Giga-AccessEtherLinX-II

Operation Manual

The above illustration is representative; some minor differences may be present in actual product

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About the Giga-AccessEtherLinX-II

The Giga-AccessEtherLinX-II Series enables service providers to offer differentiated data networking or VPN services to multi-tenant building and business customers. Residing at the customer premises or at the service provider POP, Giga-AccessEtherLinX-II provides a VLAN-based Layer 2 entry point to the MAN fiber network, trunking, differentiating and grooming customer traffic. Featuring remote SNMP management, port bandwidth control, QinQ support, QoS, traffic prioritization and multicast pruning (using IGMP v1, v2), it is an ideal solution for delivering Ethernet-based services to customers quickly and cost-effectively.

Giga-AccessEtherLinX-II offers configuration access via Telnet, console, secure IP-Less, and SNMP management channels. Software upgrades can be initiated via any one of these access methods.

The Giga-AccessEtherLinX-II includes one Uplink port (either 1000Base-FX fiber or 10/100/1000 twisted pair) and four 10/100/1000 Mbps twisted pair Ethernet Downlink Ports for connecting users/LANs, and supports jumbo frame sizes of up to 9600 bytes.

The Giga-AccessEtherLinX-II offers various wavelengths for SM and MM fiber at gigabit speed; single-strand and SFP versions are also available. As a standalone unit, it is available in an internal AC or DC version.

Installing the Giga-AccessEtherLinX-II

The Giga-AccessEtherLinX-II comes ready to install; there is no hardware configuration required. All features, such as management access, qualified VLAN tags, Link Fault Pass-Through and Auto Negotiation are software configurable.

Place the Giga-AccessEtherLinX-II on a flat surface, prior to installation. Attach the cables between the Giga-AccessEtherLinX-II and each device that will be interconnected and then plug the unit into a reliable power source.

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Rackmount Installation

The Rackmount kits for the Giga-AccessEtherLinX-II are sold separately:

Description	Part Number	Accessories	Installation
19" Rackmount brackets	895-39226	Includes two brackets that screw onto either side of the Giga-AccessEtherLinX-II.	The brackets are attached to the unit and then the Giga-AccessEtherLinX-II is installed into the rack.
19" Rackmount shelf	895-39949	Fits into the 19" rack and holds up to 3 units of the Giga-AccessEtherLinX-II.	The Giga-AccessEtherLinX-II can be secured to the shelf.

INSTALLATION TIP
Single-strand fiber products use optics that transmit and receive on two different wavelengths. Single-strand fiber products must be deployed in pairs, connecting two compatible single-strand fiber products. Connect the 852-10310 (1310 xmt and 1550 rcv), for example, to a product with 1550 xmt and 1310 rcv, e.g., 852-10311 (1550 xmt and 1310 rcv.) The two connected products must also have the same speed and distance capabilities (i.e. both are single-mode [20 km] or both are single/PLUS [40 km]).

Features

Two Layer Qualified Q-in-Q Support

Each drop port can be assigned two different VLAN tags to incoming frames based on the frames PRI or DSCP priority value and IP or Non-IP Frames types. In this way, incoming traffic to the network can be groomed into different VLAN tributaries before entering the network.

AutoCross Feature for Twisted Pair Connection

All twisted pair ports on the Giga-AccessEtherLinX-II include AutoCross, a feature which automatically selects between a Crossover workstation or Pass-Through connection depending on the connected device.

Software Configurable Features

The Link Fault Pass-Through, Selective Advertising, as well as Qualified VLAN tags and Bandwidth Control features are all configurable via the SNMP IP-Less management, DB-9 console configuration or Telnet session.

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IP-Less Management in HOST/REMOTE configurations

A proprietary, secure management communication channel is supported whenever the Giga-AccessEtherLinX-II unit is connected directly to an iMcV-GigaFiberLinX-II unit over the Fiber Uplink. This secure communication channel does not require any pre-configuration or IP address assignment. It automatically establishes an integrated Host-Remote management connection between these units, allowing them to be managed as a single unit, as long as the iMcV-Giga-FiberLinX-II unit is set to a unit via the DIP Switch setting.

Priority Queuing and Flow Control

The unit supports two different priority queuing schemes. In all modes that do not allow frame qualification, Priority Queuing is set globally for all ports as a Unit Control Setting. For modes supporting Qualification, high priority is set individually per port by the Qualification setting. Frames qualified as high priority will be given preference over low priority frames to egress the unit.

When internal congestion occurs and the unit is low on internal buffer space, only high priority frames will be allowed to enter the unit. If Flow Control is enabled, PAUSE frames will be sent to all ports causing the congestion. If PAUSE frames are received on a port, that port will not transmit frames until the PAUSE condition has expired.

Auto Negotiation, Duplex Mode and Speed

The twisted pair ports on the Giga-AccessEtherLinX-II Auto Negotiate for speed and duplex mode. This device can also selectively advertise or force the speed and duplex mode. If the device has a fiber Uplink port, it always operates at 1000 Mbps full-duplex and supports Auto Negotiation on the fiber segment.

Forcing the Speed and Duplex Mode

The twisted pair Downlink Ports on the Giga-AccessEtherLinX-II can also be manually set for 10, 100, or 1000 Mbps operation and for half- or full-duplex mode (note: 1000 Mbps only supported in full duplex).

Selective Advertising

Selective Advertising, when used in combination with Auto Negotiation, advertises only the configured speed and duplex mode for the twisted pair port.

If a specific speed and/or duplex mode is desired, use Selective Advertising, rather than a Force Mode, when connecting to devices that ONLY auto negotiate.

Bandwidth Control

The Giga-AccessEtherLinX-II includes bandwidth control functionality. A maximum bandwidth can be set independently on each port for both receive and transmit directions.

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About iView² Unit Management

iView² is a network management application for IMC Networks' intelligent networking devices. It features a GUI, which provides network managers the ability to monitor and control IMC Networks' products. The application is available in several versions including Web-Server version 3.0 and can also function as a snap-in module for HP OpenView Network Node Manager.

iView² supports the following platforms:

- Windows NT
- Windows 2000
- Windows XP
- Windows 7
- Windows Vista

Utility iConfig

iConfig is an in-band utility created by IMC Networks, used for SNMP configuration for IMC Networks' SNMP-manageable devices.

The iConfig feature allows the following to be performed:

- Set an IP address, subnet mask and default gateway
- Define community strings and SNMP traps

iConfig also includes an authorized IP address system and restricted access to MIB groups which are supported by IMC Networks' manageable devices. These extra layers of security do not affect SNMP compatibility. iConfig can upload new versions of the system software and new MIB information. It also includes diagnostic capabilities for faster resolution of technical support issues.

Default Username/Password

The default user ID and password for both iConfig and Telnet are the following:

User: admin / Password:admin

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SNMP, Telnet and Console Management

SNMP, Telnet, and iConfig management channels are always supported through the Giga-AccessEtherLinX-II Uplink Port. This provides a higher level of security so end users cannot access management, alter settings, etc. Management through other ports can be supported through unit configuration.

In order for the Giga-AccessEtherLinX-II to support SNMP management, the unit must be assigned IP configuration information (e.g., IP address, subnet mask, etc.) There are five ways to do so:

- Using iConfig (IP-Less on same Ethernet Domain)
- Host-Remote IP-Less from an iMcV-GigaFiberLinX-II
- Using the console DB9 port located on the back of the unit
- Using DHCP (Dynamic Host Control Protocol); DHCP must be enabled through the console configuration or Telnet
- Telnet (Default IP=10.10.10.10; subnet mask=255.0.0.0)

In addition to assigning an IP Address and subnet mask, the end user can create community strings, assign access rights, and configure traps for total remote management.

About Console Port Configuration

Use the console DB-9 port on the back of the unit to access the internal Command Line Interface (CLI).

To connect the Giga-AccessEtherLinX-II to a terminal/computer, use a straight-through (pin-to-pin) cable. (If the computer/terminal has a COM port using a connection not compatible with a DB-9 connector, use the pin connection chart shown below for reference in making a cable.) Make sure the cable length is less than 50 feet (15.24m). Plug one end of the cable into the DB-9 connector and the other into the appropriate computer/terminal port. Set the computer/terminal for **VT-100 emulation**, with: **38.4K baud**, **8 data bits**, **1 stop bit**, **no parity** and **no flow control**.

Console RS-232 Interface	
DB-9 Pin #	**Function**
2	Transmit (OUT)
3	Receive (IN)
5	Ground
1, 4, 6 - 9	Reserved

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Main Configuration Screen

After running through an initial self test, the screen will display: Press **Enter** for Device Configuration. Press **Enter** to be taken to the main configuration screen.

```
Saved Values. (These values will be active after reboot)
    IP Address      - 10.10.10.10
    Subnet Mask     - 255.255.255.0              DHCP is Not Active
    Default Gateway - 0.0.0.0


Current Values. (These values are in use now)
    IP Address      - 10.10.10.10
    Subnet Mask     - 255.255.255.0
    Default Gateway - 0.0.0.0


Community String: public    Access:  r/w

Press I to enter new saved parameter values. Press P to change Password.
Press T to enter new Trap Destination. Press K to remove All Trap Destinations.
Press C to enter new Community String. Press U to remove All Community Strings.
Press E to End session. Type REBOOT to reboot unit. Press D for DHCP On/Off.
Press SpaceBar for additional commands.
_
```

The Main Configuration screen contains the following:

Saved Values — displays changes made during current session.

- IP Address (Should be assigned during initial configuration)
- Subnet Mask (Should be assigned during initial configuration)
- Default Gateway

Current Values — displays values currently in use.

- IP Address (IP address of SNMP agent)
- Subnet Mask (mask to define IP subnet agent is connected to)
- Default Gateway (default router for IP traffic outside subnet)

Command List

- **I** = Enter New Saved Parameter Values
- **P** = Change Password
- **T** = New Trap Destination
- **K** = Remove ALL Trap Destinations
- **C** = New Community String
- **U** = Delete ALL Community Strings
- **D** = Enable/Disable DHCP
- **E** = End Session
- **Space Bar** = Opens device specific configuration options

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NOTE
*Reboot after making any modifications to the Saved Values or the changes will not take effect. To reboot, type **Reboot** at the prompt on the main configuration screen, or turn the chassis power OFF, then ON again.* *Because a Delete key is not available on VT-100 terminal emulators, use the F2 key instead.*

I *Assigning IP Information*

To modify the Saved Parameter Values (i.e., assign IP address and subnet mask), press **I**. Enter the IP address and subnet mask for the connected device, pressing **Enter** after each value. A default gateway can also be assigned (press **Enter** to skip). When finished, press **Enter** and then type **Reboot** for the changes to take effect. The Saved Values and Current Values should now both display the changes made (e.g., new IP address and subnet mask).

P *Change Password (only if logged in via console port)*

By default, no password is assigned via the console port. However, one can be assigned by pressing **P** from the main configuration screen. Enter a password; passwords are case sensitive and should be no more than eight characters in length, with no spaces; press **Enter**. This will be requested whenever logging on or off. To remove password protection, select **P** and instead of entering a password press **Enter**.

Passwords are a way to make the management of network devices secure. It is the responsibility of the network administrator to store and maintain the password lists.

T *Assigning Trap Destinations*

Traps are sent by the manageable device to a management PC when a certain event takes place. To enter a trap destination, press **T**. When asked to Enter a New IP Address, type the IP address of the destination device and press **Enter**. Then, type the name of the community string (that the destination device has been configured to accept) and press **Enter**. This function enables ALL of the device's traps. To selectively activate and de-activate traps, use iConfig for configuration. Supported traps include enterprise-specific and generic; generic traps include: Link Down, Link Up, Cold Start, Warm Start and Authentication Failure.

K *Removing Trap Destinations*

To remove all trap destinations, press **K**. When asked to confirm, press **Y** to continue or **N** to abort. Then, press **Enter**.

C *Creating Community Strings*

The purpose of community strings is to add a level of security to a network. The default community string is named public and has read/write access. Add the necessary custom community strings such as one with read-only access (for general use), and another with read/write access (for the administrator), then delete the

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default public string. To create a new community string, go to the main configuration screen and press **C**. Enter the name of the new community (up to 16 characters, no spaces) and press **Enter**. Then type one of the following to assign the community string's access rights:

R = read-only access
W = read/write access
Enter = abort

Press **Enter.** When finished, press **Enter** and then type **Reboot** for changes to take effect. The Saved Values and Current Values should now both display the changes made (e.g., new IP address and subnet mask).

U *Deleting Community Strings*

To delete all community strings and start over, press **U**. When asked, Are you sure you want to delete all future strings?, press **Y** to proceed or **N** to abort. Press **Enter**. This function will delete ALL community strings. Use iConfig to selectively delete community strings.

D *About DHCP*

DHCP Disable (Static IP Addressing)

DHCP is disabled in the default configuration. Initially, modules are assigned a Static default IP Address of 10.10.10.10. Changes to the Static IP Address can be added manually through iConfig, an RS-232 Console session, or Telnet. The changes will be initiated following reboot of the module.

DHCP Enable (Dynamic IP Addressing)

If a DHCP server is present on the network and DHCP is enabled, the DHCP client will initiate a dialogue with the server during the boot up sequence. The server will then issue an IP address to the management card. Once the new IP address is received, the SNMP Management Module will reboot so that the new IP address will take effect. Refer to the *About Console Port Configuration* for more information about Enabling/Disabling DHCP. When there is no DHCP server on the network, use iConfig or console configuration to manually set the IP addresses.

When DHCP is enabled, the IP address (default 10.10.10.10 or user configured) is saved. When DHCP is disabled, the saved IP address will be reinstated and the device will reboot.

DHCP servers give out lease times: devices renew their leases based on the administrator-specified time. If a device cannot renew its lease, and the lease expires, the device will be given the IP address 10.10.10.10 and will reboot.

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E *Ending a Session*

Be sure to press **E** before disconnecting the cable in order to stop the continuous stream of data to the console port.

Space Bar Device-Specific Configuration Options

The Giga-AccessEtherLinX-II also includes several device-specific options. To access these options, press the **Spacebar** from the Command List section of the Main Configuration screen, type the name of the action you want to perform (as shown below) and press **Enter**.

```
Command         Description
--------        -----------
cleandb         Reboot With Clean Database
download        File Download from TFTP Server
ifstats         Display Port Statistics
rmstats         Display Port RMON Statistics
vlan            Display And Change VLAN Settings
port            Display And Change Port Settings
unit            Display And Change Unit Settings
bw              Display And Change Bandwidth Settings
accounts        Add or Delete Username/Password Accounts
sysdescr        Change System Descriptions
version         Show Firmware Version
reboot          Reboot Unit




->
Press RETURN To Go Back To Main Screen.
```

ifstats Displays Per Port Ethernet statistics such as port status and congestion.

```
MIB-II Var          Port 1       Port 2       Port 3       Port 4       Port 5
-------------------------------------------------------------------------------
PhysAddress    00002902ACAC 00002902ACAC 00002902ACAC 00002902ACAC 00002902ACAC
AdminStatus               1            1            1            1            1
OperStatus                2            1            2            2            1
LastChange              126       167266          126          126       385030
InOctets                  0            0            0            0       614547
InUcastPkts               0            0            0            0          990
InNUcastPkts              0            0            0            0         7362
InDiscards                0            0            0            0            0
InErrors                  0            0            0            0            0
InUnknownProt             0            0            0            0            0
OutOctets                 0        79101            0            0       521180
OutUcastPkts              0            2            0            0         7952
OutNUcastPkts             0          307            0            0            3
OutDiscards               0            0            0            0            0
OutErrors                 0            0            0            0            0

Press SpaceBar to refresh, Any other key to exit
```

rmstats Displays Per Port RMON statistics such as frame and error counters.

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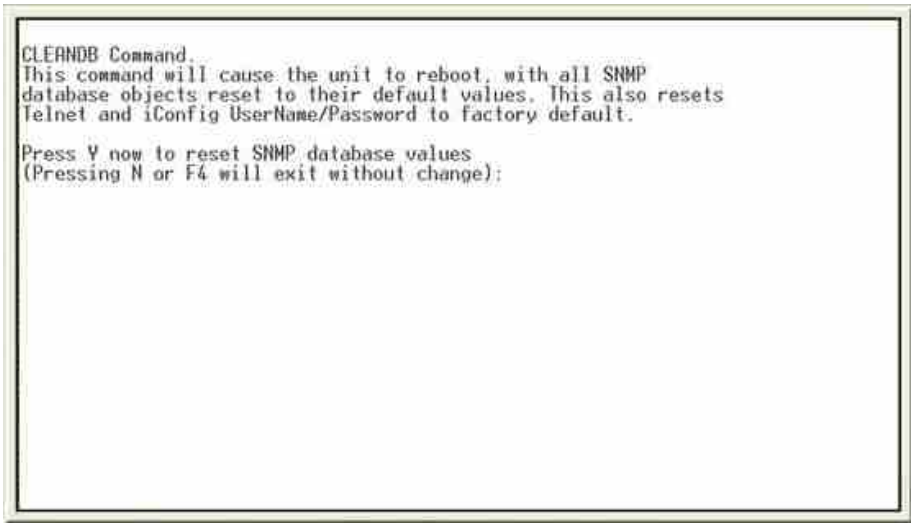
```
RMON Counter          Port 1       Port 2       Port 3       Port 4       Port 5
-------------------------------------------------------------------------------
DropEvents                 0            0            0            0            0
Octets                     0            0            0            0       615507
Pkts                       0            0            0            0         8367
BroadcastPkts              0            0            0            0          130
MulticastPkts              0            0            0            0         7247
CRCAlignErrors             0            0            0            0            0
UndersizePkts              0            0            0            0            0
OversizePkts               0            0            0            0            0
Fragments                  0            0            0            0            0
Jabbers                    0            0            0            0            0
Collisions                 0            0            0            0            0
Pkts64Octets               0            0            0            0         7990
Pkts65to127                0            0            0            0           78
Pkts128to255               0            0            0            0           61
Pkts256to511               0            0            0            0          235
Pkts512to1023              0            0            0            0            3
Pkts1024toMAX              0            0            0            0            0

Press SpaceBar to refresh, Any other key to exit
```

cleandb Reboots the Giga-AccessEtherLinX-II with a clean database. This removes all of the information in the database with an option to change the IP address of device.



download Opens the Download dialog from which you download firmware in the Main Configuration screen using TFTP protocol.

version Displays the Giga-AccessEtherLinX-II serial number and build date.

vlan Displays and changes VLAN settings (see Configuring VLANs)

reboot* Reboots the unit

accounts Allows addition/deletion of Username/Password accounts. Administrators must maintain a password list.

unit Unit Global Settings

port Displays port status values and allows some configuration (See Port Configuration section)

bw Bandwidth Limiting Controls

sysdescr Allows the editing of sysName, sysDescr, and Port information text. These entries are used to identify SNMP traps generated by this unit.

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*A **reboot** may be required for some configuration changes to take effect.

Downloading Files

Firmware and configuration files for the Giga-AccessEtherLinX-II can be downloaded from a central server via TFTP protocol. Initiate this download via console configuration or Telnet session. To download a file, type **download** and press **Enter** to be taken to the Download a file screen. This screen displays the IP Address of the TFTP server and the name of the file to be downloaded. The TFTP server should be open. Make sure the IP Address and the name of the file are correct.

Configuring VLANs

The Giga-AccessEtherLinX-II is VLAN compatible, with the ability to accept traffic containing 802.1q VLAN tags on the Uplink port and direct that traffic to the Downlink Ports where the tag is removed on egress. For even greater flexibility, each port can be individually configured as an Uplink TRUNK port or as a Downlink DROP port. Every downlink port can qualify the incoming Ethernet frame and assign one of two different VLAN tags depending on the priority of the incoming frame.

Qualified VLAN Settings

Incoming frames can be qualified based on the PRI value found in its VLAN tag or on the DiffServ value found in the IP header of the frame.

Pre Configured Modes

To help alleviate the complexity associated with this, the Giga-AccessEtherLinX unit has provided eight different modes of operation. Each mode is designed to support a common customer application to help simplify the configuration process. The following is a short summary of each mode.

Mode 1 Forwards only untagged frames. Management only accepted from the Uplink Port.

Mode 2 Forwards both tagged and untagged frames with management only accepted from Uplink Port. Management domain can flow to Downlink Ports and can be assigned a VLAN. This is the default mode and functions as a normal MAC layer switch.

Mode 3 Forwards both tagged and untagged frames with management only accepted from Uplink Port. Management domain is blocked from Downlink Ports and can be assigned a VLAN.

Mode 4 Allows fixed port-based forwarding. The user-configured virtual

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connection between ports includes management. Management can be assigned a VLAN.

Mode 5 Only accepts untagged traffic at the Downlink Ports. All Uplink traffic is tagged. Each Downlink Port adds a Qualified or Not Qualified VLAN tag to all ingress traffic. Management only accepted from Uplink Port and can be assigned a VLAN.

Mode 6 Accepts both tagged and untagged traffic at the Downlink Ports. All Uplink traffic is tagged. Each Downlink Port adds a Qualified or Not Qualified VLAN tag to all ingress traffic. Management only accepted from Uplink Port and can be assigned a VLAN.

Mode 7 Allows each port to be defined as a Drop or a Trunk port. Each Drop port assigns a Qualified or Not Qualified VLAN-tag to all ingress traffic. Assigned VLAN tags are added to the packet when they exit a Trunk port. Management is accepted on any Trunk port and can be assigned a VLAN.

Mode 8 Allows up to 64 VLAN IDs to be defined. Each port can be a tagged or no-tag member of a defined VLAN. A tag member ports will allow these tagged frames to enter/exit the port. No-tag members' ports will add this tag to assigned frames at egress. NOTE, only one No-tag VLAN can be assigned to a given port but any or all defined tags can be assigned as tags for a given port.

To configure VLAN IDs, press the **Spacebar** when in the Command List section of the Main Configuration screen (console configuration). VLAN is an available option. Type **vlan** and press **Enter** for VLAN Configuration.

VLAN Mode Screen

When accessing **vlan** in the Main Task Screen, the current VLAN mode is displayed. The first screen for each mode provides an overview and features of that mode, as well as instructions on how to proceed through the mode or return to the previous menu.

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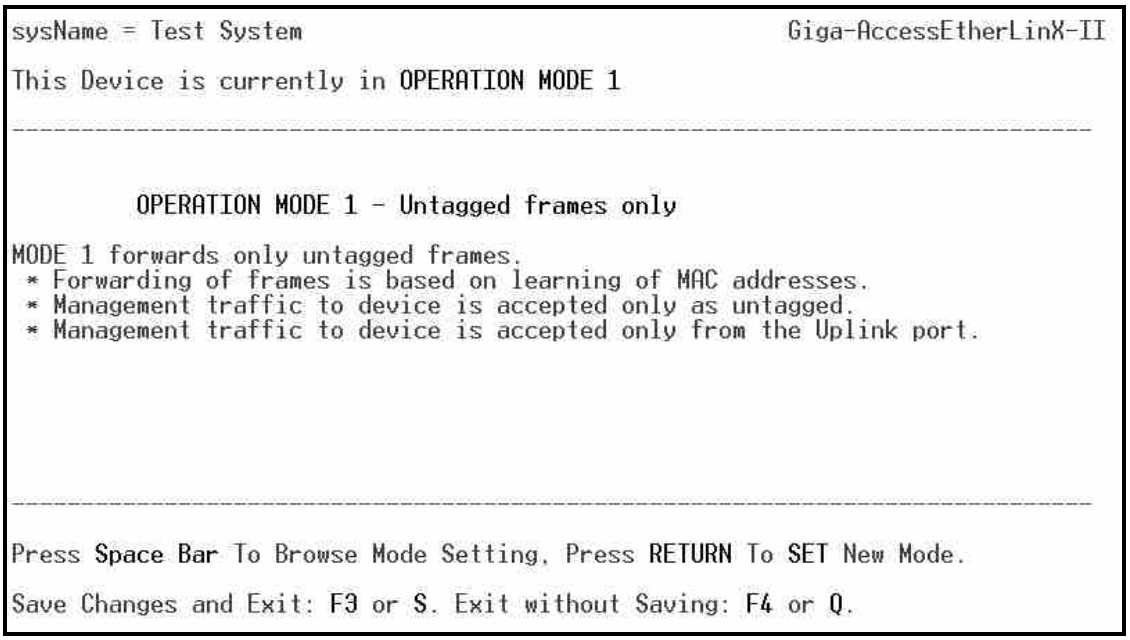
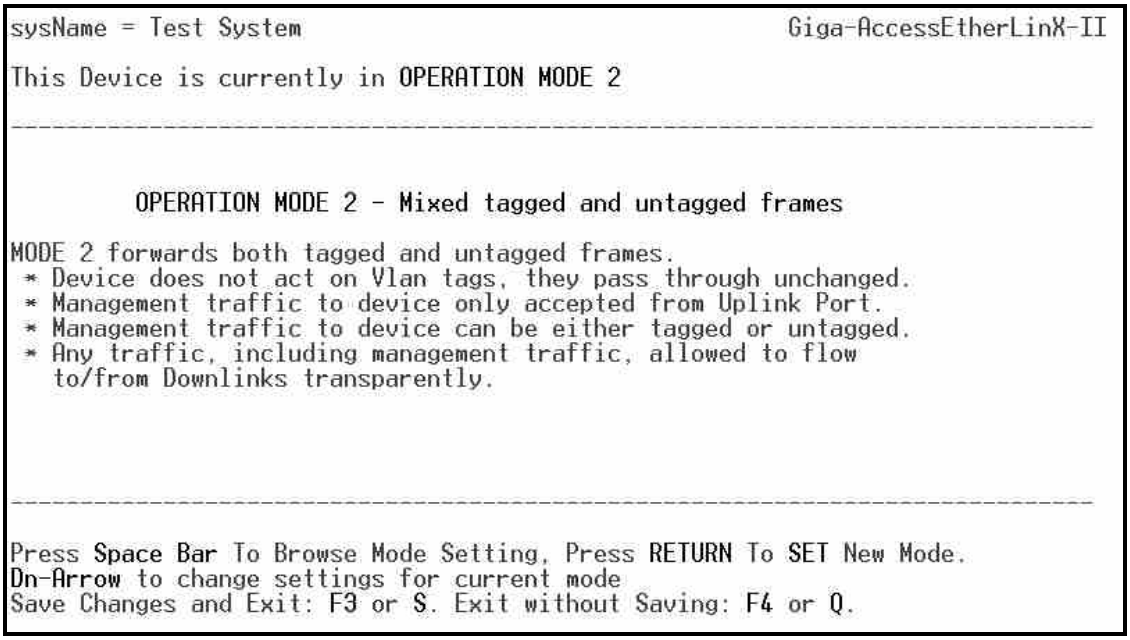
Mode 1—Untagged Frames Only



In this mode, the unit functions as a managed MAC layer switch with management only accepted on the fiber Uplink and no VLAN support.

Mode 2—Mixed Tagged and Untagged Frames (Default)



When Management can be VLAN tagged, the following screen is given for configuration.

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```
sysName = Test System                                    Giga-AccessEtherLinX-II

This Device is currently in OPERATION MODE 2

--------------------------------------------------------------------------------




   Management Domain Tags:       Tags on Management Traffic
   Management Vlan ID:            100
   Management Vlan Priority      4




--------------------------------------------------------------------------------

Enter new priority, 0 - 7

Save Changes and Exit: F3 or S. Exit without Saving: F4 or Q.
```

Mode 3— Mixed Tagged and Untagged, Block MGMT Domain

```
sysName = Test System                                    Giga-AccessEtherLinX-II

This Device is currently in OPERATION MODE 3

--------------------------------------------------------------------------------


         OPERATION MODE 3 - Mixed tagged and untagged, block mgmt. traffic

MODE 3 forwards both tagged and untagged frames.
 * Device does not act on Vlan tags, they pass through unchanged.
 * Management traffic accepted to device only from Uplink port.
 * Management traffic not allowed to flow to/from Downlink ports,
   ie. If management traffic is defined as for example VLAN 37, then
   traffic in VLAN 37 is not allowed to flow to/from Downlink ports.
   If Management traffic is defined to be untagged, then untagged traffic
   will be blocked from flowing to/from Downlink ports.


--------------------------------------------------------------------------------

Press Space Bar To Browse Mode Setting, Press RETURN To SET New Mode.
Dn-Arrow to change settings for current mode
Save Changes and Exit: F3 or S. Exit without Saving: F4 or Q.
```


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Mode 4— Port Based Forwarding

```
sysName = Test System                                    Giga-AccessEtherLinX-II

This Device is currently in OPERATION MODE 4

--------------------------------------------------------------------------------


         OPERATION MODE 4 - Port based forwarding

MODE 4 forwards both tagged and untagged frames.
 * Device does not act on Vlan tags, they pass through unchanged.
 * Management traffic accepted to device only from specified ports.
 * Specify which ports can talk to which other ports.









--------------------------------------------------------------------------------

Press Space Bar To Browse Mode Setting, Press RETURN To SET New Mode.
Dn-Arrow to change settings for current mode
Save Changes and Exit: F3 or S. Exit without Saving: F4 or Q.
```

Port Based Forwarding selection is done on the following screen:

```
sysName = Test System                                    Giga-AccessEtherLinX-II

This Device is currently in OPERATION MODE 4

--------------------------------------------------------------------------------

              UpLink5   DnLink1   DnLink2   DnLink3   DnLink4

Downlink 1    Connect

Downlink 2      --      Connect

Downlink 3      --        --      Connect

Downlink 4      --        --        --      Connect


SNMP          _ --        --        --        --      Connect
--------------------------------------------------------------------------------

Press Space Bar To Connect or Disconnect.

Save Changes and Exit: F3 or S. Exit without Saving: F4 or Q.
```

Mode 5—Port Based VLANs

Only untagged frames are delivered to the Downlinks.

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```
sysName = Test System                                    Giga-AccessEtherLinX-II

This Device is currently in OPERATION MODE 5

--------------------------------------------------------------------------------


         OPERATION MODE 5 - Port Based Vlans

In MODE 5 the Uplink traffic consists of tagged frames only.
 * Downlink traffic is only untagged frames.
 * Management traffic to device only accepted from Uplink port.
 * Untagged frames arriving on a Downlink will be given a tag with VID
   as defined for that specific Downlink.
 * Each Downlink has two VIDs, one for Classified, one for UnClassified.




--------------------------------------------------------------------------------

Press Space Bar To Browse Mode Setting, Press RETURN To SET New Mode.
Dn-Arrow to change settings for current mode
Save Changes and Exit: F3 or S. Exit without Saving: F4 or Q.
```

Each port can assign two different VLANs based on the ingress frame classification.

```
sysName = Test System                                    Giga-AccessEtherLinX-II

This Device is currently in OPERATION MODE 5

--------------------------------------------------------------------------------
           |  Classified Traffic  |   UnClassified Traffic  | Traffic
           |  VID   Priority      |   VID   Priority        | Classification
Downlink 1 |  200      1          |   100      4            | Classify
           |                      |                         |
Downlink 2 |                      |     0      _            | Don't Classify
           |                      |                         |
Downlink 3 |                      |     0      0            | Don't Classify
           |                      |                         |
Downlink 4 |                      |     0      0            | Don't Classify
           |                      |                         |
           |                      |                         |
           |                      |                         |
           |                      |                         |
           |                      |                         |
--------------------------------------------------------------------------------

Enter new priority, 0 - 7

Save Changes and Exit: F3 or S. Exit without Saving: F4 or Q.
```

For untagged frames, the DiffServ priority value of the IP frame can be used for classification. This screen allows the user to select any of the 64 values. In addition the user must identify whether non-IP frames are also classified.

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```
sysName = Test System                                    Giga-AccessEtherLinX-II

This Device is currently in OPERATION MODE 5

--------------------------------------------------------------------------------

                Traffic Classification Selections for Port 1

Classify Selection     Classify on DiffServ


             6  6         5         4         3         2         1         0
             3  0         0         0         0         0         0         0
DiffServ     X.....X.....X.....................................................
DiffServ Value: 50

Non IP Frames          Don't Classify


--------------------------------------------------------------------------------

Press Space Bar To Change Value.
Press RETURN To Set Values.
Save Changes and Exit: F3 or S. Exit without Saving: F4 or Q.
```

Mode 6—Port Based Extra Tag

In this mode both untagged and tagged frames can enter the drop ports.

```
sysName = Test System                                    Giga-AccessEtherLinX-II

This Device is currently in OPERATION MODE 6

--------------------------------------------------------------------------------


         OPERATION MODE 6 - Port based double tagging, Access Device Mode.

In MODE 6 the Uplink traffic is tagged frames.
 * Uplink traffic often has more than one tag.
 * The Downlink traffic is both tagged and untagged frames.
 * Frames arriving on a downlink will be given an extra tag with one of
   two VIDs, as defined for that specific downlink.
 * The extra tag is inserted in front of any other tags already in the frame.
 * Management traffic to device only accepted from Uplink port.



--------------------------------------------------------------------------------

Press Space Bar To Browse Mode Setting, Press RETURN To SET New Mode.
Dn-Arrow to change settings for current mode
Save Changes and Exit: F3 or S. Exit without Saving: F4 or Q.
```

Two VLANs per port can be assigned based on ingress frames classification.

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```
sysName = Test System                                    Giga-AccessEtherLinX-II

This Device is currently in OPERATIONS MODE 6

-------------------------------------------------------------------------------
           |  Classified Traffic  |   UnClassified Traffic  | Traffic
           |  VID   Priority      |   VID   Priority        | Classification
Downlink 1 |    7      4          |     1      2            | Classify
           |                      |                         |
Downlink 2 |    0      0          |     0      0            | Classify
           |                      |                         |
Downlink 3 |                      |     0      0            | Don't Classify
           |                      |                         |
Downlink 4 |                      |     0      0            | Don't Classify
           |                      |                         |
           |                      |                         |
           |                      |                         |
           |                      |                         |
-------------------------------------------------------------------------------

Press Space Bar To Change Value.
Rt-Arrow for Classification screen for this port.
Save Changes and Exit: F3 or S. Exit without Saving: F4 or Q.
```

In this mode both tagged and untagged frames can enter the drop port. Tagged frames can now be classified based on the PRI value within the incoming VLAN tag. Any PRI value can be used to classify the frame.

```
sysName = Test System                                    Giga-AccessEtherLinX-II

This Device is currently in OPERATION MODE 6

-------------------------------------------------------------------------------

                Traffic Classification Selections for Port 1

Classify Selection     Classify on DiffServ


            6  6        5        4        3        2        1        0
            3  0        0        0        0        0        0        0
DiffServ    ..........................................................

Non IP Frames          Don't Classify


-------------------------------------------------------------------------------

Press Space Bar To Change Value.
Press RETURN To Set Values.
Save Changes and Exit: F3 or S. Exit without Saving: F4 or Q.
```


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```
sysName = Test System                                    Giga-AccessEtherLinX-II

This Device is currently in OPERATION MODE 6

--------------------------------------------------------------------------------

                Traffic Classification Selections for Port 1

Classify Selection     Classify on 802.1p Priority Value



                                        7      0
Classify Tag'ed Frame If Priority Is:   X.XX....
802.1 p Value :  4

Untagged Frames                         Don't Classify


--------------------------------------------------------------------------------

Press Space Bar To Change Value.
Press RETURN To Set Values.
Save Changes and Exit: F3 or S. Exit without Saving: F4 or Q.
```

Mode 7— Port Based Extra Tag, Infrastructure

```
sysName = Test System                                    Giga-AccessEtherLinX-II

This Device is currently in OPERATION MODE 7

--------------------------------------------------------------------------------


         OPERATION MODE 7 - Port based double tagging, Infrastructure Mode.

In MODE 7 any port can be defined for double tagging
 * A port defined for double tagging is called a Trunk, others are Drop ports.
 * Traffic flows freely between Trunks. No adding or deleting of tags.
 * One tag will be removed in traffic from Trunk ports to Drops.
 * Frames arriving on a Drop port will be given an extra tag with one of
   two VIDs, as defined for that specific downlink.
 * The extra tag is inserted in front of any other tags already in the frame.
 * Management traffic to device accepted from any Trunk port.


--------------------------------------------------------------------------------

Press Space Bar To Browse Mode Setting, Press RETURN To SET New Mode.
Dn-Arrow to change settings for current mode
Save Changes and Exit: F3 or S. Exit without Saving: F4 or Q.
```


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Mode 7 allows the user to define whether a port is a Trunk (passes everything, including management), or a Drop (can add/remove VLAN tags). Unit management is also enabled through any Trunk port.

```
sysName = Test System                                    Giga-AccessEtherLinX-II

This Device is currently in OPERATION MODE 7

--------------------------------------------------------------------------------


Downlink 1              Port Is A Trunk
Downlink 2              Port Is A Trunk
Downlink 3              Port Is A Drop
Downlink 4              Port Is A Drop
Uplink 5                Port Is A Trunk


--------------------------------------------------------------------------------

Press Space Bar To Change Value.

Save Changes and Exit: F3 or S. Exit without Saving: F4 or Q.
```

Once a port is defined as a Drop Port, additional screens are provided to assign VLAN values based on the classification of the incoming frame.

```
sysName = Test System                                    Giga-AccessEtherLinX-II

This Device is currently in OPERATION MODE 7

--------------------------------------------------------------------------------
           |  Classified Traffic  |   UnClassified Traffic  | Traffic
           |  VID   Priority      |   VID   Priority        | Classification
           |                      |                         |
           |                      |                         |
           |                      |                         |
Downlink 3 |  100      1          |   400      4            | Classify
Downlink 4 |                      |     0      0            | Don't Classify
           |                      |                         |
           |                      |                         |
           |                      |                         |
--------------------------------------------------------------------------------

Press Space Bar To Change Value.

Save Changes and Exit: F3 or S. Exit without Saving: F4 or Q.
```


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```
sysName = Test System                                    Giga-AccessEtherLinX-II

This Device is currently in OPERATION MODE 7

--------------------------------------------------------------------------------

                Traffic Classification Selections for Port 3

Classify Selection      Classify on DiffServ


             6  6        5        4        3        2        1        0
             3  0        0        0        0        0        0        0
DiffServ     ^.....................................................

Non IP Frames           Classify


--------------------------------------------------------------------------------

Press Space Bar To Change Value.
Press RETURN To Set Values.
Save Changes and Exit: F3 or S. Exit without Saving: F4 or Q.
```

```
sysName = Test System                                    Giga-AccessEtherLinX-II

This Device is currently in OPERATION MODE 7

--------------------------------------------------------------------------------

                Traffic Classification Selections for Port 3

Classify Selection      Classify on 802.1p Priority Value


                                        7      0
Classify Tag'ed Frame If Priority Is:   ........

Untagged Frames                         Classify


--------------------------------------------------------------------------------

Press Space Bar To Change Value.
Press RETURN To Set Values.
Save Changes and Exit: F3 or S. Exit without Saving: F4 or Q.
```

Mode 7 also allows the user to define whether PRI or DiffServ values are used to classify incoming frames and whether non-IP frames are classified. Classification is done on a port-by-port basis.

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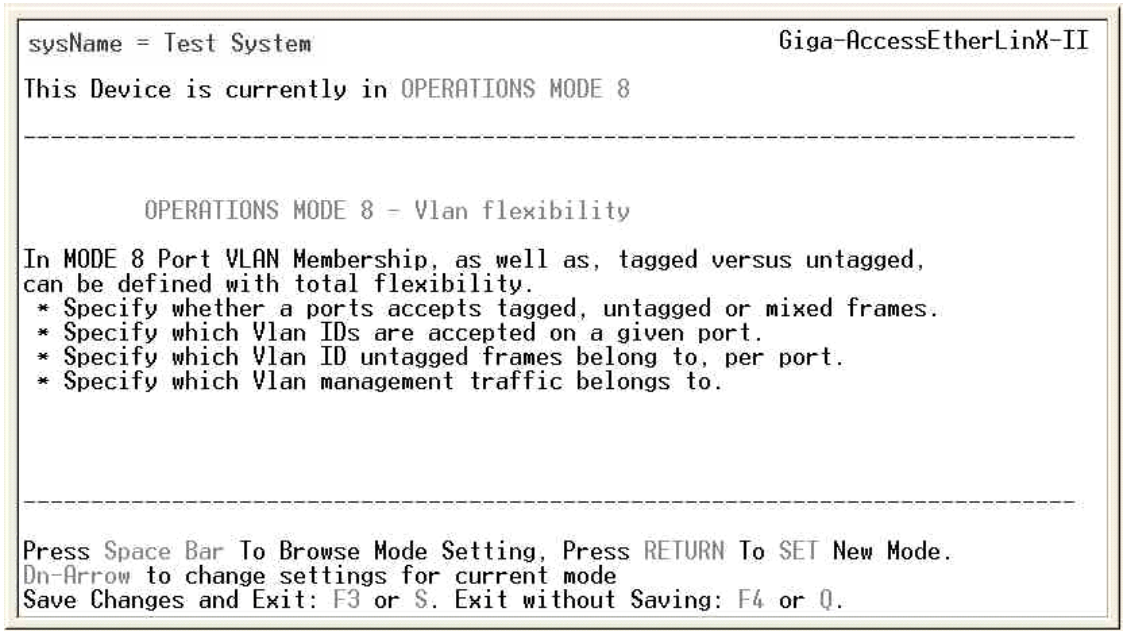
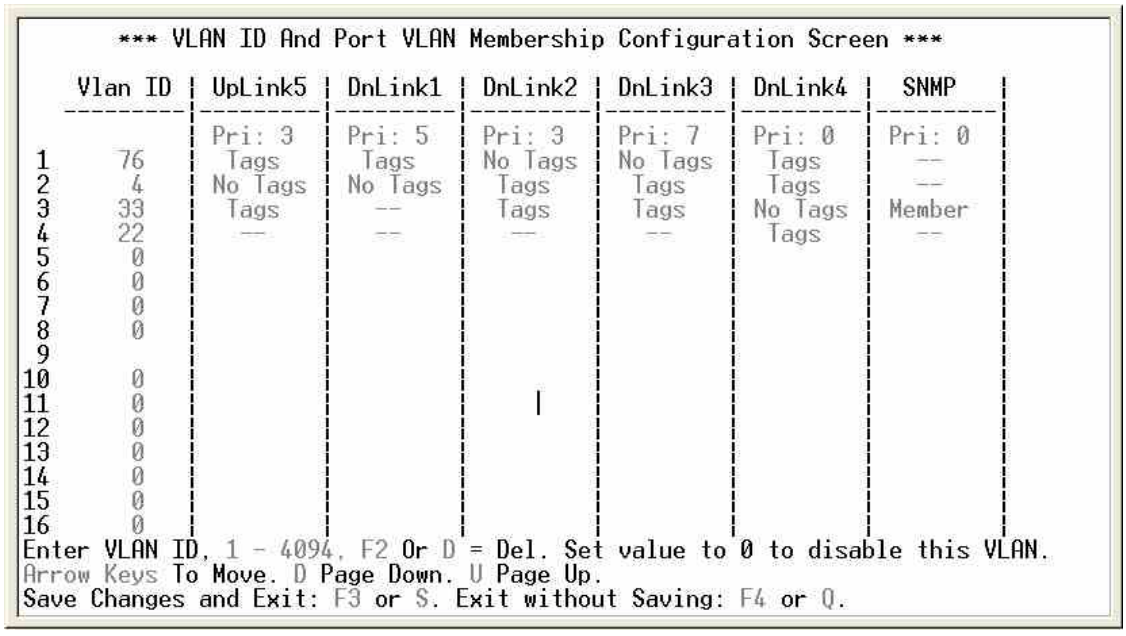
Mode 8—VLAN Assigned



Mode 8 allows up to 64 VLAN IDs to be defined. Each port can be a tags or No-tags member of a defined VLAN. A tags member port will allow these tagged frames to enter/exit the port. A No-tags member port will add this frame at egress. Only one No-tag VLAN can be assigned to a given port, but any or all defined tags can be assigned as tags for a given port.



Mode 8 allows total flexibility by combining both Trunk and Drop port capabilities allowing both VLAN filtering and tagging on the same unit.

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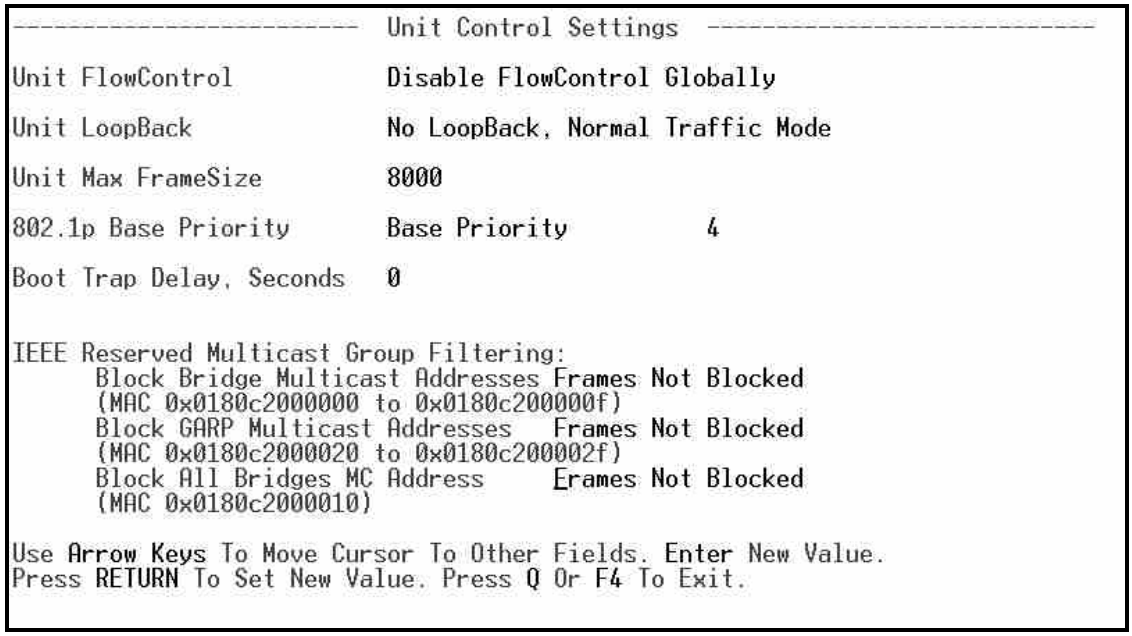
Only one No-tags can be assigned to a port; this indicates that all frames entering the port that do not match the assigned members VLAN-ID list are given this indicated tag. All frames leaving the port with this tag will have it removed. Assigned tag frames (tags) will pass through this port without changes.

Unit Control Settings



Global unit settings are configured on this screen and apply to all ports.

Unit Loopback loops all frames entering the fiber Uplink Port back to the fiber port.

Unit Max Frame Size can be set as high as 12.2K Bytes. However, the unit can not sustain a continuous stream of this jumbo frame without some frames loss. Sustained MAX frames size with no frame loss is limited to 8.2K bytes.

802.1p Base Priority is a value from 0 to 7 that is used to divide incoming frames into High and Low priority groups. A Base Value of 4 indicates that any VLAN tag with PRI$\geq$4 will be given High Priority status inside the unit, is applicable to Modes 2,3,and 4 only.

The unit can be configured to Block Bridge, GARP, and All Bridge protocol frames.

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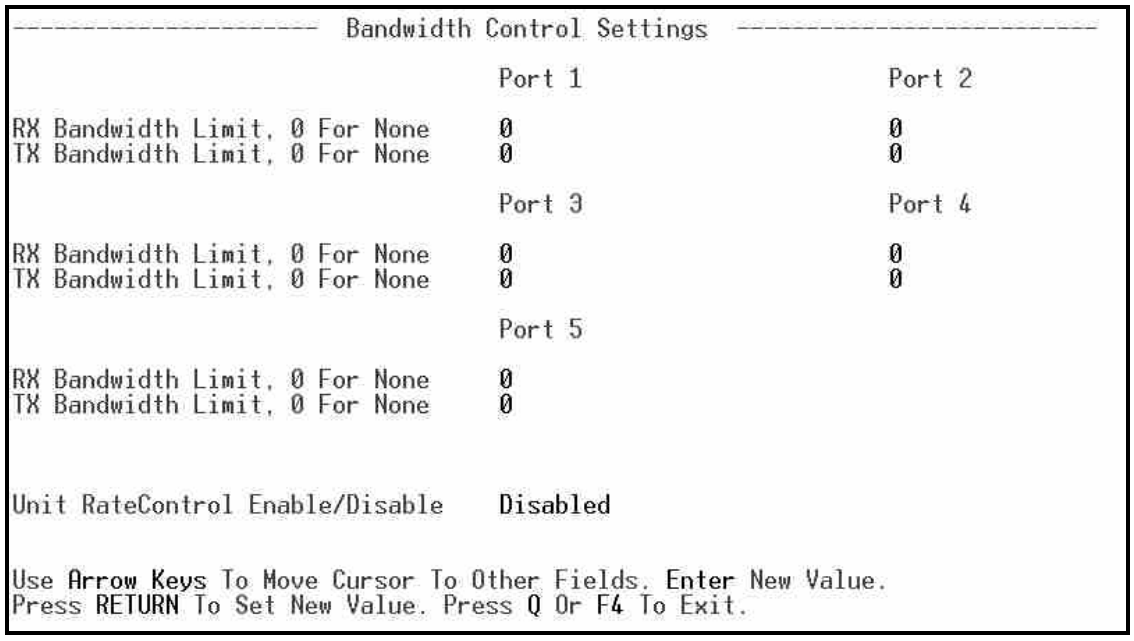
Bandwidth Limiting



Bandwidth Limiting can be set per port in both transmit and receive directions. The limiting function provides a Leaky Bucket traffic shaping function when placed on the TX side of a port. When the transmit limit is reached on a port, it will stop transmitting until the bucket level falls below the set level. When placed on the RX side it functions more like a hard Bandwidth limiter. When the Bucket level is reached, the port will stop receiving frames and will issue PAUSE frames back to the port until this bucket level clears.

Bandwidth Limiting is entered as any value from 0 to the MAX bandwidth of the port.

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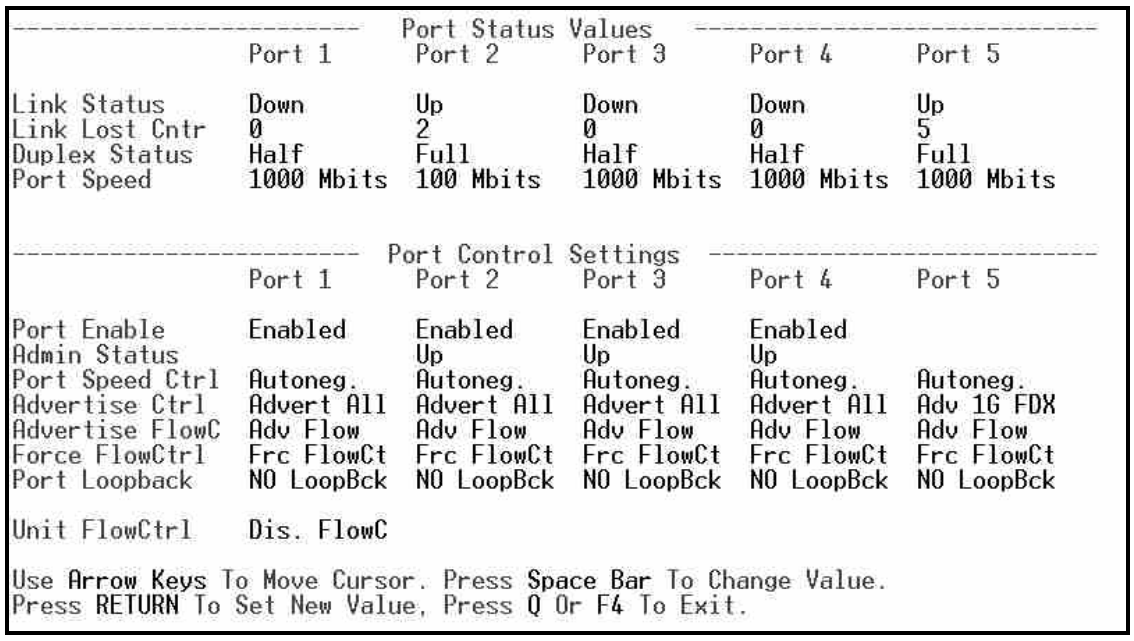
Port Configuration

The Giga-AccessEtherLinX-II Downlink Ports can be configured via console configuration. Type **ports** and press **Enter** to be taken to the Port Configuration screen. From this screen, users can enable/disable ports and set Auto Negotiation and Flow Control functions, etc. (This can also be performed via iView[2].)



```
------------------------  Port Status Values  ----------------------------
                 Port 1      Port 2      Port 3      Port 4      Port 5

Link Status      Down        Up          Down        Down        Up
Link Lost Cntr   0           2           0           0           5
Duplex Status    Half        Full        Half        Half        Full
Port Speed       1000 Mbits  100 Mbits   1000 Mbits  1000 Mbits  1000 Mbits


------------------------  Port Control Settings  ---------------------------
                 Port 1      Port 2      Port 3      Port 4      Port 5

Port Enable      Enabled     Enabled     Enabled     Enabled
Admin Status                 Up          Up          Up
Port Speed Ctrl  Autoneg.    Autoneg.    Autoneg.    Autoneg.    Autoneg.
Advertise Ctrl   Advert All  Advert All  Advert All  Advert All  Adv 1G FDX
Advertise FlowC  Adv Flow    Adv Flow    Adv Flow    Adv Flow    Adv Flow
Force FlowCtrl   Frc FlowCt  Frc FlowCt  Frc FlowCt  Frc FlowCt  Frc FlowCt
Port Loopback    NO LoopBck  NO LoopBck  NO LoopBck  NO LoopBck  NO LoopBck

Unit FlowCtrl    Dis. FlowC

Use Arrow Keys To Move Cursor. Press Space Bar To Change Value.
Press RETURN To Set New Value, Press Q Or F4 To Exit.
```

When a port is disabled, it will no longer show LINK or send any traffic to the port.

Flow Control will cause a port to send PAUSE whenever the ports internal buffer space is low. This can be affected by both Bandwidth limit setting for the port and traffic congestion on the port.

Forced Flow Control should only be used when the connected end device does not support Auto Negotiation.

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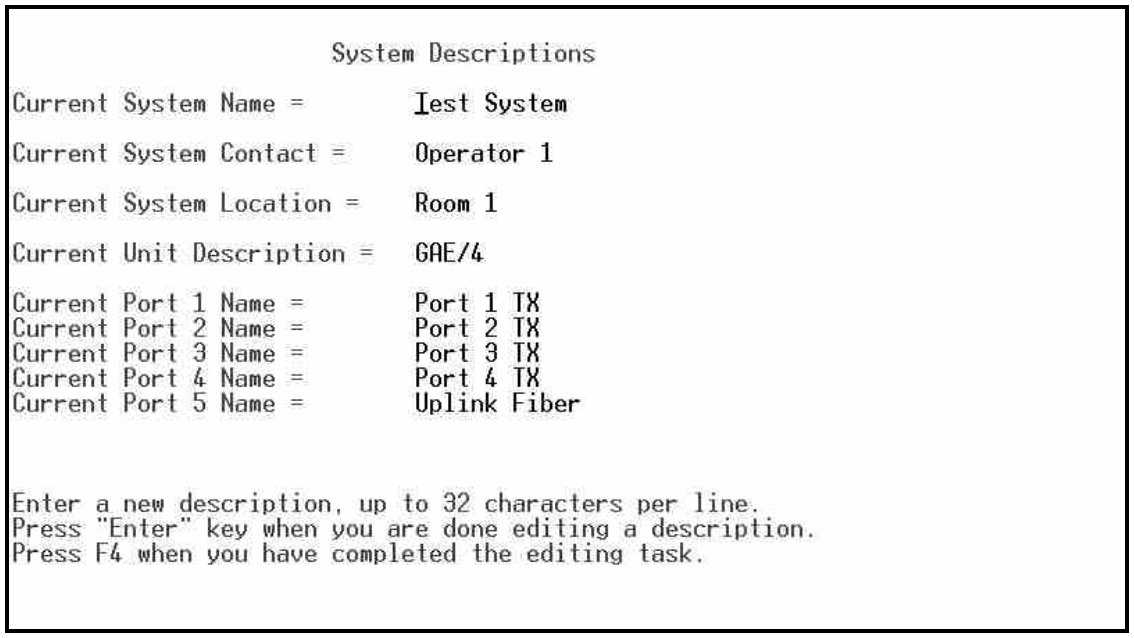
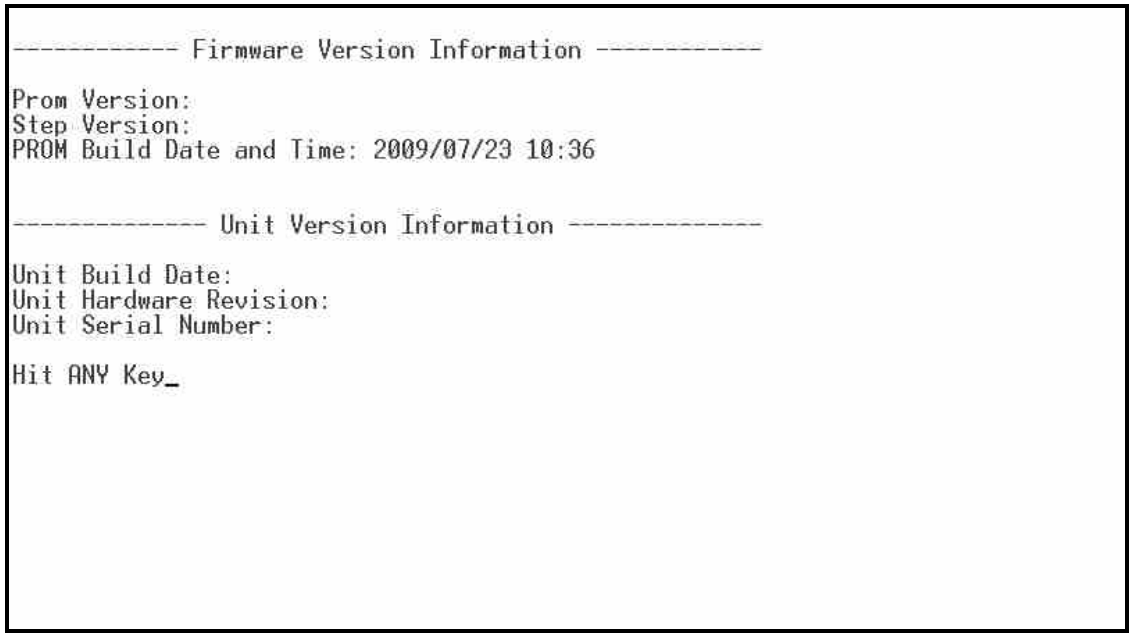
System Descriptions

This screen allows the user to define unit and port names that are incorporated by the unit into all SNMP traps. These are extremely useful in troubleshooting the system.



Firmware and Unit Version Information



To help maintain Software revision control, these reference numbers are always updated whenever unit software is downloaded to the equipment.

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Using Management

iView² is a network management application for IMC Networks intelligent networking devices. It features a GUI and gives network managers the ability to monitor and control products from a variety of platforms.

Using iView² with HP OpenView

During the installation, the iView² application will ask if HP OpenView is installed on the management PC. Click **Yes** to integrate the appropriate files. Once in OpenView, highlight the media converter icon and select the media converter; OpenView will then launch iView².

Other NMS Applications

If using an application other than iView² for management, integrate the SNMP vendor MIBs, which can be found in the MIB subdirectory of iView² installed on the chosen hard drive of a workstation.

Refer to the application's documentation for information on how MIB files are integrated.

Update Manager

iView² offers the option of scheduling an update search for IMC Networks devices listed in the Network outline. Within iView², select **Tools/SNMP Options** from the navigation toolbar. Select **Update Manager Options**, and a dialog box will be displayed, in which you can select when to run the update search. This option enables the end user to determine if they have the latest firmware, and download the latest if they do not. It does not automatically run the download, so the end user can review the release notes included with the binary file, and decide whether to download it or not.

UMA (Unified Management Agent)

The UMA allows operators to manage all IMC Networks modules with on-board logic (iMcV-GigaFiberLinX-II series) installed in an IMC Networks iMediaChassis, with a single IP address from a central location. Centralized management makes practical sense for networks of all sizes, especially service provider networks that must monitor and upgrade large quantities of devices. In addition, UMA allows users to centrally manage and administer firmware upgrades over multiple devices.

For example, the user can install ten iMcV-Giga-FiberLinX-II devices in a 20 slot iMediaChassis at the Central Office (CO) and connect each to a remote Giga-AccessEtherLinX-II unit installed at the customer's premises equipment (CPE). UMA allows users to manage all 20 devices (including the chassis at the CO) via the single

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IP address assigned to the chassis management card. Users may still assign IP addresses to each iMcV-Giga-FiberLinX-II and Giga-AccessEtherLinX-II, and manage them independently over the network being transported but this may not provide the same level of security as the UMA system.

With the Unified Management Agent

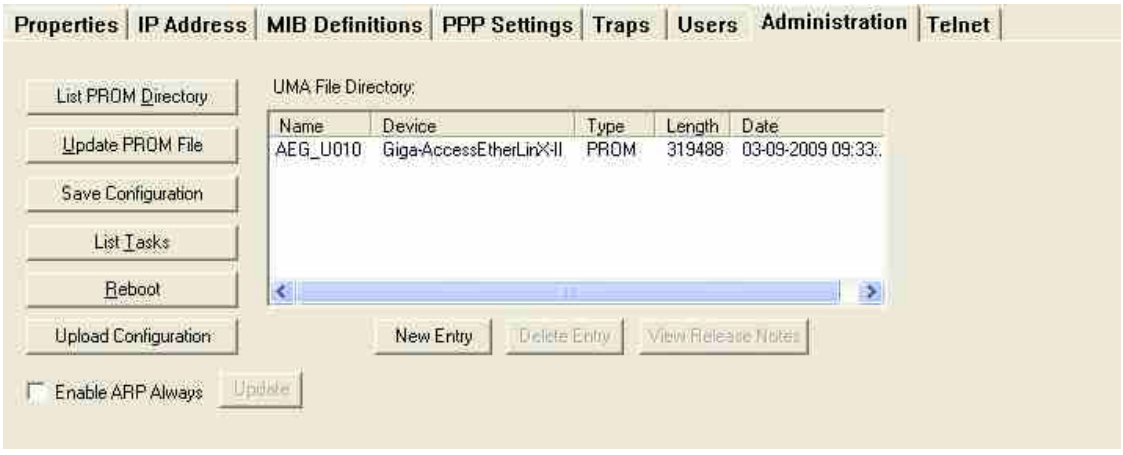
When an SNMP request for an iMcV-Giga-FiberLinX-II comes in, the SNMP Management Module in the iMediaChassis passes the request to the SNMP agent in the specific module. The SNMP agent in the iMcV-Giga-FiberLinX-II provides the relevant management information for both the iMcV-Giga-FiberLinX and the remote Giga-AccessEtherLinX-II unit using a secure IP-Less messaging channel to the remote unit.

IP-Less Management

The Giga-AccessEtherLinX-II supports the IMC Networks secure management system that allows the unit to function as an integrated remote unit when attached to a Giga-AccessEtherLinX-II Host unit over a fiber link segment. In this mode the two units are managed as one integrated pair without the need of an assigned IP address at the remote unit.

File Management for Upgrading

The following screen, located in the iConfig utility of iView^2, shows the File Management functionality of the Unified Management Agent. Operators can easily upload and store new firmware versions for upgrading multiple devices with on-board logic installed in, or connected to, an iMediaChassis.



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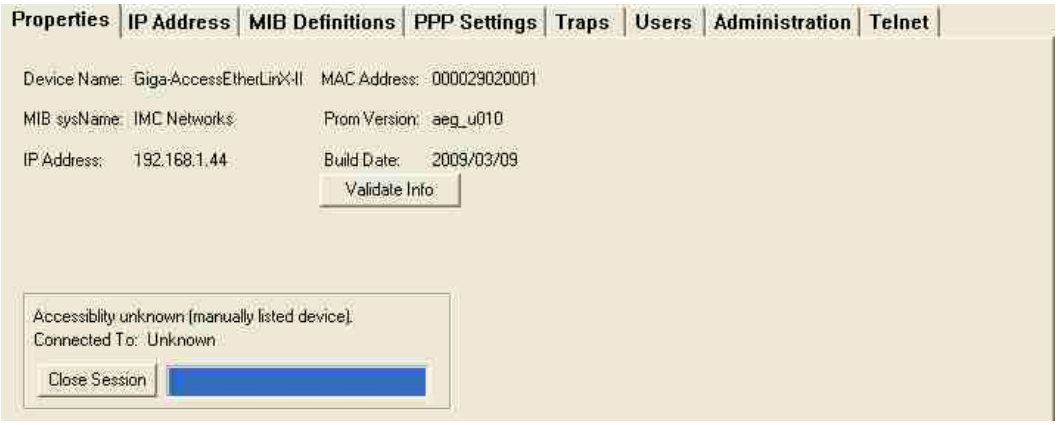
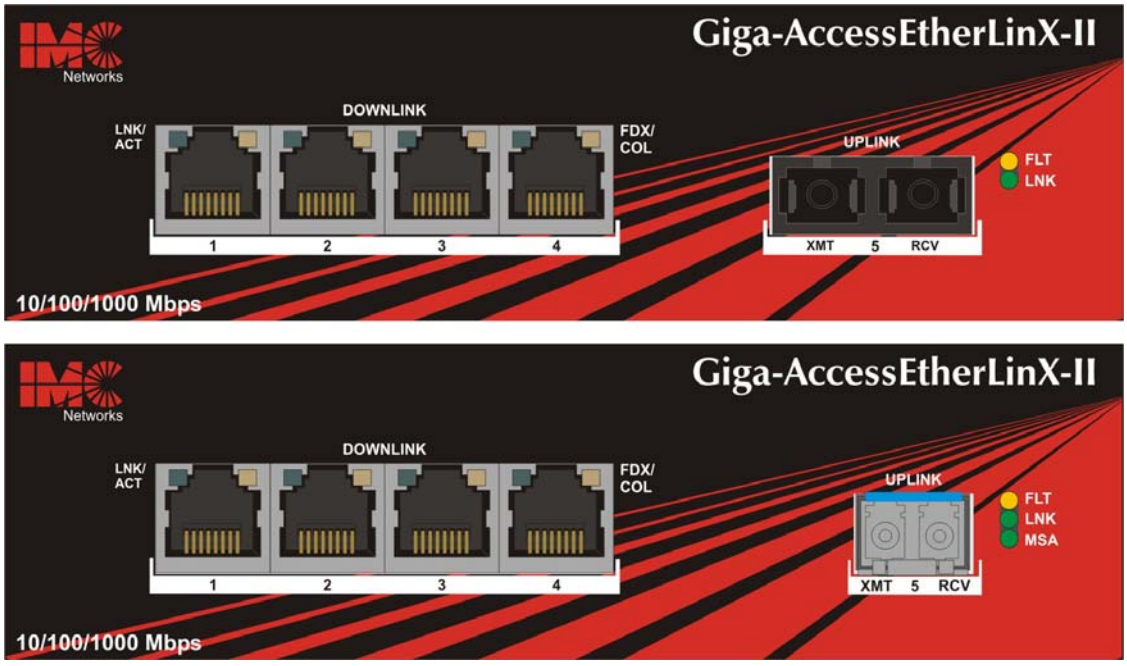


Using Telnet

Assign the Giga-AccessEtherLinX-II an IP Address or use the default IP Address 10.10.10.10, subnet mask 255.0.0.0 before using a Telnet session. All configurations done via the console port can also be performed using Telnet. The user should only open one Telnet or RS232 console session at a time. Do not use an RS232 console session and a Telnet session at the same time as unexpected results may occur.

LED Operation



Downlink Ports

LNK/ACT	Glows green when link is established on port. Blinks green during data activity on port.
FDX/COL	Glows green when port is operating in Full-Duplex. Blinks green when collisions occur on port. No display when port is operating in HDX

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Uplink Ports

FLT	Glows yellow when a fault is detected with the fiber Uplink. Faults include loss of link and half-duplex operation. Half-duplex is not defined for a fiber line running at gigabit rates.
LNK	Glows green when link is established. Blinks green during data activity.

Passwords

If the username and password are available when accessing iView², the unit can be reset back to its original factory setting with the following procedure. Open a console session by launching a Hyperterminal session with the unit. Upon completion of the boot sequence, press the **Spacebar** once and then type in the command **cleandb**. Upon completion, type in the command **reboot**. This will reset the username/password back to admin/admin.

If the username and password are lost for the console session, open iConfig within iView². In the Administration tab, upgrade the PROM with a backup copy of the last binary file, or load a current binary file downloaded from the IMC Networks download product page. By reloading the binary file, the username and password is removed.

If BOTH password accesses are lost, contact **Technical Support** at **1-800-624-1070** for information.

Before using iView²

iView² is a network management application designed for Intelligent Networking Devices from IMC Networks. It features a GUI and gives network managers the ability to monitor and control products from a variety of platforms. iView² can also function as a snap-in module for HP Open View Network Node Manager.

System Requirements

To run iView², the management PC must be equipped with the following:

- 29 MB free disk space, 64 MB RAM
- Windows: NT 4.0 Service Pack 5, 2000 Professional, or XP
- Microsoft SNMP Services Installed
- Microsoft IE 4.0 or Higher (not required as default browser)
- Microsoft IIS required for Web Server version

Java versions require the following:

- 25 MB free disk space, 64 MB RAM
- Any OS capable of running Java (Windows 98 or above, Solaris, LINUX)
- Java Runtime v 1.3

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Strongly recommended:

- 128 MB RAM
- Pentium III 650Mhz or Faster
- 17″ Monitor @ 1024 x 768 Resolution or higher

Installing and Using iView²

iView² is available to install as a download at www.imcnetworks.com/Products/iView.cfm.

When using iView² with HP OpenView

During the installation, the iView² application will ask if HP Open View is installed on the management PC. Click **Yes** to integrate the appropriate files. Once in OpenView, select IMC Networks from the toolbar to view the IMC Networks devices.

When Not Using iView²

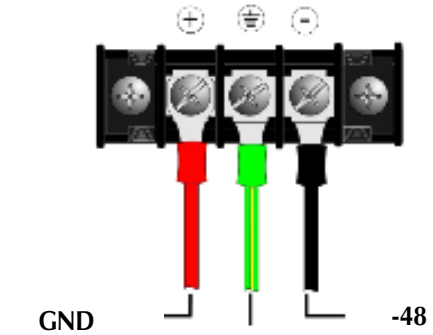
When using an application other than iView² for management, integrate the SNMP vendor files (a.k.a. MIBs) into the application. The SNMP agent uses the following Enterprise-specific MIB file and standard MIBs, which can be found in the MIB directory within the iView² download files.

Using the IMC MIBs

Refer to the MIBs folder located with the iView² software for product-related MIBs.

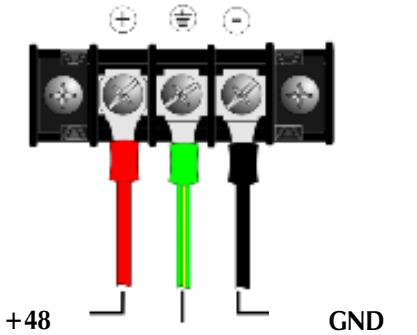
DC Power Supply Wiring Instructions

DC Power Supply
If in a -48 environment:



Terminal Block

DC Power Supply
If in a +48 environment:



Terminal Block

NOTE
Incorrect wiring will result in chassis malfunction. The Giga-AccessEtherLinX-II (DC) is compliant with Isolated Grounding Plane practices. The POSITIVE and NEGATIVE terminals are isolated from chassis ground and must have a ground reference at the power-sourcing equipment.

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This equipment is designed to permit the connection of the grounded conductor of the DC supply circuit to the grounded conductor at the equipment. If this connection is made, all of the following conditions must be met:

1. This equipment shall be connected directly to the DC supply system grounded electrode conductor or to a bonding jumper from a grounded terminal bar or bus to which the DC supply system grounding electrode conductor is connected.
2. This equipment shall be located in the same immediate area (such as, adjacent cabinets) as any other equipment that has a connection between the grounded conductor of the same DC supply circuit and the grounding conductor, and also the point of grounding of the DC system. The DC system shall not be grounded elsewhere.
3. The DC supply source shall be located within the same premises as this equipment.
4. Switching or disconnecting devices shall not be in the grounded circuit conductor between the DC source and the point of connection of the grounding electrode conductor.

Rackmount Precautions

1. Elevated Operating Ambient - If installed in a closed or multi-unit rack assembly, the operating ambient temperature of the rack environment may be greater than room ambient. Therefore, consideration should be given to installing the equipment in an environment compatible with the maximum ambient temperature (Tma) specified by the manufacturer.
2. Reduced Air Flow - Installation of the equipment in a rack should be such that the amount of air flow required for safe operation of the equipment is not compromised.
3. Mechanical Loading - Mounting of the equipment in the rack should be such that a hazardous condition is not achieved due to uneven mechanical loading.
4. Circuit Overloading - Consideration should be given to the connection of the equipment to the supply circuit and the effect that overloading of the circuits might have on overcurrent protection and supply wiring. Appropriate consideration of equipment nameplate ratings should be used when addressing this concern.
5. Reliable Grounding - Reliable grounding of rackmounted equipment should be maintained. Particular attention should be given to supply connections other than direct connections to the branch circuit (e.g., use of power strips).

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DC Power Supply Precautions

The following precautions must be observed when installing the chassis model with an internal DC power supply.

1. Check nameplate ratings to ensure there is no overloading of supply circuits that could affect over current protection and supply wiring.
2. In addition, the following must be observed:
   a. Connect the equipment to a 36 to 56.7 V DC power source that is electrically isolated from the alternating current source.

Nominal Voltage	Minimum Voltage	Maximum Voltage	Transient Voltage
48	36	56.7	75.0*

   * 75.0-V transient with a duration of 10.0 ms with a rate of rise and fall of 10 V/ms. The equipment shall meet its operational specifications during the transient.

   b. Route input wiring to terminal block and secure in such a manner that it is protected from damage and stress. Do not route wiring past sharp edges or moving parts.
   c. Incorporate a readily accessible disconnect device, with a 3mm minimum contact gap in the fixed wiring.
   d. Install only in Restricted Access Areas (dedicated Equipment Rooms, Equipment closets or the like) in accordance with Articles 110-18, 110-26, and 110-27 of the National Electric Code, ANSI/NFPA 70.
   e. Provide a listed circuit breaker suitable for branch circuit protection of the wiring and rated maximum 1A @ 48 V DC.
   f. For supply connections, use wires suitable for at least 75° C.

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Specifications

Standards

IEEE 802.3x Ethernet
IEEE 802.3u Auto Negotiation
IEEE 802.1q VLAN
IEEE 802.1p Packet Prioritization

Operating Temperature
+32° F to +122° F (0° C to +50° C)

Storage Temperature
-40° F to 185° F (-40°C to 85° C)

Humidity
10 to 95% (non-condensing)

Maximum heat generated
81 BTU/hr

Power Requirements (typical)
100-240V AC, 50/60Hz, 0.5/0.25A for AC
48V DC, 0.5A for DC

Throughput
Up to full wire speed on all ports.
Up to 9600 MTU

Dimensions
Height = 1.64″ x Width = 5.64″ x Depth = 8.95″ (4.2 cm x 14.3 cm x 22.7 cm)

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Fiber Optic Cleaning Guidelines

Fiber Optic transmitters and receivers are extremely susceptible to contamination by particles of dirt or dust, which can obstruct the optic path and cause performance degradation. Good system performance requires clean optics and connector ferrules.

1. Use fiber patch cords (or connectors, if you terminate your own fiber) only from a reputable supplier; low-quality components can cause many hard-to-diagnose problems in an installation.
2. Dust caps are installed at IMC Networks to ensure factory-clean optical devices. These protective caps should not be removed until the moment of connecting the fiber cable to the device. Should it be necessary to disconnect the fiber device, reinstall the protective dust caps.
3. Store spare caps in a dust-free environment such as a sealed plastic bag or box so that when reinstalled they do not introduce any contamination to the optics.
4. If you suspect that the optics have been contaminated, alternate between blasting with clean, dry, compressed air and flushing with methanol to remove particles of dirt.

Electrostatic Discharge Precautions

Electrostatic discharge (ESD) can cause damage to any product, add-in modules or stand alone units containing electronic components. Always observe the following precautions when installing or handling these kinds of products

1. Do not remove unit from its protective packaging until ready to install.
2. Wear an ESD wrist grounding strap before handling any module or component. If the wrist strap is not available, maintain grounded contact with the system unit throughout any procedure requiring ESD protection.
3. Hold the units by the edges; do not touch the electronic components or gold connectors.
4. After removal, always place the boards on a grounded, static-free surface, ESD pad or in a proper ESD bag. Do not slide the modules or stand alone units over any surface.

WARNING! Integrated circuits and fiber optic components are extremely susceptible to electrostatic discharge damage. Do not handle these components directly unless you are a qualified service technician and use tools and techniques that conform to accepted industry practices.

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Safety Certifications

UL/CUL: Listed to Safety of Information Technology Equipment, including Electrical Business Equipment.

CE: The products described herein comply with the Council Directive on Electromagnetic Compatibility (2004/108/EC) and the Council Directive on Electrical Equipment Designed for use within Certain Voltage Limits 2006/95/EC). Certified to Safety of Information Technology Equipment, Including Electrical Business Equipment. For further details, contact IMC Networks.

Class 1 Laser product, Luokan 1 Laserlaite,
Laser Klasse 1, Appareil A'Laser de Classe 1

European Directive 2002/96/EC (WEEE) requires that any equipment that bears this symbol on product or packaging must not be disposed of with unsorted municipal waste. This symbol indicates that the equipment should be disposed of separately from regular household waste. It is the consumer's responsibility to dispose of this and all equipment so marked through designated collection facilities appointed by government or local authorities. Following these steps through proper disposal and recycling will help prevent potential negative consequences to the environment and human health. For more detailed information about proper disposal, please contact local authorities, waste disposal services, or the point of purchase for this equipment.

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