



**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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**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.

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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.*

<b>TABLE OF CONTENTS</b>		<b>Page</b>
<b>1.0</b>	<b>SPECIFICATIONS .....</b>	<b>1</b>
1.1	Technical Specifications .....	1
1.2	Ordering Information .....	3
<b>2.0</b>	<b>INTRODUCTION .....</b>	<b>4</b>
2.1	Inspecting the Package and Product .....	4
2.2	Product Description - Magnum Quad-Series Fiber Switches .....	5
2.2.1	Magnum Quad-Series chassis models.....	5
2.2.2	Quad-port modules, 100Mb fiber .....	7
2.2.3	Quad-port modules, 10 Mb fiber.....	7
2.2.4	Quad-Port Module, RJ-45 (copper) .....	8
2.2.5	Combo “3 + 1” Quad Port Modules, 3@RJ-45 and 1@fiber.....	8
2.2.6	Frame Buffering and Latency .....	9
2.3	Features and Benefits .....	11
2.4	Applications .....	12
<b>3.0</b>	<b>INSTALLATION.....</b>	<b>15</b>
3.1	Locating Magnum Quad-Series Switches .....	15
3.2	Connecting Ethernet Media .....	16
3.2.1	Connecting Fiber Optic <u>ST-type</u> , “twist-lock” .....	16
3.2.2	Connecting Fiber Optic <u>SC-type</u> , “Snap-In” .....	17
3.2.3	Connecting <u>Single-Mode</u> Fiber Optic .....	17
3.2.4	Connect Twist Pair (RJ-45,CAT3, CAT5, Unsh or Shiel).....	17
3.3	Table-Top or Shelf Mounting .....	18
3.3.1	Wall (or Vertical Surface) Mounting, 8-port QS580 .....	18
3.3.2	Rack-mounting, models QS5108 and QS5116 .....	18
3.4	RJ-45 ports, int jump set for 10/100Mb.....	20
3.5	Fiber 100Mb ports, int jump set for 100Mb fixed .....	21
3.6	Combo(3+1) ports, int jump set for 10/100 RJ-45 Auto-Neg.....	22
3.7	Fiber 10Mb ports, int jump set for 10Mb fixed Half- or.....	23
3.8	Powering the Magnum Quad-Series Switch .....	24
3.9	Quad Port Module (QPM) Installation.....	25
3.9.1	Preparation for Installing and Removing QPMs .....	25
3.9.2	Installing QPM Cards in the Magnum Q-Series .....	27
3.9.3	Removing QPM Cards .....	29
<b>4.0</b>	<b>OPERATION .....</b>	<b>30</b>
4.1	Switching Functionality .....	30
4.2	Status LEDs .....	31
4.3	Manual Switches for Up-link push-button, for RJ-45 quad-port .....	31
4.4	Auto-negotiation, for Fast Ethernet copper ports.....	31
4.5	Auto-negotiation for 10 Mb ports, half- or full-duplex mode.....	33
4.6	Flow-control, IEEE 802.3x standard .....	33
4.7	Power Budget Calculations for Quad-Series QPM’s with Fiber .....	34

<b>5.0</b>	<b>INTRODUCTION - MAGNUM QUAD-SERIES (QPM).....</b>	<b>35</b>
5.1	Inspecting the Package and Product .....	35
5.2	Product Description .....	35
5.2.1	QPM-MST, 100Mb multi-mode FX-ST Quad-port Mod .....	36
5.2.2	QPM-MSC 100Mbps multi-mode FX-SC Quad-port, “snap-in”	37
5.2.3	QPM-SSC 100Mbps <u>single-mode</u> FX-SC-type, “snap-in” con .	37
5.2.4	QPM-MTRJ, 100Mb multi-mode FX Quad-Port, <u>MTRJ small-</u>	38
5.2.5	QPM-MV45, 100Mbps multi-mode FX Quad-Port <u>VF45 small-</u>	38
5.2.6	QPM-RJ45 (Twisted Pair), 10/100Mb TP Quad-Port.....	39
5.2.7	QPRJ-MSC, “3 + 1” 3@10/100Mb RJ-45 and 1@100Mb Fib..	40
5.2.8	QPRJ-MST, “3 + 1” 3@10/100Mb RJ-45 and 1@100Mb Fib..	41
5.2.9	QPRJ-SSC, “3 + 1” 3@10/100Mb RJ-45 and 1@100Mb Fib...	41
5.2.10	QPM-FP .....	41
<b>6.0</b>	<b>TROUBLESHOOTING .....</b>	<b>42</b>
6.1	Before Calling for Assistance .....	42
6.2	When Calling for Assistance .....	43
6.3	Return Material Authorization (RMA) Procedure .....	43
6.4	Shipping and Packaging Information.....	44
	<b><u>APPENDIX A: WARRANTY INFORMATION</u>.....</b>	<b>44</b>
	<b><u>APPENDIX B: MAGNUM INTERNAL DC POWER SUPPLY OPTION</u></b>	<b>44</b>
	<b><u>APPENDIX C: MAGNUM INTERNAL DC DUAL-SOURCE POWER ..</u></b>	<b>47</b>

### Revisions

**Rev D 12/02 :** Updated Appendices B and C for 100VDC (90 to 160v range) option

**Rev C 06/02 :** Updated the Rack Mounting and Appendix B & C with 24VDC and 125VDC Power Supply option

**Rev B 04/01 :** Change the company name to GarrettCom, Inc. (Formerly it was Garrett Communications). There are no changes to the content of the material at this time

**Rev A 08/99 :** This revision is the initial release of the Magnum Quad Series Fiber Switch user manual.

# 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 $\mu$ s + packet time (100 to 100Mbps) 15 $\mu$ s + 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 jumpers: 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.

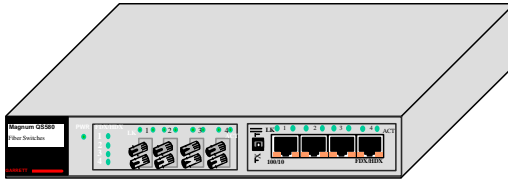
Designed for use in departments with multiple workgroups, in remote offices and in network traffic centers, the Magnum Quad-Series Switches are easy to install and use. Addresses of attached nodes are automatically learned and maintained, adapting the switching services to network changes and expansions. 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)

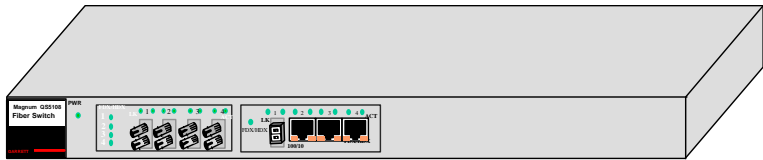
The 8-port QS580 table-top chassis is compact in size and suitable for shelf-mounted use in network wiring centers. The QS5108 and QS5116 are 19” rack-

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.

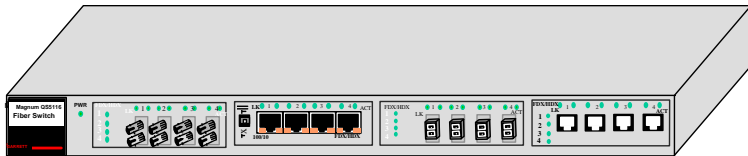


8 Ports Table-Top

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

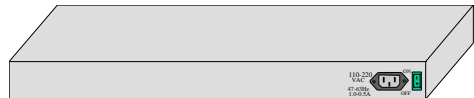
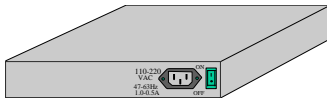


8-Port Rack Mount



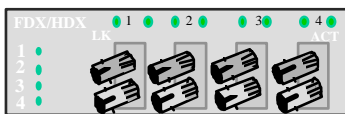
16-Port Rack Mount

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.

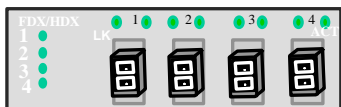


**Figure 2.2.1b: Rear view - Magnum table-top & rack-mount Quad-Series Switches**

## 2.2.2 Quad-port modules, 100Mb fiber



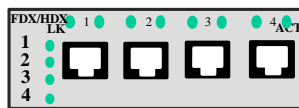
**ST-Type**



**SC-Type**



**VF45-Small Form Factor**



**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, 10 Mb 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**

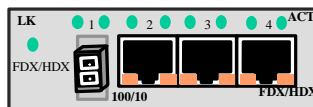
for operation at 10 or 100Mb speed in full- or half-duplex mode (as a default setting). They independently move to half-duplex mode at 10 Mb or at 100Mb speed if the device at the other end of the twisted pair cable is half-duplex or is not an auto-negotiating device.

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.

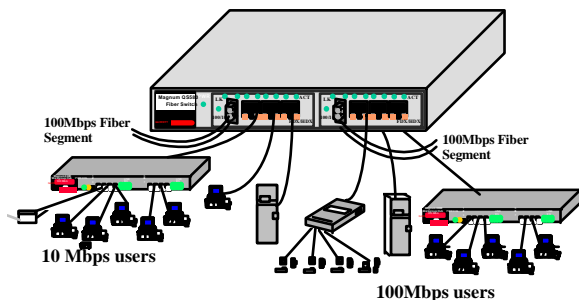
The mixed-media capability is ideal for upgrading existing Ethernet LAN networks, where existing cabling must be accommodated. The fiber-built-in media capability is ideal for integrating future-proof fiber cabling into the LAN structure.

### 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: AFTER  
Magnum QS580  
Switch provides  
central connectivity  
while maintaining  
full 10 Mbps and  
100Mbps bandwidth  
on each segment.**



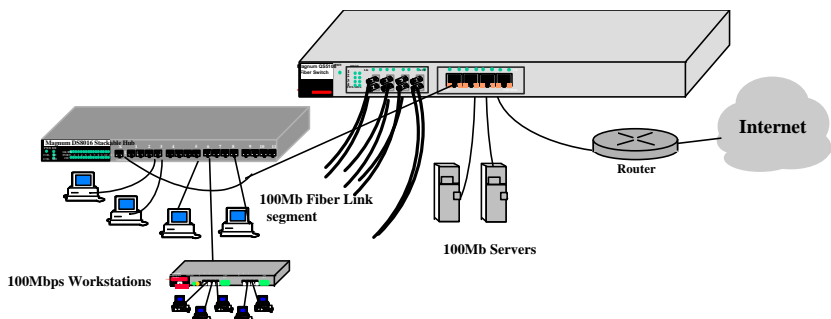
**Example 2 : Magnum 8-port QS5108**

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.



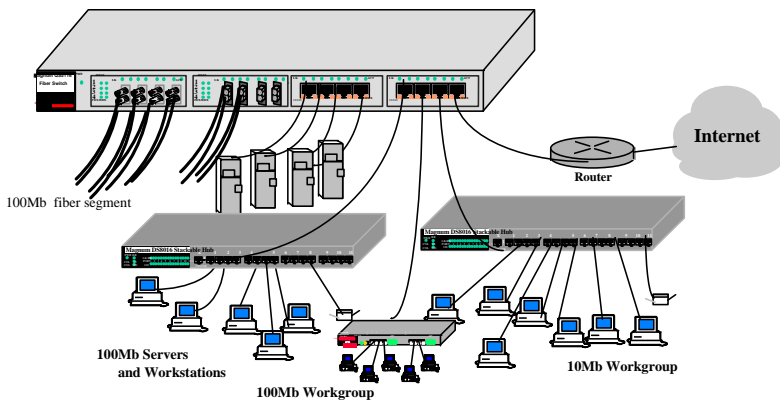
**Figure 2.4b: The Magnum QS5108 provides a 100Mb fiber backbone facility.**

**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:

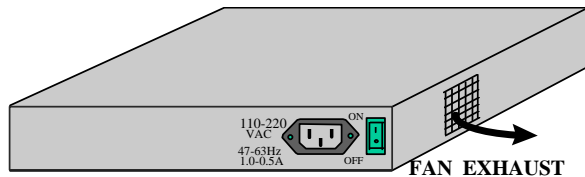
- 1.) If the equipment is mounted in an enclosed or multiple rack assembly, the environmental temperature around the equipment must be less than or equal to 50°C.
- 2.) If the equipment is mounted in an enclosed or multiple rack assembly, adequate air flow must be maintained for proper and safe operation.
- 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 or 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:

<u>IEEE Standard</u>	<u>Media Type</u>	<u>Max. Distance</u>	<u>Port Module</u>
<b><u>Fiber:</u></b>			
100BASE-FX	mm <sup>1</sup> Fiber	2.0km (6,562 ft)	QPM-MSC, -MST
	sgl.m <sup>2</sup> Fiber	18.0km (95K ft)	QPM-SSC
	small form factor mm <sup>1</sup> Fiber	2.0km (6,562 ft)	QPM-MTRJ, -MV45
10BASE-FL	mm <sup>1</sup> Fiber	2.0km(6,562 ft)	QPM10-FST

#### **Copper:**

10BASE-T & 100BASE-TX twisted pair 100m (328 ft) QPM-RJ45

<sup>1</sup> mm = multi-mode

<sup>2</sup> sgl.m = single-mode

#### 3.2.1 Connecting Fiber Optic ST-type, “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.

- 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.
- 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.*
- 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.
- 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.
- 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 SC-type, "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 Single-Mode 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).

<u>Media</u>	<u>IEEE Standard</u>	<u>Connector</u>
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.

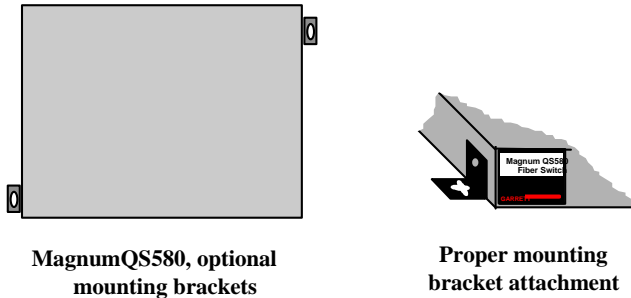
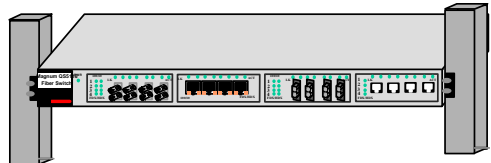


Figure 3.1: Magnum QS580, metal mounting brackets

#### 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

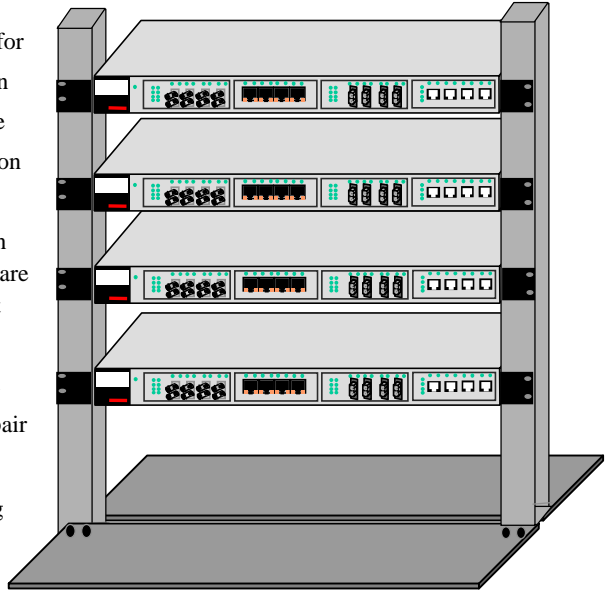


brackets and screws (included with each QS5108 and QS5116 unit). The brackets attach to the front sides of the switch, which is then fastened into a standard 19" RETMA rack.

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.



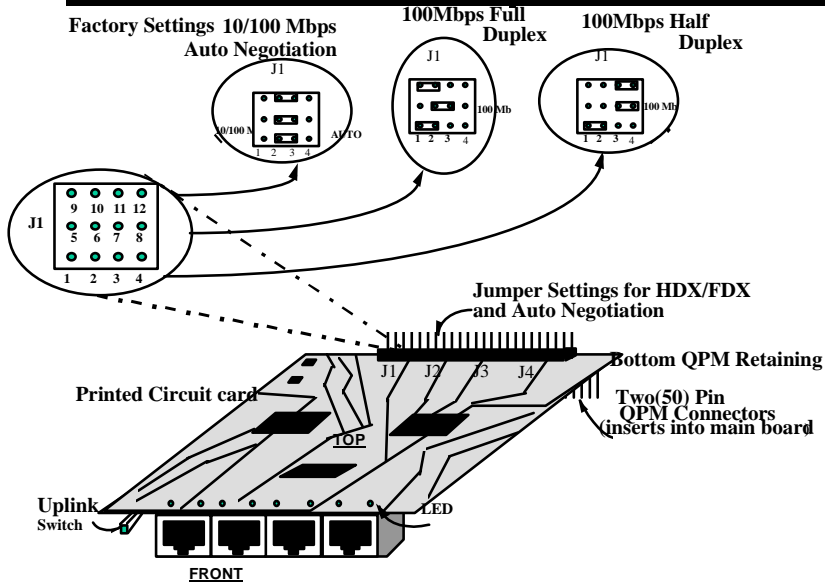
**Fig 3.8 Multiple Magnum QS5116 units rack-mounted in a 23" frame**

### 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.

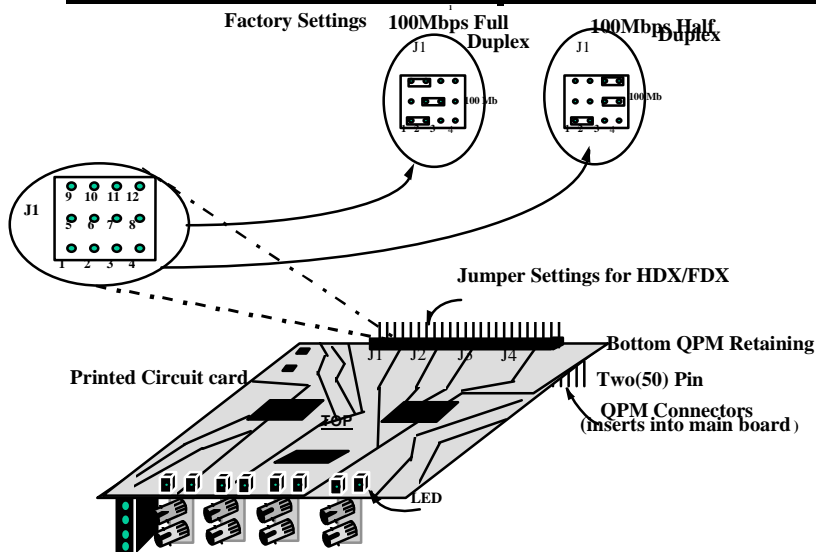
See Section 4.4 for additional information on auto-negotiation functionality.

### 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-























































