

USER MANUAL

FMUX04

*Fiber Optical Multiplexer
Standalone / Rack Type
4 Channel Fixed Design
G.703 E1, T1(DS1)
SNMP Manageable (Optional)
FXS Order Wire (Optional)*



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EN 55022:1994/A1:1995/A2:1997 Class A and EN61000-3-2:1995, EN61000-3-3:1995 and EN50082-1:1997

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FMUX04 User Manual

Fiber Multiplexer with 4 channels E1 or T1

Version 1.0 Mar 2006

This manual supports the following models:

FMUX04

This document is the first official release manual. Please check CTC Union's website for any updated manual or contact us by E-mail at info@ctcu.com. Please address any comments for improving this manual or to point out omissions or errors to marketing@ctcu.com. Thank you.

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Chapter 1. Introduction

Thank you for choosing the **FMUX04**. If you would like to skip right to the installation and configuration of the Multiplexer, proceed to Chapters 2 and 3.

This manual is used to explain the installation and operating procedures for the **FMUX04**, 4 Port Fiber Optical E1/T1 Multiplexer, and present its capabilities and specifications. This manual is divided into 5 Chapters, the Introduction, Installation, Operation, Loop Back Testing and SNMP chapters. The Appendix includes the pin assignments of special cables and gives further information on options for placing the device in service.

The divisions of the manual are intended for use by personnel to answer questions in general areas. Planners and potential purchasers may read the Introduction to determine the suitability of the product to its intended use; Installers should read the Installation Chapter and the Cabling Specification Appendix; Operating Personnel would use the Operations Chapter to become familiar with the line cards and settings. Operating Personnel and Network Administrators should read the chapters on loop back testing and on SNMP to become familiar with the diagnostic capabilities, network settings and management strategies when the optional SNMP card is installed.

1.1 General Description

The **FMUX04** is a 1U (1.75") high standalone or half rack mountable E1/T1 multiplexer over fiber link designed for cost effective applications. The **FMUX04** provides an economic optical connection solution in low-density E1 or T1 installations such as between remote offices, where multiple high speed synchronous TDM (Time Division Multiplexing) communications are required over a single fiber pair. By utilizing a fixed channel design, the unit is extremely cost effective and provides quick return on investment.

1.2 Functional and Feature Description

The standard unit is a standalone chassis with local control (DIP switch settable or via Console port) and ordered with either AC or DC power. The appropriate optical transceiver may be selected when ordering to support multi-mode or single-mode fiber cable operation, with a variety of power and connector options including ST™, SC, FC, or LC. WDM (Wave Division Multiplexing) optical transceivers are also available to provide bi-directional transmission on a single fiber to reduce cost when using leased fiber links. The range of transmission for optical connection is from 2Km (for multi-mode) up to 120Km (single mode).

SNMP (for local and remote management purposes) and FXS Order Wire are options that may be factory ordered or may be ordered separately for later installation in the unit. The **FMUX04** is available in three power supply configurations. Depending on the model, power may be derived from single AC 100~240VAC, single DC +18~36VDC, or single DC +36~72VDC power source. The **FMUX04** provides all interface connections on the rear panel. There are 4 channel connections for ITU-T G.703 E1/T1 on 4 x RJ-45 (USOC RJ-48C) or 8 x BNC connectors. Each Channel connector provides an individual channel of E1 or T1, depending on the unit's configuration.

When configured for E1 operation, the 4 channels of the **FMUX04** may use either BNC (75 Ohm unbalanced) or RJ-45 (120 Ohm balanced) connectors for E1 Line interface connections. Each separate E1 channel supports a transmission rate of 2.048Mb/s (transparent unframed E1) each.

When configured for T1 operation, the 4 channels of the **FMUX04** will use four RJ-45 (100 Ohm balanced) connectors for T1(DS1) Line interface connections. Each separate T1 (DS1) channel supports a transmission rate of 1.544Mb/s (transparent unframed T1) each.

Three state LEDs (red, green or off) on the front panel will show both the channel statuses and any alarm indications for the channels as well as the link status of the fiber optic link. The **FMUX04** E1 and T1 Interfaces fully meet all E1 and T1 specifications including ITU-T G.703, G.704, G.732, G.733, G.823 and G.824.

Each E1/T1-CHANNEL features diagnostic capabilities for performing local loop back, remote loop back, or to request remote loop back. The loop back function is controlled by front panel DIP switch setting, terminal mode (RS-232 console) or, when the SNMP option board is installed, via Telnet or SNMP set commands.

The **FMUX04** unit's optical transmission operates from an internal free running oscillator. All E1 or T1 equipment may connect to the **FMUX04** without regard to master or slave timing. The **FMUX04** is completely transparent to clocking and data transmission. This makes configuration of the MUX extremely simple. However, the **FMUX04** provides no system clock or clock source for the E1 or T1 connection. Therefore, the connected device on one side must provide the required E1 or T1 clock timing (either internal clock or recovery timing).

When the **FMUX04** is ordered with optional **SNMP**, an additional hardware card is installed inside the unit. Configuration is accomplished via the asynchronous RS-232 port with a standard VT-100 terminal, via Ethernet and Telnet, or via any standard SNMP network management software over Ethernet. If the SNMP option is not installed, local management is still possible via the unit's internal menu system accessible from the asynchronous RS-232 port with a standard VT-100 terminal. Very basic configuration may also be done via the front panel DIP switches, in which case the console functions are disabled.

The **FMUX04** also includes the ability to do in-band remote configuration. Once the fiber optic link has been established, the remote unit may be configured or status checked from the local unit using any of the available management options, including SNMP.

The **FMUX04** has the ability to upgrade its hardware and operational code by using the Xmodem protocol on the serial interface. Local upgrades are supported with this feature. TFTP upgrading of local or remote is supported when an optional SNMP module is installed.

When the **FMUX04** is ordered with optional **Order Wire**, a hardware card is installed inside the unit. The front panel's RJ-11 jack provides a "hot line" between the two **FMUX04** units in the link. Standard telephones may be connected to the RJ-11 jacks and when a phone is taken "off hook", the remote side will automatically ring. Once answered, both parties may talk normally. Following the conversation, both parties will place the phones back "on hook" and the system is again ready for any direct line calls.

Included within the **FMUX04** system unit is integrated optical BERT (Bit Error Rate Tester). This feature provides a built-in pattern generator and receiver. The BERT function is designed to run "in-band" allowing BER Testing and data transmission to co-exist on the fiber media. This allows the BERT function to be running constantly even while the unit is in service, without effecting normal customer data transmissions. The status of the error rate on the optical connection may then be monitored via LED indicators on the front panel of the **FMUX04**.

1.3 Features List

- Simple DIP switch or serial console setting.
- AC or DC models
- Non-redundant fiber for multi-mode and single mode, 2 to 120KM.
- Transceiver options include ST™, SC, FC, or LC. WDM (Wave Division Multiplexing)
- RJ-45 and BNC connectors for E1 and T1 connection.
- ITU-T G.703, G.704, G.732, G.733, G.823 and G.824 compliant.
- Fully transparent framing and timing.
- In band remote configuration supported.
- Optical and Electrical loop backs.
- Local and remote upgrade supported.
- Full time integrated Optical BER tester constantly monitors optical transmission.
- Order Wire (FXS) option.
- SNMP option.

1.4 Packing List

Upon opening your package, please check and be sure it contains the following items:

1. FMUX04 unit, AC or DC depending on modem ordered.
2. DB9F to DB9M, 1 meter, serial cable for console configuration.
3. User's Guide (hard copy or CDROM)
4. CDROM with MIB file (if SNMP option installed)
5. Clover Leaf to local power connector AC cable.

If any of these items are missing, please contact your distributor.

The following photo (AC model), with graphics, shows the major components which make up the **FMUX04** (with the Order Wire and SNMP options installed).

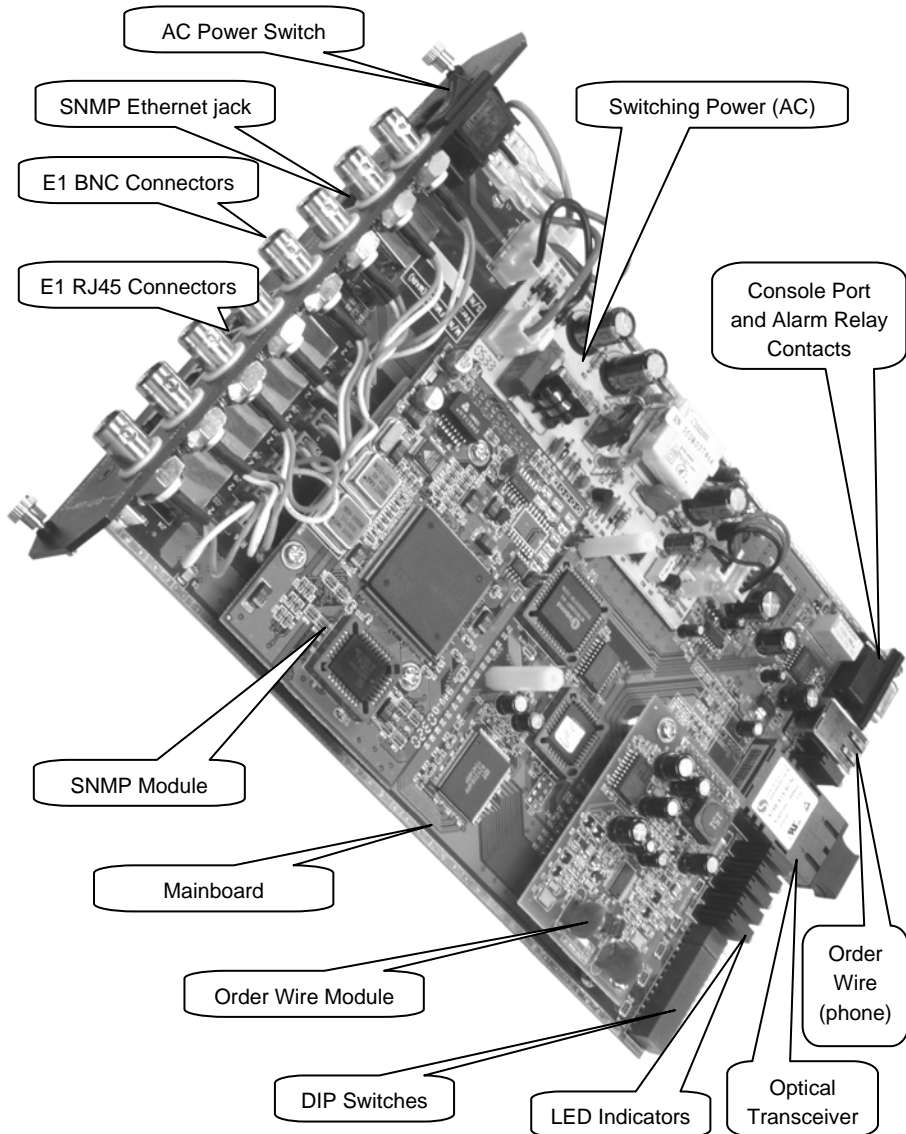


Figure 1-1 : FMUX04 Major Components

1.5 Technical Specifications**1.5.1 E1 Link**

Ports	4 fixed ports
Framing	Unframed (transparent)
Bit Rate	2.048 Mb/s +/-50ppm
Line Code	AMI HDB3
Line Impedance	Unbalanced 75 ohms (BNC) Balanced 120 ohms (RJ-45)
Receiver sensitivity	-43dB (long haul)
"Pulse" Amplitude	Nominal 2.37V+/-10% for 75 ohms Nominal 3.00V+/-10% for 120 ohms
"Zero" Amplitude	+/-0.1V
Transmit Frequency Tracking	
Recovery Timing	+/-50 ppm
Jitter Performance	According to ITU-T G.823
Complies With	ITU-T G.703 and G.823
Interface Connectors	RJ-45 120 ohm (USOC RJ-48C) BNC 75 ohm
Test Loops	LLB (Local Loop Back) RLB (Remote Loop Back) RRLB (Request Remote Loop Back)

1.5.2 T1 Link

Ports	4 fixed ports
Framing	Unframed (transparent)
Bit Rate	1.544 Mb/s +/-50ppm
Line Code	AMI B8ZS
Line Impedance	Balanced 100 ohms (RJ-45)
Receiver sensitivity	-36dB (long haul)
"Pulse" Amplitude	Nominal 3.00V+/-20% for 100 ohms
"Zero" Amplitude	+/-0.15V
Transmit Frequency Tracking	
Recovery Timing	+/-50 ppm
Jitter Performance	According to ITU-T G.824
Complies With	ITU-T G.703 and G.824
Interface Connectors	RJ-45 100 ohm (USOC RJ-48C)
Test Loops	LLB (Local Loop Back) RLB (Remote Loop Back) RRLB (Request Remote Loop Back)

1.5.6 Optical Specifications

Connector Type	ST, SC, FC, LC, MT-RJ or WDM-SC (single fiber)
Optical mode	Multi-mode or Single-mode
Wavelength	1310nm or 1550nm
Power Margin	11dB(2k,M/M), 12dB~35dB(15~120KM,S/M)
Line coding	Scrambled NRZ
Data rate	10.922 Mbps
Bit Error rate	Less than 10^{-11}
Test Loops	LLB (Local Loop Back) RLB (Remote Loop Back) RRLB (Request Remote Loop Back)

1.5.7 Transceiver Options

Type	Standard Types					WDM Types*			
	M/M	S/M	S/M	S/M	S/M	S/M	S/M	S/M	S/M
Distance (Km)	2	15	30	50	120	20(A)*	20(B)*	40(A)*	40(B)*
Wavelength (nm)	1310	1310	1310	1310	1550	Tx:	Tx:	Tx:	Tx:
						Rx:	Rx:	Rx:	Rx:
BER**	< 10^{-11}	< 10^{-11}	< 10^{-11}	< 10^{-11}	< 10^{-11}	< 10^{-11}	< 10^{-11}	< 10^{-11}	< 10^{-11}
Sensitivity	-31dBm	-32dBm	-35dBm	-36dBm	-35dBm	-32dBm	-32dBm	-32dBm	-32dBm
Output Power	-20dBm	-20dBm	-15dBm	-8dBm	0dBm	-18dBm	-15dBm	-10dBm	-7dBm
Power Margin	11dB	12dB	20dB	28dB	35dB	14dB	17dB	22dB	25dB
Return Loss	-12dBm	-12dBm	-12dBm	-12dBm	-12dBm	-14dBm	-14dBm	-14dBm	-14dBm
Connector Types	ST	V	V	V	V	V			
	SC	V	V	V	V	V	V	V	V
	LC	V	V	V	V	V			
	MT	V	V	V	V	V			
	RJ								
	FC	V	V	V	V	V			

M/M: multi-mode S/M: single-mode [All optical transceivers are rated Class A.]

* WDM types must match (A) with (B) in pairs

** Bit Error Rate

It is highly recommended that the fiber transceiver installed at the factory match the remote side's fiber transceiver.

1.5.8 Physical

Height:	43 mm (1.75")
Width:	195 mm (7.75")
Depth:	248 mm (9.75")
Weight:	850 g (1 lb. 14 oz.) Net 930 g including Order Wire & SNMP

1.5.9 Power supply

Voltage (AC source)	100 ~ 240 VAC
Voltage (DC range 1)	18 ~ 36 VDC
Voltage (DC range 2)	36 ~ 72 VDC
Frequency	47 to 63 Hz for AC power
Power consumption	15 VA maximum

1.5.10 Environment

Temperature	0-50° C / 32-122° F
Humidity	0 to 90% non-condensing

1.5.11 Miscellaneous

MTBF	300,000 hours
Emission compliance	meets FCC part 15 Sub B (class A) EN55022:1994/A1:1995/A2:1997, EN61000-3-2:1995, EN61000-3-3:1995, and EN50082-1:1997

1.6 E1 Signal Structure

1.6.1 E1 link line rate

The E1 line operates at a nominal rate of 2.048Mb/s.

1.6.2 E1 link line coding

The basic E1 line signal is coded using either the Alternate Mark Inversion (AMI) or HDB3 rule. In the AMI format, "ones" are alternately transmitted as positive and negative pulses, whereas "zeros" are transmitted as a zero voltage level. AMI is not used in most 2.048Mb/s transmissions because synchronization loss occurs during long strings of data zeros.

In the HDB3 format, a string of four consecutive zeros is replaced with a substitute string of pulses containing an intentional bipolar violation. The HDB3 code substitutions provide high pulse density so that the receiving equipment is able to maintain synchronization with the received signal.

When configured for E1, the 4-CHANNEL E1 Ports support one of two E1 line codes:

AMI coding.

HDB3 coding.

The 4-CHANNEL E1 Ports support only transparent unframed format. ie. The E1 will pass through with its original framing structure completely intact.

1.7 T1(DS1) Signal Structure

1.7.1 T1 link line rate

The T1 line operates at a nominal rate of 1.544Mb/s.

1.7.2 T1 link line coding

The basic T1 line signal is coded using either the Alternate Mark Inversion (AMI) or B8ZS rule. In the AMI format, "ones" are alternately transmitted as positive and negative pulses, whereas "zeros" are transmitted as a zero voltage level. AMI is not used in most 1.544Mb/s transmissions because synchronization loss occurs during long strings of data zeros.

In the B8ZS format, a string of eight consecutive zeros is replaced with a substitute string of pulses containing an intentional bipolar violation. The B8ZS code substitutions provide high pulse density so that the receiving equipment is able to maintain synchronization with the received signal.

When configured for T1, the 4-CHANNEL T1 Ports support one of two T1 line codes:

AMI coding.

B8ZS coding.

The 4-CHANNEL T1 Ports support only transparent unframed format. ie. The T1 will pass through with its original framing structure completely intact.

1.8 Applications / Capabilities

In the following example, the **FMUX04** utilizes an optical fiber connection between a pair of units to provide 4channels of E1 or T1 between the units. The timing scheme for typical E1 or T1 equipment is to transparently pass timing from a timing source unit on one side, to a timing slaved unit on the other. Each of the up to 4 available channels of the **FMUX04** is independent of any other channel for transparent framing or timing.

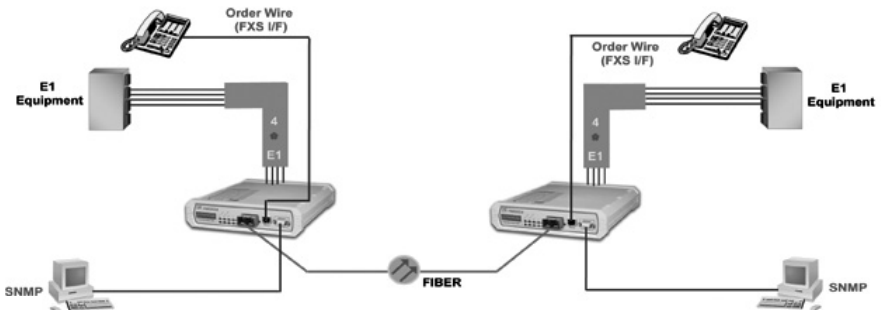


Figure 1-2 : Typical Point-to-Point Application of FMUX04

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Chapter 2. Installation

2.1 General

The Installation chapter will cover the physical installation of the **FMUX04**, Standalone/Rack Mount Fiber Optical Multiplexer, the electrical connections, interface connections and cabling requirements. A brief overview of the functional components such as main unit, order wire option and management options will also be outlined in this chapter.

Required Tools

You will need these tools to install the **FMUX04**:

- Number 2 Phillips screwdriver for the 3mm and the 12-24 rack installation screws.
- Wrist strap or other personal grounding device to prevent ESD occurrences.
- Antistatic mat or antistatic foam to set the equipment on.

2.2 Site Preparation

Install the **FMUX04** within reach of an easily accessible grounded AC outlet or site DC power. The outlet should be capable of furnishing 100 to 240 VAC (18 to 36VDC or 36 to 72 VDC for DC supply). Allow at least 10cm (4 inch) clearance at the rear and front of the **FMUX04** for power lines and interface cables.

2.3 Unpacking

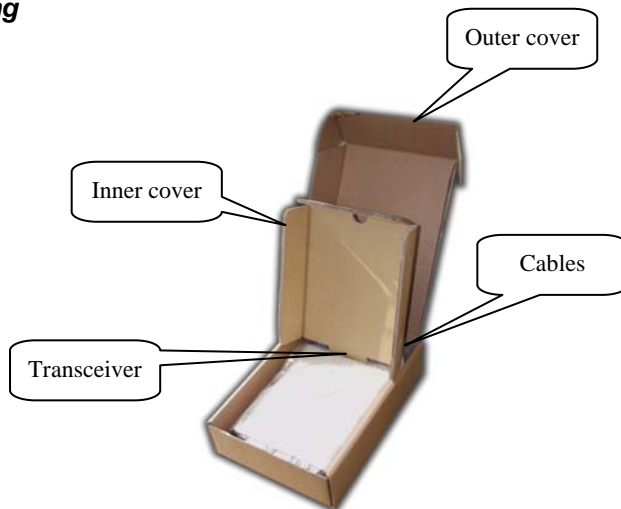


Figure 2-1. Unpacking the FMUX04.

2.4 Mechanical Assembly

The **FMUX04** is designed for standalone use, but it may be rack mounted as required with an optional mounting kit. The rack installation only requires 1U space (1 3/4") in a standard EIA 19 inch rack. The **FMUX04** is delivered completely assembled. No provision is made for bolting the **FMUX04** to a tabletop.

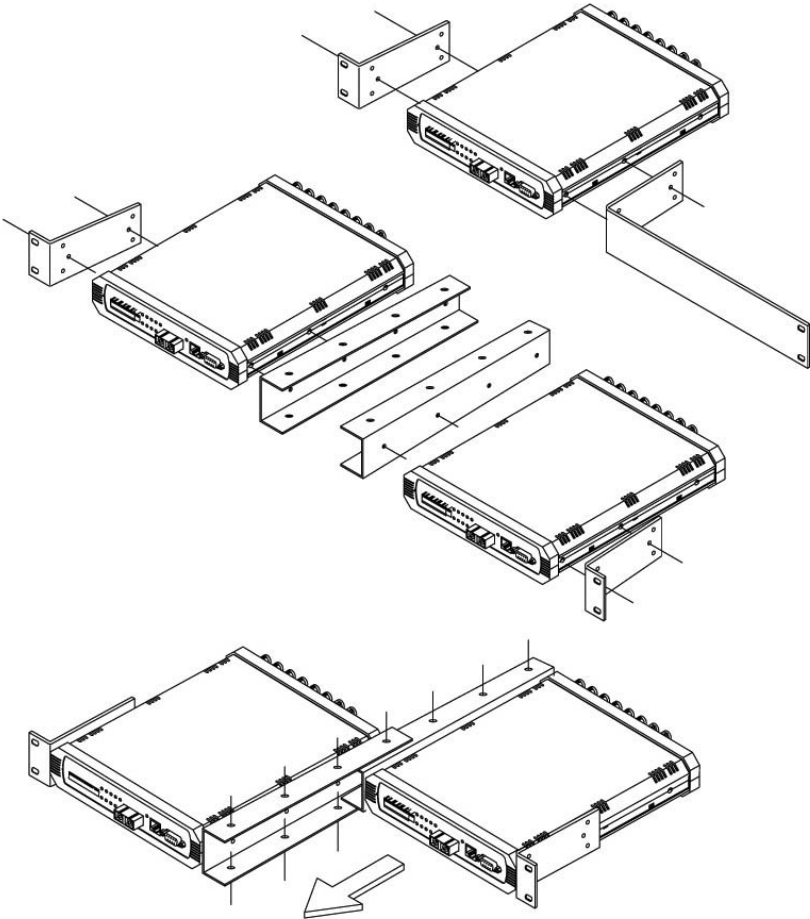
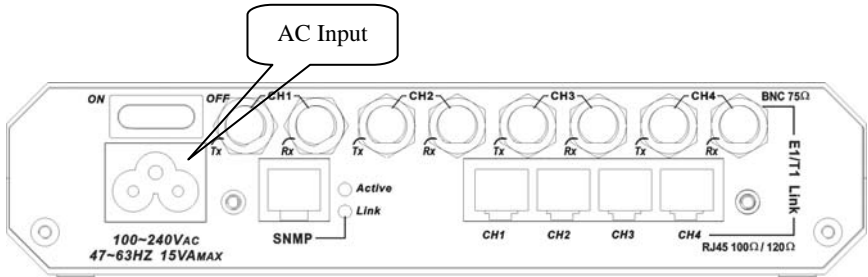


Figure 2-2. Single and tandem rack mounting of FMUX04.

2.5 Electrical Installation

2.5.1 Power connection, AC

For a model with AC power supply, AC power (100~240VAC) is supplied to the **FMUX04** through a becoming standard clover leaf 3-prong receptacle, located on the rear of the unit. The **FMUX04** should always be grounded through the protective earth lead of the power cable in AC installations.



2.5.2 Power connection, DC

For a model with DC power supply, DC -24V (18~36VDC) or DC -48V (36~72VDC) is connected to the detachable terminal block. The DC power connector uses a 'Molex' type connector with detachable terminal block. Please take extra caution to observe the proper polarity of the DC when wiring the connector. The **FMUX04** should always be grounded through the protective earth lead via the frame ground connection for DC installations.

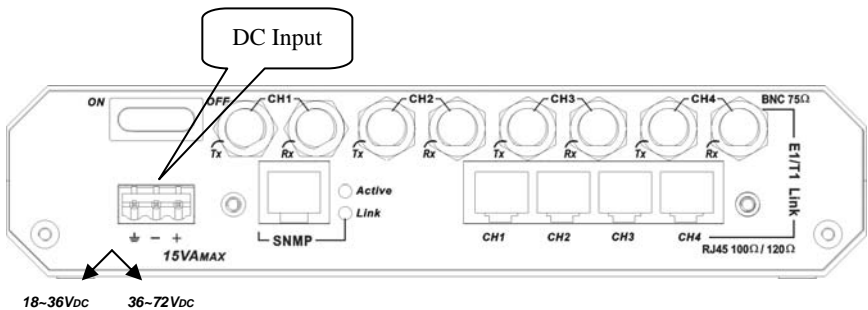


Figure 2-3 : Supply connections, AC/DC models shown

2.6 Rear Panel Connectors

The rear panel of the **FMUX04** supports the E1 and T1 interface connection, the AC or DC power connectors, the power switch and the Ethernet connector for connection to the LAN network for SNMP control (when the SNMP option is installed). The **FMUX04** routes the signals from the 4 E1/T1 channels to the multiplexing circuitry and sends the multiplexed signals to the Fiber Interface on the front panel.

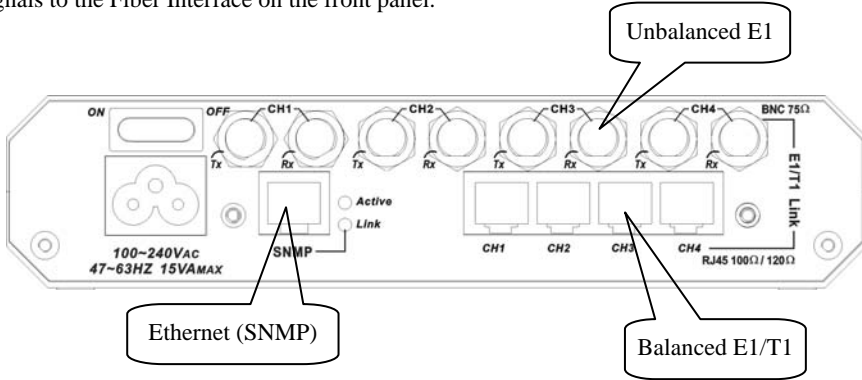


Figure 2-4 : Rear Panel Connections

2.7 Front Panel Switches, Connectors and Indicators

The front panel of the **FMUX04**, holds the optical interface, LED display, DIP switches and RS-232 Console port/Alarm Relay connector. The optical interface is fixed at the factory per order. The **FMUX04** supports single mode or multimode transceiver with SC, ST, or FC connector in powers that support 2, 15, 30, 50 or 120KM reach. The front panel also provides the Order Wire phone jack that can directly connect to any standard telephone set.

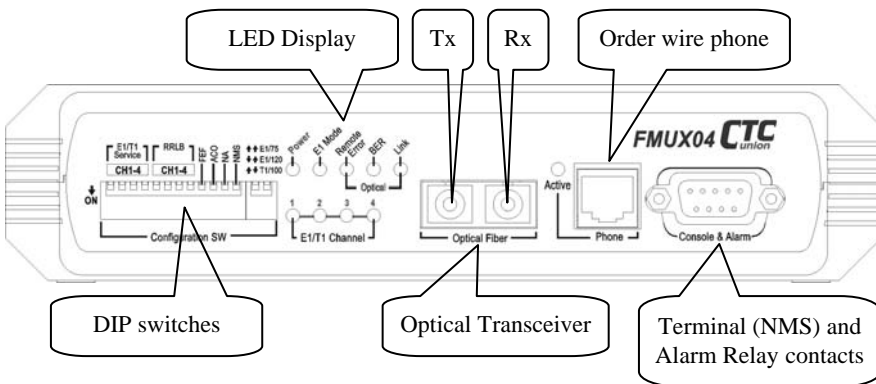


Figure 2-5 : Front Panel Controls and Indicators

2.8 Removal/Replacement Procedures

2.8.1 Order Wire Feature Module Removal / Replacement

CAUTION

This procedure should only be performed by qualified service personnel. In addition, all power connections must be removed before attempting to open the case.

The Order Wire feature is installed as separate daughter cards inside the pair of **FMUX04**. The front panel RJ-11 telephone connector routes to the OW (Order Wire) interface PCB. The OW option provides a standard FXS connection that links to the remote **FMUX04** unit via the fiber optical interface. Calls are placed simply by lifting the telephone off-hook. The remote telephone will ring.

To install or remove the OW option;

1. Loosen the captive thumb screws on the rear of the **FMUX04** until the threads are disengaged from the housing.
2. Gently pull the PCB assembly straight out the rear of the housing. Remove the Order Wire module PCB from its protective wrapping. Refer to the graphic on page 10 for the location of the Order Wire option.
3. Align the connector pins as in the following photos, seat the module, insert the two securing screws, and tighten lightly.
4. Return the PCBA to the housing and tighten the thumb screws. The unit is now ready to configuration and use.

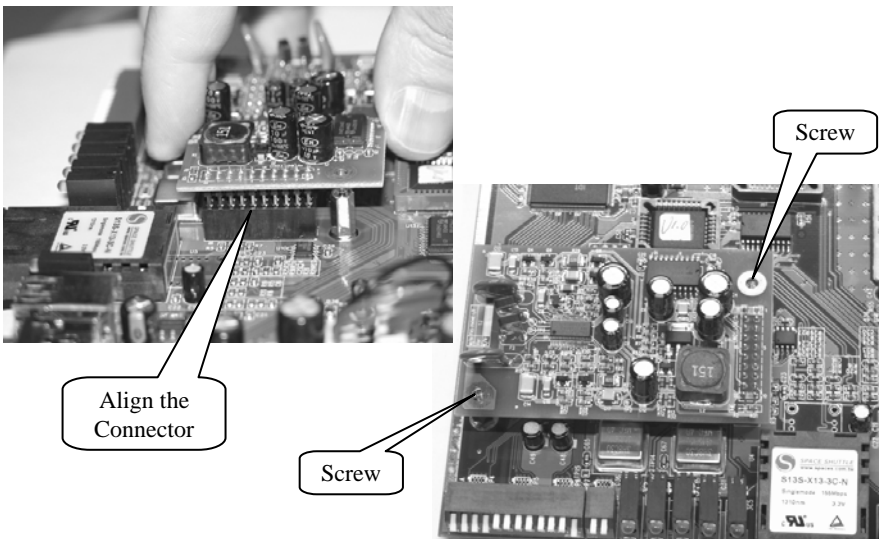


Figure 2-6 : Installation of Order Wire module.

Note: Connecting the FXS port to a live PSTN line will permanently damage the Order Wire module.

2.8.2 SNMP Feature Removal / Replacement

CAUTION

This procedure should only be performed by qualified service personnel. In addition, all power connections must be removed before attempting to open the case.

1. If the unit is installed in a rack, remove all connections and power cord.
2. Loosen the captive thumb screws on the rear of the **FMUX04** until the threads are disengaged from the housing.
3. Gently pull the PCB assembly straight out the rear of the housing. Remove the SNMP module PCBA from it's protective wrapping. Refer to the graphic on page 10 for the location of the SNMP option.
3. Align the connector pins as in the following photos, seat the module, insert the three securing screws, and tighten lightly.
4. Return the PCBA to the housing and tighten the thumb screws. The unit is now ready to configuration and use.

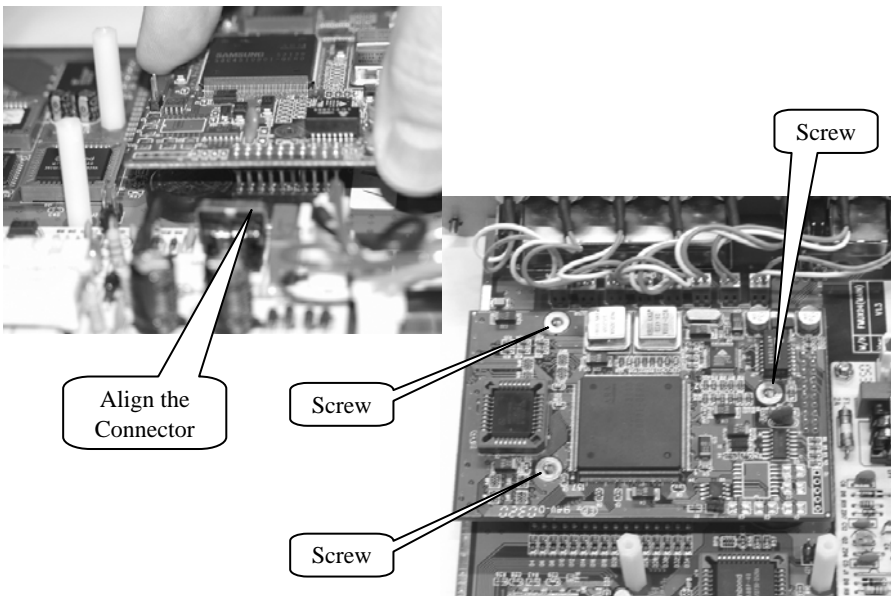


Figure 2-9 : SNMP daughter card Removal / Replacement

Note: Follow the instructions in Chapter 4 SNMP to configure the SNMP option.

Chapter 3. Operation

3.1 Introduction

This chapter will go into the details of the specific configuration and operation of the **FMUX04**. Broken into two parts, the first part outlines the procedures and functions when using the front panel DIP switches for configuration. The second section will outline the operation when using a VT-100 terminal connected to the RS-232 Console port. For more complete operation, a terminal connection to the Console port is recommended.

3.2 DIP Switch Setting Detail

DIP Switch Setting Table

SW	NO.		Status	Function	
SW.A	-1		ON	CH 1 E1/T1 In Service	
			OFF	CH 1 E1/T1 Out Of Service	
	-2		ON	CH 2 E1/T1 In Service	
			OFF	CH 2 E1/T1 Out Of Service	
	-3		ON	CH 3 E1/T1 In Service	
			OFF	CH 3 E1/T1 Out Of Service	
	-4		ON	CH 4 E1/T1 In Service	
			OFF	CH 4 E1/T1 Out Of Service	
	-5		ON	CH 1 RRLB enable	
			OFF	CH 1 RRLB Off	
	-6		ON	CH 2 RRLB enable	
			OFF	CH 2 RRLB Off	
	-7		ON	CH 3 RRLB enable	
			OFF	CH 3 RRLB Off	
	-8		ON	CH 4 RRLB enable	
			OFF	CH 4 RRLB Off	
	-9		ON	Far End Fault (FEF) Enable	
			OFF	Far End Fault (FEF) Disable	
	-10		ON	Alarm Cut Off active	
			OFF	normal	
	-11		ON	Reserved	
			OFF	Reserved	
	-12		ON	Console and SNMP Configuration Mode	
			OFF	DIP Switch Configuration mode*	
SW.B	-1	-2	OFF	OFF	E1 Line Impedance: 75 ohm
	-1	-2	ON	OFF	E1 Line Impedance: 120 ohm
	-1	-2	OFF	ON	T1 Line Impedance: 100 ohm
	-1	-2	ON	ON	Undefined

* When set to DIP Switch Configuration mode, the serial terminal cannot connect to the FMUX04. Any DIP switch change is immediately recognized without any need to power restart the FMUX04. When set to Console and SNMP mode, any other setting of DIP switches is completely ignored.

3.3 Terminal Mode Operation

A notebook computer has become an invaluable tool of the Systems Engineer. Connection between the computer and the **FMUX04** is very straight forward. The only hardware required is a DB9M to DB9F adapter cable (see pinout below). The **FMUX04**'s RS-232 Console port acts as a DCE to the PC's DTE communications port. A convenient application, provided with the Microsoft Windows® 98/NT/2K/XP operating systems, is "HyperTerminal™". The settings for console port communication with the **FMUX04** are 19.2K baud, 8 bits, no parity, 1 stop bit and no flow control. In the HyperTerminal program terminal window click the "properties" icon and set the communication parameters as in the following graphics. Click the "Configure..." button in the properties window and set the port settings. When set properly, click "OK".

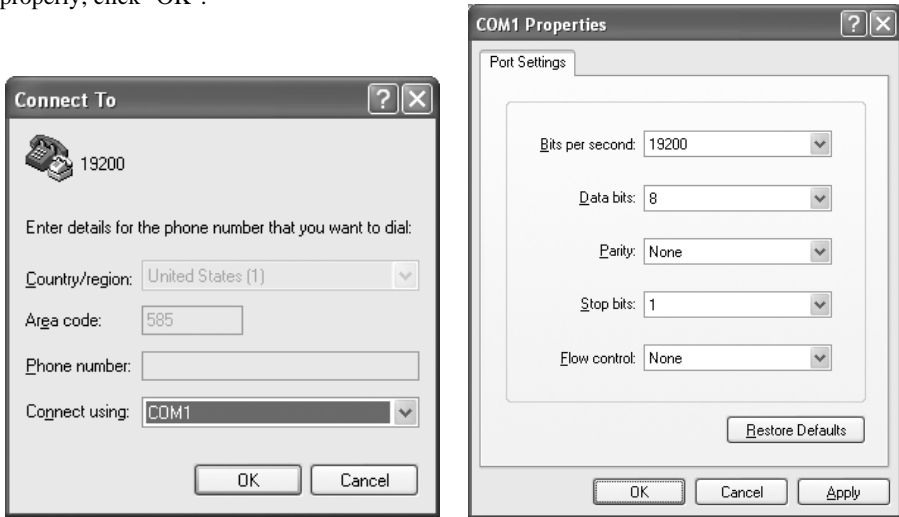


Figure 3-2 HyperTerminal port settings for FMUX04

3.4 Connecting to the FMUX04

The console port on the **FMUX04** is an RS-232D interface (DCE) that utilizes an RJ-45 connector. Use the configuration cable that is supplied with the **FMUX04** or prepare a three wire DB9(F) to DB9(M) cable with the following pin out:

DB9 (M)	signal	DB9 (F)
5	GND	5
2	TD	2
3	RD	3

3.5 Configuring in Console Mode

The **FMUX04** Control Port (labeled Console & Alarm on the front panel) is a console terminal port designed to facilitate setup of all parameters through the use of a standard text based terminal or any terminal emulation program running on a Personal Computer. Make the appropriate connections, start the terminal application, apply power to the **FMUX04**, then press ENTER on the PC keyboard. If you are using "HyperTerminal™" the display should look like the following.

```

** Welcome to FMUX04 NMS System **

```

3-3 Terminal Connection

Pressing the Enter key will open the terminal Login screen.

3.5.0 Local or Remote Login

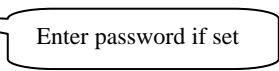
Press the "1" key to immediately enter into the Local Unit Terminal Mode.

```

*****
**** CTC UNION TECHNOLOGIES CO.,LTD ****
**** FMUX04 CONSOLE MODE Ver 1.00 ****
**** <http://www.ctcu.com> ****
*****

1. Local Login [  ]
2. Remote Login [  ]

```



If a password is required to login, please enter the 4 digit password previously set. Please see **3.5.2.1 System Configuration** regarding setting and clearing the password.

This is the main "LOCAL" root menu that will be displayed after login.

```

LOCAL          *****
                ****  CTC UNION TECHNOLOGIES CO.,LTD  ****
                ****  FMUX04 CONSOLE MODE   Ver 1.00   ****
                ****  <http://www.ctcu.com>          ****
                *****

0. Logout
1. Display System Status
2. Configure System Status
3. Display Alarm Record
4. Device Information

Please select the item 0~4
    
```

3.5.1 Display System Status

From the main root menu, select "1" to display the real-time status of the **FMUX04**.

```

LOCAL          << Display System Status >>          2006/02/16 16:03:06
    
```

Optical	[LOCAL]	[REMOTE]
Loss of Signal		
Loopback Status		
Far End Fault (FEF)	ENABLED	ENABLED
Bit Error Rate Alarm	BER = 0	BER = 0
Channels	CH1 CH2 CH3 CH4	CH1 CH2 CH3 CH4
Service Status	ON ON ON ON	ON ON ON ON
Loss of Signal		
BPV status		
Loopback Status		
Line Code	HDB3 HDB3 HDB3 HDB3	HDB3 HDB3 HDB3 HDB3
Termination Type	[E1/120/RJ45]	[E1/120/RJ45]
Alarm Relay	ENABLED / Alarm OFF	ENABLED / Alarm OFF
Phone Status	ENABLED	DISABLED

Press <ESC> to previous menu.

The display window shows the status for both the local and remote multiplexers. If the optical link is broken, the remote status will be blank. The date and time shown are the date and time from the unit that is showing the status window. If you are logged into the local device, the time displayed is read from the local device. If you are logged into the remote device, the "REMOTE" icon will be displayed in the upper left corner and the time displayed is the time set in the remote device. No matter if logged into the local or remote unit, the status display showing the local and remote status will display from the perspective of the local unit.

The **Optical** status will display 'Loss of Signal', whether loop back is active, if FEF is enabled or not and what the optical Bit Error Rate is in real-time. The **Channels** status will show the service status on or off, 'Loss of Signal', 'Bi-Polar Violation', loop back status, the running line code and the connector/termination setting. The **Alarm Relay** will show if the alarm relay function is enabled or disabled and what the current state of alarm is, on or off. The **Phone Status** will display whether the phone is enabled, disabled or if the module doesn't exist. The display is constantly being updated with fresh information reported from the multiplexer. You will find that the 'Display System Status' screen is the most useful screen when monitoring the status and health of the multiplexer and its transmission.

3.5.2 Define System Parameters

The 'Define System Parameter' menu is the main gateway to doing all configuration of the **FMUX04**. From the main menu, pressing '2' will directly enter the 'Define System Parameter' menu. Note that the upper left corner will display the word "LOCAL" in inverse text, indicating that the Terminal Mode connection is to the local unit and not the remote unit. The following menu will be displayed with configuring options for the system unit, optical interface, the 4 channels of E1/T1, alarm setting, date & time setting and configuration of the optional SNMP if installed.

```
LOCAL                << Configure System Status >>
1. System Configuration
2. Optical Configuration
3. E1/T1 Configuration
4. Phone Configuration
5. Alarm Relay
6. Date & Time Setting
7. SNMP Configuration
8. Upgrade firmware using the XMODEM console

Press <ESC> to previous menu.
```

3.5.2.1 System Configuration

Use the System Configuration menu option to save and load the single user setting, to load the factory default settings, to clear the Alarm buffer or to modify the login password.

```
LOCAL          << System Configuration >>
```

1. Save User Setting
2. Load User Setting
3. Load Default Setting
4. Clear Alarm Record
5. Modify Password

Press <ESC> to previous menu.

Functions 1 thru 4 are all immediately executed. When modifying the password please note the following: only 4 numbers are allowed for passwords; when setting the password, it must be entered twice and match; entering 4 zeros '0000' will clear the password; '0770' is the backdoor password if it is forgotten (but will not work from a Telnet session).

3.5.2.2 Optical Configuration

From the 'Configure System Status' menu, press "2" to enter the 'Optical Configuration' menu.

```
LOCAL          << Optical Configuration >>
```

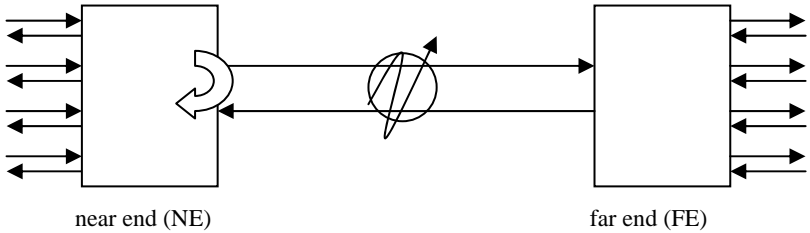
1. Loopback [OFF]
2. Far End Fault (FEF) [DISABLED]
3. Clear Bit Error Rate Alarm
4. Insert Error Bit

While in **REMOTE** display, this item is N/A, not available

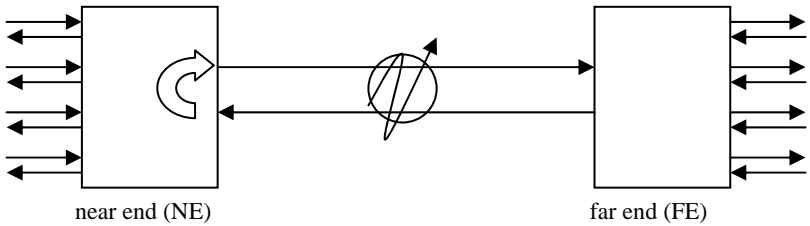
Press <ESC> to previous menu.

Loopback Descriptions

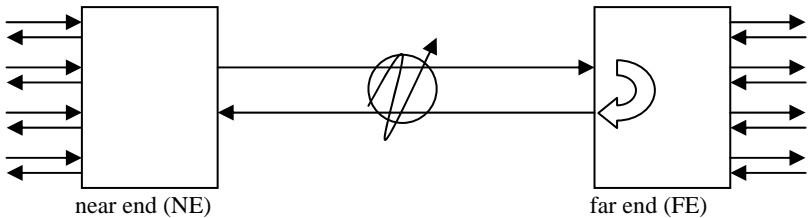
* LLB (Optical local loop back)



* RLB (Optical Remote loop back)

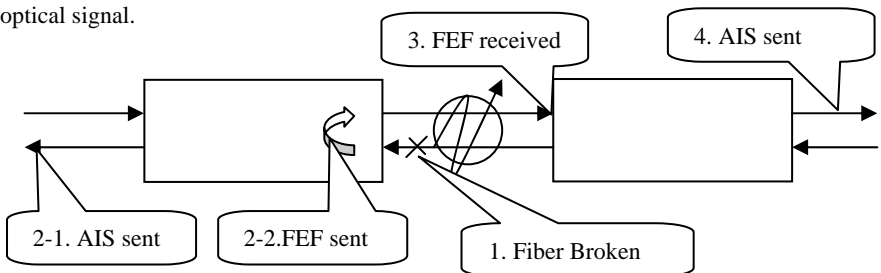


* RRLB (Request optical remote loop back)



FEF (Far End Fault)

The FEF function lets the receiving unit advise the far end unit that it has lost the receive optical signal.



In a FEF enabled unit above, loss of received optical signal will result in an FEF signal being sent to the far end unit, and AIS (Alarm Indication Signal) sent in both E1/T1 directions.

3.5.2.3 E1/T1 Configuration

```

LOCAL                << E1/T1 Configuration >>
-----
      1. CH1      2. CH2      3. CH3      4. CH4
-----
5. Service      ON          ON          ON          ON
6. Line Code    HDB3       HDB3       HDB3       HDB3
7. Loopback     OFF        OFF        OFF        OFF
8. Termination Type [      E1/75/BNC      ]
-----

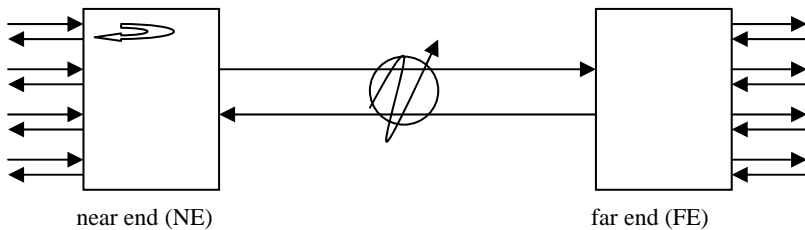
Please select 1-4 (Channel) or 8 (Termination Type) or [ESC] to
previous menu.
    
```

The third item from the 'Configure System Status' menu is the E1/T1 Configuration. First, select the channel (using 1 to 4) for configuration and then use the menu items; "5" to enable/disable the channel's service "6" to set the operating line code "7" to initiate loop back tests "8" to select the interface type E1 75 ohm BNC, E1 120 ohm RJ-45 or T1 100 ohm RJ-45. Note that all four channels must be set to the same E1 or T1 mode and with the same termination impedance.

Press "8" to select the interface type E1 75 ohm BNC, E1 120 ohm RJ-45 or T1 100 ohm RJ-45. Note that all four channels must be set to the same E1 or T1 mode and with the same termination impedance.

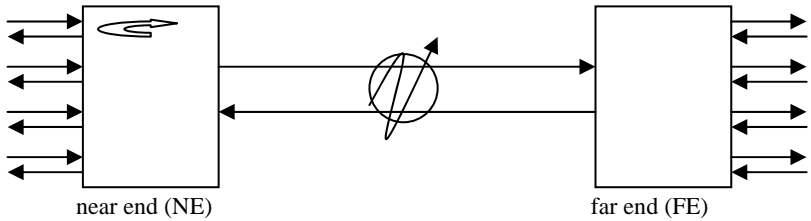
Loopback Descriptions

* LLB (E1/T1 local loop back)



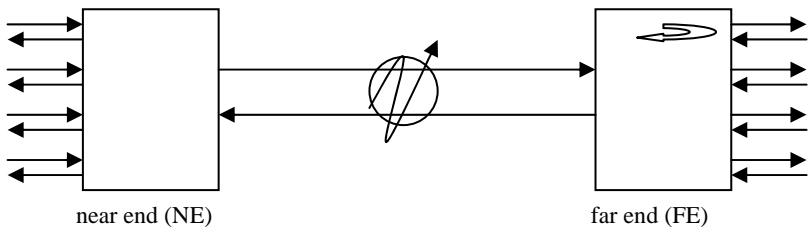
This local loop back will make the near end unit loop towards the copper side's channel.

* RLB (E1/T1 Remote loop back)



This remote loop back will loop the logical channel from the near end unit back to the far end unit via the fiber.

* RRLB (Request E1/T1 remote loop back)



The RRLB will send a coded request from the near end unit to the far end unit to request a channel to do a remote loop back.

3.5.2.4 Phone Configuration

```
LOCAL          << Phone Configuration >>

Phone Configuration [ ENABLED ]

=====
1. Phone Enable
2. Phone Disable

Press <ESC> to previous menu.
```

The fourth item from the "Configure System Status" menu is the Phone Configuration. The **FMUX04** has the option of installing an Order Wire feature that will allow voice connection between both near and far end units using standard telephone handsets. The phone function may be enabled or disabled via the Phone Configuration menu.

3.5.2.5 Alarm Relay

```
LOCAL                << Alarm Relay >>

Alarm Relay [ ENABLED ]

=====
1. Enable Alarm Relay
2. Disable Alarm Relay

Press <ESC> to previous menu.
```

The fifth item from the "Configure System Status" menu is the Alarm Relay Configuration. When disabled, the alarm relay will not close to indicate any alarm indication. Please refer to the Appendix for the relay connections and an application example using the relay.

3.5.2.6 Date & Time

```
LOCAL                << Date & Time Setting >>

1. Date [ 2006/02/16 ]
2. Time [ 16:03:06 ]

Press <ESC> to previous menu.
```

The sixth item on the "Configure System Status" menu is the date and time setting function. The **FMUX04** has a battery backed up real time clock that is used for time-stamping performance monitored data and alarm events. Select "1" to set the date and select "2" to set the time. Within each field, use the "+" or "-" keys to modify the value, and then press "Enter". Continue to modify each parameter, year, month day for the date and hour, minute, and second for the time. (Time setting follows the 24 hour format.)

3.5.2.7 SNMP Configuration

Please refer to Chapter 4 SNMP for the configuration of the SNMP option.

3.5.2.8 Upgrade firmware using the XMODEM console

```
LOCAL      << Upgrade Firmware using the XMODEM console >>
1. Upgrade the Main Board Firmware
2. Upgrade the FPGA Firmware

Press <ESC> to previous menu.
```

Note: No upgrade feature is available when logged into the **REMOTE** unit.

The 'Mainboard Firmware' is the operational program that controls the user interface (the console mode), reads the DIP switch if console mode is disabled, and controls the operation of the **FMUX04**. The 'FPGA Firmware' is the code that loads into the field programmable gate array at startup. The FPGA is the physical heart of the **FMUX04**, it provides the logic for the multiplexing of the E1/T1 signals, controls the loop back functions, provides the optical scrambling and integrated BERT among many other things. The **FMUX04** has the ability to upgrade the hardware and working firmware via the serial console connection utilizing the Xmodem serial transfer protocol. If we ever find bugs or wish to add operational improvements to the **FMUX04**, then we have the ability to upgrade the units without opening or changing any firmware chips. Upgrading the FPGA in an online unit will result in temporary loss of transmissions as the multiplexer reboots with the new logic code however, **any mainboard firmware upgrades may be done without effecting the normal transmissions on an on-line unit.**

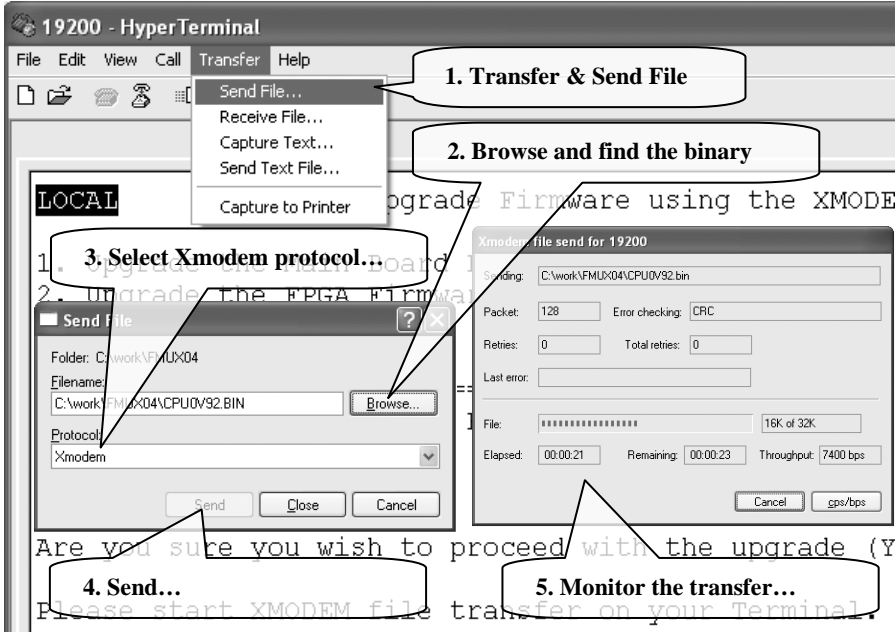
If you are using the HyperTerminal utility provided with Windows® operating system, then the send file function is found under the 'Transfer' pull down menu. The procedure to upgrade the unit is to first obtain the binary code file and place it on the terminal machine, login to the **FMUX04**, browse to the upgrade menu, choose the right upgrade component, confirm your intention to do an upgrade, and then send the binary file. After the binary image file has successfully transferred, the **FMUX04** will write the new firmware and reboot. The following page has the steps again in detail.

Upgrade Procedure

Select the upgrade option; "1" upgrade the mainboard firmware, or "2" upgrade the FPGA firmware.

Answer "y" to the confirmation message "Are your sure"

Now start the Xmodem file transfer. Here is an example using HyperTerminal.



```

LOCAL      << Upgrade Firmware using the XMODEM console >>

1. Upgrade the Main Board Firmware
2. Upgrade the FPGA Firmware

=====
<< Upgrade the Main Board Firmware>>

Are you sure you wish to proceed with the upgrade (Y/N) ? Y
Please start XMODEM file transfer on your Terminal.

*****
Warning : DO NOT power off or terminate the file transfer during the
upgrade process or the Flash will crash, leaving the system
unstable.
*****

Upgrading now ..
    
```

3.5.3 Display Alarm Record

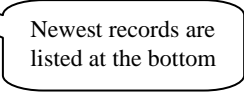
From the main login page, press "3" to display the alarm record.

```
LOCAL                << Display Alarm Record >>

<Channel>   <Alarm Type>      <Alarm ON/OFF>    <DATE>          <TIME>
Optical     Signal Loss      ON                 2006/02/21     11:35:44
Port 2      BPV Error         ON                 2006/02/21     11:35:44
Port 2      Signal Loss      ON                 2006/02/21     11:35:44
Port 2      Signal Loss      ON                 2006/02/21     11:35:44
Optical     BER >= 1e-3          ON                 2006/02/21     11:35:44
Port 2      BPV Ok           OFF                2006/02/21     11:35:45
Port 2      Signal Loss      ON                 2006/02/21     11:35:45
Port 2      Signal Loss      ON                 2006/02/21     11:35:45
Optical     1e-6 ==< BER < 1e-3  OFF                2006/02/21     11:35:50
Optical     Signal Link       OFF                2006/02/21     11:35:50
Optical     BER = 0           OFF                2006/02/21     11:35:51

                        == End of Alarm Record ==

Press <SPACE> to repeat, Press <ESC> to exit
```



The Alarm buffer keeps a record of all alarm sources (optical or port 1-4), the alarm type and a date & time timestamp of each alarm. A full list of alarm types is listed in the Appendix. The buffer may be cleared by entering the 'Configure System Status' menu from the initial login and selecting "4" to clear the alarm buffer.

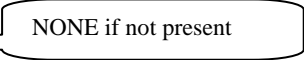
3.5.4 Device Information

From the main login page, press "4" to display the device information.

```
LOCAL                << Device Information >>

+---Module-----+
|Phone Module : [EXIST]
|SNMP Module  : [EXIST]
+---Firmware Version---+
|Main Board F/W : 1.00
|FPGA F/W      : 1.00
|SNMP F/W      : 1.00
+-----+

Press <ESC> to previous menu.
```



3.6 Remote Configuration

From the main login page select the second option "2", Remote Login.

```
REMOTE *****
**** CTC UNION TECHNOLOGIES CO.,LTD ****
**** FMUX04 CONSOLE MODE Ver 1.00 ****
**** <http://www.ctcu.com> ****
*****

0. Logout
1. Display System Status
2. Configure System Status
3. Display Alarm Record
4. Device Information

Please select the item 0-4
```

Note that the upper left hand corner of the terminal display shows "REMOTE" in inverse text. The functions of the display and configuration are exactly the same as for the local unit with one exception; there is no optical loop back available.

The optical path between the two multiplexers carries not only the multiplexed data from the E1/T1 transmissions, it also carries the integrated optical BER channel, the Order Wire voice channel, and the EOC (embedded operations channel). The EOC provides the communication path for console and SNMP between the local and remote units. Obviously if that channel is compromised either by loss of optical signal or by an optical loop back performed from the remote side, the channel and remote control will be lost. Therefore, loop back of optical when logged in to the remote is not available. If the optical link should fail while logged into the remote unit, the terminal session will auto-logoff from the remote.

This completes the overview of the Console mode configuration and status monitoring of the **FMUX04**.

Chapter 4. SNMP

4.1 General

The Simple Network Management Protocol (SNMP) is one of many protocols in the Internet Protocol (IP) suite. SNMP is the protocol recommended specifically for the exchange of management information between hosts residing on IP networks. Network management allows you to monitor and control network devices remotely using conventional computer network technology.

The SNMP management functions of the **FMUX04** are provided by an internal SNMP agent, which utilizes out-of-band communication over standard 10Base-T or 100Base-TX Ethernet. The SNMP agent is compliant with the SNMPv1 standard. SNMP communications use the User Datagram Protocol (UDP). UDP is a connectionless transport protocol, part of the TCP/IP suite. The SNMP application uses an asynchronous command/response polling protocol and operates at the OSI Layer 7 (Layer 7 is the Application Layer. Other IP applications that operate at this layer are FTP, Telnet, HTTP, SMTP, etc.). All management traffic is initiated by the SNMP-based network management station. Only the addressed managed entity (agent) answers the polling of the management station (except for trap messages).

4.2 SNMP Operations

The SNMP protocol includes four types of operations:

- getRequest** Command for retrieving specific value of an "instance" from the managed node. The managed node responds with a **getResponse** message.
- getNextRequest** Command for retrieving sequentially specific management information from the managed node. The managed node responds with a **getResponse** message.
- setRequest** Command for manipulating the value of an "instance" within the managed node. The managed node responds with a **getResponse** message.
- trap** Management message carrying unsolicited information on extraordinary events (that is, events which occurred not in response to a management operation) reported by the managed node.

4.3 The Management Information Base

The management information base (MIB) includes a collection of managed objects. Managed objects are defined as parameters that can be managed, such as specific information on device configuration or on performance statistics values.

The MIB includes the definitions of relevant managed objects (MIB variables) for the specific node. Various MIB's can be defined for various management purposes, types of equipment, etc. The management data itself is a collection of integer, string and MIB address variables that contain all the information necessary to manage the node.

A leaf object's definition includes the range of instances (values) and the "access" rights:

Read-only Instances of an object can be read, but cannot be set.
Read-write Instances of an object can be read or set.
Write-only Instances of an object can be set, but cannot be read.
Not accessible Instances of an object cannot be read, nor set.

4.4 MIB Structure

The MIB has an inverted tree-like structure (root over leaves), with each definition of a managed instance forming one leaf, located at the end of a branch of that tree. Each "leaf" in the MIB is reached by a unique path, therefore by numbering the branching points, starting with the top, each leaf can be uniquely defined by a sequence of numbers. The formal description of the managed objects and the MIB structure is provided in a special standardized format, called Abstract Syntax Notation 1, or ASN.1 (pronounced A-S-N dot one).

Since the general collection of MIB's can also be organized in a similar structure, under the supervision of the Internet Activities Board (IAB), any parameter included in a MIB that is recognized by the IAB is uniquely defined.

To provide the flexibility necessary in a global structure, MIB's are classified in various classes (branches), one of them being the experimental branch, another being the management (mgmt) branch, and yet another the group of private (enterprise-specific) branch. Under the private enterprise-specific branch of MIB's, each enterprise (manufacturer) can be assigned a number, which is its enterprise number. The assigned number designates the top of an enterprise-specific sub-tree of non-standard MIB's.

Enterprise-specific MIB's are published and distributed by their creators, who are responsible for their contents.

The MIB supported by the **FMUX04** SNMP Agent follows RFC 1158 (MIB-II standard).

4.5 SNMP Communities

To enable the delimitation of management domains, SNMP uses "communities". Each community is identified by a name, which is an alphanumeric string of up to 255 characters defined by the user. Any SNMP entity (this term includes both managed nodes and management stations) is assigned by its user a community name. In parallel, the user defines for each SNMP entity a list of the communities which are authorized to communicate with it, and the access rights associated with each community (this is the SNMP community name table of the entity).

In general, SNMP agents support two types of access rights:

Read-only the SNMP agent accepts and processes only SNMP **getRequest** and **getNextRequest** commands from management stations which have a read-only community name.

Read-write the SNMP agent accepts and processes all the SNMP commands received from a management station with a read-write community name. SNMP agents are usually configured to send traps to management stations having read-write communities.

4.6 Configuring the SNMP Agent

The agent for the **FMUX04** resides in the SNMP option card installed in the **FMUX04**. Initial configuration of the agent is accomplished via the RS-232 Control Port of the **FMUX04**. Refer to Chapter 3, section 3.5 for operation of the console for the **FMUX04** and the login procedures. From the 'Configure System Status' menu select "7", SNMP Configuration. Note: No SNMP configuration is available when logged into the **REMOTE** unit.

```
LOCAL                << SNMP Configuration >>
1. SNMP Agent Configuration
2. Manager Configuration
3. TFTP Server Configuration
4. Save Configuration and Reboot the SNMP
5. TFTP and Upgrade Firmware

Press <ESC> to previous menu.
```

Explanation

The SNMP agent is the process that runs in the SNMP module and has the ability to control the **FMUX04**. The agent requires network configuration, ie. IP address, subnet mask and default gateway settings.

The manager configuration provides the needed information to the agent for the network manager on your network. This information can be assigned for up to four different management workstations. The information set includes the IP address of the management workstation, the access rights (read/write or read only) which are provided by the community string, plus if the agent is to send traps (unsolicited messages) to the management workstation.

The TFTP server is required if doing any software upgrade of the SNMP agent. The two configuration parameters are the IP address of the TFTP server and the path to the upload file.

4.6.1 Configure the SNMP Agent

From the 'SNMP Configuration' menu select "1", SNMP Agent Configuration.

```
LOCAL                << SNMP Agent Configuration >>

1. IP Address        [172. 24.  1. 11]
2. Subnet Mask      [255.255.  0.  0]
3. Gateway IP       [172. 24.190.254]

Press <ESC> to previous menu.
```

Item number 1, IP address is the IP address that the SNMP card will answer to when "pinged", Telnet'd, TFTP'd or when accessed by SNMP.

Item number 2, is the subnet mask for the network that the card is attached to.

Item number 3, is the default gateway for the network that the card is attached to and is required if the **FMUX04** is to be managed from a different subnet.

HINT: when entering IP addresses, enter without "dots" and include any leading zeros. For example, the above IP address 172.24.1.11 would be entered as 172024001011 while 10.0.0.1 would be entered as 010000000001.

4.6.2 Manager Configuration

From the 'SNMP Configuration' menu, select item "2", Manager Configuration. Manager configuration is required to tell the agent (the SNMP card) who has authority to access the SNMP via "Get" commands (read) or "Set" commands (write) and where to send "trap" messages (unsolicited messages that are usually generated by alarms in the **FMUX04**).

```
LOCAL                << Manager Configuration >>

1. Access IP #1 [172. 24.  1.125] [Community String #1] [trap]
2. Access IP #2 [192.168.  0. 15] [Community String #2] [trap]
3. Access IP #3 [172. 24.  1.126] [Community String #2] [   ]
4. Access IP #4 [192.168.  0. 49] [Community String #2] [   ]
5. Community String #1 (Read/Write) [secret]
6. Community String #2 (Read Only) [public]

Press <ESC> to previous menu.
```


The manager configuration has the ability to setup access for up to four (4) different management workstations. The community strings act like passwords in dealing with the device via SNMP protocol. By changing the community strings (numbered 1 & 2) for read / write ('secret' in this case) and read only ('public') access, and assigning a community string to an access IP, an administrator can control access to the **FMUX04**.

HINT: when entering IP addresses, enter without "dots" and include any leading zeros. For example, the above IP address 172.24.1.125 would be entered as 172024001125 while 10.0.0.1 would be entered as 010000000001.

Note that in the above example, the management workstation with IP address 172.24.1.125 and using the community string 'secret', has full read and write access and receives traps. The management station at 192.168.0.15 has read only privileges when using the community string 'public' and can also receive trap messages. The other two stations at Access IP 3&4 have read only access and do not receive any trap messages. After all settings have been made, press ESC to the 'SNMP Configuration' menu and press "4" 'Save Configuration and Reboot the SNMP'.

4.6.3 TFTP Server Configuration

```
LOCAL          << TFTP Server Configuration >>
1. TFTP Server IP           [172. 24.  1.125]
2. File name of SNMP Firmware [c:\fmux04v1.0.bin]
3. File name of Main Board Firmware [c:\cpu1v0.bin]
4. File name of FPGA Firmware [c:\fpga1v0.bin]

Press <ESC> to previous menu.
```

Item number 1, is the IP address of a server running the TFTP protocol (trivial FTP) used for updating the SNMP firmware image in the SNMP card.

Item number 2, is the path and filename of the image file that the SNMP card will download when the TFTP SNMP upgrade function is called.

Item number 3, is the path and filename of the image file that the SNMP card will download when the TFTP Main Board Firmware upgrade function is called.

Item number 4, is the path and filename of the image file that the SNMP card will download when the TFTP FPGA Firmware upgrade function is called.

Remember, when setting the "server path" information for a UNIX or LINUX based server, the upper and lower case must be correctly observed. Also remember that UNIX path separators use "/" while Windows uses "\" to separate path directories.

4.6.4 Save Configuration and Reboot the SNMP

```
LOCAL                << SNMP Configuration >>

1. SNMP Agent Configuration
2. Manager Configuration
3. TFTP Server Configuration
4. Save Configuration and Reboot the SNMP
5. TFTP and Upgrade Firmware

Press <ESC> to previous menu.
=====

Saving the SNMP configuration, Please wait ...
```

From the 'SNMP Configuration' menu, press "4" to save the settings for the SNMP.

4.6.5 TFTP and Upgrade Firmware

To upgrade the SNMP firmware, configure a TFTP server on your network. Configuring a TFTP server is beyond the scope of this document. Place the upgrade binary file on the server and set the IP address and path of the server in the SNMP agent. Refer to 4.6.3 for configuring the SNMP card for TFTP upgrading. For any changes to be remembered in the agent, please select item #4 to "Save Configuration and Reboot the SNMP".

```
LOCAL                << SNMP Configuration >>

1. SNMP Agent Configuration
2. Manager Configuration
3. TFTP Server Configuration
4. Save Configuration and Reboot the SNMP
5. TFTP and Upgrade Firmware

Press <ESC> to previous menu.
```

From the main SNMP configuration menu, select item "5" 'TFTP and Upgrade Firmware' to enter the TFTP and upgrade firmware page.

```
LOCAL                << TFTP and Upgrade Firmware >>
1. Upgrade the SNMP Firmware
2. Upgrade the Main Board Firmware
3. Upgrade the FPGA Firmware

Press <ESC> to previous menu.
```

Make sure the TFTP server is running and enter your choice of upgrade item.

```
LOCAL                << TFTP and Upgrade Firmware >>
1. Upgrade the SNMP Firmware
2. Upgrade the Main Board Firmware
3. Upgrade the FPGA Firmware

=====
<< Upgrade the Main Board Firmware>>

Are you sure you wish to proceed with the upgrade (Y/N) ? Y

*****
Warning : DO NOT power off or terminate the file transfer during the
upgrade process or the Flash will crash, leaving the system
unstable.
*****

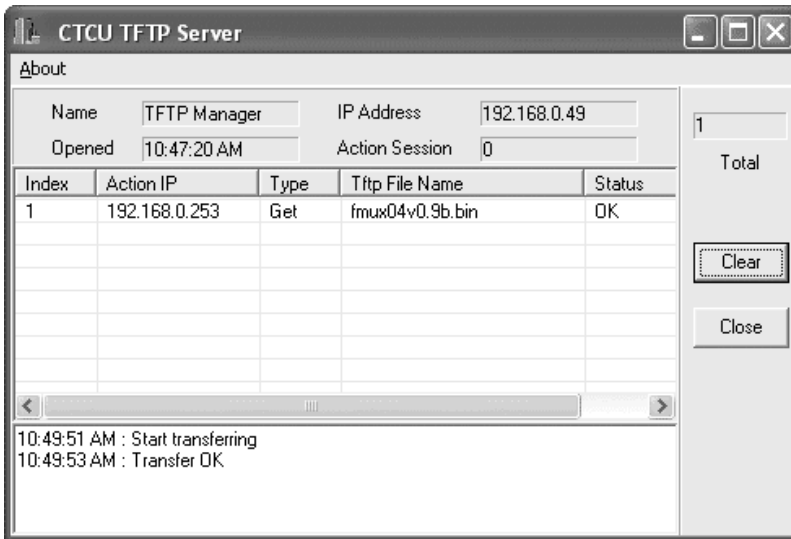
Upgrading now ....
```

DO NOT INTERRUPT POWER DURING SAVE OPERATION OR THE FLASH MEMORY MAY BECOME CORRUPT.

After the upgrade is complete and the multiplexer has rebooted, go to the 'Display Information' menu and confirm the new firmware version is correct.

CTC Union provides a TFTP utility program that runs standalone in Windows® without any installation. We recommend that you copy the program and any binary image files for upload to your Windows® desktop for convenience sake. If you place the binary files and server program in the same directory, there is no need to enter any path information in the SNMP agent. This simplifies the settings considerably, just enter the binary filename in the TFTP filename location in the SNMP agent. If you have a firewall enabled, please disable it before running the TFTP server or doing the upgrade.

Start the CTCU TFTP Server program just before executing the upgrade on the multiplexer,. After initiating the upgrade, the TFTP server will show the progress and completion of the file transfer, whether successful or not.



CTCU TFTP Server after successful file transfer.

4.7 MIB File

A MIB is a "management information base" file that allows network management software understand how to manage the **FMUX04**. Management software could be expensive packages of software such as HP OpenView® and Computer Associates Unicenter® or inexpensive MIB browsers such as those from MG-Soft. Additionally, Linux and unix type operationg systems also have SNMP utilities that allow utilizing the MIB file to access the device agent with SNMP protocol. The MIB file is just a key that fits our device; you still need the 'car' (management software running on a workstation) in order to drive.

The **FMUX04** with SNMP is provided with a MIB (Management Information Base) file. The MIB supported by the **FMUX04** SNMP Agent follows RFC 1158 (MIB-II standard). The formal description of the managed objects and the MIB structure is provided in a special standardized format, called Abstract Syntax Notation 1, or ASN.1 (pronounced A-S-N dot one).

The following graphic shows the MG-SOFT MIB Browser software, after importing and compiling the MIB file, accessing the **FMUX04** and doing an 'SNMP Walk' on the local E1 configuration OID. The query results are shown on the right screen.

The screenshot displays the MG-SOFT MIB Browser Professional Edition interface. The 'Remote SNMP Agent' is set to '192.168.0.253'. The 'MIB Tree' on the left shows a hierarchical structure: iso > org > dod > internet > mgmt > private > enterprises > ctc > fmux04 > local > local_e1_t1_Configuration. The 'Query Results' pane on the right shows the following output:

```

***** SNMP QUERY STARTED *****
1: local_ch1_service.0 (integer) on(1)
2: local_ch2_service.0 (integer) on(1)
3: local_ch3_service.0 (integer) on(1)
4: local_ch4_service.0 (integer) on(1)
5: local_ch1_linecode.0 (integer) hdb3(0)
6: local_ch2_linecode.0 (integer) hdb3(0)
7: local_ch3_linecode.0 (integer) hdb3(0)
8: local_ch4_linecode.0 (integer) hdb3(0)
9: local_ch1_loopback.0 (integer) off(0)
10: local_ch2_loopback.0 (integer) off(0)
11: local_ch3_loopback.0 (integer) off(0)
12: local_ch4_loopback.0 (integer) off(0)
13: local_ch1_ellos.0 (integer) normal(0)
14: local_ch2_ellos.0 (integer) normal(0)
15: local_ch3_ellos.0 (integer) normal(0)
16: local_ch4_ellos.0 (integer) normal(0)
17: local_ch1_bpv.0 (integer) normal(0)
18: local_ch2_bpv.0 (integer) normal(0)
19: local_ch3_bpv.0 (integer) bpv_error(1)
20: local_ch4_bpv.0 (integer) bpv_error(1)
21: local_termination_type.0 (integer) e1_75_bnc(0)
***** SNMP QUERY FINISHED *****

```

SNMP 'Walk' displayed on MG-Soft's MIB Browser

4.8 Web Based Interface

When the FMUX04 is installed with the SNMP option, the unit has the added management features of Telnet, SNMP and HTTP server. The HTTP server allows connection and configuration in a graphical, point and click environment using any standard web browser.

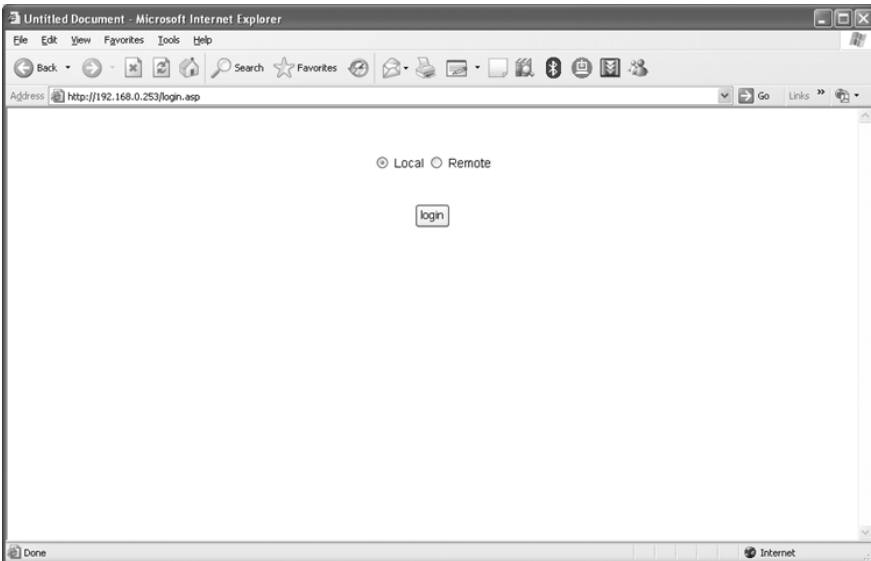
4.8.1 Security Login

To connect to the FMUX04 use the device's IP address as the URL location. For example with our setup unit, enter `http://192.168.0.253/` and Enter. A login security prompt will display.



The default user name is admin. The password is the terminal password if it has been set, or if no terminal password is set the default is 0000 (4 zeros).

4.8.2 Unit Select



Our first page is the login page to access either the local or remote unit. Click 'Login'.

4.8.3 Display System Status

The default page shown will be the Display System Status page. Note that the navigation menu is in the frame on the left side. The 'Local' designation means we are viewing the local unit (from the SNMP card's standpoint). The system status displays both local and remote.

Local

- FMUX04
 - Change Location
 - Display System Status
 - Realtime Status
 - Configure System Status
 - Display Alarm Record
 - Device Information

Display System Status

Optical			
Location	[LOCAL]		[REMOTE]
Loss of Signal	Link		Link
Loopback Status	OFF		OFF
FarEnd Fault (FEF)	Disable		Disable
Bit Error Rate Alarm	BER = 0		BER = 0

E1/T1								
Channels	CH1	CH2	CH3	CH4	CH1	CH2	CH3	CH4
Service Status	ON	ON	ON	ON	ON	ON	ON	ON
Loss of Signal	Link	Link	Link	Link	Link	Link	Link	Link
BPF Status	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
Loopback Status	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Line Code	HDB3	HDB3	HDB3	HDB3	HDB3	HDB3	HDB3	HDB3

E1/120			
Termination Type	E1/120		E1/120
Alarm Relay	ENABLED / Alarm OFF		ENABLED / Alarm OFF
Phone Status	ENABLED STANDBY		ENABLED STANDBY

4.8.4 Realtime Display

The Realtime Display shows the active state of front panel LEDs and the current DIP settings.

Local

- FMUX04
 - Change Location
 - Display System Status
 - Realtime Status
 - Configure System Status
 - Display Alarm Record
 - Device Information

DIP Panel Status

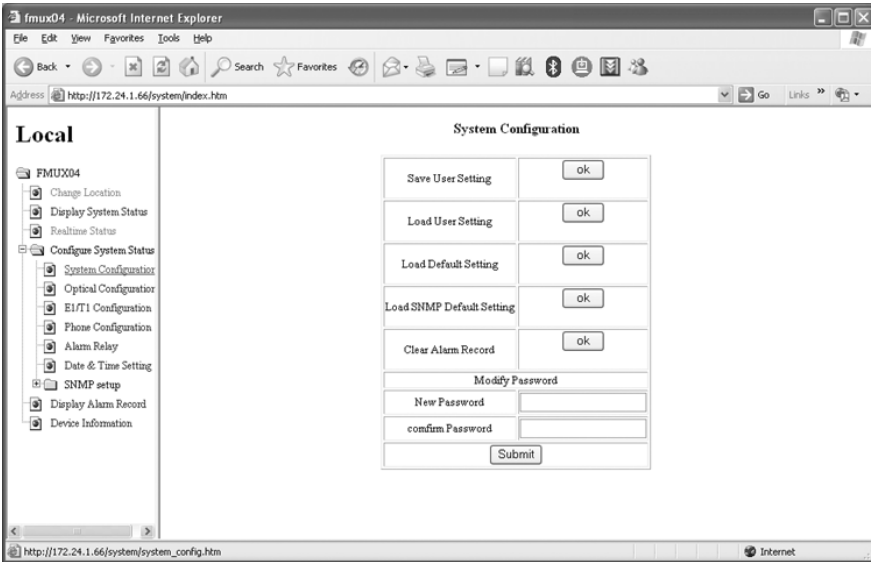
1	2	3	4	5	6	7	8	9	10	11	12	13	14
ON	ON	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF

LED Status

power	E1/T1 mode	Remote Error	BER	Link	Active	1	2	3	4
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

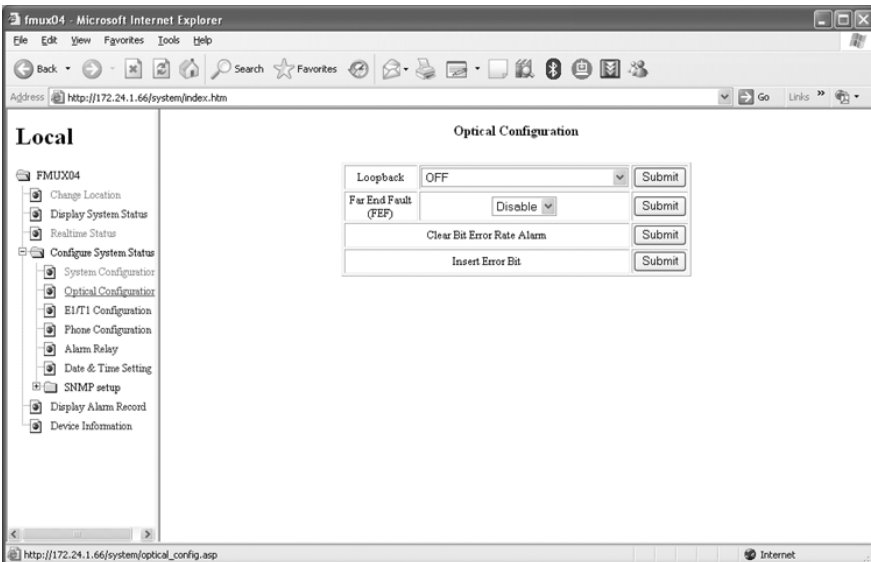
4.8.5 System Configuration

The System Configuration page is used to save and load user settings, load default settings, clear the alarm buffer record and change the login password. (refer to 3.5.2.1)



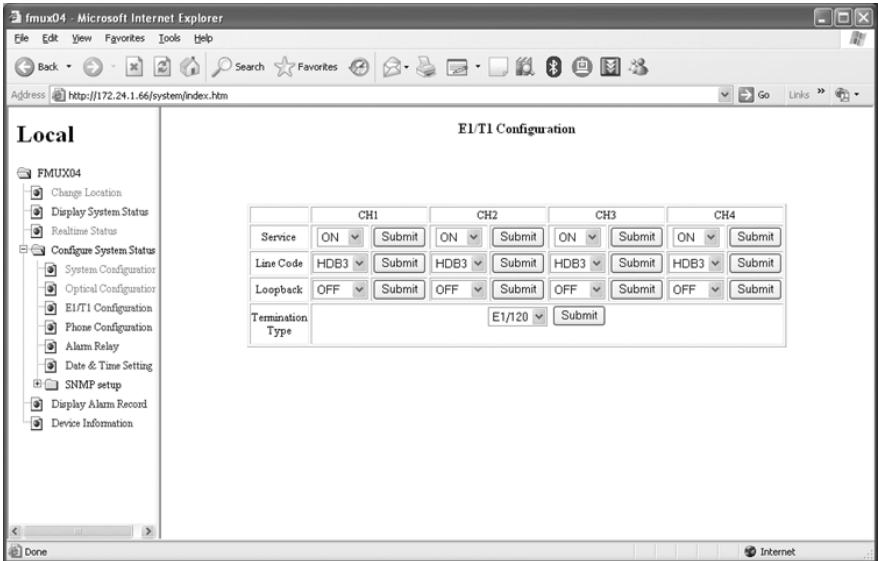
4.8.6 Optical Configuration

The Optical Configuration page allows enabling the FEF function, clearing the BER Alarm and setting the optical loop backs. (refer to 3.5.2.2)



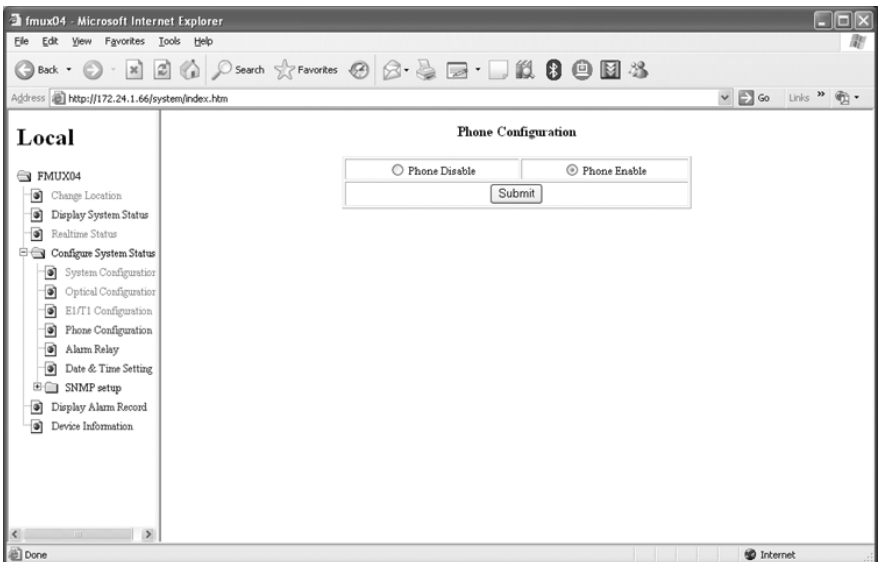
4.8.7 E1/T1 Configuration

The E1/T1 configuration page sets the channel service, line code and termination type for the E1/T1. It also sets the loop back types (see 3.5.2.3).



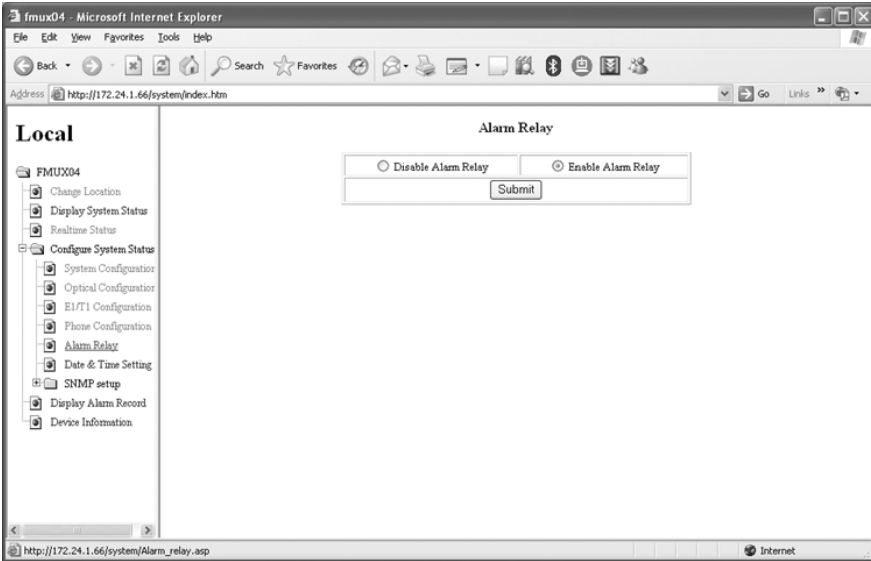
4.8.8 Phone Configuration

The Phone Configuration allows enabling or disabling the phone function, if the order wire phone option is installed. (refer to 3.5.2.4)



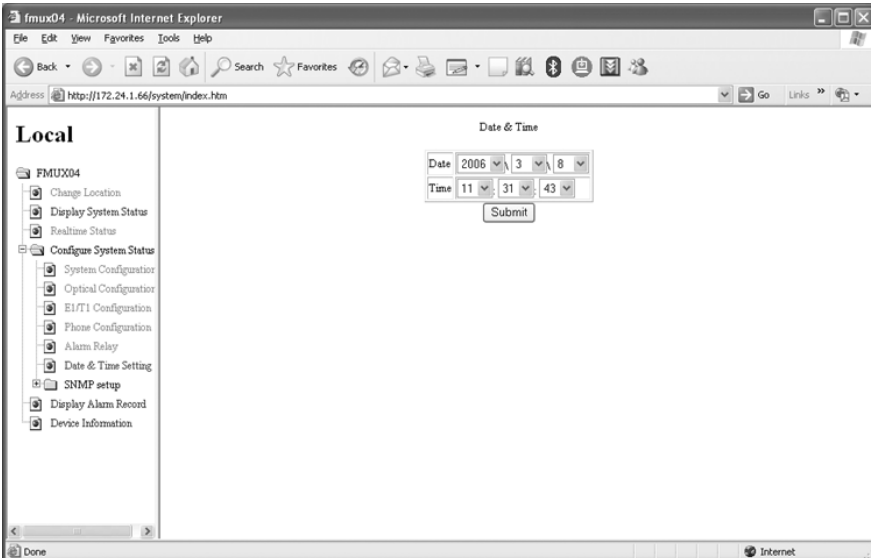
4.8.9 Alarm Configuration

The Alarm Relay page allows enabling or disabling the alarm relay function. (refer to 3.5.2.5)



4.8.10 Date & Time

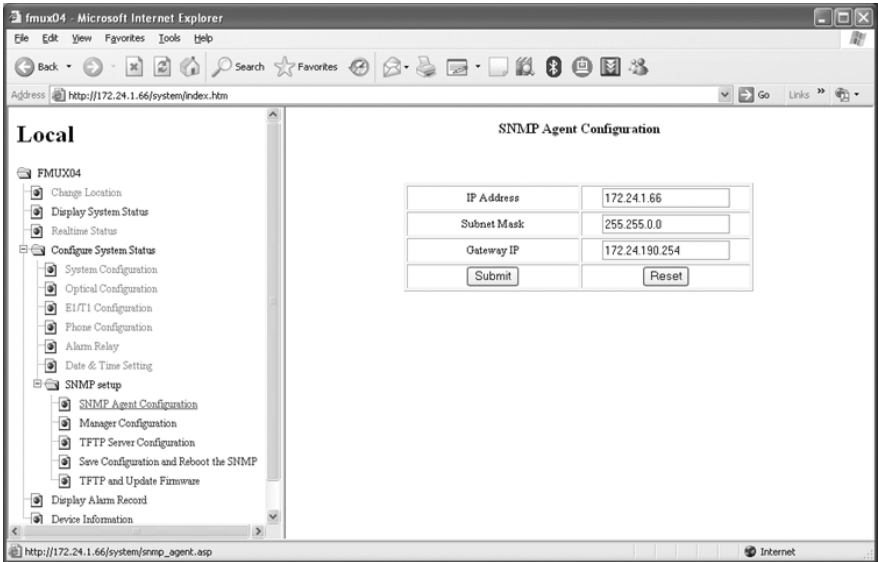
The Date & Time page allow setting the real time clock. The clock is used for timestamping alarm and performance data. (refer to 3.5.2.6)



4.8.11 SNMP Setup

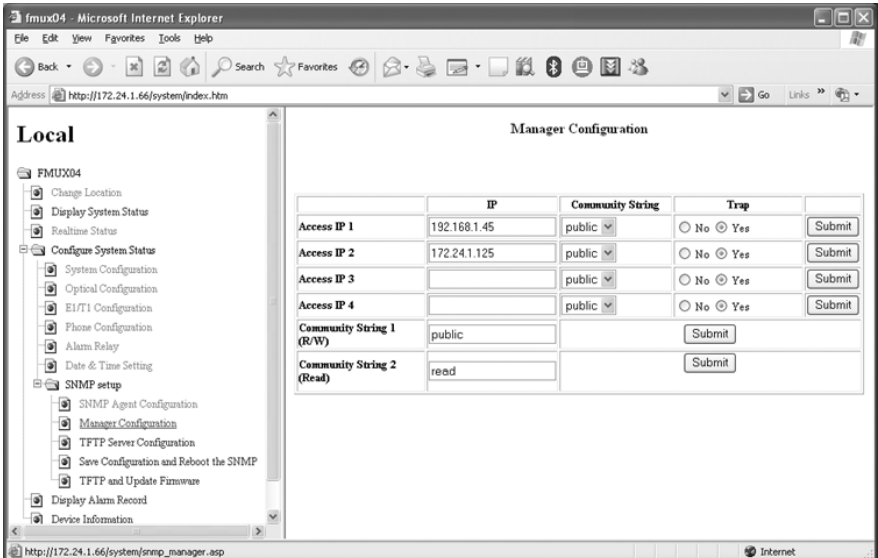
4.8.11.1 SNMP Agent Configuration

Configures the agent IP, subnet mask and default gateway. (refer to 4.6.1)



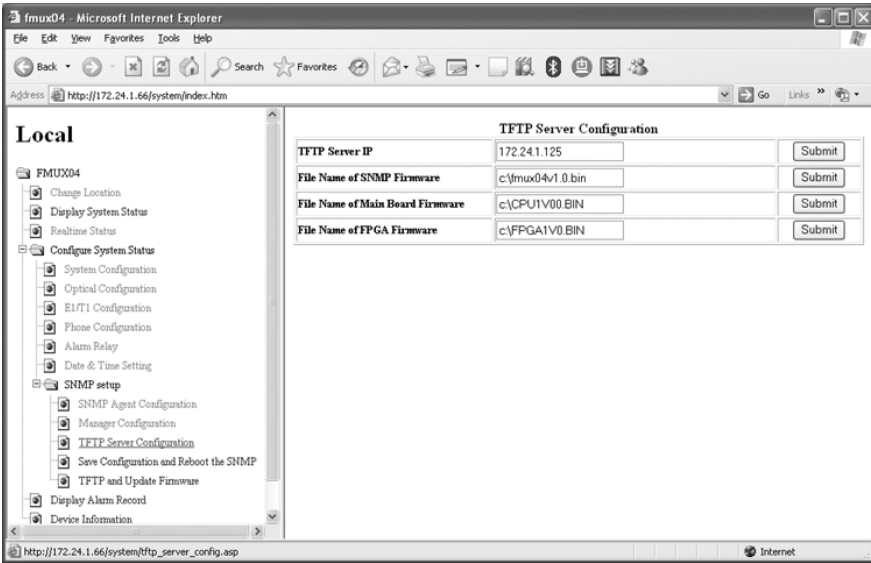
4.8.11.2 Manager Configuration

Configures the information for up to 4 management workstations, plus the community strings.



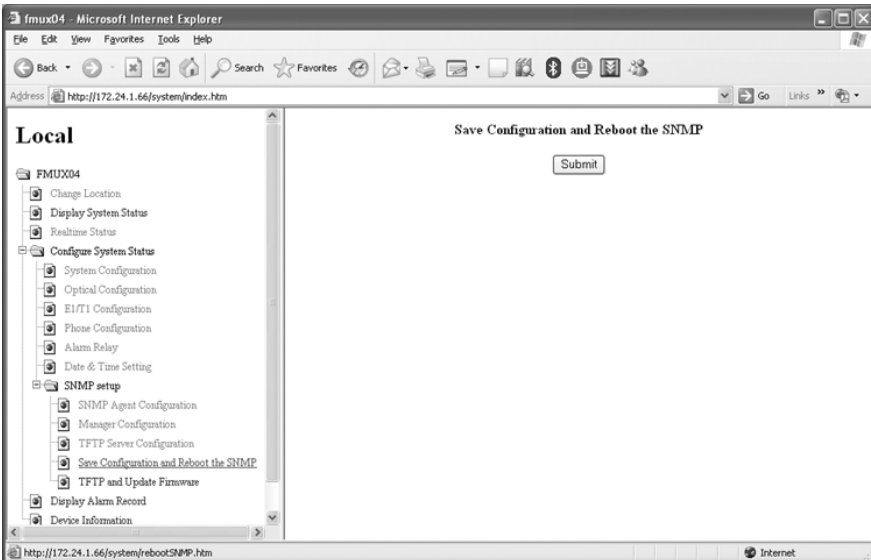
4.8.11.3 TFTP Server Configuration

Configures the SNMP card for TFTP upgrade. (refer to 4.6.3)



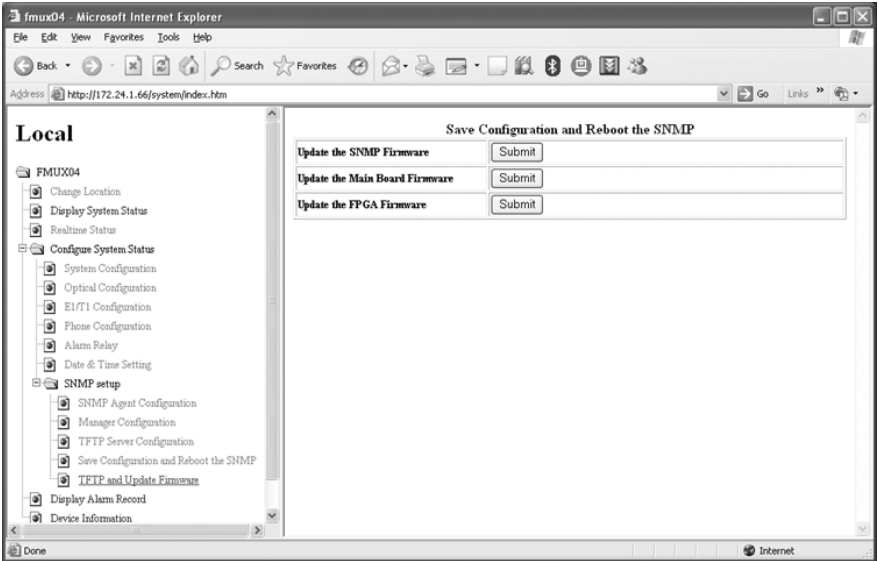
4.8.11.4 Save Configuration and Reboot

The Save Configuration page allows the settings to be written to non-volatile flash followed by rebooting of the SNMP agent. (refer to 4.6.4)



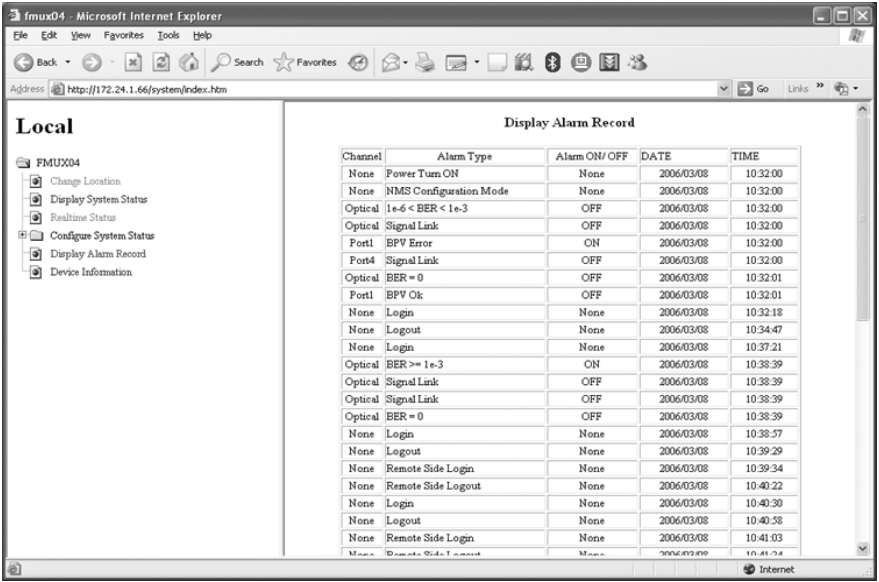
4.8.11.5 TFTP and Upgrade Firmware

Once TFTP is properly configured, this page is used to execute the upgrade for SNMP, mainboard firmware or main unit FPGA firmware. (refer to 4.6.5)



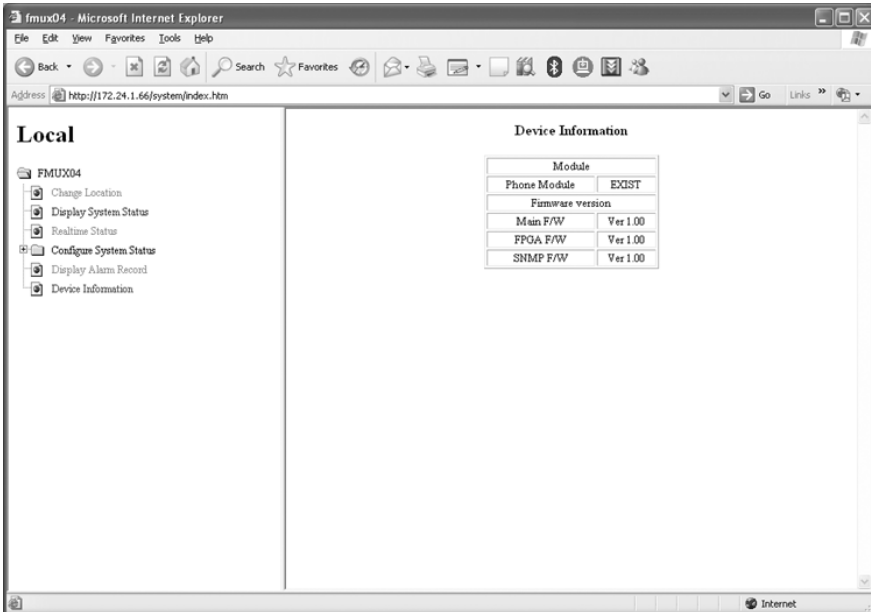
4.8.12 Display Alarm Status

This option page will display the contents of the alarm buffer, with newest entries at the bottom. (refer to 3.5.3)



4.8.13 Display Information

The Display Information page is where the current versions for main firmware, FPGA and SNMP can be displayed. (refer to 3.5.4)



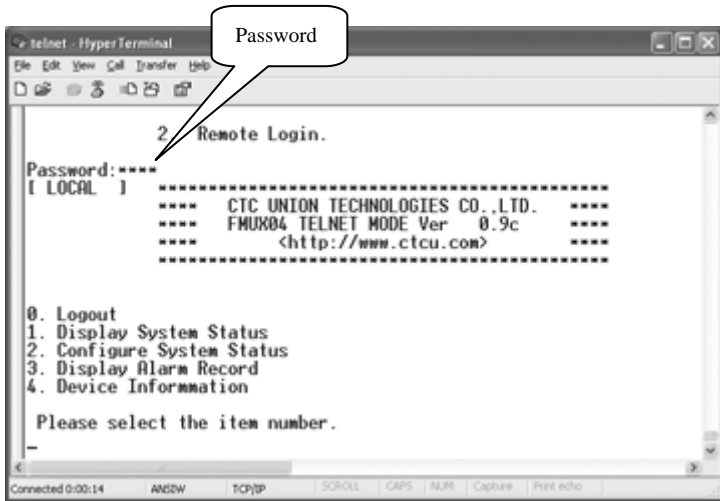
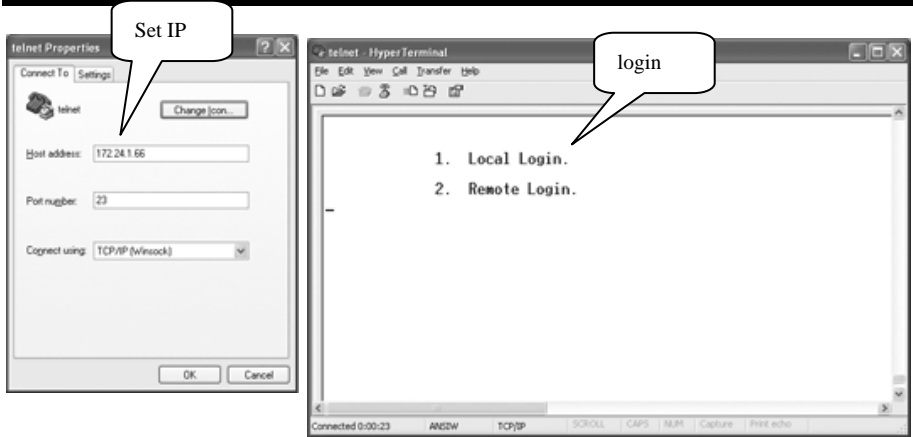
This completes the review of the Web based management features of the FMUX04.

4.9 Telnet Management

When the SNMP option is installed in the FMUX04, Telnet connection is available for console type management. Choosing a Telnet client is important to get the proper display from the SNMP agent. Clients that we have found work well are Telnet in command window for Win98, WinME, WinNT and Win2000. HyperTerminal in TCP/IP mode works well for all versions of Windows®.

Clients which we have found experience some difficulties with the agent are command mode Telnet in WinXP, Telnet from Linux or FreeBSD and Windows packages such as Putty. In command mode of WinXP, the terminal characters are echoed locally on screen, including the password as it is typed. In Linux, FreeBSD, and Putty, an Enter key must be pressed after every single keystroke, and again the characters are echoed.

When setting up HyperTerminal for Telnet, choose the connection as 'Winsock' or 'TCP/IP', and then connect with the agent's IP address. The following page has a screen capture of Telnet session in HyperTerminal.



The above examples are Telnet using Windows HyperTerminal utility. The screen displays in Telnet are the same as those from local console (RS-232) connection. (Please refer to 3.3 Terminal mode for operation details)

Appendix A. Miscellaneous

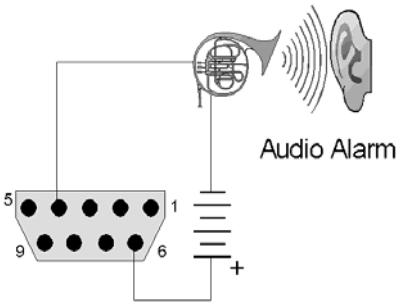
A.1 Console port pin assignment

The console port on the FMUX04 serves two purposes; it provides the RS-232 communication interface for terminal configuration and also contains one set of relay contacts for alarm.

Pin	Signal	Description	Direction	Remark
1				
2	TD	Transmit Data	IN	Towards FMUX04
3	RD	Receive Data	OUT	From FMUX04
4	NO	Relay Normally open		Closed if power fail
5	SG	Signal Ground		
6	COM	Relay Common		
7	CTS	Clear To Send	OUT	From FMUX04
8	RTS	Request To Send	IN	Towards FMUX04
9	NC	Relay Normally closed		Closed if no alarm

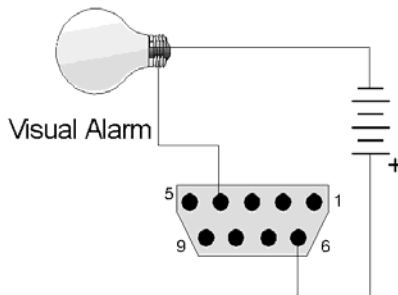
A.2 Alarm Relay Connection Detail

The following are examples of wiring audio or visual alarms to the console/alarm relay DB9F connector.



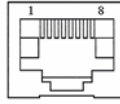
Contact Ratings:

- 1A @ 30VDC
- 0.5A @ 125VAC
- 0.25A @ 250VAC
- 500VAC Max.



A.6 SNMP RJ-45 pin assignment

Pin	Signal	Description
1	TX+	Transmit (+)*
2	TX-	Transmit (-)*
3	RX+	Receive (+)*
4	NC	No connection
5	NC	No connection
6	RX-	Receive (-)*
7	NC	No connection
8	NC	No connection



(standard Ethernet connection) *The Ethernet interface actually supports auto-MDIX and auto polarity.

A.7 SNMP Trap Messages and Alarms

Trap Code	Description	Alarm
00	Alarm Buffer Overflow	
01	System Fail	ON
02	Power Turn ON	
03	DIP Sw. Configuration Mode	
04	NMS Configuration Mode	
05	Login	
06	Logout	
07	Remote Side Login	
08	Remote Side Logout	
09	Auto Logout	
10	Signal Loss	ON
11	Signal Link	
12	FEF Signal Loss	ON
13	FEF Signal Link	
14	BPV Error	ON
15	BPV Ok	
16	Loopback ON	
17	Loopback OFF	
18	BER = 0	
19	$0 < \text{BER} < 1\text{e-}6$	
20	$1\text{e-}6 \leq \text{BER} < 1\text{e-}3$	
21	$\text{BER} \geq 1\text{e-}3$	ON
22	Phone Enabled	
23	Phone Disabled	

A.8 SNMP Object Details

Path=iso.org.dod.private.enterprise.ctc.fmux04.local

Object Identifier	Object Type	stat	Parameters
Local_system_Configuration			
	local_save_User_Setting	RW	0 - disable 1 - enable
	local_load_User_Setting	RW	0 - disable 1 - enable
	local_load_Default_Setting	RW	0 - disable 1 - enable
	local_load_snmp_Default_Setting	RW	0 - disable 1 - enable
	local_clear_Alarm_Record	RW	0 - disable 1 - enable
local_optical_Configuration			
	Local_loopback*	RW remote RO	0 -off 1 - Local_Loopback 2 - Remote_Loopback 3 - Request_Remote_Loopback
	local_Far_End_Fault	RW	0 - disable 1 - enable
	local_clear_Bit_Error_Rate_Alarm	RW	0 - disable 1 - enable
	local_insert_Error_Bit	RW	0 - disable 1 - enable
local_e1_t1_Configuration			
	local_ch1_service (ch2~4)	RW	0 - off 1 - on
	local_ch1_linecode (ch2~4)	RW	0 - hdb3/b8zs 1 - ami
	local_ch1_loopback (ch2~4)	RW	0 -off 1 - Local_Loopback 2 - Remote_Loopback 3 - Request_Remote_Loopback
	local_ch1_elos (ch2~4)	RO	0 - normal 1 - loss
	local_ch1_bpv (ch2~4)	RO	0 - normal 1 - bpv_error
	local_termination_type	RO	0 - e1_75_bnc 1 - e1_120_rj45 2 - t1_100_rj45

Appendix A. Miscellaneous

Object Identifier	Object Type	stat	Parameters
local_phone_configuration		RW	0 - off 1 - on
local_alarm_relay		RW	0 - off 1 - on
local_Date_Time			
	local_Date	RW	YY/MM/DD
	local_Time	RW	hh:mm:ss
local_display_alarm_record			
local_alarm_record1 (2~100)			
	local_l_channel (2~100)	RO	0 - none 1 - port1 2 - port2 3 - port3 4 - port4 5 - optical 6 - phone
local_device_information			
	local_phone_module	RO	0 - not_exist 1 - exist
	local_main_version	RO	Octet string
	local_fpga_version	RO	Octet string
	local_snmp_version	RO	Octet string

Path=iso.org.dod.private.enterprise.ctc.fmux04.remote

The remote follows the same object structure as the local. Except * remote optical local loopback is RO (read only).



Fiber Converter Series

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