running the Microsoft Windows® 2000, XP, Vista or Windows 7 operating system. Cattrax is a multi-system application that can communicate and control many different types of PESA equipment; it incorporates data files for specific equipment into the software structure that contain equipment-specific interface screens, configuration parameters and control functions. In order for Cattrax to "discover" and communicate with a Quadbox TX/RX module, or any other piece of PESA equipment, the proper data file must be present in the Cattrax program. In addition, the QFX USB driver file must be installed on the host PC in order for Cattrax to communicate with PESA equipment over the USB port.

Cattrax automatically searches for PESA equipment through a process called "discovery." When a piece of equipment is detected on the USB port of the host PC or connected to the facility network, the application establishes communication with the equipment and lists it as an active device in the Devices View window. Using a USB interface, only one module may be connected to the host PC at a time; Ethernet interface allows simultaneous control of multiple devices.

Procedures in the following paragraphs discuss operator screens and functions of Cattrax to control Quadbox TX/RX modules. If you need more user information on specific functions or features of the control application, refer to the Cattrax User Guide.

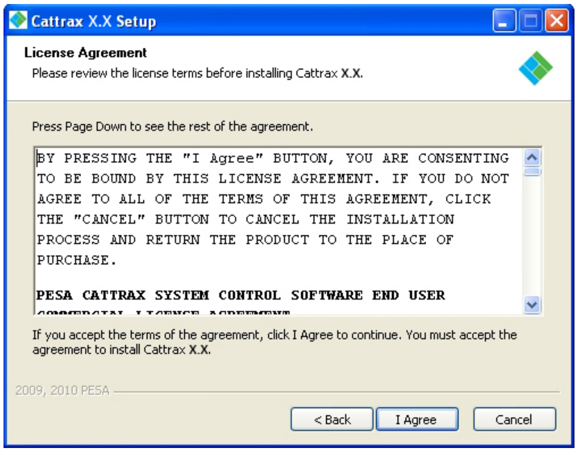
5.2 INSTALL CATTRAX AND QFX USB DRIVER ONTO THE HOST PC

Your Cattrax installation disk contains an auto-run file that guides you through the installation process. Examples of the pop-up screens you will see are shown below with the appropriate step. Notice the "X" used in place of actual values on each example screen presented here. During installation the release number of Cattrax software you are installing is displayed.

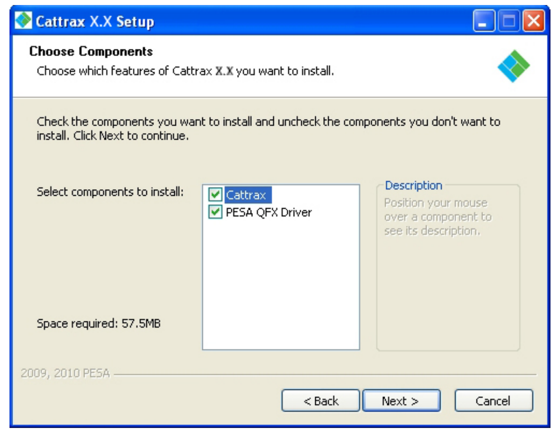
Install the Cattrax software application as follows:

1. Insert Cattrax CD into CD Drive of host PC.
2. Allow the disk to initiate the auto-run function. When initialization is complete, the banner, as shown at right, is displayed on the desktop. Click **Next** to begin installation of the Cattrax application.
3. If the auto-run function does not automatically launch, navigate to the directory of the disk drive containing the installation CD and double click the **Cattrax.exe** file. The banner shown at right should be displayed on the desktop. Click **Next** to begin installation.

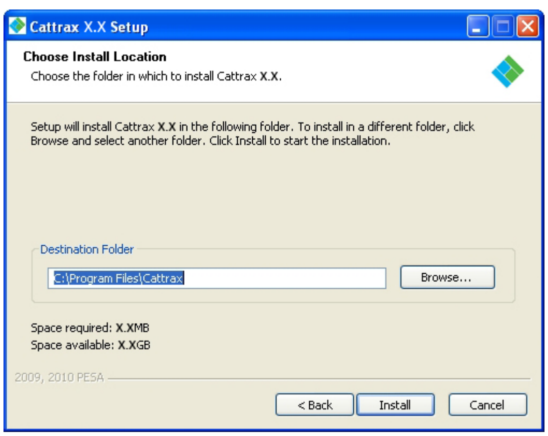
I



4. Read the license agreement and click **Agree** to continue, as shown at left.

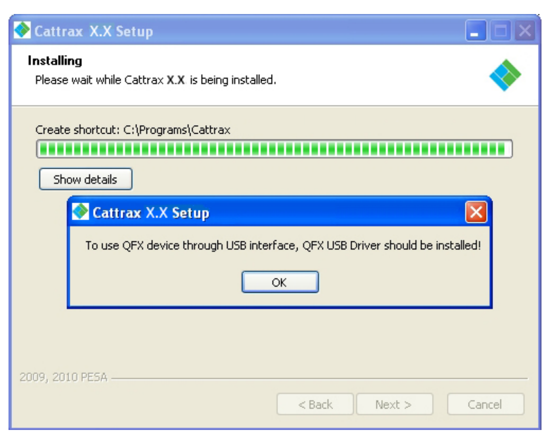


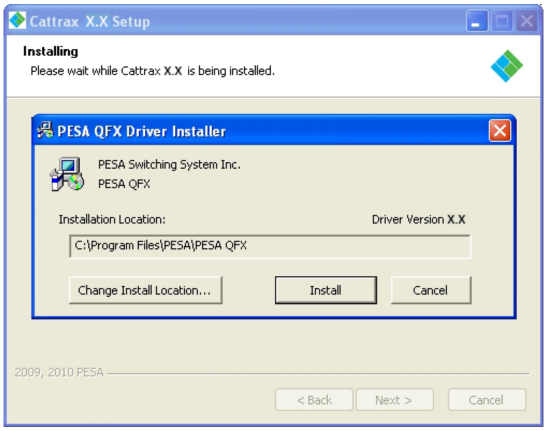
5. The Choose Components window allows you to select the software components you wish to install. During initial installation, the only option is to install the entire program. Ensure that the box next to "Cattrax" in the list box is checked.
6. If you want to install the USB port driver, also check the "PESA QFX Driver" box
7. Click **Next** to continue installation.



8. By default auto-install creates the folder shown at left for the Cattrax application. If you wish to install the software in a directory or folder other than the default, click **Browse** and navigate to the destination. Click **Install** to continue installation.

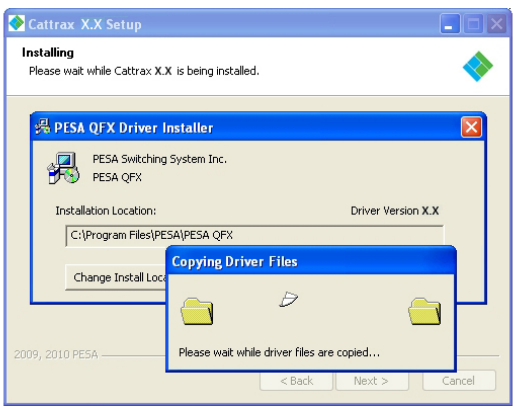
9. Once Cattrax is installed, you will receive the prompt to install the QFX USB driver. Click "OK" to install the driver. If the QFX USB driver is not present on the host PC, Cattrax will not be able to communicate with a connected device through the USB port.



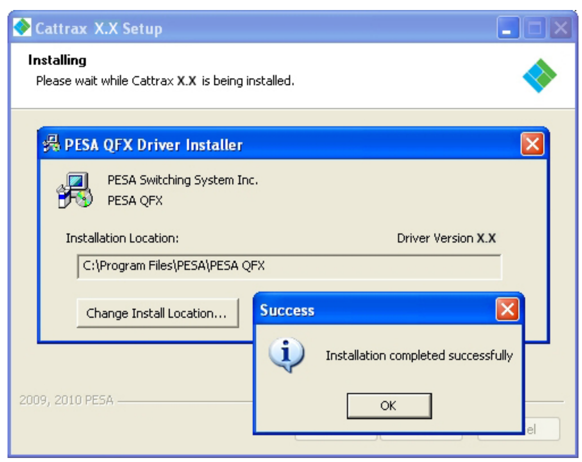


10. You may accept the default installation location, as shown at left, or browse to another folder in which you wish to install the QFX USB driver. When the destination folder is correct, click the Install button to proceed with driver installation.

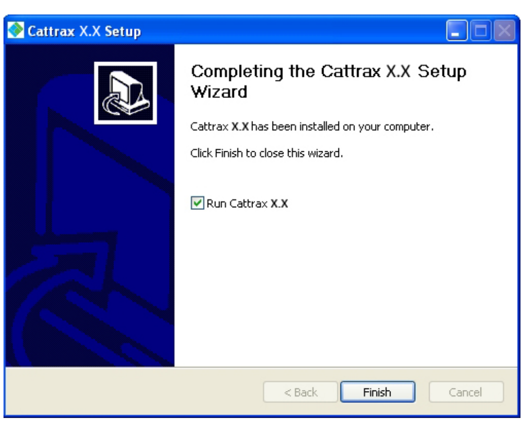
11. You may receive a message indicating that the software has not passed Windows Logo testing, as shown at right. The USB driver files have been thoroughly validated. Click “Continue Anyway” to continue.



12. You will see the screen at left as installation continues.



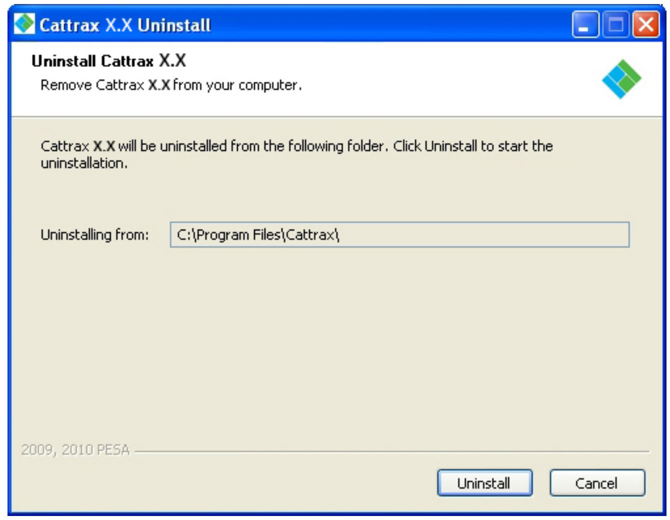
13. When driver installation is complete, you will receive a prompt indicating that the installation was successful, as shown at right. Click “OK” to continue to the “Installation Complete” prompt.



14. Click **Finish** to exit the installation process. During installation a shortcut icon to launch Cattrax is automatically placed on the desktop. If the box next to “Run Cattrax Release X.X” is checked, the application will start immediately.

5.3 REMOVING CATTRAX INSTALLATION

Should it ever be necessary to remove Cattrax from the PC, the uninstall command is available through the Start menu of the Windows® operating system. A prompt window as shown at right is displayed on the desktop. Click **Uninstall** to complete the command.



5.4 INITIAL SET-UP STEPS

In most installations Quadbox TX/RX modules are programmed at the factory and should not require additional configuration prior to installation. In some installations using Cattrax, it may be necessary to modify factory set network communication parameters.

Using Cattrax, the user can monitor and modify many functional attributes of a module, review module identification data, set data rates manually for video sources or select automatic rate selection, and map input signals to output channels on modules equipped with internal signal routing capability. Procedures for connecting a Quadbox TX/RX to a network and modifying network communication parameters with Cattrax are contained in Paragraph 5.9.

	**DO NOT connect a transmit or receive module to the host PC until the QFX USB driver is installed on the computer.**

5.5 NETWORK CONFIGURATION WITH CATTRAX

In order for Cattrax to communicate with Quadbox TX/RX modules and other PESA equipment, the network interface device used by Cattrax must be actively connected to the subnet, or multiple subnets, containing equipment you wish to control. Figure 5-1 illustrates a typical single subnet network installation with the PC running Cattrax connected to an existing switch that connects control panels and frames.

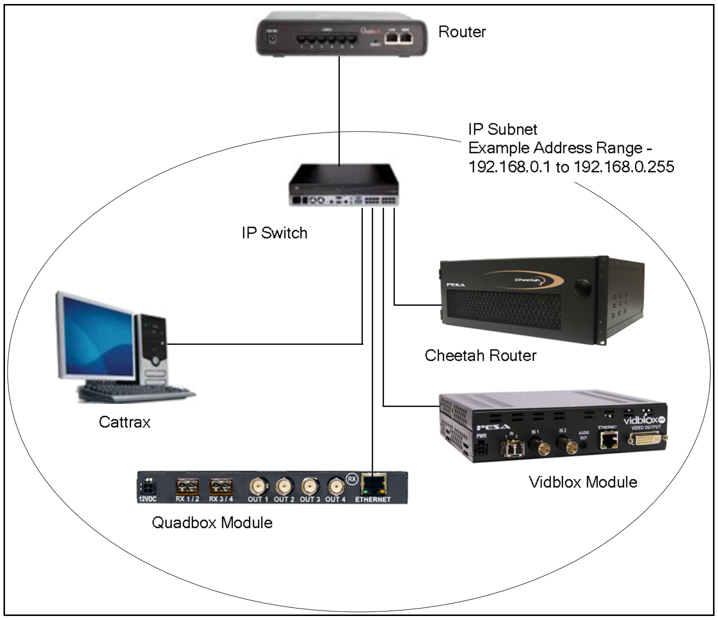
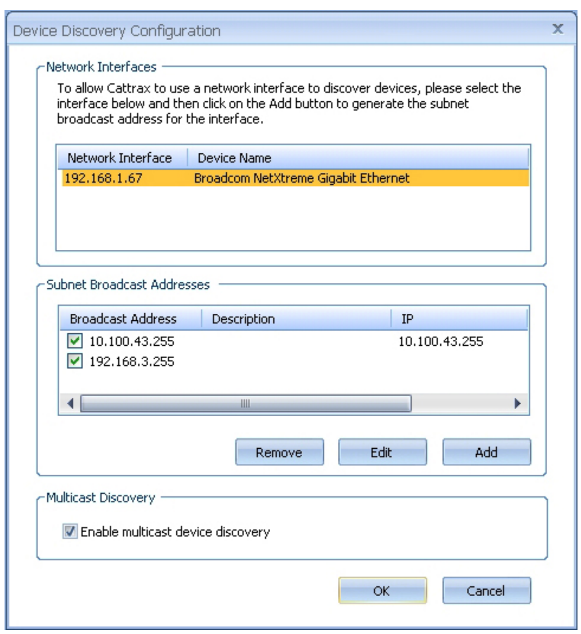


Figure 5-1 Cattrax Installation with Devices on Same Subnet

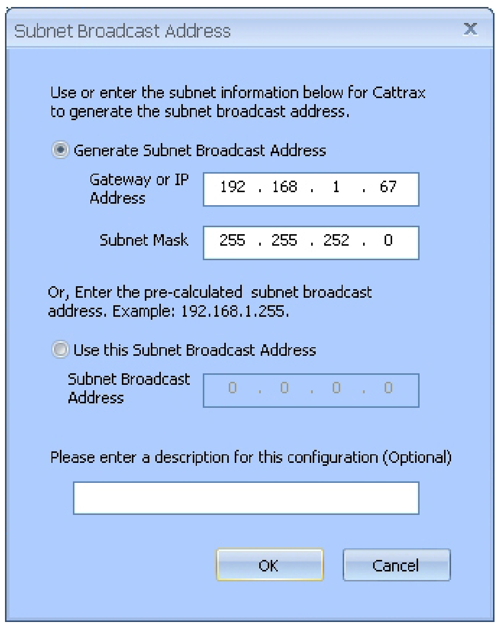
When communicating on a subnet containing PESA network controllable devices, Cattrax should immediately begin the discovery process for all devices configured for the same subnet. In many installations, Quadbox TX/RX modules and other PESA devices may reside on subnets different from one another within the network. Cattrax allows you to easily select both the network interface device it uses and the subnets on which it communicates. To view or modify current network communication parameters for Cattrax, click the ***Network Preferences*** icon under the ***Settings*** menu in the Cattrax menu bar to open the Device Discovery Configuration screen as shown here.



The upper area displays by IP address and name the network interface devices available to Cattrax. In many installations there will be only one entry in the window and by default this would be the device used by Cattrax. If there are multiple entries, as would be the case, for example, if the host PC contains both an Ethernet NIC and a wireless adapter, the device Cattrax is currently communicating through is shown highlighted. You may select the network interface device you wish Cattrax to use by double-clicking the entry in the listing. Be sure that the network interface device you select is communicating over the subnet(s) containing all Quadbox TX/RX or other PESA devices you wish to control.

Subnets currently available to Cattrax are listed in the middle area of the screen under the Broadcast Address column. A check in the box beside an entry indicates that Cattrax is actively communicating over that subnet and will automatically discover PESA devices on the subnet. If you wish to prevent Cattrax from communicating over a specific subnet, click the checkbox to remove the check. If you need to add additional subnets or modify address parameters of currently available subnets use the buttons to the right of the display window as follows:

- **Add** – allows you to add subnets to the list of those available. Clicking the Add button opens the screen shown here.



  Enter the IP and Subnet Mask data for the subnet address you wish to add. You may use the text box at the bottom of the pop-up to enter a description of the subnet. Click **OK** to enter the parameters. The new entry is added to the listing and the checkbox will be checked to activate the new subnet.

- **Edit** – allows you to modify address parameters of any entry in the listing. Highlight the entry you wish to modify and click the Edit button. The Subnet menu is displayed with current parameters for the entry listed. Make any changes you wish and enter OK to commit the changes.

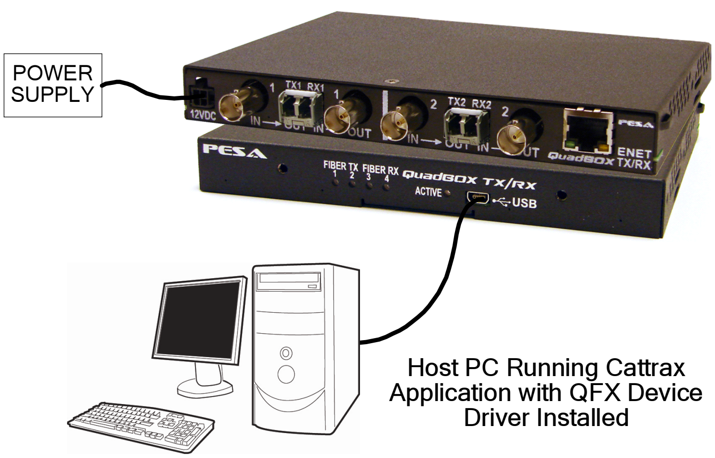
- **Remove** – allows you to remove any subnet from the listing. Highlight the entry you wish to delete and click the Remove button. The entry is immediately removed from the listing.

The lower area of the screen contains a checkbox that allows you to disable the Multicast device discovery function that allows Cattrax to automatically locate PESA devices in multiple subnets. Default selection for this function is ***Enabled*** as indicated by a check in the box. **This option should not be disabled under normal use**. When you have the network parameters properly configured, click the **OK** button to select the new configuration and exit the dialog box, or click **Cancel** to exit the box without making changes.

Quadbox TX/RX modules must be configured with a static IP address for communication on the facility network. In most installations, the network manager or IT administrator will assign IP addresses for use by PESA devices. Enter specific network parameters through the ***IP Device Properties*** window of Cattrax as discussed in Paragraph 5.9.

5.6 CONNECT A QUADBOX TX/RX MODULE TO THE HOST PC THROUGH A USB PORT

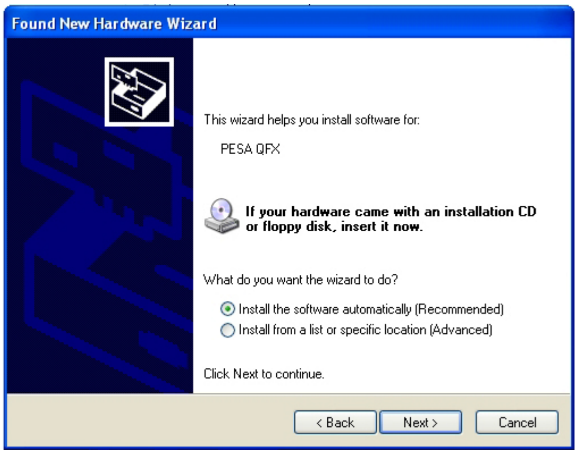
If you wish to control a Quadbox TX/RX module over a USB connection using Cattrax, perform the following steps to allow "Plug and Play" capability of the Windows® operating system to interface Quadbox TX/RX hardware to host PC.



1. Apply power to the Quadbox TX/RX module by connecting the external power supply to the module and to a source of primary power.
2. Connect the supplied USB cable first to the module and then into an open USB port on the host PC, as shown by the illustration to the left.
3. After a brief pop-up from the taskbar, the "Found New Hardware" window, as shown below, **may** appear on the monitor.

NOTE	**This window only appears if this is the first power-up after USB driver installation**

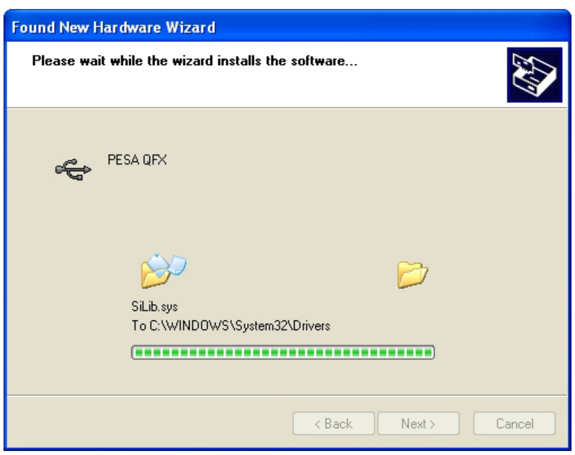
4. Select the "No, not this time" option button and then click Next to continue.



5. The Driver Installation screen, as shown to the left, prompts you for your choice of how to locate and install the hardware driver.

6. Select the first option, “Install the software automatically (recommended),” and click on the “next” button to continue.

7. You will receive a message indicating that the software has not passed Windows Logo testing, as shown to the right. The USB driver files have been thoroughly validated. Click “Continue Anyway” to continue.



8. During driver software installation, the prompt screen shown to the left is displayed. The progress bar monitors the installation procedure.

9. When hardware installation is complete, the completion screen, as shown to the left is displayed. Click the “Finish” button to exit the hardware installation wizard.

10. The Quadbox TX/RX module should now be communicating with the host PC.

5.7 START CATTRAX APPLICATION

During installation, a Cattrax icon is placed on the PC desktop. You may start the application by clicking on the desktop icon, or by navigating to the folder containing the Cattrax program files and clicking on the ***Cattrax.exe*** file.

When Cattrax is first started, an application interface similar to the one shown in Figure 5-2- is displayed on the PC monitor. If this is the first time Cattarx has been launched, the display windows will all be empty until a PESA device is connected to the USB port and "discovered" for control. If the application has been previously used, the Devices View window displays a list of inactive devices that have been discovered in previous sessions as shown in the example screen. Detailed operating instructions for the software application are contained in the Cattrax User Guide, but for purposes of this discussion there are two screen display areas we need to introduce.

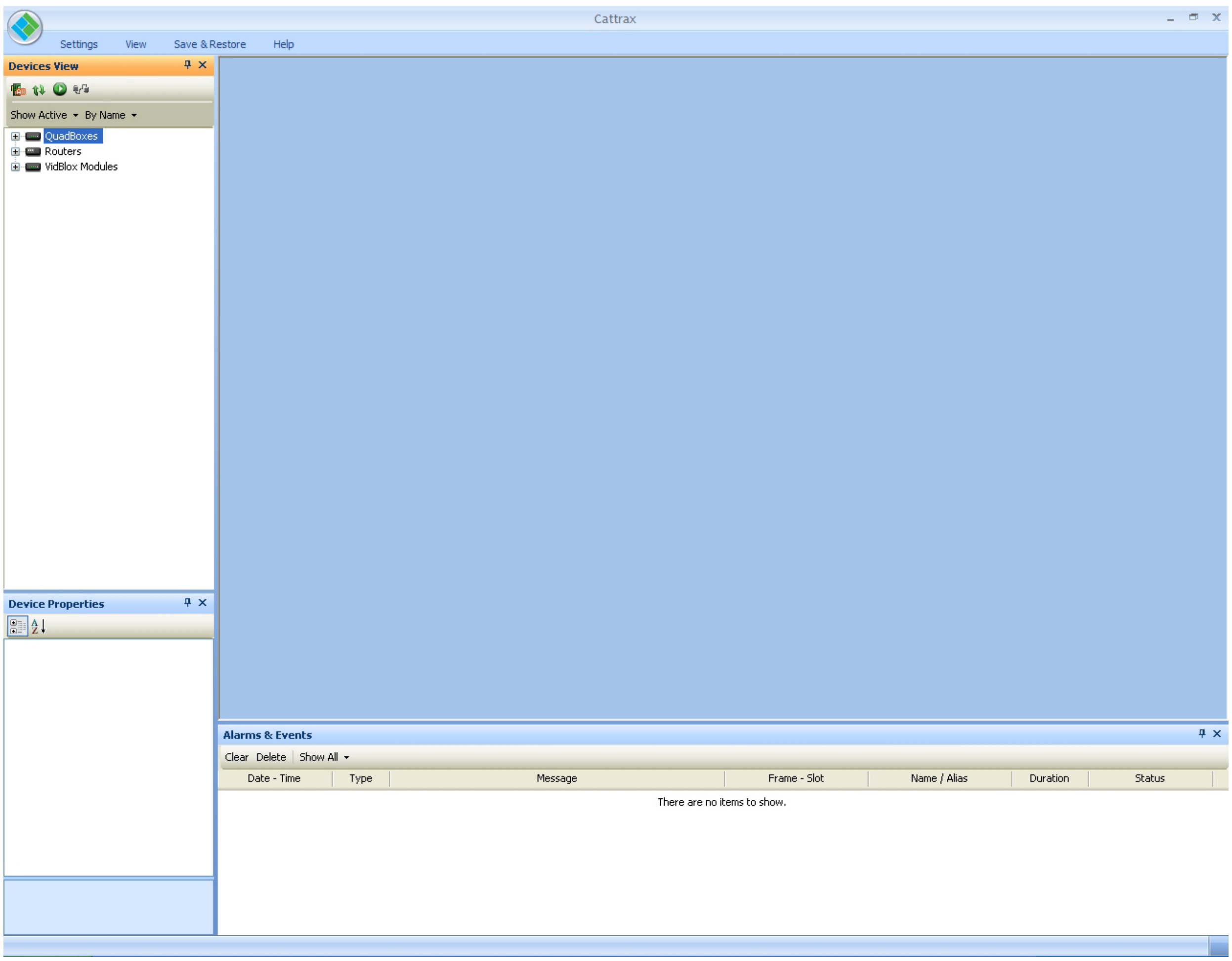


Figure 5-2 Cattrax Main Display Screen

5.7.1 DEVICES VIEW WINDOW

The Devices View window, as shown in Figure 5-3, identifies all devices on the network currently under active control. Depending on the view mode, Cattrax can also display devices that have previously been connected to the network, even if they are currently not active. Depending on the view mode selected, devices may be displayed in groups by device type as shown. Notice that the heading *Quadboxes* appears in the menu tree with branches to individual modules, identified by name that have been previously discovered or controlled by Cattrax. When a PESA device is connected to the network, and communication is established, the device ID is displayed as a branch of the menu tree in bold letters. If the *Show Active* mode is selected, only active devices are listed. When the *Show All* view mode is selected the name of devices that have been "discovered" previously but are not currently under active control appear in the menu tree in gray letters; and continue to appear in the menu trees until they are manually removed. You may obtain more information on viewing modes and other operational features and functions of Cattrax by referring to the User Guide for the software application.

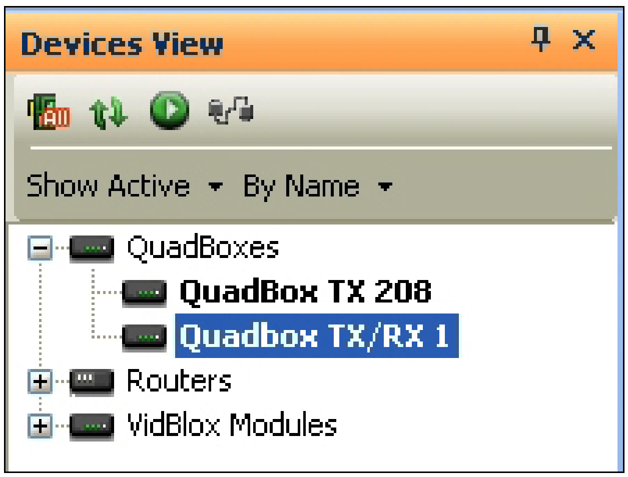


Figure 5-3 Example Devices View Screen

5.7.2 ALARMS AND EVENTS WINDOW

The Alarms and Events Window, Figure 5-4, displays flags when a defined alarm condition occurs or when a defined event occurs within the system. Notice from the example screen that when Cattrax establishes connection with a Quadbox TX/RX module, it is flagged as an event; as is disconnecting a module from the host PC USB port or the network. When a module is discovered and flagged as connected, its identity appears in the Devices View window in bold letters, and the information screen is displayed in the main display window.

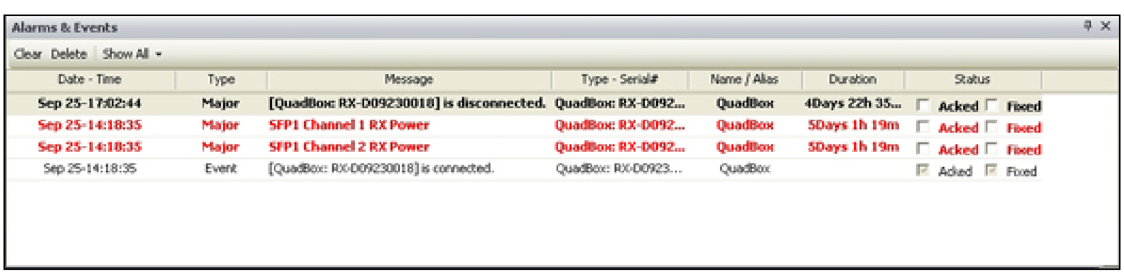


Figure 5-4 Example Alarms and Events Screen

5.8 MODULE CONFIGURATION SCREENS

When a Quadbox TX/RX module is under control of Cattrax, operator screens and functions presented in the following paragraphs are available. With Cattrax communicating with Quadbox over a network, numerous modules may be identified as active in the Devices View window. Click on any active device in the listing to access configuration screens for that module. Status and monitor information is updated for the selected module in real-time.

If a Quadbox module is attached to the USB port of the host PC when Cattrax is started, the application will automatically discover the module. When a module is discovered the identity of the connected module is displayed in bold letters in the Devices View window, and the information screen for that module opens in the main display window as shown in Figure 5-5.

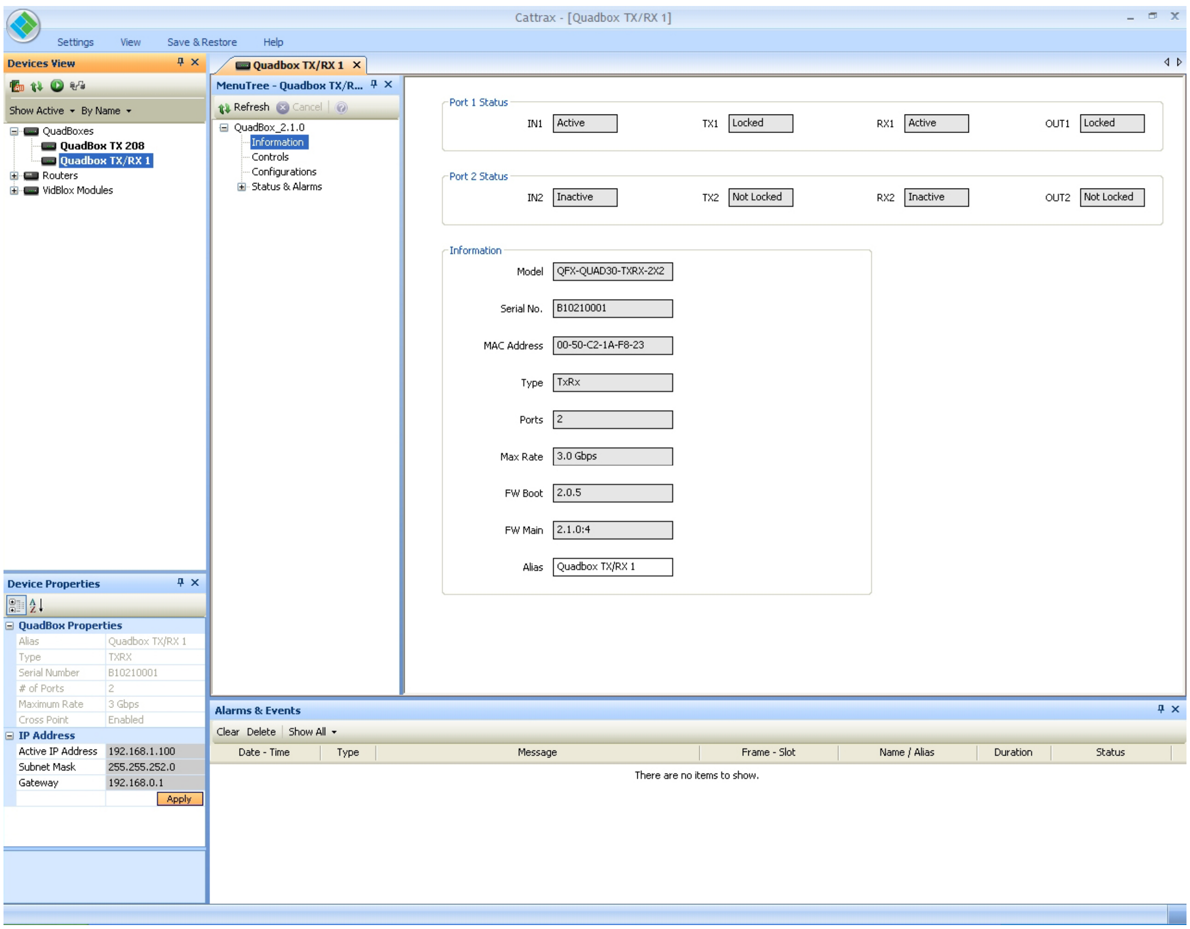


Figure 5-5 Example Quadbox TX/RX Initial Display Screen

5.8.1 STATUS DISPLAY TEXT BOXES

Regardless of which menu selection you choose from the menu tree, the top portion of the main display window always displays the status monitor text boxes as shown in Figure 5-6. Display information is updated in real-time for the selected module.

There are two rows labeled *Port 1 Status* and *Port 2 Status* with four text boxes in each row. Each text box displays status of the input or output ports of the TX/RX channel pair. Port 1 displays data for TX/RX pair 1 and port 2 displays data for TX/RX pair 2. The following paragraphs use the displays for port 1 as an example; however, the data interpretation is identical for both port 1 and port 2. The following status data is provided by these text boxes:

IN1 – Indicates the presence (Active) or absence (Inactive) of an input signal at the BNC connector (labeled TX1 IN) for TX channel 1 of TX/RX pair 1.

TX1 – Indicates whether the output signal, derived from the TX1 input port, present at the SFP module output port (labeled TX1 OUT) is Locked to a standard SMPTE output data rate. If the display reads Not Locked, the output is not clocked to a standard data rate, or the output is operating in bypass mode.

RX1 – Indicates the presence (Active) or absence (Inactive) of an input signal at the SFP fiber module input port (labeled RX1 IN) for RX channel 1 of TX/RX pair 1.

OUT1 – Indicates whether the output signal, derived from the RX1 input port, present at the BNC output connector (labeled RX1 OUT) is Locked to a standard SMPTE output data rate. If the display reads Not Locked, the output is not clocked to a standard data rate, or the output is operating in bypass mode.

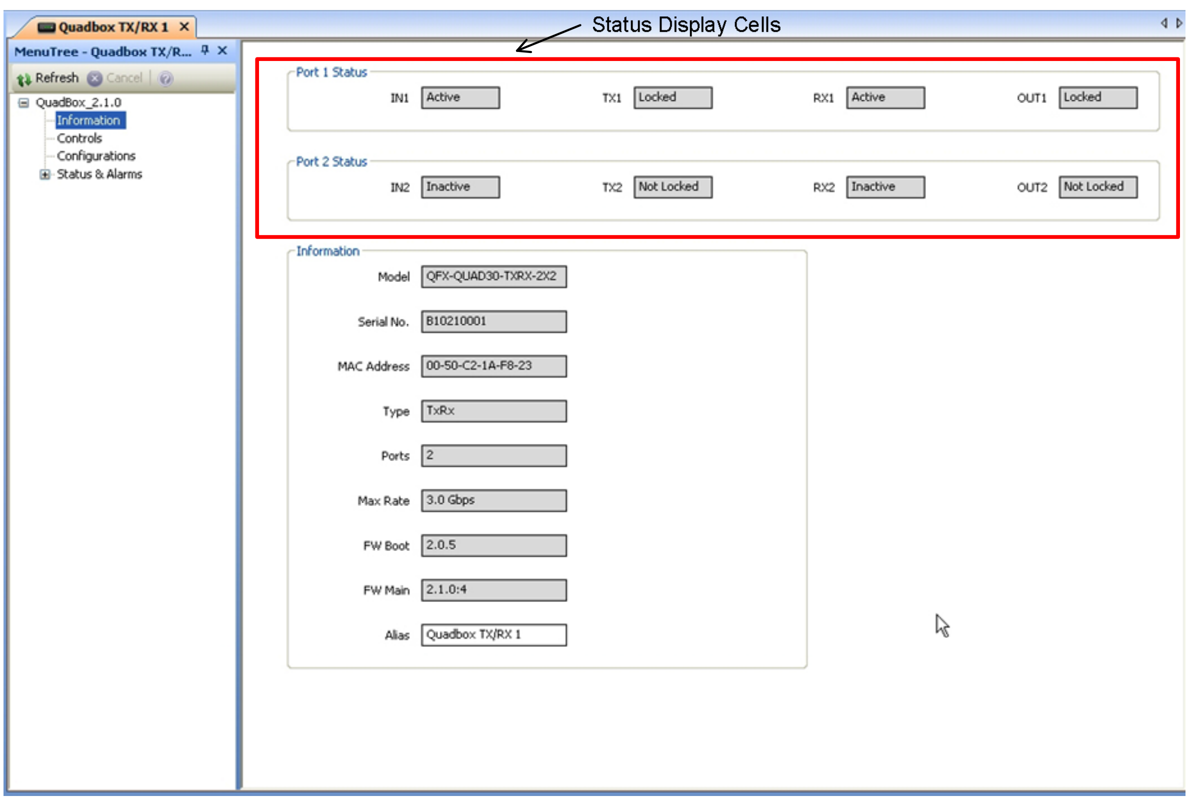


Figure 5-6 Status Display Text Boxes

5.8.2 INFORMATION MENU

When the Information menu entry is selected from the menu tree, the screen shown by Figure 5-7 is displayed. This screen provides the following configuration data for the selected Quadbox module:

- **Model Number and Serial Number** – Model and serial numbers of the selected module
- **MAC Address** – Identifies the assigned MAC address for the module
- **Type** – Indentifies whether the module is a receiver (Rx), transmitter (Tx) or combination unit (TxRx)
- **Ports** – Indicates the number of active fiber channels (2 or 4)
- **Max Rate** – This display indicates the maximum data rate capability of the module
- **FW Boot and FW Main** – Indicate the revision levels of the boot code and main program firmware
- **Alias** – Alias is a name assigned to the selected module for identification on the network or within the system of Quadbox modules; and it will become the identifier for the module in the Devices View window. You may enter any name you wish to assign the module in the Alias text box. Press the Enter key to initiate the name change.

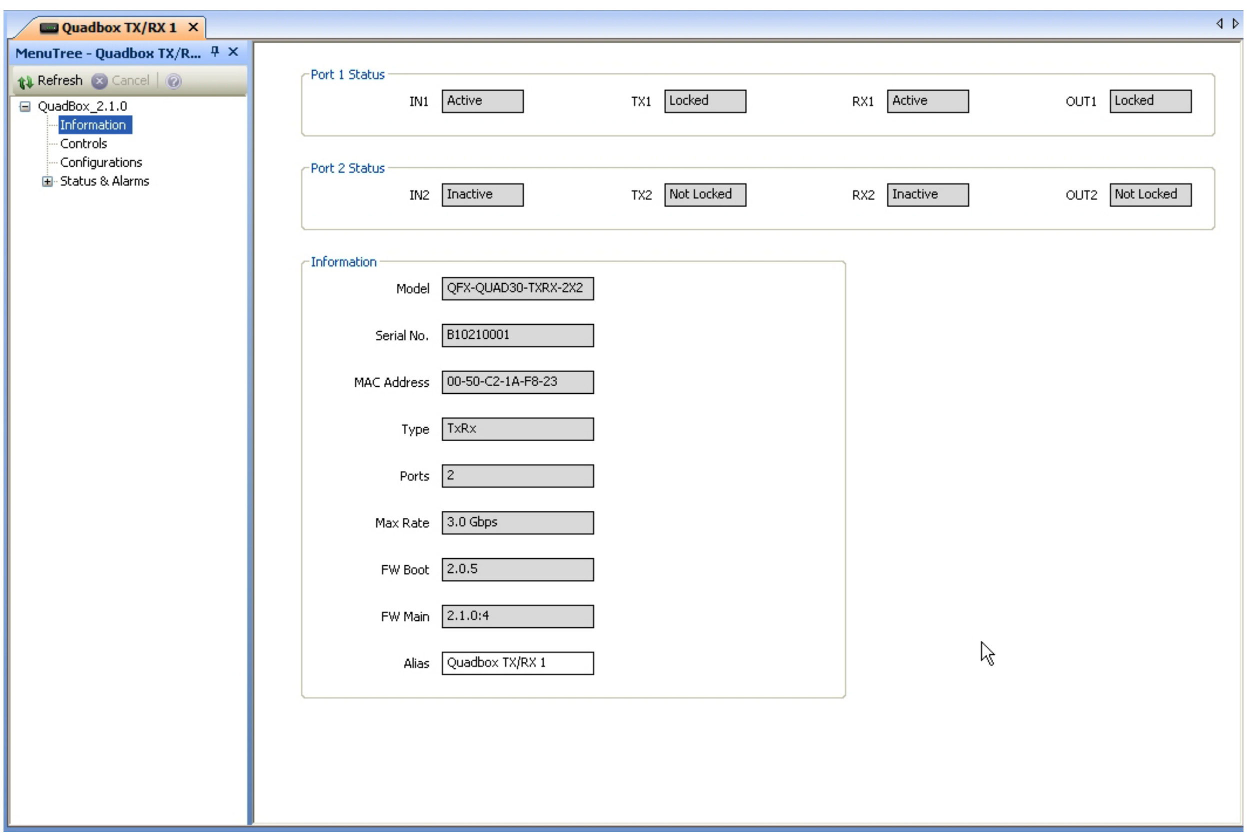


Figure 5-7 Example Information Screen

5.8.3 CONTROLS MENU

Selecting the Controls menu entry from the menu tree displays the screen shown by Figure 5-8. This screen allows you to configure the internal crosspoint, and set data rates for the output signals on the selected Quadbox module.

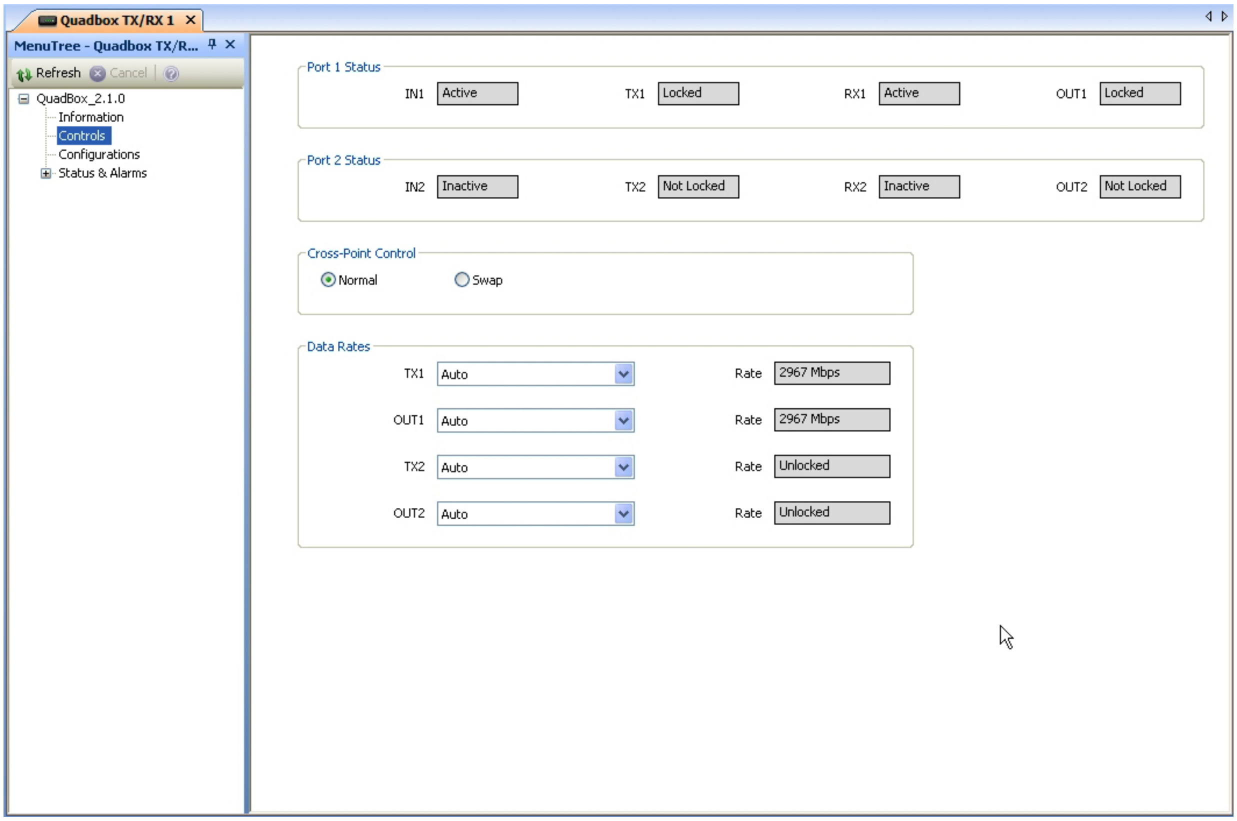


Figure 5-8 Example Controls Screen

Crosspoint Control

This control allows you to select whether signals are routed through the internal crosspoint in *Normal* or *Swap* mode. To change signal routing, click the radio button corresponding to the desired operating mode - Normal is the default routing scheme. Each routing option is discussed in the following paragraphs:

- **Normal -** Input signals to the TX/RX pair 1 coax and fiber optic input ports are routed to the TX/RX pair 1 fiber optic and coax output ports, respectively; and input signals to the TX/RX pair 2 coax and fiber optic input ports are routed to the TX/RX pair 2 fiber optic and coax output ports.
- **Swap -** Input signals to the TX/RX pair 1 coax and fiber optic input ports are routed to the TX/RX pair 2 fiber optic and coax output ports, respectively; and input signals to the TX/RX pair 2 coax and fiber optic input ports are routed to the TX/RX pair 1 fiber optic and coax output ports.

Data Rates

Each *Data Rate* pull-down box selects the reclocking rate for the indicated output port of each TX/RX pair. The pull-down menu lists all valid data reclocking rates supported by Quadbox, plus the automatic (Auto) option. When Auto is selected, the output data rate is set the same as the input signal for the TX or RX channel. If you wish to select a different data rate for the output, open the pull-down menu and select the desired value. When the Bypass option is selected, output video is not reclocked.

When configuring Receive channels the data rate selection sets output rate for the indicated BNC (copper coaxial) port, and on transmit channels sets the output rate for the indicated fiber optic output port. The following chart lists valid output data rate choices:

- Auto
- HD-SDI (1485/1483.5 MHz)
- SD-SDI / DVB-ASI (270 MHz)
- 2 x HD-SDI (2967/2970 MHz)
- 2 x SD-SDI (540 MHz)
- SD 16:9 (360 MHz)
- Composite NTSC (143 MHz)
- Composite PAL (177 MHz)
- Bypass

A text box labeled Rate is displayed to the right of each pull-down menu box. If the output signal is locked to a valid data rate, the actual data rate is displayed as a numeric value in the Rate box. If the reclocker stage is bypassed for the indicated output signal, the message Unlocked appears in the box.

5.8.4 CONFIGURATIONS MENU

Selecting the Configurations menu entry from the menu tree accesses the input Equalizer Controls for the coaxial cable input ports, as shown by Figure 5-9. The window contains a listing of the electrical signal input ports with two radio buttons in each row. These controls allow you to select, by input channel, whether the input equalizer function is On or Bypassed. Click the button for the desired equalizer setting on each input channel entry. The input equalizer function applies only to BNC connector inputs fed by copper coaxial cable.

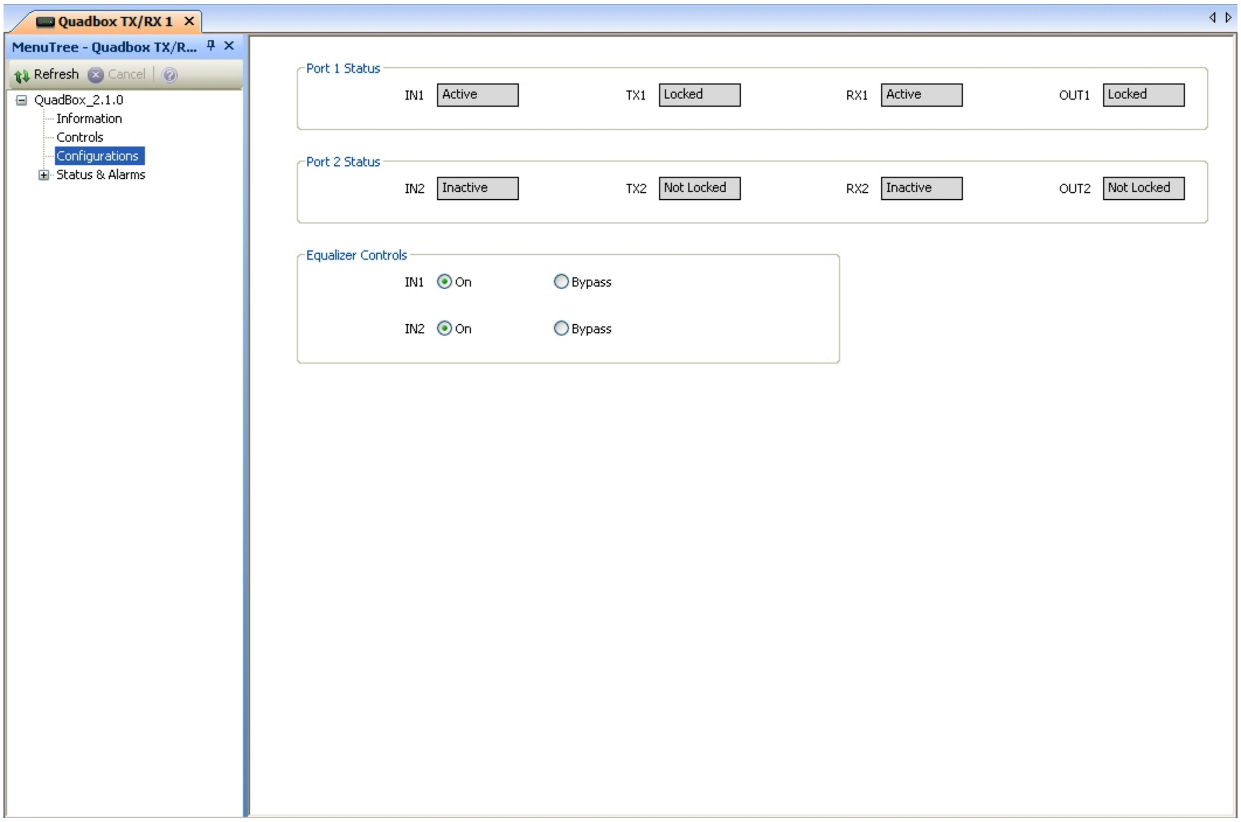


Figure 5-9 Example TX/RX Module Configurations Screen

5.8.5 SFP1 AND SFP2 STATUS MENUS

Menu entries SFP1 Status and SFP2 Status access status screens for the bi-directional SFP Module associated with each TX/RX pair. Each menu provides status monitoring data for each port of the indicated SFP module - both are identical in layout and function. An example screen for SFP1 is shown by Figure 5-10.

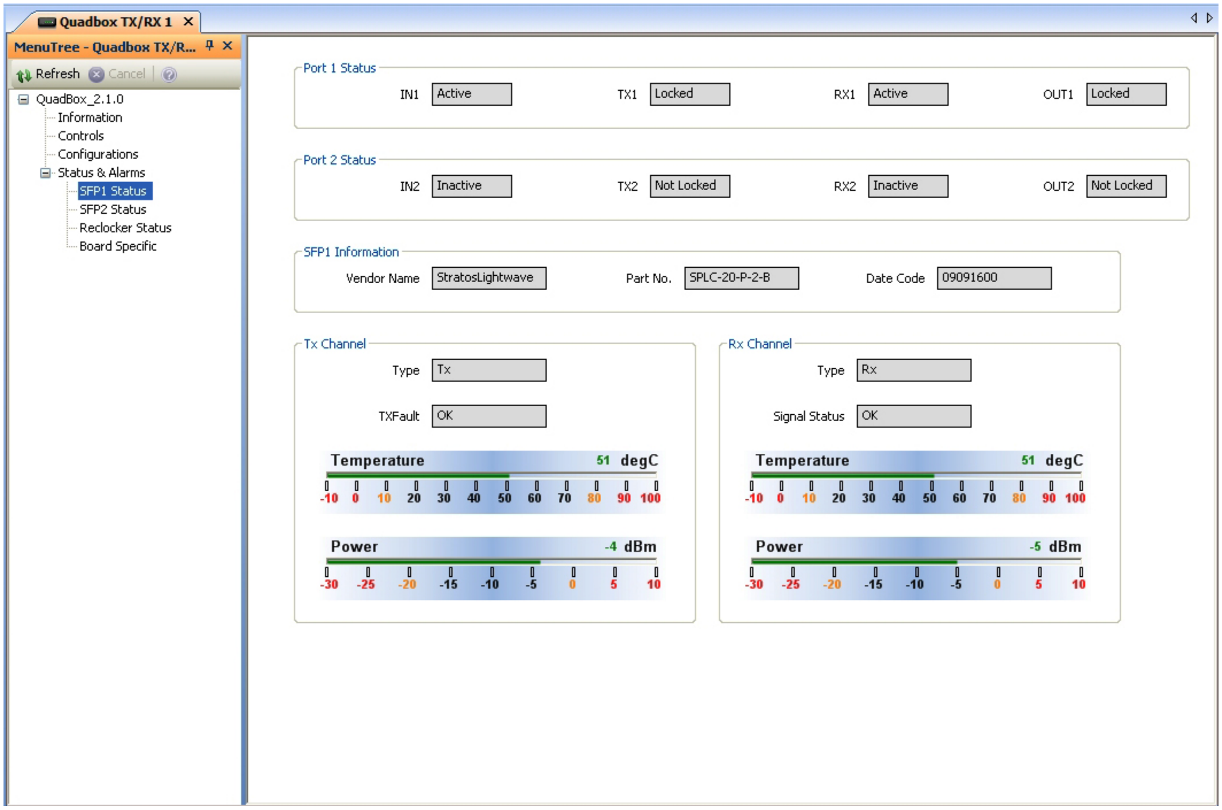


Figure 5-10 Example SFP Status Screen

SFP1 Information or SFP2 Information

There are three text boxes in the SFP information window that display the following characteristics of the indicated SFP module:

- **Vendor Name** – Identifies the manufacturer of the SFP module by name
- **Part No.** – Identifies the manufacturer's part number for the module
- **Date Code** – Displays the date of manufacture for the SFP module

TX Channel Display or RX Channel Display

There are two text boxes and two analog-type meter displays contained in the status window for both the transmit and receive port associated with the selected SFP module that provide the following real-time status monitoring data:

- **Type** – Identifies the SFP module as a transmit (Tx) or receive (Rx) module
- **TXFault (Module Transmitter Port)** – Indicates if the optical transmit signal is present (OK) or absent (Error) at the output port of the indicated SFP module
- **Signal Status (Module Receiver Port)** – Indicates if an optical input signal is present (OK) or absent (Error) at the input port of the indicated SFP module

- **Temperature** – Provides a direct analog readout of the current operating temperature of the TX or RX signal path of the indicated SFP module
- **Power** – Provides a direct analog power readout in dBm of the optical signal leaving the output port of the indicated SFP transmit module (Tx Channel display); or the optical signal entering the input port of the indicated SFP receive module (Rx Channel display).

5.8.6 RECLOCKER STATUS

Selecting the Reclocker Status menu entry from the menu tree displays the screen shown by Figure 5-11. This screen provides real-time status monitoring data for the output reclocker device on the selected Quadbox module.

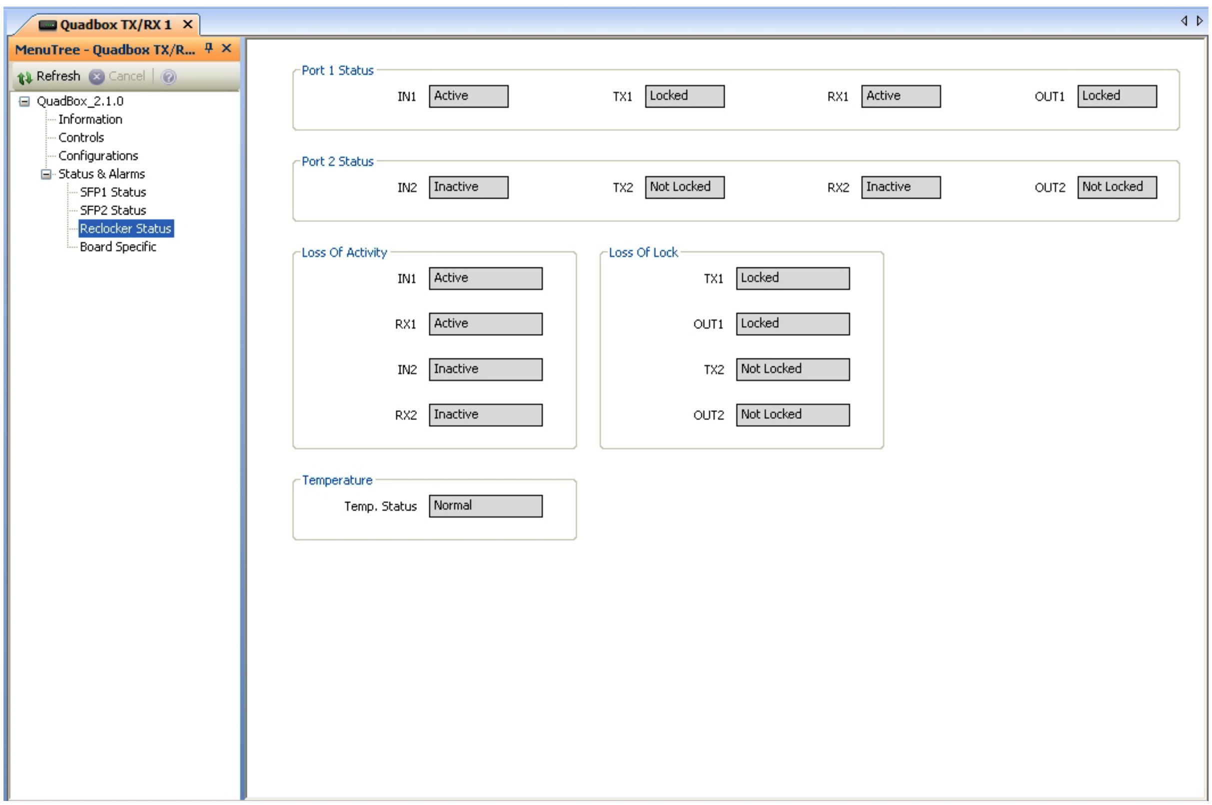


Figure 5-11 Example Reclocker Status Screen

Loss of Activity

Within the Loss of Activity window a status box is listed for each signal input port of each TX or RX channel that displays whether or not there is an Active **input** signal present on the indicated port. If the box displays the message Inactive, there is no active input for the channel. When monitoring receive channels each display box indicates an active signal on the fiber optic input port, and on transmit channels indicates an active signal on the BNC (copper coaxial) input port.

Loss of Lock

The Loss of Lock window contains a list of each signal output port of each TX or RX channel that displays whether the reclocked output is locked to a standard data rate (Locked) or bypassing the reclocker (Not Locked.) When monitoring receive channels the display indicates reclocker lock status for the BNC (copper coaxial) ports, and on transmit channels indicates reclocker lock status for the indicated fiber optic output ports.

Temperature

The Temp. Status box indicates status of the reclocker device operating temperature.

5.8.7 BOARD SPECIFIC MENU

Selecting the Board Specific Menu entry opens a display screen with monitoring data pertaining to the circuit board of the selected Quadbox module. An example screen is shown by Figure 5-12.

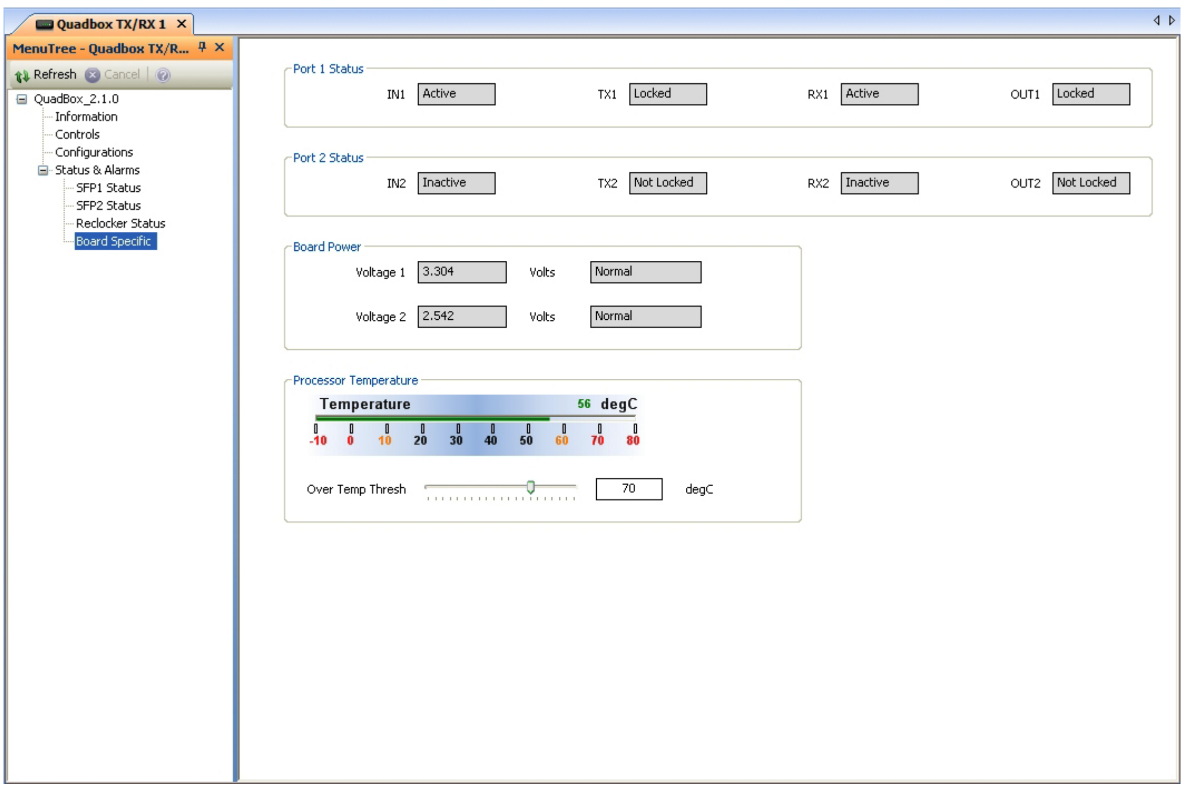


Figure 5-12 Example Board Specific Screen

<u>Board Power</u>

There are four text boxes in the Board Power information window arranged in two rows, each row indicates the voltage level and status for the main power supply rails on the circuit board. The left-hand box in each row provides a digital readout of the actual measured operating voltage for the indicated power rail. The right-hand box indicates the status of the power supply voltage as low, normal or high.

Processor Temperature

The analog-type meter display contained in the Processor Temperature window provides a direct analog readout of the current operating temperature of the processor device contained on the Quadbox circuit board.

Over Temperature Threshold

Moving the Over Temp Thresh slider beneath the temperature readout display determines the temperature (in degrees Celsius) at which the Over Temp alarm triggers an alert in the Alarms and Events panel of the Cattrax control application. The selected threshold temperature is displayed in the box beside the slider.

5.9 CHANGING DEVICE NETWORK ADDRESSING PARAMETERS

Cattrax allows users to change the IP address and other network addressing parameters of both active and inactive Quadbox modules from the Device Properties panel shown below in Figure 5-13. This feature is particularly useful for devices that are inactive due to an IP address conflict with other devices, or having a different network address. Cattrax allows the user to correctly set the IP address of such devices directly without having to isolate the device from the network.

To change networking parameters for the selected device, simply enter the desired IP address, Subnet Mask or Gateway address in the boxes contained under the **IP Address** panel on the Devices Properties panel and click **Apply**. If the new IP entered is the same as an existing IP address of another device, Cattrax reports an error.

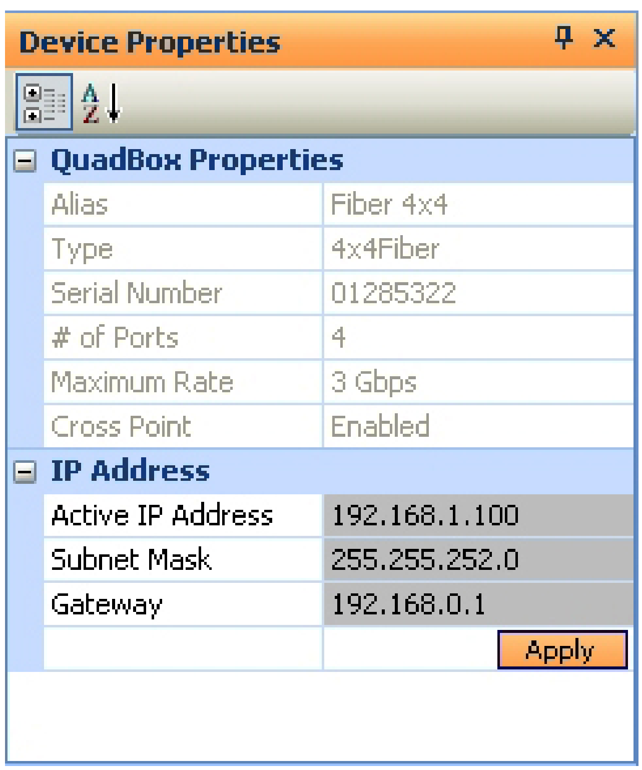


Figure 5-13 Changing IP Address from Device Properties Panel

Chapter 6 Maintenance and Repair

6.1 PERIODIC MAINTENANCE

No periodic maintenance is required.

6.2 PESA CUSTOMER SERVICE

If you are experiencing any difficulty with a Quadbox module, please contact the PESA Customer Service Department. Skilled technicians are available to assist you 24 hours a day, seven days a week.

6.3 REPAIR

Before attempting to repair this equipment, please consult your warranty documents and the PESA Customer Service Department. Unauthorized repairs may void your warranty.

CAUTION	**PC boards in this equipment contain Surface Mount Technology (SMT) components. Special tools are required to replace these components without causing damage to adjacent areas.** **Failure to consult with Customer Service before attempting to repair these boards may void your warranty.**

6.4 REPLACEMENT PARTS

Only parts of the highest quality have been used in the design and manufacture of this equipment. If the inherent stability and reliability are to be maintained, replacement parts must be of the same high quality. Please consult our Customer Service Department before installing any parts not purchased from PESA.

6.5 FACTORY SERVICE

Before returning any equipment to our factory for service or repair, please contact our Customer Service Department for an RMA number.

PESA