



# GarrettCom®

*Industrial Networking at Its Best™*

## Magnum CP80-Series Hardened Industrial Switches



### Hardware Installation and User Guide

# Magnum™ CP80-Series Hardened Industrial Switches

## Hardware Installation and User Guide

Part #: 84-00183Z (Rev. A)

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**Important:** The Magnum CP80 Series Switches contains no user serviceable parts. Attempted service by unauthorized personnel shall render all warranties null and void. If problems are experienced with Magnum CP80 Series Switches products, consult Section 6, Troubleshooting.

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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 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 their own expense, will be required to take whatever measures may be required to correct the interference.*

**Canadian Emissions Statement**

***This Class A 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 A.*

**Electrical Safety requirements:**

1. This product is to be installed Only in Restricted Access Areas (Dedicated Equipment Rooms, Electrical Closets, or the like).
2. 48VDC products shall be installed with a readily accessible disconnect device in the building installation supply circuit to the product.
3. This product shall be provided with a maximum 5A DC Listed fuse or circuit breaker in the supply circuit when connected to a 48V centralized source.
4. The external power supply for DC units shall be Listed, Direct Plug In power unit, marked Class 2, or listed ITE Power Supply, marked LPS, which has suitably rated output voltage (i.e. 24VDC or 48VDC) and suitable rated output current.
5. Product does not contain user replaceable fuses. Any internal fuses can ONLY be replaced by GarrettCom personnel through the RMA process.

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Revisions:

Rev A 05/10      Initial Release

## 1.0 SPECIFICATIONS

### 1.1 Technical Specifications

#### Performance

Filtering / Forwarding Rate:

Ethernet (10Mbps): 14,880 pps

Fast Ethernet (100Mbps): 148,800 pps

Switching Processing Type: Store and Forward with IEEE 802.3x full-duplex flow -control, non-blocking

Data Rate: 10Mbps and 100Mbps

Address Table Capacity: 4K node, self-learning with address aging

Packet buffer size: 256 KB total

Latency: 5  $\mu$ s + packet time (100 to 100Mbps)

#### Network Standards and Compliance, hardware

Ethernet V1.0/V2.0 IEEE 802.3: 10BASE-T,

IEEE 802.3u: 100Base-TX, 100BASE-FX

IEEE 802.1p: Priority protocol

IEEE 802.1d: Spanning tree protocol

IEEE 802.1w: Rapid Spanning tree protocol

IEEE 802.1q: VLAN Tagging

IEEE 802.3x: Flow Control

IEEE 802.3ad: Link Aggregation (Trunking)

IEEE 802.1x: Port based Network access control

#### 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-FX, half-duplex, single-mode	- 412 m (1350 ft)
100BASE-FX, full-duplex, single-mode	- 20.0 km (66K ft)
100BASE-FX, full-duplex, Long Reach	- 40.0 km (122K ft)

#### Fiber Multi-mode connector types supported:

Fiber Port, MTRJ-type (plug-in): SFF Fiber multi-mode 100BASE-FX

Fiber Port, LC-type (plug-in): MLC SFF Fiber multi-mode 100BASE-FX

Fiber Port, SC-type (plug-in), MSC multi-mode 100BASE-FX

Fiber Port, ST-type (twist-lock), MST multi-mode 100BASE-FX

#### Fiber Single-mode connector types:

Fiber Port, LC-type, Fiber SLC and SLCL SFF single-mode, 100BASE-FX

Fiber Port, SC-type, single-mode, SSC and SSCL SFF 100BASE-FX

Fiber Port, ST-type, single-mode, SST SFF 100Base-FX

**LED Indicators**

<b>(on chassis)</b>	<b>PWR:</b>	Steady On when power applied
<b>(per port)</b>	<b>SPEED:</b>	ON (100Mbps), OFF (10Mbps)
	<b>LINK/ACT:</b>	ON (Link), BLINKING (Activity)
	<b>F/H:</b>	ON (Full-Duplex), OFF (Half-Duplex)

**Operating Environment**

Ambient Temperature:

13° to 140° F (-25° to 60°C)

Storage Temperature: -58° to 167°F (-50° to 75°C)

Ambient Relative Humidity: 10% to 95% (non-condensing)

Altitude: -200 to 13,000 ft. (-60 to 4000m)

Conformal Coating (humidity protection) optional: Request quote

**Packaging**

Enclosure: High strength sheet metal

Dimensions: 1.25 in H x 6.6 in W x 6.0 in D

(3.18 cm H x 16.76 cm W x 15.24 cm D)

Cooling method: Convection

Weight: 1 lb. (454 g)

**DC Power Supply (Internal, floating ground)**

**DC Power Connector:** Terminal block

12VDC Power Input nominal (range 9 to 15VDC)

24VDC Power Input nominal (range 18 to 36VDC)

-48VDC Power Input nominal (range 36 to 60VDC)

Std. Terminal Block : “-, GND, +”

**Power Consumption:**

8 watts Typical. , 9 watts Max.

**Dual DC Power Input (Optional)**

A Dual-Source option is available for the 12VDC, 24VDC and -48VDC models. This provides for continuity of operation when either of the DC input sources is interrupted. See Appendices B and C.

The Dual-Source Terminal Block is marked: “+A, -A, -B, +B”

**Mounting:**

Suitable for wall or DIN-Rail mounting

**Agency Approvals and Standards Compliance:**

UL listed (UL60950), cUL, CE, Emissions meet FCC Part 15 Class A  
NEBS Level 3 and ETSI Compliant

**Warranty:** Three years, per UL 60950 temperature rating      Made in USA

Email [info@GarrettCom.com](mailto:info@GarrettCom.com) for additional information.

## 1.2 Ordering Information

### MODEL

### DESCRIPTION

**Magnum CP80-24VDC:** Magnum CP80 Series Switches with 24VDC power input, eight 10/100Mbps switched RJ45 ports; panel-mount brackets included

**CP80R-24VDC:** Same as CP80-24VDC except a DIN-Rail bracket is included

**CP80-12VDC:** Same as CP80-24VDC except the power input is 12VDC

**CP80R-12VDC:** Same as CP80-12VDC except a DIN-Rail bracket is included

**CP80-48VDC:** Same as CP80-24VDC except the power input is -48VDC

**CP80R-48VDC:** Same as CP80-48VDC except a DIN-Rail bracket is included

**Magnum CP80F-ff-24VDC:** Magnum CP80F Series Switches with 24VDC power input, eight 10/100Mbps switched RJ45 ports, one 100Mbps Fiber port and Wall mount brackets included

**CP80FR-ff-24VDC:** Same as CP80F-ff-24VDC except a DIN-Rail bracket is included

**CP80F-ff-12VDC:** Same as CP80F-ff-24VDC except the power input is 12VDC

**CP80FR-ff-12VDC:** Same as CP80F-ff-12VDC except a DIN-Rail bracket is included

**CP80F-ff-48VDC:** Same as CP80F-ff-24VDC except the power input is -48VDC

**CP80FR-ff-48VDC:** Same as CP80F-ff-48VDC except a DIN-Rail bracket is included

### Fiber Port Connectors:

#### ("ff" selections of the "fiber flavor")

"MSC" = 100Base-FX, multi-mode, SC type, 2km

"MST" = 100Base-FX, multi-mode, ST type, 2km

"MTRJ" = 100Base-FX, multi-mode, MTRJ type, 2km

"MLC" = 100Base-FX, multi-mode, LC type, 2km

"SSC" = 100Base-FX, single-mode, SC type, 20km

"SSCL" = 100Base-FX, single-mode, SC type, "Long Reach" 40km

"SST" = 100Base-FX, single-mode, ST type, 20km

"SLC" = 100Base-FX, single-mode, LC type, 20km

"SLCL" = 100Base-FX, single-mode, LC type, "Long Reach" 40km

## **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 CP80F Series Switches with a Fiber Port, or  
Magnum CP80 with all copper ports.
- 1 Set of metal clips and screws for secure shelf or wall-mounting
- 1 Installation and User Guide
- 1 Product Registration Card

Remove the Magnum CP80F or CP80 Industrial Switch 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 - General**

In factory automation control systems, field bus control systems are giving way to IP-based networks. The Magnum CP80-Series Hardened Ethernet switches provide modern Ethernet connectivity for a variety of factory automation and SCADA applications.

Magnum CP80F switches provide eight 10/100 copper ports and one 100Mbps fiber up-link port. They are hardened to withstand the stress of industrial environments, highly reliable (over 25 years MTBF), and are easily fitted into industrial and telecom control cabinets. Operation is “plug-and-play.” Front-mounted LEDs provide status information on each port. Multiple CP80-Series Switches can be linked in a cascaded or “daisy-chain” manner for expansion of the network.

The fiber port is available with a 2KM multi-mode ST, SC, LC, or MTRJ-type connector, or with a single-mode LC, SC-type to support 20 and 40 kilometers distance. (Other special fiber port types are available on request). The 100Mbps fiber port of the Magnum CP80F supports full distance fiber LAN cabling to a wiring closet switch upstream.

The CP80-Series industrial grade switch is DC-powered by 24VDC for factory floor or 48VDC for telco carrier field facilities, has a rugged metal case and metal mounting brackets suitable for panel mounting. Models with a DIN-Rail mounting bracket included are available. The Magnum CP80-series industrial hardened switches and the other Magnum industrial networking products are backed by a three-year warranty.

Industrial switches can connect a group of Ethernet-ready, process control units to a central control switch or to backhaul aggregated data from a cluster of edge switches that is typical in telecommunication environment. These switches offer real time control and input-output data flow through factory floor and are easy to bring-up because they are standards-based. These switches also are ideal for cell phone backhaul using faster and longer-range fiber cable. Typically DIN-rail mounted, these switches can withstand factory floor temperatures and telco central office environment and can be used without any special enclosures, fans or heaters.

The Magnum CP80 and CP80F are easy to install and use. Addresses of attached nodes are automatically learned and maintained, adapting the switching services to network changes and expansions to provide plug-and-play operation. Flow control maximizes throughput across all ports. Front-mounted LEDs provide status information on each port.

The CP80F model has one full-duplex 100Mbps switched fiber port, and eight switched 10/100 full/half auto-negotiating RJ-45 ports. While the switched fiber port is typically for a backbone connection, the switched RJ-45 ports can be used to connect a central control switch to various process control equipment or to aggregate data from a group of edge switches.



**Fig 2.2a CP80, CP80F-SC models shown**

### 2.2.1 Magnum CP80F chassis with ST, SC, MTRJ or LC Fiber port

The Magnum CP80F chassis houses one main PC board. The front side of the chassis has eight RJ-45 twisted-pair ports and one 100Mbps fiber port, located at the left front of the unit. Port #9 supports fiber ports only.

LEDs to indicate operating status of all ports are located on the front face per port. There is a power (PWR) indicator for the unit. For each port, there are Link and Activity (LINK/ACT) LEDs indicating traffic, and speed (ON for 100Mbps), and full/half (F/H) duplex indicators.

The DC power terminal block is located at the right side of the chassis, looking at the front. DC power option inputs are 12, 24 and -48VDC.

### 2.2.2 Magnum CP80 chassis with all RJ-45 Copper ports

The Magnum CP80 chassis houses one main PC board. The front side of the chassis has eight twisted-pair switched ports. All RJ-45 ports are Auto-negotiating and Auto-Cross MDI-MDIX.

LEDs to indicate operating status of all ports are located on the front face per port. There is a power (PWR) indicator for the unit. For each port, there are Link and Activity (LINK/ACT) LEDs indicating traffic, and speed (ON for 100Mbps), and full/half (F/H) duplex indicators.

The DC power terminal block is located at the left front side of the chassis. DC power option inputs are 12, 24 and -48VDC.

### 2.3 Fiber port, ST, SC, MTRJ, LC Connector for Model CP80F

The Fast Ethernet fiber port on the Magnum CP80F is set to operate at fixed 100Mbps speed for guaranteed high performance. The CP80F's fiber port is factory-built as either a multi-mode ST, SC, MTRJ, LC or single-mode ST, SC or LC connector. The 100Mbps fiber port will run at 100Mbps speed at all times. The 100Mbps fiber port is a switched port and performs as a domain, providing a high bandwidth backbone connection (no media converter is required!) and supporting long (up to 40km) fiber cable distances for installation versatility.

On Magnum CP80F units, there are two LED's for the fiber port. One (LK/ACT) is steady ON to indicate LINK, blinking indicates the port is transmitting and receiving. The F/H indicates full-duplex when ON, when it is OFF, operation is half-duplex.

A fiber cable must be connected to the 100Mbps port and a proper link (LK lit) 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.

### 2.4 Frame Buffering and Latency

The Magnum CP80 & CP80F 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 CP80 & CP80F Industrial Switch 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 of the Magnum CP80 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 CP80 & CP80F Industrial 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.

Another feature implemented in Magnum CP80 & CP80F Industrial 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 CP80 & CP80F Industrial 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 Mbps-to-10 Mbps or 10 Mbps-to-100Mbps or 100Mbps-to-10 Mbps forwarding, the latency is 15 microseconds plus the packet time at 10 Mbps. For 100Mbps-to-100Mbps forwarding, the latency is 5 microseconds plus the packet time at 100Mbps.

## 2.5 Features and Benefits

### ■ 100Mbps switching services for factory automation Ethernet LANs

Magnum CP80 & CP80F 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 100Mbps (or 10 Mbps) of bandwidth.

### ■ Option for one “future-proof” fiber backbone port connector, Model CP80F

Built-in fiber ports may be ordered with 100Mbps full-duplex multi-mode ST, SC, MTRJ, LC and single-mode ST, SC and LC connectors.

### ■ Model CP80 with all RJ-45 (copper) ports

RJ-45 ports provide twisted pair segment connections, with auto-negotiation and auto-cross MDI-MDIX functionality. All RJ-45 ports are capable of half- or full-duplex.

### ■ Installation is “Plug and Play”, operation is transparent to software

The Magnum CP80F & CP80 operate as a hardware switch, only forwarding those packets from each domain that are needed on the other domains. Internal address tables are self-learning, enabling users to change port connections or 10/100 domains without affecting operations.

### ■ Heavy-duty design for Industrial Ethernet and extended temperature operation

Fiber ports take more power than copper ports, but the Magnum CP80 Series design provides for this with heavy-duty components. The CP80 is designed for industrial use, is an enclosed convection-cooled package, and is UL rated at -25°C to 60°C ambient sustained temperatures.

## 2.6 Applications

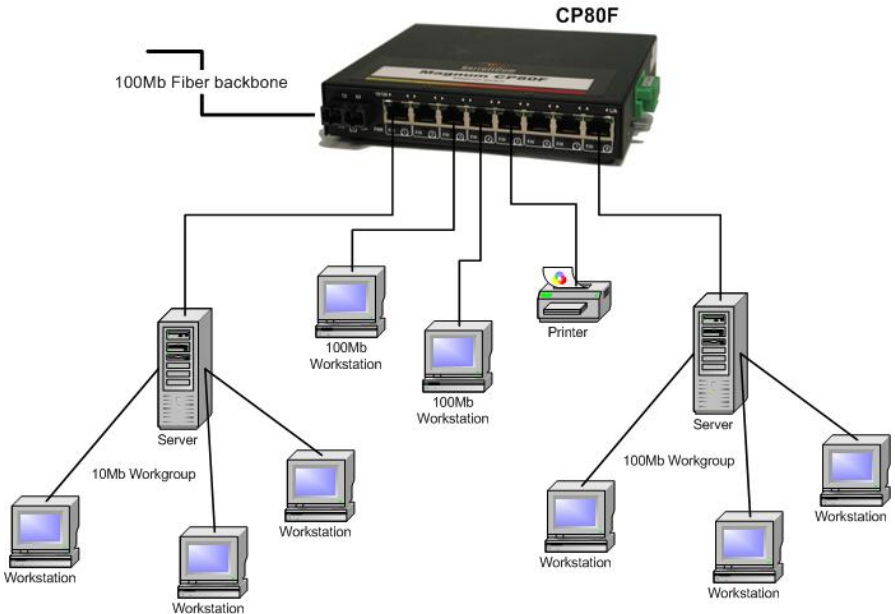
The CP80F & CP80 are designed to bring future-proof fiber connectivity and widely-used copper connectivity to factory automation control systems, fieldbus control systems and many other industrial network environments.

Ethernet networks in factory control systems provide interoperability and bandwidth with universal connectivity via 10/100 RJ-45 ports, all at an economical cost. In control system cabinets, a small group of IEDs, PLCs, sensors, WAPs and control devices are co-located and connected into the network using twisted-pair copper cabling. Then, this group of devices is linked into the overall industrial network, typically with a fiber cable for noise immunity and distance. The Magnum CP80-Series Hardened Ethernet Switches are ideal for these applications.

### Example 1. Magnum CP80F for industrial application

Equipped with lots of useful features including hardened enclosures, a wide spread of DC power supply options, and extended temperature ratings qualifies the Magnum CP80 Series Industrial switch for any Industrial factory-floor.

In an Industrial environment where the factory floors are networked with Ethernet based mixed-media LANs and equipped with PLC computers to take readings and data from M/C Client/ Server databases and transport this important data to the central office data warehouses, the CP80-Series shines. The CP80-Series features handle these kinds of networks very securely and reliably throughout the Factory-floors. The DIN-Rail Mounting options on the Magnum CP80, allow the Industrial Factory floor user to mount the CP80 securely anywhere on their Network setup.

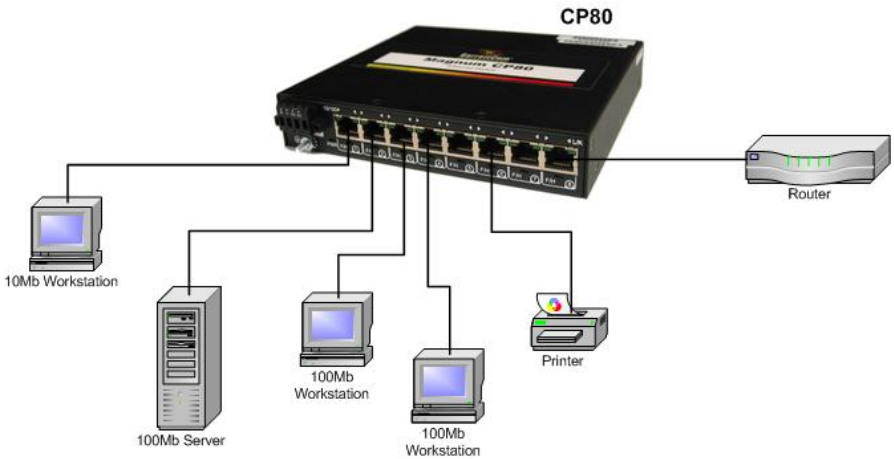


Where there is existing 10 Mbps hubs or switches users, they can easily be cascaded into any port of the CP80F. This allows a simple plug-and-play addition of 100Mbps ports to an existing 10 Mbps network without having to change it. Nodes that are capable of 100Mbps speed can be moved to a CP80F port, and will automatically operate at the higher speed.

The 100Mbps fiber port on the CP80F 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 10 Mbps domain, so overall performance of the network is sustained at the highest possible level.

### Example 2. Magnum CP80

In this example, the Magnum CP80 Switch is used to serve a small office in a factory with multi-servers, print server, internet access and mixed-speed requirements. The users operate at 100Mbps as well as at 10 Mbps, and utility devices (such as print servers) run at 10 Mbps. High performance users need a high bandwidth up-link for access to a central LAN and central file servers. Any attached node can change speed at any time without affecting network operation or impacting other users. The multi-functional CP80 switches provide this solution very efficiently and economically. Various features included MDIX, plug-n-play, Din-Rail mountings and dual LEDs make this compact switch a very effective solution for this requirement.



### 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 steady-state long-term environmental temperature around the equipment must be less than or equal to 60°C.
- 2.) If the equipment is mounted in an enclosed or multiple rack assembly, adequate airflow 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.

This section describes installation of the Magnum CP80 Switches, as well as connection of the various Ethernet media types.

#### 3.1 Locating Magnum CP80-Series Switches

For vertical panel mounting and wall mounting, see Section 3.1.2

For vertical DIN-Rail mounting, see Section 3.2

For DC power input data, see Appendix B. For Dual Source, see Appendix C

The rugged metal case of the Magnum CP80 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 convection while the unit is in operation. The CP80 has no fans, so it is silent when in operation. Internal electronics use the case as a heat sink, so the unit may normally be quite warm to the touch.

##### 3.1.1 Table Top or Shelf Mounting

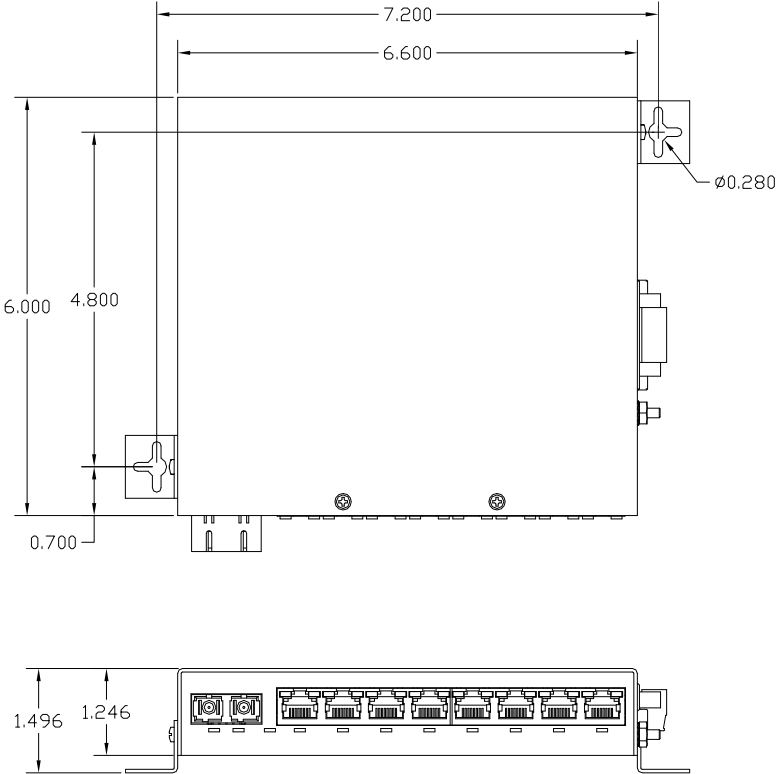
The Magnum CP80F & CP80 Industrial switch can be easily mounted on a table-top or any suitable horizontal surface, and has four rubber feet to provide stability without scratching finished surfaces.

##### 3.1.2 Mounting Dimensions for CP80 with metal brackets

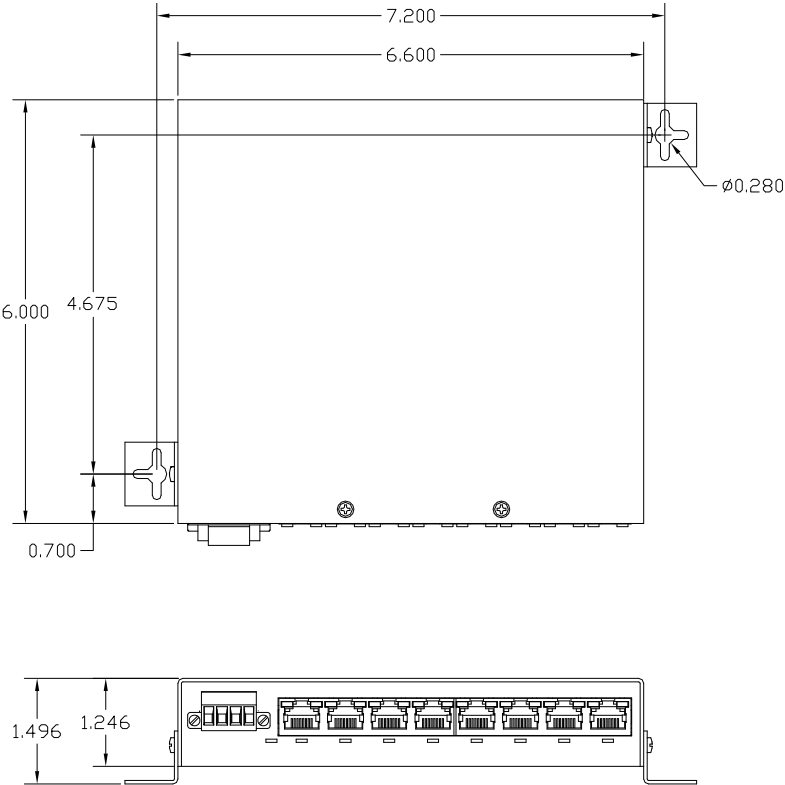
Each Manguum CP80 is supplied with metal mounting brackets and screws to mount the unit securely on a panel or wall. It is recommended to mount the CP80 vertically in the mounting position shown below, for proper cooling and long-life reliability. It is also advisable to mount the unit with space for air movement around the top and the sides, typically a minimum of 1 inch.

**Note:** The metal brackets supplied, hold the back of the CP80 unit out from the panel or wall behind it, creating a rear space of about 1/8 inch or 3mm. This allows air circulation and cooling of the rear part of the case.

For best cooling of the CP80, attach the metal brackets to metal (rather than wood or plastic). Attaching to metal helps conduct heat away from the CP80 through the metal brackets and into the metal support structure.



**Fig 3.1.2a CP80F mounting dimensions**



**Fig 3.1.2b CP80 mounting dimensions**

### 3.2 DIN-Rail Mounting the Magnum CP80



The Magnum CP80 is designed for use in a “factory floor” industrial environment. It is available with an optional DIN-Rail bracket to mount it securely in a metal factory floor enclosure, maintained vertically for proper convection cooling of the unit. The Magnum CP80 requires one DIN-Rail bracket for secure mounting. See a CP80 viewed from the bottom, at the rear, showing the DIN Rail in place.

The DIN Rail bracket is mounted to the bottom of the CP80 unit, as shown. Four threaded holes are provided on the bottom of the CP80 for DIN-Rail mounting purposes. The required four screws are included with the DIN-Rail bracket, and are no.4-40 x 9/32 PHIL.

PAN Head. The rail clip is spring-loaded with a pull-up latch at the top for easy “snap-on” attachment and removal. The Magnum CP80 models with “FR” and “R” have the DIN-Rail-MC2 bracket included and assembled with the CP80 unit at the factory.

### 3.3 Connecting Ethernet Media

The Magnum CP80 Switches are specifically designed to support standard Ethernet media types within a single Switch unit. This is accomplished by using a choice of five popular Fiber Connectors which can be individually selected and configured.

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

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

See [http://www.garrettcom.com/techsupport/power\\_budget.pdf](http://www.garrettcom.com/techsupport/power_budget.pdf) for Power budget calculations, to find fiber cable distance information.

**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 CP80-Series Switches ports are auto-sensing for either 10 and 100Mbps. Note that the auto-sensing function does not sense the cable type.*

### 3.3.1 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 a 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.

### 3.3.2 Connecting Fiber Optic ST-type, "twist-lock"

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

1. Before connecting the fiber optic cable, remove the protective dust caps from the tips of the fiber connectors. Save these dust caps for future use.
2. Wipe clean the ends of the dual connectors with a soft cloth or lint-free lens tissue dampened in alcohol. Make certain the connectors are clean before connecting.  
**Note:** *One strand of the duplex fiber optic cable is coded using color bands at regular intervals; you must use the color-coded strand on the associated ports at each end of the fiber optic segment.*
3. Connect the Transmit (TX) port (light colored post) on the Magnum 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.
4. Connect the Receive (RX) port (dark colored post) to the Transmit (TX) port of the remote device. Use the non-color coded fiber strand for this.
5. The LINK LED on the front of the 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.

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

The following procedure applies to installations using SC-type fiber connectors, i.e., using multi-mode SC and SC single-mode.

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

### 3.3.4 Connecting Fiber Optic LC-type, “Small Form factor (SFF)”

The following procedure applies to installations using LC-type fiber connectors, i.e., using LC single-mode. While connecting fiber media to LC connectors, simply snap the two square male connectors into the LC female jacks of the Fiber connector until it clicks and secures.

### 3.3.5 Connecting Fiber Optic MTRJ-type, “Small Form factor (SFF)”

The following procedure applies to installations using MTRJ-type fiber connectors, i.e., using MTRJ multi-mode. While connecting fiber media to MTRJ connector, simply snap the square male connector into the MTRJ female jack of the Fiber connector until it clicks and secures.

### 3.3.6 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 multi-mode SC.

The same procedures as for multi-mode fiber apply to single-mode fiber connectors. Follow the steps listed in Section 3.3.2 above.

### 3.3.7 Power Budget Calculations for CP80F Fiber Media

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

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

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

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

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

where the “Cable Loss” for 62.5/125 and 50/125 $\mu\text{m}$  (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

See [http://www.garrettcom.com/techsupport/power\\_budget.pdf](http://www.garrettcom.com/techsupport/power_budget.pdf) for more information on Power budget calculations

\* *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 100Mbps 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)

### 3.3.8 Connections to NICs which support Auto-Negotiation

The copper ports of Magnum CP80F and CP80 Industrial Switches 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 the CP80F or CP80, 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 100Mbps operation is agreed and in use, the SPEED LED is illuminated steady ON. It is OFF if there is no traffic or if 10 Mbps traffic.

### 3.4 Powering the Magnum CP80F and CP80

The DC internal power supply supports installation environments where the DC voltage is from 9 to 60 volts depending on the model selected. When connecting the Ethernet cabling, there is no need to power down the unit. Individual cable segments can be connected or disconnected without concern for power-related problems or damage to the unit.

Power input options are available to suit the CP80 Switches to special high-availability communications and/or heavy industrial-grade applications, including:

- \* 12VDC, -48VDC and 24VDC with single DC input,
- \* 12VDC, -48VDC and 24VDC with dual-source DC input

## 4.0 OPERATION

This chapter describes the functions and operation of the Magnum CP80 Switch.

### 4.1 Dual-Speed Functionality, and Switching

The Magnum CP80F and CP80 Hardened Industrial Switches provide eight switched ports, one of which may be 100Mbps fiber on the Model CP80F. The architecture supports a dual-speed switching environment, with a built-in full-duplex “future-proof” fiber port on the Model CP80F. The Model CP80 has RJ-45 copper on all the ports with auto-negotiation capability.

The switched RJ-45 ports are full-duplex and auto-sensing for speed. (See section 2.2). When the connected device is 10 Mbps, the CP80F obeys all the rules of 10 Mbps Ethernet configurations. The 10 Mbps users share a 10 Mbps traffic domain, and can “communicate with” 100Mbps users as well as 100Mbps domain. Similarly, the 100Mbps traffic obeys the rules of 100Mbps Ethernet, and can communicate with 10 Mbps domain too.

Magnum CP80F and CP80 units are plug-and-play devices. There is no software configuring to be done at installation or for maintenance. The internal functions of both are described below.

### Switching, 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 on the same port segment will be filtered, constraining them to 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. Packets needed for maintaining the operation of the network (such as occasional multi-cast packets) are forwarded to all ports.

The Magnum CP80F and CP80 Industrial Switches operate in the store-and-forward switching mode, which eliminates bad packets and enables peak performance to be achieved when there is heavy traffic on the network.

### Switching, Address Learning

The Magnum CP80F and CP80 units have address table capacity of 4K node addresses, and are suitable for use in large networks. They are self-learning, so that as nodes are added or removed or moved from one segment to another, the CP80F and CP80 automatically keeps up with node locations.

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

## 4.2 Auto-negotiation and Speed-sensing

All eight RJ-45 ports independently support auto-negotiation for speed in 10BASE-T and 100BASE-TX modes. Operation is according to the IEEE 802.3u standard.

When a RJ-45 cable connection is made, and each time a LINK is enabled, auto-negotiation takes place. The CP80F or CP80 advertises its capability for 10 or 100 Mbps speed, and the device at the other end of the cable should similarly advertise / respond and both sides will agree to the speed being used. Depending upon the device connected, this will result in agreement to operate at either 10 Mbps or 100Mbps speed.

When the '**LINK/ACT**' LED is ON, steady ON indicates LINK with no traffic, blinking ON indicates the port is transmitting / receiving. The port has auto-negotiated for operation. (If a CP80F or CP80 RJ-45 port is connected to a non-negotiating device, it will default to 10 Mbps speed and half-duplex mode, per the IEEE 802.3u standard).

### 4.3 Auto-Cross (MDIX) and Auto-negotiation, for RJ-45 ports

The RJ-45 ports independently support auto-cross (MDI or MDIX) in auto-negotiation mode and will work properly with all the other connected devices with RJ-45 ports whether they support auto-negotiation (e.g., 10Mbps hub, media converter) or fixed mode at 10Mbps or 100Mbps Half/Full Duplex (managed switch) or not. No cross-over cable is required while using the CP80's copper port to other devices. Operation is according to the IEEE 802.3u standard.

### 4.4 LED Indicators

- PWR:** Illuminates GREEN, steady on when power applied.
- 10/100:** Per port, ON = 100Mbps; OFF = 10 Mbps  
(when LINK is made)
- LINK/ACT:** Per port, steady ON for LINK with no traffic, blinking indicates port is transmitting and receiving.
- F/H:** ON = Full-Duplex and Link,  
OFF = Half-Duplex and / or no Link

## 5.0 TROUBLESHOOTING

All Magnum Ethernet products are designed to provide reliability and consistently high performance in all network environments. The installation of Magnum CP80F & CP80 Industrial Switch is a straightforward procedure (see INSTALLATION, Section 3.0); the operation is also straightforward and is discussed in Section 4.

Should problems develop during installation or operation, this section is intended to help locate, identify and correct these types of problems. Please follow the suggestions listed below prior to contacting your supplier. However, if you are unsure of the procedures described in this section or if the Magnum CP80F & CP80 Industrial Switch is not performing as expected, do not attempt to repair the unit; instead contact your supplier for assistance or contact GarrettCom Customer Support.

### 5.1 Before Calling for Assistance

1. If difficulty is encountered when installing or operating the unit, refer back to the Installation Section of the applicable chapter of this manual. Also check to make sure that the various components of the network are interoperable.
2. Check the cables and connectors to ensure that they have been properly connected and the cables/wires have not been crimped or in some way impaired during installation. (About 90% of network downtime can be attributed to wiring and connector problems.)
3. If the problem is isolated to a network device other than the Magnum CP80F & CP80 Industrial Switch product, it is recommended that the problem device is replaced with a known good device. Verify whether or not the problem is corrected. If not, go to Step 4 below. If the problem is corrected, the Magnum CP80F & CP80 Industrial Switch and its associated cables are functioning properly.
4. If the problem continues after completing Step 3 above, contact your supplier of the Magnum CP80F & CP80 Industrial Switch unit or if unknown, contact GarrettCom, Inc. by fax, phone or email ([support@garrettcom.com](mailto:support@garrettcom.com)) 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: DC Power Input

### B1.0 Specifications for Magnum CP80 Switches, DC Power at 12, 24 and -48VDC Power input

Each Magnum Model CP80 Switch requires DC power input, at 12, 24 and 48VDC. The wide range of DC power input types qualifies this product for use in 12, 24 and 48 applications in different industries.

**DC Power Terminals:** “+”, “-” are internally floating so that user may ground either

**GND:** ground wire connection to the CP80 chassis (#6-32 thread)

#### Power Consumption:

8 watts typical, 9 watts Max.

12VDC Power Input nominal (range 9 to 15VDC)

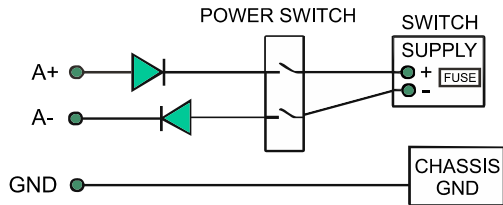
24VDC Power Input nominal (range 18 to 36VDC)

-48VDC Power Input nominal (range 36 to 60VDC)

### B2.0 12, 24 and -48VDC POWER, THEORY OF OPERATION

The 12, 24 and -48VDC power options are designed using diodes inside on each DC power input line behind the two external

power connection terminals, so that the power from an external source can only flow into the hub. This allows the Switch to operate only whenever DC power is correctly applied to the two inputs. It protects the Switch from incorrect DC input connections. An incorrect polarity connection, for example, will neither affect the Switch, its internal power supply, nor will it blow the fuse in the internal power supply.



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

Magnum CP80 Switches are easily installed in a variety of applications where 12, 24 and -48VDC power is used as the primary power source. The DC power configuration capability provides an Ethernet networking solution utilizing a special power supply in switches with a proven track record.

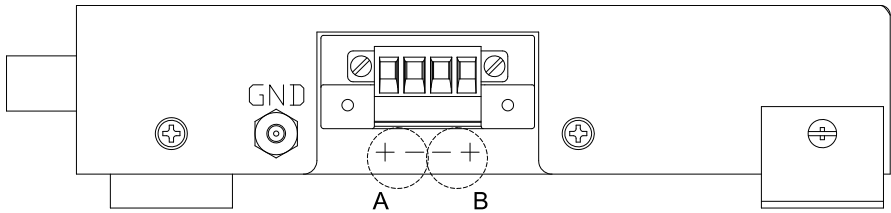
The -48VDC solution is particularly useful in the telecommunication industry, where it is common for facilities to operate on -48VDC power. Such companies include regular and wireless telephone service providers, Internet Service Providers (ISPs) and other communication companies. In addition, many high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

The 24VDC option is particularly useful in the industrial environment, where it is common for facilities to operate on 24VDC power. The 24VDC applications are mainly in heavy duty industrial automation such as factory floor, process plants, HVAC, military equipment, etc.

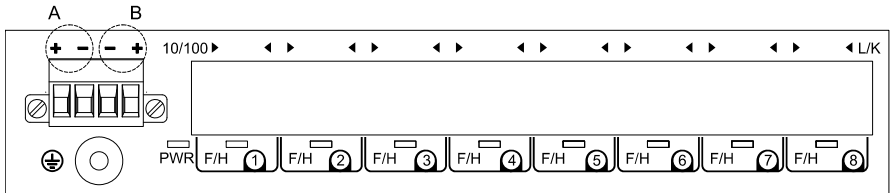
**B4.0 CP80, 12, 24 and -48VDC INSTALLATION**

This section describes the proper connection of the 12, 24, -48, leads to the DC power terminal block on the Magnum CP80 Switch. The DC terminal block on the Magnum CP80F Switch is located on the right side of the unit and the CP80 terminal block is located on the left front and both are equipped with four (4) screw-down lead posts. The power terminals are identified as positive (+) and negative (-), and they are electrically floating inside the unit so that either may be grounded by the user if desired. The chassis is “earth” or ground (GND).

The connection procedure is straightforward. Simply insert the DC leads to the Switch’s power terminals, positive (+) and negative (-) screws. The use of Ground (GND) connects to the Switch chassis screw provided under the DC terminal. Ensure that each lead is securely tightened.



**Fig B4.0a CP80F Power Input**



**Fig B4.0b CP80 Power Input**

**NOTE:** *Always use a voltmeter to measure the voltage of the incoming power supply and figure out the +ve potential lead or -ve potential lead. The more +ve potential lead will connect to the post labeled “+ve” and the rest to the “-ve”. The GND can be hooked up at the last.*

When power is applied, the green PWR LED will illuminate.

*Note: The GND should be hooked up first. The CP80 unit has a floating ground, so the user may elect to Ground either + or - terminal to suit the customer's use.*

*Before connecting live power lines to the Terminal Block of -48VDC, 12VDC and 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 “+”.*

#### **B4.1 UL Requirements for DC-powered units**

**CAUTION:** 48VDC products shall be installed with a readily accessible disconnect device in the building installation supply circuit to the product.

*Minimum 18AWG cable for connection to a Centralized DC power source.*

- 1. Minimum 14AWG cable for connection to an earth wiring.*
- 2. Use only with Listed 10A circuit breaker provided in building installation.*
- 3. “Complies with FDA radiation performance standards, 21 CFR subchapter J.” or equivalent.*
- 4. Fastening torque of the lugs on the terminal block: 9 inch-pound max.*
- 5. To secure a centralized DC Power Source cable, 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 Magnum CP80 Switches with the optional -48VDC, 12VDC and 24VDC dual-source power input is identical to that of the standard single-source DC-powered models.

#### **B6.0 TROUBLESHOOTING**

Please refer to Section 6.0 for troubleshooting

## APPENDIX C: DC Dual-Source Power Input Option

### C1.0 SPECIFICATIONS - FOR MAGNUM CP80 INDUSTRIAL SWITCH

#### Power Supply (Internal, -48VDC Dual-Source)

DC Power Connector: First Source: "A+", "A-", 2nd Source "B-", "B+"

GND: ground wire connection to the hub chassis screw

Input: Two separate sources, each at 36 - 60 VDC

#### Power Supply (Internal, 12VDC Dual-Source, model # Dual-Src-12V)

DC Power Connector: First Source: "A+", "A-", 2nd Source "B-", "B+"

GND: ground wire connection to the hub chassis screw

Input: Two separate sources, each at 9-15 VDC

#### Power Supply (Internal, 24VDC Dual-Source, model # Dual-Src-24V)

DC Power Connector: First Source: "A+", "A-", 2nd Source "B-", "B+"

GND: ground wire connection to the hub chassis screw

Input: Two separate sources, each at 18 - 36 VDC

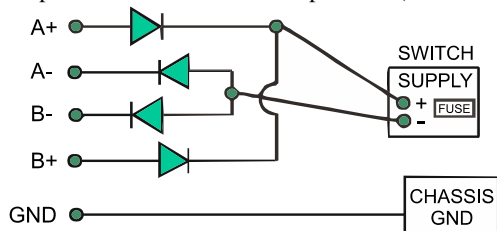
With the exception of the dual DC input power connections and the power supply, all specifications and configuration options for the Magnum CP80 -48VDC, 12VDC and 24VDC models with this Dual-Source option are identical to those listed in the *Magnum CP80 Installation and User Guide*, including Appendix B "Internal DC Power Supply Option"

### C2.0 MAGNUM CP80, with DC Dual-Source option

The CP80 Switch models with the internal -48VDC, 12VDC and 24VDC Dual-Source power supply are designed for installations where a battery plant is the power source, and where two separate power sources are utilized in order to increase operational uptime and to simplify maintenance.

### C3.0 DUAL-SOURCE OPTION, THEORY OF OPERATION

The Dual-Source DC power option is designed using diodes inside of the chassis on each DC power input line. A diode is placed in each of the four input lines (behind the four external power connection terminals) so that power from an external source can only flow into the unit. This allows the unit to operate whenever DC power is correctly applied to either or both of the two inputs.



#### C4.0 FEATURES AND BENEFITS OF THE DUAL-SOURCE DESIGN

- a) The Switch unit can receive power from either input, “A” or “B”. The hub will normally draw its power from the DC source with the highest voltage at a given time.
- b) The Switch unit will not allow power to flow from a higher voltage input to a lower voltage input, i.e. the two DC power sources are not mixed together by the hub.
- c) When one correct DC input is present, the Switch will receive power if the other DC input is absent, or even if it is connected with reverse polarity or shorted or grounded.
- d) Reverse polarity connections, if they should accidentally occur on either input, will not damage the Switch or power supply internally (nor will it blow the fuse in the internal power supply) because of the blocking action of the diodes. This is true even if one input connection is reversed while the Switch is operating from the other source.
- e) The Switch will not receive power (and will not work) when both inputs are simultaneously absent or are both incorrectly connected.

#### C5.0 INSTALLATION

This section describes the proper connection of the 12, 24, –48, Dual-Source leads to the DC power terminal block on the Magnum CP80 Switch. The DC terminal block on the Magnum CP80F Switch is located on the right side of the unit and the CP80 terminal block is located on the left front and both are equipped with four (4) screw-down lead posts. The power terminals are identified as positive (+) and negative (-), and they are electrically floating inside the unit so that either may be grounded by the user if desired. The chassis is “earth” or ground (GND).

The connection procedure is straightforward. Simply insert the DC leads to the Switch’s power terminals, positive (+) and negative (-) screws. The use of Ground (GND) connects to the Switch chassis screw provided under the DC terminal. Ensure that each lead is securely tightened.

The primary terminals are identified as positive (A+), negative (A-), and the secondary power terminals as negative (B-), positive (B+). The chassis is earth/ground (GND). Refer to Fig B4.0.1 and B4.0.2.

***Note: The GND should be hooked up first. The CP80 unit has a floating ground, so the user may elect to Ground either + or - terminal to suit the customer’s use. Before connecting live power lines to the terminal block, 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 a +ve or –ve power supply must be connected to the post labeled “+”.***

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**C6.0 ORDERING INFORMATION FOR DUAL SOURCE POWER**

To order the optional Dual-Source power supply factory installed, add “Dual-Src-xxxV” as a separate line item following the product model.

Example: **Magnum CP80-48VDC**  
**Dual-Src-48V**