GarrettCom™

Ethernet at Its Best™

Magnum Quad-Series

Fiber Switches

Installation and User Guide

Magnum™ Quad-Series

Fiber Switches

Installation and User Guide

Part #: 84-00063 (Rev. D 12/02)

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Ethernet is a trademark of Xerox Corporation

NEBS is a trademark of Telcordia Technologies

UL is a registered trademark of Underwriters Laboratories

GarrettCom, Magnum and **Personal Switch** are trademarks and **Personal Hub** is a
registered trademark of GarrettCom, Inc.

> **Important:** The Magnum Quad Series Fiber Switch contains no user
> serviceable parts. Attempted service by unauthorized personnel shall render all
> warranties null and void. If problems are experienced with Magnum Quad
> Series Fiber Switch products, consult Section 6, Troubleshooting, of this User
> Guide.

Printed in the United States of America.

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Federal Communications Commission

Radio Frequency Interference Statement

This equipment generates, uses and can radiate frequency energy and if not installed and used properly, that is in strict accordance with the manufacturer's instructions, may cause interference to radio communication. It has been tested and found to comply with the limits for a Class A computing device in accordance with the specifications in Subpart J of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

The Magnum Line

ETHERNET CONNECTIVITY PRODUCTS
"DESIGNED AND MANUFACTURED IN THE USA"

OVERVIEW

GarrettCom, Inc.offers the premium-quality Magnum™ line of Ethernet LAN connectivity products with industry-standard functionality and built-in fiber configurability. Magnum products are designed for use in demanding Carrier Class, Industrial Grade and OEM applications where reliability is a primary consideration.

6K25 Managed Fiber Switches, Gigabit, 100 and 10 Mbps, fiber and copper ports, mix-and match. Features SFF fiber for up to 25 fiber ports in a 1U unit.

4K-Series Switches, 100 and 10 Mbps, copper ports with optional fiber port, with auto-negotiating full switching performance.

Quad-Series Fiber Switches, 100 & 10Mbps, fiber and copper ports, mixed-speed and mixed-media types, full switching performance.

P62-Series "Outdoor Ethernet Switches, for temperature uncontrolled applications 6 10/100 and 2 100Mb fiber ports, managed and unmanaged models, all fiber types.

Mixed-Media Fiber Hub, 16-port Stackable, 10/100 auto-sensing

Dual Speed 8-port and 16-port Stackables, 10/100 auto-sensing

Stackable Hubs, SNMP Optional

10Mb series and 100Mb series, both w/ optional port modules

Personal Switches, 10/100Mb

8 port dual speed, Auto-negotiable with fiber option

Personal Hubs, 100Mb or 10/100Mb

8-port, with two switched ports (1 fiber built in)

Personal Hubs, 10Mb series

8-port + AUI, stackable to 5 high, + optional BNC of fiber port
8 or 9-port and 4 or 5-Port Personal Hubs, w/ man. up-link sw**.**

Media Converters, 10Mb and 100Mb series, regular and Hardened with integral DC power, all fiber media port types incl. fiber ST, SC, mm., single-mode, SFF

The "X-line" of configurable MiXed Media products:
Stackable Concentrators, SNMP optional, 13-Ports
Mini-Concentrators, 7 Ports, **Repeaters**, 2-Ports
Repeater Port Modules (RPMs), 6 types for Ethernet media
Bridge Port Modules (BPMs), 4 types, for segment isolation
Transceivers, 10Mb series Mini-Transceivers and Coax Models   **June, 03**

1.0   SPECIFICATIONS

1.1   Technical Specifications

Performance

Aggregate Filtering Rate:	2,380,800 frames/sec for 16 100Mbps ports (for Magnum QS5116)
(all ports are wire speed)	1,190,400 frames/sec for 8 100Mbps ports (for Magnum QS580 & QS5108)
Aggregate Forwarding Rate:	(for Magnum QS Fast Ethernet ports)
(all ports are wire speed)	1,190,400 frames per second, 16-port units
	595,200 frames per second, 8-port units
Data Rate:	10 Mbps and 100Mbps
Address Table Capacity:	24K node addresses, self-learning (12K on 8-port models), with address aging
Packet buffer size :	8 MB dynamic (4MB for 8-port)
Latency:	5 μs + packet time (100 to 100Mbps)
	15 μs + packet time (10 to 10 Mbps, and 10 to 100Mbps)

Network Standards

Ethernet V1.0/V2.0 IEEE 802.3: 10BASE-T,
IEEE 802.3u: 100BASE-TX, 100BASE-FX

Maximum 10 Mbps Ethernet Segment Lengths

Unshielded twisted pair	- 100 m (328 ft)
Shielded twisted pair	- 150 m (492 ft)
10BASE-FL multi-mode fiber optic	- 2 km (6,562 ft)
10BASE-FL single-mode fiber optic	- 10 km (32,810 ft)

Maximum Standard Fast Ethernet Segment Lengths:

10BASE-T (CAT 3, 4, 5 UTP)	- 100 m (328 ft)
100BASE-TX (CAT 5 UTP)	- 100 m (328 ft)
Shielded twisted pair	- 150 m (492 ft)
100BASE-FX, half-duplex, multi-mode	- 412 m (1350 ft)
100BASE-FX, full-duplex, multi-mode	- 2.0 km (6,562 ft)
100BASE-SX, short wavelength HDX m.m.	- 300 m (935 ft)
100BASE-FX, half-duplex, single-mode	- 412 m (1350 ft)
100BASE-FX, full-duplex, single-mode	- 15.0 km (49,215 ft)

Connectors for copper wiring

Twisted Pair at 10/100Mb: RJ-45 shielded, female, front mounted
   (for Magnum Quad-Series Fast Ethernet copper ports, use Cat 5 cable)

Fiber Multi-mode connector types:

Fiber Port, SC-type (snap-in):   Fiber optic multi-mode, 100BASE-FX
Fiber Port, ST-type (twist-lock): Fiber optic multi-mode, 100BASE-FX
Fiber Port, MTRJ-type (plug-in):   Fiber optic multi-mode, 100BASE-FX
Fiber Port, VF-45 type (plug-in): Fiber optic multi-mode, 100BASE-FX
Fiber Port, ST-type (twist-lock): Fiber optic multi-mode, 10ASE-FL

Fiber Single-mode connector types:

Fiber Port, SC-type: Fiber optic single-mode, 100BASE-FX

Manual switch-selections and jumpers
Up-link Push-button: Crossover sw for one RJ-45 port per QPM-RJ45
Fiber default: Full-duplex (Internal jumpers may select HDX mode)
Copper default: Auto-negotiation (Internal jumpers may alternatively select fixed 100Mb full-duplex, or fixed 100Mbps half-duplex)

LEDs: Per Port
LK: Steady ON when media link is operational
ACT: ON with receiver port activity
FDX/HDX: ON = Full-Duplex Mode
            OFF = Half-Duplex Mode
100/10: ON = 100Mbps speed
        OFF = 10 Mbps

Operating Environment
Ambient Temperature: 32° to 120° F (0° to 50°C)
Storage Temperature: -40°to 185°F (-40°to 85°C)
Ambient Relative Humidity: 10% to 95% (non-condensing)

Packaging
Enclosure: Rugged High strength metal. Suitable for stand-alone or rack-mounting
Dimensions: 1.75 in H x 17.0 in W x 9.13 in D   (10.0 in W for QS580)
            4.45cm H x 43.2cm W x 23.2cm D (25.4 cm W for QS580)
Weight: 4.0 lb. (1.8 Kg) for rack-mount models, 2.5 lb. for table-top
Cooling method: Fan cooled, @ 9 cfm

Power Supply (Internal)
AC Power Connector: IEC-type, male recessed at rear of chassis, with adjacent manual ON-OFF switch (on AC models only)
Input Voltage: 110 to 240 VAC (auto-ranging)
Input Frequency: 47 to 63 Hz (auto-ranging)
Power Consumption: 20 watts typical (8 port model)
                    35 watts typical (16 port model)
Redundant power supplies available as options

DC Power Supply (Options)
-48VDC Power Input Voltage : 36 to 70 VDC
24VDC Power Input Voltage : 20 to 36VDC
125VDC Power Input Voltage : 120 to 160VDC
Std. Terminal Block :   " -, GND, + "

Power Consumption: same as for AC models, see above

For Dual Source and Redundant DC for –48VDC, 24VDC Power & 125VDC supply options (Optional), see Appendices

For optional 23" Telco rack-mount brackets, order Model # **RMB-23W**

Agency Approvals
UL listed (UL1950), cUL, CE
Emissions meet FCC Part 15 Class A

Warranty   Three years, return to factory   Made in USA

1.2   Ordering Information

Magnum Quad-Series Fiber Switches

MODEL   DESCRIPTION

Magnum QS580   8-port 10/100 Switch, holds up to 2 Quad-port Modules with 4 switched ports each. Shelf or table-top mounting. For mixed-media flexibility, combinations of RJ-45 and various fiber port connector types, modes, and speeds can be configured. Full speed filtering and forwarding at 100Mbps speed across all ports, self-learning 12K-node address table, and large 4MB packet buffers. Front-mounted LEDs, internal auto-ranging power supply

Magnum QS5108   Same as Model QS580 Switch, but in a 19" rack-mount package, with mounting brackets.

Magnum QS5116   Same as Model QS5108, but with 24K-node address table and 8MB packet buffers. Holds up to 4 Quad-port Modules (QPMs), 19" rack-mount package, with mounting brackets.

Magnum Quad-Series Port Modules

QPM-MSC   Fiber module for Quad-Series Switches, with four 100Mbps multi-mode FX SC connectors

QPM-MST   Fiber module for Quad-Series Switches, with four 100Mbps multi-mode FX ST connectors

QPM-SSC   Fiber module for Quad-Series Switches, with four 100Mbps single-mode FX SC connectors

QPM-MV45   Fiber module for Quad-Series Switches, with four 100Mbps multi-mode FX "VF-45" connectors

QPM-MTRJ   Fiber module for Quad-Series Switches, with four 100Mbps multi-mode FX "MTRJ" connectors

QPM-RJ45   RJ-45 module for Quad-Series Switches, with four 100Mbps auto-negotiating RJ-45 ports, one of which has an up-link push-button

QPRJ-MSC   3TP+1F "3+1 combo" module for Quad-Series Switches, with three 10/100MB auto-negotiating RJ-45 ports and one fiber port with 100Mbps multi-mode FX SC connector

QPRJ-MST   3TP+1F "3+1 combo" module, same as QPRJ-MSC but with fiber ST-type connector

QPRJ-SSC   3TP+1F "3+1 combo" module, same as QPRJ-MSC but with fiber single-mode FX SC connector

QPM10-FST   Fiber module for Quad-Series Switches, with four 10 Mbps multi-mode FL ST-type connectors

GarrettCom, Incl. reserves the right to change specifications, performance characteristics and/or model offerings without notice.

2.0   INTRODUCTION

2.1   Inspecting the Package and Product

Examine the shipping container for obvious damage prior to installing this product; notify the carrier of any damage that you believe occurred during shipment or delivery. Inspect the contents of this package for any signs of damage and ensure that the items listed below are included.

This package should contain:

1   Magnum QS580, QS5108 or QS5116 Fiber Switches

1   AC Power Cord (U.S. and other 115 VAC only)

1   Set of two wall-mounting brackets (for QS580 Model only)

1   Set of metal "Ears" for optional "19" rack mounting (for QS5108 & QS5116 only)

1   Installation and User Guide (this manual)

1   Product Registration Card

Remove the items from the shipping container. Be sure to keep the shipping container should you need to re-ship the unit at a later date. To validate the product warranty, please complete and return the enclosed Product Registration Card to GarrettCom, Inc. as soon as possible.

In the event there are items missing or damaged, contact the party from whom you purchased the product. If the unit needs to be returned, please use the original shipping container if possible. Refer to Section 6, Troubleshooting, for specific return procedures.

2.2   Product Description - Magnum Quad-Series Fiber Switches

Magnum Quad-Series Fiber Switches boost the performance of large Ethernet LANs, and have the flexibility of both fiber and twisted-pair switched ports. Their "mixed-media" capability provides for a variety of configurations including various types of fiber port connectors and modes, as well as allowing a mix of 10/100Mb RJ-45 (copper) ports in the same unit. This flexibility is achieved via a family of quad-port modules that can be integrated with a base unit, in the factory and in the field, to adapt the unit to the individual application's changing mixed-media requirements for a 10/100 Switch product.

The Magnum Quad-Series provide the switching speed and the reliability to smoothly support multiple workgroups at 100Mbps or 10 Mbps speed. The Quad-Series offers the flexibility of four, eight, twelve or sixteen switched 100Mbps or 10 Mbps fiber and/or 10/100 twisted pair ports, in all the popular connector types. The Magnum Quad-Series offers the QS580, QS5108 and QS5116 models, each with a configuration of four port modules (Quad-port Modules) for fiber types and for copper, as well as "3+1" combo (3@RJ-45 and 1@fiber) port modules. The Quad-port Modules can be configured into a Quad-Series Switch base unit in any mix of port connector or media types.

Designed for use in departments with multiple workgroups, in remote offices and in network traffic centers, the Magnum Quad-Series Switches are easy to install and use. Addresses of attached nodes are automatically learned and maintained, adapting the switching services to network changes and expansions. Front-mounted LEDs provide status information on each port. The Magnum Quad-Series Switches provide high performance plug-and-play operation in convenient table-top and rack-mount packages.

2.2.1   Magnum Quad-Series chassis models

Magnum Quad-Series Switches come in three chassis sizes, an 8-port table-top, an 8-port rack-mount, and a 16-port rack-mount. Each is configurable with a selection of quad-port (i.e., 4-port) modules, providing the capability of 4, 8, 12, and 16 switched ports. The quad-port modules are normally factory installed, but may be changed or added in the field. (See Section 5)

The 8-port QS580 table-top chassis is compact in size and suitable for shelf-mounted use in network wiring centers. The QS5108 and QS5116 are 19" rack-

mountable Switches with two or four quad-port slots in the front, i.e., with a capacity of 8 or 16 switched ports. The QS5108 and QS5116 rack-mount units are typically used in larger network wiring centers.
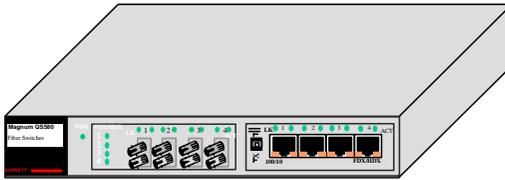
8 Ports Table-Top

Figure 2.2.1a: Front view, 8-port Magnum QS580 table-top, 8-port QS5108 and 16-port QS5116 Mixed-Media Switches

8-Port Rack Mount
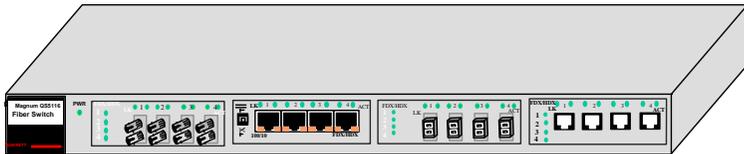
16-Port Rack Mount

. Mixed-media combination modules (4-port modules with three fiber ports and one twisted-pair port) are supported in all of the Quad-Series Fiber Switch models. All quad-module manual-selection switches and LED's are located on the front panel, with the IEC standard AC power connector (and a manual ON - OFF power switch) located at the rear. Fan-driven cooling air flows left to right.
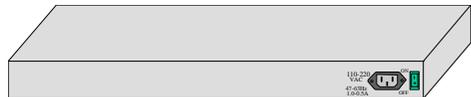
Figure 2.2.1b: Rear view - Magnum table-top & rack-mount Quad-Series Switches

2.2.2 Quad-port modules, 100Mb fiber
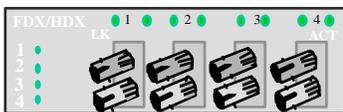
ST-Type

VF45-Small Form Factor
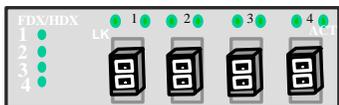
SC-Type

MTRJ-Small Form Factor

Fig.2.2.2 Fiber Quad-Port Modules, QPM ST, QPM-SC, QPM-MTRJ, QPM-MV45

In a fiber quad-port module, all of the fiber ports are of the same speed, the same multi- or single-mode, and the same connector type. Multi-mode 100Mbps models are available with ST, SC, MTRJ, and VF-45 connectors. Single-mode 100Mbps models are available with SC connectors.

The 100Mb fiber quad-port modules on the Magnum Q-Series normally are set (factory default) to operate in full-duplex mode for best fiber distance and performance. On the Magnum Q-Series, the user may select full- or half-duplex mode per-port with an internal jumper setting (See Section 3.4) for the flexibility to adapt to any type of Fast Ethernet devices.

On Magnum fiber QPMs, there are three LED's per fiber port. The Link (LK) LED indicates "ready for operation" when lit, another LED indicates operation in full-duplex mode when ON (when it is OFF, operation is half-duplex), and an LED indicates Receiving Activity (ACT) on the port. A fiber cable must be connected to each 100Mb port and a proper link (LK lit) must be made with the device at the other end of the cable in order for the LK LEDs to provide valid indications of operating conditions.

2.2.3 Quad-port modules, <u>10 Mb</u> fiber

The 10 Mb model QPM10-MST fiber quad-port module is the same as the 100Mb QPM-MST, except for 10 Mb speed
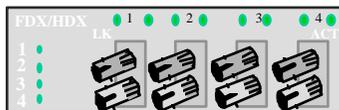
ST-Type

rather than 100Mb speed. It supports distances according to the 10Base-FL standard, i.e., 2Km distance for multi-mode fiber. (Single-mode for 10km distance may be available as a special order).

2.2.4   Quad-Port Module, RJ-45 (copper)

The Magnum Q-Series copper port module, model QPM-RJ45, provides four 10/100Mb switched. RJ-45 ports. The 10/100Mb switched ports are independently N-way auto-negotiating.

QPM-RJ45

for operation at 10 or 100Mb speed in full- or half-duplex mode (as a default setting). They independently move to half-duplex mode at 10 Mb or at 100Mb speed if the device at the other end of the twisted pair cable is half-duplex or is not an auto-negotiating device.

On the model QPM-RJ45 , there are four LED's for each port. The LK (Link) indicates "ready for operation" when lit. The ACT (Activity) indicates receiving activity on that port when lit. The 10/100 LED indicates operation at 100Mb speed when ON and at 10 Mb speed when OFF (when auto-negotiation is not disabled). The FDX/HDX LED is ON to indicate full-duplex operation and OFF to indicate half-duplex mode. A twisted pair cable must be connected into each RJ-45 10/100Mb port and a proper Link (LK lit) must be made with the device at the other end of the cable in order for the LEDs to provide valid indications of operating conditions.

Internal jumper settings (See Section 3.4) allow technicians to over-ride the auto-negotiation feature and to manually set each port at full-duplex or half-duplex. One port on each RJ-45 quad-port module is equipped with a Media Dependent Interface-Crossover (MDI-X) push-button switch to simplify cascaded or up-link connections.

2.2.5   Combo "3 + 1" Quad Port Modules, 3@RJ-45 and 1@fiber

The combo quad-port modules are combination of copper and fiber media, available as three 10/100 switched RJ-45 copper ports and one 100Mb switched multi-mode fiber ST or SC or single mode SC-type port.
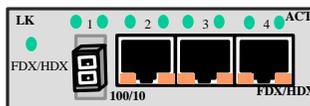
QPRJ-MSC

The RJ-45 ports run at 10/100Mbps with **N-way** auto-negotiation capability, whereas the fiber port runs at 100Mbps with half- or full-duplex capability manually selected. The default condition is full-duplex. Internal jumper settings allow technicians to set the 100Mb fiber port to half-duplex mode. (See Section 3.4).

On Magnum Combo Quad-port modules, there are four LED's for each RJ-45 port, which indicate status as described for the QPM-RJ45 in Section 2.2.4 above. The fiber port is fixed at 100Mbps speed at all times, and has LEDs that indicate status the same way as described for the Fiber Quad-port modules in Section 2.2.2 above.

2.2.6   Frame Buffering and Latency

The Magnum Quad-Series are store-and-forward switches. Each frame (or packet) is loaded into the Switch's memory and inspected before forwarding can occur. This technique ensures that all forwarded frames are of a valid length and have the correct CRC, i.e., are good packets. This eliminates the propagation of bad packets, enabling all of the available bandwidth to be used for valid information.

While other switching technologies such as "cut-through" or "express" impose minimal frame latency, they will also permit bad frames to propagate out to the Ethernet segments connected. The "cut-through" technique permits collision fragment frames, which are a result of late collisions, to be forwarded to add to the network traffic. Since there is no way to filter frames with a bad CRC (the entire frame must be present in order for CRC to be calculated), the result of indiscriminate cut-through forwarding is greater traffic congestion, especially at peak activity. Since collisions and bad packets are more likely when traffic is heavy, the result of store-and-forward operation is that more bandwidth is available for good packets when the traffic load is greatest.

To minimize the possibility of dropping frames on congested ports, each Magnum Quad-Series QS5116 Switches dynamically allocates buffer space from an 8 MB memory pool, ensuring that heavily used ports receive very large buffer space for packet storage. (Many other switches have their packet buffer storage space divided evenly across all ports, resulting in a small, fixed number of packets to be stored per port. When the port buffer fills up, dropped packets result.) The other two Q-Series Switches QS580 and QS5116 dynamically allocates buffer from an 4MB memory pool. This dynamic buffer allocation provides the capability for the maximum resources of the

Magnum Quad-Series unit to be applied to all traffic loads, even when the traffic activity is unbalanced across the ports. Since the traffic on an operating network is constantly varying in packet density per port and in aggregate density, the Magnum Quad-Series Switches are constantly adapting internally to provide maximum network performance with the least dropped packets.

When the Switch detects that its free buffer queue space is low, the Switch sends industry standard (full-duplex only) PAUSE packets out to the devices sending packets to cause "flow control". This tells the sending devices to temporarily stop sending traffic, which allows a traffic catch-up to occur without dropping packets. Then, normal packet buffering and processing resumes. This flow-control sequence occurs in a small fraction of a second and is transparent to an observer. See Section 4.6 for additional details.

Another feature implemented in Magnum Quad-Series Switches is a collision-based flow-control mechanism (when operating at half-duplex only). When the Switch detects that its free buffer queue space is low, the Switch prevents more frames from entering by forcing a collision signal on all receiving half-duplex ports in order to stop incoming traffic.

The latency (the time the frame spends in the Switch before it is sent along or forwarded to its destination) of the Quad-Series Switches varies with the port-speed types, and the length of the frame is a variable here as it is with all store-and-forward switches. For 10 Mb-to-10 Mb or 10 Mb-to-100Mb or 100Mb-to-10 Mb forwarding, the latency is 15 microseconds plus the packet time at 10 Mb. For 100Mb-to-100Mb forwarding, the latency is 5 microseconds plus the packet time at 100Mb.

2.3   Features and Benefits

■   **100Mb switching services for large, high performance Ethernet LANs**

Magnum Quad-Series Switches provide Fast Ethernet switching on all ports. They perform high speed filter/forward operations on the traffic, giving each port's segment a full 100Mb (or 10 Mb) of bandwidth.

■   **Configurable with fiber ports, all connector types and speeds**

Quad-port modules are available with 100Mb mm ST, SC, VF-45, MTRJ single-mode SC, and 10 Mb ST-type connectors. The configuration of the fiber ports, in the factory or in the field, allows the Quad-Series Switches to adapt to mixed and changing fiber types in any application.

■   **Configurable with RJ-45 (copper) ports, 10/100 auto-negotiation**

RJ-45 Quad-port modules provide twisted pair segment connections, with N-way auto-negotiation or with manual speed and mode settings per port

■   **Mixed-media configurations for maximum flexibility**

Combinations of port module types can be configured in the same unit, adapting the Quad-Series Switches to varying quantities and types of fiber vs. copper media. Port module changes can even be done in the field.

■   **Full-duplex or Half-duplex operation, auto-sensing**

All fiber and RJ-45 (copper) ports are capable of half- or full-duplex, individually selected. All RJ-45 ports support 10/100 auto-negotiation, or can be user-selected for the desired operating mode and speed.

■   **16-port, 12-port, 8-port and 4-port models**

With two chassis sizes (16-port and 8-port) configurable with 4-port QPMs, capacity options complement the mixed-media configurability.

■   **Plug-and-Play installation for high performance switching**

Magnum Quad-Series Switches are self-learning for node addresses. They can be placed into operation without complex set-up procedures, even in large networks. They operate transparent to system software.

■   **Front-mounted LEDs, world-wide AC power supply**

Front panel LED's on each quad-port module display the status of each port for easy monitoring. An internal auto-ranging AC power supply allows any Magnum Quad-Series Switches to be used throughout the world. (A 48VDC power supply is optional, see Appendix B).\

2.4   Applications

Magnum Quad-Series Mixed-Media Switches offer high performance and flexibility, and are easily used in a variety of applications including client/server computing, performance upgrades of departmental networks, and collapsed backbone applications. The Dual-Speed characteristic of the Quad-Series Switches enables them to inter-connect a series of subnets (one subnet per Q-Series Switch) in a LAN traffic center. The subnet connections may be via either fiber or twisted pair cabling, and may be 100Mbps or 10 Mbps speed and full-or half-duplex mode.

The mixed-media capability is ideal for upgrading existing Ethernet LAN networks, where existing cabling must be accommodated. The fiber-built-in media capability is ideal for integrating future-proof fiber cabling into the LAN structure.

Example 1 : Magnum QS580

In a typical 10 Mb network performance upgrade, some existing cascaded 10 Mbps hubs connect a group of users who share one 10 Mb traffic domain. The Magnum QS580 Quad-Series Switch provides eight 10/100Mb traffic domains for increased performance. It can segment 10 Mbps and 100Mbps units, hubs and servers, in the existing network into multiple domains, providing greatly increased bandwidth. In this case, two 100Mb fiber connections are required to connect to more distant LAN centers, and a configuration with two "combo" 3@RJ-45 + 1@fiber-built-in QPMs is used.

The Magnum QS580 provides complete network connectivity so that all 10 Mb and 100Mb nodes operate in a unified manner, functioning as one plug-and-play switched network facility. It filters and forwards packets from one segment to another, containing the local traffic and allowing only the packets which need to be forwarded to go outside to the appropriate other segments. This is ideal for a central departmental switch in a high-performance LAN center. Figure 2.4 illustrates this example.

Fig. 2.4a: <u>AFTER</u> Magnum QS580 Switch provides central connectivity while maintaining full 10 Mbps and 100Mbps bandwidth on each segment.

100Mbps Fiber Segment

100Mbps Fiber Segment

10 Mbps users

100Mbps users
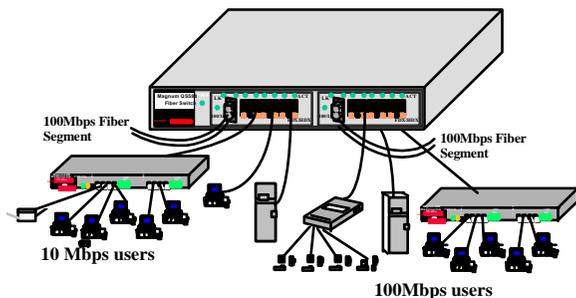
Example 2 : Magnum 8-port QS5108

In another application, a Switch is needed to provide a Fast Ethernet backbone. The backbone consists of four high-speed LAN segments, each operating over 100MB full-duplex fiber lines. In addition to interconnecting the fiber backbone segments in the network center, the Switch needs to provide high-speed switched support for two central servers, for a 100MB connection to a router, and for a dual-speed hub serving a local workgroup of over a dozen users, printers, etc.

The Magnum QS5108 equipped with one Fiber and one RJ-45 quad-port modules provides an economical solution, configured with 8 switched ports (four 100Mbps fiber and four 10/100 RJ-45) in a rack-mount box. No Media Converters are needed. The Fiber QPM can be selected to provide any 100Mbps fiber media connector type desired. QPMs with multi-mode or single-mode fiber types are available.

This requirement for connecting local devices over twisted pair cabling is handled by the Magnum QS5108 using a 4-port RJ-45 Quad-Port Module. The QPM provides a switched port for two local high speed servers, another for the router, another for the users connecting into a 16-port dual-speed hub such as the Magnum DS8016.

Since 100Mb fiber Ethernet has severe distance limitations at half-duplex, it is necessary in high speed backbones to operate fiber links in the full-duplex mode. Many low-end switches that only have RJ-45 N-way 10/100Mb ports would need to have a media converter on each fiber line. But most media converters do not support auto-negotiation and would not enable the fiber backbone lines to operate full-duplex. But the Magnum QS5108 . . . with built-in switched fiber ports at 100Mb speed, with full-duplex mode as a default setting on fiber ports, and with some RJ-45 N-way 10/100Mb ports as well. . . handles this application readily.
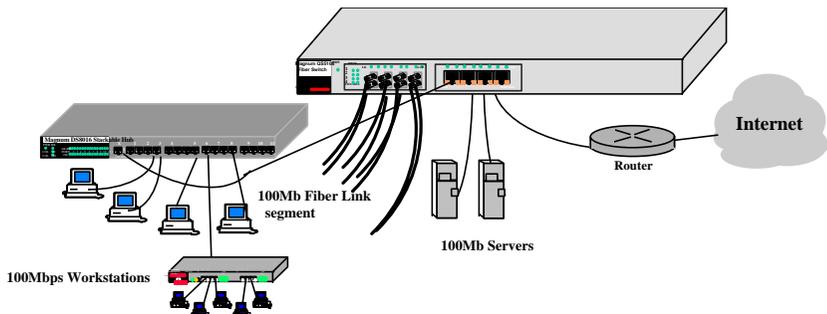
Figure 2.4b: The Magnum QS5108 provides a 100Mb fiber backbone facility.

Example 3: Magnum 16-port QS5116

In another situation similar to Example 2 above, a larger central Switch is needed to provide for a 6-segment 100Mb fiber Fast Ethernet backbone, and switched copper support for 4 high speed local servers. In addition, the router and two dual-speed hubs need switched copper ports. The total is 14 ports, 6 fiber and 8 copper.

The mixed-media flexibility of the Magnum Quad-Port Switches provides the user with more than one configuration in this case. The two ports not immediately used may be either fiber or copper. If the probable growth of the central Switch is towards more fiber backbone segments, then two quad-port fiber QPMs are selected to provide 6 required fiber ports and two for spares and/or future backbone expansion. The 8 switched copper ports are handled with two RJ-45 Quad-Port Modules configured into the Magnum QS5116. Should the number of servers expand, more than one server can be serviced by a switched QS5116 port by using a small 4-port 100Mbps hub.

If the probable growth of the central Switch is towards more local high speed servers and users, then one quad-port fiber QPM is selected to provide 4 of the required fiber ports, and two "combo 3@RJ-45 + 1@fiber" QPMs are configured for the other 2 fiber ports plus 6 of the switched copper ports. Finally, an RJ-45 QPM is configured to provide for the remaining 2 copper ports plus two for spares and/or future expansion. Should the need arise to add a built-in-fiber backbone port in the future, the RJ-45 QPM could be removed and another "3+1 combo" QPM installed in the field. Alternatively, a 100MB Media Converter (such as the Magnum 15E) may be used on a copper port, with internal jumpers (See Section 3.4) set to support fixed 100MB FDX on the RJ-45 port.
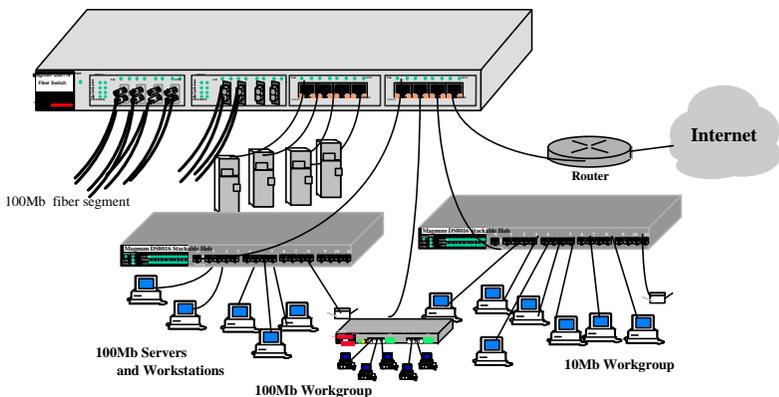
Fig 2.4c: Magnum QS5116 provides a 100Mb mixed-media backbone Switch.

3.0   INSTALLATION

```
Before installing the equipment, it is necessary to take the
following precautions:
1.) If the equipment is mounted in an enclosed or multiple rack
assembly, the environmental temperature around the equipment
must be less than or equal to 50°C.
2.) If the equipment is mounted in an enclosed or multiple rack
assembly, adequate air flow must be maintained for proper and
safe operation.
3.) If the equipment is mounted in an enclosed or multiple rack
system placement of the equipment must not overload or load
unevenly the rack system.
4.) If the equipment is mounted in an enclosed or multiple rack
assembly, verify the equipment's power requirements to prevent
overloading of the building/s electrical circuits.
5.)  If the equipment is mounted in an enclosed or multiple rack
assembly verify that the equipment has a reliable and
uncompromised earthing path.
```

Installation: This section describes installation of the Magnum Quad-Series Switches, as well as connection of the various Ethernet media types.

3.1   Locating Magnum Quad-Series Switches

The location of a Magnum Quad-Series Switch is dependent on the physical layout of the network. Typically the Switch is placed in a central wiring location where groups of network devices need to be connected in order to communicate with each other. These Switches are typically rack mounted in a wiring closet see Section 3.3.2 below), but because they have rubber feet they can also be installed on a shelf or table top. The compact size of the 8-port QS580 unit allows it to be easily placed in an office or lab area, and it can also be either shelf of wall-mounted (see Section 3.3.1 below).

Locate an AC receptacle that is within six feet (2 meters) of the intended Magnum Quad-Series site. The rugged metal case of the Magnum Quad-Series will normally protect it from accidental damage in a lab or workplace setting. Maintain an open view of the front to visually monitor the status LEDs. Keep an open area around the unit so that cooling can occur from the small fan on the left side, while the unit is in operation. See figure below.
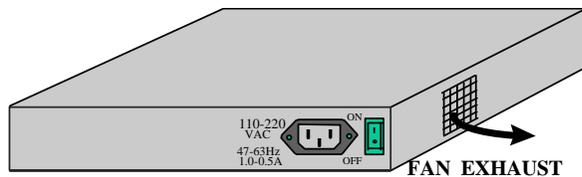
Figure 3.1: Location of 8-port Magnum QS580's cooling fan exhaust

3.2   Connecting Ethernet Media

The Magnum Quad-Series Fiber Switches are specifically designed to support all standard Ethernet media types within a single Switch unit. This is accomplished by using a family of Quad-port Modules (QPMs) which can be individually selected and configured per-port. See Section 2.4 for a description of the QPMs.

The various media types supported along with the corresponding IEEE 802.3 and 802.3u standards and connector types are as follows:

IEEE Standard	Media Type	Max. Distance	Port Module
Fiber:			
100BASE-FX	mm[1] Fiber	2.0km (6,562 ft)	QPM-MSC, -MST
	sgl.m[2] Fiber	18.0km (95K ft)	QPM-SSC
small form factor	mm[1] Fiber	2.0km (6,562 ft)	QPM-MTRJ, -MV45
10BASE-FL	mm[1] Fiber	2.0km(6,562 ft)	QPM10-FST
Copper:			
10BASE-T & 100BASE-TX	twisted pair	100m (328 ft)	QPM-RJ45

[1] mm = multi-mode   [2] sgl.m = single-mode

3.2.1   Connecting Fiber Optic <u>ST-type</u>, "twist-lock"

The following procedure applies to installations using a QPM with ST-type fiber connectors. This procedure applies to ports using a QPM-MST or QPM10-MST.

1. Before connecting the fiber optic cable, remove the protective dust caps from the tips of the connectors on the QPM. Save these dust caps for future use.
2. Wipe clean the ends of the dual connectors with a soft cloth or lint-free lens tissue dampened in alcohol. Make certain the connectors are clean before connecting.
    Note: *One strand of the duplex fiber optic cable is coded using color bands at regular intervals; you must use the color-coded strand on the associated ports at each end of the fiber optic segment.*
3. Connect the Transmit (TX) port (light colored post) on the Magnum QPM to the Receive (RX) port of the remote device. Begin with the color-coded strand of the cable for this first TX-to-RX connection.
4. Connect the Receive (RX) port (dark colored post on the PM) to the Transmit (TX) port   of the remote device. Use the non-color coded fiber strand for this.
5. The LINK LED on the front of the QPM will illuminate when a proper connection has been established at both ends (and when power is ON in the unit). If LINK is not lit after cable connection, the normal cause is improper cable polarity. Swap the fiber cables at the QPM connector to remedy this situation.

3.2.2   Connecting Fiber Optic <u>SC-type</u>, "Snap-In"

The following procedure applies to installations using a QPM with SC-type fiber connectors, i.e., using QPM-MSC, QPM-SSC single-mode, and QPM10-MSC.

When connecting fiber media to SC connectors, simply snap on the two square male connectors into the SC female jacks of the QPM until it clicks and secures.

3.2.3   Connecting <u>Single-Mode</u> Fiber Optic

When using single-mode fiber cable, be sure to use single-mode fiber port connectors. Single-mode fiber cable has a smaller diameter than multi-mode fiber cable (9/125 microns for single-mode, 50/125 or 62.5/125 microns for multi-mode where xx/xx are the diameters of the core and the core plus the cladding respectively). Single-mode fiber allows full bandwidth at longer distances, and may be used to connect 10 Mb nodes up to 10 Km apart, or 18Km with the QPM-SSC.

The same procedures as for multi-mode fiber applies to single-mode fiber connectors. Follow the steps listed in Section 3.2.2 above.

3.2.4   Connecting Twisted Pair (RJ-45,CAT3, CAT5, Unshielded or Shielded)

The RJ-45 ports of the Magnum Quad-Series can be connected to the following two media types: 100BASE-TX and 10BASE-T. CAT 5 cables should be used when making 100BASE-TX connections. When the ports are used as 10BASE-T ports, CAT 3 may be used. In either case, the maximum distance for unshielded twisted pair cabling is 100 meters (328 ft).

Media	IEEE Standard	Connector
Twisted Pair (CAT 3, 4, 5)	10BASE-T	RJ-45
Twisted Pair (CAT 5)	100BASE-TX	RJ-45

NOTE : *It is recommended that high quality CAT. 5 cables (which work for both 10 Mb and 100Mb) be used whenever possible in order to provide flexibility in a mixed-speed network, since dual-speed ports are auto-sensing for either 10 and 100Mb/s.*

The following procedure describes how to connect a 10BASE-T or 100BASE-TX twisted pair segment to the RJ-45 port. The procedure is the same for both unshielded and shielded twisted pair cables.

1.   Using standard twisted pair media, insert either end of the cable with an RJ-45 plug into the RJ-45 connector of the port. Note that, even though the connector is shielded, either unshielded or shielded cables and wiring may be used.

2.   Connect the other end of the cable to the corresponding device

3. Use the LINK LED to ensure proper connectivity by noting that the LED will be illuminated when the unit is powered and proper connection is established

3.3   Table-Top or Shelf Mounting

The Magnum Quad-Series Switches can be easily mounted on a table-top or any suitable horizontal surface, and has four rubber feet to provide stability without scratching finished surfaces.

3.3.1   Wall (or Vertical Surface) Mounting, 8-port QS580

Each Magnum QS580 Switch is shipped with two metal mounting brackets (and screws) to allow the unit to be mounted in nearly any desired orientation or position. The brackets are attached to the metal switch case using one of the metal screws for each bracket, and attached to the Magnum QS580 through the round hole of the bracket. A user-supplied screw attaches the bracket to the mounting surface. It is recommended that the mounting brackets be attached to two opposite corners of the unit. When properly attached, the brackets will extend slightly below the base of the unit to allow clearance for the rubber feet and for cooling fan exhaust space.

MagnumQS580, optional mounting brackets

Proper mounting bracket attachment
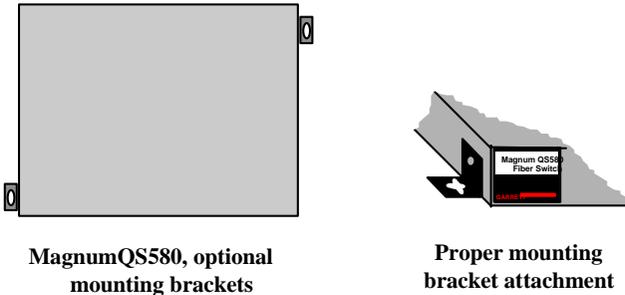
Figure 3.1: Magnum QS580, metal mounting brackets

3.3.2   Rack-mounting, models QS5108 and QS5116

Installation of a Magnum QS5108 and QS5116 mixed-media fiber Switch in a 19" rack is a simple procedure. The units are 1U (1.70") high. When properly installed, the front-mounted LED status indicators should be in plain view and easy to read. Rack-mount installation requires special 19" rack-mounted
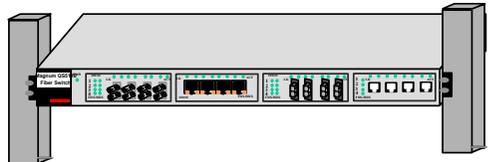
brackets and screws (included with each QS5108 and QS5116 unit). The brackets attach to the front sides of the switch, which is then fastened into a standard 19" RETMA rack.

The 23" brackets and ETSI brackets are also available (optional) for Rack-mounting of Magnum QS5108 and QS5116 mixed-media fiber Switches. The 23" brackets are more popular in Telco industry where they are standard for Central Office rack-mounting purposes. The 23" brackets are mainly used for larger equipment assemblies in rack-mounting frames, and are frequently accessed in operation from both sides.

The ETSI (European Telephone standard) brackets are similar to the 19" brackets but use metric dimensions.

The optional 23" brackets and the ETSI brackets come as a pair in a package, along with the necessary screws for attaching the brackets to the sides of the Magnum Switch unit.
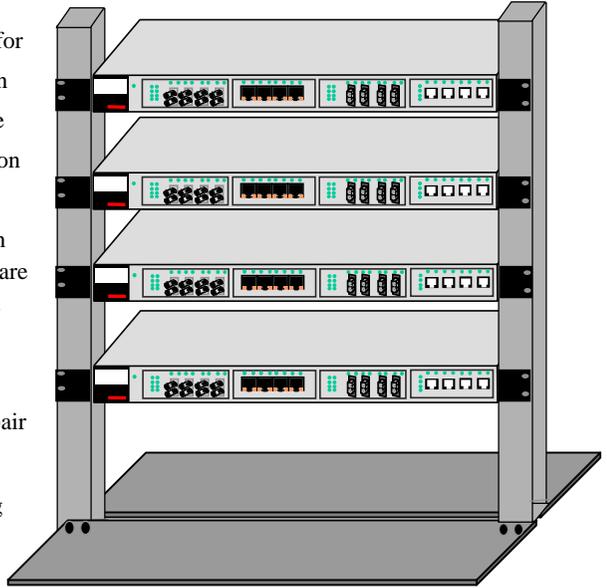
Fig 3.8 Multiple Magnum QS5116 units rack-mounted in a 23" frame

3.4 RJ-45 ports, internal jumper settings for 10/100Mb (auto-negotiation) or for fixed Half- or Full-Duplex @ 100Mb, per port

The factory (or default) setting is for auto-negotiation on all RJ-45 ports, which is generally popular. It works well under most circumstances, but cannot always be

Jumper Settings for Auto-Negotiation, or for 100MB Half or Full Duplex

Jumper	Port	Function	Factory Settings	Speed
JP2-3,6-7, 10-11	Pin 2-3,6-7,10-11	Auto-Negotiation	YES	10/100 Mb,
JP1-2, 6-7, 9-10	Pin 1-2, 6-7, 9-10	FDX @100 config	NO	100 Mb
JP1-2, 7-8, 11-12	Pin 1-2, 7-8, 11-12	HDX@100 config	NO	100 Mb
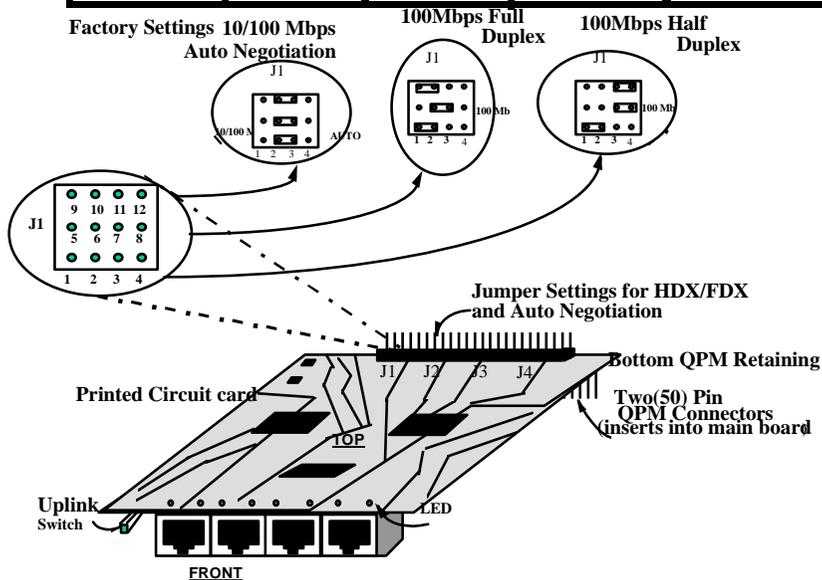
Figure 3.4. RJ-45 ports, internal jumper settings. Note: _Be certain that the main power is disconnected before opening the unit or changing any internal jumper settings._

depended upon to work as expected. If auto-negotiation will not function properly in your setup, internal jumpers allow the speed and mode of the Q-Series RJ-45 (copper) quad-ports to be fixed, even if the attached device may or may not support auto-negotiation. This is desirable when there are unknown devices presently or potentially connected, which will not operate correctly with auto-negotiation. Examples include some NICs and most Media Converters.

Therefore, the default setting of auto-negotiation (copper ports) is generally desirable because it is widely used and allows for the connection of various devices without re-configuration. Under certain conditions,(where the connected device is full duplex and does not support Auto-negotiation; or the connected device does not support Auto-negotiation properly) no auto-negotiation is better and the internal jumper settings will permit this to be selected on a per-port basis.

See Section 4.4 for additional information on auto-negotiation functionality.

3.5 Fiber 100Mb ports, internal jumper settings for 100Mb fixed Half- or Full-Duplex, per port

The factory (default) setting is for full-duplex on all fiber 100Mbps ports, which is generally popular. FDX works well under most circumstances, but cannot always be depended upon to work as expected. If full-duplex on 100Mbps will not function properly in your setup, internal jumpers allow the mode of the Q-Series fiber

Jumper Settings for 10 or 100Mbps Fiber Half or Full Duplex

Jumper	Port	Function	Factory Settings	Speed
JP1-2, 6-7, 9-10	Pin 1-2, 6-7, 9-10	FDX @100 config	YES	100 Mb
JP1-2, 7-8, 11-12	Pin 1-2, 7-8, 11-12	HDX@100config	NO	100 Mb

Figure 3.5. Fiber ports, internal jumper settings.

Note: *Be certain that the main power is disconnected before opening the unit or changing any internal jumper setting*

quad-ports to be fixed, even if the attached device may or may not support full-duplex. This is desirable when there are unknown devices presently or potentially connected, which will not operate correctly with full-duplex. Examples include hubs that support only half-duplex by default.

Therefore, the default setting of full-duplex (fiber ports) is generally desirable because it is widely used and allows for the connection of various devices without re-

configuration(specially along with switches). Under certain conditions,(where the connected device is half duplex and does not support full-duplex; or the connected device does not support full-duplex properly) no full-duplex is better and the internal jumper settings will permit this to be selected on a per-port basis.
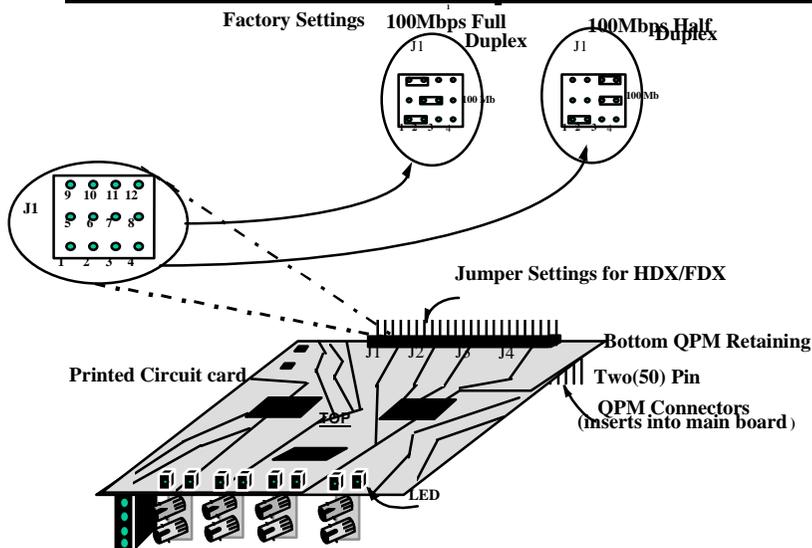
3.6 Combo(3+1) ports, internal jumper settings for 10/100 RJ-45 Auto-Negotiation or 100Mb fiber fixed Half- or Full-Duplex , per port

Jumper Settings for 10/100Mbps RJ-45 Auto-Negotiation, 100Mbps Fiber Half or Full Duplex

Jumper	Port	Function	Factory Settings	Speed
JP2 -3, 6-7, 10-11	Pin 2-3, 6-7, 10-11	Auto-Negotiation	YES	10/100 Mb(RJ-45)
JP1-2, 6-7, 9-10	Pin 1-2, 6-7, 9-10	FDX @100 config	YES	100 Mb(Fiber)
JP1-2, 7-8, 11-12	Pin 1-2, 7-8, 11-12	HDX @100 config	NO	100 Mb(Fiber)
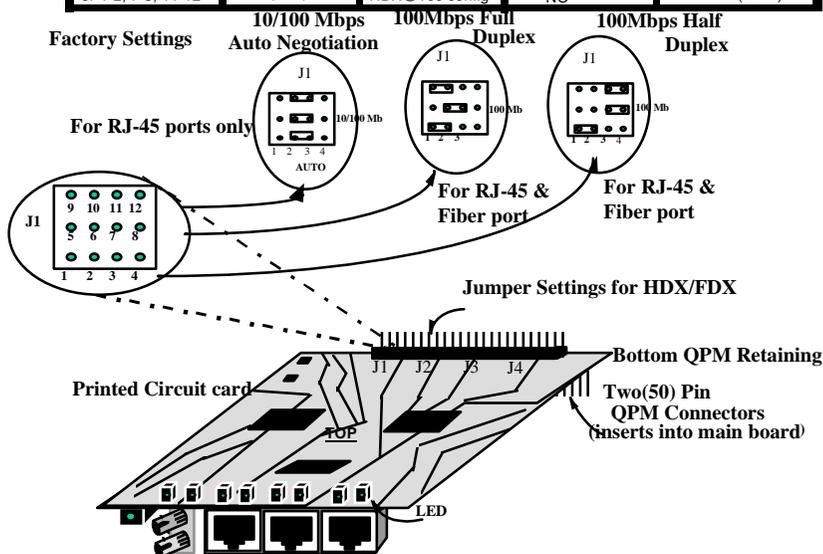
Figure 3.6 Combo ports, RJ-45 and Fiber internal jumper settings.

Note: *Be certain that the main power is disconnected before opening the unit or changing any internal jumper settings*

The factory (default) setting is Auto-Negotiation on all RJ-45 ports and full-duplex on fiber 100Mbps ports, which is generally popular. Auto-Negotiation on RJ-45 and FDX on fiber port works well under most circumstances, but cannot always be depended upon to work as expected. If full-duplex will not function properly in your setup, internal jumpers allow the speed and mode of the Q-Series Combo- quad ports to be fixed, even if the attached device may or may not support full-duplex. This is desirable when there are unknown devices presently or potentially connected, which will

not operate correctly with full-duplex or half-duplex. Examples include hubs that support only half-duplex by default.

If auto-negotiation will not function properly in your setup, internal jumpers allow the speed and mode of the Q-Series RJ-45 (copper) quad-ports to be fixed, even if the attached device may or may not support auto-negotiation. This is desirable when there are unknown devices presently or potentially connected, which will not operate correctly with auto-negotiation. Examples include some NICs and most Media Converters

3.7 Fiber 10Mb ports, internal jumper settings for 10Mb fixed Half- or Full-Duplex at all ports

The factory (default) setting is for half-duplex on all fiber 10Mbps ports, which is generally popular. HDX works well under most circumstances. If half-duplex on 10Mbps will not function properly in your setup, internal jumpers allow the duplex mode of the Q-Series fiber quad- ports to be changed, even if the attached device supports full-duplex. This is desirable when there are devices connected which will not operate correctly with half-duplex. Examples include Switches that support full-duplex only.

Therefore, the default setting of half-duplex (fiber ports) is generally desirable because it is widely used and allows for the connection of various devices without re-configuration.(where the connected device is half duplex and does not support full-duplex i.e. Hub and media-converters.)

Note: *For 10Mbps fiber ports, the user can set the jumpers either at full-duplex or half duplex on all the four ports. There is no individual port duplex options for 10 Mb port.*

Jumper Settings for 10Mb Fiber Half or Full

Jumpe	Port	Functio	Factory	Spee
JF3 JF 1-2	PIN 1-	FDX @10Mb config	NO	10 Mb
JF3 JF2-4	Pin 2-4	HDX@10Mb	YE	10 Mb
JFD1 JP1-3	PIN 1-	FDX@10Mb config	NO	10M
JFD1 JP2-	PIN 2-	HDX @10Mb config	YE	10M
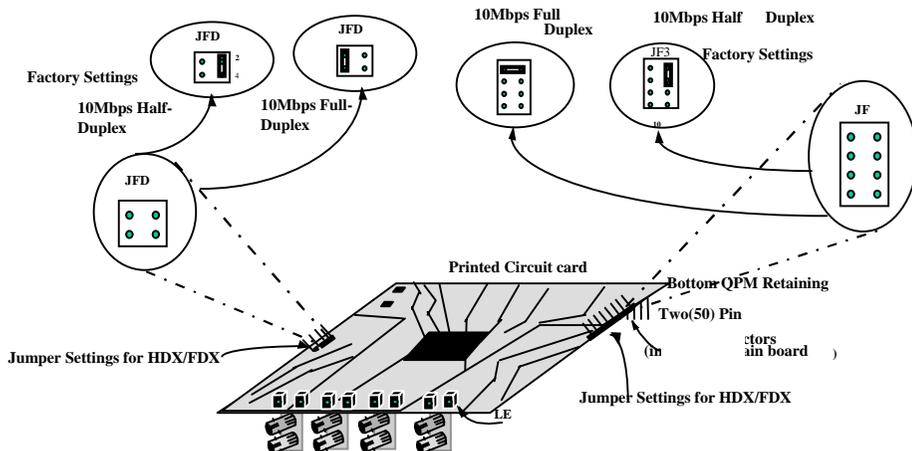
Figure 3.7 10Mbps Fiber ports internal jumper settings.

Note: *Be certain that the main power is disconnected before opening the unit or changing any internal jumper settings*

3.8   Powering the Magnum Quad-Series Switch

The Magnum Quad-Series Switches incorporate an internal universal power supply, and has a recessed male IEC connector for the AC power cord at the left-rear. A manual power ON-OFF switch is adjacent. A six-foot 115 VAC 60 Hz standard power cord is supplied with each unit shipped within the United States and Canada.
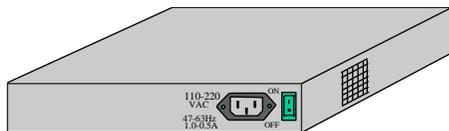
Figure 3.5: Magnum Quad-Series AC power connector

The auto-ranging power supply supports installation environments where the AC voltage is from 90 to 260 volts with a power input frequency of between 47 and 63 Hz. The 8-port units will consume just under 20 watts of power typically, and the 16-port units will consume about 35 watts typically.

When connecting the Ethernet cabling, there is no need to power down the unit. Individual segments can be connected or disconnected without concern for AC power-related problems or damage to the unit.

Power supply options are available to suit the Quad-Series Switches to special high-availability communications and/or heavy industrial-grade applications, including:

* -48VDC, 24VDC & 125VDC with single DC input,
* -48VDC, 24VDC & 125VDC with dual-source DC input,

See the Appendices of this manual for more details. Use an RFQ for other variations.

3.9   Quad Port Module (QPM) Installation

The Magnum Q-Series Fiber Switches are normally received from the factory with all required QPM modules installed. There may be situations where QPM cards need to be added or replaced. In cases where additional QPM cards are needed, the face plate for an available front-mounted slot must be removed. The following procedure describes this operation.

3.9.1   Preparation for Installing and Removing QPMs

> # STOP!!!
> **Be sure the power cord is unplugged
> from the chassis before attempting to remove
> and/or replace any QPM cards.
> Failure to do so may result in damage to the unit
> and will void the warranty.**

Caution- <u>Avoid Static Discharge:</u> <u>The port modules (like most electronic equipment) are sensitive to static discharge</u>. <u>Use proper ESD measures when handling port modules.</u>

Step 1. Make sure the QPM Card package has all necessary accessories to install it properly. The QPM Card package for field installation comes along with a QPM Card, two 7/16 stand-offs , two #4-40 Pan-Head screws, two #4-40 black color Flat-head screws and two Headers pin.

Step 2.   Remove Chassis Cover

The Magnum Q-Series chassis are combined with top and bottom part and assembled together with the help of 20 Philips head screws. There are 7 screws located on front-top of the unit and three screws each on the left and right edges. Remove these screws. Once these are removed, the top cover is easily lifted off the chassis base. When the chassis top cover has been removed, the interior of the unit is exposed.
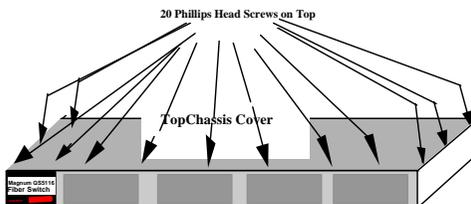
Figure 3.9.1a: Removing Chassis Cover

Caution: Be careful not to disturb the power supply.

Looking down into the Magnum Q-Series unit, notice that there are individual QPM connector sockets along with two stand-offs for each QPM card position. There are four QPM slots located on the front of the QS5116 model, whereas QS580 and QS5108 has two QPM slots in the front. (See Figure 3.9.1b).
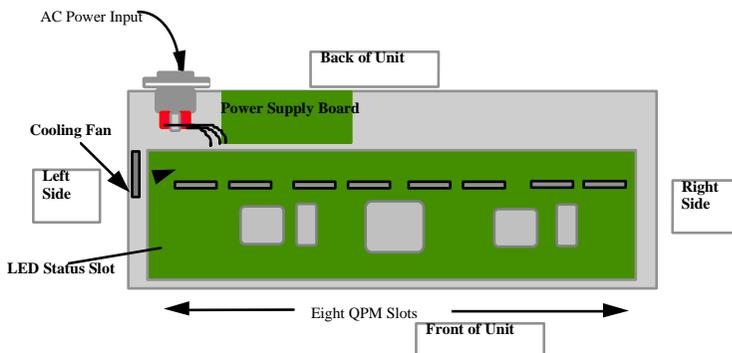
Figure 3.9.1b: Magnum QS5116, Top View with Chassis Cover

Step 3.   Remove bottom-front and modules rear top Retaining Screws in any QPM or Face Plates

On the bottom-front of the unit, there are two retaining screws for each QPM card slot as well as two other retaining screws on the rear top of the module. These four screws are used to secure a QPM face plate in position. These screws are also used to secure the individual QPM cards, which can be subjected to significant forces from the attached cables. (See Figure 3.9.1c)
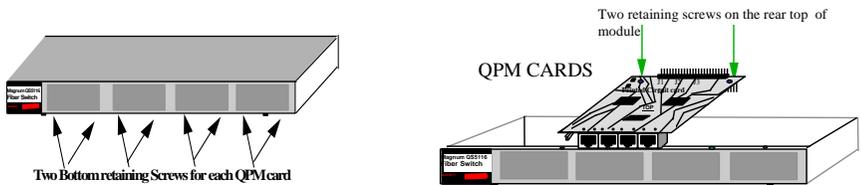
Figure 3.9.1c: Front View - QPM Retaining Screws hold Face Plates

3.9.2   Installing QPM Cards in the Magnum Q-Series

Up to four front-mounted QPM cards may be installed in one Magnum 5116 Fiber switch unit. Follow these steps to install a QPM.

Step 1.   Remove top chassis cover. See procedure in Section 3.9.1 above.

Step 2.   Screw down tightly the two 7/16 stand-off on the top of pre installed stand-off from the factory.

Step 3.   Align the two headers pin on the top of the two sets of socket fixed at the bottom side of the QPM module. (Note: After firmly attached the sockets and the header pin, move the mounted pins slightly tilted towards the front of the chassis.

Step 4.   The figure here illustrates the basic layout of an individual QPM card. Each QPM card fits into the selected QPM connector socket slot. Align the connector pins on the bottom of the QPM card with the connector socket inside the unit.
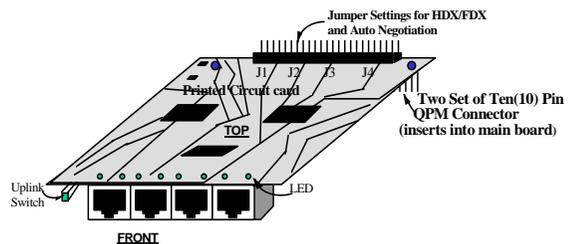
Step 5. Be sure the QPM front panel is guided into the front slot cut-out first and then precisely aligned the header pins with the holes in the socket slot mounted on the board. Slowly and carefully apply enough pressure on both rear corner of QPM Module to insert the QPM card's pins into position. A click sound will determine the proper lockup of the two, see Figure 3.9.2b. (If you <u>force</u> the QPM down when the pins are not properly aligned with the holes in the header, the pins will become bent and the QPM is damaged).

Step 6. Once inserted, the QPM card will be secured by the header connector, the front panel port slot cut-out, and retaining screws. Use #4-40 Pan Head retaining screws to secure the module rear part and #4-40 Flat Head (Black color) retaining screws for front panel.

 NOTE: <u>*If a QPM is difficult to install, try it in another port slot. Some of the port modules may fit easily in one port slot and be very hard to install in another.*</u>
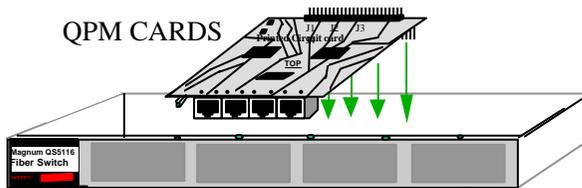
Figure 3.9.2a: Inserting QPM Cards into a Magnum QS5116

NOTE: *All QPM slots need not be filled in order for the Magnum Q-Series unit to be operational. When leaving QPM slots empty, always use a face plate (Magnum QPM-FP) to cover the slot opening in the front panel. This will maintain proper cooling air flow, safety, and operation as required by FCC, CE, and other regulations.*

Step 7.   The figure below shows the top view of QPM Card after successfully installed the QPM cards inside the QS5116.
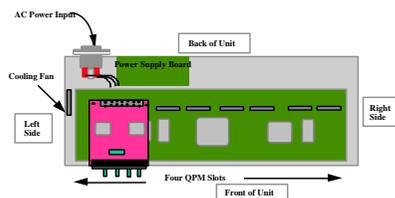
Fig. 3.9.2b   Top View :

QPM Module Installed inside a QS5116

Step 8. Once all QPM cards have been installed (including face plates for empty slots), the chassis cover should be replaced.

3.9.3   Removing QPM Cards

To properly remove a QPM card from the Fiber Switch, follow the 3 steps below.

Step 1.   Remove chassis cover   See procedure in Section 3.9.1 above.

> **Caution: Be sure the power cord is unplugged.**

Step 2.   Remove bottom-front retaining screws for the QPM and Face Plate

On the bottom-front of the unit there are two retaining screws for each QPM card and face plate slot. These screws are used to secure a QPM card in position (see Figure 3.9.3a). Remove the front screws first and then screw mounted on the rear-top of the QPM to be removed.
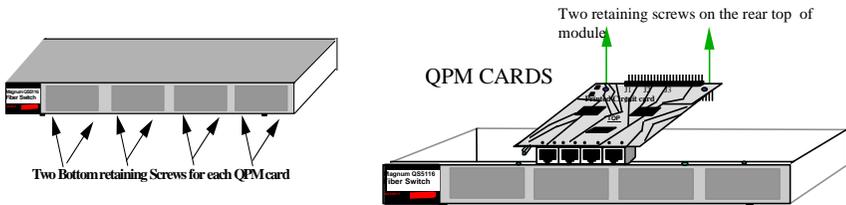
Figure 3.9.3a: Front View - Face Plate & QPM Retaining Screws

Step 3.   Remove QPM Card

Gently pull the QPM card up and out of the connector socket (see Fig.3.9.3b).
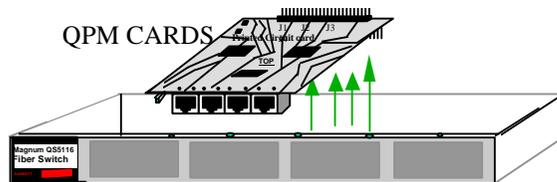
Figure 3.9.3b: Removing a QPM Card

If the slot from which the QPM card has been removed is to remain unused, be sure to install a QPM face plate cover in it. If another QPM card is replacing the one that has been removed, follow the steps as described for installing a QPM card discussed in Section 3.9.1.

4.0   OPERATION

This chapter describes the functions and operation of the Quad-Series.

4.1   Switching Functionality

A Magnum Quad-Series provides switched connectivity at Ethernet wire-speed among all of its ports. The Magnum Quad-Series supports10/100Mbs for copper media and 10 or 100Mb separate traffic domain for fiber port to maximize bandwidth utilization and network performance. All ports can communicate to all other ports in a Magnum Quad-Series, but local traffic on a port will not consume any of the bandwidth on any other port.

Magnum Quad-Series units are plug-and-play devices. There is no software configuring to be done at installation or for maintenance. The only hardware configuration settings are user options for UP-LINK on RJ-45 quad-port. Half / Full duplex mode and 10 or 100Mbps selection for the switched ports can be done through jumper settings inside the unit. The internal functions of both are described below.

Filtering and Forwarding

Each time a packet arrives on one of the switched ports, the decision is taken to either filter or to forward the packet. Packets whose source and destination addresses are on the same port segment will be filtered, constraining them to that one port and relieving the rest of the network from processing them. A packet whose destination address is on another port segment will be forwarded to the appropriate port, and will not be sent to the other ports where it is not needed. Traffic needed for maintaining the operation of the network (such as occasional multi-cast packets) is forwarded to all ports.

The Magnum Quad-Series Switches operate in the store-and-forward switching mode, which eliminates bad packets and enables peak performance to be achieved when there is heavy traffic on the network.

Address Learning

All 16-port Magnum Quad-Series units have address table capacity of 24K node addresses (12K for 8-port models), suitable for use in large networks. They are self-learning, so that as nodes are added or removed or moved from one segment to another, the Quad-Port Switch automatically keeps up with node locations.

An address-aging algorithm causes least-used addresses to fall out in favor of new frequently-used addresses. To reset the address buffer, cycle power down-and-up.

4.2   Status LEDs

For all Magnum Quad-Series models :

PWR   **:** Power LED, ON when external power is applied to the unit.
LK   **:** Steady ON, Link status for 10 Mbps and 100Mbps operation.
ACT   **:** ON with port activity for 10 Mbps and 100Mbps operation.
F/H   **:** Full / Half duplex LED, ON when the port is running full
                       duplex, OFF for half duplex.
100/10   **:** Speed LED, ON when the speed is 100Mbps , OFF when the
                        speed is 10 Mbps

4.3   Manual Switches for Up-link push-button, for RJ-45 quad-port only

Figure 4.3 :

Up-link push-button

on RJ-45 quad-port
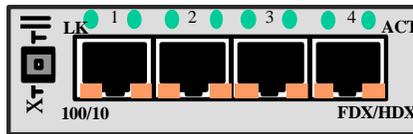
The module has a manual Up-link push-button, located on the front panel next to 10/100Mb RJ-45 Quad-port # 1 which it controls. It enables the port's cable to either connect to a user station node (push in) or to be cascaded (push out) to a 10/100Mb repeater or switching hub in the network. Verify proper Up-link push-button position by noting Port 1's LK (link) LED status, which is illuminated when a proper link is made.

4.4   Auto-negotiation, for Fast Ethernet copper ports

The Magnum Quad-Series Fast Ethernet copper ports can be set for either fixed 100Mb speed or for 10/100 F/H N-way auto-negotiation per the IEEE802.3u standard. The selection is made via an internal jumper (see Section 3.4 for jumper-setting instructions). The factory default setting is for auto-negotiation. At 100Mb-fixed speed, the user may select half- or full-duplex mode by internal jumpers for each RJ-45 port separately.

One frequently-used application for the Magnum Quad-Switch copper ports is to connect one of them using a fiber media converter to another Switch in the network backbone, or to some other remote 100Mb device. In this case, it is desirable to operate the fiber link at 100Mb speed, and at either half- or full duplex mode depending on the capabilities of the remote device. Standard commercially-available Fast Ethernet media

converters mostly do not support auto-negotiation properly, and require that the switched port to which they are connected be at 100Mb fixed speed. Attachment to 10/100 auto-negotiation ports typically will not work properly. The Quad-Switch's RJ-45 ports handle this situation by changing the internal jumper settings. (see Section 3.4)

When Quad-Switch's RJ-45 copper ports are set for auto-negotiation and connected to an another auto-negotiating device, there are 4 different speed and F/H modes selection depending on what the other device supports. These are: (1) 100Mb full-duplex, (2) 100Mb half-duplex, (3) 10 Mb full-duplex and (4) 10 Mb half-duplex.

The auto-negotiation logic will attempt to operate in descending order and will normally arrive at the highest order mode that both devices can support at that time. (Since auto-negotiation is potentially an externally-controlled process, the original "highest order mode" result can change at any time depending on network changes that may occur). If the device at the other end is not an auto-negotiating device, the Quad-Switch's RJ-45 ports will try to detect its idle signal to determine 10 or 100 speed, and will default to half-duplex at that speed per the IEEE standard.

General information -

Auto-negotiation per-port for 802.3u-compliant switches occurs when:

the devices at both ends of the cable are capable of operation at either 10 Mb or 100Mb speed and/or in full- or half-duplex mode, and can send/receive auto-negotiation pulses, and . . .

 --   when the second of the two connected devices is powered up*, i.e., when LINK is established for a port, or

--   when LINK is re-established on a port after being lost temporarily.

- **NOTE** – *some NIC cards only auto-negotiate when the computer system that they are in is powered up. These are exceptions to the "negotiate at LINK – enabled" rule above, but may be occasionally encountered.*

When operating in 100Mb half-duplex mode, cable distances and hop-counts may be limited within that collision domain. The Path Delay Value (PDV) bit-times must account for all devices and cable lengths within that domain. For Magnum Quad-Series Fast Ethernet switched ports operating at 100Mb half-duplex, the bit time delay is 50BT.

4.5   Auto-negotiation for 10 Mb ports, half- or full-duplex mode

Full-duplex Ethernet provides separate Transmit and Receive data paths, enabling simultaneous bi-directional collision-free data movements on a port. The network topology must be a "star" type, not a "bus" type. With full-duplex mode, the cable distance is only limited by the physical layer line driver and cable attenuation. There are no collision-domain restrictions or limitations.

The Magnum Quad-Series Switches perform half- or full-duplex mode auto-negotiation independently on all switched ports. If the device or node on the other end of a port's attached cable supports F/H mode auto-negotiation or is set to operate as full-duplex, the Magnum Quad-Port Switch will negotiate to run full-duplex. If the attached device or node doesn't support F/H mode auto-negotiation (for example, if it is a 10 Mb repeater or a standard 10 Mb hub), the Quad-Switch's RJ-45 ports will default to operate at half-duplex.

4.6   Flow-control, IEEE 802.3x standard

Magnum Q- Series Switches incorporate a flow-control mechanism for Full-Duplex mode. The purpose of flow-control is to reduce the risk of data loss if a long burst of activity causes the switch to save frames until its buffer memory is full. This is most likely to occur when data is moving from a 100Mb port to a 10 Mb port, and the speed difference makes the 10Mb port unable to keep up. It can also occur when multiple 100Mb ports are attempting to transmit to one 100Mb port, and in other protracted heavy traffic situations.

Magnum Q-Series Fiber Switches implement the 802.3x flow control (non-blocking) on Full-Duplex ports, which provides for a "PAUSE" packet to be transmitted to the sender when the packet buffer is nearly filled and there is danger of lost packets. The transmitting device is commanded to stop transmitting into the Quad-switch port for sufficient time to let the Switch reduce the buffer space used. When the available free-buffer queue increases, the Switch will send a "RESUME" packet to indicate the transmitter to start sending the packets. Of course, the transmitting device must also support the 802.3x flow control standard in order to communicate properly during normal operation.

Note: When in Half-Duplex mode, the quad-switch implements a back-pressure algorithm on 10/100 Mb ports for flow control. That is, the switch prevents frames from entering the device by forcing a collision indication on the half-duplex ports that are receiving. This temporary "collision" delay allows the available buffer space to improve, as the switch catches up with the traffic flow.

4.7   Power Budget Calculations for Quad-Series QPM's with Fiber Media

Receiver Sensitivity and Transmitter Power are the parameters necessary to compute the power budget. To calculate the power budget of different fiber media installations using Magnum products, the following equations should be used:

OPB (Optical Power Budget) = P_T(min) - P_R(min)

where P_T = Transmitter Output Power, and P_R = Receiver Sensitivity

Worst case OPB = OPB - 1dB(for LED aging) - 1dB(for insertion loss)

Worst case distance = {Worst case OPB, in dB} / [Cable Loss, in dB/Km]

where the "Cable Loss" for 62.5/125 and 50/125μm (M.m) is 2.8 dB/km,

and the "Cable Loss" for 100/140 (Multi-mode) is 3.3 dB/km,

and the "Cable Loss" for 9/125 (Single-mode) is 0.5 dB/km

The following data has been collected from component manufacturer's (Agilent's and Siemens') web sites and catalogs to provide guidance to network designers and installers.

Fiber Port Module	Speed, Std.	Mode	Std. km fdx (hdx)	Wave-length nm	Cable Size μm	X'mitr Output P_T, dB	R'cvr Sens. P_R, dB	Worst OPB, dB	Worst* distance Km, fdx		typical OPB, dB	typical* distance Km, fdx
QPM10-FST	10 Mb FL	Multi-mode	2 (2)	850	62.5/125 100/140 50/125	-15.0 -9.5 -19.5	-31 -31 -31	14 19.5 9.5	5 5.9 3.4		17 23.5 13.5	6 7 4.8
QPM-MST, MSC	100Mb FX	Multi-mode	2 (0.4)	1300	62.5/125 50/125	-20 -23.5	-31 -31	9.0 5.5	2.5 2.0		14 12	5 4
QPM-SSC	100Mb FX	Single-mode	18+ (0.4)	1300	9/125	-15	-31	14	28		17.5	35
QPM-MTRJ	100Mb FX	Multi-mode	2 (0.4)	1300	62.5/125 50/125	-20 -23.5	-31 -31	9.0 5.5	3.0 2.0		15.8 12.2	5.5 4.0
QPM-MV45	100Mb FX	Multi-mode	2 (0.4)	1300	62.5/125	-14	-31	15	5		16	5.7

*__*Note__: The use of either multi-mode or single-mode fiber to operate at 100Mbps speed over long distances (i.e., in excess of approx. 400 meters) can be achieved* __only__ *if the following factors are both applied:*

- *The 100Mb fiber segment must operate in full-duplex (FDX) mode, i.e. the full-duplex (factory default) setting for 100Mbps fiber ports must be used, and*

- *The worst-case OPB of the fiber link must be greater than the fiber cable's passive Attenuation.*

(Attenuation = Cable loss + LED aging loss + Insertion loss + safety factor)

5.0   INTRODUCTION - MAGNUM QUAD-SERIES QUAD-PORT MODULES (QPM)

This chapter describes each Quad-Port Module (QPM), including appearance, functionality, and status displays.

5.1   Inspecting the Package and Product

This section applies only to QPMs shipped as separate items, i.e., QPMs not factory installed in a Magnum Quad-Series QPM slot.

Examine the shipping container for obvious damage prior to installing a QPM; notify the carrier of any damage which you believe occurred during shipment or delivery. Inspect the contents of this package for any signs of damage and ensure that the items listed below are included.

This package should contain:

1 or more QPMs

Installation instructions, with illustrations

Remove the QPM(s) from the shipping container. Be sure to keep the shipping container should you need to ship any of the QPMs separately at a later date. In the event there are items missing or damaged contact your supplier. If you need to return the unit, use the original shipping container if possible. Refer to Chapter 5 for specific return procedures.

5.2   Product Description

An important feature of the Magnum Quad-Series is the use of Quad-Port Modules (QPMs) for flexible mixed-media connectivity to RJ-45 and fiber media. Since the Magnum Quad-Series Switches have dual-speed capability for copper ports, the quad-port interfaces are designed to support all standard Ethernet media types at 10 or 100Mps speed. Each QPM provides four ports for connecting Ethernet segments with its individual connector type and media.

For a list of Quad-Port Module types, refer to Section 1.2

Each QPM is individually described in the following sections.

5.2.1   QPM-MST, 100Mb multi-mode FX-ST Quad-port Module, "twist lock"

The Magnum QPM-MST is a multi-mode 100Mbps fiber optic quad-port module equipped with dual ST-type connectors. It functions as a fiber optic transceiver to support 100BASE-FX network segments. When installed in a Quad-Series Fiber Switch, it supports fiber optic cable distances up the IEEE-standard 100Mbps distance limits, i.e., typically 2km at full-duplex and 412m at half-duplex.

100BASE-FX, and 10BASE-FL ST Connectors
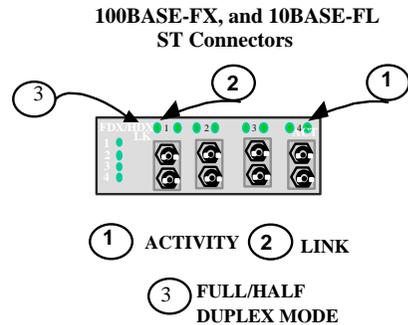
Each port has an Activity (ACT) LED indicating packets being received, a Link (LK) LED that indicates proper connectivity with the remote device when lit, and a FDX/HDX LED to indicate full-duplex mode when lit (or half-duplex when off). Lettering on the front of the module identifies it as "100 FX" to avoid confusion with other similar-looking 10 Mb fiber QPMs.

5.2.1a   QPM10-MST, 10 Mbps multi-mode FL-ST-Quad-port type, "twist-lock"

The Magnum QPM10-MST is a multi-mode 10 Mbps fiber optic module equipped with dual ST-type connectors. It looks similar to the 100Mb QPM-MST, but has the lettering "10 Mb" on the front to distinguish it. It supports fiber optic cable distances up the IEEE-standard 10 Mbps distance limits, i.e., typically 2km at full-duplex and at half-duplex.

Each port has an Activity (ACT) LED indicating packets being received, a Link (LK) LED that indicates proper connectivity with the remote device when lit, and a FDX/HDX LED to indicate full-duplex mode when lit (or half-duplex when off). Lettering on the front of the module identifies it as "10 FL" to avoid confusion with other similar-looking 100Mb fiber QPMs.

5.2.2   QPM-MSC 100Mbps multi-mode FX-SC Quad-port, "snap-in" connector

The Magnum QPM-MSC is a multi-mode 100Mbps fiber optic transceiver module, similar to the QPM-MST. It has the same LEDs indicating port activity (ACT), Link (LK), and FDX or HDX operation, and the same face-plate lettering.

100BASE-FX Multi-Mode SC Connectors

While the functionality of these two modules is essentially the same, the QPM-MSC is equipped with an SC-type "snap-in" connector instead of an ST-type.
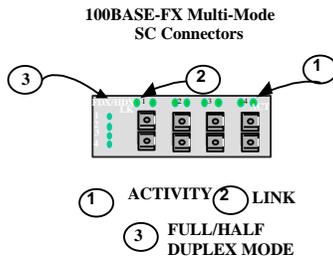
5.2.3   QPM-SSC 100Mbps single-mode FX-SC-type, "snap-in" connector

The Magnum QPM-SSC is a single-mode 100Mbps fiber optic module equipped with a dual SC-type connector. It functions as a fiber optic transceiver to the Quad-Switches, supporting four single-mode fiber network segments.

100BASE-FX Single-Mode SC Connectors

The QPM-SSC, when installed in a Magnum Quad-Series Fiber Switch operating at 100Mbps full-duplex, supports single-mode fiber cable lengths of as much as 25+ Km (see Power Budget, Section 4.5)

Each port has an Activity (ACT) LED indicating packets being received, a Link (LK) LED that indicates proper connectivity with the remote device when lit, and a FDX/HDX LED to indicate full-duplex mode when lit (or half-duplex when off). To distinguish the single-mode QPM-SSC from the multi-mode QPM-MSC, the label "Sgl. M." is at the top of the faceplate of the QPM-SSC.
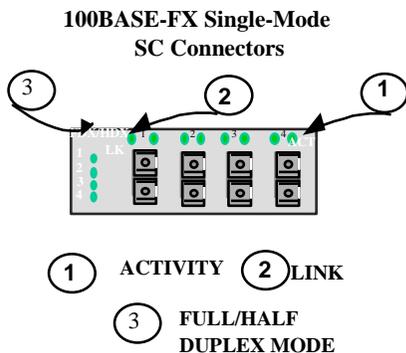
5.2.4   QPM-MTRJ, 100Mb multi-mode FX Quad-Port, <u>MTRJ small-form-factor</u>

Magnum QPM-MTRJ is a multi-mode fiber optic quad-port module equipped with a small-form-factor MTRJ-type connector. It looks almost like an RJ-45 port, but it is black in color. The MT-RJ's small size and ease of connection make it a good choice for 100Mbps "fiber-to-the-desktop" Ethernet connectivity. When installed in a Quad-Series Fiber Switch, it supports fiber optic cable distances up the IEEE-standard 100Mbps distance limits, i.e., typically 2km at full-duplex and 412m at half-duplex.

100BASE-FX MTRJ Connectors

"small-form-factor"
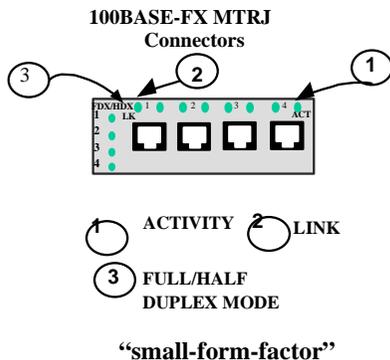
The functionality of this 100BASE-FX multi-mode QPM is essentially the same as the ST and SC-types. It has the same LEDs per port indicating port activity (ACT), Link (LK), and FDX or HDX operation. It has the same "100Mb FX" lettering on the faceplate. Note that the other end of the fiber cable may have a different connector, not necessarily an MT-RJ type.

5.2.5   QPM-MV45, 100Mbps multi-mode FX Quad-Port <u>VF45 small-form factor</u>

Magnum QPM-MV45 is a quad-port multi-mode fiber FX "small-form-factor" VF-45 connector used primarily in 100Mbps fiber-to-the-desktop links. Its size is similar to the MT-RJ port, but the VF-45 shell is slightly larger. When not in use, its appearance is distinctive because it has a tiny hinged door over the port hole to act as a dust cover.

When installed in a Quad-Series Fiber Switch, it supports fiber optic cable distances up the IEEE-standard 100Mbps distance limits, i.e., typically 2km at full-duplex and 412m at half-duplex.
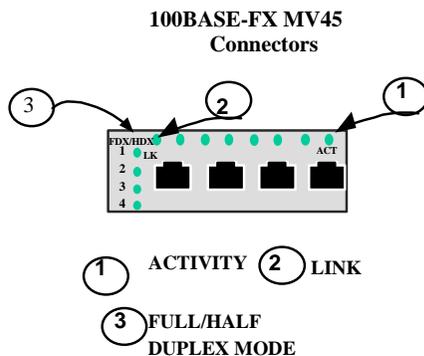
100BASE-FX MV45 Connectors

ACTIVITY   LINK

FULL/HALF DUPLEX MODE

"small-form-factor"

The small size of the VF-45, about the same as an RJ-45 port, reduces the size of wiring panels in wiring closets while providing the advantage of "future-proof" fiber optic technology.

The cable end is a "plug-in" connector, with both fiber strands terminated in one housing that cannot be improperly inserted. Each port has an Activity (ACT) LED indicating packets being received, a Link (LK) LED that indicates proper connectivity with the remote device when lit, and a FDX/HDX LED to indicate full-duplex mode when lit (or half-duplex when off).

5.2.6   QPM-RJ45 (Twisted Pair), 10/100Mb TP Quad-Port

The QPM-RJ45 module supports Ethernet twisted pair segments of any standard length. It is equipped with a four-port RJ-45 connector, and offers 10/100 full / half-duplex auto-negotiating capability on each port. The RJ-45 connector is shielded to minimize emissions and will allow both unshielded twisted pair (UTP) and shielded twisted pair (STP) cable connections.

10/100BASE-T, Quad Port RJ-45 Connectors

Cross-Over Push Switch

1 ACTIVITY   2 LINK

3 FULL/HALF DUPLEX MODE   4 SPEED
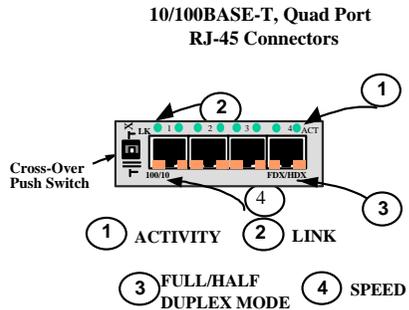
The QPM-RJ45 quad-port module is equipped with a Media Dependent Interface-Crossover (MDI-X) push-button to allow for one cascaded connection. This feature eliminates the need for a special twisted pair crossover cable when connecting to a hub or another switch.

With the push-button in the IN (X) position, the left-most RJ-45 port is used for cascaded and up-link connections (i.e.: a connection to another hub or switch typically). When used for segments going to workstations and other user node device connections, the MDI-X push-button should be in the OUT (=) position.

Each port has an Activity (ACT) LED indicating packets being received, a Link (LK) LED that indicates proper connectivity with the remote device when lit, a

FDX/HDX LED to indicate full-duplex mode when lit (or half-duplex when off), and a "speed" LED indicating 100Mb when lit (or 10 Mbps when off).

Important Note: For the QPM-RJ45 Crossover Push-button -
OUT for workstations and user node connections.
IN for Up-Link connections to other hubs, switches, etc.

The RJ-45 pins normally (TP crossover push-button DOWN) are per the standard for hubs-to-users twisted pair wiring: 1 = receive+, 2 = receive-, 3 = transmit+, 6 = transmit-, other pins not used. When the TP crossover push-button is UP, the pins of the RJ-45 port are per the standard for up-links using twisted pair wiring, i.e., the transmit and the receive pairs are exchanged: 1 = transmit+, 2 = transmit-, 3 = receive+, 6 = receive-, other pins not used.

5.2.7 QPRJ-MSC, "3 + 1" 3@10/100Mb RJ-45 and 1@100Mb Fiber SC Multi-mode Connector, "Combo" Quad-Port Module

The QPRJ-MSC "3+1 Combo" quad-port supports three auto-negotiating twisted pair ports at 10/100Mbps FDX / HDX, and one fiber port with 100Mbps multi-mode FX SC connector. The three RJ-45 ports on the right operate the same as those in the same place on the QPM-RJ45 module.

10/100BASE-T and 100BASE-FX Combo Quad-Port Connectors

1 ACTIVITY   2 LINK

3 FULL/HALF DUPLEX (RJ-45)   4 SPEED

5 FULL/HALF DUPLEX(FIBER)

The fiber SC connector functions as a fiber optic transceiver to support 100BASE-FX network segments. When installed in a Quad-Series Fiber Switch, it supports fiber cable distances up the IEEE-standard 100Mbps distance limits, i.e., typically 2km at full-duplex and 412m at half-duplex. The factory default setting is for full-duplex operation, and a jumper on the module must be moved to select half-duplex. (See Section 3.4).

Each 3+1 combo port has an Activity (ACT) LED indicating packets being received, a Link (LK) LED that indicates proper connectivity with the remote device when lit, a FDX/HDX LED to indicate full-duplex mode when lit (or half-duplex when off). In addition, the RJ-45 ports have a "speed" LED indicating 100Mb when lit (or 10 Mbps when off). The fiber port is always 100Mbps speed.

5.2.8   QPRJ-MST, "3 + 1" 3@10/100Mb RJ-45 and 1@100Mb Fiber ST Multi-mode Connector, "Combo" Quad-Port Module

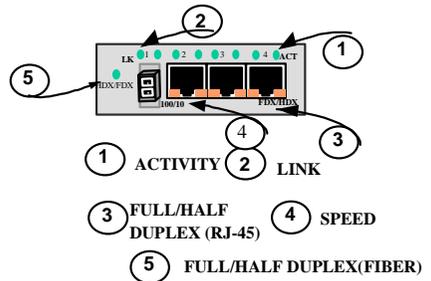The Magnum QPRJ-MST is also a 3+1 Combo quad-port. It is the same as the QPRJ-MSC "3+1 combo" module except the multi-mode fiber port is ST-type. See Section 5.2.1 for a description of the 100Mb multi-mode-mode fiber SC-type port.

5.2.9   QPRJ-SSC, "3 + 1" 3@10/100Mb RJ-45 and 1@100Mb Fiber SC <u>Single</u>-<u>mode</u> Connector, "Combo" Quad-Port Module

The Magnum QPRJ-SSC is also a 3+1 Combo quad-port module. It is the same as the QPRJ-MSC "3+1 combo" module except the fiber port is single-mode. See Section 5.2.3 for a description of the 100Mb single-mode fiber port.

5.2.10   QPM-FP

The QPM-FP is a blank face plate or cover plate that must be installed in any empty QPM slots to maintain proper cooling air flow, and for safety, etc.

Two screws underneath the front panel hold the QPM-FP in place.

Fig. 5.2.10 Blank Face Plate

6.0   TROUBLESHOOTING

All Magnum Ethernet products are designed to provide reliability and consistently high performance in all network environments. The installation of Magnum Quad Series Fiber Switch is a straightforward procedure (see INSTALLATION, Section 2.6); the operation is also straightforward and is discussed in Section 4.

Should problems develop during installation or operation, this section is intended to help locate, identify and correct these types of problems. Please follow the suggestions listed below prior to contacting your supplier. However, if you are unsure of the procedures described in this section or if the Magnum Quad Series Fiber Switch is not performing as expected, do not attempt to repair the unit; instead contact your supplier for assistance or contact GarrettCom Customer Support.

6.1   Before Calling for Assistance

1.   If difficulty is encountered when installing or operating the unit, refer back to the Installation Section of the applicable chapter of this manual. Also check to make sure that the various components of the network are interoperable.

2.   Check the cables and connectors to ensure that they have been properly connected and the cables/wires have not been crimped or in some way   impaired during installation. (About 90% of network downtime can be   attributed to wiring and connector problems.)

3.   Make sure that an AC power cord is properly attached to each Magnum Quad Series Fiber Switch unit. Be certain that each AC power cord is plugged into a functioning electrical outlet. Use the PWR LEDs to verify each unit is receiving power.

4.   If the problem is isolated to a network device other than the Magnum Quad Series Fiber Switch product, it is recommended that the problem device is replaced with a known good device. Verify whether or not the problem is corrected. If not, go to Step 5 below. If the problem is corrected, the Magnum Quad Series Fiber Switch and its associated cables are functioning properly.

5.   If the problem continues after completing Step 4 above, contact your supplier of the Magnum Quad Series Fiber Switch unit or if unknown, contact GarrettCom, Inc.by fax, phone or email (*support@garrettcom.com*) for assistance.

6.2   When Calling for Assistance

Please be prepared to provide the following information.

1.   A complete description of the problem, including the following points:

   a. The nature and duration of the problem;

   b. Situations when the problem occurs;

   c. The components involved in the problem;

   d. Any particular application that, when used, appears to create the problem;

2.   An accurate list of GarrettCom product model(s)involved, with serial number(s). Include the date(s) that you purchased the products from your supplier.

3.   It is useful to include other network equipment models and related hardware, including personal computers, workstations, terminals and printers; plus, the various network media types being used.

4.   A record of changes that have been made to your network configuration prior to the occurrence of the problem. Any changes to system administration procedures should all be noted in this record.

6.3   Return Material Authorization (RMA) Procedure

All returns for repair must be accompanied by a Return Material Authorization (RMA) number. To obtain an RMA number, please use this URL - **https://rma.garrettcom.com/rma/rma_request_noaccount.php** to fill out the form. Please have the following information readily available:

Name and phone number of your contact person.
Name of your company / institution
Your shipping address
Product name
Serial Number (or Invoice Number)
Packing List Number (or Sales Order Number)
Date of installation
Failure symptoms, including a full description of the problem.

GarrettCom will carefully test and evaluate all returned products, will repair products that are under warranty at no charge, and will return the warranty-repaired units to the sender with shipping charges prepaid (see Warranty Information, Appendix A, for complete details). However, if the problem or condition causing the return cannot be duplicated by GarrettCom, the unit will be returned as:

No Problem Found.

GarrettCom reserves the right to charge for the testing of non-defective units under warranty. Testing and repair of product that is not under warranty will result in a customer (user) charge.

6.4   Shipping and Packaging Information

Should you need to ship the unit back to GarrettCom, please follow these instructions:

1. Package the unit carefully. It is recommended that you use the original container if available. Units should be wrapped in a "bubble-wrap" plastic sheet or bag for shipping protection. (You may retain all connectors and this Installation Guide.)

CAUTION: Do not pack the unit in Styrofoam "popcorn" type packing material. This material may cause electro-static shock damage to the unit.

2. Clearly mark the Return Material Authorization (RMA) number on the outside of the shipping container.

3. GarrettCom is not responsible for your return shipping charges.

4. Ship the package to:

> **GarrettCom, Inc.**
>
> **47823 Westinghouse Dr.**
>
> **Fremont, CA 94539**
>
> **Attn.: Customer Service**

APPENDIX A: WARRANTY INFORMATION

GarrettCom, Inc. warrants its products to be free from defects in materials and workmanship for a period of three (3) years from the date of shipment by GarrettCom.

During this warranty period, GarrettCom will repair or, at its option, replace components in the products that prove to be defective at no charge other than shipping and handling, provided that the product is returned pre-paid to GarrettCom.

This warranty will not be effective if, in the opinion of GarrettCom, the product has been damaged by misuse, misapplication, or as a result of service or modification other than by GarrettCom.

GarrettCom reserves the right to make a charge for handling and inspecting any product returned for warranty repair which turns out not to be faulty.

Please complete the warranty card as this acts as a product registration, and mail it to GarrettCom within two weeks of your purchase.

APPENDIX B: MAGNUM INTERNAL DC POWER SUPPLY OPTION

B1.0   SPECIFICATIONS - FOR MAGNUM QUAD-SERIES SWITCHES

Power Supply (Internal -48 VDC Option)

DC Power Connector: 3 terminals: "–", "GND", "+"

Input Voltage: 36 - 70 VDC

Power Supply (Internal 24 VDC Option)

DC Power Connector: 3 terminals: "–", "GND", "+"

Input Voltage: 20-36 VDC

Power Supply (Internal 125 or 100VDC Option)

DC Power Connector: 3 terminals: "–", "GND", "+"

Input Voltage: "125" = 120 - 160 VDC range, "100" = 90 to 160VDC range

Surge Suppression: Varistors are installed inside to avoid QS internal damage from power spikes or excess outside electrical noise coming in on the DC power input lines

Power Consumption**: all DC Model QS5108, QS5116**: 30 watt typical,50 watts max.

With the exception of the power supply, all specifications and functions of Magnum Quad-Series Switches-48VDC, 24VDC, 100VDC and 125VDC models are identical to those listed in the main manual.

B2.0 -48VDC, 24, 100, and 125VDC POWER OPTION, THEORY OF OPERATION

The -48VDC, 24, 100 and 125VDC power options are designed using diodes inside on each DC power input line behind the two external power connection terminals, so that the power from an external source can only flow into the unit. This allows the Quad-Series Switches to operate only whenever DC power is correctly applied to the two inputs. It protects the Quad-Series Switches from incorrect DC input connections. An incorrect

polarity connection, for example, will neither affect the Quad-Series Switches, its internal power supply, nor will it blow the fuse in the internal power supply.
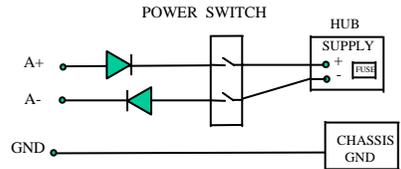
The manual power "On-Off" Switch (optional) is used for powering the unit on and off when it is placed into or taken out of service.

**B3.0   APPLICATIONS FOR DC POWERED ETHERNET SWITCHES**

Magnum Quad-Series Switches are easily installed in a variety of applications where -48VDC, 24, 100 or 125VDC power is used as the primary power source. The DC power configurationcapability provides an Ethernet networking solution utilizing a special power supply in switches with a proven track record.

The –48VDC solution is particularly useful in the telecommunication industry, where it is common for facilities to operate on -48VDC power. Such companies include regular and wireless telephone service providers, Internet Service Providers (ISPs) and other communication companies. In addition, many high availability equipment services, such as broadcasters, publishers, newspaper operations, brokerage firms and other facilities often use a battery backup system to maintain operations in the event of a power failure. It is also frequently used for computer system backup, management and operations monitoring equipment.

   The 24, 100 and 125VDC options are particularly useful in the Industrial environment, where it is common for facilities to operate on 24VDC or 125VDC power. The 100 and 125VDC options are mainly used in power utilities, such as electrical substations, electrical generating plants, etc. The 24VDC applications are mainly in the Industrial environment, such as factory floor, HVAC equipment, military equipment, etc.

B4.0   INSTALLATION

          This section describes the installation of the -48VDC, 24, 100 and 125VDC power source leads to the DC power terminal block on the Magnum Quad-Series Switches. (see figure at the right with –48VDC power as example).
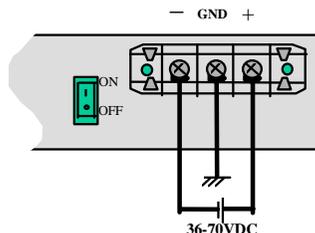
Figure B4.1: -48VDC Terminal Block on Magnum Quad-Series Switches -48VDC

          In this picture, the -48VDC terminal block on the Magnum Quad-Series Switch is located on the rear of the unit and is equipped with three (3) screw-down lead posts. It is similar for 24, 100 and 125VDC options on the Quad-Series Switch. The leads are identified as negative (-), positive (+), and chassis ground (GND).
          The actual connection procedure is very straightforward. Simply connect the leads to the Magnum unit, beginning with ground. Ensure that each lead is securely tightened.

Note: The GND should be hooked up first. The Quad-Series Switch *unit has a floating ground, so the user may elect to Ground either + or = terminal to suit the customer's use.*
          Before connecting hot lines to the Terminal Block of –48VDC, 24, 100 or 125VDC, always use a <u>digital voltmeter</u> to measure the output voltage of the power supply and determine the lead which is more "+ve potential". The more "+ve" voltage lead from the DC supply must be connected to the post labeled "+".

          An ON-OFF manual switch is optional for DC power. This can be used to cut off power connections, and as a RESET for the switch.

B4.1   UL Requirements
   1. *Minimum 14 AWG cable for connection to a Centralized DC power source.*
   2. *Fastening torque of the lugs on the terminal block: 9 inch pound max.*
   3. *Centralized DC Power Source cable securement, use at least four cable ties to secure the cable to the rack at least 4 inches apart with the first one located within 6 inches of the terminal block.*

B5.0   OPERATION
          Operation of the Magnum Quad-Series Switch with the optional -48VDC, 24V, 100 and 125VDC power supply is identical to that of the AC-powered models.

B6.0   ORDERING INFORMATION

      To order the optional –48VDC power supply factory installed, add a suffix of "-48VDC" after the product's standard model # Example: **Magnum QS5116-48VDC.**

      Similarly, to order the optional 24VDC, 100VDC, or 125VDC industrial power supply for factory installation and test, add a suffix of "–24VDC or "-100VDC" or "–125VDC" after the product's standard model #. Example**: Magnum QS5108-24VDC or Magnum QS5116-125VDC.**

B7.0   TROUBLESHOOTING   Please refer to Section 6.0

APPENDIX C: MAGNUM INTERNAL DC DUAL-SOURCE POWER OPTION

C1.0   SPECIFICATIONS - FOR MAGNUM QUAD-SERIES FIBER SWITCHES
Power Supply (Internal, -48VDC Dual-Source, model # Dual-Src48V)
      DC Power Connector: First Source: "A+", "A-", 2nd Source "B-", "B+"
      GND: Terminal for "earth" or ground wire connection to the switch chassis
      Input: Two separate sources, each at 36 - 70 VDC
      Power Consumption: **Model QS5108 & QS5116** :30 watt typical, 50 watts max.
  Power Supply (Internal, 24VDC Dual-Source, model # Dual-Src24V)
      DC Power Connector: First Source: "A+", "A-", 2nd Source "B-", "B+"
      GND: Terminal for "earth" or ground wire connection to the switch chassis
      Input: Two separate sources, each at 20 - 36 VDC
      Power Consumption: **Model QS5108 & QS5116** : 30 watt typical, 50 watts max.
  Power Supply (Internal, 100 and 125VDC Dual-Source, model # Dual-Src1xxV)
      DC Power Connector: First Source: "A+", "A-", 2nd Source "B-", "B+"
      GND: Terminal for "earth" or ground wire connection to the switch chassis
      Input: Two separate sources, each at 100 (90 to 160V) or 120 - 160 V range
      Power Consumption: **Model QS5108 & QS5116**: 30 watt typical, 50 watts max.

      With the exception of the dual DC input power connections and the power supply, all specifications and configuration options for the Magnum QS5116-48VDC, QS5116-24VDC, QS5116-100VDC, and QS5116-125VDC with this Dual-Source option are identical to those listed in the *Magnum Quad-Series Fiber Switch **Installation and User Guide***, including Appendix B "Internal DC Power Supply Option"

**C2.0   QUAD-SERIES with -48VDC, 24, 100, and 125VDC Dual-Source option**
      The QS switch models with the internal -48VDC, 24, 100 and 125VDC Dual-Source power supply are designed for installations where a battery plant is the power source, and where two separate power sources are utilized in order to increase operational uptime and to simplify maintenance.

      The functionality of the Magnum Quad-Series Switches -48VDC, 24, 100 or 125VDC Dual-Source Option switches are identical to the standard AC-powered models.

All Port Module options are available for configuration with Dual-Source Option units. Refer to the main sections of this ***Installation and User Guide*** for a detailed description of the Magnum Quad-Series Switches.

C3.0   DUAL-SOURCE OPTION, THEORY OF OPERATION

The Dual-Source DC power option is designed using diodes inside of the switch on each DC power input line. A diode is placed in each of the four input lines (behind the four external power connection terminals) so that power from an external source can only flow into the switch. This allows the switch to operate whenever DC power is correctly applied <u>to either or both of the two inputs</u>.
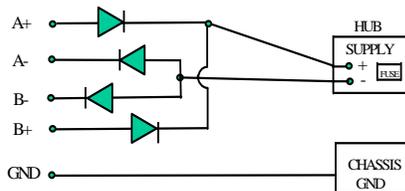
## C4.0   FEATURES AND BENEFITS OF THE DUAL-SOURCE DESIGN

a)   The switch can receive power from either input, "A" or "B". The switch will normally draw its power from the DC source with the highest voltage at a given time.

b)   The switch will not allow power to flow from a higher voltage input to a lower voltage input, i.e. the two DC power sources are not mixed together by the switch.

c)   When one correct DC input is present, the switch will receive power if the other DC input is absent, or even if it is connected with reverse polarity or shorted or grounded.

d)   Reverse polarity connections, if they should accidentally occur on either input, will not damage the switch or power supply internally (nor will it blow the fuse in the internal power supply) because of the blocking action of the diodes. This is true even if one input connection is reversed while the switch is operating from the other source.

e)   The switch will not receive power (and will not work) when both inputs are simultaneously absent or are both incorrectly connected.

C5.0   INSTALLATION

This section describes the proper connection of the -48VDC, 24, 100 and 125VDC dual source leads to the DC power terminal block on the Magnum Quad-Series Switch (shown in Figure C4.0 with 48v input as example).

The –48VDC terminal block on the Magnum Quad-Series Switch is located on the right rear of the unit and is equipped with five (5) screw-down lead posts (see Figure C5.0). The primary terminals are identified as positive (A+), negative (A-), and the secondary power terminals as negative (B-), positive (B+). The chassis "earth" or ground (GND), is a threaded post with a #6 nut. The dual source terminal block for 24, 100 and 125VDC are similar.
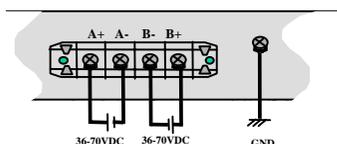
Figure C ... **to the external Terminal Block on a Mag** ... **ion**

Note: The GND should be hooked up first. The Quad-Series Switch *unit has a floating ground, so the user may elect to Ground either + or = terminal to suit the customer's use.*

Before connecting to Terminal Block of –48VDC, 24, 100 or 125VDC, always use a digital voltmeter *to measure the output voltage of the power supply and determine the lead which is more "+ve potential". The more "+ve" voltage lead from 48V or –48V supply must be connected to the post labeled "+".*

The connection procedure is straightforward. Simply connect the DC leads to the switch's power terminals, positive (+) and negative (-) screws. The use of Ground (GND) is optional; it connects to the switch chassis. Ensure that each lead is securely tightened.

C5.1 UL Requirements

The following must be adhered to in order to conform to UL requirements:
1. *Minimum 14 AWG cable for connection to a Centralized DC power source.*
2. *Fastening torque of the lugs on the terminal block: 9 inch pound max.*
3. *Centralized DC Power Source cable securement, use at least four cable ties to secure the cable to the rack at least 4 inches apart with the first one located within 6 inches of the terminal block.*

C6.0   ORDERING INFORMATION

To order the optional Dual-Source -48VDC power supply factory installed, order "Dual-Src-48V" as a separate line item following the product model.
   Example: **Magnum QS5116-48VDC**
           Dual-Src48V   for regular model with no ON-OFF switch
            or **Dual-Src48V-SWITCH** for model with ON-OFF switch

Similarly to order "Dual-Src24V" or "Dual-Src100V" or "Dual-Src125V" as a separate line item following the product model.
   Example: **Magnum QS5108-24VDC or Magnum QS5116-125VDC**
           Dual-Src48V   for regular model with no ON-OFF switch
            or **Dual-Src48V-SWITCH** for model with ON-OFF switch

C7.0   OPERATION

Operation of the Dual-Source Magnum Quad-Series Switch-48VDC, 24, 100 and 125VDC models are identical to that of the standard models. Please refer to the applicable sections of the "Installation and User Guide" for more information on the basic switches.