



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.

- 3) Hold boards by the edges only; 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 board over any surface.

WARRANTY

Please contact Black Box for complete warranty information.

FEDERAL COMMUNICATIONS COMMISSION RADIO FREQUENCY INTERFERENCE STATEMENT

This equipment has been tested and found to comply with the limits for a Class B computing device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which the user will be required to correct the interference at his own expense.

This digital apparatus does not exceed the Class B limits for radio noise emission from digital apparatus set out in the Radio Interference Regulation of the Canadian Department of Communications.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de classe B prescrites dans le Règlement sur le brouillage radioélectrique publié par le ministère des Communications du Canada.



Black Box Corporation
The World's Source for Connectivity™

Black Box Corporation
1000 Park Drive, Lawrence, PA 15055-1018
Web site: www.blackbox.com

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About IP Mux II

IP Mux II™ from Black Box is an Internet access multiplexer with bandwidth control. *IP Mux II* splits a high-speed connection among several users to provide a cost-effective, secure, bandwidth scalable interface between a group of users and an ISP Point-of-Presence (POP). Its features, capabilities and fine data rate control also lend themselves to WAN access applications in enterprise networks and at web hosting sites. The five port device includes five 100Base-TX ports (one uplink and four downlinks) with RJ-45 connectors. *IP Mux II* also features a serial port with a DB-9 connector for configuration of initial settings. *IP Mux II* installs in any compatible Black Box *PowerChassis II*.

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IP Mux II offers several unique features, including:

- A range of unique IP addresses configured to each of the downlink ports which provides for the secure forwarding of data to each individual port (similar to a VLAN switch or a router)
- Bandwidth management, where each port can be allocated bandwidth independently of all other ports
- Auto-Negotiation between 10 and 100 Mbps along with Half- and Full-Duplex
- Hack-resistant security — it is impossible to access or monitor any port from another Downlink port.

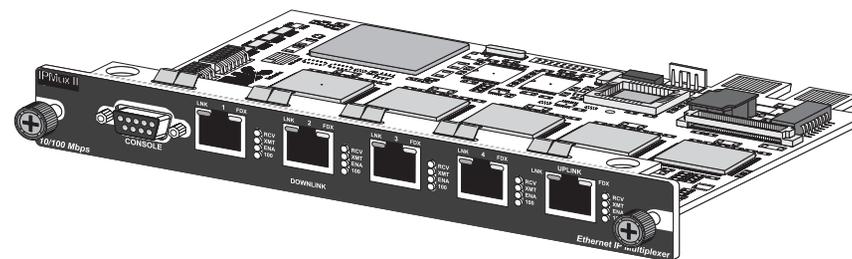


Figure 1: An IP Mux II Module

DIP Switch Settings

IP Mux II has an eight position DIP switch located at **S2** (see Figure 2 below). The function of these switches is mentioned below and is described further on pages 8 and 9.

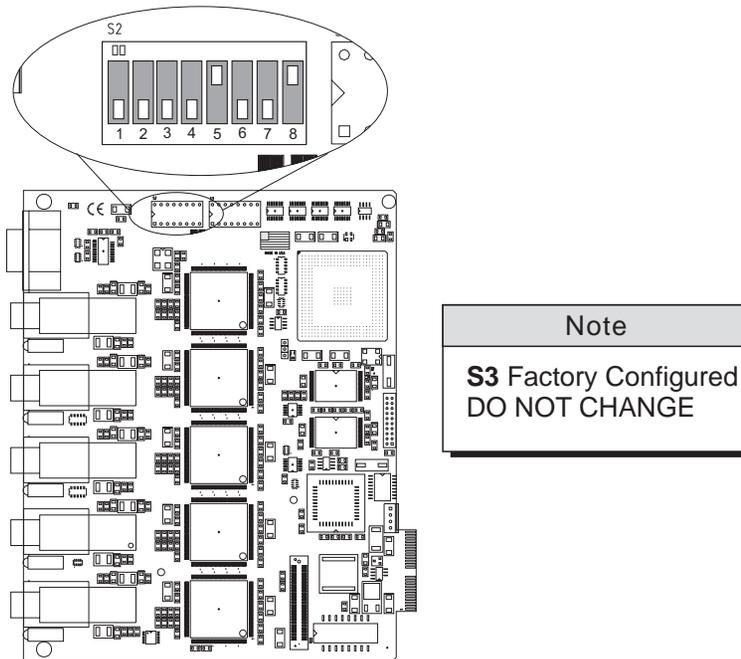


Figure 2: DIP Switch Location on IP Mux II

SWITCH	FUNCTION	DEFAULT
1	Allows Port 1 to accept SNMP and HUBCTRL32 Commands	OFF
2	Allows Port 2 to accept SNMP and HUBCTRL32 Commands	OFF
3	Allows Port 3 to accept SNMP and HUBCTRL32 Commands	OFF
4	Allows Port 4 to accept SNMP and HUBCTRL32 Commands	OFF
5	Allows Port 5 to accept SNMP and HUBCTRL32 Commands	ON
6	Duplex Setting (Port 5 Only: ON= Full Duplex, OFF = Half Duplex)*	OFF
7	Force Mode (Port 5 Only: ON = Force 10, OFF = Force100)*	OFF
8	Auto-Negotiation (Port 5 Only)*	ON

*Note: For Ports 1 - 4, these modes are configured through iView or another SNMP-compatible NMS

General Information

BLACK BOX TECHNICAL SUPPORT

Order toll-free in the U.S.: Call 877-877-BBOX (outside U.S. call 724-746-5500)
FREE technical support, 24 hours a day, 7 days a week:

Call: 724-746-5500

Fax: 724-746-0746

Mail order: Black Box Corporation, 1000 Park Drive,
Lawrence, PA 15055-1018

Web site: www.blackbox.com

E-mail: info@blackbox.com

SPECIFICATIONS

Environmental

Operating Temperature: 32° - 104° F (0° - 40° C)

Storage Temperature: 0° - 160° F (-20° - 70° C)

Humidity: 5 - 95% (non-condensing)

Electrical

Module: 5V ±5%, 1.7 Amp., 8W

Configured: 100-240 VAC ±10%, 0.2/0.1A

Heat Generation: 30 BTU/hr

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 by the manufacturer to ensure factory-clean optical devices. These protective caps should not be removed until the moment of connecting the fiber cable to the device. Assure that the fiber is properly terminated, polished and free of any dust or dirt and that the location is as free from dust and dirt as possible.
- 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) Should it be necessary to disconnect the fiber device, reinstall the protective dust caps.
- 5) 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 your add-in modules. Always observe the following precautions when installing or handling an add-in module or any board assembly.

- 1) Do not remove unit from its protective packaging until you're ready to install it.
- 2) Wear an ESD wrist grounding strap before handling any module or component. If you do not have a wrist strap, maintain grounded contact with the system unit throughout any procedure requiring ESD protection.

If Not Using iView

If you will be using another application for management, you will need to integrate the SNMP vendor files (a.k.a. MIBs) into your application. Consult the documentation of your SNMP-manageable NMS for details.

Troubleshooting

- When connecting cables to *IP Mux II*, make sure that a crossover twisted pair cable is used if connecting to a NIC. For connections to routers or switches, use a pass-through twisted pair cable.
- If *IP Mux II* is connected to a non-negotiating device, sometimes the Duplex mode will not auto-negotiate. This can be corrected by changing either the DIP switch setting for Port 5 or changing Ports 1 - 4 in *iView* so that the correct Duplex setting is used.

LED Indicators

IP Mux II features status LEDs for each port. The following illustration shows the LEDs and their locations on *IP Mux II*

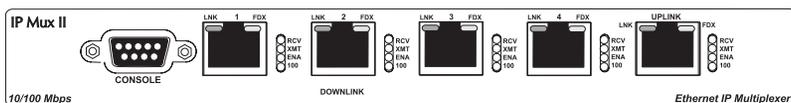


Figure 4: Faceplate for IP Mux II II

The LED functions for *IP Mux II* are as follows:

LEDs	FUNCTION
LNK	Glows green when a <i>link</i> is established. Located on the RJ-45 connector.
FDX	Glows yellow when <i>Full-Duplex</i> is selected on port. When Half-Duplex is selected, the LED is off. Located on the RJ-45 connector.
RCV	Blinks yellow when port is <i>receiving</i> data.
XMT	Blinks green when port is <i>transmitting</i> data.
ENA	Glows green when port is <i>enabled</i> .
100	Glows green when operating at <i>100 Mbps</i> . When unlit, port is operating at 10 Mbps

Installation Instructions

After configuring the DIP switches, you are ready to install *IP Mux II* into any Black Box *PowerChassis II*.

To install *IP Mux II* into a *PowerChassis II*, remove the blank bracket covering the slot, if necessary, where you will be installing the module, then slide the module into the chassis, via the cardguides, until the module is seated securely in the connector. Secure the module to the chassis by tightening the captive screws. After installing the module, you will need to assign an IP address to the *IP Mux II* device itself, which can be done via serial configuration or **HUBCTRL32™** (Hub Control 32).

Assigning IP Information

In order for *IP Mux II* to allow for SNMP-management, the module must be assigned IP configuration information (e.g., IP address, subnet mask, etc.). There are two ways to do this:

- Using *HUBCTRL32* over an Ethernet connection
- Using the unit's serial port

Besides assigning an IP address and subnet mask, the two methods will also allow you to create community strings, assign access rights, configure traps and more. However, *HUBCTRL32* offers more options than the serial port method (e.g., you can select *which* traps to assign with *HUBCTRL32*). Note that if you are using *HUBCTRL32*, you must have the SNMP/*HUBCTRL32* Function enabled via DIP switch (see Figure 2 on page 2 for details).

Once *IP Mux II* is assigned an IP address, you can use **iView™** or another SNMP-compatible Network Management System (NMS) to remotely configure, monitor and manage the *IP Mux II*.

ABOUT HUBCTRL32

HUBCTRL32 is an in-band configuration utility that lets users quickly and easily complete the first stages of SNMP configuration for Black Box's compatible SNMP-manageable devices. Tasks *HUBCTRL32* can perform include:

- setting the IP address, subnet mask and default gateway
- defining the community strings and SNMP traps

In addition to the above functions, *HUBCTRL32* offers an authorized IP address system and access restriction to MIB groups supported by Black Box manageable devices. These extra layers of security are purely optional and do not affect SNMP compatibility in any way.

HUBCTRL32 can also be used to upload new versions of the system software and new MIB information. It also offers diagnostic capabilities for faster resolution of technical support issues. *HUBCTRL32* works with the following platforms:

- Windows 98™
- Windows NT™
- Windows 2000™
- Windows XP™

HUBCTRL32 can be found on the *iView* CD. For information regarding the use of *HUBCTRL32*, refer to the *HUBCTRL32* online help file.

ABOUT SERIAL PORT CONFIGURATION

IP Mux II features a serial port that uses an IBM-compatible DB-9 serial connector. To connect *IP Mux II* to your terminal/computer, use a straight-through (pin-to-pin) cable. (If your computer/terminal has a serial port using a connection not compatible with a DB-9 COM port, use the pin connection chart below for reference in making a cable.) Make sure the cable length is under 50 ft. (15.24 m). Plug one end of the cable into the DB-9 connector on *IP Mux II* and the other into the appropriate port on your computer/terminal.

Set your computer/terminal for VT-100 emulation. The serial port on the computer/terminal should be set for:

- 38.4K baud
- 8 data bits
- 1 stop bit
- No parity
- No flow control

DB-9 PIN CONNECTION	
Pin #	Function
2	Transmit (OUT)
3	Receive (IN)
5	Ground
1, 4, 6-9	Not used

Main Configuration Screen

After running through an initial self test, the screen will display the following message: "Press <Enter> for Device Configuration."

Press **Enter** to be taken to the main configuration screen. Here you will find several displays:

Saved Values — displays changes made during current session.

- IP Address (MUST be assigned during initial configuration)
- Subnet Mask (MUST 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
- **E** = End Session

AUTO-NEGOTIATION

IP Mux II will negotiate its speed between 10 and 100 Mbps depending on the hardware connected to it. This feature is hardware configurable for the uplink port and is enabled by setting **DIP switch 8** to the **ON** position. The downlink ports are software configurable (refer to the *iView for IP Mux II TX5* help file for information).

It is possible to make a port operate as a straight 10 or 100 Mbps port by using the **Force 10** or **Force 100** modes. In **Force 10** Mode, only 10 Mbps information is transmitted or received. All 100 Mbps packets are discarded. Setting **DIP switch 7** to the **ON** position will enable this mode.

In **Force 100 Mode**, only 100 Mbps information is transmitted or received; all 10 Mbps packets are discarded. To set **Force 100 Mode**, move **DIP switch 7** to the **OFF** position. *Auto-Negotiation* is not possible in either Force mode. Note, **DIP switch 8** will override the Force and Duplex settings if enabled.

Using iView for Management

iView is a cross-platform network management application for Black Box intelligent networking devices. It features a graphic user interface (GUI) and gives network managers the ability to monitor and control Black Box products from a variety of platforms. *iView* can also function as a snap-in module for many SNMP-based applications.

SYSTEM REQUIREMENTS

To run *iView for IP Mux II*, the management PC must be equipped with:

- 20 MB free disk space, 32 MB RAM as well as one of the following operating systems:
- Windows 95/98/NT/2000/XP (standalone or with HP OpenView™)
- HP-UX™ and OpenView
- Solaris™ and OpenView

DISPLAY REQUIREMENTS

iView requires the following display settings:

- Color setting of at least 64K (higher than 256 colors)
- Monitor resolution of at least 800 x 600

INSTALLING AND USING IVIEW

Please consult the *iView* CD for assistance in installing and launching *iView for IP Mux II*. See the *iView for IP Mux II* help file for assistance in configuring and managing your *IP Mux II*.

If Using iView with HP OpenView

During installation, *iView* will ask if HP OpenView is installed on the management PC. Click **Yes** to integrate the appropriate files. You can also manually copy the file MC.REG into the appropriate OpenView resource directory on the management PC (usually C:\openview\registration\c). Once in OpenView, highlight the **IP Mux II** icon and select, **IP Mux II**; OpenView will then launch *iView*.

The eight modes are as follows:

- **Forward Everything** — Forwards ALL traffic. This mode can be used as a generic mode for uplink traffic to be forwarded onto a port.
- **Forward All IP & ARP** — Forwards all IP/ARP traffic; blocks all other protocols. As this mode allows all IP/ARP traffic to pass through, it is the recommended mode for traffic coming from the Internet to a downlink port.
- **Forward IP w/Parm + other** — Forwards IPs within a specified range along with other protocols, such as IPX.
- **Forward IP in Addr Range** — Forwards only IPs within a specified address range.
- **Forward IP Except** — Forwards everything except for IPs within a specified in IP address range, including non-IP traffic.
- **Forward IP & ARP Except** — Similar to the mode above but also forwards ARP packets.
- **Forward Single IP** — Forwards traffic from a single IP address.
- **Reserved** — This mode has been reserved for future use.

When using the latter four modes, you will also need to enter values for:

- **Forward IP** — A four-byte address that tells *IP Mux II* the common portion of the IP addresses for whose packets should be discarded (excluded) or forwarded (included), depending on mode. To specify the Base IP, place a “0” in each byte of the address which is NOT common to all packets.
- **Mux Byte** — Tells *IP Mux II* exactly which byte to multiplex the Base IP on (A for first, B for second, C for third, D for fourth) — wherever the first 0 appears.
- **High#** — Tells *IP Mux II* the high end of the range of IP addresses that should be discarded/forwarded (see **Forward IP**, page 6).
- **Low#** — Tells *IP Mux II* the low end of the range of IP addresses that should be discarded/forwarded (see **Forward IP**, page 6).
- **Single IP** (Optional) — A single IP address that will be excepted from the rule set up by the filtering mode. Typically, this is the address of a router.
- **Multicast** (Optional) — Allows multicast traffic to pass when **Yes** is selected (default is **No**).
- **Broadcast** (Optional)— Allows broadcast traffic to pass when **Yes** is selected (default is **No**). If Yes, enter the Forward IP for the stream in the text box labeled “Broadcast Mask” within the appropriate port window in *iView*.

SNMP/HUBCTRL32 TRAFFIC

You can enable and disable the ability to manage each port via SNMP or *HUBCTRL32* by configuring the DIP switches located at **S2** (See Figure 2 on page 2 for details). When one of these DIP switches (1 - 5) is in the **ON** position, the corresponding port will allow for remote management via *iView* or another SNMP-compatible NMS or *HUBCTRL32*. This allows the network administrator to permit only specific ports to configure *IP Mux II*. As any port that can be managed by SNMP will have the ability to view the data on other ports, it is important to have SNMP set on only those ports which can be accessed by the network administrator.

Assigning TCP/IP Information

NOTE

You must reboot after making any modifications to the Saved Values or your changes will not take effect. To reboot, type the word “**Reboot**” (no quote marks) at the prompt on the main configuration screen, or turn the chassis power OFF then ON.

NOTE

Because a Delete key is not available on VT-100 terminal emulators, use the **F2** key instead.

To modify the Saved Parameter Values (i.e., assign IP address and subnet mask), press **I**. You will be instructed to enter the IP address and subnet mask for the connected device. Press **Enter** after each. You may also assign a default gateway, if desired (press **Enter** to skip).

When finished, press **Enter**, 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).

Creating Community Strings

The default community string is named “public” and has read/write access. Black Box recommends you set up two communities: one with read-only access (for general use), the other with read/write access (for the administrator). 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**, 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).

NOTE: For more information on Community Strings, please see the IP Mux II Help file.

Deleting Community Strings

To delete all community strings and start over, press **U**. You will then be asked, “Are you sure you want to delete all future strings?” Press **Y** to proceed, **N** to abort. Press **Enter**. This function will delete ALL community strings. If you want to be able to selectively delete community strings, use *HUBCTRL32* to configure your device.

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**. You will then be 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 (created earlier) and press **Enter**. This function enables ALL of the traps the device is capable of. If you want to be able to selectively activate and de-activate traps, use *HUBCTRL32* to configure your device.

Removing Trap Destinations

To remove all trap destinations, press **K**. You will then be asked if you really want to remove all trap destinations. Press **Y** to continue. Press **N** to abort. Press **Enter**.

Password Protection

You can password protect the serial configuration process by pressing **P** from the main configuration screen. You will be asked to enter a password. (**NOTE: Passwords are case sensitive.**) Enter your password (spaces are NOT allowed) and press **Enter**. You will then be asked for your password whenever you log on or off. To remove password protection, select **P** and instead of entering a password, press **Enter**.

Should you forget the password, use *HUBCTRL32* to access the back-up copy of the PROM, then reburn the flash PROM (or contact Black Box technical support for assistance).

Ending Your Session

Be sure to press **E** before disconnecting the cable in order to stop the device from outputting to the serial port.

Terminology and Concept Brief

After assigning the *IP Mux II* unit an IP address, it is ready to be configured via *iView* or another NMS. The following provides an overview for the terms and concepts needed to understand this process.

FORWARD IP

The Forward IP is a four-byte address that tells *IP Mux II* what the Base IP (or common portion) is of the IP addresses being forwarded by a port. Each port can have a separate Forward IP. To specify the Forward IP, place a "0" in each byte of the address which is NOT common to all ports. For example, if the common portion of the IP addresses for all ports is 192.168.X.Y, enter 192.168.0.0 for the Forward IP. If the common portion is 192.168.54.X, enter 192.168.54.0.

MULTIPLEXING IP ADDRESS RANGES

All IP addresses are "members" of a certain range. These ranges are referred to as *subnets* and are either Class A, B or C. Historically, these classes were used to inform devices on the Internet (i.e., routers) which portion of the IP address is the network and which portion is a node on the network. For example, the IP address 192.168.0.1 is Class C where 192.168.0 represents the network and .1 is the node. The IP address 10.1.8.1 is Class A where 10 represents the network and .1.8.1 is the node.

Multiplexing in the *IP Mux II* allows a single uplink to be split among four separate downlinks. To accomplish this, the end-user assigns a **Mux byte**, or a byte which will be multiplexed on (for installations requiring less than 256 individual addresses per port, byte "4" is sufficient). The multiplexed byte then becomes the byte which is examined when data arrives at the uplink port and is then forwarded to the correct downlink port as designated by the end-user. For example, if a downlink port is assigned a Forward IP of **192.70.81.0**, *IP Mux II* will examine all incoming packets and those that have this

base IP will be forwarded to this port provided the data falls into the range that the end-user specifies (Range = 1 - 40 in this example, see Figure 3 on the following page).

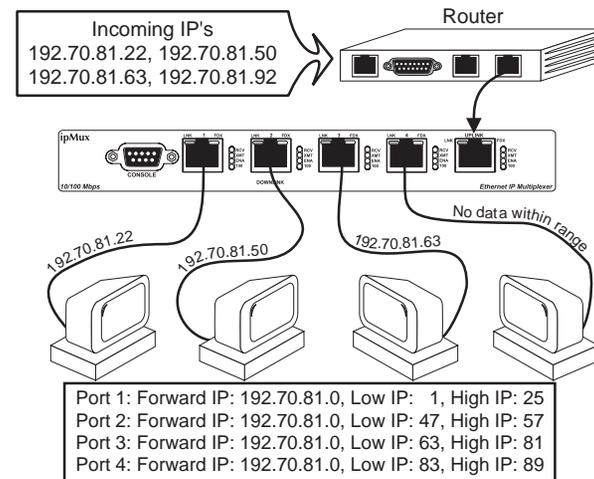


Figure 3: Multiplexing IPs with IP Mux II

You can split Class B networks among the downlink ports on *IP Mux II*, or an entire Class C network can be assigned to each port. It is also possible to use the same Class C IP address range (256 addresses) and split it among the ports (i.e., each port would be assigned a certain amount of the IP addresses within that Class C range). All ports would have the same three-byte Base IP.

BANDWIDTH ALLOCATION

The downlink ports on *IP Mux II* share a cumulative bandwidth of 100 Mbps. You can allocate a specific amount of this bandwidth to each port (i.e., 10 Mbps to Port 1, 50 Mbps to Port 2, 20 Mbps to Port 3 and 20 Mbps to Port 4) by using the Bandwidth Control function and entering a value for each port. This value can assume any value between 64 bits/sec and 100,000,000 bits/sec.

NETWORK LAYER PACKET FILTERING

IP Mux II is capable of filtering data according to its Network Layer Protocols, and provides eight modes for forwarding/discarding frames that come in contact with it. These packet filtering modes should be configured individually for each port.

The first two modes, **Forward Everything** (default) and **Forward All IP & ARP**, allow all or almost all network traffic to pass through *IP Mux II*. These modes are used most often for traffic coming from the Internet, through the router and *IP Mux II*, and on to the LAN. The other four modes use specific IP address ranges, defined by the user, to tell *IP Mux II* to either pass on or discard traffic based upon its destination IP. These modes are either inclusionary or exclusionary, and are most often used to restrict traffic coming from LAN, through *IP Mux II*, and on to a Layer 3 device.