



**GarrettCom™**  
*Ethernet at Its Best™*

**Magnum DS50 / DS60s**

# Dual Speed Hubs Plus



## Installation and User Guide

# Magnum™ DS50 / DS60s Dual Speed Ethernet Hubs Plus

## Installation and User Guide

Part #: 84-00055 (Rev C 10/01)

### Trademarks

Ethernet is a trademark of Xerox Corporation

NEBS is a trademark of Telcordia Technologies

UL is a registered trademark of Underwriters Laboratories

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**Important:** The Magnum DS50 / DS60 Dual-speed Hubs Plus contain no user serviceable parts. Attempted service by unauthorized personnel shall render any and all warranties null and void. If problems are experienced with a Magnum DS50 / DS60, consult Section 5, Troubleshooting, of this User Guide.

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**Federal Communications Commission****Radio Frequency Interference Statement**

*Warning: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.*

*NOTE: This equipment has been tested and found to comply with the limits for a class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference in a residential installation. This equipment generates, uses, and can radiate frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures.*

- *Reorient or relocate the receiving antenna.*
- *Increase the separation between the equipment and receiver.*
- *Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.*
- *Consult the dealer or an experienced radio TV technician for help.*

**Canadian Emission**

*This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.*

*Cet appareil respecte toutes les exigences du Règlement sur le matériel du Canada. Cet appareil est Classe B.*

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## REVISIONS

**Rev D 06/02:** Add 24VDC power option in Appendix B

**Rev C 11/01:** Change the company name to GarrettCom, Inc. (Formerly it was Garrett Communications). Add Fiber models to DS60s, add DIN-rail mounting option.

**Rev B 09/01:** Addition of warnings in French language. Fiber information added.

**Rev A 08/01:** This is the initial release of the DS50 / DS60 hub user manual.

# The Magnum Line

## ETHERNET CONNECTIVITY PRODUCTS

"DESIGNED AND MANUFACTURED IN THE USA"

### OVERVIEW

GarrettCom offers the Magnum line of Ethernet LAN connectivity products with industry-standard functionality. Magnum products are available worldwide through OEMs, integrators, representatives, retailers and international distributors.

**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.

**“Outdoor” Ethernet Switch**, for temperature uncontrolled locations

6 10/100 and 2 100Mb fiber ports, can be connected in strings

**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**

All media combinations, incl. fiber ST, SC, mm., single mode

**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, 02**

## 1.0 SPECIFICATIONS

### 1.1 Technical Specifications

#### Performance

##### Port 1-5: Repeater Ports, with bridge between

Data Rate: 10/100 Mbps (Dual-Speed)

PDV (Path Delay Value): 80BT

##### Port 6: Switched Port (DS60C only)

10/100Mbps (Dual-Speed)

When set to "FF":

Data Rate: 100 Mbps Full Duplex

PDV (Path Delay Value): 50BT (end node)

When set to "A"

Date Rate: 10Mbps or 100Mbps (Depends upon the connected speed on the other side; if the connected unit supports auto-negotiate then run on full-duplex otherwise half-duplex)

##### Packet Processing on Switched Port, port 6

Processing type: Store and Forward

Filtering and Forwarding Rate: Switch = "10", 14,880 pps max.

Switch = "100", 148,800 pps max

Auto-learning: 8K addresses

Packet buffers: 1MB dynamically allocated

Latency (not including packet time): 5µs

##### Packet Processing on Repeater Port, ports #1-5 bridged

Processing type: advertising and sharing

Auto-learning: 2K addresses

Packet buffers: 256 dynamically allocated and shared on ports #1-5

Latency (not including packet time): 5µs

##### Maximum Ethernet Segment Lengths

10BASE-T (unshielded twisted pair, 10Mb) - 100 m (328 ft)

100BASE-TX (Cat. 5 twisted pair, 100Mb) - 100 m (328 ft)

100BASE-FX, half-duplex: (multi-mode) - 412 m (1350 ft)

100BASE-FX, full-duplex: (multi-mode) - 2.0 km (6,562 ft)

100BASE-FX, half-duplex: (single-mode) - 412 m (1350 ft)

100BASE-FX, full-duplex: (single-mode) - 20.0 km (65,620 ft)

100BASE-FX, full-duplex: (single-mode, long)- 40.0 km (131,240 ft)

##### Network Standards

Ethernet IEEE 802.3u: 100BASE-TX

IEEE 802.3: 10BASE-T

##### Operating Environment

Ambient Temperature: 32°F to 122°F (0°C to 55°C)

Storage Temperature: -5°F to 160°F (-20°C to 70°C)

Ambient Relative Humidity: 5 % to 95 % (non-condensing)

**Power Supply (Internal) AC**

AC Power connector: IEC-type, male recessed, rear of chassis

Power Input Voltage: 100 to 240 VAC (auto-ranging)

Power Input Frequency: 47-63 Hz

Power Consumption: typical 6 watts, 10 watts max.

**Power Supply (Internal), Optional 24VDC and -48VDC**

**-48VDC Power** Input Voltage : 36 to 72 VDC

**24VDC Power** Input Voltage : 20 to 36VDC

Std. Terminal Block : “ -, GND, + ”

Power Consumption: same as for AC models, see above

DC-DC Converter Rating: 5VDC, 2Amps

**Manual Switches**

**Port 1 only, UP-LINK:** MDI-X thumb-operated slide switch, converts RJ-45 port from a regular (= position) user segment port to a crossover (X position)

**Port 6 only (DS60C):** Thumb-operated slide switch FF-A, The port #6 switched port can be set on “FF” (Full-duplex, Fixed 100Mbps) or at “A”(Auto-negotiation) to support auto-negotiate.

**Port 6 only (DS60F):** Thumb-operated slide switch FDX-HDX, The port #6 switched Fiber port can be set on “Fdx” (Full-duplex, Fixed 100Mbps) or at Hdx (Half Duplex) to provide better secure distance.

**Packaging**

Enclosure: High strength sheet metal.

Suitable for wiring closet shelf, wall or desktop mounting.

Dimensions: 9.1 in. D x 6.1 in. W x 1.3 in. H (23.0 cm x 15.5 cm x 3.3 cm)

Weight: 1.55 lb. (0.7 Kg)

Cooling method: Fan cooled, internal @ 7 cfm

**LED Indicators on Chassis**

PWR : Steady On when power applied

COL 100 (port1-5): Collision, flashing when collision occurs on ports 1-5 in the 100Mb collision domain.

COL 10 (port1-5): Collision, flashing when collision occurs on ports 1-5 in the 10 Mb collision domain.

LK/RX (port 1-5): Steady On when twisted-pair link is operational, flashing when port is receiving data

100 (port 6): Speed is at 100Mbps

FDX (port 6): Port is at Full duplex

**Agency Approvals (Under Test)**

UL Listed (UL 1950), cUL, CE

Emissions: meets FCC Part 15, Class A

**Warranty**

Three years, return to factory

Made in USA

## 1.2 Ordering Information

### Magnum DS50 / DS60 Dual-speed Hubs Plus Models

<b>Magnum DS60C</b>	Six dual speed ports, five 10/100 Dual-speed shared “hub” ports plus one 10/100 switched port, with shielded RJ-45 connectors and front-mounted LED’s. The port #6 switched port is a separate collision domain with wire-speed (10/100) filtering and forwarding of traffic, 1Mb dynamically allocated packet buffers and 8K-entry self-learning address table. The selection of Full Fixed and Auto-negotiation for port #6 can be set through manual switch. Internal universal power supply, up-link switch or port #1. Optionally available with 24VDC and -48VDC internal power supply.
<b>Magnum DS60F-MS</b>	Same as DS60C except 6 <sup>th</sup> port is switched fiber port, multi-mode SC, can be set as Full duplex (by default) or Half-duplex by manual switch underneath.
<b>Magnum DS60F-SS</b>	Same as DS60C except 6 <sup>th</sup> port is switched fiber port, single-mode SC, supports 20Km distance
<b>Magnum DS60F-SS</b>	Same as DS60C except 6 <sup>th</sup> port is switched fiber port, single-mode SC, Long reach 40Km distance
<b>Magnum DS50</b>	Same as Magnum DS60C, but without the switched port # 6, has only the 5 repeater ports with dual speed (10/100) capability.
<b>MST Conversion</b>	Special order item, convert fiber SC port to ST-type connector.

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



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## 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 DS50 or DS60s Dual-speed Hub Plus unit
- 1 AC Power Cord (U.S. and other 115 vac locations only)
- 2 Metal mounting brackets for optional vertical mounting
- 2 Mounting screws for use with the metal mounting brackets
- 1 Installation and User Guide
- 1 Product Registration Card

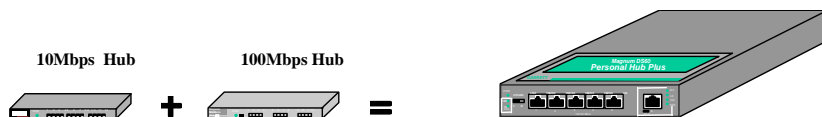
Remove the Magnum DS50 / DS60 Dual-speed Hub Plus from the shipping container. Be sure to keep the shipping container should you need to ship the unit at a later date. To validate the product warranty, please complete and return the enclosed Product Registration Card to GarrettCom as soon as possible.

In the event there are items missing or damaged, contact your supplier. If you need to return the unit, use the original shipping container. Refer to Chapter 5, Troubleshooting, for specific return procedures.

## 2.2 Product Description

The Magnum DS60C Dual-speed Hub Plus is an easy to install, cost-effective Dual-speed hub. It has five 10/100Mb repeater shared ports along with a 10/100 Mbps switched port that can be configured to provide “auto-negotiating” or “Full fixed” connectivity between a 100Mb segment and a 10Mb segment; or between two 100Mb segments at full duplex capability. The Magnum DS60F belongs to the same DS60’s family except the sixth port is a switched Fiber port at 100Mbps and can be set at Full-duplex or Half-duplex to support any connectivity with Hubs or switches. The “future-proof” fiber port provides a secure longer distance advantage and eliminates the need for a media converter,

The Magnum DS50 dual-speed hub has only the five 10/100 Mb repeater ports. Each port can independently identify (via IEEE 802.3u auto sensing) and accept either 100Mbps or 10Mbps Ethernet signals, adapting to match the best speed of the connected device. Each unit has its own internal power supply. The Magnum DS50 / DS60 Dual-speed Hub Plus has two internal traffic domains . . . one for the 100 Mb domain and one for the 10Mbps domain. The 100Mbps users share the 100Mbps domain’s bandwidth and the 10 Mbps users share the 10Mbps domain’s bandwidth.



**Fig. 2.2.1 Magnum DS50 / DS60 is functionally both a 10Mbps and 100Mbps in one**

The Magnum DS60s, because of their dual-speed capability and switched ports, are ideally suited for adding a Fast Ethernet workgroup to an existing 10Mb or 100Mb network. A small 10/100Mb workgroup connects to the five “hub” ports while another workgroup or an existing network segment . . . a separate collision domain of 10Mb or 100Mb units . . . connects to port 6. For expansion of the five 10/100Mb ports, an additional 100Mbps or 10Mb hub can be cascaded from port 1. Each domain can have its own local servers and other local traffic. Thus, the DS60s can bridge-isolate one collision domain from the other, separating the local traffic between each workgroup’s users and servers from the rest of the network. The Magnum DS60s will filter and forward the packets to / from port 6 and the other ports, thereby giving more bandwidth to each domain for maximum network performance.

The Magnum DS50 / DS60s are available with an internal AC Power supply with auto-ranging power voltage (100 - 240 VAC). The 24VDC and -48VDC Power supply option enables this product to be used in the industrial and telecom markets. The Magnum DS50 /

DS60s are “plug and play” units enclosed in a lightweight, compact, rugged metal enclosure suitable for office, lab and industrial sites. The DS50 / DS60s are available for horizontal or vertical mounting (see Section 3.1).

### 2.2.1 Magnum DS60F Dual-speed Hubs Plus, with Fiber Switched Port

The Magnum DS60F chassis houses one main board equipped with five hub ports and a switched fiber port. The switched fiber port is available with an SC connector and options of multi-mode, single-mode and long reach. It has an internal power supply and a small cooling fan in the bottom, extending ambient operation to 55C. The port side of the chassis consists of five shared 10/100Mb RJ-45 ports and one 100Mb switched SC fiber port. There is an up-link (UPLINK) switch next to Port 1, which allows this port to be used for cascading to a hub or switch. There is a manual switch “F-H” underneath the switched port #6 which provides “Full-duplex” and “Half-duplex” capability to the switched port



The Magnum DS60F has power (PWR) and collision (COL) LED's and 10 and 100 LEDs for the unit. It also has link (LINK) and receive (RX) activity LEDs for each of the five shared ports and for Port 6. The port #6 has a Full-duplex (FDX) and a speed (100) LED also. Rubber feet on the bottom provide a sturdy grip and clearance for the exhaust of the cooling fan.

The internal power supply is an auto ranging AC power supply for input of 115-230 vac, 50/60 Hz. Optionally available are 24VDC and -48VDC for the industrial and telecom markets. The recessed male IEC power connector is located at the right-rear. Two mounting brackets for optional wall mounting are supplied with each unit. An optional “edge-stand” is available (See “*Spare Parts Price List*”) and is used for floor-mounting on carpeted surfaces.

## 2.2.2 Fiber port, SC Connector for Model DS60F



### SC type (single-mode or multi-mode)

The Fast Ethernet fiber switched port on the Magnum DS60F is set to operate at fixed 100Mb speed for guaranteed high performance. The DS60F's fiber port is factory-built and available either as a multi-mode SC, or

a single-mode or long-reach SC connector. The 100Mb fiber port will run at 100Mbps speed at all times with manually selected full- and half-duplex capability. The 100Mbps fiber port is a switched port and performs as a separate traffic domain, providing a high bandwidth backbone connection (no media converter is required !) and supporting long (up to 40km) fiber cable distances for installation versatility.

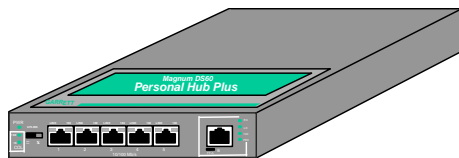
Port 6 (the fiber port) has an "F - H" user-selectable manual switch. When set in the "F" position, it forces full-duplex mode. When set in the "H" position, it forces half-duplex mode, still at 100Mbps speed.

On Magnum DS60F units, there are three LED's for the switched ports. One (LK) is steady ON to indicate LINK is operational. The speed (100) LED is ON for 100Mbps and OFF for 10Mbps (when LINK is made). The F/H indicates full-duplex when ON. When it is OFF, operation is half-duplex.

A fiber cable must be connected to the 100Mb port and a proper link (LK light) must be made with the device at the other end of the cable in order for these LEDs to provide valid indications of operating conditions.

## 2.2.3 Magnum DS60C Dual-speed Hubs Plus with Copper port, Chassis

The Magnum DS60C chassis houses one main board for the five hub ports and for the switched port. It has an internal power supply and a small cooling fan in the bottom. The front side of chassis consists of



### Magnum DS60C Dual-speed Hubs Plus

five shared 10/100Mb RJ-45 ports and one “10/100Mb switched RJ-45 port. There is an up-link (UPLINK) switch for Port 1. There is a manual switch “FF-A” underneath the switched port #6 that controls and provides “full-fixed” and “Auto-negotiation” capability to the port.

## 2.2.4 Port #6: Switched 10/100 Mb/s Port for DS60C only

For Magnum DS60C

Dual-speed Hub plus has Port 6 as a switched port located on the right front panel. Because of its dual speed and auto negotiation capability, it operates either as a 10BASE-T port or as a 100BASE-TX port. The speed may depend upon the attached unit’s speed. See section 4.3 for more details about the 10 or 100 switch.

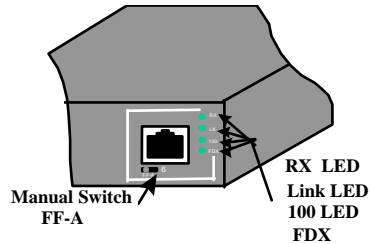


Figure 2.2.3: Port 6: Switched 10 or 100Mb Port

This switched port offers great flexibility in connecting the DS60C . . . as an additional 10/100Mb segment . . . to an existing 10 or 100Mb network. Because this port is segmented from the other DS60C ports, it provides a separate collision domain. Accordingly, the DS60C can be used as plug-and-play in practically any 10Mb or 100Mb network domain.

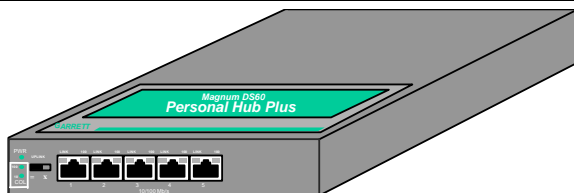
The Magnum DS60C has power (PWR) and collision (COL) LED’s and 10 and 100 LED’s for the unit. It also has link (LINK) and receive (RX) activity LED’s for each of the five shared ports and for Port 6. The port #6 has Full-duplex (FDX) and speed (100) LED’s too. Rubber feet on the bottom provide a sturdy grip and clearance for the exhaust of the cooling fan.

The internal power supply is an auto ranging AC power input of 115-230 vac, 50/60 Hz. The recessed male IEC power connector is located at the right-rear. Two mounting brackets for optional wall mounting are supplied with each unit. An optional “edge-stand” is available (See “*Spare Parts Price List*”) and is used for floor-mounting on carpeted surfaces.

## 2.2.5 Magnum DS50 Dual-speed Hubs Chassis

The Magnum DS50 chassis houses one main board for the five dual-speed repeater ports. It has an internal power supply and a small cooling fan in the bottom. The front side of chassis consists of five shared 10/100Mb RJ-45 ports. There is an up-link (UPLINK) switch next to Port # 1, which it controls.

## Magnum DS50 Dual-speed Hubs

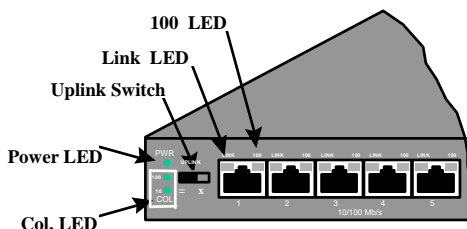


The Magnum DS50 has a power (PWR) and collision (COL) LED's and 10 and 100 LED's for the unit. It also has link (LINK) and receive (RX) activity LED's for each of the five shared ports. Rubber feet on the bottom provide a sturdy grip and clearance for the exhaust of the cooling fan.

The internal power supply is an auto ranging AC power input of 115-230 vac, 50/60 Hz. The recessed male IEC power connector is located at the right-rear. Two mounting brackets for optional wall mounting are supplied with each unit. An optional "edge-stand" is available (See "Spare Parts Price List") and is used for floor-mounting on carpeted surfaces.

### 2.2.6 Ports 1-5: 10/100 Mb/s Shared Ports for DS50 / DS60

The Magnum DS50 / DS60 Dual-speed Hubs has Ports 1-5 as shared 10Mb / 100Mb ports. Each port has its own Link LED and an RX (receive) activity LED to indicate its status. These LED's are built into the RJ-45 connector. The



**Figure 2.2.2 : Ports 1-5 : Shared 10/100Mb Ports**

Link LED will be on when proper cable connection is made on both ends and the RX LED will flash to indicate activity when the port is receiving data.

The up-link switch for Port 1 is located on the left side and enables port 1 to either connect to a user station or to cascade with another hub or switch. See section 4.4 for more details about up-link.

### 2.2.7 10 / 100 Speed Auto-sensing

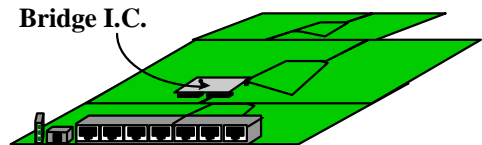
The first five ports, # 1-5 RJ-45 twisted pair ports, support auto-sensing for speed and independent of the other ports. Speed-sensing is performed by the DS50 / DS60 electronics in accordance with the standards of the IEEE 802.3u auto-negotiation standard. If the connected

device or node indicates that it is capable of 100Mbps speed, then operation on that port will be at 100Mbps. If the connected device does not positively indicate that it is capable of 100Mbps speed, then the operation on that DS50 / DS60 port will be at 10Mbps. Of course, the hubs' auto-negotiation technique is only for 10/100 speed, and does not provide for any full-duplex operation.

The per-port 10/100Mbps LK/RX LED's on each repeater port indicate the result of auto-sensed speed detection, and the resulting connectivity to either a 10Mbps or 100Mbps device. The 100Mbps LED will illuminate (GREEN) when 100Mbps signals are detected; it will have a steady ON if there is no traffic and it will have a blinking ON when the port transmits and receives data packets. Similarly, for 10Mbps speed, it will be "off" when a 10Mbps signal (or no reply to auto-negotiation) is detected, and it will blink if the linked port is transmitting and receiving.

### 2.2.8 Bridge logic between the 10 Mbps and 100Mbps Domains

**Figure 2.3 : Internal view of DS50 with bridge logic**



Magnum DS50 / DS60's contain bridge logic (in the Integrated Circuit) to interconnect the two traffic domains and filter and selectively forward packets to allow only necessary packets to cross between the domains. This enables all of the users and nodes connected into either domain, whether 100Mbps or 10Mbps, to communicate to each other. It also keeps local traffic on one domain from consuming any of the bandwidth from the other.

The bridge operates in the store-and-forward mode, which filters out bad packets and maintains optimum performance in both domains. Packet forwarding delay is only 5 $\mu$ s (plus packet time). This is much less than traditional store-and-forward bridge products, enabling DS50 / DS60's to maintain high network performance. The bridge has a 2K node address capacity, suitable for use in medium-sized networks. Addresses are self-learning so that filtering/forwarding of 10Mbps and 100Mbps packets is maintained correctly even when users move their connection, change speed, or power down.

### 2.2.9 Up-link Switch for Cascading

The unit has an up-link switch located next to Port # 1 of the hub. It enables the port's cable to cascade to another shared hub or switching hub port. (See Section 4.4 for more details about up-link). Port # 1 is a dual-speed port that will sense the speed of the connected device.

The up-link operates the same, whether Port # 1 is connected to either a 100Mbps or 10Mbps device.

When the up-link port is used to cascade two DS50 / DS60 hubs, the auto-sensing feature of the DS50 / DS60 will cause the connecting link to operate at 100Mbps speed.

## 2.3 Frame Buffering and Latency

The Magnum DS60's 6<sup>th</sup> port is a store-and-forward switch. 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, Magnum DS60's Switched port dynamically allocates buffer space from an 1MB 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.) This dynamic buffer allocation provides the capability for the maximum resources to the DS60's 6<sup>th</sup> port 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 DS60's Switched 6<sup>th</sup> port is 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 DS60's Switched port 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 DS60's Switched port 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.

## 2.4 Features and Benefits

### ■ Supports 10 or 100Mbps network connections on each of six RJ-45 ports

A Magnum DS50 / DS60 Dual-Speed hub combines two logical hubs -- one at 10Mbps and one at 100Mbps -- in one physical box supporting two traffic domains. Each port can operate at either 10 or 100Mbps, independently of the other ports.

### ■ “Future Proof” Fiber Switched port (for DS60F model only)

The Magnum DS60F model, equipped with one Switched fiber port at 100Mb, enables it to provide secure longer cable distances, and eliminates the use of a media converter. The fiber port is available in SC multi-mode, single mode and Long reach.

### ■ “Plug and Play” Installation and Operation

The DS50 / DS60 Dual-speed Hub Plus learns the network addresses of both network segments from the packets in the traffic, so there is no software set-up required. As nodes are added or changed, the unit learns the new network addresses and adapts its filtering and forwarding of packets automatically.

### ■ Segments 100Mb networks for high performance and simplified expansion

The Magnum DS60's (only) provides a separate collision domain which maximizes available bandwidth for both of the attached segments, enhancing network performance. The segmentation of the switched port 6 also resets cable distance limitations and repeater hop counts to enable easy expansion of 10/100Mb nets.

### ■ User configurable Port 6 for Auto-negotiation or Full-Fixed (DS60C only)

The Magnum DS60C sixth switched port has a manual switch underneath the port it controls. The user can manually select port #6 to Auto-negotiation as per the attached unit capability, or for Full-Fixed 100Mb FDX with no auto-negotiation..

### ■ Standard Repeater ports for network diagnostic use

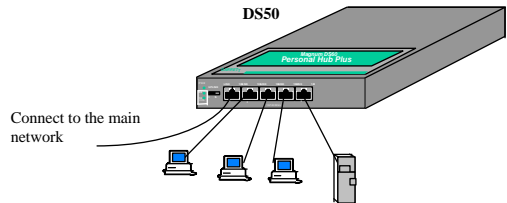
Ports 1-5 are Ethernet Repeater ports, and operate by broadcasting packets received to all the other hub ports operating at the same speed. Because they are repeater ports, ports 1-5 may be used for network diagnostic tools such as a sniffer. Note that the ports operating at 10Mb and at 100Mb are in separate traffic domains.

### ■ Compact Enclosure Allows for Versatile Installation with AC & DC

The compact physical size of the Magnum DS50 / DS60 package allows it to be installed in office or lab locations. The rugged metal enclosure provides durability, and the internal universal power supply enables one model to be usable worldwide. The optional DC power supply with -48VDC or 24VDC qualifies the DS50 / DS60s for use in Industrial and telecom applications.

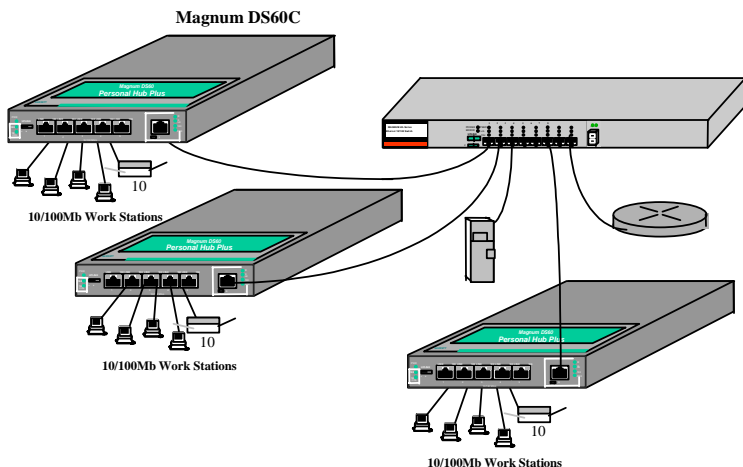
## 2.5 Applications

The Magnum Dual-speed Hub Plus is designed to provide dual speed (10/100Mbps) connectivity. Pictured below, a Magnum DS50 Dual-speed Hubs serves a small office with mixed speed requirements. Some users operate at 100Mbps, and some users and utility devices (such as print servers) run at 10Mbps. All share the same hub, and communicate to each other via the bridge logic inside. Any node can change speed at any time without affecting network operation or impacting other users. It is simple to install and use, making shared Fast Ethernet networks practical for connecting high performance user groups in a variety of ways.



Since 10/100 NICs are widely available at low cost, 100BASE-TX Fast Ethernet has become desirable for many performance-oriented users. They usually want their new 100Mb network segment to be interoperable with existing 10Mb networks, and to be a separate collision domain in order to maximize performance of both segments. This is where bridged-dual-speed provides flexibility by enabling the newly installed 100Mb ports to communicate smoothly with existing 10Mb nodes and hubs.

For this example, DS60C Port 6 may be used as a 10Mb port to an existing 10Mb hub while Ports 1-5 are a new separate collision domain of shared 10/100 ports.

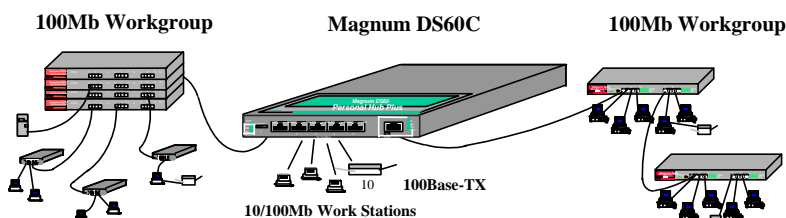


**Figure 2.4.1 : DS60C for different department with high bandwidth from switch port**

To add more 10/100Mb stations, another 10/100Mb workgroup can be added using a DS60C hub. By placing the Magnum DS60C Dual-speed Hub Plus in the middle, it acts as a bridge separating the 10Mb and the 100Mb traffic domains and provides each department with full bandwidth.

The previous examples show that the Magnum DS60C Dual-speed Hub Plus not only provides connectivity between a 100Mb workgroup and a 10Mb workgroup, but it also segments the local traffic of the new and the existing segments from each other. This type of configuration is ideal for adding a new 100Mb workgroup without slowing down the existing 10Mb network with all the unwanted local packets from the new workgroup.

Consider yet another situation in Figure 2.4.3 where a new 100Mb user group is to be added to an existing 100Mb network. The Magnum DS60C not only provides more 100Mb ports to the network, it also adds a collision domain giving configuration flexibility to the new user group. The existing network can grow without having to worry about cable distance limitations and repeater hop counts associated with the new segment.



**Figure 2.4.3 : Joining two 100Mb workgroups with a Magnum DS60C**

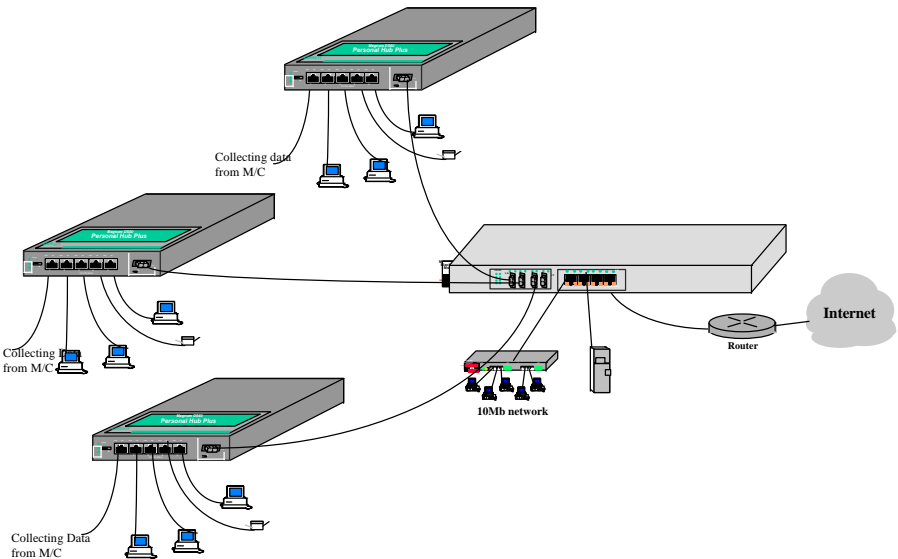
The above figure shows two 100BASE-TX segments connected via a Magnum DS60C. All packet forwarding and filtering is done by the Magnum DS60C and is transparent to the users, who only see one network in terms of node addresses. Performance of the network is enhanced as the available bandwidth on each segment will not be affected by the local traffic on the other segment.

Since the DS60C Dual-speed Hub Plus segments the network, the bandwidth available for each collision domain is maximized.

In this example, a Magnum DS60F Dual-speed Hub serves in an Industrial place with servers and mixed-speed requirements, such as collecting data or downloading data from servers or other sources. Some users operate at 100Mbps, and some users and utility devices (such as print servers) run at 10Mbps. High performance users need a high bandwidth backbone for access to a central LAN and central file servers. A Magnum DS60F Dual-speed Hub with 24VDC or -48VDC power supply serves this requirement economically. The five dual-speed port capability and a 100Mbps Fiber port makes the required setup simple. Any attached node can change speed at any time without affecting network operation or impacting other users.

Existing 10Mbps hub or switch users can easily be cascaded into any copper ports of the DS60F. This allows a simple plug-and-play addition of 100Mbps port to an existing 10Mbps network without having to change it. Nodes that are capable of 100Mbps speed can be moved to a DS60F port, and will automatically operate at the higher speed.

The 100Mb Full-duplex (default) fiber port on the DS60F can be used for accommodating high performance data transfers, and provides fiber connectivity built-in rather than needing an auxiliary media converter unit. The 100Mbps traffic does not use the bandwidth of the 10Mbps domain, so overall performance of the network is sustained at the highest possible level.



**Fig 2.4.4 DS60s in Industrial use for collecting data from the M/C**

### 3.0 INSTALLATION

This chapter provides instructions for installing the Magnum DS50 / DS60 Dual-speed Hub Plus.

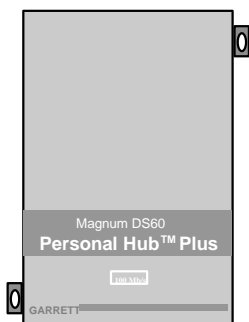
#### 3.1 Locating the Magnum DS50 / DS60 Dual-speed Hubs Plus

The location of the Magnum DS50 / DS60 Dual-speed Hub Plus is dependent on the physical layout of the network and the workgroup to be bridge-isolated. The compact size of the unit allows it to be table-top, shelf or wall-mounted. Brackets for vertical mounting are included. The cooling fan in the bottom of the unit exhausts air underneath the unit, so the space around the rubber feet should be kept clear. (An optional floor stand for edge-mounting is available - see GCI's *Spare Parts List* - and this stand is recommended for use on carpeted floors.)

Locate an AC receptacle that is within six feet (2 meters) of the intended Magnum DS50 / DS60 site. (For optional DC power, see Appendix B). The rugged metal case of the Magnum DS50 / DS60 will normally protect it from accidental damage in a lab or workplace setting. Keep an open area around the unit so that cooling can occur while the unit is in operation.

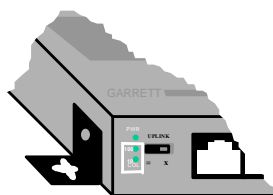
##### 3.1.1 Table-Top or Shelf Mounting

The Magnum DS50 / DS60 Dual-speed Hub Plus can be easily mounted on a table-top or any suitable horizontal surface. It also has four rubber feet to provide stability without scratching finished surfaces. Air from the cooling fan exhausts to the underneath side.



**Magnum DS60C, optional mounting brackets**

##### 3.1.2 Wall (or Vertical Surface) Mounting



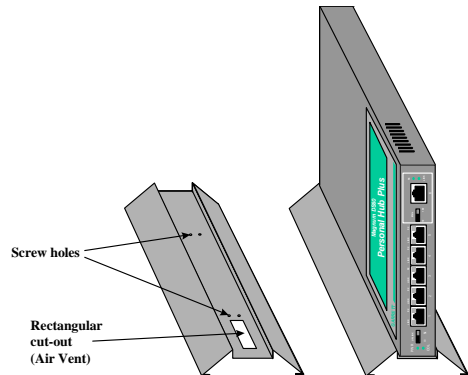
**bracket attachment  
Proper mounting**

Each Magnum DS50 / DS60 Dual-speed Hub Plus is shipped with two mounting brackets (and screws), to allow the unit to be mounted in nearly any desired orientation or position. The brackets are attached to the unit's case with one of the metal screws for each bracket. It is recommended that the brackets be attached to two opposite corners on the unit. The brackets should be attached to the Magnum DS50 / DS60 through the round hole of the bracket. When properly attached, the brackets will extend slightly below the base of the unit to allow clearance for the rubber feet.

### 3.1.2 Optional mounting methods, DIN-rail and E-Stand

**A)** For DIN-rail mounting, a kit is needed that uses the metal mounting brackets (see 3.1.1 above) to attach DIN-rail clips that hold the unit in a vertical position, Ethernet cables attaching at the bottom. For additional information on DIN mounting, email [support@GarrettCom.com](mailto:support@GarrettCom.com)

**B)** The E-Stand provides a vertical mounting option for the DS50 / DS60s. When horizontal placement is not possible or desirable (such as when the unit is placed on a carpeted floor, which would potentially block air flow from the cooling fan), the E-Stand offers a convenient installation option. Simply align the rectangular cut-out on the E-Stand with the air vent on either side of the DS50 / DS60. The E-Stand also allows the DS50 / DS60 unit to be securely mounted via two screws that connect through the E-Stand and into the side of the unit.



### 3.2 Ethernet Media, connections and Specifications

The Magnum DS50 / DS60 Dual-speed Hub Plus can be connected to the following three media types: 100BASE-TX, 10BASE-T and 100BASE-FX. 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). For fiber port 100BASE-FX multi-mode, 50/125 or 62.5/125 microns cabling can be used, whereas for single-mode, 9/125 microns cabling should be used. Fiber cabling supports much longer cable distance and higher bandwidths as compared to copper wiring.

<b>Media</b>	<b>IEEE Standard</b>	<b>Connector</b>
Twisted Pair (CAT 3 or 5)	10BASE-T	RJ-45
Twisted Pair (CAT 5)	100BASE-TX	RJ-45
Fiber (Multi-mode)	100BASE-FX	SC
Fiber (Single-mode)	100BASE-FX	SC

**NOTE :** *It is recommended that high quality CAT. 5 cables (which work for both 10Mbps and 100Mbps) be used whenever possible in order to provide flexibility in a mixed-speed network (since DS50 / DS60 hub ports are auto-sensing for either 10 or 100Mbps). Note that the auto-sensing function does not sense the cable type.*

### 3.2.1 Connecting Twisted Pair (RJ-45, CAT 3 or CAT 5, Unshielded or Shielded)

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. If this does not help, ensure that the cable is connected properly and that the device on the other end is powered and is not defective.
4. For Port # 1 or 1SW, if the LINK LED is not illuminated, move the switch which has a cross-over or up-link for linking to another hub or Switch.

### 3.2.2 Connecting Fiber Optic SC-type, "Snap-In"

The following procedure applies to installations using SC-type fiber connectors. This procedure applies to ports using multi-mode SC fiber connectors.

1. Before connecting the fiber optic cable, remove the protective dust cap / plug from the end of the fiber connectors, exposing the ports opening. Save the dust cover / plug for future use, in case the fiber cable needs to be unplugged for service.
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. Then, insert the square male connector into the SC female jack of the Fiber port connector until it clicks and secures.

**Note:** *One strand of the duplex fiber optic cable may be coded using color bands at regular intervals; you should use the color-coded strand on the associated ports at each end of the fiber optic cable segment.*

3. Connect the Transmit (TX) port on the Magnum Fiber port 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. Note – the two male square-end SC cable strands may be fastened together to plug as a unit.
4. Connect the Receive (RX) port to the Transmit (TX) port of the remote device. Use the non-color coded fiber strand for this.



- The LINK LED for the fiber connector 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 fiber connector to remedy this situation.

### 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, about 20Km with the single-mode SC.

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

### 3.2.4 Power Budget Calculations for DS60F 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:

$$\text{OPB (Optical Power Budget)} = P_T(\text{min}) - P_R(\text{min})$$

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

$$\text{Worst case OPB} = \text{OPB} - 1\text{dB}(\text{for LED aging}) - 1\text{dB}(\text{for insertion loss})$$

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

where the “Cable Loss” for 62.5/125 and 50/125 $\mu\text{m}$  (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 (HP’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 $\mu\text{m}$	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
DS60F-xMSC	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
DS60F-xSSC	100Mb FX	Single-mode	20 (0.4)	1300	9/125	-15	-31	14	28	17.5	35
“Long Reach”	100Mb FX	Single-mode	40 (0.4)	1300	9/125	-5	-34	27	54	32.5	65

\* **Note:** The use of either multi-mode or single-mode fiber to operate at 100Mbps speed over long distances (i.e., over 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, 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)

### 3.2.5 Connections to NICs which support Auto-Negotiation, RJ-45 ports

The copper ports of Magnum DS50 / DS60s will function properly with NICs (Network Interface Cards) which support Auto-Negotiation, and the Fast Link Pulse (FLP) coding for the 100BASE-TX signaling system. When connecting a NIC to a DS50 / DS60, it may be necessary to reload the NIC drivers on the user device if the NIC has been communicating with a protocol other than 100BASE-TX (such as 10BASE-T). When 100Mb speed is agreed and in use, the 10/100 LED is steady ON. It is OFF if there is no traffic or if there is 10Mbps traffic.

In cases where 100BASE-TX connection 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).

<b>Media</b>	<b>IEEE Standard</b>	<b>Connector</b>
Twisted Pair (CAT 3 or 5)	10 BASE-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 Mbps and 100Mbps) 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 100Mbps. Note that the auto-sensing function does not sense the cable type.*

### 3.2.6 Collision Domain Diameter

The Collision Domain Diameter is the length of the longest path between any two devices in a single collision domain. A collision domain is defined as a cluster of network devices that are connected by means of a repeater or repeaters such that no bridging devices are present between any two devices in the cluster. In order to install an IEEE 802.3u compliant Fast Ethernet network, the collision domain, regardless of the actual network topology, must be less than 512 BT (Bit Times). Bit Times are related to media types as shown in Table 3.2a.

**Table 3.2a: Worst case round-trip delay for Fast Ethernet media\***

<b>Media Type</b>	<b>Round-trip delay in Bit Time per Meter (BT/m)</b>
<b>Fiber Optic</b>	1.000
<b>Shielded TP cable</b>	1.112
<b>Category 5 Cable</b>	1.112
<b>Category 4 Cable</b>	1.140
<b>Category 3 Cable</b>	1.140

\*Worst case delays taken from IEEE Std 802.3u-1995, actual delays may be less for a particular cable. Contact your cable supplier for exact cable specifications.

Each Fast Ethernet device component also has an associated BT delay, which depends on the physical signaling system employed. Table 3.2b shows each Fast Ethernet device component and the associated BT delay. Note that there is only one DTE pair associated with any device-to-device path.

**Table 3.2b: Worst case round-trip delay for Fast Ethernet device components\***

Component	Round-trip delay in Bit Times (BT)
2 TX DTEs	100
2 FX DTEs	100
1 FX and 1 TX DTE	100
2 T4 DTEs	138
1 T4 and 1 TX or FX DTE	127
Class I Repeater	140
Class II Repeater with any combination of TX and FX ports	92
	<i>**Note, the delay is only 80 Bit Times for the MagnumDS50 / DS60, ports 1-5.</i>

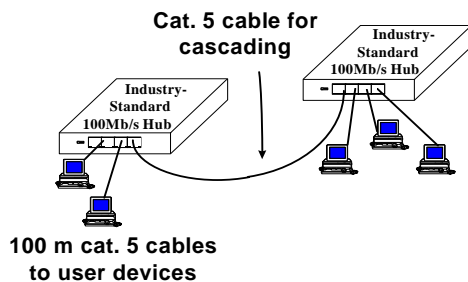
\*Worst case delays taken from IEEE Std 802.3u-1995.

To determine whether a prospective network topology adheres to the collision domain diameter specification, the following formula should be applied to the worst case path through the network. The worst case path is the path between the two Fast Ethernet devices (DTEs) which have the longest round trip time.

$$\text{PDV} = (\text{sum of cabling delays}) + (\text{sum of repeater delays}) + (\text{DTE pair delay}) + (\text{safety margin})$$

PDV is the Path Delay Value of the worst case path. For the network to adhere to IEEE standard, this value must be less than 512 BT. The safety margin is specified in BT and may be a value between 0 and 5. This margin can be used to accommodate unexpected delays, as seen when using extra long patch cables. A safety margin from about 2 to 4 BT is recommended.

A typical example of a PDV calculation is shown to the right. The example is illustrated in Figure 3.2a. Here, an integrator wishes to cascade two industry-standard Fast Ethernet hubs with 100m Category 5 user segments (i.e., from computer to hub) and



needs to know the total length of the Category 5 cable used to cascade the hubs. The variable “X” is used to represent the unknown maximum cascade length.

$$\text{PDV} = \text{X} + ((111.2 + 111.2) + (92 + 92) + (100) + 0) \text{ BT} < 512 \text{ BT}$$

$$512 > (\text{X} + 506.4) \text{ BT}$$

$$\text{X} < (512 - 506.4) \text{ BT}$$

$$\text{X} < 5.6 \text{ BT}$$

$$\text{X} < (5.6 \text{ BT}) / (1.112 \text{ m/BT})$$

$$\text{X} < 5.03 \text{ m}$$

⇒ **5.03 m maximum length for Category 5 cascaded cable**

If the integrator uses Magnum hubs, he can increase the length of the cascaded segment.

Additionally, as the Magnum hubs have a lower delay value (60BT rather than 92BT), the integrator can cascade **three** Magnum hubs with the maximum user cable lengths. The calculation is shown below. The variable “X” is used to represent the unknown maximum cascade length.

$$\text{PDV} = \text{X} + ((111.2 + 111.2) + (60 + 60 + 60) + (100) + 0) \text{ BT} < 512 \text{ BT}$$

$$512 > (\text{X} + 502.4) \text{ BT}$$

$$\text{X} < (512 - 502.4) \text{ BT}$$

$$\text{X} < 9.6 \text{ BT}$$

$$\text{X} < (9.6 \text{ BT}) / (1.112 \text{ m/BT})$$

$$\text{X} < 8.63 \text{ m}$$

⇒ **8.63 m maximum total length for Category 5 cascading segments,**

Where 111.2 is the BT delay for 100m of Category 5 cable (1.112 BT/m\* 100m), **60** is the BT delay for each of the Magnum hubs, 100 is the BT delay for the TX DTE pair, and a safety margin of 0 was used. (Note the internal switch on port 6 does not enter into this calculation of one collision domain’s cable lengths. If used, port 6 of the Magnum DS60C when set to 100Mb has a PDV of 50BT, the same as a NIC or node.).

The resulting value tells us that two Category 5 cables whose combined lengths do not exceed 8 meters may be used to cascade the three Magnum DS50 & DS60’s. Note that this cable length may alternatively be increased by shortening the lengths of the 100m cables to users.

Table 3.2c shows maximum cable lengths for common network configurations. The above calculations should be performed for calculations not listed in the table.

**Table 3.2c: Maximum segment lengths for common network configurations**

Number of Hubs	Repeater Hop Count	Max. User Segment Lengths (m)	Max. Inter-Repeater (Cascade) Length (m)	Notes
1	1	100.0	N/A.	All ports TX
2	2	100.0	5.0	All ports TX
2	2	92.0	20.0	All ports TX
2	2	79.5	1.0	1 hub T4, 1 hub TX and T4 (class I repeater), all cables Cat. 5
3+	3	60.0	1.0	All ports TX

### 3.3 Powering the Magnum DS50 / DS60

Magnum DS50 / DS60 Dual-speed Hub Plus incorporates an internal universal power supply and has a recessed male IEC connector for the AC power cord at the right-rear. A six-foot 115vac 60Hz power cord is supplied with each unit shipped within the United States and Canada.



**AC Power: Auto-ranging  
100-240 vac, 47-63 Hz**

Each DS50 / DS60 auto-ranging power supply supports installation environments where the AC voltage is from 100 to 240 volts with an input frequency between 47 and 63 Hz, and consumes a maximum of 20 watts.

In order to power down the unit, simply unplug either end of the power cable.

**NOTE:** *The DC Power Supply option, -48VDC and 24VDC are described in APPENDIX B.*

## 4.0 OPERATION

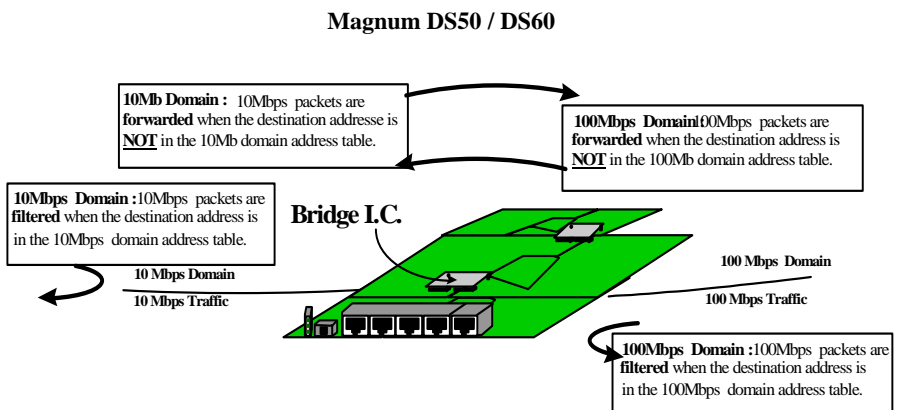
This chapter describes the function and operation of the Magnum DS50 / DS60.

### 4.1 Dual-Speed Functionality

The repeater ports (port #1-5) of a Magnum DS50 / DS60 handles the two different traffic domains separately. The DS50 / DS60 provides switched (bridged) connectivity between the Ethernet (10Mbps) and Fast Ethernet (100Mbps) domains. It joins the two network domains for unified operation and filters/ forwards packets in both directions to maximize bandwidth utilization and performance. The Magnum DS50 / DS60 is a hardware plug-and-play device. There is no software set-up to be done at installation or for maintenance. The functions of the DS50 / DS60 is described in this manual.

Each time a packet is received on one domain of the bridge logic, the decision is taken to either filter or forward the packet. Error packets are always filtered. For good packets, the filter and forward decisions are made based on the destination addresses contained in each packet. If the destination address is on the same domain from which the packet originated, then it is filtered and not forwarded to the other domain. If the destination address is not found to be a match in the address table for the originating domain, then it is forwarded to the other domain. If it is a new node address coming in which the switch did not previously know about, it “learns” the new address and puts it in the correct port address table. See “Address Learning” for more details.

This diagram below shows the filter / forward logic for both domains at port # 1-5.



**Figure 4.1 : Filtering and Forwarding at port (1-5) in DS50 / DS60 Dual-speed Hubs**

<b>Packet Source</b>	<b>Source Address</b>	<b>Destination Address</b>	<b>Address Table Maintenance</b>	<b>Filter/Forward Action</b>
10 Mbps	Not in table	Not in table	Add source to table	Forward
10Mbps	Not in table	In table	Add source to table	Filter
10Mbps	In table	Not in table	None	Forward
10Mbps	In table	In table	None	Filter
100Mbps	Not in table	Not in table	Add source to table	Forward
100Mbps	Not in table	In table	Add source to table	Filter
100Mbps	In table	Not in table	None	Forward
100Mbps	In table	In table	None	Filter

**Table 4.1: DS50 / DS60 Dual-Speed Hub Functionality**

## 2. Address Learning (Address Table Maintenance)

The Magnum DS50 / DS60 bridge logic is a state machine design which has a total address table capacity of 2K addresses. With a large address table, a Magnum DS50 / DS60 can serve the needs of medium-sized to large networks. Table 4.1 shows what filter / forward action the Magnum DS50 / DS60 will take in each packet-processing situation and when a new node address will be added to the internal Address Table. When a new node-address packet comes into a port for the first time, then the new source address is “learned” at the same time that the packet is forwarded. After learning, subsequent packets from the same node address are routinely processed. The address tables are flushed periodically to update the network status and to purge any inactive stations from the tables of both domains.

## 3. Throughput Increase

By selectively forwarding packets from each domain to the other domain based on its switching (bridging) logic, the Magnum DS50 / DS60 increases the available bandwidth for the users on both sides of the network. As shown in Figure 4.1, it keeps the local traffic on each side contained, preventing unnecessary packets and bad packets from traveling to the other domain and using up bandwidth needlessly. This results in more available network bandwidth on both sides and a throughput increase for all users on both domains.

## 4. Software Transparency

The Magnum DS50 / DS60 Dual-speed Hub need no software set-up and is transparent to system and application software, including network management software.

## 4.2 Auto-negotiation and speed-sensing

The first five RJ-45 ports independently support auto-negotiation for shared 10BASE-T and 100BASE-TX modes. Operation is according to the IEEE 802.3u standard.

When an RJ-45 cable connection is made and each time a LINK is enabled, auto-negotiation takes place. The DS50 / DS60 advertises its capability for 10 or 100Mbps speed, and the device at the other end of the cable should similarly advertise / respond. Then both sides will agree to the speed to be used. Depending upon the device connected, this will result in agreement to operate at either 10Mbps or 100Mbps speed.

When the '**10 M LINK/ACT**' LED is ON, either steady or blinking (see below), the port has auto-negotiated for 10Mbps operation. (If a DS50 / DS60 port is connected to a non-negotiating device, it will default to 10Mbps speed and half-duplex mode, per the IEEE802.3 standard). Similarly, when the '**100M LINK/ACT**' LED is lit, it means 100Mbps operation. Since Magnum DS50 / DS60 are hubs, they always operate in the shared or half-duplex mode on first five (1-5) ports.

## 4.3 Switching Functionality for port # 6 (DS60s Only)

A Magnum DS60 Dual-speed Hub Plus provides switched connectivity at Ethernet wire-speed for port #6. The Magnum DS60C supports 10/100Mbps for copper media to maximize bandwidth utilization and network performance. Similarly Magnum DS60F supports 100Mbps for Fiber media to maximize bandwidth utilization, network performance and secured longer distance. All ports can communicate to all other ports in a Magnum DS60, but local traffic on port #6 will not consume any of the bandwidth on any other port.

Magnum DS60 units are plug-and-play devices. There is no software configuring to be done at installation or for maintenance. Full duplex and Auto-negotiation mode at 10 or 100Mbps for the switched copper port can be done through the manual switch underneath the port it controls. Similarly the Fiber switched port at 100Mbps can be set at Full duplex as well as Half-duplex through the manual switch underneath the port it controls. The internal functions of switched port 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 DS60's switched port operates 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

The switched port at Magnum DS60 units have address table capacity of 8K node addresses, and 1MB dynamically allocated packet buffers, suitable for use in small and medium size networks. They are self-learning, so that as nodes are added or removed or moved from one segment to another, the DS60's switched port 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.

## 4.4 LEDs

**PWR** : Steady ON when power applied.

**COL 100 (port 1-5)** : Collision, flashing when collision occurs on ports 1-5 at 100Mbps.

**COL 10 (port 1-5)** : Collision, flashing when collision occurs on ports 1-5 at 10Mbps.

**LK/RX (port 1-5)** : Steady ON when twisted pair link is operational, Activity , flashing when port is receiving data.

**100 (port 6)** : Speed is at 100Mbps .

**FDX (port 6)** : Port is at Full-Duplex.

## 4.5 (FF-A) Manual Switch, Port 6 for DS60C

The FF-A slide switch allows users to configure Port 6 as either a Full fixed at 10/100 port or act as an Auto-negotiation Ethernet port. It is located underneath Port 6 on the right front panel of the Magnum DS60C. See figure 2.2.3 for location of the switch relative to Port 6.

### “FF-A” Switch



**FF**    **A**

After switching from Full fixed to auto-negotiation or vice versa, it is necessary that the unit be powered down and back up to reset the internal buffers of the switch. Even though it is not always required, powering down and up will enable proper packet handling in all cases for both segments of the network.

#### 4.6 (F-H) Manual Switch, Port 6 for DS60F

The manual switch provided underneath the Switched fiber port#6, allow the user to set the fiber port at 100Mbps Full duplex or 100Mbps Half-duplex.

#### “F-H” Switch



The F and H switch enable this Dual-speed Hub plus to easily connected to any other Fiber Switch or Hub. The Full-Duplex 100Mbps fiber port supports a much longer distance then the 100Mbps Half Duplex in any fast Ethernet network.

#### 4.7 Up-link Switch, Port 1

The Magnum DS50 & DS60C is equipped with one up-link slide switch for port 1. This allows repeater-to-repeater connections without a special cross-over cable. The up-link switch is located to the left of port 1.

UP-LINK



Set the slide switch to the left “=” position for twisted pair cable segments from the DS50 & DS60C port to a user device. Set the slide switch to the right “X” position for cascaded or up-link segment connections from the DS50 & DS60C port 1 to another repeater or hub in the network. Verify proper switch position by noting the port’s LINK LED status, which illuminates when proper link is established.

**Figure 4.4: Up-link Switch**

## 5.0 TROUBLESHOOTING

All Magnum Ethernet products are designed to provide reliability and consistently high performance in all network environments. Both the installation and operation of a Magnum DS50 / DS60 Dual-speed Hub Plus are simple procedures (see Section 3.0, INSTALLATION); operation is very simple and is described in Section 4.0.

Should problems develop during installation or operation, this section should help to locate, identify and correct such problems. Please follow the suggestions listed below prior to contacting your supplier. However, if you are unsure of any procedure described in this section, or if the Magnum DS50 / DS60 is not operating as expected, do not attempt to repair or alter the unit. Contact your supplier (or if unknown, contact GarrettCom) for assistance.

### 5.1 Before Calling for Assistance

1. If difficulty is encountered when installing or operating the Magnum DS50 / DS60, refer back to Section 3.0, Installation and Section 4.0, Operation. Check to make sure that the various other components of the network are operable.
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. Be certain that the AC power cord is plugged into a functioning electrical outlet. Make sure that the AC power cord is properly plugged into the DS50 / DS60 unit. Use the PWR LED to verify that the unit is receiving proper power.
4. If the problem is isolated to a network device other than the Magnum DS50 / DS60, it is recommended that the problem device be 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 DS50 / DS60 and its associated cables are functioning properly.
5. If the problem continues after completing Step 4 above, contact your supplier of the Magnum DS50 / DS60 unit (or if unknown, contact GarrettCom) by fax or by phone for assistance.

## 5.2 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.

## 5.3 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](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.

#### 5.4 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 : Optional 24VDC or -48VDC Power Supply****B1.0 SPECIFICATIONS - FOR MAGNUM DS50 / DS60 DUAL-SPEED HUBS PLUS****Power Supply (Internal -48VDC Option)**

DC Power Connector: 3 terminals: (-), "GND", (+)

Input Voltage: -36 to -72 VDC

Power Consumption: Model DS50 / DS60: 6 watts typical, 10 watts max.

**Power Supply (Internal 24VDC Option)**

DC Power Connector: 3 terminals: (-), "GND", (+)

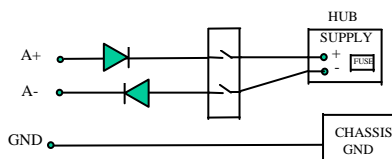
Input Voltage: 20 to 36 VDC

Power Consumption: Model DS50 / DS60: 5 watts max.

**With the exception of the power supply, all specifications and functions of Magnum DS50 / DS60 24VDC or -48VDC models are identical to those listed in the main manual.**

**B2.0 24VDC or -48VDC POWER OPTION, THEORY OF OPERATION**

The 24VDC or -48VDC power option is 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 hub. This allows the DS50/60 to operate only whenever DC power is correctly applied to



the two inputs. It protects the hub from incorrect DC input connections. An incorrect polarity connection, for example, will neither affect the Dual-speed Hubs, nor its power supply internally, nor will it blow the fuse in the internal power supply.

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

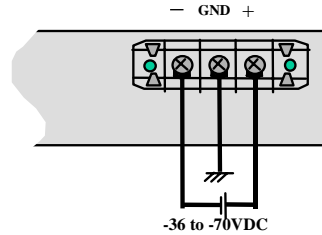
Magnum DS50 / DS60 are easily installed in a variety of applications where 24VDC or -48VDC power is used as the primary power source. The -48VDC and 24VDC power configuration provides an Ethernet networking solution utilizing a special power supply in hubs with a proven track record.

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 24VDC solution is particularly useful in the Industrial environment, where it is common for facilities to operate on 24VDC power. The 24VDC application is mainly used in the Industrial environment, such as chemical plants, paper mill, stone quarrying plant, wastewater treatment Plant etc.

## B4.0 INSTALLATION

This section describes the installation of the 24VDC or -48VDC power source leads to the 24VDC or -48VDC power terminal block on the Magnum DS50 / DS60. (see figure right).



### Figure B4.1: Optional Terminal Block on Magnum DS50 / DS60 with -48VDC power

In this picture, the 24VDC or -48VDC terminal block on the Magnum DS50 / DS60 is located on the rear of the unit and is equipped with three (3) screw-down lead posts. 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 DS50/60 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 or 24VDC, 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 "+".*

An optional ON-OFF manual switch, available on some Magnum units, is not included on the Magnum DS50 / DS60 Dual-speed Hubs Plus.

### 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 DS50 / DS60 with the optional 24VDC or -48VDC power supply is identical to that of the standard 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 DS50-48VDC**.

Similarly, to order the optional 24VDC industrial specific power supply factory installed, add a suffix of "24VDC" after the product's standard model #.

Example: **Magnum DS60-24VDC**.

## B7.0 TROUBLESHOOTING

Please refer to Section 6.0 for troubleshooting

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