RLH
RLH Industries, Inc.

iMux Fiber Optic
Multiplexer System

User Guide

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1. Important Information

Intended Audience

This manual is intended for use by knowledgeable telco/network installation, operation and repair personnel. Every effort has been made to ensure the accuracy of the information in this manual is accurate. However, due to constant product improvement, specifications and information contained in this document are subject to change without notice. Please refer to the iMux User Guide for additional information.

Conventions

Symbols for notes, attention, and caution are used throughout this manual to provide readers with additional information, advice when special attention is needed, and caution to prevent injury or equipment damage.

i Notes: Helpful information to assist in installation or operation.

! Attention: information essential to installation or operation.

⚡ Caution: Important information that may result in equipment damage or injury if ignored.

General Safety Practices

The equipment discussed in this manual may require tools designed for the purpose being described. RLH recommends that installation and service personnel be familiar with the correct handling and use of any equipment used, and follow all safety precautions including the use of protective personal equipment as required.

Caution - Severe Shock Hazard

- Never install during a lightning storm or where unsafe high voltages are present.
- Active T1 lines carry high DC voltages up to 56V. Use caution when handling T1 wiring.

Laser Safety

- Radiation emitted by laser devices is dangerous to to human eyes.
- Avoid eye exposure to direct or indirect radiation.
- Do not operate without fiber cable attached or dust caps installed.

2. Introduction

Product Description

The iMux is a powerful fiber optic modular multiplexer capable of providing up to 16 channels of T1, RS232, 4 wire data and analog phone FXO/FXS services, plus four built-in 10/100 Ethernet ports, over a single fiber.

These services are supplied by the modules, up to four, that each offer four lines of communication and may be installed in any combination. Spares or add-on modules may be ordered separately and are field installable. The optical modules are available in both dual fiber and single bi-directional fiber (WDM), and up to 2 optical modules may be installed, providing 1+1 hot-swappable optical protection and making the best use of fiber availability.

The iMux may be managed through SNMP, web Interface, craft port or LCD/menu keys on the front panel. It also has an external alarm port for alarm input monitoring, as well as 4 programmable alarm contacts. The system provides local/remote loopback functions that are ideal for network testing and maintenance. The iMux takes up 1RU and comes complete with EIA19" and 23" rack ears, or it may be used on a desktop or shelf.

Standard Features

- Multiplexes up to 16 voice and data channels plus Ethernet over a single fiber

- Up to 4 modules (each with 4 lines) may be used in any combination to mix and match services

- Convenient front LED status indicators

- T1, RS-232, POTS, & 4 Wire Data service modules

- 4 built-in 10/100 Ethernet ports

- Aggregated Ethernet throughput up to 100Mbps

- Optical module auto laser shutdown (ALS), hot swappable 1+1 protection

- Alarm relay has major and minor alarms (audible and visible alarm output)

- Supports SNMP , HTTP / FTP / TFTP remote software upgradeable

- Supports TELNET function to configure and monitor local and remote devices through TCP/IP network

- Available with ringdown circuit operation

- Redundant 48VDC or AC/DC powering options

Application Diagrams
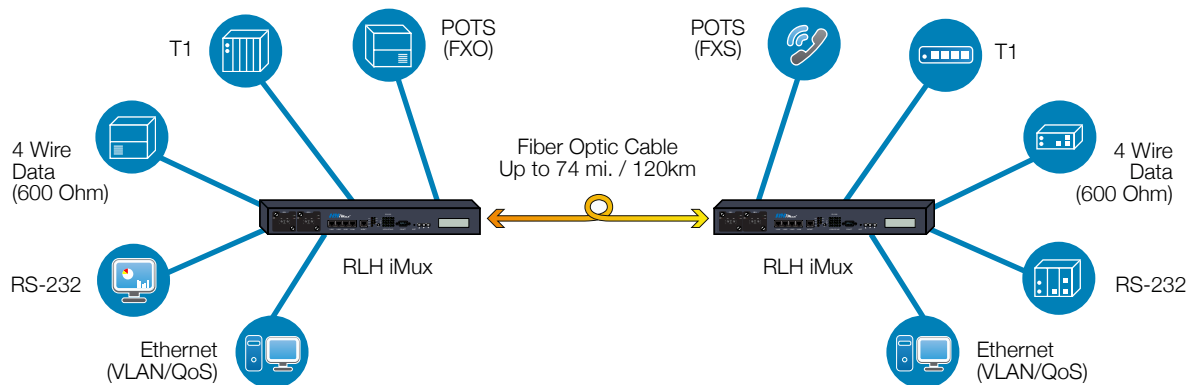
Multiple Service Example

T1

POTS (FXO)

POTS (FXS)

T1

4 Wire Data (600 Ohm)

RS-232

RLH iMux

Fiber Optic Cable Up to 74 mi. / 120km

RLH iMux

4 Wire Data (600 Ohm)

RS-232

Ethernet (VLAN/QoS)

Ethernet (VLAN/QoS)

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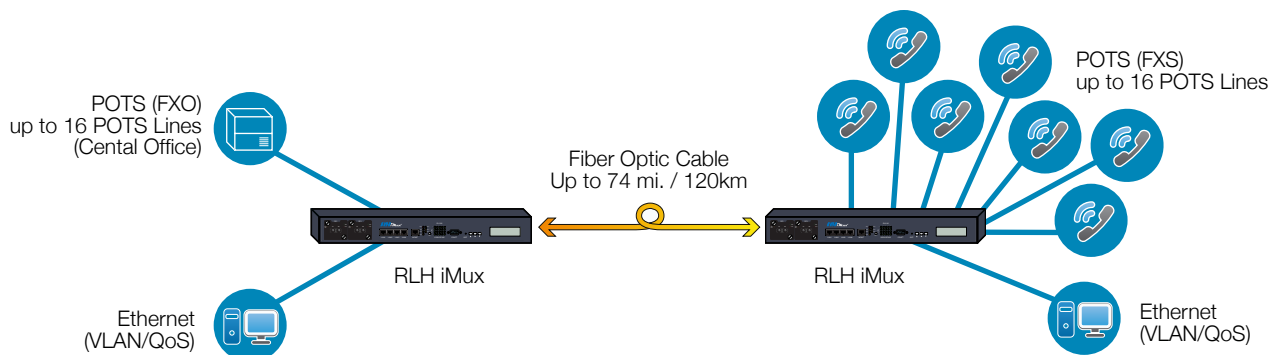
16 Channels of POTS Example

POTS (FXO) up to 16 POTS Lines (Cental Office)

Fiber Optic Cable Up to 74 mi. / 120km

POTS (FXS) up to 16 POTS Lines

RLH iMux

RLH iMux

Ethernet (VLAN/QoS)

Ethernet (VLAN/QoS)

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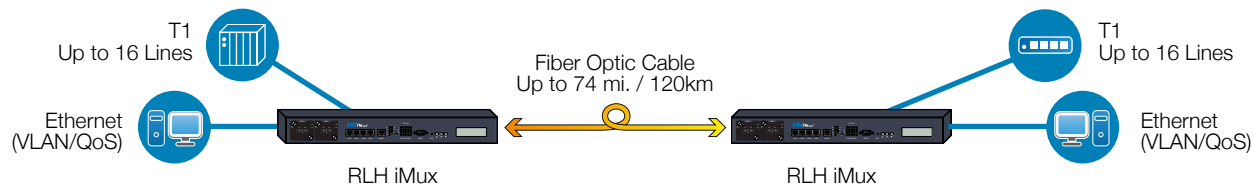
16 Channels of T1 Example

T1 Up to 16 Lines

Ethernet (VLAN/QoS)

RLH iMux

Fiber Optic Cable Up to 74 mi. / 120km

RLH iMux

T1 Up to 16 Lines

Ethernet (VLAN/QoS)
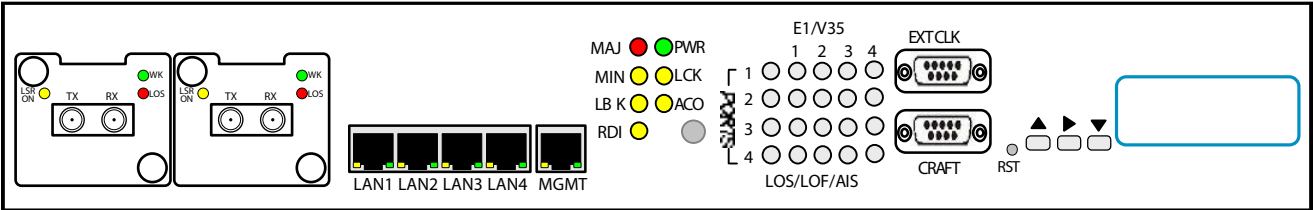
Front Panel

Front Panel LEDs

LED	Color	Name	ON condition	OFF condition
MAJ	RED	Major Alarm	Major alarm event is present and being signaled through rear panel alarm connector.	Normal operation
MIN	YEL	Minor Alarm	Minor alarm event is present and being signaled through rear panel alarm connector.	Normal operation
LBK	YEL	Loopback	E1 loopback signal received	Normal operation
RDI	YEL	Remote Defect Indication	Indicates a failure in the remote terminal.	Normal operation
PWR	GRN	Power	iMux is powered and ON	iMux is powered OFF, or no power is present
LCK	YEL	Optical Link Lock	The optical link is locked because it has switched to protect line mode.	Normal operation
ACO	YEL	Alarm Cut Off	Normal operation	ACO Button has been pressed. See note below.

Note: ACO Button and LED operation.

The ACO button mutes the audible alarm when a problem occurs. When the button is pressed the ACO LED illuminates. If any newer alarm is reposted after the ACP button has been pressed, the external alarm will activate again

Module Status LEDs
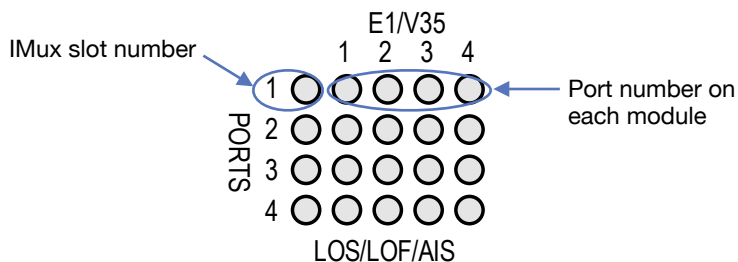
LED	Name	Color	Condition
PORT	Installed port slot	RED	No module is installed at this port number
		GRN	A module is installed at this port number
E1/V35	Module port status for any installed module	RED	No connection is detected to that port
		GRN	Active connection is attached to that module port

Note: Although the port status LEDs are labeled E1/V35, they will display the status of any module installed except the analog phone (POTS) modules. The phone module does not display connections made to each port on the module and the LEDs for those modules only will be GRN when off-hook and RED when ringing.

LAN/MGMT Port LEDs

LED	Name	Color	ON condition	OFF condition
LAN 1 ~ LAN 4	LAN port activity	YEL	Data is being received	No data is being received
		GRN	Data is being sent	No data is being sent
MGMT	SNMP management port activity	YEL	Data is being received	No data is being received
		GRN	Data is being sent	No data is being sent

Optical Module LEDs

LED	Name	Color	ON condition	OFF condition
LSR	Laser	YEL	Laser condition is OK	Laser not operating
WK	Working	GRN	Activity over fiber	No activity over fiber
LOS	Loss of Signal	RED	Loss of fiber signal	Normal operation

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Rear Panel

Any of the modules may be plugged into any position, called a Tributary Slot. These are referred to as TB1~TB4.

Refer to the Specifications section for additional information.
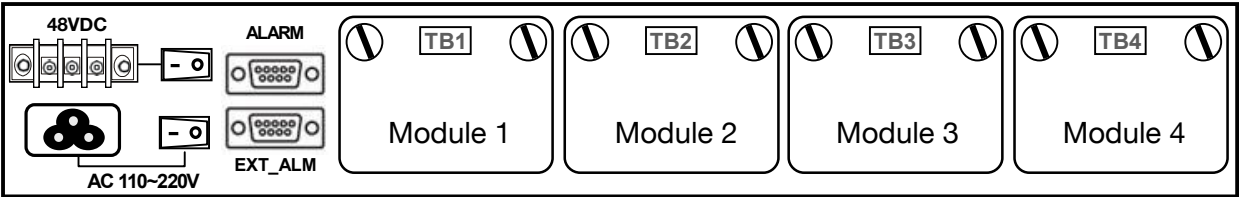
4 Channel E1 Module

The E1 module has four (4) RJ-45 connectors for input/output of four (4) individual channels of E1 signal at 120Ω.

PIN 1 ⌐   ⌐ PIN 8
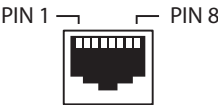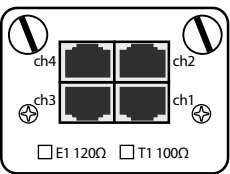
Pin	Name	Description
1	Rx Ring	
2	Rx Tip	Input to E1 Card
3	NC	
4	Tx Ring	
5	Tx Tip	Output from E1 Card
6	NC	
7	NC	
8	NC	

4 Channel T1 Module

The T1 module has four (4) RJ-45 connectors for input/output of four (4) individual channels of T1 signal at 100Ω.

PIN 1 ⌐   ⌐ PIN 8
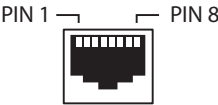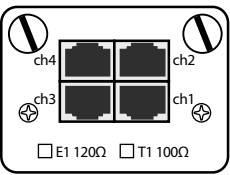
Pin	Name	Description
1	Rx Ring	
2	Rx Tip	Input to T1 Card
3	NC	
4	Tx Ring	
5	Tx Tip	Output from T1 Card
6	NC	
7	NC	
8	NC	

4 Channel RS-232 Module

The RS-232 module interface is a HD68 connector with a breakout cable to four (4) DB-9 connectors.
Breakout adapter cable is included with module.
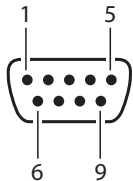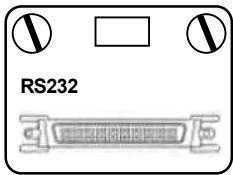
DB-9 Female DCE		
Pin	Description	I/O
1	DCD	Output
2	TXD	Output
3	RXD	Input
4	DTR	Output
5	SG	GND
6	DSR	Input
7	RTS	Output
8	CTS	Input
9	RI	Output

4 Channel V.35 Module
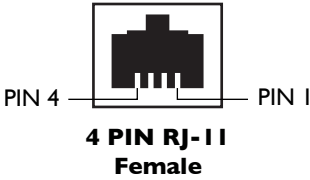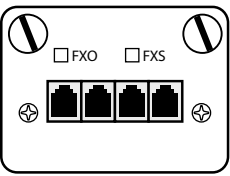
The V35 module interface is a HD68 connector with a breakout cable to four (4) M34 connectors.
Breakout adapter cable is included with module.
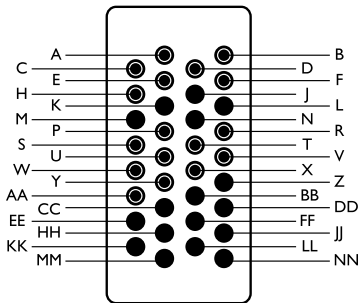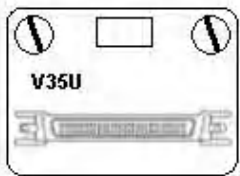
M/34 Female DCE					
Pin	Signal	Description	Pin	Signal	Description
A	Chassis Ground	-	V	Receive Timing A	Out
B	Signal Ground	-	W	Terminal Timing B	In
C	Request to Send	In	X	Receive Timing B	Out
D	Clear to Send	Out	Y	Send Timing A	Out
E	Data Set Ready	Out	Z	N/A	-
F	Data Carrier Detect	Out	AA	Send Timing B	Out
H	Data Terminal Ready	In	BB	N/A	-
J	Local Loop Back	Out	CC	N/A	-
K	Local Test	In	DD	N/A	-
L	N/A	-	EE	N/A	-
M	N/A	-	FF	N/A	-
N	N/A	-	HH	N/A	-
P	Send Data A	In	JJ	N/A	-
R	Receive Data A	Out	KK	N/A	-
S	Send Data B	In	LL	N/A	-
T	Receive Data B	Out	MM	N/A	-
U	Terminal Timing A	In	NN	N/A	-

4 Channel Analog Phone (POTS) Modules

The analog phone module has four (4) RJ-11 connectors and are supplied as FXS/Sub side and FXO/CO side modules. The FXO/CO module is connected to a central office or PBX, and the FXS/Sub module is connected to the customer telephone. The line number on one end of operation raises the same line number on the connected FXO/FXS module. For ringdown operation, a FXS/Sub module is required on each end to provide telephone lines on both ends of the system.

PIN 4 ——— PIN 1

4 PIN RJ-11 Female

Analog Channel	Pin	Description
Analog Voice	3	Tip
	2	Ring

Analog Phone FXO Module

Analog Phone FXS Module

Fiber Optic Cable

POTS

iMux

POTS

iMux

PSTN or PABX (Central Office) Analog Phone Lines

1
2
3
4

1
2
3
4

Analog Phones

4 Channel Analog Phone Module Connection Diagram

Analog Phone FXS Module

Analog Phone FXS Module

Fiber Optic Cable

POTS

iMux

POTS

iMux

Analog Phones

1
2
3
4

1
2
3
4

Analog Phones

4 Channel Analog Phone Module Ringdown Connection Diagram
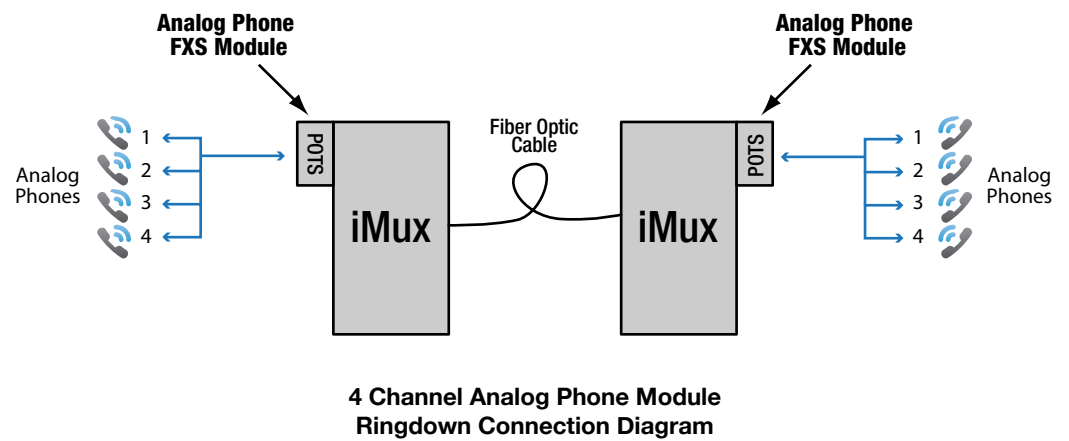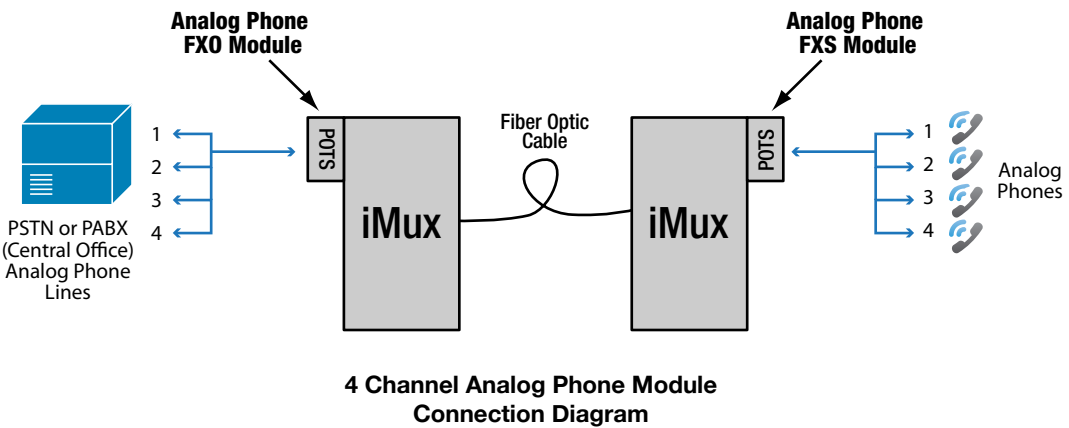
4 Channel 4 Wire Analog Data (600 Ohm Audio) Module

The 4 Wire Analog Data (600 Ohm Audio) module has RJ-11 connectors providing four individual channels of service. Each channel has 300Hz ~ 3.4kHz bandwidth.
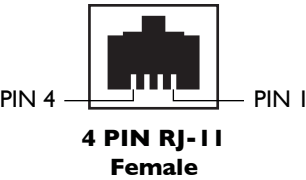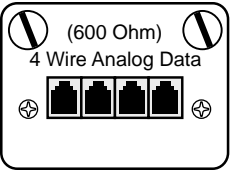
Analog Channel	Pin	Description
Input	1	Tip
	4	Ring
Output	2	Tip
	3	Ring

4 Channel 4 Wire Analog Data E&M (600 Ohms Audio) Module

The 4 Wire Analog Data E&M (600 Ohm Audio) module has RJ-45 connectors providing four individual channels of service. Each channel has 300Hz ~ 3.4kHz bandwidth. E&M type is set in software.

Master and Slave settings are set using the jumper and DIP switches on the module itself. Refer to the following pages.
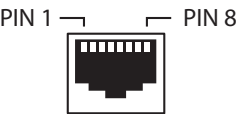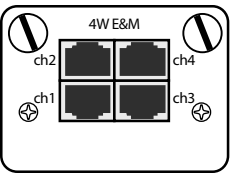
Pin	Name	Description
1	NC	NC
2	Rx Tip	Input
3	Rx Ring	Input
4	Tx Ring	Output
5	Tx Tip	Output
6	M	M Lead
7	E	E Lead
8	GND	Signal Ground

Refer to the sample E&M setting and application diagrams on the following pages.

Setting E&M Jumpers and Switches

Use the J2 jumper and the J4 DIP switches to set the E&M module mode to Master or Slave depending on the placement of the iMux in the network. The diagram on the following pages will help you determine the correct settings for your application.

Refer to the diagram below for configuration settings.

E&M Module Card
Removed from Tributary Slot

J2 Jumper

Jumper Block
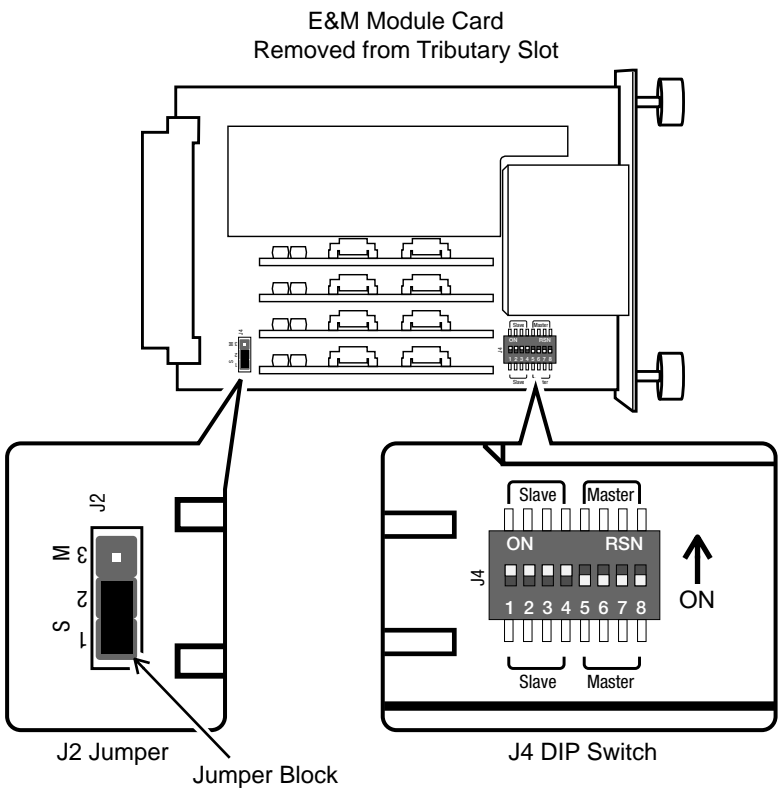
J4 DIP Switch

Mode	J2 Jumper
Slave	Jumper Pins 1 & 2
Master	Jumper Pins 2 & 3

Mode	J4 DIP Switch Setting	
Slave	Switches 1~4 ON	Switches 5~8 OFF
Master	Switches 5~8 ON	Switches 1~4 OFF

E&M module Master and Slave settings

PBX

Analog E&M
4-Wire Audio Operation

Tie-Line
Cisco Equipment

Slave
4 Wire E&M Card

Master
4 Wire E&M Card

PBX

Fiber Optic
Cable

iMux

iMux

Tie-Line
Cisco Equipment

(-48V)

(-48V)

E&M

E&M

On-hook

On-hook

-48V

detect

E

E

Off-hook

-48V

detect

E

E

Off-hook

Off-hook

Off-hook

-48V

ptc

M

M

detect

-48V

ptc

M

M

detect

On-hook

GND

On-hook

GND

4-Wire
Audio

T

T

T

T

4-Wire
Audio

R

R

R

R

T1

T1

T1

T1

4-Wire
Audio

R1

R1

R1

R1

4-Wire
Audio

Trunk Circuit

Signalling Unit

Signalling Unit

Trunk Circuit

4 Wire E&M Card - Slave

4 Wire E&M Card - Master

E&M Application Diagram

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Introduction

Acronyms

Commonly used acronyms and abbreviations

Acronym/Abbreviation	Description
B8ZS	Bipolar 8 Zero Substitution
FXO/CO	Central Office Side Equipment
FXS/Sub	Subscriber side equipment
LED	Light Emitting Diode
RX	Receive
TX	Transmit
RED	Red LED color
YEL	Yellow LED color
GRN	Green LED color

3. Before Installing

Observe Special Handling Requirements

Be careful when handling electronic components

	ATTENTION
	ELECTROSTATIC SENSITIVE DEVICES
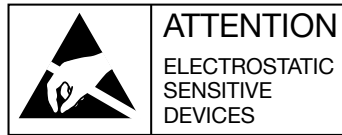
- This product contains static sensitive components.
- Handle the service port and optical modules by their faceplates only.
- Follow proper electrostatic discharge procedures.

This product utilizes component circuitry that can be damaged by static electricity. When transporting service or optical modules, use an ESD safe container such as the antistatic bag provided with the module. Before handling modules, discharge yourself of static electricity by physical bodily contact with earth ground. When handling modules, handle by the faceplate and avoid touching circuitry. Failure to follow ESD precautions may cause serious damage to modules and prevent proper operation.

Guidelines for handling terminated fiber cable
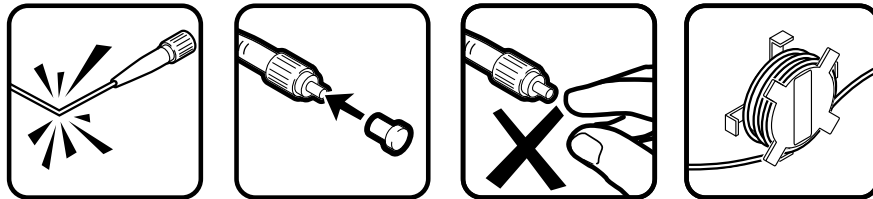
- Do not bend fiber cable sharply. Use gradual and smooth bends to avoid damaging glass fiber.
- Keep dust caps on fiber optic connectors at all times when disconnected.
- Do not remove dust caps from unused fiber.
- Keep fiber ends and fiber connectors clean and free from dust, dirt and debris. Contamination will cause signal loss.
- Do not touch fiber ends.
- Store excess fiber on fiber spools at site to avoid damage

Prepare for Installation

Check for shipping damage

Carefully unpack and inspect the unit and accessories. Contact RLH immediately if any components are damaged or missing. Electronic components, fiber optic cable, and accessories have special handling requirements to prevent damage and enhance system reliability.

If the iMux will be relocated in the future, save the cartons and protective packaging material.
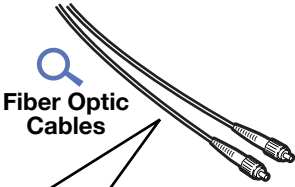
Verify system contents

The following items are shipped with your iMux system (as applicable)

- User manual CD and Quick Start Guide
- AC power converter and cord
- RS-232 DB9 breakout adapter cable

Verify matching optical module and fiber modes

Fiber mode and optical module mode must be the same.

**Fiber Optic
Cables**

Fiber Type	Color	Identifier
Single Mode	Yellow	9/125μm
Multimode	Orange	50 /125μm, 62.5/125μm

Site Requirements

Site selection

Locate the iMux to allow easy access to the equipment. Leave at least 36 inches (90 cm) clearance in the front and at least 4 inches (10.2 cm) at the rear.

To avoid overheating, do not block the cooling fan. Leave at least 1 inch (2.5 cm) clearance on either side of iMux. Do not stack other equipment directly on top of the iMux when rack or shelf mounting.

Typical application environments

Install the fiber optic cable prior to installing the iMux system.

Required power sources

You will need an acceptable power source. The iMux system accepts 90 ~ 240VAC (47Hz ~ 63Hz) and 48VDC (9 ~ 75VDC) depending on the model.

The F.C.C. requires telecommunication equipment to withstand electrical surge that may result from lighting strikes. This equipment has been tested and found to comply with the F.C.C. requirement. Users should follow the precautions below to insure the safety and minimize the risk of damage to the equipment

Make sure that the AC power outlet is properly grounded. Proper grounding should include a minimum of a grounded rod buried outside the building at least 8 feet (2.44 meters) deep.

Test Equipment

For T1 service

You will need a T1 analyzer such as a T-BERD.

Be familiar with the test settings. Some analyzers have line power and multimeter capability. For installation where no T-1 signal is available, the analyzer must be capable of generating a quasi-random T-1 signal.
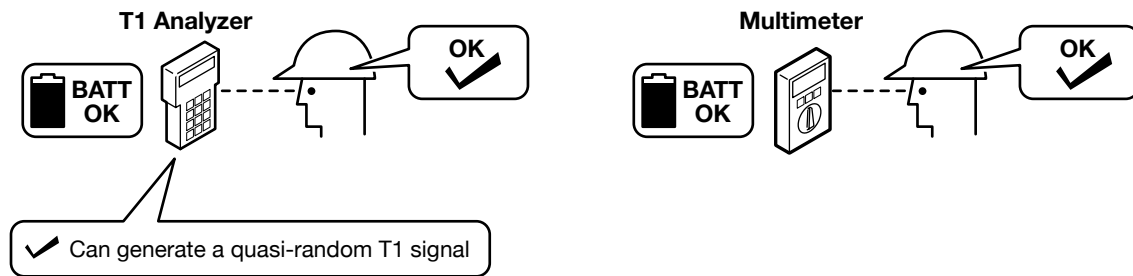
For analog phone service (POTS)

You will need a working POTS line or an analog phone signal generator.

For RS-232 service

You will need a working RS-232 interface data connection.

4. Quick Start

Easy Installation

Before starting

- Review the safety information in section **1. Important Information**
- Familiarize yourself with the iMux and it's modules as described in section **2. Introduction**
- Know how to handle fiber optic cable, have a suitable installation environment with the correct power, and have the necessary test equipment as described in section **3. Before Installing**

Install the iMux

The iMux is pre-configured at the factory for your particular requirements, and will operate without any setup. For additional configuration instructions please refer to the iMux User Guide.

- Mount the iMux in a 19" equipment rack, on a shelf or table
- Make sure the power switches are OFF

Connect power

For AC Power units

Remove power from AC mains supply. Connect the AC power cord to the terminals on the iMux and plug into 110/240VAC, 50/60Hz mains outlet.

- Alternately, wire AC mains power directly from AC power source

For DC Power supply

- Check that DC power source voltage matches voltage range of DC power input.
- Remove power from the DC power source prior to connecting to the iMux.
- Connect the DC power cables to the iMux. Check the positive and negative polarity of the connection.
- Energize the power source.

Connect fiber cables

- The fiber cable(s) must be the right type of cable, with the correct connectors and suitable length.
- Attach the connector(s) carefully using care to avoid bending the fiber cable too sharply and damaging the fiber.
- Do not touch fiber connector ends which could cause contamination and lower signal performance.

⚡ Caution

Radiation emitted by laser devices is dangerous to to human eyes. Avoid eye exposure to direct or indirect radiation. Do not operate without fiber cable attached.

Connect ethernet cables

- Attach ethernet cables to the RJ-45 ethernet ports labeled LAN1 through LAN4 on the front panel of the iMux.

Connect data/phone equipment

Attach equipment directly to the service port modules or use the provided breakout cable depending on you iMux module configuration.

Connect T1 cables

- Attach T1 cables directly to the RJ45 connectors on the T1 module.

Connect Analog Phone (POTS) FXO/FXS cables

- Attach the phone cables directly to the RJ-11 connectors on the analog phone module.

Attach RS-232 Data Cables

- Attach the breakout adapter cable to the connector on the RS-232 module.
- Connect the RS-232 data connectors to the DB-9 connectors on the breakout adapter cable.

Attach 4 Wire Analog Data (600 Ohm) Cables

- Attach cables directly to the RJ-11 connectors on the 4 Wire Analog Data module.

Refer to the **2. Introduction** section for pin out and port configuration information.

Start the system

Turn each iMux ON using the power switch on the rear panel. The system will initialize and start up. The LED indicators on the front panel will flash during initializing and stop flashing after setup is done. The iMux is now operational and may be configured as desired.

Refer to the iMux User Guide for additional configuration information.

5. Configuring the System

Management Interface

Using the VT-100 port

Any PC with an operating system that supports the VT-100 Craft Port can be used as a console. The following instructions utilize the VT-100 Craft Port on a PC running Windows 98/2000/NT.

1. Use the supplied RS-232 cable and connect the console port to the COM port of the console PC.
2. Use a telnet program such as Windows Hyper Terminal to perform the console management operations.
    Note: Other telnet client software such as NetTerm© may also be used, and may offer additional features such as function key support to help with setup.
3. VT-100 terminal settings:

Bit Rate	57600 bps
Data Bit	8 bits
Parity	No Parity
Stop Bit	1 Stop bit
Flow Control	None
Set the emulation mode to"VT-100" or "Auto Detect"	

Startup loading screen

When first connecting to iMux, the loading screen will be displayed. The loading screen permits the user to start the iMux into a particular operating mode, or return to factory profiles.

Select a Startup Profile

There are four selectable profiles. The pre-configured factory settings has been created and saved in **Profile I** and **Profile II**. The default booting process will select Profile I.

Profile Factory Default has all settings cleared, and an IP address of 0.0.0.0.

Profile factory default (IP Address: 192.168.0.1) is clear of all settings but retains the IP 192.168.0.1 address so that the user may simply connect and manage the iMux through the web interface (MGMT port) on the front panel.
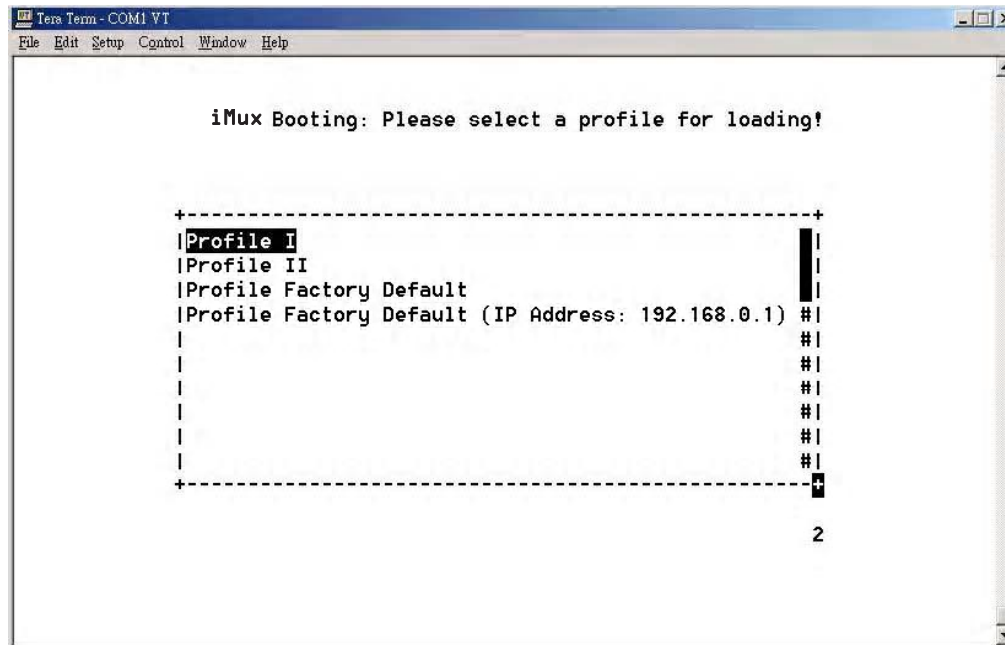
Startup Loading Screen

Once a mode has been selected, the system continues the startup procedure utilizing the built in self-diagnostic function during the boot procedure. The self-diagnostic function includes system memory access test, system main clock test and tributary card access test.
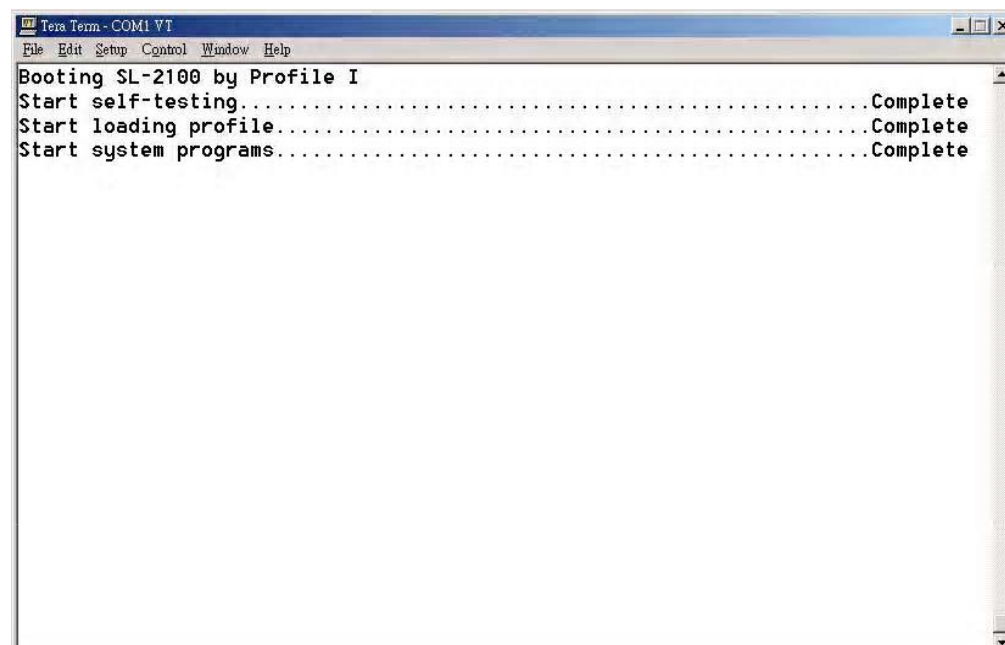
Self-diagnostic Screen

After the system test is complete, the login screen appears. Unless previously changed, enter the default User Name and User Password.

- Default User Name: **admin**
- Default Password: **1234**

Login Screen

Once login information has been entered, the main menu screen appears.

Main Menu

Any changes that are made and saved will modify the current Startup Profile except for the Profile Factory Defaults.

Show System Name   Current Location

```
Tera Term - COM1 VT
File  Edit  Setup  Control  Window  Help

System Name:                                                    Main Menu

                [F1]
                +---------------------------------------------------------+
                |[1] System Configuration                              █|
                |[2] Tributary Slot Parameters Configuration           #|
                |[3] Optical Interface Parameters Configuration        #|
                |[4] Trunk Ethernet Parameters Configuration           #|
                |[5] Data Port Parameters Configuration                #|
                |[6] Performance Management Threshold Configuration    #|
                |[7] Fault Management Parameters Configuration         #|
                |[8] External Clock Configuration and Monitoring       #|
                |[9] OE Protection Switching                           #|
                |[a] Equipment Status Monitoring                       #|
                |[b] Performance Monitoring                            #|
                |[c] Path Alarm/State Monitoring                       #|
                |[d] Loopback/V.54 Testing                             #|
                |[e] PRBS Testing                                      #|
                |[f] Event Browsing                                    #|
                +---------------------------------------------------------+
                +---------------------------------------------------------+
                |    Next[F2]          Help[F3]          Logout[F4]    |
                +---------------------------------------------------------+
```

Access items faster by using the function keys. Pressing `[F3]` brings up the online help and has definitions of the function keys.

Main Menu

After entering the main menu, the user may select any one of the nine configuration screens or six testing/monitoring screens

Configuration Screens

1. System Configuration

2. Tributary Slot Parameters Configuration

3. Optical Interface Parameters Configuration

4. Trunk Ethernet Parameters Configuration

5. Data Port Parameters Configuration

6. Performance Management Threshold Configuration

7. Fault Management Parameters Configuration

8. External Clock Configuration and Monitoring

9. OE Protection Switching

Testing/Monitoring Screens

j.   Equipment Status Monitoring

k.   Performance Monitoring

l.   Path Alarm/State Monitoring

m.   Loopback/V.54 Testing

n.   PRBS Testing

o.   Event Browsing

System Configuration

Either the local or remote iMux units may be selected for configuring. Select the **Local[F2]** or **Remote[F3]** units by using the function keys prior to making any other menu selections.

i   Each subsequent menu will display which unit (local or remote) you are changing settings on.
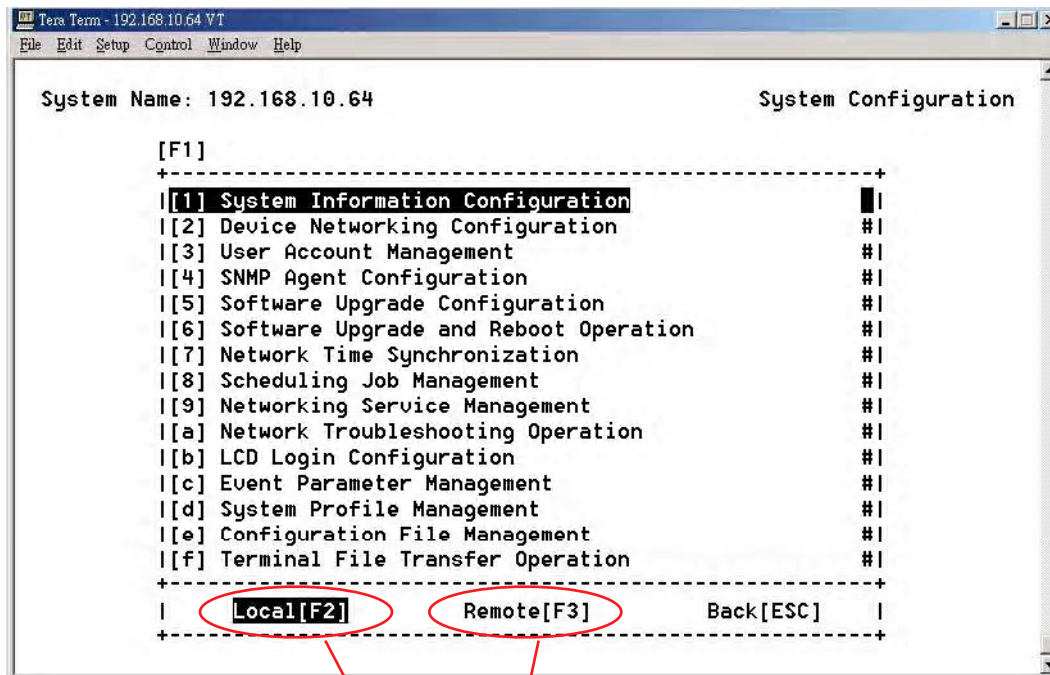
Choose either the local or remote unit for configuration before making changes.

System Configuration Screen

Use the **up** or **down** key to select any of the menu items, or press **[F1]** function key to go to that section, or **[ESC]** to return to the previous menu. Detail descriptions of each item will be covered in the following sections.

System Information Configuration

```
Tera Term - COM1 VT                                                    _ □ ×
File  Edit  Setup  Control  Window  Help

 System Name:                              System Information Configuration


        Site: Local

        [F1] System Name     : █_____

        [F3] System Location : _____

        [F4] System Contact  : _____

        [F5] System Clock    : 2000_ /2__ /3__  0__ :38_ :41_

             System Up Time  :     0 days, 00 :13 :34

             Software Version: 1.0.Beta1



        +--------------------------------------------------------+
        |       Confirm[F2]                    Back[ESC]         |
        +--------------------------------------------------------+
```

Note: This shows the local or remote device you are configuring.

System Information Configuration Screen

The system administrator can enter the system name the location of the system, and the contact person. Entries must be 256 characters or less.

Set the system clock by entering the correct time. This screen shows the running time of the system and the software version.

After making any changes, press `Confirm[F2]` to save them. Returning to the System Configuration menu by pressing `Back[ESC]` without saving first will discard any changes.

Device Networking Configuration

```
Tera Term - 192.168.10.64 VT                                          _ |□| x|
File  Edit  Setup  Control  Window  Help

  System Name: 192.168.10.64                  Device Networking Configuration

       Site: Local

       [F1] Device IP Address         : 192_ . 168_ . 10__ . 64__

       [F3] Device IP NetMask         : 255_ . 255_ . 255_ . 0___

       [F4] Default Gateway IP Address: 192_ . 168_ . 10__ . 1___

       Running IP Status:

              Mac Address              : 00.06.88.0F.5B.78

              Running IP Address       : 192.168.10.64

              Running IP NetMask       : 255.255.255.0

              Running Gateway IP Address: 192.168.10.1

       +----------------------------------------------------------+
       |    Confirm[F2]        Set Only[F5]        Back[ESC]   |
       +----------------------------------------------------------+
```

Device Networking Configuration Screen

Setting the device IP

You can set the device IP of the front panel MGMT port in this screen. The MGMT port IP address is static, so make sure there isn't a conflict on your network prior to confirming the settings.

Press **Confirm[F2]** to execute your changes and direct the system to use those settings immediately. Your changes will now be reflected as the running IP status.

Press **Set Only[F5]** when making IP changes that will only be held in temporary memory, without committing the changes to the running IP. Press **Confirm[F5]** to commit your temporary settings as the running IP.

User Account Management

```
VT  Tera Term - COM4 VT                                          _ □ ×
File  Edit  Setup  Control  Window  Help
┌─────────────────────────────────────────────────────────────────┐ ▲
│                                                                   │
│   System Name:                           User Account Management  │
│                                                                   │
│   Site: Local                                                     │
│ +---------------------------------------------------------------+ │
│ |[F1] User Name      User Group      Auto-Logout secs   Enabled/Disabled | │
│ |       admin           Admin                    0               Enabled | │
│ |     operator         Control                   0              Disabled | │
│ |      monitor         Monitor                   0              Disabled | │
│ |                                                                      | │
│ |                                                                    #| │
│ |                                                                    #| │
│ |                                                                    #| │
│ |                                                                    #| │
│ |                                                                    #| │
│ |                                                                    #| │
│ |                                                                    #| │
│ +---------------------------------------------------------------+ │
│                                                                   │
│                                                                   │
│ +---------------------------------------------------------------+ │
│ |  Add[F2]         Delete[F3]        Edit[F4]        Back[ESC]   | │
│ +---------------------------------------------------------------+ │
└─────────────────────────────────────────────────────────────────┘ ▼
```
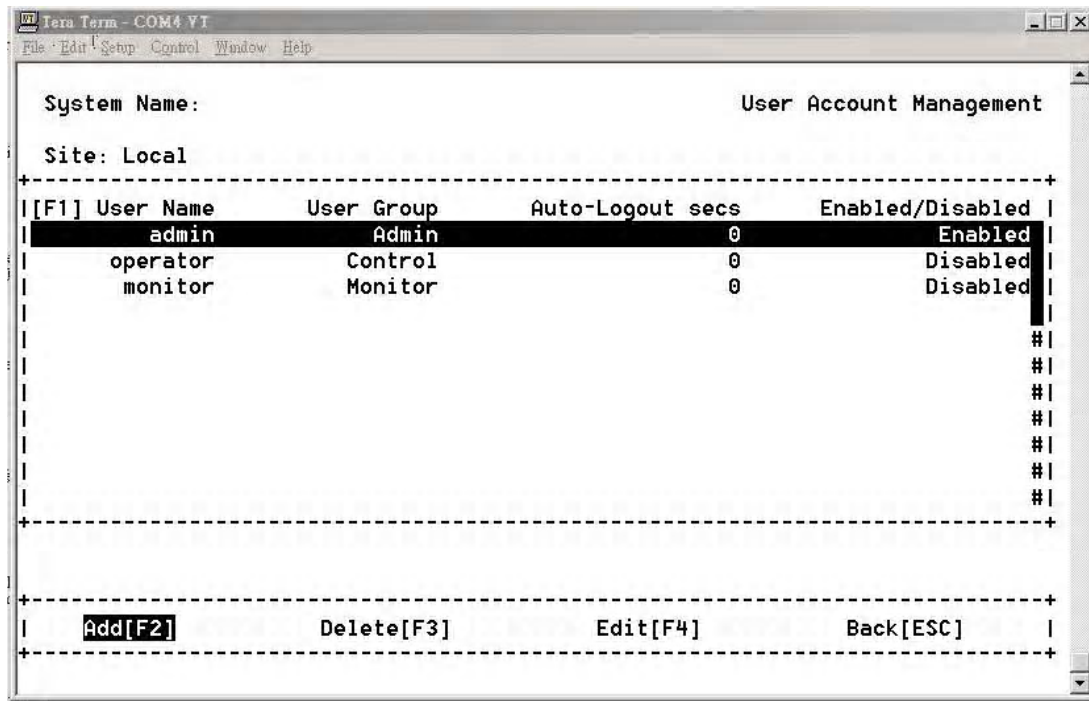
User Account Management Screen

Setting System Access Groups

The iMux provides three kinds of the user groups.

- **Admin**   The administrator group account can execute all functions.
- **Control**   The controller group account can execute all functions except the System Configuration.
- **Monitor**   The monitor group account only can monitor the system.

User accounts may be added **[F2]**, deleted **[F3]**, or edited **[F4]**.

```
System Name:                                         Add User Account


                        Site: Local

                        [F1] User Name         : _____

                        [F3] Password          : _____

                        [F4] Confirm Password  : _____

                        [F5] User Group        :   Admin ▉

                        [F6] Auto-Logout Seconds: 0_____

                        [F7] Account Status    :   Enabled ▉



                   +------------------------------------+
                   | █Confirm[F2]█       Back[ESC]     |
                   +------------------------------------+
```

Selecting **Add[F2]** opens the **Add User Account** screen. This is where new user accounts are set up. Each user may have their own password and be assigned to a Group. Setting the Auto-Logout to 0 (zero) seconds disables Auto-Logout. User accounts may also be disabled in this menu without deleting them.

SNMP Agent Configuration

```
System Name:                                    SNMP Agent Configuration

   Site: Local

   [F1] Trap IP Address 1    : 0___ . 0___ . 0___ . 0___  Port: 162___

   [F3] Trap IP Address 2    : 0___ . 0___ . 0___ . 0___  Port: 162___

   [F4] Trap IP Address 3    : 0___ . 0___ . 0___ . 0___  Port: 162___

        Trap IP Address 4    : 0___ . 0___ . 0___ . 0___  Port: 162___

   [F5] Read Community Name : public_____

   [F6] Write Community Name: private_____

   [F7] Trap Community Name : public_____

   [F8] Send Snmp Authentication Failure Trap: N▉

   +----------------------------------------------------------+
   |               Confirm[F2]                   Back[ESC]    |
   +----------------------------------------------------------+
```

Setting the Trap IP

The iMux can assign four sets of the Server IP address for sending the Traps. Enter the IP address and port number information on each line as required. Three community names may also be set. Default names are pre-configured, but may be changed using the menu items [**F5**], [**F6**] and [**F7**].

- The default Read Community Name is **public**
- The default Write Community is **private**
- The default Trap Community is **public**

Press `[F8]` to enable the `Send SNMP Authentication Failure Trap` function for sending the trap when the authentication fails.

Software Upgrade Configuration

The iMux can support two kinds of the System Software Upgrade: **Remote Server** and **Local File**.

Remote Server

Press the **space bar** to change these selections
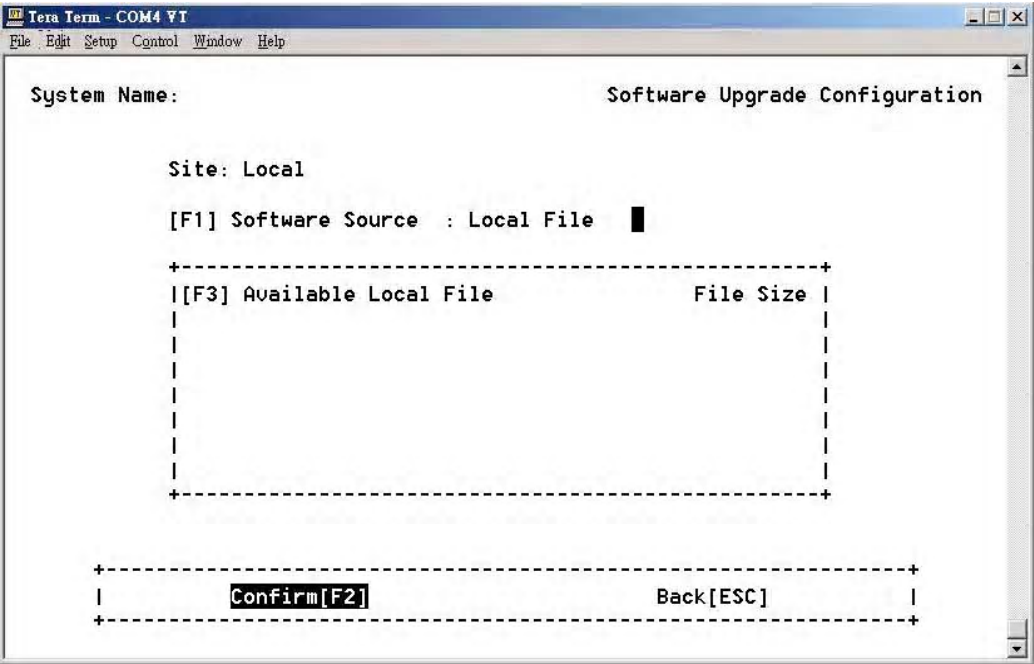
For Remote server source selection:

`[F3] Access Protocol`: Select the protocol you want to use. You may use either FTP or TFTP.
`[F4] Server IP Address`: Enter the server IP address where the new firmware is saved.

[F5] File Name: Enter the file name of new firmware.

[F6] Login User Name: Enter the remote server's user name.

Login Password: Enter the remote server's password.

Local File

For Local File source selection, the screen will show the available file stored in the system.

```
Tera Term - COM4 VT                                              _□×
File  Edit  Setup  Control  Window  Help
                                                                  ▲

  System Name:                          Software Upgrade Configuration


          Site: Local

          [F1] Software Source  : Local File    █

          +-------------------------------------------------+
          |[F3] Available Local File            File Size |
          |                                               |
          |                                               |
          |                                               |
          |                                               |
          |                                               |
          |                                               |
          |                                               |
          +-------------------------------------------------+


     +---------------------------------------------------------+
     |        Confirm[F2]                   Back[ESC]         |
     +---------------------------------------------------------+
                                                                  ▼
```

Local Upgrade File Selection Screen

Note: If the software upgrade image is stored locally, and you restart or re-boot power, that software image will be deleted.

Choose **Confirm[F2]** to save your selection.

Software Upgrade and Reboot Operation

After the software upgrade configuration is completed, the **Software Upgrade and Reboot Operation** can be executed from this menu.
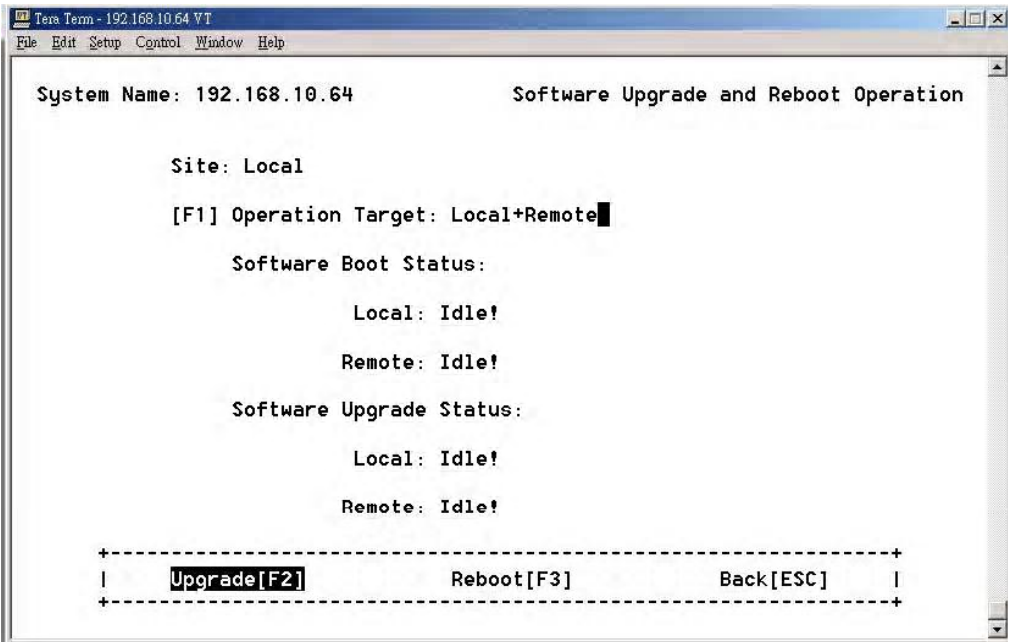
Upgrade Status

When you execute the Upgrade[F2] commend item in the local or remote side, it will display the upgrade status including:

Start upgrading!
Connecting!
Transferring!
Loading!
DeCompressing!
Flash writing!
Sending!
Upgrading complete!
**None**
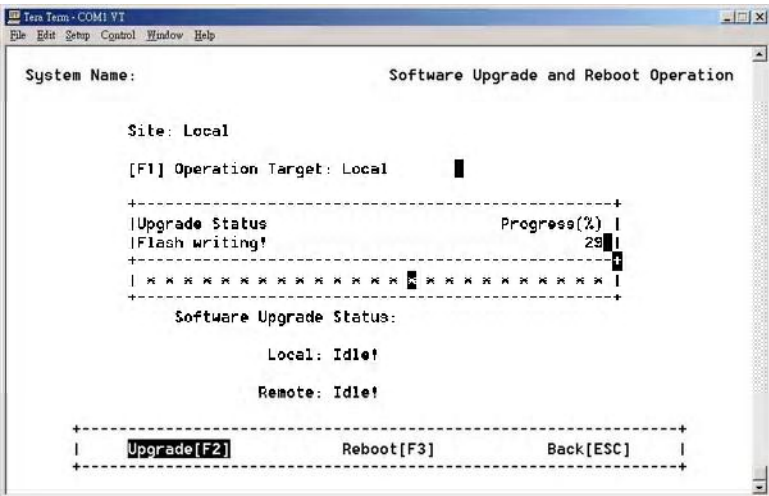
Upgrade Error Messages

If the software upgrade has an error, it will display one of the following error messages:

Internal error!

Local file not found!

Information incomplete!

Upgrading is running!

Connect failed!

Transfer failed!

Read failed!

Image file too large!

Disconnect failed!

Decompress code failed!

Invalid image format!

Abort by user!

None!

Software Reboot Status

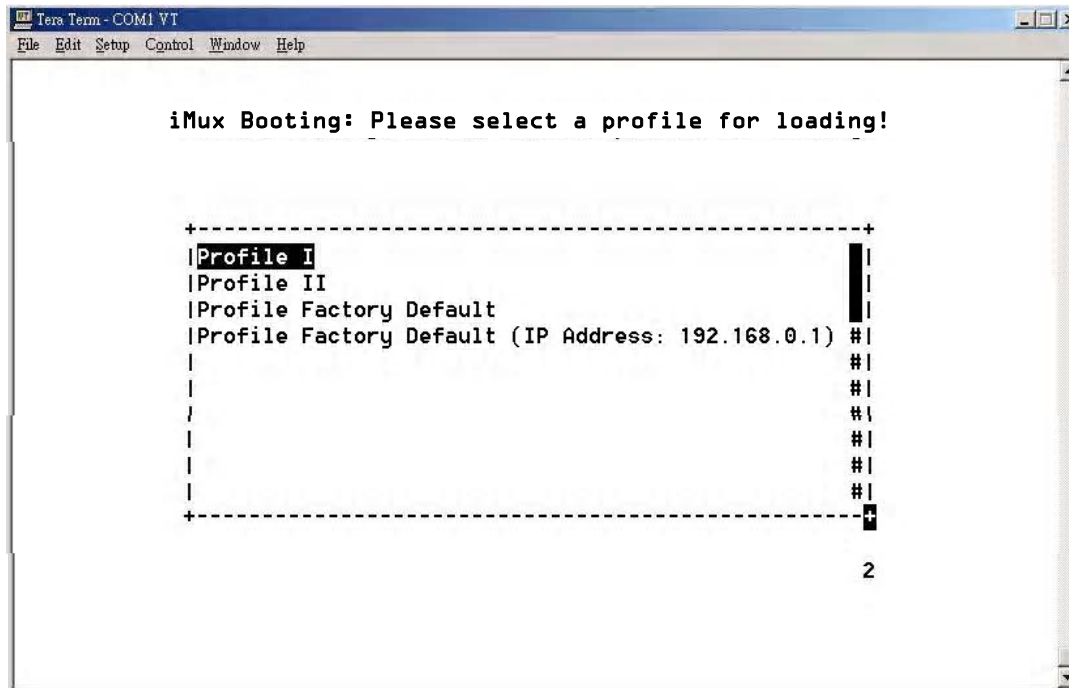When user selects the [**F3**] Reboot commend item in local or remote side, it will display the status including:

Start rebooting!

Ongoing!

Complete

Bye-!

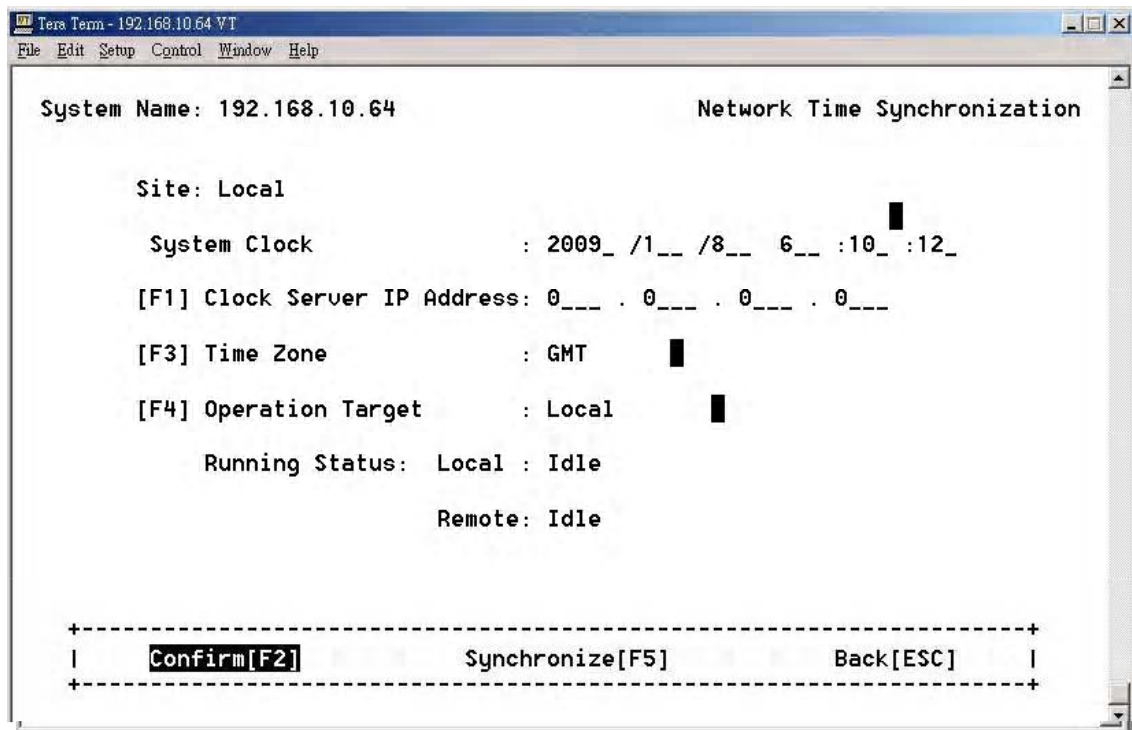**None**
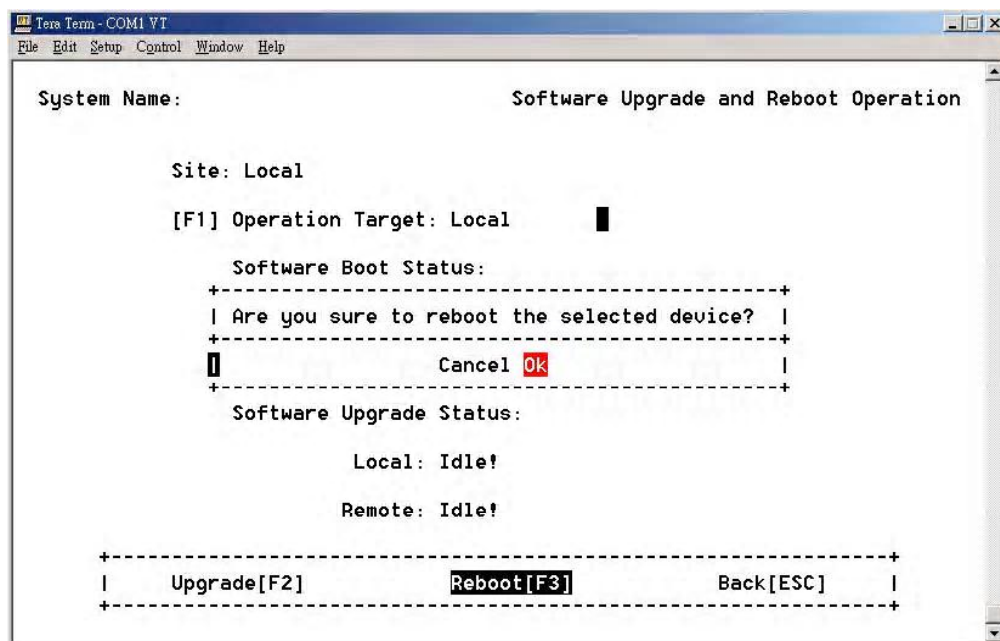
Reboot Operation Screen

When the iMux Booting screen appears, select a profile for loading. Use the up and down arrow keys to change selections, and press the enter key to load the selected profile.

> **Note:** If no key is pressed within three seconds, then the system will automatically download the previous profile. Press any key to hold and pause the screen.

Reboot profile Selection Screen

Network Time Synchronization

```
Tera Term - 192.168.10.64 VT
File  Edit  Setup  Control  Window  Help

    System Name: 192.168.10.64                    Network Time Synchronization


            Site: Local

             System Clock               : 2009_ /1__ /8__  6__ :10_ :12_

            [F1] Clock Server IP Address: 0___ . 0___ . 0___ . 0___

            [F3] Time Zone              : GMT

            [F4] Operation Target       : Local

                 Running Status:  Local : Idle

                                  Remote: Idle


    +----------------------------------------------------------------------+
    |    Confirm[F2]             Synchronize[F5]            Back[ESC]     |
    +----------------------------------------------------------------------+
```

Network Time Synchronization Screen

You may set the System clock manually, or use the network time synchronization function. To use a time server press **[F1]** and enter the time server IP address and time zone, then execute the **Synchronize[F5]** command. The system clock will be automatically set via Internet.

When user selects the synchronize commend item in local or remote side, the running status will show the following messages:

Start Synchronizing!
Synchronizing!
Synchronizing Complete!
Synchronizing Error!

If there is a synchronize error, the iMux will display one of the following error messages:

Internal Error!
Information Incomplete!
Synchronization is running!
Time Get Error!
Abort by user!
Timeout!
No Error

Scheduling Job Management
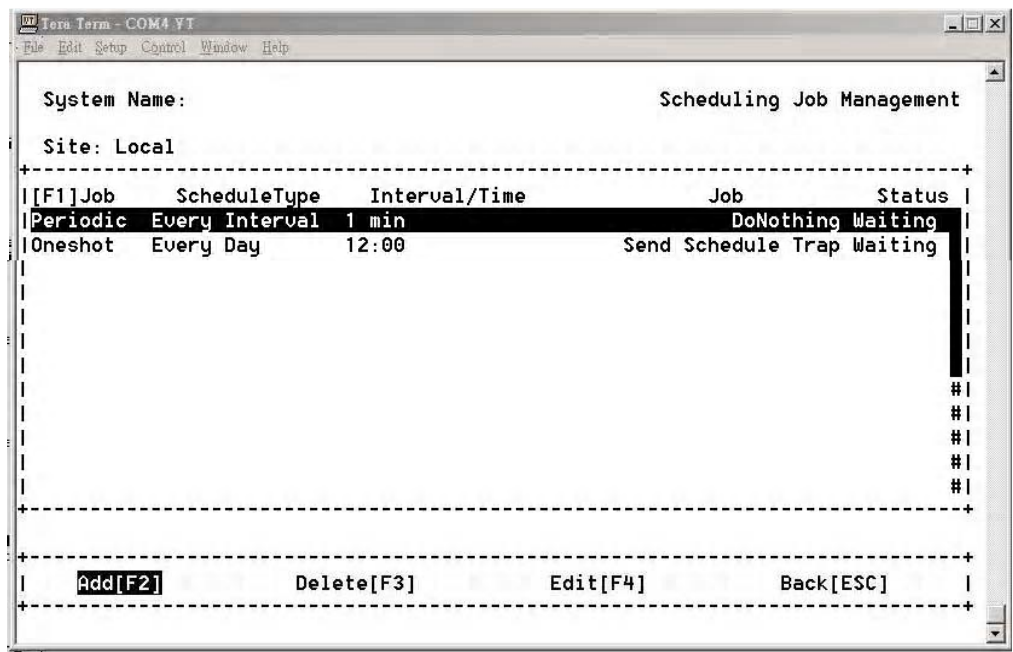
Scheduling Job Management Screen

The **Scheduling Job Management** function directs the iMux to perform certain job functions at specific times. The system administrator can arrange the schedule for each job.
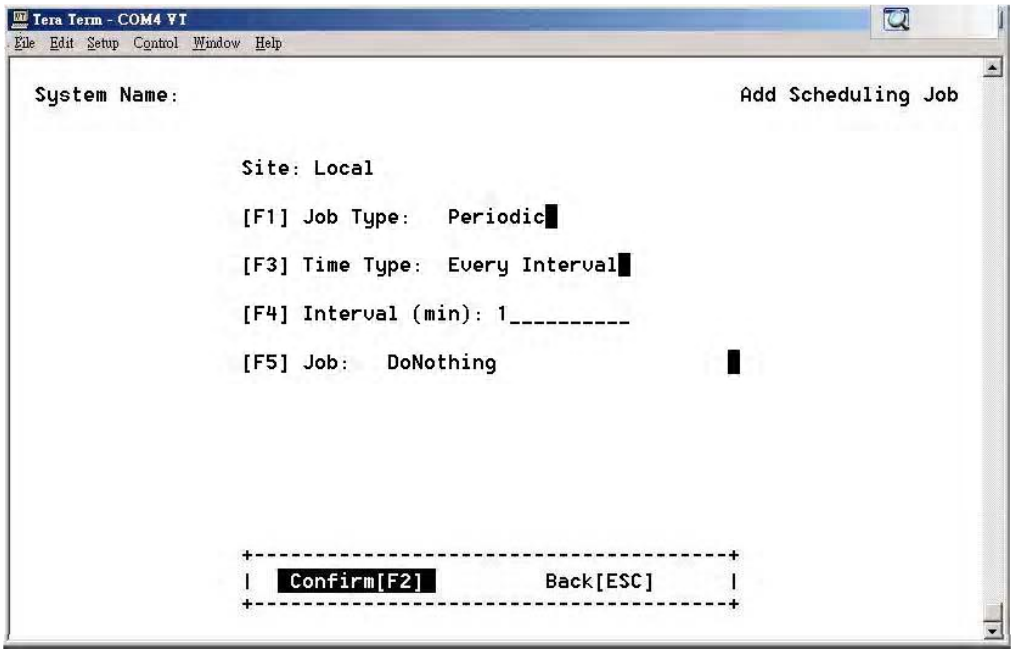
Add Scheduling Job Screen

- Job Type: **Periodic** / **One shot** / **Booting**

- Time Type: **Every Interval** / **Every Day**

Every Interval: The system will do the selected job at every time interval.

Every Day: The system will do the selected job at the desired time every day, according to the system time.

Interval (min.): Enter a number to set the interval time

Job: Do Nothing
  Send Schedule Trap
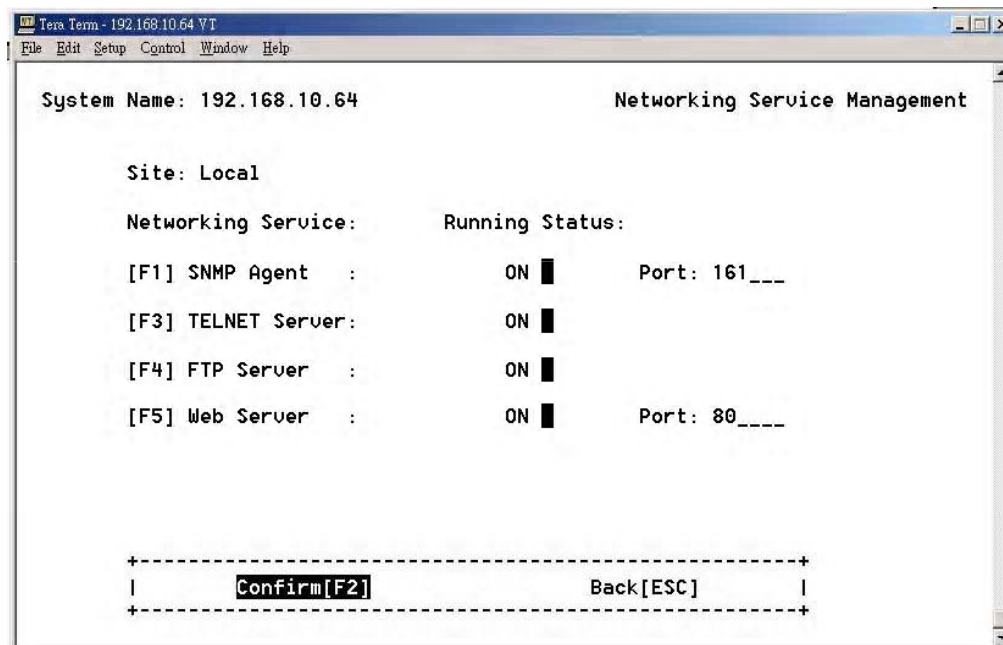 **Send Time Sync Request Trap**
  Software Upgrade
  Network Time Synchronization
  System Reboot

Press the space bar to change the selected item.
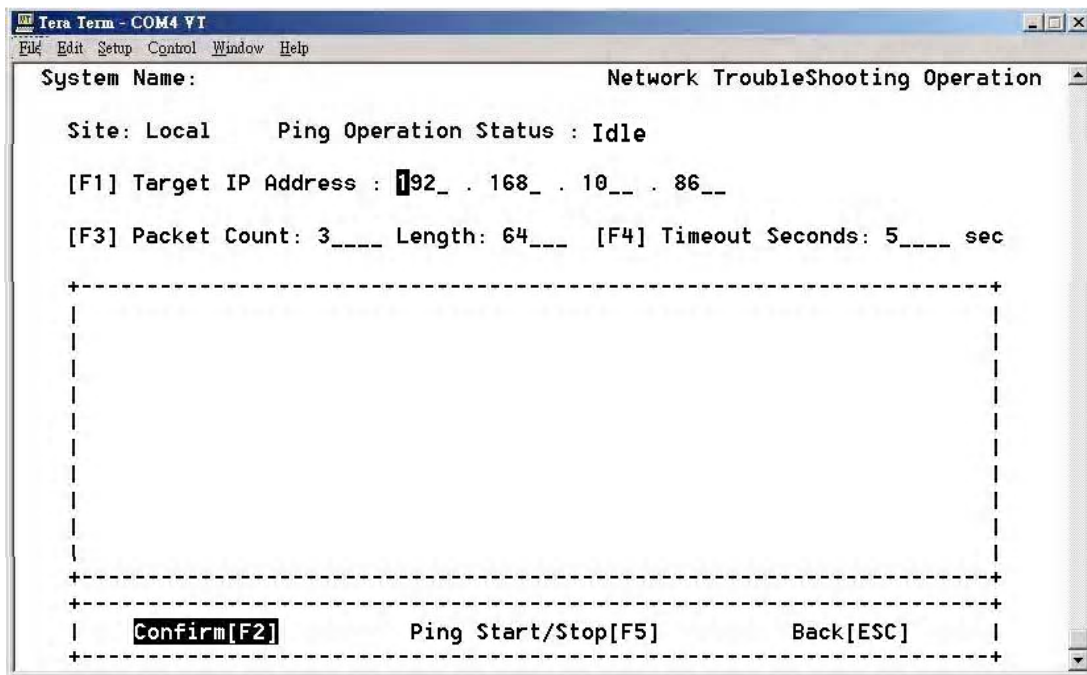
Networking Service Management

Network Service Management Screen

The system can turn on or off the functions of the SNMP Agent, TELNET Server, FTP Server, and Web Server.

When using the FTP Server, the device can act as a client or server. However the memory storage is small, so the user can only to perform a software upgrade and save EventLog operation.

> **Note:** If the software upgrade image is stored locally, and you restart or re-boot power, the software image will be deleted.

Network TroubleShooting Operation
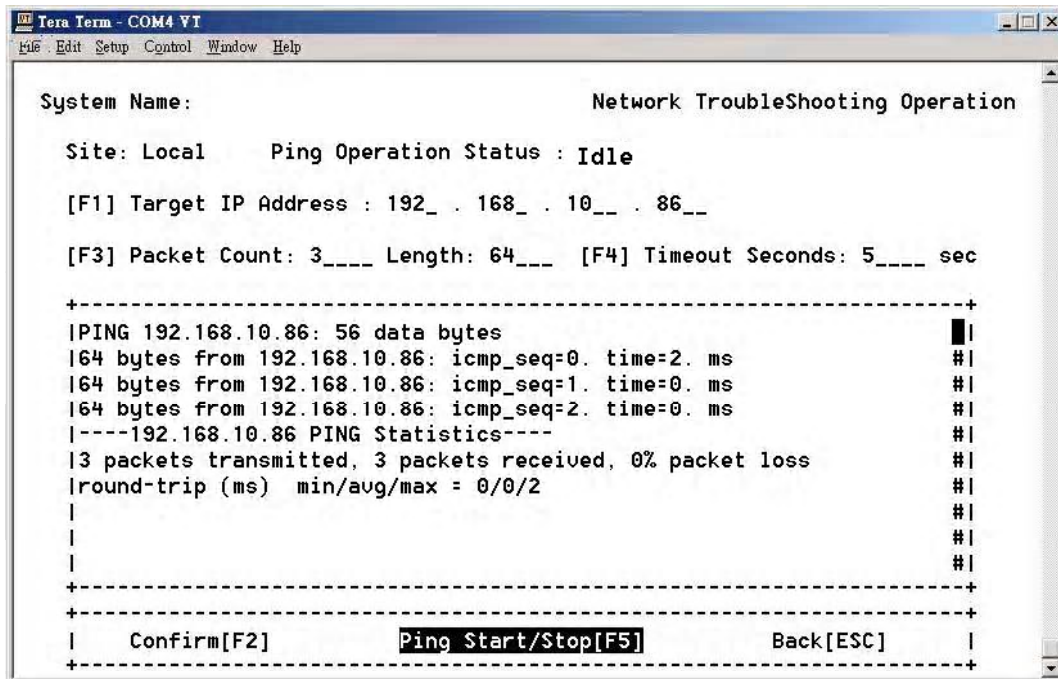
Network Ping Operation Screen

The iMux can ping an IP address to show whether it can link to a network location, and provide some information about that connection.

Enter the **[F1]Target IP Address**, **[F3]Packet Count**, **Length** and **Timeout Seconds**, then execute **Confirm[F2]** to save your entered information. Execute **Ping Start/Stop[F5]** to start the ping operation.

> **Note:** The system device IP must be set up prior to performing the ping operation.

If the target IP ping succeeds, it will display the results similar to this:

Successful Ping Results Screen

If the target IP does not answer, it will timeout with no response.

Ping Failure Screen

LCD Login Configuration
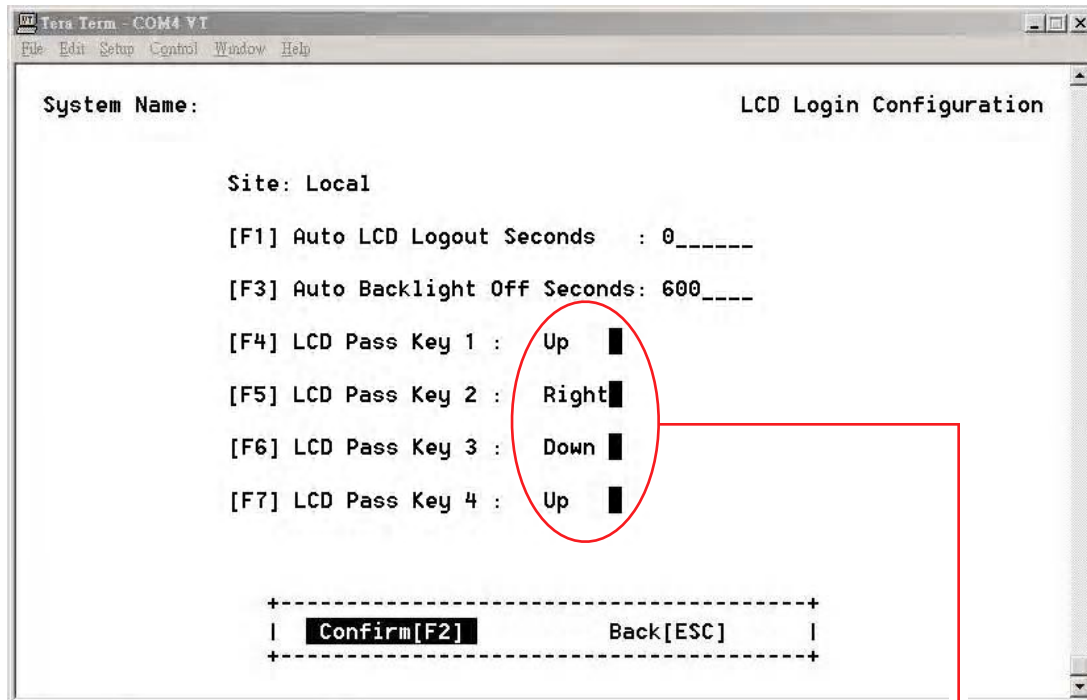
LCD Login Configuration Screen
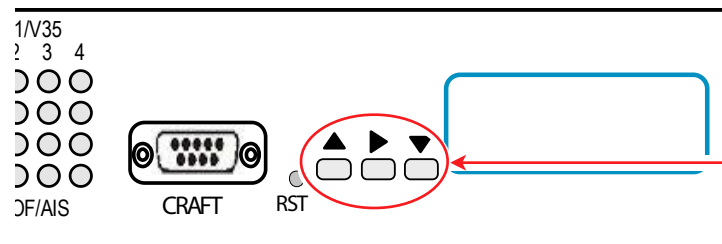
Front Panel LCD Controls

The front panel login uses the UP, RIGHT and DOWN buttons pressed in a 4 key sequence in order to gain access using the front panel. Define this key sequence by setting the pass keys using the LCD Login Screen.

Up uses the ▲ button on the front panel.

Right uses the ▶ button on the front panel.

Down uses the ▼ button on the front panel.

Setting the **[F1] Auto LCD Logout Seconds** to zero cancels auto LCD logout.

Event Management

```
Tera Term - COM4 VT
File  Edit  Setup  Control  Window  Help

System Name:                                    Event Management

Site: Local

          [F1]
          +------------------------------------------------------+
          |[1] Event Class Processing Configuration              |
          |[2] Event Alarm Processing Configuration              |
          |                                                      |
          |                                                      |
          |                                                      |
          |                                                    # |
          |                                                    # |
          |                                                    # |
          |                                                    # |
          |                                                    # |
          |                                                    # |
          +------------------------------------------------------+
          +------------------------------------------------------+
          |       Next[F2]                      Back[ESC]        |
          +------------------------------------------------------+
```
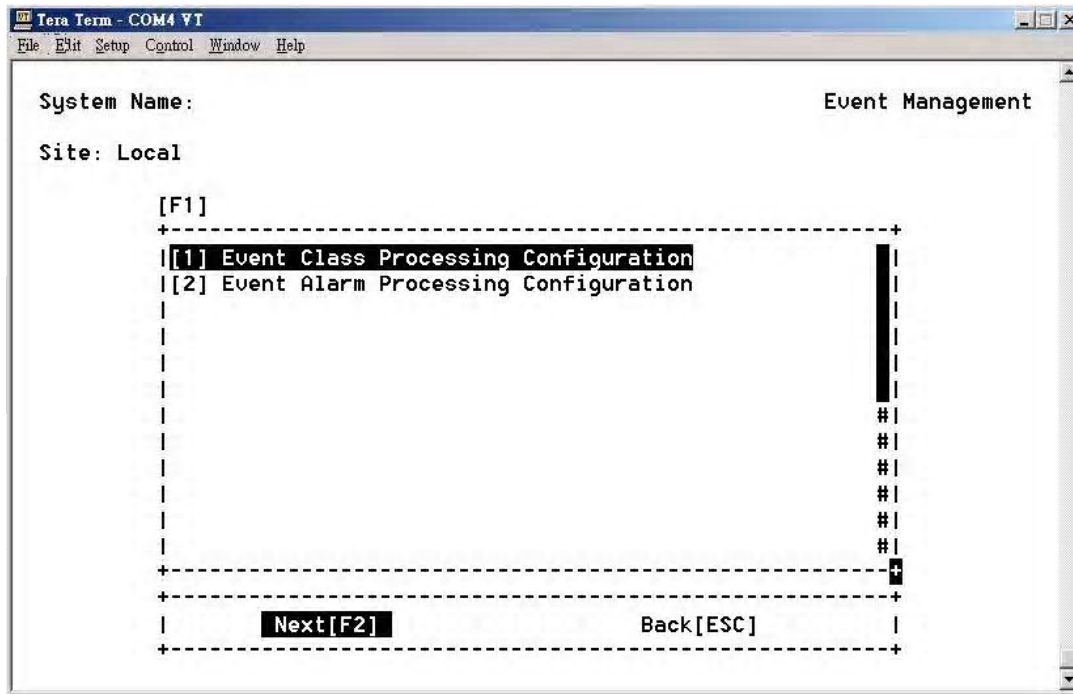
Event Management Screen

The iMux provides Event Management function that includes

[1] Event Class Processing Configuration
[2] Event Alarm Processing Configuration

Event Class Processing Configuration

Event Class Processing Screen

The event class processing configuration function can set the events of the configure, alarm, and operation to save in the flash or to send the trap.

N is not save in the flash or not to send the trap
Y is save in the flash or to send the trap

Use the **Confirm[F2]** command to save the settings.

> **Note:** Confirm the send trap status if the NMS system does not receive an alarm trap.

Event Alarm Processing Configuration


```
Tera Term - COM4 VT
File  Edit  Setup  Control  Window  Help

  System Name:                        Event Alarm Processing Configuration

  Site: Local

                Alarm Svrity    Save Flash:   Send Trap:

          [F1] Critical:            N             N

          [F3] Major    :           N             N

          [F4] Minor    :           N             N

          [F5] Warning  :           N             N




          +----------------------------------------+
          |    Confirm[F2]           Back[ESC]     |
          +----------------------------------------+
```

Event Alarm Processing Screen

The event alarm processing configuration function controls how different alarm events are handled based on severity. These events may be set to save in flash memory or to send the trap.

The four classes of the alarm severity are:

[F1] Critical
[F3] Major
[F4] Minor
[F5] Warning

> **Note:** Confirm the send trap status if the NMS system does not receive an alarm trap.

System Profile Management
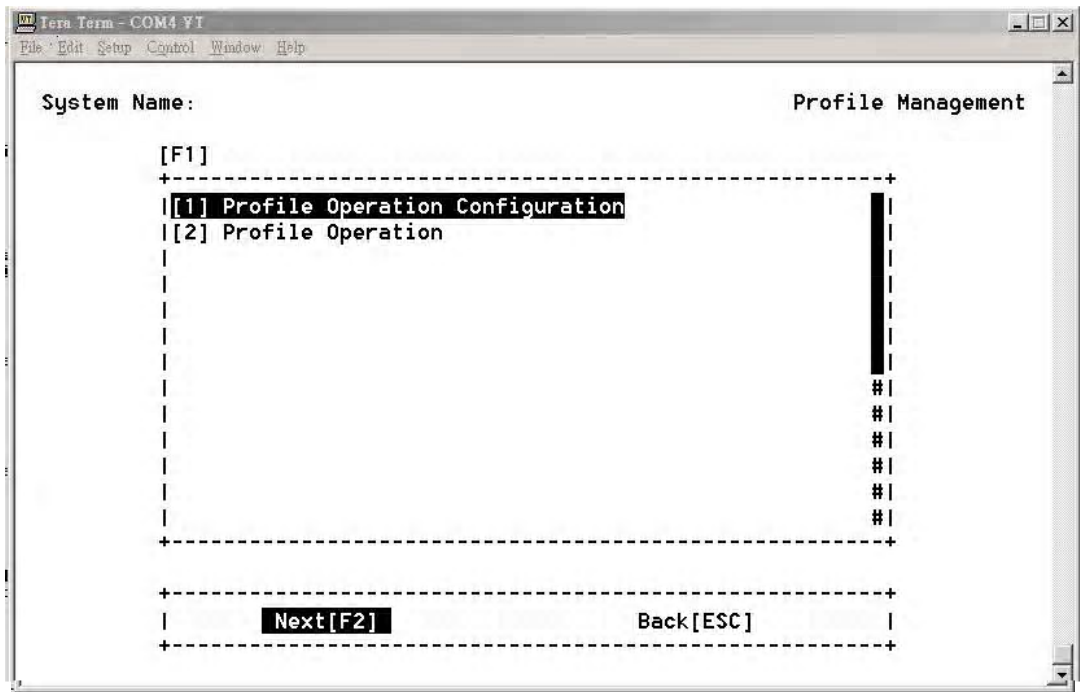
Profile Management

Select **[1] Profile Save Parameter Configuration** and then **Next[F2]**.

Profile Saving Configuration

Set the **[F1] Auto Saving** to **ON** and the auto saving interval in minutes to enable auto profile saving.

From the Profile Management screen select **[2] Profile Operation** and then **Next[F2]**.

```
Tera Term - 192.168.10.64 VT                                          _ □ ×
File  Edit  Setup  Control  Window  Help

   System Name: 192.168.10.64                        Profile Operation

            Site: Local

            Booting Profile:  Profile I

            Profile Modification:    N

            [F1]
            +--------------------------------------------------+
            |Profile I                                        ||
            |Profile II                                       ||
            |Profile Factory Default                          #|
            |Profile Factory Default (IP Address: 192.168.0.1) #|
            |                                                 #|
            |                                                 #|
            +--------------------------------------------------+


            +--------------------------------------------------+
            |    Load[F2]        Save[F3]        Back[ESC]    |
            +--------------------------------------------------+
```
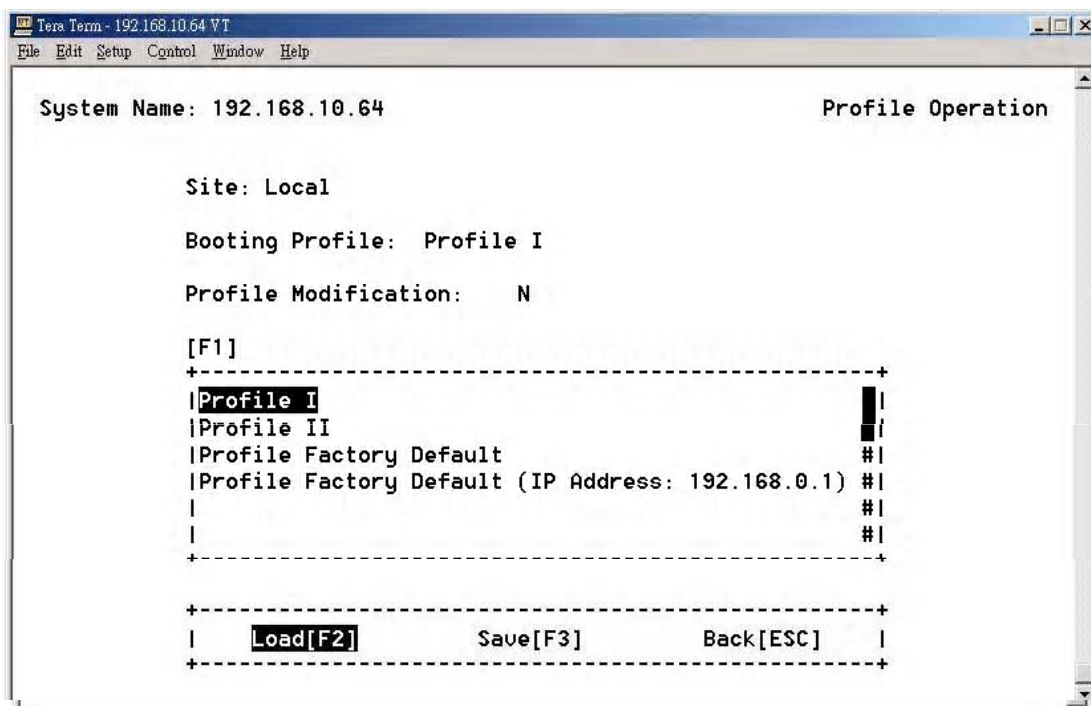
Profile Operation

This screen allows you to modify boot profiles. Although there are are four booting profiles, only **Profile I** and **Profile II** may be user modified. **Profile Factory Default** and **Profile Factory Default (IP Address: 192.168.0.1)** profiles may not be altered.

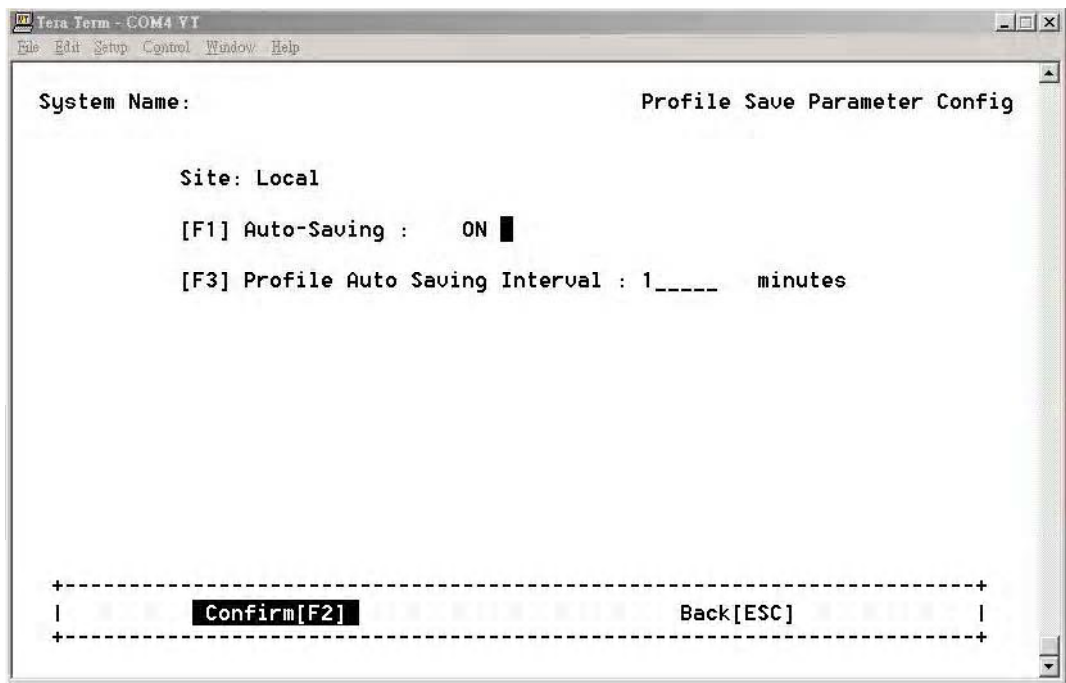> **Note:** The iMux has been pre-configured with appropriate settings for the modules that were installed at the time it left the factory. These settings were initially saved in both **Profile I** and **Profile II**. Changing these settings will alter the initial factory settings.

The **Profile Modification** will show **Y** if the profile has been changed anytime before loading the profile.

Select either **Profile I** or **Profile II** and press **Load[F2]** to open the profile for editing or review.

Configuration File Management
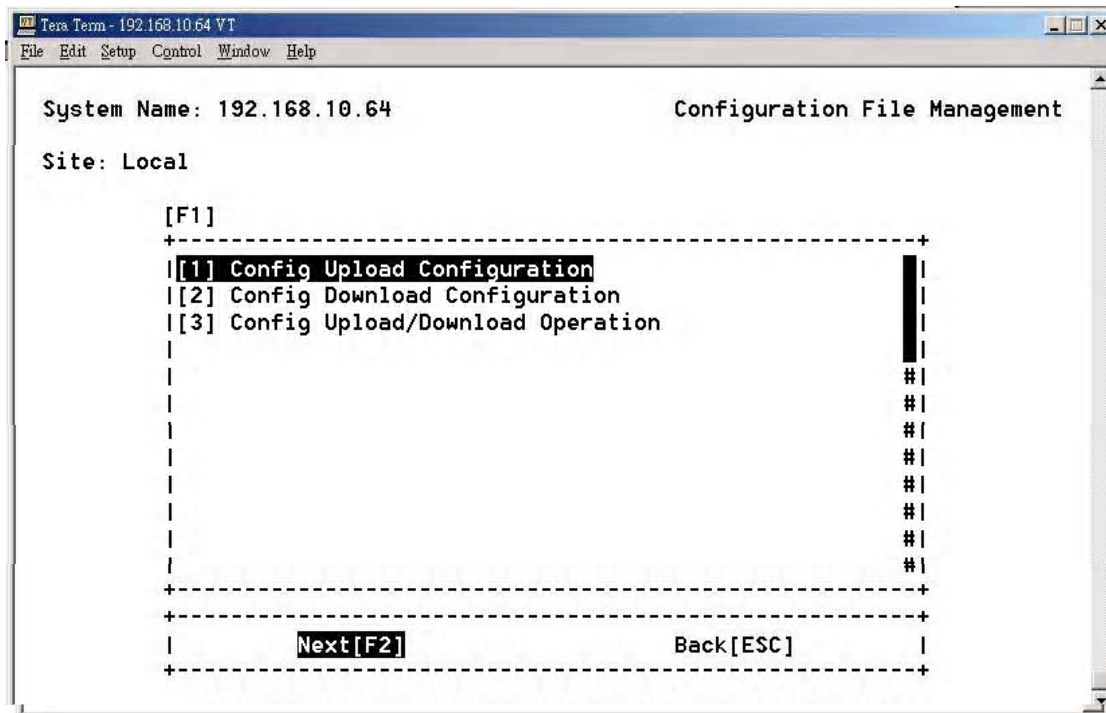
Configuration File Management Screen

You may upload or download profile configurations and easily apply it to any iMux. This allows allows you to load a profile, or upload a profile to a server for archiving, saving, or further distribution. A profile may be created at a remote location, uploaded to a server, and downloaded to another iMux for use.

First, you will specify the server and file names using **[1] Config Upload Configuration** and **[2] Config Download Configuration.** Once the configurations are set, return to this menu and initiate the transfer using **[3] Config Upload/Download Operation.**

Then choose **Next[F2]** to continue.

> **Note:** The system device IP must be set up prior to uploading or downloading.

[1] Config Upload Configuration

```
Tera Term - 192.168.10.64 VT                                    _ □ ×
File  Edit  Setup  Control  Window  Help

 System Name: 192.168.10.64                   Config Upload Configuration


            Site: Local

            [F3] Access Protocol    : FTP ■

            [F1] Server IP Address  : 0___ . 0___ . 0___ . 0___

            [F3] Upload File Name   : _____

            [F4] Login User Name    : _____

                 Login Password     : _____

            [F5] File Name Extension: None                ■


        +------------------------------------------------------+
        |         Confirm[F2]                  Back[ESC]       |
        +------------------------------------------------------+
```

Config Upload Screen

Enter the protocol, server, user and file information to upload.

Selection	Description
[F3] Access Protocol	The desired transfer protocol
[F1] Server IP Address	The server IP address where the new profile will be saved
[F3] Upload File Name	The file name of uploaded profile
[F4] Login User Name	The remote server's user name
Login Password	The remote server's password
[F5] File Name Extension	The desired file name extension

Choose **Confirm[F2]** to save the settings. Go back to the **Configuration File Management** screen using **Back[ESC]** to start the file transfer.

[2] Config Download Configuration

Config Download Configuration Screen

Enter the protocol, server, user and file information to upload.

Selection	Description
[F1] Destination	Where the desired file resides
[F3] Access Protocol	The desired transfer protocol
[F1] Server IP Address	The server IP address where the new profile will obtained from
[F3] Download File Name	The file name of file to download
[F4] Login User Name	The remote server's user name
Login Password	The remote server's password
[F5] File Name Extension	The desired file name extension

Choose **Confirm[F2]** to save the settings. Go back to the **Configuration File Management** screen using **Back[ESC]** to start the file transfer.

[3] Config Upload/Download Operation

```
Tera Term - 192.168.10.64 VT                              _ □ ×
File  Edit  Setup  Control  Window  Help

System Name: 192.168.10.64              Config Upload/Download Operation


          Site: Local

          [F4] Operation Target: Local+Remote█

          [F5] Device Networking Config: Include█


                    Upload Status          Download Status
          Local :  Idle!                   Idle!

          Remote:  Idle!                   Idle!




      +-------------------------------------------------------------+
      |    Upload[F2]           Download[F3]          Back[ESC]     |
      +-------------------------------------------------------------+
```
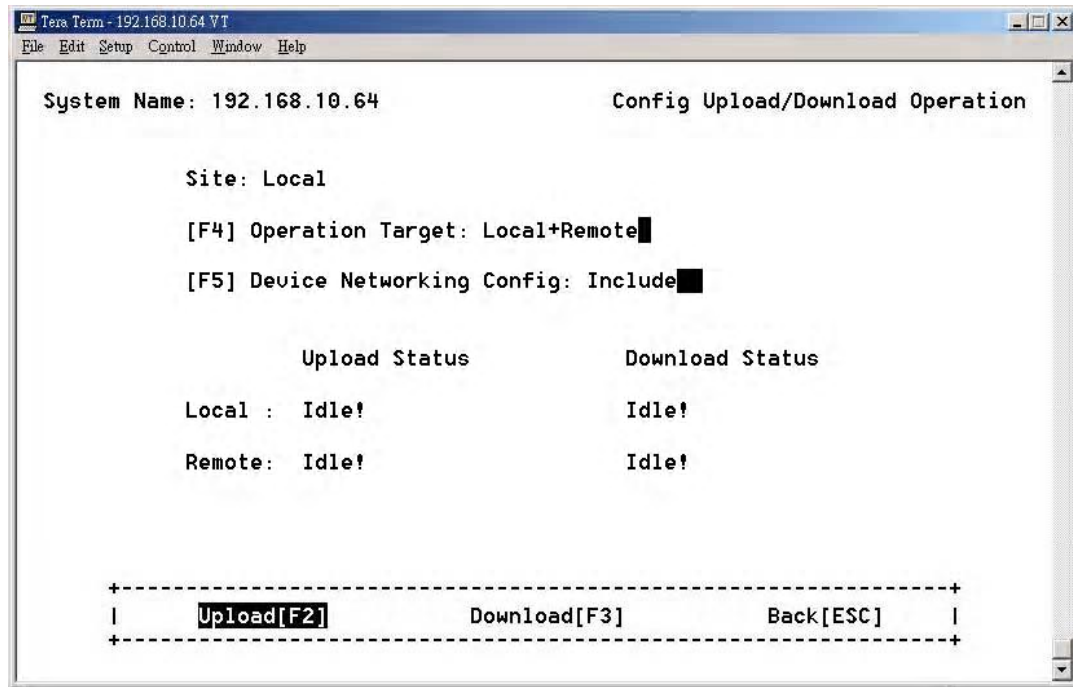
Config Upload/Download Screen

Choose the **Operation Target** and **Device Networking Config**, then execute **Upload[F2]** or **Download[F3]** to begin the transfer.
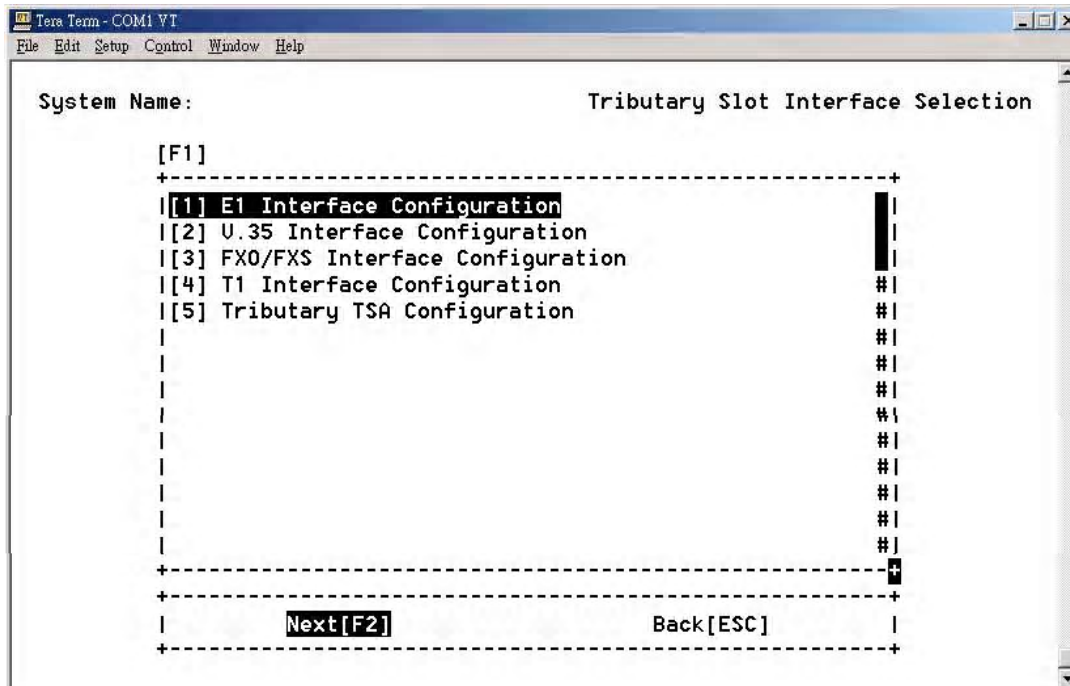
Terminal File Transfer Operation
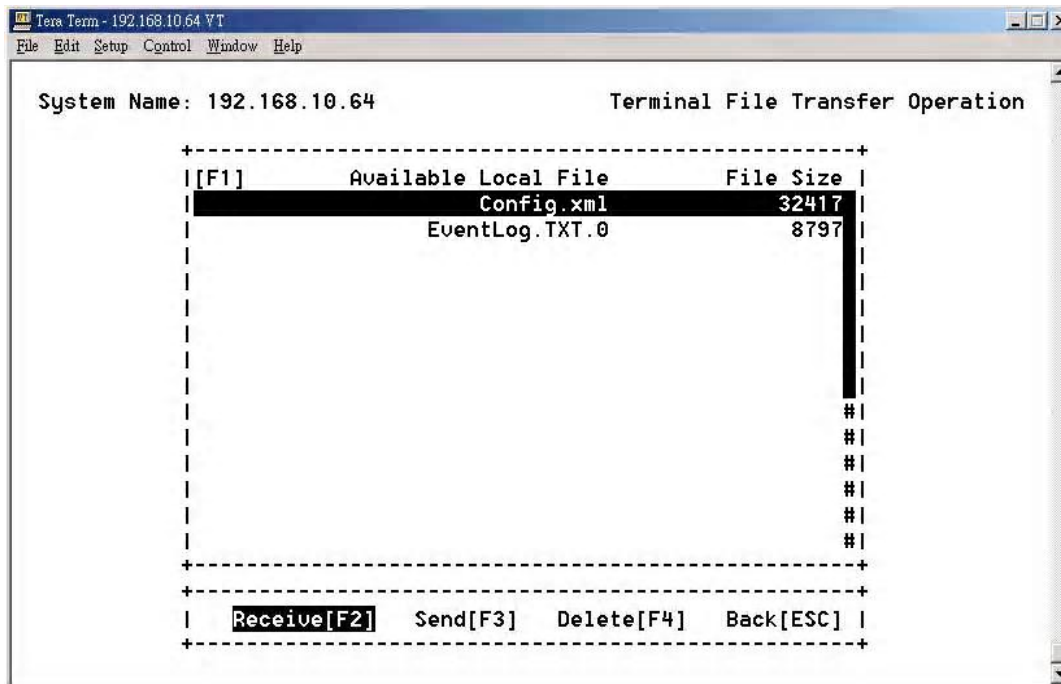
Terminal File Transfer Screen

Available files will be displayed in the file window. Choose the desired file and execute **Receive[F2]** or **Send[F3]**. Files may also be deleted by using **Delete[F4]**.

Tributary Slot Interface Selection

Tributary Slot Configuration Screen

The iMux can use different modules that mount into slots in the back of the unit. These slots are called **Tributary Slots**, and must be configured before they can be used.

> **Note:** The iMux has been pre-configured with appropriate settings for the Tributary Slots that were used at the time it left the factory. These settings were initially saved in both **Profile I** and **Profile II**. Changing these settings will alter the initial factory settings.

The Tributary Slot parameters and slot assignments are performed on the individual interface configuration screens. To set up the Tributary Slots, select an interface to configure:

[1] E1InterfaceConfiguration

[2] V.35InterfaceConfiguration

[3] FXO/FXS Interface Configuration

[4] T1InterfaceConfiguration

[5] TributaryTSAConfiguration

Choose `Next[F2]` to configure the selected interface and corresponding Tributary Slot.

E1 Interface Configuration

[F3]Site: Select **Local**, **Remote** or **All** (both sites) by using the **Space Bar**, press the **Enter** key to select it.

[F4]SlotId: Select **1~4** slots or **All** by using the **Space Bar**, press the **Enter** key to select it.

[F3]ChId: Select **1~4** individual channel ID to setup or **All** by using the **Space Bar**, press the **Enter** key to select it.

```
 Tera Term - COM4 VT                                           _ □ ×
File  Edit  Setup  Control  Window  Help

   System Name:                         E1 Interface Parameters Config

    [F3]Site: All   █    [F4]SlotId: All█    [F5]ChId: All█

   +-----------------------------------------------------------------+
   |[F1]St#/Sl#/Ch#    Service    Coding    Framing    CirId        |
   |E1/Lo/1/1          OOS        HDB3      FAS+CRC               █|
   |E1/Lo/1/2          OOS        HDB3      FAS+CRC               #|
   |E1/Lo/1/3          OOS        HDB3      FAS+CRC               #|
   |E1/Lo/1/4          OOS        HDB3      FAS+CRC               #|
   |E1/Lo/2/1          OOS        HDB3      FAS+CRC               #|
   |E1/Lo/2/2          OOS        HDB3      FAS+CRC               #|
   |E1/Lo/2/3          OOS        HDB3      FAS+CRC               #|
   |E1/Lo/2/4          OOS        HDB3      FAS+CRC               #|
   |E1/Lo/3/1          OOS        HDB3      FAS+CRC               #|
   |E1/Lo/3/2          OOS        HDB3      FAS+CRC               #|
   |E1/Lo/3/3          OOS        HDB3      FAS+CRC               #|
   |E1/Lo/3/4          OOS        HDB3      FAS+CRC               #|
   +-----------------------------------------------------------------+
   +-----------------------------------------------------------------+
   |Edit[F2]    Slot Edit[F6]    Group IS[F7]    Group OOS[F8]    Back[ESC]    |
   +-----------------------------------------------------------------+
```

E1 Interface Configuration Screen

Select the iMux site you want to change, the Tributary Slot ID, and the individual channel ID before configuring parameters. You may edit E1 Parameters for each channel or all channels of selected.

Use **Slot Edit[F6]** to edit the parameters of all channels in the same slot.

Choose **Group IS[F7]** to let the selected channels in the screen go into the in-service state, or **Group OOS[F7]** to set them to out of service.

Choose the `Edit[F2]` to set channel service types.
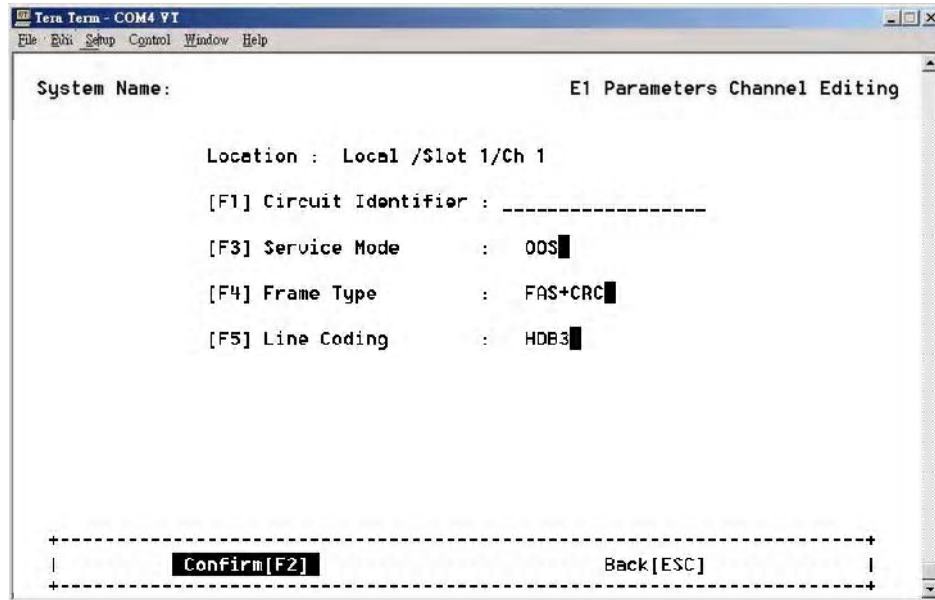
E1 Channel Parameter Editing

The `[F1] Circuit Identifier` lets you assign a name to the circuit if desired.

The `[F3] Service Mode` setting has two service modes which can select `OOS` (Out of Service) or `IS` (In Service).

Set the frame type with `[F4] Frame Type.` There are three types of E1 services available: `FAS+CRC`, `FAS Only`, `Unframed.`

Set the line coding with `[F5] Line Coding.` There are two types of E1 line coding: `HDB3` or `AMI.`

Choose `Confirm[F2]` to save the settings.

V.35 Interface Configuration

Choose the site, slot and channel as described in the **E1 Configuration** section.

V.35 Interface Configuration

Note: If the EOC connection is closed, a symbol "-" will be shown for each configuration.

Choose the `Edit[F2]` to edit channel service types.

V.35 Parameters Channel Editing

The **[F1] Circuit Identifier** lets you assign a name to the circuit if desired.

The **[F3] Service Mode** setting has two service modes which can select **OOS** (Out of Service) or **IS** (In Service).

The **[F3] Clock Source** setting permits the use of an **External** clock source, or the **Internal** clock.

You can set the polarity of Tx or Rx clock to fit the requirement of different kind of DTEs.
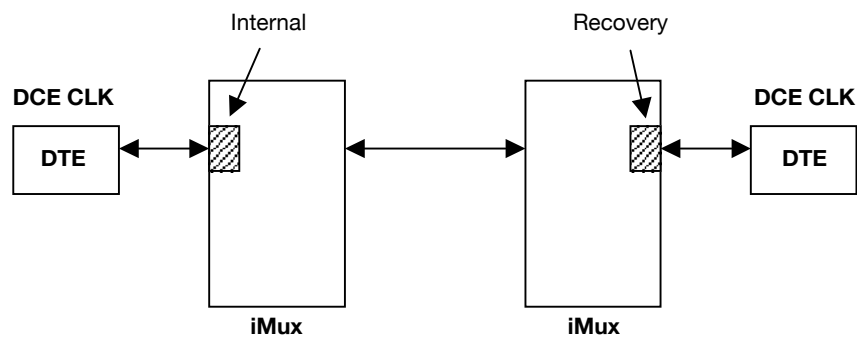
Data Rate

PCM31: 64K~1984K PCM30: 64K~1920K Unframed: 2048K

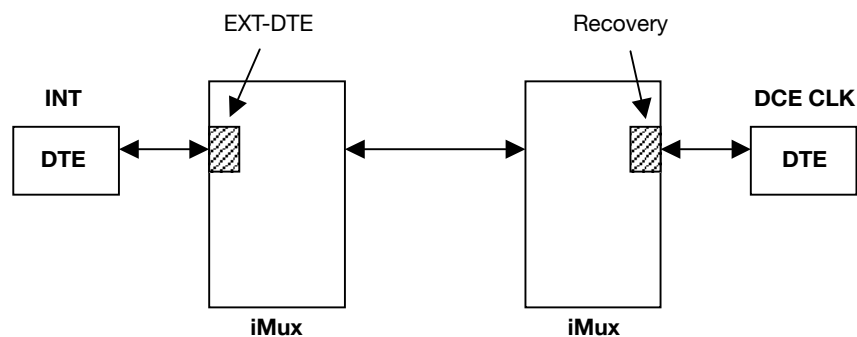To have stable V.35 configuration performance, you must make sure to set the correct clock mode.

Example clock mode settings:

Example 1

Example 2

FXO/FXS Interface Configuration

Choose the site, slot and channel as described in the **E1 Configuration** section.

FXO/FXS Interface Parameters Configuration

Choose the `Edit[F2]` to edit channel service types.

FXO/FXS Parameters Channel Editing

T1 Interface Configuration

Choose the site, slot and channel as described in the **E1 Configuration** section.

T1 Interface Parameters Configuration

Choose the `Edit[F2]` to edit the T1 channel service types.

T1 Interface Parameters Configuration

Tributary TSA configuration
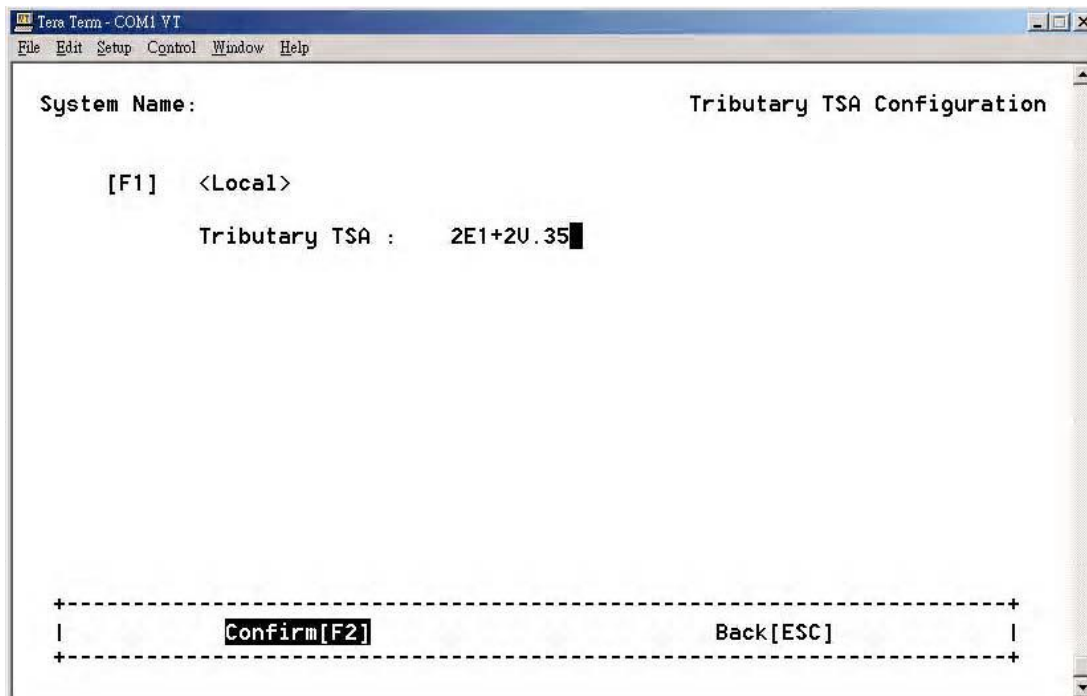
Tributary TSA Configuration Screen

The iMux provides five kinds of the Tributary TSA (Time Slot Assignments) :

• **Normal** (All E1 channels)

• **7E1+1V.35** (Seven E1 channels and one V.35 channel)

• **3E1+1V.35** (Three E1 channels and one V.35 channel)

• **CH4<->CH5** (Four E1 channels and one V.35 channel)

• **CH8<->CH9** (Eight E1 channels and one V.35 channel)

> **Note:** The V.35 interface setting will be set to **OOS** (Out of Service) when **mode1~mode4** is set to the V.35 interface. Be sure to set the V.35 to **IS** (In Service) and check the related configuration after the **mode1~mode4** is used.

Normal mode (All E1 channels)
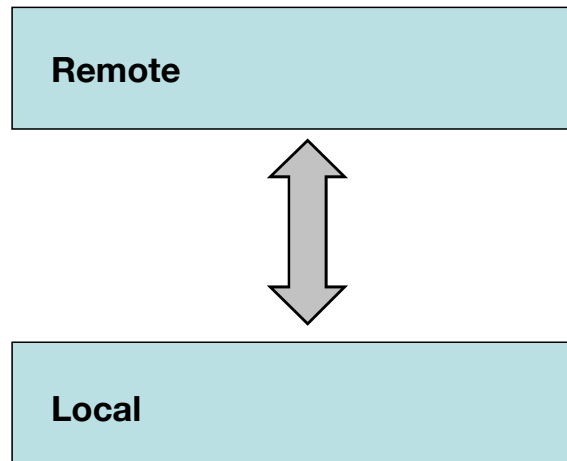
In the normal mode, every channel can also do the PRBS testing with the corresponding channel in the remote side.

>   **Note:** The clock setting needs to conform. Refer to the following block diagrams.

1. In this case, the right hand of E1 equipment is set to the internal clock.
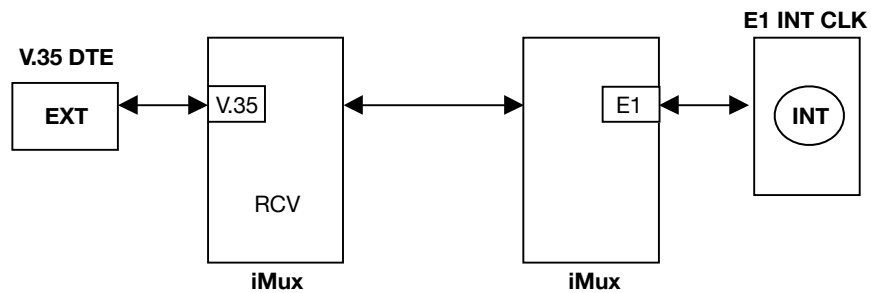
2. In this case, the right hand of E1 equipment is set to receive clock.
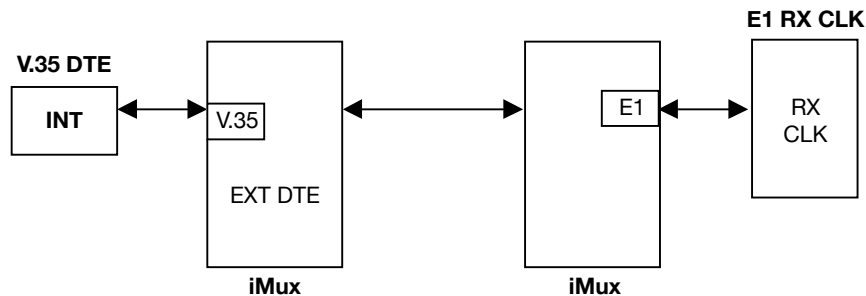
>   **Note:** When V35 data is connected with E1 data, the related timing clock should be set carefully
>   to get more stable connection.

Seven E1 channels and one V.35 channel mode
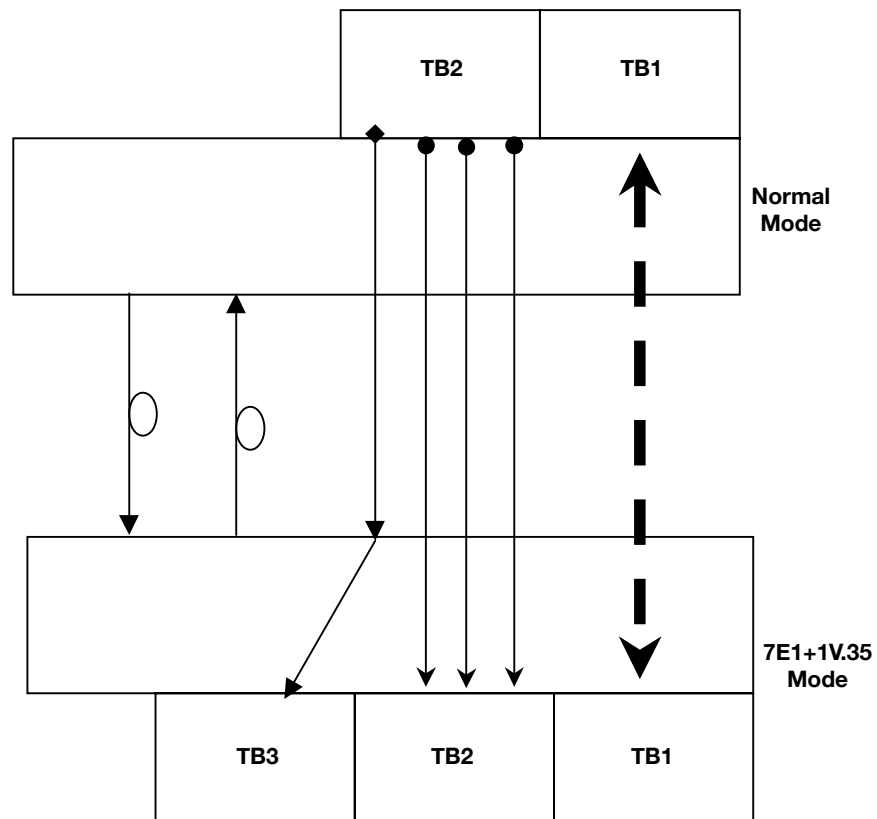
In this mode, user can also do the PRBS test which is like the figure as above. The remote side' channel will generate the test pattern to corresponding channels in the local side.

Remote (4E1 card) Ch1~Ch4 → **Local's** (4E1 card) Ch1~Ch4
Remote (4E1 card) Ch5~Ch7 → **Local's** (4E1 card) Ch5~Ch7
Remote (4E1 card) Ch8 → **Local's** (V35 card)

> **Note:** To avoid unexpected errors, **DO NOT** insert any card in TB2 and TB3 at remote side while the TSA function is **ON**.

Four E1 channels and one V.35 channel mode
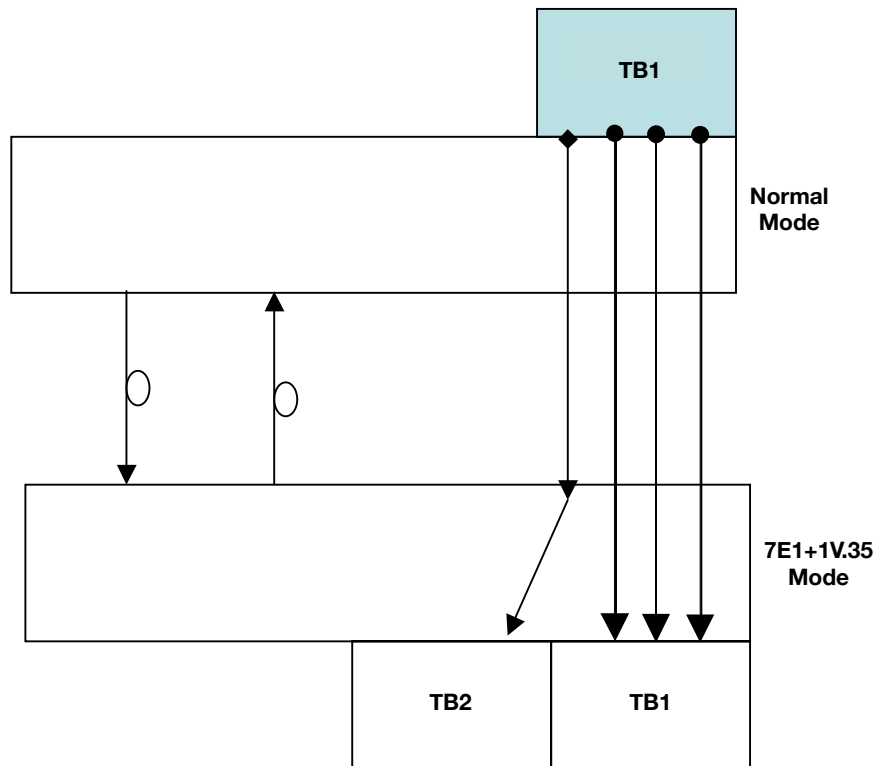
In this mode, the user can also do the PRBS test as reflected in the figure as above. The remote side's channel generates the test pattern to corresponding channels in the local side.

Remote (4E1 card) Ch1   → **Local's** (4E1 card) Ch1
Remote (4E1 card) Ch2   → **Local's** (4E1 card) Ch2
Remote (4E1 card) Ch3   → **Local's** (4E1 card) Ch3
Remote (4E1 card) Ch4   → **Local's** (V35 card)

> **Note:** To avoid unexpected errors, **DO NOT** insert any card in TB2 and TB3 at remote side while TSA function is **ON**.

Eight E1 channels and one V.35 channel mode
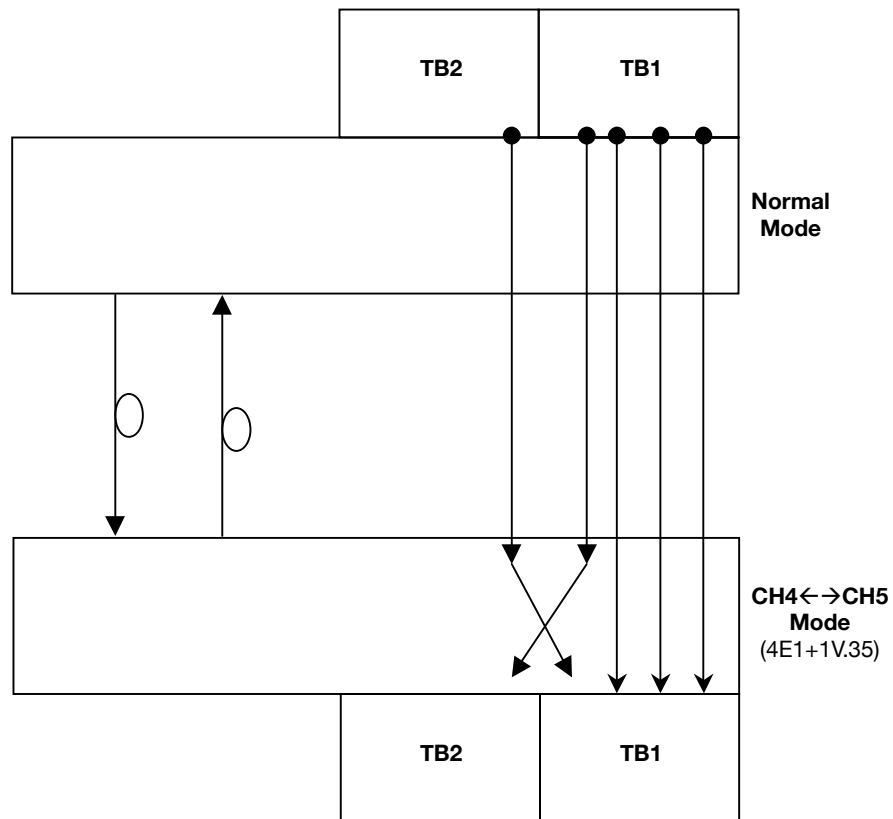
In this mode, user can also do the PRBS test as reflected in the figure as above. The remote side's channel generates the test pattern to corresponding channels in the local side.

Remote (4E1 card) Ch1~Ch3 → **Local's** (4E1 card) Ch1~Ch3
Remote (4E1 card) Ch4 → **Local's** (V35 card) Ch5
Remote (V35 card) Ch5 → **Local's** (4E1 card) Ch4

> **Note:** To avoid unexpected errors, **DO NOT** insert any card in TB2 and TB3 at remote side while TSA function is **ON**.

Optical Interface Parameters Configuration

Optical Interface Parameters Configuration Screen

Select the optical interface to configure and press `Edit[F2]` to enter the Edit Channel Screen.

Optical Interface Parameters Editing Screen

[F1] Aggr Circuit Identifier
      OE 1 Circuit Identifier
      OE 2 Circuit Identifier
Enter Circuit Identifier names as desired.

[F3] Working OE (Working Optical Enable)
Set the primary working optical interface.

[F4] ALS (Auto Laser Shutdown)
Please refer to the definition of ITU-T G.664, when the iMux detects **LOS** and the **ALS** function is enabled at the same time, then OE will shutdown the signal of Tx. It will detect the signal automatically every 100 seconds. If the alarm of **LOS** isn't cancelled immediately, then it will wait another 100 seconds again. If the **LOS** status is cleared, the system will return to normal state and transmit the laser signal again.

[F5] Standby OE Service (Standby Optical Enable Service)
Enable or disable the Standby Optical Service.

[F6] APS (Auto Protection Switch)
Set the optical auto protection to **ON** or **OFF**. When set to **OFF**, **OeLocked/OeLocked Rule/Oe Lock AutoRel Sec** will not be displayed.

[F7] OE Revertive (Optical Enable Revertive)
When set to **OFF**, **OeLocked/OeLocked Rule/Oe Lock AutoRel Sec** will not be displayed.

[F8] OE Locked (Optical Enable Locked)
Set the optical enable locked to **ON** or **OFF**.

When set to **OFF**, **OeLocked Rule/Oe Lock AutoRel Sec** will not be displayed.

When set to **ON:**

- Locks the optical system according the parameters set in the **OE Locked Rule** settings. Set the time window in minutes, and the number of times. The default setting is 10 minutes, 6 times.
- The **OE Locked AutoRel** (Auto Release) may be set will be auto-release after a user defined duration in seconds. The default setting is 3600 seconds.

    Note: If **OE Locked** is **ON**, then it needs to be released on the OE Protection Switching screen.

    Note: When any setting is changed that causes the **OeLocked/OeLocked Rule/Oe Lock AutoRel Sec** settings to be no longer displayed, rebooting the system will reload the default values.

Trunk Ethernet Configuration Selection
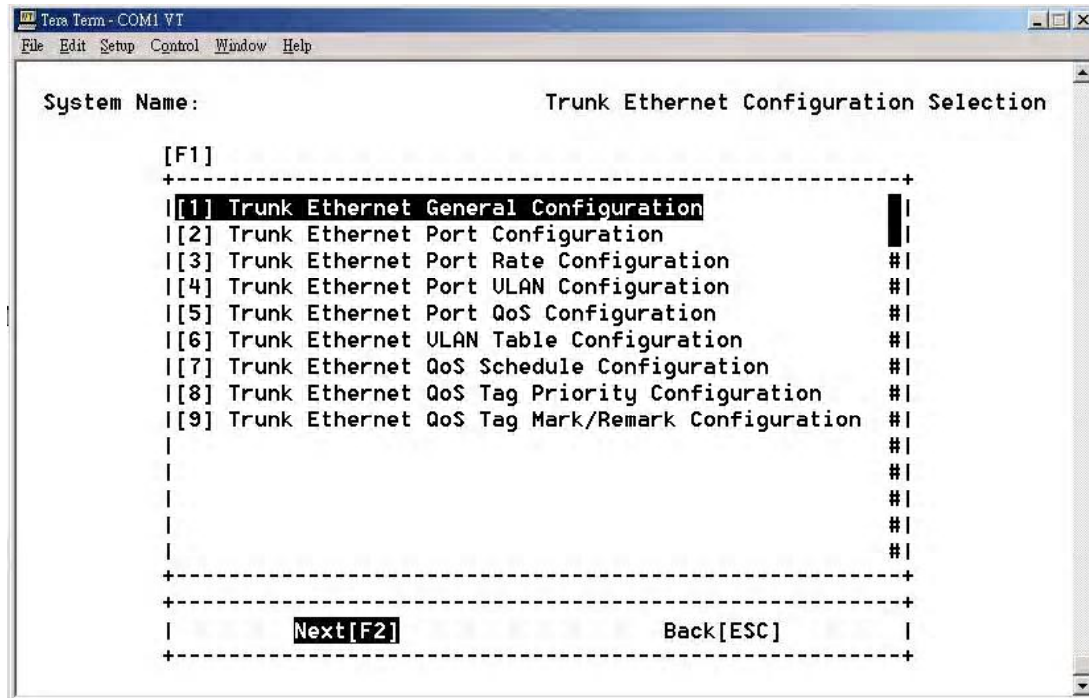
Trunk Ethernet Configuration Screen

This screen allows you to easily change port functions including the fast Ethernet rate configuration in the Ethernet interface, QoS settings and VLAN configuration.

The Trunk Ethernet Configuration menu includes:

[1] Trunk Ethernet General Configuration

[2] Trunk Ethernet Port Configuration

[3] Trunk Ethernet Port Rate Configuration

[4] Trunk Ethernet Port VLAN Configuration

[5] Trunk Ethernet Port QoS Configuration

[6] Trunk Ethernet VLAN Table Configuration

[7] Trunk Ethernet QoS Schedule Configuration

[8] Trunk Ethernet QoS Tag Priority Configuration

[9] Trunk Ethernet QoS Tag Mark/Remark Configuration

> **Note:** VLAN is enabled or disabled using the **[1] Trunk Ethernet General Configuration** menu. VLAN is configured using configuration screens **[4] Trunk Ethernet Port VLAN Configuration** and **[6] Trunk Ethernet VLAN Table Configuration** menus. These two screens follow each other in this User Guide for clarity.

Trunk Ethernet General Parameter Config


```
Tera Term - 192.168.10.84 VT                                        _□×
File  Edit  Setup  Control  Window  Help

  System Name: telways                    Trunk Ethernet General Parameter Config

       Site : Local

       [F1] VLAN Function :   Enable ▊

              Ingress Filter :     Disable▊

              Tag Aware :     Enable ▊         Tagged Only :     Disable▊

       Site : Remote

       [F3] VLAN Function :   Enable ▊

              Ingress Filter :     Disable▊

              Tag Aware :     Disable▊


       +----------------------------------------------------------------+
       |            Confirm[F2]                        Back[ESC]         |
       +----------------------------------------------------------------+
```

If the remote side shows no device or LOS, the screen will not show the remote side.
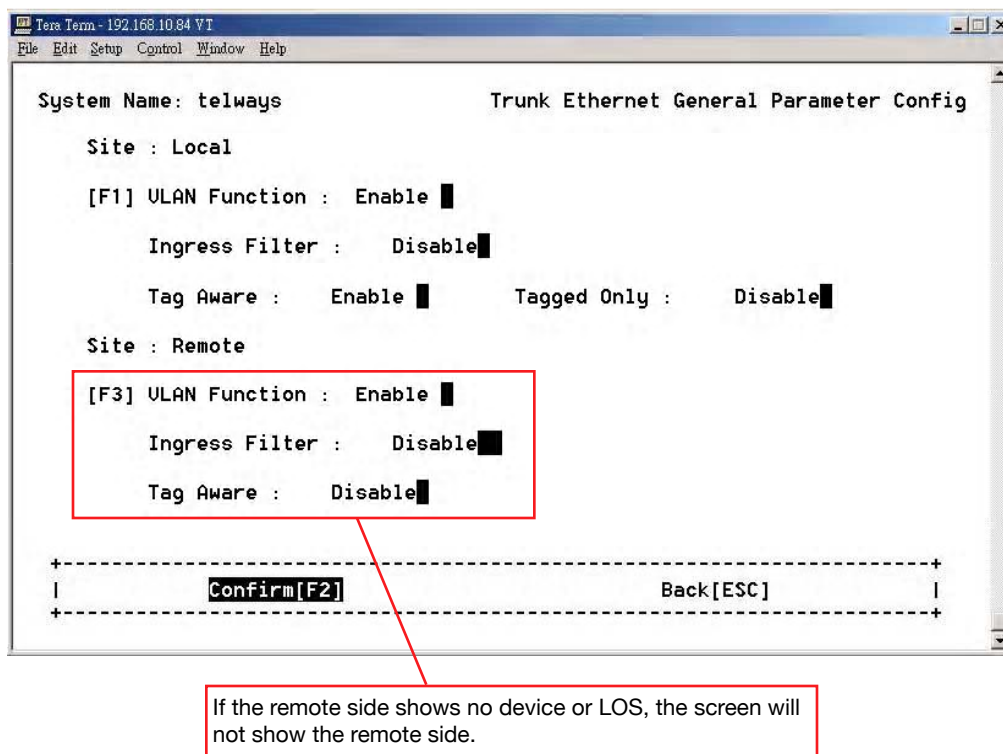
Trunk Ethernet General Configuration Screen

Set the **[F1] VLAN function** as desired.

VLAN Function

Mode	Setting	Description
Ingress Filter	**Enable**	Drop frame associated with a VLAN for which that port is not in the member set.
	Disable	Disable ingress filtering.
Tag Aware	**Enable**	Tagged-based.
	Disable	Port-based
Tag Only	**Enable**	Only accepts tagged frames and drop untagged ones.
	Disable	Accepts tagged and untagged frames.

Note: Refer to , **Trunk Ethernet Port VLAN Config**, to configure the VLAN functions.

Trunk Ethernet Parameters Config

Trunk Ethernet Parameters Configuration

Set the local and remote ports as desired.

Trunk Ethernet Parameters Configuration Slot Editing

Trunk Ethernet Port Rate Configuration

Trunk Ethernet Port Rate Configuration

You may change the Fast Ethernet port speed to another port speed. Each port may be set individually by setting the ingress and egress speed to desired speed. This setting may be extended to cover multiple network ports or limited to just either ingress or egress if needed.

- **1526** = 100M
- **152** = 10M
- **Ingress** = RX
- **Egress** = TX

Trunk Ethernet Port VLAN Config

Trunk Ethernet VLAN Config Screen

Begin setting up the VLAN configuration by using this menu.

> **Note:** The `PVID` (Port VLAN ID) must be between 1 and 4094. The `PVID` number set in this menu must also be used for the same port in the `Trunk Ethernet VLAN Configuration` screen.

Egress Mode

Mode	Description
`Unmodified`	Do not insert or remove VLAN tag to/from packets sent out from this port.
`Untagged`	If tagged packets are received, the switch will remove VLAN tag from packets
`Tagged`	If untagged packets are received, the switch will add Ingress PVID. And do nothing when switch receive any tagged packets
`Retagged`	If tagged packets received, switch will remove VLAN tags than add new tags as PVID. It is a replacement processing for tagged packets and insertion for untagged packets

After confirming the changes by selecting `Confirm [F2]`, select `[6] Trunk Ethernet VLAN Table Configuration` from the `Trunk Ethernet Configuration Selection` main menu to continue configuring VLAN.

Trunk Ethernet VLAN Table Config Management

Trunk Ethernet VLAN Table Config Screen

Select `Add[F2]` to add a VLAN configuration to the table.

Trunk Ethernet VLAN Configuration Add

Specify the `VLAN Id` and its associated port member using the same `VLAN Id` entered in the `Trunk Ethernet Port VLAN Config` screen. Select `Confirm[F2]` to add the configuration to the table.

Trunk Ethernet QoS Port Config

Trunk Ethernet QoS Port Config Screen

This screen specifies the QoS configuration for every trunk ethernet port.

QoS Mode

Mode	Description
Disable	Turn off the QoS function for this port
PortBased	Turn on the the QoS function, and the priority of each packet received from this port is assigned by the following [Priority] setting. There are four priority levels, Queue1, Queue2, Queue3, and Queue4.
Tagged	In this mode, when a packet is VLAN-tagged or priority-tagged, the priority is specified by the 3-bit tag. When a packet is untagged, its priority is assigned by the following [Priority] setting.

Trunk Ethernet QoS Schedule Config

Trunk Ethernet VLAN QoS Schedule Config Screen

This screen specifies the the packet egress scheduling configuration when QoS support is enabled.

The packet scheduling is weighted round robin (WRR), the setting [Weight] is applied to the four queues.

This approach prevents the lower priority frames from being starved out with only a slightly increased delay to the higher priority packets, and guarantee the minimal packet rate of one queue.

The range of weight for each port is between 1 and 127. For Queue3 and Queue4, the strict priority scheduling is supported.

If there is strict priority (only in Q2 and Q3) and WRR at the same time, the queue with strict priority has higher priority than WRR. When the scheduler scans queues, queues with strict priority are scanned first, and than the other queues are scanned according to WRR.

If there is more one queue with strict priority, the queue with the bigger queue ID has higher priority.

Trunk Ethernet QoS Tag Priority Config

Trunk Ethernet QoS Tag Priority Config Screen

Specifies the mapping of 3-bit tag priority to the four level priority, Queue1 ~ Queue4.

Trunk Ethernet Tag Mark/Remark Config

Trunk Ethernet QoS Tag Mark/Remark Config Screen

Specifies the remarking mapping for tagged and retagged packets.

When the VLAN tags are entered as non-tagged packets, the 3-bit priority of the inserted tag will follow this configuration.

When the Egress Mode setting is Retagged and the TagRemark setting is turned ON, the priority field of of the VLAN tag is replaced with this tag priority of the assigned queue.

Data Port Parameters Configuration
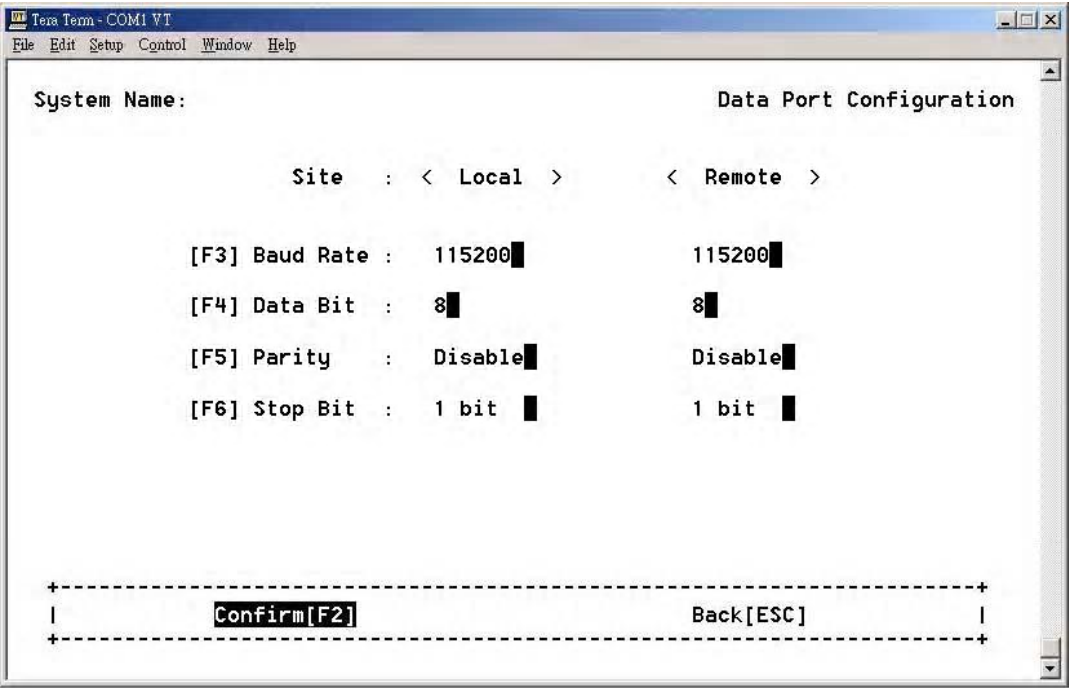
Data Port Configuration Screen

In this screen you may configure different data rates for transmitting and receiving data.

RLH Industries, Inc. • 866-DO-FIBER • www.fiberopticlink.com   System Configuration

Performance Management Threshold Configuration

PM Threshold Configuration
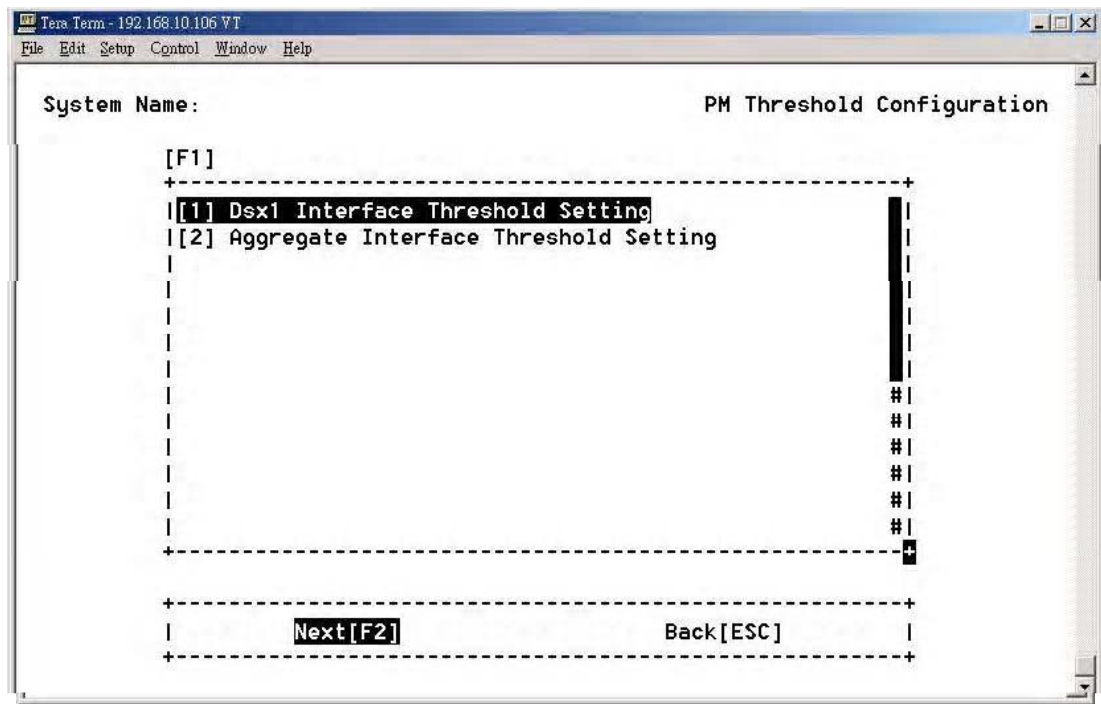
PM Threshold Configuration Screen

The Performance Management setting allows you set a PM threshold value. If the PM value is equal or over the threshold's value then it will issue the TCA alarm.

If TCA alarm is enabled, the alarm of TCA will be released after it's min/day setting.

If the value is " 0 " the TCA will be disabled.

Threshold Settings

Setting	Description
`[1] Dsx1 Interface Threshold Setting`	Electrical interface threshold setting.
`[2] Aggregate Interface Threshold Setting`	Optical interface threshold setting.

Dsx1 Interface Threshold Setting

```
Tera Term - 192.168.10.106 VT                                    _|□|×|
File  Edit  Setup  Control  Window  Help

  System Name:                          Dsx1 Threshold Parameters Setting

   [F3]Site: All   ▮   [F4]SlotId: All▮   ChId: All▮   [F5]PM Table: All ▮

  +---------------------------------------------------------------------+
  |[F1]St/Sl#/Ch#/PMType        LCV  LES  LSES     PCV  PES  PSES  PUAS  |
  |Lo/1/1/Quarter                 0    0    0        0    0    0     0 ▮|
  |Lo/1/1/Day                     0    0    0        0    0    0     0 #|
  |Lo/1/2/Quarter                 0    0    0        0    0    0     0 #|
  |Lo/1/2/Day                     0    0    0        0    0    0     0 #|
  |Lo/1/3/Quarter                 0    0    0        0    0    0     0 #|
  |Lo/1/3/Day                     0    0    0        0    0    0     0 #|
  |Lo/1/4/Quarter                 0    0    0        0    0    0     0 #|
  |Lo/1/4/Day                     0    0    0        0    0    0     0 #|
  |Lo/2/1/Quarter                 0    0    0        0    0    0     0 #|
  |Lo/2/1/Day                     0    0    0        0    0    0     0 #|
  |Lo/2/2/Quarter                 0    0    0        0    0    0     0 #|
  |Lo/2/2/Day                     0    0    0        0    0    0     0 #|
  |Lo/2/3/Quarter                 0    0    0        0    0    0     0 #|
  +---------------------------------------------------------------------+
  +---------------------------------------------------------------------+
  |   Edit[F2]        Disable[F6]        All Disable[F7]     Back[ESC]   |
  +---------------------------------------------------------------------+
```

Dsx1 Threshold Parameters Setting

You may use the function keys to modify the selected traffic link. There are two PM types:
the **Quarter** (15 minutes), the **Day** (24 hours).

Function Key	Description
[F6] Disable	Disable the PM TCA alarm on the selected E1 path by high light bar
[F7] All Disable	Disable the PM TCA alarm on the all selected E1 paths by the selection filters

Dsx1 Threshold Parameters Editing Screen

Function Key	Setting	Description
[F1] Line	**LCV:**	Line Code Violation
	LES:	Line Error Second
	LSES:	Line Several Error Second
[F3] Path	**PCV:**	Path Code Violation
	PES:	Path Error Second
	PSES:	Path Several Error Second

Aggregate Interface Threshold Setting

Aggregate Threshold Parameters Setting Screen

You may use the function keys to modify the selected traffic link. There are two PM types:
the **Quarter** (15 minutes), the **Day** (24 hours).

Aggregate Threshold Parameters Editing Screen

Fault Management Parameters Configuration

Fault Parameter Configuration
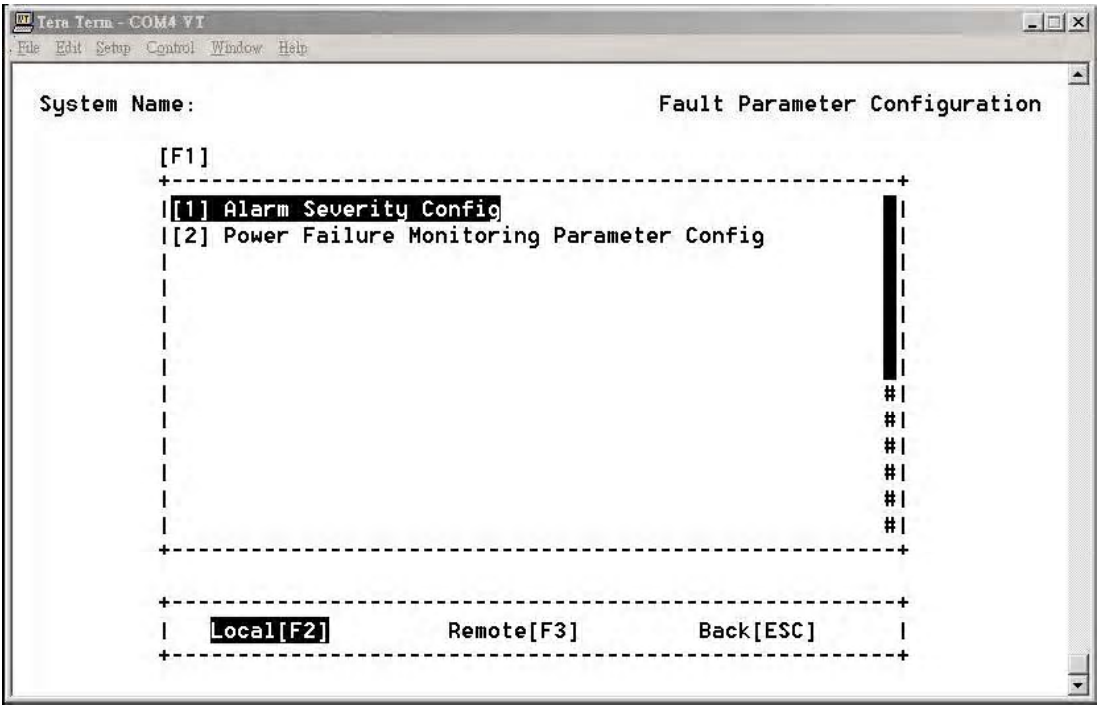
Fault Parameter Configuration Screen

The iMux provides fault management functions by setting the alarm severity for each failure alarm.

Alarm Severity Config

Alarm Severity Config Screen

The administrator can define alarm severity and easy to manage alarm status.

If the alarm severity configured as `Critical` or `Major`, the red **MAJ LED** turn on when an alarm occurs. Otherwise, both `Minor` and `Warning` alarm will turn on the yellow **MIN LED**.

Power Failure Monitoring Parameter Config
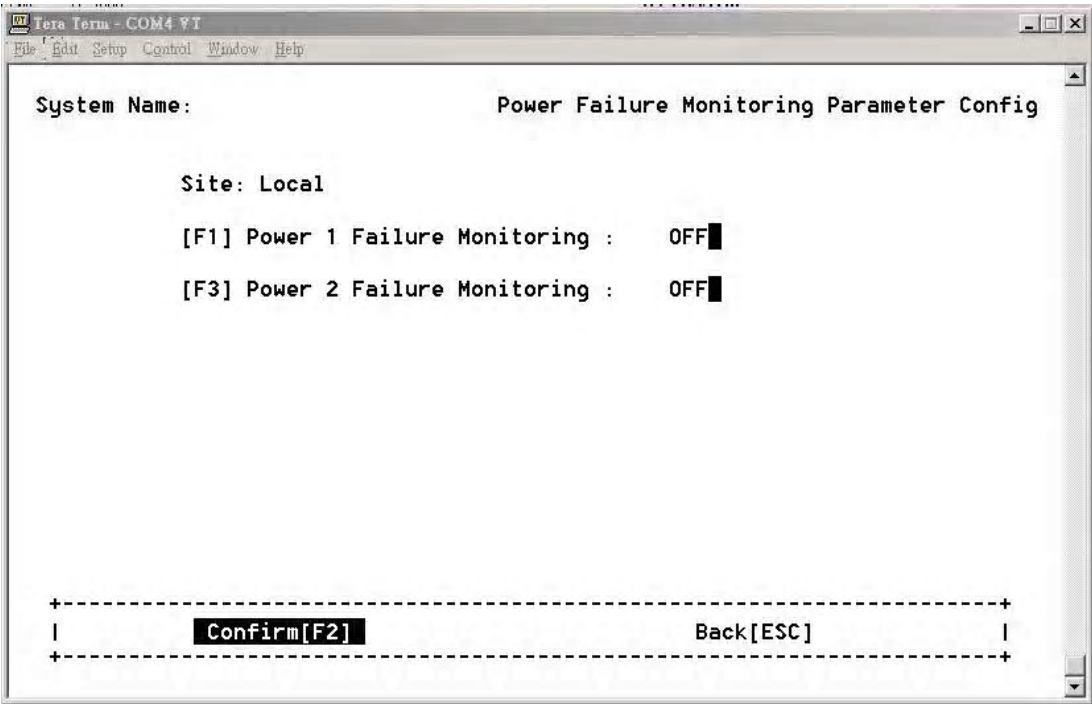
Power Failure Monitoring Parameter Config Screen

Provides the capability of power monitoring.

When **ON** is selected and the power module has failed, an alarm will be issued.

External Clock Configuration and Monitoring
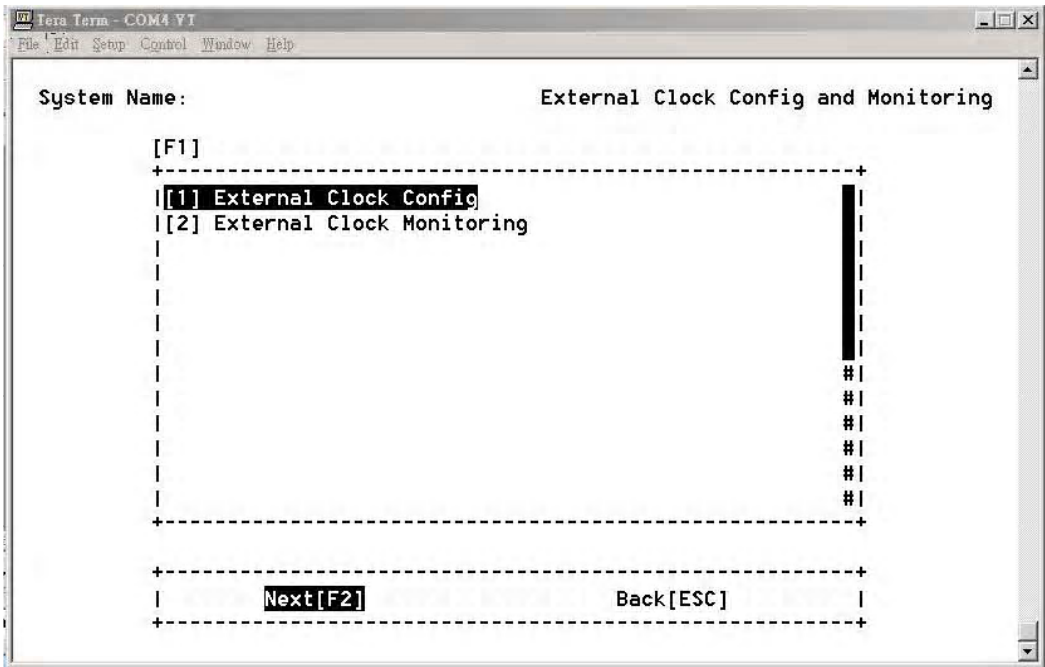
External Clock Config and Monitoring Screen

To provide more stable synchronous for the system, you can use the built-in optional external clock module. This provides the extra external clock input for the whole system's reference.

External Clock Configuration
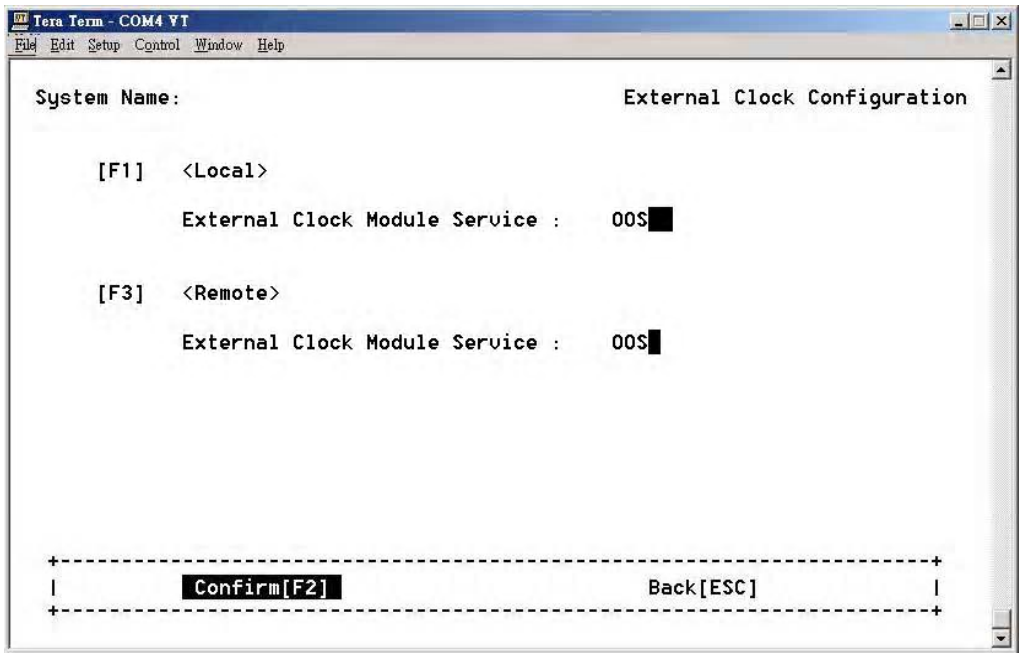
External Clock Configuration Screen

User can select **OOS** (Out of System) or **IS** (In System) to turn on or off the external clock input.

When the EOC (External Optional Clock) connection has failed or the External Cock module is not installed, the configuration will not show.

External Clock Monitoring
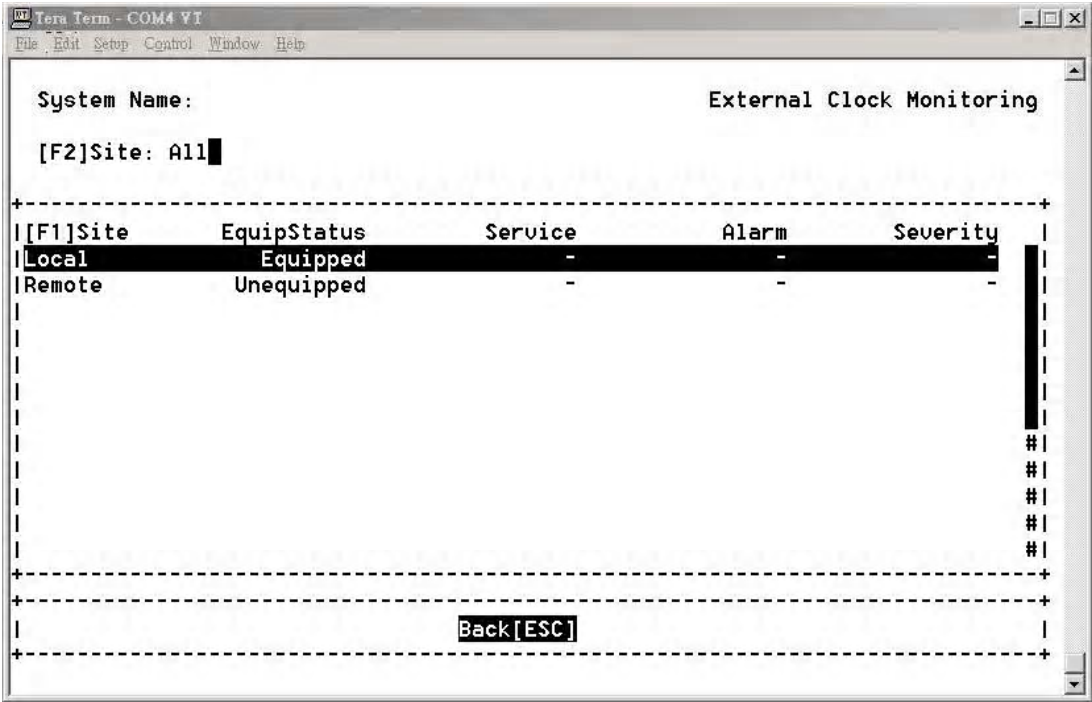
External Clock Monitoring Screen

If the External Clock Module is installed, the **EquipStatus** will show as **Equipped**, and **Unequipped** will be shown when the module is absent.

OE Protection Switching

The user may make the active OE module locked or released and manually restart the OE module from this screen.

1. **Configuration**
   Shown the configuration of `APS` (Automatic Protection Switching), `ALS` (Automatic Laser Shutdown), `Rvt` (revertive operation), `LCK` (lockout the active OE module) from the Optical Interface Parameters Configuration screen.

2. **OE Protection Switching Status**
   Shown the current status of active OE module, the status of lock-out mechanism, the OE module switched times by automatic or manually, and the seconds left for release after locked state. The lock-out mechanism can be activated or deactivated by command `OE Lock/Release [F2]` on the aggregate interface. Some parameters are configured on the Optical Interface Parameters Configuration screen.

3. **OE Status**
   Shows the alarm and laser status of the OE modules. Shut down lasers may be restarted by using `OE Restart [F4]` and `OE Restart-Test [F5]` commands on the OE interfaces.

Automatic laser shutdown

The ALS mechanism implemented in iMux is referred to the ITU Recommendation ITU-T G.664. The ALS mechanism can be enabled or disabled in the Optical Interface Parameters Configuration screen.

```
                                    ┌─────────┐
                                    │  Start  │
                                    └─────────┘
                                         │
                    ┌────────────────────┘
                    │         ┌──────────────────────────┐
                    │         │   ALS Operation Enable    │
                    │         └──────────────────────────┘
                    │                    │
         Yes        │         ┌──────────────────────────┐
      ◄─────────────┤         │  Receive signal from      │◄──────────┐
                    │         │  far end?                 │           │
                    │         └──────────────────────────┘           │
                    │                    │ No                        │
         No         │         ┌──────────────────────────┐           │
      ◄─────────────┤         │  Loss of received signal  │           │
                    │         └──────────────────────────┘           │
                    │                    │ Yes                       │
                    │         ┌──────────────────────────┐           │
                    │         │    Auto power shutdown    │           │
                    │         └──────────────────────────┘           │
```

Start

ALS Operation Enable

Receive signal from far end? — Yes

Loss of received signal — No

Auto power shutdown — Yes

| Automatic restart | Manual OE restart | Manual OE restart for test |

| Delay time 100 sec. | | |

| Tx ON for 2 sec. | Tx ON for 2 sec. | Tx ON for 90 sec. |
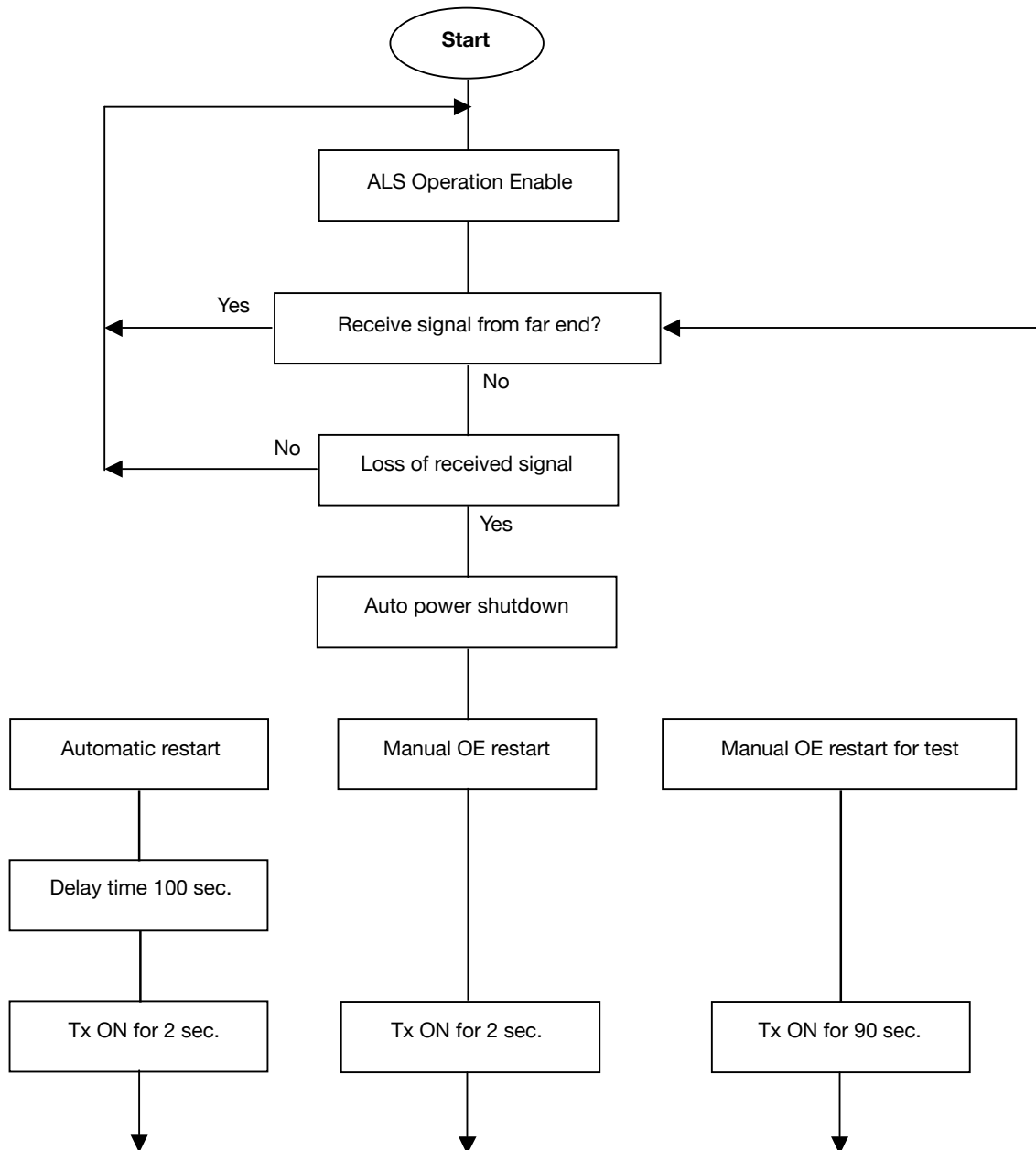
Automatic Laser Shutdown Flowchart

Equipment Status Monitoring

Status Monitoring Screen

On the equipment status monitoring screen, you can see an overall view of the alarm status of the interlinked rack systems, and it also provides the operator with direct access to the tributary card modes.

[PWR] – is power supply

[PWR] – is fan monitor

H – is external alarm occurred
L – is external alarm normal

"-" – is for Normal
F – is for Failure
G – means Green LED
R – means Red LED
Y – means Yellow LED
" " – (no character) means the device is

B – is for E1 Unbalanced (75Ω)
U – is for E1 Balanced (120Ω)

Equipment Status Monitoring Screen

Local site tributary card setting


```
Tera Term - 192.168.10.103 VT                                           _|□|×|
File  Edit  Setup  Control  Window  Help

  System Name:                              Equipment Status Monitoring
+-------------------------------------------------------------------+
|<Lo> HwVer: 0.3.3|    Optical    | LAN PORT      1     2     3     4 |
| MAJ: R    PWR: G | [OE1]   [OE2] | LINK          G     -     -     - |
| MIN: -    LCK: - | LSR: Y   LSR: | FDX/100M     G/G  -/-   -/-   -/- |
| LBK: -    ACO: - | LOS: -   LOS: | TB CH         1     2     3     4 |
| RDI: -           | WK: G    WK:  | TB1/G 4xE1F/U -     -     R     - |
|---------------------------------| TB2/G 4xE1F/U -     -     -     - |
| [PWR1]: F [FAN]: -  [ExtAlm1]: L | TB3                               |
| [PWR2]: -           [ExtAlm2]: L | TB4                               |
+-------------------------------------------------------------------+
|<Re> HwVer: 0.3.3|    Optical    | LAN PORT      1     2     3     4 |
| MAJ: R    PWR: G | [OE1]   [OE2] | LINK          G     -     -     G |
| MIN: -    LCK: - | LSR: Y   LSR: | FDX/100M     G/G  -/-   -/-   G/G |
| LBK: -    ACO: - | LOS: -   LOS: | TB CH         1     2     3     4 |
| RDI: -           | WK: G    WK:  | TB1/G 4xE1F/U R     R     R     R |
|---------------------------------| TB2/G 4xE1F/U R     R     R     R |
| [PWR1]: F [FAN]: -  [ExtAlm1]: L | TB3/G  1xV35  R                   |
| [PWR2]: -           [ExtAlm2]: L | TB4                               |
+-------------------------------------------------------------------+
|   Lo->R [F1]         TB1 Edit[F2]        TB2 Edit[F3]      Back[ESC]|
+-------------------------------------------------------------------+
```

Lo – means Local Site

When a card is plugged into **TB1** (Tributary Slot 1), this row will show TB card data here. In this example, when a module is installed, pressing **[F2]** will let you set parameters for that slot.

Into Card Parameters Setting screen


```
Tera Term - 192.168.10.101 VT                                           _□×

File  Edit  Setup  Control  Window  Help

  System Name: 1                          E1 Parameters Slot Editing


           Location :  Local /Slot 1

            All channels will be set as:

            [F1] Service Mode     :   IS ▮

            [F3] Frame Type       :   FAS     ▮

            [F4] Line Coding      :   HDB3▮




      +---------------------------------------------------+
      |      Confirm[F2]                  Back[ESC]        |
      +---------------------------------------------------+
```

Remote site

```
Tera Term - 192.168.10.103 VT
File  Edit  Setup  Control  Window  Help

System Name:                                    Equipment Status Monitoring
+-------------------------------------------------------------------------+
|<Lo> HwVer: 0.3.3|     Optical    | LAN PORT        1      2      3      4 |
| MAJ: R    PWR: G | [OE1]   [OE2] | LINK            G      -      -      - |
| MIN: -    LCK: - | LSR: Y  LSR:  | FDX/100M       G/G    -/-    -/-    -/- |
| LBK: -    ACO: - | LOS: -  LOS:  | TB CH           1      2      3      4 |
| RDI: -           | WK: G   WK:   | TB1/G 4xE1F/U   -      -      R      - |
|-----------------------------------| TB2/G 4xE1F/U   -      -      -      - |
| [PWR1]: F [FAN]: -   [ExtAlm1]: L | TB3                                   |
| [PWR2]: -            [ExtAlm2]: L | TB4                                   |
+-------------------------------------------------------------------------+
|<Re> HwVer: 0.3.3|     Optical    | LAN PORT        1      2      3      4 |
| MAJ: R    PWR: G | [OE1]   [OE2] | LINK            G      -      -      G |
| MIN: -    LCK: - | LSR: Y  LSR:  | FDX/100M       G/G    -/-    -/-    G/G |
| LBK: -    ACO: - | LOS: -  LOS:  | TB CH           1      2      3      4 |
| RDI: -           | WK: G   WK:   | TB1/G 4xE1F/U   R      R      R      R |
|-----------------------------------| TB2/G 4xE1F/U   R      R      R      R |
| [PWR1]: F [FAN]: -   [ExtAlm1]: L | TB3/G  1xV35    R                     |
| [PWR2]: -            [ExtAlm2]: L | TB4                                   |
+-------------------------------------------------------------------------+
+-------------------------------------------------------------------------+
|    Lo->Re[F1]        TB1 Edit[F2]        TB2 Edit[F3]        Back[ESC]    |
+-------------------------------------------------------------------------+
  [PWR2]: -            [ExtAlm2]: L | TB4
+-------------------------------------------------------------------------+
+-------------------------------------------------------------------------+
|    Lo->Re[F1]        TB1 Edit[F2]        TB2 Edit[F3]        Back[ESC]    |
+-------------------------------------------------------------------------+
```

Re – indicates Remote Site

When a card is plugged into **TB1** (Tributary Slot 1), this row will show TB card data here. In this example, when a module is installed, pressing the desired function key will let you set parameters for that slot.

Into Card Parameters Setting screen

```
Tera Term - 192.168.10.101 VT
File  Edit  Setup  Control  Window  Help

System Name: 1                          V.35 Parameters Slot Editing


            Location  : Remote/Slot 2

            All channels will be set as:

            [F1] Service Mode   :   IS

            [F3] Clock Source   :   Internal

            [F4] Tx Clock       :   Normal

            [F5] Rx Clock       :   Normal

            [F6] Data Rate      :   2048K

            [F7] Frame Mode     :   Unframed

    +-----------------------------------------------------------+
    |     Confirm[F2]                          Back[ESC]        |
    +-----------------------------------------------------------+
```

Performance Monitoring
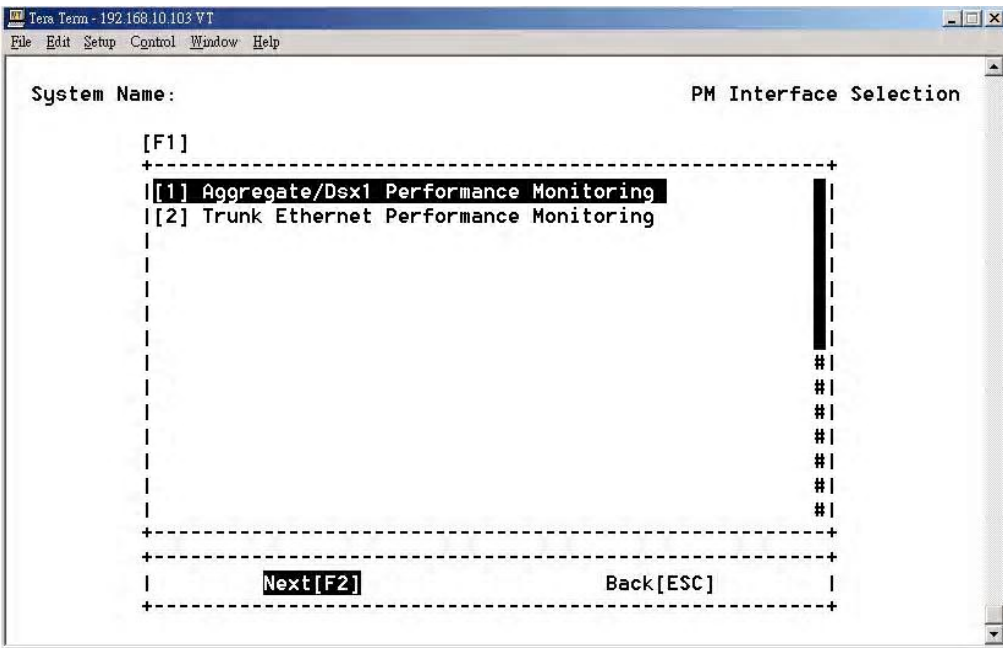
Performance Monitoring Selection Screen

The performance monitoring screen shows the Aggregate/Dsx1 and Ethernet PM (Performance Monitoring).

Aggregate/Dsx1 Performance Monitoring
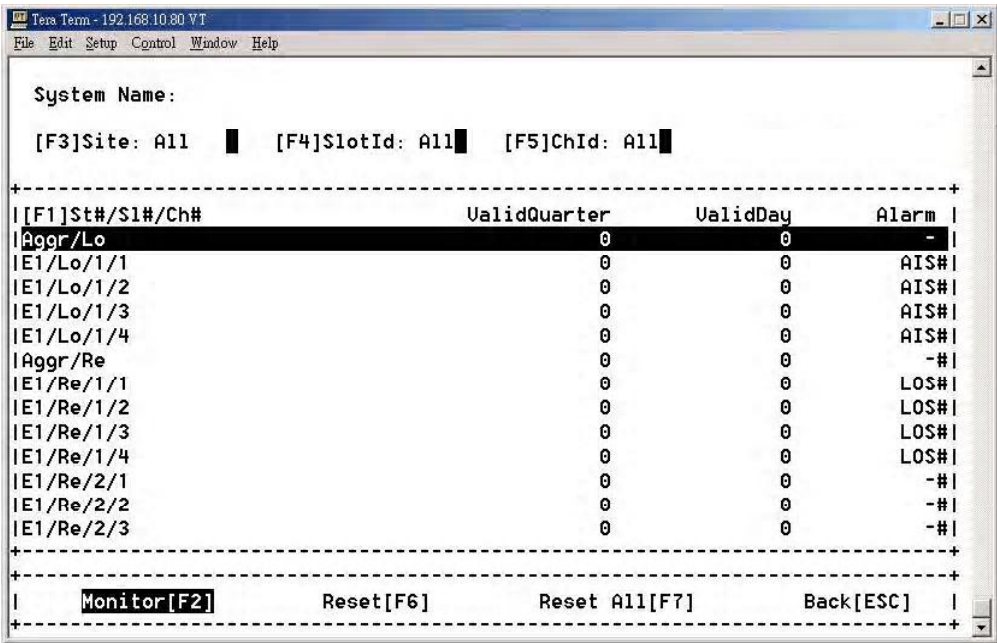
Performance Monitoring Screen

The **Performance Monitoring Screen** will show the valid quarters and valid days had been counted for each card. Select the card and access to next screen to see the detail performance data.

Function Key	Description
[F6] Reset	Clears all PM counters on the selected monitoring path
[F7] Reset All	Clears all PM counters on the monitoring paths

Performance Monitoring Settings

Performance Monitoring Settings

Function Key	Mode	Description
[F3] PM Type	CurrQuart	Current Quarter
	HistQuart	History Quarter
	CurrDay	Current Day
	HistDay	History Day
	Quarter	Quarter Hour (every 15 minutes)
[F2] Reset		Clears the selected PM type
[F5] Reset All		Clears all the PM types

Trunk Ethernet Performance Monitoring

Trunk Ethernet Performance Monitoring Screen

Menu Item	Description
`Tx`	TX byte or packet counter. This counter is incremented once for every data byte/packet of a transmitted packet.
`Rx`	RX byte or packet counter. This counter is incremented once for every data byte of a received and forwarded good packet. RX byte/packet count includes both forwarded and dropped good packets. For mirror RX forwarded packets, if these are not good packets they will not be counted.
`RxDrop`	RX drop packet count. Packet drop events could be due to lack of resource, local packet, etc. If the mirror RX function is enable and the packets are only received by the mirror port, these packets are also included in the mirrored ports drop packet counter. Packet lengths less than 64 bytes are not included.
`RxCRC`	RX CRC error packet counter. This counter is incremented once for every received packet with a length more than 64 bytes but with a CRC error. Oversize packets are also included in this counter.
`RxFragment`	RX fragment, collision, and undersize packet count. These packet lengths are less than 64 bytes.

Path Alarm/State Monitoring
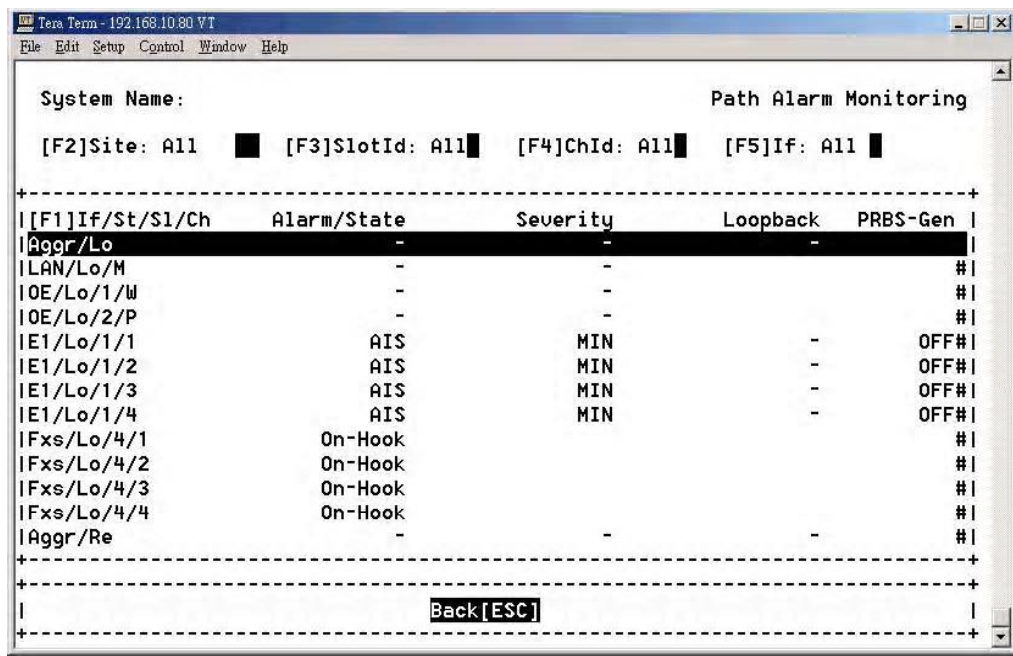
Path Alarm Monitoring Screen

This screen shows all of alarm status for all monitoring path. Some diagnostic testing work will cause an alarm to be triggered, and the status of loopback (V.54) and PRBS action shown as well.

Interface Alarms

Interface	Possible Alarms
OE	LOS
Aggr	LOF, RDI, AIS
T1/E1	LOS, LOF, RDI/AIS
V35	LOS
Ethernet	Link
LAN/WAN	Link
Fxo/Fxs	On-Hook, Off-Hook

Loopback/V.54 Testing

```
Tera Term - 192.168.10.80 VT                                  _ □ x
File  Edit  Setup  Control  Window  Help

   System Name:                                 Loopback/V.54 Testing

   [F3]Site: All    ■    [F4]SlotId: All■    [F5]ChId: All■

   +----------------------------------------------------------------+
   |[F1]If/St#/Sl#/Ch#     LoLbk/ANA   ReLbk/DIG   REM   PRBS-Gen   Alarm  |
   |Aggr/Lo                   OFF         OFF                        -  ■|
   |E1/Lo/1/1                 OFF         OFF             OFF       AIS #|
   |E1/Lo/1/2                 OFF         OFF             OFF       AIS #|
   |E1/Lo/1/3                 OFF         OFF             OFF       AIS #|
   |E1/Lo/1/4                 OFF         OFF             OFF       AIS #|
   |Aggr/Re                   OFF         OFF                        - #|
   |E1/Re/1/1                 OFF         OFF             OFF       LOS #|
   |E1/Re/1/2                 OFF         OFF             OFF       LOS #|
   |E1/Re/1/3                 OFF         OFF             OFF       LOS #|
   |E1/Re/1/4                 OFF         OFF             OFF       LOS #|
   |E1/Re/2/1                 OFF         OFF             OFF        - #|
   |E1/Re/2/2                 OFF         OFF             OFF        - #|
   |E1/Re/2/3                 OFF         OFF             OFF        - #|
   +----------------------------------------------------------------+
   +----------------------------------------------------------------+
   |     LoLbk/ANA[F2]        ReLbk/DIG[F6]      REM[F7]      Back[ESC]  |
   +----------------------------------------------------------------+
```

Loopback/V.54 Testing Screen

For diagnostic purposes, low speed E1 or V.35 data channels and high speed aggregate signals can be locally loop-backed or remotely loop-backed.

Loopback Testing

E1 Module

There are four types of loopback functions for the E1 Module:

1. Tributary Local Loopback (for each E1 signal)

2. Aggregate Local Loopback (for all multiplexed E1 signals)

3. Aggregate Remote Loopback (for all multiplexed E1 signals)

4. Tributary Remote Loopback. (for each E1 signal)

Users can select whether to diagnose a specific channel or all channels under the loopback / V.54 Testing.

Local Site   **Remote Site**
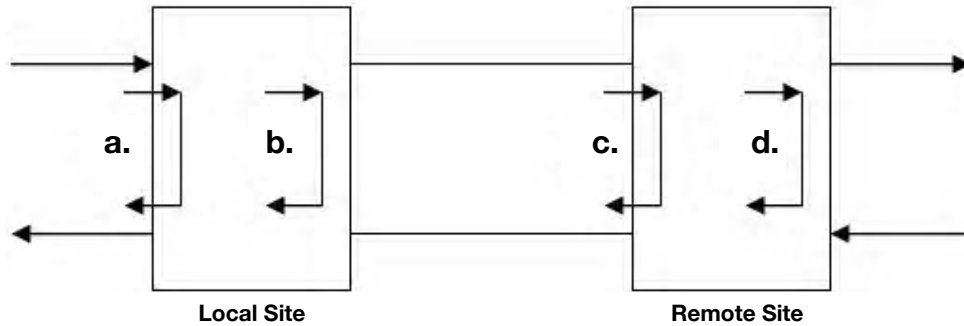
a. TributaryLocalLoopback: In the Loopback/V.54 Testing screen, select the slot ID which is on the tributary card in the local site, then choose `LoLbk/ANA[F2]`.

b. AggregateLocalLoopback: In the Loopback/V.54 Testing screen, select the `Aggr/Lo` aggregate item in the local site then choose `LoLbk/ANA[F2]`.

c. AggregateRemoteLoopback: In the Loopback/V.54 Testing screen, select the `Aggr/Lo` aggregate item in the remote site then choose `ReLbk/DIG[F6]`.

d. TributaryRemoteLoopback: In the Loopback/V.54 Testing screen, select the slot ID which is on the tributary card in the remote site then choose `ReLbk/DIG[F6]`.

   Note: In the E1 module, `REM` may not be selected because it is only for the V.35 module.

V.35 Module

There are three types of loopback functions for the V.35 Module:

1. Analog (`ANA`) Loopback

2. Digital (`DIG`) Loopback

3. Request Remote (`REM`) Loopback

V35 Card   **V35 Card**

DTE   **DTE**

Local Site   **Remote Site**
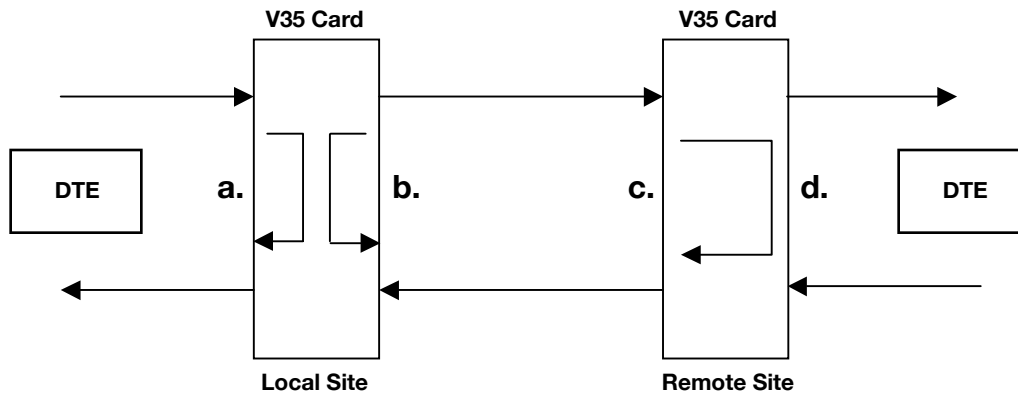
a. Analog (ANA) Loopback: In the Loopback/V.54 Testing screen, select the slot ID which is on the tributary card in the local site, then choose `LoLbk/ANA` item.

b. Digital (DIG) Loopback: In the Loopback/V.54 Testing screen, select the slot ID which is on the tributary card in the local site, then choose `ReLbk/DIG` item.

c. Request Remote (REM) Loopback: In the Loopback/V.54 Testing screen, select the slot ID which is on the tributary card in the local site, then choose `REM` item.

Note: function key **[F8]**

> If the EOC (embedded channel) had broken such as in the aggregate remote loopback state then **Undo-AgReLBK[F8]** can be used to re-built the EOC channel. But, if the optical signal is lost, this function won't be enabled.

PRBS Test


```
Tera Term - 192.168.10.80 VT                                    _ □ ×
File  Edit  Setup  Control  Window  Help

   System Name:                                        PRBS Testing

    [F3]Site: All    ■    [F4]SlotId: All■    [F5]ChId: All■

+-----------------------------------------------------------------+
|[F1]If/St#/Sl#/Ch#      PtGen    PtAna      Error     BER   Alarm |
|E1/Lo/1/1               OFF      OFF          -        -      AIS |
|E1/Lo/1/2               OFF      OFF          -        -      AIS |
|E1/Lo/1/3               OFF      OFF          -        -     AIS# |
|E1/Lo/1/4               OFF      OFF          -        -     AIS# |
|E1/Re/1/1               OFF      OFF          -        -     LOS# |
|E1/Re/1/2               OFF      OFF          -        -     LOS# |
|E1/Re/1/3               OFF      OFF          -        -     LOS# |
|E1/Re/1/4               OFF      OFF          -        -     LOS# |
|E1/Re/2/1               OFF      OFF          -        -       -# |
|E1/Re/2/2               OFF      OFF          -        -       -# |
|E1/Re/2/3               OFF      OFF          -        -       -# |
|E1/Re/2/4               OFF      OFF          -        -       -# |
|                                                               #  |
+-----------------------------------------------------------------+
+-----------------------------------------------------------------+
|      Pt-Gen[F2]                Pt-Ana[F6]           Back[ESC]    |
+-----------------------------------------------------------------+
```

Pattern Generate

Pattern Analysis

PRBS Testing Screen

The pattern of PRBS is 2^{15}-1(unframing). Both E1 and V35 are able to perform this testing.

In order to do the self-test, any E1 data link can be selected to have a PRBS test. The tested result will be shown in the number of error bits as well as its error ratio.

> **Note:** You can only choose one channel to generate or analyze at the same time.

One way PRBS test step
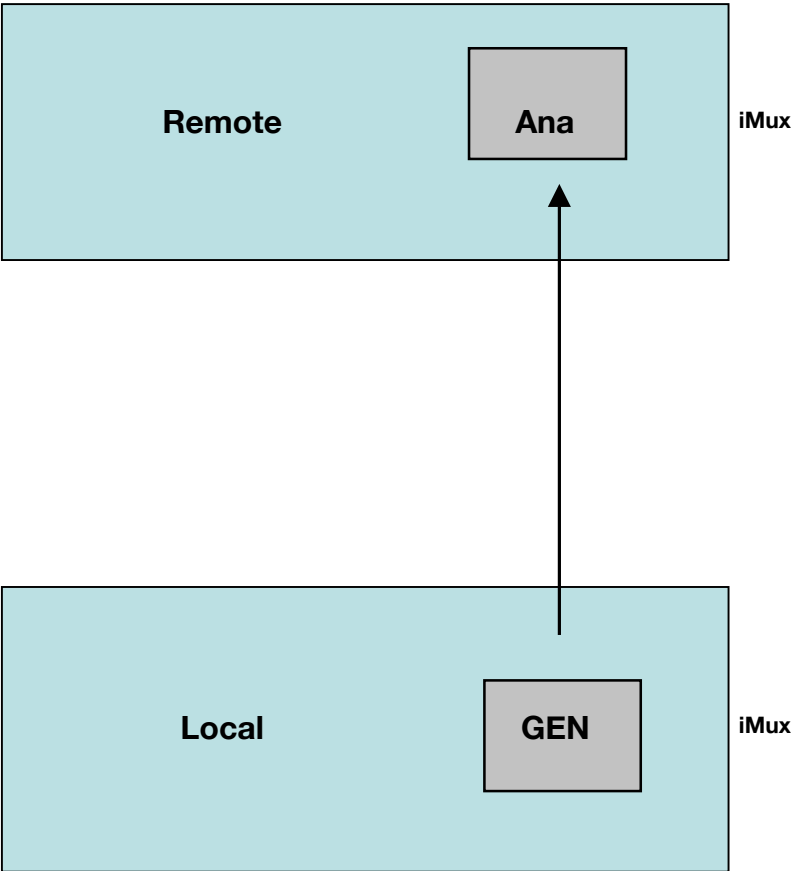
The round trip PRBS test function operating step
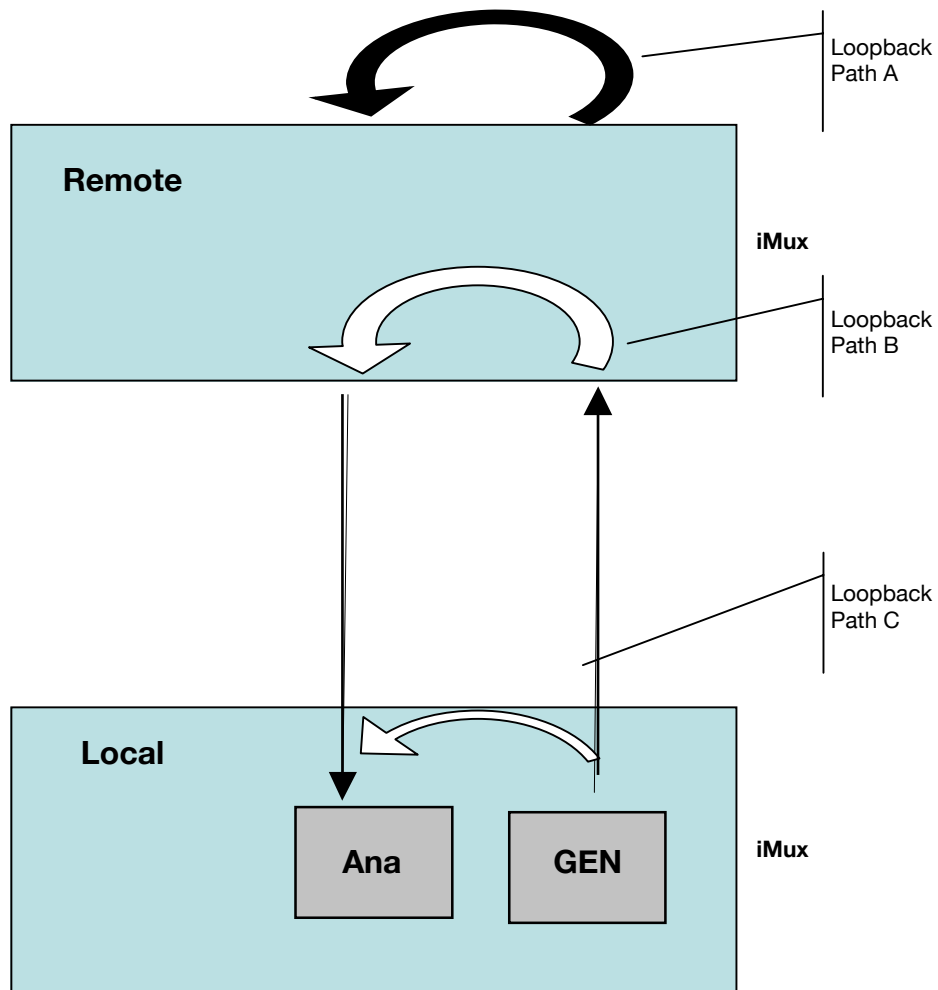
Refer to the loopback test function to verify the loopback setting.

To do the PRBS test, first set the loopback path (Loopback A, B or C) which you want to test. The local device will generate a test pattern to remote device, then the local device's analyzer will receive a test pattern through the loopback path. The test results will be shown on the screen.

Event Browsing
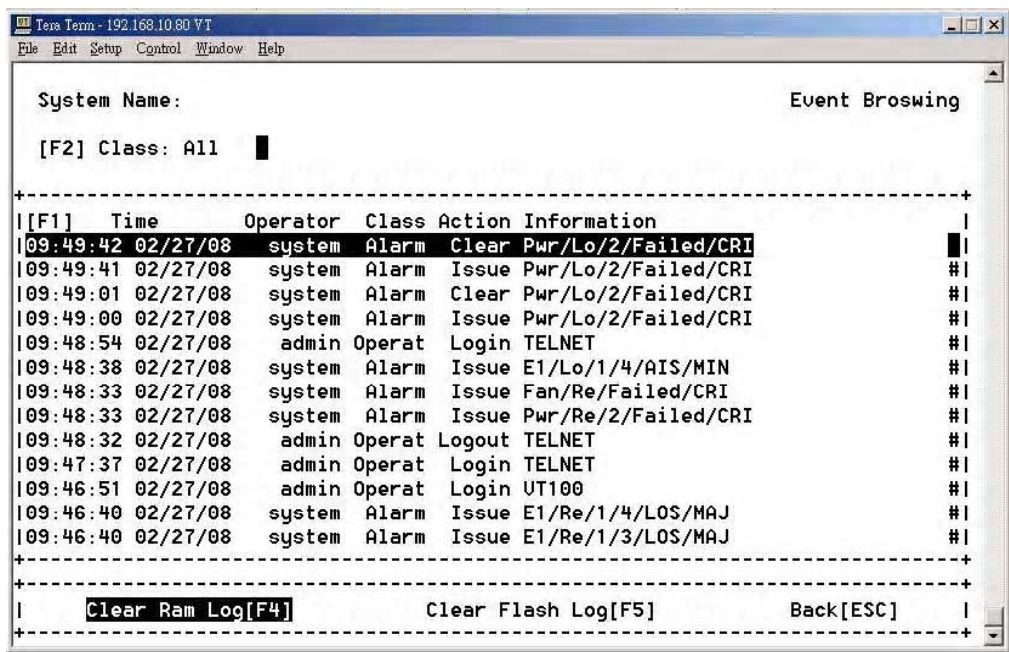
Event Browsing Screen

Menu Item	Description
`Clear Ram Log[F4]`	Clears all history events since the system last booted.
`Clear Flash Log[F5]`	If the event-saving function is enabled, this will clear all history events stored in flash memory.

6. Front Panel Operation
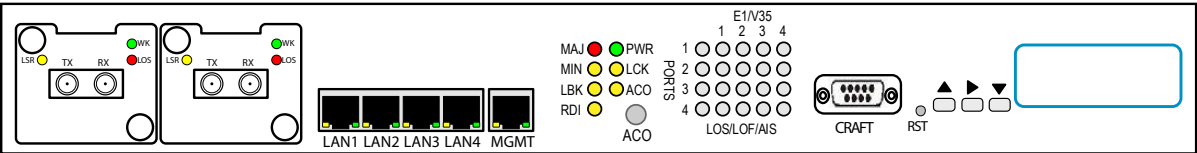
iMux Front Panel

The default password for accessing the iMux via the front panel is a combination of the buttons as below, from left to right:

Button	Up ▲	Right ▶	Down ▼	Up ▲

Note: The login password in the LCD window may be changed via VT100 setting.

Front panel button functions are as follows:

▲
Go back to the upper level of the menu

▶
Item select

▼
Enter key to go to a sub-menu or enable selected action

LCD Menu Tree

Password:_ _ _ _ (See LCD Login Configuration)

▶---System
  ▶ ----Network Service [Site]
    ▶----SNMP(ON/OFF)
    ▶----TELNET(ON/OFF)
    ▶----FTP(ON/OFF)
    ▶----WEB(ON/OFF)

  ----Profile Operation [Site/ProfID]
    ▶----Load
    ▶----Save

  ----Reboot Operation [Site]
    ▶----Reboot(DOWN)

▶---Tb Config
  ▶----E1 [Site/Slot/Ch]
    ▶----FrameType (FAS+CRC/FAS/OFF)
    ▶----LineCoding (HDB3/AMI)
    ▶----Service (IS/OOS)

  ▶----T1 [Site/Slot/Ch]
    ▶----FrameType (FAS+CRC/FAS/OFF)
    ▶----LineCoding (HDB3/AMI)
    ▶----Service (IS/OOS)
    ▶----T1 LBO (0-133 ft /133-266 ft /266-399 ft /
         399-533 ft /533-655 ft)

  ▶----V35 [Site/Slot/Ch]
    ▶----TxClkSource (ClkSrc:Internal/Ext-DTE/Recovery)
    ▶----PCM/FrameMode (PCM30/PCM31/Unframed)
    ▶----DataRate (64K/128K/192K/256K/320K/384K/448k/512k/
        576k/640k/704k/768K/832K/896K/960K/1024K/
        1088K/1152K/1216K/1280K/1344K/1408K/
        1472K/1536K/1600K/1664K/1728K/1792K/
        1856K/1920K/1984K/2048K)
    ▶----TxClkPolarity (Normal/Invert)
    ▶----RxClkPolarity (Normal/Invert)
    ▶----Service (IS/OOS)

----FXX [Site/Slot/Ch]

    ----Service (IS/OOS)

----TSA [Site]

    ----TSA (Normal/2E1+2V.35/7E1+1V.35/CH4····-··CH5)

---Opt Config [Site]

    ----Working OE (1/2)
    ----ALS (ON/OFF)
    ----Standby OE (ON/OFF)
    ----APS (ON/OFF)

---Trunk Eth Config

    ----General Config [Site]

        ----VLAN (Enable/Disable)

    ----Port Config [Site]

        ----Service (IS/OOS)
        ----AutoNeg (ON/OFF)
        ----Duplex (Full/Half)
        ----Speed (10M/100M)
        ----FlowCtrl (ON/OFF)

---Data Port Config   [Site]

    ----Baud Rate(115200/57600/38400/19200/9600)
    ----Data Bit(8/7/6/5)
    ----Parity(Disable/Even/Odd)
    ----Stop Bit(1 bit/ 1.5 bit/ 2 bit)

---External Clock

    ----Config [Site]

        ----Service (ON/OFF)

    ----Monitoring [Site]

        ----EquipStatus (Status:Equipped/Unequipped)
        ----AlarmMonitoring (Status:None/Normal/LOS)

▶---Oe Protect Sw ▲▼

    ▶----Current Status [Site] ▲▼

        ▶----WorkingOe (Status:1/2)

        ▶----OELocked (Status:-/ON/OFF)

        ▶----SwitchNo (Status:1-99)

        ▶---LeftRelSec (Status:1-99999)

        ▶----OE1Tx (Status:ON/OFF)

        ▶----OE2Tx (Status:ON/OFF)

    ▶---Oe Lock/Release [Site] ▲▼

        ▶----Lock OE
            (Status:(ON)/Release OE(DOWN))

        ▶----Lock OE
            (Status:(OFF)/Lock OE(DOWN))

    ▶---Oe Restart [Site/Oeld] ▲▼

        ▶----Restart DOWN
            (Restart OK/ Restart fail)

    ▶----Oe Test [Site/Oeld] ▲▼

        ▶----RestartTest DOWN
            (RestartTest OK/ RestartTest fail)

▶---FM Config ▲▼

    ▶----Pwr Fail Mon Cfg [Site/PwrID] ▲▼

        ▶----Service Config (IS/OOS)

▶---Alarm Monitoring ▲▼

    ▶----Equipment [Site] ▲▼

        ▶----Pwr1 (Status:NoAlarm/Failed)

        ▶----Pwr2 (Status:NoAlarm/Failed)

        ▶----Fan (Status:NoAlarm/Failed)

    ▶----Path [Site] ▲▼

        ▶----Alarm (Next)

---Loopback/V.54[Site]

    ----Aggr

        ---LLBK (ON/OFF)

        ---RLBK (ON/OFF)

        ---RRLBK (ON/OFF)

        ---UndoAgReLBK (ON/OFF)

    ----E1 [Slot/Ch]

        ---LLBK (ON/OFF)

        ---RLBK (ON/OFF)

    ----T1 [Slot/Ch]

        ---LLBK (ON/OFF)

        ---RLBK (ON/OFF)

    ----V.35 [Slot/Ch]

        ---ANA (ON/OFF)

        ---DIG (ON/OFF)

        ---REM (ON/OFF)

---PRBS Testing[Site]

    ----E1 [Slot/Ch]

        ---PTGEN (ON/OFF)

        ---PTANA (ON/OFF)

        ---PTANA Result (Status:Error/BER)

    ----T1 [Slot/Ch]

        ---PTGEN (ON/OFF)

        ---PTANA (ON/OFF)

        ---PTANA Result (Status:Error/BER)

    ----V.35 [Slot/Ch]

        ---PTGEN (ON/OFF)

        ---PTANA (ON/OFF)

        ---PTANA Result (Status:Error/BER)
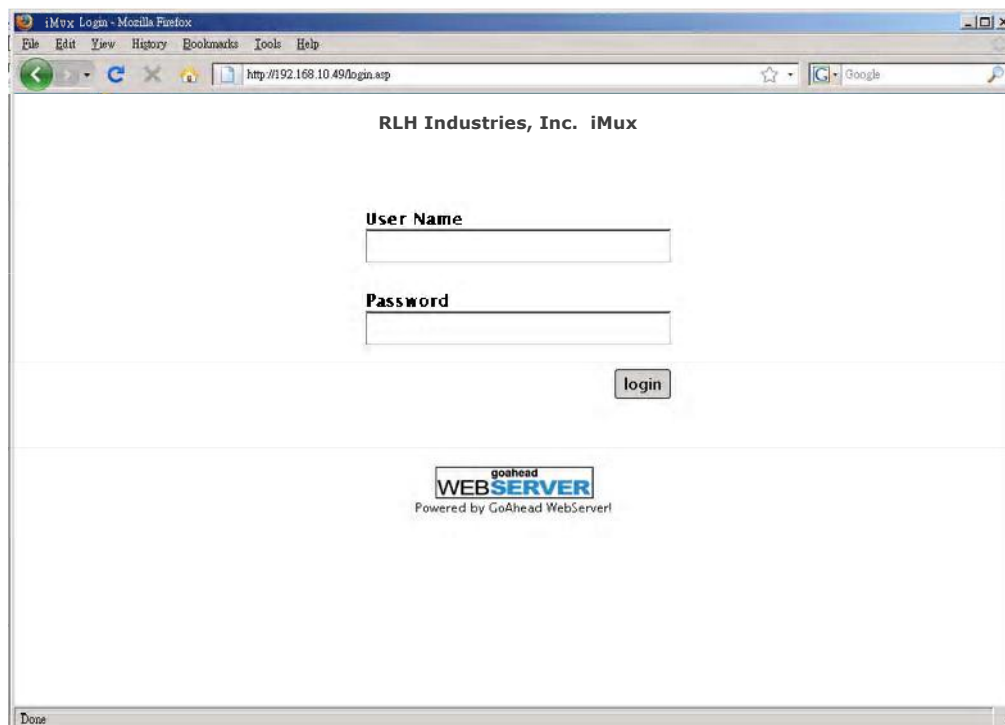
---Logout (Down)

7. Web Operating Interface

Using the web interface

To be able to use the web interface, the IP address must be enabled and configured via the command line interface. Enter the iMux IP number into a browser window to access the web interface.
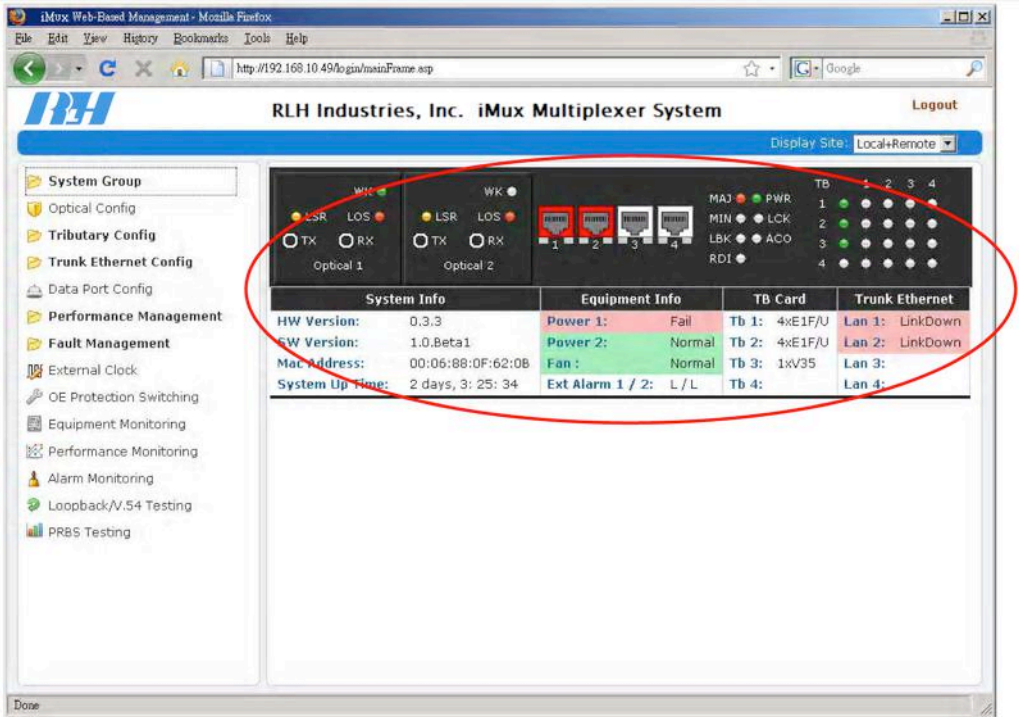
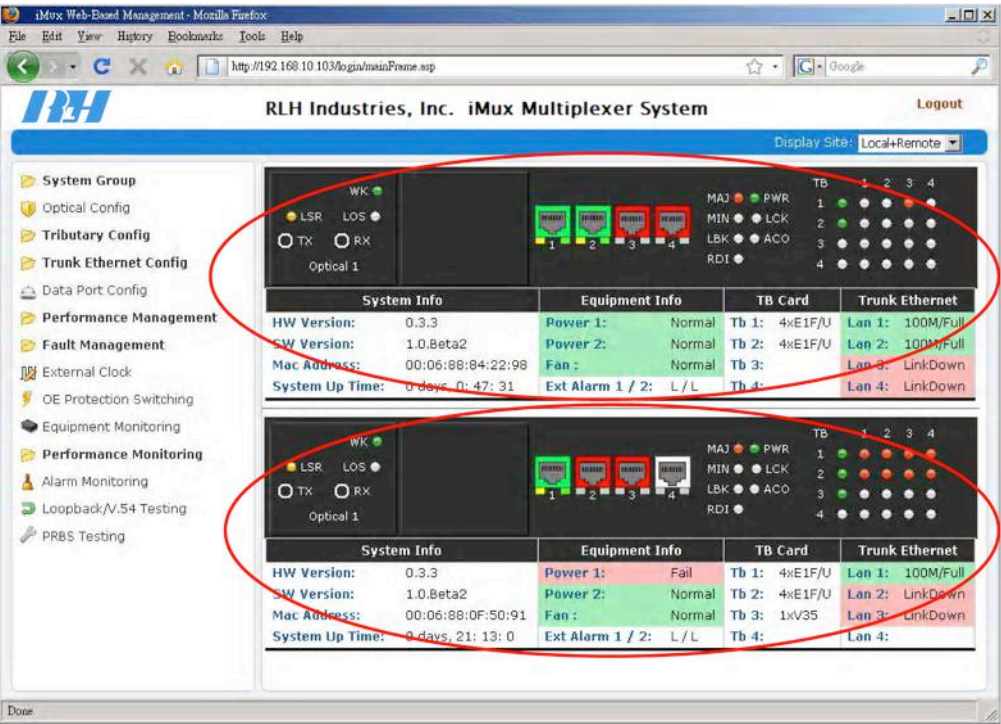Refer to **Device Networking Configuration** for IP set up information.

Web Interface Login Screen

The default user Name is **admin** and the password is **1234**. Refer to **User Account Management** for user name and password information.

After login, the equipment status screen is shown. You can display the Local site, Remote site, or Local+Remote.

Only local side displayed

Local and remote side displayed

Saving or loading profiles

Use the pull-down menu to display the **Local** side, **Remote** side, or **Local+Remote**.

If the profile had been changed earlier, during the configuration processing, the title in the blue header bar will show **Config Modified**.

After making any changes, select **Profile Management** to save changes in **Profile I** or **Profile II**.

8. Telnet Operating Interface

SNMP management

Use the RJ-45 port to connect to the SNMP management system. To be able to use the telnet interface, the device IP must be configured first.
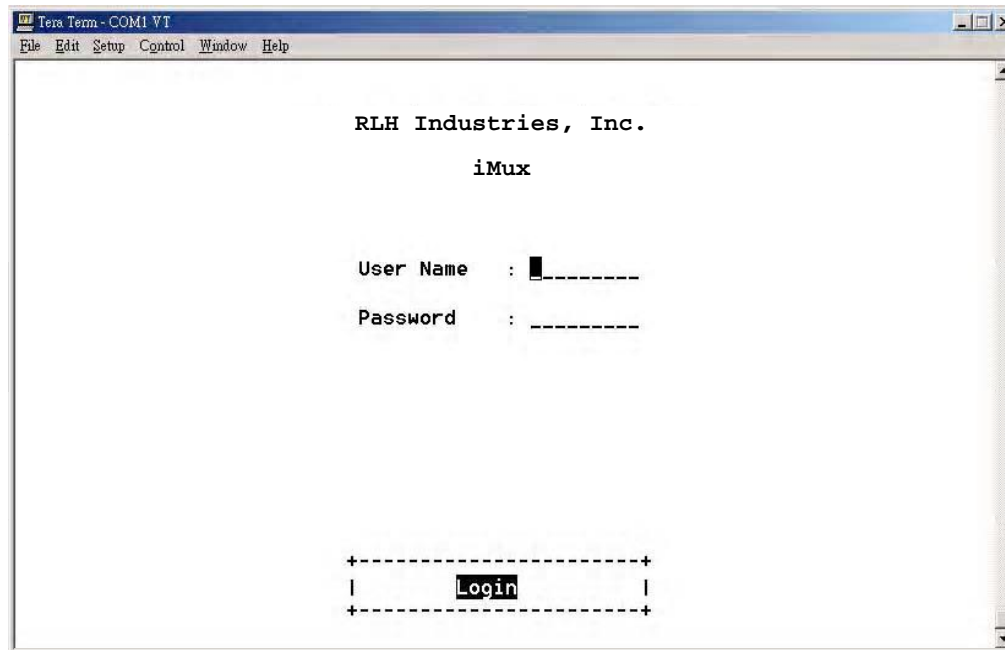
SNMP Login Screen

Refer to **Device Networking Configuration** for IP set up information.

The default user Name is **admin** and the password is **1234**. Refer to **User Account Management** for user name and password information.

9. Appendix

Craft & External Alarm Ports Pin Assignment

External clock port
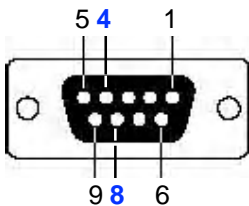
Pin 4 and Pin 8 of DB9 are used for E1 PCM data or TTL Clock input.

Craft port (VT100)
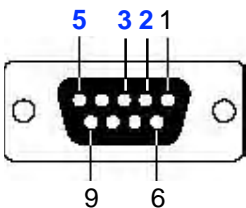
Pin No.	Signal
2	TxD
3	RxD
5	GND

Alarm port
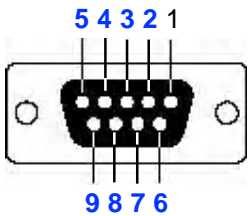
Pin No.	Signal
1	-
2	RMIN LEDA
3	RMIN BUA
4	RMAJ LEDA
5	RMAJ BUA
6	RMIN LEDB
7	RMIN BUB
8	RMAJ LEDB
9	RMAJ BUB

External alarm port
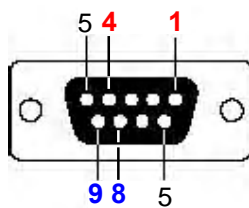
	Pin No.	Signal
Port 1	1	Positive Input
	8	Negative Input
Port 2	4	Positive Input
	9	Negative Input

The voltage offset between positive and negative input: 3 ~ 60VDC. Input current range: 0.5 ~ 8 mA

10. Troubleshooting

First Step: Isolate the problem

Following the the installation procedure will greatly speed any troubleshooting. It is designed to isolate different parts of the system during installation.

Isolating the source of trouble is essential to determining the steps needed to fix the problem. Most installation problems can be easily fixed in the field once the problem is properly identified.

Common Issues

Most problems encountered during installation and testing can be attributed to these 4 issues:

- **Problems with the incoming signal**
- **Problems providing correct power to the system**
- **Problems with the copper connections wiring due to nicking, scoring or poor terminating**
- **Problems with the fiber optic cable**
- **Problems with missing or improperly installed modules**
- **Problems with configuration**

RLH iMux systems are built to the highest standards and fully tested before leaving the factory.

Isolating and ruling out common issues with the installation will help determine if there is a problem with the unit itself.

Power supply issues

PWR LED remains off

The iMux system isn't receiving proper power.

AC power

- Check AC power using a multimeter.

DC power

- Check power at the DC terminals using a multimeter.
- No AC power can be detectable on the DC power line.
- Check wiring for nicking, scoring or poor termination.

Verifying fiber cable

Verify the fiber cable when incoming signal is good, but the other end indicates that a fiber signal is not being received. To test the fiber cable, use a fiber optic cable test set with light source and meter.

iMux System Fiber Test Specifications

Fiber Type	Wavelength	Attenuation	Maximum Distance
Multimode	850nm	10dB max.	1.5 miles (2.5km)
Single-mode	1310nm	8dB max.	9 miles (15km)
Single-mode	1310nm	8dB required min. loss	37 miles (60km)

When reconnecting fiber cables, check the correct connection of the fiber cable.

Module Installation

The iMux comes standard with modules pre-installed and pre-configured. When replacing or installing any modules, use caution to ensure that

- **The modules are fully inserted without damaging any components on the circuit board**
- **The locking screws are completely seated and hand tightened only**
- **The breakout adapter cables (where used) are properly connected and seated**
- **The optical modules are protected at all times with dust cap or fiber connector installed**
- **Special handling requirements are observed**

If the iMux module configuration is changed, or modules are moved to a different tributary slot, the system must be reconfigured accordingly using the VT100 management interface.

Troubleshooting Guide

No.	Symptom	Probable Cause	Corrective Action
1	VT-100 cannot login	• CIT cable connection invalid. • Baud Rate incorrect and com port incorrectly selected. • Input wrong account and password	• Check cable link • Check baud rate and com port • Check login name and password
2	The equipment screen alarm indicators are different from physical indicators.	• Alarm configurations incorrectly set. • Physical alarm connector faulty.	• Check Tributary Slot parameters and Ethernet parameters configuration screen. • Check service mode • Check Ethernet port contacts • Check Ethernet cable • Check duplex matching • Disable unused ports
3	Ethernet has serious packet loss.	• RJ45 connector is damaged. • FUUL/HALF duplex does not Trunk Ethernet port service.	• Check the duplex matching. • Check the auto-neg mode. • Check data forwarding mode. • Check all Trunk Ethernet port configuration functions.
4	Ping fails, can't transfer data, or can't remote Telnet.	• Trunk Ethernet port service is off. • fiber cable failure. • RJ45 connector is damaged. • Networking service management telnet function is off. • Trunk Ethernet general parameters setting error.	• Check duplex matching. • Check all Trunk Ethernet port configuration functions. • Check the fiber contacts. • Test and/or change optical cable • Check networking service management function and preform loopback test. • Execute Autoblk to check optical connection.
5	The unit is reset or powered off, all the configuration settings are lost.	• User did not save configuration. • Incorrect loading profile was selected during last startup.	• The iMux will startup according to the last startup profile loaded. • Select the correct startup profile on startup. • If you loaded the factory default profile during you last startup, the iMux will default to the factory setting upon restart.
6	The iMux cannot be managed	• Networking service management SNMP function is turned off. • Device IP is incorrect. • SNMP agent configuration read/write community is incorrect.	• Check networking service management. • Check device IP. • Check SNMP agent configuration.
7	Power indicator is off	• Power supply is not available. • The power supply switch is not turned on. • the power supply connections are loose or faulty.	• Change the power supply. • Turn on the iMux power switch. • Check all power connections.

No.	Symptom	Probable Cause	Corrective Action
8	Optical LOS alarm is on.	• If the self loop of the optical ports is normal, and the connection of the optical cables is correct, the fiber cables are faulty or the distance is too long. • The TX and RX optical cable connections are reversed.	• Test and/or change the optical cables • Change to a long distance optical module. • Exchange the TX and RX fiber cables.
9	The equipment of one side of the optical connection is normal, and the other has a LOS alarm.	• The fiber optic cable is faulty. • The optical module has malfunctioned.	• Test and/or change the optical cables. • Self loop the equipment that has the LOS alarm to test the optical module. • Contact your support representative.
10	E1 interface alarms.	• Coaxial connector is faulty. • The E1 equipment is powered off. • The E1 TX and RX interface connection is reversed. • The alarm of the E1 tributary slot is not masked.	• Replace the coaxial connector. • Verify functioning E1 signals to the iMux. • Check the E1 TX and RX connections. • PRess the MASK button mask the E1 tributary alarm.
11	V.35 interface alarms.	• Clock settings do not match. • The V.35 connector is bad.	• Check the V.35 interface configuration. • Check the V.35 connector and wiring.
12	OE module isn't switching.	• OE startup lock function is set incorrectly.	• Check optical interface parameters configuration. • Check OE switching protection status.
13	PRBS test showing bit errors, or test is OK but always showing red indicators.	• Non-compliant use of framing in unframed type. • The user lookup PRBS test result is in the wrong place.	• Configure the correct type in unframed. • Generally, the user should check the results in the PRBS testing screen.
14	Cannot login using front panel LCD controls.	• Input key sequence is incorrect. • The LCD Login Configuration has been redefined.	• Check LCD Login Configurations.
15	E1 interfaces have bit errors.	• Impedance is not matched. • E1 cables exceed length limits. • E1 connector are faulty. • 120Ω connection cables are not twisted. • The E1 terminal unit does not share a common ground with the iMux.	• Verify the impedance of the E1 equipment is the same as the iMux module. • Confirm that the E1 cable is no longer than 200 meters. • replace the E1 connectors. • Check the 120Ω RJ45 connector that pins 1 & 2 are twisted, and pins 3 & 4 are twisted. • Confirm that the E1 terminal unit and the iMux are properly grounded in accordance with proper electrical standards.

11. Specifications

General Specifications

Alarm	Relay Contact Capacity	Four (4) Contacts
	External Alarm	DB-9 connector
Power Supply	AC	115/240V (90~240V) (47Hz~63Hz)
	DC	48V (36~75V)
	Power consumption	30W maximum
Environment	Working Temp.	0℃ ~ +50℃ (32℉ ~ 122℉)
	Working Humidity	5% ~ 95% RH non-condensing
	Storage Temp., Humidity	-20℃ ~ 60℃ (-4℉ ~ 140℉), 5% ~ 95% RH
Other	EMI	Comply with CISPR 22 class A (EN55022), FCC part 15 class A subpart B
	MTBF	48,000 hours minimum
	Dimensions	W 17.3" x D 11.2" x H 1.75" (440 x 285 x 44.5mm)

Optical Module Specifications

Optical Interface Module	Optical Source	MLM 850/1310/1550nm				
	System Gain	19~30dB				
	Data Rate	155 Mb/s				
Fiber connector	100BaseFX ports, ST or SC connectors, single or multi mode					
	Dual fiber or single fiber (bi-directional) connectors (multimode single fiber is SC only)					
Fiber Type	Multimode	50 /125µm, 62.5/125µm				
	Single mode	9/125µm				
Dual Fiber Optics	Fiber Type	Multimode		Single-mode		
	Wavelength TX/RX (nm)	1310	850	1310~1550	1310~1550	1310~1550
	Distance	2km / 1.2mi.	2km / 1.2mi.	20km / 12mi.	60km / 36mi.	120km / 74mi.
	Min. TX PWR (dBm)	-18	-15	-15	-6	0
	Max. TX PWR (dBm)	-10	-5	-8	-3	+5
	RX Sensitivity (dBm)	-31	-27	-34	-34	-34
	Link Loss Budget (dB)	13	10	19	28	34
Single Fiber Optics (Bi-directional)	Fiber Type	Multimode		Single-mode		
	Wavelength TX/RX (nm)	1310/1550 1550/1310		1310/1550 1550/1310	1310/1550 1550/1310	1310/1550 1550/1310
	Distance	2km / 1.2mi.		20km / 12mi.	40km / 25mi.	60km / 36mi.
	Min. TX PWR (dBm)	-18		-10	-5	-3
	Max. TX PWR (dBm)	-8		-3	0	+2
	RX Sensitivity (dBm)	-38		-38	-38	-38
	Link Loss Budget (dB)	20		28	33	35

Service Port Module Specifications

T1 Interface Module	Service Capacity	Four (4) Channels of T1
	Port Connector	RJ-45
	Bit Rate	1.544 Mbs
	Line Code	B8ZS per ANSI T1.408 and AMI
	Line Framing	Extended superframe format (ESF 24-Frame multiframe) per ANSI T1.408
	Input Jitter Tolerance	Per AT&T TR 62411
	Output Jitter Tolerance	Per AT&T TR 62411
	Line Impedance	120Ω Balanced
10/100M Ethernet Interface	Service Capacity	Four (4) Channels of 10/100M Ethernet
	Port Connectors	RJ-45
	Compliance	IEEE 802.3/802.3u
	Configuration Modes	10/100M, full/half-duplex, auto-negotiation and auto MDI/MDIX
	Maximum Packet Length	1536/1522 Bytes
	Frame Buffer	329 frames, IEEE 802.3X standard
	MAC Table	1024-entry MAC address mapping table
	VLAN/QOS Function	Supported
	Port Rate Control	Supported
RS232 Module (DCE)	Service Capacity	Four (4) Channels of RS-232
	Port Connector Cable	One (1) HD68 connector to four (4) DB-9 connectors
	Bit Rate	115200 bps
		TXD/RXD 1.536Mbit/s
		DTR/DSR 128Kbit/s
		RTS/CTS 128Kbit/s
		DCD/RI 64Kbit/s
	Local Loopback	Supported
	Remote Loopback	Supported
4W Analog Data (600 Ohm Audio) Module	Service Capacity	Four (4) channels of 4 Wire Analog Data (600 Ohm audio)
	Port Connectors	RJ-11
	Bandwidth	300Hz ~ 3.4KHz
	Impedance	600Ohm
	Longitudinal Conversion Loss	>60dB
	Return Loss	>30dB
	Idle Channel noise	75dB
	CMRR	>60dB

12. Ordering Information

Base Systems

Part Number	Description	Power 1	Power 2	Dimensions (1RU)
RLH-IMUX-V-2	iMUX BASE SYSTEM Dual DC Input Power	48VDC	48VDC	W17.3in x D11.2in x H1.75in (440mm x 285mm x 44.5mm)
RLH-IMUX-A-2	iMUX BASE SYSTEM AC and DC Input Power	115/220VAC	48VDC	

▶ Optic and service port modules are ordered separately.
▶ Modules ordered with the base system will be pre-installed.
▶ System is pre-configured before shipping for quick and easy operation.
▶ 2 multiplexers are required for a complete system.
▶ Bidirectional single fiber models require an A side unit and a B side unit for a complete system.
▶ Please contact your RLH sales representative for pricing and delivery information.

Optical Modules

Part Number	Description	Side	Distance	Fiber	Part Number
Multimode ST	iMux Optical Module	-	2 km/1.2 mi	62.5 µm	**RLH-OM-04-1**
Bi-Directional Single-mode SC	iMux Optical Module	A	20km/12.4mi.	8~9 µm	**RLH-OM-10-1**
	iMux Optical Module	B	20km/12.4mi.	8~9 µm	**RLH-OM-11-1**
	iMux Optical Module	A	60km / 37mi.	8~9 µm	**RLH-OM-14-1**
	iMux Optical Module	B	60km / 37mi.	8~9 µm	**RLH-OM-15-1**
Single-mode SC	iMux Optical Module	-	20km/12.4mi.	8~9 µm	**RLH-OM-40-1**
	iMux Optical Module	-	60km / 37mi.	8~9 µm	**RLH-OM-41-1**
	iMux Optical Module	-	120km / 74 mi.	8~9 µm	**RLH-OM-42-1**
Single-mode ST	iMux Optical Module	-	20km/12.4mi.	8~9 µm	**RLH-OM-50-1**

▶ Optical modules ordered at same time as base system are pre-installed.
▶ System is pre-configured before shipping for quick and easy operation.
▶ Bi-directional single fiber models require an A side unit and a B side unit for a complete system
▶ Please contact your RLH sales representative for pricing and delivery information

Service Port Modules

Part Number	Description
RLH-MM-T1	T-1 MODULE - 4 Channels
RLH-MM-D1	R-232 MODULE - 4 Channels
RLH-MM-AO	2 WIRE (POTS) FXO/CO MODULE - 4 Channels
RLH-MM-AS	2 WIRE (POTS) FXS/SUB MODULE - 4 Channels
RLH-MM-D2	4 WIRE ANALOG DATA (600 Ohm AUDIO) MODULE - 4 Channels

▶ Service port modules ordered at same time as base system are pre-installed.

▶ System is pre-configured before shipping for quick and easy operation.

▶ Please contact your RLH sales representative for pricing and delivery information.

13. Support

Technical Support

Email:	support@fiberopticlink.com
24/7 technical support:	Toll Free 1-855-RLH-24X7
	Toll Free 1-855-754-2497

Contact Information

Corporate Headquarters:	RLH Industries, Inc.
	936 N. Main Street
	Orange, CA 92867 USA
Phone:	(714) 532-1672
	Toll Free 1-800-877-1672
	Toll Free 1-866-DO-FIBER
Fax:	(714) 532-1885
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Please contact your RLH sales representative for pricing and delivery information.

Specifications subject to change without notice.